Rhode Island Attainment Plan for the 8-Hour Ozone National Ambient Air Quality Standard

Rhode Island Department of Environmental Management
Office of Air Resources

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1.0 INTRODUCTION AND BACKGROUND

1.1 Summary and Purpose of Document

The Rhode Island Department of Environmental Management (RI DEM) is submitting this document, the "State Implementation Plan (SIP) to Demonstrate Attainment of the Eight-Hour National Ambient Air Quality Standard for Ozone in the Rhode Island Nonattainment Area" to the U.S. Environmental Protection Agency (EPA) to demonstrate that the Rhode Island nonattainment area, which is the entire State of Rhode Island, will be in attainment of the eight-hour National Ambient Air Quality Standard (NAAQS) for ozone by the end of the 2009 ozone season. This document also demonstrates that, by 2008, Rhode Island will achieve the Reasonable Further Progress (RFP) goals that are prescribed by the Clean Air Act (CAA) and subsequent EPA guidance.
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This submission includes the following:

- Rhode Island 2002 Emissions Inventory, which quantifies emissions of ozone precursors and other air pollutants in Rhode Island in 2002, consistent with CAA requirements for the development of periodic emissions inventories. The 2002 inventory served as the base year for the attainment demonstration and RFP analysis and was used to develop projected emissions estimates for 2008 and 2009 for use in those analyses.

- The RFP demonstration, which demonstrates that ozone precursor emissions in Rhode Island will be reduced by 15% in 2008 from 2002 baseline levels, as required by the CAA.

- A demonstration that Rhode Island sources are subject to emissions limitations consistent with the Reasonably Available Control Technology (RACT) requirements in the CAA.

- The attainment demonstration, which shows that Rhode Island will attain the 8-hour ozone NAAQS by the end of the 2009 ozone season

- An analysis consistent with EPA's Reasonable Available Control Measure (RACM) guidance that demonstrates that there are no additional reasonably available control requirements that could be adopted that would result in earlier attainment of the 8-hour NAAQS in Rhode Island.

- A demonstration that Rhode Island has contingency measures in place that will result in additional reductions in ozone precursor emissions if Rhode Island fails to meet its RFP or attainment requirements.

- On-road mobile source Transportation Conformity Budgets for Rhode Island for the 2008 RFP year and for the 2009 attainment demonstration year.

1.2 Ozone Formation and Health Impacts

Ground level ozone is formed when oxides of nitrogen (NOx), volatile organic compounds (VOCs) and, to a lesser extent, carbon monoxide (CO) interact in the atmosphere in the presence of sunlight and elevated temperatures. NOx and VOCs, the primary ozone precursors, are emitted from many types of sources, including power plants, boilers, automobiles and the use of consumer and industrial products. VOCs are also emitted from vegetation. Because airborne VOCs and NOx, as well as ozone itself, are transported over long distances, sources emitting ozone precursors in states upwind of Rhode Island contribute to ground level ozone levels in the State. Ozone levels in Rhode Island generally are highest on hot sunny summer days when the winds are from the west or southwest. Variations in annual weather patterns contribute to year-to-year differences in ozone concentrations.

Exposure to elevated ozone levels causes eye, nose and throat irritation; coughing; chest pain; shortness of breath; decreased lung function; headache; and fatigue. Repeated exposures can increase susceptibility to respiratory infection and lung inflammation and can aggravate preexisting respiratory diseases, such as asthma. Long-term exposures can cause irreversible changes in the lungs, leading to chronic respiratory illnesses such as emphysema and chronic bronchitis and to premature aging of the lungs.

Children are at a particularly high risk for ozone-related health effects because they have developing lungs and are frequently active outside during the summertime when ozone levels are at their highest. Adults who work or exercise outside and people with respiratory and heart diseases are also at an increased risk. Elevated ozone levels also reduce agricultural and commercial forest yields; reduce the growth and survivability rates of tree seedlings; increase tree and plant susceptibility to disease, pests and other environmental stresses; and have long-term effects on forests and ecosystems.

1.3 1-Hour Ozone NAAQS

In 1979, EPA adopted a NAAQS for ozone of 0.12 parts per million (ppm) averaged over a 1-hour period (the 1-hour ozone standard). Nonattainment areas were required to attain the standard by 1987. Rhode Island was in violation of that NAAQS and, as required by the CAA and EPA regulations, adopted regulations and programs to reduce emissions of ozone-precursors. Despite significant improvement in measured ozone levels, Rhode Island, along with many other areas in the northeast, continued to violate the 1-hour ozone standard throughout the 1980s.

The 1990 CAA Amendments (CAAA) required EPA to classify the severity of ozone nonattainment areas and imposed additional control requirements on areas that had not attained the 1-hour ozone NAAQS. EPA classified the Rhode Island nonattainment area, which is the entire State of Rhode Island, as a serious nonattainment area for the 1-hour standard. In March 2003, RI DEM submitted an attainment demonstration showing that Rhode Island had adopted all emissions reductions measures required by the CAAA and would attain the 1-hour ozone

NAAQS by 2007. In December 2004, RI DEM submitted a Mid-Course Review analysis demonstrating that Rhode Island continued to be on track to attain the 1-hour standard by 2007.

Rhode Island has been in monitored attainment of the 1-hour NAAQS since 2004[1]. However, on June 15, 2005, EPA revoked the 1-hour standard as part of its implementation of a new ozone NAAQS, the 8-hour ozone standard. Therefore, the 1-hour ozone NAAQS is no longer applicable.

1.4 8-Hour Ozone NAAQS

In 1997, based on evidence that exposures to ozone concentrations below the 1-hour NAAQS can cause adverse health effects, the EPA issued a new ozone standard of 0.08 ppm averaged over eight hours (the 8-hour ozone standard).[2] Legal challenges ensued but, in 2001, the U.S. Supreme Court upheld the standard and implementation of the 8-hour ozone NAAQS began. In 2004, EPA designated every county in the United States as attainment, non-attainment or unclassifiable and classified 8-hour ozone standard nonattainment areas according to the severity of their ozone violations. Rhode Island was classified as moderate non-attainment area under the 8-hour standard, based on monitored ozone readings for the 2001 – 2003 period. (69 FR 23858, April 30, 2004)

EPA promulgated implementation rules for the 8-hour ozone standard in two phases; Phase 1 was promulgated on April 30, 2004[3] and Phase 2 was promulgated on November 29, 2005.[4] The Phase I Rule delineates procedures for classification of nonattainment areas and transitioning from the 1-hour to the 8-hour ozone standard. The Phase 2 Rule requires that moderate nonattainment areas, like Rhode Island, submit revisions to their State Implementation Plans (SIPs) to EPA by June 15, 2007 demonstrating that the area will attain the 8-hour standard by the end of the 2009 ozone season (the year prior to the June 15, 2010 attainment deadline) and will reduce ozone precursor emissions by at least 15% by 2008 in order to meet Reasonable Further Progress (RFP) requirements. The Phase 2 rule also requires that nonattainment areas submit a SIP addressing 8-hour ozone RACT requirements.

The SIP for moderate nonattainment areas must include the elements listed below. This SIP submittal addresses all of the required elements in the Sections noted.

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[1] The 1-hour ozone NAAQS was violated when l-hour concentrations of 0.125 ppm were measured at a monitor in the area on 4 or more days in a three year period. The last year 3-year period in which more than 3 1-hour exceedances days occurred was 2001 – 2003.

[2] The 8-hour ozone standard is met when the 3-year average of the 4th-highest daily maximum 8-hour average does not exceed 0.08 parts per million (ppm) at any one monitor (effectively, 0.084 ppm, given accepted rounding conventions).

[3] "Final Rule to Implement the 8-Hour Ozone National Ambient Air Quality Standard - Phase 1," 69 FR 23951 April 30, 2004.

[4] "Final Rule to Implement the 8-Hour Ozone National Ambient Air Quality Standard – Phase 2", 70 FR 71612, November 29, 2005.

- Reasonable Further Progress demonstration of a 15% reduction in in-state VOC and/or NOx emissions within 6 years after the baseline year of 2002 (i.e., by 2008). (Section 4)
- Attainment demonstration that uses modeling and other technical analyses to demonstrate that attainment of the 8-hour NAAQS is projected by the end of the 2009 ozone season. (Section 5)
- Reasonably Available Control Technology (RACT) for RACT source sectors and for major sources of VOC and NOx . (Section 6)
- Reasonably available control measures (RACM) for all sources. (Section 7)
- Contingency measures to be implemented upon failure to meet RFP or attainment milestones. (Section 8)
- Transportation conformity budgets for RFP milestone and attainment years. (Section 9)
- Inspection and Maintenance (I/M) program for light-duty motor vehicles. (Adopted in Rhode Island under the 1-hour ozone standard; see Table 3-1)
- Stage II vapor recovery for gas stations. (Adopted in Rhode Island under the 1-hour ozone standard; see Table 3-1)
- New Source Review (NSR) program for major sources, including offsets for VOC and NOx at a 1.15 to 1 ratio and a permit program for new or modified sources. (Adopted in Rhode Island under the 1-hour ozone standard; see Table 3-1)

In December 2006, the U.S. Court of Appeals for the D.C. Circuit issued a ruling vacating EPA's Phase 1 rule, holding that parts of the rule violated provisions of the CAAA. On June 8, 2007, the Court clarified its decision stating that it was vacating only parts of the rule, while leaving other sections in effect. It urged EPA to promptly promulgate a revised rule. It is unclear how the future resolution of this litigation may impact 8-hour ozone SIP requirements. This SIP is based on the requirements of the published EPA rule that remain in effect and a memo from EPA concerning the implications of the June 15, 2007 opinion of the court.[5] Revisions to this SIP may be required upon resolution of the litigation and/or promulgation by EPA of a revised implementation rule.

1.5 Rhode Island's 8-Hour Ozone NAAQS Compliance

In Section 5, Attainment Demonstration, RI DEM has demonstrated through modeling that Rhode Island will attain the 8-hour ozone standard in 2009. The modeling predicts that ozone concentrations will be below the attainment cutoff of 0.085 ppm at all Rhode Island monitors in 2009 (see Section 5, Table 5-6). In fact, since the 2009 design values for all of the Rhode Island monitors are below 0.082 ppm, RI DEM is not required to submit a detailed weight of evidence demonstration, but is submitting a basic supplemental analysis to confirm the conclusion from the modeling that the State will be in attainment by 2009[6]. RI DEM has provided that support evidence in Section 5.

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[5] U.S. EPA, Memorandum from Robert J. Meyers, Acting Assistant Administrator, June 15, 2007, "Decision of the U.S. Court of Appeals for the District of Columbia Circuit on our Petition for Rehearing of the Phase 1 Rule to Implement the 8-Hour Ozone NAAQS".

[6] U.S. EPA, "Guidance on the Use of Models and Other Analyses in Attainment Demonstrations for the 8-hour Ozone NAAQS."

In addition to demonstrating attainment in the attainment year through modeling, the actual monitored design value for ozone must meet the standard in the attainment year. Rhode Island is on track to achieving monitored attainment by 2009; design values for the most recent 3-year period (2005-2007) were 0.084 ppm, slightly below the NAAQS, at the Narragansett and East Providence sites and 0.085 ppm, slightly above the standard, at the West Greenwich site. While year to year ozone concentrations are influenced by meteorological conditions, it is likely that concentrations will continue to drop and that attainment will be achieved by 2009, given the substantial emissions reductions that will take place in Rhode Island and upwind states during that period.

2.0 EMISSIONS INVENTORIES

2.1 2002 Emissions Inventory

EPA's Consolidated Emissions Reporting Rule (CERR) requires states to inventory air pollution emissions within their borders every three years. The emissions inventory for 2002 is particularly important; because the EPA has designated 2002 as the base year for attainment demonstrations and RFP calculations for the 8-hour ozone NAAQS and the NAAQS for particulate matter smaller than 2.5 microns ($PM_{2.5}$). The "Rhode Island 2002 Emissions Inventory", which is attached as Appendix 2A of this document, satisfies this requirement for the Rhode Island nonattainment area.

The inventory includes emissions from stationary point, stationary nonpoint, on-road mobile and non-road mobile sources and covers all areas of Rhode Island, since the entire State is a nonattainment area for ozone. Because high ozone concentrations are generally associated with warmer weather and emissions may vary seasonally, the inventory includes emissions estimates of VOCs, NOx, and CO for a typical summer day, as well as on an annual basis. The inventory document describes methods used for data collection, calculation of emissions and quality assurance/quality control in the preparation of the inventory. RI DEM submitted a draft of the 2002 inventory to EPA Region I for comment in December 2006. The attached version of this document incorporates comments received from EPA on the draft in February 2007

2.2 2008 Projected Inventory

Nonattainment areas must also estimate emissions in future milestone years. Moderate nonattainment areas like Rhode Island must develop a projected emissions inventory for 2008 in order to show, in the RFP, that emissions in the area will decrease by 15% between the base year, 2002, and the RFP milestone year, 2008.

Growth factors from the Emissions Growth Analysis System (EGAS) were used to calculate projected 2008 emissions for stationary point and nonpoint sources from the 2002 base year inventory. The EGAS configurations used were Default REMI 6.0 SCC for nonpoint sources and Default REMI 5.5 SIC for point sources. Emissions from point sources that permanently ceased operations between 2002 and 2008 were recorded as zero in the projected 2008 inventory, consistent with EPA guidance. Point and nonpoint growth factors and 2002 and 2008 emissions are attached as Appendix 2B.

2008 emissions from non-road mobile sources were calculated using the same methodology as that used to derive the 2002 estimates. Nonpoint 2002 and 2008 emissions and growth factors used for commercial vessels and locomotive are shown in Appendix 2C.

On-road mobile source emissions factors were generated from EPA's MOBILE model, version 6.2. Model inputs reflect air quality programs in effect in Rhode Island in 2008 and the latest registration distribution. Vehicle Miles Traveled (VMT) data were generated by the Travel Demand Model (TDM), which utilizes the most recent highway performance monitoring

(HPMS) data, roadway network information, current planning assumptions, seasonal adjustment factors, peak/off-peak period speed characteristics and 2000 census land use data The VMT generated by the TDM were then multiplied by the Mobile 6.2 emission factors by speed and roadway type, adjusted for seasonality and aggregated by functional class to calculate typical summer day emission for each pollutant for 2008. MOBILE and TDM inputs and outputs and emissions calculations are included in Appendix 2D.

2.3 2009 Projected Inventory

Projected emissions for the year for which attainment must be demonstrated, which is 2009 for moderate areas like Rhode Island, are needed as inputs to the models used to demonstrate attainment. A discussion of how 2002 emissions were projected to 2009 for the modeling inventory is included in Section 5, "Attainment Demonstration" of this document. The 2009 projections were calculated regionally and the methodology used was not the same for all source categories as that used for the 2008 inventory.

A 2009 on-road mobile source inventory was developed using the same methodology as that used for the 2008 on-road inventory. The 2008 and 2009 on-road mobile source inventories will be used as budgets for transportation conformity analyses.

2.4 Emissions Inventory Trends

Table 2-1 shows 2002 and 2008 anthropogenic emissions inventories by source type for Rhode Island, in tons per summer day.

Table 2-1 Rhode Island Anthropogenic Ozone Precursor Emissions in tons per summer day (tpsd)

SOURCE TYPE	2002 VOC	2008 VOC	2002 NOx	2008 NOx
Stationary Point	10.3	11.0	7.0	7.3
Stationary Nonpoint	47.9	56.8	3.4	3.7
Non-road Mobile	26.8	21.0	19.7	16.0
On-road Mobile[7]	32.3	24.6	42.4	28.3
Total	117.3	113.5	72.5	55.3

Projected 2008 emissions are 3% lower than those in 2002 for VOC and 24% lower for NOx. Most of the projected emissions reductions are associated with the non-road and on-road mobile source sectors. Emissions reductions are discussed further in the RFP analysis in Section 4 of this document.

[7] At the request of the Rhode Island Department of Administration, Statewide Planning Program, which is the Metropolitan Planning Organization for Rhode Island, the 2008 mobile source inventories for VOC and NOx listed above are actually 0.5 tpsd higher than those calculated. See Section 9, "Transportation Conformity."

3.0 CONTROL MEASURES

3.1 Purpose of Section

This section identifies and briefly describes the Rhode Island and federal control measures that will result in reductions of VOCs and/or NOx emissions from Rhode Island sources by 2008, for purposes of demonstrating Reasonable Further Progress (RFP) towards attainment (see Section 4,"Reasonable Further Progress"*)*, and by 2009, for purposes of demonstrating attainment of the ozone standard (see Section 5, "Attainment Demonstration"). Some of the measures delineated have already been promulgated. For other measures, RI DEM is committing to adopt regulations according to the schedule included in this section. This section also provides background for the discussions in Section 6, "RACT" and Section 7, "RACM."

3.2 Post -2002 Emissions Reductions

For the RFP analysis, Rhode Island is allowed to take credit for reductions of VOC and NOx emissions that will take place in the State between the 2002 base year and the 2008 target year for the RFP. Reductions that occur by 2009 are relevant for the attainment demonstration, Reductions may be from state or federal control measures that are not yet in place, provided that the reductions from such measures will be take place after 2002, but before the years by which RFP and attainment must be demonstrated.

Air quality in Rhode Island is significantly impacted by the transport of emissions from upwind states. Therefore, significant reductions the emissions of ozone precursors in upwind states are essential to Rhode Island's ability to attain the ozone standard, as discussed in Section 5, "Attainment Demonstration." For the RFP, however, Rhode Island can only take credit for emissions reductions that occur within the State

In May 2005, the EPA promulgated the Clean Air Interstate Transport Rule (CAIR) (70 FR 25162), which established a cap and trade program to reduce emissions of NOx and SO_2, primarily from electric generating units. The rule applied to 28 states and the District of Columbia, which had been identified, through modeling, as contributing significantly to poor air quality in downwind areas that were in nonattainment of the 8-hour ozone or fine particulate (PM2.5) NAAQS. NOx budgets set by this rule will be effective beginning in 2009. Although Rhode Island is not a CAIR state, emissions reductions from upwind states associated with this program will benefit air quality in the State.

In addition to CAIR, a number of other regulatory programs, discussed below, will result in emissions reductions between 2002 and 2009/2010. However, in 2004, the Ozone Transport Commission (OTC)[8] recognized that some states would not be able to attain the 8-hour ozone standard without more reductions than will be achieved under CAIR and other state and federal control measures expected to be in place by the 2009 attainment year. The OTC compiled a set

[8] The Ozone Transport Commission comprises Connecticut, Delaware, the District of Columbia, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, and northern Virginia. The OTC was created under the CAAA to address ozone transport issues within the Ozone Transport Region.

of recommended additional control measures that could be adopted by states to yield additional emissions reductions.[9] A list of these measures is included in Section 7 as Table 7-1. The OTC went through a similar process under the 1-hour ozone standard and, in 2001, recommended new controls to help member states attain the 1-hour ozone standard. As part of its 8-hour ozone attainment strategy, RI DEM is adopting a number of OTC recommended control measures, as discussed below.

3.2.1 Control Programs in the 1-Hour Ozone Standard SIP

The control measures adopted in Rhode Island under the 1-hour ozone standard attainment demonstration SIP are listed in Table 3-1. A large part of the emissions reductions associated with those control measures occurred prior to 2002 and are therefore reflected in the Rhode Island 2002 Base Year Inventory. However, some of the mobile sources emissions control programs adopted for the 1-hour SIP, such as the federal emissions limits on certain types of non-road engines, continue to generate additional emissions reductions as older equipment and vehicles are replaced by lower-emitting, newer models and as phased-in emissions limits tighten. Those reductions are reflected in the RFP analysis.

Table 3-1 Control Measures in the Rhode Island 1-Hour Ozone Standard Attainment Demonstration SIP

Name of Control Measure	Type of Measure	Approval Status
On-board Refueling Vapor Recovery	Federal rule	Promulgated at 40 CFR 86
Federal Motor Vehicle Control program (Tier 0)	Federal rule	Promulgated at 40 CFR 86 (pre-1990)
National Low Emission Vehicle (NLEV)	Federal voluntary rule, State opt-in	Federal rule promulgated at 40 CFR 86 State commitment to program SIP approved (65 FR 12480 ; 3/9/00)
Heavy Duty Diesel Engines (On-road)	Federal rule	Promulgated at 40 CFR 86
Federal Non-road Heavy Duty diesel engines	Federal rule	Promulgated at 40 CFR 89
Federal Non-road Gasoline Engines	Federal rule	Promulgated at 40 CFR 90
Federal Marine Engines	Federal rule	Promulgated at 40 CFR 91
Rail Road Locomotive Controls	Federal rule	Promulgated at 40 CFR 92
AIM Surface Coatings	State Initiative Contingency Regulation	SIP approved (61 FR 55903; 10/30/96)

[9] The OTC regional 8-hour ozone planning process is discussed in greater detail in Section 5, "Attainment Demonstration" and Section 7, "Reasonably Available Control Measures".

Name of Control Measure	Type of Measure	Approval Status
Consumer & commercial products	State Initiative Contingency Regulation	SIP approved (61 FR 55903; 10/30/96)
Automotive Refinishing	State Initiative- Regulation No. 30	SIP approved (61 FR 3827; 2/2/96)
Enhanced Motor Vehicle Inspection	CAA SIP requirement- DMV Regulation No. 1	SIP approved (66 FR 9663; 2/9/01)
NOx RACT	CAA SIP requirement- Regulation No. 27	SIP approved (62 FR 46202; 9/2/97)
VOC RACT pursuant to sections 182(a)(2)(A) and 182(b)(2)(B) of CAA	CAA SIP requirement	SIP approved (59 FR 52429;10/18/94)
VOC RACT pursuant to section 182(b)(2)(A) and (C) of CAA	CAA SIP requirement	Partially SIP Approved (64 FR 67500, 12/2/99). EPA approval pending for certain non-CTG RACT determinations. Marine Vessel SIP Approved (61 FR 14975, 4/4/96)
Stage II Vapor Recovery	CAA SIP requirement	SIP Approved (58 FR 65933; 12/17/93)
Reformulated Gasoline	State opt-in	SIP approved (65 FR 12476, 3/9/00)
Clean Fuel Fleets	CAA SIP requirement	SIP approved (65 FR 12476, 3/9/00) Rhode Island used RFG reductions to meet the Clean Fuel Fleet requirement.
OTC NOx MOU Phase II	State initiative regulation	SIP approved (64 FR 29567; 6/2/99)
NOx SIP Call	EPA requirement	SIP approved (65 FR 81748, 12/27/00)
New Source Review	EPA requirement	SIP approved (64 FR 67495, 12/2/99)

3.2.2 Adopted New Control Measures

As discussed above, EPA's CAIR rule is expected to result in emissions reductions in states upwind of Rhode Island by 2009, but will not affect emissions from Rhode Island sources. A discussion of Federal and State emissions controls programs that have been promulgated since the 1-hour SIP was prepared and that will result in emissions reductions in Rhode Island between 2002 and 2009/2010 follows.

3.2.2.1 Federal On-Road Mobile Source Control Measures

The EPA adopted Tier 2 Vehicle and Gasoline Sulfur Program in 2003 which set stricter tailpipe emission standards (Tier 2) for all new passenger vehicles, including cars, sport utility vehicles, minivans, vans, and pick-up trucks and which reduce the limits on sulfur content in gasoline over a 2004-2007 phase-in periods. The Tier 2 vehicle standards do not apply in Rhode Island, which has adopted the stricter California Low Emission Vehicle Program tailpipe standards discussed below. However, the low sulfur fuel requirements will reduce post-2002 motor vehicle emissions in the State.

Federal Heavy-Duty Engine and Fuel Standards promulgated in 2000 set more stringent NOx and hydrocarbon (HC) emission standards for heavy-duty diesel engines and vehicles starting with the 2004 vehicle model year and for heavy-duty gasoline engines and vehicles starting with the 2005 vehicle model year. The rules also requires that certain heavy-duty vehicles (HDVs) be equipped with on-board gasoline vapor recovery systems phased-in over 2004 – 2006 model year vehicles.

In 2001, EPA published a second phase of heavy-duty motor vehicle and fuel emission standards. The rule requires additional, significant reductions of NOx and HC (as well as particulate matter) emissions from heavy-duty engines and vehicles, beginning with vehicle model year 2007. It also requires lowering the sulfur content of diesel fuel to 15 parts per million (ppm) from previous levels of 500 ppm, beginning in 2006.

