Appendix C

VERSION 3.3 Technical Support Document for the Development of the 2017 / 2020 Emission Inventories for Regional Air Quality Modeling in the Northeast / Mid-Atlantic Region;

January 23, 2012

Technical Support Document for the Development of the 2017 / 2020 Emission Inventories for Regional Air Quality Modeling in the Northeast / Mid-Atlantic Region Version 3.3

Prepared for:

Mid-Atlantic Regional Air Management Association (MARAMA)
8600 LaSalle Road, Suite 636
Towson, MD 21286
(443) 901-1882

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Submitted by

AMEC Environment & Infrastructure
4021 Stirrup Creek Drive
Suite 100
Durham, NC 27703
919 381-9900

SRA International, Inc.
652 Peter Jefferson Parkway
Suite 300
Charlottesville, VA 22911
571 499-0833

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About MARAMA

The Mid-Atlantic Regional Air Management Association, Inc. is a voluntary, non-profit association of ten state and local air pollution control agencies. MARAMA's mission is to strengthen the skills and capabilities of member agencies and to help them work together to prevent and reduce air pollution in the Mid-Atlantic Region. MARAMA provides cost-effective approaches to regional collaboration by pooling resources to develop and analyze data, share ideas, and train staff to implement common requirements.

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Acronyms and Abbreviations

Acronym	**Description**
CAMD	Clean Air Markets Division (USEPA)
CAP	Criteria Air Pollutant
CEM	Continuous Emission Monitoring
CMV	Commercial Marine Vessel
CO	Carbon Monoxide
CTG	Control Technique Guideline
EGU	Electric Generating Unit
ERTAC	Eastern Regional Technical Advisory Committee
FIPS	Federal Information Processing Standard
GACT	Generally available control technology
GSE	Ground Support Equipment
MACT	Maximum Achievable Control Technology
MANE-VU	Mid-Atlantic/Northeast Visibility Union
MANE-VU+VA	MANE-VU States plus Virginia
MAR	Marine, Airport, Rail
MARAMA	Mid-Atlantic Regional Air Management Association
MOBILE6	USEPA model
MOVES	Motor Vehicle Emissions Simulator
NAICS	North American Industry Classification System code
NCD	National County Database
NEI	National Emission Inventory
NESCAUM	Northeast States for Coordinated Air Use Management
NH3	Ammonia
NIF3.0	National Emission Inventory Input Format Version 3.0
NMIM	National Mobile Input Model
NOF3.0	National Emission Inventory Output Format Version 3.0
NONROAD	USEPA model
NOx	Oxides of nitrogen
OAQPS	Office of Air Quality Planning and Standards (USEPA)
ORL	One-record-per-line (SMOKE Format)
OTAQ	Office of Transportation and Air Quality (USEPA)
PFC	Portable Fuel Container
PM-CON	Primary PM, Condensable portion only (< 1 micron)
PM-FIL	Primary PM, Filterable portion only
PM-PRI	Primary PM, includes filterables and condensables PM-PRI= PM-FIL + PM-CON

Acronym	**Description**
PM10-FIL	Primary PM10, Filterable portion only
PM10-PRI	Primary PM10, includes filterables and condensables, PM10- PRI = PM0-FIL + PM-CON
PM25-FIL	Primary PM2.5, Filterable portion only
PM25-PRI	Primary PM2.5, includes filterables and condensables PM25-PRI= PM25-FIL + PM-CON
RWC	Residential Wood Combustion
SEMAP	Southeast Modeling, Analysis and Planning
SIC	Standard Industrial Classification code
SIP	State Implementation Plan
SCC	Source Classification Code
S/L	State/local
SMOKE	Sparse Matrix Operator Kernel Emissions
SO2	Sulfur Dioxide
USEPA	U.S Environmental Protection Agency
VISTAS	Visibility Improvement State and Tribal Association of the Southeast
VMT	Vehicle Miles Traveled
VOC	Volatile Organic Compounds

1.0 INTRODUCTION

This technical support document (TSD) explains the data sources and methods used to prepare criteria air pollutant (CAP) and ammonia (NH3) emission projections for 2017 and 2020 for the Northeast and Mid-Atlantic/Northeast region. The region includes the jurisdictions in the Mid-Atlantic / Northeast Visibility Union (MANE-VU) area plus Virginia. In this document, these jurisdictions will be referred to as the MANE-VU+VA region. The MANE-VU+VA region includes Connecticut, Delaware, the District of Columbia, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, and Virginia.

1.1 INVENTORY PURPOSE

The MANE-VU+VA regional inventories will be used to concurrently address national ambient air quality standard (NAAQS) requirements for the new ozone and fine particle ambient standards and to evaluate progress towards long-term regional haze goals. The emission inventories will support a single integrated, one-atmosphere air quality modeling platform, state air quality attainment demonstrations, and other state air quality technical analyses.

The future year inventories account for emissions growth associated with changes in population, fuel use, and economic activity. The future year inventories also refect the emission changes between 2007 and the two future years that are projected under two emission control scenarios:

- Existing Controls – this scenario represents the best estimates for the future year, accounting for all in-place controls that are fully adopted into federal or individual state regulations or State Implementation Plans (SIPs). In the past, this inventory is also referred to as the "on-the-books (OTB)" inventory. Air quality modelers often refer to this scenario as the "future base case."

- Potential New OTC Controls – this scenario accounts for all of the emission reductions from the existing control scenario plus new state or regional measures that are under consideration by the Ozone Transport Commission (OTC) or individual states. This is a "what if" scenario that assumes that all states in the MANE-VU+VA region except Virginia will adopt all new OTC control measures under consideration by 2017. Air quality modelers sometimes call this the "future control case." It does not include any potential new <u>federal</u> control measures that are under consideration.

The U.S. Environmental Protection Agency (USEPA) has provided guidance on developing emission projections to be used with models and other analyses for demonstrating attainment of air quality goals for ozone, fine particles, and regional haze (USEPA 1999, USEPA 2005a, USEPA 2007a). In addition, the USEPA has recently developed its own emission projections that provide data on growth and future controls that were useful in developing the MANE-VU+VA future year emission inventories (USEPA 2010a). The guidance and information available from USEPA was followed and used, as appropriate, in developing the future year emission projections.

1.2 POLLUTANTS

The inventory includes annual emissions for carbon monoxide (CO), ammonia (NH3), oxides of nitrogen (NOx), particulate matter (PM), sulfur dioxide (SO2), and volatile organic compounds (VOC). The PM species in the inventory are categorized as: filterable and condensable particles with an aerodynamic diameter less than or equal to a nominal 10 and 2.5 micrometers (i.e., PM10-PRI and PM25-PRI); filterable particles with an aerodynamic diameter less than or equal to a nominal 10 and 2.5 micrometers (i.e., PM10-FIL and PM25-FIL); and condensable particles (PM-CON). Note that PM10-PRI equals the sum of PM10-FIL and PM-CON, and PM25-PRI equals the sum of PM25-FIL and PM-CON.

1.3 SOURCE CATEGORIES

Emission inventory data from six general categories are needed to support air quality modeling: electric generating units (EGUs), stationary nonEGU point-sources, stationary area-sources, on-road mobile sources, nonroad mobile sources, and biogenic/geogenic emissions. This report documents the development of emission projections for three of these sectors, as follows:

- **NonEGU Point Sources** are individual facilities and are further subdivided by stack, emission unit ("point"), and emission process ("segment"). Point source data include source-specific information on source location (e.g., latitude/longitude coordinates); stack parameters (stack diameter and height, exit gas temperature and velocity); type of process (source classification code {SCC}); and annual emissions.
- **Stationary Area Sources** include sources that in and of themselves are quite small, but in aggregate may contribute significant emissions. Examples include small industrial/commercial facilities, residential heating furnaces, VOCs volatizing from

house painting or consumer products, gasoline service stations, and agricultural fertilizer/pesticide application.

- **Non-road Mobile Sources** include internal combustion engines used to propel marine vessels, airplanes, and locomotives, or to operate equipment such as forklifts, lawn and garden equipment, portable generators, etc. For activities other than marine vessels, airplanes, and railroad locomotives (MAR), the inventory was developed using the most current version of USEPA's NONROAD model as embedded in the National Mobile Inventory Model (NMIM). Since the NONROAD model does not include emissions from MAR sources, these emissions were estimated based on data and methodologies used in recent USEPA regulatory impact analyses.

For these three sectors, emissions projections were compiled on an annual basis to represent conditions in 2017 and 2020.

Emission projections for the three other sectors are being developed by the OTC under separate efforts:

- **EGU Point Sources** are units that generate electric power and sell most of that power to the electrical grid. Emission projections for EGUs are being developed as part of an inter-RPO coordination effort under the direction of the Eastern Regional Technical Advisory Committee (ERTAC).

- **On-road Mobile Sources** are sources of air pollution from internal combustion engines used to propel cars, trucks, buses, and other vehicles on public roadways. Emission projections for on-road mobile sources are being developed under a separate effort by the OTC that will use the USEPA Motor Vehicle Emission Simulator (MOVES) model.

- **Biogenic** emissions are emitted by natural sources, such as plants, trees, and soils. The sharp scent of pine needles, for instance, is caused by monoterpenes, which are VOCs. The USEPA developed estimates of biogenic emissions from vegetation for natural areas, crops, and urban vegetation. The USEPA estimates take into account the geographic variations in vegetation land cover and species composition, as well as seasonal variations in leaf cover. Emission projections for biogenic sources will be developed under a separate effort by the OTC modeling team.

Documentation of the emission projections for these three sectors will be available from the OTC.

1.4 DATA FORMATS

The annual mass emissions inventory files were prepared in the National Emissions Inventory (NEI) Output Format Version 3.0 (NOF 3.0). Spreadsheets summarizing emissions by county, sector, source classification code, and pollutant were also prepared.

These annual emission inventories will be converted (through the emissions modeling process) from their original resolution (e.g., annual, county level) to input files for air quality models. These input files require emissions to be specified by model grid cell, hour, and model chemical species. The emission modelers in the MANE-VU+VA region are using the Sparse Matrix Operator Kernel Emissions (SMOKE) modeling system and data formats. Emission inventory files were prepared in SMOKE compatible format.

1.5 INVENTORY VERSIONS

1.5.1 Version 1 Modeling Inventory

Work commenced in 2009 to assemble comprehensive 2007 and future year emission inventories to support air quality modeling. Using data available from state agencies and the USEPA, detailed point and area source emission inventories were compiled. The NONROAD model was used to estimate emissions for the nonroad equipment categories included in the model. State and USEPA data were used to assemble the inventory for nonroad sources not included in the NONROAD model (marine vessels, aircraft, and railroad locomotives, collectively referred to as the MAR sector).

For the point, area, and MAR sectors, growth factors are applied to account for changes in population, fuel use and economic activity. Next, control factors are applied to account for future emission reductions from post-2007 control measures. The NONROAD model was used to project emissions for the nonroad equipment included in the model. The control scenario developed accounted for post-2007 emission reductions from promulgated federal, State, local, and site-specific control programs and proposed control programs that are reasonably anticipated to result in post-2007 emission reductions. A series of quality assurance steps are conducted to ensure the development of complete, accurate, and consistent emission inventories. The inventories are provided in two formats – SMOKE One-Record-Per-Line (ORL) format and a spreadsheet format suitable for SIP submittals. Finally, emission summary tables by state and pollutant were developed.

Version 1 of the 2007 base year inventory and the emission projections for 2013/2017/2020 were released for state and stakeholder review in late 2009 and early 2010.

1.5.2 Version 2 Modeling Inventory

Following the review of Version 1, significant efforts were made to improve the inventory by using more state-specific data and correcting errors or omissions that were uncovered. These improvements were completed in February of 2011 and are referred to as Version 2 of the MANE-VU+VA 2007 and 2013/2017/2020 inventories. The inventories were documented in two TSDs (MARAMA 2011a, MARAMA 2011b).

1.5.3 Version 3 Modeling Inventories with Existing and Potential Controls

Beginning in the fall of 2011, MARAMA sponsored development of Version 3 of the 2007 base year modeling inventory to incorporate new paved road emission estimates, revised modeling of nonroad and onroad sources, and other state-specific changes (MARAMA2012).

This report documents the development of Version 3 of the future year inventories for the area source, nonEGU, and nonroad sectors. The future year modeling inventories for EGU) are currently being developed under a separate effort lead by ERTAC. The future year modeling inventories for onroad sources are currently being developed by NESCAUM, MARAMA or individual states.

In Version 3, the state Air Directors issued guidance on the future year emission control scenarios to be developed, as follows:

- “A special meeting of the Air Directors was convened to discuss the controlled inventory. During that call many Air Directors indicated that they would not be able to clearly identify which of the control measures their states would adopt because of the uncertainty surrounding the ozone standard. Therefore, all states, except Virginia, requested that the contractor be instructed to calculate the effect of all measures being fully adopted by both 2017 and 2020. This will allow modelers to assess the potential effect of the measures if they were fully implemented on air quality. We can also then test the assumptions that we have been making about the cumulative percent reduction from the measures.”

Thus, these TSD discusses two future control scenarios: an “existing controls” scenario scenario intended to include all 2017/2020 control measaures included in an individual state’s regulations or SIP, and a "what if" scenario that assumes that all states adopt certain new control measures by 2017.

1.6 REPORT ORGANIZATION

Section 2 describes how point source emission units were classified into the EGU or nonEGU point source categories. Section 3 discusses the growth projection factors assembled for area and nonEGU point sources. Sections 4 and 5 describe the control factors used for area and nonEGU point sources, respectively. Section 6 describes the NONROAD model runs made for the future years. Section 7 documents how emissions for marine vessels, aircraft, and railroad equipment were projected. Section 8 provides state level emission pollutant summaries for area, nonEGU point, NONROAD, and MAR sectors. Section 9 documents the creation of SMOKE inventory modeling input files. Section 10 identifies the file names for final deliverable products. References for the TSD are provided in Section 11.

2.0 IDENTIFICATION OF EGU AND NONEGU POINT SOURCES

Only the emissions from point sources classified as nonEGUs are being projected using the methods and data contained in this report. Emissions from EGU point sources are being developed by ERTAC.

States were asked to classify units in the 2007 MANE-VU+VA emissions inventory as either EGU or nonEGU. Most, but not all, of the units that are required to report hourly emissions to USEPA's Clean Air Markets Division (CAMD) are classified as EGUs. CAMD implements USEPA's rule found in Volume 40 Part 75 of the Code of Federal Regulations (CFR), which requires an hourly accounting of emissions from each affected unit - i.e., sources participating in an emissions cap and trade program under the Acid Rain Control Program, the NOx Budget Trading Program, or the Clean Air Interstate Rule.

For the ERTAC projection methodology, the following guidance was provided to states to classify a unit as an EGU if it meets the following criteria:

- An EGU sells most of the power generated to the electrical grid;
- An EGU burns mostly commercial fuel. Commercial fuel in this case means natural gas, oil, and coal. Wood is not considered a commercial fuel because some states identify wood as renewable. Therefore, to avoid double counting, units that burn wood and other renewable sources (depending on each state's own definition) should not be considered as an EGU (unless it is already in the CAMD database).

The following are units were <u>not</u> considered as EGU for emission projections: (1) a unit that generates power for a facility but occasionally sells to the grid; (2) emergency generators; or (3) distributed generation units.

States were provided with a list of units that report to CAMD (USEPA 2009a) and a list of units with an electric generating unit SCC (1-01-xxx-xx or 2-01-xxx-xx). States identified which units should be classified as EGUs and which should be classified as nonEGUs. Appendix A identifies the units that report emissions to CAMD and whether they are classified as EGUs or nonEGUs for emission projection purposes. A few states also identified units with SCCs beginning with 1-01 or 2-01 that do not report to CAMD but which should be classified as EGUs; however, for emission projection purposes these units will be processed using the nonEGU projection methodology described in this report.

Exhibits 2.1 to 2.7 summarize EGU and nonEGU emissions for 2007. For these exhibits, EGUs are defined as units that report emissions to CAMD and have been classified as EGUs by the states for emission projection purposes.

Exhibit 2.1 2007 EGU and NonEGU Point Source CO Emissions (tons per year)

State	EGU	NonEGU	Total
CT	1,095	2,584	3,679
DE	726	7,027	7,753
DC	10	301	311
ME	460	14,023	14,483
MD	4,196	77,574	81,770
MA	5,516	4,592	10,108
NH	910	2,254	3,164
NJ	3,640	6,932	10,572
NY	13,480	52,877	66,357
PA	20,900	80,540	101,440
RI	602	1,051	1,653
VT	1,444	702	2,146
VA	7,273	63,080	70,353
TOTAL	**60,252**	**313,537**	**373,789**

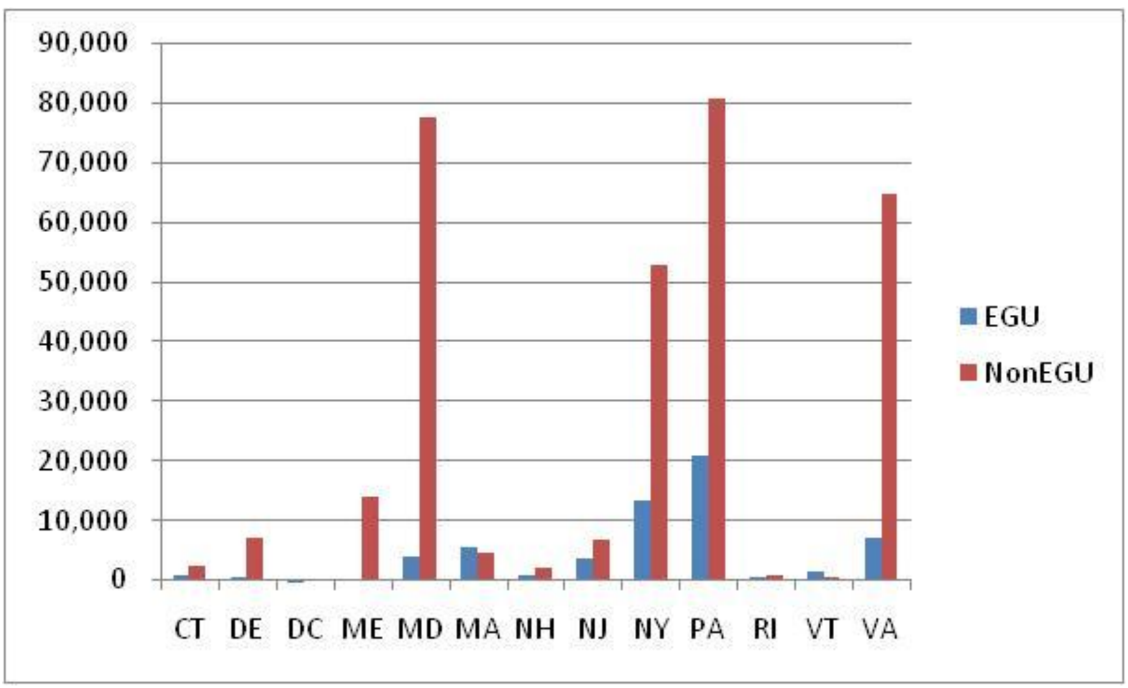


Exhibit 2.2 2007 EGU and NonEGU Point Source NH3 Emissions (tons per year)

State	EGU	NonEGU	Total
CT	0	0	0
DE	32	62	94
DC	0	0	0
ME	59	606	665
MD	0	137	137
MA	283	365	648
NH	98	30	128
NJ	708	210	918
NY	1,354	1,063	2,417
PA	309	2,070	2,379
RI	58	16	74
VT	0	0	0
VA	212	1,618	1,830
TOTAL	**3,113**	**6,177**	**9,290**

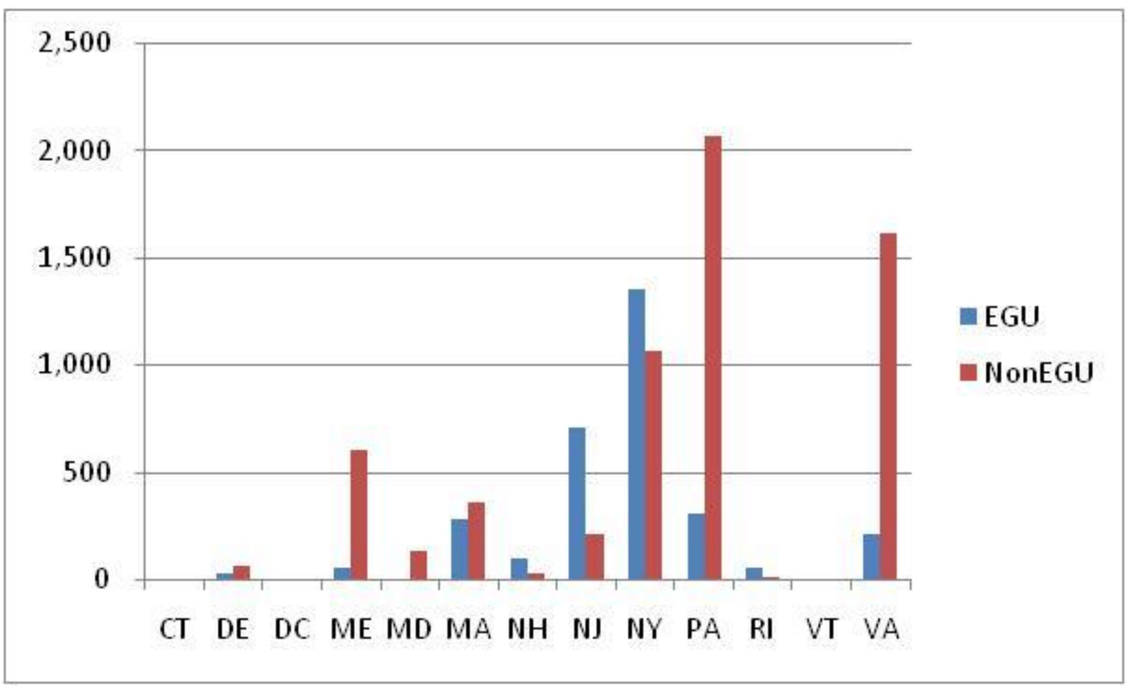


Exhibit 2.3 2007 EGU and NonEGU Point Source NOx Emissions (tons per year)

State	EGU	NonEGU	Total
CT	3,760	6,301	10,061
DE	10,507	5,121	15,628
DC	55	734	789
ME	696	17,050	17,746
MD	51,418	23,472	74,890
MA	10,755	12,873	23,628
NH	4,754	2,687	7,441
NJ	16,571	14,030	30,601
NY	47,450	35,583	83,033
PA	186,997	71,382	258,379
RI	494	950	1,444
VT	370	441	811
VA	62,673	50,265	112,938
TOTAL	**396,500**	**240,889**	**637,389**

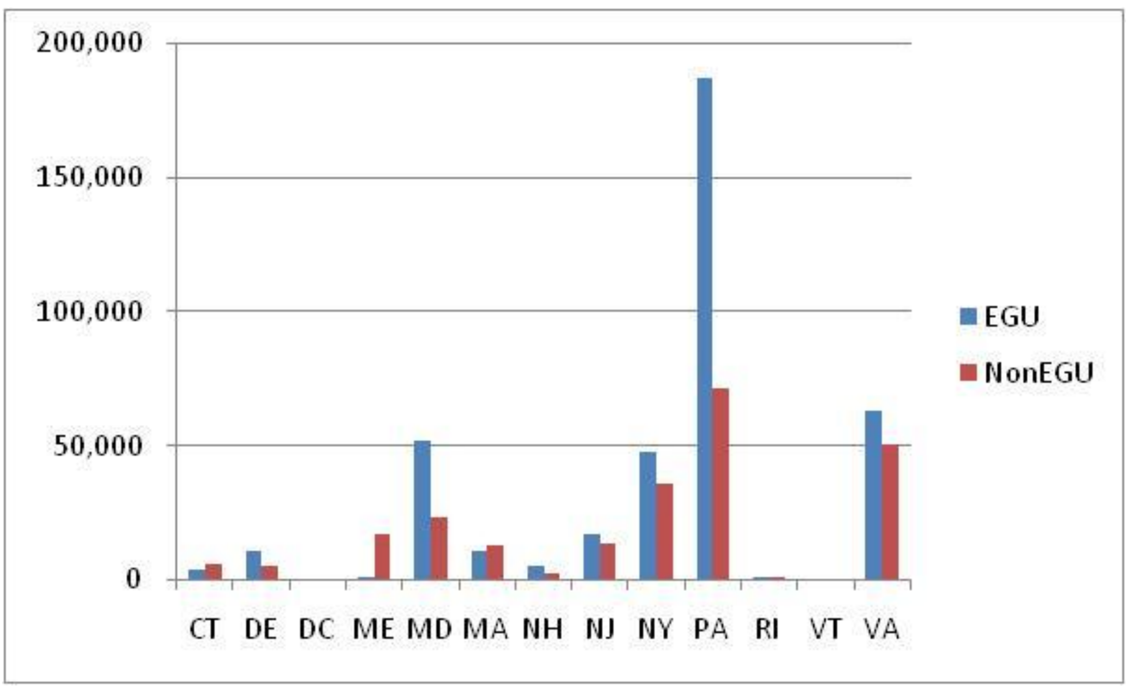


Exhibit 2.4 2007 EGU and NonEGU Point Source PM10 Emissions (tons per year)

State	EGU	NonEGU	Total
CT	705	645	1,350
DE	2,268	1,197	3,465
DC	13	46	59
ME	148	4,748	4,896
MD	13,611	5,711	19,322
MA	2,575	3,029	5,604
NH	784	1,141	1,925
NJ	4,496	3,188	7,684
NY	5,044	4,463	9,507
PA	27,470	22,275	49,745
RI	16	173	189
VT	0	146	146
VA	6,175	13,028	19,203
TOTAL	**63,305**	**59,790**	**123,095**

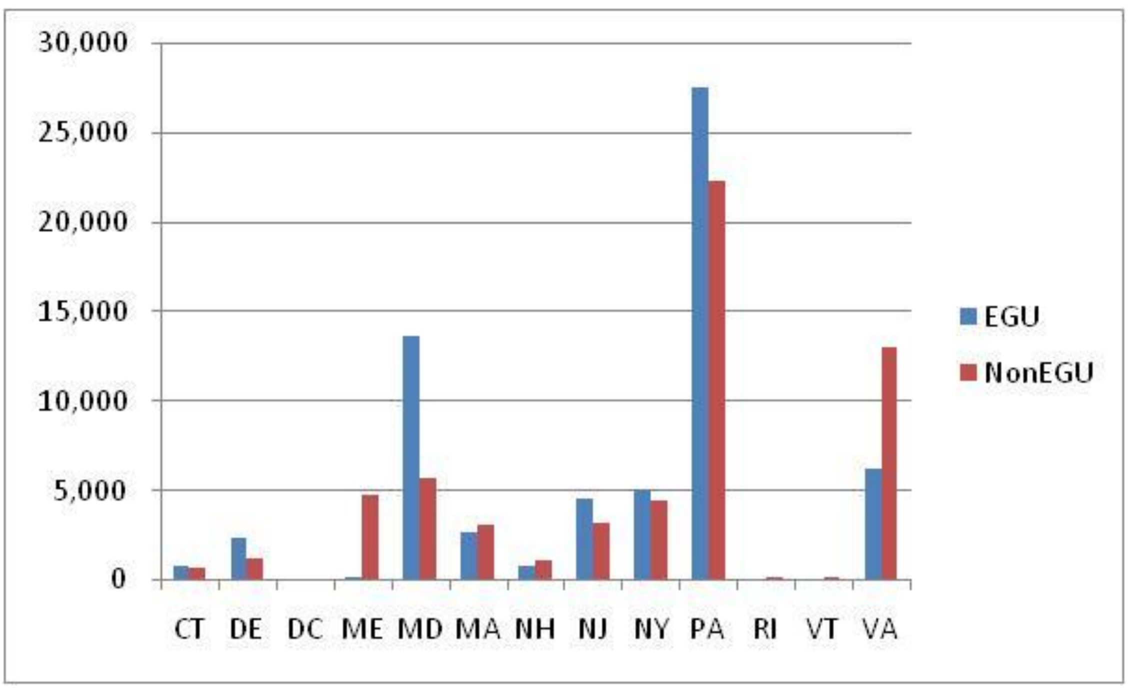


Exhibit 2.5 2007 EGU and NonEGU Point Source PM2.5 Emissions (tons per year)

State	EGU	NonEGU	Total
CT	669	573	1,242
DE	2,024	1,083	3,107
DC	10	43	53
ME	125	3,727	3,852
MD	11,805	3,877	15,682
MA	2,292	2,572	4,864
NH	602	1,061	1,663
NJ	4,410	2,453	6,863
NY	3,585	2,414	5,999
PA	19,071	13,389	32,460
RI	16	124	140
VT	0	114	114
VA	4,593	10,295	14,888
TOTAL	**49,202**	**41,725**	**90,927**

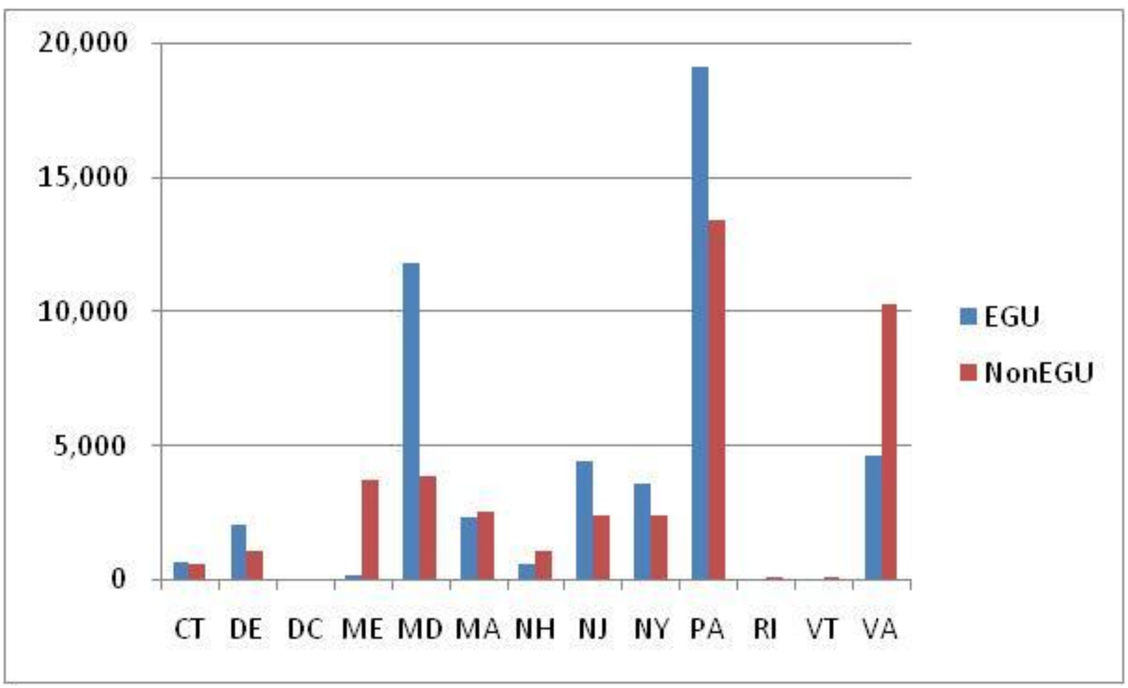


Exhibit 2.6 2007 EGU and NonEGU Point Source SO2 Emissions (tons per year)

State	EGU	NonEGU	Total
CT	4,786	3,185	7,971
DE	34,882	8,206	43,088
DC	141	471	612
ME	1,677	15,571	17,248
MD	274,207	31,176	305,383
MA	54,172	9,057	63,229
NH	42,524	2,734	45,258
NJ	37,302	3,490	40,792
NY	108,444	44,307	152,751
PA	970,726	57,330	1,028,056
RI	16	1,500	1,516
VT	6	316	322
VA	188,562	54,486	243,048
TOTAL	**1,717,445**	**231,829**	**1,949,274**

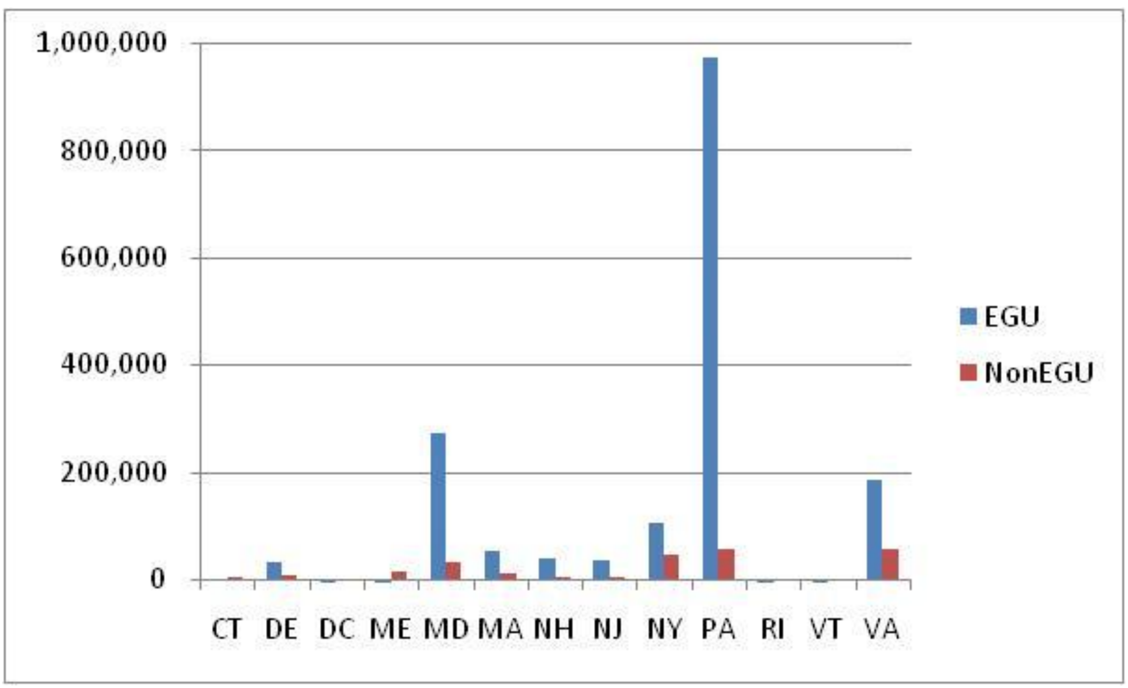
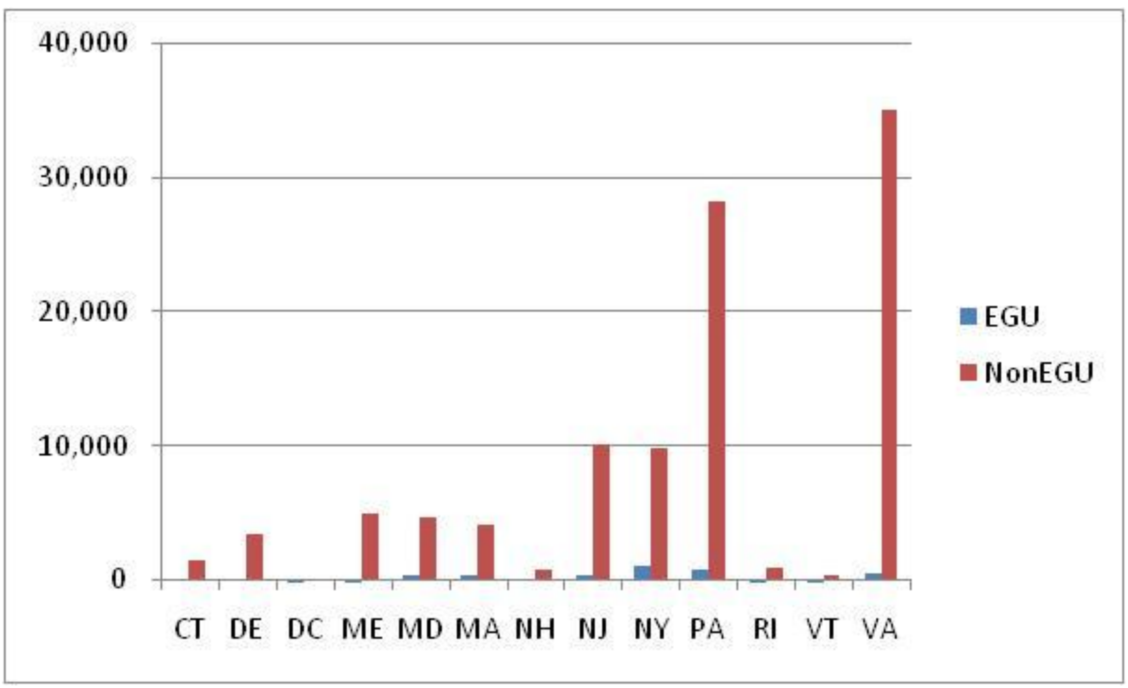


Exhibit 2.7 2007 EGU and NonEGU Point Source VOC Emissions (tons per year)

State	EGU	NonEGU	Total
CT	143	1,447	1,590
DE	83	3,406	3,489
DC	2	57	59
ME	35	4,987	5,022
MD	389	4,597	4,986
MA	463	4,094	4,557
NH	110	806	916
NJ	420	10,620	11,040
NY	1,119	9,772	10,891
PA	770	28,195	28,965
RI	49	921	970
VT	22	373	395
VA	600	35,018	35,618
TOTAL	**4,205**	**104,293**	**108,498**



3.0 GROWTH PROJECTION FACTORS FOR NONEGUs AND AREA SOURCES

The area and nonEGU point source growth factors were developed using six sets of data:

- The Annual Energy Outlook (AEO) fuel consumption forecasts;
- County-level population projections;
- State-level employment projections by NAICS code;
- County-level vehicle miles travelled (VMT) projections;
- USEPA projections for livestock and residential wood combustion; and
- Other state-specific emission projection data.

The priority for applying these growth factors was to first use the state-supplied projection data (if available). If state-supplied data were not provided, then the AEO projection factors were used for fuel consumption sources, and the population/employment/VMT data were used for other source categories.

3.1 AEO FUEL USE PROJECTIONS

The AEO is published annually by the U.S. Energy Information Administration (EIA). It presents long-term projections of energy supply, demand, and prices through 2035, based on results from EIA's National Energy Modeling System (NEMS). NEMS projects the production, imports, conversion, consumption, and prices of energy, subject to assumptions on macroeconomic and financial factors, world energy markets, resource availability and costs, behavioral and technological choice criteria, energy technology cost and performance characteristics, and demographics.

AEO provides regional fuel-use forecasts for various fuel types (e.g., coal, residual oil, distillate oil, natural gas) by end use sector (e.g., residential, commercial, industrial, transportation, and electric power). Energy use projections are reported at the Census division level. The census divisions grouped states as follows:

- South Atlantic - DE, DC, MD, VA
- Middle Atlantic – NJ, NY, PA
- New England – CT, ME, MA, NH, RI, VT

Appendices B1, B2, and B3 contain the AEO2010 fuel use projections for each of these three regions. Appendices B4, B5, and B6 contain the AEO2011 fuel use projections

Version 2 of the MANE-VU+VA future year inventories was developed using AEO2010 (EIA2010). After the release of Version 2, AEO2011 was published (EIA2011). MARAMA reviewed the updated fuel forecasts and compared the AEO2010 and AEO2011 projections. Appendix B7 documents MARAMA's analysis. MARAMA calculated the difference in projected fuel usage between AEO2010 and AEO2011 for the residential, commercial, industrial, transportation, and electric power sector for the distillate fuel oil, residual fuel oil, coal, natural gas, and renewable fuel types. MARAMA identified thresholds for what constitutes a major change as follows:

- An increase or decrease of 1% or less is considered to be no change and did not warrant a change in the growth factors between Versions 2 and 3 of the inventory;
- An increase or decrease of between 1% and 5% is considered to be a minor change, and states agreed that these differences between AEO2010 and AEO2011 did not warrant a change in the growth factors between Versions 2 and 3 of the inventory;
- An increase or decrease above 5% is considered a major change, and warrants a change in the growth factors used in Version 3.

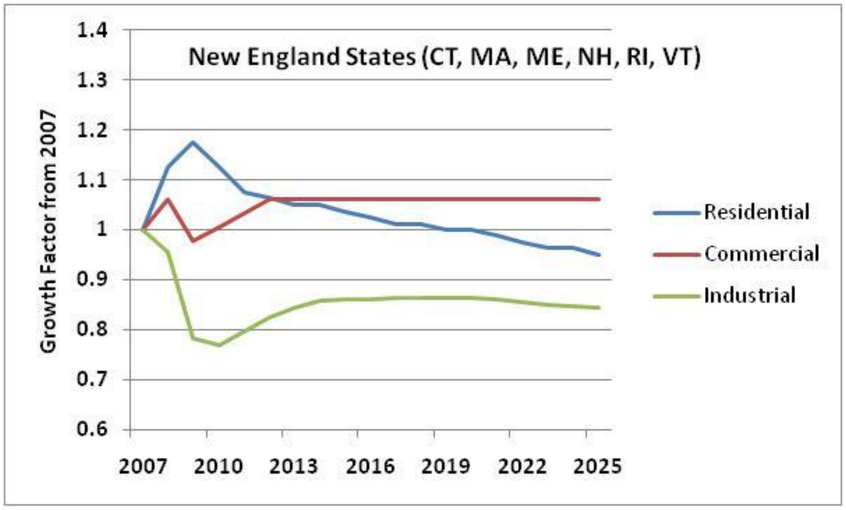
MARAMA recommended that the AEO2010 projections be retained for all residential, commercial, and industrial sector fuel use, except for industrial natural gas usage, where the AEO2011 projections will be used for Version 3 of the future year modeling inventory. New Jersey elected to use the more recent growth factors from AEO2011 instead of the AEO2010 growth factors for all area source fossil fuel use categories.

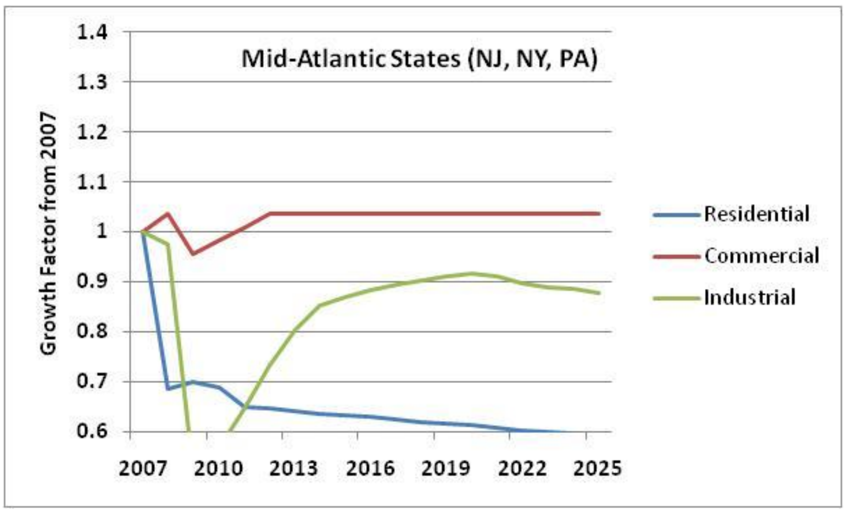
Exhibits 3.1 to 3.5 summarize the projected fuel use rates by source sector (residential, commercial, industrial, transportation) , AEO region, and fuel type for the years 2007 to 2025. The unusual growth in commercial residual oil use in the South Atlantic region could not be explained; Maryland elected to use manufacturing employment instead of the AEO2010 growth factor for commercial residual oil combustion, while Virginia and the District chose to assume flat growth in this sector.

3.2 POPULATION PROJECTIONS

States provided county-level 2007 populations and projections for future years. The historical and projection years varied from state-to-state, so values were interpolated, when necessary, to create population estimates for each year from 2007 to 2025. The population data were normalized to create growth factors from 2007 for each future year. For example, Delaware had a population of 861,087 in 2007 and the projected population in 2017 is 953,204, then the growth factor for 2017 is 953,204 / 861,087 = 1.107.

Population projections are provided in Appendix C. Exhibit 3.6 summarizes the population growth factors by state and AEO2010 region. Population is projected to grow in every state between 2007 and 2025. The population growth in the New England states varies significantly by state. Population growth in the South Atlantic states is projected to be much higher than in the New England and Mid-Atlantic states.





