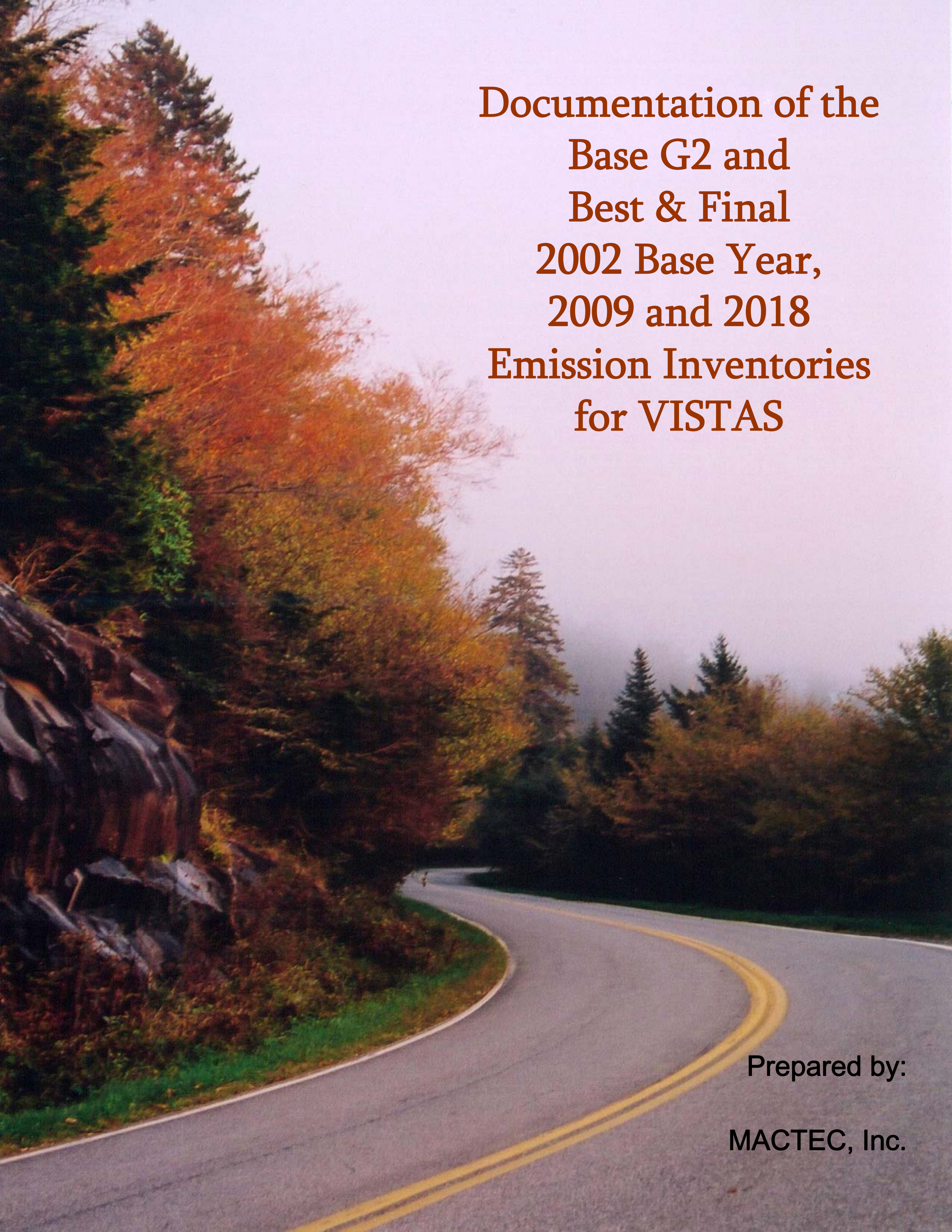
Appendix D

VISTAS and LADCO

Technical Support Documents (TSD)



Documentation of the Base G2 and Best & Final 2002 Base Year, 2009 and 2018 Emission Inventories for VISTAS

Prepared by:

MACTEC, Inc.

Documentation of the
Base G2 and Best & Final
2002 Base Year, 2009 and 2018
Emission Inventories for VISTAS

Prepared for:

Visibility Improvement State and Tribal Association of the Southeast (VISTAS)

March 14, 2008

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Acronyms and Abbreviations

AEO	Annual Energy Outlook
AF&PA	American Forest and Paper Association
APCD	Air Pollution Control District
ATP	Anti-Tampering Program
BLRID	Boiler Identification (Boiler ID)
CAA	Clean Air Act
CAIR	Clean Air Interstate Rule
CEM	Continuous Emissions Monitoring
CAMD	Clean Air Markets Division
CERR	Consolidated Emissions Reporting Rule
CMU	Carnegie Mellon University
CMV	commercial marine vessels
CE	Control Efficiency
CO	carbon monoxide
DENR	North Carolina Department of Environment and Natural Resources
DHEC	South Carolina Department of Health and Environmental Control
EDMS	Emissions Data Management Systems
ESD	Emissions Standards Division
EPA	Environmental Protection Agency
EGU	Electric Generating Unit
ICF	ICF International, Inc.
FIP	Federal Implementation Plan
FLM	Federal Land Manager
FTP	File transfer protocol
FR	Federal Register
FS	Forest Service
HDD	Heavy Duty Diesel
HDD RULE	Heavy Duty Diesel Rule
ICF	ICF International, Inc.
ID	Identification
I/M	Inspection and Maintenance
IPM®	Integrated Planning Model®
IAQTR	Interstate Air Quality Transport Rule
LTO	Landing and take off
MACT	Maximum achievable control technology

Acronyms and Abbreviations (continued)

MACTEC	MACTEC Engineering and Consulting, Inc.
MOBILE 6	MOBILE emissions estimation model version 6
MRPO	Midwest Regional Planning Organization
NH_3	Ammonia
NEI	National Emission Inventory
NIF	National Emission Inventory Format
NLEV	National Low Emission Vehicle regulation
NMIM	National Mobile Inventory Model
NONROAD	no acronym (model name)
NO_x	Oxides of nitrogen
NWR	National Wildlife Refuge
OTB	On the books
OTW	On the way
ORIS	Office of Regulatory Information Systems
OTAQ	Office of Transportation and Air Quality
OTC	Ozone Transport Commission
PFC	Portable fuel containers
PM	Particulate matter
PM_{10}-FIL	Particulate matter less than or equal to 10 microns in diameter that can be captured on a filter
PM_{10}-PRI	Particulate matter less than or equal to 10 microns in diameter that includes both the filterable and condensable components of particulate matter
$PM_{2.5}$-FIL	Particulate matter less than or equal to 2.5 microns in diameter that can be captured on a filter
$PM_{2.5}$-PRI	Particulate matter less than or equal to 2.5 microns in diameter that includes both the filterable and condensable components of particulate matter
PM-CON	Particulate matter created by the condensation of hot materials to form particulates, usually less than 2.5 microns in diameter
ppmW	parts per million by weight
PRI	Primary
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
REMI	Regional Economic Models, Inc.
RFG	Reformulated gasoline
RVP	Reid Vapor Pressure

Acronyms and Abbreviations (continued)

SCC	Source Classification Code
SIP	State Implementation Plan
SIWG	Special Interest Workgroup
S/L/T	State/Local/Tribal
SMOKE	Sparse Matrix Operator Kernel Emissions Modeling System
S/L	State and Local
SO_2	Oxides of Sulfur
T4	Tier 4
VISTAS	Visibility Improvement State and Tribal Association of the Southeast
VMT	Vehicle Miles Traveled
VOC	Volatile organic compounds
WRAP	Western Regional Air Partnership

Documentation of the Base G2 and Best & Final 2002 Base Year, 2009 and 2018, Emission Inventories for VISTAS

Introduction

Base G2 document was delivered final in Aug (?) 2007. In fall 2007 states updated specific point source EGU and non-EGU facility record in Best and Final (B&F) inventories for 2009 and 2018 to account for BART controls, consent decrees, corrections to Base G2, and source specific controls. Only EGU and non-EGU point source records were changed. Area, non-road, on-road remained the same as Base G2. In this report all records for area, non-road, and on-road were used in B&F modeling the same as Base G2. This report has been updated from the Base G2 report submitted in July 2007 just for B&F changes to EGU and non-EGU sources. A history of the development of the VISTAS inventory follows. Specific sections of the document detail the modifications made as the inventory progressed from Base F through B&F.

The Base G2 inventory included changes in 2018 controls on specific electric generating units in GA, FL, NC, and WV. There were no changes in 2009 controls for EGU and no changes between the Base G and Base G2 inventories for non-EGU point, on-road, non-road, or area sources in 2009 or 2018. The Base G2 modeling run included changes for 2018 EGU controls plus corrections in 2002 typical, 2009, and 2018 for errors in emissions processing in Base G. These corrections in emissions processing are not seen when comparing the Base G and G2 inventory files.

Base G and Base G2 inventories represent two separate model runs, as does the B&F. Since Base G2 supersedes Base G, VISTAS will maintain only the Base G2 and B&F model files since both were used in State Implementation Plan submittals.

History of VISTAS Base and Projection Year Emission Inventory Development

This section is provided to supply the history behind the development of the base and projection year inventories provided to the Visibility Improvement State and Tribal Association of the Southeast (VISTAS) and the Association for Southeast Integrated Planning (ASIP). Through the various iterations, the inventories that have been developed have typically had version numbers provided by the contractors who developed the inventories and to a certain extent these were also based on their purpose. Different components of the 2002 base year inventories have been supplied by E.H. Pechan and Associates, Inc. (Pechan), MACTEC Engineering and Consulting, Inc.

(MACTEC), and by Alpine Geophysics, Inc. (AG). The projection year inventories were developed by MACTEC and AG.

The initial 2002 base year inventory was jointly developed by Pechan and MACTEC. Pechan developed the on-road and non-road mobile source components of the inventory while MACTEC developed the point and area source component of the inventory. This version of the inventory included updates to on-road mobile that incorporated information from the 1999 NEI Version 2 final along with updated information on VMT, fuel programs, and other inputs to the MOBILE6 model to produce a draft version of the 2002 inventory. For non-road sources, a similar approach was used. Updated State information on temperatures and fuel characteristics were obtained from VISTAS States and used with the NONROAD 2002 model to calculate 2002 emissions for NONROAD model sources. These estimates were coupled with data for commercial marine vessels, locomotives and airplanes projected to 2002 using appropriate growth surrogates. A draft version of these inventories was prepared in late 2003, with a final version in early 2004. An overview of the development of the on-road component can be found at: http://www.vistas-sesarm.org/documents/Pechan_drafton-roadinventory_082803.ppt while an overview of the non-road component can be found at: http://www.vistas-sesarm.org/documents/Pechan_Non-roadInventory_082803.ppt.

Similarly, draft versions of the 2002 point and area source base year inventories were prepared by MACTEC in the same timeframe (late 2003 for the draft, final in early 2004). The point source component was based on data submitted by the VISTAS States or on the 1999 NEI. The data submitted by the States ranged from 1999 to 2001 and was all projected to 2002 using appropriate growth surrogates from Economic Growth Analysis System (EGAS) version 4. Toxic Release Inventory (TRI) data were used to augment the inventory for NH_3. Continuous Emissions Monitor (CEM) data from the U.S. EPA's Clean Air Markets Division was used to supply emissions for electric generating utilities (EGUs). Particulate matter emissions were augmented (when missing) by using emission factor ratios. Details on all these calculations are discussed in Section 1.1.1.3 of this document.

The area source component of the 2002 draft base year emissions was prepared similarly to the point sources, using State submittals and the 1999 NEI Version 2 final as the basis for projecting emissions to 2002 using EGAS growth factors. For ammonia area sources the Carnegie Mellon University (CMU) ammonia model was used to calculate emissions. Finally, data on acreage burned on a fire by fire basis was solicited from State forestry agencies in order to calculate fire emissions on a fire by fire basis. Virtually all VISTAS State forestry agencies provided data for these calculations at least for wild and

prescribed fires. An overview of the point and area source development methods can be found at:
http://www.vistas-sesarm.org/documents/MACTEC_draftpointareainventory_82803.ppt.

Three interim versions of the 2002 base year inventory were developed. The first was delivered in August of 2003, the second in April of 2004 and the final one in October of 2004. The August 2003 and April 2004 inventories were prepared by MACTEC and Pechan. A draft version of the revised 2002 base year inventory was released in June of 2004, with a final version released in October 2004. That 2002 base year inventory was solely prepared by MACTEC. The October 2004 inventory incorporated 2002 Consolidated Emissions Reporting Rule (CERR) data into the inventory along with some updated data from the VISTAS States. This inventory is typically referred to as version 3.1 of the VISTAS inventory.

Closely following the version 3.1 2002 base year inventory, a “preliminary” 2018 projection inventory was developed. This “preliminary” 2018 inventory was developed in late 2004 (Oct/Nov) and was designed solely for use in modeling sensitivity runs to provide a quick and dirty assessment of what “on the books” and “on the way” controls could be expected to provide in terms of improvements to visibility and regional haze impairment. A brief overview of the history of the three versions of the 2002 base year and the 2018 preliminary inventory use can be found at: http://www.vistas-sesarm.org/documents/STAD1204/2002and2018Emissions14Dec2004.ppt.

Following preparation of the final 3.1 version of the 2002 base year inventory, States were asked to review and provide comments on that inventory to MACTEC for update and revision. At the same time MACTEC prepared a revised draft version of the 2018 projection inventory (January 2005) and a draft version of a 2009 projection inventory (April 2005). All of these were known as version 3.1 and were provided to the VISTAS States for review and comment. Comments were received and updates to the inventories based on these comments were prepared. The revised inventories were provided to the VISTAS States. At that time to be consistent with the modeling nomenclature being used by AG in performing their modeling runs, the inventory became the Base F VISTAS inventory. The Base F inventory was delivered for review and comment in August of 2005. In addition, MACTEC delivered a report entitled *Documentation of the Revised 2002 Base Year, Revised 2018, and Initial 2009 Emission Inventories for VISTAS* on August 2, 2005 that described the methods used to develop the Base F inventories. For the Electric Generating Utilities (EGU) different versions of the Integrated Planning Model were used between Base D and Base F, resulting in different projections of future EGU emissions.

Over the period from August 2005 until June/July 2006 MACTEC received comments and updates to some categories from VISTAS States, particularly EGU. In addition, a new NONROAD model (NONROAD05) was released. Thus additional updates to the inventory were prepared based on the comments received along with revised NONROAD emission estimates from NONROAD05. The resultant inventory became the Base G inventory.

Following release of the Base G inventory in early 2007, four States specified additional changes to reflect their best estimates of EGU emission levels and controls in 2018. The resulting 2018 EGU emission inventory is referred to as Base G2, which was released in July 2007.

The current version of the VISTAS inventory is referred to as the “Best and Final (B&F)” inventory. States specified additional changes to the point source inventory to reflect improved knowledge of EGU emission levels and controls in 2009 and 2018. States also specified changes to nonEGU sources reflecting new information on anticipated controls and shutdowns. No changes to any other source sector (e.g., area, fire, nonroad, onroad) were made for the B&F inventory. The 2018 B&F inventory was released in October 2007, and the 2009 B&F inventory was released in December 2007.

This document details the development of the Base G/G2/B&F inventories for 2002, 2009 and 2018. The information that follows describes the development of the VISTAS inventory by sector from Base F forward. Unless specific updates were made to an inventory sector, the methods used for Base F were retained. Table I-1 through Table I-3 indicate roughly which version of the inventory is in use for each sector of the inventory as of the B&F inventory.

Under a separate contract, AG was asked to obtain and convert emission inventory data for the five states that make up the Midwest Regional Planning Organization (MRPO) for use by VISTAS/ASIP modelers. Details of this effort are documented in an Appendix to this report.

Table I-1 Inventory Version in Use by Year and Source Sector Through B&F - 2002

Source	AL	FL	GA	KY	MS	NC	SC	TN	VA	WV
EGU	Base G	Base G	Base G	Base G	Base G	Base G	Base G	Base G	Base G	Base G
Non-EGU Point	Base F with some source specific revisions in Base G	Base F with some source specific revisions in Base G	Base F with some source specific revisions in Base G	Base F with some source specific revisions in Base G	Base F with some source specific revisions in Base G	Base F with some source specific revisions in Base G	Base F with some source specific revisions in Base G	Base F with some source specific revisions in Base G	Base F with some source specific revisions in Base G	Base F with some source specific revisions in Base G
Area[1]	Base F for ammonia sources (CMU Model) and for some area sources, Base G for selected sources updated by the State with State supplied data	Base F except for some emissions zeroed out (and records removed) for some southern FL counties for Base G.	Base F	Base F	Base F	Base F for ammonia sources (CMU Model) and for some area sources, Base G for selected sources updated by the State with State supplied data. Some corrections applied by MACTEC to correct PM values	Base F	Base F	Base F for ammonia Sources (CMU Model) and for some area sources, Base G for selected sources updated by the State with State supplied data.	Base F
On-road	Base G	Base G	Base G	Base G	Base G	Base G	Base G	Base G	Base G	Base G
Non-road	Base G for all sources included in the NONROAD model. Base F for non-NONROAD model sources, except aircraft and locomotives updated for Base G.	Base G for all sources included in the NONROAD model. Base F for non-NONROAD model sources	Base G for all sources included in the NONROAD model. Base F for non-NONROAD model sources	Base G for all sources included in the NONROAD model. Base F for non-NONROAD model sources except for aircraft in Cincinnati/N. KY Int. Airport, which are Base G.	Base G for all sources included in the NONROAD model. Base F for non-NONROAD model sources	Base G for all sources included in the NONROAD model. NC moved from Southern to Mid-Atlantic State in seasonal adjustment file. Base F for non-NONROAD model sources	Base G for all sources included in the NONROAD model. Base F for non-NONROAD model sources	Base G for all sources included in the NONROAD model. Base F for non-NONROAD model sources	Base G for all sources included in the NONROAD model. Base F for non-NONROAD model sources, except for aircraft emissions which are Base G.	Base G for all sources included in the NONROAD model. Base F for non-NONROAD model sources
Fires	Base F Typical	Base F Typical	Base F Typical	Base F Typical	Base F Typical	Base F Typical	Base F Typical	Base F Typical	Base F Typical	Base F Typical

Notes:

Base G global Area Source changes that apply to ALL States: A) removal of Stage II refueling from area source file to non-road and on-road; B) modification of PM2.5 ratio for several fugitive dust sources per WRAP methodology; C) addition of portable fuel container (PFC) emissions to all States based on OTAQ report.

Table I-2 Inventory Version in Use by Year and Source Sector Through B&F - 2009

Source	AL	FL	GA	KY	MS	NC	SC	TN	VA	WV
EGU[1]	Best & Final	Best & Final	Best & Final	Best & Final	Best & Final	Best & Final	Best & Final	Best & Final	Best & Final	Best & Final
Non-EGU Point[2]	Base F methodology but with revised growth factors for fuel fired sources in Base G and source-specific changes in B&F	Base F methodology but with revised growth factors for fuel fired sources in Base G and source-specific changes in B&F	Base F methodology but with revised growth factors for fuel fired sources in Base and source-specific changes in B&F	Base F methodology but with revised growth factors for fuel fired sources in Base G and source-specific changes in B&F	Base F methodology but with revised growth factors for fuel fired sources in Base G and source-specific changes in B&F	Base F methodology but with revised growth factors for fuel fired sources in Base G and source-specific changes in B&F	Base F methodology but with revised growth factors for fuel fired sources in Base G and source-specific changes in B&F	Base F methodology but with revised growth factors for fuel fired sources in Base and source-specific changes in B&F	Base F methodology but with revised growth factors for fuel fired sources in Base G and source-specific changes in B&F	Base F methodology but with revised growth factors for fuel fired sources in Base G and source-specific changes in B&F
Area	Base F with updated AEO growth factors for fuel fired sources. Agricultural ammonia sources from CMU model.	Base F with updated AEO growth factors for fuel fired sources. Agricultural ammonia sources from CMU model.	Base F with updated AEO growth factors for fuel fired sources. Agricultural ammonia sources from CMU model.	Base F with updated AEO growth factors for fuel fired sources. Agricultural ammonia sources from CMU model.	Base F with updated AEO growth factors for fuel fired sources. Agricultural ammonia sources from CMU model.	Base F with updated AEO growth factors for fuel fired sources. Agricultural ammonia sources from CMU model. Some specific source categories updated using State supplied file to override projected values.	Base F with updated AEO growth factors for fuel fired sources. Agricultural ammonia sources from CMU model.	Base F with updated AEO growth factors for fuel fired sources. Agricultural ammonia sources from CMU model.	Base F with updated AEO growth factors for fuel fired sources. Agricultural ammonia sources from CMU model.	Base F with updated AEO growth factors for fuel fired sources. Agricultural ammonia sources from CMU model.
On-road	Base G	Base G	Base G	Base G	Base G	Base G	Base G	Base G	Base G	Base G
Non-road	Base G for all sources included in the NONROAD model. Base F projection methodology used for non-NONROAD model sources.	Base G for all sources included in the NONROAD model. Base F projection methodology used for non-NONROAD model sources	Base G for all sources included in the NONROAD model. Base F projection methodology used for non-NONROAD model sources	Base G for all sources included in the NONROAD model. Base F projection methodology used for non-NONROAD model sources except for aircraft in Cincinnati/N. KY Int. Airport, which are Base G using State supplied growth factors.	Base G for all sources included in the NONROAD model. Base F projection methodology used for non-NONROAD model sources	Base G for all sources included in the NONROAD model. Base F projection methodology used for non-NONROAD model sources	Base G for all sources included in the NONROAD model. Base F projection methodology used for non-NONROAD model sources	Base G for all sources included in the NONROAD model. Base F projection methodology used for non-NONROAD model sources	Base G for all sources included in the NONROAD model. Base F projection methodology used for non-NONROAD model sources	Base G for all sources included in the NONROAD model. Base F projection methodology used for non-NONROAD model sources
Fires	Base F typical except for Rx fires	Base F typical	Base F typical except for Rx fires	Base F typical except for Rx fires	Base F typical except for Rx fires	Base F typical except for Rx fires	Base F typical except for Rx fires	Base F typical except for Rx fires	Base F typical except for Rx fires	Base F typical except for Rx fires

Notes:

1. All EGU emissions updated with new IPM runs in Base G; additional EGU-specific changes specified by States for Best & Final.
2. Revised growth factors from DOE AEO2006 fuel use projections

Table I-3 Inventory Version in Use by Year and Source Sector Through B&F - 2018

Source	AL	FL	GA	KY	MS	NC	SC	TN	VA	WV
EGU[1]	Best & Final	Best & Final	Best & Final	Best & Final	Best & Final	Best & Final	Best & Final	Best & Final	Best & Final	Best & Final
Non-EGU Point[2]	Base F methodology but with revised growth factors for fuel fired sources in Base G and source-specific changes in B&F	Base F methodology but with revised growth factors for fuel fired sources in Base G and source-specific changes in Base G2 and B&F	Base F methodology but with revised growth factors for fuel fired sources in Base G and source-specific changes in Base G2 and B&F	Base F methodology but with revised growth factors for fuel fired sources in Base G and source-specific changes in B&F	Base F methodology but with revised growth factors for fuel fired sources in Base G and source-specific changes in B&F	Base F methodology but with revised growth factors for fuel fired sources in Base G and source-specific changes in Base G2 and B&F	Base F methodology but with revised growth factors for fuel fired sources in Base G and source-specific changes in B&F	Base F methodology but with revised growth factors for fuel fired sources in Base G and source-specific changes in B&F	Base F methodology but with revised growth factors for fuel fired sources in Base G and source-specific changes in B&F	Base F methodology but with revised growth factors for fuel fired sources in Base G and source-specific changes in Base G2 and B&F
Area	Base F with updated AEO growth factors for fuel fired sources. Agricultural ammonia sources from CMU model.	Base F with updated AEO growth factors for fuel fired sources. Agricultural ammonia sources from CMU model.	Base F with updated AEO growth factors for fuel fired sources. Agricultural ammonia sources from CMU model.	Base F with updated AEO growth factors for fuel fired sources. Agricultural ammonia sources from CMU model.	Base F with updated AEO growth factors for fuel fired sources. Agricultural ammonia sources from CMU model.	Base F with updated AEO growth factors for fuel fired sources. Agricultural ammonia sources from CMU model. Some specific source categories updated using State supplied file to override projected values.	Base F with updated AEO growth factors for fuel fired sources. Agricultural ammonia sources from CMU model.	Base F with updated AEO growth factors for fuel fired sources. Agricultural ammonia sources from CMU model.	Base F with updated AEO growth factors for fuel fired sources. Agricultural ammonia sources from CMU model.	Base F with updated AEO growth factors for fuel fired sources. Agricultural ammonia sources from CMU model.
On-road	Base G	Base G	Base G	Base G	Base G	Base G	Base G	Base G	Base G	Base G
Non-road	Base G for all sources included in the NONROAD model. Base F projection methodology used for non-NONROAD model sources.	Base G for all sources included in the NONROAD model. Base F projection methodology used for non-NONROAD model sources	Base G for all sources included in the NONROAD model. Base F projection methodology used for non-NONROAD model sources	Base G for all sources included in the NONROAD model. Base F projection methodology used for non-NONROAD model sources except for aircraft in Cincinnati/N. KY Int. Airport, which are Base G using State supplied growth factors.	Base G for all sources included in the NONROAD model. Base F projection methodology used for non-NONROAD model sources	Base G for all sources included in the NONROAD model. Base F projection methodology used for non-NONROAD model sources	Base G for all sources included in the NONROAD model. Base F projection methodology used for non-NONROAD model sources	Base G for all sources included in the NONROAD model. Base F projection methodology used for non-NONROAD model sources	Base G for all sources included in the NONROAD model. Base F projection methodology used for non-NONROAD model sources	Base G for all sources included in the NONROAD model. Base F projection methodology used for non-NONROAD model sources
Fires	Base F typical except for Rx fires	Base F typical	Base F typical except for Rx fires	Base F typical except for Rx fires	Base F typical except for Rx fires	Base F typical except for Rx fires	Base F typical except for Rx fires	Base F typical except for Rx fires	Base F typical except for Rx fires	Base F typical except for Rx fires

Notes:

1. All EGU emissions updated with new IPM runs in Base G; additional EGU-specific changes specified by States for Base G2 and B&F.
2. Revised growth factors from DOE AEO2006 fuel use projections

1.0 2002 Base Year Inventory Development

1.1 Point Sources

This section details the development of the 2002 base year inventory for point sources. There were two major components to the development of the point source sector of the inventory. The first component was the incorporation of data submitted by the Visibility Improvement State and Tribal Association of he Southeast (VISTAS) States and local (S/L) agencies to the United States Environmental Protection Agency (EPA) as part of the Consolidated Emissions Reporting Rule (CERR) requirements Work on incorporating the CERR data into the revised base year involved: 1) obtaining the data from EPA or the S/L agency, 2) evaluating the emissions and pollutants reported in the CERR submittals, 3) augmenting CERR data with annual emission estimates for PM_{10}-PRI and $PM_{2.5}$-PRI; 4) evaluating the emissions from electric generating units, 5) completing quality assurance reviews for each component of the point source inventory, and 6) updating the database with corrections or new information from S/L agencies based on their review of the 2002 inventory. The processes used to perform those operations are described in the first portion of this section.

The second component was the development of a “typical” year inventory for electric generating units (EGUs). VISTAS determined that a typical year electric generating units (EGU) inventory was necessary to smooth out any anomalies in emissions from the EGU sector due to meteorology, economic, and outage factors in 2002. The typical year EGU inventory is intended to represent the five year (2000-2004) period that will be used to determine the regional haze reasonable progress goals. The second part of this section discusses the development of the typical year EGU inventory.

1.1.1 Development of 2002 Point Source Inventory

MACTEC developed a draft 2002 emission inventory in June 2004 (*Development of the Draft 2002 VISTAS Emission Inventory for Regional Haze Modeling – Point Sources*, MACTEC, June 18, 2004). The starting point for the draft 2002 emission inventory was EPA’s 1999 National Emission Inventory (NEI), Version 2 Final (NEI99V2). For several states, we replaced the NEI99V2 data with more recent inventories for either calendar year 1999, 2000, or 2001 as submitted by the S/L agencies. We also performed several other updates, including updating emission estimates for selected large source of ammonia, incorporating 2002 Continuous Emissions Monitoring-(CEM)-based SO_2 and NO_x emissions for electric utilities, adding PM_{10} and $PM_{2.5}$ emissions when they were missing from an S/L submittal, and performing a variety of additional Quality assurance/Quality control (QA/QC) checks.

The next version of the 2002 inventory (referred to as Base F) was released in August 2005 (*Documentation of the Revised 2002 Base Year, Revised 2018, and Initial 2009 Emission Inventories for VISTAS*, MACTEC, August 2, 2005). The primary task in preparing the Base F 2002 base year inventory was the replacement of NEI99V2 data with data submitted by the VISTAS S/L agencies as part of the CERR submittal and included in EPA's 2002 NEI.

The next version of the 2002 inventory (referred to as Base G) was released in August 2006 and is documented in this report. The primary task in preparing the Base G 2002 base year inventory was the incorporation of corrections and new information as submitted by the S/L agencies based on their review of the Base F inventory. Note that no changes to the Base G 2002 point source inventory were made during the Base G2 and B&F update cycles (in other words, for the 2002 actual and typical inventories, Base G = Base G2 = B&F).

The following subsections document the data sources for the Base G/B&F inventory, the checks made on the CERR submittals, the process for augmenting the inventory with PM_{10} and $PM_{2.5}$ emissions, the evaluation of EGU emissions, other QA/QC checks, and other Base G updates. The final subsection summarizes the Base G/B&F 2002 inventory by state, pollutant, and sector (EGU and non-EGU).

1.1.1.1 Data Sources

Several data sources were used to compile the Base F point source inventory: 1) the inventories that the S/L submitted to EPA from May through July 2004 as required by the CERR; 2) supplemental data supplied by the S/L agencies that may have been revised or finalized after the CERR submittal to EPA, and 3) the draft VISTAS 2002 inventory in cases where S/L CERR data were not available. For the Base G inventory, we replaced data from Hamilton County, Tennessee, using data from Hamilton County's CERR submittal as contained in EPA's 2002 NEI inventory (in Base F, the inventory for Hamilton County was based on the draft VISTAS 2002 inventory, which in turn was based on the 1999 NEI).

Table 1.1-1 summarizes the data used as the starting point for the Base F 2002 inventory. Once all of the files were obtained, MACTEC ran the files through the EPA National Emission Inventory Format (NIF) Basic Format and Content checking tool to ensure that the files were submitted in standard NIF format and that there were no referential integrity issues with those files. In a couple of cases small errors were found. For example, in one case non-standard pollutant designations were used for particulate matter (PM) and ammonia emissions. MACTEC contacted each VISTAS State point source contact person to resolve the issues with the files and corrections were made. Once all corrections to the native files were made, MACTEC continued with the incorporation of the data into the VISTAS point source files. S/L agencies completed a detailed review of the Base F inventory. Additional updates and corrections to the Base F inventory were requested by S/L agencies and incorporated into the Base G inventory. The Base G changes are documented in more detail in Section 1.1.1.6. No additional changes to the Base G inventory were made as part of the Base G2/B&F round of updates.

Table 1.1-1 State Data Submittals Used for the Base F 2002 Point Source Inventory.

State / Local Program	Point Source Emissions Data Source
AL	C
FL	B
GA	B
KY	C
MS	B
NC	C
SC	C
TN	C
VA	B
WV	B
Davidson County, TN	B
Hamilton County, TN	D
Memphis/Shelby County, TN	B
Knox County, TN	B
Jefferson County, AL	B
Jefferson County, KY	B
Buncombe County, NC	B
Forsyth County, NC	B
Mecklenburg County, NC	B

Key
A = Draft VISTAS 2002
B = CERR Submittal from EPA's file transfer protocol (FTP) site
C = Other (CERR or other submittal sent directly from S/L agency to MACTEC)
D = CERR Submittal from EPA’s NEI 2002 Final Inventory

1.1.1.2 Initial Data Evaluation

For the Base F inventory, we conducted an initial review of the 2002 point source CERR data in accordance with the QA procedures specified in the Quality Assurance Project Plan (QAPP) for this project. The following evaluations were completed to identify potential data quality issues associated with the CERR data:

- Compared the number of sites in the CERR submittal to the number of sites in the VISTAS draft 2002 inventory; for all States, the number of sites in the CERR submittal was less than in the VISTAS draft 2002 inventory, since the CERR data was limited to major sources, while the VISTAS draft 2002 inventory contained data for both major and minor sources; verified with S/L contacts that minor sources not included in the CERR point source inventory were included in the CERR area source inventory.

- Checked for correct pollutant codes and corrected to make them NIF-compliant; for example, some S/L agencies reported ammonia emissions using the CAS Number or as "ammonia", rather than the NIF-compliant "NH_3" code.
- Checked for types of particulate matter codes reported (i.e., PM-FIL, PM-CON, PM-PRI, PM_{10}-PRI, PM10-FIL, $PM_{2.5}$-PRI, $PM_{2.5}$-FIL); corrected codes with obvious errors (i.e., changed PMPRI to PM-PRI). (The PM augmentation process for filling in missing PM pollutants is discussed later in Section 1.1.1.3)
- Converted all emission values that weren't in tons to tons to allow for preparation of emission summaries using consistent units.
- Checked start and end dates in the PE and EM tables to confirm consistency with the 2002 base year.
- Compared annual and daily emissions when daily emissions were reported; in some cases, the daily value was non-zero (but very small) but the annual value was zero. This was generally the result of rounding in an S/L agency's submittal.
- Compared ammonia emissions as reported in the CERR submittals and the 2002 Toxics Release Inventory; worked with S/L agencies to resolve any outstanding discrepancies.
- Compared SO_2 and NO_x emissions for EGUs to EPA's Clean Air Markets Division CEM database to identify any outstanding discrepancies. (A full discussion of the EGU emissions analysis is discussed later in Section 1.1.1.4)
- Prepared State-level emission summaries by pollutant for both the EGU and non-EGU sectors to allow S/L agencies to compare emissions as reported in the 1999 NEI Version 2, the VISTAS draft 2002 inventory, and the CERR submittals.
- Prepared facility-level emission summaries by pollutant to allow S/L agencies to review facility level emissions for reasonableness and accuracy.

We communicated the results of these analyses through email/telephone exchanges with the S/L point source contacts as well as through Excel summary spreadsheets. S/L agencies submitted corrections and updates as necessary to resolve any QA/QC issues from these checks.

1.1.1.3 PM Augmentation

Particulate matter emissions can be reported in many different forms, as follows:

PM Category	Description
PM-PRI	Primary PM (includes filterable and condensable)

PM-CON	Primary PM, condensable portion only (all less than 1 micron)
PM-FIL	Primary PM, filterable portion only
PM_{10}-PRI	Primary PM_{10} (includes filterable and condensable)
PM_{10}-FIL	Primary PM_{10} filterable portion only
$PM_{2.5}$ -PRI	Primary $PM_{2.5}$ (includes filterable and condensable)
$PM_{2.5}$ -FIL	Primary $PM_{2.5}$ filterable portion only

S/L agencies did not report PM emissions in a consistent manner. The State/local inventories submitted for VISTAS included emissions data for either PM-FIL, PM-PRI, PM_{10}-FIL, PM_{10}-PRI, $PM_{2.5}$ -FIL, $PM_{2.5}$ -PRI, and/or PM-CON. From any one of these pollutants, EPA has developed augmentation procedures to estimate PM_{10}-PRI, PM_{10}-FIL, $PM_{2.5}$ -PRI, $PM_{2.5}$ -FIL, and PM-CON. If not included in a State/local inventory, PM_{10}-PRI and $PM_{2.5}$ -PRI were calculated by adding PM_{10}-FIL and PM-CON or $PM_{2.5}$ -FIL and PM-CON, respectively.

The procedures for augmenting point source PM emissions are documented in detail in Appendix C of *Documentation for the Final 1999 National Emissions Inventory {Version 3} for Criteria Air Pollutants and Ammonia – Point Sources*, January 31, 2004). Briefly, the PM data augmentation procedure includes the following five steps:

- Step 1: Prepare S/L/T PM and PM_{10} Emissions for Input to the PM Calculator
- Step 2: Develop and Apply Source-Specific Conversion Factors
- Step 3: Prepare Factors from PM Calculator
- Step 4: Develop and Apply Algorithms to Estimate Emissions from S/L/T Inventory Data
- Step 5: Review Results and Update the NEI with Emission Estimates and Control Information.

Please refer to the EPA documentation for a complete description of the PM augmentation procedures.

Table 1.1-2 compares the original PM emission estimates from the S/L CERR submittals and the revised 2002 VISTAS emissions estimates calculated using the above methodology. This table is intended to show that we took whatever States provided in the way of PM and filled in gaps to add in PM-CON where emissions were missing in order to calculate PM_{10}-PRI and $PM_{2.5}$ -PRI for all processes to get a complete set of particulate data. We did not compare any other pollutants besides PM, since for other pollutants CERR emissions equal VISTAS emissions. As noted in Table 1.1-2, we made significant revisions to the PM emissions for Kentucky in the Base F inventory and for South Carolina in the Base G inventory.

Table 1.1-2 Comparison of Particulate Matter Emissions from the S/L Data Submittals and the Base G 2002 VISTAS Point Source Inventory

State	Database	PM-PRI	PM-FIL	PM-CON	PM_{10}-PRI	PM_{10}-FIL	$PM_{2.5}$ -PRI	$PM_{2.5}$ -FIL
AL	CERR	28,803	9,174	0	16,522	6,548	8,895	4,765
	VISTAS	43,368	33,336	10,129	32,791	22,661	23,290	13,328
FL	CERR	0	33,732	0	0	32,254	0	0
	VISTAS	61,728	37,325	24,403	57,243	32,840	46,147	21,744
GA	CERR	42,846	0	0	27,489	0	15,750	0
	VISTAS	44,835	37,088	7,799	33,202	25,403	22,777	15,085
KY	CERR	0	3,809	0	19,748	1,360	0	0
	VISTAS	27,719	22,349	5,329	21,326	15,963	14,173	8,749
MS	CERR	23,925	0	0	20,968	0	10,937	0
	VISTAS	23,928	17,632	6,296	21,089	14,793	11,044	5,739
NC	CERR	48,110	0	0	36,222	0	24,159	0
	VISTAS	48,114	41,407	6,708	36,992	30,284	27,512	21,113
SC	CERR	0	43,837	0	0	32,656	0	21,852
	VISTAS	43,844	38,633	5,210	34,799	29,588	26,418	21,207
TN	CERR	1,660	25,500	21,482	43,413	22,164	34,167	12,140
	VISTAS	56,797	32,085	24,715	50,937	26,269	41,442	16,774
VA	CERR	0	0	0	17,065	0	12,000	0
	VISTAS	40,856	36,414	4,442	17,065	12,623	12,771	8,607
WV	CERR	0	29,277	0	0	14,778	0	8445
	VISTAS	36,188	29,392	6,795	22,053	15,258	15,523	8,733

Note 1: CERR refers to data as submitted by S/L agencies; VISTAS refers to data calculated by MACTEC using the PM augmentation methodologies described in this document.

Note 2: KY DEP's initial CERR submittal reported particulate matter emissions using only PM-PRI pollutant code. MACTEC used this pollutant code during the initial PM augmentation routine. In February 2005, KY DEP indicated that data reported using the PM-PRI code should actually have been reported using the PM_{10}-PRI code. MACTEC performed a subsequent PM augmentation in April 2005 using the PM_{10}-PRI code. These changes were reflected in the Base F emission inventory.

Note 3: South Carolina Department of Health and Environmental Control (SC DHEC) initial CERR submittal reported particulate matter emissions using the PM-FIL, PM_{10}-FIL, and $PM_{2.5}$ -FIL pollutant codes. MACTEC used these pollutant codes during the initial PM augmentation routine. In August 2005, SC DHEC indicated that data reported using the PM-FIL, PM_{10}-FIL, and $PM_{2.5}$ -FIL pollutant codes should actually have been reported using the PM-PRI, PM_{10}-PRI, and $PM_{2.5}$ _PRI codes. MACTEC performed a subsequent PM augmentation in April 2006 using the revised pollutant codes. These changes were reflected in the Base G emission inventory.

Note 4: The emission values in the VISTAS emission rows above differ slightly from the final values in the Base G inventory. This is due to several corrections and updates to the 2002 inventory submitted by S/L agencies after the PM augmentation was performed as discussed in Section 1.1.1.6.

After the PM augmentation process was performed, we executed a series of checks to identify potential inconsistencies in the PM inventory. These checks included:

- PM-PRI less than PM_{10}-PRI, $PM_{2.5}$ -PRI, PM_{10}-FIL, $PM_{2.5}$ -FIL, or PM-CON;
- PM-FIL less than PM_{10}-FIL, $PM_{2.5}$ -FIL;
- PM_{10}-PRI less than $PM_{2.5}$ -PRI, PM_{10}-FIL, $PM_{2.5}$ -FIL or PM-CON;
- PM_{10}-FIL less than $PM_{2.5}$ -FIL;
- PM25-PRI less than $PM_{2.5}$ -FIL or PM-CON;
- The sum of PM_{10}-FIL and PM-CON not equal to PM_{10}-PRI; and
- The sum of $PM_{2.5}$ -FIL and PM-CON not equal to $PM_{2.5}$ -PRI.

S/L agencies were asked to review this information and provide corrections where the inconsistencies were significant. In general, corrections (or general directions) were provided in the case of the potential inconsistency issues. In other cases, the agency provided specific process level pollutant corrections.

Note that for the Base G inventory, only the PM_{10}-PRI and $PM_{2.5}$ -PRI emission estimates were retained since they are the only two PM species that are included in the air quality modeling. Other PM species were removed from the Base G inventory to facilitate emissions modeling.

1.1.1.4 EGU Analysis

We made a comparison of the annual SO_2 and NO_x emissions for EGUs as reported in the S/L agencies CERR submittals and EPA's Clean Air Markets Division (CAMD) CEM database to identify any outstanding discrepancies. Facilities report hourly CEM data to EPA for units that are subject to CEM reporting requirements of the NO_x State Implementation Plan (SIP) Call rule and Title IV of the Clean Air Act (CAA). EPA sums the hourly CEM emissions to the annual level, and we compared these annual CEM emissions to those in the S/L inventories. The 2002 CEM inventory containing NO_x and SO_2 emissions and heat input data were downloaded from the EPA CAMD web site (www.epa.gov/airmarkets).

The first step in the EGU analysis involved preparing a crosswalk file to match facilities and units in the CAMD inventory to facilities and units in the S/L inventories. In the CAMD inventory, the Office of Regulatory Information Systems (ORIS) identification (ID) code identifies unique facilities and the unit ID identifies unique boilers and internal combustion engines (i.e., turbines and reciprocating engines). In the S/L inventories, the State and county FIPS and State facility ID together identify unique facilities and the emission unit ID identifies unique boilers or internal combustion engines. In most cases, there is a one-to-one correspondence between the CAMD identifiers and the S/L identifiers. However, in some of the S/L inventories, the emissions for multiple emission units are summed and reported under one emission unit ID. We created an Excel spreadsheet that contained an initial crosswalk with the ORIS ID and unit ID in the CEM inventory matched to the State and county Federal

Implementation Plan (FIPS), State facility ID, and emission unit ID in the S/L inventory. The initial crosswalk contained both the annual emissions summed from the CAMD database as well as the S/L emission estimate. It should be noted that the initial matching of the IDs in both inventories was based on previous crosswalks that had been developed for the preliminary VISTAS 2002 inventory and in-house information compiled by MACTEC and Alpine Geophysics. The matching at the facility level was nearly complete. In some cases, however, S/L agency or stakeholder assistance was needed to match some of the CEM units to emission units in the S/L inventories.

The second step in the EGU analysis was to prepare an Excel spreadsheet that compared the annual emissions from the hourly CAMD inventory to the annual emissions reported in the S/L inventory. The facility-level comparison of CEM to emission inventory NO_x and SO_2 emissions found that for most facilities, the annual emissions from the S/L inventory equaled the CAMD CEM emissions. Minor differences could be explained because the facility in the S/L inventory contained additional small or emergency units that were not included in the CAMD database.

The final step was to compare the SO_2 and NO_x emissions for select Southern Company units in the VISTAS region. Southern Company is a super-regional company that owns EGUs in four VISTAS States – Alabama, Florida, Georgia, and Mississippi – and participates in VISTAS as an industry stakeholder. Southern Company independently provided emission estimates for 2002 as part of the development of the preliminary VISTAS 2002 inventory. In most cases, these estimates were reviewed by the States and incorporated into the States CERR submittal. The exception to this was a decision made by Georgia's Department of Environmental Protection (GDEP) to utilize CEM-based emissions for the actual 2002 emissions inventory for sources within the State when Southern Company also provided data. There were no major inconsistencies between the Southern Company data, the CAMD data, and the S/L CERR data.

The minor inconsistencies included small differences (<2 percent) in emission estimates, exclusion/inclusion of small gas-fired units in the different databases, and grouping of emission units in S/L CERR submittals where CAMD listed each unit individually. We compared SO_2 and NO_x emissions on a unit by unit basis and did not find any major inconsistencies.

1.1.1.5 QA Review of Base F Inventory

QA checks were run on the Base F point source inventory data set to ensure that all corrections provided by the S/L agencies and stakeholders were correctly incorporated into the S/L inventories and that there were no remaining QA issues. After exporting the inventory to ASCII text files in NIF 3.0, the EPA QA program was run on the ASCII files and the QA output was reviewed to verify that all QA issues that could be addressed were resolved.

Throughout the inventory development process, QA steps were performed to ensure that no double counting of emissions occurred, and to ensure that a full and complete inventory was developed for VISTAS. QA was an important component to the inventory development process and MACTEC performed the following QA steps on the point source component of the VISTAS revised 2002 base year inventory:

1. Facility level emission summaries were prepared and evaluated to ensure that emissions were consistent and that there were no missing sources.
2. State-level EGU and non-EGU comparisons (by pollutant) were developed between the Base F 2002 base year inventory, the draft VISTAS 2002 inventory, and the 1999 NEI Version 2 inventory.
3. Data product summaries and raw NIF 3.0 data files were provided to the VISTAS Emission Inventory Technical Advisor and to the Point Source, EGU, and non-EGU Special Interest Work Group representatives for review and comment. Changes based on these comments were reviewed and approved by the S/L point source contact prior to implementing the changes in the files.
4. Version numbering was used for all inventory files developed. The version numbering process used a decimal system to track major and minor changes. For example, a major change would result in a version going from Base F1 to Base F2.

1.1.1.6 Additional Base G Updates and Corrections

S/L agencies completed a detailed review of the Base F inventory. Table 1.1-3 summarizes the updates and corrections to the Base F inventory that were requested by S/L agencies and incorporated into the Base G inventory.

There was a discrepancy between the base year 2002 and 2009/2018 emissions for PM_{10}-PRI, $PM_{2.5}$-PRI, and NH_3. The 2002 emissions were provided directly by the S/L agencies and were estimated using a variety of techniques (i.e., EPA emission factors, S/L emission factors, site-specific emission factors, and source test data). The 2009/2018 emissions, on the other hand, were estimated by Pechan (see Section 2.1.1.3) using an emission factor file based solely on AP-42 emission factors. An adjustment was made for 2002 EGU PM and NH_3 emissions to reconcile these differences. The post-processed Integrated Planning Model® (IPM®) 2009/2018 output uses a set of PM and NH_3 emission factors that are "the most recent EPA approved uncontrolled emission factors" – these are most likely not the same emission factors used by States and emission inventory preparation contractors for estimating these emissions in 2002 for EGUs in the VISTAS domain. VISTAS performed a set of modifications to replace 2002 base year PM and NH_3 emission estimates with estimates derived from the most recent EPA-approved emission factors. For further details of the methodology used to make this adjustment, see *EGU Emission Factors and Emission Factor Assignment,* memorandum from Greg Stella to VISTAS State Point Source Contacts and VISTAS EGU Special Interest Workgroup, June 13, 2005.

Table 1.1-3 Summary of Updates and Corrections to the Base F 2002 Inventory Incorporated into the 2002 Base G Inventory.

Affected State(s)	Nature of Update/Correction
TN, WV	The latitude and longitude values for TN (except the four local programs) and WV were truncated to two decimal places in the Base F inventory. MACTEC re-exported the NIF ER tables in a manner that so that the latitude and longitude were not truncated in the Base G inventory.
AL	Corrected the latitude and longitude for two facilities: Ergon Terminalling (Site ID: 01-073-010730167) and Southern Power Franklin (Site ID: 01-081-0036).
	Corrections to stack parameters at 10 facilities for stacks with parameters that do not appear to fall into the ranges typically termed "acceptable" for AQ modeling.
FL	Corrected emission values for the Miami Dade RRF facility (Site ID: 12-086-0250348).
GA	Hercules Incorporated (12-051-05100005) had an erroneous process id (#3) within emission unit id SB9 and was deleted. This removes about 6,000 tons of SO_2 from the 2002 inventory.
	Provided a revised file of location coordinates at the stack level that was used to replace the location coordinated in the ER file.
NC	Made several changes to Base F inventory to correct the following errors: 1. Corrected emissions at Hooker Furniture (Site ID: 37-081-08100910), release point G-29, 9211.38 tons volatile organic compounds (VOC's) should be 212.2 tons, 529.58 tons PM_{10} should be 17.02 tons, 529.58 tons PM2.5 should be 15.79 tons in 2002 inventory. 2. Identified many stack parameters in the ER file that were unrealistic. Several have zero for height, diameter, gas velocity, and flow rate. NC used the procedures outlined in Section 8 of the document ""National Emission Inventory QA and Augmentation Report" to correct unrealistic stack parameters. 3. Identified truncated latitude and longitude values in Base F inventory. NC updated all Title V facility latitude and longitude that was submitted to EPA for those facilities in 2004. Smaller facilities with only two decimal places were not corrected. 4. Corrected emissions for International Paper (3709700045) Emission Unit ID, G-12, should be 1.8844 tons VOCs instead of 2819.19 tons in 2002
SC	Corrected PM species emission values. SC DHEC's initial CERR submittal reported particulate matter emissions using the PM-FIL, PM_{10}-FIL, and PM25-FIL pollutant codes. In August 2005, SC DHEC indicated that data reported using the PM-FIL, PM_{10}-FIL, and PM25-FIL pollutant codes should actually have been reported using the PM-PRI, PM_{10}-PRI, and PM25_PRI codes. MACTEC performed a subsequent PM augmentation in April 2006 using the revised pollutant codes. These changes were reflected in the Base G emission inventory.
TN	Identified six facilities that closed in 2000/2001 but had non-zero emissions in the 2002 Base F inventory. MACTEC changed emissions to zero for all pollutants in the Base G 2002 inventory.
	Supplied updated emission inventory for the Bowater facility (47-107-0012) based on the facility's updated 2002 emission inventory update.
	Replaced data from Hamilton County, Tennessee, using data from Hamilton County's CERR submittal as contained in EPA's 2002 NEI (in Base F, the inventory for Hamilton County was based on the draft VISTAS 2002 inventory, which in turn was based on the 1999 NEI).
	Updated emissions for PCS Nitrogen Fertilizer LP (Site ID: 47-157-00146)
WV	Updated emissions for Steel of West Virginia (Site ID: 54-011-0009)
	Made changes to several Site ID names due to changes in ownership
	Made corrections to latitude/longitude and stack parameters at a few facilities for stacks with parameters that do not appear to fall into the ranges typically termed "acceptable" for AQ modeling.

1.1.1.7 Summary of B&F 2002 Inventory

Tables 1.1-4 through 1.1-10 summarize the B&F 2002 base year inventory. All values are in tons. Note that no changes to the Base G 2002 point source inventory were made during the Base G2 and B&F update cycles (in other words, Base G = Base G2 = B&F)

For the purposes of Tables 1.1-4 through 1.1-10, EGU emissions include the emissions from all processes with a Source Classification Code (SCC) of either 1-01-xxx-xx (External Combustion Boilers – Electric Generation) or 2-01-xxx-xx (Internal Combustion Engines – Electric Generation). Emissions for all other SCCs are included in the non-EGU column. Note that aggregating emissions into EGU and non-EGU sectors based on the above SCCs causes a minor inconsistency with the EGU emissions reported in EPA's CAMD database. The EGU emissions summarized in these tables may include emissions from some smaller electric generating units in the VISTAS inventory that are not in CAMD's 2002 CEM database or the IPM forecasted emissions. The minor inconsistencies result in a less than 2 percent difference between the summary tables below and the data from CAMD's CEM database.

Table 1.1-4 Base G / B&F 2002 VISTAS Point Source Inventory for SO_2 (tons/year).

State	All Point Sources	EGUs	Non-EGUs
AL	544,309	447,828	96,481
FL	518,721	453,631	65,090
GA	568,731	514,952	53,778
KY	518,086	484,057	34,029
MS	103,388	67,429	35,960
NC	522,113	477,990	44,123
SC	259,916	206,399	53,518
TN	413,755	334,151	79,604
VA	305,106	241,204	63,903
WV	570,153	516,084	54,070
Total	**4,324,278**	**3,743,725**	**580,556**

Note: EGU emissions include SCCs 1-01-xxx-xx and 2-01-xxx-xx; non-EGU has all other SCCs.

Table 1.1-5 Base G / B&F 2002 VISTAS Point Source Inventory for NO_x (tons/year).

State	All Point Sources	EGUs	Non-EGUs
AL	244,348	161,038	83,310
FL	302,834	257,677	45,156
GA	196,767	147,517	49,251
KY	237,209	198,817	38,392
MS	104,661	43,135	61,526
NC	196,782	151,854	44,928
SC	130,394	88,241	42,153
TN	221,652	157,307	64,344
VA	147,300	86,886	60,415
WV	277,589	230,977	46,612
Total	**2,059,536**	**1,523,449**	**536,087**

Note: EGU emissions include SCCs 1-01-xxx-xx and 2-01-xxx-xx; non-EGU has all other SCCs.

Table 1.1-6 Base G / B&F 2002 VISTAS Point Source Inventory for VOC (tons/year).

State	All Point Sources	EGUs	Non-EGUs
AL	49,332	2,295	47,037
FL	40,995	2,524	38,471
GA	34,952	1,244	33,709
KY	46,321	1,487	44,834
MS	43,852	648	43,204
NC	62,170	988	61,182
SC	38,927	470	38,458
TN	85,254	926	84,328
VA	43,906	754	43,152
WV	15,775	1,180	14,595
Total	**461,484**	**12,516**	**448,970**

Note: EGU emissions include SCCs 1-01-xxx-xx and 2-01-xxx-xx; non-EGU has all other SCCs.

Table 1.1-7 Base G / B&F 2002 VISTAS Point Source Inventory for CO (tons/year).

State	All Point Sources	EGUs	Non-EGUs
AL	185,550	11,279	174,271
FL	139,045	57,113	81,933
GA	140,561	9,712	130,850
KY	122,555	12,619	109,936
MS	59,871	5,303	54,568
NC	64,461	13,885	50,576
SC	63,305	6,990	56,315
TN	122,348	7,084	115,264
VA	70,688	6,892	63,796
WV	100,220	10,341	89,879
Total	**1,068,604**	**141,218**	**927,388**

Note: EGU emissions include SCCs 1-01-xxx-xx and 2-01-xxx-xx; non-EGU has all other SCCs.

Table 1.1-8 Base G / B&F 2002 VISTAS Point Source Inventory for PM_{10}-PRI (tons/year).

State	All Point Sources	EGUs	Non-EGUs
AL	32,886	7,646	25,240
FL	57,243	21,387	35,857
GA	32,834	11,224	21,610
KY	21,326	4,701	16,626
MS	21,106	1,633	19,472
NC	36,592	22,754	13,838
SC	35,542	21,400	14,142
TN	49,814	14,640	35,174
VA	17,211	3,960	13,252
WV	22,076	4,573	17,503
Total	**326,630**	**113,918**	**212,714**

Note: EGU emissions include SCCs 1-01-xxx-xx and 2-01-xxx-xx; non-EGU has all other SCCs.

Table 1.1-9 Base G / B&F 2002 VISTAS Point Source Inventory for $PM_{2.5}$ -PRI (tons/year).

State	All Point Sources	EGUs	Non-EGUs
AL	23,291	4,113	19,178
FL	46,148	15,643	30,504
GA	22,401	4,939	17,462
KY	14,173	2,802	11,372
MS	11,044	1,138	9,906
NC	26,998	16,498	10,500
SC	27,399	17,154	10,245
TN	39,973	12,166	27,807
VA	12,771	2,606	10,165
WV	15,523	2,210	13,313
Total	**239,721**	**79,269**	**160,452**

Note: EGU emissions include SCCs 1-01-xxx-xx and 2-01-xxx-xx; non-EGU has all other SCCs.

Table 1.1-10 Base G / B&F 2002 VISTAS Point Source Inventory for NH_3 (tons/year).

State	All Point Sources	EGUs	Non-EGUs
AL	2,200	317	1,883
FL	1,657	234	1,423
GA	3,697	83	3,613
KY	1,000	326	674
MS	1,359	190	1,169
NC	1,234	54	1,180
SC	1,553	142	1,411
TN	1,817	204	1,613
VA	3,230	127	3,104
WV	453	121	332
Total	**18,200**	**1,798**	**16,402**

Note: EGU emissions include SCCs 1-01-xxx-xx and 2-01-xxx-xx; non-EGU has all other SCCs.

1.1.2 *Development of Typical Year EGU inventory*

VISTAS developed a typical year 2002 emission inventory for EGUs to avoid anomalies in emissions due to variability in meteorology, economic, and outage factors in 2002. The typical year inventory represents the five year (2000-2004) period and was used to determine the regional haze reasonable progress goals. Actual 2002 emissions were used when comparing the CMAQ modeling results to the 2002 measurements in the model performance evaluation. A detailed discussion of how the actual and typical year EGU inventories were used for modeling is contained in the *Technical Support Document for VISTAS Emissions and Air Quality Modeling to Support Regional Haze State Implementation Plans* located on the VISTAS web site (http://www.vistas-sesarm.org)

Data from EPA's CAMD were used to develop normalization factors for producing a 2002 typical year inventory for EGUs. We used the ratio of the 2000-2004 average heat input and the 2002 actual heat input to normalize the 2002 actual emissions. MACTEC obtained data from EPA's CAMD for utilities regulated by the Acid Rain program. Annual data for the period 2000 to 2004 were obtained from the CAMD web site (www.epa.gov/airmarkets). The parameters available were the SO_2 and NO_x emission rates, heat input, and operating hours. We used the actual 2002 heat input and the average heat input for the 5-year period from 2000-2004 as the normalization factor, as follows:

$$\text{Normalization Factor:} \quad \frac{\text{2000-2004 average heat input}}{\text{2002 actual heat input}}$$

If the unit did not operate for all five years, then the 2000-2004 average heat input was calculated for the one or two years in which the unit did operate. For example, if the unit operated only during 2002, then the normalization factor would be 1.0. The annual actual emissions were multiplied by the normalization factor to determine the typical emissions for 2002, as follows:

Typical Emissions = 2002 actual emissions x Normalization Factor

After applying the normalization factor, some adjustments were needed for special circumstances. For example, a unit may not have operated in 2002 and thus have zero emissions. If the unit had been permanently retired prior to 2002, then we used zero emissions for the typical year. If the unit had not been permanently retired and would normally operate in a typical year, then we used the 2001 (or 2000) heat input and emission rate to calculate the typical year emissions.

The Southern Company provided typical year data for their sources. Hourly emissions data for criteria pollutants were provided. MACTEC aggregated the hourly emissions into annual values. Further documentation of how Southern Company created the typical year inventory for their units can be found in *Developing Southern Company Emissions and Flue Gas Characteristics for VISTAS Regional Haze Modeling (April 2005, presented at 14th International Emission Inventory Conference* http://www.epa.gov/ttn/chief/conference/ei14/session9/kandasamy.pdf). Since Southern Company only supplied filterable particulate emissions, we ran the PM_{10}/$PM_{2.5}$ augmentation routine to calculate annual emission estimates for PM_{10}-PRI and $PM_{2.5}$-PRI. The Southern Company typical year data were used for Southern Company sources in Alabama, Florida, and Mississippi. Georgia EPD elected to use the typical year normalization factor derived from the CAMD data instead of the Southern Company typical year data (as was used in the Base F inventory).

The final step was to replace the 2002 actual emissions with the 2002 typical year data described above. MACTEC provided the raw data and results of the typical year calculations in a spreadsheet for S/L agency review and comment. Any comments made were incorporated into the Base G inventory.

Table 1.1-11 summarizes emissions by State and pollutant for the actual 2002 EGU inventory and the typical year EGU inventory. For the entire VISTAS region, actual 2002 SO_2 emissions were about 1.6 percent higher than the typical year emissions. The differences on a state-be-state basis ranged from actual emissions being 2.3 percent lower in Kentucky to 10.9 percent higher in Mississippi. For the entire VISTAS region, actual 2002 NO_x emissions were about 1.7 percent lower than the typical year emissions. The differences on a state-be-state basis ranged from actual emissions being 1.6 percent lower in Kentucky to 6.3 percent higher in Mississippi.

Table 1.1-11 Comparison of SO_2 and NO_x Emissions (tons/year) for EGUs.

	SO_2 Emissions (tons/year)			NO_x Emissions (tons/year)		
State	**Actual 2002**	**Typical 2002**	**Percentage Difference**	**Actual 2002**	**Typical 2002**	**Percentage Difference**
AL	447,828	423,736	5.4	161,038	154,704	3.9
FL	453,631	444,383	2.0	257,677	255,678	0.8
GA	514,952	517,633	-0.5	147,517	148,126	-0.4
KY	484,057	495,153	-2.3	198,817	201,928	-1.6
MS	67,429	60,086	10.9	43,135	40,433	6.3
NC	477,990	478,489	-0.1	151,854	148,812	2.0
SC	206,399	210,272	-1.9	88,241	88,528	-0.3
TN	334,151	320,146	4.2	157,307	152,137	3.3
VA	241,204	233,691	3.1	86,886	85,081	2.1
WV	516,084	500,381	3.0	230,977	222,437	3.7
Total	**3,743,725**	**3,683,968**	**1.6**	**1,523,449**	**1,497,864**	**1.7**

Note: a negative percentage difference indicates actual emissions are less than the typical year emissions.

1.2 Area Sources

This section details the development of the Base G 2002 base year inventory for area sources. There are three major components of the area source sector of the inventory. The first component is the "typical" year fire inventory. Version 3.1 of the VISTAS base year fire inventory provided actual 2002 emissions estimates. Since fire emissions are not easily grown or projected, in order to effectively represent fires in both the base and future year inventories, VISTAS determined that a typical year fire inventory was necessary. Development of the "typical" year fire inventory covered wildfire, prescribed burning, agricultural fires and land clearing fires. The first part of this section of the report discusses the development of the typical year fire inventory. The methodology provided in that section is identical to the documentation provided for Base F since the "typical" year inventory was developed as part of the Base F development effort. The major change in Base G for the fire component of the inventory was the development of projection year inventories that represent alternatives to the "typical" year inventory. These alternative projections incorporated projected changes in the acreage burned for prescribed fires on Federal lands. These projections are an augmentation of the "typical" year inventory.

The second component of the area source inventory was the incorporation of data submitted by the VISTAS States to the United States Environmental Protection Agency (EPA) as part of the CERR. Work on incorporating the CERR data into the revised base year involved: 1) obtaining the data from EPA, 2) evaluating the emissions and pollutants reported in order to avoid double counting and 3) backfilling from the existing VISTAS 2002 base year inventory for missing sources/pollutants. The processes used to perform those operations are described in the second portion of this section. That work was performed as part of the Base F inventory effort. In general no changes to that method were made as part of the Base G inventory updates. The methods used for the Base F inventory development effort using the CERR submittals have been maintained in this document. Where necessary, additional documentation has been added to 1) reflect changes that resulted from VISTAS States review of the Base F inventory and the incorporation of those changes into Base G, 2) changes made to how certain sources were estimated or 3) addition of new sources not found in Base F.

The final component of the area source inventory was related to the development of NH_3 emission estimates for livestock and fertilizers and paved road PM emissions. For the NH_3 emission estimates for livestock and fertilizers we used version 3.6 of the Carnegie Mellon University (CMU) NH_3 model. For the paved road PM emissions, we used the most recent estimates developed by EPA as part of the National Emission Inventory (NEI) development effort. EPA had developed an improved methodology for estimating paved road emissions so those values were substituted directly into the inventory after receiving consensus from all of the VISTAS States to perform the replacement. Details on these methods are provided in the third portion of this section of the document. That section is virtually identical to that from the Base F inventory document as there were only a couple of changes to the ammonia portion of the inventory and some updates to all fugitive dust categories including paved roads on a global basis between Base F and Base G.

Finally, quality assurance steps for each component of the area source inventory are discussed.

1.2.1 Development of a "typical" year fire inventory

Typical year fire emissions were developed starting from the actual fire acreage data and emission calculated for each VISTAS State. The table below shows the data submitted by each State in the VISTAS region indicating what data was received from each State for the purposes of calculating actual fire emissions.

Fire Type	AL	FL	GA	KY	MS	NC	SC	TN	VA	WV
Land Clearing	✓	✓	✓				✓			
Ag Burning	✓	✓	✓				✓			
Wildfires	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Prescribed	✓	✓	✓	✓	✓	✓	✓	✓		✓

In order to effectively characterize fire emissions in the VISTAS region, a typical (as opposed to strictly 2002 year based inventory) was required. Development of a typical year fire inventory provided the capability of using a comparable data set for both the base year and future years. Thus fire emissions would remain the same for air quality and visibility modeling in both the base and any future years. MACTEC originally proposed five different methods for developing the typical fire year to the VISTAS Fire Special Interest Work Group (SIWG) and requested their feedback and preference for developing the final typical year inventory. The method that was selected by SIWG members was to use a method similar to that used to develop an early version of a 2018 projection inventory. For that early 2018 inventory, State level ratios of acres over a longer term record (three or more years) developed for each fire type relative to 2002. The 2002 acreage was then scaled up or down based on these ratios to develop a typical year inventory. For Base F and G, the decision of the VISTAS Fire SIWG was to base the ratio on county level data for States that supplied long term fire-by-fire acreage data rather than State-level ratios. Where States did not supply long term fire-by-fire acreage data, MACTEC reverted to using State-level ratios. With one broad exception (wildfires) this method was implemented for all fires. MACTEC solicited long term fire-by-fire acreage data by fire type from each VISTAS State. A minimum of three or more years of data were used to develop the ratios. Those data were then used to develop a ratio for each county based on the number of acres burned in each county for each fire type relative to 2002.

Thus if we had long term county prescribed fire data from a State, we developed a county acreage ratio of:

$$Ratio = \frac{\text{Long term average county level Rx acres}}{\text{2002 actual county level Rx acreage}}$$

This ratio was then multiplied times the actual 2002 acreage to get a typical value (basically the long term average county level acres). Wherever possible this calculation was performed on a fire by fire basis. The acreage calculated using the ratio was then used with the fuel loading and emission factor values that we already had (and had been reviewed by the SIWG) to calculate emissions using the same method used for the 2002 actual values (which were previously documented). The following lists indicate which counties used the State ratios by fire type.

Land Clearing		Agricultural Fires		Prescribed Burning	
FIPS	**COUNTY**	**FIPS**	**COUNTY**	**FIPS**	**COUNTY**
12086	Miami-Dade County	13063	Clayton County	13059	Clarke County
12037	Franklin County	13083	Dade County	13083	Dade County
12043	Glades County	13089	Dekalb County	13089	Dekalb County
12045	Gulf County	13097	Douglas County	13097	Douglas County
12049	Hardee County	13121	Fulton County	13121	Fulton County
12057	Hillsborough County	13135	Gwinnett County	13123	Gilmer County
12073	Leon County	13137	Habersham County	13135	Gwinnett County
12077	Liberty County	13215	Muscogee County	13139	Hall County
12081	Manatee County	13227	Pickens County	13215	Muscogee County
12095	Orange County	13241	Rabun County	13241	Rabun County
12097	Osceola County	13247	Rockdale County	13247	Rockdale County
12103	Pinellas County	13311	White County		
12115	Sarasota County				
13015	Bartow County				
13021	Bibb County				
13045	Carroll County				
13047	Catoosa County				
13057	Cherokee County				
13059	Clarke County				
13063	Clayton County				
13073	Columbia County				
13077	Coweta County				
13083	Dade County				
13089	Dekalb County				
13097	Douglas County				
13117	Forsyth County				
13121	Fulton County				
13129	Gordon County				
13135	Gwinnett County				
13137	Habersham County				
13143	Haralson County				
13147	Hart County				

Land Clearing		Agricultural Fires		Prescribed Burning	
FIPS	**COUNTY**	**FIPS**	**COUNTY**	**FIPS**	**COUNTY**
13151	Henry County				
13169	Jones County				
13215	Muscogee County				
13237	Putnam County				
13241	Rabun County				
13291	Union County				
13311	White County				

There were three exceptions to this method.

Exception 1: Use of State Ratios for Wildfires

The first exception was that wildfires estimates were developed using State ratios rather than county ratios. This change was made after initial quality assurance of the draft estimates revealed that some counties were showing unrealistic values created by very short term data records or missing data that created unrealistic ratios. In addition, exceptionally large and small fires were removed from the database since they were felt to be atypical. For example the Blackjack Complex fire in Georgia was removed from the dataset because the number of acres burned was "atypical" in that fire. We also removed all fires less than 0.1 acres from the dataset.

Exception 2: Correction for Blackened Acres on Forest Service Lands

Following discussions with the United States Forest Service (Forest Service) (memo from Cindy Huber and Bill Jackson, dated August 13, 2004), it was determined that the acres submitted by the Forest Service for wildfires and prescribed fires represented perimeter acres rather than "blackened" acres. Thus for wildfires and prescribed fires on Forest Service lands, a further correction was implemented to correct the perimeter acre values to blackened acres. The correction was made based on the size of the fire. For prescribed fires over 100 acres in size the acreage was adjusted to be 80 percent of the initial reported value. For prescribed fires of 100 acres or less the acreage values were maintained as reported. For wildfires, all reported acreage values were adjusted to be 66 percent of their initially reported values. These changes were made to all values reported for Forest Service managed lands.

Exception 3: Missing/Non-reported data

When we did not receive data from a VISTAS State for a particular fire type, a composite average for the entire VISTAS region was used to determine the typical value for that type fire. For example, if no agricultural burning long term acreage data was reported for a particular State, MACTEC determined an overall VISTAS regional average ratio that was used to multiply times the 2002 values to produce the “typical” values. This technique was applied to all fire types when data was missing.

In addition, for wildfires and prescribed burning, ratios were developed for “northern” and “southern” tier States within the VISTAS region and those ratios were applied to each State with missing data depending upon whether they were considered a “northern” or “southern” tier State. Development of “southern” and “northern” tier data was an attempt to account for a change from a predominantly pine/evergreen ecosystem (southern) to a pine/deciduous ecosystem (northern). States classified as “southern” included: AL, FL, GA, MS, and SC. States classified as “northern” included: KY, NC, TN, VA, and WV.

Finally for land clearing and agricultural fires, there are no NH_3 and SO_2 emissions. This is due to the lack of emission factors for these pollutants for these fire types.

Table 1.2-1 shows fire emissions from the original base year emission inventory (VISTAS 3.1), the actual 2002 emissions and the typical year emissions for the entire VISTAS region. The actual 2002 and typical fire emissions represent the Base F and Base G 2002 emissions. The typical emissions also represent the 2009 and 2018 emissions for all fire types with the exception of prescribed burning. Revisions made to the typical year prescribed fire emissions for 2009 and 2018 are detailed in the projection section. Also, State level Base G emissions from fires for all years can be found in the tables in Appendix A. Values for fires in those tables are “typical” year values.

Figures 1.2-1 through 1.2-4 show the State by State changes in emissions between the original 2002 base year fire inventories, the actual 2002 and the typical year inventories for carbon monoxide (CO) by fire type. Due to the relative magnitude of CO emissions compared to other criteria and PM pollutants from fires; this pollutant is normally chosen to represent the distribution of fires in the example plots.

Table 1.2-1 Emissions from Fires in the VISTAS Region – Comparison between Original Base Year 2002 (VISTAS 3.1), 2002 Actual and Typical Year Base G Emissions.

		CO	NH_3	NO_X	PM_{10}-FIL	PM_{10}-PRI	$PM_{2.5}$-FIL	$PM_{2.5}$-PRI	SO_2	VOC
Total LC	Actual (Base G)	492,409	0	14,568	62,146	62,146	62,146	62,146	0	33,799
	Typical (Base G)	675,838	0	19,995	80,598	80,598	80,598	80,598	0	46,389
	VISTAS 3.1	484,240	0	14,327	61,325	61,325	61,325	61,325	0	33,238
Total Ag	Actual (Base G)	164,273	0	903	30,958	30,958	30,385	30,385	0	21,946
	Typical (Base G)	161,667	0	903	30,465	30,465	29,892	29,892	0	21,595
	VISTAS 3.1	331,073	0	903	41,480	41,480	40,192	40,192	0	41,875
Total WF	Actual (Base G)	298,835	1,333	6,628	28,923	28,923	24,926	24,926	1,611	16,804
	Typical (Base G)	547,174	2,451	11,955	53,070	53,070	45,635	45,635	3,072	28,491
	VISTAS 3.1	275,766	1,230	6,133	26,680	26,680	23,002	23,002	1,476	15,718
Total RX	Actual (Base G)	1,678,216	7,616	36,561	168,938	168,938	145,175	145,175	9,839	78,988
	Typical (Base G)	1,635,776	7,425	35,650	164,811	164,811	141,636	141,636	9,590	76,990
	VISTAS 3.1	1,724,940	7,822	37,556	173,590	173,590	149,181	149,181	10,101	81,188

Key: LC = Land Clearing; Ag = Agricultural burning; WF = wildfires; RX = prescribed burning. Actual and Typical represent Base F and Base G (e.g., no change in methodology for Base F and Base G) for 2002.

Figure 1.2-1 CO Emissions from Agricultural Burning for the Original Base Year, 2002 Actual Base G, and 2002 Typical Base G Inventories.

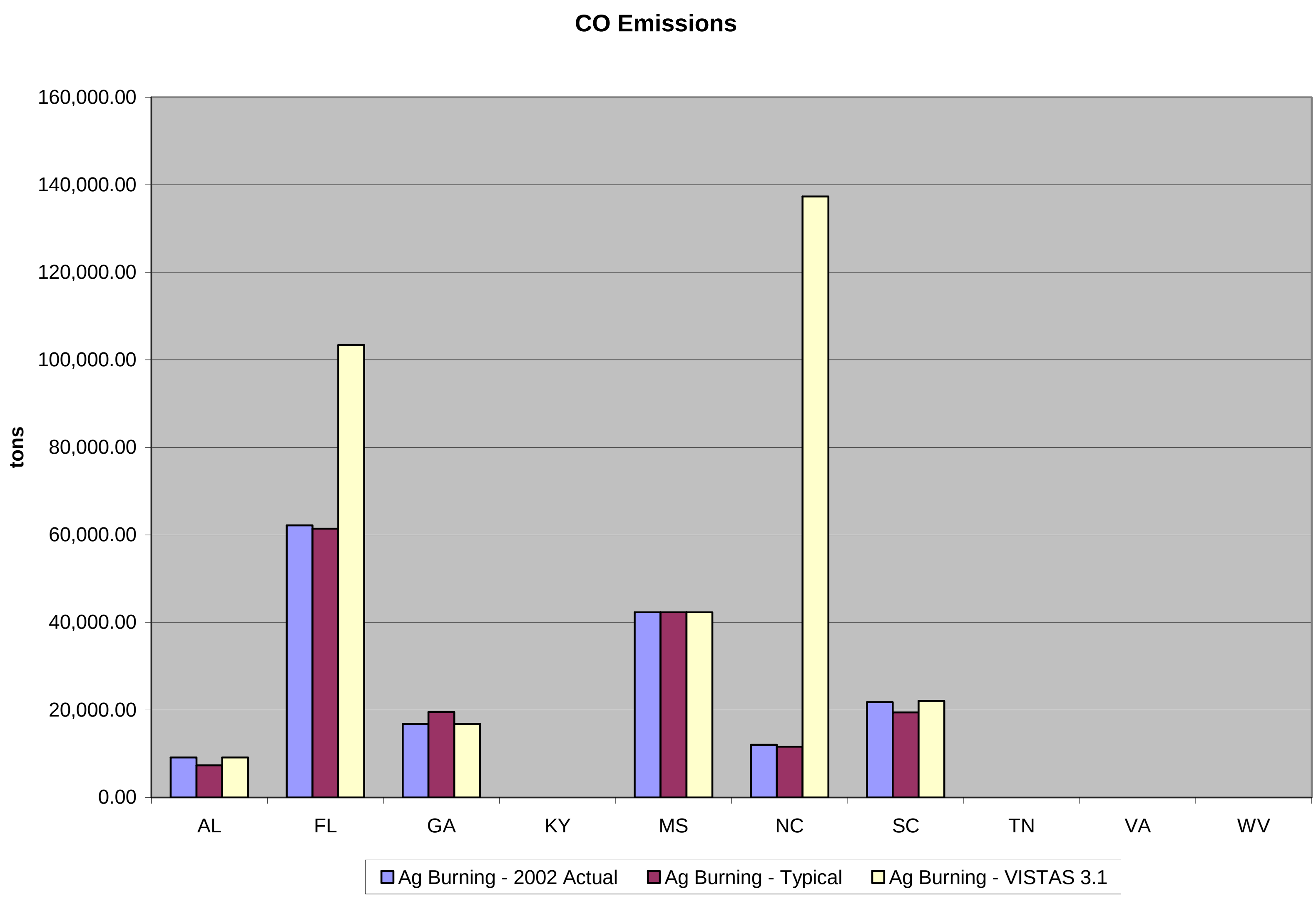


Figure 1.2-2 CO Emissions from Land Clearing Burning for the Original Base Year, 2002 Actual Base G and 2002 Typical Base G Inventories.

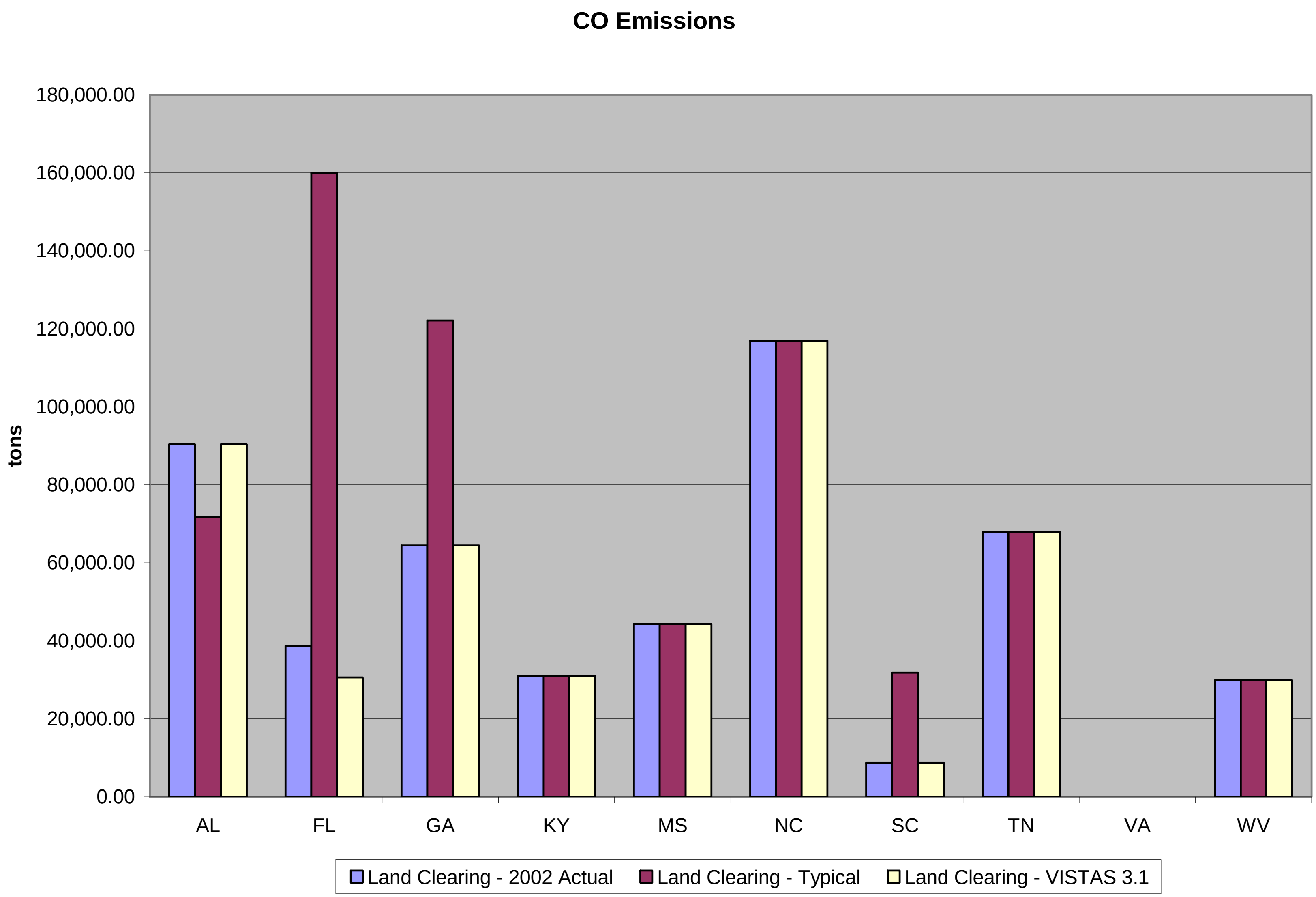


Figure 1.2-3 CO Emissions from Prescribed Burning for the Original Base Year, 2002 Actual Base G and 2002 Typical Base G Inventories.

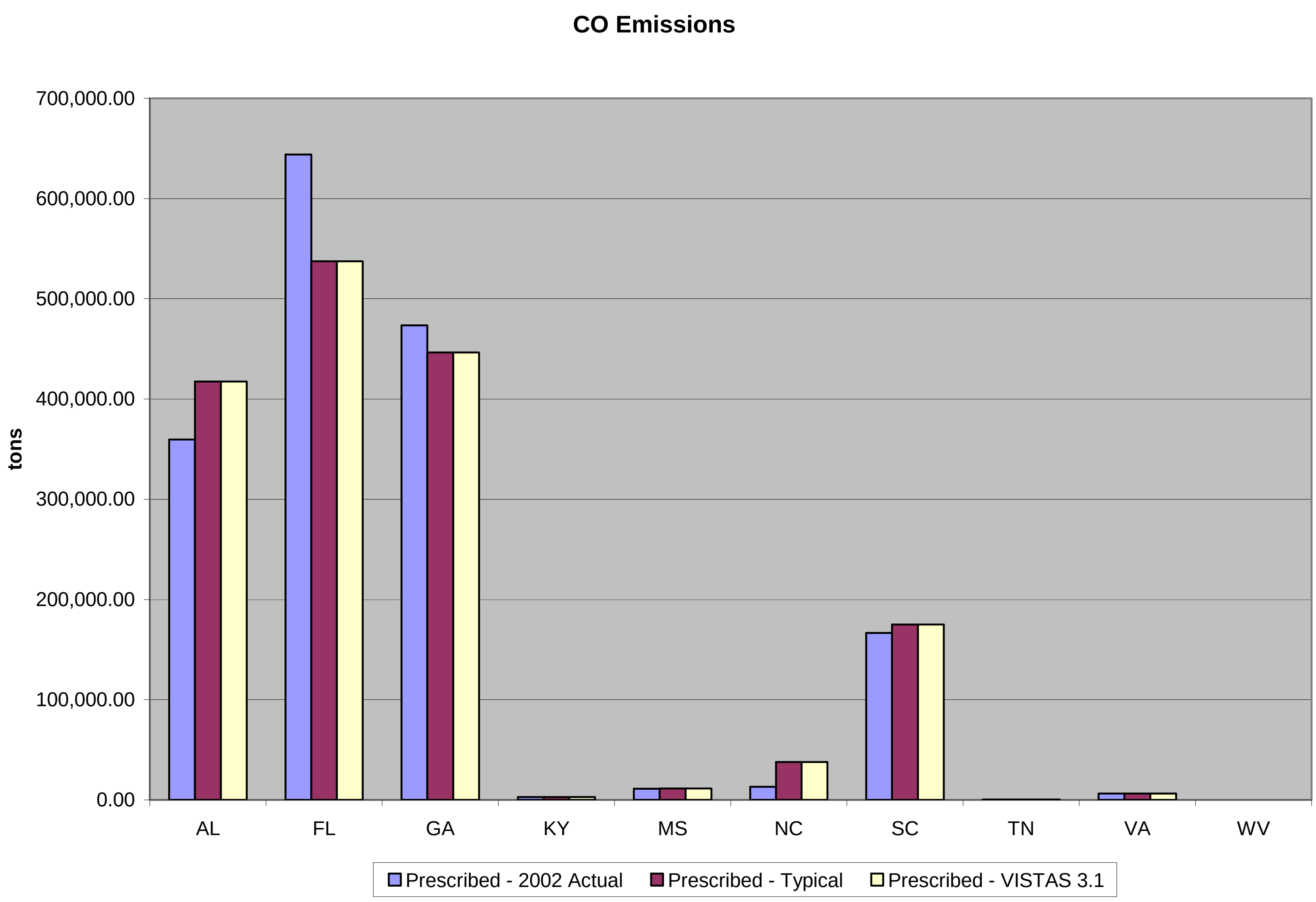
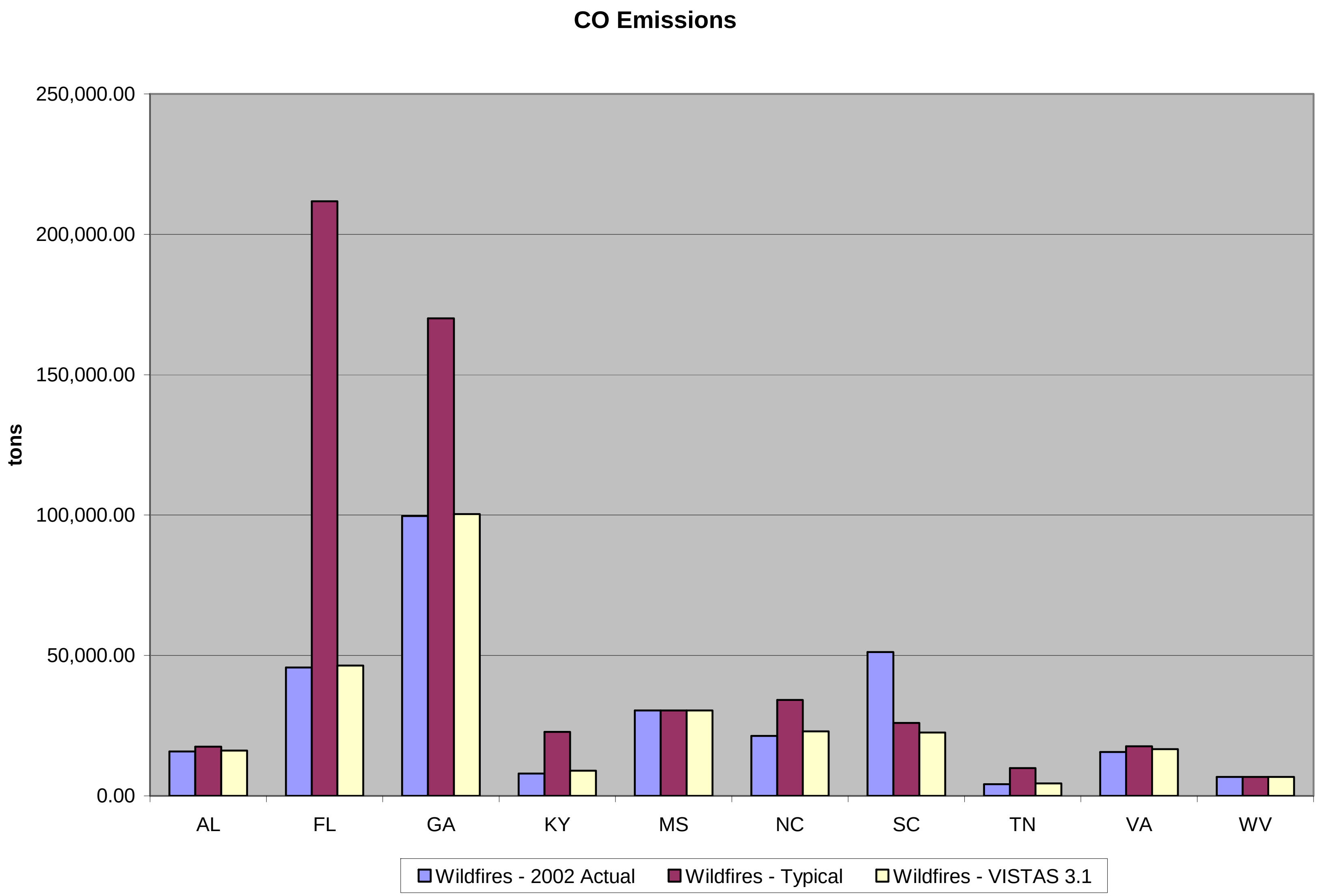


Figure 1.2-4 CO Emissions from Wildfire Burning for the Original Base Year, 2002 Actual Base G and 2002 Typical Base G Inventories.



1.2.2 Development of non-fire inventory

The second task in preparing the area source component of the Base F and Base G 2002 base year inventory was the incorporation of data submitted by the VISTAS States to the EPA as part of the CERR. With few exceptions, Base F and Base G inventories for this component of the inventory are identical. Modifications to the Base F methodology (described below) only resulted from modifications from the VISTAS States during review of the Base F inventory. The changes made to the inventory based on these reviews are described in the last portion of this section of the report. The information presented below describes the method used to incorporate CERR data as part of Base F.

Work on incorporating the CERR data into the 2002 Base F inventory involved: 1) obtaining the data from EPA, 2) evaluating the emissions and pollutants reported in order to avoid double counting and 3) backfilling from the earlier version of the VISTAS 2002 base year inventory for missing sources/pollutants. The processes used to perform those operations are described below. This work did not include any of the fire emission estimates described above. In addition it did not include emission estimates for ammonia from agricultural and fertilizer sources. Finally it did not include PM emissions from paved roads. Each of those categories was estimated separately.

Data on the CERR submittals was obtained from EPA’s Draft NEI download file transfer protocol (FTP) site where the data are stored after they’ve been processed for review. The data submitted in National Emission Inventory Format (NIF) was downloaded from that site. Once all of the files were obtained, MACTEC ran the files through the EPA NIF Format and Content checking tool to ensure that the files were submitted in standard NIF format and that there were no issues with those files. In a couple of cases small errors were found. For example, in one case a county FIPs code that was no longer in use was found. MACTEC contacted each VISTAS State area source contact person to resolve the issues with the files and corrections were made. Once all corrections to the native files were completed, MACTEC continued with the incorporation of the data into the VISTAS area source files.

Our general assumption was that unless we determined otherwise, the CERR submittals represented full and complete inventories. Where a State submitted a complete inventory, our plan was to simply delete the previous 2002 base year data and replace it with the CERR submittal. Prior to this replacement however, we stripped out the following emissions:

1. All wildfire, prescribed burning, land clearing and agricultural burning emissions submitted to EPA by the States as part of the CERR process were removed since they were to be replaced with emissions estimated using methods described earlier.
2. All fertilizer and agricultural ammonia emission records submitted to EPA by the States as part of the CERR process were removed. These were replaced with the estimates developed using the CMU Ammonia model.

3. All emissions from paved roads submitted to EPA by the States as part of the CERR process were removed. These emissions were replaced with updated emissions developed by U.S. EPA as part of their 2002 NEI development effort.

This approach was used for most State and Local emission submittals to prepare the Base F inventory. There were a few cases where alternative data were used to prepare the Base F inventory. In general, these alternatives involved submittal of alternative files to the CERR data by S/L agencies. Table 1.2-2 below summarizes the data used to prepare the Base F inventory. In general the data were derived from one of the following sources:

1. CERR submittal obtained from EPA FTP site as directed by VISTAS States;
2. State submitted file (either revised from CERR submittal or separate format);
3. VISTAS original 2002 base year (VISTAS version 3.1 base year file); or
4. EPA's preliminary 2002 NEI.

Table 1.2-2 Summary of State Data Submittals for the 2002 VISTAS Area Source Base F Inventory

State / Local Program	Area Source Emissions Data Source
AL	B
FL	B
GA	C
KY	A
MS	B
NC	C
SC	B
TN	B
VA	B
WV	A/C
Davidson County, TN	B
Hamilton County, TN	C
Memphis/Shelby County, TN	A
Knox County, TN	B
Jefferson County, AL	* so B from State
Jefferson County, KY	B
Buncombe County, NC	* so C from State
Forsyth County, NC	* so C from State
Mecklenburg County, NC	* so C from State

A = VISTAS 2002 (version 3.1)
B = CERR Submittal from EPA's ftp site
C = Other (CERR or other submittal sent directly from State to MACTEC)
* = No response

In order to track the sources of data in the final Base F and Base G NIF files, a field was added to the NIF format files developed for VISTAS to track each data source. A field named Data_Source was added to the EM table. A series of codes were added to this field to mark the source of each emissions value in the Base F and Base G inventories. Values in this field are detailed in Table 1.2-3.

Table 1.2-3 Data Source Codes and Data Sources for VISTAS 2002 Base F Area Source Emissions Inventory.

Data Source Codes	Data Source
Base F Codes	
CMU Model	CMU Ammonia model v 3.6
E-02-X or E-99-F or L-02-X or S-02-X	EPA CERR submittal (from FTP site)
EPA Paved	EPA Paved Road emissions estimates
EPAPRE02NEI	EPA Preliminary 2002 NEI
STATEFILE	State submitted file
VISTBASYR31	VISTAS 2002 Base Year version 3.1
VISTRATIO	Developed from VISTAS Ratios (used only for missing pollutants)
Additional Base G Codes	
ALBASEGFILE	Base G update file provided by AL
NCBASEGFILE	Base G update file provided by NC
OTAQRPT	Portable Fuel Container Emissions from OTAQ Report
STELLA	Revised data provided by VISTAS EI Advisor Greg Stella
VABASEGFILE	Base G update file provided by VA
VAStateFile	Revisions/additions to Base G update file provided by VA

Most States submitted complete inventories for Base F. Virginia's inventory required a two stage update. Virginia's CERR submittal only contained ozone precursor pollutants (including CO). For Virginia, MACTEC's original plan was to maintain the previous 2002 VISTAS base year emissions for non-ozone pollutants and then do a simple replacement for ozone pollutants. However during the QA phase of the work, MACTEC discovered that there were categories that had ozone precursor or CO emissions in the submittal that weren't in the original 2002 VISTAS base year inventory that should have PM or SO_2 emissions. For those records, MACTEC used an emissions ratio to build records for emissions of these pollutants. Data for Virginia PM and SO_2 emissions were generated by developing SCC level ratios to NO_x from the VISTAS 2002 base year inventory (version 3.1) or from emission factors and then calculating the emissions based on that ratio.

1.2.3 2002 Base G inventory updates

After the Base F inventory was submitted and used for modeling, VISTAS States were provided an opportunity for further review and comment on the Base F inventory. As a result of this review and comment period, several VISTAS States provided revisions to the Base F inventory.

In addition to and as an outgrowth of some of the comments provided by the States during the review process, some of the changes made to the inventory were made globally across the entire VISTAS region. This section discusses the specific State changes followed by the global changes made to the area source component of the inventory for all VISTAS States.

1.2.3.1 Changes resulting from State review and comment

<u>Alabama</u>

Alabama suggested several changes and had questions concerning a few categories in the Base F inventory. The changes/questions were:

1. For Source Classification Code (SCC) 2102005000 (Industrial Boilers: Residual Oil) and SCC 2103007000 (Institutional/Commercial Heating: Liquefied Petroleum Gas) the Alabama noted that the Base F VISTAS inventory had values for NO_x, VOC and CO for the State, but no values for SO_2, PM_{10} or $PM_{2.5}$.

MACTEC evaluated this information and found that there were actually emissions for two counties in AL for that SCC that had either SO_2 and/or PM emissions. The data used to develop the 2002 Base F inventory for AL came from the preliminary 2002 CERR submittals (see above) which should have included SO_2 and PM but did not except for two counties. According to MACTEC's protocol for use of these files, the files received from EPA were to be used "as is" unless the States provided comments during the Base F comment period to correct the CERR submittal. No comments were received from AL on the CERR submittal used for Base F. For 2002 Base G, AL provided an updated database file for these SCCs for all counties in the State that provided revised values for emissions and included SO_2 and PM. The revised file was used to update the Base F data for Base G.

2. AL noted that the Base F inventory included SCC 2401002000 (Solvent Utilization, Surface Coating, Architectural Coatings - Solvent-based, Total: All Solvent Types) and 2401003000 (Solvent Utilization, Surface Coating,

Architectural Coatings - Water-based, Total: All Solvent Types) as well as SCC 2401001000 (Solvent Utilization, Surface Coating, Architectural Coatings, Total: All Solvent Types). This resulted in double counting of the emissions for this category. AL suggested removal of the breakdown SCCs and use of the total SCC.

MACTEC deleted records for the breakdown SCCs and retained the total all solvents SCC emissions.

3. AL found the SCCs listed below missing from the Base F VISTAS inventory.

SCC	VOC Emissions	SCC Description
2401025000	1139.91	Surface Coatings: Metal Furniture, all coating types
2401030000	425.27	Surface Coatings: Paper, all coating types
2401065000	344.08	Surface Coatings: Electronic and Other Electrical, all coating types
2430000000	504.29	Solvent Utilization, Rubber/Plastics, All Processes, Total: All Solvent Types
2440020000	3043.78	Solvent Utilization, Miscellaneous Industrial, Adhesive (Industrial) Application, Total: All Solvent Types
Total for AL	5457.32	

MACTEC found that the emissions for these SCCs were included in the Base F inventory, but with slightly different total emissions. AL provided an updated county-level emissions file for use in updating the Base G inventory. That file was used to update the NIF records for AL for those SCCs.

4. AL noted that emissions in the Base F inventory were found for SCC 2465000000 and SCCs 2465100000, 2465200000, 2465400000, 2465600000, and 2465800000. These last five SCCs represent a subset of the emissions in the 246500000 SCC resulting in potential double counting of emissions.

MACTEC deleted all emissions associated with the Total SCC 2465000000 and retained the subset SCCs for the Base G inventory.

Florida

Florida provided comments indicating that they felt that emissions from the following sources and counties were too high, especially for CO and PM and were likely zero:

- motor vehicle fire - Palm Beach County
- woodstoves - Miami Dade, Hillsborough, Orange, Polk, Ft Myers, Pasco and Sarasota Counties
- fireplaces - Miami Dade and Hillsborough Counties

Emissions from these sources in the counties specified were set to zero by MACTEC for the Base G inventory.

North Carolina

North Carolina provided corrected emission files for 2002 Base F. A text file with emission values was provided and used to update the Base F emissions to Base G. The updated emissions were applied directly to the Base F NIF file. The file provided was similar to the "EM" NIF table. An update query was used to update the data supplied in the text file to the Access database NIF file. All changes were implemented.

South Carolina

South Carolina had two issues concerning the Base F inventory. These issues related to 1) additional SCCs that were in BASE F 2009 and 2018, but not in 2002 Base F and 2) SCCs that were in the U.S. EPA 2002 NEI inventory, but not in the VISTAS 2002, 2009, or 2018 Base F inventory.

MACTEC investigated the additional SCCs found in 2009 and 2018 Base F and found that the SCCs actually were not missing in the 2002 Base F inventory but only had emissions for PM. Thus the emissions were maintained as they were provided in Base F.

With respect to the SCCs that were found in the U.S. EPA 2002 NEI, MACTEC investigated and found that they were not included in the Base F inventory because they were not included in the 2002 CERR submittal used to produce the Base F updates. The SCCs were apparently added by EPA later in the NEI development process. In addition, MACTEC also evaluated whether or not the SCCs were found in other VISTAS States Base F inventories. MACTEC found that some States included them and some did not, there was no consistency between the States. MACTEC also found that typically emissions for these SCCs were low in emissions, generally with emissions of only a few tons to tens of tons per year. The decision was made with South Carolina concurrence not to add these SCCs to the Base G inventory. These SCCs were: 210205000, 2102011000, 2103007000, 2103011000, 2104007000, 2104011000, 2302002100, 2302002200, 2302003100, 2302003200, 2610000500, 2810001000, and 281001500.

Virginia

Virginia provided an updated 2002 base year emissions file. The data in that file were used to update the Base F inventory emission values to those for Base G. In addition, Virginia provided information on several source categories that required controls for future year projections since the sources were located in counties/cities in northern Virginia and were subject to future year Ozone Transport Commission (OTC) regulations. MACTEC added in the base year control levels to the Base G inventory file for these categories so that they could be estimated correctly in future years. The controls added were for mobile equipment repair/refinishing sources, architectural and industrial maintenance coating sources, consumer products sources, and solvent metal cleaning sources. Minor errors were found in some entries for the initial file provided and VA provided a revised file with corrections and minor additions.

1.2.4 Ammonia and paved road emissions

The final component of the Base F inventory development was estimation of NH_3 emission estimates for livestock and fertilizers and paved road PM emissions. For the NH_3 emission estimates for livestock and fertilizers we used version 3.6 of the CMU NH_3 model (http://www.cmu.edu/ammonia/). Results from this model were used for all VISTAS States. The CMU model version 3.6 was used in large part because it had been just recently been updated to include the latest (2002) Census of Agriculture animal population statistics. Prior to inclusion of the CMU model estimates, MACTEC removed any ammonia records for agricultural livestock or fertilizer emissions from the VISTAS 2002 initial base year inventory. MACTEC also generated emissions from human perspiration and from wildlife using the CMU model and added those emissions for each State.

For the Base G ammonia inventory, MACTEC removed all wildlife and human perspiration emissions. VISTAS decided to remove these emissions from the inventory. Human perspiration was dropped due to a discrepancy in the units used for the emission factor that was not resolved prior to preparing the estimates and wildlife was dropped because VISTAS felt the activity data was too uncertain. Thus all emissions from these two categories were deleted in the Base G 2002 inventory.

For the paved road PM Base F emissions, we used the most recent estimates developed by EPA as part of the NEI development effort (Roy Huntley, U.S. EPA, email communication, 8/30/2004). EPA had developed an improved methodology for estimating paved road emissions for 2002 and had used that method to calculate emissions for that source category. MACTEC obtained those emissions from EPA and those values were substituted directly into the inventory after receiving consensus from all of the VISTAS States to perform the replacement. These files were obtained in March of 2005 in NIF format from the EPA FTP site.

For the Base G emissions, modifications were made to the emissions estimates based on changes suggested by work of the Western Regional Air Partnership and U.S. EPA. Details of these changes are provided below in the section on global changes made as part of the Base G inventory updates.

1.2.5 Global Changes Made for Base G

There were three global changes made between the Base F and the Base G inventory (beyond the removal of wildlife and human perspiration NH_3 emissions). These changes were:

1. Removal of Stage II emissions from the area source inventory and inclusion in the mobile sector of the inventory,
2. Adjustment of fugitive dust $PM_{2.5}$ emissions, and
3. Addition of emissions from portable fuel containers.

As part of the Base F review process, several VISTAS States had expressed surprise that the Stage II refueling emission estimates were in the area source component of the inventory. This decision had been made with SIWG agreement early on in the inventory development process because 1) some States had included it in their CERR submittals and 2) because the non-road and on-road mobile estimates had differing activity factor units and could not be easily combined. However for Base G, the VISTAS States all agreed, especially in light of the different ways in which the emissions were reported in the CERR, to remove the Stage II refueling emissions from the area source inventory and include them in the non-road and on-road sectors. Thus all records related to Stage II refueling were removed from the area source component of the Base G inventory.

$PM_{2.5}$ emissions from several fugitive dust sources were also updated for Base G. The Western Regional Air Partnership (WRAP) and U.S. EPA had been investigating overestimation of the $PM_{2.5}$ / PM_{10} ratio in several fugitive dust categories and U.S. EPA was in the process of making revisions to AP-42 for several categories during preparation of the Base G inventory. Based on data received from U.S. EPA, VISTAS decided to revise the $PM_{2.5}$ emissions from construction, paved roads and unpaved road sources. $PM_{2.5}$ emissions in Base F were multiplied by 0.67, 0.6, and 0.67 for construction, paved roads and unpaved roads respectively to produce the values found in Base G. No changes were made to PM_{10}, only to $PM_{2.5}$.

Finally, as part of Virginia's comments on the Base F inventory, emissions from portable fuel containers were mentioned as being absent from the inventory. MACTEC was tasked with developing a methodology that could be used to add these emissions to the Base G area source inventory. In investigating options for a method of estimating emissions, MACTEC found that the U.S. EPA had prepared a national inventory of emissions by State for portable fuel containers. Data on emissions from this source prepared by U.S. EPA were presented in, "Estimating Emissions Associated with Portable Fuel Containers (PFCs), Draft Report, Office of Transportation and Air Quality, United States Environmental Protection Agency, Report # EPA420-D-06-003, February 2006".

State-level emission estimates for 2005 derived from Appendix Table B-2 of the PFCs report were used as the starting point for developing 2002 county-level emissions estimates. State emissions were derived from that table by using all of the emission estimates in that table with the exception of values for vapor displacement and spillage from refueling operations. Those components of the State emissions were left out of the State-level emissions to avoid double counting refueling emissions in the non-road sector. For the purposes of 2002 emission estimates for Base G, the 2005 values were assumed equal to 2002 values.

The 2005 State-level estimates minus the refueling component from Appendix Table B-2 of the report were summed for each State and then allocated to the county-level. The county-level allocation was based on the fuel usage information obtained from the NONROAD 2005 model runs conducted as part of the Base G inventory development effort (see the 2002 base year Base G non-road section below). MACTEC used the spillage file from the NONROAD model (normally located in the DATA\EMSFAC directory in a standard installation of NONROAD) to determine the SCCs that used containers for refueling. The spillage file contains information by SCC and horsepower indicating whether or not the refueling occurs using a container or a pump. All SCC and horsepower classes using containers were extracted from the file and cross-referenced with the fuel usage by county for those SCC/horsepower combinations from the appropriate year model runs (2002, 2009 or 2018). Then the fuel usages by county from the NONROAD 2005 runs prepared for VISTAS were summed for those SCCs by county. The county level fuel use was then divided by the State total fuel use for the same SCCs to determine the fraction of total State fuel usage and that fraction was used to allocate the State-level emissions to the county.

1.2.6 Quality Assurance steps

Throughout the inventory development process, quality assurance steps were performed to ensure that no double counting of emissions occurred, and to ensure that a full and complete inventory was developed for VISTAS. Quality assurance was an important component to the inventory development process and MACTEC performed the following QA steps on the area source component of the 2002 Base F inventory:

1. All CERR and NIF format State supplied data submittals were run through EPA's Format and Content checking software.

2. SCC level emission summaries were prepared and evaluated to ensure that emissions were consistent and that there were no missing sources.
3. Tier comparisons (by pollutant) were developed between the revised 2002 base year inventory and the previous (version 3.1) base year inventory.
4. Fields were either added or used within each NIF data table to track the sources of data for each emission record.
5. Data product summaries were provided to both the VISTAS Emission Inventory Technical Advisor and to Area Source and Fires SIWG representatives for review and comment. Changes based on these comments were implemented in the files.
6. Version numbering was used for all inventory files developed. The version numbering process used a decimal system to track major and minor changes. For example, a major change would result in a version going from 1.0 to 2.0. A minor change would cause a version number to go from 1.0 to 1.1. Minor changes resulting from largely editorial changes would result in a change from 1.00 to 1.01.

In addition, for the fires inventory, data related to fuel loading and fuel consumption was reviewed and approved by the VISTAS Fire SIWG to ensure that values used for each type of fire and each individual fire were appropriate. Members of the VISTAS Fire SIWG included representatives from most State Divisions of Forestry (or equivalent) as well as U.S. Forest Service and National Park Service personnel.

For Base G, similar QA steps to those outlined above for Base F were undertaken. In addition, all final NIF files were checked using the EPA Format and Content checking software and summary information by State and pollutant were prepared comparing the Base F and Base G inventories.

1.3 Mobile Sources

This section describes the revisions made to the initial 2002 VISTAS Base Year emission inventory on-road mobile source input files. For this work actual emission estimates were not made, rather data files consistent with Mobile Emissions Estimation Model Version 6 (MOBILE6) were developed and provided to the VISTAS modeling contractor. These input data files were then run during the VISTAS modeling to generate on-road mobile source emissions using episodic and meteorological specific conditions configured in the sparse matrix operator Kernel Emissions modeling system (SMOKE) emissions processor.

During initial discussions with the VISTAS Mobile Source SIWG, some States indicated a desire to use CERR mobile source emissions data in place of the VISTAS 2002 inventories generated by E.H. Pechan and Associates, Inc. (the initial VISTAS 2002 Base Year inventory files).

However, the CERR emissions data by itself were not sufficient for an inventory process that includes both base and future year inventories. MACTEC needed to be able to replicate the CERR data rather than simply obtain CERR emissions estimates. The reason for this is that only input files were being prepared to provide revised 2002 estimates during the VISTAS modeling process, rather than the actual emission estimates and that the 2002 input data files would be used as a starting point for the projected emission estimates. This meant that the appropriate vehicle miles traveled (VMT), MOBILE6, and/or NONROAD model input data needed to be provided. If these data were provided with the CERR emissions estimates we used it as the starting point for revision of the 2002 Base Year inventory. However MACTEC did not have access to the on-road mobile CERR submissions from EPA, so re-submittal of these data directly to MACTEC was requested in order to begin compiling the appropriate input file data.

In those cases where States did not provide CERR on-road mobile source input data files, our default approach was to maintain the data input files and VMT estimates for the initial 2002 Base Year inventory prepared by Pechan.

1.3.1 Development of on-road mobile source input files and VMT estimates

Development of the 2002 on-road input files and VMT was a multi-step process depending upon what the State mobile source contacts instructed us to use as their data. Information provided below provides incremental revisions made to on-road mobile source inventories or inputs in series from one inventory version to the next. In general the process involved one of three steps from the original 2002 on-road mobile source data.

Base F Revisions

1. The first step was to evaluate the initial 2002 base year files and make any non-substantive changes (i.e., changes only to confirm that the files posted for 2002 by Pechan were executable and that all the necessary external files needed to run MOBILE6 were present). This approach was taken for AL, FL, GA, MS, SC, and WV. For these States the determination was made that the previous files would be okay to use as originally prepared. For SC, the VMT file was updated, but that did not affect the MOBILE6 input files.

2. For other States, modification to the input files was required. The information below indicates what changes were made for other States in the VISTAS region.

KY – For Kentucky, the Inspection and Maintenance (I/M) records in the input files for Jefferson County were updated in order to better reflect the actual I/M program in the Louisville metropolitan area.

NC - Substantial revisions were implemented to these input files based on input from the State. The modifications necessary to reflect the desires of the State led to complete replacement of the previous input files. Among the changes made were:

- The regrouping of counties (including the movement of some counties from one county group to another and the creation of new input files for previously grouped counties). There were originally 32 input files; after the changes there were 49. The pointer file was corrected to reflect these changes.
- Travel speeds were updated in over 3000 scenarios.
- All I/M records were updated.
- All registration distributions were updated.
- I/M VMT fractions were updated (which only affected the pointer file).
- VMT estimates were updated (which has no direct effect on the MOBILE6 input files but does ultimately affect emissions).

3. VA and TN – For these States, new input files were provided due to substantive changes that the State wanted to make relative to the 2002 initial base year input files. In addition, revised VMT data were developed for each State.

Base G Revisions

For the production of the VISTAS 2002 Base G inventory, VISTAS states reviewed the Base F inputs, and provided corrections, updates and supplemental data.

For all states modeled, the Base G updates include:

Adding Stage II refueling emissions calculations to the SMOKE processing.

Revised the HDD compliance for all states. (REBUILD EFFECTS = .1)

In addition to the global changes, individual VISTAS states made the following updates:

KY – updated VMT and M6 input values for selected counties.

NC – revised VMT and registration distributions.

TN - revised VMT and vehicle registration distributions for selected counties.

VA – revised winter RFG calculations in Mobile 6 inputs.

WV – revised VMT input data.

AL, FL, and GA did not provide updates for Base G and therefore the Base F inputs were used for these States.

1.3.1.1 Emissions from on-road mobile sources

The MOBILE6 module of the Sparse Matrix Operator Kernel Emissions (SMOKE) model was used to develop the on-road mobile source emissions estimates for CO, NO_X, NH_3, SO_2, PM, and VOC emissions. The MOBILE6 parameters, vehicle fleet descriptions, and VMT estimates are combined with gridded, episode-specific temperature data to calculate the gridded, temporalized emission estimates. The MOBILE6 emissions factors are based on episode-specific temperatures predicted by the meteorological model. Further, the MOBILE6 emissions factors model accounts for the following:

- Hourly and daily minimum/maximum temperatures;
- Facility speeds;
- Locale-specific inspection/maintenance (I/M) control programs, if any;
- Adjustments for running losses;
- Splitting of evaporative and exhaust emissions into separate source categories;
- VMT, fleet turnover, and changes in fuel composition and Reid vapor pressure (RVP).

The primary input to MOBILE6 is the MOBILE shell file. The MOBILE shell contains the various options (e.g. type of inspection and maintenance program in effect, type of oxygenated fuel program in effect, alternative vehicle mix profiles, RVP of in-use fuel, operating mode) that direct the calculation of the MOBILE6 emissions factors. The shells used in these runs were based on VISTAS Base F modeling inputs as noted in the previous section.

For this analysis, the on-road mobile source emissions were produced using selected weeks (seven days) of each month and using these days as representative of the entire month. This selection criterion allows for the representation of day-of-the-week variability in the on-road motor vehicles, and models a representation of the meteorological variability in each month. The modeled weeks were selected from mid-month, avoiding inclusion of major holidays.

The parameters for the SMOKE runs are as follows:

Episodes:

2002 Initial Base Year, and

2009 and 2018 Future years, using 2009/2018 inventories and modeled using the same meteorology and episode days as 2002.

Episode represented by the following weeks per month:

January 15-21
February 12-18
March 12-18
April16-22
May 14-20
June 11-17
July 16-22
August 13-19
September 17-23
October 15-21
November 12-18
December 17-23

Days modeled as holidays for annual run:

New Year's Day - January 1
Good Friday – March 29
Memorial Day – May 27
July 4th
Labor Day – September 2
Thanksgiving Day – November 28, 29
Christmas Eve – December 24
Christmas Day – December 25

Output time zone:

Greenwich Mean Time (zone 0)

Projection:

Lambert Conformal with Alpha=33, Beta=45, Gamma=-97, and center at (-97, 40).

Domain:

36 Kilometer Grid: Origin at (-2736, -2088) kilometers with 148 rows by 112 columns and 36-km square grid cells.
12 Kilometer Grid: Origin at (108, -1620) kilometers with 168 rows by 177 columns and 12-km square grid cells.

CMAQ model species:

The CMAQ configuration was CB-IV with PM. The model species produced were: CO, NO, NO_2, ALD_2, ETH, FORM, ISOP, NR, OLE, PAR, TERPB, TOL, XYL, NH_3, SO_2, SULF, PEC, PMFINE, PNO_3, POA, PSO_4, and PMC.

Meteorology data:

Daily (25-hour). SMOKE requires the following five types of MCIP outputs: (1) Grid cross 2-d, (2) Grid cross 3-d, (3) Met cross 2-d, (4) Met cross 3-d, and (5), Met dot 3-d.

The reconstructed emissions based on the representative week run were calculated by mapping each day of week (Mon, Tue, Wed, etc.) from the modeled month to the same day of week generated in the representative week run. In the case of holidays, these days were mapped to representative week Sundays. An example of this mapping for the January episode is presented in Table 1.3-1 below. Note that although the emissions were generated for individual calendar years (2002, 2009 and 2018) the meteorology is based on 2002.

Table 1.3-1 Representative day mapping for January episode

(Highlighted representative week)

Modeled Date	Representative Day	Modeled Date	Representative Day	Modeled Date	Representative Day
1/1/2002*	1/20/2002	1/11/2002	1/18/2002	1/22/2002	1/15/2002
1/2/2002	1/16/2002	1/12/2002	1/19/2002	1/23/2002	1/16/2002
1/3/2002	1/17/2002	1/13/2002	1/20/2002	1/24/2002	1/17/2002
1/4/2002	1/18/2002	1/14/2002	1/21/2002	1/25/2002	1/18/2002
1/5/2002	1/19/2002	1/15/2002	1/15/2002	1/26/2002	1/19/2002
1/6/2002	1/20/2002	1/16/2002	1/16/2002	1/27/2002	1/20/2002
1/7/2002	1/21/2002	1/17/2002	1/17/2002	1/28/2002	1/21/2002
1/8/2002	1/15/2002	1/18/2002	1/18/2002	1/29/2002	1/15/2002
1/9/2002	1/16/2002	1/19/2002	1/19/2002	1/30/2002	1/16/2002
1/10/2002	1/17/2002	1/20/2002	1/20/2002	1/31/2002	1/17/2002
		1/21/2002	1/21/2002		

* Modeled holiday

1.3.2 Development of non-road emission estimates

Emissions from non-road sources were estimated in two steps. First, emissions for non-road sources that are included in the NONROAD model were developed. Second, emissions from sources not included in the NONROAD model were estimated. The sections below detail the procedures used for each group of sources.

1.3.2.1 Emissions from NONROAD model sources

An initial 2002 base year emissions inventory for non-road engines and equipment covered by the EPA NONROAD model was prepared for VISTAS in early 2004. The methods and assumptions used to develop the inventory are presented in a February 9, 2004 report "*Development of the VISTAS Draft 2002 Mobile Source Emission Inventory (February 2004 Version)*" as prepared by E.H. Pechan & Associates, Inc. Except as otherwise stated below, all aspects of the preparation methodology documented in that report continue to apply to the revised NONROAD modeling discussed in this section.

Revisions to the initial 2002 NONROAD emissions inventory were implemented to ensure that the latest State and local data were considered, as well as to more accurately reflect gasoline sulfur contents for 2002 and correct other State-specific discrepancies. Those revisions comprise the Base F VISTAS non-road inventory. This section details the specific revisions made to the NONROAD model input files for the Base F and Base G VISTAS base year inventories, and provides insight into some key differences between the versions of the NONROAD model employed for the Base F and Base G inventories and the previous version employed for the initial 2002 base year inventory prepared by Pechan.

Revisions to the initial 2002 emissions inventory prepared by Pechan were actually implemented in two stages. An initial set of revisions was implemented in the fall of 2004. Those revisions resulted in the Base F inventory. These were followed by a second set of revisions in the spring of 2006. Those estimates produced the Base G base year inventory. To accurately document the combined effects of both sets of revisions, each set is discussed separately below. Unless otherwise indicated, all revisions implemented in Base F were carried directly into the Base G revision process without change. Thus, the inventories that resulted from the Base F revisions served as the starting point for the Base G revisions.

For Base F, three VISTAS States provided detailed data revisions for consideration in developing revised model inputs. These States were:

1. North Carolina
2. Tennessee (including a separate submission for Davidson County), and
3. Virginia.

The remaining seven VISTAS States indicated that the initial 2002 VISTAS input files prepared by Pechan continued to reflect the most recent data available. These States were:

1. Alabama,
2. Florida,
3. Georgia,
4. Kentucky,
5. Mississippi,
6. South Carolina, and
7. West Virginia.

However, it should be recognized that the NONROAD input files for *all* ten VISTAS States were updated to reflect gasoline sulfur content revisions for the Base F 2002 base year inventory (as discussed below). The original files prepared by Pechan are available on their FTP site in the /pub/VISTAS/MOB_0104/ directory.

Before presenting the specific implemented revisions, it is important to note that the Base F 2002 base year inventory utilized a newer release of the NONROAD model than was used for the initial 2002 base year inventory (prepared by Pechan). The Base F 2002 base year inventory, as developed in spring 2004, was based on the Draft NONROAD2004 model, which was released by the EPA in May of 2004. This model is no longer available on EPA's website. The initial 2002 base year inventory (prepared by Pechan) was based on the Draft NONROAD2002a version of the model (which is also no longer available on EPA's website). Key differences between the models are as follows:

- Draft NONROAD2004 included the effects of the Tier 4 non-road engine and equipment standards (this did not impact the Base F 2002 inventory estimates, but did affect Base F future year forecasts).
- Draft NONROAD2004 included the *exhaust* emission impacts of the large spark-ignition engine standards; the evaporative impacts of these standards are *not* incorporated (this does not impact 2002 inventory estimates, but does affect future year forecasts).
- Draft NONROAD2004 included revised equipment population estimates.
- The $PM_{2.5}$ fraction for *diesel* equipment in Draft NONROAD2004 had been updated from 0.92 to 0.97.
- Draft NONROAD2004 included revisions to recreational marine activity, useful life, and emission rates.

To the extent that these revisions affect 2002 emissions estimates, they will be reflected as differentials between the initial and Base F 2002 VISTAS base year inventories. It is perhaps important to identify that, at the time of the Base F inventory revisions; the EPA recognized the Draft NONROAD2004 model as an appropriate mechanism for SIP development. Although the model was designated as a draft update, it reflected the latest and most accurate NONROAD planning data at that time, as evidenced by the EPA's use of that version for the Tier 4 Final Rulemaking.

Prior to the Base G inventory revisions implemented in 2006, the EPA released another updated version of the NONROAD model, designated as Final NONROAD2005 (which can be downloaded from: http://www.epa.gov/OMSWWW/nonrdmdl.htm#model). This version ostensibly represents the final version of the model, although certain components of it have been updated since its first release in December 2005. For the Base G inventory developed in the first half of 2006, all updates of the Final NONROAD2005 model through March 2006 are included. Key differences between Final NONROAD2005 and Draft NONROAD2004 are as follows:

- Final NONROAD2005 reflects the latest basic emission rate and deterioration data.
- Final NONROAD2005 includes emission estimates for a range of evaporative emissions categories not included in Draft NONROAD2004 (tank and hose permeation, hot soak, and running loss emissions).
- Final NONROAD2005 includes a revised diurnal emissions algorithm.
- Final NONROAD2005 includes a revised equipment scrappage algorithm.
- Final NONROAD2005 includes revised state and county equipment allocation data.
- Final NONROAD2005 allows separate sulfur content inputs for marine and land-based diesel fuel.
- Final NONROAD2005 includes revised conversion factors for hydrocarbon emissions.
- Final NONROAD2005 includes the evaporative emission impacts of the large spark-ignition engine standards (this does not impact 2002 inventory estimates, but does affect future year forecasts).

Unfortunately, due to the extensive revisions associated with Final NONROAD2005, input files created for use with Draft NONROAD2004 (e.g., Base F input files) and earlier versions of the model cannot be used directly with Final NONROAD2005 (used for Base G). This created a rather significant impact in that the VISTAS NONROAD modeling process involves the consideration of over 200 unique sets of input data. To avoid creating new input files for each of these datasets, a conversion process was undertaken wherein each of the Draft NONROAD2004 (Base F) input data files were converted into the proper format required for proper execution in Final NONROAD2005 (Base G).[1] This process consisted of the following steps:

- Revise the Draft NONROAD2004 (Base F) input files to include the following two line EPA-developed comment at the end of the input file header (this is a nonsubstantive change implemented solely for consistency with input files produced directly using Final NONROAD2005):

[1] The necessary conversions where developed by comparing substantively identical input files created using the graphical user interfaces for both Draft NONROAD2004 and Final NONROAD2005. The differences between the input files indicated the specific revisions necessary to convert existing VISTAS input files into Final NONROAD2005 format.

```
9/2005 epa: Add growth & tech years to OPTIONS packet
 and Counties & Retrofit files to RUNFILES packet.
```

- Revise the Draft NONROAD2004 (Base F) input files to include the following two command lines after the "Weekday or weekend" command in the PERIOD packet:

```
Year of growth calc:
Year of tech sel   :
```

- Revise the Draft NONROAD2004 (Base F) input files to include the following command line after the "Diesel sulfur percent" command in the OPTIONS packet:

```
Marine Dsl sulfur %: 0.2638
```

Note that the value 0.2638 (2638 parts per million by weight [ppmW]) is applicable only for 2002 modeling and was accordingly revised (as described below) for both the 2009 and 2018 Base G forecast inventories. The 2638 ppmW sulfur value for 2002 marine diesel fuel was taken from the 48-State (excludes Alaska and Hawaii) tabulation presented in the April 27, 2004 EPA document "*Diesel Fuel Sulfur Inputs for the Draft NONROAD2004 Model used in the 2004 Non-road Diesel Engine Final Rule*." It should also be noted that this value differs by about 5 percent from the 2500 ppmW value previously used for the initial 2002 VISTAS modeling (performed by Pechan). Prior to Final NONROAD2005 (used for Base G), the NONROAD model allowed only a single diesel fuel sulfur input that was applied to both land-based and marine equipment. As documented in the February 9, 2004 report "*Development of the VISTAS Draft 2002 Mobile Source Emission Inventory (February 2004 Version)*" as prepared by E.H. Pechan & Associates, Inc., a value of 2500 ppmW sulfur was used for all 2002 VISTAS NONROAD modeling. Given the ability of Final NONROAD2005 to distinguish a separate sulfur content for marine equipment and the existing EPA guidance document suggesting an appropriate marine sulfur value of 2638 ppmW for 2002, the existing modeling value of 2500 ppmW was modified (for marine equipment only).

- Replace the Draft NONROAD2004 (Base F) input files RUNFILES packet command line:

```
TECHNOLOGY     : c:\non-road\data\tech\tech.dat
```

with the command lines:

```
EXH TECHNOLOGY   : c:\non-road\data\tech\tech-exh.dat
EVP TECHNOLOGY   : c:\non-road\data\tech\tech-evp.dat
```

- Revise the Draft NONROAD2004 (Base F) input files to include the following two command lines after the "EPS2 AMS" command in the RUNFILES packet:

```
US COUNTIES FIPS  : c:\non-road\data\allocate\fips.dat
RETROFIT        :
```

- Revise the Draft NONROAD2004 (Base F) input files to include the following command line after the "Rec marine outbrd" command in the ALLOC FILES packet:

```
Locomotive NOx   : c:\non-road\data\allocate\XX_rail.alo
```

  Where "XX" varies across input files. For any given file, "XX" is the two digit abbreviation of the state associated with the scenario being modeled (e.g., for Alabama modeling, XX=AL).

- Replace the Draft NONROAD2004 (Base F) input files EMFAC FILES packet command line:

```
Diurnal      : c:\non-road\data\emsfac\diurnal.emf
```

  with the eight command lines:

```
Diurnal      : c:\non-road\data\emsfac\evdiu.emf
TANK PERM     : c:\non-road\data\emsfac\evtank.emf
NON-RM HOSE PERM  : c:\non-road\data\emsfac\evhose.emf
RM FILL NECK PERM : c:\non-road\data\emsfac\evneck.emf
RM SUPPLY/RETURN  : c:\non-road\data\emsfac\evsupret.emf
RM VENT PERM    : c:\non-road\data\emsfac\evvent.emf
HOT SOAKS     : c:\non-road\data\emsfac\evhotsk.emf
RUNINGLOSS     : c:\non-road\data\emsfac\evrunls.emfEVP
```

- Revise the Draft NONROAD2004 (Base F) input files to include the following command line after the "PM exhaust" command in the DETERIORATE FILES packet:

```
Diurnal      : c:\non-road\data\detfac\evdiu.det
```

Once revised in this format, the VISTAS non-road input files developed for use with Draft NONROAD2004 (Base F) were executable under the Final NONROAD2005 model (Base G).

The only additional revisions implemented to develop a Final NONROAD2005-based inventory (Base G) involved elimination of non-default equipment allocation files for North Carolina and West Virginia. Due to concerns about improper equipment allocation across counties under the Draft NONROAD2004 model (used for Base F), as well as for earlier versions of the NONROAD model, North Carolina had produced alternative allocation data files indicating the number of employees in air transportation by county, the number of wholesale establishments by county, and the number of employees in landscaping services by county. For the same reason, West Virginia had produced alternative equipment allocation files indicating the number of employees in air transportation by county, the tonnage of underground coal production by county, the number of golf courses and country clubs by county, the number of wholesale establishments by county, the number of employees in logging operations by county, the number of employees in landscaping services by county, the number of employees in manufacturing operations by county, the number of employees in oil and gas drilling and extraction operations by county, and the number of recreational vehicle parks and campgrounds by county. These alternative equipment allocation files were used for all VISTAS inventory modeling conducted prior to the release of Final NONROAD2005 (i.e., through Base F). However, both North Carolina and West Virginia determined that the default allocation file revisions associated with the release of Final NONROAD2005 were appropriate to address the concerns that led to the development of the alternative allocation files. As a result, all alternative allocation file commands were removed from VISTAS NONROAD2005 (Base G) input files for North Carolina and West Virginia, so that the entire region under the Base G inventory is now modeled using the default allocation files provided with NONROAD2005.

In addition to the alternative equipment allocation files, North Carolina had previously developed an alternative seasonal adjustment file that was used for the Base F inventory in place of the default file provided with Draft NONROAD2004 (and earlier model versions). The alternative data file implemented a single change, namely reclassifying North Carolina as a southeastern state rather than a mid-Atlantic state (as identified in the default data file). Since Final NONROAD2005 continues to identify North Carolina as a mid-Atlantic state, North Carolina requested that the southeastern reclassification be continued for all NONROAD2005 modeling (Base G). To ensure that any other revisions associated with the seasonal adjustment file released with NONROAD2005 were not overlooked, the previously developed alternative seasonal adjustment file for North Carolina was scrapped and a new alternative file was created from the default seasonal adjustment file provided with Final NONROAD2005 for Base G inventory development. The alternative file, which was used for all North Carolina modeling, reclassifies North Carolina from a mid-Atlantic to a southeastern state. This represents the only non-default data file used for VISTAS NONROAD2005-based (Base G) modeling.

The remainder of this section documents all changes to the originally established VISTAS input file values as documented in the February 9, 2004 report "*Development of the VISTAS Draft 2002 Mobile Source Emission Inventory (February 2004 Version)*" as prepared by E.H. Pechan & Associates, Inc. Unless specifically stated below, all values from that report continue to be used without change in the latest VISTAS modeling.

Base F Revisions:

For the initial 2002 base year inventory (developed by Pechan), all NONROAD modeling runs for VISTAS were performed utilizing a gasoline sulfur content of 339 ppmW and a diesel sulfur content of 2,500 ppmW. Although the EPA-recommended non-road diesel fuel sulfur content for 2002 is 2,283 ppmW, the 2,500 ppmW sulfur content used for the initial 2002 base year VISTAS inventory was designed to remove the effect of lower non-road diesel fuel sulfur limits applicable only in California. (The EPA recommended inputs can be found in "*Diesel Fuel Sulfur Inputs for the Draft NONROAD2004 Model used in the 2004 Non-road Diesel Engine Final Rule*," EPA, April 27, 2004.) This correction is appropriate and was retained for the Base F 2002 inventory. Thus, the Base F inventory continued to assume a diesel fuel sulfur content of 2,500 ppmW across the VISTAS region.

However, 339 ppmW is not the EPA recommended 2002 gasoline sulfur content for either eastern conventional gasoline areas or Federal Reformulated Gasoline (RFG) areas. The recommended sulfur content for eastern conventional gasoline is 279 ppmW year-round, while the recommended sulfur content for RFG areas is 129 ppmW during the summer season and 279 ppmW during the winter season. (Conventional gasoline and RFG sulfur contents for 2002 can be found in "*User's Guide to MOBILE6.1 and MOBILE6.2, Mobile Source Emission Factor Model*," EPA420-R-03-010, U.S. EPA, August 2003 [pages 149-155] (available at link at http://www.epa.gov/otaq/m6.htm) and in the source code for MOBILE6.2 at Block Data BD05.) Given the differences in the EPA-recommended values and the value used to generate the initial 2002 base year inventory, the input files for Base F for *all* VISTAS areas were updated to reflect revised gasoline sulfur content assumptions.

Since the VISTAS NONROAD modeling is performed on a seasonal basis, and since gasoline sulfur content in RFG areas varies with the RFG season, seasonally-specific gasoline sulfur content values were estimated for use in RFG area modeling. In addition, 25 counties in Georgia are subject to a summertime gasoline sulfur limit of 150 ppmW, so that seasonal sulfur content estimates were also estimated for these counties. The initial 2002 base year NONROAD inventory (prepared by Pechan) for these Georgia counties was based on a year-round 339 ppmW gasoline sulfur content, but that oversight was corrected in the Base F 2002 base year inventory. Based on the seasonal definitions employed in the NONROAD model, monthly sulfur contents were averaged to estimate seasonal gasoline sulfur contents as follows:

Month/Season	RFG Areas	Conventional Gasoline Areas	Georgia Gasoline Control Areas
March	279 ppmW	279 ppmW	279 ppmW
April	279 ppmW	279 ppmW	279 ppmW
May	129 ppmW	279 ppmW	150 ppmW
Spring	229 ppmW	279 ppmW	236 ppmW
June	129 ppmW	279 ppmW	150 ppmW
July	129 ppmW	279 ppmW	150 ppmW
August	129 ppmW	279 ppmW	150 ppmW
Summer	129 ppmW	279 ppmW	150 ppmW
September	129 ppmW	279 ppmW	150 ppmW
October	279 ppmW	279 ppmW	279 ppmW
November	279 ppmW	279 ppmW	279 ppmW
Fall	229 ppmW	279 ppmW	236 ppmW
December	279 ppmW	279 ppmW	279 ppmW
January	279 ppmW	279 ppmW	279 ppmW
February	279 ppmW	279 ppmW	279 ppmW
Winter	279 ppmW	279 ppmW	279 ppmW

Note that the seasonal data are based on simple arithmetic averages and do not consider any monthly variation in activity (and fuel sales), and that the transition between summer and winter seasons is also not considered. Additionally, the summer fuel control season is treated as though it applies from May through September, while the summer RFG season actually ends on September 15 and the Georgia fuel control season does not officially begin until June 1. This treatment is consistent with the treatment of both fuel control programs in the VISTAS on-road vehicle modeling. Each of these influences will result in some error in the estimated sulfur content estimates, but it is expected that this error is small relative to the overall correction from a year-round sulfur content estimate of 339 ppmW.

All NONROAD modeling revisions made as part of the Base F inventory preparation process are presented in Table 1.3-2. Due to more involved updates in several areas, the number of NONROAD input files as well as sequence numbers used to represent these files was also updated in a few instances (as compared to the files used to create the initial 2002 VISTAS non-road inventory, as documented in the February 9, 2004 report "*Development of the VISTAS Draft 2002 Mobile Source Emission Inventory (February 2004 Version)*" as prepared by E.H. Pechan & Associates, Inc. These structural revisions are presented in Table 1.3-3, and are provided solely for the benefit of NONROAD modelers as the indicated revisions have no impact on generated emission estimates.

Table 1.3-2 Summary of Base F NONROAD Modeling Revisions

State	Revisions Implemented
AL	(1) Gasoline sulfur content changed from 339 ppmW to 279 ppmW in all counties and all seasons (all are conventional gasoline areas).
FL	(1) Gasoline sulfur content changed from 339 ppmW to 279 ppmW in all counties and all seasons (all are conventional gasoline areas).
GA	(1) Gasoline sulfur content changed from 339 ppmW to 279 ppmW in all seasons for conventional gasoline counties. (2) Gasoline sulfur content changed from 339 ppmW to 150 ppmW in the summer for all gasoline control counties. (3) Gasoline sulfur content changed from 339 ppmW to 236 ppmW in the spring and fall for all gasoline control counties. (4) Gasoline sulfur content changed from 339 ppmW to 279 ppmW in the winter for all gasoline control counties. *Gasoline control counties: Barrow, Bartow, Butts, Carroll, Cherokee (a), Clayton (a), Cobb (a), Coweta (a), Dawson, De Kalb (a), Douglas (a), Fayette (a), Forsyth (a), Fulton (a), Gwinnett (a), Hall, Haralson, Henry (a), Jackson, Newton, Paulding (a), Pickens, Rockdale (a), Spalding, and Walton*
KY	(1) Gasoline sulfur content changed from 339 ppmW to 279 ppmW in all seasons for conventional gasoline counties. (2) Gasoline sulfur content changed from 339 ppmW to 129 ppmW in the summer for all gasoline control counties. (3) Gasoline sulfur content changed from 339 ppmW to 229 ppmW in the spring and fall for all gasoline control counties. (4) Gasoline sulfur content changed from 339 ppmW to 279 ppmW in the winter for all gasoline control counties. *Gasoline control counties: Boone, Bullitt (b), Campbell, Jefferson, Kenton, and Oldham (b)*
MS	(1) Gasoline sulfur content changed from 339 ppmW to 279 ppmW in all counties and all seasons (all are conventional gasoline areas).
NC	(1) Gasoline sulfur content changed from 339 ppmW to 279 ppmW in all counties and all seasons (all are conventional gasoline areas). (2) Utilize revised (i.e., local) allocation files for three equipment categories. (3) Utilize revised (i.e., local) seasonal activity data.
SC	(1) Gasoline sulfur content changed from 339 ppmW to 279 ppmW in all counties and all seasons (all are conventional gasoline areas).
TN	(1) Gasoline sulfur content changed from 339 ppmW to 279 ppmW in all counties and all seasons (all are conventional gasoline areas). (2) Gasoline Reid Vapor Pressure (RVP) values changed in accordance with local recommendations. (3) Temperature data changed in accordance with local recommendations. (4) Counties regrouped in accordance with local recommendations.

Table 1.3-2. Summary of Base F NONROAD Modeling Revisions (continued)

State	Revisions Implemented
VA	(1) Gasoline sulfur content changed from 339 ppmW to 279 ppmW in all seasons for conventional gasoline counties. (2) Gasoline sulfur content changed from 339 ppmW to 129 ppmW in the summer for all gasoline control counties. (3) Gasoline sulfur content changed from 339 ppmW to 229 ppmW in the spring and fall for all gasoline control counties. (4) Gasoline sulfur content changed from 339 ppmW to 279 ppmW in the winter for all gasoline control counties. (5) Gasoline RVP values changed in accordance with local recommendations. (6) Counties regrouped in accordance with local recommendations. (7) The control effectiveness for counties subject to Stage II controls revised to 77 percent in accordance with local recommendations. *Gasoline control counties: Arlington Co., Fairfax Co., Loudoun Co., Prince William Co., Stafford Co., Alexandria City, Fairfax City, Falls Church City, Manassas City, Manassas Park City, Chesterfield Co., Hanover Co., Henrico Co., Colonial Heights City, Hopewell City, Richmond City, James City, York Co., Chesapeake City, Hampton City, Newport News City, Norfolk City, Poquoson City, Portsmouth City, Suffolk City, Virginia Beach City, and Williamsburg City (c)*
WV	(1) Gasoline sulfur content changed from 339 ppmW to 279 ppmW in all counties and all seasons (all are conventional gasoline areas). (2) Continue to utilize local allocation files for nine equipment categories.

Notes:

(a) County is subject to local control currently, but is scheduled to join the RFG program in January 2005.
(b) Control area is a portion of the county, but modeling is performed as though the control applies countywide.
(c) The EPA also lists Charles City County as an RFG area, but local planners indicate that Charles City County is a conventional gasoline area and it is modeled as such.

Table 1.3-3 Base F NONROAD Input File Sequence and Structural Revisions

State	Initial 2002 Base Year Inventory Input File Sequence Numbers	Revised 2002 Inventory Input File Sequence Numbers	Reason(s) for Change	Number of Revised 2002 Inventory NONROAD Input Files
AL	01-08	01-08	No Structural Changes	32 (at 8 per season)
FL	09-10	09-10	No Structural Changes	8 (at 2 per season)
GA	11-13	11-13	No Structural Changes	12 (at 3 per season)
KY	14-22	14-22	No Structural Changes	36 (at 9 per season)
MS	48	48	No Structural Changes	4 (at 1 per season)
NC	23-25	23-25	No Structural Changes	12 (at 3 per season)
SC	26-32	26-32	No Structural Changes	28 (at 7 per season)
TN	33-34	33-34, 49-52	Counties Regrouped	24 (at 6 per season)
VA	35-43	35-38, 40-43	Counties Regrouped	32 (at 8 per season)
WV	44-47	44-47	No Structural Changes	16 (at 4 per season)
All	**01-48**	**01-38, 40-52**		**204 (at 51 per season)**

Note: (1) All files include internal revisions to reflect the data changes summarized in Table 1.3-3 above. This table is intended to present structural revisions that are of interest in assembling the NONROAD model input files into a complete VISTAS region inventory. The indicated revisions do not (in and of themselves) result in emission estimate changes.

(2) The NONROAD model imposes an eight digit input file name limit, so all input files for the revised 2002 base year inventory follow a modified naming convention to allow each to be distinguished from the input files for the initial 2002 base year inventory. For the initial 2002 base year inventory, the naming convention was:

ss02aaqq, where: ss = the two character State abbreviation,
aa = a two character season indicator as follows: AU = autumn, WI = winter, SP = spring, and SU = summer, and
qq = the two digit sequence number indicated above.

For the revised 2002 inventory, the naming convention was modified to:

ss02aFqq, where: ss = the two character State abbreviation,
a = a one character season indicator as follows: A = autumn, W = winter, S = spring, and X = summer, and
qq = the two digit sequence number indicated above.

Base G Revisions:

As described above, the primary modeling revision implemented for the Base G 2002 inventory was the use of the Final NONROAD2005 model (in place of the Base F use of Draft NONROAD2004). However, there were other minor revisions implemented for 13 Georgia counties and somewhat more significant revisions implemented for Tennessee. In Georgia, Stage II refueling control was assumed for 13 counties that previously were modeled as having no refueling control under Base F. In addition, to accommodate this Stage II change as well as forecast year changes in gasoline vapor pressure, corresponding changes in the structure and sequence of Georgia NONROAD input files were made. With the exception of the minor Stage II impacts, these structural and sequence changes have no impact on 2002 emission estimates, but allow for consistency between 2002 and forecast year input file structure and sequence. In Tennessee, more significant changes were implemented to gasoline vapor pressure assumptions, as well as similar minor changes in Stage II refueling control assumptions.

In accordance with instructions from Georgia regulators, Stage II refueling control was assumed in the following 13 Georgia counties at a control efficiency value of 81 percent for the Base G inventory:

> Cherokee, Clayton, Cobb, Coweta, DeKalb, Douglas, Fayette, Forsyth, Fulton, Gwinnett, Henry, Paulding, and Rockdale.

No Stage II control was assumed in these counties in prior inventories.

Tennessee regulators provided revised monthly values for gasoline vapor pressure. Based on the seasonal definitions employed in the NONROAD model, monthly vapor pressures were averaged to estimate seasonal vapor pressures as follows:

Month/Season	Nashville Area	Memphis Area	Remainder of Tennessee
March	13.5 psi	13.5 psi	13.5 psi
April	13.5 psi	13.5 psi	13.5 psi
May	9.0 psi	9.0 psi	9.0 psi
Spring	12.0 psi	12.0 psi	12.0 psi
June	7.8 psi	7.8 psi	9.0 psi
July	7.8 psi	7.8 psi	9.0 psi
August	7.8 psi	7.8 psi	9.0 psi
Summer	7.8 psi	7.8 psi	9.0 psi
September 1-15	7.8 psi	7.8 psi	9.0 psi
September 16-30	11.5 psi	11.5 psi	11.5 psi
October	13.5 psi	13.5 psi	13.5 psi
November	13.5 psi	13.5 psi	13.5 psi
Fall	12.2 psi	12.2 psi	12.4 psi
December	15.0 psi	15.0 psi	15.0 psi
January	15.0 psi	15.0 psi	15.0 psi
February	13.5 psi	13.5 psi	13.5 psi
Winter	14.5 psi	14.5 psi	14.5 psi

Note: The Nashville area consists of Davidson, Rutherford, Sumner, Williamson and Wilson counties, the Memphis area consists of Shelby County.

As with the Base F revisions, the seasonal data are based on simple arithmetic averages and do not consider any monthly variation in activity (and fuel sales), nor is the transition between summer and winter seasons considered. Additionally, a monthly average of the September 1-15 and September 16-30 data is calculated prior to averaging the September-November data to estimate a fall average vapor pressure, so that the month of September is weighted identically to the months of October and November.

Tennessee regulators also indicated that Stage II vapor recovery was not in effect in Shelby County, so the Base F NONROAD input files for the county (which assumed Stage II was in place) were revised accordingly.

All Base G NONROAD modeling revisions are presented in Table 1.3-4. As indicated above, the differentiation of inputs across previously grouped counties also required revision to the overall number and sequence of VISTAS NONROAD input files (as compared to the files used to create both the initial VISTAS non-road inventory, as documented in the February 9, 2004 report "*Development of the VISTAS Draft 2002 Mobile Source Emission Inventory (February 2004 Version)*" as prepared by E.H. Pechan & Associates, Inc., and the Base F revised inventory as documented above. These structural revisions are presented in Table 1.3-5, and are provided solely for the benefit of NONROAD modelers as the indicated revisions have no impact on generated emission estimates.

Table 1.3-4 Summary of Base G NONROAD Modeling Revisions

State	Revisions Implemented
AL	(1) Marine diesel sulfur content changed from 2500 ppmW to 2638 ppmW in all counties and seasons.
FL	(1) Marine diesel sulfur content changed from 2500 ppmW to 2638 ppmW in all counties and seasons.
GA	(1) Marine diesel sulfur content changed from 2500 ppmW to 2638 ppmW in all counties and seasons. (2) Stage II refueling vapor recovery implemented in 13 counties at an efficiency of 81 percent. (3) Counties regrouped to accommodate base and forecast year data differentiations. *Stage II control counties: Cherokee, Clayton, Cobb, Coweta, De Kalb, Douglas, Fayette, Forsyth, Fulton, Gwinnett, Henry, Paulding, and Rockdale*
KY	(1) Marine diesel sulfur content changed from 2500 ppmW to 2638 ppmW in all counties and seasons.
MS	(1) Marine diesel sulfur content changed from 2500 ppmW to 2638 ppmW in all counties and seasons.
NC	(1) Marine diesel sulfur content changed from 2500 ppmW to 2638 ppmW in all counties and seasons. (2) Revert to default equipment allocation files for all equipment categories. (3) Utilize revised (i.e., local) seasonal activity data.
SC	(1) Marine diesel sulfur content changed from 2500 ppmW to 2638 ppmW in all counties and seasons.
TN	(1) Marine diesel sulfur content changed from 2500 ppmW to 2638 ppmW in all counties and seasons. (2) Gasoline RVP values changed in accordance with local recommendations. (3) Stage II vapor recovery eliminated from Shelby County modeling.
VA	(1) Marine diesel sulfur content changed from 2500 ppmW to 2638 ppmW in all counties and seasons.
WV	(1) Marine diesel sulfur content changed from 2500 ppmW to 2638 ppmW in all counties and seasons. (2) Revert to default equipment allocation files for all equipment categories.

Table 1.3-5 Spring 2006 NONROAD Input File Sequence and Structural Revisions

State	2002 Inventory Input File Sequence Numbers (Fall 2004)	2002 Inventory Input File Sequence Numbers (Spring 2006)	Reason(s) for Change	Number of Final 2002 Inventory NONROAD Input Files
AL	01-08	01-08	No Structural Changes	32 (at 8 per season)
FL	09-10	09-10	No Structural Changes	8 (at 2 per season)
GA	11-13	11-13, 53-54	Counties Regrouped	20 (at 5 per season)
KY	14-22	14-22	No Structural Changes	36 (at 9 per season)
MS	48	48	No Structural Changes	4 (at 1 per season)
NC	23-25	23-25	No Structural Changes	12 (at 3 per season)
SC	26-32	26-32	No Structural Changes	28 (at 7 per season)
TN	33-34, 49-52	33-34, 49-52	No Structural Changes	24 (at 6 per season)
VA	35-38, 40-43	35-38, 40-43	No Structural Changes	32 (at 8 per season)
WV	44-47	44-47	No Structural Changes	16 (at 4 per season)
All	**01-38, 40-52**	**01-38, 40-54**		**212 (at 53 per season)**

Note: (1) All files include internal revisions to reflect the data changes summarized in Table 1.3-5 above. This table is intended to present structural revisions that are of interest in assembling the NONROAD model input files into a complete VISTAS region inventory. The indicated revisions do not (in and of themselves) result in emission estimate changes.

(2) The NONROAD model imposes an eight digit input file name limit, so all input files for the revised 2002 base year inventory follow a modified naming convention to allow each to be distinguished from the input files for the initial 2002 and fall 2004-revised 2002 base year inventory. For the initial 2002 base year inventory, the naming convention was:

ss02aaqq, where: ss = the two character State abbreviation,
aa = a two character season indicator as follows: AU = autumn, WI = winter, SP = spring, and SU = summer, and
qq = the two digit sequence number indicated above.

For the fall 2004-revised 2002 inventory, the naming convention was modified to:

ss02aFqq, where: ss = the two character State abbreviation,
a = a one character season indicator as follows: A = autumn, W = winter, S = spring, and X = summer, and
qq = the two digit sequence number indicated above.

For the spring 2006-revised 2002 inventory, the naming convention was modified to:

ss02aCqq, where: ss = the two character State abbreviation,
a = a one character season indicator as follows: A = autumn, W = winter, S = spring, and X = summer, and
qq = the two digit sequence number indicated above.

1.3.2.2 Emissions from Commercial Marine Vessels, Locomotives, and Airplanes

An initial 2002 base year emissions inventory for aircraft, locomotives, and commercial marine vessels (CMV) was prepared for VISTAS in early 2004. The methods and data used to develop the inventory are presented in a February 9, 2004 report "*Development of the VISTAS Draft 2002 Mobile Source Emission Inventory (February 2004 Version)*" as prepared by E.H. Pechan & Associates, Inc. A summary of the initial 2002 base year emissions inventory is presented in Table 1.3-6. Except as otherwise stated below, all aspects of the preparation methodology continue to apply to the Base F and Base G emission inventories.

Revisions to the initial 2002 emissions inventory (prepared by Pechan) were implemented to ensure that the latest State and local data were incorporated as well as to correct an overestimation of PM emissions from aircraft. Revisions were actually implemented in two stages. An initial set of revisions was implemented in the fall of 2004. Those revisions constitute the Base F inventory. These were followed by a second set of revisions in 2006, which constitute the Base G inventory. To accurately document the combined effects of both sets of revisions, each set is discussed separately below. Unless otherwise indicated, all revisions implemented for Base F were carried directly into the Base G revision process without change. Thus, the inventories that resulted from the Base F revisions served as the starting point for the Base G revisions.

<u>Base F Revisions:</u>

Revisions to the initial 2002 base year emissions inventory were implemented to ensure that the latest State and local data were incorporated as well as to correct an overestimation of PM emissions from aircraft. Seven of the ten VISTAS States provided revised inventory data in the form of emissions reported to the EPA under the CERR. States providing CERR data were Alabama, Georgia, Mississippi, North Carolina, Tennessee (excluding Davidson, Hamilton, Knox, and Shelby Counties), Virginia, and West Virginia.

In many cases, the CERR data were only marginally different than the initial 2002 base year inventory data, but there were several instances where significant updates were evident. The remaining three VISTAS States (Florida, Kentucky, and South Carolina), plus Davidson, Hamilton, Knox, and Shelby counties in Tennessee, indicated that the initial 2002 VISTAS inventory continued to reflect the most recent data available. Florida did provide updated aircraft emissions data for one county (Miami-Dade) and these data were incorporated into the Base F 2002 inventory as described below.

Since several States recommended retaining the initial 2002 base year inventory data for Base F, the initial step toward revising the 2002 inventory consisted of modifying the estimated aircraft PM emissions of the initial inventory. The overestimation of aircraft PM became evident shortly after the release of the initial 2002 base year inventory, when it was determined that VISTAS region airports would constitute the top seven, and 11 of the top 15, PM sources in the nation. Moreover, PM emissions for one airport (Miami International) were a full order of magnitude larger than *all* other modeled elemental carbon PM emission sources. In addition, unexpected relationships across airports were also observed, with emissions for Atlanta's Hartsfield International being substantially less than those of Miami International, even though Atlanta handles over twice as many aircraft operations annually. Given the pervasiveness of this problem, and since the CERR data submitted by States was based on the initial 2002 VISTAS inventory data, aircraft PM emissions for the entire VISTAS region were recalculated.

Table 1.3-6 Initial 2002 Base Year Aircraft, Locomotive, and Non-Recreational Marine Emissions as Reported in February 2004 Pechan Report (annual tons)

Source	State	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	VOC
Aircraft (2275)	AL	3,787	175	688	475	17	196
	FL	28,518	11,955	46,352	31,983	1,050	3,703
	GA	3,175	992	3,919	2,704	94	353
	KY	2,666	657	2,597	1,792	63	263
	MS	1,593	140	553	381	13	96
	NC	6,088	1,548	6,115	4,219	148	613
	SC	6,505	515	452	312	88	863
	TN	6,854	2,665	7,986	5,510	225	920
	VA	17,676	5,607	14,476	9,988	234	3,229
	WV	1,178	78	310	214	8	66
	Total	**78,040**	**24,332**	**83,448**	**57,578**	**1,940**	**10,302**
Commercial Marine (2280)	AL	1,195	9,217	917	843	3,337	736
	FL	5,888	44,817	1,936	1,781	6,683	1,409
	GA	1,038	7,874	334	307	1,173	246
	KY	6,607	50,267	2,246	2,066	9,608	1,569
	MS	5,687	43,233	1,903	1,750	7,719	1,351
	NC	599	4,547	193	178	690	142
	SC	1,067	8,100	343	316	1,205	253
	TN	4,129	31,397	1,390	1,278	5,753	980
	VA	1,198	3,426	929	855	3,258	596
	WV	2,094	15,882	668	614	720	497
	Total	**29,503**	**218,760**	**10,858**	**9,989**	**40,146**	**7,779**
Military Marine (2283)	VA	136	387	28	26	30	59
	Total	**136**	**387**	**28**	**26**	**30**	**59**
Locomotives (2285)	AL	3,490	26,339	592	533	1,446	1,354
	FL	1,006	9,969	247	222	605	404
	GA	2,654	26,733	664	598	1,622	1,059
	KY	2,166	21,811	542	488	1,321	867
	MS	2,302	23,267	578	520	1,429	899
	NC	1,638	16,502	410	369	1,001	654
	SC	1,160	11,690	291	261	710	462
	TN	4,530	44,793	1,110	999	2,689	1,805
	VA	1,928	19,334	1,407	1,266	3,443	798
	WV	1,105	11,150	277	249	681	436
	Total	**21,980**	**211,588**	**6,118**	**5,505**	**14,947**	**8,738**
Grand Total		**129,659**	**455,067**	**100,452**	**73,099**	**57,062**	**26,877**

Aircraft do emit PM while operating. However, official EPA inventory procedures for aircraft generally do not include PM emission factors and, therefore, aircraft PM is generally erroneously reported as zero. In an effort to overcome this deficiency, the developers of the initial VISTAS 2002 base year aircraft inventory (Pechan) estimated PM emission rates for aircraft using estimated NO_x emissions and an unreported PM-to-NO_x ratio (i.e., PM = NO_x times a PM-to-NO_x ratio). According to the initial 2002 base year inventory documentation, this approach was applied only to commercial aircraft NO_x, but a review of that inventory indicates that the technique was also applied to military, general aviation, and air taxi aircraft in many, but not all, instances. Although there is nothing inherently incorrect with this approach, the accuracy and inconsistent application of the assumed PM-to-NO_x ratio results in grossly overestimated aircraft PM.

Through examination of the initial 2002 base year aircraft inventory (prepared by E.H. Pechan and Associates, Inc.), it is apparent that the commercial aircraft PM-to-NO_x ratio used to generate PM emission estimates was approximately equal to 3.95 (i.e., PM = NO_x times 3.95). While the majority of observed commercial aircraft PM-to-NO_x ratios in that inventory are equal to 3.95, a few range as low as 3.00. If all aircraft estimates are included (i.e., commercial plus military, general aviation, and air taxi), observed PM-to-NO_x ratios range from 0 to 123.0, and average 3.43 as illustrated in Table 1.3-7

Table 1.3-7 PM-to-NO_x Ratios by Aircraft Type In Initial 2002 Base Year Inventory.

Aircraft Type	Average PM-to-NO_x	Range of PM-to-NO_x	Average $PM_{2.5}$ / PM_{10}	Range of $PM_{2.5}$ / PM_{10}
Undefined (1)	0.046	0-0.062	0.690	0.690-0.690
Military	0.073	0-92.3	0.688	0.333-1.000
Commercial	3.953	3.00-3.953	0.690	0.667-0.696
General Aviation	2.059	0-9.00	0.689	0.500-1.000
Air Taxi	2.734	0-123.0	0.690	0.500-1.000
Aggregate	3.427	0-123.0	0.690	0.333-1.000

Note: (1) Two counties report aircraft emissions as SCC 2275000000 “all aircraft.”

As indicated, the aggregate PM-to-NO_x ratio is similar in magnitude to the ratio for commercial aircraft. This results from the dominant nature of commercial aircraft NO_x emissions relative to NO_x from other aircraft types. It is surmised that ratios that deviate from 3.95 are based on PM emission estimates generated by local planners, which were retained without change in the PM estimation process (although a considerable number of unexplained “zero PM” records also exist in the initial 2002 base year inventory dataset). Regardless, based on previous statistical analyses performed in support of aircraft emissions inventory development outside the VISTAS region, a PM-to-NO_x ratio of 3.95 is too large by over an order of magnitude.

In analyses performed for the Tucson, Arizona planning area, PM-to-NO_x ratios for aircraft over a standard aircraft landing and takeoff (LTO) cycle are shown in Table 1.3-8. Data for this table is taken from "Emissions Inventories for the Tucson Air Planning Area, Volume I., Study Description and Results," prepared for the Pima Association of Governments, Tucson, AZ, November 2001. Pages 4-40 through 4-42 of that report, which document the statistical derivation of these ratios, are included in this report as Appendix E.

Table 1.3-8 Tucson, AZ PM-to-NO_x Ratios by Aircraft Type.

Aircraft Type	PM-to-NO_x
Commercial Aircraft	0.26
Military Aircraft	0.88
Air Taxi Aircraft	0.50
General Aviation Aircraft	1.90

Note:

The PM and NO_x emission estimates presented in the Tucson study are for local aircraft operating mode times. For this work, emission estimates for Tucson were recalculated for a standard LTO cycle, so that the ratios presented are applicable to the standard LTO cycle and not a Tucson-specific cycle. Thus, the ratios presented herein vary somewhat from those associated with the emission estimates presented in the Tucson study report.

In reviewing these data, it should be considered that they apply to a standard (i.e., EPA-defined) commercial aircraft LTO cycle.[2] Aircraft PM-to-NO_x ratios vary with operating mode, so that aircraft at airports with mode times that differ from the standard cycle will exhibit varying ratios. However, conducting an airport-specific analysis for all airports in the VISTAS region was beyond the scope of this work. While local PM-to-NO_x ratios could vary somewhat from the indicated standard cycle ratios, any error due to this variation will be significantly less than the order of magnitude error associated with the 3.95 commercial aircraft ratio used for the initial 2002 base year inventory.

It should be recognized that while the Tucson area is far removed from the VISTAS region, the data analyzed to generate the PM-to-NO_x ratios is standard aircraft emission factor data routinely employed for inventory purposes throughout the United States (as encoded in models such as the

[2] As defined in *AP-42, Compilation of Air Pollutant Emission Factors, Volume II, Mobile Sources, a standard commercial aircraft LTO cycle consists of 4 minutes of approach time, 26 minutes of taxi (7 minutes in plus 19 minutes out), 0.7 minutes of takeoff, and 2.2 minutes of climbout time (approach and climbout times being based on a 3000 foot mixing height).*

Federal Aviation Administration's Emissions Data Management Systems [EDMS]). With the exception of aircraft operating conditions, there are no inherent geographic implications associated with the use of data from the Tucson study. As indicated above, issues associated with local operating conditions have been eliminated by recalculating the Tucson study ratios for a standard LTO cycle.

To implement the revised PM-to-NO_x ratios in the Base F inventory, *all* aircraft PM records were removed from the initial 2002 base year inventory (prepared by Pechan). This includes records for which local planners may have estimated PM emissions. This approach was taken for two reasons. First, there is no way to distinguish which records may have been generated by local planners. Second, the data available to local planners may be no better than that used to generate the presented PM-to-NO_x ratio data, so the consistent application of these data to the entire VISTAS region was determined to be the most appropriate approach to generating consistent inventories throughout the region. In undertaking this removal, it became apparent that there was an imbalance in the aircraft NO_x and PM records in the initial 2002 base year inventory. Whereas there were 1,531 NO_x records in the NIF emission data sets for this source category, there were only 1,212 PM records. The imbalance was distributed between three States, South Carolina, Tennessee, and Virginia as follows:

Table 1.3-9 Non-Corresponding Aircraft Emissions Records

Aircraft NO_x records with no corresponding PM record:

Aircraft Type	South Carolina	Virginia	Total
Military Aircraft	8	100	108
General Aviation Aircraft	14	94	108
Air Taxi Aircraft	5	99	104
Aggregate	27	293	320

Aircraft PM records with no corresponding NO_x record:

Aircraft Type	Tennessee	Total
Air Taxi Aircraft	1	1
Aggregate	1	1

The unmatched PM record was for Hamilton County (Chattanooga), Tennessee and when removed, was not replaced since there was no corresponding NO_x record with which to estimate revised PM emissions. It is unclear how this orphaned record originated, but clearly there can be no air taxi PM emissions without other combustion-related emissions. Thus, the removal of the PM_{10} and $PM_{2.5}$ records for Hamilton County permanently reduced the overall size of the 2002 initial base year inventory database used as a starting point for Base F by two records.

Of the 320 unmatched NO_x records, 269 were records for which the reported emission rate was zero. Therefore, even though associated PM records were missing, the overall inventory was not affected. However, the 51 missing records for which NO_x emissions were non-zero, did impact PM estimates for the overall inventory.

Replacement PM_{10} records were calculated for all aircraft NO_x records using the PM-to-NO_x ratios presented above. Aircraft type-specific ratios were utilized in all cases, except for two counties where aircraft emissions were reported under the generic aircraft SCC 2275000000. For these counties (Palm Beach County, Florida and Davidson County, Tennessee), the commercial aircraft PM-to-NO_x ratio was applied since both contain commercial airports (Palm Beach International and Nashville International).

Replacement aircraft $PM_{2.5}$ records were also developed. The initial 2002 base year inventory assumed that aircraft $PM_{2.5}$ was 69 percent of aircraft PM_{10}. The origin of this fraction is not clear, but it is very low for combustion related PM. The majority of internal combustion engine related PM is typically 1 micron or smaller ($PM_{1.0}$), so that typical internal combustion engine $PM_{2.5}$ fractions approach 100 percent. For example, the EPA NONROAD model assumes 92 percent for gasoline engine particulate and 97 percent for diesel engine particulate. Based on recent correspondence from the EPA, it appears that the agency is preparing to recommend a $PM_{2.5}$ fraction of 98 percent for aircraft. (August 12, 2004 e-mail correspondence from U.S. EPA to Gregory Stella of Alpine Geophysics.) This is substantially more consistent with expectations based on emissions test data for other internal combustion engine sources and was used as the basis for the recalculated aircraft $PM_{2.5}$ emission estimates in the Base F inventory.

Although a substantial portion of the initial 2002 base year inventory was ultimately replaced with data prepared by State and local planners under CERR requirements in developing the Base F inventory, it was necessary to first revise the initial 2002 base year aircraft inventory as described so that records extracted from the inventory for areas not supplying CERR data for the Base F update would be accurate. Therefore, in *no case* is the aggregated State data reported for the Base F inventory identical to that of the initial 2002 base year inventory. Even areas relying on the initial 2002 base year inventory will reflect updates in Base F due to changes in emissions of PM_{10} and $PM_{2.5}$ from aircraft.

Table 1.3-10 presents the updated initial 2002 base year inventory estimates. These estimates do not reflect any changes related to modifications made to incorporate the CERR data, but instead indicate the impacts associated solely with the recalculation of aircraft PM emissions alone to apply the more appropriate PM to NO_x ratios. Table 1.3-11 presents a summary of the net impacts of these changes, where an over 90 percent reduction in aircraft PM is observed for all VISTAS areas except South Carolina and Virginia. The reasons for the lesser changes in these two States is that the overall aircraft NO_x inventories for both include a large share of military aircraft NO_x to which no (or very low) particulate estimates were assigned in the initial 2002 base year inventory. Since these operations are assigned non-zero PM emissions under the revised approach, the increase in military aircraft PM offsets a portion of the reduction in commercial aircraft PM. In Virginia, zero (or near zero) PM military operations were responsible for about 35 percent of total aircraft NO_x, while the corresponding fraction in South Carolina was almost 70 percent. As indicated, aggregate aircraft, locomotive, and commercial marine vessel PM is 70-75 percent lower in the updated 2002 base year inventory.

Table 1.3-10 Initial 2002 Base Year Aircraft, Locomotive, and Non-Recreational Marine Emissions with Modified Aircraft PM Emission Rates (annual tons)

Source	State	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	VOC
Aircraft (2275)	AL	3,787	175	64	62	17	196
	FL	28,518	11,955	3,193	3,129	1,050	3,703
	GA	3,175	992	269	264	94	353
	KY	2,666	657	179	175	63	263
	MS	1,593	140	44	43	13	96
	NC	6,088	1,548	419	411	148	613
	SC	6,505	515	409	401	88	863
	TN	6,854	2,665	707	692	225	920
	VA	17,676	5,607	2,722	2,667	234	3,229
	WV	1,178	78	25	24	8	66
	Total	**78,040**	**24,332**	**8,030**	**7,870**	**1,940**	**10,302**
Commercial Marine (2280)	AL	1,195	9,217	917	843	3,337	736
	FL	5,888	44,817	1,936	1,781	6,683	1,409
	GA	1,038	7,874	334	307	1,173	246
	KY	6,607	50,267	2,246	2,066	9,608	1,569
	MS	5,687	43,233	1,903	1,750	7,719	1,351
	NC	599	4,547	193	178	690	142
	SC	1,067	8,100	343	316	1,205	253
	TN	4,129	31,397	1,390	1,278	5,753	980
	VA	1,198	3,426	929	855	3,258	596
	WV	2,094	15,882	668	614	720	497
	Total	**29,503**	**218,760**	**10,858**	**9,989**	**40,146**	**7,779**
Military Marine (2283)	VA	136	387	28	26	30	59
	Total	136	387	28	26	30	59
Locomotives (2285)	AL	3,490	26,339	592	533	1,446	1,354
	FL	1,006	9,969	247	222	605	404
	GA	2,654	26,733	664	598	1,622	1,059
	KY	2,166	21,811	542	488	1,321	867
	MS	2,302	23,267	578	520	1,429	899
	NC	1,638	16,502	410	369	1,001	654
	SC	1,160	11,690	291	261	710	462
	TN	4,530	44,793	1,110	999	2,689	1,805
	VA	1,928	19,334	1,407	1,266	3,443	798
	WV	1,105	11,150	277	249	681	436
	Total	**21,980**	**211,588**	**6,118**	**5,505**	**14,947**	**8,738**
Grand Total		**129,659**	**455,067**	**25,034**	**23,390**	**57,062**	**26,877**

Table 1.3-11 Change in Initial 2002 Base Year Emissions due to Aircraft PM Emission Rate Modifications.

Source	State	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	VOC
Aircraft (2275)	AL	0%	0%	-91%	-87%	0%	0%
	FL	0%	0%	-93%	-90%	0%	0%
	GA	0%	0%	-93%	-90%	0%	0%
	KY	0%	0%	-93%	-90%	0%	0%
	MS	0%	0%	-92%	-89%	0%	0%
	NC	0%	0%	-93%	-90%	0%	0%
	SC	0%	0%	-9%	+29%	0%	0%
	TN	0%	0%	-91%	-87%	0%	0%
	VA	0%	0%	-81%	-73%	0%	0%
	WV	0%	0%	-92%	-89%	0%	0%
	Total	**0%**	**0%**	**-90%**	**-86%**	**0%**	**0%**
Commercial Marine (2280)	AL	0%	0%	0%	0%	0%	0%
	FL	0%	0%	0%	0%	0%	0%
	GA	0%	0%	0%	0%	0%	0%
	KY	0%	0%	0%	0%	0%	0%
	MS	0%	0%	0%	0%	0%	0%
	NC	0%	0%	0%	0%	0%	0%
	SC	0%	0%	0%	0%	0%	0%
	TN	0%	0%	0%	0%	0%	0%
	VA	0%	0%	0%	0%	0%	0%
	WV	0%	0%	0%	0%	0%	0%
	Total	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**
Military Marine (2283)	VA	0%	0%	0%	0%	0%	0%
	Total	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**
Locomotives (2285)	AL	0%	0%	0%	0%	0%	0%
	FL	0%	0%	0%	0%	0%	0%
	GA	0%	0%	0%	0%	0%	0%
	KY	0%	0%	0%	0%	0%	0%
	MS	0%	0%	0%	0%	0%	0%
	NC	0%	0%	0%	0%	0%	0%
	SC	0%	0%	0%	0%	0%	0%
	TN	0%	0%	0%	0%	0%	0%
	VA	0%	0%	0%	0%	0%	0%
	WV	0%	0%	0%	0%	0%	0%
	Total	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**
Grand Total		**0%**	**0%**	**-75%**	**-68%**	**0%**	**0%**

As indicated above, for the Base F 2002 base year inventory, data for all or portions of seven VISTAS States were replaced with corresponding data from recent (as of the fall of 2004) CERR submissions for 2002. Before replacing these data, however, an analysis of the CERR data was performed to ensure consistency with VISTAS inventory methods. It should perhaps also be noted that three of the CERR datasets provided for the Base F 2002 base year inventory (specifically those for Tennessee, Virginia, and West Virginia) included both annual and daily emissions data. Only the annual data were used. Daily values were removed.

Several important observations resulted from this analysis. First, it was clear that all of the CERR data continued to rely on the inaccurate aircraft PM estimation approach employed for the initial 2002 base year inventory. Therefore, an identical aircraft PM replacement procedure as described above for updating the initial 2002 base year inventory was undertaken for CERR supplied data. As a result, the CERR data for *all* VISTAS States has been modified for inclusion in the Base F 2002 VISTAS base year inventory due to PM replacement procedures.

As was the case with the initial VISTAS 2002 base year inventory, there were a substantial number of aircraft NO_x records without corresponding PM records, so that the number of recalculated PM records added to the CERR dataset is greater than the number of PM records removed. The aggregated CERR inventory data, reflecting data for all or parts of seven States, consisted of 13,656 records, of which 1,211 were aircraft NO_x records. However, the number of corresponding aircraft PM records was 662 (662 PM_{10} records and 662 $PM_{2.5}$ records). This imbalance was distributed as follows:

Table 1.3-12 CERR Aircraft NO_x Records with No Corresponding PM Record.

Aircraft Type	Georgia	Tennessee	Virginia	Total
Military Aircraft			136	136
Commercial Aircraft		4	136	140
General Aviation Aircraft	1		136	137
Air Taxi Aircraft			136	136
Aggregate	**1**	**4**	**544**	**549**

From this tabulation, it is clear that virtually the entire imbalance is associated with the Virginia CERR submission, with minor imbalances in Georgia and Tennessee. Of the 549 unmatched NO_x records, 461 were records for which the reported emission rate was zero. Therefore, even though the associated PM records were missing, the overall inventory was not affected. However, the 88 missing records for which NO_x emissions were non-zero do impact PM emission estimates for the overall inventory.

Replacement aircraft PM records (both PM_{10} and $PM_{2.5}$) were generated for the CERR dataset using procedures identical to those described above for the updated initial 2002 base year inventory.

Further analysis revealed that the CERR data for Virginia included only VOC, CO, and NO_x emissions for all aircraft, locomotives, and non-recreational marine vessels. Since SO_2, PM_{10}, and $PM_{2.5}$ records are included in the 2002 VISTAS inventory, an estimation method was developed for these emission species and applied to the Virginia CERR data. For PM, the developed methodology was only employed for locomotive and marine vessel data since aircraft PM was estimated using the PM-to-NO_x ratio methodology described above.

Consideration was given to simply adding the Virginia SO_2 and non-aircraft PM records from the initial 2002 VISTAS inventory dataset, but it is very unlikely that either the source distribution or associated emission rates are identical across the CERR and initial VISTAS inventories. This was confirmed through a comparative analysis of dataset CO records. Therefore, an estimation methodology was developed using Virginia source-specific SO_2/CO, PM_{10}/CO, and $PM_{2.5}$/PM_{10} ratios from the initial 2002 base year VISTAS inventory. The calculated ratios were then applied to the source-specific CERR CO emission estimates to derive associated source-specific SO_2, PM_{10}, and $PM_{2.5}$ emissions for the Base F inventory.

Initially, the development of the emissions ratios from the initial 2002 base year inventory was performed at the State (i.e., Virginia), county, and SCC level of detail. However, it readily became clear that there were substantial inconsistencies in ratios for identical SCCs across counties. For example, in one county, the SO_2/CO ratio might be 0.2, while in the next county it would be 2.0. Since the sources in question are virtually identical (e.g., diesel locomotives) and since the fueling infrastructure for these large non-road equipment sources is regional as opposed to local in nature, such variations in emission rates are not realistic. Therefore, a more aggregated approach was employed in which SCC-specific emission ratios were developed for the State as a whole. Through this approach county-to-county variation in emission ratios is eliminated, but the underlying variation in CO emissions does continue to influence the resulting aggregate emission estimates. The applied emission ratios are as follows:

Table 1.3-13 Calculated Emission Ratios for VA.

Source	SCC	SO_2/CO	PM_{10}/CO	$PM_{2.5}$/CO	$PM_{2.5}$/PM_{10}
Military Aircraft	2275001000	0.0215	*Emissions estimated using PM-to-NO_x ratios as described previously.*		
Commercial Aircraft	2275020000	0.3292			
General Aviation Aircraft	2275050000	0.0002			
Air Taxi Aircraft	2275060000	0.0015			
Aircraft Refueling	2275900000	0.0000	0.0000	0.0000	
Diesel Commercial Marine	2280002000	0.3697	0.3434	0.3157	0.92
Residual Commercial Marine	2280003000	0.3697	0.3434	0.3157	0.92
Diesel Military Marine	2283002000	0.2422	0.2248	0.2068	0.92
Line Haul Locomotives	2285002005	3.2757	1.2999	1.1696	0.90
Yard Locomotives	2285002010	2.2908	1.2461	1.1205	0.90

It is important to recognize that the inconsistency of emissions ratios across Virginia counties for sources of virtually identical design, which utilize a regional rather than local fueling infrastructure, has potential implications for other VISTAS States. There is no immediately obvious reason to believe that such inconsistencies would be isolated to Virginia.

One final revision to the CERR dataset was undertaken as part of the Base F effort, and that was the removal of two records for unpaved airstrip particulate (SCC 2275085000) in Alabama. Otherwise identical records for these emissions were reported both in terms of filterable and primary particulate. The filterable particulate records were removed as all other particulate emissions in the VISTAS inventories are in terms of primary particulate. It is also perhaps worth noting that a series of aircraft refueling records (SCC 2275900000) for Virginia were left in place, even through typically such emissions would be reported under SCC 2501080XXX in the area source inventory. If additional VISTAS aircraft refueling emissions are reported under SCC 2501080XXX, then it may be desirable to recode these records.

Finally, data for areas of the VISTAS region not represented in the CERR dataset were added to the CERR data by extracting the appropriate records from the initial 2002 base year inventory (with revisions for aircraft PM to NO_x ratios). Specifically, records applicable to the States of Florida, Kentucky, South Carolina, and the Tennessee counties of Davidson, Hamilton, Knox, and Shelby were extracted from the revised initial 2002 inventory and added to the CERR dataset to establish the 2002 Base F inventory.

Following this aggregation, one last dataset revision was implemented to complete the development of the 2002 Base F inventory. As indicated in the introduction of this section, the initial 2002 base year emission estimates for Miami International Airport were determined to be excessive. Although the reason for this inaccuracy was not apparent, revised estimates for aircraft emissions in Miami-Dade County were obtained from Florida planners and used to overwrite the erroneous estimates. (Aircraft emission estimates were provided in an August 10, 2004 e-mail transmittal from Bruce Coward of Miami-Dade County to Martin Costello of the Florida Department of Environmental Protection.)

Table 1.3-14 presents a summary of the resulting Base F VISTAS 2002 base year inventory estimates for aircraft, locomotives, and non-recreational marine vessels. Table 1.3-15 provides a comparison of the Base F 2002 base year inventory estimates to those of the initial 2002 base year inventory. As indicated, total emissions for VOC, CO, NO_x, and SO_2 are generally within 10 percent, but final PM emissions are reduced by 70-80 percent due to the approximate 90 percent reductions in aircraft PM estimates. In addition, the significant changes in Georgia aircraft emissions are due to the CERR correction of Atlanta Hartsfield International Airport emissions, which were significantly underestimated in the initial 2002 base year inventory. The reduction in Florida aircraft emissions due to the correction of Miami International estimates is also apparent.

Lastly, Table 1.3-16 provides a direct comparison of emission estimates from the initial and Base F 2002 base year inventories for all 16 VISTAS region airports with estimated annual aircraft NO_x emissions of 200 tons or greater (as identified at the conclusion of the Base F revisions).[3] The table entries are sorted in order of decreasing NO_x and once again, the dramatic reduction in PM emissions is evident. However, in addition, the appropriate reversal of the relationship between Atlanta's Hartsfield and Miami International Airport is also depicted. As a rough method of quality assurance, Table 1.3-15 also includes a *gross* estimate of expected airport NO_x emissions using detailed NO_x estimates developed for Tucson International Airport in conjunction with the ratio of local to Tucson LTOs. (The Tucson NO_x estimates are revised to reflect a standard LTO cycle rather than the Tucson-specific LTO cycle. This should provide for a more realistic comparison to VISTAS estimates.) This is not meant to serve as anything other than a crude indicator of the propriety of the developed VISTAS estimates, and it is clear that the range of estimated-to-expected NO_x emissions has been substantially narrowed in the Base F 2002 base year inventory. Whereas estimated-to-expected ratios varied from about 0.2 to over 3.5 in the initial 2002 base year inventory, the range of variation is tightened on both ends, from about 0.5 to 1.75 for the Base F 2002 base year inventory. In effect, all estimates are now within a factor of two of the expected estimates, which is quite reasonable given likely variation in local and standard LTO cycles and variations in aircraft fleet mix across airports.

It is perhaps important to note that some shifting in county emissions assignments is evident between the initial and Base F 2002 base year aircraft inventories. For example, for the initial 2002 base year inventory, Atlanta Hartsfield estimates were assigned to Fulton County (FIP 13121), while they are assigned to Clayton County (FIP 13063) for the Base F 2002 base year inventory. Similarly, Dulles International Airport emissions were assigned solely to Fairfax County, Virginia (FIP 51059) in the initial 2002 base year inventory, but are split between Fairfax and Loudoun County (FIP 51107) for Base F. Such shifts reflect local planner decision-making and are not an artifact of the revisions described above.

[3] Subsequent revisions performed for Base G result in the addition of the Cincinnati/Northern Kentucky International Airport to the group of airports with aircraft operations generating at least 200 tons of NO_x. These revisions are discussed below, including the addition of an appropriately modified version of the aircraft emissions table.

Table 1.3-14 Base F 2002 Base Year Aircraft, Locomotive, and Non-Recreational Marine Emissions (tons/year)

Source	State	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	VOC
Aircraft (2275)	AL	3,787	175	226	87	17	196
	FL	25,431	8,891	2,424	2,375	800	3,658
	GA	6,622	5,372	1,475	1,446	451	443
	KY	2,666	657	179	175	63	263
	MS	1,593	140	44	43	13	96
	NC	6,088	1,548	419	411	148	613
	SC	6,505	515	409	401	88	863
	TN	7,251	2,766	734	719	235	943
	VA	9,763	2,756	1,137	1,115	786	2,529
	WV	1,178	78	25	24	8	66
	Total	**70,884**	**22,899**	**7,072**	**6,797**	**2,607**	**9,670**
Commercial Marine (2280)	AL	1,196	9,218	917	844	3,337	737
	FL	5,888	44,817	1,936	1,781	6,683	1,409
	GA	1,038	7,875	334	307	1,173	246
	KY	6,607	50,267	2,246	2,066	9,608	1,569
	MS	5,688	43,233	1,903	1,751	7,719	1,351
	NC	599	4,547	193	178	690	142
	SC	1,067	8,100	343	316	1,205	253
	TN	3,624	27,555	1,217	1,120	4,974	860
	VA	972	2,775	334	307	359	483
	WV	1,528	11,586	487	448	525	362
	Total	**28,207**	**209,972**	**9,911**	**9,118**	**36,275**	**7,413**
Military Marine (2283)	VA	110	313	25	23	27	48
	Total	**110**	**313**	**25**	**23**	**27**	**48**
Locomotives (2285)	AL	3,490	26,339	592	533	1,446	1,354
	FL	1,006	9,969	247	222	605	404
	GA	2,725	27,453	682	614	1,667	1,086
	KY	2,166	21,811	542	488	1,321	867
	MS	2,302	23,267	578	520	1,429	899
	NC	1,638	16,502	410	369	1,001	654
	SC	1,160	11,690	291	261	710	462
	TN	2,626	25,627	633	570	1,439	1,041
	VA	1,186	11,882	1,529	1,375	3,641	492
	WV	1,311	13,224	329	296	808	517
	Total	**19,611**	**187,764**	**5,833**	**5,248**	**14,066**	**7,777**
Grand Total		**118,812**	**420,948**	**22,841**	**21,186**	**52,976**	**24,908**

Table 1.3-15 Change in 2002 Emissions, Base F Inventory Relative to Initial Inventory

Source	State	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	VOC
Aircraft (2275)	AL	0%	0%	-67%	-82%	0%	0%
	FL	-11%	-26%	-95%	-93%	-24%	-1%
	GA	+109%	+442%	-62%	-47%	+379%	+26%
	KY	0%	0%	-93%	-90%	0%	0%
	MS	0%	0%	-92%	-89%	0%	0%
	NC	0%	0%	-93%	-90%	0%	0%
	SC	0%	0%	-9%	+29%	0%	0%
	TN	+6%	+4%	-91%	-87%	+4%	+2%
	VA	-45%	-51%	-92%	-89%	+236%	-22%
	WV	0%	0%	-92%	-89%	0%	0%
	Total	**-9%**	**-6%**	**-92%**	**-88%**	**+34%**	**-6%**
Commercial Marine (2280)	AL	+0%	+0%	+0%	+0%	+0%	+0%
	FL	0%	0%	0%	0%	0%	0%
	GA	+0%	+0%	+0%	+0%	+0%	+0%
	KY	0%	0%	0%	0%	0%	0%
	MS	+0%	+0%	+0%	+0%	+0%	+0%
	NC	+0%	+0%	+0%	+0%	+0%	+0%
	SC	0%	0%	0%	0%	0%	0%
	TN	-12%	-12%	-12%	-12%	-14%	-12%
	VA	-19%	-19%	-64%	-64%	-89%	-19%
	WV	-27%	-27%	-27%	-27%	-27%	-27%
	Total	**-4%**	**-4%**	**-9%**	**-9%**	**-10%**	**-5%**
Military Marine (2283)	VA	-19%	-19%	-12%	-12%	-12%	-19%
	Total	**-19%**	**-19%**	**-12%**	**-12%**	**-12%**	**-19%**
Locomotives (2285)	AL	0%	0%	0%	0%	0%	0%
	FL	0%	0%	0%	0%	0%	0%
	GA	+3%	+3%	+3%	+3%	+3%	+3%
	KY	0%	0%	0%	0%	0%	0%
	MS	0%	0%	0%	0%	0%	0%
	NC	0%	0%	0%	0%	0%	0%
	SC	0%	0%	0%	0%	0%	0%
	TN	-42%	-43%	-43%	-43%	-46%	-42%
	VA	-38%	-39%	+9%	+9%	+6%	-38%
	WV	+19%	+19%	+19%	+19%	+19%	+19%
	Total	**-11%**	**-11%**	**-5%**	**-5%**	**-6%**	**-11%**
Grand Total		**-8%**	**-7%**	**-77%**	**-71%**	**-7%**	**-7%**

Table 1.3-16 Base F Comparison of Aircraft Emissions (Airports with Aircraft NO_x > 200 tons per year)

Airport	FIP	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	VOC	Approx. LTOs	Predicted NO_x	VISTAS to Predicted
Initial 2002 Base Year Inventory										
Miami	12086	9,757	5,997	23,706	16,357	525	1,641	150,000	1,680	3.57
Orlando	12095	3,456	2,170	8,578	5,919	204	642	150,000	1,680	1.29
Memphis	47157	3,462	1,934	7,645	5,275	185	603	125,000	1,400	1.38
Reagan	51013	3,892	1,806	7,138	4,925	164	302	100,000	1,120	1.61
Hampton	51650	2,690	1,705	0	0	0	611	Military		
Dulles	51059	2,032	1,330	5,246	3,620	0	272	75,000	840	1.58
Orlando-Sanford	12117	3,615	1,225	4,837	3,337	100	351			
Atlanta	13121	1,457	913	3,608	2,490	86	274	420,000	4,704	0.19
Fort Lauderdale	12011	1,930	809	3,196	2,206	75	257	75,000	840	0.96
Charlotte	37119	1,643	788	3,113	2,148	75	255	150,000	1,680	0.47
Tampa	12057	1,399	785	3,101	2,140	74	240	75,000	840	0.93
Nashville	47037	1,819	653	40	28	33	239	60,000	672	0.97
Raleigh	37183	1,584	592	2,338	1,613	56	204	75,000	840	0.70
Louisville	21111	1,073	468	1,851	1,277	45	155	60,000	672	0.70
Jacksonville	12031	871	325	1,284	886	31	112	30,000	336	0.97
Palm Beach	12099	1,156	226	0	0	1	132	30,000	336	0.67
Aggregate		41,836	21,724	75,682	52,220	1,655	6,290			0.19-3.57
Base F 2002 Base Year Inventory										
Atlanta	13063	4,121	5,288	1,435	1,406	443	337	420,000	4,704	1.12
Miami	12086	6,670	2,933	805	789	274	1,596	150,000	1,680	1.75
Orlando	12095	3,456	2,170	568	556	204	642	150,000	1,680	1.29
Memphis	47157	3,462	1,934	506	495	185	603	125,000	1,400	1.38
Orlando-Sanford	12117	3,615	1,225	338	332	100	351			
Fort Lauderdale	12011	1,930	809	217	212	75	257	75,000	840	0.96
Charlotte	37119	1,643	788	206	202	75	255	150,000	1,680	0.47
Tampa	12057	1,399	785	206	202	74	240	75,000	840	0.93
Nashville	47037	1,819	653	170	166	33	239	60,000	672	0.97
Reagan	51013	1,269	635	171	168	193	97	100,000	1,120	0.57
Dulles 1	51107	1,807	595	164	161	252	153	37,500	420	1.42
Raleigh	37183	1,584	592	156	153	56	204	75,000	840	0.70
Dulles 2	51059	1,095	591	156	153	252	115	37,500	420	1.41
Hampton	51650	858	535	471	461	18	305	Military		
Louisville	21111	1,073	468	123	121	45	155	60,000	672	0.70
Jacksonville	12031	871	325	87	85	31	112	30,000	336	0.97
Palm Beach	12099	1,156	226	59	58	1	132	30,000	336	0.67
Aggregate		37,829	20,550	5,838	5,721	2,312	5,793			0.47-1.75
Net Change		**-10%**	**-5%**	**-92%**	**-89%**	**+40%**	**-8%**			

Note: For the Base F inventory, Dulles International Airport emissions are split between two Virginia counties.
Predicted NO_x is based on the ratio of airport LTOs to test airport (Tucson International Airport) LTOs and NO_x.
This is not a rigorous comparison, but rather an approximate indicator of expected magnitude.

Base G Revisions:

Further revisions to the 2002 base year emissions inventory were implemented in response to additional state data submittals in the spring of 2006. The inventories developed through the Base F revision process (as described above) served as the starting point for the 2006 revisions. Thus, unless otherwise indicated below, all documented Base F revisions continue to apply to the Base G-revised 2002 base year inventory.

As part of the Base G review and update process, Virginia regulators provided 443 updated emission records for aircraft. These records reflected revisions to aircraft VOC, CO, and NO_x, and in a few cases SO_2, emissions records that were already in the Base F VISTAS 2002 inventory (as opposed to the addition of previously unreported data). The specific revisions broke down as follows:

Table 1.3-17 Base G VA Aircraft Records Updates

Aircraft Type	VOC	CO	NO_x	SO_2	Total
Military Aircraft	9	9	9	1	28
Commercial Aircraft	12	12	12	17	53
General Aviation Aircraft	65	66	66	0	197
Air Taxi Aircraft	56	56	53	0	165
Aggregate	142	143	140	18	443

Emissions values for each of the 443 records in the Base F 2002 VISTAS inventory were updated for Base G to reflect the revised data. However, as described above for the Base F revisions, all aircraft SO_2, PM_{10}, and $PM_{2.5}$ emissions in Virginia are estimated on the basis of CO (in the case of SO_2) and NO_x emissions (in the cases of PM_{10} and $PM_{2.5}$). Therefore, since Virginia regulators did not provide updated SO_2 emissions for all updated CO emissions records, or updated PM_{10} or $PM_{2.5}$ emissions for all updated NO_x emissions records, it was necessary to re-estimate aircraft SO_2, PM_{10}, and $PM_{2.5}$ emissions in all cases where updated CO or NO_x emissions were provided for Base G (and explicit SO_2 and/or PM_{10} and $PM_{2.5}$ emissions were not).

The procedure used to estimate the SO_2, PM_{10}, and $PM_{2.5}$ emissions revisions was identical to that described above for the Base F inventory revisions, except that revised SO_2-to-CO emissions ratios were calculated for commercial aircraft, where 12 pairs of revised CO and SO_2 emissions estimates were available. Although a single pair of revised CO and SO_2 emissions records was available for military aircraft, this was deemed an insufficient sample with which to replace the military aircraft SO_2-to-CO emissions ratios previously calculated in Base F. However, it is worth noting that the SO_2-to-CO emissions ratio for the revised military aircraft emissions pair was within 16 percent of the previously calculated ratio, so any error associated with retention of the Base F ratio will be minor. Table 1.3-18 presents the emissions ratios.

Table 1.3-18 Calculated Base G Emission Ratios for VA.

Source	SCC	SO_2/CO (fall 2004)	SO_2/CO (spring 2006)	SO_2/CO (used in 2006)	PM_{10}/NO_x	$PM_{2.5}/PM_{10}$
Military Aircraft	2275001000	0.0215	0.0180	0.0215	0.88	0.98
Commercial Aircraft	2275020000	0.3292	0.0696	0.0696	0.26	0.98
General Aviation Aircraft	2275050000	0.00016	n/a	0.00016	1.9	0.98
Air Taxi Aircraft	2275060000	0.0015	n/a	0.0015	0.5	0.98

Application of the SO_2-to-CO emissions ratios to the 130 revised aircraft CO records, for which no corresponding SO_2 emission revisions were provided, resulted in an additional 130 aircraft SO_2 emission records updates for Virginia. Similarly, application of the PM_{10}-to-NO_x emissions ratios to the 140 revised aircraft NO_x records for which no corresponding PM_{10} emission revisions were provided, resulted in an additional 140 aircraft PM_{10} emission records updates for Virginia. Application of the $PM_{2.5}$-to-PM_{10} emissions ratios to the 140 revised aircraft PM_{10} records resulted in an additional 140 aircraft $PM_{2.5}$ emission records updates for Virginia. Thus, in total, 853 (443+130+140+140) Virginia aircraft emissions records were updated for Base G.

Also as part of the Base G review and update process, Alabama regulators provided 178 updated PM emission records for aircraft (89 records for PM_{10} and 89 records for $PM_{2.5}$), 42 additional emissions records for locomotives (14 records for VOC, 14 records for CO, and 14 records for NO_x), and 179 additional emission records for aircraft (30 records for VOC, 30 records for CO, 30 records for NO_x, 29 records for SO_2, 30 records for PM_{10}, and 30 records for $PM_{2.5}$). After review, it was determined that the 178 updated PM emission records for aircraft actually reflected the original (overestimated) aircraft PM data that was replaced universally throughout the VISTAS region for Base F. Implementing these latest revisions would, in effect, "undo" the Base F aircraft PM revisions. Following discussions with Alabama regulators, it was determined that the 178 aircraft PM records would not be updated for the Base G revisions.

The 42 additional emissions records for locomotives were determined to correspond exactly to existing SO_2, PM_{10}, and $PM_{2.5}$ emissions records already in the Base F VISTAS 2002 inventory. It is not clear why these existing records contained no corresponding data for VOC, CO, and NO_x, but those data are now reflected through the additional 42 records that have now been added to the Base G 2002 VISTAS inventory for Alabama.

After examining the 179 additional aircraft emissions records in conjunction with Alabama regulators, it was determined that 17 of the records (commercial aircraft records in Dale, Limestone, and Talladega counties) were erroneous and should be excluded from the update. The remaining 162 records reflected additional general aviation, air taxi, and military aircraft activity in 20 counties and were specifically comprised of 27 records each for VOC, CO, NO_x, SO_2, PM_{10}, and $PM_{2.5}$. There were no further issues with the VOC, CO, NO_x, and SO_2 records and these were added to the Base G 2002 VISTAS inventory without change. It was, however, apparent that the PM_{10} and $PM_{2.5}$ records reflected an overestimation of aircraft PM similar to that which was previously corrected throughout the VISTAS region for Base F (as documented above). To overcome this overestimation, the additional aircraft PM_{10} and $PM_{2.5}$ records provided by Alabama regulators were replaced with revised emission estimates developed on the basis of the PM_{10}-to-NO_x and $PM_{2.5}$-to-PM_{10} ratios documented under the Base F revisions above. So although 27 aircraft PM_{10} records and 27 aircraft $PM_{2.5}$ records were added to the 2002 Alabama inventory, they reflected different emissions values than those provided directly by Alabama regulators.

In total, 204 additional emissions records (42 for locomotives and 162 for aircraft) were added to the Base G 2002 Alabama inventory.

Finally, as part of the Base G review and update process, Kentucky regulators provided 12 updated aircraft emission records for Boone County, to correct previously underestimated aircraft emissions associated with the Cincinnati/Northern Kentucky International Airport. VOC, CO, and NO_x emissions data were provided for military, commercial, general aviation, and air taxi aircraft. No associated updates for SO_2, PM_{10}, or $PM_{2.5}$ emissions were provided. Corresponding PM_{10} emission estimates were developed by applying the PM_{10}-to-NO_x ratios presented in Table 1.3-17 above to the updated NO_x emission estimates. $PM_{2.5}$ emission estimates were developed by applying the $PM_{2.5}$-to-PM_{10} ratios from that same table to the estimated PM_{10} emissions. SO_2 emission estimates were developed by applying the SO_2-to-PM_{10} ratios developed from the older data (i.e., the data being replaced) for Boone County aircraft to the updated PM_{10} emissions. Thus, a total of 24 inventory records for Kentucky were updated (VOC, CO, NO_x, SO_2, PM_{10}, and $PM_{2.5}$ for four aircraft types).

Upon implementation of the universe of updates, 877 existing emission records were revised (853 in Virginia and 24 in Kentucky) and 204 additional emission records (all in Alabama) were added to the 2002 VISTAS inventory. The total number of aircraft, locomotive, and commercial marine inventory records thus changed from 22,838 records in Base F to 23,042 records in Base G.

Table 1.3-19 presents a summary of the resulting Base G VISTAS 2002 base year inventory estimates for aircraft, locomotives, and non-recreational marine vessels. Table 1.3-20 provides a comparison of the Base G 2002 base year inventory estimates to those of the Base F 2002 base year inventory. As indicated, total emissions for VOC, CO, NO_x, and SO_2 are generally within about 5 percent, with changes restricted to the states of Alabama, Kentucky, and Virginia.

Lastly, Table 1.3-21 provides an updated comparison of emission estimates from the Base F and Base G 2002 base year inventories for all 17 VISTAS region airports with estimated annual aircraft NO_x emissions of 200 tons or greater. As compared to Table 1.3-16, the table reflects the Base G addition of the Cincinnati/Northern Kentucky International Airport. Aircraft emission estimates for the other 16 airports are unchanged from their Base F values.

Table 1.3-19 Base G-Revised 2002 Base Year Aircraft, Locomotive, and Non-Recreational Marine Emissions (tons/year)

Source	State	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	VOC
Aircraft (2275)	AL	5,595	185	238	99	18	276
	FL	25,431	8,891	2,424	2,375	800	3,658
	GA	6,620	5,372	1,475	1,446	451	443
	KY	5,577	925	251	246	88	397
	MS	1,593	140	44	43	13	96
	NC	6,088	1,548	419	411	148	613
	SC	6,505	515	409	401	88	863
	TN	7,251	2,766	734	719	235	943
	VA	11,873	3,885	2,010	1,970	272	2,825
	WV	1,178	78	25	24	8	66
	Total	**77,712**	**24,305**	**8,029**	**7,734**	**2,121**	**10,179**
Commercial Marine (2280)	AL	1,196	9,218	917	844	3,337	737
	FL	5,888	44,817	1,936	1,781	6,683	1,409
	GA	1,038	7,875	334	307	1,173	246
	KY	6,607	50,267	2,246	2,066	9,608	1,569
	MS	5,688	43,233	1,903	1,751	7,719	1,351
	NC	599	4,547	193	178	690	142
	SC	1,067	8,100	343	316	1,205	253
	TN	3,624	27,555	1,217	1,120	4,974	860
	VA	972	2,775	334	307	359	483
	WV	1,528	11,586	487	448	525	362
	Total	**28,207**	**209,972**	**9,911**	**9,118**	**36,275**	**7,413**
Military Marine (2283)	VA	110	313	25	23	27	48
	Total	**110**	**313**	**25**	**23**	**27**	**48**
Locomotives (2285)	AL	3,518	26,623	592	533	1,446	1,365
	FL	1,006	9,969	247	222	605	404
	GA	2,654	26,733	664	598	1,622	1,059
	KY	2,166	21,811	542	488	1,321	867
	MS	2,302	23,267	578	520	1,429	899
	NC	1,638	16,502	410	369	1,001	654
	SC	1,160	11,690	291	261	710	462
	TN	2,626	25,627	633	570	1,439	1,041
	VA	1,186	11,882	1,529	1,375	3,641	492
	WV	1,311	13,224	329	296	808	517
	Total	**19,568**	**187,328**	**5,815**	**5,232**	**14,022**	**7,761**
Grand Total		**125,597**	**421,918**	**23,780**	**22,107**	**52,444**	**25,401**

Table 1.3-20 Change in 2002 Emissions, Base G Inventory Relative to Base F Inventory

Source	State	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	VOC
Aircraft (2275)	AL	+48%	+6%	+5%	+14%	+7%	+41%
	FL	0%	0%	0%	0%	0%	0%
	GA	0%	0%	0%	0%	0%	0%
	KY	+109%	+41%	+40%	+40%	+41%	+51%
	MS	0%	0%	0%	0%	0%	0%
	NC	0%	0%	0%	0%	0%	0%
	SC	0%	0%	0%	0%	0%	0%
	TN	0%	0%	0%	0%	0%	0%
	VA	+22%	+41%	+77%	+77%	-65%	+12%
	WV	0%	0%	0%	0%	0%	0%
	Total	**+10%**	**+6%**	**+14%**	**+14%**	**-19%**	**+5%**
Commercial Marine (2280)	AL	0%	0%	0%	0%	0%	0%
	FL	0%	0%	0%	0%	0%	0%
	GA	0%	0%	0%	0%	0%	0%
	KY	0%	0%	0%	0%	0%	0%
	MS	0%	0%	0%	0%	0%	0%
	NC	0%	0%	0%	0%	0%	0%
	SC	0%	0%	0%	0%	0%	0%
	TN	0%	0%	0%	0%	0%	0%
	VA	0%	0%	0%	0%	0%	0%
	WV	0%	0%	0%	0%	0%	0%
	Total	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**
Military Marine (2283)	VA	0%	0%	0%	0%	0%	0%
	Total	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**
Locomotives (2285)	AL	+1%	+1%	0%	0%	0%	+1%
	FL	0%	0%	0%	0%	0%	0%
	GA	0%	0%	0%	0%	0%	0%
	KY	0%	0%	0%	0%	0%	0%
	MS	0%	0%	0%	0%	0%	0%
	NC	0%	0%	0%	0%	0%	0%
	SC	0%	0%	0%	0%	0%	0%
	TN	0%	0%	0%	0%	0%	0%
	VA	0%	0%	0%	0%	0%	0%
	WV	0%	0%	0%	0%	0%	0%
	Total	**+0%**	**+0%**	**0%**	**0%**	**0%**	**+0%**
Grand Total		**+6%**	**+0%**	**+4%**	**+4%**	**-1%**	**+2%**

Table 1.3-21 Base G Comparison of Aircraft Emissions (Airports with Aircraft NO_x > 200 tons per year)

Airport	FIP	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	VOC	Approx. LTOs	Predicted NO_x	VISTAS to Predicted
Base F 2002 Base Year Inventory										
Atlanta	13063	4,121	5,288	1,435	1,406	443	337	420,000	4,704	1.12
Miami	12086	6,670	2,933	805	789	274	1,596	150,000	1,680	1.75
Orlando	12095	3,456	2,170	568	556	204	642	150,000	1,680	1.29
Memphis	47157	3,462	1,934	506	495	185	603	125,000	1,400	1.38
Orlando-Sanford	12117	3,615	1,225	338	332	100	351			
Fort Lauderdale	12011	1,930	809	217	212	75	257	75,000	840	0.96
Charlotte	37119	1,643	788	206	202	75	255	150,000	1,680	0.47
Tampa	12057	1,399	785	206	202	74	240	75,000	840	0.93
Nashville	47037	1,819	653	170	166	33	239	60,000	672	0.97
Reagan	51013	1,269	635	171	168	193	97	100,000	1,120	0.57
Dulles 1	51107	1,807	595	164	161	252	153	37,500	420	1.42
Raleigh	37183	1,584	592	156	153	56	204	75,000	840	0.70
Dulles 2	51059	1,095	591	156	153	252	115	37,500	420	1.41
Hampton	51650	858	535	471	461	18	305	Military		
Louisville	21111	1,073	468	123	121	45	155	60,000	672	0.70
Jacksonville	12031	871	325	87	85	31	112	30,000	336	0.97
Palm Beach	12099	1,156	226	59	58	1	132	30,000	336	0.67
Cincinnati	21015	467	144	38	37	14	54	50,000	560	0.26
Aggregate		38,296	20,694	5,876	5,758	2,326	5,847			0.26-1.75
Base G 2002 Base Year Inventory										
Atlanta	13063	4,121	5,288	1,435	1,406	443	337	420,000	4,704	1.12
Miami	12086	6,670	2,933	805	789	274	1,596	150,000	1,680	1.75
Orlando	12095	3,456	2,170	568	556	204	642	150,000	1,680	1.29
Memphis	47157	3,462	1,934	506	495	185	603	125,000	1,400	1.38
Orlando-Sanford	12117	3,615	1,225	338	332	100	351			
Fort Lauderdale	12011	1,930	809	217	212	75	257	75,000	840	0.96
Charlotte	37119	1,643	788	206	202	75	255	150,000	1,680	0.47
Tampa	12057	1,399	785	206	202	74	240	75,000	840	0.93
Nashville	47037	1,819	653	170	166	33	239	60,000	672	0.97
Reagan	51013	1,269	635	171	168	193	97	100,000	1,120	0.57
Dulles 1	51107	1,807	595	164	161	252	153	37,500	420	1.42
Raleigh	37183	1,584	592	156	153	56	204	75,000	840	0.70
Dulles 2	51059	1,095	591	156	153	252	115	37,500	420	1.41
Hampton	51650	858	535	471	461	18	305	Military		
Louisville	21111	1,073	468	123	121	45	155	60,000	672	0.70
Cincinnati	21015	3,378	411	110	107	39	187	50,000	560	0.73
Jacksonville	12031	871	325	87	85	31	112	30,000	336	0.97
Palm Beach	12099	1,156	226	59	58	1	132	30,000	336	0.67
Aggregate		41,207	20,961	5,947	5,828	2,352	5,981			0.47-1.75
Net Change		**+8%**	**+1%**	**+1%**	**+1%**	**+1%**	**+2%**			

Note: For the revised inventory, Dulles International Airport emissions are split between two Virginia counties.
Predicted NO_x is based on the ratio of airport LTOs to test airport (Tucson International Airport) LTOs and NO_x.
This is not a rigorous comparison, but rather an approximate indicator of expected magnitude.

1.3.2.3 Emissions from NONROAD Model Sources in Illinois, Indiana, and Ohio

As part of the Base G update process, VISTAS requested that emissions estimates for 2002 be produced for the states of Illinois, Indiana, and Ohio. These estimates were to be produced at the same spatial (i.e., county level by SCC) and temporal resolution as estimates for the VISTAS region.

The requested estimates were produced by extracting a complete set of county-level input data applicable to each of the three states from the latest version of the EPA's NMIM (National Mobile Inventory Model) model. This included appropriate consideration of all non-default NMIM input files generated by the Midwest Regional Planning Organization (MRPO), as described below. These input data were then assembled into appropriate input files for the Final NONROAD2005 model and emission estimates were produced using the same procedure employed for the VISTAS region as part of the Base G updates.

A complete set of monthly input data was developed for each county in Illinois, Indiana, and Ohio by extracting data from the following NMIM database files (using the NMIM MySQL query browser):

> county, countrynrfile, countyyear, countyyearmonth, countyyearmonthhour, gasoline, diesel, and natural gas

The database files:

> countrynrfile, countyyear, countyyearmonth, and gasoline

were non-default database files provided to VISTAS by the MRPO, and are intended to reflect the latest planning data being used by MRPO modelers.

From these files, monthly data for gasoline vapor pressure, gasoline oxygen content, gasoline sulfur content, diesel sulfur content for land-based equipment, diesel sulfur content for marine-based equipment, natural gas sulfur content, minimum daily temperature, maximum daily temperature, and average daily temperature were developed. In addition, the altitude and Stage II refueling control status of each county, as well as the identity of the associated equipment population, activity, growth, allocation, and seasonal distribution files, was determined. These data were then assembled into Final NONROAD2005 input files on a seasonal basis, with monthly data being arithmetically averaged to produce seasonal equivalents as follows:

Winter	=	Average of December, January, and February
Spring	=	Average of March, April, and May
Summer	=	Average of June, July, and August,
Fall	=	Average of September, October, and November

Unlike the VISTAS Base G approach, this approach results in the use of the following non-default data files during the Final NONROAD2005 modeling process:

Table 1.3-22 Non-Default Files Used for MRPO Modeling

Data File	Illinois	Indiana	Ohio
Activity File	1700002.act	1800002.act	3900002.act
Growth File	17000.grw	18000.grw	39000.grw
Population File	17000.pop	18000.pop	39000.pop
Season File	17000.sea	18000.sea	39000.sea
Inboard Marine Allocation File	17000wib.alo	18000wib.alo	39000wib.alo
Outboard Marine Allocation File	17000wob.alo	18000wob.alo	39000wob.alo
Specific Fuel Consumption	MRPO-specific file provided by MRPO modelers (arbitrarily named “mrpoBSFC.emf” for this work)		

One compromise was made relative to the level of resolution that is available through the basic approach described above, that being the treatment of ambient temperature data. Because NMIM offers a unique temperature profile for every U.S. county -- developed by aggregating temperature data from included and surrounding weather stations on the basis of their distances from the county population centroid -- it is not possible to explicitly group counties with otherwise identical input streams. Ungrouped however, there would be 1,128 distinct input streams to be processed (102 Illinois counties plus 92 Indiana counties plus 88 Ohio counties at four seasons each), or over five times the number of files processed for the entire VISTAS region.

To surmount this problem and allow counties with similar temperature profiles to be grouped an approach was employed wherein counties were considered groupable if *all* temperature inputs[4] are within ± 2 ºF of the corresponding group average. This criterion is quite stringent in that it results in less tolerant grouping than that employed for VISTAS modeling, which uses temperature data from the nearest meteorological station as opposed to "unique" meteorological

[4] Non-road temperature inputs used for county grouping are: winter minimum, spring minimum, summer minimum, fall minimum, winter maximum, spring maximum, summer maximum, fall maximum, winter average, spring average, summer average, and fall average.

data for each county. Under this approach, the actual deviation for grouped counties is *much* less that ± 2º F for the overwhelming majority of the 12 grouped temperature inputs.

In addition to the required temperature consistency, all other input data for counties to be grouped had to be identical for all four seasons. Using this criterion, Illinois emissions were modeled using 12 county groups, Indiana emissions were modeled using 9 county groups, and Ohio emissions were modeled using 10 county groups. Thus, 31 iterations of NONROAD2002 were required per season, as compared to the 53 iterations per season required for the VISTAS region.

It should be noted that a potential quality assurance issue was noted in assembling the NONROAD2005 input data for a number of Indiana counties. Specifically, the gasoline vapor pressure for most Indiana counties reflects a value of 9.0 psi in *all* spring, summer, fall, and winter months. This is likely to indicate a problem with the accuracy of the NMIM databases for these counties, but these data were used as defined for this work.

1.3.3 Quality Assurance steps

Throughout the inventory development process, quality assurance steps were performed to ensure that no double counting of emissions occurred, and to ensure that a full and complete inventory was developed for VISTAS. Quality assurance was an important component to the inventory development process and MACTEC performed the following QA steps on the area source component of the 2002 base year revised:

1. All CERR and NIF format State supplied data submittals were run through EPA's Format and Content checking software.
2. SCC level emission summaries were prepared and evaluated to ensure that emissions were consistent and that there were no missing sources.
3. Tier comparisons (by pollutant) were developed between the revised 2002 base year inventory and the initial base year inventory.
4. Data product summaries were provided to both the VISTAS Emission Inventory Technical Advisor and to Mobile Source SIWG representatives for review and comment. Changes based on these comments were implemented in the files.
5. Version numbering was used for all inventory files developed. The version numbering process used a decimal system to track major and minor changes. For example, a major change would result in a version going from 1.0 to 2.0. A minor change would cause a version number to go from 1.0 to 1.1. Minor changes resulting from largely editorial changes would result in a change from 1.00 to 1.01.

2.0 Projection Inventory Development

2.1 Point Sources

We used different approaches for different sectors of the point source inventory:

- For the EGUs, VISTAS relied primarily on the Integrated Planning Model® (IPM®) to project future generation as well as to calculate the impact of future emission control programs. The IPM results were adjusted based on S/L agency knowledge of planned emission controls at specific EGUs.
- For non-EGUs, we used recently updated growth and control data consistent with the data used in EPA's CAIR analyses, and supplemented these data with available S/L agency knowledge of planned emission controls or other changes at specific non-EGUs and updated fuel use forecast data for the U.S. Department of Energy.