3.2.2.2 Rhode Island On-Road Mobile Source Control Measures

In June 1996, RI DEM Adopted APC Regulation No. 37, "Rhode Island's Low Emissions Vehicle Program," which requires adherence to EPA's National Low Emissions Vehicles (NLEV) program in Rhode Island for passenger cars and light duty trucks beginning with model year 1999. In December 2005, RI DEM modified Regulation No. 37, to require the more stringent California Low Emission Vehicle (CAL-LEV) standards for passenger cars and light duty trucks beginning with model year 2008 and for medium duty trucks with model year 2009. The Rhode Island program includes 1) the California fleet-wide emission average for non-methane organic gases (NMOG); 2) the second generation of California emission standards known as "LEV II"; 3) the LEV I & II emission standards for medium-duty vehicles (including diesel vehicles and engines); and 4) Zero Emissions Vehicles (ZEV) specifications. This program will provide control benefits in 2009 estimated at 0.2% additional reductions of NOx and VOC as compared to those that would be realized from the NLEV program. Reductions will be more substantial in later years (additional reductions of 0.6% NOx and 0.9% VOC in 2012 and 5.2% NOx and 6.6% VOC in 2020, as compared to NLEV).[10]

3.2.2.3 Federal Non-Road Mobile Source Control Measures

EPA has adopted national regulations that impose emission and fuel standards on new non-road engines. The regulations establish four tiers of emission standards for new non-road diesel engines. Tier 1 emission standards were issued in 1994 for most large (greater than 50 horsepower (hp)), land-based non-road diesel engines used in agricultural and construction equipment. These were phased-in between 1996 and 2000. In 1998, EPA promulgated Tier 1 standards for smaller (< 50 hp) diesel engines, which were phased-in between 1999 and 2000. At that time, EPA also issued more stringent Tier 2 emission standards for all non-road diesel

[10] Calculations by Cambridge Systematics, April 9, 2004.

engine sizes, with a 2001- 2006 phase-in, and Tier 3 standards for new diesel engines between 50 and 750 hp, with a 2006 - 2008 phase-in.

In 2004, EPA promulgated regulations that integrate new non-road diesel engine emission standards (Tier 4 standards) with requirements to decrease the allowable levels of sulfur in non-road diesel fuel. The regulations set emission standards for engines used in most construction, agricultural, industrial, and airport equipment beginning in 2008. Fuel requirements will decrease the sulfur levels in non-road diesel fuel to prevent damage to emission-control systems. Current sulfur levels of about 3,000 ppm will be reduced to a maximum of 500 ppm in 2007. The second phase will reduce sulfur levels in non-road diesel fuel to 15 ppm in 2010, except for locomotive and marine diesel fuel, which will be reduced to 15 ppm in 2012.

In 1995, EPA issued Phase 1 standards for model year 1997 and newer small (< 25 hp) non-road spark-ignited engines, which are used primarily in lawn and garden equipment. In 1999, EPA issued more stringent Phase 2 emission standards for small non-handheld engines (e.g., lawn mowers, generator sets, air compressors) and, in 2000, for small handheld engines (e.g., leaf blowers, chain saws, augers). Phase 2 standards were phased-in from 2001 to 2007 for non-handheld engines and from 2002 to 2007 for handheld engines. In 1996, EPA finalized emission standards for new gasoline spark-ignition marine engines to be phased-in between 1998 and 2000. These engines are used for outboard engines, personal watercraft, and jet boats.

In 2002, EPA promulgated new engine emission standards for large spark-ignition engines rated over 19 kilowatts (kW), or >25 hp. These are used in a variety of commercial and industrial settings, including forklifts, electric generators, airport baggage transport vehicles, farming and construction. The standards were implemented in two tiers - Tier 1 started in 2004 and Tier 2 in 2007. EPA's 2002 rulemaking also include exhaust emission standards for engines in recreational vehicles including snowmobiles, off-highway motorcycles, and all-terrain-vehicles (ATVs). These standards are phased-in in 2006 and 2007, except for snowmobiles, which have until 2009 to be fully phased-in. Plastic fuel tanks and rubber hoses available on recreational vehicles will also be subject to permeation standards effective in 2008.

In 1999, EPA promulgated regulations setting emission standards for certain classes of new commercial marine diesel engines starting in 2004 and for other classes in 2007. In 2002, EPA promulgated new emission standards for recreational marine diesel engines, which are used in yachts, cruisers, and other types of pleasure craft. The standards are phased-in, beginning in 2006, depending on the size of the engine. By 2009, emission standards will be in effect for all new recreational, marine diesel engines.

3.2.2.4 New Federal Portable Fuel Containers Regulation

In 2001, the OTC developed a model rule for reducing emissions for portable fuel containers (PFCs), gas cans, based on the California PFC regulation. In 2006, the OTC developed a revised model rule for this category, based on revisions to the California regulation. RI DEM did not adopt a PFC regulation for 1-hour ozone standard attainment, but intended to do so as part of its 8-hour attainment strategy. However, in February 2007, EPA finalized a national regulation to reduce hazardous air pollutant emissions from mobile sources, which includes standards to reduce PFC emissions from evaporation, permeation, and spillage (72FR 8428, February 26, 2007). The standards apply to containers manufactured on or after January 1, 2009. Emission reductions will be realized incrementally as consumers replace older PFCs with new ones. Because EPA's rule has been finalized with a 2009 effective date and will achieve reductions equivalent to the OTC model rule, RI DEM no longer intends to adopt a state rule for this category.

3.3 Planned Emissions Controls

Among the control strategies developed by the OTC in 2001 were model rules for the Architectural and Industrial Maintenance (AIM) coatings and Consumer Products source categories. Those model rules were based on regulations in place for those source categories in California. In 2006, OTC produced an updated model rule for Consumer Products, which corresponds to newer California requirements. RI DEM planned to adopt rules for those categories as part of its 8-hour attainment strategy. However, on May 30, 2007 EPA issued a memo committing to adopt federal rules consistent with the OTC model rules for AIM and Consumer Products with emissions limits that would be effective by January 1, 2009.[11]. Based on that commitment, RI DEM decided not to promulgate state-specific regulations for those source categories. If, however, EPA does not propose those rules by July 1, 2008, RI DEM will adopt state rules consistent with the OTC models that will be effective by January 1, 2009. Those rules will be submitted to the EPA as a SIP revision by October 1, 2008.

The 2001 OTC model rule for consumer products contains VOC limits for adhesives and sealants. However, with the exception of aerosol adhesives, the definitions of these products generally exempt products sold in larger containers. The OTC identified industrial and commercial use of adhesives as a category where additional reductions could be achieved and developed a 2006 OTC Adhesives model rule, based on a reasonably available control technology determination prepared by the California Air Resources Board in 1998. RI DEM commits to submit a new regulation for this category based on the OTC model rule by October 1, 2008 with an effective date of January 1, 2009.

The OTC 2001 model rules included a rule for limiting emissions from Solvent Cleaning operations. The 2006 OTC recommendations included a rule prohibiting the use of cutback asphalt and substantially restricting the use of emulsified asphalt. Rhode Island already has rules in place that are, for the most part, equivalent to the model rules. However, RI DEM had identified areas where the Rhode Island rules are not as stringent as the OTC recommendations and is committing to amend its existing rules for solvent cleaning and asphalt paving, APC Regulations No. 36 and 25, respectively, to address those discrepancies. The planned regulatory changes are discussed in more detail in Section 6.6, "RACT Changes." These amendments will be submitted to the EPA as SIP revisions by January 1, 2009 and will be effective by April 1, 2009.

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[11] Memo from Stephen Page, Air Division Director, EPA Office of Air Quality Planning and Standards to Regional Air Division Directors, "Emission Reduction Credit for Three Federal Rules for Categories of Consumer and Commercial Products," May 30, 2007.

In addition, as discussed in Section 6, “Reasonably Available Control Technology,” RI DEM plans to update APC Regulations No. 19, “Control of Volatile Organic Compounds from Surface Coating Operations,” and Regulation No. 35, “Control of Volatile Organic Compounds and Volatile Hazardous Air Pollutants from Wood Products Manufacturing Operations,” to be consistent with the provisions of a Control Technique Guideline for Flat Wood Paneling Coating which was finalized by the EPA in 2006. These amendments will be submitted to the EPA as a SIP revision by January 1, 2009 and will be effective by April 1, 2009.

As discussed in Section 6, RI DEM is currently evaluating the applicability of CTGs released by the EPA in 2006 for Lithographic Printing Materials, Letterpress Printing Materials and Flexible Packaging Printing Materials to sources in Rhode Island. If it is determined that regulatory action is required for those sources, APC Regulation No. 21, “Control of Volatile Organic Compound Emissions from Printing Operations,” will be amended accordingly. Any such amendments will be submitted as a SIP revision by January 1, 2009 and will be effective by April 1, 2009. In addition, RI DEM plans to evaluate the applicability of new CTGs issued in October 2007 for paper, film and foil coating, metal furniture coating and large appliance coating to Rhode Island sources. If necessary, APC Regulation No. 19, “Control of Volatile Organic Compounds from Surface Coating Operations,” will be amended to reflect the new CTGs on the same schedule.

Table 3-2 lists RI DEM’s commitments for regulatory amendments to reduce emissions in Rhode Island.

Table 3-2 RI DEM Control Technology Regulatory Action Commitments

Source Category	Affected APC Regulation	Comments	SIP Submittal Date	Effective Date
AIM Coatings	Reg. No. 33	State regulation will be amended to be consistent with 2001 OTC model rule only if EPA fails to propose a federal rule for this category by 7/1/08	10/1/08	1/1/09
Consumer Products	Reg. No. 31	State regulation will be amended to be consistent with 2006 OTC model rule only if EPA fails to propose a federal rule for this category by 7/1/08	10/1/08	1/1/09
Adhesives and Sealants	new regulation	Consistent with 2006 OTC model rule	10/1/08	1/1/09
Industrial Solvents	Reg. No. 36	Consistent with 2001 OTC model rule and 2006 CTG.	1/1/09	4/1/09
Asphalt Paving	Reg. No.25	Consistent with 2006 OTC recommendations as feasible in Rhode Island	1/1/09	4/1/09
Flat Wood Paneling	Reg. Nos. 19 and 35	Consistent with 2006 CTG	1/1/09	4/1/09
Lithographic Printing Materials, Letterpress Printing Materials, Flexible Packaging Printing Materials	Reg. No. 21	State regulation will be amended to be consistent with 2006 CTG if determined to be applicable and feasible in Rhode Island	1/1/09	4/1/09
Paper, Film and Foil coating; Metal Furniture coating; Large Appliance Coating	Reg. No. 19	State regulation will be amended to be consistent with 2007 CTG if determined to be applicable and feasible in Rhode Island	1/1/09	4/1/09
RI Low Emission Vehicle Program	Reg. No. 37	Submit updated regulation as SIP revision	6/1/08	
RI Motor Vehicle Inspection/Maintenance Program	Reg. No. 34	Finalize updated regulation and submit as SIP revision	6/1/08	

4.0 REASONABLE FURTHER PROGRESS ANALYSIS

4.1 Purpose of Section

This section demonstrates that Rhode Island will meet the Reasonable Further Progress (RFP) requirement in EPA's Phase 2 Rule. That rule requires that, by the end of 2008, emissions of VOC, NOx, or a combination of VOC and NOx must be at least 15% lower than the 2002 baseline. As discussed in Section 2.2, RI DEM developed a 2008 projected emissions inventory for VOC and NOx that took into account anticipated growth in the economy and control measures expected to be in effect by that date. The projections demonstrate that emissions will decrease in the State by an amount greater than the required 15% reduction by 2008.

4.2 Reasonable Further Progress Requirements and Methodology

Since Rhode Island is a moderate nonattainment area, the Phase 2 Rule requires the State to demonstrate that emissions of VOC, NOx or a combination of VOC and NOx will be reduced by at least 15% by 2008 from the 2002 baseline. The procedures and methodology for demonstrating compliance with the 1-hour ozone standard Rate of Progress requirements were established in a 1992 EPA guidance document; these procedures are still applicable for purposes of the 8-hour ozone standard RFP.[12] EPA's method for demonstrating that RFP requirements are met calls for:

1. Developing a 2002 base year inventory for a nonattainment area;
2. Adjusting that inventory to subtract emissions reductions determined to be non-creditable;
3. Establishing a target level of emissions for 2008 that reflects the required 15% reduction from the adjusted base year inventory;
4. Developing a projected inventory of VOC and NOx emissions for 2008; and
5. Demonstrating that the projected 2008 emissions of NOx, VOC or a combination of NOx and VOC will be less than or equal to the target level for that year.

Using this methodology, RI DEM will demonstrate in the calculations below that the Rhode Island nonattainment area has met the RFP requirements.

4.3 2002 Adjusted Base Year Inventory

Estimates of typical summer day Rhode Island anthropogenic emissions of VOC and NOx for the 2002 base year were obtained from the 2002 Emissions Inventory discussed in Section 2 and attached as Appendix 2A. That inventory does not include organic compounds that are excluded from the EPA definition of "VOC." Pursuant to EPA's RFP methodology, for the purpose of the RFP, RI DEM adjusted this inventory by subtracting from the VOC and NOx base year

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[12] *Guidance on the Adjusted Base Year Emissions Inventory and the 1996 Target for the 15 Percent Rate of Progress Plans*, U.S. EPA, Office of Air Quality Planning and Standards, EPA-452/R-92-005, October 1992.

emissions non-creditable emissions reductions, which are those realized from the pre-1990 federal limits on the Reid Vapor Pressure (RVP) of gasoline (RVP of 9.0) and the Federal Motor Vehicle Control Program (FMVCP).[13] Consistent with EPA guidance, non-creditable emissions reductions of VOC and NOx were calculated using the following methodology:

1. EPA's MOBILE model, version 6.2, was run for 2002 using the same highway vehicle activity inputs used to calculate the actual 2002 emissions but with FMVCP and RVP = 9.0 as the only control measures (all other control measures turned off).

2. Similarly, MOBILE 6.2 was run for 2008 using the same highway vehicle activity inputs used to project 2008 emissions for the 2008 projected inventory but with FMVCP and RVP = 9.0 as the only control measures (all other control measures turned off).

3. Non-creditable emissions reductions were calculated by subtracting the 2008 emissions factors calculated in Step 2 from the 2002 factors calculated in Step 1 and multiplying the difference by 2002 VMT.

Non-creditable emissions calculated by this method are 5.51 tpsd VOC and 3.19 tpsd NOx. Non-creditable emissions calculations are shown in Appendix 4A. Table 4-1 shows the 2002 Base Year and Adjusted Base Year Inventories of NOx and VOC, in tons per summer day

Table 4-1 Rhode Island Base Year and Adjusted Base Year Emissions (tpsd)

SOURCE TYPE	2002 Base Year VOC	2002 Adjusted VOC	2002 Base Year NOx	2002 Adjusted NOx
Stationary Point	10.3	10.3	7.0	7.0
Stationary Nonpoint	47.9	47.9	3.4	3.4
Non-road Mobile	26.8	26.8	19.7	19.7
On-road Mobile	32.3	26.8	42.4	39.2
Total	117.3	111.8	72.5	69.3

[13] The CAA (Section 182(b)(1)(D)) provides that reductions from the following measures are not creditable toward the required reductions: (1) Federal Motor Vehicle Control Program (FMVCP) tailpipe and evaporative standards issued in 1990; (2) Federal regulations limiting the Reid Vapor Pressure (RVP) of gasoline in ozone nonattainment areas issued by June 15, 1990; (3) State regulations correcting deficiencies in reasonably available control technology (RACT) rules; (4) Measures required to be enacted immediately after passage of the 1990 CAA Amendments concerning corrections to vehicle inspection and maintenance (I/M) programs. Only the FMVCP continues to generate emission reductions through 2008 in Rhode Island.

4.4 Target Level of Emissions

To fulfill RFP requirements, projected emissions for 2008 must be at least 15% lower than the 2002 Adjusted Base Year Inventory shown in Table 4-2. The reductions can be VOCs, NOx or any combination of both. RI DEM is establishing its target levels based on a 15% reduction in NOx emissions. The 2008 Target Levels and resultant required emissions reductions were calculated as follows:

NOx:

Required Emissions Reductions = 2002 Adjusted Emissions (69.3 tpsd) X 0.15 = 10.4 tpsd

2008 Target = 2002 Adjusted Emissions (69.3 tpsd) – Required Reductions (10.4 tpsd) = 58.9 tpsd

VOC

Required Emissions Reductions = 2002 Adjusted Emissions (111.8 tpsd) X 0.00 = 0.0 tpsd

2008 Target = 2002 Adjusted Emissions (111.8 tpsd) – Required Reductions (0.0 tpsd) = 111.8 tpsd

4.5 2008 Projected Emissions Inventory

Projected emissions in 2008 were calculated by estimating anticipated growth in emissions between 2002 and 2008 and then adjusting for any controls that will reduce emissions during that time period. Calculations of the projected 2008 inventory are discussed in Section 2.2 of this document.

4.6 Results of RFP Analysis

The 2008 projections are shown in Table 4-2 below. Reductions anticipated by 2008 are compared to the reductions required to meet RFP. As shown, projected 2008 VOC emissions in Rhode Island are 1.5% (1.7 tons per day) higher than the target level. To compensate for the higher VOC levels, an additional 1.5% reduction in NOx emissions, for a total 16.5%, is needed to meet the RFP requirements. As shown in Table 4-2, projected 2008 NOx emissions are 20.1% lower than the 2002 adjusted baseline; therefore RFP requirements will be met and NOx emissions will be reduced an additional 3.6% beyond the required reductions.. These emissions reductions occur primarily in the non-road and on-road mobile sectors. Note that the 2008 on-road mobile emissions of VOC and NOx used in these calculations are 0.5 tons per day higher than the 2008 modeled on-road mobile source emissions to allow for a buffer in the transportation conformity budget for 2008. This issue is discussed further in section 9.4, “Mobile Source Budgets.”

Table 4-2 RFP Calculations

Emissions	VOC (tpsd) 2002 RFP Inventory	VOC (tpsd) 2008 Inventory	NOx (tpsd) 2002 RFP Inventory	NOx (tpsd) 2008 Inventory
Stationary Point	10.3	11.0	7.0	7.3
Stationary Nonpoint	47.9	56.8	3.4	3.7
Non-road Mobile	26.8	21.0	19.7	16.0
On-road Mobile (adjusted)	26.8	24.6	39.2	28.3
Total	111.8	113.5	69.3	55.3
2008 RFP Target Emissions		111.8		58.9
Predicted 2002-2008 Emissions Reductions (Increases)	(1.6) tpsd (1.4%) of 2002 RFP inventory)		13.9 tpsd (20.1% of 2002 RFP inventory)	
Required 2002-2008 Emissions Reductions	0.0 tpsd (0.0% of 2002 RFP inventory)		10.4 tpsd (15.0% of 2002 RFP inventory)	
Excess Emissions Reductions	(1.7) tpsd (1.5%) of 2002 RFP inventory)		3.5 tpsd (5.1% of 2002 RFP inventory)	
2008 RFP Target NOx Emissions Adjusted to Account for Increase in VOC Emissions			57.8 tpsd (16.5% reduction from 2002 RFP inventory)	
Required Emissions Reductions Adjusted to Account for Increase in VOC Emissions			11.4 tpsd (16.5% of 2002 RFP inventory)	
Excess Emissions Reductions Adjusted to Account for Increase in VOC Emissions			2.5 tpsd (3.6% of 2002 RFP inventory)	

5.0 ATTAINMENT DEMONSTRATION

5.1 Purpose of Section

EPA requires states with moderate ozone nonattainment areas to prepare and adopt SIP revisions demonstrating attainment of the 8-hour ozone standard using photochemical grid modeling and weight-of-evidence (WOE) analyses. States with moderate nonattainment areas are required to attain the 8-hour ozone NAAQS by June 15, 2010. However, because the June 15, 2010 deadline occurs in the middle of the ozone season, according to EPA modeling guidance, modeled attainment must be based on the ozone season preceding 2010. Therefore, the target year for attainment monitoring is calendar year 2009.

The following attainment demonstration demonstrates that, as a result of reductions in ozone precursor emissions in Rhode Island and upwind of Rhode Island, Rhode Island will attain the 8-hour ozone NAAQS by 2009. The attainment demonstration is based upon the regional ozone attainment planning process undertaken by the OTC and OTC states to develop a SIP-quality ozone modeling platform and to prepare candidate control strategies for ozone attainment demonstrations.

5.2 Ozone Conceptual Model

5.2.1 Conceptual Description for Ozone Episodes in Rhode Island

The Northeast States for Coordinated Air Use Management (NESCAUM), on behalf of the OTC, produced a comprehensive conceptual description of the meteorological processes underlying the formation of ozone episodes. The NESCAUM report (NESCAUM, 2006) was intended as a reference for SIP attainment demonstrations and is contained in Appendix 5A. State-specific information for Rhode Island is presented below.

5.2.2 Geographical Considerations

Rhode Island, at about 41 degrees north latitude, lies closer to the mean position of the polar front than more southern states in the Ozone Transport Region are. For that reason, Rhode Island experiences cooling and cleansing cold frontal passages more frequently than in areas to its south, resulting in fewer and shorter, although not necessarily weaker, ozone episodes.

Although Rhode Island contributes to pollutant levels in Massachusetts, it is primarily considered to be a downwind state, being a recipient of ozone and precursors from much of the northeast corridor including Baltimore, Washington D.C., Philadelphia, New Jersey, and New York City. Stagnation, which occasionally results in elevated ozone in southern states, is not a major factor in Rhode Island episodes. Exceedances in Rhode Island are almost always due to elevated ozone and precursors transported from upwind areas; this is particularly true for the State's Narragansett and W. Greenwich monitoring locations, which are upwind of the highly populated Providence metropolitan area.

5.2.3 Transport

Global scale circulations, while not a direct cause of Rhode Island ozone episodes, govern the location and strength of synoptic scale features such as high and low pressure systems and fronts, which are normally associated with ozone episodes. Global systems ultimately control the duration of weather patterns and how often they recur, thus determining the severity of an ozone season. When a summertime air mass resides for a long period over the eastern United States and this pattern becomes recurrent, Rhode Island is likely to experience an above average ozone season.

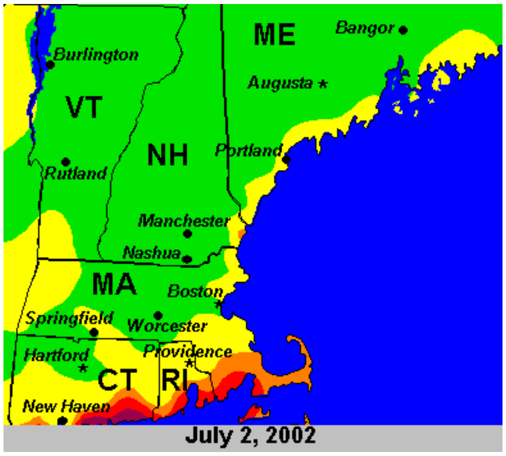
Mesoscale features also influence the spatial pattern of ozone development in Rhode Island. Sea breezes often draw cleaner air onshore, thus lowering ozone concentrations, but they sometimes have the opposite effect. If a plume of ozone lies offshore, such circulations can bring polluted air onto the land, causing a rapid rise in ozone readings. This is a particular issue for the coastal Narragansett monitoring site. Lee troughs, induced by mountain ranges like the Appalachians, align the southwesterly airflow with the mountains, resulting in more highly concentrated streams of pollution entering Rhode Island's airways. Low-level nocturnal jets are relative newcomers in our understanding of ozone transport. This rapid transit mechanism can move pollution long distances from southwest to northeast to spread ozone episodes hundreds of miles overnight.

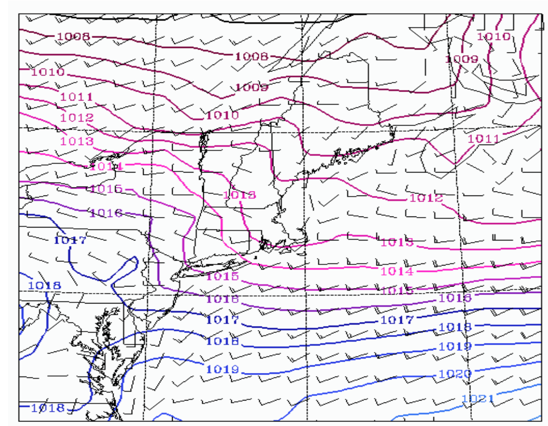
Smaller microscale circulations include the whorls and eddies that transfer heat and energy vertically. This transfer mechanism often shuts down in the evening when the earth cools and temperature inversions form. Ozone trapped near the ground is destroyed via chemical transformation and deposition. But ozone aloft remains relatively undepleted and mixes back to the surface the following morning when heating-induced eddies grow and erode the inversion. This mechanism is basic to the diurnal rise and fall of surface ozone values.

5.2.4 Primary Meteorological Regimes for Rhode Island

Two primary synoptic meteorological patterns typically trigger severe ozone episodes in Rhode Island and result in episodes having markedly different ozone signatures. The first synoptic type affects the immediate south coast and is controlled by the Atlantic oceanic anticyclone (high pressure area), which extends westward well into interior of the eastern United States. This results in westerly to sometimes a west-northwesterly surface winds over Rhode Island, with pollution transport from the New York and New Jersey area eastward across Long Island Sound, bringing ozone and precursors to coastal Connecticut, Rhode Island and Massachusetts. The westerly flow also blocks the plume's northward penetration, keeping the rest of the state's air relatively clean. A good example of this episode type is shown in 5-1 with (on the left) a distinct ribbon of high ozone along the New England south coast with (on the right) the westerly surface winds that forced the plume seaward.