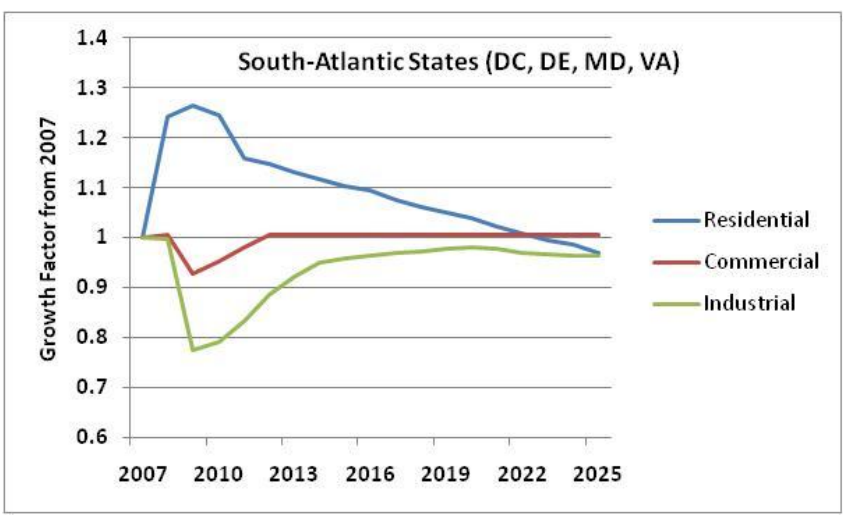
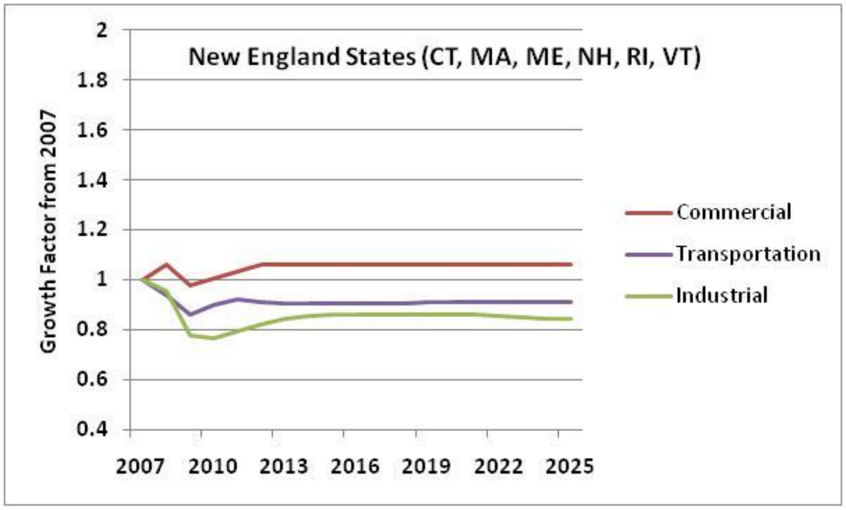
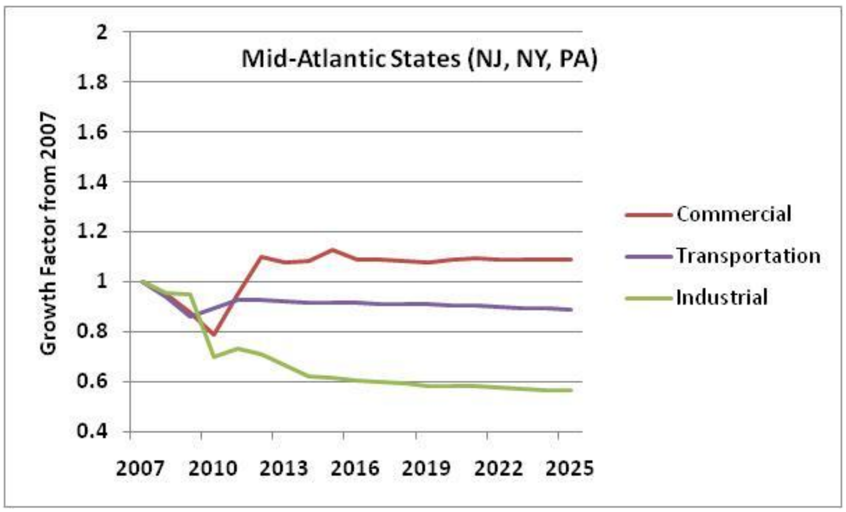


Exhibit 3.1 AEO2010 Growth Factors for Coal by AEO Region 2007 – 2025





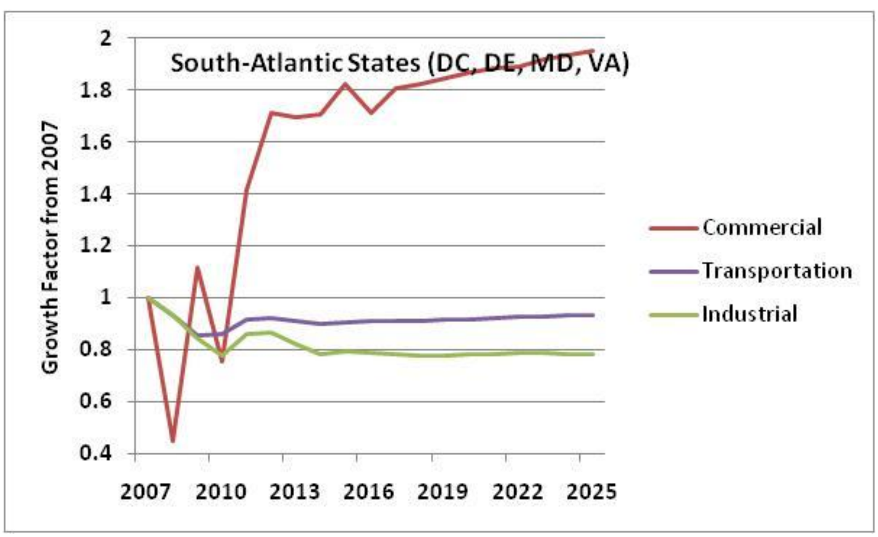
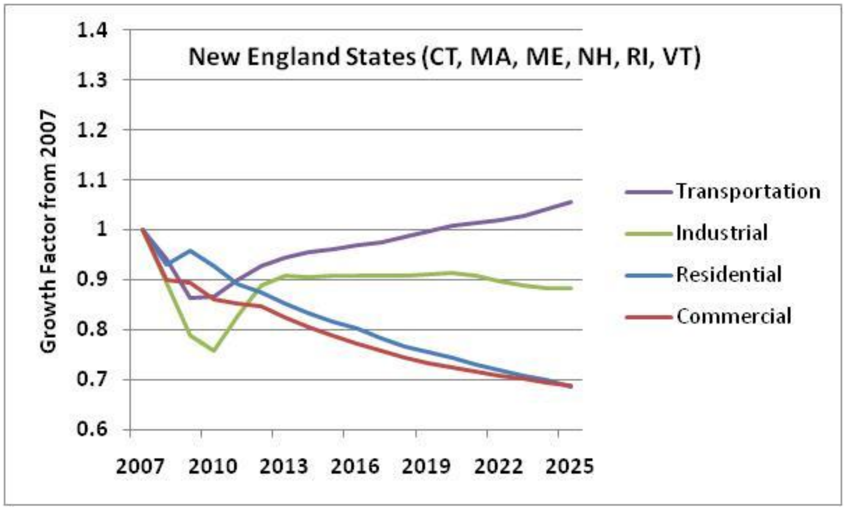
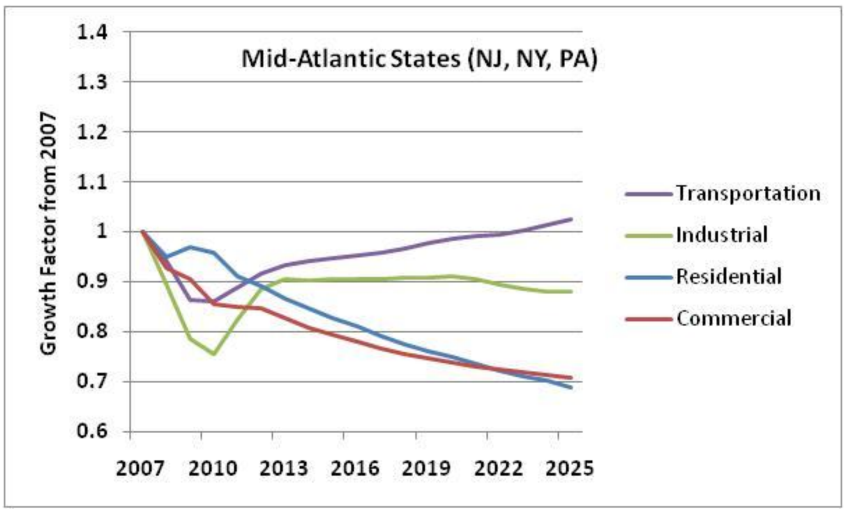


Exhibit 3.2 Growth Factors for Residual Oil by AEO Region 2007 – 2025





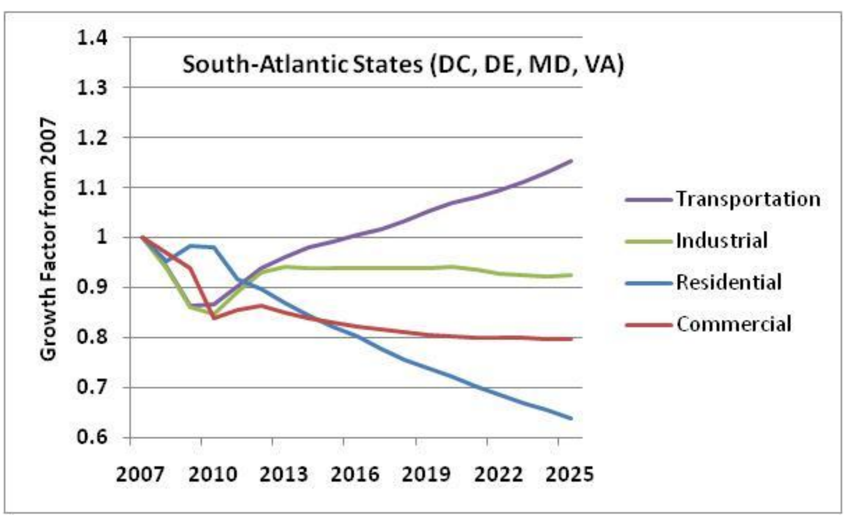
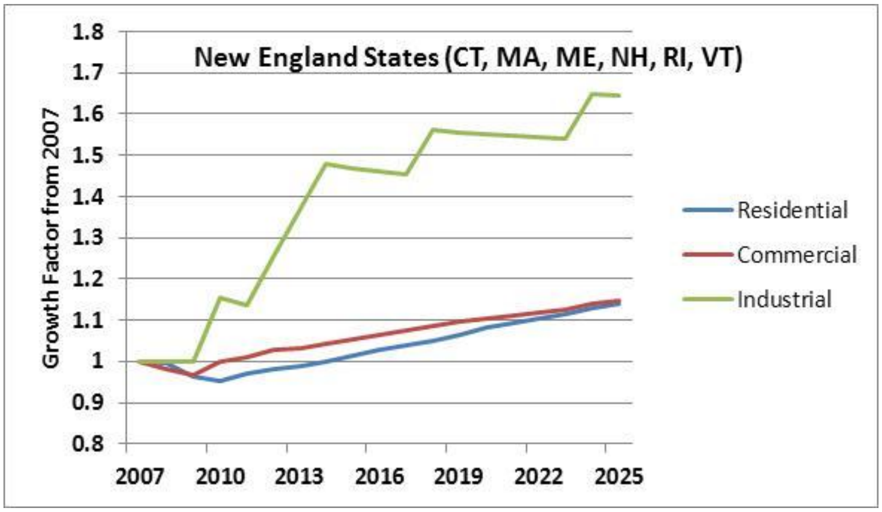
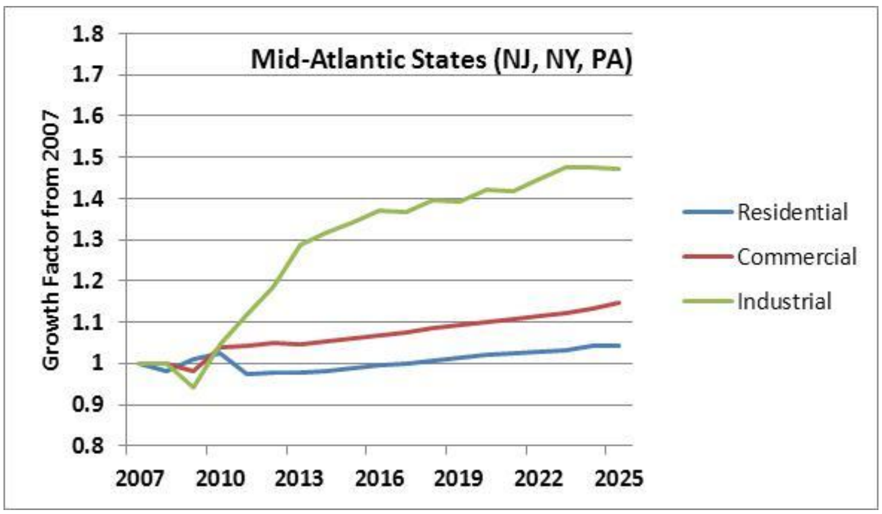


Exhibit 3.3 AEO2010 Growth Factors for Distillate Oil by AEO Region 2007 – 2025





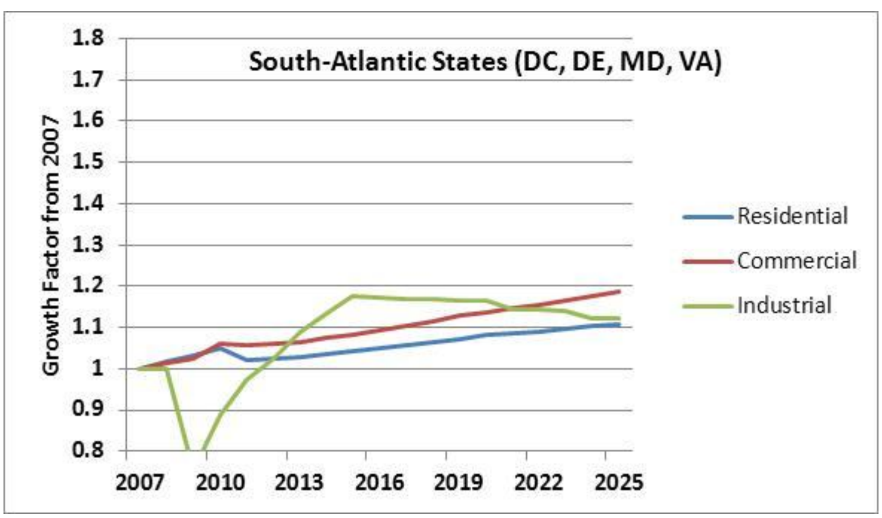
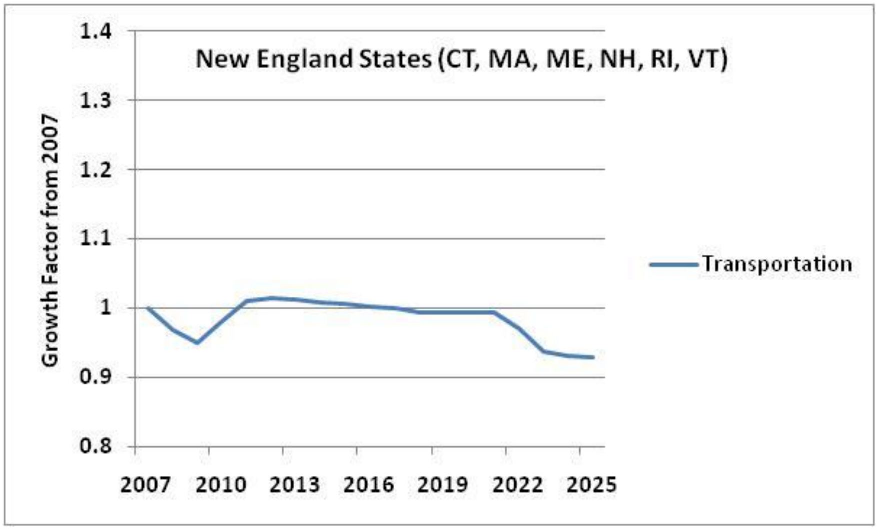
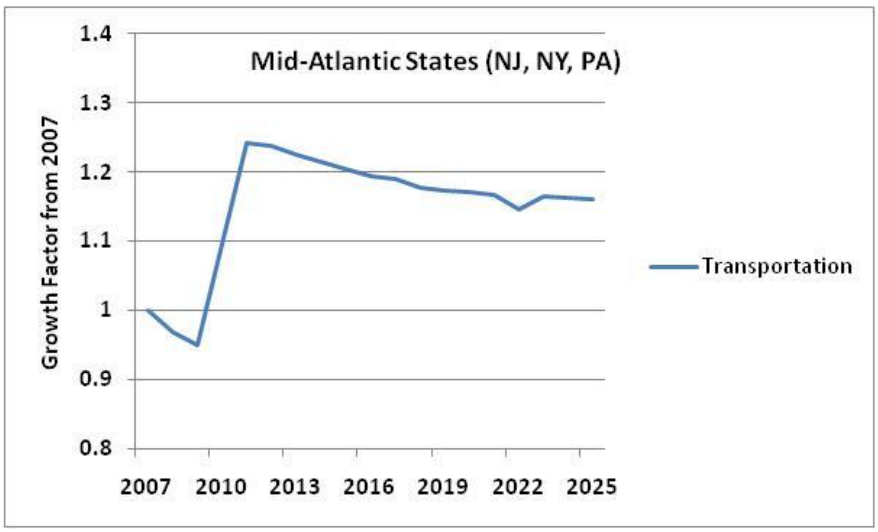


Exhibit 3.4 Growth Factors for Natural Gas by AEO Region 2007 – 2025
AEO2010 for Residential/Commercial, AEO2011 for Industrial





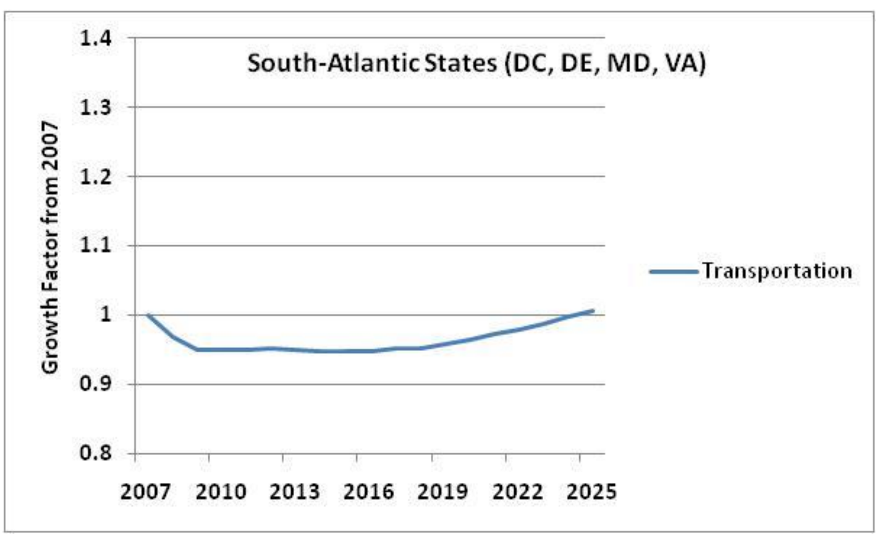


Exhibit 3.5 AEO2010 Growth Factors for Gasoline by AEO Region 2007 – 2025

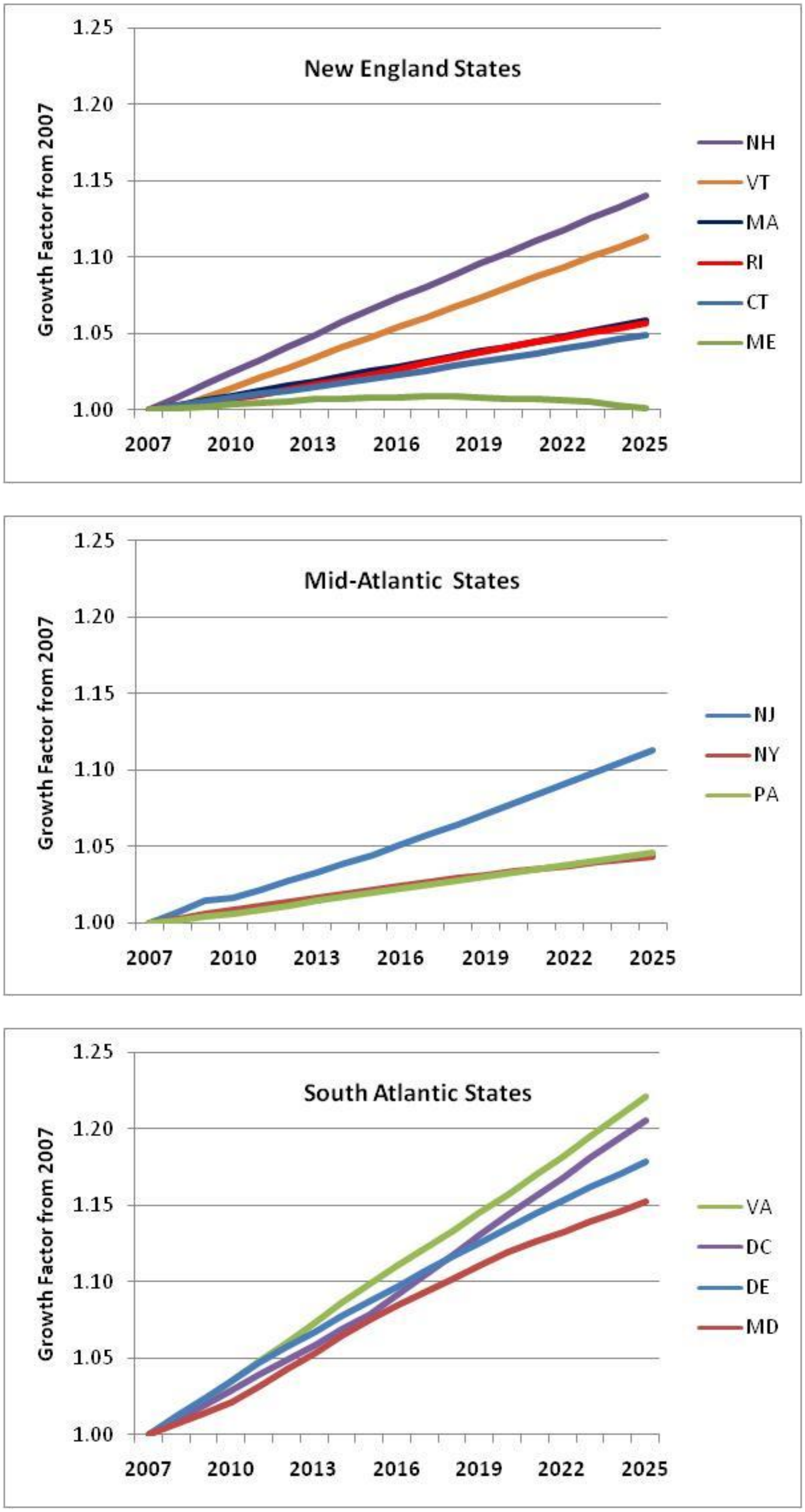


Exhibit 3.6 Population Growth Factors by AEO Region 2007 – 2025

3.3 EMPLOYMENT PROJECTIONS

Every two years, the federal Bureau of Labor Statistics produces long-term industry and occupation forecasts for ten future years and states are asked to do the same for their respective economies. The most recent projections from state Department's of Labor of for the period 2006 to 2016, most of which were published in 2008. These 10-year forecasts are updated every other year. The next set of state-specific projections will be for the period 2008 to 2018. Only the District of Columbia and Delaware were able to provide employment projections for 2008 to 2018; the 2008 to 2018 projections were not available for other states in time for use on this project. The employment projections are state-wide by 3-digit NAICS code. Employment projections are provided in Appendix D. Exhibit 3.7 summarizes the manufacturing employment (NAICS sector 31-33) growth factors by state and AEO2010 region. States in the Northeast / Mid-Atlantic region show a marked decrease in manufacturing employment from 2007 forward.

3.4 VEHICLE MILES TRAVELED PROJECTIONS

States developed projections of vehicle miles traveled (VMT) for 2007, 2017 and 2020 which were used as the growth factor for projecting emissions from re-entrained road dust from travel on paved roads (SCC 22-94-000-000). The 2007 and future year VMT are identical to those used in the MOVES modeling. Exhibit 3.8 shows the state level VMT growth between 2007 and 2020. Growth factors for years where VMT were not directly provided by states were estimated by a linear interpolation of available data. County-specific VMT projections are provided in Appendix E.

3.5 NO GROWTH ASSIGNMENT FOR CERTAIN AREA SOURCE CATEGORIES

For several area source categories, it seems reasonable that emissions would not change from the 2007 values. No growth was applied to the 2007 emissions for the area source categories shown in Exhibit 3.9.

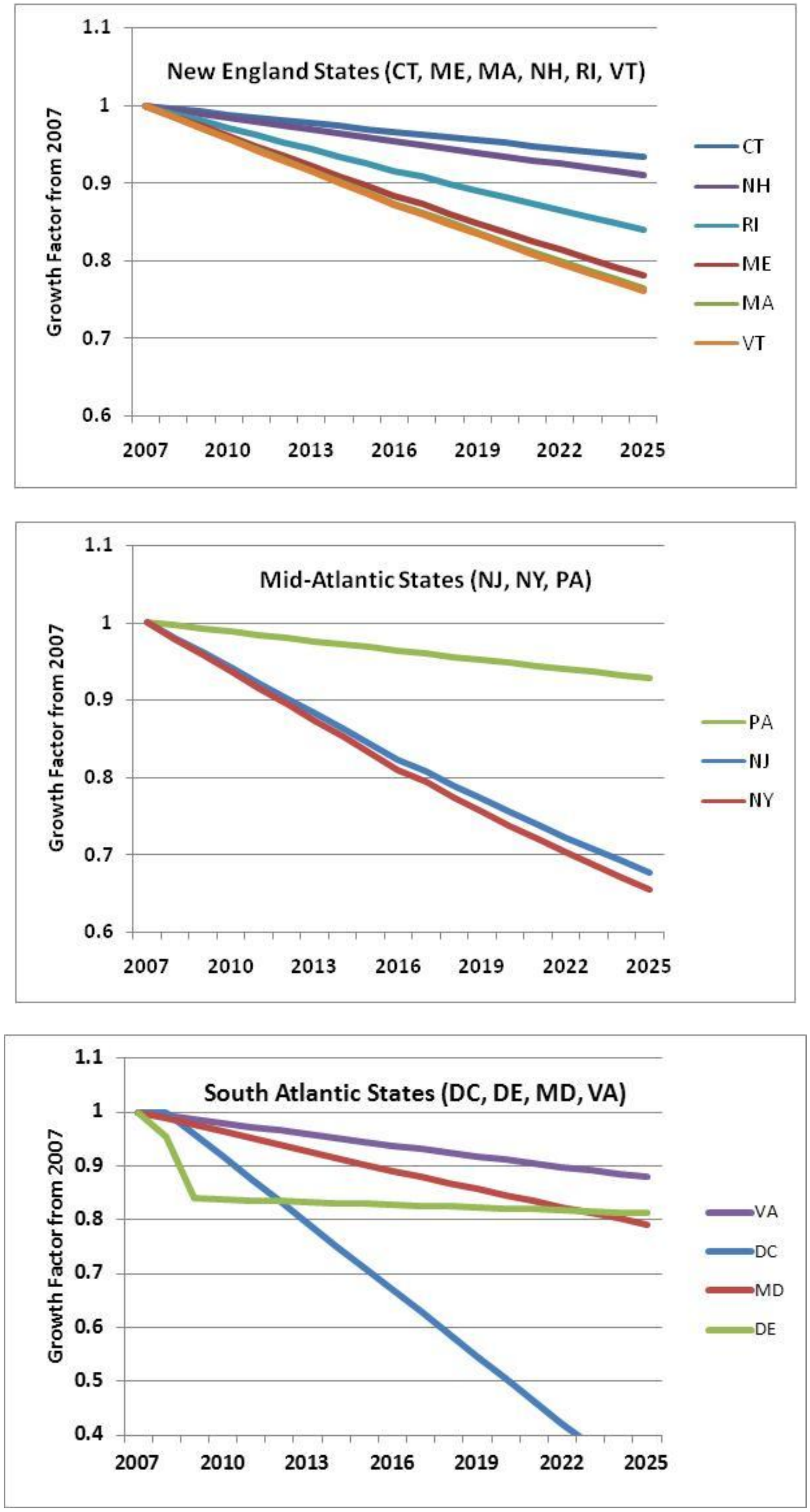


Exhibit 3.7. Manufacturing Employment Growth Factors by AEO Region 2007 - 2025

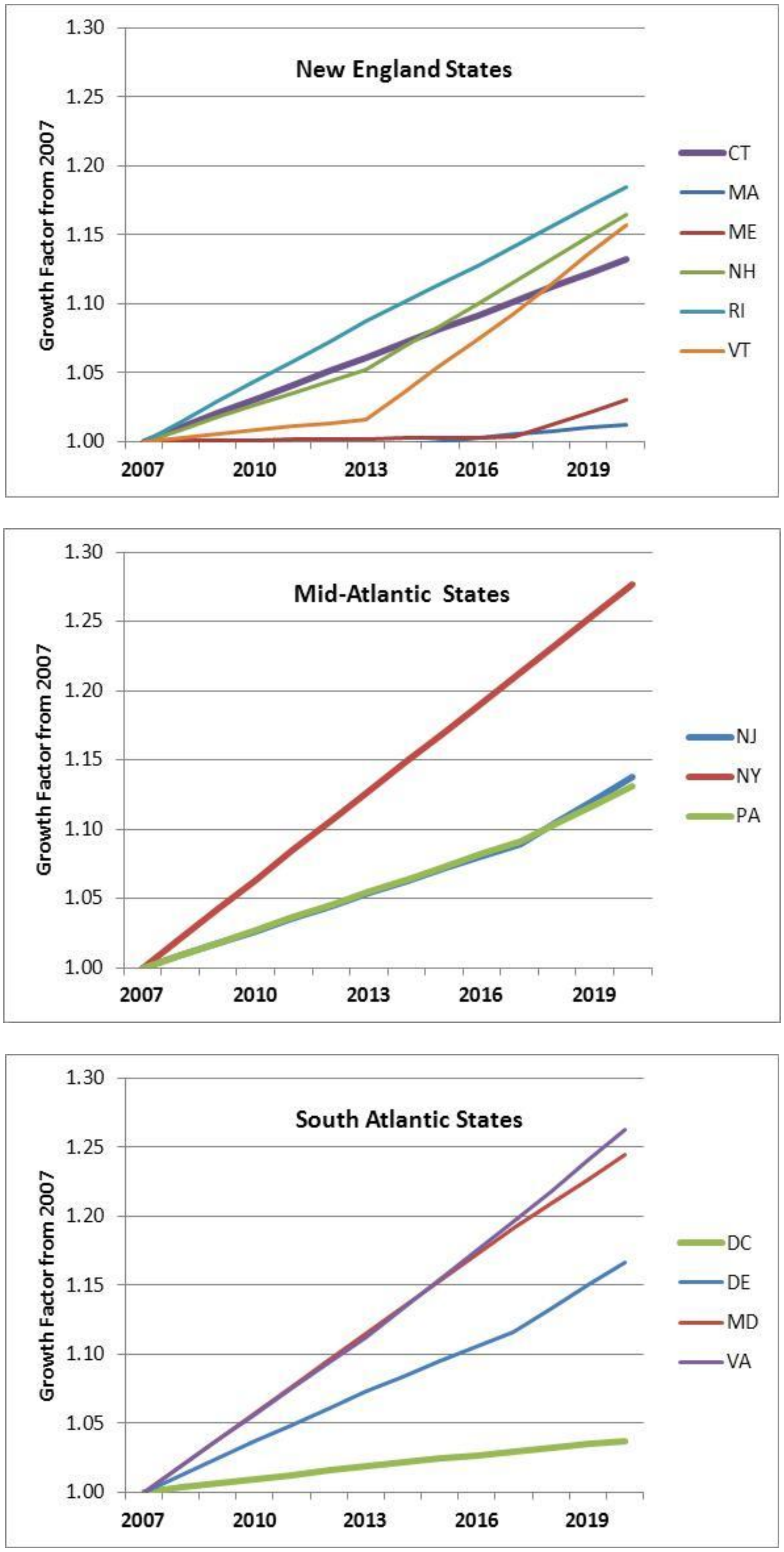


Exhibit 3.8 State VMT Growth Factors 2007 – 2020

Exhibit 3.9 Area Source Categories with No Growth Assignment

SCC	SCC Description
2296000000	Unpaved Roads /All Unpaved Roads /Total: Fugitives
2401008000	Surface Coating /Traffic Markings /Total: All Solvent Types
2461020000	Misc Non-industrial: Commercial /Asphalt Application: All Processes /Total: All
2461021000	Misc Non-industrial: Commercial /Cutback Asphalt /Total: All Solvent Types
2461022000	Misc Non-industrial: Commercial /Emulsified Asphalt /Total: All Solvent Types
2461023000	Misc Non-industrial: Commercial /Asphalt Roofing /Total: All Solvent Types
2601000000	On-site Incineration /All Categories /Total
2601010000	On-site Incineration /Industrial /Total
2601010000	On-site Incineration /Industrial /Total
2601020000	On-site Incineration /Commercial/Institutional /Total
2601020000	On-site Incineration /Commercial/Institutional /Total
2601030000	On-site Incineration /Residential /Total
2610000100	Open Burning /All Categories /Yard Waste - Leaf Species Unspecified
2610000400	Open Burning /All Categories /Yard Waste - Brush Species Unspecified
2610000500	Open Burning /All Categories /Land Clearing Debris (use 28-10-005-000 for Loggin
2610030000	Open Burning /Residential /Household Waste (use 26-10-000-xxx for Yard Wastes)
2610040400	Open Burning /Municipal (from residences, parks,other for central burn)
2660000000	Leaking Underground Storage Tanks /Leaking Underground Storage Tanks /Total: All
2680001000	Composting /100% Biosolids (e.g., sewage sludge, manure, mixtures of these matls
2680002000	Composting /Mixed Waste (e.g., a 50:50 mixture of biosolids and green wastes)
2806010000	Domestic Animals Waste Emissions /Cats /Total
2806015000	Domestic Animals Waste Emissions /Dogs /Total
2807020001	Wild Animals Waste Emissions /Bears /Black Bears
2807020002	Wild Animals Waste Emissions /Bears /Grizzly Bears
2807025000	Wild Animals Waste Emissions /Elk /Total
2807030000	Wild Animals Waste Emissions /Deer /Total
2807040000	Wild Animals Waste Emissions /Birds /Total
2810001000	Forest Wildfires - Wildfires – Unspecified
2810005000	Managed Burning, Slash (Logging Debris) /Unspecified Burn Method
2810010000	Human Perspiration and Respiration /Total
2810014000	Prescribed Burning /Generic - Unspecified land cover, ownership, class/purpose
2810015000	Prescribed Forest Burning /Unspecified
2810020000	Prescribed Rangeland Burning /Unspecified
2810030000	Structure Fires /Unspecified
2810035000	Firefighting Training /Total
2810050000	Motor Vehicle Fires /Unspecified
2810060200	Cremation /Animals
2810090000	Open Fire /Not categorized
2820010000	Cooling Towers /Process Cooling Towers /Total
2830000000	Catastrophic/Accidental Releases /All Catastrophic/Accidental Releases /Total
2830010000	Catastrophic/Accidental Releases /Transportation Accidents /Total

3.6 EPA 2020 PROJECTIONS FOR RESIDENTIAL WOOD AND LIVESTOCK

EPA's Office of Air Quality Planning and Standards (OAQPS) made available its 2020 emissions projections associated with its 2005-based v4 modeling platform. MARAMA used the OAQPS emission projection parameters for two area source sectors –livestock and residential wood combustion. OAQPS's methodology and data sources are summarized below (USEPA 2008a).

OAQPS projected residential wood combustion emissions are based on the expected increase in the number of low-emitting wood stoves and the corresponding decrease in other types of wood stoves. As newer, cleaner woodstoves replace older, more polluting stoves, there will be an overall reduction of emissions from this category. The approach used by OAQPS was developed as part of a modeling exercise to estimate the expected benefits of the woodstove changeout program. This methodology uses a combination of growth and control factors and is based on activity not pollutant. The growth and control are accounted for in a single factor for each residential wood SCC (certain SCCs represent controlled equipment, while other SCCs represent uncontrolled equipment). Control factors are indirectly incorporated based on which stove is used. The specific assumptions OAQPS made were:

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

For the general woodstoves and fireplaces category (SCC 2104008000) OAQPS computed a weighted average distribution based on 19.4% fireplaces, 71.6% old woodstoves, 9.1% new woodstoves using 2002 Platform emissions for PM2.5. These fractions are based on the fraction of emissions from these processes in states that did not have the "general woodstoves and fireplaces" SCC in the 2002 NEI. This approach results in an overall decrease of 1.056% per year for this source category. Appendix F contains the residential wood projection data from OAQPS.

OAQPS based growth in emissions from livestock on projections of growth in animal population. Except for dairy cows and turkeys, the animal projection factors are derived from national-level animal population projections from the U.S. Department of Agriculture (USDA) and the Food and Agriculture Policy and Research Institute (FAPRI).

For dairy cows and turkeys OAQPS assumed that there would be no growth in emissions. This assumption was based on an analysis of historical trends in the number of such animals compared to production rates. While productions rates have increased, the number of animals has declined. In particular, the dairy cow population is projected to decrease in the future as it has for the past few decades; however, milk production is expected to increase over the same period. Thus, OAQPS does not believe that production forecasts provide representative estimates of the future number of cows and turkeys. Therefore, OAQPS did not use these forecasts for estimating future-year emissions from these animals. Note that the ammonia emissions from dairies are related to both animal population and nitrogen excretion. Appendix G contains the livestock projection data from OAQPS.

3.7 SCC, SIC, NAICS AND GROWTH PARAMETER CROSSWALK

Since the employment projections were based on 3-digit NAICS code, it was necessary to map NAICS codes to SCCs and SIC codes that were used by states. Employment projections at the more specific 4-digit or 6-digit NAICS codes were not available.

The first step for developing a comprehensive crosswalk between the different source classification codes (SCC, SIC, and NAICS codes) and emission activity growth indicators was to compile a complete list of the NAICS codes in the 2007 point source inventory. Some states use the SIC code while other use the NAICS code. Still other states use both the SIC and NAICS codes. When the NAICS code was not available SIC codes were converted to NAICS codes. The 6-digit NAICS code was truncated to a 3-digit code, which represents major industry subsectors of the economy. A U.S. Census Bureau document was used to perform this conversion (CENSUS 2000).

The next step was to review parameters that could be used as the emission activity growth indicator for each SCC or NAICS. We initially relied on two USEPA crosswalks (USEPA 2004a, USEPA 2004b) to match area and nonEGU point source SCCs to AEO2010 categories, employment NAICS codes, and population. The sector specific spreadsheets identify the growth parameter used to project emissions for each SCC.

3.8 FINAL GROWTH FACTORS FOR NONEGU / AREA SOURCES

The previous section described the growth factors initially recommended to project future year emissions inventories for area and non-EGU sources. Draft growth and control factors, and a draft technical support document, were circulated for review by MARAMA and state agencies. During the review, it was noted that several emissions categories show negative growth into the future, particularly categories related to fossil fuel combustion and manufacturing employment.

Many of the growth factors used to project emissions for area and non-EGU sources were based on the AEO2010 fuel consumption forecasts and state-level employment projections. The AEO2010 forecasts show declining trends for many fuel consumption sectors, especially industrial, residential, and commercial distillate fuel oil use. Similarly, the employment projections show declines in the predicted number of employees for many sectors of the economy. This is particularly true for the manufacturing sector, which is of interest because this sector is often associated with higher emissions than those for other sectors. By contrast, the employment projections show increasing trends in retail and service-related sectors. However, these sectors are not typically associated with significant emissions.

Predicted declines in fuel use and employment resulted in growth factors less than unity (i.e., represent negative growth) for many area and non-EGU point source categories. Consequently, for some categories, emissions are lower for the projected future years than for the base year, even before the application of control assumptions (i.e. the future "growth only" emissions are lower than the base year emissions). The MARAMA emissions inventory workgroup met on several occasions via conference calls and email exchanges to discuss whether the negative growth projections were realistic, and what additional assumptions should be made. A topic of particular concern is negative growth for non-EGU point sources versus the treatment of Emissions Reduction Credits (ERCs) in the future year inventories (see Section 3.9 for a discussion of how ERCs were handled).

One conclusion the workgroup reached is that growth methods and assumptions for area sources and non-EGUs should be as consistent as possible with those that are being used by the Eastern Regional Technical Advisory Committee (ERTAC) for the projection of emissions from EGUs. ERTAC is using AEO2010 as a starting point for estimating projected future year emissions, and their preliminary analysis shows some indications of negative growth. But their analysis is still on-going, and it is too early in the process to draw firm conclusions or make solid recommendations at this time regarding their work and its relationship to the area and non-EGU projections.

A few states cited the importance of the negative growth issue for non-EGUs and how it relates to their ERC programs which are critical to new businesses being able to locate in those states. Because businesses could apply for and sell ERCs at the level of the base year inventory, it would not be realistic to show negative growth for non-EGU point sources. During an economic downturn, a facility could shut down and sell its ERCs, making the effective level of future year emissions equal to (i.e. no lower than) the base year. Therefore, a recommended conservative approach for addressing negative growth for non-EGU point sources is to set a minimum growth rate of 1 (no growth).

During the July 23, 2010 conference call held to discuss the negative growth issue, state and agency representatives on the call were polled as to whether or not they felt that the current set of proposed growth factors - including the negative growth factors - were realistic for their state or district. In reply, some representatives mentioned that they have observed historic state-specific data that supports the trends displayed by the proposed growth factors. Other representatives mentioned that they feel comfortable with the growth factors and don't have a technical basis to change them or suggest others.

As a result of these discussions, each state provided guidance on how to handle projections when negative growth is indicated. Exhibit 3.10 shows the state recommendations for nonEGU point source, and Exhibit 3.11 shows the state recommendations for area sources. The sector specific spreadsheets identify the growth parameter used to project emissions for each SCC.

3.9 EMISSION REDUCTION CREDITS

Mulitple states (Connecticut, Maryland, Massachesetts, New Hampshire and New Jersey) added county level records account for account emission reduction credits (ERCs) issued to stationary sources pursuant to state regulations. States provided ERCs on a county-by-county basis. Fictitious facilities with an identifier of “OFFSET99999” were created for each county using SCC 23-99-000-000 (miscellaneous industrial processes: not elsewhere classified). Stack data were developed that assumed that emissions were released at the county centroid with an assumed release height of 10 feet. For the 2017 and 2020 inventories, ERC emissions were set to the amount of banked emissions available in 2007.

Delaware included the banked credits at the specific locations that they were generated.

Virginia does not have a formal banking and trading program. Virginia used growth rates of 1 for those SCCs in the point source emissions inventory that showed a negative growth. In addition, for units that have or are projected to have shut down, Virginia preserved the 2007 emissions in the inventory to account for potential use as offsets or credits.

Other states did not provide any additional information on how to account for ERCs.

Exhibit 3.10 State Recommendations to Address Negative Growth for the NonEGU Point Source Sector

State	AEO Growth Factors	Employment Growth Factors
CT	Use no growth (growth factor=1) when AEO growth is negative; otherwise use AEO2010 if positive growth	Use state DOL employment projections by 3-digit NAICS
DE	Use AEO2010 growth rates	For 2013, use state DOL employment projections by 3-digit NAICS; For 2017 and 2020, use no growth (growth factor=1) when employment growth is negative; otherwise use employment if positive growth
DC	Use AEO2010 growth rates	Use 2008-2018 employment projections; use no growth (growth factor=1) when employment growth is negative; otherwise use employment if positive growth
ME	Use AEO2010 growth rates	Use state DOL employment projections by 3-digit NAICS
MD	Do not use AEO growth factors Use MD DOL employment projections for industrial and commercial fuel use SCCs, unless employment growth rate is negative, in which case use no growth (growth factor=1)	Use updated state DOL employment projections by 3-digit NAICS; For DoD facilities, account for impacts of Base Realignment and Closure; For source that have closed, account for emission reduction credits
MA	Use AEO2010 growth rates	Use state DOL employment projections by 3-digit NAICS
NH	Use AEO2010 growth rates	Use state DOL employment projections by 3-digit NAICS
NJ	New Jersey submitted state specific growth factors. Used either state specific growth factors, no growth (growth factor=1) when state AEO growth is negative or AEO if positive growth	NJ submitted state specific growth factors. Used either state specific factors, no growth (growth factor=1) when state DOL employment growth is negative or employment if positive growth
NY	Use no growth (growth factor=1) when AEO growth is negative; otherwise use AEO2010 if positive growth	Use no growth (growth factor=1) when employment growth is negative; otherwise use employment if positive growth
PA	Use no growth (growth factor=1) when AEO growth is negative; otherwise use AEO2010 if positive growth	Use no growth (growth factor=1) when employment growth is negative; otherwise use employment if positive growth
RI	Use AEO2010 growth rates	Use state DOL employment projections by 3-digit NAICS
VT	Use AEO2010 growth rates	Use state DOL employment projections by 3-digit NAICS
VA	Use no growth (growth factor=1) when AEO growth is negative; otherwise use AEO2010 if positive growth	Use no growth (growth factor=1) when employment growth is negative; otherwise use employment if positive growth

Exhibit 3.11 State Recommendations to Address Negative Growth and Other Growth Factors for the Area Source Sector

State	AEO Growth Factors	Employment Growth Factors	Population Growth Factors
CT	Use AEO2010 growth rates	Use state DOL employment projections by 3-digit NAICS	Use county-level population projections
DE	Use AEO2010 growth rates; no growth for suspect AEO2010 projection for commercial / institutional residual oil	For 2013, use state DOL employment projections by 3-digit NAICS; For 2017 and 2020, use no growth (growth factor=1) when employment growth is negative; otherwise use employment if positive growth	Use county-level population projections
DC	Use AEO2010 growth rates; no growth for suspect AEO2010 projection for commercial / institutional residual oil	Use DOL employment growth for NAICS 722 for food and kindred product SCC; otherwise use orginial estimates	For dry cleaning, use employment growth for NAICS 812 instead of population
ME	Use AEO2010 growth rates	Use state DOL employment projections by 3-digit NAICS	Use county-level population projections
MD	Not using AEO2010; used employment for commercial & institurional fuel; used housing units for residential fuel	Provided updated employment projections; changed xwalk between NAICS code and SCC for selected source categories	Provided updated population projections by county
MA	Use AEO2010 growth rates	Use state DOL employment projections by 3-digit NAICS	Use county-level population projections
NH	Use AEO2010 growth rates	Use state DOL employment projections by 3-digit NAICS	Use county-level population projections
NJ	NJ submitted state specific growth factors. For fuel combustion categories only, used AEO2011 growth rates except for residual oil (use no growth)	NJ submitted state specific growth factors.	NJ submitted state specific growth factors and provided population projections by county
NY	Use AEO2010 growth rates	Use state DOL employment projections by 3-digit NAICS	Use county-level population projections
PA	Use AEO2010 growth rates	Use state DOL employment projections by 3-digit NAICS	Use county-level population projections
RI	Use AEO2010 growth rates	Use state DOL employment projections by 3-digit NAICS	Use county-level population projections
VT	Use AEO2010 growth rates	Use state DOL employment projections by 3-digit NAICS	Use county-level population projections
VA	Use AEO2010 growth rates; no growth for suspect AEO2010 projection for commercial / institutional residual oil	Use state DOL employment projections by 3-digit NAICS	Use county-level population projections

4.0 AREA SOURCE CONTROL FACTORS

Control factors were developed to estimate post-2007 emission reductions resulting from on-the-books regulations and proposed regulations/actions. Control factors were developed for the following national and regional measures:

- Federal Rules Affecting Area Sources
- Federal MACT Rules
- Control Technique Guidelines
- OTC Model Rules

These control programs are discussed in the following subsections. The control factors used for area sources are provided in V3_3 Area_07_17_20.xlsx

4.1 FEDERAL RULES AFFECTING AREA SOURCES

USEPA made available its 2020 emissions projections associated with its 2005-based v4 modeling platform (USEPA 2010b). USEPA accounted for control strategies for four area source categories. These categories, and their treatment in the emission projection inventories, are described below:

- Woodstoves - As noted in Section 3.6, USEPA developed projection factors to account for the replacement of retired woodstoves that emit at pre-new source performance standard (NSPS) levels with lower-emitting woodstoves. We used USEPA's latest methodology which uses a combination growth and control factor and is based on activity and not pollutant. The growth and control are accounted for in a single factor for specific SCCs that account for the turnover from pre-NSPS to post-NSPS woodstove.
- Landfills: USEPA estimated a 75% reduction in VOC emissions from municipal solid waste landfills. However, since the compliance date for this standard was January 2004, no post-2007 reductions were applied to the MANE-VU+VA projection inventory since the emission reductions from this MACT standard should be reflected in the 2007 inventory and not as an additional post-2007 credit.
- Vehicle Refueling (Stage II): VOC emissions from the gasoline Stage II (vehicle refueling) are affected by two emission control programs. Many areas in the region have Stage II vapor recovery rules that were in effect prior to 2007 that require the capture of gasoline vapors generated when a motor vehicle fuel tank is filled at a gasoline station. The vapors are transferred from the fuel tank in the vehicle to the storage tank at the station as the vehicle fuel tank is filled. Beginning with the 1998 model year, USEPA established a phase-in schedule requiring vehicles to

incorporate on-board equipment to capture the gasoline vapor emissions from refueling. These controls, referred to as on-board refueling vapor recovery (ORVR), have been required on the vast majority of gasoline powered motor vehicles since the 2006 model year. VOC emissions for 2020 from vehicle refueling were estimated by NESCAUM using the MOVES model (NESCAUM2011). VOC emissions for 2017 were estimated by interpolating between the MOVES 2007 and 2020 results. Appendix H contains the VOC control efficiencies by county used in the MOVES modeling for displacement losses and for spillage losses.

