5.0 ATTAINMENT DEMONSTRATION

5.1 Introduction

As discussed in Section 1.0, states are required to submit State Implementation Plan (SIP) revisions that contain attainment demonstrations for their $PM_{2.5}$ nonattainment areas within three years after the effective date of the nonattainment designation. The designation date for both the Northern New Jersey/New York/Connecticut nonattainment area and the Southern New Jersey/Philadelphia nonattainment area was December 17, 2004, with an effective date of April 5, 2005.[1] Therefore, the $PM_{2.5}$ attainment demonstration SIP revision was due to the USEPA by April 5, 2008 (40 C.F.R. § 51.1002; 72 Fed. Reg. 20587, April 25, 2007). These SIPs must demonstrate that the measures and rules contained within them are adequate to provide for the timely attainment and maintenance of the $PM_{2.5}$ National Ambient Air Quality Standard (NAAQS). In accordance with 40 C.F.R. § 51.112, each implementation plan must include:

- A summary of the computations, assumptions, and judgments used to determine the degree of reduction of emissions (or reductions in the growth of emissions) that will result from the implementation of the control strategy;
- A presentation of emission levels expected to result from implementation of each measure of the control strategy;
- A presentation of the air quality levels expected to result from implementation of the overall control strategy showing expected maximum pollutant concentration;
- A description of the dispersion models used to project air quality and to evaluate control strategies; and
- For interstate regions, the analysis from each constituent state must, where practicable, be based upon the same regional emission inventory and air quality baseline.

The attainment demonstration in this proposed SIP revision addresses the 1997 annual $PM_{2.5}$ standard. New Jersey and the other states that share New Jersey's 1997 $PM_{2.5}$ multi-state nonattainment areas have always met and are in attainment with the 1997 daily $PM_{2.5}$ health-based standard of 65 $\mu g/m^3$. According to the USEPA's modeling guidance,[2] since these levels are well below the standard and have continued to improve

[1] 70 Fed. Reg. 944 (January 5, 2005).
[2] USEPA. Guidance on the Use of Models and Other Analyses for Demonstrating Attainment of Air Quality Goals for Ozone, $PM_{2.5}$, and Regional Haze. United States Environmental Protection Agency, Office of Air Quality Planning and Standards, Air Quality Analysis Division, Air Quality Modeling Group, Research Triangle Park, NC, EPA-454/B-07-002, April 2007, page 56.

since 2001 (see Chapter 2), the modeled attainment test for the 1997 daily $PM_{2.5}$ standard is not needed nor is included in this attainment demonstration.

Chapter 4 discussed and summarized Federal, New Jersey and regional efforts to identify control measures. This chapter presents the State's analyses of the impact that the implementation of the control measures identified for attainment, in combination with existing and already on the way measures, have on the State's air quality by 2009. Since this attainment demonstration will show attainment of the $PM_{2.5}$ standard within five years of the date of designation, the State is not required to submit a separate Reasonable Further Progress Plan.[3] Chapter 6 provides for contingencies in the event that either of New Jersey's nonattainment areas fails to reach attainment.

5.2 Photochemical Modeling

5.2.1 Introduction

The USEPA modeling guidance suggests the use of a photochemical model to determine attainment of the fine particulate NAAQS and has created a model which will predict concentrations of both ozone and fine particulate levels within the same modeling run.[4] As such, New Jersey's attainment demonstrations for both Northern New Jersey/New York/Connecticut and the Southern New Jersey/Philadelphia nonattainment areas include the same parameters in the photochemical grid modeling as were used in the modeling runs used to demonstrate attainment of the ozone NAAQS. This analysis is also supplemented by other information to demonstrate that all the monitors in both nonattainment areas are predicted by the photochemical modeling to be in attainment of the $PM_{2.5}$ annual health-based standard by 2010.

The objective of the photochemical modeling test is to enable New Jersey, to analyze the efficacy of various control strategies in reducing air pollution. The Ozone Transport Commission (OTC) on behalf of its member states (which include New Jersey, New York, Connecticut, Delaware, and Pennsylvania) undertook a photochemical modeling study to demonstrate compliance with the 8-hour ozone NAAQS for their multi-state nonattainment areas and built upon these efforts to demonstrate compliance with the annual $PM_{2.5}$ NAAQS. The OTC Modeling Committee directed the 8-hour ozone attainment modeling study. The OTC Modeling Committee consisted of the following workgroups: OTC Photochemical Workgroup, OTC Meteorological Modeling Workgroup, OTC Emissions Inventory Development Workgroup, and the OTC Control Strategy Workgroup. The emissions inventory work was performed in conjunction with the Mid-Atlantic/Northeast Visibility Union (MANE-VU). The OTC Air Directors served on the OTC Oversight Committee and provided oversight of the process. Since the 8-hour ozone modeling was limited to the ozone season (May 1 through September

[3] 72 Fed. Reg. 20666 (April 25, 2007).
[4] USEPA. Guidance on the Use of Models and Other Analyses for Demonstrating Attainment of Air Quality Goals for Ozone, $PM_{2.5}$, and Regional Haze. United States Environmental Protection Agency, Office of Air Quality Planning and Standards, Air Quality Analysis Division, Air Quality Modeling Group, Research Triangle Park, NC, EPA-454/B-07-002, April 2007.

30), additional modeling was needed to demonstrate attainment of the annual $PM_{2.5}$ NAAQS. This additional modeling was performed by the University of Medicine and Dentistry of New Jersey's Ozone Research Center (UMDNJ/ORC), the Northeast States for Coordinated Air Use Management (NESCAUM) and the University of Maryland (UMD).

The remainder of this section discusses the model used in this regional modeling analysis, the specific modeling parameters, including inventory development, and the results of that modeling exercise.

5.2.2 "One-Atmosphere" Air Quality Model

The photochemical model selected for the attainment modeling demonstration was the USEPA's Models-3/Community Multi-scale Air Quality (CMAQ) modeling system. The CMAQ modeling system was selected for the attainment demonstration primarily because it is a photochemical grid model capable of modeling a variety of pollutants over a range of time and space scales, i.e., a "one-atmosphere" photochemical grid model. Not only was CMAQ used to model ozone formation, but also was used to model the components that make up the particles with an aerodynamic diameter less than or equal to a nominal 2.5 micrometers ($PM_{2.5}$) and Regional Haze in the Northeast. The model is capable of calculating the formation of secondary aerosols which are a prime component of fine particulate matter in the northeastern United States. The model is also recommended in the USEPA's Modeling Guidance.[5] All of the regional modeling was conducted in accordance with the USEPA's Modeling Guidance.

Under the direction of the OTC Modeling Committee, several states and modeling centers performed the regional modeling runs and/or contributed to the preparation of technical information for the regional modeling effort. Those organizations included:

1) New York State Department of Environmental Conservation (NYSDEC),
2) Ozone Research Center at University of Medicine & Dentistry of NJ/Rutgers University (ORC),
3) University of Maryland (UMD),
4) Virginia Department of Environmental Quality,
5) Northeast States for Coordinated Air Use Management (NESCAUM)
6) Maryland Department of the Environment,
7) New Hampshire Department of Environmental Services, and
8) Mid-Atlantic Regional Air Management Agency (MARAMA).

The lead agency for coordinating the running of the CMAQ model and performing the modeling runs for the OTC was the NYSDEC.[6] The NYSDEC ran the CMAQ model

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[5] USEPA. Guidance on the Use of Models and Other Analyses for Demonstrating Attainment of Air Quality Goals for Ozone, $PM_{2.5}$, and Regional Haze. United States Environmental Protection Agency, Office of Air Quality Planning and Standards, Air Quality Analysis Division, Air Quality Modeling Group, Research Triangle Park, NC, EPA-454/B-07-002, April 2007.

[6] New Jersey wishes to thank the NYSDEC for its leadership in the regional modeling effort.

using the protocol in Appendix B1 for the May 1 through September 30 ozone season, which was supplemented by modeling runs performed by the UMDNJ/ORC (March and April), NESCAUM (October, November, December), and the University of Maryland (January, February) for the purposes of determining $PM_{2.5}$ attainment. The four regional modeling centers were, therefore, able to model an entire year of meteorology and emissions. The NYSDEC was responsible for post-processing the results for the Northern New Jersey/New York /Connecticut nonattainment area, including calculating the projected $PM_{2.5}$ concentrations using the relative response factor (RRF) method specified in the USEPA's Modeling Guidance, included in Appendix B2. The projected $PM_{2.5}$ concentrations for the Southern New Jersey/Philadelphia nonattainment area were calculated by the UMDNJ/ORC.

The CMAQ model requires specific inputs, including meteorological information and emissions information. The remainder of this section discusses, in general, the needed data inputs for the CMAQ model, the particular parameters of the CMAQ model chosen for the $PM_{2.5}$ modeling runs, and the validation of the CMAQ model for use in the regional modeling effort. For more specific information, see Appendices B3, B4, B5, B6, and B7.

5.2.2.1 Meteorology Data

As explained in the USEPA's Emission Inventory Guidance,[7] 2002 was designated as the base year for 8-hour ozone SIPs, $PM_{2.5}$ SIPs, and regional haze plans; therefore, wherever possible, 2002 was used for baseline modeling for the $PM_{2.5}$ standard. The Pennsylvania State University/National Center for Atmospheric Research Mesoscale Meteorological Model (MM5) version 3.6 was used to generate the annual 2002 meteorology for the modeling analysis. The MM5 model is a non-hydrostatic, prognostic meteorological model routinely used for urban- and regional-scale photochemical regulatory modeling studies. Professor Da-Lin Zhang (University of Maryland) performed the MM5 modeling in consultation with the NYSDEC and Maryland Department of the Environment staff. The analyses showed that in general, the performance of the MM5 is reasonable both at the surface and in the vertical, thereby providing confidence in the use of these data in the CMAQ simulations. The documents supporting the MM5 modeling analysis are provided in Appendix B3. Based on model validation and sensitivity testing, the model results met the evaluation criteria and the MM5 configurations were used for the regional modeling effort.

[7] USEPA. Emissions Inventory Guidance for Implementation of Ozone and Particulate Matter National Ambient Air Quality Standards (NAAQS) and Regional Haze Regulations. United States Environmental Protection Agency, Emissions Inventory Group, Emissions, Monitoring, and Analysis Division, Office of Air Quality Planning and Standards, Research Triangle Park, NC, EPA-454/R-05-001, August 2005, updated November 2005.

5.2.2.2 Regional Emission Inventories

Both the nonattainment areas associated with New Jersey have an attainment date of no later than April 5, 2010. Since January through April represents only part of the year, attainment must be demonstrated for the last full year prior to the attainment date; in this case 2009.[8] Emission reductions included in the regional modeling, therefore, should be implemented no later than the beginning of 2009 for the air quality benefits to have the greatest likelihood of improving air quality throughout the entire year and showing attainment of the annual standard. As such, the attainment modeling run is designed to show the incremental emission reductions associated with the implementation of control measures between the base year (2002) and the “attainment” year (2009).

To complete this modeling exercise, two regional emission inventories were developed to represent the 2002 base case and the 2009 control case. In addition, two other future control case emission inventories (for 2012 and 2018, respectively) were developed simultaneous with the 2009 control case emission inventory to allow for additional modeling exercises. These future year emission inventories were developed by projecting the 2002 base year emissions inventory using standard emissions projection techniques discussed in Appendix B8-1. These future year emission inventories include emissions growth due to projected increases in economic activity, as well as the emissions reductions due to the implementation of control measures. All of the regional emission inventories in this chapter are hereafter referred to as the modeling inventories.

The 2002 emissions were first generated by the individual Ozone Transport Region states. MARAMA then coordinated and quality assured the 2002 inventory data, and projected it for the relevant control years. The 2002 emissions for non-Ozone Transport Region areas within the modeling domain were obtained from other Regional Planning Organizations for their corresponding areas. These Regional Planning Organizations included the Visibility Improvement State and Tribal Association of the Southeast (VISTAS), the Midwest Regional Planning Organization and the Central Regional Air Planning Association. The documentation for the OTC base and control modeling inventories are presented in Appendices B8-1 and B9. The use of emission inventory data from the non-MANE-VU states is documented in Appendix B6.

As discussed in Chapter 4, the OTC member states selected several control strategies for inclusion in the attainment demonstration modeling. These strategies were selected from groups of measures developed by the technical subcommittees responsible for identifying and developing the regulations and/or control measures to attain the ozone health standard. Consideration was given to maintaining consistency with control measures likely to be implemented in other Regional Planning Organizations. Emission reduction requirements mandated by the Clean Air Act were also included in projecting future year emissions. Additional information on the emissions used in future year modeling is provided in Appendix B6. The following sections provide a more detailed discussion of base and control inventories used in the regional modeling.

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[8] Success will be judged by three years of data, i.e., 2007, 2008, and 2009, to calculate the 2009 design value.

5.2.2.2.1 Base Emission Inventory

Version 3 of the 2002 base year emission inventory was used in the regional modeling exercises. The technical support document for this inventory, which is included in Appendix B9, explains the data sources, methods, and results for preparing this version of the 2002 base year criteria air pollutant and ammonia emissions inventories for point, area, onroad, nonroad, and biogenic sources for the MANE-VU Regional Planning Organization. In addition to relying on this base inventory for $PM_{2.5}$ SIP-related activities, the MANE-VU states will use this base inventory to support air quality modeling, control measure development, and implementation activities for the Regional Haze SIP.

The inventory and supporting data include the following:

1) Comprehensive, county-level modeling inventories for 2002 emissions for criteria air pollutants and ammonia for the State and Local agencies included in the MANE-VU region;
2) The temporal, speciation, and spatial allocation profiles for the MANE-VU region inventories;
3) Inventories for wildfires, prescribed burning, and agricultural field burning for the southeastern provinces of Canada; and
4) Inventories for other Regional Planning Organizations, Canada, and Mexico.

The mass emissions inventory files were converted to the National Emissions Inventory Input Format Version 3.0. As discussed in greater detail in Section 5.2.2.3, the modeling inventory files were processed in Sparse Matrix Operator Kernel Emissions (SMOKE) /Inventory Data Analyzer.

The inventories include annual emissions for oxides of nitrogen (NO_x), volatile organic compounds (VOC), carbon monoxide, sulfur dioxide (SO_2), ammonia, particles with an aerodynamic diameter less than or equal to a nominal 10 micrometers (PM_{10}) and, particles with an aerodynamic diameter less than or equal to a nominal 2.5 micrometers ($PM_{2.5}$). The inventories also included summer day, winter day, and average day emissions. However, not all states included daily emissions in their inventories. In these instances, temporal profiles prepared for this project were used to calculate daily emissions.

Work on Version 1 of the 2002 MANE-VU inventory began in April 2004. The consolidated inventory for point, area, onroad, and nonroad sources was prepared by starting with the inventories that the MANE-VU state/local agencies submitted to the USEPA from May through July of 2004 as a requirement of the Consolidated Emissions Reporting Rule (CERR). This version of the final inventory and SMOKE input files were finalized during January 2005.

Work on Version 2 (covering the period from April through September 2005) involved incorporating revisions requested by some MANE-VU state/local agencies on the point, area, and onroad inventories. Work on Version 3 (covering the period from December

2005 through April 2006) included additional revisions to the point, area, and onroad inventories as requested by some states. Thus, the Version 3 inventory for point, area, and onroad sources were built upon Versions 1 and 2. This work also included development of the biogenics inventory. In version 3, the nonroad inventory was completely redone because of changes that the USEPA made to the NONROAD2005 model.

