E.0 EXECUTIVE SUMMARY TO CONNECTICUT'S 8-HOUR OZONE ATTAINMENT DEMONSTRATION

This document presents the Connecticut Department of Environmental Protection's (CTDEP) air quality state implementation plan (SIP) revision for attaining the federal 8-hour National Ambient Air Quality Standard (NAAQS) for ground-level ozone.

E.1 Abstract and Conclusions

The plan describes the national, regional and local control measures to be implemented to reduce emissions and uses air quality modeling and other analyses of air quality and meteorological data to assess the likelihood of reaching attainment in Connecticut by the 2010 attainment deadline.

As described in detail in the document, results of these analyses lead CTDEP to conclude that attainment will be achieved by the end of the 2009 ozone season in the five-county Greater Connecticut portion of the State. For the three-county Southwest Connecticut portion of the greater New York City nonattainment area, evidence suggests there is a credible case for attainment by the end of the 2009 ozone season, with the probability of attainment increasing in subsequent years, as emissions are reduced, such that attainment is highly likely to occur no later than the 2012 ozone season. Because ozone levels in Connecticut are dominated by transport from upwind areas, attainment can be assured in 2009 by securing additional emission reductions from upwind states that contribute significantly to nonattainment in Connecticut.

E.2 Background

Ozone is a highly reactive gas, each molecule consisting of three oxygen atoms. Ground level, or tropospheric ozone is produced through a combination of atmospheric chemical reactions between volatile organic compounds (VOCs) and nitrogen oxides (NO_X) in the presence of sunlight. Ozone precursors are emitted from many human activities as well as from natural processes. Anthropogenic emissions of VOCs include evaporation and combustion of gasoline and evaporation of industrial and commercial solvents and a host of consumer products. VOCs emitted by vegetation and other biogenic sources in Connecticut are estimated to be equivalent in magnitude to anthropogenic VOC emission levels in 2002. Nitrogen oxides are generally formed as a product of high temperature combustion such as in internal combustion engines and utility and industrial boilers. Ozone and the pollutants that form ozone are often transported into Connecticut from pollution sources found hundreds of miles upwind.

The adverse effects of ozone exposure on lung health have been well documented in recent decades. Results show that ground-level ozone at concentrations currently experienced in the U.S. can cause several types of short-term health effects. Ozone can irritate the respiratory system, causing wheezing and coughing, can irritate the eyes and nose, and can cause headaches. Ozone can affect lung function, reducing the amount of air that can be inhaled and limiting the maximum rate of respiration, even in otherwise healthy individuals. Exposure to high levels of ozone can also increase the frequency and severity of asthmatic attacks, resulting in more emergency room visits, medication treatments and lost school days. In addition, ozone can enhance people's sensitivity to asthma-triggering allergens such as pollen and dust mites.

1-hour Ozone NAAQS. The 1970 CAA amendments established health and welfare protective limits, or national ambient air quality standards (NAAQS), for a number of air pollutants, including "photochemical oxidants," of which ozone was a key component. The 1977 CAA amendments modified the photochemical oxidants standard to focus only on ozone, leading to the establishment in 1979 of a 1-hour average ozone NAAQS of 0.12 parts per million (ppm). The U.S. Environmental Protection Agency (EPA) classified areas as "nonattainment" if monitors in the area measured ozone levels exceeding the NAAQS on more than three days over a 3-year period. Nonattainment areas were required to adopt programs to provide for attainment of the ozone standard no later than 1987. Despite implementation of a variety of emission reduction strategies and significant improvement in measured ozone levels, many areas, including Connecticut, did not attain the standard by the 1987 deadline.

In 1990, additional amendments to the CAA were enacted, including the establishment of different classification levels of 1-hour ozone nonattainment, based on the severity of the ozone problem in each area. Areas measuring more severe ozone levels were provided more time to attain but were also required to adopt more stringent control programs. Pursuant to the 1990 amendments, the EPA designated all of Connecticut as nonattainment for the 1-hour NAAQS. Southwest Connecticut (i.e., all of Fairfield County except the town of Shelton, plus the Litchfield County towns of Bridgewater and New Milford) was assigned to the New York-Northern New Jersey-Long Island (NY/NJ/CT) nonattainment area, with a severe classification and associated attainment date of 2007. The remainder of Connecticut, known as the Greater Connecticut area, was classified as serious nonattainment with a required attainment date of 1999.

CTDEP submitted a series of 1-hour ozone SIP revisions and attainment demonstrations for both the Southwest Connecticut and Greater Connecticut ozone nonattainment areas between 1998 and 2005. The attainment demonstrations relied on photochemical grid modeling, air quality trends and other corroborating weight-of-evidence (WOE) to demonstrate that adopted and mandated control programs within Connecticut and upwind areas were sufficient to enable all areas of the State to achieve attainment of the 1-hour ozone NAAQS by 2007. The attainment demonstration for Greater Connecticut included a technical analysis, showing that overwhelming transport of ozone and ozone precursor emissions (*i.e.*, VOCs and NO_X) from upwind areas precluded compliance by that area's required 1999 attainment date, and a request was made for an extension of the attainment date to 2007. EPA published a series of rulemakings approving CTDEP's attainment demonstrations and associated revisions between 1999 and 2007. Table E.1 summarizes control measures implemented to comply with the 1-hour ozone NAAQS.

8-Hour Ozone NAAQS. The CAA requires EPA to periodically review (every five years) and revise NAAQS as appropriate to ensure that public health is protected with an adequate margin of safety. Following revisions, states are then required to develop plans to ensure that air quality levels are reduced to below the level of the NAAQS.

