7.0 Air Quality Trends, Baselines & Projections for the New York Nonattainment Area (New York Metropolitan Area, Connecticut and Northern New Jersey)

7.1 Air Quality Trends - New York

With the promulgation of the annual and daily $PM_{2.5}$ national ambient air quality standards (NAAQS) in 1997, and the establishment of the Federal Reference Method (FRM) for monitoring $PM_{2.5}$ and the $PM_{2.5}$ monitoring network, the New York State Department of Environmental Conservation (Department) initiated monitoring for this pollutant on a statewide basis beginning in 1998/1999. A majority of the monitoring efforts to date have involved 24-hour, filter-based FRM samplers. Most of the FRM samplers operate on a 1-in-3-day schedule, although a few monitors operate on a daily basis. Also, as per network design requirements, several FRM sites have collocated duplicate samplers.

The $PM_{2.5}$ NAAQS is mass-based, but ambient $PM_{2.5}$ has a complex morphology and chemical composition. In order to obtain information on species composition, the Department also has operated Speciation Trends Network (STN) monitors at several locations across the state. Similar to the FRM network, the STN samplers operate on a 1-in-3-day schedule. The STN program provides for the concentration of major ions, carbon compounds, and trace elements, which generally constitute the bulk of $PM_{2.5}$ mass.

7.1.1 FRM data

Table1 lists the site locations and sampling periods between 1999-2006 for all FRM monitors in the three Department sub-regions that cover parts of the New York Metropolitan Non-Attainment Area (NY Metro NAA): Region 1 (Long Island; 6 sites), Region 2 (New York City; 19 sites), and Region 3 (Lower Hudson River Valley; 3 sites). The analysis included Dutchess County for completeness, even though it is not part of the NY Metro NAA area. Seven of the Region 2 sites have collocated duplicate monitors. Three of the sites also operated daily for at least part of the time. A map of the FRM locations is shown in Figure 7-1.

Table 2 lists the linear trends in $PM_{2.5}$ mass at longest-running sites FRM sites in the New York metropolitan area. These sites operated from 1999/2000 through 2006, and the trends reported in Table 7-2 are based on quarterly average values at each site. Only those quarters with at least 10 valid data points were included in the linear trend estimates. Consistent with the composite averages presented earlier, $PM_{2.5}$ mass appears to be decreasing at each of these longest-running sites, by ~0.1-0.5 ug/m3/yr.

7.1.2 STN data

Table 7-3 lists the site locations and sampling periods of the STN monitors. Each of these sites is collocated with an FRM monitor. The STN samplers collect five ions – sulfate (SO_4), nitrate (NO_3), ammonium (NH_4), potassium (K), and sodium (Na) – nearly 50 trace elements, and various carbon species – elemental carbon (EC) and organic carbon (OC). For this analysis, it was assumed that $PM_{2.5}$ is primarily composed of only SO_4, NO_3, NH_4, EC, OC, and major crustal species (major oxides of Al, Ca, Fe, Si, and Ti; e.g., US EPA, 2007), and hereafter refer to the sum of these species as the "reconstructed mass." Although the $PM_{2.5}$ NAAQS is strictly mass-based, here an attempt is made to approximate the average species composition of the ambient $PM_{2.5}$ in New York City.

Figure 2 displays the annual, wintertime, and summertime average major $PM_{2.5}$ speciation levels. On an overall annual basis, SO_4 and OC account for about 27% and 35%, respectively, of the reconstructed mass in New York City, roughly twice the contribution of NO_3. During the winter months, OC is the largest contributor to the reconstructed mass (34%), while SO_4 and NO_3 also account for about 20%. The relative importance of NO_3 is higher during the winter months because NO_3 volatilization is much lower during the colder months. During the summer months, SO_4 and OC levels are considerably higher than during the winter months, and account for about 70% of the reconstructed mass. The smallest components of reconstructed mass correspond to EC and crustal mass (~4-8%). On average, the reconstructed mass in New York City is about 18.2 ug/m3 during the summer months, and about 15.2 ug/m3 during the winter months.

7.1.3 Trend Summary - New York

The FRM data collected across the New York metropolitan area over the past seven years suggest that $PM_{2.5}$ levels are generally higher in the core urban areas compared to the surrounding suburban counties. While this is a rather short time period, it appears that $PM_{2.5}$ levels have been decreasing across the entire metropolitan area since the early 2000's. In terms of species composition, SO_4 and OC are the most important species, especially during the summer months, while NO_3 is also an important species during the winter months. It appears that emissions control programs that target precursors of SO_4, NO_3, and OC will be needed to further reduce $PM_{2.5}$ levels across the metropolitan area.

7.2 Air Quality Trends - Connecticut and New Jersey

An analysis was conducted of the ambient data for those monitors in Connecticut (two counties) and New Jersey (10 counties) that are part of the NY Metro NAA for $PM_{2.5}$. The analysis is based upon the FRM data covering the period of 1999 to 2006, which were extracted from the EPA Air Quality System (AQS) data on December 26, 2007. To be consistent with the analysis reported in TSD-3a (2007) “Analysis of Ambient $PM_{2.5}$ Mass and Speciation for the New York metropolitan area through 2006. NYSDEC, Division of Air Resources, Albany, NY 12233,” the data from July 6-9, 2002 that was associated with large-scale Canadian forest fires were excluded.

7.2.1 Connecticut

The Connecticut portion of the NY Metro NAA had 14 sites at various times during this period; five of these sites have collocated duplicate monitors and two of the sites had every day sampling for at least a portion of the time. It should be noted that the New Haven/Stiles St. monitor was designated as a “special purpose” monitor, and as such cannot be used to make an attainment or non-attainmment designation. The stations are listed in Table 4 along with their operational dates.

7.2.2 New Jersey

The New Jersey portion of the NY Metro NAA had 15 monitoring sites at various times during this period; three of these sites have collocated duplicate monitors and two of the sites had every day sampling for at least a portion of the time. Information on these monitors is listed in Table 7-4.

7.2.3 Analysis

A very cursory analysis was performed on these data, similar to what was done for the NY sites. The annual average estimates are listed in Table 7-5. Only those monitors with at least 75% valid samples in a given year are shown and blank cells indicate that either the sampler was not in operation or it did not meet the 75% criteria.

In general, the CT monitors are below the level of the annual $PM_{2.5}$ National Ambient Air Quality Standard (NAAQS) of 15 ug/m3, with the exception of the New Haven/Stile Street special purpose monitoring site.

In the case of NJ, there is obvious year-to-year variation at some of the sites, and a few of the monitors are above the level of the annual $PM_{2.5}$ NAAQS. However, this estimated annual average should not be confused with that based on the regulatory process that requires estimation of the annual average based upon individual quarterly data.

Table 7-6 lists the 98^{th} percentile of the $PM_{2.5}$ concentration at each of these monitors, and again, only those years that had 75% valid samples are shown.

7.2.4 Trend Summary - Connecticut and New Jersey

The above data were used to estimate the annual trends at the longest-running sites. For this analysis, quarterly averages were computed at these sites. Quarters were considered to be complete if there were at least 10 valid samples.

Table 7-7 lists the estimated linear trends on an annual basis. All monitors except for the New Haven/Stiles Street special purpose monitor show a downward trend, varying between 0.05 ug/m3 and 0.49 ug/m3, indicating general improvement in PM2.5 air quality over the region and consistent with what was reported for the NY monitors.

7.3 Baseline and Future PM2.5 Design Values

Baseline PM2.5 design values for a given area are based solely on measured Federal Reference Method (FRM) data, whereas air quality model-based results utilizing emissions from a target future year are needed to project PM2.5 design values to determine future attainment status of that area. The modeling guidance (USEPA, 2007a) states that the results from the regulatory applications of air quality models are not to be used in an absolute sense; rather, they are to be used to estimate the effects of changes in emissions on pollutant levels in a relative sense. For a single pollutant like ozone, the future design value at a given location is the product of the current observed value and the ratio of the future-to-current model predictions. The ratio of the future-to-current model prediction is also known as the relative response factor (RRF). Unlike ozone, PM2.5 is comprised of a variety of ions, trace elements, and carbon species. To demonstrate future attainment of air quality standards for PM2.5, one needs to project how each of the major species changes between the baseline and future model years. That is, it is necessary to estimate speciated RRF values. In this document, an overview is presented of the calculation of the baseline PM2.5 design values and speciated RRFs for monitors in the 22-county New York City non-attainment area (NYC NAA), which when combined yield future year PM2.5 design values across the NYC NAA.

In the February 11, 2008 addendum to the technical support documentation (See the appendices to this document) for the annual PM2.5 SIP for the New York City non-attainment area (NYC NAA), “Current and Future PM2.5 Design Values in the New York City Metropolitan Non-Attainment Area (TSD-5).” The USEPA has since released a beta version of the Modeled Attainment Test Software (MATS, version 1.3.1) for computing baseline and future design values for the annual National Ambient Air Quality Standard (NAAQS). This Addendum does not replace TSD-5, although all design values listed in TSD-5 should be considered preliminary because they were not computed with the MATS. Note that one site – 340172002 (Union City [Hudson County], NJ) – was included in TSD-5 but is not included in the addendum. The data from this site were classified as complete in the MATS because of “minimum value substitution,” with a design value exceeding 15 ug/m3 for the 2001-2002 period; however, the monitor was shut down during the first quarter of 2002. With only one complete, classifiable year of actual monitoring data during the five-year baseline design value period (2000-2004), this site was not used by the MATS and is, therefore, not included in this Addendum.

The PM2.5 data across much of the northeastern United States was dramatically affected by large forest fires in eastern Canada during the July 6-9, 2002 period. Many states submitted exceptional event flags with the data on selected days during this period. In March 2003, the Department sent documentation (see Attachment A) to USEPA Region 2 seeking concurrence that the data from July 7, 2002 be excluded for the estimation of the daily and annual standards. Since the USEPA did not concur with these exceptional event flags, the data from this day and other flagged days around this day were included in the official Federal Reference Method (FRM) database in the beta version of the MATS. This issue was raised again with USEPA Region 2 in January 2008, which has since concurred with the Department’s findings (see Attachment B). In terms of official FRM locations in the NYC NAA, there are two daily sites in New York (360050110, I.S. 52 [Bronx County]; and 360810124, Queens College [Queens County]) and one daily site in New Jersey (340390004, Elizabeth/NJ Turnpike [Union County]). In the USEPA’s Air Quality System (AQS) database, the data from the daily New York sites are flagged as exceptional events on July 6 and 7, while the Elizabeth data are flagged from July 7-9.