- <u>Portable fuel containers (PFCs)</u>: VOC emissions from PFCs will be reduced due to the federal regulation controlling air toxic emissions from mobile sources promulgated in 2007. Most northeastern and mid-Atlantic states had already adopted similar regulations prior to the federal rule. Refer to the OTC 2006 model rules subsection later in this document (Section 4.4.6) for a discussion of the approach for accounting for VOC emission reductions from PFCs.

4.2 FEDERAL MACT RULES

USEPA developed guidance for estimating VOC and NOx emission changes from MACT Rules (USEPA 2007b). We reviewed the guidance to identify possible area source controls associated with the federal maximum achievable control technology (MACT) standards for controlling hazardous air pollutants (HAPs). Although designed to reduce HAPs, many of the MACT standards also provide a reduction in criteria air pollutants. The USEPA document provides an estimate of the percent reduction in VOC and NOx from each standard, and the compliance date for the standard. This information was used to determine whether the MACT standard provided post-2007 emission reductions. For example, if a compliance period of a MACT standard was 2007 or earlier, then we assumed that the emission reductions from the MACT standard should be reflected in the baseline year and not as an additional post- 2007 credit.

Only one area source category was listed in the USEPA guidance document - municipal solid waste landfills. Since the compliance date for this standard was January 2004, no post-2007 reductions were applied since the emission reductions from the MACT standard should be reflected in the 2007 inventory and not as an additional post-2007 credit.

USEPA has or will soon develop MACT standards for about 70 area source categories. We reviewed USEPA's 2020 emissions projections described in the previous section and found that USEPA did not include emission reductions from recent area source MACT standards. We conducted a review of USEPA's air toxic website and found that USEPA determined that many area source MACT standards would result in nationwide reductions in criteria air pollutants in addition to the reductions in HAP emissions. However, many states in the MANE-VU+VA region already have emission standards for many categories that are as stringent as the Federal area source MACT standards. For example, many states in the MANE-VU+VA region already have requirements as stringent as the Gasoline Distribution MACT and GACT (generally achievable control technology) standards, and little additional VOC reductions would be realized in the region. Given the resources allocated to this project, it was beyond the scope to conduct an analysis of the area source MACT requirements and state-by-state emission regulations to determine whether there would be emission reductions resulting from the area source MACT standards.

The only exception to the above discussion of area source MACT standards pertains to the recently promulgated rules for reciprocating internal combustion engines (RICE). USEPA made available an estimate of the percent reduction in emissions attributable to the RICE MACT rule in 2012 and 2014 (USEPA 2010c). The USEPA 2014 estimates shown in Exhibit 4.1 were used for the MANE-VU+VA 2017 and 2020 inventories.

4.3 RECENT CONTROL TECHNIQUE GUIDELINES

Control Techniques Guidelines (CTGs) are documents issued by USEPA to provide states with recommendation on VOC controls from a specific product or source category in an ozone nonattainment area. USEPA issued new or updated CTGs for 13 VOC categories in 3 groups during 2006, 2007 and 2008 (USEPA 2008b). The categories are:

- 2006 CTGs
  - Flat Wood Paneling Coatings
  - Industrial Cleaning Solvents
  - Flexible Package, Lithographic and Letterpress Printing
- 2007 CTGs
  - Large Appliance Surface Coating
  - Metal Furniture Coatings
  - Paper Film and Foil Coatings
- 2008 CTGs
  - Miscellaneous Metal Parts Coatings
  - Plastic Parts Coatings
  - Auto and Light-duty Truck Assembly Coatings
  - Fiberglass Boat Manufacturing
  - Miscellaneous Industrial Adhesives

States indicated that they expected very littleadditional reductions from these new or amended CTGs. Therefore, no emission reductions were included in the inventory.

Exhibit 4.1 USEPA Estimated Percent Reductions for RICE MACT Standard by 2014

SCC	CO	NOx	PM10	PM2.5	VOC	SCC Description
2101004000	12.42		7.57	7.57	30.85	Electric Utility;Distillate Oil;Total: Boilers and IC Engines
2101004002	16.9		11.81	11.81	33.78	Electric Utility;Distillate Oil;All IC Engine Types
2101006000	11.07	7.97			16.71	Electric Utility;Natural Gas;Total: Boilers and IC Engines
2101006002	15.47	9.87			21.24	Electric Utility;Natural Gas;All IC Engine Types
2102004000	12.42		7.57	7.57	30.85	Industrial;Distillate Oil;Total: Boilers and IC Engines
2102006000	11.07	7.97			16.71	Industrial;Natural Gas;Total: Boilers and IC Engines
2102006002	15.47	9.87			21.24	Industrial;Natural Gas;All IC Engine Types
2103004000	12.42		7.57	7.57	30.85	Commercial/Institutional;Distillate Oil;Total: Boilers and IC Engines
2103006000	11.07	7.97			16.71	Commercial/Institutional;Natural Gas;Total: Boilers and IC Engines
2199004000	12.42		7.57	7.57	30.85	Area Source Fuel Combustion;Distillate Oil;Total: Boilers and IC Engines
2199004002	16.9		11.81	11.81	33.78	Area Source Fuel Combustion;Distillate Oil;All IC Engine Types
2199006000	11.07	7.97			16.71	Area Source Fuel Combustion;Natural Gas;Total: Boilers and IC Engines
2310000000	19.86	12.53			23.87	Oil and Gas Production: All Processes;Total: All Processes
2310000220	19.86	12.53			23.87	Oil and Gas Exploration/Production; Drill Rigs
2310000440	19.86	12.53			23.87	Oil and Gas Exploration/Production; Saltwater Disposal Engines
2310001000	19.86	12.53			23.87	Oil and Gas Production: SIC 13; On-shore;Total: All Processes
2310002000	19.86	12.53			23.87	Oil and Gas Production: SIC 13; Off-shore;Total: All Processes
2310020000	19.86	12.53			23.87	Oil and Gas Production: SIC 13;Natural Gas;Total: All Processes
2310020600	19.86	12.53			23.87	Oil and Gas Exploration and Production;Natural Gas;Compressor Engines
2310023000	19.86	12.53			23.87	Oil and Gas Exploration and Production;Natural Gas;Cbm Gas Well - Dewatering Pump Engines

4.4 OTC MODEL RULES FOR AREA SOURCES

The Ozone Transport Commission (OTC) developed model rules for member states in 2001 for several area source categories: consumer products, architectural and industrial maintenance (AIM) coatings, portable fuel containers (PFCs), mobile equipment repair and refinishing, solvent cleaning, and industrial boilers. In 2006 the OTC introduced model rules for two additional area source categories (adhesives/sealants and asphalt paving), more stringent requirements for consumer products, portable fuel containers, and industrial boilers. In 2009/2010, the OTC recommended additional controls for autobody refinishing operations, consumer products, AIM coatings, and small new natural gas-fired boilers. In addition, MANE-VU states committed to the use of low sulfur home heating, distillate and residual fuel oil. Exhibit 4-2 briefly describes the OTC and MANE-VU control measures affecting area sources that have been recommended for adoption by the states in the OTR.

Individual states are in various stages of adopting the OTC recommendations into their rules and SIPs. OTC's status reports were reviewed to identify each state's adoption status (OTC 2009, OTC 2011a, OTC2011b). To obtain further clarification, states were polled to determine whether they have adopted a rule that would achieve reductions equivalent to the OTC model rule or recommendation and whether credit for each rule was already accounted for in the 2007 inventory.

To evaluate the impact of the rules currently in place as well as the potential adoption of all control measures by all states except Virginia, the state Air Directors specified that two emission control scenarios should be developed as follows:

- Existing Controls - this scenario represents the best estimates for the future year, accounting for all in-place controls that are fully adopted into federal or individual state regulations or SIPs.

- Potential New OTC Controls – this scenario accounts for all of the emission reductions from the existing control scenario plus new state or regional measures that are under consideration by the OTC or individual states. This is a "what if" scenario that assumes that all states in the MANE-VU+VA region except Virginia will adopt all new OTC control measures under consideration by 2017. It does not include any potential new <u>federal</u> control measures that are under consideration.

The following paragraphs describe the control factors applied for each control measure by state and future year.

Exhibit 4.2 Summary of Area Source OTC Control Measures

Source Category	Pollutants	Description
Consumer Products	VOC	OTC 2001. Specified VOC content limits for certain categories that are more stringent than Federal limits OTC 2006. Included additional products and more restrictive VOC limits for certain products OTC 2009/2010. Specified more restrictive VOC limits for 14 existing consumer product categories and three new categories
Architectural and Industrial Maintenance Coatings	VOC	OTC 2001. Specified VOC content limits for certain categories that are more stringent than Federal limits OTC 2009/2010. Eliminated 15 categories (replaced by new categories or deemed unnecessary), added 10 new categories, and specified stricter VOC limits for 19 categories
Portable Fuel Containers	VOC	OTC 2001. Provided container design specifications to reduce emissions from spillage and evaporation OTC 2006. Revised and clarified design specifications and added kerosene containers and utility jugs.
Mobile Equipment Repair and Refinishing	VOC	OTC 2001. Required use of high efficiency coating application equipment, spray gun cleaning equipment that minimizes solvent loss, and enclosed spray gun cleaning. OTC 2009/2010. Limited the VOC content of coatings more stringent than the Federal limits and the VOC content of cleaning solvents
Solvent Cleaning	VOC	OTC 2001. Established hardware and operating requirements for specified vapor cleaning machines, and solvent volatility limits and operating practices for cold cleaners
Adhesives and Sealants	VOC	OTC 2006. Provided VOC content limits and other restrictions on adhesives used primarily by commercial and industrial users.
Asphalt Paving	VOC	OTC 2006. Suggested VOC content limits for emulsified and cutback asphalts use for road paving
NOx ICI Boiler Controls	NOx	OTC 2001. Recommended NOx emission rate limits for industrial boilers greater than 5 mmBtu/hour OTC 2006. Recommended lower NOx emission rate limits for industrial, commercial, and institutional boilers OTC 2010. Recommended national NOx controls for ICI boilers
Small Natural Gas-Fired Boilers	NOx	OTC 2009/2010. Recommended NOx emission rate limits for new boilers less than 5 mmBtu/hr
Low Sulfur Fuel Oil	SO2	MANE-VU 2006. Recommends sulfur content limits for home heating oil, distillate oil, and residual oil

4.4.1 OTC Model Rule for Adhesives/Sealants

VOC emissions in this category are primarily from commercial applications such as floor covering installation (carpet and wood flooring), roof installations and repair and upholstery shops. The category also includes industrial applications such as wood product manufacturers. Adhesives in small containers are not included in this category but are regulated under the consumer products regulations.

The OTC 2006 model rule for industrial adhesives and sealants is based on the reasonably available control technology (RACT) and best available retrofit control technology (BARCT) determination by the California Air Resources Board (CARB) developed in 1998. The OTC model rule regulates the application of adhesives, sealants, adhesive primers and sealant primers by providing options for appliers to either use a product with a VOC content equal to or less than a specified limit or to use add-on controls to achieve an equivalent reduction. The emission reduction benefit estimation methodology for area sources is based on information developed and used by CARB as discussed in their 1998 RACT report. A 64.4 percent reduction in VOC emissions was estimated for SCC 24-40-020-000.

States were polled to determine whether they have adopted a rule that would achieve reductions equivalent to the 2006 OTC recommendations and whether the estimated reduction in VOC emissions should be applied in 2017 and 2020. State-by-state recommendations are shown in Exhibit 4.3.

It should be noted that not all states account for emissions from this category in a separate area source inventory. Some states, based on information received from USEPA, excluded this category because the emissions to some extent may be accounted for in the area source commercial and consumer products category or in the nonEGU point source inventory.

Exhibit 4.3 State Recommendations for OTC Industrial Adhesives/Sealants Rule

State	Is Rule Accounted for in 2007 Inventory*	Incremental VOC Reduction to Apply:			
		2017 Existing Controls	2017 Potential Controls	2020 Existing Controls	2020 Potential Controls
CT	No	64.4	0	64.4	0
DE	No	64.4	0	64.4	0
DC	No	n/a	n/a	n/a	n/a
ME	No	64.4	0	64.4	0
MD	No	64.4	0	64.4	0

State	Is Rule Accounted for in 2007 Inventory*	Incremental VOC Reduction to Apply:			
		2017 Existing Controls	2017 Potential Controls	2020 Existing Controls	2020 Potential Controls
MA	No	64.4	0	64.4	0
NH	No	n/a	n/a	n/a	n/a
NJ	No	64.4	0	64.4	0
NY	No	64.4	0	64.4	0
PA	No	64.4	0	64.4	0
RI	No	n/a	n/a	n/a	n/a
VT	n/a	n/a	n/a	n/a	n/a
VA	No	n/a	n/a	n/a	n/a

* n/a means SCC 24-40-020-000 not included in 2007 inventory; see text for further discussion

4.4.2 OTC Model Rules for Architectural and Industrial Maintenance Coatings

On August 14, 1998, USEPA issued the final version of their National Volatile Organic Compound Emission Standards for Architectural Coatings under Section 183(e) of the Clean Air Act. This final rule applied only to manufacturers and importers of architectural coatings, and set VOC content limits for 61 coating categories. This rule specifically allowed states or local governments to adopt more stringent coating limits.

The OTC adopted an AIM model rule more stringent than the national rule, and based primarily on the 2000 CARB suggested control measure (SCM) for AIM coatings. The 2001 OTC model rule was estimated to provide a 31 percent incremental reduction in VOC emissions compared to the Federal Part 59 rule and was applied to the following SCCs:

- 24-01-001-000 All Architectural Coatings
- 24-01-002-000 Architectural Coatings Solvent Based
- 24-01-003-000 Architectural Coatings Water Based
- 24-01-008-000 Traffic Markings
- 24-01-100-000 Industrial Maintenance Coatings
- 24-01-200-000 Other Special Purpose Coatings

The OTC 2009/2010 model rule is an update of the 2001 model rule. It is based the 2007 CARB suggested control measure. The OTC 2009/2010 rule includes new categories which were defined in the 2007 CARB measure and revised limits for several coating categories In addition to the revised limits in the 2007 CARB SCM, the OTC model rule also includes a more stringent VOC limit for the Industrial Maintenance (IM) coating category that was included in the 2000 CARB SCM. The 2000 CARB SCM proposed a limit of 250 g/L with an optional limit of 340 g/L for colder climates. The 2002 OTC model rule included the 340 g/l due to concerns about the ability to comply in the colder northeast. Because of the success of implementing the revised limit throughout California and the advent of t-butyl acetate as a delisted solvent, OTC believes a 250 g/L VOC limit is now feasible and has included this new lowered limit in the 2010 model rule.

The CARB SCM data was used to estimate a 34.4 percent reduction for architectural coatings and a 9.7 percent reduction for traffic markings. For industrial maintenance coatings, a 26.5 percent reduction was estimated based on lowering the VOC content limit from 340 g/L to 250 g/L. Other specialty coatings are another form of industrial high performance maintenance coatings (IM), so the IM control factor was also used for the other specialty coatings SCC.

States were polled to determine whether they had adopted a rule that would achieve reductions equivalent to the 2006 OTC recommendations and whether the estimated reduction in VOC emissions should be applied in 2017 and 2020. Many states adopted the rule prior to 2007 and have already accounted for the reductions attributable to the rule in their 2007 inventories. Other states had compliance dates after 2007 and the effect of the rule was not accounted for in their 2007 inventory. State-by-state recommendations to account for the AIM rule are shown in Exhibit 4.4.

Exhibit 4.4 State Recommendations for OTC AIM Rule

State	Is OTC 2001 Rule Accounted for in 2007 Inventory*	Incremental VOC Percent Reduction to Apply:			
		2017 Existing Controls	2017 Potential Controls	2020 Existing Controls	2020 Potential Controls
CT	No	31 AIM	34.4 ARCH 9.7 TM 26.5 IM	31 AIM	34.4 ARCH 9.7 TM 26.5 IM
DE	Yes	0 AIM	34.4 ARCH 9.7 TM 26.5 IM	0 AIM	34.4 ARCH 9.7 TM 26.5 IM
DC	Yes	0 AIM	34.4 ARCH 9.7 TM 26.5 IM	0 AIM	34.4 ARCH 9.7 TM 26.5 IM
ME	No	31 AIM	34.4 ARCH 9.7 TM	31 AIM	34.4 ARCH 9.7 TM

State	Is OTC 2001 Rule Accounted for in 2007 Inventory*	Incremental VOC Percent Reduction to Apply:			
		2017 Existing Controls	2017 Potential Controls	2020 Existing Controls	2020 Potential Controls
			26.5 IM		26.5 IM
MD	Yes	0 AIM	34.4 ARCH 9.7 TM 26.5 IM	0 AIM	34.4 ARCH 9.7 TM 26.5 IM
MA	No	31 AIM	34.4 ARCH 9.7 TM 26.5 IM	31 AIM	34.4 ARCH 9.7 TM 26.5 IM
NH	No	0 AIM	55.5 ARCH 37.7 TM 49.4 IM	0 AIM	55.5 ARCH 37.7 TM 49.4 IM
NJ	Yes	0 AIM	34.4 ARCH 9.7 TM 26.5 IM	0 AIM	34.4 ARCH 9.7 TM 26.5 IM
NY	Yes	0 AIM	34.4 ARCH 9.7 TM 26.5 IM	0 AIM	34.4 ARCH 9.7 TM 26.5 IM
PA	Yes	0 AIM	34.4 ARCH 9.7 TM 26.5 IM	0 AIM	34.4 ARCH 9.7 TM 26.5 IM
RI	No	31 AIM	34.4 ARCH 9.7 TM 26.5 IM	31 AIM	34.4 ARCH 9.7 TM 26.5 IM
VT	No	0 AIM	55.5 ARCH 37.7 TM 49.4 IM	0 AIM	55.5 ARCH 37.7 TM 49.4 IM
VA-NVA	Yes	0 AIM	0 AIM	0 AIM	0 AIM
VA-FRD	No	31 AIM	0 AIM	31 AIM	0 AIM
VA-Other	No	0 AIM	0 AIM	0 AIM	0 AIM

AIM – includes all AIM coatings listed below:
ARCH – architectural
TM - traffic markings
IM - industrial maintenance

VA-NVA includes the cities/counties in the Northern Virginia emission control area
VA-FRD includes the cities/counties in the Fredericksburg emission control area
VA-Other includes cities/counties in Virginia not listed above

4.4.3 OTC Model Rule for Asphalt Paving

OTC Resolution 06-02 recommends that states establish rules to achieve a 20 percent reduction in VOC emissions from the application and use of emulsified and cutback asphalt. The reductions apply to the following SCCs:

- 24-61-021-000 Cutback Asphalt
- 24-61-022-000 Emulsified Asphalt

States were polled to determine whether they have adopted a rule that would achieve reductions equivalent to the 2006 OTC recommendations and whether the estimated reduction in VOC emissions should be applied in 2017 and 2020. Some states adopted the rule prior to 2007 and have already accounted for the reductions attributable to the rule in their 2007 inventories. Other states had compliance dates after 2007 and the effect of the rule was not accounted for in their 2007 inventory. State recommendations to account for the asphalt paving recommendation are shown in Exhibit 4.5.

Exhibit 4.5 State Recommendations for OTC Cutback and Emulsified Asphalt Paving Recommendation

State	Is Rule Accounted for in 2007 Inventory*	Incremental VOC Percent Reduction to Apply:			
		2017 Existing Controls	2017 Potential Controls	2020 Existing Controls	2020 Potential Controls
CT	No	20	0	20	0
DE	Yes	0	0	0	0
DC	No	0	20	0	20
ME	No emissions in inventory	0	0	0	0
MD	No	0	20	0	20
MA	No	20	0	20	0
NH	No	0	20	0	20
NJ	No	56% Cutback 25% Emulsified	0	56% Cutback 25% Emulsified	0
NY	No	20	0	20	0
PA	No	0	20	0	20
RI	No	20	0	20	0
VT	No emissions in inventory	0	0	0	0
VA-NVA	No	0	0	0	0
VA-Other	No	0	0	0	0

4.4.4 OTC Model Rules for Consumer Products

Several states began regulating the VOC content of consumer products in the early 1990s. The USEPA promulgated a national rule in 1998 (40CFR, Part 59, Subpart C). Both the California Air Resources Board (CARB) and the OTC states have periodically updated their state rules to obtain VOC reductions beyond those required by the federal rule. Following the lead of CARB, the OTC 2001 model rule for consumer products adopted more stringent VOC content limits for certain categories. The OTC 2006 model rule modified the OTC 2001 model rule based on amendments adopted by CARB in July 2005 to include additional products and more stringent VOC limits for certain products. CARB amended their rules again in 2006 and the OTC 2010 model rule is based on those amendments.

The OTC 2010 model amendments have more restrictive VOC limits for 14 existing consumer product categories (15 including subcategories) and three new categories (five including subcategories) will be regulated for the first time with VOC limits. The OTC 2010 model rule amendments also clarify or modify previously defined or regulated categories. The model rules also contained optional prohibitions on the use of chlorinated toxic compounds in certain consumer product categories. CARB adopted these provisions simultaneous with their VOC limits to address the use of non-VOC chlorinated solvent use increasing as they are used as replacement compounds.

The VOC percentage reduction from the various rules and amendments are summarized in Exhibit 4.6. The emissions reductions from the latest OTC consumer products rule update used information developed by CARB for its 2006 amendments. The OTC estimated a 4.8 percent reduction of the total consumer products inventory for states that included CARB's ban of chlorinated toxic compounds in brake cleaners, and an estimated 3.3 percent reduction of the total consumer products inventory for states that did not include this ban.

States reported VOC emissions from consumer products inventory in two different manners – using an aggregated SCC or subcategory SCCs, as follows:

Aggregated SCC:	24-60-000-000 Consumer Products, All Products
	24-65-000-000 Consumer Products, All Products
Disaggregated SCCs:	24-60-100-000 Consumer Products, Personal Care Products
	24-60-200-000 Consumer Products, Household Products
	24-60-400-000 Consumer Products, Auto Aftermarket Products
	24-60-500-000 Consumer Products, Coatings
	24-60-600-000 Consumer Products, Adhesives and Sealants
	24-60-800-000 Consumer Products, FIFRA Products
	24-60-900-000 Consumer Products, Misc. Products

Exhibit 4.6 VOC Emission Factors for Consumer Products

Uncontrolled Emission Factor:	=	7.84 lbs/capita
Emission Factor after 1998 Federal Rule:	=	7.06 lbs/capita
Percent Reduction from 1998 Federal Rule compared to uncontrolled	= =	100%* (7.84 - 7.06) / 7.84 9.95%
Emission Factor after 2001 OTC Rule	=	6.06 lbs/capita
Percent Reduction from 2001 OTC Rule compared to Federal Rule	= =	100%* (7.06 - 6.06) / 7.06 14.2%
Emission Factor after 2006 OTC Rule	=	5.94 lbs/capita
Percent Reduction from 2006 OTC Rule compared to OTC 2001 Rule	= =	100%* (6.06 -5.94) / 6.06 2.0%
Emission Factor after 2010 OTC Rule (without brake cleaner chlorinated toxic ban)	=	5.745 lbs/capita
Percent Reduction from 2010 OTC Rule compared to OTC 2006 Rule	= =	100%* (5.94 – 5.745) / 5.94 3.3%
Emission Factor after 2010 OTC Rule (with brake cleaner chlorinated toxic ban)	=	5.655 lbs/capita
Percent Reduction from 2010 OTC Rule compared to OTC 2006 Rule	= =	100%* (5.94 – 5.655) / 5.94 4.8%

The reductions shown above were applied to the above SCCs based on each state's adoption of the various rules and amendments as well as the decision with respect to the ban on chlorinated toxic compounds used in brake cleaners. States were polled to determine whether they have adopted a rule that would achieve reductions equivalent to the OTC 2006 recommendations and whether the estimated reduction in VOC emissions should be applied in 2017 and 2020. For the 2001 OTC rule, some states adopted the rule prior to 2007 and have already accounted for the reductions attributable to the OTC 2001 rule in their 2007 inventories. Other states had compliance dates after 2007 and the effect of the OTC 2001 rule was not accounted for in their 2007 inventory. None of the states have accounted for the OTC 2006 rule in their 2007 inventories. State-by-state recommendations to account for both the OTC 2001 and 2006 consumer products rules are shown in Exhibit 4.7.

Exhibit 4.7 State Recommendations for OTC 2001 and 2006 Consumer Products Rules

State	Is 2001 Rule Accounted for in 2007 Inventory	Is 2006 Rule Accounted for in 2007 Inventory	VOC Percent Reduction to use in:			
			2017 Existing Controls	2017 Potential Controls	2020 Existing Controls	2020 Potential Controls
CT	No	No	15.9	4.8	15.9	4.8
DE	Yes	No	2.0	4.8	2.0	4.8
DC	No	No	2.0	4.8	2.0	4.8
ME	No	No	15.9	4.8	15.9	4.8
MD	Yes	No	2.0	4.8	2.0	4.8
MA	No	No	15.9	4.8	15.9	4.8
NH	No	No	14.2	5.2	14.2	5.2
NJ	Yes	No	2.0	4.8	2.0	4.8
NY	Yes	No	2.0	4.8	2.0	4.8
PA	Yes	No	2.0	4.8	2.0	4.8
RI	No	No	15.9	4.8	15.9	4.8
VT	No	No	0	18.6	0	18.6
VA-NVA	Yes	No	2.0	0	2.0	0
VA-FRD	No	No	15.9	0	15.9	0
VA-RCH	No	No	15.9	0	15.9	0
VA-Other	No	No	0	0	0	0

NH indicated that their amendments to include the OTC 2006 recommendations won't be completed in time to include in the OTB/OTW inventory

4.4.5 OTC Model Rules for Mobile Equipment Repair and Refinishing

The USEPA promulgated a national rule in 1998 (40CFR, Part 59, Subpart B) to limit the VOC content of coatings usedin the refinishing of automobiles. The federal standards were estimated to reduce nationwide emissions of VOC by about 37 percent compared to uncontrolled 1998 emissions. The 2002 OTC model rule established requirements for using higher efficiency coating application equipment, such as high volume-low pressure paint guns, using spray gun cleaning equipment that minimizes solvent loss, and enclosed spray gun cleaning. The Federal VOC limits on the paints was maintained in the model rule. An incremental control effectiveness of 38 percent was estimated for the OTC 2001 model rule (post-1998 federal standard emissions).

The 2009 OTC model rule for Motor Vehicle and Mobile Equipment Non-assembly Line Coating Operations (2009 OTC MVME model rule) seeks to limit the VOC content in coatings and cleaning solvents used in motor vehicle and mobile equipment non-assembly line coating operations. The 2009 OTC MVME model rule is an update of the 2002 OTC MERR model rule. The OTC developed the 2009 OTC MVME Model Rule using the CARB 2005 Suggested Control Measure (SCM) for Automotive Coatings as a guideline. The CARB 2005 SCM estimated a 65 percent reduction in VOC emissions from 2002 CARB baseline emissions, which are post-1998 federal standard emissions. Similar reductions of 65 percent are expected from implementation of the 2009 OTC MVME Model Rule.

A few OTC states adopted the 2002 OTC model rule and accounted for the 38 percent reduction in the 2007 MANEVU+VA inventory. Other states adopted the 2002 OTC model rules after 2007, so the reduction was not included in 2007 but was included in the 2017/2020 "on-the-books" inventory. Still other states have not yet adopted the 2002 OTC model rule. Exhibit 4.8 summarizes the percent reductions that will be applied based on the adoption status of each state:

Exhibit 4.8 VOC Emission Reductions for Auto Refinishing

State Rule Adoption Status	VOC Reduction:	
	2017/2020 Existing	2017/2020 Potential
Accounted for 2002 OTC rule in 2007 inventory Will adopt 2009 OTC rule by 2017	0 %	65 %
Did not account for 2002 OTC rule in 2007 inventory Did account for 2002 OTC rule in 2017/2020 OTB inventory Will adopt 2009 OTC rule by 2017	38 %	65 %
Did not account for 2002 OTC rule in 2007 inventory Did not account for it in 2017/2020 OTB inventory Will adopt 2009 OTC rule by 2017	0 %	78.3 %

The reductions have traditionally been applied to the following area source SCCs:

24-01-005-000 Auto Refinishing / All Solvent Types

24-01-005-500 Auto Refinishing / Surface Preparation Solvents

24-01-005-600 Auto Refinishing / Primers

24-01-005-700 Auto Refinishing / Top Coats

24-01-005-800 Auto Refinishing / Clean-up Solvents

States were polled to determine whether they have adopted a rule that would achieve reductions equivalent to the 2006 OTC recommendations and whether the estimated reduction in VOC emissions should be applied in 2017 and 2020. Many states adopted the rule prior to 2007 and have already accounted for the reductions attributable to the rule in their 2007 inventories. Other states had compliance dates after 2007 and the effect of the rule was not accounted for in their 2007 inventory. State-by-state recommendations to account for the auto refinishing rule are shown in Exhibit 4.9.

Exhibit 4.9 State Recommendations for OTC Auto Refinishing Rule

State	Is OTC 2001 Rule Accounted for in 2007 Inventory*	Incremental VOC Reduction to Apply:			
		2017 Existing Controls	2017 Potential Controls	2020 Existing Controls	2020 Potential Controls
CT	Yes	0	65	0	65
DE	Yes	0	65	0	65
DC	No	38	65	38	65
ME	No	38	65	38	65
MD	Yes	Yes	0	65	0
MA	No	0	78.3	0	78.3
NH	No	0	78.3	0	78.3
NJ	Yes	0	65	0	65
NY	Yes	0	65	0	65
PA	Yes	0	65	0	65
RI	Yes	0	65	0	65
VT	No emissions in inventory	0	0	0	0
VA-NVA	Yes	0	0	0	0
VA-FRD	No	38	0	38	0
VA-Other	No	0	0	0	0

4.4.6 OTC Model Rules for Portable Fuel Containers

In 2001, the OTC developed a model rule to control VOC emissions from portable fuel containers. The 2001 model rule was based on the technical work conducted by California Air Resources Board (CARB) for developing California's 2000 fuel container rule. Several, but not all, of the MANEVU+VA states adopted regulations which became effective prior to 2007.

After OTC developed its model rule in 2001, CARB realized that its original study and rule had some defects and decided to conduct further studies and research on fuel containers. Based on its new studies, CARB revised its rule twice. In 2006, the OTC developed a second model rule for PFCs to reflect the CARB revisions. Thereafter, USEPA developed a federal rule in 2007 which included, among other things, requirements for portable fuel containers equivalent to OTC's 2006 requirements.

The federal requirements became effective on January 1, 2009. States have analyzed the federal rule and determined that the federal rule has requirements that are essentially equivalent to the OTC 2006 model rule. These new federal requirements will reduce hydrocarbon emissions from uncontrolled fuel containers by approximately 75 percent. Assuming a 10-year turnover to compliant cans, only 10 percent of the existing inventory of PFCs will comply with the new requirements in 2010. Therefore, only 10 percent of the full emission benefit estimated by USEPA will occur by 2010 – the incremental reduction will be about 7.5 percent in 2010. In 2013, there will be a 40 percent turnover to compliant cans, resulting in an incremental reduction of about 60 percent. By 2017, the will be 80 percent penetration to compliant PFCs, resulting in an incremental reduction of 58 percent in 2018. By 2020, there will be 100 percent penetration to compliant PFCs, resulting in an incremental reduction of 75 percent in 2020.

The reductions apply to the following SCCs:

- 25-01-011-xxx Residential PFCs
- 24-01-012-xxx Commercial PFCs

States were polled to determine the status of PFC regulations in each state. Some states have adopted a rule that would achieve reductions equivalent to the 2001 or 2006 OTC rules. Other states will rely exclusively on the Federal rule. State-by-state recommendations to account for the OTC and federal PFC rules are shown in Exhibit 4.10.

Exhibit 4.10 State Recommendations for OTC and Federal Portable Fuel Container Rules

State	Compliance Date for OTC 2001 Rule	Compliance Date for OTC 2006 Rule	Rely on Federal Rule?	VOC Percent Reduction to use in:			
				2017 Existing Controls	2017 Potential Controls	2020 Existing Controls	2020 Potential Controls
CT	May 2004	Jun 2008	No	81	0	81	0
DE	Jan 2003	Apr 2010	Yes	75	0	78	0
DC	Dec 2004	Feb 2012	Yes	79	0	81	0
ME	Jan 2004	n/a	Yes	77	0	80	0
MD	May 2003	Jan 2009	No	76	0	79	0
MA	n/a	n/a	Yes	77	0	85	0
NH	n/a	Jan 2008	No	85	0	85	0
NJ	Jan 2005	Jan 2009	No	83	0	83	0
NY	Jan 2005	Jan 2010	Yes	79	0	82	0
PA	Jan 2005	n/a	Yes	75	0	78	0
RI	n/a	n/a	Yes	77	0	85	0
VT	n/a	n/a	Yes	77	0	85	0
VA-NVA	Jan 2005	Aug 2010	Yes	79	0	82	0
VA-FRD	Jan 2008	Aug 2010	Yes	83	0	85	0
VA-RCH	n/a	n/a	Yes	77	0	85	0
VA-Oth	n/a	n/a	Yes	77	0	85	0

4.4.7 OTC Model Rule for Solvent Cleaning

The OTC model rule establishes hardware and operating requirements for specified vapor cleaning machines, and solvent volatility limits and operating practices for cold cleaners. An incremental control effectiveness of 66 percent was estimated for the OTC model rule relative to the base case. The reductions apply SCCs in the 24-15-xxx-xxx series (Degreasing All Industries and Processes). States were polled to determine whether they have adopted a rule that would achieve reductions equivalent to the 2001 OTC recommendations and whether the estimated reduction in VOC emissions should be applied in 2017 and 2020. Many states adopted the rule prior to 2007 and have already accounted for the reductions attributable to the rule in their 2007 inventories. Other states had compliance dates after 2007 and the effect of the rule was not accounted for in their 2007 inventory. State-by-state recommendations to account for the solvent cleaning rule are shown in Exhibit 4.11.

Exhibit 4.11 State Recommendations for 2001 OTC Solvent Cleaning Rule

State	Is Rule Accounted for in 2007 Inventory*	Incremental VOC Reduction to Apply:			
		2017 Existing Controls	2017 Potential Controls	2020 Existing Controls	2020 Potential Controls
CT	No	66	0	66	0
DE	Yes	0	0	0	0
DC	No	66	0	66	0
ME	No	66	0	66	0
MD	Partially	30	0	30	0
MA	No	66	0	66	0
NH	No	0	66	0	66
NJ	Yes	0	0	0	0
NY	Yes	0	0	0	0
PA	Yes	0	0	0	0
RI	No	66	0	66	0
VT	n/a	0	66	0	66
VA-NVA	Yes	0	0	0	0
VA-Other	No	0	0	0	0

4.4.8 OTC Model Rules for ICI Boilers

In Resolution 06-02, the OTC Commissioners recommended that OTC member states pursue as necessary and appropriate state-specific rulemakings or other implementation methods to establish emission reduction percentages, emission rates or technologies for ICI boilers based on guidelines that varied by boiler size and fuel type.

States were polled to determine whether they have adopted a rule that would achieve reductions equivalent to the 2006 OTC recommendations and whether the estimated reduction in NOx emissions should be applied in 2017 and 2020. All but one state indicated that they have not adopted rules for area sources equivalent to the 2006 OTC recommendations. New Jersey specified that they have post-2007 ICI boiler rules that reduce NOx emissions and provided the estimates of the reductions in NOx emissions by SCC resulting from boiler tuneup requirements, as shown in Exhibit 4.12:

Exhibit 4.12 Area Source Emission Reductions from New Jersey ICI Boiler NOx Rules

SCC	Source Category	Percent Reduction from Tuneups 2007-2017	Rule Effectiveness	Rule Penetration	Overall Percent Reduction 2007-2017
2102004000	Industrial Distillate	25%	80%	30%	6%
2102005000	Industrial Residual	25%	80%	30%	6%
2102006000	Industrial Natural Gas	25%	80%	30%	6%
2102007000	Industrial LPG	25%	80%	30%	6%
2103004000	Commercial Distillate	25%	80%	30%	6%
2103005000	Commercial Residual	25%	80%	30%	6%
2103006000	Commercial Natural Gas	25%	80%	30%	6%
2103007000	Commercial LPG	25%	80%	30%	6%

Other states indicated that they will likely depend on USEPA national rule for possible inclusion in the BOTW inventory. OTC Resolution 10-01 (June, 2010) called on USEPA for national regulations for ICI boilers. The guidelines from OTC Resolution 06-02 shown in Exhibit 4.13 were used to estimate potential area source NOx reductions for the "what if" control scenario for all states in the MANE-VU+VA inventory except New Jersey and Virginia.

Exhibit 4.13 OTC Resolution 06-02 Guidelines for ICI Boiler NOx Rules

Boiler Size (mmBtu/hr)	NOx Percent Reduction from Base Emissions by Fuel Type			
	Natural Gas	#2 Fuel Oil	#4/#6 Fuel Oil	Coal
<25	10	10	10	10
25 to 50	50	50	50	50*
50 to 100	10	10	10	10*
100 to 250	76	40	40	40*
>250	**	**	**	**

* Resolution 06-02 did not specify a percent reduction for coal; for modeling purposes, the same percent reduction specified for #4/#6 fuel oil was used for coal.

** Resolution 06-02 specified the reduction for > 250mmBtu/hour boilers to be the "same as EGUs of similar size." The OTC Commissioners have not yet recommended an emission rate or percent reduction for EGUs. As a result, no reductions for ICI boilers > 250 mmBtu/hour were included in the potential controls inventory.

Since the above guidelines vary by boiler size and fuel type, the specific percent reduction applied to an area source category depends on the SCC and design capacity of the source. The SCC identifies the fuel type (for example, SCC 21-02-004-xxx describes distillate oilfired industrial boilers, SCC 21-02-006-xxx describes natural gas-fired industrial boilers). The area source inventory does not contain any information on the sizes of the units included in the inventories. To apportion area source emissions to the boiler size ranges listed above, we used data from an Oak Ridge National Laboratory study (EEA 2005). We used the national estimates of boiler capacity by size range to calculate the percentage of total boiler capacity in each size range. Since the Oak Ridge report distinguished between industrial boilers and commercial/institutional boilers, we developed separate profiles for industrial boilers and for commercial/institutional boilers. We used these boiler size profiles to calculate weighted average percent reductions industrial boilers by fuel type and commercial/institutional boilers by fuel type, as follows:

- 34.5 percent reduction in NOx emissions from industrial boilers, all fuel types
- 28.1 percent reduction in NOx emissions from commercial/institutional boilers, all fuel types

Appendix I contains the data used to develop the NOx control factors for area source ICI boilers.

4.4.9 OTC Model Rule for New, Small, Natural Gas-fired Boilers

The provisions of this model rule limit NOx emissions from new natural gas-fired ICI and residential boilers, steam generators, process heaters, and water heaters greater than 75,000 BTUs and less than 5.0 million BTUs. This model rule may be implemented as a manufacturing restriction, a sales restriction, a use restriction, or a combination of these restrictions. Each implementing state agency will choose the entities to regulate after consideration of the agency's compliance assurance and enforcement practices and policies.

The emission limits of this model rule were developed from requirements now in effect in certain jurisdictions, including: (1) San Joaquin Valley Air Pollution Control District Rule 4308 for boilers, steam generators, process heaters and water heaters with maximum rated heat input capacity equal to or greater than 75,000 Btu/hr and up to but less than 2.0 million Btu/hr; (2) San Joaquin Valley Air Pollution Control District Rule 4307 for gas-fired and liquid fuel-fired boilers, steam generators, and process heaters with maximum rated capacity of 2.0 million Btu/hr up to and including 5.0 million Btu/hr; and (3) similar rules adopted by other California Air Pollution Control Districts and the State of Texas.

Since the OTC model rule is based on SJVAPCD Rules 4307 and 4308, one method for estimating potential NOx reductions for the OTC states from both Rule 4307 and Rule 4308 is to compare the natural gas usage in the San Joaquin Valley to the natural gas usage in the OTC states and calculate the proportional NOx reductions.

The SJV 4308 Rule, Final Staff Report estimated NOx reductions of 2.0 annual average tons per day (730 tons per year), and the 2008 SJV 4307 Rule Proposal estimated NOx reductions of 1.15 annual average tons per day (420 tons per year). The total reduction from both rules was estimated to be 3.15 tons per day (1,150 tons per year) after a 15-year period for complete turnover to compliant equipment. These SJV data were used to calculate a ton per year emission reduction, assuming implementation begins in 2014, as summarized in Exhibit 4.14 and further documented in Appendix J.

Exhibit 4.14 NOx Control Factors for the OTC Rule for New, Small, Natural Gas-fired Units

State	Percent Reduction in NOx Emissions from Residential and Commercial Natural Gas Use	
	2017	2020
CT	5.0%	8.4%
DE	6.1%	10.1%
DC	2.3%	3.9%
ME	0.0%	0.0%
MD	3.2%	5.4%
MA	5.3%	8.8%
NH	7.1%	11.8%
NJ	3.5%	5.9%
NY	5.1%	8.5%
PA	4.7%	7.8%
RI	7.0%	11.7%
VT	3.1%	5.1%
VA	0%	0%

4.4.10 MANE-VU Low Sulfur Fuel Oil Strategy

MANE-VU developed a low sulfur fuel oil strategy to help states develop Regional Haze SIPs (MANE_VU 2007). The sulfur in fuel oil recommendations are shown in Exhibit 4.15 and vary by state, type of fuel oil, and year of implementation.

Exhibit 4.15 MANE-VU Low Sulfur Fuel Oil Strategy

Inner Zone States (DE, NJ, NY, PA)		
Fuel Oil Type	**Sulfur Content 2012**	**Sulfur Content 2016**
Distillate	500 ppm	15 ppm
#4 Residual	0.25 %	0.25 %
#6 Residual	0.3 to 0.5 %	0.3 to 0.5 %
Outer Zone States (CT, DC, MA, MD, ME, NH, RI, VT)		
Fuel Oil Type	**Sulfur Content 2014**	**Sulfur Content 2018**
Distillate	500 ppm	15 ppm
#4 Residual	n/a	0.25 to 0.5 %
#6 Residual	n/a	0.5 %

Each state was polled and asked to provide guidance as to when, if at all, the MANE-VU strategy would be incorporated into their state rules. States were also asked to provide the 2007 sulfur contents for each fuel type by county in order to calculate the percent reduction in emissions for the future years. Three states (MD, NJ, and NY) have adopted or are committed to adopting the strategy into their rules. The reductions for these three states were accounted for in the "existing controls" inventory. All other jurisdictions indicated that not enough regulatory development progress has been made to include the reductions in future years with absolute certainty. The potential reductions for these states were accounted for in the "potential new controls" inventory. One state (VA) has no plans to adopt the low sulfur fuel oil strategy. The percent reductions by fuel type and county are contained in Appendix K.

5.0 NONEGU POINT SOURCE CONTROL FACTORS

Control factors were developed to estimate post-2007 emission reductions resulting from on-the-books regulations and proposed regulations/actions. Control factors were considered for the following national and regional measures:

- Federal Rules Affecting NonEGU Point Sources
- Control Technique Guidelines
- OTC Model Rules

These control programs are discussed in the following subsections. The control factors used for nonEGU point sources are provided in V3_3 NonEGU_07_17_20.xlsx.

5.1 FEDERAL ACTIONS AFFECTING NONEGU POINT SOURCES

USEPA made available its 2020 emissions projections associated with its 2005-based v4 modeling platform (USEPA 2010a). These categories, and how they were accounted for in the MANE-VU+VA emission projection inventories, are described below:

- <u>MACT Standards</u> - USEPA developed guidance for estimating VOC and NO_x emission changes from MACT Rules (USEPA 2007b). We reviewed the guidance to identify nonEGU source controls associated with MACT standards for controlling HAPs. The information concerning MACT compliance periods was used to determine whether the MACT standard resulted in post-2007 emission reductions. Because major source categories had a compliance period of 2007 or earlier, we assumed that the emission reductions from the MACT standard should be reflected in the baseline year and not as an additional post- 2007 credit. The only exception to the above discussion of area source MACT standards pertains to the recently promulgated rules for reciprocating internal combustion engines. USEPA made available an estimate of the percent reduction in emissions attributable to the RICE MACT rule in 2012 and 2014 (USEPA 2010b). These reductions by SCC are shown in Exhibit 5.1. The USEPA 2014 estimates were used for the MANE-VU+VA 2017, 2020 and 2025 inventories.

- <u>Industrial, Commercial, and Institutional Boilers and Process Heaters MACT Standard</u> - USEPA' s 2020 control factor file identified a number of solid fuel-burning SCCs for which they estimated an 87% reduction in both PM10 and PM2.5. These were used for 2025 also for the affected SCCs.

Exhibit 5.1 USEPA Estimated Percent Reductions for RICE MACT Standard

SCC	CO	NOx	PM10	PM2.5	VOC	SCC Description
20100102	20.36		15.14	15.14	36.72	Electric Generation;Distillate Oil (Diesel);Reciprocating
20100105	20.36		15.14	15.14	36.72	Electric Generation;Distillate Oil (Diesel);Reciprocating: Crankcase Blowby
20100107	20.36		15.14	15.14	36.72	Electric Generation;Distillate Oil (Diesel);Reciprocating: Exhaust
20100202	19.86	12.53			23.87	Electric Generation;Natural Gas;Reciprocating
20100207	19.86	12.53			23.87	Electric Generation;Natural Gas;Reciprocating: Exhaust
20200102	20.36		15.14	15.14	36.72	Industrial;Distillate Oil (Diesel);Reciprocating
20200104	20.36		15.14	15.14	36.72	Industrial;Distillate Oil (Diesel);Reciprocating: Cogeneration
20200107	20.36		15.14	15.14	36.72	Industrial;Distillate Oil (Diesel);Reciprocating: Exhaust
20200202	19.86	12.53			23.87	Industrial;Natural Gas;Reciprocating
20200204	19.86	12.53			23.87	Industrial;Natural Gas;Reciprocating: Cogeneration
20200207	19.86	12.53			23.87	Industrial;Natural Gas;Reciprocating: Exhaust
20200253	19.18	37.96			29.74	Industrial;Natural Gas;4-cycle Rich Burn
20200254	37.85				28.59	Industrial;Natural Gas;4-cycle Lean Burn
20200256	37.85				28.59	Industrial;Natural Gas;4-cycle Clean Burn
20200301	19.18	37.96			29.74	Industrial;Gasoline;Reciprocating
20200307	19.18	37.96			29.74	Industrial;Gasoline;Reciprocating: Exhaust
20201001	19.86	12.53			23.87	Industrial;Liquified Petroleum Gas (LPG);Propane
20201002	19.86	12.53			23.87	Industrial;Liquified Petroleum Gas (LPG);Butane
20201702	19.18	37.96			29.74	Industrial;Gasoline;Reciprocating Engine
20201707	19.18	37.96			29.74	Industrial;Gasoline;Reciprocating: Exhaust
20300101	20.36		15.14	15.14	36.72	Commercial/Institutional;Distillate Oil (Diesel);Reciprocating
20300105	20.36		15.14	15.14	36.72	Commercial/Institutional;Distillate Oil (Diesel);Reciprocating: Crankcase Blowby
20300106	20.36		15.14	15.14	36.72	Commercial/Institutional;Distillate Oil (Diesel);Reciprocating: Evaporative Losses
20300107	20.36		15.14	15.14	36.72	Commercial/Institutional;Distillate Oil (Diesel);Reciprocating: Exhaust
20300201	19.86	12.53			23.87	Commercial/Institutional;Natural Gas;Reciprocating

SCC	CO	NOx	PM10	PM2.5	VOC	SCC Description
20300204	19.86	12.53			23.87	Commercial/Institutional;Natural Gas;Cogeneration
20300207	19.86	12.53			23.87	Commercial/Institutional;Natural Gas;Reciprocating: Exhaust
20300301	19.18	37.96			29.74	Commercial/Institutional;Gasoline;Reciprocating
20300307	19.18	37.96			29.74	Commercial/Institutional;Gasoline;Reciprocating: Exhaust
20301001	19.86	12.53			23.87	Commercial/Institutional;Liquified Petroleum Gas (LPG);Propane
20301002	19.86	12.53			23.87	Commercial/Institutional;Liquified Petroleum Gas (LPG);Butane
20400401	19.18	37.96			29.74	Engine Testing;Reciprocating Engine;Gasoline
20400402	20.36		15.14	15.14	36.72	Engine Testing;Reciprocating Engine;Diesel/Kerosene
20400403	20.36		15.14	15.14	36.72	Engine Testing;Reciprocating Engine;Distillate Oil: CI: CI: VOC 2005cr = 0
31000203	19.86	12.53			23.87	Oil and Gas Production;Natural Gas Production;Compressors
50100421	19.86	12.53			23.87	Solid Waste Disposal;Landfill Dump;Waste Gas Recovery: Internal Combustion Device

- Petroleum refinery enforcement settlements - For the facilities identified by USEPA located in New Jersey and Pennsylvania we applied post-2007 estimated reductions for NO_x, PM10, PM2.5, and SO_2 to affected units.

