



## **Development of Annual Point Source Emission Inventory for 2007 in the Northeast/Mid-Atlantic Region**

*Prepared for:*

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## Acronyms and Abbreviations

<b>Acronym</b>	<b>Description</b>
CAMD	Clean Air Markets Division of EPA
CEM	Continuous Emission Monitoring System
EGU	Electric Generating Unit
EPA	U.S. Environmental Protection Agency
MANE-VU	Mid-Atlantic/Northeast Visibility Union
MARAMA	Mid-Atlantic Regional Air Management Association
NH <sub>3</sub>	Ammonia
NIF3.0	National Emission Inventory Input Format Version 3.0
NO <sub>x</sub>	Oxides of nitrogen
PM-CON	Primary PM, Condensable portion only (all < 1 micron)
PM-FIL	Primary PM, Filterable portion only
PM-PRI	Primary PM, includes filterables and condensibles PM-PRI= PM-FIL + PM-CON
PM10-FIL	Primary PM10, Filterable portion only
PM10-PRI	Primary PM10, includes filterables and condensibles, PM10- PRI = PM0-FIL + PM-CON
PM25-FIL	Primary PM2.5, Filterable portion only
PM25-PRI	Primary PM2.5, includes filterables and condensibles PM25-PRI= PM25-FIL + PM-CON
SIC	Standard Industrial Classification code
SIP	State Implementation Plan
SCC	Source Classification Code
SO <sub>2</sub>	Sulfur dioxide
VOC	Volatile organic compounds

## **1.0 ANNUAL 2007 INVENTORY FOR POINT SOURCES**

### **1.1 INTRODUCTION**

This technical support document (TSD) explains the data sources, methods, and results for preparing Version 1 of the 2007 criteria air pollutant (CAP) and ammonia (NH<sub>3</sub>) emission inventory for point sources for the Northeast and Mid-Atlantic/Northeast region. The region includes Connecticut, Delaware, the District of Columbia, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, and Virginia. Local air planning agencies include Philadelphia and Allegheny County, Pennsylvania. The inventory will be used to support air quality modeling, State Implementation Plan (SIP) development, and implementation activities for the regional haze rule and fine particulate matter (PM) and ozone National Ambient Air Quality Standards (NAAQS).

The inventory includes annual emissions for sulfur dioxide (SO<sub>2</sub>), oxides of nitrogen (NO<sub>x</sub>), volatile organic compounds (VOC), carbon monoxide (CO), ammonia (NH<sub>3</sub>), and five components of particulate matter (PM).

The inventory also includes particulate matter (PM) emissions, categorized as either filterable, condensable, or total. Filterable emissions are generally considered to be the particles that are trapped by the glass fiber filter in the front half of a Reference Method 5 or Method 17 sampling train. Vapors and particles less than 0.3 microns pass through the filter. Condensable particulate matter is material that is emitted in the vapor state which later condenses to form homogeneous and/or heterogeneous aerosol particles. The PM species in the inventory are categorized as: all filterable and condensable particles with an aerodynamic diameter less than or equal to a nominal 10 and 2.5 micrometers (i.e., PM<sub>10</sub>-PRI and PM<sub>25</sub>-PRI); filterable particles with an aerodynamic diameter less than or equal to a nominal 10 and 2.5 micrometers (i.e., PM<sub>10</sub>-FIL and PM<sub>25</sub>-FIL); and condensable particles (PM-CON). Note that PM<sub>10</sub>-PRI equals the sum of PM<sub>10</sub>-FIL and PM-CON, and PM<sub>25</sub>-PRI equals the sum of PM<sub>25</sub>-FIL and PM-CON.

### **1.2 INITIAL DATA SOURCES AND QA REVIEW**

Version 1 of the 2007 point source inventory was developed using the 2007 inventories that S/L agencies submitted to MARAMA and data from the EPA's Clean Air Markets Division (CAMD) continuous emission monitoring (CEM) database.

### 1.2.1 State NIF Submittals

State and local (S/L) agencies prepared and submitted emission inventory files in the National Emissions Inventory (NEI) Input Format Version 3.0 (NIF 3.0). The NIF format includes eight tables: Transmittal (TR), Site (SI), Emission Unit (EU), Emission Release Point (ER), Emission Process (EP), Emission Period (PE), Emission (EM), and Control Equipment (CE). Detailed specifications for the NIF tables can be found in Appendix A. States were requested to submitted 2007 data for those major sources that they would normally submit to EPA during the 3-year requirements of the Consolidated Emission Reporting Rule (CERR). All 13 State agencies submitted point source inventories to MARAMA. In addition, Allegheny and Philadelphia Counties in Pennsylvania each submitted their own point source inventories to EPA.

Upon receipt of the NIF submittals, MACTEC performed an initial review of the S/L inventories with the following QA checks:

- EPA's Basic Format and Content Checker tool was used to verify format and check for referential integrity and duplicate record issues. Only very minor issues were identified and were resolved by MACTEC without the need for S/L assistance.
- Facility-level comparisons were made between the MANEVU Version 3/VISTAS Best and Final 2002 inventories and the S/L 2007 submittals to identify facilities included in the 2002 inventory but not in the 2007 inventory. For four S/L agencies (NY, PA, Allegheny and Philadelphia Counties), the number of facilities included in the 2007 were far less than the number of facilities reported in 2002. These S/L agencies provided revised files with a lower facility emission cutoff level to ensure that all major sources were included in the 2007 inventory. S/L agencies were asked to review this list and verify that facilities not in the 2007 inventory were either closed or included in the area source inventory.
- Facility-level comparisons were made between the MANEVU/VISTAS 2002 inventories and the S/L 2007 submittals to identify facilities included in the 2007 inventory but not in the 2002 inventory. S/L agencies were asked to review this list to verify the reasonableness of this list of sources.
- Facility-level comparisons were made between the MANEVU/VISTAS 2002 inventories and the S/L 2007 submittals to identify facilities that were included in both the 2002 inventory and 2007 inventory. Facility-level emission changes were calculated, large differences between 2002 and 2007 emissions were flagged, and

S/L agencies were asked to review the reasonableness of the emission changes between 2002 and 2007.

- Facility-level comparisons were made between the MANEVU/VISTAS 2002 inventories and the S/L 2007 submittals

Following this initial QA review, these individual inventory files were consolidated into a single data set. S/L responses and updates to the inventory files resulting from the initial QA review are discussed later in this document.

### **1.2.2 EPA CAMD CEM Data**

The second source of data was the CEM data reported to EPA by facilities to comply with various provisions of the Clean Air Act (CAA). MARAMA downloaded the 2007 CEM annual inventory containing NO<sub>x</sub> and SO<sub>2</sub> emissions, heat input data and other information from the CAMD web site ([www.epa.gov/airmarkets](http://www.epa.gov/airmarkets)) in May 2009.

MARAMA prepared an initial crosswalk file to match facilities and units in the CEM inventory to facilities and units in the 2002 MANEVU Version 3 inventory. In the CEM 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). MARAMA sent an Excel Workbook to each S/L agencies that contained an initial crosswalk with the ORIS ID and unit ID in the CEM inventory matched to the state and county FIPS, state facility ID, and EU ID in the 2002 MANEVU Version 3 inventory. The crosswalk contained the annual 2007 NO<sub>x</sub>, SO<sub>2</sub>, and heat input (except for those units that are required to report for only 6 months, wherein the data were for the 6 month period). The crosswalk also included other information from the 2002 MANVEU inventory, including stack and location coordinates.

Agencies were asked to confirm/correct/supplement the information in the crosswalk, provide annual 2007 emissions for the 6-month CEM reporting units, and to provide 2007 annual emissions for other CAPs and NH<sub>3</sub>.

The updated crosswalk was provided to MACTEC who updated the crosswalk in the following ways:

- In most of the S/L inventories, the state and county FIPS and state facility ID together identify unique facilities and the EU ID identifies unique boilers or internal combustion engines. However, in some of the S/L inventories, the emissions for multiple EUs were summed and reported under the same EU ID. To provide a better linkage between the CEM data and the S/L inventories, MACTEC

worked with States to establish the crosswalk at the EU ID / EP ID / ER ID. This effort resulted in a much better linkage between the CEM and S/L inventories.

- In several cases, the EU ID / EP ID / ER ID identifiers in the 2002 MANVU inventory were changed in the 2007 S/L agency submittals. MACTEC worked with the S/L agencies to correct these broken linkages by updating the EU ID / EP ID / ER ID identifiers as necessary.
- MACTEC downloaded the 2007 CEM hourly inventory containing hourly NO<sub>x</sub> and SO<sub>2</sub> emissions and heat input data from the CAMD website. MACTEC summed the hourly emissions to the annual level (or 6-month level for 6-month reporting units) by emission unit. The summed hourly data was compared to the annual summary data, which matched in virtually all cases. This check was made because MARAMA is considering using the actual 2007 hourly data rather than average temporal profiles in the next round of regional air quality modeling.
- As another QA check, MACTEC compiled a list of sources with EGU SCCs of 1-01-xxx-xx and 2-01-xxx-xx in the State NIF tables that could not be linked to the CAMD CEM table. States were asked to review this list and to verify that there are no large EGUs missing from the CAMD CEM to NIF crosswalk.

MACTEC prepared an Excel Workbook file for each S/L agency with updated linkages between the CEM identifiers and the S/L agency identifiers and a comparison between the CEM annual summary emissions, the annual emissions summed from the hourly CEM inventory, and annual emissions reported in the S/L inventory. This spreadsheet matches the CAMD CEM unit-level IDs (ORISID and UNITID) with corresponding NIF table IDs (FIPS, SITE ID, EU ID, EP ID, ER ID). MACTEC made the necessary corrections to the State's original submittal to ensure that the 2007 CAMD CEM identifiers were properly linked with the 2007 NIF table IDs. Emissions are shown as obtained from (1) the CAMD unit level file, (2) the sum of the CAMD hourly emission file, and (3) the State submitted NIF tables. Note that the CAMD Emissions are reported at the unit level while the NIF emissions are reported at the Unit/Process/Stack level. Also note that for CEM units that report only for 6-months, the CAMD emissions are 6-month totals and the NIF emissions are annual.