Prompted by increasing evidence of health effects at lower concentrations over longer exposure periods, EPA promulgated a more stringent ozone health standard in 1997 based on an 8-hour averaging period. The revised NAAQS was established as an 8-hour average of 0.08 ppm. Compliance is determined in an area using the monitor measuring the highest 3-year average of

Table E.1: Control Strategies Implemented Statewide in Connecticut to Meet the 1-Hour Ozone NAAQS

Stationary Source Strategy	Initial Year		Mobile Source Strategy	Initial Year
Consumer Products	1999		Enhanced I/M (ASM 2525 phase-in cut points)	2000
Architectural & Industrial Maintenance Coatings	2000		Enhanced I/M (ASM 2525 final cut points)	2004
Autobody Refinishing VOC Limits	1999		OBD-II Enhanced I/M	2004
Stage I Vapor Recovery at Gasoline Service Stations	1992		Reformulated Gasoline - Phase I	1995
Stage II Vapor Recovery at Gasoline Service Stations	1994		Reformulated Gasoline - Phase II	2000
VOC RACT	1984+		Tier 1 Motor Vehicle Controls	1994
Cutback Asphalt: Increased Rule Effectiveness	1998		On-board Refueling Vapor Recovery	1997-2005
Gasoline Loading Racks: Increased Rule Effectiveness	1998		National Low Emission Vehicle Program	1998 (in CT)
CT NO_X "RACT" Regulation	1994		Tier 2 Motor Vehicle Controls/Low Sulfur Gasoline	2004-2008
OTC Phase II NO_X Controls	1999		California Low Emission Vehicle Phase 2 (CALEV2)	2007
NO_X Budget Program (EPA NO_X SIP Call)	2003		Heavy-Duty Diesel Vehicle Controls and Fuels	2004-2005
Municipal Waste Combustor Controls	2000, 2003		Non-Road Engine Standards	1996-2008
Automotive Refinishing Operations (Spray Guns)	2002			
Gasoline Stations Stage II & Pressure-Vent Valves	2004, 2005			
Portable Fuel Containers	2004			

each year's 4th highest daily maximum 8-hour ozone concentration. In February 2001, after extended delays resulting from legal challenges to this new NAAQS, the US Supreme Court upheld the EPA's authority to establish the 8-hour ozone standards. As required through a subsequent consent decree with environmental groups, in April 2004 EPA published final area designations pursuant to CAA section 107(d) and the Transportation Equity Act for the Twenty-first Century (TEA–21) and final area classifications pursuant to CAA sections 172(a) and 181. These determinations became effective on June 15, 2004.

As shown in Figure E.1, Connecticut, along with other states in the Northeast and other areas of the country, was designated as nonattainment by EPA based on measured 8-hour ozone values from the 2001-2003 period. Portions of Connecticut were included in two nonattainment areas. Fairfield, New Haven, and Middlesex Counties were included as part of a moderate 8-hour ozone NAAQS nonattainment area, along with the New York and New Jersey counties that make up the metropolitan New York Consolidated Statistical Area. The remaining five counties in Connecticut were grouped as a separate moderate nonattainment area, known as the Greater Connecticut 8-hour ozone NAAQS nonattainment area.

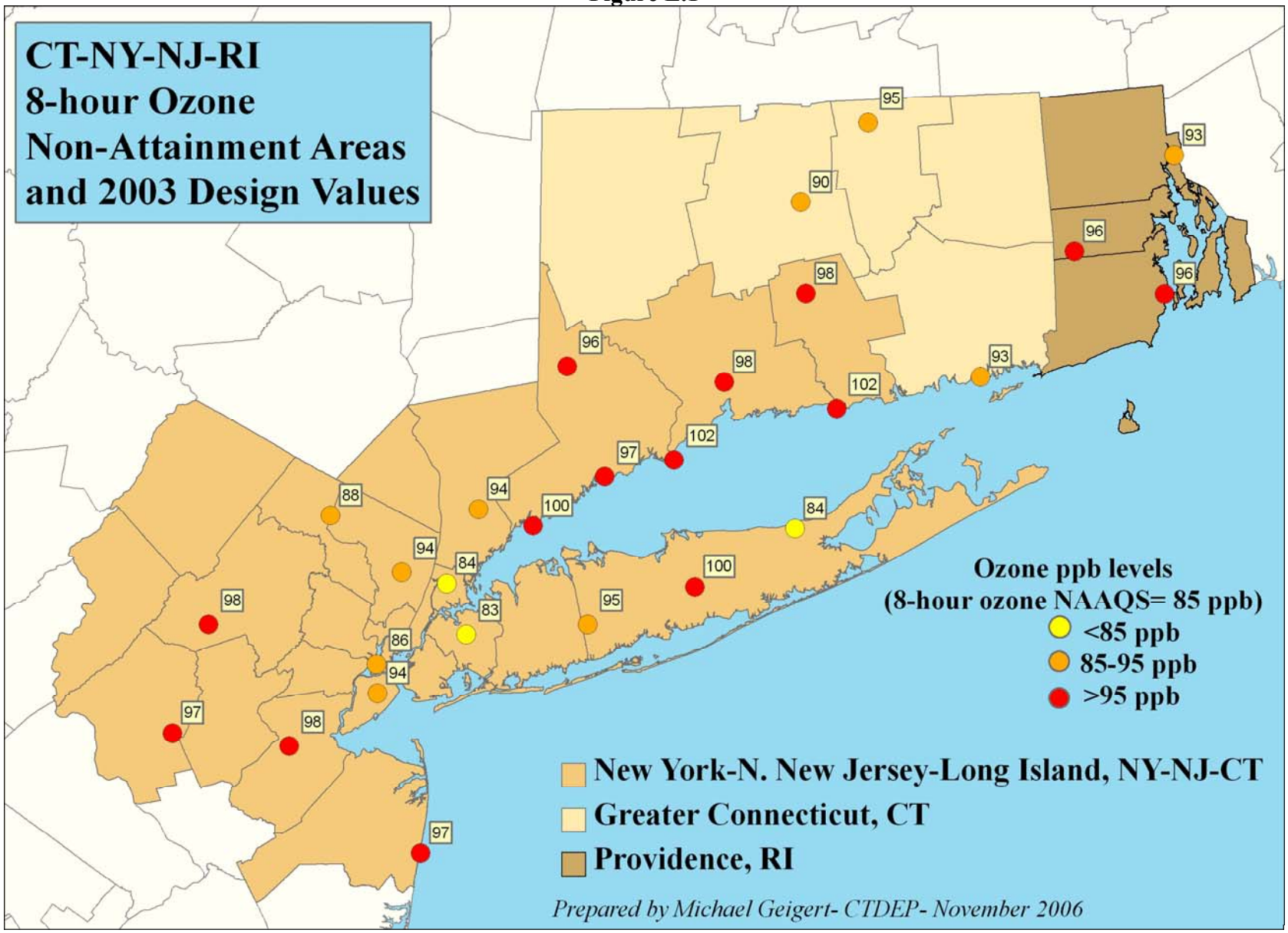
EPA published final 8-hour ozone implementation rules in two phases: Phase 1 on April 30, 2004 and Phase 2 on November 29, 2005. Those rules require moderate 8-hour ozone nonattainment areas, such as those in Connecticut, to submit revisions to the SIP that meet the following planning requirements:

- Reasonable Further Progress (RFP): Achieve 15% VOC reduction within 6 years after the baseline year of 2002 (i.e., reductions must occur by 2008). Equivalent NO_X reductions can substitute for any portion of the required VOC reductions;
- Attainment demonstration: Using modeling and other technical analyses to demonstrate that adopted control measures are sufficient to project attainment of the 8-hour NAAQS by the end of the 2009 ozone season;
- New Source Review (NSR) and Reasonably Available Control Technology (RACT) major source applicability: 100 tons/year (tpy) for NO_X and 50 tpy for VOC (CAA Section 184);
- NSR emission offset ratio: 1.15 to 1 for NO_X and VOC;
- NSR permits: Required for new or modified major stationary sources;
- NO_X control for RACT: requirement for major stationary VOC sources also applies to major NO_X sources;
- RACM/RACT: Reasonably available control technology (RACT) required for all EPA-defined control technique guideline (CTG) sources and all other major sources; reasonably available control measures (RACM) required for all other sources;
- Basic Inspection and Maintenance (I/M): Required for light-duty motor vehicles;
- Stage II vapor recovery: Required for gas stations with a throughput of at 10,000 or more gallons per month;
- Transportation conformity budgets: Budgets that are consistent with the attainment plan are required to be established for the RFP year (i.e., 2008) and the attainment year (i.e., 2009); and
- Contingency measures: Implementation is required upon failure to meet RFP milestones or attainment.

In addition to prescribing the planning requirements for meeting the 8-hour NAAQS, EPA's ozone implementation rules specified the process for transitioning from the 1-hour to the 8-hour ozone NAAQS. The transition included revocation of the 1-hour NAAQS, effective June 15, 2005, and EPA's approach to preventing backsliding from 1-hour ozone requirements.

Given Connecticut's previous classifications as "severe" (Fairfield County) and "serious" (remainder of the State) for the 1-hour ozone NAAQS, Connecticut's regulations continue to

Figure E.1


CT-NY-NJ-RI
8-hour Ozone
Non-Attainment Areas
and 2003 Design Values
95
93
90
96
98
96
96
93
98
102
102
97
94
88
100
84
94
84
100
98
83
95
86
94
97
98
97
Ozone ppb levels
(8-hour ozone NAAQS= 85 ppb)
<85 ppb
85-95 ppb
>95 ppb
New York-N. New Jersey-Long Island, NY-NJ-CT
Greater Connecticut, CT
Providence, RI
Prepared by Michael Geigert- CTDEP- November 2006

include more stringent NSR requirements pursuant to CAA section 182(d) than are required under the State's current "moderate" 8-hour ozone classification.

Conceptual Model. A conceptual overview of the ozone problem is provided in the document from both a regional and local perspective. The regional perspective was developed by the Northeast States for Coordinated Air Use Management (NESCAUM) for the Ozone Transport Commission (OTC) states (see Figure E.2) and is provided as Appendix 2A.

The report describes many of the mechanisms that lead to the buildup and transport of ozone across the eastern United States on hot summer days, with detailed descriptions of weather systems such as the Bermuda high pressure system which tends to stagnate in the southeastern U.S. while transporting surface ozone and precursors in a northeasterly direction towards Connecticut. One transport mechanism that has fairly recently come to light and can play a key role in moving pollution long distances is the nocturnal low-level jet. The jet is a regional scale phenomenon of higher wind speeds that often forms at night during ozone events a few hundred meters above the ground just above the stable nocturnal boundary layer. It can convey air pollution several hundreds of miles overnight from southwest to northeast, directly in line with the major population centers of the Northeast Corridor stretching from Washington, DC to Boston, Massachusetts.

Other transport mechanisms occur over smaller scales. These include land, sea, mountain, and valley breezes that can selectively affect relatively local areas. They play a vital role in drawing ozone-laden air into some areas, such as coastal Maine, that are far removed from major source regions.