For both sectors, we generated 2009 and 2018 inventories for a combined on-the-books (OTB) and on-the-way (OTW) control scenario. The OTB/OTW control scenario accounts for post-2002 emission reductions from promulgated and proposed non-EGU federal control programs as of July 1, 2004; the final Clean Air Interstate Rule (CAIR); and State, local, and site-specific control programs as of October 1, 2007. Section 2.1.1 discusses the EGU projection inventory development, while Section 2.1.2 discusses the non-EGU projection inventory development.

2.1.1 EGU Emission Projections

The following subsections discuss the following specific aspects of the development of the EGU projections. First, we present a chronology of the EGU development process and discuss key decisions in selecting the final methods for performing the emissions projections. Next, we describe the development of the final set of IPM runs that are included in the VISTAS Base G inventory. Next, we describe the process of transforming the IPM parsed files into NIF format. Fourth, we discuss the process for ensuring that units accounted for in IPM were not double-counted in the non-EGU inventory. Fifth, we describe the QA/QC checks that were made to ensure that the IPM results were properly incorporated into the VISTAS inventory. Sixth, we document the changes to the IPM results that S/L agencies specified they wanted included in the VISTAS inventory based on new information that were not accounted for in the IPM runs. Finally, we present summaries of the B&F projected EGU emissions by year, state, and pollutant.

2.1.1.1 Chronology of the Development of EGU Projections

At the beginning of the EGU inventory development process, VISTAS considered three options for developing the VISTAS 2009 and 2018 projection inventories for EGUs:

- Option 1 – Use the results of IPM modeling conducted in support of the proposed Clean Air Interstate Rule (CAIR) base and control case analyses as the starting point and refine the projections with readily available inputs from stakeholders; these IPM runs were conducted for 2010 and 2015, which VISTAS would use to represent projected emissions in 2009 and 2018 respectively.
- Option 2 – Use the VISTAS 2002 typical year as the starting point, apply growth factors from the Energy Information Administration, and refine future emission rates with stakeholder input regarding utilization rates, capacity, retirements, and new unit information.
- Option 3 – Use the results of a new round of IPM modeling sponsored by VISTAS and the Midwest Regional Planning Organization (MRPO). These runs incorporated VISTAS specific unit and regulation modified parameters, and generate results for 2009 and 2018 explicitly.

An additional consideration for each of the three options was the inclusion of emission projections developed by the Southern Company specifically for their units. Southern Company is a super-regional company which owns EGUs in Alabama, Florida, Georgia, and Mississippi and participates in VISTAS as an industry stakeholder. Southern Company used their energy budget forecast to project net generation and heat input for every existing and future Southern Company EGU for the years 2009 and 2018. Further documentation of how Southern Company generated the 2009/2018 inventory for their units can be found in *Developing Southern Company Emissions and Flue Gas Characteristics for VISTAS Regional Haze Modeling (April 2005, presented at 14th International Emission Inventory Conference).*

Each of these three options and the Southern Company projections were discussed in a series of conference calls with the VISTAS EGU Special Interest Work Group (SIWG) during the fall of 2004. During a conference call on December 6, 2004, the VISTAS EGU SIWG approved the use of the latest VISTAS/MRPO sponsored IPM runs (Option 3) to represent the 2009 and 2018 EGU forecasts of emissions for the OTB and OTW cases. During the call, Alabama and Georgia specified that they did not wish to use Southern Company provided emissions forecasts of 2009 and 2018 to represent the sources in their States. Mississippi decided to utilize the Southern Company projections to represent activity at Southern Company facilities in Mississippi. After the call, Florida decided against using Southern Company provided emissions forecasts of 2009 and 2018 to represent the sources in their State. Thus, Southern Company data was used only for Southern Company units in Mississippi for both the Base F and Base G projections.

The Option 3 IPM modeling resulted from a joint agreement by VISTAS and MRPO to work together to develop future year utility emissions based on IPM modeling. The decision to use

IPM modeling was based in part on a study of utility forecast methods by E.H. Pechan and Associates, Inc. (Pechan) for MRPO, which recommended IPM as a viable methodology (see *Electricity Generating Unit {EGU} Growth Modeling Method Task 2 Evaluation*, February 11, 2004). Although IPM results were available from EPA's modeling to support their rulemaking for the Clean Air Interstate Rule (CAIR), VISTAS stakeholders felt that certain model inputs needed to be improved. Thus, VISTAS and MRPO decided to hire contractors to conduct new IPM modeling and to post-process the IPM results. Southern Company projections in 2009 were roughly comparable with IPM. For 2018, Southern Company projections were generally less than IPM because of assumptions made by Southern Company on which units would be economical to control and incorrect data in the NEEDS database which feeds IPM.

In August 2004, VISTAS contracted with ICF International, Inc., to run IPM to provide utility forecasts for 2009 and 2018 under two future scenarios – Base Case and CAIR Case. The Base Case represents the current operation of the power system under currently known laws and regulations (as known at the time the run was made), including those that come into force in the study horizon. The CAIR Case is the Base Case with the proposed CAIR rule superimposed. The run results were parsed at the unit level for the 2009 and 2018 run years. Also in August 2004, MRPO contracted with E.H. Pechan to post-process the IPM outputs generated by ICF to provide model-ready emission files. The IPM output files were delivered by ICF to VISTAS in November (*Future Year Electricity Generating Sector Emission Inventory Development Using the Integrated Planning Model (IPM®) in Support of Fine Particulate Mass and Visibility Modeling in the VISTAS and Midwest RPO Regions*, January 2005), and the post-processed data files were delivered by Pechan to the MRPO in December 2004 (*LADCO IPM Model Parsed File Post-Processing Methodology and File Preparation*, February 8, 2005).

On March 10, 2005, EPA issued the final Clean Air Interstate Rule. VISTAS and MRPO, in conjunction with other RPOs, conducted another round of IPM modeling which reflected changes to control assumptions based on the final CAIR as well as additional changes to model inputs based on S/L agency and stakeholder comments. Several conference calls were conducted in the spring of 2005 to discuss and provide comments on IPM assumptions related to six main topics: power system operation, generating resources, emission control technologies, set-up parameters and rule, financial assumptions, and fuel assumptions. Based on these discussions, VISTAS sponsored a new set of IPM runs to reflect the final CAIR requirements as well as certain changes to IPM assumptions that were agreed to by the VISTAS states. This set of IPM runs is documented in *Future Year Electricity Generating Sector Emission Inventory Development Using the Integrated Planning Model (IPM®) in Support of Fine Particulate Mass and Visibility Modeling in the VISTAS and Midwest RPO Regions*, April 2005 (these runs are referred to as the VISTAS Phase I analysis).

Further refinements to the IPM inputs and assumptions were made by the RPOs, and ICF performed the following four runs using IPM during the summer of 2005 (these runs are referred to as the VISTAS/CENRAP Phase II analysis):

- Base Case with EPA 2.1.9 coal, gas and oil price assumptions.
- Base Case with EPA 2.1.9 coal and gas supply curves adjusted for AEO 2005 reference case price and volume relationships.
- Strategy Case with EPA 2.1.9 coal, gas and oil price assumptions.
- Strategy Case with EPA 2.1.9 coal and gas supply curves adjusted for AEO 2005 reference case price and volume relationships.

The above runs were parsed for 2009 and 2018 run years. The above four runs were based on VISTAS Phase I and the EPA 2.1.9 assumptions. The changes that were implemented in the above four runs are summarized below:

- Unadjusted AEO 2005 electricity demand projections were incorporated in the above four runs.
- The gas supply curves were adjusted for AEO 2005 reference case price and volume relationships. The EPA 2.1.9 gas supply curves were scaled such that IPM will solve for AEO 2005 gas prices when the power sector gas demand in IPM is consistent with AEO 2005 power sector gas demand projections.
- The coal supply curves used in EPA 2.1.9 were scaled in such a manner that the average mine mouth coal prices that the IPM is solving in aggregated coal supply regions are comparable to AEO 2005. Due to the fact that the coal grades and supply regions between AEO 2005 and the EPA 2.1.9 are not directly comparable, this was an approximate approach and had to be performed in an iterative fashion. The coal transportation matrix was not updated with EIA assumptions due to significant differences between the EPA 2.1.9 and EIA AEO 2005 coal supply and coal demand region configurations.
- The cost and performance of new units were updated to AEO 2005 reference case levels in all of the above four funs.
- The run years 2008, 2009, 2012, 2015, 2018, 2020 and 2026 were modeled.
- The AEO 2005 life extension costs for fossil and nuclear units were incorporated in the above runs.

- The extensive NEEDS comments provided by VISTAS, MRPO, CENRAP and MANE-VU were incorporated into the VISTAS Phase I NEEDS.
- MANE-VU's comments in regards to the state regulations in the northeast were incorporated.
- Renewable Portfolio Standards (RPS) in the northeast was modeled based on the Regional Greenhouse Gas Initiative analysis. A single RPS cap was modeled for MA, RI, NY, NJ, MD and CT. These states could buy credits from NY, PJM and New England model regions.
- The investments required under the Illinois power, Mirant and First Energy NSR settlements were incorporated in the above runs.

For the VISTAS/CENRAP Phase II set of IPM runs, ICF generated two different parsed files. One file includes all fuel burning units (fossil, biomass, landfill gas) as well as non-fuel burning units (hydro, wind, etc.). The second file contains just the fossil-fuel burning units (e.g., emissions from biomass and landfill gas are omitted). The RPOs decided to use the fossil-only file for modeling to be consistent with EPA, since EPA used the fossil only results for CAIR analyses. For the 10 VISTAS states, non-fossil fuels accounted for only 0.13 percent of the NOx emissions and 0.04 percent of the SO_2 emissions in the 2009 IPM runs.

S/L agencies reviewed the results of the VISTAS/CENRAP Phase II set of IPM runs, which were incorporated into the VISTAS Base F inventory. S/L agencies primarily reviewed and commented on the IPM results with respect to IPM decisions on NO_x post-combustion controls and SO_2 scrubbers. S/L agencies provided the latest information on when and where new SO_2 and NO_x controls are planned to come online. S/L agencies also reviewed the IPM results to verify that existing controls and emission rates were properly reflected in the IPM runs. As directed by the S/L agencies, adjustments to the IPM results were made to specific units with any new information they had as part of the permitting process or other contact with the industry that indicates which units will install controls as a result of CAIR and when these new controls will come on-line. Mississippi decided to continue to use the Southern Company projections instead of the IPM projections to represent emissions at Southern Company facilities in Mississippi. The initial set of state-specified changes to the VISTAS/CENRAP Phase II set of IPM runs were used to create the Base G projection inventory (and are documented later in Section 2.1.1.6). The second set of state specified changes were made only for the 2018 inventory, resulting in the Base G2 2018 inventory (documented later in Section 2.1.1.7). The final set of state specified changes applied to both the 2009 and 2018 inventories and were used to create the B&F 2009 and 2018 inventories (documented later in Section 2.1.1.8).

2.1.1.2 VISTAS IPM runs for EGU sources

The following general summary of the VISTAS IPM® modeling is based on ICF's documentation *Future Year Electricity Generating Sector Emission Inventory Development Using the IPM® in Support of Fine Particulate Mass and Visibility Modeling in the VISTAS and Midwest RPO Regions,* April 2005. The ICF documentation is to be used as an extension to EPA's proposed CAIR modeling runs documented in *Documentation Supplement for EPA Modeling Applications (V.2.1.6) Using the IPM,* EPA 430/R-03-007, July 2003.

IPM provides "forecasts of least-cost capacity expansion, electricity dispatch, and emission control strategies for meeting energy demand and environmental, transmission, dispatch, and reliability constraints." The underlying database in this modeling is U.S. EPA's National Electric Energy Data System (NEEDS) released with the CAIR Notice of Data Availability (NODA). The NEEDS database contains the existing and planned/committed unit data in EPA modeling applications of IPM. NEEDS includes basic geographic, operating, air emissions, and other data on these generating units. VISTAS States and stakeholders provided changes for:

- NO_x post-combustion control on existing units
- SO_2 scrubbers on existing units
- SO_2 emission limitations
- PM controls on existing units
- Summer net dependable capacity
- Heat rate for existing units
- SO_2 and NO_x control plans based on State rules or enforcement settlements

The years 2009 and 2018 were explicitly modeled.

2.1.1.3 Post-Processing of IPM Parsed Files

The following summary of the VISTAS/Midwest Regional Planning Organization (MRPO) IPM modeling is based on Pechan's documentation *LADCO IPM Model Parsed File Post-Processing Methodology and File Preparation*, February 8, 2005. The essence of the IPM model post-processing methodology is to take an initial IPM model output file and transform it into air quality model input files. ICF via VISTAS/MRPO provides an initial spreadsheet file containing unit-level records of both

(1) "existing" units and

(2) committed or new generic aggregates.

All records have unit and fuel type data; existing, retrofit (for SO_2 and NO_x), and separate NO_x control information; annual SO_2 and NO_x emissions and heat input; summer season (May-September) NO_x and heat input; July day NO_x and heat input; coal heat input by coal type;

nameplate capacity megawatt (MW), and State FIPS code. Existing units also have county FIPS code, a unique plant identifier (ORISPL) and unit ID (also called boiler ID) (BLRID); generic units do not have these data. The processing includes estimating various types of emissions and adding in control efficiencies, stack parameters, latitude-longitude coordinates, and State identifiers (plant ID, point ID, stack ID, process ID). Additionally, the generic units are sited in a county and given appropriate IDs. This processing is described in more detail below.

The data are prepared by transforming the generic aggregates into units similar to the existing units in terms of the available data. The generic aggregates are split into smaller generic units based on their unit types and capacity, are provided a dummy ORIS unique plant and boiler ID, and are given a county FIPS code based on an algorithm that sites each generic by assigning a sister plant that is in a county based on its attainment/nonattainment status. Within a State, plants (in county then ORIS plant code order) in attainment counties are used first as sister sites to generic units, followed by plants in PM nonattainment counties, followed by plants in 8-hour ozone nonattainment counties. Note that no LADCO or VISTAS States provided blackout counties that would not be considered when siting generics, so this process is identical to the one used for EPA IPM post-processing.

SCCs were assigned for all units; unit/fuel/firing/bottom type data were used for existing units' assignments, while only unit and fuel type were used for generic units' assignments. Latitude-longitude coordinates were assigned, first using the EPA-provided data files, secondly using the September 17, 2004 Pechan in-house latitude-longitude file, and lastly using county centroids. These data were only used when the data were not provided in the 2002 NIF files. Stack parameters were attached, first using the EPA-provided data files, secondly using a March 9, 2004 Pechan in-house stack parameter file based on previous EIA-767 data, and lastly using an EPA June 2003 SCC-based default stack parameter file. These data were only used when the data were not provided in the 2002 NIF files.

Additional data were required for estimating VOC, CO, filterable primary PM_{10} and PM2.5, PM condensable, and NH_3 emissions for all units. Thus, ash and sulfur contents were assigned by first using 2002 EIA-767 values for existing units or SCC-based defaults; filterable PM10 and PM2.5 efficiencies were obtained from the 2002 EGU NEI that were based on 2002 EIA-767 control data and the PM Calculator program (a default of 99.2 percent is used for coal units if necessary); fuel use was back calculated from the given heat input and a default SCC-based heat content; and emission factors were obtained from an EPA-approved October 7, 2004 Pechan emission factor file based on AP-42 emission factors. Note that this updated file is not the one used for estimating emissions for previous EPA post-processed IPM files. Emissions for 28 temporal-pollutant combinations were estimated since there are seven pollutants (VOC, CO, primary PM_{10} and $PM_{2.5}$, NH_3, SO_2 and NO_x) and four temporal periods (annual, summer season, winter season, July day).

The next step was to match the IPM unit IDs with the identifiers in VISTAS 2002 inventory. A crosswalk file was used to obtain FIPS State and county, plant ID (within State and county), and point ID. If the FIPS State and county, plant ID and point ID are in the 2002 VISTAS NIF tables, then the process ID and stack ID are obtained from the NIF; otherwise, defaults, described above, were used.

Pechan provided the post-processed files in NIF 3.0 format. Two sets of tables were developed : "NIF files" for IPM units that have a crosswalk match and are in the 2002 VISTAS inventory, and "NoNIF files" for IPM units that are not in the 2002 VISTAS inventory (which includes existing units with or without a crosswalk match as well as generic units).

For Base F and Base G projections, VISTAS reviewed the PM and NH_3 emissions from EGUs as provided by Pechan and identified significantly higher emissions in 2009/2018 than in 2002. VISTAS determined that Pechan used a set of PM and NH_3 emission factors that are "the most recent EPA approved uncontrolled emission factors" for estimating 2009/2018 emissions. These factors are most likely not the same emission factors used by States for estimating these emissions in 2002 for EGUs in the VISTAS domain. Thus, the emission increase from 2002 to 2009/2018 was simply an artifact of the change in emission factor, not anything to do with changes in activity or control technology application. Also, VISTAS identified an inconsistent use of SCCs for determining emission factors between the base and future years.

VISTAS resolution of the PM and NH_3 problem is fully documented in *EGU Emission Factors and Emission Factor Assignment,* memorandum from Greg Stella to VISTAS State Point Source Contacts and VISTAS EGU Special Interest Workgroup, June 13, 2005. The first step was the adjustment of the 2002 base year emissions inventory. Using the latest "EPA-approved" uncontrolled emission factors by SCC, Alpine Geophysics utilized CERR or VISTAS reported annual heat input, fuel throughput, heat, ash and sulfur content to estimate annual uncontrolled emissions for units identified as output by IPM. This step was conducted for non-CEM pollutants (CO, VOC, PM, and NH_3) only. For PM emissions, the condensable component of emissions was calculated and added to the resulting PM primary estimations. The resulting emissions were then adjusted by any control efficiency factors reported in the CERR or VISTAS data collection effort. The second adjustment was to the future year inventories. Alpine Geophysics updated the SCCs in the future year inventory to assign the same base year SCC. Using the same methods as described for the 2002 revisions, those non-IPM generated pollutants were estimated using IPM predicted fuel characteristics and base year 2002 SCC assignments.

2.1.1.4 Eliminating Double Counting of EGU Units

The following procedures were used to avoid double counting of EGU emissions in the 2009/2018 point source inventory. The 2002 VISTAS point source emission inventory contains both EGUs and non-EGUs. Since this file contains both EGUs and non-EGU point sources, and

EGU emissions are projected using the IPM, it was necessary to split the 2002 point source file into two components. The first component contains those emission units accounted for in the IPM forecasts. The second component contains all other point sources not accounted for in IPM.

As described in the previous section, Pechan developed 2009/2018 NIF files for EGUs from the IPM parsed files. All IPM matched units were initially removed from the 2009/2018 point source inventory to create the non-EGU inventory (which was projected to 2009/2018 using the non-EGU growth and control factors described in Section 2.1.2). This was done on a unit-by-unit basis based on a cross-reference table that matches IPM emission unit identifiers (ORISPL plant code and BLRID emission unit code) to VISTAS NIF emission unit identifiers (FIPSST state code, FIPSCNTY county code, State Plant ID, State Point ID). When there was a match between the IPM ORISPL/BLRID and the VISTAS emission unit ID, the unit was assigned to the EGU inventory; all other emission units were assigned to the non-EGU inventory.

If an emission unit was contained in the NIF files created by Pechan from the IPM output, the corresponding unit was removed from the initial 2009/2018 point source inventory. The NIF 2009/2018 EGU files from the IPM parsed files were then merged with the non-EGU 2009/2018 files to create the 2009/2018 Base F point source files.

Next, we prepared several ad-hoc QA/QC queries to verify that there was no double-counting of emissions in the EGU and non-EGU inventories:

- We reviewed the IPM parsed files {VISTASII_PC_1f_AllUnits_2009 (To Client).xls and VISTASII_PC_1f_AllUnits_2018 (To Client).xls} to identify EGUs accounted for in IPM. We compared this list of emission units to the non-EGU inventory derived from the VISTAS cross-reference table to verify that units accounted for in IPM were not double-counted in the non-EGU inventory. As a result of this comparison, we made a few adjustments in the cross-reference table to add emission units for four plants to ensure these units accounted for in IPM were moved to the EGU inventory.
- We reviewed the non-EGU inventory to identify remaining emission units with an Standard Industrial Classification (SIC) code of “4911 Electrical Services” or Source Classification Code of “1-01-xxx-xx External Combustion Boiler, Electric Generation”. We compared the list of sources meeting these selection criteria to the IPM parsed file to ensure that these units were not double-counted.

S/L agencies also reviewed the 2009/2018 point source inventory to verify whether there was any double counting of EGU emissions. In two instances, S/L agencies provided corrections where an emission unit was double counted.

2.1.1.5 Quality Assurance Steps

Quality assurance was an important component to the inventory development process. The following QA steps on the EGU component of the VISTAS revised 2009/2018 EGU inventory:

1. Provided parsed files (i.e., Excel spreadsheets that provide unit-level results derived from the model plant projections obtained by the IPM) to the VISTAS EGU SIWG for review.
2. Provided facility level emission summaries for 2009/2018 for both the base case and CAIR case to the VISTAS EGU SIWG to ensure that emissions were consistent and that there were no missing sources.
3. Compared, at the State-level, emissions from the IPM parsed files and the post-processed NIF files to verify that the post-processed NIF files were consistent with the IPM parsed file results.

VISTAS requested S/L review of these files – the changes specified by states as a result of this review are documented in the following subsection.

2.1.1.6 S/L Adjustments to IPM Modeling Results for Base G Projections

After S/L agency review of the final set of IPM runs (as incorporated into the Base F inventory), S/L agencies specified a number of changes to the IPM results to better reflect current information on when and where future controls would occur. These changes to the IPM results primarily involved S/L agency addition or subtraction future emission controls based on the best available data from state rules, enforcement agreements, compliance plans, permits, and discussions/commitments from individual companies.

For example, Dominion Virginia Power released their company-wide plan to reduce emission to meet the requirements of CAIR and other programs. This plan varies substantially from the IPM results both in terms current and future controls and timing of these controls. As a result, VA DEQ developed their best estimates of future controls on EGUs in Virginia. Also, Duke Energy and Progress Energy have updated their plans for complying with North Carolina’s Clean Smokestack Act. These plans vary substantially from the IPM results both in terms current and future controls and timing of these controls. As a result, NC DENR replaced the IPM emission projections for 2009 with projections from the Duke Energy and Progress Energy compliance plan. NC DENR elected to use the IPM results for 2018.

Some S/L agencies specified changes to the controls assigned by IPM to reflect their best estimates of emission controls. These changes involved either 1) adding selective catalytic reduction (SCR) or scrubber controls to units where IPM did not predict SCR or scrubber controls, or 2) removing IPM-assigned SCR or scrubber controls at units where the S/L agency indicated their were no firm plans for controls at those units. We generally used a control efficiency of 90 percent when adding or removing SO_2 scrubber controls (unless a different control efficiency was provided by the State). We generally used a control efficiency of 90 percent when adding or removing NO_x SCR controls at coal-fired plants, 80 percent when adding or removing NO_x SCR controls at gas-fired plants, and 35 percent when adding or removing NO_x SNCR controls (unless a different control efficiency was provided by the State). The changes specified by the S/L agencies are summarized in Table 2.1-1. A comparison of the IPM and VISTAS control assumptions for all coal-fired EGUs in the Base G/G2 inventories are summarized in Appendix H. In addition to the changes to the IPM-assigned controls, the S/L agencies also specified other types of changes to the IPM results. These other specific changes to the IPM results are summarized in Table 2.1-2.

S/L agencies provided information and/or comment on changes in stack parameters from the 2002 inventory for 2009/2018 inventory. Changes to stack parameters were also made in cases where new controls are scheduled to be installed. In cases where an emission unit projected to have a SO_2 scrubber in either 2009 or 2018, some states were able to provide revised stack parameters for some units based on design features for the new control system. Other units projected to install scrubbers by 2009 or 2018 are not far enough along in the design process to have specific design details. For those units, the VISTAS EGU SIWG made the following assumptions: 1) the scrubber is a wet scrubber; 2) keep the current stack height the same; 3) keep the current flow rate the same, and 4) change the stack exit temperature to 169 degrees F (this is the virtual temperature derived from a wet temperature of 130 degrees F). VISTAS determined that exit temperature (wet) of 130 degrees F +/- 5 degrees F is representative of different size units and wet scrubber technology.

2.1.1.7 S/L Adjustments to IPM Modeling Results for Base G2 2018 Projections

Following release of the Base G inventory, four States specified additional changes to reflect their best estimates of emission controls in 2018. These additional changes are marked with an "*" in Tables 2.1-1 and 2.1-2. The following changes were requested and implemented in the VISTAS 2018 Base G2 EGU emissions and modeling inventories:

- **Florida** - Removed scrubbers from Smith units 1 & 2. Added scrubbers to Crist units 4, 5, & 6. Forecast emissions (from 2002 base) using growth factors for Northside units 1A and 2A. These units were estimated to be non operational in the IPM base case run.
- **Georgia** - Added scrubbers to Plant Scherer (Units 1-4) and Plant Yates (Units 6 & 7).
- **North Carolina** - Remove scrubber from F Lee unit 3.
- **West Virginia** - Pleasants Units 1 and 2 had SO2 emissions reduced to account for the facility's inclusion of previously bypassed 15% effluent stream to the scrubber and the control efficiency and emissions will reflect a change from 79.9% to 95% control.

Table 2.1-1 Adjustments to IPM Control Determinations Specified by S/L Agencies for the Base G/G2 2009/2018 EGU Inventories.

State	Plant Name and ID	Unit	NO_x Retrofit Emission Controls				SO_2 Retrofit Emission Controls			
			2009		2018		2009		2018	
			IPM	State	IPM	State	IPM	State	IPM	State
AL	James H. Miller ORISID=6002	1 & 2	SCR during ozone season	SCR probable year round due to CAIR	SCR during ozone season	SCR probable year round due to CAIR	None	None	None	Scrubber
		3 & 4	SCR during ozone season	SCR year round from Consent Decree	SCR during ozone season	SCR year round from Consent Decree	None	None	None	Scrubber
	Barry ORISID=3	1, 2, 3	None	SNCR	SCR	SNCR	None	None	None	None
		4	None	SNCR	SCR	SNCR	None	None	Scrubber	Scrubber
		5	None	None	SCR	SCR	None	None	Scrubber	Scrubber
	E C Gaston ORISID=26	1 - 4	SCR	None	SCR	None	None	None	Scrubber	Scrubber
		5	SCR	SCR	SCR	SCR	Scrubber	None	Scrubber	Scrubber
	Gorgas ORISID=8	6 & 7	None	None	None	None	None	None	None	None
		8 & 9	None	None	None	None	None	Scrubber	None	Scrubber
		10	SCR	SCR	SCR	SCR	None	Scrubber	Scrubber	Scrubber
	Charles R. Lowman ORISID=56	1	None	None	None	None	None	Scrubber	None	Scrubber
		2 & 3	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
FL	Lansing Smith ORISID=643	1	None	None	SCR	SCR	None	None	Scrubber	None*
		2	None	None	SCR	SCR	None	None	Scrubber	None*
	Northside ORISID=667	1A & 1B	No operation	No operation	No operation	No control, emissions forecasted using growth rates*	No operation	No operation	No operation	No control, emissions forecasted using growth rates*

Table 2.1-1 (continued)

State	Plant Name and ID	Unit	NO_x Retrofit Emission Controls				SO_2 Retrofit Emission Controls			
			2009		2018		2009		2018	
			IPM	State	IPM	State	IPM	State	IPM	State
FL	Crist ORISID=641	4	None	None	None	None	None	None	None	Scrubber*
		5	None	None	None	None	None	None	None	Scrubber*
		6	None	None	None	None	None	None	None	Scrubber*
GA	Bowen ORISID=703	1BLR	SCR	SCR	SCR	SCR	IPM had retrofit scrubbers but little emission reductions	None	Scrubber	Scrubber
		2BLR	SCR	SCR	SCR	SCR		None	Scrubber	Scrubber
		3BLR	SCR	SCR	SCR	SCR		Scrubber	Scrubber	Scrubber
		4BLR	SCR	SCR	SCR	SCR		Scrubber	Scrubber	Scrubber
	Wansley ORISID=6052	1	SCR	SCR	SCR	SCR	IPM had retrofit scrubbers but little emission reductions	Scrubber	Scrubber	Scrubber
		2	SCR	SCR	SCR	SCR		None	Scrubber	Scrubber
	Kraft ORISID=733	1, 2	None	None	None	None	None	None	None	None
		3	None	None	SCR	None	None	None	None	None
	McIntosh ORISID=6124	1	None	None	SCR	None	None	None	None	None
	Yates ORISID=728	1	None	None	None	None	Scrubber	Scrubber	Scrubber	Scrubber
		2, 3	None	None	None	None	None	None	None	None
		4, 5	None	None	SCR	SCR	None	None	Scrubber	None
		6, 7	None	None	SCR	SCR	None	None	Scrubber	Scrubber*

Table 2.1-1 (continued)

State	Plant Name and ID	Unit	NO_x Retrofit Emission Controls				SO_2 Retrofit Emission Controls			
			2009		2018		2009		2018	
			IPM	State	IPM	State	IPM	State	IPM	State
GA	Hammond ORISID=708	1	None	None	SCR	SCR	None	Scrubber	Scrubber	Scrubber
		2	None	None	SCR	SCR	None	Scrubber	Scrubber	Scrubber
		3	None	None	SCR	SCR	None	Scrubber	Scrubber	Scrubber
		4	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
	Scherer ORISID=6257	1	None	None	None	None	None	None	None	Scrubber*
		2	None	None	None	None	None	None	None	Scrubber*
		3	None	None	None	None	None	None	None	Scrubber*
		4	None	None	None	None	None	None	None	Scrubber*
KY	Ghent ORISID=1356	1	None	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
		2	None	None	SCR	SCR	None	Scrubber	Scrubber	Scrubber
		3, 4	None	SCR	SCR	SCR	None	Scrubber	Scrubber	Scrubber
	Coleman ORISID=1381	C1	None	None	SCR	SCR	None	Scrubber	Scrubber	Scrubber
		C2	None	None	SCR	SCR	None	Scrubber	Scrubber	Scrubber
		C3	None	None	SCR	SCR	None	Scrubber	Scrubber	Scrubber
	HMP&L Station 2	H1	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
		H2	None	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
	E W Brown ORISID=1355	1	None	None	None	None	None	Scrubber	None	Scrubber
		2	None	None	SCR	SCR	None	Scrubber	Scrubber	Scrubber
		3	None	None	SCR	SCR	None	Scrubber	Scrubber	Scrubber
SC	Jeffries ORISID=3319	3	SCR	None	SCR	None	None	None	None	None
		4	None	None	None	None	None	None	None	None
	Wateree ORISID=3297	WAT1	SCR	SCR	SCR	SCR	None	Scrubber	None	Scrubber
		WAT2	SCR	SCR	SCR	SCR	None	Scrubber	Scrubber	Scrubber

Table 2.1-1 (continued)

State	Plant Name and ID	Unit	NO_x Retrofit Emission Controls				SO_2 Retrofit Emission Controls			
			2009		2018		2009		2018	
			IPM	State	IPM	State	IPM	State	IPM	State
SC	Canadys ORISID=3280	CAN1	None	None	None	None	None	None	None	None
		CAN2	None	None	None	None	None	None	None	None
		CAN3	None	None	None	None	None	Scrubber	None	Scrubber
	Rainey ORISID=7834	CT1A	None	SCR	None	SCR	None	None	None	None
		CT1B	None	SCR	None	SCR	None	None	None	None
TN	Kingston ORISID=3407	1 – 8	SCR	SCR	SCR	SCR	None	None	Scrubber	Scrubber
		9	None	SCR	SCR	SCR	None	None	Scrubber	Scrubber
	Johnsonville ORISID=3406	1 – 10	SCR	None	SCR	SCR	None	None	None	None
WV	Willow Island ORISID=3946	2	SCR	None	SCR	SCR	Scrubber	None	Scrubber	Scrubber
	Kammer ORISID=3947	1 -3	SCR	None	SCR	SCR	Scrubber	None	Scrubber	Scrubber

Note: See Appendix H for a complete list of IPM and VISTAS control determinations for all coal and oil/gas units.

Table 2.1-2 Other Adjustments to IPM Results Specified by S/L Agencies for the Base G/G2 2009/2018 EGU Inventories.

State	Plant Name and ID	Unit	Nature of Update/Correction
FL	Central Power and Lime ORISID= 10333	GEN1	Central Power and Lime (ORIS10333) is a duplicate entry. This is point 18 in Florida Crushed Stone (12-053-0530021). Removed IPM emissions for Central Power and Lime.
	Cedar Bay Generating ORISID=10672	GEN1	FLDEP disagrees with IPM projections - no knowledge of expansion of this facility and the cogeneration facility should not grow faster than the underlying industry. Cedar Bay is connected to Stone Container (12-031-0310067). Replaced IPM emissions with 2002 emissions for Cedar Bay (12-031-0310337) times the growth factors for Stone Container.
	Indiantown Cogeneration ORISID=50976	GEN1	FLDEP disagrees with IPM projections - no knowledge of expansion of this facility and the cogeneration facility should not grow faster than the underlying industry. Indiantown is connected to Louis Dreyfus Citrus (12-085-0850002). Replaced IPM emissions with 2002 emissions for Indiantown (12-085-0850102) times the growth factors for Louis Drefus Citrus.
GA	Bowen ORISID=703	1BLR 2BLR 3BLR 4BLR	IPM indicated retrofit scrubbers on all 4 units in 2009, but the IPM emissions showed little reductions from 2002 levels. Changed emissions to reflect scrubbers on 3BLR and 4BLR by 2009.
	Wansley ORISID=6052	1, 2	IPM indicated retrofit scrubbers on both units in 2009, but the IPM emissions showed little reductions from 2002 levels. Changed emissions to reflect one scrubber on Unit 1 by 2009.
	Riverside ORISID=734	4	All of plant Riverside was retired from service June 1, 2005; emissions set to zero in 2009 and 2018.
	McIntosh ORISID=727	CT10A CT10B CT11A CT11B	The McIntosh Combined Cycle facility became commercial June 1, 2005. Added 346 tons of NO_x and 121 tons of SO_2 per unit to the 2009 and 2018 inventories.
	Longleaf Energy Station	1, 2	Longleaf Energy Station is being proposed by LS Power Development, Inc. GA specified that the emissions from this proposed plant be included in the 2018 projections. Boilers 1 and 2 added 1,882 tons of NO_x and 3,227 tons of SO_2 per unit to the 2018 inventory.
	Duke Murray (55382)	1	Corrected coordinates to 34.7189 and -84.9353
MS	R D Morrow ORISID=6061	1, 2	Revised the 2018 emissions to reflect controls not indicated by IPM. The SO_2 emissions are much lower than IPM, but their expected NO_x emissions are actually higher than IPM. The controls will be coming online 2009 or 2010, so the 2009 inventory did not change.
	Jack Watson (2049) Victor J Daniel (6073) Chevron Oil (2047)	All	MS DEQ specified that the emission projections provided by the Southern Company for their units in Mississippi were to be used instead of the IPM results.

Table 2.1-2 (continued)

State	Plant Name and ID	Unit	Nature of Update/Correction
NC	G G Allen (2718) Belews Creek (8042)1 Buck (2720) Cliffside (2721) Dan River (2723) Marshall (2727) Riverbend (2732)	All	Replaced all IPM 2009 results with emission projections from Duke Power's NC Clean Air Compliance Plan for 2006. Used IPM results for 2018
	Asheville (2706) Cape Fear (2708) Lee (2709) Mayo (6250) Roxboro (2712) Sutton (2713) Weatherspoon (2716)	All	Replaced all IPM 2009 results with emission projections from Progress Energy's NC Clean Smokestacks Act Calendar Year 2005 Progress Report. Used IPM results for 2018, except for Lee #3* where IPM projected a retrofit scrubber but NC specified that no scrubber was to be applied.
	Dwayne Collier Battle Cogeneration Facility ORISID=10384	GEN1 GEN2	Dwayne Collier Battle is a duplicate entry. This is Cogentrix of Rocky Mount (37-065-3706500146, stacks G-26 and G-27). Duplicate entries were removed both the 2009 and 2018 inventories.
	Kannapolis Energy Partners ORISID=10626	GEN2 GEN3	Kannapolis Energy emissions are being used as credits for another facility. IPM emissions from this facility (37-025-ORIS10626) were removed from the EGU inventory for 2009 and 2018. Emissions from Kannapolis Energy (37-025-3702500113) were carried forward in the 2009/2018 inventory.
SC	Cross ORISID=130	1, 2	Unit 1: upgrade scrubber from 82 percent to 95 percent removal efficiency by June 30, 2006. Recalculate emissions based on upgrade in control efficiency. Unit 2: upgrade scrubber from 70 percent to 87 percent removal efficiency by June 30, 2006. Recalculate emissions based on upgrade in control efficiency.
	Winyah ORISID=6249	1 – 4	Unit 1: Install scrubber that meets 95 percent removal efficiency by Dec. 31, 2008; Upgrade ESP from 0.38 to 0.03 lb/mmBTU by Dec. 31, 2008 Unit 2: Replace scrubber with one that meets 95 percent removal efficiency from 45 percent by Dec. 31, 2008; Upgrade ESP from 0.10 to 0.03 lb/mmBTU by Dec. 31, 2008 Unit 3: Upgrade scrubber from 70 percent to 90 percent removal efficiency by Dec. 31, 2012; Upgrade ESP from 0.10 to 0.03 lb/mmBTU by Dec. 31, 2012 Unit 4: Upgrade scrubber from 70 percent to 90 percent removal efficiency by Dec. 31, 2007; Upgrade ESP from 0.10 to 0.03 lb/mmBTU by Dec. 31, 2007 Recalculated SO_2 and PM emissions based on upgrade in control efficiencies.

Table 2.1-2 (continued)

State	Plant Name and ID	Unit	Nature of Update/Correction
SC	Dolphus Grainger ORISID=3317	1, 2	Unit 1: Upgrade ESP from 0.60 to 0.03 lb/mmBTU by Dec. 31, 2012. Reduced PM_{10} and PM25 emissions in 2018 by 95 percent based on change in allowable emission rate Unit 2: Install low NO_x burners that meet 0.46 lb/mmBTU from 0.9 by May 1, 2004. Recalculated NO_x emissions using 0.46/lbs/mmBtu and IPM heat input Unit 2: Upgrade ESP from 0.60 to 0.03 lb/mmBTU by Dec. 31, 2012. Reduced PM_{10} and PM25 emissions in 2018 by 95 percent based on change in allowable emission rate
	Jeffries ORISID=3319	3, 4	Unit 3: Upgrade ESP from 0.54 to 0.03 lb/mmBTU by Dec. 31, 2012. Reduced PM_{10} and PM25 emissions in 2018 by 94.44 percent based on change in allowable emission rate Unit 4: Upgrade ESP from 0.54 to 0.03 lb/mmBTU by Dec. 31, 2012. Reduced PM_{10} and PM25 emissions in 2018 by 94.44 percent based on change in allowable emission rate
	W S Lee ORISID=3264	1, 2	IPM does not indicate that these units are installing SOFA NO_x control technology by April 30, 2006 to meet 0.27 lb/mmBTU, down from 0.45 lb/mmBtu. Calculated NO_x emissions using IPM heat input and 0.27 lbs/mmBtu
	Generic Unit ORISID=900545	All	All predictions for generic units appear reasonable with the exception of Plant ID ORIS900545 Point ID GSC45 which was modeled in Georgetown County. It will be very difficult to add new generation this close to the Cape Romain Class I area. Santee Cooper has no plans for future generation in Georgetown County, but does have plans for new future generation in Florence County. This unit was moved to coordinates specified in Florence County.
VA	AEP Clinch River ORISID=3775	1, 2, 3	Used IPM results for 2009; replaced all 2018 IPM results with VADEQ's growth and control estimates (no SCR or scrubbers).
	AEP Glen Lyn ORISID=3776	51, 52, 6	Used 2009/2018 IPM results for units 51 and 52; used 2009 IPM for unit 6; replaced 2018 IPM for unit 6 with VADEQ's growth and control estimates (nor SCR or scrubber).
	Dominion Clover ORISID=7213	1, 2	Used 2009/2018 IPM results.
	Dominion Bremo ORISID=3796	3, 4	Used 2009/2018 IPM results.
	Dominion Chesterfield ORISID=3797	3, 4, 5, 6	Replaced all 2009/2018 IPM results using VADEQ's growth and control estimates.
	Dominion Yorktown ORISID=3809	1, 2, 3	Units 1, 2: Used 2009/2018 IPM results for NOx and used VADEQ's growth and control estimates for SO2. Unit 3: IPM predicts zero heat input for this 880 MW #6 oil fired unit. Dominion plans to continue to operate Unit 3. Replaced all 2009/2018 IPM results using VADEQ's growth and control estimates.

Table 2.1-2 (continued)

State	Plant Name and ID	Unit	Nature of Update/Correction
VA	Dominion Chesapeake ORISID=3803	1 – 4	Unit 1: Used 2009/2018 IPM for NOx; used 2009 IPM for SO2; used VADEQ's growth and control estimates for SO2 (added scrubber that IPM did not have) Unit 2: Used 2009/2018 IPM for NOx; used 2009 IPM for SO2; used VADEQ's growth and control estimates for SO2 (added scrubber that IPM did not have) Unit 3: Used VA DEQ's growth and control estimates for 2009 NOx (added SCR that IPM did not have); used IPM result for 2018 NOx; Used 2009/2018 IPM for SO2. Unit 4: Used VA DEQ's growth and control estimates for 2009 NOx (added SCR that IPM did not have); used IPM result for 2018 NOx; Used 2009/2018 IPM for SO2.
	Dominion Possum Point ORISID=3804	3 & 4 5 6	Unit 3&4: IPM had 137 tons of NO_x for these units in 2009 and 111 tons in 2018. VA DEQ specified that the permitted emission rates should be used, which equates to 3,066 tons in 2009 and 2018. Unit 5: IPM had zero heat input. Replaced all 2009/2018 IPM results using VADEQ's growth and control estimates. Unit 6: Replaced all 2009/2018 IPM results using VADEQ's growth and control estimates.
	Potomac River ORISID=3788	1 - 5	Units 1&2: IPM retired these units. Mirant has no plans at this time to retire any units. Replaced all 2009/2018 IPM results using VADEQ's growth and control estimates. Units 3, 4, 5: Replaced all 2009/2018 IPM results using VADEQ's growth and control estimates.
WV	Albright ORISID=3942	1, 2	IPM predicted early retirement for these units. AEP indicated there are no plans for early retirement. For 2009, used 2002 actual emissions as these units are not likely to retire by 2009. For 2018, used IPM prediction of retirement.
	Rivesville ORISID=3945	7, 8	IPM predicted early retirement for these units. AEP indicated there are no plans for early retirement. For 2009, used 2002 actual emissions as these units are not likely to retire by 2009. For 2018, used IPM prediction of retirement.
	Willow Island ORISID=3946	1, 2	Unit 1: IPM predicted early retirement for these units. AEP indicated there are no plans for early retirement. For 2009, used 2002 emissions as these units are not likely to retire by 2009. For 2018, used IPM prediction of retirement. Unit 2: IPM predicted SCR and scrubber for 2009. These controls will not be in place by 2009.
	North Branch ORISID=7537	1A, 1B	SO_2 Permit Rate was corrected from 2.7 to 0.678 lb/MMBtu. Used SO_2 Permit Rate and IPM predicted total fuel used to calculate SO_2 emissions in 2009 and 2018
	Mt. Storm ORISID=3954	1, 2, 3	SO_2 Permit Rate was corrected from 2.7 to 0.15 lb/MMBtu. Used SO_2 Permit Rate of 0.15 lb/MMBtu and IPM predicted total fuel used to calculate SO_2 emissions in 2009 and 2018
	Pleasants Power Station ORISID=6004	1, 2	IPM applied a scrubber with a 79.9% control efficiency; WV indicated that the control efficiency should be 95%.

2.1.1.8 S/L Adjustments to IPM Modeling Results for B&F Projections

For the B&F inventory, the S/L agencies were asked to review the Base G2 inventory with respect to the following items:

- Identify any updates needed to better reflect current information on when and where future controls would occur based on the best available data from state rules, enforcement agreements, compliance plans, permits, and discussions/commitments from individual companies;
- Identify any updates needed to change the IPM determination that most oil/gas steam units would either retire early or have no operation in 2009 or 2018; and
- Identify any updates needed to change the IPM assignment and VISTAS post-processing of generic units with specific information on new capacity.

The changes specified by the S/L agencies are summarized in Table 2.1-3. A comparison of the IPM and VISTAS control assumptions for all coal-fired EGUs in the B&F inventories are summarized in Appendix I.

Table 2.1-3 Additional Adjustments to IPM Results Specified by S/L Agencies for the B&F 2009/2018 EGU Inventories.

State	Plant Name and ID	Unit	Nature of Update/Correction
FL	Cape Canaveral Indian River Port Everglades Turkey Point Manatee Martin Riviera Anclote CD McIntosh Northside B Suwannee River	1, 2 1, 2, 3 1 – 4 1, 2 1, 2 1, 2 3, 4 1, 2 1 3 3	The IPM 2009/2018 solution has either shut-down these oil-fired units or converted them to natural gas only. FLDEP has reason to believe that these units may continue to operate using oil. For some of these units, the owner or operator of the units have provided (and FLDEP approved) an estimate of how the units will be operated in 2009/2018. For others, to be conservative, FLDEP assumed that the oil-fired units will operate in 2009/2018 exactly as they operated in 2002.
	Gulf Power Schultz ORISID=643	1 - 4	Plant is expected to shut down and was taken out of the 2018 projection.
	Northside ORISID=667	1A, 1B	These units were estimated to be non operational by IPM in 2009 and 2018. FLDEP believes these units will continue to operate. Emissions were estimated using the 2002 base case emissions and growth factors for Northside units 1A and 2A. The changes for 2009 were made in the B&F inventory; the changes for 2018 were made in the Base G2 inventory.
	Crist ORISID=641	4, 5 6, 7	IPM did not assign scrubbers to these units. Scrubbers are currently being installed and should be operational in 2009. SO2 emissions reduced by 90%.
GA	Mitchell ORISID=727	SG03	GADNR provided new emission projections for 2018.

Table 2.1-3 (continued)

State	Plant Name and ID	Unit	Nature of Update/Correction
GA	Kraft ORISID=733	SG03	GADNR provided new emission projections for 2018.
	McIntosh ORISID=6124	SG01	GADNR provided new emission projections for 2018.
	Bowen ORISID=703	SG03 SG04	GADNR provided new SO2 emission projections for 2009 and 2018 based on a 95% control efficiency instead of 90%.
	Hammond ORISID=708	SG01 to SG04	GADNR provided new SO2 emission projections for 2009 and 2018 based on a 95% control efficiency instead of 90%.
	Wansley ORISID=6052	SG01	GADNR provided new SO2 emission projections for 2009 and 2018 based on a 95% control efficiency instead of 90%.
KY	John Sherman Cooper ORISID=1384	1	IPM did not assign a scrubber to this unit in 2018. KDAQ believes that a scrubber should be assigned for 2018.
	John Sherman Cooper ORISID=1384	2	IPM assigned SCR in 2009. KDAQ does not expect SCR by then; emissions changed to reflect low-NOx burner.
	Spurlock Station ORISID=6041	1, 2	IPM did not assign scrubbers to these units in 2009. Per a consent decree and for BART, KDAQ specified a 90% reduction in SO2 emissions from SO2 controls.
	Big Sandy ORISID=1353	BSU1	IPM assigned a scrubber and SCR in 2009. KDAQ does not expect scrubber or SCR controls to be operational in 2009.
MS	Entergy Delta Entergy Rex Brown Entergy Baxter Wilson Entergy Gerald Andrus	1, 2 3, 4 1, 2 1	The IPM 2009/2018 solution has either shut-down these oil-fired units or converted them to natural gas only. MSDEQ has reason to believe that these units may continue to operate using oil. To be conservative, MSDEQ assumed that the oil-fired units will operate in 2009/2018 exactly as they operated in 2002.
NC	Cliffside ORISID=2721	7	Removed Unit 7 from the 2018 inventory since the NC Utilities Commission disapproved the permit application.
	Cape Fear ORISID=2798	1, 2	IPM assigned scrubbers to both units in 2018; NCDENR indicated that the facility projected Furnace Sorbent Injection. Increased SO2 emissions to reflect change in control efficiency.
SC	99 Oil-fired Units		The IPM 2009/2018 solution has either shut-down 99 oil-fired units or converted them to natural gas only. SCDHEC has reason to believe that these units may continue to operate using oil. To be conservative, SCDHEC assumed that the oil-fired units will operate in 2009/2018 exactly as they operated in 2002.
SC	Santee Cooper Cross ORISID=130	4	For both 2009 and 2018, added in a new 660 MW Unit 4 (not in IPM) that is identical to the new Unit 3 (which was in IPM). Used the new Unit 4 to replace the IPM-generated 500 MW coal-fired Generic Unit (ORIS900545) located in the adjacent county.

Table 2.1-3 (continued)

State	Plant Name and ID	Unit	Nature of Update/Correction
SC	New Santee Cooper Units Planned for Florence County	1, 2	Santee Cooper is planning two new coal burning units in Florence County, each at 660 MW. These units were not explicitly identified in IPM. Used these new units to replace three IPM-generated 500 MW coal-fired Generic Units (ORIS900145, ORIS900245, ORIS900345) in Darlington and Colleton Counties.
	USDOE SRS Area D ORISID=7652	1	Facility is replacing coal-fired boilers with three biomass boilers. Recalculated emissions for 2018 using emission factors for biomass combustion and IPM heat inputs.
VA	Dominion Chesapeake ORISID=3803	1 - 4	Changed SO2 emissions in 2009 and 2018 to reflect information from the facility on project SO2 controls.
	Dominion Southwest Virginia Project	1	For 2018, replace the IPM generated Generic Unit located in Russell county (ORISID=900251) to Wise County to reflect the planned Dominion facility going into Wise County. Used the potential to emit for the Dominion facility.
	Clinch River ORISID=3775	1, 2, 3	Changed emissions in 2018 to reflect requirements of Consent Order. The CO requires SNCR by 12/31/2009; IPM assigned SCR in 2018. The CO caps SO2 emissions at 16,300 tpy starting Jan 1, 2015.
WV	Pleasants Power Station ORISID=6004	1, 2	For both 2009 and 2018, Units 1 and 2 had SO2 emissions reduced to account for the facility's inclusion of previously bypassed 15% effluent stream to the scrubber. The control efficiency and emissions changed from 79.9% to 95% control.
	Nine Generic Units Generated by IPM		IPM placed 746 MW of new fossil fuel-fired generation in West Virginia - 173 MW coal-fired, 24 MW IGCC, and the remainder gas-fired. A 600 MW pulverized coal-fired EGU is under construction, scheduled to be online in 2010 [Longview]; a 98 MW CFB co-generation unit is permitted and expected to be built [Western Greenbrier]; and a 600 MW IGCC plant is currently in the permitting process [Mountaineer IGCC]. WVDEP decided to replace the IPM generic units in WV with the 3 units mentioned above.
	Longview Site ID: 54- 061-0134	1	For 2018 inventory, added Longview which is permitted, under construction, and scheduled to be online in 2010. The unit is a 600 MW pulverized coal-fired unit with baghouse, LNB, SCR, and wet FGD as required controls. Used permitted emission rates for 2018.
WV	Western Greenbriar Site ID: 54-025-0066	1	For 2018 inventory, added Western Greenbrier, which is permitted but not under construction. The unit is a 98 MW coal-fired CFB burning waste coal. Used permitted emission rates for 2018.
	Mountaineer IGCC Site ID: 54-053-00063	1	For 2018 inventory, added Mountaineer IGCC, which has applied for a permit to construct a nominal 600 MW IGCC. Used emission rates from the permit application for 2018.

2.1.1.9 Conversion of MRPO BaseM 2009 EGU Data to SMOKE Input Format

To support ASIP $PM_{2.5}$ CAMx modeling of the future year 2009, Alpine Geophysics obtained and processed an emission inventory for the 5 MRPO states (Illinois, Indiana, Michigan, Wisconsin, and Ohio). Appendix x details the technical steps that were made as part of the conversion of the MRPO BaseM EGU files into IDA format for ASIP PM-2.5 CAMx modeling of the future year 2009.

2.1.1.10 Summary of 2009/2018 EGU Point Source Inventories

Tables 2.1-4 through 2.1-10 compare the Base G 2002 base year inventory to the Base F, Base G/G2 and B&F 2009/2018 projection inventories. The Base F projections rely primarily on the results of the IPM, while the Base G and B&F projections include the adjustments to the IPM results specified by the S/L agencies in the previous section.

Table 2.1-4 EGU Point Source SO_2 Emission Comparison for 2002/2009/2018.

	2002	2009			2018		
State	**Actual Base G**	**Base F IPM Based**	**Base G IPM with State/local Updates**	**B&F IPM with Additional State/local Updates**	**Base F IPM Based**	**Base G2 IPM with State/local Updates**	**B&F IPM with Additional State/local Updates**
AL	447,828	340,194	378,052	378,052	190,099	135,851	135,851
FL	453,631	195,790	186,055	291,831	141,551	138,340	194,028
GA	514,952	534,469	417,449	408,679	180,178	79,430	68,515
KY	484,057	371,944	290,193	271,669	229,603	226,062	222,102
MS	67,429	85,629	76,579	76,646	27,230	15,146	15,213
NC	477,990	205,018	242,286	242,286	110,382	114,771	120,165
SC	206,399	171,206	124,608	129,122	121,694	93,274	95,377
TN	334,151	255,400	255,410	255,410	112,662	112,672	112,672
VA	241,204	169,714	193,112	174,777	90,935	114,255	98,988
WV	516,084	226,127	277,489	268,952	124,466	105,935	106,199
	3,743,725	**2,555,491**	**2,441,233**	**2,497,423**	**1,328,800**	**1,135,736**	**1,169,110**

Note: Emission summaries above are based on SCCs 1-01-xxx-xx and 2-01-xxx-xx.

Table 2.1-5 EGU Point Source NO_x Emission Comparison for 2002/2009/2018.

	2002	2009			2018		
State	Actual Base G	Base F IPM Based	Base G IPM with State/local Updates	B&F IPM with Additional State/local Updates	Base F IPM Based	Base G2 IPM with State/local Updates	B&F IPM with Additional State/local Updates
AL	161,038	70,852	82,305	82,305	42,769	64,358	64,358
FL	257,677	89,610	86,165	132,535	77,080	74,640	87,645
GA	147,517	97,146	98,497	98,497	58,095	75,717	69,856
KY	198,817	107,890	92,021	97,263	64,378	64,378	64,378
MS	43,135	11,475	36,011	47,276	8,945	10,271	21,535
NC	151,853	66,431	66,522	66,521	60,914	62,353	61,110
SC	88,241	43,817	46,915	48,668	48,346	51,456	51,751
TN	157,307	41,767	66,405	66,405	31,725	31,715	31,715
VA	86,886	63,220	62,547	64,358	49,420	66,074	64,344
WV	230,977	63,510	86,328	85,476	51,241	51,241	51,474
	1,523,448	**655,718**	**723,717**	**789,304**	**492,913**	**552,203**	**568,166**

Note: Emission summaries above are based on SCCs 1-01-xxx-xx and 2-01-xxx-xx.

Table 2.1-6 EGU Point Source VOC Emission Comparison for 2002/2009/2018.

	2002	2009			2018		
State	Actual Base G	Base F IPM Based	Base G IPM with State/local Updates	B&F IPM with Additional State/local Updates	Base F IPM Based	Base G2 IPM with State/local Updates	B&F IPM with Additional State/local Updates
AL	2,295	2,441	2,473	2,473	2,952	2,952	2,952
FL	2,524	1,867	1,910	2,730	2,324	2,422	3,047
GA	1,244	1,571	2,314	2,314	1,903	2,841	2,816
KY	1,487	1,369	1,369	1,369	1,426	1,426	1,426
MS	648	406	404	564	1,124	1,114	1,274
NC	988	974	954	954	1,272	1,345	1,302
SC	470	660	660	723	906	906	931
TN	926	932	932	932	977	976	976
VA	754	685	778	788	903	1,014	980
WV	1,180	1,342	1,361	1,361	1,387	1,387	1,387
	12,516	**12,247**	**13,155**	**14,208**	**15,174**	**16,383**	**17,091**

Note: Emission summaries above are based on SCCs 1-01-xxx-xx and 2-01-xxx-xx.

Table 2.1-7 EGU Point Source CO Emission Comparison for 2002/2009/2018.

	2002	2009			2018		
State	Actual Base G	Base F IPM Based	Base G IPM with State/local Updates	B&F IPM with Additional State/local Updates	Base F IPM Based	Base G2 IPM with State/local Updates	B&F IPM with Additional State/local Updates
AL	11,279	14,948	14,986	14,986	24,342	24,342	24,342
FL	57,113	45,391	35,928	71,072	63,673	54,146	85,495
GA	9,712	20,066	23,721	23,721	32,744	44,476	44,269
KY	12,619	15,812	15,812	15,812	17,144	17,144	17,144
MS	5,303	5,078	5,051	7,116	15,364	15,282	17,348
NC	13,885	15,141	14,942	14,942	19,612	20,223	19,870
SC	6,990	11,135	11,135	11,643	14,786	14,786	14,975
TN	7,084	7,221	7,213	7,214	7,733	7,723	7,723
VA	6,892	11,869	12,509	12,535	14,755	15,564	18,850
WV	10,341	11,328	11,493	11,493	11,961	11,961	12,397
	141,218	**157,989**	**152,790**	**190,535**	**222,114**	**225,647**	**262,413**

Note: Emission summaries above are based on SCCs 1-01-xxx-xx and 2-01-xxx-xx.

Table 2.1-8 EGU Point Source PM_{10}-PRI Emission Comparison for 2002/2009/2018.

	2002	2009			2018		
State	Actual Base G	Base F IPM Based	Base G IPM with State/local Updates	B&F IPM with Additional State/local Updates	Base F IPM Based	Base G2 IPM with State/local Updates	B&F IPM with Additional State/local Updates
AL	7,646	6,959	6,969	6,969	7,822	7,822	7,822
FL	21,387	9,384	9,007	20,182	10,310	10,022	12,791
GA	11,224	17,088	17,891	17,891	18,329	20,909	20,732
KY	4,701	6,463	6,463	6,463	6,694	6,694	6,694
MS	1,633	5,487	4,957	5,182	7,624	7,187	7,412
NC	22,754	22,888	22,152	22,152	33,742	37,376	35,275
SC	21,400	28,650	19,395	20,041	37,864	28,826	27,640
TN	14,640	15,608	15,608	15,608	15,941	15,941	15,941
VA	3,960	4,479	5,508	5,606	12,744	13,832	12,551
WV	4,573	5,471	5,657	5,657	6,349	6,349	5,784
	113,918	**122,477**	**113,607**	**125,750**	**157,419**	**154,958**	**152,642**

Note: Emission summaries above are based on SCCs 1-01-xxx-xx and 2-01-xxx-xx.

Table 2.1-9 EGU Point Source $PM_{2.5}$ -PRI Emission Comparison for 2002/2009/2018.

	2002	2009			2018		
State	Actual Base G	Base F IPM Based	Base G IPM with State/local Updates	B&F IPM with Additional State/local Updates	Base F IPM Based	Base G2 IPM with State/local Updates	B&F IPM with Additional State/local Updates
AL	4,113	3,916	3,921	3,921	4,768	4,768	4,768
FL	15,643	6,250	5,910	14,790	7,171	6,886	9,417
GA	4,939	10,104	10,907	10,907	11,403	13,983	13,881
KY	2,802	4,279	4,279	4,279	4,434	4,434	4,434
MS	1,138	5,310	4,777	4,996	7,469	7,033	7,252
NC	16,498	16,514	15,949	15,949	26,966	29,792	28,137
SC	17,154	23,366	16,042	16,548	32,180	25,032	23,794
TN	12,166	13,092	13,092	13,092	13,387	13,387	13,387
VA	2,606	3,194	4,067	4,165	11,101	11,976	10,773
WV	2,210	2,850	2,940	2,940	3,648	3,648	3,116
	79,269	**88,875**	**81,884**	**91,587**	**122,527**	**120,939**	**118,959**

Note: Emission summaries above are based on SCCs 1-01-xxx-xx and 2-01-xxx-xx.

Table 2.1-10 EGU Point Source NH_3 Emission Comparison for 2002/2009/2018.

	2002	2009			2018		
State	Actual Base G	Base F IPM Based	Base G IPM with State/local Updates	B&F IPM with Additional State/local Updates	Base F IPM Based	Base G2 IPM with State/local Updates	B&F IPM with Additional State/local Updates
AL	317	359	359	359	1,072	1,072	1,072
FL	234	1,659	1,631	1,629	3,004	2,976	2,976
GA	83	686	686	686	1,677	1,677	1,677
KY	326	400	400	400	476	476	476
MS	190	333	333	334	827	827	827
NC	54	423	445	445	691	663	663
SC	142	343	343	370	617	617	625
TN	204	227	227	227	241	241	241
VA	127	632	694	694	558	622	606
WV	121	330	330	330	180	180	143
	1,798	**5,392**	**5,448**	**5,474**	**9,343**	**9,351**	**9,306**

Note: Emission summaries above are based on SCCs 1-01-xxx-xx and 2-01-xxx-xx.

2.1.2 Non-EGU Emission Projections

The general approach for assembling future year data was to use growth and control data consistent with the data used in EPA's Clean Air Interstate Rule analyses, supplement these data with available stakeholder input, and provide the results for stakeholder review to ensure credibility. We used the revised 2002 VISTAS base year inventory, based on the 2002 CERR submittals as the starting point for the non-EGU projection inventories. As described in Section 2.1.1.4, we split the point source inventory into EGU and non-EGU components. MACTEC performed the following activities to apply growth and control factors to the 2002 inventory to generate the 2009 and 2018 projection inventories:

- Obtained, reviewed, and applied the most current growth factors developed by EPA, based on forecasts from an updated Regional Economic Models, Inc. (REMI) model (version 5.5) and the latest *Annual Energy Outlook* published by the Department of Energy (DOE);
- Obtained, reviewed, and applied any State-specific or sector-specific growth factors submitted by stakeholders;
- Obtained and incorporated information regarding sources that have shut down after 2002 and set the emissions to zero in the projection inventories;
- Obtained, reviewed, and applied control assumptions for programs "on-the-books" and "on-the-way";
- Provided data files in NIF3.0 format and emission summaries in EXCEL format for review and comment; and
- Updated the database with corrections or new information from S/L agencies based on their review of the Base F 2009/2018 inventories.

The following sections discuss each of these steps.

2.1.2.1 Growth assumptions for non-EGU sources

This section describes the growth factor data used in developing the Base F inventory for 2009 and 2018, as well as the changes to the growth factor data made for the Base G inventory.

The growth factor data used in developing the Base F inventory were consistent with EPA's analyses for the CAIR rulemaking. These growth factors are fully documented in the reports entitled *Development of Growth Factors for Future Year Modeling Inventories* (dated April 30, 2004) and *CAIR Emission Inventory Overview* (dated July 23, 2004). Three sources of data were used in developing the growth factors for the Base F inventory:

- State-specific growth rates from the Regional Economic Model, Inc. (REMI) Policy Insight® model, Version 5.5 (being used in the development of the EGAS Version 5.0). The REMI socioeconomic data (output by industry sector, population, farm sector value added, and gasoline and oil expenditures) are available by 4-digit SIC code at the State level.

- Energy consumption data from the DOE's Energy Information Administration's (EIA) *Annual Energy Outlook 2004, with Projections through 2025* for use in generating growth factors for non-EGU fuel combustion sources. These data include regional or national fuel-use forecast data that were mapped to specific SCCs for the non-EGU fuel use sectors (e.g., commercial coal, industrial natural gas). Growth factors for the residential natural gas combustion category, for example, are based on residential natural gas consumption forecasts that are reported at the Census division level. These Census divisions represent a group of States (e.g., the South Atlantic division includes eight southeastern States and the District of Columbia). Although one would expect different growth rates in each of these States due to unique demographic and socioeconomic trends, EIA's projects all States within each division using the same growth rate.

- Specific changes for sectors (e.g., plastics, synthetic rubber, carbon black, cement manufacturing, primary metals, fabricated metals, motor vehicles and equipment) where the REMI-based rates were unrealistic or highly uncertain. Growth projections for these sectors were based on industry group forecasts, Bureau of Labor Statistics (BLS) projections and Bureau of Economic Analysis (BEA) historical growth from 1987-2002.

In addition to the growth data described above, we received two sets of growth projections from VISTAS stakeholders.

The American Forest and Paper Association (AF&PA) supplied growth projections for the pulp and paper sector, which were applied to SIC 26xx Paper and Allied Products. The AF&PA projection factors are for the U.S. industry and apply to all States equally. The numbers come from the 15-year forecast for world pulp and recovered paper prepared by Resource Information Systems Inc. (RISI).

SIC Code	Sector	AF&PA Growth Factor	
		2002 to 2009	2002 to 2018
2611	Pulp Mills	1.067	1.169
2621	Paper Mills	1.067	1.169
2631	Paperboard Mills	1.067	1.169

For both the Base F and Base G inventories, we used the above AF&PA growth factors by SIC instead of the factors obtained from EPA's CAIR analysis.

For the Base F inventory, the NCDENR supplied recent projections for three key sectors in North Carolina where declining production was anticipated – SIC 22xx Textile Mill Products, 23xx Apparel and Other Fabrics, and 25xx Furniture and Fixtures. For the Base G inventory, NCDENR decided to use a growth factor of 1.0 for these SIC codes for both 2009 and 2018. Although NCDENR has data that shows a steady decline in these industries in NC, NCDENR wanted to maintain the emission levels at 2002 levels so the future emission reduction credits were available in the event that they are needed for nonattainment areas. The specific growth factors for these industrial sectors in North Carolina were:

NCDENR Growth Factors for Specific Industrial Sectors					
SIC Code	**Industrial Sector**	**2009**		**2018**	
		Base F	**Base G**	**Base F**	**Base G**
22xx	Textile Mill Products	0.6239	1.00	0.2792	1.00
23xx	Apparel and Other Fabrics	0.5867	1.00	0.2247	1.00
25xx	Furniture and Fixtures	0.8970	1.00	0.7647	1.00

For the Base G inventory, we made one additional change to the growth factors. The Base F inventory relied on DOE's AEO2004 forecasts for projecting emissions for fuel-burning SCCs (applies mainly to ICI boilers 1-02-xxx-xx and 1-03-xxx-xx, as well as in-process fuel use). We replaced the AEO2004 data with the more recent AEO2006 forecasts (released in February 2006) to reflect changes in the energy market and to improve the emissions growth factors produced. We obtained the corresponding AEO2006 projection tables from DOE's web site located at http://www.eia.doe.gov/oiaf/aeo/supplement/supref.html. We developed tables comparing the growth factors based on AEO2004 and AEO2006. These comparison tables were reviewed by the S/L agencies. Based on this review, VISTAS decided to use the AEO2006 growth factors for fuel burning SCCs.

We used the EPA's EGAS model and updated the corresponding AEO2006 projection tables to create growth factors by SCC. We applied the updated growth factors to 2002 actual emissions and replaced the 2009 and 2018 emissions in NIF EM tables for the affected SCCs.

2.1.2.2 Source Shutdowns

A few states indicated that significant source shutdowns have occurred since 2002 and that emissions from these sources should not be included in the future year inventories. These sources are identified in Table 2.1-11.

Table 2.1-11 Summary of Source Shutdowns Incorporated in Base G Inventory.

State	Description of Source Shutdowns
AL	None specified.
FL	The following facilities are shutdown and projected emissions were set to zero in 2009/2018. 0570075 CORONET INDUSTRIES, INC. 1050050 U S AGRI-CHEMICALS CORP. 1050051 U.S. AGRI-CHEMICALS CORPORATION These facilities emitted 2,417 tons of SO_2 and 113 tons of NO_x in 2002.
GA	Georgia indicated that the former Blue Circle (now LaFarge) facility in downtown Atlanta will likely shut down before 2009. The facility has two cement kilns, one of which is already shut down. The second kiln will continue to operate until the new facility in Alabama has enough milling capacity, after which the entire Atlanta facility will be completely closed down. This facility emitted 1,617 tons of SO_2 and 587 tons of NO_x in 2002.
KY	None specified.
MS	AF&PA indicated that the International Paper Natchez Mill (28-001-2800100010) has shut down. This facility emitted 1,398 tons of SO_2 and 1,773 tons of NO_x in 2002.
	The Magnolia Resources - Pachuta Harmony Gas Plant (28-023-00031) is out of business and no longer holds an air permit. This facility emitted 2,257 tons of $SO_2$and 134 tons of NO_x in 2002.
NC	In Base F, two paper mills were identified as being shut down in the 2018 inventory. NCDENR indicated that these mills are not expected to close. The two facilities are Ecusta Business Development (37-175-3717500056) and International Paper (37-083-00007). Their emissions were added back into the Base G 2018 inventory.
	BASF Corporation (37-021-724) in Buncombe County is currently operating but has plans to shut down in 2007. This facility emitted 461 tons of SO_2 and 266 tons of NO_x in 2002.
SC	South Carolina provided a list of facilities that were identified as closing down on or after Jan. 1, 2003. The emissions for these facilities were set to zero in the 2009 and 2018 projection inventories. Emissions from these plants in 2002 were: 6,195 tons of SO_2, 2,994 tons of NO_x, and 2,836 tons of VOC. Most of the emissions were from one facility – Celanese Acetate (45-091-2440-0010) in York County.
TN	Davidson County (Nashville) indicated that significant source shutdowns have occurred since data were submitted for the 2002 CERR. Source number 47-037-00002 (Dupont) shut down a portion of their facility, which was permanently taken out of service. Source 47-037-00050 (Nashville Thermal Transfer Corp.) shut down their municipal waste combustors and replaced them with natural gas fired boilers with propane stand by.
	Weyerhaeuser (AKA Willamette) Power Boiler 7 (47-163-0022, EU ID = 017) is being shut down. This emission unit emitted 4,297 tons of SO_2 and 1,443 tons of NO_x in 2002.
	Liberty Fibers (47-063-0197) in Hamblen County has recently shut down. This facility emitted 5,377 tons of SO_2; 2,057 tons of NO_x; and 9,059 tons of VOC in 2002.
VA	Rock-Tenn (51-680-00097) received a permit dated 9/13/2003 which required the shutdown of units 1 and 2 by 2/27/2004. This permit was part of a netting exercise that allowed the installation of a new NG/DO boiler. These two units emitted 507 tons of SO_2 and 276 tons of NO_x in 2002.
WV	None specified.

2.1.2.3 Control Programs applied to non-EGU sources

We used the same control programs for both the 2009 and 2018 non-EGU point inventory. Two control scenarios were developed: on-the-books (OTB) controls and on-the-way (OTW) controls. The OTB control scenario accounts for post-2002 emission reductions from promulgated federal, State, local, and site-specific control programs. The OTW control scenario accounts for proposed (but not final) control programs that are reasonably anticipated to result in post-2002 emission reductions. The methodologies used to account for the emission reductions associated with these emission control programs are discussed in the following sections.

Table 2.1-12 Non-EGU Point Source Control Programs Included in 2009/2018 Projection Inventories.

On-the-Books (Cut-off of July 1, 2004 for Base 1 adoption)

- Atlanta / Northern Kentucky / Birmingham 1-hr SIPs
- Industrial Boiler/Process Heater/RICE MACT (see Section 2.1.2.3.2)
- NO_x RACT in 1-hr NAA SIPs
- NO_x SIP Call (Phase I- except where States have adopted II already e.g. NC)
- Petroleum Refinery Initiative (October 1, 2003 notice; MS & WV)
- RFP 3 percent Plans where in place for one hour plans
- VOC 2-, 4-, 7-, and 10-year maximum achievable control technology (MACT0 Standards
- Combustion Turbine MACT

On-the-Way

- NO_x SIP Call (Phase II – remaining States & IC engines)

2.1.2.3.1 OTB - NO_x SIP Call (Phase I)

Phase I of the NO_x SIP call applies to certain large non-EGUs, including large industrial boilers and turbines, and cement kilns. States in the VISTAS region affected by the NO_x SIP call have developed rules for the control of NO_x emissions that have been approved by EPA. We reviewed the available State rules and guidance documents to determine the affected sources and ozone season allowances. We also obtained and reviewed information in the EPA's CAMD NO_x Allowance Tracking System – Allowances Held Report. Since these controls are to be in effect by the year 2007, we capped the emissions for NO_x SIP call affected sources at 2007 levels and carried forward the capped levels for the 2009/2018 future year inventories. Since the NO_x SIP call allowances are given in terms of tons per ozone season (5 month period from May to

September), we calculated annual emissions by multiplying the 5-month allowances by a factor of 12 divided by 5.

2.1.2.3.2 OTB - Industrial Boiler/Process Heater MACT

EPA anticipates reductions in PM and SO_2 as a result of the Industrial Boiler/Process Heater MACT standard. The methods used to account for these reductions are the same as those used for the CAIR analysis. Reductions were included for existing units firing solid fuel (coal, wood, waste, biomass) which had a design capacity greater than 10 mmBtu/hr. EPA prepared a list of SCCs for solid fuel industrial and commercial/ institutional boilers and process heaters. We identified boilers greater than 10 mmBtu/hr using either the boiler capacity from the VISTAS 2002 inventory, or if the boiler capacity was missing, a default capacity based on a methodology developed by EPA for assigning default capacities based on SCC. The applied MACT control efficiencies were 4 percent for SO_2 and 40 for percent for PM_{10} and PM2.5 to account for the co-benefit from installation of acid gas scrubbers and other control equipment to reduce HAPs. On June 8, 2007, the U.S. Court of Appeals for the District of Columbia Circuit vacated and remanded the NESHAP for Industrial, Commercial and Institutional Boilers and Process Heaters. VISTAS States decided to leave the emission reductions in place since they envision using a 112(j) strategy (e.g., the “MACT hammer”) to obtain similar levels of control)

2.1.2.3.3 OTB - 2, 4, 7, and 10-year MACT Standards

Maximum achievable control technology (MACT) requirements were also applied, as documented in the report entitled *Control Packet Development and Data Sources,* dated July 14, 2004. The point source MACTs and associated emission reductions were designed from Federal Register (FR) notices and discussions with EPA’s Emission Standards Division (ESD) staff. We did not apply reductions for MACT standards with an initial compliance date of 2001 or earlier, assuming that the effects of these controls are already accounted for in the 2002 inventories supplied by the States. Emission reductions were applied only for MACT standards with an initial compliance date of 2002 or greater.

2.1.2.3.4 OTB Combustion Turbine MACT

The projection inventories do not include the NO_x co-benefit effects of the MACT regulations for Gas Turbines or stationary Reciprocating Internal Combustion Engines, which EPA estimates to be small compared to the overall inventory.

2.1.2.3.5 OTB - Petroleum Refinery Initiative (MS and WV)

Three refineries in the VISTAS region are affected by two October 2003 Clean Air Act settlements under the EPA Petroleum Refinery Initiative. The refineries are: (1) the Chevron refinery in Pascagoula, MS; (2) the Ergon refinery in Vicksburg, MS; and (3) the Ergon refinery in Newell, WV.

The first consent decree pertained to Chevron refineries in Richmond and El Segundo, CA; Pascagoula, MS; Salt Lake City, UT; and Kapolei, HI. Actions required under the Consent Decree will reduce annual emissions of NO_x by 3,300 tons and SO_2 by 6,300 tons. The consent decree requires a program to reduce NO_x emissions from refinery heaters and boilers through the installation of NO_x controls that meet at least an SNCR level of control. The refineries are to eliminate fuel oil burning in any combustion unit. The consent decree also requires reductions of NO_x and SO_2 from the fluid catalytic cracking unit and control of acid gas flaring incidents. The consent decree does not provide sufficient information to calculate emission reductions for the FCCU or flaring at the Pascagoula refinery. Therefore, we calculated a general percent reduction for NO_x and SO_2 by dividing the expected emission reductions at the five Chevron refineries by the total emissions from these five refineries (as reported in the 1999 NEI). This resulted in applying percent reductions of 45 percent for SO_2 and 28 percent for NO_x to FCCU and flaring emissions at the Chevron Pascagoula refinery.

The second consent decree pertained to the Ergon-West Virginia refinery in Newell, WV; and the Ergon Refining facility in Vicksburg, MS. The consent decree requires the two facilities to implement a 6-year program to reduce NO_x emission from all heaters and boilers greater than 40 mmBtu/hr, and to eliminate fuel oil burning in any combustion unit (except during periods of natural gas curtailment). Specifically, ultra low NO_x burners are required on Boilers A and B at Newell, a low NO_x-equivalent level of control for heater H-101 at Newell and heaters H-1 and H-3 at Vicksburg, and an ultra low NO_x burner level of control for heater H-451 at Vicksburg.

2.1.2.3.6 OTW - NO_x SIP Call (Phase II)

The final Phase II NO_x SIP call rule was finalized on April 21, 2004. States had until April 21, 2005, to submit SIPs meeting the Phase II NO_x budget requirements. The Phase II rule applies to large IC engines, which are primarily used in pipeline transmission service at compressor stations. We identified affected units using the same methodology as was used by EPA in the proposed Phase II rule (i.e., a large IC engine is one that emitted, on average, more than 1 ton per day during 2002). The final rule reflects a control level of 82 percent for natural gas-fired IC engines and 90 percent for diesel or dual fuel categories. As shown later in Table 2.1-12, several S/L agencies provided move specific information on the anticipated controls at the compressor stations. This information was used in the Base G inventory instead of the default approach used by EPA in the proposed Phase II rule.

2.1.2.3.7 Clean Air Interstate Rule

CAIR does not require or assume additional emission reductions from non-EGU boilers and turbines.

2.1.2.4 Quality Assurance steps

Final QA checks were run on the revised projection inventory data set to ensure that all corrections provided by the S/L agencies and stakeholders were correctly incorporated into the S/L inventories and that there were no remaining QA issues that could be addressed during the duration of the project. After exporting the inventory to ASCII text files in NIF 3.0, the EPA QA program was run on the ASCII files and the QA output was reviewed to verify that all QA issues that could be addressed were resolved

Throughout the inventory development process, quality assurance steps were performed to ensure that no double counting of emissions occurred, and to ensure that a full and complete inventory was developed for VISTAS. Quality assurance was an important component to the inventory development process and MACTEC performed the following QA steps on the point source component of the VISTAS revised 2002 base year inventory:

Facility level emission summaries were prepared and evaluated to ensure that emissions were consistent and reasonable. The summaries included base year 2002 emissions, 2009/2018 projected emissions accounting only for growth, 2009/2018 projected emissions accounting for both growth and emission reductions from OTB and OTW controls.

State-level non-EGU comparisons (by pollutant) were developed for the base year 2002 emissions, 2009/2018 projected emissions accounting only for growth, 2009/2018 projected emissions accounting for both growth and emission reductions from OTB and OTW controls.

Data product summaries and raw NIF 3.0 data files were provided to the VISTAS Emission Inventory Technical Advisor and to the Point Source, EGU, and non-EGU Special Interest Work Group representatives for review and comment. Changes based on these comments were reviewed and approved by the S/L point source contact prior to implementing the changes in the files.

Version numbering was used for all inventory files developed. The version numbering process used a decimal system to track major and minor changes. For example, a major change would result in a version going from Base F1 to Base F2.

2.1.2.5 Additional Base G Updates and Corrections

Table 2.1-13 summarizes the updates and corrections to the Base F inventory that were requested by S/L agencies and incorporated into the Base G 2009/2018 inventories.

Table 2.1-13 Summary of Updates and Corrections Incorporated into the Base G 2009/2018 Non-EGU Inventories.

State	Nature of Update/Correction
AL	Corrected the latitude and longitude for two facilities: Ergon Terminalling (Site ID: 01-073-010730167) and Southern Power Franklin (Site ID: 01-081-0036).
	Corrections to stack parameters at 10 facilities for stacks with parameters that do not appear to fall into the ranges typically termed "acceptable" for AQ modeling.
FL	Corrected 2009/2018 emission values for the Miami Dade RRF facility (Site ID: 12-086-0250348) based on revised 2002 emissions and application of growth control factors for 2009/2018.
GA	Hercules Incorporated (12-051-05100005) had an erroneous process id (#3) within emission unit id SB9 and was deleted. This removes about 6,000 tons of SO_2 from the 2009/2018 inventories.
	Provided a revised file of location coordinates at the stack level that was used to replace the location coordinated in the ER file.
	There are several sources that have updated their emissions from their BART eligible units. most of these changes were for fairly small (<50 tpy) sources.
NC	Made several changes to Base F inventory to correct the following errors: 1. Corrected emissions at Hooker Furniture (Site ID: 37-081-3708100910), release point G-29, to use the corrected values in 2002 and carry those same numbers through to 2009 and 2018 since NCDENR assumes zero growth for furniture industry. 2. Identified many stack parameters in the ER file that were unrealistic. Several have zero for height, diameter, gas velocity, and flow rate. NC used the procedures outlined in Section 8 of the document ""National Emission Inventory QA and Augmentation Report" to correct unrealistic stack parameters. 3. Identified truncated latitude and longitude values in Base F inventory. NC updated all Title V facility latitude and longitude that was submitted to EPA for those facilities in 2004. Smaller facilities with only two decimal places were not corrected. 4. Corrected 2018 VOC emissions for International Paper (3709700045) Emission Unit ID, G-12, to reflect changes to the 2002 inventory.
	There are three Transcontinental Natural Gas Pipeline facilities in NC that are subject to the NO_x SIP call. NCDENR took 2004 emissions and grew them to 2009 & 2018 and capped those units that are subject to the NO_x SIP Call Rule. These facility IDs are 37-057-3705700300, 37-097-3709700225, and 37-157-3715700131.
	NCDENR applied NO_x RACT to a two facilities located in the Charlotte nonattainment area. NCDENR provided 2009 & 2018 emissions for Philip Morris USA (37-025-3702500048) and Norandal USA (37-159-3715900057).
SC	Corrected PM species emission values. SC DHEC's initial CERR submittal reported particulate matter emissions using the PM-FIL, PM_{10}-FIL, and $PM_{2.5}$ -FIL pollutant codes. In August 2005, SC DHEC indicated that data reported using the PM-FIL, PM_{10}-FIL, and $PM_{2.5}$ -FIL pollutant codes should actually have been reported using the PM-PRI, PM_{10}-PRI, and $PM_{2.5}$ _PRI codes. MACTEC performed a subsequent PM augmentation in April 2006 using the revised pollutant codes. These changes were reflected in the Base G 2009/2018 emission inventory.
	Specified that the Bowater Inc. facility (45-091-2440-0005) in York County conducted an expansion in 2003/2004 and plans a future expansion. SC provided updated emissions for 2009 and 2018 for this facility.

Table 2.1-13. Continued.

State	Nature of Update/Correction
TN	Updated 2009/2018 emissions for Eastman Chemical (47-163-0003) based on final (Feb. 2005) BART rule.
	Updated 2009/2018 emission inventory for the Bowater facility (47-107-0012) based on the facility's updated 2002 emission inventory update.
	Replaced 2009/2018 data from Hamilton County, Tennessee, using data from Hamilton County's CERR submittal as contained in EPA's 2002 NEI (in Base F, the inventory for Hamilton County was based on the draft VISTAS 2002 inventory, which in turn was based on the 1999 NEI); applied growth and control factors to revised 2002 inventory to generate emission projections for 2009/2018.
	Updated 2009/2018 emissions for PCS Nitrogen Fertilizer LP (Site ID: 47-157-00146) based on the facility's updated 2002 emission inventory update.
	The 2002 NEI correctly reports the actual emissions for CEMEX (47-093-0008) after the NO_x SIP call. There is no reason to suspect that that rate would change in 2008, 2009, or 2018. Emissions for 2009/2018 were set equal to 2002 emissions.
	In the Base F 2009/2018 inventories, NO_x controls were applied for two units at Columbia Gulf Transmission (47-111-0004). There are no plans for controls at these units, EO3 and EO4. The assumed control efficiency of 82 percent was backed out in the 2009/2018 inventories.
VA	VADEQ provided 2009/2018 NO_x emission estimates for NO_x Phase II gas transmission sources at three Transco facilities (51-011-00011, 51-137-00027, 51-143-00120) which were used to replace the default NO_x Phase II control assumptions for these facilities.
	VADEQ provided updated 2009/2018 NO_x and SO_2 emissions based on new controls required by a November 2005 permit modification and netting exercise. The entire power plant facility is limited to 213 tons of NO_x and 107 tons of SO_2 per year. The permit also allowed the installation of 3 new boilers, also under the 213 tons of NO_x /year cap.
WV	Updated 2009/2018 emissions for Steel of West Virginia (Site ID: 54-011-0009) based on the facility's updated 2002 emission inventory update.
	Made changes to several Site ID names due to changes in ownership
	Base F emissions were much too high for Weirton Steel (54-021-0029). WV believes that the source is very unlikely to emit the NO_x SIP Call budgeted amounts in 2009 or 2018. WV provided revised emission estimates based on EGAS for 2009/2018.
	Made corrections to latitude/longitude and stack parameters at a few facilities for stacks with parameters that do not appear to fall into the ranges typically termed "acceptable" for AQ modeling.

2.1.2.6 Additional B&F Updates and Corrections

Table 2.1-14 summarizes the updates and corrections to the Base G non-EGU inventory that were requested by S/L agencies and incorporated into the B&F 2009/2018 non-EGU inventories. The changes were primarily related to better information on anticipated BART controls for specific facilities and emission units.

Table 2.1-14 Summary of Updates and Corrections Incorporated into the B&F 2009/2018 Non-EGU Inventories.

State	Nature of Update/Correction
AL	For 2018, incorporated emission changes due to BART controls at Exxon Mobil (Site ID: 01-053-0007), International Paper (Site ID: 01-079-0001), and Solutia (Site ID: 01-103-0010). International Paper (Site ID: 01-079-0001) Unit 004 to be shutdown in the 2018 inventory.
FL	For both 2009 and 2018, incorporated emission changes due to BART controls at Georgia Pacific (Site ID: 12-107-1070005) Unit 15.
MS	For 2018 only, changed SO2 emission estimate for Pursue Energy (Site ID: 28-121-00036) based on the facility's estimates of the gas reserve at the site.
	For 2018 only, changed emission estimates for all pollutants at several emission units at the Chevron Pascagoula Refinery (Site ID: 28-059-00058) to reflect BART source reductions.
SC	For both 2009 and 2018, identified 15 facilities that have permanently closed. Emissions from these facilities set to zero for all pollutants.
TN	For both 2009 and 2018, identified seven facilities that have permanently closed. Emissions from these facilities were set to zero for all pollutants.
	For both 2009 and 2018, identified three emission units that have permanently closed. Emissions from these units were set to zero for all pollutants. 47-009-0130-002 (APAC – TN, Inc.-Harrison Construction – Asphalt plant), 47-009-0130-003 (APAC – TN, Inc.-Harrison Construction – Asphalt crusher), and 47-139-0004-001 (Intertrade - Number 6 acid plant)
	The following individual source will be shut down in 2010: 47-001-0020-002 (DOE, Y-12 – Boilers 1-4). For the 2018 inventory only, emissions from this unit were set to zero for all pollutants.
	A portion of 47-163-0003-020101 (Eastman, B-83-1 Stoker Boilers). This source previously consisted of 14 boilers (Boilers 11-24). Boilers 11-17 have been removed from service. Emissions for both 2009 and 2018 were reduced by 26.64%, based on the portion of the heat input capacity that is being removed from service.
	SO2 emissions in 2018 from 47-163-0003-021520 (Eastman, B-253-1 Tangential PC Boilers) were reduced by 90% to reflect anticipated BART controls.
	Reduced SO2 emissions at 47-157-00475 (Lucite International) in Shelby County as a result of a consent decree with U.S. EPA.
VA	Changed SO2 emissions in 2009 and 2018 for thirteen facilities to reflect updated information from VADEQ regarding projected SO2 controls.
WV	Weirton Steel (54-029-00001) and Wheeling Pittsburgh Steel (54-009-00002) have undergone significant, permanent process changes since 2002. WV DEP staff have consulted with facility staff and determined that calendar year 2004 emissions represent a better basis for future year emissions estimates. Therefore, WVDEP compiled emissions data from the 2004 inventory for these sources and applied the most current VISTAS growth factors to estimate emissions in 2009 and 2018.

2.1.2.7 Conversion of MRPO BaseM 2009 non-EGU Data to SMOKE Input Format

To support ASIP $PM_{2.5}$ CAMx modeling of the future year 2009, Alpine Geophysics obtained and processed an emission inventory for the 5 MRPO states (Illinois, Indiana, Michigan, Wisconsin, and Ohio). Appendix x details the technical steps that were made as part of the conversion of the MRPO BaseM non-EGU files into IDA format for ASIP PM-2.5 CAMx modeling of the future year 2009.

2.1.2.8 Summary of the 2009/2018 non-EGU Point Source Inventories

Tables 2.1-15 through 2.1-21 summarize the revised 2009/2018 non-EGU point source inventories. The "growth only" column does not include the shutdowns (section 2.1.2.2) or control factors (section 2.1.2.3), only the growth factors described in section 2.1.2.1.

Table 2.1-15 Non-EGU Point Source SO_2 Emission Comparison for 2002/2009/2018.

	2002	2009			2018		
State	**Base G**	**Base F**	**Base G**	**B&F**	**Base F**	**Base G**	**B&F**
AL	96,481	100,744	101,246	101,246	112,703	113,224	103,303
FL	65,090	68,549	65,511	62,651	79,015	75,047	71,810
GA	53,778	61,535	53,987	53,987	68,409	59,349	59,349
KY	34,029	35,470	36,418	36,418	38,806	40,682	40,682
MS	35,960	27,488	25,564	25,564	40,195	26,678	25,674
NC	44,123	48,751	42,536	42,536	50,415	46,314	46,314
SC	53,518	55,975	48,324	47,193	56,968	53,577	52,410
TN	79,604	89,149	70,678	64,964	96,606	77,247	56,682
VA	63,903	63,075	62,560	58,039	69,776	68,909	57,790
WV	54,070	54,698	55,973	55,598	60,137	62,193	61,702
	580,556	**605,434**	**562,797**	**548,196**	**673,030**	**623,220**	**575,716**

Note: Emission summaries above include all SCCs except 1-01-xxx-xx and 2-01-xxx-xx.

Table 2.1-16 Non-EGU Point Source NO_x Emission Comparison for 2002/2009/2018.

	2002	2009			2018		
State	**Base G**	**Base F**	**Base G**	**B&F**	**Base F**	**Base G**	**B&F**
AL	83,310	69,676	69,409	69,409	79,101	78,318	77,960
FL	45,156	44,859	46,020	47,125	50,635	51,902	52,959
GA	49,251	51,556	50,353	50,353	57,323	55,824	55,824
KY	38,392	36,526	37,758	37,758	40,363	41,034	41,034
MS	61,526	55,877	56,397	56,398	62,132	61,533	61,252
NC	44,929	44,877	34,767	34,768	47,200	37,801	37,802
SC	42,153	42,501	40,019	39,368	44,480	44,021	43,331
TN	64,344	63,431	57,883	57,514	70,313	63,453	62,519
VA	60,415	51,335	51,046	51,001	56,876	55,945	55,734
WV	46,612	40,433	38,031	38,023	44,902	43,359	43,280
	536,088	**501,071**	**481,683**	**481,715**	**553,325**	**533,190**	**531,695**

Note: Emission summaries above include all SCCs except 1-01-xxx-xx and 2-01-xxx-xx.

Table 2.1-17 Non-EGU Point Source VOC Emission Comparison for 2002/2009/2018.

	2002	2009			2018		
State	**Base G**	**Base F**	**Base G**	**B&F**	**Base F**	**Base G**	**B&F**
AL	47,037	46,660	46,644	46,644	54,268	54,291	54,290
FL	38,471	36,675	36,880	36,882	42,787	42,811	42,813
GA	33,709	34,082	34,116	34,116	40,267	40,282	40,282
KY	44,834	47,648	47,785	47,785	55,564	55,861	55,861
MS	43,204	37,921	37,747	37,747	45,769	45,338	45,335
NC	61,182	70,464	61,925	61,925	76,027	70,875	70,875
SC	38,458	38,273	35,665	34,403	44,545	43,656	41,987
TN	84,328	89,380	74,089	73,498	111,608	93,266	92,456
VA	43,152	43,620	43,726	43,725	53,065	53,186	53,186
WV	14,595	14,012	13,810	13,043	16,632	16,565	15,582
	448,970	458,735	432,387	429,768	540,532	516,131	512,667

Note: Emission summaries above include all SCCs except 1-01-xxx-xx and 2-01-xxx-xx.

Table 2.1-18 Non-EGU Point Source CO Emission Comparison for 2002/2009/2018.

	2002	2009			2018		
State	**Base G**	**Base F**	**Base G**	**B&F**	**Base F**	**Base G**	**B&F**
AL	174,271	176,899	180,369	180,369	194,280	201,794	201,663
FL	81,933	83,937	87,037	87,661	96,642	96,819	97,438
GA	130,850	147,362	147,427	147,427	168,570	167,904	167,904
KY	109,936	121,727	122,024	122,024	139,121	139,437	139,437
MS	54,568	58,023	57,748	57,749	67,764	66,858	65,884
NC	50,576	53,955	53,744	53,744	61,127	62,197	62,197
SC	56,315	62,144	60,473	59,934	71,318	68,988	68,415
TN	115,264	123,844	119,665	119,216	146,407	140,942	140,556
VA	63,796	67,046	68,346	68,326	74,364	76,998	76,846
WV	89,879	100,248	100,045	93,839	119,318	119,332	111,302
	927,388	**995,185**	**996,878**	**990,289**	**1,138,911**	**1,141,269**	**1,131,642**

Note: Emission summaries above include all SCCs except 1-01-xxx-xx and 2-01-xxx-xx.

Table 2.1-19 Non-EGU Point Source PM_{10}-PRI Emission Comparison for 2002/2009/2018.

	2002	2009			2018		
State	**Base G**	**Base F**	**Base G**	**B&F**	**Base F**	**Base G**	**B&F**
AL	25,240	25,450	25,421	25,421	29,973	29,924	29,889
FL	35,857	39,363	39,872	39,947	46,573	46,456	46,492
GA	21,610	23,509	23,103	23,103	27,781	27,273	27,273
KY	16,626	17,164	17,174	17,174	20,142	20,153	20,153
MS	19,472	19,200	19,245	19,244	22,952	22,859	22,837
NC	13,838	14,738	13,910	13,910	15,816	15,737	15,737
SC	14,142	17,631	13,370	12,959	20,197	15,139	14,674
TN	35,174	37,040	34,833	34,581	45,168	42,280	41,999
VA	13,252	13,043	13,048	13,046	15,150	15,112	15,111
WV	17,503	17,723	17,090	11,882	21,699	21,735	14,202
	212,714	224,861	217,066	211,267	265,451	256,668	248,367

Note: Emission summaries above include all SCCs except 1-01-xxx-xx and 2-01-xxx-xx.

Table 2.1-20 Non-EGU Point Source PM25-PRI Emission Comparison for 2002/2009/2018.

	2002	2009			2018		
State	Base G	Base F	Base G	B&F	Base F	Base G	B&F
AL	19,178	19,256	19,230	19,230	22,628	22,598	22,584
FL	30,504	33,387	33,946	34,019	39,436	39,430	39,486
GA	17,462	19,361	18,982	18,982	22,882	22,416	22,416
KY	11,372	11,680	11,686	11,686	13,734	13,739	13,739
MS	9,906	9,144	9,199	9,199	10,768	10,739	10,719
NC	10,500	11,192	10,458	10,458	11,927	11,825	11,825
SC	10,245	13,101	9,390	9,048	14,947	11,086	10,699
TN	27,807	29,302	27,577	27,367	35,750	33,532	33,293
VA	10,165	9,980	9,988	9,988	11,604	11,594	11,605
WV	13,313	13,364	12,769	7,638	16,474	16,516	9,124
	160,452	**169,767**	**163,225**	**157,615**	**200,150**	**193,475**	**185,490**

Note: Emission summaries above include all SCCs except 1-01-xxx-xx and 2-01-xxx-xx.

Table 2.1-21 Non-EGU Point Source NH_3 Emission Comparison for 2002/2009/2018.

	2002	2009			2018		
State	Base G	Base F	Base G	B&F	Base F	Base G	B&F
AL	1,883	2,132	2,132	2,132	2,464	2,464	2,464
FL	1,423	1,544	1,544	1,544	1,829	1,829	1,829
GA	3,613	3,963	3,963	3,963	4,799	4,797	4,797
KY	674	733	760	760	839	901	901
MS	1,169	667	668	668	761	764	764
NC	1,180	1,288	1,285	1,285	1,422	1,466	1,466
SC	1,411	1,578	1,578	1,578	1,779	1,779	1,779
TN	1,613	1,861	1,841	1,840	2,240	2,214	2,213
VA	3,104	3,050	3,049	3,045	3,613	3,604	3,604
WV	332	341	341	314	416	413	378
	16,402	**17,157**	**17,161**	**17,129**	**20,162**	**20,231**	**20,195**

Note: Emission summaries above include all SCCs except 1-01-xxx-xx and 2-01-xxx-xx.

2.2 Area Sources

This section describes the methodology used to develop the 2009 and 2018 projection Base F and Base G projection inventories. This section describes two approaches to these projections. Separate methods for projecting emissions were used for non-agricultural (stationary area) and agricultural area sources (predominantly NH_3 emissions). The two methods used for these sectors are described in the sections that follow.

2.2.1 Stationary area sources

The general approach used to calculate Base F projected emissions for stationary area sources was as follows:

1. Use the VISTAS Base F 2002 base year inventory as the starting point for projections.

2. MACTEC then worked with the VISTAS States (via the Stationary Area Source SIWG) to obtain any State specific growth factors and/or future controls from the States to use in developing the projections.

3. MACTEC then back calculated uncontrolled emissions from the Base F 2002 base year inventory based on existing controls reported in the 2002 Base F base year inventory.

4. Controls (including control efficiency, rule effectiveness and rule penetration) provided by the States or originally developed for use in estimating projected emissions for U.S. EPA's Heavy Duty Diesel (HDD) rulemaking emission projections and used in the Clean Air Interstate Rule (CAIR) projections were then used to calculate controlled emissions. State submitted controls had precedence over the U.S. EPA developed controls.

5. Growth factors supplied from the States or the U.S. EPA's CAIR emission projections were then applied to project the controlled emissions to the appropriate year. In some cases EGAS Version 5 growth factors were used if no growth factor was available from either the States or the CAIR growth factor files. The use of EGAS Version 5 growth factors was on a case-by-case basis wherever State-supplied or CAIR factors were not available for SCCs found in the 2002 Base F inventory. Use of the EGAS factors was necessitated due to the CERR submittals used in constructing the Base F 2002 inventory. Use of the CERR data resulted in SCCs that were not found in the CAIR inventory and if no State-supplied growth factor was provided required the use of an EGAS growth factor.

6. MACTEC then provided the final draft Base F projection inventory for review and comment by the VISTAS States.

For Base F stationary area sources, no State-supplied growth or control factors were provided. Thus for all of the sources in this sector of the inventory, growth and controls for Base F were applied based on controls initially identified for the CAIR and growth factors identified for the CAIR projections.

For the Base G projections, the Base G 2002 base year inventory (see section 1.2.3) was used as a starting point. States provided some updated future controls but growth factors used were identical to those used for Base F. The revised controls for Base G were largely for new sources added as part of the 2002 Base F comments. The calculation of Base G projections was identical to the six steps outlined above with the exception of revisions made to prescribed fire for 2009 and 2018 and for the State of North Carolina. North Carolina provided 2009 and 2018 updated emission files used to update the emissions for each year for several source categories. However not all sources in the inventory were included in these NC updates. As a consequence, the final Base G 2009 and 2018 inventory for NC included emissions updated using the NC supplied files and emissions developed using growth and control factors as outlined above.

In a few cases, additional growth factors had to be added for source categories that had not initially been included in the Base F inventory. These growth factors were obtained from EGAS 5.0. Finally updates to growth factors from EGAS 5.0 were made for fuel fired emission sources. The updated growth factors reflected the most recent data from the Department of Energy's Annual Energy Outlook (AEO). These data were used to reflect changes in energy efficiency resulting from new or updated fuel firing technologies.

2.2.1.1 Stationary area source controls

The controls obtained by MACTEC for the HDD rulemaking were controls for the years 2007, 2020, and 2030. Since MACTEC was preparing 2009 and 2018 projections, control values for intermediate years were prepared using a straight line interpolation of control level between 2007 and 2020. The equation used to calculate the control level was as follows:

$$CE = (((2020\ CE - 2007\ CE)/13) * YRS) + 2007\ CE$$

Where:

CE	=	Control Efficiency for either 2009 or 2018
2020 CE	=	HDD Control Efficiency value for 2020
2007 CE	=	HDD Control Efficiency value for 2007
13	=	Number of years between 2020 and 2007
YRS	=	Number of years beyond 2007 to VISTAS Projection year

For 2009 the value of YRS would be two (2) and for 2018 the value would be eleven (11). Control efficiency values were determined for VOC, CO and PM. Rule penetration values for each year in the HDD controls tables obtained by MACTEC were always 100 percent so those values were maintained for the VISTAS projections.

Prior to performing the linear interpolation of the controls, MACTEC evaluated controls from the CAIR projections (NOTE: Initially the controls came from the IAQTR projections, however the controls used in CAIR were virtually identical to those in IAQTR). Those controls appeared to be identical to those used for the HDD rulemaking. In addition, MACTEC received some additional information on some controls for area source solvents (email from Jim Wilson, E.H. Pechan and Associates, Inc. to Gregory Stella, VISTAS Emission Inventory Technical Advisor, 3/5/04) that were used to check against the controls in the HDD rulemaking files. Where those controls proved to be more stringent than the HDD values, MACTEC updated the control file with those values (which were then used in the interpolation to develop 2009 and 2018 values). Finally, for VOC the HDD controls were initially provided at the State-county-SCC level. However, upon direction from the VISTAS Emission Inventory Technical advisor, the VOC controls were consolidated at the SCC level and applied across all counties within the VISTAS region (email from Gregory Stella, Alpine Geophysics, 3/3/2004) to ensure that no controls were missed due to changes in county FIPS codes and/or SCC designations between the time the HDD controls were developed and 2002.

The equation below indicates how VOC emissions were projected for stationary area sources.

$$VOC_{2018} = VOC_{2002}\ x \left(1 - \left(\frac{VOC\_CE_{2018}}{100}\right)\left(\frac{VOC\_RE_{2018}}{100}\right)\left(\frac{VOC\_RP_{2018}}{100}\right)\right)$$

Where:

VOC_{2018} = VOC emissions for 2018

VOC_{2002} = Uncontrolled VOC emissions for 2002

VOC_CE_{2018} = Control Efficiency for VOC (in this example for 2018)

VOC_RE_{2018} = Rule Effectiveness for VOC (in this example for 2018)

VOC_RP_{2018} = Rule Penetration for VOC (in this example for 2018)

A similar equation could be constructed for either PM or CO. It should be noted that the control efficiencies calculated based on the HDD rulemaking were only applied if they were greater than any existing 2002 base year controls. No controls were found for SO_2 or NO_x area sources.

In the pre-Base F 2018 emission estimates, an energy efficiency factor was applied to energy related stationary area sources. The energy efficiency factor was applied along with the growth factor to account for both growth and changes in energy efficiency. That factor was not applied to the Base F projections since information supplied by U.S. EPA related to the CAIR growth factors indicated that growth values for those categories were derived from U.S. Department of Energy (DOE) and were felt to account for changes in growth and projected energy efficiency. For the Base G inventory, these energy efficiency factors were re-instituted and used in conjunction with EGAS 5.0 growth factors in a manner identical to that used for the pre-Base F inventories. The energy efficiency factors were derived from U.S. DOE's Annual Energy Outlook report.

One significant difference between the Base F and Base G control factors was for counties and independent cities in northern Virginia. Several counties and independent cities in northern Virginia are subject to Ozone Transport Commission rules. For these counties and independent cities, controls for portable fuel containers, mobile equipment repair/refinishing, consumer products, solvent metal cleaning, and the architectural and industrial maintenance rules were added. The counties/independent cities (FIPS code) included in the changes for Base G were: Alexandria City (51510), Arlington (51013), Fairfax City (51600), Fairfax (51059), Falls Church City (51610), Fredericksburg City (51630), Loudoun (51107), Manassas City (51683), Manassas Park City (51685), Prince William County (51153), Spotsylvania (51177), and Stafford (51179). Not all OTC rules applied to all counties/cities.

2.2.1.2 Stationary area source growth

As indicated above, growth factors for the Base F and Base G 2009 and 2018 inventories were obtained from the U.S. EPA and are linear interpolations of the growth factors used for the Clean Air Interstate Rule (CAIR) projections. The growth factors for the CAIR obtained by MACTEC were developed using a base year of 2001 and provided growth factors for 2010 and 2015. MACTEC used the TREND function in Microsoft Excel™ to calculate 2002, 2009 and 2018 values from the 2001, 2010 and 2015 values. The TREND function provides a linear interpolation of intermediate values from a known series of data points (in this case the 2001, 2010 and 2015 values) based on the equation for a straight line. These values were calculated at the State and SCC level with the exception of paved road emissions (SCC = 2294000000). The growth factors for paved roads were available in the CAIR data set at the State, county and SCC level so they were applied at that level.

Prior to utilizing the growth factors from the CAIR projections, MACTEC confirmed that all SCCs found in the VISTAS 2002 base year inventory were in the CAIR file (for Base F the starting point was the version 3.1 2002 base year inventory, for Base G the starting point was the Base F 2002 base year inventory). Some SCCs were not found in the CAIR file. For those SCCs, the growth factors used were derived in one of five ways. First where possible, they were taken from a beta version of EGAS 5.0. In other cases, the growth factor was set to one (i.e., no growth). In other cases, a similar SCC that had a CAIR growth factor was used. In a few cases a growth factor based on an average CAIR growth at the 6 digit SCC level was calculated. Finally a number of records used population as the growth surrogate. For the Base G inventory, CAIR growth factors for fuel fired area sources were replaced with EGAS 5.0 growth factors (used in conjunction with AEO fuel efficiency factors). A comment field in the growth factor file was used to mark those records that were not taken directly from the CAIR projection growth factors.

2.2.1.3 Differences between 2009/2018

Methodologically, there was no difference in the way that 2009 and 2018 emissions were calculated for stationary area sources. The individual control and growth factors were different (due to the linear interpolation used to calculate the values) but the calculation methods were identical. This applies to both Base F and Base G.

The only exception to this is for the State of North Carolina for Base G. North Carolina provided an emissions update file used to override calculated projections for a number of area source categories. The values in these files (provided for both 2009 and 2018) were used to overwrite the calculated projected emissions in the final NIF file.

2.2.2 Agricultural area sources

The general approach used to calculate projected emissions for agricultural area sources (predominantly NH_3 emission sources) was as follows:

1. MACTEC used the version 3.1 2002 base year inventory data (which was based on the CMU ammonia model version 3.6).
2. MACTEC worked with the VISTAS States (via the Agricultural Sources SIWG) to obtain any State specific growth and/or future controls from the States for agricultural sources.
3. Since the base year emissions were uncontrolled, and no future controls for these sources were identified, MACTEC projected the agricultural emissions using State-specific growth if available, otherwise the U.S. EPA’s Interstate Air Quality Transport Rule (IAQTR)/Ammonia inventory was used to develop the growth factors used to project the revised 2002 base year inventory to 2009 or 2018. Since the IAQTR inventory was only used to construct growth factors rather than using the emissions directly, no updated growth factors were prepared from the CAIR inventory values.

4. MACTEC then provided the final draft inventory for review and comment by the VISTAS States.

No change in the agricultural area source emission projections were made between Base F and Base G other than the removal of wild animal and human perspiration as a result of their removal from the 2002 base year file for Base G.

2.2.2.1 Control assumptions for agricultural area sources

No controls were identified either by the individual VISTAS States or in the information provided in the EPA's IAQTR or CAIR Ammonia inventory documents. Thus all projected emissions for agricultural area sources represent simple growth with no controls.

2.2.2.2 Growth assumptions for agricultural area sources

Growth for several agricultural area source livestock categories was developed using the actual emission estimates developed by the EPA as part of the NEI. That work included projections for the years 2002, 2010, 2015, 2020, and 2030. The actual emissions themselves were not used other than to develop growth factors since the 2002 NEI upon which the growth projections were based was prepared prior to the release of the 2002 Census of Agriculture data which was included in the CMU model (version 3.6) used to develop the Base F 2002 VISTAS base year inventory. Thus VISTAS Agricultural Sources SIWG decided to use the NEI ammonia inventory projected emissions to develop the 2009 and revised 2018 growth factors used to project emission for VISTAS. Details on the NEI inventory and projections can be found at:

http://www.epa.gov/ttn/chief/ap42/ch09/related/nh3inventorydraft_jan2004.pdf. The actual data files for the projected emissions can be found at:

http://www.epa.gov/ttn/chief/ap42/ch09/related/nh3output01_23_04.zip.

In order to use the NEI projected emissions as growth factors, several steps were required. These steps were as follows:

1. NEI projected emissions were only available for the years 2002, 2010, 2015, 2020, and 2030, thus the first task was to calculate intermediate year emissions for 2009 and 2018. These values were calculated based on linear interpolation of the existing data.

2. Once the intermediate emissions were calculated, MACTEC developed emission ratios to provide growth factors for 2009 and 2018. Ratios of emissions were established relative to the 2002 NEI emissions.

3. Once the growth factors were established, MACTEC then evaluated whether or not all agricultural SCCs within the revised 2002 base year inventory had corresponding

growth factors. MACTEC established that not all SCCs within the base year inventory had growth factors. These SCCs fell into one of two categories:

b. SCCs that had multiple entries in the NEI but only a single SCC in the 2002 VISTAS base year inventory. The NEI was established using a process model and for some categories of animals, emissions were calculated for several aspects of the process. The CMU model version 3.6 which was the basis for the VISTAS 2002 Base F inventory did not use a process model. As a consequence a mapping of SCCs in the NEI projections and corresponding SCCs in the CMU inventory was made and for those SCCs an average growth factor was calculated from the NEI projections for use with the corresponding SCC in the CMU based 2002 Base F inventory.

c. There were also State, county, SCC trios in the 2002 VISTAS Base F inventory which had no corresponding emissions in the NEI files. For these instances, MACTEC first developed State level average growth factors from the NEI projections for use in growing these records. Even after developing State level average growth factors there were still some State/SCC pairs that did not have matching growth. For these records, MACTEC developed VISTAS regional average growth factors at the SCC level from the NEI data.

1. Once all of the growth factors were developed, they were used to project the emissions to 2009 and 2018. Growth factors were first applied at the State, county and SCC level. Then remaining records were grown with the State/SCC specific growth factors. Finally, any remaining ungrown records were projected at the SCC level using the VISTAS regional growth factor.

For the livestock categories, the NEI emission projections only had data for beef and dairy cattle, poultry and swine. Thus for other livestock categories and for fertilizers alternative growth factors were required.

The growth factors for other livestock categories and fertilizers were obtained from growth factors used for the IAQTR projections made by the U.S. EPA. The methodology for these categories was identical to that used for dairy, beef, poultry and swine with the exception that State/SCC and VISTAS/SCC growth factors were not required for these categories since the IAQTR data contained State, county and SCC level growth factors. The IAQTR data provided growth factors for 1996, 2007, 2010, 2015 and 2020. Linear interpolation was used to develop the growth factors for the intermediate years 2009 and 2018 required for the VISTAS projections.

There were a few exceptions to the methods used for projecting agricultural sources for the VISTAS projections. These exceptions were:

1. All swine emissions for North Carolina were maintained at 2002 levels for each projection year to capture a moratorium on swine production in that State.
2. Ammonia growth factors for a few categories (mainly feedlots) were assigned to be the same as growth factors for PM emissions from the NEI projections. This assignment was made because the CMU model showed emissions from these categories but the NEI projections did not show ammonia emissions but did show PM emissions.
3. No growth factors were found for horse and pony emissions. These emissions were held constant at 2002 levels.

There was no change in this method between Base F and Base G. Thus Base F and Base G agricultural emissions are the same in each inventory. Future efforts on the agricultural emissions category should look at any changes made to the CMU model to reflect the model farm approach used by EPA in their inventory plus any updated growth factors that may be more recent than the EPA inventory used to develop growth estimates for Base F/G.

2.2.2.2.1 Differences between 2009/2018

Methodologically, there was no difference in the way that 2009 and 2018 emissions were calculated for agricultural area sources. The growth factors were different (due to the linear interpolation used to calculate the values) but the calculation methods were identical. In addition there was no difference between Base F and Base G for this category. Thus Base F and Base G agricultural emissions are the same in each inventory.

Tables 2.2-1 show the differences between Base F and Base G emissions for all area sources (including agricultural sources but excluding fires) for the 2002 base year and 2009 and 2018 by State and pollutant.

Table 2.2-1 2002 Base Year Emissions and Percentage Difference for Base F and Base G (based on actual emissions).

Actual Area 2002 - Base G							
State	**CO**	**NH3**	**NOX**	**PM10-PRI**	**PM25-PRI**	**SO2**	**VOC**
AL	83,958	58,318	23,444	393,588	56,654	52,253	182,674
FL	71,079	37,446	28,872	443,346	58,878	40,491	404,302
GA	108,083	80,913	36,142	695,414	103,794	57,559	299,679
KY	66,752	51,135	39,507	233,559	45,453	41,805	95,375
MS	37,905	58,721	4,200	343,377	50,401	771	131,808
NC	345,315	161,860	36,550	280,379	64,052	5,412	237,926
SC	113,714	28,166	19,332	260,858	40,291	12,900	161,000
TN	89,828	34,393	17,844	212,554	42,566	29,917	153,307
VA	155,873	43,905	51,418	237,577	43,989	105,890	174,116
WV	39,546	9,963	12,687	115,346	21,049	11,667	60,443
Base F							
AL	83,958	59,486	23,444	393,093	73,352	47,074	196,538
FL	105,849	44,902	29,477	446,821	81,341	40,537	439,019
GA	107,889	84,230	36,105	695,320	133,542	57,555	309,411
KY	66,752	51,097	39,507	233,559	52,765	41,805	100,174
MS	37,905	59,262	4,200	343,377	63,135	771	135,106
NC	373,585	164,467	48,730	303,492	69,663	7,096	346,060
SC	113,714	29,447	19,332	260,858	51,413	12,900	187,466
TN	89,235	35,571	17,829	211,903	49,131	29,897	161,069
VA	155,873	46,221	51,418	237,577	52,271	9,510	129,792
WV	39,546	10,779	12,687	115,346	25,850	11,667	61,490
Percentage Difference (negative values means Base G increased from Base F)							
AL	0.00%	1.96%	0.00%	-0.13%	22.76%	-11.00%	7.05%
FL	32.85%	16.61%	2.05%	0.78%	27.62%	0.12%	7.91%
GA	-0.18%	3.94%	-0.10%	-0.01%	22.28%	-0.01%	3.15%
KY	0.00%	-0.07%	0.00%	0.00%	13.86%	0.00%	4.79%
MS	0.00%	0.91%	0.00%	0.00%	20.17%	0.00%	2.44%
NC	7.57%	1.59%	24.99%	7.62%	8.05%	23.74%	31.25%
SC	0.00%	4.35%	0.00%	0.00%	21.63%	0.00%	14.12%
TN	-0.67%	3.31%	-0.09%	-0.31%	13.36%	-0.07%	4.82%
VA	0.00%	5.01%	0.00%	0.00%	15.84%	-1013.45%	-34.15%
WV	0.00%	7.57%	0.00%	0.00%	18.57%	0.00%	1.70%

Table 2.2-2 2009 Projection Year Emissions and Percentage Difference for Base F and Base G (based on actual emissions).

State	CO	NH3	NOX	PM10-PRI	PM25-PRI	SO2	VOC
Actual Area 2009 - Base G							
AL	66,654	64,268	23,930	413,020	58,699	48,228	143,454
FL	57,011	38,616	28,187	503,230	64,589	36,699	420,172
GA	94,130	89,212	37,729	776,411	112,001	57,696	272,315
KY	57,887	53,005	42,088	242,177	46,243	43,087	94,042
MS	27,184	63,708	4,249	356,324	51,661	753	124,977
NC	301,163	170,314	39,954	292,443	69,457	5,751	187,769
SC	90,390	30,555	19,360	278,299	41,613	13,051	146,107
TN	74,189	35,253	18,499	226,098	44,124	30,577	154,377
VA	128,132	46,639	52,618	252,488	44,514	105,984	147,034
WV	31,640	10,625	13,439	115,089	20,664	12,284	55,288
Base F							
AL	68,882	65,441	26,482	411,614	76,248	17,818	157,405
FL	101,356	46,950	31,821	507,515	90,487	52,390	462,198
GA	103,579	92,838	38,876	776,935	146,691	57,377	294,204
KY	64,806	53,023	42,122	242,345	54,397	40,779	94,253
MS	37,161	64,289	4,789	356,516	65,321	637	125,382
NC	332,443	173,187	53,550	317,847	75,570	7,607	252,553
SC	95,826	31,966	20,852	278,852	54,230	12,945	176,104
TN	82,196	36,578	19,148	225,650	51,753	29,787	160,265
VA	133,738	49,173	53,344	252,924	54,587	10,619	120,022
WV	37,704	11,461	13,816	115,410	25,835	12,156	57,082
Percentage Difference (negative values means Base G increased from Base F)							
AL	3.24%	1.79%	9.64%	-0.34%	23.02%	-170.67%	8.86%
FL	43.75%	17.75%	11.42%	0.84%	28.62%	29.95%	9.09%
GA	9.12%	3.91%	2.95%	0.07%	23.65%	-0.56%	7.44%
KY	10.68%	0.03%	0.08%	0.07%	14.99%	-5.66%	0.22%
MS	26.85%	0.90%	11.27%	0.05%	20.91%	-18.10%	0.32%
NC	9.41%	1.66%	25.39%	7.99%	8.09%	24.41%	25.65%
SC	5.67%	4.41%	7.16%	0.20%	23.27%	-0.82%	17.03%
TN	9.74%	3.62%	3.39%	-0.20%	14.74%	-2.65%	3.67%
VA	4.19%	5.15%	1.36%	0.17%	18.45%	-898.09%	-22.51%
WV	16.08%	7.29%	2.73%	0.28%	20.02%	-1.06%	3.14%

Table 2.2-3 2018 Projection Year Emissions and Percentage Difference for Base F and Base G (based on actual emissions).

Actual Area 2018 - Base G							
State	**CO**	**NH3**	**NOX**	**PM10-PRI**	**PM25-PRI**	**SO2**	**VOC**
AL	59,626	71,915	25,028	445,256	62,323	50,264	153,577
FL	53,903	40,432	30,708	578,516	72,454	38,317	489,975
GA	93,827	99,885	41,332	880,199	123,704	59,729	319,328
KY	54,865	55,211	44,346	256,052	47,645	44,186	103,490
MS	22,099	69,910	4,483	375,495	53,222	746	140,134
NC	290,809	180,866	43,865	315,294	71,262	6,085	189,591
SC	83,167	33,496	20,592	304,251	44,319	13,457	161,228
TN	68,809	36,291	19,597	246,252	46,692	31,962	182,222
VA	121,690	50,175	56,158	275,351	46,697	109,380	150,919
WV	28,773	11,504	14,828	121,549	21,490	12,849	60,747
Base F							
AL	63,773	73,346	28,754	445,168	82,449	49,975	168,507
FL	100,952	49,889	35,047	582,832	101,872	59,413	533,141
GA	105,059	103,911	42,260	880,800	163,925	61,155	342,661
KY	65,297	55,356	45,597	256,544	57,110	42,326	102,117
MS	36,425	70,565	5,230	375,931	68,338	831	139,419
NC	327,871	184,167	60,073	345,275	85,018	8,273	234,207
SC	89,343	35,082	22,467	304,940	58,441	13,517	196,946
TN	81,242	37,812	20,928	245,893	55,712	31,047	188,977
VA	129,037	53,023	56,668	275,790	58,141	11,479	128,160
WV	36,809	12,390	15,079	121,964	27,088	13,450	62,164
Percentage Difference (negative values means Base G increased from Base F)							
AL	6.50%	1.95%	12.96%	-0.02%	24.41%	-0.58%	8.86%
FL	46.61%	18.96%	12.38%	0.74%	28.88%	35.51%	8.10%
GA	10.69%	3.87%	2.20%	0.07%	24.54%	2.33%	6.81%
KY	15.98%	0.26%	2.74%	0.19%	16.57%	-4.40%	-1.34%
MS	39.33%	0.93%	14.28%	0.12%	22.12%	10.19%	-0.51%
NC	11.30%	1.79%	26.98%	8.68%	16.18%	26.45%	19.05%
SC	6.91%	4.52%	8.34%	0.23%	24.16%	0.44%	18.14%
TN	15.30%	4.02%	6.36%	-0.15%	16.19%	-2.95%	3.57%
VA	5.69%	5.37%	0.90%	0.16%	19.68%	-852.83%	-17.76%
WV	21.83%	7.15%	1.66%	0.34%	20.66%	4.46%	2.28%

2.2.3 Changes to Prescribed Fire for 2009/2018 Base G

Just prior to release of version 3.1 of the VISTAS inventory several Federal agencies indicated that they had plans for increased prescribed fire burning in future years and that the "typical" fire inventory would likely not adequately capture those increases (memo from Bill Jackson and Cindy Huber, August 13, 2004). However data were not readily available to incorporate those changes up through the Base F inventory. As a consequence MACTEC worked with Federal Land Managers to acquire the data necessary to provide 2009 and 2018 specific projections for the prescribed fire component of the Base G fire inventory. The 2009 and 2018 projections developed using the method described below are being used by VISTAS as the 2009 and 2018 base case inventories for all States except FL. For FL the supplied data from the FLMs is not being used as FL felt that their data adequately reflected current and future prescribed burning practices. The “typical” fire projection is the 2002 base prescribed fire projection.

One of the biggest issues in preparing the projection was how best to incorporate the data. Two agencies submitted data: Fish and Wildlife Service (FWS) and Forest Service (FS). FWS submitted annual acreage data by National Wildlife Refuge (NWR) and county with estimates of acres burned per day for each NWR. FS provided fire-by-fire acreage estimates based on mapping projected burning acreage to current 2002 modeling days. However, FWS did not submit data for VISTAS original base year preparation process, thus there was no known FWS data in the 2002 actual or typical inventories. Thus MACTEC had to develop a method that could use the county level data submitted by FWS.

In addition, despite the fact that the FS submitted fire-by-fire data for the 2002 actual inventory and had mapped the projections to current burn days in the 2002 actual inventory, MACTEC could not do a simple replacement of those records with the 2009/2018 projections. This situation was created because several VISTAS States run a prescribed fire permitting program. To avoid double counting, only State data was used in those States for the 2002 actual inventory. Thus there were no Federal data in those States since the Federal data could have potentially duplicated State-supplied prescribed fire data. In VISTAS States without permit programs, the FS supplied data for 2002 was used and those records were marked in database. Thus for those States, the FS supplied 2009/2018 data could be directly substituted for the 2002 data.

The method used by MACTEC to include the FS data applied a county level data approach for FS data where a State had a prescribed fire permitting program and a fire-by-fire replacement for FS data in States without permit programs. MACTEC used a county level approach for all of the FWS data. The approach used for each data set is discussed below.

For the FWS data MACTEC summed the annual acres burned supplied by the FWS across all NWRs in a county. We then subtracted out 2002 acreage for that county from the FWS projected acreage annual total to avoid double counting. The remaining acreage was then multiplied by 0.8 to account for blackened acres instead of the total perimeter acres that were reported. The revised total additional FWS acreage was then added to the total county “typical” acreage to determine future acreage burned for either 2009 or 2018. MACTEC then allocated the increased acreage to current modeling days. The average daily acres burned data provided by FWS per NWR/county was used to allocate the acreage to the correct number of days required to burn all of the acres. Guidance supplied by FWS indicated that up to three times the average daily acres burned could potentially be allocated to any one day. Thus if the estimated acreage per day were 100 acres then up to 300 acres could actually be allocated to a particular day. This approach (use of up to three times the average daily acres burned) was used if there were an insufficient number of 2002 modeling days available to account for all of the acreage increase. MACTEC used an incremental approach to using the increase above the base average daily acres. First we used twice the average daily acreage if that was sufficient to completely allocate the increased acreage over the total number of days available. If that wasn't sufficient then we used three times the average daily acres burned to allocate the acreage. We applied the highest increases to days in the database that already had the highest acreage burned since we felt those days were most likely to represent days with representative conditions for conducting prescribed burns.

The approach used by MACTEC for the FS was slightly different. For States that had permit programs, we used similar approach to the FWS county level approach. First we summed the FS data at county level, we then added that value to the typical acreage and then we allocated the acres to current modeling days. The mapping to current modeling days was performed by Bill Jackson of the USFS and provided to MACTEC. For States that do not have a prescribed fire permit program, MACTEC simply replaced the current fire-by-fire records in the database with fire-by-fire records from the FS and recalculated emissions based on fuel model and fuel loading. We also applied the same 0.8 correction for blackened acres applied to all FS supplied acreage as the supplied values represented perimeter acres.

An additional problem with developing year-specific prescribed fire projections was how to adequately capture the temporal profile for those fires. In the 2002 actual fire inventory, fires occur on same days as state/FLM records. In the 2002 "typical" year inventory, fire acreage increased or decreased from acreage on the same fire days as were in the 2002 actual inventory, since the acres were simply increased for each day based on a multiplier used to convert from actual to typical.

When prescribed fires acreage was added to a future year, MACTEC added acreage to individual fire days proportional to the annual increase (if acreage on a day is 10 percent of annual, add 10 percent of projected increase to that same day).

The table below shows how the FWS data for Okefenokee NWR were allocated for 2009 for Clinch County (Okefenokee NWR is located in four different counties). You can see that the total additional acres for the Clinch County portion of Okefenokee NWR was 1,956 acres. Two hundred eighty (280) acres were the estimated average daily acres burned for that NWR/county combination. Thus to allocate the entire 1,956 acres would require almost 7 burn days (1,956 divided by 280). However only 5 burn days were found for Clinch County in the 2002 actual fire database. Thus we allocated twice the average acreage to the burn day with the most acres burned in the 2002 actual fire database (since our method allowed us to increase the average daily acres burned up to three times the recommended level). Thus the first burn day received 560 acres and all others received 280 except the final day which received 276 to make the total equal to the required 1,956 acres. The table also indicates that the increased acres burned provided increases of from 10-48 percent in the acres burned on the individual burn days and an average of approximately 14 percent for the year as a whole.

CLINCH COUNTY	3/1/2002	4/1/2002	2/1/2002	1/1/2002	11/1/2002	12/1/2002	Total Annual
Acres (typical)	3,757	2,612	1,996	1,801	616	472	11,764
Add on FWS Projection	560	280	280	280	280	276	1,956
Total	4,316	2,891	2,276	2,080	895	747	13,720
Percent Increase	14.9%	10.7%	14.0%	15.6%	45.5%	58.5%	14.3%

The figure below shows the increases for prescribed burning in the four counties that comprise the Okefenokee NWR area (which also includes FS land). In this figure you can see the additional acreage added for the burn days from FWS and the individual day increases caused by projected increases in prescribed burning based on FS data. It should be noted that while the emissions represent 2009, all fire event dates listed are for 2002 to match up with the base year meteorology used in modeling exercises.

Table 2.2-4 shows the percentage difference between the 2009 and 2018 projections developed for Base F and Base G. Base G includes the revised prescribed burning estimates described above. Values are calculated using Base F as the basis for change, thus negative values imply an increase in emissions for Base G.

Figure 2.2-1 Prescribed Fire Projection for Okeefenokee NWR for 2009

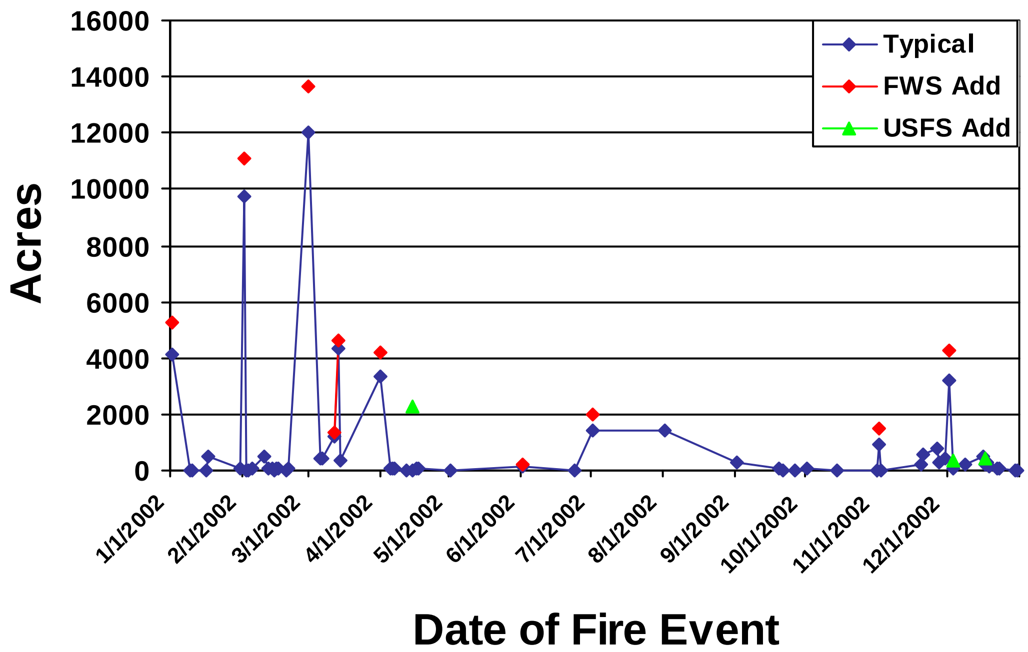


Table 2.2-4 Percentage Difference Between Base F and Base G Fire Emissions by State

State	CO	NH3	NOX	PM10-PRI	PM25-PRI	SO2	VOC	CO	NH3	NOX	PM10-PRI	PM25-PRI	SO2	VOC
2009 Fires Base G								**2018 Fires Base G**						
AL	534,873	2,050	11,901	52,851	46,543	2,681	27,502	535,658	2,054	11,918	52,927	46,608	2,686	27,539
FL	923,310	3,157	19,791	98,470	88,756	4,129	51,527	923,310	3,157	19,791	98,470	88,756	4,129	51,527
GA	637,177	2,229	14,243	63,973	57,116	2,914	34,710	637,177	2,229	14,243	63,973	57,116	2,914	34,710
KY	31,810	143	682	3,093	2,653	187	1,497	33,296	150	714	3,237	2,777	196	1,567
MS	48,160	217	1,033	4,683	4,016	283	2,266	50,037	225	1,073	4,865	4,173	294	2,355
NC	96,258	433	2,065	9,359	8,027	566	4,530	111,266	501	2,387	10,819	9,279	655	5,236
SC	282,307	1,039	5,899	29,153	25,955	1,359	16,045	282,307	1,039	5,899	29,153	25,955	1,359	16,045
TN	17,372	78	373	1,689	1,449	102	817	18,860	85	405	1,834	1,573	111	888
VA	21,130	95	453	2,054	1,762	124	994	26,923	121	578	2,618	2,245	158	1,267
WV	3,949	18	85	384	329	23	186	5,013	23	108	487	418	29	236
2009 Fires Base F								**2018 Fires Base F**						
AL	514,120	1,957	11,456	50,833	44,812	2,559	26,526	514,120	1,957	11,456	50,833	44,812	2,559	26,526
FL	923,310	3,157	19,791	98,470	88,756	4,129	51,527	923,310	3,157	19,791	98,470	88,756	4,129	51,527
GA	620,342	2,153	13,882	62,336	55,712	2,815	33,918	620,342	2,153	13,882	62,336	55,712	2,815	33,918
KY	56,686	110	1,460	6,667	6,310	136	3,338	56,686	110	1,460	6,667	6,310	136	3,338
MS	128,471	177	3,328	14,693	13,680	100	13,625	128,471	177	3,328	14,693	13,680	100	13,625
NC	200,564	324	5,005	20,488	19,491	423	12,499	200,564	324	5,005	20,488	19,491	423	12,499
SC	253,005	908	5,270	26,304	23,511	1,187	14,666	253,005	908	5,270	26,304	23,511	1,187	14,666
TN	78,370	46	2,232	8,875	8,730	59	5,153	78,370	46	2,232	8,875	8,730	59	5,153
VA	19,159	159	978	18,160	17,361	99	912	19,159	159	978	18,160	17,361	99	912
WV	32,656	12	944	3,276	3,239	16	2,184	32,656	12	944	3,276	3,239	16	2,184
Percentage Difference (negative number means an increase in Base G emissions)														
AL	-4.04%	-4.77%	-3.89%	-3.97%	-3.86%	-4.77%	-3.68%	-4.19%	-4.95%	-4.03%	-4.12%	-4.01%	-4.95%	-3.82%
FL	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
GA	-2.71%	-3.52%	-2.60%	-2.63%	-2.52%	-3.52%	-2.34%	-2.71%	-3.52%	-2.60%	-2.63%	-2.52%	-3.52%	-2.34%
KY	43.88%	-29.52%	53.25%	53.61%	57.96%	-37.90%	55.15%	41.26%	-35.57%	51.07%	51.44%	56.00%	-44.34%	53.06%
MS	62.51%	-22.07%	68.95%	68.13%	70.64%	-183.85%	83.37%	61.05%	-26.83%	67.74%	66.89%	69.50%	-194.91%	82.72%
NC	52.01%	-33.75%	58.74%	54.32%	58.82%	-33.75%	63.76%	44.52%	-54.60%	52.31%	47.19%	52.40%	-54.60%	58.11%
SC	-11.58%	-14.52%	-11.93%	-10.83%	-10.39%	-14.52%	-9.40%	-11.58%	-14.52%	-11.93%	-10.83%	-10.39%	-14.52%	-9.40%
TN	77.83%	-69.40%	83.30%	80.97%	83.41%	-74.42%	84.14%	75.93%	-83.92%	81.87%	79.34%	81.98%	-89.36%	82.78%
VA	-10.29%	40.36%	53.67%	88.69%	89.85%	-25.40%	-9.03%	-40.53%	24.00%	40.97%	85.59%	87.07%	-59.79%	-38.93%
WV	87.91%	-48.65%	91.03%	88.28%	89.83%	-49.46%	91.49%	84.65%	-88.70%	88.61%	85.12%	87.09%	-89.73%	89.20%

2.2.4 Quality Assurance steps

Throughout the inventory development process, quality assurance steps were performed to ensure that no double counting of emissions occurred, to ensure that a full and complete inventory was developed for VISTAS, and to make sure that projection calculations were working correctly. Quality assurance was an important component to the inventory development process and MACTEC performed the following QA steps on the stationary and agricultural area source components of the 2009 and revised 2018 projection inventories:

1. All final files were run through EPA's Format and Content checking software.
2. SCC level emission summaries were prepared and evaluated to ensure that emissions were consistent and that there were no missing sources.
3. Tier comparisons (by pollutant) were developed between the 2002 base year inventory and the 2009 and 2018 projection inventories. In addition, total VISTAS pollutant summaries were prepared to compare total emissions by pollutant between versions of the inventory (e.g., between Base F and Base G).
4. Data product summaries were provided to both the VISTAS Emission Inventory Technical Advisor and to the SIWG representatives for review and comment. Changes based on these comments were implemented in the files.
5. Version numbering was used for all inventory files developed. The version numbering process used a decimal system to track major and minor changes. For example, a major change would result in a version going from 1.0 to 2.0. A minor change would cause a version number to go from 1.0 to 1.1. Minor changes resulting from largely editorial changes would result in a change from 1.00 to 1.01.

2.3 Mobile Sources

Our general approach for assembling data was to use as much existing data from the pre-Base F preliminary projections as possible for these inventories, supplement these data with easily available stakeholder input, and provide the results for stakeholder review to ensure credibility. To develop the "base case" projections, MACTEC originally assembled data to develop two 2009 and 2018 base case inventories: 1) an inventory that included all "on-the-books" control programs and 2) an "on-the-way" inventory that included controls that were likely to be "on-the-way". For the Base F and Base G emission forecasts to the mobile source sector, "on-the-books" and "on-the-way" are defined with the same strategies and therefore only a single projection scenario was developed for each forecast year.

To ensure consistency across evaluation years, the 2009 and 2018 base case inventories were developed, to the maximum extent practical, using methodologies identical to those employed in developing the 2002 on-road portion of the revised 2002 VISTAS base year inventory. All modifications to the 2002 inventory methods were developed in consultation with the Mobile Source Special Interest Workgroup (MSSIWG). Generally, modifications were only made to properly account for actual changes expected in the intervening period (i.e., between 2002 and 2009 and between 2002 and 2018), but the underlying inventory development methodology was identical, except to the extent requested by VISTAS or the MSSIWG.

MACTEC developed a preliminary 2018 inventory in early 2004. That inventory was designed to 1) be used for modeling sensitivity evaluations and 2) help establish the methods that would be used for the final 2018 inventory and the initial 2009 inventory. Since that work took place prior to the revision of the 2002 base year inventory data files, MACTEC provided a review of the data and methods used to develop on-road mobile source input files for the initial 2002 base year inventory prior to developing the preliminary 2018 inventory. Through this review, MACTEC determined the following:

- On-road VMT. Most States provided local data for 2002 (or a neighboring year that was converted to 2002 using appropriate VMT growth surrogates such as population). Since these data were not applicable to 2018 due to intervening growth, input for 2018 was solicited from the MSSIWG. At the same time we researched county-specific growth rate data utilized for recent national rulemakings as a backstop approach to State supplied VMT projections.

- Modeling Temperatures. Actual 2002 temperatures were used for the initial 2002 base year inventory.

- Vehicle Registration Mix (age fractions by type of vehicle). A mix of State, local, and MOBILE6 default data were used for the 2002 initial base year inventory. Forecast data were solicited from the States, with a fallback position that we hold the fractions constant at their 2002 values.

- Vehicle Speed by Roadway Type. For the 2002 initial base year inventory, speeds varying by vehicle and road type were used.

- VMT Mixes (fraction of VMT by vehicle type). A mix of State, local, and quasi MOBILE6 default (i.e., MOBILE6 defaults normalized to better reflect local conditions) data were used for the 2002 initial base year inventory. Forecast data were solicited from the States.

- Diesel Sales Fractions. As with the VMT mix data, the diesel sales fraction data employed for the 2002 initial base year inventory represents a mix of State, local, and quasi MOBILE6 default data. The issues related to updating these data to 2018 are also similar, but are complicated by the fact that MOBILE6 treats diesel sales fraction on a model year, rather than age specific basis. Therefore, diesel sales fractions generally cannot be held constant across time. Once again, we solicited any local projections, with a fallback position that we would keep the data for 2002 and earlier model years constant for the forecast inventory, supplemented with MOBILE6 default data for 2003 and newer model years.

- State/Local Fuel Standards. For the 2002 initial base year inventory, these data were based on appropriate local requirements and updated data for 2018 was only required if changes were expected between 2002 and 2018. There are some national changes in required fuel quality for both on-road and non-road fuels that are expected to occur between 2002 and 2018 and these would be reflected in the 2018 inventory in the absence of more stringent local fuel controls. Expected changes in local fuel control programs were solicited.
- Vehicle Standards. The 2002 initial base year inventory assumed NLEV applicability. This was altered to reflect Tier 2 for 2018, unless a State indicated a specific plan to adopt the California LEV II program. If so, we made the required changes to implement those plans for the preliminary 2018 inventory.
- Other Local Controls. This includes vehicle emissions inspection (i.e., I/M) programs, Stage II vapor recovery programs, anti tampering programs, etc. By nature, the assumptions used for the 2002 initial base year inventory vary across the VISTAS region, but our presumption is that these data accurately reflected each State's situation as it existed in 2002. If a State had no plans to change program requirements between 2002 and 2018, we proposed to maintain the 2002 program descriptions without change. However, if a State planned changes, we requested information on those plans. In the final implementation of the Base F and earlier inventories, Stage II controls were exercised in the area source component of the inventory, since the units used to develop Stage II refueling estimates are different between MOBILE6 and the NONROAD models. However, in the Base G inventories, Stage II refueling was moved to the on-road and non-road sectors.

Once the preliminary 2018 (pre-Base F) base case projection inventory data were compiled, MACTEC applied the data and methods selected and proceeded to develop the preliminary (pre-base F) base case 2018 projection inventories. The resulting inventories were provided to the MSSIWG in a user-friendly format for review. After stakeholder review and comment, the final preliminary 2018 base case inventories and input files were provided to VISTAS in formats identified by the VISTAS Technical Advisor (in this case, MOBILE input files and VMT, NONROAD input files and annual inventory files for NONROAD in NIF 3.0 format). Annual inventory files for MOBILE were not developed as part of this work, only input files and VMT forecasts. MOBILE emissions were calculated by VISTAS air quality modeling contractor using the provided files.

2.3.1 Development of on-road mobile source input files

As indicated above, MACTEC prepared a preliminary version of the 2018 base case mobile inventory input data files. These files were then updated to provide a final set of 2018 base case inventory input data files as well as a set of input files for 2009. The information below describes the updates performed on the preliminary 2018 files and the development of the 2009 input data files for Base F emission estimation.

Our default approach to preparing the revised 2018 and initial 2009 projection inventories for on-road mobile sources was to estimate the emissions by using either:

1. the revised 2002 data provided by each State coupled with the projection methods employed for the preliminary 2018 inventory, or
2. the same data and methods used to generate the preliminary 2018 inventory.

We also investigated whether or not there was more recent VMT forecasting data available (e.g., from the CAIR and if appropriate revised the default VMT growth rates accordingly. This did not affect any State that provided local VMT forecasting data, but would alter the VMT estimates used for other areas.

Since no preliminary 2009 inventory was developed there did not exist an option (2) above for 2009. As a consequence, MACTEC crafted the 2009 initial inventory for on-road mobile sources using methods identical to those employed for the 2018 preliminary inventories coupled with any changes/revisions provided by the States during the review of the revised 2002 base year and the 2018 preliminary inventories. Therefore, as was the case for 2018, we obtained from the States any input data revisions, methodological revisions, and local control program specifications (to the extent that they differed from 2002/2018).

2.3.1.1 Preparation of revised 2018 input data files

Preparation of the revised 2018 inventories required the following updates:

1. The evaluation year was updated to 2018 in all files.
2. The diesel fuel sulfur content was revised from 500 ppm to 11 ppm, consistent with EPA data for 2018 in all files.
3. Since the input data is model year, rather than age, specific for diesel sales fractions (with data for the newest 25 model years required), we updated all files that included

diesel sales fractions. In the revised 2002 base year files, the data included applied to model years 1978-2002. For 2018, the data included would reflect model years 1994-2018. To forecast the 2002 data, MACTEC took the data for 1994-2002 from the 2002 files and added data for 2003-2018. To estimate the data for these years, we employed the assumption employed by "default" in MOBILE6 -- namely that diesel sales fractions for 1996 and later are constant. Therefore, we set the diesel sales fractions for 2003-2018 at the same value as 2002.

4. VMT mix fractions must be updated to reflect expected changes in sales patterns between 2002 and 2018. If explicit VMT mix fractions are not provided, these changes are handled internally by MOBILE6 or externally through absolute VMT distributions. However, files that include explicit VMT mix fractions override the default MOBILE6 update and may or may not be consistent with external VMT distributions. MACTEC updated the VMT mix in such files as follows:

   First, we calculated the VMT fractions for LDV, LDT1, LDT2, HDV, and MC from the external VMT files for 2018. This calculation was performed in accordance with section 5.3.2 of the MOBILE6 Users Guide which indicates:

   LDV = LDGV + LDDV

   LDT1 = LDGT1 + LDDT

   LDT2 = LDGT2

   HDV = HDGV + HDDV

   MC = MC

   The resulting five VMT fractions were then split into the 16 fractions required by MOBILE6 using the distributions for 2018 provided in Appendix D of the MOBILE6 Users Guide. This approach ensures that explicit input file VMT fractions are consistent with the absolute VMT distributions prepared by MACTEC. These changes were made to all files that included VMT mixes.

5. All other input data were retained at 2002 values, except as otherwise instructed by the States. This includes all control program descriptions (I/M, Anti-Tampering Program [ATP], Stage II, etc.), all other fuel qualities (RVP, oxy content, etc.), all other vehicle descriptive data (registrations age distributions, etc.), and all scenario descriptive data. The State-specific updates performed are described below.

Kentucky:

MACTEC revised the 2018 input files for the Louisville, Kentucky area (Louisville Air Pollution Control District [APCD]) based on comments received relative to several components of

MOBILE input data. Based on these comments, the input files for Jefferson County, Kentucky were updated accordingly as follows:

a) I/M and tampering program definitions were removed since the program was discontinued at the end of 2003.

b) The "Speed VMT", "Facility VMT" and "Registration Age Distribution" file pointers were updated to reflect revised 2002 files provided by the Louisville APCD.

c) The "VMT Mix" data, which was previously based on the default approach of "growing" 2002 data, was replaced by 2018-specific data provided by the Louisville APCD.

North Carolina:

North Carolina provided a wide range of revised input data, including complete MOBILE6 input files for July modeling. MACTEC did not use the provided input files directly as they did not match the 2002 NC input files for critical elements such as temperature distributions and gasoline RVP (while they were close, they were slightly different). To maintain continuity between 2002 and 2018 modeling, MACTEC instead elected to revise the 2002 input files to reflect all control program and vehicle-related changes implied by the new 2018 files, while retaining the basic temperature and gasoline RVP assumptions at their 2002 values. Under this approach, the following changes were made:

a) NC provided a county cross reference file specific to 2018 that differed from that used for 2002. We removed files that were referenced in the 2002 input data and replaced those files with those referenced in the 2018 data. In addition, since NC only provided 2018 input files for July, we estimated the basic data for these new files for the other months by cross referencing the target files for 2002 by county against the target files for 2018 by county.

b) We then revised the 2002 version of each input file to reflect the 2018 "header" data included in the NC-provided 2018 files. These data are exclusively limited to I/M and ATP program descriptions, so that the 2002 I/M and ATP data were replaced with 2018 I/M and ATP data.

c) We retained the registration age fractions at their 2002 "values" (external file pointers) as per NC instructions.

d) We retained all scenario-specific data (i.e., temperatures, RVP, etc.) at 2002 values, which (as indicated above), were slightly different in most cases from data included in the 2018 files provided by NC. We believe these differences were due to small deviations between the data assembled to support VISTAS 2002 and the process used to generate the 2018 files provided by NC, and that revising the VISTAS 2002 data to reflect these variations was not appropriate given the resulting inconsistencies that would be reflected between VISTAS 2002 and VISTAS 2018.

e) NC also provided non-I/M versions of the 2018 input files that would generally be used to model the non-I/M portion of VMT. While these files were retained they were not used for the 2018 input data preparation.

Finally, NC also provided a speed profile file and a speed profile cross reference file for 2018. We did not use these in our updates as they have no bearing on the MOBILE6 input files, but they were maintained in case they needed to be included in SMOKE control files for a future year control strategy scenario.

Virginia:

In accordance with instructions from VA, the input files that referenced an external I/M descriptive program file (VAIM02.IM) were revised to reference an alternative external file (VAIM05.IM). This change was to make the I/M program more relevant to the year 2018.

One additional important difference was made with respect to the revised 2018 and initial 2009 on-road mobile source input data files for all States. MACTEC developed updated SMOKE ready input files rather than MOBILE6 files so that the input data could be used directly by the VISTAS modeling contractor to estimate on-road mobile source emissions during modeling runs.

2.3.1.2 Preparation of initial 2009 input data files

The methodology used to develop the 2009 on-road input files was based on forecasting the previously developed revised 2002 base year input files and is identical to that previously described for the revised 2018 methodology except as follows:

1. The evaluation year was updated to 2009.
2. Diesel fuel sulfur content was revised from 500 ppm to 29 ppm. The 29 ppm value was derived from an EPA report entitled "Summary and Analysis of the Highway Diesel Fuel 2003 Pre-compliance Reports" (EPA420-R-03-013, October 2003), which includes the Agency's estimates for the year-to-year fuel volumes associated with the transition from 500 ppm to 15 ppm diesel fuel. According to Table 2 of the report, there will be 2,922,284 barrels per day of 15 ppm diesel distributed in 2009 along with 110,488 barrels per day of 500 ppm diesel. Treating the 15 ppm diesel as 11 ppm on average (consistent with EPA assumptions and assumptions employed for the 2018 input files) and sales weighting the two sulfur content fuels results in an average 2009 diesel fuel sulfur content estimate of 29 ppm.

3. Diesel sales fractions were updated identically to 2018 except that the diesel sales fractions for 2003-2009 were set at the same value as those for 2002 (rather than 2003-2018).

4. VMT mix fractions were updated to 2009 using an identical method to that described for 2018.

5. All other input data were retained at 2002 values, except as otherwise instructed by individual States (see below). This includes all control program descriptions (I/M, ATP, Stage II, etc.), all other fuel qualities (RVP, oxy content, etc.), all other vehicle descriptive data (registration age distributions, etc.), and all scenario descriptive data.

In addition to the updates described above that were applied to all VISTAS-region inputs, the following additional State-specific updates were performed:

KY – Identical changes to those made for 2018 (but specific to 2009) were made for the 2009 input files.

NC – Identical changes to those made for 2018 (but specific to 2009) were made for the 2009 input files.

VA – Identical changes to those made for 2018 were made for 2009.

2.3.2 VMT Data

The basic methodology used to generate the 2009 and 2018 VMT for use in estimating on-road mobile source emissions was as follows:

1. All estimates start from the final VMT estimates used for the 2002 revised base year inventory.

2. Initial 2009 and 2018 VMT estimates were based on linear growth rates for each State, county, and vehicle type as derived from the VMT data assembled by the U.S. EPA for their most recent HDD (heavy duty diesel) rulemaking. The methodology used to derive the growth factors is identical to that employed for the preliminary 2018 VMT estimates (which is described in the next section).

3. For States that provided no independent forecast data, the estimates derived in step 2 are also the final estimates. These States are: Alabama, Florida, Georgia, Kentucky, Mississippi, and West Virginia. For States that provided forecast data, the provided data were used to either replace or augment the forecast data based on the HDD rule. These States, and the specific approaches employed, are detailed following the growth method description.

The steps involved in performing the growth estimates for VMT were as follows:

1. Linear growth estimates were used (although MACTEC investigated the potential use of nonlinear factors and presented that information to the MSSIWG, the decision was made to use linear growth factors instead of nonlinear).
2. Estimates were developed at the vehicle class (i.e., LDGV, LDGT1, LDGT2, etc.) level of detail since the base year 2002 estimates were presented at that level of resolution. In effect, the county and vehicle class specific growth factors were applied to the 2002 VMT estimates for each vehicle and road class.
3. Overall county-specific VMT estimates for each year (developed by summing the vehicle and road class specific forecasts) were then compared to overall county-specific growth. Since overall county growth is a more appropriate controlling factor as it includes the combined impacts of all vehicle classes, the initial year-specific vehicle and road class VMT forecasts were normalized so that they matched the overall county VMT growth. Mathematically, this process is as follows:

$$(Est\_rv\_f) = (Est\_rv\_i) * (C\_20XX / Sum(Est\_rv\_i))$$

where:

Est_rv_f = the final road/vehicle class-specific estimates,

Est_rv_i = the initial road/vehicle class-specific estimates, and

C_20XX = the county-specific growth target for year 20XX.

Table 2.3-1 presents a basic summary of the forecasts for the preliminary 2018 inventory for illustrative purposes:

Table 2.3-1 2002 versus 2018 VMT (million miles per year)

State	2002	2018	Growth Factor
Alabama	55,723	72,966	1.309
Florida	178,681	258,191	1.445
Georgia	106,785	148,269	1.388
Kentucky	51,020	66,300	1.299
Mississippi	36,278	46,996	1.295
North Carolina	80,166	110,365	1.377
South Carolina	47,074	63,880	1.357
Tennessee	68,316	91,647	1.342
Virginia	76,566	102,971	1.345
West Virginia	19,544	24,891	1.274

The following States provided some types of forecast data for VMT. The information presented below indicates how those data were processed by MACTEC for use in the VISTAS projection inventories.

Kentucky:

Revised 2009 and 2018 VMT mix data were provided by the Louisville APCD. Therefore, the distribution of Jefferson County VMT by vehicle type within the KY VMT file was revised to reflect the provided mix. This did not affect the total forecasted VMT for either Jefferson County or the State, but does alter the fraction of that VMT accumulated by each of the eight vehicle types reflected in the VMT file. The following procedure was employed to make the VMT estimates consistent with the provided 2009/2018 VMT mix:

a) The 16 MOBILE6 VMT mix fractions were aggregated into the following five vehicle types: LDV, LDT1, LDT2, HDV, and MC.

b) The 8 VMT mileage classes were aggregated into the same five vehicle types (across all roadway types) and converted to fractions by normalizing against the total Jefferson County VMT.

c) The ratio of the "desired" VMT fraction (i.e., that provided in the Louisville APCD VMT mix) to the "forecasted" VMT fraction (i.e., that calculated on the basis of the forecasted VMT data) was calculated for each of the five vehicle classes.

d) All forecasted VMT data for Jefferson County were multiplied by the applicable ratio from step c as follows:

new LDGV = old LDGV * LDV ratio
new LDGT1 = old LDGT1 * LDT1 ratio
new LDGT2 = old LDGT2 * LDT2 ratio
new HDGV = old HDGV * HDV ratio
new LDDV = old LDDV * LDV ratio
new LDDT = old LDDT * LDT1 ratio
new HDDV = old HDDV * HDV ratio
new MC = old MC * MC ratio

The total forecasted VMT for Jefferson County was then checked to ensure that it was unchanged.

North Carolina:

North Carolina provided both VMT and VMT mix data by county and roadway type for 2018. Therefore, these data replaced the data developed for North Carolina using HDD rule growth rates in their entirety. Similar data were submitted for 2009. Table 2.3-2 presents the resulting VMT estimates which differ from the "default" HDD rule estimates as follows:

Table 2.3-2 VMT and HDD Rule Estimates for North Carolina (million miles per year)

North Carolina		
2002	106,795	
	State Data	**HDD Data**
2009	123,396	124,626
2018	129,552	146,989

As indicated, there are substantial reductions in the State-provided forecast data relative to that derived from the HDD rule. The growth rates for both 2009 and 2018 are only about half that implied by the HDD data (1.15 versus 1.17 for 2009 and 1.21 versus 1.38 for 2018). The resulting growth rates are the lowest in the VISTAS region.

NC did not provide VMT mix data for 2009. Therefore, the VMT mix fractions estimated using the "default" HDD rule growth rates were applied to the State-provided VMT estimates to generate vehicle-specific VMT. Essentially, the default HDD methodology produces VMT estimates at the county-road type-vehicle type level of detail, and these data can be converted into VMT fractions at that same level of detail. Note that these are not HDD VMT fractions, but VMT fractions developed from 2002 NC data using HDD vehicle-specific growth rates. In effect, they are 2002 NC VMT fractions "grown" to 2009.

The default VMT mix fraction was applied to the State-provided VMT data at the county and road type level of detail to generate VMT data at the county-road type-vehicle type level of detail. The one exception was for county 063, road 110, for which no VMT data were included in the HDD rule. For this single county/road combination, State-aggregate VMT mix fractions (using the HDD growth methodology) were applied to the county/road VMT data. The difference between road 110 VMT fractions across all NC counties is minimal, so there is no effective difference in utilizing this more aggregate approach vis-à-vis the more resolved county/road approach.

<u>South Carolina:</u>

South Carolina provided county and roadway type-specific VMT data for several future years. Data for 2018 was included and was used directly. Data for 2009 was not included, but was linearly interpolated from data provided for 2007 and 2010. The data were disaggregated into vehicle type-specific VMT using the VMT mixes developed for South Carolina using the HDD rule VMT growth rates. Table 2.3-3 presents the resulting VMT estimates which differ from the "default" HDD rule estimates as follows:

Table 2.3-3 VMT and HDD Rule Estimates for South Carolina (million miles per year)

South Carolina		
2002	**47,074**	
	State Data	**HDD Data**
2009	55,147	54,543
2018	65,133	63,880

Tennessee:

In general, Tennessee estimates are based on the HDD rule growth rate as described in step two. However, Knox County provided independent VMT estimates for 2018 and these were used in place of the HDD rule-derived estimates. The Knox County estimates were total county VMT data only, so these were disaggregated into roadway and vehicle-type VMT using the distributions developed for Knox County in step two using the HDD rule VMT growth rates. No data for Knox County were provided for 2009, so the estimates derived using the HDD rule growth factors were adjusted by the ratio of "Knox County provided 2018 VMT" to "Knox County HDD Rule-derived 2018 VMT." Table 2.3-4 presents the resulting VMT estimates which differ from the "default" HDD rule estimates as follows:

Table 2.3-4 VMT and HDD Rule Estimates for Tennessee (million miles per year)

Tennessee		
2002	68,316	
	State Data	**HDD Data**
2009	78,615	78,813
2018	91,417	91,647

Virginia:

Virginia provided county and roadway type-specific annual VMT growth rates and these data were applied to Virginia -provided VMT data for 2002 to estimate VMT in both 2009 and 2018. Virginia provided VMT mix data for 2002, but not 2009 or 2018. Therefore, the estimated VMT data for both 2009 and 2018 were disaggregated into vehicle type-specific VMT using the VMT mixes developed for VA using the HDD rule VMT growth rates. Table 2.3-5 presents the resulting VMT estimates which differ from the "default" HDD rule estimates as follows:

Table 2.3-5 VMT and HDD Rule Estimates for Virginia (million miles per year)

Virginia		
2002	77,472	
	State Data	**HDD Data**
2009	88,419	89,196
2018	104,944	104,164

2.3.3 Base G Revisions

For the development of the VISTAS 2009 and 2018 Base G inventories and input files, VISTAS states reviewed the Base F inputs, and provided corrections, updates and supplemental data as noted below.

For all states modeled, the Base G updates include:

- Adding Stage II refueling emissions calculations to the SMOKE processing.
- Revised the HDD compliance. (REBUILD EFFECTS = .1)
- Revised Diesel sulfur values in 2009 to 43 ppm and 2018 to 11 ppm

In addition to the global changes, individual VISTAS states made the following updates:

KY – updated VMT and M6 input values for selected counties

NC – revised VMT estimates, speeds and vehicle distributions and updated registration distributions for Mobile 6.

TN - revised VMT and vehicle registration distributions for selected counties.

WV – revised VMT input data

AL, FL, and GA and VA did not provide updates for 2009/2018 Base G, and the Base F inputs were used for these States.

2.3.4 Development of non-road emission estimates

The sections that follow describe the projection process used to develop 2009 and 2018 non-road projection estimates, as revised through the spring of 2006, for sources found in the NONROAD model and those sources estimated outside of the model (locomotives, airplanes and commercial marine vessels).

2.3.4.1 NONROAD model sources

NONROAD model input files were prepared in both the fall of 2004 (Base F) and the spring of 2006 (Base G) based on the corresponding 2002 base year inventory input files available at the time the forecasts were developed, with appropriate updates for the projection years. Generally, this means that the Base F 2002 base year input files (as updated through the fall of 2004) were used as the basis for Base F projection year input file development and Base G 2002 base year input files as updated through the spring of 2006 were used as the basis for Base G projection year input file development. Thus, all base year revisions are inherently incorporated into the associated projection year revisions. Other specific updates for the projection years for NONROAD model sources consist of:

1. Revise the emission inventory year in the model (as well as various output file naming commands) to be reflective of the projection year.
2. Revise the fuel sulfur content for gasoline and diesel powered equipment.
3. Implement a limited number of local control program charges (national control program changes are handled internally within the NONROAD model, so explicit input file changes are not required).

All equipment population growth and fleet turnover impacts are also handled internally within the NONROAD model, so that explicit changes input file changes are not required.

Base F Input File Changes:

To correctly account for diesel fuel sulfur content differences between the base and projection years, two sets of input and output files were prepared for each forecast year, one set for land-based equipment and one set for marine equipment. This two-step projection process was required for Base F, because diesel fuel sulfur contents varied between land-based and marine-based non-road equipment and the Draft NONROAD2004 used for Base F allowed only a single diesel fuel sulfur input. Thus, the model was executed separately for land-based and marine-based equipment for Base F, and the associated outputs subsequently combined. The specific diesel fuel sulfur contents modeled were as follows:

Diesel S (ppm)	2002	2009	2018
Land-Based	2500	348	11
Marine-Based	2500	408	56

As indicated, the Draft NONROAD2004 model was run with both sets of input files and the output file results were then combined to produce a single NONROAD output set.

To correctly account for the national reduction in gasoline sulfur content (a national control not explicitly handled by the NONROAD model), all NONROAD input files for both 2009 and 2018 were revised to reflect a gasoline fuel sulfur content of 30 ppmW.

Base G Input File Changes:

With the release of Final NONROAD2005 that was used for the Base G projection year inventory development, the NONROAD model is capable of handling separate diesel fuel sulfur inputs for land-based and marine-based non-road equipment in a single model execution. Therefore, the two step modeling process described above for Base F updates was no longer required. Instead, the differential diesel fuel sulfur values are assembled into a single NONROAD input file as follows:

Diesel S (ppm)	2002	2009	2018
Land-Based	2500	348	11
Marine-Based	2638	408	56

Additionally, revised gasoline vapor pressure data were provided by Georgia regulators for 20 counties[5] where reduced volatility requirements were established in 2003. Since this requirement began after the 2002 base year, the vapor pressure values in the base year input files for these counties are not correct for either the 2009 or 2018 forecast years. Therefore, to correctly forecast emissions in these counties, the forecast year gasoline vapor pressure inputs were revised to:

Gasoline RVP (psi)	2002	2009	2018
Spring	9.87	9.2	9.2
Summer	9.0	7.0	7.0
Fall	9.87	9.2	9.2
Winter	12.5	12.5	12.5

The summer vapor pressure was simply set equal to the 2003 control value, while the spring and fall vapor pressures were adjusted to reflect a single month of the reduced volatility limit. The winter volatility was assumed to be unaffected by the summertime control requirement.

2.3.4.1.1 Differences between 2009/2018

Other than diesel fuel sulfur content and the year of the projections, there are no differences in the methodology used to estimate emissions from NONROAD model sources. As indicated above, however the Base F 2009/2018 projections were developed using Draft NONROAD2004, while the Base G 2009/2018 projections were made using Final NONROAD2005.

5 The specific counties are: Banks, Chattooga, Clarke, Floyd, Gordon, Heard, Jasper, Jones, Lamar, Lumpkin, Madison, Meriwether, Monroe, Morgan, Oconee, Pike, Polk, Putnam, Troup, and Upson.

2.3.4.2 Non-NONROAD model sources

Using the 2002 base year emissions inventory for aircraft, locomotives, and commercial marine vessels (CMV) prepared as described earlier in this document, corresponding emission projections for 2009 and 2018 were developed in both the fall of 2004 (Base F) and the spring of 2006 (Base G). This section describes the procedures employed in developing those inventories. The information presented is intended to build off of that presented in the section describing the 2002 Base F base year inventory. It should be recognized that for both the Base F and Base G inventories, the base year inventory used to develop the emission forecasts was the latest available at the time of forecast development. Generally, this means that the 2002 base year inventory as updated through the fall of 2004 was used as the basis for the Base F projection year inventory development, and the Base F 2002 base year inventory was used as the basis for Base G projection year inventory development. Thus, all base year revisions (as described earlier in this document) are inherently incorporated into the associated projection year revisions.

Base F Revisions:

Table 2.3-6 shows the 2002 base year emissions for each State in the VISTAS region for aircraft, locomotives and CMV (as they existed prior to Base F development).

Table 2.3-6 Pre-Base F 2002 Aircraft, Locomotive, and Non-Recreational Marine Emissions (annual tons, as of the fall of 2004)

Source	State	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	VOC
Aircraft (2275)	AL	3,787	175	226	87	17	196
	FL	25,431	8,891	2,424	2,375	800	3,658
	GA	6,620	5,372	1,475	1,446	451	443
	KY	2,666	657	179	175	63	263
	MS	1,593	140	44	43	13	96
	NC	6,088	1,548	419	411	148	613
	SC	6,505	515	409	401	88	863
	TN	7,251	2,766	734	719	235	943
	VA	9,763	2,756	1,137	1,115	786	2,529
	WV	1,178	78	25	24	8	66
	Total	**70,882**	**22,899**	**7,072**	**6,797**	**2,607**	**9,670**
Commercial Marine (2280)	AL	1,196	9,218	917	844	3,337	737
	FL	5,888	44,817	1,936	1,781	6,683	1,409
	GA	1,038	7,875	334	307	1,173	246
	KY	6,607	50,267	2,246	2,066	9,608	1,569
	MS	5,688	43,233	1,903	1,751	7,719	1,351
	NC	599	4,547	193	178	690	142
	SC	1,067	8,100	343	316	1,205	253
	TN	3,624	27,555	1,217	1,120	4,974	860
	VA	972	2,775	334	307	359	483
	WV	1,528	11,586	487	448	525	362
	Total	**28,207**	**209,972**	**9,911**	**9,118**	**36,275**	**7,413**
Military Marine (2283)	VA	110	313	25	23	27	48
	Total	**110**	**313**	**25**	**23**	**27**	**48**
Locomotives (2285)	AL	3,490	26,339	592	533	1,446	1,354
	FL	1,006	9,969	247	222	605	404
	GA	2,654	26,733	664	598	1,622	1,059
	KY	2,166	21,811	542	488	1,321	867
	MS	2,302	23,267	578	520	1,429	899
	NC	1,638	16,502	410	369	1,001	654
	SC	1,160	11,690	291	261	710	462
	TN	2,626	25,627	633	570	1,439	1,041
	VA	1,186	11,882	1,529	1,375	3,641	492
	WV	1,311	13,224	329	296	808	517
	Total	**19,540**	**187,044**	**5,815**	**5,232**	**14,022**	**7,750**
Grand Total		**118,739**	**420,228**	**22,823**	**21,170**	**52,931**	**24,881**

Although some of the data utilized was updated, the methodology used to develop the Base F 2009 and 2018 emissions forecasts for aircraft, locomotives, and CMV is identical to that used earlier to develop preliminary 2018 Base 1 (“On the Books”) and 2018 Base 2 (“On the Way”) inventories. Briefly, the methodology relies on growth and control factors developed from inventories used in support of recent EPA rulemakings, and consists of the following steps:

(a) Begin with the 2002 base year emission estimates for aircraft, locomotive, and CMV as described above (at the State-county-SCC-pollutant level of detail).

(b) Detailed inventory data (both before and after controls) for these same emission sources for 1996, 2010, 2015, and 2020 were obtained from the EPA's Clean Air Interstate Rule (CAIR) Technical Support Document (which can be found at http://www.epa.gov/cair/pdfs/finaltech01.pdf). Using these data, combined growth and control factors for the period 2002-2009 and 2002-2018 were estimated using straight line interpolation between 1996 and 2010 (for 2009) and 2015 and 2020 (for 2018). This is done at the State-county-SCC-pollutant level of detail.

(c) The EPA growth and control data are matched against the 2002 VISTAS base year data using State-county-SCC-pollutant as the match key. Ideally, there would be a one-to-one match and the process would end at this point. Unfortunately, actual match results were not always ideal, so additional matching criteria were required. For subsequent reference, this initial (highest resolution) matching criterion is denoted as the “CAIR-Primary” criterion.

(d) A second matching criterion is applied that utilizes a similar, but higher-level SCC (lower resolution) matching approach. For example, SCC 2275020000 (commercial aircraft) in the 2002 base year inventory data would be matched with SCC 2275000000 (all aircraft) in the CAIR data. This criterion is applied to records in the 2002 base year emissions file that are not matched using the “CAIR-Primary” criterion, and is also performed at the State-county-SCC-pollutant level of detail. For subsequent reference, this is denoted as the “CAIR-Secondary” criterion. At the end of this process, a number of unmatched records remained, so a third level matching criterion was required.

(e) In the third matching step, the most frequently used SCC in the EPA CAIR files for each of the aircraft, locomotive, and commercial marine sectors was averaged at the State level to produce a “default” State and pollutant-specific growth and control factor for the sector. The resulting factor is used as a “default” growth factor for all unmatched county-SCC-pollutant level data in each State. In effect, State-specific growth data are applied to county level data for which an explicit match between the VISTAS 2002 base year data and EPA CAIR data could not be developed. The default growth and control

SCCs are 2275020000 (commercial aircraft) for the aircraft sector, 2280002000 (commercial marine diesel total) for the CMV sector, and 2285002000 (railroad equipment diesel total) for the locomotive sector. Matches made using this criterion are denoted as “CAIR-Tertiary” matches.

(f) According to EPA documentation, the CAIR baseline emissions include the impacts of the (then proposed) Tier 4 (T4) non-road diesel rulemaking, which implements a low sulfur fuel requirement that affects both future CMV and locomotive emissions. However, the impacts of this rule were originally intended to be excluded from the initial VISTAS 2018 forecast, which was to include only “on-the-books” controls. (The T4 rule was finalized subsequent to the development of the preliminary 2018 inventory in March of 2004.) Given its final status, T4 impacts were moved into the “on the books” inventory for non-road equipment. In addition, since there are no other proposed rules affecting the non-road sector between 2002 and 2018, there is no difference between the 2018 “on the books” and 2018 “on the way” inventories for the sector; so that only a single forecast inventory (for each evaluation year) was developed. Nevertheless, since the algorithms developed to produce the VISTAS forecasts were developed when there was a distinction between the “on the books” and “on the way” inventories, the distinct algorithms used to produce the two inventories have been maintained even though the conceptual distinctions have been lost. This approach was taken for two reasons. First, it allowed the previously developed algorithms to be utilized without change. Second, it allowed for separate treatment of the T4 emissions impact which was important as those impacts changed between the proposed and final T4 rules. Thus, previous EPA inventories that include the proposed T4 impacts would not be accurate. Therefore, the procedural discussion continues to reflect the distinctions between non-T4 and T4 emissions, as these distinctions continue to be intrinsically important to the forecasting process. Therefore, a second set of EPA CAIR files that excluded the Tier 4 diesel impacts was obtained and the same matching exercise described above in steps (b) through (e) was performed using these “No T4” files. It is important to note that the matching exercise described in steps (b) through (e) cannot simply be replaced because the “No T4” files obtained from the EPA include only those SCCs specifically affected by the T4 rule (i.e., diesel CMV and locomotives). So in effect, the matching exercise was augmented (rather than replaced) with an additional three criteria analogous to those described in steps (c) through (e), and these are denoted as the “No T4-Primary,” “No T4-Secondary,” and “No T4-Tertiary” criteria. Because they exclude the impacts of the proposed T4 rule, matches using the “No T4” criteria supersede matches made using the basic CAIR criteria (as described in steps (c) through (e) above).

(g) The CAIR matching criteria were overridden for any record for which States provided local growth data. Only North Carolina provided these forecasts, as that State has provided specific growth factors for airport emissions in four counties. Because the provided data were based on forecasted changes in landings and takeoffs at major North Carolina airports, the factors were applied only to commercial (SCC 2275020000) and air taxi (SCC 2275060000) emissions. Emissions forecasts for military and general aviation aircraft operations, as well as all aircraft operations in counties other than the four identified in the North Carolina growth factor submission, continued to utilize the growth factors developed according to steps (b) through (f) above. Table 2.3-7 presents the locally generated growth factors applied in North Carolina.

Table 2.3-7 Locally Generated Growth Factors for North Carolina

FIP	2009 Factor	2018 Factor
37067	0.71	0.84
37081	0.97	0.89
37119	1.15	1.01
37183	0.88	0.81

Note:

Growth factor = Year Emissions/2002 Emissions.
Under CAIR approach, 2009 = 1.16 to 1.17 for all 4 counties.
Under CAIR approach, 2018 = 1.36 to 1.37 for all 4 counties.

(h) Using this approach, each State-county-SCC-pollutant was assigned a combined growth and control factor using the EPA CAIR forecast or locally provided data. The 22,838 data records for aircraft, locomotives, and CMV in the 2002 revised base year emissions file were assigned growth factors in accordance with the following breakdown:

48 records matched State-provided growth factors,
4,179 records matched using the CAIR-Primary criterion,
240 records matched using the CAIR-Secondary criterion,
7,463 records matched using the CAIR-Tertiary criterion,
720 records matched using the No T4-Primary criterion,
3,858 records matched using the No T4-Secondary criterion, and
6,330 records matched using the No T4-Tertiary criterion.

(i) Finally, the impacts of the T4 rule as adopted were applied to the grown "non T4" emission estimates. The actual T4 emission standards do not affect aircraft, locomotive, or CMV directly, but associated diesel fuel sulfur requirements do affect locomotives and CMV. Lower fuel sulfur content affects both SO_2 and PM emissions. Expected fuel sulfur contents were obtained for each evaluation year from the EPA technical support document for the final T4 rule (*Final Regulatory Analysis: Control of Emissions from Non-road Diesel Engines*, EPA420-R-04-007, May 2004). According to that document, the average diesel fuel sulfur content for locomotives and CMV is expected to be 408 ppmW in 2009 and 56 ppmW in 2018. These compare to expected non-T4 fuel sulfur levels of 2599 ppmW in 2009 and 2336 ppmW in 2018. Table 2.3-8 uses calculated emissions estimates for base and T4 control scenarios to estimate emission reduction impacts.

Table 2.3-8 Estimated Emission Reduction Impacts based on T-4 Rule

				2009	2018
CMV SO_2	=	Non-T4 SO_2	×	0.1569	0.0241
Locomotive SO_2	=	Non-T4 SO_2	×	0.1569	0.0241
CMV PM	=	Non-T4 PM	×	0.8962	0.8762
Locomotive PM	=	Non-T4 PM	×	0.8117	0.7734

However, since the diesel fuel sulfur content assumed for the 2002 VISTAS base year inventory, upon which both the 2009 and 2018 inventories were based, is 2500 ppmW, a small adjustment to the emission reduction multipliers calculated from the T4 rule is appropriate since they are measured relative to modestly different sulfur contents (2599 ppmW for 2009 and 2336 ppmW for 2018). Correcting for these modest differences produces the emission reduction impact estimates relative to forecasts based on the VISTAS 2002 inventory shown in Table 2.3-9.

Table 2.3-9 Estimated Emission Reduction Impacts Relative to VISTAS 2002 Base Year Values

				2009	2018
CMV SO_2	=	Non-T4 SO_2	×	0.1632	0.0225
Locomotive SO_2	=	Non-T4 SO_2	×	0.1632	0.0225
CMV PM	=	Non-T4 PM	×	0.9004	0.8685
Locomotive PM	=	Non-T4 PM	×	0.8187	0.7610

These factors were applied directly to the non-T4 emission forecasts to produce the final VISTAS 2009 and 2018 emissions inventories for aircraft, locomotive, and CMV.

The only exception is for Palm Beach County, Florida, where CMV emissions are reported as “all fuels” rather than separately by residual and diesel fuel components. To estimate T4 impacts in Palm Beach County, the ratio of diesel CMV emissions to total

CMV emissions in the remainder of Florida was calculated and the T4 impact estimates for Palm Beach County were adjusted to reflect that ratio. Table 2.3-10 shows the calculated diesel CMV ratios.

Table 2.3-10 Diesel CMV Adjustment Ratios for Palm Beach County, FL

GROWTH BASIS	SO_2	PM
2009 (1996, 2020 Growth Basis)	0.2410	0.7861
2009 (1996, 2010, 2015, and 2020 Growth Basis)	0.1279	0.7875
2018 (1996, 2020 Growth Basis)	0.2432	0.7925
2018 (1996, 2010, 2015, and 2020 Growth Basis)	0.2624	0.7918

The differences between the growth bases are discussed in detail below.

Combining these ratios with the T4 impact estimates for diesel engines, as presented above, yields the following impact adjustment factors for Palm Beach County:

Table 2.3-11 Overall Adjustment Factors for Palm Beach County, FL

GROWTH BASIS		
2009 SO_2 (19, 20 Growth Basis)	0.7894	[0.1632×0.2410+(1-0.2410)]
2009 SO_2 (96, 10, 15, and 20 Growth Basis)	0.8930	[0.1632×0.1279+(1-0.1279)]
2018 SO_2 (96, 20 Growth Basis)	0.7623	[0.0225×0.2432+(1-0.2432)]
2018 SO_2 (96, 10, 15, and 20 Growth Basis)	0.7436	[0.0225×0.2624+(1-0.2624)]
2009 PM (19, 20 Growth Basis)	0.9217	[0.9004×0.7861+(1-0.7861)]
2009 PM (96, 10, 15, and 20 Growth Basis)	0.9216	[0.9004×0.7875+(1-0.7875)]
2018 PM (96, 20 Growth Basis)	0.8958	[0.8685×0.7925+(1-0.7925)]
2018 PM (96, 10, 15, and 20 Growth Basis)	0.8959	[0.8685×0.7918+(1-0.7918)]

The differences between the growth bases are discussed in detail below.

Utilizing this approach, emission inventory forecasts for both 2009 and 2018 were developed. As indicated in step (b) above, basic growth factors were developed using EPA CAIR inventory data for 1996, 2010, 2015, and 2020. From these data, equivalent EPA CAIR inventories for 2002 and 2009 were developed through linear interpolation of the 1996 and 2010 inventories, while an equivalent CAIR inventory for 2018 was developed through linear interpolation of the 2015 and 2020 inventories. Growth factors for 2009 and 2018 were then estimated as the ratios of the CAIR 2009 and 2018 inventories to the CAIR 2002 inventory.

During the development of the preliminary 2018 VISTAS inventory in March 2004, this process yielded reasonable results and exhibited no particular systematic concerns. However, when the 2009 Base F inventory was developed, significant concerns related to SO_2 and PM were encountered. Essentially, what was revealed by the Base F 2009 forecast was a series of apparent inconsistencies in the CAIR 2010 and 2015 emission inventories (as compared to the 1996 and 2020 CAIR inventories) that were masked during the construction of the "longer-term" 2018 inventory.

The apparent inconsistencies are best illustrated by looking at the actual data extracted from the CAIR inventory files. Note that although a limited example is being presented, the same general issue applies throughout the CAIR files. For FIP 01001 (Autauga County, Alabama) and SCC 2285002000 (Diesel Rail), the CAIR inventories indicate SO_2 emission estimates as shown in Table 2.3-12.

Table 2.3-12 SO_2 Emissions for Diesel Rail in Autauga County, AL from the CAIR Projections

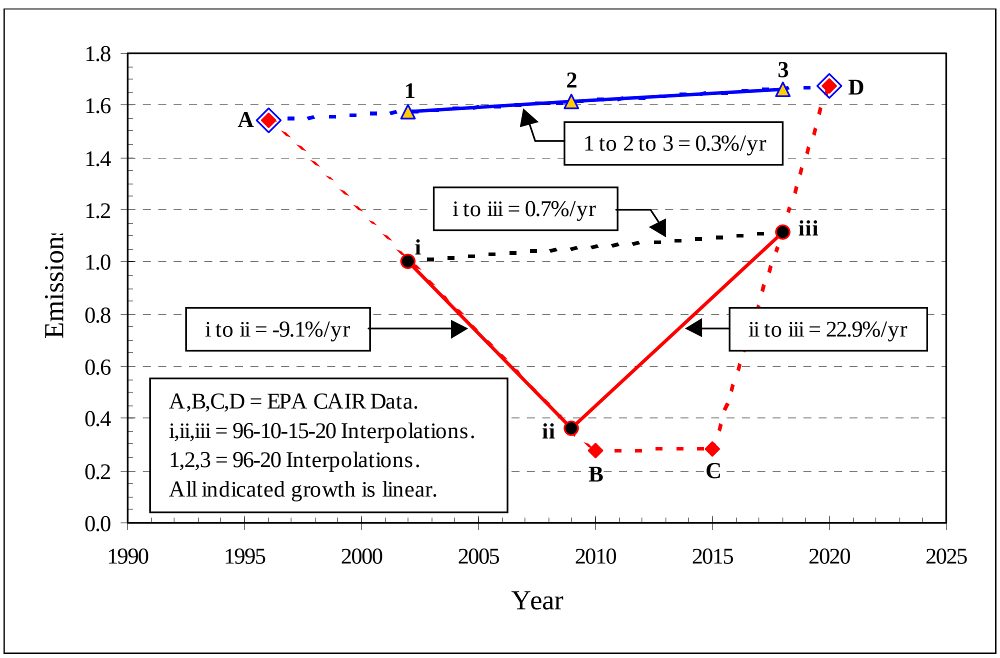
YEAR	TONS
1996:	15.3445
2010:	2.7271
2015:	2.8178
2020:	16.6232

Clearly, there is a major drop in emissions between 1996 and 2010, followed by a major increase in emissions between 2015 and 2020. Several observations regarding these changes are important. First, the CAIR data were reported to exclude the T4 rule, so that the drop in emissions should be related to something other than simply a change in diesel fuel sulfur content. Second, if the T4 rule impacts were "accidentally" included in the estimates, there should be a resultant 90 percent drop in diesel sulfur between 2010 and 2015; so such inclusion is unlikely. Third, the rate of growth between 2015 and 2020 (43 percent *per year* compound or 97 percent *per year* linear) is well beyond any reasonable expectations for rail service; and fuel sulfur content during this period is constant both with and without T4. In short, there appeared to be no rational explanation for the data, yet the same basic relations are observed for thousands of CAIR inventory records.

For the most part, the issue seems to be centered on SO_2 and PM records, which are those records primarily affected by the T4 rule. But, as noted above, there does not seem to be any pattern of consistency that would indicate that either inclusion or exclusion of T4 rule impacts is the underlying cause. Moreover, where they occur, the observed growth extremes generally affect both SO_2 and PM equally, while one would expect PM effects to be buffered if the T4 rule was the underlying cause, since changes in diesel fuel sulfur content will only affect a fraction of PM (i.e., sulfate), while directly reducing SO_2.

The data presented in Figure 2.3-1 illustrates what this meant to the VISTAS forecasting process. Figure 2.3-1 depicts the same data presented above for Autauga County, Alabama, but normalized so that the interpolated 2002 CAIR emissions estimate equals unity. The “raw” CAIR data is depicted by the markers labeled A, B, C, and D. Interpolated data for 2002 and 2009, based on 1996 and 2010 CAIR data, is depicted by the markers labeled “i” and “ii.” Interpolated data for 2018, based on 2015 and 2020 CAIR data is depicted by the marker labeled “iii.” The relationship between marker “iii” and marker “i” is exactly the relationship used to construct the preliminary (e.g., pre-Base F) 2018 VISTAS inventory (i.e., a linear growth rate equal to 0.7 percent per year). Thus, it is easy to see that although there is a major “dip and rise” between 2002 and 2018, it is essentially masked unless data for intervening years are examined. Since no intervening year was examined for the preliminary 2018 inventory, the “dip and rise” was not discovered. However, upon the development of the 2009 inventory forecast, the issue became obvious, as the marker labeled “ii” readily illustrates. In effect, the 2009 inventory reflected very low negative “growth rates” for some SCCs and pollutants relative to the 2002 inventory, while the 2018 inventory reflected very high and positive growth rates for those same SCCs and pollutants. In effect, the path between 2002 and 2018 that previously looked like the dotted line connecting markers “i” and “iii,” now looks like the solid line connecting markers “i”, “ii,” and “iii.” For reference purposes, this path is hereafter referred to as the 1996, 2010, 2015, and 2020 growth basis, since all interpolated data is based on CAIR data for those four years.

Figure 2.3-1 Impacts of the Apparent CAIR Inventory Discrepancy



In light of the apparent discrepancies inherent in the 1996, 2010, 2015, and 2020 growth basis data and the inconsistencies its use would impart into the 2009 and 2018 VISTAS inventories, a secondary forecasting method was developed. This second method relies on the apparent consistency between the 1996 and 2020 non-T4 CAIR inventories, interpolating equivalent 2002, 2009, and 2018 inventories solely from these two inventories. In effect, the CAIR inventories for 2010 and 2015 are ignored. In Figure 2.3-1, this secondary approach is depicted by the data points that lie along the lines connecting markers A and D. Markers A and D represent the 1996 and 2020 CAIR inventories, and the markers labeled 1, 2, and 3 represent the interpolated 2002, 2009, and 2018 CAIR equivalent inventories. The growth rate between 2009 and 2002 is then equal to the ratio of the 2009 and 2002 CAIR inventories, while that between 2018 and 2002 is equal to the ratio of the 2018 and 2002 CAIR inventories. For the example data, the resulting linear growth estimate is 0.3 percent per year. For reference purposes, this path is hereafter referred to as the 1996-2020 growth basis, since all interpolated data are based on CAIR data for only those two years.

It is perhaps worth noting that the only elements of Figure 2.3-1 that have any bearing on the VISTAS inventories are the growth rates. The absolute CAIR data are of importance only in determining those rates, as all VISTAS inventories were developed on the basis of the VISTAS 2002 base year inventory, not any of the CAIR inventories. So referring to Figure 2.3-1, the two growth options are summarized in Table 2.3-13.

Table 2.3-13 Growth Options based on CAIR Data

GROWTH BASIS	PERCENT PER YEAR
1996, 2010, 2015, 2020 Growth Basis:	-9.1% per year (linear) between 2002 and 2009
1996-2020 Growth Basis:	+0.3% per year (linear) between 2002 and 2009
1996, 2010, 2015, 2020 Growth Basis:	+22.9% per year (linear) between 2009 and 2018
1996-2020 Growth Basis:	+0.3% per year (linear) between 2009 and 2018
1996, 2010, 2015, 2020 Growth Basis:	+0.7% per year (linear) between 2002 and 2018
1996-2020 Growth Basis:	+0.3% per year (linear) between 2002 and 2018

Of course, these specific rates are applicable only to the example case (i.e., diesel rail SO_2 in Autauga County, Alabama), but there are thousands of additional CAIR records that are virtually identical from a growth viewpoint.

While forecast inventories for aircraft, locomotives, and CMV were developed for 2009 and 2018 using both growth methods, it was ultimately decided to utilize the 1996-2020 growth basis for Base F since it provided more reasonable growth rates for 2009. Tables 2.3-14 and 2.3-15 present a summary of each Base F inventory, while Tables 2.3-16 and 2.3-17 present the associated change in emissions for each Base F forecast inventory relative to the Base F 2002 base year VISTAS inventory. The larger reduction in CMV SO_2 emissions in 2009 and 2018 (relative to 2002) for Virginia and West Virginia is notable relative to the other VISTAS States, but this has been checked and is attributable to a high diesel contribution to total CMV SO_2 in the 2002 inventories for these two States.

Figures 2.3-2 through 2.3-13 graphically depict the relationships between the various Base F inventories and preliminary 2002 and 2018 projections prepared prior to Base F. There are two figures for each pollutant, the first of which presents a comparison of total VISTAS regional emission estimates for aircraft, locomotives, and CMV, and the second of which presents total VISTAS region emission estimates for locomotives only. This two figure approach is intended to provide a more robust illustration of the differences between the various inventories, as some of the differences are less distinct when viewed through overall aggregate emissions totals. All of the figures include the following emissions estimates:

- The 2002 Base F base year VISTAS emissions inventory (labeled as “2002”),
- The 2002 pre-Base F base year VISTAS emissions inventory (labeled as “2002 Prelim”),
- The Base F 2009 VISTAS emissions inventory developed using growth rates derived from 1996 and 2020 EPA CAIR data (labeled as “2009”),
- The Base F 2018 VISTAS emissions inventory developed using growth rates derived from 1996 and 2020 EPA CAIR data (labeled as “2018”), and
- The pre-Base F 2018 VISTAS emissions inventory estimates as developed using growth rates derived from 1996, 2010, 2015, and 2020 EPA CAIR data (labeled as “2018 Prelim”).

All 12 figures generally illustrate a reduction in emissions estimates between the 2002 pre-Base F emission estimates published in February 2004 (the initial 2002 VISTAS inventory) and the 2002 Base F emission estimates. This reduction generally results from emission updates reflected in the State 2002 CERR submittals used to develop the Base F 2002 base year inventory, although the major differences in aggregate PM emission estimates are driven to a greater extent by modifications in the methodology used to estimate aircraft PM in the Base F 2002 base year inventory (as documented under the base year inventory section of this report).

Table 2.3-14 Base F 2009 Aircraft, Locomotive, and Non-Recreational Marine Emissions (annual tons) -- Based on Growth Using 1996 and 2020 EPA Inventories

Source	State	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	VOC
Aircraft (2275)	AL	4,178	202	278	102	19	217
	FL	29,258	10,316	2,812	2,756	928	4,235
	GA	7,635	6,233	1,712	1,678	523	512
	KY	3,075	762	207	203	73	304
	MS	1,765	162	51	50	16	108
	NC	6,551	1,601	436	427	153	644
	SC	7,372	559	446	437	98	975
	TN	8,020	3,096	824	807	268	1,050
	VA	10,994	3,094	1,239	1,214	907	2,892
	WV	1,312	91	28	28	9	74
	Total	**80,159**	**26,116**	**8,033**	**7,704**	**2,993**	**11,011**
Commercial Marine (2280)	AL	1,280	8,888	872	802	2,753	768
	FL	6,236	43,198	1,838	1,691	5,864	1,467
	GA	1,097	7,599	317	291	974	256
	KY	7,087	48,039	2,158	1,985	8,350	1,649
	MS	6,074	41,437	1,821	1,676	6,587	1,415
	NC	634	4,386	184	169	584	148
	SC	1,133	7,796	326	300	1,012	264
	TN	3,887	26,333	1,168	1,074	4,512	904
	VA	1,042	2,662	312	286	61	506
	WV	1,638	11,073	455	419	89	381
	Total	**30,109**	**201,412**	**9,450**	**8,693**	**30,786**	**7,759**
Military Marine (2283)	VA	118	299	23	21	5	50
	Total	**118**	**299**	**23**	**21**	**5**	**50**
Locomotives (2285)	AL	3,648	23,529	452	406	242	1,279
	FL	1,052	8,905	189	170	101	382
	GA	2,769	24,398	507	456	271	1,003
	KY	2,264	19,597	415	374	221	819
	MS	2,406	20,785	441	397	239	849
	NC	1,712	14,741	313	282	167	618
	SC	1,213	10,443	222	200	119	437
	TN	2,745	23,924	483	435	240	984
	VA	1,236	11,134	1,167	1,050	608	467
	WV	1,369	12,177	251	226	135	489
	Total	**20,412**	**169,635**	**4,440**	**3,995**	**2,343**	**7,328**
Grand Total		**130,798**	**397,462**	**21,946**	**20,413**	**36,126**	**26,148**

Table 2.3-15 Base F 2018 Aircraft, Locomotive, and Non-Recreational Marine Emissions (annual tons) -- Based on Growth Using 1996 and 2020 EPA Inventories

Source	State	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	VOC
Aircraft (2275)	AL	4,681	236	345	122	23	245
	FL	34,178	12,147	3,312	3,246	1,093	4,976
	GA	8,939	7,340	2,016	1,976	616	601
	KY	3,602	898	244	239	86	357
	MS	1,986	190	60	58	18	122
	NC	6,728	1,454	400	392	139	615
	SC	8,487	616	493	484	112	1,119
	TN	9,009	3,519	939	921	309	1,187
	VA	12,578	3,528	1,370	1,342	1,063	3,358
	WV	1,484	106	33	33	10	85
	Total	**91,670**	**30,035**	**9,213**	**8,814**	**3,468**	**12,666**
Commercial Marine (2280)	AL	1,388	8,464	880	809	2,715	809
	FL	6,684	41,117	1,853	1,705	6,248	1,543
	GA	1,174	7,246	319	293	976	269
	KY	7,703	45,174	2,199	2,023	8,383	1,752
	MS	6,571	39,129	1,850	1,702	6,556	1,498
	NC	679	4,179	185	170	596	155
	SC	1,217	7,406	329	303	1,027	278
	TN	4,225	24,763	1,190	1,095	4,808	960
	VA	1,133	2,517	314	289	9	537
	WV	1,781	10,412	459	422	13	404
	Total	**32,554**	**190,407**	**9,578**	**8,811**	**31,330**	**8,205**
Military Marine (2283)	VA	128	282	23	21	1	53
	Total	**128**	**282**	**23**	**21**	**1**	**53**
Locomotives (2285)	AL	3,850	19,917	381	343	34	1,183
	FL	1,110	7,538	159	143	14	353
	GA	2,917	21,395	427	385	38	932
	KY	2,389	16,751	352	317	31	757
	MS	2,540	17,594	372	335	34	785
	NC	1,807	12,478	264	237	24	571
	SC	1,280	8,840	187	168	17	404
	TN	2,897	21,735	407	367	34	910
	VA	1,300	10,173	983	885	86	436
	WV	1,444	10,831	212	190	19	453
	Total	**21,534**	**147,252**	**3,744**	**3,368**	**333**	**6,785**
Grand Total		**145,885**	**367,975**	**22,557**	**21,015**	**35,132**	**27,709**

Table 2.3-16 Change in Emissions between 2009 and 2002 Base F Inventories (Based on Growth Using 1996 and 2020 EPA Inventories)

Source	State	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	VOC
Aircraft (2275)	AL	+10%	+15%	+23%	+18%	+16%	+11%
	FL	+15%	+16%	+16%	+16%	+16%	+16%
	GA	+15%	+16%	+16%	+16%	+16%	+16%
	KY	+15%	+16%	+16%	+16%	+16%	+16%
	MS	+11%	+16%	+15%	+15%	+16%	+12%
	NC	+8%	+3%	+4%	+4%	+3%	+5%
	SC	+13%	+9%	+9%	+9%	+12%	+13%
	TN	+11%	+12%	+12%	+12%	+14%	+11%
	VA	+13%	+12%	+9%	+9%	+15%	+14%
	WV	+11%	+16%	+15%	+15%	+16%	+12%
	Total	**+13%**	**+14%**	**+14%**	**+13%**	**+15%**	**+14%**
Commercial Marine (2280)	AL	+7%	-4%	-5%	-5%	-18%	+4%
	FL	+6%	-4%	-5%	-5%	-12%	+4%
	GA	+6%	-3%	-5%	-5%	-17%	+4%
	KY	+7%	-4%	-4%	-4%	-13%	+5%
	MS	+7%	-4%	-4%	-4%	-15%	+5%
	NC	+6%	-4%	-5%	-5%	-15%	+4%
	SC	+6%	-4%	-5%	-5%	-16%	+4%
	TN	+7%	-4%	-4%	-4%	-9%	+5%
	VA	+7%	-4%	-7%	-7%	-83%	+5%
	WV	+7%	-4%	-7%	-7%	-83%	+5%
	Total	**+7%**	**-4%**	**-5%**	**-5%**	**-15%**	**+5%**
Military Marine (2283)	VA	+7%	-4%	-7%	-7%	-83%	+5%
	Total	**+7%**	**-4%**	**-7%**	**-7%**	**-83%**	**+5%**
Locomotives (2285)	AL	+5%	-11%	-24%	-24%	-83%	-6%
	FL	+5%	-11%	-24%	-24%	-83%	-6%
	GA	+4%	-9%	-24%	-24%	-83%	-5%
	KY	+5%	-10%	-23%	-23%	-83%	-6%
	MS	+5%	-11%	-24%	-24%	-83%	-6%
	NC	+5%	-11%	-24%	-24%	-83%	-6%
	SC	+5%	-11%	-24%	-24%	-83%	-6%
	TN	+5%	-7%	-24%	-24%	-83%	-6%
	VA	+4%	-6%	-24%	-24%	-83%	-5%
	WV	+4%	-8%	-24%	-24%	-83%	-5%
	Total	**+4%**	**-9%**	**-24%**	**-24%**	**-83%**	**-5%**
Grand Total		**+10%**	**-5%**	**-4%**	**-4%**	**-32%**	**+5%**

Table 2.3-17 Change in Emissions between 2018 and 2002 Base F Inventories (Based on Growth Using 1996 and 2020 EPA Inventories)

Source	State	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	VOC
Aircraft (2275)	AL	+24%	+35%	+53%	+41%	+36%	+25%
	FL	+34%	+37%	+37%	+37%	+37%	+36%
	GA	+35%	+37%	+37%	+37%	+37%	+36%
	KY	+35%	+37%	+37%	+37%	+37%	+36%
	MS	+25%	+36%	+35%	+35%	+36%	+27%
	NC	+10%	-6%	-5%	-5%	-6%	0%
	SC	+30%	+20%	+21%	+21%	+27%	+30%
	TN	+24%	+27%	+28%	+28%	+31%	+26%
	VA	+29%	+28%	+20%	+20%	+35%	+33%
	WV	+26%	+36%	+35%	+35%	+36%	+28%
	Total	**+29%**	**+31%**	**+30%**	**+30%**	**+33%**	**+31%**
Commercial Marine (2280)	AL	+16%	-8%	-4%	-4%	-19%	+10%
	FL	+14%	-8%	-4%	-4%	-7%	+9%
	GA	+13%	-8%	-5%	-5%	-17%	+9%
	KY	+17%	-10%	-2%	-2%	-13%	+12%
	MS	+16%	-9%	-3%	-3%	-15%	+11%
	NC	+13%	-8%	-4%	-4%	-14%	+9%
	SC	+14%	-9%	-4%	-4%	-15%	+10%
	TN	+17%	-10%	-2%	-2%	-3%	+12%
	VA	+17%	-9%	-6%	-6%	-98%	+11%
	WV	+17%	-10%	-6%	-6%	-98%	+12%
	Total	**+15%**	**-9%**	**-3%**	**-3%**	**-14%**	**+11%**
Military Marine (2283)	VA	+17%	-10%	-6%	-6%	-98%	+12%
	Total	**+17%**	**-10%**	**-6%**	**-6%**	**-98%**	**+12%**
Locomotives (2285)	AL	+10%	-24%	-36%	-36%	-98%	-13%
	FL	+10%	-24%	-36%	-36%	-98%	-13%
	GA	+10%	-20%	-36%	-36%	-98%	-12%
	KY	+10%	-23%	-35%	-35%	-98%	-13%
	MS	+10%	-24%	-36%	-36%	-98%	-13%
	NC	+10%	-24%	-36%	-36%	-98%	-13%
	SC	+10%	-24%	-36%	-36%	-98%	-13%
	TN	+10%	-15%	-36%	-36%	-98%	-13%
	VA	+10%	-14%	-36%	-36%	-98%	-11%
	WV	+10%	-18%	-36%	-36%	-98%	-12%
	Total	**+10%**	**-21%**	**-36%**	**-36%**	**-98%**	**-12%**
Grand Total		**+23%**	**-12%**	**-1%**	**-1%**	**-34%**	**+11%**

Figure 2.3-2 Total Aircraft, Locomotive, and CMV CO Emissions (Base F)

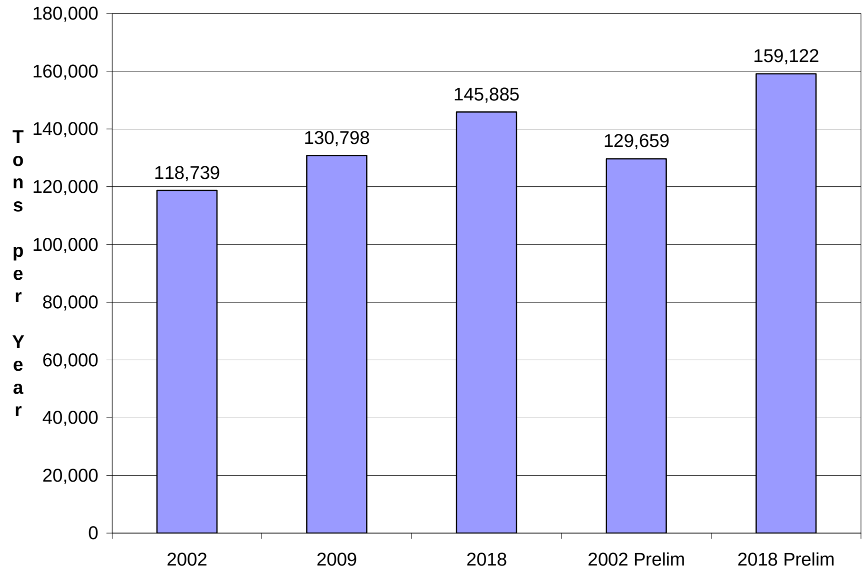


Figure 2.3-3 Locomotive CO Emissions (Base F)

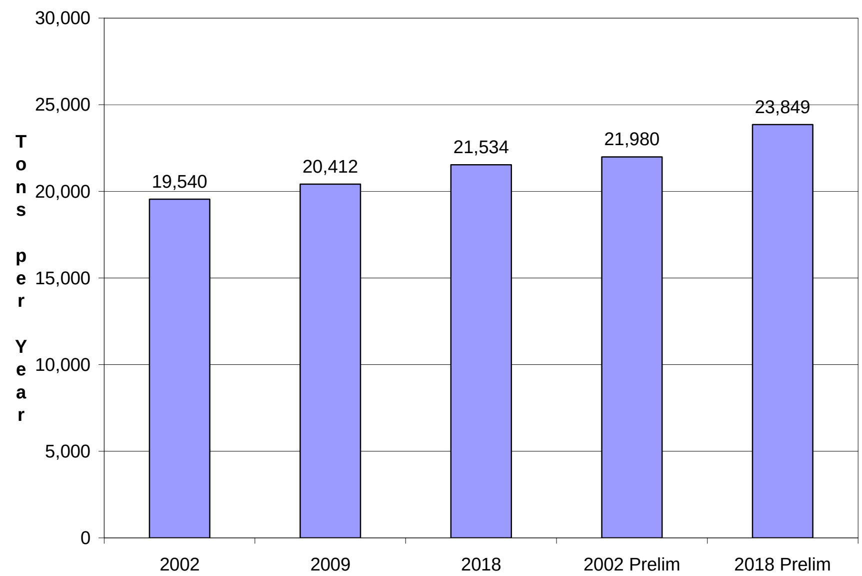


Figure 2.3-4 Total Aircraft, Locomotive, and CMV NO_x Emissions (Base F)

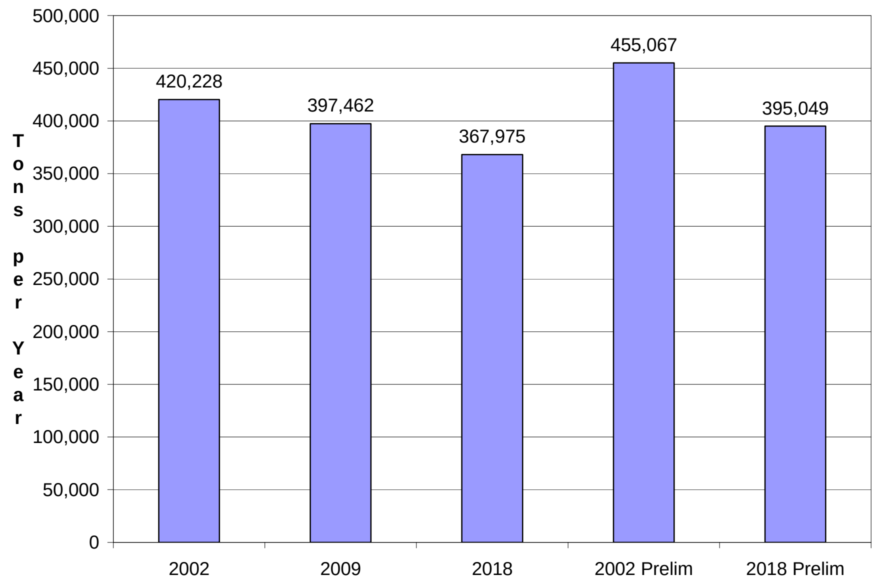


Figure 2.3-5 Locomotive NO_x Emissions (Base F)

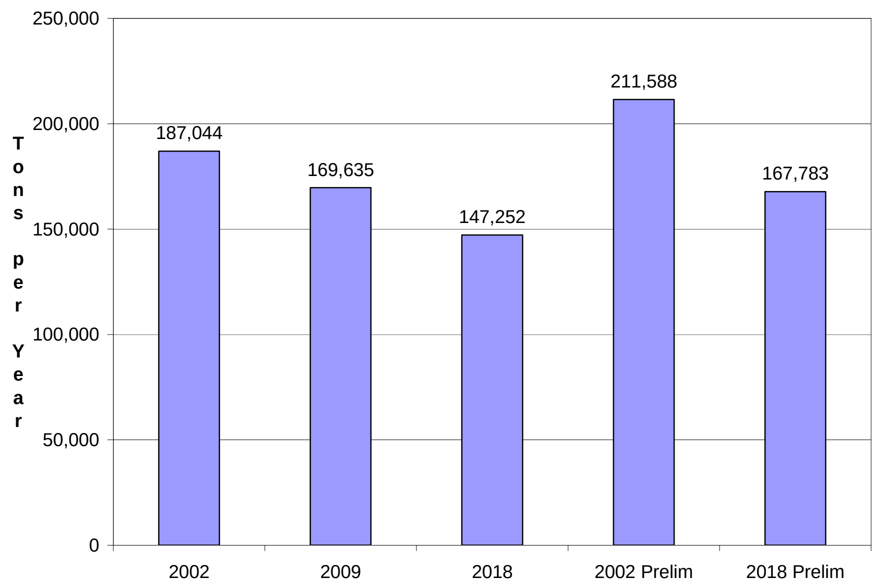


Figure 2.3-6 Total Aircraft, Locomotive, and CMV PM_{10} Emissions (Base F)

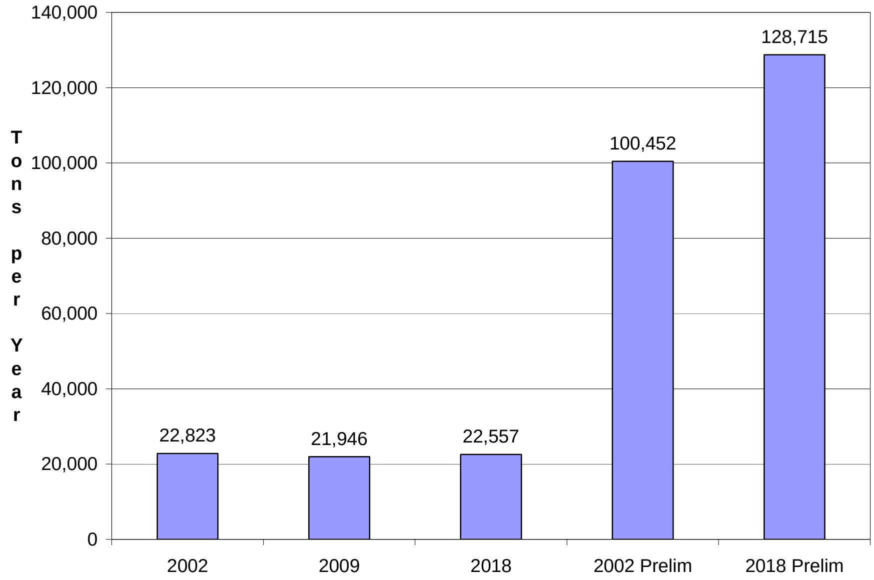


Figure 2.3-7 Locomotive PM_{10} Emissions (Base F)

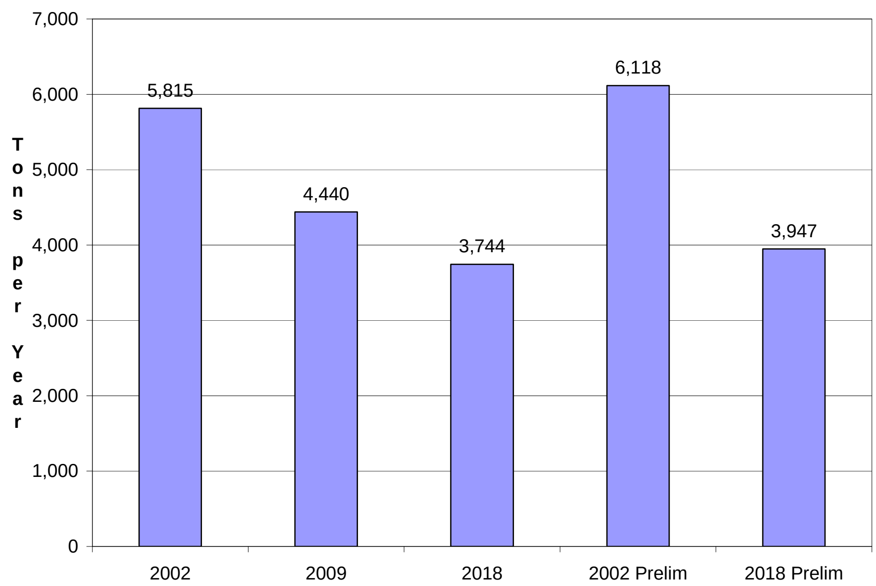


Figure 2.3-8 Total Aircraft, Locomotive, and CMV $PM_{2.5}$ Emissions (Base F)

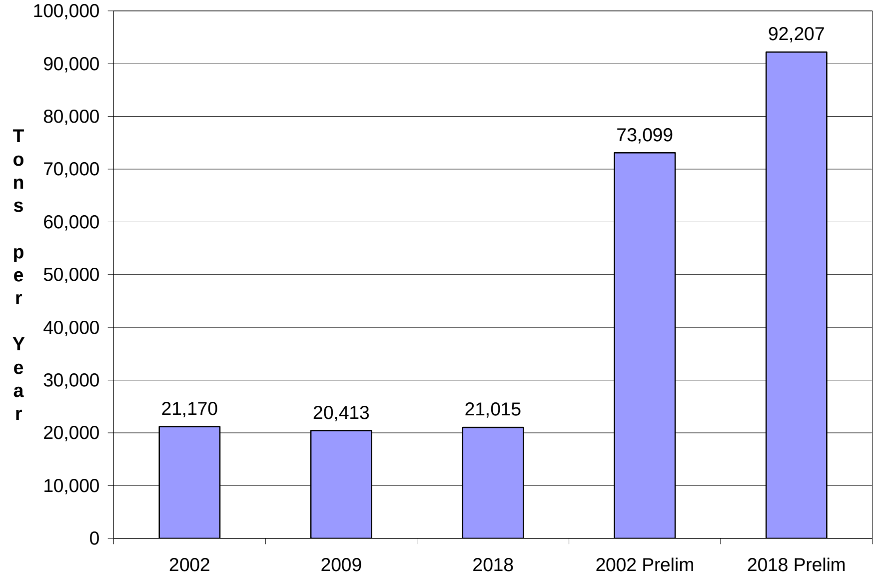


Figure 2.3-9 Locomotive $PM_{2.5}$ Emissions (Base F)

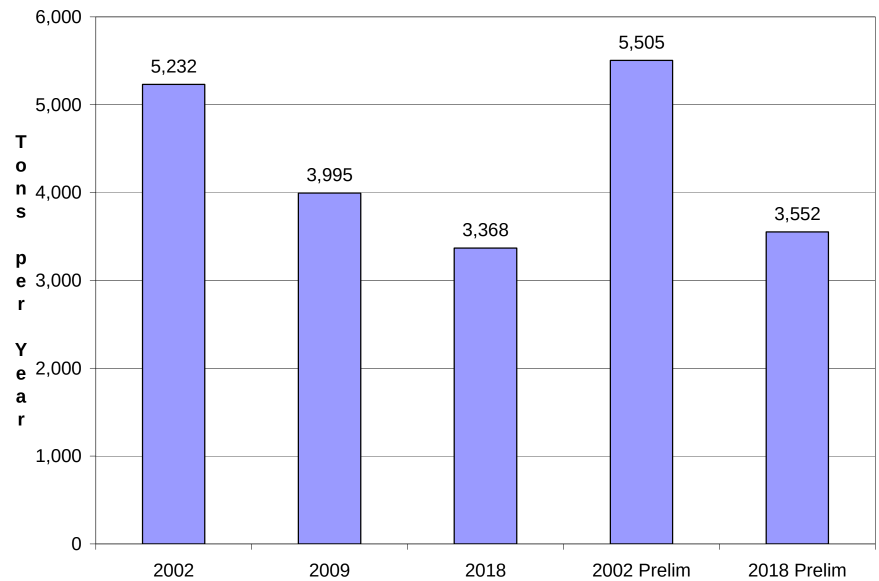


Figure 2.3-10 Total Aircraft, Locomotive, and CMV SO_2 Emissions (Base F)

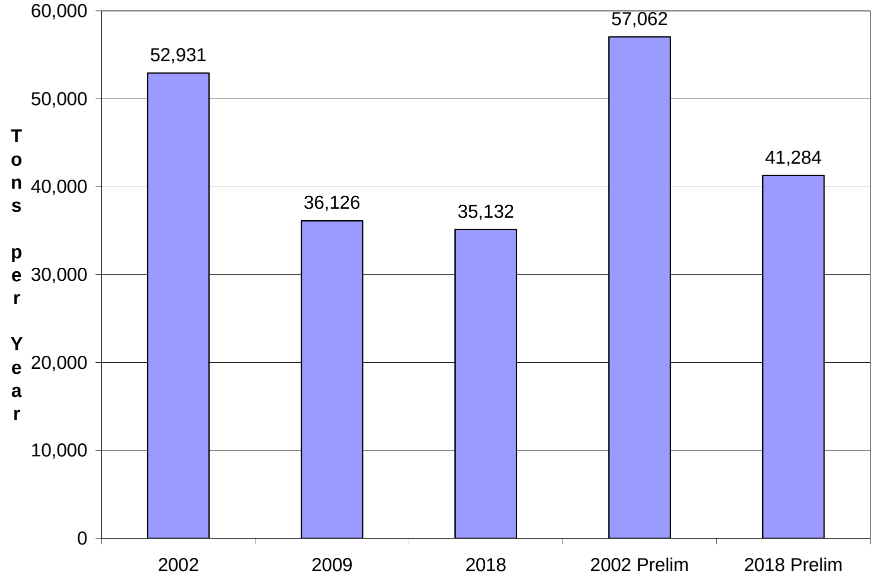


Figure 2.3-11 Locomotive SO_2 Emissions (Base F)

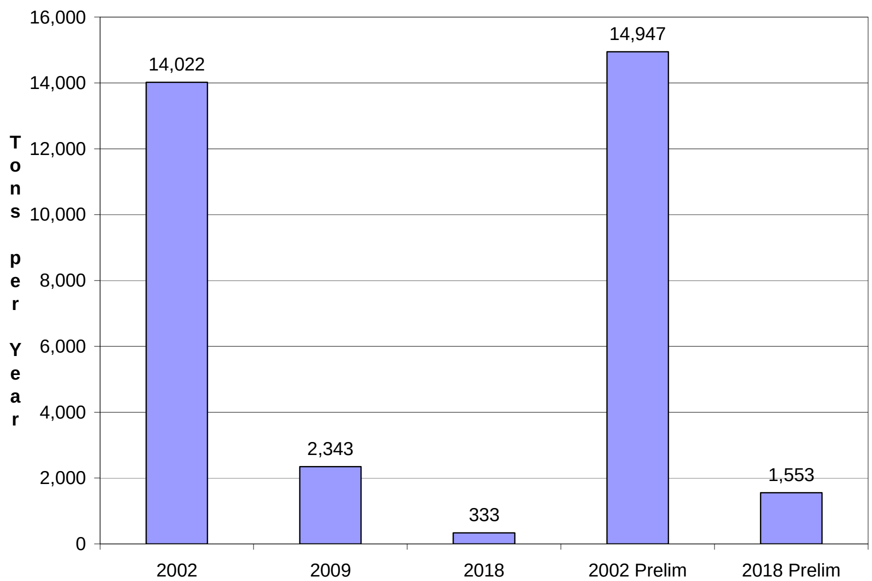


Figure 2.3-12 Total Aircraft, Locomotive, and CMV VOC Emissions (Base F)

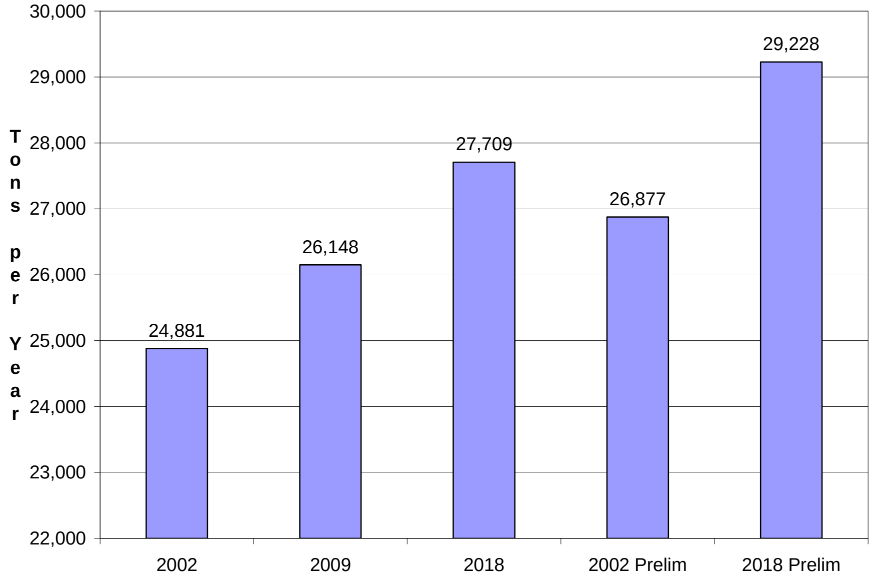
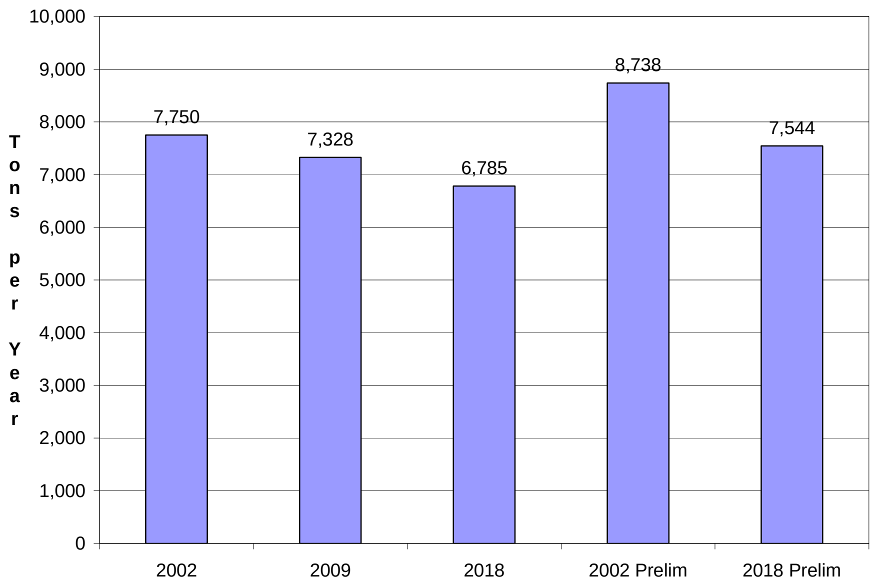


Figure 2.3-13 Locomotive VOC Emissions (Base F)



Base G Revisions:

Table 2.3-18 shows the Base G 2002 base year emissions for each State in the VISTAS region for aircraft, locomotives and CMV. Although some of these data are updated relative to those used as the basis of the Base F emissions forecasts, the methodology used to develop 2009 and 2018 emissions forecasts for aircraft, locomotives, and CMV for Base G is identical to that used for Base F (as documented above). The only exceptions are as follows:

(a) As indicated in the discussion of the Base F forecasts, the CAIR (growth rate) matching criteria were overridden for any record for which States provided local growth data. For Base F, only North Carolina provided such data. However, for Base G, Kentucky regulators provided growth data for aircraft emissions associated with Cincinnati/Northern Kentucky International Airport (located in Boone County, Kentucky). These data were applied to all pollutants and all aircraft types (i.e., military aircraft (SCC 2275001000), commercial aircraft (SCC 2275020000), general aviation aircraft (SCC 2275050000), and air taxi aircraft (SCC 2275060000)). Emissions forecasts for all aircraft operations in counties other than Boone continued to utilize the growth factors developed according to the CAIR matching criteria. Table 2.3-19 presents the locally generated growth factors applied in Kentucky. It should be recognized that although the locally provided growth factors presented in the table are significantly greater than those that would apply under the CAIR matching criteria, this is to be expected as local regulators noted a very significant decline in activity at the Cincinnati/Northern Kentucky International Airport in 2002 (relative to activity in preceding years). Moreover, this downward spike seems to have been alleviated since 2002, so that the provided growth factors represent not only “routine” growth expected between 2002 and the two forecast years, but growth required to offset the temporary decline observed in 2002.