Appendix A contains the current version of the crosswalk. Remaining linkage issues are highlighted in of the spreadsheet. There are five types of possible linkages:

CAMD unit has no match in NIF tables (these are highlighted in **YELLOW** in the spreadsheet)



CAMD unit matches with a single NIF record (linkage is correct)

CAMD unit matches with multiple NIF records (linkage is correct; in most cases, the NIF tables include multiple records for different fuel types, and the sum of the emissions for the multiple NIF records are generally very close to the CAMD unit level emissions)

Multiple CAMD units match to a single NIF record (these are highlight in **PINK** in the spreadsheet)

Multiple CAMD units match to a multiple NIF records (these are highlight in **PINK** in the spreadsheet)

Depending on the magnitude of the emissions flagged for investigation, further discussion with SMOKE modelers is appropriate to decide on a course of action for resolving these linkage issues that remain for some States. The S/L agencies then indicated if they did or did not want to use the hourly CEM inventory.

### **1.3 PM AUGMENTATION**

PM compounds may be reported in several forms, as identified in Exhibit 1. Exhibit 2 provides a count of the number of annual NIF EM table records in each agency's NIF Submittal by type of PM compound. The PM augmentations process gap-fills missing PM pollutant complements. For example, if a S/L agency provided only PM10-PRI pollutants, the PM augmentation process filled in the PM25-PRI pollutants.

A second aspect of the PM augmentation process is to utilize improved condensable emission factors for EGUs. Condensable emissions were not calculated uniformly across all states in the MANE-VU region in the 2002 emissions inventory. Because of the need to model the effect of condensable emissions on regional haze and fine particles, MARAMA has requested that MACTEC use recently updated emission factors for condensable emissions from EGUs.

The PM augmentation process was divided into two components – the first applying to EGUs and the second to all other point sources. EGUs were identified as those units that CEM data to EPA's CAMD database. Because of the differences in the augmentation process for EGUs and nonEGUs, each process is discussed separately in the following sections. The EGU process uses the updated condensable emission factors, while the nonEGU process is essentially the same process used in developing the 2002 MANE-VU Version 3 inventory.

**Exhibit 1 – PM Compound Descriptions**

<b>Pollutant Code</b>	<b>Pollutant</b>	<b>Pollutant Description</b>
PM-CON	Primary PM Condensable portion only (all < 1 micron)	Material that is vapor phase at stack conditions, but which condenses and/or reacts upon cooling and dilution in the ambient air to form solid or liquid PM immediately after discharge from the stack.
PM-FIL	Primary PM, Filterable portion only	Particles that are directly emitted by a source as a solid or liquid at stack or release conditions and captured on the filter of a stack test train.
PM-PRI	Primary PM, includes filterables and condensibles PM-PRI= PM-FIL + PM-CON	Particles that enter the atmosphere as a direct emission from a stack or an open source. It is comprised of two components: Filterable PM and Condensable PM.
PM10-FIL	Primary PM10, Filterable portion only	Particles with an aerodynamic diameter equal to or less than 10 micrometers that are directly emitted by a source as a solid or liquid at stack or release conditions and captured on the filter of a stack test train.
PM10-PRI	Primary PM10, includes filterables and condensibles, PM10- PRI = PM0-FIL + PM-CON	Particles with an aerodynamic diameter equal to or less than 10 micrometers that enter the atmosphere as a direct emission from a stack or an open source. It is comprised of two components: Filterable PM and Condensable PM. (As specified in § 51.15 (a)(2), These two PM components are the components measured by a stack sampling train such as EPA Method 5.)
PM25-FIL	Primary PM2.5, Filterable portion only	Particles with an aerodynamic diameter equal to or less than 2.5 micrometers that are directly emitted by a source as a solid or liquid at stack or release conditions and captured on the filter of a stack test train.
PM25-PRI	Primary PM2.5, includes filterables and condensibles PM25-PRI= PM25-FIL + PM-CON	Particles with an aerodynamic diameter equal to or less than 2.5 micrometers that enter the atmosphere as a direct emission from a stack or an open source. It is comprised of two components: Filterable PM and Condensable PM. (As specified in § 51.15 (a)(2), These two PM components are the components measured by a stack sampling train such as EPA Method 5.)

**Exhibit 2 – PM Compounds Reported in State NIF Inventories**

Agency	Number of Annual EM Records in Agency's NIF Submittal						
	PM-CON	PM-FIL	PM-PRI	PM10-FIL	PM10-PRI	PM25-FIL	PM25-PRI
CT <sup>1</sup>	---	---	---	122	1,300	---	5
DE	449	---	---	886	756	734	699
DC	70	---	---	70	70	70	70
ME	---	9	---	1,150	---	1,053	---
MD	1,265	---	---	3,543	3,750	3,040	2,477
MA	---	---	6	6,614	---	5,930	---
NH	---	463	---	464	---	461	---
NJ	---	---	5,966	---	5,848	---	---
NY	---	---	1,220	---	1,201	---	---
PA	---	---	---	---	5,738	---	3,949
Allegheny <sup>2</sup>	434	881	---	881	---	836	---
Philadelphia	---	---	---	1,178	27	351	21
RI	12	12	105	12	46	12	48
VT	---	64	---	---	---	---	---
VA <sup>3</sup>	---	---	---	5,204	---	3,302	---

After reviewing the initial draft inventory that was posted in October, 2009, three agencies provided the following changes to their initial submittals. These changes are reflected in the record counts in the above table. The PM augmentation routine was re-executed to account for these changes.

- 1) Connecticut indicated that the PM records in their original submittal for oil and coal-fired boilers should have been submitted as PM10-FIL and not PM10-PRI. All natural gas-fired units and oil-fired turbines were correctly reported as PM10-PRI.
- 2) Allegheny County provided information on 31 additional facilities that were not included in their original submittal.
- 3) Virginia indicated that all of the PM records in their original submittal used incorrect pollutant codes. Records in the original submittal designated as PM10-PRI should have been submitted as PM10-FIL, and PM25-PRI should have been PM25-FIL.

### 1.3.1 EGU PM Augmentation

The EGU PM augmentation process utilized the recently updated condensable emission factors for EGUs developed for MARAMA in 2008. Appendix B contains the technical memorandum describing how the emission factors were developed. The general process is to use the emission factors and heat input to calculate the PM-CON emissions, and then to perform the gap filling for any compounds missing from the S/L submittal.

#### 1.3.1.1 EGU Condensable Emission Factors

As described in Appendix B, two sets of emission factors were developed by 6-digit SCC corresponding to equipment type (boiler or IC engine) and fuel type. The first set is based on all available source tests, while the second set includes only source tests where nitrogen purging occurred. As described in more detail in Appendix B, in measuring condensable PM from combustion of fuels containing sulfur, it has been shown by EPA that SO<sub>2</sub> collected in the impingers can be oxidized to sulfate and produce a variable sulfate artifact that results in overestimation of condensable emissions. In this example, if impingers are not purged with nitrogen, errors associated with the sulfate artifact may be inflated resulting in an overestimation of condensable PM emissions.

Exhibit 3 shows the emission factors considered for use in estimating EGU condensable PM emissions. It shows the new emission factors developed using all available test data as well as the emission factors based only on those tests that utilized a nitrogen purge. In addition, emission factors are available from EPA's AP-42 emission factor document. The emission factors actually used in the augmentation process are **highlighted in bold** in Exhibit 3. Emission factors based on purged test were used where available; otherwise the emission factors based on all tests were used. Since Appendix B did not provide a condensable PM emission factors for residual oil, we used the AP-42 condensable PM emission factor for residual oil.

While Appendix B only provided emission factors for electric generation SCCs (e.g., 1-01-xxx-xx or 2-01-xxx-xx), a review of the S/L agency NIF submittals showed that several other SCCs were used by EGUs. These additional SCCs are *highlighted in italics* in Exhibit 3. Since these SCCs were associated with EGUs, it was assumed that emission factors would apply to these SCCs also. Note also that there were several other SCCs associated with EGUs for which condensable PM emission factors were not available. These SCCs are listed at the bottom of Exhibit 3.

**Exhibit 3 - Emission Factors Used to Estimate EGU Condensable PM Emissions**

SCC (6-digit)	SCC (6-digit) Description	Emission Factor (lbs/mmBtu)		
		MARAMA <sup>1</sup> All Tests	MARAMA <sup>1</sup> Purged Tests Only	AP-42 <sup>2</sup>
1-01-001 1-02-001	Boiler / EGU / Anthracite Coal <i>Boiler / Industrial / Anthracite Coal</i>	<b>0.0084</b>	---	---
1-01-002 1-02-002 1-03-002	Boiler / EGU / Bituminous/Subbituminous Coal <i>Boiler / Industrial / Bituminous/Subbit. Coal</i> <i>Boiler / Commercial / Bituminous/Subbit. Coal</i>	0.022	<b>0.013</b>	0.04 to 0.37 <sup>3</sup> depending on sulfur content
1-01-003 1-02-003	Boiler / EGU / Lignite <i>Boiler / Industrial / Lignite</i>	<b>0.039</b>	---	0.014
1-01-004 1-02-004	Boiler / EGU / #6 Fuel Oil <i>Boiler / Industrial / #6 Fuel Oil</i>	---	---	<b>0.01</b>
1-01-005 1-02-005 1-03-005	Boiler / Industrial / #2 Fuel Oil <i>Boiler / Commercial / #2 Fuel Oil</i> <i>Boiler / EGU / #2 Fuel Oil</i>	<b>0.014</b>	---	0.00928
1-01-006 1-02-006 1-03-006	Boiler / EGU / Natural Gas <i>Boiler / Industrial / Natural Gas</i> <i>Boiler / Commercial / Natural Gas</i>	<b>0.00249</b>	---	0.00559
1-01-008	Boiler / EGU / Petroleum Coke	<b>0.05</b>	---	---
2-01-001 2-01-009 2-02-009	IC Engine / EGU/ Fuel Oil <i>IC Engine / EGU/ Kerosene</i> <i>IC Engine / Industrial / Kerosene</i>	0.013	<b>0.01</b>	0.0072
2-01-002 2-02-002 2-03-002	IC Engine / EGU / Natural Gas <i>IC Engine / Industrial/ Natural Gas</i> <i>IC Engine / Commercial / Natural Gas</i>	0.005	<b>0.0015</b>	0.0047

- 1) Source: *Emissions Factors for Condensable Particulate Matter Emissions from Electric Generating Units*; memo dated August 20, 2008, from Arthur Werner (MACTEC) to Julie McDill (MARAMA). In accordance with EPA guidance, CPM emissions determined from Method 202 tests that apply nitrogen purging are more reliable than results from tests where purging was not used.
- 2) Source: *AP 42, Fifth Edition, Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources*.
- 3) Based on typical bituminous sulfur content range of 0.7 to 4.0 % by weight.
- 4) Based on typical lignite sulfur content of 0.4 % by weight.
- 5) **Bolded** numbers are the emission factors actually used to calculated condensable emissions.