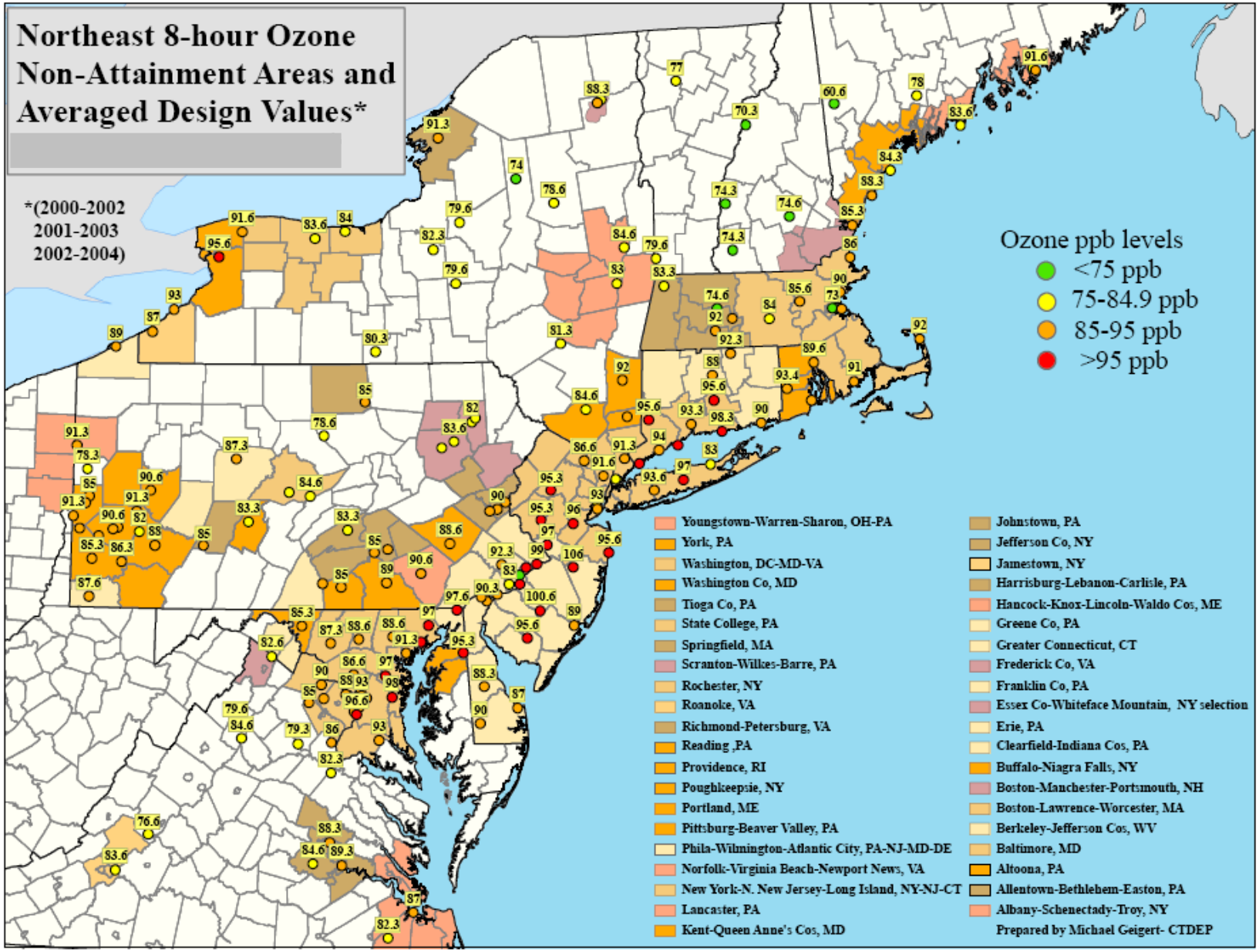
E.3 Air Quality and Trends

The CTDEP has been monitoring ambient ozone levels throughout the state since the early 1970s. The current network consists of the eleven sites depicted on the map in Figure E.3. In addition to ozone monitoring, since 1994 Connecticut has operated up to four Photochemical Assessment Monitoring Stations (PAMS) to collect ambient concentrations of volatile organic compounds (VOCs), carbon monoxide (CO) and nitrogen oxides (NO and NO_2, which are collectively referred to as NO_X).

The form of the 8-hour ozone standard is the three-year average of the fourth highest 8-hour ozone levels for each year. Compliance with the standard is achieved when this "design value" is less than 0.08 parts per million (which equates to 85 parts per billion, or ppb, using standard round-off convention).

The trends in design values for each site in the Greater Connecticut area and Southwest Connecticut portion of NY/NJ/CT nonattainment area are plotted in Figures E.4 and E.5, respectively**.** The maximum design values in the Greater Connecticut non-attainment area have decreased by approximately 40% since the mid 1980s, from over 140 ppb to about 85 ppb in 2006. Similarly, the maximum design value in the Southwest Connecticut portion of NY/NJ/CT non-attainment area has decreased from over 155 ppb in 1983 to 90 ppb in 2006.

Figure E.2



Note: Values shown are the average of the three design values (3-year averages of the 4th maximum 8-hour ozone level) for the set of years 2000-2002, 2001-2003, and 2002-2004. The figure shows the regional nature of ozone levels in the OTR, with a number of closely adjacent nonattainment areas (average design values ≥ 85 ppb) along with a broader region of elevated regional ozone (e.g., average design values ≥ 75 ppb).