Addressing Woodsmoke Emissions

There are differences between the 2002 base case inventory that was developed by New Jersey and the 2002 alternative wood burning emissions inventory that was developed regionally for modeling (fractional reduction from the base case). Both NO_x and VOC emissions are different in the base case and the modeling case, too.

The reason for this difference is that the regional modeling was conducted by starting with a ton per year value, not ton per day emissions as was used by the State's emission inventory. The Sparse Matrix Operator Kernel Emissions (SMOKE) model takes those tons per year emissions and breaks them into hourly emissions using the temporal profiles built into the SMOKE model. Using this SMOKE temporal profile fewer residential wood burning emissions are placed into the model in the summer months, as most residential wood burning is not done in the summer. This would also be consistent with how the New Jersey Department of Environmental Protection (NJDEP) developed emissions in its inventory. However, SMOKE further speciates the tons of VOC from woodsmoke into specific species, so that it is not possible from the SMOKE output to see where that ton of emissions went. The ton of VOC disappears into the sum of all component species.

5.2.2.2.2 Emission Control Inventories

The following is a summary of the future year inventories that were developed:

- Three projection years: 2009, 2012, and 2018;

- Three source sectors: non-Electric Generating Units (non-EGUs) point sources, area sources, and nonroad mobile sources. Under separate efforts, MANE-VU prepared EGU projections using the Integrated Planning Model and onroad mobile source projections using the SMOKE emission modeling system. The documentation for those efforts is included in Appendix B8-1.

The two emission control scenarios are:

1) A combined "on-the-books/on-the-way" (OTB/OTW) control strategy accounting for emission control regulations already in place, as well as some emission control regulations that are not yet finalized but are likely to achieve additional reductions by 2009 (i.e., adoption of the six shortfall measures by states outside the core Ozone Transport Region states); and

2) A beyond on the way (BOTW) scenario to account for controls from potential new regulations that may be necessary to meet attainment and other regional air quality goals.

The inventories were developed for seven pollutants, which are SO_2, NO_x, VOCs, carbon monoxide, PM_{10}-$_{Primary}$ (sum of the filterable and condensable components), $PM_{2.5}$-$_{Primary}$ (sum of the filterable and condensable components), and ammonia.

The states included in the emission inventory are those that comprise the MANE-VU region. In addition to the District of Columbia, the 11 MANE-VU states are Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont.

An inventory technical support document for these future inventories is included in Appendices B8-1 and B8-2 and explains the data sources, methods, and results for future year emission forecasts for three years; three emission sectors; two emission control scenarios; seven pollutants; and eleven states plus the District of Columbia.

5.2.2.3 Emissions Processor Selection and Configuration

The SMOKE Processing System was selected for the modeling analysis. SMOKE is principally an emissions processing system; this means that, with the exception of mobile and biogenic sources, its purpose is to provide an efficient, modern tool for converting emissions inventory data into the formatted emissions files required for a photochemical air quality model.

Inside the Ozone Transport Region, the modeling inventories were processed by the NYSDEC and NESCAUM using the SMOKE (Version 2.1) processor to provide inputs for the CMAQ model. A detailed description of all SMOKE input files such as area, mobile, fire, point and biogenic emissions files and the SMOKE model configuration are provided in Appendices B4, B5, and B6.

5.2.2.4 Regional Modeling Coordination

The CMAQ model was installed at all participating modeling centers and diagnostic tests were run to insure that the model was operating as designed. In addition, the CMAQ model was benchmarked against other modeling platforms to ensure similar results. The OTC modeling committee oversaw the modeling effort and reported to the OTC Oversight Committee. The NJDEP participated as a member of the various OTC committees. While the focus of this modeling effort was to develop estimates of ozone formation, care was taken during the process to ensure that the data developed could be useful for future particulate SIP efforts.

5.2.2.5 Domain and Data Base Issues

5.2.2.5.1 Episode Selection

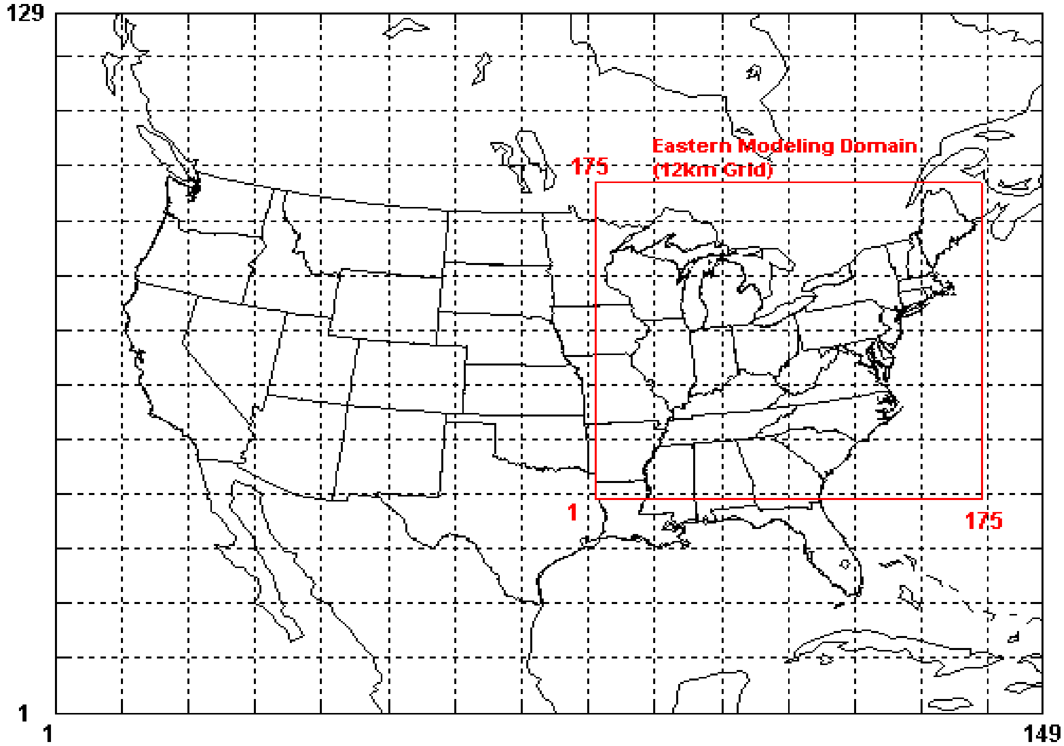
The entire 2002 base case and 2009 future case years were simulated with 2002 meteorological conditions for $PM_{2.5}$ modeling. This complete year of modeling provides a more robust analysis of the seasonal variations in $PM_{2.5}$ levels due to secondary aerosol formation, an important pathway to understanding the transport of particulate matter from out-of-state sources.

5.2.2.5.2 Size of the Modeling Domain

In defining the modeling domain, the location of the local urban area, the downwind extent of the elevated $PM_{2.5}$ levels, the location of large emission sources, and the availability of meteorological and air quality data need to be considered. The domain or spatial extent to be modeled includes as its core the nonattainment area. Beyond this, the domain includes enough of the surrounding area such that major upwind sources fall within the domain and the emissions produced in the nonattainment area remain within the domain throughout the day.

Figure 5.1 shows the OTC modeling boundaries. This domain covers the Northeast region, including the Northeastern, Central and Southeastern United States as well as Southeastern Canada. The final SIP modeling analysis utilized this modeling domain. Further discussion of the modeling domain selection is provided in Appendices B1 and B3.

Figure 5.1: Mid-Atlantic/Northeast Visibility Union 12-Kilometer CMAQ Modeling Domain



5.2.2.5.3 Horizontal Grid Size

The basic CMAQ modeling platform utilized a two-way nested domain consisting of a course 36 km horizontal grid resolution for the continental United States domain and a fine 12-km grid over the eastern United States. A larger domain was selected for the MM5 simulations to provide a buffer of several grid cells around each boundary of the CMAQ 36 km domain. This was designed to minimize any errors in the meteorology from boundary effects. A 12 km inner domain was selected to better characterize air quality in the Ozone Transport Region and surrounding Regional Planning Organization regions. The horizontal grid definitions for the CMAQ and MM5 modeling domains are contained in Appendices B1 and B3.

5.2.2.5.4 Vertical Resolution

The vertical grid used in the CMAQ modeling was primarily defined by the MM5 vertical structure. The MM5 model employed a terrain following coordinate system defined by atmospheric pressure. The layer averaging scheme adopted for CMAQ was designed to reduce the computational demands of the CMAQ simulations, therefore only the uppermost layers of the CMAQ domain were coalesced. All layers in the planetary boundary layer were unchanged between the MM5 and the CMAQ simulation. This ensures that the near-surface processes that affect air pollution the most are represented realistically in CMAQ, while the meteorological systems that are driven by upper level winds are allowed to develop properly in MM5. The effects of layer averaging have a relatively minor effect on the model performance metrics when compared to ambient monitoring data. The vertical layer definitions and other details related to the MM5 and CMAQ modeling domains are contained in Appendices B1 and B3.

5.2.2.5.5 Initial and Boundary Conditions

The objective of a photochemical grid model is to estimate the air quality given a set of meteorological and emissions conditions. When initializing a modeling simulation, the exact concentration fields are not known in every grid cell for the start time. Therefore, typically photochemical grid models begin with clean conditions within the domain and are allowed to stabilize before the period of interest is simulated. In practice this is accomplished by starting the model several days prior to the period of interest; this is called spin-up time.

The winds move pollutants into, out of, and within the domain. The model handles the movement of pollutants within the domain and out of the domain. An estimate of the concentration of pollutants at the edge of the domain, and therefore the quantity of pollutants moving into the domain, is needed as an input to the model. These are called boundary conditions. The 12 km grid boundary conditions were extracted from the 36 km CMAQ simulation. To estimate the boundary conditions for the modeling study, boundary conditions for the inner OTR 12-km grid used hour by hour boundary conditions extracted from the continental 36 km CMAQ run results by researchers at Harvard University using the GEOS-CHEM global chemical transport model.[9,10]

The influence of initial conditions was minimized by using a 15-day spin-up period, which is sufficient to establish pollutant levels that are encountered in the eastern United States. Additionally, the predominant winds flow from west to east, thus New Jersey is not influenced by nearby boundary conditions as the boundary begins in the states west of the Mississippi River. Additional information on the extraction of boundary conditions is provided in Appendix B1.

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[9] Moo, N. and Byun, D. A Simple User's Guide For "geos2cmaq" Code: Linking CMAQ with GEOS-CHEM. Version 1.0. Institute for Multidimensional Air Quality Studies (IMAQS). University of Houston, Houston, Texas, 2004.

[10] Baker, K. Model Performance for Ozone in the Upper Midwest over 3 Summers. Presentation given at the Lake Michigan Air Directors Consortium, 2005 AWMA Annual Conference, Minneapolis, MN, June 24, 2005.

5.2.2.6 Quality Assurance

All the air quality, emissions, and meteorological data within the MANE-VU Regional Planning Organization used in the regional modeling effort were reviewed to ensure completeness, accuracy, and consistency before proceeding with modeling. Any errors, missing data or inconsistencies, were addressed using appropriate methods that are consistent with standard practices. All modeling was benchmarked through the duplication of a set of standard modeling results across different modeling centers using different computer platforms to calculate results. Emissions inventories obtained from the other Regional Planning Organizations were examined to check for errors in the emissions estimates. When such errors were discovered, the problems in the input data files were corrected, and the models were run again.

The CMAQ air quality model inputs and outputs were plotted and examined to ensure sufficiently accurate representation of the observed data in the model ready fields, and temporal and spatial consistency and reasonableness. The output of the CMAQ model results for the 2002 period underwent operational and scientific evaluations of the meteorological and air quality modeling data used and is discussed in greater detail in Section 5.2.2.7.

5.2.2.7 Model Performance Evaluation

The first step in the modeling process is to verify the model's performance in terms of its ability to predict particulate concentration fields in the right locations and at the right levels. To do this, model predictions for the base year simulation are compared to the actual ambient data observed in the historical episode. This verification is a combination of statistical and graphical evaluations. If the model appears to be predicting particulate matter in the right locations for the right reasons, then the model can be used as a predictive tool to evaluate various control strategies and their effects on particulate formation. The purpose of the model performance evaluation is to assess how accurately the model predicts particulate levels observed in the historical episode and to use the knowledge of CMAQ's performance to put CMAQ's predictions of future year air quality in the appropriate context so that future policy decisions are informed by CMAQ's predictions and its performance.

The results of a model performance evaluation were examined prior to using CMAQ's results to support the attainment demonstration. The performance of CMAQ was evaluated using both operational and diagnostic methods. Operational evaluation refers to the model's ability to replicate observed concentrations of particulate matter and/or its precursors (surface and aloft), whereas diagnostic evaluation assesses the model's accuracy with respect to characterizing the sensitivity of particulate formation to changes in emissions (i.e., relative response factors).

The NYSDEC conducted a performance evaluation of the 2002 base case CMAQ simulation for $PM_{2.5}$ on behalf of the Ozone Transport Region member states. Appendix B7 provides comprehensive operational and diagnostic evaluation results, including spreadsheets containing the assumptions made to compute statistics. Highlights of this evaluation are summarized in Section 5.2.2.7.1.

5.2.2.7.1 Summary of Model Performance

The CMAQ model was employed to simulate $PM_{2.5}$ for the entire year of 2002. A comparison of the temporal and spatial distributions of $PM_{2.5}$ and its precursors was conducted for the study domain, with additional focus placed on performance in both the Northern New Jersey/New York/Connecticut and Southern New Jersey/Philadelphia nonattainment areas.

The model performance for both Northern New Jersey/New York/Connecticut and the Southern New Jersey/Philadelphia nonattainment areas averaged over all stations and all days met the guidelines in the USEPA Modeling Guidance. Applying those criteria to individual days is a much more stringent test that is not required by the USEPA. In general, the CMAQ model results were best for daily maximum ozone and daily average $PM_{2.5}$ and sulfate (SO_4) mass.

No significant differences in model performance for particulate and its precursors were encountered across different areas of the Ozone Transport Region. While there are some differences in the spatial data among sub-regions, there is nothing to suggest a tendency for the model to respond in a systematically different manner between regions. Examination of the statistical metrics by sub-region confirms the absence of significant performance problems arising in one area but not in another, building confidence that the CMAQ modeling system is operating consistently across the full Ozone Transport Region domain.

Also, the USEPA Modeling Guidance suggests the use of the concentrations estimated from the mean of the nearby grid cells where the ambient monitor is located unless large concentration gradients are encountered within the adjoining grid cells. If the modeling shows that large concentration gradients exist then the USEPA guidance suggests using only the concentration from the grid cell containing the monitor. An analysis of the Relative Reduction Factors (RRFs) in the grid cell containing the monitor and the average of the nine grid cells surrounding the monitor shows that large concentration gradients do not exist in the modeling conducted. This analysis is presented in Appendix B10 of this SIP and shows relatively consistent results whether the concentrations of the one cell or concentrations of the average of nine cells are used. The attainment demonstration will, therefore, present the RRFs for the nine cell mean or average of the grid cells as this is consistent with USEPA guidance.[11]

As stated previously, the model performance for the 2002 annual run meets all USEPA guidelines and thus demonstrates that the modeling platform is appropriate for modeling

[11] USEPA. Guidance on the Use of Models and Other Analyses for Demonstrating Attainment of Air Quality Goals for Ozone, $PM_{2.5}$, and Regional Haze. United States Environmental Protection Agency, Office of Air Quality Planning and Standards, Air Quality Analysis Division, Air Quality Modeling Group, Research Triangle Park, NC, EPA-454/B-07-002, April 2007, page 28.

emissions control scenarios for the Northern New Jersey/New York/Connecticut and the Southern New Jersey/Philadelphia nonattainment areas. The CMAQ model has been evaluated by using measures that reflect its ability to represent average conditions instead of its ability to respond to changes in emissions. Therefore, although CMAQ has met the traditional performance measures as stated in the USEPA Modeling Guidance, it may in fact under or over predict the magnitude of secondary aerosol formation changes due to the various control measures being modeled. This means future year (i.e., 2009) modeling results should not be viewed as exact, but should be utilized in a relative manner (see Section 5.2.4). Additional discussion on the uncertainty associated with the CMAQ model results is provided in Section 5.3.