SCCs associated with CAMD CEM units for which condensable emission factors were not available

- 1-01-009 Boiler / EGU / Wood or Bark Waste
- 1-01-010 Boiler / EGU / LPG
- 1-01-012 Boiler / EGU / Solid Waste
- 1-01-013 Boiler / EGU / Liquid Waste
- 1-02-009 Boiler / Industrial / Wood or Bark Waste
- 1-02-010 Boiler / Industrial / LPG
- 1-02-014 Boiler / CO Boiler / Natural or Process Gas
- 3-05-007 Cement Manufacturing / Kilns
- 3-06-002 Petroleum Refining / Catalytic Cracking Units
- 3-06-012 Petroleum Refining / Fluid Coking Units
- 3-90-001 In-process Fuel / Anthracite Coal
- 3-90-012 In-process Fuel / Solid Waste
- 3-99-999 Misc. Industrial Processes

### 1.3.1.2 EGU Heat Input

The annual heat input in mmBtu/year by unit and fuel type is also needed to calculate condensable PM emissions. Heat input was available from two sources. The CAMD CEM database provides heat input, but there are two limitations for each use in this analysis. First, the heat input is reported at the unit level and does not provide a breakout of heat input for units using multiple fuels. Second, only a 6-month heat input value is provided for those units only required to report for six months.

As an alternative to the CAMD CEM heat input, the S/L NIF tables usually provide a fuel process annual throughput which can be used to calculate the heat input using the heating value of the fuel. By calculating the heat input using the NIF annual throughput, the annual heat input is available by fuel type for both 6-month and 12-month reporting units. Where NIF annual throughput was available, it was used to calculate the annual heat input which was then used to calculate condensable PM emissions. In cases where the S/L NIF tables do not provide an annual throughput, the CAMD CEM heat input was assigned to the primary fuel type and used in the condensable PM emission calculations.

### 1.3.1.3 EGU PM Emission Calculations

In addition to calculating the condensable PM emissions, the EGU PM augmentation also gap-fills missing PM compounds. The gap-filling requires that the data be analyzed and separated into cases. The cases determine which math steps and ratios of PM terms will be applied. Exhibit 4 shows the various cases and the augmentation method that was applied. Appendix C is a spreadsheet that shows all data used and results obtained from the EGU PM augmentation process.

**Exhibit 4 – PM Cases and Required Steps to Augment EGU PM Emissions**

Case	PM Reported	Augmentation Methodology
1	---	None required; all PM compounds = 0
2	PM25-PRI	$PM\text{-CON} = HEAT\_USED * EMIS\_FACT$ $PM25\text{-PRI} = PM\text{-CON}$ (only if $PM\text{-CON} > PM25\text{-PRI}$ ) $PM25\text{-FIL} = PM25\text{-PRI} - PM\text{-CON}$ $PM10\text{-FIL} = PM25\text{-FIL} * F10\_F25$ ratio $PM10\text{-PRI} = PM\text{-CON} + PM10\text{-FIL}$
3	PM10-PRI	$PM\text{-CON} = HEAT\_USED * EMIS\_FACT$ $PM10\text{-PRI} = PM\text{-CON}$ (only if $PM\text{-CON} > PM10\text{-PRI}$ ) $PM10\text{-FIL} = PM10\text{-PRI} - PM\text{-CON}$ $PM25\text{-FIL} = PM10\text{-FIL} / F10\_F25$ ratio $PM25\text{-PRI} = PM\text{-CON} + PM25\text{-FIL}$

Case	PM Reported	Augmentation Methodology
4	PM25-PRI PM10-PRI	PM-CON = HEAT_USED * EMIS_FACT PM10-PRI = PM-CON (only if PM-CON > PM10-PRI) PM25-PRI = PM-CON (only if PM-CON > PM25-PRI) PM10-FIL = PM10-PRI - PM-CON PM25-FIL = PM25-PRI - PM-CON
5	PM10-FIL	PM-CON = HEAT_USED * EMIS_FACT PM10-PRI = PM-CON + PM10-FIL PM25-FIL = PM10-FIL / F10_F25 ratio PM25-PRI = PM-CON + PM25-FIL
6	PM10-FIL PM25-FIL	PM-CON = HEAT_USED * EMIS_FACT PM10-PRI = PM-CON + PM10-FIL PM25-PRI = PM-CON + PM25-FIL
7	PM10-FIL PM10-PRI PM25-FIL PM25-PRI	PM-CON = HEAT_USED * EMIS_FACT
8	PM-PRI	PM-CON = HEAT_USED * EMIS_FACT PM-PRI = PM-CON (only if PM-CON > PM-PRI) PM-FIL = PM-PRI - PM-CON PM10-FIL = PM-FIL * F10_FIL ratio PM10-PRI = PM-CON + PM10-FIL PM25-FIL = PM10-FIL / F10_F25 ratio PM25-PRI = PM-CON + PM25-FIL
9	PM-PRI PM10-PRI	PM-CON = HEAT_USED * EMIS_FACT PM10-PRI = PM-CON (only if PM-CON > PM10-PRI) PM10-FIL = PM10-PRI - PM-CON PM25-FIL = PM10-FIL / F10_F25 ratio PM25-PRI = PM-CON + PM25-FIL
10	PM-PRI PM10-FIL	PM-CON = HEAT_USED * EMIS_FACT PM10-PRI = PM-CON + PM10-FIL PM25-FIL = PM10-FIL / F10_F25 ratio PM25-PRI = PM-CON + PM25-FIL
11	PM-FIL	PM-CON = HEAT_USED * EMIS_FACT PM10-FIL = PM-FIL * F10_FIL ratio PM10-PRI = PM-CON + PM10-FIL PM25-FIL = PM10-FIL / F10_F25 ratio PM25-PRI = PM-CON + PM25-FIL
12	PM-FIL PM10-FIL PM25-FIL	PM-CON = HEAT_USED * EMIS_FACT PM10-PRI = PM-CON + PM10-FIL PM25-PRI = PM-CON + PM25-FIL
13	PM-CON PM10-FIL PM25-FIL	PM10-PRI = PM10-FIL + PM-CON PM25-PRI = PM25-FIL + PM-CON
14	PM-CON PM10-FIL PM10-PRI	PM25-FIL = PM10-FIL / F10_F25 ratio PM25-PRI = PMCON + PM25-FIL

Case	PM Reported	Augmentation Methodology
15	PM-CON PM10-FIL PM10-PRI PM25-FIL PM25-PRI	None required; all PM compounds present
16	PM-CON PM-PRI	None required; only one occurrence and emissions were trivial
17	PM-CON PM-PRI PM10-FIL PM10-PRI PM25-FIL PM25-PRI	None required; all PM compounds present
18	PM-CON PM-FIL PM-PRI PM10-FIL PM10-PRI PM25-FIL PM25-PRI	None required; all PM compounds present

### 1.3.2 NONEGU PM Augmentation

The nonEGU PM augmentation process utilized the methodology developed for MARAMA for the 2002 MANE-VU Version 3 inventory. The steps in the PM augmentation process were as follows:

- Step 1: Initial QA and remediation of S/L provided PM pollutants;
- Step 2: Updating of PM factor ratios previously developed for MARAMA based on factors from the Factor Information and Retrieval (FIRE) Data System and the EPA PM Calculator;
- Step 3: Implementation of the ratios developed in step 2.; and
- Step 4: Presentation of PM augmentation results to S/L agencies for review and comment.



### 1.3.2.1 Initial QA and Remediation of PM Pollutants

Before we run the nonEGU PM augmentation process, we first reviewed the data for inconsistencies. If values are found to be inconsistent, they will be replaced. The consistency checks and replacement actions are as follows:

1. If  $PM_{10-PRI} > 0$  and  $PM_{25-PRI} > PM_{10-PRI}$  (and  $PM_{10-FIL}$ ,  $PM_{25-FIL}$  and  $PM-CON$  are null or 0), then set  $PM_{25-PRI} = PM_{10-PRI}$ .
2. If  $PM_{10-FIL} > 0$  and  $PM_{25-FIL} > PM_{10-FIL}$  (and  $PM_{10-PRI}$ ,  $PM_{25-PRI}$  and  $PM-CON$  are null or 0), then set  $PM_{25-FIL} = PM_{10-FIL}$ .
3. If  $PM_{10-PRI} > 0$  and  $PM_{10-FIL} > PM_{10-PRI}$  (and  $PM_{25-PRI}$ ,  $PM_{25-FIL}$  and  $PM-CON$  are null or 0), then set  $PM_{10-FIL} = PM_{10-PRI}$ .
4. If  $PM_{25-PRI} > 0$  and  $PM_{25-FIL} > PM_{25-PRI}$  (and  $PM_{10-PRI}$ ,  $PM_{10-FIL}$  and  $PM-CON$  are null or 0), then set  $PM_{25-FIL} = PM_{25-PRI}$ .

The consistency checks revealed very few occurrences of inconsistencies, and when inconsistencies did occur, the emission values were very small. As a result, S/L agencies were not asked to review this information and provide corrections because the inconsistencies did not involve significant emission sources. The replacement actions above were appropriate for an inventory used for regional air quality modeling.

### 1.3.2.2 Updating of PM Factor Ratios

The augmentation steps require the use of ratios developed from available emissions and particle size distribution data. These ratios are needed when only one PM term is available, and two or more terms need to be augmented. Examples of how we used the PM ratios are shown below:

$$PM-FIL \times Ratio_{CON/FIL} = PM-CON$$

$$PM-PRI \times Ratio_{CON/PRI} = PM-CON$$

$$PM-CON \times Ratio_{FIL/CON} = PM-FIL$$

$$PM-CON \times Ratio_{PRI/CON} = PM-PRI$$

For the MANE-VU 2002 inventory, a table of PM compound ratios was developed. The development of this table is documented in the *TSD for the 2002 MANE-VU SIP Modeling Inventories, Version 3*. The primary deliverable of this step of the process was the development of a table keyed by SCC, primary control device, and secondary control device. This table is called the SCC Control Device Ratios table (Reference Tables MANEVU\_PMAugmentation.mdb ). We updated this table to include SCC, primary

control device, and secondary control device codes found in the 2007 inventory that were not contained in the 2002 MANE-VU inventory.

### 1.3.2.3 nonEGU PM Emission Calculations

The gap-filling requires that the data be analyzed and separated into cases. The cases determine which math steps and ratios of PM terms will be applied. Exhibit 5 shows the various cases and the augmentation method that was applied.