Figure E.3: Connecticut Ozone Monitoring Sites in 2007

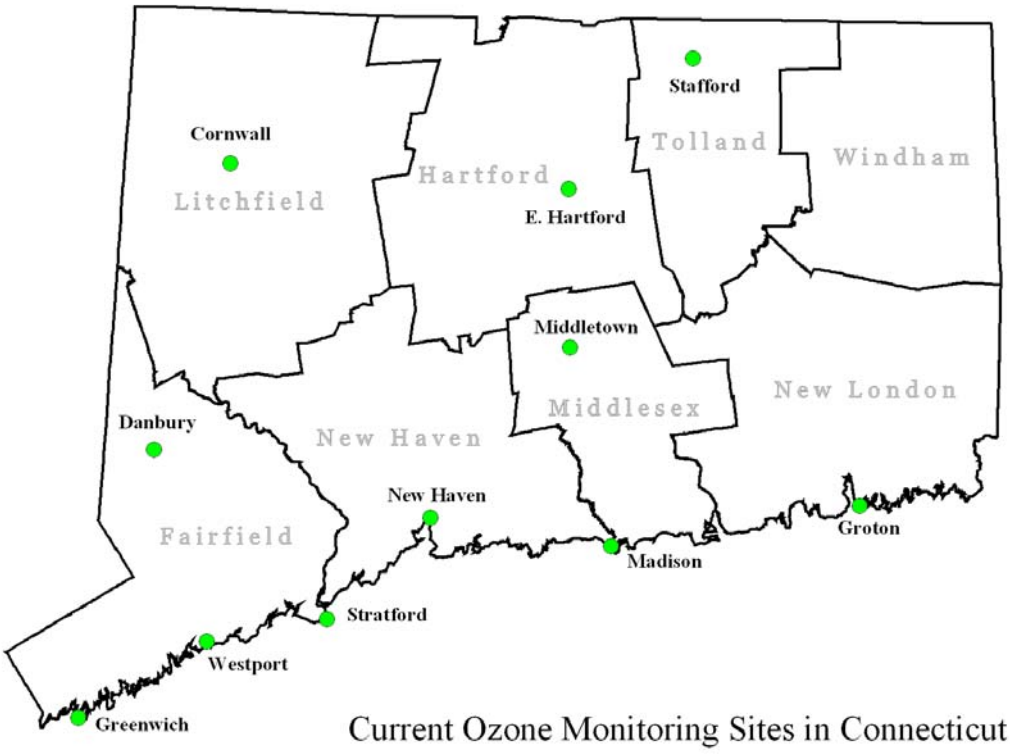
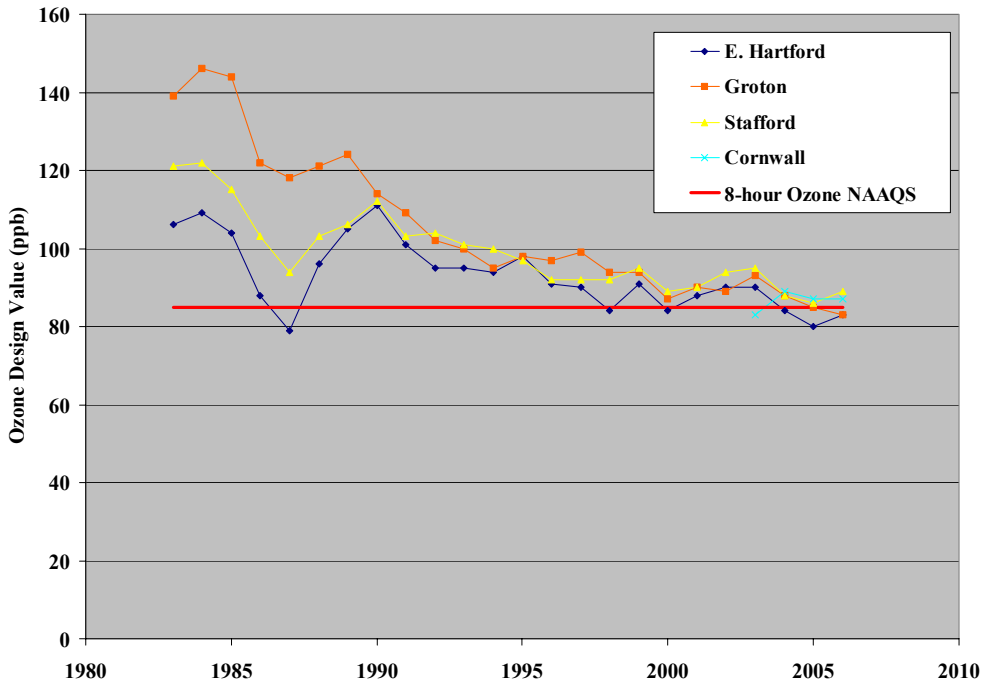
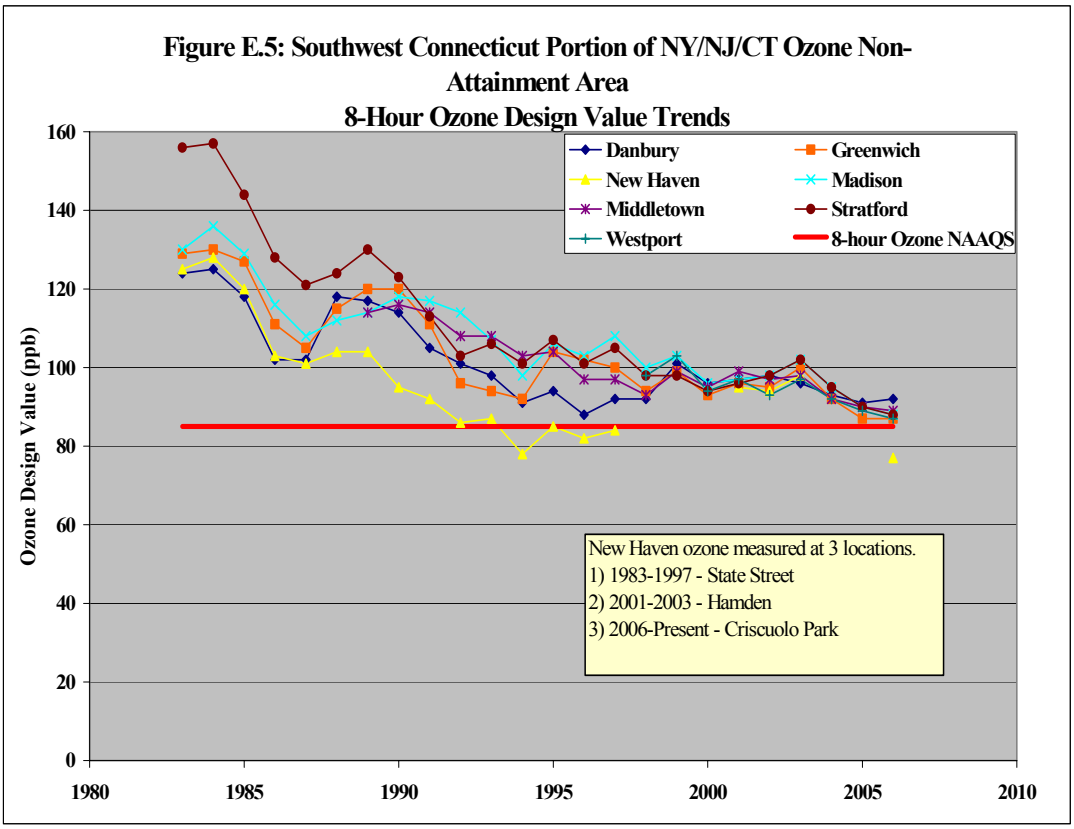


Figure E.4: Greater Connecticut Ozone Non-Attainment Area
8-Hour Ozone Design Value Trends





E.4 Emissions and Controls: Base Year and Projections to 2009 and 2012

CTDEP has adopted, or is currently pursuing adoption of, several regulations to provide in-state reductions of ozone precursor (i.e., VOC and NO_X) emissions. These in-state measures, along with national measures targeted at on-road and non-road emission sources, are expected to provide significant emission reductions through 2009 and beyond. Section 4 documents the level of emissions in Connecticut in the baseline year of 2002, provides descriptions of the measures relied upon to meet CAA RFP and attainment requirements, and summarizes estimates of projected future emissions resulting from these state and federal measures.

2002 Base Year Inventory. Some adjustments were made to the December 2005 version of the 2002 Periodic Emissions Inventory (PEI) to account for recent updates to emission calculation methods and inputs. The resulting updated 2002 Base Year Inventory is used for demonstrating reasonable further progress compliance, and is summarized for VOC and NO_X in Tables E.2 and E.3. On a statewide basis in 2002, biogenic sources contributed 50% of the total summer day VOC emissions, with the bulk of the remaining emissions accounted for by stationary area sources (20%), non-road mobile sources (16%) and on-road mobile sources (12%). For statewide NO_X emissions in 2002, the largest contributing category was on-road mobile sources (57%), with large contributions from the non-road mobile (21%) and stationary point (17%) source sectors as well. A more complete source category breakdown of 2002 base year emissions is included in Appendix 4C.