Figure 5-1: July 2, 2002 Ozone and Isobar Maps



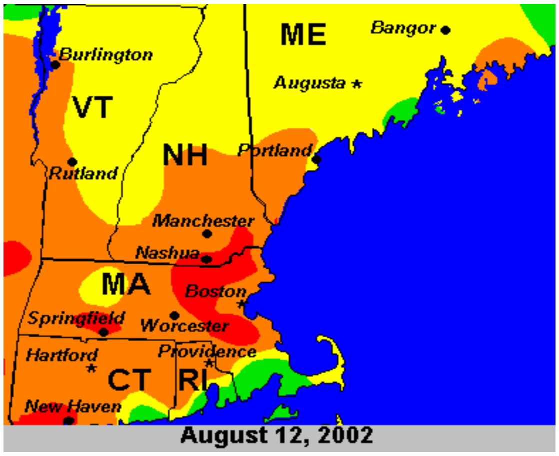


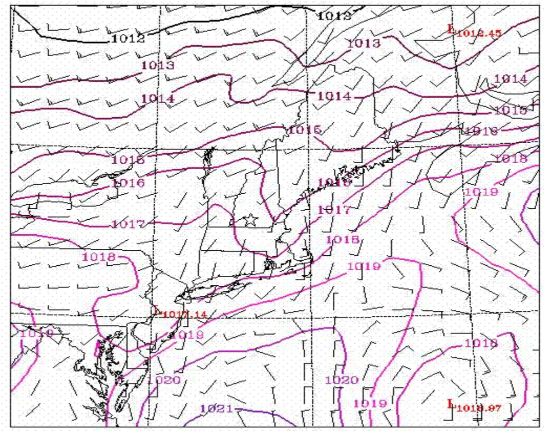
LEFT: EPA ozone mapping showing peak 8-hr values on July 2, 2002. Levels above the 8-hour NAAQS (orange and red) occurred along the south coast, while concentrations were lower inland. RIGHT: Surface isobars (sea-level pressure) and wind vectors at 2PM EST, July 2, 2002. (NOAA Air Resources Lab)

The second synoptic type occurs when the Atlantic anticyclone has a more northeast-southwest orientation (as opposed to the west – east orientation in the previous example) with less extension into the interior of the eastern United States. This pattern generates a more south-southwesterly wind across southern New England, which carries pollutants from the New York City area northeastward into Western and Central New England. This flow keeps the main pollutant plume in the interior of or to the west of Rhode Island, since southerly coastal breezes draw in cleaner marine air. In this case, the ozone gradient is reversed from the first episode type discussed above; ozone levels tend to be lowest along the south coast, while levels are elevated to the north and west. An example of this second flow pattern is shown in Figure 5-2 showing clean air along the south coast with higher ozone over more northern interior sections of southern New England. The surface flow with marine air drawn inland along south coastal locales can be seen on the right side of Figure 5-2.

These two meteorological regimes occurred many times during 2002, resulting in exceedances of the 8-hour ozone NAAQS at one or more of the Rhode Island monitors on seventeen days. (See Table 5-1) Similarly, a significant number of elevated ozone days occurred in many other portions of the eastern Unite States that year. Therefore, 2002 is an appropriate ozone season for use in modeling to demonstrate ozone attainment in Rhode Island and other parts of the OTR.

Figure 5-2: August 12, 2002 Ozone and Isobar Maps





LEFT: EPA ozone mapping showing peak 8-hr values on August 12, 2002. Colors range from green (good air quality) along the south coast to red (unhealthy) inland. RIGHT: Surface isobars (sea-level pressure) and wind vectors at 2PM EST, August 12, 2002 (NOAA Air Resources Lab)

Table 5-1 Rhode Island Ozone Concentrations on 8-Hour Exceedance Days in 2002 (ppb)

	W. Greenwich	E Providence	Narragansett
17-Apr	NA	69	**86**
24-May	69	73	**86**
11-Jun	**89**	81	73
23-Jun	**92**	**87**	76
26-Jun	**86**	**88**	79
27-Jun	**92**	**91**	84
1-Jul	**101**	**97**	**98**
2-Jul	76	79	**112**
8-Jul	66	NA	**86**
9-Jul	**111**	**103**	79
18-Jul	**91**	**86**	**101**
19-Jul	**91**	76	79
4-Aug	79	77	**94**
11-Aug	**95**	84	70
12-Aug	**100**	**87**	56
13-Aug	**120**	**120**	**92**
14-Aug	**92**	**92**	70

5.3 OTC Modeling Protocol

5.3.1 Modeling Protocol (2002)

In 2002 the Ozone Transport Commission began developing a SIP modeling system for using photochemical grid models to assess the impact of candidate ozone control strategies in the OTR. EPA's Community Multi-scale Air Quality Modeling System (CMAQ) was selected for attainment demonstrations in the OTC states. Air quality staff from the OTC states subsequently prepared a modeling protocol for attainment demonstrations in the OTR. The modeling protocol, entitled "Modeling Protocol for the OTC SIP Quality Modeling System For Assessment of the Ozone National Ambient Air Quality Standard in the Ozone Transport Region", was endorsed by OTC at the November 12-13, 2003 Fall meeting.

5.3.2 Modeling Protocol (2006)

The modeling protocol, now dated December 31, 2006, has been modified several times since then to incorporate CMAQ model modifications, boundary condition estimates and emission inventory improvements. The New York Department of Environmental Conservation (NY DEC), under the direction of the OTC Modeling Committee, agreed to be the lead agency for developing and using the SIP quality ozone modeling system as specified in the modeling protocol. The subject protocol, which describes the modeling procedures and databases to be used for SIP attainment demonstrations in the OTR, is contained in Appendix 5B.

5.4 Review of 2002 Ozone Episodes

5.4.1 Episode Selection Criteria

Ozone-based research has shown that model performance evaluations and the model response to emissions reductions need to consider relatively long time periods. In order to examine the response to ozone control strategies, EPA recommends that episode days should be meteorologically representative of typical high ozone exceedance days and so severe that any control strategies predicted to attain the ozone NAAQS for that episode day would also result in attainment for all other exceedance days (EPA, 2007). Time periods to be modeled should display increasing ozone concentrations over time, followed by a ramp-down period to cleaner conditions to allow for a more complete evaluation of model performance under a variety of meteorological conditions.

5.4.2 Episode Selection Procedure

Because of the large areal extent of the OTR modeling domain, the OTC Modeling Committee decided to model the entire 5-month ozone season in order to investigate numerous ozone episodes and to provide for better assessment of simulated pollutant fields. The 2002 ozone season was selected since a significant number of exceedance days were recorded across the eastern United States that year. A multi-year review (1997-2003) of elevated ozone days in the OTR indicted that associated meteorological regimes during high ozone days in 2002 were for the most part very similar to those found to occur in other years. The multi-year review, prepared by Environ (Environ, 2005) is contained in Appendix 5C. Based on this work, the OTC Modeling Committee is confident that the 2002 season is representative for purposes of photochemical modeling for ozone SIP attainment demonstrations.

5.5 Modeling Domain

5.5.1 Description

The OTR modeling domain is displayed in Figure 5-3. The OTR modeling domain is embedded in the national grid that was adopted by the five U.S. Regional Haze Regional Planning Organizations (RPOs) for photochemical grid modeling. Individual RPOs are shown in Figure 5-4.

The OTR modeling domain was designed to both capture the effects of emissions transported into the OTR and to test the effectiveness of 2009 control strategies in the OTR states. OTR states consist of Connecticut, Delaware, Washington D.C., Maryland, Maine, Massachusetts, New Jersey, New York, New Hampshire, Pennsylvania, Rhode Island, Vermont and Virginia. Non-OTR states in the OTR modeling domain consist of Alabama, Arkansas, Georgia, Iowa, Louisiana, Illinois, Indiana, Kentucky, Michigan, Minnesota, Missouri, North Carolina, Ohio, South Caroline, Tennessee, Virginia and Wisconsin. The horizontal grid resolution is 12 km and there are 172 grids in the east-west and 172 grids in north-south direction. Details of the modeling system grid setup are contained in Appendix 5D.

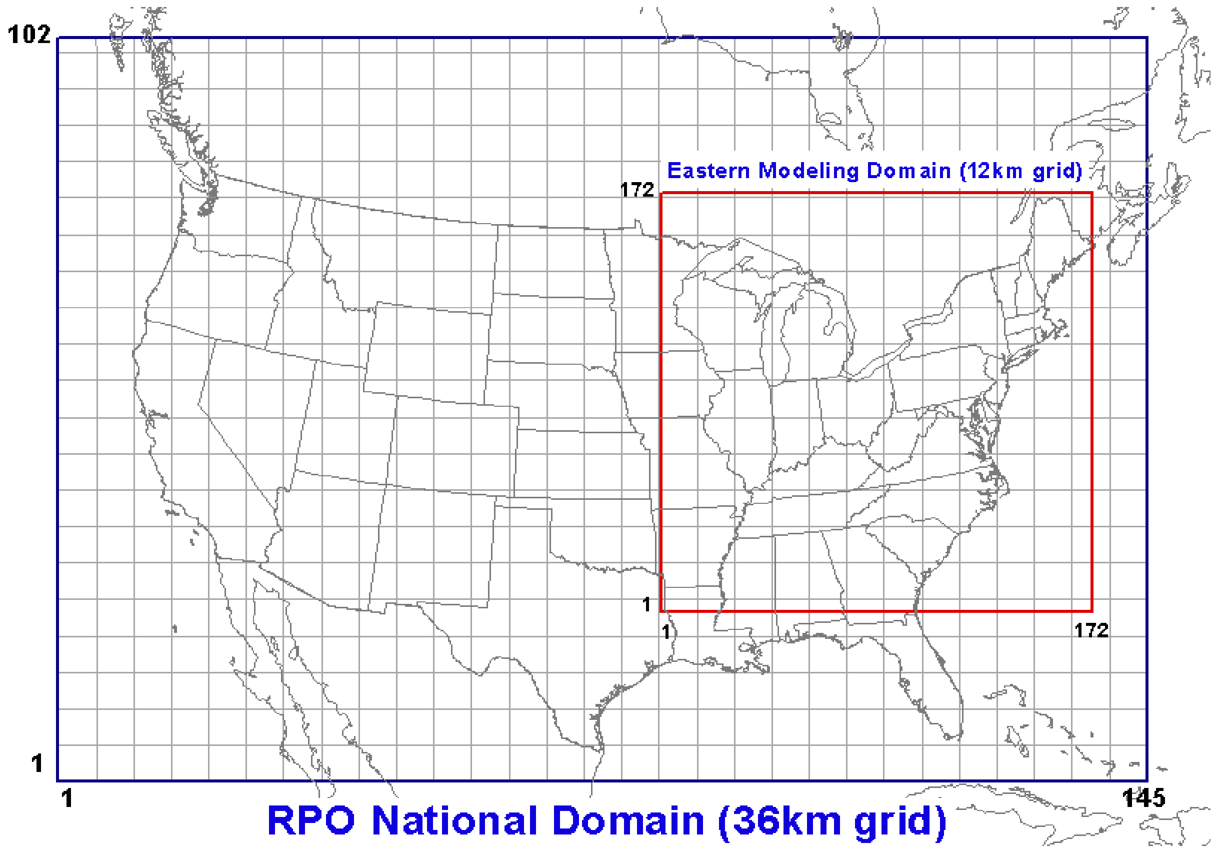
5.5.2 Horizontal Grid Size

Following EPA guidance and as noted above, a 12 km grid resolution was used for the domain. Details of the horizontal grid layers are contained in Appendix 5D.

5.5.3 Number of Vertical Layers

Although the definition of the vertical structure can be adopted on a one-to-one basis with the meteorological model (which is 29 layers), it was decided not to do so. Given the available computational resources and runtime needs, it was decided to limit the number of vertical layers in the photochemical model to 22, with the lowest 16 layers (where most of the ozone chemistry takes place) set one-to-one with those of the meteorological model. Details of vertical grid layers are contained in Appendix 5D.

Figure 5-3: OTR Photochemical Grid Modeling Domain (Eastern Modeling Domain)



5.6 Photochemical Grid Modeling System

5.6.1 Photochemical Grid Modeling System

EPA's Community Multi-scale Air Quality Modeling System (CMAQ) was selected for ozone attainment demonstrations in the OTR because it addresses multiple pollutants and different spatial scales (http://www.epa.gov/asmdnerl/CMAQ/index.html). The CMAQ platform is also being used for regional haze applications in the OTR and for PM2.5 attainment demonstrations for those jurisdictions within the OTR designated as non-attainment for the PM2.5. The CMAQ framework is an advanced computational platform that provides a sophisticated and powerful modeling environment for science and regulatory communities. CMAQ has a "one atmosphere" perspective; it was specifically designed to approach air quality as a whole by including state-of-the-science capabilities to address multiple air quality issues, including tropospheric ozone, fine particles, toxics, acid deposition, and visibility degradation. The target grid resolutions and domain sizes for CMAQ can range spatially and temporally over several orders of magnitude. In addition, CMAQ also has temporal flexibility; simulations can be performed for long-term (annual to multi-year) pollutant climatologies as well as short term (weeks to months) to simulate transport of precursor emissions from localized sources.

Figure 5-4: Regional Haze Regional planning Organizations (RPOs)

5.6.2 CMAQ Modeling System Source Codes

The CMAQ modeling system contains three types of modeling components: a meteorological modeling system (MM5) for the description of atmospheric states and motions; an emission model (SMOKE) for man-made and natural emissions that are injected into the atmosphere; and a chemistry-transport modeling system (CMAQ) for simulation of the chemical transformation and fate. Because CMAQ is designed to handle scale-dependent meteorological formulations and a large amount of system flexibility, CMAQ's governing equations are expressed in a generalized coordinate system. The generalized coordinate system determines the necessary grid and coordinate transformations and can accommodate various vertical coordinates and map projections. The SMOKE and CMAQ codes are available at http://www.cmascenter.org/ and MM5 codes can be obtained at http://www.mmm.ucar.edu/mm5/

5.6.3 CMAQ Model Setup for the OTR Domain

The CMAQ Model (Version 4.5.1) was used to predict ozone concentrations in the OTR modeling domain. The CMAQ model configuration and the MM5/SMOKE/CMAQ modeling system grid specifications employed by the NY DEC are presented in Appendix 5D.

5.7 Meteorological Modeling System

5.7.1 MM5 Meteorological Model

The Fifth-Generation Pennsylvania State University/NCAR mesoscale model, referred to as MM5, was used by the University of Maryland (UMD) to generate meteorological fields for the OTR modeling domain. MM5 is a limited-area, non-hydrostatic, terrain-following sigma-coordinate model designed to simulate mesoscale atmospheric circulation. MM5 codes can be obtained at http://www.mmm.ucar.edu/mm5/. The set of options used by UMD for running MM5 (Version 3.6) in consultation with NY DEC are listed in Appendix 5E.

5.7.2 MM5 Meteorological Fields

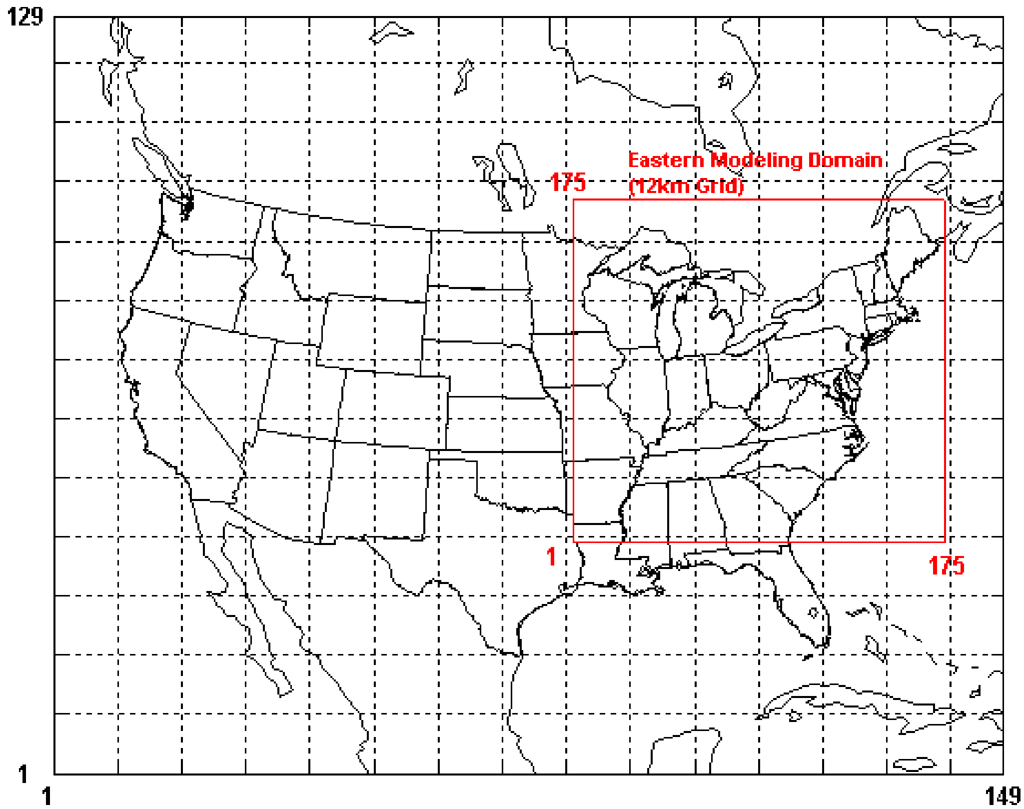
The National Weather Service NCEP ETA 40 km resolution-forecasting model was employed to initialize the MM5 model and to provide outer edge boundary conditions for the MM5 model. To minimize model error, the model applied four-dimensional data assimilation nudging techniques employing National Weather Service surface wind and upper air data (Zheng and Zheng, 2004). The model was applied in a Lambert conformal map projection over two-way nested domains. The coarse grid (36 km) domain and the fine grid (12 km) domain are shown in Figure 5-5. MM5 was used to produce hourly meteorological fields for the calendar year 2002.

Since there are a variety of options that can be exercised with MM5, initial testing was performed for a high ozone event of 2002 with commonly used default options as well as with modified boundary layer schemes (Zhang and Zheng 2004). Based on this work, a modified Blackadar scheme was employed in order to produce more accurate diurnal cycles of surface winds and temperatures. A description of the preparation of MM5 meteorological fields for the OTR modeling domain is contained in 5F.

5.7.3 MM5 Model Performance

NY DEC and UMD tested several MM5 configurations before settling on one that included a modification to the Blackadar planetary boundary scheme in order to obtain an accurate rendering of three-dimensional meteorological fields over the OTR modeling domain. This work was coordinated through the OTC Modeling Committee.

Figure 5-5: MM5 Modeling Domains (36 km and 12 km)



After MM5 hourly meteorological fields were prepared, the simulated meteorological fields for 2002 ozone season (May 1 to September 30) were compared to National Weather Service (NWS) and CASTNet surface temperature, wind speed, and humidity observations. CASTNet is the nation's primary source of rural ground-level ozone measurements and associated meteorological data. Comparisons with CASTNet data provide a more independent assessment of the MM5 model since CASTNet data, unlike NWS data, is not used to in the MM5 application to improve model performance (model nudging). MM5 results were also compared with wind profiler data and cloud data derived from satellite images to diagnose if the MM5 simulation is yielding the right type of dynamics in the vertical. These analyses (Appendix 5F) indicate that the performance of MM5 is reasonable across the OTR both at the surface and in the vertical, thereby providing confidence in the use of MM5 results for the CMAQ simulations.

5.8 Biogenic emissions

5.8.1 BEIS Modeling System

Biogenic emissions of VOCs, NOx and CO from natural sources for the time period from January 1, 2002 – December 31, 2002 were calculated by the NY DEC using the Biogenic

Emissions Inventory System (BEIS version 3.12) integrated within SMOKE2.1. The procedures used to calculate biogenic emissions are contained in Appendix 5G.

5.8.2 OTR Modeling Domain Biogenic Emissions

NY DEC used gridded land use data and emissions factors to produce gridded normalized biogenic emissions for 34 species/compounds in the OTR modeling domain. The gridded land use file utilized by NY DEC included the fractional coverage of 230 different land use types for each of the 12-km grid cells in the OTR modeling domain. MM5/MCIP meteorological variables were then used to compute hour-specific, gridded biogenic emissions, which were then converted to CO, NO, and the Carbon Bond IV (CB-IV) VOC species utilized in CMAQ Model.

5.9 Boundary and Initial Conditions

5.9.1 Generation of Boundary Conditions

NY DEC prepared boundary conditions for the OTR 12 km domain by performing a CMAQ simulation for a continental U.S. grid with a 36 km grid spacing. The simulation utilized the 2002 emissions data provided from the five U.S. RPOs and the 2002 MM5 meteorological fields developed by the UMD (Section 7). Clean initial conditions were employed, and boundary conditions for the continental USA simulation were extracted from a simulation of the GEOS-CHEM global chemical model. The interface program used to extract 36 km boundary conditions from the GEOS-CHEM global model was developed by University of Houston (Moon and Byun, 2004). The CMAQ 36km simulation ran from December 15, 2001 to December 31, 2002 with the first 15 days in December 2001 as ramp up period. The boundary conditions simulation is described in more detail in Appendix 5H.

5.9.2 OTR Modeling Domain Boundary Conditions

The hourly boundary fields for the 12km CMAQ domain were obtained by using a boundary condition program (BCON) to extract the 3-D concentration fields from the NY DEC continental CMAQ run at the boundaries of the OTC 12 km modeling domain. Boundary conditions were obtained for the ozone season simulation period (May 1 through September 30) with the first 14 days of May set as a ramp-up period to minimize the propagation of the boundary fields into the areas of concern. Clean initial conditions were employed at the start of the ramp-up period.

5.10 CMAQ Emission Files for 2002

5.10.1 Regional Planning Organization Annual Emission Inventories for 2002

The OTR modeling domain (previously shown on Figure 5-3) contains states from 4 of the 5 U.S. RPOs: Mid-Atlantic/Northeast Visibility Union (MANE-VU), Central Regional Air Planning Association (CENRAP), Midwest Regional Planning Organization (MRPO) and the Visibility Improvement State and Tribal Association of the Southwest (VISTAS). These RPOs were established by EPA to support regional haze planning activities, including the development of coordinated multi-purpose emission inventories. Each RPO has prepared detailed emission inventories for calendar year 2002 that are being used for ozone, PM2.5 and regional haze SIP attainment demonstrations. RPO boundaries were previously shown in Figure 5-4.

5.10.2 MANE-VU Annual Emission Inventory for 2002

The OTR states, except for Virginia, are members of the MANE-VU RPO (Virginia is in the VISTAS RPO). The Mid-Atlantic Regional Air Management Association (MARAMA) directed the preparation of the 2002 MANE-VU emission inventory. The MANE-VU states consist of Connecticut, Delaware, the District of Columbia, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont. A detailed technical support document describing the development of 2002 MANE-VU emission inventory is contained in Appendix 5I.

The 2002 MANE-VU emission inventory was based upon point, nonpoint, on-road, and non-road emission inventory data submitted by MANE-VU states to EPA in 2004 as a requirement of the Consolidated Emissions Reporting Rule. Under contract to MARAMA, E.H. Pechan & Associates (Pechan) collected this information and ran EPA format and content quality assurance programs and other checks to identify format and data content issues. Data gaps were filled in accordance with a Quality Assurance Project Plan prepared for this project (MANE-VU, 2004a).

After making corrections and filling data gaps, emission files for sulfur dioxide (SO_2), oxides of nitrogen (NO_x), volatile organic compounds (VOC), carbon monoxide (CO), ammonia ($NH_{3)}$ and particles with aerodynamic diameters less than or equal to a nominal 10 and 2.5 micrometers (primary PM_{10} and $PM_{2.5}$) were prepared in National Emissions Inventory Input Format (NIF 3.0) and placed on the MARAMA ftp site.

Several versions of the emission inventory were prepared by Pechan to address corrections, improvements and ongoing state-of-the-art changes (for example, the non-road inventory was completely redone in Version 3 due to EPA modifications to the NONROAD2005 model). The most current version of the MANE-VU emission inventory (Version 3) was used for OTR state attainment demonstrations. MANE-VU state emission totals are shown in Table 5-2.

Table 5-2: MANE-VU 2002 Anthropogenic Emissions (Tons/Year)

2002 Version 3 Base Case	CO	NOx	VOC	NH_3	SO_2	PM10	PM2.5	PMC
Connecticut	992201	125208	162492	8598	32077	27061	15795	11266
Delaware	273433	58764	41120	14376	79868	15214	7931	7284
District of Columbia	101372	15389	14893	415	2939	2889	1276	1613
Maine	759882	94932	166501	11060	39362	64103	28458	35645
Maryland	1905406	283387	265220	31712	315251	72234	34805	37428
Massachusetts	1838763	276530	294703	25737	164112	89984	40667	49317
New Hampshire	594257	67326	111333	3678	55295	25796	19479	6316

New Jersey	2276006	303053	378877	24931	91273	47021	29350	17671
New York	5223096	655774	921593	83801	448322	229391	90977	138413
Pennsylvania	4448357	806061	594355	91842	1077658	228459	82467	145992
Rhode Island	312263	29418	57200	1789	8022	5058	2486	2571
Vermont	351716	28290	50461	10608	6022	21218	8330	12888
Total	19076752	2744133	3058749	308548	2320202	828427	362022	466405

Note that the Rhode Island emissions in the MANE-VU inventory are slightly different from those in Rhode Island's 2002 Emissions Inventory, which is Appendix 2A of this document, due to the timing of the preparation of the inventories. However, as shown in Table 5-3, these differences are minor and would not affect the modeling results.