After completing the calculations, the data was QA checked to ensure that the calculations resulted in consistent values for the PM complement. On a few occasions, the mix of ratio value and the pollutants and values provided by the S/L agency resulted in negative values when FIL was back-calculated. In this case the negative FIL value was set to zero and the PRI value was readjusted. In a few cases the appropriate combination of ratios, SCC, and control efficiencies were not available to calculate the PM10-PRI and PM25-PRI values. In these cases, PM10-PRI and PM25-PRI were set equal.

### 1.3.2.4 nonEGU PM Emission Results

Appendix D is a spreadsheet that shows all data used and results obtained from the nonEGU PM augmentation process.

#### Exhibit 5 – PM Cases and Required Steps to Augment nonEGU PM Emissions

Case	PM Reported	Augmentation Methodology
1	PM25-PRI	$PM-CON = PM25-PRI * CON\_P25 \text{ ratio}$ $PM25-FIL = PM25-PRI - PM-CON$ $PM10-FIL = PM25-FIL * F10\_F25 \text{ ratio}$ $PM10-PRI = PM-CON + PM10-FIL$
2	PM10-PRI	$PM-CON = PM10-PRI * CON\_P10 \text{ ratio}$ $PM10-FIL = PM10-PRI - PM-CON$ $PM25-FIL = PM10-FIL / F10\_F25 \text{ ratio}$ $PM25-PRI = PM-CON + PM25-FIL$
3	PM25-PRI PM10-PRI	$PM-CON = PM10-PRI * CON\_P10 \text{ ratio}$ $PM10-FIL = PM10-PRI - PM-CON$ $PM25-FIL = PM25-PRI - PM-CON$
4	PM10-FIL	$PM-CON = PM-CON * CON\_F10 \text{ ratio}$ $PM10-PRI = PM-CON + PM10-FIL$ $PM25-FIL = PM10-FIL / F10\_F25 \text{ ratio}$ $PM25-PRI = PM-CON + PM25-FIL$
5	PM10-FIL PM25-FIL	$PM-CON = PM10-FIL * CON\_F10 \text{ ratio}$ $PM10-PRI = PM-CON + PM10-FIL$ $PM25-PRI = PM-CON + PM25-FIL$

6	PM10-FIL PM10-PRI	PM-CON = PM10-PRI - PM10-FIL PM25-FIL = PM10-FIL * F25_F10 ratio PM25-PRI = PM-CON + PM25-FIL
7	PM25-FIL	PM-CON = PM25-FIL * CON_F25 ratio PM10-FIL = PM25-FIL * F10_F25 ratio PM10-PRI = PM-CON + PM10-FIL PM25-PRI = PM-CON + PM25-FIL
8	PM10-FIL PM10-PRI PM25-FIL PM25-PRI	PM-CON = PM25-PRI - PM25-FIL
9	PM-PRI	PM-CON = PM-PRI * CON_PRI ratio PM-FIL = PM-PRI - PM-CON PM10-FIL = PM-FIL * F10_FIL ratio PM10-PRI = PM-CON + PM10-FIL PM25-FIL = PM10-FIL / F10_F25 ratio PM25-PRI = PM-CON + PM25-FIL
10	PM25-FIL PM25-PRI	PMCON = PM25-PRI - PM25-FIL PM10-FIL = PM25-FIL * F10_F25 ratio PM10-PRI = PM-CON + PM10-FIL
11	PM-CON PM10-FIL PM25-FIL	PM10-PRI = PM-CON + PM10-FIL PM25-PRI = PM-CON + PM25-FIL
12	PM-CON	PM10-FIL = PM-CON * F10_CON ratio PM25-FIL = PM10-FIL * F25_F10 ratio PM10-PRI = PM-CON + PM10-FIL PM25-PRI = PM-CON + PM25-FIL
13	PM-CON PM10-FIL PM10-PRI	PM25-FIL = PM10-FIL / F10_F25 ratio PM25-PRI = PMCON + PM25-FIL
14	PM-CON PM10-FIL PM10-PRI PM25-FIL PM25-PRI	None required; all PM compounds present
15	PM-CON PM-FIL	PM10-FIL = PM-CON / CON_F10 ratio PM25-FIL = PM10-FIL / F10_F25 ratio PM10-PRI = PM-CON + PM10-FIL PM25-PRI = PM-CON + PM25-FIL
16	PM-CON PM10-PRI PM25-PRI	PM10-FIL = PM10-PRI - PM-CON PM25-FIL = PM25-PRI - PM-CON
17	PM-FIL	PM10-FIL = PM-FIL * F10_FIL ratio PM_CON = PM10-FIL * CON_F10 ratio PM25-FIL = PM10-FIL / F10_F25 ratio PM10-PRI = PM-CON + PM10-FIL PM25-PRI = PM-CON + PM25-FIL

## **1.4 STAKEHOLDER REVIEW, COMMENT AND RESPONSE**

On October 6, 2009, MARAMA provided a notice to stakeholders of the opportunity to review the initial draft of the 2007 point source inventory data and documentation. Stakeholders were invited to review and comment on the draft 2007 inventory of air emissions from point sources to be used for regional air quality modeling. On October 20, MARAMA hosted a conference call that provided an opportunity for stakeholders to ask questions about the draft 2007 point source modeling inventory. Written comments were reviewed by the State inventory staff and MARAMA, and resulted in several changes to the draft documentation and inventory data. The changes requested by stakeholders and approved by the States are summarized in the following subsections.

### **1.4.1 Connecticut Response to Stakeholder Comments**

Sikorsky Aircraft provided comments on roughly ten sources regarding the SO<sub>x</sub>, PM, and VOC emissions. All requested changes were very small (under a ton per year). Connecticut accepted all of Sikorsky Aircraft's comments.

Covanta Energy commented that the annual NO<sub>x</sub> emissions for the Covanta Bristol Unit #1 (Facility ID 09003-0902, emission unit P0026) were abnormally low because of a temporary pilot test of a NO<sub>x</sub> emission control technology. Covanta requested that 2005 emissions should be used since the 2007 actual emissions are not representative of previous or subsequent years. Since the 2007 inventory is being used for air quality modeling that will be tied to actual air quality data, Connecticut decided to use actual 2007 emission values rather than 2005 values as requested by Covanta. Connecticut will consider this comment again during the development of the future year inventories to ensure that reasonable future year emissions are estimated.

Hamilton Sundstrand commented that three emission units at its facility (Facility ID 09003-8602, emission units P0038, P0079, and R0097) were permanently shut down in 2008. Since the 2007 inventory is being used for air quality modeling that will be tied to actual air quality data, Connecticut decided to use actual 2007 emission values. Connecticut will consider this comment again during the development of the future year inventories to ensure that reasonable future year emissions are estimated.

NRG Energy provided very minor revisions to the SO<sub>2</sub>, NO<sub>x</sub>, CO, VOC, and NH<sub>3</sub> emissions data for the Montville (Facility ID 09011-1505) and Norwalk (Facility ID 09001-4214) facilities. Connecticut accepted these changes. NRG also requested minor revisions to the PM emissions data for these two facilities. Connecticut accepted these changes as well.

#### **1.4.2 Maryland Response to Stakeholder Comments**

NRG Energy requested a change to the VOC emissions for the Vienna Power Generating Station (Facility ID 019-0013, emission unit 4-0065). Maryland agreed to make the change, revising the VOC emissions from 0.9455 to 0.9641 tons per year.

Transcontinental Gas Pipe Line Company commented that the inventory for its facility in Howard County (Facility ID 027-0223) has 12 internal combustion engines represented by one grouped emission unit, which gives the impression that there is one large source when there are actually 12 smaller units. Maryland did not change the inventory based on this comment since the 12 engines are nearly identical and identifying each engine individually is not needed for the 2007 modeling inventory.

Covanta Energy requested changes to the stack parameters for the three units at the Montgomery County Resource Recovery Facility (Facility ID 031-1718). Maryland agreed to make those revisions.

#### **1.4.3 Massachusetts Response to Stakeholder Comments**

Saint Gobain Containers requested minor changes to the annual emissions and stack parameters for its facility in Milford (Facility ID 25027-1200856). Massachusetts accepted the changes and the 2007 inventory was updated to reflect the stakeholder comments.

#### **1.4.4 New Jersey Response to Stakeholder Comments**

RRI Energy provided updated emissions and stack data for several of its facilities, mostly minor changes to PM emission values and revisions to stack parameters. New Jersey agreed to make the revisions provided by RRI Energy.

BASF identified that its plant in East Newark (Facility ID 34017-10419) was permanently shut down and did not operate in 2007. New Jersey agreed and the 2007 emissions were set to zero.

Merck & Co., Inc indicated that its facility in Rahway, NJ (Facility ID 34039-41712) emitted 3.42 tons/yr of ammonia emissions from their boilers in 2007. New Jersey agreed and the ammonia emissions were added to the inventory.

Georgia Pacific Gypsum LLC submitted updates for its Camden facility (Facility ID 34007-51611) to correct the 2007 emissions based upon recent stack test data for board dryer U7 and process emissions factors from kettles U3, U4 and U5. Total PM2.5 emissions were also updated using current AP-42 factors for the Gypsum industry. In

addition, the ammonia emissions were missing from the inventory. New Jersey agreed to make the requested changes.

E.R. Squibb & Sons, LLC, requested changes to the ammonia and PM<sub>2.5</sub> emissions for its facilities in Lawrenceville, NJ (Facility ID 34021-61052), New Brunswick, NJ (Facility ID 34023-17739), and Hopewell (Facility ID 34021-61053). New Jersey agreed to make the requested changes.

Schering Corporation supplied corrections to the ammonia emissions from its Kenilworth facility (Facility ID 34039-41806). New Jersey agreed to make the requested changes.

ConocoPhillips Company provided revisions to ammonia and VOC emissions for the Bayway Refinery (Facility ID 34039-41805). They also provided revisions to selected Source Classification Codes for certain heaters, sulfur recovery units, truck loading activities, marine vessel loading activities, and emergency flares. ConocoPhillips also requested that certain parts of the refinery be modeled as area sources rather than point sources, and provided rectangular grid coordinates to define the area sources. While this change would be appropriate for a fence-line modeling study, it cannot be accommodated in a multi-State regional air quality model since the SMOKE emission modeling system is not capable of handling area sources that are smaller than the air quality model grid cell.

Covanta Energy requested minor revisions to the ammonia and PM emissions at the Union County Resource Recovery Facility (Facility ID 34039-41814) and Warren Energy Resource Facility (Facility ID 34041-85455). New Jersey agreed to make those revisions.