Table E.2: Summary of Connecticut's 2002 Base Year VOC Inventory* (tons / summer day)

Source Category	Greater CT	Southwest CT	State Total
Stationary Point	4.6	11.3	15.8
Stationary Area	75.5	84.1	159.7
On - Road Mobile	45.1	48.3	93.4
Non - Road Mobile	56.2	66.0	122.2
Total Anthropogenic VOC	**181.4**	**209.7**	**391.1**
Biogenic VOC	268.6	125.6	394.2
Total VOC	**450.0**	**335.3**	**785.3**

* Updates to the 2002 PEI include incorporation of emission estimates from EPA's most recent version of the NONROAD model, more recent traffic information input to the MOBILE6.2 model, and inclusion of evaporative VOC emissions from portable fuel containers (i.e., gasoline cans).

Table E.3: Summary of Connecticut's 2002 Base Year NO_X Inventory* (tons / summer day)

Source Category	Greater CT	Southwest CT	State Total
Stationary Point	19.0	37.7	56.8
Stationary Area	6.4	7.2	13.5
On - Road Mobile	89.3	102.7	192.0
Non - Road Mobile	30.8	38.7	69.5
Total Anthropogenic NO_X	**145.5**	**186.3**	**331.8**
Biogenic NO_X	1.3	0.7	1.9
Total NO_X	**146.8**	**187.0**	**333.7**

* Updates to the 2002 PEI include incorporation of emission estimates from EPA's most recent version of the NONROAD model and more recent traffic information input to the MOBILE6.2 model.

Post-2002 Control Measures Included in Future Year Projections

Numerous state and federal control strategies are included in the 8-hour Ozone Attainment Plan, resulting in significant emission reductions for all sectors of the emissions inventory: on road and non-road mobile sources as well as stationary area sources and point sources. Many of the state measures identified in this section came out of regional planning processes coordinated by the

OTC. The OTC process included development of model rules to regulate products, activities and stationary sources to reduce ozone precursor emissions. Model rules were prepared in 2001-2002 to serve 1-hour ozone NAAQS purposes and in 2005-2006 to serve as templates for creating additional reductions for 8-hour ozone NAAQS purposes.

On-Road and Non-Road Mobile Sources and Fuels

There are various federal measures that reduce ozone precursors through more stringent emission standards for vehicles, engines and equipment; changes to fuel type and quality; and influences on human behavior associated with vehicle use. Such federal control measures, along with state counterparts, provide emissions reductions through 2007 and beyond. Control programs for on-road sources are summarized in Table E.4. Programs addressing non-road sources are summarized in Table E.5.

Connecticut's Control of Stationary and Area Sources

Given federal efforts to address emissions from mobile sources, Connecticut has focused its post-2002 reduction strategy on stationary and area sources of VOC and NO_X. The twelve measures identified in Table E.6 create emissions reductions after the 2002 baseline emissions inventory year and, therefore, are creditable towards 8-hour ozone NAAQS RFP and attainment efforts.

Future year emission projections were developed from the 2002 Base Year Inventory, applying the growth factors described in Section 4.3.1 and the emission reductions described in Section 4.3.2. Resulting emission projections for 2008, 2009 and 2012 are depicted in Figures E.6 and E.7.

Both VOC and NO_X emissions are projected to decrease dramatically in Connecticut over the 10-year period from 2002 to 2012 due to these federal and state control programs. Statewide anthropogenic VOC emissions are projected to decrease 19% by 2008, 25% by 2009 and 30% by 2012, after accounting for growth. Statewide NO_X emission reductions are projected to be even greater, with estimated reductions of 25% by 2008, 31% by 2009 and 42% by 2012.

Table E.4: On-Road Mobile Sources Control Strategies

Control Strategy	Pollutant		Federal Program	State Program	Rule Approval Date[1]	Initial Year of Implementation[2]
	VOC	NO_X				
Reformulated Gasoline - Phase I[3]	●	●	●		12/23/1991[4]	1995
Reformulated Gasoline - Phase II[3]	●	●	●		2/16/1994[4]	2000
Tier 1 Motor Vehicle Controls	●	●	●		6/5/1991	1994
National Low Emission Vehicle Program	●	●	●		3/02/1998[5]	1998 (in CT)
Tier 2 Motor Vehicle Controls/Low Sulfur Gasoline	●	●	●		2/10/2000	2004-2008
On-board Refueling Vapor Recovery	●		●		4/6/1994	1997-2005
Heavy-Duty Diesel Vehicle Controls and Fuels	●	●	●		10/6/2000	2004-2005
2007 Highway Rule	●	●	●		1/18/2001	2006-2007
California Low Emission Vehicle Phase 2 (CALEV2)	●	●	●	●	[6]	2007
Enhanced I/M (ASM 2525 phase-in standards)	●	●		●	3/10/1999	2000
Enhanced I/M (ASM 2525 final standards)	●	●		●	10/27/2000	2004
OBD-II Enhanced I/M	●	●		●	[7]	2004
Highway Motorcycle Exhaust Emission Standards	●	●	●		1/15/2004	2006-2010
Mobile Source Air Toxics Rule	●	●	●		3/29/2001	2002
Control of Hazardous Air Pollutants	●	●	●		2/26/2007	2009-2015
Renewable Fuel Standard Program[8]	●	●	●		5/01/2007	2006,2007-2012

[1] Unless otherwise noted, this is the date of Federal Register publication of either a final federal rule or EPA's approval of a state SIP submittal, as appropriate for the indicated control strategy.

[2] A range of implementation years is listed for some strategies due to phase-in of standards. In addition, all listed mobile source strategies (except enhanced I/M and reformulated gasoline) result in increased levels of emission reductions through and beyond 2007 due to the gradual turnover of the affected fleets.

[3] Reformulated gasoline requirements also result in a reduction in evaporative VOC emissions throughout the gasoline distribution system.

[4] Promulgated statewide under 40 CFR 80.70. Approved for 15% rate-of-progress on 03/10/99.

[5] EPA determined that the NLEV program was in place on 03/02/98. As a result, rules published on 06/06/97 and 01/07/98 went into effect.

[6] Regulation adopted 12/03/04. Not submitted to EPA as of the date of this submission.

[7] Amendment to incorporate OBD-II adopted 08/25/04. Not submitted to EPA as of the date of this submission.