It should be noted that Connecticut flagged all data from July 6-9, 2002 and received EPA concurrence. Hence, the official quarterly average FRM database in this beta version of the MATS does not include these days at the Connecticut monitors, and as such, the design values at these monitors are not impacted by this unusual period.

7.3.1 Current PM2.5 Design Values

The first step in the modeled attainment test for the annual NAAQS is to compute the baseline design values at each FRM site in the NYC NAA. The current design value is based on a five-year weighted average of observations from 2000-2004 to straddle the baseline emissions/modeling year of 2002 (USEPA, 2007). MATS was used to compute the baseline PM2.5 design values two ways. The first method takes the official quarterly average database included in the MATS, which incorporates the flagged FRM data from New York and New Jersey during July 2002. For the second method, the FRM data on these flagged days were ignored at the New York and New Jersey monitors, and recomputed the averages for the third quarter of 2002. Table 7-8 lists the average PM2.5 levels at the New York and New Jersey monitors during the third quarter of 2002, both including and excluding the flagged days. By ignoring these exceptional days, the averages during this quarter were lower by about 2 ug/m3 across these sites. The only site whose quarterly average was not impacted by this day was 360390006 (Elizabeth [Union County], NJ), because the FRM data were already missing on this day.

Table 7-9 lists the baseline PM2.5 design values using these two methods. At the Connecticut monitors there is no difference between these two methods, since the data from this day were already flagged and not used. At most of the New York and New Jersey monitors, exclusion of the flagged data from July 2002 results in lowering of the baseline PM2.5 design values which by about 0.1-0.2 ug/m3. All subsequent analysis presented here disregard all flagged data from July 2002.

7.3.1.1 Baseline Species Concentrations

The next step in the modeled attainment test is to determine the baseline species composition at each FRM monitor, based on measured species data. The $PM_{2.5}$ species composition is highly complex, but if the goal of air quality management decisions is to reduce $PM_{2.5}$, it is necessary to know the dominant chemical species. The MATS includes speciation data for the 2002-2004 period, which are derived from

Speciation Trends Network (STN) and Interagency Monitoring of Protected Visual Environments (IMPROVE) monitor data. These networks measure major ions, including sulfate (SO_4), nitrate (NO_3), and ammonium (NH_4); carbonaceous species, including elemental carbon (EC) and organic carbon (OC); and dozens of trace elements.

It is known that FRM monitor filters do not retain semi-volatile species such as ammonium nitrate and some organics with high efficiency, particularly during the warmer months. Hence, one cannot simply add up the major species measured by the STN or IMPROVE monitors and expect to relate this identically to the total mass from the FRM monitor. According to the modeling guidance (USEPA, 2007) the mass from the FRM monitor can be expressed as:

$PM_{2.5}$ = "retained nitrate mass" + "ammoniated sulfate mass" + "ammonium associated with sulfate and retained nitrate" + "particle-bound water"+ "other primary $PM_{2.5}$" + "salt" + "blank mass" + "carbonaceous mass" [Eq. 1]

Where $PM_{2.5}$ refers to the total mass measured at each FRM site; "retained nitrate mass" (NO_3r) and "ammonium associated with sulfate and retained nitrate" refer only to the fractions of NO_3 and NH_4, respectively, that are not volatilized; "ammoniated sulfate mass" refers to the SO_4 that is measured by the STN; "particle-bound water" refers to water that is associated with the hygroscopic ammonium sulfate and nitrate, and can be estimated as a polynomial function of retained ammonium, sulfate, and nitrate; "other primary $PM_{2.5}$" refers to unspeciated, inert $PM_{2.5}$ such as soil/crustal elements (here assumed to be the sum of major crustal oxides – Si, Ca, Fe, and Ti); "salt" is 1.8×Cl; "blank mass" refers to passively collected contamination, assumed to be 0.5 mg m^{-3}; and "carbonaceous mass" refers to EC and an estimate of retained OC. Because of uncertainties in the measured OC, the modeling guidance suggests that organic mass be computed as the difference between the measured FRM mass and the sum of the other species listed above.

MATS and the official speciation database, which includes adjustments to the various species, were used to compute baseline species concentrations at each FRM site in the NYC NAA. The MATS also performs spatial averaging of the adjusted speciation data since actual STN or IMPROVE data are not available at every FRM location. It should be noted that the July 7, 2002 data from the STN monitors in the NYC NAA in the official MATS database were flagged by EPA and, hence, not used to compute baseline species composition. Table 7-10 lists the non-blank baseline species composition, as defined in Equation

1 above. Note that in the case of retained NH_4, the actual measured data were not used here, due to uncertainties in its measurement. The modeling guidance (USEPA, 2007) suggests that NH_4 be estimated according to degree of neutralization (DON) of sulfate:

$$NH_4 = DON \times SO_4 + 0.29 \times NO_3r \quad \text{[Eq. 2]}$$

to allow the future NH_4 value to depend only on SO_4 and NO_3r, since reductions in emissions generally are targeting precursors of SO_4 and NO_3.

7.3.1.2 Relative Response Factors

As stated in the modeling guidance (USEPA, 2007), the air quality modeling results are to be used in a relative sense to compute future PM2.5 design values. For each species i, the future concentration of each species (CFi) is the product of the current concentration (CCi) and the corresponding RRFi:

$$CFi = CCi \times RRFi \quad \text{[Eq. 3]}$$

The RRF values for SO4, NO3r, OM, EC, and OPP were based on application of the CMAQ model for the baseline year of 2002 and future year of 2009. All RRF values were computed by the MATS on a quarterly basis. Earlier chapters of the technical supporting documentation describe the annual model applications in detail: biogenic emissions (TSD-2a), base year 2002 emissions (TSD-2b), emissions processing and air quality modeling using CMAQ (TSD-2c), and future year 2009 emissions (TSD-4).

7.3.2 Future $PM_{2.5}$ Design Values

Table 7-11 lists the current and future design values at each FRM location in the NYC NAA. Note that on the average the design values across the NYC NAA were lowered by about 1.6 ug/m3, ranging from 1.3-2.1 ug/m3, in 2009 compared to the baseline 2002 design values. Also note that every site has a future design below the annual NAAQS level of 15 ug/m3, with the exception of one site – P.S. 59 (360610056) in New York County, NY – which has a future design value of 15.2 ug/m3. Additional corroboratory analyses and weight of evidence (WOE) determinations are necessary to demonstrate attainment at this monitor, since this future design value falls within the 14.5-15.5 ug/m3 WOE guideline range. In addition, the Canal Street (360610062) monitor, also in New York County, has a future year design value of 14.5 ug/m3. Attachment 2 from TSD-5 details the Department's WOE analysis that supports the projection that the NYC NAA, including New York County, will be considered to be in attainment of the annual PM2.5 NAAQS.

7.4 Weight of Evidence (WOE) in Support of Modeled Attainment of the $PM_{2.5}$ NAAQS in the New York City Nonattainment Area

The EPA modeling guidance (US EPA, 2007), in conjunction with ambient Federal Reference Method (FRM) $PM_{2.5}$ mass data from 2000-2004 and baseline and future air quality modeling results, has been applied to determine the attainment status of the NY Metro NAA with respect to the annual National Ambient Air Quality Standard (NAAQS). The application of the EPA guidance for estimating the future design values based on the use of relative response factor (RRF) has resulted in one monitor – P.S. 59 (360610056), located in New York County, NY – to exceed the annual $PM_{2.5}$ NAAQS level of 15 ug/m3. The estimated future $PM_{2.5}$ design value at this monitor, based on this procedure, is 15.3 ug/m3. This value falls within the uncertainty range of ±0.5 ug/m3 of the annual $PM_{2.5}$ NAAQS, and supplemental analyses are needed for this monitor to be considered to be in attainment. In the following sections, information is provided to suggest that there is high degree of potential that estimated future design value will be below the annual NAAQS.

7.4.1 Monitoring Network in New York County and Surroundings

For most of the 2000-2004 period New York County, NY had 4 FRM monitors, but only one Speciation Trends Network (STN) monitor collocated with the FRM at the Canal Street site (360610062) to provide information on composition of the baseline PM2.5 species. Figure 7-3 displays the location of the four monitors as well as monitors in the surrounding counties. Table 7-12 lists the dates of operation of the FRM monitors in New York County; the base year design value for 2002, which is a weighted average of the measurements in the 2000 to 2004 period; and the nearest STN monitor. It should be noted that not all monitors in New York County were assigned the same STN monitor, because the approach selected was to use the nearest neighborhood monitor to link the FRM and STN. In the case of the J.H.S.45 (36061007) FRM monitor in New York County, the nearest STN monitor is the Bronx County I.S.52 site (360050110), and this site is also included in Table 7-12.

The current speciation levels estimated at these monitors are listed in Table 7-13. Only two of these sites – Canal Street and I.S.52 – have collocated STN monitors, while the species composition at the other FRM sites are only estimates based on the speciation data from a nearby monitor. Examination of the speciation data at Canal Street and I.S.52 suggests that there may be fairly substantial gradients in $PM_{2.5}$ species composition over the non-attainment area, on the order of several tenths of a ug/m3. Thus the estimates listed for the other monitors should only be considered approximate, and in some cases may not necessarily be representative of species composition at these monitors. This is certainly a limitation that needs to be taken into consideration when projecting the future design values using the model results and the current speciation levels.

Although the air quality modeling results are to be used in a relative sense, it is instructive to examine the changes in $PM_{2.5}$ mass that the model predicts in an absolute sense to see the direct impacts of emissions reductions. The CMAQ-predicted average $PM_{2.5}$ mass over the nine-grid cells that surround each of these FRM monitors (see Table 14) in the base (2002) and future (2009) years was examined. Note that CMAQ predicts a consistent reduction of about 16% over each FRM monitor in New York County. Although not shown here, future $PM_{2.5}$ concentrations at each FRM location across the 22-county NY Metro NAA are predicted by CMAQ to decrease by 12-18%.