Air Engineering submitted comments on behalf of EF Kenilworth LLC (Facility ID 34029-41741), requesting minor changes to PM emissions and revisions to stack parameters. New Jersey agreed to make the requested changes.

Air Engineering submitted comments on behalf of Rowan University (Facility ID 34015-55779), requesting adding ammonia emissions for its sources. New Jersey agreed to make the requested changes.

Air Engineering submitted comments on behalf of The College of New Jersey (Facility ID 34021-61008), requesting adding ammonia emissions for its sources and revisions to stack parameters. New Jersey agreed to make the requested changes.

Actavis requested the addition of 0.13 tons per year of ammonia for their facility (Facility ID 34039-40295). New Jersey agreed to make the addition.

PSEG Power LLC requested a few changes to Source Classification Codes and stack parameters, as well as numerous minor changes to emission estimates, for its facilities in New Jersey. New Jersey agreed to make the revisions. PSEG also requested the units classified as “insignificant units” be excluded from the modeling inventory. New Jersey elected to keep the emissions from insignificant units in the inventory because the purpose of the inventory is to model all of the emissions actually emitted in 2007.

MRPC/OEC-LES requested changes Source Classification Codes, ammonia and PM emissions, and stack parameters for its facility (Facility ID 34029-78901). New Jersey agreed to make the revisions.

#### **1.4.5 New York Response to Stakeholder Comments**

Covanta Energy provided updated PM emissions and stack data for several of its facilities, mostly minor changes to PM emission values and revisions to stack parameters. New York agreed to make the revisions provided by Covanta Energy.

NRG Energy provided updated PM emissions and stack data for its facilities. NRG Energy also provided updated data for the individual turbine units at the Astoria Gas Turbine Power Plant (ORISID=55243). New York agreed to make the revisions provided by NRG Energy. NRG Energy also noted that baghouses are being installed at the Dunkirk and Huntley coal-fired plants. These changes were noted and will be accounted for in the future year inventories.

#### **1.4.6 Pennsylvania Response to Stakeholder Comments**

Covanta Energy requested changes to stack parameters at the Delaware Valley (Facility ID 420450059), Lancaster County (Facility ID 420710145), Plymouth (420910295) and Harrisburg (Facility ID 420430017) facilities. Covanta also requested minor changes to the emission estimates at the Plymouth facility. Pennsylvania agreed to make those revisions.

RRI Energy provided updated emissions and stack data for several of its facilities. The most notable change was a significant increase in PM emissions at several coal-fired units. Pennsylvania agreed to make the revisions provided by RRI Energy.

Saint Gobain Containers requested minor changes to the annual emissions and stack parameters for its facility in Port Allegheny (Facility ID 420830006). Pennsylvania accepted the changes and the 2007 inventory was updated to reflect the stakeholder comments.

The National Lime Association requested changes to the PM emissions for four of their member facilities: Mercer Lime & Stone (Facility ID 420190021), Graymont/Pleasant Gap (Facility ID 420270003), Carmeuse Lime/Millard Lime (Facility ID 420750016), and OWB Refractories (Facility ID 421330007). Pennsylvania accepted the changes and the 2007 inventory was updated to reflect the stakeholder comments.

#### **1.4.7 Virginia Response to Stakeholder Comments**

Virginia received comments from Covanta Energy and Transco requesting very minor changes to the emissions for their facilities (generally less than 0.1 ton change in emissions). Virginia decided not to make those changes because of the insignificant impact on the regional modeling inventory.

BASF identified that its plant in Virginia is permanently shut down. Since it did operate in 2007, the actual 2007 emissions will be used for the 2007 modeling. Emissions from the plant will be set to zero for future year inventories.

Michigan Cogen Systems requested minor changes to stack parameters for their facility. Virginia approved the requested changes.

### **1.5 ADDITIONAL STATE-SPECIFIC UPDATES**

Several States and local agencies provided revisions and updates following their review of the initial draft of the point source inventory posted in October, 2009. These changes are summarized in the following subsections.

#### **1.5.1 Connecticut**

During the review of the initial draft 2007 inventory, Connecticut identified several emission units with unexpectedly high emission values. Connecticut determined that its original submittal had emissions adjusted for rule effectiveness. Since the 2007 inventory is being used for air quality modeling that will be tied to actual air quality data, Connecticut decided to use actual 2007 emission values rather than values that had been artificially adjusted to account for rule effectiveness. MACTEC calculated the actual emissions for all units with a non-zero rule effectiveness value by backing out the rule effectiveness value. These actual emission values were supplied to Connecticut for review and approval. Connecticut recommended that the actual emissions calculated by MACTEC be used instead of the values originally supplied by Connecticut which included rule effectiveness.

Connecticut indicated that some of the PM records in their original submittal used incorrect pollutant codes. Connecticut indicated that the PM records in their original



submittal for oil and coal-fired boilers should have been submitted as PM10-FIL and not PM10-PRI. All natural gas-fired units and oil-fired turbines were correctly reported as PM10-PRI. The PM augmentation routine described in Section 1.3 was re-executed for the coal- and oil-fired units.

#### **1.5.2 Delaware**

No revisions to the initial inventory were requested or made.

#### **1.5.3 District of Columbia**

The District of Columbia made revisions to the emission inventory for Benning Road (Facility ID 11001-0001). There are four emission units at the facility designated as Units 1, 2, 15, and 16. Units 15 and 16 report emissions to EPA's CAMD CEM database, while units 1 and 2 do not. Units 1 and 2 were not included in the initial point source inventory. These two units were added to the inventory and increased facility-wide SO<sub>2</sub> emissions by about 100 tons per year and NO<sub>x</sub> emissions by 50 tons per year. Smaller increases were added for the other pollutants.

#### **1.5.4 Maine**

Maine provided a small correction to the SO<sub>2</sub> emissions for the Maine Independence Station (Facility ID 2301900115).

Maine provided small corrections to the SO<sub>2</sub> and NO<sub>x</sub> emissions for Westbrook Energy Center (Facility ID 2300500193). Also there was an error in the cross-reference between the EPA CAMD database and the State's NIF database, which was corrected.

#### **1.5.5 Maryland**

No additional revisions beyond those requested by stakeholder were requested or made.

#### **1.5.6 Massachusetts**

Maine identified an error in the PM augmentation routine that incorrectly replaced State-reported PM<sub>25</sub>-FIL values. MACTEC reviewed the PM augmentation routine and identified the error that affected "Case 5" nonEGU PM<sub>25</sub>-FIL and PM<sub>25</sub>-PRI values. This error also affected numerous small sources in Massachusetts. The error was corrected and the State-reported PM<sub>25</sub>-FIL values were retained during the PM augmentation process and that the PM<sub>25</sub>-PRI values were correctly calculated using the State-reported PM<sub>25</sub>-FIL value.

### **1.5.7 Maine**

Maine identified an error in the PM augmentation routine that incorrectly replaced State-reported PM25-FIL values. MACTEC reviewed the PM augmentation routine and identified the error that affected “Case 5” nonEGU PM25-FIL and PM25-PRI values. The error was corrected and the State-reported PM25-FIL values were retained during the PM augmentation process and that the PM25-PRI values were correctly calculated using the State-reported PM25-FIL value.

### **1.5.8 New Hampshire**

Maine identified an error in the PM augmentation routine that incorrectly replaced State-reported PM25-FIL values. MACTEC reviewed the PM augmentation routine and identified the error that affected “Case 5” nonEGU PM25-FIL and PM25-PRI values. This error also affected numerous small sources in New Hampshire. The error was corrected and the State-reported PM25-FIL values were retained during the PM augmentation process and that the PM25-PRI values were correctly calculated using the State-reported PM25-FIL value.

### **1.5.9 New Jersey**

New Jersey identified numerous emission units that were inadvertently missing from their initial submittal. Most of these units were flagged as “insignificant units” or “non-source fugitive” sources in New Jersey’s data system and were excluded during the initial conversion to NIF tables. New Jersey subsequently identified these “unmatched” units and submitted pertinent data for inclusion in the 2007 modeling inventory. MACTEC added these units and emissions to the NIF database. The emissions added to the inventory from these units were about: 60 tpy of CO, 50 tpy of NO<sub>x</sub>, 672 tpy of PM10-PRI, 257 tpy of PM25-PRI, 5 tpy of SO<sub>2</sub>, and 1,477 tpy of VOC.

Ammonia emissions were missing from New Jersey’s initial submittal. New Jersey supplied the missing ammonia emissions, which added about 845 tpy of NH<sub>3</sub> to the point source inventory.

### **1.5.10 Pennsylvania – Allegheny County**

Allegheny County’s initial 2007 submittal included only the five “very large” sources that were submitted to EPA for the 2007 NEI. After the release of the initial version of the point source inventory in October, 2009, the agency provided a second submittal with an addition 31 facilities. The second submittal was subjected to the QA and PM augmentation procedures described previously in Sections 1.2 and 1.3 of this report.

### **1.5.11 Pennsylvania - Philadelphia**

Philadelphia provided the following revisions to the initial draft inventory:

- Boiler #3 at Sunoco Chemical Frankford Plant (Facility ID 4210101551 and emission point 052) was linked to CAMD ORIS ID 880007 and boilerID 52.
- VOC emissions at Cardone Industries (Facility ID 4210103887) were increased from 75.96 to 143.98 tons per year.

### **1.5.12 Rhode Island**

Rhode Island revised the emissions for Providence Metallizing Co. (Facility ID 44007AIR1230 and emission point 2). All emissions for this emission point were changed to zero for 2007.

### **1.5.13 Vermont**

No revisions to the initial inventory posted in October 2009 were requested or made.

### **1.5.14 Virginia**

After the release of the initial version of the point source inventory in October, 2009, the agency provided a second submittal with a number of additional distributed generation units. The second submittal was subjected to the QA and PM augmentation procedures described previously in Sections 1.2 and 1.3 of this report. A flag was added to the EP table to identify the distributed generation units for both the units in Virginia's original submittal as well as the new units.

Virginia indicated that all of the PM records in their original submittal used incorrect pollutant codes. Records in the original submittal designated as PM10-PRI should have been submitted as PM10-FIL, and PM25-PRI should have been PM25-FIL. The PM augmentation routine described in Section 1.3 was re-executed after changing all PM10-PRI to PM10-FIL and all PM25-PRI to PM25-FIL.

Virginia revised the PM data for the Mirant Potomac River Generating Station (SiteID: 51-510-00003) using 2007 condensable test data using the test method with the nitrogen purge to replace the emission factors previously applied by MACTEC.