Table 2.3-18 Base G 2002 Aircraft, Locomotive, and Non-Recreational Marine Emissions (annual tons)

Source	State	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	VOC
Aircraft (2275)	AL	5,595	185	238	99	18	276
	FL	25,431	8,891	2,424	2,375	800	3,658
	GA	6,620	5,372	1,475	1,446	451	443
	KY	5,577	925	251	246	88	397
	MS	1,593	140	44	43	13	96
	NC	6,088	1,548	419	411	148	613
	SC	6,505	515	409	401	88	863
	TN	7,251	2,766	734	719	235	943
	VA	11,873	3,885	2,010	1,970	272	2,825
	WV	1,178	78	25	24	8	66
	Total	**77,712**	**24,305**	**8,029**	**7,734**	**2,121**	**10,179**
Commercial Marine (2280)	AL	1,196	9,218	917	844	3,337	737
	FL	5,888	44,817	1,936	1,781	6,683	1,409
	GA	1,038	7,875	334	307	1,173	246
	KY	6,607	50,267	2,246	2,066	9,608	1,569
	MS	5,688	43,233	1,903	1,751	7,719	1,351
	NC	599	4,547	193	178	690	142
	SC	1,067	8,100	343	316	1,205	253
	TN	3,624	27,555	1,217	1,120	4,974	860
	VA	972	2,775	334	307	359	483
	WV	1,528	11,586	487	448	525	362
	Total	**28,207**	**209,972**	**9,911**	**9,118**	**36,275**	**7,413**
Military Marine (2283)	VA	110	313	25	23	27	48
	Total	**110**	**313**	**25**	**23**	**27**	**48**
Locomotives (2285)	AL	3,518	26,623	592	533	1,446	1,365
	FL	1,006	9,969	247	222	605	404
	GA	2,654	26,733	664	598	1,622	1,059
	KY	2,166	21,811	542	488	1,321	867
	MS	2,302	23,267	578	520	1,429	899
	NC	1,638	16,502	410	369	1,001	654
	SC	1,160	11,690	291	261	710	462
	TN	2,626	25,627	633	570	1,439	1,041
	VA	1,186	11,882	1,529	1,375	3,641	492
	WV	1,311	13,224	329	296	808	517
	Total	**19,568**	**187,328**	**5,815**	**5,232**	**14,022**	**7,761**
Grand Total		**125,597**	**421,918**	**23,780**	**22,107**	**52,444**	**25,401**

Table 2.3-19 Locally Generated Growth Factors for Kentucky

FIP	2009 Factor	2018 Factor
21015	1.31	1.81

Note:

Growth factor = Year Emissions/2002 Emissions.
Under CAIR approach, 2009 = 0.99 to 1.17.
Under CAIR approach, 2018 = 0.97 to 1.40.

(b) Because of the additional emissions records added in Alabama, as discussed in the Base G 2002 base year inventory section of this report, the total number of emissions records in the Base G 2009 and 2018 forecasts increased to 23,042 (as compared to 22,838 for Base F). The 23,042 data records for aircraft, locomotives, and CMV were assigned growth factors in accordance with the following breakdown:

72 records matched State-provided growth factors,
4,287 records matched using the CAIR-Primary criterion,
240 records matched using the CAIR-Secondary criterion,
7,511 records matched using the CAIR-Tertiary criterion,
720 records matched using the No T4-Primary criterion,
3,858 records matched using the No T4-Secondary criterion, and
6,354 records matched using the No T4-Tertiary criterion.

Tables 2.3-20 and 2.3-21 present a summary of the resulting Base G 2009 and 2018 inventories, while Tables 2.3-22 and 2.3-23 present the associated change in emissions for each forecast inventory relative to the Base G 2002 base year VISTAS. As was the case with Base F, the larger reduction in CMV SO_2 emissions in 2009 and 2018 (relative to 2002) for Virginia and West Virginia is notable relative to the other VISTAS States, but is attributable to a high diesel contribution to total CMV SO_2 in the 2002 inventories for these two States.

Figures 2.3-14 through 2.3-25 graphically depict the relationships between the various inventories, as revised through Base G. There are two figures for each pollutant, the first of which presents a comparison of total VISTAS regional emission estimates for aircraft, locomotives, and CMV, and the second of which presents total VISTAS region emission estimates for locomotives only. This two figure approach is intended to provide a more robust illustration of the differences between the various inventories, as some of the differences are less distinct when viewed through overall aggregate emissions totals. All of the figures include the following emissions estimates:

- The Base G 2002 base year VISTAS emissions inventory (labeled as “2002”),
- The pre-Base F 2002 base year VISTAS emissions inventory (labeled as “2002 Prelim”),
- The Base G 2009 VISTAS emissions inventory developed using growth rates derived from 1996 and 2020 EPA CAIR data (labeled as “2009”),
- The Base G 2018 VISTAS emissions inventory developed using growth rates derived from 1996 and 2020 EPA CAIR data (labeled as “2018”), and
- The pre-Base F 2018 VISTAS emissions inventory estimates developed using growth rates derived from 1996, 2010, 2015, and 2020 EPA CAIR data (labeled as “2018 Prelim”).

All 12 figures generally illustrate a reduction in emissions estimates between the pre-Base F 2002 emission estimates published in February 2004 and the Base G 2002 base year emission estimates. This reduction generally results from emission updates reflected in the Base F State CERR submittals, although the major differences in aggregate PM emission estimates are driven to a greater extent by modifications in the methodology used to estimate aircraft PM in the Base F revisions to the 2002 Base F base year inventory (as documented under the base year inventory section of this report).

Table 2.3-20 Base G 2009 Aircraft, Locomotive, and Non-Recreational Marine Emissions (annual tons) -- Based on Growth Using 1996 and 2020 EPA Inventories

Source	State	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	VOC
Aircraft (2275)	AL	6,265	213	292	116	21	309
	FL	29,258	10,316	2,812	2,756	928	4,235
	GA	7,635	6,233	1,712	1,678	523	512
	KY	6,959	1,135	307	301	108	487
	MS	1,765	162	51	50	16	108
	NC	6,991	1,795	486	477	171	709
	SC	7,372	559	446	437	98	975
	TN	8,020	3,096	824	807	268	1,050
	VA	13,141	4,244	2,124	2,082	306	3,153
	WV	1,312	91	28	28	9	74
	Total	**88,716**	**27,844**	**9,083**	**8,732**	**2,447**	**11,612**
Commercial Marine (2280)	AL	1,280	8,888	872	802	2,753	768
	FL	6,236	43,198	1,838	1,691	5,864	1,467
	GA	1,097	7,599	317	291	974	256
	KY	7,087	48,039	2,158	1,985	8,350	1,649
	MS	6,074	41,437	1,821	1,676	6,587	1,415
	NC	634	4,386	184	169	584	148
	SC	1,133	7,796	326	300	1,012	264
	TN	3,887	26,333	1,168	1,074	4,512	904
	VA	1,042	2,662	312	286	61	506
	WV	1,638	11,073	455	419	89	381
	Total	**30,108**	**201,412**	**9,450**	**8,693**	**30,786**	**7,759**
Military Marine (2283)	VA	118	299	23	21	5	50
	Total	**118**	**299**	**23**	**21**	**5**	**50**
Locomotives (2285)	AL	3,677	23,783	452	406	242	1,289
	FL	1,052	8,905	189	170	101	382
	GA	2,769	24,398	507	456	271	1,003
	KY	2,264	19,597	415	374	221	819
	MS	2,406	20,785	441	397	239	849
	NC	1,690	14,662	311	279	165	613
	SC	1,213	10,443	222	200	119	437
	TN	2,745	23,924	483	435	240	984
	VA	1,236	11,134	1,167	1,050	608	467
	WV	1,369	12,177	251	226	135	489
	Total	**20,420**	**169,808**	**4,437**	**3,993**	**2,341**	**7,333**
Grand Total		**139,362**	**399,364**	**22,994**	**21,440**	**35,578**	**26,754**

Table 2.3-21 Base G 2018 Aircraft, Locomotive, and Non-Recreational Marine Emissions (annual tons) -- Based on Growth Using 1996 and 2020 EPA Inventories

Source	State	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	VOC
Aircraft (2275)	AL	7,126	249	361	139	24	352
	FL	34,178	12,147	3,312	3,246	1,093	4,976
	GA	8,939	7,340	2,016	1,976	616	601
	KY	9,078	1,446	391	383	138	623
	MS	1,986	190	60	58	18	122
	NC	8,150	2,114	572	561	202	831
	SC	8,487	616	493	484	112	1,119
	TN	9,009	3,519	939	921	309	1,187
	VA	14,770	4,706	2,271	2,226	349	3,574
	WV	1,484	106	33	33	10	85
	Total	**103,206**	**32,435**	**10,450**	**10,027**	**2,871**	**13,472**
Commercial Marine (2280)	AL	1,388	8,464	880	809	2,715	809
	FL	6,684	41,117	1,853	1,705	6,248	1,543
	GA	1,174	7,246	319	293	976	269
	KY	7,703	45,174	2,199	2,023	8,383	1,752
	MS	6,571	39,129	1,850	1,702	6,556	1,498
	NC	678	4,179	185	170	596	155
	SC	1,217	7,406	329	303	1,027	278
	TN	4,225	24,763	1,190	1,095	4,808	960
	VA	1,133	2,517	314	289	9	537
	WV	1,781	10,412	459	422	13	404
	Total	**32,554**	**190,407**	**9,578**	**8,811**	**31,330**	**8,205**
Military Marine (2283)	VA	128	282	23	21	1	53
	Total	**128**	**282**	**23**	**21**	**1**	**53**
Locomotives (2285)	AL	3,881	20,131	381	343	34	1,192
	FL	1,110	7,538	159	143	14	353
	GA	2,917	21,395	427	385	38	932
	KY	2,389	16,751	352	317	31	757
	MS	2,540	17,594	372	335	34	785
	NC	1,782	12,539	263	237	23	570
	SC	1,280	8,840	187	168	17	404
	TN	2,897	21,735	407	367	34	910
	VA	1,300	10,173	983	885	86	436
	WV	1,444	10,831	212	190	19	453
	Total	**21,539**	**147,527**	**3,743**	**3,368**	**332**	**6,792**
Grand Total		**157,427**	**370,651**	**23,794**	**22,227**	**34,534**	**28,522**

Table 2.3-22 Change in Emissions between 2009 Base G and 2002 Base F Inventories (Based on Growth Using 1996 and 2020 EPA Inventories)

Source	State	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	VOC
Aircraft (2275)	AL	+12%	+15%	+23%	+18%	+16%	+12%
	FL	+15%	+16%	+16%	+16%	+16%	+16%
	GA	+15%	+16%	+16%	+16%	+16%	+16%
	KY	+25%	+23%	+23%	+23%	+23%	+23%
	MS	+11%	+16%	+15%	+15%	+16%	+12%
	NC	+15%	+16%	+16%	+16%	+16%	+16%
	SC	+13%	+9%	+9%	+9%	+12%	+13%
	TN	+11%	+12%	+12%	+12%	+14%	+11%
	VA	+11%	+9%	+6%	+6%	+12%	+12%
	WV	+11%	+16%	+15%	+15%	+16%	+12%
	Total	**+14%**	**+15%**	**+13%**	**+13%**	**+15%**	**+14%**
Commercial Marine (2280)	AL	+7%	-4%	-5%	-5%	-18%	+4%
	FL	+6%	-4%	-5%	-5%	-12%	+4%
	GA	+6%	-3%	-5%	-5%	-17%	+4%
	KY	+7%	-4%	-4%	-4%	-13%	+5%
	MS	+7%	-4%	-4%	-4%	-15%	+5%
	NC	+6%	-4%	-5%	-5%	-15%	+4%
	SC	+6%	-4%	-5%	-5%	-16%	+4%
	TN	+7%	-4%	-4%	-4%	-9%	+5%
	VA	+7%	-4%	-7%	-7%	-83%	+5%
	WV	+7%	-4%	-7%	-7%	-83%	+5%
	Total	**+7%**	**-4%**	**-5%**	**-5%**	**-15%**	**+5%**
Military Marine (2283)	VA	+7%	-4%	-7%	-7%	-83%	+5%
	Total	**+7%**	**-4%**	**-7%**	**-7%**	**-83%**	**+5%**
Locomotives (2285)	AL	+5%	-11%	-24%	-24%	-83%	-6%
	FL	+5%	-11%	-24%	-24%	-83%	-6%
	GA	+4%	-9%	-24%	-24%	-83%	-5%
	KY	+5%	-10%	-23%	-23%	-83%	-6%
	MS	+5%	-11%	-24%	-24%	-83%	-6%
	NC	+3%	-11%	-24%	-24%	-83%	-6%
	SC	+5%	-11%	-24%	-24%	-83%	-6%
	TN	+5%	-7%	-24%	-24%	-83%	-6%
	VA	+4%	-6%	-24%	-24%	-83%	-5%
	WV	+4%	-8%	-24%	-24%	-83%	-5%
	Total	**+4%**	**-9%**	**-24%**	**-24%**	**-83%**	**-6%**
Grand Total		**+11%**	**-5%**	**-3%**	**-3%**	**-32%**	**+5%**

Table 2.3-23 Change in Emissions between 2018 Base G and 2002 Base F Inventories (Based on Growth Using 1996 and 2020 EPA Inventories)

Source	State	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	VOC
Aircraft (2275)	AL	+27%	+35%	+52%	+41%	+36%	+28%
	FL	+34%	+37%	+37%	+37%	+37%	+36%
	GA	+35%	+37%	+37%	+37%	+37%	+36%
	KY	+63%	+56%	+56%	+56%	+56%	+57%
	MS	+25%	+36%	+35%	+35%	+36%	+27%
	NC	+34%	+37%	+36%	+36%	+37%	+36%
	SC	+30%	+20%	+21%	+21%	+27%	+30%
	TN	+24%	+27%	+28%	+28%	+31%	+26%
	VA	+24%	+21%	+13%	+13%	+28%	+27%
	WV	+26%	+36%	+35%	+35%	+36%	+28%
	Total	**+33%**	**+33%**	**+30%**	**+30%**	**+35%**	**+32%**
Commercial Marine (2280)	AL	+16%	-8%	-4%	-4%	-19%	+10%
	FL	+14%	-8%	-4%	-4%	-7%	+9%
	GA	+13%	-8%	-5%	-5%	-17%	+9%
	KY	+17%	-10%	-2%	-2%	-13%	+12%
	MS	+16%	-9%	-3%	-3%	-15%	+11%
	NC	+13%	-8%	-4%	-4%	-14%	+9%
	SC	+14%	-9%	-4%	-4%	-15%	+10%
	TN	+17%	-10%	-2%	-2%	-3%	+12%
	VA	+17%	-9%	-6%	-6%	-98%	+11%
	WV	+17%	-10%	-6%	-6%	-98%	+12%
	Total	**+15%**	**-9%**	**-3%**	**-3%**	**-14%**	**+11%**
Military Marine (2283)	VA	+17%	-10%	-6%	-6%	-98%	+12%
	Total	**+17%**	**-10%**	**-6%**	**-6%**	**-98%**	**+12%**
Locomotives (2285)	AL	+10%	-24%	-36%	-36%	-98%	-13%
	FL	+10%	-24%	-36%	-36%	-98%	-13%
	GA	+10%	-20%	-36%	-36%	-98%	-12%
	KY	+10%	-23%	-35%	-35%	-98%	-13%
	MS	+10%	-24%	-36%	-36%	-98%	-13%
	NC	+9%	-24%	-36%	-36%	-98%	-13%
	SC	+10%	-24%	-36%	-36%	-98%	-13%
	TN	+10%	-15%	-36%	-36%	-98%	-13%
	VA	+10%	-14%	-36%	-36%	-98%	-11%
	WV	+10%	-18%	-36%	-36%	-98%	-12%
	Total	**+10%**	**-21%**	**-36%**	**-36%**	**-98%**	**-12%**
Grand Total		**+25%**	**-12%**	**+0%**	**+1%**	**-34%**	**+12%**

Figure 2.3-14 Total Aircraft, Locomotive, and CMV CO Emissions (Base G)

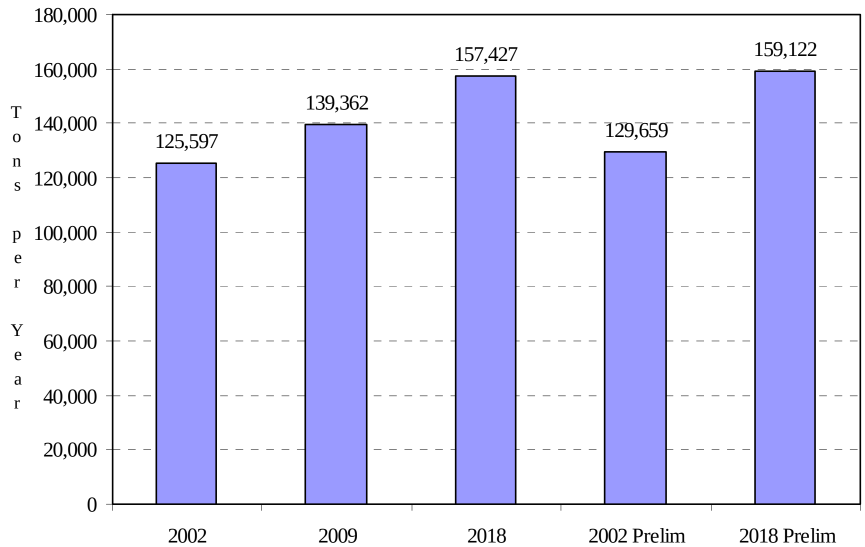


Figure 2.3-15 Locomotive CO Emissions (Base G)

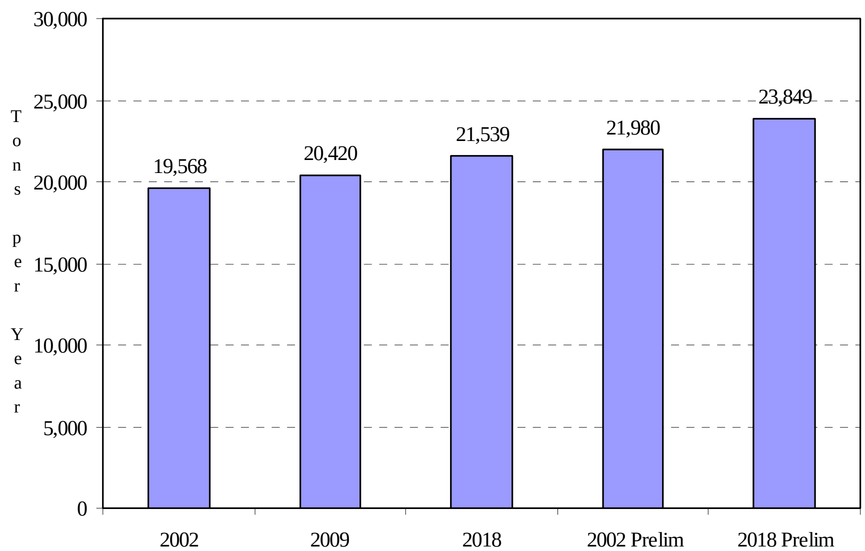


Figure 2.3-16 Total Aircraft, Locomotive, and CMV NO_x Emissions (Base G)

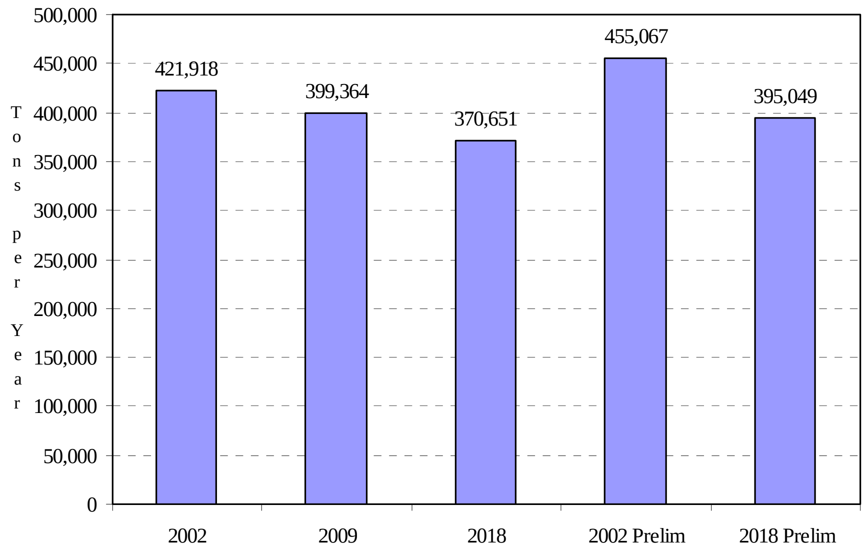


Figure 2.3-17 Locomotive NO_x Emissions (Base G)

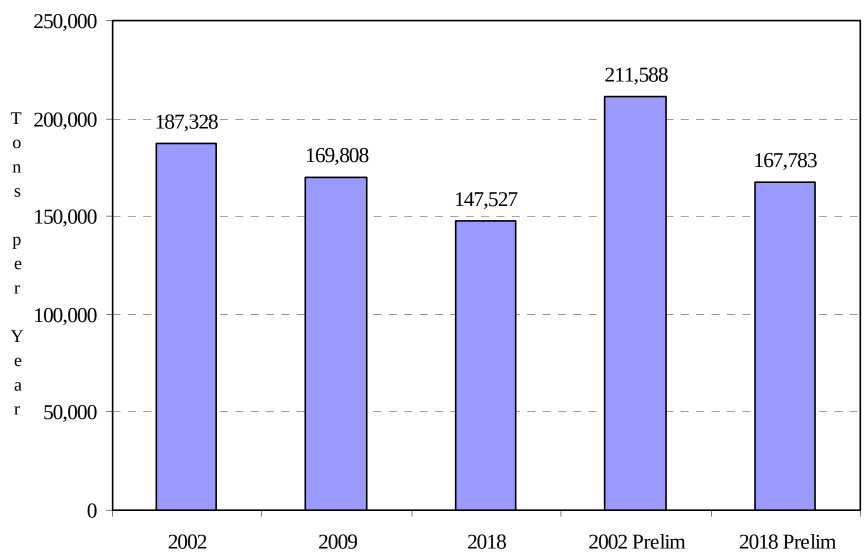


Figure 2.3-18 Total Aircraft, Locomotive, and CMV PM_{10} Emissions (Base G)

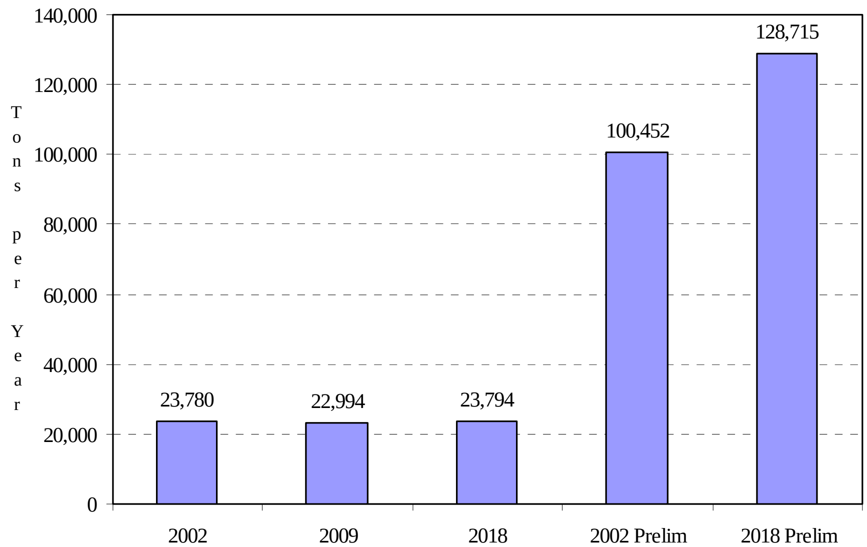


Figure 2.3-19 Locomotive PM_{10} Emissions (Base G)

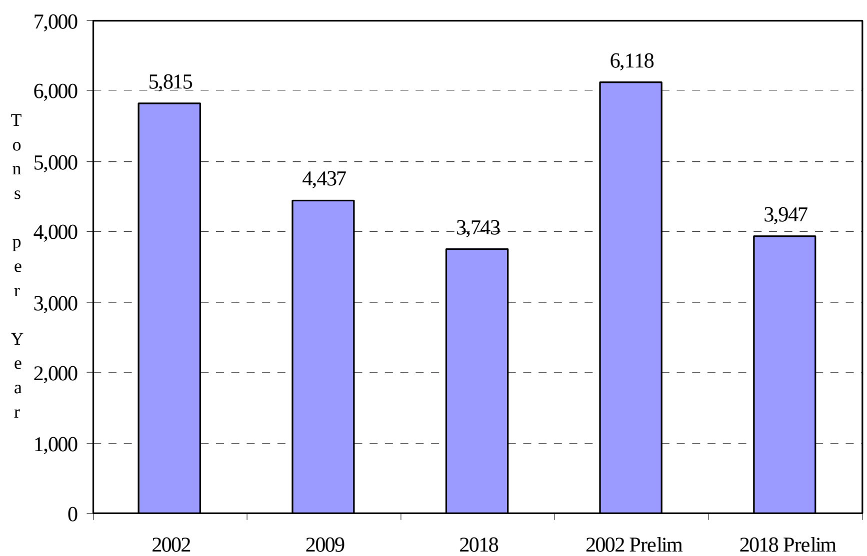


Figure 2.3-20 Total Aircraft, Locomotive, and CMV $PM_{2.5}$ Emissions (Base G)

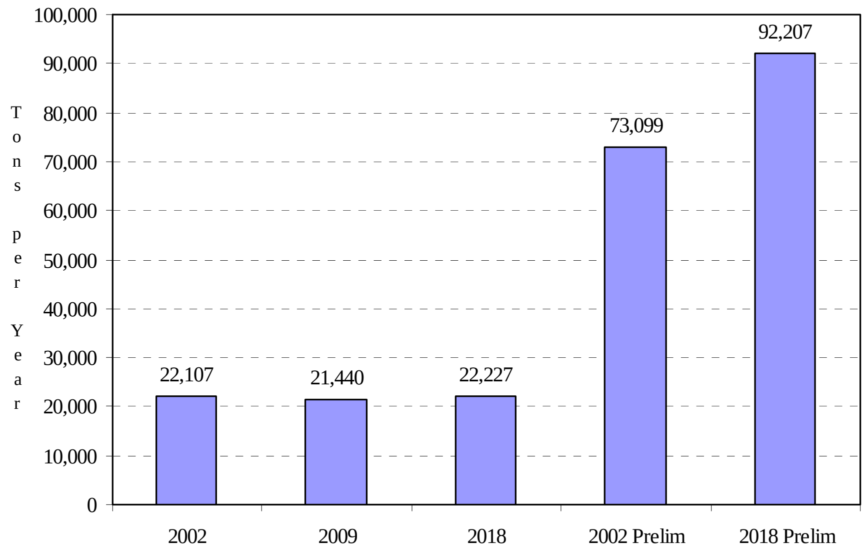


Figure 2.3-21 Locomotive $PM_{2.5}$ Emissions (Base G)

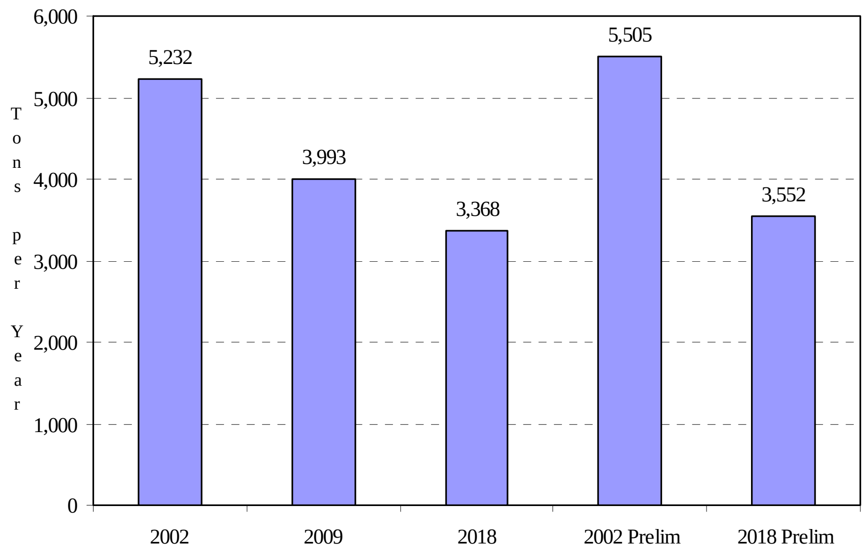


Figure 2.3-22 Total Aircraft, Locomotive, and CMV SO_2 Emissions (Base G)

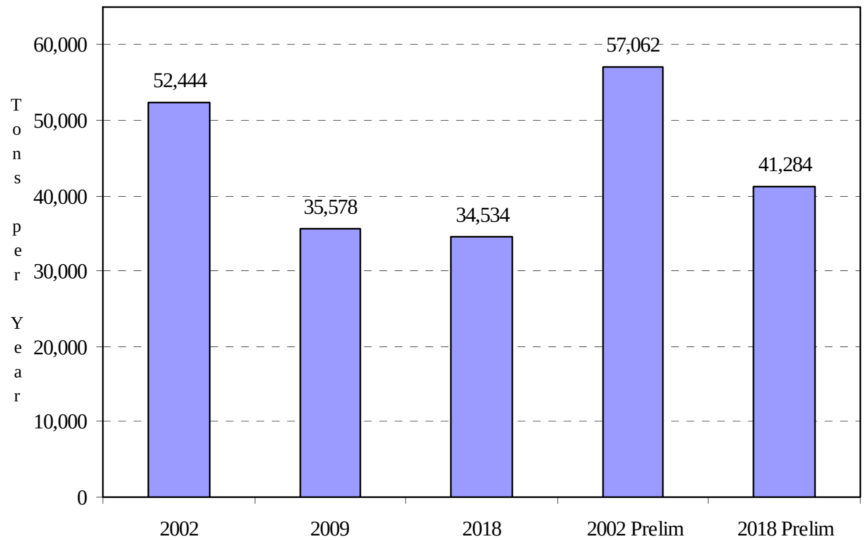


Figure 2.3-23 Locomotive SO_2 Emissions (Base G)

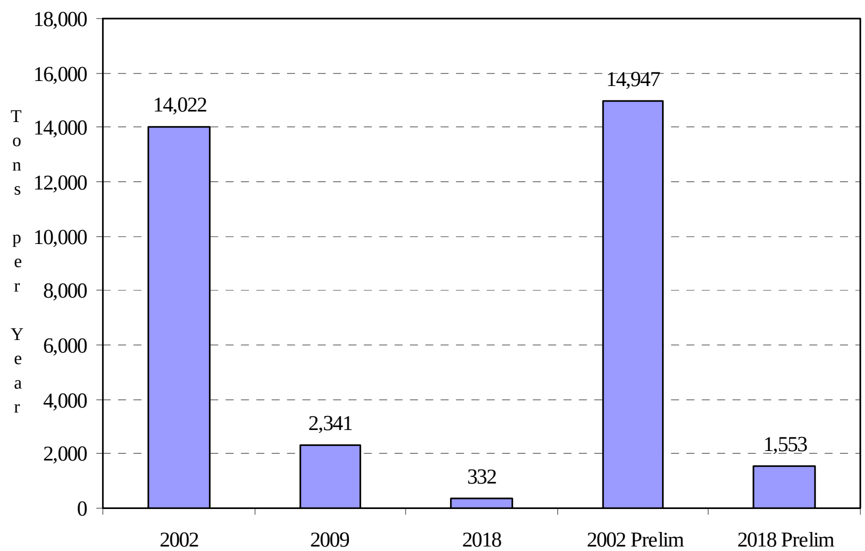


Figure 2.3-24 Total Aircraft, Locomotive, and CMV VOC Emissions (Base G)

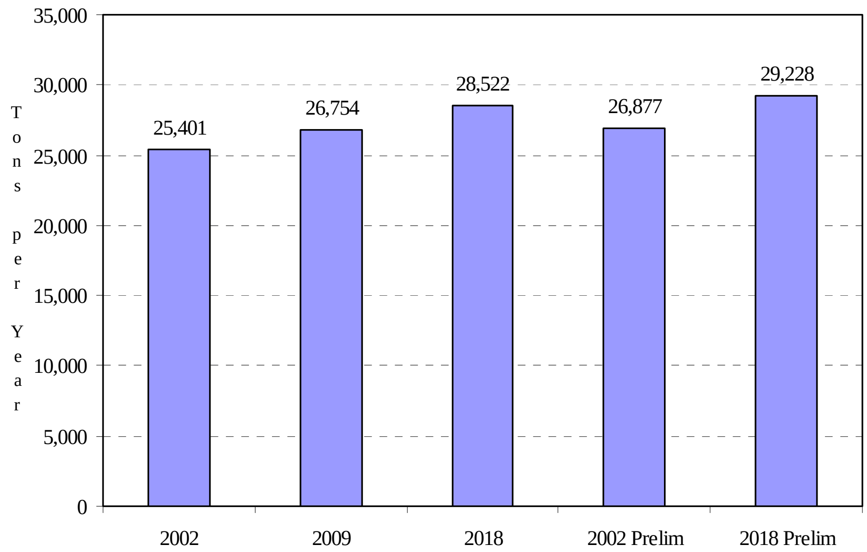
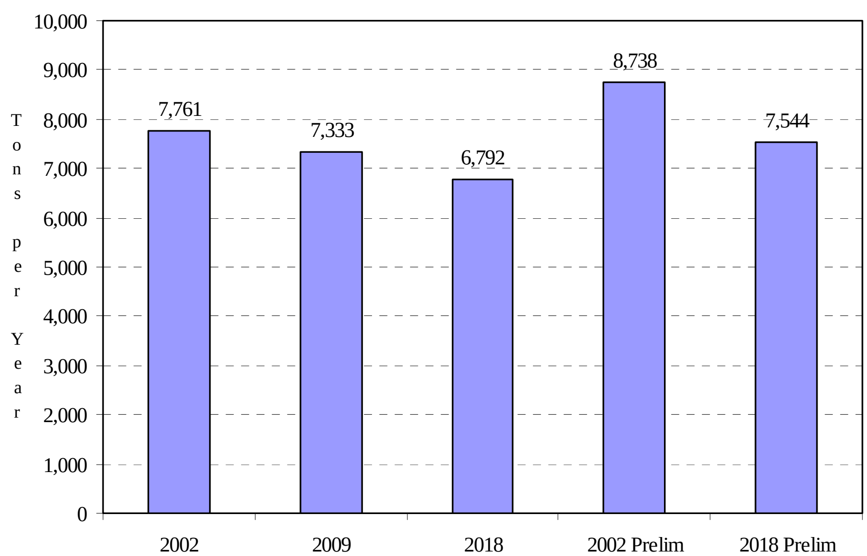


Figure 2.3-25 Locomotive VOC Emissions (Base G)



2.3.4.3 Emissions from NONROAD Model Sources in Illinois, Indiana, and Ohio

Base G projection inventories for 2009 and 2018 for NONROAD model sources in the states of Illinois, Indiana, and Ohio were produced using a methodology identical to that employed to develop a Base G 2002 base year inventory for the same states (as documented earlier in this report). This method consists of the extraction of a complete set of county-level input data applicable to each of the three states (in each of the two projection years) from the latest version of the EPA's NMIM model. This includes appropriate consideration of all non-default NMIM input files generated by the Midwest Regional Planning Organization as documented earlier in the discussion of the Base G 2002 base year inventory. These input data were then assembled into appropriate input files for the Final NONROAD2005 model and emission estimates were produced using the same procedure employed for the VISTAS region.

Changes noted between the base year (2002) and forecast year (2009 and 2018) input data extracted from NMIM include differences in gasoline vapor pressure, gasoline sulfur content, and diesel sulfur content in most counties. All temperature data (minimum, maximum, and average daily temperatures) was constant across years.

As described in the discussion of the Base G 2002 base year inventory, counties in the three states were grouped for modeling purposes using a temperature aggregation scheme that allowed for county-specific temperature variations of no more that 2 ºF from group average temperatures (for all temperature inputs). The same grouping scheme was applied to projection year modeling, so that Illinois emissions were modeled using 12 county groups, Indiana emissions were modeled using 9 county groups, and Ohio emissions were modeled using 10 county groups. Thus, 31 iterations of NONROAD2002 were required per season per projection year, as compared to the 53 iterations per season per projection year required for the VISTAS region.

As was also described in the discussion of the Base G 2002 base year inventory, several non-default equipment population, growth, activity, seasonal distribution, and county allocation files are assigned by NMIM model inputs for these counties. As was the case for the base year inventory development, these same non-default assignments were retained for both projection inventories.

2.3.4.4 Differences between 2009/2018

Methodologically, there was no difference in the way that 2009 and 2018 emissions were calculated for non-road mobile sources. The actual value of the growth factors were different for each type of mobile source considered, but the calculation methods were identical.

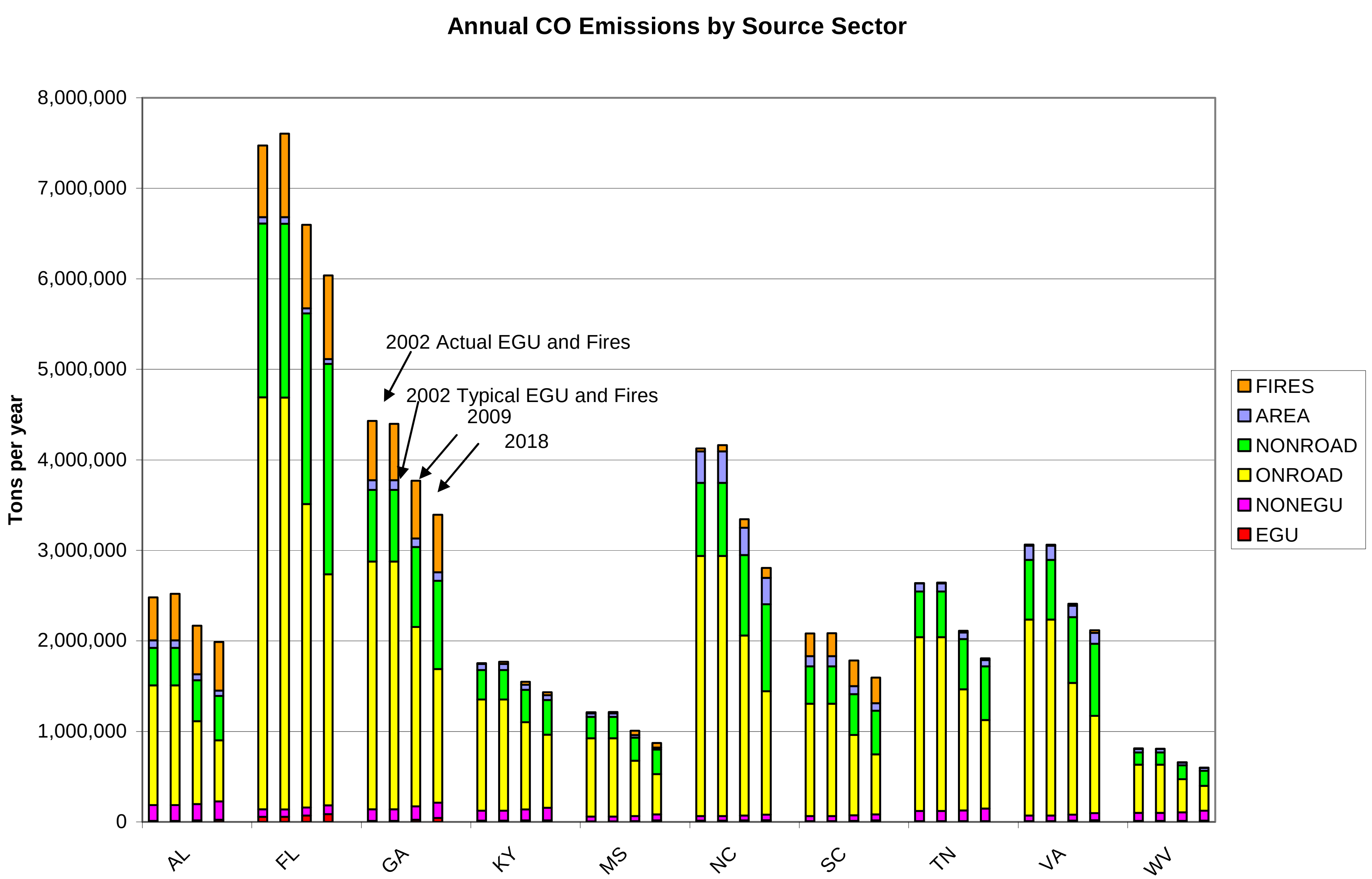
2.3.5 Quality Assurance steps

Throughout the inventory development process, quality assurance steps were performed to ensure that no double counting of emissions occurred, to ensure that a full and complete inventory was developed for VISTAS, and to make sure that projection calculations were working correctly. Quality assurance was an important component to the inventory development process and MACTEC performed the following QA steps on mobile source components of the 2009 and revised 2018 projection inventories:

1. All final files (NONROAD only) were run through EPA's Format and Content checking software. Input data files for MOBILE and VMT growth estimates were reviewed by the corresponding SIWG and by the VISTAS Emission Inventory Technical Advisor.
2. SCC level emission summaries were prepared and evaluated to ensure that emissions were consistent and that there were no missing sources (NONROAD only).
3. Tier comparisons (by pollutant) were developed between the 2002 base year inventory and the 2009 and 2018 projection inventories (NONROAD only). Total VISTAS level summaries by pollutant were developed for these sources to compare Base F and Base G emission levels.
4. Data product summaries were provided to both the VISTAS Emission Inventory Technical Advisor and to the SIWG representatives for review and comment. Changes based on these comments were implemented in the files.
5. Version numbering was used for all inventory files developed. The version numbering process used a decimal system to track major and minor changes. For example, a major change would result in a version going from 1.0 to 2.0. A minor change would cause a version number to go from 1.0 to 1.1. Minor changes resulting from largely editorial changes would result in a change from 1.00 to 1.01.

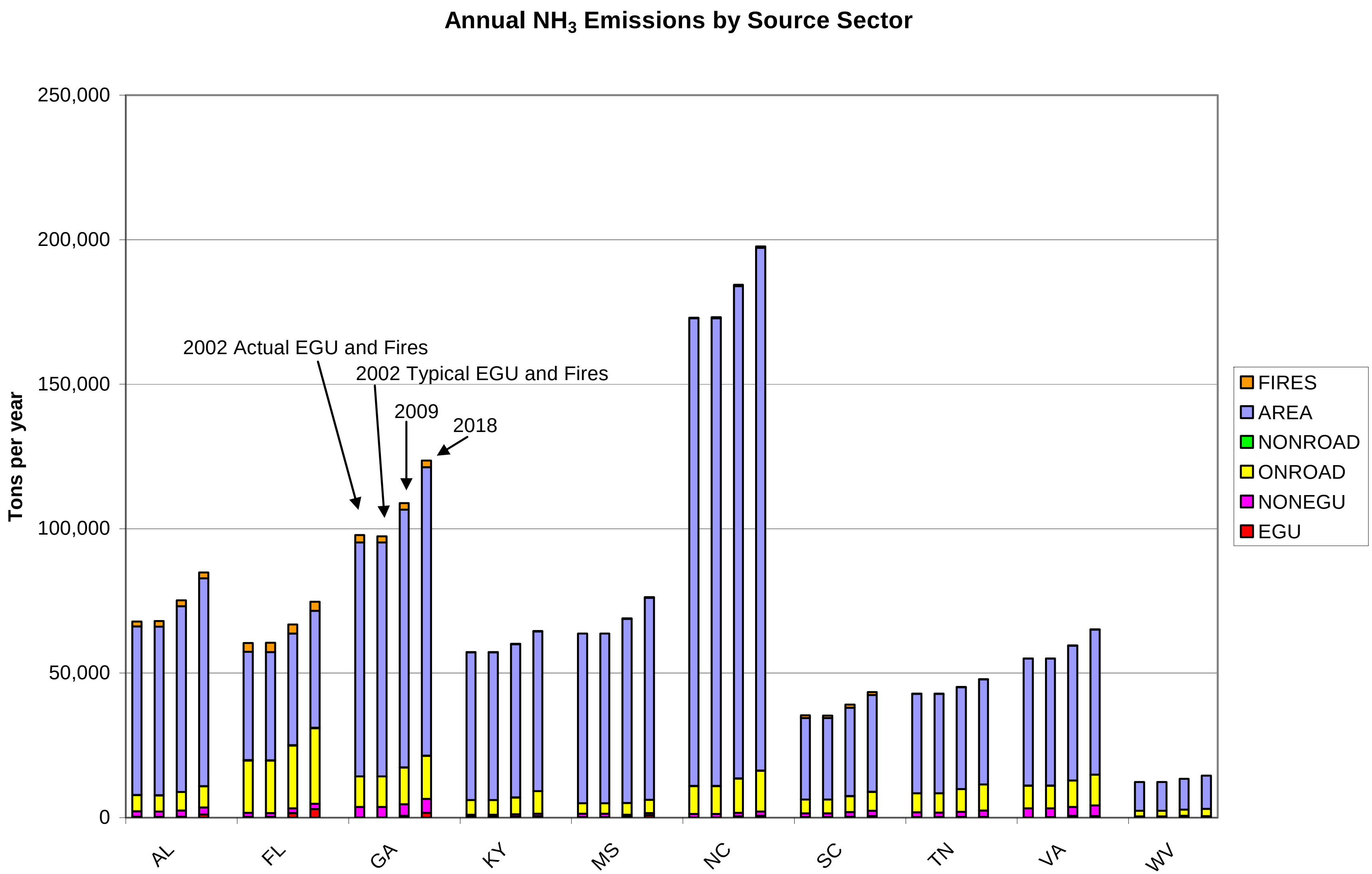
Appendix A:

STATE EMISSION TOTALS BY POLLUTANT AND SECTOR


Annual CO Emissions by Source Sector
Tons per year
8,000,000
7,000,000
6,000,000
5,000,000
4,000,000
3,000,000
2,000,000
1,000,000
0
2002 Actual EGU and Fires
2002 Typical EGU and Fires
2009
2018
AL
FL
GA
KY
MS
NC
SC
TN
VA
WV
FIRES
AREA
NONROAD
ONROAD
NONEGU
EGU

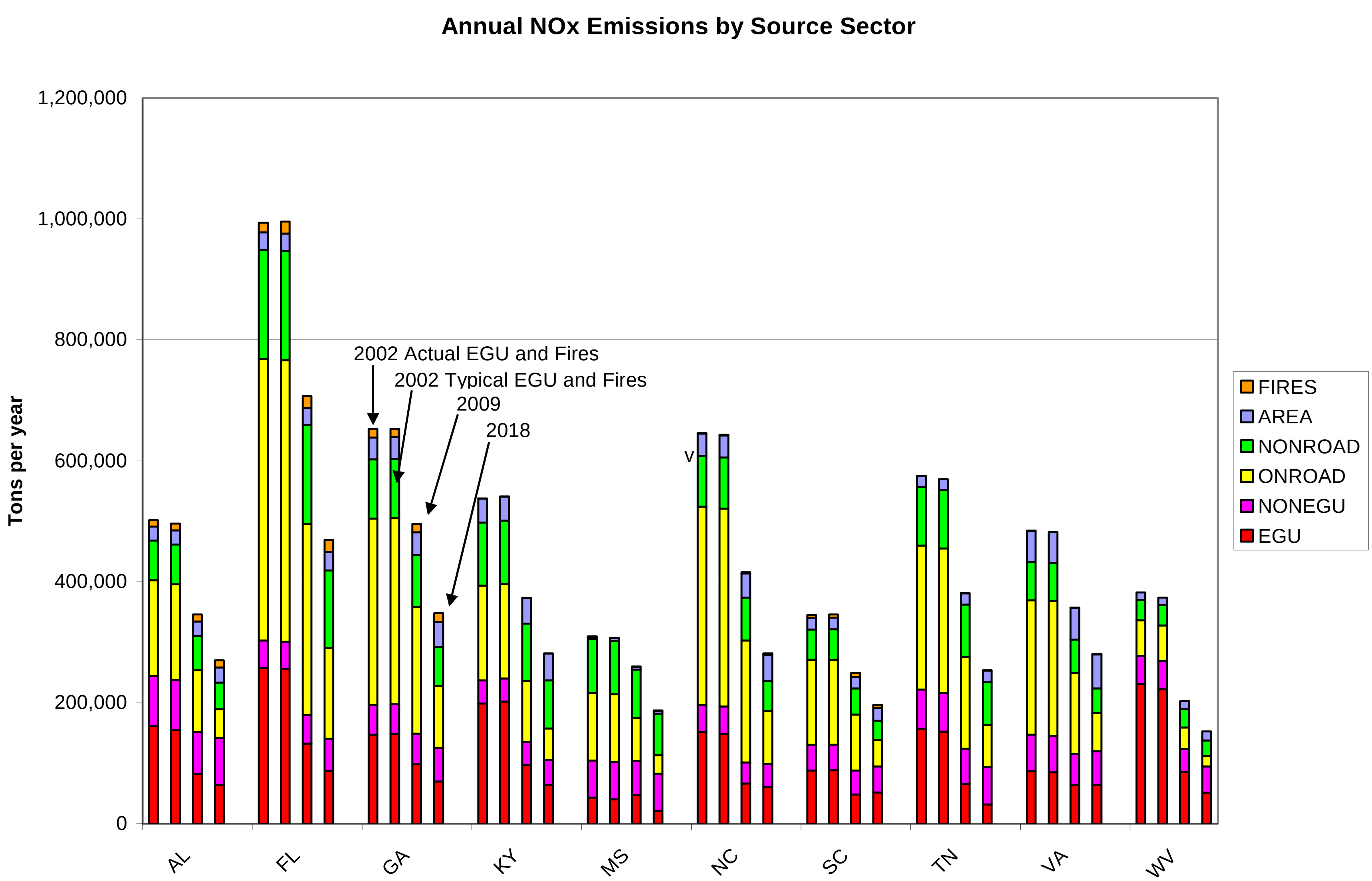
Annual CO Emissions by Source Sector

Name	EGU	NONEGU	ONROAD	NONROAD	AREA	FIRES	YEAR
AL	11,279	174,271	1,321,528	414,385	83,958	474,959	2002 Actual
	11,460	174,260	1,321,528	414,385	83,958	514,120	2002 Typical
	14,986	180,369	915,647	454,686	66,654	534,873	2009
	24,342	201,663	676,210	488,924	59,626	535,658	2018
FL	57,113	81,933	4,550,447	1,920,729	71,079	790,620	2002 Actual
	55,899	81,928	4,550,447	1,920,729	71,079	923,310	2002 Typical
	71,072	87,661	3,352,509	2,104,920	57,011	923,310	2009
	85,495	97,438	2,554,160	2,323,327	53,903	923,310	2018
GA	9,712	130,850	2,735,968	791,158	108,083	654,411	2002 Actual
	9,650	130,850	2,735,968	791,158	108,083	620,342	2002 Typical
	23,721	147,427	1,983,803	882,970	94,130	637,177	2009
	44,269	167,904	1,476,981	973,872	93,827	637,177	2018
KY	12,619	109,936	1,230,148	325,993	66,752	8,703	2002 Actual
	12,607	109,936	1,230,148	325,993	66,752	24,900	2002 Typical
	15,812	122,024	963,762	357,800	57,887	31,810	2009
	17,144	139,437	807,536	381,215	54,865	33,296	2018
MS	5,303	54,568	864,290	236,752	37,905	13,209	2002 Actual
	5,219	54,568	864,290	236,752	37,905	14,353	2002 Typical
	7,116	57,749	609,972	257,453	27,184	48,160	2009
	17,348	65,884	445,493	270,726	22,099	50,037	2018
NC	13,885	50,576	2,873,992	808,231	345,315	34,515	2002 Actual
	14,074	50,576	2,873,992	808,231	345,315	71,970	2002 Typical
	14,942	53,744	1,991,708	887,605	301,163	96,258	2009
	19,870	62,197	1,362,214	960,709	290,809	111,266	2018
SC	6,990	56,315	1,241,359	413,964	113,714	248,341	2002 Actual
	6,969	56,315	1,241,359	413,964	113,714	253,005	2002 Typical
	11,643	59,934	889,957	448,625	90,390	282,307	2009
	14,975	68,415	663,493	481,332	83,167	282,307	2018
TN	7,084	115,264	1,917,842	505,163	89,828	4,302	2002 Actual
	6,787	115,264	1,917,842	505,163	89,828	10,124	2002 Typical
	7,214	119,216	1,338,016	554,121	74,189	17,372	2009
	7,723	140,556	976,634	593,100	68,809	18,860	2018
VA	6,892	63,796	2,163,259	660,105	155,873	15,625	2002 Actual
	6,797	63,784	2,163,259	660,105	155,873	12,611	2002 Typical
	12,535	68,326	1,453,946	726,815	128,132	21,130	2009
	18,850	76,846	1,075,104	797,683	121,690	26,923	2018
WV	10,341	89,879	533,471	133,113	39,546	6,738	2002 Actual
	10,117	89,878	533,471	133,113	39,546	2,652	2002 Typical
	11,493	93,839	365,549	152,862	31,640	3,949	2009
	12,397	111,302	274,804	167,424	28,773	5,013	2018


Annual NH_3 Emissions by Source Sector
Tons per year
250,000
200,000
150,000
100,000
50,000
0
2002 Actual EGU and Fires
2002 Typical EGU and Fires
2009
2018
AL
FL
GA
KY
MS
NC
SC
TN
VA
WV
FIRES
AREA
NONROAD
ONROAD
NONEGU
EGU

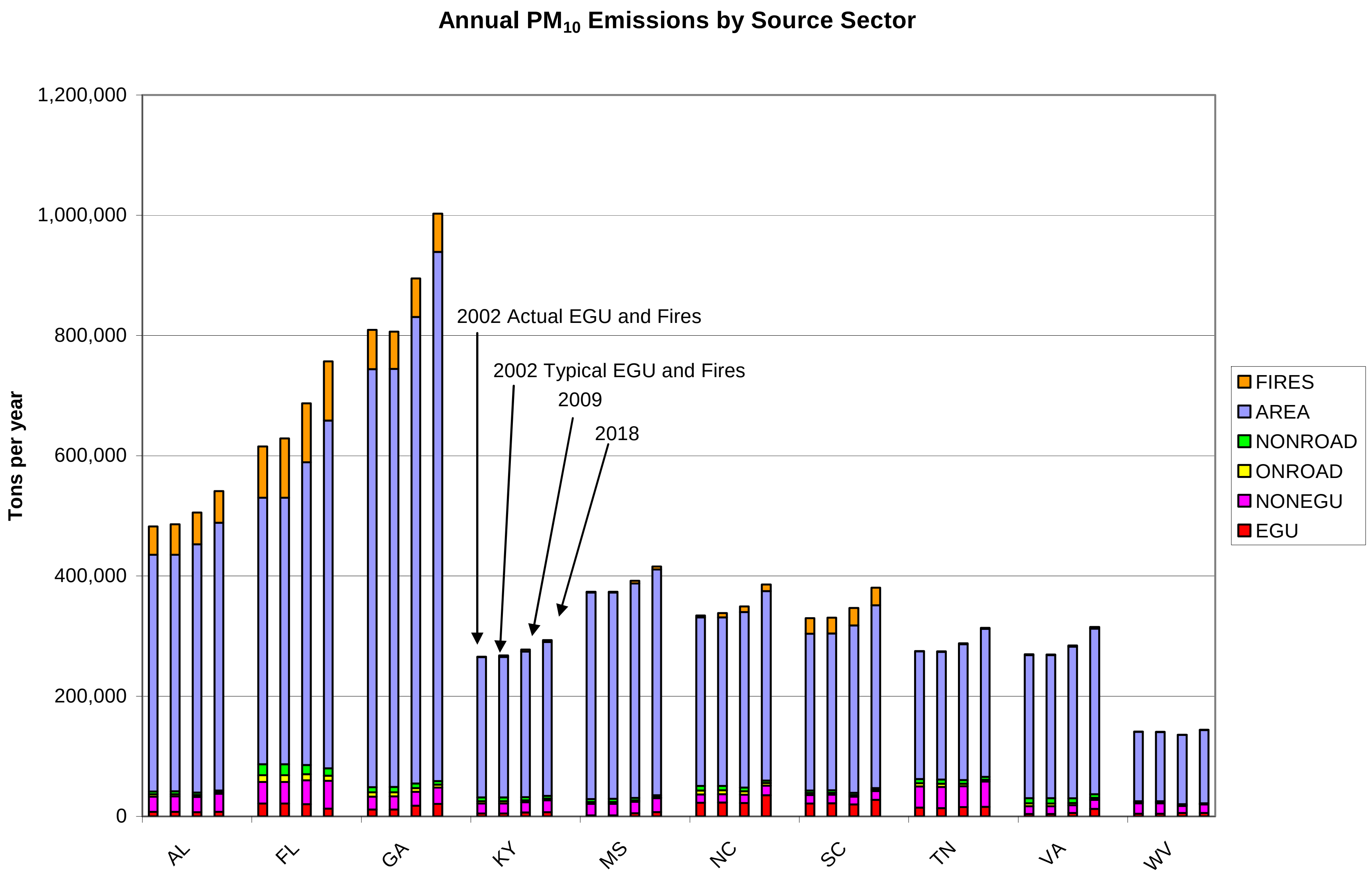
Annual NH_3 Emissions by Source Sector

Name	EGU	NONEGU	ONROAD	NONROAD	AREA	FIRES	YEAR
AL	317	1,883	5,588	33	58,318	1,689	2002 Actual
	239	1,883	5,588	33	58,318	1,957	2002 Typical
	359	2,132	6,364	36	64,268	2,050	2009
	1,072	2,464	7,298	42	71,915	2,054	2018
FL	234	1,423	18,114	134	37,446	3,102	2002 Actual
	222	1,423	18,114	134	37,446	3,157	2002 Typical
	1,629	1,544	21,781	148	38,616	3,157	2009
	2,976	1,829	26,163	171	40,432	3,157	2018
GA	83	3,613	10,546	60	80,913	2,578	2002 Actual
	86	3,613	10,546	60	80,913	2,153	2002 Typical
	686	3,963	12,687	68	89,212	2,229	2009
	1,677	4,797	14,873	79	99,885	2,229	2018
KY	326	674	5,055	31	51,135	39	2002 Actual
	321	674	5,055	31	51,135	112	2002 Typical
	400	760	5,796	34	53,005	143	2009
	476	901	7,811	40	55,211	150	2018
MS	190	1,169	3,585	23	58,721	59	2002 Actual
	198	1,169	3,585	23	58,721	65	2002 Typical
	334	668	4,035	25	63,708	217	2009
	827	764	4,566	29	69,910	225	2018
NC	54	1,179	9,702	65	161,860	155	2002 Actual
	55	1,179	9,702	65	161,860	324	2002 Typical
	445	1,285	11,825	72	170,314	433	2009
	663	1,465	14,065	83	180,866	501	2018
SC	142	1,411	4,694	33	28,166	980	2002 Actual
	141	1,411	4,694	33	28,166	908	2002 Typical
	370	1,578	5,523	36	30,555	1,039	2009
	625	1,779	6,473	41	33,496	1,039	2018
TN	204	1,613	6,625	43	34,393	19	2002 Actual
	197	1,613	6,625	43	34,393	46	2002 Typical
	227	1,840	7,782	48	35,253	78	2009
	241	2,213	9,021	55	36,291	85	2018
VA	127	3,104	7,852	48	43,905	70	2002 Actual
	130	3,104	7,852	48	43,905	57	2002 Typical
	694	3,045	9,086	53	46,639	95	2009
	606	3,604	10,624	61	50,175	121	2018
WV	121	332	1,908	9	9,963	30	2002 Actual
	121	332	1,908	9	9,963	12	2002 Typical
	330	314	2,148	11	10,625	18	2009
	143	378	2,497	13	11,504	23	2018


Annual NOx Emissions by Source Sector
Tons per year
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
2002 Actual EGU and Fires
2002 Typical EGU and Fires
2009
2018
AL
FL
GA
KY
MS
NC
SC
TN
VA
WV
FIRES
AREA
NONROAD
ONROAD
NONEGU
EGU

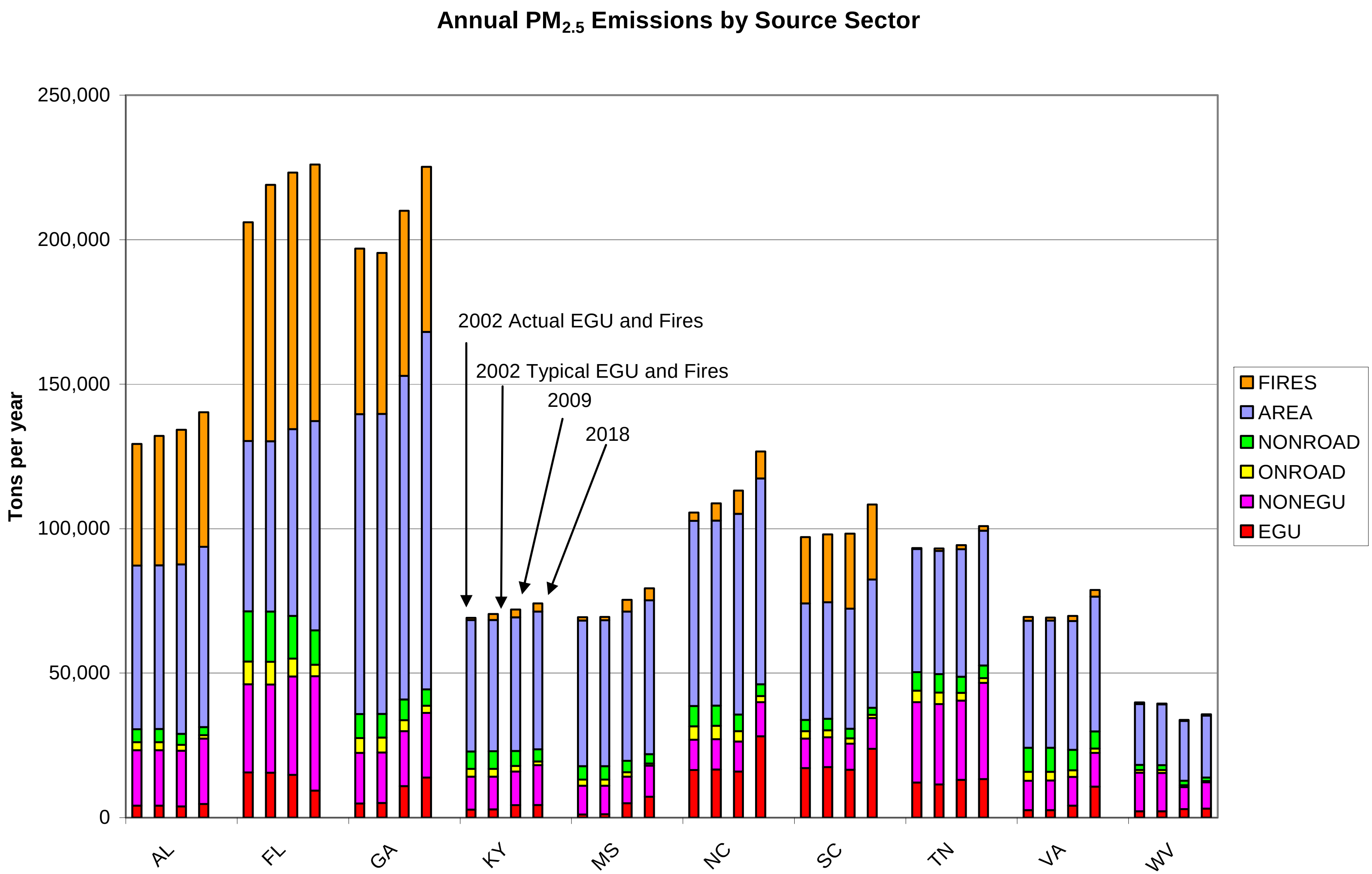
Annual NO_x Emissions by Source Sector

Name	EGU	NONEGU	ONROAD	NONROAD	AREA	FIRES	YEAR
AL	161,038	83,310	158,212	65,366	23,444	10,728	2002 Actual
	154,704	83,302	158,212	65,366	23,444	11,456	2002 Typical
	82,305	69,409	101,831	56,862	23,930	11,901	2009
	64,358	77,960	47,298	43,799	25,028	11,918	2018
FL	257,677	45,156	465,640	180,627	28,872	15,942	2002 Actual
	255,678	45,150	465,640	180,627	28,872	19,791	2002 Typical
	132,535	47,125	315,840	163,794	28,187	19,791	2009
	87,645	52,959	150,180	127,885	30,708	19,791	2018
GA	147,517	49,251	307,732	97,961	36,142	14,203	2002 Actual
	148,126	49,251	307,732	97,961	36,142	13,882	2002 Typical
	98,497	50,353	209,349	85,733	37,729	14,243	2009
	69,856	55,824	102,179	64,579	41,332	14,243	2018
KY	198,817	38,392	156,417	104,571	39,507	187	2002 Actual
	201,928	38,434	156,417	104,571	39,507	534	2002 Typical
	97,263	37,758	101,182	94,752	42,088	682	2009
	64,378	41,034	52,263	79,392	44,346	714	2018
MS	43,135	61,526	111,914	88,787	4,200	283	2002 Actual
	40,433	61,553	111,914	88,787	4,200	308	2002 Typical
	47,276	56,398	70,743	80,567	4,249	1,033	2009
	21,535	61,252	30,619	68,252	4,483	1,073	2018
NC	151,850	44,929	327,329	84,284	36,550	740	2002 Actual
	148,812	44,929	327,329	84,284	36,550	1,544	2002 Typical
	66,521	34,768	201,609	70,997	39,954	2,065	2009
	61,110	37,802	87,791	49,046	43,865	2,387	2018
SC	88,241	42,153	140,489	50,249	19,332	4,932	2002 Actual
	88,528	42,153	140,489	50,249	19,332	5,270	2002 Typical
	48,668	39,368	92,499	43,235	19,360	5,899	2009
	51,751	43,331	43,490	31,758	20,592	5,899	2018
TN	157,307	64,344	238,577	96,827	17,844	92	2002 Actual
	152,137	64,344	238,577	96,827	17,844	217	2002 Typical
	66,405	57,514	151,912	86,641	18,499	373	2009
	31,715	62,519	69,385	70,226	19,597	405	2018
VA	86,886	60,415	222,374	63,219	51,418	335	2002 Actual
	85,081	60,390	222,374	63,219	51,418	271	2002 Typical
	64,358	51,001	134,232	54,993	52,618	453	2009
	64,344	55,734	63,342	40,393	56,158	578	2018
WV	230,977	46,612	58,999	33,239	12,687	145	2002 Actual
	222,437	46,618	58,999	33,239	12,687	57	2002 Typical
	85,476	38,023	35,635	30,133	13,439	85	2009
	51,474	43,280	17,247	25,710	14,828	108	2018


Annual PM_{10} Emissions by Source Sector
Tons per year
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
AL
FL
GA
KY
MS
NC
SC
TN
VA
WV
2002 Actual EGU and Fires
2002 Typical EGU and Fires
2009
2018
FIRES
AREA
NONROAD
ONROAD
NONEGU
EGU

Annual PM_{10} Emissions by Source Sector

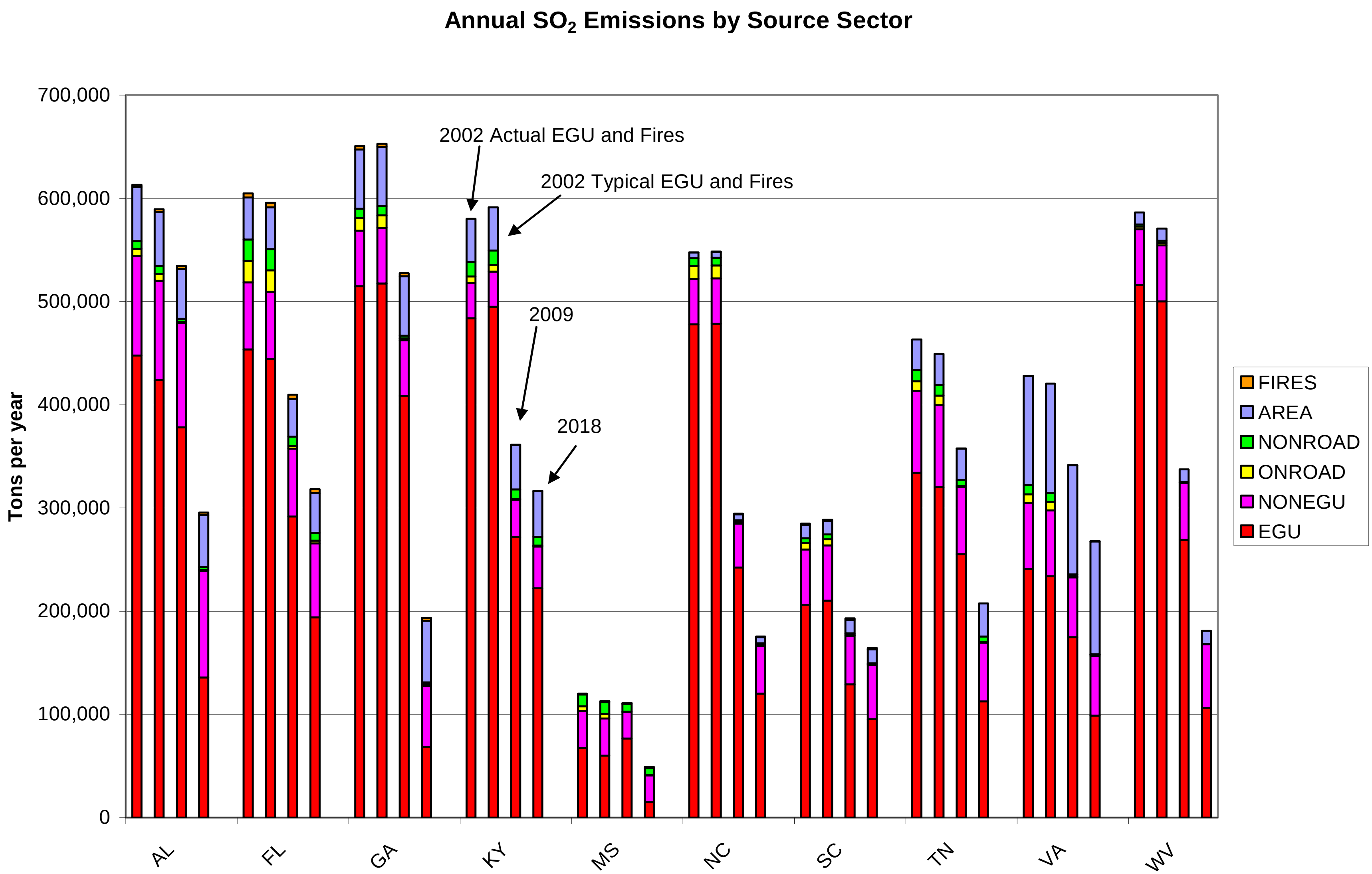
Name	EGU	NONEGU	ONROAD	NONROAD	AREA	FIRES	YEAR
AL	7,646	25,240	3,903	4,787	393,588	47,237	2002 Actual
	7,845	25,239	3,903	4,787	393,588	50,833	2002 Typical
	6,969	25,421	3,171	4,027	413,020	52,851	2009
	7,822	29,889	2,410	3,041	445,256	52,927	2018
FL	21,387	35,857	11,275	18,281	443,346	85,263	2002 Actual
	21,391	35,856	11,275	18,281	443,346	98,470	2002 Typical
	20,182	39,947	9,911	15,613	503,230	98,470	2009
	12,791	46,492	8,268	12,497	578,516	98,470	2018
GA	11,224	21,610	7,246	8,618	695,414	65,227	2002 Actual
	11,467	21,610	7,246	8,618	695,414	62,336	2002 Typical
	17,891	23,103	6,072	7,521	776,411	63,973	2009
	20,732	27,273	4,844	6,015	880,199	63,973	2018
KY	4,701	16,626	3,723	6,425	233,559	846	2002 Actual
	4,795	16,626	3,723	6,425	233,559	2,421	2002 Typical
	6,463	17,174	2,976	5,544	242,177	3,093	2009
	6,694	20,153	2,580	4,556	256,052	3,237	2018
MS	1,633	19,472	2,859	5,010	343,377	1,284	2002 Actual
	1,706	19,469	2,859	5,010	343,377	1,396	2002 Typical
	5,182	19,245	2,275	4,270	356,324	4,683	2009
	7,412	22,837	1,624	3,452	375,495	4,865	2018
NC	22,754	13,838	6,579	7,348	280,379	3,356	2002 Actual
	22,994	13,838	6,579	7,348	280,379	6,998	2002 Typical
	22,152	13,910	5,572	6,055	292,443	9,359	2009
	35,275	15,737	4,392	4,298	315,294	10,819	2018
SC	21,400	14,142	3,452	4,152	260,858	25,968	2002 Actual
	21,827	14,142	3,452	4,152	260,858	26,304	2002 Typical
	20,041	12,959	2,862	3,471	278,299	29,153	2009
	27,640	14,674	2,184	2,617	304,251	29,153	2018
TN	14,640	35,174	5,371	6,819	212,554	418	2002 Actual
	13,866	35,174	5,371	6,819	212,554	984	2002 Typical
	15,608	34,581	4,206	5,877	226,098	1,689	2009
	15,941	41,999	3,092	4,672	246,252	1,834	2018
VA	3,960	13,252	4,549	8,728	237,577	1,519	2002 Actual
	3,892	13,252	4,549	8,728	237,577	1,226	2002 Typical
	5,606	13,046	3,747	7,510	252,488	2,054	2009
	12,551	15,111	3,212	6,208	275,351	2,618	2018
WV	4,573	17,503	1,381	1,850	115,346	655	2002 Actual
	4,472	17,503	1,381	1,850	115,346	258	2002 Typical
	5,657	11,882	1,068	1,640	115,089	384	2009
	5,784	14,202	819	1,292	121,549	487	2018



Annual $PM_{2.5}$ Emissions by Source Sector
Tons per year
250,000
200,000
150,000
100,000
50,000
0
2002 Actual EGU and Fires
2002 Typical EGU and Fires
2009
2018
FIRES
AREA
NONROAD
ONROAD
NONEGU
EGU
AL
FL
GA
KY
MS
NC
SC
TN
VA
WV

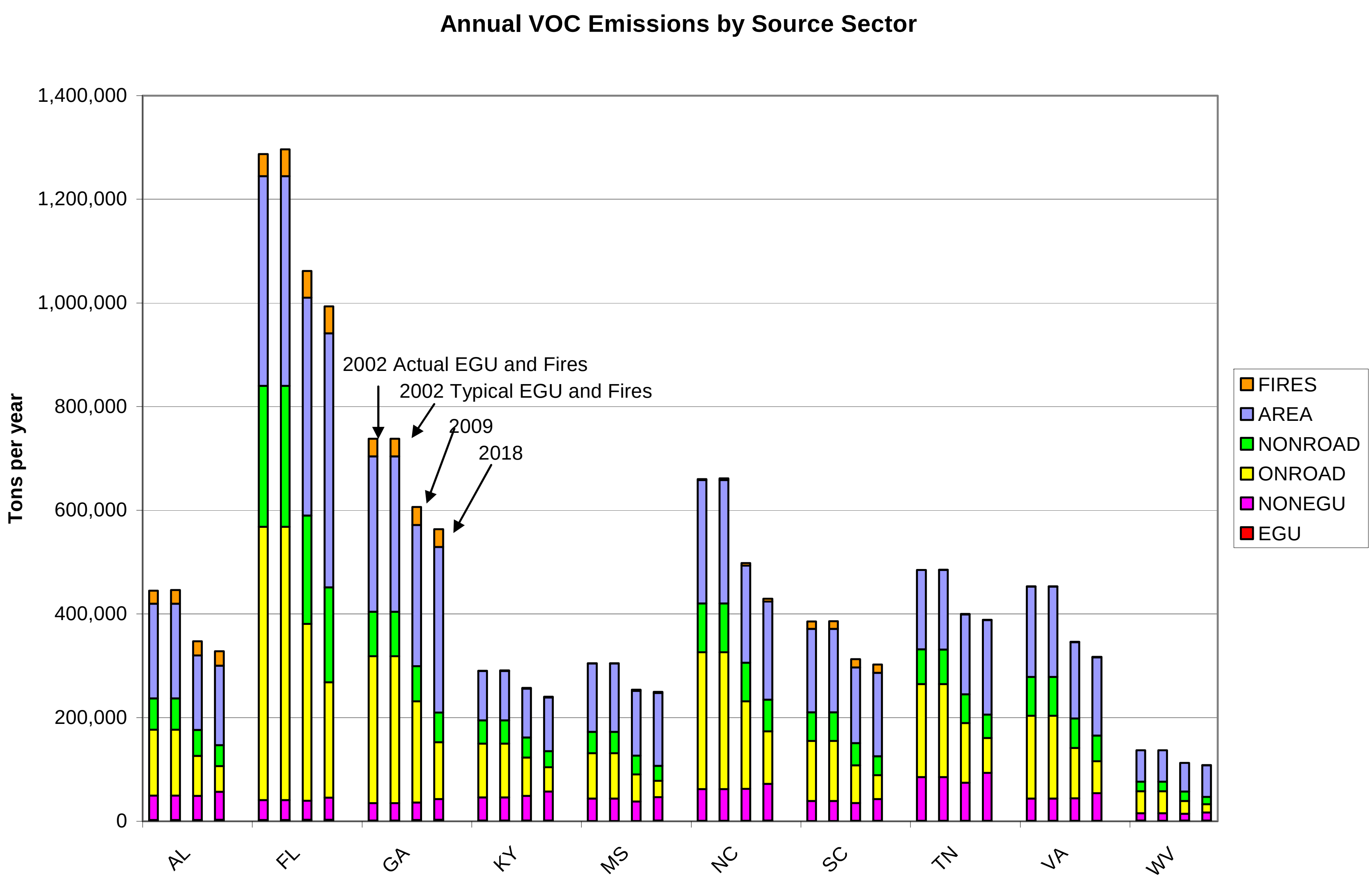
Annual $PM_{2.5}$ Emissions by Source Sector

Name	EGU	NONEGU	ONROAD	NONROAD	AREA	FIRES	YEAR
AL	4,113	19,178	2,799	4,502	56,654	42,041	2002 Actual
	4,176	19,177	2,799	4,502	56,654	44,812	2002 Typical
	3,921	19,230	2,032	3,776	58,699	46,543	2009
	4,768	22,584	1,192	2,835	62,323	46,608	2018
FL	15,643	30,504	7,868	17,415	58,878	75,717	2002 Actual
	15,575	30,504	7,868	17,415	58,878	88,756	2002 Typical
	14,790	34,019	6,173	14,866	64,589	88,756	2009
	9,417	39,486	4,038	11,868	72,454	88,756	2018
GA	4,939	17,462	5,168	8,226	103,794	57,293	2002 Actual
	5,070	17,462	5,168	8,226	103,794	55,712	2002 Typical
	10,907	18,982	3,840	7,175	112,001	57,116	2009
	13,881	22,416	2,380	5,730	123,704	57,116	2018
KY	2,802	11,372	2,697	6,046	45,453	726	2002 Actual
	2,847	11,372	2,697	6,046	45,453	2,076	2002 Typical
	4,279	11,686	1,920	5,203	46,243	2,653	2009
	4,434	13,739	1,272	4,256	47,645	2,777	2018
MS	1,138	9,906	2,112	4,690	50,401	1,102	2002 Actual
	1,147	9,902	2,112	4,690	50,401	1,197	2002 Typical
	4,996	9,199	1,508	3,985	51,661	4,016	2009
	7,252	10,719	819	3,203	53,222	4,173	2018
NC	16,498	10,500	4,623	7,005	64,052	2,878	2002 Actual
	16,623	10,500	4,623	7,005	64,052	6,002	2002 Typical
	15,949	10,458	3,493	5,760	69,457	8,027	2009
	28,137	11,825	2,123	4,069	71,262	9,279	2018
SC	17,154	10,245	2,501	3,945	40,291	22,953	2002 Actual
	17,521	10,245	2,501	3,945	40,291	23,511	2002 Typical
	16,548	9,048	1,855	3,294	41,613	25,955	2009
	23,794	10,699	1,087	2,474	44,319	25,955	2018
TN	12,166	27,807	3,949	6,458	42,566	359	2002 Actual
	11,491	27,807	3,949	6,458	42,566	844	2002 Typical
	13,092	27,367	2,751	5,557	44,124	1,449	2009
	13,387	33,293	1,544	4,403	46,692	1,573	2018
VA	2,606	10,165	3,102	8,288	43,989	1,303	2002 Actual
	2,650	10,165	3,102	8,288	43,989	1,052	2002 Typical
	4,165	9,988	2,241	7,136	44,514	1,762	'2009
	10,773	11,605	1,543	5,891	46,697	2,245	2018
WV	2,210	13,313	995	1,728	21,049	562	2002 Actual
	2,163	13,313	995	1,728	21,049	221	2002 Typical
	2,940	7,638	684	1,528	20,664	329	2009
	3,116	9,124	405	1,198	21,490	418	2018


Annual SO_2 Emissions by Source Sector
700,000
600,000
500,000
400,000
300,000
200,000
100,000
0
Tons per year
2002 Actual EGU and Fires
2002 Typical EGU and Fires
2009
2018
AL
FL
GA
KY
MS
NC
SC
TN
VA
WV
FIRES
AREA
NONROAD
ONROAD
NONEGU
EGU

Annual SO_2 Emissions by Source Sector

Name	EGU	NONEGU	ONROAD	NONROAD	AREA	FIRES	YEAR
AL	447,828	96,481	6,900	7,584	52,253	2,208	2002 Actual
	423,736	96,481	6,900	7,584	52,253	2,559	2002 Typical
	378,052	101,246	810	3,471	48,228	2,681	2009
	135,851	103,303	720	2,818	50,264	2,686	2018
FL	453,631	65,090	20,915	20,614	40,491	4,057	2002 Actual
	444,383	65,090	20,915	20,614	40,491	4,129	2002 Typical
	291,831	65,651	2,612	8,967	36,699	4,129	2009
	194,028	71,810	2,533	7,536	38,317	4,129	2018
GA	514,952	53,774	12,184	9,005	57,559	3,372	2002 Actual
	517,633	53,778	12,184	9,005	57,559	2,815	2002 Typical
	408,679	53,983	1,585	2,725	57,696	2,914	2009
	68,515	59,343	1,457	1,709	59,729	2,914	2018
KY	484,057	34,029	6,308	14,043	41,805	51	2002 Actual
	495,153	34,029	6,308	14,043	41,805	146	2002 Typical
	271,669	36,418	759	9,180	43,087	187	2009
	222,102	40,682	763	8,592	44,186	196	2018
MS	67,429	35,960	4,614	11,315	771	78	2002 Actual
	60,086	35,954	4,614	11,315	771	84	2002 Typical
	76,646	25,564	537	7,191	753	283	2009
	15,213	25,674	440	6,638	746	294	2018
NC	477,990	44,123	12,420	7,693	5,412	203	2002 Actual
	478,488	44,123	12,420	7,693	5,412	423	2002 Typical
	242,286	42,536	1,503	1,892	5,751	566	2009
	120,165	46,314	1,481	905	6,085	655	2018
SC	206,399	53,518	5,972	4,866	12,900	1,281	2002 Actual
	210,272	53,518	5,972	4,866	12,900	1,187	2002 Typical
	129,122	47,193	721	1,701	13,051	1,359	2009
	95,377	52,410	643	1,198	13,457	1,359	2018
TN	334,151	79,604	9,226	10,441	29,917	25	2002 Actual
	320,146	79,604	9,226	10,441	29,917	60	2002 Typical
	255,410	64,964	1,076	5,651	30,577	102	2009
	112,672	56,682	948	5,207	31,962	111	2018
VA	241,204	63,903	8,294	8,663	105,890	92	2002 Actual
	233,691	63,900	8,294	8,663	105,890	74	2002 Typical
	174,777	58,039	1,079	1,707	105,984	124	2009
	98,988	57,790	1,043	507	109,380	158	2018
WV	516,084	54,070	2,464	2,112	11,667	40	2002 Actual
	500,381	54,077	2,464	2,112	11,667	16	2002 Typical
	268,952	55,598	279	359	12,284	23	2009
	106,199	61,702	253	56	12,849	29	2018


Annual VOC Emissions by Source Sector
Tons per year
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
2002 Actual EGU and Fires
2002 Typical EGU and Fires
2009
2018
AL
FL
GA
KY
MS
NC
SC
TN
VA
WV
FIRES
AREA
NONROAD
ONROAD
NONEGU
EGU

Annual VOC Emissions by Source Sector

Name	EGU	NONEGU	ONROAD	NONROAD	AREA	FIRES	YEAR
AL	2,295	47,037	127,295	60,487	182,674	25,278	2002 Actual
	2,288	47,035	127,295	60,487	182,674	26,526	2002 Typical
	2,473	46,644	76,990	50,249	143,454	27,502	2009
	2,952	54,291	49,175	40,407	153,577	27,539	2018
FL	2,524	38,471	527,209	272,072	404,302	42,724	2002 Actual
	2,531	38,471	527,209	272,072	404,302	51,527	2002 Typical
	2,730	36,882	340,947	209,543	420,172	51,527	2009
	3,047	42,813	222,303	183,452	489,975	51,527	2018
GA	1,244	33,709	283,421	85,965	299,679	33,979	2002 Actual
	1,256	33,709	283,421	85,965	299,679	33,918	2002 Typical
	2,314	34,116	195,125	67,686	272,315	34,710	2009
	2,816	40,282	109,763	56,761	319,328	34,710	2018
KY	1,487	44,834	103,503	44,805	95,375	410	2002 Actual
	1,481	44,834	103,503	44,805	95,375	1,172	2002 Typical
	1,369	47,786	73,942	38,558	94,042	1,497	2009
	1,426	55,861	47,066	30,920	103,490	1,567	2018
MS	648	43,204	87,672	41,081	131,808	622	2002 Actual
	629	43,203	87,672	41,081	131,808	675	2002 Typical
	564	37,747	52,107	36,197	124,977	2,266	2009
	1,274	45,335	31,616	28,842	140,134	2,355	2018
NC	988	61,182	263,766	94,480	237,926	1,624	2002 Actual
	986	61,182	263,766	94,480	237,926	3,387	2002 Typical
	954	61,925	168,676	74,056	187,769	4,530	2009
	1,302	70,875	101,099	61,327	189,591	5,236	2018
SC	470	38,458	116,163	55,016	161,000	14,202	2002 Actual
	470	38,458	116,163	55,016	161,000	14,666	2002 Typical
	723	34,403	72,603	43,061	146,107	16,045	2009
	931	41,987	46,301	36,131	161,228	16,045	2018
TN	926	84,328	179,807	66,450	153,307	202	2002 Actual
	890	84,328	179,807	66,450	153,307	476	2002 Typical
	932	73,498	115,181	55,358	154,377	817	2009
	976	92,456	67,324	45,084	182,222	888	2018
VA	754	43,152	159,790	74,866	174,116	735	2002 Actual
	747	43,152	159,790	74,866	174,116	593	2002 Typical
	788	43,726	96,770	57,009	147,034	994	2009
	980	53,186	61,964	49,052	150,919	1,267	2018
WV	1,180	14,595	42,174	18,566	60,443	317	2002 Actual
	1,140	14,595	42,174	18,566	60,443	125	2002 Typical
	1,361	13,043	24,843	18,069	55,288	186	2009
	1,387	15,582	16,121	14,086	60,747	236	2018

APPENDIX B:

STATE VMT TOTALS

State VMT Totals

Million Miles Per Year

2002	LDGV	LDGT1	LDGT2	HDDV	LDDV	LDDT	HDDV	MC	TOTAL
AL	31,982	12,728	4,347	1,630	63	69	4,709	196	55,723
FL	105,340	40,835	13,945	5,079	206	220	12,465	591	178,681
GA	61,660	24,394	8,331	3,103	121	132	8,673	371	106,785
KY	28,751	12,189	3,366	1,606	55	55	4,827	171	51,020
MS	23,933	6,724	439	1,025	330	125	3,610	92	36,278
NC	51,189	30,339	10,787	4,119	230	230	9,440	461	106,795
SC	26,672	10,750	3,671	1,395	52	58	4,306	171	47,074
TN	30,809	20,272	6,922	2,943	52	111	6,810	397	68,316
VA	36,336	24,784	8,667	2,148	61	139	4,969	369	77,472
WV	9,010	5,931	2,028	732	25	37	1,664	117	19,544

2009	LDGV	LDGT1	LDGT2	HDDV	LDDV	LDDT	HDDV	MC	TOTAL
AL	30,638	18,598	5,511	2,069	65	72	5,976	249	63,178
FL	107,641	62,449	18,697	6,820	215	230	16,743	794	213,590
GA	61,569	36,641	10,933	4,077	126	137	11,374	487	125,343
KY	28,006	16,984	4,428	1,983	58	57	5,983	231	57,729
MS	23,641	10,131	573	1,341	356	135	4,719	120	41,017
NC	48,495	43,484	15,122	4,576	40	224	10,928	527	123,396
SC	26,451	16,119	4,796	1,824	55	61	5,617	223	55,147
TN	28,775	28,650	8,521	3,627	52	111	8,391	490	78,615
VA	33,663	34,814	10,597	2,624	61	137	6,073	451	88,419
WV	8,128	8,205	2,427	878	25	37	1,995	140	21,835

2018	LDGV	LDGT1	LDGT2	HDDV	LDDV	LDDT	HDDV	MC	TOTAL
AL	31,706	23,562	6,990	2,634	67	84	7,607	317	72,966
FL	116,576	83,385	24,996	9,156	221	301	22,491	1,066	258,191
GA	65,214	47,687	14,245	5,332	129	171	14,853	637	148,269
KY	29,353	21,058	5,558	2,463	60	66	7,454	288	66,300
MS	24,787	12,984	736	1,727	372	159	6,076	155	46,996
NC	42,247	51,568	18,260	4,985	279	279	11,396	553	129,566
SC	27,930	20,880	6,220	2,375	57	75	7,306	290	65,133
TN	29,253	35,702	10,629	4,538	52	130	10,500	613	91,417
VA	35,030	44,438	13,543	3,358	62	164	7,770	578	104,944
WV	8,130	10,025	2,969	1,078	25	41	2,451	172	24,891

APPENDIX C:

STATE TIER 1 EMISSION TOTALS

State Tier 1 Emission Totals

State	Year	TIER1	TIER 1 NAME	CO	NH3	NOX	PM10	PM2.5	SO2	VOC
AL	2002	01	FUEL COMB. ELEC. UTIL.	11,279	317	161,038	7,646	4,113	447,828	2,295
AL	2002	02	FUEL COMB. INDUSTRIAL	67,132	234	51,535	6,730	3,792	40,918	2,239
AL	2002	03	FUEL COMB. OTHER	70,498	169	19,237	6,411	5,528	39,606	56,120
AL	2002	04	CHEMICAL & ALLIED PRODUCT MFG	5,721	35	2,032	1,220	888	12,770	7,273
AL	2002	05	METALS PROCESSING	38,247	376	6,011	9,107	7,803	14,039	3,299
AL	2002	06	PETROLEUM & RELATED INDUSTRIES	13,606	0	878	194	155	22,991	4,024
AL	2002	07	OTHER INDUSTRIAL PROCESSES	47,676	1,468	25,252	22,689	9,516	17,904	25,304
AL	2002	08	SOLVENT UTILIZATION	216	0	226	149	126	3	108,437
AL	2002	09	STORAGE & TRANSPORT	174	0	230	1,086	636	13	16,522
AL	2002	10	WASTE DISPOSAL & RECYCLING	104,914	10	4,016	15,832	14,946	489	12,612
AL	2002	11	HIGHWAY VEHICLES	1,321,528	5,588	158,212	3,903	2,799	6,900	127,295
AL	2002	12	OFF-HIGHWAY	414,385	33	65,366	4,787	4,502	7,584	60,487
AL	2002	14	MISCELLANEOUS	385,005	59,596	8,065	402,646	74,483	2,208	19,161
	2002 Total			**2,480,381**	**67,827**	**502,098**	**482,402**	**129,287**	**613,255**	**445,065**
AL	2009	01	FUEL COMB. ELEC. UTIL.	14,986	359	82,305	6,969	3,921	378,052	2,473
AL	2009	02	FUEL COMB. INDUSTRIAL	68,146	274	36,301	6,140	3,438	40,651	2,191
AL	2009	03	FUEL COMB. OTHER	52,256	158	19,514	5,904	5,104	36,048	31,403
AL	2009	04	CHEMICAL & ALLIED PRODUCT MFG	6,118	38	2,273	1,257	912	13,660	6,613
AL	2009	05	METALS PROCESSING	38,969	500	6,021	9,062	7,756	16,629	3,305
AL	2009	06	PETROLEUM & RELATED INDUSTRIES	13,241	0	858	221	177	22,495	3,336
AL	2009	07	OTHER INDUSTRIAL PROCESSES	52,004	1,571	26,340	24,196	10,197	19,383	26,519
AL	2009	08	SOLVENT UTILIZATION	247	0	257	165	139	4	92,631
AL	2009	09	STORAGE & TRANSPORT	192	0	253	1,146	584	14	17,738
AL	2009	10	WASTE DISPOSAL & RECYCLING	87,225	11	3,634	14,504	13,485	590	11,207
AL	2009	11	HIGHWAY VEHICLES	915,647	6,364	101,831	3,171	2,032	810	76,990
AL	2009	12	OFF-HIGHWAY	454,686	36	56,862	4,027	3,776	3,471	50,249
AL	2009	14	MISCELLANEOUS	463,498	65,899	9,788	428,698	82,679	2,681	22,657
	2009 Total			**2,167,216**	**75,209**	**346,238**	**505,457**	**134,201**	**534,489**	**347,312**
AL	2018	01	FUEL COMB. ELEC. UTIL.	24,342	1,072	64,358	7,822	4,768	135,851	2,952
AL	2018	02	FUEL COMB. INDUSTRIAL	69,068	275	38,424	6,427	3,599	40,126	2,293
AL	2018	03	FUEL COMB. OTHER	43,744	164	20,185	5,641	4,818	37,162	21,215
AL	2018	04	CHEMICAL & ALLIED PRODUCT MFG	7,384	46	2,804	1,523	1,106	16,509	8,040
AL	2018	05	METALS PROCESSING	49,770	674	7,519	11,036	9,423	21,824	4,234
AL	2018	06	PETROLEUM & RELATED INDUSTRIES	13,002	0	848	258	207	15,364	3,421
AL	2018	07	OTHER INDUSTRIAL PROCESSES	60,452	1,732	30,831	27,727	11,812	21,843	30,267
AL	2018	08	SOLVENT UTILIZATION	301	0	317	200	169	4	112,412
AL	2018	09	STORAGE & TRANSPORT	234	0	307	1,366	699	17	18,900
AL	2018	10	WASTE DISPOSAL & RECYCLING	88,758	13	3,867	15,343	14,143	718	11,938
AL	2018	11	HIGHWAY VEHICLES	676,210	7,298	47,298	2,410	1,192	720	49,175
AL	2018	12	OFF-HIGHWAY	488,924	42	43,799	3,041	2,835	2,818	40,407
AL	2018	14	MISCELLANEOUS	464,235	73,529	9,803	458,551	85,538	2,686	22,686
	2018 Total			**1,986,424**	**84,845**	**270,362**	**541,346**	**140,310**	**295,642**	**327,940**

State Tier 1 Emission Totals

State	Year	TIER1	TIER 1 NAME	CO	NH3	NOX	PM10	PM2.5	SO2	VOC
FL	2002	01	FUEL COMB. ELEC. UTIL.	57,113	234	257,677	21,387	15,643	453,631	2,524
FL	2002	02	FUEL COMB. INDUSTRIAL	64,798	131	45,157	20,442	18,547	42,524	4,219
FL	2002	03	FUEL COMB. OTHER	49,230	99	11,597	8,464	8,074	20,031	16,123
FL	2002	04	CHEMICAL & ALLIED PRODUCT MFG	745	1,101	2,221	1,868	1,488	34,462	3,542
FL	2002	05	METALS PROCESSING	1,404	1	194	449	334	882	82
FL	2002	06	PETROLEUM & RELATED INDUSTRIES	1,070	0	560	259	129	470	724
FL	2002	07	OTHER INDUSTRIAL PROCESSES	18,586	19	12,325	23,419	11,844	6,515	27,024
FL	2002	08	SOLVENT UTILIZATION	0	0	1	128	110	0	304,582
FL	2002	09	STORAGE & TRANSPORT	161	0	561	1,645	720	38	79,281
FL	2002	10	WASTE DISPOSAL & RECYCLING	54,721	351	2,535	9,943	9,405	659	9,125
FL	2002	11	HIGHWAY VEHICLES	4,550,447	18,114	465,640	11,275	7,868	20,915	527,209
FL	2002	12	OFF-HIGHWAY	1,920,729	134	180,627	18,281	17,415	20,614	272,072
FL	2002	14	MISCELLANEOUS	752,915	40,269	14,821	497,846	114,447	4,057	40,795
	2002 Total			**7,471,920**	**60,454**	**993,915**	**615,407**	**206,025**	**604,797**	**1,287,301**
FL	2009	01	FUEL COMB. ELEC. UTIL.	35,928	1,631	86,165	9,007	5,910	186,055	1,910
FL	2009	02	FUEL COMB. INDUSTRIAL	69,972	146	44,480	16,265	14,827	38,225	4,473
FL	2009	03	FUEL COMB. OTHER	33,014	100	10,800	7,555	7,174	19,882	10,907
FL	2009	04	CHEMICAL & ALLIED PRODUCT MFG	901	1,231	2,461	1,908	1,526	34,961	3,821
FL	2009	05	METALS PROCESSING	1,545	1	176	361	251	993	82
FL	2009	06	PETROLEUM & RELATED INDUSTRIES	1,190	0	612	304	156	519	748
FL	2009	07	OTHER INDUSTRIAL PROCESSES	18,593	26	13,521	33,084	19,357	6,881	26,413
FL	2009	08	SOLVENT UTILIZATION	0	0	1	132	113	0	319,723
FL	2009	09	STORAGE & TRANSPORT	187	0	621	1,661	727	50	83,880
FL	2009	10	WASTE DISPOSAL & RECYCLING	177,953	342	6,251	22,971	22,364	698	17,241
FL	2009	11	HIGHWAY VEHICLES	3,308,863	21,549	312,321	9,801	6,104	2,584	336,707
FL	2009	12	OFF-HIGHWAY	2,104,920	148	163,794	15,613	14,866	8,967	209,543
FL	2009	14	MISCELLANEOUS	764,004	41,471	15,075	557,331	120,796	4,129	41,290
	2009 Total			**6,596,484**	**66,874**	**707,273**	**687,353**	**223,192**	**406,888**	**1,061,801**
FL	2018	01	FUEL COMB. ELEC. UTIL.	85,495	2,976	87,645	12,791	9,417	194,028	3,047
FL	2018	02	FUEL COMB. INDUSTRIAL	77,465	156	48,879	17,876	16,324	37,205	4,894
FL	2018	03	FUEL COMB. OTHER	27,094	110	12,356	7,255	6,853	20,975	8,879
FL	2018	04	CHEMICAL & ALLIED PRODUCT MFG	1,200	1,448	3,119	2,367	1,907	41,395	4,739
FL	2018	05	METALS PROCESSING	1,973	2	225	466	323	1,325	106
FL	2018	06	PETROLEUM & RELATED INDUSTRIES	1,513	0	778	387	198	659	918
FL	2018	07	OTHER INDUSTRIAL PROCESSES	20,748	35	15,855	39,842	23,289	7,741	29,716
FL	2018	08	SOLVENT UTILIZATION	0	0	1	158	135	0	387,657
FL	2018	09	STORAGE & TRANSPORT	226	0	690	2,004	877	58	87,732
FL	2018	10	WASTE DISPOSAL & RECYCLING	180,730	418	6,486	24,140	23,427	769	18,335
FL	2018	11	HIGHWAY VEHICLES	2,554,160	26,163	150,180	8,268	4,038	2,533	222,303
FL	2018	12	OFF-HIGHWAY	2,323,327	171	127,885	12,497	11,868	7,536	183,452
FL	2018	14	MISCELLANEOUS	763,701	43,251	15,068	628,984	127,364	4,129	41,338
	2018 Total			**6,037,633**	**74,728**	**469,168**	**757,033**	**226,019**	**318,353**	**993,116**

State Tier 1 Emission Totals

State	Year	TIER1	TIER 1 NAME	CO	NH3	NOX	PM10	PM2.5	SO2	VOC
GA	2002	01	FUEL COMB. ELEC. UTIL.	9,712	83	147,517	11,224	4,939	514,952	1,244
GA	2002	02	FUEL COMB. INDUSTRIAL	59,492	27	53,039	12,037	7,886	88,791	3,956
GA	2002	03	FUEL COMB. OTHER	63,314	17	14,465	10,142	10,057	10,740	27,226
GA	2002	04	CHEMICAL & ALLIED PRODUCT MFG	5,387	920	2,277	391	305	2,721	2,668
GA	2002	05	METALS PROCESSING	330	0	60	147	94	0	70
GA	2002	06	PETROLEUM & RELATED INDUSTRIES	41	0	3	69	44	68	175
GA	2002	07	OTHER INDUSTRIAL PROCESSES	27,960	2,666	12,215	39,630	13,073	8,701	26,999
GA	2002	08	SOLVENT UTILIZATION	4	0	22	13	13	0	234,744
GA	2002	09	STORAGE & TRANSPORT	39	0	6	583	360	0	26,334
GA	2002	10	WASTE DISPOSAL & RECYCLING	146,183	16	5,164	23,422	22,506	312	15,003
GA	2002	11	HIGHWAY VEHICLES	2,735,968	10,546	307,732	7,246	5,168	12,184	283,421
GA	2002	12	OFF-HIGHWAY	791,158	60	97,961	8,618	8,226	9,005	85,965
GA	2002	14	MISCELLANEOUS	590,400	83,458	12,308	695,723	124,142	3,372	29,640
	2002 Total			**4,429,989**	**97,795**	**652,769**	**809,244**	**196,815**	**650,846**	**737,444**
GA	2009	01	FUEL COMB. ELEC. UTIL.	23,721	686	98,497	17,891	10,907	408,679	2,314
GA	2009	02	FUEL COMB. INDUSTRIAL	63,067	28	53,726	11,206	7,390	89,850	4,163
GA	2009	03	FUEL COMB. OTHER	45,184	17	15,347	8,496	8,400	10,981	15,683
GA	2009	04	CHEMICAL & ALLIED PRODUCT MFG	6,044	1,032	2,531	436	341	2,743	2,814
GA	2009	05	METALS PROCESSING	363	0	61	159	100	0	47
GA	2009	06	PETROLEUM & RELATED INDUSTRIES	50	0	4	83	54	82	154
GA	2009	07	OTHER INDUSTRIAL PROCESSES	29,976	2,902	12,528	45,339	14,758	7,662	28,441
GA	2009	08	SOLVENT UTILIZATION	4	0	25	14	14	0	216,248
GA	2009	09	STORAGE & TRANSPORT	45	0	7	649	401	0	27,821
GA	2009	10	WASTE DISPOSAL & RECYCLING	218,460	18	7,419	31,955	30,900	360	18,711
GA	2009	11	HIGHWAY VEHICLES	1,983,803	12,687	209,349	6,072	3,840	1,585	195,125
GA	2009	12	OFF-HIGHWAY	882,970	68	85,733	7,521	7,175	2,725	67,686
GA	2009	14	MISCELLANEOUS	515,329	91,406	10,637	765,043	125,665	2,914	26,388
	2009 Total			**3,769,016**	**108,844**	**495,864**	**894,865**	**209,944**	**527,582**	**605,595**
GA	2018	01	FUEL COMB. ELEC. UTIL.	44,269	1,677	69,856	20,732	13,881	68,515	2,816
GA	2018	02	FUEL COMB. INDUSTRIAL	67,067	30	57,232	11,755	7,769	94,403	4,424
GA	2018	03	FUEL COMB. OTHER	39,440	17	17,801	7,722	7,622	11,958	11,482
GA	2018	04	CHEMICAL & ALLIED PRODUCT MFG	7,076	1,208	2,982	517	405	3,436	3,524
GA	2018	05	METALS PROCESSING	421	0	76	185	118	0	55
GA	2018	06	PETROLEUM & RELATED INDUSTRIES	63	0	5	105	68	104	191
GA	2018	07	OTHER INDUSTRIAL PROCESSES	33,611	3,559	14,460	55,130	17,899	8,748	33,333
GA	2018	08	SOLVENT UTILIZATION	5	0	30	22	22	0	264,326
GA	2018	09	STORAGE & TRANSPORT	54	0	9	764	470	0	29,409
GA	2018	10	WASTE DISPOSAL & RECYCLING	235,690	22	8,120	35,280	34,038	423	20,411
GA	2018	11	HIGHWAY VEHICLES	1,476,981	14,873	102,179	4,844	2,380	1,457	109,763
GA	2018	12	OFF-HIGHWAY	973,872	79	64,579	6,015	5,730	1,709	56,761
GA	2018	14	MISCELLANEOUS	515,220	102,075	10,635	859,835	134,730	2,914	26,368
	2018 Total			**3,393,769**	**123,540**	**347,964**	**1,002,907**	**225,133**	**193,668**	**562,862**

State Tier 1 Emission Totals

State	Year	TIER1	TIER 1 NAME	CO	NH3	NOX	PM10	PM2.5	SO2	VOC
KY	2002	01	FUEL COMB. ELEC. UTIL.	12,619	326	198,817	4,701	2,802	484,057	1,487
KY	2002	02	FUEL COMB. INDUSTRIAL	14,110	182	60,674	2,155	1,463	41,825	1,565
KY	2002	03	FUEL COMB. OTHER	40,806	55	4,997	7,679	7,352	9,647	12,711
KY	2002	04	CHEMICAL & ALLIED PRODUCT MFG	176	214	296	774	581	2,345	3,462
KY	2002	05	METALS PROCESSING	89,197	6	1,082	3,396	2,720	12,328	1,508
KY	2002	06	PETROLEUM & RELATED INDUSTRIES	4,304	335	2,519	308	205	5,747	2,895
KY	2002	07	OTHER INDUSTRIAL PROCESSES	6,493	78	6,518	31,429	10,394	3,333	25,388
KY	2002	08	SOLVENT UTILIZATION	0	10	9	317	241	1	61,834
KY	2002	09	STORAGE & TRANSPORT	33	8	15	1,920	1,177	3	18,853
KY	2002	10	WASTE DISPOSAL & RECYCLING	20,622	8	1,768	7,229	6,476	606	7,927
KY	2002	11	HIGHWAY VEHICLES	1,230,148	5,055	156,417	3,723	2,697	6,308	103,503
KY	2002	12	OFF-HIGHWAY	325,993	31	104,571	6,425	6,046	14,043	44,805
KY	2002	14	MISCELLANEOUS	9,651	50,953	209	195,827	26,941	51	4,476
	2002 Total			**1,754,151**	**57,261**	**537,890**	**265,880**	**69,094**	**580,293**	**290,414**
KY	2009	01	FUEL COMB. ELEC. UTIL.	15,812	400	97,263	6,463	4,279	271,669	1,369
KY	2009	02	FUEL COMB. INDUSTRIAL	14,986	195	61,683	2,105	1,456	42,433	1,476
KY	2009	03	FUEL COMB. OTHER	30,045	54	5,178	7,035	6,725	10,123	9,148
KY	2009	04	CHEMICAL & ALLIED PRODUCT MFG	179	249	300	851	633	2,384	3,635
KY	2009	05	METALS PROCESSING	99,428	7	1,156	3,246	2,550	13,735	1,772
KY	2009	06	PETROLEUM & RELATED INDUSTRIES	4,818	377	2,828	344	230	6,460	3,052
KY	2009	07	OTHER INDUSTRIAL PROCESSES	7,212	84	6,674	32,194	10,912	3,634	27,548
KY	2009	08	SOLVENT UTILIZATION	0	10	11	371	283	1	62,595
KY	2009	09	STORAGE & TRANSPORT	38	9	18	2,064	1,268	3	20,038
KY	2009	10	WASTE DISPOSAL & RECYCLING	22,388	9	1,979	7,770	6,925	733	7,725
KY	2009	11	HIGHWAY VEHICLES	963,762	5,796	101,182	2,976	1,920	759	73,942
KY	2009	12	OFF-HIGHWAY	357,800	34	94,752	5,544	5,203	9,180	38,558
KY	2009	14	MISCELLANEOUS	32,627	52,915	702	206,463	29,601	187	6,335
	2009 Total			**1,549,096**	**60,139**	**373,725**	**277,427**	**71,984**	**361,300**	**257,193**
KY	2018	01	FUEL COMB. ELEC. UTIL.	17,144	476	64,378	6,694	4,434	222,102	1,426
KY	2018	02	FUEL COMB. INDUSTRIAL	15,692	205	64,533	2,203	1,528	43,772	1,555
KY	2018	03	FUEL COMB. OTHER	24,764	53	5,550	6,469	6,169	9,947	7,479
KY	2018	04	CHEMICAL & ALLIED PRODUCT MFG	219	317	367	1,054	781	2,884	4,384
KY	2018	05	METALS PROCESSING	114,470	9	1,508	3,898	3,065	15,800	2,343
KY	2018	06	PETROLEUM & RELATED INDUSTRIES	5,495	434	3,244	392	262	7,426	3,394
KY	2018	07	OTHER INDUSTRIAL PROCESSES	8,303	93	7,872	35,349	12,377	4,141	31,394
KY	2018	08	SOLVENT UTILIZATION	0	12	14	464	352	1	73,525
KY	2018	09	STORAGE & TRANSPORT	44	10	21	2,408	1,481	4	21,196
KY	2018	10	WASTE DISPOSAL & RECYCLING	24,677	11	2,256	8,481	7,518	894	8,392
KY	2018	11	HIGHWAY VEHICLES	807,536	7,811	52,263	2,580	1,272	763	47,066
KY	2018	12	OFF-HIGHWAY	381,215	40	79,392	4,556	4,256	8,592	30,920
KY	2018	14	MISCELLANEOUS	33,931	55,118	729	218,725	30,626	196	7,254
	2018 Total			**1,433,491**	**64,588**	**282,127**	**293,273**	**74,122**	**316,520**	**240,329**

State Tier 1 Emission Totals

State	Year	TIER1	TIER 1 NAME	CO	NH3	NOX	PM10	PM2.5	SO2	VOC
MS	2002	01	FUEL COMB. ELEC. UTIL.	5,303	190	43,135	1,633	1,138	67,429	648
MS	2002	02	FUEL COMB. INDUSTRIAL	22,711	28	48,699	5,011	3,638	9,746	8,024
MS	2002	03	FUEL COMB. OTHER	36,752	34	4,502	5,445	5,414	789	22,923
MS	2002	04	CHEMICAL & ALLIED PRODUCT MFG	15,410	361	1,725	849	440	1,663	2,375
MS	2002	05	METALS PROCESSING	1,031	0	115	122	58	36	371
MS	2002	06	PETROLEUM & RELATED INDUSTRIES	975	20	1,187	790	335	15,560	20,788
MS	2002	07	OTHER INDUSTRIAL PROCESSES	13,884	747	9,219	27,617	8,051	8,866	15,525
MS	2002	08	SOLVENT UTILIZATION	45	7	105	219	178	1	80,760
MS	2002	09	STORAGE & TRANSPORT	74	0	80	124	38	40	23,327
MS	2002	10	WASTE DISPOSAL & RECYCLING	1,414	9	89	447	324	31	886
MS	2002	11	HIGHWAY VEHICLES	864,290	3,585	111,914	2,859	2,112	4,614	87,672
MS	2002	12	OFF-HIGHWAY	236,752	23	88,787	5,010	4,690	11,315	41,081
MS	2002	14	MISCELLANEOUS	13,386	58,741	288	323,511	42,932	78	654
	2002 Total			**1,212,028**	**63,748**	**309,845**	**373,637**	**69,348**	**120,166**	**305,035**
MS	2009	01	FUEL COMB. ELEC. UTIL.	7,116	334	47,276	5,182	4,996	76,646	564
MS	2009	02	FUEL COMB. INDUSTRIAL	24,607	30	44,095	3,728	2,787	7,388	8,007
MS	2009	03	FUEL COMB. OTHER	26,024	33	4,514	5,278	5,245	751	17,445
MS	2009	04	CHEMICAL & ALLIED PRODUCT MFG	16,141	405	1,955	941	488	1,880	2,614
MS	2009	05	METALS PROCESSING	1,098	0	128	129	62	37	402
MS	2009	06	PETROLEUM & RELATED INDUSTRIES	1,101	23	1,262	894	379	7,926	13,317
MS	2009	07	OTHER INDUSTRIAL PROCESSES	14,181	197	8,376	31,380	8,628	8,254	16,282
MS	2009	08	SOLVENT UTILIZATION	50	8	118	239	194	1	80,393
MS	2009	09	STORAGE & TRANSPORT	92	0	100	172	59	49	23,494
MS	2009	10	WASTE DISPOSAL & RECYCLING	1,486	10	95	473	339	32	743
MS	2009	11	HIGHWAY VEHICLES	609,972	4,035	70,743	2,275	1,508	537	52,107
MS	2009	12	OFF-HIGHWAY	257,453	25	80,567	4,270	3,985	7,191	36,197
MS	2009	14	MISCELLANEOUS	48,314	63,886	1,037	337,018	46,695	283	2,295
	2009 Total			**1,007,634**	**68,987**	**260,266**	**391,978**	**75,365**	**110,975**	**253,858**
MS	2018	01	FUEL COMB. ELEC. UTIL.	17,348	827	21,535	7,412	7,252	15,213	1,274
MS	2018	02	FUEL COMB. INDUSTRIAL	26,082	33	46,792	4,073	3,039	5,167	8,556
MS	2018	03	FUEL COMB. OTHER	20,900	32	4,768	4,964	4,928	726	14,670
MS	2018	04	CHEMICAL & ALLIED PRODUCT MFG	20,175	475	2,337	1,132	588	2,242	3,290
MS	2018	05	METALS PROCESSING	1,357	0	167	160	79	48	461
MS	2018	06	PETROLEUM & RELATED INDUSTRIES	1,267	26	1,294	1,010	430	8,484	14,407
MS	2018	07	OTHER INDUSTRIAL PROCESSES	16,267	216	9,996	38,492	10,492	9,657	20,301
MS	2018	08	SOLVENT UTILIZATION	60	9	141	301	244	1	98,354
MS	2018	09	STORAGE & TRANSPORT	115	0	124	210	73	62	24,537
MS	2018	10	WASTE DISPOSAL & RECYCLING	1,638	12	114	533	372	34	870
MS	2018	11	HIGHWAY VEHICLES	445,493	4,566	30,619	1,624	819	440	31,616
MS	2018	12	OFF-HIGHWAY	270,726	29	68,252	3,452	3,203	6,638	28,842
MS	2018	14	MISCELLANEOUS	50,160	70,096	1,076	352,321	47,869	294	2,377
	2018 Total			**871,587**	**76,321**	**187,215**	**415,685**	**79,388**	**49,006**	**249,556**

State Tier 1 Emission Totals

State	Year	TIER1	TIER 1 NAME	CO	NH3	NOX	PM10	PM2.5	SO2	VOC
NC	2002	01	FUEL COMB. ELEC. UTIL.	13,885	54	151,850	22,754	16,498	477,990	988
NC	2002	02	FUEL COMB. INDUSTRIAL	23,578	301	48,590	5,596	4,334	33,395	2,540
NC	2002	03	FUEL COMB. OTHER	217,008	2,318	16,460	31,777	26,746	3,971	87,985
NC	2002	04	CHEMICAL & ALLIED PRODUCT MFG	13,952	535	859	866	538	5,736	4,313
NC	2002	05	METALS PROCESSING	5,876	60	201	564	467	1,010	2,512
NC	2002	06	PETROLEUM & RELATED INDUSTRIES	461	0	174	104	52	283	140
NC	2002	07	OTHER INDUSTRIAL PROCESSES	8,552	480	7,380	25,328	8,924	3,426	18,025
NC	2002	08	SOLVENT UTILIZATION	130	307	229	524	484	26	151,383
NC	2002	09	STORAGE & TRANSPORT	66	46	53	639	354	1	16,120
NC	2002	10	WASTE DISPOSAL & RECYCLING	125,528	247	7,482	2,239	2,218	1,666	15,568
NC	2002	11	HIGHWAY VEHICLES	2,873,992	9,702	327,329	6,579	4,623	12,420	263,766
NC	2002	12	OFF-HIGHWAY	808,231	65	84,284	7,348	7,005	7,693	94,480
NC	2002	14	MISCELLANEOUS	35,218	158,900	757	229,909	33,291	203	1,765
	2002 Total			**4,126,478**	**173,014**	**645,648**	**334,226**	**105,533**	**547,821**	**659,585**
NC	2009	01	FUEL COMB. ELEC. UTIL.	14,942	445	66,516	22,152	15,949	242,286	954
NC	2009	02	FUEL COMB. INDUSTRIAL	24,871	312	38,161	5,159	3,871	30,788	2,510
NC	2009	03	FUEL COMB. OTHER	158,837	2,723	18,441	25,334	19,467	4,060	49,819
NC	2009	04	CHEMICAL & ALLIED PRODUCT MFG	14,732	599	933	981	607	6,286	4,925
NC	2009	05	METALS PROCESSING	6,358	67	207	627	528	1,130	2,790
NC	2009	06	PETROLEUM & RELATED INDUSTRIES	556	0	212	127	64	349	162
NC	2009	07	OTHER INDUSTRIAL PROCESSES	9,211	507	8,061	28,524	9,788	3,712	18,144
NC	2009	08	SOLVENT UTILIZATION	142	335	246	549	506	28	136,114
NC	2009	09	STORAGE & TRANSPORT	75	51	55	696	380	1	17,367
NC	2009	10	WASTE DISPOSAL & RECYCLING	139,518	307	8,354	2,774	2,750	1,913	17,331
NC	2009	11	HIGHWAY VEHICLES	1,991,708	11,825	201,609	5,572	3,493	1,503	168,676
NC	2009	12	OFF-HIGHWAY	887,605	72	70,997	6,055	5,760	1,892	74,056
NC	2009	14	MISCELLANEOUS	96,825	167,131	2,080	250,912	49,956	566	4,648
	2009 Total			**3,345,380**	**184,373**	**415,874**	**349,461**	**113,118**	**294,514**	**497,496**
NC	2018	01	FUEL COMB. ELEC. UTIL.	19,870	663	61,103	35,275	28,137	120,165	1,302
NC	2018	02	FUEL COMB. INDUSTRIAL	26,873	341	40,898	5,594	4,222	32,507	2,702
NC	2018	03	FUEL COMB. OTHER	131,365	2,857	20,027	21,847	16,231	4,050	34,104
NC	2018	04	CHEMICAL & ALLIED PRODUCT MFG	18,463	702	1,105	1,175	726	7,414	6,113
NC	2018	05	METALS PROCESSING	7,576	76	255	771	657	1,335	3,516
NC	2018	06	PETROLEUM & RELATED INDUSTRIES	712	0	272	162	82	448	207
NC	2018	07	OTHER INDUSTRIAL PROCESSES	10,675	559	9,259	34,339	11,601	4,357	20,978
NC	2018	08	SOLVENT UTILIZATION	169	375	277	588	540	31	152,979
NC	2018	09	STORAGE & TRANSPORT	91	59	67	808	430	2	19,511
NC	2018	10	WASTE DISPOSAL & RECYCLING	156,599	387	9,456	3,502	3,474	2,234	19,789
NC	2018	11	HIGHWAY VEHICLES	1,362,214	14,065	87,791	4,392	2,123	1,481	101,099
NC	2018	12	OFF-HIGHWAY	960,709	83	49,046	4,298	4,069	905	61,327
NC	2018	14	MISCELLANEOUS	111,705	177,474	2,399	273,030	54,376	655	5,333
	2018 Total			**2,807,022**	**197,643**	**281,955**	**385,780**	**126,667**	**175,583**	**428,960**

State Tier 1 Emission Totals

State	Year	TIER1	TIER 1 NAME	CO	NH3	NOX	PM10	PM2.5	SO2	VOC
SC	2002	01	FUEL COMB. ELEC. UTIL.	6,990	142	88,241	21,400	17,154	206,399	470
SC	2002	02	FUEL COMB. INDUSTRIAL	31,771	97	38,081	5,308	3,641	44,958	1,338
SC	2002	03	FUEL COMB. OTHER	75,800	65	4,367	6,261	6,166	4,318	49,171
SC	2002	04	CHEMICAL & ALLIED PRODUCT MFG	2,526	173	25	501	318	59	8,784
SC	2002	05	METALS PROCESSING	13,833	0	450	639	408	4,160	660
SC	2002	06	PETROLEUM & RELATED INDUSTRIES	248	0	283	120	71	170	114
SC	2002	07	OTHER INDUSTRIAL PROCESSES	9,502	1,237	15,145	15,224	6,981	12,128	16,342
SC	2002	08	SOLVENT UTILIZATION	0	1	1	78	60	0	88,878
SC	2002	09	STORAGE & TRANSPORT	10	0	4	1,025	626	0	21,009
SC	2002	10	WASTE DISPOSAL & RECYCLING	44,844	10	3,380	6,852	6,321	625	13,708
SC	2002	11	HIGHWAY VEHICLES	1,241,359	4,694	140,489	3,452	2,501	5,972	116,163
SC	2002	12	OFF-HIGHWAY	413,964	33	50,249	4,152	3,945	4,866	55,016
SC	2002	14	MISCELLANEOUS	239,836	28,975	4,678	264,959	48,898	1,281	13,655
	2002 Total			**2,080,683**	**35,426**	**345,395**	**329,971**	**97,090**	**284,936**	**385,308**
SC	2009	01	FUEL COMB. ELEC. UTIL.	11,643	370	48,668	20,041	16,548	129,122	723
SC	2009	02	FUEL COMB. INDUSTRIAL	32,661	105	35,011	2,978	2,087	36,660	1,374
SC	2009	03	FUEL COMB. OTHER	49,914	63	4,551	5,264	5,183	4,359	25,073
SC	2009	04	CHEMICAL & ALLIED PRODUCT MFG	2,798	173	26	543	345	60	7,409
SC	2009	05	METALS PROCESSING	15,632	0	448	631	378	4,856	663
SC	2009	06	PETROLEUM & RELATED INDUSTRIES	302	0	340	145	86	200	131
SC	2009	07	OTHER INDUSTRIAL PROCESSES	10,241	1,403	15,069	18,201	7,997	13,443	15,425
SC	2009	08	SOLVENT UTILIZATION	1	1	1	75	58	0	94,590
SC	2009	09	STORAGE & TRANSPORT	13	0	5	569	352	0	21,987
SC	2009	10	WASTE DISPOSAL & RECYCLING	70,379	11	4,215	9,526	8,977	666	15,998
SC	2009	11	HIGHWAY VEHICLES	889,957	5,523	92,499	2,862	1,855	721	72,603
SC	2009	12	OFF-HIGHWAY	448,625	36	43,235	3,471	3,294	1,701	43,061
SC	2009	14	MISCELLANEOUS	250,690	31,416	4,962	282,480	51,151	1,359	13,906
	2009 Total			**1,782,856**	**39,101**	**249,028**	**346,786**	**98,312**	**193,147**	**312,943**
SC	2018	01	FUEL COMB. ELEC. UTIL.	14,975	625	51,751	27,640	23,794	95,377	931
SC	2018	02	FUEL COMB. INDUSTRIAL	35,532	113	36,645	3,683	2,548	38,548	1,482
SC	2018	03	FUEL COMB. OTHER	39,627	65	5,135	4,791	4,711	4,469	16,391
SC	2018	04	CHEMICAL & ALLIED PRODUCT MFG	3,296	212	32	664	423	74	9,107
SC	2018	05	METALS PROCESSING	18,853	0	585	773	476	5,920	867
SC	2018	06	PETROLEUM & RELATED INDUSTRIES	389	0	438	186	110	258	166
SC	2018	07	OTHER INDUSTRIAL PROCESSES	12,136	1,566	17,507	20,128	8,981	15,863	18,290
SC	2018	08	SOLVENT UTILIZATION	1	1	1	93	72	0	119,154
SC	2018	09	STORAGE & TRANSPORT	16	0	6	1,380	842	0	22,739
SC	2018	10	WASTE DISPOSAL & RECYCLING	73,403	13	4,512	10,038	9,443	735	17,167
SC	2018	11	HIGHWAY VEHICLES	663,493	6,473	43,490	2,184	1,087	643	46,301
SC	2018	12	OFF-HIGHWAY	481,332	41	31,758	2,617	2,474	1,198	36,131
SC	2018	14	MISCELLANEOUS	250,637	34,345	4,961	306,342	53,367	1,359	13,896
	2018 Total			**1,593,690**	**43,455**	**196,820**	**380,519**	**108,327**	**164,444**	**302,623**

State Tier 1 Emission Totals

State	Year	TIER1	TIER 1 NAME	CO	NH3	NOX	PM10	PM2.5	SO2	VOC
TN	2002	01	FUEL COMB. ELEC. UTIL.	7,084	204	157,307	14,640	12,166	334,151	926
TN	2002	02	FUEL COMB. INDUSTRIAL	15,257	6	44,510	8,015	6,649	74,146	2,021
TN	2002	03	FUEL COMB. OTHER	77,857	25	15,568	7,967	7,549	16,253	18,346
TN	2002	04	CHEMICAL & ALLIED PRODUCT MFG	36,920	1,518	1,772	3,246	2,201	6,516	24,047
TN	2002	05	METALS PROCESSING	41,371	14	1,182	7,620	7,030	5,818	6,898
TN	2002	06	PETROLEUM & RELATED INDUSTRIES	543	0	331	314	243	383	1,850
TN	2002	07	OTHER INDUSTRIAL PROCESSES	9,420	44	11,794	30,484	12,867	5,845	27,336
TN	2002	08	SOLVENT UTILIZATION	275	1	5,066	2,103	1,818	58	110,872
TN	2002	09	STORAGE & TRANSPORT	22	24	105	1,249	736	134	21,962
TN	2002	10	WASTE DISPOSAL & RECYCLING	22,143	31	1,839	7,068	6,469	349	15,505
TN	2002	11	HIGHWAY VEHICLES	1,917,842	6,625	238,577	5,371	3,949	9,226	179,807
TN	2002	12	OFF-HIGHWAY	505,163	43	96,827	6,819	6,458	10,441	66,450
TN	2002	14	MISCELLANEOUS	5,003	34,292	100	179,440	24,708	25	1,978
	2002 Total			**2,638,901**	**42,825**	**574,980**	**274,337**	**92,841**	**463,345**	**477,997**
TN	2009	01	FUEL COMB. ELEC. UTIL.	7,214	227	66,405	15,608	13,092	255,410	932
TN	2009	02	FUEL COMB. INDUSTRIAL	15,536	6	37,046	7,157	5,973	63,076	1,773
TN	2009	03	FUEL COMB. OTHER	61,442	27	14,792	7,134	6,786	16,955	12,781
TN	2009	04	CHEMICAL & ALLIED PRODUCT MFG	35,440	1,719	1,958	3,369	2,271	1,949	15,492
TN	2009	05	METALS PROCESSING	45,183	15	1,245	7,337	6,823	6,537	7,671
TN	2009	06	PETROLEUM & RELATED INDUSTRIES	572	0	328	355	276	263	1,401
TN	2009	07	OTHER INDUSTRIAL PROCESSES	9,911	62	12,635	32,599	13,687	6,240	28,338
TN	2009	08	SOLVENT UTILIZATION	309	1	5,983	2,431	2,095	65	112,264
TN	2009	09	STORAGE & TRANSPORT	26	31	12	1,218	733	42	23,686
TN	2009	10	WASTE DISPOSAL & RECYCLING	23,810	35	1,993	7,618	6,968	393	14,922
TN	2009	11	HIGHWAY VEHICLES	1,338,016	7,782	151,912	4,206	2,751	1,076	115,181
TN	2009	12	OFF-HIGHWAY	554,121	48	86,641	5,877	5,557	5,651	55,358
TN	2009	14	MISCELLANEOUS	17,921	35,200	379	192,464	26,830	102	2,814
	2009 Total			**2,109,500**	**45,152**	**381,331**	**287,371**	**93,842**	**357,760**	**392,612**
TN	2018	01	FUEL COMB. ELEC. UTIL.	7,723	241	31,715	15,941	13,387	112,672	976
TN	2018	02	FUEL COMB. INDUSTRIAL	16,702	7	38,028	7,648	6,408	47,982	1,905
TN	2018	03	FUEL COMB. OTHER	54,486	30	15,502	6,757	6,412	18,091	10,269
TN	2018	04	CHEMICAL & ALLIED PRODUCT MFG	45,455	2,053	2,424	4,263	2,888	6,563	19,950
TN	2018	05	METALS PROCESSING	52,834	17	1,589	9,579	8,953	7,790	9,950
TN	2018	06	PETROLEUM & RELATED INDUSTRIES	665	0	378	414	324	309	1,598
TN	2018	07	OTHER INDUSTRIAL PROCESSES	10,946	88	14,157	38,196	16,242	7,286	35,126
TN	2018	08	SOLVENT UTILIZATION	380	1	7,675	3,154	2,717	79	140,760
TN	2018	09	STORAGE & TRANSPORT	33	41	14	1,571	939	49	25,491
TN	2018	10	WASTE DISPOSAL & RECYCLING	26,712	42	2,326	8,562	7,828	468	17,530
TN	2018	11	HIGHWAY VEHICLES	976,634	9,021	69,385	3,092	1,544	948	67,324
TN	2018	12	OFF-HIGHWAY	593,100	55	70,226	4,672	4,403	5,207	45,084
TN	2018	14	MISCELLANEOUS	19,210	36,213	408	209,058	28,209	111	3,293
	2018 Total			**1,804,879**	**47,809**	**253,828**	**312,906**	**100,255**	**207,555**	**379,257**

State Tier 1 Emission Totals

State	Year	TIER1	TIER 1 NAME	CO	NH3	NOX	PM10	PM2.5	SO2	VOC
VA	2002	01	FUEL COMB. ELEC. UTIL.	6,892	127	86,886	3,960	2,606	241,204	754
VA	2002	02	FUEL COMB. INDUSTRIAL	64,398	100	75,831	18,480	8,453	137,451	5,332
VA	2002	03	FUEL COMB. OTHER	98,788	13	15,648	11,572	11,236	5,508	54,496
VA	2002	04	CHEMICAL & ALLIED PRODUCT MFG	321	2,158	8,062	449	393	2,126	1,530
VA	2002	05	METALS PROCESSING	3,580	0	937	1,575	1,349	5,251	513
VA	2002	06	PETROLEUM & RELATED INDUSTRIES	23,384	0	182	255	153	170	501
VA	2002	07	OTHER INDUSTRIAL PROCESSES	12,002	726	9,279	33,409	9,795	17,702	13,086
VA	2002	08	SOLVENT UTILIZATION	0	4	0	225	210	2	111,511
VA	2002	09	STORAGE & TRANSPORT	16	7	11	745	505	0	26,121
VA	2002	10	WASTE DISPOSAL & RECYCLING	16,566	109	1,866	3,152	1,277	1,581	4,065
VA	2002	11	HIGHWAY VEHICLES	2,163,259	7,852	222,374	4,549	3,102	8,294	159,790
VA	2002	12	OFF-HIGHWAY	660,105	48	63,219	8,728	8,288	8,663	74,866
VA	2002	14	MISCELLANEOUS	16,238	43,961	350	182,486	22,086	92	848
	2002 Total			**3,065,551**	**55,105**	**484,646**	**269,585**	**69,453**	**428,046**	**453,413**
VA	2009	01	FUEL COMB. ELEC. UTIL.	12,535	694	64,358	5,606	4,165	174,777	788
VA	2009	02	FUEL COMB. INDUSTRIAL	67,422	105	67,263	18,346	8,345	131,459	5,483
VA	2009	03	FUEL COMB. OTHER	66,016	10	15,920	10,059	9,741	5,118	28,062
VA	2009	04	CHEMICAL & ALLIED PRODUCT MFG	286	2,082	7,790	477	413	1,996	1,419
VA	2009	05	METALS PROCESSING	3,397	0	827	1,563	1,332	4,813	390
VA	2009	06	PETROLEUM & RELATED INDUSTRIES	26,288	0	197	275	169	187	557
VA	2009	07	OTHER INDUSTRIAL PROCESSES	12,471	733	9,425	33,961	9,984	18,643	13,394
VA	2009	08	SOLVENT UTILIZATION	0	5	0	248	231	3	110,127
VA	2009	09	STORAGE & TRANSPORT	17	7	12	797	544	0	26,456
VA	2009	10	WASTE DISPOSAL & RECYCLING	20,109	119	2,174	3,823	1,515	1,805	4,789
VA	2009	11	HIGHWAY VEHICLES	1,453,946	9,086	134,232	3,747	2,241	1,079	96,770
VA	2009	12	OFF-HIGHWAY	726,815	53	54,993	7,510	7,136	1,707	57,009
VA	2009	14	MISCELLANEOUS	21,582	46,719	464	198,040	23,990	124	1,077
	2009 Total			**2,410,884**	**59,612**	**357,655**	**284,451**	**69,806**	**341,710**	**346,321**
VA	2018	01	FUEL COMB. ELEC. UTIL.	18,850	606	64,344	12,551	10,773	98,988	980
VA	2018	02	FUEL COMB. INDUSTRIAL	72,065	114	70,132	19,247	8,904	134,790	5,861
VA	2018	03	FUEL COMB. OTHER	53,171	14	17,852	9,427	9,086	5,230	18,603
VA	2018	04	CHEMICAL & ALLIED PRODUCT MFG	338	2,462	9,211	579	502	1,297	1,708
VA	2018	05	METALS PROCESSING	4,034	0	1,017	1,861	1,592	5,374	469
VA	2018	06	PETROLEUM & RELATED INDUSTRIES	30,284	0	228	315	194	217	642
VA	2018	07	OTHER INDUSTRIAL PROCESSES	14,029	877	10,836	37,553	11,276	18,088	15,636
VA	2018	08	SOLVENT UTILIZATION	0	6	0	314	293	3	127,953
VA	2018	09	STORAGE & TRANSPORT	21	8	15	949	648	0	27,357
VA	2018	10	WASTE DISPOSAL & RECYCLING	24,293	141	2,595	4,694	1,828	2,170	5,821
VA	2018	11	HIGHWAY VEHICLES	1,075,104	10,624	63,342	3,212	1,543	1,043	61,964
VA	2018	12	OFF-HIGHWAY	797,683	61	40,393	6,208	5,891	507	49,052
VA	2018	14	MISCELLANEOUS	27,223	50,279	584	218,141	26,225	158	1,322
	2018 Total			**2,117,096**	**65,192**	**280,549**	**315,051**	**78,754**	**267,867**	**317,368**

State Tier 1 Emission Totals

State	Year	TIER1	TIER 1 NAME	CO	NH3	NOX	PM10	PM2.5	SO2	VOC
WV	2002	01	FUEL COMB. ELEC. UTIL.	10,341	121	230,977	4,573	2,210	516,084	1,180
WV	2002	02	FUEL COMB. INDUSTRIAL	8,685	97	33,825	1,583	1,332	37,111	1,097
WV	2002	03	FUEL COMB. OTHER	29,480	13	15,220	3,814	3,683	3,990	9,275
WV	2002	04	CHEMICAL & ALLIED PRODUCT MFG	50,835	80	1,627	950	831	9,052	5,755
WV	2002	05	METALS PROCESSING	28,837	143	1,570	8,749	7,515	5,619	1,393
WV	2002	06	PETROLEUM & RELATED INDUSTRIES	1	0	1,086	475	475	7,550	2,163
WV	2002	07	OTHER INDUSTRIAL PROCESSES	2,003	56	5,347	18,751	5,567	2,316	1,803
WV	2002	08	SOLVENT UTILIZATION	15	0	18	49	44	0	35,989
WV	2002	09	STORAGE & TRANSPORT	15	0	3	1,952	947	0	12,432
WV	2002	10	WASTE DISPOSAL & RECYCLING	9,395	8	599	4,153	3,731	100	5,098
WV	2002	11	HIGHWAY VEHICLES	533,471	1,908	58,999	1,381	995	2,464	42,174
WV	2002	12	OFF-HIGHWAY	133,113	9	33,239	1,850	1,728	2,112	18,566
WV	2002	14	MISCELLANEOUS	6,897	9,928	149	93,030	10,799	40	349
	2002 Total			**813,089**	**12,364**	**382,659**	**141,310**	**39,857**	**586,436**	**137,275**
WV	2009	01	FUEL COMB. ELEC. UTIL.	11,493	330	85,476	5,657	2,940	268,952	1,361
WV	2009	02	FUEL COMB. INDUSTRIAL	9,529	104	27,109	1,432	1,243	36,964	979
WV	2009	03	FUEL COMB. OTHER	21,558	13	14,229	3,351	3,216	4,047	6,824
WV	2009	04	CHEMICAL & ALLIED PRODUCT MFG	58,271	82	1,804	981	858	10,102	5,426
WV	2009	05	METALS PROCESSING	24,501	116	1,494	2,016	1,507	5,608	831
WV	2009	06	PETROLEUM & RELATED INDUSTRIES	1	0	1,221	535	535	8,495	2,172
WV	2009	07	OTHER INDUSTRIAL PROCESSES	2,288	59	4,995	19,240	5,910	2,570	2,064
WV	2009	08	SOLVENT UTILIZATION	17	0	20	52	47	0	32,199
WV	2009	09	STORAGE & TRANSPORT	17	0	3	1,756	695	0	12,997
WV	2009	10	WASTE DISPOSAL & RECYCLING	9,131	8	583	4,036	3,618	97	4,806
WV	2009	11	HIGHWAY VEHICLES	365,549	2,148	35,635	1,068	684	279	24,843
WV	2009	12	OFF-HIGHWAY	152,862	11	30,133	1,640	1,528	359	18,069
WV	2009	14	MISCELLANEOUS	4,116	10,574	89	93,957	11,002	23	219
	2009 Total			**659,332**	**13,446**	**202,791**	**135,720**	**33,782**	**337,495**	**112,790**
WV	2018	01	FUEL COMB. ELEC. UTIL.	12,397	143	51,474	5,784	3,116	106,199	1,387
WV	2018	02	FUEL COMB. INDUSTRIAL	10,174	111	28,764	1,505	1,308	38,571	1,048
WV	2018	03	FUEL COMB. OTHER	18,891	16	17,254	3,160	3,024	4,065	6,270
WV	2018	04	CHEMICAL & ALLIED PRODUCT MFG	70,252	99	2,183	1,181	1,034	12,196	6,560
WV	2018	05	METALS PROCESSING	28,563	148	1,929	2,491	1,887	6,735	1,087
WV	2018	06	PETROLEUM & RELATED INDUSTRIES	1	0	1,407	616	616	9,786	2,338
WV	2018	07	OTHER INDUSTRIAL PROCESSES	2,756	68	5,949	21,363	6,809	3,101	2,561
WV	2018	08	SOLVENT UTILIZATION	20	0	24	61	55	0	37,886
WV	2018	09	STORAGE & TRANSPORT	19	0	4	2,080	824	0	13,394
WV	2018	10	WASTE DISPOSAL & RECYCLING	9,237	10	592	4,116	3,674	98	5,153
WV	2018	11	HIGHWAY VEHICLES	274,804	2,497	17,247	819	405	253	16,121
WV	2018	12	OFF-HIGHWAY	167,424	13	25,710	1,292	1,198	56	14,086
WV	2018	14	MISCELLANEOUS	5,175	11,453	112	99,667	11,803	29	268
	2018 Total			**599,712**	**14,557**	**152,647**	**144,134**	**35,752**	**181,088**	**108,159**

State Tier 1 Emission Totals

	CO	NH3	NOX	PM10	PM2.5	SO2	VOC
VISTAS 2002 Total	**30,073,168**	**665,818**	**5,429,845**	**3,895,998**	**1,075,343**	**4,879,941**	**5,178,836**
VISTAS 2009 Total	**25,397,398**	**721,736**	**3,790,044**	**4,160,870**	**1,123,548**	**3,465,859**	**4,187,921**
VISTAS 2018 Total	**22,645,302**	**792,678**	**2,722,636**	**4,548,634**	**1,194,728**	**2,169,725**	**3,910,170**

APPENDIX D:

VISTAS TIER 1 EMISSION TOTALS

VISTAS Tier 1 Emission Totals

Year	TIER1	TIER1NAME	CO	NH3	NOX	PM10-PRI	PM25-PRI	SO2	VOC
2002	01	FUEL COMB. ELEC. UTIL.	141,217	1,799	1,523,445	113,917	79,269	3,743,723	12,515
2002	02	FUEL COMB. INDUSTRIAL	371,932	1,204	499,943	85,357	59,735	550,866	32,333
2002	03	FUEL COMB. OTHER	759,534	2,810	122,062	99,532	91,805	114,852	354,375
2002	04	CHEMICAL & ALLIED PRODUCT MFG	131,993	7,093	20,896	11,114	7,982	77,450	63,748
2002	05	METALS PROCESSING	223,705	601	11,801	32,367	27,778	49,143	17,306
2002	06	PETROLEUM & RELATED INDUSTRIES	44,633	355	7,204	2,887	1,863	53,392	33,374
2002	07	OTHER INDUSTRIAL PROCESSES	156,077	7,520	114,474	267,980	97,013	86,736	196,831
2002	08	SOLVENT UTILIZATION	687	331	5,677	3,805	3,284	90	1,288,990
2002	09	STORAGE & TRANSPORT	610	85	1,069	10,968	6,100	230	261,959
2002	10	WASTE DISPOSAL & RECYCLING	546,331	801	28,738	80,336	73,673	6,418	99,497
2002	11	HIGHWAY VEHICLES	19,432,305	73,670	2,187,683	50,338	35,813	89,296	1,890,798
2002	12	OFF-HIGHWAY	6,209,596	477	865,130	72,019	68,302	96,336	813,788
2002	14	MISCELLANEOUS	2,054,548	569,073	41,724	3,065,377	522,726	11,407	113,321
2002 Total			**30,073,168**	**665,818**	**5,429,845**	**3,895,998**	**1,075,343**	**4,879,941**	**5,178,836**
2009	01	FUEL COMB. ELEC. UTIL.	190,535	5,474	789,299	125,750	91,587	2,497,423	14,208
2009	02	FUEL COMB. INDUSTRIAL	391,422	1,305	445,967	74,588	51,491	514,636	32,431
2009	03	FUEL COMB. OTHER	544,289	3,198	123,297	85,410	77,042	112,323	207,146
2009	04	CHEMICAL & ALLIED PRODUCT MFG	140,910	7,611	22,031	11,742	8,394	76,021	54,168
2009	05	METALS PROCESSING	236,473	705	11,763	25,130	21,288	54,337	17,954
2009	06	PETROLEUM & RELATED INDUSTRIES	48,118	399	7,863	3,282	2,124	46,975	25,028
2009	07	OTHER INDUSTRIAL PROCESSES	166,088	7,545	117,625	298,719	111,218	90,420	202,567
2009	08	SOLVENT UTILIZATION	771	360	6,662	4,274	3,679	100	1,256,884
2009	09	STORAGE & TRANSPORT	702	98	1,087	10,729	5,743	160	275,462
2009	10	WASTE DISPOSAL & RECYCLING	770,459	869	36,697	105,449	97,841	7,287	113,473
2009	11	HIGHWAY VEHICLES	13,864,869	87,027	1,414,834	41,861	26,498	10,962	1,217,185
2009	12	OFF-HIGHWAY	6,827,857	530	767,707	61,528	58,279	42,845	649,786
2009	14	MISCELLANEOUS	2,214,906	606,617	45,212	3,312,407	568,364	12,370	121,629
2009 Total			**25,397,398**	**721,736**	**3,790,044**	**4,160,870**	**1,123,548**	**3,465,859**	**4,187,921**
2018	01	FUEL COMB. ELEC. UTIL.	262,414	9,306	568,158	152,642	118,959	1,169,110	17,090
2018	02	FUEL COMB. INDUSTRIAL	416,721	1,383	470,326	80,011	55,648	513,072	34,720
2018	03	FUEL COMB. OTHER	453,482	3,358	136,431	78,032	69,854	116,672	149,363
2018	04	CHEMICAL & ALLIED PRODUCT MFG	173,857	9,023	26,564	14,454	10,360	94,010	67,414
2018	05	METALS PROCESSING	279,850	926	14,871	31,221	26,572	66,150	23,089
2018	06	PETROLEUM & RELATED INDUSTRIES	53,392	460	8,891	3,845	2,490	43,055	27,283
2018	07	OTHER INDUSTRIAL PROCESSES	189,922	8,793	136,722	348,119	130,778	100,824	237,601
2018	08	SOLVENT UTILIZATION	936	404	8,480	5,354	4,601	119	1,515,005
2018	09	STORAGE & TRANSPORT	855	119	1,258	13,540	7,283	192	290,267
2018	10	WASTE DISPOSAL & RECYCLING	821,737	1,068	40,324	114,690	105,745	8,544	125,406
2018	11	HIGHWAY VEHICLES	10,312,627	103,394	663,796	33,426	16,403	10,281	752,732
2018	12	OFF-HIGHWAY	7,438,312	612	601,040	48,648	45,927	35,166	546,062
2018	14	MISCELLANEOUS	2,241,196	653,831	45,776	3,624,653	600,107	12,532	124,137
2018 Total			**22,645,302**	**792,678**	**2,722,636**	**4,548,634**	**1,194,728**	**2,169,725**	**3,910,170**

APPENDIX E:

AIRCRAFT PM EXCERPT FROM 2001 TUCSON REPORT

Final Report

EMISSIONS INVENTORIES FOR THE TUCSON AIR PLANNING AREA

VOLUME I. STUDY DESCRIPTION AND RESULTS

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ABBREVIATIONS AND ACRONYMS

ADEQ	Arizona Department of Environmental Quality
ADWM	Arizona Department of Weights and Measures
ALD2	High Molecular Weight Aldehydes (RCHO, R≠H)
AML	Arc Macro Language
AQM	Air Quality Model
APU	Aircraft Power Unit
ARB	California Air Resources Board
ASC	Area Source Category Code
AT	Air Taxi
CNG	Compressed Natural Gas
CO	Carbon Monoxide
CSF	Chemical Speciation Factor
DM	Davis-Monthan Air Force Base
DOT	Department of Transportation
EDMS	Emissions Dispersion Modeling System
EEA	Energy & Environmental Analysis, Inc.
EIPP	Emission Inventory Preparation Plan
EPA	The U.S. Environmental Protection Agency
ETH	Ethene ($CH_2{=}CH_2$)
FAA	Federal Aviation Administration
FAEED	FAA Aircraft Engine Emission Database
FIPS	Federal Information Processing System
FIRE	EPA's Factor Information REtrieval Data System
FORM	Formaldehyde ($CH_2{=}O$)
GA	General Aviation
GIS	Geographical Information System
GSE	Ground Support Equipment
ICAO	International Civil Aviation Organization

ABBREVIATIONS AND ACRONYMS

ISOP	Isoprene
LPG	Liquid Petroleum Gas
LTO	Landing and TakeOff
NAD27	North American Datum - 1927
NCDC	National Climatic Data Center
NEI	US EPA National Emission Inventory
NEVES	Nonroad Engine and Vehicle Emission Study
NG	Natural Gas
NO	Nitric Oxide
NO_2	Nitrogen Dioxide
NO_X	Oxides of Nitrogen
OLE	Olefinic Carbon Bond (C═C)
ORNL	Oak Ridge National Laboratory
PAG	Pima Association of Governments
PAR	Paraffinic Carbon Bond (C—C)
PDEQ	Pima County Department of Environmental Quality
PM	Particulate Matter
$PM_{2.5}$	Particulate Matter less than 2.5 microns
PM_{10}	Particulate Matter less than 10 microns
RASP	Regional Aviation System Plan
RVP	Reid Vapor Pressure
SAF	Spatial Allocation Factor
SCC	Source Category Code
SCF	Standard Cubic Foot
SIC	Standard Industrial Classification
SIP	State Implementation Plan
SO_2	Sulfur Dioxide
SO_X	Oxides of Sulfur
TAF	Temporal Allocation Factor

ABBREVIATIONS AND ACRONYMS

TAPA	Tucson Air Planning Area
TAZ	Transportation Analysis Zone
THC	Total Hydrocarbon
TIA	Tucson International Airport
TIM	Time-In-Mode
TOL	Tolulene (C_6H_5—CH_3)
TTN	EPA Technology Transfer Network
UAM	Urban Airshed Model
UP	Union Pacific Railroad
VOC	Volatile Organic Compounds as defined by the 1990 Clean Air Act Amendments
XYL	Xylene (C_6H_6—$(CH_3)_2$)

(Prior material unrelated to VISTAS modeling is intentionally omitted)

While emission rates for HC, CO, and NO_x are routinely measured from (new) commercial air carrier engines under the emissions certification component of International Civil Aviation Organization (ICAO) regulations, measurement of PM emissions is not required. As a result, almost all aircraft engine PM emission rate data have been collected under special studies. Currently, such data exists for only about 20 aircraft engines, with a considerable portion of these data collected by the U.S. Air Force for military aircraft engines. While emission factors for these engines are included in the AP-42 database upon which the FAEED and EDMS emission inventory models were developed, they have not been included in either model due to their limited applicability. To date, it has been standard EPA practice not to estimate PM emissions for aircraft engines. However, since the emissions models maintain a placekeeper for PM emission rates and include PM emission estimates for GSE, it can appear to the uninformed user that aircraft PM emission rates are zero. As a result, aircraft are often incorrectly considered to be insignificant PM sources even though those engines tested for PM have demonstrated significant emission rates. This policy of exclusion by omission is not appropriate in developing an accurate modeling inventory, even in the absence of a large emissions database. While a precise emissions estimate cannot be made with available data, it is clear that a zero emission rate is far from accurate.

As an alternative for this study, measured emissions data for aircraft engines that have been tested for PM were statistically analyzed to determine whether or not a relationship to other measured emissions parameters could be established. Intuitively, it was hoped that an inverse relationship with NO_x might be demonstrated, as such a relationship is theoretically attractive. While the level of sophistication of the statistical analysis is constrained by the quantity of data available, simple direct and indirect linear relationships can be examined. Because data are not available for each test engine in each of the four LTO cycle modes and because relationships might be expected to vary by operating mode (due to significant changes in engine and combustion efficiency), all statistical analysis was performed for each operating mode individually.

Statistically significant relationships were found for the direct linear analysis for three of the four LTO cycle modes. Significant in this context means that coefficient t-statistics for one or more of the other measured pollutants (HC, CO, or NO_x) indicated a direct relationship with measured PM (at a confidence level exceeding 95 percent). In all cases, correlation coefficients were poor (as expected), suggesting a high level of variability and poor predictability of PM emissions for any given engine. Nevertheless, statistics were unbiased and should provide an accurate mechanism to initially assess PM emissions on a aggregate basis (i.e., over a range of aircraft engine models such as those associated with an analysis for an entire set of airport operations). Only at idle was no significant relation found, which is not surprising given relative engine inefficiency in this mode.

The indirect linear analysis revealed a consistent and significant inverse relationship between PM and NO_x based on calculated t-statistics. Correlation coefficients continue to be poor, but t-statistics are generally improved over those of the direct linear analysis (all developed inverse relations, including idle, were significant at the 99 percent confidence level). In selecting the most appropriate relationship for estimation of PM emission rates for non-tested aircraft engines, the statistical analysis that produced the best combination of a significant t-statistic, a relatively low root mean square error, and an intuitive engineering basis was identified. This was the inverse NO_x relationship for the takeoff (i.e., full throttle) mode of operation. Figure 4-1 illustrates the selected statistical relationship.

With this relationship established, PM emission rate data for the other aircraft operating modes (i.e., the approach, taxi, and climbout modes) was statistically analyzed against observed PM emission rate data for the takeoff mode. Statistically significant relations were developed for all three modes. Table 4-23 presents the coefficients developed for these PM-to-PM regressions as well as the statistics for the PM-to-NO_x regression developed for the takeoff mode. These four relations were used to develop a set of fleetwide PM emission factors based on measured takeoff NO_x emission rates. These emission factors were then input into the EEA aircraft emissions model and used to generate PM emission estimates for TIA aircraft operations.

FIGURE 4-1. Relationship Used to Estimate Aircraft PM Emission Rates

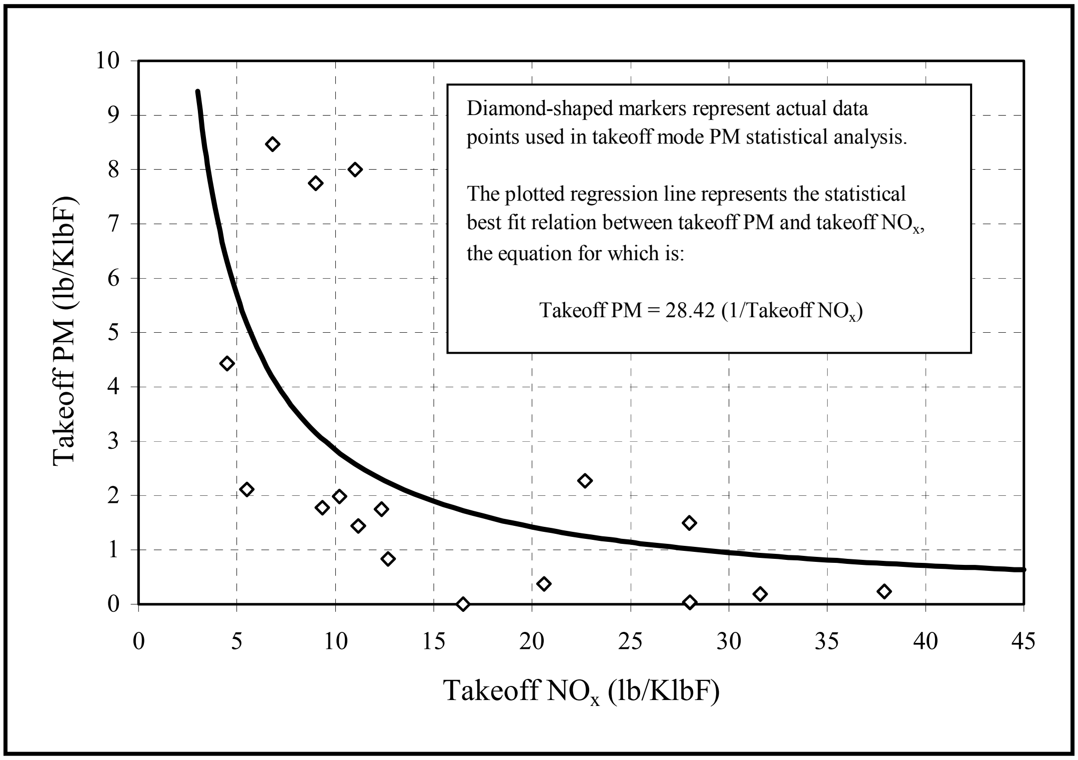


TABLE 4-23. Statistics for Aircraft and APU PM Relations

Statistical Parameter	Takeoff PM	Climbout PM	Approach PM	Taxi PM
Predictive Parameter	1/Takeoff NO_x	Takeoff PM	Takeoff PM	Takeoff PM
Coefficient	28.42	1.42	1.53	3.10
Coefficient t-statistic	5.1	11.8	14.9	5.7
Correlation Coefficient	0.30	0.84	0.91	0.56
F-statistic	7.4	86.1	135.7	21.9
Number of Observations	18	17	15	18

(Subsequent material unrelated to VISTAS modeling is intentionally omitted)

APPENDIX F:

COMPARISON OF BASE F AND BASE G ON-ROAD MOBILE EMISSIONS

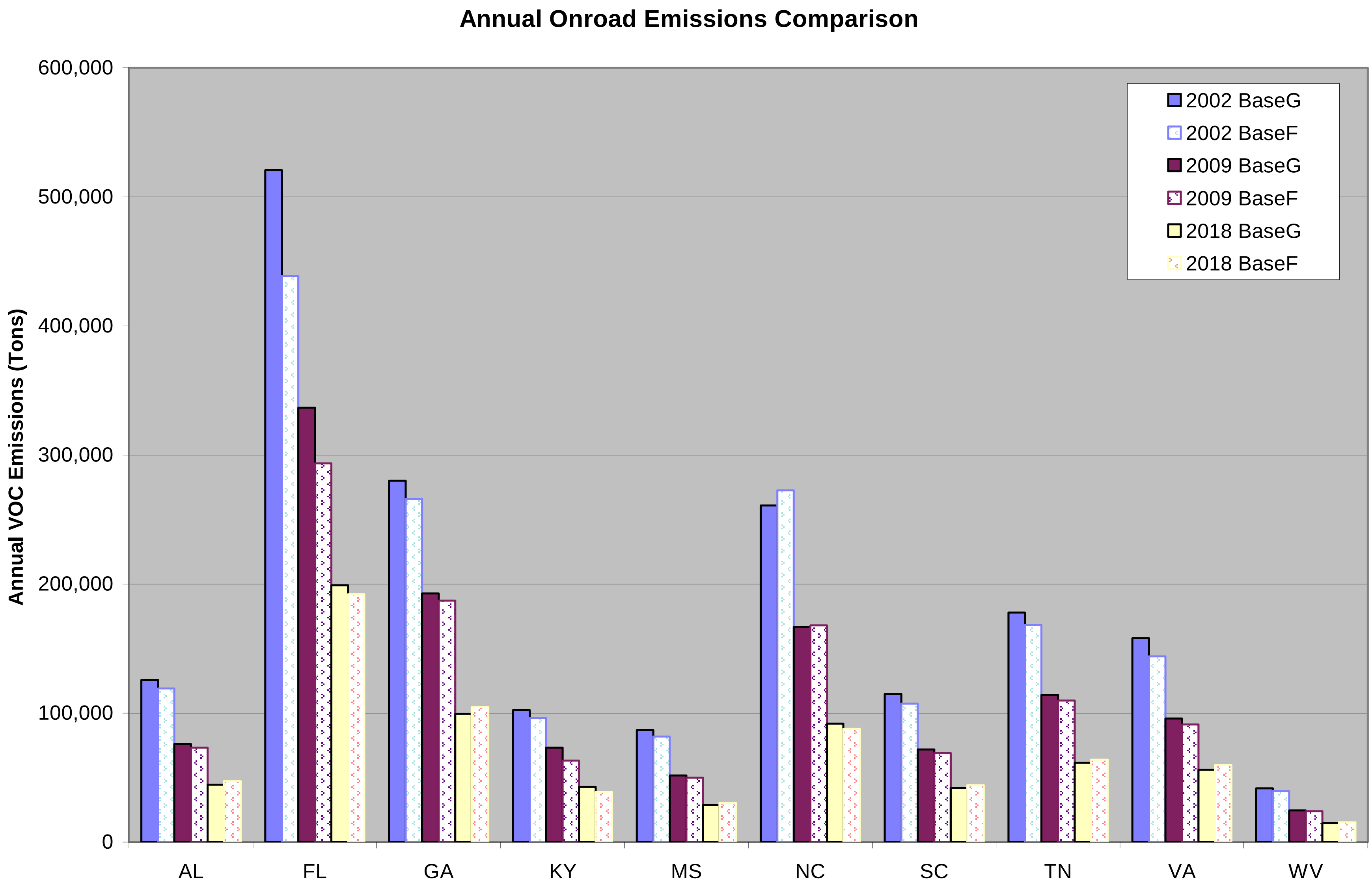
Base G Onroad Mobile Emissions (Annual Tons)																					
	VOC			NOx			CO			SO2			PM-10			PM-2.5			NH3		
FIPSST	2002	2009	2018	2002	2009	2018	2002	2009	2018	2002	2009	2018	2002	2009	2018	2002	2009	2018	2002	2009	2018
AL	125,768	76,065	44,503	156,460	100,693	42,622	1,303,508	902,469	594,725	6,827	802	654	3,861	3,136	2,193	2,768	2,010	1,085	5,530	6,298	6,630
FL	520,757	336,707	199,050	460,503	312,321	136,040	4,493,820	3,308,863	2,263,190	20,687	2,584	2,302	11,148	9,801	7,516	7,779	6,104	3,671	17,922	21,549	23,778
GA	279,975	192,773	99,464	304,309	207,024	92,113	2,699,650	1,956,263	1,303,529	12,043	1,568	1,325	7,165	6,005	4,406	5,110	3,797	2,166	10,436	12,554	13,511
KY	102,362	73,142	42,810	154,634	100,025	46,993	1,214,191	950,912	711,211	6,238	751	694	3,682	2,944	2,348	2,667	1,899	1,158	5,003	5,737	7,095
MS	86,811	51,600	28,699	110,672	69,952	27,620	853,774	602,257	394,247	4,566	532	401	2,828	2,250	1,479	2,089	1,491	746	3,549	3,995	4,147
NC	260,895	166,844	91,720	323,606	199,281	79,433	2,839,283	1,966,195	1,207,391	12,286	1,487	1,346	6,505	5,510	3,994	4,571	3,453	1,931	9,601	11,702	12,776
SC	114,861	71,781	41,866	138,940	91,471	39,348	1,226,555	878,825	588,536	5,909	713	584	3,414	2,831	1,986	2,473	1,834	988	4,646	5,466	5,878
TN	177,943	114,032	61,339	235,869	150,179	62,446	1,893,704	1,320,562	863,682	9,127	1,065	862	5,312	4,160	2,813	3,904	2,720	1,405	6,556	7,702	8,196
VA	157,989	95,694	55,992	219,835	132,699	57,192	2,136,288	1,435,359	954,463	8,196	1,067	949	4,499	3,706	2,922	3,067	2,216	1,404	7,770	8,990	9,653
WV	41,703	24,570	14,652	58,340	35,234	15,530	526,841	360,865	243,683	2,438	276	231	1,366	1,057	747	984	676	369	1,889	2,126	2,268
VISTAS	**1,869,063**	**1,203,208**	**680,096**	**2,163,168**	**1,398,879**	**599,336**	**19,187,613**	**13,682,570**	**9,124,656**	**88,316**	**10,844**	**9,348**	**49,780**	**41,400**	**30,403**	**35,411**	**26,200**	**14,922**	**72,902**	**86,118**	**93,932**

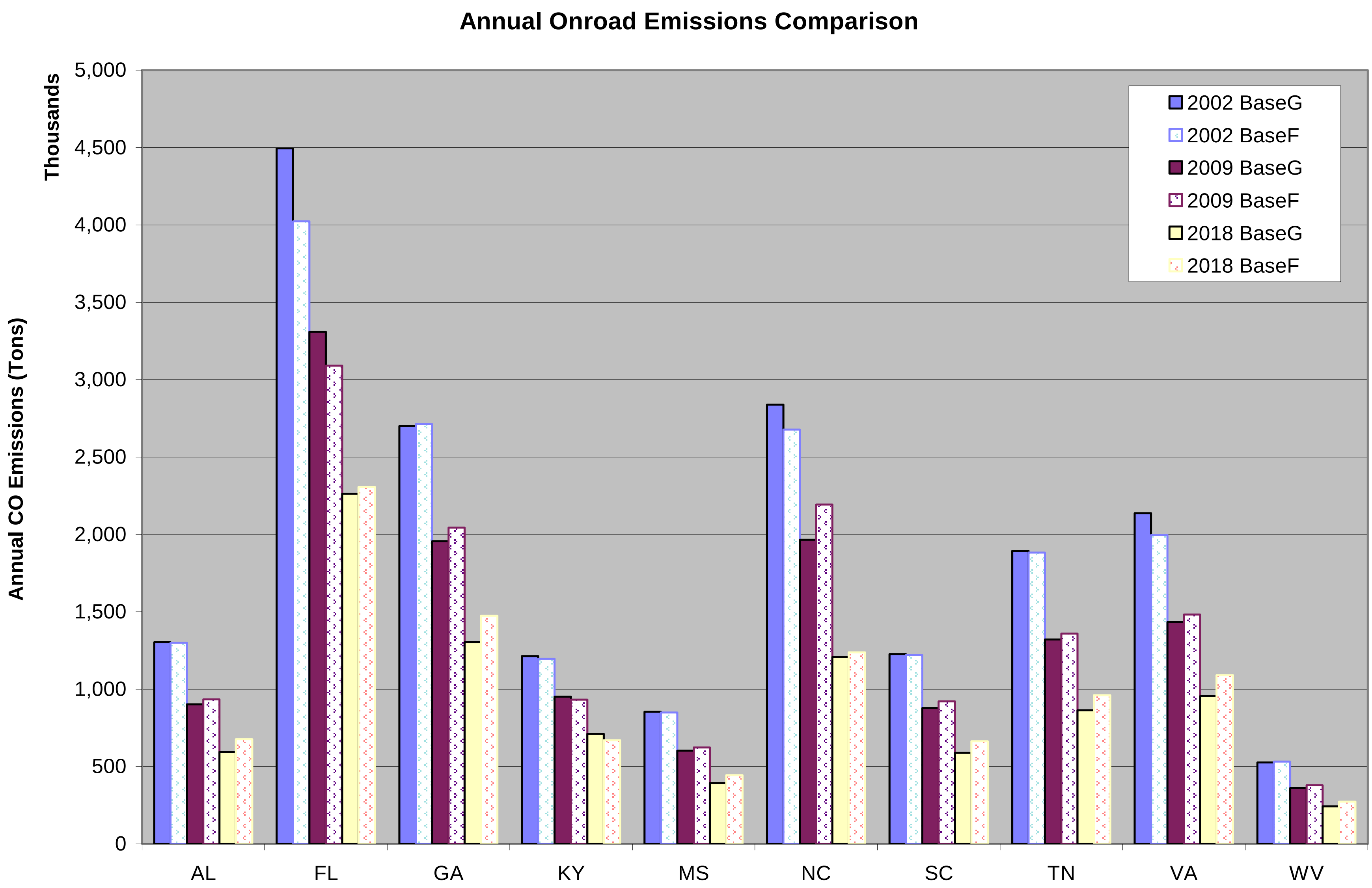
Base F Onroad Mobile (Annual Tons)																					
	VOC			NOx			CO			SO2			PM-10			PM-2.5			NH3		
FIPSST	2002	2009	2018	2002	2009	2018	2002	2009	2018	2002	2009	2018	2002	2009	2018	2002	2009	2018	2002	2009	2018
AL	118,978	73,137	47,151	157,626	101,299	46,598	1,300,754	934,442	675,902	6,898	637	720	3,905	3,195	2,488	2,799	2,053	1,262	5,586	6,362	7,296
FL	438,761	293,423	192,096	402,099	284,737	134,465	4,022,000	3,090,443	2,306,759	18,802	1,911	2,289	10,185	9,027	7,691	7,126	5,653	3,848	16,183	19,553	23,595
GA	265,972	187,102	104,678	306,998	208,568	100,707	2,712,473	2,044,169	1,474,029	12,182	1,256	1,458	7,252	6,116	4,995	5,169	3,877	2,517	10,545	12,685	14,870
KY	96,202	63,210	38,814	154,093	97,731	43,014	1,195,656	932,296	669,891	5,988	587	651	3,728	3,008	2,283	2,699	1,946	1,160	5,055	5,807	6,584
MS	81,701	49,986	30,337	110,242	69,949	29,829	849,049	624,575	445,150	4,614	398	441	2,863	2,296	1,688	2,114	1,525	876	3,585	4,035	4,565
NC	272,594	167,894	87,718	290,873	207,670	83,399	2,677,118	2,192,253	1,238,802	12,482	1,314	1,323	6,733	5,874	4,299	4,754	3,651	2,158	9,711	12,663	13,077
SC	107,236	69,026	44,121	139,403	91,832	42,641	1,220,825	921,308	663,597	5,972	558	643	3,454	2,884	2,258	2,502	1,874	1,154	4,694	5,522	6,472
TN	168,389	109,716	63,916	233,324	147,591	66,879	1,881,893	1,359,880	961,929	9,202	833	944	5,349	4,247	3,199	3,927	2,788	1,643	6,629	7,753	8,962
VA	143,969	91,230	59,737	222,830	133,039	64,079	1,996,287	1,483,125	1,091,546	7,234	902	1,059	4,546	3,768	3,343	3,097	2,258	1,641	7,852	9,084	10,757
WV	39,581	23,914	15,375	60,335	36,000	16,940	533,258	379,272	273,900	2,495	228	255	1,399	1,099	844	1,005	705	428	1,938	2,188	2,484
VISTAS	**1,733,382**	**1,128,638**	**683,942**	**2,077,822**	**1,378,416**	**628,551**	**18,389,312**	**13,961,764**	**9,801,505**	**85,868**	**8,622**	**9,783**	**49,414**	**41,513**	**33,086**	**35,191**	**26,330**	**16,687**	**71,778**	**85,652**	**98,664**

Emissions Change (Base G - Base F, Annual Tons) -- Positive Value Indicates Increase from Base F																					
	VOC			NOx			CO			SO2			PM-10			PM-2.5			NH3		
FIPSST	2002	2009	2018	2002	2009	2018	2002	2009	2018	2002	2009	2018	2002	2009	2018	2002	2009	2018	2002	2009	2018
AL	6,789	2,928	-2,647	-1,166	-606	-3,977	2,754	-31,973	-81,178	-71	165	-66	-45	-58	-295	-31	-43	-178	-56	-63	-666
FL	81,997	43,284	6,955	58,404	27,584	1,575	471,820	218,420	-43,569	1,885	672	14	963	774	-175	653	451	-177	1,738	1,996	183
GA	14,003	5,671	-5,214	-2,689	-1,544	-8,594	-12,823	-87,906	-170,500	-139	312	-133	-86	-111	-589	-59	-80	-352	-109	-131	-1,359
KY	6,160	9,933	3,996	541	2,294	3,979	18,534	18,615	41,319	250	164	43	-46	-65	65	-32	-47	-2	-52	-70	512
MS	5,110	1,613	-1,638	430	3	-2,209	4,724	-22,319	-50,903	-48	134	-41	-35	-46	-209	-25	-34	-130	-35	-40	-419
NC	-11,699	-1,049	4,001	32,734	-8,389	-3,966	162,165	-226,057	-31,411	-196	174	23	-228	-364	-304	-183	-198	-226	-111	-961	-302
SC	7,625	2,755	-2,255	-462	-362	-3,293	5,731	-42,483	-75,061	-63	156	-59	-40	-53	-272	-29	-40	-166	-48	-56	-594
TN	9,554	4,316	-2,577	2,545	2,589	-4,433	11,811	-39,318	-98,246	-75	232	-82	-37	-87	-385	-22	-68	-238	-73	-52	-766
VA	14,020	4,464	-3,744	-2,995	-340	-6,887	140,001	-47,766	-137,084	962	165	-110	-47	-62	-420	-30	-42	-237	-83	-94	-1,104
WV	2,122	656	-723	-1,995	-766	-1,410	-6,416	-18,407	-30,217	-57	49	-24	-32	-42	-97	-22	-29	-59	-49	-62	-217
VISTAS	**135,680**	**74,570**	**-3,846**	**85,346**	**20,462**	**-29,215**	**798,301**	**-279,194**	**-676,850**	**2,448**	**2,222**	**-435**	**367**	**-114**	**-2,683**	**219**	**-130**	**-1,764**	**1,123**	**466**	**-4,732**

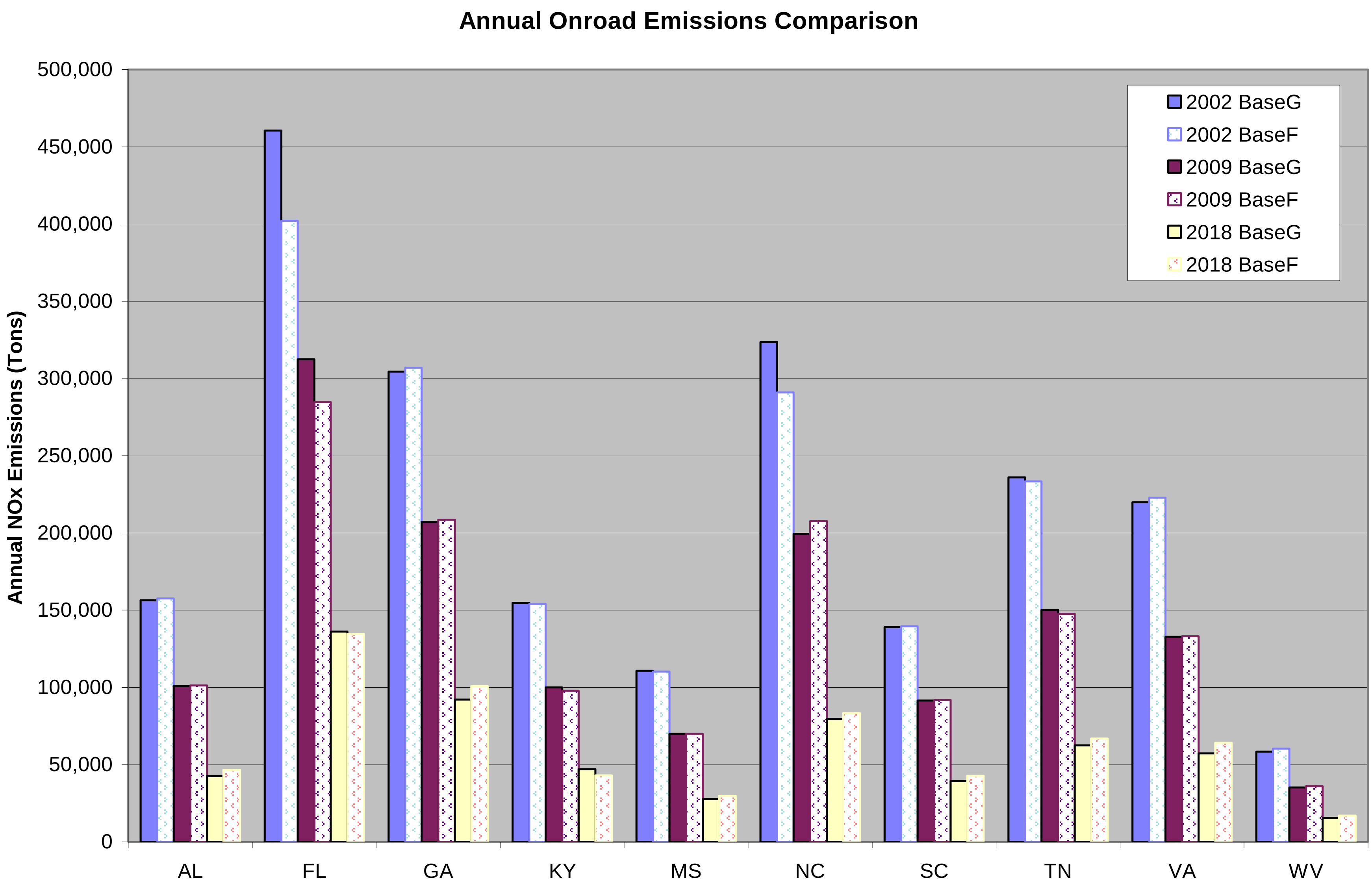
Emissions Change (Base G - Base F/Base F, Annual %) -- Positive Value Indicates Increase from Base F																					
	VOC			NOx			CO			SO2			PM-10			PM-2.5			NH3		
FIPSST	2002	2009	2018	2002	2009	2018	2002	2009	2018	2002	2009	2018	2002	2009	2018	2002	2009	2018	2002	2009	2018
AL	6%	4%	-6%	-1%	-1%	-9%	0%	-3%	-12%	-1%	26%	-9%	-1%	-2%	-12%	-1%	-2%	-14%	-1%	-1%	-9%
FL	19%	15%	4%	15%	10%	1%	12%	7%	-2%	10%	35%	1%	9%	9%	-2%	9%	8%	-5%	11%	10%	1%
GA	5%	3%	-5%	-1%	-1%	-9%	0%	-4%	-12%	-1%	25%	-9%	-1%	-2%	-12%	-1%	-2%	-14%	-1%	-1%	-9%
KY	6%	16%	10%	0%	2%	9%	2%	2%	6%	4%	28%	7%	-1%	-2%	3%	-1%	-2%	0%	-1%	-1%	8%
MS	6%	3%	-5%	0%	0%	-7%	1%	-4%	-11%	-1%	34%	-9%	-1%	-2%	-12%	-1%	-2%	-15%	-1%	-1%	-9%
NC	-4%	-1%	5%	11%	-4%	-5%	6%	-10%	-3%	-2%	13%	2%	-3%	-6%	-7%	-4%	-5%	-10%	-1%	-8%	-2%
SC	7%	4%	-5%	0%	0%	-8%	0%	-5%	-11%	-1%	28%	-9%	-1%	-2%	-12%	-1%	-2%	-14%	-1%	-1%	-9%
TN	6%	4%	-4%	1%	2%	-7%	1%	-3%	-10%	-1%	28%	-9%	-1%	-2%	-12%	-1%	-2%	-14%	-1%	-1%	-9%
VA	10%	5%	-6%	-1%	0%	-11%	7%	-3%	-13%	13%	18%	-10%	-1%	-2%	-13%	-1%	-2%	-14%	-1%	-1%	-10%
WV	5%	3%	-5%	-3%	-2%	-8%	-1%	-5%	-11%	-2%	21%	-9%	-2%	-4%	-12%	-2%	-4%	-14%	-3%	-3%	-9%
VISTAS	**8%**	**7%**	**-1%**	**4%**	**1%**	**-5%**	**4%**	**-2%**	**-7%**	**3%**	**26%**	**-4%**	**1%**	**0%**	**-8%**	**1%**	**0%**	**-11%**	**2%**	**1%**	**-5%**

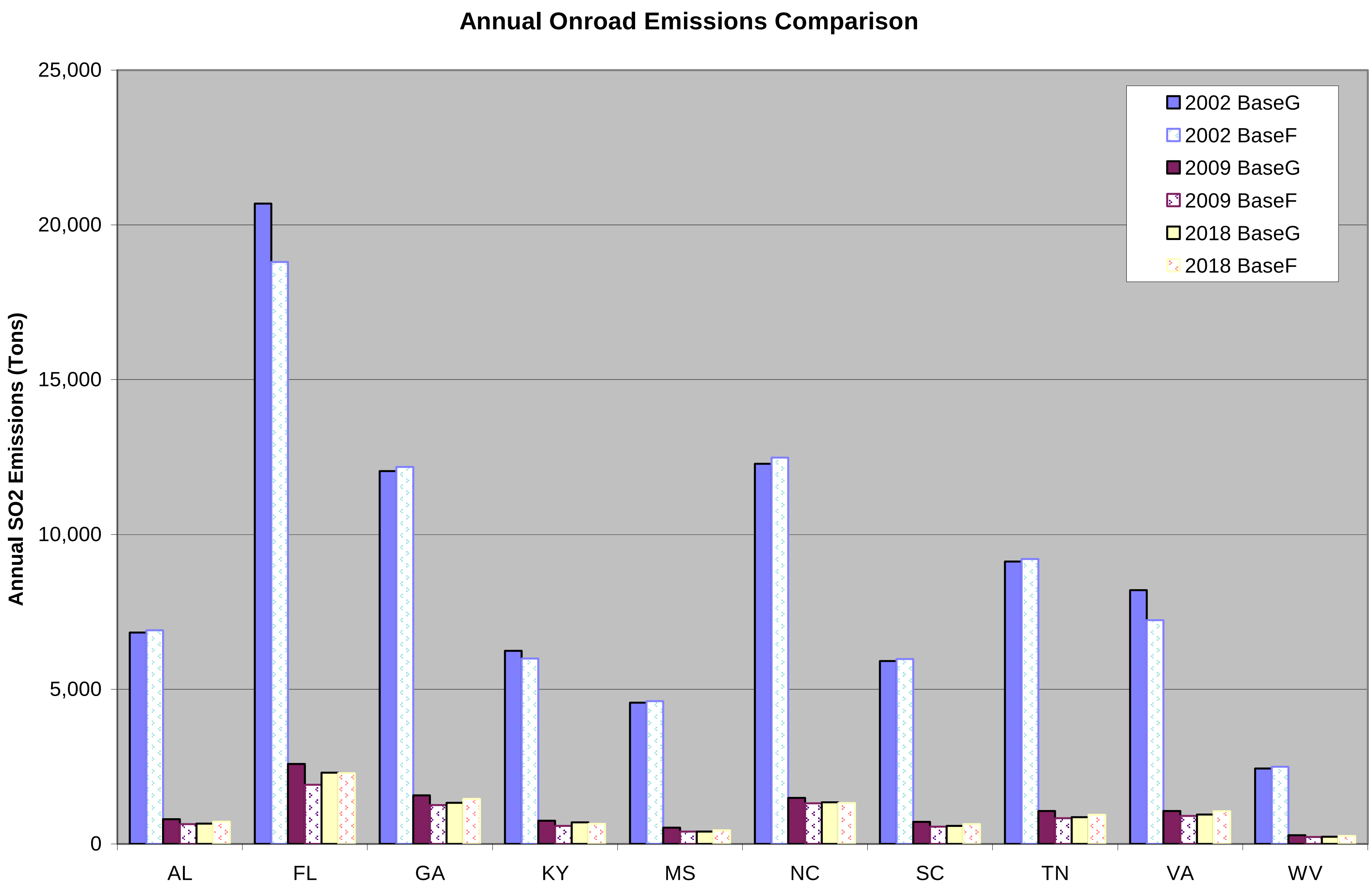
Note: Base G is equivalent to the Best and Final inventory for onroad mobile sources.

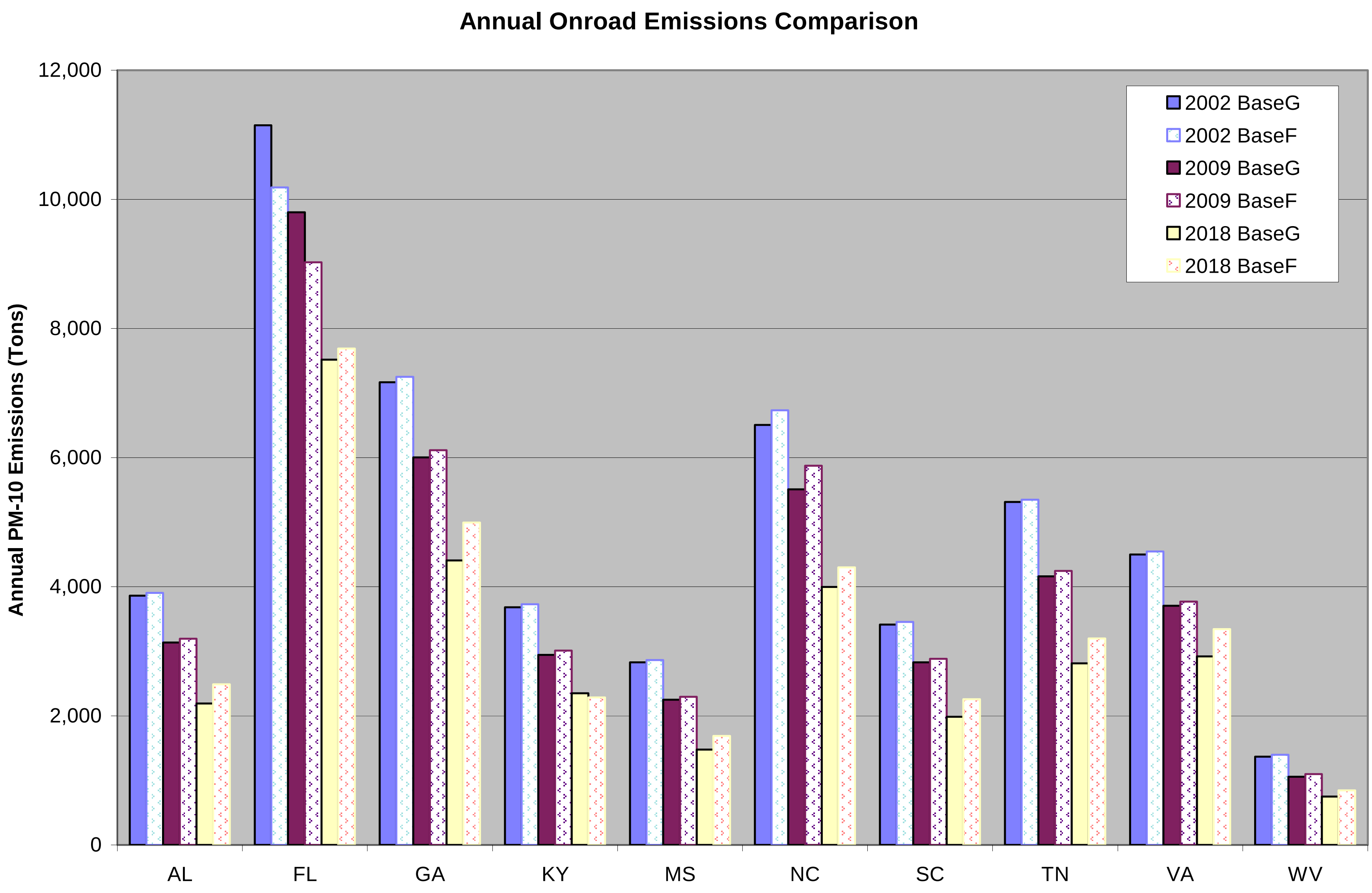

Annual Onroad Emissions Comparison
Annual VOC Emissions (Tons)
600,000
500,000
400,000
300,000
200,000
100,000
0
2002 BaseG
2002 BaseF
2009 BaseG
2009 BaseF
2018 BaseG
2018 BaseF
AL
FL
GA
KY
MS
NC
SC
TN
VA
WV

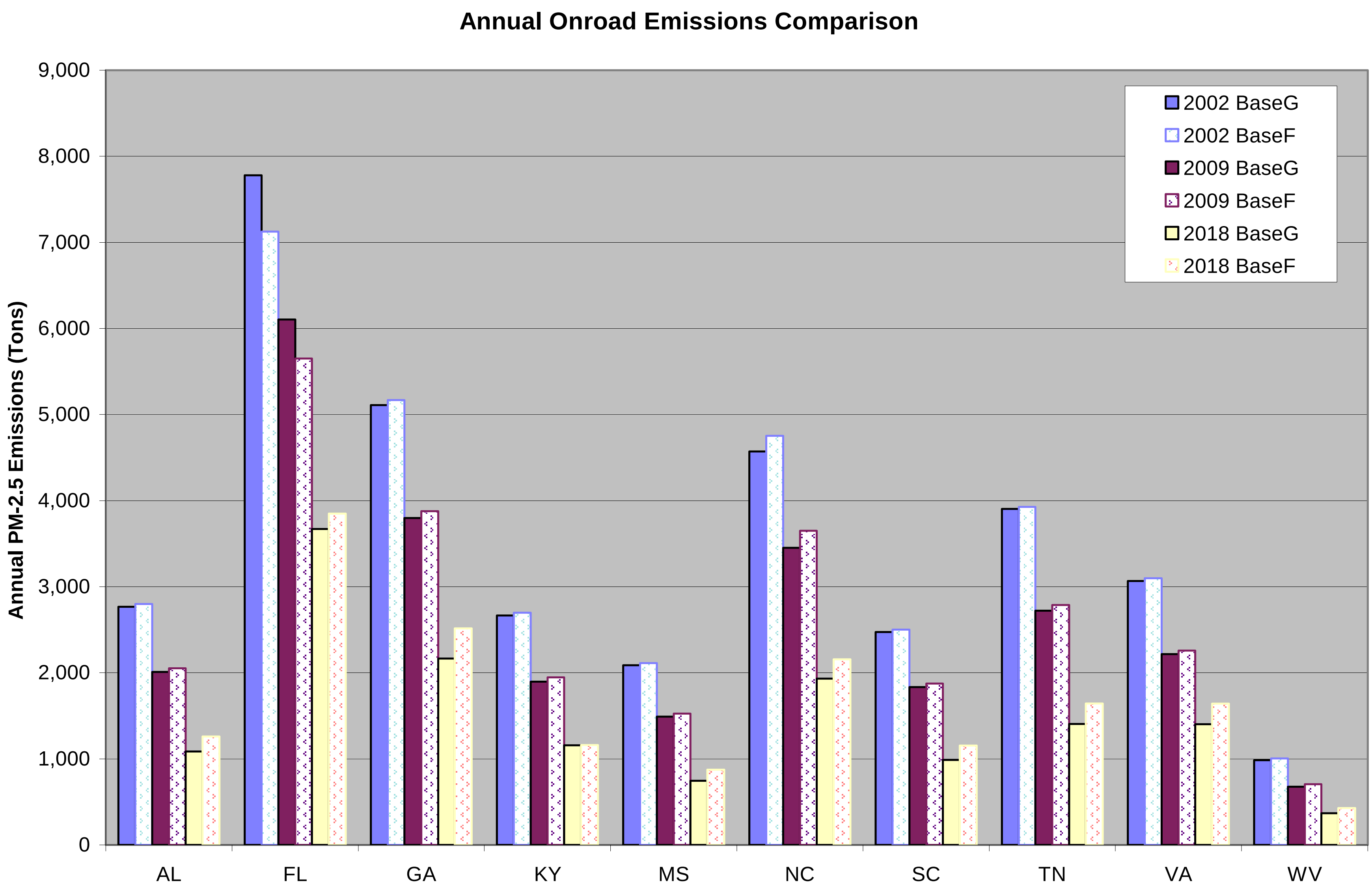


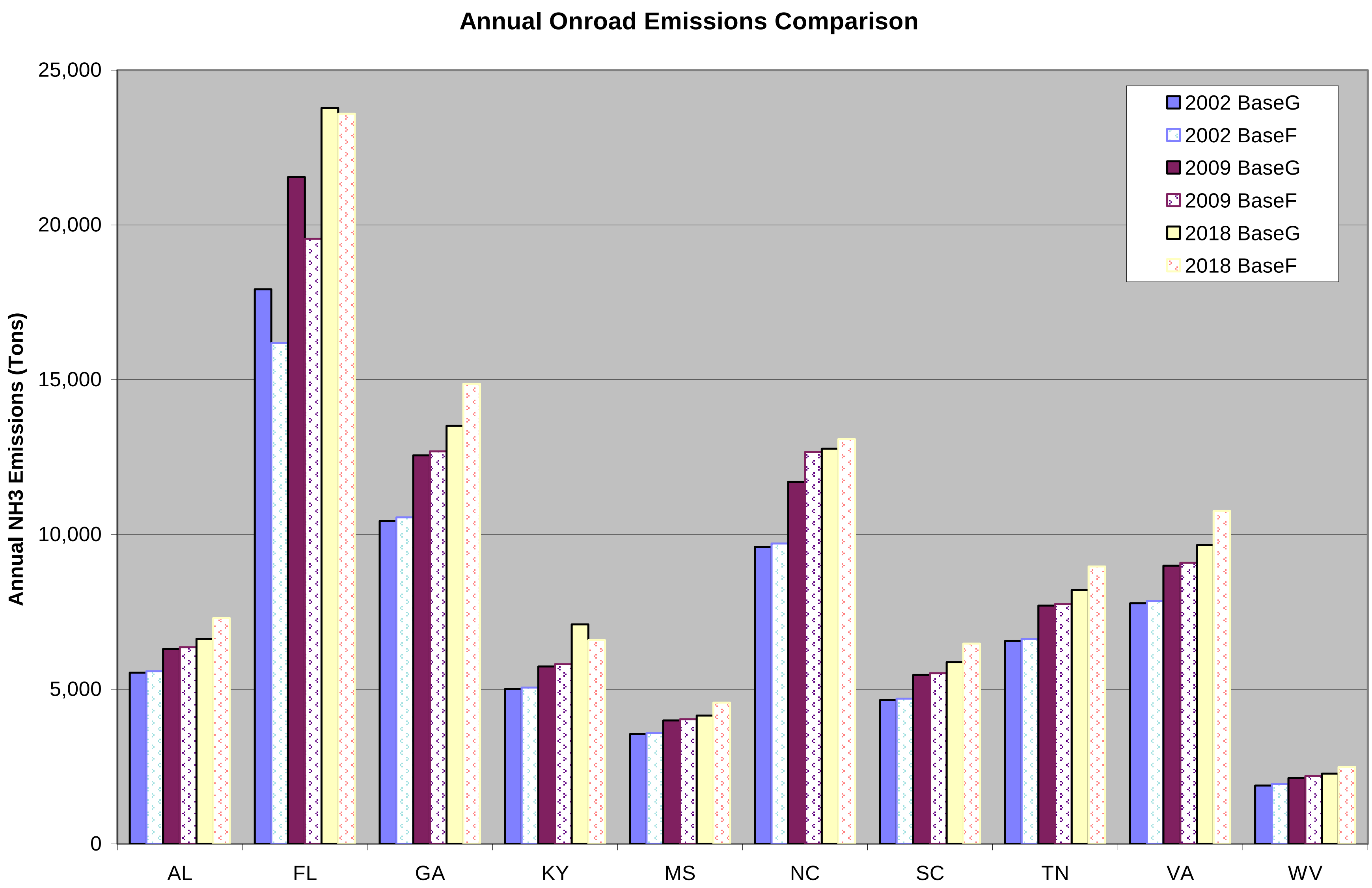
Annual Onroad Emissions Comparison
Thousands
Annual CO Emissions (Tons)
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
2002 BaseG
2002 BaseF
2009 BaseG
2009 BaseF
2018 BaseG
2018 BaseF
AL
FL
GA
KY
MS
NC
SC
TN
VA
WV


Annual Onroad Emissions Comparison
Annual NOx Emissions (Tons)
500,000
450,000
400,000
350,000
300,000
250,000
200,000
150,000
100,000
50,000
0
AL
FL
GA
KY
MS
NC
SC
TN
VA
WV
2002 BaseG
2002 BaseF
2009 BaseG
2009 BaseF
2018 BaseG
2018 BaseF


Annual Onroad Emissions Comparison
Annual SO2 Emissions (Tons)
25,000
20,000
15,000
10,000
5,000
0
AL
FL
GA
KY
MS
NC
SC
TN
VA
WV
2002 BaseG
2002 BaseF
2009 BaseG
2009 BaseF
2018 BaseG
2018 BaseF


Annual Onroad Emissions Comparison
Annual PM-10 Emissions (Tons)
12,000
10,000
8,000
6,000
4,000
2,000
0
AL
FL
GA
KY
MS
NC
SC
TN
VA
WV
2002 BaseG
2002 BaseF
2009 BaseG
2009 BaseF
2018 BaseG
2018 BaseF


Annual Onroad Emissions Comparison
Annual PM-2.5 Emissions (Tons)
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
AL
FL
GA
KY
MS
NC
SC
TN
VA
WV
2002 BaseG
2002 BaseF
2009 BaseG
2009 BaseF
2018 BaseG
2018 BaseF


Annual Onroad Emissions Comparison
Annual NH3 Emissions (Tons)
25,000
20,000
15,000
10,000
5,000
0
AL
FL
GA
KY
MS
NC
SC
TN
VA
WV
2002 BaseG
2002 BaseF
2009 BaseG
2009 BaseF
2018 BaseG
2018 BaseF

APPENDIX G:

CONVERSION OF MRPO BaseM POINT SOURCE DATA TO SMOKE INPUT FORMAT

MEMORANDUM

To: Pat Brewer, VISTAS
From: Gregory Stella, Alpine Geophysics, LLC
Re: Conversion of MRPO BaseM Point Source Data to SMOKE Input Format
Date: 13 February 2008

The Midwest Regional Planning Organization (MRPO) periodically produces a five State emission inventory for Illinois, Indiana, Michigan, Wisconsin, and Ohio. These data are used as the basis for various MRPO modeling and regulatory analyses. These data are prepared with the help of each State's emission inventory divisions and are felt to be the most representative account for emissions activities for those States at any one time.

The most recent version prepared and distributed by MRPO is currently called BaseM. Associated with this 2005 base year inventory release is a set of growth and control factors that are used to additionally simulate future year conditions under "On-The-Books" (base case or known control programs requirements to be implemented in future years) or incremental control situations to test sensitivity or strategies which would be implemented in whole or in part during the same future years.

The purpose of this document is to detail the technical steps that were made as part of the conversion of the MRPO BaseM point sources files (electric generating unit [EGU] and non-EGU) into IDA format for ASIP PM-2.5 CAMx modeling of the future year 2009. Because of the timing and complications relative to converting multiple and various emission files for all source types, it was determined that only point source emissions would be converted for processing at this time.

Data Sources and Description

A series of data files and associated documentation was obtained from MRPO staff in 2007. These files were the input data sets for base year 2005 and growth and control factors related to MRPO's BaseM and Round 5 inventories[6]. Because of the emission processing tools that MRPO currently executes for its analyses, these files are in formats that are not read by the SMOKE emissions processor currently in use by VISTAS/ASIP modelers (contract teams and participating states). Alpine Geophysics, under the Emissions Inventory Technical Advisor contract, was asked to obtain and convert these data into the formats that could be used by these modeling agencies.

Through additional contact with MRPO staff, the base year 2005 non-EGU point source files and associated growth and control factors necessary to forecast the data to 2009 base case conditions were identified and extracted from the originally provided data. EGU sources were identified to be already prepared for the future year (2010 substituted for 2009) and were based on recent IPM 3.0 model runs with incremental adjustment made by MRPO states to best reflect expected emission controls and operating conditions. The "will do" simulation series for EGUs was identified as "egu5b_2010."

The main purpose of the SMOKE conversion task was to prepare five state emission inventories provided in National Input Format (NIF) format into the IDA format required by the SMOKE model for the criteria pollutants VOC, NOx, CO, SO2, PM-10, PM-2.5, and NH3. Annual emissions were taken directly from the NIF structured inventories with no alternate temporal calculations performed (e.g., estimate seasonal emissions from annual or annual from seasonal). The temporal allocation module of the SMOKE emissions processor was intended to be used to further define temporal distribution of these emissions.

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[6] http://www.ladco.org/tech/emis/r5/round5_reports.htm

No quality assurance (QA) related to the reported values in the MRPO was conducted (e.g., it was assumed that reported emission levels were correct) and therefore the QA focus of these tasks was to maintain the integrity of the mass files in the conversion to IDA.

Each set of NIF structured data had a unique set of relational tables necessary to maintain the information required in each source sector based on its reporting requirements. Alpine had previously developed scripts to read the information from each of these relational data sets and convert them to the IDA structures required by this task. Prior to and after each major source sector was converted from NIF to IDA, we developed a list of emission summary reports to check that the emissions input into the conversion process were the same as output into the IDA formatted files.

Non-EGU Point Source Conversion

Non-EGU point source emissions from 2005 BaseM were converted to future year 2009 IDA format using the annual emission records directly from the NIF structured data sets and associated SCC growth factors and unit, facility, county, state, or nationally applied controls[7]. These controls were applied in a hierarchical fashion starting with the most defined (unit-segment-pollutant level) through least defined (national-SCC-pollutant) and when a match was found during the implementation, no additional controls were sought or applied to that emission record. In other words, if a match were found at the unit-segment level of control, no additional controls were applied to that segment/pollutant combination again in the forecast process. This prevented multiple control programs from being implemented when the intent of the originally provided control files were to assign a single applicable reduction.

The Round 5 factors for point sources provided by MRPO were in the RPO Data Exchange Format (RPODx) and had growth and control factors available at the State, county, plant, unit, segment, stack, and SCC level of detail. In order to apply these factors in a fashion consistent with that of the MRPO utilized processing system and duplicative of how MRPO would have generated its BaseM forecasts, a hierarchical approach was utilized to match and assign growth and control values.

Growth Factor Application

Using the 2005 EM table from the BaseM inventory files in NIF format, we first selected each emissions record for forecasting. In this conversion case, these EM records were limited to those emissions identified as annual using the NIF coding convention. As noted in the limitations section below, there oftentimes were emissions provided by MRPO in a summer season convention.

We next selected the base year for application as the RPODx for growth rates allows for the flexibility of input growth factors for multiple base year inventories. In this assignment, the base year was always 2005, as that was the base year provided by MRPO and the future year was 2009, as selected by ASIP.

The next step was to determine the growth basis for each individual emission record of the file. This “growth basis” is the key with which the growth factor is associated. For point sources, this key is based on a combination of FIPS, SCC, and pollutant codes. Multiple keys are calculated for each individual emission record and that key with the highest resolution of matching to the growth factor file using the hierarchy identified in Table 1 below is the one chosen to assign a growth rate to the base year emissions.

7 http://www.ladco.org/tech/emis/r5/reports/LADCO%202005%20Base%20Yr%20Growth%20and%20Controls%20Report_Final.pdf

Table 1. Point Source Growth Factor Application Hierarchy.

Order	Key or "Growth/Control Basis"
1	state/county code, 10-digit SCC, pollutant
2	state/county code, 10-digit SCC
3	state code, 10-digit SCC, pollutant
4	state code, 10-digit SCC
5	state/county code, pollutant
6	state/county code
7	state code, pollutant
8	state code
9	10-digit SCC, pollutant
10	10-digit SCC
11	Pollutant

Using the hierarchical application, growth basis, and dates (base year and alternate year), we matched each emission record to the growth table to obtain a growth factor. The factors are defined in the growth table as a multiplier for the base year period that calculates the alternate year of interest. In other words, multiplying the base year emissions value by the growth factor provides you with the emissions for the alternate year of interest.