5.2 RECENT CONTROL TECHNIQUE GUIDELINES

Control Techniques Guidelines (CTGs) are documents issued by USEPA to provide states with the USEPA's recommendation on how to control the emissions of VOC from a specific type of product or source category in an ozone nonattainment area. USEPA issued new or updated CTGs for 13 VOC categories in 3 groups during 2006, 2007 and 2008 (USEPA 2008b). The categories are:

- 2006 CTGs
  - Flat Wood Paneling Coatings
  - Industrial Cleaning Solvents
  - Flexible Package Printing
  - Lithographic Printing
  - Letterpress Printing
- 2007 CTGs
  - Large Appliance Surface Coating
  - Metal Furniture Coatings
  - Paper Film and Foil Coatings
- 2008 CTGs
  - Miscellaneous Metal Parts Coatings
  - Plastic Parts Coatings
  - Auto and Light-duty Truck Assembly Coatings
  - Fiberglass Boat Manufacturing
  - Miscellaneous Industrial Adhesives

States indicated that they expected very little additional reductions from these new or amended CTGs. Therefore, no emission reductions were included in the inventory.

5.3 OTC MODEL RULES FOR NONEGUs

The OTC developed NOx control measures for industrial, commercial, and institutional (ICI) boilers and distributed generation units in 2001 (OTC 2001). We reviewed the OTC's status reports to identify states status in adopting the OTC 2001 model rules (OTC 2009). Most states have adopted the OTC model rules with compliance dates in 2007 or earlier. As a result, we assumed that the emission reductions from the 2001 OTC model rules for nonEGUs are already reflected in the 2007 inventory and no post- 2007 reductions were applied.

In 2006, the OTC introduced model rules (OTC 2007) for one nonEGU VOC source category (adhesives/sealants) and new/more stringent requirements for several NOx source categories (asphalt production plants, cement kilns, glass/fiberglass furnaces, and industrial, commercial, and institutional {ICI} boilers).

These model rules and recommendations provided a consistent framework for air pollution regulation throughout the region. In addition, MANE-VU provided recommendations to require low sulfur home heating, distillate and residul fuel oil. Exhibit 5-2 briefly describes the OTC and MANE-VU control measures affecting point sources that have been recommended for adoption by the states in the OTR. Recommendations for EGUs are not addressed in this section since the projection of EGU emissions is being accomplished by ERTAC under a separate agreement.

Individual states are in various stages of adopting the OTC recommendations into the rules and SIPs. We reviewed the OTC's status reports to identify each state's adoption status (OTC 2009, OTC 2011a, OTC2011b). To obtain further clarification, states were polled to determine whether they have adopted a rule that would achieve reductions equivalent to the OTC model rule or recommendation and whether credit for each rule was already accounted for in the 2007 inventory.

Not all states have adopted all rules. In order to evaluate the impact of both the rules currently in place as well as the potential adoption of all control measures by all states, the state Air Directors specified that two emission control scenarios should be developed.

- Existing Controls - this scenario represents the best estimates for the future year, accounting for all in-place controls that are fully adopted into federal or individual state regulations or SIPs.
- Potential New OTC Controls – this scenario accounts for all of the emission reductions from the existing control scenario plus new state or regional measures that are under consideration by the OTC or individual states. This is a "what if" scenario that assumes that all states in the MANE-VU+VA region except Virginia will adopt all new OTC control measures under consideration by 2017. It does not include any potential new <u>federal</u> control measures that are under consideration.

The following paragraphs describe the control factors applied for each control measure by state and future year.

Exhibit 5.2 Summary of Point Source OTC Control Measures

Source Category	Pollutants	Description
EGUs	NOx	OTC 2001. Provided emission standards for stationary combustion turbines, emergency generators, and load shaving units. OTC 2009/2010. Recommended NOx emission rate limits for oil and gas boilers serving EGUs and emission rate limits for high energy demand day combustion turbines.
Asphalt Production Plants	NOx	OTC 2006. Provided emission rate limits and recommended a 35% reduction in NOx emissions.
Cement Kilns	NOx	OTC 2006. Provided emission rate limits and recommended a 60% reduction in NOx emissions.
Glass Furnaces	NOx	OTC 2006. Provided emission rate limits and recommended a 85% reduction in NOx emissions.
ICI Boiler Controls	NOx	OTC 2001. Recommended NOx emission rate limits for industrial boilers greater than 5 mmBtu/hour OTC 2006. Recommended lower NOx emission rate limits for industrial, commercial, and institutional boilers OTC 2010. Recommended national NOx controls for ICI boilers
Low Sulfur Fuel Oil	SO2	MANE-VU 2006. Recommends sulfur content limits for home heating oil, distillate oil, and residual oil
Adhesives and Sealants	VOC	OTC 2006. Provided VOC content limits and other restrictions on adhesives used in industrial and commercial settings.
Large Petroleum Storage Tanks	VOC	OTC 2009/2010. Addresses high vapor pressure VOCs, such as gasoline and crude oil, stored in large aboveground stationary storage tanks, which are typically located at refineries, terminals and pipeline breakout stations.

5.3.1 OTC 2006 Model Rule for Adhesives and Sealants

The 2006 OTC model rule is intended to achieve VOC emission reductions from adhesive application sources. The OTC 2006 model rule for adhesives and sealants is based on the reasonably available control technology (RACT) and best available retrofit control technology (BARCT) determination by the California Air Resources Board (CARB) developed in 1998. The emission reduction benefit estimation methodology is based on information developed and used by CARB for their RACT/BARCT determination in 1998. The vast majority of the emissions regulated by this rule are in the area source inventory.

For point sources, we first identified those sources applying adhesives and sealants (using the SCC of 4-02-007-xx, adhesives application). Next, we reviewed the 2007 inventory to determine whether these sources had existing capture and control systems. Most of the sources did not have control information in the NIF database. However, several sources reported capture and destruction efficiencies in the 70 to 99 percent range, with a few sources reporting capture and destruction efficiencies of 99+ percent. Sources with existing control systems that exceeded an 85 percent overall capture and destruction efficiency would comply with the OTC 2006 model rule provision for add-on air pollution control equipment; therefore, no additional reductions were calculated for these sources. For point sources without add-on control equipment, we used a 64.4 percent reduction based on the CARB determination.

States were polled to determine whether they have adopted a rule that would achieve reductions equivalent to the 2006 OTC model rule and whether the estimated reduction in VOC emissions should be applied in 2017 and 2020. New Hampshire indicated that they have no existing rule in place and no reductions should be applied. Virginia indicated that reductions from existing rules only apply in three regions:

- Northern Virginia (Arlington, Alexandria, Manassas, Manassas Park, Prince William, Loudon, Fairfax, Fairfax City, Falls Church, and Stafford),
- Fredericksburg (Fredericksburg and Spotsylvania), and
- Richmond (Charles City, Colonial Heights, Chesterfield, Hopewell, Hanover, Petersburg, Henrico, City of Richmond, and Prince George).

All other states have existing rules in place that will require VOC reductions before 2017. Exhibit 5.3 shows the reduction that were applied by state under both the existing controls inventory and the “what if” inventory.

Exhibit 5.3 State Recommendations for OTC Adhesives/Sealants Rule

State	Is Rule Accounted for in 2007 Inventory*	Incremental VOC Reduction to Apply:			
		2017 Existing Controls	2017 Potential Controls	2020 Existing Controls	2020 Potential Controls
CT	No	64.4	0	64.4	0
DE	No	64.4	0	64.4	0
DC	n/a	n/a	n/a	n/a	n/a
ME	No	64.4	0	64.4	0
MD	No	64.4	0	64.4	0
MA	No	64.4	0	64.4	0
NH	No	0	64.40	0	64.4
NJ	No	64.4	0	64.4	0
NY	No	64.4	0	64.4	0
PA	No	64.4	0	64.4	0
RI	No	64.4	0	64.4	0
VT	n/a	n/a	n/a	n/a	n/a
VA-NVA	No	64.4	0	64.4	0
VA-FRD	No	64.4	0	64.4	0
VA-RCH	No	64.4	0	64.4	0
VA-Other	No	0	0	0	0

* Some sources in the 2007 inventory had VOC controls greater than 85% and already complied with the requirements; no incremental reduction was taken for these sources (see text)
n/a - no affected point sources identified in the inventory

5.3.2 OTC 2009/2010 Model Rule for Large Storage Tanks

The OTC model rule addresses high vapor pressure VOCs, such as gasoline and crude oil, stored in large aboveground stationary storage tanks, which are typically located at refineries, terminals and pipeline breakout stations. The OTC model rule is based on recent revisions to New Jersey's VOC storage tank rules located at N.J.A.C. 7:27-16.2. The OTC model rules requires: 1) retrofiting floating roof tanks to reduce emissions from deck fittings; 2) retrofitting external floating roof tanks with domes; 3) controlling roof landing losses; and 4) adding controls for degassing and interior tank cleaning. New Jersey estimated reductions for tanks located in New Jersey would total approximately 2,000 tons per year by 2020. In making these estimates, New Jersey developed the following VOC percent reduction estimates for the following categories of storage tanks:

Tank Location	Point Source SCC	VOC Percent Reduction	
		2017	2020
Refinery	4-03-011-xx (floating roof tank SCCs, gasoline or crude oil only)	82	85
Bulk Terminal	4-04-001-xx (floating roof tank SCCs)	40	50
Bulk Plant and Pipeline Breakout Station	4-04-002-xx (floating roof tank SCCs gasoline or crude oil only)	52	65

Only New Jersey has existing rules in place, and the above percent reductions were applied to the existing controls inventory.

For all other states with affected sources, the potential reductions from the OTC rule were applied in the "what if" inventory.

5.3.3 OTC 2006 Model Rule for Asphalt Production Plants

The OTC recommended that member states pursue state-specific rulemakings or other implementation methods that would achieve a 35 percent reduction in NOx emissions. States were polled to determine whether they have adopted a rule that would achieve reductions equivalent to the 2006 OTC model rule and whether the estimated reduction in NOx emissions should be applied in 2017 and 2020. Only Maine, New Jersey and New York indicated that the reductions should be applied. A 35 percent reduction in NOx emissions for fuel burning SCCs in the 3-05-002-xx series was applied to the existing controls inventory for Maine, New Jersey, and New York.

All other states indicated that the NOx reductions should not be applied in the existing controls inventory. The 35 percent reduction for other states was applied in the "what if" inventory.

5.3.4 OTC 2006 Model Rule for Cement Manufacturing Plants

Cement kilns are located in Maine, Maryland, New York, Pennsylvania, and Virginia. The OTC recommended state-specific rulemakings or other implementation methods that would result in about a 60 percent reduction in uncontrolled levels NOx emissions or meet the following emission limits based on kiln type:

- Wet: 3.88 lb/ton clinker
- Long Dry: 3.44 lb/ton clinker
- Preheater: 2.36 lb/ton clinker
- Precalciner: 1.52 lb/ton clinker

Cement kilns are already subject to NOx controls as part of Phase I of the NO_x SIP call or state-specific RACT requriements. The emission reductions resulting from the NOx SIP call or RACT requirements are already accounted for in the 2007 inventory.

The following methods were used to calculate the additional reductions from the OTC 2006 Control Measure in each state:

- Maine has a single kiln that was converted from an existing wet process cement kiln to a dry process (preheater/precalciner type) kiln and underwent a BACT review around 2005. The permitted emission rate is 1,533 tons per year with an annual capacity of 766,500 tons of clinker (e.g., about 4 lbs/ton of clinker). Maine does not plan on any additional controls, so no incremental reductions were applied for the either the existing controls or "what if" inventory.

- Maryland indicated controls will become effective in 2011 for the two facilities in the state. Maryland specified a 25 percent reduction for the Holcim facility and a 40 percent reduction for the Lehigh facility for the existing controls inventory. No reductions were specified for the two kilns at the Essroc facility for the existing controls inventory. No additional reductions were specified for any cement kiln for the "what if" inventory.

- New York three cement plants: Each has a different RACT requirement effective 7/1/2012. The three limits are; 6.59 lb/ton, 2.88 lb/ton and 1.5 lb/tom (30 day rolling average). For this inventory, we have assumed that these post-2007 RACT requirements have an incremental control efficiency of 40 percent and we have applied this reduction in the existing controls inventory. No additional reductions were specified for any cement kiln for the "what if" inventory.

- Pennsylvania provided kiln-specific projected future year NOx emissions for 2017 and 2020 based on existing post-2007 state requirements. A kiln-specific control factor was calculated based on the ratio of the future year emissions to the 2007 emissions and was applied for the existing controls inventory. No additional reductions were specified for any cement kiln for the "what if" inventory.

- Virginia has a single preheater/precalciner kiln that is not located in the OTR. Virginia does not plan on any additional controls since the facility is not in the OTR, so no incremental reductions were applied for the either the existing controls or "what if " inventories.

5.3.5 OTC 2006 Model Rule for Glass and Fiberglass Furnaces

The OTC recommended state-specific rulemakings or other implementation methods to achieve an approximately 85 percent reduction in NOx emissions from uncontrolled levels. Emission reductions for glass and fiberglass furnaces were calculated using the methodology previously developed and documented in the OTC report (OTC 2007). Glass and fiberglass furnaces are located in Maryland, Massachusetts, New Jersey, New York, Pennsylvania, and Virginia. The following methods were used to calculate the additional reductions from the OTC 2006 Control Measure in each state:

- Maryland indicated that a 48 percent reduction should be applied to the single glass manufacturing facility in Maryland.
- Massachusetts indicated that they have a single facility with two furnaces furnaces; one furnace installing oxy-firing at 1.3 lb NOx per ton of glass, and the other at 5.3 lb/ton. The facility will be complying with EPA NSR enforcement Consent Decree by 2017. Massachusetts indicated that plant-wide emissions are expected to decrease by 35 percent in 2017 and 2020.
- New Jersey indicated that a 50 percent reduction in NOx emissions should be applied to glass and fiberglass furnaces in 2013, 2017, 2020 and 2025.
- New York did not provide guidance regarding glass and fiberglass furnaces. We used the percent reductions developed and documented in the previous round of emission projections developed for MARAMA (MARAMA 2007). An incremental control efficiency of 70 percent was used for New York glass and fiberglass furnaces in that inventory.
- Virginia indicated that they have no plans to implement the OTC measure, and no NOx reductions were applied to glass/fiberglass furnaces in Virginia.

All of the above reductions for glass and fiberglass furnaces were accounted for in the existing controls inventory. No additional reductions were specified for any glass or fiberglass furnace for the “what if” inventory.

5.3.6 OTC 2006 Model Rule for ICI Boilers

In Resolution 06-02, the OTC recommended that OTC member states pursue as necessary and appropriate state-specific rulemakings or other implementation methods to establish emission reduction percentages, emission rates or technologies for ICI boilers based on guidelines that varied by boiler size and fuel type..

States were polled to determine whether they have adopted a rule that would achieve reductions equivalent to the 2006 OTC recommendations and whether the estimated reduction in NOx emissions should be applied in 2017 and 2020. Most states have not adopted rules equivalent to the 2006 OTC recommendations. These states indicated that they will likely to depend on USEPA national rule for possible inclusion in the BOTW inventory. Specifically, the OTC Resolution 10-01 (June, 2010) called on USEPA for national regulations for ICI boilers.

Three states specified that that have adopted post-2007 ICI boiler rules to reduce NOx emissions. The percent reductions for ICI boilers were for these states were calculated as describe in the following paragraphs.

New Jersey provided NOx percent reductions that varied by heat input rate and fuel/boiler type and included an 80 percent rule effectiveness adjustment, as shown in Exhibit 5.4. The NIF file submitted by New Jersey for this project did not include the boiler design capacity. This data gap was filled using the boiler design capacities previously developed for the OTC study in 2006, if available; otherwise the SCC description was used to assign a default boiler design capacity. No additional reductions were specified for the "what if" inventory for New Jersey.

Exhibit 5.4 NonEGU Point Source Emission Reductions from New Jersey ICI Boiler NOx Rules

Heat Input Rate (mmBtu/hr)	Fuel/Boiler Type	Overall % Reduction 2007-2017
at least 5 but < 10	All	20%
at least 10 but < 20	All	20%
at least 25 but < 50	Natural gas only	40%
	No. 2 Fuel oil only	40%
	Refinery fuel gas and other gaseous fuels	40%
	Other liquid fuels	40%
	Duel Fuel using fuel oil and/or natural gas	40%
at least 50 but < 100	Natural gas only	40%
	No. 2 Fuel oil only	27%
	Other liquid fuels	27%
	Duel Fuel using fuel oil and/or natural gas	40%
at least 100 or greater	No. 2 Fuel oil only	40%

New York specified that a 50 percent reduction should be applied in the existing controls inventory for all boilers with greater than 25 mmBtu/hour design capacity. The NIF file submitted by New York for this project did not include the boiler design capacity. This data gap was filled using the boiler design capacities previously developed for the OTC study in 2006, if available; otherwise the SCC description was used to assign a default boiler design capacity. No additional reductions were specified for the "what if" inventory for New York.

New Hampshire specified that reductions should be applied to boilers in the 50-100 and 100-250 mmBtu/hour size ranges. We used the methodology previously developed and documented in the OTC report (OTC 2007). Reductions vary by size range and fuel type. State-by-state emission reduction percentages were developed by comparing the state emission limit in lbs/mmBTU to the OTC 2006 recommended limit. There are no coal-fired ICI boilers in New Hampshire. For other fossil fuels used in New Hampshire, the NOx percent reduction was as follows:

- Natural gas, 50-100 mmBtu/hr: 50% reduction
- Natural gas, 100-250 mmBtu/hr: 0% reduction
- Residual/distillate oil, 50-100 mmBtu/hr: 33.3% reduction
- Residual/distillate oil, 100-250 mmBtu/hr: 33.3% reduction

No additional reductions were specified for the "what if" inventory for New Hampshire.

All other states do not have existing rules that would result in post-2007 emission reductions. These states indicated that they will likely to depend on USEPA national rule for possible inclusion in the BOTW inventory. Specifically, the OTC Resolution 10-01 (June, 2010) called on USEPA for national regulations for ICI boilers. However, in order to estimate the potential NOx emission reductions for the "what if" control scenario, the guidelines from OTC Resolution 06-02 shown in Exhibit 5.5 were used to estimate potential NOx reductions in the "what if" inventory for those states without existing rules, except Virginia.

Exhibit 5.5 OTC Resolution 06-02 Guidelines for ICI Boiler NOx Rules

Boiler Size (mmBtu/hr)	NOx Percent Reduction from Base Emissions by Fuel Type			
	Natural Gas	#2 Fuel Oil	#4/#6 Fuel Oil	Coal
<25	10	10	10	10
25 to 50	50	50	50	50*
50 to 100	10	10	10	10*
100 to 250	76	40	40	40*

>250	**	**	**	**

* Resolution 06-02 did not specify a percent reduction for coal; for modeling purposes, the same percent reduction specified for #4/#6 fuel oil was used for coal.

** Resolution 06-02 specified the reduction for > 250mmBtu/hour boilers to be the "same as EGUs of similar size." The OTC Commissioners have not yet recommended an emission rate or percent reduction for EGUs. As a result, no reductions for ICI boilers > 250 mmBtu/hour were included in the potential controls inventory.

Since the above guidelines vary by boiler size and fuel type, the specific percent reduction applied to an individual source depends on the SCC and design capacity of the source. The SCC identifies the fuel type, while the design capacity identifies the boiler size. In many cases, the design capacities in the MANE-VU NIF database were missing. The following hierarchy was used in filling in gaps where design capacities were missing:

- Use the design capacity field from the NIF EU table, if available;
- Use the design capacities provided by agencies to fill in the data gaps in the MANE-VU 2002 inventory;
- Use design capacity as reported either the Unit Description field in the NIF EU table or the Process Description field from the NIF EP table, if available;
- Use design capacity from the source's Title V permit, if the Title V permit was online;
- Use the SCC description to determine the design capacity (for example, SCC 1-02-006-01 describes a >100 mmBtu/hr natural gas-fired boiler, SCC 1-02-006-02 describes a 10-100 mmBtu/hr natural gas-fired boiler).

After performing this gap-filling exercise, each boiler was assigned to one of the size ranges and fuel types shown in the above table. The emission reduction percentages by boiler size range and fuel type were then applied.

5.4 FUEL OIL SULFUR LIMITS

MANE-VU developed a low sulfur fuel oil strategy to help states develop Regional Haze SIPs (MANE-VU 2007). As previously discussed in Section 4.5, Each state was polled and asked to indicate when, if at all, the MANE-VU strategy would be incorporated into their state rules. States were also asked to provide the 2007 sulfur contents for each fuel type by county in order to calculate the percent reduction in emissions for the future years. Three states (MD, NJ, and NY) have adopted or are committed to adopting the strategy into their rules. The reductions for these three states were accounted for in the "existing controls" inventory. All other jurisdictions indicated that not enough regulatory development progress has been made to include the reductions in future years with absolute certainty. The potential reductions for these states were accounted for in the "potential new controls" inventory. One state (VA) has no plans to adopt the low sulfur fuel oil strategy. The percent reductions by fuel type and county are contained in Appendix K.

5.5 STATE-SPECIFIC NONEGU CONTROL FACTORS

The following state-specific nonEGU control factors were provided:

- **Bellefield Boiler Plant, Allegheny County.** Allegheny County indicated that this facility changed their fuel source from coal to natural gas in July 2009 and future year emissions were changed to reflect the fuel switch.
- **USS Clairton Works**, **Allegheny County.** The facility will remove Batteries 7-9 and have Battery C operational by 2013, resulting in a change in PM emissions in 2013. Also, USS Clairton Works will remove Batteries 1-3 and have Battery D operational in 2015, resulting in a change in PM emissions in 2017 and 2020.
- **Chrysler, Delaware.** The Chrysler facility (ID 1000300128) shut down in 2009. Delaware specified that only a 25 percent reduction should be taken for all pollutants since some emissions will be banked for future use by other sources.
- **O S G Ship Management (ID 1000500093), Delaware.** Delaware provided source-specific growth factors and percent reductions in VOC emissions for 2017 and 2020 from the lightering operations at O S G Ship Management (ID 1000500093).
- **Control Technology Guidance (CTG) Documents, Delaware.** Delaware determined that VOC emission reductions from new CTG recommendations would be very small. Although the new CTGs set up new recommendations for higher control efficiencies, the actual VOC reductions would be minimum, if not none, because most DE's existing facilities are not affected by the new requirements and emissions from those facilities are relatively small (based on 2002 inventory).
- **Unit Shutdowns, Delaware.** Delaware identified several emission units that have shut down at the following facilities: Dow Reichhold Specialty Latex (ID 1000100016), SPI Poly-Ols (ID 1000300426), and Invistas (ID 1000500002). Emissions for all pollutants were set to zero for these units.

- **Dover Air Force Base, Delaware.** Delaware identified four boilers at Dover Air Force Base (ID 1000100001) that ceased using fuel oil in March 2010. SO2 emissions for these boilers were set to zero.
- **Premcor Refinery NOx Plantwide Cap, Delaware.** The refinery was sold to the Delaware City Refining Company and an agreement was reached with DNREC's Secretary that allows plant-wide applicability limit (cap) for NOx. To project emissions, as well as for modeling purposes, Delaware decided to spread out the NOx-cap to each stack. Delaware estimated a plantwide reduction of 10.05 percent in 2013 and 41.22 percent in both 2017 and 2020.
- **Wausau Paper Specialty Products, Maine.** The Wausau Paper Specialty Products facility (ID 2300700007) closed in 2009. All emissions were set to zero for this facility in the 2017 and 2020 projection inventories.
- **2009 NJ Rule for NOx for Municipal Solid Waste Incinerators, New Jersey.** This rule will achieve a 27 percent reduction from one facility - Camden County Energy Recovery Associates, L.P. (ID 3400751614).
- **NJ rule for VOC Storage Tanks, New Jersey.** New Jersey provided expected VOC emission reductions resulting from post-2007 rules for VOC storage tanks. For refinery floating roof storage tanks (SCC 4-03-011-xx), the reductions are 75 percent for 2013, 82 percent for 2017, and 85 percent for 2020. For bulk terminal tanks (SCC 4-04-001-xx), the reductions are 20 percent for 2013, 40 percent for 2017, and 50 percent for 2020. For pipeline breakout stations (SCCs 4-04-002-xx and 4-06-005-xx), the reductions are 26 percent for 2013, 52 percent for 2017, and 65 percent for 2020.
- **International Paper – Franklin Mill, Virginia.** The International Paper – Franklin Mill (ID 5109300006) closed effective 2010. All emissions were set to zero for this facility in the 2017 and 2020 projection inventories.

6.0 NONROAD MODEL CATEGORIES

The USEPA's NONROAD model estimates emissions from equipment such as recreational marine vessels, recreational land-based vehicles, farm and construction machinery, lawn and garden equipment, aircraft ground support equipment (GSE) and rail maintenance equipment. This equipment is powered by diesel, gasoline, compressed natural gas (CNG) or liquefied petroleum gas (LPG) engines.

The National Mobile Inventory Model (NMIM) was developed by USEPA to develop county-level emission estimates for certain types of nonroad equipment. NMIM uses the current version the NONROAD model to develop emission estimates and was used to develop the projection inventories discussed here. The NMIM national county database contains monthly input data to reflect county specific fuel parameters and temperatures. Most of the work associated with executing NMIM involved updating the NMIM county database with State-specific information. For this analysis, we used the NMIM2008 software (version NMIM20090504), the National County Database (version NCD20090531), and NONROAD2008a (July 2009 version) as a starting point. Changes were made to the NCD20090531 based on review of data by the States. The purpose of this review was to create a new NCD specific to the 2007 base year model runs and the three projection year model runs. Changes were made to a copy of the NCD20090531 to create a new NCD used for the emission inventory runs. That NCD is called NCD20090910MARAMA.

6.1 STATE REVIEW OF NMIM FUEL CHARACTERISTICS

For the 2017 and 2020 projection year inventories, AMEC provided data on fuel characteristics from the NCD20090531 to the States to determine if they had additional changes required for the fuel characteristics for future year inventories. None of the States had changes to the fuel characteristics, except for CT which provided revisions to the six fuels that they had provided for the 2007 base year inventory to account for a number of changes including changes to RVP and fuel sulfur.

Connecticut provided updated values for the volume and market share components for ethanol which is used by NMIM to determine the oxygen percentage for NONROAD runs. Complete data replacement records were obtained for CT for the following tables: gasoline inputs, diesel inputs, countymonthyear inputs, and datasource inputs. CT added six new fuels which were given NRGasolineIds of 5000-5005 inclusive. Data was provided for both the base year (2007) and projection years (2013, 2017, and 2020).

The diesel fuel sulfur values for the projection years were maintained at their default values for all other States since they matched the USEPA recommended values.

6.2 USE OF EXTERNAL FILES IN THE PROJECTION YEAR NMIM RUNS

For the 2007 base year inventory (MARAMA 2012), revisions were made to the allocation files for several categories. These files are used to allocate emissions calculated at the state level down to the county level and to add entries to the countynrfile NCD table. States were asked if they would like to revise this table for future years. No revisions were recommended. Thus external files used for the 2007 base year runs were used in the runs for the projection years.

6.3 NMIM RUN SPECIFICATIONS

The specifications for each NMIM run were developed for groups of States within the MANE-VU+VA region. All States except for CT, NY, NJ and PA were run together for each year. CT was run alone for 2007, 2017, and 2020 because changes were requested for the base year. NY, NJ and PA were run together for each individual projection year. The settings for each specification panel within the NMIM model for the projection year runs are detailed below.

- Description: A short descriptive term for the run was entered for each specific run.
- Geography: The "county" option was selected for each run. All counties within the State were selected.
- Time: Every month in the Months check box area was selected. On the time panel, the year (2017 or 2020) was selected in the drop down box and added to the year selections area. With the exception of the CT, all runs were performed for only one year. The Use Yearly Weather Data check box was selected; however, year specific data was not available within NMIM for the projection years. The only years included within the NMIM model for NCD20090531 are 1999-2008 inclusive. If the specific year requested is not available, then NMIM uses 20 year average data for the estimates. Thus while the Use Yearly Weather Data box was checked, since the specific year was not there (except for the CT 2007 base year re-run), the 20 year average data in the countymonthhour table are used. However, because the meteorology data for future years will be assumed to be the same as was used for 2007, AMEC revised the AverageTemp and AverageRelHumidity values in the countymonthhour table of the NCD20090910MARAMA to reflect actual 2007 values. Thus the values in that table are 2007 values not 20 year average values and thus causes the NMIM model to run with the same data used for the 2007 base year runs.
- Vehicles/Equipment: Only the nonroad vehicle/equipment area was selected. All fuels and all vehicle types were selected for each State run. Aircraft ground support

equipment was included in the run specifications but those records were removed during post-processing steps.

- Fleet: No selections or information was entered in this panel.
- Pollutants: Exhaust PM10, PM2.5, and Criteria pollutants (with HC reported as VOC) were selected except for CO_2.
- Advanced features: Only the server and database were selected in this panel.
- Output: Under the Geographic Representation panel the County selection was made. In the General Output area, a new database was selected on the server for the output.

All added external files for use in each State run were placed in the externalfiles directory of the NCD. Entries for all external files included were included in the countynrfiles table of the NCD.

6.4 REMOVAL OF AIRPORT GROUND SUPPORT EQUIPMENT

The NMIM/NONROAD model calculates emissions from airport ground support equipment. As discussed in Section 7 of this TSD, emissions from airport ground support equipment is also included in USEPA's aircraft inventory prepared using the Federal Aviation Administration's Emissions and Dispersion Modeling System (EDMS). Correspondence with USEPA indicated that USEPA considers the emissions calculated by EDMS to be better than those calculated by NONROAD. For this reason, all emissions calculated by NMIM/NONROAD for airport ground support equipment were removed from the inventory to avoid double counting.

6.5 STATE AND STAKEHOLDER REVIEW AND COMMENT

New York state provided the results of their own NONROAD model runs for 2017 and 2020. These model results were provided by month and were used instead of the NMIM model runs made by MACTEC.

6.6 CHANGES MADE FOR VERSION 3 MODEL RUNS

Two sectors of the inventory were updated in version 3. First, Virginia and New York requested that their emissions be recalculated using the information developed through Version 2 of the inventory for the MARAMA States. The Virginia reruns were performed for all categories except for ground support equipment and for recreational marine vessels. Recreational marine vessel emissions for Virginia were calculated along with those for other states (see below). Those values replaced the SEMAP supplied values used in versions prior to Version 3. In addition, estimates for all sectors of the inventory for New York other than ground support equipment and recreational marine vessels were calculated using NMIM default data for the MARAMA area. New York had originally provided data from NONROAD model runs that they performed separately. For Version 3 of the inventory, New York emissions were calculated using NMIM runs set up using the same criteria as those for other states in earlier versions of the inventory. Both New York and Virginia were provided with the opportunity to review fuel characteristics prior to their runs. Only Virginia made changes to the fuels, however the only changes that were made were to assign alternative default fuels to counties. The fuel characteristics were not modified from the NMIM defaults, only the fuel IDs associated with a particular county/month combination were changed to another default fuel. Those changes were instituted in the NCD developed specifically for MARAMA. New York did not request any changes to the default values. In addition, the revisions made to the housing population allocation files were instituted for both states.

The second change in version 3 was to modify the recreational marine vessel populations for all states except Vermont and Maine. A revised population file was prepared for Virginia but not utilized in the version 3 runs. Estimates for Virginia, Vermont and Maine were prepared using the growth algorithm built into the NMIM/NONROAD model. For all other states, revised population data was estimated for the years 2017 and 2020. EPA had recommended that rather than use the default growth algorithm of the model for those states that had their 2007 base year data updated for this category, separate population estimates for each projection year should be prepared and included in the population files. The 2007 population data was provided by the National Marine Manufacturers Association (NMMA). Total state populations for each of the three major categories contained in the NONROAD model (outboard, inboard/sterndrive and personal watercraft) were provided for each state. Because the population files used by the NONROAD model (and thus NMIM) were configured with population values for various horsepower categories, AMEC (formerly AMEC) determined the fraction of the total for each marine vessel type in each horsepower category from the NONROAD default population files. These fractions were then used to allocate the total state population obtained from NMMA to the various horsepower categories.

The only exception to this was that some states added in data for sailboats. The sailboat populations were split among two of the default categories. In addition, New Hampshire provided their own revised population file. Their population data for New Hampshire was provided by the New Hampshire DMV and is not from NMMA.

AMEC then used the national growth factors supplied in the default NMIM/NONROAD model to estimate populations for each year. Each horsepower/population category in the 2007 population file was grown to either 2017 or 2020 using the ratio between the 2005 and 2015 growth factors (to represent growth between 2007 and 2017) and between the 2005 and 2025 growth factors (to represent growth between 2007 and 2020). Those ratios were used to grow the 2007 population to 2017 and 2020 respectively. The only exception to this was Pennsylvania. Pennsylvania presented data indicating that there was little growth expected during the time periods that were considered and thus maintained the 2007 population estimates for both 2017 and 2020.

Pennsylvania presented information showing from historical data that indicated a downward trend in the overall motorized pleasure craft population in 6 of the last 9 years. The data also indicated that the population was essentially unchanged in the last three years due to an adverse economic environment. Populations of all motorized pleasure craft in Pennsylvania as tracked by the Pennsylvania Fish and Boat Commission showed nearly a 6 percent decline from 2001 to 2007 or an average annual decline of 1.0 percent over that period. Pleasure craft populations remained nearly unchanged from 2008 to 2010.

As a consequence, they forecaste zero percent growth for pleasure craft is from 2007 to 2017 and 2007 to 2020. The types of pleasure craft affected by this growth rate are:

- 2282005010, 2-stroke outboard,
- 2282005015, 2-stroke personal water craft,
- 2282010005, 4-stroke inboard/sterndrive,
- 2282020005, diesel inboard/sterndrive, and
- 2282020010, diesel outboards

6.7 NMIM/NONROAD GROWTH AND CONTROL INFORMATION

In estimating future year emissions, the NMIM/NONROAD model includes growth and scrappage rates for equipment in addition to a variety of control programs. It is not possible separate out the future year emissions due to “growth only” or “control only” in a single run. That is, the model run provides a single future year estimate that is a “growth and control” scenario.

The growth data used in the NMIM/NONROAD model is documented in a USEPA report (USEPA 2004c). The GROWTH packet of the NONROAD model cross-references each SCC to a growth indicator code. The indicator code is an arbitrary code that identifies an actual predicted value such as human population or employment that is used to estimate the future year equipment population. The GROWTH packet also defines the scrappage curves used to estimate the future year model year distribution.

The NMIM/NONROAD model also accounts for all USEPA emission standards for nonroad equipment. There are mulitiple standards that vary by equipment type, rated power, model year, and pollutatant. Exhibit 6.1 is a summary of the emission control programs accounted for in the NMIM/NONROAD model. A complete summary of the nonroad equipment emission standards can be found on the USEPA nonroad emission standards reference guide website (USEPA 2011).

Exhibit 6.1 Control Programs Included in the NMIM/NONROAD Model

Regulation	Description
Control of Air Pollution; Determination of Significance for Nonroad Sources and Emission Standards for New Nonroad Compression Ignition Engines At or Above 37 Kilowatts 59 FR 31036 June 17, 1994	This rule establishes Tier 1 exhaust emission standards for HC, NOx, CO, and PM for nonroad compression-ignition (CI) engines ≥37kW (≥50hp). Marine engines are not included in this rule. The start dates and pollutants affected vary by hp category as follows: 50-100 hp: Tier 1,1998; NOx only 100-175 hp: Tier 1, 1997; NOx only 175-750 hp: Tier 1, 1996; HC, CO, NOx, PM >750 hp: Tier 1, 2000; HC, CO, NOx, PM
Emissions for New Nonroad Spark-Ignition Engines At or Below 19 Kilowatts; Final Rule 60 FR 34581 July 3, 1995	This rule establishes Phase 1 exhaust emission standards for HC, NOx, and CO for nonroad spark-ignition engines ≤19kW (≤25hp). This rule includes both handheld (HH) and nonhandheld (NHH) engines. The Phase 1 standards become effective in 1997 for : Class I NHH engines (<225cc), Class II NHH engines (≥225cc), Class III HH engines (<20cc), and Class IV HH engines (≥20cc and <50cc). The Phase 1 standards become effective in 1998 for: Class V HH engines (≥50cc)
Final Rule for New Gasoline Spark-Ignition Marine Engines; Exemptions for New Nonroad Compression-Ignition Engines at or Above 37 Kilowatts and New Nonroad Spark-Ignition Engines at or Below 19 Kilowatts 61 FR 52088 October 4, 1996	This rule establishes exhaust emission standards for HC+NOx for personal watercraft and outboard (PWC/OB) marine SI engines. The standards are phased in from 1998-2006.
Control of Emissions of Air Pollution From Nonroad Diesel Engines 63 FR 56967 October 23, 1998	This final rule sets Tier 1 standards for engines under 50 hp, phasing in from 1999 to 2000. It also phases in more stringent Tier 2 standards for all engine sizes from 2001 to 2006, and yet more stringent Tier 3 standards for engines rated over 50 hp from 2006 to 2008. The Tier 2 standards apply to NMHC+NOx, CO, and PM, whereas the Tier 3 standards apply to NMHC+NOx and CO. The start dates by hp category and tier are as follows:

Regulation	Description
	hp<25: Tier 1,2000; Tier 2, 2005; no Tier 3 25-50 hp: Tier 1, 1999; Tier 2, 2004; no Tier 3 50-100 hp: Tier 2, 2004; Tier 3, 2008 100-175 hp: Tier 2, 2003; Tier 3, 2007 175-300 hp: Tier 2, 2003; Tier 3, 2006 300-600 hp: Tier 2, 2001, Tier 3, 2006 600-750 hp: Tier 2, 2002; Tier 3, 2006 >750 hp: Tier 2, 2006, no Tier 3 This rule does not apply to marine diesel engines above 50 hp.
Phase 2: Emission Standards for New Nonroad Nonhandheld Spark Ignition Engines At or Below 19 Kilowatts 64 FR 15207 March 30, 1999	This rule establishes Phase 2 exhaust emission standards for HC+NOx for nonroad nonhandheld (NHH) spark-ignition engines ≤19kW (≤25hp). The Phase 2 standards for Class I NHH engines (<225cc) become effective on August 1, 2007 (or August 1, 2003 for any engine initially produced on or after that date). The Phase 2 standards for Class II NHH engines (≥225cc) are phased in from 2001-2005.
Phase 2: Emission Standards for New Nonroad Spark-Ignition Handheld Engines At or Below 19 Kilowatts and Minor Amendments to Emission Requirements Applicable to Small Spark-Ignition Engines and Marine Spark-Ignition Engines; Final Rule 65 FR 24268 April 25, 2000	This rule establishes Phase 2 exhaust emission standards for HC+NOx for nonroad handheld (HH) spark-ignition engines ≤19kW (≤25hp). The Phase 2 standards are phased in from 2002-2005 for Class III and Class IV engines and are phased in from 2004-2007 for Class V engines.
Control of Emissions From Nonroad Large Spark-Ignition Engines and Recreational Engines (Marine and Land-Based); Final Rule 67 FR 68241 November 8, 2002	This rule establishes exhaust and evaporative standards for several nonroad categories: 1) Two tiers of emission standards are established for large spark-ignition engines over 19 kW. Tier 1 includes exhaust standards for HC+NOx and CO and is phased in from 2004-2006. Tier 2 becomes effective in 2007 and includes exhaust standards for HC+NOx and CO as well as evaporative controls affecting fuel line permeation, diurnal emissions and running loss emissions. 2) Exhaust and evaporative emission standards are established for recreational vehicles, which include snowmobiles, off-highway motorcycles, and all-terrain vehicles (ATVs). For snowmobiles, HC and CO exhaust standards are phased-in from 2006-2012. For off-highway motorcycles, HC+NOx and CO exhaust emission standards are phased in from 2006-2007. For ATVs, HC+NOx and CO exhaust emission standards are phased in from 2006-2007. Evaporative emission standards for fuel tank and hose permeation apply to all recreational vehicles beginning in 2008. 3) Exhaust emission standards for HC+NOx, CO, and PM for recreational marine diesel engines over 50 hp begin in 2006-2009, depending on the engine displacement. These are “Tier 2” equivalent standards.

Regulation	**Description**
Control of Emissions of Air Pollution From Nonroad Diesel Engines and Fuel; Final Rule (Clean Air Nonroad Diesel Rule – Tier 4) 69 FR 38958 June 29, 2004	This final rule sets Tier 4 exhaust standards for CI engines covering all hp categories (except marine and locomotives), and also regulates nonroad diesel fuel sulfur content. 1) The Tier 4 start dates and pollutants affected vary by hp and tier as follows: hp<25: 2008, PM only 25-50 hp: Tier 4 transitional, 2008, PM only; Tier 4 final, 2013, NMHC+NOx and PM 50-75 hp: Tier 4 transitional, 2008; PM only; Tier 4 final, 2013, NMHC+NOx and PM 75-175 hp: Tier 4 transitional, 2012, HC, NOx, and PM; Tier 4 final, 2014, HC,NOx,PM 175-750 hp:Tier 4 transitional, 2011, HC, NOx, and PM; Tier 4 final, 2014, HC,NOx,PM >750 hp: Tier 4 transitional, 2011, HC, NOx, and PM; Tier 4 final, 2015, HC,NOx,PM 2) This rule will reduce nonroad diesel fuel sulfur levels in two steps. First, starting in 2007, fuel sulfur levels in nonroad diesel fuel will be limited to a maximum of 500 ppm, the same as for current highway diesel fuel. Second, starting in 2010, fuel sulfur levels in most nonroad diesel fuel will be reduced to 15 ppm.
Control of Emissions From Nonroad Spark-Ignition Engines and Equipment; Final Rule (Bond Rule) 73 FR 59034 October 8, 2008	This rule establishes exhaust and evaporative standards for small SI engines and marine SI engines: 1) Phase 3 HC+NOx exhaust emission standards are established for Class I NHH engines starting in 2012 and for Class II NHH engines starting in 2011. There are no new exhaust emission standards for handheld engines. New evaporative standards are adopted for both handheld and nonhandheld equipment. The new evaporative standards control fuel tank permeation, fuel hose permeation, and diffusion losses. The evaporative standards begin in 2012 for Class I NHH engines and 2011 for Class II NHH engines. For handheld engines, the evaporative standards are phased-in from 2012-2016. 2) More stringent HC+NOx and CO standards are established for marine SI PWC/OB engines beginning in 2010. In addition, new exhaust HC+NOx and CO standards are established for sterndrive and inboard (SD/I) marine SI engines also beginning in 2010. High performance SD/I engines are subject to separate HC+NOx and CO exhaust standards that are phased-in from 2010-2011. New evaporative standards were also adopted for all marine SI engines that control fuel hose permeation, diurnal emissions, and fuel tank permeation emissions. The hose permeation, diurnal, and tank permeation standards take effect in 2009, 2010, and 2011.

Source: USEPA 2010e

7.0 NONROAD MAR SOURCE CATEGORIES

The USEPA's NONROAD model does not estimate emissions for three nonroad source categories: commercial marine vessel, aircraft, and railroad locomotives. The emission projection methodology and data sources for these three categories (collectively referred to as marine, airport, railroad {or MAR}) are discussed in this section. The data used to calculate the growth and control factors for MAR sources are included in Appendix L.

7.1 COMMERCIAL MARINE VESSELS

For the purpose of emission calculations, marine vessel engines are divided into three categories based on displacement (swept volume) per cylinder. Category 1 and Category 2 marine diesel engines typically range in size from about 500 to 8,000 kW (700 to 11,000 hp). These engines are used to provide propulsion power on many kinds of vessels including tugboats, pushboats, supply vessels, fishing vessels, and other commercial vessels in and around ports. They are also used as stand-alone generators for auxiliary electrical power on vessels. Category 3 marine diesel engines typically range in size from 2,500 to 70,000 kW (3,000 to 100,000 hp). These are very large marine diesel engines used for propulsion power on ocean-going vessels such as container ships, oil tankers, bulk carriers, and cruise ships.

The majority of marine vessels are powered by diesel engines that are either fueled with distillate or residual fuel oil blends. For the purpose of emission inventories, USEPA has assumed that Category 3 vessels primarily use residual blends while Category 1 and 2 vessels typically use distillate fuels.

EPA developed national emission inventories for Category 1 and 2 vessels and Category 3 vessels for calendar years 2002 through 2040 as part of its effort to develop emission standards for these vessels. The methodologies used to develop the emission projections (for both a baseline and controlled scenario) are documented in a regulatory impact assessment (USEPA 2008c). We used the USEPA data and methodologies from these RIAs to develop separate growth and control factors for Category 1 and 2 vessels (diesel) and Category 3 vessels (residual).

7.1.1 CMV Diesel Growth Factors

For Category 1 and 2 diesel vessels, USEPA used projection data for domestic shipping from the AEO2006 (EIA 2006). The annual growth rate reported in the RIA is 0.9%. More recent growth data for domestic shipping is available in the AEO2010 (EIA 2010). Since Category 1 and 2 vessels primarily accounts for activity data for ships that carry domestic cargo, we decided to use the recent growth data for domestic shipping available in the AEO2010. We used Table A-7 of the AEO2010 for international shipping to calculate the growth factor for 2007-2013 to be 0.975, for 2007-2017 to be 1.003, and for 2007-2020 to be 1/033. These growth factors were used for for CMV diesel port emissions (SCC 22-80-002-100) and CMV diesel underway emissions (SCC 22-80-002-200).

7.1.2 CMV Diesel Control Factors

In developing their emission projections, USEPA developed two scenarios that accounted for both the 2004 nonroad diesel rule and the 2008 diesel marine vessel rule:

- The USEPA's baseline (pre-control) inventory accounted for:
    1. the 0.9 percent annual growth in fuel use,
    2. the impact of existing engine regulations that took effect in 2008,
    3. the 2004 Clean Air Nonroad Diesel Rule that will decrease the allowable levels of sulfur in fuel beginning in 2012, and
    4. fleet turnover.
- The USEPA's controlled inventory accounted for:
    1. the 0.9 percent annual growth in fuel use;
    2. the reductions included in the baseline inventory, and the reductions from USEPA's 2008 rule Final Locomotive-Marine rule for Tier 3 and 4 engines; and
    3. The 2008 final rule that includes the first-ever national emission standards for existing marine diesel engines, applying to engines larger than 600kW when they are remanufactured. The rule also sets Tier 3 emissions standards for newly-built engines that are phasing in from 2009. Finally, the rule establishes Tier 4 standards for newly-built commercial marine diesel engines above 600kW, phasing in beginning in 2014.