Table 5-3 Comparison of RIDEM and MARAMA 2002 Emissions Inventory for Rhode Island (tons per year)

	VOC		NOx	
	RI DEM	MARAMA	RIDEM	MARAMA
Point	3,095	1,928	2,225	2,764
Nonpoint	16,809	31,402	3,045	3,886
On-Road	8,763	7,780	5,934	5,001
Non-Road	12,827	12,538	16,720	16,677
Biogenic	18,120	19,233	158	211
Total	59,614	72,881	28,082	28,539

The only substantial difference between the MARAMA and RI DEM emissions estimates is in emissions of VOC from nonpoint sources, specifically the nonpoint source surface coating and degreasing categories. MARAMA's nonpoint source surface coating and degreasing emissions estimates came from 1999 EPA data based on outdated emissions factors, grown to 2002. RI DEM updated emissions estimates for both of these categories based on comments received on the draft inventory from EPA Region I The updated RI DEM emissions estimates for those categories are, as recommended, from an the EPA report "Solvent Mass Balance Approach for Estimating VOC Emissions from Eleven Point Source Categories." Those emissions are much lower than the older EPA estimates for the nonpoint source surface coating and degreasing categories.

RI DEM also modified its estimates of emissions from process solvents, graphic arts, gasoline distribution and asphalt paving after the MARAMA inventory was developed. Since, the RI DEM emissions estimates are, overall, lower than those in the MARAMA inventory, modeling done to show attainment, which used the MARAMA data, would actually slightly overestimate Rhode Island's contribution to ozone levels in and downwind of the State.

5.10.3 Emission files for the OTR Domain

CMAQ-ready emission files for each RPO in the OTR domain (MANE-VU, CENRAP, MRPO, and VISTAS) were prepared by NY DEC. Emission files for portions of Canada in the OTR domain were also prepared by NY DEC. Emission processing procedures are summarized below and described in more detail in Appendix 5J.

5.10.3.1 MANE-VU Emission Files for 2002

Point, nonpoint, and non-road source emissions for MANE-VU states (MANE-VU Version 3 emission inventory) were obtained from the MARAMA ftp site and mobile emissions were obtained from the NESCAUM ftp site. NY DEC processed these emission files with SMOKE2.2 to prepare CMAQ-ready hourly emission input files

5.10.3.2 CENRAP Emission Files for 2002

CENRAP states in the OTR modeling domain consist of Arkansas, Iowa, Louisiana, Minnesota, and Missouri. Point, nonpoint, mobile and non-road source emissions for CENRAP states (CENRAP Version BaseB emission inventory) were obtained from the CENRAP ftp site by NY DEC and processed with SMOKE2.2 to prepare CMAQ-ready hourly emission input files.

5.10.3.3 MRPO Emission Files for 2002

MRPO states in the OTR modeling domain consist of Illinois, Indiana, Michigan Ohio, and Wisconsin. Point, nonpoint, mobile and non-road emissions for MRPO states were generated by Alpine Geophysics through a contract from MARAMA to convert the MRPO BaseK emission inventory to IDA format. The files were then obtained from the MARAMA ftp site by NY DEC and processed with SMOKE2.2 to prepare CMAQ-ready hourly emission input files.

5.10.3.4 VISTAS Emission Files for 2002

VISTAS states in the OTR modeling domain consist of Alabama, Georgia, Kentucky, North Carolina, South Caroline, Tennessee and Virginia. Point, nonpoint, mobile and non-road emission files for VISTAS states (VISTAS BaseG emission inventory) were obtained from the Alpine Geophysics ftp site by NY DEC and processed with SMOKE2.2 to prepare CMAQ-ready hourly emission input files.

5.10.3.5 Canadian Emissions Files for 2002

Canadian non-road and mobile source emission files were obtained from EPA and processed with SMOKE2.1 by NY DEC. Non-EGU and EGU point source emissions were obtained from Canadian National Pollutant Release Inventory (NPRI) database. NY DEC inserted SCC code estimates (NPRI has no SCC codes) and then processed the emission files with SMOKE2.2 to prepare CMAQ-ready hourly emission input files.

5.11 New OTR Control Measures for 2009

5.11.1 Potential Beyond On the Way (BOTW) Control Measures

Preliminary ozone modeling efforts (EPA, 2004) to support the proposed Clean Air Interstate Air Quality Rule (CAIR) indicated that additional controls beyond federal and state CAA control measures would be needed to attain the 8-hour ozone NAAQS in several portions of the OTR. Accordingly, OTC staff and member states formed several OTC workgroups to identify and evaluate potential control measures. Control measures were identified through published sources such as the U.S. Environmental Protection Agency's Control Technique Guidelines, STAPPA/ALAPCO Menu of Options documents, the AirControlNET database, emission control initiatives in member states, state/regional consultations, and stakeholder input. OTC workgroups compiled and reviewed a list of approximately 1,000 candidate control measures from which 30 control measures were selected for detailed analyses.

5.11.2 Final OTC Beyond On the Way (BOTW) Control Measures

The OTC workgroups discussed the candidate control measures during a series of conference calls and workshops from the spring of 2004 through the autumn of 2006. OTC workgroups collected and evaluated information regarding emission benefits, cost-effectiveness, and implementation issues, and stakeholders were provided opportunity to review and provide input. The procedures used to develop and evaluate these control measures (MACTEC, 2007b) are contained in Appendix 5K.

Based on this information, the OTC recommended that States consider emission reductions from the following source categories: Consumer Products, Portable Fuel Containers, Adhesives and Sealants Application, Diesel Engine Chip Reflash, Cutback and Emulsified Asphalt Paving, Asphalt Production Plants, Cement Kilns, Glass Furnaces, Industrial, Commercial, and Institutional (ICI) Boilers and Regional Fuels. These control measures are collectively referred to as beyond on the way (BOTW) control measures.

As part of its 8-Hour Ozone Attainment Demonstration SIP, RI DEM plans to adopt a regulation to limit emissions from adhesives and sealants and to modify its regulations for Asphalt Paving (APC Regulation No. 25) and Solvent Metal Degreasing (APC Regulation No. 36) to be consistent with control measures recommended in the BOTW measures.

The EPA's Mobile Source Air Toxics rule, which was adopted in February 2007 (72 FR 8428, February 26, 2007), contains specifications for Portable Fuel Containers effective in 2009 similar to the OTC BOTW recommendations. Similarly, the EPA issued a memo on May 30, 2007 committing to adopt federal rules consistent with the OTC BOTW limits for the Architectural and Industrial Maintenance(AIM) coatings category that would be effective by January 1, 2009.[14]. Therefore, RI DEM plans to adopt state-specific regulations for those source categories only if EPA fails to fulfill its commitment in this area..

Rhode Island also does not plan to adopt rules for the source categories corresponding to the remaining BOTW categories. In January 2007, in response to a court ruling invalidating the California Chip Reflash regulation, which was the basis for the OTC recommendations for that source category, the California Air Resources Board announced that it would no longer enforce that regulation. Rhode Island has no major sources in the Asphalt Production Plant source category and has no Cement Kilns. The one Rhode Island Glass Furnace facility has permitted emissions limits lower than those in the OTC BOTW recommendations. Rhode Island already requires reformulated gasoline statewide, and thus would not benefit from the OTC Regional Fuels measure. The larger Industrial, Commercial, and Institutional (ICI) Boilers in Rhode Island are currently regulated under APC Regulation No. 27; RI DEM believes that further regulation of this source category at this time is unlikely to yield significant additional emissions reductions.

In summary, Rhode Island will adopt all of the OTC BOTW measures that would feasibly yield additional emissions reductions in the State in 2009. BOTW measures included in the 2009 modeling for Rhode Island are listed in Table 5-3A, along with the status of the adoption of those measures in Rhode Island.

5.12 CMAQ Emission Files for 2009 with OTC BOTW Control Measures

5.12.1 Regional Planning Organization Annual Emission Inventories for 2009

The CENRAP, MRPO, VISTAS and MANE-VU RPOs prepared future year emission inventories for 2009 by applying growth and control measures to the 2002 base year emission inventories. The control measures reflected all control programs that are already on the way and in effect by 2009. These emission inventories, referred to as "on the way" emission inventories, reflect NOx SIP Call and CAIR requirements (http://www.epa.gov/interstateairquality/), federal on-road and off-road fuels, federal motor vehicle standards and state LEV (low emission vehicle) programs, federal MACT rules, 2001 OTC model rules for consumer products, architectural coatings, distributed generation and any other state-specific rules in effect by 2009. The inter-RPO work group utilized the Integrated Planning Model (IPM) to develop state and unit-level EGU emissions reflecting EPA's Clean Air Interstate Rule (CAIR) in the CENRAP, MRPO, VISTAS and MANE-VU RPOs (ICF, 2005).

[14] Memo from Stephen Page, Air Division Director, EPA Office of Air Quality Planning and Standards to Regional Air Division Directors, "Emission Reduction Credit for Three Federal Rules for Categories of Consumer and Commercial Products," May 30, 2007.

Table 5-3A Status of Adoption of Rhode Island BOTW Control Measures

Control Measure	Status
Consumer Products	Will submit by 10/1/08 if EPA has not proposed by 7/1/08
AIM Coatings (OTB/OTW)	Will submit by 10/1/08 if EPA has not proposed by 7/1/08
Portable Fuel Containers	Equivalent requirements adopted in EPA Mobile Source Air Toxics rule
Mobile Equipment Repair & Refinishing (OTB/OTW)	Equivalent rule (APC Regulation No. 30) adopted 1994
Solvent Cleaning (OTB/OTW)	Will submit update to APC Regulation No. 36 by 1/1/09
Adhesives and Sealants	Will submit new rule by 10/1/08
Asphalt Paving	Will submit update to APC Regulation No. 25 by 1/1/09

5.12.2 MANEVU Annual Emission Inventory with BOTW Control Measures for 2009

The Mid-Atlantic Regional Air Management Association (MARAMA) contracted MACTEC to prepare 2009 emissions for non-EGU point sources, nonpoint sources and non-road sources that reflected control measures that were already on the way and in effect by 2009. MACTEC in consultation with MANE-VU states developed the necessary growth and control factors and applied them to the 2002 MANE-VU emission inventory (Version 3) previously described in Section 10. Details of this work effort are contained in Appendix 5L (MACTEC, 2007a). Mobile source emissions were prepared by VA DEQ and NESCAUM, using MOBILE 6 input files and projected 2009 VMTs supplied by the MANE-VU states.

MACTEC then calculated “beyond on the way” (BOTW) emission reductions reflecting the new OTC 2006 model rules for non-EGU point sources and several nonpoint source categories in the OTR states (previously described in Section 5.11). The BOTW control measures were developed because preliminary ozone modeling efforts indicated additional controls would be needed to attain the 8-hour ozone NAAQS in portions of the OTR. Emission reduction calculations are presented in Appendix 5K (MACTEC, 2007b). State totals for the MANE-VU 2009 emission inventory reflecting BOTW control measures are shown in Table 5-4. BOTW emission reductions were incorporated into the 2009 MANE-VU 2009 emission inventory and all emission files were placed on the MARAMA ftp site

5.12.3 Emission files for the OTR Domain

CMAQ-ready emission files for 2009 for each RPO in the OTR modeling domain (MANE-VU, CENRAP, MRPO, and VISTAS) were prepared or obtained by NY DEC. Emission files for portions of Canada in the OTR domain were also prepared by NY DEC. Emission processing procedures are summarized below and described in more detail Appendix 5M.

Table 5-4: MANE-VU 2009 Anthropogenic Emissions with BOTW Controls (Tons/Yr)

2009 Version 3 BOTW	CO	NOx	VOC	NH_3	SO_2	PM10	PM2.5	PMC
Connecticut	751975	82139	122353	9255	22796	26481	15037	11443
Delaware	231392	49658	32109	14695	42569	15372	7694	7679
District of Columbia	67904	10433	10403	436	2297	2006	1124	882
Maine	579671	60201	141619	12974	38737	64881	27633	37247
Maryland	1373959	147710	205097	38971	114046	80496	39550	40946
Massachusetts	1290133	180391	229386	26513	64733	93839	42428	51411
New Hampshire	443286	44339	94330	4266	18597	26087	19511	6577
New Jersey	1778637	185314	285559	27935	49535	46183	28753	17430
New York	3730881	456457	710567	100682	325621	242237	98945	143293
Pennsylvania	3422688	518109	477042	113344	403150	259116	107315	151801
Rhode Island	240906	21900	44612	2144	8359	5410	2608	2802
Vermont	236142	17793	43063	13038	5966	22103	8099	14004
Total	14147574	1774443	2396138	364252	1096404	884212	398696	485516

5.12.3.1 MANE-VU Emission Files for 2009

Non-EGU point source and nonpoint source emissions for MANE-VU states (2009 MANE-VU Version 3 emission inventory) reflecting BOTW control measures were obtained from the MARAMA ftp site by NY DEC and processed with SMOKE2.2 to prepare CMAQ-ready emission input files. Mobile source emissions for MANE-VU states were obtained from the MARAMA ftp site by NY DEC and processed with SMOKE2.2 to prepare CMAQ-ready emission input files. Non-road source emissions (2009 MANE-VU Version 3 emission inventory) were obtained from the MARAMA ftp site by VA DEQ and processed with SMOKE2.2 to prepare CMAQ-ready emission input files. EGU emissions (IPM2.1.9) were obtained from ICF (ICF, 2005) by VA DEQ and processed with SMOKE2.2 to prepare CMAQ-ready hourly emission input files.

5.12.3.2 CENRAP Emission files for 2009

Non-EGU point, nonpoint, mobile and non-road emissions for CENRAP states in the OTR domain (2009 CENRAP BaseB emission inventory) were obtained from the CENRAP ftp site by VA DEQ and processed with SMOKE2.2 to prepare CMAQ-ready emission input files for the 2009 simulation. EGU emissions (IPM2.1.9) were obtained from ICF (ICF, 2005) by VA DEQ and processed with SMOKE2.2 to prepare CMAQ-ready hourly emission input files.

5.12.3.3 MRPO Emission files for 2009

Nonpoint and non-road emissions for MRPO states in the OTR domain (2009 MRPO BaseK emission inventory) were obtained from the MRPO by NY DEC and processed with SMOKE2.2 to prepare CMAQ-ready emission files for the 2009 simulation. Non-EGU and mobile emissions were obtained from the 2009 MRPO BaseK emission inventory by VA DEQ and processed with SMOKE2.2 to prepare CMAQ-ready emission input files. EGU emissions (IPM2.1.9) were obtained from ICF (ICF, 2005) by VA DEQ and processed with SMOKE2.2 to prepare CMAQ-ready hourly emission input files.

5.12.3.4 VISTAS Emission Files for 2009

Non-EGU point, nonpoint, mobile and non-road emission files for VISTAS states in the OTR domain (2009 VISTAS BaseG emission inventory) were obtained from the Alpine Geophysics ftp site by VA DEQ and processed with SMOKE2.2 to prepare CMAQ-ready emission input files for the 2009 simulation. VISTAS EGU emissions were obtained from ICF (ICF, 2005) by VA DEQ and processed with SMOKE2.2 to prepare CMAQ-ready hourly emission input files.

5.12.3.5 Canadian Emission Files for 2009

NY DEC obtained nonpoint, non-road and mobile source emission files for 2010 from EPA and obtained EGU point source emissions for 2010 from Environment Canada. These were considered to be a reasonable surrogate for 2009. Non-EGU point source emissions for 2002 (Section 10.3) were used as a surrogate for 2009. NY DEC processed these Canadian emission files with SMOKE2.2 to prepare CMAQ-ready hourly emission input files.

5.13 Quality Assurance of CMAQ Databases

All air quality, emissions, and meteorological data were reviewed to ensure completeness, accuracy, and consistency before proceeding with modeling. Any errors, missing data or inconsistencies were addressed using standard practices. All modeling was benchmarked through the duplication of a set of standard modeling results including benchmark runs with five modeling centers in the OTR (New York Department of Environmental Conservation, University of Maryland, NESCAUM, Rutgers University, and Virginia Department of Environment Quality).

Quality assurance activities were carried out for the various emissions, meteorological, and photochemical modeling components of the modeling study. Emissions inventories obtained from all RPOs (CENRAP, MANE-VU, MWRPO and VISTEAS) were examined to check for errors in the emissions estimates. When such errors were discovered, the problems in the input data files were corrected.

The MM5 meteorological and CMAQ air quality model inputs and outputs were plotted and examined by NY DEC to ensure accurate representation of the observed data in the model-ready fields, and temporal and spatial consistency and reasonableness. Both MM5 and CMAQ underwent operational and scientific evaluations by NYDEC and the OTC Modeling Committee to facilitate the quality assurance review of meteorological and air quality modeling procedures.

5.14 CMAQ Model Simulation for 2002 Base Case

5.14.1 CMAQ Model 2002 Application

The CMAQ 2002 base case simulation was performed by NY DEC using a one-way nesting approach for the 12 km OTR modeling domain. The OTR modeling domain was previously described in Section 4. CMAQ (version 4.5.1) was used with CB-IV chemistry, the aerosol module for $PM_{2.5}$ and the Regional Air Deposition Model (RADM) cloud scheme. The simulation ran from May 1 to September 30, with the first 14 days of May used as a ramp-up period to minimize the propagation of boundary fields into areas of concern. The CMAQ results used for the performance evaluation were from May 15 through September 30. Details of the CMAQ setup and application are listed in Appendix 5N.

5.14.2 CMAQ Input Files for 2002

5.14.2.1 Emission Files for 2002 simulation

The CMAQ-ready hourly emission files described in Sub-Section 10 for all RPO states and Canadian Provinces in the OTR modeling domain were used for the 2002 CMAQ base case simulation. As described in Section 8, NY DEC used the BEIS model to prepare gridded normalized biogenic emission files for CO, NO, and the CB-IV VOC species for the 2002 simulation.

5.14.2.2 Boundary and Initial Conditions for 2002 simulation

As described in Sub-Section 9, hourly boundary fields for the 12km CMAQ domain were obtained by NY DEC using the BCON program to extract the 3-D concentration fields from the NY DEC continental USA CMAQ run at the four edges of the OTR modeling domain. Clean initial conditions were employed.

5.14.2.3 Meteorological Files for 2002 simulation

The meteorological data for the 2002 simulation were based on the MM5 modeling described in Sub-Section 7. The MM5 fields for the May 1 to September 30 MM5 simulation were processed with Meteorology Chemistry Interface Processor (MCIP Version 3.0) obtained from the CMAS Modeling Center (http://www.cmascenter.org) in order to provide CMAQ model-ready hourly meteorological input files.

5.14.2.4 Photolysis Rates

Photolysis rate lookup tables were generated by NY DEC for each day using CMAQ's Photolysis Rates Processor (JPROC) software (http://www.cmascenter.org). Daily ozone column measurements from NASA's Earthprobe Total Ozone Mapping Spectrometer (TOMS) instrument (ftp://toms.gsfc.nasa.gov/pub/eptoms/data/ozone/Y2002/) were downloaded and used as input to the JPROC processing software.

5.14.3 CMAQ Output Files

Predicted hourly ozone concentrations for each ozone monitoring station location in all OTR states are listed in Appendix 5O. Daily ozone maps for the 2002 ozone season are contained in Appendix 5P. All input and output files for the 2002 Base Case CMAQ simulation for the OTR modeling domain are listed in Appendix 5U. Files are available in electronic format from NY DEC for use with the SMOKE/CMAQ system. Please contact Gopal Sistla at 518-402-8402 data file requests.

5.15 Performance Evaluation of 2002 Simulation

5.15.1 NY DEC Performance Evaluation for OTR Modeling Domain

NY DEC conducted a detailed performance evaluation of the OTC CMAQ modeling platform simulation for the 2002 ozone season (Appendix 5Q). The CMAQ simulation ran from May 1 to September 30; May 1 through May 14 was the ramp up period to minimize effects of boundary conditions and the results for May 15 though September 30 were used for the performance evaluation. Air quality predictions for O_3, CO, NO, NO2, SO2, C_2H_4, C_5H_8, HCHO, $PM_{2.5}$ and several regional haze aerosol species were compared to measurements in every grid cell where air quality data were available. Hourly ozone measurements from 234 monitors were available to assess CMAQ model performance in the OTR.

A variety of model performance metrics for each of these pollutants - observed average, predicted average, correlation coefficient (R2), normalized mean error, root mean square error (RMSE), mean absolute gross error (MAGE), mean normalized gross error (MNGE), mean bias (MB), mean normalized bias (MNB), mean fractionalized bias (MFB), normalized mean bias (NMB), along with temporal plots and daily ozone maps were prepared in order to help assess model performance. In general, the observed and predicted composite average ozone concentrations track well, although there was fairly substantial under-prediction during the mid-August period. Model performance was better in the vicinity of urban areas and along the northeastern corridor, compared to the performance in rural areas where the model tended to under-predict daily maximum concentrations. A complete set of model performance statistics for all OTR monitoring locations is contained in Appendix 5R.

5.15.2 CMAQ Spatial Performance in New England States

In assessing spatial performance of the CMAQ model, two elements are critical: (1) the model's ability to replicate the general spatial pattern of ozone across most of the domain and, in particular, the New England region, and (2) whether the model can reproduce concentration gradients often observed along and within a few miles of the New England coast. A review of side-by-side maps of observed and predicted peak ozone values for the 2002 ozone season indicate the CMAQ model is doing a fairly good job of replicating spatial patterns and concentration gradients. A complete set of daily maps is contained in Appendix 5P.

Figures 5-6 – 5-9 reveal good consistency between predicted and observed daily peak 8-hour ozone values. The simulations in Figure 5-6 and 5-7, for example, capture the narrow strip of elevated ozone from around Maryland northeastward to southern New England. The CMAQ model reproduced the splotchy areas of high ozone from the Midwest down across Tennessee (Figure5-7), as well as the clean areas near the Carolina coasts. In Figure 5-8, not only are the New England plume and broad Midwest region of high ozone captured, but the area of relative minimum ozone across Pennsylvania and New York is also replicated.

In addition, and perhaps most importantly for New England, it appears that the model correctly handles the effect of slight wind trajectory differences on ozone patterns across the southern New England coast. Figure 5-8 shows that the CMAQ model correctly predicted high ozone values across southern New England, along with a clean area on the south coast caused by marine air blowing onshore. A reverse of that pattern is shown in Figure 5-9, in which south coastal New England has elevated ozone while values in interior southern New England are low. This typical westerly (as opposed to southwesterly) flow scenario draws polluted air from the New York City/New Jersey areas eastward along the New England south coast. Air reaching interior sections of New England had earlier crossed central New York and thus arrived fairly clean. That the model discerned these two episode types and reproduced the north-south gradient is encouraging, and gives confidence that the CMAQ model can replicate daily maximum 8-hour ozone concentrations in New England.