7.4.2 Other Data Analysis

A recent study by Qin et al. (2006) suggest that sum of sulfate and nitrate comprise about 40% or more of the $PM_{2.5}$ mass in the NYC metropolitan area, and that 70% or more of the $PM_{2.5}$ measured in NYC results from transport into the region. Based on results from source apportionment modeling using Positive Matrix Factorization (PMF), the authors determined that the largest single source factor affecting NYC is "secondary sulfate" associated with SO_2 emissions from upwind regions. It is clear that emission reductions in upwind states will be needed to further reduce $PM_{2.5}$ in the NY Metro NAA.

In TSD-3a, found in the appendices to this document, $PM_{2.5}$ levels appear to be decreasing across the NY Metro NAA. Although the data records for $PM_{2.5}$ are somewhat short, it is estimated that $PM_{2.5}$ mass is decreasing by about 0.1-0.5ug/m^3/yr. At the P.S.59 site $PM_{2.5}$ mass measurements are decreasing by about 0.3ug/m^3/yr during 1999-2006. In addition to $PM_{2.5}$ mass, several criteria pollutants are also measured at the P.S.59 site. The trends in SO_2 and NO_2 from 1993 to 2006 were examined using the seasonal Kendall test, and found that ambient levels are declining at rates of 3.4% yr^{-1} and 1.7% yr^{-1}, respectively. This again points to the potential that this area would be meeting the annual NAAQS, given that there are various measures under consideration that are aimed at decreasing the emissions of $PM_{2.5}$ precursors.

7.4.4 Summary

In summary, the above analysis shows that, based upon the EPA guidance only one monitor in the New York $PM_{2.5}$ nonattainment area falls slightly above the level of the annual NAAQS, but still within the framework of uncertainty. The analysis suggests that lack of collocated speciation monitors and use of speciation information from the nearest neighborhood monitor may have contributed to the estimate of PM2.5 being above the level of NAAQS at the P.S.59 monitor. Examining the trends in precursors as well as measured PM2.5 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. Analysis based on the only other monitor (360610062) with similar PM2.5 concentrations is projected to be below the level of the annual NAAQS, suggests that P.S.59 (360610056) would also be similarly be below the level of the annual NAAQS.

7.4.5 Additional Information

It should be noted that more specific information and the detailed analyses on the determination of baseline and future design values, and air quality trends, are presented in Appendix B of this document.

7.5 Weight of Evidence: Additional Measures Not Accounted for in Modeling Projections

This section was modified by the NJDEP by information received by NY

A number of control programs are being adopted or implemented that are not represented in the projection inventories for 2009. The control programs in this section include:

- Part 222, Distributed Generation
- Part 227-2, NOx 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, NOx and PM Reductions
- Canadian Air Quality Efforts
- Governor Spitzer's "15 by 15" Initiative
- NYSERDA Programs

As discussed in section 7.1 of this document, the species composition of PM2.5 has a significant influence on the measured levels. In terms of species composition, SO_4 and OC (the primary sources of which are VOC emissions) are the most important species, especially during the summer months, while NO_3 is also an important species during the winter months. It appears that emissions control programs that target precursors of SO_4, NO_3, and OC will be needed to further reduce $PM_{2.5}$ levels across the metropolitan area. The measures described below will reduce PM and precursor emissions by significant amounts. The Part 222 and Subpart 227-2 regulations being adopted by the Department will yield quantifiable, enforceable NOx emissions reductions on the order of 50 tons per day. When compared to those measures included in the modeling and the base and projected NOx inventories, it is apparent that reductions of this magnitude have the ability to reduce PM2.5 levels substantially. Given that New Jersey and Connecticut as well as other northeastern states (Delaware, Maryland and Pennsylvania) are committing to similar measures that will also yield substantial reductions in PM2.5 and precursor emissions, it is expected that NOx and PM2.5 emissions on days of high electricity demand will be reduced substantially throughout the Northeast corridor.

7.5.1 Part 222, Distributed Generation

This regulation will set limits on small generators that are not currently controlled. As minor sources, these sources need only to stay below the major source threshold to avoid reasonably available control technology (RACT). Most of these sources (generally diesel-fired stationary internal combustion engines) tend to operate on days of high electricity demand and when called upon to address reliability concerns. This regulation will place NOx and PM limits on existing sources as well as restrict the number of megawatts that can be called to operate under demand response. It will also set strict emission standards for new units. It is expected that NOx emissions on High Electricity Demand Days (HEDD) could be reduced by 10 to 15 tons per day in 2012 through the implementation of this regulation.

7.5.2 NOx RACT (High Electricity Demand Day Units)

This regulatory revision will set new more stringent NOx limits on electricity generating units. On High Electricity Demand Days (HEDD) base loaded, load following and peaking units all increase operations to meet demand. HEDDs are generally those days when the potential for ozone formation is highest (hazy, hot and humid weather). The Department is specifically moving to revise the NOx emission limits for all very large boilers and combustion turbines. These emission limits are expected to result in the reduction of 35 to 40 tons per day of NOx emissions.

7.5.3 Clean Air Interstate Rule

On May 12, 2005, EPA published its Clean Air Interstate Rule (70 FR 25162) designed to reduce northeastern U.S. power plant emissions which affect air quality in downwind states. Because New York State contributes to ozone and PM2.5 nonattainment areas in downwind states, it was required to address NOx and SO2 emissions under CAIR. CAIR specified the reductions necessary in order to fulfill its obligations under CAA Section 110(a)(2)(D), and established budgets for EGUs in New York and the other CAIR states.

The CAIR Trading Program was established in three parts under Title 6 which establish the necessary allowance programs for New York State: Part 243, “CAIR NOx Ozone Season Trading Program; Part 244, “CAIR NOx Annual Trading Program; and Part 245, “CAIR SO2 Trading Program.” These three regulations represent the three model rules released by EPA in association with CAIR which the Department chose to adopt.

All three regulations were effective October 19, 2007. Within the regulations, CAIR NOx units and CAIR SO2 units are defined. Also included are permit and monitoring requirements, emission requirements pertaining to allowances, and guidelines for recordkeeping and reporting.

EPA’s CAIR Program set the goal of 70 percent SO2 and NOx emissions reductions. Aside from the intended goal of aiding the nonattainment areas in downwind states, these reductions through CAIR will greatly benefit PM2.5 levels within New York State. This includes a reduction of PM2.5 levels in the NYMA nonattainment area due to decreased SO2 and NOx emissions by upwind facilities. The NOx portion of the trading program will go into effect in 2009, while the SO2 trading program goes into effect in 2010.

7.5.4 Diesel Emissions Reduction Act of 2006

The New York State Senate recently approved the Diesel Emissions Reduction Act of 2006, for which rulemaking is currently underway. This regulation will require thousands of state-owned or -operated diesel-powered vehicles to be retrofitted with emission control equipment to cut down on the release of exhaust particles, of which a large percentage is direct PM emissions. The benefit will be seen with existing engines which are not expected to be replaced with new, cleaner engines for some time. Promulgation of this regulation is currently anticipated to be completed in time to see some reductions in 2009, which will contribute to the attainment of the PM NAAQS.

7.5.4 Existing State VOC Reduction Measures

7.5.4.1 Part 230: Gasoline Dispensing Sites and Transport Vehicles

Requirements for Stage I and Stage II gasoline dispensing sites are contained in 6 NYCRR Part 230, "Gasoline Dispensing Sites and Transport Vehicles." Stage I systems are required state-wide, while Stage II systems are mandated only in the New York Metropolitan Area (NYMA) and lower Orange County. Part 230 affects those gasoline-dispensing sites whose annual throughput exceeds 120,000 gallons. (This minimum throughput level is waived for NYMA.)

A Stage I vapor collection system captures gasoline vapors which are displaced from underground gasoline storage tanks when those tanks are filled. These vapors are forced into a vapor-tight gasoline transport vehicle or vapor control system through direct displacement by the gasoline being loaded. A Stage II vapor collection system captures at least 90 percent, by weight, of the gasoline vapors that are displaced or drawn from a vehicle fuel tank during refueling; these vapors are then captured and either retained in the storage tanks or destroyed in an emission control device.

7.5.4.2 Part 212: General Process Emission Sources

This rule, which applies to both VOC and NOx emissions, requires the application of Reasonably Available Control Technology (RACT) for each emission point which emits NOx for major NOx facilities or VOCs for major VOC facilities. Its requirements are mostly generic, with specific requirements only for coating operations not subject to Part 228.

7.5.4.3 Part 226: Solvent Metal Cleaning

Guidelines for the cleaning of metal surfaces by VOC-containing substances are expressed in 6 NYCRR Part 226, "Solvent Metal Cleaning Processes." Listed in this regulation are general provisions for storage and recordkeeping, specifications for the types of control equipment to be used, and operating practices for solvent metal cleaning. The Department may accept a lesser degree of control upon submission of satisfactory evidence that the person engaging in solvent metal cleaning is applying RACT and has a plan to develop the technologies necessary to comply with the aforementioned requirements.

7.5.4.4 Part 228: Surface Coating Processes

6 NYCRR Part 228 limits the VOC content for each gallon of coating and sets minimum efficiency for VOC incinerators used as control equipment for VOC emissions from coating processes. It also provides for the use of source-specific analyses of control requirements where the requirements of the rules cannot be met. Additionally, Part 228 contains requirements for paints and coatings used in auto body refinishing and repairing, including spray equipment and housekeeping.

7.5.4.5 Part 229: Petroleum and Volatile Organic Liquid Storage and Transfer

Limitations are placed on VOC emissions from applicable gasoline bulk plants, gasoline loading terminals, marine loading vessels, petroleum liquid storage tanks, and organic liquid storage tanks in 6 NYCRR Part 229, "Petroleum and Volatile Organic Liquid Storage and Transfer." The regulation details the separate applicability thresholds and compliance schedules for NYMA, the Lower Orange County metropolitan area, upstate ozone non-attainment areas, and remaining areas.

7.5.4.6 Part 233: Pharmaceutical and Cosmetic Manufacturing Processes

VOC emissions from synthesized pharmaceutical or cosmetic manufacturing processes at a major source facility are limited under 6 NYCRR Part 233, "Pharmaceutical and Cosmetic Manufacturing Processes." This regulation outlines the separate requirements and compliance schedules for NYMA, the Lower Orange County metropolitan area, and facilities outside these areas. Compliance requires the installation of control devices, along with monitoring, recordkeeping, and leak repair.