## **1.6 EMISSION RELEASE POINT QA CHECKS**

Stack parameters are an important component of an emission inventory used for regional air quality modeling. Careful QA is required to ensure that the point source emissions are properly located both horizontally and vertically on the modeling grid. This section

describes the procedures used to quality assure, augment, and where necessary, revise, stack parameters using standardized procedures to identify and correct stack data errors. These procedures were implemented within the NIF file itself, and are based on the QA procedures built into SMOKE that are designed to catch missing or out-of-range stack parameters.

### **1.6.1 QA Checks and Gap-Filling for Location Coordinates**

Because air quality modeling strives to replicate the actual physical and chemical processes that occur in an inventory domain, it is important that the physical location of emissions be determined as accurately as possible. The emission release (ER) point record is used to report the location and relevant physical attributes of the emission release point. Location coordinates must be reported to identify where emissions are released to the ambient air, via a stack or non-stack (e.g., fugitive release). If a non-stack, or fugitive release, coordinates may be reported for the general location of the emission release point.

In the ER record, location data may be reported as x and y coordinates from either of two coordinate systems - Latitude / Longitude (LATLON), or Universal TransMercator (UTM). X - Y coordinates reported as Latitude and Longitude must be reported in the decimal degree format specified. X - Y coordinates reported as UTM Easting and UTM Northing, must be reported in kilometers.

Any UTM data received in the MARAMA files was processed by the MACTEC Team and converted to, and stored as Latitude Measure and Longitude Measure in decimal degrees. All conversions of UTM to LATLON were conducted using a spreadsheet<sup>1</sup> developed by Professor Steven Dutch, School of Natural and Applied Sciences, University of Wisconsin - Green Bay. This spreadsheet tool allowed for batch conversion of UTM data to decimal degree format and was configured for WGS 84 DATUM. While errors using this spreadsheet are typically a few meters, rarely 10 or more, the accuracy of the conversion is limited to the accuracy of the initial UTM data.

Once all conversions were made to LATLON decimal degrees (also the requirement of the SMOKE emissions processing system), reasonableness checks were conducted on each release point relative to county centroids and min/max coordinates associated with the FIPS codes assigned to each stack. If a stack was found to exist outside of the western-, eastern-, northern- or southern-most boundary of the county (based on SMOKE's county

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<sup>1</sup> <http://www.uwgb.edu/dutchs/FieldMethods/UTMSystem.htm>

lat/lon file), the point was flagged for additional review. These flagged sources were then mapped with GIS software to determine their placement relative to the FIPS County associated with the stack. If a source was found to be outside of the county boundaries, it was further identified and reported for review.

### **1.6.2 QA Checks and Gap-Filling for Emission Release Parameters**

In preparing emissions for grid modeling, valid parameters for the physical characteristics of each release point (stack height, diameter, temperature, velocity, and flow) are necessary to correctly place facility release points and associated emissions into vertical layers for proper air quality modeling. The EPA's QA guidance for diagnosing stack parameter issues was generally applied to identify QA issues in the S/L point source inventories. The QA guidance involved diagnosing the correct assignment of the ERP type (i.e., stack or fugitive), parameters with zero values, parameters not within the range of values specified in the EPA's QA procedures, and consistency checks (i.e., comparing calculated values against the values reported in the inventory). In many cases errors were caused by missing or zero values.

The first step of our quality assurance (QA) involves review of the Emission Release Point Type. Using this type code, we used a routine to assess the validity of the stack parameters, to replace values if necessary, and to fill-in missing data points. We employed a routine that compared each emission release point parameter to a minimum and maximum range of values and when that parameter was missing or was found to exist outside of that range, we augmented the parameter. We also checked non-fugitive stack parameters for internal consistency between:

- stack height and diameter, and  
stack diameter, exit gas velocity, and exit gas flow rate.

When internal consistency was not met, we provided replacement values for the parameters.

The following steps summarize the process of finding and replacing missing, out-of-range, or internally inconsistent stack parameters.

#### **Step 1: For fugitive emission release points, replace stack parameters**

For fugitive emission release points (ERPTYPE=01), we first compared the existing fugitive emission height against the following range thought to be representative of the minimum and maximum values allowable for most fugitive emission release points.

Fugitive Release Height: 0.1 to 100 ft

In all but one case, the fugitive release height was valid and we kept the fugitive release height and replaced all other stack parameters with the defaulted values listed below. In some cases, the fugitive release height was blank but the S/L agency provided a stack height and we retained the S/L supplied stack height. In other cases, the S/L agency provided a temperature for the fugitive emissions and we retained the S/L supplied temperature. The following summarizes the procedure for filling in stack parameters for fugitive emission release points:

Stack Height: use fugitive release height, if valid; if fugitive release height not present and stack height provided, use the stack height; if neither fugitive release height or stack height not present, use 10 feet as the default.

Stack Temperature: use temperature provided by S/L agency, if valid; otherwise used 72 °F.

Stack Diameter: use 0.003 feet for all fugitive sources

Stack Velocity: 0.0003 feet per second for all fugitive sources

Stack Flow: use 0.0 cubic feet per second for all fugitive sources

**Step 2: For non-fugitive emission release points, find and replace out-of-range or missing stack heights and temperatures**

For non-fugitive emission release points, we first compared existing stack parameters against a set of the following ranges thought to be representative of the minimum and maximum values allowable for most emission release points.

Stack Height: 0.1 to 1000 feet

Stack Temperature: 50 to 1,800 °F

Stack Diameter: 0.1 to 50 feet

First we identified missing or out-of range parameters. Then we evaluated the source category to determine if out-of-range parameters were plausible. If any parameter was missing or out-of range, the parameter was replaced using the procedures described below.

Stack Height: All stack heights were less than the maximum value of 1000 feet. Numerous stack heights were zero or missing, in which case the stack height was filled in using national default sets of physical parameter data based on the SCC.

Stack Temperature: There were 30 records where the stack temperature exceeded 1,800 °F. We reviewed the stack description table for these records, which indicated that most of these stacks were for flares or furnaces. We deemed the S/L supplied temperature data as plausible and retained the S/L provided value. There were 100 records where the stack temperature was less than 50 °F and not equal to 0 °F or missing. We reviewed the stack description table for these records, which indicated that many of these stacks were for refrigerated tanks or other sources where the S/L supplied temperature data was deemed plausible. For example, there is a nylon manufacturing facility in Virginia that emits thousands of tons of NOx emissions per year. Most of the NOx is emitted from a handful of fairly cold stacks, with exit gas temperatures generally ranging from 40-60 degrees. Rather than replace these S/L supplied values that seemed plausible with national defaults, we retained the S/L supplied data. Where the stack temperature was reported as 0 °F or missing, we replaced the stack temperature with the national default based on the SCC.

**Step 3: For non-fugitive emission release points, find and replace out-of-range or missing stack diameters, velocities, and flow rates**

First, we evaluated the stack diameter to determine if it was within the valid range of 0.1 to 50 feet. There were 200 records where the stack diameter exceeded 50 feet. We reviewed the stack description table for these records, which indicated that most of these were large storage tanks, cooling towers, wastewater treatment ponds or area-type sources such as process equipment leaks. Based on this review, we deemed the S/L supplied diameter data as plausible and retained the S/L provided value.

There were 66 records records with missing stack diameters where both the velocity and flow rate were provided. For these records, the stack diameter was calculated using the following equation:

$$\text{Stack Diameter [ft]} = \text{SQRT} ( 4 * \text{Stack Flow [cu ft/sec]} / (\text{Stack Velocity [ft/sec]} * \pi [\text{Pi}]))$$

For the remaining cases where the stack diameter was reported as zero or missing, we replaced the stack diameter with the national default based on the SCC.

The velocity and flow rate were evaluated next. If the diameter, velocity and flow rate were all non-zero, we determined the internal consistency between diameter, velocity and flow rate using the following equation.

$$\text{Stack Flow [cu ft/sec]} = (\pi [\text{Pi}] * (\text{Stack Diameter [ft]} / 2) ^ 2) * \text{Stack Velocity [ft/sec]}$$

If the calculated flow and the reported flow are within 10 % of one another, then internal consistency was assumed to be valid. If the velocity and flow rate were found to be consistent, no additional steps were taken. If the internal consistency was not met for velocity and flow rate, Exhibit 6 below provides instructions on how we replaced missing, out-of-range values, or internally inconsistent values for velocity and flow rate based on different reported scenarios. Velocity and flow rate were augmented either by calculation or the use of national defaults by SCC when necessary.

## **1.7 EMISSION SUMMARY**

Exhibits 7-13 present a State-level summaries of the annual point source emissions by pollutant in the 2007 inventory and compares the emissions to Version 3 of the 2002 MANE-VU inventory. For most States and pollutants, point source emissions have decreased from 2002 to 2007. A notable exception is the large increase in PM emissions in Maryland, which needs to be investigated.



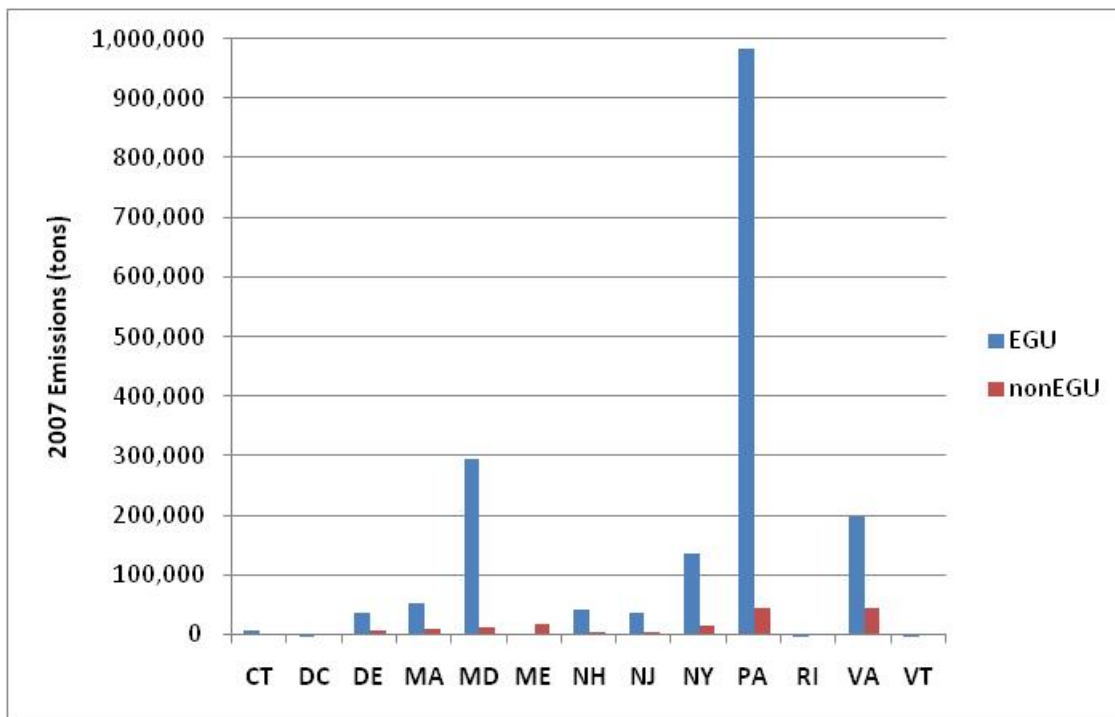
**Table 1. Stack Parameter Data Replacement Matrix (X = Data value present)**