5.2.3 Control Measures Modeled

As previously stated, the objective of the photochemical modeling analysis is to enable state air agencies to analyze the efficacy of various control strategies, and to demonstrate that the measures proposed to be adopted as part of the SIP will result in attainment of the $PM_{2.5}$ standard by 2009. New Jersey's attainment demonstration relies on the Beyond-on-the-Way (BOTW) 2009 modeling run, which predicts future 2009 air quality conditions, after accounting for all air pollution controls that have been implemented since the base year of 2002 (OTB/OTW measures), and applying new control measures (BOTW measures) that will be implemented in time to reduce emissions in 2009. Table 5.1 lists all of the control measures included for New Jersey in the projected 2009 BOTW CMAQ modeling run. Each of these control measures is discussed in detail in Chapter 4.

While Table 5.1 shows all the OTB/OTW and BOTW measures that New Jersey took into account within the 2009 attainment demonstration model run, the overall attainment demonstration is reliant upon all the states' in the Ozone Transport Region implementing measures to reduce the amount of their emissions in order for New Jersey to achieve its goals. Table 5.2 shows which BOTW measures each state in the Ozone Transport Region believed would be implemented in time to achieve benefits in 2009. These were the measures included in the BOTW model run for each state.

<u>Table 5.1</u>: Modeled Control Measures Included in the 2009 BOTW Model Run

<u>Pre-2002 with benefits achieved Post-2002 - On the Books</u>
Federal
Residential Woodstove NSPS
Onboard Refueling Vapor Recovery (ORVR) beyond Stage II
Tier 1 Vehicle Program
National Low Emission Vehicle Program (NLEV)
Tier 2 Vehicle Program/Low Sulfur Fuels
HDDV Defeat Device Settlement
HDDV Engine Standards
Nonroad Diesel Engines
Large Industrial Spark-Ignition Engines over 19 kilowatts
Recreational Vehicles (includes snowmobiles, off-highway motorcycles and all-terrain vehicles)
Diesel Marine Engines over 37 kilowatts
Phase 2 Standards for Small Spark-Ignition Handheld Engines at or below 19 kilowatts
Phase 2 Standards for New Nonroad Spark-Ignition Non-Handheld Engines at or below 19 kilowatts
<u>Post-2002 - On the Books</u>
New Jersey Measures Done Through a Regional Effort
Consumer Products 2005
Architectural Coatings 2005
Portable Fuel Containers 2005
Mobile Equipment Repair and Refinishing
Solvent Cleaning
NO_x RACT rule 2006 (includes distributed generation)
New Jersey Heavy Duty Diesel Rules Including "Not-To-Exceed" (NTE) Requirements
New Jersey Only
Stage I and Stage II (Gasoline Transfer Operations)
On-Board Diagnostics (OBD) – (I/M) Program for Gasoline Vehicles
Federal
USEPA MACT Standards including Industrial Boiler/Process Heater MACT
Acid Rain
CAIR (NO_x Controls in 2009 Only)
Refinery Enforcement Initiative
<u>Post-2002 - Beyond on the Way</u>
New Jersey Measures Done Through a Regional Effort
Consumer Products 2009 Amendments
Portable Fuel Containers 2009 Amendments
Asphalt Paving

Adhesives and Sealants
Refineries – Fugitive Equipment Leaks
Industrial/Commercial/Institutional (ICI) Boiler Rule Changes (for certain categories)
New Jersey Only
New Jersey Low Emission Vehicle (LEV) Program

Table 5.2: Ozone Transport Region-Wide Modeling Assumptions for the 2009 BOTW Model Run

	Consumer Products 2005/2009	PFC 2005/ 2009	Asphalt Paving	Adhesives & Sealants	ICI Boilers - Area Sources			ICI Boilers - Non-EGU Point Sources					Cement Kilns	Glass Furnances	Asphalt Plants
					< 25 mmBtu/ hr	25-50 mmBtu/ hr	50-100 mmBtu/ hr	< 25 mmBtu/ hr	25-50 mmBtu/ hr	50-100 mmBtu/ hr	100-250 mmBtu/ hr	>250 mmBtu/ hr			
NY NAA															
Connecticut	x	x	x	x	x	x	x	x	x	x	x				x
New Jersey	x	x	x	x		x	x	x			x				
New York	x	x	x	x	x	x	x	x	x	x	x		x	x	x
Phila. NAA															
Delaware	x	x		x							x				
Maryland	x	x	x	x							x		x	x	
New Jersey	x	x	x	x		x	x	x			x				
Pennsylvania	x	x		x										x	
Other States															
Maine	x	x		x									x		
New Hampshire	x	x	x						x	x	x				
Vermont															
Massachusetts	x		x	x										x	
Rhode Island	x	x	x	x											
DC	x	x	x	x											x

*Source: MACTEC. Development of Emission Projections for 2009, 2012, and 2018 for NonEGU Point, Area, and Nonroad Sources in the MANE-VU Region, Final TSD. Prepared for the Mid-Atlantic Regional Air Management Association by MACTEC Federal Programs, Inc., February 28, 2007.

It is also important to note that the 2009 BOTW modeling did not contain the first round of Clean Air Interstate Rule (CAIR) controls for SO_2 expected to occur in 2010. If these lowered emissions were modeled, the modeling results would show lower predicted levels of $PM_{2.5}$ than are presented in this attainment demonstration. Implementation of the CAIR SO_2 controls is expected to provide a more assurance that the annual $PM_{2.5}$ standard of 15.0 $\mu g/m^3$ will be attained by 2010.

5.2.4 Photochemical Modeling Results

The USEPA recommends using the regional photochemical model estimates in a "relative" rather than "absolute" sense, due to the uncertainties and biases in the modeling system. Thus, the assumption is that the change between the modeled base year (2002) and the modeled future year (2009) reflects the impact of growth and control over time and is an appropriate use of the results. The "absolute" modeled results are used in a "relative" sense by applying the ratios of the model's future to current (baseline) predictions at each $PM_{2.5}$ monitor to the actual 2002 design values, thereby grounding the future design value to the monitored results. These ratios are termed the "relative reduction factor" (RRF). An RRF is defined by the USEPA as the ratio of a future maximum concentration predicted "near a monitor" to a baseline maximum concentration predicted "near the monitor" averaged over selected days.[12, 13] More simply put, the RRF is the ratio of average future concentrations over average baseline concentrations for each monitoring site.

The baseline design values used in the modeling application were calculated differently from the monitored design values although both are based on monitored ambient air quality data. The monitoring design values are calculated as the three-year average of the one-year annual average values where the one-year annual average value for a given year is first calculated using the quarterly average of the daily values at each monitoring site. In other words, the quarterly average mass is calculated first, and then the average annual mass is calculated from the quarterly values for a given year. For modeling purposes, the baseline design value is calculated by averaging three three-year design value periods, centered on the base inventory year of 2002. Specifically, the modeling baseline design value was calculated using the 2000-2002, 2001-2003, and 2002-2004 periods. For more information about the modeling design values and how they were calculated, see Appendices B11-1 and B11-2. The average annual base line design value (DV_{B-I}) as shown in Table 5.3 and Table 5.4 was calculated using the three, three-year average design values centered around the 2002 base year. These values, calculated using the five years of monitoring data from 2000 to 2004, were then applied to the modeling output using the relative reductions as determined by the future year modeling.

Four monitoring sites located in New Jersey contain monitors that measure the component species of $PM_{2.5}$ and are designated as Speciation Trends Network (STN)

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[12] ibid.

[13] "Near a monitor" was determined by using an average of the concentration predicted within a 3x3 array of grid cells surrounding each monitor, as recommended by the USEPA for 12-km grid resolution modeling.

monitors. These monitors are located in Camden, Chester, Elizabeth, and New Brunswick. The STN monitoring program provides for the concentration of major ions, carbon compounds, and trace elements which constitute the bulk of the $PM_{2.5}$ mass. The STN samplers operate on a one-in-three day sampling schedule. It is important to note that only one of the STN samplers, the Camden monitor, is located in the New Jersey portion of the Southern New Jersey/Philadelphia nonattainment area; the other three (Chester, Elizabeth, and New Brunswick) are located in the Northern New Jersey/New York/Connecticut nonattainment area.

Most of the samples from the $PM_{2.5}$ monitoring sites in New Jersey are collected and analyzed according to the Federal Reference Method (FRM). The FRM for fine particulate matter requires a 24-hour collection period using a filter-based collection method to measure fine particulate mass. The FRM samplers, like the STN samplers, operate on a one-in-three day schedule. Also, as per the network design requirements, several FRM sites have collocated duplicate samplers or measure fine particulate matter by other means than the Federal Reference Method (e.g., Tapered Element Oscillating Microbalance (TEOM) sampling).

It is important to understand the unique aspects of measuring and modeling particulate matter as it relates to determining attainment. The $PM_{2.5}$ attainment test uses both the total $PM_{2.5}$ mass results from the FRM monitors as well as the individual components of $PM_{2.5}$ as measured at the STN sites. Therefore, the modeled attainment test for $PM_{2.5}$ is called the Speciated Modeled Attainment Test (SMAT). In order to perform the recommended modeled attainment, the observed total mass concentrations of $PM_{2.5}$ as measured at the FRM monitoring sites need to be first partitioned into seven components (plus passive mass).[14] These components are:

- Mass associated with sulfates
- Mass associated with nitrates
- Mass associated with ammonium
- Mass associated with organic carbon
- Mass associated with elemental carbon
- Mass associated with particle bound water
- Mass associated with "other" primary inorganic particulate matter, and
- Passively collected mass.

A separate site specific calculation of the quantity of the component species was performed for each of these $PM_{2.5}$ components (except passive mass) for each FRM monitoring site. This calculation applied the same ratio of each species collected from the "nearest" STN site, to the total $PM_{2.5}$ mass measured at the FRM site. Each of these site-specific ratios is called a component-specific design value.

[17] The monitors are located either within the boundaries of the nonattainment area, or in close proximity to the nonattainment area.

Future $PM_{2.5}$ design values were estimated at each existing FRM monitoring site by multiplying the modeled RRF "near" each monitor times the observed "component specific design value." Future total $PM_{2.5}$ design values at a site were then estimated by summing the future year design values of the seven $PM_{2.5}$ components. If the total of all future species-specific $PM_{2.5}$ annual design values for each site was less than or equal to 15.0 $\mu g/m^3$, the annual $PM_{2.5}$ NAAQS, the test for attainment of the standard, is passed.

Since the USEPA Speciated Modeled Attainment Test software is not available for the states to use for their attainment demonstrations, the following procedure was performed by the NYSDEC and the UMDNJ/ORC (see Appendices B2, B11-1, B11-2, and B12), following the USEPA guidance for modeling attainment of the $PM_{2.5}$ health standard, to analyze the 2009 BOTW modeling results.

1. Using the data provided by the USEPA Region 2[15] on the monitored levels of particulate matter through the USEPA's Air Quality System (AQS) database, the quarterly averages of Federal Reference Method (FRM) mass for each monitor were determined.

2. The average quarterly STN speciation ratio for the years 2002 to 2004 (using the Camden, Chester, Elizabeth, and New Brunswick, New Jersey and the four New York-sited STN monitors to determine the fraction of each species that would be present in the total $PM_{2.5}$ mass measured at the FRM monitoring sites) was determined. (Note: In order to ensure that comparable mass measurements between STN and FRM measurement techniques were used, an adjustment for a blank correction was made to remove the blank mass).

3. The quarterly RRF values from the modeling results for all the species using the 2002 Base B1 and 2009 BOTW B4 were calculated (Note: nine cell averages of the grid cells surrounding each monitoring site were used to calculate the RRF.)

4. The measured FRM mass at each monitoring site was divided by the total mass into the individual species using the ratio from Step 2.

5. Computed future values of species other than water and ammonia through RRF scaling using the Degree of Neutralization (DON) and future sulfate, retained nitrate to estimate the ammonia concentration, and a polynomial approximation from the NYSDEC to estimate water within the total $PM_{2.5}$ mass.[16]

6. The blank mass was then added back to the total mass to determine the total measured $PM_{2.5}$ mass so that the predicted modeled results could be directly compared to measured concentrations.

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[15] Personal communication by e-mail, entitled "Fw: Re: Files from MATS," between Kenneth Fradkin, USEPA, Region 2 and Ray Papalski, NJDEP, August 17, 2007.

[16] See Appendix B12.

The following equation illustrates how New Jersey calculated the future design values for each monitoring site (i):

$(RRF)_{ij}$ for each species = $([C_{j,\text{projected of species x}}]/[C_{j,\text{current of species x}}])_i$

Where:

$C_{j,current}$ is the quarterly mean concentration of species x predicted at or near the monitoring site (i) with emissions characteristic of the period used to calculate the baseline design value for annual $PM_{2.5}$

$C_{j,projected}$ is the future year quarterly mean concentration of species x predicted at or near the monitoring site (i) from a representative STN monitoring location.

The design value for each species or component was then calculated as follows:

DV_{F-I} for each species = $(RRF_I * DV_{B-I})$

Where:

DV_{B-I} = the average base concentration (design value) of each component monitored at site I, in micrograms per cubic meter ($\mu g/m^3$)

RRF_I = the relative response factor calculated for each component at site (i)

DV_{F-I} = the estimated future design value for the time attainment is required, in $\mu g/m^3$

The quarterly mean of each component was then summed to get quarterly mean $PM_{2.5}$ values. Then the quarterly mean $PM_{2.5}$ concentrations were averaged to get a future year annual average $PM_{2.5}$ estimate for each FRM monitoring site.

Table 5.3 shows the $PM_{2.5}$ modeling results using the 2009 BOTW run for all monitors located within the Northern New Jersey /New York/Connecticut nonattainment area.