Figure 5-6: Maximum 8-Hour Values on August 8, 2002

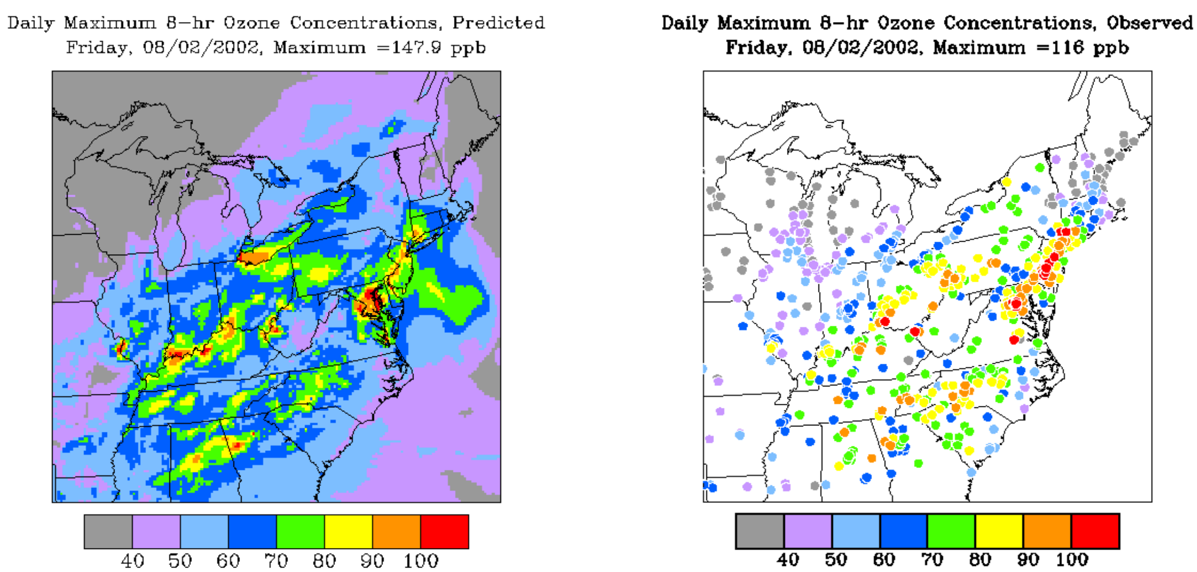


Figure 5-7: Maximum 8-Hour Values on August 8, 2002

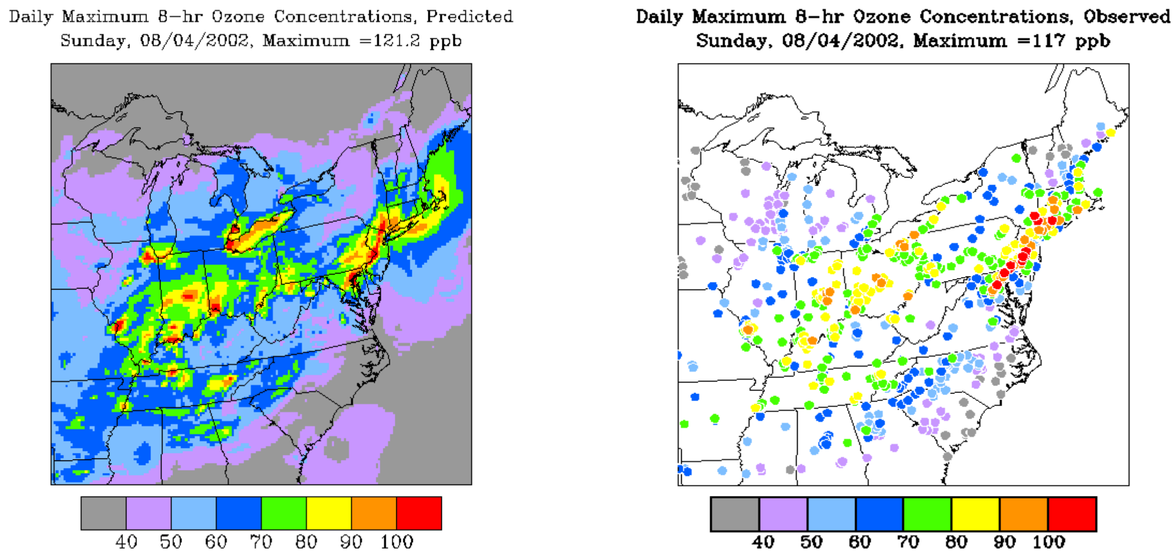


Figure 5-8: Maximum 8-Hour Values on June 21, 2002

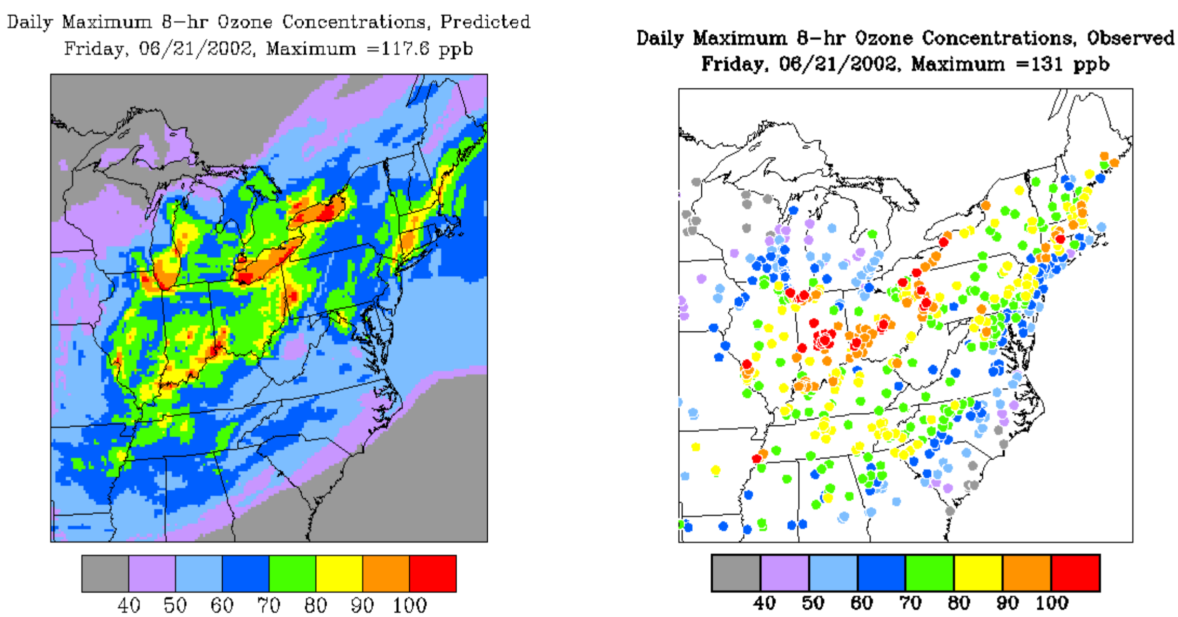
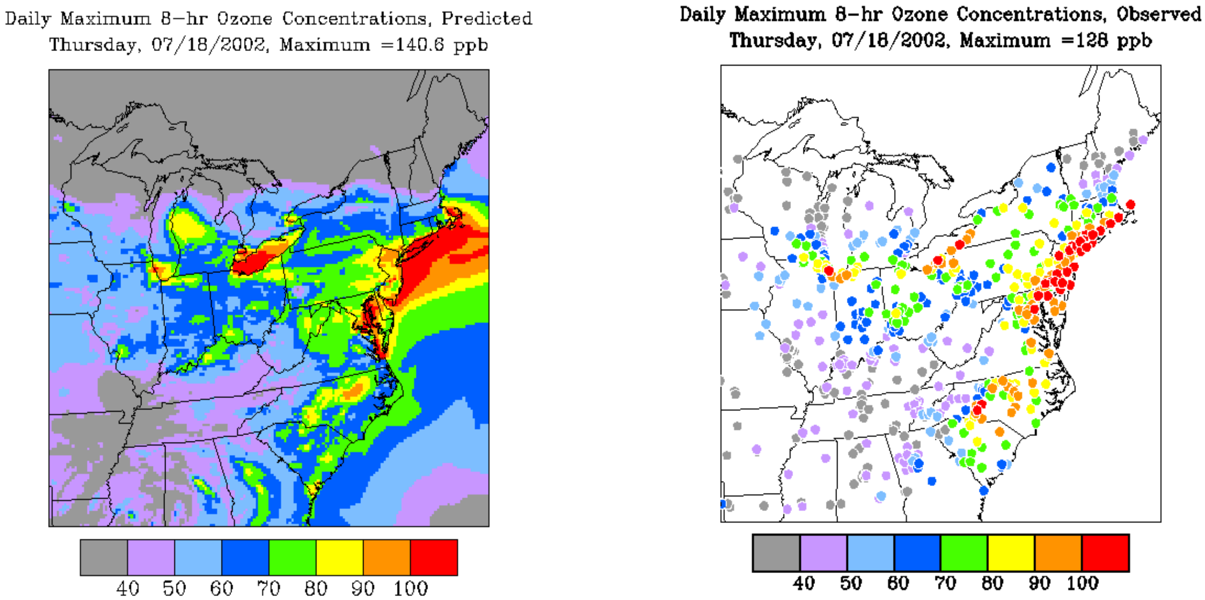
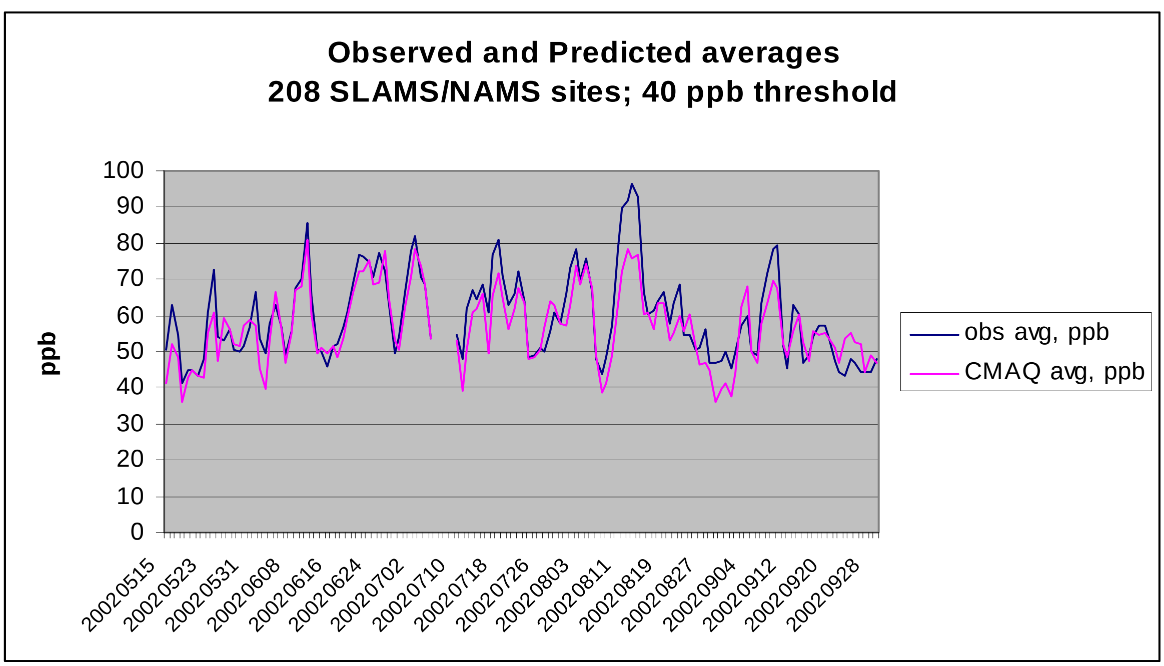


Figure 5-9: Maximum 8-Hour Values on July 18, 2002



Finally, the CMAQ model appears to do a reasonable job of simulating ground level ozone diurnal buildup and decay. Figure 5-10 is a time series of observed and modeled peak 8-hour ozone values averaged over the domain for the entire modeling period (NYDEC, 2006).

Figure 5-10: Hourly Ozone Values for 2002 Ozone Season



Although an under prediction is evident, it is consistent, and the predictions do track the observations well. The model's under prediction of ozone is not a big concern since CMAQ modeling results are to be used in a relative sense, and because the under-prediction is consistent over the modeling period and across the modeling domain.

5.15.3 CMAQ Selected Model Metrics for New England States

EPA recommends that several statistical metrics be developed for air quality modeling (EPA, 2007). Two metrics that are most often used to assess performance are mean normalized gross error (MNGE) and the mean normalized bias (MNB). The mean normalized gross error provides an overall assessment of model performance and can be interpreted as precision, and the mean normalized bias parameter measures a model's ability to reproduce observed spatial and temporal patterns, and can be interpreted as accuracy. EPA suggests a MNGE of less than 35% above a threshold ozone level of 40-60 ppb and a MNB of less than ±15% as a reasonable test for acceptable model performance. The MNGE and the MNB for maximum daily 8-hour concentrations at or above 60 ppb at Rhode Island ozone monitors for the 2002 CMAQ simulation are shown in Table 5-5.

Table 5-5: Mean Normalized Gross Error and Mean Normalized Bias for RI Ozone Monitors

State	AIRS-ID	Location	Observed ppb	CMAQ ppb	MNGE %	MNB %
RI	440030002	W. Greenwich	77.9	75.7	10.5	-1.8
RI	440071010	E. Providence	77.6	74.0	10.8	-4.3
RI	440090007	Narragansett	76.9	83.3	14.9	9.4
		AVERAGE			12.1	1.1
		Recommended			<35%	<±15%

Both of the metrics, MNGE and MNB, are well within the acceptable range at all three of Rhode Island's monitors.

The MNGE and the MNB for maximum daily 8-hour concentrations at or above 60 ppb at all other New England state ozone monitors are listed in Table 5-6. The other New England state ozone monitors also meet the MNGE criteria of 35%. The MNB values are above the ±15% criteria at two sites in Massachusetts and at several ozone monitoring locations in Vermont and New Hampshire. This under-prediction at these monitors is not considered to be a significant concern since the 2002 design values at these monitors (Table 5-9 and Table 5-12) are already below or close to the ozone NAAQS. In addition, CMAQ modeling results are being used in a relative way which helps minimize the under-prediction of peak ozone concentrations.

Table 5-6: Mean Normalized Gross Error and Mean Normalized Bias for Other New England Ozone Monitors

State	AIRS-ID	Location	Observed ppb	CMAQ ppb	MNGE %	MNB %
MA	250010002	Truro	76.3	82.8	14.0	9.1
MA	250034002	Adams	73.6	61.2	16.4	**-16.0**
MA	250051002	Fairhaven	74.3	74.6	11.5	1.6
MA	250090005	Lawrence	80.0	72.3	14.6	-8.0
MA	250092006	Lynn	80.8	71.6	13.7	-10.7
MA	250094004	Newbury	79.4	87.6	14.7	10.3
MA	250130003	Agawam	76.6	67.1	15.1	-11.7
MA	250130008	Chicopee	76.4	65.2	15.3	-14.0
MA	250150103	Amherst	73.8	65.6	12.9	-10.9
MA	250154002	Ware	76.0	66.7	14.9	-11.7
MA	250171102	Stow	76.3	66.2	13.7	-12.8
MA	250213003	Milton	79.6	68.3	15.4	-13.7
MA	250250041	Boston (Long I)	76.7	76.1	17.1	0.2
MA	250250042	Boston (Harris)	72.4	65.8	12.9	-8.4
MA	250270015	Worcester	82.7	65.9	19.8	**-19.8**
MA		AVERAGE			14.8	-7.8
CT	090010017	Greenwich	78.2	77.8	13.8	0.3
CT	090011123	Danbury	80.9	73.4	13.4	-8.7
CT	090013007	Stratford	80.8	80.0	17.1	-0.1
CT	090019003	Westport	80.7	78.9	12.2	-1.8
CT	090031003	E. Hartford	77.8	78.6	13.8	2.3
CT	090050005	Cornwall	78.8	64.5	20.2	**-17.8**
CT	090070007	Middletown	80.5	77.9	10.7	-3.7
CT	090093002	Madison	83.1	83.8	14.5	1.7
CT	090099005	Hamden	79.4	78.0	13.0	-1.0
CT	090110008	Groton	75.5	94.4	30.3	**28.1**
CT	090131001	Stafford	78.2	71.1	12.2	-8.7
CT		AVERAGE			15.6	-0.9
NH	330012004	Laconia	70.1	52.7	24.6	**-24.6**
NH	330031002	Conway	67.5	52.8	21.8	**-21.3**
NH	330050007	Keene	75.9	64.5	15.9	-14.5
NH	330074001	Mt Washington top	72.3	50.5	30.0	**-30.0**
NH	330074002	Mt Washington base	66.7	57.0	17.4	-14.5

State	AIRS-ID	Location	Observed ppb	CMAQ ppb	MNGE %	MNB %
NH	330074003	Pittsburg	68.7	54.7	20.5	**-20.5**
NH	330090008	Haverhill	68.0	52.8	22.1	**-22.1**
NH	330110020	Manchester	74.5	62.9	15.5	-15.0
NH	330111010	Nashua	76.1	66.0	13.9	-12.3
NH	330115001	Peterborough	80.9	60.3	24.7	**-24.7**
NH	330130007	Concord	74.2	58.5	20.9	**-20.7**
NH	330150012	Rye	78.2	69.6	13.4	-11.1
NH	330150013	999	73.9	61.9	16.7	**-15.3**
NH	330150015	Portsmouth	79.1	72.4	9.7	-8.5
NH	330173002	Rochester	74.7	64.0	15.5	-14.0
NH	330190003	Claremont	72.1	55.9	22.2	**-22.2**
NH		AVERAGE			19.0	**-18.2**
VT	500030004	Bennington	70.9	59.2	16.5	**-15.7**
VT	500070007	Underhill	74.8	56.1	24.2	**-24.2**
VY		AVERAGE			20.3	**-19.9**
ME	230052003	Cape Elizabeth	76.0	72.4	13.6	-3.1
ME	230090102	ANP Cadillac M	79.0	70.3	12.8	-10.7
ME	230090103	ANP McFarland	76.4	69.4	11.6	-8.5
ME	230090301	Castine	72.3	73.7	10.2	2.8
ME	230112005	Gardiner Pray	77.3	65.4	17.2	-14.8
ME	230130004	Port Clyde	73.1	77.1	15.6	5.6
ME	230173001	North Lovell	67.6	51.8	24.0	**-24.0**
ME	230194008	Holden Rider B	74.1	58.7	21.1	**-20.3**
ME	230230004	Georgetown	75.6	83.4	12.5	11.0
ME	230310038	West Buxton	76.8	62.1	19.0	**-19.0**
ME	230313002	Kittery	82.3	71.6	15.9	-11.8
ME	230312002	Kennebunkport	80.3	70.1	13.8	-12.3
ME	239010001	Scotia Prince Ferry	73.0	64.7	17.8	-11.6
ME		AVERAGE			15.8	-9.0

5.16 CMAQ Model Simulation for 2009 Control Strategy

5.16.1 CMAQ Model 2009 Application

The CMAQ 2009 base case simulation was performed by NY DEC in the same manner as the CMAQ 2002 base case simulation. The simulation period ran from May 1 to September 30, with the first 14 days of May as a ramp-up period to minimize the propagation of the boundary fields into areas of concern. The actual CMAQ results for the CMAQ control strategy evaluation were from May 15 through September 30.

5.16.2 CMAQ Input Files for 2009.

5.16.2.1 Emission Files for 2009 simulation

The CMAQ 2009 control strategy simulation employed the 2009 CMAQ-ready hourly emission files described in Sub-Section 12 for RPO states and Canadian Provinces in the OTR modeling domain. These emission files reflect "beyond on the way" (BOTW) controls in all OTR states and "on the way controls" (OTW) controls in CENRAP, MRPO and VISTAS states in the OTR modeling domain**.** The 2002 hourly biogenic were also used for 2009 CMAQ simulations since significant change in land use would not be expected to occur between 2002 and 2009.

5.16.2.2 Boundary and Initial Conditions for 2009 simulation

The 2002 hourly boundary condition files (Section 14) were used for the 2009 future year CMAQ simulation. This was considered to be a reasonable and conservative approach since air pollution levels and emissions are expected to be lower in 2009.

5.16.2.3 Meteorological Files for 2009 simulation

The 2002 hourly meteorological files (Section 14) were used for the 2009 simulation.

5.16.2.4 Photolysis Rates

The photolysis rate tables generated for 2002 (Section 14) were used for 2009 simulation.

5.16.3 CMAQ Output Files

All input and output files for 2009 BOTW CMAQ simulation for the OTR modeling domain are listed in Appendix 5S. Files are available in electronic format for the 12km domain from NYSDEC for use with the SMOKE/CMAQ system. Please contact NY DEC Gopal Sistla at 518-402-8402) for data file requests.

5.17 Predicted Design Values for 2009

5.17.1 Design Values for 2002 Base Case

Design values at each monitoring site were calculated in accordance with 40 CFR Part 50.10, Appendix I. The design value for a three-year period of time is calculated as the 3-year average of the fourth highest monitored daily 8-hour maximum value. For example, the design value for the 2000-2002 periods is the average of the fourth highest monitored daily 8-hour maximum values in 2000, 2001 and 2002.

For the modeled attainment test, EPA guidance (EPA, 2007) recommends averaging three design values that straddle the baseline inventory year (the baseline inventory year is 2002). Therefore, the 2002 design value for the attainment demonstration is the average of the "2002 design value" (determined from 2000-2002 observations), the "2003 design value" (determined from 2001-2003 observations), and the "2004 design value" (determined from 2002-2004 observations).

The 2002 design value (DVC) was calculated in ppb, and carried to 1 significant digit. The 2002 design values for Rhode Island ozone monitors are listed in Table 5-7 and the 2002 design values for the other New England states are shown in Table 5-8 to 5-12. The design values for all other ozone monitors in the OTR are listed in Appendix 5T.

5.17.2 Relative Response Factor for 2009 (RRF)

In order to minimize the under-prediction or over-prediction of peak ozone concentrations, EPA recommends that photochemical grid models be used in a relative way for modeled attainment demonstrations (EPA, 2007). Instead of using the absolute modeled results for 2009, EPA recommends that the change in predicted ozone concentrations between 2002 and 2009 be used for the attainment demonstration. EPA recommends that the 2009 design value be determined by multiplying the 2002 design value by a quantity referred to as a relative response factor (RRF). The RRF is the ratio of the 2009 ozone prediction divided by the 2002 ozone prediction.

The EPA guidance requires that an average daily RRF be determined for each monitor using the CMAQ model results from grid cells that are at and near a monitor with near being defined as a 3 by 3 grid array centered on the monitoring station location. For each day, the maximum predicted 2002 base case concentration and the maximum predicted 2009 BOTW emission scenario concentration are selected from the 3 X 3 grid array surrounding for each monitor.

Because photochemical models are less responsive to emission reductions on days of lower ozone concentrations, EPA guidance recommends applying screening criteria minimize using low ozone days when calculating RRFs (EPA, 2007). At least 10 days above 85 ppb are required to calculate the RRF at each monitoring location; if 10 days above 85 ppb are not available, EPA guidance allows for a smaller number of days at lower ozone concentrations. The minimum criterion is 5 days at or above 70 ppb for calculating a meaningful average daily RRF value. The detailed criteria for selecting high ozone days and calculating RRFs (to 3 significant digits) are described in Appendix 5T.

The 2009 relative response factors (RRFs) calculated for each Rhode Island ozone monitor for the 2009 BOTW emission scenario are listed in Table 5-7, and the 2009 RRFs for all other New England states are shown in Table 5-8 – 5-12. The RRFs for each ozone monitor in the OTR are contained in Appendix 5U.

5.17.3 Design Values for 2009

The 2009 future case design value (DVF) for the BOTW emission scenario was determined by multiplying the 2002 DVC for each monitor by the 2009 relative response factor (RRF) determined for each monitor. After the DVF was calculated, the DVF was truncated at the decimal point and then compared to the ozone 8-hour NAAQS. A truncated value at or below 84 ppb is considered to be a demonstration of modeled attainment (EPA, 2007).

The 2009 DVFs for Rhode Island monitors are shown in Table 5-7. The highest predicted 2009 DVF is 81 ppb at the Narragansett site, which is below the modeled attainment test of 84 ppb. The 2009 DVFs for other New England states are shown in Table 5-8 – 5-12. The highest 2009 DVFs in Massachusetts, New Hampshire and Maine, areas that are downwind of Rhode Island, are 82 ppb, 74 ppb and 79 ppb, also below the modeled attainment test of 84 ppb. The 2009 DVFs for all ozone monitors in the OTR for the 2009 BOTW emission scenario are contained in Appendix 5U.