Diameter	Velocity	Flow Rate	Action
-	X	X	1. Calculate diameter using velocity and flow rate. 2. Check that calculated diameter is within range.
-	-	-	1. Replace diameter, velocity, and flow rate with national SCC default values.
-	-	X	1. Replace diameter, velocity, and flow rate with national SCC default values.
-	X	-	1. Replace diameter, velocity, and flow rate with national SCC default values.
X	-	-	1. Default velocity using national default sets. 2. Calculate flow rate using internal consistency formula.
X	-	X	1. Calculate velocity using internal consistency formula. 2. Check that calculated velocity is within range (less than 150 ft/sec). A. If calculated velocity is not within range, then default all 3 parameters using national default sets.
X	X	-	1. Check that velocity is within range (less than 150 ft/sec). A. If velocity is within range, then: > Calculate flow rate using internal consistency formula. B. If velocity is not within range, then: > Default all 3 parameters using national default sets.
X	X	X	1. Check that velocity is within range (less than 150 ft/sec). A. If velocity is within range and flow rate does not meet internal consistency for diameter, velocity and flow rate, then: > Calculate flow rate using internal consistency formula. B. If velocity is not within range, then: > Calculate velocity using internal consistency formula. > Check that calculated velocity is within range. If so, then default to calculated velocity. > If calculated velocity is not within range, then default all 5 parameters using national default set.

**Exhibit 7 – 2002 and 2007 Point Source SO2 Emissions by State (tons/year)**

STATE	2002	2007	Change
Connecticut	15,988	7,971	-50%
Delaware	73,744	43,088	-42%
District of Columbia	963	612	-36%
Maine	23,711	17,248	-27%
Maryland	290,929	305,383	5%
Massachusetts	106,960	63,229	-41%
New Hampshire	46,560	45,258	-3%
New Jersey	61,217	40,703	-34%
New York	294,729	152,751	-48%
Pennsylvania	995,175	1,028,056	3%
Rhode Island	2,666	1,516	-43%
Vermont	905	322	-64%
Virginia	305,106	243,048	-20%
	<b>2,218,653</b>	<b>1,949,185</b>	<b>-12%</b>

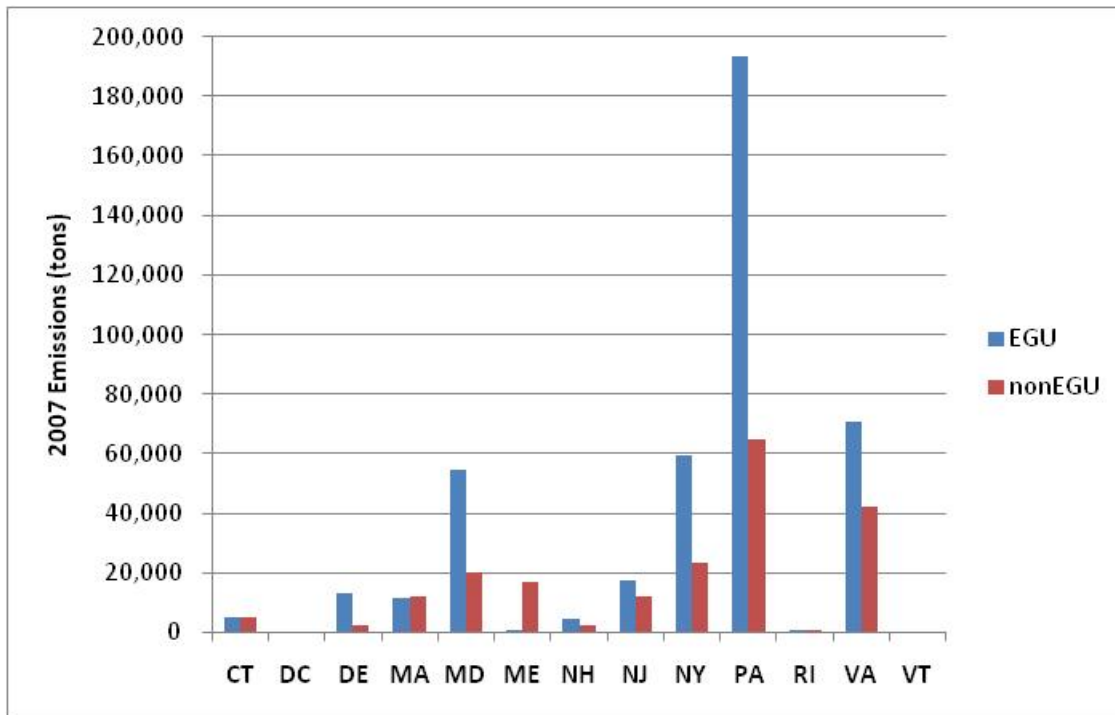
**Exhibit 8 – EGU and nonEGU 2007 Point Source SO2 Emissions by State**



**Exhibit 9 – 2002 and 2007 Point Source NOx Emissions by State (tons/year)**

STATE	2002	2007	Change
Connecticut	12,923	10,061	-22%
Delaware	16,345	15,628	-4%
District of Columbia	780	789	1%
Maine	19,939	17,746	-11%
Maryland	95,369	74,890	-21%
Massachusetts	48,607	23,628	-51%
New Hampshire	9,759	7,441	-24%
New Jersey	51,593	30,088	-42%
New York	118,978	83,033	-30%
Pennsylvania	297,379	258,379	-13%
Rhode Island	2,764	1,444	-48%
Vermont	787	811	3%
Virginia	147,300	112,938	-23%
	<b>822,523</b>	<b>636,876</b>	<b>-23%</b>

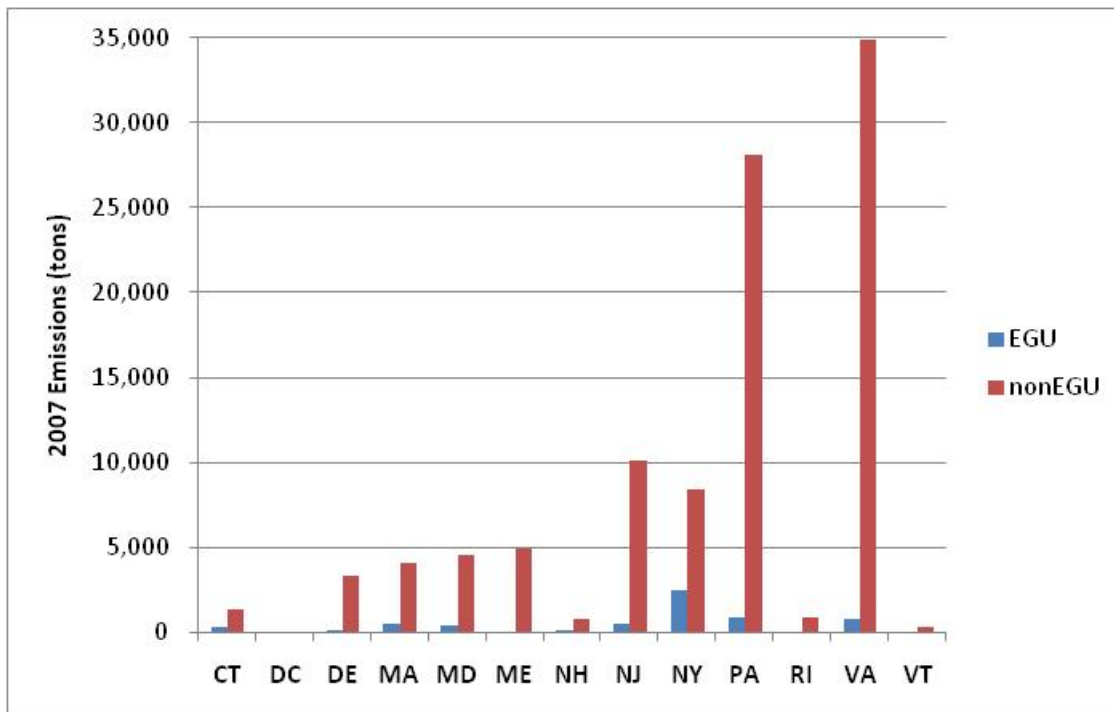
**Exhibit 10 – EGU and nonEGU 2007 Point Source NOx Emissions by State**



**Exhibit 11 – 2002 and 2007 Point Source VOC Emissions by State (tons/year)**

STATE	2002	2007	Change
Connecticut	4,907	1,590	-68%
Delaware	4,755	3,489	-27%
District of Columbia	69	59	-14%
Maine	5,319	5,022	-6%
Maryland	6,187	4,986	-19%
Massachusetts	8,350	4,557	-45%
New Hampshire	1,599	916	-43%
New Jersey	16,547	10,526	-36%
New York	11,456	10,891	-5%
Pennsylvania	37,323	28,965	-22%
Rhode Island	1,928	970	-50%
Vermont	1,097	395	-64%
Virginia	43,906	35,618	-19%
	<b>143,443</b>	<b>107,984</b>	<b>-25%</b>