Table 5.3: 2009 Modeled $PM_{2.5}$ Design Values for the Northern New Jersey/New York/Connecticut Nonattainment Areas

(Bold Type indicates Values over the Annual Standard of 15.0 µg/m³)

Site ID	Monitoring Site Name	State Name	Average Annual Baseline Design Value (DV_{B-I}) (µg/m³)	Projected 2009 Annual Design Value (DV_{F-I}) (µg/m³)
90010010	Bridgeport - Roosevelt School	Connecticut	13.1	11.5
90010113	Bridgeport - Congress Street	Connecticut	12.6	11.2
90011123	Danbury	Connecticut	12.8	11.2
90012124	Stamford	Connecticut	12.9	11.4
90013005	Norwalk	Connecticut	12.9	11.3
90019003	Westport	Connecticut	11.8	10.4
90090018	New Haven - Stiles Street[17]	Connecticut	**16.3**	14.4
90091123	New Haven- 715 State St	Connecticut	13.7	11.7
90092123	Waterbury	Connecticut	13.1	11.2
90099005	Hamden	Connecticut	11.6	9.9
340030003	Fort Lee Library	New Jersey	13.7	12.1
340130015	Newark Cultural Center	New Jersey	13.9	11.8
340130016	Newark Lab	New Jersey	14.7	12.5
340171003	Jersey City Primary	New Jersey	14.9	13.3
340172002	Union City	New Jersey	**16.0**	14.3
340210008	Trenton	New Jersey	13.9	11.8
340218001	Washington Crossing	New Jersey	11.9	10.1
340230006	New Brunswick	New Jersey	12.5	10.4
340270004	Morristown	New Jersey	12.4	10.4
340273001	Chester	New Jersey	11.1	9.3
340310005	Paterson	New Jersey	13.2	11.4
340390004	Elizabeth	New Jersey	**15.7**	13.5
340390006	Elizabeth Downtown	New Jersey	13.5	11.8
340392003	Rahway	New Jersey	13.1	11.4
360050080	Morrisania Center -Gerard Ave.	New York	**15.8**	14.2
360050083	Botanical Gardens	New York	13.8	12.4
360050110	East 156 Street	New York	14.7	13.3
360470052	PS 314-60th St and GawanusExp.	New York	**15.2**	13.4
360470076	PS 321- 180 7th Ave.	New York	14.4	12.7
360470122	JHS 126 424 Leonard St	New York	14.7	13.0
360590012	East Hills Elementary School	New York	11.9	10.5
360590013	1055 Stewart Place	New York	12.0	10.6

[17] The New Haven/Stiles St. monitor was designated as a "special purpose" monitor, and as such cannot be used to make an attainment or nonattainment designation. The site was found to be overly influenced by micro-scale phenomena, including heavy duty truck exhaust from trucks leaving the New Haven Terminal area and accelerating uphill on the Interstate-95 on-ramp. The monitor was less than twenty feet from the traffic lane. Following a special, multi-site monitoring study conducted by CTDEP, the Stiles Street monitor was deemed unrepresentative of population exposure in the City of New Haven. In 2006, it was shut down as part of the I-95 bridge reconstruction project. The information on this site, therefore, is for informational purposes only and should not be used to assess attainment of the standard.

Site ID	Monitoring Site Name	State Name	**Average Annual Baseline Design Value (DV_{B-I}) (µg/m^3)**	**Projected 2009 Annual Design Value (DV_{F-I}) (µg/m^3)**
360610056	PS 59, 288 E. 57th St., Manhattan	New York	**17.4**	**15.3**
360610062	Post Office, 350 Canal St.	New York	**16.3**	14.1
360610079	School IS 45, 2351 1st Ave.	New York	14.7	12.9
360610128	PS 19, 185 1st Avenue	New York	**15.9**	14.0
360710002	NYC- 55 Broadway	New York	11.5	10.2
360810094	NYC- PS 29 125-10 23rd Avenue	New York	13.7	12.1
360810096	NYC- 3115 140th Street	New York	13.7	12.1
360810124	NYC- 14439 Gravett Road	New York	13.3	11.8
360850055	Post Office, 364 Port Richmond	New York	14.0	12.0
360850067	Susan Wagner	New York	12.1	10.4
361030001	East Farmingdale Water Plant	New York	12.1	10.6
361191002	5th Avenue & Madison, Thruway Exit 9	New York	12.3	10.8

As can be seen from this table, the only site with a projected 2009 design value greater than the annual fine particulate standard of 15.0 µg/m^3 is the P.S. 59 site located in Manhattan, New York City. This is also illustrated in Figure 5.2. All other sites are below the annual fine particulate standard. The projected 2009 value for the P.S. 59 site is within the weight-of-evidence range of values defined in the $PM_{2.5}$ modeling guidance as 14.5 µg/m^3 through 15.5 µg/m^3.[18] Further justification to explain why New Jersey, New York, and Connecticut believe that fine particulate levels at this site as well as all other sites, will be lower than predicted in 2009 and why this site will achieve the annual standard by 2009 is presented in Section 5.3

Table 5.4 shows the $PM_{2.5}$ modeling results using the 2009 BOTW run for all monitors located within the Southern New Jersey/Philadelphia nonattainment area.

[18] USEPA. Guidance on the Use of Models and Other Analyses for Demonstrating Attainment of Air Quality Goals for Ozone, $PM_{2.5}$, and Regional Haze. United States Environmental Protection Agency, Office of Air Quality Planning and Standards, Air Quality Analysis Division, Air Quality Modeling Group, Research Triangle Park, NC, EPA-454/B-07-002, April 2007, page 105.

Figure 5.2: Map of the 1997 $PM_{2.5}$ Northern New Jersey/New York/Connecticut Nonattainment Area

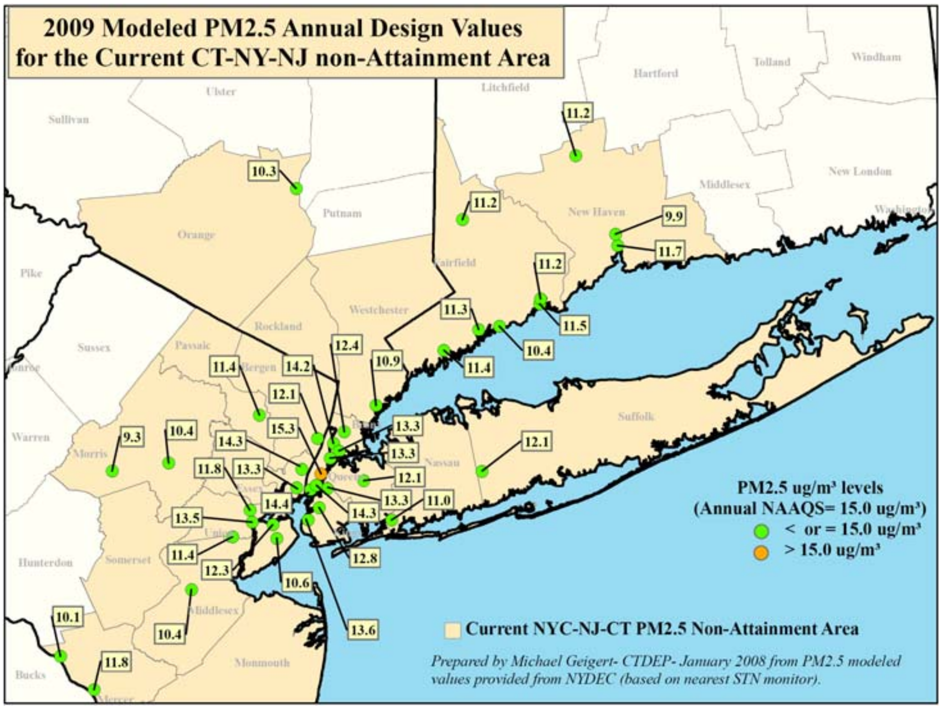

Table 5.4: 2009 Modeled $PM_{2.5}$ Design Values for the Southern New Jersey/Philadelphia/Delaware Nonattainment Area

(Bold Type indicates Values over the Annual Standard of 15.0 µg/m³)

Site ID	Monitoring Site Name	State Name	Average Annual Baseline Design Value (DV_{B-I}) (µg/m³)	Projected 2009 Annual Design Value(DV_{F-I}) (µg/m³)
100031003	Bellefonte	Delaware	14.7	12.6
100031007	Lums2	Delaware	13.6	11.4
100031012	Newark-Univ. Del. No. Campus	Delaware	**15.0**	12.8
100032004	Wilmington	Delaware	**16.0**	13.7
340070003	Camden	New Jersey	14.3	12.3
340071007	Pennsauken	New Jersey	14.3	12.4
340155001	Clarksboro	New Jersey	13.7	11.8
420170012	Bristol	Pennsylvania	14.1	12.0
420290100	New Garden (Airport)	Pennsylvania	14.9	12.5
420450002	Chester	Pennsylvania	**15.3**	13.3
420910013	Norristown	Pennsylvania	13.7	11.9
421010004	Frankford (Lab	Pennsylvania	14.9	12.9
421010014	Philadelphia- Roxy Water Pump Station	Pennsylvania	13.6	11.8
421010020	Philadelphia- Belmont Avenue	Pennsylvania	14.2	12.4

Site ID	Monitoring Site Name	State Name	Average Annual Baseline Design Value (DV_{B-I}) ($\mu g/m^3$)	Projected 2009 Annual Design Value(DV_{F-I}) ($\mu g/m^3$)
	Water Plant			
421010024	Philadelphia - Northeast Airport	Pennsylvania	13.8	11.8
421010047	Philadelphia- 500 South Broad Street[19]	Pennsylvania	**16.1**	13.9
421010052	Philadelphia- 1439 East Passyunk Avenue	Pennsylvania	13.1	11.4
421010136	Philadelphia- Southwest (Elm)	Pennsylvania	14.5	12.6

As can be seen from this table, all sites in the Southern New Jersey/Philadelphia nonattainment area are projected to be below the annual fine particulate standard of 15.0 $\mu g/m^3$ and below the weight of evidence range of values.

5.3 Demonstrations

5.3.1 Introduction

A modeled attainment demonstration consists of:

- Analyses which estimate whether selected emission reductions will result in ambient concentrations that meet the NAAQS, and

- An identified set of control measures which will result in the required emission reductions.

An analysis of the selected emission reductions which will result in ambient concentrations that meet the annual $PM_{2.5}$ NAAQS is discussed in Section 5.2.4. The measures included in the photochemical modeling, the 2009 BOTW modeling run, are listed in Table 5.1. Table 5.3 and Table 5.4 provide 2002 modeling baseline design value concentrations and projected 2009 annual $PM_{2.5}$ concentrations, by nonattainment area. These tables show that all but one monitor in the Northern New Jersey/New York/Connecticut nonattainment area and all the monitors in the New Jersey/Philadelphia nonattainment area are predicted to be in attainment of the annual $PM_{2.5}$ NAAQS by the attainment date of April 5, 2010.

[19] The site at 500 South Broad St. was the design value monitoring site for the City of Philadelphia for $PM_{2.5}$ NAAQS, and had been an area of focus for the USEPA-Region 3 due to the need to find a suitable location for this monitoring site as a result of the pending closure of the 500 South Broad Street office. Additionally, data from the fourth quarter of 2005 have not been quality assured but had been reported to AIRS-AQS. The NJDEP expects that the City of Philadelphia and the State of Pennsylvania will resolve the data quality issues with this site in the near future and address them in their own State's SIP. It is not expected that this site will be over the annual standard of 15 $\mu g/m^3$ using the latest, quality-assured monitoring data.

In the Northern New Jersey/ New York/Connecticut nonattainment area, one monitor is predicted to be above the annual $PM_{2.5}$ standard of 15.0 μg/m^3 in 2009. This monitor is located at P.S. 59 in Manhattan, New York City. This monitor is predicted to be at a value of 15.3 μg/m^3. This value is within the weight-of-evidence range that is defined in USEPA guidance: 14.5 μg/m^3 to 15.5 μg/m^3.[20] Additional emission reductions of $PM_{2.5}$ and precursors will occur between now and 2009 and are discussed in Section 5.3.2.6.

In the Southern New Jersey/Philadelphia nonattainment area, the monitors located in New Jersey, Pennsylvania (Philadelphia area), and Delaware are predicted to come into attainment by 2009 (see Table 5.4). The highest value predicted in this nonattainment area is located on Broad Street in Philadelphia, PA, and the value is predicted to be 13.9 μg/m^3. This value is below the weight-of-evidence range that is defined in the USEPA guidance: 14.5 μg/m^3 to 15.5 μg/m^3. Additional emission reductions of $PM_{2.5}$ and precursors will occur between now and 2010 and are discussed in Section 5.3.2.5.

5.3.2 Supplemental Analysis/Weight-of-Evidence

While the USEPA attainment demonstration guidance emphasizes a single design value from a single modeling simulation as the core of any attainment demonstration, [21] it also supports, in conjunction with the Clean Air Act Advisory Committee (CAAAC), states utilizing a multi-analysis approach to their $PM_{2.5}$ attainment demonstrations.[22] This is because the principles of atmospheric science acknowledge that, in using models, all of the uncertainties and biases need to be considered. Uncertainties associated with emission inventories, meteorological data, and the representation of photochemistry in the model can result in over or under predictions in design values. The CAAAC also recommends that states decrease reliance on modeling results to demonstrate attainment and rather focus more on ambient air monitoring data.

5.3.2.1 Monitoring Data Shows Trend toward Attainment of the Annual $PM_{2.5}$ NAAQS and a Downward Trend in Ambient Air Concentrations

Tables 5.5 and 5.6 present the annual average monitoring results and design values, respectively, from the Northern New Jersey/New York/Connecticut nonattainment area $PM_{2.5}$ monitors from 2000 through 2006. These monitoring results show that the measured values at the monitors in the nonattainment area have generally been decreasing since 2000, and that the monitored values in 2006 were all below the lower range of values for the weight-of-evidence range for annual $PM_{2.5}$ (14.5 μg/m^3 to 15.5 μg/m^3). During the period of 2000 to 2006, two New Jersey monitors in the Northern

[20] USEPA. Guidance on the Use of Models and Other Analyses for Demonstrating Attainment of Air Quality Goals for Ozone, $PM_{2.5}$, and Regional Haze. United States Environmental Protection Agency, Office of Air Quality Planning and Standards, Air Quality Analysis Division, Air Quality Modeling Group, Research Triangle Park, NC, EPA-454/B-07-002, April 2007, page 17.
[21] USEPA. Guidance on the Use of Models and Other Related Analyses in Attainment Demonstrations for the 8-Hour Ozone NAAQS. United States Environmental Protection Agency, Office of Air Quality Planning and Standards, Emissions, Monitoring, and Analysis Division, Air Quality Modeling Group, Research Triangle Park, North Carolina, EPA-454/R-05-002, October 2005.
[22] ibid.

New Jersey/New York/Connecticut nonattainment area were not operating for part of the time, Union City and Newark Lab. The site located in Union City, New Jersey had the highest annual $PM_{2.5}$ results in 2000 within the State, although not the highest values within the nonattainment area. The annual $PM_{2.5}$ result at the Union City monitor in 2006 was 13.9 µg/m^3; preliminary results for 2007 show that this value is the same at this monitor and below the weight of evidence range of values. The downward trends in these values are consistent with the annual $PM_{2.5}$ results seen in Chapter 2.

Table 5.6 contains the design values for the monitors in the Northern New Jersey/New York/Connecticut nonattainment area. Despite slightly elevated $PM_{2.5}$ values in 2005, the 2006 design values are also showing a decreasing trend. These results further reinforce that the New Jersey portion of the Northern New Jersey/New York/Connecticut nonattainment will attain the annual $PM_{2.5}$ standard in 2009.

Tables 5.7 and 5.8 present the annual average monitoring results and design values, respectively, from the Southern New Jersey/Philadelphia $PM_{2.5}$ monitors from 2000 through 2006. These monitoring results show that the measured values at the monitors in the nonattainment area have been decreasing, and that the monitored values in 2006 were all below the lower range of values for the weight-of-evidence range for annual $PM_{2.5}$ (14.5 µg/m^3 to 15.5 µg/m^3). The design values in Table 5.8 show that the air quality in the New Jersey portion of the Southern New Jersey/Philadelphia nonattainment area is in attainment of the annual $PM_{2.5}$ NAAQS.