To calculate a control factor that accounts for reductions included in the USEPA controlled inventory, it was necessary to first calculate a "growth only" scenario applying USEPA's 0.9 percent annual growth rate to the 2006 base emissions. Once the growth rate was applied, then a control factor for each pollutant was calculated by dividing the future year controlled emissions by the future year "growth only" emissions. Exhibit 7.1 shows the control factors for 2017 and 2020 for diesel commercial marine vessels.

Exhibit 7.1 CMV Diesel Control Factors by Year and Pollutant

Year	CO	NOx	PM10	PM2.5	SO2	VOC
2013	0.885	0.787	0.747	0.747	0.464	0.871
2017	0.830	0.642	0.550	0.550	0.076	0.708
2020	0.801	0.537	0.460	0.460	0.032	0.586

7.1.3 CMV Residual Oil Growth Factors

For Category 3 residual oil vessels, data from an USEPA-sponsored study was used to develop an annualized growth factor of 4.5 percent for the region. A few states considered the growth rate to be extremely high and not reflective of recent economic conditions. Since USEPA's Category 3 vessel inventory is primarily based on activity data for ships that carry foreign cargo, we decided to use the recent growth data for international shipping available in the AEO2010. We used data from Table A-7 of the AEO2010 for international shipping to calculate the growth factor for 2007-2013 to be 0.940, for 2007-2017 to be 0.946, and for 2007-2020 to be 0.950. These growth factors were used for CMV residual oil port emissions (SCC 22-80-003-100) and CMV residual oil underway emissions (SCC 22-80-003-200).

7.1.4 CMV Residual Oil Control Factors

On December 22nd, 2009, USEPA announced final emission standards under the Clean Air Act for new marine diesel engines with per-cylinder displacement at or above 30 liters (called Category 3 marine diesel engines) installed on U.S.-flagged vessels. The final engine standards are equivalent to those adopted in the amendments to Annex VI to the International Convention for the Prevention of Pollution from Ships (a treaty called "MARPOL"). The emission standards apply in two stages: near-term standards for newly-built engines will apply beginning in 2011, and long-term standards requiring an 80 percent reduction in NOx will begin in 2016. USEPA also adopted changes to the diesel fuel program to allow for the production and sale of diesel fuel with no more than 1,000 ppm sulfur for use in Category 3 marine vessels. The regulations generally forbid production and sale of fuels with more than 1,000 ppm sulfur for use in most U.S. waters, unless operators achieve equivalent emission reductions in other ways.

On March 26, 2010, the International Maritime Organization (IMO) officially designated waters off North American coasts as an emissions control area (ECA) in which stringent international emission standards will apply to ships. In practice, implementation of the ECA means that ships entering the designated area would need to use compliant fuel for the duration of their voyage that is within that area, including time in port and voyages whose routes pass through the area without calling on a port. The North American ECA includes waters adjacent the Atlantic extending up to 200 nautical miles from east coast of the United States. The quality of fuel that complies with the ECA standard will change over time. From the effective date in 2012 until 2015, fuel used by vessels operating in designated areas cannot exceed 1.0 percent sulfur (10,000 ppm). Beginning in 2015, fuel used by vessels operating in these areas cannot exceed 0.1 percent sulfur (1000 ppm). Beginning in 2016, NOx aftertreatment requirements become applicable.

To calculate a control factor that accounted for reductions included in the USEPA controlled inventory, it was necessary to first calculate a "growth only" scenario applying USEPA's 4.5 percent annual growth rate to the 2006 base emissions. Once the growth rate was applied, then a control factor for each pollutant was calculated by dividing the future year controlled emissions by the future year "growth only" emissions.

Exhibit 7.2 shows the control factors for 2017 and 2020 for residual oil commercial marine vessels.

Exhibit 7.2 CMV Residual Oil Control Factors by Year and Pollutant

Year	CO	NOx	PM10	PM2.5	SO2	VOC
2013	1.000	0.736	0.353	0.353	0.270	1.000
2017	1.000	0.654	0.216	0.216	0.120	1.000
2020	1.000	0.597	0.137	0.137	0.036	1.000

7.1.5 Military Vessels Growth and Control Factors

Virginia reported emissions for military vessels, but did not distinguish between diesel or residual fuels. We assumed that there would be "no growth" for military vessel activity and emissions in Virginia would remain at 2007 levels in 2017 and 2020. Virginia was the only state to report emission from military vessels.

7.2 AIRCRAFT

Aircraft emissions in the 2007 MANE-VU+VA inventory are available on either a county-by-county or airport-by-airport basis for six types of aircraft operations:

- Air carrier operations represent landings and take-offs (LTOs) of commercial aircraft with seating capacity of more than 60 seats;
- Commuter/air taxi operations are one category. Commuter operations include LTOs by aircraft with 60 or fewer seats that transport regional passengers on

scheduled commercial flights. Air taxi operations include LTOs by aircraft with 60 or fewer seats conducted on non-scheduled or for-hire flights;

- General aviation represents all civil aviation LTOs not classified as commercial;
- Military operations represent LTOs by military aircraft;
- Ground Support Equipment (GSE) typically includes aircraft refueling and baggage handling vehicles and equipment, aircraft towing vehicles, and passenger buses; and
- Auxiliary power units (APUs) provide power to start the main engines and run the heating, cooling, and ventilation systems prior to starting the main engines.

7.2.1 Aircraft Growth Factors

Aircraft operations were projected to future years by applying activity growth using data on itinerant (ITN) operations at airports as reported in the Federal Aviation Administration's (FAA) Terminal Area Forecast (TAF) System for 2009-2030 (FAA 2010). The ITN operations are defined as aircraft take-offs or landings. This information is available for approximately 3300 individual airports. Actual LTOs are reported for 2007 and projected LTOs are provided for all years up to 2030.

We aggregated and applied this information at the county level for the four operation types: commercial, general, air taxi, military. We computed growth factors for each operation type by dividing future-year ITN by 2007-year ITN. We assigned factors to inventory SCCs based on the operation type, as shown in Exhibit 7.3.

Exhibit 7.3 Crosswalk between SCC and FAA Operations Type

SCC	SCC Description	FAA Operation Type Used for Growth Factor
2265008005	Airport Ground Support Equipment, 4-Stroke Gas	Total Itinerant Operations
2267008005	Airport Ground Support Equipment, LPG	Total Itinerant Operations
2268008005	Airport Ground Support Equipment, CNG	Total Itinerant Operations
2270008000	Airport Ground Support Equipment, Diesel	Total Itinerant Operations
2270008005	Airport Ground Support Equipment, Diesel	Total Itinerant Operations
2275001000	Aircraft /Military Aircraft /Total	Itinerant Military Operations
2275020000	Aircraft /Commercial Aircraft /Total: All Types	Itinerant Air Carrier Operations
2275050000	Aircraft /General Aviation /Total	Itinerant General Aviation Operations
2275050011	Aircraft /General Aviation /Piston	Itinerant General Aviation Operations
2275050012	Aircraft /General Aviation /Turbine	Itinerant General Aviation Operations

SCC	SCC Description	FAA Operation Type Used for Growth Factor
2275060000	Aircraft /Air Taxi /Total	Itinerant Air Taxi Operations
2275060011	Aircraft /Air Taxi /Piston	Itinerant Air Taxi Operations
2275060012	Aircraft /Air Taxi /Turbine	Itinerant Air Taxi Operations
2275070000	Aircraft /Aircraft Auxiliary Power Units /Total	Total Itinerant Operations

Exhibit 7.4 summarizes the region-wide growth factors by FAA operation type. The growth factor for individual airports/counties may deviate substantially from these region-wide growth factors.

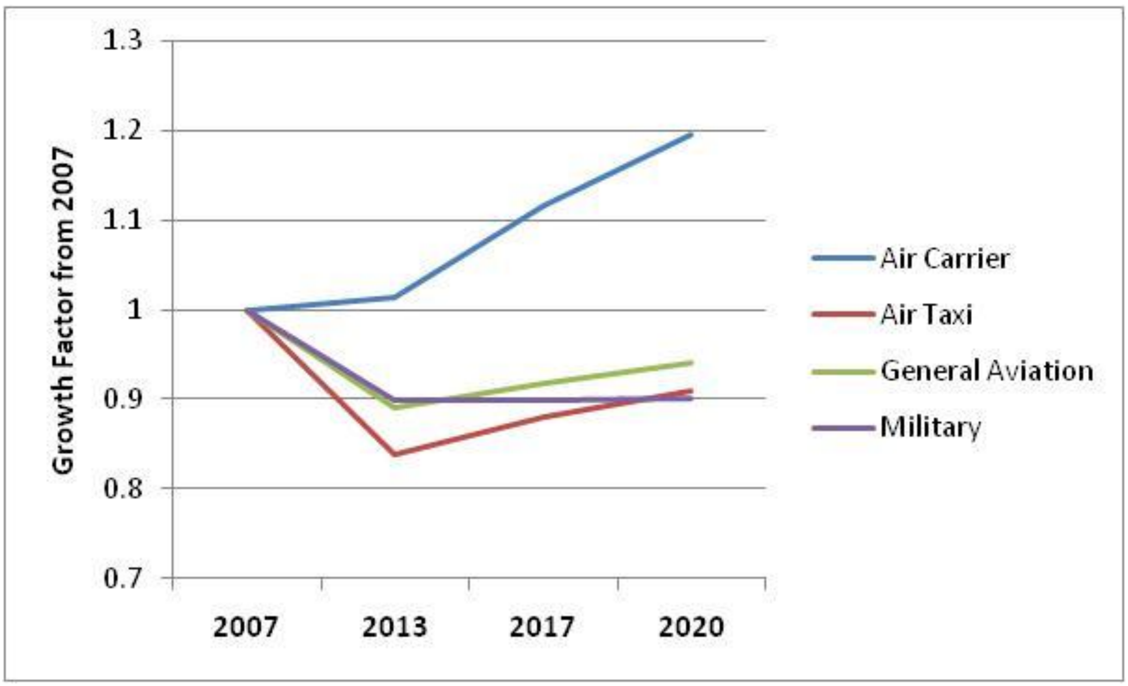


Exhibit 7.4 Region-wide Growth Factors from 2007 by FAA Operations Type

7.2.2 Aircraft Control Factors

The NOx aircraft engine emissions standards adopted by USEPA in November 2005 (USEPA 2005b) were reviewed. The standards are equivalent to the NOx emission standards (adopted in 1999 for implementation beginning in 2004) of the United Nations International Civil Aviation Organization (ICAO), and will bring the United States aircraft standards into alignment with the international standards. The standards apply to new aircraft engines used on commercial aircraft including small regional jets, single-aisle and twin-aisle aircraft, and 747s and larger aircraft. The standards also apply to general aviation and military aircraft, which sometimes use commercial engines. For example, small regional jet engines are used in executive general aviation aircraft, and larger commercial aircraft engines may be used in military transport aircraft.

Nearly all previously certified or in-production engine models currently meet or perform better than the standards USEPA adopted in the November 2005 rule. In addition, manufacturers have already been developing improved technology in response to the ICAO standards. According to USEPA's recent analysis for the proposed transport rule (USEPA 2010a), this rule is expected to reduce NOx emissions by approximately 2 percent in 2015 and 3 percent in 2020. Because of the relatively small amount of NOx reductions, our aircraft emission projections do not account for this control program.

EPA has also issued an Advance Notice of Proposed Rulemaking (ANPR) on lead emissions from piston-engine aircraft using leaded aviation gasoline (USEPA 2010d). However, this rule has not yet been adopted and co-benefits for criteria air pollutants are likely to be small. Therefore, the effects of this rule were not included in the future-year emissions projections.

7.3 RAILROAD EQUIPMENT

Railroad locomotive engine emissions in the 2007 MARAMA inventory are classified into the following categories:

- Class I line haul locomotives are operated by large freight railroad companies and are used to power freight train operations over long distances (SCC 22-85-002-006);
- Class II/III line haul locomotives are operated by smaller freight railroad companies and are used to power freight train operations over long distances (SCC 22-85-002-007);
- Inter-city passenger train locomotives are operated primarily by Amtrak to provide inter-city passenger transport (SCC 22-85-002-008);
- Independent commuter rail systems operate locomotives provide passenger transport within a metropolitan area (SCC 22-85-002-009); and
- Yard/switch locomotives are used in freight yards to assemble and disassemble trains, or for short hauls of trains that are made up of only a few cars (SCC 22-85-002-010).

7.3.1 Railroad Growth Factors

In March 2008, USEPA finalized a three part program that will dramatically reduce emissions from diesel locomotives of all types -- line-haul, switch, and passenger rail. As part of this work USEPA developed a national emission inventory for calendar years 2002 through 2040. Emission projections methodologies for a baseline and controlled scenario were developed and documented (USEPA 2008c). USEPA used projection data from the AEO2006 (EIA 2006). Table A-7 of AEO2006 showed that freight rail energy use will grow 1.6 percent annually.

More recent growth data is available in the AEO2010 which was published in May 2010. There are separate projections for passenger rail and freight rail energy use. For the MANE VU+VA inventory we relied on the more recent AEO2010 growth projections.

Passenger rail data from AEO2010 Table A-7 was used to calculate the growth factor for 2007-2013 to be 1.046, for 2007-2017 to be 1.121, and for 2007-2020 to be 1.171. These growth factors were applied to inter-city passenger train locomotives (SCC 22-85-002-008) and independent commuter rail systems (SCC 22-85-002-009).

For freight rail, the data from AEO2010 Table A-7 was used to calculate the growth factor for 2007-2013 to be 0.969, for 2007-2017 to be 1.018, and for 2007-2020 to be 1.053. We used the freight rail annual growth factors for Class I line haul (SCC 22-85-002-006), Class II/III line haul (SCC 22-85-002-007), and yard switch (SCC 22-85-002-010) locomotives.

7.3.2 Railroad Control Factors

USEPA developed two scenarios that accounted for both the 2004 nonroad diesel rule and the 2008 diesel locomotive rule:

- The USEPA baseline (pre-control) inventory accounted for

    1. AEO2006 annual growth in fuel use,
    2. The impact of existing regulations for Tier 0, 1, and 2 locomotive engines that take effect in 2008,
    3. The 2004 Clean Air Nonroad Diesel Rule that will decrease allowable levels of sulfur in locomotives fuel beginning in 2012, and
    4. Fleet turnover.

- The USEPA controlled inventory accounted for

    1. AEO2006 annual growth in fuel use,
    2. Reductions included in the baseline inventory, and

3. Reductions from USEPA's 2008 rule Final Locomotive-Marine rule for Tier 3 and 4 engines. This rule lowered diesel sulfur content and tightened emission standards for existing and new locomotives.
4. Voluntary retrofits under the National Clean Diesel Campaign are not included in our projections.

To calculate a factor that accounted for reductions included in the USEPA controlled inventory, it was necessary to first calculate a "growth only" scenario applying USEPA's 1.6% annual growth rate to the 2006 base emissions. Once the growth rate was applied, then a control factor for each pollutant was calculated by dividing the future year controlled emissions by the future year "growth only" emissions.

Exhibit 7.5 shows the control factors for 2017 and 2020 for the five locomotive classifications and pollutants.

Exhibit 7.5 Rail Control Factors by Year, Pollutant, and SCC

Year	NOx	PM10	PM2.5	HC	CO	VOC	SO2
SCC 22-85-002-006 Line Haul Class I Operations							
2017	0.633	0.449	0.449	0.480	1.000	0.480	0.003
2020	0.547	0.364	0.364	0.382	1.000	0.382	0.003
SCC 22-85-002-007 Line Haul Class II / III Operations							
2017	0.960	0.791	0.791	1.000	1.000	1.000	0.003
2020	0.920	0.752	0.752	1.000	1.000	1.000	0.003
SCC 22-85-002-008 Inter-City Passenger							
2017	0.421	0.402	0.402	0.437	0.917	0.437	0.003
2020	0.340	0.294	0.294	0.290	0.895	0.290	0.003
SCC 22-85-002-009 Commuter Rail							
2017	0.421	0.402	0.402	0.437	0.917	0.437	0.003
2020	0.340	0.294	0.294	0.290	0.895	0.290	0.003
SCC 22-85-002-010 Yard / Switch							
2017	0.843	0.712	0.712	0.809	1.000	0.809	0.003
2020	0.771	0.650	0.650	0.726	1.000	0.726	0.003

8.0 SUMMARY OF PROJECTED EMISSIONS

8.1 AREA SOURCE PROJECTED EMISSIONS

Exhibits 8.1 to 8.7 summarize the 2007 and projected future year area source emissions by state for each criteria air pollutant. Seven values are listed for each pollutant:

- 2007 emissions
- 2017 projected emissions with growth only (GO)
- 2017 projected emissions with growth and existing controls (GC)
- 2017 projected emissions with growth, existing and potential new OTC controls (GX)
- 2020 projected emissions with growth only (GO)
- 2020 projected emissions with growth and existing controls (GC)
- 2020 projected emissions with growth, existing and potential new OTC controls (GX)

Detailed summaries by County and SCC are provided on MARAMA's ftp site.

CO emissions in most states decline between 2007 and 2020, primarily due to decreases in residential wood combustion emissions resulting from the turnover to NSPS-compliant wood stoves. The two exceptions are DC and NY, where there is a slight increase in CO emissions from 2007 to 2020. There are no additional reductions expected from potential new OTC control measures.

NH3 emissions are projected to increase in most states between 2007 and 2020. This is due primarily to the growth predicted for fertilizer application on cropland and certain livestock waste products. There are no additional reductions expected from any existing control program or any potential new OTC control measures.

Under the "growth only" scenario, NOx emissions are projected to decline by about 5 percent between 2007 and 2017 due to AEO fuel use projections that generally show decreases in residential, commercial, and industrial fuel consumption. Under the "existing controls" scenario, NOx emissions in 2017 are projected to decrease by about 6.7 percent regionwide from 2007 levels due primarily to RICE MACT controls. Under the "potential new OTC controls" scenario, NOx emissions are projected to decrease by about 17 percent between 2007 and 2017 due to potential new controls on ICI boilers and new, small, natural gas-fired units.

PM10-PRI emissions are projected to increase slightly in all states between 2007 and 2017. Reentrained road dust on paved roads is a large source of PM10-PRI emissions and is directly proportional to the projected increases in VMT on paved roads. These increases from paved road dust are somewhat offset by decreases resulting from the turnover to NSPS-compliant wood stoves and the AEO fuel use projections that generally show decreases in residential, commercial, and industrial fuel consumption, especially for coal and oil. There are no additional reductions expected from potential new OTC control measures.

PM25-PRI emissions are projected to increase slightly from 2007 to 2020. Increases from paved road dust are somewhat offset by decreases resulting from the turnover to NSPS-compliant wood stoves and the AEO fuel use projections that generally show decreases in residential, commercial, and industrial fuel consumption, especially for coal and oil. There are no additional reductions expected from potential new OTC control measures.

Under the "growth only" scenario, SO2 emissions are projected to decline by about 16 percent between 2007 and 2017 due to AEO fuel use projections that generally show decreases in residential, commercial, and industrial fuel consumption, especially for coal and oil. Under the "existing controls" scenario, SO2 emissions in 2017 are projected to decrease by about 42 percent regionwide from 2007 levels due primarily to low sulfur fuel oil limits in MD, NJ, and NY. Under the "potential new OTC controls" scenario, SO2 emissions are projected to decrease by about 68 percent between 2007 and 2017 due to the potential implementation of low sulfur fuel oil limits in other MANE-VU states.

Under the "growth only" scenario, VOC emissions are projected to decrease slightly due to the turnover to NSPS-compliant wood stoves and the turnover over of vehicles equipped with on-board vapor recovery canisters. Under the "existing controls" scenario, VOC emissions in 2017 are projected to decrease by about 10 percent regionwide from 2007 levels due implementation of various OTC control measures in multiple states. Under the "potential new OTC controls" scenario, VOC emissions are projected to decrease by about 15 percent between 2007 and 2017 due to the continued implementation of both OTC control measures.

Exhibit 8.1 2007 and Projected Future Year Area Source CO Emissions (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	41,496	38,245	38,161	38,161	37,352	37,266	37,266
DE	8,266	7,961	7,881	7,881	7,857	7,776	7,776
DC	5,488	5,319	5,247	5,247	5,274	5,200	5,200
ME	50,496	47,290	47,266	47,266	46,359	46,337	46,337
MD	74,188	72,896	72,631	72,631	72,501	72,231	72,231
MA	79,226	75,912	75,482	75,482	75,073	74,626	74,626
NH	39,677	37,470	37,405	37,405	36,883	36,816	36,816
NJ	77,687	74,444	73,562	73,562	73,298	72,406	72,406
NY	205,055	218,875	218,374	218,374	223,510	223,021	223,021
PA	217,079	205,020	203,489	203,489	202,084	200,507	200,507
RI	15,419	14,391	14,308	14,308	14,097	14,011	14,011
VT	51,109	46,595	46,551	46,551	45,288	45,243	45,243
VA	132,098	129,923	129,479	129,479	129,390	128,937	128,937
	997,285	**974,342**	**969,836**	**969,836**	**968,966**	**964,377**	**964,377**

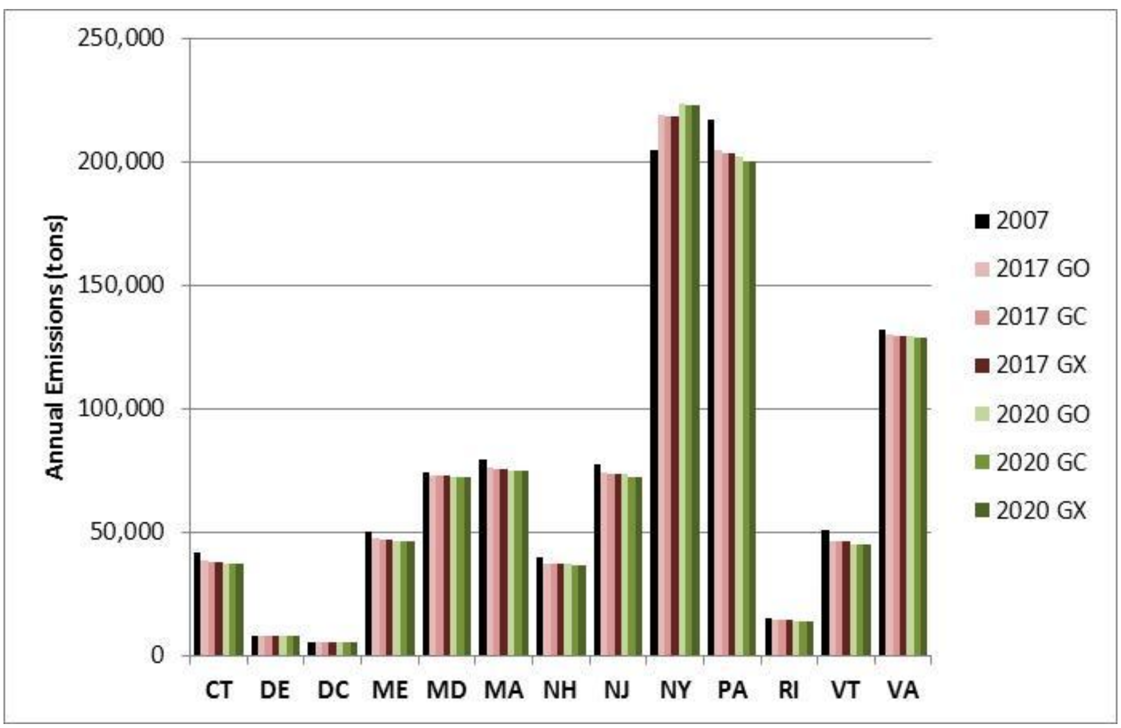


Exhibit 8.2 2007 and Projected Future Year Area Source NH3 Emissions (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	4,421	4,451	4,451	4,451	4,476	4,476	4,476
DE	12,382	15,233	15,233	15,233	15,924	15,924	15,924
DC	183	188	188	188	191	191	191
ME	5,736	6,203	6,203	6,203	6,337	6,337	6,337
MD	26,006	26,081	26,081	26,081	26,102	26,102	26,102
MA	13,791	13,913	13,913	13,913	13,996	13,996	13,996
NH	1,500	1,528	1,528	1,528	1,534	1,534	1,534
NJ	15,736	16,375	16,375	16,375	16,593	16,593	16,593
NY	45,693	46,221	46,221	46,221	46,368	46,368	46,368
PA	72,569	77,383	77,383	77,383	78,550	78,550	78,550
RI	625	629	629	629	636	636	636
VT	8,013	8,013	8,013	8,013	8,013	8,013	8,013
VA	43,394	45,862	45,862	45,862	46,434	46,434	46,434
	250,049	**262,079**	**262,079**	**262,079**	**265,152**	**265,152**	**265,152**

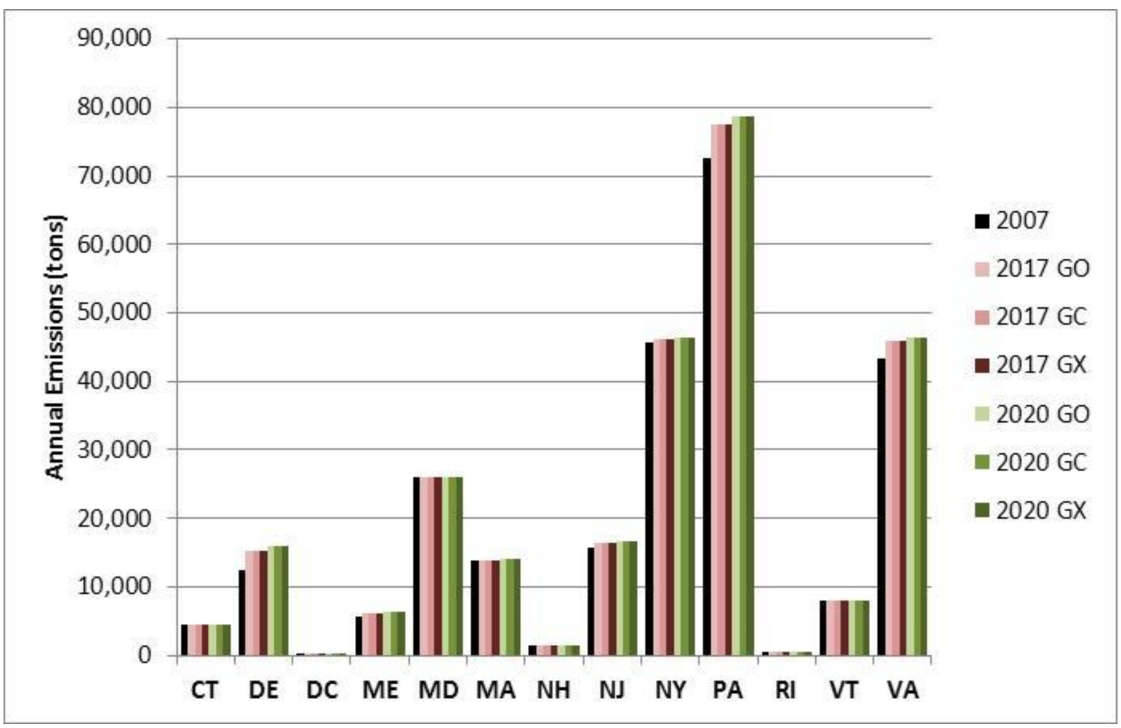


Exhibit 8.3 2007 and Projected Future Year Area Source NOx Emissions (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	12,421	11,278	11,101	9,747	11,232	11,049	9,560
DE	2,237	2,292	2,210	1,796	2,300	2,218	1,768
DC	1,547	1,620	1,560	1,318	1,654	1,592	1,325
ME	6,656	5,960	5,960	5,734	5,851	5,851	5,633
MD	10,312	11,148	10,948	9,887	11,389	11,185	9,978
MA	20,252	19,316	18,984	16,730	19,498	19,151	16,638
NH	4,737	4,196	4,152	3,761	4,156	4,111	3,699
NJ	24,175	24,662	23,331	22,727	24,685	23,339	22,310
NY	72,053	63,961	63,711	55,057	63,337	63,082	53,872
PA	47,545	47,179	45,925	37,636	47,613	46,318	37,392
RI	3,469	3,370	3,301	2,830	3,400	3,329	2,788
VT	3,996	3,667	3,641	3,305	3,672	3,645	3,302
VA	19,056	18,704	18,411	18,411	18,821	18,520	18,520
	228,457	**217,352**	**213,235**	**188,939**	**217,608**	**213,387**	**186,784**

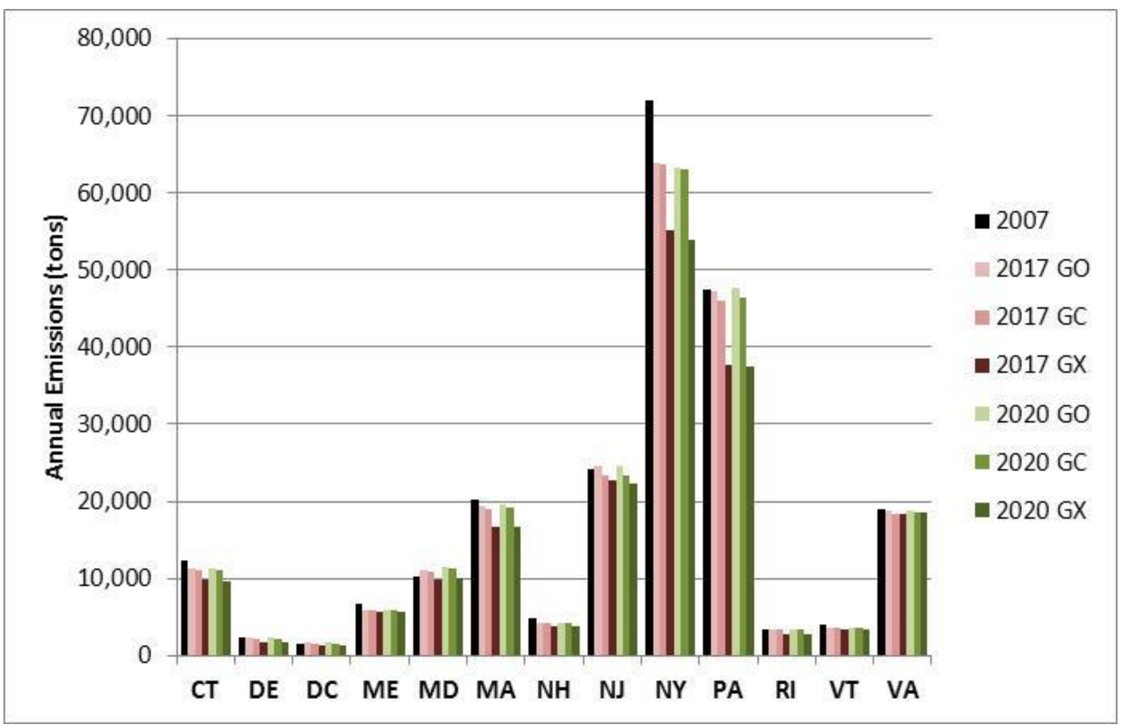


Exhibit 8.4 2007 and Projected Future Year Area Source PM10-PRI Emissions (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	30,577	31,061	31,052	31,052	31,224	31,214	31,214
DE	10,499	11,169	11,168	11,168	11,675	11,675	11,675
DC	4,873	5,078	5,077	5,077	5,141	5,141	5,141
ME	54,445	54,438	54,431	54,431	54,995	54,988	54,988
MD	72,454	78,559	78,555	78,555	80,345	80,340	80,340
MA	148,756	148,471	148,459	148,459	148,577	148,564	148,564
NH	27,742	28,916	28,912	28,912	29,420	29,416	29,416
NJ	39,140	41,202	41,189	41,189	42,104	42,090	42,090
NY	272,674	291,578	291,476	291,476	297,738	297,639	297,639
PA	287,998	295,026	295,006	295,006	298,020	298,001	298,001
RI	11,361	12,151	12,150	12,150	12,395	12,394	12,394
VT	47,993	47,675	47,671	47,671	47,823	47,819	47,819
VA	183,341	188,240	188,211	188,211	190,126	190,097	190,097
	1,191,853	**1,233,566**	**1,233,356**	**1,233,356**	**1,249,581**	**1,249,377**	**1,249,377**

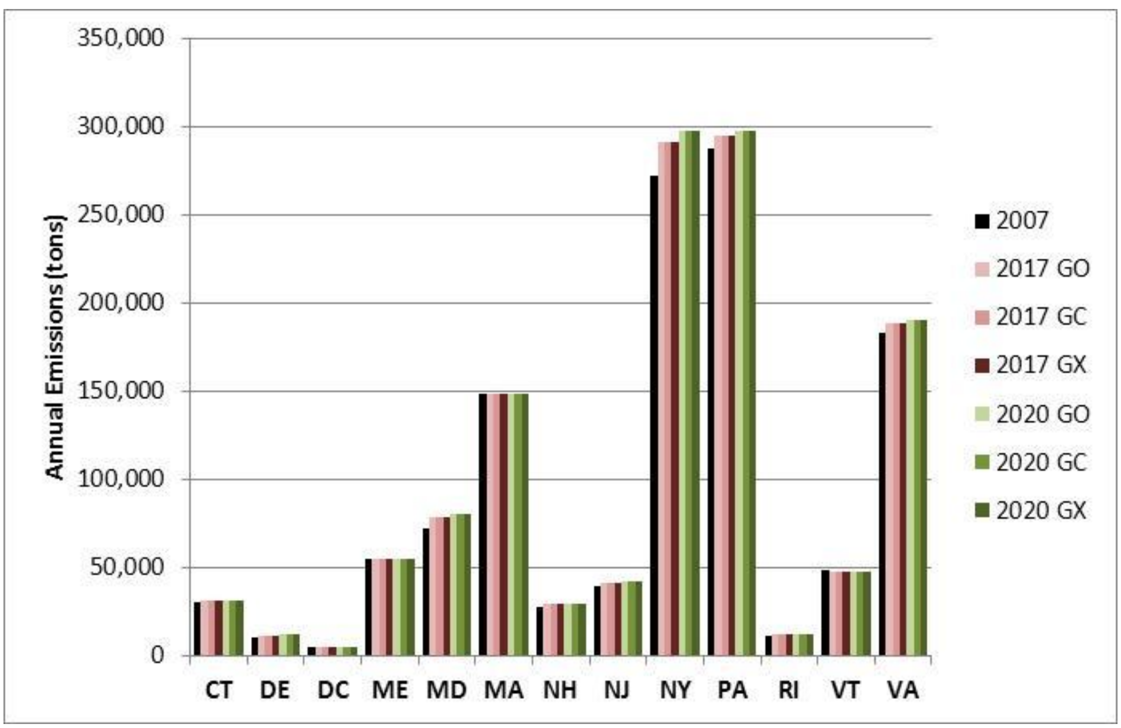


Exhibit 8.5 2007 and Projected Future Year Area Source PM25-PRI Emissions (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	10,606	10,298	10,290	10,290	10,225	10,217	10,217
DE	3,031	3,131	3,131	3,131	3,212	3,212	3,212
DC	1,542	1,560	1,560	1,560	1,567	1,566	1,566
ME	12,526	12,068	12,062	12,062	12,005	11,999	11,999
MD	19,789	20,888	20,884	20,884	21,206	21,201	21,201
MA	30,438	29,955	29,945	29,945	29,893	29,883	29,883
NH	8,623	8,602	8,598	8,598	8,637	8,633	8,633
NJ	18,299	18,453	18,441	18,441	18,579	18,568	18,568
NY	63,906	68,492	68,408	68,408	70,080	70,000	70,000
PA	73,514	73,070	73,054	73,054	73,243	73,227	73,227
RI	3,896	3,923	3,922	3,922	3,937	3,936	3,936
VT	13,106	12,596	12,593	12,593	12,520	12,517	12,517
VA	44,102	44,872	44,851	44,851	45,237	45,216	45,216
	303,378	**307,908**	**307,739**	**307,739**	**310,340**	**310,175**	**310,175**

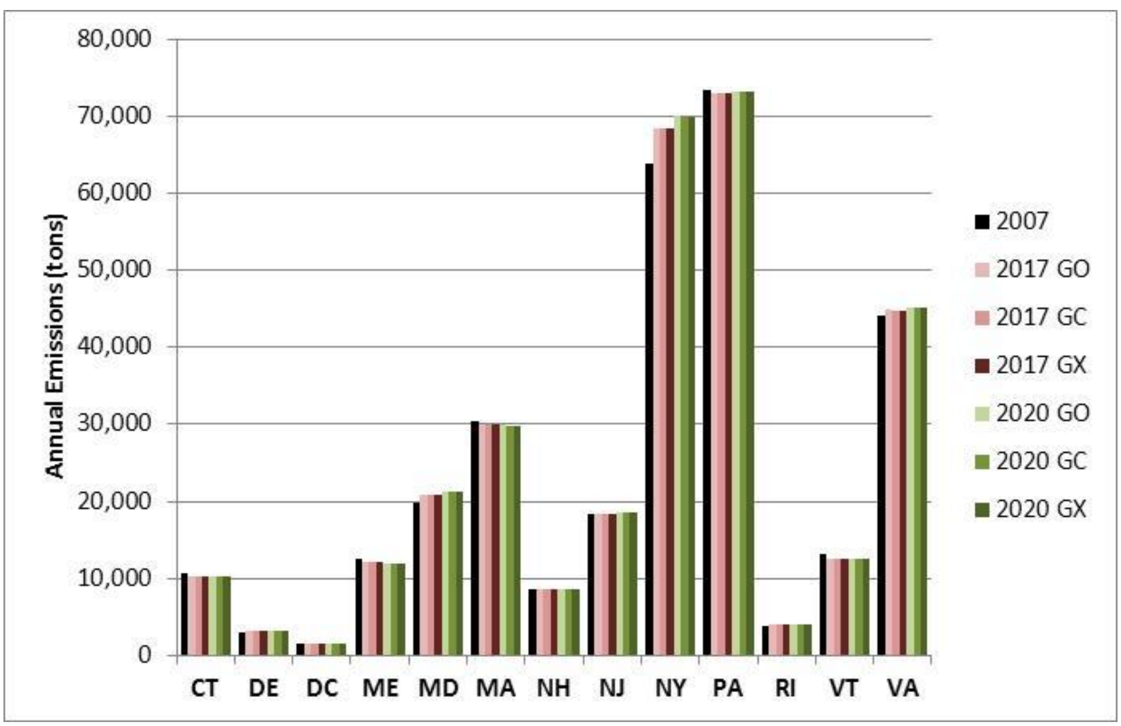


Exhibit 8.6 2007 and Projected Future Year Area Source SO2 Emissions (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	16,083	12,943	12,943	3,325	12,401	12,401	838
DE	1,144	946	946	107	911	911	106
DC	1,241	995	995	181	953	953	23
ME	9,812	7,870	7,870	1,450	7,609	7,609	200
MD	5,960	6,566	1,674	1,674	6,745	1,704	1,704
MA	19,859	15,996	15,996	4,093	15,357	15,357	1,391
NH	5,283	4,176	4,176	804	3,991	3,991	147
NJ	8,811	7,423	706	706	7,090	704	704
NY	70,044	58,753	11,651	11,651	57,030	11,670	11,670
PA	66,584	55,878	55,878	32,309	55,018	55,018	32,278
RI	3,897	3,222	3,222	1,270	3,108	3,108	491
VT	3,752	3,158	3,158	1,654	3,085	3,085	634
VA	17,098	14,880	14,880	14,880	14,616	14,616	14,616
	229,569	**192,807**	**134,097**	**74,104**	**187,914**	**131,127**	**64,803**

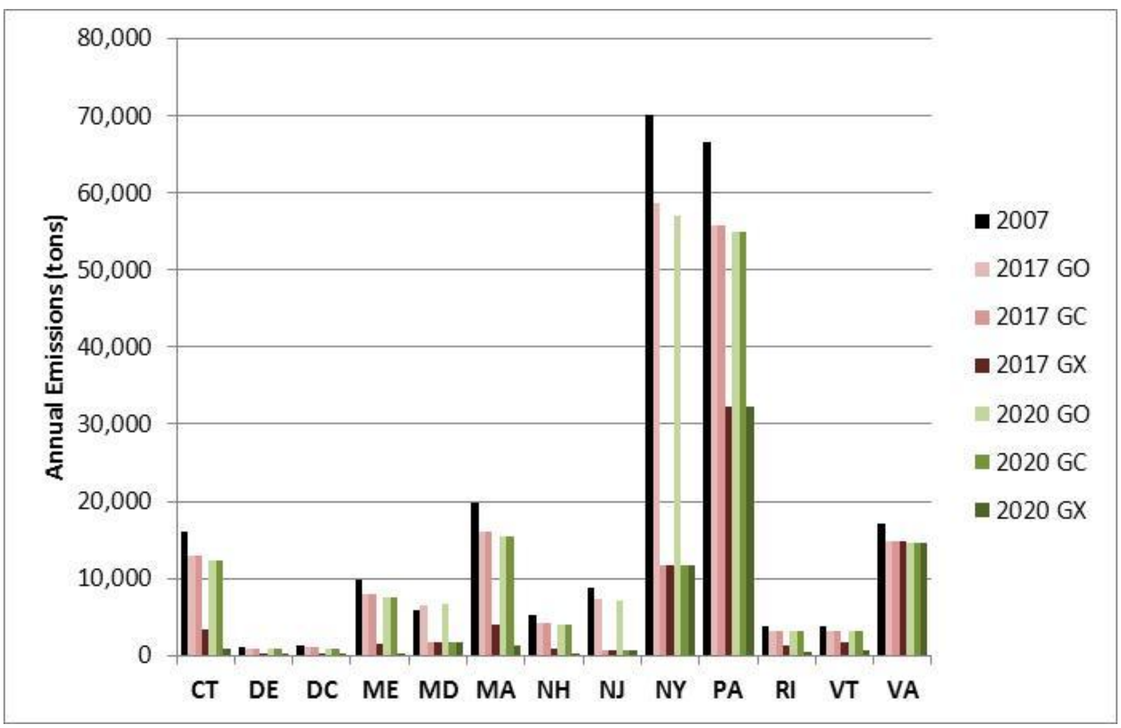
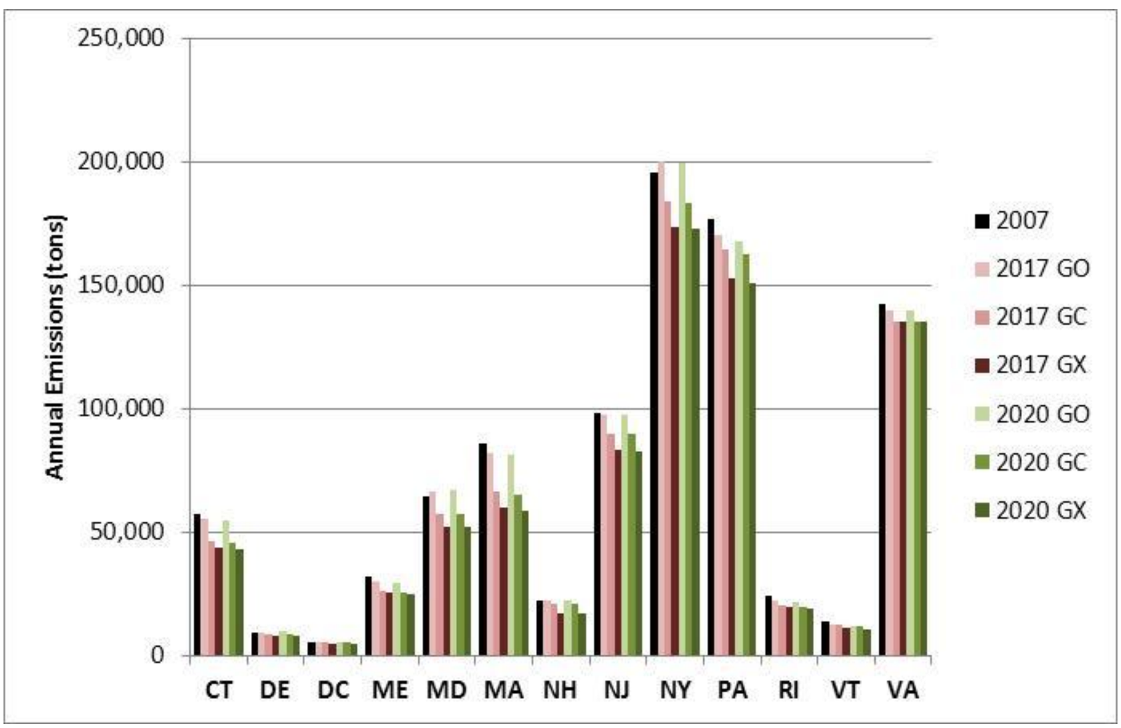


Exhibit 8.7 2007 and Projected Future Year Area Source VOC Emissions (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	57,253	55,386	46,364	43,764	54,857	45,849	43,229
DE	9,482	9,525	8,631	7,910	9,596	8,673	7,930
DC	5,568	5,540	5,324	4,932	5,591	5,369	4,965
ME	31,966	29,957	26,113	25,412	29,422	25,631	24,931
MD	64,429	66,399	57,045	52,018	66,825	57,042	51,901
MA	85,870	82,334	66,211	59,886	81,373	65,306	58,945
NH	22,343	22,117	20,894	17,258	22,041	20,807	17,164
NJ	98,121	97,769	89,972	83,323	97,551	89,699	82,956
NY	195,976	199,975	184,269	173,703	199,522	183,721	173,081
PA	176,781	170,123	164,863	153,166	167,744	162,374	150,596
RI	24,214	22,319	20,292	19,603	21,796	19,750	19,053
VT	14,108	12,516	12,311	10,972	12,127	11,904	10,561
VA	142,218	139,719	135,379	135,379	139,631	135,002	135,002
	928,330	**913,678**	**837,668**	**787,325**	**908,077**	**831,128**	**780,314**



8.2 NONEGU POINT SOURCE PROJECTED EMISSIONS

Exhibits 8.8 to 8.14 summarize the 2007 and projected future year area source emissions by state for each criteria air pollutant. Seven values are listed for each pollutant:

- 2007 emissions
- 2017 projected emissions with growth only (GO)
- 2017 projected emissions with growth and existing controls (GC)
- 2017 projected emissions with growth, existing and potential new OTC controls (GX)
- 2020 projected emissions with growth only (GO)
- 2020 projected emissions with growth and existing controls (GC)
- 2020 projected emissions with growth, existing and potential new OTC controls (GX)

Detailed summaries by County and SCC are provided on MARAMA's ftp site.

Regionwide, CO emissions increase slightly between 2007 and 2020. Maryland shows a significant decline due to a source closure. Maine, New Hampshire, and Vermont show significant increases due to projected increases in nonEGU wood combustion. There are no additional reductions expected from potential new OTC control measures.

NH3 emissions are projected to increase slightly between 2007 and 2020. There are no additional reductions expected from any existing control program or any potential new OTC control measures.