When no match from any of the hierarchical keys was identified, a growth rate of 1.00 (no growth) was assigned. This maintained the 2005 emission level in the future year inventory.

Control Factor Application

Similar to the process identified above for the assignment and application of growth factors, the control factor assignment was based on a hierarchical key, this time, however, using FIPS, plantid, pointid, stackid, segment, SCC, and pollutant codes applied in a parallel process to the growth factor assignment.

Using the 2005 EM table from the BaseM inventory files in NIF format, we selected each annual emissions record for forecasting. We next selected the base year for application, and again, the base year was always 2005, as that was the base year provided by MRPO.

Once the base year was identified, we determined the alternate year for our forecast. Depending on the specific year used in each conversion, growth rates were limited to those with a base year of 2005 and a future year *less than or equal to* that of our forecast. This variation in method is intended to allow us to identify all controls implemented prior to or during the year of interest and will consider them as viable options at the latest provided level of control.

In other words, since we selected 2009 as the future year of choice, we limit the control factor table to control strategies implemented during or prior to 2009. If in our matching to the control factor table we find that for a certain control basis key there is no match because a program may have been fully implemented in a prior year (say 2007), then we do not want to exclude this reduction from our forecast. Additionally, if we find that there are multiple entries in the control factor table because of incremental implementation of a rule, we select the closest year to that of our intended forecast. So if a particular rule was incrementally implemented from 2005 through 2009 and there were control records available for each year in between, we would select the record with the latest year to apply in our forecast.

The next step was to determine the control basis for each individual emission record of the file. This "control basis" is the key with which the control strategy or technology is associated. Although we developed code to support the hierarchical application of control factors for the BaseM emissions, all control factors provided by MRPO in the Round 5 files were segment-SCC-pollutant specific. This eliminated the need for a search on the key that has the greatest resolution as all matches were at the segment-SCC-pollutant level.

Using the control basis and dates (base year and alternate year), we matched each emission record to the control table to obtain a control factor. The factors are defined in the control table as a group of values (control efficiency, rule effectiveness, and rule penetration) for the future year period that gets assigned to an uncontrolled future year emission value. In other words, we first "backed out" existing base year controls from our future year emissions estimate and then multiplied this uncontrolled value by the control factors for the alternate year of interest. These calculations are defined in Equations 1 and 2 below.

Equation 1. Uncontrolled emissions calculation.

$$Emiss_{Unc} = Emiss_{Base} / (1-((CE_{Base}/100)*(RE_{Base}/100)*(RP_{Base}/100)))$$

Where,

$Emiss_{Unc}$	= Uncontrolled emissions
$Emiss_{Base}$	= Base year emissions
CE_{Base}	= Base year control efficiency
RE_{Base}	= Base year rule effectiveness
RP_{Base}	= Base year rule penetration

Equation 2. Application of new control calculation.

$$Emiss_{New} = Emiss_{Unc} *(1-((CE_{New}/100)*(RE_{New}/100)*(RP_{New}/100)))$$

Where,

$Emiss_{New}$	= Future year emissions
$Emiss_{Unc}$	= Uncontrolled emissions
CE_{New}	= Future year control efficiency
RE_{New}	= Future year rule effectiveness
RP_{New}	= Future year rule penetration

When no match from any of the hierarchical keys was identified, the same control efficiency, rule efficiency, and rule penetration values from the base year inventory were used in the calculation and the only change in emissions would have been the result of growth factor application. In instances where PM-10 annual emissions were found to be less than PM-2.5 annual emission values, the PM-2.5 emission values were changed to equal that of PM-10.

<u>EGU Point Source Conversion</u>

EGU point source emissions from the egu5b_2010 scenario (2010 IPM 3.0 run with modifications) were converted to year 2009 IDA format using the annual emission records directly from the NIF structured data sets. Since these emissions already accounted for growth and control application, no additional modifications were required.

One ASIP requested modification for its PM-2.5 CAMx modeling was to adjust the 2009 file to match W. H. Sammis facility's planned response to the control requirements from the consent decree USA vs. Ohio Edison; Civil Action No: 2:99-CV-1181; March 18, 2005. These changes were not implemented in the ASIP 2009 CMAQ runs. These adjustments for SO2 are noted in Table 2 below.

Table 2. SO2 Control Requirements from USA vs. Ohio Edison Consent Decree

Units 1-4	Induct Scrubbing
	50% removal (1.1 lbs/MMBtu)
	At least one unit by Sept. 30, 2008
	Second unit by Dec. 31, 2008
	Other two units by Dec. 31, 2009
Unit 5	Flash Dryer Absorber or Electro-Catalytic Oxidation no later than Dec. 31, 2008
	50% removal (1.1 lbs/MMBtu)
Units 6/7	Scrubber no later than December 31, 2010
	95% removal (0.13 lbs/MMBtu)
Plantwide	Emission cap of 101,500 by end of 2009
	Emission cap of 101,500 by end of 2010
	Emission cap of 29,900 by end of 2011

Conversion Limitations

As noted above, Alpine limited our conversion to all records in the MRPO point source files that were identified as annual. In some cases the MRPO NIF files had additional non-annual summer season emission records configured as a higher percentage than the annual average that was used in our emissions comparison.

In other words, the MRPO file sometimes had two emission record types that it uses for its modeling; one for the summer period and one for the rest of the year. Since SMOKE uses temporal allocation factors to make this summer/winter split, our converted values do not match MRPO's summertime reports. We see a high percentage difference in the Alpine converted data compared to the MRPO output reports in these two States for the July 12 example for this reason.

Since we confirmed this difference and reason for this difference in the 2005 data sets with MRPO, our objective for QA on the projections also included delta emissions from the projection year to the base year. Although the absolute daily emission values (in tpd) were found to be different as noted above, in all cases, the difference between 2005 and the projection year calculations as made by Alpine was within confidence ranges of the ratio of future year to base year as posted by MRPO. See Table 3 below. For this reason, we were convinced that our projection methodology is capturing the growth and control factors that MRPO applied in its emissions modeling.

Table 3. Emissions Comparison of ASIP Converted and MRPO Non-EGU Emissions.

Comparison of ASIP Converted and MRPO Non-EGU Emissions

		ASIP 2009 Annual Emissions (Tons/Year)						
FIPSST	**State**	**VOC**	**NOX**	**CO**	**SO2**	**PM-10**	**PM-2.5**	**NH3**
17	Illinois	61,760	85,142	71,725	150,506	20,315	6,256	1,059
18	Indiana	48,287	65,132	339,642	82,040	22,118	12,774	782
26	Michigan	36,753	85,014	67,564	55,435	13,235	6,567	788
39	Ohio	31,530	67,275	212,626	116,942	15,930	10,443	3,239
55	Wisconsin	31,377	36,827	43,014	60,955	456	43	346
	MRPO	**209,707**	**339,390**	**734,570**	**465,878**	**72,054**	**36,082**	**6,214**

		ASIP 2009 July 12 Summer Daily Emissions (Tons/Day)						
FIPSST	**State**	**VOC**	**NOX**	**CO**	**SO2**	**PM-10**	**PM-2.5**	**NH3**
17	Illinois	222.3	315.1	250.9	412.3	55.6	17.1	2.9
18	Indiana	132.3	178.4	930.5	224.8	60.6	35.0	2.1
26	Michigan	115.8	232.4	193.6	144.9	40.8	19.3	2.4
39	Ohio	86.4	184.3	582.5	320.4	43.6	28.6	8.9
55	Wisconsin	86.0	100.9	117.8	167.0	1.3	0.1	0.9
	MRPO	**642.7**	**1,011.1**	**2,075.4**	**1,269.4**	**202.0**	**100.2**	**17.2**

		2009 July 12 Summer Daily Emissions (Tons/Day)						
FIPSST	**State**	**VOC**	**NOX**	**CO**	**SO2**	**PM-10**	**PM-2.5**	**NH3**
17	Illinois	218.1	217.8	255.7	335.0	56.0	16.8	2.8
18	Indiana	137.2	175.2	888.8	216.2	60.7	36.5	2.3
26	Michigan	119.1	242.0	206.5	148.6	43.6	20.3	2.4
39	Ohio	87.1	166.3	540.7	288.0	43.0	27.6	8.3
55	Wisconsin	87.7	92.9	120.0	152.1	23.2	0.1	1.0
	MRPO	**649.2**	**894.2**	**2,011.7**	**1,139.9**	**226.5**	**101.3**	**16.8**

		ASIP 2009 July 12 Summer Daily Emissions (% of MRPO Total)						
FIPSST	**State**	**VOC**	**NOX**	**CO**	**SO2**	**PM-10**	**PM-2.5**	**NH3**
17	Illinois	29.5%	25.1%	9.8%	32.3%	28.2%	17.3%	17.0%
18	Indiana	23.0%	19.2%	46.2%	17.6%	30.7%	35.4%	12.6%
26	Michigan	17.5%	25.0%	9.2%	11.9%	18.4%	18.2%	12.7%
39	Ohio	15.0%	19.8%	28.9%	25.1%	22.1%	28.9%	52.1%
55	Wisconsin	15.0%	10.9%	5.9%	13.1%	0.6%	0.1%	5.6%
	MRPO	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

		2009 July 12 Summer Daily Emissions (% of MRPO Total)						
FIPSST	**State**	**VOC**	**NOX**	**CO**	**SO2**	**PM-10**	**PM-2.5**	**NH3**
17	Illinois	33.6%	24.4%	12.7%	29.4%	24.7%	16.6%	16.7%
18	Indiana	21.1%	19.6%	44.2%	19.0%	26.8%	36.0%	13.7%
26	Michigan	18.3%	27.1%	10.3%	13.0%	19.2%	20.0%	14.3%
39	Ohio	13.4%	18.6%	26.9%	25.3%	19.0%	27.2%	49.4%
55	Wisconsin	13.5%	10.4%	6.0%	13.3%	10.2%	0.1%	6.0%
	MRPO	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

APPENDIX H:

COMPARISON OF EGU CONTROLS FOR COAL AND OIL/GAS UNITS BASED ON IPM MODELING AND STATE-PROVIDED INFORMATION FOR THE BASE G/G2 INVENTORY

APPENDIX H: EGU CONTROLS FOR COAL AND OIL/GAS UNITS FOR THE BASE G/G2 INVENTORY

							Post-Combustion Controls							
FIPS	Facility Name	ORIS ID	BLR ID	SITE ID	UNIT ID	Plant Type	VISTAS NOx 2009 Controls	IPM NOx 2009 Controls	VISTAS NOx 2018 Controls	IPM NOx 2018 Controls	VISTAS SO2 2009 Controls	IPM SO2 2009 Controls	VISTAS SO2 2018 Controls	IPM SO2 2018 Controls
01033	TVA COLBERT	47	1	0010	010	Coal Steam	None	None	SCR	SCR	None	None	Scrubber	Scrubber
01033	TVA COLBERT	47	2	0010	011	Coal Steam	None	None	SCR	SCR	None	None	Scrubber	Scrubber
01033	TVA COLBERT	47	3	0010	012	Coal Steam	None	None	SCR	SCR	None	None	Scrubber	Scrubber
01033	TVA COLBERT	47	4	0010	013	Coal Steam	None	None	SCR	SCR	None	None	Scrubber	Scrubber
01033	TVA COLBERT	47	5	0010	014	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
01055	ALABAMA POWER COMPANY GADSDEN	7	1	0002	002	Coal Steam	None	None	None	None	None	None	None	None
01055	ALABAMA POWER COMPANY GADSDEN	7	2	0002	003	Coal Steam	None	None	None	None	None	None	None	None
01063	ALABAMA POWER COMPANY GREENE COUNTY	10	1	0001	002	Coal Steam	SCR	SCR	SCR	SCR	None	None	Scrubber	Scrubber
01063	ALABAMA POWER COMPANY GREENE COUNTY	10	2	0001	003	Coal Steam	SCR	SCR	SCR	SCR	None	None	Scrubber	Scrubber
01071	TVA - WIDOWS CREEK	50	1	0008	002	Coal Steam	SCR	SCR	SCR	SCR	None	None	None	None
01071	TVA - WIDOWS CREEK	50	2	0008	003	Coal Steam	SCR	SCR	SCR	SCR	None	None	None	None
01071	TVA - WIDOWS CREEK	50	3	0008	004	Coal Steam	SCR	SCR	SCR	SCR	None	None	None	None
01071	TVA - WIDOWS CREEK	50	4	0008	005	Coal Steam	SCR	SCR	SCR	SCR	None	None	None	None
01071	TVA - WIDOWS CREEK	50	5	0008	006	Coal Steam	SCR	SCR	SCR	SCR	None	None	None	None
01071	TVA - WIDOWS CREEK	50	6	0008	007	Coal Steam	SCR	SCR	SCR	SCR	None	None	None	None
01071	TVA - WIDOWS CREEK	50	7	0008	008	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
01071	TVA - WIDOWS CREEK	50	8	0008	009	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber

APPENDIX H: EGU CONTROLS FOR COAL AND OIL/GAS UNITS FOR THE BASE G/G2 INVENTORY

							Post-Combustion Controls							
FIPS	Facility Name	ORIS ID	BLR ID	SITE ID	UNIT ID	Plant Type	VISTAS NOx 2009 Controls	IPM NOx 2009 Controls	VISTAS NOx 2018 Controls	IPM NOx 2018 Controls	VISTAS SO2 2009 Controls	IPM SO2 2009 Controls	VISTAS SO2 2018 Controls	IPM SO2 2018 Controls
01073	ALABAMA POWER COMPANY (MILLER POWER PLANT)	6002	4	010730011	001	Coal Steam	SCR All Year	SCR Summer	SCR All Year	SCR Summer	None	None	Scrubber	None
01073	ALABAMA POWER COMPANY (MILLER POWER PLANT)	6002	3	010730011	002	Coal Steam	SCR All Year	SCR Summer	SCR All Year	SCR Summer	None	None	Scrubber	None
01073	ALABAMA POWER COMPANY (MILLER POWER PLANT)	6002	2	010730011	004	Coal Steam	SCR All Year	SCR Summer	SCR All Year	SCR Summer	None	None	Scrubber	None
01073	ALABAMA POWER COMPANY (MILLER POWER PLANT)	6002	1	010730011	005	Coal Steam	SCR All Year	SCR Summer	SCR All Year	SCR Summer	None	None	Scrubber	None
01097	ALABAMA POWER COMPANY BARRY	3	1	1001	002	Coal Steam	SNCR	None	SNCR	SCR	None	None	None	None
01097	ALABAMA POWER COMPANY BARRY	3	2	1001	003	Coal Steam	SNCR	None	SNCR	SCR	None	None	None	None
01097	ALABAMA POWER COMPANY BARRY	3	3	1001	004	Coal Steam	SNCR	None	SNCR	SCR	None	None	None	None
01097	ALABAMA POWER COMPANY BARRY	3	4	1001	005	Coal Steam	SNCR	None	SNCR	SCR	None	None	Scrubber	Scrubber
01097	ALABAMA POWER COMPANY BARRY	3	5	1001	006	Coal Steam	None	None	SCR	SCR	None	None	Scrubber	Scrubber
01117	ALABAMA POWER COMPANY E C GASTON	26	1	0005	002	Coal Steam	None	SCR	None	SCR	None	None	Scrubber	Scrubber
01117	ALABAMA POWER COMPANY E C GASTON	26	2	0005	003	Coal Steam	None	SCR	None	SCR	None	None	Scrubber	Scrubber
01117	ALABAMA POWER COMPANY E C GASTON	26	3	0005	004	Coal Steam	None	SCR	None	SCR	None	None	Scrubber	Scrubber
01117	ALABAMA POWER COMPANY E C GASTON	26	4	0005	005	Coal Steam	None	SCR	None	SCR	None	None	Scrubber	Scrubber
01117	ALABAMA POWER COMPANY E C GASTON	26	5	0005	006	Coal Steam	SCR	SCR	SCR	SCR	None	Scrubber	Scrubber	Scrubber
01127	ALABAMA POWER COMPANY GORGAS	8	6	0001	004	Coal Steam	None	None	None	None	None	None	None	None
01127	ALABAMA POWER COMPANY GORGAS	8	7	0001	005	Coal Steam	None	None	None	None	None	None	None	None
01127	ALABAMA POWER COMPANY GORGAS	8	8	0001	006	Coal Steam	None	None	None	None	Scrubber	None	Scrubber	None

APPENDIX H: EGU CONTROLS FOR COAL AND OIL/GAS UNITS FOR THE BASE G/G2 INVENTORY

							Post-Combustion Controls							
FIPS	Facility Name	ORIS ID	BLR ID	SITE ID	UNIT ID	Plant Type	VISTAS NOx 2009 Controls	IPM NOx 2009 Controls	VISTAS NOx 2018 Controls	IPM NOx 2018 Controls	VISTAS SO2 2009 Controls	IPM SO2 2009 Controls	VISTAS SO2 2018 Controls	IPM SO2 2018 Controls
01127	ALABAMA POWER COMPANY GORGAS	8	9	0001	007	Coal Steam	None	None	None	None	Scrubber	None	Scrubber	None
01127	ALABAMA POWER COMPANY GORGAS	8	10	0001	008	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	None	Scrubber	Scrubber
01129	ALABAMA ELECTRIC COOP CHARLES R LOWMAN	56	1	0001	002	Coal Steam	None	None	None	None	Scrubber	None	Scrubber	None
01129	ALABAMA ELECTRIC COOP CHARLES R LOWMAN	56	2	0001	003	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
01129	ALABAMA ELECTRIC COOP CHARLES R LOWMAN	56	3	0001	004	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
12001	GAINESVILLE REGIONAL UTILITIES JOHN R KELLY	664	JRK6			O/G Steam	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement
12001	GAINESVILLE REGIONAL UTILITIES JOHN R KELLY	664	JRK7			O/G Steam	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement
12001	GAINESVILLE REGIONAL UTILITIES JOHN R KELLY	664	JRK8	0010005	7		O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement
12001	CITY OF GAINESVILLE, GRU DEERHAVEN	663	B1	0010006	3	O/G Steam	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
12001	CITY OF GAINESVILLE, GRU DEERHAVEN	663	B2	0010006	5	Coal Steam	None	None	SCR	SCR	None	None	Scrubber	Scrubber
12005	GULF POWER COMPANY LANSING SMITH PLANT	643	1	0050014	1	Coal Steam	None	None	SCR	SCR	None	None	None	Scrubber
12005	GULF POWER COMPANY LANSING SMITH PLANT	643	2	0050014	2	Coal Steam	None	None	SCR	SCR	None	None	None	Scrubber
12009	FLORIDA POWER & LIGHT (PCC) CAPE CANAVERAL	609	PCC1	0090006	1	O/G Steam	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
12009	FLORIDA POWER & LIGHT (PCC) CAPE CANAVERAL	609	PCC2	0090006	2	O/G Steam	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
12011	FLORIDA POWER & LIGHT (PPE) PORT EVERGLADES	617	PPE1	0110036	1	O/G Steam	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
12011	FLORIDA POWER & LIGHT (PPE) PORT EVERGLADES	617	PPE2	0110036	2	O/G Steam	None	None	None	None	None	None	None	None
12011	FLORIDA POWER & LIGHT (PPE) PORT EVERGLADES	617	PPE3	0110036	3	O/G Steam	None	None	None	None	None	None	None	None

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							Post-Combustion Controls							
FIPS	Facility Name	ORIS ID	BLR ID	SITE ID	UNIT ID	Plant Type	VISTAS NOx 2009 Controls	IPM NOx 2009 Controls	VISTAS NOx 2018 Controls	IPM NOx 2018 Controls	VISTAS SO2 2009 Controls	IPM SO2 2009 Controls	VISTAS SO2 2018 Controls	IPM SO2 2018 Controls
12011	FLORIDA POWER & LIGHT (PPE) PORT EVERGLADES	617	PPE4	0110036	4	O/G Steam	None	None	None	None	None	None	None	None
12017	PROGRESS ENERGY FLORIDA CRYSTAL RIVER	628	1	0170004	1	Coal Steam	None	None	None	None	None	None	None	None
12017	PROGRESS ENERGY FLORIDA CRYSTAL RIVER	628	2	0170004	2	Coal Steam	None	None	None	None	None	None	None	None
12017	PROGRESS ENERGY FLORIDA CRYSTAL RIVER	628	5	0170004	3	Coal Steam	None	None	SCR	SCR	None	None	Scrubber	Scrubber
12017	PROGRESS ENERGY FLORIDA CRYSTAL RIVER	628	4	0170004	4	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
12031	SAINT JOHNS RIVER	207	1	0310045-A	16		SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
12031	SAINT JOHNS RIVER	207	2	0310045-A	17		SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
12031	NORTHSIDE	667	2A	0310045-B	26	O/G Steam	No Operation	No Operation	None	No Operation	No Operation	No Operation	None	No Operation
12031	NORTHSIDE	667	1A	0310045-B	27	O/G Steam	No Operation	No Operation	None	No Operation	No Operation	No Operation	None	No Operation
12031	NORTHSIDE	667	3	0310045-B	3	O/G Steam	None	None	None	No Operation	None	None	None	None
12031	CEDAR BAY COGENERATION INC.	10672	GEN1	0310337	1	Coal Steam	None	SNCR	None	SNCR	Scrubber	Scrubber	Scrubber	Scrubber
12031	CEDAR BAY COGENERATION INC.			0310337	2									
12031	CEDAR BAY COGENERATION INC.			0310337	3									
12033	GULF POWER COMPANY CRIST ELECTRIC GENERATION	641	1	0330045	1									
12033	GULF POWER COMPANY CRIST ELECTRIC GENERATION	641	2	0330045	2	O/G Steam	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement
12033	GULF POWER COMPANY CRIST ELECTRIC GENERATION	641	3	0330045	3	O/G Steam	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement
12033	GULF POWER COMPANY CRIST ELECTRIC GENERATION	641	4	0330045	4	Coal Steam	None	None	None	None	None	None	Scrubber	None

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							Post-Combustion Controls							
FIPS	Facility Name	ORIS ID	BLR ID	SITE ID	UNIT ID	Plant Type	VISTAS NOx 2009 Controls	IPM NOx 2009 Controls	VISTAS NOx 2018 Controls	IPM NOx 2018 Controls	VISTAS SO2 2009 Controls	IPM SO2 2009 Controls	VISTAS SO2 2018 Controls	IPM SO2 2018 Controls
12033	GULF POWER COMPANY CRIST ELECTRIC GENERATION	641	5	0330045	5	Coal Steam	None	None	None	None	None	None	Scrubber	None
12033	GULF POWER COMPANY CRIST ELECTRIC GENERATION	641	6	0330045	6	Coal Steam	SNCR	SNCR	SNCR	SNCR	None	None	Scrubber	None
12033	GULF POWER COMPANY CRIST ELECTRIC GENERATION	641	7	0330045	7	Coal Steam	SCR	SCR	SCR	SCR	None	None	Scrubber	Scrubber
12053	Central Power and Lime Incorporated	10333	GEN1	0530021	18	Coal Steam	None	None	None	None	Scrubber	Scrubber	Scrubber	Scrubber
12057	TAMPA ELECTRIC COMPANY BIG BEND STATION	645	BB01	0570039	1	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
12057	TAMPA ELECTRIC COMPANY BIG BEND STATION	645	BB02	0570039	2	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
12057	TAMPA ELECTRIC COMPANY BIG BEND STATION	645	BB03	0570039	3	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
12057	TAMPA ELECTRIC COMPANY BIG BEND STATION	645	BB04	0570039	4	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
12057	TAMPA ELECTRIC COMPANY F.J. GANNON STATION	646	GB01	0570040	1		No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
12057	TAMPA ELECTRIC COMPANY F.J. GANNON STATION	646	GB02	0570040	2		No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
12057	TAMPA ELECTRIC COMPANY F.J. GANNON STATION	646	GB03	0570040	3		No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
12057	TAMPA ELECTRIC COMPANY F.J. GANNON STATION	646	GB04	0570040	4		No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
12057	TAMPA ELECTRIC COMPANY F.J. GANNON STATION	646	GB05	0570040	5		No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
12057	TAMPA ELECTRIC COMPANY F.J. GANNON STATION	646	GB06	0570040	6		No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
12061	CITY OF VERO BEACH	693		0610029	1	O/G Steam	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement
12061	CITY OF VERO BEACH	693	3	0610029	3	O/G Steam	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
12061	CITY OF VERO BEACH	693	4	0610029	4	O/G Steam	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation

APPENDIX H: EGU CONTROLS FOR COAL AND OIL/GAS UNITS FOR THE BASE G/G2 INVENTORY

FIPS	Facility Name	ORIS ID	BLR ID	SITE ID	UNIT ID	Plant Type	Post-Combustion Controls VISTAS NOx 2009 Controls	IPM NOx 2009 Controls	VISTAS NOx 2018 Controls	IPM NOx 2018 Controls	VISTAS SO2 2009 Controls	IPM SO2 2009 Controls	VISTAS SO2 2018 Controls	IPM SO2 2018 Controls
12063	GULF POWER COMPANY SCHOLZ	642	1	0630014	1	Coal Steam	None	None	None	None	None	None	None	None
12063	GULF POWER COMPANY SCHOLZ	642	2	0630014	2	Coal Steam	None	None	None	None	None	None	None	None
12073	CITY OF TALLAHASSEE ARVAH B.HOPKINS	688	1	0730003	1	O/G Steam	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
12073	CITY OF TALLAHASSEE ARVAH B.HOPKINS	688	2	0730003	4	O/G Steam	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
12081	FLORIDA POWER & LIGHT (PMT) MANATEE POWER	6042	PMT1	0810010	1	O/G Steam	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
12081	FLORIDA POWER & LIGHT (PMT) MANATEE POWER	6042	PMT2	0810010	2	O/G Steam	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
12085	FLORIDA POWER & LIGHT (PMR) FPL / MARTIN	6043	PMR1	0850001	1	O/G Steam	None	None	No Operation	No Operation	None	None	No Operation	No Operation
12085	FLORIDA POWER & LIGHT (PMR) FPL / MARTIN	6043	PMR2	0850001	2	O/G Steam	None	None	No Operation	No Operation	None	None	No Operation	No Operation
12085	INDIANTOWN COGENERATION, L.P.	50976	GEN1	0850102	1	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
12086	FLORIDA POWER & LIGHT (PCU) CUTLER POWER	610	PCU5	0250001	3	O/G Steam	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
12086	FLORIDA POWER & LIGHT (PCU) CUTLER POWER	610	PCU6	0250001	4	O/G Steam	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
12086	FLORIDA POWER & LIGHT (PTF) TURKEY POINT	621	PTP1	0250003	1	O/G Steam	None	None	No Operation	No Operation	None	None	No Operation	No Operation
12086	FLORIDA POWER & LIGHT (PTF) TURKEY POINT	621	PTP2	0250003	2	O/G Steam	None	None	No Operation	No Operation	None	None	No Operation	No Operation
12095	ORLANDO UTILITIES COMMISSION STANTON ENERGY	564	1	0950137	1	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
12095	ORLANDO UTILITIES COMMISSION STANTON ENERGY	564	2	0950137	2	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
12099	FLORIDA POWER & LIGHT (PRV) RIVIERA POWE	619	PRV3	0990042	3	O/G Steam	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
12099	FLORIDA POWER & LIGHT (PRV) RIVIERA POWE	619	PRV4	0990042	4	O/G Steam	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation

APPENDIX H: EGU CONTROLS FOR COAL AND OIL/GAS UNITS FOR THE BASE G/G2 INVENTORY

							Post-Combustion Controls							
FIPS	Facility Name	ORIS ID	BLR ID	SITE ID	UNIT ID	Plant Type	VISTAS NOx 2009 Controls	IPM NOx 2009 Controls	VISTAS NOx 2018 Controls	IPM NOx 2018 Controls	VISTAS SO2 2009 Controls	IPM SO2 2009 Controls	VISTAS SO2 2018 Controls	IPM SO2 2018 Controls
12099	CITY OF LAKE WORTH UTILITIES TOM G. SMITH	673	S-1	0990045	7	O/G Steam	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement
12099	CITY OF LAKE WORTH UTILITIES TOM G. SMITH	673	S-3	0990045	9	O/G Steam	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement
12101	PROGRESS ENERGY FLORIDA ANCLOTE	8048	1	1010017	1	O/G Steam	None	None	No Operation	No Operation	None	None	No Operation	No Operation
12101	PROGRESS ENERGY FLORIDA ANCLOTE	8048	2	1010017	2	O/G Steam	None	None	No Operation	No Operation	None	None	No Operation	No Operation
12103	PROGRESS ENERGY FLORIDA BARTOW	634	1	1030011	1	O/G Steam	No Operation	No Operation	None	No Operation	No Operation	No Operation	No Operation	No Operation
12103	PROGRESS ENERGY FLORIDA BARTOW	634	2	1030011	2	O/G Steam	O/G Early Retirement	O/G Early Retirement	None	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement
12103	PROGRESS ENERGY FLORIDA BARTOW	634	3	1030011	3	O/G Steam	No Operation	No Operation	None	No Operation	No Operation	No Operation	No Operation	No Operation
12105	LAKELAND ELECTRIC CHARLES LARSEN	675	7	1050003	4	O/G Steam	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement
12105	LAKELAND ELECTRIC C.D. MCINTOSH, JR.	676	3	1050004	6	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
12107	SEMINOLE ELECTRIC COOPERATIVE, INC.	136	1	1070025	1	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
12107	SEMINOLE ELECTRIC COOPERATIVE, INC.	136	2	1070025	2	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
12111	FT PIERCE UTILITIES AUTHORITY FT PIERCE	658	7	1110003	7	O/G Steam	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
12111	FT PIERCE UTILITIES AUTHORITY FT PIERCE	658	8	1110003	8	O/G Steam	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
12121	PROGRESS ENERGY FLORIDA SUWANNEE RIVER	638	1	1210003	1	O/G Steam	O/G Early Retirement	O/G Early Retirement	None	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement
12121	PROGRESS ENERGY FLORIDA SUWANNEE RIVER	638	2	1210003	2	O/G Steam	O/G Early Retirement	O/G Early Retirement	None	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement
12121	PROGRESS ENERGY FLORIDA SUWANNEE RIVER	638	3	1210003	3	O/G Steam	No Operation	No Operation	None	No Operation	No Operation	No Operation	No Operation	No Operation
12127	FLORIDA POWER & LIGHT (PSN) SANFORD POWER	620	PSN3	1270009	1	O/G Steam	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement

APPENDIX H: EGU CONTROLS FOR COAL AND OIL/GAS UNITS FOR THE BASE G/G2 INVENTORY

							Post-Combustion Controls							
FIPS	Facility Name	ORIS ID	BLR ID	SITE ID	UNIT ID	Plant Type	VISTAS NOx 2009 Controls	IPM NOx 2009 Controls	VISTAS NOx 2018 Controls	IPM NOx 2018 Controls	VISTAS SO2 2009 Controls	IPM SO2 2009 Controls	VISTAS SO2 2018 Controls	IPM SO2 2018 Controls
12127	FLORIDA POWER & LIGHT (PSN) SANFORD POWER	620	PSN4	1270009	2		No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
12129	TALLAHASSEE CITY PURDOM GENERATING STATION	689	7	1290001	7	O/G Steam	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
13015	GEORGIA POWER COMPANY, BOWEN STEAM-ELECT	703	1BLR	01500011	SG01	Coal Steam	SCR	SCR	SCR	SCR	None	Scrubber	Scrubber	Scrubber
13015	GEORGIA POWER COMPANY, BOWEN STEAM-ELECT	703	2BLR	01500011	SG02	Coal Steam	SCR	SCR	SCR	SCR	None	Scrubber	Scrubber	Scrubber
13015	GEORGIA POWER COMPANY, BOWEN STEAM-ELECT	703	3BLR	01500011	SG03	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
13015	GEORGIA POWER COMPANY, BOWEN STEAM-ELECT	703	4BLR	01500011	SG04	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
13021	ARKWRIGHT	699	1	0002	1		No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
13021	ARKWRIGHT	699	2	0002	2		No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
13021	ARKWRIGHT	699	3	0002	3		No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
13021	ARKWRIGHT	699	4	0002	4		No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
13051	SAVANNAH ELECTRIC: KRAFT STEAM	733	1	05100006	SG01	Coal Steam	None	None	None	None	None	None	None	None
13051	SAVANNAH ELECTRIC: KRAFT STEAM	733	2	05100006	SG02	Coal Steam	None	None	None	None	None	None	None	None
13051	SAVANNAH ELECTRIC: KRAFT STEAM	733	3	05100006	SG03	Coal Steam	None	None	None	SCR	None	None	None	None
13051	SAVANNAH ELECTRIC: KRAFT STEAM	733	4	05100006	SG04	O/G Steam	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
13051	RIVERSIDE	734	11	05100018	11	O/G Steam	None	No Operation	No Operation	No Operation	None	No Operation	No Operation	No Operation
13051	RIVERSIDE	734	12	05100018	12	O/G Steam	None	No Operation	No Operation	No Operation	None	No Operation	No Operation	No Operation
13051	RIVERSIDE	734	4	05100018	4	O/G Steam	None	None	None	None	None	None	None	None

APPENDIX H: EGU CONTROLS FOR COAL AND OIL/GAS UNITS FOR THE BASE G/G2 INVENTORY

							Post-Combustion Controls							
FIPS	Facility Name	ORIS ID	BLR ID	SITE ID	UNIT ID	Plant Type	VISTAS NOx 2009 Controls	IPM NOx 2009 Controls	VISTAS NOx 2018 Controls	IPM NOx 2018 Controls	VISTAS SO2 2009 Controls	IPM SO2 2009 Controls	VISTAS SO2 2018 Controls	IPM SO2 2018 Controls
13051	RIVERSIDE	734	5	05100018	5	O/G Steam	None	No Operation	No Operation	No Operation	None	No Operation	No Operation	No Operation
13051	RIVERSIDE	734	6	05100018	6	O/G Steam	None	No Operation	No Operation	No Operation	None	No Operation	No Operation	No Operation
13067	GEORGIA POWER COMPANY, MCDONOUGH STEAM	710	MB1	06700003	SGM1	Coal Steam	None	None	SCR	SCR	None	None	Scrubber	Scrubber
13067	GEORGIA POWER COMPANY, MCDONOUGH STEAM	710	MB2	06700003	SGM2	Coal Steam	None	None	SCR	SCR	None	None	Scrubber	Scrubber
13077	GEORGIA POWER COMPANY, YATES STEAM-ELECTRIC	728	Y1BR	07700001	SG01	Coal Steam	None	None	None	None	Scrubber	Scrubber	Scrubber	Scrubber
13077	GEORGIA POWER COMPANY, YATES STEAM-ELECTRIC	728	Y2BR	07700001	SG02	Coal Steam	None	None	None	None	None	None	None	None
13077	GEORGIA POWER COMPANY, YATES STEAM-ELECTRIC	728	Y3BR	07700001	SG03	Coal Steam	None	None	None	None	None	None	None	None
13077	GEORGIA POWER COMPANY, YATES STEAM-ELECTRIC	728	Y4BR	07700001	SG04	Coal Steam	None	None	SCR	SCR	None	None	None	Scrubber
13077	GEORGIA POWER COMPANY, YATES STEAM-ELECTRIC	728	Y5BR	07700001	SG05	Coal Steam	None	None	SCR	SCR	None	None	None	Scrubber
13077	GEORGIA POWER COMPANY, YATES STEAM-ELECTRIC	728	Y6BR	07700001	SG06	Coal Steam	None	None	SCR	SCR	None	None	Scrubber	Scrubber
13077	GEORGIA POWER COMPANY, YATES STEAM-ELECTRIC	728	Y7BR	07700001	SG07	Coal Steam	None	None	SCR	SCR	None	None	Scrubber	Scrubber
13095	GEORGIA POWER COMPANY, MITCHELL STEAM-ELECTRIC	727		09500002	SG01		No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
13095	GEORGIA POWER COMPANY, MITCHELL STEAM-ELECTRIC	727		09500002	SG02		No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
13095	GEORGIA POWER COMPANY, MITCHELL STEAM-ELECTRIC	727	3	09500002	SG03	Coal Steam	None	None	None	None	None	None	None	None
13103	SAVANNAH ELECTRIC: MCINTOSH STEAM - ELECTRIC	6124	1	10300003	SG01	Coal Steam	None	None	None	SCR	None	None	None	None
13115	GEORGIA POWER COMPANY, HAMMOND STEAM-ELECTRIC	708	1	11500003	SG01	Coal Steam	None	None	SCR	SCR	Scrubber	None	Scrubber	Scrubber
13115	GEORGIA POWER COMPANY, HAMMOND STEAM-ELECTRIC	708	2	11500003	SG02	Coal Steam	None	None	SCR	SCR	Scrubber	None	Scrubber	Scrubber

APPENDIX H: EGU CONTROLS FOR COAL AND OIL/GAS UNITS FOR THE BASE G/G2 INVENTORY

							Post-Combustion Controls							
FIPS	Facility Name	ORIS ID	BLR ID	SITE ID	UNIT ID	Plant Type	VISTAS NOx 2009 Controls	IPM NOx 2009 Controls	VISTAS NOx 2018 Controls	IPM NOx 2018 Controls	VISTAS SO2 2009 Controls	IPM SO2 2009 Controls	VISTAS SO2 2018 Controls	IPM SO2 2018 Controls
13115	GEORGIA POWER COMPANY, HAMMOND STEAM-ELECTRIC	708	3	11500003	SG03	Coal Steam	None	None	SCR	SCR	Scrubber	None	Scrubber	Scrubber
13115	GEORGIA POWER COMPANY, HAMMOND STEAM-ELECTRIC	708	4	11500003	SG04	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
13127	GEORGIA POWER COMPANY, MCMANUS STEAM-ELECTRIC	715	1	12700004	SG01	O/G Steam	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
13127	GEORGIA POWER COMPANY, MCMANUS STEAM-ELECTRIC	715	2	12700004	SG02	O/G Steam	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
13149	GEORGIA POWER COMPANY, WANSLEY STEAM-ELECTRIC	6052	1	14900001	SG01	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
13149	GEORGIA POWER COMPANY, WANSLEY STEAM-ELECTRIC	6052	2	14900001	SG02	Coal Steam	SCR	SCR	SCR	SCR	None	Scrubber	Scrubber	Scrubber
13207	GEORGIA POWER COMPANY, SCHERER STEAM-ELECTRIC	6257	1	20700008	SG01	Coal Steam	None	None	None	None	None	None	Scrubber	None
13207	GEORGIA POWER COMPANY, SCHERER STEAM-ELECTRIC	6257	2	20700008	SG02	Coal Steam	None	None	None	None	None	None	Scrubber	None
13207	GEORGIA POWER COMPANY, SCHERER STEAM-ELECTRIC	6257	3	20700008	SG03	Coal Steam	None	None	None	None	None	None	Scrubber	None
13207	GEORGIA POWER COMPANY, SCHERER STEAM-ELECTRIC	6257	4	20700008	SG04	Coal Steam	None	None	None	None	None	None	Scrubber	None
13237	GEORGIA POWER COMPANY, HARLLEE BRANCH	709	1	23700008	SG01	Coal Steam	None	None	SCR	SCR	None	None	Scrubber	Scrubber
13237	GEORGIA POWER COMPANY, HARLLEE BRANCH	709	2	23700008	SG02	Coal Steam	None	None	SCR	SCR	None	None	Scrubber	Scrubber
13237	GEORGIA POWER COMPANY, HARLLEE BRANCH	709	3	23700008	SG03	Coal Steam	None	None	SCR	SCR	None	None	Scrubber	Scrubber
13237	GEORGIA POWER COMPANY, HARLLEE BRANCH	709	4	23700008	SG04	Coal Steam	None	None	SCR	SCR	None	None	Scrubber	Scrubber
21015	CINCINNATI GAS & ELECTRIC EAST BEND STAT	6018	2	2101500029	002	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
21041	KENTUCKY UTILITIES CO GHENT GENERATING STATION	1356	1	2104100010	001	Coal Steam	SCR	None	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
21041	KENTUCKY UTILITIES CO GHENT GENERATING STATION	1356	2	2104100010	002	Coal Steam	None	None	SCR	SCR	Scrubber	None	Scrubber	Scrubber

APPENDIX H: EGU CONTROLS FOR COAL AND OIL/GAS UNITS FOR THE BASE G/G2 INVENTORY

							Post-Combustion Controls							
FIPS	Facility Name	ORIS ID	BLR ID	SITE ID	UNIT ID	Plant Type	VISTAS NOx 2009 Controls	IPM NOx 2009 Controls	VISTAS NOx 2018 Controls	IPM NOx 2018 Controls	VISTAS SO2 2009 Controls	IPM SO2 2009 Controls	VISTAS SO2 2018 Controls	IPM SO2 2018 Controls
21041	KENTUCKY UTILITIES CO GHENT GENERATING STATION	1356	3	2104100010	003	Coal Steam	SCR	None	SCR	SCR	Scrubber	None	Scrubber	Scrubber
21041	KENTUCKY UTILITIES CO GHENT GENERATING STATION	1356	4	2104100010	004	Coal Steam	SCR	None	SCR	SCR	Scrubber	None	Scrubber	Scrubber
21049	EAST KY POWER COOP WILLIAM C DALE PLANT	1385	1	2104900003	001	Coal Steam	None	None	None	None	None	None	None	None
21049	EAST KY POWER COOP WILLIAM C DALE PLANT	1385	2	2104900003	002	Coal Steam	None	None	None	None	None	None	None	None
21049	EAST KY POWER COOP WILLIAM C DALE PLANT	1385	3	2104900003	003	Coal Steam	None	None	None	None	None	None	None	None
21049	EAST KY POWER COOP WILLIAM C DALE PLANT	1385	4	2104900003	004	Coal Steam	None	None	None	None	None	None	None	None
21059	OWENSBORO MUNICIPAL UTIL ELMER SMITH STATION	1374	1	2105900027	001	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
21059	OWENSBORO MUNICIPAL UTIL ELMER SMITH STATION	1374	2	2105900027	002	Coal Steam	None	None	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
21091	WESTERN KY ENERGY CORP COLEMAN STATION	1381	C1	2109100003	001	Coal Steam	None	None	SCR	SCR	Scrubber	None	Scrubber	Scrubber
21091	WESTERN KY ENERGY CORP COLEMAN STATION	1381	C2	2109100003	002	Coal Steam	None	None	SCR	SCR	Scrubber	None	Scrubber	Scrubber
21091	WESTERN KY ENERGY CORP COLEMAN STATION	1381	C3	2109100003	003	Coal Steam	None	None	SCR	SCR	Scrubber	None	Scrubber	Scrubber
21101	HENDERSON MUN POW & LIGHT	1372	6	2110100012	002	Coal Steam	None	None	None	None	None	None	None	None
21101	HENDERSON MUN POW & LIGHT	1372	5	2110100012	5	Coal Steam	None	None	None	None	None	None	None	None
21111	LOU GAS & ELEC, CANE RUN	1363	4	0126	04	Coal Steam	None	None	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
21111	LOU GAS & ELEC, CANE RUN	1363	5	0126	05	Coal Steam	None	None	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
21111	LOU GAS & ELEC, CANE RUN	1363	6	0126	06	Coal Steam	None	None	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
21111	LOU GAS & ELEC, MILL CREEK	1364	1	0127	01	Coal Steam	None	None	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber

APPENDIX H: EGU CONTROLS FOR COAL AND OIL/GAS UNITS FOR THE BASE G/G2 INVENTORY

							Post-Combustion Controls							
FIPS	Facility Name	ORIS ID	BLR ID	SITE ID	UNIT ID	Plant Type	VISTAS NOx 2009 Controls	IPM NOx 2009 Controls	VISTAS NOx 2018 Controls	IPM NOx 2018 Controls	VISTAS SO2 2009 Controls	IPM SO2 2009 Controls	VISTAS SO2 2018 Controls	IPM SO2 2018 Controls
21111	LOU GAS & ELEC, MILL CREEK	1364	2	0127	02	Coal Steam	None	None	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
21111	LOU GAS & ELEC, MILL CREEK	1364	3	0127	03	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
21111	LOU GAS & ELEC, MILL CREEK	1364	4	0127	04	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
21127	KENTUCKY POWER CO BIG SANDY PLANT	1353	BSU1	2112700003	001	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
21127	KENTUCKY POWER CO BIG SANDY PLANT	1353	BSU2	2112700003	002	Coal Steam	SCR	SCR	SCR	SCR	None	None	Scrubber	Scrubber
21145	TVA-ENVIRONMENTAL AFFAIRS SHAWNEE PLANT	1379	1	2114500006	001	Coal Steam	None	None	None	None	None	None	None	None
21145	TVA-ENVIRONMENTAL AFFAIRS SHAWNEE PLANT	1379	2	2114500006	002	Coal Steam	None	None	None	None	None	None	None	None
21145	TVA-ENVIRONMENTAL AFFAIRS SHAWNEE PLANT	1379	3	2114500006	003	Coal Steam	None	None	None	None	None	None	None	None
21145	TVA-ENVIRONMENTAL AFFAIRS SHAWNEE PLANT	1379	4	2114500006	004	Coal Steam	None	None	None	None	None	None	None	None
21145	TVA-ENVIRONMENTAL AFFAIRS SHAWNEE PLANT	1379	5	2114500006	005	Coal Steam	None	None	None	None	None	None	None	None
21145	TVA-ENVIRONMENTAL AFFAIRS SHAWNEE PLANT	1379	6	2114500006	006	Coal Steam	None	None	None	None	None	None	None	None
21145	TVA-ENVIRONMENTAL AFFAIRS SHAWNEE PLANT	1379	7	2114500006	007	Coal Steam	None	None	None	None	None	None	None	None
21145	TVA-ENVIRONMENTAL AFFAIRS SHAWNEE PLANT	1379	8	2114500006	008	Coal Steam	None	None	None	None	None	None	None	None
21145	TVA-ENVIRONMENTAL AFFAIRS SHAWNEE PLANT	1379	9	2114500006	009	Coal Steam	None	None	None	None	None	None	None	None
21145	TVA-ENVIRONMENTAL AFFAIRS SHAWNEE PLANT	1379	10	2114500006	016	Coal Steam	None	None	None	None	None	None	None	None
21161	EAST KY POWER COOP SPURLOCK ST. MAYSVILLE	6041	1	2116100009	001	Coal Steam	SCR	SCR	SCR	SCR	None	None	Scrubber	Scrubber

APPENDIX H: EGU CONTROLS FOR COAL AND OIL/GAS UNITS FOR THE BASE G/G2 INVENTORY

FIPS	Facility Name	ORIS ID	BLR ID	SITE ID	UNIT ID	Plant Type	Post-Combustion Controls							
							VISTAS NOx 2009 Controls	IPM NOx 2009 Controls	VISTAS NOx 2018 Controls	IPM NOx 2018 Controls	VISTAS SO2 2009 Controls	IPM SO2 2009 Controls	VISTAS SO2 2018 Controls	IPM SO2 2018 Controls
21161	EAST KY POWER COOP SPURLOCK ST. MAYSVILLE	6041	2	2116100009	002	Coal Steam	SCR	SCR	SCR	SCR	None	None	Scrubber	Scrubber
21167	KENTUCKY UTILITIES CO BROWN FACILITY	1355	1	2116700001	001	Coal Steam	None	None	None	None	Scrubber	None	Scrubber	None
21167	KENTUCKY UTILITIES CO BROWN FACILITY	1355	2	2116700001	002	Coal Steam	None	None	SCR	SCR	Scrubber	None	Scrubber	Scrubber
21167	KENTUCKY UTILITIES CO BROWN FACILITY	1355	3	2116700001	003	Coal Steam	None	None	SCR	SCR	Scrubber	None	Scrubber	Scrubber
21177	KENTUCKY UTILITIES CO GREEN RIVER STATION	1357	4	2117700001	003	Coal Steam	None	None	None	None	None	None	None	None
21177	KENTUCKY UTILITIES CO GREEN RIVER STATION	1357	5	2117700001	004	Coal Steam	None	None	None	None	None	None	None	None
21177	TVA PARADISE STEAM PLANT	1378	1	2117700006	001	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
21177	TVA PARADISE STEAM PLANT	1378	2	2117700006	002	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
21177	TVA PARADISE STEAM PLANT	1378	3	2117700006	003	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
21183	WESTERN KY ENERGY CORP WILSON STATION	6823	W1	2118300069	001	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
21199	EAST KY POWER COOP JOHN SHERMAN COOPER	1384	1	2119900005	001	Coal Steam	None	None	None	None	None	None	None	None
21199	EAST KY POWER COOP JOHN SHERMAN COOPER	1384	2	2119900005	002	Coal Steam	SCR	SCR	SCR	SCR	None	None	Scrubber	Scrubber
21223	LOUISVILLE GAS & ELECTRIC TRIMBLE CO GEN	6071	1	2122300002	001	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
21233	HENDERSON STATION 2	1382	H1	2123300001-A	002	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
21233	HENDERSON STATION 2	1382	H2	2123300001-A	003	Coal Steam	SCR	None	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
21233	WESTERN KY ENERGY CORP REID	1383	R1	2123300001-B	001	Coal Steam	None	None	None	None	None	None	None	None
21233	WESTERN KY ENERGY CORP GREEN STATION	6639	G1	2123300052	001	Coal Steam	None	None	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber

APPENDIX H: EGU CONTROLS FOR COAL AND OIL/GAS UNITS FOR THE BASE G/G2 INVENTORY

FIPS	Facility Name	ORIS ID	BLR ID	SITE ID	UNIT ID	Plant Type	Post-Combustion Controls							
							VISTAS NOx 2009 Controls	IPM NOx 2009 Controls	VISTAS NOx 2018 Controls	IPM NOx 2018 Controls	VISTAS SO2 2009 Controls	IPM SO2 2009 Controls	VISTAS SO2 2018 Controls	IPM SO2 2018 Controls
21233	WESTERN KY ENERGY CORP GREEN STATION	6639	G2	2123300052	002	Coal Steam	None	None	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
21239	KENTUCKY UTILITIES TYRONE FACILITY	1361	5	2123900001	005	Coal Steam	None	None	None	None	None	None	None	None
28011	ENTERGY MISSISSIPPI INC, DELTA PLANT	2051	1	2801100031	001	O/G Steam	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement
28011	ENTERGY MISSISSIPPI INC, DELTA PLANT	2051		2801100031	002		O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement
28011	ENTERGY MISSISSIPPI INC, DELTA PLANT	2051	2	2801100031	003	O/G Steam	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement
28011	ENTERGY MISSISSIPPI INC, DELTA PLANT	2051		2801100031	004		O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement
28019	CHOCTAW GENERATION LLP, RED HILLS GENERATING	55076	AA001	2801900011	001A	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
28019	CHOCTAW GENERATION LLP, RED HILLS GENERATING	55076	AA002	2801900011	001B		None	None	None	None	None	None	None	None
28035	MISSISSIPPI POWER COMPANY, PLANT EATON	2046		2803500038	001	O/G Steam	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
28035	MISSISSIPPI POWER COMPANY, PLANT EATON	2046		2803500038	002	O/G Steam	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
28035	MISSISSIPPI POWER COMPANY, PLANT EATON	2046		2803500038	003	O/G Steam	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
28047	MISSISSIPPI POWER COMPANY, PLANT JACK WATSON	2049	1	2804700055	001	O/G Steam	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
28047	MISSISSIPPI POWER COMPANY, PLANT JACK WATSON	2049	2	2804700055	002	O/G Steam	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
28047	MISSISSIPPI POWER COMPANY, PLANT JACK WATSON	2049	3	2804700055	003	O/G Steam	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
28047	MISSISSIPPI POWER COMPANY, PLANT JACK WATSON	2049	4	2804700055	004	Coal Steam	None	SCR	SCR	SCR	None	None	None	Scrubber
28047	MISSISSIPPI POWER COMPANY, PLANT JACK WATSON	2049	5	2804700055	005	Coal Steam	None	SCR	SCR	SCR	None	None	Scrubber	Scrubber

APPENDIX H: EGU CONTROLS FOR COAL AND OIL/GAS UNITS FOR THE BASE G/G2 INVENTORY

							Post-Combustion Controls							
FIPS	Facility Name	ORIS ID	BLR ID	SITE ID	UNIT ID	Plant Type	VISTAS NOx 2009 Controls	IPM NOx 2009 Controls	VISTAS NOx 2018 Controls	IPM NOx 2018 Controls	VISTAS SO2 2009 Controls	IPM SO2 2009 Controls	VISTAS SO2 2018 Controls	IPM SO2 2018 Controls
28049	ENTERGY MISSISSIPPI INC, REX BROWN PLANT	2053	4	2804900112	001	O/G Steam	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement
28049	ENTERGY MISSISSIPPI INC, REX BROWN PLANT	2053	3	2804900112	002	O/G Steam	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement
28059	MISSISSIPPI POWER COMPANY, PLANT DANIEL	6073	1	2805900090	001	Coal Steam	None	SCR	SCR	SCR	None	None	Scrubber	Scrubber
28059	MISSISSIPPI POWER COMPANY, PLANT DANIEL	6073	2	2805900090	002	Coal Steam	None	SCR	SCR	SCR	None	None	Scrubber	Scrubber
28067	MOSELLE SOUTH MISSISSIPPI ELECTRIC POWER ASSOCIATION	2070	1	2806700035	001	O/G Steam	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
28067	MOSELLE SOUTH MISSISSIPPI ELECTRIC POWER ASSOCIATION	2070	2	2806700035	002	O/G Steam	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
28067	MOSELLE SOUTH MISSISSIPPI ELECTRIC POWER ASSOCIATION	2070	3	2806700035	003	O/G Steam	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
28073	RD MORROW SOUTH MISSISSIPPI ELECTRIC POWER ASSOCIATION	6061	1	2807300021	001	Coal Steam	None	None	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
28073	RD MORROW SOUTH MISSISSIPPI ELECTRIC POWER ASSOCIATION	6061	2	2807300021	002	Coal Steam	None	None	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
28075	MISSISSIPPI POWER COMPANY, PLANT SWEATT	2048	1	2807500032	001	O/G Steam	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
28075	MISSISSIPPI POWER COMPANY, PLANT SWEATT	2048	2	2807500032	002	O/G Steam	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
28083	GREENWOOD UTILITIES, HENDERSON STATION	2062	H1	2808300048	001	O/G Steam	None	None	None	None	No Operation	No Operation	No Operation	No Operation
28083	GREENWOOD UTILITIES, HENDERSON STATION	2062	H3	2808300048	003	O/G Steam	None	None	None	None	No Operation	No Operation	No Operation	No Operation
28149	ENTERGY MISSISSIPPI INC, BAXTER WILSON	2050	1	2814900027	001	O/G Steam	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement
28149	ENTERGY MISSISSIPPI INC, BAXTER WILSON	2050	2	2814900027	002	O/G Steam	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement
28151	ENTERGY MISSISSIPPI INC, GERALD ANDRUS	8054	1	2815100048	001	O/G Steam	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation

APPENDIX H: EGU CONTROLS FOR COAL AND OIL/GAS UNITS FOR THE BASE G/G2 INVENTORY

							Post-Combustion Controls							
FIPS	Facility Name	ORIS ID	BLR ID	SITE ID	UNIT ID	Plant Type	VISTAS NOx 2009 Controls	IPM NOx 2009 Controls	VISTAS NOx 2018 Controls	IPM NOx 2018 Controls	VISTAS SO2 2009 Controls	IPM SO2 2009 Controls	VISTAS SO2 2018 Controls	IPM SO2 2018 Controls
28163	YAZOO CITY PUBLIC SERVICE COMMISSION	2067	3	2816300005	001	O/G Steam	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement
37017	ELIZABETHTOWN POWER, LLC	10380	UNIT1	3701700043	G-17A	Coal Steam	None	None	None	None	None	None	None	None
37017	ELIZABETHTOWN POWER, LLC	10380	UNIT2	3701700043	G-17B		None	None	None	None	None	None	None	None
37019	COGENTRIX OF NORTH CAROLINA INC - SOUTHPORT	10378	GEN1	3701900067	G-29	Coal Steam	None	None	None	None	None	None	None	None
37019	COGENTRIX OF NORTH CAROLINA INC - SOUTHPORT	10378	GEN2	3701900067	G-30	Coal Steam	None	None	None	None	None	None	None	None
37021	CAROLINA POWER & LIGHT ASHEVILLE STEAM	2706	1	628	1	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
37021	CAROLINA POWER & LIGHT ASHEVILLE STEAM	2706	2	628	2	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
37025	KANNAPOLIS ENERGY PARTNERS LLC			3702500113	G-2	Coal Steam	None	None	None	None	None	None	None	None
37025	KANNAPOLIS ENERGY PARTNERS LLC			3702500113	G-3	Coal Steam	None	None	None	None	None	None	None	None
37035	DUKE ENERGY CORPORATION MARSHALL STEAM	2727	3	3703500073	G-1	Coal Steam	SNCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
37035	DUKE ENERGY CORPORATION MARSHALL STEAM	2727	4	3703500073	G-2	Coal Steam	SNCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
37035	DUKE ENERGY CORPORATION MARSHALL STEAM	2727	1	3703500073	G-4	Coal Steam	SNCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
37035	DUKE ENERGY CORPORATION MARSHALL STEAM	2727	2	3703500073	G-5	Coal Steam	SNCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
37037	PROGRESS ENERGY CAROLINAS CAPE FEAR	2708	5	3703700063	G-1	Coal Steam	SNCR	SNCR	SNCR	SNCR	None	None	Scrubber	Scrubber
37037	PROGRESS ENERGY CAROLINAS CAPE FEAR	2708	6	3703700063	G-2	Coal Steam	SNCR	SNCR	SNCR	SNCR	None	None	Scrubber	Scrubber
37071	DUKE ENERGY CORPORATION ALLEN STEAM	2718	1	3707100039	G-14	Coal Steam	SNCR	SNCR	SNCR	SNCR	Scrubber	Scrubber	Scrubber	Scrubber
37071	DUKE ENERGY CORPORATION ALLEN STEAM	2718	2	3707100039	G-15	Coal Steam	SNCR	SNCR	SNCR	SNCR	Scrubber	Scrubber	Scrubber	Scrubber

APPENDIX H: EGU CONTROLS FOR COAL AND OIL/GAS UNITS FOR THE BASE G/G2 INVENTORY

							Post-Combustion Controls							
FIPS	Facility Name	ORIS ID	BLR ID	SITE ID	UNIT ID	Plant Type	VISTAS NOx 2009 Controls	IPM NOx 2009 Controls	VISTAS NOx 2018 Controls	IPM NOx 2018 Controls	VISTAS SO2 2009 Controls	IPM SO2 2009 Controls	VISTAS SO2 2018 Controls	IPM SO2 2018 Controls
37071	DUKE ENERGY CORPORATION ALLEN STEAM	2718	3	3707100039	G-16	Coal Steam	SNCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
37071	DUKE ENERGY CORPORATION ALLEN STEAM	2718	4	3707100039	G-17	Coal Steam	SNCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
37071	DUKE ENERGY CORPORATION ALLEN STEAM	2718	5	3707100039	G-18	Coal Steam	SNCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
37071	DUKE ENERGY CORPORATION RIVERBEND STEAM	2732	7	3707100040	G-17	Coal Steam	SNCR	SNCR	SNCR	SNCR	None	None	None	None
37071	DUKE ENERGY CORPORATION RIVERBEND STEAM	2732	8	3707100040	G-18	Coal Steam	SNCR	SNCR	SNCR	SNCR	None	None	None	None
37071	DUKE ENERGY CORPORATION RIVERBEND STEAM	2732	9	3707100040	G-19	Coal Steam	SNCR	SNCR	SNCR	SNCR	None	None	None	None
37071	DUKE ENERGY CORPORATION RIVERBEND STEAM	2732	10	3707100040	G-20	Coal Steam	SNCR	SNCR	SNCR	SNCR	None	None	None	None
37083	ROANOKE VALLEY ENERGY FACILITY			3708300174	G-27	Coal Steam	None	None	None	None	None	None	None	None
37083	ROANOKE VALLEY ENERGY FACILITY			3708300174	G-7	Coal Steam	None	None	None	None	None	None	None	None
37129	L V SUTTON STEAM ELECTRIC PLANT	2713	1	3712900036	G-187	Coal Steam	None	SNCR	SNCR	SNCR	None	None	None	None
37129	L V SUTTON STEAM ELECTRIC PLANT	2713	2	3712900036	G-188	Coal Steam	None	SCR	SCR	SCR	None	None	None	None
37129	L V SUTTON STEAM ELECTRIC PLANT	2713	3	3712900036	G-189	Coal Steam	None	SCR	SCR	SCR	None	Scrubber	Scrubber	Scrubber
37145	CP&L - ROXBORO STEAM ELECTRIC PLANT	2712	1	3714500029	G-29	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
37145	CP&L - ROXBORO STEAM ELECTRIC PLANT	2712	2	3714500029	G-30	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
37145	CP&L - ROXBORO STEAM ELECTRIC PLANT	2712	3A	3714500029	G-35A	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
37145	CP&L - ROXBORO STEAM ELECTRIC PLANT	2712	3B	3714500029	G-35B	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
37145	CP&L - ROXBORO STEAM ELECTRIC PLANT	2712	4A	3714500029	G-36A	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber

APPENDIX H: EGU CONTROLS FOR COAL AND OIL/GAS UNITS FOR THE BASE G/G2 INVENTORY

							Post-Combustion Controls							
FIPS	Facility Name	ORIS ID	BLR ID	SITE ID	UNIT ID	Plant Type	VISTAS NOx 2009 Controls	IPM NOx 2009 Controls	VISTAS NOx 2018 Controls	IPM NOx 2018 Controls	VISTAS SO2 2009 Controls	IPM SO2 2009 Controls	VISTAS SO2 2018 Controls	IPM SO2 2018 Controls
37145	CP&L - ROXBORO STEAM ELECTRIC PLANT	2712	4B	3714500029	G-36B	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
37145	CP&L - MAYO FACILITY	6250	1A	3714500045	G-46A	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
37145	CP&L - MAYO FACILITY	6250	1B	3714500045	G-46B	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
37155	PROGRESS ENERGY CAROLINAS, INC., W.H. WEATHERSPOON	2716	1	3715500147	G-24	Coal Steam	None	SNCR	SNCR	SNCR	None	None	None	None
37155	PROGRESS ENERGY CAROLINAS, INC., W.H. WEATHERSPOON	2716	2	3715500147	G-25	Coal Steam	None	SNCR	SNCR	SNCR	None	None	None	None
37155	PROGRESS ENERGY CAROLINAS, INC., W.H. WEATHERSPOON	2716	3	3715500147	G-26	Coal Steam	None	SNCR	SNCR	SNCR	None	None	None	None
37155	LUMBERTON POWER, LLC	10382	UNIT1	3715500166	G-17A	Coal Steam	None	None	None	None	None	None	None	None
37155	LUMBERTON POWER, LLC	10382	UNIT2	3715500166	G-17B		None	None	None	None	None	None	None	None
37157	DUKE ENERGY CORP DAN RIVER STEAM	2723	3	3715700015	G-21	Coal Steam	None	SNCR	SNCR	SNCR	None	None	None	None
37157	DUKE ENERGY CORP DAN RIVER STEAM	2723	1	3715700015	G-22	Coal Steam	None	SNCR	SNCR	SNCR	None	None	None	None
37157	DUKE ENERGY CORP DAN RIVER STEAM	2723	2	3715700015	G-23	Coal Steam	None	SNCR	SNCR	SNCR	None	None	None	None
37159	DUKE ENERGY CORPORATION BUCK STEAM	2720	5	3715900004	G-1	Coal Steam	None	SNCR	SNCR	SNCR	None	None	None	None
37159	DUKE ENERGY CORPORATION BUCK STEAM	2720	6	3715900004	G-2	Coal Steam	None	SNCR	SNCR	SNCR	None	None	None	None
37159	DUKE ENERGY CORPORATION BUCK STEAM	2720	7	3715900004	G-3	Coal Steam	SNCR	SNCR	SNCR	SNCR	None	None	None	None
37159	DUKE ENERGY CORPORATION BUCK STEAM	2720	8	3715900004	G-4	Coal Steam	SNCR	SNCR	SNCR	SNCR	None	None	None	None
37159	DUKE ENERGY CORPORATION BUCK STEAM	2720	9	3715900004	G-5	Coal Steam	SNCR	SNCR	SNCR	SNCR	None	None	None	None

APPENDIX H: EGU CONTROLS FOR COAL AND OIL/GAS UNITS FOR THE BASE G/G2 INVENTORY

							Post-Combustion Controls							
FIPS	Facility Name	ORIS ID	BLR ID	SITE ID	UNIT ID	Plant Type	VISTAS NOx 2009 Controls	IPM NOx 2009 Controls	VISTAS NOx 2018 Controls	IPM NOx 2018 Controls	VISTAS SO2 2009 Controls	IPM SO2 2009 Controls	VISTAS SO2 2018 Controls	IPM SO2 2018 Controls
37161	DUKE ENERGY CORPORATION CLIFFSIDE STEAM	2721	1	3716100028	G-82	Coal Steam	None	SNCR	SNCR	SNCR	None	None	None	None
37161	DUKE ENERGY CORPORATION CLIFFSIDE STEAM	2721	2	3716100028	G-83	Coal Steam	None	SNCR	SNCR	SNCR	None	None	None	None
37161	DUKE ENERGY CORPORATION CLIFFSIDE STEAM	2721	3	3716100028	G-84	Coal Steam	None	SNCR	SNCR	SNCR	None	None	None	None
37161	DUKE ENERGY CORPORATION CLIFFSIDE STEAM	2721	4	3716100028	G-85	Coal Steam	None	SNCR	SNCR	SNCR	None	None	None	None
37161	DUKE ENERGY CORPORATION CLIFFSIDE STEAM	2721	5	3716100028	G-86	Coal Steam	SCR	SCR	SCR	SCR	None	Scrubber	Scrubber	Scrubber
37161	DUKE ENERGY CORPORATION CLIFFSIDE STEAM	2721	6	3716100028	G-87		No Operation	Not in IPM	SCR	Not in IPM	No Operation	Not in IPM	Scrubber	Not in IPM
37161	DUKE ENERGY CORPORATION CLIFFSIDE STEAM	2721	7	3716100028	G-88		No Operation	Not in IPM	SCR	Not in IPM	No Operation	Not in IPM	Scrubber	Not in IPM
37169	DUKE ENERGY CORP BELEWS CREEK STEAM	8042	1	3716900004	G-17	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
37169	DUKE ENERGY CORP BELEWS CREEK STEAM	8042	2	3716900004	G-18	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
37191	PROGRESS ENERGY F LEE PLANT	2709	1	3719100017	G-2	Coal Steam	None	SNCR	SNCR	SNCR	None	None	None	None
37191	PROGRESS ENERGY F LEE PLANT	2709	2	3719100017	G-3	Coal Steam	None	SNCR	SNCR	SNCR	None	None	None	None
37191	PROGRESS ENERGY F LEE PLANT	2709	3	3719100017	G-4	Coal Steam	None	SCR	SCR	SCR	None	Scrubber	None	Scrubber
45003	SCE&G:URQUHART	3295	URQ3	0080-0011	003	Coal Steam	None	None	None	None	None	None	None	None
45003	SCE&G:SRS AREA D			0080-0044	001	Coal Steam	None	None	None	None	None	None	None	None
45003	SCE&G:SRS AREA D			0080-0044	002		None	None	None	None	None	None	None	None
45003	SCE&G:SRS AREA D			0080-0044	003		None	None	None	None	None	None	None	None
45003	SCE&G:SRS AREA D			0080-0044	004		None	None	None	None	None	None	None	None

APPENDIX H: EGU CONTROLS FOR COAL AND OIL/GAS UNITS FOR THE BASE G/G2 INVENTORY

							Post-Combustion Controls							
FIPS	Facility Name	ORIS ID	BLR ID	SITE ID	UNIT ID	Plant Type	VISTAS NOx 2009 Controls	IPM NOx 2009 Controls	VISTAS NOx 2018 Controls	IPM NOx 2018 Controls	VISTAS SO2 2009 Controls	IPM SO2 2009 Controls	VISTAS SO2 2018 Controls	IPM SO2 2018 Controls
45007	DUKE ENERGY:LEE	3264	1	0200-0004	001	Coal Steam	None	None	None	None	None	None	None	None
45007	DUKE ENERGY:LEE	3264	2	0200-0004	002	Coal Steam	None	None	None	None	None	None	None	None
45007	DUKE ENERGY:LEE	3264	3	0200-0004	003	Coal Steam	None	None	None	None	None	None	None	None
45015	SANTEE COOPER JEFFERIES	3319	1	0420-0003	001	O/G Steam	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
45015	SANTEE COOPER JEFFERIES	3319	2	0420-0003	002	O/G Steam	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
45015	SANTEE COOPER JEFFERIES	3319	3	0420-0003	003	Coal Steam	None	SCR	None	SCR	None	None	None	None
45015	SANTEE COOPER JEFFERIES	3319	4	0420-0003	004	Coal Steam	None	None	None	None	None	None	None	None
45015	SCE&G:WILLIAMS	3298	WIL1	0420-0006	001	Coal Steam	SCR	SCR	SCR	SCR	None	None	Scrubber	Scrubber
45015	SANTEE COOPER CROSS	130	1	0420-0030	001	Coal Steam	SCR	SCR	SCR	SCR	Scrubber Upgrade	Scrubber	Scrubber Upgrade	Scrubber
45015	SANTEE COOPER CROSS	130	2	0420-0030	002	Coal Steam	SCR	SCR	SCR	SCR	Scrubber Upgrade	Scrubber	Scrubber Upgrade	Scrubber
45015	SANTEE COOPER CROSS	130	3	0420-0030	3	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
45015	SANTEE COOPER CROSS	130	4	0420-0030	4		No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
45029	SCE&G:CANADYS	3280	CAN1	0740-0002	001	Coal Steam	None	None	None	None	None	None	None	None
45029	SCE&G:CANADYS	3280	CAN2	0740-0002	002	Coal Steam	None	None	None	None	None	None	None	None
45029	SCE&G:CANADYS	3280	CAN3	0740-0002	003	Coal Steam	None	None	None	None	Scrubber	None	Scrubber	None
45031	PROGRESS ENERGY ROBINSON STATION	3251	1	0820-0002	001	Coal Steam	None	None	None	None	None	None	None	None
45043	SANTEE COOPER WINYAH	6249	1	1140-0005	001	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber

APPENDIX H: EGU CONTROLS FOR COAL AND OIL/GAS UNITS FOR THE BASE G/G2 INVENTORY

							Post-Combustion Controls							
FIPS	Facility Name	ORIS ID	BLR ID	SITE ID	UNIT ID	Plant Type	VISTAS NOx 2009 Controls	IPM NOx 2009 Controls	VISTAS NOx 2018 Controls	IPM NOx 2018 Controls	VISTAS SO2 2009 Controls	IPM SO2 2009 Controls	VISTAS SO2 2018 Controls	IPM SO2 2018 Controls
45043	SANTEE COOPER WINYAH	6249	2	1140-0005	002	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
45043	SANTEE COOPER WINYAH	6249	3	1140-0005	003	Coal Steam	SCR	SCR	SCR	SCR	Scrubber Upgrade	Scrubber	Scrubber Upgrade	Scrubber
45043	SANTEE COOPER WINYAH	6249	4	1140-0005	004	Coal Steam	SCR	SCR	SCR	SCR	Scrubber Upgrade	Scrubber	Scrubber Upgrade	Scrubber
45051	SANTEE COOPER GRAINGER	3317	1	1340-0003	001	Coal Steam	None	None	None	None	None	None	None	None
45051	SANTEE COOPER GRAINGER	3317	2	1340-0003	002	Coal Steam	None	None	None	None	None	None	None	None
45063	SCE&G:MCMEEKIN	3287	MCM1	1560-0003	001	Coal Steam	None	None	None	None	None	None	None	None
45063	SCE&G:MCMEEKIN	3287	MCM2	1560-0003	002	Coal Steam	None	None	None	None	None	None	None	None
45075	SCE&G:COPE	7210	COP1	1860-0044	001	Coal Steam	None	None	None	None	Scrubber	Scrubber	Scrubber	Scrubber
45079	SCE&G:WATEREE	3297	WAT1	1900-0013	001	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	None	Scrubber	None
45079	SCE&G:WATEREE	3297	WAT2	1900-0013	002	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	None	Scrubber	Scrubber
47001	TVA BULL RUN FOSSIL PLANT	3396	1	0009	001	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
47073	TVA JOHN SEVIER FOSSIL PLANT	3405	1	0007	001	Coal Steam	None	None	SCR	SCR	None	None	Scrubber	Scrubber
47073	TVA JOHN SEVIER FOSSIL PLANT	3405	2	0007	002	Coal Steam	None	None	SCR	SCR	None	None	Scrubber	Scrubber
47073	TVA JOHN SEVIER FOSSIL PLANT	3405	3	0007	003	Coal Steam	None	None	SCR	SCR	None	None	Scrubber	Scrubber
47073	TVA JOHN SEVIER FOSSIL PLANT	3405	4	0007	004	Coal Steam	None	None	SCR	SCR	None	None	Scrubber	Scrubber
47085	TVA JOHNSONVILLE FOSSIL PLANT	3406	1	0011	001	Coal Steam	None	SCR	SCR	SCR	None	None	None	None
47085	TVA JOHNSONVILLE FOSSIL PLANT	3406	2	0011	002	Coal Steam	None	SCR	SCR	SCR	None	None	None	None

APPENDIX H: EGU CONTROLS FOR COAL AND OIL/GAS UNITS FOR THE BASE G/G2 INVENTORY

							Post-Combustion Controls							
FIPS	Facility Name	ORIS ID	BLR ID	SITE ID	UNIT ID	Plant Type	VISTAS NOx 2009 Controls	IPM NOx 2009 Controls	VISTAS NOx 2018 Controls	IPM NOx 2018 Controls	VISTAS SO2 2009 Controls	IPM SO2 2009 Controls	VISTAS SO2 2018 Controls	IPM SO2 2018 Controls
47085	TVA JOHNSONVILLE FOSSIL PLANT	3406	3	0011	003	Coal Steam	None	SCR	SCR	SCR	None	None	None	None
47085	TVA JOHNSONVILLE FOSSIL PLANT	3406	4	0011	004	Coal Steam	None	SCR	SCR	SCR	None	None	None	None
47085	TVA JOHNSONVILLE FOSSIL PLANT	3406	5	0011	005	Coal Steam	None	SCR	SCR	SCR	None	None	None	None
47085	TVA JOHNSONVILLE FOSSIL PLANT	3406	6	0011	006	Coal Steam	None	SCR	SCR	SCR	None	None	None	None
47085	TVA JOHNSONVILLE FOSSIL PLANT	3406	7	0011	007	Coal Steam	None	SCR	SCR	SCR	None	None	None	None
47085	TVA JOHNSONVILLE FOSSIL PLANT	3406	8	0011	008	Coal Steam	None	SCR	SCR	SCR	None	None	None	None
47085	TVA JOHNSONVILLE FOSSIL PLANT	3406	9	0011	009	Coal Steam	None	SCR	SCR	SCR	None	None	None	None
47085	TVA JOHNSONVILLE FOSSIL PLANT	3406	10	0011	010	Coal Steam	None	SCR	SCR	SCR	None	None	None	None
47145	TVA KINGSTON FOSSIL PLANT	3407	1	0013	001	Coal Steam	SCR	SCR	SCR	SCR	None	None	Scrubber	Scrubber
47145	TVA KINGSTON FOSSIL PLANT	3407	2	0013	002	Coal Steam	SCR	SCR	SCR	SCR	None	None	Scrubber	Scrubber
47145	TVA KINGSTON FOSSIL PLANT	3407	3	0013	003	Coal Steam	SCR	SCR	SCR	SCR	None	None	Scrubber	Scrubber
47145	TVA KINGSTON FOSSIL PLANT	3407	4	0013	004	Coal Steam	SCR	SCR	SCR	SCR	None	None	Scrubber	Scrubber
47145	TVA KINGSTON FOSSIL PLANT	3407	5	0013	005	Coal Steam	SCR	SCR	SCR	SCR	None	None	Scrubber	Scrubber
47145	TVA KINGSTON FOSSIL PLANT	3407	6	0013	006	Coal Steam	SCR	SCR	SCR	SCR	None	None	Scrubber	Scrubber
47145	TVA KINGSTON FOSSIL PLANT	3407	7	0013	007	Coal Steam	SCR	SCR	SCR	SCR	None	None	Scrubber	Scrubber
47145	TVA KINGSTON FOSSIL PLANT	3407	8	0013	008	Coal Steam	SCR	SCR	SCR	SCR	None	None	Scrubber	Scrubber
47145	TVA KINGSTON FOSSIL PLANT	3407	9	0013	009	Coal Steam	SCR	None	SCR	SCR	None	None	Scrubber	Scrubber

APPENDIX H: EGU CONTROLS FOR COAL AND OIL/GAS UNITS FOR THE BASE G/G2 INVENTORY

							Post-Combustion Controls							
FIPS	Facility Name	ORIS ID	BLR ID	SITE ID	UNIT ID	Plant Type	VISTAS NOx 2009 Controls	IPM NOx 2009 Controls	VISTAS NOx 2018 Controls	IPM NOx 2018 Controls	VISTAS SO2 2009 Controls	IPM SO2 2009 Controls	VISTAS SO2 2018 Controls	IPM SO2 2018 Controls
47157	ALLEN FOSSIL PLANT	3393	1	00528	Boilr1	Coal Steam	SCR	SCR	SCR	SCR	None	None	None	None
47157	ALLEN FOSSIL PLANT	3393	2	00528	Boilr2	Coal Steam	SCR	SCR	SCR	SCR	None	None	None	None
47157	ALLEN FOSSIL PLANT	3393	3	00528	Boilr3	Coal Steam	SCR	SCR	SCR	SCR	None	None	None	None
47161	TVA CUMBERLAND FOSSIL PLANT	3399	1	0011	001	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
47161	TVA CUMBERLAND FOSSIL PLANT	3399	2	0011	002	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
47165	TVA GALLATIN FOSSIL PLANT	3403	1	0025	001	Coal Steam	None	None	None	None	None	None	Scrubber	Scrubber
47165	TVA GALLATIN FOSSIL PLANT	3403	2	0025	002	Coal Steam	None	None	None	None	None	None	Scrubber	Scrubber
47165	TVA GALLATIN FOSSIL PLANT	3403	3	0025	003	Coal Steam	None	None	None	None	None	None	Scrubber	Scrubber
47165	TVA GALLATIN FOSSIL PLANT	3403	4	0025	004	Coal Steam	None	None	None	None	None	None	Scrubber	Scrubber
51031	DOMINION - ALTAVISTA POWER STATION	10773	1	00156	1	Coal Steam	SNCR	SNCR	SNCR	SNCR	Scrubber	Scrubber	Scrubber	Scrubber
51031	DOMINION - ALTAVISTA POWER STATION	10773	2	00156	2		None	None	None	None	None	None	None	None
51041	DOMINION - CHESTERFIELD POWER STATION	3797	3	00002	3	Coal Steam	None	None	None	None	None	None	Scrubber	None
51041	DOMINION - CHESTERFIELD POWER STATION	3797	4	00002	4	Coal Steam	SCR	None	SCR	SCR	None	None	Scrubber	Scrubber
51041	DOMINION - CHESTERFIELD POWER STATION	3797	5	00002	6	Coal Steam	SCR	None	SCR	SCR	None	None	Scrubber	Scrubber
51041	DOMINION - CHESTERFIELD POWER STATION	3797	6	00002	8	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
51065	DOMINION - BREMO POWER STATION	3796	3	00001	1	Coal Steam	None	None	None	None	None	None	None	None
51065	DOMINION - BREMO POWER STATION	3796	4	00001	2	Coal Steam	SNCR	SNCR	SNCR	SNCR	None	None	None	None

APPENDIX H: EGU CONTROLS FOR COAL AND OIL/GAS UNITS FOR THE BASE G/G2 INVENTORY

							Post-Combustion Controls							
FIPS	Facility Name	ORIS ID	BLR ID	SITE ID	UNIT ID	Plant Type	VISTAS NOx 2009 Controls	IPM NOx 2009 Controls	VISTAS NOx 2018 Controls	IPM NOx 2018 Controls	VISTAS SO2 2009 Controls	IPM SO2 2009 Controls	VISTAS SO2 2018 Controls	IPM SO2 2018 Controls
51071	AMERICAN ELECTRIC POWER GLEN LYN	3776	51	00002	1	Coal Steam	None	None	None	None	None	None	None	None
51071	AMERICAN ELECTRIC POWER GLEN LYN	3776	52	00002	2	Coal Steam	None	None	None	None	None	None	None	None
51071	AMERICAN ELECTRIC POWER GLEN LYN	3776	6	00002	3	Coal Steam	None	None	None	None	None	None	None	Scrubber
51083	DOMINION - CLOVER POWER STATION	7213	1	00046	1	Coal Steam	SNCR	SNCR	SNCR	SNCR	Scrubber	Scrubber	Scrubber	Scrubber
51083	DOMINION - CLOVER POWER STATION	7213	2	00046	2	Coal Steam	SNCR	SNCR	SNCR	SNCR	Scrubber	Scrubber	Scrubber	Scrubber
51099	BIRCHWOOD POWER PARTNERS, L.P.	54304	1	00012	1	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
51117	Mecklenburg Cogeneration Facility	52007	GEN1	00051	1	Coal Steam	None	None	None	None	Scrubber	Scrubber	Scrubber	Scrubber
51117	Mecklenburg Cogeneration Facility	52007	GEN2	00051	2	Coal Steam	None	None	None	None	Scrubber	Scrubber	Scrubber	Scrubber
51153	DOMINION - POSSUM POINT	3804	3	00002	3	Coal Steam	None	Combined Cycle	None	Combined Cycle	None	Combined Cycle	None	Combined Cycle
51153	DOMINION - POSSUM POINT	3804	4	00002	4	Coal Steam	None	Combined Cycle	None	Combined Cycle	None	Combined Cycle	None	Combined Cycle
51153	DOMINION - POSSUM POINT	3804	5	00002	5	O/G Steam	None	No Operation	None	No Operation	None	No Operation	None	No Operation
51153	DOMINION - POSSUM POINT	3804	6	00002		Combined Cycle	Combined Cycle	Combined Cycle	Combined Cycle	Combined Cycle	Combined Cycle	Combined Cycle	Combined Cycle	Combined Cycle
51167	AMERICAN ELECTRIC POWER CLINCH RIVER PLANT	3775	1	00003	1	Coal Steam	None	None	None	SCR	None	None	None	Scrubber
51167	AMERICAN ELECTRIC POWER CLINCH RIVER PLANT	3775	2	00003	2	Coal Steam	None	None	None	SCR	None	None	None	Scrubber
51167	AMERICAN ELECTRIC POWER CLINCH RIVER PLANT	3775	3	00003	3	Coal Steam	None	None	None	SCR	None	None	None	Scrubber
51175	LG&E Westmoreland Southampton	10774	GEN1	00051	1	Coal Steam	None	None	None	None	Scrubber	Scrubber	Scrubber	Scrubber
51175	LG&E Westmoreland Southampton			00051	2		None	None	None	None	None	None	None	None

APPENDIX H: EGU CONTROLS FOR COAL AND OIL/GAS UNITS FOR THE BASE G/G2 INVENTORY

							Post-Combustion Controls							
FIPS	Facility Name	ORIS ID	BLR ID	SITE ID	UNIT ID	Plant Type	VISTAS NOx 2009 Controls	IPM NOx 2009 Controls	VISTAS NOx 2018 Controls	IPM NOx 2018 Controls	VISTAS SO2 2009 Controls	IPM SO2 2009 Controls	VISTAS SO2 2018 Controls	IPM SO2 2018 Controls
51175	LG&E Westmoreland Southampton			00051	4		None	None	None	None	None	None	None	None
51199	DOMINION - YORKTOWN POWER STATION	3809	3	00001	3	O/G Steam	SNCR	No Operation	SNCR	No Operation	None	No Operation	Scrubber	No Operation
51199	DOMINION - YORKTOWN POWER STATION	3809	2	00001	5	Coal Steam	SNCR	SNCR	SNCR	SNCR	None	None	Scrubber	None
51199	DOMINION - YORKTOWN POWER STATION	3809	1	00001	6	Coal Steam	SNCR	SNCR	SNCR	SNCR	None	None	Scrubber	None
51510	POTOMAC RIVER GENERATING STATION	3788	1	00003	1	Coal Steam	SNCR	Coal Early Retirement	SNCR	Coal Early Retirement	None	Coal Early Retirement	None	Coal Early Retirement
51510	POTOMAC RIVER GENERATING STATION	3788	2	00003	2	Coal Steam	SNCR	Coal Early Retirement	SNCR	Coal Early Retirement	None	Coal Early Retirement	None	Coal Early Retirement
51510	POTOMAC RIVER GENERATING STATION	3788	3	00003	3	Coal Steam	SNCR	None	SNCR	None	None	None	None	None
51510	POTOMAC RIVER GENERATING STATION	3788	4	00003	4	Coal Steam	SNCR	None	SNCR	None	None	None	None	None
51510	POTOMAC RIVER GENERATING STATION	3788	5	00003	5	Coal Steam	SNCR	None	SNCR	None	None	None	None	None
51550	DOMINION - CHESAPEAKE	3803	1	00026	1	Coal Steam	SNCR	SNCR	SNCR	SNCR	None	None	Scrubber	None
51550	DOMINION - CHESAPEAKE	3803	2	00026	2	Coal Steam	SNCR	SNCR	SNCR	SNCR	None	None	Scrubber	None
51550	DOMINION - CHESAPEAKE	3803	3	00026	3	Coal Steam	SCR	None	SCR	SCR	None	None	Scrubber	Scrubber
51550	DOMINION - CHESAPEAKE	3803	4	00026	4	Coal Steam	SCR	None	SCR	SCR	None	None	Scrubber	Scrubber
54023	MOUNT STORM POWER PLANT	3954	1	0003	001	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
54023	MOUNT STORM POWER PLANT	3954	2	0003	002	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
54023	MOUNT STORM POWER PLANT	3954	3	0003	003	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
54023	NORTH BRANCH POWER STATION	7537	1A	0014	001	Coal Steam	None	None	None	None	None	None	None	None

APPENDIX H: EGU CONTROLS FOR COAL AND OIL/GAS UNITS FOR THE BASE G/G2 INVENTORY

							Post-Combustion Controls							
FIPS	Facility Name	ORIS ID	BLR ID	SITE ID	UNIT ID	Plant Type	VISTAS NOx 2009 Controls	IPM NOx 2009 Controls	VISTAS NOx 2018 Controls	IPM NOx 2018 Controls	VISTAS SO2 2009 Controls	IPM SO2 2009 Controls	VISTAS SO2 2018 Controls	IPM SO2 2018 Controls
54023	NORTH BRANCH POWER STATION	7537	1B	0014	002	Coal Steam	None	None	None	None	None	None	None	None
54033	MONONGAHELA POWER CO HARRISON	3944	1	0015	001	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
54033	MONONGAHELA POWER CO HARRISON	3944	2	0015	002	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
54033	MONONGAHELA POWER CO HARRISON	3944	3	0015	003	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
54039	APPALACHIAN POWER KANAWHA RIVER PLANT	3936	1	0006	001	Coal Steam	None	None	SCR	SCR	None	None	Scrubber	Scrubber
54039	APPALACHIAN POWER KANAWHA RIVER PLANT	3936	2	0006	002	Coal Steam	None	None	SCR	SCR	None	None	Scrubber	Scrubber
54049	MONONGAHELA POWER CO. RIVESVILLE POWER	3945	7	0009	001	Coal Steam	None	Coal Early Retirement	None	Coal Early Retirement	None	Coal Early Retirement	Coal Early Retirement	Coal Early Retirement
54049	MONONGAHELA POWER CO. RIVESVILLE POWER	3945	8	0009	002	Coal Steam	None	Coal Early Retirement	None	Coal Early Retirement	None	Coal Early Retirement	Coal Early Retirement	Coal Early Retirement
54049	AMERICAN BITUMINOUS POWER GRANT TOWN PLT	10151		0026	001		None	None	None	None	Scrubber	Scrubber	Scrubber	Scrubber
54049	GRANT TOWN POWER PLANT	10151	GEN1	ORIS10151	GEN1	Coal Steam	None	None	None	None	Scrubber	Scrubber	Scrubber	Scrubber
54051	OHIO POWER MITCHELL PLANT	3948	1	0005	001	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
54051	OHIO POWER MITCHELL PLANT	3948	2	0005	002	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
54051	OHIO POWER KAMMER PLANT	3947	1	0006	001	Coal Steam	None	SCR	SCR	SCR	None	Scrubber	Scrubber	Scrubber
54051	OHIO POWER KAMMER PLANT	3947	2	0006	002	Coal Steam	None	SCR	SCR	SCR	None	Scrubber	Scrubber	Scrubber
54051	OHIO POWER KAMMER PLANT	3947	3	0006	003	Coal Steam	None	SCR	SCR	SCR	None	Scrubber	Scrubber	Scrubber
54053	APPALACHIAN POWER CO. PHILIP SPORN PLANT	3938	11	0001	001	Coal Steam	None	None	SCR	SCR	None	None	Scrubber	Scrubber
54053	APPALACHIAN POWER CO. PHILIP SPORN PLANT	3938	21	0001	002	Coal Steam	None	None	SCR	SCR	None	None	Scrubber	Scrubber

APPENDIX H: EGU CONTROLS FOR COAL AND OIL/GAS UNITS FOR THE BASE G/G2 INVENTORY

							Post-Combustion Controls							
FIPS	Facility Name	ORIS ID	BLR ID	SITE ID	UNIT ID	Plant Type	VISTAS NOx 2009 Controls	IPM NOx 2009 Controls	VISTAS NOx 2018 Controls	IPM NOx 2018 Controls	VISTAS SO2 2009 Controls	IPM SO2 2009 Controls	VISTAS SO2 2018 Controls	IPM SO2 2018 Controls
54053	APPALACHIAN POWER CO. PHILIP SPORN PLANT	3938	31	0001	003	Coal Steam	None	None	SCR	SCR	None	None	Scrubber	Scrubber
54053	APPALACHIAN POWER CO. PHILIP SPORN PLANT	3938	41	0001	004	Coal Steam	None	None	SCR	SCR	None	None	Scrubber	Scrubber
54053	APPALACHIAN POWER CO. PHILIP SPORN PLANT	3938	51	0001	005	Coal Steam	None	None	SCR	SCR	None	None	Scrubber	Scrubber
54053	APPALACHIAN POWER MOUNTAINEER PLANT	6264	1	0009		Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
54061	MONONGAHELA POWER CO. FORT MARTIN POWER	3943	1	0001	001	Coal Steam	SNCR	SNCR	SNCR	SNCR	None	None	Scrubber	Scrubber
54061	MONONGAHELA POWER CO. FORT MARTIN POWER	3943	2	0001	002	Coal Steam	SNCR	SNCR	SNCR	SNCR	None	None	Scrubber	Scrubber
54061	MORGANTOWN ENERGY ASSOCIATES			0027	043		None	None	None	None	None	None	None	None
54061	MORGANTOWN ENERGY FACILITY	10743	GEN1	ORIS10743	GEN1	Coal Steam	None	None	None	None	None	None	None	None
54073	MONONGAHELA POWER CO. WILLOW ISLAND	3946	1	0004	001	Coal Steam	None	Coal Early Retirement	None	Coal Early Retirement	None	Coal Early Retirement	Coal Early Retirement	Coal Early Retirement
54073	MONONGAHELA POWER CO. WILLOW ISLAND	3946	2	0004	002	Coal Steam	None	SCR	SCR	SCR	None	Scrubber	Scrubber	Scrubber
54073	MONONGAHELA POWER CO PLEASANTS POWER STATION	6004	1	0005	001	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
54073	MONONGAHELA POWER CO PLEASANTS POWER STATION	6004	2	0005	002	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber Upgrade	Scrubber
54077	MONONGAHELA POWER CO ALBRIGHT	3942	1	0001	001	Coal Steam	None	Coal Early Retirement	Coal Early Retirement	Coal Early Retirement	None	Coal Early Retirement	Coal Early Retirement	Coal Early Retirement
54077	MONONGAHELA POWER CO ALBRIGHT	3942	2	0001	002	Coal Steam	None	Coal Early Retirement	Coal Early Retirement	Coal Early Retirement	None	Coal Early Retirement	Coal Early Retirement	Coal Early Retirement
54077	MONONGAHELA POWER CO ALBRIGHT	3942	3	0001	003	Coal Steam	None	None	SCR	SCR	None	None	Scrubber	Scrubber
54079	APPALACHIAN POWER JOHN E AMOS PLANT	3935	1	0006	001	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
54079	APPALACHIAN POWER JOHN E AMOS PLANT	3935	2	0006	002	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber

APPENDIX H: EGU CONTROLS FOR COAL AND OIL/GAS UNITS FOR THE BASE G/G2 INVENTORY

							Post-Combustion Controls							
FIPS	Facility Name	ORIS ID	BLR ID	SITE ID	UNIT ID	Plant Type	VISTAS NOx 2009 Controls	IPM NOx 2009 Controls	VISTAS NOx 2018 Controls	IPM NOx 2018 Controls	VISTAS SO2 2009 Controls	IPM SO2 2009 Controls	VISTAS SO2 2018 Controls	IPM SO2 2018 Controls
54079	APPALACHIAN POWER JOHN E AMOS PLANT	3935	3	0006	003	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber

APPENDIX I:

COMPARISON OF EGU CONTROLS FOR COAL AND OIL/GAS UNITS BASED ON IPM MODELING AND STATE-PROVIDED INFORMATION FOR THE B&F INVENTORY

APPENDIX I: EGU CONTROLS FOR COAL AND OIL/GAS UNITS FOR THE B&F INVENTORY

							Post-Combustion Controls							
FIPS	Facility Name	ORIS ID	BLR ID	SITE ID	UNIT ID	Plant Type	VISTAS NOx 2009 Controls	IPM NOx 2009 Controls	VISTAS NOx 2018 Controls	IPM NOx 2018 Controls	VISTAS SO2 2009 Controls	IPM SO2 2009 Controls	VISTAS SO2 2018 Controls	IPM SO2 2018 Controls
01033	TVA COLBERT	47	1	0010	010	Coal Steam	None	None	SCR	SCR	None	None	Scrubber	Scrubber
01033	TVA COLBERT	47	2	0010	011	Coal Steam	None	None	SCR	SCR	None	None	Scrubber	Scrubber
01033	TVA COLBERT	47	3	0010	012	Coal Steam	None	None	SCR	SCR	None	None	Scrubber	Scrubber
01033	TVA COLBERT	47	4	0010	013	Coal Steam	None	None	SCR	SCR	None	None	Scrubber	Scrubber
01033	TVA COLBERT	47	5	0010	014	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
01055	ALABAMA POWER COMPANY GADSDEN	7	1	0002	002	Coal Steam	None	None	None	None	None	None	None	None
01055	ALABAMA POWER COMPANY GADSDEN	7	2	0002	003	Coal Steam	None	None	None	None	None	None	None	None
01063	ALABAMA POWER COMPANY GREENE COUNTY	10	1	0001	002	Coal Steam	SCR	SCR	SCR	SCR	None	None	Scrubber	Scrubber
01063	ALABAMA POWER COMPANY GREENE COUNTY	10	2	0001	003	Coal Steam	SCR	SCR	SCR	SCR	None	None	Scrubber	Scrubber
01071	TVA - WIDOWS CREEK	50	1	0008	002	Coal Steam	SCR	SCR	SCR	SCR	None	None	None	None
01071	TVA - WIDOWS CREEK	50	2	0008	003	Coal Steam	SCR	SCR	SCR	SCR	None	None	None	None
01071	TVA - WIDOWS CREEK	50	3	0008	004	Coal Steam	SCR	SCR	SCR	SCR	None	None	None	None
01071	TVA - WIDOWS CREEK	50	4	0008	005	Coal Steam	SCR	SCR	SCR	SCR	None	None	None	None
01071	TVA - WIDOWS CREEK	50	5	0008	006	Coal Steam	SCR	SCR	SCR	SCR	None	None	None	None
01071	TVA - WIDOWS CREEK	50	6	0008	007	Coal Steam	SCR	SCR	SCR	SCR	None	None	None	None
01071	TVA - WIDOWS CREEK	50	7	0008	008	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber

APPENDIX I: EGU CONTROLS FOR COAL AND OIL/GAS UNITS FOR THE B&F INVENTORY

FIPS	Facility Name	ORIS ID	BLR ID	SITE ID	UNIT ID	Plant Type	Post-Combustion Controls							
							VISTAS NOx 2009 Controls	IPM NOx 2009 Controls	VISTAS NOx 2018 Controls	IPM NOx 2018 Controls	VISTAS SO2 2009 Controls	IPM SO2 2009 Controls	VISTAS SO2 2018 Controls	IPM SO2 2018 Controls
01071	TVA - WIDOWS CREEK	50	8	0008	009	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
01073	ALABAMA POWER COMPANY (MILLER POWER PLANT)	6002	4	010730011	001	Coal Steam	SCR All Year	SCR Summer	SCR All Year	SCR Summer	None	None	Scrubber	None
01073	ALABAMA POWER COMPANY (MILLER POWER PLANT)	6002	3	010730011	002	Coal Steam	SCR All Year	SCR Summer	SCR All Year	SCR Summer	None	None	Scrubber	None
01073	ALABAMA POWER COMPANY (MILLER POWER PLANT)	6002	2	010730011	004	Coal Steam	SCR All Year	SCR Summer	SCR All Year	SCR Summer	None	None	Scrubber	None
01073	ALABAMA POWER COMPANY (MILLER POWER PLANT)	6002	1	010730011	005	Coal Steam	SCR All Year	SCR Summer	SCR All Year	SCR Summer	None	None	Scrubber	None
01097	ALABAMA POWER COMPANY BARRY	3	1	1001	002	Coal Steam	SNCR	None	SNCR	SCR	None	None	None	None
01097	ALABAMA POWER COMPANY BARRY	3	2	1001	003	Coal Steam	SNCR	None	SNCR	SCR	None	None	None	None
01097	ALABAMA POWER COMPANY BARRY	3	3	1001	004	Coal Steam	SNCR	None	SNCR	SCR	None	None	None	None
01097	ALABAMA POWER COMPANY BARRY	3	4	1001	005	Coal Steam	SNCR	None	SNCR	SCR	None	None	Scrubber	Scrubber
01097	ALABAMA POWER COMPANY BARRY	3	5	1001	006	Coal Steam	None	None	SCR	SCR	None	None	Scrubber	Scrubber
01117	ALABAMA POWER COMPANY E C GASTON	26	1	0005	002	Coal Steam	None	SCR	None	SCR	None	None	Scrubber	Scrubber
01117	ALABAMA POWER COMPANY E C GASTON	26	2	0005	003	Coal Steam	None	SCR	None	SCR	None	None	Scrubber	Scrubber
01117	ALABAMA POWER COMPANY E C GASTON	26	3	0005	004	Coal Steam	None	SCR	None	SCR	None	None	Scrubber	Scrubber
01117	ALABAMA POWER COMPANY E C GASTON	26	4	0005	005	Coal Steam	None	SCR	None	SCR	None	None	Scrubber	Scrubber
01117	ALABAMA POWER COMPANY E C GASTON	26	5	0005	006	Coal Steam	SCR	SCR	SCR	SCR	None	Scrubber	Scrubber	Scrubber

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							Post-Combustion Controls							
FIPS	Facility Name	ORIS ID	BLR ID	SITE ID	UNIT ID	Plant Type	VISTAS NOx 2009 Controls	IPM NOx 2009 Controls	VISTAS NOx 2018 Controls	IPM NOx 2018 Controls	VISTAS SO2 2009 Controls	IPM SO2 2009 Controls	VISTAS SO2 2018 Controls	IPM SO2 2018 Controls
01127	ALABAMA POWER COMPANY GORGAS	8	6	0001	004	Coal Steam	None	None	None	None	None	None	None	None
01127	ALABAMA POWER COMPANY GORGAS	8	7	0001	005	Coal Steam	None	None	None	None	None	None	None	None
01127	ALABAMA POWER COMPANY GORGAS	8	8	0001	006	Coal Steam	None	None	None	None	Scrubber	None	Scrubber	None
01127	ALABAMA POWER COMPANY GORGAS	8	9	0001	007	Coal Steam	None	None	None	None	Scrubber	None	Scrubber	None
01127	ALABAMA POWER COMPANY GORGAS	8	10	0001	008	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	None	Scrubber	Scrubber
01129	ALABAMA ELECTRIC COOP CHARLES R LOWMAN	56	1	0001	002	Coal Steam	None	None	None	None	Scrubber	None	Scrubber	None
01129	ALABAMA ELECTRIC COOP CHARLES R LOWMAN	56	2	0001	003	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
01129	ALABAMA ELECTRIC COOP CHARLES R LOWMAN	56	3	0001	004	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
12001	GAINESVILLE REGIONAL UTILITIES JOHN R KELLY	664	JRK6			O/G Steam	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement
12001	GAINESVILLE REGIONAL UTILITIES JOHN R KELLY	664	JRK7			O/G Steam	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement
12001	GAINESVILLE REGIONAL UTILITIES JOHN R KELLY	664	JRK8	0010005	7		O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement
12001	CITY OF GAINESVILLE, GRU DEERHAVEN	663	B1	0010006	3	O/G Steam	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
12001	CITY OF GAINESVILLE, GRU DEERHAVEN	663	B2	0010006	5	Coal Steam	None	None	SCR	SCR	None	None	Scrubber	Scrubber
12005	GULF POWER COMPANY LANSING SMITH PLANT	643	1	0050014	1	Coal Steam	None	None	SCR	SCR	None	None	None	Scrubber
12005	GULF POWER COMPANY LANSING SMITH PLANT	643	2	0050014	2	Coal Steam	None	None	SCR	SCR	None	None	None	Scrubber
12009	FLORIDA POWER & LIGHT (PCC) CAPE CANAVERAL	609	PCC1	0090006	1	O/G Steam	None	No Operation	None	No Operation	None	No Operation	None	No Operation

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							Post-Combustion Controls							
FIPS	Facility Name	ORIS ID	BLR ID	SITE ID	UNIT ID	Plant Type	VISTAS NOx 2009 Controls	IPM NOx 2009 Controls	VISTAS NOx 2018 Controls	IPM NOx 2018 Controls	VISTAS SO2 2009 Controls	IPM SO2 2009 Controls	VISTAS SO2 2018 Controls	IPM SO2 2018 Controls
12009	FLORIDA POWER & LIGHT (PCC) CAPE CANAVERAL	609	PCC2	0090006	2	O/G Steam	None	No Operation	None	No Operation	None	No Operation	None	No Operation
12011	FLORIDA POWER & LIGHT (PPE) PORT EVERGLADES	617	PPE1	0110036	1	O/G Steam	None	No Operation	None	No Operation	None	No Operation	None	No Operation
12011	FLORIDA POWER & LIGHT (PPE) PORT EVERGLADES	617	PPE2	0110036	2	O/G Steam	None	None	None	None	None	None	None	None
12011	FLORIDA POWER & LIGHT (PPE) PORT EVERGLADES	617	PPE3	0110036	3	O/G Steam	None	None	None	None	None	None	None	None
12011	FLORIDA POWER & LIGHT (PPE) PORT EVERGLADES	617	PPE4	0110036	4	O/G Steam	None	None	None	None	None	None	None	None
12017	PROGRESS ENERGY FLORIDA CRYSTAL RIVER	628	1	0170004	1	Coal Steam	None	None	None	None	None	None	None	None
12017	PROGRESS ENERGY FLORIDA CRYSTAL RIVER	628	2	0170004	2	Coal Steam	None	None	None	None	None	None	None	None
12017	PROGRESS ENERGY FLORIDA CRYSTAL RIVER	628	5	0170004	3	Coal Steam	None	None	SCR	SCR	None	None	Scrubber	Scrubber
12017	PROGRESS ENERGY FLORIDA CRYSTAL RIVER	628	4	0170004	4	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
12031	SAINT JOHNS RIVER	207	1	0310045-A	16		SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
12031	SAINT JOHNS RIVER	207	2	0310045-A	17		SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
12031	NORTHSIDE	667	2A	0310045-B	26	O/G Steam	None	No Operation	None	No Operation	None	No Operation	None	No Operation
12031	NORTHSIDE	667	1A	0310045-B	27	O/G Steam	None	No Operation	None	No Operation	None	No Operation	None	No Operation
12031	NORTHSIDE	667	3	0310045-B	3	O/G Steam	None	None	None	No Operation	None	None	None	None
12031	CEDAR BAY COGENERATION INC.	10672	GEN1	0310337	1	Coal Steam	None	SNCR	None	SNCR	Scrubber	Scrubber	Scrubber	Scrubber
12031	CEDAR BAY COGENERATION INC.			0310337	2		None		None					

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							Post-Combustion Controls							
FIPS	Facility Name	ORIS ID	BLR ID	SITE ID	UNIT ID	Plant Type	VISTAS NOx 2009 Controls	IPM NOx 2009 Controls	VISTAS NOx 2018 Controls	IPM NOx 2018 Controls	VISTAS SO2 2009 Controls	IPM SO2 2009 Controls	VISTAS SO2 2018 Controls	IPM SO2 2018 Controls
12031	CEDAR BAY COGENERATION INC.			0310337	3		None		None					
12033	GULF POWER COMPANY CRIST ELECTRIC GENERATION	641	1	0330045	1									
12033	GULF POWER COMPANY CRIST ELECTRIC GENERATION	641	2	0330045	2	O/G Steam	O/G Early Retireme nt	O/G Early Retireme nt	O/G Early Retireme nt	O/G Early Retireme nt	O/G Early Retireme nt	O/G Early Retireme nt	O/G Early Retireme nt	O/G Early Retireme nt
12033	GULF POWER COMPANY CRIST ELECTRIC GENERATION	641	3	0330045	3	O/G Steam	O/G Early Retireme nt	O/G Early Retireme nt	O/G Early Retireme nt	O/G Early Retireme nt	O/G Early Retireme nt	O/G Early Retireme nt	O/G Early Retireme nt	O/G Early Retireme nt
12033	GULF POWER COMPANY CRIST ELECTRIC GENERATION	641	4	0330045	4	Coal Steam	None	None	None	None	Scrubber	None	Scrubber	None
12033	GULF POWER COMPANY CRIST ELECTRIC GENERATION	641	5	0330045	5	Coal Steam	None	None	None	None	Scrubber	None	Scrubber	None
12033	GULF POWER COMPANY CRIST ELECTRIC GENERATION	641	6	0330045	6	Coal Steam	SNCR	SNCR	SNCR	SNCR	Scrubber	None	Scrubber	None
12033	GULF POWER COMPANY CRIST ELECTRIC GENERATION	641	7	0330045	7	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	None	Scrubber	Scrubber
12053	Central Power and Lime Incorporated	10333	GEN1	0530021	18	Coal Steam	None	None	None	None	Scrubber	Scrubber	Scrubber	Scrubber
12057	TAMPA ELECTRIC COMPANY BIG BEND STATION	645	BB01	0570039	1	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
12057	TAMPA ELECTRIC COMPANY BIG BEND STATION	645	BB02	0570039	2	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
12057	TAMPA ELECTRIC COMPANY BIG BEND STATION	645	BB03	0570039	3	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
12057	TAMPA ELECTRIC COMPANY BIG BEND STATION	645	BB04	0570039	4	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
12057	TAMPA ELECTRIC COMPANY F.J. GANNON STATION	646	GB01	0570040	1		No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
12057	TAMPA ELECTRIC COMPANY F.J. GANNON STATION	646	GB02	0570040	2		No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
12057	TAMPA ELECTRIC COMPANY F.J. GANNON STATION	646	GB03	0570040	3		No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation

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FIPS	Facility Name	ORIS ID	BLR ID	SITE ID	UNIT ID	Plant Type	Post-Combustion Controls							
							VISTAS NOx 2009 Controls	IPM NOx 2009 Controls	VISTAS NOx 2018 Controls	IPM NOx 2018 Controls	VISTAS SO2 2009 Controls	IPM SO2 2009 Controls	VISTAS SO2 2018 Controls	IPM SO2 2018 Controls
12057	TAMPA ELECTRIC COMPANY F.J. GANNON STATION	646	GB04	0570040	4		No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
12057	TAMPA ELECTRIC COMPANY F.J. GANNON STATION	646	GB05	0570040	5		No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
12057	TAMPA ELECTRIC COMPANY F.J. GANNON STATION	646	GB06	0570040	6		No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
12061	CITY OF VERO BEACH	693		0610029	1	O/G Steam	O/G Early Retireme nt	O/G Early Retireme nt	O/G Early Retireme nt	O/G Early Retireme nt	O/G Early Retireme nt	O/G Early Retireme nt	O/G Early Retireme nt	O/G Early Retireme nt
12061	CITY OF VERO BEACH	693	3	0610029	3	O/G Steam	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
12061	CITY OF VERO BEACH	693	4	0610029	4	O/G Steam	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
12063	GULF POWER COMPANY SCHOLZ	642	1	0630014	1	Coal Steam	None	None	Shut Down	None	None	None	Shut Down	None
12063	GULF POWER COMPANY SCHOLZ	642	2	0630014	2	Coal Steam	None	None	Shut Down	None	None	None	Shut Down	None
12073	CITY OF TALLAHASSEE ARVAH B.HOPKINS	688	1	0730003	1	O/G Steam	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
12073	CITY OF TALLAHASSEE ARVAH B.HOPKINS	688	2	0730003	4	O/G Steam	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
12081	FLORIDA POWER & LIGHT (PMT) MANATEE POWER	6042	PMT1	0810010	1	O/G Steam	None	No Operation	None	No Operation	None	No Operation	None	No Operation
12081	FLORIDA POWER & LIGHT (PMT) MANATEE POWER	6042	PMT2	0810010	2	O/G Steam	None	No Operation	None	No Operation	None	No Operation	None	No Operation
12085	FLORIDA POWER & LIGHT (PMR) FPL / MARTIN	6043	PMR1	0850001	1	O/G Steam	None	None	None	No Operation	None	None	None	No Operation
12085	FLORIDA POWER & LIGHT (PMR) FPL / MARTIN	6043	PMR2	0850001	2	O/G Steam	None	None	None	No Operation	None	None	None	No Operation
12085	INDIANTOWN COGENERATION, L.P.	50976	GEN1	0850102	1	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
12086	FLORIDA POWER & LIGHT (PCU) CUTLER POWER	610	PCU5	0250001	3	O/G Steam	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation

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							Post-Combustion Controls							
FIPS	Facility Name	ORIS ID	BLR ID	SITE ID	UNIT ID	Plant Type	VISTAS NOx 2009 Controls	IPM NOx 2009 Controls	VISTAS NOx 2018 Controls	IPM NOx 2018 Controls	VISTAS SO2 2009 Controls	IPM SO2 2009 Controls	VISTAS SO2 2018 Controls	IPM SO2 2018 Controls
12086	FLORIDA POWER & LIGHT (PCU) CUTLER POWER	610	PCU6	0250001	4	O/G Steam	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
12086	FLORIDA POWER & LIGHT (PTF) TURKEY POINT	621	PTP1	0250003	1	O/G Steam	None	None	None	No Operation	None	None	None	No Operation
12086	FLORIDA POWER & LIGHT (PTF) TURKEY POINT	621	PTP2	0250003	2	O/G Steam	None	None	None	No Operation	None	None	None	No Operation
12095	ORLANDO UTILITIES COMMISSION STANTON ENERGY	564	1	0950137	1	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
12095	ORLANDO UTILITIES COMMISSION STANTON ENERGY	564	2	0950137	2	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
12099	FLORIDA POWER & LIGHT (PRV) RIVIERA POWE	619	PRV3	0990042	3	O/G Steam	None	No Operation	None	No Operation	None	No Operation	None	No Operation
12099	FLORIDA POWER & LIGHT (PRV) RIVIERA POWE	619	PRV4	0990042	4	O/G Steam	None	No Operation	None	No Operation	None	No Operation	None	No Operation
12099	CITY OF LAKE WORTH UTILITIES TOM G. SMITH	673	S-1	0990045	7	O/G Steam	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement
12099	CITY OF LAKE WORTH UTILITIES TOM G. SMITH	673	S-3	0990045	9	O/G Steam	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement
12101	PROGRESS ENERGY FLORIDA ANCLOTE	8048	1	1010017	1	O/G Steam	None	None	None	No Operation	None	None	None	No Operation
12101	PROGRESS ENERGY FLORIDA ANCLOTE	8048	2	1010017	2	O/G Steam	None	None	None	No Operation	None	None	None	No Operation
12103	PROGRESS ENERGY FLORIDA BARTOW	634	1	1030011	1	O/G Steam	No Operation	No Operation	None	No Operation	No Operation	No Operation	No Operation	No Operation
12103	PROGRESS ENERGY FLORIDA BARTOW	634	2	1030011	2	O/G Steam	O/G Early Retirement	O/G Early Retirement	None	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement
12103	PROGRESS ENERGY FLORIDA BARTOW	634	3	1030011	3	O/G Steam	No Operation	No Operation	None	No Operation	No Operation	No Operation	No Operation	No Operation
12105	LAKELAND ELECTRIC CHARLES LARSEN	675	7	1050003	4	O/G Steam	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement
12105	LAKELAND ELECTRIC C.D. MCINTOSH, JR.	676	3	1050004	1	Coal Steam	None	Combined Cycle	None	Combined Cycle	None	Combined Cycle	None	Combined Cycle

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							Post-Combustion Controls							
FIPS	Facility Name	ORIS ID	BLR ID	SITE ID	UNIT ID	Plant Type	VISTAS NOx 2009 Controls	IPM NOx 2009 Controls	VISTAS NOx 2018 Controls	IPM NOx 2018 Controls	VISTAS SO2 2009 Controls	IPM SO2 2009 Controls	VISTAS SO2 2018 Controls	IPM SO2 2018 Controls
12105	LAKELAND ELECTRIC C.D. MCINTOSH, JR.	676	3	1050004	5	Coal Steam	None	Combined Cycle	None	Combined Cycle	None	Combined Cycle	None	Combined Cycle
12105	LAKELAND ELECTRIC C.D. MCINTOSH, JR.	676	3	1050004	6	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
12107	SEMINOLE ELECTRIC COOPERATIVE, INC.	136	1	1070025	1	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
12107	SEMINOLE ELECTRIC COOPERATIVE, INC.	136	2	1070025	2	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
12111	FT PIERCE UTILITIES AUTHORITY FT PIERCE	658	7	1110003	7	O/G Steam	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
12111	FT PIERCE UTILITIES AUTHORITY FT PIERCE	658	8	1110003	8	O/G Steam	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
12121	PROGRESS ENERGY FLORIDA SUWANNEE RIVER	638	1	1210003	1	O/G Steam	O/G Early Retirement	O/G Early Retirement	None	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	None	O/G Early Retirement
12121	PROGRESS ENERGY FLORIDA SUWANNEE RIVER	638	2	1210003	2	O/G Steam	O/G Early Retirement	O/G Early Retirement	None	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	None	O/G Early Retirement
12121	PROGRESS ENERGY FLORIDA SUWANNEE RIVER	638	3	1210003	3	O/G Steam	None	No Operation	None	No Operation	None	No Operation	None	No Operation
12127	FLORIDA POWER & LIGHT (PSN) SANFORD POWER	620	PSN3	1270009	1	O/G Steam	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement
12127	FLORIDA POWER & LIGHT (PSN) SANFORD POWER	620	PSN4	1270009	2		No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
12129	TALLAHASSEE CITY PURDOM GENERATING STATION	689	7	1290001	7	O/G Steam	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
13015	GEORGIA POWER COMPANY, BOWEN STEAM-ELECT	703	1BLR	01500011	SG01	Coal Steam	SCR	SCR	SCR	SCR	None	Scrubber	Scrubber	Scrubber
13015	GEORGIA POWER COMPANY, BOWEN STEAM-ELECT	703	2BLR	01500011	SG02	Coal Steam	SCR	SCR	SCR	SCR	None	Scrubber	Scrubber	Scrubber
13015	GEORGIA POWER COMPANY, BOWEN STEAM-ELECT	703	3BLR	01500011	SG03	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
13015	GEORGIA POWER COMPANY, BOWEN STEAM-ELECT	703	4BLR	01500011	SG04	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber

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							Post-Combustion Controls							
FIPS	Facility Name	ORIS ID	BLR ID	SITE ID	UNIT ID	Plant Type	VISTAS NOx 2009 Controls	IPM NOx 2009 Controls	VISTAS NOx 2018 Controls	IPM NOx 2018 Controls	VISTAS SO2 2009 Controls	IPM SO2 2009 Controls	VISTAS SO2 2018 Controls	IPM SO2 2018 Controls
13021	ARKWRIGHT	699	1	0002	1		No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
13021	ARKWRIGHT	699	2	0002	2		No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
13021	ARKWRIGHT	699	3	0002	3		No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
13021	ARKWRIGHT	699	4	0002	4		No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
13051	SAVANNAH ELECTRIC: KRAFT STEAM	733	1	05100006	SG01	Coal Steam	None	None	None	None	None	None	None	None
13051	SAVANNAH ELECTRIC: KRAFT STEAM	733	2	05100006	SG02	Coal Steam	None	None	None	None	None	None	None	None
13051	SAVANNAH ELECTRIC: KRAFT STEAM	733	3	05100006	SG03	Coal Steam	None	None	None	SCR	None	None	None	None
13051	SAVANNAH ELECTRIC: KRAFT STEAM	733	4	05100006	SG04	O/G Steam	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
13051	RIVERSIDE	734	11	05100018	11	O/G Steam	None	No Operation	No Operation	No Operation	None	No Operation	No Operation	No Operation
13051	RIVERSIDE	734	12	05100018	12	O/G Steam	None	No Operation	No Operation	No Operation	None	No Operation	No Operation	No Operation
13051	RIVERSIDE	734	4	05100018	4	O/G Steam	None	None	None	None	None	None	None	None
13051	RIVERSIDE	734	5	05100018	5	O/G Steam	None	No Operation	No Operation	No Operation	None	No Operation	No Operation	No Operation
13051	RIVERSIDE	734	6	05100018	6	O/G Steam	None	No Operation	No Operation	No Operation	None	No Operation	No Operation	No Operation
13067	GEORGIA POWER COMPANY, MCDONOUGH STEAM	710	MB1	06700003	SGM1	Coal Steam	None	None	SCR	SCR	None	None	Scrubber	Scrubber
13067	GEORGIA POWER COMPANY, MCDONOUGH STEAM	710	MB2	06700003	SGM2	Coal Steam	None	None	SCR	SCR	None	None	Scrubber	Scrubber
13077	GEORGIA POWER COMPANY, YATES STEAM-ELECTRIC	728	Y1BR	07700001	SG01	Coal Steam	None	None	None	None	Scrubber	Scrubber	Scrubber	Scrubber
13077	GEORGIA POWER COMPANY, YATES STEAM-ELECTRIC	728	Y2BR	07700001	SG02	Coal Steam	None	None	None	None	None	None	None	None

APPENDIX I: EGU CONTROLS FOR COAL AND OIL/GAS UNITS FOR THE B&F INVENTORY

							Post-Combustion Controls							
FIPS	Facility Name	ORIS ID	BLR ID	SITE ID	UNIT ID	Plant Type	VISTAS NOx 2009 Controls	IPM NOx 2009 Controls	VISTAS NOx 2018 Controls	IPM NOx 2018 Controls	VISTAS SO2 2009 Controls	IPM SO2 2009 Controls	VISTAS SO2 2018 Controls	IPM SO2 2018 Controls
13077	GEORGIA POWER COMPANY, YATES STEAM-ELECTRIC	728	Y3BR	07700001	SG03	Coal Steam	None	None	None	None	None	None	None	None
13077	GEORGIA POWER COMPANY, YATES STEAM-ELECTRIC	728	Y4BR	07700001	SG04	Coal Steam	None	None	SCR	SCR	None	None	None	Scrubber
13077	GEORGIA POWER COMPANY, YATES STEAM-ELECTRIC	728	Y5BR	07700001	SG05	Coal Steam	None	None	SCR	SCR	None	None	None	Scrubber
13077	GEORGIA POWER COMPANY, YATES STEAM-ELECTRIC	728	Y6BR	07700001	SG06	Coal Steam	None	None	SCR	SCR	None	None	Scrubber	Scrubber
13077	GEORGIA POWER COMPANY, YATES STEAM-ELECTRIC	728	Y7BR	07700001	SG07	Coal Steam	None	None	SCR	SCR	None	None	Scrubber	Scrubber
13095	GEORGIA POWER COMPANY, MITCHELL STEAM-ELECTRIC	727		09500002	SG01		No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
13095	GEORGIA POWER COMPANY, MITCHELL STEAM-ELECTRIC	727		09500002	SG02		No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
13095	GEORGIA POWER COMPANY, MITCHELL STEAM-ELECTRIC	727	3	09500002	SG03	Coal Steam	None	None	None	None	None	None	None	None
13103	SAVANNAH ELECTRIC: MCINTOSH STEAM - ELECTRIC	6124	1	10300003	SG01	Coal Steam	None	None	None	SCR	None	None	None	None
13115	GEORGIA POWER COMPANY, HAMMOND STEAM-ELECTRIC	708	1	11500003	SG01	Coal Steam	None	None	SCR	SCR	Scrubber	None	Scrubber	Scrubber
13115	GEORGIA POWER COMPANY, HAMMOND STEAM-ELECTRIC	708	2	11500003	SG02	Coal Steam	None	None	SCR	SCR	Scrubber	None	Scrubber	Scrubber
13115	GEORGIA POWER COMPANY, HAMMOND STEAM-ELECTRIC	708	3	11500003	SG03	Coal Steam	None	None	SCR	SCR	Scrubber	None	Scrubber	Scrubber
13115	GEORGIA POWER COMPANY, HAMMOND STEAM-ELECTRIC	708	4	11500003	SG04	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
13127	GEORGIA POWER COMPANY, MCMANUS STEAM-ELECTRIC	715	1	12700004	SG01	O/G Steam	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
13127	GEORGIA POWER COMPANY, MCMANUS STEAM-ELECTRIC	715	2	12700004	SG02	O/G Steam	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
13149	GEORGIA POWER COMPANY, WANSLEY STEAM-ELECTRIC	6052	1	14900001	SG01	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber

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							Post-Combustion Controls							
FIPS	Facility Name	ORIS ID	BLR ID	SITE ID	UNIT ID	Plant Type	VISTAS NOx 2009 Controls	IPM NOx 2009 Controls	VISTAS NOx 2018 Controls	IPM NOx 2018 Controls	VISTAS SO2 2009 Controls	IPM SO2 2009 Controls	VISTAS SO2 2018 Controls	IPM SO2 2018 Controls
13149	GEORGIA POWER COMPANY, WANSLEY STEAM-ELECTRIC	6052	2	14900001	SG02	Coal Steam	SCR	SCR	SCR	SCR	None	Scrubber	Scrubber	Scrubber
13207	GEORGIA POWER COMPANY, SCHERER STEAM-ELECTRIC	6257	1	20700008	SG01	Coal Steam	None	None	None	None	None	None	Scrubber	None
13207	GEORGIA POWER COMPANY, SCHERER STEAM-ELECTRIC	6257	2	20700008	SG02	Coal Steam	None	None	None	None	None	None	Scrubber	None
13207	GEORGIA POWER COMPANY, SCHERER STEAM-ELECTRIC	6257	3	20700008	SG03	Coal Steam	None	None	None	None	None	None	Scrubber	None
13207	GEORGIA POWER COMPANY, SCHERER STEAM-ELECTRIC	6257	4	20700008	SG04	Coal Steam	None	None	None	None	None	None	Scrubber	None
13237	GEORGIA POWER COMPANY, HARLLEE BRANCH	709	1	23700008	SG01	Coal Steam	None	None	SCR	SCR	None	None	Scrubber	Scrubber
13237	GEORGIA POWER COMPANY, HARLLEE BRANCH	709	2	23700008	SG02	Coal Steam	None	None	SCR	SCR	None	None	Scrubber	Scrubber
13237	GEORGIA POWER COMPANY, HARLLEE BRANCH	709	3	23700008	SG03	Coal Steam	None	None	SCR	SCR	None	None	Scrubber	Scrubber
13237	GEORGIA POWER COMPANY, HARLLEE BRANCH	709	4	23700008	SG04	Coal Steam	None	None	SCR	SCR	None	None	Scrubber	Scrubber
13297	GENERIC UNIT	900113	GSC13	ORIS900113	GSC13	Coal Steam	No Operation	No Operation	SCR	SCR	No Operation	No Operation	Scrubber	Scrubber
21015	CINCINNATI GAS & ELECTRIC EAST BEND STAT	6018	2	2101500029	002	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
21041	KENTUCKY UTILITIES CO GHENT GENERATING STATION	1356	1	2104100010	001	Coal Steam	SCR	None	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
21041	KENTUCKY UTILITIES CO GHENT GENERATING STATION	1356	2	2104100010	002	Coal Steam	None	None	SCR	SCR	Scrubber	None	Scrubber	Scrubber
21041	KENTUCKY UTILITIES CO GHENT GENERATING STATION	1356	3	2104100010	003	Coal Steam	SCR	None	SCR	SCR	Scrubber	None	Scrubber	Scrubber
21041	KENTUCKY UTILITIES CO GHENT GENERATING STATION	1356	4	2104100010	004	Coal Steam	SCR	None	SCR	SCR	Scrubber	None	Scrubber	Scrubber
21049	EAST KY POWER COOP WILLIAM C DALE PLANT	1385	1	2104900003	001	Coal Steam	None	None	None	None	None	None	None	None

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							Post-Combustion Controls							
FIPS	Facility Name	ORIS ID	BLR ID	SITE ID	UNIT ID	Plant Type	VISTAS NOx 2009 Controls	IPM NOx 2009 Controls	VISTAS NOx 2018 Controls	IPM NOx 2018 Controls	VISTAS SO2 2009 Controls	IPM SO2 2009 Controls	VISTAS SO2 2018 Controls	IPM SO2 2018 Controls
21049	EAST KY POWER COOP WILLIAM C DALE PLANT	1385	2	2104900003	002	Coal Steam	None	None	None	None	None	None	None	None
21049	EAST KY POWER COOP WILLIAM C DALE PLANT	1385	3	2104900003	003	Coal Steam	None	None	None	None	None	None	None	None
21049	EAST KY POWER COOP WILLIAM C DALE PLANT	1385	4	2104900003	004	Coal Steam	None	None	None	None	None	None	None	None
21059	OWENSBORO MUNICIPAL UTIL ELMER SMITH STATION	1374	1	2105900027	001	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
21059	OWENSBORO MUNICIPAL UTIL ELMER SMITH STATION	1374	2	2105900027	002	Coal Steam	None	None	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
21091	WESTERN KY ENERGY CORP COLEMAN STATION	1381	C1	2109100003	001	Coal Steam	None	None	SCR	SCR	Scrubber	None	Scrubber	Scrubber
21091	WESTERN KY ENERGY CORP COLEMAN STATION	1381	C2	2109100003	002	Coal Steam	None	None	SCR	SCR	Scrubber	None	Scrubber	Scrubber
21091	WESTERN KY ENERGY CORP COLEMAN STATION	1381	C3	2109100003	003	Coal Steam	None	None	SCR	SCR	Scrubber	None	Scrubber	Scrubber
21091	GENERIC UNIT	900121	GSC21	ORIS900121	GSC21	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
21101	HENDERSON MUN POW & LIGHT	1372	6	2110100012	002	Coal Steam	None	None	None	None	None	None	None	None
21101	HENDERSON MUN POW & LIGHT	1372	5	2110100012	5	Coal Steam	None	None	None	None	None	None	None	None
21111	LOU GAS & ELEC, CANE RUN	1363	4	0126	04	Coal Steam	None	None	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
21111	LOU GAS & ELEC, CANE RUN	1363	5	0126	05	Coal Steam	None	None	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
21111	LOU GAS & ELEC, CANE RUN	1363	6	0126	06	Coal Steam	None	None	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
21111	LOU GAS & ELEC, MILL CREEK	1364	1	0127	01	Coal Steam	None	None	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
21111	LOU GAS & ELEC, MILL CREEK	1364	2	0127	02	Coal Steam	None	None	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber

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							Post-Combustion Controls							
FIPS	Facility Name	ORIS ID	BLR ID	SITE ID	UNIT ID	Plant Type	VISTAS NOx 2009 Controls	IPM NOx 2009 Controls	VISTAS NOx 2018 Controls	IPM NOx 2018 Controls	VISTAS SO2 2009 Controls	IPM SO2 2009 Controls	VISTAS SO2 2018 Controls	IPM SO2 2018 Controls
21111	LOU GAS & ELEC, MILL CREEK	1364	3	0127	03	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
21111	LOU GAS & ELEC, MILL CREEK	1364	4	0127	04	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
21127	KENTUCKY POWER CO BIG SANDY PLANT	1353	BSU1	2112700003	001	Coal Steam	None	SCR	SCR	SCR	None	Scrubber	Scrubber	Scrubber
21127	KENTUCKY POWER CO BIG SANDY PLANT	1353	BSU2	2112700003	002	Coal Steam	SCR	SCR	SCR	SCR	None	None	Scrubber	Scrubber
21145	TVA-ENVIRONMENTAL AFFAIRS SHAWNEE PLANT	1379	1	2114500006	001	Coal Steam	None	None	None	None	None	None	None	None
21145	TVA-ENVIRONMENTAL AFFAIRS SHAWNEE PLANT	1379	2	2114500006	002	Coal Steam	None	None	None	None	None	None	None	None
21145	TVA-ENVIRONMENTAL AFFAIRS SHAWNEE PLANT	1379	3	2114500006	003	Coal Steam	None	None	None	None	None	None	None	None
21145	TVA-ENVIRONMENTAL AFFAIRS SHAWNEE PLANT	1379	4	2114500006	004	Coal Steam	None	None	None	None	None	None	None	None
21145	TVA-ENVIRONMENTAL AFFAIRS SHAWNEE PLANT	1379	5	2114500006	005	Coal Steam	None	None	None	None	None	None	None	None
21145	TVA-ENVIRONMENTAL AFFAIRS SHAWNEE PLANT	1379	6	2114500006	006	Coal Steam	None	None	None	None	None	None	None	None
21145	TVA-ENVIRONMENTAL AFFAIRS SHAWNEE PLANT	1379	7	2114500006	007	Coal Steam	None	None	None	None	None	None	None	None
21145	TVA-ENVIRONMENTAL AFFAIRS SHAWNEE PLANT	1379	8	2114500006	008	Coal Steam	None	None	None	None	None	None	None	None
21145	TVA-ENVIRONMENTAL AFFAIRS SHAWNEE PLANT	1379	9	2114500006	009	Coal Steam	None	None	None	None	None	None	None	None
21145	TVA-ENVIRONMENTAL AFFAIRS SHAWNEE PLANT	1379	10	2114500006	016	Coal Steam	None	None	None	None	None	None	None	None
21161	EAST KY POWER COOP SPURLOCK ST. MAYSVILLE	6041	1	2116100009	001	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	None	Scrubber	Scrubber
21161	EAST KY POWER COOP SPURLOCK ST. MAYSVILLE	6041	2	2116100009	002	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	None	Scrubber	Scrubber

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FIPS	Facility Name	ORIS ID	BLR ID	SITE ID	UNIT ID	Plant Type	Post-Combustion Controls							
							VISTAS NOx 2009 Controls	IPM NOx 2009 Controls	VISTAS NOx 2018 Controls	IPM NOx 2018 Controls	VISTAS SO2 2009 Controls	IPM SO2 2009 Controls	VISTAS SO2 2018 Controls	IPM SO2 2018 Controls
21167	KENTUCKY UTILITIES CO BROWN FACILITY	1355	1	2116700001	001	Coal Steam	None	None	None	None	Scrubber	None	Scrubber	None
21167	KENTUCKY UTILITIES CO BROWN FACILITY	1355	2	2116700001	002	Coal Steam	None	None	SCR	SCR	Scrubber	None	Scrubber	Scrubber
21167	KENTUCKY UTILITIES CO BROWN FACILITY	1355	3	2116700001	003	Coal Steam	None	None	SCR	SCR	Scrubber	None	Scrubber	Scrubber
21177	KENTUCKY UTILITIES CO GREEN RIVER STATION	1357	4	2117700001	003	Coal Steam	None	None	None	None	None	None	None	None
21177	KENTUCKY UTILITIES CO GREEN RIVER STATION	1357	5	2117700001	004	Coal Steam	None	None	None	None	None	None	None	None
21177	TVA PARADISE STEAM PLANT	1378	1	2117700006	001	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
21177	TVA PARADISE STEAM PLANT	1378	2	2117700006	002	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
21177	TVA PARADISE STEAM PLANT	1378	3	2117700006	003	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
21183	WESTERN KY ENERGY CORP WILSON STATION	6823	W1	2118300069	001	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
21199	EAST KY POWER COOP JOHN SHERMAN COOPER	1384	1	2119900005	001	Coal Steam	None	None	None	None	None	None	Scrubber	None
21199	EAST KY POWER COOP JOHN SHERMAN COOPER	1384	2	2119900005	002	Coal Steam	None	SCR	SCR	SCR	None	None	Scrubber	Scrubber
21223	LOUISVILLE GAS & ELECTRIC TRIMBLE CO GEN	6071	1	2122300002	001	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
21233	HENDERSON STATION 2	1382	H1	2123300001 -A	002	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
21233	HENDERSON STATION 2	1382	H2	2123300001 -A	003	Coal Steam	SCR	None	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
21233	WESTERN KY ENERGY CORP REID	1383	R1	2123300001 -B	001	Coal Steam	None	None	None	None	None	None	None	None
21233	WESTERN KY ENERGY CORP GREEN STATION	6639	G1	2123300052	001	Coal Steam	None	None	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber

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FIPS	Facility Name	ORIS ID	BLR ID	SITE ID	UNIT ID	Plant Type	Post-Combustion Controls VISTAS NOx 2009 Controls	IPM NOx 2009 Controls	VISTAS NOx 2018 Controls	IPM NOx 2018 Controls	VISTAS SO2 2009 Controls	IPM SO2 2009 Controls	VISTAS SO2 2018 Controls	IPM SO2 2018 Controls
21233	WESTERN KY ENERGY CORP GREEN STATION	6639	G2	2123300052	002	Coal Steam	None	None	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
21239	KENTUCKY UTILITIES TYRONE FACILITY	1361	5	2123900001	005	Coal Steam	None	None	None	None	None	None	None	None
28011	ENTERGY MISSISSIPPI INC, DELTA PLANT	2051	1	2801100031	001	O/G Steam	None	O/G Early Retireme nt	None	O/G Early Retireme nt	None	O/G Early Retireme nt	None	O/G Early Retireme nt
28011	ENTERGY MISSISSIPPI INC, DELTA PLANT	2051		2801100031	002		None	O/G Early Retireme nt	None	O/G Early Retireme nt	None	O/G Early Retireme nt	None	O/G Early Retireme nt
28011	ENTERGY MISSISSIPPI INC, DELTA PLANT	2051	2	2801100031	003	O/G Steam	None	O/G Early Retireme nt	None	O/G Early Retireme nt	None	O/G Early Retireme nt	None	O/G Early Retireme nt
28011	ENTERGY MISSISSIPPI INC, DELTA PLANT	2051		2801100031	004		None	O/G Early Retireme nt	None	O/G Early Retireme nt	None	O/G Early Retireme nt	None	O/G Early Retireme nt
28019	CHOCTAW GENERATION LLP, RED HILLS GENERATING	55076	AA001	2801900011	001A	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
28019	CHOCTAW GENERATION LLP, RED HILLS GENERATING	55076	AA002	2801900011	001B									
28035	MISSISSIPPI POWER COMPANY, PLANT EATON	2046		2803500038	001	O/G Steam	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
28035	MISSISSIPPI POWER COMPANY, PLANT EATON	2046		2803500038	002	O/G Steam	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
28035	MISSISSIPPI POWER COMPANY, PLANT EATON	2046		2803500038	003	O/G Steam	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
28047	MISSISSIPPI POWER COMPANY, PLANT JACK WATSON	2049	1	2804700055	001	O/G Steam	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
28047	MISSISSIPPI POWER COMPANY, PLANT JACK WATSON	2049	2	2804700055	002	O/G Steam	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
28047	MISSISSIPPI POWER COMPANY, PLANT JACK WATSON	2049	3	2804700055	003	O/G Steam	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
28047	MISSISSIPPI POWER COMPANY, PLANT JACK WATSON	2049	4	2804700055	004	Coal Steam	None	SCR	SCR	SCR	None	None	None	Scrubber

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							Post-Combustion Controls							
FIPS	Facility Name	ORIS ID	BLR ID	SITE ID	UNIT ID	Plant Type	VISTAS NOx 2009 Controls	IPM NOx 2009 Controls	VISTAS NOx 2018 Controls	IPM NOx 2018 Controls	VISTAS SO2 2009 Controls	IPM SO2 2009 Controls	VISTAS SO2 2018 Controls	IPM SO2 2018 Controls
28047	MISSISSIPPI POWER COMPANY, PLANT JACK WATSON	2049	5	2804700055	005	Coal Steam	None	SCR	SCR	SCR	None	None	Scrubber	Scrubber
28049	ENTERGY MISSISSIPPI INC, REX BROWN PLANT	2053	4	2804900112	001	O/G Steam	None	O/G Early Retirement	None	O/G Early Retirement	None	O/G Early Retirement	None	O/G Early Retirement
28049	ENTERGY MISSISSIPPI INC, REX BROWN PLANT	2053	3	2804900112	002	O/G Steam	None	O/G Early Retirement	None	O/G Early Retirement	None	O/G Early Retirement	None	O/G Early Retirement
28059	MISSISSIPPI POWER COMPANY, PLANT DANIEL	6073	1	2805900090	001	Coal Steam	None	SCR	SCR	SCR	None	None	Scrubber	Scrubber
28059	MISSISSIPPI POWER COMPANY, PLANT DANIEL	6073	2	2805900090	002	Coal Steam	None	SCR	SCR	SCR	None	None	Scrubber	Scrubber
28067	MOSELLE SOUTH MISSISSIPPI ELECTRIC POWER ASSOCIATION	2070	1	2806700035	001	O/G Steam	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
28067	MOSELLE SOUTH MISSISSIPPI ELECTRIC POWER ASSOCIATION	2070	2	2806700035	002	O/G Steam	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
28067	MOSELLE SOUTH MISSISSIPPI ELECTRIC POWER ASSOCIATION	2070	3	2806700035	003	O/G Steam	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
28073	RD MORROW SOUTH MISSISSIPPI ELECTRIC POWER ASSOCIATION	6061	1	2807300021	001	Coal Steam	None	None	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
28073	RD MORROW SOUTH MISSISSIPPI ELECTRIC POWER ASSOCIATION	6061	2	2807300021	002	Coal Steam	None	None	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
28075	MISSISSIPPI POWER COMPANY, PLANT SWEATT	2048	1	2807500032	001	O/G Steam	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
28075	MISSISSIPPI POWER COMPANY, PLANT SWEATT	2048	2	2807500032	002	O/G Steam	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation
28083	GREENWOOD UTILITIES, HENDERSON STATION	2062	H1	2808300048	001	O/G Steam	None	None	None	None	No Operation	No Operation	No Operation	No Operation
28083	GREENWOOD UTILITIES, HENDERSON STATION	2062	H3	2808300048	003	O/G Steam	None	None	None	None	No Operation	No Operation	No Operation	No Operation
28149	ENTERGY MISSISSIPPI INC, BAXTER WILSON	2050	1	2814900027	001	O/G Steam	None	O/G Early Retirement	None	O/G Early Retirement	None	O/G Early Retirement	None	O/G Early Retirement

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							Post-Combustion Controls							
FIPS	**Facility Name**	**ORIS ID**	**BLR ID**	**SITE ID**	**UNIT ID**	**Plant Type**	**VISTAS NOx 2009 Controls**	**IPM NOx 2009 Controls**	**VISTAS NOx 2018 Controls**	**IPM NOx 2018 Controls**	**VISTAS SO2 2009 Controls**	**IPM SO2 2009 Controls**	**VISTAS SO2 2018 Controls**	**IPM SO2 2018 Controls**
28149	ENTERGY MISSISSIPPI INC, BAXTER WILSON	2050	2	2814900027	002	O/G Steam	None	O/G Early Retirement	None	O/G Early Retirement	None	O/G Early Retirement	None	O/G Early Retirement
28151	ENTERGY MISSISSIPPI INC, GERALD ANDRUS	8054	1	2815100048	001	O/G Steam	None	No Operation	None	No Operation	None	No Operation	None	No Operation
28163	YAZOO CITY PUBLIC SERVICE COMMISSION	2067	3	2816300005	001	O/G Steam	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement	O/G Early Retirement
37017	ELIZABETHTOWN POWER, LLC	10380	UNIT1	3701700043	G-17A	Coal Steam	None	None	None	None	None	None	None	None
37017	ELIZABETHTOWN POWER, LLC	10380	UNIT2	3701700043	G-17B		None	None	None	None	None	None	None	None
37019	COGENTRIX OF NORTH CAROLINA INC - SOUTHPORT	10378	GEN1	3701900067	G-29	Coal Steam	None	None	None	None	None	None	None	None
37019	COGENTRIX OF NORTH CAROLINA INC - SOUTHPORT	10378	GEN2	3701900067	G-30	Coal Steam	None	None	None	None	None	None	None	None
37021	CAROLINA POWER & LIGHT ASHEVILLE STEAM	2706	1	628	1	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
37021	CAROLINA POWER & LIGHT ASHEVILLE STEAM	2706	2	628	2	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
37025	KANNAPOLIS ENERGY PARTNERS LLC			3702500113	G-2	Coal Steam	None	None	None	None	None	None	None	None
37025	KANNAPOLIS ENERGY PARTNERS LLC			3702500113	G-3	Coal Steam	None	None	None	None	None	None	None	None
37035	DUKE ENERGY CORPORATION MARSHALL STEAM	2727	3	3703500073	G-1	Coal Steam	SNCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
37035	DUKE ENERGY CORPORATION MARSHALL STEAM	2727	4	3703500073	G-2	Coal Steam	SNCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
37035	DUKE ENERGY CORPORATION MARSHALL STEAM	2727	1	3703500073	G-4	Coal Steam	SNCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
37035	DUKE ENERGY CORPORATION MARSHALL STEAM	2727	2	3703500073	G-5	Coal Steam	SNCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
37037	PROGRESS ENERGY CAROLINAS CAPE FEAR	2708	5	3703700063	G-1	Coal Steam	SNCR	SNCR	SNCR	SNCR	None	None	Furnace Sorbent Injection	Scrubber

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							Post-Combustion Controls							
FIPS	Facility Name	ORIS ID	BLR ID	SITE ID	UNIT ID	Plant Type	VISTAS NOx 2009 Controls	IPM NOx 2009 Controls	VISTAS NOx 2018 Controls	IPM NOx 2018 Controls	VISTAS SO2 2009 Controls	IPM SO2 2009 Controls	VISTAS SO2 2018 Controls	IPM SO2 2018 Controls
37037	PROGRESS ENERGY CAROLINAS CAPE FEAR	2708	6	3703700063	G-2	Coal Steam	SNCR	SNCR	SNCR	SNCR	None	None	Furnace Sorbent Injection	Scrubber
37045	GENERIC UNIT	900137	GSC37	ORIS900137	GSC37	Coal Steam	No Operation	No Operation	SCR	SCR	No Operation	No Operation	Scrubber	Scrubber
37055	GENERIC UNIT	900237	GSC37	ORIS900237	GSC37	Coal Steam	No Operation	No Operation	SCR	SCR	No Operation	No Operation	Scrubber	Scrubber
37055	GENERIC UNIT	900337	GSC37	ORIS900337	GSC37	Coal Steam	No Operation	No Operation	SCR	SCR	No Operation	No Operation	Scrubber	Scrubber
37061	GENERIC UNIT	900437	GSC37	ORIS900437	GSC37	Coal Steam	No Operation	No Operation	SCR	SCR	No Operation	No Operation	Scrubber	Scrubber
37083	GENERIC UNIT	900537	GSC37	ORIS900537	GSC37	Coal Steam	No Operation	No Operation	SCR	SCR	No Operation	No Operation	Scrubber	Scrubber
37083	GENERIC UNIT	900637	GSC37	ORIS900637	GSC37	Coal Steam	No Operation	No Operation	SCR	SCR	No Operation	No Operation	Scrubber	Scrubber
37071	DUKE ENERGY CORPORATION ALLEN STEAM	2718	1	3707100039	G-14	Coal Steam	SNCR	SNCR	SNCR	SNCR	Scrubber	Scrubber	Scrubber	Scrubber
37071	DUKE ENERGY CORPORATION ALLEN STEAM	2718	2	3707100039	G-15	Coal Steam	SNCR	SNCR	SNCR	SNCR	Scrubber	Scrubber	Scrubber	Scrubber
37071	DUKE ENERGY CORPORATION ALLEN STEAM	2718	3	3707100039	G-16	Coal Steam	SNCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
37071	DUKE ENERGY CORPORATION ALLEN STEAM	2718	4	3707100039	G-17	Coal Steam	SNCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
37071	DUKE ENERGY CORPORATION ALLEN STEAM	2718	5	3707100039	G-18	Coal Steam	SNCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
37071	DUKE ENERGY CORPORATION RIVERBEND STEAM	2732	7	3707100040	G-17	Coal Steam	SNCR	SNCR	SNCR	SNCR	None	None	None	None
37071	DUKE ENERGY CORPORATION RIVERBEND STEAM	2732	8	3707100040	G-18	Coal Steam	SNCR	SNCR	SNCR	SNCR	None	None	None	None
37071	DUKE ENERGY CORPORATION RIVERBEND STEAM	2732	9	3707100040	G-19	Coal Steam	SNCR	SNCR	SNCR	SNCR	None	None	None	None
37071	DUKE ENERGY CORPORATION RIVERBEND STEAM	2732	10	3707100040	G-20	Coal Steam	SNCR	SNCR	SNCR	SNCR	None	None	None	None

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FIPS	Facility Name	ORIS ID	BLR ID	SITE ID	UNIT ID	Plant Type	Post-Combustion Controls							
							VISTAS NOx 2009 Controls	IPM NOx 2009 Controls	VISTAS NOx 2018 Controls	IPM NOx 2018 Controls	VISTAS SO2 2009 Controls	IPM SO2 2009 Controls	VISTAS SO2 2018 Controls	IPM SO2 2018 Controls
37083	ROANOKE VALLEY ENERGY FACILITY			3708300174	G-27	Coal Steam	None	None	None	None	None	None	None	None
37083	ROANOKE VALLEY ENERGY FACILITY			3708300174	G-7	Coal Steam	None	None	None	None	None	None	None	None
37129	L V SUTTON STEAM ELECTRIC PLANT	2713	1	3712900036	G-187	Coal Steam	None	SNCR	SNCR	SNCR	None	None	None	None
37129	L V SUTTON STEAM ELECTRIC PLANT	2713	2	3712900036	G-188	Coal Steam	None	SCR	SCR	SCR	None	None	None	None
37129	L V SUTTON STEAM ELECTRIC PLANT	2713	3	3712900036	G-189	Coal Steam	None	SCR	SCR	SCR	None	Scrubber	Scrubber	Scrubber
37145	CP&L - ROXBORO STEAM ELECTRIC PLANT	2712	1	3714500029	G-29	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
37145	CP&L - ROXBORO STEAM ELECTRIC PLANT	2712	2	3714500029	G-30	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
37145	CP&L - ROXBORO STEAM ELECTRIC PLANT	2712	3A	3714500029	G-35A	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
37145	CP&L - ROXBORO STEAM ELECTRIC PLANT	2712	3B	3714500029	G-35B	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
37145	CP&L - ROXBORO STEAM ELECTRIC PLANT	2712	4A	3714500029	G-36A	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
37145	CP&L - ROXBORO STEAM ELECTRIC PLANT	2712	4B	3714500029	G-36B	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
37145	CP&L - MAYO FACILITY	6250	1A	3714500045	G-46A	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
37145	CP&L - MAYO FACILITY	6250	1B	3714500045	G-46B	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
37155	PROGRESS ENERGY CAROLINAS, INC., W.H. WEATHERSPOON	2716	1	3715500147	G-24	Coal Steam	None	SNCR	SNCR	SNCR	None	None	None	None
37155	PROGRESS ENERGY CAROLINAS, INC., W.H. WEATHERSPOON	2716	2	3715500147	G-25	Coal Steam	None	SNCR	SNCR	SNCR	None	None	None	None
37155	PROGRESS ENERGY CAROLINAS, INC., W.H. WEATHERSPOON	2716	3	3715500147	G-26	Coal Steam	None	SNCR	SNCR	SNCR	None	None	None	None

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							Post-Combustion Controls							
FIPS	Facility Name	ORIS ID	BLR ID	SITE ID	UNIT ID	Plant Type	VISTAS NOx 2009 Controls	IPM NOx 2009 Controls	VISTAS NOx 2018 Controls	IPM NOx 2018 Controls	VISTAS SO2 2009 Controls	IPM SO2 2009 Controls	VISTAS SO2 2018 Controls	IPM SO2 2018 Controls
37155	LUMBERTON POWER, LLC	10382	UNIT1	3715500166	G-17A	Coal Steam	None	None	None	None	None	None	None	None
37155	LUMBERTON POWER, LLC	10382	UNIT2	3715500166	G-17B		None	None	None	None	None	None	None	None
37157	DUKE ENERGY CORP DAN RIVER STEAM	2723	3	3715700015	G-21	Coal Steam	None	SNCR	SNCR	SNCR	None	None	None	None
37157	DUKE ENERGY CORP DAN RIVER STEAM	2723	1	3715700015	G-22	Coal Steam	None	SNCR	SNCR	SNCR	None	None	None	None
37157	DUKE ENERGY CORP DAN RIVER STEAM	2723	2	3715700015	G-23	Coal Steam	None	SNCR	SNCR	SNCR	None	None	None	None
37159	DUKE ENERGY CORPORATION BUCK STEAM	2720	5	3715900004	G-1	Coal Steam	None	SNCR	SNCR	SNCR	None	None	None	None
37159	DUKE ENERGY CORPORATION BUCK STEAM	2720	6	3715900004	G-2	Coal Steam	None	SNCR	SNCR	SNCR	None	None	None	None
37159	DUKE ENERGY CORPORATION BUCK STEAM	2720	7	3715900004	G-3	Coal Steam	SNCR	SNCR	SNCR	SNCR	None	None	None	None
37159	DUKE ENERGY CORPORATION BUCK STEAM	2720	8	3715900004	G-4	Coal Steam	SNCR	SNCR	SNCR	SNCR	None	None	None	None
37159	DUKE ENERGY CORPORATION BUCK STEAM	2720	9	3715900004	G-5	Coal Steam	SNCR	SNCR	SNCR	SNCR	None	None	None	None
37161	DUKE ENERGY CORPORATION CLIFFSIDE STEAM	2721	1	3716100028	G-82	Coal Steam	None	SNCR	SNCR	SNCR	None	None	None	None
37161	DUKE ENERGY CORPORATION CLIFFSIDE STEAM	2721	2	3716100028	G-83	Coal Steam	None	SNCR	SNCR	SNCR	None	None	None	None
37161	DUKE ENERGY CORPORATION CLIFFSIDE STEAM	2721	3	3716100028	G-84	Coal Steam	None	SNCR	SNCR	SNCR	None	None	None	None
37161	DUKE ENERGY CORPORATION CLIFFSIDE STEAM	2721	4	3716100028	G-85	Coal Steam	None	SNCR	SNCR	SNCR	None	None	None	None
37161	DUKE ENERGY CORPORATION CLIFFSIDE STEAM	2721	5	3716100028	G-86	Coal Steam	SCR	SCR	SCR	SCR	None	Scrubber	Scrubber	Scrubber
37161	DUKE ENERGY CORPORATION	2721	6	3716100028	G-87	Coal Steam	No Operation	Not in IPM	SCR	Not in IPM	No Operation	Not in IPM	Scrubber	Not in IPM

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							Post-Combustion Controls							
FIPS	Facility Name	ORIS ID	BLR ID	SITE ID	UNIT ID	Plant Type	VISTAS NOx 2009 Controls	IPM NOx 2009 Controls	VISTAS NOx 2018 Controls	IPM NOx 2018 Controls	VISTAS SO2 2009 Controls	IPM SO2 2009 Controls	VISTAS SO2 2018 Controls	IPM SO2 2018 Controls
	CLIFFSIDE STEAM													
37161	DUKE ENERGY CORPORATION CLIFFSIDE STEAM	2721	7	3716100028	G-88		No Operation	Not in IPM	No Operation	Not in IPM	No Operation	Not in IPM	No Operation	Not in IPM
37169	DUKE ENERGY CORP BELEWS CREEK STEAM	8042	1	3716900004	G-17	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
37169	DUKE ENERGY CORP BELEWS CREEK STEAM	8042	2	3716900004	G-18	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
37191	PROGRESS ENERGY F LEE PLANT	2709	1	3719100017	G-2	Coal Steam	None	SNCR	SNCR	SNCR	None	None	None	None
37191	PROGRESS ENERGY F LEE PLANT	2709	2	3719100017	G-3	Coal Steam	None	SNCR	SNCR	SNCR	None	None	None	None
37191	PROGRESS ENERGY F LEE PLANT	2709	3	3719100017	G-4	Coal Steam	None	SCR	SCR	SCR	None	Scrubber	None	Scrubber
45003	SCE&G:URQUHART	3295	URQ3	0080-0011	003	Coal Steam	None	None	None	None	None	None	None	None
45003	SCE&G:SRS AREA D			0080-0044	001	Coal Steam	None	None	None	None	None	None	None	None
45003	SCE&G:SRS AREA D			0080-0044	002		None	None	None	None				
45003	SCE&G:SRS AREA D			0080-0044	003		None	None	None	None				
45003	SCE&G:SRS AREA D			0080-0044	004		None	None	None	None				
45007	DUKE ENERGY:LEE	3264	1	0200-0004	001	Coal Steam	None	None	None	None	None	None	None	None
45007	DUKE ENERGY:LEE	3264	2	0200-0004	002	Coal Steam	None	None	None	None	None	None	None	None
45007	DUKE ENERGY:LEE	3264	3	0200-0004	003	Coal Steam	None	None	None	None	None	None	None	None
45015	SANTEE COOPER JEFFERIES	3319	1	0420-0003	001	O/G Steam	No Operation	No Operation	None	No Operation	No Operation	No Operation	None	No Operation

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							Post-Combustion Controls							
FIPS	Facility Name	ORIS ID	BLR ID	SITE ID	UNIT ID	Plant Type	VISTAS NOx 2009 Controls	IPM NOx 2009 Controls	VISTAS NOx 2018 Controls	IPM NOx 2018 Controls	VISTAS SO2 2009 Controls	IPM SO2 2009 Controls	VISTAS SO2 2018 Controls	IPM SO2 2018 Controls
45015	SANTEE COOPER JEFFERIES	3319	2	0420-0003	002	O/G Steam	No Operation	No Operation	None	No Operation	No Operation	No Operation	None	No Operation
45015	SANTEE COOPER JEFFERIES	3319	3	0420-0003	003	Coal Steam	None	SCR	None	SCR	None	None	None	None
45015	SANTEE COOPER JEFFERIES	3319	4	0420-0003	004	Coal Steam	None	None	None	None	None	None	None	None
45015	SCE&G:WILLIAMS	3298	WIL1	0420-0006	001	Coal Steam	SCR	SCR	SCR	SCR	None	None	Scrubber	Scrubber
45015	SANTEE COOPER CROSS	130	1	0420-0030	001	Coal Steam	SCR	SCR	SCR	SCR	Scrubber Upgrade	Scrubber	Scrubber Upgrade	Scrubber
45015	SANTEE COOPER CROSS	130	2	0420-0030	002	Coal Steam	SCR	SCR	SCR	SCR	Scrubber Upgrade	Scrubber	Scrubber Upgrade	Scrubber
45015	SANTEE COOPER CROSS	130	3	0420-0030	3	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
45015	SANTEE COOPER CROSS	130	4	0420-0030	4	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
45029	SCE&G:CANADYS	3280	CAN1	0740-0002	001	Coal Steam	None	None	None	None	None	None	None	None
45029	SCE&G:CANADYS	3280	CAN2	0740-0002	002	Coal Steam	None	None	None	None	None	None	None	None
45029	SCE&G:CANADYS	3280	CAN3	0740-0002	003	Coal Steam	None	None	None	None	Scrubber	None	Scrubber	None
45031	PROGRESS ENERGY ROBINSON STATION	3251	1	0820-0002	001	Coal Steam	None	None	None	None	None	None	None	None
45043	SANTEE COOPER WINYAH	6249	1	1140-0005	001	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
45043	SANTEE COOPER WINYAH	6249	2	1140-0005	002	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
45043	SANTEE COOPER WINYAH	6249	3	1140-0005	003	Coal Steam	SCR	SCR	SCR	SCR	Scrubber Upgrade	Scrubber	Scrubber Upgrade	Scrubber
45043	SANTEE COOPER WINYAH	6249	4	1140-0005	004	Coal Steam	SCR	SCR	SCR	SCR	Scrubber Upgrade	Scrubber	Scrubber Upgrade	Scrubber
45051	SANTEE COOPER GRAINGER	3317	1	1340-0003	001	Coal Steam	None	None	None	None	None	None	None	None

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							Post-Combustion Controls							
FIPS	Facility Name	ORIS ID	BLR ID	SITE ID	UNIT ID	Plant Type	VISTAS NOx 2009 Controls	IPM NOx 2009 Controls	VISTAS NOx 2018 Controls	IPM NOx 2018 Controls	VISTAS SO2 2009 Controls	IPM SO2 2009 Controls	VISTAS SO2 2018 Controls	IPM SO2 2018 Controls
45051	SANTEE COOPER GRAINGER	3317	2	1340-0003	002	Coal Steam	None	None	None	None	None	None	None	None
45063	SCE&G:MCMEEKIN	3287	MCM1	1560-0003	001	Coal Steam	None	None	None	None	None	None	None	None
45063	SCE&G:MCMEEKIN	3287	MCM2	1560-0003	002	Coal Steam	None	None	None	None	None	None	None	None
45075	SCE&G:COPE	7210	COP1	1860-0044	001	Coal Steam	None	None	None	None	Scrubber	Scrubber	Scrubber	Scrubber
45079	SCE&G:WATEREE	3297	WAT1	1900-0013	001	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	None	Scrubber	None
45079	SCE&G:WATEREE	3297	WAT2	1900-0013	002	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	None	Scrubber	Scrubber
45029	GENERIC UNIT	900145	GSC45	ORIS900145	GSC45	Coal Steam	No Operation	No Operation	SCR	SCR	No Operation	No Operation	Scrubber	Scrubber
45031	GENERIC UNIT	900245	GSC45	ORIS900245	GSC45	Coal Steam	No Operation	No Operation	SCR	SCR	No Operation	No Operation	Scrubber	Scrubber
45031	GENERIC UNIT	900345	GSC45	ORIS900345	GSC45	Coal Steam	No Operation	No Operation	SCR	SCR	No Operation	No Operation	Scrubber	Scrubber
45039	GENERIC UNIT	900445	GSC45	ORIS900445	GSC45	Coal Steam	No Operation	No Operation	SCR	SCR	No Operation	No Operation	Scrubber	Scrubber
45043	GENERIC UNIT	900545	GSC45	ORIS900545	GSC45	Coal Steam	No Operation	No Operation	Cross Unit 4	SCR	No Operation	No Operation	Cross Unit 4	Scrubber
47001	TVA BULL RUN FOSSIL PLANT	3396	1	0009	001	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
47073	TVA JOHN SEVIER FOSSIL PLANT	3405	1	0007	001	Coal Steam	None	None	SCR	SCR	None	None	Scrubber	Scrubber
47073	TVA JOHN SEVIER FOSSIL PLANT	3405	2	0007	002	Coal Steam	None	None	SCR	SCR	None	None	Scrubber	Scrubber
47073	TVA JOHN SEVIER FOSSIL PLANT	3405	3	0007	003	Coal Steam	None	None	SCR	SCR	None	None	Scrubber	Scrubber
47073	TVA JOHN SEVIER FOSSIL PLANT	3405	4	0007	004	Coal Steam	None	None	SCR	SCR	None	None	Scrubber	Scrubber
47085	TVA JOHNSONVILLE FOSSIL PLANT	3406	1	0011	001	Coal Steam	None	SCR	SCR	SCR	None	None	None	None

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FIPS	Facility Name	ORIS ID	BLR ID	SITE ID	UNIT ID	Plant Type	Post-Combustion Controls VISTAS NOx 2009 Controls	IPM NOx 2009 Controls	VISTAS NOx 2018 Controls	IPM NOx 2018 Controls	VISTAS SO2 2009 Controls	IPM SO2 2009 Controls	VISTAS SO2 2018 Controls	IPM SO2 2018 Controls
47085	TVA JOHNSONVILLE FOSSIL PLANT	3406	2	0011	002	Coal Steam	None	SCR	SCR	SCR	None	None	None	None
47085	TVA JOHNSONVILLE FOSSIL PLANT	3406	3	0011	003	Coal Steam	None	SCR	SCR	SCR	None	None	None	None
47085	TVA JOHNSONVILLE FOSSIL PLANT	3406	4	0011	004	Coal Steam	None	SCR	SCR	SCR	None	None	None	None
47085	TVA JOHNSONVILLE FOSSIL PLANT	3406	5	0011	005	Coal Steam	None	SCR	SCR	SCR	None	None	None	None
47085	TVA JOHNSONVILLE FOSSIL PLANT	3406	6	0011	006	Coal Steam	None	SCR	SCR	SCR	None	None	None	None
47085	TVA JOHNSONVILLE FOSSIL PLANT	3406	7	0011	007	Coal Steam	None	SCR	SCR	SCR	None	None	None	None
47085	TVA JOHNSONVILLE FOSSIL PLANT	3406	8	0011	008	Coal Steam	None	SCR	SCR	SCR	None	None	None	None
47085	TVA JOHNSONVILLE FOSSIL PLANT	3406	9	0011	009	Coal Steam	None	SCR	SCR	SCR	None	None	None	None
47085	TVA JOHNSONVILLE FOSSIL PLANT	3406	10	0011	010	Coal Steam	None	SCR	SCR	SCR	None	None	None	None
47145	TVA KINGSTON FOSSIL PLANT	3407	1	0013	001	Coal Steam	SCR	SCR	SCR	SCR	None	None	Scrubber	Scrubber
47145	TVA KINGSTON FOSSIL PLANT	3407	2	0013	002	Coal Steam	SCR	SCR	SCR	SCR	None	None	Scrubber	Scrubber
47145	TVA KINGSTON FOSSIL PLANT	3407	3	0013	003	Coal Steam	SCR	SCR	SCR	SCR	None	None	Scrubber	Scrubber
47145	TVA KINGSTON FOSSIL PLANT	3407	4	0013	004	Coal Steam	SCR	SCR	SCR	SCR	None	None	Scrubber	Scrubber
47145	TVA KINGSTON FOSSIL PLANT	3407	5	0013	005	Coal Steam	SCR	SCR	SCR	SCR	None	None	Scrubber	Scrubber
47145	TVA KINGSTON FOSSIL PLANT	3407	6	0013	006	Coal Steam	SCR	SCR	SCR	SCR	None	None	Scrubber	Scrubber
47145	TVA KINGSTON FOSSIL PLANT	3407	7	0013	007	Coal Steam	SCR	SCR	SCR	SCR	None	None	Scrubber	Scrubber
47145	TVA KINGSTON FOSSIL PLANT	3407	8	0013	008	Coal Steam	SCR	SCR	SCR	SCR	None	None	Scrubber	Scrubber

APPENDIX I: EGU CONTROLS FOR COAL AND OIL/GAS UNITS FOR THE B&F INVENTORY

							Post-Combustion Controls							
FIPS	Facility Name	ORIS ID	BLR ID	SITE ID	UNIT ID	Plant Type	VISTAS NOx 2009 Controls	IPM NOx 2009 Controls	VISTAS NOx 2018 Controls	IPM NOx 2018 Controls	VISTAS SO2 2009 Controls	IPM SO2 2009 Controls	VISTAS SO2 2018 Controls	IPM SO2 2018 Controls
47145	TVA KINGSTON FOSSIL PLANT	3407	9	0013	009	Coal Steam	SCR	None	SCR	SCR	None	None	Scrubber	Scrubber
47157	ALLEN FOSSIL PLANT	3393	1	00528	Boilr1	Coal Steam	SCR	SCR	SCR	SCR	None	None	None	None
47157	ALLEN FOSSIL PLANT	3393	2	00528	Boilr2	Coal Steam	SCR	SCR	SCR	SCR	None	None	None	None
47157	ALLEN FOSSIL PLANT	3393	3	00528	Boilr3	Coal Steam	SCR	SCR	SCR	SCR	None	None	None	None
47161	TVA CUMBERLAND FOSSIL PLANT	3399	1	0011	001	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
47161	TVA CUMBERLAND FOSSIL PLANT	3399	2	0011	002	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
47165	TVA GALLATIN FOSSIL PLANT	3403	1	0025	001	Coal Steam	None	None	None	None	None	None	Scrubber	Scrubber
47165	TVA GALLATIN FOSSIL PLANT	3403	2	0025	002	Coal Steam	None	None	None	None	None	None	Scrubber	Scrubber
47165	TVA GALLATIN FOSSIL PLANT	3403	3	0025	003	Coal Steam	None	None	None	None	None	None	Scrubber	Scrubber
47165	TVA GALLATIN FOSSIL PLANT	3403	4	0025	004	Coal Steam	None	None	None	None	None	None	Scrubber	Scrubber
51031	DOMINION - ALTAVISTA POWER STATION	10773	1	00156	1	Coal Steam	SNCR	SNCR	SNCR	SNCR	Scrubber	Scrubber	Scrubber	Scrubber
51031	DOMINION - ALTAVISTA POWER STATION	10773	2	00156	2		0	0	0	0	0	0	0	0
51041	DOMINION - CHESTERFIELD POWER STATION	3797	3	00002	3	Coal Steam	None	None	None	None	None	None	Scrubber	None
51041	DOMINION - CHESTERFIELD POWER STATION	3797	4	00002	4	Coal Steam	SCR	None	SCR	SCR	None	None	Scrubber	Scrubber
51041	DOMINION - CHESTERFIELD POWER STATION	3797	5	00002	6	Coal Steam	SCR	None	SCR	SCR	None	None	Scrubber	Scrubber
51041	DOMINION - CHESTERFIELD POWER STATION	3797	6	00002	8	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
51065	DOMINION - BREMO POWER STATION	3796	3	00001	1	Coal Steam	None	None	None	None	None	None	None	None

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							Post-Combustion Controls							
FIPS	Facility Name	ORIS ID	BLR ID	SITE ID	UNIT ID	Plant Type	VISTAS NOx 2009 Controls	IPM NOx 2009 Controls	VISTAS NOx 2018 Controls	IPM NOx 2018 Controls	VISTAS SO2 2009 Controls	IPM SO2 2009 Controls	VISTAS SO2 2018 Controls	IPM SO2 2018 Controls
51065	DOMINION - BREMO POWER STATION	3796	4	00001	2	Coal Steam	SNCR	SNCR	SNCR	SNCR	None	None	None	None
51071	AMERICAN ELECTRIC POWER GLEN LYN	3776	51	00002	1	Coal Steam	None	None	None	None	None	None	None	None
51071	AMERICAN ELECTRIC POWER GLEN LYN	3776	52	00002	2	Coal Steam	None	None	None	None	None	None	None	None
51071	AMERICAN ELECTRIC POWER GLEN LYN	3776	6	00002	3	Coal Steam	None	None	None	None	None	None	None	Scrubber
51083	DOMINION - CLOVER POWER STATION	7213	1	00046	1	Coal Steam	SNCR	SNCR	SNCR	SNCR	Scrubber	Scrubber	Scrubber	Scrubber
51083	DOMINION - CLOVER POWER STATION	7213	2	00046	2	Coal Steam	SNCR	SNCR	SNCR	SNCR	Scrubber	Scrubber	Scrubber	Scrubber
51099	BIRCHWOOD POWER PARTNERS, L.P.	54304	1	00012	1	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
51117	Mecklenburg Cogeneration Facility	52007	GEN1	00051	1	Coal Steam	None	None	None	None	Scrubber	Scrubber	Scrubber	Scrubber
51117	Mecklenburg Cogeneration Facility	52007	GEN2	00051	2	Coal Steam	None	None	None	None	Scrubber	Scrubber	Scrubber	Scrubber
51153	DOMINION - POSSUM POINT	3804	3	00002	3	Coal Steam	None	Combined Cycle	None	Combined Cycle	None	Combined Cycle	None	Combined Cycle
51153	DOMINION - POSSUM POINT	3804	4	00002	4	Coal Steam	None	Combined Cycle	None	Combined Cycle	None	Combined Cycle	None	Combined Cycle
51153	DOMINION - POSSUM POINT	3804	5	00002	5	O/G Steam	None	No Operation	None	No Operation	None	No Operation	None	No Operation
51153	DOMINION - POSSUM POINT	3804	6	00002		Combined Cycle	Combined Cycle	Combined Cycle	Combined Cycle	Combined Cycle	Combined Cycle	Combined Cycle	Combined Cycle	Combined Cycle
51167	AMERICAN ELECTRIC POWER CLINCH RIVER PLANT	3775	1	00003	1	Coal Steam	None	None	SNCR	SCR	None	None	Emission Cap	Scrubber
51167	AMERICAN ELECTRIC POWER CLINCH RIVER PLANT	3775	2	00003	2	Coal Steam	None	None	SNCR	SCR	None	None	Emission Cap	Scrubber
51167	AMERICAN ELECTRIC POWER CLINCH RIVER PLANT	3775	3	00003	3	Coal Steam	None	None	SNCR	SCR	None	None	Emission Cap	Scrubber

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							Post-Combustion Controls							
FIPS	Facility Name	ORIS ID	BLR ID	SITE ID	UNIT ID	Plant Type	VISTAS NOx 2009 Controls	IPM NOx 2009 Controls	VISTAS NOx 2018 Controls	IPM NOx 2018 Controls	VISTAS SO2 2009 Controls	IPM SO2 2009 Controls	VISTAS SO2 2018 Controls	IPM SO2 2018 Controls
51175	LG&E Westmoreland Southampton	10774	GEN1	00051	1	Coal Steam	None	None	None	None	Scrubber	Scrubber	Scrubber	Scrubber
51175	LG&E Westmoreland Southampton			00051	2		None	None	None	None	0	0	0	0
51175	LG&E Westmoreland Southampton			00051	4		None	None	None	None	0	0	0	0
51199	DOMINION - YORKTOWN POWER STATION	3809	3	00001	3	O/G Steam	SNCR	No Operation	SNCR	No Operation	None	No Operation	Scrubber	No Operation
51199	DOMINION - YORKTOWN POWER STATION	3809	2	00001	5	Coal Steam	SNCR	SNCR	SNCR	SNCR	None	None	Scrubber	None
51199	DOMINION - YORKTOWN POWER STATION	3809	1	00001	6	Coal Steam	SNCR	SNCR	SNCR	SNCR	None	None	Scrubber	None
51510	POTOMAC RIVER GENERATING STATION	3788	1	00003	1	Coal Steam	SNCR	Coal Early Retirement	SNCR	Coal Early Retirement	None	Coal Early Retirement	None	Coal Early Retirement
51510	POTOMAC RIVER GENERATING STATION	3788	2	00003	2	Coal Steam	SNCR	Coal Early Retirement	SNCR	Coal Early Retirement	None	Coal Early Retirement	None	Coal Early Retirement
51510	POTOMAC RIVER GENERATING STATION	3788	3	00003	3	Coal Steam	SNCR	None	SNCR	None	None	None	None	None
51510	POTOMAC RIVER GENERATING STATION	3788	4	00003	4	Coal Steam	SNCR	None	SNCR	None	None	None	None	None
51510	POTOMAC RIVER GENERATING STATION	3788	5	00003	5	Coal Steam	SNCR	None	SNCR	None	None	None	None	None
51550	DOMINION - CHESAPEAKE	3803	1	00026	1	Coal Steam	SNCR	SNCR	SNCR	SNCR	Low S Coal	None	Scrubber	None
51550	DOMINION - CHESAPEAKE	3803	2	00026	2	Coal Steam	SNCR	SNCR	SNCR	SNCR	Low S Coal	None	Scrubber	None
51550	DOMINION - CHESAPEAKE	3803	3	00026	3	Coal Steam	SCR	None	SCR	SCR	Low S Coal	None	Scrubber	Scrubber
51550	DOMINION - CHESAPEAKE	3803	4	00026	4	Coal Steam	SCR	None	SCR	SCR	Low S Coal	None	Scrubber	Scrubber
51159	GENERIC UNIT	900151	GSC51	ORIS900151	GSC51	Coal Steam	No Operation	No Operation	SCR	SCR	No Operation	No Operation	Scrubber	Scrubber

APPENDIX I: EGU CONTROLS FOR COAL AND OIL/GAS UNITS FOR THE B&F INVENTORY

FIPS	Facility Name	ORIS ID	BLR ID	SITE ID	UNIT ID	Plant Type	Post-Combustion Controls: VISTAS NOx 2009 Controls	IPM NOx 2009 Controls	VISTAS NOx 2018 Controls	IPM NOx 2018 Controls	VISTAS SO2 2009 Controls	IPM SO2 2009 Controls	VISTAS SO2 2018 Controls	IPM SO2 2018 Controls
51167	GENERIC UNIT	900251	GSC51	ORIS900251	GSC51	Coal Steam	No Operation	No Operation	SCR	SCR	No Operation	No Operation	Scrubber	Scrubber
51195	GENERIC UNIT	900251	GSC51	ORIS900251	GSC51	Coal Steam	No Operation	No Operation	SCR	SCR	No Operation	No Operation	Scrubber	Scrubber
51175	GENERIC UNIT	900351	GSC51	ORIS900351	GSC51	Coal Steam	No Operation	No Operation	SCR	SCR	No Operation	No Operation	Scrubber	Scrubber
51175	GENERIC UNIT	900451	GSC51	ORIS900451	GSC51	Coal Steam	No Operation	No Operation	SCR	SCR	No Operation	No Operation	Scrubber	Scrubber
51181	GENERIC UNIT	900551	GSC51	ORIS900551	GSC51	Coal Steam	No Operation	No Operation	SCR	SCR	No Operation	No Operation	Scrubber	Scrubber
54023	MOUNT STORM POWER PLANT	3954	1	0003	001	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
54023	MOUNT STORM POWER PLANT	3954	2	0003	002	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
54023	MOUNT STORM POWER PLANT	3954	3	0003	003	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
54023	NORTH BRANCH POWER STATION	7537	1A	0014	001	Coal Steam	None	None	None	None	None	None	None	None
54023	NORTH BRANCH POWER STATION	7537	1B	0014	002	Coal Steam	None	None	None	None	None	None	None	None
54025	WESTERN GREENBRIER			00066	GEN1	Coal Steam	No Operation	No Operation	SCR	No Operation	No Operation	No Operation	SCR	No Operation
54033	MONONGAHELA POWER CO HARRISON	3944	1	0015	001	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
54033	MONONGAHELA POWER CO HARRISON	3944	2	0015	002	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
54033	MONONGAHELA POWER CO HARRISON	3944	3	0015	003	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
54039	APPALACHIAN POWER KANAWHA RIVER PLANT	3936	1	0006	001	Coal Steam	None	None	SCR	SCR	None	None	Scrubber	Scrubber
54039	APPALACHIAN POWER KANAWHA RIVER PLANT	3936	2	0006	002	Coal Steam	None	None	SCR	SCR	None	None	Scrubber	Scrubber
54049	MONONGAHELA POWER CO. RIVESVILLE POWER	3945	7	0009	001	Coal Steam	None	Coal Early	None	Coal Early	None	Coal Early	Coal Early	Coal Early

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							Post-Combustion Controls							
FIPS	**Facility Name**	**ORIS ID**	**BLR ID**	**SITE ID**	**UNIT ID**	**Plant Type**	**VISTAS NOx 2009 Controls**	**IPM NOx 2009 Controls**	**VISTAS NOx 2018 Controls**	**IPM NOx 2018 Controls**	**VISTAS SO2 2009 Controls**	**IPM SO2 2009 Controls**	**VISTAS SO2 2018 Controls**	**IPM SO2 2018 Controls**
								Retirement		Retirement		Retirement	Retirement	Retirement
54049	MONONGAHELA POWER CO. RIVESVILLE POWER	3945	8	0009	002	Coal Steam	None	Coal Early Retirement	None	Coal Early Retirement	None	Coal Early Retirement	Coal Early Retirement	Coal Early Retirement
54049	AMERICAN BITUMINOUS POWER GRANT TOWN PLT	10151		0026	001		None	None	None	None	Scrubber	Scrubber	Scrubber	Scrubber
54049	GRANT TOWN POWER PLANT	10151	GEN1	ORIS10151	GEN1	Coal Steam	SNCR	None	None	None	Scrubber	Scrubber	Scrubber	Scrubber
54051	OHIO POWER MITCHELL PLANT	3948	1	0005	001	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
54051	OHIO POWER MITCHELL PLANT	3948	2	0005	002	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
54051	OHIO POWER KAMMER PLANT	3947	1	0006	001	Coal Steam	None	SCR	SCR	SCR	None	Scrubber	Scrubber	Scrubber
54051	OHIO POWER KAMMER PLANT	3947	2	0006	002	Coal Steam	None	SCR	SCR	SCR	None	Scrubber	Scrubber	Scrubber
54051	OHIO POWER KAMMER PLANT	3947	3	0006	003	Coal Steam	None	SCR	SCR	SCR	None	Scrubber	Scrubber	Scrubber
54053	APPALACHIAN POWER CO. PHILIP SPORN PLANT	3938	11	0001	001	Coal Steam	None	None	SCR	SCR	None	None	Scrubber	Scrubber
54053	APPALACHIAN POWER CO. PHILIP SPORN PLANT	3938	21	0001	002	Coal Steam	None	None	SCR	SCR	None	None	Scrubber	Scrubber
54053	APPALACHIAN POWER CO. PHILIP SPORN PLANT	3938	31	0001	003	Coal Steam	None	None	SCR	SCR	None	None	Scrubber	Scrubber
54053	APPALACHIAN POWER CO. PHILIP SPORN PLANT	3938	41	0001	004	Coal Steam	None	None	SCR	SCR	None	None	Scrubber	Scrubber
54053	APPALACHIAN POWER CO. PHILIP SPORN PLANT	3938	51	0001	005	Coal Steam	None	None	SCR	SCR	None	None	Scrubber	Scrubber
54053	APPALACHIAN POWER MOUNTAINEER PLANT	6264	1	0009		Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
54061	MONONGAHELA POWER CO. FORT MARTIN POWER	3943	1	0001	001	Coal Steam	SNCR	SNCR	SNCR	SNCR	None	None	Scrubber	Scrubber

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							Post-Combustion Controls							
FIPS	Facility Name	ORIS ID	BLR ID	SITE ID	UNIT ID	Plant Type	VISTAS NOx 2009 Controls	IPM NOx 2009 Controls	VISTAS NOx 2018 Controls	IPM NOx 2018 Controls	VISTAS SO2 2009 Controls	IPM SO2 2009 Controls	VISTAS SO2 2018 Controls	IPM SO2 2018 Controls
54061	MONONGAHELA POWER CO. FORT MARTIN POWER	3943	2	0001	002	Coal Steam	SNCR	SNCR	SNCR	SNCR	None	None	Scrubber	Scrubber
54061	MORGANTOWN ENERGY ASSOCIATES			0027	043		None	None	None	None	None	None	None	None
54061	MORGANTOWN ENERGY FACILITY	10743	GEN1	ORIS10743	GEN1	Coal Steam	None	None	None	None	None	None	None	None
54061	LONGVIEW			00134	GEN1	Coal Steam	No Operation	No Operation	SCR	No Operation	No Operation	No Operation	Scrubber	No Operation
54061	GENERIC UNIT	900154	GSC54	ORIS900154	GSC54	Coal Steam	No Operation	No Operation	No Operation	SCR	No Operation	No Operation	No Operation	Scrubber
54073	MONONGAHELA POWER CO. WILLOW ISLAND	3946	1	0004	001	Coal Steam	None	Coal Early Retirement	None	Coal Early Retirement	None	Coal Early Retirement	Coal Early Retirement	Coal Early Retirement
54073	MONONGAHELA POWER CO. WILLOW ISLAND	3946	2	0004	002	Coal Steam	None	SCR	SCR	SCR	None	Scrubber	Scrubber	Scrubber
54073	MONONGAHELA POWER CO PLEASANTS POWER STATION	6004	1	0005	001	Coal Steam	SCR	SCR	SCR	SCR	Scrubber Upgrade	Scrubber	Scrubber Upgrade	Scrubber
54073	MONONGAHELA POWER CO PLEASANTS POWER STATION	6004	2	0005	002	Coal Steam	SCR	SCR	SCR	SCR	Scrubber Upgrade	Scrubber	Scrubber Upgrade	Scrubber
54077	MONONGAHELA POWER CO ALBRIGHT	3942	1	0001	001	Coal Steam	None	Coal Early Retirement	Coal Early Retirement	Coal Early Retirement	None	Coal Early Retirement	Coal Early Retirement	Coal Early Retirement
54077	MONONGAHELA POWER CO ALBRIGHT	3942	2	0001	002	Coal Steam	None	Coal Early Retirement	Coal Early Retirement	Coal Early Retirement	None	Coal Early Retirement	Coal Early Retirement	Coal Early Retirement
54077	MONONGAHELA POWER CO ALBRIGHT	3942	3	0001	003	Coal Steam	None	None	SCR	SCR	None	None	Scrubber	Scrubber
54079	APPALACHIAN POWER JOHN E AMOS PLANT	3935	1	0006	001	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
54079	APPALACHIAN POWER JOHN E AMOS PLANT	3935	2	0006	002	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber
54079	APPALACHIAN POWER JOHN E AMOS PLANT	3935	3	0006	003	Coal Steam	SCR	SCR	SCR	SCR	Scrubber	Scrubber	Scrubber	Scrubber

Regional Air Quality Analyses for Ozone, PM2.5, and Regional Haze:
Final Technical Support Document (Supplement), September 12, 2008

The purpose of this paper is to summarize a new modeling analysis performed by the Lake Michigan Air Directors Consortium (LADCO) to address the effect of the recent court decision vacating EPA's Clean Air Interstate Rule (CAIR). This new modeling is intended to supplement the LADCO Technical Support Document ("Regional Air Quality Analyses for Ozone, PM2.5, and Regional Haze: Final Technical Support Document", April 25, 2008), which summarizes the air quality analyses conducted by LADCO and its contractors to support the development of State Implementation Plans for ozone, PM2.5, and regional haze in the States of Illinois, Indiana, Michigan, Ohio, and Wisconsin.

Compared to the previous LADCO modeling (Round 5.1), the new modeling shows similar results for ozone, but much more nonattainment for PM2.5 and higher visibility levels for regional haze. Specifically, the new modeling shows:

> **Ozone:** Attainment of the 0.08 ppm standard by 2009 everywhere in the region, except Holland, MI, and nonattainment of the 0.075 ppm standard through at least 2018.
>
> **PM2.5**: Widespread nonattainment of annual (15 ug/m^3) and daily (35 ug/m^3) standards.
>
> **Haze:** Higher visibility levels on the 20% worst visibility days in 2018 in Class I areas in the eastern U.S., resulting in most areas being above the glide path.

Background: On July 11, 2008, the U.S. Court of Appeals for D.C. Circuit vacated EPA's CAIR rule (cite). The reductions in NOx and SO2 emissions associated with this rule were a key part of the LADCO States' attainment demonstrations for ozone and PM2.5 and the reasonable progress determinations for regional haze. LADCO's previous modeling (Round 5.1) relied on EGU emission projections from EPA's IPM3.0 analysis, which assumed implementation of Phases I and II of CAIR. For this new modeling, alternative EGU emission projections were developed, which did not rely on CAIR (or IPM).

Model Set-Up: The new modeling was performed consistent with LADCO's previous modeling (Round 5.1):

Model Version: CAMx v4.50beta_deposition
Future Years: 2009, 2012, 2018
Runs: (a) Ozone: Summer 2005 meteorology with 12 km grids
(b) PM2.5 and haze: Full year 2005 meteorology with 36 km grids

Emission Scenarios: The new modeling assumed the same set of "on the books" controls as in LADCO's previous modeling (Round 5.1) for all sectors, except EGUs. In light of the CAIR decision, three new EGU scenarios were prepared:

Scenario A: 2007 CEM-based emissions were projected for all states in the modeling domain based on EIA growth rates by state (NERC region) and fuel type. The assumed growth rates for the Midwest States were: MAIN (IL, IA, MO, WI): 8.8% (2007-2018); ECAR (IN, KY, MI, OH): 13.5% (2007-2018); and MAPP (MN): 15.1% (2007-2018). No control was applied. The annual emissions were temporalized based on profiles derived from 2004-2006 CEM data. (Note, these are the same temporal profiles used in Round 5.1.)

Scenario B. Scenario A emissions for the LADCO States and select neighboring states (e.g., MN, IA, MO, KY, TN, and WV) were adjusted by applying legally enforceable controls (i.e., emission reductions required by a Consent Decree, state rule, or permit). Only those legally enforceable controls identified (and justified) by the States were applied. The States also supplied the appropriate control factors. A table summarizing the Scenario B controls is provided in Appendix I.

Scenario C. For the years 2009 and 2012, Scenario A emissions for all states were adjusted by applying all planned SO2 and NOx controls based on the July 10 CAMD list (i.e., 90% reduction for scrubbers, 95% reduction for SCRs). Because the July 10 CAMD list only includes controls generally out to 2011, additional SO2 and NOx controls for the year 2018 were assumed for all BART-eligible EGUs in the five LADCO State plus MN, IA, MO, KY, TN, and MO list (i.e., 90% reduction for scrubbers, 95% reduction for SCRs).[1] All Scenario B controls were included in Scenario C. A table summarizing the Scenario C controls is provided in Appendix II.

Table 1 and Figure 1 provide a summary of the 5-state regional NOx and SO2 emissions for each scenario and future year. (Note, the CAIR emissions included here are based on EPA's IPM3.0 modeling.) Several comments on the emissions should be noted:

Summer NOx

- There is llittle difference between the three alternative scenarios and CAIR. This suggests that summer ozone concentrations for the alternative scenarios are likely to be similar to those predicted with CAIR (i.e., Round 5.1).

Annual NOx:

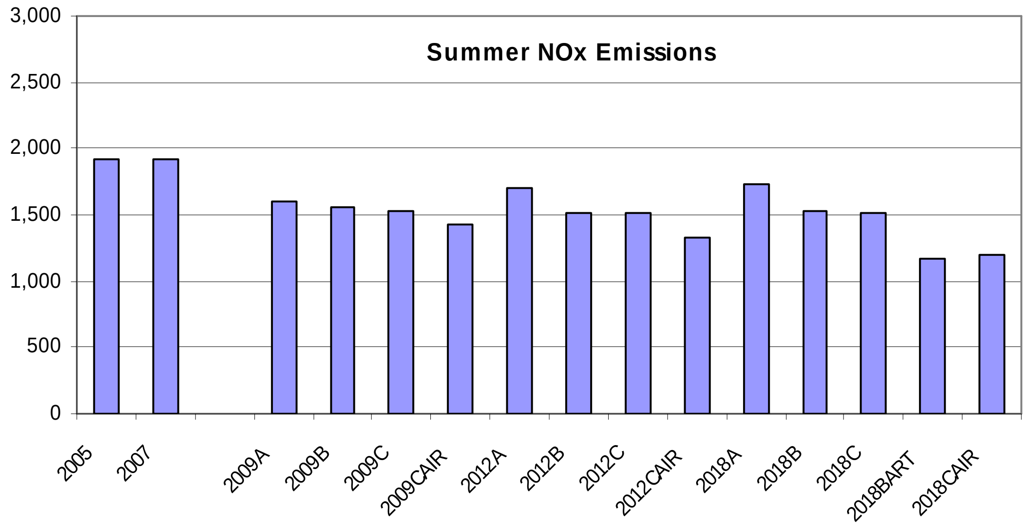
- There is a significant change in emissions between scenarios, mostly during the non-summer months.
- Scenario B reflects application of NOx controls in several states (e.g., IL,OH,WI).
- Because there are relatively few SCRs (in the LADCO States) on the CAMD list, Scenario C results in only a small emissions decrease compared to Scenario B.
- Assumed BART controls result in a significant emissions decrease.

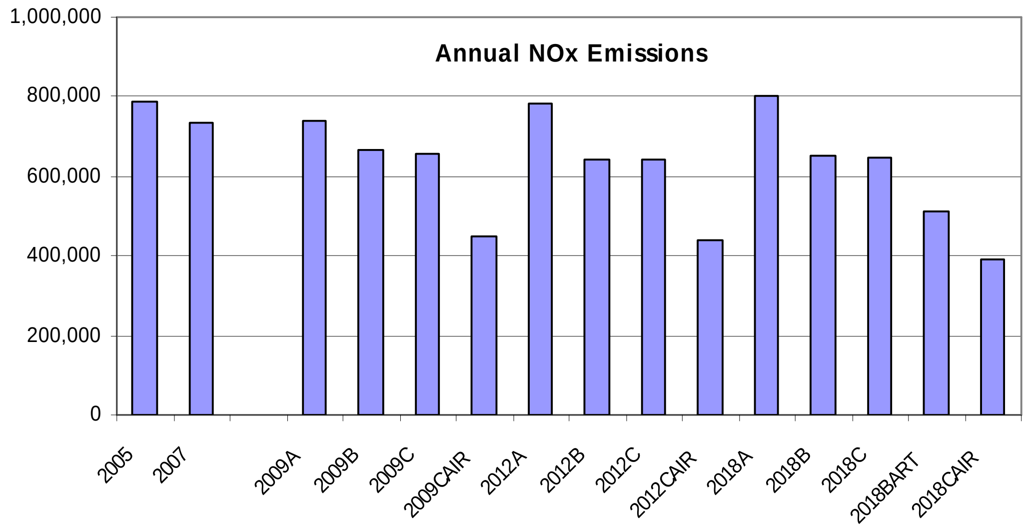
Annual SO2

- There is a significant change in emissions between scenarios.
- Scenario B reflects application of SO2 controls in several states (e.g., IL,OH,WI).
- Because there are several FGDs (in the LADCO States) on the CAMD list, Scenario C results in a large emissions decrease compared to Scenario B.
- Assumed BART controls result in a significant emissions decrease (i.e., even lower emissions than the IPM-estimated CAIR emissions).

[1] A subsequent analysis was conducted with the following inventory changes: (a) 95% reduction for scrubbers, 90% redcuction for SCRs (consistent with EPA's default assumptions for IPM), and (b) revisions provided for a few plants in Indiana and Minnesota. The changes resulted in a relatively small difference in the regioinal NOx and SO2 emissions (e.g., about a 2% NOx increase and about a 1-2% decrease in SO2). To assess the impact of the changes, PM2.5 modleing was conducted with the new Scenario B and Scenario C emissions for 2012. The modeling showed little change in the predicted PM2.5 concentrations.

Figure 1. Regional NOx and SO2 Emissions





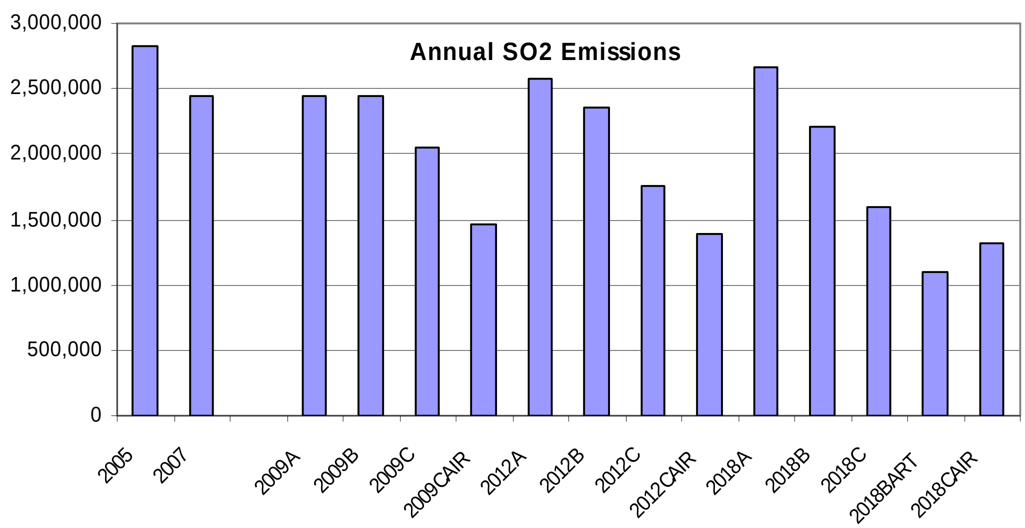


Table 1. Regional NOx and SO2 Emissions

Summer NOx Emissions (TPD)

	2005	2007		2009 A	2009 B	2009 C	2010 CAIR	2012 A	2012 B	2012 C	2012 CAIR	2018 A	2018 B	2018 C	2018 C-BART	2018 CAIR
IL	305	305		311	311	311	275	340	236	236	266	333	227	227	219	224
IN	393	393		376	376	374	384	393	393	390	368	410	386	383	292	264
MI	393	393		350	350	350	242	366	366	366	229	377	377	377	260	243
OH	408	408		395	355	335	285	423	351	351	290	431	366	366	230	290
WI	413	413		167	160	160	238	184	170	170	177	183	168	168	168	177
	1,912	**1,912**		**1,599**	**1,552**	**1,530**	**1,424**	**1,706**	**1,516**	**1,513**	**1,330**	**1,734**	**1,524**	**1,521**	**1,169**	**1,198**

Annual NOx Emissions (TPY)

	2005	2007		2009 A	2009 B	2009 C	2010 CAIR	2012 A	2012 B	2012 C	2012 CAIR	2018 A	2018 B	2018 C	2018 C-BART	2018 CAIR
IL	126,786	121,006		124,917	124,917	124,917	83,224	137,438	81,989	81,989	82,248	135,983	79,771	79,771	63,590	69,958
IN	214,727	203,493		203,776	203,776	201,947	133,188	212,790	212,790	210,877	125,541	221,950	212,805	210,810	177,027	90,415
MI	120,332	112,484		112,478	112,478	112,478	83,117	117,621	117,621	117,621	77,897	122,447	122,447	122,447	89,444	79,543
OH	255,554	240,351		240,016	173,071	164,911	94,346	251,065	172,514	172,514	97,679	261,644	179,737	179,737	125,762	95,678
WI	71,414	54,582		56,540	54,065	54,065	53,032	62,266	57,759	57,759	56,480	61,812	56,952	56,952	56,952	56,158
	788,812	**731,917**		**737,727**	**668,307**	**658,317**	**446,908**	**781,179**	**642,673**	**640,760**	**439,845**	**803,837**	**651,712**	**649,717**	**512,774**	**391,752**

Annual SO2 Emissions (TPY)

	2005	2007		2009 A	2009 B	2009 C	2010 CAIR	2012 A	2012 B	2012 C	2012 CAIR	2018 A	2018 B	2018 C	2018 C-BART	2018 CAIR
IL	326,598	273,467		281,028	281,028	281,028	295,516	309,209	196,238	194,746	267,110	305,364	106,638	105,152	82,351	275,716
IN	866,964	722,301		721,252	721,252	619,486	374,335	754,323	754,323	558,567	379,144	786,551	764,065	559,945	426,695	359,915
MI	350,694	343,487		343,140	343,140	315,326	227,296	358,879	358,879	301,062	233,204	373,964	373,964	313,677	178,680	242,853
OH	1,100,510	960,820		959,466	959,466	693,438	427,145	1,003,633	897,099	572,807	370,532	1,045,945	819,770	481,623	333,740	315,560
WI	181,426	137,562		142,007	142,007	133,738	139,181	156,659	144,818	133,592	139,203	155,818	144,027	132,849	77,214	127,073
	2,826,192	**2,437,638**		**2,446,892**	**2,446,892**	**2,043,017**	**1,463,473**	**2,582,703**	**2,351,356**	**1,760,775**	**1,389,192**	**2,667,641**	**2,208,463**	**1,593,245**	**1,098,679**	**1,321,116**

Modeling Results: Several tables summarizing the modeling results are provided:

Table 2 - future year ozone and PM2.5 concentrations for key monitors in the LADCO region

Table 3 - number of monitoring sites greater than the National Ambient Air Quality Standards (NNAQS)

Table 4 – visibility levels for Class I areas in the eastern U.S.

Note, given that Scenario B and BART controls were only applied in an 11-state Midwest region, the validity of the results for other Class I areas in the eastern U.S. may be questionable. The Scenario C controls, on the other hand, cover all states and are, thus, likely valid in other Class I areas.

Spatial plots of the future year ozone and PM2.5 concentrations are provided in Figures 2 – 4.

Based on these results, the following key findings should be noted:

Ozone

- There is little change from the previous LADCO modeling (Round 5.1 with CAIR)
- The modeling shows attainment of the 0.08 ppm (85 ppb) standard by 2009, except Holland. (Note, Holland does meet this standard by 2012.)
- The modeling shows nonattainment of the 0.075 ppm (75 ppb) standard through 2018.

PM2.5 - Annual

- There is a significant change from the previous LADCO modeling (Round 5.1 with CAIR)
- The modeling shows extensive nonattainment of the annual standard.

PM2.5 - Daily

- There is a significant change from the previous LADCO modeling (Round 5.1 with CAIR)
- The modeling shows extensive nonattainment of the daily standard.

Haze

- There is a significant change from the previous LADCO modeling (Round 5.1 with CAIR)
- The modeling shows higher visibility levels in 2018 for the 20% worst visibility days (average about 0.5 deciviews for the northern Class I areas). The resulting visibility levels in the northern Class I areas (except Voyageurs) are above the glide path.