[8] Renewable fuels may be blended into conventional gasoline or diesel fuel. Eventually, emission impacts may be witnessed in the non-road category, in addition to the on-road emission impacts.

Table E.5: Federal Non-Road Mobile Sources Control Strategies

Non-Road Engine Category	Date of Final Rule	Implementation Phase-In Period
Compression Ignition (diesel) Engines		
Tier 1: Land-Based Diesel Engines > 50 hp	06/17/1994 (59 FR 31306)	1996-2000
Tier 1: Small Diesel Engines < 50 hp	10/23/1998 (63 FR 56968)	1999-2000
Tier 2: Diesel Engines (all sizes)	10/23/1998 (63 FR 56968)	2001-2006
Tier 3: Diesel Engines 50 - 750 hp	10/23/1998 (63 FR 56968)	2006-2008
Tier 4: All Diesel Engines (Except locomotive and marine vessels)	06/29/2004 (69 FR 38958)	2008-2015
Spark-Ignition (e.g., gasoline) Engines		
Phase 1: SI Engines < 25 hp (except marine & recreational)	07/03/1995 (60 FR 34581)	1997
Phase 2: Non-Handheld SI Engines < 25 hp	03/30/1999 (64 FR 15208)	2001-2007
Phase 2: Handheld SI < 25 hp	04/25/2000 (65 FR 24268)	2002-2007
Gasoline SI Marine Engines (outboard & personal watercraft)	10/04/1996 (61 FR 52088)	1998-2000
Large Spark-Ignition Engines >19 kW (or >25 hp)	11/08/2002 (67 FR 68242)	2004/2007
Recreational Land-Based Spark-Ignition Engines	11/08/2002 (67 FR 68242)	2006-2012
Marine Diesel Engines		
MARPOL: New/Old Engines on Vessels Constructed Starting 1/1/2000	09/27/1997 MARPOL (Annex VI of International Convention on Prevention of Pollution from Ships)	2000
Commercial Marine Diesel Engines[1] (US-flagged vessels)	12/29/1999 (64 FR 73300)	2004/2007
Recreational Marine Diesel Engines >37 kW (or >50 hp)	11/08/2002 (67 FR 68242)	2006-2009
Marine Diesel Engines (US-flagged vessels) >30 liters/cylinder	02/28/2003 (68 FR 9746)	2004
Locomotives		
New & Remanufactured Locomotives and Locomotive Engines[2]	04/16/1998 (63 FR 18978)	(see note 2) Tier 0: 1973-2001 Tier 1: 2002-2004 Tier 2: 2005 +
Non-Road Diesel Fuel	06/29/2004 (69 FR 38958)	2007/2010
Aircrafts		
Control of Air Pollution From Aircraft and Aircraft Engines 1	05/08/1997 (62 FR 25356)	1997
Control of Air Pollution From Aircraft and Aircraft Engines 2	11/17/2005 (70 FR 69664)	2005
Future Control Measures		
Proposed Locomotive & Marine Diesel Rule	04/03/2007[3] (72 FR 15938)	2008-2015
Proposed Spark-Ignition Engines, Equipment, and Vessels Rule	05/18/2007[3] (72 FR 28098)	2009, 2011-2012

[1] Only applies to commercial marine diesel engines with displacements under 30 liters per cylinder.

[2] EPA has established three sets of locomotive standards, applied based on the date the locomotive was first manufactured (i.e. during the Tier 0, Tier 1, or Tier 2 periods). The applicable standards take effect when the locomotive or locomotive engine is first manufactured and continue to apply at each periodic remanufacture.

[3] This is a proposed rule, not yet finalized.

Table E.6: Connecticut's Post-2002 Control Measures included in Future Year Projections

Control Measure	Pollutant	Section of the Regulations of Connecticut State Agencies	Status of Regulation Adoption
VOC Content Limits for Consumer Products	VOC	22a-174-40	Adoption completed July 26, 2007
Design Improvements for Portable Fuel Containers (1) and (2)	VOC	22a-174-43	Initial rule adopted May 10, 2004; amendment adopted January 29, 2007
VOC Content Limits for Architectural and Industrial Maintenance (AIM) Coatings	VOC	22a-174-41	Adoption completed July 26, 2007
Restrictions on Asphalt in Paving Operations	VOC	22a-174-20(k)	Public hearing held May 1, 2007
Restrictions on the Manufacture and Use of Adhesives and Sealants	VOC	22a-174-44	Public hearing held October 16, 2007
Automotive refinishing operations	VOC	22a-174-3b(d)	Adoption of amendment completed on April 4, 2006
Stage II Vapor Recovery – Gasoline Service Station Pressure Vent Valves	VOC	22a-174-30	Adoption of amendment completed on May 10, 2004
Reduced Vapor Pressure Limitation for Solvent Cleaning	VOC	22a-174-20(*l*)	Adoption completed July 26, 2007
Standards for Municipal Waste Combustion	NO_X	22a-174-38	Adoption of amendment completed October 26, 2000
NO_X Reductions from Industrial, Commercial and Institutional (ICI) Boilers	NO_X	22a-174-22	Public hearing held October 19, 2006
CAIR NO_X Ozone Season Trading Program	NO_X	22a-174-22c	Adoption completed September 4, 2007