These results further reinforce that the New Jersey portion of the Southern New Jersey/Philadelphia will attain the annual $PM_{2.5}$ standard in 2009.

5.3.2.2 Monitoring Data Shows Progress towards Attainment of the New Daily $PM_{2.5}$ NAAQS of 35 µg/m^3

While the monitoring data shows a consistent downward trend in fine particulate concentrations, the monitored values are still above the new 2006 Federal 24-hour NAAQS of 35 µg/m^3. Tables 5.9 and 5.10 show the monitored fine particulate levels associated with New Jersey's Northern New Jersey/New York/Connecticut nonattainment area and the Southern New Jersey/Philadelphia nonattainment, respectively. For 2006, several sites (shown in bold and shaded) are above the 35 µg/m^3 daily standard but it should be noted that all sites are well below the former daily standard of 65 µg/m^3.

<u>Table 5.5</u>: Annual Ambient $PM_{2.5}$ Levels in the Northern New Jersey/New York/Connecticut Nonattainment Area

State	County	Monitor Site Address	2000	2001	2002	2003	2004	2005	2006
NJ	Bergen	Fort Lee	14.6	14.5	13.0	13.3	12.0	14.5	11.8
	Essex	Newark Cultural Center	15.6	13.5	13.2	14.1	13.2	14.3	12.1
	Essex	Newark Lab		15.3	14.1	13.1			
	Hudson	Jersey City Primary	16.8	14.1	14.3	14.8	13.8	15.2	13.3
	Hudson	Union City	17.1	15.8	16.8			17.4	13.9
	Mercer	Trenton	14.7	14.9	13.0	13.5	12.5	13.0	12.5
	Mercer	Washington Crossing	12.1	12.2	11.5	12.0	11.0	12.1	10.0
	Middlesex	New Brunswick	13.1	13.2	11.1	13.0	11.2	13.4	10.8
	Morris	Chester	11.1	11.8	10.5	10.7	10.1	10.9	9.0
	Morris	Morristown	12.9	13.4	11.5	12.2	11.1	12.5	10.1
	Passaic	Paterson	13.7	13.1	12.9	13.3	12.6	13.4	12.0
	Union	Elizabeth Turnpike Primary	16.9	15.8	14.9	16.2	15.2	15.2	14.2
	Union	Elizabeth Downtown	15.2	13.4	13.1	14.0	12.6	14.3	12.4
	Union	Rahway	14.2	12.8	12.4	13.3	12.6	14.0	11.9
NY	Bronx	Morrisania Center, 1225-57 Gerard Ave.	16.6	15.9	15.4	15.7	14.6	16.9	13.9
	Bronx	200th St. And Southern Blvd.		14.4	13.5	13.4	12.7	13.9	12.0
	Bronx	E 156th St. Bet Dawson and Kelly	15.3	14.6	15.0	14.8	13.5	14.8	12.8
	Kings	Jhs 126 424 Leonard St.		15.3	14.0	14.8	13.8	15.3	12.8
	Nassau	Lawrence High School, Arlington Place	12.2	12.9	11.4	12.4	11.4	12.4	10.8
	New York	Ps 59, 288 E. 57th Street	18.5	17.8	16.4		15.4	17.0	14.4
	New York	Post Office, 350 Canal St.	17.6	17.3	16.0	15.8	14.5	15.7	12.8
	New York	School Is 45, 2351 1st Ave.	15.5	15.2	14.7	14.5	13.2	14.3	12.7
	Orange	55 Broadway		11.6	11.0	11.8	10.4	12.1	9.7
	Orange	14439 Gravett Rd.		14.2	12.7	13.5	12.2	12.4	11.6
	Richmond	Post Office, 364 Port Richmond Ave.	14.3	14.5	13.8		13.3	14.5	12.2
	Richmond	Susan Wagner HS, Brielle Ave. & Manor Rd.	12.4	13.1	11.5		11.6	12.5	10.4
	Suffolk	East Farmingdale Water Plant		13.0	11.4	11.9	10.7	12.0	
	Westchester	5th Ave. & Madison, Thruway Exit 9		12.9	11.8	12.1	11.3	12.4	11.0
CT	Fairfield	Roosevelt School Park Ave.	14.0	13.7	12.8	12.8	12.7	14.4	12.5

State	County	Monitor Site Address	2000	2001	2002	2003	2004	2005	2006
	Fairfield	Trailer, W. Connecticut State University	12.7	13.2	12.6	13.3	11.2	13.4	12.3
	Fairfield	Hillandale Ave.	12.9	13.0	12.7	13.5	11.8		
	Fairfield	Norwalk Health Dept., 137 East Ave.		13.4	12.6	13.1	12.4	13.2	11.7
	Fairfield	Sherwood Island State Park	13.0	12.1	11.5	11.7	11.1	12.2	10.7
	New Haven	Stiles St.	16.2	17.0	15.9	16.8	15.4	18.9	
	New Haven	Woodward Ave.				11.9	11.5	13.1	11.7
	New Haven	1 James St.					12.2	13.3	12.2
	New Haven	715 State St.	14.1	14.3	13.3	14.0	12.8	13.8	12.7
	New Haven	Agri. Expr. Sta. Huntington St.				11.9	11.1	11.8	10.8
	New Haven	Shed Meadow and Bank St.	13.7	13.9	13.1	12.6	12.1	14.1	11.9

Table 5.6: Ambient $PM_{2.5}$ Design Values in the Northern New Jersey/New York Connecticut Nonattainment Area[23]

State	County	Monitor Site Address	2000-2002	2001-2003	2002-2004	2003-2005	2004-2006
NJ	Bergen	Fort Lee	14.0	13.6	12.8	13.3	12.8
	Essex	Newark Cultural Center	14.1	13.6	13.5	13.9	13.2
	Essex	Newark Lab	14.7	14.2	13.6	13.1	
	Hudson	Jersey City Primary	15.1	14.4	14.3	14.6	14.1
	Hudson	Union City	16.6	16.3	16.8	17.4	15.7
	Mercer	Trenton	14.2	13.8	13.0	13.0	12.7
	Mercer	Washington Crossing	11.9	11.9	11.5	11.7	11.0
	Middlesex	New Brunswick	12.5	12.4	11.8	12.5	11.8
	Morris	Chester	11.1	11.0	10.5	10.6	10.0
	Morris	Morristown	12.6	12.4	11.6	11.9	11.2
	Passaic	Paterson	13.2	13.1	12.9	13.1	12.7
	Union	Elizabeth Turnpike Primary	15.9	15.6	15.4	15.5	14.9
	Union	Elizabeth Downtown	13.9	13.5	13.2	13.6	13.1
	Union	Rahway	13.1	12.8	12.8	13.3	12.8
NY	Bronx	Morrisania Center, 1225-57 Gerard Ave.	16.0	15.7	15.2	15.7	15.1
	Bronx	200th St. And Southern Blvd.	14.2	13.9	13.4	13.3	12.9
	Bronx	E 156th St. Bet Dawson and Kelly	15.0	14.8	14.4	14.4	13.7
	Kings	Jhs 126 424 Leonard St.		14.9	14.4	14.6	14.0
	Nassau	Lawrence High School, Arlington Place	12.3	12.4			
	New York	Ps 59, 288 E. 57th Street	17.6	17.6	16.8	17.0	15.6
	New York	Post Office, 350 Canal St.	17.0	16.4	15.4	15.3	14.3
	New York	School Is 45, 2351 1st Ave.	15.1	14.8	14.1	14.0	13.4
	New York	55 Broadway		15.7	15.8	15.8	15.2
	Orange	14439 Gravett Rd.	11.7	11.6	11.2	11.4	10.7
	Queens	Post Office, 364 Port Richmond Ave.		13.6	12.9	12.7	12.1
	Richmond	Susan Wagner HS, Brielle Ave. & Manor Rd.	14.4	14.0	13.7	13.7	13.4
	Richmond	East Farmingdale Water Plant	12.5	12.2	11.7	11.9	11.5

[23] Monitoring sites with only two or less three-year average values are not shown as no discernable trends can be seen due to a lack of sufficient data points. Also, only one monitoring value is shown at some sites that have duplicate monitoring performed to avoid confusion. In these limited cases, the higher value of the two monitors is shown.

State	County	Monitor Site Address	2000-2002	2001-2003	2002-2004	2003-2005	2004-2006
	Suffolk	5th Ave. & Madison, Thruway Exit 9	12.5	12.3	11.5	11.5	
	Westchester	Morrisania Center, 1225-57 Gerard Ave.		12.5	11.9	12.0	11.6
CT	Fairfield	Roosevelt School Park Ave.	13.4	13.1	12.7	13.3	13.2
	Fairfield	Trailer, W. Connecticut State University	12.8	13.1	12.4	12.7	12.3
	Fairfield	Hillandale Avenue	12.9	13.1	12.7		
	Fairfield	Norwalk Health Dept., 137 East Avenue	12.9	13.0	12.7	12.9	12.4
	Fairfield	Sherwood Island State Park	12.2	11.8	11.4	11.7	11.3
	New Haven	Stiles Street 24	16.4	16.6	16.1	17.1	
	New Haven	715 State Street	13.8	13.7	13.1	13.4	13.1
	New Haven	Shed Meadow And Bank Street	13.8	13.7	12.9	13.4	12.9
	New Haven	Mill Rock Basin	11.5	11.8			

[24] See Footnote 20 for explanation of the Stiles Street monitor.

Table 5.7: Annual Ambient $PM_{2.5}$ Levels in the Southern New Jersey/Philadelphia Nonattainment Area

State	County	Monitor Site Address	2000	2001	2002	2003	2004	2005	2006
NJ	Camden	Pennsauken	15.5	14.2	13.9	13.9	13.2	14.3	12.4
	Camden	Camden Lab Primary	15.0	14.5	13.3	16.3	13.3	14.4	12.2
	Gloucester	Gibbstown	15.1	14.5	12.3	13.8	12.4	14.1	9.0
PA	Bucks	Rockview Lane	13.6	14.5	14.2	14.4	13.0	14.3	12.2
	Chester	New Garden Airport - Toughkenamon			14.6	15.6	14.3	15.9	12.6
	Delaware	Front St. & Norris St.	16.0	15.9	14.7	15.3	15.0	16.5	14.0
	Montgomery	State Armory - 1046 Belvoir Rd.	13.5	14.9	13.6	13.9	12.0	12.5	12.1
	Philadelphia	1501 E. Lycoming Ave. Ams Lab	14.9	16.5	14.8	14.8	13.9	14.3	13.5
	Philadelphia	Ford Rd.-Belmont Ave. Water Treat Plant	14.7	15.4	13.8	13.7	13.9		
	Philadelphia	Grant-Ashton Roads, Phila. NE Airport	14.4	14.6	13.9	13.0	12.8	13.0	12.4
	Philadelphia	500 South Broad St. - Parking Lot (Chs)	17.0	16.6	16.2	15.5	14.4		
	Philadelphia	Amtrak, 5917 Elmwood Ave.	14.8	16.7	14.4	14.1	12.8	14.3	13.2
DE	New Castle	River Road Park, Bellefonte	15.4	15.6	14.0	14.8	13.9	14.3	12.3
	New Castle	Lums Pond State Park	14.2	14.5	13.0	13.3	13.2	13.8	11.4
	New Castle	Univ. Del. North Campus	15.4	15.8	14.3	14.8	14.5	14.4	12.7
	New Castle	MLK Blvd. and Justison St.	16.4	17.6	14.8	15.5	14.9	15.0	14.7

Table 5.8: Ambient $PM_{2.5}$ Design Values in the Southern New Jersey/Philadelphia Nonattainment Area[25]

State	County	Monitor Site Address	2000-2002	2001-2003	2002-2004	2003-2005	2004-2006
NJ	Camden	Pennsauken	14.5	14.0	13.7	13.8	13.3
	Camden	Camden Lab Primary	14.3	14.7	14.3	14.7	13.3
	Gloucester	Gibbstown	14.0	13.5	12.8	13.4	11.8
PA	Bucks	Rockview Lane	14.1	14.3	13.9	13.9	13.2
	Chester	New Garden Airport - Toughkenamon			14.8	15.2	14.2
	Delaware	Front St. & Norris St.	15.5	15.3	15.0	15.6	15.2
	Montgomery	State Armory - 1046 Belvoir Rd.	14.0	14.1	13.2	12.8	12.2
	Philadelphia	1501 E. Lycoming Ave. Ams Lab	15.4	15.4	14.5	14.3	13.9
	Philadelphia	Ford Rd.-Belmont Ave. Water Treat Plant	14.6	14.3	13.8		
	Philadelphia	Grant-Ashton Roads, Phila. NE Airport	14.3	13.8	13.2	12.9	12.7
	Philadelphia	500 South Broad St. - Parking Lot	16.6	16.1	15.4		
	Philadelphia	Amtrak, 5917 Elmwood Ave.	15.3	15.0	13.7	13.7	13.4
DE	New Castle	River Road Park, Bellefonte	15.0	14.8	14.2	14.3	13.5
	New Castle	Lums Pond State Park	13.9	13.6	13.2	13.4	12.8
	New Castle	Univ. Del. North Campus	15.2	15.0	14.6	14.6	13.9
	New Castle	MLK Blvd. and Justison St.	16.6	16.7	15.7	15.8	15.5

[25] Monitoring sites with only two or less three-year average values are not shown as no discernable trends can be seen due to a lack of sufficient data points. Also, only one monitoring value is shown at some sites that have duplicate monitoring performed to avoid confusion. In these limited cases, the higher value of the two monitors is shown.