7.5.4.7 Part 205: Architectural and Industrial Maintenance (AIM) Coatings

Applicability of 6 NYCRR Part 205, "Architectural and Industrial Maintenance (AIM) Coatings," extends to anyone who supplies, sells, offers for sale, or manufactures any architectural coating for use within New York State, as well as anyone who applies or solicits the application of any architectural coating within the state. This regulation places VOC content limits on a wide variety of architectural coatings. Part 205 also contains labeling and reporting requirements, compliance provisions and test methods.

7.5.4.8 Part 208: Landfill Gas Collection & Control Systems for Certain Municipal Solid Waste Landfills

The operation of certain municipal solid waste (MSW) landfills is regulated under 6 NYCRR Part 208, "Landfill Gas Collection & Control Systems for Certain Municipal Solid Waste Landfills." For landfills whose non-methane hydrocarbon emissions exceed 50 megagrams per year, the operator must design and install a collection and control system to be operated in accordance with the provisions of the regulation. The regulation additionally contains requirements for monitoring, testing, recordkeeping and reporting.

7.5.5 New or Revised State VOC Reduction Measures

7.5.5.1 Part 228: Surface Coating Processes and Part 235: Consumer Products

As a method to combat ozone issues in nonattainment areas throughout New York State, the Department worked in conjunction with the Ozone Transport Commission (OTC) on measures to reduce NOx and VOC emissions from a number of sources. In 2006 the OTC released its model rule for VOC emissions from adhesives, sealants, adhesive primers and sealant primers. The Department intends to use this model rule as a guide in revising 6 NYCRR Part 228, "Surface Coating Processes," and Part 235, "Consumer Products." Emission reductions should be observed for area sources as well as point sources, due to the variety of industrial and commercial applications for the subject products.

EPA's consumer and commercial products rule was published September 11, 1998 (40 CFR Part 59 Subpart D). This rule applied only to household adhesive use, and did not regulate adhesives used in commercial and industrial applications. The OTC's 2001 model rule proposed additional product categories and stricter standards, but its definitions of products generally exempted those products being sold in large containers.

The OTC 2006 model rule, based upon 1998 RACT and Best Available Retrofit Control Technology (BARCT) developments by CARB, places stricter VOC limits on a greater range of products. The proposed rule prohibits the sale or use of adhesives, sealants, adhesive primers or sealant primers in excess of its proposed VOC content limits after January 1, 2009. It also requires that labels have the product's VOC content clearly expressed, and presents an option for add-on control systems to meet the required content limit. OTC calculations predict that New York State will see a savings of 21.5 tons of VOC each summer day, or 3290 tons over the entire 153-day ozone season lasting from May 1-September 30.

7.5.5.2 Part 235: Consumer Products

The Department is intending to modify 6 NYCRR Part 235, "Consumer Products," under which a VOC content limit is placed on a range of consumer and commercial products. A federal consumer and commercial products rule was published on September 11, 1998 as 40 CFR Part 59 Subpart D. Feeling this rule regulated an inadequate portion of the consumer and commercial products inventory, the OTC in 2001 developed model regulations for additional product categories and more stringent VOC limits. These suggestions were used as a basis for the VOC limits contained in Part 235, which took effect on January 1, 2005.

The OTC developed its 2006 model rule, finalized September 13, 2006, to again expand the VOC content limitations that participating states may adopt for their own programs. Included are limits for 13 new product categories, a more restrictive limit on one previously regulated category, and additional requirements for two other previously regulated categories. The OTC rule is influenced by amendments put forth by CARB in July 2005. The Department will again use the OTC's proposed model rule as a guideline for its amendment of Part 235.

The California Air Resources Board (CARB) calculated per capita VOC reductions in conjunction with its 2005 rule. Because the proposed rule mirrors that of CARB so closely, it is assumed that a similar per capita savings will result, which equates to a yearly reduction of 0.122 lb/capita. These reductions come in addition to the 6.06 lb/capita witnessed from the 2001 model rule. Adoption and implementation of the OTC 2006 model rule will result in VOC emissions reductions of 3.7 tons per summer day and 566 tons over the ozone season in New York State in 2009. CARB estimated the average cost effectiveness of these amendments to be $4,000 per ton VOC reduced.

7.5.5.3 Part 234: Graphic Arts

Amendments are being made to the graphic arts industry regulations under 6 NYCRR Part 234, "Graphic Arts." These amendments are in response to two Control Techniques Guidelines (CTG) documents published by the EPA in September 2006: "Control Techniques Guidelines for Flexible Package Printing" and "Control Techniques Guidelines for Offset Lithographic Printing and Letterpress Printing."

CAA Section 182(b)(2)(A) provides that for non-attainment areas designated moderate or worse, RACT provisions must be included in the applicable SIP for "each category of VOC sources in the area covered by a CTG document issued by the Administrator between the date of the enactment of the Clean Air Act Amendments of 1990 and the date of attainment." These CTGs present guidance in determining RACT for VOC emissions from inks, coatings, adhesives and cleaning materials within facilities that conduct the aforementioned printing processes. The Department will use the CTG emission limit and control technology recommendations for flexible package printing, offset lithographic printing, and letterpress printing in its revisions to Part 234.

Cost analyses were performed by the EPA, for which details can be found in the CTG documents. These calculations included equipment, instrument and installation costs, as well as estimations of labor, maintenance, utility, and overhead costs. For flexible package printing, a catalytic oxidizer was analyzed under different operating scenarios, leading to estimated costs of $1,300-$5,700 per ton VOC removed. Lithographic and letterpress printing presses will see estimated costs of $2,010 per ton of VOC removed by controls on heatset inks; costs of $855/ton for cleaning materials; and an actual savings due to alcohol substitutes in fountain solutions. Consumers are not expected to incur any significant price increases.

7.5.5.4 Part 239: Portable Fuel Containers

EPA recently finalized the rule, "Control of Hazardous Air Pollutants From Mobile Sources" (72 FR 8427). The Department is planning to use this federal rule as a basis for amending the existing 6 NYCRR Part 239, "Portable Fuel Container Spillage Control."

With this federal rule, EPA sets regulations for portable fuel containers (PFCs), as well as for gasoline and passenger vehicles. The purpose is to significantly reduce emissions of hazardous air pollutants from mobile sources, referred to as "mobile source air toxics" (MSATs), to which exposure is known or suspected to cause serious health effects, including cancer. The PFC controls will considerably reduce such MSATs as benzene, 1,3-butadiene, formaldehyde, acetaldehyde, acrolein, and naphthalene, in addition to the secondary PM reductions.

Since the Department issued Part 239 in October 2002, a number of problems have been identified, as follows:

$ An automatic shutoff feature, intended to cut off fuel flow when the tank reaches a prescribed level, has proven to be incompatible with many types of fuel tanks. This leads to additional spillage and has frustrated many consumers;

$ Poor production quality of the PFCs, as demonstrated by a CARB compliance test resulting in nearly 50 percent failure of PFCs that have already been introduced to the market; and

$ Storage of gasoline in non-regulated containers designed for other fluids, such as kerosene.

As a result of these issues, emissions will still be lost due to evaporation through the diurnal cycle, as well as through spillage. The federal rule contains methods considered "best available controls" to correct these problems. The anticipated modifications to Part 239 will:

$ Eliminate the existing automatic shutoff feature, fill height and flow rate standards to simplify fueling and lessen spillage;

$ Require certification and compliance of PFCs prior to their introduction to the market; and

$ Expand the definition of a non-compliant container, effectively regulating diesel and kerosene containers in the same manner as PFCs

Along with these modifications, EPA has issued a standard of 0.3 grams per gallon per day (g/gal/day) of hydrocarbons. This standard was established based upon the emissions from a can over a diurnal test cycle, and requires stringent compliance testing to ensure emissions control over the life of the product. This standard must be met for containers manufactured on or after January 1, 2009. These new requirements will reduce hydrocarbon emissions from uncontrolled fuel containers by approximately 75 percent.

Both area and non-road source inventories are expected to be affected by these amendments. Of the projected VOC emission reductions, approximately 70 percent will be attributed to the area source inventory. These changes come from reductions in diurnal and permeation emissions from storage, and transport/spillage emissions from re-fueling at gas pumps. The remaining 30 percent will be accounted for in the non-road source inventory, where emissions will be reduced during re-fueling of non-road sources (e.g. lawnmowers, personal watercraft, etc.).

7.5.5.5 Part 241: Asphalt Formulation

The Department is considering changes to the use of cutback and emulsified asphalts in paving operations. The proposed ban on cutback asphalts and increased restrictions on emulsified asphalts will be made in 6 NYCRR Part 241, "Asphalt Formulation."

While cutback and emulsified asphalts are used in similar applications, they differ in how they are prepared. In preparing cutback asphalt, asphalt cement is blended with a diluent that is typically 25 to 45 percent by volume petroleum distillate. Emulsified asphalt preparation involves mixing asphalt cement with water and an emulsifying agent, such as soap. It is possible for emulsified asphalts to contain no VOCs, though some may contain up to 12 percent VOC by volume.

Currently, New York permits the use of cutback asphalt only during the cooler portion of the year from October 16 to May 1, and allows for emulsified asphalt to contain 2 to 12 percent VOCs, depending on the grade established by the American Society for Testing and Materials (ASTM). This proposed rule will have a similar, ozone-season ban on cutback asphalt; and will also limit the use of emulsified asphalt to that which contains not more than 0.5mL oil distillate from a 200mL sample—effectively 0.25 percent VOC content. Certain exemptions when necessary may be granted by the State Commissioner.

In calculating reductions resulting from these anticipated rule changes, an average baseline VOC content of 2.5 percent for emulsified asphalt was assumed. Thus, reducing the average VOC content from 2.5 percent to 0.25 percent represents a 90 percent reduction in emissions.

This would lead to a projected savings of 16.5 tons VOC per summer day, or 2525 tons per ozone season for New York State in 2009. It is believed that no additional costs would be incurred from the use of low-VOC emulsified asphalts due to their current availability.

7.5.6 Federal VOC Measures

7.5.6.1 VOC MACT

Pursuant to Section 112 of the CAA, the EPA is required to promulgate National Emission Standards for Hazardous Air Pollutants (NESHAPs), otherwise known as Maximum Achievable Control Technology (MACT) standards for chemicals known to cause cancer or other serious health effects. As EPA updates or releases new MACT standards, they are incorporated by reference into 6 NYCRR Part 200. Many of the chemical substances regulated as VOCs are also listed as HAPs. Therefore, many of the MACT control requirements effectively reduce emissions of VOCs as well.