Table 2a. Ozone Modeling Results

		2005	2009				2012				2018				
			Round 5 without CAIR			Round 5 with CAIR	Round 5 without CAIR			Round 5 with CAIR	Round 5 without CAIR				Round 5 with CAIR
Site	Site ID	Base Year	Scen. A	Scen. B	Scen.C		Scen. A	Scen. B	Scen.C		Scen. A	Scen. B	Scen.C	Scen.C-BART	
Lake Michigan Area															
Chiwaukee	550590019	84.7	82.2	82.2	82.0	82.3	81.1	80.8	80.6	80.9	77.2	77.2	77.0	76.0	76.2
Racine	551010017	80.3	77.8	77.8	77.5	77.5	76.6	76.2	76.1	76.1	72.9	72.3	72.1	71.1	71.2
Milwaukee-Bayside	550890085	82.7	79.9	79.9	79.7	79.8	78.5	78.0	78.0	78.0	74.3	73.6	73.4	72.4	72.7
Harrington Beach	550890009	83.3	80.1	80.1	79.9	80.1	78.6	78.1	78.0	78.3	73.9	73.2	73.1	72.2	72.5
Manitowoc	550710007	85.0	80.8	80.8	80.7	80.8	79.0	78.5	78.4	78.6	73.9	73.2	73.1	72.0	72.5
Sheboygan	551170006	88.0	84.1	84.0	83.9	84.0	82.2	81.7	81.5	81.8	76.9	76.0	75.9	74.8	75.4
Kewaunee	550610002	82.7	78.2	78.2	78.0	78.1	76.4	75.9	75.7	75.9	71.3	70.7	70.5	69.4	69.9
Door County	550290004	88.7	84.1	84.1	83.9	83.9	82.0	81.4	81.3	81.5	76.5	75.6	75.5	74.2	74.7
Hammond	180892008	77.7	76.2	76.2	76.0	75.4	75.6	75.3	75.2	74.6	73.2	72.7	72.6	71.7	71.6
Whiting	180890030	79.3	77.8	77.8	77.7	77.0	77.2	76.9	76.8	76.2	74.8	74.3	74.2	73.2	73.1
Michigan City	180910005	77.0	74.5	74.5	74.3	73.9	73.3	72.9	72.8	72.5	69.7	69.2	69.1	68.1	68.1
Ogden Dunes	181270020	78.3	76.3	76.3	76.2	75.6	75.5	75.1	75.0	74.5	72.9	72.3	72.1	71.2	70.8
Holland	260050003	90.0	85.7	85.7	85.5	85.3	83.5	83.1	82.9	82.8	78.2	77.5	77.3	76.0	76.1
Jenison	261390005	82.0	76.8	76.8	76.7	76.0	75.1	74.6	74.5	74.5	70.2	69.6	69.5	67.9	68.7
Muskegon	261210039	85.0	80.6	80.6	80.5	80.5	78.6	78.2	78.1	78.0	73.5	72.8	72.8	71.5	71.9
Indianapolis Area															
Noblesville	189571001	82.7	78.3	78.3	78.1	78.1	76.1	75.9	75.7	75.6	70.2	69.9	69.8	68.9	68.7
Fortville	180590003	78.0	74.1	74.1	73.9	73.9	71.9	71.8	71.7	71.4	66.7	66.5	66.3	65.4	65.1
Fort B. Harrison	180970050	78.7	75.4	75.3	75.2	75.1	73.8	73.6	73.6	73.2	70.6	70.3	70.2	69.3	69.1
Detroit Area															
New Haven	260990009	86.0	82.4	82.3	82.1	81.4	81.4	81.2	81.1	80.2	78.1	77.8	77.7	76.5	76.1
Warren	260991003	84.0	82.4	82.3	82.2	81.3	82.1	81.8	81.7	80.7	79.7	79.4	79.3	78.0	77.6
Port Huron	261470005	82.7	78.2	78.2	78.1	77.5	76.5	76.3	76.2	75.5	72.6	72.5	72.3	70.9	70.9
Cleveland Area															
Ashtabula	390071001	89.0	84.2	84.1	83.9	83.4	82.0	81.8	81.6	81.0	76.8	76.5	76.4	74.8	75.1
Geauga	390550004	79.3	75.8	75.8	75.6	74.7	74.0	73.8	73.7	72.7	69.5	69.2	69.1	67.6	67.3
Eastlake	390850003	86.3	83.1	83.1	82.9	81.9	81.8	81.6	81.5	80.5	78.2	78.0	77.8	76.5	76.2
Akron	391530020	83.7	79.1	79.1	79.0	78.1	76.9	76.7	76.6	75.6	70.9	70.6	70.4	68.7	68.7
Cincinnati Area															
Wilmington	390271002	82.3	77.3	77.4	77.1	77.5	75.3	75.2	74.8	74.9	70.1	69.9	69.5	67.1	68.3
Sycamore	390610006	84.7	81.5	81.4	81.1	81.9	80.4	80.2	79.8	80.3	76.4	76.0	75.7	73.5	74.6
Lebanon	391650007	87.7	82.8	82.8	82.4	83.0	80.8	80.7	80.3	80.7	75.4	75.1	74.8	72.6	74.2
Columbus Area															
London	390970007	79.7	75.0	75.0	74.8	75.0	73.0	72.8	72.7	72.6	68.1	67.8	67.6	65.9	66.3
New Albany	390490029	86.3	82.1	82.1	81.9	81.8	80.2	80.0	79.9	79.6	74.7	74.3	74.2	73.3	73.0
Franklin	290490028	80.3	76.7	76.6	76.5	75.9	75.1	74.9	74.8	74.1	70.5	70.2	70.1	70.2	69.0
St. Louis Area															
W. Alton (MO)	291831002	86.3	81.1	81.2	81.1	81.0	80.0	79.9	79.9	78.6	76.9	76.8	76.7	74.2	74.9
Orchard (MO)	291831004	87.0	82.1	82.1	82.0	82.0	80.9	80.8	80.7	80.0	77.7	77.6	77.4	75.2	76.2
Sunset Hills (MO)	291890004	82.3	79.2	79.2	79.1	78.7	78.3	78.1	78.1	77.1	75.3	75.2	75.1	73.0	73.9
Arnold (MO)	290990012	82.3	77.8	77.8	77.7	77.2	76.7	76.6	76.5	75.6	73.6	73.4	73.4	71.3	72.0
Margaretta (MO)	295100086	83.0	79.8	79.8	79.7	79.3	78.8	78.7	78.6	77.9	75.7	75.6	75.5	73.7	74.4
Maryland Heights (MO)	291890014	87.3	85.4	85.4	85.3	84.0	84.3	84.1	84.0	81.7	81.1	80.9	80.8	78.4	78.1

Table 2b. $PM_{2.5}$ Modeling Results (Annual)

		2005	2009				2012				2018				
			Round 5 without CAIR			Round 5 with CAIR	Round 5 without CAIR			Round 5 with CAIR	Round 5 without CAIR				Round 5 with CAIR
Site	Site ID	Base Year	Scen. A	Scen. B	Scen.C		Scen. A	Scen. B	Scen.C		Scen. A	Scen. B	Scen.C	Scen.C-BART	
Illinois															
Chicago - Washington HS	170310022	**15.2**	14.9	14.8	14.5	14.1	14.8	14.7	14.2	14.0	15.0	14.6	14.2	13.7	13.9
Chicago - Mayfair	170310052	**15.8**	**15.1**	**15.1**	14.8	14.4	**15.1**	14.9	14.5	14.2	**15.1**	14.7	14.3	13.7	13.9
Chicago - Springfield	170310057	**15.0**	14.6	14.6	14.3	13.9	14.6	14.4	14.0	13.8	14.8	14.4	14.0	13.4	13.7
Chicago - Lawndale	170310076	14.9	14.5	14.5	14.2	13.8	14.5	14.3	13.9	13.7	14.7	14.3	13.9	13.3	13.6
Blue Island	170312001	14.8	14.4	14.4	14.0	13.7	14.4	14.2	13.8	13.6	14.5	14.1	13.7	13.2	13.4
Summit	170313301	**15.2**	14.9	14.9	14.6	14.2	14.9	14.7	14.3	14.0	15.0	14.6	14.3	13.7	13.9
Cicero	170316005	**15.5**	**15.1**	**15.1**	14.8	14.4	**15.1**	14.9	14.5	14.3	**15.2**	14.9	14.4	13.9	14.2
Granite City	171191007	**16.7**	**16.3**	**16.2**	**15.9**	**15.1**	**16.1**	**16.0**	**15.3**	14.9	**15.9**	**15.6**	14.9	14.2	14.3
E. St. Louis	171630010	**15.6**	**15.2**	**15.2**	14.8	14.1	15.0	14.9	14.3	13.9	14.9	14.6	14.0	13.3	13.4
Indiana															
Jeffersonville	180190005	**16.4**	**15.8**	**15.7**	14.8	13.8	**15.8**	**15.6**	14.5	13.7	**16.0**	**15.5**	14.3	13.7	13.4
Jasper	180372001	**15.2**	14.3	14.2	13.4	12.4	14.2	14.0	13.0	12.2	14.3	13.9	12.8	12.1	11.8
Gary	180890031	**15.6**	13.9	13.9	13.5	13.0	13.8	13.6	13.1	12.8	13.7	13.4	12.9	12.3	12.4
Indy-Washington Park	180970078	**15.3**	14.4	14.4	13.6	12.8	14.3	14.2	13.2	12.6	14.3	13.9	12.9	12.2	12.0
Indy-W 18th Street	180970081	**16.0**	**15.1**	**15.1**	14.3		15.0	14.9	13.9		15.0	14.6	13.5	12.8	
Indy- Michigan Street	180970083	**15.9**	15.0	15.0	14.2	13.4	14.9	14.8	13.8	13.1	14.9	14.5	13.5	12.8	12.6
Michigan															
Allen Park	261630001	14.5	11.0	14.0	13.5	13.0	14.0	13.8	13.2	12.8	13.9	13.6	13.0	12.4	12.4
Southwest HS	261630015	**15.9**	**15.3**	**15.3**	14.8	14.2	**15.2**	15.0	14.4	13.9	**15.1**	14.8	14.1	13.5	13.5
Linwood	261630016	14.6	14.1	14.1	13.6	13.1	14.0	13.9	13.3	12.8	13.9	13.6	13.0	12.5	12.5
Dearborn	261630033	**17.5**	**17.0**	**17.0**	**16.4**	**15.8**	**16.9**	**16.7**	**16.0**	**15.5**	**16.8**	**16.4**	**15.7**	**15.1**	**15.1**
Wyandotte	261630036	**14.7**	14.2	14.1	13.6	13.1	14.1	13.9	13.3	12.8	14.0	13.7	13.0	12.4	12.5
Ohio															
Middletown - Bonita	390170003	**16.2**	**15.3**	**15.2**	14.3	13.5	**15.2**	15.0	13.9	13.2	**15.2**	14.8	13.7	13.0	12.8
Fairfield	390170016	**15.8**	**15.1**	15.0	14.1	13.1	**15.1**	14.9	13.7	12.9	**15.2**	14.7	13.5	12.8	12.5
Cleveland-28th Street	390350027	**15.4**	14.9	14.9	14.3	13.5	14.7	14.5	13.9	13.2	14.6	14.2	13.5	12.8	12.7
Cleveland-St. Tikhon	390350038	**17.4**	**16.7**	**16.7**	**16.0**	**15.2**	**16.5**	**16.3**	**15.6**	14.8	**16.3**	**16.0**	**15.2**	14.4	14.3
Cleveland-Broadway	390350045	**16.5**	**15.9**	**15.8**	**15.2**	14.4	**15.6**	**15.5**	14.8	14.0	**15.5**	**15.1**	14.4	13.6	13.5
Cleveland-GT Craig	390350060	**17.1**	**16.5**	**16.4**	**15.8**	15.0	**16.3**	**16.1**	**15.4**	14.6	**16.1**	**15.7**	15.0	14.2	14.1
Newburg Hts - Harvard Ave	390350065	**16.0**	**15.4**	**15.3**	14.7	14.0	**15.2**	15.0	14.3	13.6	**15.1**	14.7	14.0	13.2	13.1
Columbus - Fairgrounds	390490024	**15.3**	14.6	14.5	13.7	12.9	14.4	14.1	13.2	12.6	14.2	13.8	12.8	12.2	12.0
Columbus - Ann Street	390490025	**15.1**	14.4	14.3	13.5	12.7	14.2	13.9	13.1	12.4	14.1	13.6	12.6	12.0	11.9
Cincinnati - Seymour	390610014	**17.3**	**16.6**	**16.5**	**15.5**	14.5	**16.5**	**16.3**	**15.1**	14.3	**16.6**	**16.2**	14.9	14.2	13.8
Cincinnati - Taft Ave	390610040	**15.5**	14.8	14.7	13.8	12.8	14.8	14.6	13.4	12.6	14.9	14.5	13.2	12.5	12.2
Cincinnati - 8th Ave	390610042	**16.9**	**12.0**	**16.1**	15.0	14.0	**16.1**	**15.9**	14.7	13.8	**16.2**	**15.7**	14.4	13.7	13.4
Sharonville	390610043	**15.6**	14.9	14.8	13.9	12.9	14.9	14.7	13.5	12.7	14.9	14.5	13.3	12.6	12.3
Norwood	390617001	**16.2**	**15.5**	**15.4**	14.4	13.4	**15.4**	**15.2**	14.0	13.2	**15.5**	**15.1**	13.8	13.1	12.8
St. Bernard	390618001	**17.6**	**16.8**	**16.7**	**15.7**	14.7	**16.7**	**16.5**	**15.3**	14.4	**16.8**	**16.4**	**15.1**	14.3	14.0
Steubenville	390810016	**15.8**	14.5	14.4	13.5	12.8	14.3	14.2	13.1	12.5	14.8	14.5	13.3	12.9	12.7
Mingo Junction	390811001	**16.5**	**15.2**	**15.2**	14.3	13.5	15.0	14.9	13.8	13.2	**15.6**	**15.2**	14.0	13.6	13.4
Ironton	390870010	**15.2**	14.8	14.6	13.6	12.8	14.6	14.4	13.2	12.5	14.8	14.1	12.8	12.4	12.3
Dayton	391130032	**15.5**	14.9	14.8	14.0	13.2	14.8	14.6	13.6	12.9	14.8	14.3	13.3	12.6	12.4
New Boston	391450013	14.7	12.0	14.0	13.0	12.1	14.1	13.8	12.5	11.9	14.2	13.6	12.2	11.7	11.6
Canton - Dueber	391510017	**16.3**	**15.7**	**15.6**	14.8	14.0	**15.5**	**15.3**	14.4	13.6	**15.4**	14.9	14.0	13.3	13.3
Canton - Market	391510020	**14.6**	11.0	14.1	13.3	12.6	13.9	13.7	12.9	12.3	13.9	13.5	12.6	12.0	11.9
Akron - Brittain	391530017	**15.1**	14.6	14.5	13.8	13.0	14.4	14.2	13.4	12.7	14.3	13.8	13.0	12.3	12.3
Akron - W. Exchange	391530023	14.3	13.7	13.7	13.0	12.3	13.6	13.3	12.6	12.0	13.4	13.0	12.2	11.6	11.5

Table 2c. $PM_{2.5}$ Modeling Results (Daily)

			2005	2009				2012				2018				
				Round 5 without CAIR			Round 5 with CAIR	Round 5 without CAIR			Round 5 with CAIR	Round 5 without CAIR				Round 5 with CAIR
Key Site	County	Site ID	Base Year	Scen. A	Scen. B	Scen.C		Scen. A	Scen. B	Scen.C		Scen. A	Scen. B	Scen.C	Scen. C - BART	
Illinois																
Chicago - Washington HS	Cook	170310022	36.6	36	36	36	36	36	36	37	36	37	36	37	37	35
Chicago - Mayfair	Cook	170310052	40.3	37	37	37	36	37	36	37	36	38	37	37	37	36
Chicago - Springfield	Cook	170310057	37.4	34	34	33	32	35	34	33	32	36	34	33	33	31
Chicago - Lawndale	Cook	170310076	38.1	35	35	35	35	36	35	36	35	36	35	36	36	34
McCook	Cook	170311016	43.0	39	39	39	39	40	39	40	39	40	40	41	40	38
Blue Island	Cook	170312001	37.7	35	35	35	34	36	35	36	34	36	35	36	36	33
Schiller Park	Cook	170313103	41.6	40	40	40	39	40	40	40	39	41	40	40	39	39
Summit	Cook	170313301	40.2	38	38	39	38	39	38	39	38	39	38	39	39	37
Maywood	Cook	170316005	39.2	38	38	38	38	38	38	39	38	39	38	39	39	37
Granite City	Madison	171191007	39.2	36	36	35	33	36	35	34	33	36	35	35	33	32
E. St. Louis	St. Clair	171630010	33.7	31	31	30	28	31	30	29	28	31	30	30	29	28
Indiana																
Jeffersonville	Clark	180190005	38.4	35	33	31	29	35	34	32	31	37	35	34	33	31
Jasper	Dubois	180372001	36.2	32	32	30	28	32	32	30	29	33	31	31	30	28
Gary - IITRI	Lake	180890022	39.0	35	35	35	34	35	34	35	34	36	36	36	35	35
Gary - Burr School	Lake	180890026	39.0	34	34	34	33	34	34	35	34	34	34	34	34	32
Gary	Lake	180890031	35.2	29	28	26	24	28	28	24	24	29	28	27	27	27
Indy-West Street	Marion	180970043	38.0	34	34	33	33	35	35	34	33	36	35	34	34	33
Indy-English Avenue	Marion	180970066	38.0	34	34	32	32	35	34	33	32	35	34	33	33	32
Indy-Washington Park	Marion	180970078	36.6	33	33	32	31	33	33	32	31	34	33	32	32	32
Indy-W 18th Street	Marion	180970081	38.3	33	33	31	31	33	33	32	31	34	33	32	32	31
Indy- Michigan Street	Marion	180970083	36.0	32	32	29	28	32	31	29	28	32	31	29	29	29
Michigan																
Luna Pier	Monroe	261150005	38.9	34	34	32	32	34	34	32	32	34	33	32	31	31
Oak Park	Oakland	261250001	39.9	38	38	37	36	38	37	37	36	38	37	37	36	35
Port Huron	St. Clair	261470005	39.6	36	35	35	34	35	35	35	34	35	35	34	33	33
Ypsilanti	Washtenaw	261610008	39.5	37	37	36	35	37	36	36	35	37	36	36	35	34
Allen Park	Wayne	261630001	38.6	36	36	36	35	36	35	35	34	36	35	35	34	33
Southwest HS	Wayne	261630015	40.1	36	36	36	35	36	35	35	35	36	35	35	34	33
Linwood	Wayne	261630016	43.0	40	40	40	39	40	40	40	39	40	39	39	39	38
E 7 Mile	Wayne	261630019	41.0	39	39	39	38	39	39	39	38	39	38	38	38	37
Dearborn	Wayne	261630033	43.9	41	41	41	40	41	41	41	40	41	40	40	40	39
Wyandotte	Wayne	261630036	37.2	36	36	36	35	35	35	35	35	35	35	35	35	34
Newberry	Wayne	261630038	42.7	39	39	39	38	39	38	38	37	39	38	38	37	36
FIA	Wayne	261630039	39.7	35	34	34	33	35	34	34	33	35	34	33	33	31
Ohio																
Middleton	Butler	390170003	39.3	33	32	29	28	33	33	29	28	34	32	29	28	27
Fairfield	Butler	390170016	37.1	32	31	29	27	31	30	28	28	32	30	29	28	27
	Butler	390170017	40.8	33	32	30	29	33	33	30	29	33	32	30	29	28
Cleveland-28th Street	Cuyahoga	390350027	36.9	34	34	33	32	34	33	33	32	34	33	33	31	31
Cleveland-St. Tikhon	Cuyahoga	390350038	44.2	40	40	37	36	40	39	36	35	40	38	36	35	34
Cleveland-Broadway	Cuyahoga	390350045	38.8	35	35	33	31	35	34	32	30	35	34	31	29	29
Cleveland-GT Craig	Cuyahoga	390350060	42.1	39	39	38	37	39	38	38	37	39	38	37	36	35
Newburg Hts - Harvard Ave	Cuyahoga	390350065	38.9	35	35	33	31	35	34	32	30	36	35	32	31	30
Columbus - Fairgrounds	Franklin	390490024	38.5	34	34	33	33	34	33	32	32	34	34	33	32	31
Columbus - Ann Street	Franklin	390490025	38.5	34	33	31	31	33	33	31	31	34	33	31	31	30
Cincinnait	Hamilton	390610006	40.6	33	33	30	27	33	32	29	28	34	32	29	28	27

Table 2c. $PM_{2.5}$ Modeling Results (Daily)

			2005	2009				2012				2018				
				Round 5 without CAIR			Round 5 with CAIR	Round 5 without CAIR			Round 5 with CAIR	Round 5 without CAIR				Round 5 with CAIR
Key Site	**County**	**Site ID**	**Base Year**	**Scen. A**	**Scen. B**	**Scen.C**		**Scen. A**	**Scen. B**	**Scen.C**		**Scen. A**	**Scen. B**	**Scen.C**	**Scen. C - BART**	
Cincinnati - Seymour	Hamilton	390610014	38.4	33	33	28	26	33	32	27	25	33	31	29	25	24
Cincinnati - Taft Ave	Hamilton	390610040	36.7	31	30	26	24	31	30	26	24	32	29	26	24	23
Cincinnati - 8th Ave	Hamilton	390610042	37.3	32	32	30	28	32	31	29	28	33	31	29	28	27
Sharonville	Hamilton	390610043	36.0	32	31	30	28	32	31	29	28	32	31	29	28	27
Norwood	Hamilton	390617001	38.8	34	33	32	30	33	33	31	30	34	33	31	30	29
St. Bernard	Hamilton	390618001	40.6	35	35	32	30	35	34	31	30	35	33	32	31	29
Steubenville	Jefferson	390810016	40.7	**36**	35	32	29	35	34	30	28	**37**	35	31	29	28
Mingo Junction	Jefferson	390811001	42.0	**37**	**37**	33	30	**37**	**36**	32	30	**38**	**36**	32	30	30
Dayton	Montgomery	391130032	37.8	34	33	31	30	33	33	31	30	34	33	31	31	30
Canton - Dueber	Stark	391510017	38.6	33	32	30	28	33	31	30	28	33	30	29	28	27
Akron - Brittain	Summit	391530017	38.1	33	33	31	30	33	32	31	30	33	32	30	29	29
Wisconsin																
Green Bay - Est High	Brown	550090005	37.1	35	34	35	35	34	35	35	34	33	33	33	32	32
Madison	Dane	550250047	36.4	33	33	32	32	33	32	32	31	32	31	30	29	29
Milwaukee-Health Center	Milwaukee	550790010	38.7	35	35	35	35	35	35	35	34	35	34	34	34	33
Milwaukee-SER Hdqs	Milwaukee	550790026	37.4	34	34	34	34	34	34	34	34	34	34	34	34	33
Milwaukee-Virginia FS	Milwaukee	550790043	39.9	**37**	**37**	**37**	**36**	**37**	**36**	**37**	**36**	**36**	**36**	**37**	**36**	**36**
Milwaukee- Fire Dept Hdqs	Milwaukee	550790099	37.8	34	34	33	33	34	33	33	32	34	33	33	33	32
Waukesha	Waukesha	551330027	35.5	32	32	32	31	32	32	32	31	32	31	31	30	29

Table 3. Modeling Results: Number of Sites > NAAQS

Ozone (85 ppb)		Round 5 without CAIR				Round 5 w/ CAIR
2009	**Baseyear**	**Scen. A**	**Scen. B**	**Scen. C**	**Scen. C-BART**	
IL	0	0	0	0	----	0
IN	0	0	0	0	----	0
MI	3	1	1	1	----	1
OH	4	0	0	0	----	0
WI	2	0	0	0	----	0
Total	**9**	**1**	**1**	**1**		**1**
2012						
IL	0	0	0	0	----	0
IN	0	0	0	0	----	0
MI	3	0	0	0	----	0
OH	4	0	0	0	----	0
WI	2	0	0	0	----	0
Total	**9**	**0**	**0**	**0**		**0**
2018						
IL	0	0	0	0	0	0
IN	0	0	0	0	0	0
MI	3	0	0	0	0	0
OH	4	0	0	0	0	0
WI	2	0	0	0	0	0
Total	**9**	**0**	**0**	**0**	**0**	**0**
Ozone (75 ppb)		**Round 5 without CAIR**				**Round5 w/ CAIR**
2009	**Baseyear**	**Scen. A**	**Scen. B**	**Scen. C**	**Scen. C-BART**	
IL	12	6	6	6	----	4
IN	26	10	9	8	----	5
MI	21	12	12	12	----	12
OH	45	27	25	24	----	21
WI	12	10	10	10	----	10
Total	**116**	**65**	**62**	**60**	**----**	**52**
2012						
IL	12	3	3	3	----	1
IN	26	5	4	4	----	3
MI	21	9	8	8	----	6
OH	45	18	14	12	----	11
WI	12	10	9	9	----	9
Total	**116**	**45**	**38**	**36**		**30**
2018						
IL	12	0	0	0	0	0
IN	26	0	0	0	0	0
MI	21	3	3	3	3	3
OH	45	3	3	2	1	1
WI	12	3	2	1	1	1
Total	**116**	**9**	**8**	**6**	**5**	**5**

PM2.5 - Annual		Round 5 without CAIR				Round 5 w/ CAIR
2009	**Baseyear**	**Scen. A**	**Scen. B**	**Scen. C**	**Scen. C-BART**	
IL	7	4	4	1	----	1
IN	6	2	2	0	----	0
MI	2	2	2	1	----	1
OH	26	13	12	5	----	1
WI	0	0	0	0	----	0
Total	**41**	**21**	**20**	**7**		**3**
2012						
IL	7	3	1	1	----	0
IN	6	1	1	0	----	0
MI	2	2	1	1	----	1
OH	26	12	9	4	----	0
WI	0	0	0	0	----	0
Total	**41**	**18**	**12**	**6**		**1**
2018						
IL	7	3	1	0	0	0
IN	6	1	1	0	0	0
MI	2	2	1	1	1	1
OH	26	13	8	2	0	0
WI	0	0	0	0	0	0
Total	**41**	**19**	**11**	**3**	**1**	**1**
PM2.5 - Daily						
		Round 5 without CAIR				**Round 5 w/ CAIR**
2009	**Baseyear**	**Scen. A**	**Scen. B**	**Scen. C**	**Scen. C-BART**	
IL	16	7	7	6	----	6
IN	13	0	0	0	----	0
MI	14	10	9	9	----	5
OH	31	4	3	2	----	2
WI	8	1	1	1	----	1
Total	**82**	**22**	**20**	**18**	**----**	**14**
2012						
IL	16	9	6	8	----	6
IN	13	0	0	0	----	0
MI	14	8	6	6	----	5
OH	31	3	3	2	----	1
WI	8	1	1	1	----	1
Total	**82**	**21**	**16**	**17**		**13**
2018						
IL	16	10	6	8	8	5
IN	13	4	1	1	0	0
MI	14	8	6	6	5	4
OH	31	5	3	2	1	0
WI	8	1	1	1	1	1
Total	**82**	**28**	**17**	**18**	**15**	**10**

Table 4. Modeling Results: Future Year Visibility Levels

Worst 20%				2018				
				Round 5 without CAIR				Round 5 w/ CAIR
Site	Baseline (2000-2004)	2018 URP		Scen. A	Scen. B	Scen. C	Scen. C-BART	
BOWA1	19.86	17.94		19.09	18.87	18.54	18.02	17.94
VOYA2	19.48	17.75		18.60	18.44	18.17	17.77	17.63
SENE1	24.38	21.64		24.02	23.58	23.03	22.38	22.59
ISLE1	21.59	19.43		21.05	20.86	20.62	20.22	20.09
ISLE9	21.59	19.43		20.83	20.58	20.38	19.84	19.84
HEGL1	26.75	23.13		26.24	25.83	24.87	24.23	24.22
MING1	28.15	24.27		27.51	26.98	25.81	24.93	24.74
CACR1	26.36	22.91		25.32	24.80	23.57	22.97	22.44
UPBU1	26.27	22.82		25.31	24.79	23.50	22.79	22.59
MACA1	31.37	26.64		30.11	29.08	27.06	26.24	26.10
DOSO1	29.05	24.69		27.88	26.96	24.36	23.74	23.00
SHEN1	29.31	25.12		28.38	27.65	25.24	24.69	23.92
JARI1	29.12	24.91		28.06	27.21	25.00	24.48	24.06
BRIG1	29.01	25.05		28.10	28.07	26.57	26.25	25.21
LYBR1	24.45	21.48		24.06	23.86	22.58	22.30	21.14
ACAD1	22.89	20.45		22.88	22.76	22.31	22.16	21.49
Best 20%				2018				
				Round 5 without CAIR				Round 5 w/ CAIR
Site	Baseline (2000-2004)	2018 Max		Scen. A	Scen. B	Scen. C	Scen. C-BART	
BOWA1	6.42	6.42		6.20	6.17	6.16	6.12	6.14
VOYA2	7.09	7.09		6.87	6.83	6.81	6.78	6.75
SENE1	7.14	7.14		7.80	7.78	7.81	7.77	7.71
ISLE1	6.75	6.75		6.77	6.76	6.72	6.67	6.60
ISLE9	6.75	6.75		6.63	6.61	6.58	6.53	6.52
HEGL1	12.84	12.84		12.17	12.20	12.07	11.63	11.66
MING1	14.46	14.46		13.78	13.77	13.70	13.37	13.28
CACR1	11.24	11.24		10.94	10.99	10.97	10.78	10.52
UPBU1	11.71	11.71		11.18	11.23	11.18	10.96	10.73
MACA1	16.51	16.51		16.32	16.21	15.76	15.34	15.25
DOSO1	12.28	12.28		12.02	11.84	11.27	11.03	11.00
SHEN1	10.93	10.93		10.98	10.91	10.25	10.16	9.91
JARI1	14.21	14.21		14.19	13.98	13.42	13.21	13.14
BRIG1	14.33	14.33		14.32	14.46	14.22	14.17	13.92
LYBR1	6.37	6.37		6.39	6.38	6.31	6.28	6.14
ACAD1	8.78	8.78		8.97	8.96	8.90	8.89	8.82

Figure 2. Ozone Modeling Results

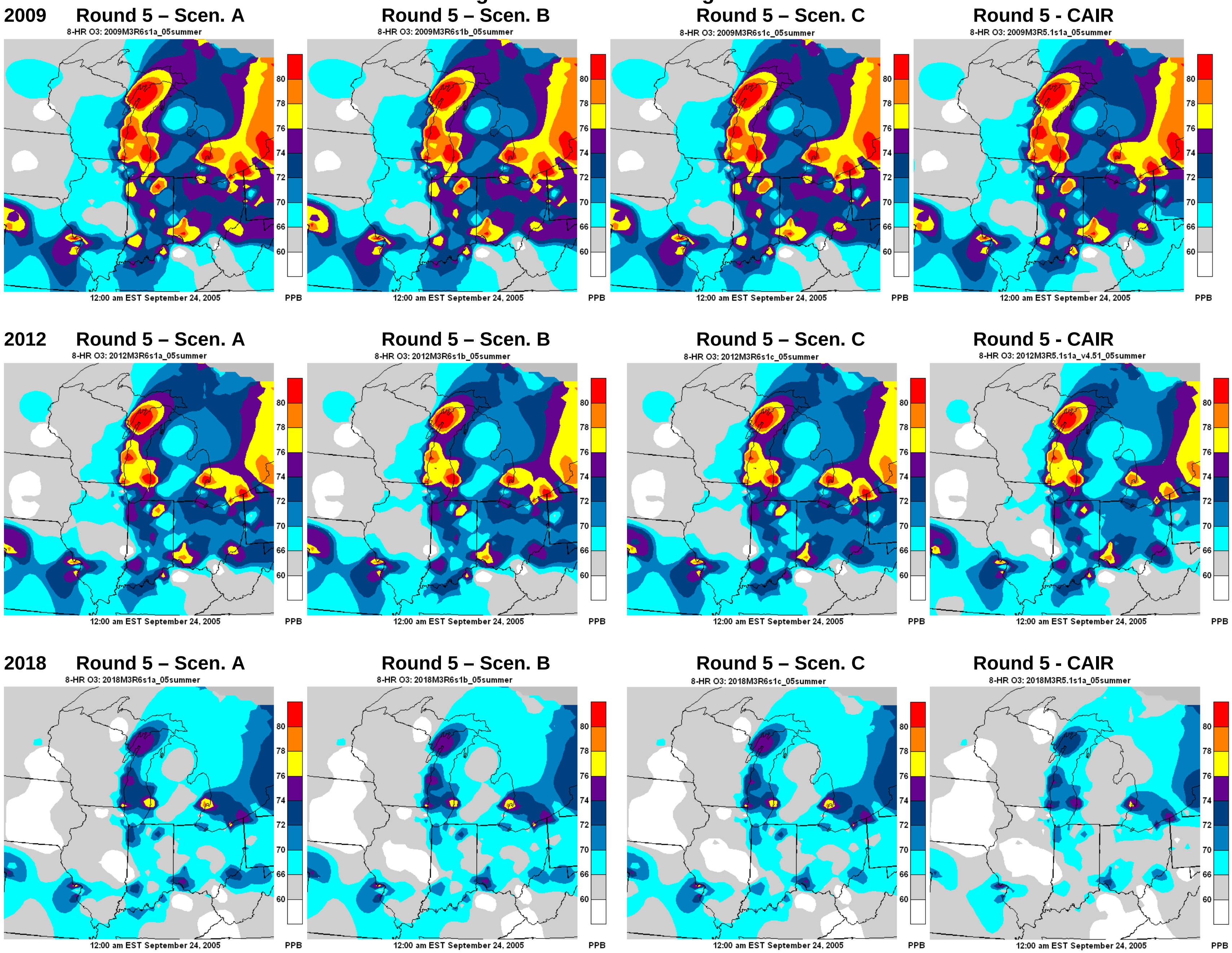


Figure 3. PM2.5 Annual Modeling Results

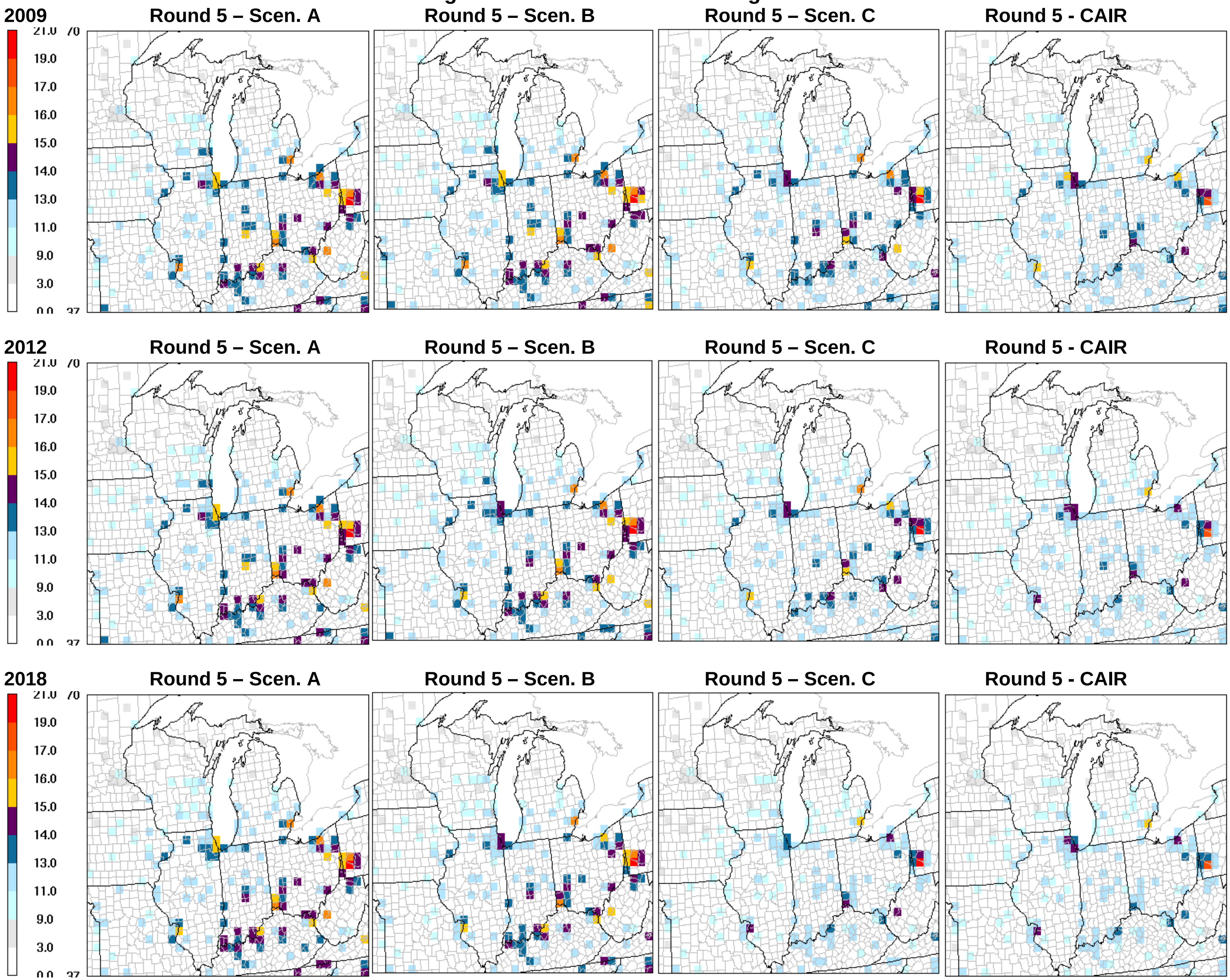
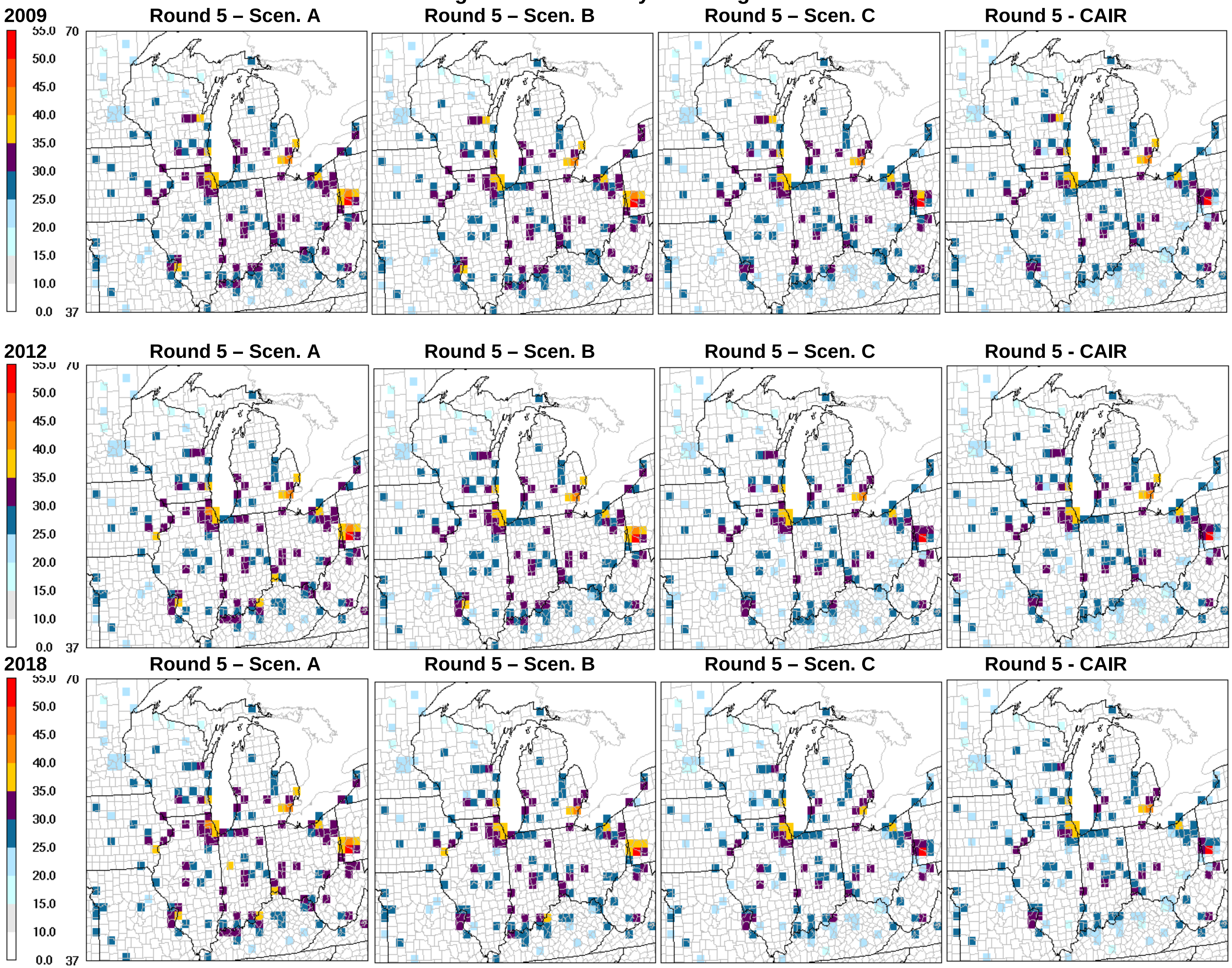


Figure 4. PM2.5 Daily Modeling Results



Appendix I

Scenario B (Legally Enforceable) Controls

NOx – 2009

Point Source Grown and Controlled Emissions by facility for NOX r6s1b_2009 Base Year = 2002
Future Year = 2009

STID=17 CYID=57 fcid=057801AAA name=AES DUCK CREEK

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
17	57	057801AAA	0001	0001	01	10100202	NOX	0.8147	0.8416	0.8416	0.00	0.00	SCR	SCR added by LADCO

STID=17 CYID=143 fcid=143805AAG name=AES ED EDWARDS STATION

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
17	143	143805AAG	0001	0001	01	10100202	NOX	3.0515	3.1522	3.1522	0.00	0.00	lnb	LNB added by LADCO
17	143	143805AAG	0001	0003	01	10100202	NOX	6.9419	7.1708	7.1708	0.00	0.00	lnb	LNB added by LADCO
17	143	143805AAG	0002	0004	01	10100202	NOX	2.1310	2.2013	2.2013	0.00	0.00	lnb	LNB added by LADCO
----								--------	--------	----------				
fcid								12.1244	12.5243	12.5243				
cyid								12.1244	12.5243	12.5243				
stid								12.9392	13.3659	13.3659				

STID=39 CYID=1 fcid=0701000007 name="DP&L, J.M. STUART GENERATING STATION"

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
39	1	0701000007	R1	B001	B001P1	10100202	NOX	6.9860	6.9756	2.3252	0.85	0.95	SCR	SCR added by LADCO
39	1	0701000007	R2	B002	B002P1	10100202	NOX	3.6327	3.6273	1.2091	0.85	0.95	SCR	SCR added by LADCO
39	1	0701000007	R3	B003	B003P1	10100202	NOX	5.0133	5.0058	1.6686	0.85	0.95	SCR	SCR added by LADCO
39	1	0701000007	R4	B004	B004P1	10100202	NOX	7.8493	7.8376	2.6125	0.85	0.95	SCR	SCR added by LADCO
----								--------	--------	----------				
fcid								23.4814	23.4464	7.8155				
cyid								23.4814	23.4464	7.8155				

STID=39 CYID=167 fcid=0684000000 name=MUSKINGUM RIVER POWER PLANT

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
39	167	0684000000	R1	B001	B001P1	10200501	NOX	0.0017	0.0017	0.0001	0.00	0.95	SCR	SCR added by LADCO
39	167	0684000000	R2	B002	B002P1	10100201	NOX	5.8167	5.8080	0.2904	0.00	0.95	SCR	SCR added by LADCO
39	167	0684000000	R2	B002	B002P2	10100501	NOX	0.0000	0.0000	0.0000	0.00	0.95	SCR	SCR added by LADCO
39	167	0684000000	R3	B003	B003P1	10100201	NOX	7.9017	7.8899	0.3945	0.00	0.95	SCR	SCR added by LADCO
39	167	0684000000	R3	B003	B003P2	10100501	NOX	0.0000	0.0000	0.0000	0.00	0.95	SCR	SCR added by LADCO
39	167	0684000000	R4	B004	B004P1	10100203	NOX	7.8775	7.8657	0.3933	0.00	0.95	SCR	SCR added by LADCO
39	167	0684000000	R4	B004	B004P2	10100501	NOX	0.0000	0.0000	0.0000	0.00	0.95	SCR	SCR added by LADCO
39	167	0684000000	R6	B006	B006P1	10100202	NOX	3.8586	3.8528	0.1926	0.00	0.95	SCR	SCR added by LADCO
39	167	0684000000	R6	B006	B006P2	10100501	NOX	0.0000	0.0000	0.0000	0.00	0.95	SCR	SCR added by LADCO
----								--------	--------	----------				
fcid								25.4561	25.4182	1.2709				
cyid								25.4561	25.4182	1.2709				
stid								48.9375	48.8646	9.0864				

STID=55 CYID=79 fcid=241007800 name=WIS ELECTRIC POWER VALLEY STATION

Base Yr Grown Controlled Base Year Future Year

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Tons/Day	Tons/Day	Tons/Day	Control EF	Control EF	ctrltype	ctrldes
55	79	241007800	S11	B21	01	10100202	NOX	2.7972	2.8895	1.6470	0.00	0.43	SCR	SCR added by LADCO
55	79	241007800	S11	B22	01	10100202	NOX	2.9073	3.0032	1.7118	0.00	0.43	SCR	SCR added by LADCO
55	79	241007800	S12	B23	01	10100202	NOX	2.3270	2.4038	1.2740	0.00	0.47	SCR	SCR added by LADCO
55	79	241007800	S12	B24	01	10100202	NOX	2.3427	2.4199	1.2826	0.00	0.47	SCR	Scrubber added by LADCO
----								--------	--------	----------				
fcid								10.3742	10.7164	5.9154				
cyid								10.3742	10.7164	5.9154				

STID=55 CYID=117 fcid=460033090 name=WP & L Alliant Energy - Edgewater Gen Station

								Base Yr	Grown	Controlled	Base Year	Future Year		
STID	CYID	fcid	stkid	dvid	prid	scc	polid	Tons/Day	Tons/Day	Tons/Day	Control EF	Control EF	ctrltype	ctrldes
55	117	460033090	S11	B23	01	10100203	NOX	1.6197	1.6731	1.0038	0.00	0.40	SCR	SCR added by LADCO
55	117	460033090	S11	B24	01	10100203	NOX	4.1072	4.2426	3.4789	0.00	0.18	SCR	SCR added by LADCO
55	117	460033090	S12	B25	01	10100221	NOX	5.6804	5.8677	4.9876	0.00	0.15	SCR	SCR added by LADCO
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fcid								11.4072	11.7834	9.4703				
cyid								11.4072	11.7834	9.4703				
stid								21.7814	22.4997	15.3857				
								========	========	==========				
								83.6581	84.7302	37.8380				

NOx - 2012

Point Source Grown and Controlled Emissions by facility for NOX r6s1b_2012 Base Year = 2002
Future Year = 2012

STID=17 CYID=33 fcid=033801AAA name=AMEREN ENERGY GENERATING CO

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
17	33	033801AAA	0005	0005	01	10100202	NOX	1.642	1.871	0.9357	0.00	0.500	SCR	SCR added by LADCO
17	33	033801AAA	0006	0006	01	10100202	NOX	2.116	2.413	1.2063	0.00	0.500	SCR	SCR added by LADCO
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fcid								3.758	4.284	2.1420				
cyid								3.758	4.284	2.1420				

STID=17 CYID=57 fcid=057801AAA name=AES DUCK CREEK

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
17	57	057801AAA	0001	0001	01	10100202	NOX	0.815	0.929	0.9288	0.00	0.000	SCR	SCR added by LADCO

STID=17 CYID=79 fcid=079808AAA name=AMEREN ENERGY GENERATING CO

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
17	79	079808AAA	0003	0003	01	10100202	NOX	6.735	7.678	7.6780	0.00	0.000	SCR	SCR added by LADCO
17	79	079808AAA	0012	0013	01	10100501	NOX	5.936	5.378	5.3781	0.00	0.000	SCR	SCR added by LADCO
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fcid								12.671	13.056	13.0561				
cyid								12.671	13.056	13.0561				

STID=17 CYID=97 fcid=097190AAC name=MIDWEST GENERATION LLC

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
17	97	097190AAC	0016	0031	02	10100401	NOX	0.000	0.000	0.0000	0.00	0.999	SHUTDOWN	SCR added by LADCO

STID=17 CYID=137 fcid=137805AAA name=AMEREN ENERGY GENERATING CO

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
17	137	137805AAA	0003	0003	01	10100202	NOX	5.356	6.106	6.1058	0.00	0.000	LNB	LNB added by LADCO

STID=17 CYID=143 fcid=143805AAG name=AES ED EDWARDS STATION

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
17	143	143805AAG	0001	0001	01	10100202	NOX	3.052	3.479	3.4789	0.00	0.000	lnb	LNB added by LADCO
17	143	143805AAG	0001	0003	01	10100202	NOX	6.942	7.914	7.9141	0.00	0.000	lnb	LNB added by LADCO
17	143	143805AAG	0002	0004	01	10100202	NOX	2.131	2.429	2.4294	0.00	0.000	lnb	LNB added by LADCO
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fcid								12.124	13.822	13.8224				
cyid								12.124	13.822	13.8224				

STID=17 CYID=167 fcid=167120AAO name=CITY WATER LIGHT & POWER

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
17	167	167120AAO	0010	0012	01	10100203	NOX	6.527	7.441	0.0074	0.00	0.999	SHUTDOWN	SHUTDOWN added by LADCO
17	167	167120AAO	0010	0013	01	10100203	NOX	2.646	3.017	0.0030	0.00	0.999	SHUTDOWN	SHUTDOWN added by LADCO
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fcid								9.173	10.458	0.0105				
cyid								9.173	10.458	0.0105				

STID=17 CYID=179 fcid=179801AAA name=MIDWEST GENERATION LLC

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
17	179	179801AAA	0018	0029	01	10100203	NOX	22.429	25.570	1.2785	0.00	0.950	SCR	SCR added by LADCO
17	179	179801AAA	0018	0031	01	10100203	NOX	38.993	44.454	2.2227	0.00	0.950	SCR	SCR added by LADCO
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fcid								61.422	70.024	3.5012				
cyid								61.422	70.024	3.5012				

STID=17 CYID=197 fcid=197809AAO name=MIDWEST GENERATION LLC

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
17	197	197809AAO	0032	0033	02	10100604	NOX	0.000	0.000	0.0000	0.00	0.800	SCR	SCR added by LADCO

STID=17 CYID=197 fcid=197810AAK name=MIDWEST GENERATION LLC

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
17	197	197810AAK	0011	0016	02	10100222	NOX	5.731	6.534	3.9203	0.00	0.400	SCR	SCR added by LADCO
17	197	197810AAK	0011	0016	03	10100501	NOX	0.000	0.000	0.0000	0.00	0.400	SCR	SCR added by LADCO
17	197	197810AAK	0013	0010	02	10100223	NOX	8.598	9.802	0.0098	0.00	0.999	SHUTDOWN	SCR added by LADCO
17	197	197810AAK	0013	0010	03	10100501	NOX	0.000	0.000	0.0000	0.00	0.999	SHUTDOWN	SCR added by LADCO
17	197	197810AAK	0007	0012	02	10100223	NOX	10.974	12.511	0.0125	0.00	0.999	SHUTDOWN	SCR added by LADCO
17	197	197810AAK	0007	0012	03	10100501	NOX	0.000	0.000	0.0000	0.00	0.999	SHUTDOWN	SCR added by LADCO
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fcid								25.303	28.847	3.9426				
cyid								25.303	28.847	3.9426				
stid								130.622	147.527	43.5096				

STID=27 CYID=61 fcid=2706100004 name=Minnesota Power Inc - Boswell Energy Ctr

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
27	61	2706100004	SV003	EU003	001	10100226	NOX	13.661	14.142	2.8284	0.00	0.800	SCR	SCR added by LADCO
27	61	2706100004	SV003	EU003	002	10100501	NOX	0.000	0.000	0.0000	0.00	0.800	SCR	SCR added by LADCO
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fcid								13.661	14.142	2.8284				
cyid								13.661	14.142	2.8284				

STID=27 CYID=109 fcid=2710900011 name=Rochester Public Utilities - Silver Lake

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes

27	109	2710900011	SV003	EU004	001	10100202	NOX	2.079	2.152	1.2911	0.00	0.400	SNCR	SCR added by LADCO
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stid								15.739	16.294	4.1195				

STID=39 CYID=1 fcid=0701000007 name="DP&L, J.M. STUART GENERATING STATION"

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
39	1	0701000007	R1	B001	B001P1	10100202	NOX	6.986	7.296	2.4319	0.85	0.950	SCR	SCR added by LADCO
39	1	0701000007	R2	B002	B002P1	10100202	NOX	3.633	3.794	1.2646	0.85	0.950	SCR	SCR added by LADCO
39	1	0701000007	R3	B003	B003P1	10100202	NOX	5.013	5.235	1.7452	0.85	0.950	SCR	SCR added by LADCO
39	1	0701000007	R4	B004	B004P1	10100202	NOX	7.849	8.197	2.7324	0.85	0.950	SCR	SCR added by LADCO
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fcid								23.481	24.522	8.1740				
cyid								23.481	24.522	8.1740				

STID=39 CYID=31 fcid=0616000000 name=CONESVILLE POWER PLANT

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
39	31	0616000000	R4	B004	B004P1	10100212	NOX	20.852	21.776	1.0888	0.00	0.950	SCR	SCR added by LADCO

STID=39 CYID=167 fcid=0684000000 name=MUSKINGUM RIVER POWER PLANT

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
39	167	0684000000	R1	B001	B001P1	10200501	NOX	0.002	0.002	0.0001	0.00	0.950	SCR	SCR added by LADCO
39	167	0684000000	R2	B002	B002P1	10100201	NOX	5.817	6.074	0.3037	0.00	0.950	SCR	SCR added by LADCO
39	167	0684000000	R2	B002	B002P2	10100501	NOX	0.000	0.000	0.0000	0.00	0.950	SCR	SCR added by LADCO
39	167	0684000000	R3	B003	B003P1	10100201	NOX	7.902	8.252	0.4126	0.00	0.950	SCR	SCR added by LADCO
39	167	0684000000	R3	B003	B003P2	10100501	NOX	0.000	0.000	0.0000	0.00	0.950	SCR	SCR added by LADCO
39	167	0684000000	R4	B004	B004P1	10100203	NOX	7.877	8.227	0.4113	0.00	0.950	SCR	SCR added by LADCO
39	167	0684000000	R4	B004	B004P2	10100501	NOX	0.000	0.000	0.0000	0.00	0.950	SCR	SCR added by LADCO
39	167	0684000000	R6	B006	B006P1	10100202	NOX	3.859	4.030	0.2015	0.00	0.950	SCR	SCR added by LADCO
39	167	0684000000	R6	B006	B006P2	10100501	NOX	0.000	0.000	0.0000	0.00	0.950	SCR	SCR added by LADCO
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fcid								25.456	26.584	1.3292				
cyid								25.456	26.584	1.3292				
stid								69.789	72.882	10.5920				

STID=55 CYID=79 fcid=241007690 name=WIS ELECTRIC POWER OAK CREEK STATION

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
55	79	241007690	S13	B25	01	10100202	NOX	4.755	5.421	3.0898	0.00	0.430	SCR	SCR added by LADCO
55	79	241007690	S13	B26	01	10100202	NOX	3.277	3.736	2.2045	0.00	0.410	SCR	SCR added by LADCO
55	79	241007690	S14	B27	01	10100212	NOX	3.333	3.800	2.8499	0.00	0.250	SCR	SCR added by LADCO
55	79	241007690	S14	B28	01	10100212	NOX	3.384	3.857	2.9316	0.00	0.240	SCR	SCR added by LADCO
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fcid								14.749	16.814	11.0757				

STID=55 CYID=79 fcid=241007800 name=WIS ELECTRIC POWER VALLEY STATION

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
55	79	241007800	S11	B21	01	10100202	NOX	2.797	3.189	1.8177	0.00	0.430	SCR	SCR added by LADCO
55	79	241007800	S11	B22	01	10100202	NOX	2.907	3.314	1.8893	0.00	0.430	SCR	SCR added by LADCO
55	79	241007800	S12	B23	01	10100202	NOX	2.327	2.653	1.4061	0.00	0.470	SCR	SCR added by LADCO
55	79	241007800	S12	B24	01	10100202	NOX	2.343	2.671	1.4155	0.00	0.470	SCR	Scrubber added by LADCO
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fcid								10.374	11.827	6.5285				
cyid								25.123	28.641	17.6042				

STID=55 CYID=117 fcid=460033090 name=WP & L Alliant Energy - Edgewater Gen Station

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
55	117	460033090	S11	B23	01	10100203	NOX	1.620	1.846	1.1079	0.00	0.400	SCR	SCR added by LADCO
55	117	460033090	S11	B24	01	10100203	NOX	4.107	4.682	3.8395	0.00	0.180	SCR	SCR added by LADCO
55	117	460033090	S12	B25	01	10100221	NOX	5.680	6.476	5.5045	0.00	0.150	SCR	SCR added by LADCO
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fcid								11.407	13.005	10.4519				
cyid								11.407	13.005	10.4519				
stid								36.530	41.646	28.0562				
								========	========	==========				
								252.681	278.349	86.2773				

NOx 2018

Point Source Grown and Controlled Emissions by facility for NOX r6s1b_2018 Base Year = 2002

Future Year = 2018

STID=17 CYID=31 fcid=031600AIN name=MIDWEST GENERATION LLC

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
17	31	031600AIN	0010	0013	01	10100226	NOX	2.283	2.592	1.5550	0.00	0.400	SCR	SCR added by LADCO
17	31	031600AIN	0010	0013	02	10100601	NOX	0.000	0.000	0.0000	0.00	0.400	SCR	SCR added by LADCO
17	31	031600AIN	0012	0016	01	10100226	NOX	3.991	4.531	2.7184	0.00	0.400	SCR	SCR added by LADCO
17	31	031600AIN	0012	0016	02	10100601	NOX	0.000	0.000	0.0000	0.00	0.400	SCR	SCR added by LADCO
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fcid								6.274	7.122	4.2734				
cyid								6.274	7.122	4.2734				

STID=17 CYID=33 fcid=033801AAA name=AMEREN ENERGY GENERATING CO

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
17	33	033801AAA	0005	0005	01	10100202	NOX	1.642	1.863	0.9317	0.00	0.500	SCR	SCR added by LADCO
17	33	033801AAA	0006	0006	01	10100202	NOX	2.116	2.402	1.2012	0.00	0.500	SCR	SCR added by LADCO
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fcid								3.758	4.266	2.1329				
cyid								3.758	4.266	2.1329				

STID=17 CYID=57 fcid=057801AAA name=AES DUCK CREEK

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
17	57	057801AAA	0001	0001	01	10100202	NOX	0.815	0.925	0.9249	0.00	0.000	SCR	SCR added by LADCO

STID=17 CYID=79 fcid=079808AAA name=AMEREN ENERGY GENERATING CO

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
17	79	079808AAA	0003	0003	01	10100202	NOX	6.735	7.645	7.6453	0.00	0.000	SCR	SCR added by LADCO
17	79	079808AAA	0012	0013	01	10100501	NOX	5.936	3.984	3.9838	0.00	0.000	SCR	SCR added by LADCO
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fcid								12.671	11.629	11.6291				
cyid								12.671	11.629	11.6291				

STID=17 CYID=97 fcid=097190AAC name=MIDWEST GENERATION LLC

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
17	97	097190AAC	0016	0031	02	10100401	NOX	0.000	0.000	0.0000	0.00	0.999	SHUTDOWN	SCR added by LADCO

STID=17 CYID=137 fcid=137805AAA name=AMEREN ENERGY GENERATING CO

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
17	137	137805AAA	0003	0003	01	10100202	NOX	5.356	6.080	6.0798	0.00	0.000	LNB	LNB added by LADCO

STID=17 CYID=143 fcid=143805AAG name=AES ED EDWARDS STATION

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
17	143	143805AAG	0001	0001	01	10100202	NOX	3.052	3.464	3.4641	0.00	0.000	lnb	LNB added by LADCO
17	143	143805AAG	0001	0003	01	10100202	NOX	6.942	7.880	7.8804	0.00	0.000	lnb	LNB added by LADCO
17	143	143805AAG	0002	0004	01	10100202	NOX	2.131	2.419	2.4191	0.00	0.000	lnb	LNB added by LADCO
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fcid								12.124	13.764	13.7636				
cyid								12.124	13.764	13.7636				

STID=17 CYID=167 fcid=167120AAO name=CITY WATER LIGHT & POWER

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
17	167	167120AAO	0010	0012	01	10100203	NOX	6.527	7.410	0.0074	0.00	0.999	SHUTDOWN	SHUTDOWN added by LADCO
17	167	167120AAO	0010	0013	01	10100203	NOX	2.646	3.004	0.0030	0.00	0.999	SHUTDOWN	SHUTDOWN added by LADCO
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fcid								9.173	10.414	0.0104				
cyid								9.173	10.414	0.0104				

STID=17 CYID=179 fcid=179801AAA name=MIDWEST GENERATION LLC

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
17	179	179801AAA	0018	0029	01	10100203	NOX	22.429	25.462	1.2731	0.00	0.950	SCR	SCR added by LADCO
17	179	179801AAA	0018	0031	01	10100203	NOX	38.993	44.265	2.2132	0.00	0.950	SCR	SCR added by LADCO
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fcid								61.422	69.726	3.4863				
cyid								61.422	69.726	3.4863				

STID=17 CYID=197 fcid=197809AAO name=MIDWEST GENERATION LLC

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
17	197	197809AAO	0032	0033	02	10100604	NOX	0.000	0.000	0.0000	0.00	0.800	SCR	SCR added by LADCO

STID=17 CYID=197 fcid=197810AAK name=MIDWEST GENERATION LLC

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
17	197	197810AAK	0011	0016	02	10100222	NOX	5.731	6.506	3.9036	0.00	0.400	SCR	SCR added by LADCO
17	197	197810AAK	0011	0016	03	10100501	NOX	0.000	0.000	0.0000	0.00	0.400	SCR	SCR added by LADCO
17	197	197810AAK	0013	0010	02	10100223	NOX	8.598	9.760	0.0098	0.00	0.999	SHUTDOWN	SCR added by LADCO
17	197	197810AAK	0013	0010	03	10100501	NOX	0.000	0.000	0.0000	0.00	0.999	SHUTDOWN	SCR added by LADCO
17	197	197810AAK	0007	0012	02	10100223	NOX	10.974	12.458	0.0125	0.00	0.999	SHUTDOWN	SCR added by LADCO
17	197	197810AAK	0007	0012	03	10100501	NOX	0.000	0.000	0.0000	0.00	0.999	SHUTDOWN	SCR added by LADCO
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fcid								25.303	28.724	3.9258				
cyid								25.303	28.724	3.9258				
stid								136.896	152.649	46.2263				

STID=18 CYID=147 fcid=00020 name=INDIANA MICHIGAN POWER-ROCKPORT

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
18	147	00020	1	001	01	10100222	NOX	23.226	25.291	1.2646	0.00	0.950	SCR	SCR added by LADCO
18	147	00020	1	001	02	10100501	NOX	0.000	0.000	0.0000	0.00	0.950	SCR	SCR added by LADCO
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fcid								23.226	25.291	1.2646				
cyid								23.226	25.291	1.2646				
stid								23.226	25.291	1.2646				

STID=27 CYID=61 fcid=2706100004 name=Minnesota Power Inc - Boswell Energy Ctr

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
27	61	2706100004	SV003	EU003	001	10100226	NOX	13.661	15.733	3.1466	0.00	0.800	SCR	SCR added by LADCO
27	61	2706100004	SV003	EU003	002	10100501	NOX	0.000	0.000	0.0000	0.00	0.800	SCR	SCR added by LADCO
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fcid								13.661	15.733	3.1466				
cyid								13.661	15.733	3.1466				

STID=27 CYID=109 fcid=2710900011 name=Rochester Public Utilities - Silver Lake

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
27	109	2710900011	SV003	EU004	001	10100202	NOX	2.079	2.394	1.4363	0.00	0.400	SNCR	SCR added by LADCO
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stid								15.739	18.127	4.5830				

STID=39 CYID=1 fcid=0701000007 name="DP&L, J.M. STUART GENERATING STATION"

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
39	1	0701000007	R1	B001	B001P1	10100202	NOX	6.986	7.607	2.5358	0.85	0.950	SCR	SCR added by LADCO
39	1	0701000007	R2	B002	B002P1	10100202	NOX	3.633	3.956	1.3186	0.85	0.950	SCR	SCR added by LADCO
39	1	0701000007	R3	B003	B003P1	10100202	NOX	5.013	5.459	1.8197	0.85	0.950	SCR	SCR added by LADCO
39	1	0701000007	R4	B004	B004P1	10100202	NOX	7.849	8.547	2.8491	0.85	0.950	SCR	SCR added by LADCO
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fcid								23.481	25.570	8.5232				
cyid								23.481	25.570	8.5232				

STID=39 CYID=31 fcid=0616000000 name=CONESVILLE POWER PLANT

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
39	31	0616000000	R4	B004	B004P1	10100212	NOX	20.852	22.706	1.1353	0.00	0.950	SCR	SCR added by LADCO

STID=39 CYID=167 fcid=0684000000 name=MUSKINGUM RIVER POWER PLANT

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
39	167	0684000000	R1	B001	B001P1	10200501	NOX	0.002	0.002	0.0001	0.00	0.950	SCR	SCR added by LADCO

39	167	0684000000	R2	B002	B002P1	10100201	NOX	5.817	6.334	0.3167	0.00	0.950	SCR	SCR added by LADCO
39	167	0684000000	R2	B002	B002P2	10100501	NOX	0.000	0.000	0.0000	0.00	0.950	SCR	SCR added by LADCO
39	167	0684000000	R3	B003	B003P1	10100201	NOX	7.902	8.604	0.4302	0.00	0.950	SCR	SCR added by LADCO
39	167	0684000000	R3	B003	B003P2	10100501	NOX	0.000	0.000	0.0000	0.00	0.950	SCR	SCR added by LADCO
39	167	0684000000	R4	B004	B004P1	10100203	NOX	7.877	8.578	0.4289	0.00	0.950	SCR	SCR added by LADCO
39	167	0684000000	R4	B004	B004P2	10100501	NOX	0.000	0.000	0.0000	0.00	0.950	SCR	SCR added by LADCO
39	167	0684000000	R6	B006	B006P1	10100202	NOX	3.859	4.202	0.2101	0.00	0.950	SCR	SCR added by LADCO
39	167	0684000000	R6	B006	B006P2	10100501	NOX	0.000	0.000	0.0000	0.00	0.950	SCR	SCR added by LADCO
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fcid								25.456	27.720	1.3860				
cyid								25.456	27.720	1.3860				
stid								69.789	75.996	11.0445				

STID=54 CYID=39 fcid=0006 name=APPALACHIAN POWER - KANAWHA RIVER PLANT

								Base Yr	Grown	Controlled	Base Year	Future Year		
STID	CYID	fcid	stkid	dvid	prid	scc	polid	Tons/Day	Tons/Day	Tons/Day	Control EF	Control EF	ctrltype	ctrldes
54	39	0006	012	001	99	10100202	NOX	4.829	5.258	2.6291	0.00	0.500	SCR	Scrubber added by LADCO
54	39	0006	012	002	99	10100202	NOX	4.921	5.359	2.6794	0.00	0.500	SCR	Scrubber added by LADCO
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fcid								9.750	10.617	5.3085				
cyid								9.750	10.617	5.3085				
stid								9.750	10.617	5.3085				

STID=55 CYID=79 fcid=241007690 name=WIS ELECTRIC POWER OAK CREEK STATION

								Base Yr	Grown	Controlled	Base Year	Future Year		
STID	CYID	fcid	stkid	dvid	prid	scc	polid	Tons/Day	Tons/Day	Tons/Day	Control EF	Control EF	ctrltype	ctrldes
55	79	241007690	S13	B25	01	10100202	NOX	4.755	5.398	3.0766	0.00	0.430	SCR	SCR added by LADCO
55	79	241007690	S13	B26	01	10100202	NOX	3.277	3.720	2.1951	0.00	0.410	SCR	SCR added by LADCO
55	79	241007690	S14	B27	01	10100212	NOX	3.333	3.784	2.8378	0.00	0.250	SCR	SCR added by LADCO
55	79	241007690	S14	B28	01	10100212	NOX	3.384	3.841	2.9191	0.00	0.240	SCR	SCR added by LADCO
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fcid								14.749	16.743	11.0285				

STID=55 CYID=79 fcid=241007800 name=WIS ELECTRIC POWER VALLEY STATION

								Base Yr	Grown	Controlled	Base Year	Future Year		
STID	CYID	fcid	stkid	dvid	prid	scc	polid	Tons/Day	Tons/Day	Tons/Day	Control EF	Control EF	ctrltype	ctrldes
55	79	241007800	S11	B21	01	10100202	NOX	2.797	3.175	1.4289	0.00	0.550	SCR	SCR added by LADCO
55	79	241007800	S11	B22	01	10100202	NOX	2.907	3.300	1.4852	0.00	0.550	SCR	SCR added by LADCO
55	79	241007800	S12	B23	01	10100202	NOX	2.327	2.642	1.1887	0.00	0.550	SCR	SCR added by LADCO
55	79	241007800	S12	B24	01	10100202	NOX	2.343	2.659	1.1967	0.00	0.550	SCR	SCR added by LADCO
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fcid								10.374	11.777	5.2995				
cyid								25.123	28.519	16.3281				

STID=55 CYID=117 fcid=460033090 name=WP & L Alliant Energy - Edgewater Gen Station

								Base Yr	Grown	Controlled	Base Year	Future Year		
STID	CYID	fcid	stkid	dvid	prid	scc	polid	Tons/Day	Tons/Day	Tons/Day	Control EF	Control EF	ctrltype	ctrldes
55	117	460033090	S11	B23	01	10100203	NOX	1.620	1.839	1.1032	0.00	0.400	SCR	SCR added by LADCO

55	117	460033090	S11	B24	01	10100203	NOX	4.107	4.662	3.8232	0.00	0.180	SCR	SCR added by LADCO
55	117	460033090	S12	B25	01	10100221	NOX	5.680	6.448	5.4811	0.00	0.150	SCR	SCR added by LADCO
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fcid								11.407	12.949	10.4074				
cyid								11.407	12.949	10.4074				
stid								36.530	41.469	26.7355				
								========	========	==========				
								291.931	324.149	95.1624				

SO2 – 2009

Point Source Grown and Controlled Emissions by facility for SO2 r6s1b_2009

Base Year = 2002

Future Year = 2009

STID=19 CYID=115 fcid=58-07-001 name=MIDAMERICAN ENERGY CO. - LOUISA STATION

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
19	115	58-07-001	117487	147281	99	10100222	SO2	33.664	34.774	3.4774	0.0	0.90	SCRUBBER	Scrubber added by LADCO

STID=21 CYID=161 fcid=2116100009 name=EAST KY POWER COOP

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
21	161	2116100009	1	001	99	10100202	SO2	42.166	42.103	4.2103	0.0	0.90	SCRUBBER	Scrubber added by LADCO
21	161	2116100009	2	002	99	10100212	SO2	55.385	55.303	5.5303	0.0	0.90	SCRUBBER	Scrubber added by LADCO
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fcid								97.551	97.406	9.7406				
cyid								97.551	97.406	9.7406				
stid								97.551	97.406	9.7406				

STID=27 CYID=141 fcid=2714100004 name=NSP - Sherburne Generating Plant

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
27	141	2714100004	SV001	EU001	001	10100222	SO2	16.765	16.987	3.6401	0.3	0.85	SCRUBBER	Scrubber added by LADCO
27	141	2714100004	SV001	EU002	001	10100222	SO2	22.549	22.848	4.8959	0.3	0.85	SCRUBBER	Scrubber added by LADCO
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fcid								39.314	39.834	8.5360				
cyid								39.314	39.834	8.5360				
stid								39.314	39.834	8.5360				

STID=54 CYID=51 fcid=0005 name=OHIO POWER - MITCHELL PLANT

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
54	51	0005	012	001	99	10100202	SO2	17.775	17.748	1.7748	0.0	0.90	SCRUBBER	Scrubber added by LADCO
54	51	0005	012	002	99	10100202	SO2	5.689	5.680	0.5680	0.0	0.90	SCRUBBER	Scrubber added by LADCO
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fcid								23.463	23.428	2.3428				
cyid								23.463	23.428	2.3428				

STID=54 CYID=53 fcid=0009 name=APPALACHIAN POWER - MOUNTAINEER PLANT

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
54	53	0009	001	001	99	10100202	SO2	11.196	11.179	1.1179	0.0	0.90	SCRUBBER	Scrubber added by LADCO

STID=54 CYID=79 fcid=0006 name=APPALACHIAN POWER - JOHN E AMOS PLANT

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes

54	79	0006	012	001	99	10100202	SO2	79.635	79.516	7.9516	0.0	0.90	SCRUBBER	Scrubber added by LADCO
54	79	0006	003	003	99	10100202	SO2	139.377	139.169	13.9169	0.0	0.90	SCRUBBER	Scrubber added by LADCO
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fcid								219.012	218.685	21.8685				
cyid								219.012	218.685	21.8685				
stid								253.671	253.293	25.3293				
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								424.200	425.307	47.0832				

SO2 – 2012

Point Source Grown and Controlled Emissions by facility for SO2 r6s1b_2012

Base Year = 2002

Future Year = 2012

STID=17 CYID=31 fcid=031600AMI name=MIDWEST GENERATION LLC

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
17	31	031600AMI	0007	0010	01	10100226	SO2	16.13	18.39	1.839	0.0	0.900	SCRUBBER	Scrubber added by LADCO

STID=17 CYID=97 fcid=097190AAC name=MIDWEST GENERATION LLC

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
17	97	097190AAC	0018	0033	01	10100226	SO2	24.14	27.52	2.752	0.0	0.900	SCRUBBER	Scrubber added by LADCO
17	97	097190AAC	0021	0036	01	10100226	SO2	19.23	21.92	2.192	0.0	0.900	SCRUBBER	Scrubber added by LADCO
17	97	097190AAC	0016	0031	01	10100203	SO2	4.59	5.24	0.005	0.0	0.999	SHUTDOWN	Scrubber added by LADCO
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fcid								47.96	54.68	4.950				
cyid								47.96	54.68	4.950				

STID=17 CYID=125 fcid=125804AAB name=DYNEGY MIDWEST GENERATION INC

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
17	125	125804AAB	0019	0023	01	10100202	SO2	22.34	25.47	3.821	0.0	0.850	SCRUBBER	Scrubber added by LADCO

STID=17 CYID=127 fcid=127855AAC name=ELECTRIC ENERGY INC

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
17	127	127855AAC	0001	0001	01	10100222	SO2	11.83	13.48	13.482	0.0	0.000	LNB	LNB added by LADCO
17	127	127855AAC	0001	0002	01	10100222	SO2	11.48	13.09	13.085	0.0	0.000	LNB	LNB added by LADCO
17	127	127855AAC	0002	0003	01	10100222	SO2	10.25	11.68	11.680	0.0	0.000	LNB	LNB added by LADCO
17	127	127855AAC	0002	0004	01	10100222	SO2	12.04	13.73	13.731	0.0	0.000	LNB	LNB added by LADCO
17	127	127855AAC	0003	0006	01	10100222	SO2	12.68	14.46	14.456	0.0	0.000	LNB	LNB added by LADCO
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fcid								58.27	66.43	66.435				
cyid								58.27	66.43	66.435				

STID=17 CYID=135 fcid=135803AAA name=AMEREN ENERGY GENERATING CO

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
17	135	135803AAA	0001	0001	01	10100203	SO2	32.99	37.61	3.761	0.0	0.900	SCRUBBER	Scrubber added by LADCO
17	135	135803AAA	0001	0003	01	10100203	SO2	72.92	83.13	8.313	0.0	0.900	SCRUBBER	Scrubber added by LADCO
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fcid								105.91	120.74	12.074				
cyid								105.91	120.74	12.074				

STID=17 CYID=157 fcid=157851AAA name=DYNEGY MIDWEST GENERATION INC

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
17	157	157851AAA	0001	0001	01	10100203	SO2	25.14	28.66	4.299	0.0	0.850	SCRUBBER	Scrubber added by LADCO
17	157	157851AAA	0002	0002	01	10100203	SO2	25.79	29.41	4.411	0.0	0.850	SCRUBBER	Scrubber added by LADCO
17	157	157851AAA	0013	0013	01	10100202	SO2	27.79	31.68	4.752	0.0	0.850	SCRUBBER	Scrubber added by LADCO
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fcid								78.72	89.75	13.462				
cyid								78.72	89.75	13.462				

STID=17 CYID=167 fcid=167120AAO name=CITY WATER LIGHT & POWER

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
17	167	167120AAO	0010	0012	01	10100203	SO2	44.20	50.39	0.050	0.0	0.999	SHUTDOWN	Scrubber added by LADCO
17	167	167120AAO	0010	0013	01	10100203	SO2	16.40	18.70	0.019	0.0	0.999	SHUTDOWN	Scrubber added by LADCO
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fcid								60.61	69.10	0.069				
cyid								60.61	69.10	0.069				

STID=17 CYID=179 fcid=179801AAA name=MIDWEST GENERATION LLC

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
17	179	179801AAA	0018	0029	01	10100203	SO2	25.35	28.90	2.890	0.0	0.900	SCRUBBER	Scrubber added by LADCO
17	179	179801AAA	0018	0031	01	10100203	SO2	41.57	47.39	4.739	0.0	0.900	SCRUBBER	Scrubber added by LADCO
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fcid								66.91	76.29	7.629				
cyid								66.91	76.29	7.629				

STID=17 CYID=197 fcid=197810AAK name=MIDWEST GENERATION LLC

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
17	197	197810AAK	0013	0010	03	10100501	SO2	0.00	0.00	0.000	0.0	0.999	SHUTDOWN	Scrubber added by LADCO
17	197	197810AAK	0007	0012	02	10100223	SO2	15.33	17.48	0.017	0.0	0.999	SHUTDOWN	Scrubber added by LADCO
17	197	197810AAK	0007	0012	03	10100501	SO2	0.00	0.00	0.000	0.0	0.999	SHUTDOWN	Scrubber added by LADCO
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fcid								15.33	17.48	0.017				
cyid								15.33	17.48	0.017				
stid								472.19	538.32	110.295				

STID=19 CYID=115 fcid=58-07-001 name=MIDAMERICAN ENERGY CO. - LOUISA STATION

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
19	115	58-07-001	117487	147281	99	10100222	SO2	33.66	38.38	3.838	0.0	0.900	SCRUBBER	Scrubber added by LADCO

STID=21 CYID=161 fcid=2116100009 name=EAST KY POWER COOP

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes

21	161	2116100009	1	001	99	10100202	SO2	42.17	44.03	4.403	0.0	0.900	SCRUBBER	Scrubber added by LADCO
21	161	2116100009	2	002	99	10100212	SO2	55.39	57.84	5.784	0.0	0.900	SCRUBBER	Scrubber added by LADCO
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fcid								97.55	101.87	10.187				
cyid								97.55	101.87	10.187				
stid								97.55	101.87	10.187				

STID=27 CYID=61 fcid=2706100004 name=Minnesota Power Inc - Boswell Energy Ctr

								Base Yr	Grown	Controlled	Base Year	Future Year		
STID	CYID	fcid	stkid	dvid	prid	scc	polid	Tons/Day	Tons/Day	Tons/Day	Control EF	Control EF	ctrltype	ctrldes
27	61	2706100004	SV003	EU003	001	10100226	SO2	33.99	35.19	15.081	0.3	0.700	SCRUBBER	Scrubber added by LADCO
27	61	2706100004	SV003	EU003	002	10100501	SO2	0.00	0.00	0.000	0.3	0.700	SCRUBBER	Scrubber added by LADCO
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fcid								33.99	35.19	15.081				
cyid								33.99	35.19	15.081				

STID=27 CYID=109 fcid=2710900011 name=Rochester Public Utilities - Silver Lake

								Base Yr	Grown	Controlled	Base Year	Future Year		
STID	CYID	fcid	stkid	dvid	prid	scc	polid	Tons/Day	Tons/Day	Tons/Day	Control EF	Control EF	ctrltype	ctrldes
27	109	2710900011	SV003	EU004	001	10100202	SO2	7.86	8.13	1.220	0.0	0.850	SCRUBBER	Scrubber added by LADCO

STID=27 CYID=141 fcid=2714100004 name=NSP - Sherburne Generating Plant

								Base Yr	Grown	Controlled	Base Year	Future Year		
STID	CYID	fcid	stkid	dvid	prid	scc	polid	Tons/Day	Tons/Day	Tons/Day	Control EF	Control EF	ctrltype	ctrldes
27	141	2714100004	SV001	EU001	001	10100222	SO2	16.76	17.36	3.719	0.3	0.850	SCRUBBER	Scrubber added by LADCO
27	141	2714100004	SV001	EU002	001	10100222	SO2	22.55	23.34	5.002	0.3	0.850	SCRUBBER	Scrubber added by LADCO
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fcid								39.31	40.70	8.721				
cyid								39.31	40.70	8.721				
stid								81.16	84.02	25.023				

STID=39 CYID=13 fcid=0607130015 name=R. E. BURGER PLANT

								Base Yr	Grown	Controlled	Base Year	Future Year		
STID	CYID	fcid	stkid	dvid	prid	scc	polid	Tons/Day	Tons/Day	Tons/Day	Control EF	Control EF	ctrltype	ctrldes
39	13	0607130015	R6	B011	B011P1	10100202	SO2	29.83	31.15	3.115	0.0	0.900	SCRUBBER	Scrubber added by LADCO
39	13	0607130015	R7	B012	B012P1	10100202	SO2	34.77	36.31	3.631	0.0	0.900	SCRUBBER	Scrubber added by LADCO
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fcid								64.60	67.46	6.746				
cyid								64.60	67.46	6.746				

STID=39 CYID=31 fcid=0616000000 name=CONESVILLE POWER PLANT

								Base Yr	Grown	Controlled	Base Year	Future Year		
STID	CYID	fcid	stkid	dvid	prid	scc	polid	Tons/Day	Tons/Day	Tons/Day	Control EF	Control EF	ctrltype	ctrldes
39	31	0616000000	R4	B004	B004P1	10100212	SO2	316.00	330.00	33.000	0.0	0.900	SCRUBBER	Scrubber added by LADCO
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stid								380.60	397.46	39.746				

STID=47 CYID=1 fcid=0009 name=TVA BULL RUN FOSSIL PLANT

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
47	1	0009	S-1	001	99	10100212	SO2	130.81	133.01	13.301	0.0	0.900	SCRUBBER	Scrubber added by LADCO

STID=47 CYID=73 fcid=0007 name=TVA JOHN SEVIER FOSSIL PLANT

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
47	73	0007	S-1A	001	99	10100212	SO2	20.15	20.49	2.049	0.0	0.900	SCRUBBER	Scrubber added by LADCO
47	73	0007	S-1B	002	99	10100212	SO2	20.25	20.59	2.059	0.0	0.900	SCRUBBER	Scrubber added by LADCO
47	73	0007	S-2A	003	99	10100212	SO2	19.62	19.95	1.995	0.0	0.900	SCRUBBER	Scrubber added by LADCO
47	73	0007	S-2B	004	99	10100212	SO2	18.93	19.25	1.925	0.0	0.900	SCRUBBER	Scrubber added by LADCO
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fcid								78.95	80.28	8.028				
cyid								78.95	80.28	8.028				

STID=47 CYID=85 fcid=0011 name=TVA JOHNSONVILLE FOSSIL PLANT

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
47	85	0011	S1-01	001	99	10100212	SO2	17.06	17.35	1.735	0.0	0.900	SCRUBBER	Scrubber added by LADCO
47	85	0011	S1-04	004	99	10100212	SO2	19.85	20.18	2.018	0.0	0.900	SCRUBBER	Scrubber added by LADCO
47	85	0011	S1-05	005	99	10100212	SO2	24.11	24.52	2.452	0.0	0.900	SCRUBBER	Scrubber added by LADCO
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fcid								61.02	62.04	6.204				
cyid								61.02	62.04	6.204				

STID=47 CYID=145 fcid=0013 name=TVA KINGSTON FOSSIL PLANT

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
47	145	0013	S-1	001	99	10100202	SO2	12.68	12.89	1.289	0.0	0.900	SCRUBBER	Scrubber added by LADCO
47	145	0013	S-1	002	99	10100202	SO2	14.00	14.24	1.424	0.0	0.900	SCRUBBER	Scrubber added by LADCO
47	145	0013	S-1	003	99	10100202	SO2	13.80	14.04	1.404	0.0	0.900	SCRUBBER	Scrubber added by LADCO
47	145	0013	S-1	004	99	10100202	SO2	12.24	12.44	1.244	0.0	0.900	SCRUBBER	Scrubber added by LADCO
47	145	0013	S-1	005	99	10100202	SO2	19.57	19.90	1.990	0.0	0.900	SCRUBBER	Scrubber added by LADCO
47	145	0013	S-2	006	99	10100202	SO2	18.92	19.24	1.924	0.0	0.900	SCRUBBER	Scrubber added by LADCO
47	145	0013	S-2	007	99	10100202	SO2	21.30	21.66	2.166	0.0	0.900	SCRUBBER	Scrubber added by LADCO
47	145	0013	S-2	008	99	10100202	SO2	18.54	18.85	1.885	0.0	0.900	SCRUBBER	Scrubber added by LADCO
47	145	0013	S-2	009	99	10100202	SO2	20.72	21.07	2.107	0.0	0.900	SCRUBBER	Scrubber added by LADCO
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fcid								151.77	154.33	15.433				
cyid								151.77	154.33	15.433				

STID=47 CYID=165 fcid=0025 name=TVA GALLATIN FOSSIL PLANT

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
47	165	0025	S-01	001	99	10100212	SO2	13.91	14.14	1.414	0.0	0.900	SCRUBBER	Scrubber added by LADCO
47	165	0025	S-01	002	99	10100212	SO2	14.87	15.12	1.512	0.0	0.900	SCRUBBER	Scrubber added by LADCO
47	165	0025	S-02	003	99	10100212	SO2	16.33	16.60	1.660	0.0	0.900	SCRUBBER	Scrubber added by LADCO
47	165	0025	S-02	004	99	10100212	SO2	20.39	20.73	2.073	0.0	0.900	SCRUBBER	Scrubber added by LADCO
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	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day
fcid	65.49	66.59	6.659
cyid	65.49	66.59	6.659
stid	488.04	496.25	49.625

STID=54 CYID=51 fcid=0005 name=OHIO POWER - MITCHELL PLANT

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
54	51	0005	012	001	99	10100202	SO2	17.77	18.56	1.856	0.0	0.900	SCRUBBER	Scrubber added by LADCO
54	51	0005	012	002	99	10100202	SO2	5.69	5.94	0.594	0.0	0.900	SCRUBBER	Scrubber added by LADCO
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fcid								23.46	24.50	2.450				
cyid								23.46	24.50	2.450				

STID=54 CYID=53 fcid=0009 name=APPALACHIAN POWER - MOUNTAINEER PLANT

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
54	53	0009	001	001	99	10100202	SO2	11.20	11.69	1.169	0.0	0.900	SCRUBBER	Scrubber added by LADCO

STID=54 CYID=79 fcid=0006 name=APPALACHIAN POWER - JOHN E AMOS PLANT

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
54	79	0006	012	001	99	10100202	SO2	79.63	83.16	8.316	0.0	0.900	SCRUBBER	Scrubber added by LADCO
54	79	0006	012	002	99	10100202	SO2	100.33	104.78	10.478	0.0	0.900	SCRUBBER	Scrubber added by LADCO
54	79	0006	003	003	99	10100202	SO2	139.38	145.55	14.555	0.0	0.900	SCRUBBER	Scrubber added by LADCO
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fcid								319.35	333.50	33.350				
cyid								319.35	333.50	33.350				
stid								354.00	369.69	36.969				

STID=55 CYID=79 fcid=241007690 name=WIS ELECTRIC POWER OAK CREEK STATION

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
55	79	241007690	S13	B25	01	10100202	SO2	12.75	14.54	3.490	0.0	0.760	SCRUBBER	Scrubber added by LADCO
55	79	241007690	S13	B26	01	10100202	SO2	8.68	9.89	2.473	0.0	0.750	SCRUBBER	Scrubber added by LADCO
55	79	241007690	S14	B27	01	10100212	SO2	10.97	12.51	2.876	0.0	0.770	SCRUBBER	Scrubber added by LADCO
55	79	241007690	S14	B28	01	10100212	SO2	11.28	12.86	2.958	0.0	0.770	SCRUBBER	Scrubber added by LADCO
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fcid								43.68	49.80	11.797				
cyid								43.68	49.80	11.797				
stid								43.68	49.80	11.797				
								========	========	==========				
								1950.90	2075.80	287.480				

SO2 – 2018

Point Source Grown and Controlled Emissions by facility for SO2 r6s1b_2018

Base Year = 2002

Future Year = 2018

STID=17 CYID=31 fcid=031600AIN name=MIDWEST GENERATION LLC

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
17	31	031600AIN	0010	0013	01	10100226	SO2	10.92	12.39	1.239	0.0	0.900	SCRUBBER	Scrubber added by LADCO
17	31	031600AIN	0012	0016	01	10100226	SO2	17.69	20.08	2.008	0.0	0.900	SCRUBBER	Scrubber added by LADCO
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fcid								28.61	32.48	3.248				

STID=17 CYID=31 fcid=031600AMI name=MIDWEST GENERATION LLC

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
17	31	031600AMI	0007	0010	01	10100226	SO2	16.13	18.31	1.831	0.0	0.900	SCRUBBER	Scrubber added by LADCO
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cyid								44.74	50.79	5.079				

STID=17 CYID=79 fcid=079808AAA name=AMEREN ENERGY GENERATING CO

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
17	79	079808AAA	0003	0003	01	10100202	SO2	36.35	41.27	4.127	0.0	0.900	SCRUBBER	Scrubber added by LADCO
17	79	079808AAA	0012	0013	01	10100501	SO2	28.99	19.46	1.946	0.0	0.900	SCRUBBER	Scrubber added by LADCO
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fcid								65.34	60.72	6.072				
cyid								65.34	60.72	6.072				

STID=17 CYID=97 fcid=097190AAC name=MIDWEST GENERATION LLC

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
17	97	097190AAC	0018	0033	01	10100226	SO2	24.14	27.40	2.740	0.0	0.900	SCRUBBER	Scrubber added by LADCO
17	97	097190AAC	0021	0036	01	10100226	SO2	19.23	21.83	2.183	0.0	0.900	SCRUBBER	Scrubber added by LADCO
17	97	097190AAC	0016	0031	01	10100203	SO2	4.59	5.22	0.005	0.0	0.999	SHUTDOWN	Scrubber added by LADCO
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fcid								47.96	54.45	4.928				
cyid								47.96	54.45	4.928				

STID=17 CYID=125 fcid=125804AAB name=DYNEGY MIDWEST GENERATION INC

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
17	125	125804AAB	0019	0023	01	10100202	SO2	22.34	25.36	3.805	0.0	0.850	SCRUBBER	Scrubber added by LADCO

STID=17 CYID=127 fcid=127855AAC name=ELECTRIC ENERGY INC

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes

17	127	127855AAC	0002	0003	01	10100222	SO2	10.25	11.63	11.630	0.0	0.000	LNB	LNB added by LADCO
17	127	127855AAC	0002	0004	01	10100222	SO2	12.04	13.67	13.673	0.0	0.000	LNB	LNB added by LADCO
17	127	127855AAC	0001	0001	01	10100222	SO2	11.83	13.42	1.342	0.0	0.900	SCRUBBER	Scrubber added by LADCO
17	127	127855AAC	0001	0002	01	10100222	SO2	11.48	13.03	1.303	0.0	0.900	SCRUBBER	Scrubber added by LADCO
17	127	127855AAC	0003	0005	01	10100222	SO2	11.72	13.31	1.331	0.0	0.900	SCRUBBER	Scrubber added by LADCO
17	127	127855AAC	0003	0006	01	10100222	SO2	12.68	14.39	1.439	0.0	0.900	SCRUBBER	Scrubber added by LADCO
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fcid								70.00	79.46	30.719				
cyid								70.00	79.46	30.719				

STID=17 CYID=135 fcid=135803AAA name=AMEREN ENERGY GENERATING CO

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
17	135	135803AAA	0001	0001	01	10100203	SO2	32.99	37.45	3.745	0.0	0.900	SCRUBBER	Scrubber added by LADCO
17	135	135803AAA	0001	0003	01	10100203	SO2	72.92	82.77	8.277	0.0	0.900	SCRUBBER	Scrubber added by LADCO
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fcid								105.91	120.22	12.022				
cyid								105.91	120.22	12.022				

STID=17 CYID=143 fcid=143805AAG name=AES ED EDWARDS STATION

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
17	143	143805AAG	0002	0004	01	10100202	SO2	15.28	17.34	1.734	0.0	0.900	SCRUBBER	Scrubber added by LADCO

STID=17 CYID=157 fcid=157851AAA name=DYNEGY MIDWEST GENERATION INC

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
17	157	157851AAA	0001	0001	01	10100203	SO2	25.14	28.54	4.281	0.0	0.850	SCRUBBER	Scrubber added by LADCO
17	157	157851AAA	0002	0002	01	10100203	SO2	25.79	29.28	4.392	0.0	0.850	SCRUBBER	Scrubber added by LADCO
17	157	157851AAA	0013	0013	01	10100202	SO2	27.79	31.54	4.732	0.0	0.850	SCRUBBER	Scrubber added by LADCO
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fcid								78.72	89.36	13.404				
cyid								78.72	89.36	13.404				

STID=17 CYID=167 fcid=167120AAO name=CITY WATER LIGHT & POWER

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
17	167	167120AAO	0010	0012	01	10100203	SO2	44.20	50.18	0.050	0.0	0.999	SHUTDOWN	Scrubber added by LADCO
17	167	167120AAO	0010	0013	01	10100203	SO2	16.40	18.62	0.019	0.0	0.999	SHUTDOWN	Scrubber added by LADCO
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fcid								60.61	68.80	0.069				
cyid								60.61	68.80	0.069				

STID=17 CYID=179 fcid=179801AAA name=MIDWEST GENERATION LLC

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
17	179	179801AAA	0018	0029	01	10100203	SO2	25.35	28.77	2.877	0.0	0.900	SCRUBBER	Scrubber added by LADCO
17	179	179801AAA	0018	0031	01	10100203	SO2	41.57	47.19	4.719	0.0	0.900	SCRUBBER	Scrubber added by LADCO
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fcid 66.91 75.96 7.596
cyid 66.91 75.96 7.596

STID=17 CYID=197 fcid=197809AAO name=MIDWEST GENERATION LLC

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
17	197	197809AAO	0006	0009	01	10100203	SO2	15.89	18.04	1.804	0.0	0.900	SCRUBBER	Scrubber added by LADCO
17	197	197809AAO	0016	0031	01	10100202	SO2	27.43	31.13	3.113	0.0	0.900	SCRUBBER	Scrubber added by LADCO
17	197	197809AAO	0017	0033	01	10100202	SO2	23.13	26.26	2.626	0.0	0.900	SCRUBBER	Scrubber added by LADCO

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fcid 66.45 75.44 7.544

STID=17 CYID=197 fcid=197810AAK name=MIDWEST GENERATION LLC

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
17	197	197810AAK	0009	0014	02	10100222	SO2	11.64	13.21	1.321	0.0	0.900	SCRUBBER	Scrubber added by LADCO
17	197	197810AAK	0011	0016	02	10100222	SO2	25.67	29.14	2.914	0.0	0.900	SCRUBBER	Scrubber added by LADCO
17	197	197810AAK	0013	0010	03	10100501	SO2	0.00	0.00	0.000	0.0	0.999	SHUTDOWN	Scrubber added by LADCO
17	197	197810AAK	0007	0012	02	10100223	SO2	15.33	17.40	0.017	0.0	0.999	SHUTDOWN	Scrubber added by LADCO
17	197	197810AAK	0007	0012	03	10100501	SO2	0.00	0.00	0.000	0.0	0.999	SHUTDOWN	Scrubber added by LADCO

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fcid 52.64 59.75 4.252
cyid 119.09 135.19 11.796
stid 696.90 777.66 97.225

STID=18 CYID=147 fcid=00020 name=INDIANA MICHIGAN POWER-ROCKPORT

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
18	147	00020	1	001	01	10100222	SO2	66.42	72.32	7.232	0.0	0.900	SCRUBBER	Scrubber added by LADCO
18	147	00020	1	001	02	10100501	SO2	0.00	0.00	0.000	0.0	0.900	SCRUBBER	Scrubber added by LADCO

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fcid 66.42 72.32 7.232
cyid 66.42 72.32 7.232
stid 66.42 72.32 7.232

STID=19 CYID=115 fcid=58-07-001 name=MIDAMERICAN ENERGY CO. - LOUISA STATION

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
19	115	58-07-001	117487	147281	99	10100222	SO2	33.66	38.22	3.822	0.0	0.900	SCRUBBER	Scrubber added by LADCO

STID=21 CYID=127 fcid=2112700003 name=KENTUCKY POWER CO

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
21	127	2112700003	2	002	99	10100202	SO2	104.52	113.82	11.382	0.0	0.900	SCRUBBER	Scrubber added by LADCO

STID=21 CYID=161 fcid=2116100009 name=EAST KY POWER COOP

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes

21	161	2116100009	1	001	99	10100202	SO2	42.17	45.92	4.592	0.0	0.900	SCRUBBER	Scrubber added by LADCO
21	161	2116100009	2	002	99	10100212	SO2	55.39	60.31	6.031	0.0	0.900	SCRUBBER	Scrubber added by LADCO
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fcid								97.55	106.23	10.623				
cyid								97.55	106.23	10.623				
stid								202.07	220.04	22.004				

STID=27 CYID=61 fcid=2706100004 name=Minnesota Power Inc - Boswell Energy Ctr

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
27	61	2706100004	SV003	EU003	001	10100226	SO2	33.99	39.15	16.778	0.3	0.700	SCRUBBER	Scrubber added by LADCO
27	61	2706100004	SV003	EU003	002	10100501	SO2	0.00	0.00	0.000	0.3	0.700	SCRUBBER	Scrubber added by LADCO
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fcid								33.99	39.15	16.778				
cyid								33.99	39.15	16.778				

STID=27 CYID=109 fcid=2710900011 name=Rochester Public Utilities - Silver Lake

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
27	109	2710900011	SV003	EU004	001	10100202	SO2	7.86	9.05	1.357	0.0	0.850	SCRUBBER	Scrubber added by LADCO

STID=27 CYID=141 fcid=2714100004 name=NSP - Sherburne Generating Plant

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
27	141	2714100004	SV001	EU001	001	10100222	SO2	16.76	19.31	4.138	0.3	0.850	SCRUBBER	Scrubber added by LADCO
27	141	2714100004	SV001	EU002	001	10100222	SO2	22.55	25.97	5.565	0.3	0.850	SCRUBBER	Scrubber added by LADCO
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fcid								39.31	45.28	9.703				
cyid								39.31	45.28	9.703				
stid								81.16	93.48	27.838				

STID=39 CYID=13 fcid=0607130015 name=R. E. BURGER PLANT

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
39	13	0607130015	R6	B011	B011P1	10100202	SO2	29.83	32.48	3.248	0.0	0.900	SCRUBBER	Scrubber added by LADCO
39	13	0607130015	R7	B012	B012P1	10100202	SO2	34.77	37.86	3.786	0.0	0.900	SCRUBBER	Scrubber added by LADCO
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fcid								64.60	70.34	7.034				
cyid								64.60	70.34	7.034				

STID=39 CYID=31 fcid=0616000000 name=CONESVILLE POWER PLANT

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes
39	31	0616000000	R4	B004	B004P1	10100212	SO2	316.00	344.11	34.411	0.0	0.900	SCRUBBER	Scrubber added by LADCO

STID=39 CYID=167 fcid=0684000000 name=MUSKINGUM RIVER POWER PLANT

STID	CYID	fcid	stkid	dvid	prid	scc	polid	Base Yr Tons/Day	Grown Tons/Day	Controlled Tons/Day	Base Year Control EF	Future Year Control EF	ctrltype	ctrldes

39	167	0684000000	R2	B002	B002P1	10100201	SO2	65.07	70.85	7.085	0.0	0.900	SCRUBBER	Scrubber added by LADCO
39	167	0684000000	R2	B002	B002P2	10100501	SO2	0.00	0.00	0.000	0.0	0.900	SCRUBBER	Scrubber added by LADCO
39	167	0684000000	R3	B003	B003P1	10100201	SO2	94.58	103.00	10.300	0.0	0.900	SCRUBBER	Scrubber added by LADCO
39	167	0684000000	R3	B003	B003P2	10100501	SO2	0.00	0.00	0.000	0.0	0.900	SCRUBBER	Scrubber added by LADCO
39	167	0684000000	R4	B004	B004P1	10100203	SO2	81.64	88.90	8.890	0.0	0.900	SCRUBBER	Scrubber added by LADCO
39	167	0684000000	R4	B004	B004P2	10100501	SO2	0.00	0.00	0.000	0.0	0.900	SCRUBBER	Scrubber added by LADCO
39	167	0684000000	R5	B005	B005P1	10100203	SO2	97.22	105.87	10.587	0.0	0.900	SCRUBBER	Scrubber added by LADCO
39	167	0684000000	R5	B005	B005P2	10100501	SO2	0.00	0.00	0.000	0.0	0.900	SCRUBBER	Scrubber added by LADCO
39	167	0684000000	R6	B006	B006P1	10100202	SO2	113.96	124.10	12.410	0.0	0.900	SCRUBBER	Scrubber added by LADCO
39	167	0684000000	R6	B006	B006P2	10100501	SO2	0.00	0.00	0.000	0.0	0.900	SCRUBBER	Scrubber added by LADCO
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fcid								452.48	492.72	49.272				
cyid								452.48	492.72	49.272				
stid								833.08	907.16	90.716				

STID=47 CYID=1 fcid=0009 name=TVA BULL RUN FOSSIL PLANT

								Base Yr	Grown	Controlled	Base Year	Future Year		
STID	CYID	fcid	stkid	dvid	prid	scc	polid	Tons/Day	Tons/Day	Tons/Day	Control EF	Control EF	ctrltype	ctrldes
47	1	0009	S-1	001	99	10100212	SO2	130.81	136.82	13.682	0.0	0.900	SCRUBBER	Scrubber added by LADCO

STID=47 CYID=73 fcid=0007 name=TVA JOHN SEVIER FOSSIL PLANT

								Base Yr	Grown	Controlled	Base Year	Future Year		
STID	CYID	fcid	stkid	dvid	prid	scc	polid	Tons/Day	Tons/Day	Tons/Day	Control EF	Control EF	ctrltype	ctrldes
47	73	0007	S-1A	001	99	10100212	SO2	20.15	21.07	2.107	0.0	0.900	SCRUBBER	Scrubber added by LADCO
47	73	0007	S-1B	002	99	10100212	SO2	20.25	21.18	2.118	0.0	0.900	SCRUBBER	Scrubber added by LADCO
47	73	0007	S-2A	003	99	10100212	SO2	19.62	20.52	2.052	0.0	0.900	SCRUBBER	Scrubber added by LADCO
47	73	0007	S-2B	004	99	10100212	SO2	18.93	19.80	1.980	0.0	0.900	SCRUBBER	Scrubber added by LADCO
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fcid								78.95	82.57	8.257				
cyid								78.95	82.57	8.257				

STID=47 CYID=85 fcid=0011 name=TVA JOHNSONVILLE FOSSIL PLANT

								Base Yr	Grown	Controlled	Base Year	Future Year		
STID	CYID	fcid	stkid	dvid	prid	scc	polid	Tons/Day	Tons/Day	Tons/Day	Control EF	Control EF	ctrltype	ctrldes
47	85	0011	S1-01	001	99	10100212	SO2	17.06	17.84	1.784	0.0	0.900	SCRUBBER	Scrubber added by LADCO
47	85	0011	S1-04	004	99	10100212	SO2	19.85	20.76	2.076	0.0	0.900	SCRUBBER	Scrubber added by LADCO
47	85	0011	S1-05	005	99	10100212	SO2	24.11	25.22	2.522	0.0	0.900	SCRUBBER	Scrubber added by LADCO
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fcid								61.02	63.82	6.382				
cyid								61.02	63.82	6.382				

STID=47 CYID=145 fcid=0013 name=TVA KINGSTON FOSSIL PLANT

								Base Yr	Grown	Controlled	Base Year	Future Year		
STID	CYID	fcid	stkid	dvid	prid	scc	polid	Tons/Day	Tons/Day	Tons/Day	Control EF	Control EF	ctrltype	ctrldes
47	145	0013	S-1	001	99	10100202	SO2	12.68	13.26	1.326	0.0	0.900	SCRUBBER	Scrubber added by LADCO
47	145	0013	S-1	002	99	10100202	SO2	14.00	14.65	1.465	0.0	0.900	SCRUBBER	Scrubber added by LADCO

47	145	0013	S-1	003	99	10100202	SO2	13.80	14.44	1.444	0.0	0.900	SCRUBBER	Scrubber added by LADCO
47	145	0013	S-1	004	99	10100202	SO2	12.24	12.80	1.280	0.0	0.900	SCRUBBER	Scrubber added by LADCO
47	145	0013	S-1	005	99	10100202	SO2	19.57	20.47	2.047	0.0	0.900	SCRUBBER	Scrubber added by LADCO
47	145	0013	S-2	006	99	10100202	SO2	18.92	19.79	1.979	0.0	0.900	SCRUBBER	Scrubber added by LADCO
47	145	0013	S-2	007	99	10100202	SO2	21.30	22.28	2.228	0.0	0.900	SCRUBBER	Scrubber added by LADCO
47	145	0013	S-2	008	99	10100202	SO2	18.54	19.39	1.939	0.0	0.900	SCRUBBER	Scrubber added by LADCO
47	145	0013	S-2	009	99	10100202	SO2	20.72	21.68	2.168	0.0	0.900	SCRUBBER	Scrubber added by LADCO
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fcid								151.77	158.75	15.875				
cyid								151.77	158.75	15.875				

STID=47 CYID=165 fcid=0025 name=TVA GALLATIN FOSSIL PLANT

								Base Yr	Grown	Controlled	Base Year	Future Year		
STID	CYID	fcid	stkid	dvid	prid	scc	polid	Tons/Day	Tons/Day	Tons/Day	Control EF	Control EF	ctrltype	ctrldes
47	165	0025	S-01	001	99	10100212	SO2	13.91	14.54	1.454	0.0	0.900	SCRUBBER	Scrubber added by LADCO
47	165	0025	S-01	002	99	10100212	SO2	14.87	15.56	1.556	0.0	0.900	SCRUBBER	Scrubber added by LADCO
47	165	0025	S-02	003	99	10100212	SO2	16.33	17.08	1.708	0.0	0.900	SCRUBBER	Scrubber added by LADCO
47	165	0025	S-02	004	99	10100212	SO2	20.39	21.32	2.132	0.0	0.900	SCRUBBER	Scrubber added by LADCO
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fcid								65.49	68.50	6.850				
cyid								65.49	68.50	6.850				
stid								488.04	510.46	51.046				

STID=54 CYID=39 fcid=0006 name=APPALACHIAN POWER - KANAWHA RIVER PLANT

								Base Yr	Grown	Controlled	Base Year	Future Year		
STID	CYID	fcid	stkid	dvid	prid	scc	polid	Tons/Day	Tons/Day	Tons/Day	Control EF	Control EF	ctrltype	ctrldes
54	39	0006	012	001	99	10100202	SO2	19.45	21.18	10.591	0.0	0.500	SCRUBBER	Scrubber added by LADCO
54	39	0006	012	002	99	10100202	SO2	20.94	22.80	11.399	0.0	0.500	SCRUBBER	Scrubber added by LADCO
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fcid								40.39	43.98	21.990				
cyid								40.39	43.98	21.990				

STID=54 CYID=51 fcid=0005 name=OHIO POWER - MITCHELL PLANT

								Base Yr	Grown	Controlled	Base Year	Future Year		
STID	CYID	fcid	stkid	dvid	prid	scc	polid	Tons/Day	Tons/Day	Tons/Day	Control EF	Control EF	ctrltype	ctrldes
54	51	0005	012	001	99	10100202	SO2	17.77	19.36	1.936	0.0	0.900	SCRUBBER	Scrubber added by LADCO
54	51	0005	012	002	99	10100202	SO2	5.69	6.19	0.619	0.0	0.900	SCRUBBER	Scrubber added by LADCO
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fcid								23.46	25.55	2.555				

STID=54 CYID=51 fcid=0006 name=OHIO POWER - KAMMER PLANT

								Base Yr	Grown	Controlled	Base Year	Future Year		
STID	CYID	fcid	stkid	dvid	prid	scc	polid	Tons/Day	Tons/Day	Tons/Day	Control EF	Control EF	ctrltype	ctrldes
54	51	0006	013	001	99	10100203	SO2	47.06	51.25	5.125	0.0	0.900	SCRUBBER	Scrubber added by LADCO
54	51	0006	013	002	99	10100203	SO2	47.66	51.90	5.190	0.0	0.900	SCRUBBER	Scrubber added by LADCO
54	51	0006	013	003	99	10100203	SO2	41.94	45.67	4.567	0.0	0.900	SCRUBBER	Scrubber added by LADCO

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fcid								136.67	148.82	14.882				
cyid								160.13	174.37	17.437				

STID=54 CYID=53 fcid=0001 name=APPALACHIAN POWER CO.-PHILIP SPORN PLANT

								Base Yr	Grown	Controlled	Base Year	Future Year		
STID	CYID	fcid	stkid	dvid	prid	scc	polid	Tons/Day	Tons/Day	Tons/Day	Control EF	Control EF	ctrltype	ctrldes
54	53	0001	014	001	99	10100202	SO2	18.65	20.31	2.031	0.0	0.900	SCRUBBER	Scrubber added by LADCO
54	53	0001	014	002	99	10100202	SO2	15.87	17.28	1.728	0.0	0.900	SCRUBBER	Scrubber added by LADCO
54	53	0001	014	003	99	10100202	SO2	21.46	23.36	2.336	0.0	0.900	SCRUBBER	Scrubber added by LADCO
54	53	0001	014	004	99	10100202	SO2	20.53	22.36	2.236	0.0	0.900	SCRUBBER	Scrubber added by LADCO
54	53	0001	005	005	99	10100202	SO2	46.82	50.98	5.098	0.0	0.900	SCRUBBER	Scrubber added by LADCO
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fcid								123.33	134.30	13.430				

STID=54 CYID=53 fcid=0009 name=APPALACHIAN POWER - MOUNTAINEER PLANT

								Base Yr	Grown	Controlled	Base Year	Future Year		
STID	CYID	fcid	stkid	dvid	prid	scc	polid	Tons/Day	Tons/Day	Tons/Day	Control EF	Control EF	ctrltype	ctrldes
54	53	0009	001	001	99	10100202	SO2	11.20	12.19	1.219	0.0	0.900	SCRUBBER	Scrubber added by LADCO
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cyid								134.53	146.49	14.649				

STID=54 CYID=79 fcid=0006 name=APPALACHIAN POWER - JOHN E AMOS PLANT

								Base Yr	Grown	Controlled	Base Year	Future Year		
STID	CYID	fcid	stkid	dvid	prid	scc	polid	Tons/Day	Tons/Day	Tons/Day	Control EF	Control EF	ctrltype	ctrldes
54	79	0006	012	001	99	10100202	SO2	79.63	86.72	8.672	0.0	0.900	SCRUBBER	Scrubber added by LADCO
54	79	0006	012	002	99	10100202	SO2	100.33	109.26	10.926	0.0	0.900	SCRUBBER	Scrubber added by LADCO
54	79	0006	003	003	99	10100202	SO2	139.38	151.77	15.177	0.0	0.900	SCRUBBER	Scrubber added by LADCO
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fcid								319.35	347.75	34.775				
cyid								319.35	347.75	34.775				
stid								654.39	712.59	88.851				

STID=55 CYID=79 fcid=241007690 name=WIS ELECTRIC POWER OAK CREEK STATION

								Base Yr	Grown	Controlled	Base Year	Future Year		
STID	CYID	fcid	stkid	dvid	prid	scc	polid	Tons/Day	Tons/Day	Tons/Day	Control EF	Control EF	ctrltype	ctrldes
55	79	241007690	S13	B25	01	10100202	SO2	12.75	14.48	3.475	0.0	0.760	SCRUBBER	Scrubber added by LADCO
55	79	241007690	S13	B26	01	10100202	SO2	8.68	9.85	2.462	0.0	0.750	SCRUBBER	Scrubber added by LADCO
55	79	241007690	S14	B27	01	10100212	SO2	10.97	12.45	2.864	0.0	0.770	SCRUBBER	Scrubber added by LADCO
55	79	241007690	S14	B28	01	10100212	SO2	11.28	12.81	2.945	0.0	0.770	SCRUBBER	Scrubber added by LADCO
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fcid								43.68	49.59	11.746				
cyid								43.68	49.59	11.746				
stid								43.68	49.59	11.746				
								========	========	==========				
								3099.41	3381.52	400.481				

Appendix II

Scenario C Controls (CAMD List)

NOx Controls (SCRs, 2007 – 2013))

Plant Name	UniqueID_Final	State Name	County	Capacity MW	On Line Year	SCR Online Year
Chesterfield	3797_B_4	Virginia	Chesterfield	166	1960	2013
Chesterfield	3797_B_5	Virginia	Chesterfield	310	1964	2012
Scherer	6257_B_3	Georgia	Monroe	875	1987	2011
Chesterfield	3797_B_6	Virginia	Chesterfield	658	1969	2011
Sandow No 4	6648_B_4	Texas	Milam	545	1981	2011
Beech Hollow Power Project	82704_B_1	Pennsylvania	Washington	272	2011	2011
Longview Power	82702_B_1	West Virginia	Monongalia	695	2011	2011
Cliffside	2721_B_6	North Carolina	Cleveland	800	2011	2011
AES Westover	2526_B_11	New York	Broome	22	1943	2010
AES Westover	2526_B_12	New York	Broome	22	1943	2010
AES Westover	2526_B_13	New York	Broome	84	1951	2010
Iatan 2	6065_B_2	Missouri	Platte	850	2010	2010
Southwest	6195_B_2	Missouri	Greene	300	2010	2010
Trimble Station (LGE)	6071_B_2	Kentucky	Trimble	732	2010	2010
Elm Road Generating Station	56068_B_2	Wisconsin	Milwaukee	615	2010	2010
Clay Boswell	1893_B_3	Minnesota	Itasca	350	1973	2009
Asheville	2706_B_2	North Carolina	Buncombe	184	1971	2009
Conesville	2840_B_4	Ohio	Coshocton	780	1973	2009
Marshall	2727_B_3	North Carolina	Catawba	657	1969	2009
St Johns River Power Park	207_B_1	Florida	Duval	626	1987	2009
Ghent	1356_B_2	Kentucky	Carroll	469	1977	2009
Chalk Point LLC	1571_B_1	Maryland	Prince George's	341	1964	2009
Chalk Point LLC	1571_B_2	Maryland	Prince George's	342	1965	2009
San Juan	2451_B_2	New Mexico	San Juan	320	1973	2009
Big Bend	645_B_BB01	Florida	Hillsborough	411	1970	2009
Big Bend	645_B_BB02	Florida	Hillsborough	391	1973	2009
Big Bend	645_B_BB03	Florida	Hillsborough	414	1976	2009
Nebraska City Unit 2	6096_B_2	Nebraska	Otoe	663	2009	2009
Cross	130_B_4	South Carolina	Berkeley	652	2009	2009
Springerville	8223_B_4	Arizona	Apache	400	2009	2009
Sandow 5	82010_B_5	Texas	Milam	600	2009	2009
Oak Grove	82011_B_1	Texas	Robertson	800	2009	2009
Oak Grove	82011_B_2	Texas	Robertson	800	2009	2009
TS Power Plant	82013_B_1	Nevada	Eureka	200	2009	2009
Plum Point Energy	82014_B_1	Arkansas	Mississippi	665	2009	2009
Comanche	470_B_3	Colorado	Pueblo	750	2009	2009
Elm Road Generating Station	56068_B_1	Wisconsin	Milwaukee	615	2009	2009
Two Elk Generating Station	55360_B_1	Wyoming	Campbell	300	2009	2009
J K Spruce	7097_B_BLR2	Texas	Bexar	750	2009	2009
Dallman	963_B_34	Illinois	Sangamon	200	2009	2009
AES Greenidge LLC	2527_B_4	New York	Yates	27	1950	2008
AES Greenidge LLC	2527_B_5	New York	Yates	27	1950	2008
AES Greenidge LLC	2527_B_6	New York	Yates	106	1953	2008
Charles R Lowman	56_B_2	Alabama	Washington	238	1979	2008
Charles R Lowman	56_B_3	Alabama	Washington	238	1980	2008
Barry	3_B_5	Alabama	Mobile	750	1971	2008
St Johns River Power Park	207_B_2	Florida	Duval	626	1988	2008
Morgantown Generating Plant	1573_B_2	Maryland	Charles	620	1971	2008

Bailly	995_B_7	Indiana	Porter	160	1962	2008
San Juan	2451_B_1	New Mexico	San Juan	322	1976	2008
San Juan	2451_B_3	New Mexico	San Juan	495	1979	2008
Weston	4078_B_4	Wisconsin	Marathon	519	2008	2008
AES Deepwater	10670_B_AAB001	Texas	Harris	140	1986	2007
La Cygne	1241_B_1	Kansas	Linn	724	1973	2007
Morgantown Generating Plant	1573_B_1	Maryland	Charles	624	1970	2007
PSEG Hudson Generating Station	2403_B_2	New Jersey	Hudson	583	1967	2007
San Juan	2451_B_4	New Mexico	San Juan	506	1982	2007
Big Bend	645_B_BB04	Florida	Hillsborough	457	1985	2007
Cross	130_B_3	South Carolina	Berkeley	620	2007	2007
Wygen II	55479_B_4	Wyoming	Campbell	90	2007	2007
Council Bluffs	1082_B_4	Iowa	Pottawattamie	790	2007	2007

SO2 Controls (FGDs, 2007 – 2012)

Plant Name	UniqueID_Final	State Name	County	Capacity MW	On Line Year	Scrubber Online Year
James H Miller Jr	6002_B_1	Alabama	Jefferson	684	1978	2011
James H Miller Jr	6002_B_2	Alabama	Jefferson	687	1985	2011
James H Miller Jr	6002_B_3	Alabama	Jefferson	687	1989	2011
James H Miller Jr	6002_B_4	Alabama	Jefferson	688	1991	2011
Cape Fear	2708_B_5	North Carolina	Chatham	143	1956	2011
Baldwin Energy Complex	889_B_1	Illinois	Randolph	624	1970	2011
Baldwin Energy Complex	889_B_2	Illinois	Randolph	629	1973	2011
Baldwin Energy Complex	889_B_3	Illinois	Randolph	629	1975	2011
Scherer	6257_B_3	Georgia	Monroe	875	1987	2011
Milton R Young	2823_B_B1	North Dakota	Oliver	250	1970	2011
W H Sammis	2866_B_6	Ohio	Jefferson	630	1969	2011
W H Sammis	2866_B_7	Ohio	Jefferson	630	1971	2011
PSEG Hudson Generating Station	2403_B_2	New Jersey	Hudson	583	1967	2011
John Sevier	3405_B_1	Tennessee	Hawkins	176	1955	2011
John Sevier	3405_B_2	Tennessee	Hawkins	176	1955	2011
John Sevier	3405_B_3	Tennessee	Hawkins	176	1956	2011
John Sevier	3405_B_4	Tennessee	Hawkins	176	1957	2011
Beech Hollow Power Project	82704_B_1	Pennsylvania	Washington	272	2011	2011
Longview Power	82702_B_1	West Virginia	Monongalia	695	2011	2011
Cliffside	2721_B_6	North Carolina	Cleveland	800	2011	2011
AES Greenidge LLC	2527_B_4	New York	Yates	27	1950	2010
AES Greenidge LLC	2527_B_5	New York	Yates	27	1950	2010
Barry	3_B_5	Alabama	Mobile	750	1971	2010
E C Gaston	26_B_5	Alabama	Shelby	861	1974	2010
Warrick	6705_B_4	Indiana	Warrick	300	1970	2010
Coffeen	861_B_01	Illinois	Montgomery	340	1965	2010
Coffeen	861_B_02	Illinois	Montgomery	560	1972	2010
Cardinal	2828_B_3	Ohio	Jefferson	630	1977	2010
Brandon Shores	602_B_1	Maryland	Anne Arundel	643	1984	2010
Brandon Shores	602_B_2	Maryland	Anne Arundel	643	1991	2010
Monroe	1733_B_4	Michigan	Monroe	775	1974	2010
Cliffside	2721_B_5	North Carolina	Cleveland	550	1972	2010
Crystal River	628_B_4	Florida	Citrus	720	1982	2010
Bowen	703_B_1BLR	Georgia	Bartow	713	1971	2010

Crist	641_B_6	Florida	Escambia	302	1970	2010
Crist	641_B_7	Florida	Escambia	477	1973	2010
Clifty Creek	983_B_1	Indiana	Jefferson	217	1955	2010
Clifty Creek	983_B_2	Indiana	Jefferson	217	1955	2010
Clifty Creek	983_B_3	Indiana	Jefferson	217	1955	2010
Clifty Creek	983_B_4	Indiana	Jefferson	217	1955	2010
Clifty Creek	983_B_5	Indiana	Jefferson	217	1955	2010
Clifty Creek	983_B_6	Indiana	Jefferson	217	1956	2010
Chalk Point LLC	1571_B_1	Maryland	Prince George's	341	1964	2010
Chalk Point LLC	1571_B_2	Maryland	Prince George's	342	1965	2010
Dickerson	1572_B_1	Maryland	Montgomery	182	1959	2010
Dickerson	1572_B_2	Maryland	Montgomery	182	1960	2010
Dickerson	1572_B_3	Maryland	Montgomery	182	1962	2010
R E Burger	2864_B_7	Ohio	Belmont	156	1955	2010
R E Burger	2864_B_8	Ohio	Belmont	156	1955	2010
Kyger Creek	2876_B_1	Ohio	Gallia	217	1955	2010
Kyger Creek	2876_B_2	Ohio	Gallia	217	1955	2010
Kyger Creek	2876_B_3	Ohio	Gallia	217	1955	2010
Kyger Creek	2876_B_4	Ohio	Gallia	217	1955	2010
Kyger Creek	2876_B_5	Ohio	Gallia	217	1955	2010
Cheswick	8226_B_1	Pennsylvania	Allegheny	580	1970	2010
PSEG Mercer Generating Station	2408_B_1	New Jersey	Mercer	315	1960	2010
PSEG Mercer Generating Station	2408_B_2	New Jersey	Mercer	310	1961	2010
Silver Lake	2008_B_4	Minnesota	Olmsted	61	1969	2010
Kingston	3407_B_1	Tennessee	Roane	135	1954	2010
Kingston	3407_B_2	Tennessee	Roane	135	1954	2010
Kingston	3407_B_3	Tennessee	Roane	135	1954	2010
Kingston	3407_B_4	Tennessee	Roane	135	1954	2010
Kingston	3407_B_5	Tennessee	Roane	177	1955	2010
Kingston	3407_B_6	Tennessee	Roane	177	1955	2010
Kingston	3407_B_7	Tennessee	Roane	177	1955	2010
Kingston	3407_B_8	Tennessee	Roane	177	1955	2010
Kingston	3407_B_9	Tennessee	Roane	178	1955	2010
Sioux	2107_B_1	Missouri	St. Charles	497	1967	2010
Sioux	2107_B_2	Missouri	St. Charles	497	1968	2010
Chesterfield	3797_B_5	Virginia	Chesterfield	310	1964	2010
Yorktown	3809_B_1	Virginia	York	159	1957	2010
AES Westover	2526_B_11	New York	Broome	22	1943	2010
AES Westover	2526_B_12	New York	Broome	22	1943	2010
AES Westover	2526_B_13	New York	Broome	84	1951	2010
Iatan 2	6065_B_2	Missouri	Platte	850	2010	2010
Southwest	6195_B_2	Missouri	Greene	300	2010	2010
Trimble Station (LGE)	6071_B_2	Kentucky	Trimble	732	2010	2010
Elm Road Generating Station	56068_B_2	Wisconsin	Milwaukee	615	2010	2010
Cholla	113_B_3	Arizona	Navajo	271	1980	2009
Mayo	6250_B_1A	North Carolina	Person	362	1983	2009
Mayo	6250_B_1B	North Carolina	Person	362	1983	2009
Conesville	2840_B_4	Ohio	Coshocton	780	1973	2009
G G Allen	2718_B_1	North Carolina	Gaston	162	1957	2009
G G Allen	2718_B_2	North Carolina	Gaston	162	1957	2009
G G Allen	2718_B_3	North Carolina	Gaston	260	1959	2009

G G Allen	2718_B_4	North Carolina	Gaston	275	1960	2009
G G Allen	2718_B_5	North Carolina	Gaston	265	1961	2009
H L Spurlock	6041_B_1	Kentucky	Mason	315	1977	2009
Crystal River	628_B_5	Florida	Citrus	717	1984	2009
Deerhaven Generating Station	663_B_B2	Florida	Alachua	228	1981	2009
Bowen	703_B_2BLR	Georgia	Bartow	718	1972	2009
Wansley	6052_B_2	Georgia	Heard	892	1978	2009
E W Brown	1355_B_1	Kentucky	Mercer	94	1957	2009
E W Brown	1355_B_2	Kentucky	Mercer	160	1963	2009
E W Brown	1355_B_3	Kentucky	Mercer	422	1971	2009
Ghent	1356_B_2	Kentucky	Carroll	469	1977	2009
Fayette Power Project	6179_B_1	Texas	Fayette	598	1979	2009
Fayette Power Project	6179_B_2	Texas	Fayette	598	1980	2009
Morgantown Generating Plant	1573_B_1	Maryland	Charles	624	1970	2009
Morgantown Generating Plant	1573_B_2	Maryland	Charles	620	1971	2009
PPL Brunner Island	3140_B_1	Pennsylvania	York	321	1961	2009
PPL Brunner Island	3140_B_2	Pennsylvania	York	378	1965	2009
Keystone	3136_B_1	Pennsylvania	Armstrong	850	1967	2009
Keystone	3136_B_2	Pennsylvania	Armstrong	850	1968	2009
Bull Run	3396_B_1	Tennessee	Anderson	881	1967	2009
Bay Shore	2878_B_4	Ohio	Lucas	215	1968	2009
Hatfields Ferry Power Station	3179_B_1	Pennsylvania	Greene	530	1969	2009
Hatfields Ferry Power Station	3179_B_2	Pennsylvania	Greene	530	1970	2009
Hatfields Ferry Power Station	3179_B_3	Pennsylvania	Greene	530	1971	2009
Nebraska City Unit 2	6096_B_2	Nebraska	Otoe	663	2009	2009
Cross	130_B_4	South Carolina	Berkeley	652	2009	2009
Springerville	8223_B_4	Arizona	Apache	400	2009	2009
Sandow 5	82010_B_5	Texas	Milam	600	2009	2009
Oak Grove	82011_B_1	Texas	Robertson	800	2009	2009
Oak Grove	82011_B_2	Texas	Robertson	800	2009	2009
TS Power Plant	82013_B_1	Nevada	Eureka	200	2009	2009
Plum Point Energy	82014_B_1	Arkansas	Mississippi	665	2009	2009
Comanche	470_B_3	Colorado	Pueblo	750	2009	2009
Elm Road Generating Station	56068_B_1	Wisconsin	Milwaukee	615	2009	2009
Two Elk Generating Station	55360_B_1	Wyoming	Campbell	300	2009	2009
J K Spruce	7097_B_BLR2	Texas	Bexar	750	2009	2009
Dallman	963_B_34	Illinois	Sangamon	200	2009	2009
Charles R Lowman	56_B_1	Alabama	Washington	86	1969	2008
John E Amos	3935_B_1	West Virginia	Putnam	800	1971	2008
John E Amos	3935_B_2	West Virginia	Putnam	800	1972	2008
Cholla	113_B_4	Arizona	Navajo	380	1981	2008
Roxboro	2712_B_1	North Carolina	Person	369	1966	2008
Roxboro	2712_B_3A	North Carolina	Person	341	1973	2008
Roxboro	2712_B_3B	North Carolina	Person	341	1973	2008
Miami Fort	2832_B_7	Ohio	Hamilton	500	1975	2008
Miami Fort	2832_B_8	Ohio	Hamilton	500	1978	2008
Cogentrix Virginia Leasing Corp	10071_B_2A	Virginia	Portsmouth	19	1988	2008
Cogentrix Virginia Leasing Corp	10071_B_2B	Virginia	Portsmouth	19	1988	2008
Cogentrix Virginia Leasing Corp	10071_B_2C	Virginia	Portsmouth	19	1988	2008
J M Stuart	2850_B_1	Ohio	Adams	585	1971	2008
J M Stuart	2850_B_2	Ohio	Adams	597	1970	2008

J M Stuart	2850_B_3	Ohio	Adams	597	1972	2008
J M Stuart	2850_B_4	Ohio	Adams	597	1974	2008
Monroe	1733_B_3	Michigan	Monroe	795	1973	2008
Belews Creek	8042_B_1	North Carolina	Stokes	1,115	1974	2008
Belews Creek	8042_B_2	North Carolina	Stokes	1,115	1975	2008
Bowen	703_B_3BLR	Georgia	Bartow	902	1974	2008
Bowen	703_B_4BLR	Georgia	Bartow	929	1975	2008
Hammond	708_B_1	Georgia	Floyd	112	1954	2008
Hammond	708_B_2	Georgia	Floyd	112	1954	2008
Hammond	708_B_3	Georgia	Floyd	112	1955	2008
Hammond	708_B_4	Georgia	Floyd	510	1970	2008
Wansley	6052_B_1	Georgia	Heard	891	1976	2008
Harding Street	990_B_70	Indiana	Marion	435	1973	2008
Cogentrix Hopewell	10377_B_1A	Virginia	Hopewell (city)	18	1987	2008
Cogentrix Hopewell	10377_B_1B	Virginia	Hopewell (city)	18	1987	2008
Cogentrix Hopewell	10377_B_1C	Virginia	Hopewell (city)	18	1987	2008
Ghent	1356_B_4	Kentucky	Carroll	478	1984	2008
Council Bluffs	1082_B_3	Iowa	Pottawattamie	690	1978	2008
PPL Brunner Island	3140_B_3	Pennsylvania	York	749	1969	2008
PPL Montour	3149_B_1	Pennsylvania	Montour	774	1972	2008
PPL Montour	3149_B_2	Pennsylvania	Montour	766	1973	2008
Comanche	470_B_1	Colorado	Pueblo	366	1973	2008
Comanche	470_B_2	Colorado	Pueblo	370	1975	2008
Cayuga	1001_B_2	Indiana	Vermillon	473	1972	2008
Winyah	6249_B_1	South Carolina	Georgetown	295	1975	2008
Winyah	6249_B_2	South Carolina	Georgetown	295	1977	2008
Winyah	6249_B_3	South Carolina	Georgetown	295	1980	2008
Chesterfield	3797_B_6	Virginia	Chesterfield	658	1969	2008
Brayton Point	1619_B_1	Massachusetts	Bristo	243	1963	2008
Brayton Point	1619_B_2	Massachusetts	Bristo	244	1964	2008
Weston	4078_B_4	Wisconsin	Marathon	519	2008	2008
Gorgas	8_B_10	Alabama	Walker	690	1972	2007
Gorgas	8_B_8	Alabama	Walker	165	1956	2007
Gorgas	8_B_9	Alabama	Walker	175	1958	2007
John E Amos	3935_B_3	West Virginia	Putnam	1,300	1973	2007
Mountaineer	6264_B_1	West Virginia	Mason	1,300	1980	2007
Cardinal	2828_B_1	Ohio	Jefferson	600	1967	2007
Cardinal	2828_B_2	Ohio	Jefferson	600	1967	2007
Roxboro	2712_B_2	North Carolina	Person	639	1968	2007
Roxboro	2712_B_4A	North Carolina	Person	343	1980	2007
Roxboro	2712_B_4B	North Carolina	Person	343	1980	2007
Cogentrix Virginia Leasing Corp	10071_B_1A	Virginia	Portsmouth	19	1988	2007
Cogentrix Virginia Leasing Corp	10071_B_1B	Virginia	Portsmouth	19	1988	2007
Cogentrix Virginia Leasing Corp	10071_B_1C	Virginia	Portsmouth	19	1988	2007
Killen Station	6031_B_2	Ohio	Adams	615	1982	2007
Marshall	2727_B_2	North Carolina	Catawba	378	1966	2007
Marshall	2727_B_3	North Carolina	Catawba	657	1969	2007
Cogentrix Hopewell	10377_B_2A	Virginia	Hopewell (city)	18	1987	2007
Cogentrix Hopewell	10377_B_2B	Virginia	Hopewell (city)	18	1987	2007
Cogentrix Hopewell	10377_B_2C	Virginia	Hopewell (city)	18	1987	2007
Ghent	1356_B_3	Kentucky	Carroll	478	1981	2007

Louisa	6664_B_101	Iowa	Louisa	700	1983	2007
Allen S King	1915_B_1	Minnesota	Washington	571	1968	2007
Mitchell	3948_B_1	West Virginia	Marshall	800	1971	2007
Gibson	6113_B_1	Indiana	Gibson	630	1975	2007
Gibson	6113_B_2	Indiana	Gibson	628	1975	2007
Winyah	6249_B_4	South Carolina	Georgetown	270	1981	2007
Pleasant Prairie	6170_B_2	Wisconsin	Kenosha	617	1985	2007
Cross	130_B_3	South Carolina	Berkeley	620	2007	2007
Wygen II	55479_B_4	Wyoming	Campbell	90	2007	2007
Council Bluffs	1082_B_4	Iowa	Pottawattamie	790	2007	2007

Assumed BART Facilities and Units

State	County	Fac ID	Facility Name	Unit ID
MI	Bay	B2840	CE - KARN/WEADOCK	EU00036
MI	Bay	B2840	CE - KARN/WEADOCK	EU00037
MI	Eaton	B4001	LAN. BW&L ERICKSON	EU00007
MI	Houghton	B6553	UP POWER CO / PORTAGE	EU00008
MI	Huron	B2815	DTE - HARBOR BEACH	EU00009
MI	Ingham	B2647	LAN. BW&L Eckert	RG00023
MI	Ingham	B2647	LAN. BW&L Eckert	RG00023
MI	Ingham	B2647	LAN. BW&L Eckert	RG00023
MI	Ingham	B2647	LAN. BW&L Moores Park	RG00021
MI	Marquette	B4261	WE-ENERGIES	EU00029
MI	Marquette	B4261	WE-ENERGIES	EU00030
MI	Marquette	B4261	WE-ENERGIES	EU00031
MI	Marquette	B4261	WE-ENERGIES	EU00032
MI	Marquette	B4261	WE-ENERGIES	EU00033
MI	Monroe	B2816	DTE - MONROE	EU00062
MI	Monroe	B2816	DTE - MONROE	EU00068
MI	Monroe	B2816	DTE - MONROE	EU00063
MI	Monroe	B2816	DTE - MONROE	EU00064
MI	Ottawa	B2835	CE – CAMPBELL	EU00062
MI	Ottawa	B2835	CE – CAMPBELL	EU00061
MI	Saint Clair	B2796	DTE - ST. CLAIR / BELLE RIVER	EU00111
MI	Saint Clair	B6145	DTE – GREENWOOD	EU00009
MI	Wayne	B2132	WYANDOTTE	EU00036
MI	Wayne	B2185	DETROIT PLD, MISTERSKY	EU00014
MI	Wayne	B2811	DTE – TRENTON	EU00035
OH	Lake	0243160009	CEI., EASTLAKE PLANT	B005
OH		0247030013	Orion Power Midwest	B012
OH		0285010188	Dept of Public Utilities, City of Orrville	B001
OH		0285010188	Dept of Public Utilities, City of Orrville	B004
OH		0448020006	Toledo Edison Co., Bay Shore	B003
OH		0448020006	Toledo Edison Co., Bay Shore	B004
OH		0616000000	Conesville Power Plant	B003
OH		0616000000	Conesville Power Plant	B004
OH		0616000000	Conesville Power Plant	B007
OH		0641050002	Cardinal Power Plant	B001
OH		0641050002	Cardinal Power Plant	B002

OH		0641050002	Cardinal Power Plant	B003
OH		0641050002	Cardinal Power Plant	B004
OH		0641050002	Cardinal Power Plant	B008
OH		0641050002	Cardinal Power Plant	B009
OH		0641050002	Cardinal Power Plant	B009
OH	Jefferson	0641160017	W. H. SAMMIS PLANT	B011
OH	Jefferson	0641160017	W. H. SAMMIS PLANT	B012
OH	Jefferson	0641160017	W. H. SAMMIS PLANT	B013
OH		0684000000	Muskingum River Power Plant	B006
OH	Adams	0701000007	DP&L, J.M. Stuart Generating Station	B001
OH	Adams	0701000007	DP&L, J.M. Stuart Generating Station	B002
OH	Adams	0701000007	DP&L, J.M. Stuart Generating Station	B003
OH	Adams	0701000007	DP&L, J.M. Stuart Generating Station	B004
OH		0701000060	DP&L, Killen Station	B001
OH		1409040243	City of Hamilton Dept of Public Utilities	B002
OH		1409040243	City of Hamilton Dept of Public Utilities	B008
OH		1409040243	City of Hamilton Dept of Public Utilities	B009
OH		1413100008	CG&E W. C. BECKJORD	B005
OH		1413100008	CG&E W. C. BECKJORD	B006
OH		1431350093	CG&E MIAMI FORT STATION	B015
IL	Peoria	856	Ameren – Edwards	2
IL	Sangamon	963	CWLP – Dallman	31
IL	Sangamon	963	CWLP – Dallman	32
IL	Christian	876	Dominion – Kincaid	1
IL	Christian	876	Dominion – Kincaid	2
WI	COLUMBIA	111003090	Alliant Energy-Columbia Generating	B20
WI	COLUMBIA	111003090	Alliant Energy-Columbia Generating	B21
WI	COLUMBIA	111003090	Alliant Energy-Columbia Generating	B22
WI	GRANT	122014530	Alliant Energy, Nelson Dewey	B22 (unit 2)
WI	MILWAUKEE	241007690	We Energies-Oak Creek Station	B26 (Unit 6)
WI	MILWAUKEE	241007690	We Energies-Oak Creek Station	B27 (Unit 7)
WI	MILWAUKEE	241007690	We Energies-Oak Creek Station	B28
WI	MILWAUKEE	241007800	We Energies-Valley Station	B21
WI	MILWAUKEE	241007800	We Energies-Valley Station	B23
WI	MILWAUKEE	241007800	We Energies-Valley Station	B24
WI	BROWN	405031990	WI Public Service Corp - JP Pulliam	B27 (unit 8)
WI	SHEBOYGAN	460033090	WP & L Alliant Energy – Edgewater	B24
WI	BUFFALO	606034110	Dairyland Power Coop Alma Station (J.P. Madgett boilers)	B25 (+B26)
WI	BUFFALO	606034110	Dairyland Power Coop Alma Station	B27
WI	VERNON	663020930	Dairyland Power Coop Genoa Station	B20
WI	VERNON	663020930	Dairyland Power Coop Genoa Station	B25
IN	Porter	995	Bailly	7
IN	Porter	995	Bailly	8
IN	Vermillion	1001	Cayuga	1
IN	Vermillion	1001	Cayuga	2
IN	Montgomery	1024	Crawfordsville	6
IN	Warrick	1012	Culley	2

IN	Warrick	1012	Culley	3
IN	Gibson	6113	Gibson	1
IN	Gibson	6113	Gibson	2
IN	Cass	1032	Logansport	6
IN	Sullivan	6213	Merom	1
IN	Sullivan	6213	Merom	2
IN	LaPorte	997	Michigan City	12
IN	Lake	996	Mitchell	11
IN	Pike	994	Petersburg	1
IN	Pike	994	Petersburg	2
IN	Pike	994	Petersburg	3
IN	Pike	1043	Ratts	1
IN	Pike	1043	Ratts	2
IN	Wayne	7335	RPL	2
IN	Jasper	6085	Schahfer	14
IN	Jasper	6085	Schahfer	15
IN	Lake	981	Stateline	4
IN	Marion	990	Stout	70
IN	Dearborn	988	Tanners Creek	4
IN	Vigo	1010	Wabash River	6
IN	Warrick	6705	Warrick	4
IA		07-02-005	Cedar Falls Utilities	Unit #7 (EU10.1A)
IA		88-01-004	Central Iowa Power Cooperative (CIPCO) – Summit Lake Station	CombTurbines (EU 1/1G, EU2/2G)
IA		70-08-003	Central Iowa Power Cooperative (CIPCO) – Fair Station	Unit # 2 (EU 2 & EU 2G)
IA		85-01-006	City of Ames - Steam Electric Plant	Boiler #7 (EU 2)
IA		29-01-013	Interstate Power & Light - Burlington	Main Plant Boiler.
IA		03-03-001	Interstate Power & Light - Lansing	Boiler #4. Sixteen units in total.
IA		23-01-014	Interstate Power & Light - ML Kapp	Boiler #2. Six units in total.
IA		57-01-042	Interstate Power & Light - Prairie Creek	Boiler #4. Fourteen units in total.
IA		78-01-026	MidAmerican Energy Co - Council Bluffs	Boiler #3 (EU003)
IA		97-04-010	MidAmerican Energy Co - Neal North	Boilers #1-3 (EU001 - EU003)
IA		97-04-011	MidAmerican Energy Co - Neal South	Boiler #4 (EU003)
IA		70-01-011	Muscatine Power and Water	Boiler #8
IA		63-02-005	Pella Municipal Power Plant	Boilers #6-8
MN		2709900001	Austin Utilities NE Power Station	EU001
MN		2713700027	Hibbing Public Utilities	EU003
MN		2703100001	MN Power, Taconite Harbor	EU003
MN		2706100004	MN Power, Boswell Energy Center	EU003
MN		2701500010	New Ulm Public Utilities	EU003 - Boiler 4
MN		2711100002	Otter Tail Power Hoot Lake	EU003
MN		2710900011	Rochester Public Utilities, Silver Lake	EU003
MN		2710900011	Rochester Public Utilities, Silver Lake	EU004
MN		2713700028	Virginia Public Utilities	EU003 - Boiler 9
MN		2714100004	Xcel Energy, Sherco	EU001, EU002
MN		2716300005	Xcel Energy, Allen S King	EU001 - Boiler 1

MN		2705300015	Xcel Energy, Riverside	EU003 - Boiler 8
MO		290710003	Ameren -Labadie	B1, B2, B3, B4
MO		291830001	Ameren - Sioux	B1, B2
MO		290990016	Ameren - Rush Island	B1, B2
MO		290950031	Auila - Sibley	B3 - 5C
MO		291430004	Assoc. Electric - New Madrid	B1(EP-01), B2 (EP-02)
MO		290770039	City Utilities Springfield - Southwest	B1 (E09)
MO		290770005	City Utilities Springfield - James River	EO7, EO8
MO		290970001	Empire Distric Electric - Asbury	B7
MO		290830001	KC Power and Light - Montrose	EP08
MO		290210004	Aqula - Lake Road	EP06
MO		291750001	Assoc. Electric - Thomas Hill	EP01, EP02
MO		290950021	Trigen - Kansas City	B1A
MO		290190002	City of Columbia Municipal Power Plant	EP02
MO		291950010	Marshall Munipal Utilities	EP05
MO		290950050	Independence Power & Light-Blue Valley	B3 (EP05)
WV		3943	Fort Martin	
WV		6004	Pleasants	
WV		3948	Mitchell	
WV		3935	Amos	
WV		6264	Mountaineer	
WV		3944	Harrison	
TN		3396	TVA Bull Run	
TN		3399	TVA Cumberland	
KY		1363	Cane Run	
KY		1364	Mill Creek	
KY		6041	Spurlock	
KY		1384	John Sherman Cooper	
KY		1353	Big Sandy	
KY		1356	Ghent	
KY		1355	Brown	
KY		1374	Owensboro Municipal	
KY		1372	Henderson Municipal	
KY		1378	Paradise	
KY		1361	Coleman	
KY		1382	Reid/Henderson 2	
KY		6639	Green	

Regional Air Quality Analyses for Ozone, $PM_{2.5}$, and Regional Haze:

Final Technical Support Document

April 25, 2008

States of Illinois, Indiana, Michigan, Ohio, and Wisconsin

Table of Contents

EXECUTIVE SUMMARY

States in the upper Midwest face a number of air quality challenges. More than 50 counties are currently classified as nonattainment for the 8-hour ozone standard and 60 for the fine particle ($PM_{2.5}$) standard (1997 versions). A map of these nonattainment areas is provided in the figure below. In addition, visibility impairment due to regional haze is a problem in the larger national parks and wilderness areas (i.e., Class I areas). There are 156 Class I areas in the U.S., including two in northern Michigan.

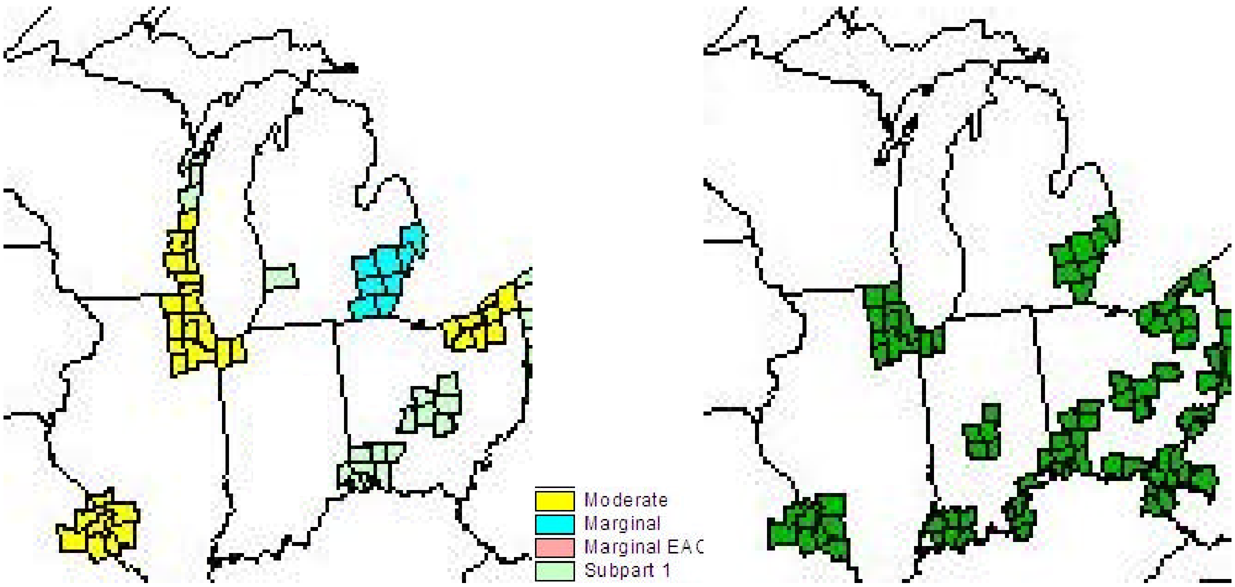


Figure i. Current nonattainment counties for ozone (left) and $PM_{2.5}$ (right)

To support the development of State Implementation Plans (SIPs) for ozone, $PM_{2.5}$, and regional haze in the States of Illinois, Indiana, Michigan, Ohio, and Wisconsin, technical analyses were conducted by the Lake Michigan Air Directors Consortium (LADCO), its member states, and various contractors. The analyses include preparation of regional emissions inventories and meteorological data, evaluation and application of regional chemical transport models, and collection and analysis of ambient monitoring data.

Monitoring data were analyzed to produce a conceptual understanding of the air quality problems. Key findings of the analyses include:

Ozone

- Current monitoring data (2005-2007) show about 20 sites in violation of the 8-hour ozone standard of 85 parts per billion (ppb). Historical ozone data show a steady downward trend over the past 15 years, especially since 2001-2003, due likely to federal and state emission control programs.

- Ozone concentrations are strongly influenced by meteorological conditions, with more high ozone days and higher ozone levels during summers with above normal temperatures.

- Inter- and intra-regional transport of ozone and ozone precursors affects many portions of the five states, and is the principal cause of nonattainment in some areas far from population or industrial centers.

$PM_{2.5}$

- Current monitoring data (2005-2007) show 30 sites in violation of the annual $PM_{2.5}$ standard of 15 ug/m^3. Nonattainment sites are characterized by an elevated regional background (about 12 – 14 ug/m^3) and a significant local (urban) increment (about 2 – 3 ug/m^3). Historical $PM_{2.5}$ data show a slight downward trend since deployment of the $PM_{2.5}$ monitoring network in 1999.

- $PM_{2.5}$ concentrations are also influenced by meteorology, but the relationship is more complex and less well understood compared to ozone.

- On an annual average basis, $PM_{2.5}$ chemical composition consists mostly of sulfate, nitrate, and organic carbon in similar proportions.

Haze

- Current monitoring data (2000-2004) show visibility levels in the Class I areas in northern Michigan are on the order of 22 – 24 deciviews. The goal of EPA's visibility program is to achieve natural conditions, which is about 12 deciviews for these Class I areas, by the year 2064.

- Visibility impairment is dominated by sulfate and nitrate.

Air quality models were applied to support the regional planning efforts. Two base years were used in the modeling analyses: 2002 and 2005. Basecase modeling was conducted to evaluate model performance (i.e., assess the model's ability to reproduce observed concentrations). This exercise was intended to build confidence in the model prior to its use in examining control strategies. Model performance for ozone and $PM_{2.5}$ was found to be generally acceptable.

Future year strategy modeling was conducted to determine whether existing ("on the books") controls would be sufficient to provide for attainment of the standards for ozone and $PM_{2.5}$ and if not, then what additional emission reductions would be necessary for attainment. Based on the modeling and other supplemental analyses, the following general conclusions can be made:

- Existing controls are expected to produce significant improvement in ozone and $PM_{2.5}$ concentrations and visibility levels.

- The choice of the base year affects the future year model projections. A key difference between the base years of 2002 and 2005 is meteorology. 2002 was more ozone conducive than 2005. The choice of which base year to use as the basis for the SIP is a policy decision (i.e., how much safeguard to incorporate).

- Modeling suggests that most sites are expected to meet the current 8-hour ozone standard by the applicable attainment date, except for sites in western Michigan and, possibly, in eastern Wisconsin and northeastern Ohio.

- Modeling suggests that most sites are expected to meet the current $PM_{2.5}$ standard by the applicable attainment date, except for sites in Detroit, Cleveland, and Granite City.

  The regional modeling for $PM_{2.5}$ does not include air quality benefits expected from local controls. States are conducting local-scale analyses and will use these results, in conjunction with the regional-scale modeling, to support their attainment demonstrations for $PM_{2.5}$.

- These findings of residual nonattainment for ozone and $PM_{2.5}$ are supported by current (2005 – 2007) monitoring data which show significant nonattainment in the region (e.g., peak ozone design values on the order of 90 – 93 ppb, and peak $PM_{2.5}$ design values on the order of 16 - 17 ug/m^3). It is unlikely that sufficient emission reductions will occur in the next couple of years to provide for attainment at all sites.

- Attainment at most sites by the applicable attainment date is dependent on actual future year meteorology (e.g., if the weather conditions are consistent with [or less severe than] 2005, then attainment is likely) and actual future year emissions (e.g., if the emission reductions associated with the existing controls are achieved, then attainment is likely). If either of these conditions is not met, then attainment may be less likely.

- Modeling suggests that the new $PM_{2.5}$ 24-hour standard and the new lower ozone standard will not be met at several sites, even by 2018, with existing controls.

- Visibility levels in a few Class I areas in the eastern U.S. are expected to be greater than (less improved than) the uniform rate of visibility improvement values in 2018 based on existing controls, including those in northern Michigan and some in the northeastern U.S. Visibility levels in many other Class I areas in the eastern U.S. are expected to be less than (more improved than) the uniform rate of visibility improvement values in 2018. These results, along with information on the costs of compliance, time necessary for compliance, energy and non air quality environmental impacts of compliance, and remaining useful life of existing sources, should be considered by the states in setting reasonable progress goals for regional haze.

Section 1.0 Introduction

This Technical Support Document summarizes the final air quality analyses conducted by the Lake Michigan Directors Consortium (LADCO)[1] and its contractors to support the development of State Implementation Plans (SIPs) for ozone, fine particles ($PM_{2.5}$), and regional haze in the States of Illinois, Indiana, Michigan, Ohio, and Wisconsin. The analyses include preparation of regional emissions inventories and meteorological modeling data for two base years (2002 and 2005), evaluation and application of regional chemical transport models, and analysis of ambient monitoring data.

Two aspects of the analyses should be emphasized. First, a regional, multi-pollutant approach was taken in addressing ozone, $PM_{2.5}$, and haze for technical reasons (e.g., commonality in precursors, emission sources, atmospheric processes, transport influences, and geographic areas of concern), and practical reasons (e.g., more efficient use of program resources). Furthermore, EPA has consistently encouraged multi-pollutant planning in its rule for the haze program (64 FR 35719), and its implementation guidance for ozone (70 FR 71663) and $PM_{2.5}$ (72 FR 20609). Second, a weight-of-evidence approach was taken in considering the results of the various analyses (i.e., two sets of modeling results -- one for a 2002 base year and one for a 2005 base year -- and ambient data analyses) in order to provide a more robust assessment of expected future year air quality.

The report is organized in the following sections. This Introduction provides an overview of regulatory requirements and background information on regional planning. Section 2 reviews the ambient monitoring data and presents a conceptual model of ozone, $PM_{2.5}$, and haze for the region. Section 3 discusses the air quality modeling analyses, including development of the key model inputs (emissions inventory and meteorological data), and basecase model performance evaluation. A modeled attainment demonstration for ozone and $PM_{2.5}$ is presented in Section 4, along with relevant data analyses considered as part of the weight-of-evidence determination. Section 5 documents the reasonable progress assessment for regional haze, along with relevant data analyses considered as part of the weight-of-evidence determination. Finally, key study findings are reviewed and summarized in Section 6.

1.1 SIP Requirements

For ozone, EPA promulgated designations on April 15, 2004 (69 FR 23858, April 30, 2004). In the 5-state region, more than 100 counties were designated as nonattainment.[2] The designations became effective on June 15, 2004. SIPs for ozone were due no later than three years from the effective date of the nonattainment designations (i.e., by June 2007). The attainment date for ozone varies as a function of nonattainment classification. For the region, the attainment dates are either June 2007 (marginal nonattainment areas), June 2009 (basic nonattainment areas), or June 2010 (moderate nonattainment areas).

[1] A sub-entity of LADCO, known as the Midwest Regional Planning Organization (MRPO), is responsible for the regional haze activities of the multi-state organization.

[2] Based on more recent air quality data, many counties in Indiana, Michigan, and Ohio were subsequently redesignated as attainment. As of December 31, 2007, there are 53 counties designated as nonattainment in the region.

For $PM_{2.5}$, EPA promulgated designations on December 17, 2004 (70 FR 944, January 5, 2005). In the 5-state region, 70 counties were designated as nonattainment.[3] The designations became effective on April 5, 2005. SIPs for $PM_{2.5}$ are due no later than three years from the effective date of the nonattainment designations (per section 172(b) of the Clean Air Act) (i.e., by April 2008) and for haze no later than three years after the date on which the Administrator promulgated the $PM_{2.5}$ designations (per the Omnibus Appropriations Act of 2004) (i.e., by December 2007). The applicable attainment date for $PM_{2.5}$ nonattainment areas is five years from the date of the nonattainment designation (i.e., by April 2010).

For haze, the Clean Air Act sets "as a national goal the prevention of any future, and the remedying of any existing, impairment of visibility in Class I areas which impairment results from manmade air pollution." There are 156 Class I areas, including two in northern Michigan: Isle Royale National Park and Seney National Wildlife Refuge[4]. EPA's visibility rule (64 FR 35714, July 1, 1999) requires reasonable progress in achieving "natural conditions" by the year 2064. As noted above, the first regional haze SIP was due in December 2007 and must address the initial 10-year implementation period (i.e., reasonable progress by the year 2018). SIP requirements (pursuant to 40 CFR 51.308(d)) include setting reasonable progress goals, determining baseline conditions, determining natural conditions, providing a long-term control strategy, providing a monitoring strategy (air quality and emissions), and establishing BART emissions limitations and associated compliance schedule.

1.2 Organization

LADCO was established by the States of Illinois, Indiana, Michigan, and Wisconsin in 1989. The four states and EPA signed a Memorandum of Agreement (MOA) that initiated the Lake Michigan Ozone Study (LMOS) and identified LADCO as the organization to oversee the study. Additional MOAs were signed by the States in 1991 (to establish the Lake Michigan Ozone Control Program), January 2000 (to broaden LADCO's responsibilities), and June 2004 (to update LADCO's mission and reaffirm the commitment to regional planning). In March 2004, Ohio joined LADCO. LADCO consists of a Board of Directors (i.e., the State Air Directors), a technical staff, and various workgroups. The main purposes of LADCO are to provide technical assessments for and assistance to its member states, and to provide a forum for its member states to discuss regional air quality issues.

MRPO is a similar entity led by the five LADCO States and involves the federally recognized tribes in Michigan and Wisconsin, EPA, and Federal Land Managers (i.e., National Park Service, U.S. Fish & Wildlife Agency, and U.S. Forest Service). In October 2000, the States of Illinois, Indiana, Michigan, Ohio, and Wisconsin signed an MOA that established the MRPO. An operating principles document for MRPO, which describe the roles and responsibilities of states, tribes, federal agencies, and stakeholders, was issued in March 2001. MRPO has a similar purpose as LADCO, but is focused on visibility impairment due to regional haze in the Federal Class I areas located inside the borders of the five states, and the impact of emissions from the five states on visibility impairment due to regional haze in the Federal Class I areas located outside the borders of the five states. MRPO works cooperatively with the Regional Planning Organizations (RPOs) representing other parts of the country. The RPOs sponsored several

[3] USEPA subsequently adjusted the final designations, which resulted in 63 counties in the region being designated as nonattainment (70 FR 19844, April 15, 2005).

[4] Although Rainbow Lake in northern Wisconsin is also a Class I area, the visibility rule does not apply because the Federal Land Manager determined that visibility is not an air quality related value there.

joint projects and, with assistance by EPA, maintain regular contact on technical and policy matters.

1.3 Technical Work: Overview

To ensure the reliability and effectiveness of its planning process, LADCO has made data collection and analysis a priority. More than $7M in RPO grant funds were used for special purpose monitoring, preparing and improving emissions inventories, and conducting air quality analyses[5]. An overview of the technical work is provided below.

Monitoring: Numerous monitoring projects were conducted to supplement on-going state and local air pollution monitoring. These projects include rural monitoring (e.g., comprehensive sampling in the Seney National Wildlife Refuge and in Bondville, IL); urban monitoring (e.g., continuation of the St. Louis Supersite); aloft (aircraft) measurements; regional ammonia monitoring; and organic speciation sampling in Seney, Bondville, and five urban areas.

Emissions: Baseyear emissions inventories were prepared for 2002 and 2005. States provided point source and area source emissions data, and MOBILE6 input files and mobile source activity data. LADCO and its contractors developed the emissions data for other source categories (e.g., select nonroad sources, ammonia, fires, and biogenics) and processed the data for input into an air quality model. To support control strategy modeling, future year inventories were prepared. The future years of interest include 2008 (planning year to address the 2009 attainment year for basic ozone nonattainment ares), 2009 (planning year to address the 2010 attainment year for $PM_{2.5}$ and moderate ozone nonattainment areas), 2012 (planning to address a 2013 alternative attainment date), and 2018 (first milestone year for regional haze).

Air Quality Analyses: The weight-of-evidence approach relies on data analysis and modeling. Air quality data analyses were used to provide both a conceptual model (i.e., a qualitative description of the ozone, $PM_{2.5}$, and regional haze problems) and supplemental information for the attainment demonstration. Given uncertainties in emissions inventories and modeling, especially for $PM_{2.5}$, these data analyses are a necessary part of the overall technical support.

Modeling includes baseyear analyses for 2002 and 2005 to evaluate model performance and future year strategy analyses to assess candidate control strategies. The analyses were conducted in accordance with EPA's modeling guidelines (EPA, 2007a). The PM/haze modeling covers the full calendar year (2002 and 2005) for an eastern U.S. 36 km domain, while the ozone modeling focuses on the summer period (2002 and 2005) for a Midwest 12 km subdomain. The same model (CAMx) was used for ozone, $PM_{2.5}$, and regional haze.

[5] Since 1999, MRPO has received almost $10M in RPO grant funds from USEPA.

Section 2.0 Ambient Data Analyses

An extensive network of air quality monitors in the 5-state region provides data for ozone (and its precursors), $PM_{2.5}$ (both total mass and individual chemical species), and visibility. These data are used to determine attainment/nonattainment designations, support SIP development, and provide air quality information to public (see, for example, www.airnow.gov).

Analyses of the data were conducted to produce a conceptual model, which is a qualitative summary of the physical, chemical, and meteorological processes that control the formation and distribution of pollutants in a given region. This section reviews the relevant data analyses and describes our understanding of ozone, $PM_{2.5}$, and regional haze with respect to current conditions, data variability (spatial, temporal, and chemical), influence of meteorology (including transport patterns), precursor sensitivity, and source culpability.

2.1 Ozone

In 1979, EPA adopted an ozone standard of 0.12 ppm, averaged over a 1-hour period. This standard is attained when the number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is equal to or less than 1.0, averaged over a 3-year period, which generally reflects a design value (i.e., the 4^{th} highest daily 1-hour value over a 3-year period) less than 0.12 ppm.

In 1997, EPA tightened the ozone standard to 0.08 ppm, averaged over an 8-hour period[6]. The standard is attained if the 3-year average of the 4th-highest daily maximum 8-hour average ozone concentrations (i.e., the design value) measured at each monitor within an area is less than 0.08 ppm (or 85 ppb).

Current Conditions: A map of the 8-hour ozone design values at each monitoring site in the region for the 3-year period 2005-2007 is shown in Figure 1. The "hotter" colors represent higher concentrations, where yellow and orange dots represent sites with design values above the standard. Currently, there are 19 sites in violation of the 8-hour ozone NAAQS in the 5-state region, including sites in the Lake Michigan area, Detroit, Cleveland, Cincinnati, and Columbus.

Table 1 provides the 4^{th}-highest daily 8-hour ozone values and the associated design values since 2001 for several high monitoring sites throughout the region.

[6] On March 12, 2008, USEPA further tightened the 8-hour ozone standard to increase public health protection and prevent environmental damage from ground-level ozone. USEPA set the primary (health) standard and secondary (welfare) standard at the same level: 0.075 ppm (75 ppb), averaged over an 8-hour period.

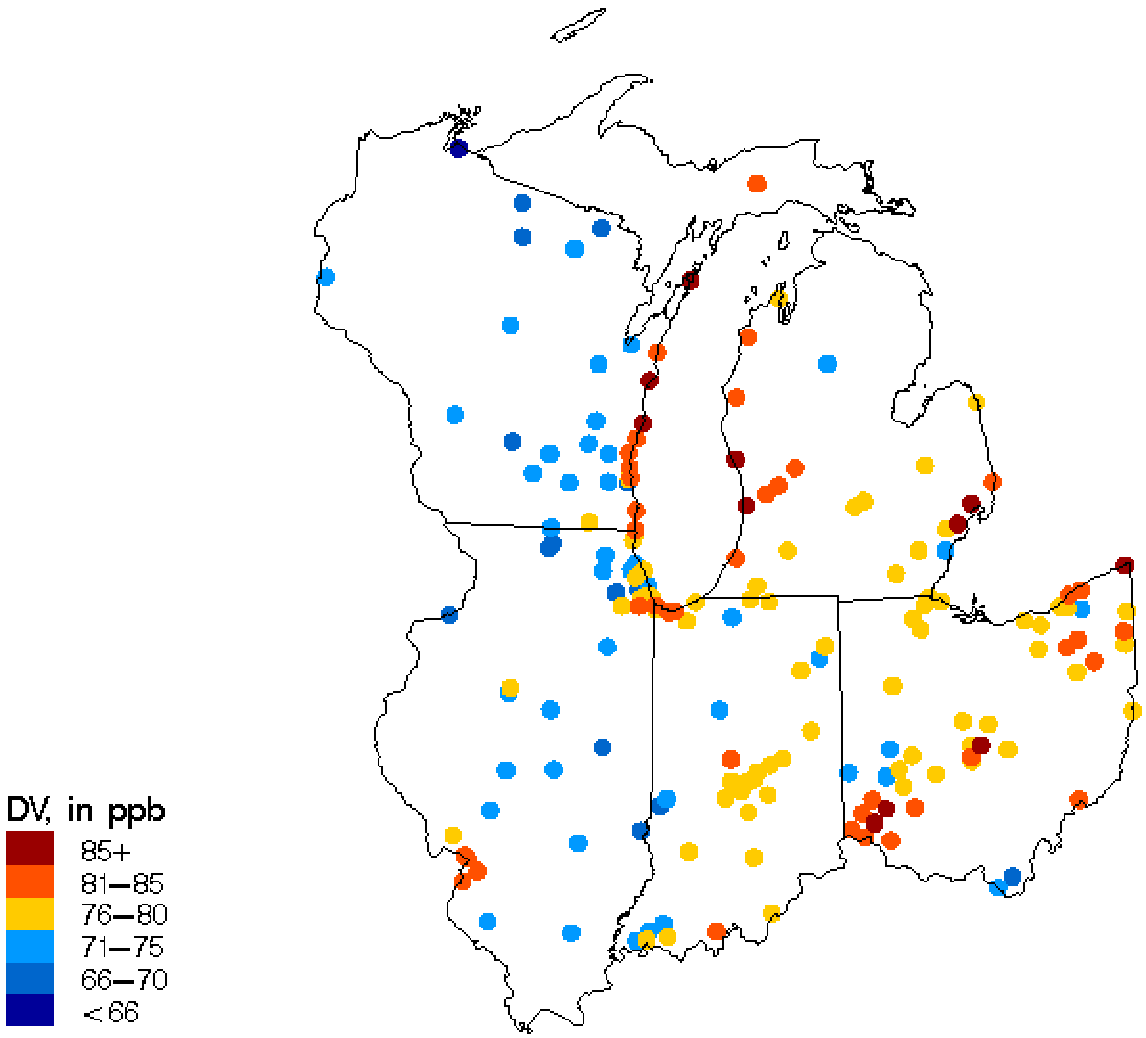


Figure 1. 8-hour ozone design values (2005-2007)

Table 1. Ozone Data for Select Sites in 5-State Region

Key Sites	4th High 8-hour Value								Design Values				
	'01	'02	'03	'04	'05	'06	'07		'01-'03	'02-'04	'03-'05	'04-'06	'05-'07
Lake Michigan Area													
Chiwaukee	99	116	88	78	93	79	85		101	94	86	83	85
Racine	92	111	82	69	95	71	77		95	87	82	78	81
Milwaukee-Bayside	93	99	92	73	93	73	83		94	88	86	79	83
Harrington Beach	102	93	99	72	94	72	84		98	88	88	79	83
Manitowoc	97	83	92	74	95	78	85		90	83	87	82	86
Sheboygan	102	105	93	78	97	83	88		100	92	89	86	89
Kewaunee	90	92	97	73	88	76	85		93	87	86	*79*	83
Door County	95	95	93	78	101	79	92		94	88	90	86	90
Hammond	90	101	81	67	87	75	77		90	83	78	76	79
Whiting				64	88	81	88					77	85
Michigan City	90	107	82	70	84	75	73		93	86	78	76	77
Ogden Dunes	85	101	77	69	90	70	84		87	82	78	76	81
Holland	92	105	96	79	94	91	94		97	93	89	88	93
Jenison	86	93	91	69	86	83	88		90	84	82	79	85
Muskegon	95	96	94	70	90	90	86		95	86	84	83	88
Indianapolis Area													
Noblesville	88	101	101	75	87	77	84		96	92	87	79	82
Fortville	89	101	92	72	80	75	81		94	88	81	75	78
Fort B. Harrison	87	100	91	73	80	76	83		92	88	81	76	79
Detroit Area													
New Haven	95	95	102	81	88	78	93		97	92	90	82	86
Warren	94	92	101	71	89	78	91		95	88	87	79	86
Port Huron	84	100	87	74	88	78	89		90	87	83	80	85
Cleveland Area													
Ashtabula (Conneaut)	97	103	99	81	93	86	92		99	94	91	86	90
Notre Dame (Geauga)	99	115	97	75	88	70	68		103	95	86	77	75
Eastlake (Lake)	89	104	92	79	97	83	74		95	91	89	86	84
Akron (Summit)	98	103	89	77	89	77	91		96	89	85	81	85
Cincinnati Area													
Wilmington (Clinton)	93	99	96	78	83	81	82		96	91	85	80	82
Sycamore (Hamilton)	88	100	93	76	89	81	90		93	89	86	82	86
Hamilton (Butler)	83	100	94	75	86	79	91		92	89	85	80	85
Middleton (Butler)	87	98	83	76	88	76	91		89	85	82	80	85
Lebanon (Warren)	85	98	95	81	92	86	88		92	91	89	86	88
Columbus Area													
London (Madison)	84	97	90	75	81	76	83		90	87	82	77	80
New Albany (Franklin)	90	103	94	78	92	82	87		95	91	88	84	87
Franklin (Franklin)	83	99	84	73	86	79	79		88	85	81	79	81
Ohio Other Areas													
Marietta (Washington)	85	95	80	77	88	81	86		86	84	81	82	85
St. Louis Area													
W. Alton (MO)	85	99	91	77	89	91	89		91	89	85	85	89
Orchard (MO)	88	98	90	76	92	92	83		92	88	86	86	89
Sunset Hills (MO)	88	98	88	70	89	80	89		91	85	82	79	86
Arnold (MO)	86	93	82	70	92	79	87		87	81	81	80	86
Margaretta (MO)	80	98	90	72	91	76	91		89	86	84	79	86
Maryland Heights (MO)					88	84	94						88

Meteorology and Transport: Most pollutants exhibit some dependence on meteorological factors, especially wind direction, because that governs which sources are upwind and thus most influential on a given sample. Ozone is even more dependent, since its production is driven by high temperatures and sunlight, as well as precursor concentrations (see, for example, Figure 2).

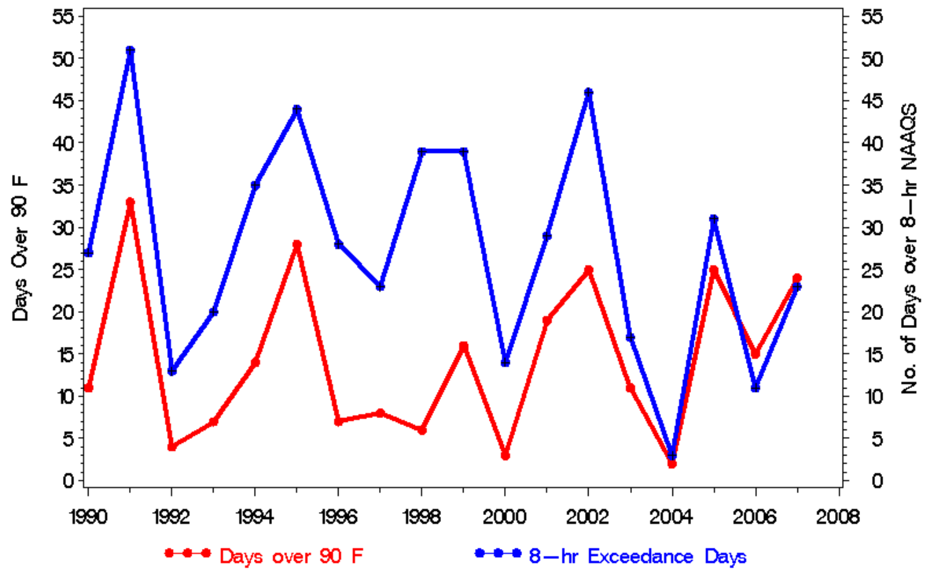


Figure 2. Number of hot days and 8-hour "exceedance" days in 5-state region

Qualitatively, ozone episodes in the region are associated with hot weather, clear skies (sometimes hazy), low wind speeds, high solar radiation, and southerly to southwesterly winds. These conditions are often a result of a slow-moving high pressure system to the east of the region. The relative importance of various meteorological factors is discussed later in this section.

Transport of ozone (and its precursors) is a significant factor and occurs on several spatial scales. Regionally, over a multi-day period, somewhat stagnant summertime conditions can lead to the build-up in ozone and ozone precursor concentrations over a large spatial area. This pollutant air mass can be advected long distances, resulting in elevated ozone levels in locations far downwind. An example of such an episode is shown in Figure 3.

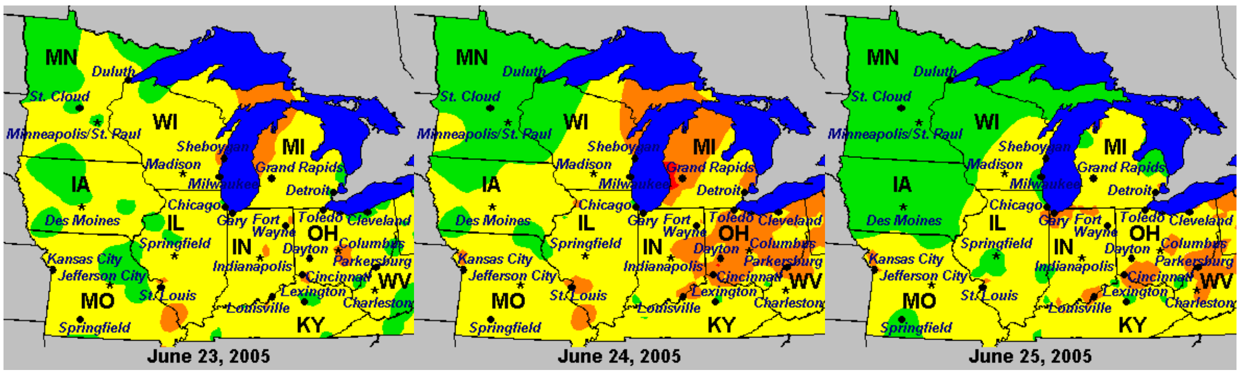


Figure 3. Example of elevated regional ozone concentrations (June 23 – 25, 2005)

Note: hotter colors represent higher concentrations, with orange representing concentrations above the 8-hour standard

Locally, emissions from urban areas add to the regional background leading to ozone concentration hot spots downwind. Depending on the synoptic wind patterns (and local land-lake breezes), different downwind areas are affected (see, for example, Figure 4).

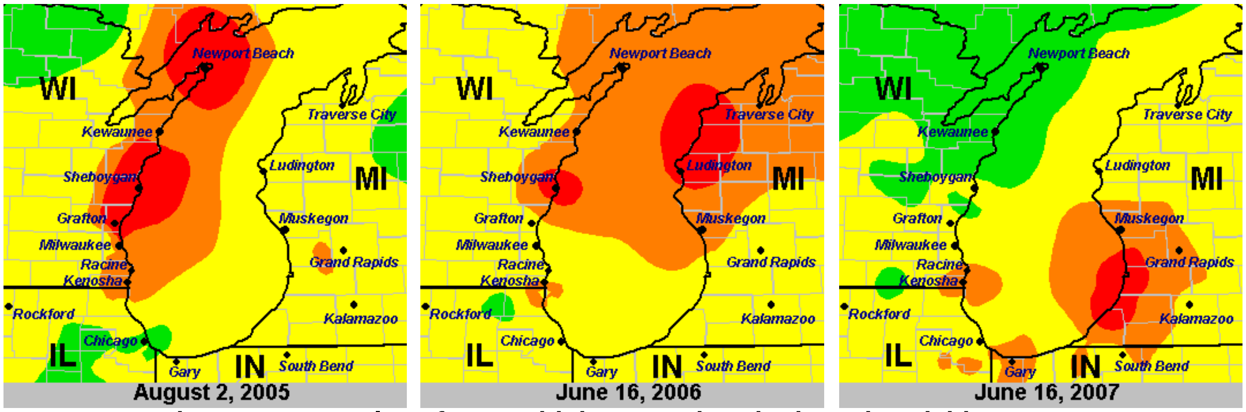


Figure 4. Examples of recent high ozone days in the Lake Michigan area

Note: hotter colors represent higher concentrations, with orange representing concentrations above the 8-hour standard

Aloft (aircraft) measurements in the Lake Michigan area also provide evidence of elevated regional background concentrations and "plumes" from urban areas. For one example summer day (August 20, 2003 – see Figure 5), the incoming background ozone levels were on the order of 80 – 100 ppb and the downwind ozone levels over Lake Michigan were on the order of 100 - 150 ppb (STI, 2004).

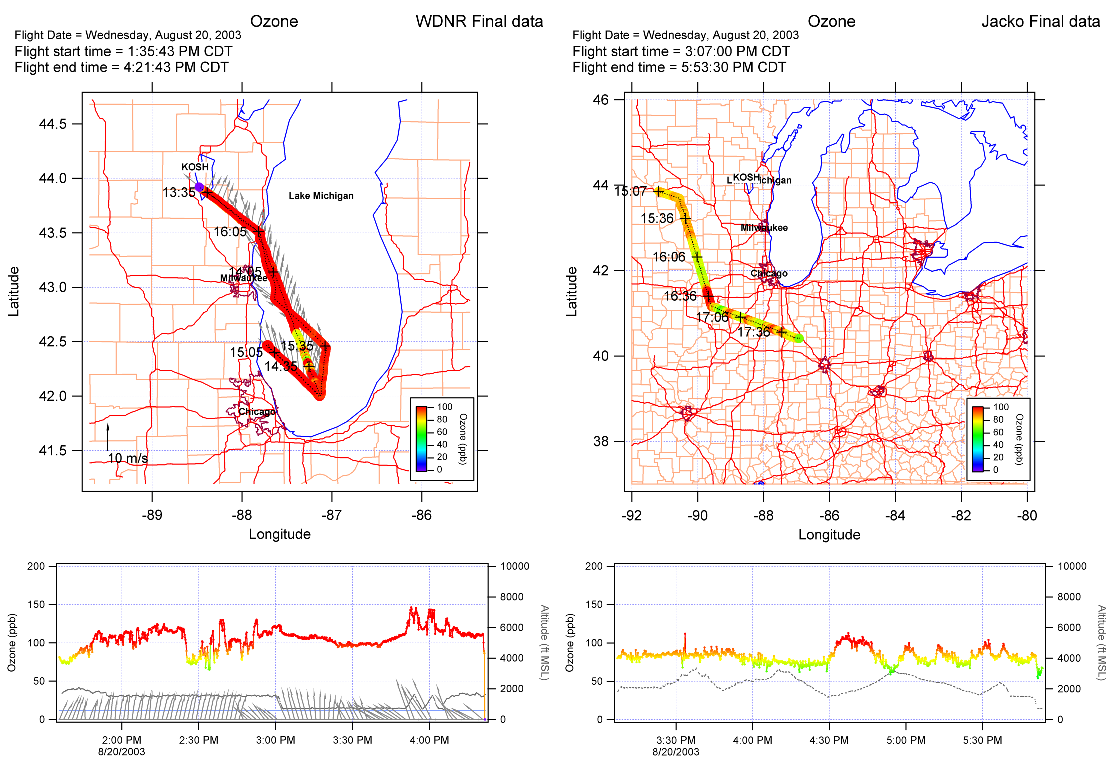


Figure 5. Aircraft ozone measurements over Lake Michigan (left) and along upwind boundary (right) – August 20, 2003 (Note: aircraft measurements reflect instantaneous values)

As discussed in Section 4, residual nonattainment is projected in at least one area in the 5-state region –i.e., western Michigan. To understand the source regions likely impacting high ozone concentrations in western Michigan and estimate the impact of these source regions, two simple transport-related analyses were performed.

First, back trajectories were constructed using the HYSPLIT model for high ozone days (8-hour peak > 80 ppb) during the period 2002-2006 in western Michigan to characterize general transport patterns. Composite trajectory plots for all high ozone days based on data from three sites (Cass County, Holland, and Muskegon) are provided in Figure 6. The plots point back to areas located to the south-southwest (especially, northeastern Illinois and northwestern Indiana) as being upwind on these high ozone days.

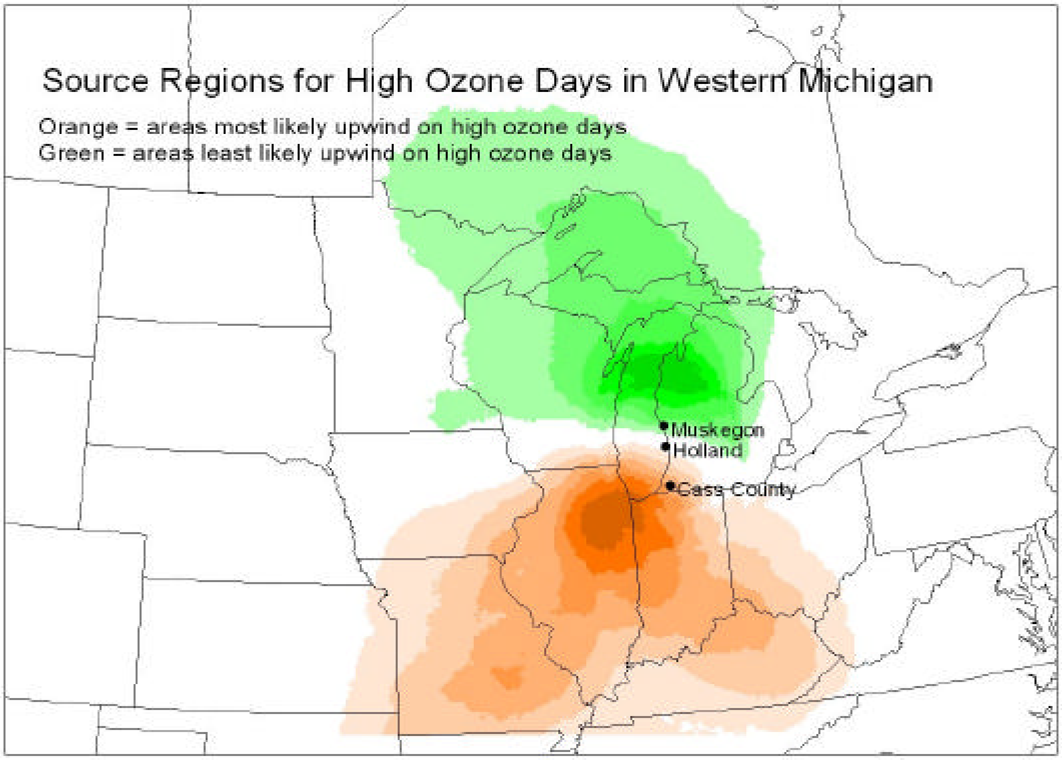


Figure 6 Back trajectory analysis showing upwind areas associated with high ozone concentrations

Second, to assess the impact from Chicago/NW Indiana, Blanchard (2005a) compared ozone concentrations upwind (Braidwood, IL), within Chicago (ten sites in the City), and downwind (Holland and Muskegon) for days in 1999 – 2002 with southwesterly winds - i.e., transport towards western Michigan. Figure 7 shows the distribution of daily peak 8-hour ozone concentrations by day-of-week, with a line connecting the mean values. The difference between day-of-week mean values at downwind and upwind sites indicates that Chicago/NW Indiana contributes about 10-15 ppb to downwind ozone levels.

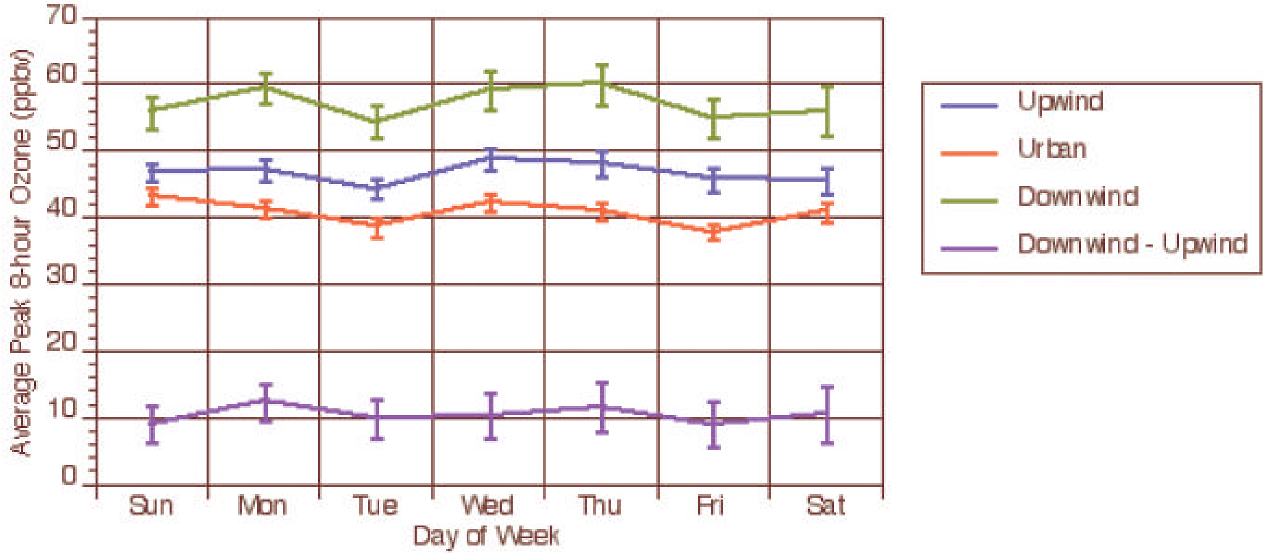


Figure 7. Mean day-of-week peak 8-hour ozone concentrations at sites upwind, within, and downwind of Chicago, 1999 – 2002 (southwesterly wind days)

Based on this information, the following key findings related to transport can be made:

- Ozone transport is a problem affecting many portions of the eastern U.S. The Lake Michigan area (and other areas in the LADCO region) both receive high levels of incoming (transported) ozone and ozone precursors from upwind source areas on many hot summer days, and contribute to the high levels of ozone and ozone precursors affecting downwind receptor areas.

- The presence of a large body of water (i.e., Lake Michigan) influences for the formation and transport of ozone in the Lake Michigan area. Depending on large-scale synoptic winds and local-scale lake breezes, different parts of the area experience high ozone concentrations. For example, under southerly flow, high ozone can occur in eastern Wisconsin, and under southwesterly flow, high ozone can occur in western Michigan.

- Downwind shoreline areas around Lake Michigan are affected by both regional transport of ozone and subregional transport from major cities in the Lake Michigan area. Counties along the western shore of Michigan (from Benton Harbor to Traverse City, and even as far north as the Upper Peninsula) are impacted by high levels of incoming (transported) ozone.

Data Variability: Since 1980, considerable progress has been made to meet the previous 1-hour ozone standard. Figure 8 shows the decline in both the 1-hour and 8-hour design values for the 5-state LADCO region over the last 25 years.

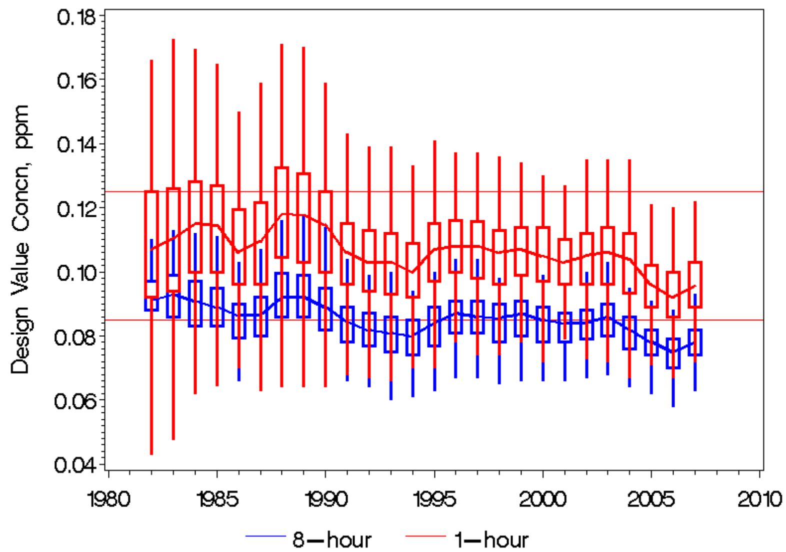


Figure 8 Ozone design value trends in 5-State region

The trend is more dramatic for the higher ozone sites in the 5-state region (see Figure 9). This plot shows a pronounced downward trend in the design value since the 2001-2003 period, due, in part, to the very low 4th high values in 2004.

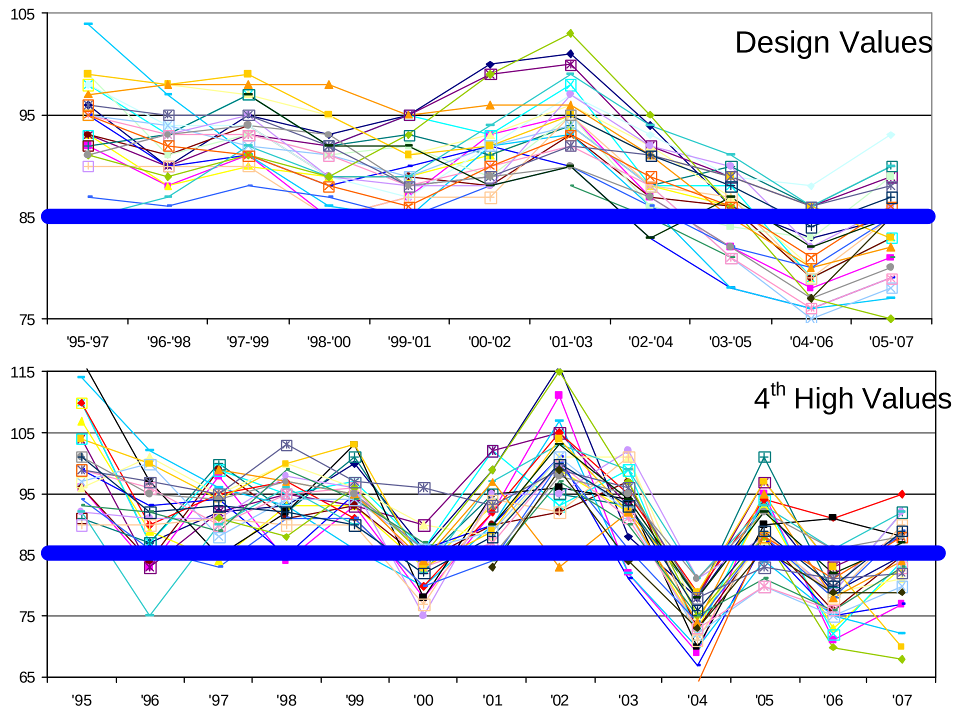


Figure 9. Trend in ozone design values and 4th high values for higher ozone sites in region

The improvement in ozone concentrations is also seen in the decrease in the number of sites measuring nonattainment over the past 15 years in the Lake Michigan area (see Figure 10).

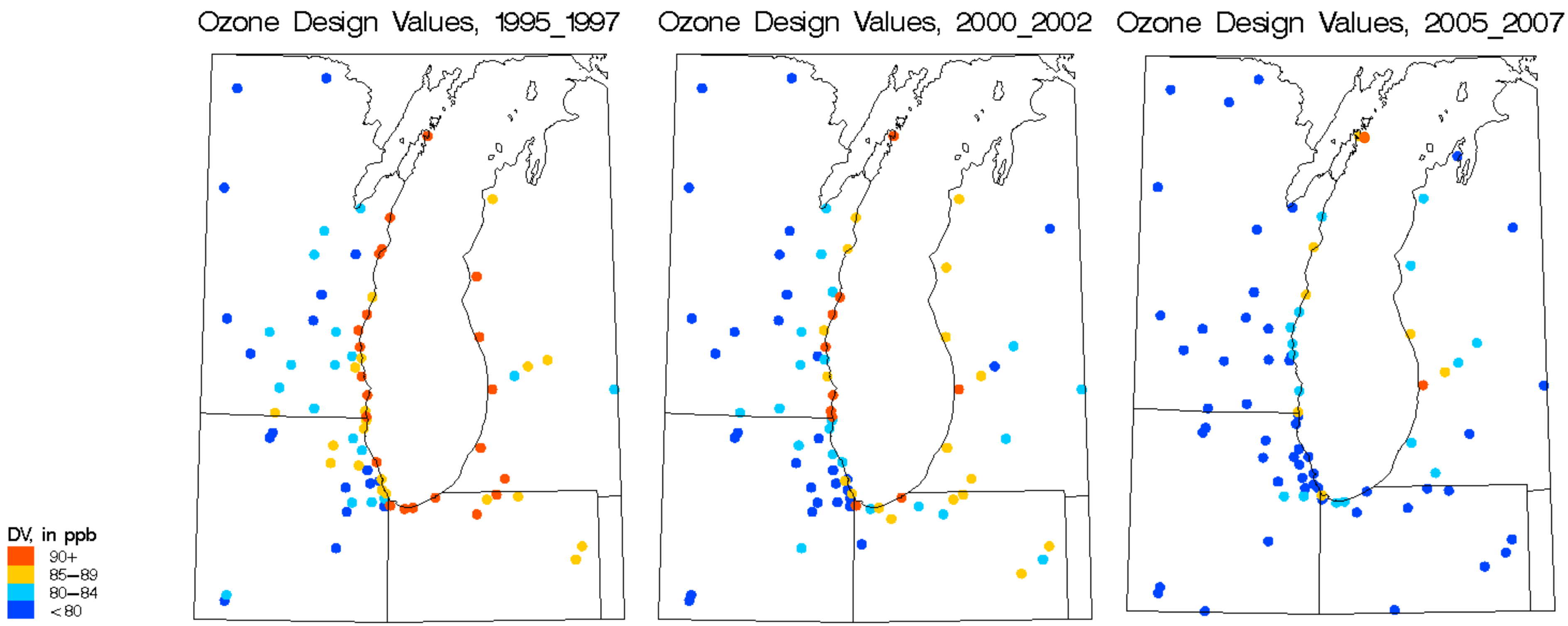


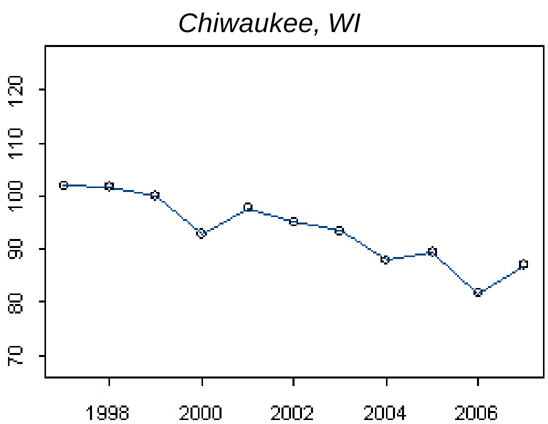
Figure 10. Ozone design value maps for 1995-1997, 2000-2002, and 2005-2007

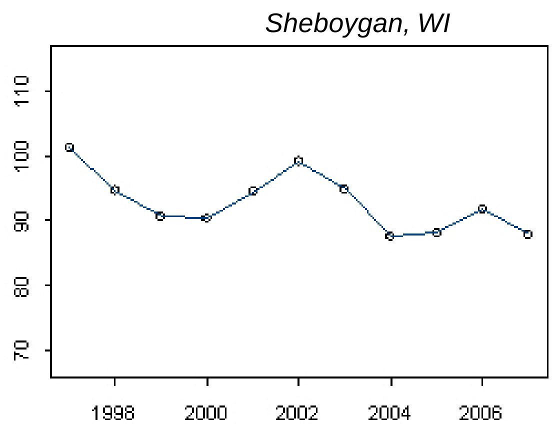
Given the effect of meteorology on ambient ozone levels, year-to-year variations in meteorology can make it difficult to assess trends in ozone air quality. Two approaches were considered to adjust ozone trends for meteorological influences: an air quality-meteorology statistical model developed by EPA (i.e., Cox method), and statistical grouping of meteorological variables performed by LADCO (i.e., Classification and Regression Trees, or CART).

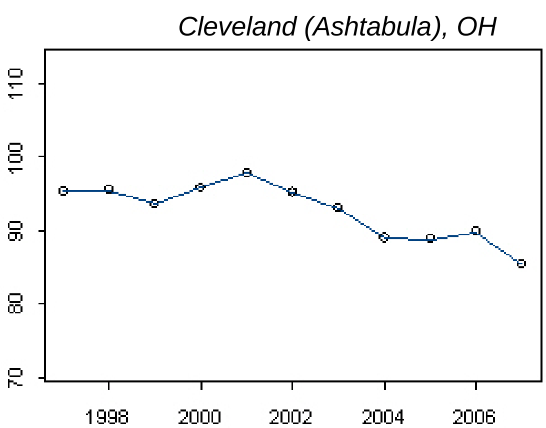
Cox Method: This method uses a statistical model to 'remove' the annual effect of meteorology on ozone (Cox and Chu, 1993). A regression model was fit to the 1997-2007 data to relate daily peak 8-hour ozone concentrations to six daily meteorological variables plus seasonal and annual factors (Kenski, 2008a). Meteorological variables included were daily maximum temperature, mid-day average relative humidity, morning and afternoon wind speed and wind direction. The model is then used to predict 4^{th} high ozone values. By holding the meteorological effects constant, the long term trend can be examined independently of meteorology. Presumably, any trend reflects changes in emissions of ozone precursors.

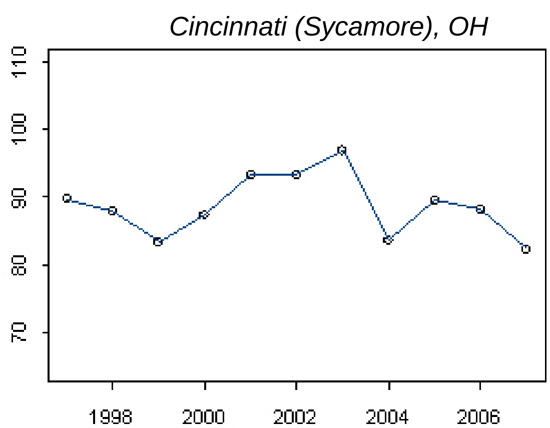
Figure 11a shows the meteorologically-adjusted 4^{th} high ozone concentrations for several monitors near major urban areas in the region. The plots indicate a general downward trend since the late 1990s for most cities, indicating that recent emission reductions have had a positive effect in improving ozone air quality.

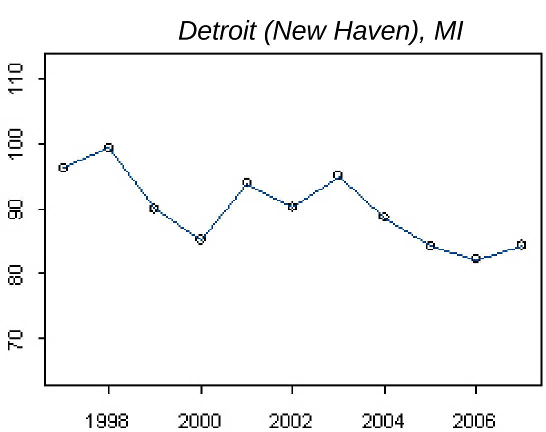
A similar model was run to examine meteorologically adjusted trends in seasonal average ozone. This model incorporates more meteorological variables, including rain and long-distance transport (direction and distance). Model development was documented in Camalier et al., 2007. The seasonal average trends are shown in Figure 11b. Trends determined by seasonal model for the same set of sites examined above are consistent with those developed by the 4^{th} high model.

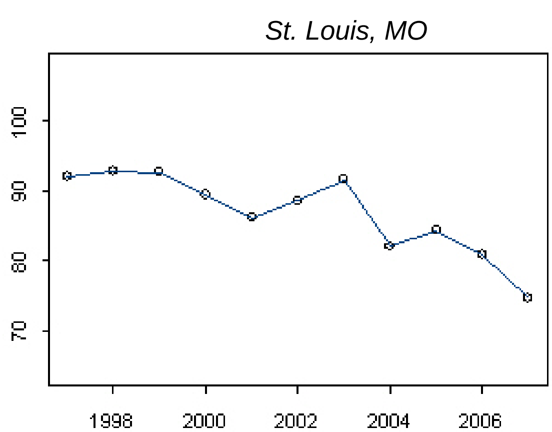












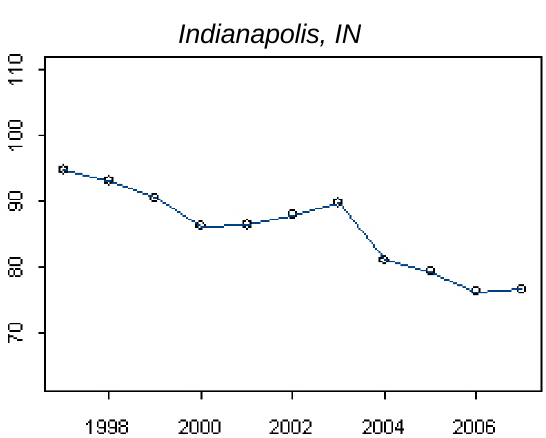


Figure 11a. Trends in meteorologically adjusted 4th high 8-hour ozone concentrations for seven Midwestern sites (1997 – 2007)

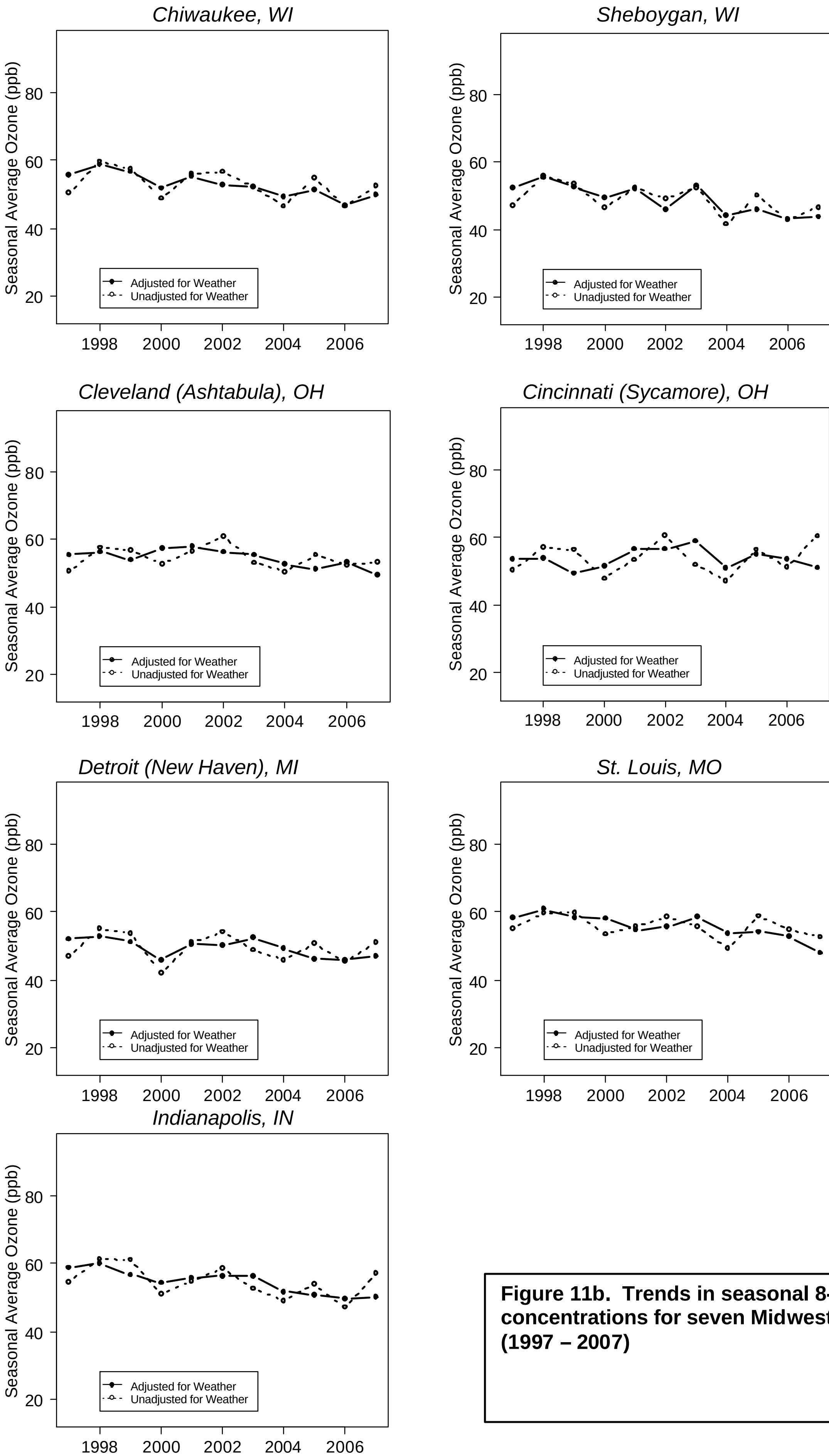


Figure 11b. Trends in seasonal 8-hour ozone concentrations for seven Midwestern sites (1997 – 2007)

CART: Classification and Regression Tree (CART) analysis is another statistical technique which partitions data sets into similar groups (Breiman et al., 1984). CART analysis was performed using data for the period 1995-2007 for 22 selected ozone monitors with current 8-hour design values close to or above the standard (Kenski, 2008b). The CART model searches through 60 meteorological variables to determine which are most efficient in predicting ozone. Although the exact selection of predictive variables changes from site to site, the most common predictors were temperature, wind direction, and relative humidity. Only occasionally were upper air variables, transport time or distance, lake breeze, or other variables significant. (Note, the ozone and meteorological data for the CART analysis are the same as used in the EPA/Cox analysis.)

For each monitor, regression trees were developed that classify each summer day (May-September) by its meteorological conditions. Similar days are assigned to nodes, which are equivalent to branches of the regression tree. Ozone time series for the higher concentration nodes are plotted for select sites in Figure 12. By grouping days with similar meteorology, the influence of meteorological variability on the trend in ozone concentrations is partially removed; the remaining trend is presumed to be due to trends in precursor emissions or other non-meteorological influences. Trends over the 13-year period at most sites were found to be declining, with the exception of Detroit which showed fairly flat trends. Comparison of the average of the high concentration node values for 2001-2003 v. 2005-2007 showed an improvement of about 5 ppb across all sites (even Detroit).

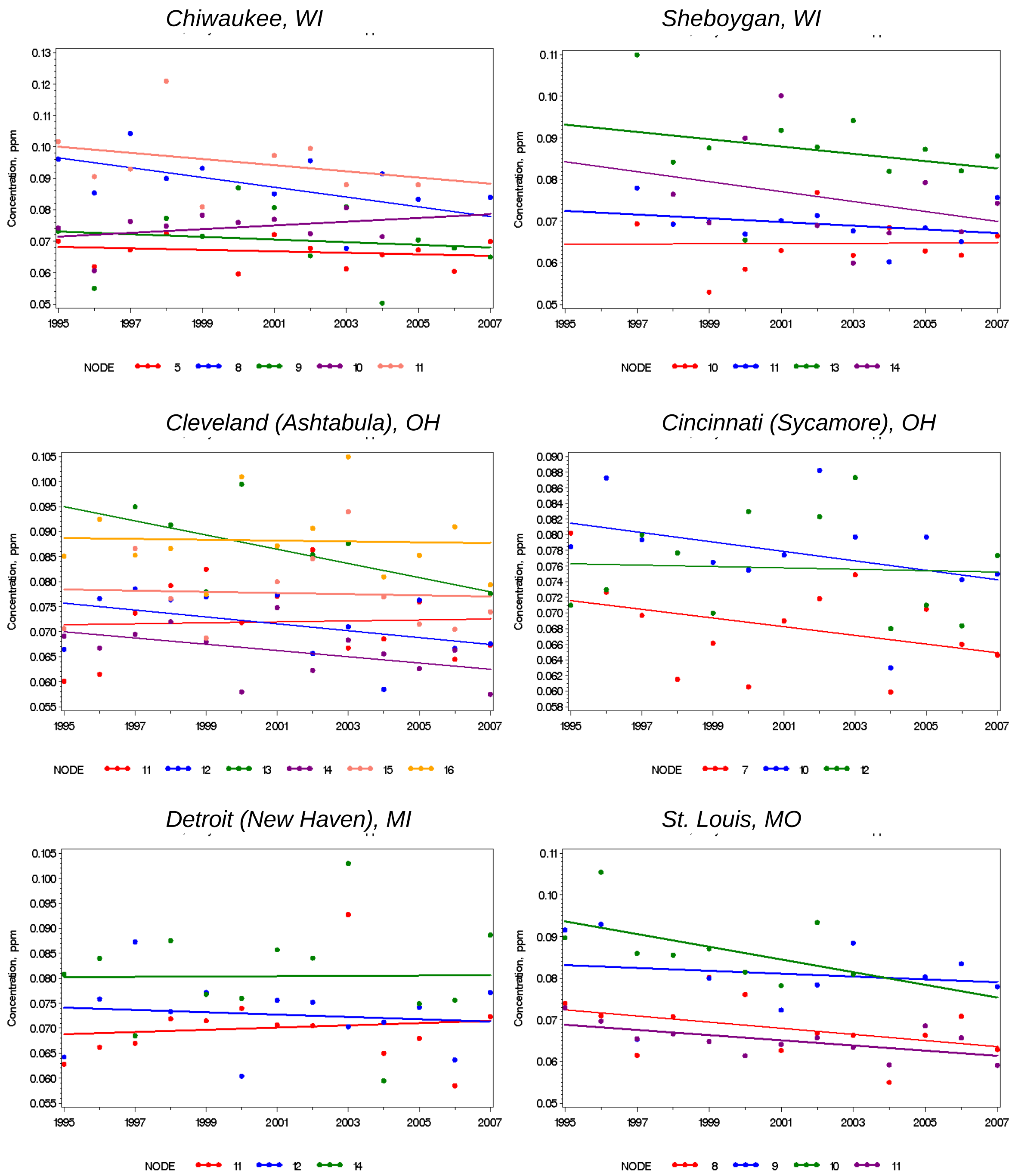
The effect of meteorology was further examined by using an ozone conduciveness index (Kenski, 2008b). This metric reflects the variability from the 13-year average in the number of days in the higher ozone concentration nodes (see Figure 13). Examination of these plots indicates:

- 2002 and 2005 were both above normal, with 2002 tending to be more severe; and

- 2001-2003 and 2005-2007 were both above normal, with no clear pattern in which period was more severe (i.e., ozone conduciveness values were similar at most sites, 2001-2003 values were higher at a few sites, and 2005-2007 values were higher at a few sites).

Given the similarity in ozone conduciveness between 2001-2003 and 2005-2007, the improvement in ozone levels noted above is presumed to be due to non-meteorological factors (i.e., emission reductions).

In conclusion, all three statistical approaches (CART and the two nonlinear regression models) show a similar result; ozone in the urban areas of the LADCO region has declined during the 1997-2007 period, even when meteorological variability is accounted for. The decreases are present whether seasonal average ozone, peak values (annual 4^{th} highs), or a subset of high days with similar meteorology are considered. The consistency in results across models is a good indication that these trends reflect impacts of emission control programs.



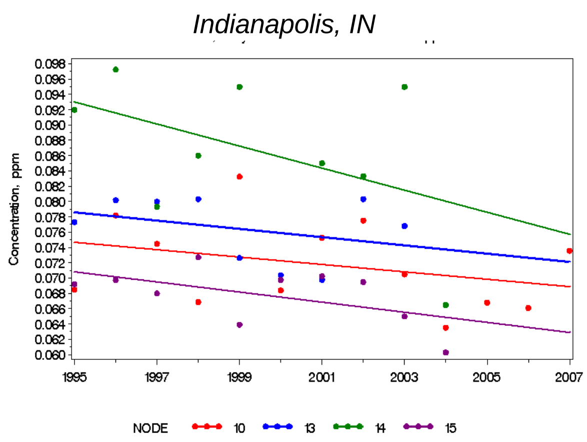
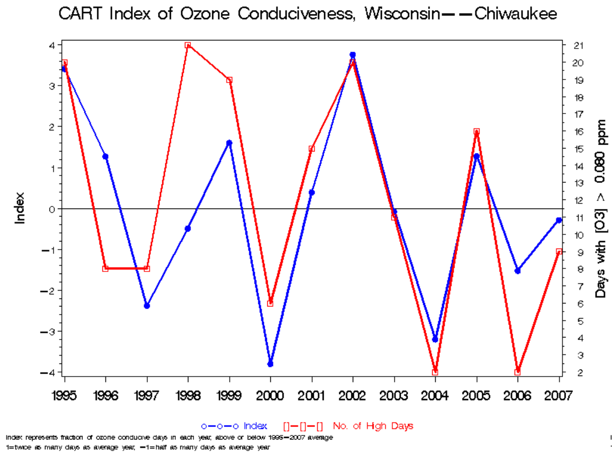
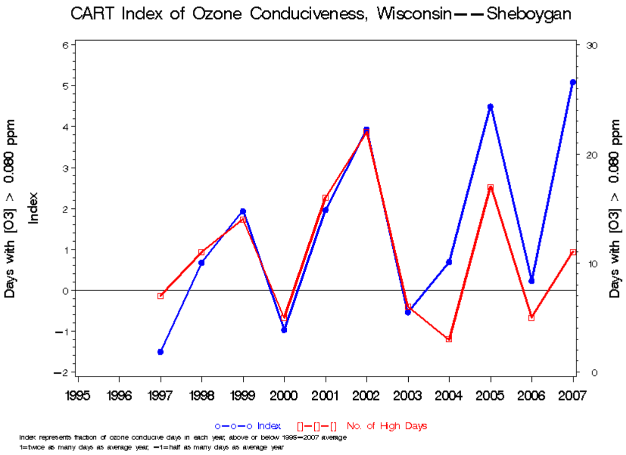
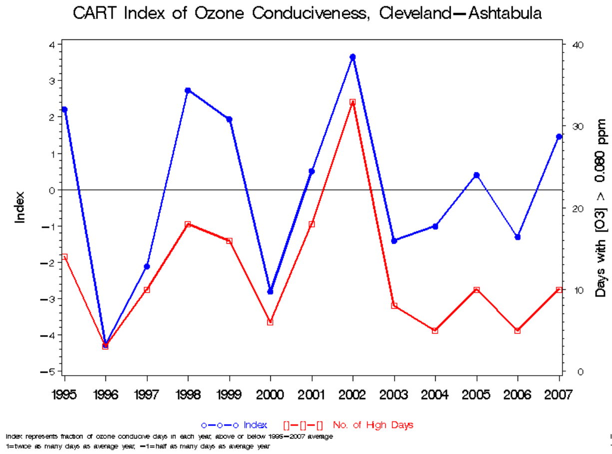


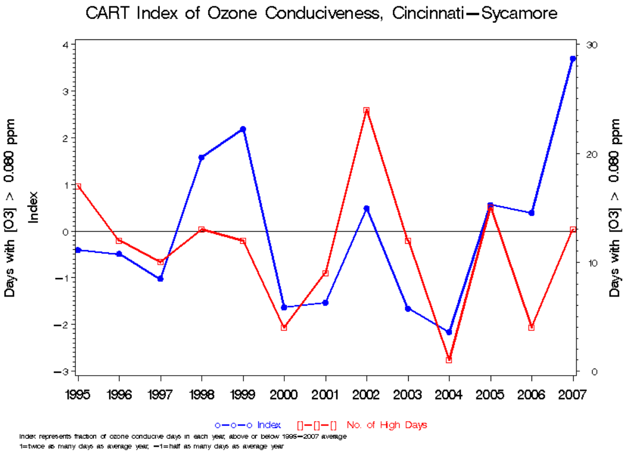
Figure 12. Trends for higher ozone CART groups (average ozone > 65 ppb) for seven Midwestern sites (1995 – 2007)

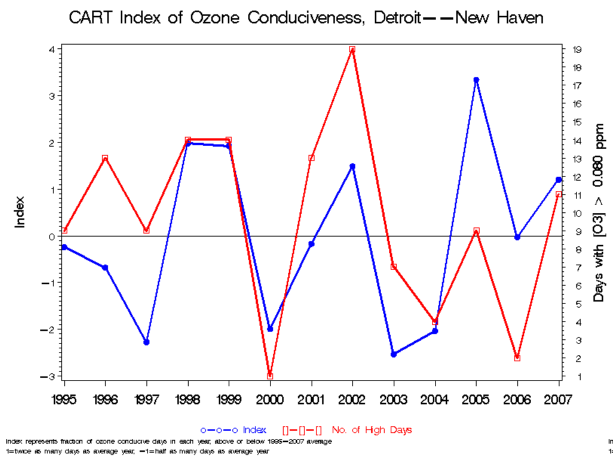
Note: line represents linear best fit

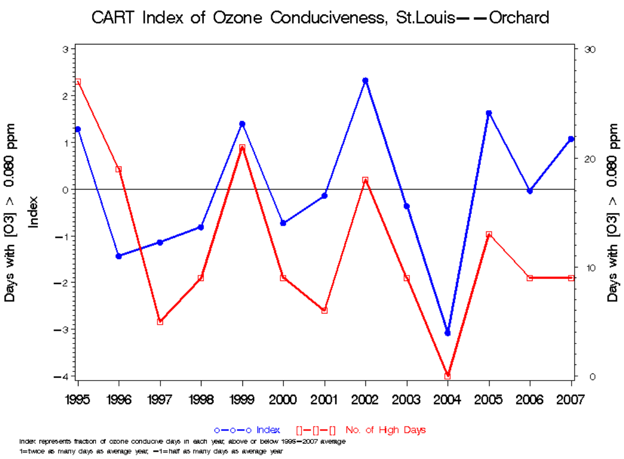












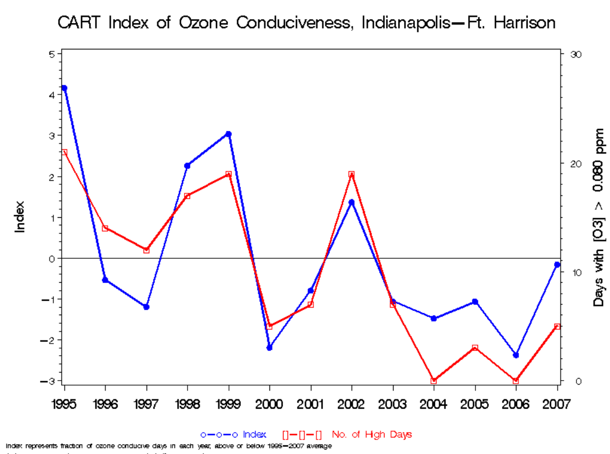


Figure 13. Ozone conduciveness index (and number of high ozone days) for seven Midwestern site (1995 – 2007)

Precursor Sensitivity: Ozone is formed from the reactions of hydrocarbons and nitrogen oxides under meteorological conditions that are conducive to such reactions (i.e., warm temperatures and strong sunlight). In areas with high VOC/NOx ratios, typical of rural environments (with low NOx), ozone tends to be more responsive to reductions in NOx. Conversely, in areas with low VOC/NOx ratios, typical of urban environments (with high NOx), ozone tends to be more responsive to VOC reductions.

An analysis of VOC and NO_x-limitation was conducted with the ozone MAPPER program, which is based on the Smog Production (SP) algorithm (Blanchard, et al., 2003). The "Extent of Reaction" parameter in the SP algorithm provides an indication of VOC and NOx sensitivity:

Extent Range	Precursor Sensitivity
< 0.6	VOC-sensitive
0.6 – 0.8	Transitional
> 0.8	NOx-sensitive

A map of the Extent of Reaction values for high ozone days is provided in Figure 14. As can be seen, ozone is usually VOC-limited in cities and NOx-limited in rural areas. (Data from aircraft measurements suggest that ozone is usually NO_x-limited over Lake Michigan and away from urban centers on days when ozone in the urban centers is VOC-limited.) The highest ozone days were found to be NO_x-limited. This analysis suggests that a NOx reduction strategy would be effective in reducing ozone levels. Examination of day-of-week concentrations, however, raises some question about the effectiveness of NOx reductions.

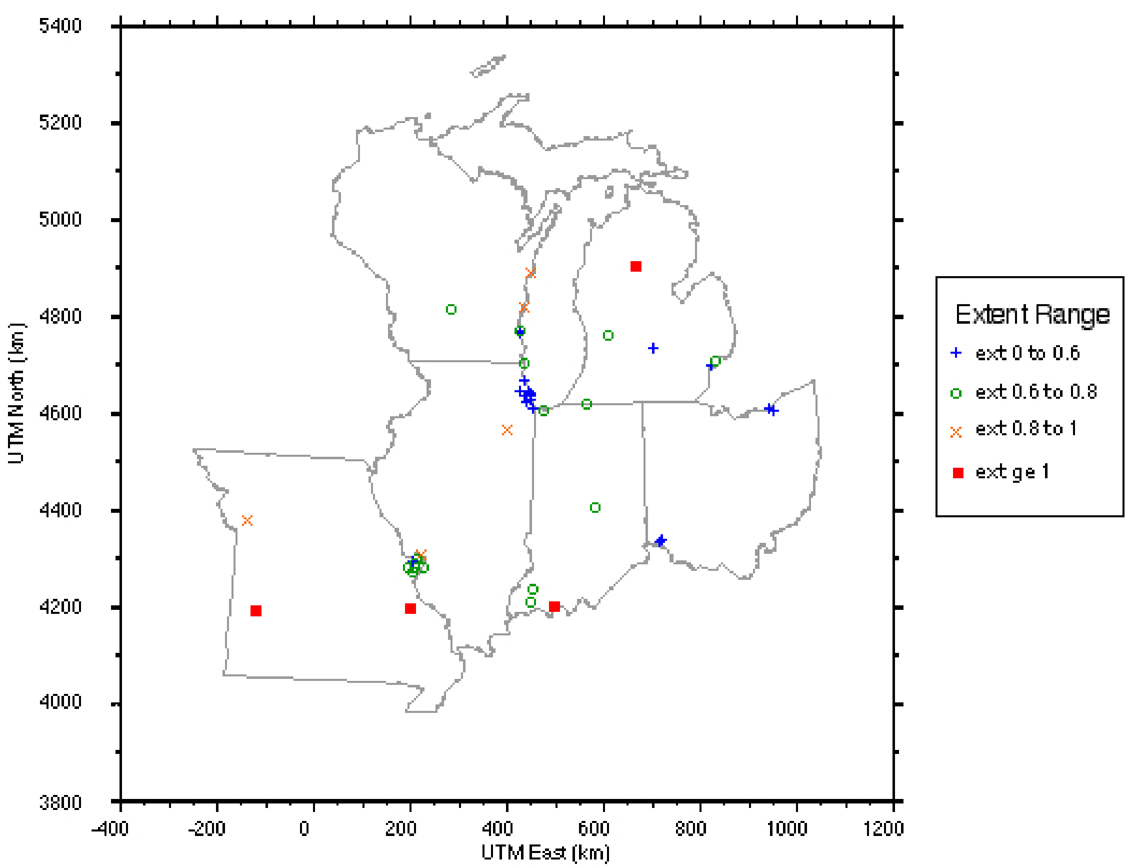


Figure 14. Mean afternoon extent of reaction (1998 – 2002)

Blanchard (2004 and 2005a) examined weekend-weekday differences in ozone and NO_x in the Midwest. All urban areas in these two studies exhibited substantially lower (40-60%) weekend concentrations of NO_x compared to weekday concentrations. Despite lower weekend NO_x concentrations, weekend ozone concentrations were not lower; in fact, most urban sites had higher concentrations of ozone, although the increase was generally not statistically significant (see Figure 15). This small but counterproductive change in **local** ozone concentrations suggests that **local** urban-scale NO_x reductions alone may not be very effective.