Under the "growth only" scenario, regional NOx emissions are projected to increase by about 12 percent from 2007 to 2017. This is due partially to the projected increases in fuel consumption and the addition of ERCs to the inventory. Under the "existing controls" scenario, NOx emissions are projected to be about 2 percent lower in 2017 than in 2007 because of petroleum refinery enforcement settlements; source shutdowns; ICI boiler controls in New Hampshire, New Jersey, and New York; and additional controls on glass furnace and cement kilns. Under the "potential new OTC controls" scenario, NOx emissions are projected to be about 5 percent lower in 2017 than in 2007 because of ICI boiler controls in additional states.

Under the "growth only" scenario, regional PM10-PRI and PM2.5-PRI emissions are projected to increase slightly. Under the "existing controls" scenario, PM10-PRI and PM2.5-PRI are project to be about 5 percent lower in 2017 than in 2007 due primarily to reductions the ICI boiler MACT standard and source closures. There are no additional reductions expected from potential new OTC control measures.

Under the "growth only" scenario, regional SO2 emissions are projected to remain relatively constant from 2007 to 2017. Under the "existing controls" scenario, SO2 emissions are projected to be about 5 percent lower in 2017 than in 2007 because of petroleum refinery enforcement settlements; source shutdowns; and low sulfur fuel oil requirements in Maryland, New Jersey, and New York. Under the "potential new OTC controls" scenario, SO2 emissions are projected to be about 8 percent lower in 2017 than in 2007 because of low sulfur fuel oil limits in additional states. SO2 emission are projected to be about 12 percent lower in 2020 than in 2007 because of additional low sulfur fuel oil limits in outer zone states that are projected to take effect in 2018..

VOC emissions are projected to increase slightly between 2007 and 2020 under the "growth only" scenario due primarily to the inclusion of ERCs in the future year inventories. Under the "existing controls" scenario, VOC emissions are projected to be less than 1 percent lower in 2017 than in 2007, with reductions resulting from the RICE MACT standard and OTC adhesives application rule. Under the "potential new OTC controls" scenario, VOC emissions are projected to be about 1.5 percent lower in 2017 than in 2007 due to the projected implementation of the OTC rule on large storage tanks.

Exhibit 8.8 2007 and Projected Future Year NonEGU CO Emissions (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	2,583	3,067	3,041	3,041	3,197	3,171	3,171
DE	7,027	7,300	7,271	7,271	7,320	7,292	7,292
DC	301	335	327	327	338	330	330
ME	14,023	20,975	20,941	20,941	21,238	21,204	21,204
MD	77,574	68,273	68,221	68,221	68,323	68,268	68,268
MA	4,592	5,999	5,919	5,919	6,165	6,082	6,082
NH	2,255	4,977	4,975	4,975	5,084	5,081	5,081
NJ	6,907	7,227	7,151	7,151	7,323	7,246	7,246
NY	52,877	54,959	54,646	54,646	55,439	55,115	55,115
PA	80,540	84,178	83,211	83,211	84,799	83,800	83,800
RI	1,051	873	870	870	940	937	937
VT	702	1,242	1,242	1,242	1,294	1,294	1,294
VA	63,079	67,090	65,740	65,740	67,833	66,212	66,212
	313,512	**326,496**	**323,556**	**323,556**	**329,293**	**326,031**	**326,031**

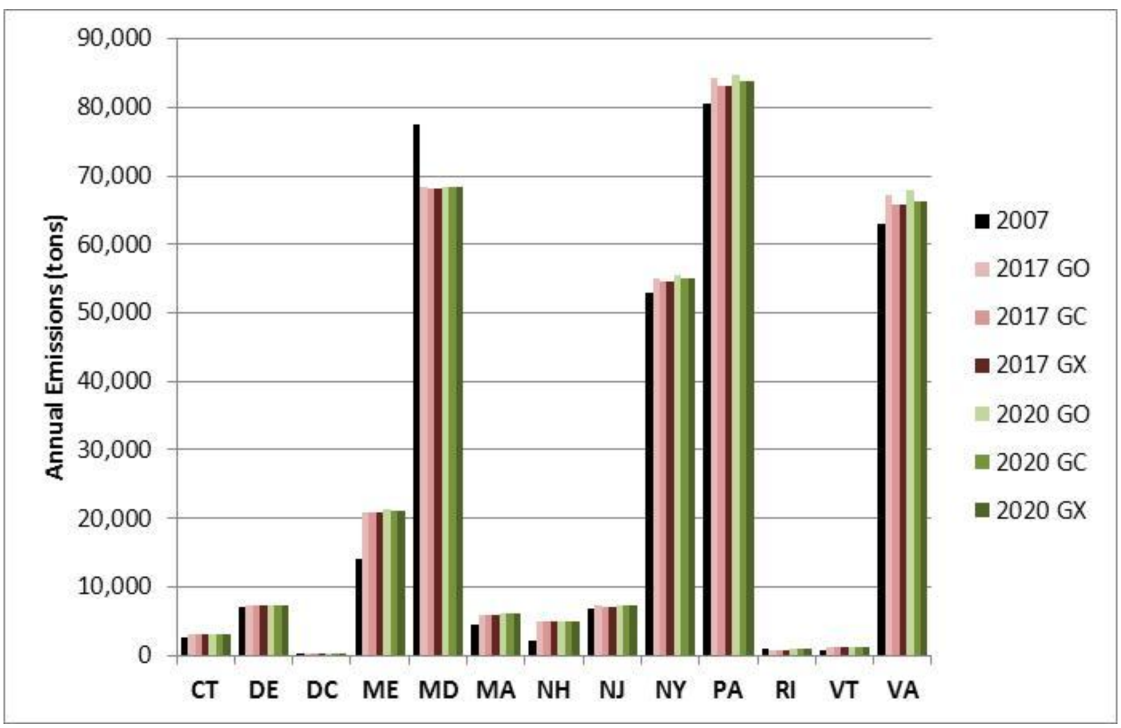


Exhibit 8.9 2007 and Projected Future Year NonEGU NH3 Emissions (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	0	0	0	0	0	0	0
DE	62	63	58	58	63	58	58
DC	0	0	0	0	0	0	0
ME	605	588	585	585	569	566	566
MD	137	137	137	137	137	137	137
MA	365	353	353	353	357	357	357
NH	30	36	36	36	36	36	36
NJ	208	216	216	216	219	219	219
NY	1,064	1,083	1,083	1,083	1,086	1,086	1,086
PA	2,070	2,111	2,111	2,111	2,119	2,119	2,119
RI	16	13	13	13	13	13	13
VT	0	0	0	0	0	0	0
VA	1,618	1,698	1,698	1,698	1,709	1,709	1,709
	6,175	**6,298**	**6,290**	**6,290**	**6,307**	**6,300**	**6,300**

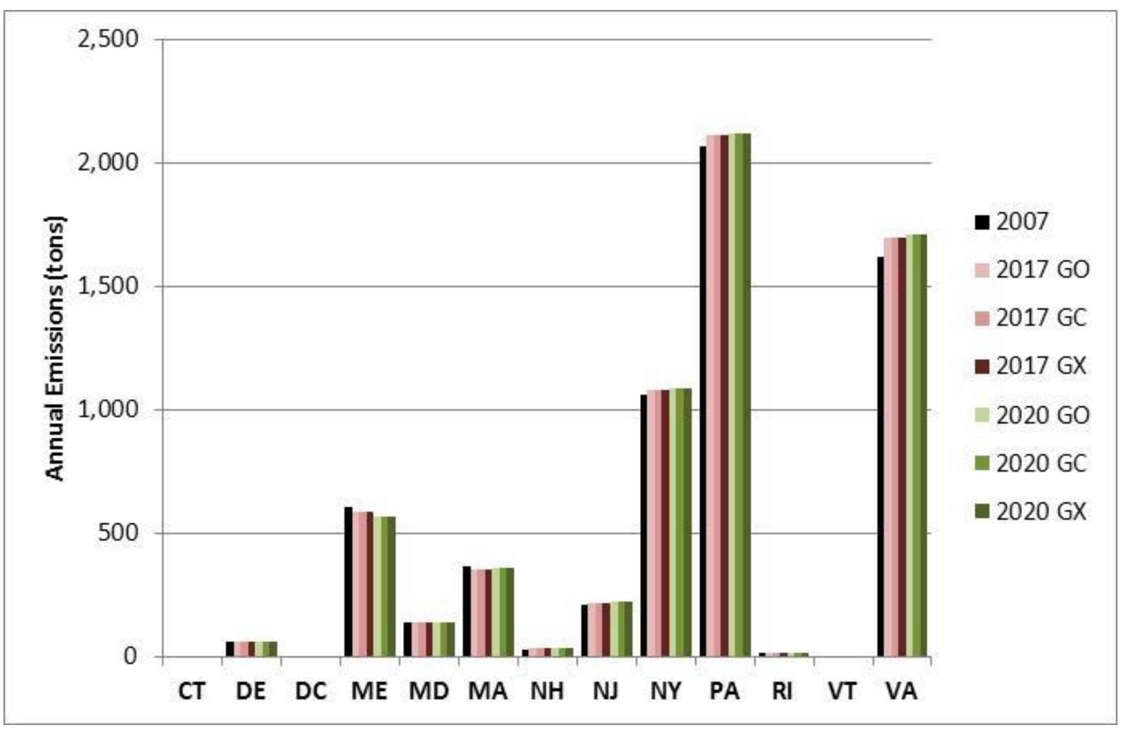


Exhibit 8.10 2007 and Projected Future Year NonEGU NOx Emissions (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	6,302	8,949	8,913	8,531	9,336	9,297	8,900
DE	5,122	4,774	3,328	2,861	4,652	3,271	2,796
DC	734	844	779	598	860	792	609
ME	17,050	20,527	20,398	19,272	20,573	20,447	19,332
MD	23,472	28,520	26,322	25,197	28,694	26,496	25,353
MA	12,872	15,011	14,797	13,238	15,525	15,298	13,695
NH	2,687	5,529	3,388	3,277	5,642	3,467	3,356
NJ	13,517	14,880	11,879	11,879	15,155	12,092	12,092
NY	35,583	38,125	27,632	27,632	38,686	28,080	28,080
PA	71,382	76,378	63,904	61,046	77,220	62,606	59,691
RI	950	857	854	720	868	862	727
VT	441	791	791	743	808	808	761
VA	50,265	53,919	53,236	53,236	54,476	53,591	53,591
	240,378	**269,103**	**236,221**	**228,228**	**272,496**	**237,107**	**228,984**

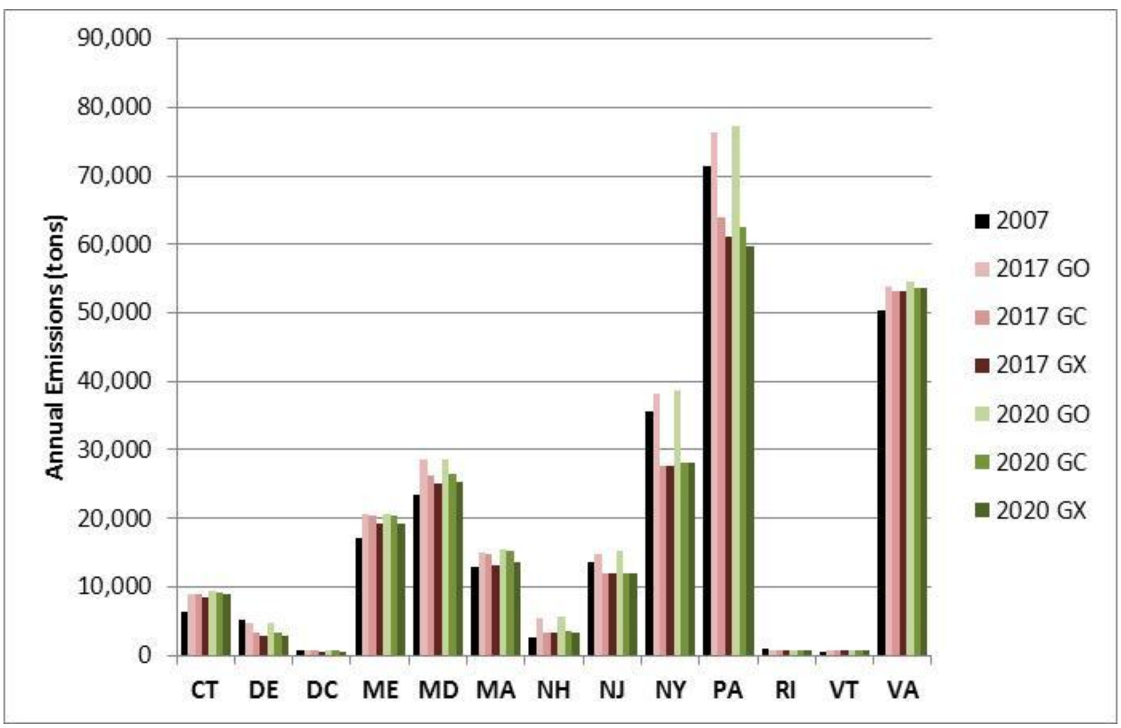


Exhibit 8.11 2007 and Projected Future Year NonEGU PM10-PRI Emissions (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	645	702	594	594	717	609	609
DE	1,197	1,140	973	973	1,115	947	947
DC	46	52	29	29	53	30	30
ME	4,748	4,667	4,475	4,475	4,636	4,449	4,449
MD	5,711	6,177	5,498	5,498	6,181	5,502	5,502
MA	3,029	2,927	2,904	2,904	2,977	2,953	2,953
NH	1,141	1,259	1,258	1,258	1,270	1,269	1,269
NJ	3,147	3,381	3,331	3,331	3,444	3,392	3,392
NY	4,463	4,572	4,260	4,260	4,595	4,283	4,283
PA	22,275	22,832	20,891	20,891	22,937	20,996	20,996
RI	173	174	174	174	179	179	179
VT	146	128	128	128	128	128	128
VA	13,028	13,419	12,517	12,517	13,507	12,602	12,602
	59,749	**61,430**	**57,032**	**57,032**	**61,741**	**57,339**	**57,339**

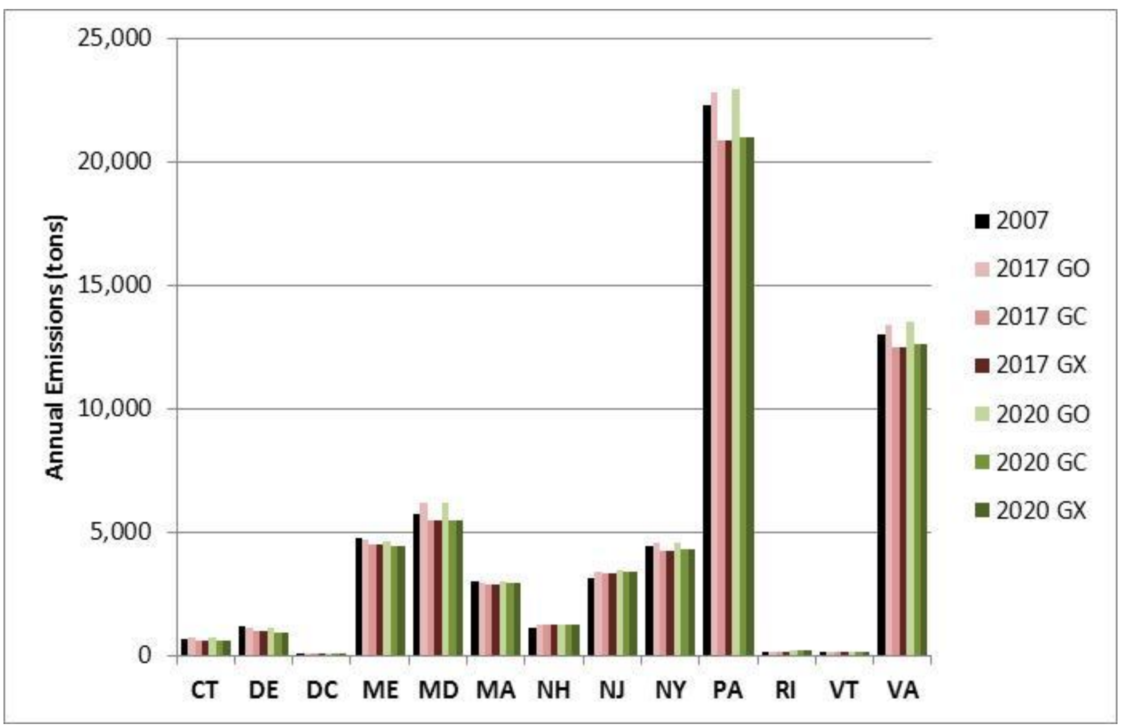


Exhibit 8.12 2007 and Projected Future Year NonEGU PM25-PRI Emissions (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	573	627	526	526	641	540	540
DE	1,083	1,021	876	876	993	848	848
DC	43	48	28	28	48	29	29
ME	3,727	3,811	3,658	3,658	3,802	3,653	3,653
MD	3,876	4,328	3,764	3,764	4,336	3,772	3,772
MA	2,572	2,495	2,485	2,485	2,542	2,532	2,532
NH	1,061	1,169	1,169	1,169	1,179	1,179	1,179
NJ	2,452	2,583	2,533	2,533	2,625	2,574	2,574
NY	2,415	2,517	2,329	2,329	2,538	2,350	2,350
PA	13,389	13,851	12,729	12,729	13,934	12,845	12,845
RI	124	124	124	124	128	128	128
VT	114	98	98	98	97	97	97
VA	10,296	10,611	9,885	9,885	10,674	9,947	9,947
	41,726	**43,281**	**40,204**	**40,204**	**43,538**	**40,492**	**40,492**

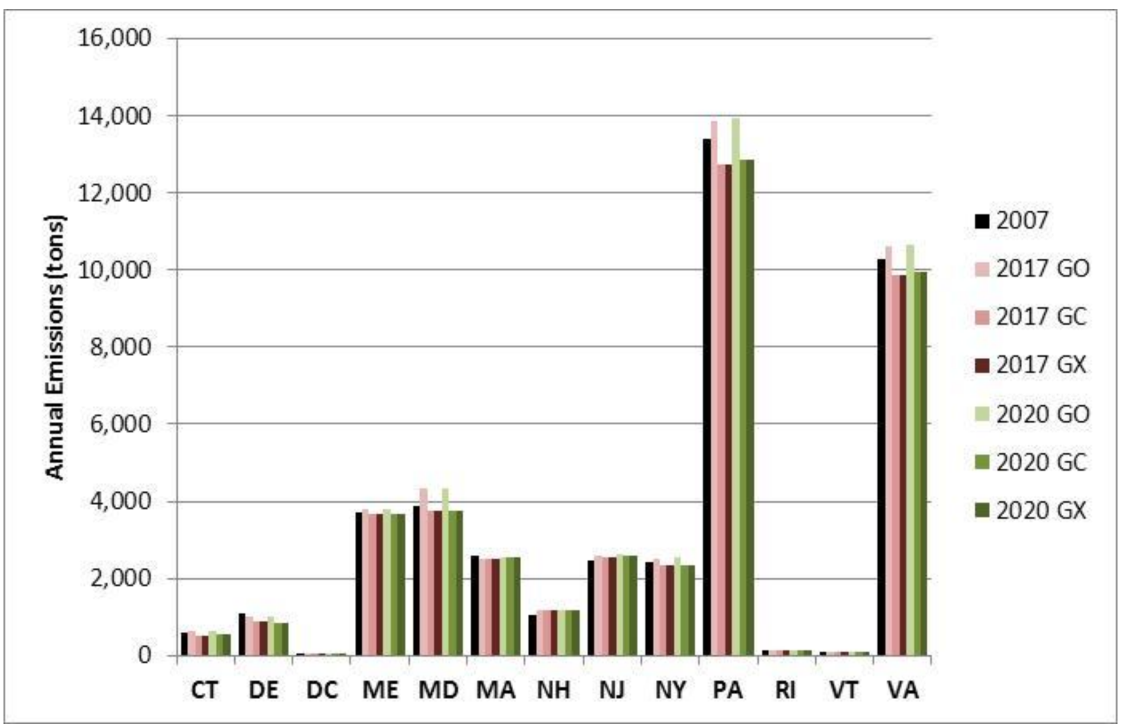


Exhibit 8.13 2007 and Projected Future Year NonEGU SO2 Emissions (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	3,185	3,236	3,236	3,117	3,253	3,253	2,773
DE	8,206	7,883	6,541	5,598	7,703	6,357	5,378
DC	471	510	380	358	518	382	337
ME	15,571	13,194	12,678	12,462	13,049	12,545	6,510
MD	31,176	36,658	34,278	34,278	36,636	34,289	34,289
MA	9,057	8,259	8,041	7,592	8,254	8,041	5,192
NH	2,734	2,655	2,655	2,582	2,658	2,658	1,030
NJ	3,401	3,736	2,591	2,591	3,818	2,645	2,645
NY	44,307	44,712	42,072	42,072	44,792	42,150	42,150
PA	57,330	58,464	53,489	49,814	58,627	53,652	49,975
RI	1,501	1,415	1,415	1,321	1,437	1,437	1,002
VT	316	248	248	243	243	243	92
VA	54,486	55,328	52,044	52,044	55,623	52,338	52,338
	231,742	**236,297**	**219,668**	**214,071**	**236,610**	**219,988**	**203,710**

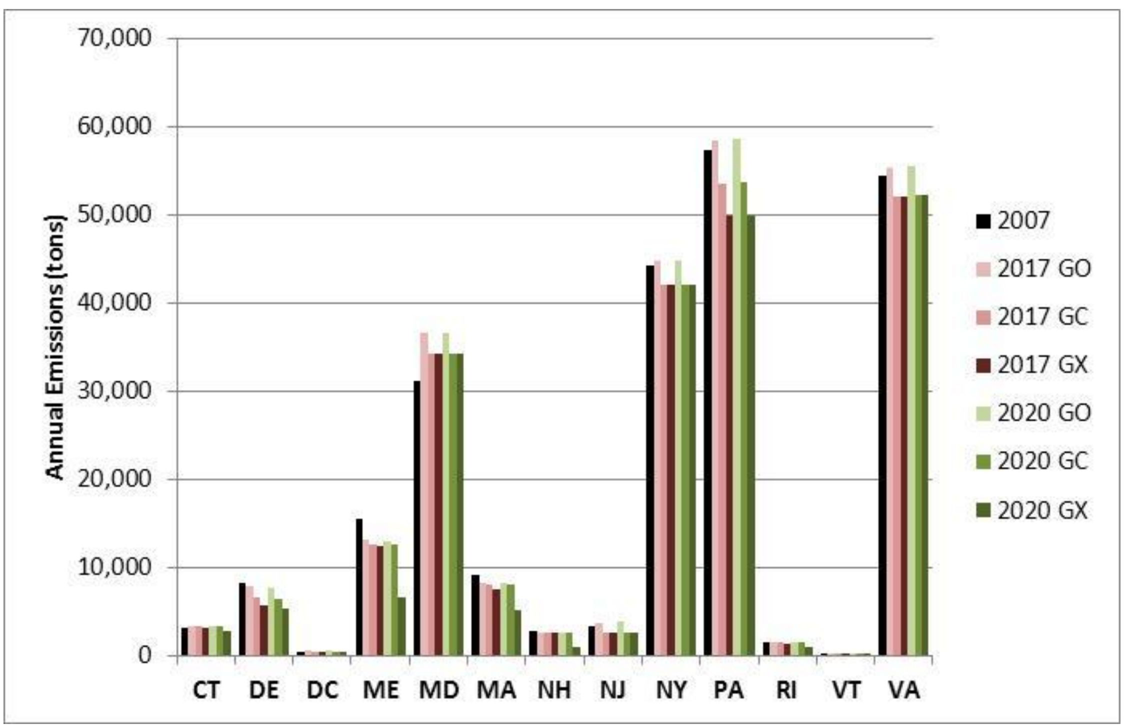
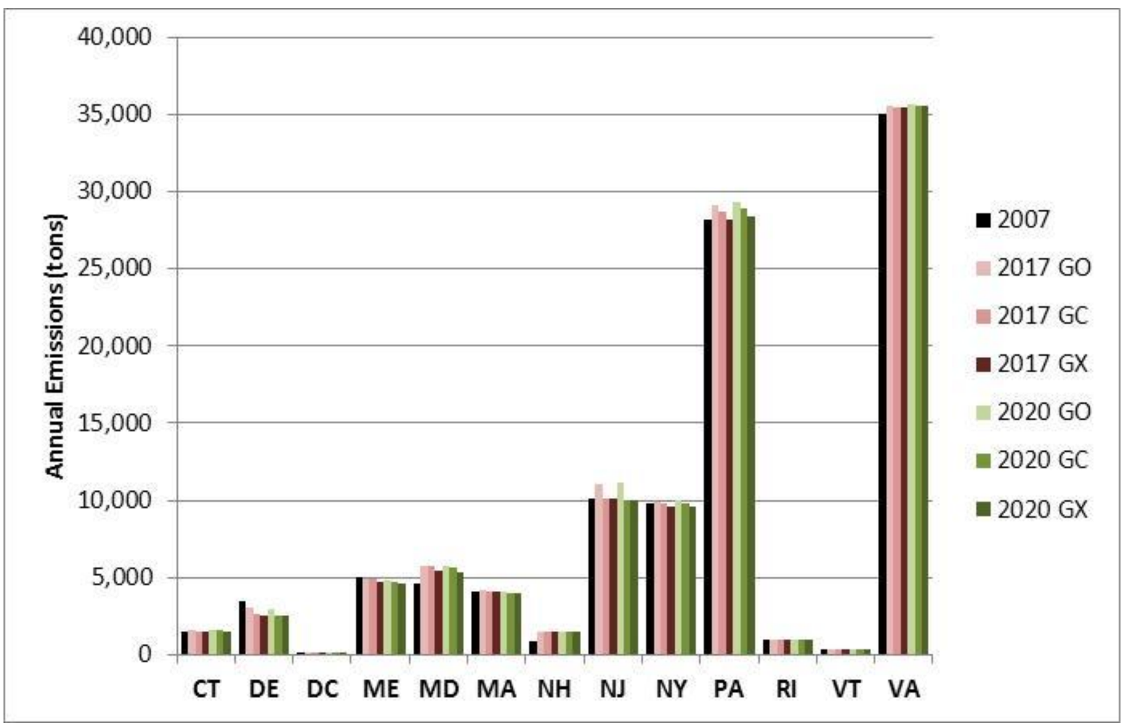


Exhibit 8.14 2007 and Projected Future Year NonEGU VOC Emissions (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	1,447	1,547	1,530	1,468	1,574	1,556	1,476
DE	3,406	3,068	2,588	2,547	2,972	2,572	2,530
DC	58	60	59	59	60	59	59
ME	4,987	4,931	4,885	4,745	4,760	4,718	4,559
MD	4,598	5,745	5,715	5,466	5,707	5,677	5,367
MA	4,094	4,156	4,102	4,057	4,077	4,022	3,965
NH	807	1,490	1,489	1,448	1,479	1,478	1,440
NJ	10,106	11,044	10,086	10,086	11,180	10,041	10,041
NY	9,772	9,948	9,815	9,640	9,985	9,849	9,635
PA	28,195	29,153	28,712	28,236	29,376	28,925	28,396
RI	922	950	945	919	967	963	930
VT	373	316	316	316	302	302	302
VA	35,018	35,538	35,461	35,461	35,670	35,593	35,593
	103,783	**107,947**	**105,705**	**104,450**	**108,110**	**105,755**	**104,292**



8.3 NONROAD NMIM SOURCE PROJECT EMISSIONS

Exhibits 8.15 to 8.21 summarize the 2007 and projected emissions for NONROAD model sources by state for each criteria air pollutant. Seven values are listed for each pollutant:

- 2007 emissions
- 2017 projected emissions with growth only (GO)
- 2017 projected emissions with growth and existing controls (GC)
- 2017 projected emissions with growth, existing and potential new OTC controls (GX)
- 2020 projected emissions with growth only (GO)
- 2020 projected emissions with growth and existing controls (GC)
- 2020 projected emissions with growth, existing and potential new OTC controls (GX)

Detailed summaries by County and SCC are provided on MARAMA's ftp site.

It is not possible to isolate the emission changes due to growth versus the emission changes due to future controls in a single NMIM run. Therefore, the emissions under the growth only (GO) and growth and existing controls (GC) scenarios are the same. There are currently no potential new OTC control measures for sources whose emissions are estimated by the NONROAD model. Therefore, the emissions under the growth and existing controls (GC) and with growth, existing and potential new OTC controls (GX) scenarios are the same.

Exhibit 8.15 presents a state-level comparison of 2007, 2017 and 2020 annual CO emissions for NMIM/NONROAD sources. Emissions decrease by about 21% between 2007 and 2013, but remain relatively flat from 2017 to 2020.

Exhibit 8.16 shows that annual NH3 emissions are very small relative to other source sectors (e.g., agricultural ammonia) and generally increase slightly from 2007 to 2020.

Exhibit 8.17 shows that annual NOx emissions decrease by about 42% between 2007 and 2020 and by about 49% between 2007 and 2020 due to the turnover to newer engines subject to more stringent national emission standards.

Exhibits 8.18 and 8.19 shows that PM10-PRI and PM25-PRI emissions decrease about 33% between 2007 and 2020 and by about 41% between 2007 and 2020.

Exhibit 8.20 shows that annual SO2 emissions are virtually eliminated by 2017 due to lower national limits on the sulfur content of nonroad diesel fuel.

Exhibit 8.21 shows that annual VOC emissions decrease by about 41% between 2007 and 2020 and by about 46% between 2007 and 2020 due to the turnover to newer engines subject to more stringent national emission standards.

Exhibit 8.15 2007/2013/2017/2020 NMIM/NONROAD CO Emissions by State (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	181,817	143,586	143,586	143,586	147,193	147,193	147,193
DE	55,173	40,188	40,188	40,188	40,703	40,703	40,703
DC	14,319	10,246	10,246	10,246	10,322	10,322	10,322
ME	131,319	92,029	92,029	92,029	90,629	90,629	90,629
MD	297,832	247,766	247,766	247,766	254,083	254,083	254,083
MA	324,793	240,812	240,812	240,812	246,540	246,540	246,540
NH	90,461	73,012	73,012	73,012	73,294	73,294	73,294
NJ	445,302	362,054	362,054	362,054	372,857	372,857	372,857
NY	911,813	716,153	716,153	716,153	730,897	730,897	730,897
PA	719,517	533,798	533,798	533,798	542,133	542,133	542,133
RI	54,028	35,863	35,863	35,863	36,713	36,713	36,713
VT	52,497	35,978	35,978	35,978	35,608	35,608	35,608
VA	415,093	335,531	335,531	335,531	341,458	341,458	341,458
	3,693,965	**2,867,016**	**2,867,016**	**2,867,016**	**2,922,431**	**2,922,431**	**2,922,431**

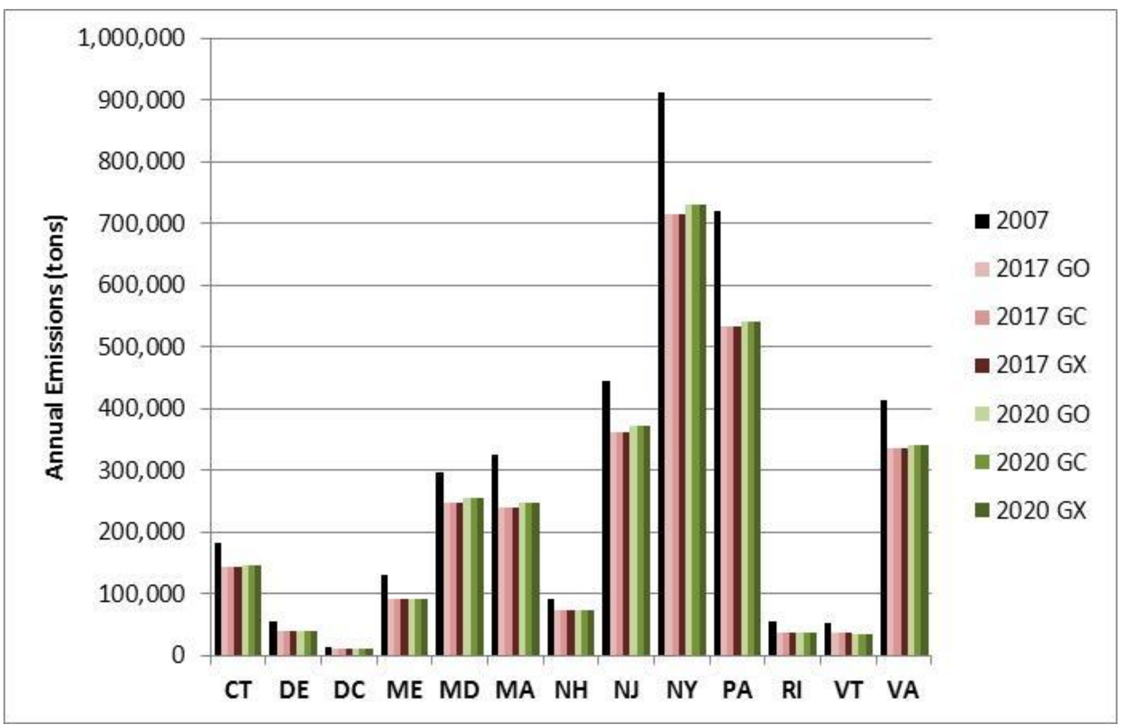


Exhibit 8.16 2007/2013/2017/2020 NMIM/NONROAD NH3 Emissions by State (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	16	20	20	20	21	21	21
DE	6	6	6	6	7	7	7
DC	3	3	3	3	3	3	3
ME	13	15	15	15	15	15	15
MD	29	35	35	35	37	37	37
MA	28	34	34	34	36	36	36
NH	10	12	12	12	13	13	13
NJ	40	47	47	47	50	50	50
NY	83	99	99	99	105	105	105
PA	60	71	71	71	74	74	74
RI	5	5	5	5	5	5	5
VT	5	6	6	6	6	6	6
VA	45	53	53	53	55	55	55
	342	**405**	**405**	**405**	**427**	**427**	**427**

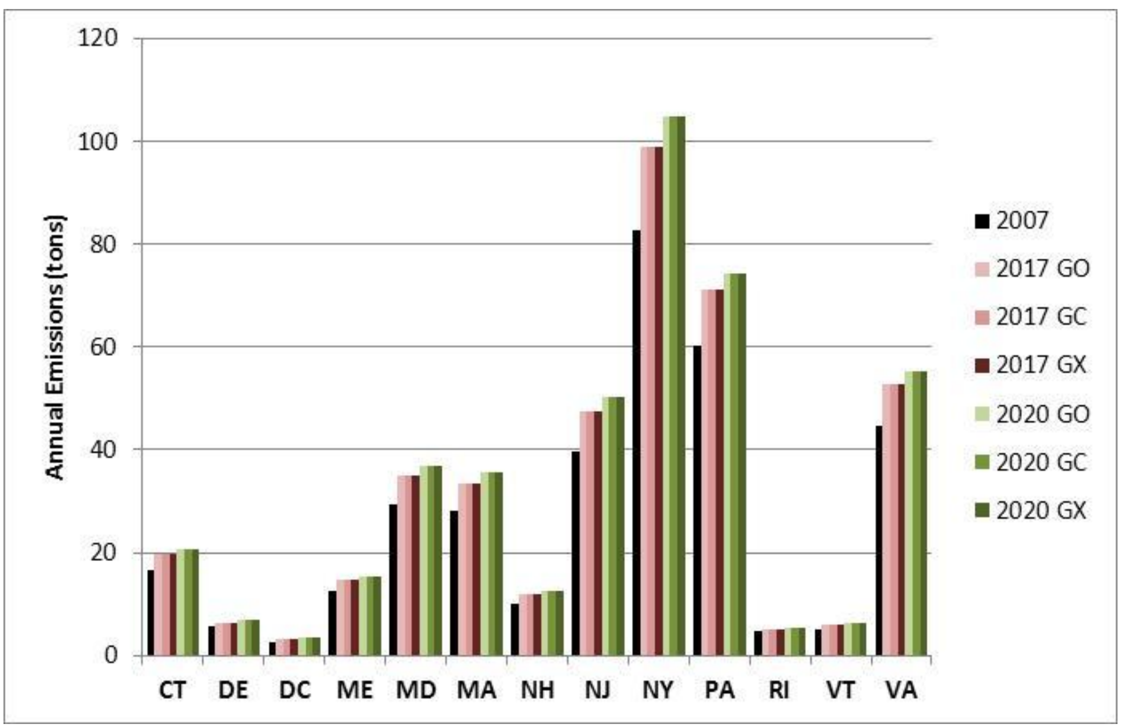


Exhibit 8.17 2007/2013/2017/2020 NMIM/NONROAD NOx Emissions by State (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	16,056	8,748	8,748	8,748	7,786	7,786	7,786
DE	4,998	3,096	3,096	3,096	2,723	2,723	2,723
DC	2,788	1,534	1,534	1,534	1,250	1,250	1,250
ME	7,439	5,216	5,216	5,216	4,783	4,783	4,783
MD	25,726	15,357	15,357	15,357	13,481	13,481	13,481
MA	26,471	14,820	14,820	14,820	13,163	13,163	13,163
NH	8,562	5,530	5,530	5,530	5,277	5,277	5,277
NJ	36,345	20,713	20,713	20,713	18,361	18,361	18,361
NY	72,271	43,490	43,490	43,490	38,871	38,871	38,871
PA	55,362	30,467	30,467	30,467	26,182	26,182	26,182
RI	4,388	2,348	2,348	2,348	2,114	2,114	2,114
VT	3,743	2,364	2,364	2,364	2,109	2,109	2,109
VA	41,325	23,658	23,658	23,658	20,189	20,189	20,189
	305,475	**177,343**	**177,343**	**177,343**	**156,288**	**156,288**	**156,288**

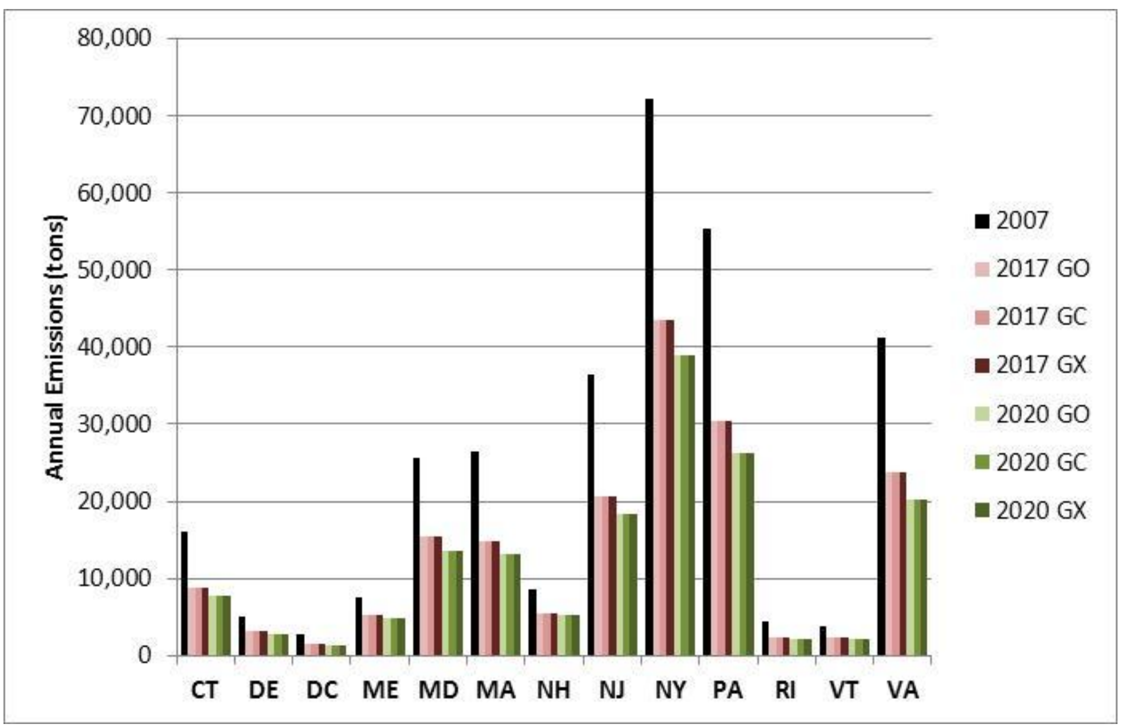


Exhibit 8.18 2007/2013/2017/2020 NMIM/NONROAD PM10-PRI Emissions by State (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	1,412	976	976	976	868	868	868
DE	476	300	300	300	258	258	258
DC	242	138	138	138	106	106	106
ME	1,151	810	810	810	706	706	706
MD	2,600	1,781	1,781	1,781	1,570	1,570	1,570
MA	2,384	1,630	1,630	1,630	1,438	1,438	1,438
NH	846	595	595	595	527	527	527
NJ	3,377	2,347	2,347	2,347	2,086	2,086	2,086
NY	7,059	4,684	4,684	4,684	4,075	4,075	4,075
PA	5,623	3,717	3,717	3,717	3,217	3,217	3,217
RI	367	229	229	229	202	202	202
VT	482	327	327	327	281	281	281
VA	4,128	2,695	2,695	2,695	2,319	2,319	2,319
	30,146	**20,229**	**20,229**	**20,229**	**17,652**	**17,652**	**17,652**

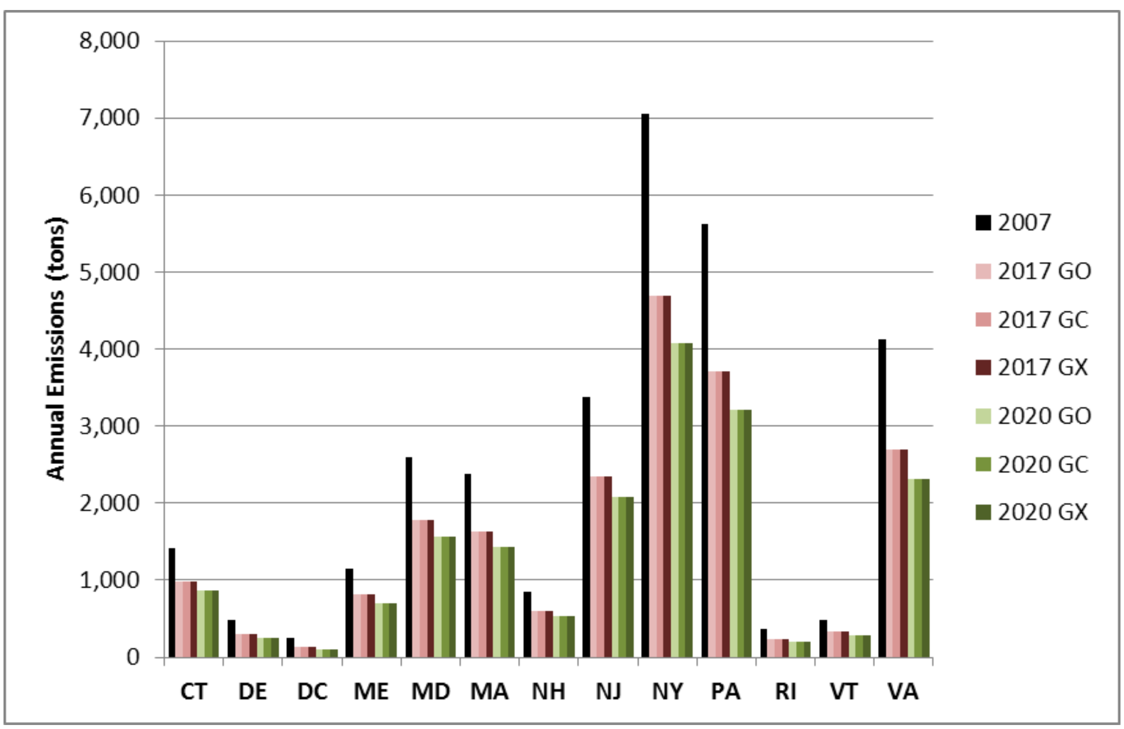


Exhibit 8.19 2007/2013/2017/2020 NMIM/NONROAD PM25-PRI Emissions by State (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	1,343	922	922	922	818	818	818
DE	453	284	284	284	243	243	243
DC	234	132	132	132	102	102	102
ME	1,080	756	756	756	657	657	657
MD	2,473	1,681	1,681	1,681	1,477	1,477	1,477
MA	2,268	1,540	1,540	1,540	1,355	1,355	1,355
NH	799	559	559	559	494	494	494
NJ	3,213	2,217	2,217	2,217	1,964	1,964	1,964
NY	6,715	4,430	4,430	4,430	3,843	3,843	3,843
PA	5,346	3,511	3,511	3,511	3,029	3,029	3,029
RI	349	216	216	216	191	191	191
VT	455	307	307	307	263	263	263
VA	3,933	2,549	2,549	2,549	2,185	2,185	2,185
	28,660	**19,105**	**19,105**	**19,105**	**16,621**	**16,621**	**16,621**

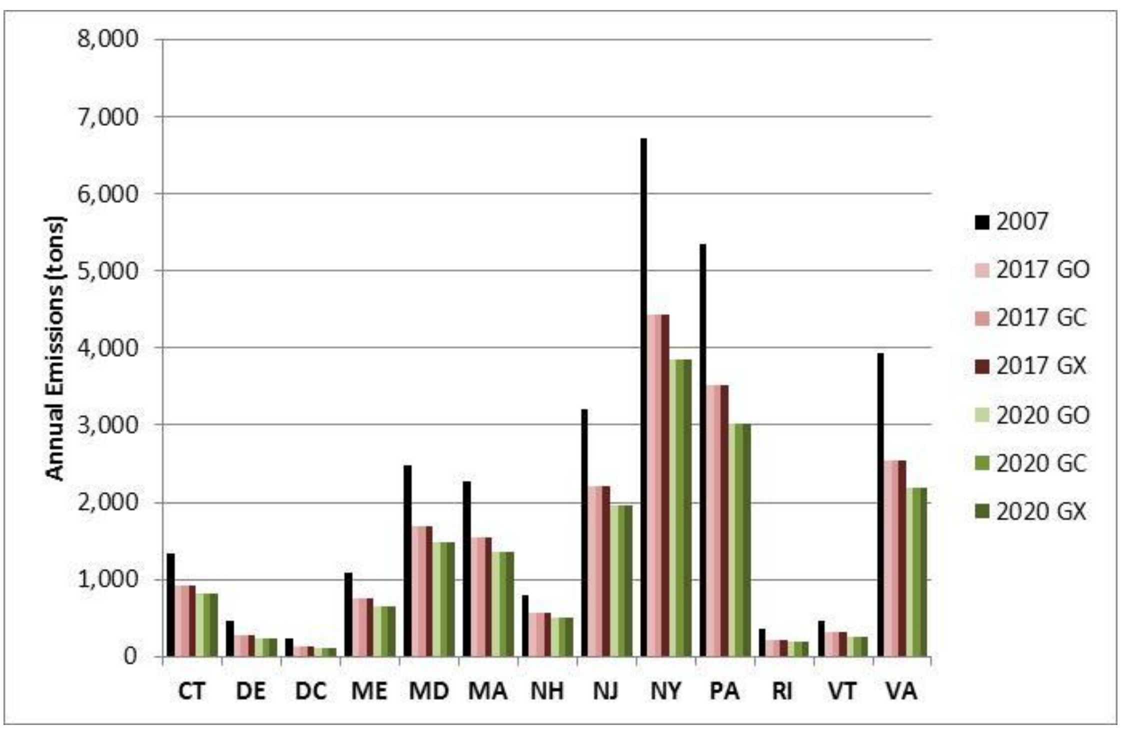


Exhibit 8.20 2007/2013/2017/2020 NMIM/NONROAD SO2 Emissions by State (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	802	30	30	30	32	32	32
DE	266	7	7	7	7	7	7
DC	196	3	3	3	3	3	3
ME	416	16	16	16	17	17	17
MD	1,436	36	36	36	38	38	38
MA	1,377	41	41	41	44	44	44
NH	441	16	16	16	18	18	18
NJ	1,905	55	55	55	58	58	58
NY	3,957	118	118	118	126	126	126
PA	2,972	84	84	84	86	86	86
RI	211	7	7	7	7	7	7
VT	202	7	7	7	7	7	7
VA	2,284	90	90	90	94	94	94
	16,464	**511**	**511**	**511**	**537**	**537**	**537**