7.5.6.2 Federal Reformulated Gasoline

Section 211(k) of the CAA deemed that reformulated gasoline, which is blended to burn cleaner and reduce emissions of certain pollutants, must be sold in major metropolitan areas with the worst ozone air pollution problems. Federal reformulated gasoline allows for a maximum of 1 percent benzene by volume. Phase I of the rule took effect January 1, 1995 with preliminary VOC and air toxics standards. These reformulated gasoline standards were replaced with Phase II standards, effective January 1, 2000, which called for broader emissions controls, requiring 25 to 29 percent VOC emission reductions and 20 to 22 percent air toxics reductions. Retail distribution of reformulated gasoline is required in the New York Metropolitan Area and Orange County. Dutchess County and a portion of Essex County have voluntarily opted to use reformulated gasoline.

7.5.7 Proposed Federal Rules

7.5.7.1 Aerosol Coatings Proposed Rule

On July 16, 2007, EPA published its proposed rule titled “National Volatile Organic Compound Emission Standards for Aerosol Coatings”

(72 FR 38952). The proposed rule will apply to manufacturers, processors, wholesale distributors, or importers of aerosol coatings used by the general public and in industrial applications. The proposed rule will also apply to distributors who are responsible for labeling of aerosol products.

While traditional VOC limits were based on the weight of VOC ingredients per weight or volume of product, the proposed rule implements a standard based upon the rate of ozone production of the VOC components, expressed in terms of weight of ozone generated from the VOC ingredients per weight of coating material. The proposed regulatory limits are a series of reactivity limits for six general coating categories and 30 subcategories of specialty coatings, expressed in terms of mass of ozone generation per gram of product.

The proposed rule requires all regulated entities to comply by January 1, 2009. Temporary variances may be granted to entities are unable to comply with the proposed requirements. The proposed rule also requires certain labeling, recordkeeping and reporting measures. EPA believes nationwide emissions of VOCs from aerosol products would be reduced by 18 to 19.4 percent from the 1990 baseline value (88.3 tons).

7.5.7.2 Locomotive Engines and Marine Compression-Ignition Engines Proposed Rule

Locomotives and marine diesel engines are important contributors to the nation's air pollution, as they emit large amounts of direct PM and NOx. In 2007, these engines accounted for approximately 20 percent of mobile source NOx and 25 percent of mobile source diesel PM2.5 emissions. EPA published its proposed rule, "Control of Emissions of Air Pollution From Locomotive Engines and Marine Compression-Ignition Engines Less than 30 Liters per Cylinder" on April 3, 2007 (72 FR 15938) to dramatically reduce emissions from these engines. It would set new exhaust emission standards on all types of locomotive engines, and on all types of marine diesel engines below 30 liters per cylinder displacement.

This proposed program includes a set of near-term emission standards for newly-built engines, which would begin to be phased in starting 2009, and for existing locomotives, which would take effect as soon as

2008 but no later than 2010 (2013 for Tier 2 locomotives)–as soon as certified remanufacture systems are available. Further long-term standards would be phased in over time, starting in 2014. Provisions are also being proposed to reduce unnecessary locomotive engine idling. Compared to engines meeting current standards, these stricter requirements would ultimately result in estimated PM reductions of 90 percent and NOx reductions of 80 percent. In addition to PM and NOx reductions, the proposed standards would effectively reduce nonmethane hydrocarbons, carbon monoxide, and air toxics.

7.5.7.3 Federal Nonroad Spark-Ignition Engines/Equipment Proposed Rule

EPA has proposed emission standards for spark-ignition engines used in marine vessels, including outboard engines, personal watercraft, and sterndrive/inboard engines in their proposed rule, "Control of Emissions from Nonroad Spark-Ignition Engines and Equipment" (72 FR 28098).

The engines and vehicles covered by this proposal are significant sources of air pollution. They account for about 25 percent of mobile source hydrocarbon emissions and 30 percent of mobile source carbon monoxide emissions.

The proposed standards continue the process of establishing nonroad standards as required by the Clean Air Act. EPA is required to study emissions from nonroad engines and vehicles and to set emissions standards if the level of pollutants from these sources cause or significantly contribute to air pollution and, more specifically, if the emissions of CO, NOx or hydrocarbons contribute significantly to the formation of ozone and carbon monoxide in more than one area of the country currently not meeting ozone and carbon monoxide standards.

EPA has proposed a more stringent level of emission standards for outboard and personal watercraft engines starting with the 2009 model year. The proposed standards for engines above 40 kW are 16 g/kW-hr for HC+NOx and 200 g/kW-hr for CO. For engines below 40 kW, the standards increase gradually based on the engine's maximum power. It is expected that manufacturers will meet these standards with improved fueling systems and other in-cylinder controls. The levels of the standards are consistent with the requirements recently adopted by California ARB with the advantage of a simplified form of the standard for different power ratings and with a CO standard.

EPA has also proposed new exhaust emission standards for sterndrive and inboard marine engines. The proposed standards are 5 g/kW-hr for HC+NOx and 75 g/kW-hr for CO starting with the 2009 model year. Manufacturers are expected to meet these standards with three-way catalysts and closed-loop fuel injection. To ensure proper functioning of these emission control systems in use, a requirement is proposed that engines have a diagnostic system for detecting a failure in the emission control system. For sterndrive and inboard marine engines above 373 kW with high-performance characteristics (generally referred to as "SD/I high-performance engines"), a CO standard of 350 g/kW-hr is being proposed. EPA is also proposing a variety of other special provisions for these engines to reflect unique operating characteristics and to make it feasible to meet emission standards using emission credits. These standards are consistent with the requirements recently adopted by California ARB, with some adjustment to the provisions for SD/I high-performance engines and with a CO standard.

The emission standards described above relate to engine operation over a prescribed duty cycle for testing in the laboratory. Also proposed are “not-to-exceed” standards that require manufacturers to maintain a certain level of emission control when engines operate under normal speed-load combinations that are not included in the certification duty cycle.

EPA is also proposing new standards to control evaporative emissions for all vessels using marine spark-ignition engines. The new standards include requirements to control fuel tank permeation, fuel line permeation, and diurnal emissions, including provisions to ensure that refueling emissions do not increase.

When fully implemented, the proposed standards would result in a 70 percent reduction in HC+NOx emissions, and a 20 percent reduction in CO from new engines’ exhaust. The proposed standards would result in a 70 percent reduction in evaporative emissions.

EPA estimates that by 2030, the proposed standards would result in significant annual reductions of pollutant emissions from regulated engine and equipment sources nationwide, including 630,000 tons of volatile organic hydrocarbon emissions, 98,000 tons of NOx emissions, and 6,300 tons of direct particulate matter (PM2.5) emissions. These reductions correspond to significant reductions in the formation of ground-level ozone and ambient PM2.5. In addition, these measures are expected to result in annual reductions of 2.7 million tons of carbon monoxide emissions, with the greatest reductions in areas where there have been problems with individual exposures.

7.5.8 ***This section was removed by NY***

7.5.9 Canadian Emission Reductions

Some portion of the particulate matter present in the air in the northern United States originates in Canada. The sources of this contamination are the industrial and commercial operations, fossil fuel and woodburning and especially the emissions of particulate matter and its precursors from coal-fired power plants A number of initiatives have been put in place in Canada that will reduce emissions and have a positive effect in the air quality in the northeast United States.

The first of these are the Canada-Wide Standards for Mercury Emissions from Coal-Fired Electric Power Generation Plants. Under these provisions, a reduction of approximately 52% to 58% in mercury emissions is expected nationally by 2010. The Ontario Power Authority (OPA) has been directed to replace Ontario's coal-fired generation facilities by cleaner sources "in the earliest practical time frame that ensures adequate generating capacity and electricity system reliability in Ontario." The reduction in mercury emissions is expected to have the co-benefit of the reduction of the emission of other pollutants as well, including particulate and its precursors (SO2 and NOx), organics, metals and greenhouse gases. The replacement of coal-fired units in Ontario, which are most likely to affect New York's air quality, will have a significant effect on ambient particulate concentrations and haze.

The second initiative in Canada that will affect New York's air quality is the promulgation of air quality standards for PM2.5 and ozone at a level of 30ug/m3 on a 24-hour basis and 65 ppb on an 8-hour basis, respectively. The intention is to meet these standards by 2010, and the result of which will have a positive effect on New York's air quality as well. Quebec's five-year report on their reduction efforts to date discusses the measures taken from 2001 to 2005[1]. The control measures instituted by Canada are

[1] http://www.menv.gouv.qc.ca/air/particules_ozone/rapport_quin-en.pdf

aimed at reducing industrial emissions. Specifically, regulations like Quebec's "Regulation respecting the quality of the atmosphere"[2] contain control measures for new and existing sources of VOC's similar to those in New York and other states, and set ambient air quality standards. VOC controls address surface coating processes, automotive painting operations, printing, dry cleaning, formaldehyde from panelboard mills, pulp and paper operations, styrene from composite material manufacturing (fiberglass and resins), and transportation. Particulate emissions measures include the control of fugitive emissions from mining and sandblasting, granaries, mills, distilleries, breweries, powder milk plants, fertilizer mixing plants, concrete plants, vitreous enamel operations, earthenware and ceramic products plant, polyvinyl chloride production or processing plant, wood processing plants, and aluminum manufacturing. Programs also control particulate and NOx emissions from combustion operations (boilers, turbines, and internal combustion), as well as fuel sulfur content (2.0% by weight for "heavy oil," 1.0% by weight for "intermediate oil," 0.5% by weight for "light oil," and 2.0% in weight for coal). Many other categories are covered as well woodburning, smelting, charcoal kilns, incinerators, refineries, storage tanks, metallic processing plants, as well as other industrial processes.

Additional measures are planned in the next five years to achieve their goals by 2010, including reducing emissions from residential wood heating, establishing and inspection and maintenance program for light vehicles, and implementing "other measures in the transportation, energy and climate change sectors."

The above measures are efforts by the Canadian or Provincial governments to improve air quality. They were not included in the present attainment demonstration and will not be enforceable by New York or the federal government. However, give the proximity to New York State, air quality improvements in Canada will certainly impact New York and the northeastern United States.