Table 5-7: 2009 Design Values (DVF) in Rhode Island for 2009 BOTW Emission Scenario

State	AIRS-ID	Location	DVC	RRF 2009	DVF 2009
RI	440030002	West Greenwich	93.3	0.862	80
RI	440071010	East Providence	89.7	0.868	77
RI	440090007	Narragansett	93.3	0.876	81

Table 5-8: 2009 Design Values (DVF) in Massachusetts for 2009 BOTW Emission Scenario

State	AIRS-ID	Location	DVC	RRF 2009	DVF 2009
MA	250010002	Truro	92.0	0.877	80
MA	250034002	Adams	83.3	0.877	73
MA	250051002	Fairhaven	91.0	0.878	79
MA	250090005	Lawrence	70.0	0.880	61
MA	250092006	Lynn	90.0	0.916	82
MA	250094004	Newbury	86.0	0.882	75
MA	250130003	Agawam	83.0	0.873	72
MA	250130008	Chicopee	92.0	0.872	80
MA	250150103	Amherst	74.7	0.874	65
MA	250154002	Ware	86.3	0.873	75

MA	250171102	Stow	85.7	0.870	74
MA	250213003	Milton	91.0	0.911	82
MA	250250041	Boston (Long I)	88.7	0.909	80
MA	250250042	Boston (Harris)	73.0	0.908	66
MA	250270015	Worcester	84.0	0.863	72

Table 5-9: 2009 Design Values (DVF) in New Hampshire for 2009 BOTW Emission Scenario

State	AIRS-ID	Location	DVC	RRF 2009	DVF 2009
NH	330012004	Laconia	76.5	below criteria	below criteria
NH	330031002	Conway	67.0	below criteria	below criteria
NH	330050007	Keene	74.3	0.865	64
NH	330090008	Haverhill	70.3	below criteria	below criteria
NH	330111010	Nashua	86.0	0.867	74
NH	330115001	Peterborough	84.0	0.873	73
NH	330130007	Concord	74.7	below criteria	below criteria
NH	330150012	Rye	83.5	0.869	72
NH	330150013	Rockingham	80.0	0.858	68
NH	330150015	Portsmouth	68.0	0.869	59
NH	330173002	Rochester	78.5	0.860	67
NH	330190003	Claremont	74.3	below criteria	below criteria

Table 5-10: 2009 Design Values (DVF) in Connecticut for 2009 BOTW Emission Scenario

State	AIRS-ID	Location	DVC	RRF 2009	DVF 2009
6		7			
CT	090010017	Greenwich	95.7	0.913	87
CT	090011123	Danbury	95.7	0.897	85
CT	090013007	Stratford	98.3	0.919	90
CT	090019003	Westport	94.0	0.909	85
CT	090031003	E. Hartford	88.0	0.876	77
CT	090050005	Cornwall	89.0	0.870	77
CT	090070007	Middletown	95.7	0.888	84
CT	090093002	Madison	98.3	0.905	88
CT	090099005	Hamden	93.3	0.912	85
CT	090110008	Groton	90.0	0.879	79
CT	090131001	Stafford	92.3	0.867	80

Table 5-11: 2009 Design Values (DVF) in Maine for 2009 BOTW Emission Scenario

State	AIRS-ID	Location	DVC	RRF 2009	DVF 2009
ME	230038001	Ashland135	64.0	below criteria	below criteria
ME	230052003	Cape Elizabeth	84.3	0.873	73
ME	230090102	ANP Cadillac M	91.7	0.869	79
ME	230090103	ANP McFarland	83.7	0.871	72
ME	230090301	Castine	75.0	0.879	65
ME	230112005	Gardiner Pray	78.0	0.869	67
ME	230130004	Port Clyde	83.7	0.871	72
ME	230173001	North Lovell	60.7	below criteria	below criteria
ME	230194007	Howland	66.7	below criteria	below criteria
ME	230194008	Holden Rider B	79.0	below criteria	below criteria
ME	230310038	West Buxton	75.0	0.860	64
ME	230312002	Kennebunkport	88.3	0.875	77
ME	230313002	Kittery	85.3	0.869	74

Table 5-12: 2009 Design Values (DVF) in Vermont for 2009 BOTW Emission Scenario

State	AIRS-ID	Location	DVC	RRF 2009	DVF 2009
VT	500030004	Bennington	79.7	0.883	70
VT	500070007	Underhill	77.0	below criteria	below criteria

5.18 Estimating Design Values at Unmonitored Locations

5.18.1 Rhode Island Ozone Monitoring Network

Based on our understanding of ozone formation, transport, and destruction and the size of the State, RI DEM considers Rhode Island's network of ozone monitors to be adequate for measuring the highest ozone values occurring in the State. .

Generally, ozone production via chemical transformation occurs some distance downwind of areas containing significant precursor emissions. What happens still farther downwind depends on the number and size of precursor emission sources in that area. If it lacks such sources, ozone will eventually be depleted because of its high reactivity (provided transport is over land). It would then follow that, in areas where ozone levels drop off, additional monitoring would be unnecessary.

The primary source of ozone in Rhode Island is the stream of pollution from upwind states to the southwest. This is evidenced by the fact that ozone levels at the W. Greenwich monitor, which is in a rural area in the southwest portion of the State, upwind of the high population density, high emissions areas of Rhode Island, generally records higher ozone concentrations than those at the E. Providence site, which is downwind of the Providence metropolitan areas. Therefore, RI DEM believes that additional monitoring coverage in Rhode Island is unnecessary.

5.18.2 Future Year Design Values at Unmonitored Locations

Since VOC and NOx emissions are trending lower in Rhode Island and elsewhere in the region, RI DEM believes that using design values from the 2002 network to construct future year design values provides a reasonable estimate of maximum predicted design values in Rhode Island for 2009 and beyond.

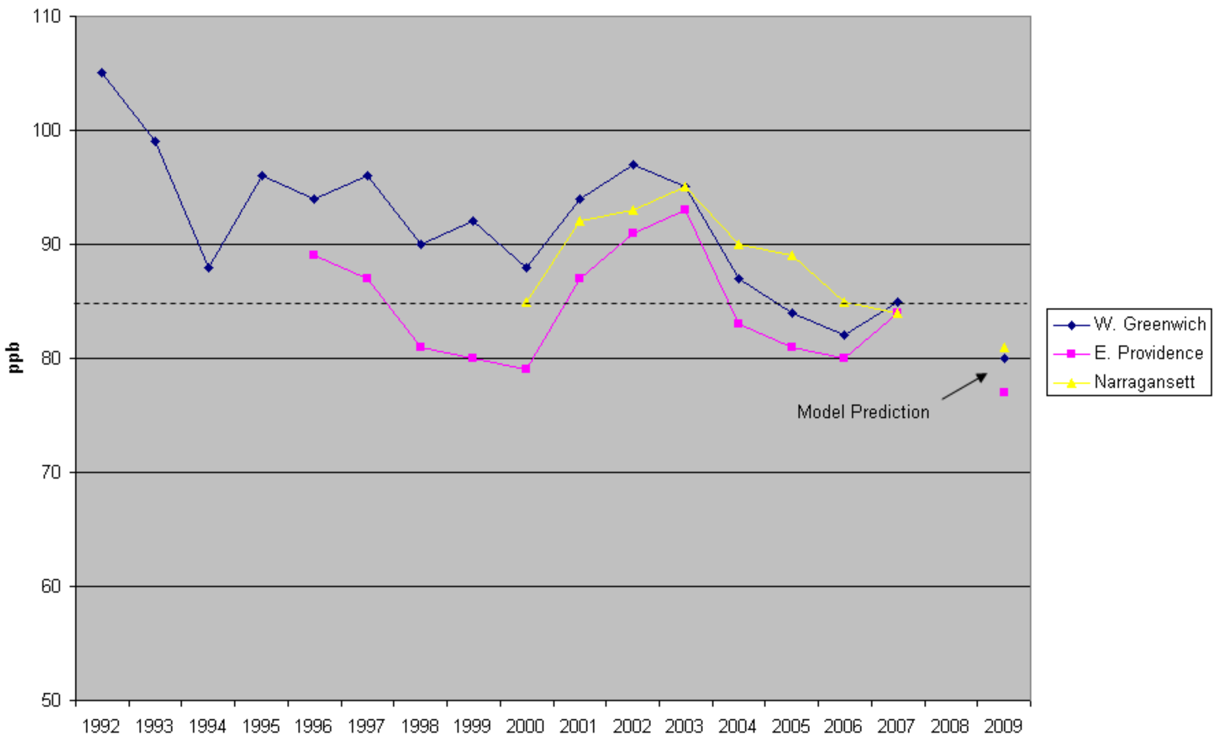
5.19 Weight of Evidence

EPA modeling guidance provides that a state include in its attainment demonstration additional evidence to support its modeling analysis and to better assess the likelihood of attainment. EPA will review all of the evidence and make its determination as to the likelihood that the area will attain the ozone standard in the attainment year based on the entire “weight of evidence”(WOE). A WOE analysis must be included in the attainment demonstration when the modeling is deemed “inconclusive”. EPA’s guidance establishes the “inconclusive” range for 8-hour ozone modeling results at 82 ppb through 87 ppb for the required attainment year. If all predicted future design values for a State are less than 82 ppb, only a basic supplemental analysis is required to confirm the outcome of the modeling. Since the highest modeled design value for 2009 in Rhode Island is 81 ppb, Rhode Island falls into the latter category, and only a basic supplemental analysis is required.

5.19.1 Air Quality Trends

Figure 5-11 displays Rhode Island ozone design values from 2002-2007. For comparison, the predicted design values for the 2009 BOTW emission scenario were inserted on the chart. The graphs suggest that Rhode Island is on track to meet the ozone NAAQS (85 ppb) by 2009.

Figure 5-11: Design Value Trends for Rhode Island



5.19.2 Emission Trends

The principal precursors for ozone are NOx and VOCs. Substantial NOx and VOC emission reductions will take place between 2002 and 2009 in the OTR. Most of these reductions are associated with the NOx SIP Call, CAIR, federal on-road and non-road fuels, federal motor vehicle standards and state LEV (Low Emission Vehicle) programs, federal MACT rules, 2001 OTC model rules for consumer products, architectural coatings, distributed generation and many state-specific rules in effect by 2009. In addition to these reductions, new 2006 OTC recommended control measures previously discussed in Section 11 (BOTW emission scenario) will provide for additional reductions by 2009. Finally, on-road and non-road federal motor vehicle control measures will provide substantial additional reductions between 2009 and 2012.

MANE-VU state emission inventory totals for 2002 and 2009 are shown in Table 5-13. NOx and VOC emissions for MANE-VU states (which include all of OTR states except for Virginia) trend downward between 2002 and 2012. Rhode Island's annual NOx and VOC emissions are estimated to go down by 26% and 22%, respectively, between 2002 and 2009. Similar emission reductions are taking place in states upwind of Rhode Island. NOx and VOC emissions in Connecticut, New York and New Jersey are estimated to go down by 33% and 24%, respectively, in that time period. .

Table 5-13: MANE-VU Anthropogenic Emissions for 2002 and 2009

	NOx			VOC		
	2002 (tpy)	**2009 (tpy)**	**% decrease**	**2002 (tpy)**	**2009 (tpy)**	**% decrease**
Connecticut	125,208	82,139	34	162,492	122,353	25
Delaware	58,764	49,658	15	41,120	32,109	22
District of Columbia	15,389	10,433	32	14,893	10,403	30
Maine	94,932	60,201	37	166,501	141,619	15
Maryland	283,387	147,710	48	265,220	205,097	23
Massachusetts	276,530	180,391	35	294,703	229,386	22
New Hampshire	67,326	44,339	34	111,333	94,330	15
New Jersey	303,053	185,314	39	378,877	285,559	25
New York	655,774	456,457	30	921,593	710,567	23
Pennsylvania	806,061	518,109	36	594,355	477,042	20
Rhode Island	29,418	21,900	26	57,200	44,612	22
Vermont	28,290	17,793	37	50,461	43,063	15
Total	**2,744,133**	**1,774,443**	**35**	**3,058,749**	**2,396,138**	**22**

5.19.3 Extra Ozone Reductions

Rhode Island will be in monitored attainment of the 8-hour ozone NAAQS if design values at all three of the State's monitors are 84 ppb or less in 2009. The model predicts design values for that year that are significantly below that target (80 ppb for W. Greenwich, 77 ppb for E. Providence and 81 ppb for Narragansett). This provides a margin of safety for attaining the standard, even if monitored values are somewhat higher than those predicted by the model.

5.20 Conclusions

The above attainment demonstration demonstrates that reductions in ozone precursor emissions in Rhode Island and upwind of Rhode Island will result in statewide attainment of the 8-hour ozone NAAQS by 2009. The attainment demonstration was based on SIP-quality CMAQ ozone modeling results for 2002 and 2009. The attainment demonstration consisted of choosing a base year (2002) to test model performance and then rerunning the model using a future year emission scenario (2009) in order to determine the predicted reductions in ozone calculated levels in and downwind of Rhode Island.

The 2002 ozone season was selected as the base year for OTR attainment demonstrations because a significant number of exceedance days were recorded that year over the eastern United States. A multi-year review of elevated ozone days in the OTR indicted that meteorological regimes associated with high ozone levels also occurred during 2002. In other words, 2002 meteorology contained a good set of meteorological conditions for testing the effectiveness of ozone control strategies. The 2002 CMAQ model run results indicated that the CMAQ model was performing adequately and was acceptable for simulating future year emission scenarios in and downwind of Rhode Island.

In 2006, all states in the OTR modeling domain prepared future year emission inventories for 2009 by applying growth and control measures to 2002 base year emission inventories. The control measures reflected controls programs that were already on the way and in effect by 2009. These emission inventories, referred to as “on the way” emission inventories, reflect the NOx SIP Call and CAIR requirements, federal on-road and non-road fuels, federal motor vehicle standards and state LEV (Low Emission Vehicle) programs, 2001 OTC model rules for consumer products, architectural coatings, distributed generation and any other state-specific rules in effect by 2009. In addition, OTC states prepared a “beyond on the way” (BOTW) emission inventory for selected non-EGUs and nonpoint sources in the OTR. The BOTW emissions reflect new OTC 2006 model rules for several source categories in OTR states. The BOTW control measures were developed because preliminary ozone modeling efforts indicated additional controls would be needed to attain the 8-hour ozone NAAQS in portions of the OTR.

The CMAQ model was run using emission input files prepared for the 2009 emission scenario (“on the way” emissions throughout the OTR modeling domain and “beyond on the way” control measures in OTC states). The 2009 and 2002 modeling results were then compared to determine the percent reduction in ozone levels between 2002 and 2009. The percent reduction was applied to the 2002 ozone design value at each ozone monitoring location in the OTR in order to calculate a design value for 2009. The maximum 2009 design value in Rhode Island was 81 ppb, indicating that Rhode Island will attain the ozone NAAQS (85 ppb) with “on the way” control measures throughout the OTR modeling domain and “beyond on the way” control measures in OTC states.

Ozone air quality trends and ozone precursor trends also indicate that Rhode Island will be in attainment with the 8-hour ozone NAAQS. Based upon ozone modeling results, ozone air quality trends and ozone precursor trends, RI DEM expects that the State of Rhode Island will attain the 8-hour ozone NAAQS by 2009.

6.0 REASONABLY AVAILABLE CONTROL TECHNOLOGY (RACT)

6.1 Purpose of Section

The CAA requires moderate and above ozone nonattainment areas to adopt rules that require Reasonably Available Control Technology (RACT) for applicable sources. To facilitate this process, EPA issued three sets of Control Techniques Guideline (CTG) and Alternate Control Techniques (ACT) documents, which delineate measures for controlling VOC and NOx emissions from stationary sources. Under the CAAA, RACT is required in moderate and above nonattainment areas for sources covered by a CTG and for non-CTG major sources. RI DEM demonstrated in its March 2003 attainment demonstration for the one-hour ozone NAAQS that Rhode Island had fulfilled that requirement.

The Phase 2 8-Hour Ozone Implementation rule requires states to assure that RACT continues to be met in nonattainment areas, either through a certification that previously adopted one-hour ozone SIP approved RACT controls represent RACT for 8-hour implementation purposes or through adoption of more stringent regulations consistent with RACT. In this section RI DEM is certifying that all RACT measures adopted and in effect in Rhode Island pursuant to the 1-hour ozone standard continue to constitute RACT under the 8-hour ozone standard, except for the following categories: solvent metal degreasing and asphalt paving. For these categories, RI DEM has concluded that RACT measures previously adopted no longer constitute RACT and is committing to promulgate revised regulations that will further reduce emissions from applicable sources. Rhode Island RACT source categories and point sources for which source-specific RACT determinations have been made are listed in Tables 6-1 and 6-2.

6.2 1-Hour Ozone Standard RACT

6.2.1 Pre-1990 VOC RACT Requirements

Prior to the 1990 CAAA, RACT requirements were governed by CAA Section 172(c), which provides that non-attainment areas must implement ... "all reasonably available control measures [RACM]...including such reductions in emissions from existing sources in the area as may be obtained through the adoption ... of reasonably available control technology [RACT]." EPA defined RACT as "the lowest emission limit that a polluting source is capable of meeting if it uses pollution control equipment and/or material or process changes that are reasonably available considering costs and current technology." (44 FR 53762, September 17, 1979)

To assist states with implementation of RACT, EPA issued Control Technique Guidelines (CTGs) for several categories of VOC sources.[15] CTGs establish a ``presumptive norm" for RACT for the VOC source category addressed. Some CTGs cover only major[16] sources of VOC

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[15]. Prior to the 1990 CAA Amendments, EPA issued three sets of CTG documents: Group 1: 15 CTGs issued before January 1978; Group 2: 9 CTGs issued in 1978; and Group III: 5 CTGs issued in the early 1980s. (A list of all CTGs, as compiled by EPA, is in Table 6-1.)

[16]. The emission threshold for a major source varies. Prior to the 1990 CAA Amendments, major VOC sources were those with a potential to emit $\geq$100 tons of VOCs per year. After the 1990 Clear Air Act amendments, major source thresholds for VOC and NOx were tied to a non-attainment areas classification and whether the state is located

emissions. Other CTGs apply at thresholds below the major source level. In addition, states were required to adopt RACT controls for all major sources of VOCs, whether or not they were within a CTG source category.

6.2.2 1990 CAA Amendments (CAAA)

The 1990 CAAA made the general Section 172 RACT requirements more specific. Amendments to section 182(a)(2)(A) required that ozone non-attainment areas classified as marginal or above "fix" any deficient VOC RACT rules by May 1991. A new provision, Section 182(f), required states to adopt RACT for all major stationary NOx sources. Amendments to Section 184, which addresses control of ozone in an Ozone Transport Region, lowered the major source applicability threshold of RACT for states within the OTR from sources with a potential to emit 100 tons of VOC per year to sources with a potential to emit 50 tons per year.

To assist states with NOx RACT implementation, EPA issued Alternative Control Technology Documents (ACTs), which provide analyses of the reductions that can be achieved with various controls at various levels of stringency, and the costs per ton to achieve those levels of control. Unlike CTGs, ACTs do not establish a presumptive RACT level of control.

6.2.3 Rhode Island 1-Hour RACT Compliance

During the late 1970s and the 1980s, RI DEM adopted and from time-to-time amended Air Pollution Control (APC) regulations which limited emissions from VOC sources consistent with EPA's pre-1990 CTGs. Those regulations include: APC Regulation No. 11, "Petroleum Liquids Marketing and Storage," No. 18 (later superseded by APC Regulation No. 36), "Control of Organic Solvent Cleaners," No. 19, "Control of Volatile Organic Compounds from Surface Coating Operations," and No. 21, "Control of Volatile Organic Compound Emissions from Printing Operations." EPA approved these regulations as meeting RACT and incorporated them into the Rhode Island ozone SIP.[17]

The CTGs issued by EPA and the Rhode Island regulation that was adopted to meet the presumptive level of RACT established in the CTG for RACT is listed in Table 6-1. If there were no facilities within a CTG source category in the State, RI DEM submitted a "negative declaration" to EPA. The negative declaration categories are also listed in Table 6-1.

For major sources not in a CTG category, RI DEM adopted APC Regulation No. 15, "Control of Organic Solvent Emissions," which requires RACT controls for major non-CTG sources through single-source RACT SIPs. EPA approved RI DEM's single-source RACT determinations pursuant to APC Regulation No. 15 as part of the Rhode Island SIP. The facilities subject to single-source RACT agreements are listed in Table 6-2.
The 1990 CAAA required states to adopt "fix up" and "catch up" measures to ensure that all areas classified as moderate or above nonattainment areas are subject to requirements equivalent

within an ozone transport region. In Rhode Island, sources that have the potential to emit at least 50 tons per year of VOC or NOx are considered major sources.

[17] See 40 CFR 52.2062 for a complete list of the EPA-approved Rhode Island SIP revisions, including those related to RACT regulations and determinations.

to those specified in the CTGs and to reduce the non-CTG RACT major source applicability threshold form 100 tons to 50 tons of VOC emissions per year. To comply with these requirements, RI DEM adopted or amended the following regulations: APC Regulation No. 15, "Control of Organic Solvent Emissions," No. 19, ``Control of Volatile Organic Compounds from Surface Coating Operations," No. 21, "Control of Volatile Organic Compound Emissions from Printing Operations," No. 25, ``Control of Volatile Organic Compound Emissions from Cutback and Emulsified Asphalt," and No. 26, ``Control of Volatile Organic Compound Emissions from Manufacture of Synthetic Pharmaceutical Products," No. 30, "Control of VOCs from Automotive Refinishing Operations," No. 35, "Control of VOC and Volatile Hazardous Air Pollutants from Wood Products Manufacturing Operations" and No. 36, "Control of Emissions from Organic Solvent Emissions." These amended and new regulations were submitted to the EPA and approved as amendments to the SIP (see dates in Table 6-1).

To address the 1990 CAAA NOx RACT requirement, RI DEM adopted APC Regulation No. 27, "Control of Nitrogen Oxide Emissions," on February 1, 1994. That regulation, which required sources which have the potential to emit 50 tons or more per year of NOx to submit RACT plans, was approved by EPA as a SIP revision in 1997 (62 FR 42602). RACT plans prepared to comply with this requirement were submitted as single-source SIP revisions and are listed in Table 6-2.

Rhode Island has adopted all RACT rules and submitted all RACT determinations necessary to comply with 1-hour ozone standard RACT requirements.

6.3 8-Hour Ozone Standard RACT Requirements

6.3.1 Required Analysis

EPA's Phase 2 Rule states that:

> Where a State has adopted, and EPA has approved, a control measure as RACT for a specific major stationary source or source category for the 1-hour ozone NAAQS and absent data indicating that the previous RACT determination is no longer appropriate, the State may submit a certification that the source is subject to a SIP-approved RACT requirement (70 FR 71652).

Subsequent to the issuance of the Phase 2 Rule, EPA developed a set of questions and answers (Q&A) to further explain 8-hour ozone standard RACT SIP requirements. The Q&A document states that, in order for a state to certify that previously required RACT controls or newly applied controls represent RACT for 8-hour ozone standard purposes, a state should evaluate RACT for a source or source category by examining EPA guidance and other information. When a state concludes that the existing level of control is RACT and that no control is required beyond what was required for the 1-hour standard, it must submit its conclusions in its RACT SIP.

The state may address RACT through adoption of rules, submission of permits or through negative declarations stating that there are no sources subject to RACT. If the state determines that additional controls are needed to meet 8-hour ozone standard RACT requirements, the controls must be made federally enforceable through a SIP revision. Any new RACT requirements must be implemented no later than May 1, 2009.

As required by the Phase 2 Rule, RI DEM has reviewed its current RACT requirements. It has determined that VOC controls previously adopted as RACT for CTG source categories and non-CTG major sources still constitute RACT for 8-hour ozone standard purposes, except for two source categories - solvent metal degreasing and asphalt paving. It has also determined that RACT controls adopted for major sources of NOx continue to constitute RACT. RI DEM has, therefore, certified in Tables 6-1 and 6-2 that its current RACT requirements are consistent with 8-hour RACT, except for the categories of solvent metal degreasing and asphalt paving. RI DEM is committing to submit revisions to the regulations for solvent metal degreasing and asphalt paving (APC Regulations No. 36 and 25, respectively) by January 1, 2009 and that the amended regulations will be effective by April 1, 2009.

6.4 VOC RACT Analysis

6.4.1 CTGs

As noted under the 1-hour RACT discussion, a state regulation imposing VOC controls that met EPA's presumptive CTG control levels met 1-hour RACT requirements. Table 6-1 lists the VOC source categories for which EPA issued CTGs and the corresponding RI DEM APC regulation for each of these categories. For all CTG categories for which there are applicable sources in Rhode Island, RI APC regulations either incorporated the CTG recommended controls or achieved a level of control equivalent to those specified in the CTGs and were, as such, approved by EPA as meeting 1-hour RACT. Note that Regulations No. 11 and 25 were amended in 2001 to update control requirements. Those amendments were submitted to the EPA in January 2001 but have not as yet been approved as SIP revisions. Note also that virtually all of the APC regulations were modified in 2007; these modifications were primarily administrative in nature, e.g. the removal of the definitions of certain terms previously defined in more than one regulation to a separate definitions regulation. The updated versions of these regulations will be submitted as SIP revisions to the EPA in 2008.

RI DEM has reviewed the APC regulations for all sources subject to CTGs and has determined that, with two exceptions, the levels of control required by these regulations continue to constitute VOC RACT under the 8-hour ozone standard. Pursuant to the requirement of the Phase 2 Rule, RI DEM certifies in Table 6-1 that the level of control in the current regulatory requirements for all CTG categories for which there are Rhode Island sources except solvent metal degreasing and asphalt paving are consistent with 8-hour RACT.

Table 6-1 also lists the CTG categories for which there are no Rhode Island sources; RI DEM is making a negative declaration for those CTG categories. In making this determination, RI DEM reviewed its 2002 stationary point source inventory database for facilities with North American Industrial Classification System (NAICS) codes that correspond to the CTG categories and consulted relevant inspection and permitting records.

6.4.2 New CTGs

In October 2006, EPA adopted new CTGs for the following five source categories: Lithographic Printing Materials, Letterpress Printing Materials, Flexible Packaging Printing Materials, Flat Wood Paneling Coatings and Industrial Cleaning Solvents. (71 FR 58745, October 5, 2006) States are required to submit SIP revisions incorporating requirements of a new CTG for which there are sources in the state within one year of EPA's promulgation of the final CTG.