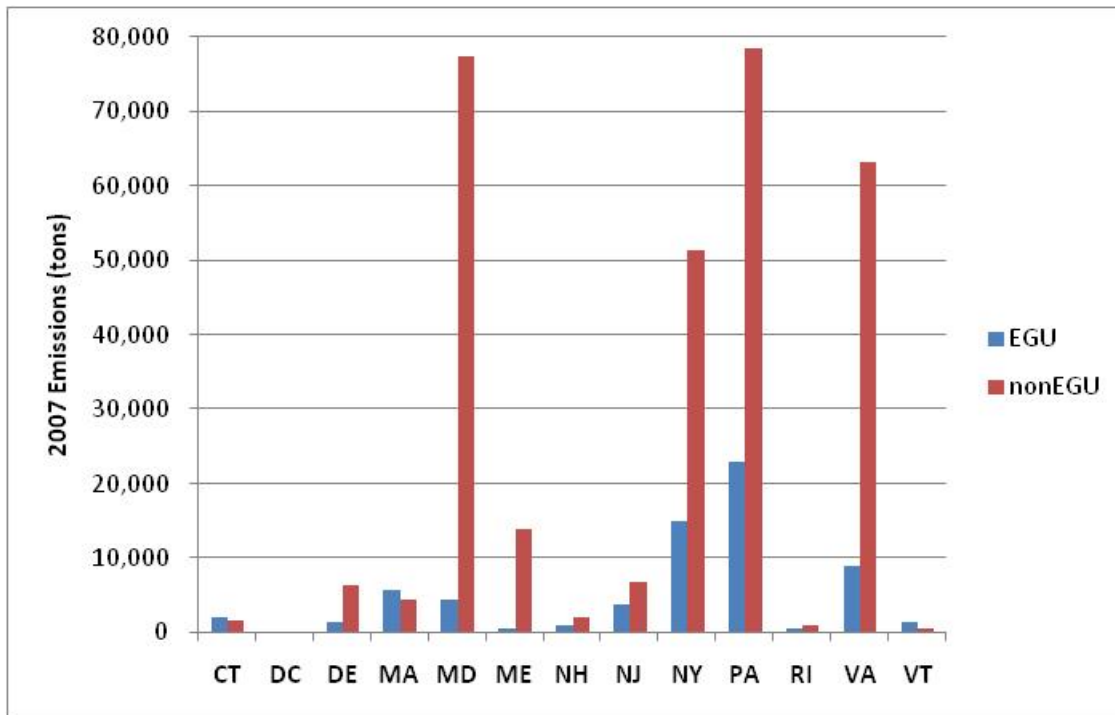
**Exhibit 12 – EGU and nonEGU 2007 Point Source VOC Emissions by State**



**Exhibit 13 – 2002 and 2007 Point Source CO Emissions by State (tons/year)**

STATE	2002	2007	Change
Connecticut	4,053	3,679	-9%
Delaware	9,766	7,753	-21%
District of Columbia	248	311	25%
Maine	17,005	14,483	-15%
Maryland	99,032	81,770	-17%
Massachusetts	21,641	10,108	-53%
New Hampshire	2,725	3,164	16%
New Jersey	12,300	10,548	-14%
New York	66,427	66,357	0%
Pennsylvania	121,524	101,440	-17%
Rhode Island	2,234	1,653	-26%
Vermont	1,078	2,146	99%
Virginia	70,688	72,029	2%
	<b>428,721</b>	<b>375,441</b>	<b>-12%</b>

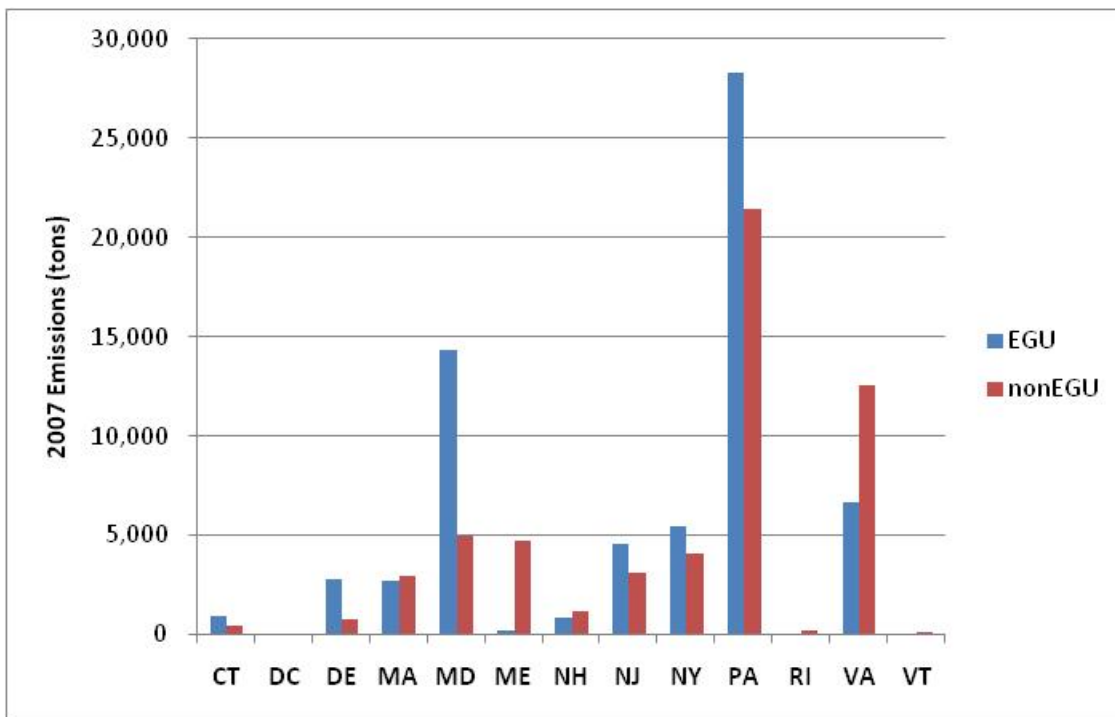
**Exhibit 14 – EGU and nonEGU 2007 Point Source CO Emissions by State**



**Exhibit 15 – 2002 and 2007 Point Source PM10-PRI Emissions by State (tons/year)**

STATE	2002	2007	Change
Connecticut	1,617	1,350	-17%
Delaware	4,217	3,465	-18%
District of Columbia	161	59	-63%
Maine	7,289	4,896	-33%
Maryland	9,046	19,322	114%
Massachusetts	5,852	5,604	-4%
New Hampshire	3,332	1,925	-42%
New Jersey	6,072	7,642	26%
New York	10,392	9,507	-9%
Pennsylvania	40,587	49,745	23%
Rhode Island	300	189	-37%
Vermont	304	146	-52%
Virginia	17,211	19,203	12%
	<b>106,380</b>	<b>123,053</b>	<b>16%</b>

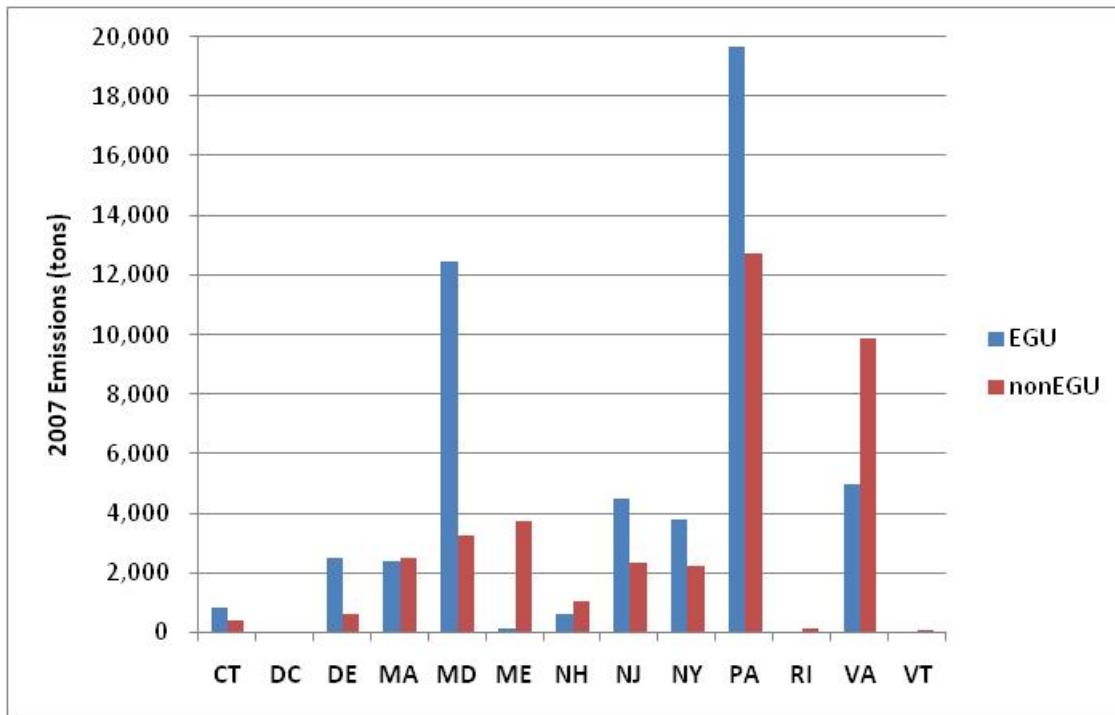
**Exhibit 16 – EGU and nonEGU 2007 Point Source PM10-PRI Emissions by State**



**Exhibit 17 – 2002 and 2007 Point Source PM25-PRI Emissions by State (tons/year)**

STATE	2002	2007	Change
Connecticut	1,283	1,242	-3%
Delaware	3,666	3,107	-15%
District of Columbia	132	53	-60%
Maine	5,787	3,852	-33%
Maryland	5,054	15,682	210%
Massachusetts	4,161	4,864	17%
New Hampshire	2,938	1,663	-43%
New Jersey	4,779	6,821	43%
New York	7,080	5,999	-15%
Pennsylvania	20,116	32,460	61%
Rhode Island	183	140	-23%
Vermont	267	114	-57%
Virginia	12,771	14,888	17%
	<b>68,217</b>	<b>90,885</b>	<b>33%</b>

**Exhibit 18 – EGU and nonEGU 2007 Point Source PM25-PRI Emissions by State**



**Exhibit 19 – 2002 and 2007 Point Source NH3 Emissions by State (tons/year)**

STATE	2002	2007	Change
Connecticut	0	0	
Delaware	196	94	-52%
District of Columbia	4	0	-100%
Maine	845	665	-21%
Maryland	305	137	-55%
Massachusetts	1,578	2,956	87%
New Hampshire	74	128	73%
New Jersey	0	918	
New York	1,861	2,417	30%
Pennsylvania	1,388	2,379	71%
Rhode Island	58	74	28%
Vermont	0	0	
Virginia	3,230	1,830	-43%
	<b>9,539</b>	<b>11,598</b>	<b>22%</b>

**Exhibit 20 – EGU and nonEGU 2007 Point Source NH3 Emissions by State**