7.5.10 New York State’s “15 by 15" Program

New York Governor Spitzer has initiated a clean energy plan with the goal

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[2]http://www2.publicationsduquebec.gouv.qc.ca/dynamicSearch/telecharge.php?type=3&file=/Q_2/Q2R20_A.htm

of reducing New York's energy demand by 15% by 2015. The plan, known as "15 by 15," focuses on energy efficiency, conservation, and investment in renewable energy sources as the keys to achieving economic and environmental goals. The specific goals and highlights of the plan include:

$ Reduce electricity use by 15 percent from forecasted levels by the year 2015 through new energy efficiency programs in industry and government;

$ Eliminate incentives in the marketplace that discourages utilities from conserving energy by requiring annual adjustments to rates to make utilities whole for lost revenues caused by energy efficiency programs.

$ The approval of 21 contract awards by state agencies for clean, renewable power plants upstate that will replace older plants.

$ Establish new appliance efficiency standards and set more rigorous energy building codes;

$ Invest $295 million for renewable energy projects throughout the state; and

$ Propose power plant siting legislation that creates an expedited review process for new wind power projects, repowering projects that reduce emissions, and other power plants that have very low levels of carbon dioxide emissions.

The benefits of this plan for New York and for the environment include a reduction in the electricity that must be purchased, the creation of new jobs, and a reduction in emissions as a result of the need to produce less power and the substitution of clean power sources for those already in operation. The emission reductions for the “15 by 15" plan are also estimated to result in an annual carbon dioxide reduction of about 12.8 million tons, which is the equivalent of removing 2.5 million cars from the road.

The Department is not committing to the inclusion of any of these measures as part of the SIP at this time, The Department will evaluate each measure resulting from this initiative individually to determine if it is appropriate to be included in the SIP. The Department will need to consider among other things whether the measure is quantifiable, enforceable, and include emissions reductions that are additional to other adopted SIP measures.

7.5.11 NYSERDA Programs

The New York State Energy Research and Development Authority (NYSERDA) was established in 1975 and is primarily funded by state rate payers through the System Benefits Charge (SBC). The SBC has recently been extended through June 30, 2011. NYSERDA has introduced a number of programs and services to promote energy efficiency amongst the industrial, commercial, municipal, and residential sectors throughout the state, for which they provide technical and financial assistance.

One initiative that has seen success is the New York Energy $mart Program. NYSERDA has allocated funding towards energy efficiency programs, low-income energy affordability programs, and research and development projects with focuses on renewable resources, distributed generation, and combined heat and power installations. In the last five years, the New York Energy $mart Program has created a wealth of economic and environmental benefits[3]:

$ Approximately $198 million in annual energy savings

$ 1,400 Gwh saved per year

$ 860 MW in reduced demand

$ Fuel savings of 3.3 Tbtu

$ Annual carbon dioxide reduction equivalent to 200,000 fewer cars

$ Significant annual greenhouse gas emission reductions:

Nitrogen Oxides - 1,280 tons

Sulfur Dioxides - 2,320 tons

Carbon Dioxide - 1,000,000 tons

In addition to Energy $mart, there are many other programs which result in reductions of emissions of PM and its precursors. For example, the Peak-Load Reduction Program offers incentives to offset costs to companies

[3]http://www.nyserda.org/ny_energy_smart.asp

that implement either short-term demand response measures, or long-term permanent demand reduction, for days in which electric demand is very high. The Enhanced Commercial/Industrial Performance Program contains three tiers of incentives for the installation of energy-efficient equipment resulting in reduced electrical demand and cost. A wide range of businesses, schools, universities, state and local governments, and other institutions are eligible for these incentives. And, NYSERDA's Alternative-Fuel Vehicle Program aims to encourage fleets to purchase vehicles powered by natural gas, propane, biofuels, and electricity, and to encourage the use of emission reduction technologies and anti-idling technologies for diesel vehicles.

Table 7-1. Listing of FRM sites, 1999-2006. Some locations have primary (“P”) and duplicate (“D”) samplers. Dates with an asterix denote daily sampling for at least part of the period.

NYSDEC Region	Site Name	County	Dates
1	Eisenhower Park	Nassau	1/1999 – 12/1999
1	Hempstead	Nassau	1/1999 – 12/2006
1	Briarcliffe	Nassau	2/2000 – 3/2003
1	Roslyn	Nassau	7/2000 – 3/2003
1	Roslyn Heights	Nassau	1/1999 – 3/2000
1	Babylon	Suffolk	1/1999 – 12/2006
2	Mabel Dean H.S.	New York	1/1999 – 6/2001*
2	J.H.S. 45	New York	P: 1/2000 – 12/2006 D: 1/2006 – 12/2006
2	P.S. 59	New York	P: 1/1999 – 12/2006 D: 1/1999 – 12/2005
2	P.S. 19	New York	10/2001 – 12/2006
2	Canal Street Post Office	New York	P: 1/1999 – 12/2006 D: 8/1999 – 9/2001
2	I.S. 155	Bronx	P: 1/1999 – 7/1999 D: 1/1999 – 7/1999
2	Morrisania II	Bronx	1/1999 – 12/2006
2	N.Y. Botanical Gardens	Bronx	1/1999 – 12/2006
2	I.S. 52	Bronx	P: 9/1999 – 12/2006* D: 9/1999 – 12/2006
2	Greenpoint	Kings	P: 1/1999 – 12/2000 D: 1/1999 – 7/1999
2	P.S. 321	Kings	1/1999 – 3/2003
2	P.S. 314	Kings	4/2000 – 1/2003
2	J.H.S. 126	Kings	1/2001 – 12/2006

2	Queensboro Community College	Queens	1/1999 – 12/2000
2	P.S. 29	Queens	P: 7/1999 – 1/2003 D: 8/1999 – 1/2003
2	P.S. 214	Queens	4/2000 – 3/2003
2	Queens College II/P.S. 219	Queens	1/2001 – 4/2006*
2	Susan Wagner H.S.	Richmond	1/1999 – 12/2006
2	Port Richmond Post Office	Richmond	12/1999 – 12/2006
3	Poughkeepsie	Dutchess	7/1999 – 3/2003
3	Newburgh	Orange	2/2000 – 12/2006
3	Mamaroneck	Westchester	2/2000 – 12/2006

Table 7-2. Trends in $PM_{2.5}$ mass at the longest running FRM monitors, based on quarterly averages from 1999-2006, in mg m^{-3} yr^{-1}. Only those quarters with at least 10 valid samples are included in this trend estimate.

Site Name	**Trend (ug/m^3/yr)**
Hempstead	-0.12
Babylon	-0.34
J.H.S. 45	-0.42
P.S. 59	-0.30
Canal Street Post Office	-0.50
Morrisania II	-0.27
N.Y. Botanical Gardens	-0.15
I.S. 52 (P)	-0.33
I.S. 52 (D)	-0.23
Susan Wagner H.S.	-0.13
Port Richmond Post Office	-0.20
Newburgh	-0.20
Mamaroneck	-0.20

Figure 7-1 - Map of Downstate FRM Sites

Table 7-3. Listing of Speciation Trends Network (STN) sites, 2000-2006. All sites are located in NYSDEC Region 2.

Site Name	County	Dates
Canal Street Post Office	New York	8/2002 – 12/2006
N.Y. Botanical Gardens	Bronx	2/2000 – 12/2005
I.S. 52	Bronx	1/2001 – 12/2006
Queens College II/P.S. 219	Queens	4/2001 – 12/2006

Figure 7-2 - Average $PM_{2.5}$ Speciation – Annual, Winter, and Summer

Table 7-4. Listing of FRM sites, 1999-2006. Some locations have primary ("P") and duplicate ("D") samplers. Dates with an asterix denote daily sampling for at least part of the period. The New Haven/Stiles St. monitor was designated as "special purpose," and is included here for completeness only (*in italics*).

State	AQS ID	Site Name	County	Dates
CT	090010010	Bridgeport/Roosevelt School	Fairfield CT	P: 1/1999 – 12/2006 D: 1/1999 – 1/2003
	090010113	Bridgeport/Edison School	Fairfield CT	9/2000 – 12/2003
	090011123	Danbury WCSU	Fairfield CT	1/1999 – 12/2006
	090012124	Stamford H.S.	Fairfield CT	1/1999 – 12/2004
	090013005	Norwalk Health Dept.	Fairfield CT	3/2000 – 12/2006
	090019003	Westport/Sherwood Island	Fairfield CT	1/1999 – 12/2006
	090090018	*New Haven/Stiles St.*	*New Haven CT*	*P: 1/1999 – 9/2005** *D: 1/1999 – 1/2003*
	090090026	New Haven/Woodward Firehouse	New Haven CT	4/2003 – 12/2006
	090090027	New Haven/Criscuolo Park	New Haven CT	P: 1/2004 – 12/2006* D: 2/2005 – 12/2006
	090091123	New Haven/State St.	New Haven CT	P: 1/1999 – 12/2006 D: 1/1999 – 2/2005
	090092008	New Haven/Ag. Center	New Haven CT	4/2003 – 12/2006
	090092123	Waterbury/Bank St.	New Haven CT	P: 1/1999 – 12/2006 D: 1/1999 – 12/2006
	090098003	West Haven Toll	New Haven CT	4/2003 – 12/2004
	090099005	Hamden Mill Basins	New Haven CT	7/1999 – 12/2003
NJ	340030003	Fort Lee Library	Bergen NJ	1/1999 – 12/2006
	340130011	Newark/St. Charles	Essex NJ	1/1999 – 12/1999
	340130015	Newark/Willis Center	Essex NJ	4/1999 – 12/2006
	340130016	Newark Lab	Essex NJ	P: 8/2001 – 5/2003 D: 8/2001 – 5/2003
	340171003	Jersey City Firehouse	Hudson NJ	P: 1/1999 – 12/2006 D: 12/1999 – 12/2006
	340172002	Union City	Hudson NJ	1/1999 – 3/2002, 7/2005 – 12/2006
	340210008	Trenton	Mercer NJ	1/1999 – 12/2006

	340218001	Washington Crossing	Mercer NJ	1/1999 – 12/2006
	340230006	New Brunswick	Middlesex NJ	1/1999 – 12/2006
	340270004	Morristown Ambulance Squad	Morris NJ	5/1999 – 12/2006
	340273001	Chester	Morris NJ	1/1999 – 12/2006
	340310005	Paterson	Passaic NJ	1/1999 – 12/2006
	340390004	Elizabeth Lab	Union NJ	P: 1/1999 – 12/2006* D: 1/1999 – 12/2006
	340390006	Elizabeth/Mitchell Bldg.	Union NJ	1/1999 – 12/2006
	340392003	Rahway	Union NJ	12/1999 – 12/2006*

Table 7- 5. Annual average $PM_{2.5}$ levels for sites with at least 75% valid samples in a given year, 2000-2006. Incomplete years are left blank.