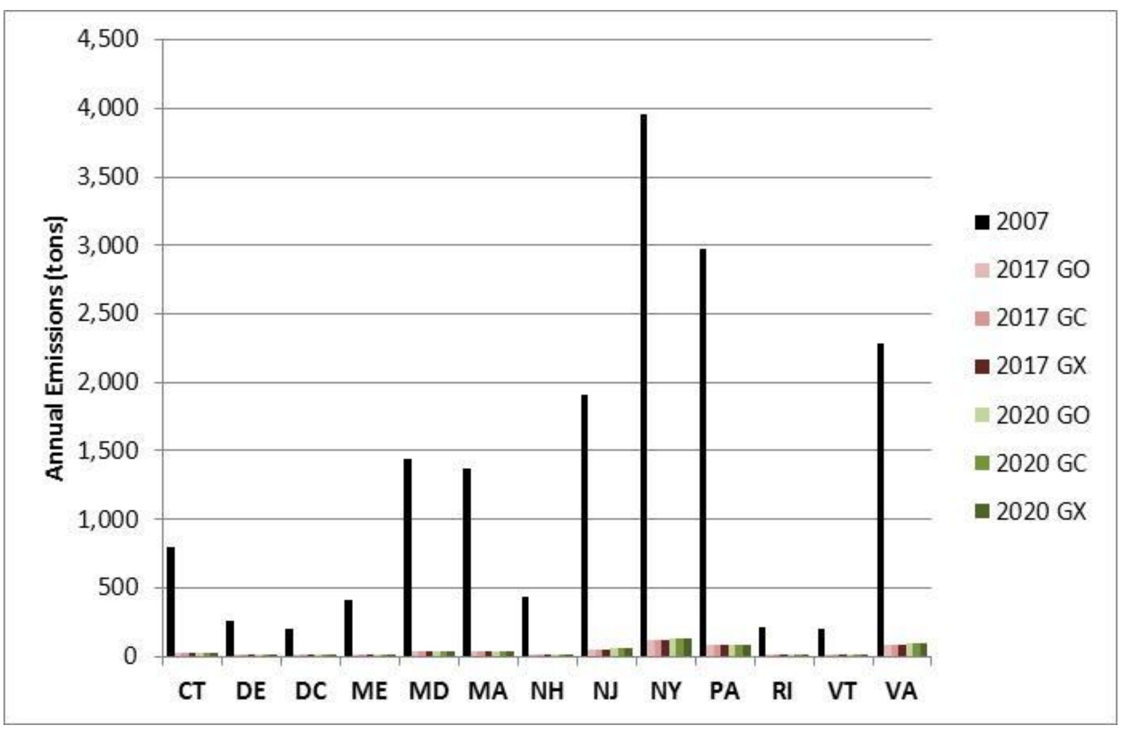
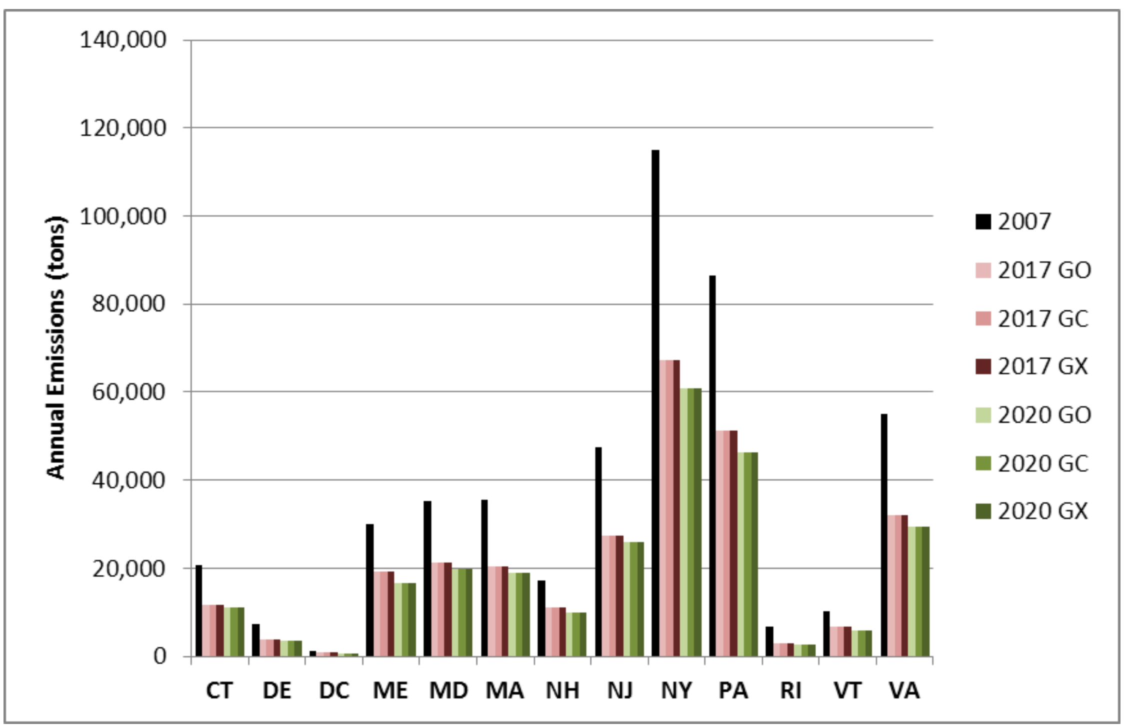


Exhibit 8.21 2007/2013/2017/2020 NMIM/NONROAD VOC Emissions by State (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	20,721	11,803	11,803	11,803	10,985	10,985	10,985
DE	7,157	3,888	3,888	3,888	3,498	3,498	3,498
DC	1,324	749	749	749	710	710	710
ME	29,880	19,303	19,303	19,303	16,729	16,729	16,729
MD	35,160	21,226	21,226	21,226	19,890	19,890	19,890
MA	35,676	20,510	20,510	20,510	18,990	18,990	18,990
NH	17,108	11,030	11,030	11,030	9,785	9,785	9,785
NJ	47,521	27,430	27,430	27,430	25,802	25,802	25,802
NY	114,935	67,238	67,238	67,238	60,945	60,945	60,945
PA	86,397	51,382	51,382	51,382	46,399	46,399	46,399
RI	6,721	2,885	2,885	2,885	2,657	2,657	2,657
VT	10,339	6,714	6,714	6,714	5,864	5,864	5,864
VA	55,135	32,141	32,141	32,141	29,303	29,303	29,303
	468,074	**276,299**	**276,299**	**276,299**	**251,556**	**251,556**	**251,556**



8.4 NONROAD COMMERCIAL MARINE VESSEL EMISSIONS

Exhibits 8.22 to 8.28 summarize the 2007 and projected future year commercial marine vessel emissions by state for each criteria air pollutant. Seven values are listed for each pollutant:

- 2007 emissions
- 2017 projected emissions with growth only (GO)
- 2017 projected emissions with growth and existing controls (GC)
- 2017 projected emissions with growth, existing and potential new OTC controls (GX)
- 2020 projected emissions with growth only (GO)
- 2020 projected emissions with growth and existing controls (GC)
- 2020 projected emissions with growth, existing and potential new OTC controls (GX)

Detailed summaries by County and SCC are provided on MARAMA's ftp site.

Emissions of all pollutants except NH3 are projected to decrease as a result of Federal rules affecting Category 1 / 2 and Category 3 marine engines, including more stringent engine emission standards and sulfur in fuel limitations. There are currently no potential new OTC control measures for commercial marine vessels.

Exhibit 8.22 presents a state-level comparison of 2007, 2017 and 2020 annual CO emissions for commercial marine vessels. Emissions decrease by about 13 percent from 2007 to 2017, and 12 percent from 2007 to 2020.

Exhibit 8.23 shows that there are very little NH3 emissions from this sector.

Exhibit 8.24 shows that annual NOx emissions from commercial marine vessels decrease by 32 percent from 2007 to 2017 and 40 percent from 2007 to 2020.

Exhibits 9.25 and 9.26 show that annual PM10-PRI and PM2.5-PRI emissions from commercial marine vessels decrease substantially after 2007. For both pollutants, emissions are reduced by about 57 percent from 2007 to 2017 and 66 percent from 2007 to 2020.

Exhibit 8.27 shows that that annual SO2 emissions from commercial marine vessels decrease dramatically after 2007. SO2 emissions are reduced by about 89 percent from 2007 to 2017 and 93 percent from 2007 to 2020.

Exhibit 8.28 shows that annual VOC emissions from commercial marine vessels decrease by 15 percent from 2007 to 2017, and 20 percent from 2007 to 2020.

Exhibit 8.22 2007 and Projected CO Emissions for CMV (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	1,078	1,073	912	912	1,102	908	908
DE	554	543	485	485	554	484	484
DC	1	1	1	1	1	1	1
ME	522	521	438	438	536	435	435
MD	2,795	2,792	2,350	2,350	2,871	2,337	2,337
MA	1,473	1,475	1,232	1,232	1,518	1,225	1,225
NH	89	84	83	83	85	84	84
NJ	1,619	2,202	2,067	2,067	2,427	2,254	2,254
NY	3,476	3,452	2,961	2,961	3,541	2,949	2,949
PA	1,294	1,283	1,106	1,106	1,315	1,102	1,102
RI	522	523	437	437	538	434	434
VT	0	0	0	0	0	0	0
VA	3,735	3,731	3,166	3,166	3,831	3,150	3,150
	17,156	**17,681**	**15,238**	**15,238**	**18,319**	**15,363**	**15,363**

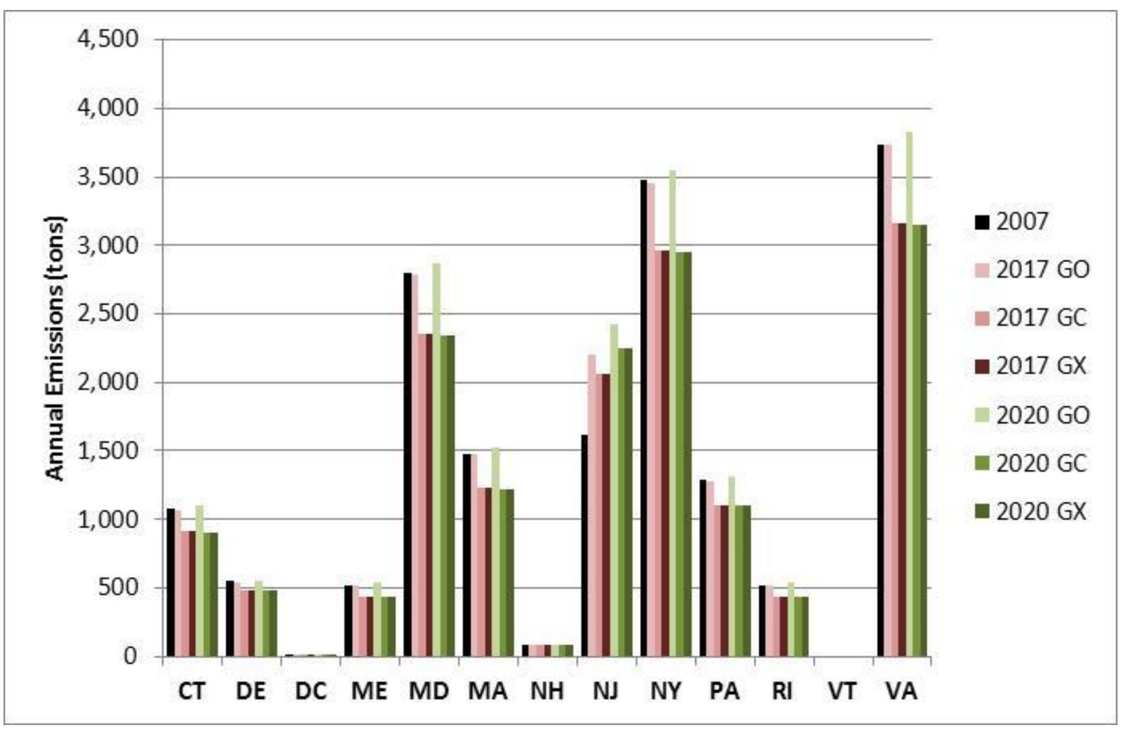


Exhibit 8.23 2007 and Projected NH3 Emissions for CMV (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	3	3	3	3	3	3	3
DE		0	0	0	0	0	0
DC	0	0	0	0	0	0	0
ME		0	0	0	0	0	0
MD	8	8	8	8	8	8	8
MA		0	0	0	0	0	0
NH		0	0	0	0	0	0
NJ	8	11	11	11	12	12	12
NY	2	2	2	2	2	2	2
PA	13	12	12	12	13	13	13
RI	1	1	1	1	1	1	1
VT	0	0	0	0	0	0	0
VA	9	9	9	9	9	9	9
	44	**46**	**46**	**46**	**47**	**47**	**47**

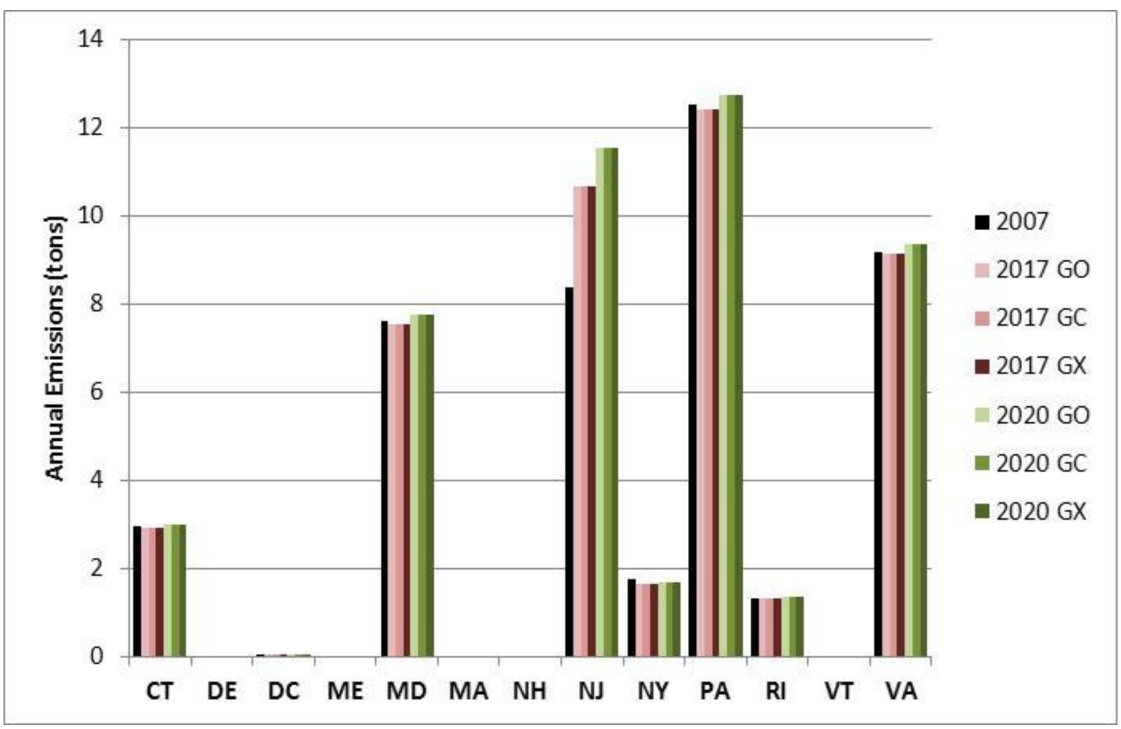


Exhibit 8.24 2007 and Projected NOx Emissions for CMV (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	6,528	6,454	4,162	4,162	6,608	3,642	3,642
DE	5,095	4,966	3,217	3,217	5,054	2,857	2,857
DC	6	6	4	4	6	3	3
ME	1,659	1,638	1,057	1,057	1,676	926	926
MD	16,027	15,929	10,256	10,256	16,343	8,922	8,922
MA	3,246	3,247	2,086	2,086	3,340	1,803	1,803
NH	271	258	169	169	260	154	154
NJ	11,197	15,318	11,140	11,140	16,906	10,251	10,251
NY	28,180	27,913	17,990	17,990	28,598	15,709	15,709
PA	11,378	11,237	7,249	7,249	11,498	6,350	6,350
RI	2,829	2,825	1,816	1,816	2,904	1,572	1,572
VT	0	0	0	0	0	0	0
VA	21,760	21,643	14,445	14,445	22,172	12,750	12,750
	108,175	**111,435**	**73,591**	**73,591**	**115,365**	**64,937**	**64,937**

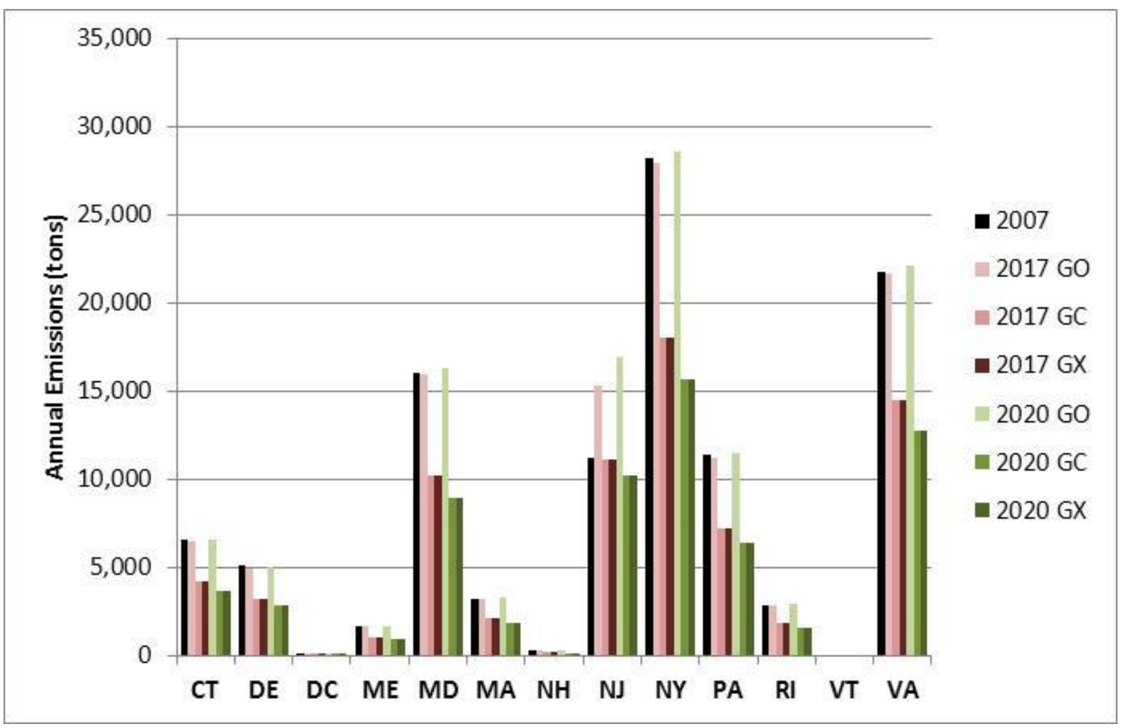


Exhibit 8.25 2007 and Projected PM10-PRI Emissions for CMV (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	312	305	124	124	310	101	101
DE	327	315	99	99	319	75	75
DC	0	0	0	0	0	0	0
ME	395	384	144	144	391	114	114
MD	657	649	301	301	664	251	251
MA	316	315	162	162	323	138	138
NH	13	12	3	3	13	2	2
NJ	622	887	244	244	989	241	241
NY	1,671	1,649	753	753	1,686	626	626
PA	524	511	197	197	519	158	158
RI	112	112	55	55	115	47	47
VT	0	0	0	0	0	0	0
VA	947	934	461	461	953	394	394
	5,897	**6,072**	**2,543**	**2,543**	**6,283**	**2,146**	**2,146**

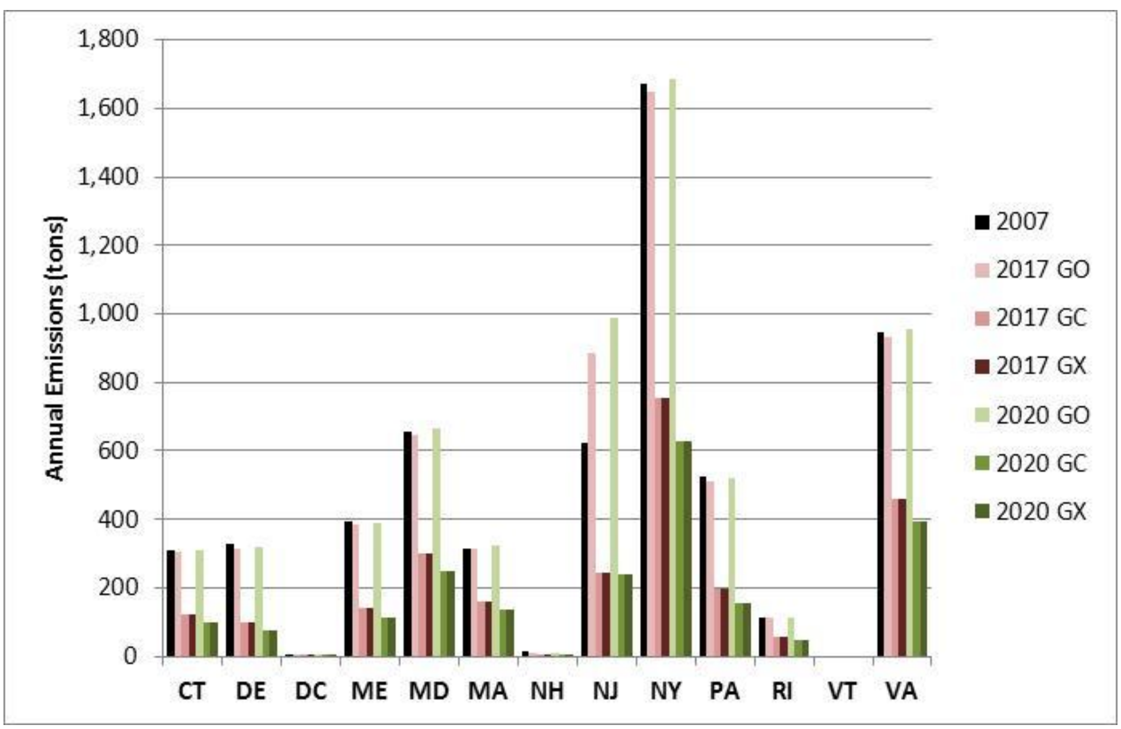


Exhibit 8.26 2007 and Projected PM25-PRI Emissions for CMV (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	296	290	119	119	295	97	97
DE	305	294	93	93	297	70	70
DC	0	0	0	0	0	0	0
ME	364	354	132	132	359	105	105
MD	606	600	285	285	614	239	239
MA	290	289	149	149	297	127	127
NH	12	11	3	3	12	2	2
NJ	575	820	225	225	915	223	223
NY	1,541	1,520	695	695	1,555	578	578
PA	484	472	183	183	480	146	146
RI	108	107	53	53	110	45	45
VT	0	0	0	0	0	0	0
VA	908	896	446	446	915	383	383
	5,491	**5,654**	**2,384**	**2,384**	**5,851**	**2,016**	**2,016**

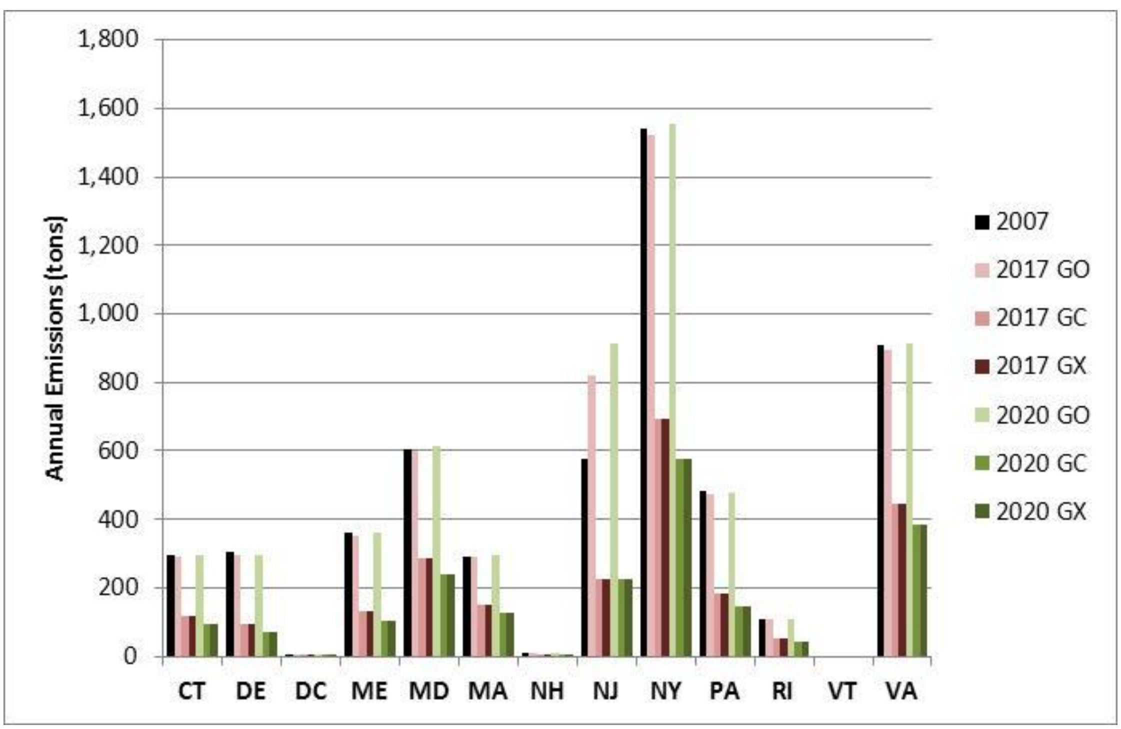


Exhibit 8.27 2007 and Projected SO2 Emissions for CMV (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	1,386	1,327	147	147	1,341	60	60
DE	2,079	1,984	225	225	2,000	84	84
DC	1	1	0	0	1	0	0
ME	189	185	17	17	189	12	12
MD	2,170	2,099	217	217	2,128	109	109
MA	698	684	64	64	698	42	42
NH	506	482	55	55	486	20	20
NJ	6,712	10,085	403	403	11,405	452	452
NY	9,321	9,181	821	821	9,383	601	601
PA	3,067	2,909	343	343	2,925	111	111
RI	632	607	66	66	613	28	28
VT	0	0	0	0	0	0	0
VA	4,058	3,928	940	940	3,969	747	747
	30,820	**33,473**	**3,296**	**3,296**	**35,139**	**2,268**	**2,268**

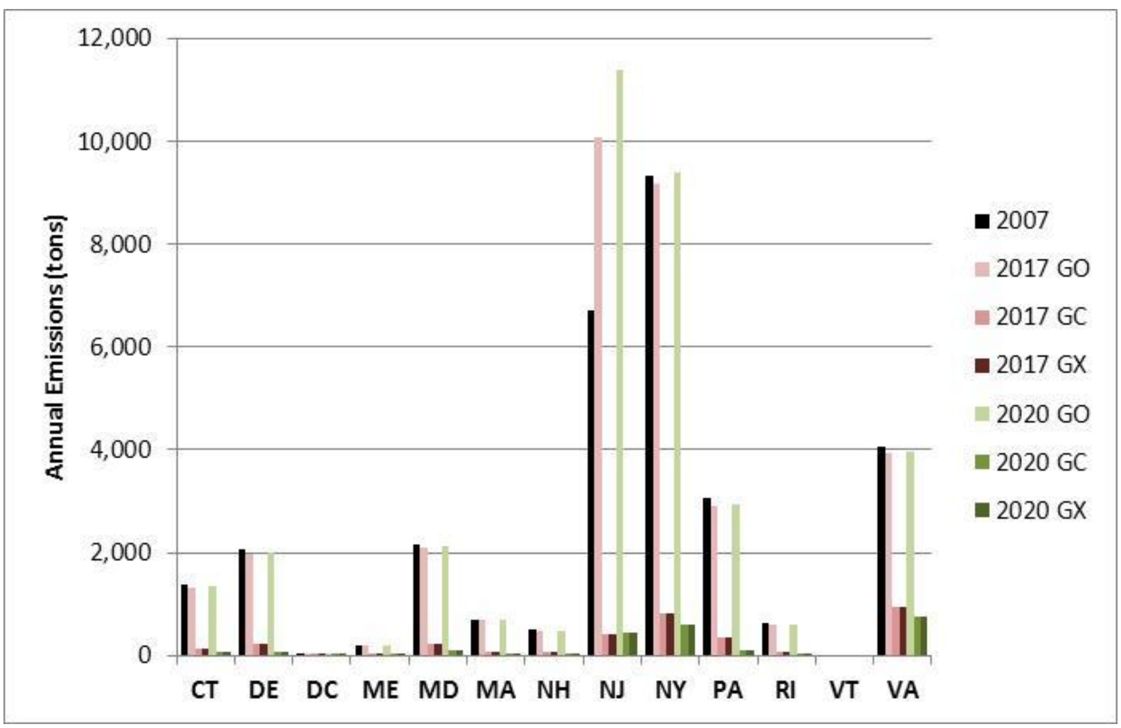
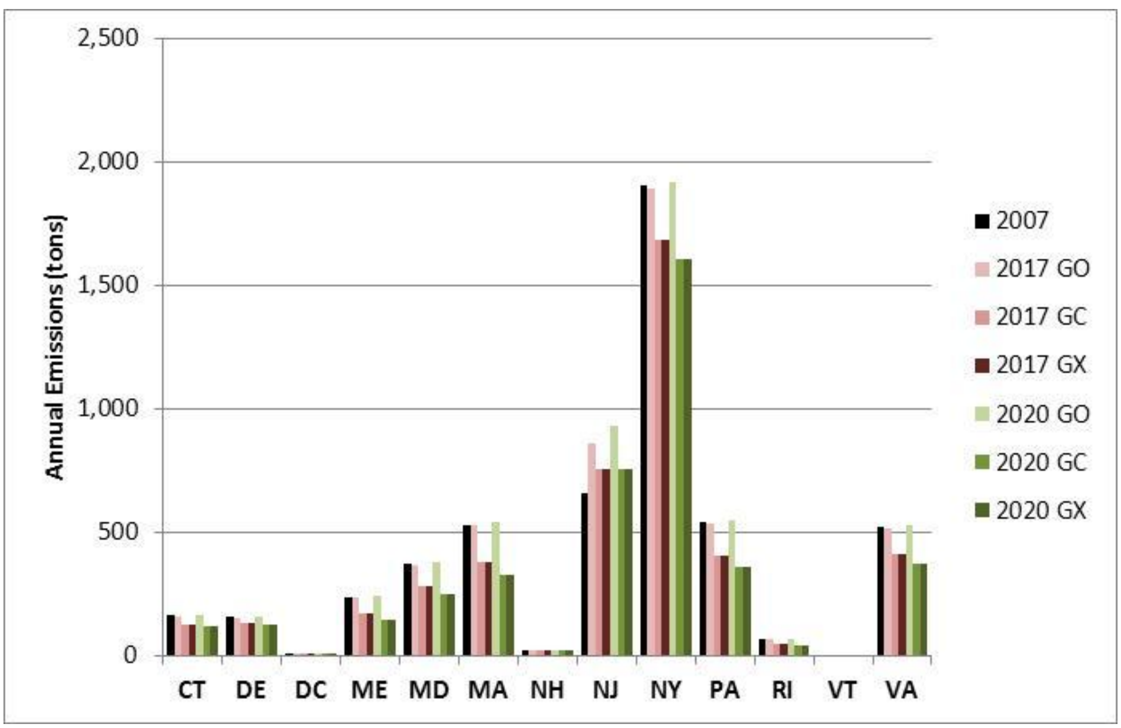


Exhibit 8.28 2007 and Projected VOC Emissions for CMV (tons)

State	2007 2007	2017 Growth Only 2017 GO	2017 Growth & Existing Controls 2017 GC	2017 Growth & Existing & New OTC Controls 2017 GX	2020 Growth Only 2020 GO	2020 Growth & Existing Controls 2020 GC	2020 Growth & Existing & New OTC Controls 2020 GX
CT	161	158	127	127	162	117	117
DE	158	153	133	133	156	127	127
DC	0	0	0	0	0	0	0
ME	234	234	168	168	240	145	145
MD	371	367	282	282	376	252	252
MA	528	529	381	381	544	328	328
NH	23	21	21	21	22	21	21
NJ	658	857	753	753	933	754	754
NY	1,906	1,895	1,681	1,681	1,918	1,606	1,606
PA	538	534	406	406	547	360	360
RI	64	64	47	47	66	42	42
VT	0	0	0	0	0	0	0
VA	523	518	409	409	530	370	370
	5,164	**5,331**	**4,410**	**4,410**	**5,493**	**4,121**	**4,121**



8.5 NONROAD AIRPORT EMISSIONS

Exhibits 9.29 to 9.35 summarize the 2007 and projected future year airport emissions by state for each criteria air pollutant. Seven values are listed for each pollutant:

- 2007 emissions
- 2017 projected emissions with growth only (GO)
- 2017 projected emissions with growth and existing controls (GC)
- 2017 projected emissions with growth, existing and potential new OTC controls (GX)
- 2020 projected emissions with growth only (GO)
- 2020 projected emissions with growth and existing controls (GC)
- 2020 projected emissions with growth, existing and potential new OTC controls (GX)

Detailed summaries by County and SCC are provided on MARAMA's ftp site.

There were no NH3 emissions reported for airport operations. Emissions of other pollutants are projected to change as a result of changes in airline activity levels. No state or Federal rules were identified that would reduce emissions from aircraft operations in the future. There are currently no potential new OTC control measures for airports.

CO, PM10, PM2.5 and VOC emissions are projected to remain relatively constant between 2007 levels by 2017. By 2020, the will be a slight increase in emissions from 2007 due to increased operations by 2020.

NOx and SO2 emissions are projected to increase by 7 percent from 2007 levels by 2017 and by 13 percent by 2020 due to increased air traffic.

Exhibit 8.29 2007 and Projected CO Emissions for Airports (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	4,659	4,224	4,224	4,224	4,386	4,386	4,386
DE	1,625	1,550	1,550	1,550	1,593	1,593	1,593
DC	14	14	14	14	14	14	14
ME	32,879	32,774	32,774	32,774	32,802	32,802	32,802
MD	10,265	10,042	10,042	10,042	10,335	10,335	10,335
MA	15,495	14,592	14,592	14,592	14,940	14,940	14,940
NH	2,089	1,861	1,861	1,861	1,883	1,883	1,883
NJ	21,878	21,837	21,837	21,837	22,411	22,411	22,411
NY	17,403	18,579	18,579	18,579	19,706	19,706	19,706
PA	26,540	26,165	26,165	26,165	27,345	27,345	27,345
RI	1,739	2,255	2,255	2,255	2,280	2,280	2,280
VT	2,420	2,100	2,100	2,100	2,127	2,127	2,127
VA	22,009	22,689	22,689	22,689	23,190	23,190	23,190
	159,016	**158,684**	**158,684**	**158,684**	**163,012**	**163,012**	**163,012**

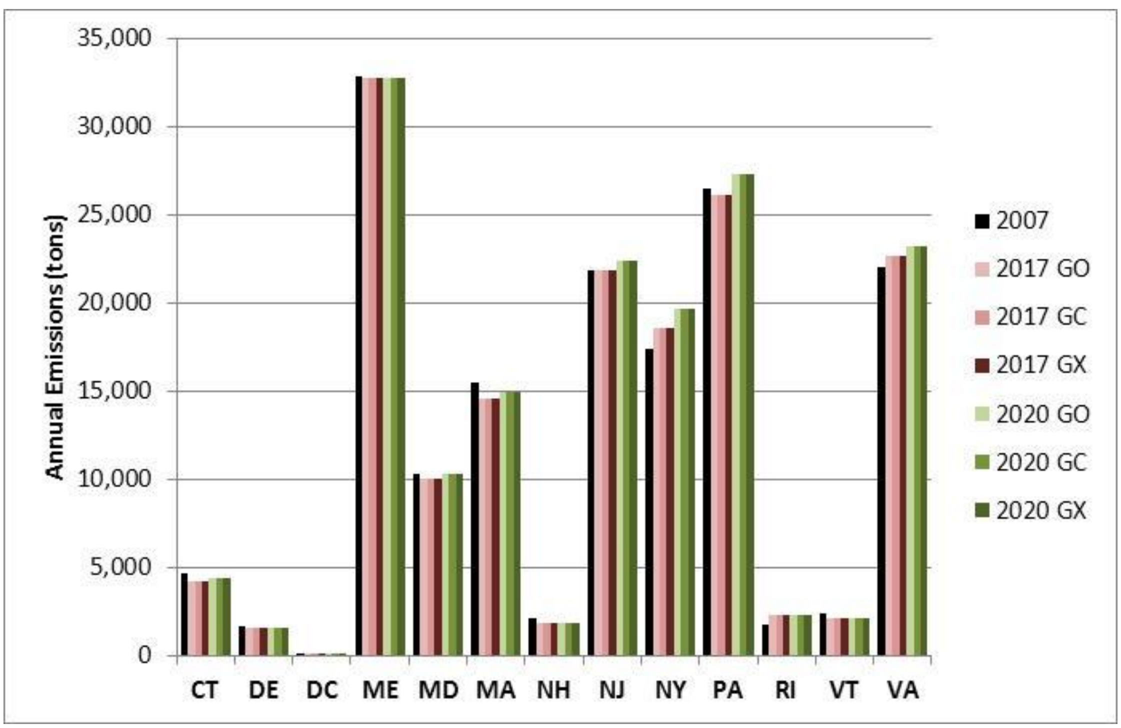


Exhibit 8.30 2007 and Projected NH3 Emissions for Airports (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	0	0	0	0	0	0	0
DE	0	0	0	0	0	0	0
DC	0	0	0	0	0	0	0
ME	0	0	0	0	0	0	0
MD	0	0	0	0	0	0	0
MA	0	0	0	0	0	0	0
NH	0	0	0	0	0	0	0
NJ	0	0	0	0	0	0	0
NY	0	0	0	0	0	0	0
PA	0	0	0	0	0	0	0
RI	0	0	0	0	0	0	0
VT	0	0	0	0	0	0	0
VA	0	0	0	0	0	0	0
	0	0	0	0	0	0	0

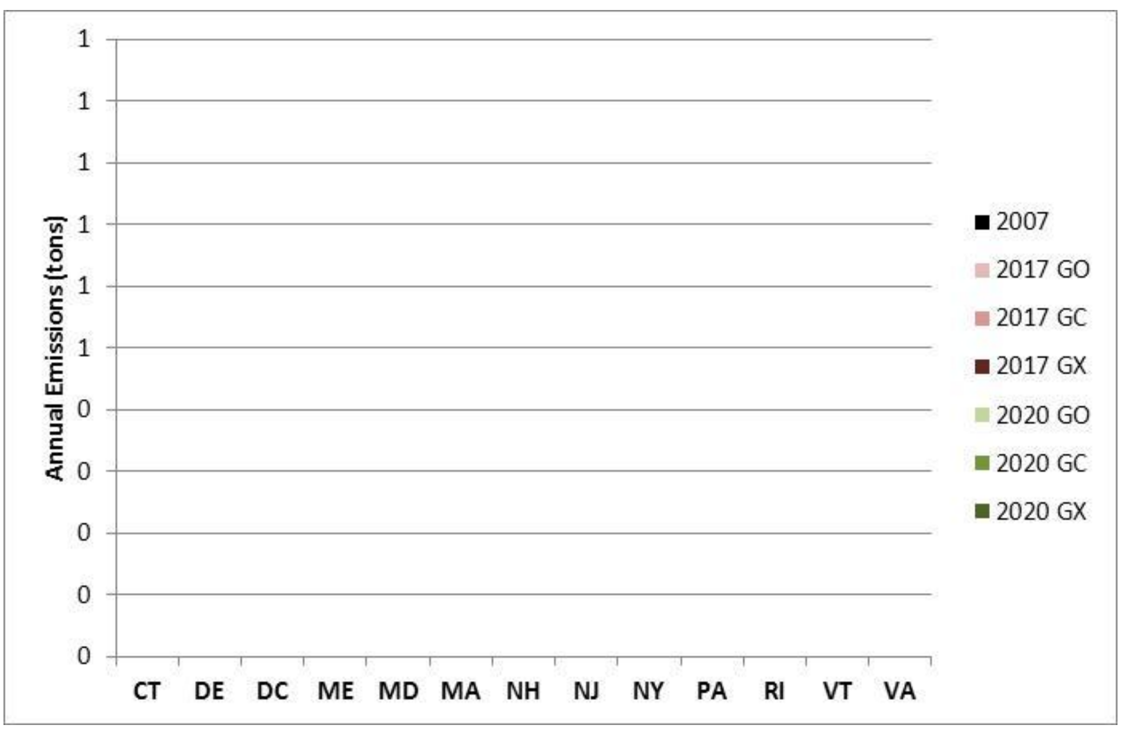


Exhibit 8.31 2007 and Projected NOx Emissions for Airports (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	713	657	657	657	688	688	688
DE	805	801	801	801	802	802	802
DC	0	0	0	0	0	0	0
ME	134	144	144	144	144	144	144
MD	1,910	2,021	2,021	2,021	2,119	2,119	2,119
MA	3,190	3,267	3,267	3,267	3,365	3,365	3,365
NH	278	256	256	256	260	260	260
NJ	5,105	5,408	5,408	5,408	5,612	5,612	5,612
NY	6,998	8,081	8,081	8,081	8,789	8,789	8,789
PA	3,738	4,094	4,094	4,094	4,406	4,406	4,406
RI	289	281	281	281	294	294	294
VT	103	113	113	113	117	117	117
VA	5,520	5,762	5,762	5,762	5,889	5,889	5,889
	28,783	**30,885**	**30,885**	**30,885**	**32,485**	**32,485**	**32,485**

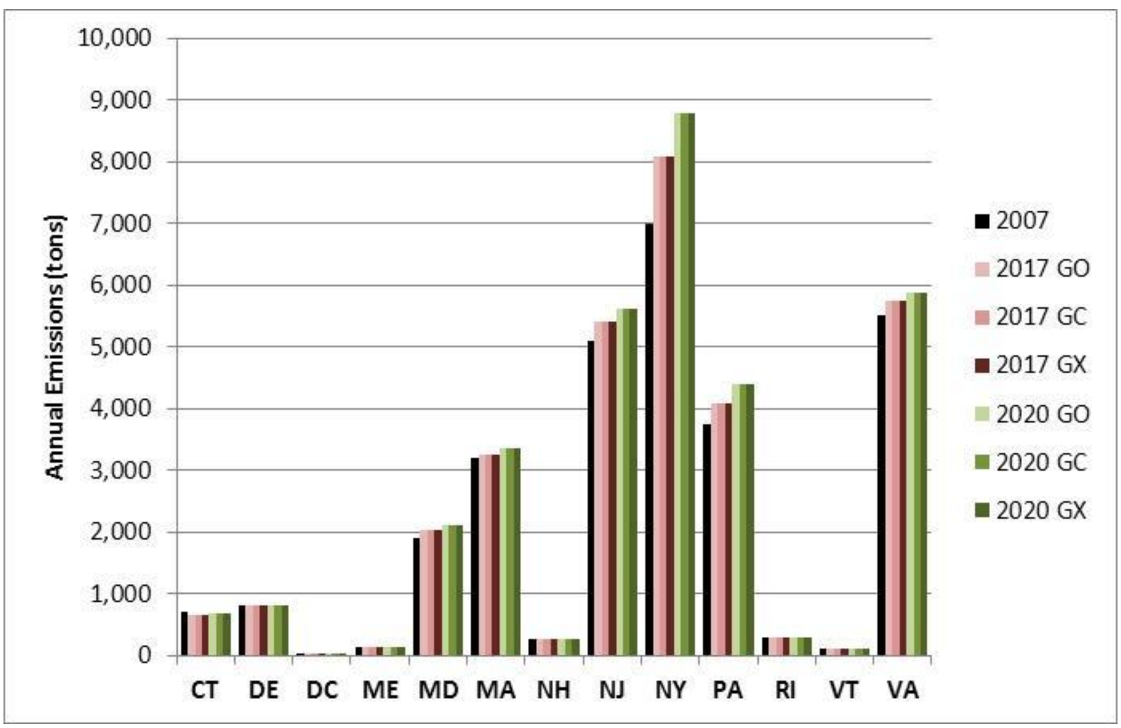


Exhibit 8.32 2007 and Projected PM10-PRI Emissions for Airports (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	66	59	59	59	61	61	61
DE	27	25	25	25	25	25	25
DC	0	0	0	0	0	0	0
ME	83	82	82	82	82	82	82
MD	74	70	70	70	73	73	73
MA	295	284	284	284	289	289	289
NH	37	34	34	34	34	34	34
NJ	170	173	173	173	177	177	177
NY	140	158	158	158	170	170	170
PA	396	385	385	385	400	400	400
RI	22	33	33	33	33	33	33
VT	46	40	40	40	40	40	40
VA	821	840	840	840	847	847	847
	2,176	**2,183**	**2,183**	**2,183**	**2,234**	**2,234**	**2,234**