Table 5.9: Averaged Daily $PM_{2.5}$ Ambient Levels in the Northern New Jersey/New York/Connecticut Nonattainment Area ($\mu g/m^3$)

			98th Percentile 24-Hour Average ($\mu g/m^3$)								3-Year Average 98th Percentile 24-Hour Average ($\mu g/m^3$)					
State	**County**	**Monitor Site Address**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**1999-2001**	**2000-2002**	**2001-2003**	**2002-2004**	**2003-2005**	**2004-2006**
NJ	Bergen	Fort Lee	39	36	30	33	39	31	41	38	35	33	34	34	37	**37**
	Essex	Newark Cultural Center	44	42	29	32	40	35	40	40	38	34	34	36	38	**38**
	Hudson	Jersey City Primary	46	40	34	34	46	37	38	41	40	36	38	39	41	**39**
	Hudson	Union City	50	39	35	38			44	41	42	37	36	38	44	**43**
	Mercer	Trenton	33	43	31	35	41	33	34	36	35	36	35	36	36	34
	Mercer	Washington Crossing	28	32	26	32	35	28	33	30	29	30	31	32	32	30
	Middlesex	New Brunswick	31	35	27	26	45	36	34	33	31	29	33	36	38	34
	Morris	Chester	30	29	31	30	36	30	33	28	30	30	32	32	33	31
	Morris	Morristown	35	30	27	30	37	31	33	30	31	29	31	33	34	31
	Passaic	Paterson	41	35	30	35	40	31	41	33	35	33	35	35	37	**35**
	Union	Elizabeth Turnpike Primary	41	39	38	42	37	41	43	40	39	40	39	40	40	**41**
	Union	Elizabeth Downtown	43	36	26	30	41	33	39	39	35	31	32	35	38	**37**
	Union	Rahway	17	38	29	31	35	37	38	38	28	33	32	34	37	**37**
NY	Bronx	Morrisania Center, 1225-57 Gerard Ave.	45	40	37	35	45	38	38	40	41	37	39	39	40	**39**
	Bronx	200th St. And Southern Blvd.	35	39	35	33	38	31	37	35	36	36	36	34	35	34
	Bronx	E 156th St. Bet Dawson and Kelly	34	41	39	41	38	29	37	38	38	40	39	36	34	**35**
	Kings	PS 321 180 7th Av	38	42	35	32	33				38	36	33			
	Kings	Jhs 126 424 Leonard St.			35	36	41	37	36	38			37	38	38	**37**
	Nassau	Lawrence High School, Arlington Place		32	31	32	39	31	35	33	32	32	34	34	35	33
	New York	PS 59, 288 E. 57th St. (monitor 2)	47	42	40	38	37	41	39		43	40	38	39	39	
	New York	PS 59, 288 E. 57th St. (monitor 1)	36	42	40	38	37	41	40	41	39	40	38	39	39	**41**
	New York	Post Office, 350 Canal St. (monitor 1)	45	41	42	39	46	39	40	36	43	41	42	41	42	**38**
	New York	School Is 45, 2351 1st Ave. (monitor 1)		41	36	36	46	38	37	38		38	39	40	40	**37**
	New York	PS 19 185 1st Ave.			38	38	48	39	38	38			42	42	42	**38**
	New York	55 Broadway		30	28	32	31	27	30	28		30	30	30	29	28
	Queens	14439 Gravett Rd.			36	39	39	33	34	34			38	37	36	34
	Richmond	Post Office, 364 Port Richmond Ave.		40	32	40	46	31	33	36		37	39	39	37	34
	Richmond	Susan Wagner HS, Brielle Ave.& Manor Rd.		33	31	28	32	34	33	32	32	31	30	31	33	33

			98th Percentile 24-Hour Average (µg/m³)								3-Year Average 98th Percentile 24-Hour Average (µg/m³)					
State	County	Monitor Site Address	1999	2000	2001	2002	2003	2004	2005	2006	1999-2001	2000-2002	2001-2003	2002-2004	2003-2005	2004-2006
	Suffolk	East Farmingdale Water Plant		32	34	36	39	31	34		33	34	36	35	35	
	Suffolk	East Farmingdale Water Dist.,Gazza Blvd.				36	39	31	34	32				35	35	32
	Westchester	5th Ave. & Madison, Thruway Exit 9			34	33	37	34	33	34			35	34	34	34
CT	Fairfield	Roosevelt School Park Ave.	31	42	40	35	40	34	38	37	38	39	38	36	37	**36**
	Fairfield	Trailer, W. Connecticut State University		33	35	31	37	28	33	34		33	34	32	33	32
	Fairfield	Hillandale Ave.		36	37	35	42	32				36	38	36		
	Fairfield	Norwalk Health Dept., 137 East Ave.			36	34	43	35	35	36			38	37	38	35
	Fairfield	Sherwood Island State Park		33	35	31	44	31	35	31		33	36	35	37	32
	New Haven	Stiles St.	40	40	41	40	44	35	44		40	40	42	40	41	
	New Haven	Woodward Ave.					46	32	36	37					38	35
	New Haven	1 James St.						37	38	37						**37**
	New Haven	715 State St.	32	37	40	32	44	36	41	38	36	36	39	38	40	**38**
	New Haven	Agri. Expr. Sta. Huntington St.					44	32	33	34					36	33
	New Haven	Shed Meadow and Bank St. (USEPA, monitor 1)	38	34	35	33	13	30	34	36	36	34	27	25	26	33
	New Haven	Shed Meadow and Bank St. (CTDEP)	38	34	35	33	38	30	36	36	36	34	35	34	35	34
	New Haven	Mill Rock Basin	28	35	32	29	44				32	32	35			

Table 5.10: Averaged Daily $PM_{2.5}$ Ambient Levels in the Southern New Jersey/Philadelphia Nonattainment Area ($\mu g/m^3$)

			98th Percentile 24-Hour Average (µg/m3)								3-Year Average 98th Percentile 24-Hour Average (µg/m3)					
State	**County**	**Monitor Site Address**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**1999-2001**	**2000-2002**	**2001-2003**	**2002-2004**	**2003-2005**	**2004-2006**
NJ	Camden	Pennsauken	35	36	33	35	38	35	37	38	35	35	35	36	37	**37**
	Camden	Camden Lab Primary	32	32	30	35	43	35	38	34	31	32	36	38	39	**36**
	Gloucester	Gibbstown	25	34	29	29	35	29	32	24	29	31	31	31	32	29
PA	Bucks	Rockview Lane		38	39	37	40	30	35	34		38	39	36	35	33
	Chester	New Garden Airport - Toughkenamon				34	39	33	34	38				35	35	35
	Delaware	Front St. & Norris St.	36	36	40	32	38	31	37	37	37	36	37	34	35	35
	Delaware	State Armory - 1046 Belvoir Rd.		32	48	37	38	29		36		39	41	35		
	Philadelphia	1501 E. Lycoming Ave. Ams Lab	39	41	40	40	40	34	36	38	40	40	40	38	37	**36**
	Philadelphia	Ford Rd-Belmont Ave. Water Treat Plant		32	36	34	39	29				34	37	34		
	Philadelphia	Grant-Ashton Roads Phila. NE Airport		38	37	34	39	33	36	35		36	37	35	36	35
	Philadelphia	500 South Broad St.		39	40	36	42	32				38	39	37		
	Philadelphia	Amtrak, 5917 Elmwood Ave.		39	46	37	36	30		38		41	40	34		
DE	New Castle	River Road Park, Bellefonte	33	38	41	34	36	33	35		37	38	37	34	34	33
	New Castle	Lums Pond State Park		36	36		37	31	36	29	35	34	34	33	35	32
	New Castle	Univ. Del. - North Campus	35	40	40	42	36	29	35	31	38	41	39	36	33	32
	New Castle	MLK Blvd. and Justison St.	38	39	43	41	37	34	37	38	40	41	40	37	36	**36**

5.3.2.3 Discussion of Monitoring Results Collected at P.S. 59, Manhattan, New York

One monitor associated with New Jersey's Northern New Jersey/New York/Connecticut nonattainment area is projected to have fine particulate levels slightly above the annual fine particulate standard of 15.0 µg/m^3 in 2009. The annual $PM_{2.5}$ design value at this monitor located at P.S. 59 in New York City is predicted to be 15.3 µg/m^3 in 2009. This predicted value is within the USEPA weight-of-evidence range of values.

New York has prepared a weight-of-evidence demonstration for the P.S. 59 monitor to point out the factors unique to this site that need to be considered when determining that the site will attain the annual $PM_{2.5}$ NAAQS by April 5, 2010. First, the monitoring data is lacking complete information for the third quarter of 2003. During this period, construction work was occurring at the site location that potentially invalidated a number of samples during the quarter and unfairly biased the collected fine particulate levels to the high side (see Appendix B2-1, Attachment 1); the construction work was the sole reason for the incomplete dataset. Also, analysis of the monitoring data suggests that lack of collocated speciation monitors and use of speciation information from the nearest neighborhood monitor may have contributed to the estimate of $PM_{2.5}$ being above the level of NAAQS at the P.S.59 monitor. Examining the trends in precursors as well as measured $PM_{2.5}$ at P.S.59 suggests a downward path and that coupled with the observation that the contribution to the secondary species is from upwind regions rather than local, favors strongly that this monitor will also be in attainment similar to the rest of them in the region. A more detailed discussion of these measures is included in Appendix B12.

In addition, New York lists the following programs in the process of being adopted or implemented in their state, that are not represented in the projection inventories for 2009 and that will contribute to attainment at the P.S. 59 monitor (refer to Appendix B12 for a comprehensive discussion of each of these measures):

- Part 222, Distributed Generation
- Part 227-2, NO_x RACT (High Electric Demand Day Units)
- Parts 243, 244, and 245, Clean Air Interstate Rule
- Diesel Emissions Reduction Act of 2006
- Existing and New/Revised State VOC Reduction Measures
- Federal Rules for VOC Reductions
- Proposed Federal Rules for VOC, NO_x, and PM Reductions
- PlaNYC (New York City emission reduction initiatives)
- Canadian Air Quality Efforts
- Governor Spitzer's "15 by 15" Initiative
- New York State Energy Research and Development Authority (NYSERDA) Programs

The local reduction of $PM_{2.5}$, as outlined in PlaNYC,[26] at the P.S. 59 monitor and at similarly situated monitors in New York City suggest attainment will occur by 2009. New Jersey agrees with this demonstration and further believes that additional control measures not included in the 2009 modeling, like those that will occur in New Jersey (see Section 5.3.2.5) and the early implementation of CAIR SO_2 controls prior to 2010, will lower ambient concentrations even further than the levels needed to demonstrate attainment of the annual fine particulate standard. New York's weight-of-evidence discussion for the P.S. 59 monitor is included in Appendix B12.

Table 5.11: Local Control Measures Proposed in PlaNYC[27] Associated with the P.S. 59 Monitor in New York City

Measure	Description
Reduce road vehicle emissions	• Capture the air quality benefits of the transportation plan • Improve fuel efficiency of private cars • Reduce emissions from taxis, black cars, and for-hire vehicles • Replace, retrofit, and refuel diesel trucks • Decrease school bus emissions
Reduce other transportation emissions	• Retrofit ferries and promote use of cleaner fuels • Seek to partner with the Port Authority to reduce emissions from Port facilities • Reduce emissions from construction vehicles
Reduce emissions from buildings	• Capture the air quality benefits of the energy plan • Promote the use of cleaner burning heating fuels • Pursue natural solutions to improve air quality • Capture the benefits of the open space plan • Reforest targeted areas of the parkland • Increase tree plantings on lots
Understand the scope of the challenge	• Launch collaborative local air quality study

26 PlaNYC: A Greener, Greater New York. The City of New York, Mayor Michael R. Bloomberg. April 22, 2007. Accessible at http://www.nyc.gov/html/planyc2030/downloads/pdf/full_report.pdf. (Also see Appendix B12)

27 PlaNYC: A Greener, Greater New York. The City of New York, Mayor Michael R. Bloomberg. April 22, 2007. Accessible at http://www.nyc.gov/html/planyc2030/downloads/pdf/full_report.pdf. (Also see Appendix B12)

5.3.2.4 The Contribution of Transport to Nonattainment

Representing the amount of transported particulates, and the components that contribute to secondary aerosol formation, accurately in the regional modeling not only affects the accuracy of the modeling results but also the contribution of regional sources to nonattainment at a particular location. This information ultimately helps to inform the process on what sources to control to reduce precursor pollutants and thus fine particulate matter.

Fine particulate pollution apportionment modeling analyses show that transport from states outside the State are significant contributors to nonattainment in New Jersey. Recent modeling conducted in 2005 by the USEPA to support the implementation of the CAIR indicates that out-of-state contributions of sulfate and nitrate to Union County, New Jersey from just the Electric Generating Units in other states will contribute at least 3.4 $\mu g/m^3$ to the projected 2010 levels and at least 4.8 $\mu g/m^3$ (or about 30 percent) to the P.S. 59 monitor in New York City.[28]

Chapter 2 describes several studies that analyzed the sources of fine particulate matter in New Jersey's air. Secondary sulfate appears as the largest portion of the fine particulate mass in both urban and rural areas of New Jersey. Transported sulfate concentrations from upwind electric power plants appears to be the largest contributor to these sulfate levels. Implementation of SO_2 controls under the first phase of CAIR in 2010 is anticipated to provide additional benefits as explained in Section 5.3.2.5. The implementation of the second phase of CAIR in 2015 will also have an air quality benefit on New Jersey.

5.3.2.5 SO_2 CAIR Reductions May Provide Early Reductions in $PM_{2.5}$

The effects of the SO_2 reductions from implementation of the Clean Air Interstate Rule in 2010 on air quality in the Northern New Jersey/New York/Connecticut nonattainment area were not evaluated as part of the 2009 modeling. As the focus of that modeling was to gauge attainment of the ozone and fine particulate matter standards in 2009, adding SO_2 emission reductions which had not yet occurred, but would appear a year later in 2010, would not be appropriate for the 2009 modeling year. It is anticipated that these additional SO_2 reductions through CAIR will further lower fine particulate levels in 2010, and these reductions may occur sooner.

A substantial amount of technical information was provided by the USEPA when it promulgated the CAIR. Part of this information included an analysis of the contributions from upwind states to downwind states fine particulate levels in the outside air. The USEPA defined the states listed in Table 5.12 as significantly contributing to fine particulate or ozone levels in New Jersey and quantified the contribution that these states

[28] USEPA. Technical Support Document for the Final Clean Air Interstate Rule: Air Quality Modeling Analyses, Appendix H: $PM_{2.5}$ Contributions to Each Nonattainment County in 2010. United States Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, March 2005.

were having on the county containing the monitor of concern for the Northern New Jersey/New York/Connecticut nonattainment area in this proposed SIP revision (i.e., New York, New York). Table 5.12 shows the 2003 emissions of SO_2 and additional SO_2 reductions through CAIR implementation in the states identified by the USEPA as significantly contributing and the modeled contribution that these states were having prior to implementation of CAIR.

Table 5.12: Reductions from CAIR in 2010 in States that Significantly Contribute to Ozone or Fine Particulate Levels in New Jersey and the Modeled Contribution to NYC from those States

State	**2003 SO_2 Emissions (thousand tons per year)**	**2010 SO_2 Emissions (thousand tons per year)**	**SO_2 Emission Reductions by 2010 (thousand tons per year)**	**Modeled $PM_{2.5}$ Contribution to NY, NY (µg/m^3)**
New Jersey	51	27	24	0.45
New York	254	66	188	2.00
Pennsylvania	967	235	732	0.95
Delaware	37	28	9	0.09
Maryland	269	62	207	0.22
West Virginia	540	250	290	0.17
Virginia	216	136	80	0.21
Massachusetts	0	0	0	0.12
Ohio	1,176	298	878	0.41
Michigan	351	381	-30*	0.21
District of Columbia	51	27	24	NA (w/ Maryland)
Total	3,912	1,510	2,403	4.83

Source: USEPA at http://www.epa.gov/oar/interstateairquality/where.html
* A negative number indicates an increase

Regional modeling results for 2009, presented in Table 5.3 predicts that the annual $PM_{2.5}$ design value in 2009 at the P.S. 59 monitor (i.e., the design value monitor) will be 15.3 µg/m^3 after implementation of the first phase of the CAIR for additional NO_x (but not SO_2) controls. The USEPA analysis used a starting concentration without CAIR implementation (i.e., a 2010 Base Case) of 16.29 µg/m^3 and determined that 4.83 µg/m^3 of this fine particulate level came from the states that significantly contribute. As the effects of the first phase of the NO_x reductions were already accounted for in the OTC modeling to obtain the predicted concentration of 15.3 µg/m^3, it would not be appropriate to again account for this effect on air quality. Holding the emissions of NO_x constant, and adjusting for the emission reductions from SO_2 in 2010, a 48 percent additional reduction in the total amount of SO_2 will occur (USEPA estimate) as a result of the first phase of CAIR SO_2 reductions in 2010 in the states significantly contributing to New Jersey's air quality.[29] A 48 percent reduction of the 4.83 µg/m^3 that these states contributed in 2003 would then also be expected due to the additional SO_2 controls. Using the data presented from the USEPA modeling, an additional 2.31 µg/m^3 reduction will occur at the P.S. 59 monitor as a result of CAIR SO_2 controls.[30] The predicted concentration in 2010, or earlier, at the P.S. 59 monitor due to the CAIR SO_2 reductions would be 13.0 µg/m^3,[31] well below the weight-of-evidence range of values for the annual $PM_{2.5}$ NAAQS. This estimate of SO_2 reductions provides further assurance that the P.S. 59 monitor will be in attainment by 2010.