Site Name	2000	2001	2002	2003	2004	2005	2006
Bridgeport/Roosevelt School (P)	13.88	13.71	12.72	12.98	12.92	14.32	12.51
Bridgeport/Roosevelt School (D)	15.63	13.49	11.82				
Bridgeport/Edison School		12.77	12.88	12.27			
Danbury WCSU	12.70	13.22	12.51	13.37	11.25	13.44	12.17
Stamford H.S.	12.90	13.01	12.81	13.51	11.78		
Norwalk Health Dept.	12.86	13.41	12.58	12.96	12.23	13.32	11.77
Westport/Sherwood Island	13.03	12.15	11.49	11.63	11.06	12.18	10.69
New Haven/Stiles St. (P)	*15.94*	*16.88*	*16.00*	*16.91*	*15.40*		
New Haven/Stiles St. (D)	*18.78*	*18.60*	*16.19*				
New Haven/Woodward Firehouse					11.56	13.05	11.72
New Haven/Criscuolo Park (P)					12.21	13.62	12.21
New Haven/Criscuolo Park (D)						14.01	12.81
New Haven/State St. (P)	14.07	14.32	13.03	13.59	12.66	13.88	12.63
New Haven/State St. (D)		14.58	12.38	15.49	12.39		
New Haven/Ag. Center					11.14	11.73	10.76
Waterbury/Bank St. (P)	13.61	13.98	13.23	12.64	12.04	14.00	11.98
Waterbury/Bank St. (D)	14.82	14.21	12.75	14.09	11.97	14.14	12.26
West Haven Toll					12.91		
Hamden Mill Basins	11.49	11.88	11.09	12.29			
Fort Lee Library	14.57	13.85	12.99	13.34	12.05	14.65	11.82
Newark/Willis Center	15.60	13.06	13.16	13.84	13.17	14.35	12.12
Newark Lab (P)			14.12				
Newark Lab (D)			14.05				
Jersey City Firehouse (P)	16.78	14.01	14.34	14.81	13.66	15.10	13.35
Jersey City Firehouse (D)			13.99	16.26	12.93	16.07	14.67
Union City	17.08	15.54					13.83
Trenton	14.71	14.46	12.94	13.41	12.48	12.90	12.19

Washington Crossing	12.05		11.35	12.18	10.96	12.27	10.06
New Brunswick	13.00	12.72	11.12	12.91	11.11	13.33	10.77
Morristown Ambulance Squad	12.88		11.48	12.16	11.27	12.33	10.12
Chester	11.09		10.46	10.77	9.99	10.77	9.01
Paterson	13.56		12.90	13.26	12.60	13.44	11.88
Elizabeth Lab (P)		15.53	14.56	15.96	15.08	15.24	14.16
Elizabeth Lab (D)	18.49	15.42	14.78	16.97	14.19	16.65	14.72
Elizabeth/Mitchell Bldg.	15.20	12.88	13.11	13.97	12.68	14.33	12.36
Rahway	14.10	12.77	12.04	13.24	12.53	13.91	11.92

Table 7-6. The 98th percentile of $PM_{2.5}$ levels for sites with at least 75% valid samples in a given year, 2000-2006. Incomplete years are left blank.

Site Name	2000	2001	2002	2003	2004	2005	2006
Bridgeport/Roosevelt School (P)	41.5	40.1	32.9	39.6	34.2	38.3	36.7
Bridgeport/Roosevelt School (D)	42.8	40.6	34.0				
Bridgeport/Edison School		32.1	33.2	40.4			
Danbury WCSU	32.9	35.2	30.7	37.3	27.5	33.4	33.8
Stamford H.S.	36.3	37.4	34.5	41.5	32.2		
Norwalk Health Dept.	35.3	35.7	34.3	42.9	35.2	34.9	35.9
Westport/Sherwood Island	33.4	34.5	30.8	44.0	30.9	35.2	31.3
New Haven/Stiles St. (P)	*39.5*	*40.6*	*40.4*	*44.0*	*34.9*		
New Haven/Stiles St. (D)	*44.8*	*43.0*	*34.5*				
New Haven/Woodward Firehouse					31.5	36.4	36.5
New Haven/Criscuolo Park (P)					33.2	38.2	36.7
New Haven/Criscuolo Park (D)						39.1	31.6
New Haven/State St. (P)	37.2	39.5	32.4	40.6	36.2	40.8	38.1
New Haven/State St. (D)		40.6	32.3	38.9	29.9		
New Haven/Ag. Center					32.1	32.8	33.9
Waterbury/Bank St. (P)	34.4	35.4	32.6	37.7	30.4	34.1	35.6
Waterbury/Bank St. (D)	36.0	34.9	33.5	32.8	26.1	35.9	35.2
West Haven Toll					30.8		
Hamden Mill Basins	34.7	32.1	29.4	44.0			
Fort Lee Library	36.4	34.4	33.0	38.9	31.0	40.5	38.2
Newark/Willis Center	41.6	32.1	32.3	39.8	34.9	40.4	39.9
Newark Lab (P)			34.6				
Newark Lab (D)			39.9				
Jersey City Firehouse (P)	39.5	34.1	34.3	46.4	37.4	37.9	41.0
Jersey City Firehouse (D)			36.8	41.1	29.1	38.3	38.9
Union City	39.3	39.5					
Trenton	43.1	35.4	35.4	40.5	33.3	33.6	36.2

Washington Crossing	31.5		32.2	34.9	28.0	33.0	29.5
New Brunswick	34.5	34.1	26.0	45.0	35.5	33.8	32.8
Morristown Ambulance Squad	30.2		29.7	36.8	31.1	32.9	30.4
Chester	29.4		30.0	35.7	29.8	33.4	28.3
Paterson	35.4		34.9	39.8	31.0	40.5	33.4
Elizabeth Lab (P)		39.7	41.7	37.0	40.5	42.5	39.8
Elizabeth Lab (D)	46.6	50.3	39.3	41.2	36.5	39.8	41.9
Elizabeth/Mitchell Bldg.	36.0	33.8	30.0	40.9	33.1	38.6	38.7
Rahway	38.0	30.4	31.1	35.2	36.6	38.2	37.5

Table 7-7. Trends in $PM_{2.5}$ mass at the longest running FRM monitors, based on quarterly averages from 1999-2006, in ug/m^3/yr. Only those quarters with at least 10 valid samples are included in this trend estimate.

Site Name	Trend (ug/$m^{3/}$/yr)
Bridgeport/Roosevelt School (P)	-0.07
Danbury WCSU	-0.05
Norwalk Health Dept.	-0.18
Westport/Sherwood Island	-0.19
New Haven/Stiles St. (P)	*+0.02*
New Haven/State St. (P)	-0.19
New Haven/State St. (D)	-0.32
Waterbury/Bank St. (P)	-0.16
Waterbury/Bank St. (D)	-0.13
Fort Lee Library	-0.25
Newark/Willis Center	-0.37
Jersey City Firehouse (P)	-0.34
Jersey City Firehouse (D)	-0.25
Trenton	-0.27
Washington Crossing	-0.14
New Brunswick	-0.11
Morristown Ambulance Squad	-0.49
Chester	-0.21
Paterson	-0.06
Elizabeth Lab (P)	-0.27
Elizabeth Lab (D)	-0.43
Elizabeth/Mitchell Bldg.	-0.30
Rahway	-0.15

Table 7-8. Third quarter 2002 average $PM_{2.5}$ values at the NY and NJ FRM monitors in the NYC NAA, both including and excluding the flagged data from July 2002.

FRM site	County, State	3rd Quarter 2002 Average $PM_{2.5}$, ug/m3 (include flagged days)	3rd Quarter 2002 Average $PM_{2.5}$, ug/m3 (exclude flagged days)
340030003	Bergen County, NJ	16.05	13.99
340171003	Hudson County, NJ	16.83	14.68
340210008	Mercer County, NJ	17.99	15.03
340218001	Mercer County, NJ	16.71	14.74
340230006	Middlesex County, NJ	16.60	13.84
340270004	Morris County, NJ	16.84	14.49
340273001	Morris County, NJ	16.14	13.63
340310005	Passaic County, NJ	16.50	14.43
340390004	Union County, NJ	18.97	17.18
340390006	Union County, NJ	13.69	13.69
340392003	Union County, NJ	17.03	14.37
360050080	Bronx County, NY	16.96	14.92
360050083	Bronx County, NY	15.80	13.66
360050110	Bronx County, NY	16.82	15.85
360470052	Kings County, NY	16.66	13.63
360470076	Kings County, NY	15.82	13.66
360470122	Kings County, NY	16.50	14.34
360590008	Nassau County, NY	13.93	11.62
360610056	New York County, NY	17.38	15.33
360610062	New York County, NY	17.44	15.26
360610079	New York County, NY	16.50	14.39
360610128	New York County, NY	17.61	15.40
360710002	Orange County, NY	14.84	12.96
360810124	Queens County, NY	15.69	14.74
360850055	Richmond County, NY	16.26	13.90

360850067	Richmond County, NY	14.86	12.60
361030001	Suffolk County, NY	14.34	12.16
361191002	Westchester County, NY	14.85	12.76

Table 7-9. Baseline $PM_{2.5}$ design values at all FRM monitors across the NYC NAA as computed by MATS using the official EPA database (which includes flagged data from July 2002 in NY and NJ), and excluding the flagged data from July 2002 in NY and NJ.