RI DEM has identified one source in Rhode Island that is subject to the Flat Wood Paneling CTG. The coating lines at that facility received preconstruction permits from RI DEM in 2000. Although the emissions limits established in that permit reflected Best Available Control Technology (BACT) at that time, they are not as stringent as those recommended in the CTG. Therefore, RI DEM is committing to revise APC Regulations No. 19, "Control of Volatile Organic Compounds from Surface Coating Operations," and Regulation No. 35, "Control of Volatile Organic Compounds and Volatile Hazardous Air Pollutants from Wood Products Manufacturing Operations," to make the requirements for flat wood paneling sources in Rhode Island consistent with the provisions of the 2006 Control Technique Guideline. These amendments will be submitted to the EPA as a SIP revision by January 1, 2009 and will be effective by April 1, 2009.

The CTG for Industrial Cleaning Solvents contains VOC content, operations and equipment requirements for all industrial cleaning categories and operations[18] that have VOC emissions of at least 15 lb/day. The requirements in APC Regulation No. 36 are, for the most part, consistent with the requirements in the new CTG, with the exception of a solvent vapor pressure limit for cold cleaners, which is in the CTG but not in Regulation No. 36. RI DEM plans to amend APC Regulation No. 36 to include that requirement. With that amendment, the requirements in APC Regulation No. 36 will be consistent with the new CTG. That amendment will be submitted to the EPA as a SIP revision by January 1, 2009 and will be effective by April 1, 2009. This source category is discussed further in Section 6.6.1.

RI DEM has not yet determined whether its existing regulations include controls that are equivalent to the new CTGs for the three printing categories. RI DEM plans to survey potentially applicable sources in these categories in the first quarter of calendar year 2008 to define the universe of sources applicable to these CTGs in the State and to determine, in consultation with the EPA, whether the existing Rhode Island regulations provide for controls equivalent to those specified in the new CTGs. If deficiencies are identified, RI DEM will amend its existing regulations to ensure that requirements for sources in those categories meet the presumptive RACT limits established in these new CTGs Amended regulations, if needed, will be submitted to the EPA as a SIP revision by January 1, 2009 to be effective by April 1, 2009.

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[18] EPA states that all operations evaluated to date by EPA can be categorized under one of the nine "Unit Operations" (UO) identified in the CTG: Spray Gun Cleaning; Spray Booth Cleaning; Large Manufactured Components Cleaning; Parts Cleaning; Equipment Cleaning; Line Cleaning; Floor Cleaning; Tank Cleaning; and Small Manufactured Components Cleaning.

On October 9, 2007, EPA issued new CTGs for the following source categories: paper, film, and foil coatings; metal furniture coatings, and large appliance coatings. RI DEM will analyze the CTGs to determine whether there are applicable sources in Rhode Island and will amend its regulations as necessary so that control requirements for applicable Rhode Island source categories are consistent with those in the CTG. All regulatory amendments will be submitted to the EPA as SIP revisions by January 1, 2009 to be effective by April 1, 2009.

6.4.3 Non-CTG Major VOC Sources

As previously discussed, States must require RACT controls for all non-CTG major VOC sources. APC Regulation No. 15, "Control of Organic Solvent Emissions," established requirements for major facilities not covered by a CTG. RACT specifications for each such facility are delineated in an emission control plan specific to that facility. RI DEM issued a number of single-source RACT determinations pursuant to APC Regulation No. 15. The single-source VOC RACT determinations, which were approved by EPA as part of the Rhode Island SIP, are listed in Table 6-2 along with the date of approval and the current status of the facility. For facilities that are still operating, RI DEM has concluded that the controls specified in the single-source agreements constitute RACT under the 8-hour standard.

6.5 NOx RACT Analysis

RI DEM's APC Regulation No. 27, "Control of Nitrogen Oxide Emissions," requires RACT for stationary sources emitting 50 or more tons per year of NOx. The regulation includes specific emissions limits for utility boilers, industrial-commercial-institutional boilers and internal combustion engines and requires all applicable sources to submit RACT plans to RI DEM which, after review, are incorporated into an enforceable agreement. The enforceable agreement is then submitted to the EPA as a single-source RACT determination. Single-source NOx RACT determinations issued by RI DEM pursuant to APC Regulation No. 27 and submitted to the EPA as source-specific SIP revisions are listed in Table 6-2. RI DEM certifies that APC Regulation No. 27 and the single-source NOx RACT SIP revisions listed in Table 6-2 are consistent with RACT requirements for the 8-hour ozone NAAQS.

In addition to the requirements in APC Regulation No. 27, electric generation units (EGUs) and large industrial boilers in Rhode Island are also subject to APC Regulation No. 41, "NOx Budget Trading Program," which caps emissions of NOx from covered sources for the 2003 through 2008 ozone seasons. This regulation was adopted in 1999 to meet the requirements of EPA's NOx SIP Call (63 CFR 61712). EPA's Phase 2 Rule provides that compliance with the NOx SIP Call, regardless of the manner of compliance by individual sources (e.g. control equipment installation or purchase of allowances from other sources), constitutes RACT. States need not submit 8-hour RACT analyses for sources in compliance with a SIP meeting the NOx SIP Call. EPA determined that the Rhode Island NOx Budget Program met the NOx SIP Call and approved it as part of the Rhode Island 1-hour Ozone SIP. Therefore, RI DEM certifies that all NOx sources regulated by APC Regulation No. 41 meet 8-hour ozone RACT requirements for 2003 - 2008.

These sources and the NOx allowances allocated to each source in APC Regulation No. 41 for the control periods (May 1 – September 30) in 2003 through 2008 are as follows:

Ocean State Power	275 tons
Pawtucket Power	42 tons
Manchester Street	262 tons
Tiverton Power	46 tons
Rhode Island State Energy Center	52 tons
Total allocation:	677 tons

The quantity of allowances allocated to each of the above sources is equal to the potential to emit for that source for the control period. Therefore for 2009 and beyond the nitrogen oxides emissions from the five existing power plants cannot exceed the 677 ton cap that had been in place from the NO_x Budget Trading program.

These five power plants are the only sources in Rhode Island that are subject to the NO_x Budget Trading Program. No new EGUs have been permitted since the promulgation of APC Regulation No. 41. RI DEM has not yet determined how it will regulate new sources to ensure that NO_x SIP call requirements continue after 2008.

As discussed in Section 5.11.2, the OTC identified potential additional control measures for ICI boilers at major sources in its February 2007 document entitled "Identification and Evaluation of Candidate Control Measures, Final Technical Support Document," which is attached as Appendix 5k. RI DEM examined the OTC recommendations and determined that adoption of additional controls for that source category would yield minimal emissions reductions in Rhode Island and are not cost effective. The OTC estimated in the above document that implementation of its recommended ICI boiler control measures would reduce summer day NOx emissions in Rhode Island by 0.5 tons. Almost all of the ICI boilers located at major sources in Rhode Island are currently equipped with low-NO_x burners with flue gas recirculation. Replacing that equipment to meet the recommended OTC limits would require the facilities to incur substantial expenses while only marginally reduce emissions. Such a requirement would also create a substantial administrative burden for RI DEM with minimal effect. Therefore, it is not economically reasonable to require this measure in Rhode Island.

6.6 RACT Revisions

RI DEM has determined that its existing solvent metal degreasing and asphalt paving regulations do not constitute RACT under the 8-hour ozone standard and will revise its regulations for these categories to require additional VOC controls, as discussed below.

6.6.1 Solvent Degreasing

The CTG covering solvent metal degreasing applies to units that clean/degrease metal in three types of systems - cold cleaning, open top vapor degreasers and conveyorized degreasers. The control measures specified in the CTG for this sector are largely equipment and operating practice specifications rather than emission limits. APC Regulation No. 36 is consistent with, or more stringent than, those requirements.

However, APC Regulation No. 36 does not include vapor pressure limits on solvents used in cold cleaning consistent with the CTG and with the model rule for this source category developed by OTC and adopted by several OTC states. Therefore, RI DEM has determined that APC Regulation No. 36 is not currently consistent with RACT and is committing to amend that regulation accordingly. The amendment will be submitted to the EPA as a SIP revision by January 1, 2009 and will be effective by April 1, 2009. With this revision, Rhode Island will meet 8-hour RACT control requirements for this source category.

6.6.2 Asphalt Paving

Asphalt paving is used to pave, seal and repair surfaces such as roads, parking lots, and walkways. Asphalt paving is grouped into three general categories: hotmix, cutback, and emulsified. Hot-mix asphalt, the most commonly used paving asphalt, produces minimal VOC emissions. Cutback asphalt is prepared by blending asphalt cement with a diluent, typically from 25 to 45 percent by volume of petroleum distillates. Emulsified asphalt is a lower emitting alternative to cutback asphalt; emulsified asphalts use a blend of asphalt cement, water and an emulsifying agent, such as soap. Some emulsified asphalts may contain virtually no VOCs; others may contain up to 12% VOC by volume.

The EPA published a CTG for the use of cutback asphalt in December 1977. The CTG recommended replacing cutback asphalt binders with emulsified asphalt during the ozone season. In 1979, EPA added a specification for emulsified asphalt to the CTG recommendations to limit the content of oil distillate in emulsified asphalt to no higher than 7 percent oil distillate. APC Regulation No. 25, "Control of Volatile Organic Compound Emissions from Cutback and Emulsified Asphalt," which was adopted in November 1992, contains requirements that are at least as stringent as those in the CTG for this source category and which met 1-hour RACT. It bans the use of cutback asphalt during the ozone season, but with a number of exceptions, and limits the VOC content of emulsified asphalt to 3 – 12%, depending on the type of application. .

During its review of additional control measures that states should consider adopting as part of the OTC regional 8-hour ozone attainment strategy, the OTC identified asphalt paving as a category where further VOC emission reductions could be achieved. It developed a model rule for this source category that prohibits the use of cutback asphalt during the ozone season and limits the use of emulsified asphalt to that which contains not more than 0.5 mL of oil distillate from a 200 mL sample (as determined using American Society for Testing and Materials Methods) regardless of application. This is equivalent to a VOC content of 0.25 percent.

RI DEM will propose an amendment to APC Regulation No. 25 to eliminate all exceptions to the ozone season ban on use of cutback. It will also propose to limit the VOC content of emulsified asphalt to the level proposed in the OTC model rule, or to the most stringent level that is determined to be feasible in Rhode Island. Upon completion of this rule amendment process, Rhode Island will meet 8-hour RACT control requirements for this source category. RI DEM will submit the amended regulation to the EPA as a SIP revision by January 1, 2009. The revised requirements will be effective by April 1, 2009.

6.6 Conclusions

By complying with 1-hour ozone standard RACT requirements, emissions of VOCs and NOx from stationary point and nonpoint sources have decreased significantly over the past 30 years. In order to meet the 8-hour ozone standard RACT requirements, RI DEM is committing to further reduce VOC emissions for the source categories solvent metal degreasing and asphalt paving by adopting revised regulations that will be submitted as SIP revision to the EPA by January 1, 2009 with an effective date no later than April 1, 2009.

RI DEM intends to review the three printing CTGs finalized by EPA in October 2006 and, if necessary, to propose new regulatory requirements for these source categories. Amendments would be submitted to the EPA as SIP revisions by January 1, 2009 and would be effective by April 1, 2009. RI DEM will also review the CTGs for paper, film and foil coating, metal furniture coating and large appliance coating issued in October 2007 and, if applicable, submit appropriate SIP revisions relative to these source categories by January 1, 2009 with any amended control requirements effective on April 1, 2009. For each CTG for which RI DEM determines that are not applicable in Rhode Island, RI DEM will submit a negative declaration.

With respect to all other CTG RACT categories and major non-CTG sources of VOC and NOx emissions, RI DEM certifies that current RACT controls, as adopted and approved by EPA under the 1-hour ozone standard, constitute RACT under the 8-hour ozone standard.

Table 6-1 RI DEM 1-hour Ozone Standard RACT Regulations and 8-Hour Ozone Standard RACT Certification

EPA Control Technology Guidelines (CTGs)	Corresponding RI DEM APC Regulation	Most Recent SIP Approval of APC Regulation	Date APC Regulation Last Amended	RI DEM Certification: 8-hour Ozone Standard RACT
Pre-1990 CTGs: Group 1				
1. Stage I Vapor Control Systems (1975)	Regulation No. 11, "Petroleum Liquids Marketing and Storage"	2/17/93, 58 FR 65933 (1/31/93 version of regulation)	7/18/07	Current regulation meets 8-hour RACT
2. Surface Coating of Cans, Coils, Paper, Fabrics, Automobiles, and Light-duty trucks (1977)	Regulation No. 19, "Control of Volatile Organic Compounds form Surface Coating Operations"	12/2/99, 64 FR 67495 (3/7/96 version of regulation)	.7/18/07	Current regulation meets 8-hour RACT for all categories with sources in RI. There are no applicable can, automobile or truck surface coaters in RI.
3. Refinery Vacuum Producing Systems, Wastewater Separators, and Process Unit Turnarounds (1977)	Negative Declaration			There are no applicable sources in RI
4. Solvent Metal Cleaning (1977)	Regulation No. 36, "Control of Emissions from Organic Solvent Cleaning" (superseded Regulation No. 18 in 1996)	12/2/99, 64 FR 67495 (4/18/96 version of regulation)	7/18/07	RI DEM commits to revise Regulation No. 36 to incorporate a solvent vapor pressure limit of 1.0 mm Hg to meet 8-hour RACT.
5. Tank Truck Gasoline Loading Terminals (1977).	Regulation No. 11, "Petroleum Liquids Marketing and Storage"	2/17/93, 58 FR 65933 (1/31/93 version of regulation)	7/18/07	Current regulation meets 8-hour RACT
6. Surface Coating Metal Furniture (1977)	Regulation No. 19, "Control of Volatile Organic Compounds form Surface Coating Operations"	12/2/99, 64 FR 67495 (3/7/96 version of regulation)	. 7/18/07	Current regulation meets 8-hour RACT

EPA Control Technology Guidelines (CTGs)	Corresponding RI DEM APC Regulation	Most Recent SIP Approval of APC Regulation	Date APC Regulation Last Amended	RI DEM Certification: 8-hour Ozone Standard RACT
7. Surface Coating Magnet Wire (1977)	Regulation No. 19, "Control of Volatile Organic Compounds form Surface Coating Operations"	12/2/99, 64 FR 67495 (3/7/96 version of regulation)	. 7/18/07	Current regulation meets 8-hour RACT
8. Surface Coating Large Appliances (1977)	Regulation No. 19, "Control of Volatile Organic Compounds form Surface Coating Operations"	12/2/99, 64 FR 67495 (3/7/96 version of regulation)	. 7/18/07	Current regulation meets 8-hour RACT
9. Bulk Gasoline Plants (1977)	Regulation No. 11, "Petroleum Liquids Marketing and Storage"	2/17/93, 58 FR 65933 (1/31/93 version of regulation)	7/18/07	Current regulation meets 8-hour RACT
10. Fixed Roof Petroleum Tanks (1977)	Regulation No. 11, "Petroleum Liquids Marketing and Storage"	2/17/93, 58 FR 65933 (1/31/93 version of regulation)	7/18/07	Current regulation meets 8-hour RACT
11. Use of Cutback Asphalt (1977)	Regulation No. 25, "Control of VOC Emissions from Cutback and Emulsified Asphalt	12/2/99, 64 FR 67495 (4/8/96 version of regulation)	7/18/07	RI DEM will submit amendments to Regulation No. 25 by 1/1/09 to be effective by 4/1/09. Amended regulation will meet 8-hour RACT.
Pre-1990 CTGs: Group II				
12. Surface Coating Misc. Metal Parts (1978)	Regulation No. 19, "Control of Volatile Organic Compounds form Surface Coating Operations"	12/2/99, 64 FR 67495 (3/7/96 version of regulation)	. 7/18/07	Current regulation meets 8-hour RACT
13. Surface Coating Flat Wood Paneling (1978)	Regulation No. 19, "Control of Volatile Organic Compounds form Surface Coating Operations"	12/2/99, 64 FR 67495 (3/7/96 version of regulation)	. 7/18/07	RI DEM will submit amendments to Regulations No.19 and 35 by 1/1/09 to be effective by 4/1/09 in response to 2006 CTG. Amended regulation will meet 8-hour RACT

EPA Control Technology Guidelines (CTGs)	Corresponding RI DEM APC Regulation	Most Recent SIP Approval of APC Regulation	Date APC Regulation Last Amended	RI DEM Certification: 8-hour Ozone Standard RACT
14. Leaks from Petroleum Refinery Equipment (1978)	Negative Declaration		.	There are no applicable sources in RI
15. Manufacture of Synthetic Pharmaceutical Product (1978)	Regulation No. 26, "Control of Organic Solvent Emissions from Manufacture of Synthesized Pharmaceutical Products"	12/2/99, 64 FR 67495 (4/8/96 version of regulation)	7/18/07.	Current regulation meets 8-hour RACT
16. Manufacture of Pneumatic Rubber Tires (1978)	Negative Declaration			There are no applicable sources in RI
17. Graphic Arts – Rotogravure & Flexography (1978)	Regulation No. 21, "Control of Volatile Organic Compounds from Printing Operations:	12/2/99, 64 FR 67495 (4/8/96 version of regulation)	7/18/07.	Current regulation meets 8-hour RACT
18. Petroleum Storage in External Floating Roof Tanks (1978)	Regulation No. 11, "Petroleum Liquids Marketing and Storage"	2/17/93, 58 FR 65933 (1/31/93 version of regulation)	7/18/07	Current regulation meets 8-hour RACT
19. Perchloroethylene Dry Cleaning Systems (1978)	Regulation No. 23, "Control of Perchloroethylene Emissions from Dry Cleaning Operations"		7/18/07.	No certification required. Perchloroethylene has been delisted as a VOC.
20. Leaks from Gasoline Tank Trucks and Vapor Collection System (1978)	Regulation No. 11, "Petroleum Liquids Marketing and Storage"	2/17/93, 58 FR 65933 (1/31/93 version of regulation)	7/18/07	Current regulation meets 8-hour RACT
Pre-1990 CTGs: Group III				
21. Large Petroleum Dry Cleaners (1982)	Negative Declaration		.	There are no applicable sources in RI
22. Manufacture of High-Density Polyethylene, Polypropylene and Polystyrene Resins (1983)	Negative Declaration			There are no applicable sources in RI

EPA Control Technology Guidelines (CTGs)	Corresponding RI DEM APC Regulation	Most Recent SIP Approval of APC Regulation	Date APC Regulation Last Amended	RI DEM Certification: 8-hour Ozone Standard RACT
23. Natural Gas/Gasoline Process Leaks (1983)	Negative Declaration			There are no applicable sources in RI
24. Synthetic Organic Chemical Mfg Equipment Fugitive Emissions (1984)	Negative Declaration	12/2/95, 64 FR 67495 (submitted 4/5/95)		There still are no applicable sources in RI
25. Synthetic Organic Chemical Mfg Air Oxidation Processes (1984)	Negative Declaration	12/2/95, 64 FR 67495 (submitted 4/5/95)		There still are no applicable sources in RI
Post-1990 CTGs				
1. Synthetic Organic Chemical Manufacturing Industry (SOCMI) Distillation Operations and Reactor Processes (1993)	Negative Declaration	12/2/95, 64 FR 67495 (submitted 4/5/95)		There still are no applicable sources in RI
2. Wood Furniture Manufacturing (1996)	Regulation No. 35, "Control of VOCs and Volatile Hazardous Air Pollutants from Wood Products Manufacturing Operations"	12/2/99, 64 FR 67495 (7/7/96 version of regulation)	7/18/07	Current regulation meets 8-hour RACT
3. Ship Building and Repair (1996)				2 applicable sources (Senesco and General Dynamics), both subject to federally enforceable permit limits consistent with CTG- Senesco: Approval Nos.1991-93, General Dynamics: Approval No. 1882 and Title V Permit No. RI 32-03.
4. Aerospace Coatings (1996 draft)	Negative Declaration	7/10/00, 65 FR 42290 (submitted 3/28/00)		There still are no applicable sources in RI

EPA Control Technology Guidelines (CTGs)	Corresponding RI DEM APC Regulation	Most Recent SIP Approval of APC Regulation	Date APC Regulation Last Amended	RI DEM Certification: 8-hour Ozone Standard RACT
5. Flat Wood Paneling (2006)				RI DEM will submit amendments to Regulations No. 19 and 35 as a SIP revision by 1/1/09; amendments will be effective by 4/1/09. Amended regulation will meet 8-hour RACT.
6. Industrial Cleaning Solvents (2006)	RI DEM intends to propose amendments to Regulation No. 36, "Control of Emissions from Organic Solvent Cleaning." The amended regulation will be consistent with the 2006 CTG.			RI DEM will submit amendments to Regulation No. 36 as a SIP revision by 1/1/09; amendments will be effective by 4/1/09. Amended regulation will meet 8-hour RACT.
7. Lithographic print materials (2006)	RI DEM will survey sources that may be applicable to this CTG and, if necessary, to amend APC Regulation No. 21 to be consistent with the CTG			Survey will be sent to printers by 4/15/08. If it is determined that it is necessary, regulations will be submitted as SIP revisions by 1/1/09 to be effective by 4/1/09.
8. Letterpress printing materials (2006)	See #7.			
9. Flexible packaging printing materials (2006)	See #7.			
NOx RACT Categories				
EPA's NOx Achievable Control Technology (ACT) documents are listed below only to illustrate NOx RACT source categories. ACTs do	Regulation No. 27, "Control of Nitrogen Oxide Emissions," applies to all sources with a potential to emit ≥ 50 tons per year of	9/20/97, 62 FR 46202 (1/16/96 version of regulation)	.7/18/07	

EPA Control Technology Guidelines (CTGs)	Corresponding RI DEM APC Regulation	Most Recent SIP Approval of APC Regulation	Date APC Regulation Last Amended	RI DEM Certification: 8-hour Ozone Standard RACT
not establish presumptive levels of control; therefore RI DEM is not required to certify that RACT is consistent with the ACTs.	NOx, with certain exceptions. Applicability to an individual unit at a source is based on exceedance of a minimum capacity rating.			
1. Nitric and Adipic Acid Plants (1991)	Negative Declaration		.	There are no sources in RI
2. Combustion Turbines (1993)	Regulation No. 27, "Control of Nitrogen Oxide Emissions"	9/20/97, 62 FR 46202 (1/16/96 version of regulation)	.7/18/07	Current regulation meets 8-hour RACT
3. Process Heaters (1993)	Regulation No. 27, "Control of Nitrogen Oxide Emissions"	9/20/97, 62 FR 46202 (1/16/96 version of regulation)	.7/18/07	Current regulation meets 8-hour RACT
4. Internal Combustion Engines (1993)	Regulation No. 27, "Control of Nitrogen Oxide Emissions"	9/20/97, 62 FR 46202 (1/16/96 version of regulation)	.7/18/07	Current regulation meets 8-hour RACT
5. Utility Boilers (1994)	Regulation No. 27, "Control of Nitrogen Oxide Emissions" Regulation No. 41, "NOx Budget Trading Program"	9/20/97, 62 FR 46202 (1/16/96 version of regulation) 12/27/00, 65 FR 81743, (10/1/99 version of regulation	7/18/07 7/18/07	Current regulations meet 8-hour RACT.
6. Cement Manufacturing (1994, updated 2000)	. Negative Declaration		.	There are no sources in RI.
7. ICI Boilers (1994)	Regulation No. 27, "Control of Nitrogen Oxide Emissions"	9/20/97, 62 FR 46202 (1/16/96 version of regulation)	.7/18/07	Current regulation meets 8-hour RACT

EPA Control Technology Guidelines (CTGs)	Corresponding RI DEM APC Regulation	Most Recent SIP Approval of APC Regulation	Date APC Regulation Last Amended	RI DEM Certification: 8-hour Ozone Standard RACT
8. Glass Manufacturing (1994)	Regulation No. 27, "Control of Nitrogen Oxide Emissions"	9/20/97, 62 FR 46202 (1/16/96 version of regulation)	.7/18/07	Current regulation meets 8-hour RACT
9. Iron and Steel (1994)	Negative Declaration		.	There are no sources in RI.
10. Municipal Waste Combustors (no ACT)	Negative Declaration		.	There are no sources in RI.

Table 6-2 RI DEM Single Source 1-Hour Ozone Standard RACT Determinations and 8-Hour Ozone Standard RACT Certification

Single Source VOC RACT determinations were made for major VOC sources not covered by a CTG pursuant to APC Regulation No. 15.

Single Source NOx RACT determinations were made for major NOx sources pursuant to APC Regulation No. 27.