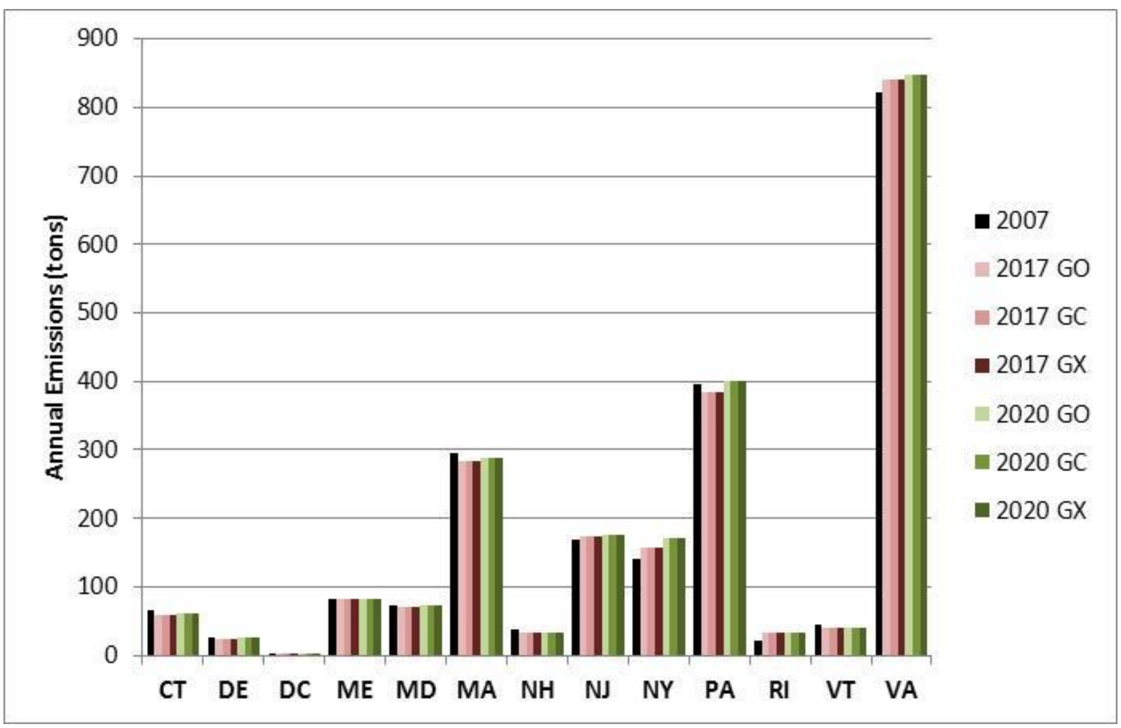


Exhibit 8.33 2007 and Projected PM25-PRI Emissions for Airports (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	51	46	46	46	48	48	48
DE	19	17	17	17	18	18	18
DC	0	0	0	0	0	0	0
ME	61	61	61	61	61	61	61
MD	16	17	17	17	17	17	17
MA	215	208	208	208	212	212	212
NH	27	25	25	25	25	25	25
NJ	143	146	146	146	150	150	150
NY	139	157	157	157	170	170	170
PA	294	288	288	288	300	300	300
RI	17	25	25	25	25	25	25
VT	32	28	28	28	29	29	29
VA	580	595	595	595	601	601	601
	1,595	**1,613**	**1,613**	**1,613**	**1,656**	**1,656**	**1,656**

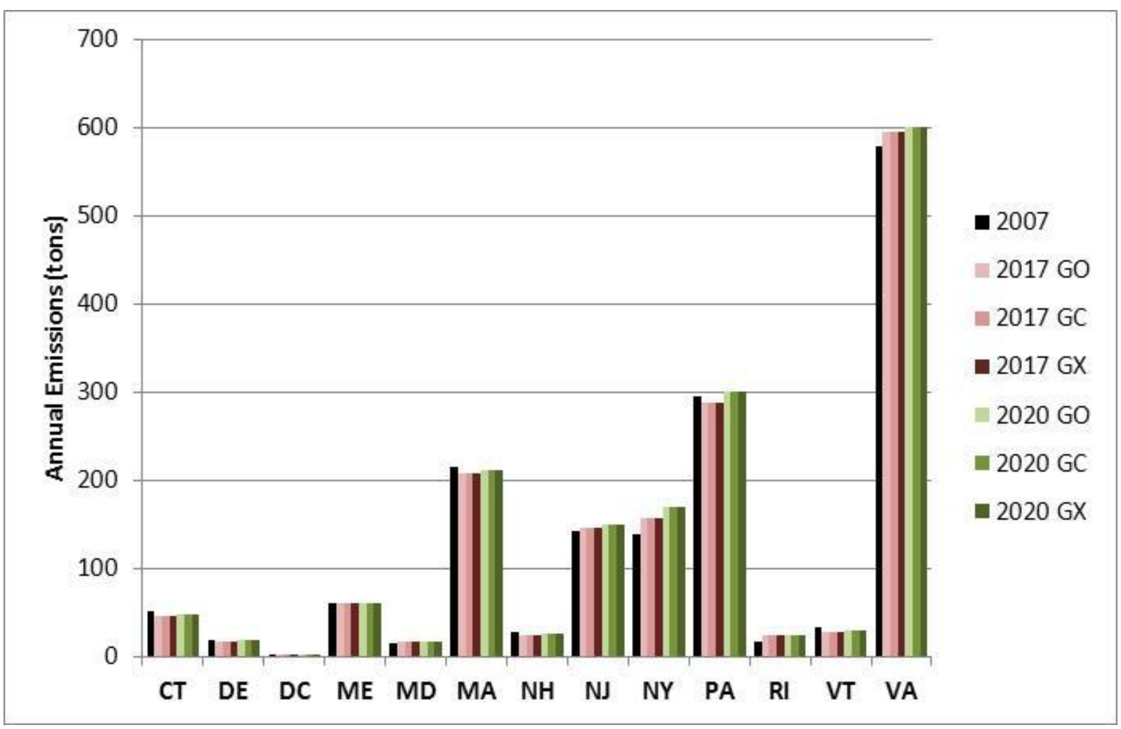


Exhibit 8.34 2007 and Projected SO2 Emissions for Airports (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	96	87	87	87	91	91	91
DE	55	55	55	55	55	55	55
DC	0	0	0	0	0	0	0
ME	14	16	16	16	16	16	16
MD	247	255	255	255	266	266	266
MA	218	226	226	226	236	236	236
NH	28	26	26	26	26	26	26
NJ	507	534	534	534	557	557	557
NY	699	808	808	808	877	877	877
PA	416	455	455	455	488	488	488
RI	30	29	29	29	31	31	31
VT	12	13	13	13	13	13	13
VA	424	455	455	455	466	466	466
	2,746	**2,959**	**2,959**	**2,959**	**3,122**	**3,122**	**3,122**

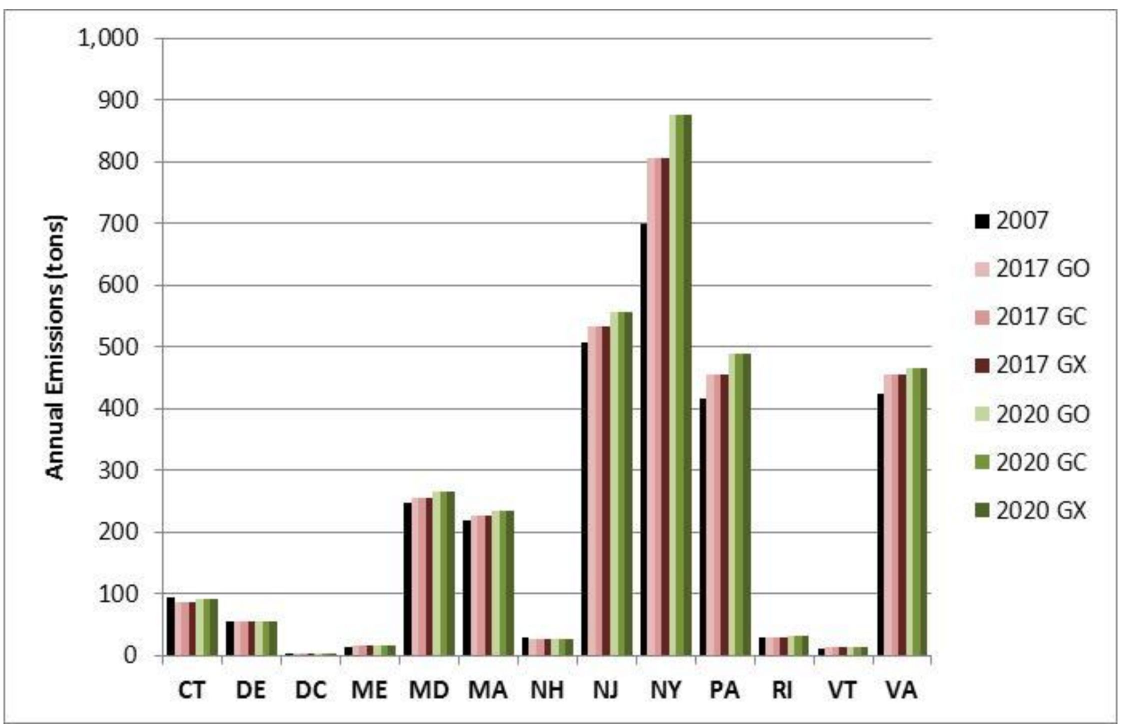
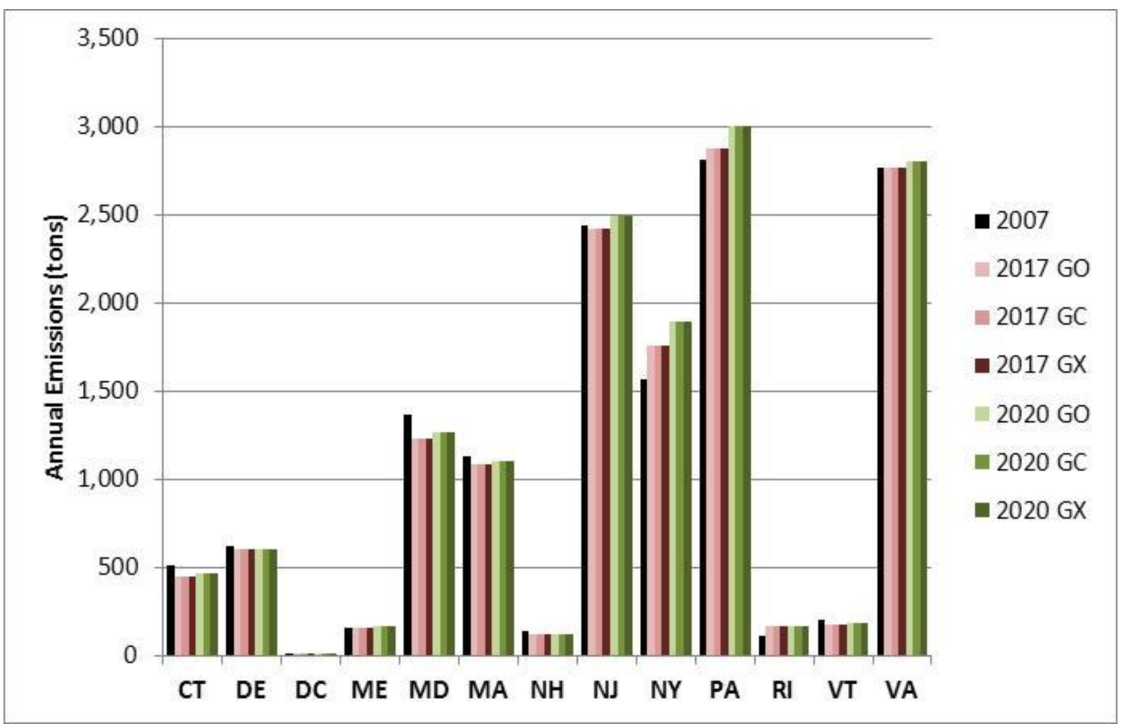


Exhibit 8.35 2007 and Projected VOC Emissions for Airports (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	509	452	452	452	469	469	469
DE	620	598	598	598	600	600	600
DC	1	1	1	1	1	1	1
ME	161	161	161	161	162	162	162
MD	1,365	1,228	1,228	1,228	1,265	1,265	1,265
MA	1,129	1,080	1,080	1,080	1,105	1,105	1,105
NH	134	116	116	116	118	118	118
NJ	2,438	2,426	2,426	2,426	2,498	2,498	2,498
NY	1,571	1,761	1,761	1,761	1,896	1,896	1,896
PA	2,813	2,879	2,879	2,879	3,004	3,004	3,004
RI	112	166	166	166	168	168	168
VT	204	179	179	179	181	181	181
VA	2,764	2,764	2,764	2,764	2,802	2,802	2,802
	13,822	**13,813**	**13,813**	**13,813**	**14,269**	**14,269**	**14,269**



8.6 NONROAD RAILROAD LOCOMOTIVE EMISSIONS

Exhibits 9.36 to 9.42 summarize the 2007 and projected future year railroad locomotive emissions by state for each criteria air pollutant. Seven values are listed for each pollutant:

- 2007 emissions
- 2017 projected emissions with growth only (GO)
- 2017 projected emissions with growth and existing controls (GC)
- 2017 projected emissions with growth, existing and potential new OTC controls (GX)
- 2020 projected emissions with growth only (GO)
- 2020 projected emissions with growth and existing controls (GC)
- 2020 projected emissions with growth, existing and potential new OTC controls (GX)

Detailed summaries by County and SCC are provided on MARAMA's ftp site.

Emissions of all pollutants except CO and NH3 are projected to decrease as a result of Federal rules affecting railroad locomotive engines, including more stringent engine emission standards and sulfur in fuel limitations. There are currently no potential new OTC control measures for railroad locomotives.

Exhibit 8.36 presents a state-level comparison of 2007, 2017 and 2020 annual CO emissions for railroad locomotives. CO emissions show small changes (< 7 percent) between 2007 and 2017/2020.

Exhibit 8.37 shows that there are very little NH3 emissions from this sector.

Exhibit 8.38 shows that annual NOx emissions from railroad locomotives decrease by 33 percent from 2007 to 2017, and 39 percent from 2007 to 2020.

Exhibits 9.39 and 9.40 show that annual PM10-PRI and PM2.5-PRI emissions from railroad locomotives decrease substantially after 2007. For both pollutants, emissions are reduced by about 49 percent from 2007 to 2017, and 57 percent from 2007 to 2020.

Exhibit 8.41 shows that SO2 emissions from railroad locomotives are virtually eliminatd by 2017.

Exhibit 8.42 shows that annual VOC emissions from railroad locomotives decrease by 42 percent from 2007 to 2017 and 50 percent from 2007 to 2020.

Exhibit 8.36 2007 and Projected CO Emissions for Railroads (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	184	198	188	188	206	193	193
DE	75	76	76	76	79	79	79
DC	73	75	75	75	78	77	77
ME	188	191	191	191	198	198	198
MD	700	720	713	713	746	736	736
MA	646	695	662	662	723	679	679
NH	88	90	90	90	93	93	93
NJ	665	780	744	744	818	771	771
NY	3,061	3,181	3,122	3,122	3,298	3,220	3,220
PA	2,987	3,044	3,041	3,041	3,149	3,145	3,145
RI	15	15	15	15	16	16	16
VT	72	74	74	74	76	76	76
VA	2,701	2,758	2,750	2,750	2,854	2,843	2,843
	11,456	**11,899**	**11,741**	**11,741**	**12,333**	**12,126**	**12,126**

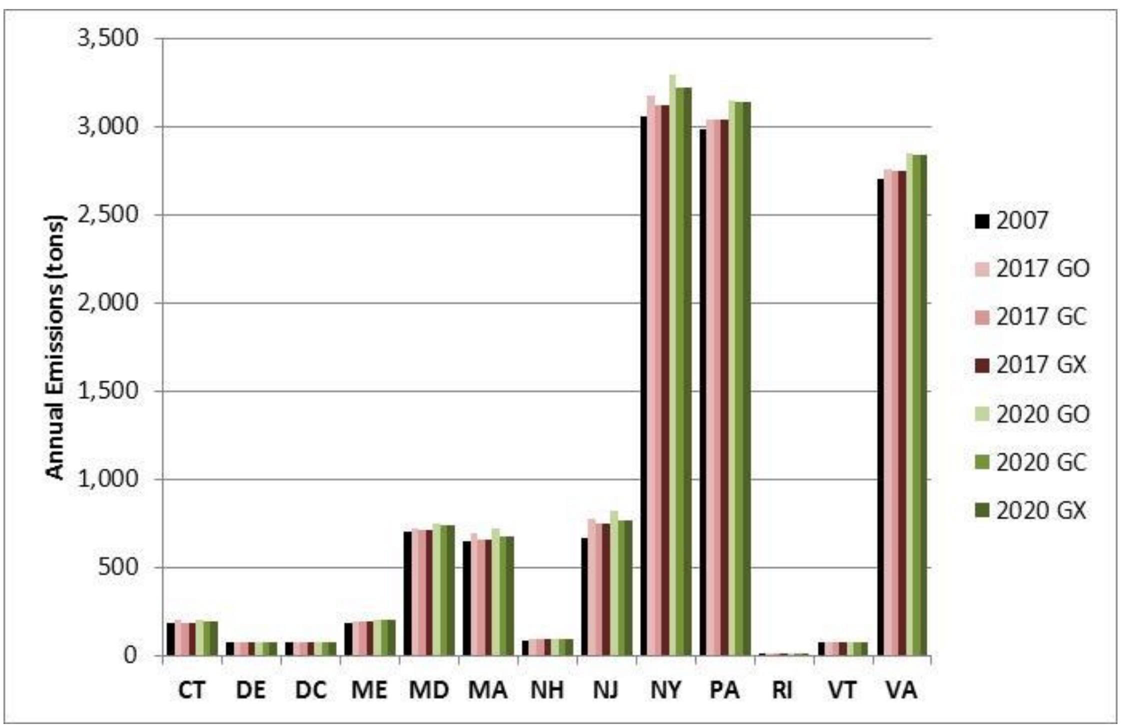


Exhibit 8.37 2007 and Projected NH3 Emissions for Railroads (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	1	1	1	1	1	1	1
DE	0	0	0	0	0	0	0
DC	0	0	0	0	0	0	0
ME	0	0	0	0	0	0	0
MD	0	0	0	0	0	0	0
MA	2	2	2	2	2	2	2
NH	0	0	0	0	0	0	0
NJ	2	2	2	2	3	3	3
NY	0	1	1	1	1	1	1
PA	9	9	9	9	10	10	10
RI	0	0	0	0	0	0	0
VT	0	0	0	0	0	0	0
VA	8	8	8	8	9	9	9
	23	**24**	**24**	**24**	**25**	**25**	**25**

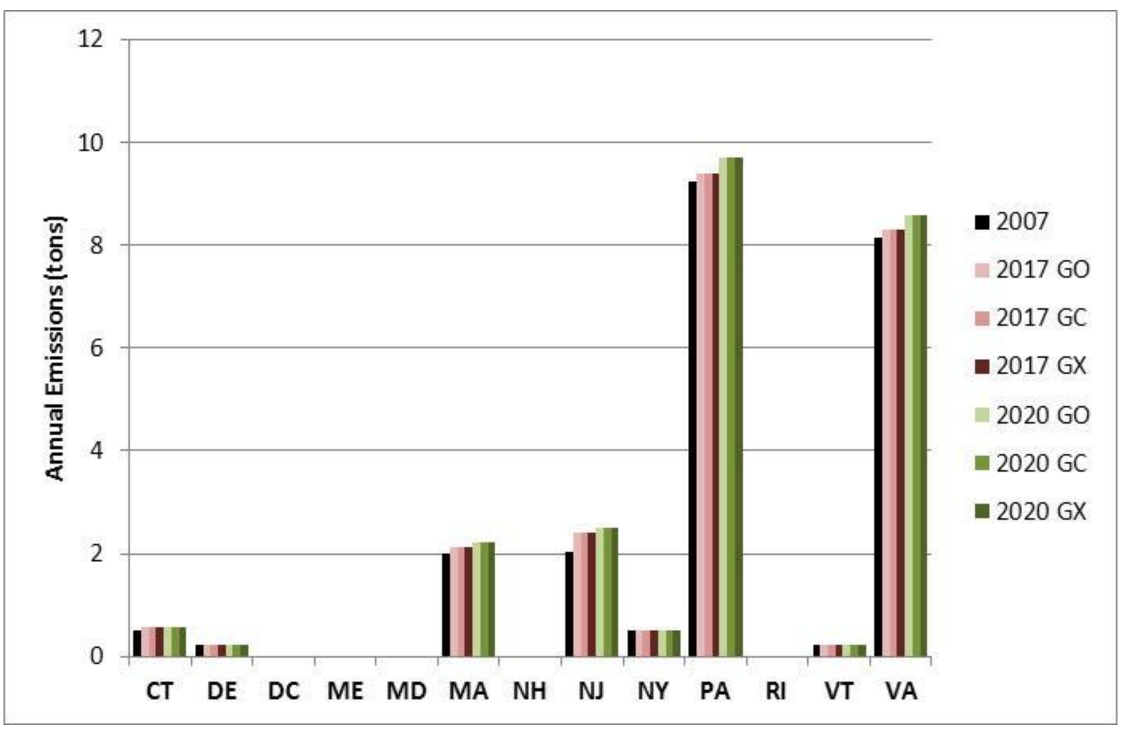


Exhibit 8.38 2007 and Projected NOx Emissions for Railroads (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	1,723	1,866	1,088	1,088	1,942	991	991
DE	384	391	279	279	404	256	256
DC	505	521	353	353	540	322	322
ME	1,369	1,394	1,289	1,289	1,442	1,262	1,262
MD	4,767	4,904	3,127	3,127	5,078	2,815	2,815
MA	6,133	6,623	3,743	3,743	6,893	3,368	3,368
NH	891	907	871	871	939	864	864
NJ	5,957	6,982	3,839	3,839	7,323	3,469	3,469
NY	20,675	21,473	13,144	13,144	22,259	11,782	11,782
PA	20,675	21,080	14,413	14,413	21,808	13,174	13,174
RI	144	147	99	99	152	90	90
VT	736	749	719	719	775	713	713
VA	18,319	18,728	12,061	12,061	19,381	10,856	10,856
	82,279	**85,765**	**55,025**	**55,025**	**88,936**	**49,960**	**49,960**

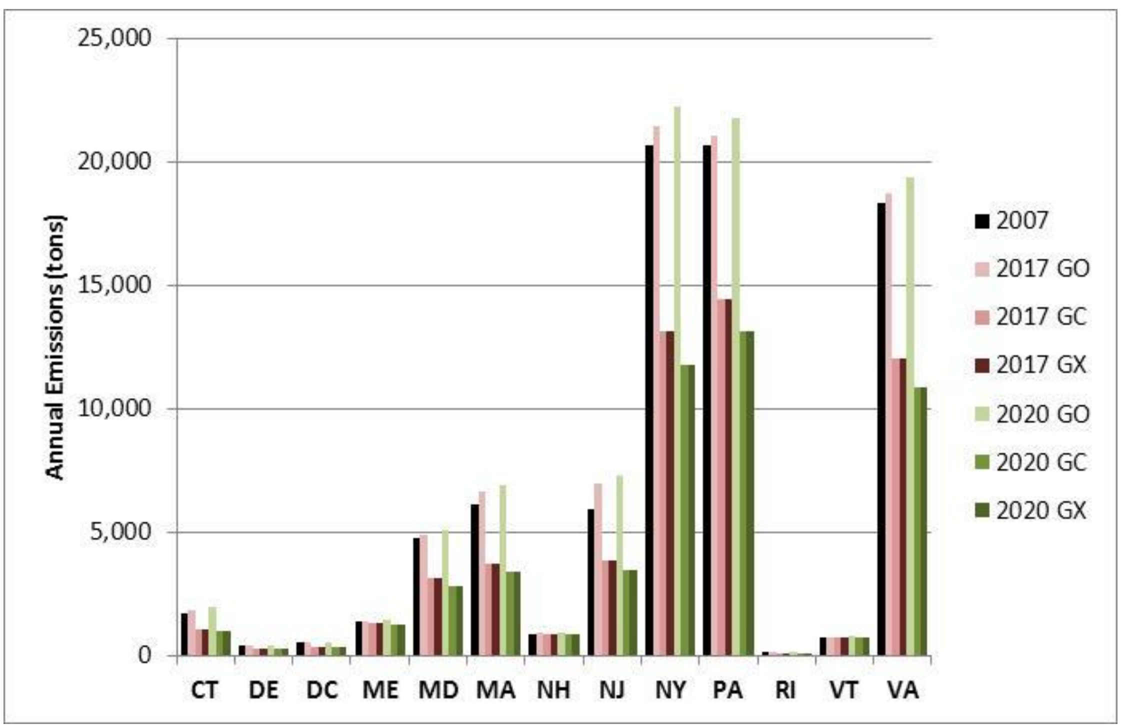


Exhibit 8.39 2007 and Projected PM10-PRI Emissions for Railroads (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	46	49	27	27	51	23	23
DE	15	16	8	8	16	7	7
DC	12	12	6	6	13	6	6
ME	28	28	22	22	29	21	21
MD	166	171	80	80	177	68	68
MA	159	171	84	84	178	71	71
NH	22	22	18	18	23	17	17
NJ	160	187	89	89	196	75	75
NY	608	631	295	295	654	249	249
PA	704	717	356	356	742	309	309
RI	4	4	2	2	4	2	2
VT	18	18	15	15	19	14	14
VA	634	648	303	303	670	257	257
	2,574	**2,675**	**1,303**	**1,303**	**2,772**	**1,119**	**1,119**

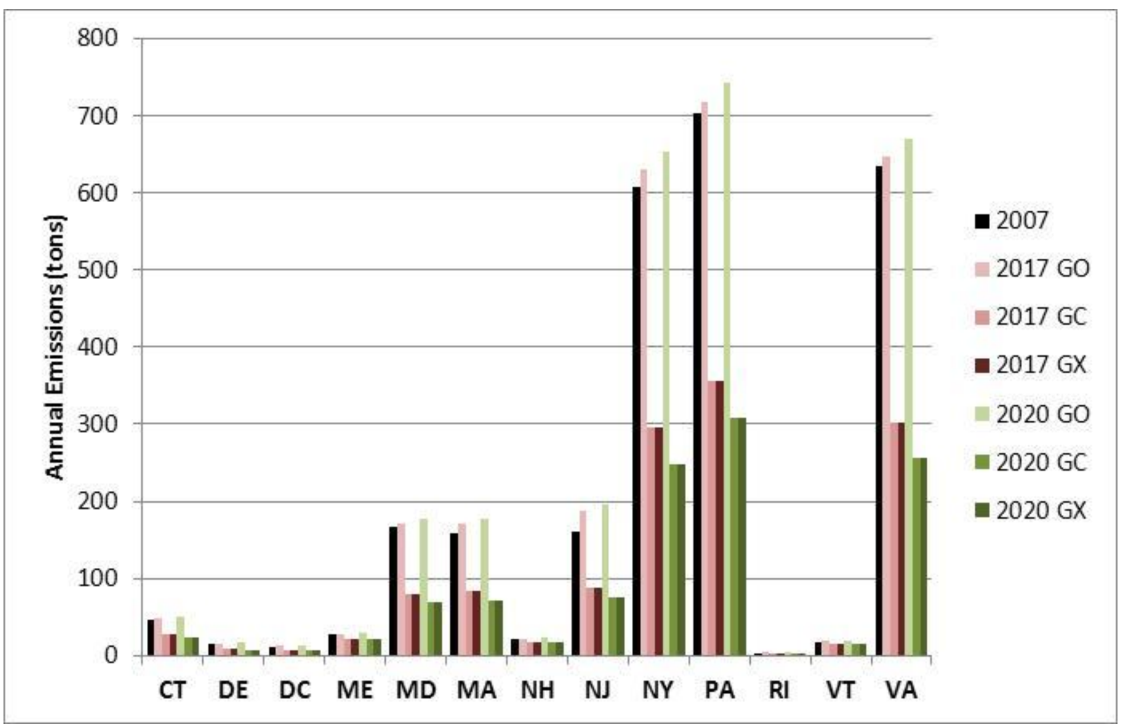


Exhibit 8.40 2007 and Projected PM25-PRI Emissions for Railroads (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	39	42	22	22	44	19	19
DE	15	15	8	8	16	7	7
DC	11	12	6	6	12	6	6
ME	25	26	20	20	27	19	19
MD	161	166	78	78	172	66	66
MA	145	157	77	77	163	65	65
NH	21	21	17	17	22	17	17
NJ	147	173	82	82	181	69	69
NY	572	595	278	278	616	235	235
PA	650	663	330	330	686	286	286
RI	3	3	2	2	3	1	1
VT	17	17	13	13	18	13	13
VA	586	599	280	280	620	238	238
	2,395	**2,488**	**1,213**	**1,213**	**2,579**	**1,041**	**1,041**

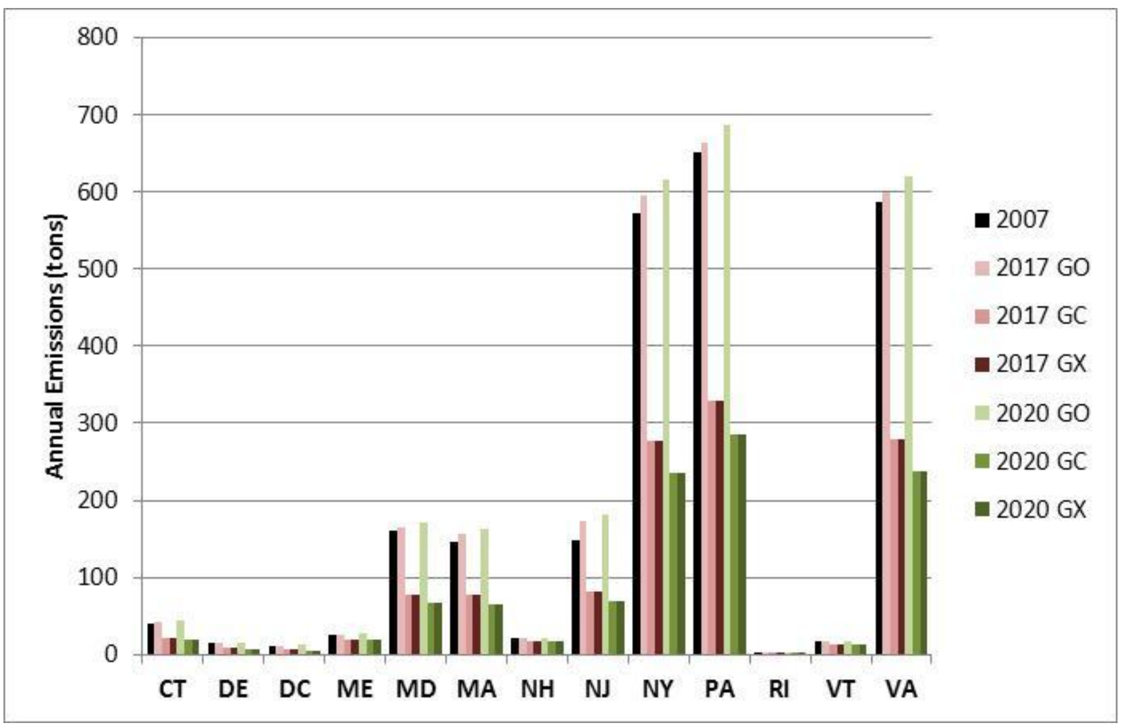


Exhibit 8.41 2007 and Projected SO2 Emissions for Railroads (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	57	61	5	5	64	5	5
DE	5	5	0	0	6	0	0
DC	37	38	0	0	39	0	0
ME	92	94	0	0	97	0	0
MD	64	66	0	0	68	0	0
MA	66	70	0	0	73	0	0
NH	10	10	0	0	11	0	0
NJ	52	61	0	0	64	0	0
NY	616	641	2	2	665	2	2
PA	211	216	1	1	223	1	1
RI	5	6	0	0	6	0	0
VT	5	5	0	0	5	0	0
VA	192	196	1	1	203	1	1
	1,413	**1,469**	**9**	**9**	**1,522**	**10**	**10**

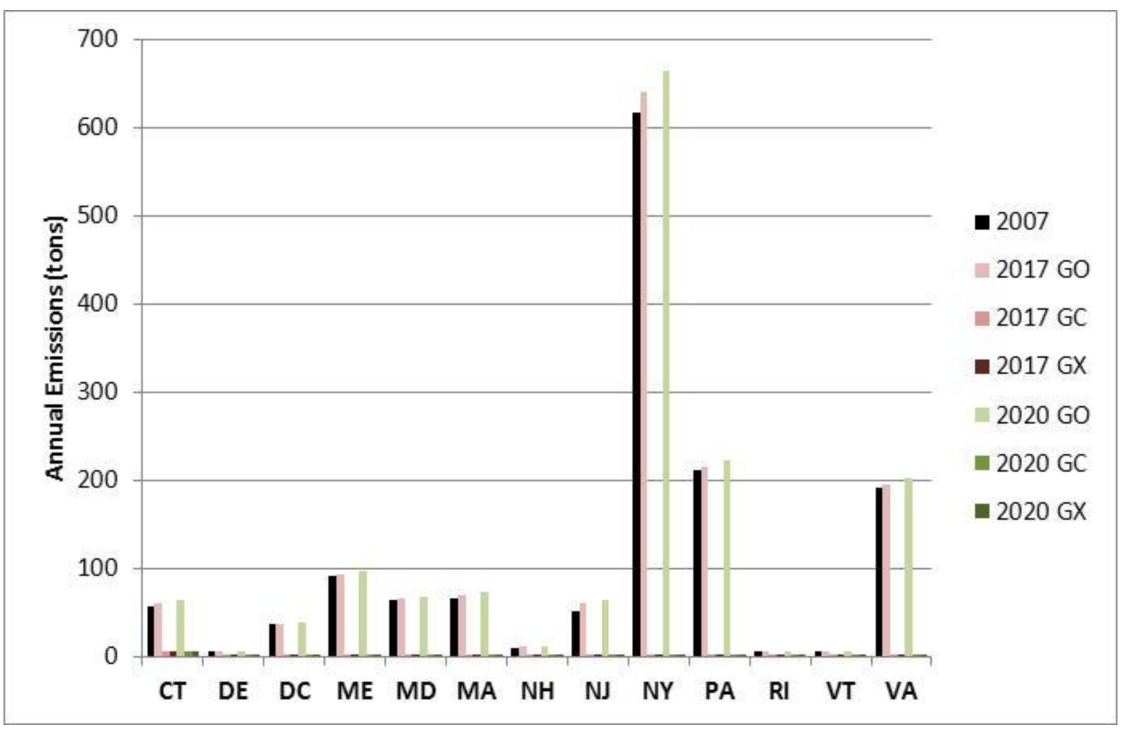
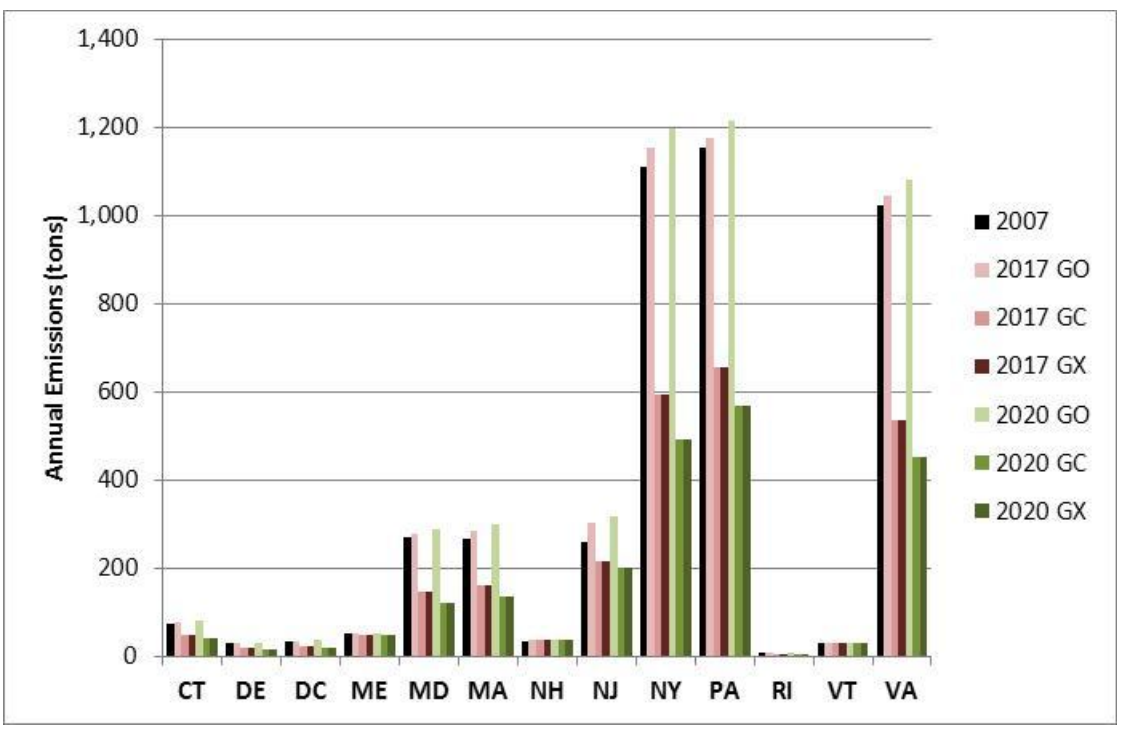


Exhibit 8.42 2007 and Projected VOC Emissions for Railroads (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	73	79	49	49	82	42	42
DE	28	29	17	17	30	15	15
DC	34	35	23	23	36	20	20
ME	51	51	47	47	53	47	47
MD	271	279	146	146	289	122	122
MA	267	286	162	162	298	135	135
NH	35	36	36	36	37	37	37
NJ	258	302	216	216	317	200	200
NY	1,112	1,155	596	596	1,197	493	493
PA	1,153	1,176	655	655	1,216	569	569
RI	8	8	4	4	8	4	4
VT	29	29	29	29	30	30	30
VA	1,025	1,047	537	537	1,083	451	451
	4,343	**4,511**	**2,519**	**2,519**	**4,676**	**2,167**	**2,167**



9.0 PREPARATION OF SMOKE MODEL FILES

Air quality modelers in the Mid-Atlantic and Northeastern states use the SMOKE Modeling System to create gridded, speciated, hourly emissions for input into a variety of air quality models. This section describes how the SMOKE inventory files were developed. It also describes how the SMOKE the temporal allocation, speciation, and spatial allocation profiles, respectively, were developed. . SMOKE inventory files were created for the following types of sources (which are described in Section 1.3):

9.1 NONEGU POINT SOURCE SMOKE EMISSION FILES

Annual nonEGU point source inventories were prepared in SMOKE PTINV ORL format.

9.2 AREA SOURCE SMOKE EMISSION FILES

Annual area source inventories for 2017 and 2020 were prepared in SMOKE ARINV ORL format. In developing the SMOKE ARINV ORL files for area sources, the USEPA "transport factor" was applied to reduce fugitive dust emissions to account for the removal of particles near their emission source by vegetation and surface features. The transport factor was NOT applied to the NIF-formatted annual emissions, but only to the SMOKE ARINV ORL-formatted file.

The standard transport fractions and SCC assignments from the USEPA CHIEF website (USEPA 2007c) were used to reduce the PM10-PRI and PM25-PRI emissions in the area source inventories. Two files were used. The first file contains a list of SCCs for which the transport factor was applied. The major source categories included paved and unpaved roads, construction activity, agricultural crop land tilling, and agricultural livestock operations. The second file contains the transport factor which varies by county. For example, in Connecticut the transport fraction ranges from 0.21 in Tolland County to 0.44 in New Haven County.

Applying the transport factor to area source fugitive dust emissions significantly reduces that amount of particulate matter included in the air quality modeling. Region wide, PM10-PRI emissions are reduced by about 54 percent and PM25-PRI emissions are reduced by about 25 percent by applying the transport fraction. The percent reduction varies by state due to the relative importance of the area source fugitive dust emissions compared to non-fugitive dust source emissions.

9.3 NONROAD NMIM SMOKE EMISSION FILES

As discussed in Section 7, the NMIM/NONROAD model was executed using specifications to generate monthly emission files. Monthly SMOKE ARINV ORL files were created. Average day emissions were calculated by dividing the NONROAD generated monthly emissions by the number of days in each month. Summary reports were prepared to verify agreement between the average day, monthly, and annual emissions.

9.4 NONROAD MAR SMOKE EMISSION FILES

Annual inventories for marine vessels, airport operations and railroad locomotives were prepared in SMOKE ARINV ORL format for each county in the region. Average day emissions were calculated by dividing the annual emissions by 365 days. The ORL files for Category 3 commercial marine vessels include only the emissions that occur in state waters (generally from the shoreline to 3–10 nautical miles from shore).

10.0 FINAL DELIVERABLES

Exhibits 10.1 to10.3 identify the deliverable products for the 2017 and 2020 MANE-VU+VA emission inventories developed by MACTEC under this contract. The exhibit also identifies deliverables associated with the 2017 and 2020 MANE-VU+VA inventories under development by other agencies.

Files are stored on MARAMA ftp site:

Address: ftp.marama.org

Login ID: regionalei

Password: marama2007

Files are stored in the following directories:

\MARAMA 07-17-20 Version 3\Final 2017 2020 (Version 3_3)/NIF

\MARAMA 07-17-20 Version 3\Final 2017 2020 (Version 3_3)/SMOKE

\MARAMA 07-17-20 Version 3\Final 2017 2020 (Version 3_3)/TSD

\MARAMA 07-17-20 Version 3\Final 2017 2020 (Version 3_3)/XLS

The contents of each folder are provided in Exhibits 10.1, 10.2, and 10.3.

Exhibit 10.1 – NIF Data Files for the 2017/2020 MANE-VU+VA Emission Inventories

File Description	File Name	Format	Notes
2017 Annual Point Source Emission Inventory in NOF format	MANEVU+VA_V3_3 Point_2017_NOF.mdb	NOF ACCESS	File includes only those point sources classified as "nonEGU" according to the ERTAC definition. See file for Field Definitions
2020 Annual Point Source Emission Inventory in NOF format	MANEVU+VA_V3_3 Point_2020_NOF.mdb	NOF ACCESS	
2017 Annual Area Source Emission Inventory in NOF format	MANEVU+VA_V3_3 Area_2017_NOF.mdb	NOF ACCESS	See file for Field Definitions
2020 Annual Area Source Emission Inventory in NOF format	MANEVU+VA_V3_3 Area_2020_NOF.mdb	NOF ACCESS	See file for Field Definitions
2017 Annual NMIM/NONROAD Emission Inventory in NOF format	2017MARAMANMIMv3.mdb	NOF ACCESS	See file for Field Definitions
2020 Annual NMIM/NONROAD Emission Inventory in NOF format	2020MARAMANMIMv3.mdb	NOF ACCESS	See file for Field Definitions
2017 Annual MAR Emission Inventory in NOF format	MANEVU+VA_V3_3_MAR_2017_NOF.mdb	NOF ACCESS	See file for Field Definitions
2020 Annual MAR Emission Inventory in NOF format	MANEVU+VA_V3_3_MAR_2020_NOF.mdb	NOF ACCESS	See file for Field Definitions

Exhibit 10.2 – Summary Spreadsheet Files for the 2017/2020 MANE-VU+VA Emission Inventories

File Description	File Name	Format	Notes
County/SCC level emissions for all 2017/2020 scenarios	V3_3 Area_07_17_20.xlsx	MS EXCEL	See file for Field Definitions
Excel summary of emissions by State and SCC for 2017	MANEVU+VA_V3_3_Area_2017_ExistingControls_StateSCCSummaries.xlsx	MS EXCEL	See file for Field Definitions
Excel summary of emissions by State and SCC for 2017	MANEVU+VA_V3_3_Area_2017_What IfControls_StateSCCSummaries.xlsx	MS EXCEL	See file for Field Definitions
Excel summary of emissions by State and SCC for 2020	MANEVU+VA_V3_3_Area_2020_ExistingControls_StateSCCSummaries.xlsx	MS EXCEL	See file for Field Definitions
Excel summary of emissions by State and SCC for 2020	MANEVU+VA_V3_3_Area_2020_What IfControls_StateSCCSummaries.xlsx	MS EXCEL	See file for Field Definitions
Tables and graphs used in the TSD	TSD V3_3 2017_2020 Area Graphs.xlsx	MS EXCEL	See file for Field Definitions
County/SCC level emissions for all 2017/2020 scenarios	V3_3 MAR_07_17_20.xlsx	MS EXCEL	See file for Field Definitions
Excel summary of emissions by State and SCC for 2017	MANEVU+VA_V3_3_MAR_2017_StateSCCSummaries.xlsx	MS EXCEL	See file for Field Definitions
Excel summary of emissions by State and SCC for 2020	MANEVU+VA_V3_3_MAR_2020_StateSCCSummaries.xlsx	MS EXCEL	See file for Field Definitions
Tables and graphs used in the TSD	TSD V3_3 2017_2020 MAR Graphs.xlsx	MS EXCEL	See file for Field Definitions
Process level emissions for all 2017/2020 scenarios	V3_3 NonEGU_07_17_20.xlsx	MS EXCEL	See file for Field Definitions
Excel summary of emissions by State and SCC for 2017	MANEVU+VA_V3_3_NonEGU_2017_ExistingControls_StateSCCSummaries.xlsx	MS EXCEL	See file for Field Definitions
Excel summary of emissions by State and SCC for 2017	MANEVU+VA_V3_3_NonEGU_2017_What IfControls_StateSCCSummaries.xlsx	MS EXCEL	See file for Field Definitions
Excel summary of emissions by State and SCC for 2020	MANEVU+VA_V3_3_NonEGU_2020_ExistingControls_StateSCCSummaries.xlsx	MS EXCEL	See file for Field Definitions

Excel summary of emissions by State and SCC for 2020	MANEVU+VA_V3_3_NonEGU_2020_What IfControls_StateSCCSummaries.xlsx	MS EXCEL	See file for Field Definitions
Tables and graphs used in the TSD	TSD V3_3 2017_2020 NonEGU Graphs.xlsx	MS EXCEL	See file for Field Definitions
Excel summary of emissions by State and SCC for 2017	MANEVU+VA_V3_3_NMIM_2017_StateSCCSummaries.xlsx	MS EXCEL	See file for Field Definitions
Excel summary of emissions by State and SCC for 2020	MANEVU+VA_V3_3_NMIM_2020_StateSCCSummaries.xlsx	MS EXCEL	See file for Field Definitions
Tables and graphs used in the TSD	TSD V3_3 2017_2020 NMIM Graphs.xlsx	MS EXCEL	See file for Field Definitions

Exhibit 10.2 – SMOKE Files for the 2013/2017/2020 MANE-VU+VA Emission Inventories

File Description	File Name	Format	Notes
2017 Annual Point Source Emission Inventory in SMOKE ORL format	PTINV_2017_NonHourly_ExistingControls_Jan2012.orl	SMOKE PTINV ORL	Files includes only those point sources classified as "nonEGU" according to the ERTAC definition. See file for Field Definitions
2017 Annual Point Source Emission Inventory in SMOKE ORL format	PTINV_2017_NonHourly_WhatIfControls_Jan2012.orl	SMOKE PTINV ORL	
2020 Annual Point Source Emission Inventory in SMOKE ORL format	PTINV_2020_NonHourly_ExistingControls_Jan2012.orl	SMOKE PTINV ORL	
2020 Annual Point Source Emission Inventory in SMOKE ORL format	PTINV_2020_NonHourly_WhatIfControls_Jan2012.orl	SMOKE PTINV ORL	
2017 Annual Area Source Emission Inventory in SMOKE ORL format	ARINV_2017_Area_ExistingControls_Jan2012.orl	SMOKE ARINV ORL Nonpoint	These files have the PM transport factors by county applied to the NOF emissions. See section 10.2 for discussion. See http://www.smoke-model.org/version2.6/html/ for file format
2017 Annual Area Source Emission Inventory in SMOKE ORL format	ARINV_2017_Area_WhatIfControls_Jan2012.orl	SMOKE ARINV ORL Nonpoint	
2020 Annual Area Source Emission Inventory in SMOKE ORL format	ARINV_2020_Area_ExistingControls_Jan2012.orl	SMOKE ARINV ORL nonpoint	
2020 Annual Area Source Emission Inventory in SMOKE ORL format	ARINV_2020_Area_WhatIfControls_Jan2012.orl	SMOKE ARINV ORL nonpoint	
2013 Annual MAR Source Emission Inventory in SMOKE ORL format	ARINV_2017_MAR_Jan2012.txt	SMOKE ARINV ORL Nonpoint	See http://www.smoke-model.org/version2.6/html/ for file format
2017 Annual MAR Source Emission Inventory in SMOKE ORL format	ARINV_2020_MAR_Jan2012.txt	SMOKE ARINV ORL Nonpoint	See http://www.smoke-model.org/version2.6/html/ for file format

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