5.3.2.6 Additional Measures Not Included in the 2009 BOTW Attainment Modeling

5.3.2.6.1 Introduction

New Jersey is working to propose and implement a number of additional control measures by 2010 that were not included in the attainment demonstration modeling. In addition, some Federal measures are expected to become effective by 2010 that will provide air quality benefits. All these additional measures were the result of the efforts by the USEPA, the OTC, New Jersey's Reasonably Available Control Technology (RACT) analysis, or other New Jersey initiatives to identify measures that would improve air quality.

While there are numerous reasons why certain emission control measures were not included in a modeling scenario, the two most significant are:

- The preparatory work needed to run these models is resource-intensive, making it neither practical nor reasonable to model every possible control measure, and

- The uncertainty in calculating emission reduction benefits from certain types of control measures is acknowledged by the USEPA in its guidance for emerging measures, or measures that are difficult to accurately quantify.[32] Examples of these types of measures include tree planting or replacing roofs with reflective material, both of which help to decrease the high temperatures in an urban area that result from the 'heat island effect' that indirectly impacts ozone and $PM_{2.5}$ concentrations.

Although these additional measures and refinements were finalized too late to be included in the 2009 BOTW modeling, they will provide additional emission reductions by 2009 or by 2010, the attainment year for the annual fine particulate standard. As such,

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[29] The 48 percent is determined by (1 minus (1,118 thousand tons of NO_x in 2003 + 1,510 thousand tons of SO_2 predicted to be emitted in 2010) divided by (1,118 thousand tons of NO_x held constant + 3,912 thousand tons of SO_2 emitted in 2003)) times 100 to get percent.
[30] 4.83 µg/m^3 times 48 percent = 2.3 µg/m^3
[31] 15.3 µg/m^3 predicted – 2.3 µg/m^3 reduction from first round SO2 reductions = 13.0 µg/m^3
[32] USEPA. Incorporating Emerging and Voluntary Measures in a State Implementation Plan (SIP). United States Environmental Protection Agency (USEPA), Office of Air and Radiation, Air Quality Strategies and Standards Division, Office of Air Quality Planning and Standards, Research Triangle Park, NC, September 2004.

they provide additional evidence to support New Jersey's conclusion that both of its associated nonattainment areas will attain the annual $PM_{2.5}$ standard by their required attainment dates in addition to the continued monitored attainment of the areas. These measures will also bring us closer to attaining New Jersey's goal of a 12 $\mu g/m^3$ annual standard and closer to attaining the 2006 24-hour $PM_{2.5}$ standard of 35 $\mu g/m^3$.

5.3.2.6.2 Additional Measures to Improve Air Quality

Even though it is not yet possible to determine the associated emission reductions from certain type of programs with the precision necessary for full Federal approval and for SIP credit toward attainment of the $PM_{2.5}$ NAAQS, the programs discussed in this section provide a cumulative effect of reducing air emissions, which will help bring New Jersey and its associated nonattainment areas into attainment. For example, some of the measures listed in this section will result in reductions of VOC emissions, and although New Jersey has not identified VOCs as a $PM_{2.5}$ precursor, we expect that these measures will also result in improved air quality. However, emission reductions of these air pollution control strategies were not included in the scenarios utilized in the modeling analysis, as a quantified benefit is needed for each control measure that is used in photochemical modeling.

New Jersey is aware that the control measures in this section do and will continue to improve the State's overall air quality by indirectly decreasing fine particulate matter concentrations. As such, these strategies will result in actual air quality benefits that will be reflected in the monitoring data in both the Northern New Jersey/New York/Connecticut and Southern New Jersey/Philadelphia nonattainment areas in the years leading up to 2010. New Jersey promotes and supports these measures, but is not relying upon them to demonstrate attainment.

The control measures and strategies that will further improve air quality can be grouped into 11 categories:

1) Contingency Measures

Contingency measures are additional controls needed to further reduce emissions in the event a nonattainment area fails to attain by its attainment date. These contingency measures must be fully adopted rules or measures that are ready for implementation quickly without further action by the State or the USEPA upon failure to reach attainment. New Jersey contingency measures have been identified and quantified and are discussed in Chapter 6 and in Appendix C. A more detailed explanation of these control measures is included in Chapter 4. The measures listed below are either in effect now or are anticipated to be proposed in the near future.

a) Diesel idling rule changes,
b) Diesel smoke rule changes,
c) Municipal Waste Combustor (MWC) rule changes,
d) Refinery rules,

e) Onroad Motor Vehicle Control Programs (Fleet turnover 2010),
f) Nonroad Motor Vehicle Control Programs (Fleet turnover 2010),
g) Certain Categories of ICI Boilers – additional credit,
h) NO_x RACT (2006) for engines used for distributed generation and certain boilers,
i) Asphalt Production Plants Rule, and
j) Federal Clean Air Interstate Rule (CAIR) Program – Phase I 2010 SO_2 Cap.

2) <u>Point Source Related Measures</u>

The NJDEP Air Quality Permitting Program (AQPP) is responsible for permitting and testing stationary sources of air pollution to ensure they do not adversely affect air quality in the State. Most old sources (those already constructed) and newer facilities are permitted. To accomplish this, the AQPP reviews air pollution control permit applications, evaluates air quality impact and health risks, and ensures stack emissions are measured properly. Some examples of point source related measures that improve air quality that were not included in the 2009 BOTW attainment modeling, but are expected to result in $PM_{2.5}$ benefits, include enhanced controls for glass furnaces, Nonattainment New Source Review (NNSR), and additional controls for $PM_{2.5}$ and SO_2 at Public Service Electric and Gas Company (PSE&G) Hudson.

New Jersey plans to propose amendments to its current glass manufacturing rules at N.J.A.C. 7:27-19.10. The proposed amendments, based on OTC guidance, would revise the NO_x emission rates to reduce emissions consistent with the installation of oxy-fuel firing at the time of the next furnace re-build. Of New Jersey's 25 glass manufacturing furnaces, five are already equipped with oxy-fuel firing and nine are electric. In addition to demonstrated nitrogen reduction at a reasonable cost, oxy-firing may result in reduced $PM_{2.5}$ emissions, lowered energy consumption, and increased glass production.

The Clean Air Act (CAA), 42 <u>U.S.C.</u> § 7503, requires new or modified major sources to install the Lowest Achievable Emission Rate (LAER) control equipment and obtain a one for one emission offsets in order to locate in a nonattainment area. Thus, the NNSR program provides for continual emission reductions to help improve the air quality in the nonattainment area and further downwind.

For more information on the enhanced controls for glass furnaces and NNSR, see Chapter 4.

In addition, on November 30, 2006, the USEPA, U.S. Department of Justice, and the State of New Jersey reached a settlement with PSE&G related to failure to comply with a 2002 consent decree requiring installation of pollution controls at its coal-fired power plants in Jersey City (Hudson) and Hamilton (Mercer), New Jersey. The settlement required additional air pollution reductions, tighter controls, environmental projects, and a penalty. At the Hudson plant, PSE&G was required to take interim steps to reduce emissions of NO_x, SO_2, and PM until the required pollution control equipment was installed as required by the original consent decree or the unit was shut down. These interim measures included year-round operation of the existing NO_x control equipment utilizing selective non-catalytic reduction (SNCR) to reduce NO_x, use of ultra-low sulfur coal, compliance with annual emission caps for NO_x and SO_2, and operation of an electrostatic precipitator and a fly ash conditioning system to control PM.[33] These additional emission control measures will improve air quality in the region. This agreement also included new fabric filters being installed on the PSE&G Mercer generating plant by December 31, 2008. For the period of the consent decree, PSE&G will significantly reduce its emissions of NO_x, SO_2, and PM in order to achieve the same reductions required under the 2002 Consent Decree. Even after expiration of the decree, the USEPA estimates that PSE&G will permanently reduce its NO_x emissions by 534 tons per year, SO_2 emissions by 257 tons per year, and fine particle emissions of 252 tons per year.34

3) <u>VOC Measures</u>

The State is implementing several VOC control measures that were adopted as discussed in the 2007 8-hour Ozone Attainment Demonstration SIP.[35] Although the USEPA does not consider VOC as a $PM_{2.5}$ precursor for SIP and conformity purposes, New Jersey anticipates some $PM_{2.5}$ benefit from the implementation of these measures. The VOC measures that were not included in the 2009 BOTW attainment modeling, but are still expected to result in a $PM_{2.5}$ benefit, include VOC stationary storage tank measures and USEPA CTGs.

4) <u>Federal Measures</u>

The Federal government plans to implement several measures that will provide emission reductions prior to the summer of 2009. These Federal measures included the Small Offroad Engine Standards rule and a rule for Locomotive Engines and Marine Compression-Ignition Engines Less Than 30 Liters per Cylinder.

The Small Offroad Engine Standards rule[36] was adopted by the USEPA on May 18, 2007 and will set stricter standards for most lawn and garden equipment and small recreational watercraft. The USEPA has indicated that states can claim the benefits from its proposed Small Offroad Engine Standards rule for contingency.[37] However, the USEPA has not released official guidance on the credit that states can claim for this proposed rulemaking.

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[33] USEPA. United States and New Jersey Announce Clean Air Act Settlement with PSE&G Fossil LLC for Violations of 2002 Consent Decree; Utility Required to Pay Significantly Increased Penalties and Reduce Emissions. Accessed from: http://yosemite.epa.gov/opa/admpress.nsf/1ef7cd36224b565785257359003f533f/c59ece80a8a072d1852572360065c298!OpenDocument. November 30, 2006.

[34] op. cit.

[35] NJDEP. State Implementation Plan (SIP) Revision for the Attainment and Maintenance of the Ozone National Ambient Air Quality Standard: 8-Hour Ozone Attainment Demonstration Proposal. New Jersey Department of Environmental Protection, June 15, 2007.

[36] 72 <u>Fed.</u> <u>Reg.</u> 28098-146 (May 18, 2007).

[37] Personal email communication from Paul Truchan, USEPA Region 2 to Christine Schell, NJDEP, May 16, 2007.

The Locomotive Engines and Marine Compression-Ignition Engines Less than 30 Liters per Cylinder rule,[38] adopted by the USEPA on March 14, 2008, requires more stringent exhaust emission standards for locomotives and marine diesel engines. This rule will result in reduced direct $PM_{2.5}$ and NO_x emissions. As stated in Chapter 4, the standards for remanufactured locomotives will take effect as soon as certified remanufacture systems are available (as early as 2008). Tier 3 standards for newly-built locomotive and marine engines would phase in starting in 2009. Tier 4 standards for newly-built locomotives and marine diesel engines would phase in beginning in 2014 for marine diesel engines and 2015 for locomotives.

All of these actions, while not quantified, will provide continued reductions toward attaining the annual and daily revisions to the $PM_{2.5}$ NAAQS, and added public health and environmental protection to address adverse impacts of $PM_{2.5}$ below the current NAAQS. Detailed discussions of these measures are included in Chapter 4.

5) $PM_{2.5}$ RACT measures

New Jersey conducted a Reasonably Available Control Technology (RACT) analysis which demonstrates that additional reductions of direct $PM_{2.5}$ emissions and its precursors, SO_2 and NO_x, from the following major stationary source categories are reasonable:

a) Fugitive Dust Sources – $PM_{2.5}$
b) Measures at Petroleum Refineries – NO_x, SO_2, VOC
c) #6 Fuel Oil-Fired Boilers – $PM_{2.5}$
d) PM Measures at Municipal Waste Combustors – SO_2
e) Stationery Diesel Engines – $PM_{2.5}$

These measures may not be implemented prior to 2009, but will result in air quality improvements. New Jersey also intends to implement a long-term regional strategy to reduce the sulfur content of fuel oil consistent with the Mid-Atlantic/Northeast Visibility Union (MANE-VU) statement.[39] New Jersey's $PM_{2.5}$ RACT analysis is discussed in detail in Appendix A7.

6) Voluntary Strategies

The strategies in this category are/will be implemented on a voluntary basis. Companies and organizations commit to various initiatives that reduce fine particulate and the secondary aerosol precursors. Examples of these strategies include: state-level programs for days with high levels of particulate; a Federal campaign that targets reducing raw material usage; reusing waste products, and decreasing waste production; and a tool to help permit writers, enforcement officers, and the regulated community identify and

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[38] 73 Fed. Reg. 25097 (May 6, 2008).
[39] MANE-VU. Statement of the Mid-Atlantic/Northeast Visibility Union (MANE-VU) Concerning a Course of Action within MANE-VU toward Assuring Reasonable Progress. Adopted June 20, 2007.

employ pollution prevention methods to reduce or eliminate releases of hazardous materials to the environment.

7) Energy Savings and Alternative Energy Strategies

The strategies in this category are specific to reducing energy consumption and utilizing alternative energy sources. Examples of strategies in this category include New Jersey's Clean Energy Program and USEPA's Green Power Partnership. Energy efficiency measures have a lasting "cumulative" effect on electric demand. The savings in the installation year of an energy efficiency measure continue for the duration of its life. Therefore, the efficiency savings installed one year can be added to the measures included in all of the preceding years within its life. These energy efficiency and renewable energy programs are designed to lower the growth of electricity demand and avoid emissions associated with such growth.

The United States Department of Energy (USDOE), USEPA, NJDEP, and New Jersey Board of Public Utilities (NJBPU) collaborated on efforts to estimate emission reductions from energy efficiency.[40] The scenarios analyzed by this effort may be utilized in the future to determine SIP credit when the environmental benefits from the Clean Energy Program are realized with the implementation of the New Jersey CAIR NO_x Trading Program and the retirement of NO_x allowances issued for the Clean Energy Program by the NJBPU. The NJDEP expects to take SIP credit for the environmental benefits of the Clean Energy Program after 2009.[41]

8) High Electrical Demand Day Program (HEDD)

As discussed in Chapter 4, the regional High Electrical Demand Day (HEDD) program will address peak load emissions from the electrical generation sector on a seasonal basis on days when the demand for electricity is high. Therefore, the High Electrical Demand Day program provides reductions only on the days that are categorized with a high electrical demand, not on a daily basis. The High Electrical Demand Day measure is expected to provide significant NO_x emission reductions on the days they are most needed.

In March 2007, following a year long process, six of the OTC states committed to pursue reductions in NO_x emissions from electrical generating units that primarily operate on

[40] USDOE. Final Report on the Clean Energy/Air Quality Integration Initiative Pilot Project of the U.S. Department of Energy's Mid-Atlantic Regional Office. United States Department of Energy, Office of Energy Efficiency and Renewable Energy, Philadelphia, PA, May 2006.