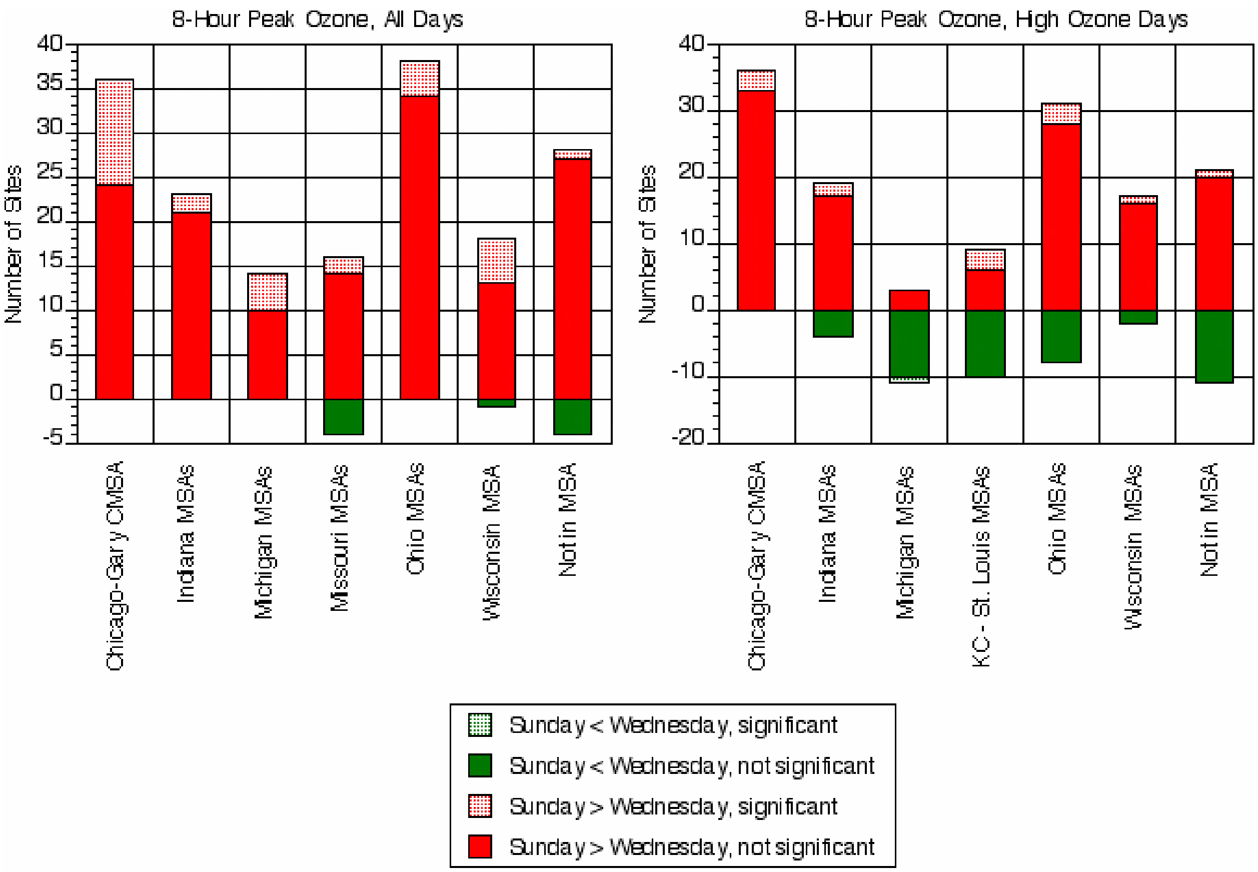


Figure 15. Weekday/weekend differences in 8-hour ozone – number of sites with weekend increase (positive values) v. number of sites with weekend decreases (negative values)

Two additional analyses, however, demonstrate the positive effect of NOx emission reductions on downwind ozone concentrations. First, Blanchard (2005a) looked at the effect of changes in precursor emissions in Chicago on downwind ozone levels in western Michigan. For the transport days of interest (i.e., southwesterly flow during the summers of 1999 – 2002), mean NOx concentrations in Chicago are about 50% lower and mean ozone concentrations at the (downwind) western Michigan sites are about 1.5 – 5.2 ppb (3 – 8 %) lower on Sunday compared to Wednesday. This degree of change in downwind ozone levels suggests a positive, albeit non-linear response to urban area emission reductions.

Second, Environ (2007a) examined the effect of differences in day-of-week emissions in southeastern Michigan on downwind ozone levels. This modeling study found that weekend changes in ozone precursor emissions cause both increases and decreases in Southeast Michigan ozone, depending upon location and time:

- Weekend increases in 8-hour maximum ozone occur in and immediately downwind of the Detroit urban area (i.e., in VOC-sensitive areas).
- Weekend decreases in 8-hour maximum ozone occur outside and downwind of the Detroit urban area (i.e., in NOx-sensitive areas).
- At the location of the peak 8-hour ozone downwind of Detroit, ozone was lower on weekends than weekdays.
- Ozone benefits (reductions) due to weekend emission changes in Southeast Michigan can be transported downwind for hundreds of miles.
- Southeast Michigan benefits from lower ozone transported into the region on Saturday through Monday because of weekend emission changes in upwind areas.

In summary, these analyses suggest that urban VOC reductions and regional (urban and rural) NOx reductions will be effective in lowering ozone concentrations. Local NOx reductions can lead to local ozone increases (i.e., NOx disbenefits), but this effect does not appear to pose a problem with respect to attainment of the standard. It should also be noted that urban VOC and regional NOx reductions are likely to have multi-pollutant benefits (e.g., both lower ozone and $PM_{2.5}$ impacts).

2.2 $PM_{2.5}$

In 1997, EPA adopted the $PM_{2.5}$ standards of 15 ug/m^3 (annual average) and 65 ug/m3 (24-hour average). The annual standard is attained if the 3-year average of the annual average $PM_{2.5}$ concentration is less than or equal to the level of the standard. The daily standard is attained if the 98th percentile of 24-hour $PM_{2.5}$ concentrations in a year, averaged over three years, is less than or equal to the level of the standard.

In 2006, EPA revised the $PM_{2.5}$ standards to 15 ug/m^3 (annual average) and 35 ug/m^3 (24-hour average).

Current Conditions: Maps of annual and 24-hour $PM_{2.5}$ design values for the 3-year period 2005-2007 are shown in Figure 16. The “hotter” colors represent higher concentrations, where red dots represent sites with design values above the annual standard. Currently, there are 30 sites in violation of the annual $PM_{2.5}$ standard.

Table 2 provides the annual $PM_{2.5}$ concentrations and associated design values since 2003 for several high monitoring sites throughout the region.

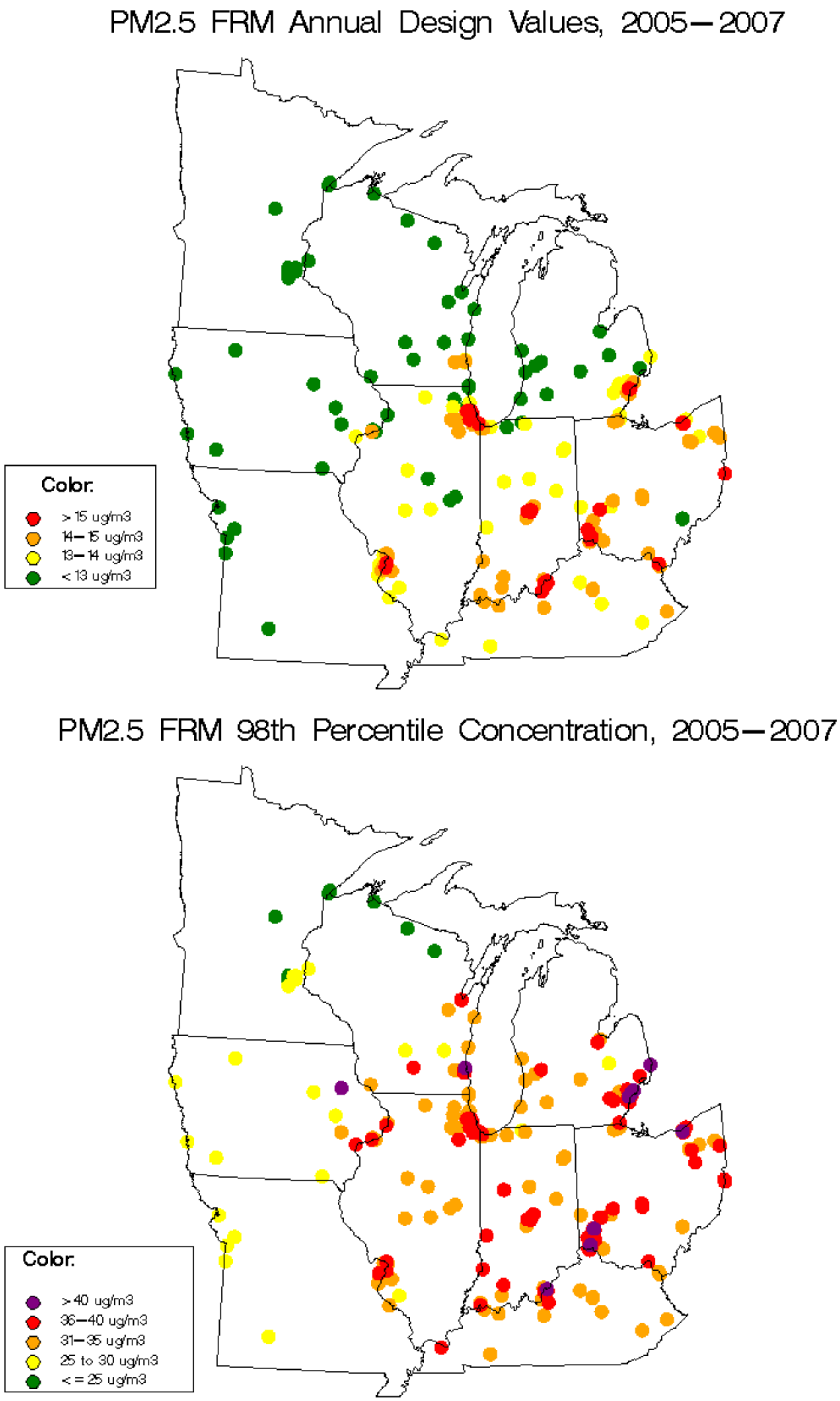


Figure 16. $PM_{2.5}$ design values - annual average (top) and 24-hour average (bottom) (2005-2007)

Table 2. PM2.5 Data for Select Sites in 5-State Region

Key Site	County	Site ID	Annual Average Conc. '03	'04	'05	'06	'07	Design Values '03 - '05	'04 - '06	'05 - '07	2005 BY Average w/ 2007	2002 BY Average
Chicago - Washington HS	Cook	170310022	15.6	14.2	16.9	13.2	15.7	15.6	14.8	15.3	**15.2**	**15.9**
Chicago - Mayfair	Cook	170310052	15.9	15.3	17.0	14.5	15.5	16.1	15.6	15.7	**15.8**	**17.1**
Chicago - Springfield	Cook	170310057	15.6	13.8	16.7	13.5	15.1	15.4	14.7	15.1	**15.0**	**15.6**
Chicago - Lawndale	Cook	170310076	14.8	14.2	16.6	13.5	14.3	15.2	14.8	14.8	14.9	**15.6**
Blue Island	Cook	170312001	14.9	14.1	16.4	13.2	14.3	15.1	14.6	14.6	14.8	**15.6**
Summit	Cook	170313301	15.6	14.2	16.9	13.8	14.8	15.6	15.0	15.2	**15.2**	**16.0**
Cicero	Cook	170316005	16.8	15.2	16.3	14.3	14.8	16.1	15.3	15.1	**15.5**	**16.4**
Granite City	Madison	171191007	17.5	15.4	18.2	16.3	15.1	17.0	16.6	16.5	**16.7**	**17.3**
E. St. Louis	St. Clair	171630010	14.9	14.7	17.1	14.5	15.6	15.6	15.4	15.7	**15.6**	**16.2**
Jeffersonville	Clark	180190005	15.8	15.1	18.5	15.0	16.5	16.5	16.2	16.7	**16.4**	**17.2**
Jasper	Dubois	180372001	15.7	14.4	16.9	13.5	14.4	15.7	14.9	14.9	**15.2**	**15.5**
Gary	Lake	180890031			16.8	13.3	14.5	16.8	15.1	14.9	**15.6**	
Indy - Washington Park	Marion	180970078	15.5	14.3	16.4	14.1	15.8	15.4	14.9	15.4	**15.3**	**16.2**
Indy - W 18th Street	Marion	180970081	16.2	15.0	17.9	14.2	16.1	16.4	15.7	16.1	**16.0**	
Indy - Michigan Street	Marion	180970083	16.3	15.0	17.5	14.1	15.9	16.3	15.5	15.8	**15.9**	**16.6**
Allen Park	Wayne	261630001	15.2	14.2	15.9	13.2	12.8	15.1	14.4	14.0	14.5	**15.8**
Southwest HS	Wayne	261630015	16.6	15.4	17.2	14.7	14.5	16.4	15.8	15.5	**15.9**	**17.3**
Linwood	Wayne	261630016	15.8	13.7	16.0	13.0	13.9	15.2	14.2	14.3	14.6	**15.5**
Dearborn	Wayne	261630033	19.2	16.8	18.6	16.1	16.9	18.2	17.2	17.2	**17.5**	**19.3**
Wyandotte	Wayne	261630036	16.3	13.7	16.4	12.9	13.4	15.5	14.3	14.2	14.7	**16.6**
Middleton	Butler	390170003	17.2	14.1	19.0	14.1	15.4	16.8	15.7	16.2	**16.2**	**16.5**
Fairfield	Butler	390170016	15.8	14.7	17.9	14.0	14.9	16.1	15.5	15.6	**15.8**	**15.9**
Cleveland-28th Street	Cuyahoga	390350027	15.4	15.6	17.3	13.0	14.5	16.1	15.3	14.9	**15.4**	**16.5**
Cleveland-St. Tikhon	Cuyahoga	390350038	17.6	17.5	19.2	14.9	16.2	18.1	17.2	16.8	**17.4**	**18.4**
Cleveland-Broadway	Cuyahoga	390350045	16.4	15.3	19.3	14.0	15.3	17.0	16.2	16.2	**16.5**	**16.7**
Cleveland-E14 & Orange	Cuyahoga	390350060	17.2	16.4	19.4	15.0	15.9	17.7	16.9	16.8	**17.1**	**17.6**
Newburg Hts - Harvard Ave	Cuyahoga	390350065	15.6	15.2	18.6	13.1	15.8	16.5	15.6	15.8	**16.0**	**16.2**
Columbus - Fairgrounds	Franklin	390490024	16.4	15.0	16.4	13.6	14.6	15.9	15.0	14.9	**15.3**	**16.5**
Columbus - Ann Street	Franklin	390490025	15.3	14.6	16.4	13.6	14.7	15.4	14.9	14.9	**15.1**	**16.0**
Columbus - Maple Canyon	Franklin	390490081	14.9	13.6	14.6	12.9	13.1	14.4	13.7	13.5	13.9	**16.0**
Cincinnati - Seymour	Hamilton	390610014	17.0	15.9	19.8	15.5	16.5	17.6	17.1	17.3	**17.3**	**17.7**
Cincinnati - Taft Ave	Hamilton	390610040	15.5	14.6	17.5	13.6	15.1	15.9	15.2	15.4	**15.5**	**15.7**
Cincinnati - 8th Ave	Hamilton	390610042	16.7	16.0	19.1	14.9	15.9	17.3	16.7	16.6	**16.9**	**17.3**
Sharonville	Hamilton	390610043	15.7	14.9	16.9	14.5	14.8	15.8	15.4	15.4	**15.6**	**16.0**
Norwood	Hamilton	390617001	16.0	15.3	18.4	14.4	15.1	16.6	16.0	15.9	**16.2**	**16.3**
St. Bernard	Hamilton	390618001	17.3	16.4	20.0	15.9	16.1	17.9	17.4	17.3	**17.6**	**17.3**
Steubenville	Jefferson	390810016	17.7	15.9	16.4	13.8	16.2	16.7	15.4	15.5	**15.8**	**17.7**
Mingo Junction	Jefferson	390811001	17.3	16.2	18.1	14.6	15.6	17.2	16.3	16.1	**16.5**	**17.5**
Ironton	Lawrence	390870010	14.3	13.7	17.0	14.4	15.0	15.0	15.0	15.4	**15.2**	**15.7**
Dayton	Montgomery	391130032	15.9	14.5	17.4	13.6	15.6	15.9	15.2	15.5	**15.5**	**15.9**
New Boston	Scioto	391450013	14.7	13.0	16.2	14.3	14.0	14.6	14.5	14.8	14.7	**17.1**
Canton - Dueber	Stark	391510017	16.8	15.6	17.8	14.6	15.9	16.7	16.0	16.1	**16.3**	**17.3**
Canton - Market	Stark	391510020	15.0	14.1	16.6	11.9	14.4	15.2	14.2	14.3	14.6	**15.7**
Akron - Brittain	Summit	391530017	15.4	15.0	16.4	13.5	14.4	15.6	15.0	14.8	**15.1**	**16.4**
Akron - W. Exchange	Summit	391530023	14.2	13.9	15.7	12.8	13.7	14.6	14.1	14.1	14.3	**15.6**

When EPA initially set the 24-hour standard at 65 µg/m^3, it also adopted the following concentration ranges for its Air Quality Index (AQI) scale:

Good	< 15 ug/m^3
Moderate	15-40 µg/m^3
Unhealthy for Sensitive Groups (USG)	40-65 µg/m^3
Unhealthy	65-150 µg/m^3

Figure 17 shows the frequency of these AQI categories for major metropolitan areas in the region. Daily average concentrations are often in the moderate range and occasionally in the USG range. Moderate and USG levels can occur any time of the year.

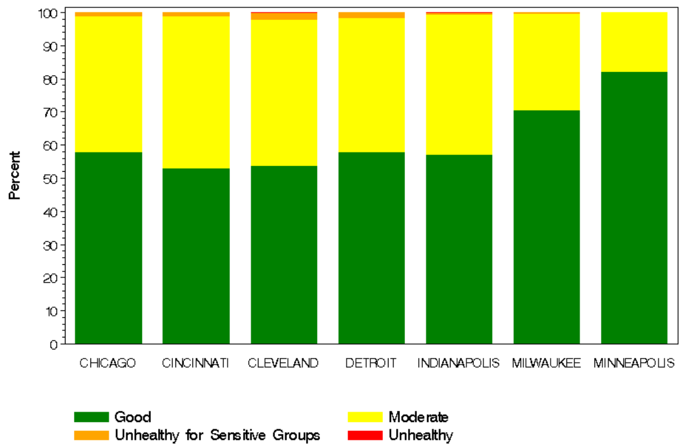


Figure 17. Percent of days in AQI categories for $PM_{2.5}$ (2002-2004)

Data Variability: $PM_{2.5}$ concentrations vary spatially, temporally, and chemically in the region. This variability is discussed further below.

On an annual basis, $PM_{2.5}$ exhibits a distinct and consistent spatial pattern. As seen in Figure 16, across the Midwest, annual concentrations follow a gradient from low values (5-6 µg/m^3) in northern and western areas (Minnesota and northern Wisconsin) to high values (17-18 µg/m^3) in Ohio and along the Ohio River. In addition, concentrations in urban areas are higher than in upwind rural areas, indicating that local urban sources add a significant increment of 2-3 µg/m^3 to the regional background of 12 - 14 µg/m^3 (see Figure 18).

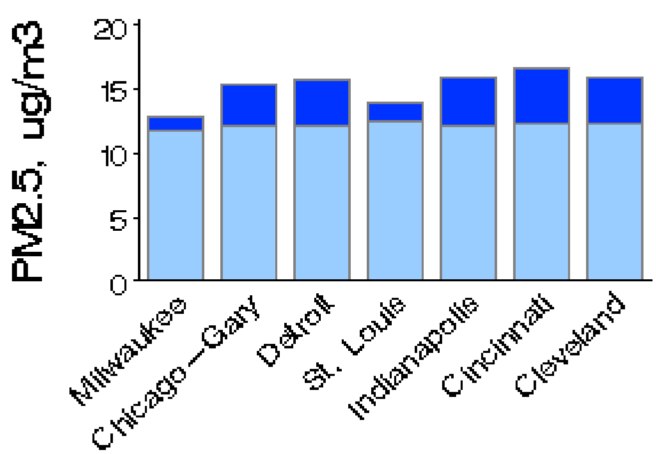
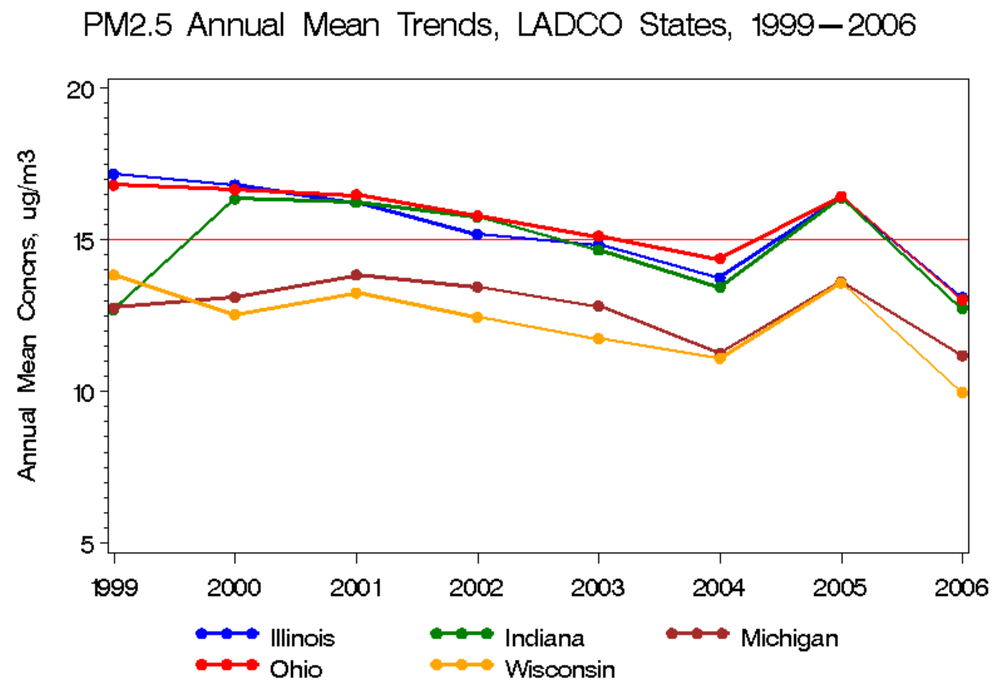


Figure 18. Regional (lighter shading) v. local components (darker shading) of annual average $PM_{2.5}$ concentrations

Because monitoring for $PM_{2.5}$ only began in earnest in 1999, after promulgation of the $PM_{2.5}$ standard, limited data are available to assess trends. Time series based on federal reference method (FRM) $PM_{2.5}$-mass data show a downward trend in each state (see Figure 19)[7].



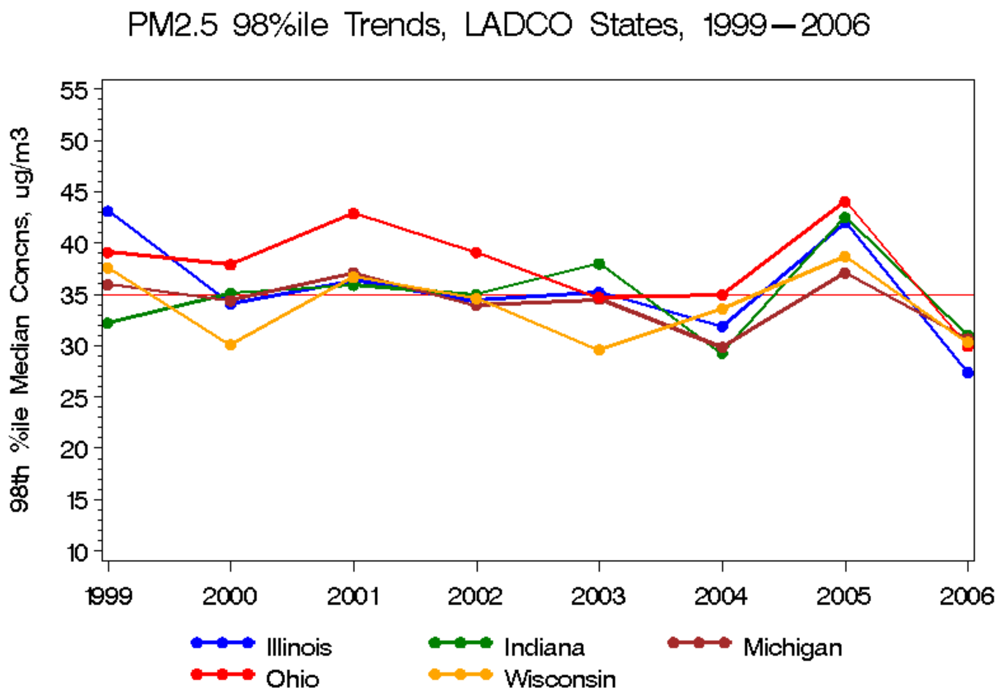


Figure 19. $PM_{2.5}$ trends in annual average (top) and daily concentrations (bottom)

[7] Despite the general downward trend since 1999, all states experienced an increase during 2005. Further analyses are underway to understand this increase (e.g., examination of meteorological and emissions effects).

A statistical analysis of $PM_{2.5}$ trends was performed using the nonparametric Theil test for slope (Hollander and Wolfe, 1973). Trends were generally consistent around the region, for both PM mass and for the individual components of mass. Figure 20 shows trends for $PM_{2.5}$ based on FRM data at sites with six or more years of data since 1999. The size and direction of each arrow shows the size and direction of the trend for each site; solid arrows show statistically significant trends and open arrows show trends that are not significant. Region-wide decreases are widespread and consistent; all sites had decreasing concentration trends (13 of the 38 were statistically significant). The average decrease for this set of sites is -0.24 ug/m^3/year.

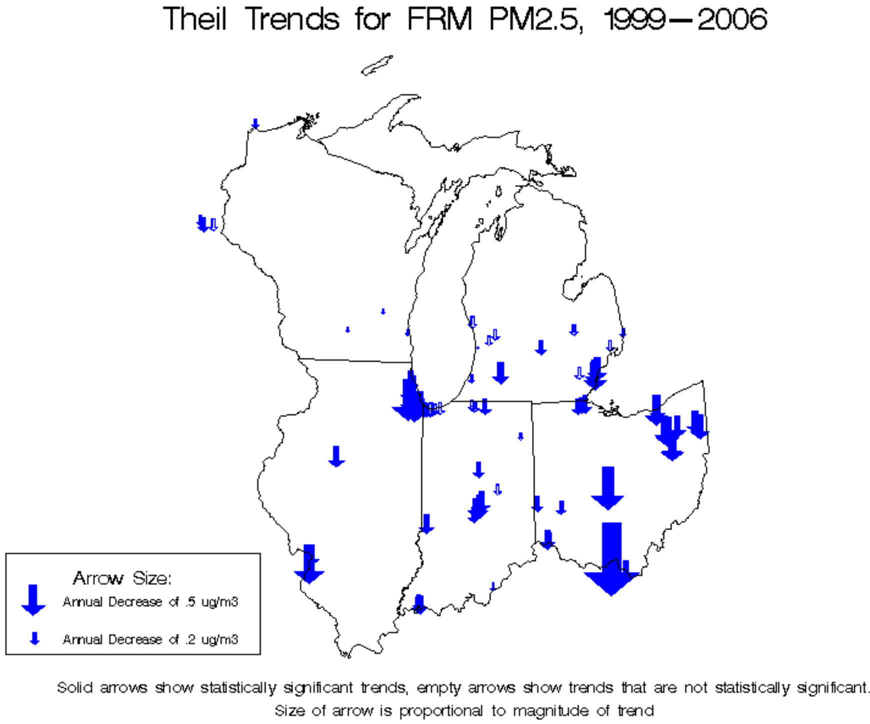


Figure 20. Annual trends in $PM_{2.5}$ mass (1999 – 2006)

Seasonal trends show mostly similar patterns (Figure 21). Trends were downward at most sites and seasons, with overall seasonal averages varying between -0.15 to -0.56 ug/m^3/year. The strongest and most significant decreases took place during the winter quarter (January - March). No statistically significant increasing trends were observed.

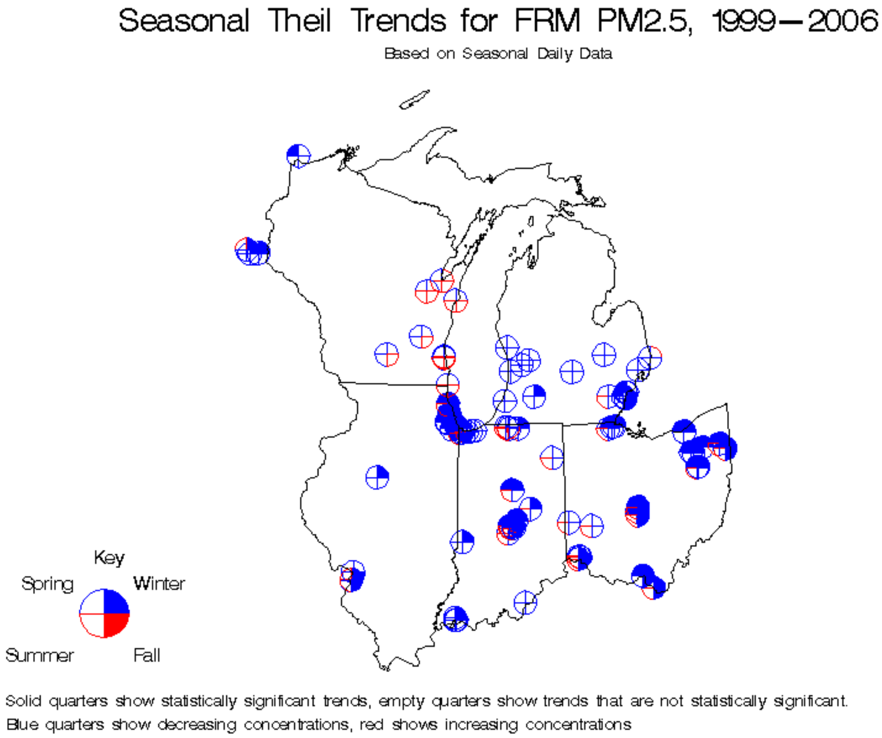


Figure 21. Seasonal trends in $PM_{2.5}$ mass (1999 – 2006)

$PM_{2.5}$ shows a slight variation from weekday to weekend, as seen in Figure 22. Although most cities have slightly lower concentrations on the weekend, the difference is usually less than 1 µg/m^3. There is a more pronounced weekday/weekend difference at monitoring sites that are strongly source-influenced. Rural monitors tend to show less of a weekday/weekend pattern than urban monitors.

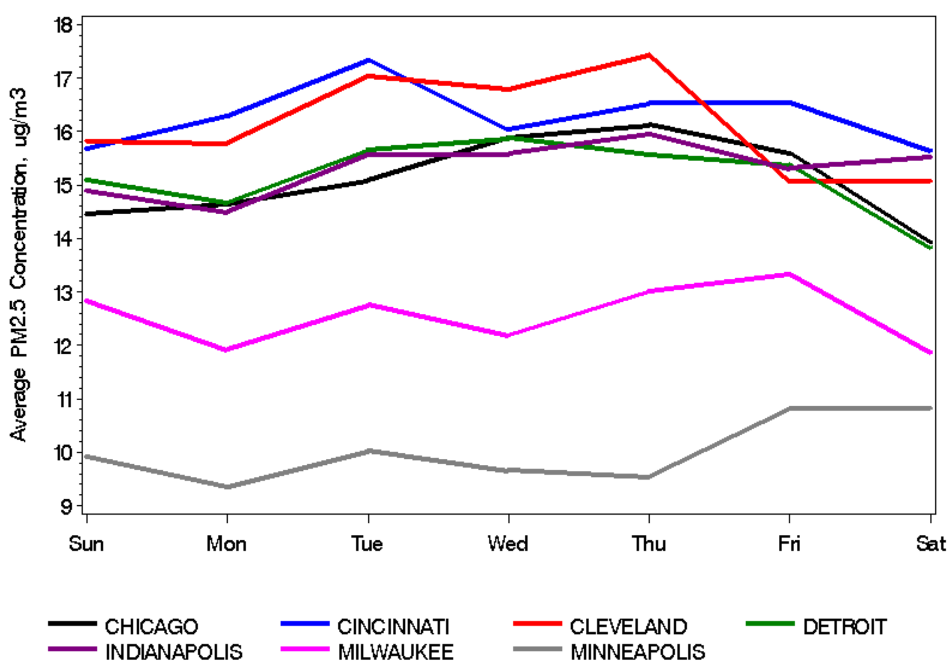


Figure 22 Day-of-week variability in $PM_{2.5}$ (2002-2004)

In the Midwest, $PM_{2.5}$ is made up of mostly ammonium sulfate, ammonium nitrate, and organic carbon in approximately equal proportions on an annual average basis. Elemental carbon and crustal matter (also referred to as soil) contribute less than 5% each.

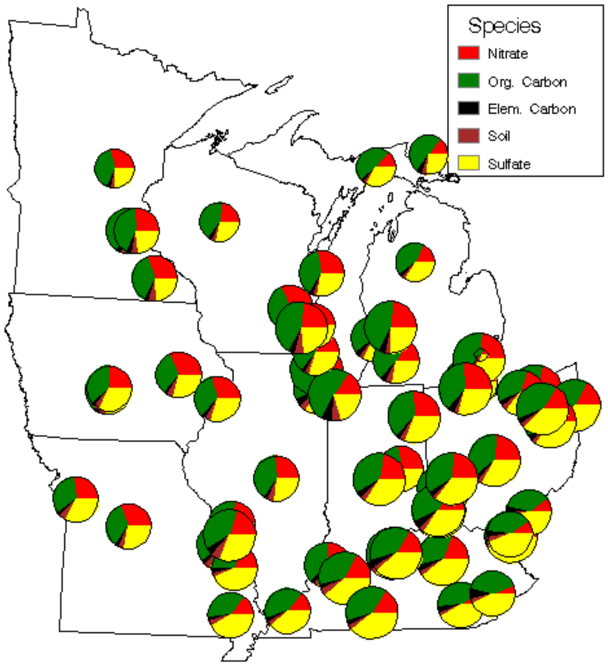


Figure 23. Spatial map of $PM_{2.5}$ chemical composition in the Midwest (2002-2003)

The three major components vary spatially (Figure 23), including notable urban and rural differences (Figure 24). The components also vary seasonally (Figure 25). These patterns account for much of the annual variability in $PM_{2.5}$ mass noted above.

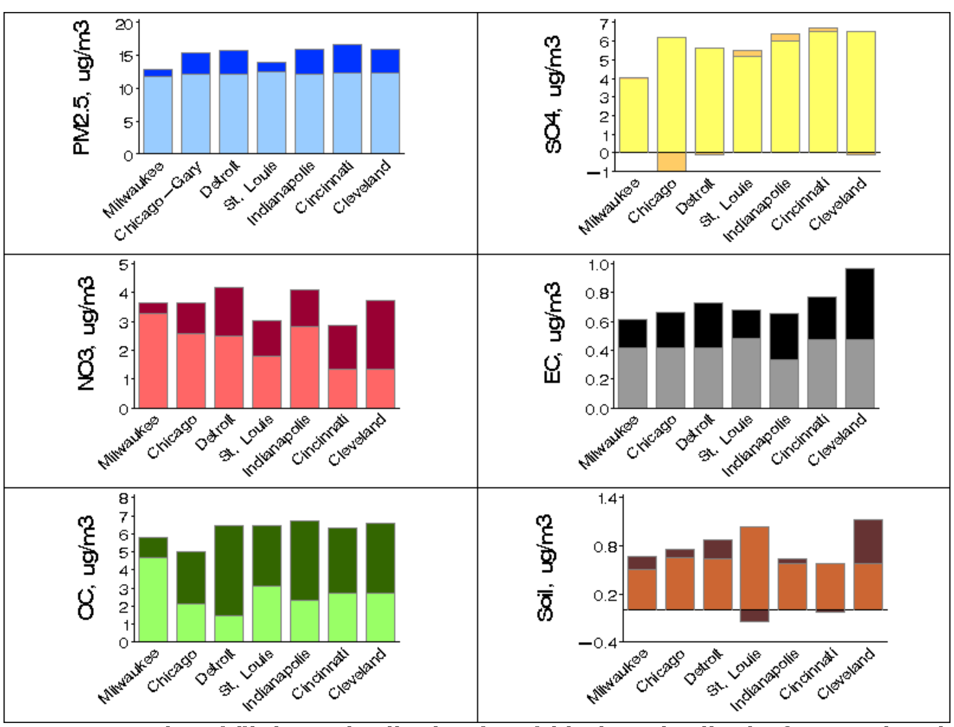


Figure 24. Average regional (lighter shading) v. local (darker shading) of $PM_{2.5}$ chemical species

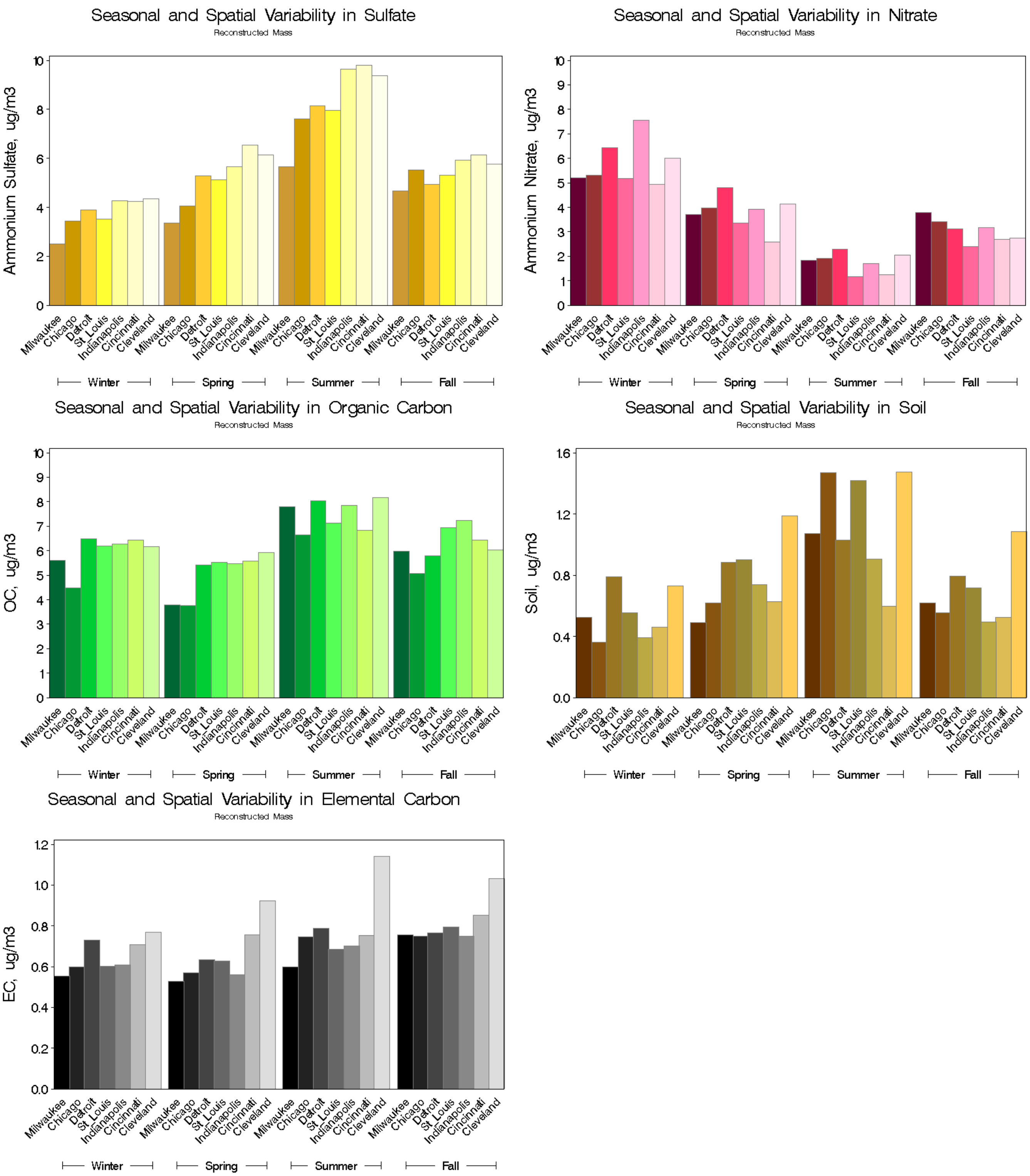


Figure 25 Seasonal and spatial variability in $PM_{2.5}$ components

Ammonium sulfate peaks in the summer and is highest in the southern and eastern parts of the Midwest, closest to the Ohio River Valley. Sulfate is primarily a regional pollutant; concentrations are similar in rural and urban areas and highly correlated over large distances. It is formed when sulfuric acid (an oxidation product of sulfur dioxide) and ammonia react in the atmosphere, especially in cloud droplets. Coal combustion is the primary source of sulfur dioxide; ammonia is emitted primarily from animal husbandry operations and fertilizer use.

Ammonium nitrate has almost the opposite spatial and seasonal pattern, with the highest concentrations occurring in the winter and in the northern parts of the region. Nitrate seems to have both regional and local sources, because urban concentrations are higher than rural upwind concentrations. Ammonium nitrate forms when nitric acid reacts with ammonia, a process that is enhanced when temperatures are low and humidity is high. Nitric acid is a product of the oxidation of nitric oxide, a pollutant that is emitted by combustion processes.

Organic carbon is more consistent from season to season and city to city, although concentrations are generally slightly higher in the summer. Like nitrate, organic carbon has both regional and local components. Particulate organic carbon can be emitted directly from cars and other fuel combustion sources or formed in a secondary process as volatile organic gases react and condense. In rural areas, summer organic carbon has significant contributions from biogenic sources.

Precursor Sensitivity: Data from the Midwest ammonia monitoring network were analyzed with thermodynamic equilibrium models to assess the effect of changes in precursor gas concentrations on $PM_{2.5}$ concentrations (Blanchard, 2005b). These analyses indicate that particle formation responds in varying degrees to reductions in sulfate, nitric acid, and ammonia. Based on Figure 26, which shows $PM_{2.5}$ concentrations as a function of sulfate, nitric acid (HNO3), and ammonia (NH3), several key findings should be noted:

- $PM_{2.5}$ mass is sensitive to reductions in sulfate at all times of the year and all parts of the region. Even though sulfate reductions cause more ammonia to be available to form ammonium nitrate (PM-nitrate increases slightly when sulfate is reduced), this increase is generally offset by the sulfate reductions, such that $PM_{2.5}$ mass decreases.

- $PM_{2.5}$ mass is also sensitive to reductions in nitric acid and ammonia. The greatest $PM_{2.5}$ decrease in response to nitric acid reductions occurs during the winter, when nitrate is a significant fraction of $PM_{2.5}$.

- Under conditions with lower sulfate levels (i.e., proxy of future year conditions), $PM_{2.5}$ is more sensitive to reductions in nitric acid compared to reductions in ammonia.

- Ammonia becomes more limiting as one moves from west to east across the region.

Examination of weekend/weekday difference in PM-nitrate and NOx concentrations in the Midwest demonstrate that reductions in local (urban) NOx lead to reductions, albeit non-proportional reductions, in PM-nitrate (Blanchard, 2004). This result is consistent with analyses of continuous PM-nitrate from several US cities, including St. Louis (Millstein, et al, 2007).

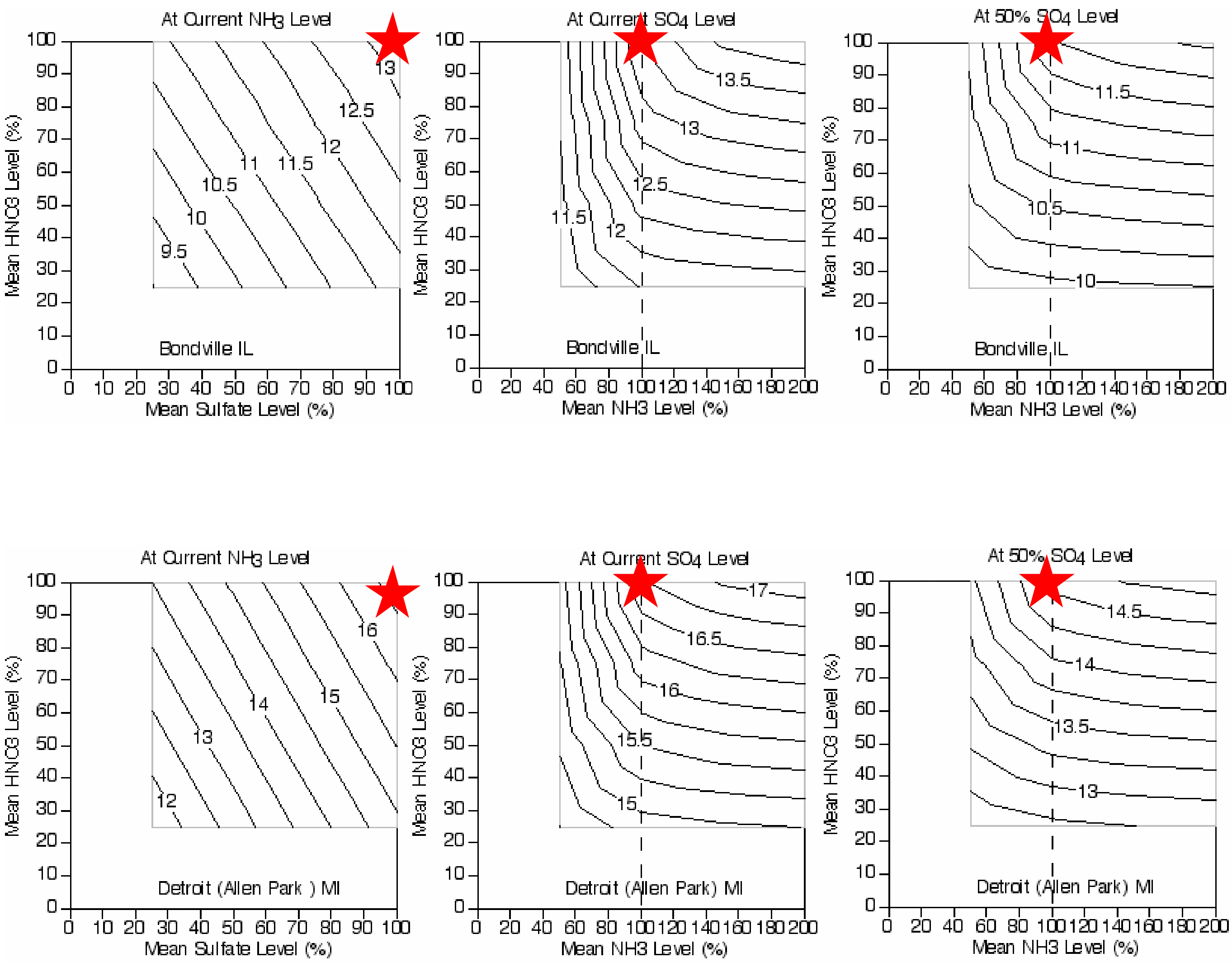


Figure 26. Predicted mean PM fine mass concentrations at Bondville, IL (top) and Detroit (Allen Park), MI (bottom) as functions of changes in sulfate, nitric acid (HNO3), and ammonia (NH3)

Note: starting at the baseline values (represented by the red star), either moving downward (reductions in nitric acid) or moving leftward (reductions in sulfate or ammonia) results in lower $PM_{2.5}$ values

Meteorology: $PM_{2.5}$ concentrations are not as strongly influenced by meteorology as ozone, but the two pollutants share some similar meteorological dependencies. In the summer, conditions that are conducive to ozone (hot temperatures, stagnant air masses, and low wind speeds due to stationary high pressure systems) also frequently give rise to high $PM_{2.5}$. In the case of PM, the reason is two-fold: (1) stagnation and limited mixing under these conditions cause $PM_{2.5}$ to build up, usually over several days, and (2) these conditions generally promote higher conversion of important precursors (SO_2 to SO_4) and higher emissions of some precursors, especially biogenic carbon. Wind direction is another strong determinant of $PM_{2.5}$; air transported from polluted source regions has higher concentrations.

Unlike ozone, $PM_{2.5}$ has occasional winter episodes. Conditions are similar to those for summer episodes, in that stationary high pressure and (seasonally) warm temperatures are usually factors. Winter episodes are also fueled by high humidity and low mixing heights.

$PM_{2.5}$ chemical species show noticeable transport influences. Trajectory analyses have demonstrated that high PM-sulfate is associated with air masses that traveled through the sulfate-rich Ohio River Valley (Poirot, et al, 2002 and Kenski, 2004). Likewise, high PM-nitrate is associated with air masses that traveled through the ammonia-rich Midwest. Figure 27 shows results from an ensemble trajectory analysis of 17 rural eastern IMPROVE sites.

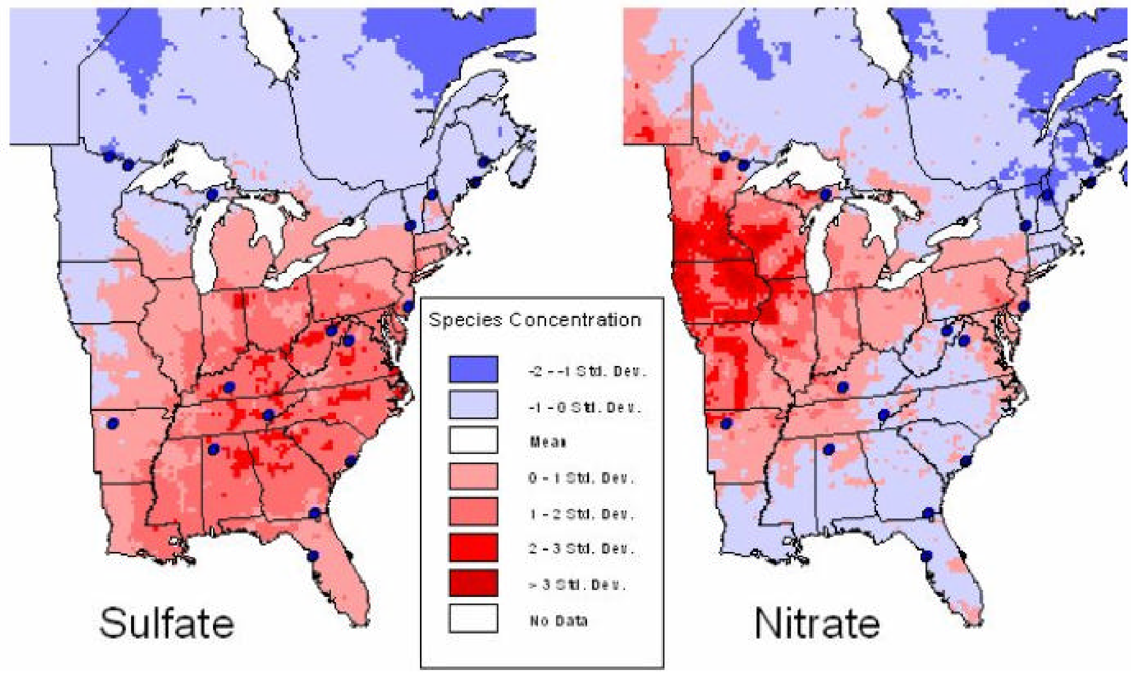


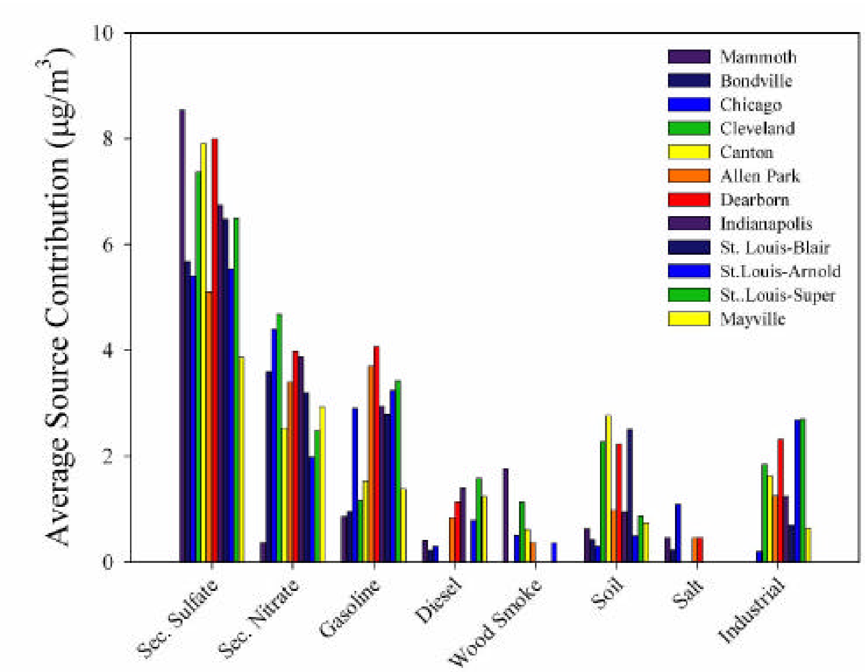
Figure 27. Sulfate and nitrate source regions based on ensemble trajectory analysis

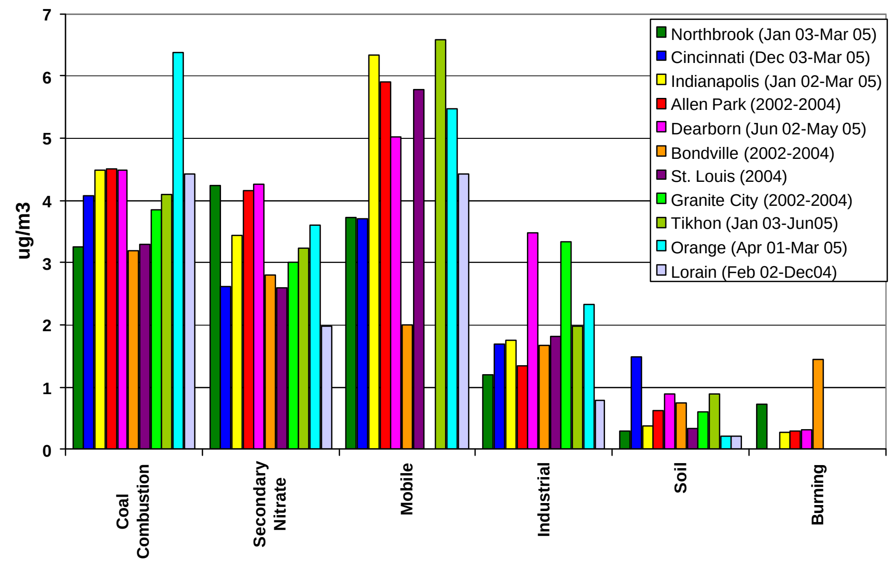
When these results are considered together with analyses of precursor sensitivity (e.g., Figure 26), one possible conclusion is that ammonia control in the Midwest could be effective at reducing nitrate concentrations. The thermodynamic equilibrium modeling shows that ammonia reductions would reduce PM concentrations in the Midwest, but that nitric acid reductions are more effective when the probable reductions in future sulfate levels are considered.

Source Culpability: Three source apportionment studies were performed using speciated $PM_{2.5}$ monitoring data and statistical analysis methods (Hopke, 2005, STI, 2006, and STI, 2008). Figure 28 summarizes the source contributions from these studies. The studies show that a large portion of $PM_{2.5}$ mass consists of secondary, regional impacts, which cannot be attributed to individual facilities or sources (e.g., secondary sulfate, secondary nitrate, and secondary organic aerosols). Nevertheless, wind analyses (e.g., Figure 27) provide information on likely source regions. Regional- or national-scale control programs may be the most effective way to deal with these impacts. EPA's CAIR, for example, will provide for substantial reductions in SO2 emissions over the eastern half of the U.S., which will reduce sulfate (and $PM_{2.5}$) concentrations and improve visibility levels.

The studies also show that a smaller, yet significant portion of $PM_{2.5}$ mass is due to emissions from nearby (local) sources. Local (urban) excesses occur in many urban areas for organic and elemental carbon, crustal matter, and, in some cases, sulfate. The statistical analysis methods help to identify local sources and quantify their impact. This information is valuable to states wishing to develop control programs to address local impacts. A combination of national/regional-scale and local-scale emission reductions may be necessary to provide for attainment.

The carbon sources are not easily identified in complex urban environments. LADCO's Urban Organics Study (STI, 2006) identified four major sources of organic carbon: mobile sources, burning, industrial sources, and secondary organic aerosols. Additional sampling and analysis is underway in Cleveland and Detroit to provide further information on sources of organic carbon.





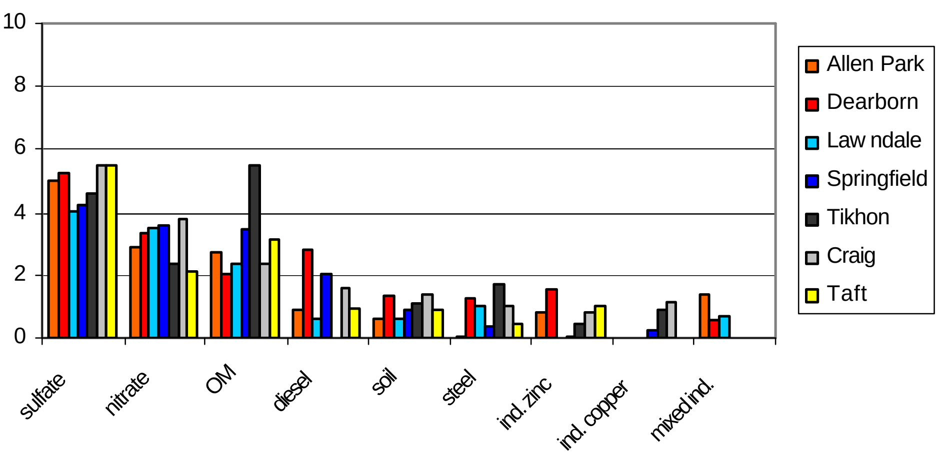


Figure 28. Major Source Contributions in the Midwest based on Hopke, 2005 (upper left), STI, 2006 (upper right), and STI, 2008 (lower left) (Note: the labeling of similar source types varies between studies – e.g., organic carbon/mobile sources are named gasoline and diesel by Hopke, mobile by STI 2006, and OM and diesel by STI 2008)

2.3 Haze

Section 169A of the Clean Air Act sets as a national goal "the prevention of any future, and the remedying of any existing, impairment of visibility in mandatory Class I Federal areas which impairment results from manmade air pollution". To implement this provision, in 1999, EPA adopted regulations to address regional haze visibility impairment (USEPA, 1999). EPA's rule requires states to "make reasonable progress toward meeting the national goal". Specifically, states must establish reasonable progress goals, which provide for improved visibility on the most impaired (20% worst) days sufficient to achieve natural conditions by the year 2064, and for no degradation on the least impaired (20% best) days.

The primary cause of impaired visibility in the Class I areas is pollution by fine particles that scatter light. The degree of impairment, which is expressed in terms of visual range, light extinction (1/Mm), or deciviews (dv), depends not just on the total $PM_{2.5}$ mass concentration, but also on the chemical composition of the particles and meteorological conditions.

Current Conditions: A map of the average light extinction values for the most impaired (20% worst) visibility days for the 5-year baseline period (2000-2004) is shown in Figure 29.

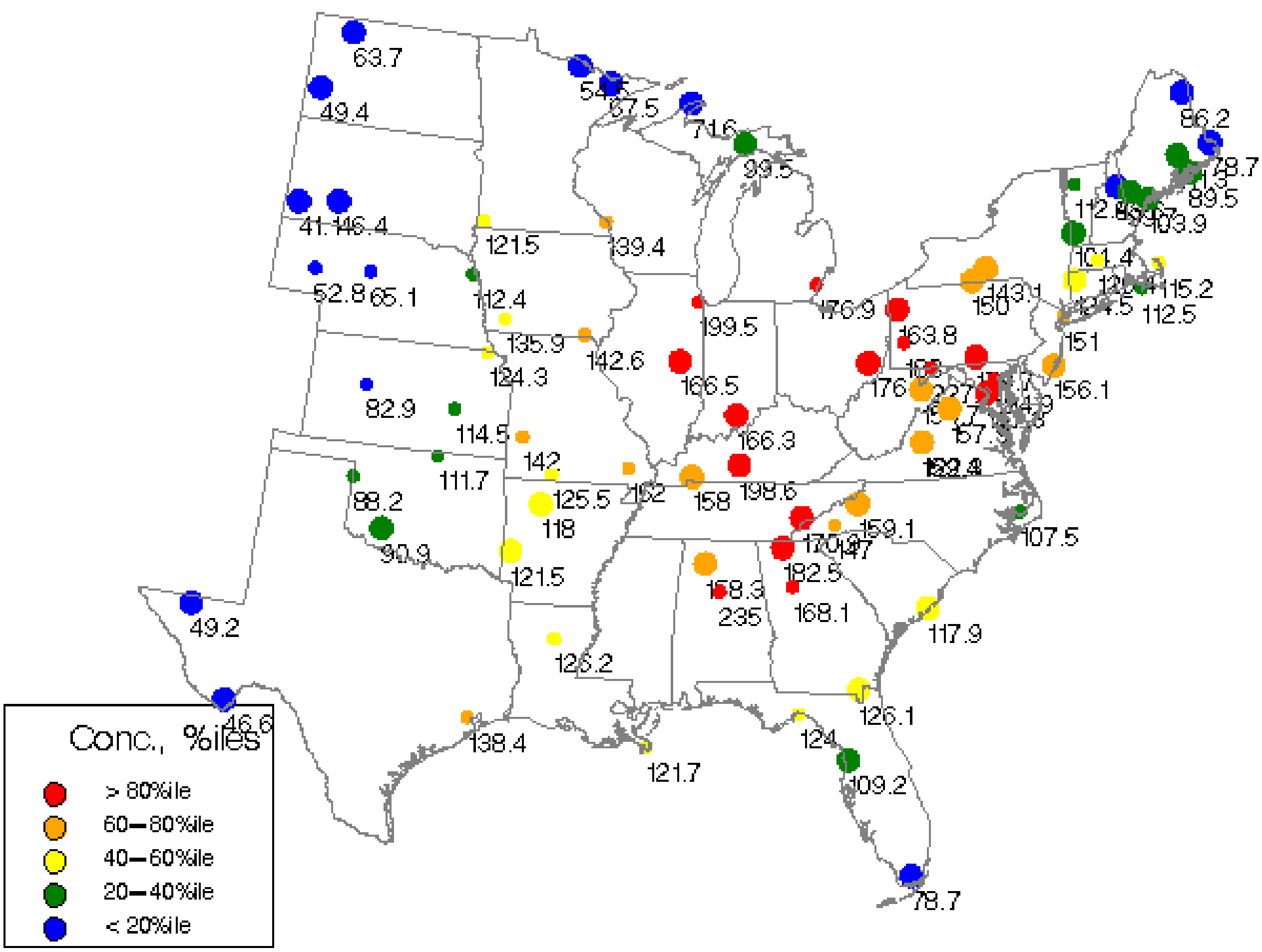


Figure 29. Baseline Visibility Levels for 20% Worst Days (2000 – 2004), units: Mm^{-1}

Initially, the baseline (2000 – 2004) visibility condition values were derived using the average for the 20% worst and 20% best days for each year, as reported on the VIEWS website: http://vista.cira.colostate.edu/views/Web/IMPROVE/SummaryData.aspx . These values were calculated using the original IMPROVE equation for reconstructed light extinction.

Three changes were made to the baseline calculations to produce a new set of values. First, the reconstructed light extinction equation was revised by the IMPROVE Steering Committee in 2005. The new IMPROVE equation was used to calculate updated baseline values.

Second, due to sampler problems, the 2002-2004 data for Boundary Waters were invalid for certain chemical species. (Note, sulfate and nitrate data were valid.) A "substituted" data set was developed by using values from Voyageurs for the invalid species.

Third, LADCO identified a number of days during 2000-2004 where data capture at the Class I monitors was incomplete (Kenski, 2007b). The missing data cause these days to be excluded from the baseline calculations. However, the light extinction due to the remaining measured species is significant (i.e., above the 80th percentile). It makes sense to include these days in the baseline calculations, because they are largely dominated by anthropogenic sources. (Only one of these days is driven by high organic carbon, which might indicate non-anthropogenic aerosol from wildfires.) As seen in Table 3, inclusion of these days in the baseline calculation results in a small, but measurable, effect on the baseline values (i.e., values increase from 0.2 to 0.8 dv).

Table 3. Average of 20% worst days, with and without missing data days

	Average Worst Day DV, per RHR	Average Worst Day DV, with Missing Data Days	Difference
BOWA	19.59	19.86	0.27
ISLE	20.74	21.59	0.85
SENE	24.16	24.38	0.22
VOYA	19.27	19.48	0.21

A summary of the initial and updated baseline values for the Class I areas in northern Michigan and northern Minnesota are presented in Table 4. The updated baseline values reflect the most current, complete understanding of visibility impairing effects and, as such, will be used for SIP planning purposes.

Table 4. Summary of visibility metrics (deciviews) for northern Class I areas

Old IMPROVE Equation (Cite: VIEWS, November 2005)									
		20% Worst Days							
		2000	**2001**	**2002**	**2003**	**2004**	**Baseline Value**	**2018 URI Value**	**Natural Conditions**
Voyageurs		18.50	18.00	19.00	19.20	17.60	18.46	16.74	11.09
BWCA		19.85	19.99	19.68	19.73	17.65	19.38	17.47	11.21
Isle Royale		20.00	22.00	20.80	19.50	19.10	20.28	18.17	11.22
Seney		22.60	24.90	24.00	23.80	22.60	23.58	20.73	11.37
		20% Best Days							
		2000	**2001**	**2002**	**2003**	**2004**	**Baseline Value**		**Natural Conditions**
Voyageurs		6.30	6.20	6.70	7.00	5.40	6.32		3.41
BWCA		5.90	6.52	6.93	6.67	5.61	6.33		3.53
Isle Royale		5.70	6.40	6.40	6.30	5.30	6.02		3.54
Seney		5.80	6.10	7.30	7.50	5.80	6.50		3.69
New IMPROVE Equation (Cite: VIEWS, March 2006)									
		20% Worst Days							
		2000	**2001**	**2002**	**2003**	**2004**	**Baseline Value**	**2018 URI Value**	**Natural Conditions**
Voyageurs		19.55	18.57	20.14	20.25	18.87	19.48	17.74	12.05
BWCA		20.20	20.04	20.76	20.13	18.18	19.86	17.94	11.61
Isle Royale		20.53	23.07	21.97	22.35	20.02	21.59	19.43	12.36
Seney		22.94	25.91	25.38	24.48	23.15	24.37	21.64	12.65
		20% Best Days							
		2000	**2001**	**2002**	**2003**	**2004**	**Baseline Value**		**Natural Conditions**
Voyageurs		7.01	7.12	7.53	7.68	6.37	7.14		4.26
BWCA		6.00	6.92	7.00	6.45	5.77	6.43		3.42
Isle Royale		6.49	7.16	7.07	6.99	6.12	6.77		3.72
Seney		6.50	6.78	7.82	8.01	6.58	7.14		3.73

Notes: (1) BWCA values for 2002 - 2004 reflect "substituted" data.
(2) New IMPROVE equation values include Kenski, 2007 adjustment for missing days

URI = uniform rate of improvement

As noted above, the goal of the visibility program is to achieve natural conditions. Initially, the natural conditions values for each Class I area were taken directly from EPA guidance (EPA, 2003). These values were calculated using the original IMPROVE equation. This equation was revised by the IMPROVE Steering Committee in 2005, and the new IMPROVE equation was used to calculate updated natural conditions values. The updated values are reported on the VIEWS website.

A summary of the initial and updated natural conditions values are presented in Table 4. The updated natural conditions values (based on the new IMPROVE equation) will be used for SIP planning purposes.

Data Variability: For the four northern Class I areas, the most important $PM_{2.5}$ chemical species are ammonium sulfate, ammonium nitrate, and organic carbon. The contribution of these species on the 20% best and 20% worst visibility days (based on 2000 – 2004 data) is provided in Figure 30. For the 20% worst visibility days, the contributions are: sulfate = 35-55%, nitrate = 25-30%, and organic carbon = 12-22%. Although the chemical composition is similar, sulfate increases in importance from west to east and concentrations are highest at Seney (the easternmost site). It should also be noted that sulfate and nitrate contribute more to light extinction than to $PM_{2.5}$ mass because of their hygroscopic properties.

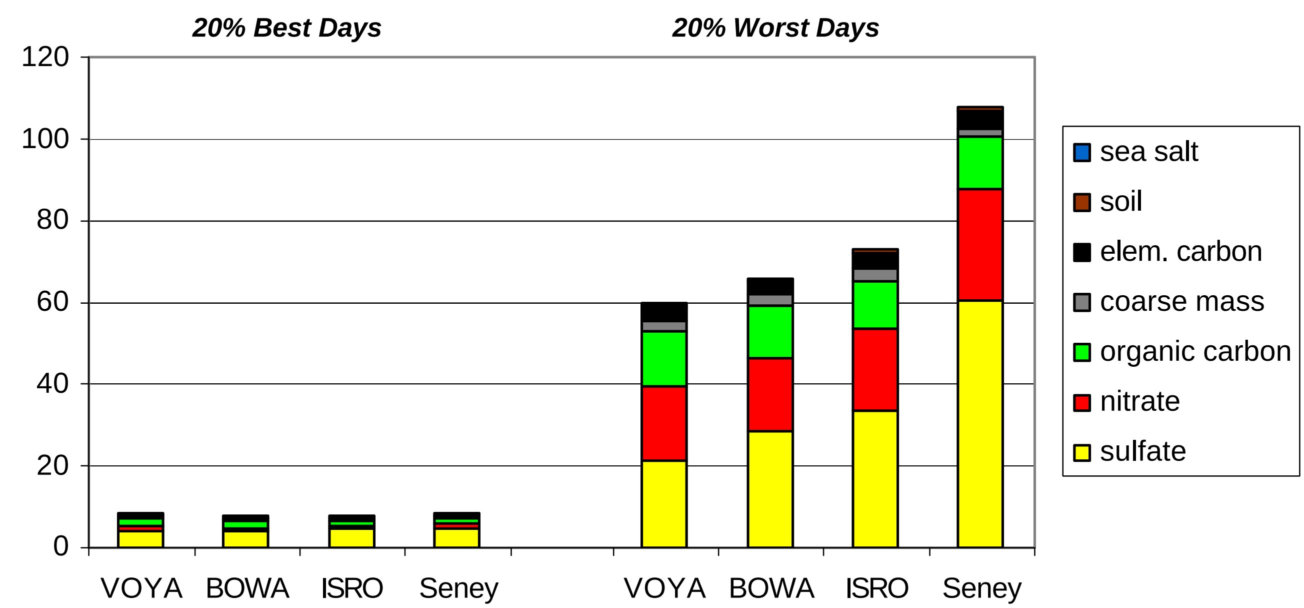


Figure 30. Chemical composition of light extinction for 20% best visibility days (left) and 20% worst visibility days (right) in terms of Mm^{-1}

Analysis of $PM_{2.5}$ mass and chemical species for rural IMPROVE (and IMPROVE-protocol) sites in the eastern U.S. showed a high degree of correlation between $PM_{2.5}$-mass, sulfate, and nitrate levels (see Figure 31). The Class I sites in northern Michigan and northern Minnesota, in particular, are highly correlated for $PM_{2.5}$ mass, sulfates, and organic carbon mass (AER, 2004).

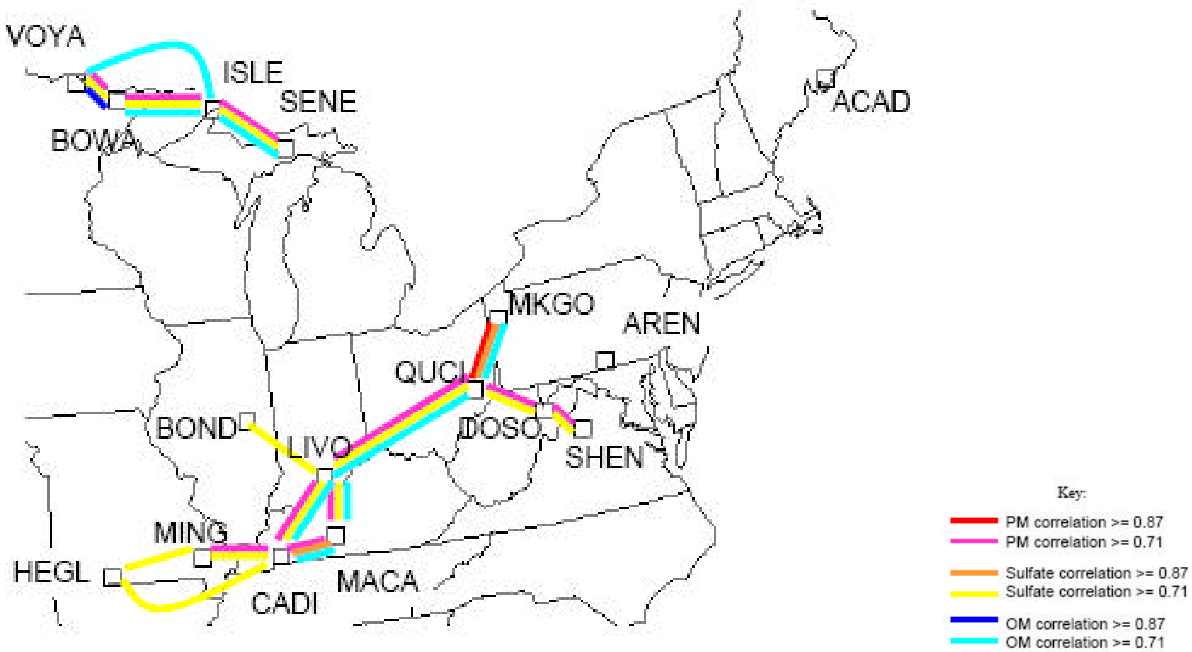


Figure 31. Correlations among IMPROVE (and IMPROVE-protocol) monitoring sites in Eastern U.S.

Long-term trends at Boundary Waters (the only regional site with a sufficient data record) show significant decreases in total $PM_{2.5}$ (-0.005 ug/year) and SO4 (-0.04 ug/year) and an increase in NO3 (+0.01 ug/year). These $PM_{2.5}$ and SO4 trends are generally consistent with long-term trends at other IMPROVE sites in the eastern U.S., which have shown widespread decreases in SO4 and $PM_{2.5}$ (DeBell, et al, 2006). Detecting changes in nitrate has been hampered by uncertainties in the IMPROVE data for particular years and, thus, this estimate should be considered tentative.

Haze in the Midwest Class I areas has no strong seasonal pattern. Poor visibility days occur throughout the year, as indicated in Figure 32. (Note, in contrast, other parts of the country, such as Shenandoah National Park in Virginia, show a strong tendency for the worst air quality days to occur in the summer months.) This figure and Figure 33 (which presents the monthly average light extinction values based on all sampling days) also show that sulfate and organic carbon concentrations are higher in the summer, and nitrate concentrations are higher in the winter, suggesting the importance of different sources and meteorological conditions at different times of the year.

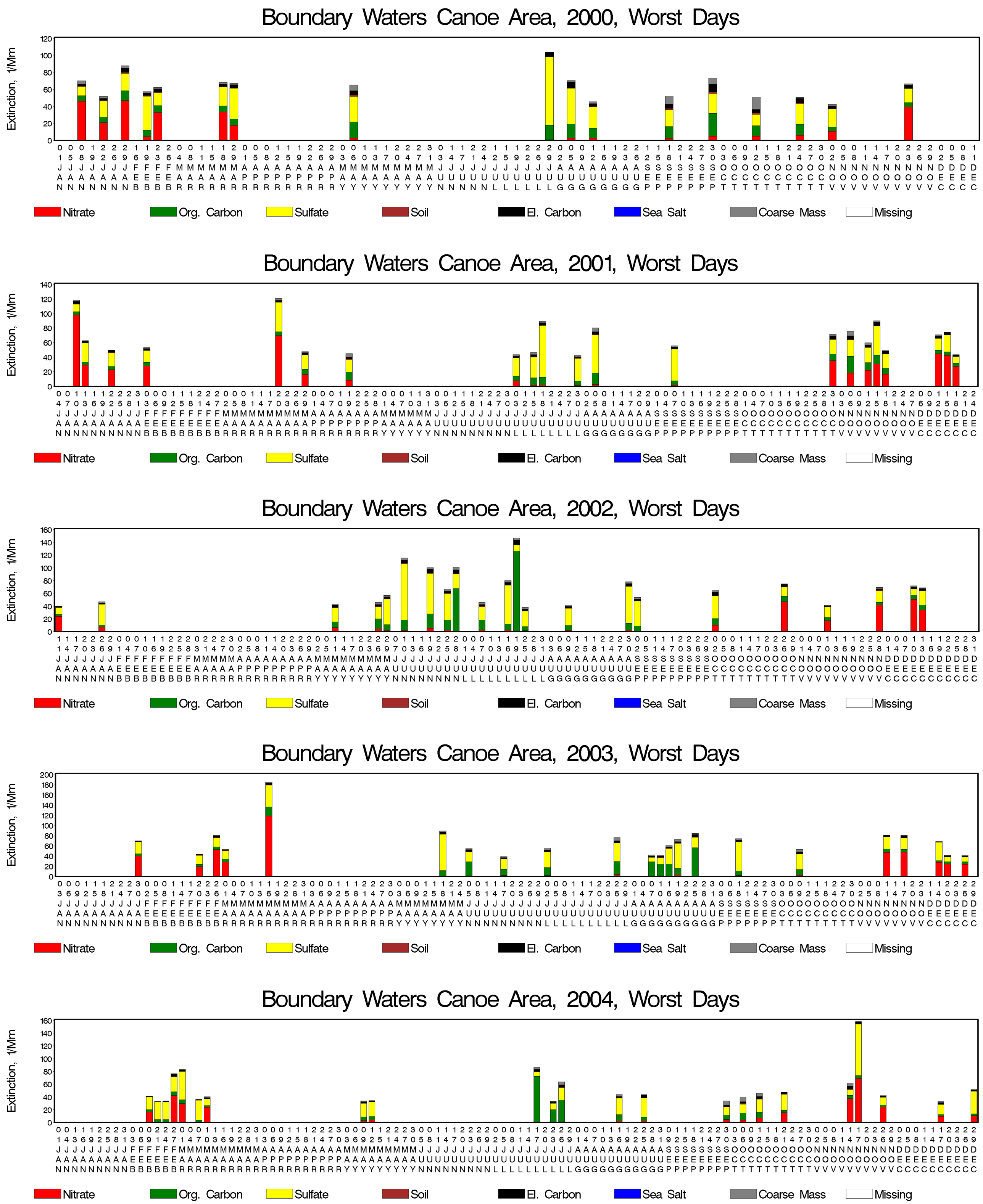


Figure 32. Daily light extinction values for 20% worst days at Boundary Waters (2000 – 2004)

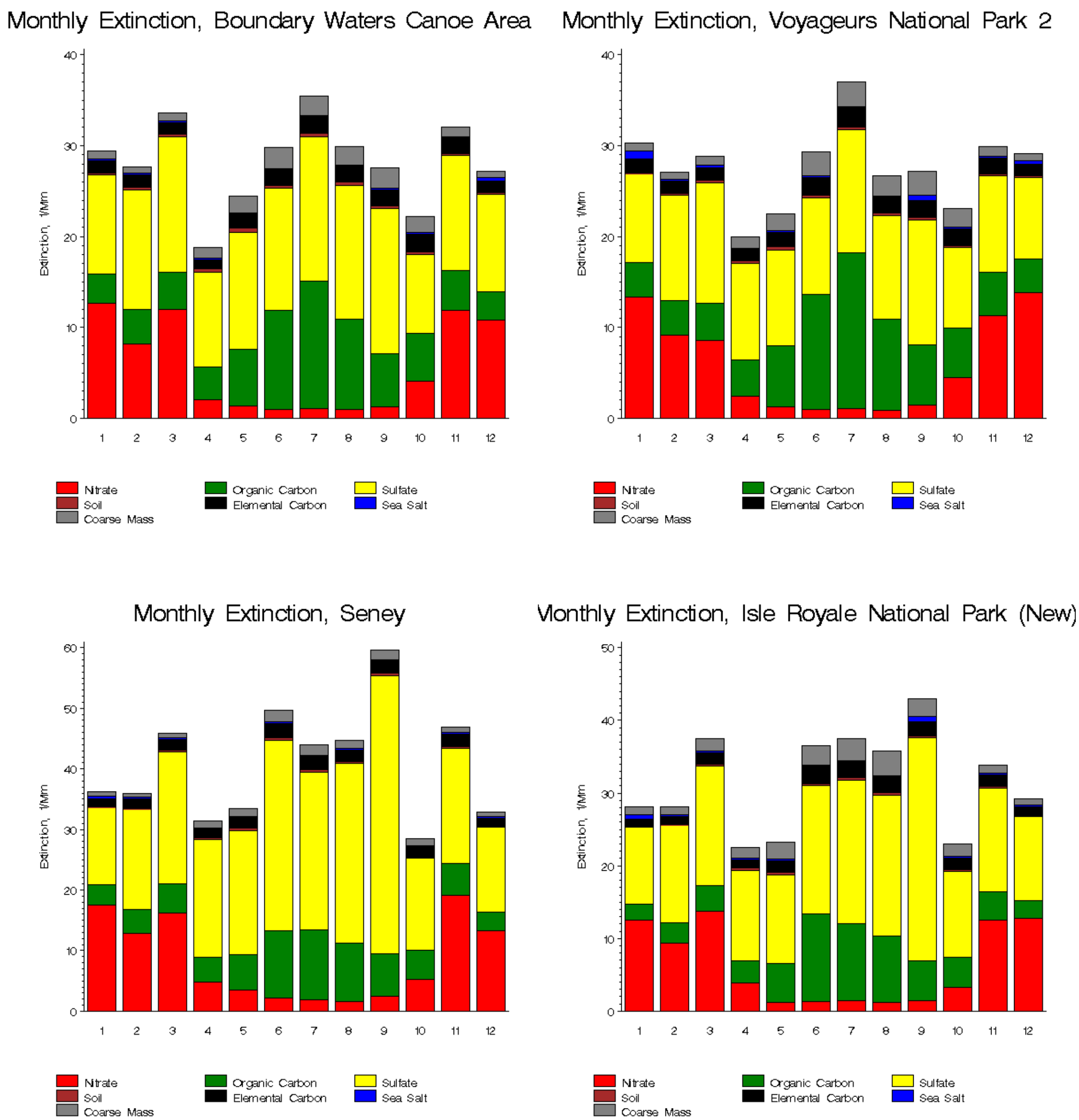


Figure 33. Monthly average light extinction values for northern Class I areas

Precursor Sensitivity: Results from two analyses using thermodynamic equilibrium models provide information on the effect of changes in precursor concentrations on $PM_{2.5}$ concentrations (and, in turn, visibility levels) in the northern Class I areas. First, a preliminary analysis using data collected at Seney indicated that $PM_{2.5}$ there is most sensitive to reductions in sulfate, but is also sensitive to reductions in nitric acid (Blanchard, 2004).

Second, an analysis was performed using data from the Midwest ammonia monitoring network for a site in Minnesota -- Great River Bluffs, which is the closest ammonia monitoring site to the northern Class I areas (Blanchard, 2005b). Figure 34 shows $PM_{2.5}$ concentrations as a function of sulfate, nitric acid (HNO3), and ammonia (NH3). Reductions in sulfate (i.e., movement to the left of baseline value [represented by the red star]), as well as reductions in nitric acid (i.e., movement downward) and NH3 (i.e., movement to the left), result in lower $PM_{2.5}$ concentrations. Thus, reductions in sulfate, nitric acid, and ammonia will lower $PM_{2.5}$ concentrations and improve visibility in the northern Class I areas.

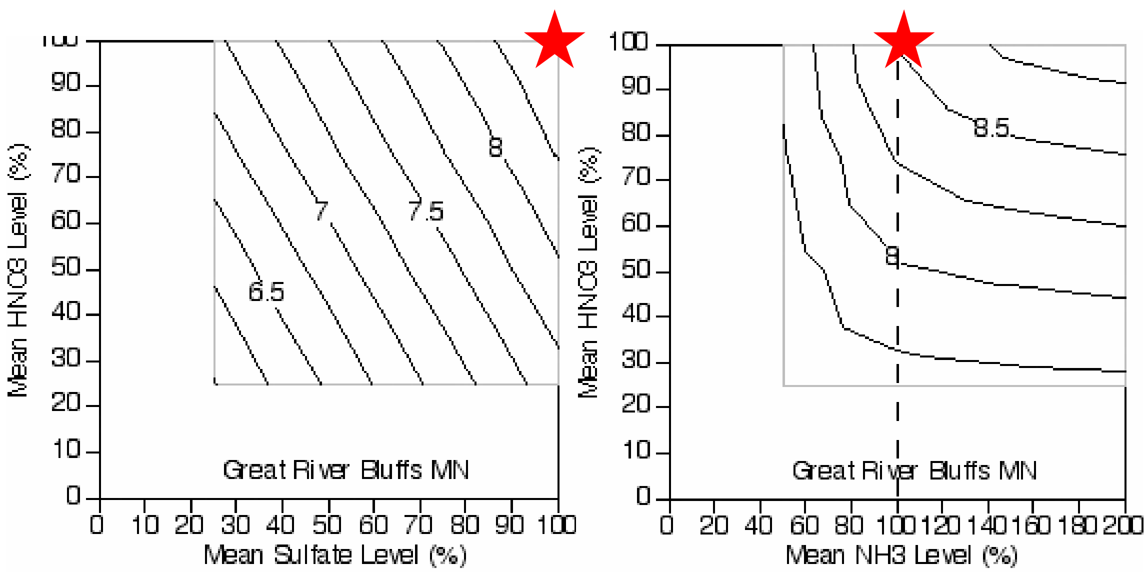


Figure 34. Predicted $PM_{2.5}$ mass concentrations at Great River Bluffs, MN as functions of changes in sulfate, nitric acid, and ammonia

Meteorology and Transport: The role of meteorology in haze is complex. Wind speed and wind direction govern the movement of air masses from polluted areas to the cleaner wilderness areas. As noted above, increasing humidity increases the efficiency with which sulfate and nitrate aerosols scatter light. Temperature and humidity together govern whether ammonium nitrate can form from its precursor gases, nitric acid and ammonia. Temperature and sunlight also play an indirect role in emissions of biogenic organic species that condense to form particulate organic matter; emissions increase in the summer daylight hours.

Trajectory analyses were performed to understand transport patterns for the 20% worst and 20% best visibility days. The composite results for the four northern Class I areas are provided in Figure 35. The orange areas are where the air is most likely to come from, and the green areas are where the air is least likely to come from. As can be seen, bad air days are generally associated with transport from regions located to the south, and good air days with transport from Canada.

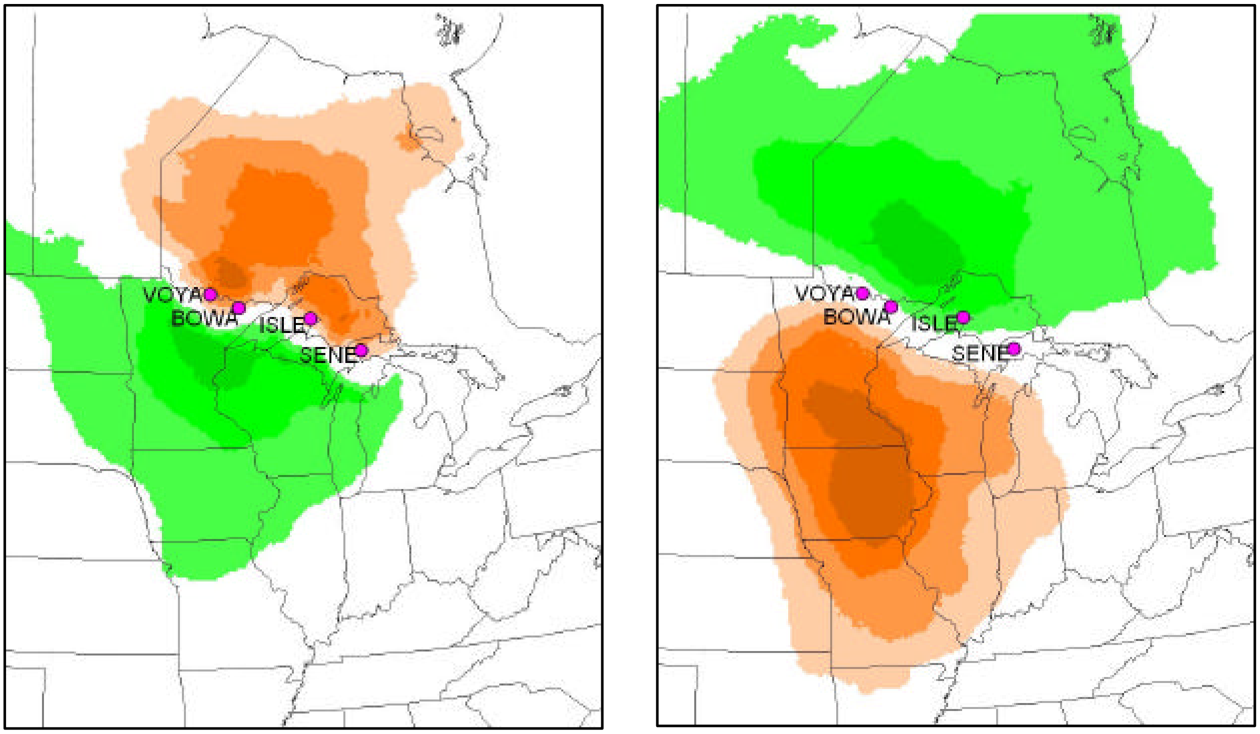


Figure 35. Composite back trajectories for light extinction- 20% best visibility days (left) and 20% worst visibility days (right) (2000 – 2005)

Source Culpability: Air quality data analyses (including the trajectory analyses above) and dispersion modeling were used to provide information on source region and source sector contributions to regional haze in the northern Class I areas (see MRPO, 2008). Based on this information, the most important contributing states are Michigan, Minnesota, and Wisconsin, as well as Missouri, North Dakota, Iowa, Indiana and Illinois (see, for example, Figure 35 above). The most important contributing pollutants and source sectors are SO2 emissions from electrical generating units (EGUs) and certain non-EGUs, which lead to sulfate formation, and NOx emissions from a variety of source types (e.g., motor vehicles), which lead to nitrate formation. Ammonia emissions from livestock waste and fertilizer applications are also important, especially for nitrate formation.

A source apportionment study was performed using monitoring data from Boundary Waters and statistical analysis methods (DRI, 2005). The study shows that a large portion of $PM_{2.5}$ mass consists of secondary, regional impacts, which cannot be attributed to individual facilities or sources (e.g., secondary sulfate, secondary nitrate, and secondary organic aerosols). Industrial sources contribute about 3-4% and mobile sources about 4-7% to $PM_{2.5}$ mass.

A special study was performed in Seney to identify sources of organic carbon (Sheesley, et al, 2004). As seen in Figure 36, the highest $PM_{2.5}$ concentrations occurred during the summer, with organic carbon being the dominant species. The higher summer organic carbon concentrations were attributed mostly to secondary organic aerosols of biogenic origin because of the lack of primary emission markers, and concentrations of know biogenic-related species (e.g., pinonic acid – see Figure 36) were also high during the summer.

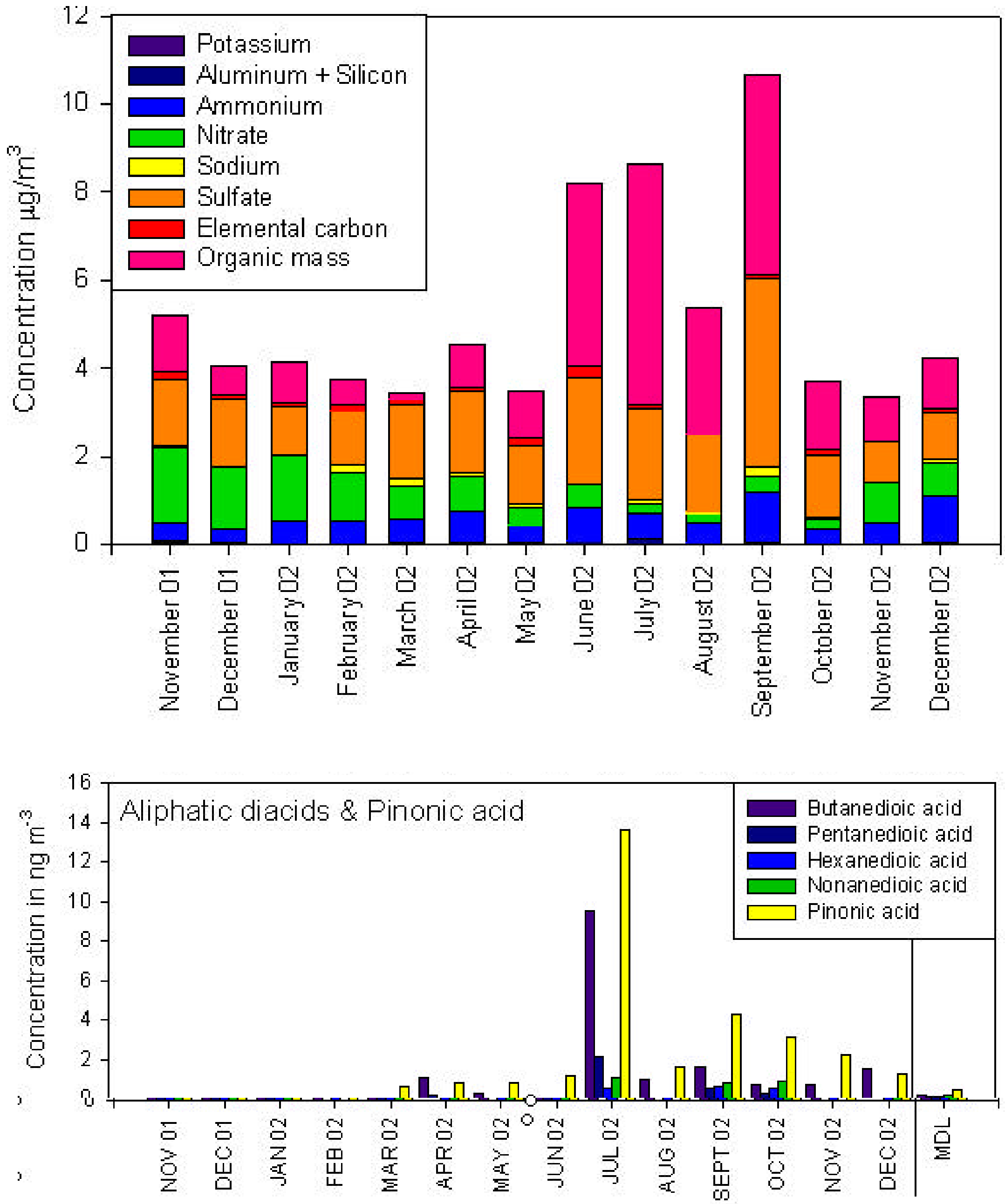


Figure 36. Monthly concentrations of $PM_{2.5}$ species (top), and secondary and biogenic-related organic carbon species in Seney (bottom)

Although the Seney study showed that biomass burning was a relatively small contributor to organic carbon on an annual average basis, episodic impacts are apparent (see, for example, high organic carbon days in Figure 32). To assess further whether burning is a significant contributor to visibility impairment in the northern Class I areas, the $PM_{2.5}$ chemical speciation data were examined for days with high organic carbon and elemental carbon concentrations, which are indicative of biomass burning impacts. Only a handful of such days were identified:

Table 5. Days with high OC and EC concentrations in northern Class I areas

Site	2000	2001	2002	2003	2004
Voyageurs	---	---	Jun 1	Aug 25	Jul 17
			Jun 28		
			Jul 19		
Boundary Waters	---	---	Jun 28	Aug 25	Jul 17
			Jul 19		
Isle Royale	---	---	Jun 1	Aug 25	---
			Jun 28		
Seney	---	---	Jun 28	---	---

Back trajectories on these days point mostly to wildfires in Canada. Elimination of these high organic carbon concentration days has a small effect in lowering the baseline visibility levels in the northern Class I areas (i.e., Minnesota Class I areas change by about 0.3 deciviews and Michigan Class I areas change by less than 0.2 deciviews). This suggests that fire activity, although significant on a few days, is on average a relatively small contributor to visibility impairment in the northern Class I areas.

In summary, these analyses show that organic carbon in the northern Class I is largely uncontrollable.

Section 3.0 Air Quality Modeling

Air quality models are relied on by federal and state regulatory agencies to support their planning efforts. Used properly, models can assist policy makers in deciding which control programs are most effective in improving air quality, and meeting specific goals and objectives. For example, models can be used to conduct "what if" analyses, which provide information for policy makers on the effectiveness of candidate control programs.

The modeling analyses were conducted in accordance with EPA's modeling guidelines (EPA, 2007a). Further details of the modeling are provided in two protocol documents: LADCO, 2007a and LADCO, 2007b.

This section reviews the development and evaluation of the modeling system used for the multi-pollutant analyses. Application of the modeling system (i.e., attainment demonstration for ozone and $PM_{2.5}$, and reasonable progress assessment for haze) is covered in the following sections.

3.1 Selection of Base Year

Two base years were used in the modeling analyses: 2002 and 2005. EPA's modeling guidance recommends using 2002 as the baseline inventory year, but also allows for use of an alternative baseline inventory year, especially a more recent year. Initially, LADCO conducted modeling with a 2002 base year (i.e., Base K/Round 4 modeling, which was completed in 2006). A decision was subsequently made to conduct modeling with a 2005 base year (i.e., Base M/Round 5, which was completed in 2007). As discussed in the previous section, 2002 and 2005 both had above normal ozone conducive conditions, although 2002 was more severe compared to 2005. Examination of multiple base years provides for a more complete technical assessment. Both sets of model runs are discussed in this document.

3.2 Future Years of Interest

To address the multiple attainment requirements for ozone and $PM_{2.5}$, and reasonable progress goals for regional haze, several future years are of interest:

- 2008 Planning year for ozone basic nonattainment areas (attainment date 2009)[8]
- 2009 Planning year for ozone moderate nonattainment areas and $PM_{2.5}$ nonattainment areas (attainment date 2010)
- 2012 Planning year for ozone moderate nonattainment areas and $PM_{2.5}$ nonattainment areas, with 3-year extension (attainment date 2013)
- 2018 First milestone year for regional haze planning

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[8] According to USEPA's ozone implementation rule (USEPA, 2005), emission reductions needed for attainment must be implemented by the beginning of the ozone season immediately preceding the area's attainment date. The PM2.5 implementation rule contains similar provisions – i.e., emission reductions should be in place by the beginning of the year preceding the attainment date (USEPA, 2007c). The logic for requiring emissions reductions by the year (or season) immediately preceding the attainment year follows from language in the Clean Air Act, and the ability for an area to receive up to two 1-year extensions. Therefore, emissions in the year preceding the attainment year should be at a level that is consistent with attainment. It also follows that the year preceding the attainment year should be modeled for attainment planning purposes.

Detailed emissions inventories were developed for 2009 and 2018. To support modeling for other future years, less rigorous emissions processing was conducted (e.g., 2012 emissions were estimated for several source sectors by interpolating between 2009 and 2018 emissions).

3.3 Modeling System

The air quality analyses were conducted with the CAMx model, with emissions and meteorology generated using EMS (and CONCEPT) and MM5, respectively. The selection of CAMx as the primary model is based on several factors: performance, operator considerations (e.g., ease of application and resource requirements), technical support and documentation, model extensions (e.g., 2-way nested grids, process analysis, source apportionment, and plume-in-grid), and model science. CAMx model set-up for Base M and Base K is summarized below:

Base M (2005)	Base K (2002)
• CAMx v4.50	* CAMx 4.30
• CB05 gas phase chemistry	* CB-IV with updated gas-phase chemistry
• SOA chemistry updates	* No SOA chemistry updates
• AERMOD dry deposition scheme	* Wesley-based dry deposition
• ISORROPIA inorganic chemistry	• ISORROPIA inorganic chemistry
• SOAP organic chemistry	• SOAP organic chemistry
• RADM aqueous phase chemistry	• RADM aqueous phase chemistry
• PPM horizontal transport	• PPM horizontal transport

3.4 Domain/Grid Resolution

The National RPO grid projection was used for this modeling. A subset of the RPO domain was used for the LADCO modeling. For $PM_{2.5}$ and haze, the large eastern U.S. grid at 36 km (see box on right side of Figure 36) was used. A $PM_{2.5}$ sensitivity run was also performed for this domain at 12 km. For ozone, the smaller grid at 12 km (see shaded portion of the box on the right side of Figure 37) was used for most model runs. An ozone sensitivity run was also performed with a 4km sub-grid over the Lake Michigan area and Detroit/Cleveland.

The vertical resolution in the air quality model consists of 16 layers extending up to 15 km, with higher resolution in the boundary layer.

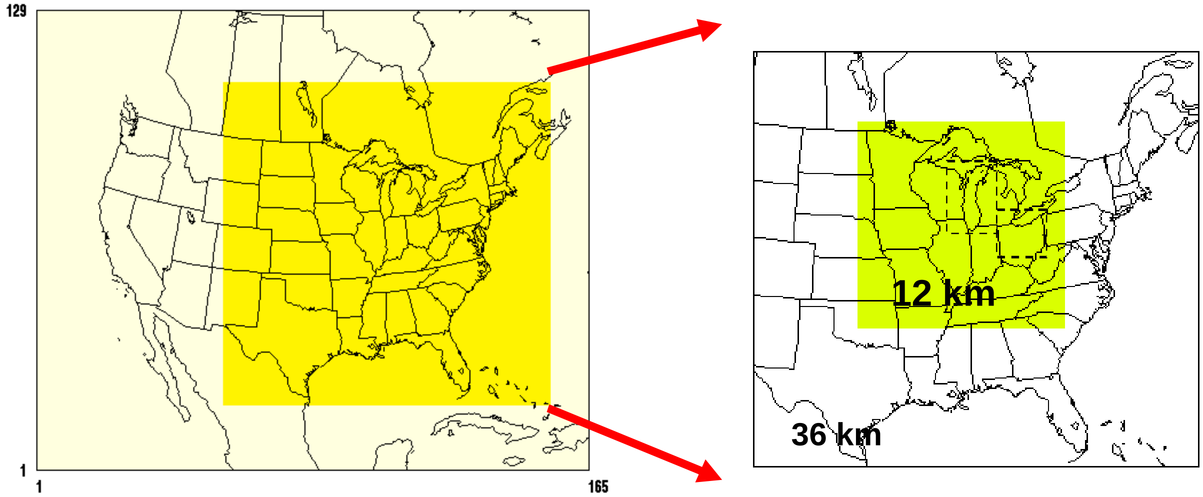

Figure 37. Modeling grids – RPO domain (left) and LADCO modeling domain (right)

3.5 Model Inputs: Meteorology
Meteorological inputs were derived using the Fifth-Generation NCAR/Penn State Meteorological Model (MM5) – version 3.6.3 for the years 2001–2003, and version 3.7 for the year 2005. The MM5 modeling domains are consistent with the National RPO grid projections (see Figure 38).

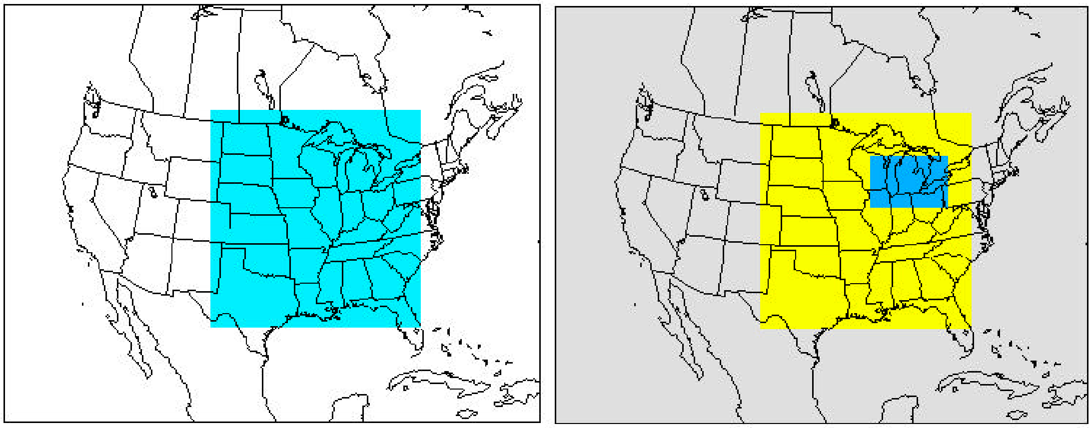

Figure 38. MM5 modeling domain for 2001-2003 (left) and 2005 (right)

The annual 2002 36 km MM5 simulation was completed by Iowa DNR. The 36/12 km 2-way nested simulation for the summers of 2001, 2002, and 2003 were conducted jointly by Illinois EPA and LADCO. The 36 km non-summer portion of the annual 2003 simulation was conducted by Wisconsin DNR. The annual 2005 36/12 km (and summer season 4 km) MM5 modeling was completed by Alpine Geophysics. Wisconsin DNR also completed 36/12 km MM5 runs for the summer season of 2005.

Model performance was assessed quantitatively with the METSTAT tool from Environ. The metrics used to quantify model performance include mean observation, mean prediction, bias, gross error, root mean square error, and index of agreement. Model performance metrics were calculated for several sub-regions of the modeling domain (Figure 39) and represent hourly spatial averages of multiple monitor locations. Additional analysis of rainfall is done on a monthly basis.

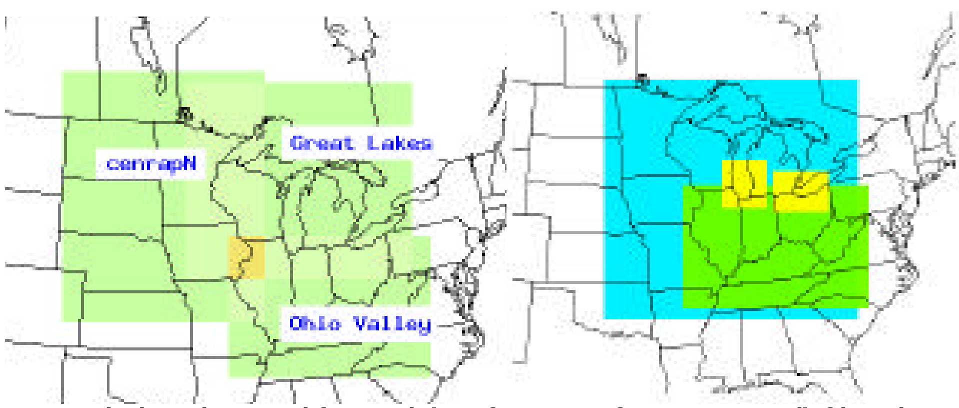

Figure 39. Sub-domains used for model performance for 2001-2003 (left) and 2005 (right)

A summary of the performance evaluation results for the meteorological modeling is provided below. Further details are provided in two summary reports (LADCO, 2005 and LADCO, 2007c).

Temperature: The biggest issue with the performance in the upper Midwest is the existence of a cool diurnal temperature bias in the winter and warm temperature bias over night during the summer (see Figure 40). These features are common to other annual MM5 simulations for the central United States and do not appear to adversely affect model performance.

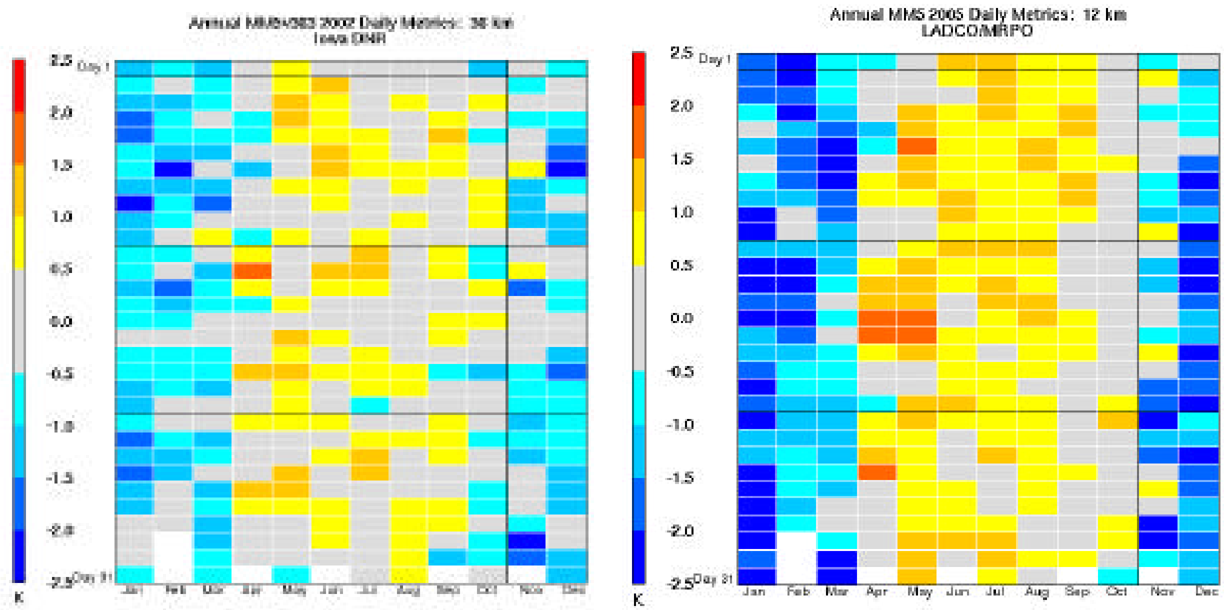

Figure 40. Daily temperature bias for 2002 (left) and 2005 (right) with hotter colors (yellow/orange/red) representing overestimates and cooler colors (blues) representing underestimates

Note: months are represented from left to right (January to December) and days are represented from top to bottom (1 to 30(31) – i.e., upper left hand corner is January 1 and lower right hand corner is December 31

Wind Fields: The wind fields are generally good. Wind speed bias is less than 0.5 m/sec and wind speed error is consistently between 1.0 and 1.5 m/sec. Wind direction error is generally within 15-30 degrees.

Mixing Ratio: The mixing ratio (a measure of humidity) is over-predicted in the late spring and summer months, and mixing ratio error is highest during this period. There is little bias and error during the cooler months when there is less moisture in the air.

Rainfall: The modeled and observed rainfall totals show good agreement spatially and in terms of magnitude in the winter, fall, and early spring months. There are, however, large over-predictions of rainfall in the late spring and summer months (see Figure 41). These over-predictions are seen spatially and in magnitude over the entire domain, particularly in the Southeast United States, and are likely due to excessive convective rainfall being predicted in MM5. This over-prediction of rainfall in MM5 does not necessarily translate into over-prediction of wet deposition in the photochemical model. CAMx does not explicitly use the convective and non-convective rainfall output by MM5, but estimates wet scavenging by hydrometeors using cloud, ice, snow, and rain water mixing ratios output by MM5. Nevertheless, this could have an effect on model performance for $PM_{2.5}$, as discussed in Section 3.7, and may warrant further attention.

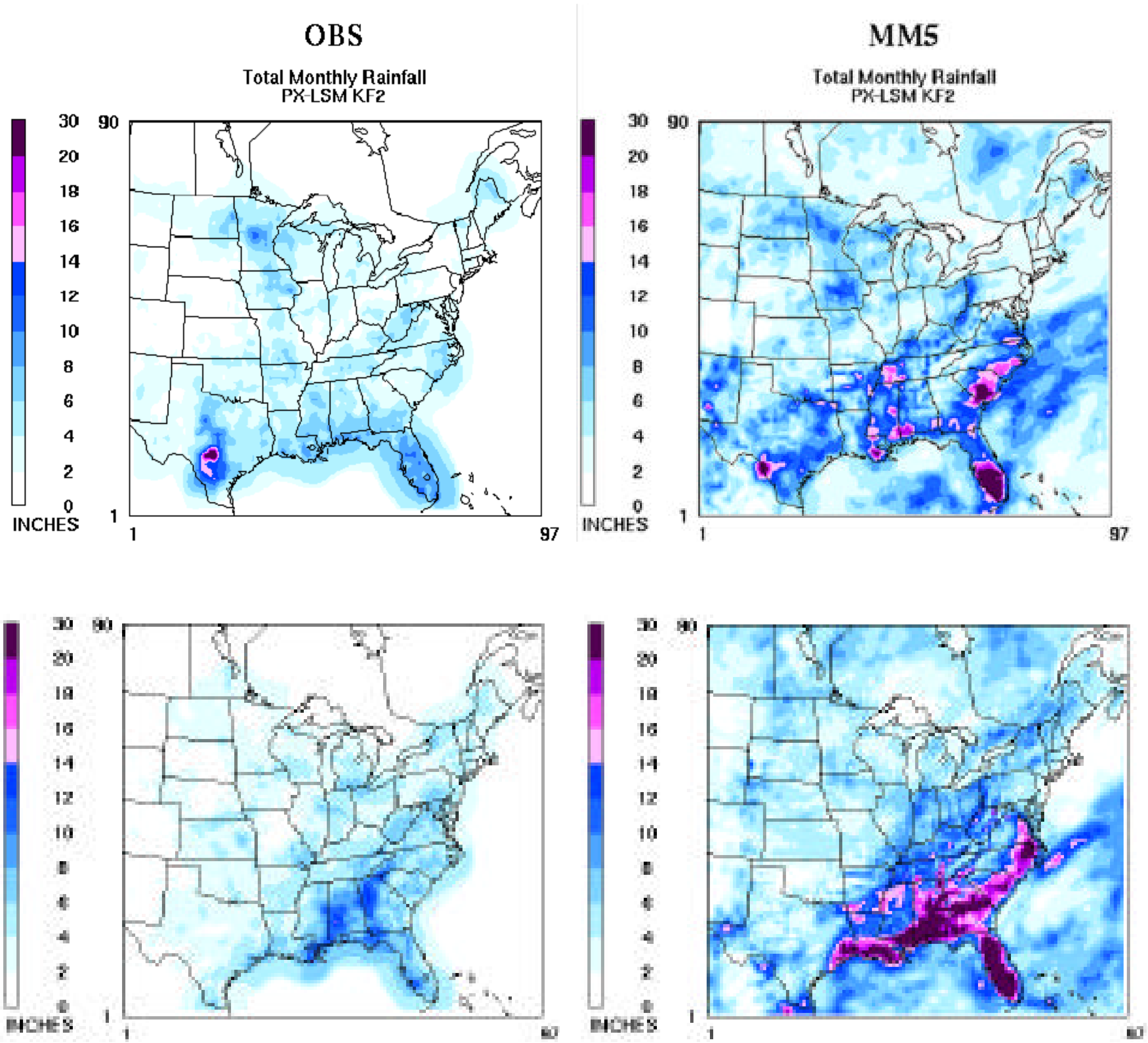

Figure 41. Comparison of observed (left column) and modeled (right column) monthly rainfall for July 2002 (top) and July 2005 (bottom)

3.6 Model Inputs: Emissions

Emission inventories were prepared for two base years: 2002 (Base K) and 2005 (Base M), and several future years: 2008, 2009, 2012, and 2018. Further details of the emission inventories are provided in two summary reports (LADCO, 2006a and LADCO, 2008a) and the following pages of the LADCO web site:

http://www.ladco.org/tech/emis/basek/BaseK_Reports.htm
http://www.ladco.org/tech/emis/r5/round5_reports.htm

For on-road, nonroad, ammonia, and biogenic sources, emissions were estimated by models. For the other sectors (point sources, area sources, and MAR [commercial marine, aircraft, and railroads]), emissions were prepared using data supplied by the LADCO States and other RPOs.

Base Year Emissions: State and source sector emission summaries for 2002 (Base K) and 2005 (Base M) are compared in Figure 42. Additional detail is provided in Tables 6a (all sectors – tons per day) and 6b (EGUs – tons per year).

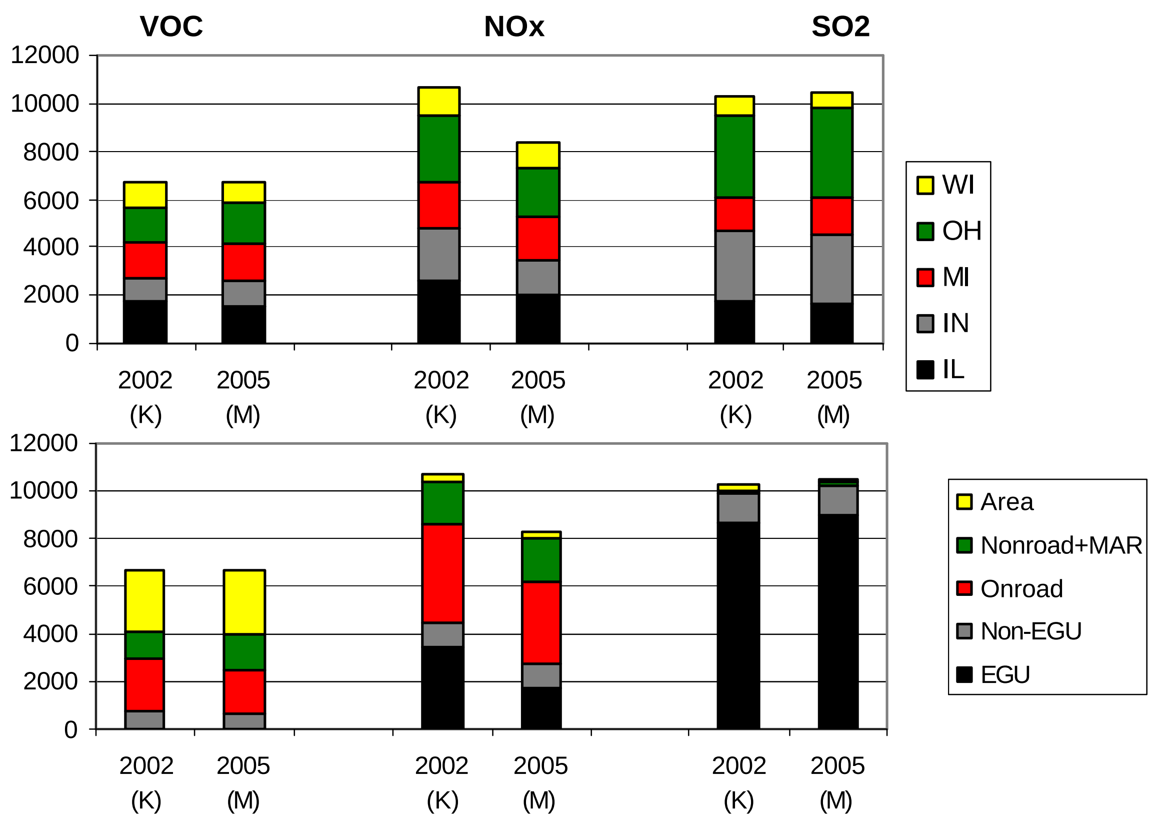

Figure 42. Base K and Base M emissions for 5-state LADCO region by state (top) and source sector (bottom), units: tons per summer weekday

A summary of the base year emissions by sector for the LADCO States is provided below.

	VOC	Base M	BaseK	Base M	BaseK	BaseK	Base M		NOx	Base M	BaseK	Base M	BaseK	BaseK	Base M		SOX	Base M	BaseK	Base M	BaseK	BaseK	Base M		PM2.5	Base M	BaseK	Base M	BaseK	BaseK	Base M
July	2002	2005	2009	2009	2012	2018	2018		2002	2005	2009	2009	2012	2018	2018		2002	2005	2009	2009	2012	2018	2018		2002	2005	2009	2009	2012	2018	2018
Nonroad																															
IL	224	321	164	257	149	130	213		324	333	263	275	224	154	155		31	33	5	5	0.6	0.4	0.4			30		24			14
IN	125	195	94	160	95	95	128		178	191	142	158	141	141	89		17	19	3	3	3	0.3	0.2			17		13			7
MI	348	414	307	350	276	222	271		205	239	159	197	133	93	112		19	22	3	3	0.5	0.3	0.3			22		18			11
OH	222	356	161	294	145	126	238		253	304	195	246	162	109	135		23	29	4	5	0.5	0.3	0.4			27		22			13
WI	214	238	194	203	175	140	157		145	157	114	129	97	69	77		13	15	2	2	0.3	0.2	0.2			14		12			7
5-State Total	1133	1524	920	1264	840	713	1007		1105	1224	873	1005	757	566	568		103	118	17	18	4.9	1.5	1.5			110		89			52
U.S. Total	8463	9815	5442	8448		5244	6581		6041	9060	6057	8120		5832	5100		505	654	117	153		104	13			573		750			475
MAR																															
IL	10	11	10	10	10	10	6		277	246	201	228	195	186	165		0	22	0	19	0	0	17			7		6			4
IN	5	5	5	5	5	5	3		123	93	89	87	87	84	65		0.2	8	0.2	7	0.2	0.2	6			2		2			2
MI	7	7	7	7	7	8	7		114	87	112	82	111	110	65		0.6	21	0.7	14	0.7	0.8	8			3		3			2
OH	8	7	8	7	8	8	5		177	134	128	126	126	122	94		0.4	14	0.3	12	0.3	0.3	10			4		4			2
WI	4	4	4	4	4	4	3		79	58	59	54	59	57	41		12.7	8	9.5	6	9.5	8.7	5			2		2			1
5-State Total	34	34	34	33	34	35	24		770	618	589	577	578	559	430		13.9	73	10.7	58	10.7	10	46			18		17			11
U.S. Total	307	317	321	157	329	346	334		4968	4515	4002	1813	3964	3919	3812		620	512	509	122	509	503	290			147		57			165
OtherArea																															
IL	679	675	688	594	700	738	582		62	48	68	48	70	73	49		11	11	12	16	12	13	16			40		64			69
IN	354	391	365	358	373	398	384		62	56	65	58	67	69	59		158	32	150	32	151	153	32			2		2			2
MI	518	652	516	562	520	541	549		49	49	52	50	53	54	51		71	29	68	29	68	68	28			111		114			120
OH	546	604	550	506	558	593	487		50	93	59	108	60	62	108		22	6	34	15	35	35	14			19		35			34
WI	458	315	467	290	474	506	293		32	37	34	37	34	35	37		9	17	9	13	10	10	13			11		12			12
5-State Total	2555	2637	2586	2310	2625	2776	2295		255	283	278	301	284	293	304		271	95	273	105	276	279	103			183		227			237
U.S. Total	17876	21093	18638	18683		20512	24300		3856	4899	4100	4220		4418	5357		2075	2947	2062	2559		2189	2709			2735		2621			2570
On-Road																															
IL	446	341	314	268	260	197	151		890	748	578	528	474	300	201			9		4			3			13		10			6
IN	405	282	237	235	193	150	138		703	541	425	402	313	187	173			11		3			2			9		7			2
MI	522	351	335	269	303	217	163		926	722	680	501	619	385	204			14		4			3			12		9			3
OH	574	680	365	424	340	238	242		1035	934	609	693	512	270	274			18		4			4			16		12			4
WI	238	175	144	119	117	88	68		481	457	303	322	226	118	138			9		2			2			8		6			2
5-State Total	2185	1829	1395	1315	1213	890	762		4035	3402	2595	2446	2144	1260	990			61		17			14			58		44			17
U.S. Total	14263				7825				23499				13170																		
EGU																															
IL	9	7	8	6	8	9	7		712	305	227	275	244	231	224		1310	1158	944	958	789	810	869			13		34			77
IN	6	6	6	6	7	6	6		830	393	406	370	424	283	255		2499	2614	1267	1033	1263	1048	1036			16		73			74
MI	12	6	11	4	11	12	4		448	393	218	242	219	247	243		1103	1251	1022	667	1031	1058	725			15		25			29
OH	5	4	6	5	7	7	6		1139	408	330	280	322	271	285		3131	3405	1463	1326	994	701	983			28		94			80
WI	3	5	3	2	4	4	3		293	213	146	165	139	147	177		602	545	512	460	492	500	435			0		22			25
5-State Total	35	28	34	23	37	38	26		3422	1712	1327	1332	1348	1179	1184		8645	8973	5208	4444	4569	4117	4048			72		248			285
U.S. Total	214	140	195	124	197	215	138		14371	10316	7746	7274	7721	7007	6095		31839	34545	20163	16903	17629	14727	14133			685		1131			1571
Non-EGU																															
IL	313	221	286	218	305	350	258		356	330	334	218	338	343	235		373	423	251	335	257	249	346			16		17			19
IN	150	130	160	137	170	199	167		238	179	212	175	216	225	178		292	218	270	216	274	290	180			35		36			44
MI	123	116	115	119	122	139	140		216	240	208	242	214	229	271		162	158	166	148	171	185	163			20		21			25
OH	77	84	75	87	79	90	104		177	175	157	166	160	167	178		240	289	231	288	210	216	293			27		28			33
WI	88	84	97	87	104	120	106		98	97	91	93	92	94	81		163	156	154	152	155	156	85			0		0.1			0.1
5-State Total	751	635	733	648	780	898	775		1085	1021	1002	894	1020	1058	943		1230	1244	1072	1139	1067	1096	1067			98		102			121
U.S. Total	4087	3877	4409		4700	5378			6446	6730	6129		6435	6952			5759	5630	6093		6340	6970						1444			1777
IL	1681	1576	1470	1353	1432	1434	1217		2621	2010	1671	1572	1545	1287	1029		1725	1656	1212	1337	1059	1072	1251			119		155			189
IN	1045	1009	867	901	843	853	826		2134	1453	1339	1250	1248	989	819		2966	2902	1690	1294	1691	1492	1256			81		133			131
MI	1530	1546	1291	1311	1239	1139	1134		1958	1730	1429	1314	1349	1118	946		1356	1495	1260	865	1271	1312	927			183		190			190
OH	1432	1735	1165	1323	1137	1062	1082		2831	2048	1478	1619	1342	1001	1074		3416	3761	1732	1650	1240	953	1304			121		195			166
WI	1005	821	909	705	878	862	630		1128	1019	747	800	647	520	551		800	750	687	635	667	675	540			35		54			47
5-State Total	6693	6687	5702	5593	5529	5350	4889		10672	8260	6664	6555	6131	4915	4419		10263	10564	6581	5781	5928	5504	5280			539		727			723

Table 6b. EGU Emissions for Midwest States (2018)						
	Heat Input (MMBTU/year)	Scenario	SO2 (tons/year)	SO2 (lb/MMBTU)	NOx (tons/year)	NOx (lb/MMBTU)
IL	**980,197,198**	**2001 - 2003 (average)**	**362,417**	**0.74**	**173,296**	**0.35**
		IPM 2.1.9	241,000		73,000	
	1,310,188,544	IPM3.0 (base)	277,337	0.423	70,378	0.107
		IPM3.0 - will do	140,296	0.214	62,990	0.096
		IPM3.0 - may do	140,296	0.214	62,990	0.096
IN	**1,266,957,401**	**2001 - 2003 (average)**	**793,067**	**1.25**	**285,848**	**0.45**
		IPM 2.1.9	377,000		95,000	
	1,509,616,931	IPM3.0 (base)	361,835	0.479	90,913	0.120
		IPM3.0 - will do	417,000	0.552	94,000	0.125
		IPM3.0 - may do	417,000	0.552	94,000	0.125
MI	**756,148,700**	**2001 - 2003 (average)**	**346,959**	**0.92**	**132,995**	**0.35**
		IPM 2.1.9	399,000		100,000	
	1,009,140,047	IPM3.0 (base)	244,151	0.484	79,962	0.158
		IPM3.0 - will do	244,151	0.484	79,962	0.158
		IPM3.0 - may do	244,151	0.484	79,962	0.158
OH	**1,306,296,589**	**2001 - 2003 (average)**	**1,144,484**	**1.75**	**353,255**	**0.54**
		IPM 2.1.9	216,000		84,000	
	1,628,081,545	IPM3.0 (base)	316,883	0.389	96,103	0.118
		IPM3.0 - will do	348,000		101,000	
		IPM3.0 - may do	348,000		101,000	
WI	**495,475,007**	**2001 - 2003 (average)**	**191,137**	**0.77**	**90,703**	**0.36**
		IPM 2.1.9	155,000		46,000	
	675,863,447	IPM3.0 (base)	127,930	0.379	56,526	0.167
		IPM3.0 - will do	150,340	0.445	55,019	0.163
		IPM3.0 - may do	62,439	0.185	46,154	0.137
IA	**390,791,671**	**2001 - 2003 (average)**	**131,080**	**0.67**	**77,935**	**0.40**
		IPM 2.1.9	147,000		51,000	
	534,824,314	IPM3.0 (base)	115,938	0.434	59,994	0.224
		IPM3.0 - will do	115,938	0.434	59,994	0.224
		IPM3.0 - may do	100,762	0.377	58,748	0.220
MN	**401,344,495**	**2001 - 2003 (average)**	**101,605**	**0.50**	**85,955**	**0.42**
		IPM 2.1.9	86,000		42,000	
	447,645,758	IPM3.0 (base)	61,739	0.276	41,550	0.186
		IPM3.0 - will do	54,315	0.243	49,488	0.221
		IPM3.0 - may do	51,290	0.229	39,085	0.175
MO	**759,902,542**	**2001 - 2003 (average)**	**241,375**	**0.63**	**143,116**	**0.37**
		IPM 2.1.9	281,000		78,000	
	893,454,905	IPM3.0 (base)	243,684	0.545	72,950	0.163
		IPM3.0 - will do	237,600	0.532	72,950	0.163
		IPM3.0 - may do	237,600	0.532	72,950	0.163
ND	**339,952,821**	**2001 - 2003 (average)**	**145,096**	**0.85**	**76,788**	**0.45**
		IPM 2.1.9	109,000		72,000	
	342,685,501	IPM3.0 (base)	41,149	0.240	44,164	0.258
		IPM3.0 - will do	56,175	0.328	58,850	0.343
		IPM3.0 - may do	56,175	0.328	58,850	0.343
SD	**39,768,357**	**2001 - 2003 (average)**	**12,545**	**0.63**	**15,852**	**0.80**
		IPM 2.1.9	12,000		15,000	
	44,856,223	IPM3.0 (base)	4,464	0.199	2,548	0.114
		IPM3.0 - will do	4,464	0.199	2,548	0.114
		IPM3.0 - may do	4,464	0.199	2,548	0.114

On-road Sources: For 2002, EMS was run by LADCO using VMT and MOBILE6 inputs supplied by the LADCO States. EMS was run to generate 36 days (weekday, Saturday, Sunday for each month) at 36 km, and 9 days (weekday, Saturday, Sunday for June – August) at 12 km. For 2005, CONCEPT was run by a contractor (Environ) using transportation data (e.g., VMT and vehicle speeds) supplied by the state and local planning agencies in the LADCO States and Minnesota for 24 networks. These data were first processed with T3 (Travel Demand Modeling [TDM] Transformation Tool) to provide input files for CONCEPT to calculate link-specific, hourly emission estimates (Environ, 2008). CONCEPT was run with meteorological data for a July and January weekday, Saturday, and Sunday (July 15 – 17 and January 16 – 18). A spatial plot of emissions is provided in Figure 43.

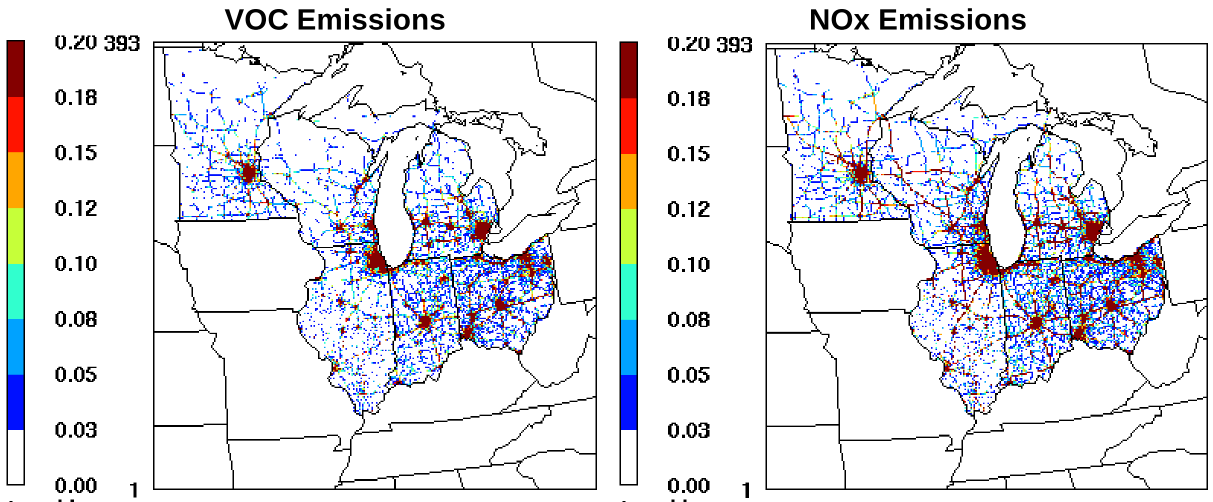

Figure 43. Motor vehicle emissions for VOC (left) and NOx (right) for a July weekday (2005)

Off-road Sources: For 2002 and 2005, NMIM and NMIM2005, respectively, were run by Wisconsin DNR. Additional off-road sectors (i.e., commercial marine, aircraft, and railroads [MAR]) were handled separately. Local data for agricultural equipment, construction equipment, commercial marine, recreational marine, and railroads were prepared by contractors (Environ, 2004, and E.H. Pechan, 2004). For Base M, updated local data for railroads and commercial marine were prepared by a contractor (Environ, 2007b, 2007c). Table 7 compares the Base M 2005 and Base K 2002 emissions. Compared to 2002, the new 2005 emissions reflect substantially lower commercial marine emissions and lower locomotive NOx emissions.

Table 7. Locomotive and commercial marine emissions for the five LADCO States (2002 v. 2005)

	Railroads (TPY)			Commercial Marine (TPY)	
	2002	2005		2002	2005
VOC	7,890	7,625		1,562	828
CO	20,121	20,017		8,823	6,727
NOx	182,226	145,132		64,441	42,336
PM	5,049	4,845		3,113	1,413
SO2	12,274	12,173		25,929	8,637
NH3	86	85		----	----

Area Sources: For 2002 and 2005, EMS was run by LADCO using data supplied by the LADCO States to produce weekday, Saturday, and Sunday emissions for each month. For 2005, special attention was given to two source categories: industrial adhesive and sealant solvents (which were dropped from the inventory to avoid double-counting) and outdoor wood boilers (which were added to the inventory).

Point Sources: For 2002 and 2005, EMS was run by LADCO using data supplied by the LADCO States to produce weekday, Saturday, and Sunday emissions for each month. For EGUs, the annual and summer season emissions were temporalized for modeling purposes using profiles prepared by Scott Edick (Michigan DEQ) based on CEM data.

Biogenics: For Base M, a contractor (Alpine) provided an updated version of the CONCEPT/MEGAN biogenics model. Compared to the previous (EMS/BIOME) emissions, there is more regional isoprene using MEGAN compared to the BIOME estimates used for Base K (see Figure 44). Also, with the secondary organic aerosol updates to the CAMx air quality model, Base M includes emissions for monoterpenes and sesquiterpenes, which are pre-cursors of secondary $PM_{2.5}$ organic carbon mass.

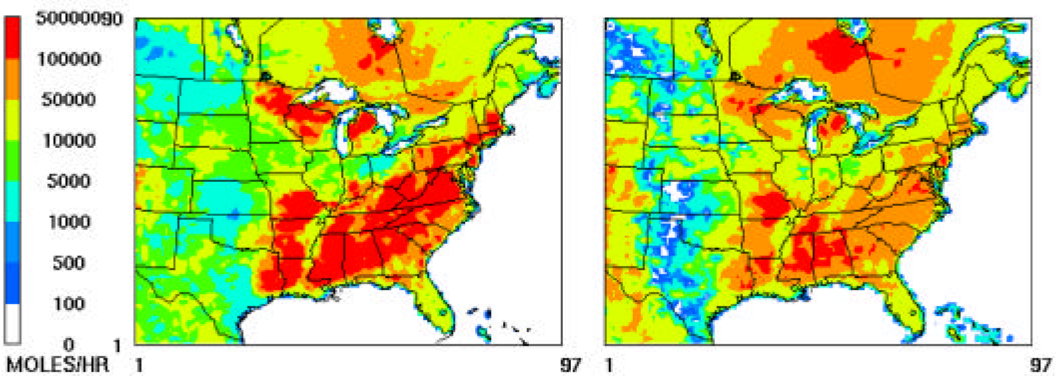

Figure 44. Isoprene emissions for Base M (left) v. Base K (right)

Ammonia: For Base M, the CMU-based 2002 (Base K) ammonia emissions were projected to 2005 using growth factors from the Round 4 emissions modeling. These emissions were then adjusted by applying temporal factors by month based on the process-based ammonia emissions model (Zhang, et al, 2005, and Mansell, et al, 2005). A plot of average daily emissions by state and month is provided in Figure 45. A spatial plot of emissions is provided in Figure 46, which shows high emissions densities in the central U.S.

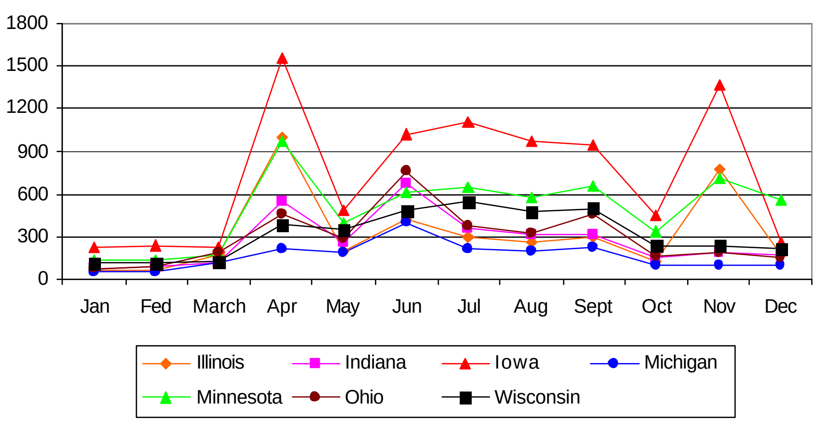

Figure 45. Average daily ammonia emissions for Midwest States by month (2005) - (units: average daily emissions – tons per day)

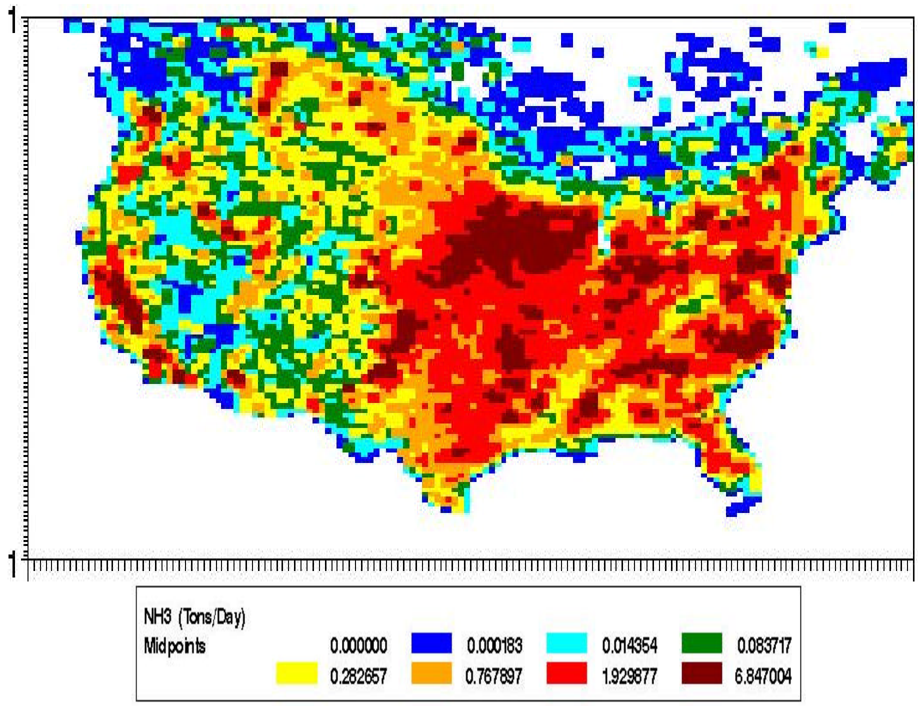

Figure 46. Ammonia emissions for a July weekday (2005) – 12 km modeling domain

Canadian Emissions: For Base M, Scott Edick (Michigan DEQ) processed the 2005 Canadian National Pollutant Release Inventory, Version 1.0 (NPRI). Specifically, a subset of the NPRI data (emissions and stack parameters) relevant to the air quality modeling were reformatted. The resulting emissions represent a significant improvement in the base year emissions.

A spatial plot of point source SO2 and NOx emissions is provided in Figure 47. Additional plots and emission reports are available on the LADCO website (http://www.ladco.org/tech/emis/basem/canada/index.htm).

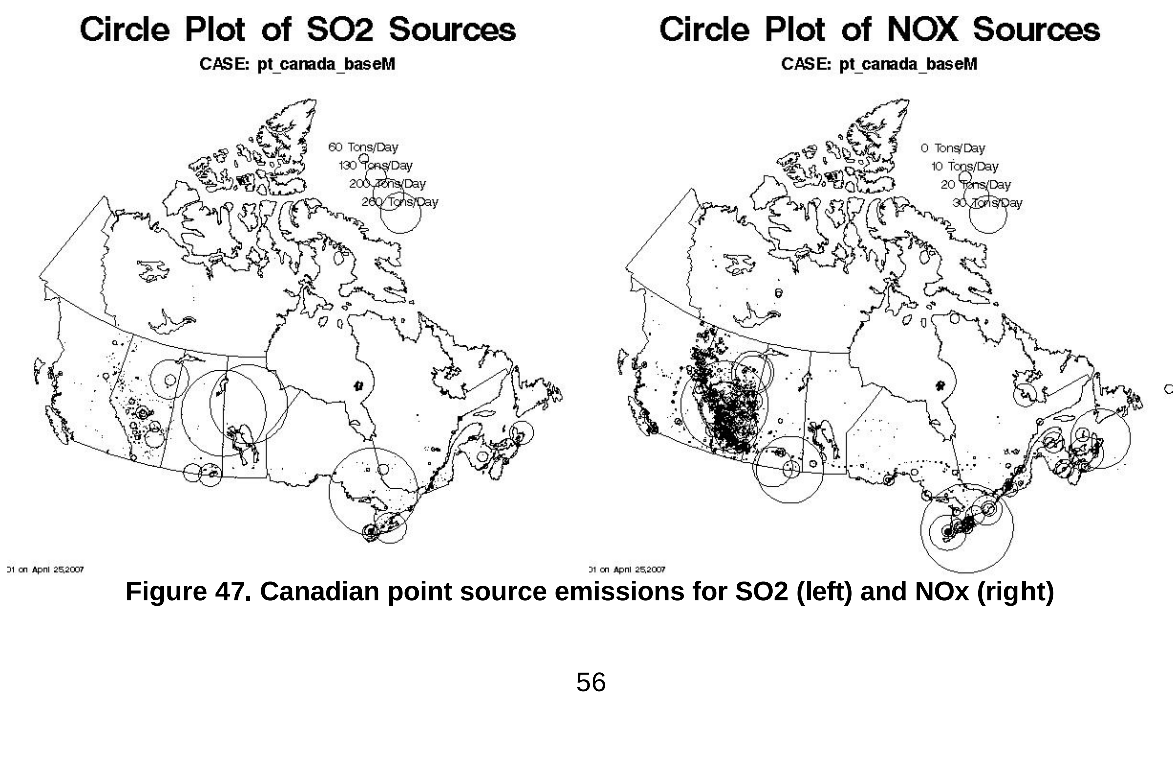

Figure 47. Canadian point source emissions for SO2 (left) and NOx (right)

Fires: For Base K, a contractor (EC/R, 2004) developed a 2001, 2002, and 2003 fire emissions inventory for eight Midwest States (five LADCO states plus Iowa, Minnesota, and Missouri), including emissions from wild fires, prescribed fires, and agricultural burns. Projected emissions were also developed for 2010 and 2018 assuming “no smoke management” and “optimal smoke management” scenarios. An early model sensitivity run showed very little difference in modeled $PM_{2.5}$ concentrations. Consequently, the fire emissions were not included in subsequent modeling runs (i.e., they were not in the Base K or Base M modeling inventories).

Future Year Emissions: Complete emission inventories were developed for several future years: Base K – 2009, 2012, and 2018, and Base M – 2009 and 2018. In addition, 2008 (Base K and Base M) and 2012 (Base M) proxy inventories were estimated based on the 2009 and 2018 data. (Note, the EGU emissions for the Base M 2012 inventory were based on EPA’s IPM3.0 modeling.)

Source sector emission summaries for the base years and future years are shown in Figure 48. Additional detail is provided in Tables 6a and 6b.

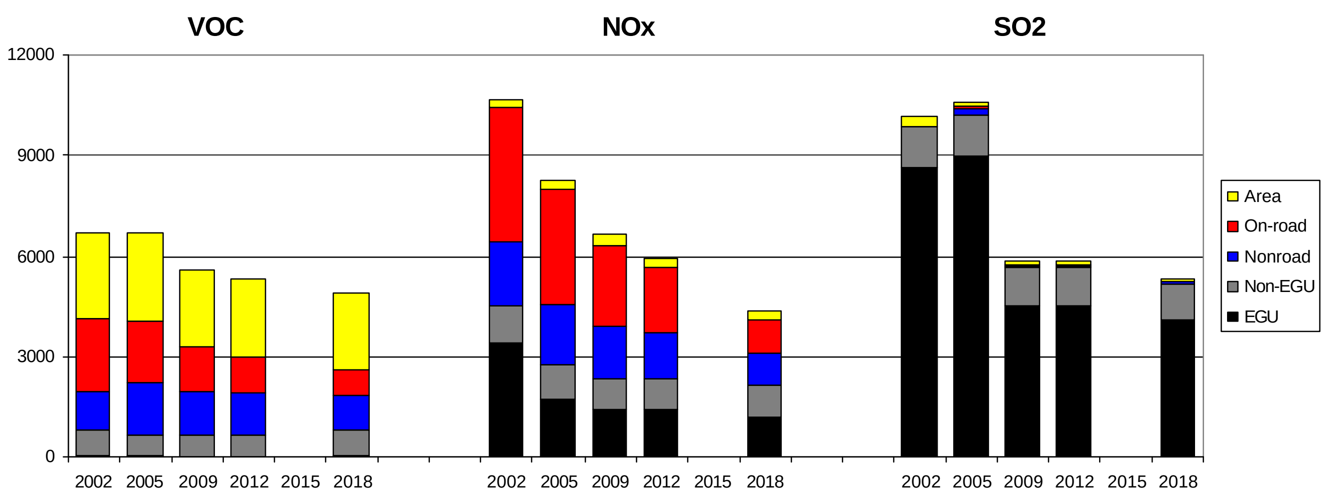

Figure 48. Base year and future year emissions for 5-State LADCO Region (TPD, July weekday)

For on-road, and nonroad, the future year emissions were estimated by models (i.e., EMS/CONCEPT and NMIM, respectively). One adjustment was made to the 2009 and 2018 motor vehicle emission files prepared by Environ with CONCEPT. To reflect newer transportation modeling conducted by CATS for the Chicago area, emissions were increased by 9% in 2009 and 2018. The 2005 base year and adjusted 2009 and 2018 motor vehicle emissions are provided in Table 8.

Table 8. Motor Vehicle Emissions Produced by CONCEPT Modeling (July weekday – tons per day)

Year	State	Sum of CO	Sum of TOG	Sum of NOx	Sum of PM2.5	Sum of SO2	Sum of NH3	Sum of VMT
2005	IL	3,684.3	341.5	748.2	12.9	9.6	35.9	344,087,819.6
	IN	3,384.9	282.0	541.1	8.9	11.1	25.7	245,537,231.9
	MI	4,210.3	351.9	722.0	12.4	13.9	35.3	340,834,025.9
	MN	2,569.1	218.7	380.5	6.3	7.6	17.7	170,024,599.7
	OH	6,113.4	679.8	933.6	16.2	18.8	36.5	360,521,068.6
	WI	2,206.0	175.1	457.5	7.8	9.2	19.7	189,123,964.3
Total		22,168.0	2,049.0	3,782.9	64.5	70.2	170.8	1,650,128,709.9
2009	IL	2,824.4	268.0	527.8	10.1	4.2	38.9	372,132,591.1
	IN	2,839.5	234.9	401.9	6.7	2.8	26.1	249,817,026.3
	MI	3,172.0	269.2	500.9	9.2	4.0	37.1	356,347,010.5
	MN	2,256.8	206.3	307.5	5.1	2.3	21.5	204,443,017.8
	OH	4,619.2	423.7	693.5	11.8	4.7	39.5	387,428,127.2
	WI	1,673.4	119.4	322.1	5.7	2.3	20.6	197,729,964.9
Total		17,385.3	1,521.5	2,753.6	48.7	20.3	183.6	1,767,897,737.8
2018	IL	2,084.7	151.5	200.7	6.3	3.7	43.1	413,887,887.3
	IN	2,217.3	138.4	173.0	4.4	2.6	30.2	288,042,232.1
	MI	2,434.3	163.5	204.1	5.9	3.6	40.5	388,128,431.8
	MN	1,799.6	123.1	137.1	3.6	2.2	24.9	237,022,213.7
	OH	3,361.5	242.5	274.1	6.8	4.0	43.1	421,694,093.4
	WI	1,255.5	68.4	138.5	3.9	2.0	22.2	218,277,167.5
Total		13,152.9	887.5	1,127.5	30.8	18.1	203.9	1,967,052,025.8

For EGUs, future year emissions were based on IPM2.1.9 modeling completed by the RPOs in July 2005 Base K and IPM3.0 completed by EPA in February 2007 for Base M. Several CAIR scenarios were assumed:

Base K
1a: IPM2.1.9, with full trading and banking
1b: IPM2.1.9, with restricted trading (compliance with state-specific emission budgets) and full trading
1d: IPM2.1.9, with restricted trading (compliance with state-specific emission budgets)

Base M
5a: EPA's IPM3.0 was assumed as the future year base for EGUs.
5b: EPA's IPM3.0, with several "will do" adjustments identified by the States. These adjustments should reflect a legally binding commitment (e.g., signed contract, consent decree, or operating permit).
5c: EPA's IPM3.0, with several "may do" adjustments identified by the States. These adjustments reflect less rigorous criteria, but should still be some type of public reality (e.g., BART determination or press announcement).

For other sectors (area, MAR, and non-EGU point sources), the future year emissions for the LADCO States were derived by applying growth and control factors to the base year inventory. These factors were developed by a contractor (E.H. Pechan, 2005 and E.H. Pechan, 2007). For the non-LADCO States, future year emission files were based on data from other RPOs.

Growth factors were based initially on EGAS (version 5.0), and were subsequently modified (for select, priority categories) by examining emissions activity data. Due to a lack of information on future year conditions, the biogenic VOC and NOx emissions, and all Canadian emissions were assumed to remain the constant between the base year and future years.

A "base" control scenario was prepared for each future year based on the following "on the books" controls:

On-Highway Mobile Sources
- Federal Motor Vehicle Emission Control Program, low-sulfur gasoline and ultra-low sulfur diesel fuel
- Inspection - maintenance programs, including IL's vehicle emissions tests (NE IL), IN's vehicle emissions testing program (NW IN), OH's E-check program (NE OH), and WI's vehicle inspection program (SE WI) – note: a special emissions modeling run was done for the Cincinnati/Dayton area to reflect the removal of the state's E-check program and inclusion of low RVP gasoline
- Reformulated gasoline, including in Chicago-Gary,-Lake County, IL,IN; and Milwaukee, Racine, WI

Off-Highway Mobile Sources
- Federal control programs incorporated into NONROAD model (e.g., nonroad diesel rule), plus the evaporative Large Spark Ignition and Recreational Vehicle standards
- Heavy-duty diesel (2007) engine standard/Low sulfur fuel
- Federal railroad/locomotive standards
- Federal commercial marine vessel engine standards

Area Sources (Base M only)
- Consumer solvents
- AIM coatings
- Aerosol coatings
- Portable fuel containers

Power Plants
- Title IV (Phases I and II)
- NOx SIP Call
- Clean Air Interstate Rule

Other Point Sources

- VOC 2-, 4-, 7-, and 10-year MACT standards
- Combustion turbine MACT

Other controls included in the modeling include: consent decrees (refineries, ethanol plants, and ALCOA)[9], NOx RACT in Illinois and Ohio[10], and BART for a few non-EGU sources in Indiana and Wisconsin.

For Base K, several additional control scenarios were considered:

Scenario 2 – “base” controls plus additional controls recommended in LADCO White Papers for stationary and mobile sources

Scenario 3 – Scenario 2 plus additional White Papers for stationary and mobile sources

Scenario 4 – “base” controls plus additional candidate control measures under discussion by State Commissioners

Scenario 5 – “base” controls plus additional candidate control measures identified by the LADCO Project Team

3.7 Basecase Modeling Results

The purpose of the basecase modeling is to evaluate model performance (i.e., assess the model's ability to reproduce the observed concentrations). The model performance evaluation focused on the magnitude, spatial pattern, and temporal of modeled and measured concentrations. This exercise was intended to assess whether, and to what degree, confidence in the model is warranted (and to assess whether model improvements are necessary).

Model performance was assessed by comparing modeled and monitored concentrations. Graphical (e.g., side-by-side spatial plots, time series plots, and scatter plots) and statistical analyses were conducted. No rigid acceptance/rejection criteria were used for this study. Instead, the statistical guidelines recommended by EPA and other modeling studies (e.g., modeling by the other RPOs) were used to assess the reasonableness of the results. The model performance results presented here describe how well the model replicates observed ozone and $PM_{2.5}$ concentrations after a series of iterative improvements to model inputs.

Ozone: Spatial plots are provided for high ozone periods in June 2002 and June 2005 (see Figures 49a and 49b). The plots show that the model is doing a reasonable job of reproducing the magnitude, day-to-day variation, and spatial pattern of ozone concentrations. There is a tendency, however, to underestimate the magnitude of regional ozone levels. This is more apparent with the 2002 modeling; the regional concentrations in the 2005 modeling agree better with observations due to model and inventory improvements.

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[9] E.H. Pechan’s original control file included control factors for three sources in Wayne County, MI. These control factors were not applied in the regional-scale modeling to avoid double-counting with the State’s local-scale analysis for PM2.5

[10] NOx RACT in Wisconsin is included in the 2005 basecase (and EGU “will do” scenario). NOx RACT in Indiana was not included in the modeling inventory.

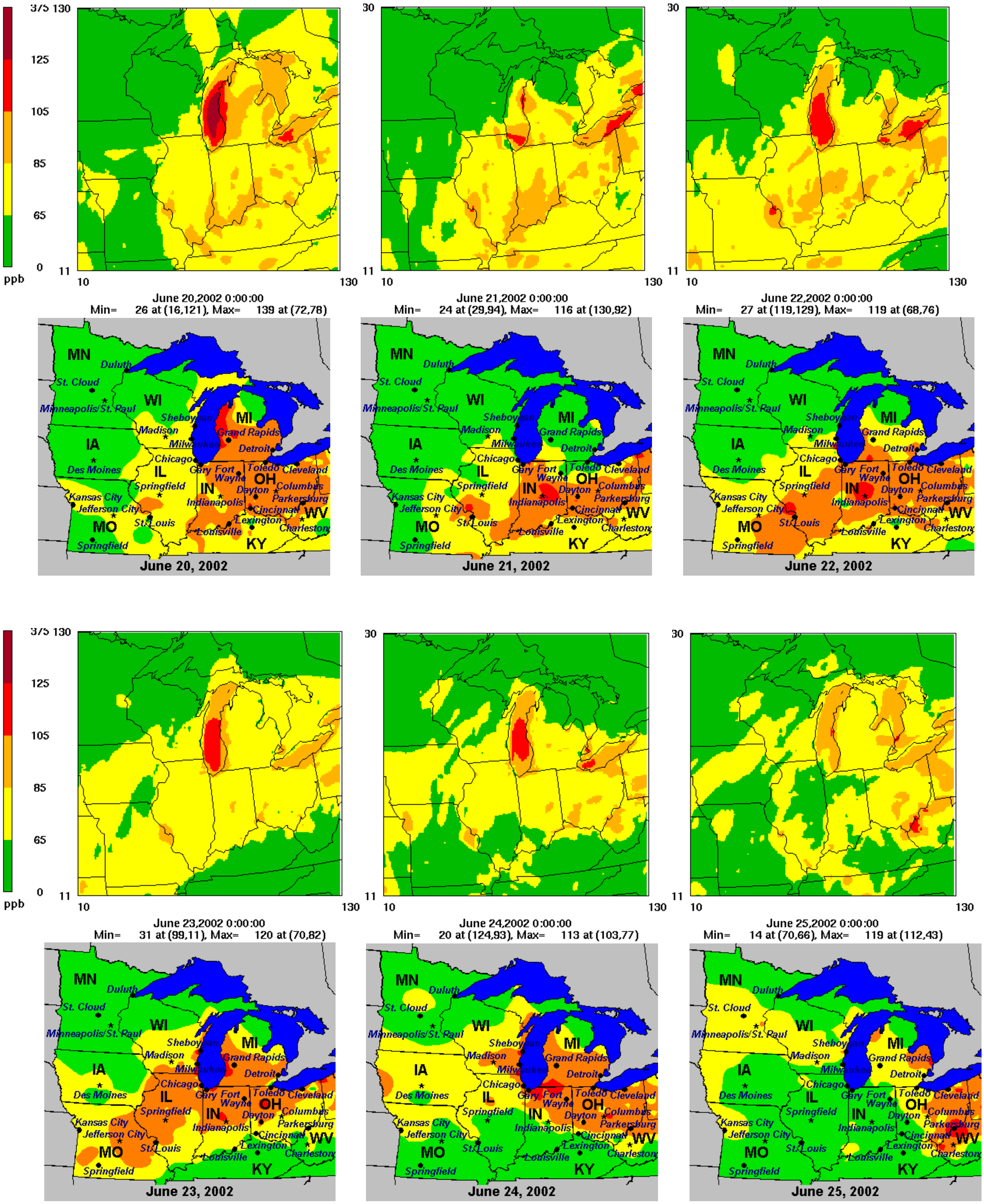


Figure 49a. Modeled (top) v. monitored (bottom) 8-hour ozone concentrations: June 20 – 25, 2002

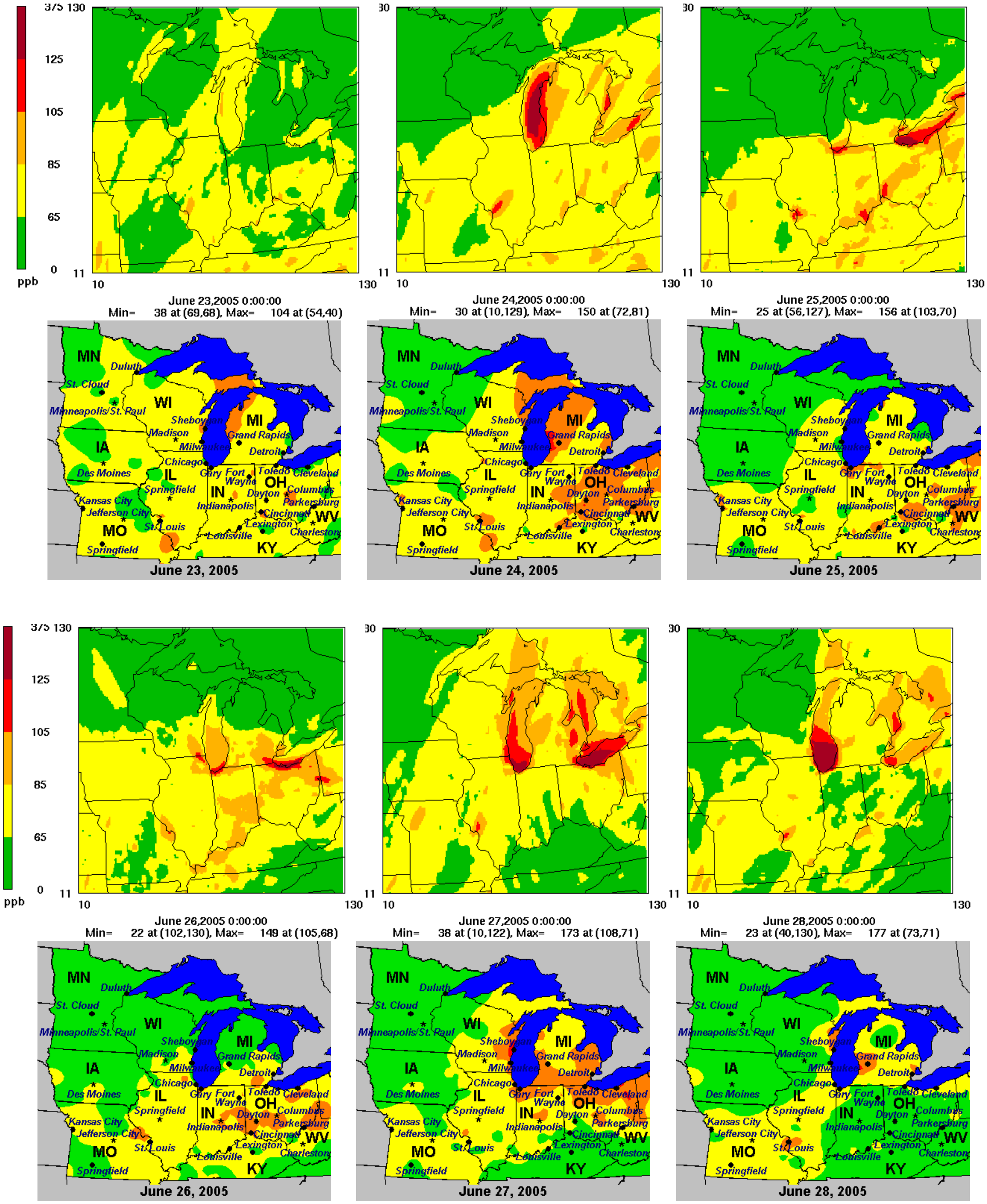


Figure 49b Modeled (top) v. monitored (bottom) 8-hour ozone concentrations: June 23– 28 2005

Standard model performance statistics were generated for the entire 12 km domain, and by day and by monitoring site. The domain-wide mean normalized bias for the 2005 base year is similar to that for the 2002 base year and is generally within 30% (see Figure 50).

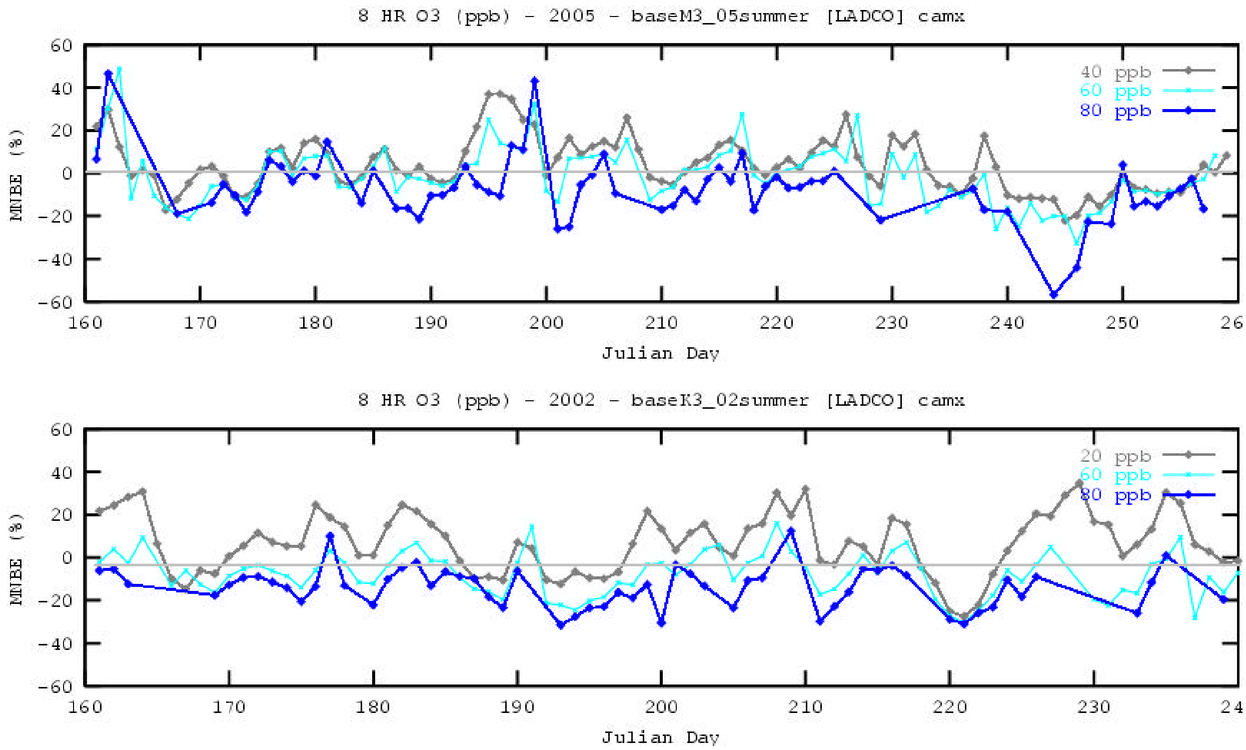


Figure 50. Mean bias for summer 2005 (Base M) and summer 2002 (Base K)

Station-average metrics (over the entire summer) are shown in Figure 51. The bias results further demonstrate the model's tendency to underestimate absolute ozone concentrations.

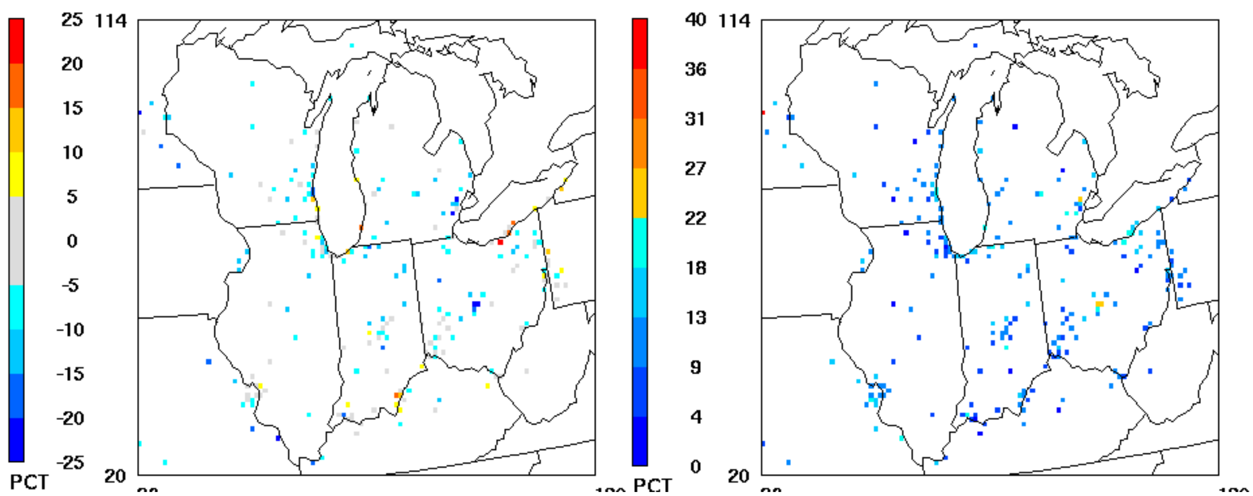


Figure 51. Mean bias (left) and gross error (right) for summer 2005

A limited 4 km ozone analysis was performed by LADCO to address the effect of grid spacing. For this modeling, 4 km grids were placed over Lake Michigan and the Detroit-Cleveland area (see Figure 52). Model inputs included 4 km emissions developed by LADCO (consistent with Base K/Round 4) and the 4 km meteorology developed by Alpine Geophysics.

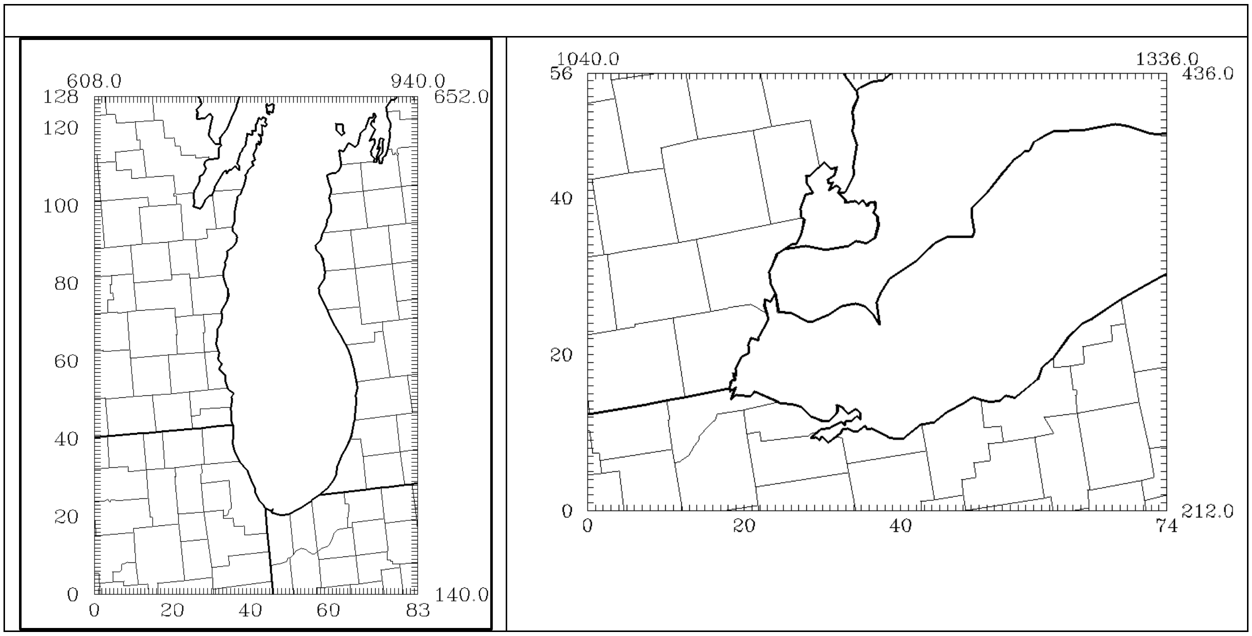


Figure 52. 4 km grids for Lake Michigan region and Detroit-Cleveland region

Hourly time series plots were prepared for several monitors (see Figure 53). The results are similar at 12 km and 4 km, with some site-by-site and day-by-day differences.

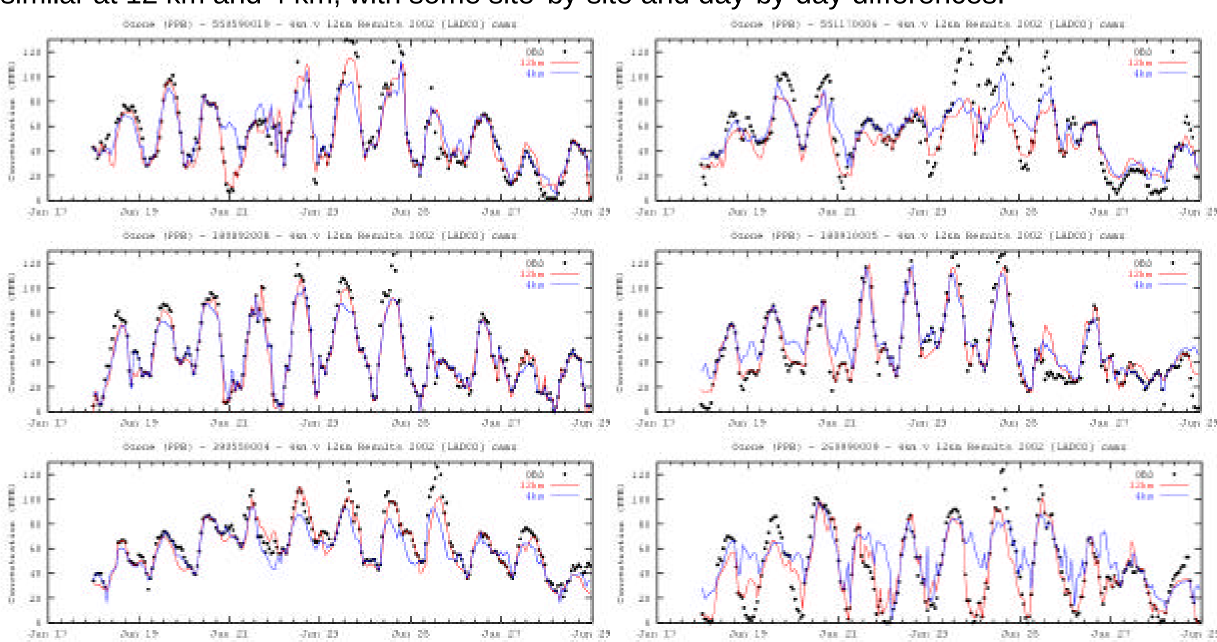
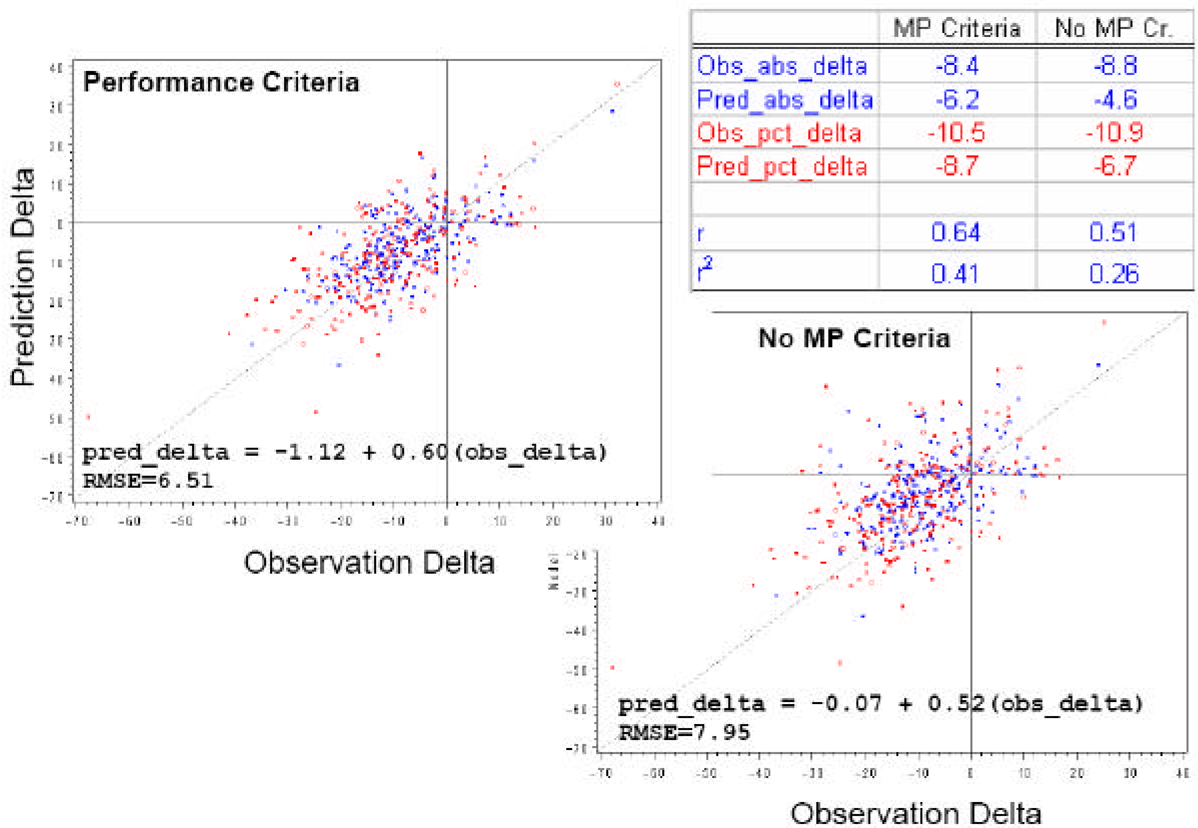


Figure 53. Ozone time series plots for 12 km and 4 km modeling (June 17-29, 2002)

An additional diagnostic analysis was performed to assess the response of the modeling system to changes in emissions (Baker and Kenski, 2007). Specifically, the 2002-to-2005 change in observed ozone concentrations was compared to the change in modeled ozone concentrations based on the 95th percentile(and above) concentration values for each monitor. This analysis was also done with the inclusion of model performance criteria which eliminated poorly performing days (i.e., error > 35%). The results show good agreement in the modeled and monitored ozone concentration changes (e.g., ozone improves by about 9-10 ppb between 2002 and 2005 according to the model and the measurements) – see Figure 54. This provides further support for using the model to develop ozone control strategies.



	MP Criteria	No MP Cr.
Obs_abs_delta	-8.4	-8.8
Pred_abs_delta	-6.2	-4.6
Obs_pct_delta	-10.5	-10.9
Pred_pct_delta	-8.7	-6.7
r	0.64	0.51
r^2	0.41	0.26

Figure 54. Comparison of change in predicted and observed ozone concentrations (2002 v. 2005)

PM$_{2.5}$: Time series plots of the monthly average mean bias and annual fractional bias for Base M and Base K are shown in Figure 55. As can be seen, Base M model performance for most species is fair (i.e., close to "no bias" throughout most of the year), with two main exceptions. First, the Base M and Base K results for organic carbon are poor, suggesting the need for more work on primary organic carbon emissions. Second, the Base M results for sulfate, while acceptable (i.e., bias values are within 35%), are not as good as the Base K results (e.g., noticeable underprediction during the summer months).

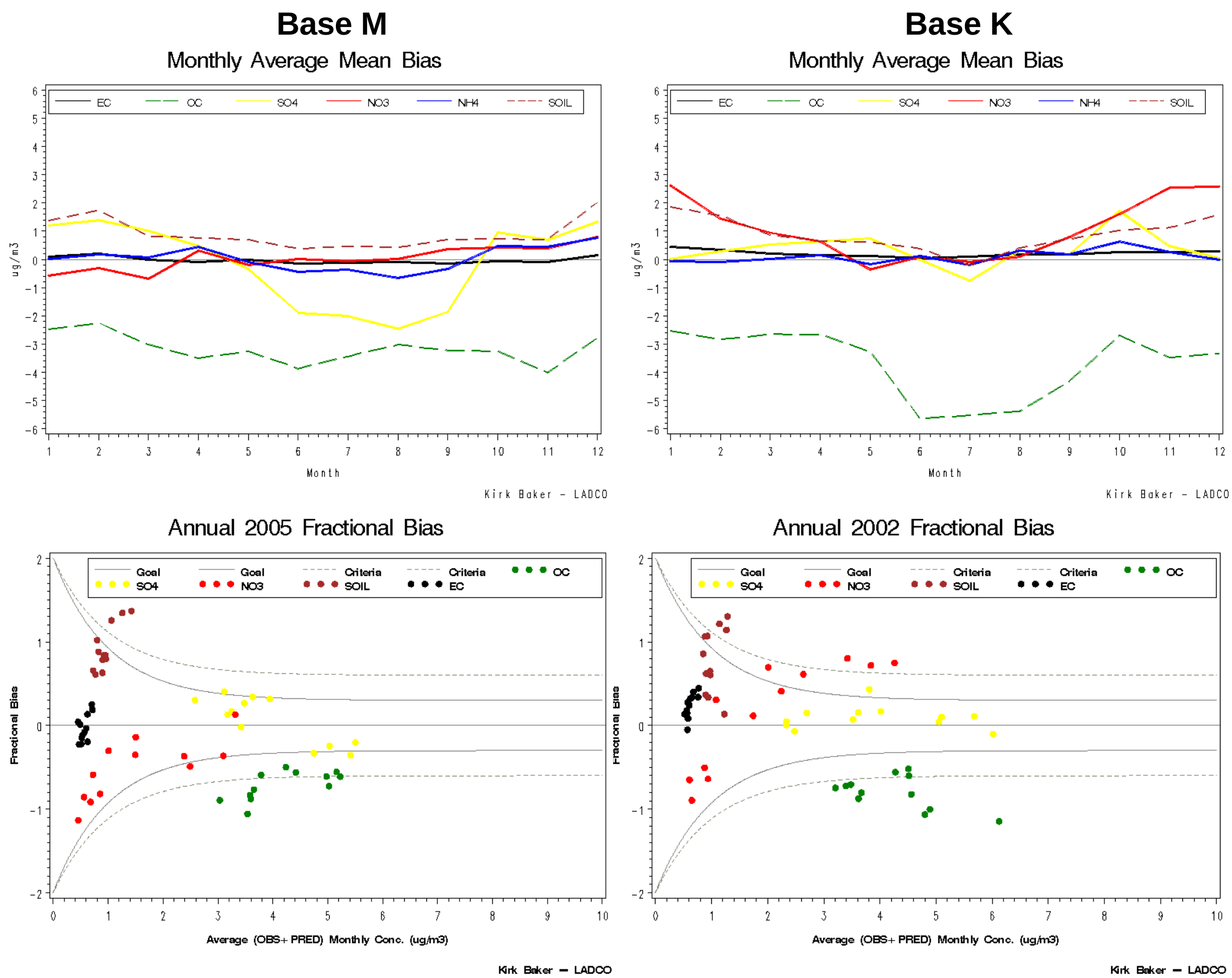


Figure 55. PM$_{2.5}$ Model performance - monthly average mean bias and annual fractional bias for Base M (left column) and Base K (right column)

Two analyses were undertaken to understand sulfate model performance for 2005:

- Assess Meteorological Influences: The MM5 model performance evaluation showed that rainfall is over-predicted by MM5 over most of the domain during the summer months (LADCO, 2007c). Because CAMx does not explicitly use the rainfall output by MM5, this may or may not result in over-prediction sulfate wet deposition (and under-prediction of sulfate concentrations). A sensitivity run was performed with no wet deposition for July, August, and September. The resulting model performance (see green line in Figure 56) showed a noticeable difference from the basecase (i.e., higher sulfate concentrations), and suggests that further evaluation of MM5 precipitation fields may be warranted.

- Assess Emissions Influences: The major contributor to sulfate concentrations in the region is SO2 emitted from EGUs. The basecase modeling inventory for EGUs is based on annual emissions, which were allocated to a typical weekday, Saturday, and Sunday by month using CEM-based temporal profiles. A sensitivity run was performed using day-specific emissions. The resulting model performance (see purple line in Figure 56) showed little difference from the basecase.

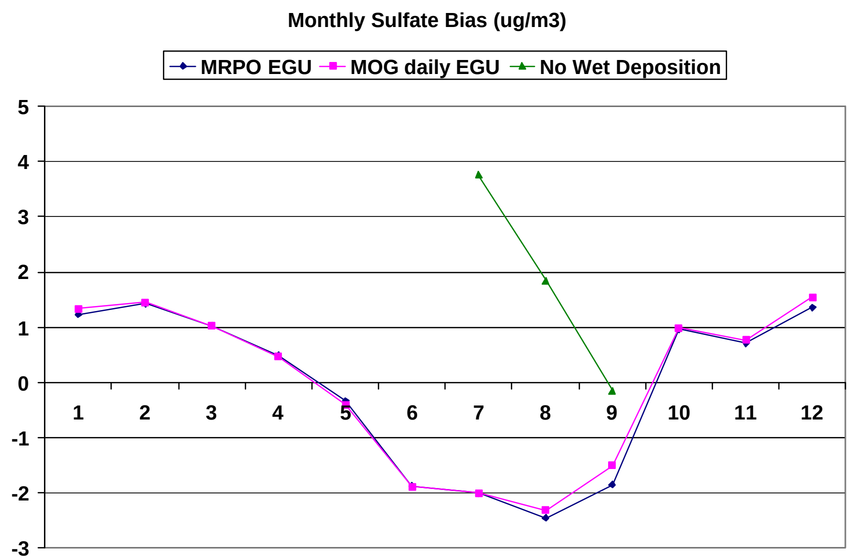


Figure 56. Monthly sulfate bias for Base M (MRPO EGU) v. two sensitivity analyses (Note: positive values indicate over-prediction, negative values indicate under-prediction)

To assess the effect of the wet deposition issue on future year modeled values, another sensitivity run was conducted with no wet deposition in Quarters 2-3 for the base year (2005) and 2018. The resulting future year values were only slightly different from the current base strategy run. In general, the future year values (without wet deposition) were a little higher (+0.15 ug/m^3 or less) in the Ohio Valley and a little lower (-.10 ug/m^3 of less) in the Great Lakes region. This sensitivity run provides a bound for sulfate wet deposition issue in terms of the attainment test, given that having no wet deposition is unrealistic. The results suggest that even with an improved wet deposition treatment, the Base M strategy results are not expected to change very much.

Time series plots of daily sulfate, nitrate, elemental carbon, and organic carbon concentrations for three Midwestern locations are presented in Figures 57 (2002) and 58 (2005). These results are consistent with the model performance statistics (i.e., good agreement for sulfates and nitrates and poor agreement [large underprediction] for organic carbon).

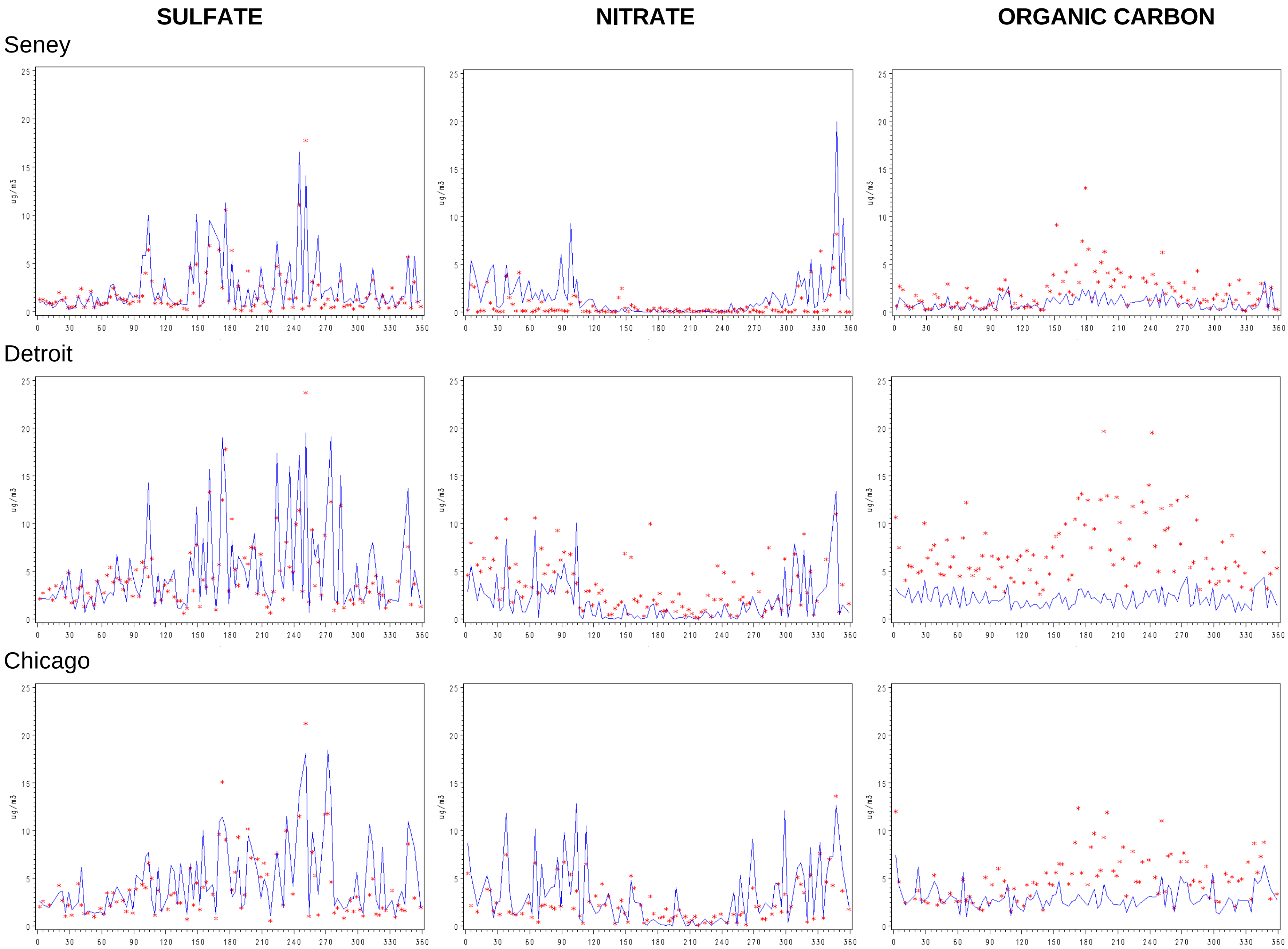


Figure 57. Time series of sulfate, nitrate, and organic carbon at three Midwest sites for 2005

Figure 58. Time series of sulfate, nitrate, and organic carbon at three Midwest sites for 2005

In summary, model performance for ozone and $PM_{2.5}$ is generally acceptable and can be characterized as follows:

Ozone

- Good agreement between modeled and monitored concentration for higher concentration levels (> 60 ppb) – i.e., bias within 30%

- Regional modeled concentrations appear to be underestimated in the 2002 base year, but show better agreement (with monitored data) in the 2005 base year due to model and inventory improvements.

- Day-to-day and hour-to-hour variation in and spatial patterns of modeled concentrations are consistent with monitored data

- Model accurately simulates the change in monitored ozone concentrations due to reductions in precursor emissions.

$PM_{2.5}$

- Good agreement in the magnitude of fine particle mass, but some species are overestimated and some are underestimated (during periods of the year when it is important)
    - Sulfates: good agreement in the 2002 base year, but underestimated in the summer in the 2005 base year due probably to meteorological factors
    - Nitrates: slightly overestimated in the winter in the 2002 base year, but good agreement in the 2005 base year as a result of model and inventory improvements
    - Organic Carbon: grossly underestimated in the 2002 and 2005 base years due likely to missing primary organic carbon emissions and, possibly, other factors (e.g., grid resolution and model chemistry).

- Temporal variation and spatial patterns of modeled concentrations are consistent with monitored data

Several observations should be noted on the implications of these model performance findings on the attainment modeling presented in the following section. First, it has been demonstrated that model performance overall is acceptable and, thus, the model can be used for air quality planning purposes. Second, consistent with EPA guidance, the model is used in a relative sense to project future year values. EPA suggests that this approach "should reduce some of the uncertainty attendant with using absolute model predictions alone" (EPA, 2007a). Furthermore, the attainment modeling is supplemented by additional information to provide a weight of evidence determination.

Section 4.0 Attainment Demonstration for Ozone and $PM_{2./5}$

Air quality modeling and other information were used to determine whether existing ("on the books") controls would be sufficient to provide for attainment of the NAAQS for ozone and $PM_{2.5}$ and if not, then what additional emission reductions would be necessary for attainment. Traditionally, attainment demonstrations involved a "bright line" test in which a single modeled value was compared to the ambient standard. To provide a more robust assessment of expected future year air quality, EPA's modeling guidelines call for consideration of supplemental information. This section summarizes the results of the primary (guideline) modeling analysis and a weight of evidence determination based on the modeling results and other supplemental analyses.

4.1 Future Year Modeling Results

The purpose of the future year modeling is to assess the effectiveness of existing and possible additional control programs. The model was used in a relative sense to project future year values, which are then compared to the standard to determine attainment/nonattainment. Specifically, the modeling test consists of the following steps:

(1) Calculate base year design values: For ozone and $PM_{2.5}$, the base year design values were derived by averaging the three 3-year periods centered on the emissions base year:

2002 base year: 2000-2002, 2001-2003, and 2002-2004
2005 base year: 2003-2005, 2004-2006, and 2005-2007[11]

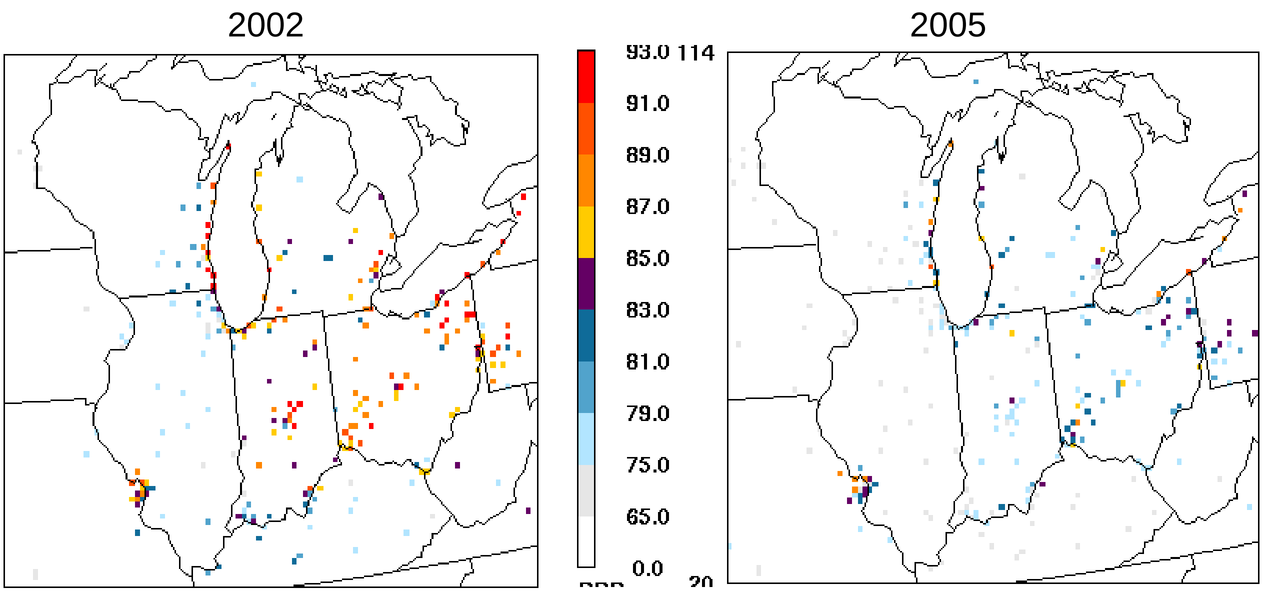
(2) Estimate the expected change in air quality: For each grid cell, a relative reduction factor (RRF) is calculated by taking the ratio of the future year and baseline modeling results.

(3) Calculate future year values: For each grid cell (with a monitor), the RRFs are multiplied by the base year design values to project the future year values

(4) Assess attainment: Future year values are compared to the NAAQS to assess attainment or nonattainment.

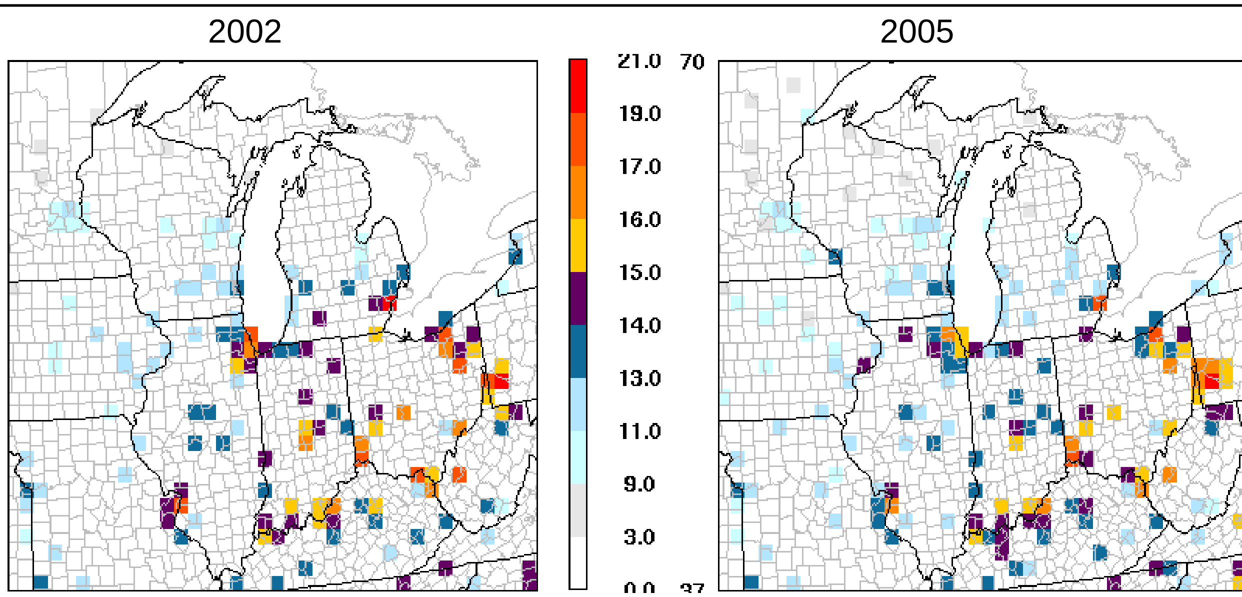
A comparison of the 2002 and 2005 base year design values for ozone and $PM_{2.5}$ is provided in Figure 59. In general, the figure shows that the 2005 base year design values are much lower than the 2002 base year design values, especially for ozone.

[11] A handful of source-oriented PM2.5 monitors in Illinois and Indiana were excluded from the annual attainment test, because these monitors are not to be used to judging attainment of the annual standard.



Statistical Summary

	2002	2005
# Sites > NAAQS	93	9
Peak Value	99.0 ppb	90.0 ppb
Ave Exceedance Amount	7 ppb	2 ppb



Statistical Summary

	2002	2005
# Sites > NAAQS	58	41
Peak Value	19.3 ug/m^3	17.7 ug/m^3
Ave Exceedance Amount	1.2 ug/m^3	0.9 ug/m^3

Figure 59. 2002 v. 2005 base year design values for ozone (top) and $PM_{2.5}$ (bottom)

Ozone results are provided for those grid cells with ozone monitors. The RRF calculation considers all nearby grid cells (i.e., 3x3 for 12 km modeling) and a threshold of 85 ppb. (If there were less than 10 days above this value, then the threshold was lowered until either there were 10 days or the threshold reached 70 ppb.) $PM_{2.5}$ results are provided for those grid cells with FRM ($PM_{2.5}$-mass) monitors. Spatial mapping was performed to extrapolate $PM_{2.5}$-speciation data from STN and IMPROVE sites to FRM sites. RRF values for $PM_{2.5}$ were derived as a function of quarter and chemical species.

Additional, hot-spot modeling will be performed by the states for certain $PM_{2.5}$ nonattainment areas (e.g., Detroit, Cleveland, and Granite City) to address primary emissions from local point sources which may not be adequately accounted for by the regional grid modeling. This modeling will consist of Gaussian dispersion modeling (e.g., AERMOD) performed in accordance with EPA's modeling guidance (see Section 5.3 of the April 2007 guidance document). Further analyses will need to be undertaken to determine how to best combine the regional modeling and the hot-spot modeling. This could mean some adjustment to the model results presented in this document to reflect better the regional component.

The ozone and $PM_{2.5}$ modeling results are provided in Appendix I for select monitors (high concentration sites) in the 5-state region for the following future years of interest: 2008 (ozone only), 2009, 2012, and 2018. (Note, RRF values for ozone, and for $PM_{2.5}$ by season and chemical species are also included in Appendix I for key monitoring sites.) A summary of the modeling results is provided in Table 9 (ozone) and Table 10 ($PM_{2.5}$), and spatial maps of the Base M future year concentrations are provided in Figures 60-62.