FRM site	County, State	Baseline Design Value, ug/m3 (include flagged days)	Baseline Design Value, ug/m3 (exclude flagged days)
090010010	Fairfield County, CT	13.1	13.1
090010113	Fairfield County, CT	12.7	12.7
090011123	Fairfield County, CT	12.8	12.8
090012124	Fairfield County, CT	12.9	12.9
090013005	Fairfield County, CT	13.0	13.0
090019003	Fairfield County, CT	11.4	11.4
090091123	New Haven County, CT	13.7	13.7
090092123	New Haven County, CT	13.1	13.1
090099005	New Haven County, CT	11.6	11.6
340030003	Bergen County, NJ	13.0	12.8
340171003	Hudson County, NJ	14.9	14.8
340210008	Mercer County, NJ	13.9	13.7
340218001	Mercer County, NJ	11.6	11.5
340230006	Middlesex County, NJ	12.5	12.2
340270004	Morris County, NJ	11.8	11.6
340273001	Morris County, NJ	10.7	10.5
340310005	Passaic County, NJ	13.1	12.9
340390004	Union County, NJ	15.7	15.5
340390006	Union County, NJ	13.2	13.2
340392003	Union County, NJ	13.1	12.9
360050080	Bronx County, NY	15.8	15.6
360050083	Bronx County, NY	13.8	13.7
360050110	Bronx County, NY	14.3	14.3
360470052	Kings County, NY	15.7	15.5
360470076	Kings County, NY	14.6	14.4

360470122	Kings County, NY	14.7	14.5
360590008	Nassau County, NY	12.2	12.0
360610056	New York County, NY	16.9	16.7
360610062	New York County, NY	16.3	16.1
360610079	New York County, NY	14.7	14.5
360610128	New York County, NY	15.9	15.6
360710002	Orange County, NY	11.5	11.4
360810124	Queens County, NY	12.9	12.8
360850055	Richmond County, NY	14.4	14.2
360850067	Richmond County, NY	12.1	12.0
361030001	Suffolk County, NY	12.1	11.9
361191002	Westchester County, NY	12.2	12.0

Table 7-10. Baseline non-blank species composition at all FRM monitors across the NYC NAA as computed by MATS. "SO_4" is sulfate; "NO_3r" is retained nitrate; "OM" is organic aerosol mass; "EC" is elemental carbon (OM+EC = carbonaceous mass); "PBW" is particle-bound water; "NH_4" is ammonium associated with SO_4 and NO_3r; "OPP" is other primary $PM_{2.5}$, assumed to equal the sum of major crustal oxides (Si, Ca, Fe, and Ti); and "Salt" is 1.8×Cl.

FRM site	SO_4	NO_3r	OM	EC	PBW	NH_4	OPP	Salt
090010010	3.60	0.59	4.84	0.80	1.05	1.27	0.45	0.03
090010113	3.55	0.55	4.52	0.79	1.04	1.24	0.44	0.03
090011123	3.75	0.65	3.97	0.87	1.15	1.36	0.46	0.04
090012124	3.59	0.67	4.44	0.83	1.06	1.30	0.46	0.03
090013005	3.46	0.55	5.16	0.75	0.97	1.19	0.43	0.02
090019003	3.59	0.62	2.78	0.88	1.19	1.37	0.46	0.06
090091123	3.90	0.50	4.84	0.86	1.21	1.41	0.46	0.04
090092123	3.92	0.69	3.83	0.94	1.26	1.47	0.49	0.05
090099005	3.59	0.65	2.93	0.89	1.18	1.38	0.46	0.06
340030003	3.71	0.80	3.25	1.08	1.28	1.52	0.55	0.08
340171003	3.99	1.14	4.08	1.24	1.36	1.75	0.60	0.09
340210008	4.51	0.98	3.06	0.74	1.52	1.81	0.50	0.05
340218001	3.86	0.67	2.61	0.58	1.30	1.49	0.41	0.03
340230006	3.67	0.70	3.16	0.99	1.26	1.46	0.45	0.05
340270004	3.93	0.59	2.72	0.71	1.28	1.45	0.38	0.03

340273001	3.15	0.50	2.85	0.75	1.08	1.21	0.38	0.03
340310005	3.79	0.80	3.28	1.10	1.31	1.54	0.53	0.07
340390004	4.29	0.99	4.95	1.02	1.45	1.76	0.56	0.08
340390006	3.57	0.78	3.72	1.37	1.23	1.49	0.52	0.06
340392003	3.54	0.76	3.60	1.29	1.22	1.46	0.50	0.05
360050080	4.11	1.02	4.91	1.19	1.41	1.74	0.62	0.12
360050083	4.17	1.01	2.96	1.10	1.43	1.76	0.61	0.12
360050110	3.96	0.93	4.06	1.20	1.34	1.62	0.59	0.08
360470052	4.13	1.18	4.44	1.28	1.41	1.81	0.61	0.10
360470076	3.82	1.12	4.18	1.15	1.30	1.68	0.57	0.09
360470122	4.01	1.12	3.86	1.16	1.37	1.75	0.60	0.10
360590008	3.67	0.82	2.84	0.83	1.26	1.51	0.50	0.09
360610056	4.35	1.17	5.28	1.27	1.49	1.88	0.64	0.11
360610062	4.31	1.04	4.97	1.23	1.48	1.80	0.62	0.12
360610079	4.20	1.05	3.61	1.17	1.44	1.78	0.62	0.12
360610128	4.02	1.19	4.84	1.23	1.37	1.78	0.60	0.10
360710002	3.68	0.62	2.79	0.81	1.15	1.34	0.43	0.03
360810124	3.80	0.89	3.02	1.10	1.31	1.58	0.56	0.09
360850055	3.94	0.92	3.71	1.47	1.36	1.66	0.58	0.08
360850067	3.12	0.67	3.69	1.09	1.08	1.29	0.45	0.06
361030001	3.74	0.73	2.87	0.85	1.23	1.44	0.50	0.06
361191002	3.64	0.76	2.80	1.05	1.23	1.44	0.53	0.06

Table 7-11. Baseline and future $PM_{2.5}$ design values at all FRM monitors across the NYC NAA as computed by MATS, excluding flagged FRM days.

FRM site	County, State	Baseline Design Value, ug/m3	Future Design Value, ug/m3
090010010	Fairfield County, CT	13.1	11.7
090010113	Fairfield County, CT	12.7	11.2
090011123	Fairfield County, CT	12.8	11.2
090012124	Fairfield County, CT	12.9	11.5
090013005	Fairfield County, CT	13.0	11.7
090019003	Fairfield County, CT	11.4	9.8
090091123	New Haven County, CT	13.7	12.0
090092123	New Haven County, CT	13.1	11.4
090099005	New Haven County, CT	11.6	10.0
340030003	Bergen County, NJ	12.8	11.3
340171003	Hudson County, NJ	14.8	13.2
340210008	Mercer County, NJ	13.7	11.6
340218001	Mercer County, NJ	11.5	9.6
340230006	Middlesex County, NJ	12.2	10.3
340270004	Morris County, NJ	11.6	9.7
340273001	Morris County, NJ	10.5	8.8
340310005	Passaic County, NJ	12.9	11.1
340390004	Union County, NJ	15.5	13.5
340390006	Union County, NJ	13.2	11.5
340392003	Union County, NJ	12.9	11.2
360050080	Bronx County, NY	15.6	14.2
360050083	Bronx County, NY	13.7	12.2
360050110	Bronx County, NY	14.3	13.0
360470052	Kings County, NY	15.5	14.0
360470076	Kings County, NY	14.4	13.1
360470122	Kings County, NY	14.5	13.1
360590008	Nassau County, NY	12.0	10.7
360610056	New York County, NY	16.7	15.2

360610062	New York County, NY	16.1	14.5
360610079	New York County, NY	14.5	13.2
360610128	New York County, NY	15.6	14.2
360710002	Orange County, NY	11.4	10.0
360810124	Queens County, NY	12.8	11.5
360850055	Richmond County, NY	14.2	12.4
360850067	Richmond County, NY	12.0	10.5
361030001	Suffolk County, NY	11.9	10.5
361191002	Westchester County, NY	12.0	10.6

Table 7-12. Information for the five FRM monitors considered in this analysis: site name and ID, dates of operation during 2000-2004, base year $PM_{2.5}$ design value, and the nearest STN monitor.

Site Name	FRM site	Operational periods during 2000-2004	Base year Design Value, ug/m^3	Nearest STN monitor
P.S.59	360610056	1st qtr 2000 – 4th qtr 2004	16.9	360610062
Canal St	360610062	1st qtr 2000 – 4th qtr 2004	16.3	360610062
J.H.S.45	360610079	1st qtr 2000 – 4th qtr 2004	14.7	360050110
P.S.19	360610128	3rd qtr 2001 – 4th qtr 2004	15.9	360610062
I.S.52	360050110	1st qtr 2000 – 4th qtr 2004	14.7	360050110

Table 7-13. Current $PM_{2.5}$ species composition at each site: sulfate (SO_4), retained nitrate (NO_3r), organic carbon (OC), elemental carbon (EC), particle-bound water (PBW), retained ammonium (NH_4), and other primary $PM_{2.5}$ (OPP).

FRM site	SO_4	NO_3r	OC	EC	PBW	NH_4	OPP
360610056	4.98	1.50	3.81	1.51	1.65	2.19	0.77
360610062*	4.81	1.40	3.66	1.45	1.59	2.10	0.74
360610079	4.41	1.05	3.58	1.13	1.47	1.84	0.71
360610128	4.68	1.39	3.59	1.42	1.55	2.05	0.72
360050110*	4.39	1.08	3.56	1.14	1.46	1.84	0.71

* FRM Monitor with collocated STN

Table 7-14. Annual average $PM_{2.5}$ mass over the nine grid cells surrounding each monitor from the base year (2002) and future year (2009) CMAQ simulations, as well as the absolute and percent reductions.

FRM site	2002 avg., ug/m^3	2009 avg., ug/m^3	Change ug/m^3	Change (%)
360610056	24.28	20.51	-3.77	-15.5

360610062	23.70	19.80	-3.90	-16.5
360610079	24.28	20.51	-3.77	-15.5
360610128	23.66	20.01	-3.65	-15.4
360050110	24.28	20.51	-3.77	-15.5

Table 7-15. Base and future year $PM_{2.5}$ design values.

FRM site	Base Year Design Value, ug/m^3	Future $PM_{2.5}$ Design Value, ug/m^3
360610056	16.9	15.3
360610062	16.3	14.4
360610079	14.7	13.3
360610128	15.9	14.3
360050110	14.7	13.3

Figure 7-3 - PM2.5 FRM Sites in New York City