FACILITY	EPA Approval of Single-Source SIP Revision	Current Facility Status	Major for VOC or NOx?	Certification of 8-hour RACT	Comments
Keene Corp (Arlon)	8/31/87, 52 FR 32793	Closed	VOC	Not required	
Tech Industries	3/10/89, 54 FR 10145	Open	VOC	Current requirements meet 8-hour RACT.	
University of Rhode Island	9/20/97, 62FR 46202	Open	NOx	Current requirements meet 8-hour RACT.	
Providence Metalizing	9/6/90, 55 FR 36635	Open	VOC	Current requirements meet 8-hour RACT.	
Tillotson-Pearson (now Pearson Composites)	8/31/90, 55 FR 35623	Open	VOC	Current requirements meet 8-hour RACT.	Updated RACT Approval submitted as SIP revision on 6/18/03
Rhode Island Hospital	9/20/97, 62 FR 46202	Open	NOx	Current requirements meet 8-hour RACT	Updated requirements in Title V permit
Osram Sylvania	9/20/97, 62 FR 46202	Open	NOx	Current requirements meet 8-hour RACT	
Algonquin Gas Transmission Co.	9/20/97, 62 FR 46202	Open	NOx	Current requirements meet 8-hour RACT	
Bradford Dyeing Assoc.	9/20/97, 62 FR 46202	Open	NOx	Current requirements meet 8-hour RACT.	
Hoechst Celanese Corp. (now Clariant)	9/20/97, 62 FR 46202	Open	NOx	Current requirements meet 8-hour RACT.	Plant scheduled to close 12/08

Naval Education and Training Center	9/20/97, 62 FR 46202	Open	NOx	Current requirements meet 8-hour RACT.	Updated requirements in Title V permit.
Rhode Island Economic Development	6/02/99, 64 FR 29567	Closed	NOx	Not required	
Cranston Print Works	12/02/99, 64 FR 67495	Closed	VOC	Not required	
CCL Custom Mfg.	12/02/99, 64 FR 67495	Open	VOC	Current requirements meet 8-hour RACT.	Updated RACT Plan submitted as SIP revision 1/19/05.
Victory Finishing Technologies	12/02/99, 64 FR 67495	Open	VOC	Current requirements meet 8-hour RACT.	
Quality Spray and Stenciling	12/02/99, 64 FR 67495	Open	VOC	Current requirements meet 8-hour RACT.	
Guild Music	12/02/99, 64 FR 67495	Closed	VOC	Not required .	

7.0 REASONABLY AVAILABLE CONTROL MEASURES (RACM)

7.1 Purpose of Section

This section consists of an analysis to determine whether any reasonably available control measures (RACM) could be adopted in Rhode Island that would result in the State attaining the 8-hour ozone standard earlier than the required 2009 attainment date. Consistent with EPA guidance, RI DEM has examined potential control measures for point and nonpoint sources and potential Transportation Control Measures (TCMs) for mobile sources to determine whether such measures: 1) would provide emissions reductions sufficient to accelerate attainment; and 2) are feasible both economically and technically. RI DEM concludes that there are no control measures that could be adopted in Rhode Island that satisfy those RACM criteria.

7.2 RACM Analysis Criteria

Section 172(c)(1) of the CAAA requires that SIPs include RACM, as necessary, to provide for attainment as expeditiously as practicable, and that RACM include, at a minimum, reductions in emissions from existing sources as may be obtained from RACT. EPA's Phase 2 Rule provides that states must include a RACM analysis in their attainment demonstration SIPs.

EPA guidance[19] interpreting the RACM requirements of section 172(c)(1) provides that, for purposes of attainment demonstration SIPs, a potentially available control measure can be justified as not meeting RACM if the measure (a) is not technically or economically feasible, or (b) does not advance the attainment date for the area. EPA's guidance further provides that states may consider local conditions, including economic impacts and implementation issues, in rejecting potential control measures. EPA does not require that all sources apply RACM if less than all RACM will suffice for reasonable further progress and attainment and application of RACM will not advance the attainment date.

According to EPA modeling guidance, areas such as Rhode Island that have an attainment date of June 15, 2010 must implement the emission reductions needed for attainment no later than June 2009. Thus, to advance the attainment date, the potential RACM measures would have to achieve the emission reductions needed for attainment during the 2008 ozone season.

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[19] EPA Memorandum, "Guidance on the RACM Requirement and Attainment Demonstration Submissions for Ozone Nonattainment Areas", from John S. Seitz, EPA Director, Office of Air Quality Planning and Standards to the Regional Air Division Directors, November 1999. EPA Memorandum, "Additional Submission on RACM From States With Severe 1-hour Ozone Nonattainment Area SIPs", from John S. Seitz, EPA, Director Office of Air Quality Planning and Standards and Marge Oge, EPA Director, Office of Transportation and Air Quality, to Regional Air Division Directors, December 14, 2000.

66 Federal Register No. 2, January 3, 2001, Final Rule for Approval and Promulgation of Air quality Implementation Plans: Connecticut, 1-Hour Ozone Attainment Demonstration for the Greater Connecticut Ozone Nonattainment Area.

7.3 OTC Regional RACM Analysis

As discussed in Section 5, "Attainment Demonstration," the OTC conducted an extensive regional attainment planning process for the 8-hour ozone standard. That planning effort included an assessment of the nature and magnitude of the ozone problem in the region, a comprehensive review and analysis of potential additional controls within the OTC region, regional modeling under various control scenarios, and formal recommendations by the OTC to its member states to adopt selected control measures.

At the November 2004 OTC Meeting, the OTC directed its Stationary and Area Sources Committee to review programs to address emissions from all stationary point and nonpoint sources. At the same meeting, it directed the Mobile Source Committee to identify mobile source control measures for evaluation.[20] OTC staff compiled an initial list of over 1,000 candidate control measures identified through published sources such as EPA's Control Technique Guidelines, STAPPA/ALAPCO "Menu of Options" documents, emission control initiatives in other states including California, state/regional consultations, and stakeholder input.[21] From that list, workgroups comprised of OTC staff and member states' air quality staff eliminated measures that were not feasible because of technical, economic and/or implementation issues. The list was narrowed to approximately 50 candidate control measures that were considered to have the potential to advance ozone attainment in the OTC states.

These measures were subjected to more detailed analysis of the potential for reductions of VOCs or NOx, cost effectiveness, likelihood of implementation, and effectiveness in reducing ozone levels in the OTC region. After consideration of these criteria, the OTC Control Measures Workgroup identified the most promising candidates from the list of approximately 50 measures and developed separate Control Measures Summary Sheets for these measures. The Control Measure Summary Sheets are in Appendix 5K[22]. They provide they the following information for each measure:

1. A summary of potential additional controls for the sector.
2. A review of existing controls in OTC states and in other states (most often California).
3. A detailed description of the candidate control measures, including estimates of cost per ton of emissions reductions, estimate of reductions that could be achieved, time in which the measure could be implemented, and technical and implementation issues.
4. A rationale for the proposed strategy and a policy recommendation with respect to whether it should be adopted by the OTC as a recommendation to the states.

These Control Measures Summary Sheets are a product of the comprehensive review and analysis of OTC member states' staff with a wide range of expertise concerning the potential for

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[20] OTC Formal Actions related to the regional ozone planning process are available on the OTC website at http://www.otcair.org/document.asp?fview=Formal

[21] The initial list of control measures is on the OTC web site at http://www.otcair.org/document.asp?fview=Report# [21] under "Documents/OTC Reports/Control Measures 2007.

[22] All of the Control Measure Summary Sheets relate to controls for point and area sources, with the exception of Reformulated Gasoline, a mobile source control measure.

control measures for point and nonpoint sources. Iterations of the proposed control measures were made available to stakeholders who commented on the technical and economic feasibility of the various measures, the proposed timeframes for implementation and other issues. Frequently, the summary sheets were modified to reflect stakeholder comments. Thus, the Control Measures Summary Sheets are the outcome of a thorough analysis of the availability and feasibility of additional control measures for all point and nonpoint source sectors.

The OTC Workgroup made its recommendations concerning the control measures to the Ozone Transport Commission. After further review, the Commission recommended to OTC member states that they individually consider adoption of additional measures.[23] These measures are listed in Table 7-1.

7.4 Point and Nonpoint Source RACM Analysis for Rhode Island

RI DEM has reviewed the applicability of the OTC recommendations to Rhode Island sources; the result of that analysis is summarized in Table 7-1. The OTC regional review and analysis of potential control measures, in combination with the RI DEM assessment of the applicability and potential for these measures to meet the RACM criteria, constitute a comprehensive point and nonpoint source RACM analysis for Rhode Island. RI DEM has determined that there are no RACM for point and nonpoint sources that could be adopted in Rhode Island that would advance the attainment year to 2008.

[23] As noted in footnote 2, all OTC formal actions are available on the OTC website. The formal recommendations concerning control measures are at Documents/Formal Actions.

Table 7-1 OTC Recommended Control Measures and RI RACM Analysis

Source Categories for which OTC Recommended Controls	OTC Action	RI DEM RACM Analysis
Adhesives and Sealants	**2006 model rule**	RI DEM is committing to adopt controls for this category consistent with the OTC Model Rule. Rule will be submitted as a SIP revision by 10/1/08 with a 1/1/09 effective date.
Architectural and Industrial Maintenance Coatings	**2001 model rule**	If, by July 1, 2008, the EPA has not fulfilled its commitment[24] to adopt a federal regulation for this category which is as stringent as the 2001 OTC Model Rule and which will be effective by 2009, RI DEM commits to submit an equivalent State regulation as a SIP revision by 10/1/08, effective on 1/1/09.
Asphalt Paving (Emulsified and Cutback)	**2006 control recommendations**	RI DEM is committing to submit an amended rule for this category consistent with OTC recommendations as a SIP revision by 1/1/09, effective by 4/1/09.
Asphalt Production Plants	**2006 control recommendations for major sources**	Not applicable No major sources in Rhode Island
Cement Kilns	**2006 control recommendations**	Not applicable No sources in Rhode Island
Chip Reflash (Heavy Duty Diesel Engines)	**2006 model mandatory rule, staff report**	See discussion in Section 7.5, "Mobile Sources"

[24] [24] Memo from Stephen Page, Air Division Director, EPA Office of Air Quality Planning and Standards to Regional Air Division Directors, "Emission Reduction Credit for Three Federal Rules for Categories of Consumer and Commercial Products," May 30, 2007.

Source Categories for which OTC Recommended Controls	OTC Action	RI DEM RACM Analysis
Consumer Products	**2001 model rule 2006 updated model rule**	If, by July 1, 2008, the EPA has not fulfilled its commitment[25] to adopt a federal regulation for this category which is as stringent as the 2006 OTC Model Rule and which will be effective by 2009, RI DEM commits to submit an equivalent State regulation as a SIP revision by 10/1/08, effective on 1/1/09.
Distributive Generation Standards	**2001 model rule**	APC Regulation No. 43, "General Permits for Smaller-Scale Electric Generating Facilities," includes standards for this sector effective 5/15/07.
Glass and Fiberglass Furnaces	**2006 control recommendations**	Only 1 facility in RI, federally enforceable permitted emissions limits are lower than those recommended by OTC (Approval 1350 and Title V Operating Permit RI-07.
Industrial, Commercial, Institutional Boilers	**2006 control recommendations**	RI DEM has determined that additional emissions reductions from this category are not feasible in the State.
Mobile Equipment Repair and Refinishing	**2001 model rule**	Sources in this category are subject to APC Regulation No. 30, "Control of VOCs from Automobile Refinishing Operations," which is essentially equivalent to the 2001 OTC model rule.
Municipal Waste Combustors	**No regional measure recommended but individual states should evaluate**.	Not applicable. No sources in RI.

[25] [25] Memo from Stephen Page, Air Division Director, EPA Office of Air Quality Planning and Standards to Regional Air Division Directors, "Emission Reduction Credit for Three Federal Rules for Categories of Consumer and Commercial Products," May 30, 2007.

Source Categories for which OTC Recommended Controls	OTC Action	RI DEM RACM Analysis
Portable Fuel Containers	**2001 model rule** **2006 updated model rule**	EPA's requirements for this category in its Mobile Source Air Toxics rule will take effect 1/1/09. It would be impractical for RI DEM to adopt a State regulation with an earlier effective date.
Solvents and Cleaners	**2001 model rule**	RI DEM will submit amendments to APC Regulation No. 36, "Control of Emissions from Organic Solvent Cleaning," by 1/1/09 to incorporate recommended vapor pressure limits for cold cleaners effective by 4/1/09.

7.5 Mobile Source RACM Analysis for Rhode Island

Emissions from non-road and on-road mobile sources together constituted 51% of the daily VOC and 86% of the daily NOx anthropogenic emissions in Rhode Island in 2002. A number of programs are in place that will substantially reduce emissions from these sectors before the 2009 attainment date. These programs are discussed in Section 3.2.2.1 and 3.2.2.2 (on-road mobile source control programs) and 3.2.2.3 (non-road mobile source control programs).

Since states are generally precluded from regulating engines and fuels used in on-road and non-road vehicles and engine,[26] Rhode Island has a limited ability to further reduce emissions from mobile sources. However, RI DEM, in conjunction with the State Planning Council, the Office of Statewide Planning, the RI Department of Transportation (RI DOT) and others, is involved with the design of the State's Congestion Mitigation and Air Quality program(CMAQ program), which aims to reduce ozone precursor emissions in the transportation sector.

Table 7-2 lists the CMAQ program projects that are included in Rhode Island's 2006-2007 Transportation Implementation Plan (TIP), along with the expected emissions reductions associated with those programs. These programs include measures aimed at increasing pedestrian, bicycle, ferry and public transit travel, facilitating intermodal connections, eliminating traffic congestion through improving transportation management, signalization and roadways, and reducing emissions from the installation of emissions controls on public transit diesel busses. Together, these programs are expected to reduce VOC emissions in the State by 138.5 kilograms (kg), or 0.15 tons, per summer day, and to reduce NOx emissions by 123.8 kg, or 0.14 tons, per summer day.

[26] The only OTC recommendation concerning mobile source controls was that states that had not already adopted reformulated gas (RFG) statewide do so. Rhode Island already has RFG statewide.

Implementation of these projects and other similar programs that will be funded with CMAQ program monies in the coming years will not result in an acceleration of the attainment date. However, it is important that such projects continue to be funded, because, at the current growth rate, the increase in vehicles mile traveled in the State will eventually outstrip efforts to reduce emissions from cars with stricter inspections, cleaner engines and cleaner fuels.

Since a large number of mobile source emissions control programs are already being implemented and since additional measures funded by CMAQ program monies would not accelerate the attainment date, RI DEM did not identify any additional mobile source RACM measures.

Table 7-2 CMAQ Program Projects in 2006-2007 Transportation Implementation Plan

Project Name	VOC Reductions (kg/day)	NOx Reductions (kg/day)
Transportation Management Center	59.7	9.2
South County Commuter Rail	46.3	60.9
Bicycle / Pedestrian Program	5.0	5.2
Arterial Program - Warwick Avenue	0.3	0.3
Bus Service Initiatives	8.6	6.9
Bus Operations Initiatives	0.2	0.1
Express Travel	0.5	0.5
Passenger Initiatives	0.4	0.4
Comparison of Alternative Fuels for Providence-Newport Ferry: Ultra Low Sulfur Diesel	0.0	32.8
Comparison of Alternative Fuels for Providence-Newport Ferry: Biodiesel Fuel	4.9	(3.6)
Traffic Signal Control Center	6.9	5.3
Islander Shuttle Train	3.5	3.4
Ferry/Airport/Train Shuttle Service	0.6	0.6
Ferry Facility Improvements	1.6	1.8
Total	138.5	123.8

7.6 Overall RACM Conclusions

There are no control measures that could be implemented in Rhode Island for any source sectors that meet the RACM feasibility criteria and that would advance the date that the State attains the 8-hour ozone NAAQS.

8.0 CONTINGENCY MEASURES

8.1 Purpose of Section

This section demonstrates that the Rhode Island nonattainment area meets the requirements for SIP contingency measures related to both Reasonable Further Progress (RFP) and to the attainment of the ozone standard. If implemented, the contingency measures discussed in this section would result in reductions in addition to those required to demonstrate RFP (discussed in Section 4) and in addition to those that have been taken into account in the attainment demonstration (discussed in Section 5). Contingency measures ensure that if Rhode Island fails to achieve the 15% required RFP reductions by the 2008 RFP milestone year, or fails to attain the ozone standard by 2010[27], additional reductions will occur without further state or federal action.

8.2 Contingency Requirements

Section 172(c)(9) of the CAA and EPA's Phase 2 Rule require that nonattainment areas include contingency measures in their RFP and attainment SIPs. If a state receives a notification from EPA that a nonattainment area within its borders has failed to achieve the level of reductions demonstrated in the RFP SIP by the milestone year (2008 for moderate areas such as Rhode Island), or has failed to attain the standard by the attainment date (June 2010 for Rhode Island), the area must be able to implement contingency measures within one year after EPA's notice.

The RFP contingency and the attainment contingency must each provide for reductions equivalent to at least 3% of the 2002 RFP Adjusted Base Year VOC emissions inventory.[28] The contingency reductions are in addition to the 15% reduction required to demonstrate RFP and in addition to the reductions taken into account in the attainment demonstration.

8.3 RFP Contingency

As discussed in Section 4, RI DEM is meeting the requirement to reduce emissions by 15% in the 2008 RFP milestone year through reductions in NOx emissions. Since VOC emissions are projected to be 1.7 tons (1.5%) higher in 2008 than those in the 2002 adjusted RFP inventory, NOx emissions reductions totaling 16.5% were needed to satisfy the RFP requirement. To satisfy the contingency requirement, RI DEM must be able to demonstrate that if Rhode Island fails to achieve the required RFP target by 2008, without further state or federal action, an additional 3% reduction could be achieved from control measures not already taken in account in the RFP calculations.

[27] The attainment date for moderate nonattainment areas is June 15, 2010. For attainment contingency purposes, this is the milestone year. This is in contrast to the milestone year for the attainment demonstration, which is the ozone season prior to the attainment year – 2009.

[28] The RFP Adjusted Base Year Inventory is based on the RI 2002 Base Year Inventory adjusted for RFP purposes, as discussed in detail in Section 4.

According to EPA's interpretation of this requirement, the RFP contingency may be met by showing reductions in the 2008 RFP milestone year of at least 3% beyond those required to meet the RFP.[29] As demonstrated in Section 4, NOx emissions in Rhode Island will be reduced an additional 3.6% between 2002 and 2008 beyond the reductions required to meet the RFP target (See Table 4-2). Therefore, Rhode Island has met the RFP contingency requirement.

In addition, RI DEM is committing in this document to adopt a number of further control measures that will be effective before the 2009 ozone season, resulting in further emissions reductions that would qualify as contingency measures. For example, VOC limitations for consumer products and AIM coatings, which will be effective in January 2009, will reduce VOC emissions by 5.0 tons per day from the 2002 baseline (see calculations consistent with EPA guidance in Appendix 8A).

8.4 Attainment Contingency

EPA will assess whether Rhode Island has attained the 8-hour standard by June 2010, based on monitored ozone readings for 2007 – 2009. If the State is not meeting the standard based on readings for the 3-year period, EPA may issue a notification of failure to attain. The notification will trigger a requirement for RI DEM to implement contingency reductions within one year of the notification. For purposes of this contingency analysis, RI DEM is assuming that the contingency measures would need to be in place by June 2011. Therefore, to meet the attainment contingency requirement, RI DEM must identify control measures that will achieve reductions in emissions after 2009 and before June 2011 from control measures that will be effective without any further state or federal action.

The amount of additional reductions that must be achieved in order to meet the attainment contingency requirement is 3% of the 2002 RFP Adjusted Base Year VOC emissions. While the required reductions are calculated as a percentage of the 2002 VOC emissions, NOx reductions can be used as a direct substitute for up to 90% of the required reductions of 3% of VOCs Therefore, only 0.3% of the reductions achieved by the contingency measures must be VOCs.

Calculations of the required emissions reductions for attainment contingency are as follows:

2002 Adjusted Base Year Inventory:

VOC	111.80 tpsd
NOx	69.26 tpsd

Required Attainment Contingency (tpsd) = VOC Adjusted Base Year Inventory * 0.03
= 111.80 tpsd * 0.03
= 3.4 tpsd

This contingency reduction can be made up of a combination of NOx and VOC reductions, as long as at least 10% (0.3 tpsd) is VOC..

[29] U.S. EPA Memorandum from Michael H. Shapiro to Region 1 through 10 Air Directors, "Guidance on Issues Related to 15% Rate-of-Progress Plans," August 23, 1993.

RI DEM will meet this attainment contingency requirement by taking credit for emission reductions that will be achieved from the existing federal and state on-road and federal on-road and non-road mobile source control measures described in Section 7.5, "Mobile Source RACM Analysis for Rhode Island.," including the Rhode Island Low-Emission Vehicle (LEV) Program. These measures will continue to provide substantial VOC and NOx emission reductions through 2011 (and beyond) as newer, less-polluting vehicles and equipment replace the older fleet. As shown in Appendix 8B, emissions from the non-road mobile source categories calculated using the Non-Road model are projected to decrease by 2.0 tpsd of VOC and 1.8 tpsd of NOx between 2008 and 2011 without the imposition of additional controls. Although quantitative estimates of 2011 on-road mobile source emissions are not available, those emissions will also decrease during that period. As shown below in Section 9.0, on-road emissions of VOC are projected to decrease by 1.2 tons and NOx by 2.1 tons in the one year period between 2008 and 2009. That decline is projected to continue in subsequent years, as a result of fleet turnover.

Therefore, without the need for imposition of additional controls, emissions in Rhode Island will continue to decline after the attainment year and Rhode Island will meet its attainment contingency obligations.

8.5 Conclusions

Rhode Island has met the RFP contingency by demonstrating that the reductions of VOC and NOx projected by 2008 are greater than the 18% reduction that is required (15% for RFP and 3% for RFP contingency). For the attainment contingency, the reductions of VOC and NOx that will be achieved during the 2009-2011 period from the on-road and non-road mobile source control measures already in effect are greater than reductions needed to meet the 3% attainment contingency requirement. Therefore, Rhode Island meets the attainment contingency requirement.

9.0 TRANSPORTATION CONFORMITY

9.1 Purpose of Section

This section establishes Transportation Conformity budgets for the on-road mobile source sector for Rhode Island in the 2008 RFP milestone year and in the 2009 attainment demonstration year. The Transportation Conformity budgets set the levels of mobile source emissions that may not be exceeded in the State in the budget years. The budget was developed using the Rhode Island Statewide Travel Demand Model using methods agreed upon by RIDEM, the Rhode Island Statewide Planning Program (RISPP) and the Rhode Island Department of Transportation, in consultation with EPA Region 1.

Technical data files related to the Mobile 6 model runs used to estimate mobile source emissions in the budget years and an explanation of the modeling methodology are attached in Appendix 2D.

9.2 Background

Transportation conformity is required by section 176(c) of the CAA to ensure that transportation plans, programs and projects receiving federal funds are consistent with the SIP. Conformity to a SIP means that transportation activities will not produce new air quality violations, worsen existing violations, or delay timely attainment of a NAAQS.

EPA's Phase 2 Implementation Rule provides that nonattainment areas establish motor vehicle emissions budgets for the RFP milestone year (2008) and for the attainment demonstration year (2009). The budgets are set at the level of emissions from the on-road mobile sector projected for these years. Emissions of VOC and NOx from this sector may not exceed the budget levels. Emissions in years for which no budget is set may not exceed the budget established for the most recent prior year.

RI DEM established a conformity budgets for Rhode Island under the 1-hour ozone standard. The budget was submitted to the EPA as part of the State's 1-hour ozone standard attainment demonstration on March 24, 2003 and was approved by the EPA on April 7, 2003. (68 FR 16724) The 2007 budget is shown in Table 9-1.

The 2008 and 2009 transportation conformity budgets presented in the document, once approved by EPA, will replace the conformity budgets previously submitted and approved.

9.3 Methodology

Conformity budgets are set through a conformity consultation process. The 2008 and 2009 budgets were developed using the Rhode Island Statewide Travel Demand Model using methods agreed upon by RIDEM, the Rhode Island Statewide Planning Program (RISPP) and the Rhode Island Department of Transportation, in consultation with EPA Region 1. The methodology used to calculate the budget is described in a document entitled "Rhode Island 2008 and 2009 Mobile Source Emissions," which was prepared for the Rhode Island Department of Administration, Statewide Planning Program, RISPP, by Vanasse, Hangen and Brustlin, Inc. and which is attached as Appendix 2D.

9.4 Mobile Source Budgets

Application of the methods described in the Vanasse et al document resulted in the projected emissions for the 2008 and 2009 years for Rhode Island shown in Table 9-1. However, the RISSP, which is the Metropolitan Planning Organization (MPO) for the State of Rhode Island, requested, in a letter attached in Appendix 9A, that the 2008 VOC and NOx budgets be set at a level 0.5 tons per day higher than those predicted by the model to allow a buffer for conformity analyses.

2007 emissions budgets, projected 2008 and 2009 emissions, and the emissions budgets for 2008 and 2009 requested by the RISPP are shown in Table 9-1. Since RI DEM used the requested 2008 emissions budgets in its RFP calculations, allowing the requested 2008 budget will not interfere with the State's ability to make RFP or contingency targets. Therefore, RIDEM plans to accept the requested budgets, pending approval by the EPA.

Table 9-1 2007 Emissions Budget, Projected 2008 and 2009 Inventory and Requested 2008 and 2009 Emissions Budgets (tons per summer day)

	2007 Budget	2008 Projected Inventory	2008 Mobile Source Budget	2009 Projected Inventory	2009 Mobile Source Budget
VOC	30.68	24.14	24.64	22.75	22.75
NOx	33.97	27.76	28.26	25.29	25.29