Table 9. Summary of Ozone Modeling Results											
Key Sites		**2008**			**2009**			**2012**			**2018**
		Round 5	Round 4		Round 5	Round 4		Round 5	Round 4		Round 5
Lake Michigan Area											
Chiwaukee	550590019	82.0	**93.0**		82.3	**92.0**		80.9	**90.3**		76.2
Racine	551010017	77.6	**85.9**		77.5	84.9		76.1	82.9		71.2
Milwaukee-Bayside	550190085	79.6	**85.4**		79.8	84.9		78.0	82.3		72.7
Harrington Beach	550890009	80.0	**86.7**		80.1	**85.4**		78.3	82.9		72.5
Manitowoc	550710007	81.3	80.3		80.8	78.9		78.6	76.3		72.5
Sheboygan	551170006	84.4	**90.0**		84.0	**88.9**		81.8	**86.4**		75.4
Kewaunee	550610002	78.9	82.5		78.1	81.0		75.9	79.1		69.9
Door County	550290004	84.8	83.6		83.9	81.8		81.5	79.3		74.7
Hammond	180892008	75.4	**86.9**		75.4	**86.6**		74.6	**86.3**		71.6
Whiting	180890030	77.0			77.0			76.2			73.1
Michigan City	180910005	74.2	**87.4**		73.9	**86.5**		72.5	**85.4**		68.1
Ogden Dunes	181270020	75.7	82.3		75.6	82.8		74.5	82.0		70.8
Holland	260050003	**85.6**	84.9		**85.3**	83.4		82.8	81.0		76.1
Jenison	261390005	77.9	78.7		77.1	77.6		74.5	75.5		68.7
Muskegon	261210039	80.8	82.7		80.5	81.5		78.0	79.4		71.9
Indianapolis Area											
Noblesville	189571001	78.0	**85.2**		78.1	83.7		75.6	82.0		68.7
Fortville	180590003	73.9	**85.1**		73.9	83.8		71.4	82.1		65.1
Fort B. Harrison	180970050	74.8	84.8		75.1	83.7		73.2	82.4		69.1
Detroit Area											
New Haven	260990009	82.7	**86.3**		81.4	**85.3**		80.2	83.5		76.1
Warren	260991003	82.5	84.3		81.3	83.3		80.7	81.9		77.6
Port Huron	261470005	79.0	80.5		77.5	79.1		75.5	77.0		70.9
Cleveland Area											
Ashtabula	390071001	84.9	84.7		83.4	82.7		81.0	80.2		75.1
Geauga	390550004	75.7	**90.3**		74.7	**88.8**		72.7	**86.2**		67.3
Eastlake	390850003	82.8	84.2		81.9	82.8		80.5	80.6		76.2
Akron	391530020	79.3	83.0		78.1	81.4		75.6	78.5		68.7
Cincinnati Area											
Wilmington	390271002	77.8	84.8		77.5	83.5		74.9	81.1		68.3
Sycamore	390610006	81.7	**85.4**		81.9	84.7		80.3	82.9		74.6
Lebanon	391650007	83.6	80.1		83.0	79.0		80.7	77.0		74.2
Columbus Area											
London	390970007	75.4	79.9		75.0	78.4		72.6	76.5		66.3
New Albany	390490029	82.4	84.1		81.8	82.6		79.6	80.2		73.0
Franklin	290490028	77.0	77.7		75.9	76.5		74.1	74.7		69.0
St. Louis Area											
W. Alton (MO)	291831002	82.4	**86.1**		81.0	**85.2**		78.6	84.0		74.9
Orchard (MO)	291831004	83.3	83.3		82.0	82.2		80.0	80.4		76.2
Sunset Hills (MO)	291890004	79.5	82.8		78.7	81.9		77.1	80.6		73.9
Arnold (MO)	290990012	78.7	78.4		77.2	77.4		75.6	75.8		72.0
Margaretta (MO)	295100086	79.8	84.0		79.3	83.4		77.9	82.5		74.4
Maryland Heights (MO)	291890014	84.5			83.4			81.7			78.1

Table 10. Summary of PM2.5 Modeling Results

County	Site ID	Site	2009 Round 5	2009 Round4	2012 Round 5	2012 Round4	2018 Round 5	2018 Round4
Cook	170310022	Chicago - Washington HS	14.1	14.8	14.0	14.6	13.9	14.4
Cook	170310052	Chicago - Mayfair	14.4	**15.8**	14.2	**15.5**	13.9	**15.0**
Cook	170310057	Chicago - Springfield	13.9	14.5	13.8	14.3	13.7	14.1
Cook	170310076	Chicago - Lawndale	13.8	14.5	13.7	14.3	13.6	14.1
Cook	170312001	Blue Island	13.7	14.5	13.6	14.3	13.4	14.1
Cook	170313301	Summit	14.2	14.8	14.0	14.6	13.9	14.4
Cook	170316005	Cicero	14.4	**15.3**	14.3	**15.1**	14.2	14.9
Madison	171191007	Granite City	**15.1**	**16.0**	14.9	**15.8**	14.3	**15.5**
St. Clair	171630010	E. St. Louis	14.1	14.9	13.9	14.7	13.4	14.5
Clark	180190005	Jeffersonville	13.8	**15.5**	13.7	**15.0**	13.4	14.4
Dubois	180372001	Jasper	12.4	13.8	12.2	13.5	11.8	13.0
Lake	180890031	Gary	13.0		12.8		12.4	
Marion	180970078	Indy-Washington Park	12.8	14.5	12.6	14.2	12.0	13.7
Marion	180970083	Indy- Michigan Street	13.4	14.8	13.1	14.9	12.6	14.0
Wayne	261630001	Allen Park	13.0	14.5	12.8	14.1	12.4	13.3
Wayne	261630015	Southwest HS	14.2	**15.8**	13.9	**15.3**	13.5	14.4
Wayne	261630016	Linwood	13.1	14.1	12.8	13.7	12.5	13.0
Wayne	261630033	Dearborn	**15.8**	**17.7**	**15.5**	**17.1**	**15.1**	**16.1**
Wayne	261630036	Wyandotte	13.1	**15.1**	12.8	14.7	12.5	13.9
Butler	390170003	Middleton	13.5	14.2	13.2	13.7	12.8	13.1
Butler	390170016	Fairfield	13.1	13.5	12.9	12.9	12.5	12.2
Cuyahoga	390350027	Cleveland-28th Street	13.5	14.4	13.2	13.8	12.7	12.9
Cuyahoga	390350038	Cleveland-St. Tikhon	**15.2**	**16.1**	14.8	**15.4**	14.3	14.4
Cuyahoga	390350045	Cleveland-Broadway	14.4	14.6	14.0	14.0	13.5	13.1
Cuyahoga	390350060	Cleveland-GT Craig	15.0	**15.3**	14.6	14.7	14.1	13.7
Cuyahoga	390350065	Newburg Hts - Harvard Ave	14.0	14.1	13.6	13.5	13.1	12.6
Franklin	390490024	Columbus - Fairgrounds	12.9	14.6	12.6	14.0	12.0	13.0
Franklin	390490025	Columbus - Ann Street	12.7	14.1	12.4	13.5	11.9	12.5
Franklin	390490081	Columbus - Maple Canyon	11.7	14.0	11.4	13.4	10.9	12.5
Hamilton	390610014	Cincinnati - Seymour	14.5	**15.5**	14.3	14.8	13.8	14.0
Hamilton	390610040	Cincinnati - Taft Ave	12.8	13.6	12.6	13.0	12.2	12.3
Hamilton	390610042	Cincinnati - 8th Ave	14.0	14.6	13.8	14.0	13.4	13.2
Hamilton	390610043	Sharonville	12.9	13.6	12.7	13.0	12.3	12.2
Hamilton	390617001	Norwood	13.4	14.2	13.2	13.6	12.8	12.8
Hamilton	390618001	St. Bernard	14.7	**15.2**	14.4	14.6	14.0	13.8
Jefferson	390810016	Steubenville	12.8	**16.3**	12.5	**15.9**	12.7	**16.2**
Jefferson	390811001	Mingo Junction	13.5	**15.5**	13.2	**15.0**	13.4	**15.3**
Lawrence	390870010	Ironton	12.8	14.2	12.5	13.7	12.3	13.2
Montgomery	391130032	Dayton	13.2	13.7	12.9	13.2	12.4	12.3
Scioto	391450013	New Boston	12.1	**15.4**	11.9	14.8	11.6	14.2
Stark	391510017	Canton - Dueber	14.0	**15.0**	13.6	14.3	13.3	13.6
Stark	391510020	Canton - Market	12.6	13.6	12.3	13.0	11.9	12.2
Summit	391530017	Akron - Brittain	13.0	14.4	12.7	13.6	12.3	12.9
Summit	391530023	Akron - W. Exchange	12.3	13.6	12.0	13.0	11.5	12.2

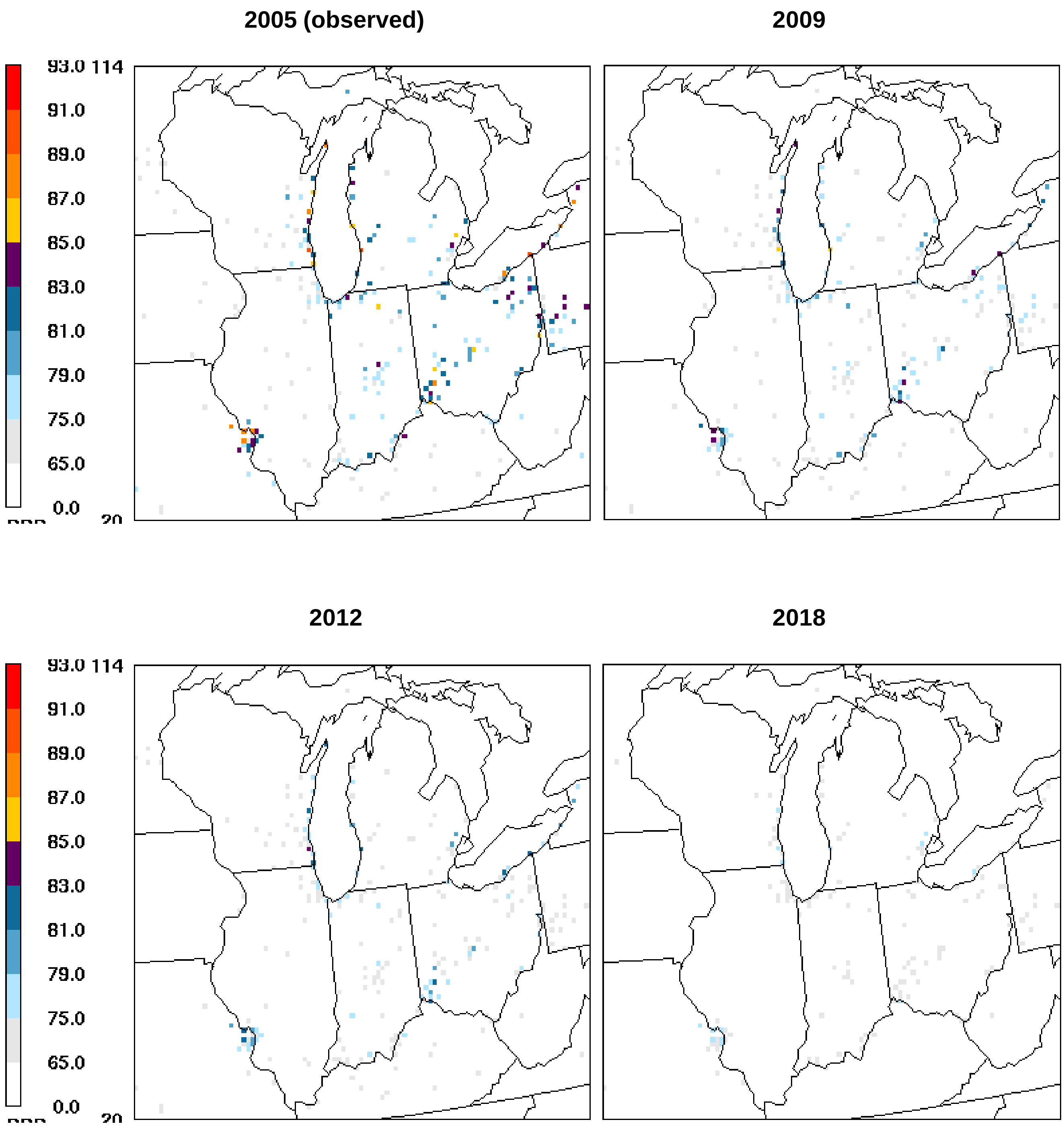


Figure 60. Observed base year and projected future year design values for ozone – Base M

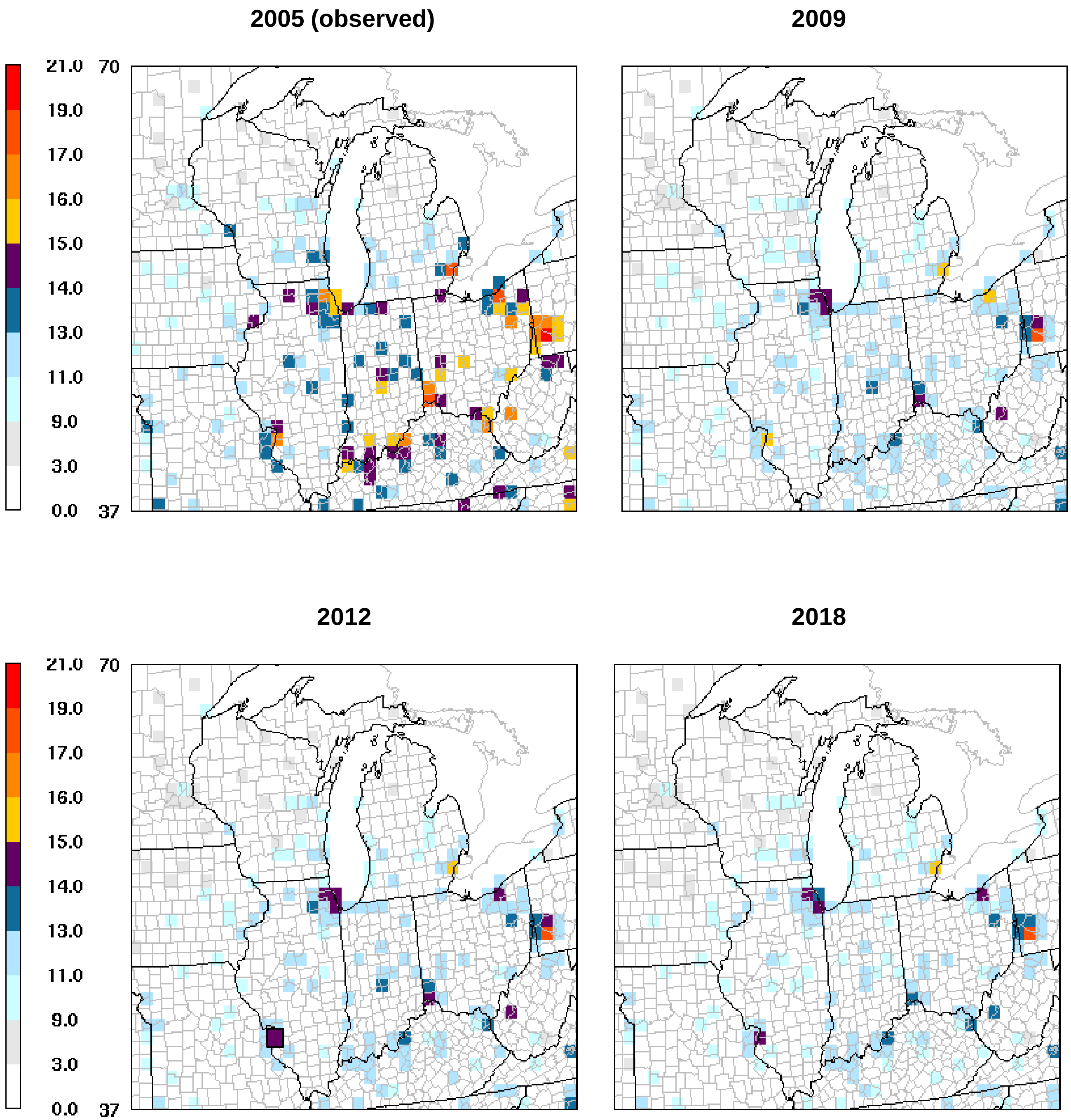


Figure 61. Observed base year and projected future year design values for $PM_{2.5}$ (annual average)–Base M

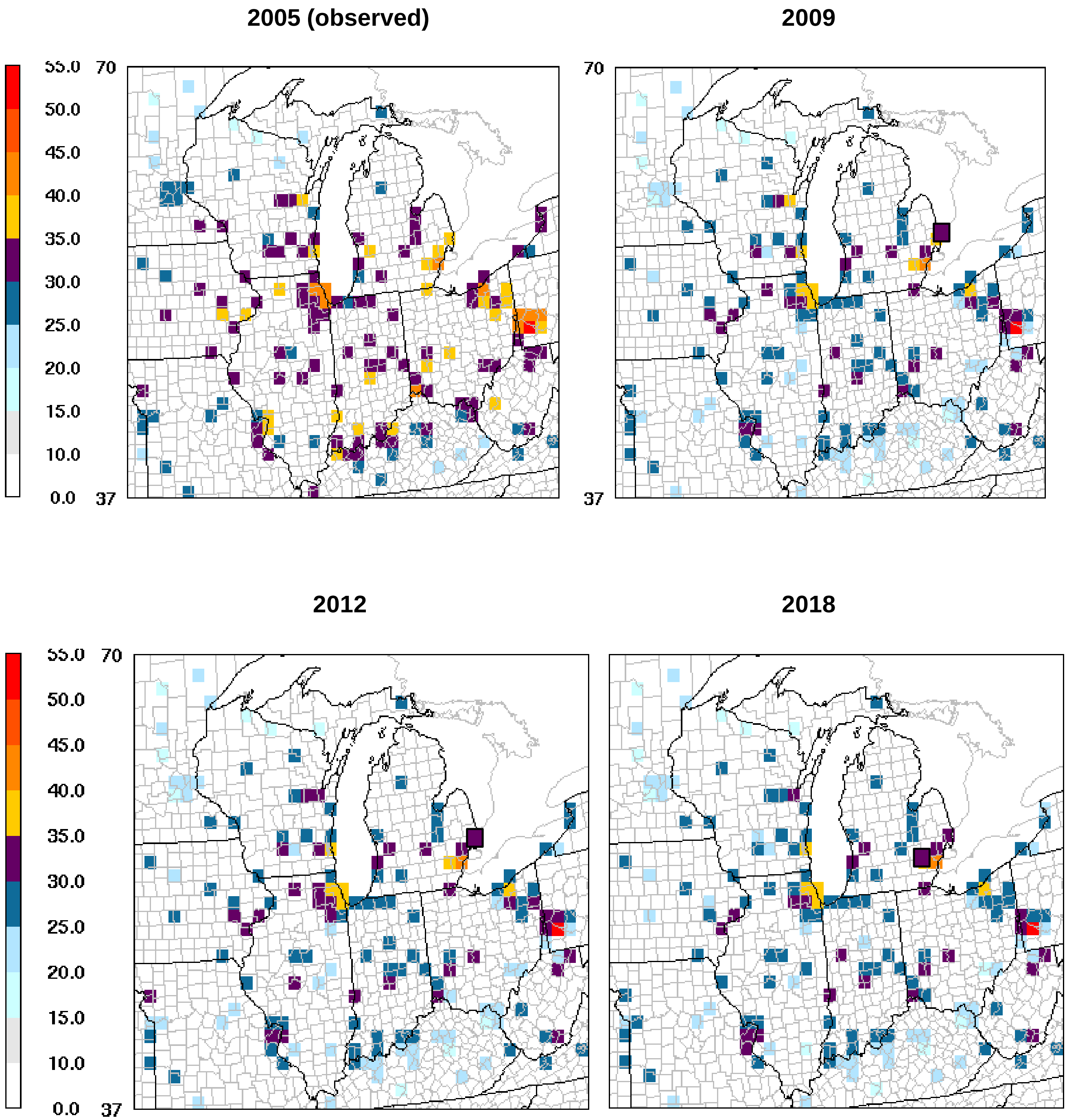


Figure 62. Observed base year and projected future year design values for $PM_{2.5}$ (24-hr average)-Base M

The number of monitors with design values above the standard are as follows:

Table 11. Number of sites above standard

Ozone (8 hour: 85 ppb)											
State	2002	2005		2009			2012			2018	
	BaseK	Base M		BaseK	Base M		BaseK	Base M		BaseK	Base M
IL	3	0		0	0		0	0		0	0
IN	22	0		0	0		0	0		0	0
MI	15	3		1	1		0	0		0	0
OH	40	4		1	0		1	0		0	0
WI	13	2		4	0		3	0		1	0
Total	93	9		6	1		4	0		1	0
PM2.5 (Annual: 15 ug/m³)											
State	2002	2005		2009			2012			2018	
	BaseK	Base M		BaseK	Base M		BaseK	Base M		BaseK	Base M
IL	11	7		3	1		3	0		2	0
IN	10	6		1	0		1	0		0	0
MI	6	2		3	1		2	1		0	0
OH	31	26		7	1		4	0		1	1
WI	0	0		0	0		0	0		2	0
Total	58	41		14	3		10	1		5	1

The modeling results above reflect the "base" controls identified in Section 3.6, with EGU emissions based on IPM modeling (i.e., Round 4 – IPM2.1.9, and Round 5 – IPM3.0). In addition, two sets of alternative future year EGU emissions were examined in Round 5. First, alternative control assumptions were provided for several facilities by the states (i.e., "will do" and "may do" scenarios). In general, these scenarios produced a small change in future year ozone and $PM_{2.5}$ concentrations (i.e., about 0.1 ug/m^3 for $PM_{2.5}$ and 0.1-0.2 ppb for ozone). Second, EPA suggested adjustments to the 2010 IPM emissions to reflect 2009 conditions. The revised (2009) SO2 emissions represent a 5-6% increase in domainwide SO2 emissions. The increased SO2 emissions result in slightly greater annual average $PM_{2.5}$ concentrations (on the order of 0.1 – 0.2 ug/m^3), but do not produce any new residual nonattainment areas.

The limited 4 km ozone modeling (based on Base K) performed by LADCO included a future year analysis for 2009. The figure below shows the 2009 values with 12 km and 4 km grid spacing for the LADCO modeling and similar modeling conducted by a stakeholder group (Midwest Ozone Group).

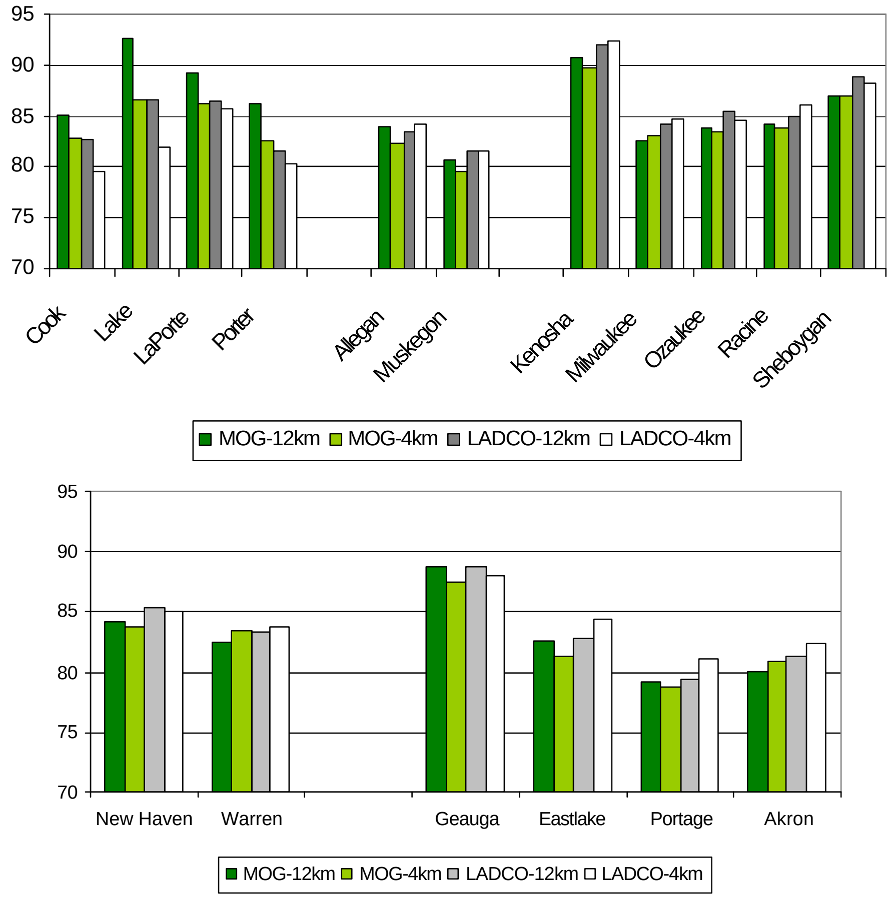


Figure 63. Future year (2009) values for Lake Michigan area (top) and Detroit-Cleveland region (bottom)

These results show that the 12 km and 4 km values are similar, with the most notable changes in northwestern Indiana and northeastern Illinois (e.g., 4 km values are as much as 4 ppb lower than 12 km values). The differences in the southern part of the Lake Michigan area are plausible, given the tight emissions gradient there (i.e., finer grid resolution appears to provide more appropriate representation).

In light of these findings, 12 km grid spacing can continue to be used for ozone modeling, but the Base K/Round 4 results for northwestern Indiana/northeastern Illinois should be viewed with caution (i.e., probably 1 – 4 ppb too high).

In summary, the ozone modeling provides the following information for the nonattainment areas in the region (see Table 12):

Table 12. Ozone Nonattainment Areas in the LADCO Region (as of December 31, 2007)

Area Name	Category	Number of Counties	Attainment Deadline
Detroit-Ann Arbor, MI	Marginal	8	2007
Chicago-Gary-Lake County, IL-IN	Moderate	10	2010
Cleveland-Akron-Lorain, OH	Moderate	8	2010
Milwaukee-Racine, WI	Moderate	6	2010
Sheboygan, WI	Moderate	1	2010
St Louis, MO-IL	Moderate	4	2010
Allegan Co, MI	Subpart 1	1	2009
Cincinnati-Hamilton, OH-KY-IN	Subpart 1	6	2009
Columbus, OH	Subpart 1	6	2009
Door Co, WI	Subpart 1	1	2009
Kewaunee Co, WI	Subpart 1	1	2009
Manitowoc Co, WI	Subpart 1	1	2009
		53	

Marginal Areas (2007 attainment date): No modeling was conducted for the 2006 SIP planning year. Rather, 2005 – 2007 air quality data are available to determine attainment.

Basic (Subpart 1) Areas (2009 attainment date): The modeling results for the 2008 SIP planning year show:

- Base K: all areas in attainment, except Cincinnati and Indianapolis
- Base M: all areas in attainment, except Holland (Allegan County)

Moderate Areas (2010 attainment date): The modeling results for the 2009 SIP planning year show:

- Base K: all areas still in nonattainment
- Base M: all areas in attainment

The $PM_{2.5}$ modeling results show:

- Base K: all areas in attainment, except for Chicago, Cincinnati, Cleveland, Detroit, Granite City (IL), Louisville, Portsmouth (OH), and Steubenville
- Base M: all areas in attainment, except for Cleveland, Detroit, and Granite City (IL)

With respect to the new lower 8-hour ozone standard, the modeling about 30 sites in 2012 and 5 sites in 2018 with design values greater than 75 ppb. With respect to the new lower 24-hour $PM_{2.5}$ standard, the modeling shows 13 sites in 2012 and 10 in 2018 with design values greater than 35 ug/m^3.

4.2 Supplemental Analyses

EPA's modeling guidelines recommend that attainment demonstrations consist of a primary (guideline) modeling analysis and supplemental analyses. Three basic types of supplemental analyses are recommended:

- additional modeling
- analyses of trends in ambient air quality and emissions, and
- observational models and diagnostic analyses

Furthermore, according to EPA's guidelines, if the future year modeled values are "close" to the standard (i.e., 82 – 87 ppb for ozone and 14.5 – 15.5 ug/m^3 for $PM_{2.5}$), then the results of the primary modeling should be reviewed along with the supplemental information in a "weight of evidence" assessment of whether each area is likely to achieve timely attainment.

A WOE determination for ozone and $PM_{2.5}$ is provided in the following sections. Special attention is given to the following areas with future year modeled values that exceed or are "close" to the ambient standard (see Appendix I):

Ozone	**PM2.5**
Lake Michigan area	Chicago, IL
Cleveland, OH	Cleveland, OH
Cincinnati, OH	Cincinnati, OH
	Granite City, IL
	Detroit, MI

4.3 Weight-of-Evidence Determination for Ozone

The WOE determination for ozone consists of the primary modeling and other supplemental analyses (some of which were discussed in Section 2). A summary of this information is provided below.

Primary (Guideline) Modeling: The guideline modeling is presented in Section 4.1. Key findings from this modeling include:

- Base M regional modeling shows attainment by 2008 and 2009 at all sites, except Holland (MI), and attainment at all sites by 2012.

- Base K modeling results reflect generally higher future year values, and show more sites in nonattainment compared to the Base M modeling. The difference in the two modeling analyses is due mostly to lower base year design values in Base M.

- Base K and Base M modeling analyses are considered "SIP quality", so the attainment demonstration for ozone should reflect a weight-of-evidence approach, with consideration of monitoring based information.

- Base M modeling also shows that the proposed lower 8-hour standard will not be met at many sites, even by 2018, with existing controls.

Additional Modeling: Four additional modeling analyses were considered: (1) re-examination of the primary modeling to estimate attainment probabilities, (2) remodeling with different assumptions, (3) an unmonitored area analysis, and (4) EPA's latest regional ozone modeling. Each of these analyses is described below.

First, the primary modeling results (which were initially processed using EPA's attainment test) were re-examined to estimate the probability of attaining the ozone standard (Lopez, 2007, and LADCO, 2008b). Seven estimates of future year ozone concentrations were calculated based on model-based RRFs and appropriate monitor-based concentrations for each year between 2001 and 2007. RRF values for 2001, 2003, 2004, 2006, and 2007 were derived based on the 2002 and 2005 modeling results. Monitor-based concentrations reflect 4th high values, design values, or average of three design values centered on the year in question. The probability of attainment was determined as the percentage of these seven estimates below the standard. The results indicate that sites in the Lake Michigan area (Chiwaukee, Sheboygan, Holland, Muskegon), Cleveland (Ashtabula), and St. Louis (W Alton) have a fairly low probability of attainment by 2009 (i.e., about 50% or less).

Second, the primary modeling analysis was redone with different types of assumptions for calculating base year design values (i.e., using the 3-year period centered on base year, and using the highest 3-year period that includes the base year), and for calculating RRFs (i.e., using all days with base year modeled value > 70 ppb, and using all days with base year modeled value > 85 ppb, with at least 10 days and "acceptable" model performance). The results for several high concentration sites are presented in Tables 13a and 13b for 2009. The different modeling assumptions produce eight estimates of future year ozone concentrations. The highest estimates are associated with base year design values representing the 3-year average for 2001-2003, and the lowest estimates are associated with base year design values representing the 3-year average 2004-2006. The different RRF approaches produce little change in future year ozone concentrations. This suggests that future year concentration estimates are most sensitive to the choice of the base year and the methodology used to derive the base year design values.

Third, EPA's modeling guidelines recommend that an "unmonitored area analysis" be included as a supplemental analysis, particularly in nonattainment areas where the monitoring network just meets or minimally exceeds the size of the network required to report data to EPA's Air Quality System. The purpose of this analysis is to identify areas where future year values are predicted to be greater than the NAAQS.

Based on examination of the spatial plots in Figures 49a and 49b, the most notable areas of high modeled ozone concentrations are over the Great Lakes. Over-water monitoring, however, is not required by EPA[12]. A cursory analysis of unmonitored areas for ozone was performed by LADCO using an earlier version of the 2002 base year modeling (i.e, Base I) (Baker, 2005). Base year and future year "observed" values were derived for unmonitored grid cells using the absolute modeled concentrations (in all grid cells) and the observed values (in monitored grid cells). A spatial map of the estimated 2009 values is provided in Figure 64. As can be seen, there are very few (over land) grid cells where additional monitors may be desirable. This indicates that the current modeling analysis, which focuses on monitored locations, is addressing areas of high ozone throughout the region.

[12] Air quality measurements over Lake Michigan were collected by LADCO previously to understand ozone transport in the area (see, for example, Figure 5). Due to cut-backs in USEPA funding, however, these measurements were discontinued in 2003.

Table 13a. Primary and Additional Ozone Modeling Results – Lake Michigan and Cleveland Areas (2009)

2009 Modeling Results		Lake Michigan Area								Cleveland Area		
		Chiwaukee	Harr.Beach	Sheboygan	DoorCounty	Holland	Hammond	MichiganCity		Ashtabula	Geauga	Eastlake
		550590019	550890009	551170006	550290004	260050003	180892008	180910005		390071001	390550004	390850003
Attainment Test (based on EPA guidance-2002 baseyear)												
Base Year Design Value (average of three 3-year periods)		*98.3*	*93.0*	*97.0*	*91.0*	*94.0*	*88.3*	*90.3*		*95.7*	*99.0*	*92.7*
RRF (all days > 85 ppb, or at least 10 days)		0.935	0.918	0.916	0.899	0.888	0.980	0.958		0.865	0.897	0.894
Future Year Design Value		**91.9**	**85.4**	**88.9**	**81.8**	83.5	**86.5**	**86.5**		82.8	**88.8**	82.9
Attainment Test (based on EPA guidance-2005 baseyear)												
Base Year Design Value (average of three 3-year periods)		*84.7*	*83.3*	*88.0*	*88.7*	*90.0*	*77.7*	*77.0*		*89.0*	*79.3*	*86.3*
RRF (all days > 85 ppb, or at least 10 days)		0.972	0.961	0.955	0.946	0.948	0.971	0.960		0.937	0.942	0.949
Future Year Design Value		82.3	80.1	84.0	83.9	**85.3**	75.4	73.9		83.4	74.7	81.9
Weight of Evidence (alternative approaches-2002baseyear)												
Alt 1 - Base Year Des. Value (3-year period centered on 2002)		*101.0*	*98.0*	*100.0*	*94.0*	*97.0*	*90.0*	*93.0*		*99.0*	*103.0*	*95.0*
Alt 2 - Base Year Des. Value (Highest 3-year period including 2002)		*101.0*	*98.0*	*100.0*	*94.0*	*97.0*	*92.0*	*93.0*		*99.0*	*103*	*95.0*
RRF (all days > 85 ppb, or at least 10 days)		0.935	0.918	0.916	0.899	0.888	0.980	0.958		0.865	0.897	0.894
Alt 1 - Future Year Projected Value		**94.4**	**90.0**	**91.6**	84.5	**86.1**	**88.2**	**89.1**		**85.6**	**92.4**	84.9
Alt 2 - Future Year Projected Value		**94.4**	**90.0**	**91.6**	84.5	**86.1**	**90.2**	**89.1**		**85.6**	**92.4**	84.9
Alt 1 - RRF (all days > 70 ppb)		0.933	0.918	0.912	0.907	0.893	0.969	0.947		0.876	0.907	0.900
Alt 1 - Future Year Projected Value		**94.2**	**90.0**	**91.2**	**85.3**	**86.6**	**87.2**	**88.1**		**86.7**	**93.4**	**85.5**
Alt 2 - Future Year Projected Value		**94.2**	**90.0**	**91.2**	**85.3**	**86.6**	**89.1**	**88.1**		**86.7**	**93.4**	**85.5**
Alt 2 - RRF (all days > 85 ppb, or at least 10 days; with acceptable model performance)		0.945	0.904	0.910	0.904	0.887	0.976	0.964		0.866	0.896	0.894
Alt 1 - Future Year Projected Value		**95.4**	**88.6**	**91.0**	**85.0**	**86.0**	**87.8**	**89.7**		**85.7**	**92.3**	84.9
Alt 2 - Future Year Projected Value		**95.4**	**88.6**	**91.0**	**85.0**	**86.0**	**89.8**	**89.7**		**85.7**	**92.3**	84.9
Weight of Evidence (alternative approaches-2005baseyear)												
Alt 1 - Base Year Des. Value (3-year period centered on 2005)		*83.0*	*79.0*	*86.0*	*86.0*	*88.0*	*76.0*	*76.0*		*86.0*	*77.0*	*86.0*
Alt 2 - Base Year Des. Value (Highest 3-year period including 2005)		*86.0*	*88.0*	*89.0*	*90.0*	*93.0*	*79.0*	*78.0*		*91.0*	*86.0*	*89.0*
Alt 1 - Future Year Projected Value		80.7	75.9	82.1	81.4	83.4	73.8	73.0		80.6	72.5	81.6
Alt 2 - Future Year Projected Value		83.6	84.6	**85.0**	**85.1**	**88.2**	76.7	74.9		**85.3**	81.0	84.5

Table 13b. Primary and Additional Ozone Modeling Results – Cincinnati, Columbus, St. Louis, Indianapolis, and Detroit (2009)

2009 Modeling Results	Cincinnati Area			Columbus	St. Louis Area		Indianapolis Area		Detroit Area
	Wilmington	Lebanon	Sycamore	NewAlbany	W. Alton	OrchardFarm	Noblesville	Fortville	New Haven
	390271002	39165007	390610006	390490029	291831002	291831004	180571001	18059003	260990009
Attainment Test (based on EPA guidance-2002 baseyear)									
Base Year Design Value (average of three 3-year periods)	*94.3*	*90.7*	*90.7*	*94.0*	*90.0*	*90.0*	*93.7*	*91.3*	*92.3*
RRF (all days > 85 ppb, or at least 10 days)	0.885	0.908	0.938	0.888	0.947	0.914	0.894	0.918	0.924
Future Year Design Value	83.5	82.4	**85.1**	83.5	**85.2**	82.3	83.8	83.8	**85.3**
Attainment Test (based on EPA guidance-2005 baseyear)									
Base Year Design Value (average of three 3-year periods)	*82.3*	*87.7*	*84.3*	*86.3*	*86.3*	*87.0*	*83.3*	*78.7*	*86.0*
RRF (all days > 85 ppb, or at least 10 days)	0.941	0.947	0.967	0.947	0.938	0.942	0.945	0.947	0.947
Future Year Design Value	77.4	83.1	81.5	81.7	80.9	82.0	78.7	74.5	81.4
Weight of Evidence (alternative approaches-2002baseyear)									
Alt 1 - Base Year Des. Value (3-year period centered on 2002)	*96.0*	*92.0*	*93.0*	*95.0*	*91.0*	*92.0*	*96.0*	*94.0*	*97.0*
Alt 2 - Base Year Des. Value (Highest 3-year period including 2002)	*96.0*	*92.0*	*93.0*	*96.0*	*91.0*	*92.0*	*96.0*	*94.0*	*97.0*
RRF (all days > 85 ppb, or at least 10 days)	0.885	0.908	0.938	0.888	0.947	0.914	0.894	0.918	0.924
Alt 1 - Future Year Projected Value	**85.0**	83.5	**87.2**	84.4	**86.2**	84.1	**85.8**	**86.3**	**89.6**
Alt 2 - Future Year Projected Value	**85.0**	83.5	**87.2**	**85.2**	**86.2**	84.1	**85.8**	**86.3**	**89.6**
Alt 1 - RRF (all days > 70 ppb)	0.885	0.914	0.940	0.901	0.945	0.911	0.912	0.907	0.918
Alt 1 - Future Year Projected Value	**85.0**	84.1	**87.4**	**85.6**	**86.0**	83.8	**87.6**	**85.3**	**89.0**
Alt 2 - Future Year Projected Value	**85.0**	84.1	**87.4**	**86.5**	**86.0**	83.8	**87.6**	**85.3**	**89.0**
Alt 2 - RRF (all days > 85 ppb, or at least 10 days; with acceptable model performance)	0.880	0.911	0.940	0.886	0.951	0.913	0.894	0.916	0.935
Alt 1 - Future Year Projected Value	84.5	83.8	**87.4**	84.2	**86.5**	84.0	**85.8**	**86.1**	**90.7**
Alt 2 - Future Year Projected Value	84.5	83.8	**87.4**	**85.1**	**86.5**	84.0	**85.8**	**86.1**	**90.7**
Weight of Evidence (alternative approaches-2005baseyear)									
Alt 1 - Base Year Des. Value (3-year period centered on 2005)	*80.0*	*86.0*	*81.0*	*84.0*	*85.0*	*86.0*	*80.0*	*76.0*	*82.0*
Alt 2 - Base Year Des. Value (Highest 3-year period including 2005)	*85.0*	*89.0*	*86.0*	*88.0*	*89.0*	*89.0*	*87.0*	*81.0*	*90.0*
Alt 1 - Future Year Projected Value	75.3	81.4	78.3	79.5	79.7	81.0	75.6	72.0	77.7
Alt 2 - Future Year Projected Value	80.0	84.3	83.2	83.3	83.5	83.8	82.2	76.7	**85.2**

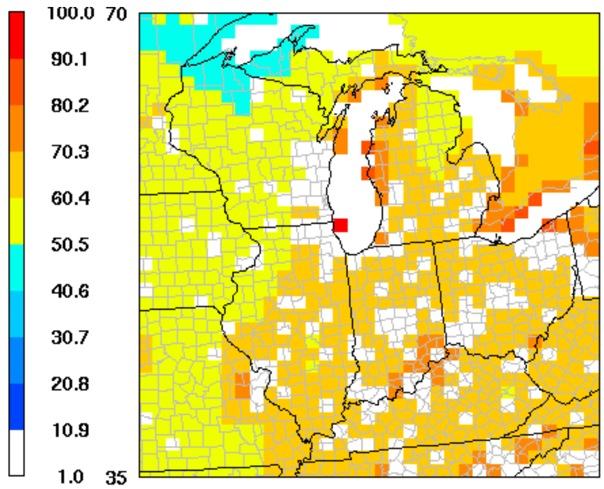


Figure 64. Estimated Future Year Values (unmonitored grid cells)

Finally, EPA's latest regional ozone modeling was considered as corroborative information. This modeling was performed as part of the June 2007 proposal to revise the ozone standard (EPA, 2007b). EPA applied the CMAQ model with 2001 meteorology to first estimate ozone levels in 2020 based on the current standard and national rules in effect or proposed (i.e., the baseline), and then to evaluate strategies for attaining a more stringent (70 ppb) primary standard. Baseline (2020) ozone levels were predicted to be below the current standard in 481 of the 491 counties with ozone monitors. Of the 10 counties predicted to be above the standard, there is one county in the LADCO region (i.e., Kenosha County, WI at 86 ppb). This result is consistent with LADCO's Base K modeling for 2018 (i.e., Kenosha County, WI at 86.7 ppb), which is not surprising given that EPA's modeling and LADCO's Base K modeling have a similar base year (2001 v. 2002).

Analysis of Trends: EPA's modeling guidelines note that while air quality models are generally the most appropriate tools for assessing the expected impacts of a change in emissions, it may also be possible to extrapolate future trends based on measured historical trends of air quality and emissions. To do so, USEPA's guidance suggests that ambient trends should first be normalized to account for year-to-year variations in meteorological conditions (EPA, 2002). Meterologically-adjusted 4^{th} high 8-hour ozone concentrations were derived using the air quality – meteorological regression model developed by EPA (i.e., Cox method – see Section 2.1).

The historical trend in these met-adjusted ozone concentrations were extrapolated to estimate future year ozone concentrations based on historical and projected trends in precursor emissions. Both VOC and NOx emissions affect ozone concentrations. Given that observation-based methods show that urban areas in the region are generally VOC-limited and rural areas in the region are NOx-limited (see Section 2.1), urban VOC emissions and regional NOx emissions are considered important. The trends in urban VOC and regional NOx emissions were calculated to produce appropriate weighting factors.

The resulting 2009 and 2012 ozone values are provided in Figure 65, along with the primary and alternative modeling ozone values for key sites in the Lake Michigan, Cleveland, and Cincinnati areas. The results reflect a fairly wide scatter, but, on balance, the supplemental information is supportive of the primary modeling results (i.e., sites in the Lake Michigan area and Cleveland are expected to be close to the standard).

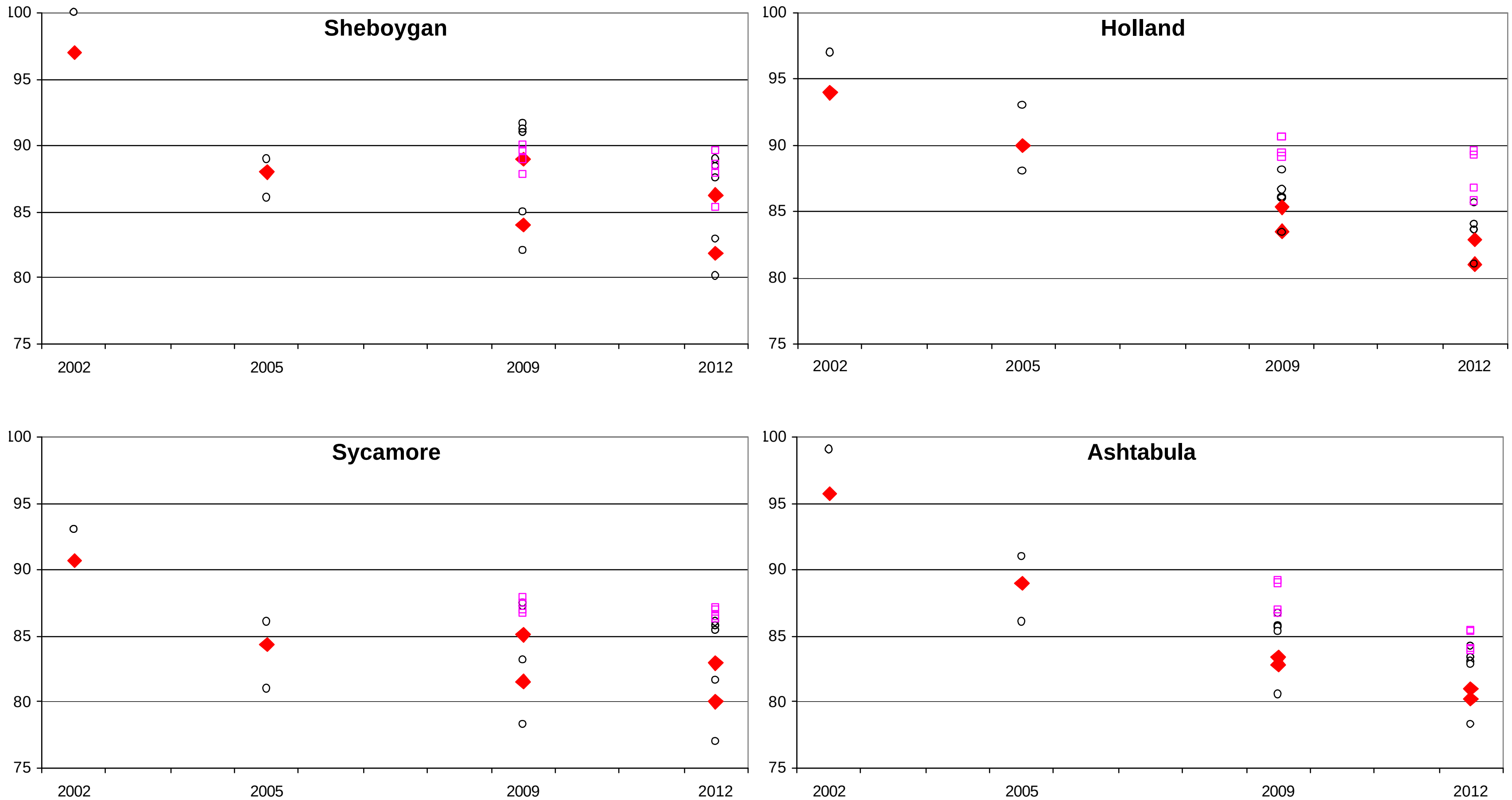


Figure 65. Estimates of Future Year Ozone Concentrations – Lake Michigan Area (Sheboygan and Holland), Cincinnati (Sycamore), and Cleveland (Ashtabula)

Note: Primary (guideline) modeling values (Base K and Base M results) are represented by large red diamonds, additional modeling values by small black circles, and trends-based values by small pink squares

Observational Models and Diagnostic Analyses: The observation-based modeling (i.e., MAPPER) is presented in Section 3. The key findings from this modeling are that most urban areas are VOC-limited and rural areas are NOx-limited.

The primary diagnostic analysis is source apportionment modeling with CAMx to provide more quantitative information on source region (and source sector) impacts (Baker, 2007a). Specifically, the model estimated the impact of 18 geographic source regions (which are identified in Figure 66) and 6 source sectors (EGU point, non-EGU point, on-road, off-road, area, and biogenic sources) at ozone monitoring sites in the region.

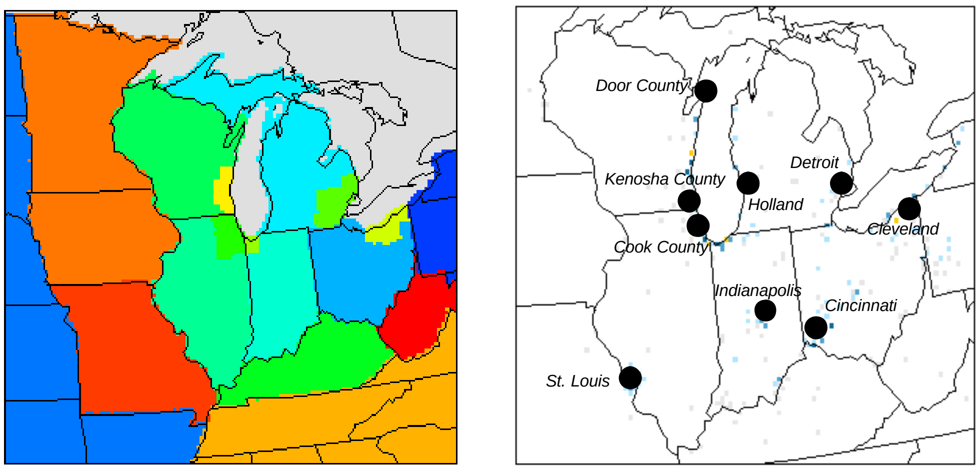


Figure 66. Source regions (left) and key monitoring sites (right) for ozone modeling analysis

Modeling results for 2009 (Base M) and 2012 (Base K) are provided in Appendix II for several key monitoring sites. For each monitoring site, there are two graphs: one showing sector-level contributions, and one showing source region and sector-level contributions in terms of percentages. (Note, in the sector-level graph, the contributions from NOx emissions are shown in blue, and from VOC emissions in green.)

The sector-level results (see, for example, Figure 67) show that on-road and nonroad NOx emissions generally have the largest contributions at the key monitor locations (> 15% each). EGU and non-EGU NOx emissions are also important contributors (> 10% each). The source group contributions vary by receptor location due to emissions inventory differences.

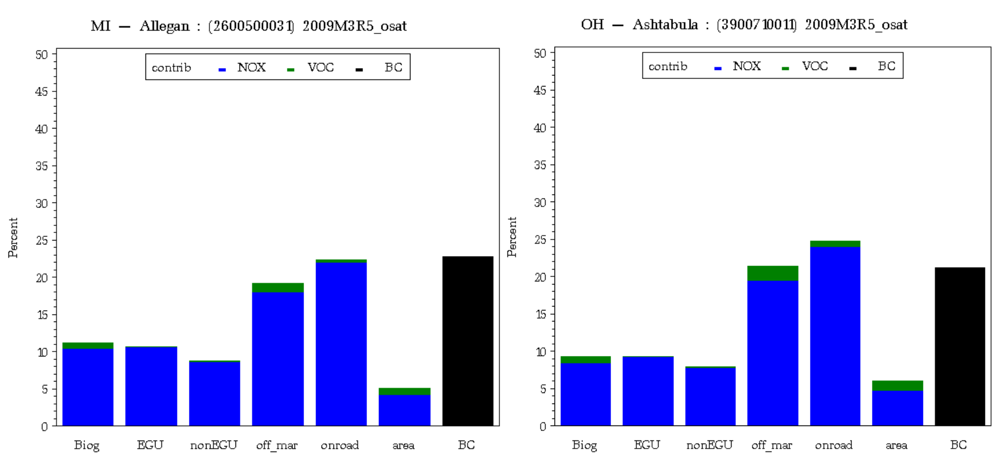


Figure 67. Source-sector results for Holland (left) and Ashtabula (right) monitors – 2009 (Base M)

The source region results (see, for example, Figure 68) show that while nearby areas generally have the highest impacts (e.g., the northeastern IL/northwestern IN/southeastern WI nonattainment area contributes 25-35% to high sites in the Lake Michigan area, and Cleveland nonattainment counties contribute 20-25% to high sites in northeastern Ohio), there is an even larger regional impact (i.e., contribution from other states).

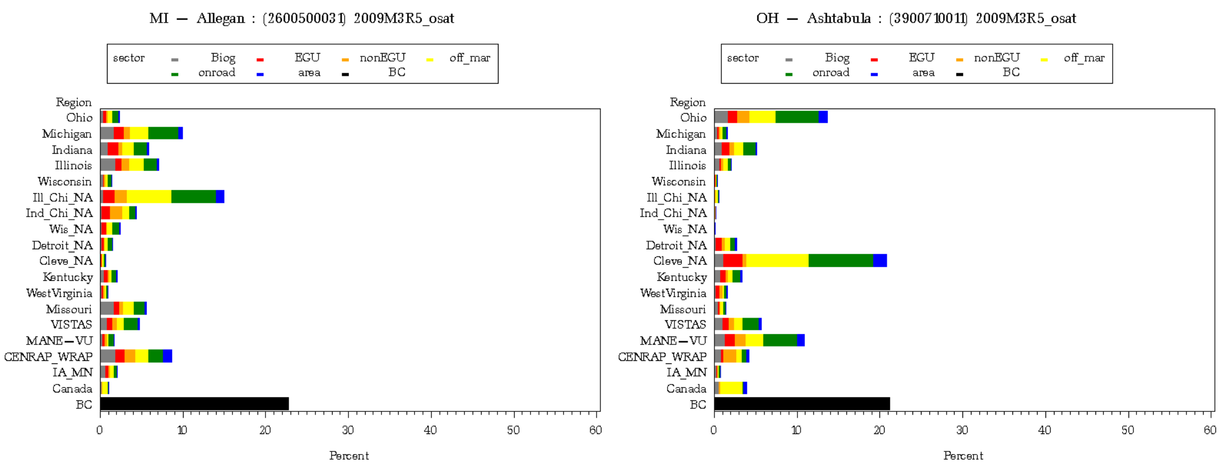


Figure 68. Source-region results for Holland (left) and Ashtabula (right) monitors – 2009 (Base M)

Summary: Air quality modeling and other supplemental analyses were performed to estimate future year ozone concentrations. Based on this information, the following general conclusions can be made:

- Existing ("on the books") controls are expected to produce significant improvement in ozone air quality.

- The choice of the base year affects the future year model projections. A key difference between the base years of 2002 and 2005 is meteorology. As noted above, 2002 was more ozone conducive than 2005. The choice of which base year to use as the basis for the SIP is a policy decision (i.e., how much safeguard to incorporate).

- Most sites are expected to meet the current 8-hour standard by the applicable attainment date, except, for sites in western Michigan and, possibly, in eastern Wisconsin and northeastern Ohio.

- Current monitoring data show significant nonattainment in these areas (e.g., peak design values on the order of 90 – 93 ppb). It is not clear whether sufficient emission reductions will occur in the next couple of years to provide for attainment.

- Attainment by the applicable attainment date is dependent on actual future year meteorology (e.g., if the weather conditions are consistent with [or less severe than] 2005, then attainment is likely) and actual future year emissions (e.g., if the emission reductions associated with the existing controls are achieved, then attainment is likely). On the other hand, if either of these conditions is not met, then attainment may be less likely.

4.3 Weight-of-Evidence Determination for $PM_{2.5}$
The WOE determination for $PM_{2.5}$ consists of the primary modeling and other supplemental analyses. A summary of this information is provided below.

Primary (Guideline) Modeling: The results of the guideline modeling are presented in Section 4.1. Key findings from this modeling include:

- Base M regional modeling shows attainment by 2009 at all sites, except Detroit, Cleveland, and Granite City, and attainment at all sites by 2012, except for Detroit and Granite City.

  The regional modeling for $PM_{2.5}$ does not reflect any air quality benefit expected from local controls. States are conducting local-scale analyses and will use these results, in conjunction with the regional-scale modeling, to support their attainment demonstrations for $PM_{2.5}$

- Base K modeling results reflect generally higher future year values, and show more sites in nonattainment in 2009 and 2012 compared to the Base M modeling. The difference in the two modeling analyses is due mostly to lower base year design values in Base M.

- Base K and Base M modeling analyses are considered "SIP quality", so the attainment demonstration for $PM_{2.5}$ should reflect a weight-of-evidence approach, with consideration of monitoring based information.

- Base M modeling also shows that the new $PM_{2.5}$ 24-hour standard will not be met at many sites, even by 2018, with existing controls.

Additional Modeling: EPA's latest regional $PM_{2.5}$ modeling was considered as corroborative information. This modeling was performed as part of the September 2006 revision to the $PM_{2.5}$ standard (USEPA, 2006). EPA applied the CMAQ model with 2001 meteorology to estimate $PM_{2.5}$ levels in 2015 and 2020 first with national rules in effect or proposed, and then with additional controls to attain the current standard (15 ug/m^3 annual/65 ug/m^3 daily). Additional analyses were performed to evaluate strategies for attaining more stringent standards in 2020 (15/35, and 14/35). Baseline (2015) $PM_{2.5}$ levels were predicted to be above the current standard in four counties in the LADCO region: Madison County, IL at 15.2 ug/m^3, Wayne County, MI at 17.4, Cuyahoga County, OH at 15.4, and Scioto County, OH at 15.6. These results are consistent with LADCO's Base K modeling for 2012/2018, which is not surprising given that EPA's modeling and LADCO's Base K modeling have a similar base year (2001 v. 2002).

Observational Models and Diagnostic Analyses: The observation-based modeling (i.e., application of thermodynamic equilibrium models) is presented in Section 3. The key findings from this modeling are that $PM_{2.5}$ mass is sensitive to reductions in sulfate, nitric acid, and ammonia concentrations. Even though sulfate reductions cause more ammonia to be available to form ammonium nitrate (PM-nitrate increases slightly when sulfate is reduced), this increase is generally offset by the sulfate reductions, such that $PM_{2.5}$ mass decreases. Under conditions with lower sulfate levels (i.e., proxy of future year conditions), $PM_{2.5}$ is more sensitive to reductions in nitric acid compared to reductions in ammonia.

The primary diagnostic analysis is source apportionment modeling with CAMx to provide more quantitative information on source region (and source sector) impacts (Baker, 2007b). Specifically, the model estimated the impact of 18 geographic source regions (which are identified in Figure 69) and 6 source sectors (EGU point, non-EGU point, on-road, off-road, area, and biogenic sources) at $PM_{2.5}$ monitoring sites in the region.

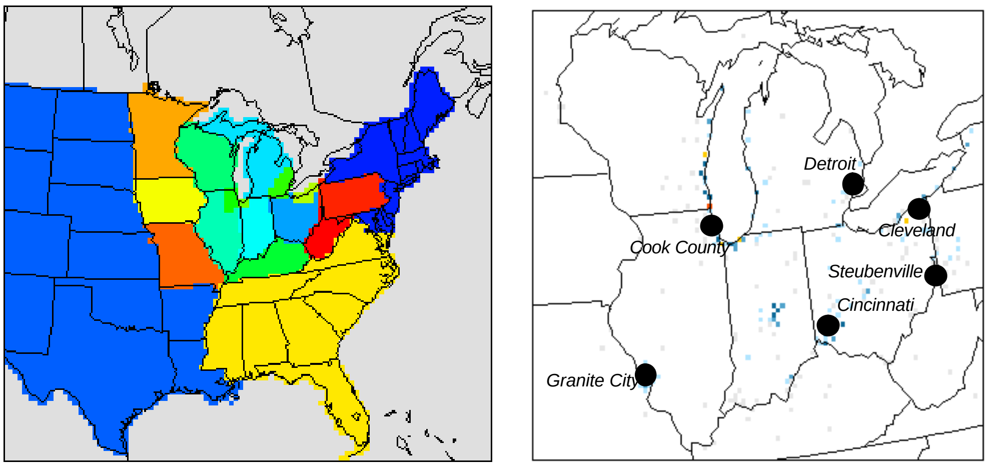


Figure 69. Source regions (left) and key monitoring sites (right) for $PM_{2.5}$ modeling analysis

Modeling results for 2012 (Base K) and 2018 (Base M) are provided in Appendix III for several key monitoring sites. For each monitoring site, there are two graphs: one showing sector-level contributions, and one showing source region and sector-level contributions in terms of absolute modeled values.

The sector-level results (see, for example, Figure 70) show that EGU sulfate, non-EGU-sulfate, and area organic carbon emissions generally have the largest contributions at the key monitor locations (> 15% each). Ammonia emissions are also important contributors (> 10%). The source group contributions vary by receptor location due to emissions inventory differences.

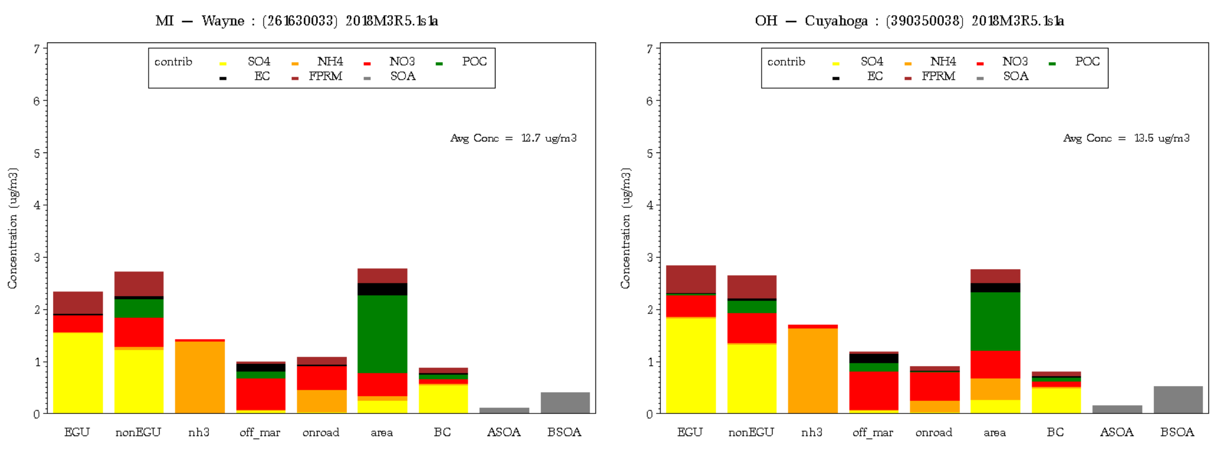


Figure 70. Source-sector results for Detroit (left) and Cleveland (right) monitors – 2018 (Base M)

The source region results (see, for example, Figure 71) show that while nearby areas generally have the highest impacts (e.g., Detroit nonattainment counties contribute 40% to high sites in southeastern Michigan, and Cleveland nonattainment counties contribute 35% to high sites in northeastern Ohio), there is an even larger regional impact (i.e., contribution from other states).

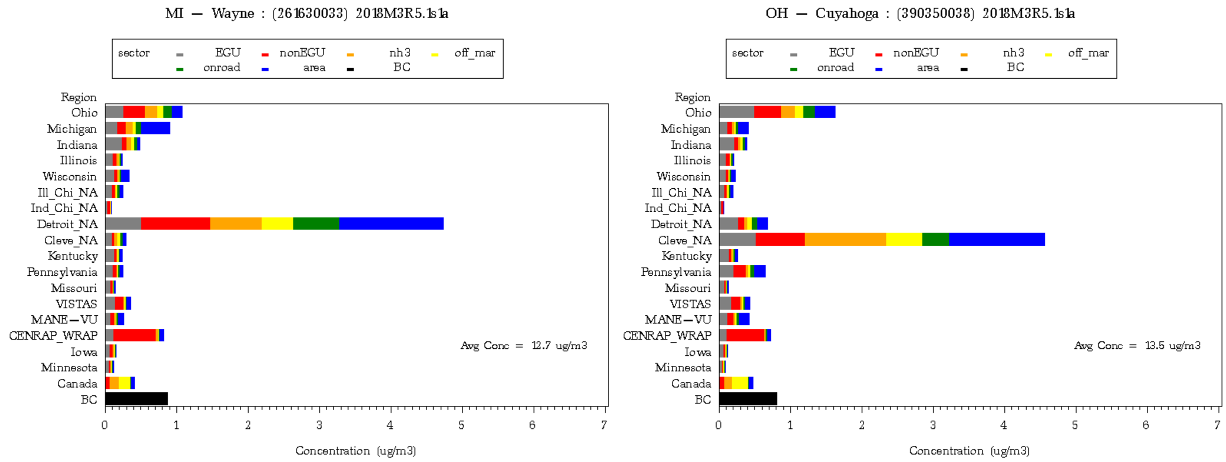


Figure 71. Source-region results for Detroit (left) and Cleveland (right) monitors – 2018 (Base M)

Summary: Air quality modeling and other supplemental analyses were performed to estimate future year $PM_{2.5}$ concentrations. Based on this information, the following general conclusions can be made:

- Existing ("on the books") controls are expected to produce significant improvement in $PM_{2.5}$ air quality.

- The choice of the base year affects the future year model projections. It is not clear how much of this is attributable to differences in meteorology, because, as noted in Section 3, $PM_{2.5}$ concentrations are not as strongly influenced by meteorology as ozone.

- Most sites are expected to meet the current $PM_{2.5}$ standard by the applicable attainment date, except for sites in Detroit, Cleveland, and Granite City.

- Current monitoring data show significant nonattainment in these areas (e.g., peak design values on the order of 16 – 17 ug/m^3). It is not clear whether sufficient emission reductions will occur in the next couple of years to provide for attainment. States are conducting local-scale analyses for Detroit, Cleveland, and Granite City, in particular, to identify appropriate additional local controls.

- Attainment by the applicable attainment date is dependent (possibly) on actual future year meteorology and (more likely) on actual future year emissions (e.g., if the emission reductions associated with the "on the books" controls are achieved, then attainment is likely). On the other hand, if either of these conditions is not met (especially, with respect to emissions), then attainment may be less likely.

Section 5. Reasonable Progress Assessment for Regional Haze

Air quality modeling and other information were used to assess the improvement in visibility that would be provided by existing ("on the books") controls and possible additional control programs. In determining reasonable progress for regional haze, Section 169A of the Clean Air Act and EPA's visibility rule requires states to consider five factors:

- costs of compliance
- time necessary for compliance
- energy and non-air quality environmental impacts of compliance
- remaining useful life of any existing source subject to such requirements
- uniform rate of visibility improvement needed to attain natural visibility conditions by 2064

The uniform rate of visibility improvement requirement can be depicted graphically in the form of a "glide path" (see Figure 72).

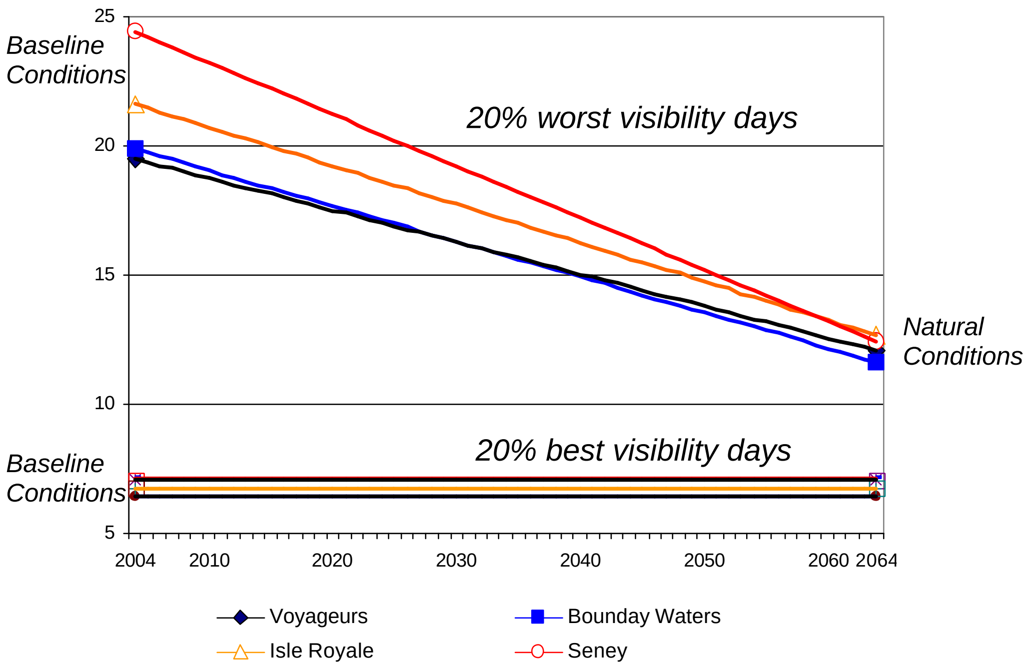


Figure 72. Visibility "glide paths" for northern Class I areas (units: deciviews)

5.1 Class I Areas Impacted

EPA's visibility rule requires a state to "address regional haze in each mandatory Class I Federal area located within the State and in each mandatory Class I Federal area located outside the State which may be affected by emissions from within the State." (40 CFR Part 51.308(d)) To meet this requirement, technical analyses conducted by the RPOs were consulted to obtain information on areas of influence and culpability for Class I areas in the eastern U.S. (MRPO, 2007). A summary of this information is provided in Table 1 (MRPO, 2007). The table shows that every LADCO State impacts multiple Class I areas in the eastern U.S.

Table 14. Draft List of Class I Areas Impacted by LADCO States

AREA NAME	IL	IN	MI	OH	WI
81.401 Alabama.					
Sipsey Wilderness Area	(1)	(1)			
81.404 Arkansas.					
Caney Creek Wilderness Area	(2), (4)	(2), (4)		(2), (4)	
Upper Buffalo Wilderness Area	(1),(2),(4),(5)	(2), (4)		(2), (4)	(2)
81.408 Georgia.					
Cohotta Wilderness Area					
Okefenokee Wilderness Area					
Wolf Island Wilderness Area					
81.411 Kentucky.					
Mammoth Cave NP	(1), (2), (5)	(1), (2), (5)	(1), (2)	(1), (2), (5)	
81.412 Louisiana.					
Breton Wilderness Area					
81.413 Maine.					
Acadia National Park	(3)	(3)	(3)	(3)	
Moosehorn Wilderness Area.	(3)	(3)	(3)	(3)	
81.414 Michigan.					
Isle Royale NP.	(1), (2)	(1), (2)	(1), (2)		(1), (2)
Seney Wilderness Area	(1), (2)	(1), (2)	(1), (2)	(1), (2)	(1), (2)
81.415 Minnesota.					
Boundary Waters Canoe Area Wilderness	(2)	(2)	(2)		(1), (2)
Voyageurs NP	(2)	(2)			(1), (2)
81.416 Missouri.					
Hercules-Glades Wilderness Area	(2), (4), (5)	(2), (4), (5)		(2), (4)	(2)
Mingo Wilderness Area	(2), (4), (5)	(2), (4), (5)	(2)	(2), (4)	(2)
81.419 New Hampshire.					
Great Gulf Wilderness Area	(3)	(3)	(3)	(1), (3)	
Pres. Range-Dry River Wilderness Area.					
81.42 New Jersey.					
Brigantine Wilderness Area	(3)	(3)	(1), (3)	(1), (3)	

81.422 North Carolina.					
Great Smoky Mountains NP{1}	(1)	(1)		(1)	
Joyce Kilmer-Slickrock Wilderness Area{2}					
Linville Gorge Wilderness Area.					
Shining Rock Wilderness Area.					
Swanquarter Wilderness Area					
81.426 South Carolina.					
Cape Romain Wilderness					
81.428 Tennessee.					
Great Smoky Mountains NP{1}.	(1)	(1)		(1)	
Joyce Kilmer-Slickrock Wilderness{2}					
81.431 Vermont.					
Lye Brook Wilderness	(2), (3)	(2), (3)	(2), (3)	(1), (2), (3)	
81.433 Virginia.					
James River Face Wilderness.	(2)	(2)	(2)	(2), (5)	
Shenandoah NP	(2), (3)	(1), (2), (3)	(2), (3)	(1),(2),(3),(5)	
81.435 West Virginia.					
Dolly Sods/Otter Creek Wilderness.	(2), (3)	(1), (2), (3)	(1), (2), (3)	(1),(2),(3),(5)	

Key
(1) MRPO Back Trajectory Analyses
(2) MRPO PSAT Modeling
(3) MANE-VU Contribution Assessment
(4) Missouri-Arkansas Contribution Assessment
(5) VISTAS Areas of Influence

5.2 Future Year Modeling Results
For regional haze, the calculation of future year conditions assumed:

- baseline concentrations based on 2000-2004 IMPROVE data, with updated (subsitituted) data for Mingo, Boundary Waters, Voyageurs, Isle Royale, and Seney (see Section 2.3);

- use of the new IMPROVE light extinction equation; and

- use of EPA default values for natural conditions, based on the new IMPROVE light extinction equation.

The uniform rate of visibility improvement values for the 2018 planning year were derived (for the 20% worst visibility days) based on a straight line between baseline concentration value (plotted in the year 2004 -- end year of the 5-year baseline period) and natural condition value (plotted in the year 2064 -- date for achieving natural conditions). Plots of these "glide paths" with the Base M modeling results are presented in Figure 73 for Class I areas in the eastern U.S. A tabular summary of measured baseline and modeled future year deciview values for these Class I areas are provided in Table 15 (2002 base year) and Table 16 (2005 base year)[13].

The haze results show that several Class I areas in the eastern U.S. are expected to be greater than (less improved than) the uniform rate of visibility improvement values (in 2018), including those in northern Michigan and several in the northeastern U.S. Many other Class I areas in the eastern U.S. are expected to be less than (more improved than) the uniform rate of visibility improvement values (in 2018). As noted above, states should consider these results, along with information on the other four factors, in setting reasonable progress goals.

An assessment of the five factors was performed for LADCO and the State of Minnesota by a contractor (EC/R, 2007). Specifically, ECR examined reductions in SO2 and NOx emissions from EGUs and industrial, commercial and institutional (ICI) boilers; NOx emissions from mobile sources and reciprocating engines and turbines; and ammonia emissions from agricultural operations. The impacts of "on the books" controls were also examined to provide a frame of reference for assessing the impacts of the additional control measures.

The results of ECR's analysis of the five factors are summarized below:

Factor 1 (Cost of Compliance): The average cost effectiveness values (in terms of $M per ton) are provided in Table 16. For comparison, cost-effectiveness estimates previously provided for "on the books" controls include:

CAIR SO2: $700 - $1,200, NOx: $1,400 – $2.600 ($/T)

BART SO2: $300 - $963, NOx: $248 - $1,770

MACT SO2: $1,500, NOx: $7,600

Most of the cost-effectiveness values for the additional controls are within the range of cost-effectiveness values for "on the books" controls.

[13] Model results reflect the grid cell where the IMPROVE monitor is located.

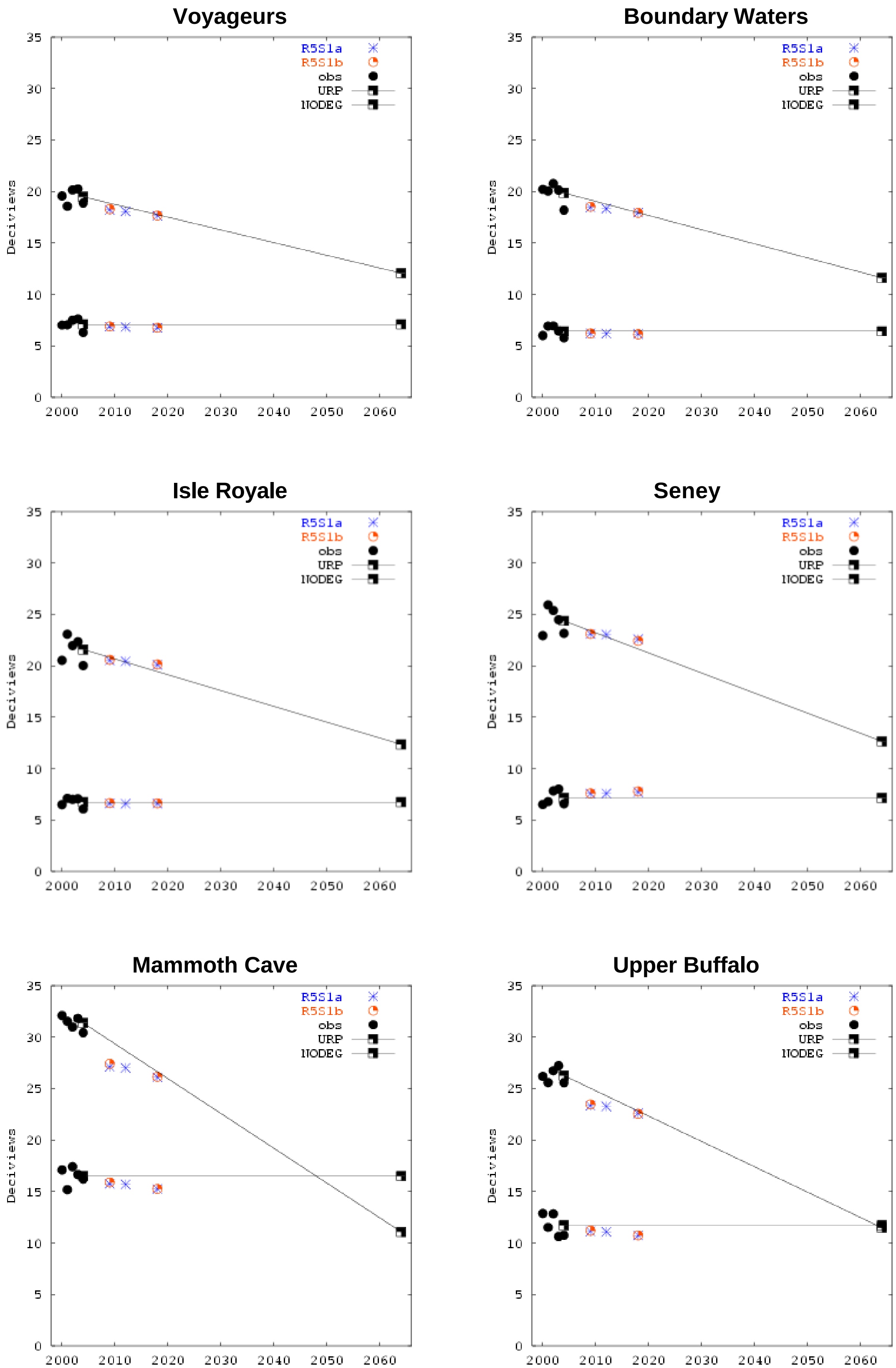


Figure 73. Visibility modeling results for Class I areas in eastern U.S.

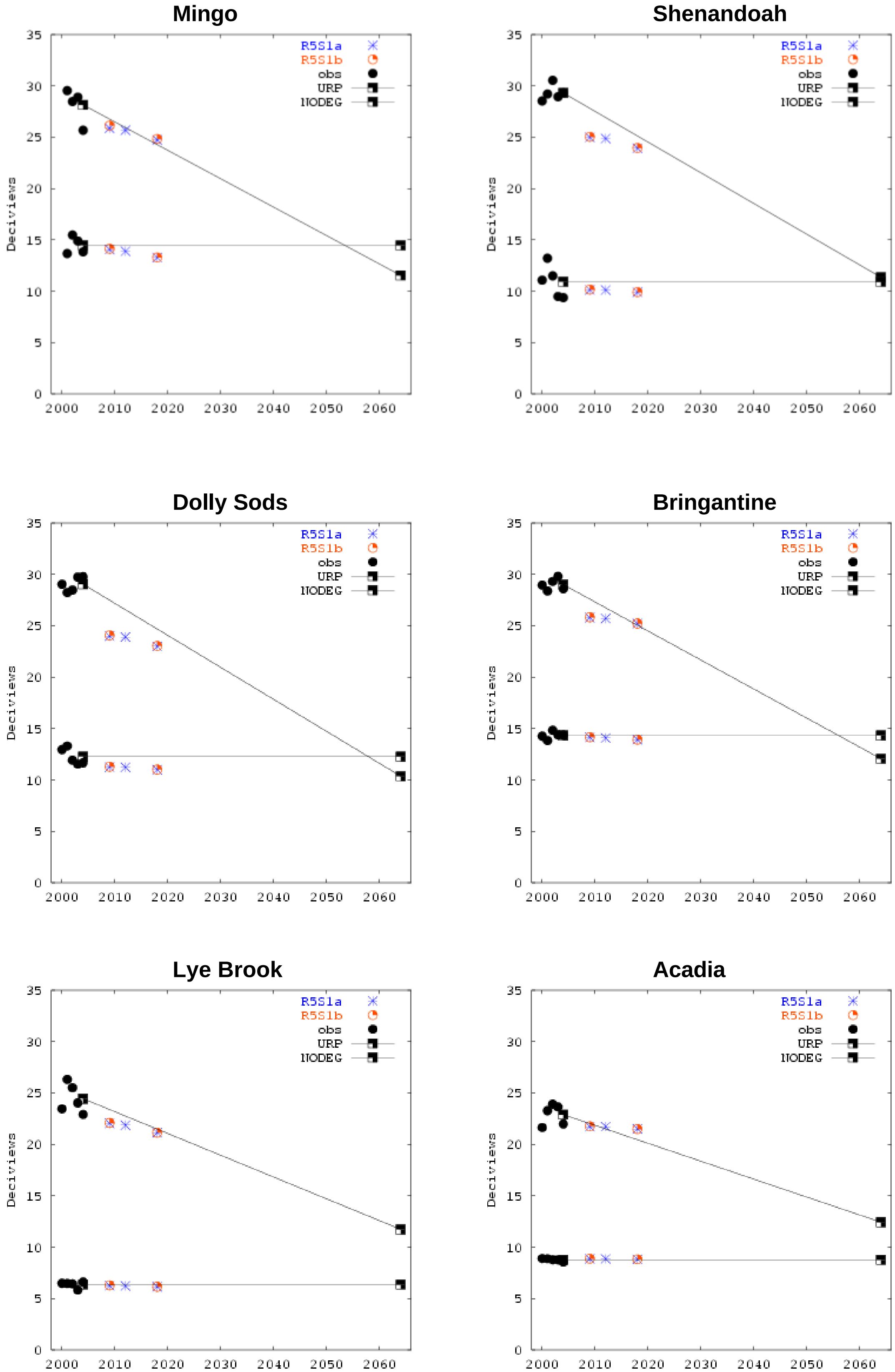


Figure 73 (cont.) Visibility modeling results for Class I areas in eastern U.S.

Table 15. Haze Results - Round 4 (Based on 2000-2004)							
Worst 20%		**2018**	**2009**	**2012**	**2018**	**2018**	**2018**
Site	**Baseline**	**URP**	**OTB**	**OTB**	**OTB**	**EGU2 (5-state region)**	**EGU2 (12-state region)**
BOWA1	19.86	17.70	19.05	19.01	**18.94**	**18.40**	17.72
VOYA2	19.48	17.56	19.14	19.19	**19.18**	**18.94**	**18.38**
SENE1	24.38	21.35	22.98	22.71	**22.38**	21.26	20.63
ISLE1	21.59	19.21	20.46	20.28	**20.04**	19.09	18.64
HEGL1	26.75	22.76	24.73	24.34	**23.85**	**23.01**	22.04
MING1	28.15	24.08	25.18	24.67	24.01	22.53	21.45
CACR1	26.36	22.55	24.01	23.55	**22.99**	22.43	21.57
UPBU1	26.27	22.47	24.02	23.58	**23.06**	22.31	21.38
MACA1	31.37	26.14	28.06	27.03	25.52	24.27	22.57
DOSO1	29.04	24.23	24.86	23.59	22.42	21.60	20.15
SHEN1	29.31	24.67	24.06	22.79	21.57	20.43	19.42
JARI1	29.12	24.48	24.81	23.79	22.42	21.59	20.88
BRIG1	29.01	24.68	25.87	25.25	24.39	23.91	23.45
LYBR1	24.45	21.16	21.80	21.32	20.69	20.18	19.79
Best 20%		**2018**	**2009**	**2012**	**2018**	**2018**	**2018**
Site	**Baseline**	**URP**	**OTB**	**OTB**	**OTB**	**EGU2 (5-state region)**	**EGU2 (12-state region)**
BOWA1	6.42	6.42	6.71	6.73	6.87	6.83	6.81
VOYA2	7.09	7.09	7.21	7.25	7.34	7.31	7.26
SENE1	7.14	7.14	7.19	7.19	7.23	7.06	6.91
ISLE1	6.75	6.75	6.57	6.51	6.47	6.20	6.06
HEGL1	12.84	12.84	12.61	12.62	12.61	12.43	12.02
MING1	14.46	14.46	13.96	13.93	13.94	13.74	13.33
CACR1	11.24	11.24	10.91	10.92	10.90	10.75	10.42
UPBU1	11.71	11.71	11.47	11.46	11.42	11.28	11.01
MACA1	16.51	16.51	16.06	15.91	15.54	15.18	14.75
DOSO1	12.28	12.28	11.72	11.45	11.19	10.93	10.67
SHEN1	10.93	10.93	9.73	9.53	9.17	9.05	8.90
JARI1	14.21	14.21	13.56	13.33	12.97	12.65	12.46
BRIG1	14.33	14.33	13.74	13.69	13.47	13.32	13.21
LYBR1	6.36	6.36	6.12	6.05	5.96	5.88	5.82

Table 16. Haze Results - Round 5.1 (Based on 2000-2004)						
Worst 20%		**2018**	**2009**	**2012**	**2018**	**2018**
Site	**Baseline**	**URP**	**OTB**	**OTB**	**OTB**	**OTB+Will DO**
BOWA1	19.86	17.94	18.45	18.33	17.94	17.92
VOYA2	19.48	17.75	18.20	18.07	17.63	17.66
SENE1	24.38	21.64	23.10	23.04	**22.59**	**22.42**
ISLE1	21.59	19.43	20.52	20.43	**20.09**	**20.13**
ISLE9	21.59	19.43	20.33	20.22	**19.84**	**19.82**
HEGL1	26.75	23.13	24.72	24.69	**24.22**	**24.17**
MING1	28.15	24.27	25.88	25.68	**24.74**	**24.83**
CACR1	26.36	22.91	23.39	23.29	22.44	22.40
UPBU1	26.27	22.82	23.34	23.27	22.59	22.55
MACA1	31.37	26.64	27.11	27.01	26.10	26.15
DOSO1	29.05	24.69	24.00	23.90	23.00	23.04
SHEN1	29.31	25.12	24.99	24.87	23.92	23.95
JARI1	29.12	24.91	25.17	25.01	24.06	24.12
BRIG1	29.01	25.05	25.79	25.72	**25.21**	**25.22**
LYBR1	24.45	21.48	22.04	21.86	21.14	21.14
ACAD1	22.89	20.45	21.72	21.72	**21.49**	**21.49**
Best 20%		**2018**	**2009**	**2012**	**2018**	**2018**
Site	**Baseline**	**Max**	**OTB**	**OTB**	**OTB**	**OTB+Will DO**
BOWA1	6.42	6.42	6.21	6.19	6.14	6.12
VOYA2	7.09	7.09	6.86	6.83	6.75	6.76
SENE1	7.14	7.14	7.57	7.58	7.71	7.78
ISLE1	6.75	6.75	6.62	6.59	6.60	6.62
ISLE9	6.75	6.75	6.56	6.55	6.52	6.50
HEGL1	12.84	12.84	12.51	12.32	11.66	11.64
MING1	14.46	14.46	14.07	13.89	13.28	13.29
CACR1	11.24	11.24	10.88	10.85	10.52	10.52
UPBU1	11.71	11.71	11.13	11.08	10.73	10.74
MACA1	16.51	16.51	15.76	15.69	15.25	15.25
DOSO1	12.28	12.28	11.25	11.23	11.00	11.01
SHEN1	10.93	10.93	10.13	10.11	9.91	9.91
JARI1	14.21	14.21	13.38	13.38	13.14	13.14
BRIG1	14.33	14.33	14.15	14.08	13.92	13.92
LYBR1	6.37	6.37	6.25	6.23	6.14	6.15
ACAD1	8.78	8.78	8.86	8.86	8.82	8.82

Table 17. Estimated Cost Effectiveness for Potential Control Measures

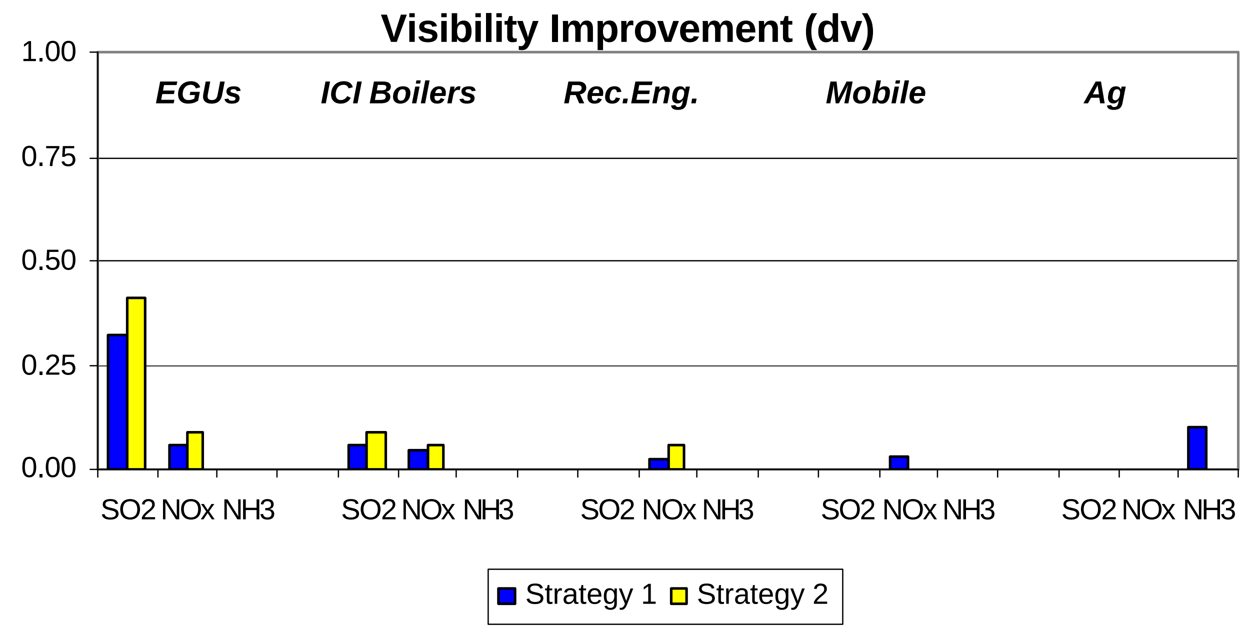
			Average Cost effectiveness ($/ton)		
Emission category	Control strategy	Region	SO2	NOX	NH3
EGU	EGU1	3-State	1,540	2,037	
		9-State	1,743	1,782	
	EGU2	3-State	1,775	3,016	
		9-State	1,952	2,984	
ICI boilers	ICI1	3-State	2,992	2,537	
		9-State	2,275	1,899	
	ICI Workgroup	3-State	2,731	3,814	
		9-State	2,743	2,311	
Reciprocating engines and turbines	Reciprocating engines emitting 100 tons/year or more	3-State		538	
		9-State		506	
	Turbines emitting 100 tons/year or more	3-State		754	
		9-State		754	
	Reciprocating engines emitting 10 tons/year or more	3-State		1,286	
		9-State		1,023	
	Turbines emitting 10 tons/year or more	3-State		800	
		9-State		819	
Agricultural sources	10% reduction	3-State			31 - 2,700
		9-State			31 - 2,700
	15% reduction	3-State			31 - 2,700
		9-State			31 - 2,700
Mobile sources	Low-NOX Reflash	3-State		241	
		9-State		241	
	MCDI	3-State		10,697	
		9-State		2,408	
	Anti-Idling	3-State		(430) - 1,700	
		9-State		(430) - 1,700	
	Cetane Additive Program	3-State		4,119	
		9-State		4,119	
Cement Plants	Process Modification	Michigan		-	
	Conversion to dry kiln	Michigan		9,848	
	LoTox™	Michigan		1,399	
Glass Manufacturing	LNB	Wisconsin		1,041	
	Oxy-firing	Wisconsin		2,833	
	Electric boost	Wisconsin		3,426	
	SCR	Wisconsin		1,054	
	SNCR	Wisconsin		1,094	
Lime Manufacturing	Mid-kiln firing	Wisconsin		688	
	LNB	Wisconsin		837	
	SNCR	Wisconsin		1,210	
	SCR	Wisconsin		5,037	
	FGD	Wisconsin		128 - 4,828	
Oil Refinery	LNB	Wisconsin		3,288	
	SNCR	Wisconsin		4,260	
	SCR	Wisconsin		17,997	
	LNB+FGR	Wisconsin		4,768	
	ULNB	Wisconsin		2,242	
	FGD	Wisconsin		1,078	

Factor 2 (Time Necessary for Compliance): All of the control measures can be implemented by 2018. Thus, this factor can be easily addressed.

Factor 3 (Energy and Non-Air Quality Environmental Impacts): The energy and other environmental impacts are believed to be manageable. For example, the increased energy demand from add-on control equipment is less than 1% of the total electricity and steam production in the region, and solid waste disposal and wastewater treatment costs are less than 5% of the total operating costs of the pollution control equipment. It should also be noted that the SO2 and NOx controls would have beneficial environmental impacts (e.g., reduced acid deposition and nitrogen deposition).

Factor 4 (Remaining Useful Life): The additional control measures are intended to be market-based strategies applied over a broad geographic region. It is not expected that the control requirements will be applied to units that will be retired prior to the amortization period for the control equipment. Thus, this factor can be easily addressed.

Factor 5 (Visibility Impacts): The estimated incremental improvement in 2018 visibility levels for the additional measures is shown in Figure 74, along with the cost-effectiveness expressed in $M per deciview improvement). These results show that although EGU and ICI boiler controls have higher cost-per-deciview values (compared to some of the other measures), their visibility impacts are larger.



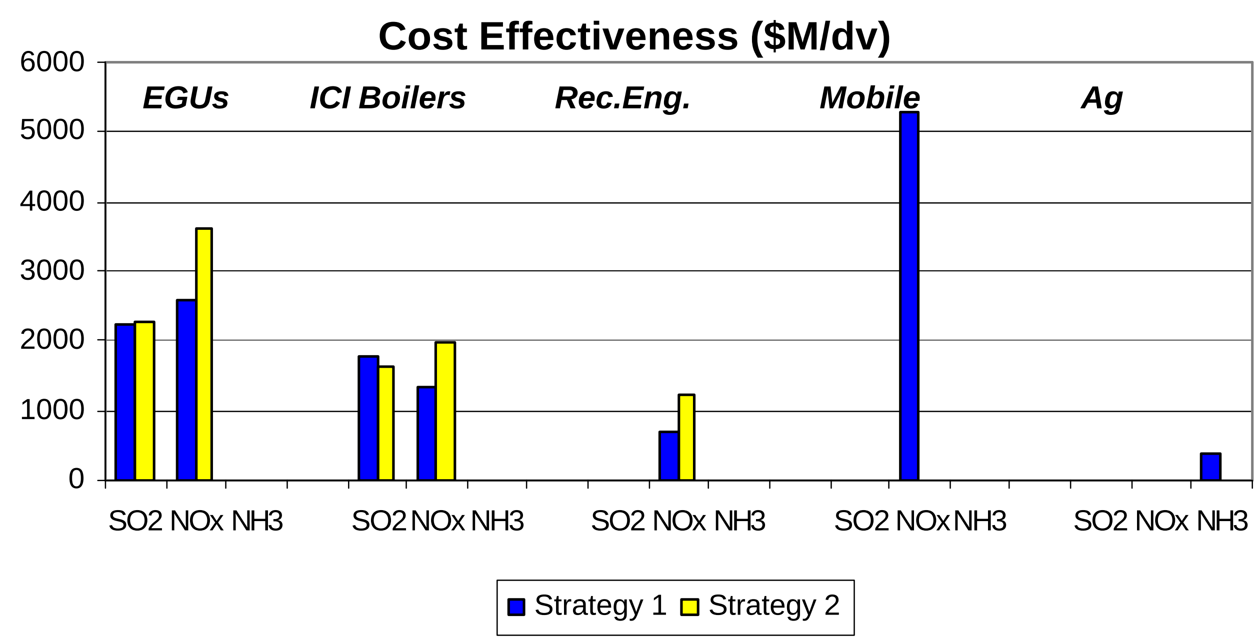


Figure 74. Results of ECR analysis of reasonable progress factors – visibility improvement (Factor 5) is on top, and cost effectiveness (Factor 1) is on bottom

5.3 Weight-of-Evidence Determination for Haze

The WOE determination for haze consists of the primary modeling and other supplemental analyses. A summary of this information is provided below.

Primary (Guideline) Modeling: The results of the guideline modeling are presented in Section 4.1. Key findings from this modeling include:

- Base M modeling results show that the northern Minnesota Class I areas are close to the glide path, whereas the northern Michigan Class I areas are above the glide path in 2018. Other sites in the eastern U.S. are close to (or below) the glide path, except for Mingo (MO), Brigantine (NJ), and Acadia (ME).

- Base K modeling results show that the northern Minnesota and northern Michigan Class I areas are above the glide path in 2018. Other sites in the eastern U.S. are close to (or below) the glide path.

- The difference in the two modeling analyses is due mostly to differences in future year emission projections, especially for EGUs (e.g., use of IPM2.1.9 v. IPM3.0).

- Base K and Base M modeling analyses are considered "SIP quality", so the attainment demonstration for haze should reflect a weight-of-evidence approach, with consideration of monitoring based information.

Additional Modeling: Two additional modeling analyses were considered: (1) the primary modeling redone with different baseline values, and (2) modeling by the State of Minnesota which looked at different receptor locations in the northern Class I areas (MPCA, 2008). Each of these analyses is described below.

First, the primary modeling analysis (Base M) was revised using an alternative baseline value. Specifically, the data for the period 2000-2005 were used to calculate the baseline, given that the Base M modeling reflects a 2005 base year. The results of this alternative analysis (see Table 18) are generally consistent with the primary modeling (see Table 16).

Second, Minnesota's modeling reflects a 2002 base year and much of the data developed by LADCO for its modeling. (Note, Minnesota conducted modeling for LADCO's domain at 36 km, and for a statewide domain at 12 km.) The purpose of the 12 km modeling was to address local scale impacts on the northern Class I areas at several locations, not just the location of the IMPROVE monitor. Results for the Boundary Waters on the 20% worst days range from 18.3 – 19.0 dv, with an average value of 18.7 dv, which is consistent with Minnesota's 36 km modeling results at the IMPROVE monitor. This variability in visibility levels should be kept in mind when reviewing the values presented in Tables 15, 16, and 18, which reflect results at the IMPROVE monitor locations.

Table 18. Haze Results - Round 5.1 (Based on 2000-2005)						
Worst 20%			**2009**	**2012**	**2018**	**2018**
Site	**Baseline**	**URP**	**OTB**	**OTB**	**OTB**	**OTB+Will DO**
BOWA1	20.10	18.12	18.63	18.51	18.12	18.09
VOYA2	19.62	17.86	18.27	18.15	17.70	17.72
SENE1	24.77	21.94	23.44	23.39	**22.94**	**22.77**
ISLE1	21.95	19.71	20.84	20.76	**20.41**	**20.44**
ISLE9	21.95	19.71	20.65	20.55	**20.15**	**20.13**
HEGL1	27.45	23.67	25.30	25.27	**24.79**	**24.73**
MING1	28.92	24.86	25.88	25.68	24.74	24.83
CACR1	27.05	23.44	23.88	23.78	22.92	22.86
UPBU1	26.97	23.36	23.92	23.85	23.14	23.09
MACA1	31.76	26.93	27.42	27.32	26.39	26.44
DOSO1	29.36	24.92	24.20	24.11	23.19	23.23
SHEN1	29.45	25.23	25.06	24.94	23.98	24.01
JARI1	29.40	25.13	25.32	25.17	24.22	24.28
BRIG1	29.12	25.14	25.84	25.77	**25.26**	**25.26**
LYBR1	24.71	21.69	22.22	22.06	21.36	21.36
ACAD1	22.91	20.47	21.72	21.72	**21.49**	**21.49**
Best 20%			**2009**	**2012**	**2018**	**2018**
Site	**Baseline**	**URP**	**OTB**	**OTB**	**OTB**	**OTB+Will DO**
BOWA1	6.40	6.40	6.20	6.17	6.13	6.10
VOYA2	7.05	7.05	6.82	6.78	6.71	6.71
SENE1	7.20	7.20	7.60	7.61	7.73	7.80
ISLE1	6.80	6.80	6.67	6.64	6.65	6.66
ISLE9	6.80	6.80	6.62	6.61	6.57	6.55
HEGL1	13.04	13.04	12.71	12.51	11.85	11.82
MING1	14.68	14.68	14.07	13.89	13.28	13.29
CACR1	11.62	11.62	11.24	11.20	10.86	10.86
UPBU1	11.99	11.99	11.41	11.36	11.01	11.02
MACA1	16.64	16.64	15.88	15.82	15.37	15.38
DOSO1	12.24	12.24	11.21	11.19	10.96	10.97
SHEN1	10.85	10.85	10.04	10.02	9.82	9.83
JARI1	14.35	14.35	13.51	13.51	13.27	13.27
BRIG1	14.36	14.36	14.17	14.10	13.94	13.94
LYBR1	6.21	6.21	6.11	6.09	6.01	6.01
ACAD1	8.57	8.57	8.67	8.66	8.62	8.62

Observational Models and Diagnostic Analyses: The observation-based modeling (i.e., application of thermodynamic equilibrium models) is presented in Section 3. The key findings from this modeling are that $PM_{2.5}$ mass is sensitive to reductions in sulfate, nitric acid, and ammonia concentrations. Even though sulfate reductions cause more ammonia to be available to form ammonium nitrate (PM-nitrate increases slightly when sulfate is reduced), this increase is generally offset by the sulfate reductions, such that $PM_{2.5}$ mass decreases and visibility improves. Under conditions with lower sulfate levels (i.e., proxy of future year conditions), $PM_{2.5}$ is more sensitive to reductions in nitric acid compared to reductions in ammonia.

As discussed in Section 2, thermodynamic equilibrium modeling based on data collected at Seney indicates that $PM_{2.5}$ there is most sensitive to reductions in sulfate, but also responsive to reductions in nitric acid (Blanchard, 2004). An analysis using data from the Midwest ammonia monitoring network for a site in Minnesota (i.e., Great River Bluffs, which is the closest ammonia monitoring site to the northern Class I areas) suggested that reductions in sulfate, nitric acid, and ammonia concentrations will lower $PM_{2.5}$ concentrations and improve visibility levels in the northern Class I areas.

Trajectory analyses for the 20% worst visibility days for the four northern Class I areas are provided in Figure 75. (Note, this figure is similar to Figure 34, but the trajectory results for each Class I area are displayed separately here.) The orange areas are where the air is most likely to come from, and the green areas are where the air is least likely to come from. Darker shading represents higher frequency. As can be seen, bad air days are generally associated with transport from regions located to the south, and good air days with transport from Canada.

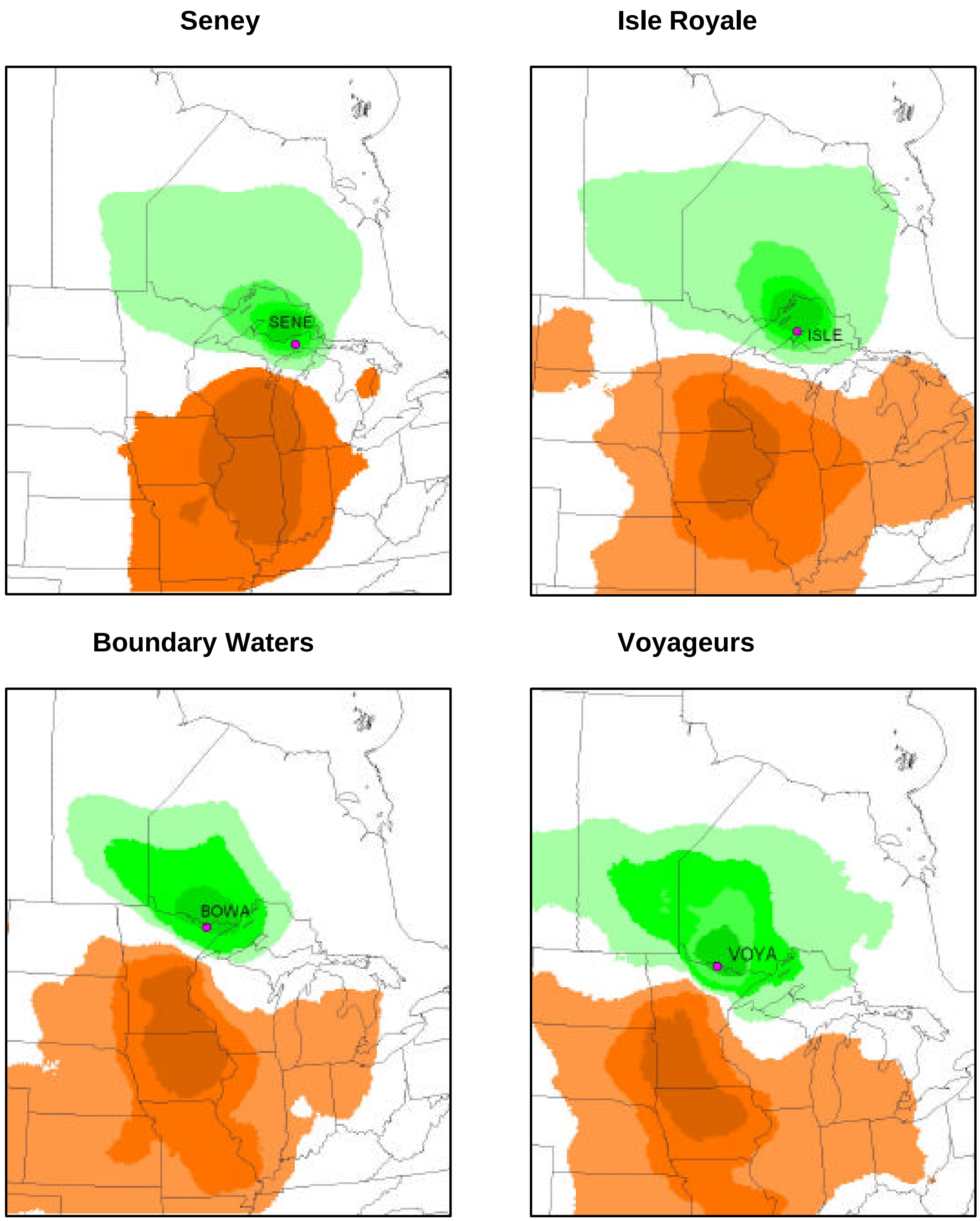


Figure 75. Trajectory analysis results for northern Class I areas on 20% worst visibility days

The primary diagnostic analysis is source apportionment modeling with CAMx to provide more quantitative information on source region (and source sector) impacts (Baker, 2007b). Specifically, the CAMx model was applied to provide source contribution information. Specifically, the model estimated the impact of 18 geographic source regions (which are identified in Figure 76) and 6 source se ctors (EGU point, non-EGU point, on-road, off-road, area, and ammonia sources) at visibility/haze monitoring sites in the eastern U.S.

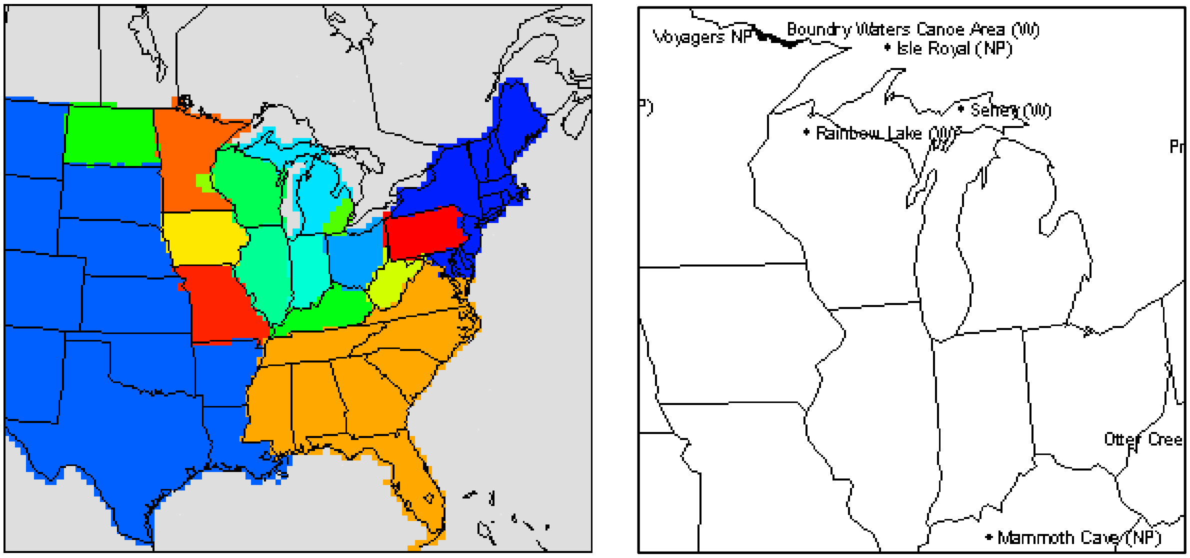


Figure 76. Source regions (left) and key monitoring sites (right) for haze modeling analysis

Modeling results for 2018 (Base K and Base M) are provided in Appendix IV for several key monitoring sites (Class I areas). For each monitoring site, there are two graphs: one showing sector-level contributions, and one showing source region and sector-level contributions in terms of absolute modeled values.

The sector-level results (see, for example, Figure 77) show that EGU sulfate, non-EGU-sulfate, and ammonia emissions generally have the largest contributions at the key monitor locations. The source group contributions vary by receptor location due to emissions inventory differences.

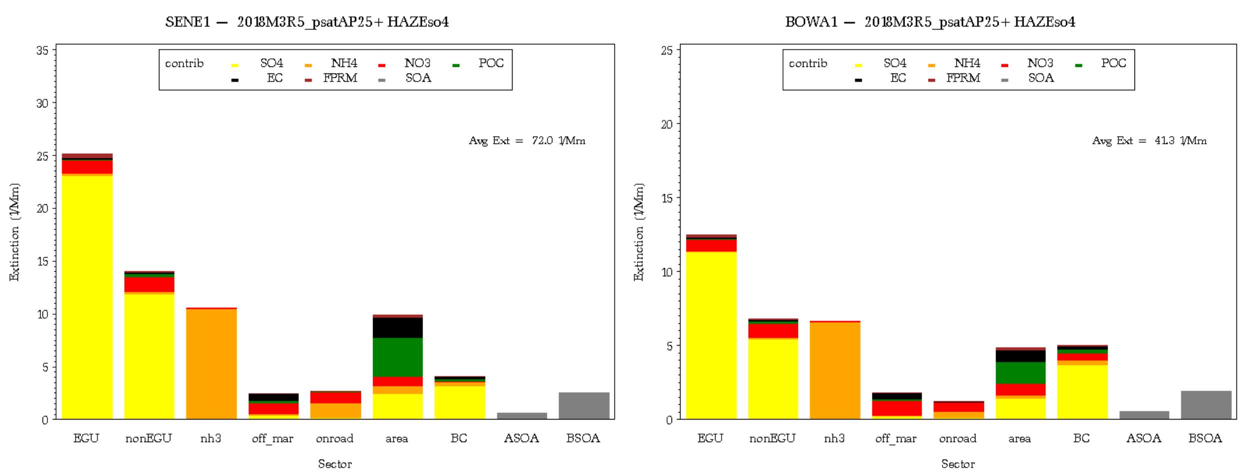


Figure 77. Source-sector results for Seney (left) and Boundary Waters (right) – 2018 (Base M)

The source region results (see, for example, Figure 78) show that emissions from a number of nearby states contribute to regional haze levels.

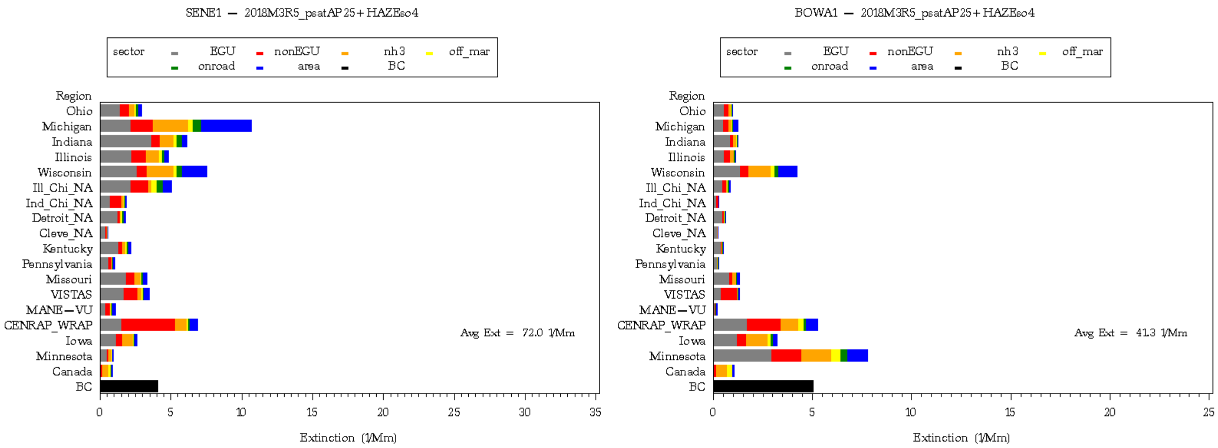


Figure 78. Source-region results for Seney (left) and Boundary Waters (right) – 2018 (Base M)

Table 19 provides a summary of the estimated state-level culpabilities based on the LADCO back trajectory analyses and the PSAT analyses for 2018.

Summary: Air quality modeling and other supplemental analyses were performed to estimate future year visibility levels. Based on this information, the following general conclusions can be made:

- Existing ("on the books") controls are expected to improve visibility levels in the northern Class I areas.

- Visibility levels in a few Class I areas in the eastern U.S. are expected to be greater than (less improved than) the uniform rate of visibility improvement values in 2018, including those in northern Michigan and some in the northeastern U.S.

- Visibility levels in many other Class I areas in the eastern U.S. are expected to be less than (more improved than) the uniform rate of visibility improvement values in 2018.

Table 19. State Culpabilities Based on PSAT Modeling and Trajectory Analyses

	Boundary Waters						Seney			
	LADCO - Round 4 PSAT	LADCO - Round 5 PSAT	MPCA-PSAT	CENRAP - PSAT	LADCO - Traj. Analysis		LADCO - Round 4 PSAT	LADCO - Round 5 PSAT	CENRAP - PSAT	LADCO - Traj. Analysis
Michigan	3.4%	4.8%	3.0%	1.9%	0.7%		13.8%	18.1%		14.7%
Minnesota	30.5%	23.5%	28.0%	30.6%	37.6%		4.8%	1.6%		3.8%
Wisconsin	10.4%	10.9%	10.0%	6.4%	10.6%		12.6%	10.9%		8.4%
Illinois	5.2%	5.1%	6.0%	3.5%	2.7%		13.0%	14.3%		7.4%
Indiana	2.9%	3.9%	3.0%	1.8%	1.2%		9.6%	11.6%		2.2%
Iowa	7.6%	8.3%	8.0%	2.5%	7.4%		6.2%	3.8%		5.7%
Missouri	5.2%	3.4%	6.0%	2.1%	3.3%		6.5%	4.8%		3.2%
N. Dakota	5.7%	1.1%	6.0%	4.6%	5.9%		1.5%	0.1%		0.6%
Canada	1.9%	2.7%	3.0%	12.5%	15.1%		2.1%	1.2%		11.1%
CENRAP-WRAP	10.9%	13.5%		4.2%	10.1%		13.1%	10.0%		7.0%
	83.6%	**77.2%**	**73.0%**	**70.2%**	**94.6%**		**83.3%**	**76.4%**		**64.1%**
	Voyageurs						Isle Royale			
	LADCO - Round 4 PSAT	LADCO - Round 5 PSAT	MPCA-PSAT	CENRAP - PSAT	LADCO - Traj. Analysis		LADCO - Round 4 PSAT	LADCO - Round 5 PSAT	CENRAP - PSAT	LADCO - Traj. Analysis
Michigan	2.0%	4.9%	2.0%	1.0%	1.6%		12.7%	13.4%		
Minnesota	35.0%	20.2%	31.0%	31.5%	36.9%		14.1%	9.5%		
Wisconsin	6.3%	7.9%	6.0%	3.7%	9.7%		16.3%	14.7%		
Illinois	3.0%	7.1%	3.0%	1.8%	1.2%		7.0%	8.7%		
Indiana	1.6%	4.6%	2.0%	0.8%			5.6%	5.2%		
Iowa	7.4%	7.1%	7.0%	2.4%	10.2%		6.9%	8.3%		
Missouri	4.3%	4.0%	4.0%	1.6%	0.3%		3.9%	4.6%		
N. Dakota	10.3%	1.7%	13.0%	6.1%	7.1%		3.6%	0.3%		
Canada	2.7%	3.3%	5.0%	17.2%	13.3%		2.2%	1.7%		
CENRAP-WRAP	10.2%	13.7%		6.1%	16.5%		12.5%	12.6%		
	82.7%	**74.5%**	**73.0%**	**72.2%**	**96.8%**		**84.9%**	**79.0%**		

Section 6. Summary

To support the development of SIPs for ozone, $PM_{2.5}$, and regional haze in the States of Illinois, Indiana, Michigan, Ohio, and Wisconsin, technical analyses were conducted by LADCO, its member states, and various contractors. The analyses include preparation of regional emissions inventories and meteorological modeling data for two base years, evaluation and application of regional chemical transport models, and review of ambient monitoring data.

Analyses of monitoring data were conducted to produce a conceptual model, which is a qualitative summary of the physical, chemical, and meteorological processes that control the formation and distribution of pollutants in a given region. Key findings of the analyses include:

Ozone

- Current monitoring data show about 20 sites in violation of the 8-hour ozone standard of 85 ppb. Historical ozone data show a steady downward trend over the past 15 years, especially since 2001-2003, due likely to federal and state emission control programs.

- Ozone concentrations are strongly influenced by meteorological conditions, with more high ozone days and higher ozone levels during summers with above normal temperatures.

- Inter- and intra-regional transport of ozone and ozone precursors affects many portions of the five states, and is the principal cause of nonattainment in some areas far from population or industrial centers

$PM_{2.5}$

- Current monitoring data show 30 sites in violation of the annual $PM_{2.5}$ standard of 15 ug/m^3. Nonattainment sites are characterized by an elevated regional background (about 12 – 14 ug/m^3) and a significant local (urban) increment (about 2 – 3 ug/m^3). Historical $PM_{2.5}$ data show a slight downward trend since deployment of the $PM_{2.5}$ monitoring network in 1999.

- $PM_{2.5}$ concentrations are also influenced by meteorology, but the relationship is more complex and less well understood compared to ozone.

- On an annual average basis, $PM_{2.5}$ chemical composition consists of mostly sulfate, nitrate, and organic carbon in similar proportions.

Haze

- Current monitoring data show visibility levels in the Class I areas in northern Michigan are on the order of 22 – 24 deciviews. The goal of EPA's visibility program is to achieve natural conditions, which is on the order of 12 deciviews for these Class I areas, by the year 2064.

- Visibility impairment is dominated by sulfate and nitrate.

Air quality models were applied to support the regional planning efforts. Two base years were used in the modeling analyses: 2002 and 2005. EPA's modeling guidance recommends using

2002 as the baseline inventory year, but also allows for use of an alternative baseline inventory year, especially a more recent year. Initially, LADCO conducted modeling with a 2002 base year (i.e., Base K modeling, which was completed in 2006). A decision was subsequently made to conduct modeling with a 2005 base year (i.e., Base M, which was completed in 2007). Statistical analyses showed that 2002 and 2005 both had above normal ozone-conducive conditions, although 2002 was more severe compared to 2005. Examination of multiple base years provides for a more complete technical assessment. Both sets of model runs are discussed in this document.

Basecase modeling was conducted to evaluate model performance (i.e., assess the model's ability to reproduce the observed concentrations). This exercise was intended to assess whether, and to degree, confidence in the model is warranted (and to assess whether model improvements are necessary). Model performance for ozone and $PM_{2.5}$ was generally acceptable and can be characterized as follows:

Ozone

- Good agreement between modeled and monitored concentration for higher concentration levels (> 60 ppb) – i.e., bias within 30%

- Regional modeled concentrations appear to be underestimated in the 2002 base year, but show better agreement (with monitored data) in the 2005 base year due to model and inventory improvements.

- Day-to-day and hour-to-hour variation in and spatial patterns of modeled concentrations are consistent with monitored data

- Model accurately simulates the change in monitored ozone concentrations due to reductions in precursor emissions.

$PM_{2.5}$

- Good agreement in the magnitude of fine particle mass, but some species are overestimated and some are underestimated
    - Sulfates: good agreement in the 2002 base year, but underestimated in the summer in the 2005 base year due probably to meteorological factors
    - Nitrates: slightly overestimated in the winter in the 2002 base year, but good agreement in the 2005 base year as a result of model and inventory improvements
    - Organic Carbon: grossly underestimated in the 2002 and 2005 base years due likely to missing primary organic carbon emissions

- Temporal variation and spatial patterns of modeled concentrations are consistent with monitored data

Future year strategy modeling was conducted to determine whether existing ("on the books") controls would be sufficient to provide for attainment of the standards for ozone and $PM_{2.5}$ and if not, then what additional emission reductions would be necessary for attainment. Traditionally, attainment demonstrations involved a "bright line" test in which a single modeled value (based on EPA guidance) was compared to the ambient standard. To provide a more robust assessment of expected future year air quality, other information was considered. Furthermore, according to EPA's modeling guidance, if the future year modeled values are "close" to the standard (i.e., 82 – 87 ppb for ozone and 14.5 – 15.5 ug/m^3 for $PM_{2.5}$), then the results of the primary modeling should be reviewed along with the supplemental information in a "weight of evidence" (WOE) assessment of whether each area is likely to achieve timely attainment. Key findings of the WOE determination include:

- Existing controls are expected to produce significant improvement in ozone and $PM_{2.5}$ concentrations and visibility levels.

- The choice of the base year affects the future year model projections. A key difference between the base years of 2002 and 2005 is meteorology. 2002 was more ozone conducive than 2005. The choice of which base year to use as the basis for the SIP is a policy decision (i.e., how much safeguard to incorporate).

- Most sites are expected to meet the current 8-hour standard by the applicable attainment date, except for sites in western Michigan and, possibly, in eastern Wisconsin and northeastern Ohio.

- Most sites are expected to meet the current $PM_{2.5}$ standard by the applicable attainment date, except for sites in Detroit, Cleveland, and Granite City.

  The regional modeling for $PM_{2.5}$ does not reflect air quality benefits expected from local controls. States are conducting local-scale analyses and will use these results, in conjunction with the regional-scale modeling, to support their attainment demonstrations for $PM_{2.5}$.

- These findings of residual nonattainment for ozone and $PM_{2.5}$ are supported by current (2005 – 2007) monitoring data which show significant nonattainment in the region (e.g., peak ozone design values on the order of 90 – 93 ppb, and peak $PM_{2.5}$ design values on the order of 16 - 17 ug/m^3). It is unlikely that sufficient emission reductions will occur in the next few of years to provide for attainment at all sites.

- Attainment at most sites by the applicable attainment date is dependent on actual future year meteorology (e.g., if the weather conditions are consistent with [or less severe than] 2005, then attainment is likely) and actual future year emissions (e.g., if the emission reductions associated with the existing controls are achieved, then attainment is likely). If either of these conditions is not met, then attainment may be less likely.

- The new $PM_{2.5}$ 24-hour standard and the new lower ozone standard will not be met at several sites, even by 2018, with existing controls.

- Visibility levels in a few Class I areas in the eastern U.S. are expected to be greater than (less improved than) the uniform rate of visibility improvement values in 2018 based on existing controls, including those in northern Michigan and some in the northeastern U.S. Visibility levels in many other Class I areas in the eastern U.S. are expected to be less than (more improved than) the uniform rate of visibility improvement values in 2018.

Section 7. References

Alpine Geophysics, 2007, “Emissions Inventory Assistance: 2005 Base Year Biogenic and Other (non-LADCO) State Emissions, Preparation and Delivery of Non-MRPO Emission Files< March 12, 2007.

AER, 2004, “Analysis of Recent Regional Haze Data”, Atmospheric and Environmental Research, Inc., August 2004.

Baker, K., “Hot Spot Test (Draft), Lake Michigan Air Directors Consortium, March 23, 2005

Baker, K. 2007a, “Ozone Source Apportionment Results for Receptors in Non-Attainment Counties in the Great Lakes Region”, Lake Michigan Air Directors Consortium, October 2007.

Baker, K., 2007b, “Source Apportionment Results for $PM_{2.5}$ and Regional Haze at Receptors in the Great Lakes Region”, Lake Michigan Air Directors Consortium, November 2007.

Baker, K. and D. Kenski, 2007, “Diagnostic and Operational Evaluation of 2002 and 2005 8-Hour Ozone to Support Model Attainment Demonstrations”, Lake Michigan Air Directors Consortium, October 2007.

Blanchard, C.L., and S. Tanenbaum, 2003, “VOC and NO_x Limitation of Ozone Formation at Monitoring Sites in Illinois, Indiana, Michigan, Missouri, Ohio, and Wisconsin, 1998-2002”, Report to LADCO, February 2003..

Blanchard, C.L., and S. Tanenbaum, 2004, “The Effects of Changes in Sulfate, Ammonia, and Nitric Acid on Fine PM Composition at Monitoring Sites in Illinois, Indiana, Michigan, Missouri, Ohio, and Wisconsin, 2000-2002”, Report to LADCO, February 2004.

Blanchard, C.L., and S. Tanenbaum, 2005a, “Weekday/Weekend Differences in Ambient Concentrations of Primary and Secondary Air Pollutants in Atlanta, Baltimore, Chicago, Dallas-Fort Worth, Denver, Houston, New York, Phoenix, Washington, and Surrounding Areas”, Prepared for National Renewable Energy Laboratory, NREL Project ES04-1, July 30, 2005.

Blanchard, C.L., and S. Tanenbaum, 2005b, “Analysis of Data from the Midwest Ammonia Monitoring Project”, Draft Final Technical Memorandum, March 31, 2005.

Breiman, L., J. Friedman, R. Olshen, and C. Stone, 1984, “Classification and Regression Trees”, Chapman & Hall (1984).

Camalier, L., Cox, W., Dolwick, P., 2007. The effects of meteorology on ozone in urban areas and their use in assessing ozone trends. Atmospheric Environment 41, 7127-7137

Cox, W.M, and S.-H. Chu, 1993, Meteorologically Adjusted Ozone Trends in Urban Areas: A Probabililistic Approach, Atmospheric Environment 27B(4):425-434 (1993).

DeBell, L.J., K. Gebhart, J. Hand, W. Malm, M. Pitchford, B. Schichtel, and W. White, 2006, “Spatial and Seasonal Patterns and Temporal Variability of Haze and its Constituents in the United States, Report IV”, Cooperative Institute for Research in the Atmosphere, November 2006

DRI, 2005, “Source Apportionment Analysis of Air Quality Monitoring Data: Phase II”, Desert Research Institute. March 2005

EC/R, Incorporated, 2004, “Fire Emissions Inventory Development for the Midwest Regional Planning Organization”, Final Report, September 30, 2004.

EC/R, Incorporated, 2007, “Reasonable Progress for Class I Areas in the Northern Midwest – Factor Analysis”, Draft Final Technical Memorandum, July 18, 2007.

E.H. Pechan, 2004, “LADCO Nonroad Emissions Inventory Project – Development of Local Data for Construction and Agricultural Equipment”, Final Report, September 10, 2004

E.H. Pechan, 2005, “Development of Updated Growth and Control Factors for Lake Michigan Air Directors Consortium (LADCO)”, Draft Report, December 29, 2005.

E. H. Pechan, 2007, “Development of 2005 Base Year Growth and Control Factors for Lake Michigan Air Directors Consortium (LADCO)”, Final Report, September 2007.

Environ, 2004, “LADCO Nonroad Emissions Inventory Project for Locomotive, Commercial Marine, and Recreational Marine Emission Sources, Final Report, December 2004.

Environ, 2007a, “Modeling Weekend and Weekday Ozone in Southeast Michigan”, Draft Final Report, Prepared for National Renewable Energy Laboratory, July 30, 2007.

Environ, 2007b, “LADCO 2005 Locomotive Emissions”, Draft, February 2007.

Environ, 2007c, “LADCO 2005 Commercial Marine Emissions”, Draft, March 2, 2007.

Environ, 2008, “LADCO On-Road Emission Inventory Development Using CONCEPT MV”, January 2008..

Hollander, M. and D. Wolfe, 1973, “Nonparametric Statistical Methods”, John Wiley & Sons, New York (1973).

Hopke, P. K., 2005, Analyses of Midwest PM-Related Measurements, Report to LADCO, March 2005.

Kenski, D.M., 2004, Quantifying Transboundary Transport of $PM_{2.5}$: A GIS Analysis, Proc. AWMA 97th Annual Conf., Indianapolis, June 2004.

Kenski, D.M., 2007a, “CART Analysis for Ozone Trends and Meteorological Similarity”, May 10, 2007.

Kenski, D.M., 2007b, “Impact of Missing Data on Worst Days at Midwest Northern Class 1 Areas”, Donna Kenski, Midwest RPO, March 12, 2007 (revised 6/19/07).

Kenski, D.M., 2008a, “Updated Cox Trends Analysis”, February 2008.

Kenski, D.M. 2008b, “Updated CART Analysis for Ozone through 2007”, January 30, 2008.

LADCO, 2005, “Meteorological Modeling Performance Summary for Applications to $PM_{2.5}$/Haze/Ozone Modeling Projects”, February 18, 2005.

LADCO, 2006a, “Base K/Round 4 Strategy Modeling” Emissions”, May 16, 2006.

LADCO, 2006b, “Base K/Round 4 Modeling: Summary”, August 31, 2006.

LADCO, 2007a, “Modeling Protocol: 2002 Basecase Technical Details”, October 17, 2007

LADCO, 2007b, “Modeling Protocol: 2005 Basecase Technical Details”, October 19, 2007

LADCO, 2007c, “An Evaluation of an Annual 2005 MM5 Simulation to Support Photochemical and Emissions Modeling Applications”, January 10, 2007.

LADCO, 2007d, “Base M/Round 5 Modeling: Summary (DRAFT), October 10, 2007

LADCO, 2008a, “Base M Strategy Modeling: Emissions (Revised)”, February 27, 2008

LADCO, 2008b, “Critique: Modeled Attainment Probability (i.e., Bob Lopez’ analysis)”, January 10, 2008

Lopez, 2007, “Assessing the Site-Specific and Region-wide Probability of Attainment Level Ozone Air Quality under varying seasonal conditions using the results of 2002 (Round 4) and 2005 (Round 5) Regional Modeling”, Draft 2, Bob Lopez, WDNR, December 12, 2007

Mansell, G, Z. Wang, R. Zhang, J. Fadel, T. Ramsey, H. Xin, Y. Liang, and J. Arogo, 2005, “An Improved Process-Based Ammonia Emissions Model for Agricultural Sources – Emission Estimates”

MPCA, 2008, “Technical Support Document for the Minnesota State Implementation Plan for Regional Haze”, Draft, March 4, 2008.

MRPO, 2001, “Principles for Regional Planning”, March 9, 2001.

MRPO, 2007, “Draft List of Class I Areas Located Within (or Impacted by) Midwest RPO States”, June 26, 2007.

MRPO, 2008, “Regional Haze in the Upper Midwest: Summary of Technical Information”, Version 2.2, February 22, 2008.

Millstein, D.E., R.A. Harley, and S.V. Hering, 2007, “Weekly cycles in fine particulate matter”, Atmospheric Environment (2007), doi:10.1016/j.atmosenv.2007.10.010.

Poirot, R. L.; Wishinski, P. R.; Hopke, P. K.; Polissar, A. V.; Comparative Application of Multiple Receptor Methods To Identify Aerosol Sources in Northern Vermont, Environ. Sci. Technol., *36*(4); 820-820 (2002).

Sheesley, R.J., J.J. Schauer, E. Bean, and D. Kenski, Trends in Secondary Organic Aerosol at a Remote Site in Michigan’s Upper Peninsula, Env. Sci. and Tech. *38*(24); 6491-6500 (Oct 2004).

STI, 2004, “Data Processing and Analysis of Aloft Air Quality Data Collected in the Upper Midwest”, Executive Summary, STI-903470-2568-ES3, Sonoma Technology, Inc, August 5, 2004.

STI, 2006a, “Integration of Results for the Upper Midwest Urban Organics Study”, Final Report, STI-903520-2942-FR, Sonoma Technology, Inc. March 31, 2006.

STI, 2008, “Data Analysis and Source Apportionment of $PM_{2.5}$ in Selected Midwestern Cities”, Final Report, STI-907018.03-3264-DRF, Sonoma Technology, Inc., February 2008.

EPA, 1999, Regional Haze Regulations, 64 FR 35714, July 1, 1999.

EPA, 2003, “Guidance for Estimating Natural Visibility Conditions Under the Regional Haze Rule”, EPA-454/B-03-005, September 2003.

EPA, 2002, “Recommended Approach for Performing Mid-Course Review of SIPs to Meet the 1-Hour NAAQS for Ozone”, January 2002.

EPA, 2005, Final Rule to Implement the 8-Hour Ozone National Ambient Air Quality Standard, 70 FR 71612, November 29, 2005

EPA, 2006, “Regulatory Impact Analysis of the Revisions to the National Ambient Air Quality Standards”, September 2006 (http://www.epa.gov/ttn/ecas/ria.html#ria2007)

EPA, 2007a, "Guidance for on the Use of Models and Other Analyses for Demonstrating Attainment of Air Quality Goals for Ozone, $PM_{2.5}$, and Regional Haze”, EPA-454/B07-002, April 2007.

EPA, 2007b, “Regulatory Impact Analysis of the Proposed Revisions to the National Ambient Air Quality Standards”, EPA-452/R-07-008, July 2007 (http://www.epa.gov/ttn/ecas/ria.html#ria2007)

EPA, 2007c, Clean Air Fine Particle Implementation Rule, 72 FR 20586, April 25, 2007

Zhang, R, T. Ramsey, J. Fadel, J. Arogo, Z. Wang, G. Mansell, and H. Xin, 2005, “An Improved Process-Based Ammonia Emissions Model for Agricultural Sources – Model Development”

Web Sites:
http://www.ladco.org/tech/emis/basem/canada/index.htm

http://www.ladco.org/tech/emis/basek/BaseK_Reports.htm

http://www.ladco.org/tech/emis/r5/round5_reports.htm

http://vista.cira.colostate.edu/views/

APPENDIX I

Ozone and $PM_{2.5}$ Modeling Results

Key Sites		4th High 8-hour Value					Des. Values (truncated)			2005 BY	2002 BY	2008 - OTB		
		'03	'04	'05	'06	'07	'03-'05	'04-'06	'05-'07	Average	Average	RRF	Round 5	
Lake Michigan Area														***Lake Michigan Area***
Chiwaukee	550590019	88	78	93	79	85	86	83	85	84.7	98.3	0.968	82.0	Chiwaukee
Racine	551010017	82	69	95	71	77	82	78	81	80.3	91.7	0.966	77.6	Racine
Milwaukee-Bayside	550190085	92	73	93	73	83	86	79	83	82.7	91.0	0.963	79.6	Milwaukee-Bayside
Harrington Beach	550890009	99	72	94	72	84	88	79	83	83.3	93.0	0.960	80.0	Harrington Beach
Manitowoc	550710007	92	74	95	78	85	87	82	86	85.0	87.0	0.957	81.3	Manitowoc
Sheboygan	551170006	93	78	97	83	88	89	86	89	88.0	97.0	0.959	84.4	Sheboygan
Kewaunee	550610002	97	73	88	76	85	86	79	83	82.7	89.3	0.954	78.9	Kewaunee
Door County	550290004	93	78	101	79	92	90	86	90	88.7	91.0	0.956	84.8	Door County
Hammond	180892008	81	67	87	75	77	78	76	79	77.7	88.3	0.971	75.4	Hammond
Whiting	180890030		64	88	81	88	76	77	85	79.3		0.971	77.0	Whiting
Michigan City	180910005	82	70	84	75	73	78	76	77	77.0	90.3	0.964	74.2	Michigan City
Ogden Dunes	181270020	77	69	90	70	84	78	76	81	78.3	86.3	0.967	75.7	Ogden Dunes
Holland	260050003	96	79	94	91	94	89	88	93	90.0	94.0	0.951	85.6	Holland
Jenison	261390005	91	69	86	83	88	82	79	85	82.0	86.0	0.950	77.9	Jenison
Muskegon	261210039	94	70	90	90	86	84	83	88	85.0	90.0	0.951	80.8	Muskegon
Indianapolis Area														***Indianapolis Area***
Noblesville	189571001	101	75	87	77	84	87	79	82	82.7	93.7	0.944	78.0	Noblesville
Fortville	180590003	92	72	80	75	81	81	75	78	78.0	91.3	0.948	73.9	Fortville
Fort B. Harrison	180970050	91	73	80	76	83	81	76	79	78.7	90.0	0.951	74.8	Fort B. Harrison
Detroit Area														***Detroit Area***
New Haven	260990009	102	81	88	78	93	90	82	86	86.0	92.3	0.962	82.7	New Haven
Warren	260991003	101	71	89	78	91	87	79	86	84.0	90.0	0.982	82.5	Warren
Port Huron	261470005	87	74	88	78	89	83	80	85	82.7	88.0	0.956	79.0	Port Huron
Cleveland Area														***Cleveland Area***
Ashtabula	390071001	99	81	93	86	92	91	86	90	89.0	95.7	0.954	84.9	Ashtabula
Geauga	390550004	97	75	88	70	68	86	77	75	79.3	99.0	0.954	75.7	Geauga
Eastlake	390850003	92	79	97	83	74	89	86	84	86.3	92.7	0.959	82.8	Eastlake
Akron	391530020	89	77	89	77	91	85	81	85	83.7	93.3	0.948	79.3	
Cincinnati Area														***Cincinnati Area***
Wilmington	390271002	96	78	83	81	82	85	80	82	82.3	94.3	0.945	77.8	Wilmington
Sycamore	390610006	93	76	89	81	90	86	82	86	84.7	90.3	0.965	81.7	Sycamore
Lebanon	391650007	95	81	92	86	88	89	86	88	87.7	87.0	0.954	83.6	Lebanon
Columbus Area														***Columbus Area***
London	390970007	90	75	81	76	83	82	77	80	79.7	88.7	0.946	75.4	London
New Albany	390490029	94	78	92	82	87	88	84	87	86.3	93.0	0.954	82.4	New Albany
Franklin	290490028	84	73	86	79	79	81	79	81	80.3	86.0	0.958	77.0	Franklin
St. Louis Area														***St. Louis Area***
W. Alton (MO)	291831002	91	77	89	91	89	85	85	89	86.3	90.0	0.954	82.4	W. Alton (MO)
Orchard (MO)	291831004	90	76	92	92	83	86	86	89	87.0	90.0	0.958	83.3	Orchard (MO)
Sunset Hills (MO)	291890004	88	70	89	80	89	82	79	86	82.3	88.3	0.966	79.5	Sunset Hills (MO)
Arnold (MO)	290990012	82	70	92	79	87	81	80	86	82.3	84.7	0.956	78.7	Arnold (MO)
Margaretta (MO)	295100086	90	72	91	76	91	84	79	86	83.0	87.7	0.962	79.8	Margaretta (MO)
Maryland Heights (MO)	291890014			88	84	94	88	86	88	87.3		0.967	84.5	Maryland Heights (MO)

Key Sites		4th High 8-hour Value					Des. Values (truncated)			2005 BY	2002 BY	2009 - OTB			2009 - Will Do		
		'03	'04	'05	'06	'07	'03-'05	'04-'06	'05-'07	Average	Average	RRF	Round 5	Round 4	RRF	Round 5	
Lake Michigan Area																	***Lake Michigan Area***
Chiwaukee	550590019	88	78	93	79	85	86	83	85	84.7	98.3	0.972	82.3	92.0	0.971	82.2	Chiwaukee
Racine	551010017	82	69	95	71	77	82	78	81	80.3	91.7	0.965	77.5	84.9	0.964	77.4	Racine
Milwaukee-Bayside	550190085	92	73	93	73	83	86	79	83	82.7	91.0	0.965	79.8	84.9	0.964	79.7	Milwaukee-Bayside
Harrington Beach	550890009	99	72	94	72	84	88	79	83	83.3	93.0	0.961	80.1	85.4	0.960	80.0	Harrington Beach
Manitowoc	550710007	92	74	95	78	85	87	82	86	85.0	87.0	0.951	80.8	78.9	0.949	80.7	Manitowoc
Sheboygan	551170006	93	78	97	83	88	89	86	89	88.0	97.0	0.955	84.0	88.9	0.953	83.9	Sheboygan
Kewaunee	550610002	97	73	88	76	85	86	79	83	82.7	89.3	0.945	78.1	81.0	0.943	78.0	Kewaunee
Door County	550290004	93	78	101	79	92	90	86	90	88.7	91.0	0.946	83.9	81.8	0.945	83.8	Door County
Hammond	180892008	81	67	87	75	77	78	76	79	77.7	88.3	0.971	75.4	86.6	0.970	75.3	Hammond
Whiting	180890030		64	88	81	88	76	77	85	79.3		0.971	77.0		0.970	77.0	Whiting
Michigan City	180910005	82	70	84	75	73	78	76	77	77.0	90.3	0.960	73.9	86.5	0.959	73.8	Michigan City
Ogden Dunes	181270020	77	69	90	70	84	78	76	81	78.3	86.3	0.965	75.6	82.8	0.964	75.5	Ogden Dunes
Holland	260050003	96	79	94	91	94	89	88	93	90.0	94.0	0.948	85.3	83.4	0.947	85.2	Holland
Jenison	261390005	91	69	86	83	88	82	79	85	82.0	86.0	0.940	77.1	77.6	0.939	77.0	Jenison
Muskegon	261210039	94	70	90	90	86	84	83	88	85.0	90.0	0.947	80.5	81.5	0.945	80.3	Muskegon
Indianapolis Area																	***Indianapolis Area***
Noblesville	189571001	101	75	87	77	84	87	79	82	82.7	93.7	0.945	78.1	83.7	0.946	78.2	Noblesville
Fortville	180590003	92	72	80	75	81	81	75	78	78.0	91.3	0.947	73.9	83.8	0.948	73.9	Fortville
Fort B. Harrison	180970050	91	73	80	76	83	81	76	79	78.7	90.0	0.955	75.1	83.7	0.956	75.2	Fort B. Harrison
Detroit Area																	***Detroit Area***
New Haven	260990009	102	81	88	78	93	90	82	86	86.0	92.3	0.947	81.4	85.3	0.947	81.4	New Haven
Warren	260991003	101	71	89	78	91	87	79	86	84.0	90.0	0.968	81.3	83.3	0.969	81.4	Warren
Port Huron	261470005	87	74	88	78	89	83	80	85	82.7	88.0	0.937	77.5	79.1	0.938	77.5	Port Huron
Cleveland Area																	***Cleveland Area***
Ashtabula	390071001	99	81	93	86	92	91	86	90	89.0	95.7	0.937	83.4	82.7	0.941	83.7	Ashtabula
Geauga	390550004	97	75	88	70	68	86	77	75	79.3	99.0	0.942	74.7	88.8	0.945	75.0	Geauga
Eastlake	390850003	92	79	97	83	74	89	86	84	86.3	92.7	0.949	81.9	82.8	0.954	82.4	Eastlake
Akron	391530020	89	77	89	77	91	85	81	85	83.7	93.3	0.934	78.1	81.4	0.935	78.2	
Cincinnati Area																	***Cincinnati Area***
Wilmington	390271002	96	78	83	81	82	85	80	82	82.3	94.3	0.941	77.5	83.5	0.942	77.6	Wilmington
Sycamore	390610006	93	76	89	81	90	86	82	86	84.7	90.3	0.967	81.9	84.7	0.968	82.0	Sycamore
Lebanon	391650007	95	81	92	86	88	89	86	88	87.7	87.0	0.947	83.0	79.0	0.948	83.1	Lebanon
Columbus Area																	***Columbus Area***
London	390970007	90	75	81	76	83	82	77	80	79.7	88.7	0.941	75.0	78.4	0.942	75.0	London
New Albany	390490029	94	78	92	82	87	88	84	87	86.3	93.0	0.947	81.8	82.6	0.948	81.8	New Albany
Franklin	290490028	84	73	86	79	79	81	79	81	80.3	86.0	0.945	75.9	76.5	0.948	76.2	Franklin
St. Louis Area																	***St. Louis Area***
W. Alton (MO)	291831002	91	77	89	91	89	85	85	89	86.3	90.0	0.938	81.0	85.2	0.932	80.5	W. Alton (MO)
Orchard (MO)	291831004	90	76	92	92	83	86	86	89	87.0	90.0	0.942	82.0	82.2	0.939	81.7	Orchard (MO)
Sunset Hills (MO)	291890004	88	70	89	80	89	82	79	86	82.3	88.3	0.956	78.7	81.9	0.954	78.5	Sunset Hills (MO)
Arnold (MO)	290990012	82	70	92	79	87	81	80	86	82.3	84.7	0.938	77.2	77.4	0.937	77.1	Arnold (MO)
Margaretta (MO)	295100086	90	72	91	76	91	84	79	86	83.0	87.7	0.955	79.3	83.4	0.955	79.3	Margaretta (MO)
Maryland Heights (MO)	291890014			88	84	94	88	86	88	87.3		0.955	83.4		0.954	83.3	Maryland Heights (MO)

Key Sites		4th High 8-hour Value					Des. Values (truncated)			2005 BY	2002 BY	2012 - OTB			2018 - OTB		
		'03	'04	'05	'06	'07	'03-'05	'04-'06	'05-'07	Average	Average	RRF	Round 5	Round 4	RRF	Round 5	
Lake Michigan Area																	***Lake Michigan Area***
Chiwaukee	550590019	88	78	93	79	85	86	83	85	84.7	98.3	0.956	80.9	90.3	0.900	76.2	Chiwaukee
Racine	551010017	82	69	95	71	77	82	78	81	80.3	91.7	0.947	76.1	82.9	0.886	71.2	Racine
Milwaukee-Bayside	550190085	92	73	93	73	83	86	79	83	82.7	91.0	0.944	78.0	82.3	0.880	72.7	Milwaukee-Bayside
Harrington Beach	550890009	99	72	94	72	84	88	79	83	83.3	93.0	0.939	78.3	82.9	0.870	72.5	Harrington Beach
Manitowoc	550710007	92	74	95	78	85	87	82	86	85.0	87.0	0.925	78.6	76.3	0.853	72.5	Manitowoc
Sheboygan	551170006	93	78	97	83	88	89	86	89	88.0	97.0	0.930	81.8	86.4	0.857	75.4	Sheboygan
Kewaunee	550610002	97	73	88	76	85	86	79	83	82.7	89.3	0.918	75.9	79.1	0.845	69.9	Kewaunee
Door County	550290004	93	78	101	79	92	90	86	90	88.7	91.0	0.919	81.5	79.3	0.843	74.7	Door County
Hammond	180892008	81	67	87	75	77	78	76	79	77.7	88.3	0.960	74.6	86.3	0.922	71.6	Hammond
Whiting	180890030		64	88	81	88	76	77	85	79.3		0.960	76.2		0.922	73.1	Whiting
Michigan City	180910005	82	70	84	75	73	78	76	77	77.0	90.3	0.942	72.5	85.4	0.884	68.1	Michigan City
Ogden Dunes	181270020	77	69	90	70	84	78	76	81	78.3	86.3	0.951	74.5	82.0	0.904	70.8	Ogden Dunes
Holland	260050003	96	79	94	91	94	89	88	93	90.0	94.0	0.920	82.8	81.0	0.846	76.1	Holland
Jenison	261390005	91	69	86	83	88	82	79	85	82.0	86.0	0.909	74.5	75.5	0.838	68.7	Jenison
Muskegon	261210039	94	70	90	90	86	84	83	88	85.0	90.0	0.918	78.0	79.4	0.846	71.9	Muskegon
Indianapolis Area																	***Indianapolis Area***
Noblesville	189571001	101	75	87	77	84	87	79	82	82.7	93.7	0.914	75.6	82.0	0.831	68.7	Noblesville
Fortville	180590003	92	72	80	75	81	81	75	78	78.0	91.3	0.916	71.4	82.1	0.835	65.1	Fortville
Fort B. Harrison	180970050	91	73	80	76	83	81	76	79	78.7	90.0	0.931	73.2	82.4	0.879	69.1	Fort B. Harrison
Detroit Area																	***Detroit Area***
New Haven	260990009	102	81	88	78	93	90	82	86	86.0	92.3	0.932	80.2	83.5	0.885	76.1	New Haven
Warren	260991003	101	71	89	78	91	87	79	86	84.0	90.0	0.961	80.7	81.9	0.924	77.6	Warren
Port Huron	261470005	87	74	88	78	89	83	80	85	82.7	88.0	0.913	75.5	77.0	0.858	70.9	Port Huron
Cleveland Area																	***Cleveland Area***
Ashtabula	390071001	99	81	93	86	92	91	86	90	89.0	95.7	0.910	81.0	80.2	0.844	75.1	Ashtabula
Geauga	390550004	97	75	88	70	68	86	77	75	79.3	99.0	0.916	72.7	86.2	0.848	67.3	Geauga
Eastlake	390850003	92	79	97	83	74	89	86	84	86.3	92.7	0.932	80.5	80.6	0.883	76.2	Eastlake
Akron	391530020	89	77	89	77	91	85	81	85	83.7	93.3	0.903	75.6	78.5	0.821	68.7	Akron
Cincinnati Area																	***Cincinnati Area***
Wilmington	390271002	96	78	83	81	82	85	80	82	82.3	94.3	0.910	74.9	81.1	0.830	68.3	Wilmington
Sycamore	390610006	93	76	89	81	90	86	82	86	84.7	90.3	0.948	80.3	82.9	0.881	74.6	Sycamore
Lebanon	391650007	95	81	92	86	88	89	86	88	87.7	87.0	0.921	80.7	77.0	0.846	74.2	Lebanon
Columbus Area																	***Columbus Area***
London	390970007	90	75	81	76	83	82	77	80	79.7	88.7	0.911	72.6	76.5	0.832	66.3	London
New Albany	390490029	94	78	92	82	87	88	84	87	86.3	93.0	0.922	79.6	80.2	0.845	73.0	New Albany
Franklin	290490028	84	73	86	79	79	81	79	81	80.3	86.0	0.923	74.1	74.7	0.859	69.0	Franklin
St. Louis Area																	***St. Louis Area***
W. Alton (MO)	291831002	91	77	89	91	89	85	85	89	86.3	90.0	0.911	78.6	84.0	0.868	74.9	W. Alton (MO)
Orchard (MO)	291831004	90	76	92	92	83	86	86	89	87.0	90.0	0.919	80.0	80.4	0.876	76.2	Orchard (MO)
Sunset Hills (MO)	291890004	88	70	89	80	89	82	79	86	82.3	88.3	0.937	77.1	80.6	0.897	73.9	Sunset Hills (MO)
Arnold (MO)	290990012	82	70	92	79	87	81	80	86	82.3	84.7	0.918	75.6	75.8	0.874	72.0	Arnold (MO)
Margaretta (MO)	295100086	90	72	91	76	91	84	79	86	83.0	87.7	0.939	77.9	82.5	0.896	74.4	Margaretta (MO)
Maryland Heights (MO)	291890014			88	84	94	88	86	88	87.3		0.936	81.7		0.894	78.1	Maryland Heights (MO)

			Annual Average Conc.					Design Values			2005 BY	2002 BY	2009 Modeling Results		
Key Site	**County**	**Site ID**	**'03**	**'04**	**'05**	**'06**	**'07**	**'03 - '05**	**'04 - '06**	**'05 - '07**	**Average w/ 2007**	**Average**	**Round 5**	**Round4**	**Key Site**
Chicago - Washington HS	Cook	170310022	15.6	14.2	16.9	13.2	15.7	15.6	14.8	15.3	**15.2**	**15.9**	**14.1**	**14.8**	Chicago - Washington HS
Chicago - Mayfair	Cook	170310052	15.9	15.3	17.0	14.5	15.5	16.1	15.6	15.7	**15.8**	**17.1**	**14.4**	**15.8**	Chicago - Mayfair
Chicago - Springfield	Cook	170310057	15.6	13.8	16.7	13.5	15.1	15.4	14.7	15.1	15.0	**15.6**	13.9	**14.5**	Chicago - Springfield
Chicago - Lawndale	Cook	170310076	14.8	14.2	16.6	13.5	14.3	15.2	14.8	14.8	14.9	**15.6**	13.8	**14.5**	Chicago - Lawndale
Blue Island	Cook	170312001	14.9	14.1	16.4	13.2	14.3	15.1	14.6	14.6	14.8	**15.6**	13.7	**14.5**	Blue Island
Summit	Cook	170313301	15.6	14.2	16.9	13.8	14.8	15.6	15.0	15.2	**15.2**	**16.0**	**14.2**	**14.8**	Summit
Cicero	Cook	170316005	16.8	15.2	16.3	14.3	14.8	16.1	15.3	15.1	**15.5**	**16.4**	**14.4**	**15.3**	Cicero
Granite City	Madison	171191007	17.5	15.4	18.2	16.3	15.1	17.0	16.6	16.5	**16.7**	**17.3**	**15.1**	**16.0**	Granite City
E. St. Louis	St. Clair	171630010	14.9	14.7	17.1	14.5	15.6	15.6	15.4	15.7	**15.6**	**16.2**	**14.1**	**14.9**	E. St. Louis
Jeffersonville	Clark	180190005	15.8	15.1	18.5	15.0	16.5	16.5	16.2	16.7	**16.4**	**17.2**	13.8	**15.5**	Jeffersonville
Jasper	Dubois	180372001	15.7	14.4	16.9	13.5	14.4	15.7	14.9	14.9	**15.2**	**15.5**	12.4	13.8	Jasper
Gary	Lake	180890031			16.8	13.3	14.5	16.8	15.1	14.9	**15.6**		13.0		Gary
Indy-Washington Park	Marion	180970078	15.5	14.3	16.4	14.1	15.8	15.4	14.9	15.4	**15.3**	**16.2**	12.8	**14.5**	Indy-Washington Park
Indy-W 18th Street	Marion	180970081	16.2	15.0	17.9	14.2	16.1	16.4	15.7	16.1	**16.0**		13.4		Indy-W 18th Street
Indy- Michigan Street	Marion	180970083	16.3	15.0	17.5	14.1	15.9	16.3	15.5	15.8	**15.9**	**16.6**	13.4	**14.8**	Indy- Michigan Street
Allen Park	Wayne	261630001	15.2	14.2	15.9	13.2	12.8	15.1	14.4	14.0	14.5	**15.8**	13.0	**14.5**	Allen Park
Southwest HS	Wayne	261630015	16.6	15.4	17.2	14.7	14.5	16.4	15.8	15.5	**15.9**	**17.3**	**14.2**	**15.8**	Southwest HS
Linwood	Wayne	261630016	15.8	13.7	16.0	13.0	13.9	15.2	14.2	14.3	14.6	**15.5**	13.1	**14.1**	Linwood
Dearborn	Wayne	261630033	19.2	16.8	18.6	16.1	16.9	18.2	17.2	17.2	**17.5**	**19.3**	**15.8**	**17.7**	Dearborn
Wyandotte	Wayne	261630036	16.3	13.7	16.4	12.9	13.4	15.5	14.3	14.2	14.7	**16.6**	13.1	**15.1**	Wyandotte
Middleton	Butler	390170003	17.2	14.1	19.0	14.1	15.4	16.8	15.7	16.2	**16.2**	**16.5**	13.5	**14.2**	Middleton
Fairfield	Butler	390170016	15.8	14.7	17.9	14.0	14.9	16.1	15.5	15.6	**15.8**	**15.9**	13.1	13.5	Fairfield
Cleveland-28th Street	Cuyahoga	390350027	15.4	15.6	17.3	13.0	14.5	16.1	15.3	14.9	**15.4**	**16.5**	13.5	**14.4**	Cleveland-28th Street
Cleveland-St. Tikhon	Cuyahoga	390350038	17.6	17.5	19.2	14.9	16.2	18.1	17.2	16.8	**17.4**	**18.4**	**15.2**	**16.1**	Cleveland-St. Tikhon
Cleveland-Broadway	Cuyahoga	390350045	16.4	15.3	19.3	14.1	15.3	17.0	16.2	16.2	**16.5**	**16.7**	**14.4**	**14.6**	Cleveland-Broadway
Cleveland-E14 & Orange	Cuyahoga	390350060	17.2	16.4	19.4	15.0	15.9	17.7	16.9	16.8	**17.1**	**17.6**	**15.0**	**15.3**	Cleveland-E14 & Orange
Newburg Hts - Harvard Ave	Cuyahoga	390350065	15.6	15.2	18.6	13.1	15.8	16.5	15.6	15.8	**16.0**	**16.2**	**14.0**	**14.1**	Newburg Hts - Harvard Ave
Columbus - Fairgrounds	Franklin	390490024	16.4	15.0	16.4	13.6	14.6	15.9	15.0	14.9	**15.3**	**16.5**	12.9	**14.6**	Columbus - Fairgrounds
Columbus - Ann Street	Franklin	390490025	15.3	14.6	16.5	13.8	14.7	15.5	15.0	15.0	**15.1**	**16.0**	12.7	**14.1**	Columbus - Ann Street
Columbus - Maple Canyon	Franklin	390490081	14.9	13.6	14.6	12.9	13.1	14.4	13.7	13.5	13.9	**16.0**	11.7	**14.0**	Columbus - Maple Canyon
Cincinnati - Seymour	Hamilton	390610014	17.0	15.9	19.8	15.5	16.5	17.6	17.1	17.3	**17.3**	**17.7**	**14.5**	**15.5**	Cincinnati - Seymour
Cincinnati - Taft Ave	Hamilton	390610040	15.5	14.6	17.5	13.6	15.1	15.9	15.2	15.4	**15.5**	**15.7**	12.8	13.6	Cincinnati - Taft Ave
Cincinnati - 8th Ave	Hamilton	390610042	16.7	16.0	19.1	14.9	15.9	17.3	16.7	16.6	**16.9**	**17.3**	**14.0**	**14.6**	Cincinnati - 8th Ave
Sharonville	Hamilton	390610043	15.7	14.9	16.9	14.5	14.8	15.8	15.4	15.4	**15.6**	**16.0**	12.9	13.6	Sharonville
Norwood	Hamilton	390617001	16.0	15.3	18.4	14.4	15.1	16.6	16.0	16.0	**16.2**	**16.3**	13.4	**14.2**	Norwood
St. Bernard	Hamilton	390618001	17.3	16.4	20.0	15.9	16.1	17.9	17.4	17.3	**17.6**	**17.3**	**14.7**	**15.2**	St. Bernard
Steubenville	Jefferson	390810016	17.7	15.9	16.4	13.8	16.2	16.7	15.4	15.5	**15.8**	**17.7**	12.8	**16.3**	Steubenville
Mingo Junction	Jefferson	390811001	17.3	16.2	18.1	14.6	15.6	17.2	16.3	16.1	**16.5**	**17.5**	13.5	**15.5**	Mingo Junction
Ironton	Lawrence	390870010	14.3	13.7	17.0	14.4	15.0	15.0	15.0	15.5	**15.2**	**15.7**	12.8	**14.2**	Ironton
Dayton	Montgomery	391130032	15.9	14.5	17.4	13.6	15.6	15.9	15.2	15.5	**15.5**	**15.9**	13.2	13.7	Dayton
New Boston	Scioto	391450013	14.7	13.0	16.2	14.3	14.0	14.6	14.5	14.8	14.7	**17.1**	12.1	**15.4**	New Boston
Canton - Dueber	Stark	391510017	16.8	15.6	17.8	14.6	15.9	16.7	16.0	16.1	**16.3**	**17.3**	**14.0**	**15.0**	Canton - Dueber
Canton - Market	Stark	391510020	15.0	14.1	16.6	11.9	14.4	15.2	14.2	14.3	14.6	**15.7**	12.6	13.6	Canton - Market
Akron - Brittain	Summit	391530017	15.4	15.0	16.4	13.5	14.4	15.6	15.0	14.8	**15.1**	**16.4**	13.0	**14.4**	Akron - Brittain
Akron - W. Exchange	Summit	391530023	14.2	13.9	15.7	12.8	13.7	14.6	14.1	14.1	14.3	**15.6**	12.3	13.6	Akron - W. Exchange

			Annual Average Conc.					Design Values			2005 BY	2002 BY	2012 Modeling Results		
Key Site	County	Site ID	'03	'04	'05	'06	'07	'03 - '05	'04 - '06	'05 - '07	Average w/ 2007	Average	Round 5	Round4	Key Site
Chicago - Washington HS	Cook	170310022	15.6	14.2	16.9	13.2	15.7	15.6	14.8	15.3	15.2	15.9	14.0	14.6	Chicago - Washington HS
Chicago - Mayfair	Cook	170310052	15.9	15.3	17.0	14.5	15.5	16.1	15.6	15.7	15.8	17.1	14.2	15.5	Chicago - Mayfair
Chicago - Springfield	Cook	170310057	15.6	13.8	16.7	13.5	15.1	15.4	14.7	15.1	15.0	15.6	13.8	14.3	Chicago - Springfield
Chicago - Lawndale	Cook	170310076	14.8	14.2	16.6	13.5	14.3	15.2	14.8	14.8	14.9	15.6	13.7	14.3	Chicago - Lawndale
Blue Island	Cook	170312001	14.9	14.1	16.4	13.2	14.3	15.1	14.6	14.6	14.8	15.6	13.6	14.3	Blue Island
Summit	Cook	170313301	15.6	14.2	16.9	13.8	14.8	15.6	15.0	15.2	15.2	16.0	14.0	14.6	Summit
Cicero	Cook	170316005	16.8	15.2	16.3	14.3	14.8	16.1	15.3	15.1	15.5	16.4	14.3	15.1	Cicero
Granite City	Madison	171191007	17.5	15.4	18.2	16.3	15.1	17.0	16.6	16.5	16.7	17.3	14.9	15.8	Granite City
E. St. Louis	St. Clair	171630010	14.9	14.7	17.1	14.5	15.6	15.6	15.4	15.7	15.6	16.2	13.9	14.7	E. St. Louis
Jeffersonville	Clark	180190005	15.8	15.1	18.5	15.0	16.5	16.5	16.2	16.7	16.4	17.2	13.7	15.0	Jeffersonville
Jasper	Dubois	180372001	15.7	14.4	16.9	13.5	14.4	15.7	14.9	14.9	15.2	15.5	12.2	13.5	Jasper
Gary	Lake	180890031			16.8	13.3	14.5	16.8	15.1	14.9	15.6		12.8		Gary
Indy-Washington Park	Marion	180970078	15.5	14.3	16.4	14.1	15.8	15.4	14.9	15.4	15.3	16.2	12.6	14.2	Indy-Washington Park
Indy-W 18th Street	Marion	180970081	16.2	15.0	17.9	14.2	16.1	16.4	15.7	16.1	16.0		13.2		Indy-W 18th Street
Indy- Michigan Street	Marion	180970083	16.3	15.0	17.5	14.1	15.9	16.3	15.5	15.8	15.9	16.6	13.1	14.9	Indy- Michigan Street
Allen Park	Wayne	261630001	15.2	14.2	15.9	13.2	12.8	15.1	14.4	14.0	14.5	15.8	12.8	14.1	Allen Park
Southwest HS	Wayne	261630015	16.6	15.4	17.2	14.7	14.5	16.4	15.8	15.5	15.9	17.3	13.9	15.3	Southwest HS
Linwood	Wayne	261630016	15.8	13.7	16.0	13.0	13.9	15.2	14.2	14.3	14.6	15.5	12.8	13.7	Linwood
Dearborn	Wayne	261630033	19.2	16.8	18.6	16.1	16.9	18.2	17.2	17.2	17.5	19.3	15.5	17.1	Dearborn
Wyandotte	Wayne	261630036	16.3	13.7	16.4	12.9	13.4	15.5	14.3	14.2	14.7	16.6	12.8	14.7	Wyandotte
Middleton	Butler	390170003	17.2	14.1	19.0	14.1	15.4	16.8	15.7	16.2	16.2	16.5	13.2	13.7	Middleton
Fairfield	Butler	390170016	15.8	14.7	17.9	14.0	14.9	16.1	15.5	15.6	15.8	15.9	12.9	12.9	Fairfield
Cleveland-28th Street	Cuyahoga	390350027	15.4	15.6	17.3	13.0	14.5	16.1	15.3	14.9	15.4	16.5	13.2	13.8	Cleveland-28th Street
Cleveland-St. Tikhon	Cuyahoga	390350038	17.6	17.5	19.2	14.9	16.2	18.1	17.2	16.8	17.4	18.4	14.8	15.4	Cleveland-St. Tikhon
Cleveland-Broadway	Cuyahoga	390350045	16.4	15.3	19.3	14.1	15.3	17.0	16.2	16.2	16.5	16.7	14.0	14.0	Cleveland-Broadway
Cleveland-E14 & Orange	Cuyahoga	390350060	17.2	16.4	19.4	15.0	15.9	17.7	16.9	16.8	17.1	17.6	14.6	14.7	Cleveland-E14 & Orange
Newburg Hts - Harvard Ave	Cuyahoga	390350065	15.6	15.2	18.6	13.1	15.8	16.5	15.6	15.8	16.0	16.2	13.6	13.5	Newburg Hts - Harvard Ave
Columbus - Fairgrounds	Franklin	390490024	16.4	15.0	16.4	13.6	14.6	15.9	15.0	14.9	15.3	16.5	12.6	14.0	Columbus - Fairgrounds
Columbus - Ann Street	Franklin	390490025	15.3	14.6	16.5	13.8	14.7	15.5	15.0	15.0	15.1	16.0	12.4	13.5	Columbus - Ann Street
Columbus - Maple Canyon	Franklin	390490081	14.9	13.6	14.6	12.9	13.1	14.4	13.7	13.5	13.9	16.0	11.4	13.4	Columbus - Maple Canyon
Cincinnati - Seymour	Hamilton	390610014	17.0	15.9	19.8	15.5	16.5	17.6	17.1	17.3	17.3	17.7	14.3	14.8	Cincinnati - Seymour
Cincinnati - Taft Ave	Hamilton	390610040	15.5	14.6	17.5	13.6	15.1	15.9	15.2	15.4	15.5	15.7	12.6	13.0	Cincinnati - Taft Ave
Cincinnati - 8th Ave	Hamilton	390610042	16.7	16.0	19.1	14.9	15.9	17.3	16.7	16.6	16.9	17.3	13.8	14.0	Cincinnati - 8th Ave
Sharonville	Hamilton	390610043	15.7	14.9	16.9	14.5	14.8	15.8	15.4	15.4	15.6	16.0	12.7	13.0	Sharonville
Norwood	Hamilton	390617001	16.0	15.3	18.4	14.4	15.1	16.6	16.0	16.0	16.2	16.3	13.2	13.6	Norwood
St. Bernard	Hamilton	390618001	17.3	16.4	20.0	15.9	16.1	17.9	17.4	17.3	17.6	17.3	14.4	14.6	St. Bernard
Steubenville	Jefferson	390810016	17.7	15.9	16.4	13.8	16.2	16.7	15.4	15.5	15.8	17.7	12.5	15.9	Steubenville
Mingo Junction	Jefferson	390811001	17.3	16.2	18.1	14.6	15.6	17.2	16.3	16.1	16.5	17.5	13.2	15.0	Mingo Junction
Ironton	Lawrence	390870010	14.3	13.7	17.0	14.4	15.0	15.0	15.0	15.5	15.2	15.7	12.5	13.7	Ironton
Dayton	Montgomery	391130032	15.9	14.5	17.4	13.6	15.6	15.9	15.2	15.5	15.5	15.9	12.9	13.2	Dayton
New Boston	Scioto	391450013	14.7	13.0	16.2	14.3	14.0	14.6	14.5	14.8	14.7	17.1	11.9	14.8	New Boston
Canton - Dueber	Stark	391510017	16.8	15.6	17.8	14.6	15.9	16.7	16.0	16.1	16.3	17.3	13.6	14.3	Canton - Dueber
Canton - Market	Stark	391510020	15.0	14.1	16.6	11.9	14.4	15.2	14.2	14.3	14.6	15.7	12.3	13.0	Canton - Market
Akron - Brittain	Summit	391530017	15.4	15.0	16.4	13.5	14.4	15.6	15.0	14.8	15.1	16.4	12.7	13.6	Akron - Brittain
Akron - W. Exchange	Summit	391530023	14.2	13.9	15.7	12.8	13.7	14.6	14.1	14.1	14.3	15.6	12.0	13.0	Akron - W. Exchange

			Annual Average Conc.					Design Values			2005 BY	2002 BY	2018 Modeling Results			
Key Site	County	Site ID	'03	'04	'05	'06	'07	'03 - '05	'04 - '06	'05 - '07	Average w/ 2007	Average	Round 5 OTB	Round 5 Will Do	Round4	Key Site
Chicago - Washington HS	Cook	170310022	15.6	14.2	16.9	13.2	15.7	15.6	14.8	15.3	**15.2**	**15.9**	13.9	13.8	**14.4**	Chicago - Washington HS
Chicago - Mayfair	Cook	170310052	15.9	15.3	17.0	14.5	15.5	16.1	15.6	15.7	**15.8**	**17.1**	13.9	13.8	**15.0**	Chicago - Mayfair
Chicago - Springfield	Cook	170310057	15.6	13.8	16.7	13.5	15.1	15.4	14.7	15.1	15.0	**15.6**	13.7	13.5	**14.1**	Chicago - Springfield
Chicago - Lawndale	Cook	170310076	14.8	14.2	16.6	13.5	14.3	15.2	14.8	14.8	14.9	**15.6**	13.6	13.4	**14.1**	Chicago - Lawndale
Blue Island	Cook	170312001	14.9	14.1	16.4	13.2	14.3	15.1	14.6	14.6	14.8	**15.6**	13.4	13.3	**14.1**	Blue Island
Summit	Cook	170313301	15.6	14.2	16.9	13.8	14.8	15.6	15.0	15.2	**15.2**	**16.0**	13.9	13.8	**14.4**	Summit
Cicero	Cook	170316005	16.8	15.2	16.3	14.3	14.8	16.1	15.3	15.1	**15.5**	**16.4**	**14.2**	**14.0**	**14.9**	Cicero
Granite City	Madison	171191007	17.5	15.4	18.2	16.3	15.1	17.0	16.6	16.5	**16.7**	**17.3**	**14.3**	**14.2**	**15.5**	Granite City
E. St. Louis	St. Clair	171630010	14.9	14.7	17.1	14.5	15.6	15.6	15.4	15.7	**15.6**	**16.2**	13.4	13.3	**14.5**	E. St. Louis
Jeffersonville	Clark	180190005	15.8	15.1	18.5	15.0	16.5	16.5	16.2	16.7	**16.4**	**17.2**	13.4	13.4	**14.4**	Jeffersonville
Jasper	Dubois	180372001	15.7	14.4	16.9	13.5	14.4	15.7	14.9	14.9	**15.2**	**15.5**	11.8	11.9	13.0	Jasper
Gary	Lake	180890031			16.8	13.3	14.5	16.8	15.1	14.9	**15.6**		12.4	12.4		Gary
Indy-Washington Park	Marion	180970078	15.5	14.3	16.4	14.1	15.8	15.4	14.9	15.4	**15.3**	**16.2**	12.0	12.1	13.7	Indy-Washington Park
Indy-W 18th Street	Marion	180970081	16.2	15.0	17.9	14.2	16.1	16.4	15.7	16.1	**16.0**		12.6	12.7		Indy-W 18th Street
Indy- Michigan Street	Marion	180970083	16.3	15.0	17.5	14.1	15.9	16.3	15.5	15.8	**15.9**	**16.6**	12.6	12.6	**14.0**	Indy- Michigan Street
Allen Park	Wayne	261630001	15.2	14.2	15.9	13.2	12.8	15.1	14.4	14.0	14.5	**15.8**	12.4	12.4	13.3	Allen Park
Southwest HS	Wayne	261630015	16.6	15.4	17.2	14.7	14.5	16.4	15.8	15.5	**15.9**	**17.3**	13.5	13.5	**14.4**	Southwest HS
Linwood	Wayne	261630016	15.8	13.7	16.0	13.0	13.9	15.2	14.2	14.3	14.6	**15.5**	12.5	12.5	13.0	Linwood
Dearborn	Wayne	261630033	19.2	16.8	18.6	16.1	16.9	18.2	17.2	17.2	**17.5**	**19.3**	**15.1**	**15.1**	**16.1**	Dearborn
Wyandotte	Wayne	261630036	16.3	13.7	16.4	12.9	13.4	15.5	14.3	14.2	14.7	**16.6**	12.5	12.5	13.9	Wyandotte
Middleton	Butler	390170003	17.2	14.1	19.0	14.1	15.4	16.8	15.7	16.2	**16.2**	**16.5**	12.8	12.8	13.1	Middleton
Fairfield	Butler	390170016	15.8	14.7	17.9	14.0	14.9	16.1	15.5	15.6	**15.8**	**15.9**	12.5	12.6	12.2	Fairfield
Cleveland-28th Street	Cuyahoga	390350027	15.4	15.6	17.3	13.0	14.5	16.1	15.3	14.9	**15.4**	**16.5**	12.7	12.9	12.9	Cleveland-28th Street
Cleveland-St. Tikhon	Cuyahoga	390350038	17.6	17.5	19.2	14.9	16.2	18.1	17.2	16.8	**17.4**	**18.4**	**14.3**	**14.5**	**14.4**	Cleveland-St. Tikhon
Cleveland-Broadway	Cuyahoga	390350045	16.4	15.3	19.3	14.1	15.3	17.0	16.2	16.2	**16.5**	**16.7**	13.5	13.7	13.1	Cleveland-Broadway
Cleveland-E14 & Orange	Cuyahoga	390350060	17.2	16.4	19.4	15.0	15.9	17.7	16.9	16.8	**17.1**	**17.6**	**14.1**	**14.2**	13.7	Cleveland-E14 & Orange
Newburg Hts - Harvard Ave	Cuyahoga	390350065	15.6	15.2	18.6	13.1	15.8	16.5	15.6	15.8	**16.0**	**16.2**	13.1	13.3	12.6	Newburg Hts - Harvard Ave
Columbus - Fairgrounds	Franklin	390490024	16.4	15.0	16.4	13.6	14.6	15.9	15.0	14.9	**15.3**	**16.5**	12.0	12.1	13.0	Columbus - Fairgrounds
Columbus - Ann Street	Franklin	390490025	15.3	14.6	16.5	13.8	14.7	15.5	15.0	15.0	**15.1**	**16.0**	11.9	11.9	12.5	Columbus - Ann Street
Columbus - Maple Canyon	Franklin	390490081	14.9	13.6	14.6	12.9	13.1	14.4	13.7	13.5	13.9	**16.0**	10.9	11.0	12.5	Columbus - Maple Canyon
Cincinnati - Seymour	Hamilton	390610014	17.0	15.9	19.8	15.5	16.5	17.6	17.1	17.3	**17.3**	**17.7**	13.8	13.9	**14.0**	Cincinnati - Seymour
Cincinnati - Taft Ave	Hamilton	390610040	15.5	14.6	17.5	13.6	15.1	15.9	15.2	15.4	**15.5**	**15.7**	12.2	12.3	12.3	Cincinnati - Taft Ave
Cincinnati - 8th Ave	Hamilton	390610042	16.7	16.0	19.1	14.9	15.9	17.3	16.7	16.6	**16.9**	**17.3**	13.4	13.4	13.2	Cincinnati - 8th Ave
Sharonville	Hamilton	390610043	15.7	14.9	16.9	14.5	14.8	15.8	15.4	15.4	**15.6**	**16.0**	12.3	12.4	12.2	Sharonville
Norwood	Hamilton	390617001	16.0	15.3	18.4	14.4	15.1	16.6	16.0	16.0	**16.2**	**16.3**	12.8	12.8	12.8	Norwood
St. Bernard	Hamilton	390618001	17.3	16.4	20.0	15.9	16.1	17.9	17.4	17.3	**17.6**	**17.3**	**14.0**	**14.1**	13.8	St. Bernard
Steubenville	Jefferson	390810016	17.7	15.9	16.4	13.8	16.2	16.7	15.4	15.5	**15.8**	**17.7**	12.7	12.7	**16.2**	Steubenville
Mingo Junction	Jefferson	390811001	17.3	16.2	18.1	14.6	15.6	17.2	16.3	16.1	**16.5**	**17.5**	13.4	13.4	**15.3**	Mingo Junction
Ironton	Lawrence	390870010	14.3	13.7	17.0	14.4	15.0	15.0	15.0	15.5	**15.2**	**15.7**	12.3	12.3	13.2	Ironton
Dayton	Montgomery	391130032	15.9	14.5	17.4	13.6	15.6	15.9	15.2	15.5	**15.5**	**15.9**	12.4	12.5	12.3	Dayton
New Boston	Scioto	391450013	14.7	13.0	16.2	14.3	14.0	14.6	14.5	14.8	14.7	**17.1**	11.6	11.6	**14.2**	New Boston
Canton - Dueber	Stark	391510017	16.8	15.6	17.8	14.6	15.9	16.7	16.0	16.1	**16.3**	**17.3**	13.3	13.3	13.6	Canton - Dueber
Canton - Market	Stark	391510020	15.0	14.1	16.6	11.9	14.4	15.2	14.2	14.3	14.6	**15.7**	11.9	12.0	12.2	Canton - Market
Akron - Brittain	Summit	391530017	15.4	15.0	16.4	13.5	14.4	15.6	15.0	14.8	**15.1**	**16.4**	12.3	12.3	12.9	Akron - Brittain
Akron - W. Exchange	Summit	391530023	14.2	13.9	15.7	12.8	13.7	14.6	14.1	14.1	14.3	**15.6**	11.5	11.6	12.2	Akron - W. Exchange

24-Hour $PM_{2.5}$			98th Percentile (24-hour)					Design Values			Base Year	Round 5 Modeling Results			
Key Site	County	Site ID	'03	'04	'05	'06	'07	'03-'05	'04-'06	'05-'07	Average w/ 2007	2009	2012	2018	Key Site
Chicago - Washington HS	Cook	170310022	37.7	32.5	45.7	27.0	35.7	38.6	35.1	36.1	36.6	**36**	**36**	35	Chicago - Washington HS
Chicago - Mayfair	Cook	170310052	37.3	38.8	48.3	31.6	39.4	41.5	39.6	39.8	40.3	**36**	**36**	**36**	Chicago - Mayfair
Chicago - Springfield	Cook	170310057	36.4	33.1	46.5	27.7	38.9	38.7	35.8	37.7	37.4	32	32	31	Chicago - Springfield
Chicago - Lawndale	Cook	170310076	32.6	39.7	45.1	29.0	37.2	39.1	37.9	37.1	38.1	35	35	34	Chicago - Lawndale
McCook	Cook	170311016									43.0	**39**	**39**	**38**	McCook
Blue Island	Cook	170312001	39.6	38.5	43.8	28.1	35.1	40.6	36.8	35.7	37.7	34	34	33	Blue Island
Schiller Park	Cook	170313103		40.7	50.3	30.0	36.6	45.5	40.3	39.0	41.6	**39**	**39**	**39**	Schiller Park
Summit	Cook	170313301	38.4	42.4	49.1	27.4	36.7	43.3	39.6	37.7	40.2	**38**	**38**	**37**	Summit
Maywood	Cook	170316005	38.5	42.5	44.6	29.2	36.9	41.9	38.8	36.9	39.2	**38**	**38**	**37**	Maywood
Granite City	Madison	171191007	40.8	35.4	44.1	36.3	36.0	40.1	38.6	38.8	39.2	33	33	32	Granite City
E. St. Louis	St. Clair	171630010	32.6	30.2	39.6	29.2	33.1	34.1	33.0	34.0	33.7	28	28	28	E. St. Louis
Jeffersonville	Clark	180190005		28.4	45.5	35.9	43.3	37.0	36.6	41.6	38.4	29	31	31	Jeffersonville
Jasper	Dubois	180372001	39.5	30.0	41.2	31.6	39.5	36.9	34.3	37.4	36.2	28	29	28	Jasper
Gary - IITRI	Lake	180890022									39.0	34	34	35	Gary - IITRI
Gary - Burr School	Lake	180890026									39.0	33	34	32	Gary - Burr School
Gary	Lake	180890031			38.7	27.1	36.2	38.7	32.9	34.0	35.2	24	24	27	Gary
Indy-West Street	Marion	180970043									38.0	33	33	33	Indy-West Street
Indy-English Avenue	Marion	180970066									38.0	32	32	32	Indy-English Avenue
Indy-Washington Park	Marion	180970078	39.3	31.0	42.5	31.7	37.6	37.6	35.1	37.3	36.6	31	31	32	Indy-Washington Park
Indy-W 18th Street	Marion	180970081	36.2	31.9	45.7	34.8	38.4	37.9	37.5	39.6	38.3	31	31	31	Indy-W 18th Street
Indy- Michigan Street	Marion	180970083	36.7	31.3	40.3	33.5	37.2	36.1	35.0	37.0	36.0	28	28	29	Indy- Michigan Street
Luna Pier	Monroe	261150005	34.7	35.0	49.3	32.6	32.2	39.7	39.0	38.0	38.9	32	32	31	Luna Pier
Oak Park	Oakland	261250001	36.6	32.5	52.2	33.0	35.3	40.4	39.2	40.2	39.9	**36**	**36**	35	Oak Park
Port Huron	St. Clair	261470005	37.2	32.2	47.6	37.9	36.3	39.0	39.2	40.6	39.6	34	34	33	Port Huron
Ypsilanti	Washtenaw	261610008	38.8	31.5	52.1	31.3	34.5	40.8	38.3	39.3	39.5	35	35	34	Ypsilanti
Allen Park	Wayne	261630001	40.5	36.9	43.0	34.1	35.9	40.1	38.0	37.7	38.6	35	34	33	Allen Park
Southwest HS	Wayne	261630015	33.6	36.0	49.7	36.2	34.0	39.8	40.6	40.0	40.1	35	35	33	Southwest HS
Linwood	Wayne	261630016	46.2	38.3	51.8	36.9	34.8	45.4	42.3	41.2	43.0	**39**	**39**	**38**	Linwood
E 7 Mile	Wayne	261630019	37.1	35.0	52.3	36.2	33.0	41.5	41.2	40.5	41.0	**38**	**38**	**37**	E 7 Mile
Dearborn	Wayne	261630033	42.8	39.4	50.2	43.1	36.6	44.1	44.2	43.3	43.9	**40**	**40**	**39**	Dearborn
Wyandotte	Wayne	261630036	34.8	32.3	46.7	33.2	28.6	37.9	37.4	36.2	37.2	35	35	34	Wyandotte
Newberry	Wayne	261630038		36.8	57.5	28.6	33.4		39.1	39.8	42.7	**38**	**37**	**36**	Newberry
FIA	Wayne	261630039			43.9	32.4	34.8			37.0	39.7	33	33	31	FIA
Middleton	Butler	390170003	38.6	37.2	47.6	30.2	37.1	41.1	38.3	38.3	39.3	28	28	27	Middleton
Fairfield	Butler	390170016	34.8	32.2	43.4	35.2	34.5	36.8	36.9	37.7	37.1	27	28	27	Fairfield
	Butler	390170017	34.6	34.3	44.9			37.9	39.6		40.8	29	29	28	
Cleveland-28th Street	Cuyahoga	390350027	41.3	40.9	35.7	31.5	39.0	39.3	36.0	35.4	36.9	32	32	31	Cleveland-28th Street
Cleveland-St. Tikhon	Cuyahoga	390350038	47.3	42.5	51.2	36.1	39.7	44.9	47.0	42.3	44.2	**36**	35	34	Cleveland-St. Tikhon
Cleveland-Broadway	Cuyahoga	390350045	42.2	36.1	46.2	29.5	37.0	41.5	37.3	37.6	38.8	31	30	29	Cleveland-Broadway
Cleveland-GT Craig	Cuyahoga	390350060	45.5	42.2	49.5	31.0	38.7	45.7	40.9	39.7	42.1	**37**	**37**	35	Cleveland-GT Craig
Newburg Hts - Harvard Ave	Cuyahoga	390350065	39.1	36.1	47.9	27.8	39.1	41.0	37.3	38.3	38.9	31	30	30	Newburg Hts - Harvard Ave
Columbus - Fairgrounds	Franklin	390490024	39.2	35.1	45.0	34.0	34.2	39.8	38.0	37.7	38.5	33	32	31	Columbus - Fairgrounds
Columbus - Ann Street	Franklin	390490025	37.0	35.5	44.9	34.0	35.5	39.1	38.1	38.1	38.5	31	31	30	Columbus - Ann Street
Cincinnait	Hamilton	390610006			45.0	33.3	34.7			37.7	40.6	27	28	27	Cincinnait
Cincinnati - Seymour	Hamilton	390610014	37.8	42.0	38.5	35.2	38.1	39.4	38.6	37.3	38.4	26	25	24	Cincinnati - Seymour
Cincinnati - Taft Ave	Hamilton	390610040	31.9	30.5	45.8	32.8	34.7	36.1	36.4	37.8	36.7	24	24	23	Cincinnati - Taft Ave
Cincinnati - 8th Ave	Hamilton	390610042	33.8	31.9	44.4	34.5	35.9	36.7	36.9	38.3	37.3	28	28	27	Cincinnati - 8th Ave
Sharonville	Hamilton	390610043	37.3	31.4	39.9	34.9	34.0	36.2	35.4	36.3	36.0	28	28	27	Sharonville
Norwood	Hamilton	390617001	37.1	34.6	47.1	34.0	33.7	39.6	38.6	38.3	38.8	30	30	29	Norwood
St. Bernard	Hamilton	390618001	35.8	33.9	51.4	36.1	35.4	40.4	40.5	41.0	40.6	30	30	29	St. Bernard
Steubenville	Jefferson	390810016	39.6	43.8	43.8	32.1	43.5	42.4	39.9	39.8	40.7	29	28	28	Steubenville
Mingo Junction	Jefferson	390811001	40.9	51.5	44.2	32.9	35.4	45.5	42.9	37.5	42.0	30	30	30	Mingo Junction
Dayton	Montgomery	391130032	42.7	32.5	45.0	30.3	36.9	40.1	35.9	37.4	37.8	30	30	30	Dayton
Canton - Dueber	Stark	391510017	34.2	36.3	47.6	32.2	33.4	39.4	38.7	37.7	38.6	28	28	27	Canton - Dueber
Akron - Brittain	Summit	391530017	36.9	36.9	45.2	31.5	33.3	39.7	37.9	36.7	38.1	30	30	29	Akron - Brittain
Green Bay - Est High	Brown	550090005	33.5	32.3	41.5	36.9	37.1	35.8	36.9	38.5	37.1	35	34	32	Green Bay - Est High
Madison	Dane	550250047	32.0	31.9	40.1	33.4	44.3	34.7	35.1	39.3	36.4	32	31	29	Madison
Milwaukee-Health Center	Milwaukee	550790010	33.2	38.4	38.7	40.7	40.6	36.8	39.3	40.0	38.7	35	34	33	Milwaukee-Health Center
Milwaukee-SER Hdqs	Milwaukee	550790026	29.6	28.7	41.5	42.6	39.8	33.3	37.6	41.3	37.4	34	34	33	Milwaukee-SER Hdqs
Milwaukee-Virginia FS	Milwaukee	550790043	39.2	41.4	37.1	44.0	38	39.2	40.8	39.7	39.9	**36**	**36**	**36**	Milwaukee-Virginia FS
Milwaukee- Fire Dept Hdqs	Milwaukee	550790099	33.7	38.9	37.1	38.3	40.7	36.6	38.1	38.7	37.8	33	32	32	Milwaukee- Fire Dept Hdqs
Waukesha	Waukesha	551330027	29.1	38.4	41.1	28.2	33.8	36.2	35.9	34.4	35.5	31	31	29	Waukesha

PM2.5 RRFs by Species and Season (2009)						
Site ID	State	County	Season	Species	Species Comp. of Ave. FRM (fraction)	Species RRF
1703100521	IL	Cook	winter	so4	0.1772	0.9342
1703100521	IL	Cook	winter	no3	0.3099	1.0128
1703100521	IL	Cook	winter	ocm	0.2147	0.9942
1703100521	IL	Cook	winter	ec	0.0372	0.888
1703100521	IL	Cook	winter	soil	0.0242	1.1674
1703100521	IL	Cook	winter	nh4	0.1421	0.97
1703100521	IL	Cook	winter	pbw	0.0947	0.9678
1703100521	IL	Cook	spring	so4	0.32	0.8018
1703100521	IL	Cook	spring	no3	0.0609	0.9385
1703100521	IL	Cook	spring	ocm	0.2742	1.0629
1703100521	IL	Cook	spring	ec	0.0501	0.8712
1703100521	IL	Cook	spring	soil	0.0505	1.1796
1703100521	IL	Cook	spring	nh4	0.1203	0.8619
1703100521	IL	Cook	spring	pbw	0.0984	0.8492
1703100521	IL	Cook	summer	so4	0.3089	0.725
1703100521	IL	Cook	summer	no3	0	1.0124
1703100521	IL	Cook	summer	ocm	0.1599	1.069
1703100521	IL	Cook	summer	ec	0.0351	0.8683
1703100521	IL	Cook	summer	soil	0.0318	1.204
1703100521	IL	Cook	summer	nh4	0.0932	0.7354
1703100521	IL	Cook	summer	pbw	0.094	0.7217
1703100521	IL	Cook	fall	so4	0.1872	0.9151
1703100521	IL	Cook	fall	no3	0.1628	0.9408
1703100521	IL	Cook	fall	ocm	0.2389	1.0091
1703100521	IL	Cook	fall	ec	0.0403	0.8623
1703100521	IL	Cook	fall	soil	0.0284	1.1443
1703100521	IL	Cook	fall	nh4	0.1062	0.9247
1703100521	IL	Cook	fall	pbw	0.0614	0.9233
1711910071	IL	Madison	winter	so4	0.213	0.9195
1711910071	IL	Madison	winter	no3	0.2705	1.0306
1711910071	IL	Madison	winter	ocm	0.2093	0.9289
1711910071	IL	Madison	winter	ec	0.0434	0.9083
1711910071	IL	Madison	winter	soil	0.0306	1.1782
1711910071	IL	Madison	winter	nh4	0.1528	0.9513
1711910071	IL	Madison	winter	pbw	0.0804	0.9243
1711910071	IL	Madison	spring	so4	0.3194	0.7717
1711910071	IL	Madison	spring	no3	0.0189	0.8611
1711910071	IL	Madison	spring	ocm	0.2455	1.1103
1711910071	IL	Madison	spring	ec	0.0564	1.0046
1711910071	IL	Madison	spring	soil	0.0459	1.2252
1711910071	IL	Madison	spring	nh4	0.1121	0.7894
1711910071	IL	Madison	spring	pbw	0.1085	0.7783
1711910071	IL	Madison	summer	so4	0.313	0.705
1711910071	IL	Madison	summer	no3	0	0.884
1711910071	IL	Madison	summer	ocm	0.153	1.1546
1711910071	IL	Madison	summer	ec	0.0345	1.0513
1711910071	IL	Madison	summer	soil	0.0302	1.2532
1711910071	IL	Madison	summer	nh4	0.102	0.7409
1711910071	IL	Madison	summer	pbw	0.1096	0.7133
1711910071	IL	Madison	fall	so4	0.2058	0.9037
1711910071	IL	Madison	fall	no3	0.1308	0.9426
1711910071	IL	Madison	fall	ocm	0.259	1.0233
1711910071	IL	Madison	fall	ec	0.0563	0.9248
1711910071	IL	Madison	fall	soil	0.0549	1.1412
1711910071	IL	Madison	fall	nh4	0.1073	0.9185
1711910071	IL	Madison	fall	pbw	0.0655	0.918

Site ID	State	County	Season	Species	Species Comp. of Ave. FRM (fraction)	Species RRF
1803720011	IN	Dubois	winter	so4	0.2669	0.8833
1803720011	IN	Dubois	winter	no3	0.2548	0.9526
1803720011	IN	Dubois	winter	ocm	0.1747	0.9374
1803720011	IN	Dubois	winter	ec	0.0313	0.9319
1803720011	IN	Dubois	winter	soil	0.0192	1.1349
1803720011	IN	Dubois	winter	nh4	0.1646	0.9069
1803720011	IN	Dubois	winter	pbw	0.0885	0.9006
1803720011	IN	Dubois	spring	so4	0.4141	0.6808
1803720011	IN	Dubois	spring	no3	0.0022	0.8106
1803720011	IN	Dubois	spring	ocm	0.178	0.9997
1803720011	IN	Dubois	spring	ec	0.0324	0.9083
1803720011	IN	Dubois	spring	soil	0.0218	1.1284
1803720011	IN	Dubois	spring	nh4	0.1432	0.7075
1803720011	IN	Dubois	spring	pbw	0.1556	0.6916
1803720011	IN	Dubois	summer	so4	0.3687	0.644
1803720011	IN	Dubois	summer	no3	0	0.8029
1803720011	IN	Dubois	summer	ocm	0.1174	1.0136
1803720011	IN	Dubois	summer	ec	0.0207	0.913
1803720011	IN	Dubois	summer	soil	0.0213	1.1988
1803720011	IN	Dubois	summer	nh4	0.1168	0.6789
1803720011	IN	Dubois	summer	pbw	0.1246	0.6613
1803720011	IN	Dubois	fall	so4	0.2964	0.8232
1803720011	IN	Dubois	fall	no3	0.138	0.8797
1803720011	IN	Dubois	fall	ocm	0.2116	0.9861
1803720011	IN	Dubois	fall	ec	0.0437	0.9019
1803720011	IN	Dubois	fall	soil	0.03	1.1387
1803720011	IN	Dubois	fall	nh4	0.1449	0.8444
1803720011	IN	Dubois	fall	pbw	0.0941	0.8558
1809700811	IN	Marion	winter	so4	0.2358	0.9192
1809700811	IN	Marion	winter	no3	0.2729	0.9769
1809700811	IN	Marion	winter	ocm	0.1851	0.9546
1809700811	IN	Marion	winter	ec	0.0385	0.8647
1809700811	IN	Marion	winter	soil	0.0239	1.0835
1809700811	IN	Marion	winter	nh4	0.1561	0.9446
1809700811	IN	Marion	winter	pbw	0.0877	0.944
1809700811	IN	Marion	spring	so4	0.3745	0.6868
1809700811	IN	Marion	spring	no3	0.0167	0.8082
1809700811	IN	Marion	spring	ocm	0.2034	0.9881
1809700811	IN	Marion	spring	ec	0.0447	0.8547
1809700811	IN	Marion	spring	soil	0.0376	1.0625
1809700811	IN	Marion	spring	nh4	0.1313	0.7182
1809700811	IN	Marion	spring	pbw	0.1309	0.7056
1809700811	IN	Marion	summer	so4	0.3582	0.6529
1809700811	IN	Marion	summer	no3	0	0.8099
1809700811	IN	Marion	summer	ocm	0.1231	1.0043
1809700811	IN	Marion	summer	ec	0.03	0.8444
1809700811	IN	Marion	summer	soil	0.0253	1.0918
1809700811	IN	Marion	summer	nh4	0.1114	0.6854
1809700811	IN	Marion	summer	pbw	0.1163	0.6674
1809700811	IN	Marion	fall	so4	0.2751	0.8538
1809700811	IN	Marion	fall	no3	0.149	0.9452
1809700811	IN	Marion	fall	ocm	0.223	0.9648
1809700811	IN	Marion	fall	ec	0.0525	0.8412
1809700811	IN	Marion	fall	soil	0.0358	1.089
1809700811	IN	Marion	fall	nh4	0.1378	0.8905
1809700811	IN	Marion	fall	pbw	0.0865	0.8888

Site ID	State	County	Season	Species	Species Comp. of Ave. FRM (fraction)	Species RRF
2616300331	MI	Wayne	winter	so4	0.1587	0.9206
2616300331	MI	Wayne	winter	no3	0.2394	0.9813
2616300331	MI	Wayne	winter	ocm	0.3193	1.0781
2616300331	MI	Wayne	winter	ec	0.0383	0.9279
2616300331	MI	Wayne	winter	soil	0.0541	1.0206
2616300331	MI	Wayne	winter	nh4	0.1188	0.9518
2616300331	MI	Wayne	winter	pbw	0.0714	0.9566
2616300331	MI	Wayne	spring	so4	0.3383	0.7398
2616300331	MI	Wayne	spring	no3	0.0259	0.8787
2616300331	MI	Wayne	spring	ocm	0.3543	1.0234
2616300331	MI	Wayne	spring	ec	0.0504	0.8671
2616300331	MI	Wayne	spring	soil	0.0915	1.0153
2616300331	MI	Wayne	spring	nh4	0.1191	0.7818
2616300331	MI	Wayne	spring	pbw	0.1126	0.7619
2616300331	MI	Wayne	summer	so4	0.3311	0.6681
2616300331	MI	Wayne	summer	no3	0	0.8431
2616300331	MI	Wayne	summer	ocm	0.2297	1.0029
2616300331	MI	Wayne	summer	ec	0.0362	0.8332
2616300331	MI	Wayne	summer	soil	0.061	1.0177
2616300331	MI	Wayne	summer	nh4	0.1027	0.6974
2616300331	MI	Wayne	summer	pbw	0.1073	0.6754
2616300331	MI	Wayne	fall	so4	0.1898	0.854
2616300331	MI	Wayne	fall	no3	0.1075	0.9367
2616300331	MI	Wayne	fall	ocm	0.3689	1.0607
2616300331	MI	Wayne	fall	ec	0.0546	0.8862
2616300331	MI	Wayne	fall	soil	0.1676	1.0317
2616300331	MI	Wayne	fall	nh4	0.0866	0.8919
2616300331	MI	Wayne	fall	pbw	0.0553	0.8821
3903500381	OH	Cuyahoga	winter	so4	0.2117	0.8993
3903500381	OH	Cuyahoga	winter	no3	0.2665	0.9856
3903500381	OH	Cuyahoga	winter	ocm	0.2048	0.9716
3903500381	OH	Cuyahoga	winter	ec	0.0413	0.8903
3903500381	OH	Cuyahoga	winter	soil	0.0465	1.0959
3903500381	OH	Cuyahoga	winter	nh4	0.1459	0.9416
3903500381	OH	Cuyahoga	winter	pbw	0.0832	0.9541
3903500381	OH	Cuyahoga	spring	so4	0.3334	0.7145
3903500381	OH	Cuyahoga	spring	no3	0.0374	0.8393
3903500381	OH	Cuyahoga	spring	ocm	0.2068	1.0899
3903500381	OH	Cuyahoga	spring	ec	0.052	0.9362
3903500381	OH	Cuyahoga	spring	soil	0.0697	1.0601
3903500381	OH	Cuyahoga	spring	nh4	0.1256	0.7666
3903500381	OH	Cuyahoga	spring	pbw	0.115	0.7761
3903500381	OH	Cuyahoga	summer	so4	0.3241	0.6303
3903500381	OH	Cuyahoga	summer	no3	0	0.89
3903500381	OH	Cuyahoga	summer	ocm	0.1306	1.0998
3903500381	OH	Cuyahoga	summer	ec	0.0419	0.9354
3903500381	OH	Cuyahoga	summer	soil	0.0583	1.0906
3903500381	OH	Cuyahoga	summer	nh4	0.1074	0.7038
3903500381	OH	Cuyahoga	summer	pbw	0.1183	0.6674
3903500381	OH	Cuyahoga	fall	so4	0.2055	0.8193
3903500381	OH	Cuyahoga	fall	no3	0.1275	0.9189
3903500381	OH	Cuyahoga	fall	ocm	0.2234	1.0245
3903500381	OH	Cuyahoga	fall	ec	0.0499	0.8913
3903500381	OH	Cuyahoga	fall	soil	0.0675	1.0927
3903500381	OH	Cuyahoga	fall	nh4	0.1034	0.8615
3903500381	OH	Cuyahoga	fall	pbw	0.0637	0.8564

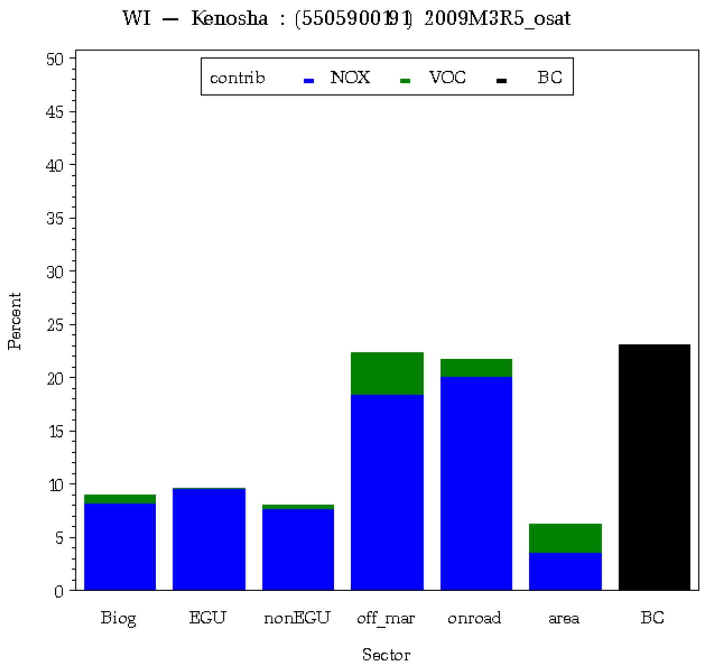
Site ID	State	County	Season	Species	Species Comp. of Ave. FRM (fraction)	Species RRF
3904900241	OH	Franklin	winter	so4	0.2555	0.8622
3904900241	OH	Franklin	winter	no3	0.2373	1.0002
3904900241	OH	Franklin	winter	ocm	0.2082	0.974
3904900241	OH	Franklin	winter	ec	0.0375	0.8537
3904900241	OH	Franklin	winter	soil	0.0259	1.0844
3904900241	OH	Franklin	winter	nh4	0.1495	0.9261
3904900241	OH	Franklin	winter	pbw	0.0861	0.9274
3904900241	OH	Franklin	spring	so4	0.3754	0.6615
3904900241	OH	Franklin	spring	no3	0.0176	0.8436
3904900241	OH	Franklin	spring	ocm	0.2069	1.062
3904900241	OH	Franklin	spring	ec	0.0405	0.8678
3904900241	OH	Franklin	spring	soil	0.0371	1.0551
3904900241	OH	Franklin	spring	nh4	0.1296	0.7212
3904900241	OH	Franklin	spring	pbw	0.128	0.6992
3904900241	OH	Franklin	summer	so4	0.3703	0.622
3904900241	OH	Franklin	summer	no3	0	0.9056
3904900241	OH	Franklin	summer	ocm	0.1343	1.0654
3904900241	OH	Franklin	summer	ec	0.0311	0.8565
3904900241	OH	Franklin	summer	soil	0.0267	1.0667
3904900241	OH	Franklin	summer	nh4	0.1142	0.7021
3904900241	OH	Franklin	summer	pbw	0.1186	0.6614
3904900241	OH	Franklin	fall	so4	0.2692	0.8119
3904900241	OH	Franklin	fall	no3	0.1186	0.9099
3904900241	OH	Franklin	fall	ocm	0.2489	1.019
3904900241	OH	Franklin	fall	ec	0.0533	0.8371
3904900241	OH	Franklin	fall	soil	0.0423	1.0924
3904900241	OH	Franklin	fall	nh4	0.1217	0.8539
3904900241	OH	Franklin	fall	pbw	0.0821	0.8519
3906100141	OH	Hamilton	winter	so4	0.2685	0.8104
3906100141	OH	Hamilton	winter	no3	0.2378	1.0886
3906100141	OH	Hamilton	winter	ocm	0.19	0.961
3906100141	OH	Hamilton	winter	ec	0.035	0.8969
3906100141	OH	Hamilton	winter	soil	0.0229	1.4146
3906100141	OH	Hamilton	winter	nh4	0.1583	0.9077
3906100141	OH	Hamilton	winter	pbw	0.0874	0.8687
3906100141	OH	Hamilton	spring	so4	0.3583	0.6331
3906100141	OH	Hamilton	spring	no3	0.0025	1.0155
3906100141	OH	Hamilton	spring	ocm	0.1986	1.0798
3906100141	OH	Hamilton	spring	ec	0.0466	0.9228
3906100141	OH	Hamilton	spring	soil	0.0289	1.3785
3906100141	OH	Hamilton	spring	nh4	0.1215	0.6968
3906100141	OH	Hamilton	spring	pbw	0.128	0.6307
3906100141	OH	Hamilton	summer	so4	0.3722	0.577
3906100141	OH	Hamilton	summer	no3	0	1.0923
3906100141	OH	Hamilton	summer	ocm	0.121	1.082
3906100141	OH	Hamilton	summer	ec	0.0309	0.9099
3906100141	OH	Hamilton	summer	soil	0.0199	1.537
3906100141	OH	Hamilton	summer	nh4	0.1178	0.6441
3906100141	OH	Hamilton	summer	pbw	0.1261	0.5734
3906100141	OH	Hamilton	fall	so4	0.2608	0.7754
3906100141	OH	Hamilton	fall	no3	0.1184	0.9857
3906100141	OH	Hamilton	fall	ocm	0.213	1.0235
3906100141	OH	Hamilton	fall	ec	0.0512	0.8876
3906100141	OH	Hamilton	fall	soil	0.0328	1.4007
3906100141	OH	Hamilton	fall	nh4	0.1254	0.846
3906100141	OH	Hamilton	fall	pbw	0.0828	0.8172

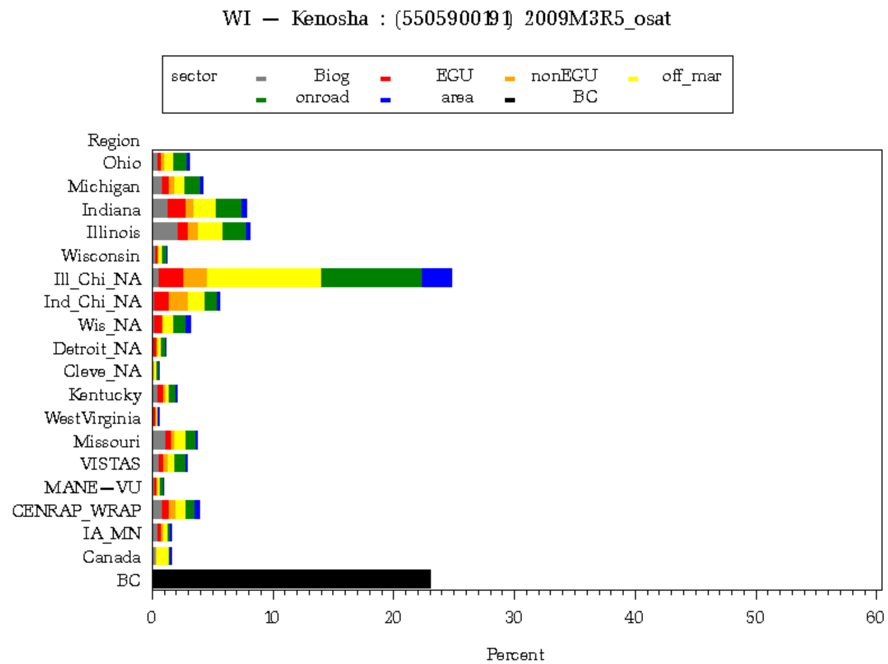
Site ID	State	County	Season	Species	Species Comp. of Ave. FRM (fraction)	Species RRF
3908110011	OH	Jefferson	winter	so4	0.2367	0.8217
3908110011	OH	Jefferson	winter	no3	0.1709	1.0522
3908110011	OH	Jefferson	winter	ocm	0.3288	0.8819
3908110011	OH	Jefferson	winter	ec	0.0435	0.9091
3908110011	OH	Jefferson	winter	soil	0.0272	0.4368
3908110011	OH	Jefferson	winter	nh4	0.1199	0.8904
3908110011	OH	Jefferson	winter	pbw	0.073	0.8583
3908110011	OH	Jefferson	spring	so4	0.3508	0.6666
3908110011	OH	Jefferson	spring	no3	0.0154	0.9156
3908110011	OH	Jefferson	spring	ocm	0.3078	0.9995
3908110011	OH	Jefferson	spring	ec	0.0395	0.9853
3908110011	OH	Jefferson	spring	soil	0.0407	0.4844
3908110011	OH	Jefferson	spring	nh4	0.114	0.7054
3908110011	OH	Jefferson	spring	pbw	0.1095	0.6713
3908110011	OH	Jefferson	summer	so4	0.3779	0.6156
3908110011	OH	Jefferson	summer	no3	0	1.0837
3908110011	OH	Jefferson	summer	ocm	0.2098	1.0145
3908110011	OH	Jefferson	summer	ec	0.0308	0.9689
3908110011	OH	Jefferson	summer	soil	0.0323	0.3632
3908110011	OH	Jefferson	summer	nh4	0.1065	0.6428
3908110011	OH	Jefferson	summer	pbw	0.1007	0.625
3908110011	OH	Jefferson	fall	so4	0.2315	0.7694
3908110011	OH	Jefferson	fall	no3	0.0702	1.0302
3908110011	OH	Jefferson	fall	ocm	0.372	0.9312
3908110011	OH	Jefferson	fall	ec	0.051	0.9086
3908110011	OH	Jefferson	fall	soil	0.0344	0.4555
3908110011	OH	Jefferson	fall	nh4	0.0859	0.8284
3908110011	OH	Jefferson	fall	pbw	0.0629	0.7951
3911300321	OH	Montgomer	winter	so4	0.2613	0.8598
3911300321	OH	Montgomer	winter	no3	0.2407	1.029
3911300321	OH	Montgomer	winter	ocm	0.1954	0.9442
3911300321	OH	Montgomer	winter	ec	0.036	0.8746
3911300321	OH	Montgomer	winter	soil	0.0259	1.1295
3911300321	OH	Montgomer	winter	nh4	0.1531	0.9304
3911300321	OH	Montgomer	winter	pbw	0.0876	0.9205
3911300321	OH	Montgomer	spring	so4	0.3659	0.6606
3911300321	OH	Montgomer	spring	no3	0.0163	0.8639
3911300321	OH	Montgomer	spring	ocm	0.1895	1.0976
3911300321	OH	Montgomer	spring	ec	0.0442	0.9417
3911300321	OH	Montgomer	spring	soil	0.0253	1.0873
3911300321	OH	Montgomer	spring	nh4	0.1313	0.7149
3911300321	OH	Montgomer	spring	pbw	0.1326	0.6839
3911300321	OH	Montgomer	summer	so4	0.375	0.6234
3911300321	OH	Montgomer	summer	no3	0	0.9474
3911300321	OH	Montgomer	summer	ocm	0.128	1.1047
3911300321	OH	Montgomer	summer	ec	0.029	0.9496
3911300321	OH	Montgomer	summer	soil	0.0205	1.1299
3911300321	OH	Montgomer	summer	nh4	0.1114	0.6931
3911300321	OH	Montgomer	summer	pbw	0.1114	0.6482
3911300321	OH	Montgomer	fall	so4	0.3062	0.8033
3911300321	OH	Montgomer	fall	no3	0.1012	0.9634
3911300321	OH	Montgomer	fall	ocm	0.2221	1.0158
3911300321	OH	Montgomer	fall	ec	0.0514	0.877
3911300321	OH	Montgomer	fall	soil	0.028	1.1391
3911300321	OH	Montgomer	fall	nh4	0.1352	0.8625
3911300321	OH	Montgomer	fall	pbw	0.0982	0.8475

Site ID	State	County	Season	Species	Species Comp. of Ave. FRM (fraction)	Species RRF
3915100171	OH	Stark	winter	so4	0.2362	0.8558
3915100171	OH	Stark	winter	no3	0.2234	1.0222
3915100171	OH	Stark	winter	ocm	0.2478	0.9255
3915100171	OH	Stark	winter	ec	0.0414	0.8866
3915100171	OH	Stark	winter	soil	0.0334	1.099
3915100171	OH	Stark	winter	nh4	0.1376	0.925
3915100171	OH	Stark	winter	pbw	0.0802	0.9155
3915100171	OH	Stark	spring	so4	0.3581	0.6834
3915100171	OH	Stark	spring	no3	0.0236	0.855
3915100171	OH	Stark	spring	ocm	0.221	1.0892
3915100171	OH	Stark	spring	ec	0.0501	1.0017
3915100171	OH	Stark	spring	soil	0.058	1.0528
3915100171	OH	Stark	spring	nh4	0.1288	0.7264
3915100171	OH	Stark	spring	pbw	0.1256	0.7009
3915100171	OH	Stark	summer	so4	0.3621	0.6277
3915100171	OH	Stark	summer	no3	0	0.8203
3915100171	OH	Stark	summer	ocm	0.1483	1.0984
3915100171	OH	Stark	summer	ec	0.0403	1.016
3915100171	OH	Stark	summer	soil	0.037	1.0781
3915100171	OH	Stark	summer	nh4	0.1157	0.6739
3915100171	OH	Stark	summer	pbw	0.124	0.651
3915100171	OH	Stark	fall	so4	0.2293	0.8041
3915100171	OH	Stark	fall	no3	0.1262	0.9363
3915100171	OH	Stark	fall	ocm	0.2722	1.0226
3915100171	OH	Stark	fall	ec	0.0545	0.9202
3915100171	OH	Stark	fall	soil	0.0461	1.0959
3915100171	OH	Stark	fall	nh4	0.1105	0.8549
3915100171	OH	Stark	fall	pbw	0.0706	0.8428
3915300171	OH	Summit	winter	so4	0.2511	0.8771
3915300171	OH	Summit	winter	no3	0.2376	1.0052
3915300171	OH	Summit	winter	ocm	0.2185	0.9429
3915300171	OH	Summit	winter	ec	0.0334	0.8677
3915300171	OH	Summit	winter	soil	0.0255	1.0835
3915300171	OH	Summit	winter	nh4	0.1489	0.9374
3915300171	OH	Summit	winter	pbw	0.0851	0.945
3915300171	OH	Summit	spring	so4	0.387	0.7046
3915300171	OH	Summit	spring	no3	0.0072	0.8466
3915300171	OH	Summit	spring	ocm	0.1901	1.0967
3915300171	OH	Summit	spring	ec	0.035	0.9482
3915300171	OH	Summit	spring	soil	0.0304	1.0524
3915300171	OH	Summit	spring	nh4	0.1294	0.7521
3915300171	OH	Summit	spring	pbw	0.1342	0.7384
3915300171	OH	Summit	summer	so4	0.3694	0.6378
3915300171	OH	Summit	summer	no3	0	0.8587
3915300171	OH	Summit	summer	ocm	0.1417	1.1077
3915300171	OH	Summit	summer	ec	0.0332	0.9506
3915300171	OH	Summit	summer	soil	0.0198	1.0744
3915300171	OH	Summit	summer	nh4	0.1121	0.6961
3915300171	OH	Summit	summer	pbw	0.1146	0.6691
3915300171	OH	Summit	fall	so4	0.2443	0.8074
3915300171	OH	Summit	fall	no3	0.1175	0.9392
3915300171	OH	Summit	fall	ocm	0.2636	1.0252
3915300171	OH	Summit	fall	ec	0.0623	0.8883
3915300171	OH	Summit	fall	soil	0.0494	1.086
3915300171	OH	Summit	fall	nh4	0.109	0.8622
3915300171	OH	Summit	fall	pbw	0.0723	0.8506

APPENDIX II

Ozone Source Apportionment Modeling Results


WI — Kenosha : (550590019l) 2009M3R5_osat
contrib NOX VOC BC
Percent
Biog
EGU
nonEGU
off_mar
onroad
area
BC
Sector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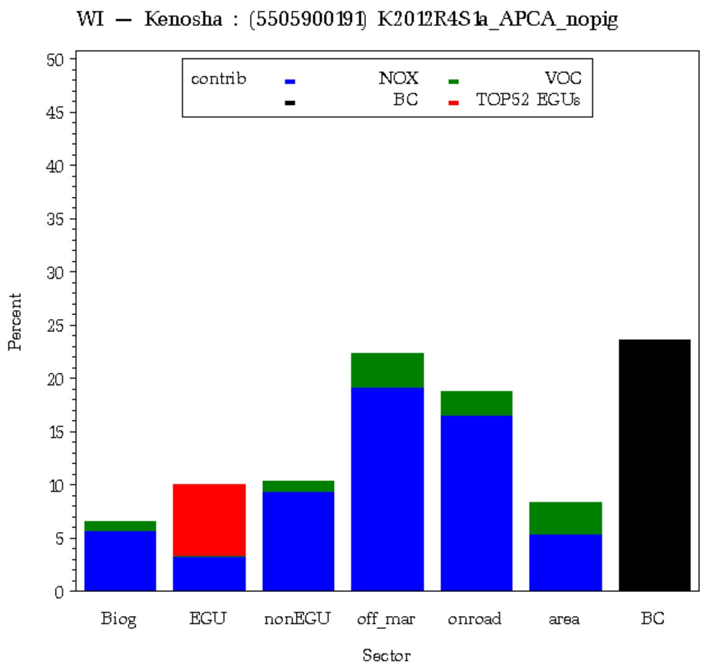
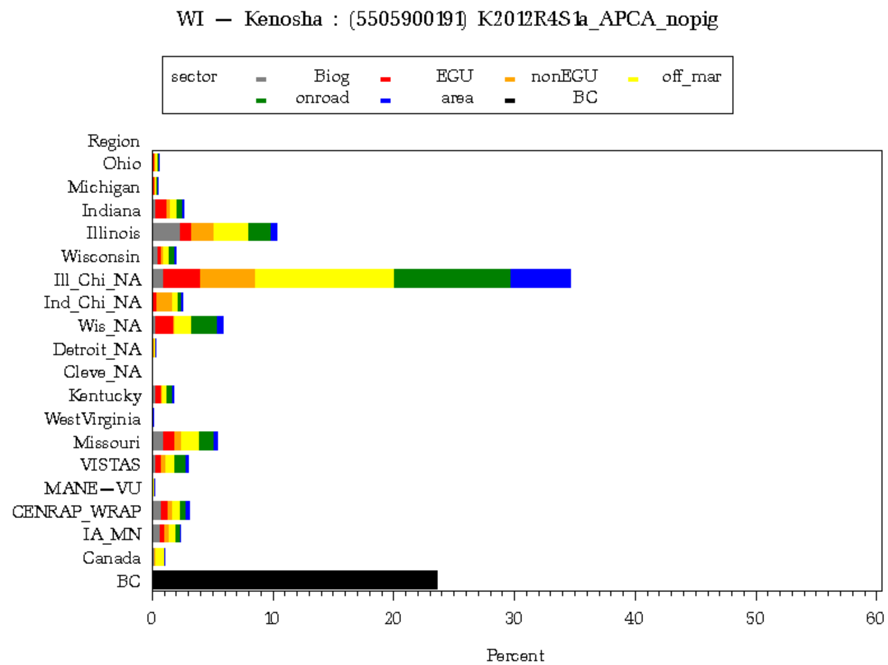
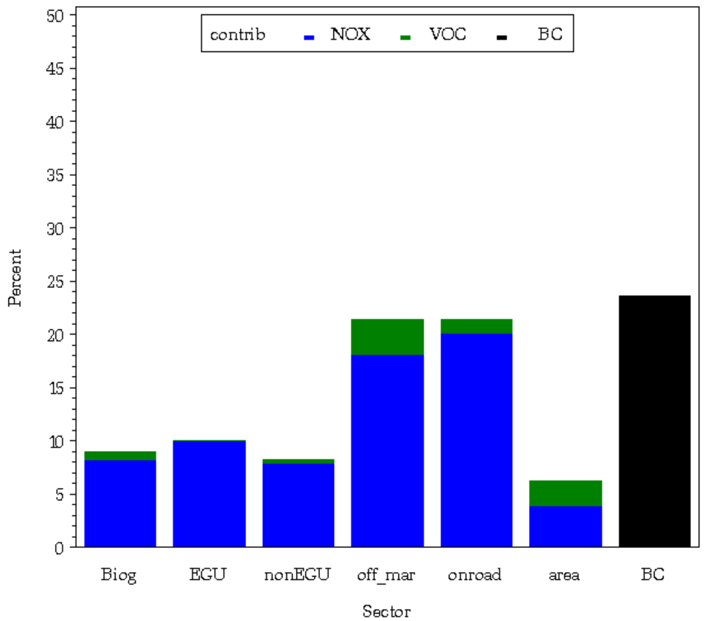
sector Biog EGU nonEGU off_mar onroad area BC
Region
Ohio
Michigan
Indiana
Illinois
Wisconsin
Ill_Chi_NA
Ind_Chi_NA
Wis_NA
Detroit_NA
Cleve_NA
Kentucky
WestVirginia
Missouri
VISTAS
MANE-VU
CENRAP_WRAP
IA_MN
Canada
BC
Percent