[41] New Jersey's new rules for the CAIR NO_x Trading Program, adopted on July 16, 2007 (see Chapter 4), include the creation of an incentive reserve that requires the New Jersey's Clean Energy Program to retire NO_x allowances from the projects they fund for the benefit of the environment. The rules take effect beginning in 2009. These rules were adopted after the regional modeling for the 8-hour ozone attainment demonstration was completed, and were not included in the emission reductions.

high electrical demand days (HEDD) starting with the 2009 ozone season.[42] On these high electric demand days, increased power generation is needed, usually on short notice.

As part of the HEDD initiative, New Jersey plans to reduce NO_x emissions by 19.8 tpd on these high electrical demand days starting in 2009. Specifically, power generators in New Jersey will be responsible for securing these reductions and will be required to submit a plan on how they will reduce NO_x. The generators will have flexibility in securing the 2009 to 2015 reductions. New Jersey also plans to require that all HEDD units meet performance standards that reflect modern low NO_x technology by May 1, 2015. This will result in greater reductions on HEDD and throughout the year for NO_x, with co-benefits for $PM_{2.5}$ and SO_2.

9) Mobile Strategies

The strategies in this category focus on reducing vehicle miles traveled and fuel consumption, and increasing the use of alternative fuel sources. Mobile strategies target onroad and nonroad vehicles and equipment. Examples of strategies in this category include Carpool Makes $ense Program (Governor Corzine's Initiative), the USEPA's SmartWay Transport Partnership, and the Northeast Diesel Collaborative.

10) New Jersey Diesel Strategies

The NJDEP has an active Diesel Risk Reduction Program. This effort includes both Federal and State retrofit programs, including the USEPA's Voluntary Diesel Retrofit Program and projects under New Jersey's Diesel Risk Reduction Program. In New Jersey, the Diesel Retrofit Law in 2005 was passed by the Legislature to clean up emissions from certain onroad, diesel-powered motor vehicles and nonroad vehicles/equipment through the use of retrofit emission control technology. The benefits of this law and the subsequent regulations adopted by the NJDEP are a reduction of the harmful diesel exhaust that New Jersey citizens are exposed to every day. The regulations require a variety of vehicles and equipment to install "retrofits" by established deadlines at State expense. The mandatory installation of this technology will decrease emissions of particulate matter by 150 tons per year.[43] Additional information on this effort may be found at http://www.state.nj.us/dep/stopthesoot/retrofit.htm.

In addition to the mandatory diesel retrofit law, the Diesel Risk Reduction Program is involved in voluntary projects that also result in improved air quality. One of these projects includes the reduction of diesel emissions from ports.

With respect to emissions from train engines, New Jersey Transit (NJ Transit) has voluntarily implemented an "Idling Reduction Policy" to shut down their diesel passenger locomotives within one hour of idling when the temperature is above zero

[42] OTC. Memorandum of Understanding among the States of the Ozone Transport Commission Concerning the Incorporation of High Electrical Demand Day Emission Reduction Strategies into Ozone Attainment State Implementation Planning. Ozone Transport Commission, March 2, 2007.
[43] 38 N.J.R. 5244(a) (December 18, 2006).

degrees. The NJ Transit has also agreed to move forward with a New Jersey Transportation Planning Authority (NJTPA) proposal to install idling reduction technologies and is seeking funding. Benefits from this voluntary action at one train station are estimated to be 1.5 tons per year, based on an 82 percent emissions reduction from implementing this policy.[44] However, New Jersey is not claiming these benefits in this proposed SIP revision.

Additional diesel reductions from trucks may be realized from truck stop electrification projects where trucks are encouraged to turn off their engines and instead use electricity provided. New Jersey is also working on establishing an inspection program for medium duty vehicles with a gross weight between 8,501 – 17,999 pounds. The inspection program will be a combination of on-board diagnostic (OBD) and smoke opacity inspections, and would help control particulate emissions. New Jersey's diesel initiatives are described further in Chapter 4.

11) Wood Burning Strategies

Several wood burning strategies to lower emissions from the burning of wood have been investigated. In order to provide information on wood burning, New Jersey has developed an informational webpage regarding techniques for proper wood burning, health effects of wood burning, and links to other useful web pages.[45]

This source category is also addressed in the "Smoke Management" section of the proposed Regional Haze SIP (including the agricultural and forestry smoke management, prescribed burning, and agricultural management discussions in that SIP proposal). One particulate control measure has already been implemented, namely to limit air pollution control permits to prevent open burning on days forecast to be of unhealthful air quality. This permit condition requires the permit holder to delay open burning until forecast meteorological conditions and air quality have improved so that forecasted unhealthful conditions for that day will not be made worse by this activity. Similarly, New Jersey is considering a seasonal home wood heating advisory program to further curtail wood smoke emissions, similar to the program adopted in Lane County, Oregon.[46] This program would advise homeowners when they could heat their homes with wood, according to the current air quality. Additionally, New Jersey will propose changes to New Jersey's open burning regulation (N.J.A.C. 7:27-2 et seq.) to limit the types of eligible open burning activities, and to increase fees for the activity; these changes are included in Chapter 4. Other control measures might include wood stove and fireplace change-out programs. Financial incentives would be necessary to ensure a productive program. New Jersey would consider implementing a change-out program in the future if

[44] Data are not available to calculate emission benefits from all NJ Transit locomotives but an assumption could be made that an 82 percent reduction in idling is occurring from its 100 locomotives.
[45] NJDEP. Wood Burning in New Jersey. New Jersey Department of Environmental Protection, Bureau of Air Quality Planning. http://www.state.nj.us/dep/baqp/woodburning.html, April 15, 2008.
[46] LRAPA. Public Education: Home Wood Heating Programs. Lane Regional Air Protection Agency (LRAPA). http://www.lrapa.org/public_education/home_wood_heating_programs/, accessed May 14, 2008.

funds become available. New Jersey expects to include additional wood burning strategies in the proposed SIP for the 2006 24-hour $PM_{2.5}$ NAAQS.

5.4 Results

When added together, all the control measures and refinements discussed in Section 5.3.2.6.2 will result in emission reductions of direct $PM_{2.5}$, NO_x, and SO_2 in the Northern New Jersey/New York/Connecticut nonattainment area and in the Southern New Jersey/Philadelphia nonattainment area.[47] These reductions will occur in addition to those included in the regional modeling and will further reduce the uncertainty associated with the 2009 modeled design values and supports New Jersey's demonstration of attainment of the $PM_{2.5}$ NAAQS in its two multi-state nonattainment areas.

The regional modeling assessment discussed in Section 5.2 demonstrates that the New Jersey-associated nonattainment areas have attained the $PM_{2.5}$ NAAQS by their designated attainment date. New Jersey is not directly relying on these additional measures to demonstrate attainment of the annual $PM_{2.5}$ NAAQS. These measures will help attain the new 24-hour $PM_{2.5}$ NAAQS and the New Jersey annual goal of 12 $\mu g/m^3$. These control measures and refinements are not being considered as “bundled measures” for this final SIP revision.[48] Rather, this evaluation of emission reductions expected from these additional control measures and refinements provides further confidence that New Jersey will attain the $PM_{2.5}$ standard by 2010, and gives the State an abundance of additional emission reductions to rely upon in the event of exceedance. The benefits of these measures and refinements will be reflected in the ambient air monitors. These measures are discussed further as part of the State’s contingency measure strategy for attainment in Chapter 6.

5.5 Unmonitored Area Analysis

The USEPA’s modeling guidance[49] requires an unmonitored area analysis:

> “The unmonitored area analysis for a particular nonattainment area is intended to address potential problems within or near that nonattainment area. The analysis should include, at a minimum, all nonattainment counties and counties surrounding the nonattainment area (located within the State).”[50]

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[47] These are approximate emission reduction totals as the additional control measures and refinements to be proposed and adopted by May 2008, in accordance with New Jersey Administrative Procedures Act (N.J.S.A. 52:14B-1 et. seq.) and the Air Pollution Control Act (N.J.S.A. 26:2C-1 et. seq.).

[48] USEPA. Incorporating Bundled Measures in a State Implementation Plan (SIP). United States Environmental Protection Agency (USEPA), Office of Air and Radiation, Air Quality Strategies and Standards Division, Office of Air Quality Planning and Standards, and Office of Transportation and Air Quality, Transportation and Regional Programs Division, Research Triangle Park, NC, August 2005.

[49] USEPA. Guidance on the Use of Models and Other Analyses for Demonstrating Attainment of Air Quality Goals for Ozone, $PM_{2.5}$, and Regional Haze. United States Environmental Protection Agency, Office of Air Quality Planning and Standards, Air Quality Analysis Division, Air Quality Modeling Group, Research Triangle Park, NC, EPA-454/B-07-002, April 2007.

[50] USEPA. Guidance on the Use of Models and Other Related Analyses in Attainment Demonstrations for the 8-Hour Ozone NAAQS. United States Environmental Protection Agency, Office of Air Quality

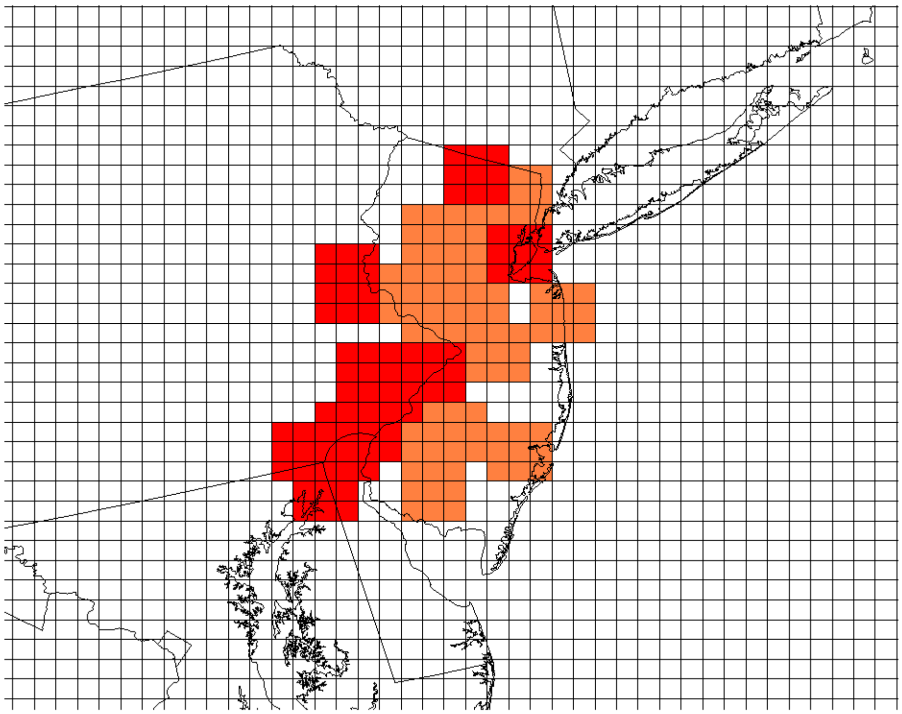
The USEPA has developed a software package called "Modeled Attainment Test Software" (MATS)[51] which will spatially interpolate data, adjust the spatial fields based on model output gradients and multiply the fields by model calculated RRFs. The MATS software for $PM_{2.5}$ was not available at the time of SIP development. Therefore, New Jersey performed its own unmonitored area analysis and was unable to verify the results of this analysis using the MATS software.

Thirteen New Jersey counties are designated as nonattainment of the annual $PM_{2.5}$ standard. Ten of those counties are associated with the Northern New Jersey/New York/Connecticut nonattainment area and three with the Southern New Jersey/Philadelphia nonattainment area. New Jersey's monitoring program and the use of the modeling results from a 9-cell average provide adequate coverage of the State to determine attainment of the fine particulate standard. All modeling grid cells containing a monitor and the eight (8) adjoining grid cells were analyzed in New Jersey's attainment demonstrations to get a nine cell average of grid cells. By using this technique, a large area of the State is included in the analysis and is represented by the monitoring program. Therefore, New Jersey does not have any areas that would be considered unmonitored. Figure 5.3 shows the coverage that is afforded by the current NJDEP monitoring network and the surrounding grid cells included in the modeling analysis. Note, on this map, areas covered solely by New Jersey's monitoring stations are colored in orange (in black & white - lightly shaded) and areas covered by either New Jersey's monitoring stations or by those in another bordering state are shaded in red (in black & white - darker shaded).

Planning and Standards, Emissions, Monitoring, and Analysis Division, Air Quality Modeling Group, Research Triangle Park, NC, EPA-454/R-05-002, October 2005.

[51] USEPA. Guidance on the Use of Models and Other Analyses for Demonstrating Attainment of Air Quality Goals for Ozone, $PM_{2.5}$, and Regional Haze. United States Environmental Protection Agency, Office of Air Quality Planning and Standards, Air Quality Analysis Division, Air Quality Modeling Group, Research Triangle Park, NC, EPA-454/B-07-002, April 2007.

<u>Figure 5.3</u>: Map of Grid Cells Used in Photochemical Modeling Associated With New Jersey Fine Particulate Matter Monitors



<u>Legend</u>

*Orange (in black & white - lightly shaded): Areas covered solely by New Jersey's monitoring stations.

*Red (in black & white - darker shaded): Areas covered by either New Jersey's monitoring stations or by those in another bordering State.

5.6 Conclusions

The current air quality data (2006) demonstrates that the New Jersey monitors are currently in attainment of the annual $PM_{2.5}$ NAAQS. With the exception of the Union City monitor, the design values at all New Jersey monitors are in attainment of the annual $PM_{2.5}$ NAAQS, and are below the weight-of-evidence range of values (14.5 µg/m^3 through 15.5 µg/m^3. The regional air quality modeling demonstrates the two multi-state nonattainment areas which include New Jersey will be in attainment of the annual $PM_{2.5}$ NAAQS by 2009. The only site with a projected 2009 design value greater than the annual fine particulate standard of 15.0 µg/m^3 is the P.S. 59 site located in Manhattan, New York City. All other sites are below the annual fine particulate standard and lower bound of the weight-of-evidence range. The projected 2009 value for the P.S. 59 site is within the weight-of-evidence range of values defined in the $PM_{2.5}$ modeling guidance as 14.5 µg/m^3 through 15.5 µg/m^3.[52]

Additional air quality benefits associated with the control measures not included in the modeling reduces the uncertainty of the demonstration and thus supports New Jersey's demonstration of attainment of the $PM_{2.5}$ standard by 2010 in the Northern New Jersey/New York/Connecticut and Southern New Jersey/Philadelphia nonattainment areas. Additional support for this conclusion includes those additional measures being implemented in New York City to provide emission reductions. All areas of the two nonattainment areas are expected to be in attainment by April 5, 2010.

The 2006 design value data show that more emission reductions are necessary to attain the State's internal goal for annual $PM_{2.5}$ of 12 µg/m^3 and to meet the 2006 24-hour $PM_{2.5}$ NAAQS. Only four of the 13 New Jersey monitors in the Northern New Jersey/New York/ Connecticut nonattainment area are currently below the annual $PM_{2.5}$ goal of 12 µg/m^3 and only eight of the 13 New Jersey monitors in the Northern New Jersey/New York/ Connecticut nonattainment area are above the 2006 24-hour $PM_{2.5}$ NAAQS.

[52] USEPA. Guidance on the Use of Models and Other Analyses for Demonstrating Attainment of Air Quality Goals for Ozone, $PM_{2.5}$, and Regional Haze. United States Environmental Protection Agency, Office of Air Quality Planning and Standards, Air Quality Analysis Division, Air Quality Modeling Group, Research Triangle Park, NC, EPA-454/B-07-002, April 2007, page 105.