WI — Kenosha : (550590019l) K2012R4S1a_APCA_nopig
contrib NOX VOC BC TOP52 EGUs
Percent
Biog
EGU
nonEGU
off_mar
onroad
area
BC
Sector


WI — Kenosha : (550590019l) K2012R4S1a_APCA_nopig
sector Biog EGU nonEGU off_mar onroad area BC
Region
Ohio
Michigan
Indiana
Illinois
Wisconsin
Ill_Chi_NA
Ind_Chi_NA
Wis_NA
Detroit_NA
Cleve_NA
Kentucky
WestVirginia
Missouri
VISTAS
MANE-VU
CENRAP_WRAP
IA_MN
Canada
BC
Percent

WI — Racine : (551010017 1) 2009M3R5_osat



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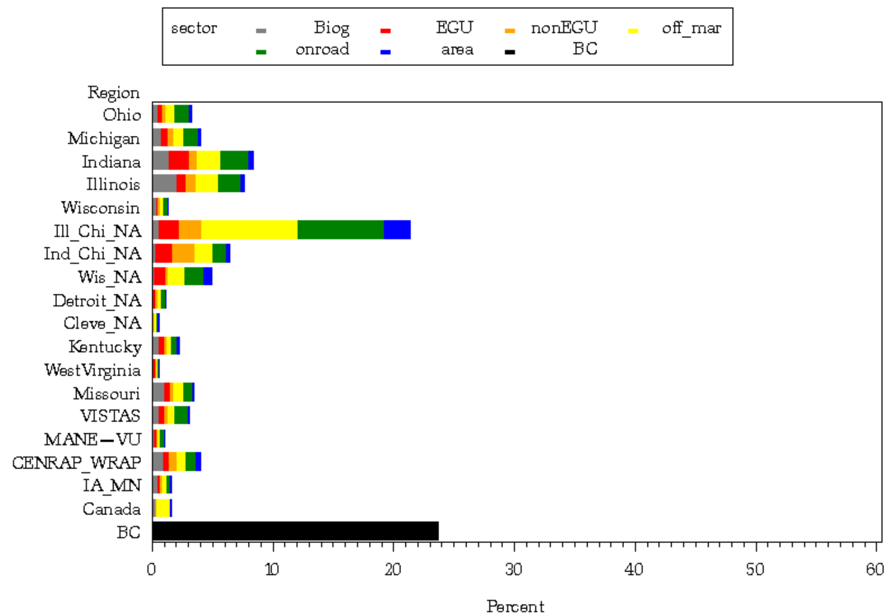

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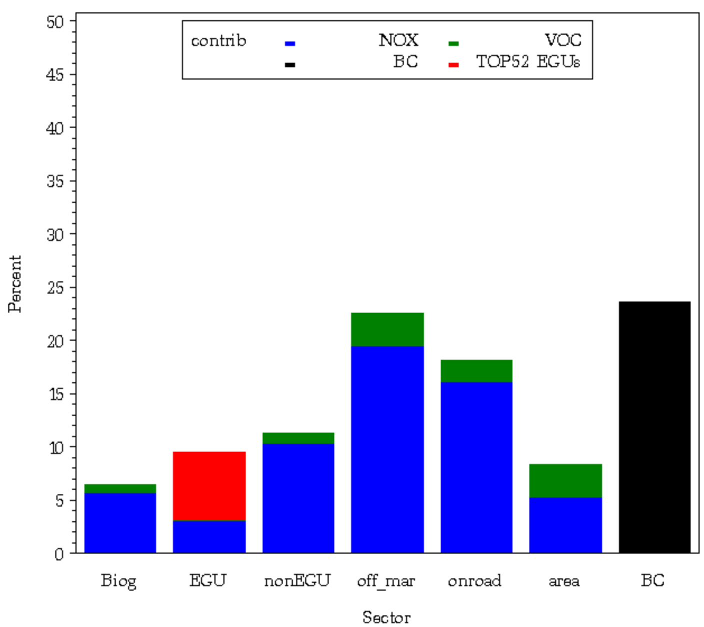

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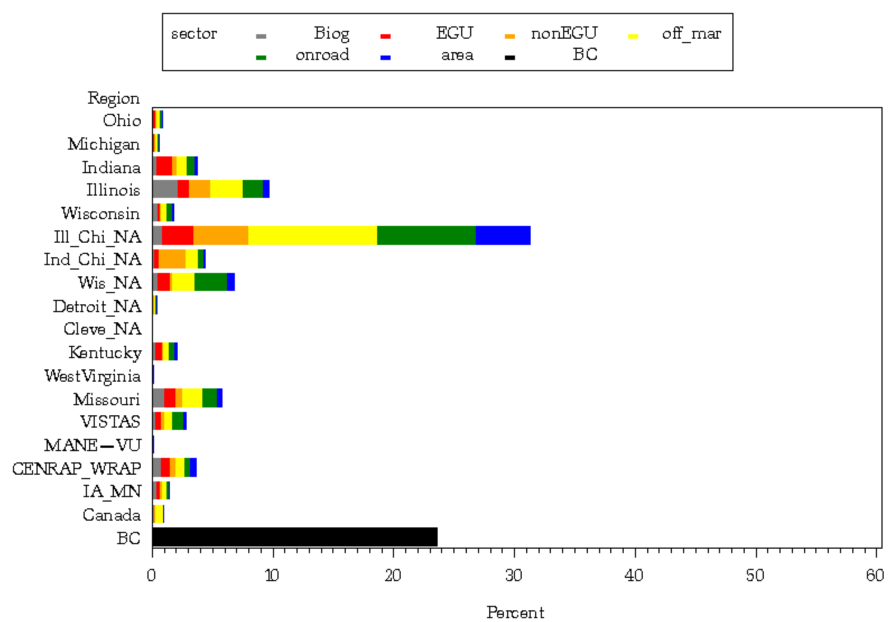

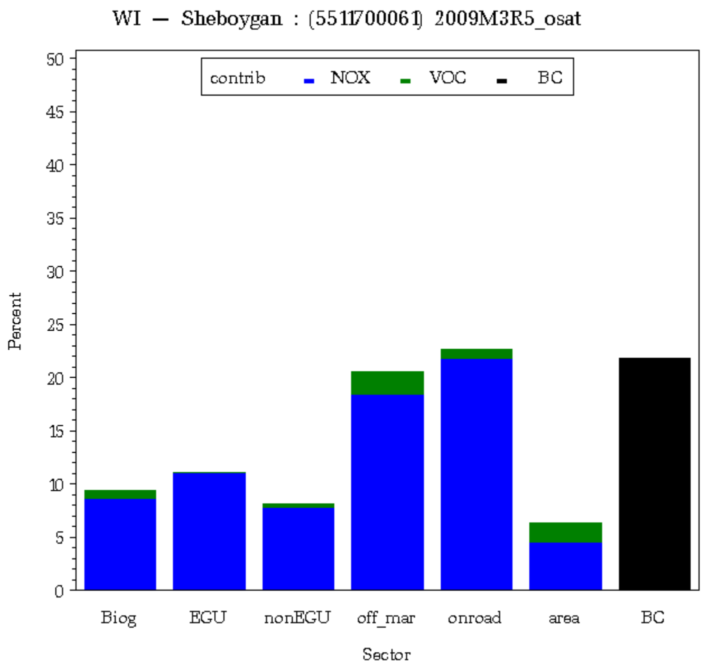
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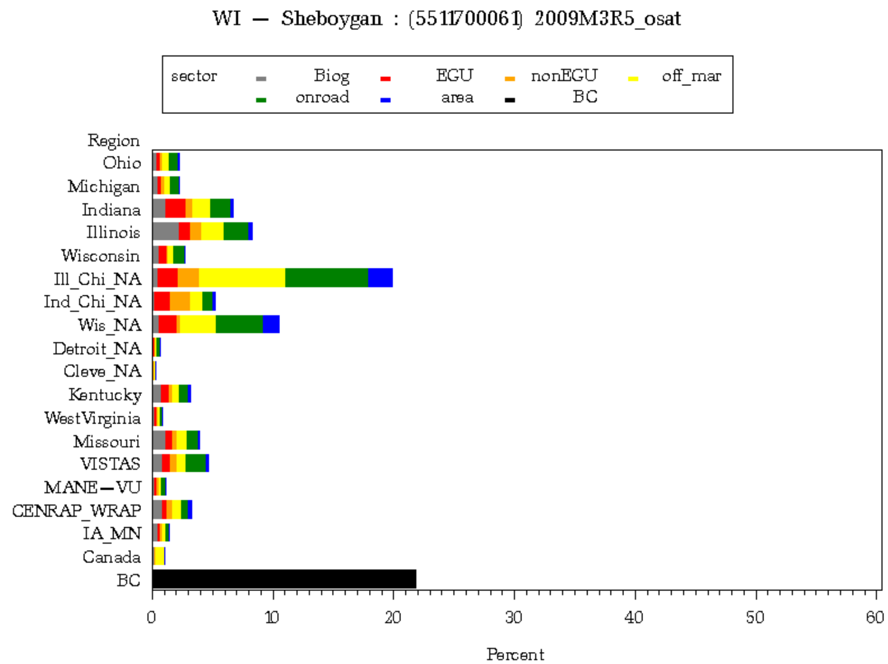
Percent
Biog EGU nonEGU off_mar onroad area BC
Sector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sector Biog EGU nonEGU off_mar onroad area BC
Region
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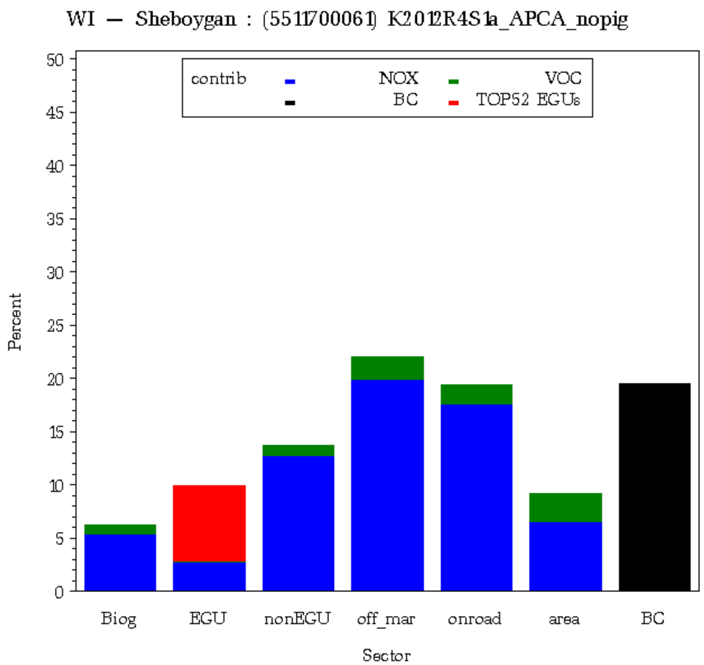
Indiana
Illinois
Wisconsin
Ill_Chi_NA
Ind_Chi_NA
Wis_NA
Detroit_NA
Cleve_NA
Kentucky
WestVirginia
Missouri
VISTAS
MANE-VU
CENRAP_WRAP
IA_MN
Canada
BC
Percent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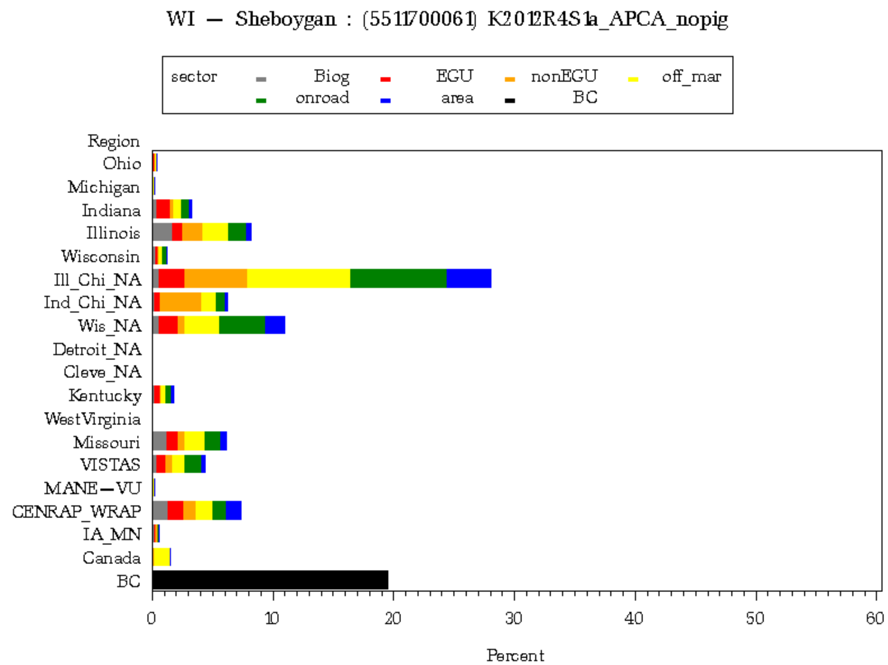
Percent
Biog EGU nonEGU off_mar onroad area BC
Sector


WI — Sheboygan : (551170061) K2012R4S1a_APCA_nopig
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Region
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Michigan
Indiana
Illinois
Wisconsin
Ill_Chi_NA
Ind_Chi_NA
Wis_NA
Detroit_NA
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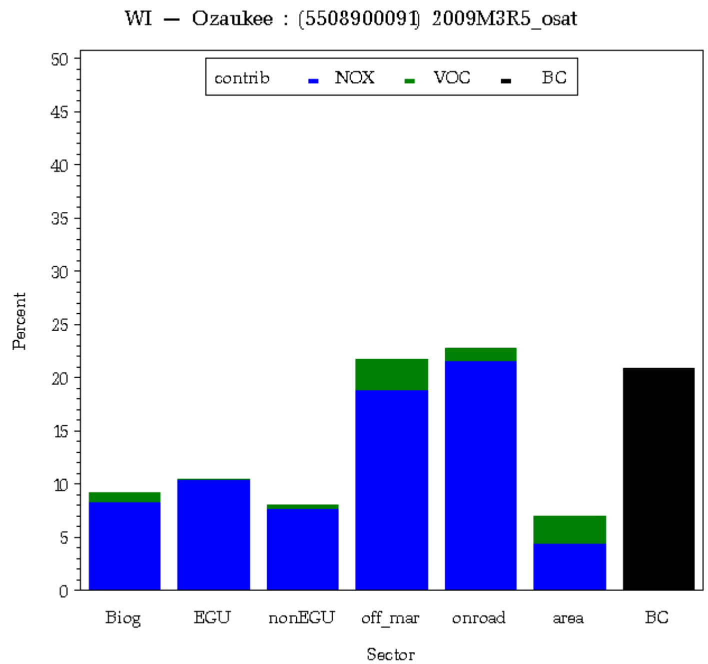
Missouri
VISTAS
MANE-VU
CENRAP_WRAP
IA_MN
Canada
BC
Percent


WI — Ozaukee : (5508900091) 2009M3R5_osat
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Percent
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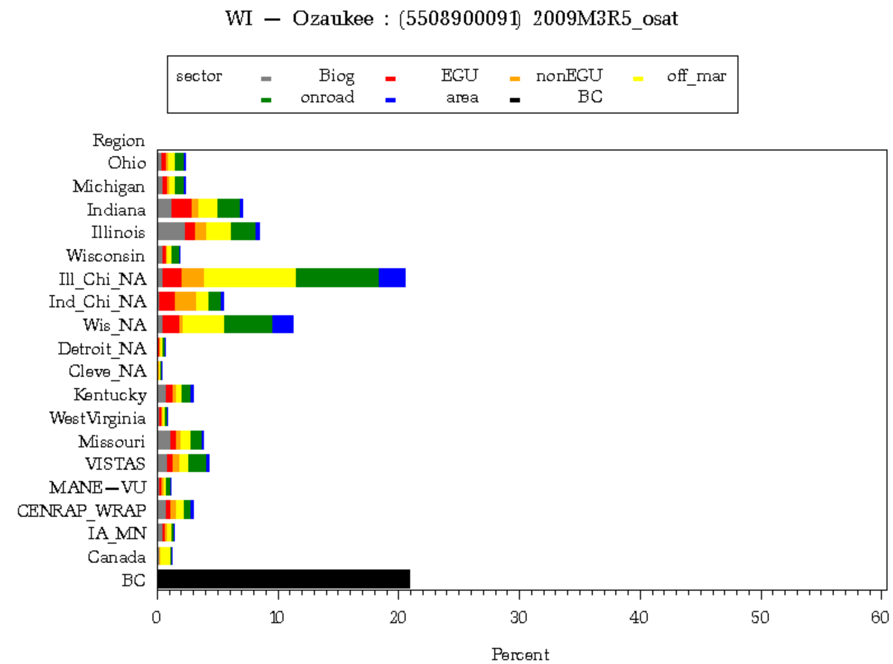
Biog EGU nonEGU off_mar onroad area BC
Sector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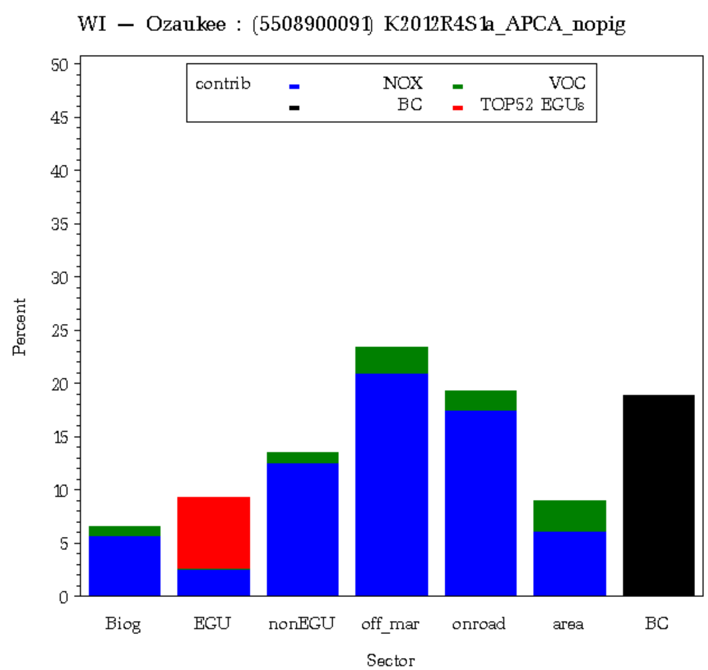
Indiana
Illinois
Wisconsin
Ill_Chi_NA
Ind_Chi_NA
Wis_NA
Detroit_NA
Cleve_NA
Kentucky
WestVirginia
Missouri
VISTAS
MANE—VU
CENRAP_WRAP
IA_MN
Canada
BC
0 10 20 30 40 50 60
Percent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contrib NOX VOC BC TOP52 EGUs
Percent
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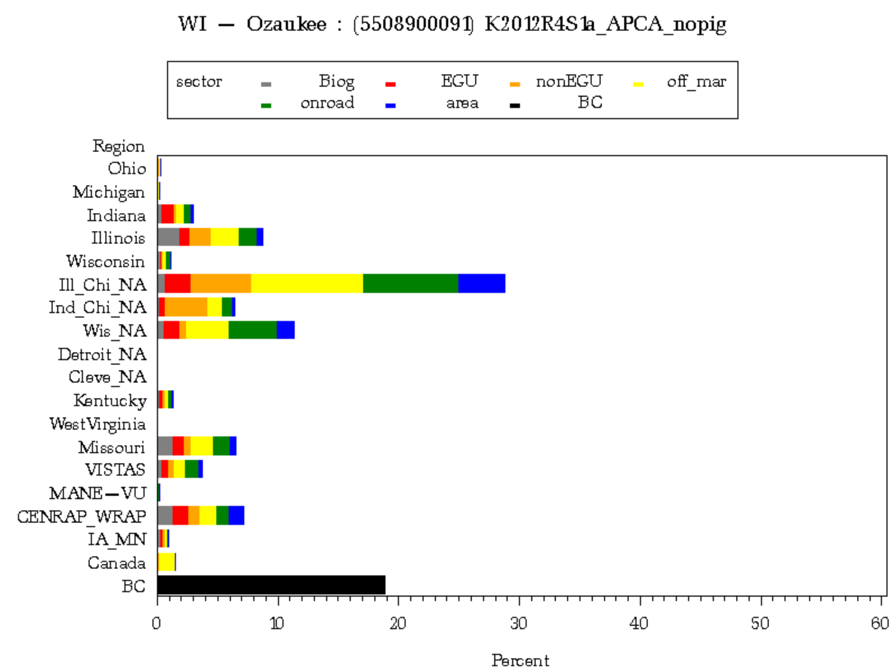
Biog EGU nonEGU off_mar onroad area BC
Sector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Region
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Indiana
Illinois
Wisconsin
Ill_Chi_NA
Ind_Chi_NA
Wis_NA
Detroit_NA
Cleve_NA
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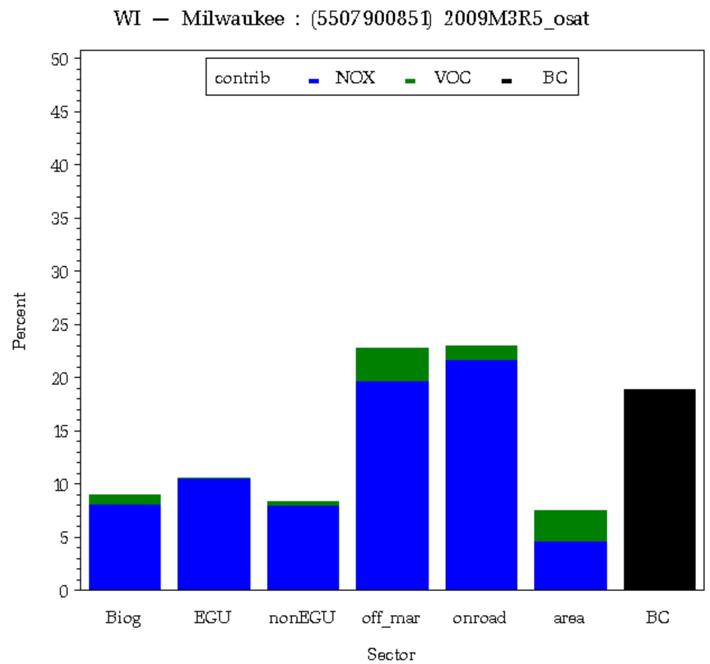
VISTAS
MANE—VU
CENRAP_WRAP
IA_MN
Canada
BC
0 10 20 30 40 50 60
Percent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contrib NOX VOC BC
Percent
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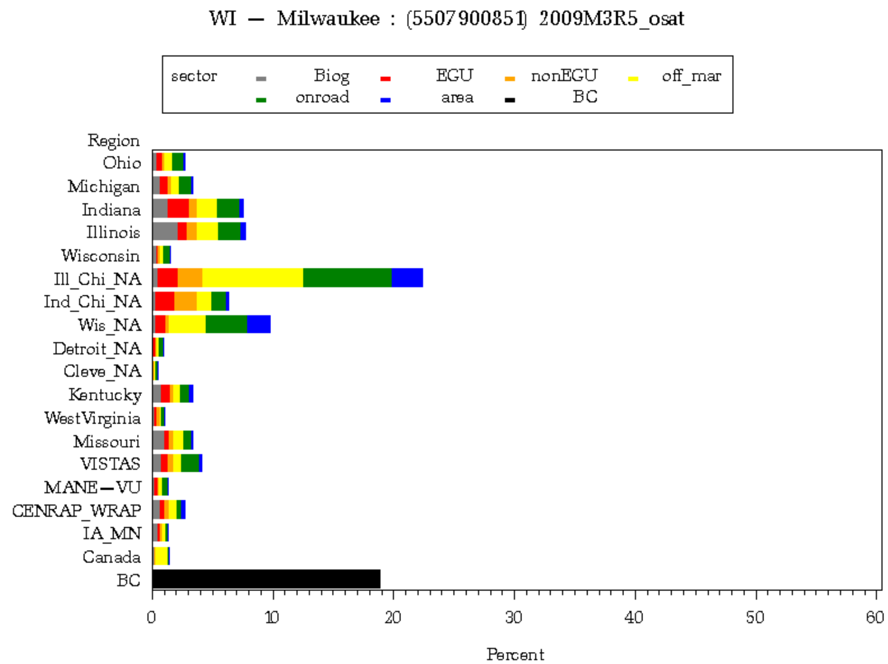
Sector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Indiana
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Wisconsin
Ill_Chi_NA
Ind_Chi_NA
Wis_NA
Detroit_NA
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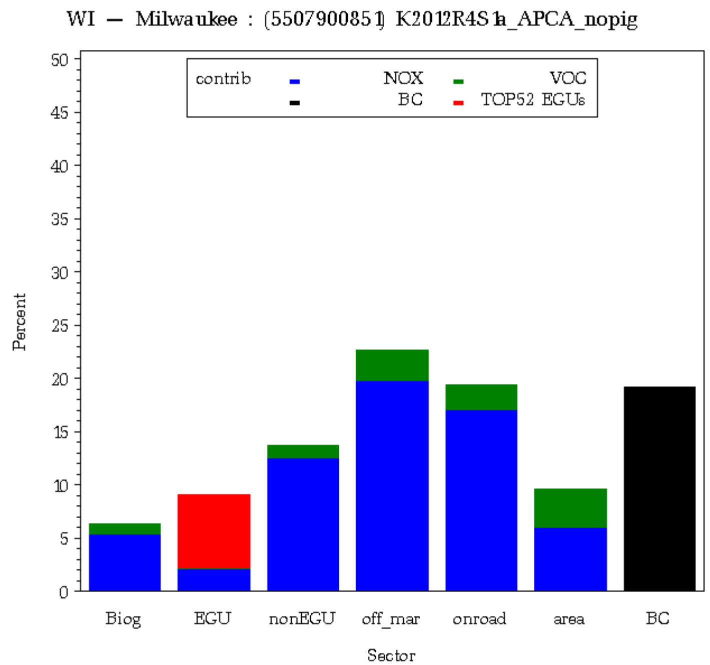
Missouri
VISTAS
MANE-VU
CENRAP_WRAP
IA_MN
Canada
BC
Percent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Percent
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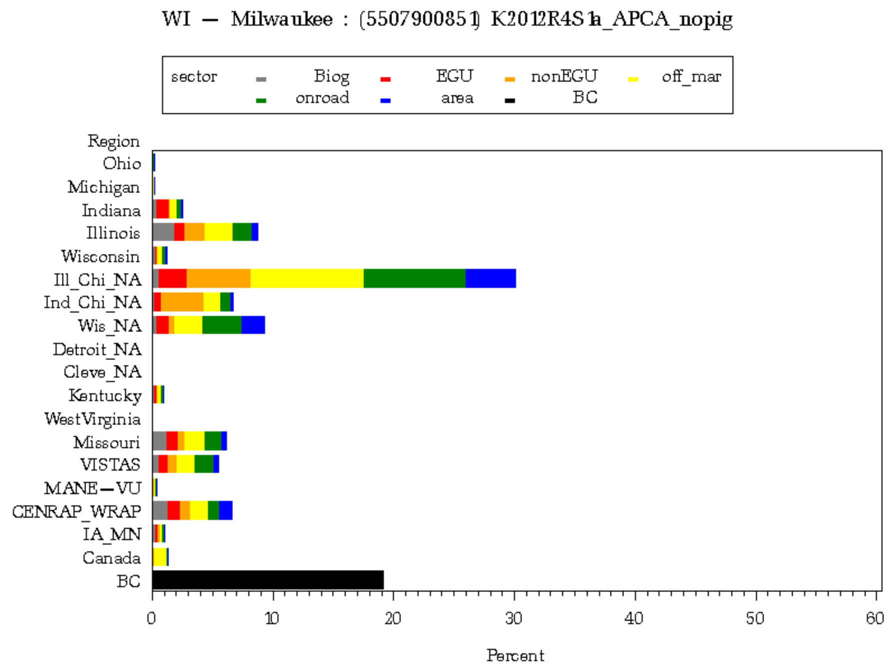
Sector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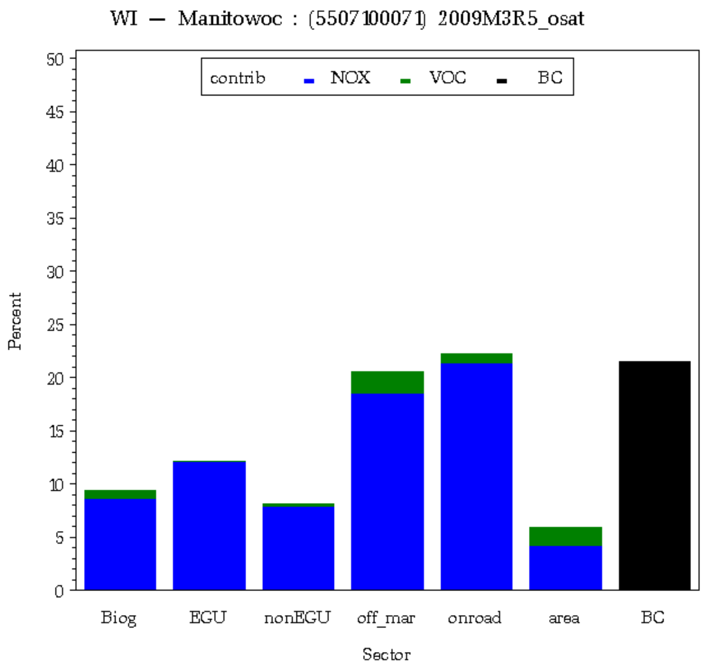
Indiana
Illinois
Wisconsin
Ill_Chi_NA
Ind_Chi_NA
Wis_NA
Detroit_NA
Cleve_NA
Kentucky
WestVirginia
Missouri
VISTAS
MANE-VU
CENRAP_WRAP
IA_MN
Canada
BC
Percent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Percent
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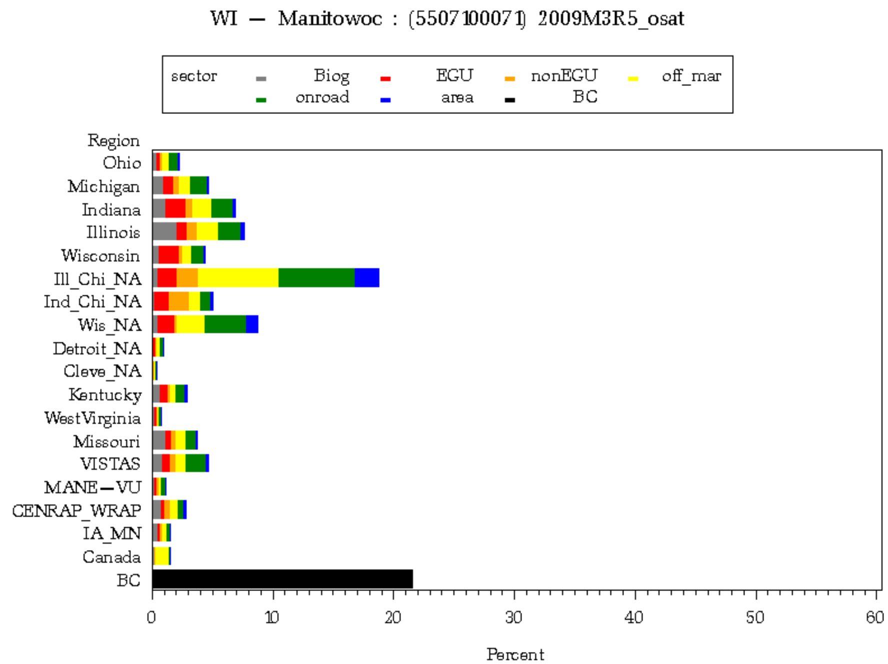
Sector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Illinois
Wisconsin
Ill_Chi_NA
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Wis_NA
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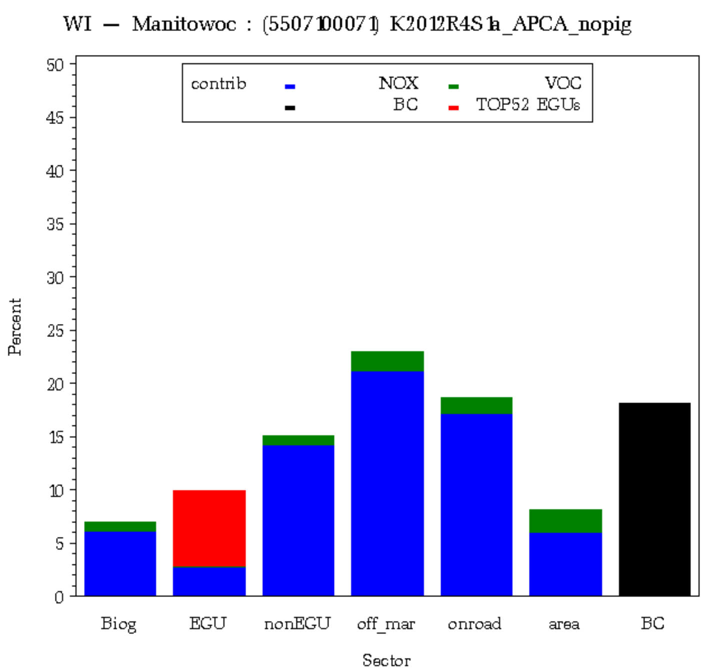
Missouri
VISTAS
MANE—VU
CENRAP_WRAP
IA_MN
Canada
BC
Percent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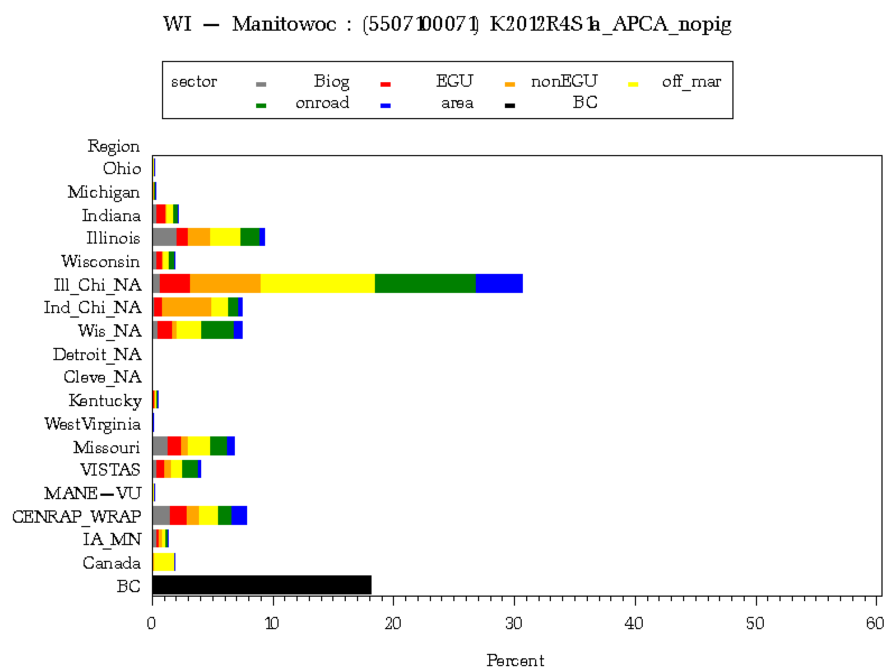
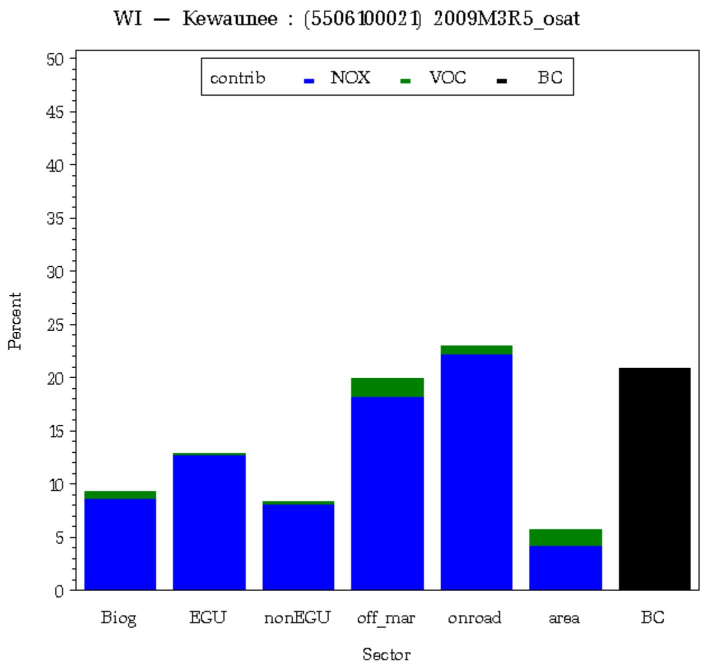
contrib NOX VOC BC TOP52 EGUs
Percent
Biog EGU nonEGU off_mar onroad area BC
Sector


WI — Manitowoc : (550710007 1) K2012R4S1a_APCA_nopig
sector Biog EGU nonEGU off_mar onroad area BC
Region
Ohio
Michigan
Indiana
Illinois
Wisconsin
Ill_Chi_NA
Ind_Chi_NA
Wis_NA
Detroit_NA
Cleve_NA
Kentucky
WestVirginia
Missouri
VISTAS
MANE—VU
CENRAP_WRAP
IA_MN
Canada
BC
Percent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contrib NOX VOC BC
Percent
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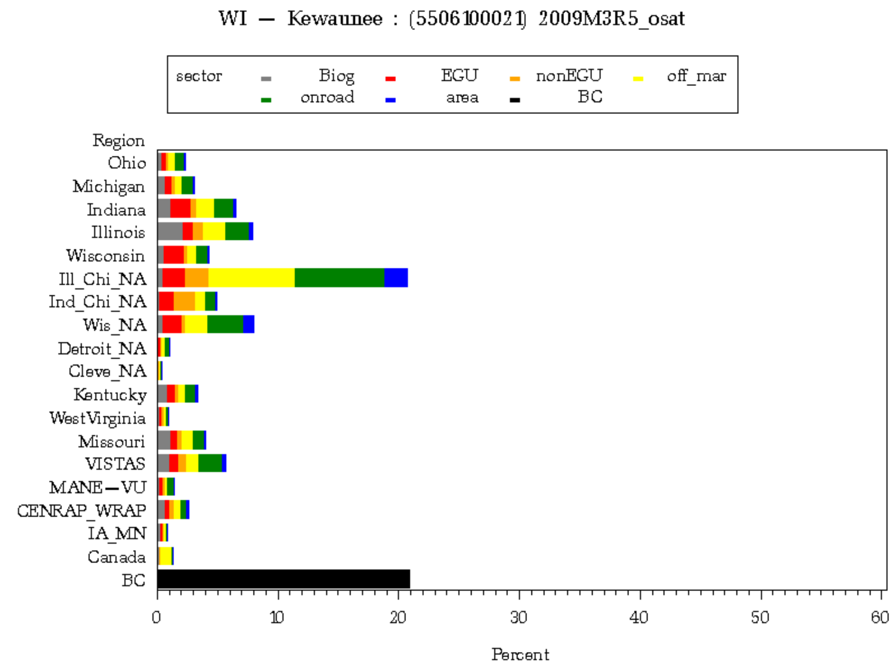
Biog EGU nonEGU off_mar onroad area BC
Sector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sector Biog EGU nonEGU off_mar onroad area BC
Region
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Michigan
Indiana
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Wisconsin
Ill_Chi_NA
Ind_Chi_NA
Wis_NA
Detroit_NA
Cleve_NA
Kentucky
WestVirginia
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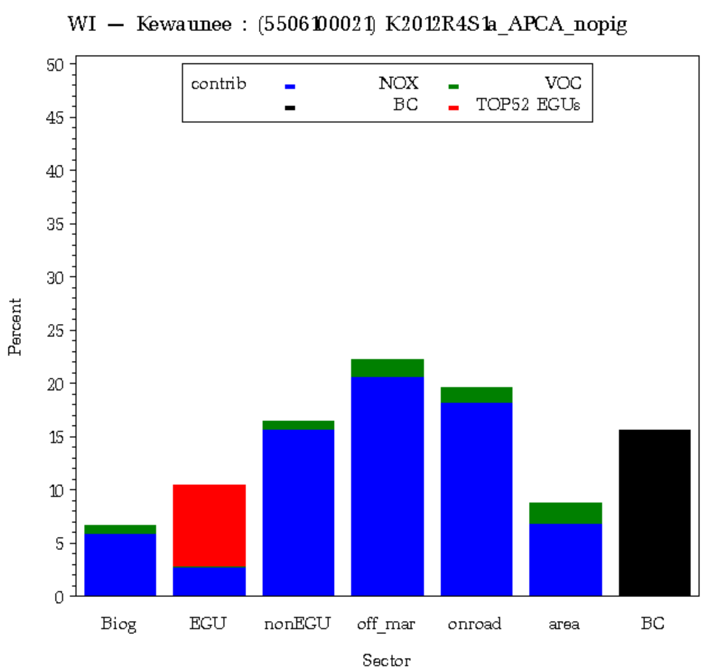
VISTAS
MANE—VU
CENRAP_WRAP
IA_MN
Canada
BC
0 10 20 30 40 50 60
Percent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contrib NOX VOC BC TOP52 EGUs
Percent
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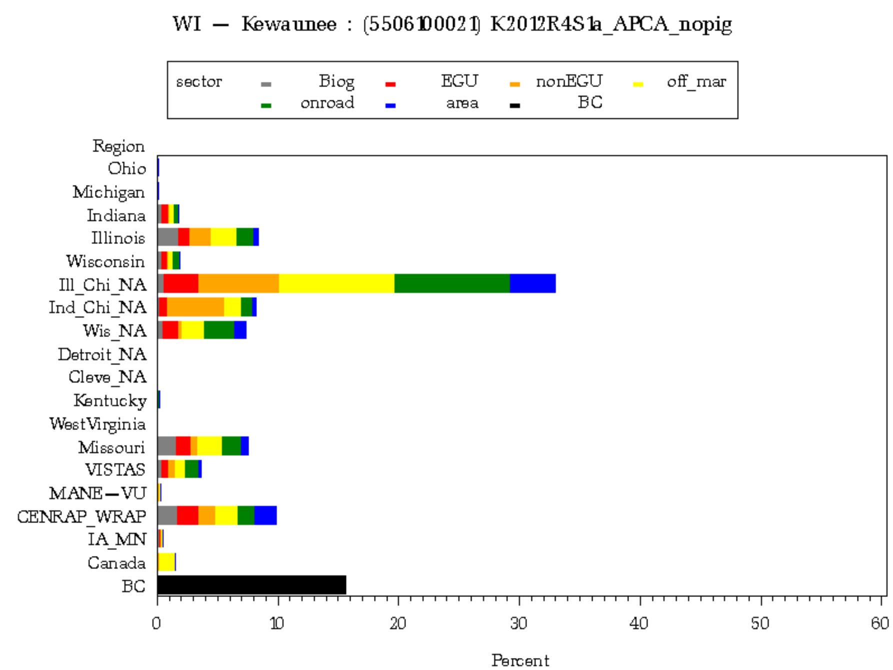
Biog EGU nonEGU off_mar onroad area BC
Sector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Region
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Indiana
Illinois
Wisconsin
Ill_Chi_NA
Ind_Chi_NA
Wis_NA
Detroit_NA
Cleve_NA
Kentucky
WestVirginia
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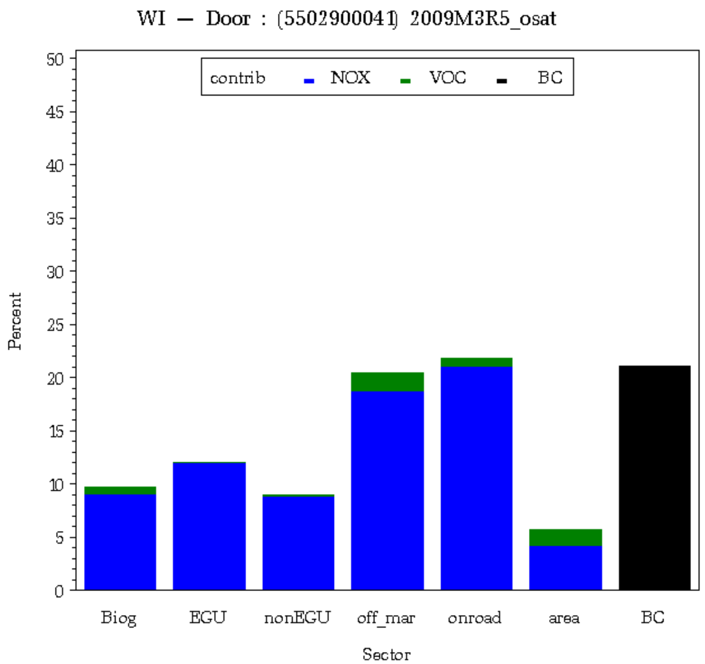
VISTAS
MANE—VU
CENRAP_WRAP
IA_MN
Canada
BC
0 10 20 30 40 50 60
Percent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Percent
Sector
Biog EGU nonEGU off_mar onroad area BC
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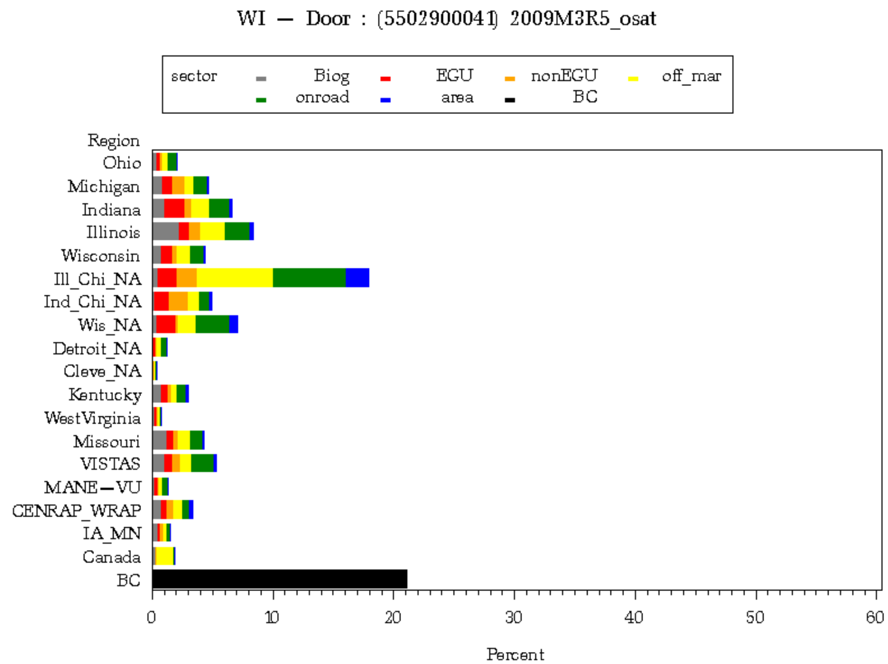
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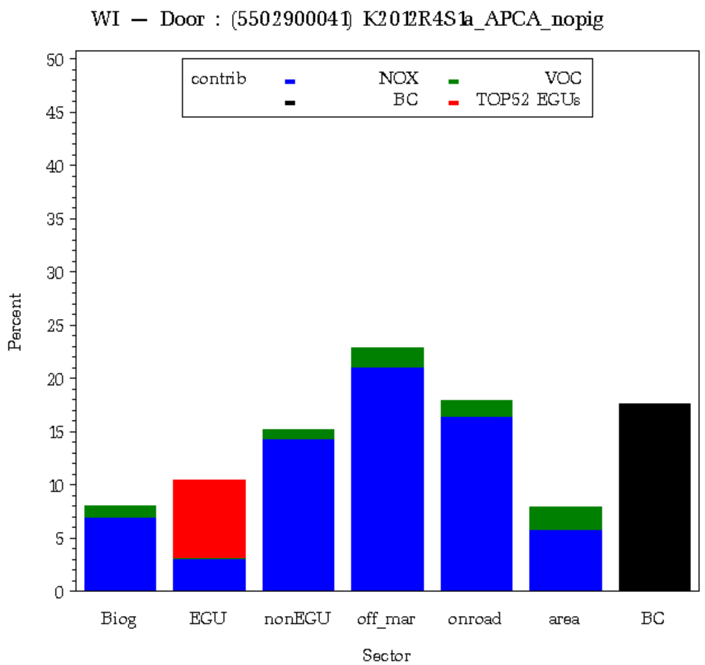
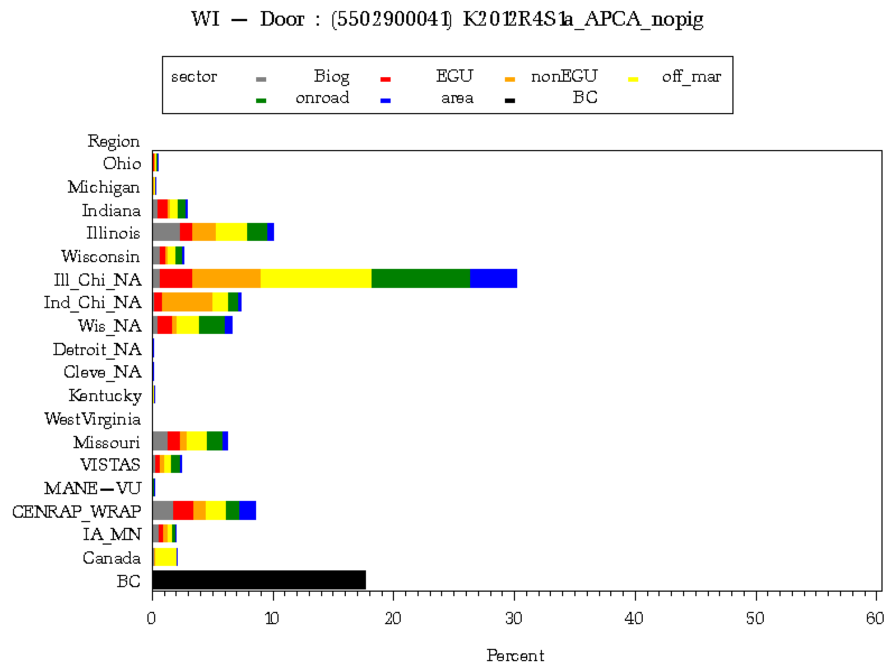
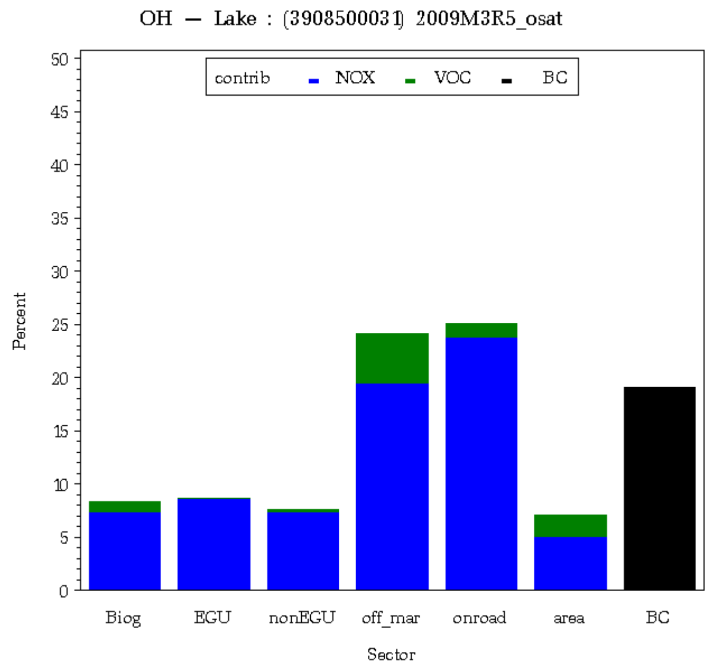
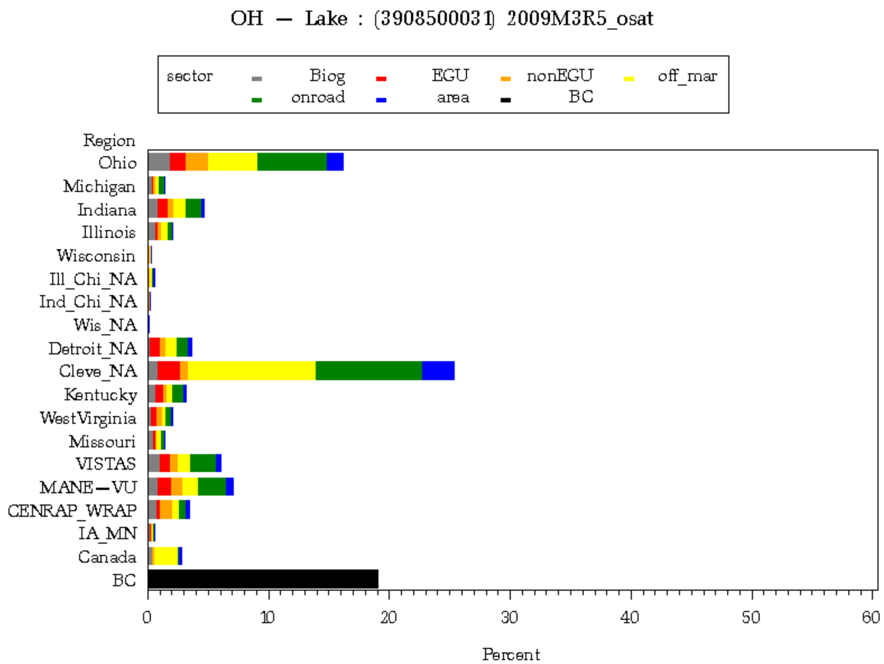
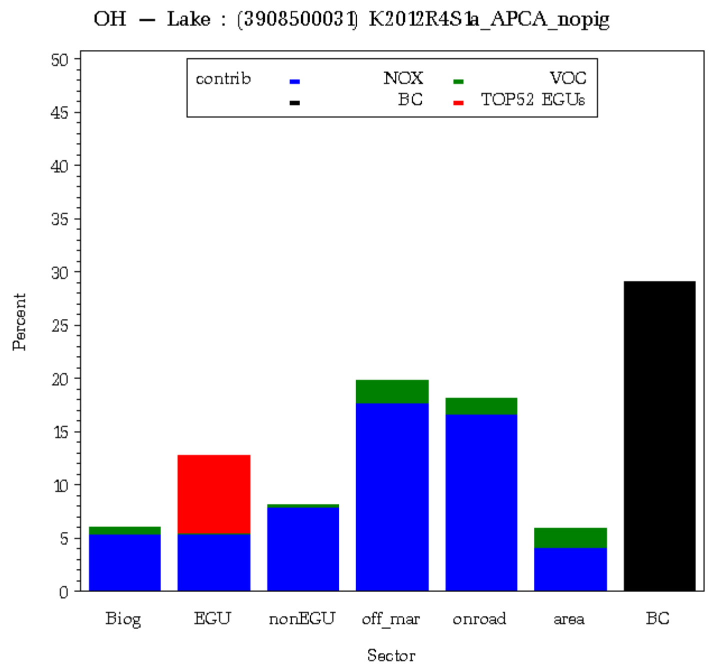
Region
Ohio
Michigan
Indiana
Illinois
Wisconsin
Ill_Chi_NA
Ind_Chi_NA
Wis_NA
Detroit_NA
Cleve_NA
Kentucky
WestVirginia
Missouri
VISTAS
MANE—VU
CENRAP_WRAP
IA_MN
Canada
BC
0 10 20 30 40 50 60
Percent

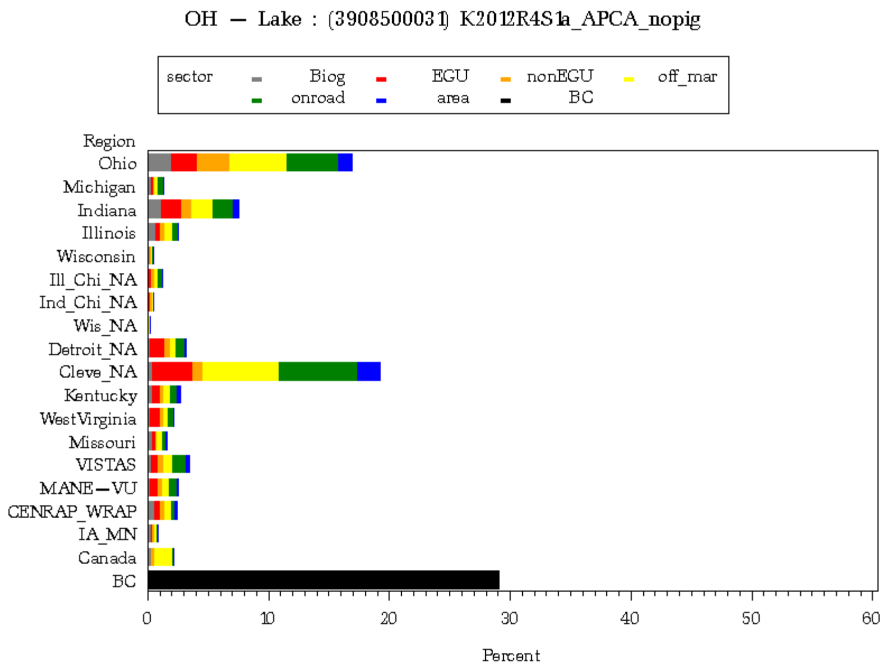

WI — Door : (5502900041) K2012R4S1a_APCA_nopig
contrib NOX VOC BC TOP52 EGUs
Percent
Sector
Biog EGU nonEGU off_mar onroad area BC
0 5 10 15 20 25 30 35 40 45 50


WI — Door : (5502900041) K2012R4S1a_APCA_nopig
sector Biog EGU nonEGU off_mar onroad area BC
Region
Ohio
Michigan
Indiana
Illinois
Wisconsin
Ill_Chi_NA
Ind_Chi_NA
Wis_NA
Detroit_NA
Cleve_NA
Kentucky
WestVirginia
Missouri
VISTAS
MANE—VU
CENRAP_WRAP
IA_MN
Canada
BC
0 10 20 30 40 50 60
Percent

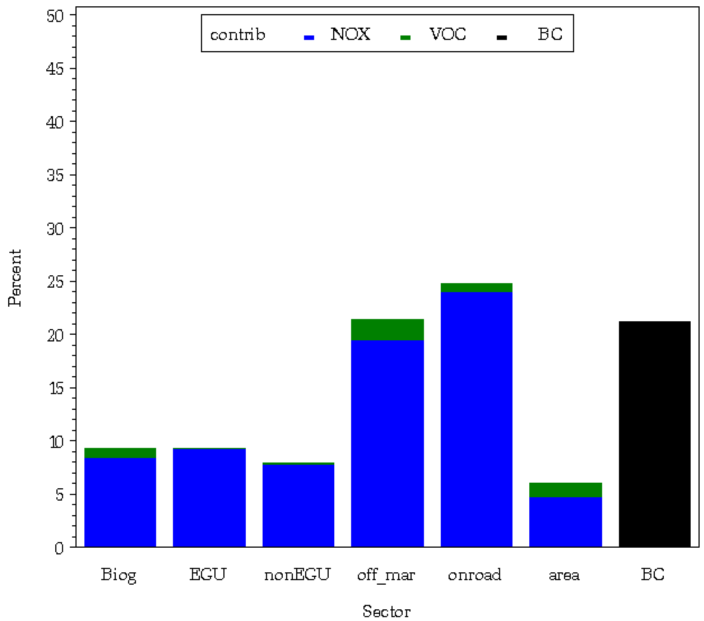

OH — Lake : (390850003 1) 2009M3R5_osat
contrib NOX VOC BC
Percent
Sector
Biog EGU nonEGU off_mar onroad area BC


OH — Lake : (390850003 1) 2009M3R5_osat
sector Biog EGU nonEGU off_mar onroad area BC
Region
Ohio
Michigan
Indiana
Illinois
Wisconsin
Ill_Chi_NA
Ind_Chi_NA
Wis_NA
Detroit_NA
Cleve_NA
Kentucky
WestVirginia
Missouri
VISTAS
MANE—VU
CENRAP_WRAP
IA_MN
Canada
BC
Percent

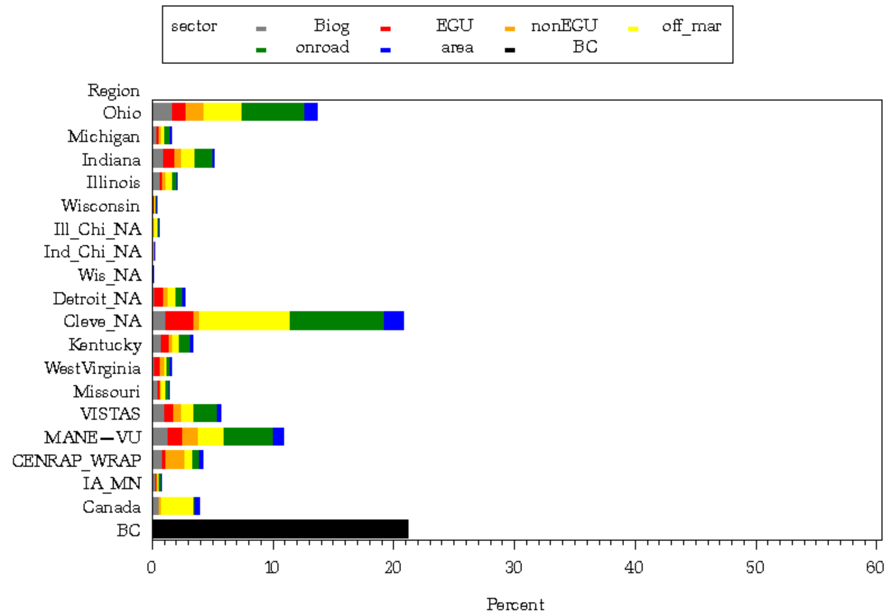

OH — Lake : (390850003 1) K2012R4S1a_APCA_nopig
contrib NOX VOC BC TOP52 EGUs
Percent
Sector
Biog EGU nonEGU off_mar onroad area BC


OH — Lake : (390850003 1) K2012R4S1a_APCA_nopig
sector Biog EGU nonEGU off_mar onroad area BC
Region
Ohio
Michigan
Indiana
Illinois
Wisconsin
Ill_Chi_NA
Ind_Chi_NA
Wis_NA
Detroit_NA
Cleve_NA
Kentucky
WestVirginia
Missouri
VISTAS
MANE—VU
CENRAP_WRAP
IA_MN
Canada
BC
Percent

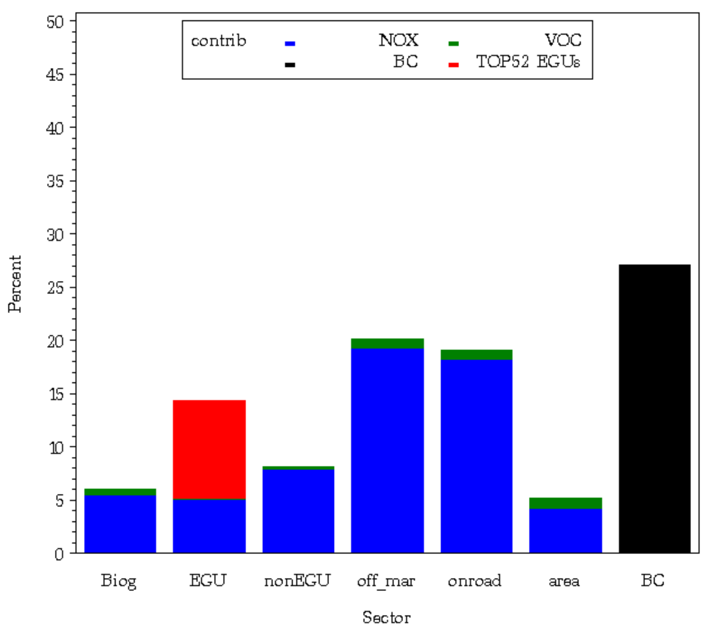
OH — Ashtabula : (390071001) 2009M3R5_osat



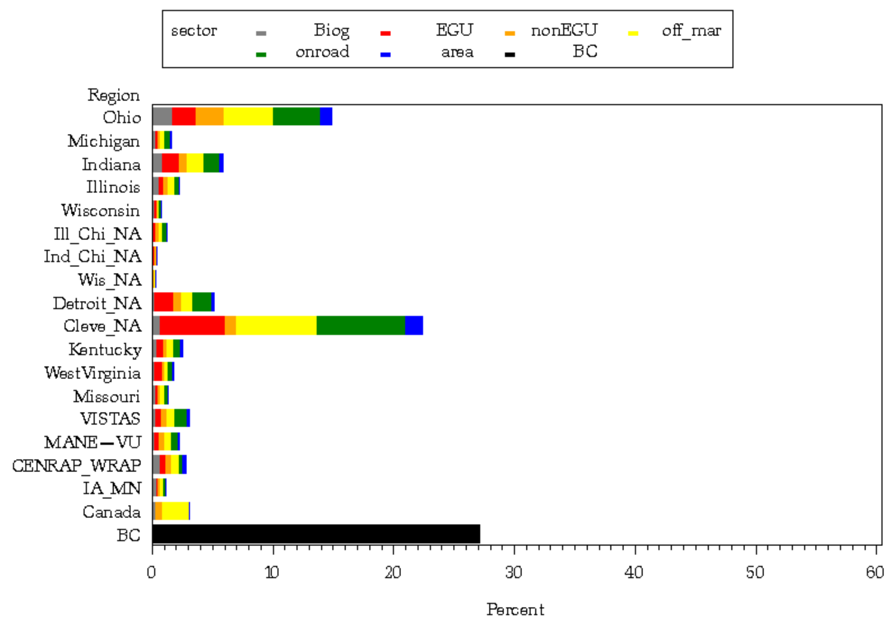
OH — Ashtabula : (390071001) 2009M3R5_osat

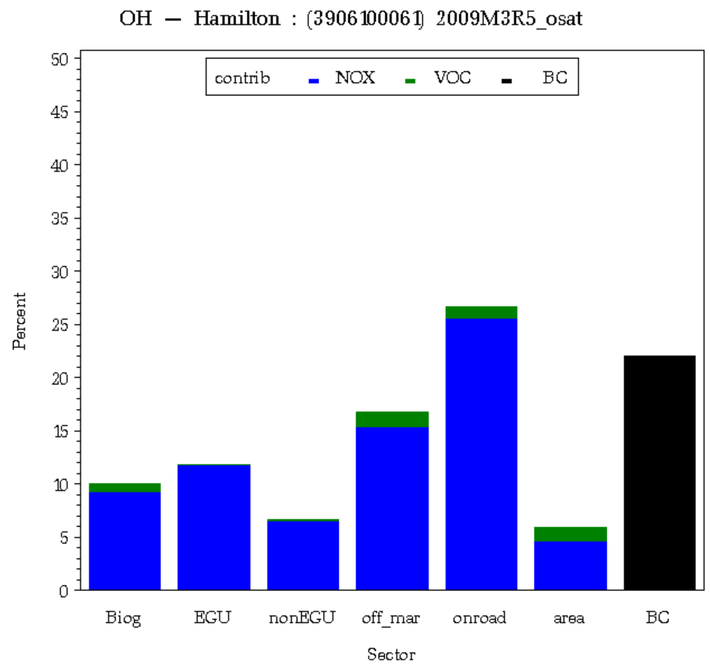


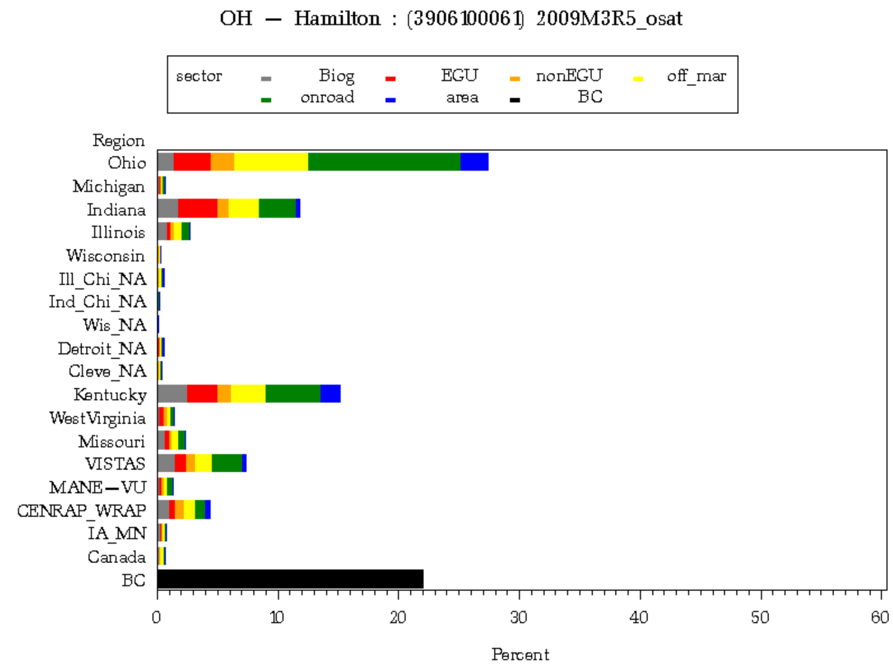
OH — Ashtabula : (390071001) K2012R4S1a_APCA_nopig

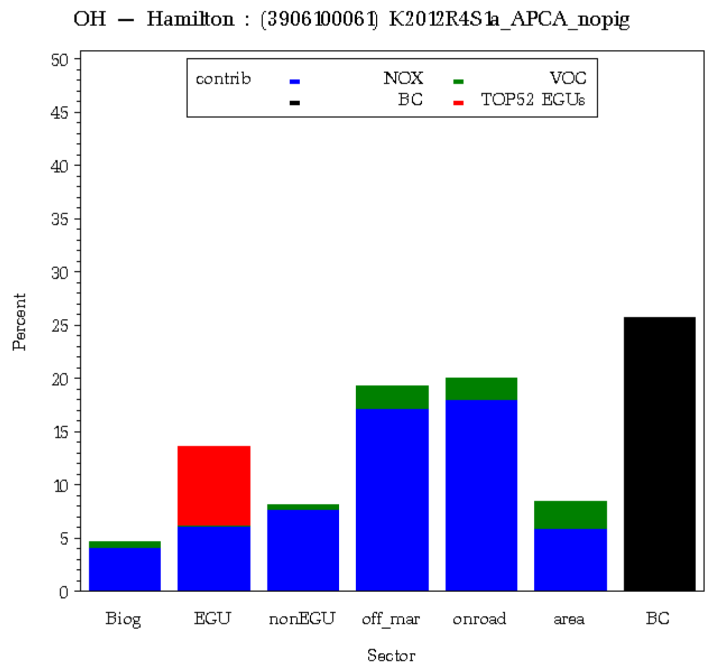


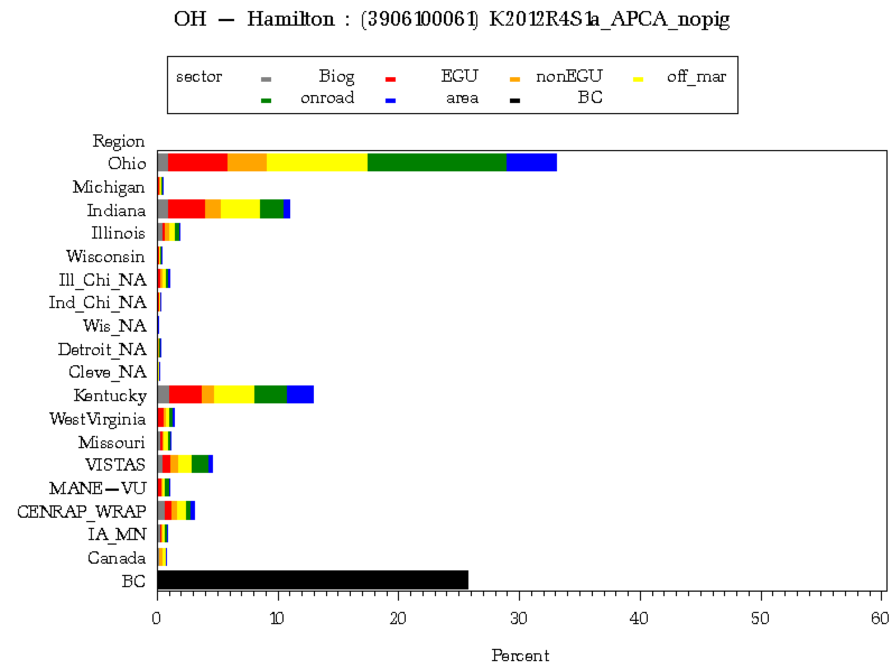
OH — Ashtabula : (390071001) K2012R4S1a_APCA_nopig

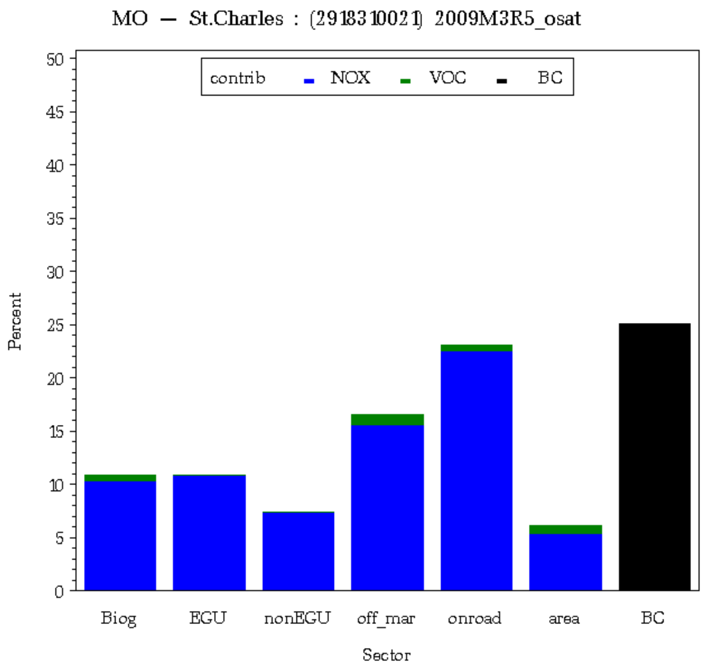



OH — Hamilton : (390610006 1) 2009M3R5_osat
contrib NOX VOC BC
Percent
Sector
Biog EGU nonEGU off_mar onroad area BC
0 5 10 15 20 25 30 35 40 45 50

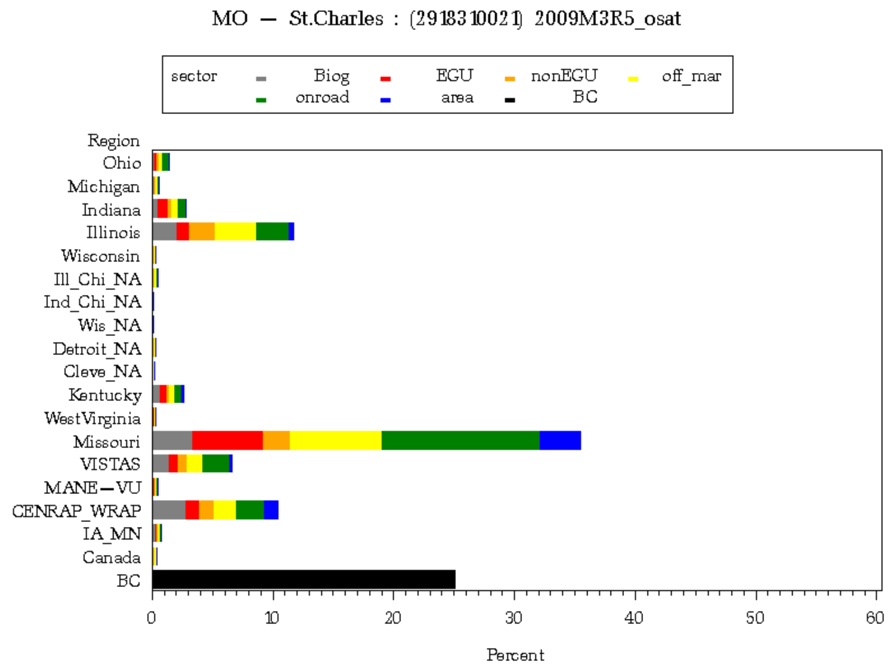

OH — Hamilton : (390610006 1) 2009M3R5_osat
sector Biog EGU nonEGU off_mar onroad area BC
Region
Ohio Michigan Indiana Illinois Wisconsin Ill_Chi_NA Ind_Chi_NA Wis_NA Detroit_NA Cleve_NA Kentucky WestVirginia Missouri VISTAS MANE—VU CENRAP_WRAP IA_MN Canada BC
Percent
0 10 20 30 40 50 60


OH — Hamilton : (390610006 1) K2012R4S1a_APCA_nopig
contrib NOX VOC BC TOP52 EGUs
Percent
Sector
Biog EGU nonEGU off_mar onroad area BC
0 5 10 15 20 25 30 35 40 45 50


OH — Hamilton : (390610006 1) K2012R4S1a_APCA_nopig
sector Biog EGU nonEGU off_mar onroad area BC
Region
Ohio Michigan Indiana Illinois Wisconsin Ill_Chi_NA Ind_Chi_NA Wis_NA Detroit_NA Cleve_NA Kentucky WestVirginia Missouri VISTAS MANE—VU CENRAP_WRAP IA_MN Canada BC
Percent
0 10 20 30 40 50 60

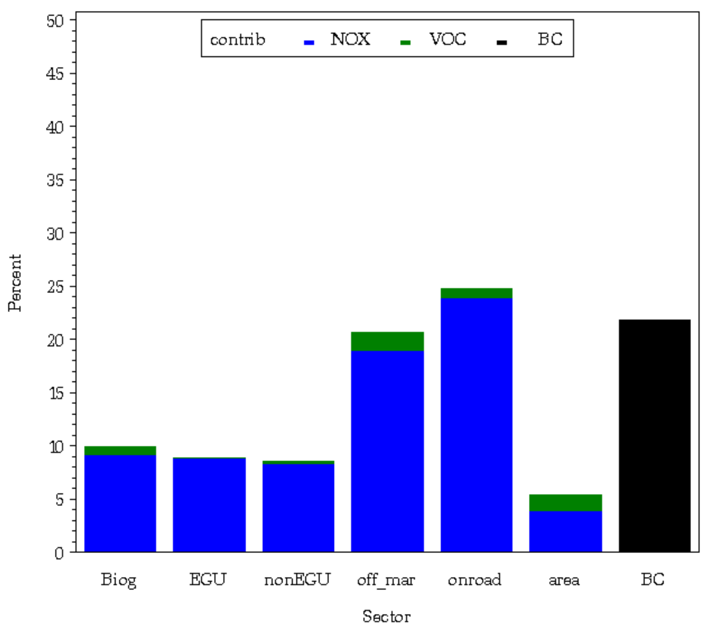


MO — St.Charles : (291831002 1) 2009M3R5_osat
contrib NOX VOC BC
Percent
0
5
10
15
20
25
30
35
40
45
50
Biog
EGU
nonEGU
off_mar
onroad
area
BC
Sector

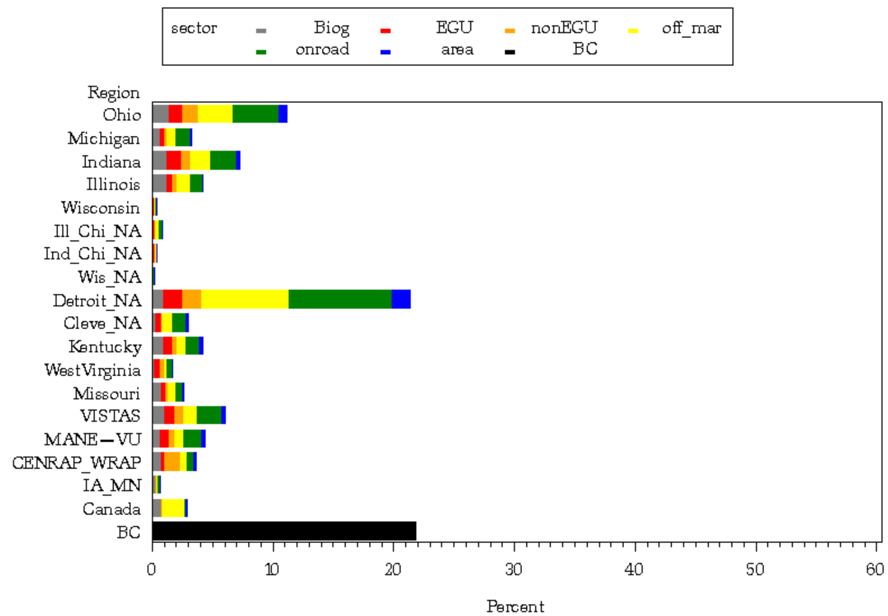


MO — St.Charles : (291831002 1) 2009M3R5_osat
sector Biog EGU nonEGU off_mar onroad area BC
Region
Ohio
Michigan
Indiana
Illinois
Wisconsin
Ill_Chi_NA
Ind_Chi_NA
Wis_NA
Detroit_NA
Cleve_NA
Kentucky
WestVirginia
Missouri
VISTAS
MANE—VU
CENRAP_WRAP
IA_MN
Canada
BC
0
10
20
30
40
50
60
Percent

MI — Macomb : (260990009) 2009M3R5_osat



MI — Macomb : (260990009) 2009M3R5_osat



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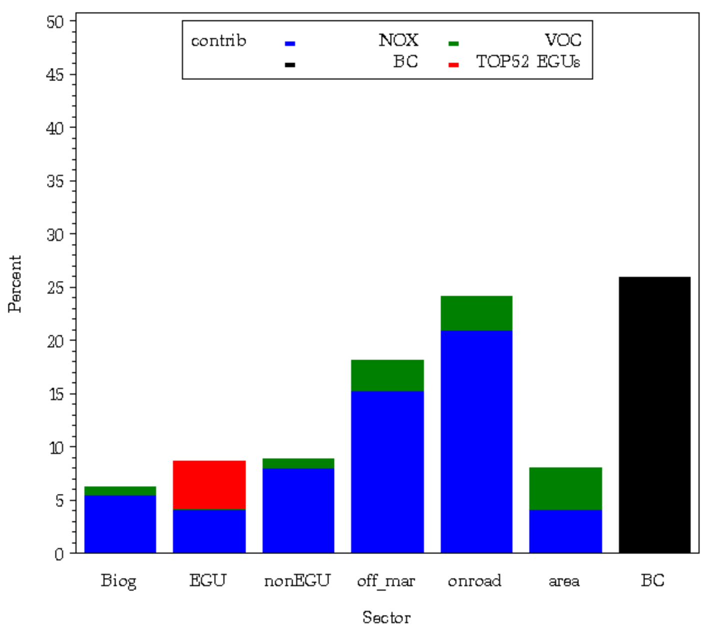

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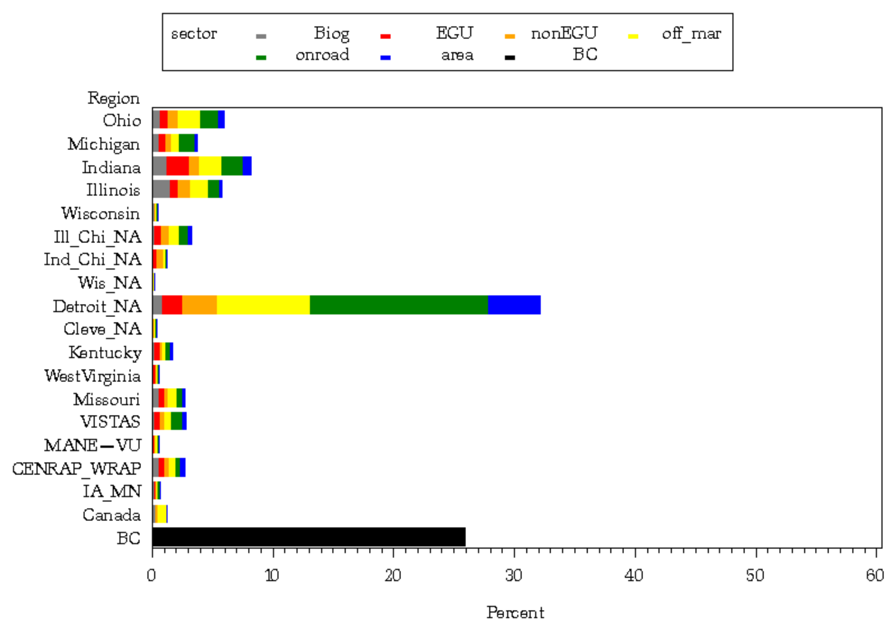

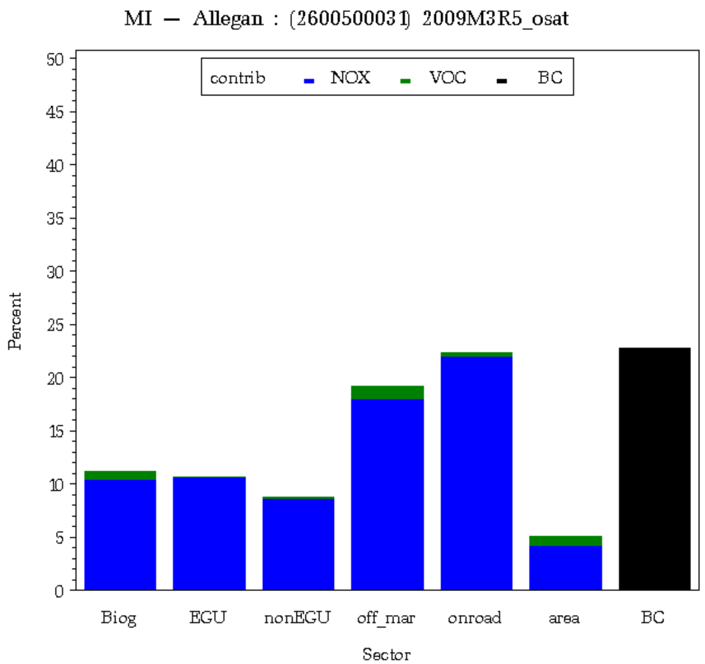
MI — Allegan : (260050031) 2009M3R5_osat
contrib
NOX
VOC
BC
Percent
Sector
Biog
EGU
nonEGU
off_mar
onroad
area
BC
0
5
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15
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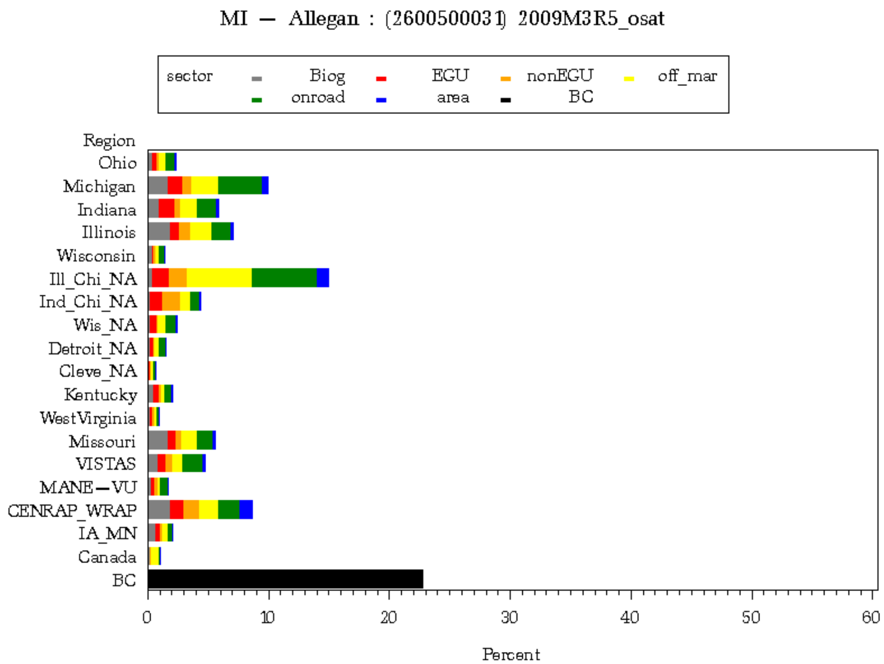
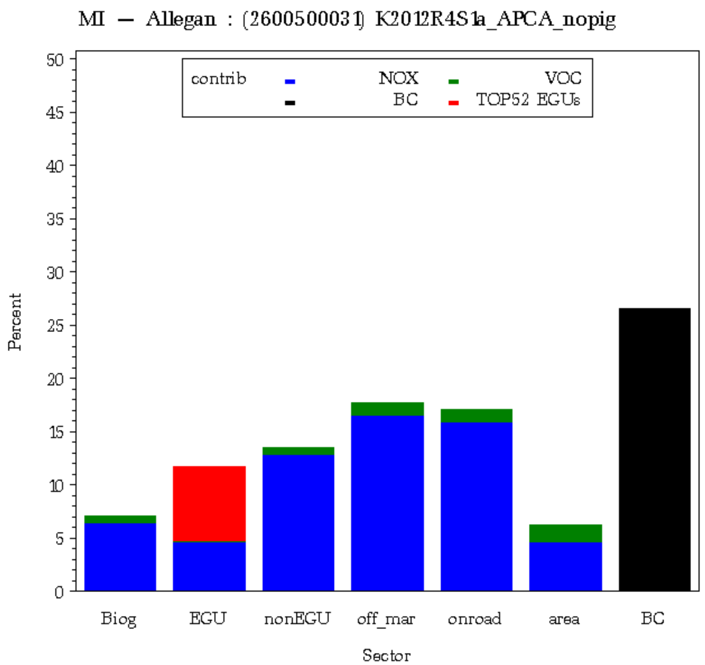
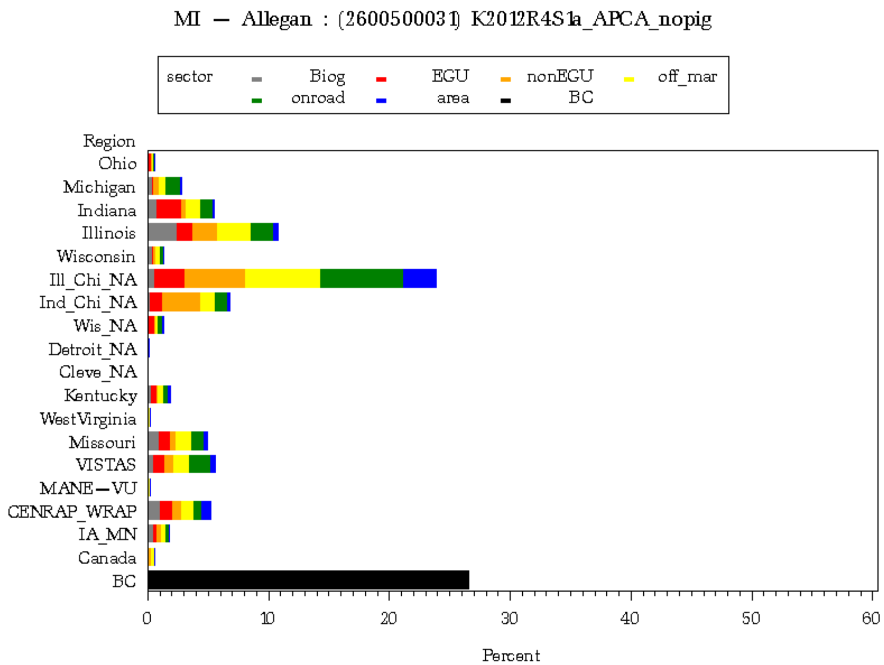
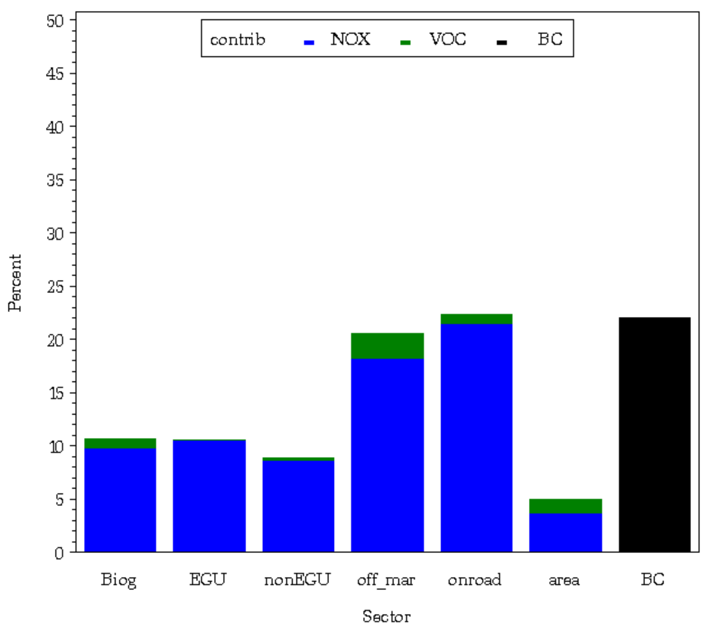
25
30
35
40
45
50


MI — Allegan : (260050031) 2009M3R5_osat
sector
Biog
EGU
nonEGU
off_mar
onroad
area
BC
Region
Ohio
Michigan
Indiana
Illinois
Wisconsin
Ill_Chi_NA
Ind_Chi_NA
Wis_NA
Detroit_NA
Cleve_NA
Kentucky
WestVirginia
Missouri
VISTAS
MANE-VU
CENRAP_WRAP
IA_MN
Canada
BC
0
10
20
30
40
50
60
Percent


MI — Allegan : (260050031) K2012R4S1a_APCA_nopig
contrib
NOX
VOC
BC
TOP52 EGUs
Percent
Sector
Biog
EGU
nonEGU
off_mar
onroad
area
BC
0
5
10
15
20
25
30
35
40
45
50


MI — Allegan : (260050031) K2012R4S1a_APCA_nopig
sector
Biog
EGU
nonEGU
off_mar
onroad
area
BC
Region
Ohio
Michigan
Indiana
Illinois
Wisconsin
Ill_Chi_NA
Ind_Chi_NA
Wis_NA
Detroit_NA
Cleve_NA
Kentucky
WestVirginia
Missouri
VISTAS
MANE-VU
CENRAP_WRAP
IA_MN
Canada
BC
0
10
20
30
40
50
60
Percent

IN — LaPorte : (1809100051) 2009M3R5_osat



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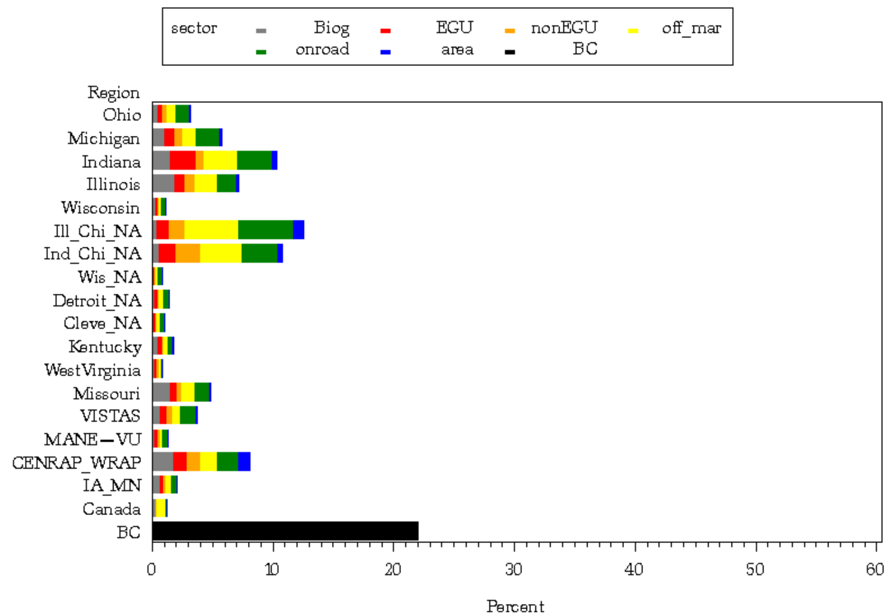
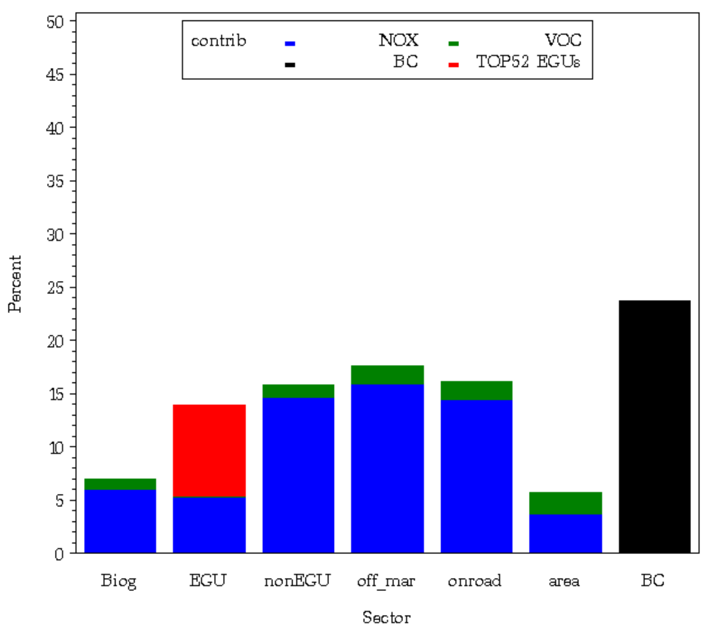
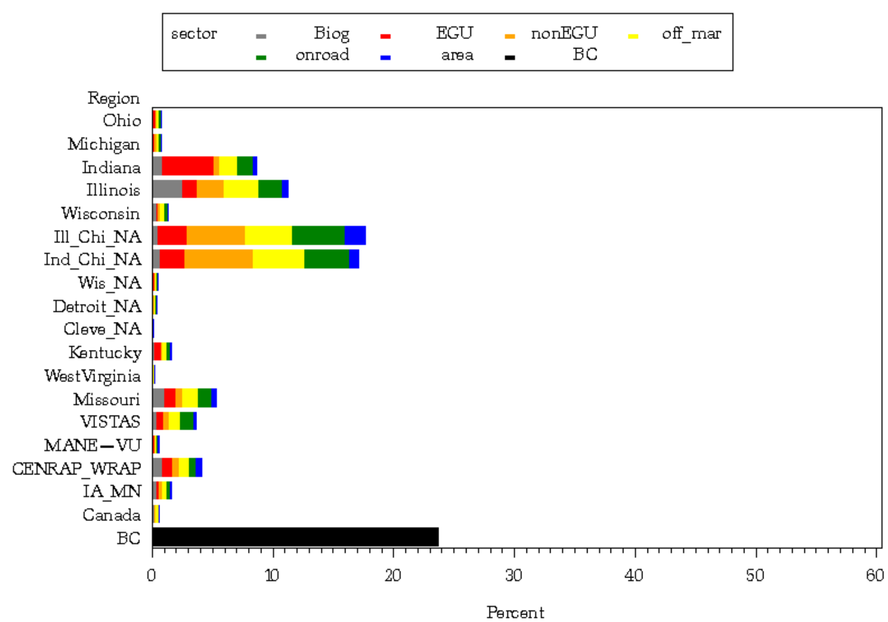
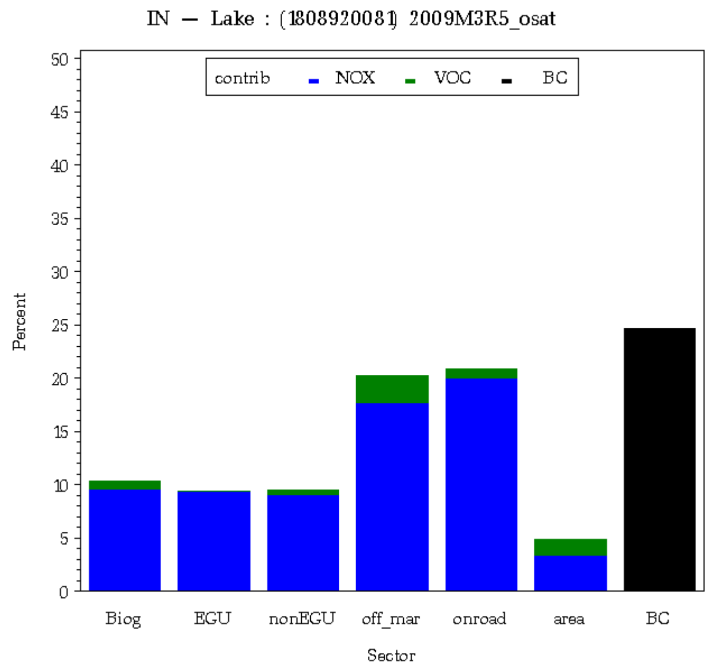


IN — LaPorte : (1809100051) K2012R4S1a_APCA_nopig

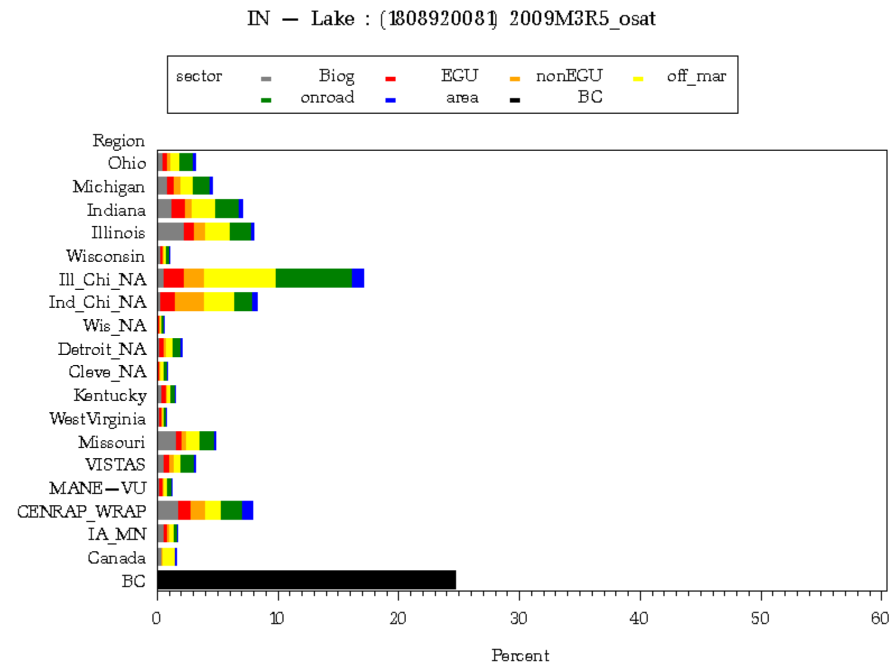


IN — LaPorte : (1809100051) K2012R4S1a_APCA_nopig



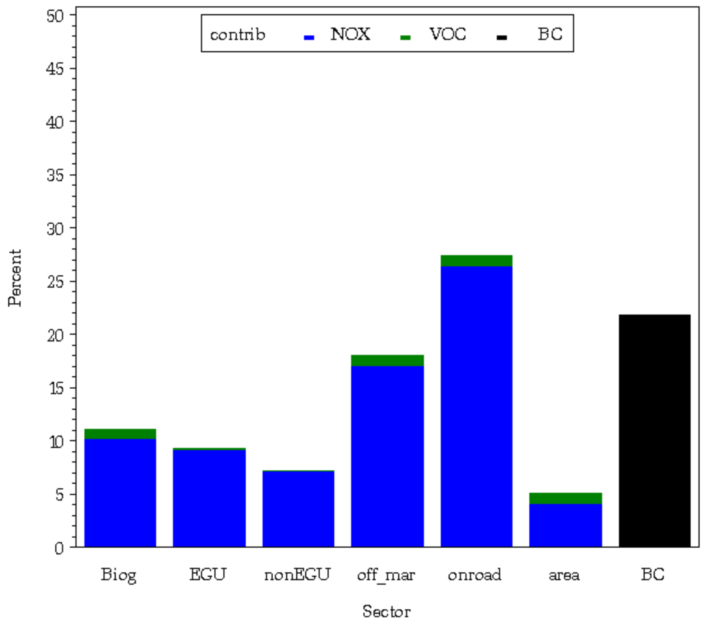


IN — Lake : (180892008I) 2009M3R5_osat
contrib NOX VOC BC
Percent
0
5
10
15
20
25
30
35
40
45
50
Biog
EGU
nonEGU
off_mar
onroad
area
BC
Sector

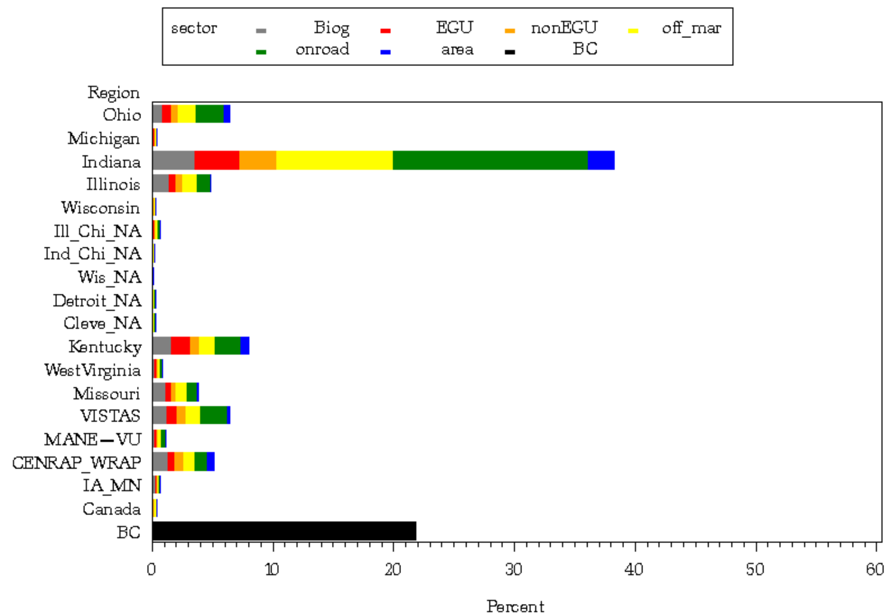


IN — Lake : (180892008I) 2009M3R5_osat
sector Biog EGU nonEGU off_mar onroad area BC
Region
Ohio
Michigan
Indiana
Illinois
Wisconsin
Ill_Chi_NA
Ind_Chi_NA
Wis_NA
Detroit_NA
Cleve_NA
Kentucky
WestVirginia
Missouri
VISTAS
MANE—VU
CENRAP_WRAP
IA_MN
Canada
BC
0
10
20
30
40
50
60
Percent

IN — Hamilton : (180571001l) 2009M3R5_osat



IN — Hamilton : (180571001l) 2009M3R5_osat



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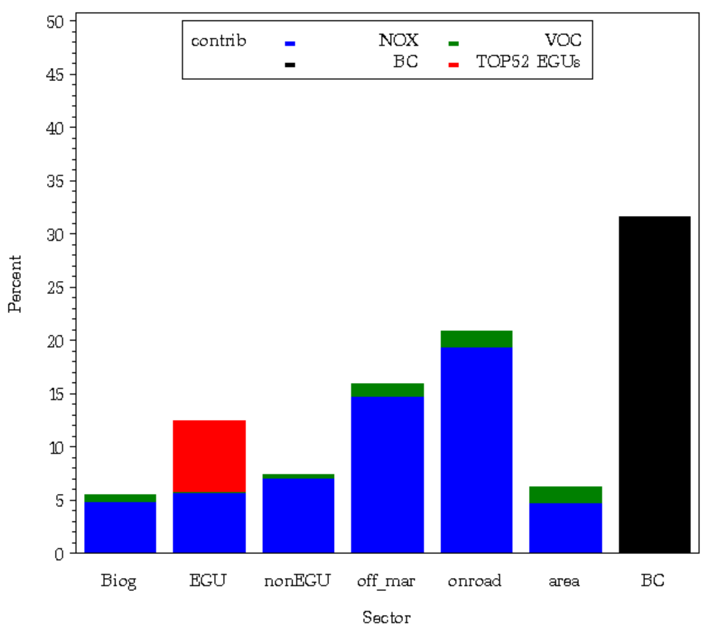
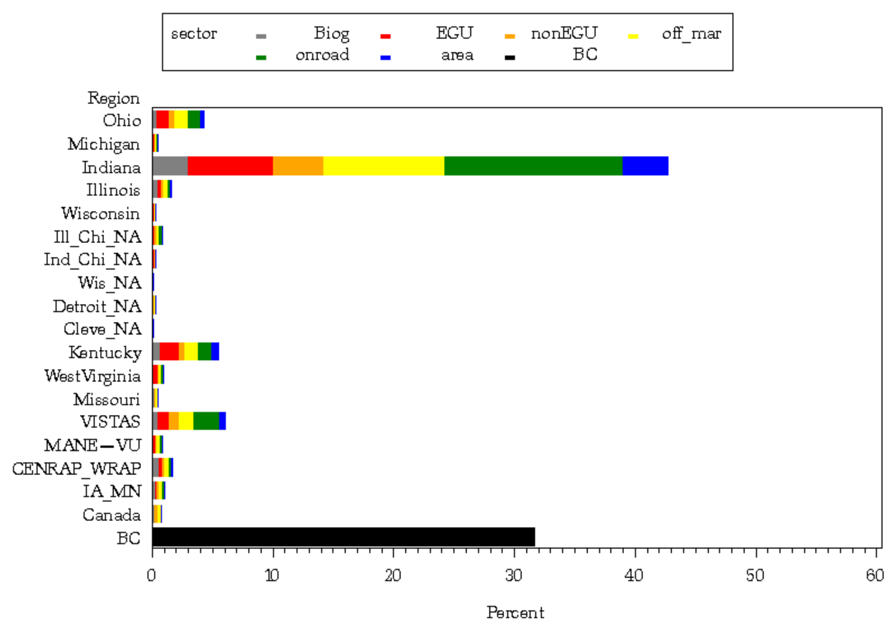


IN — Hamilton : (180571001l) K2012R4S1a_APCA_nopig

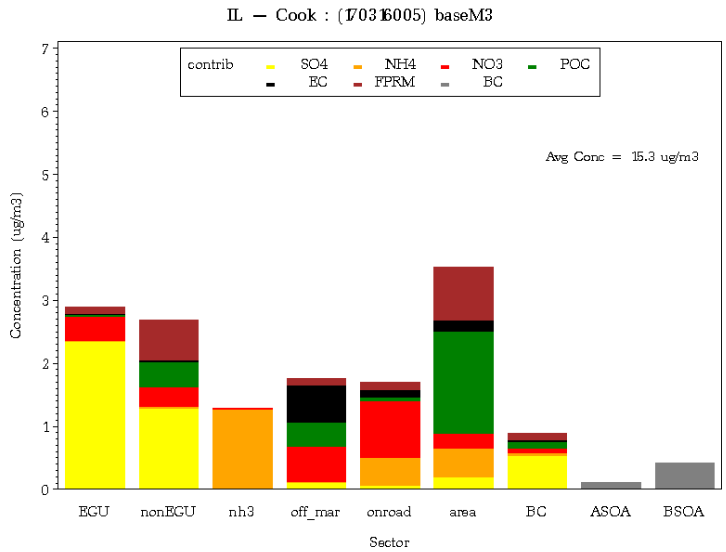


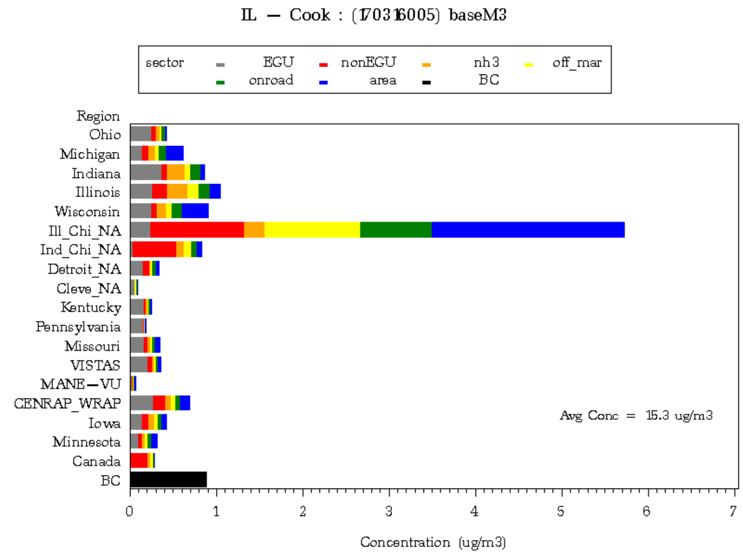
APPENDIX III

$PM_{2.5}$ Source Apportionment Modeling Results

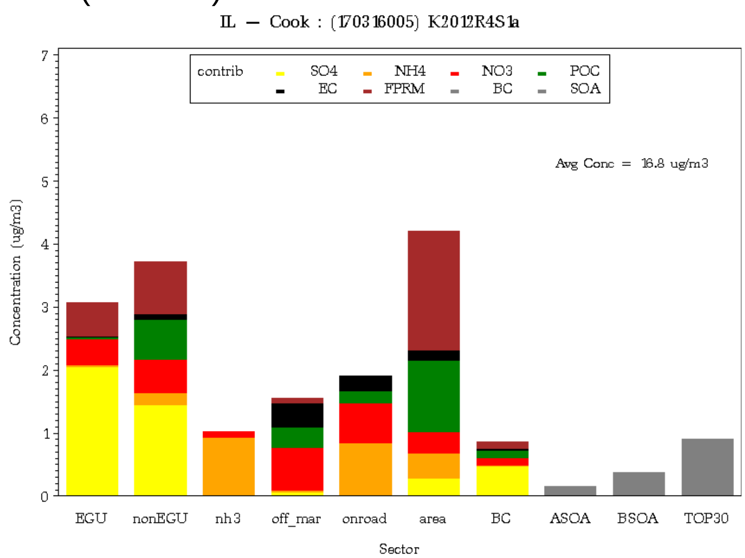
Chicago (Cicero), Illinois

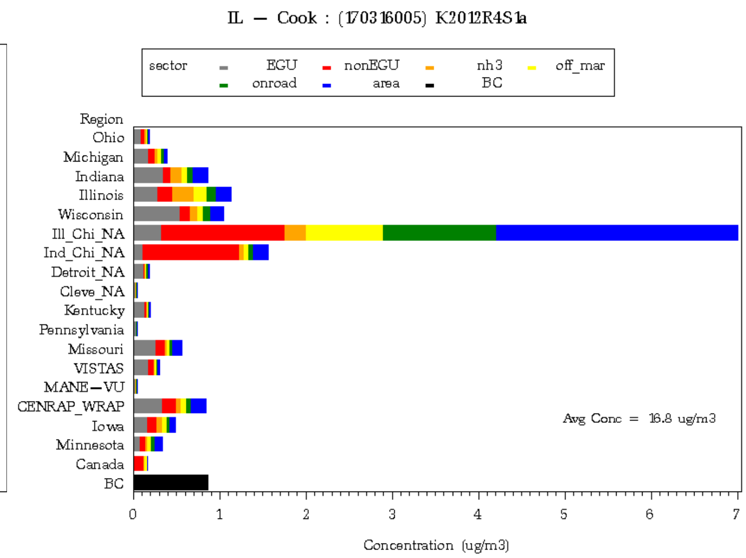
2005 (Round 5)



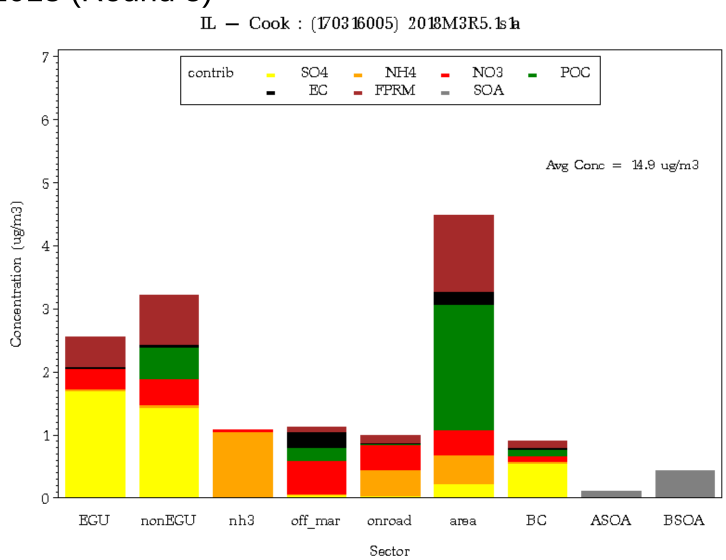


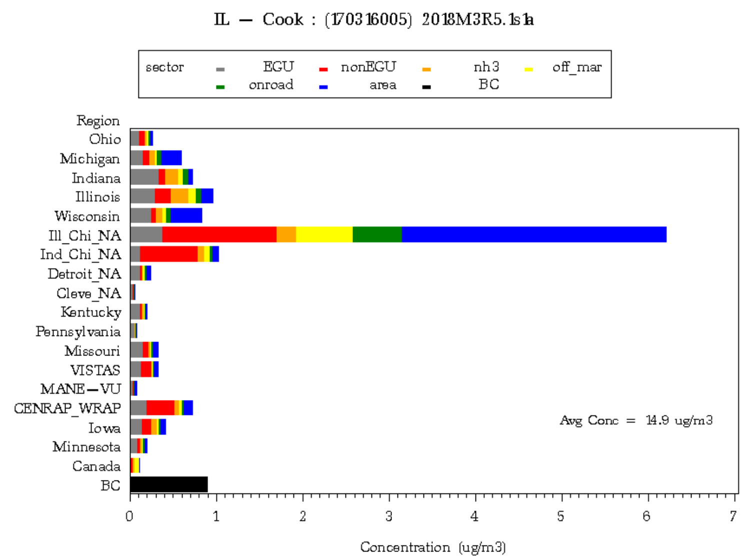
2012 (Round 4)





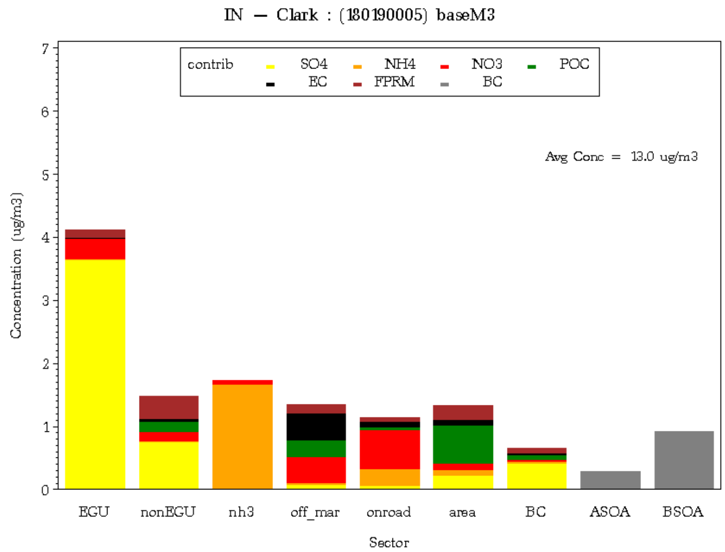
2018 (Round 5)

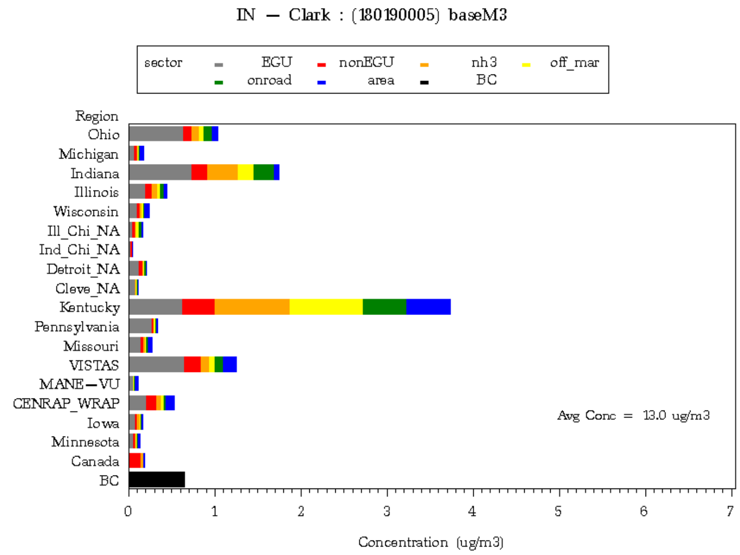




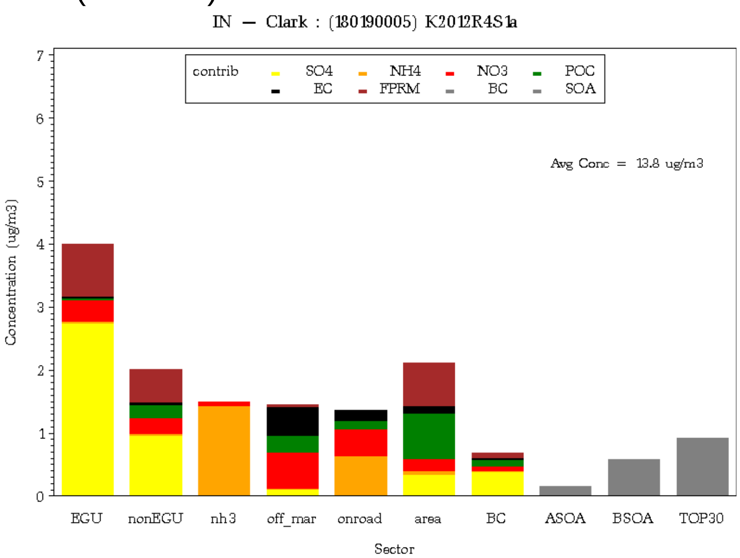
Clark County, Indiana

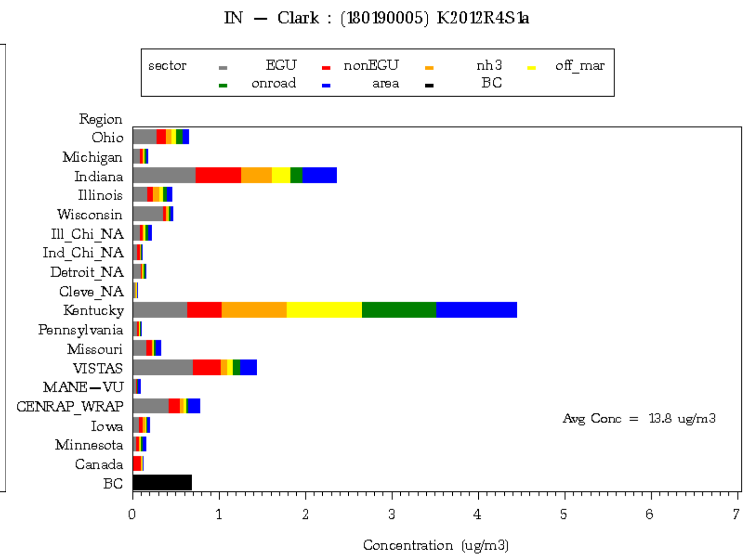
2005 (Round 5)



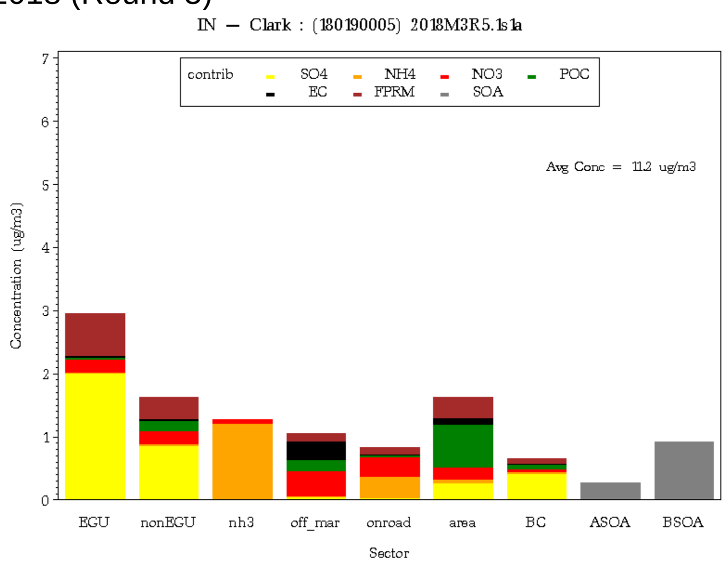


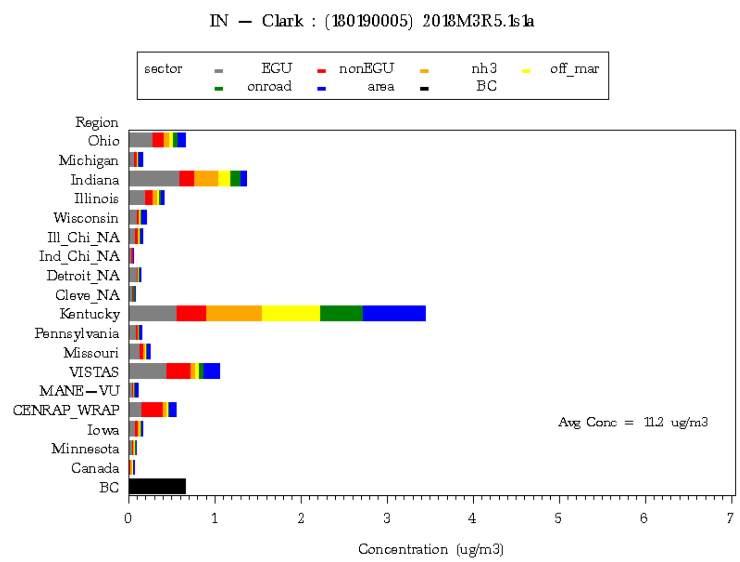
2012 (Round 4)





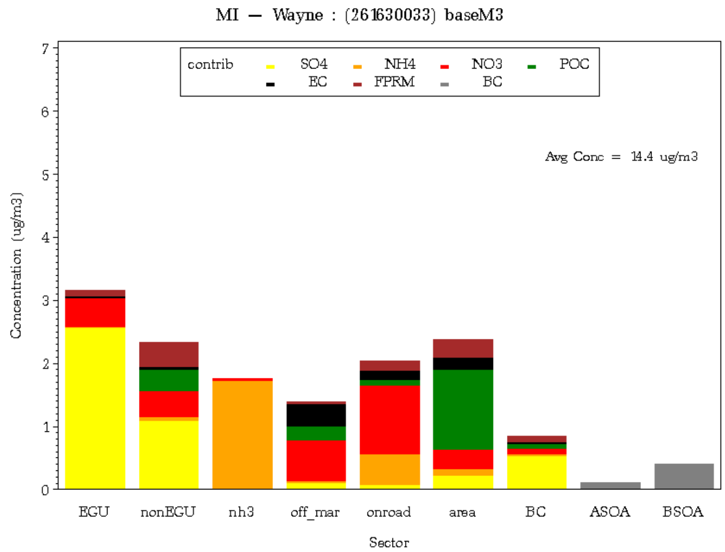
2018 (Round 5)

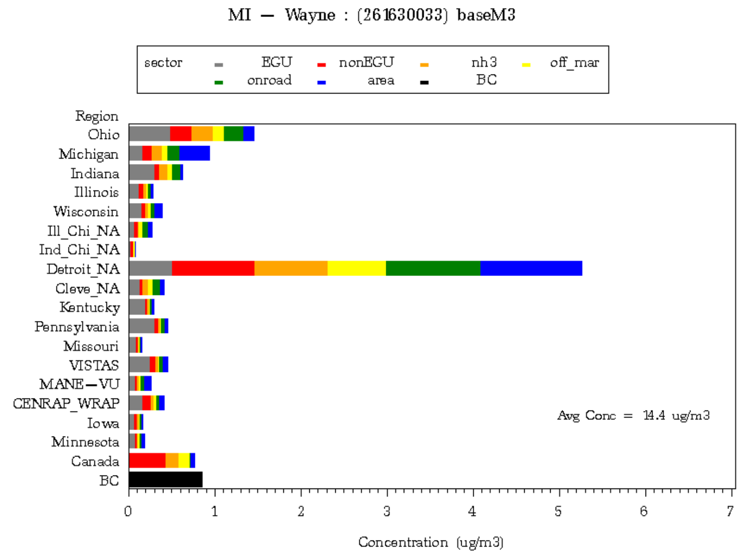




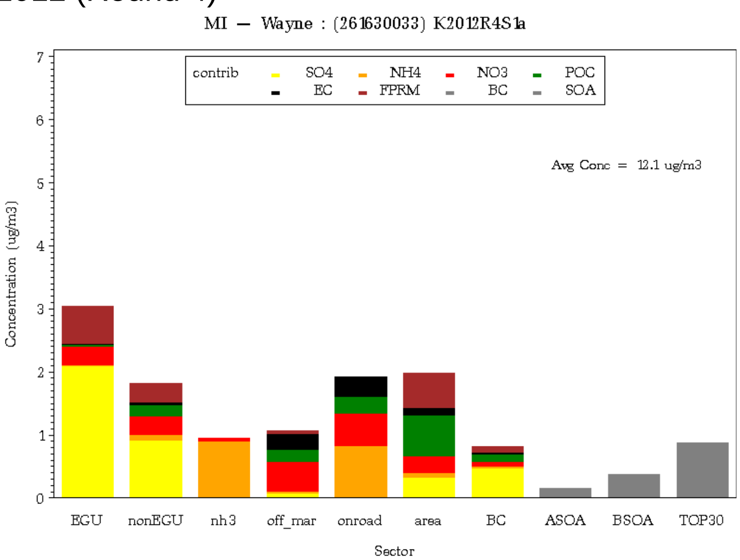
Dearborn, Michigan

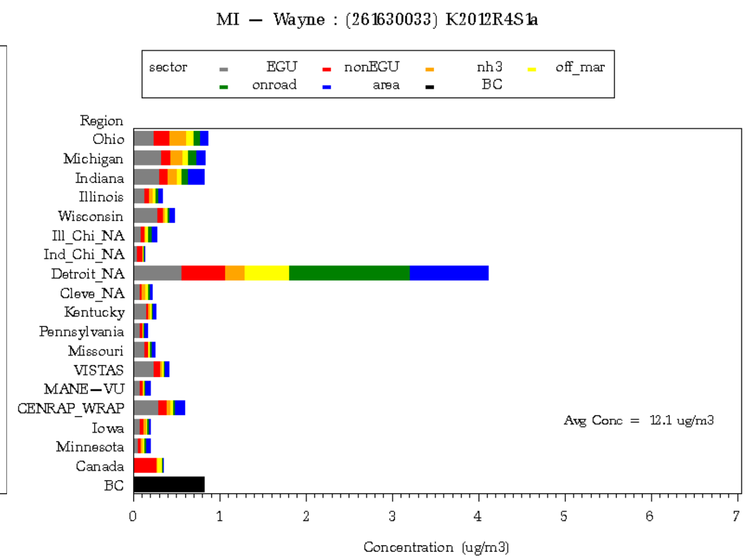
2005 (Round 5)



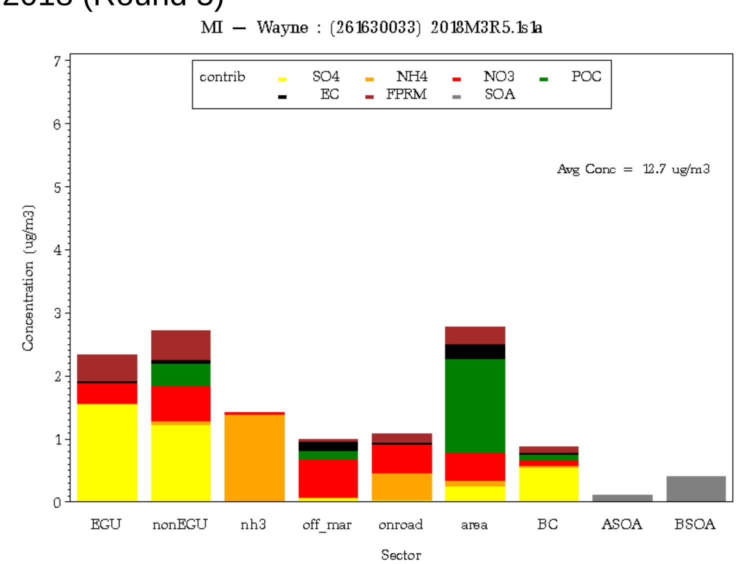


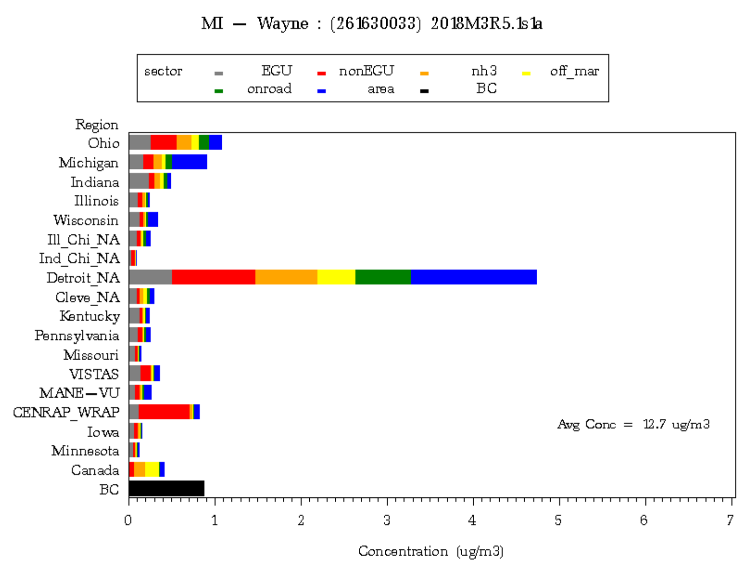
2012 (Round 4)





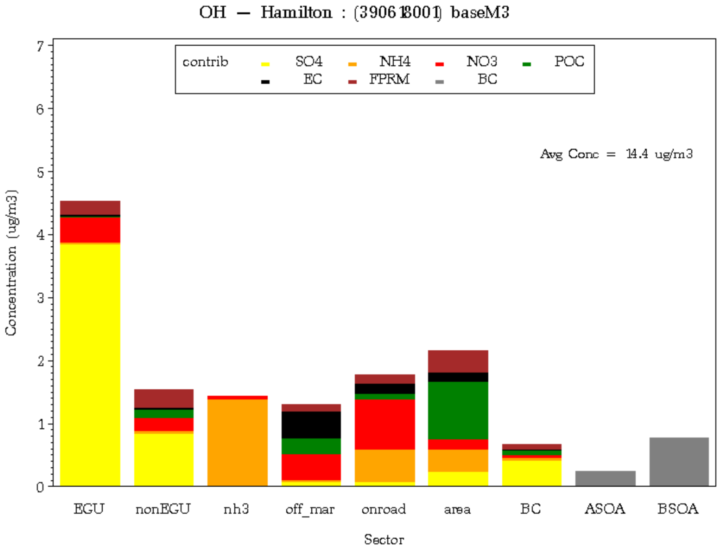
2018 (Round 5)

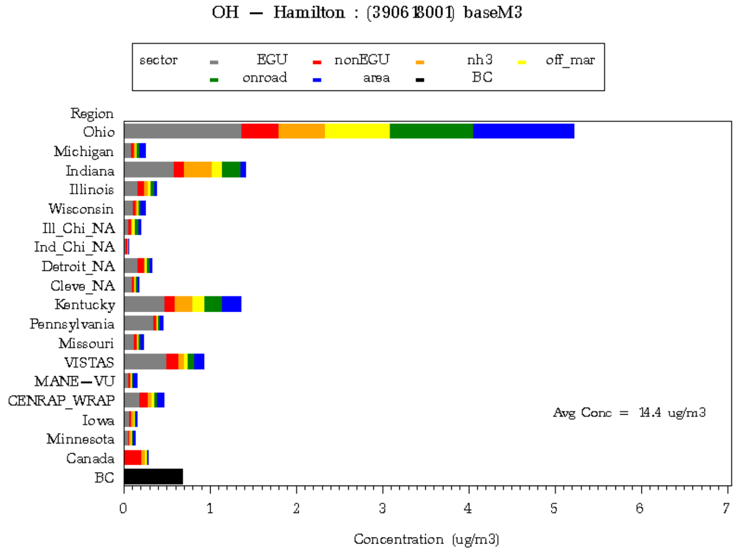




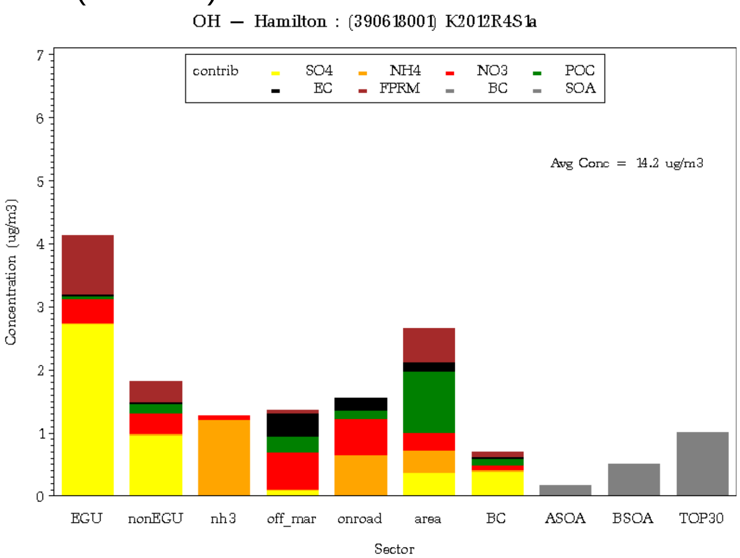
Cincinnati, Ohio

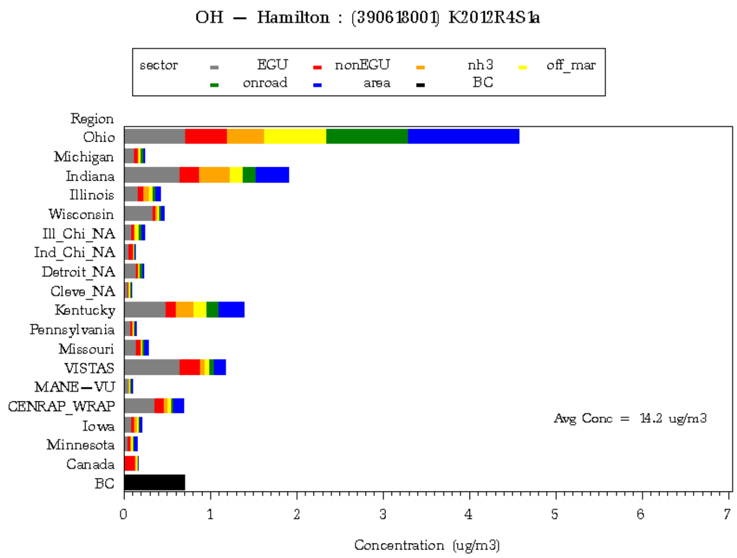
2005 (Round 5)



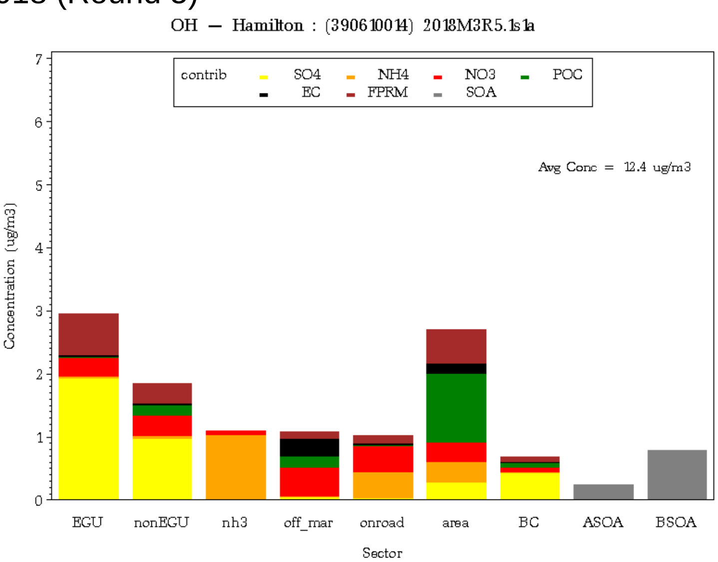


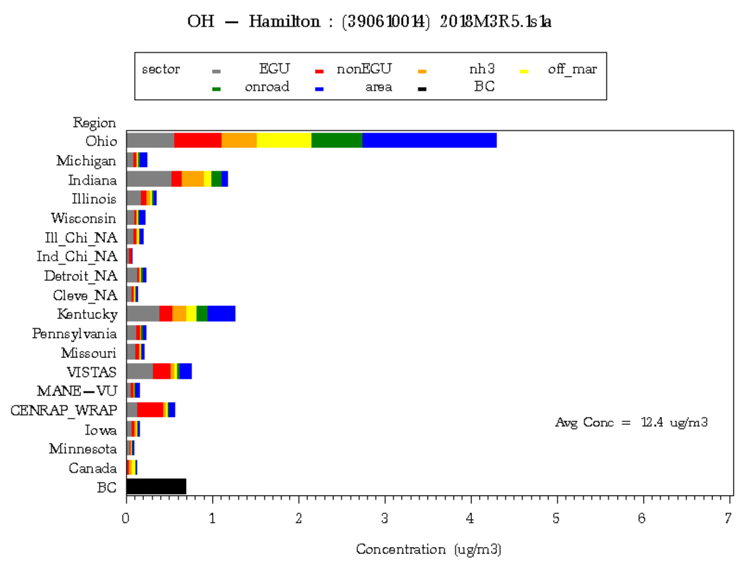
2012 (Round 4)





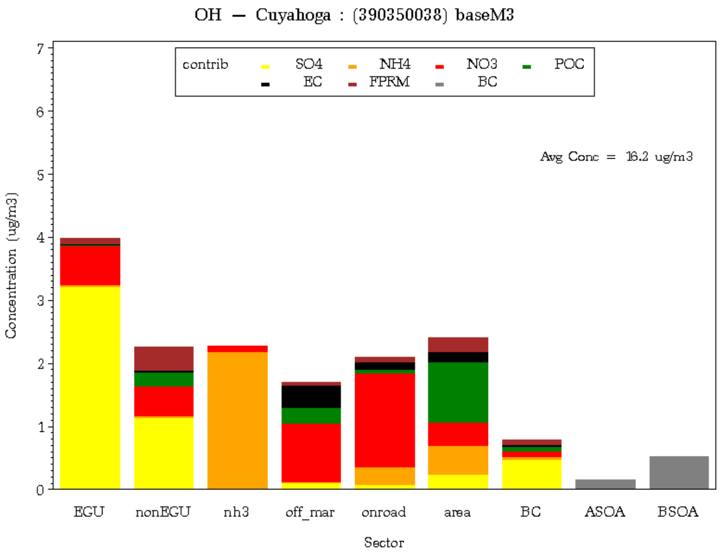
2018 (Round 5)

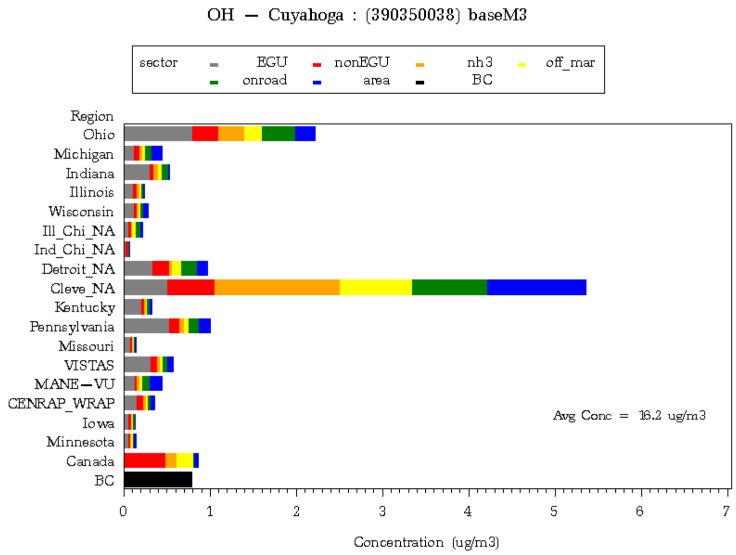




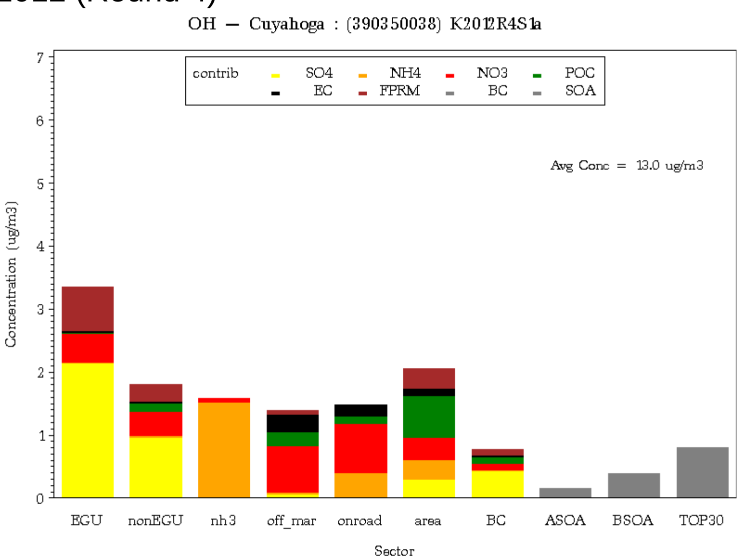
Cleveland, Ohio

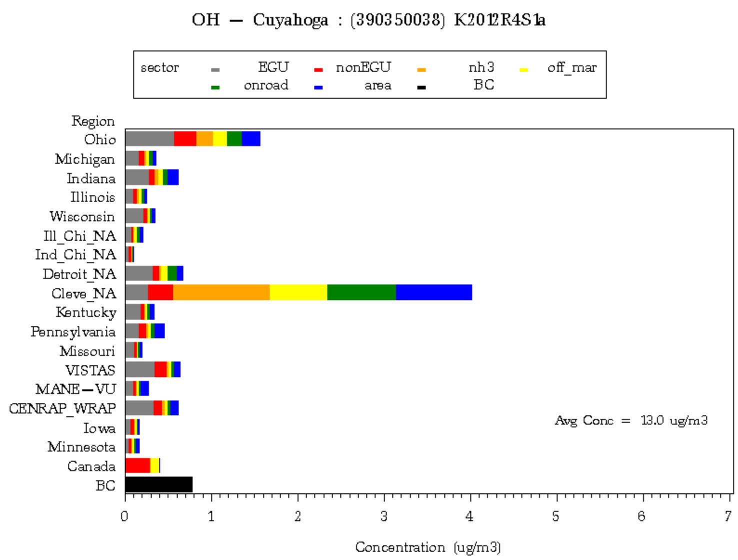
2005 (Round 5)



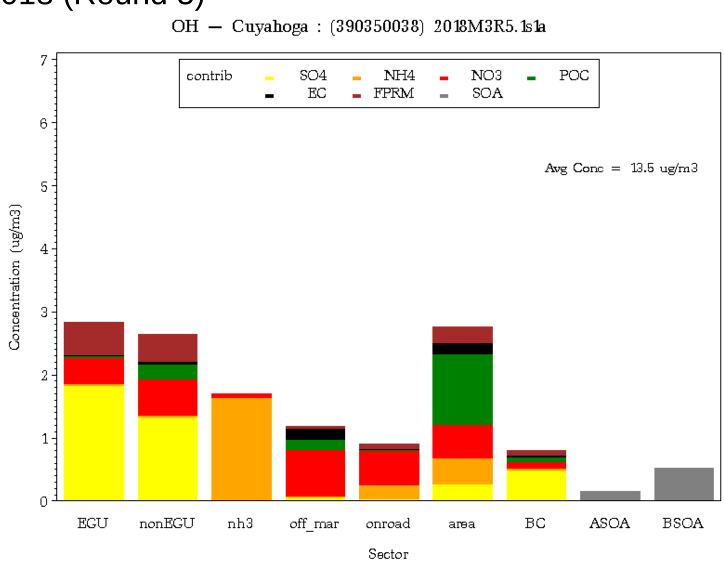


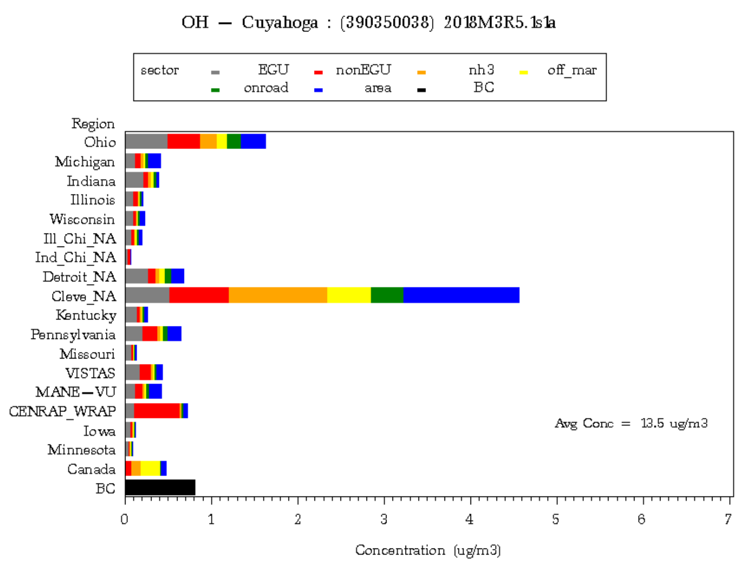
2012 (Round 4)





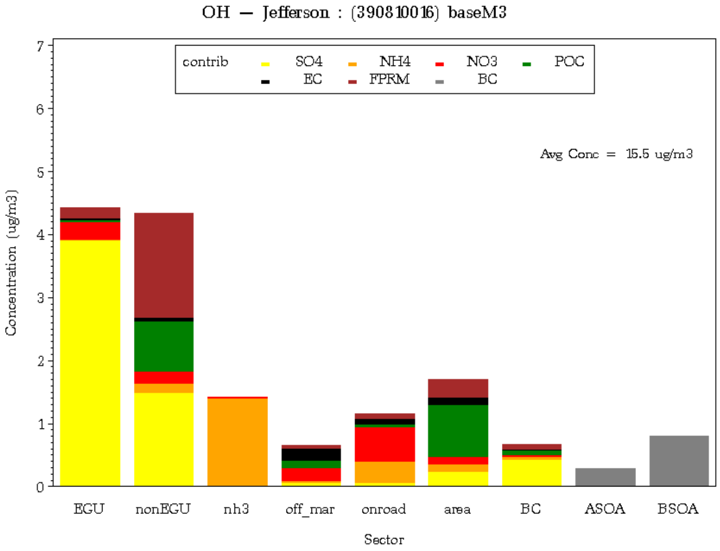
2018 (Round 5)

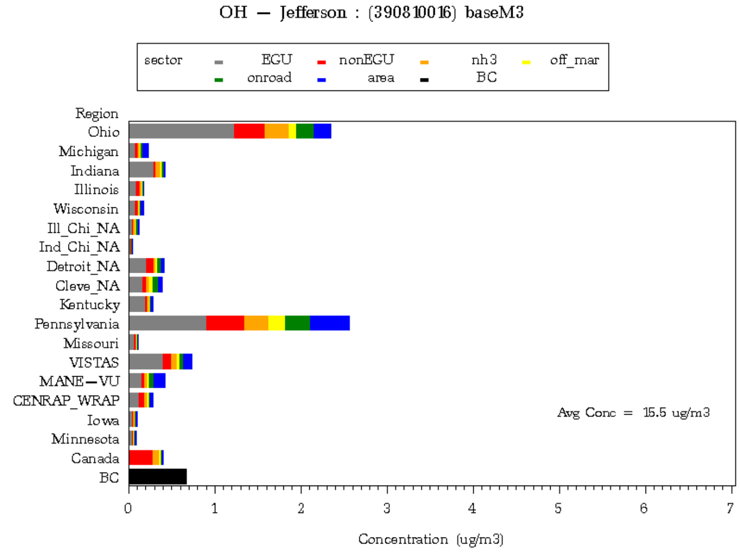




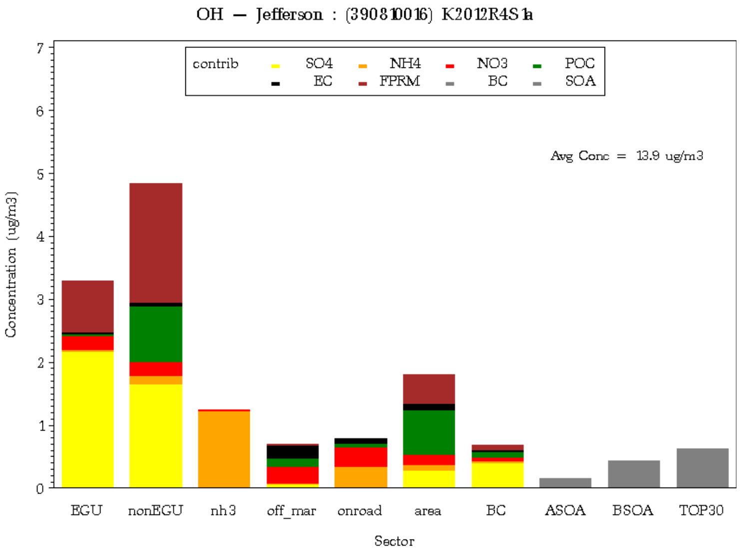
Steubenville, Ohio

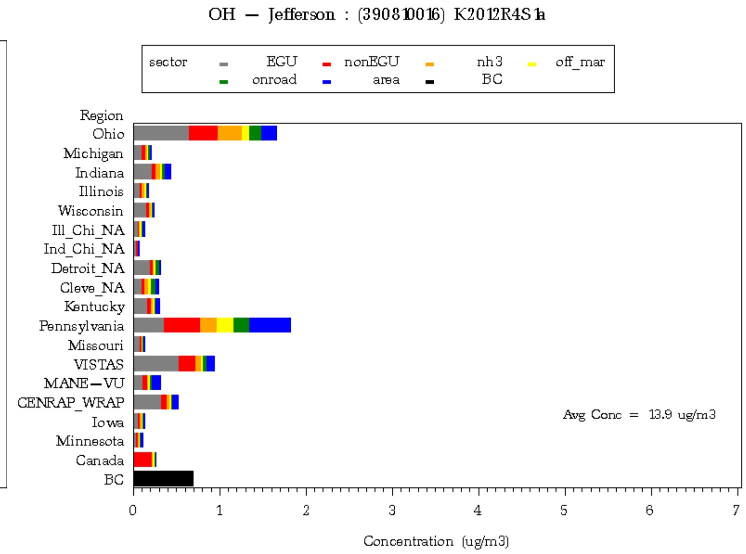
2005 (Round 5)



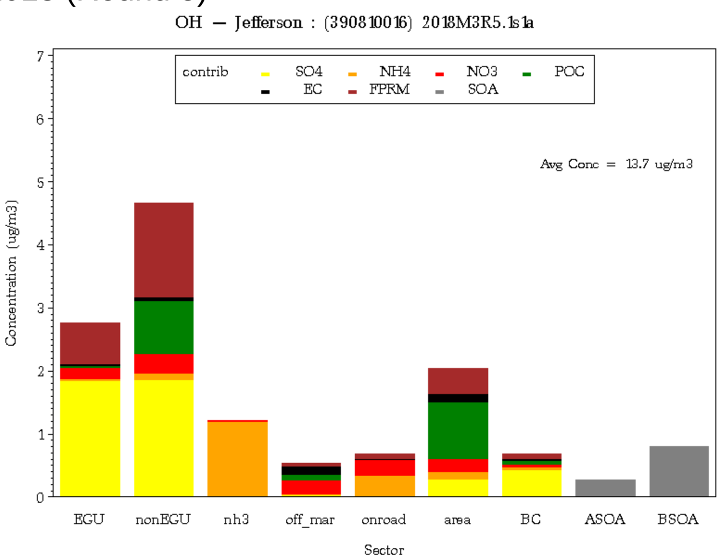


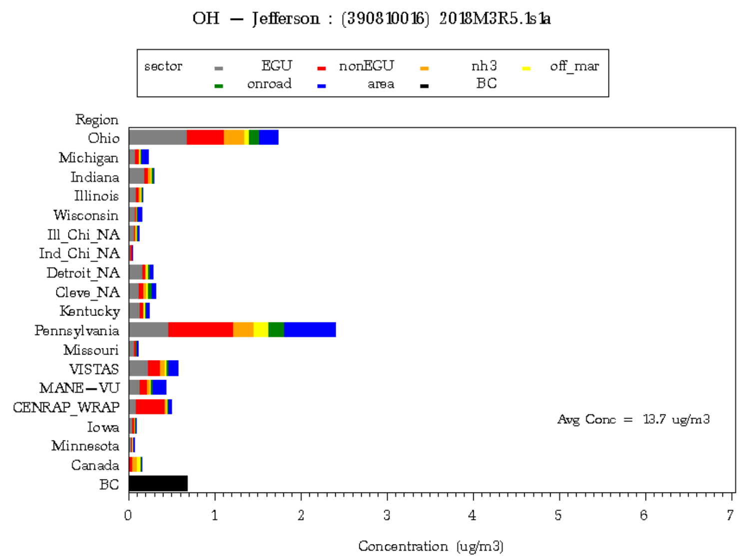
2012 (Round 4)





2018 (Round 5)



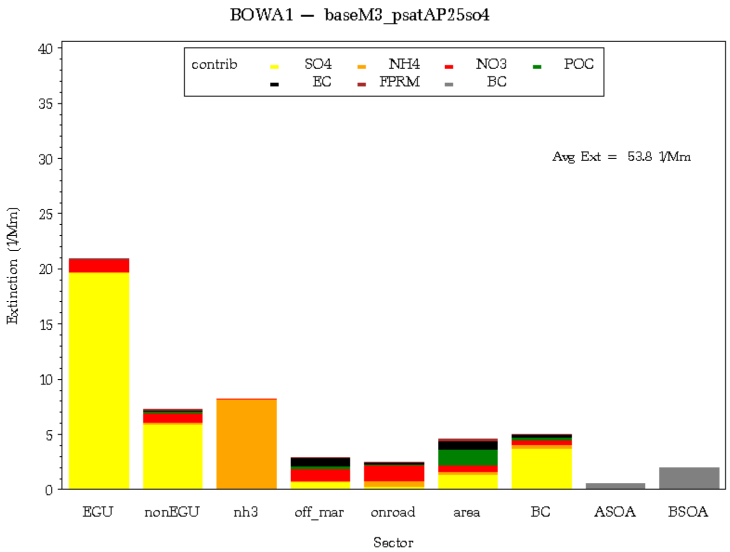


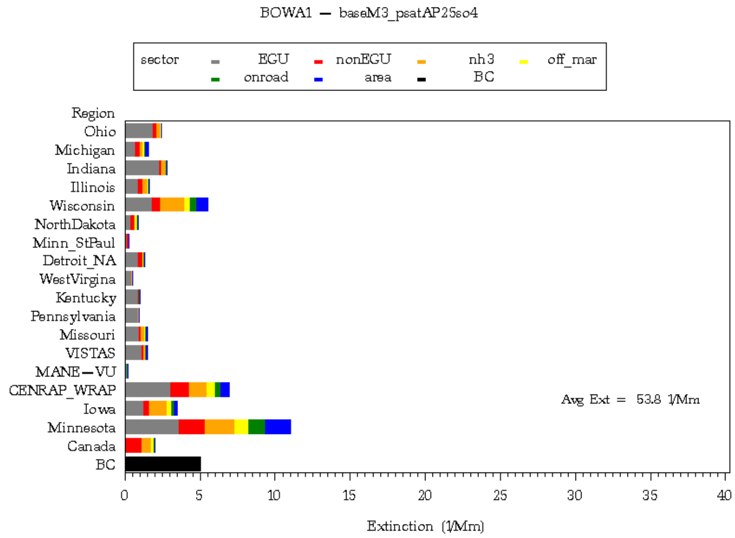
APPENDIX IV

Haze Source Apportionment Modeling Results

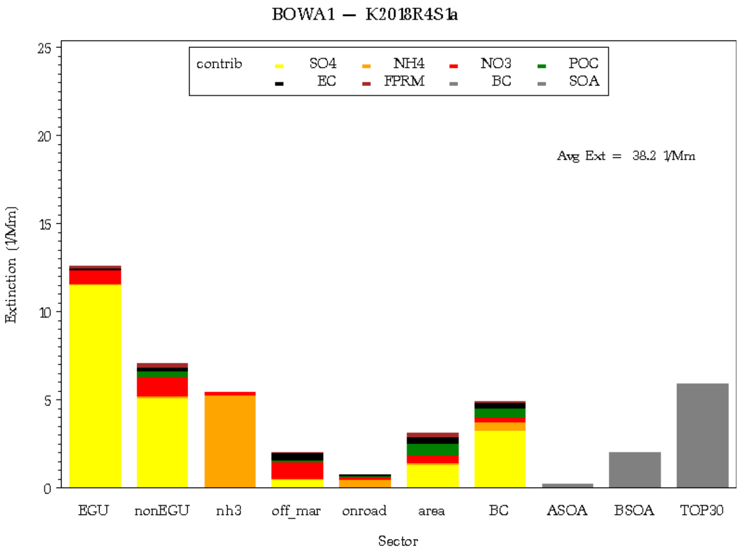
Boundary Waters, Minnesota

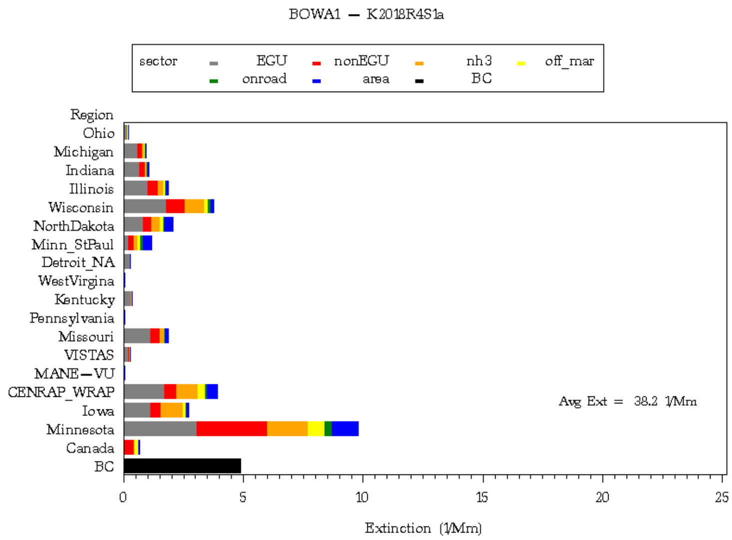
2005 (Round 5)



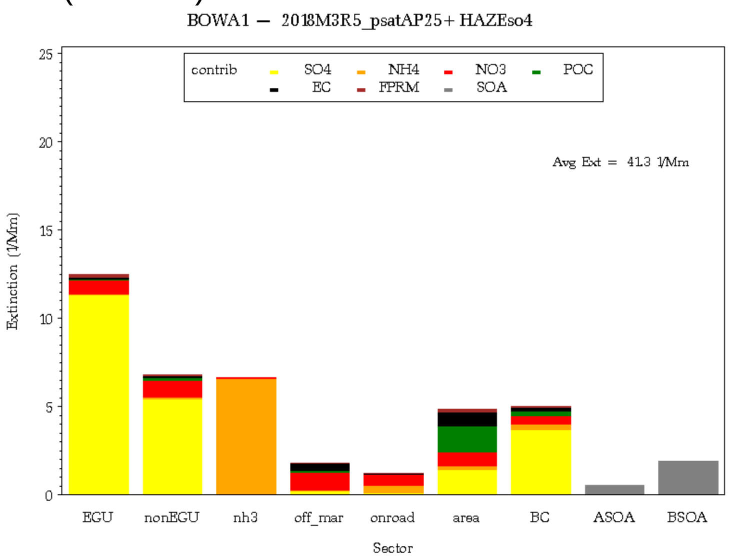


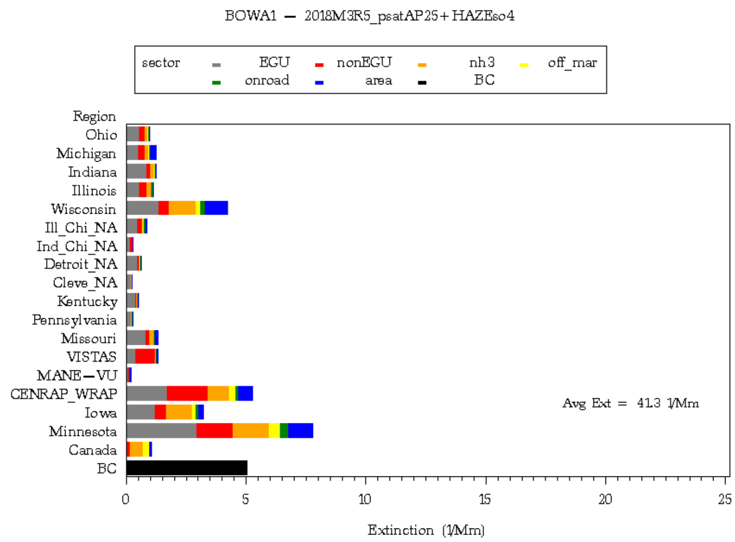
2018 (Round 4)





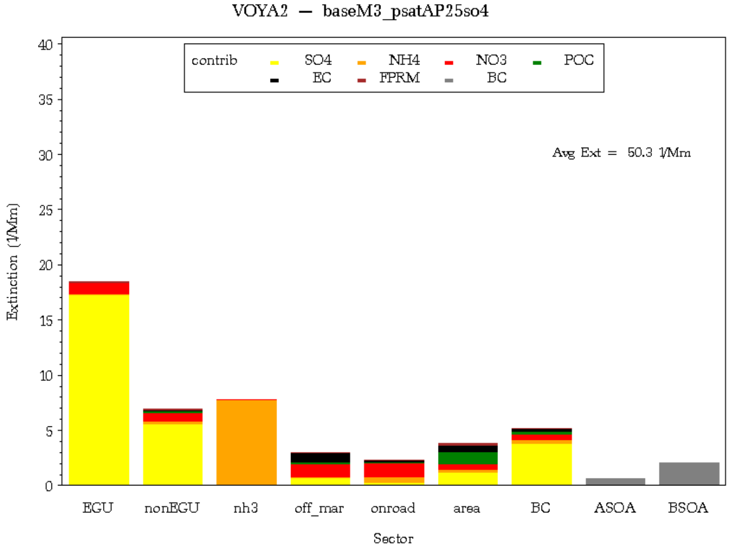
2018 (Round 5)

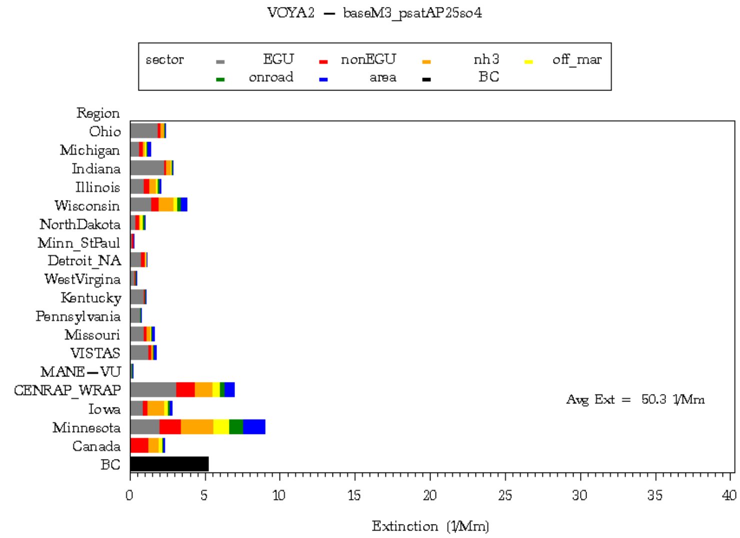




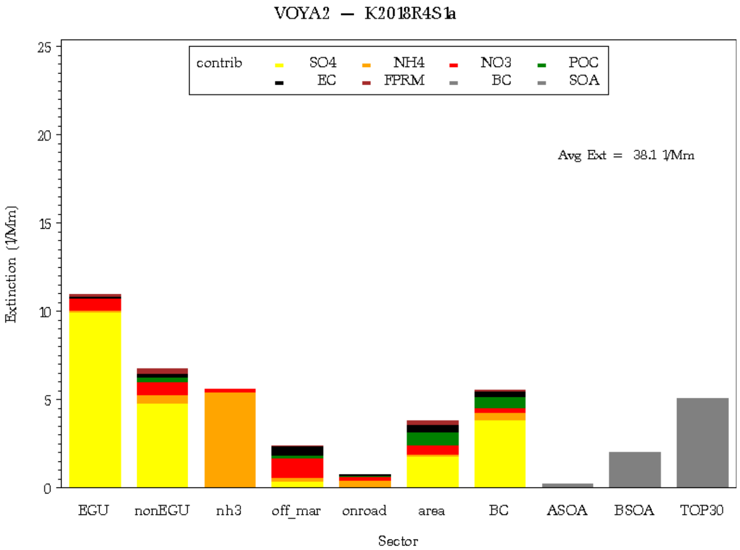
Voyageurs, Minnesota

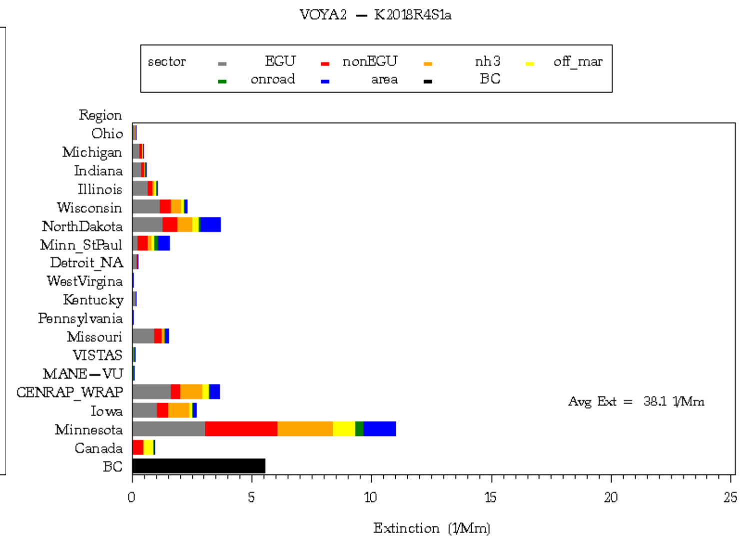
2005 (Round 5)



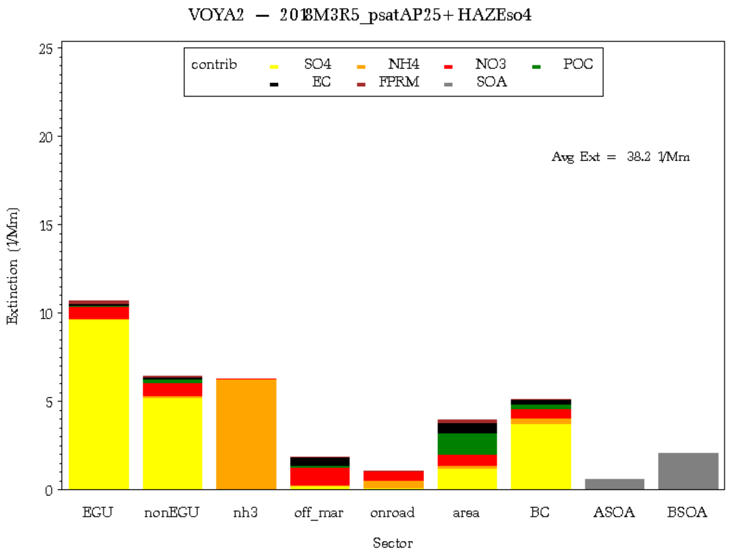


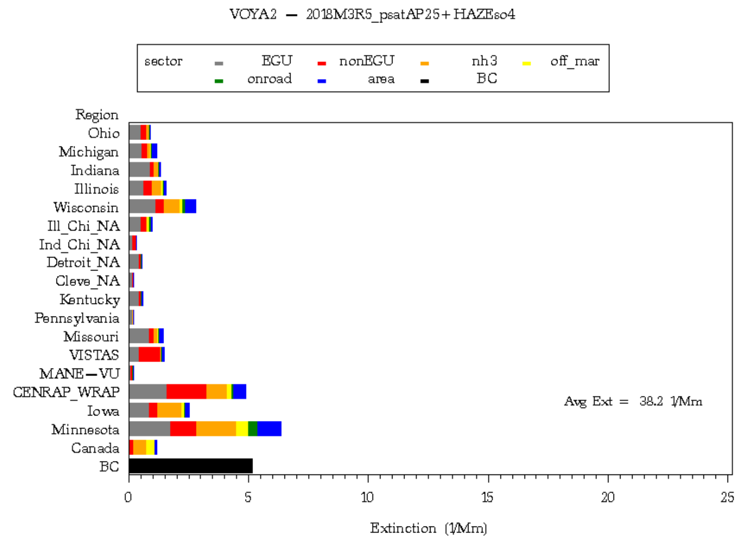
2018 (Round 4)





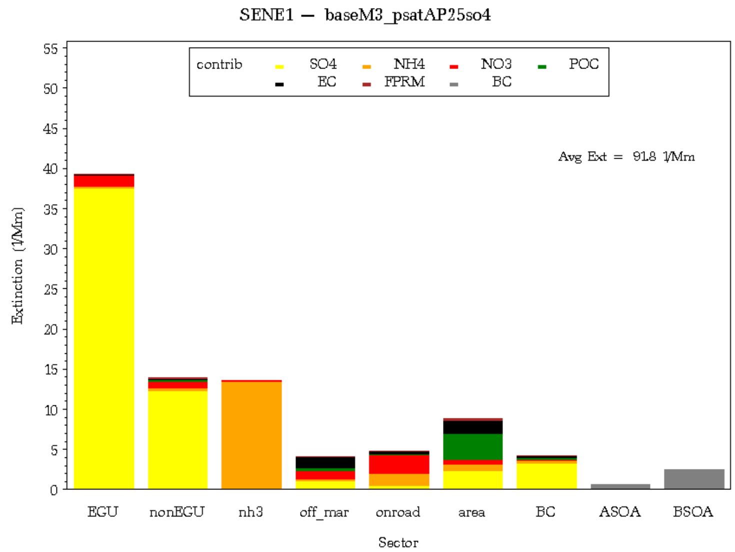
2018 (Round 5)

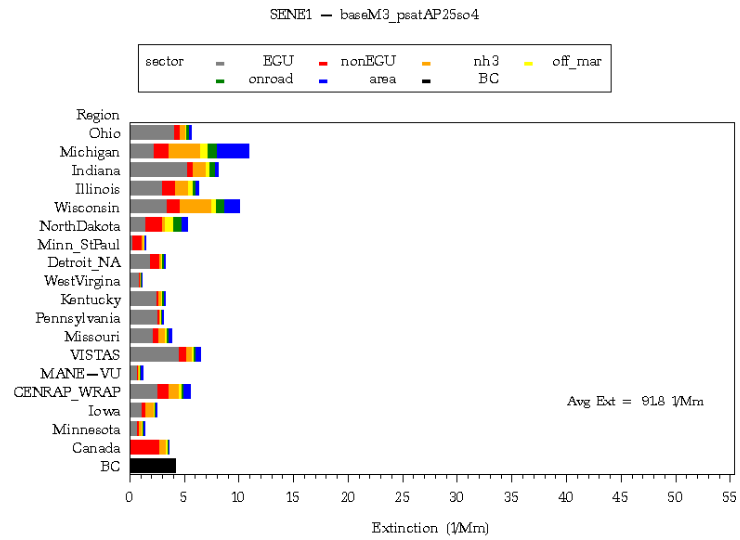




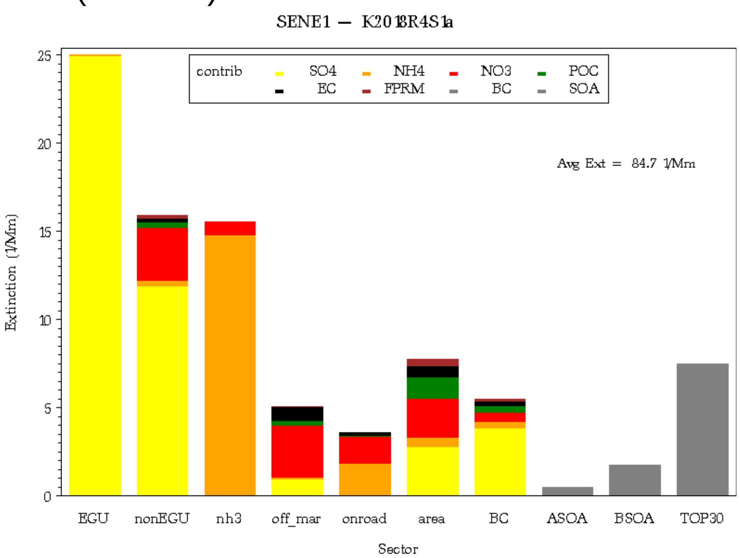
Seney, Michigan

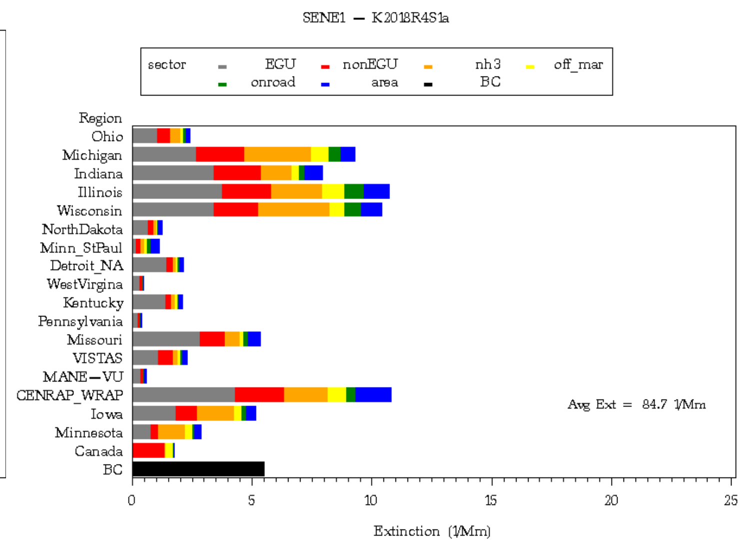
2005 (Round 5)



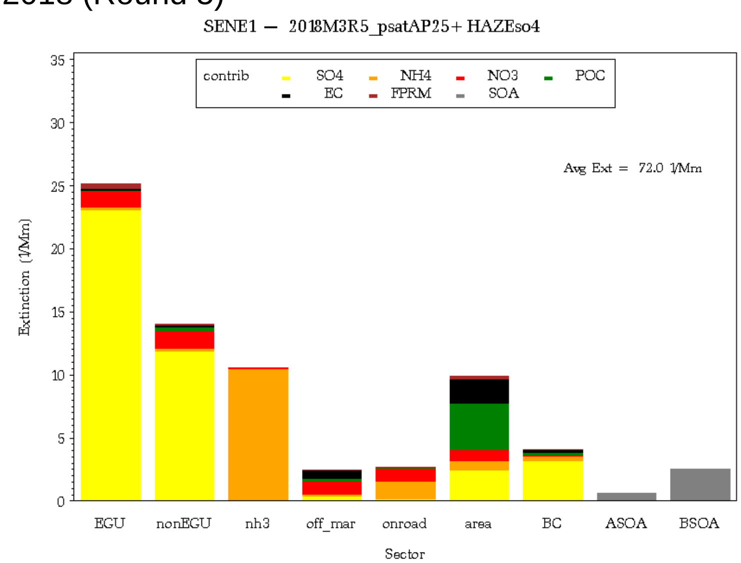


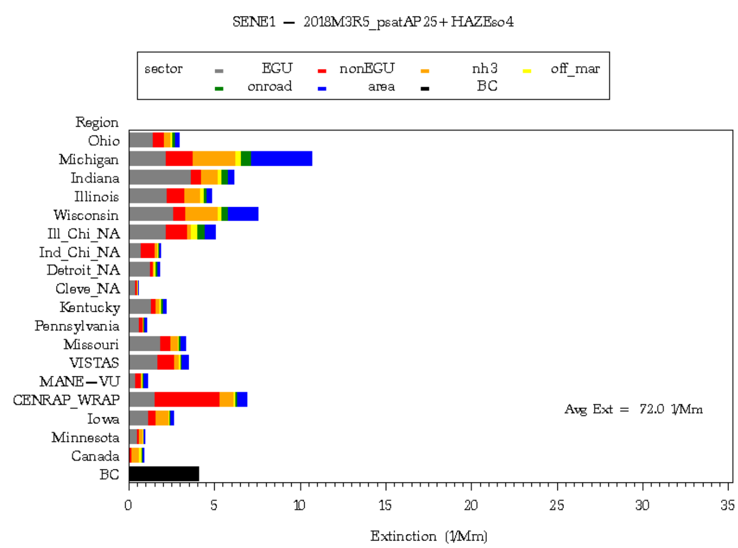
2018 (Round 4)





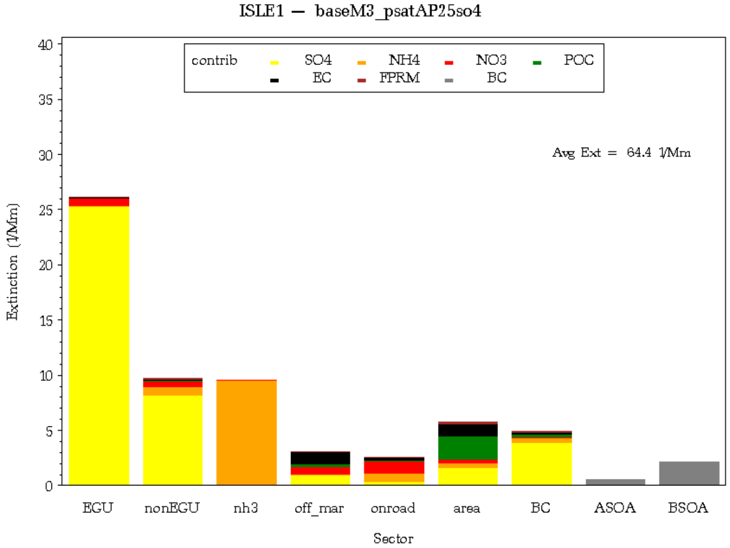
2018 (Round 5)

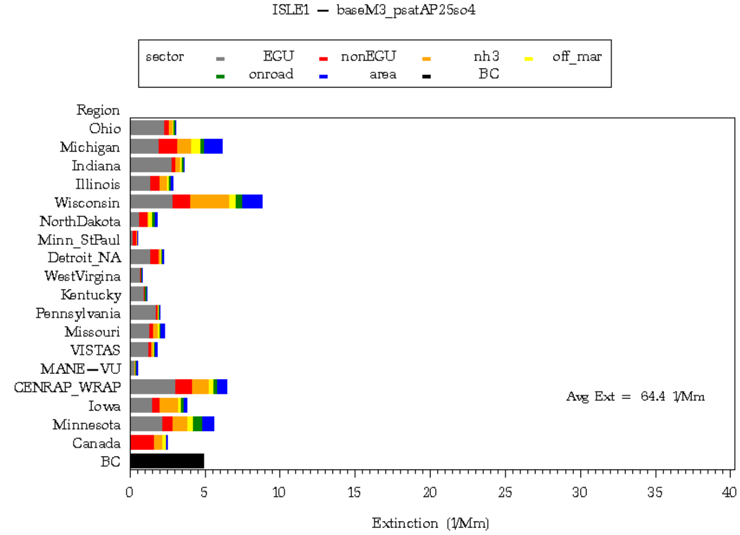




Isle Royale, Michigan

2005 (Round 5)





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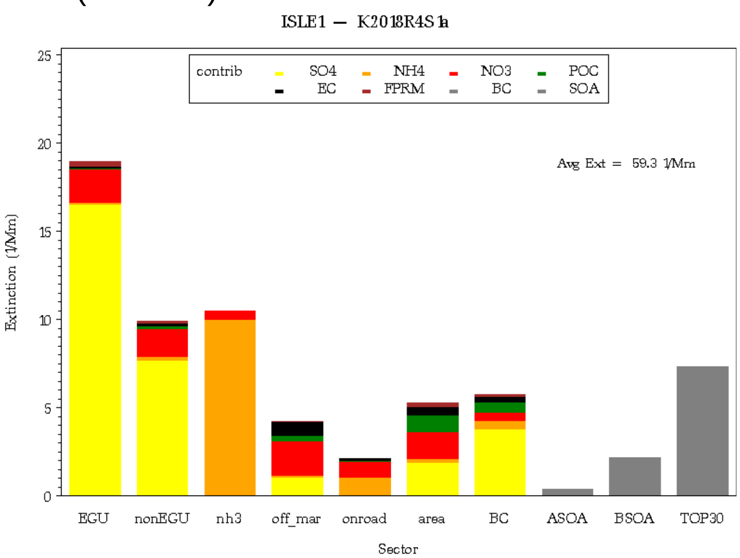
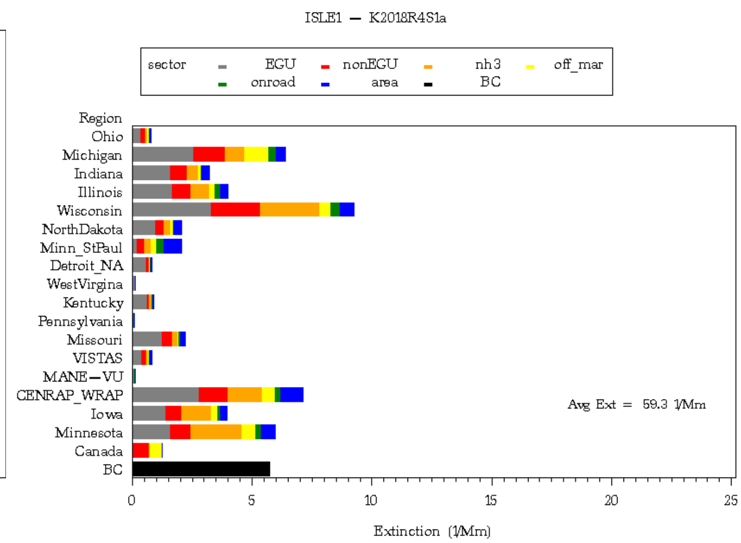
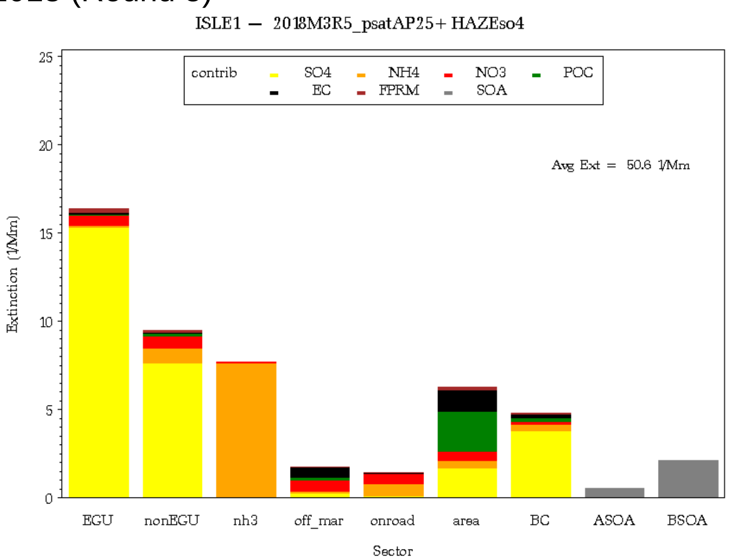
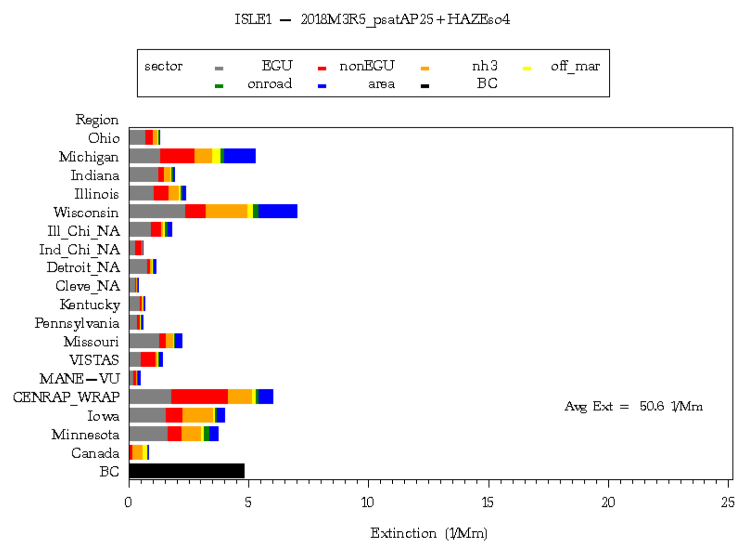




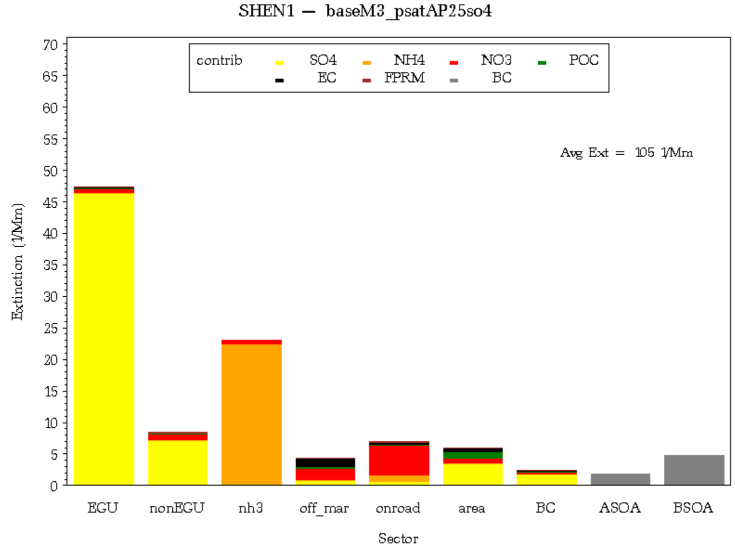
2018 (Round 5)

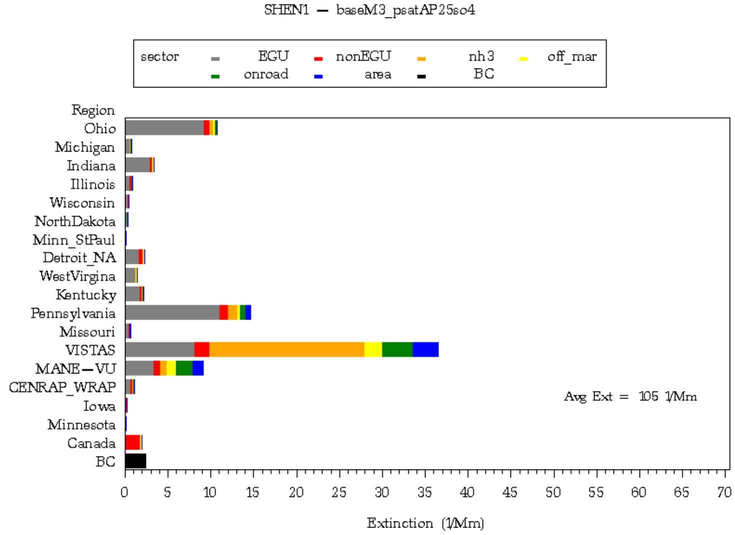




Shenandoah, Virginia

2005 (Round 5)





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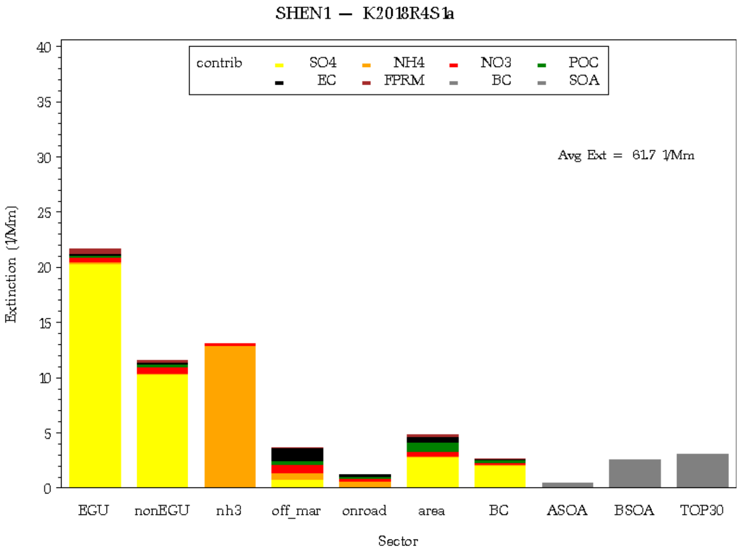
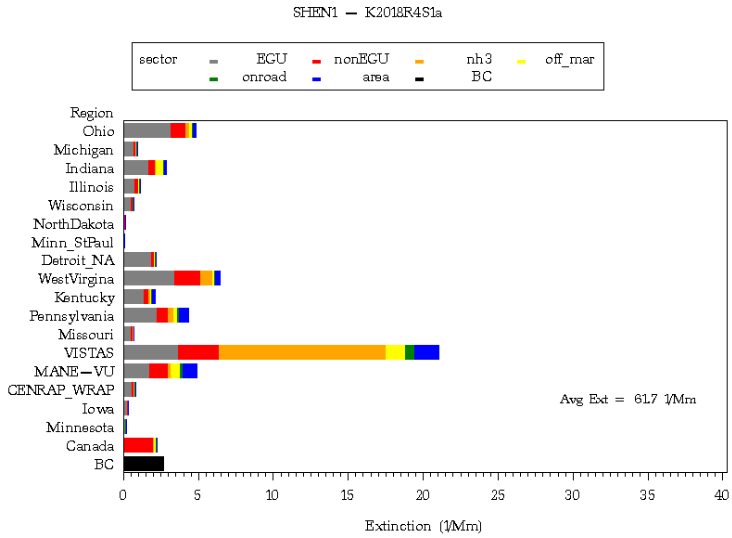
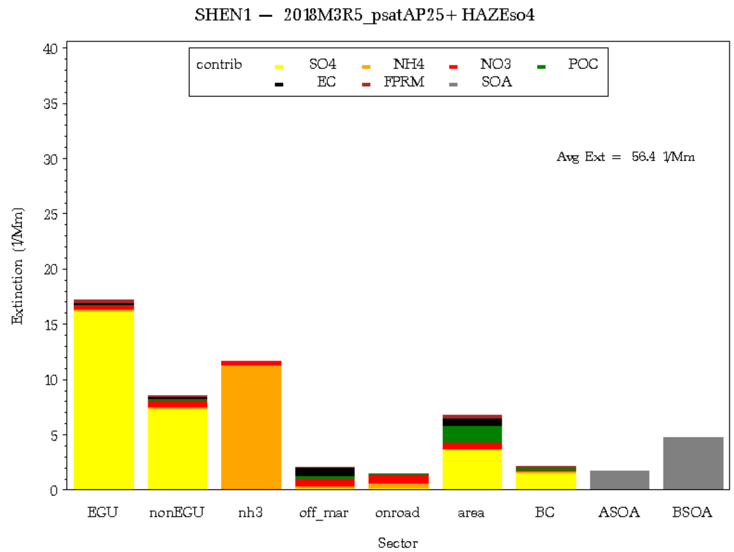
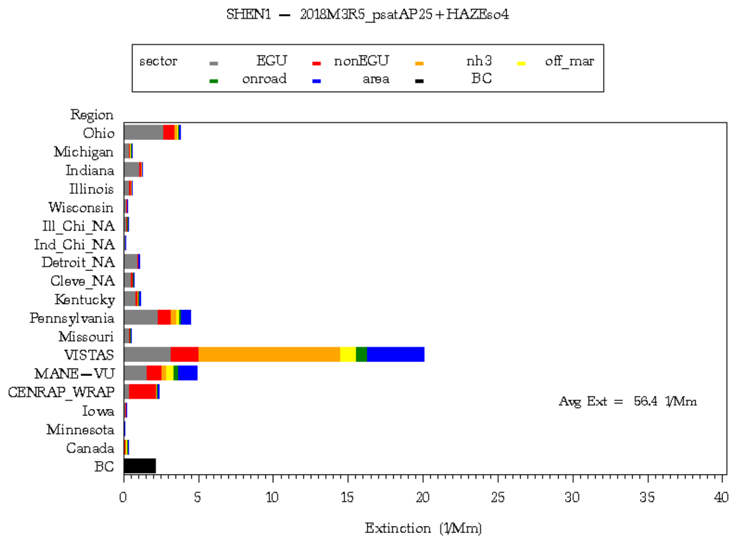




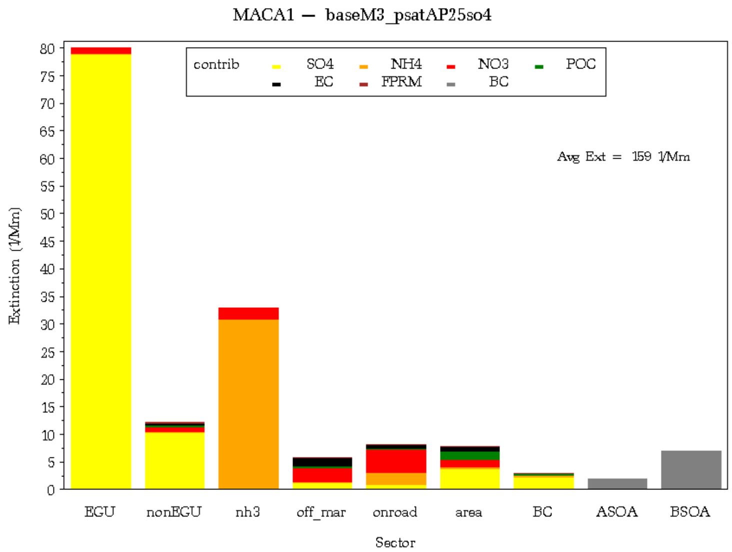
2018 (Round 5)

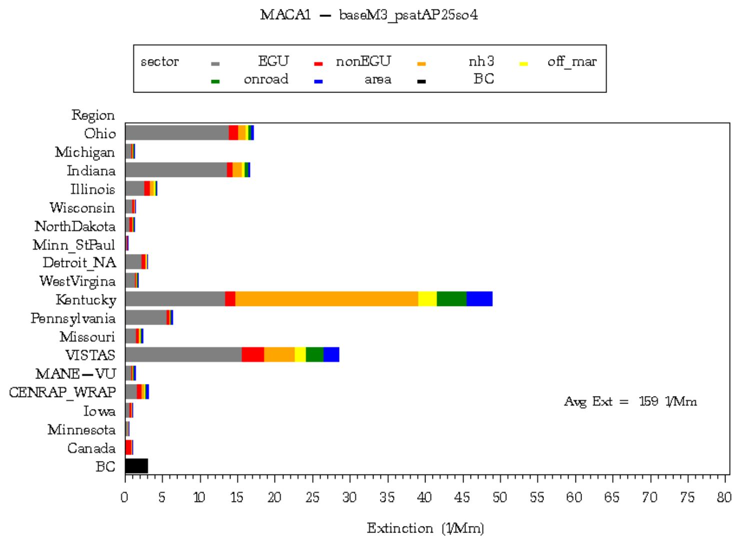




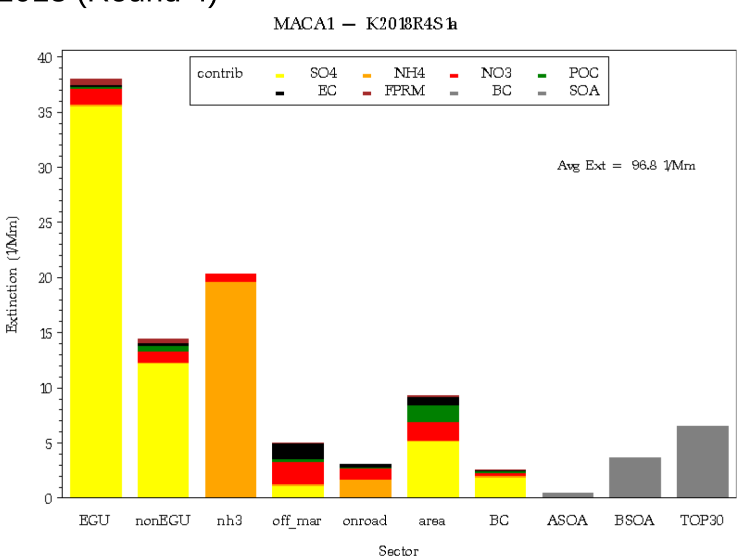
Mammoth Cave, Kentucky

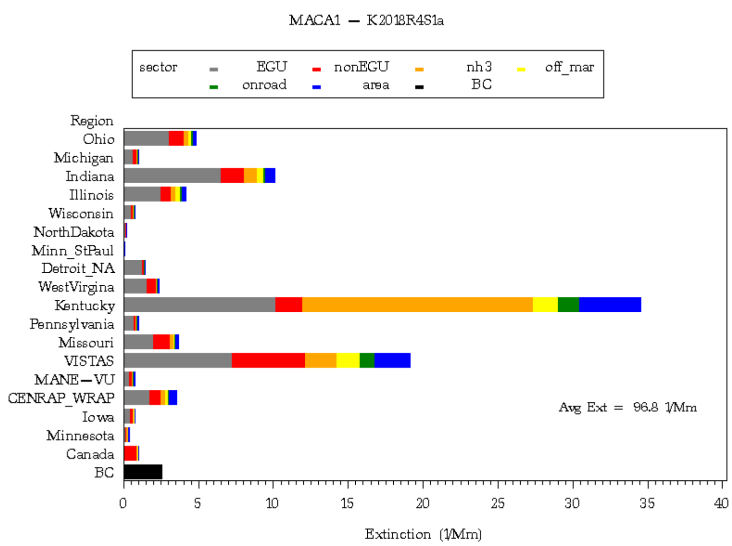
2005 (Round 5)



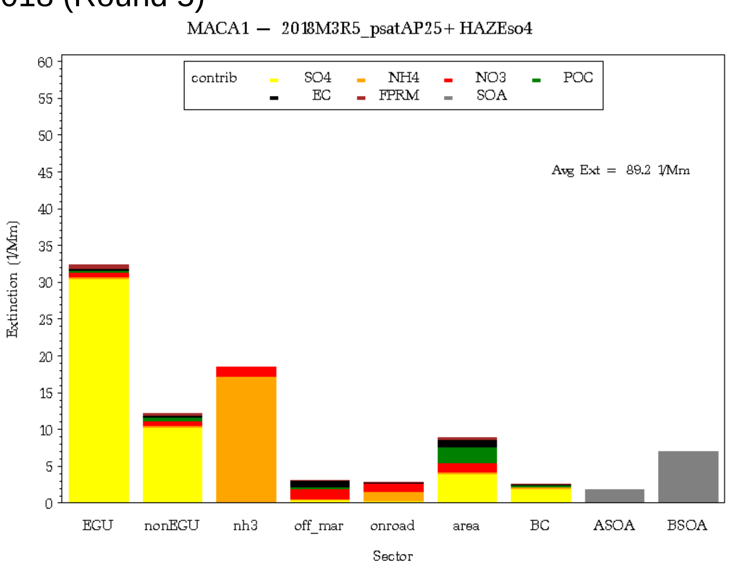


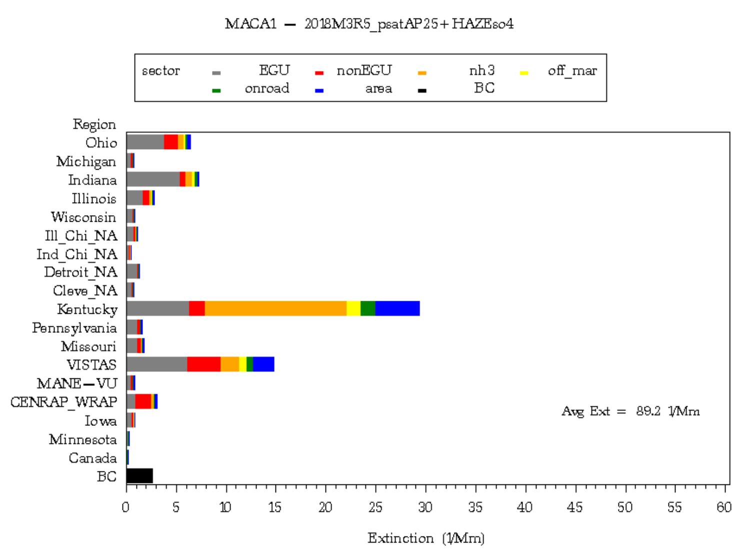
2018 (Round 4)





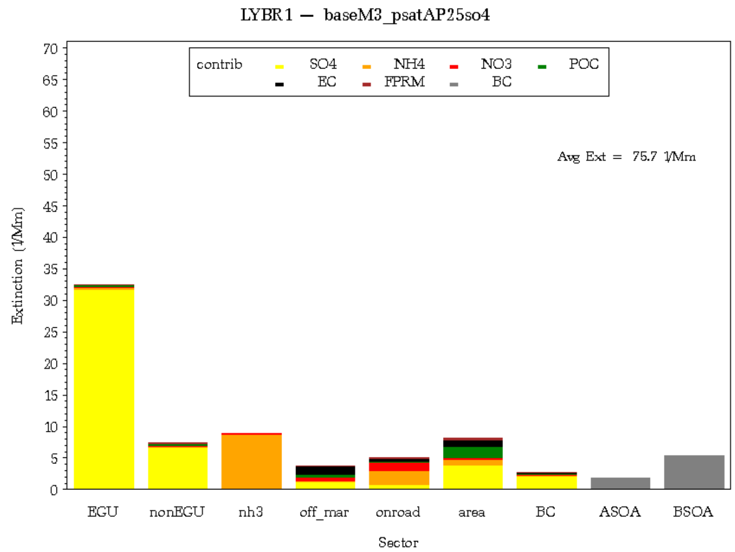
2018 (Round 5)

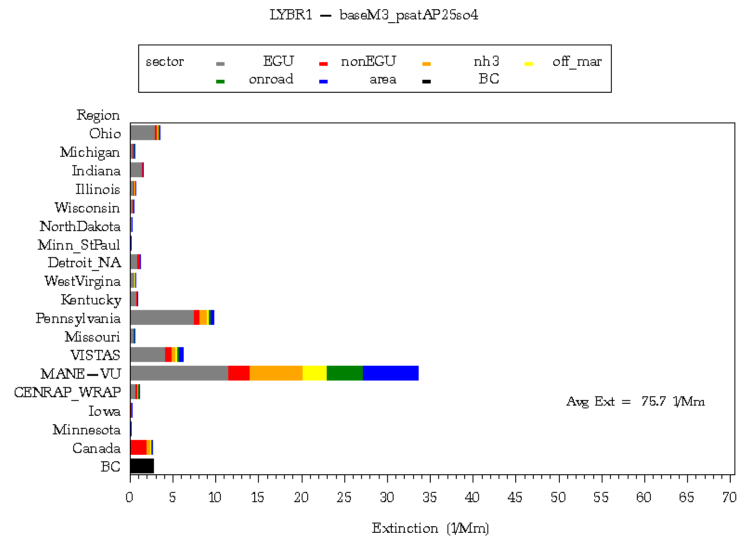




Lye Brook, Vermont

2005 (Round 5)





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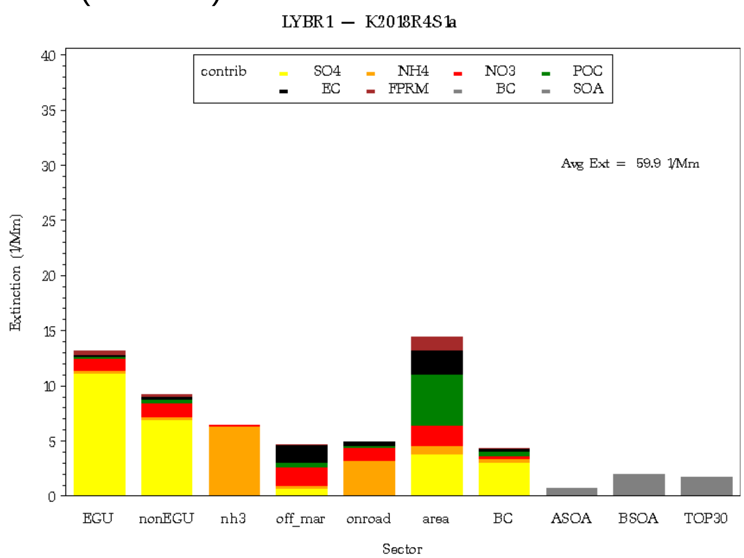

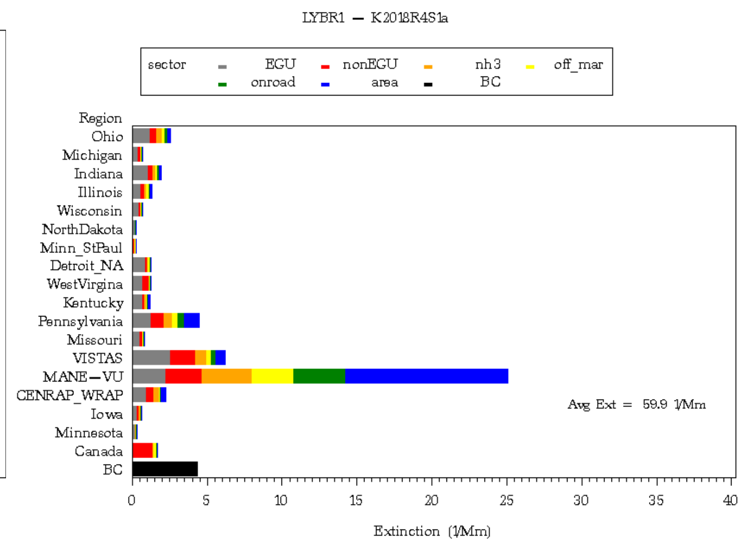

2018 (Round 5)