Figure E.6: Projected Anthropogenic VOC Emission Trends for Connecticut

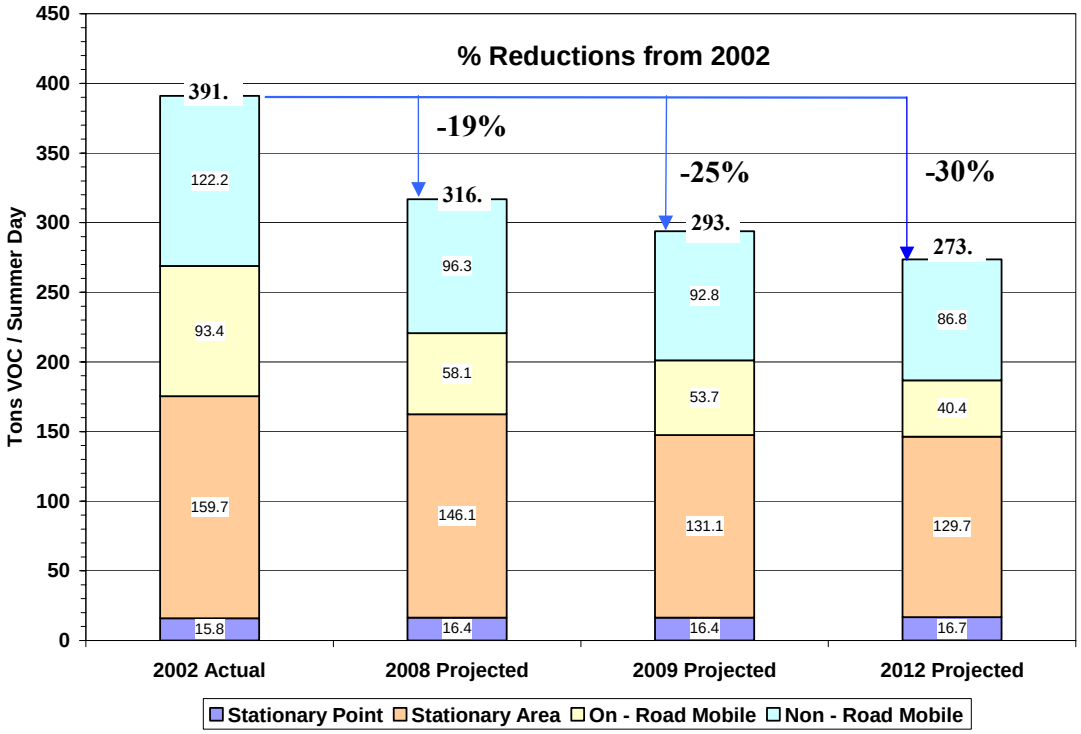
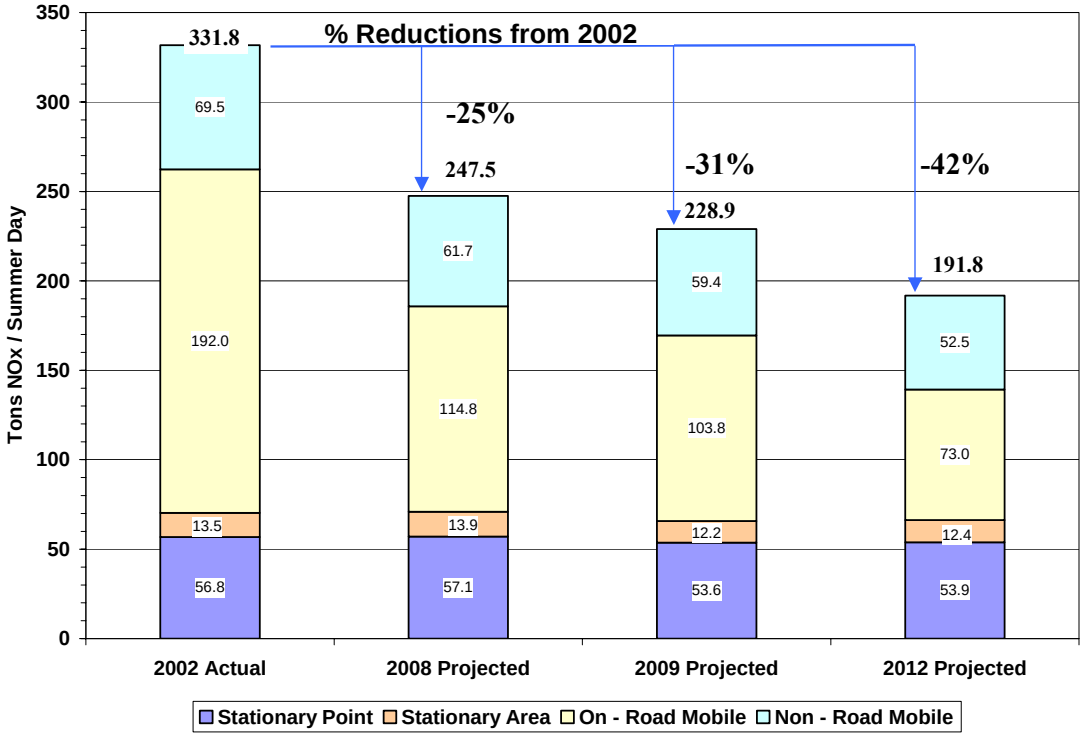


Figure E-7: Projected Anthropogenic NOx Emission Trends for Connecticut



E.5 Reasonable Further Progress (RFP)

The Phase 2 Ozone Implementation Rule includes EPA's interpretation of the CAA requirement that nonattainment areas demonstrate RFP towards attaining the ozone NAAQS. For moderate 8-hour ozone nonattainment areas, such as Greater Connecticut and Southwest Connecticut, with attainment dates at least five years after designation, the rule requires a demonstration that areas will achieve at least a 15% emission reduction between 2002 and 2008. The 15% reduction requirement can be satisfied with any combination of VOC and NO_X reductions. Additional reductions are also required to achieve attainment beyond 2008.

As shown in Tables E.7 and E.8, projected 2008 emissions in both areas are significantly less than the required RFP target levels corresponding to a total of 15% reduction in VOC and/or NO_X emissions. For Greater Connecticut, the combined reduction of VOC and NO_X emissions is projected to be 37.2%, more than double the required 15% reduction. Similarly for Southwest Connecticut, the projected combined VOC and NO_X reduction of 37.8% is also more than double the RFP requirement for 2008.

Table E.7: Greater Connecticut Demonstration of Reasonable Further Progress Comparison of 2008 Projected and Target Level Emissions (tons / summer day)

Description	Anthropogenic VOC	Anthropogenic NO_X
2008 RFP Target Levels (Portion of Required 15% VOC+ NO_X RFP)	159.4 (10%)	129.5 (5%)
2008 Projected Emissions (% Reduction Projected to be Achieved)	149.3 (15.7%)	107.0 (21.5%)
Combined VOC + NO_X Reduction	37.2%	
Excess Reduction Beyond 15% Requirement	22.2%	

Table E.8: Southwest Connecticut Demonstration of Reasonable Further Progress Comparison of 2008 Projected and Target Level Emissions (tons / summer day)

Description	Anthropogenic VOC	Anthropogenic NO_X
2008 RFP Target Levels (Portion of Required 15% VOC+ NO_X RFP)	184.6 (10%)	165.9 (5%)
2008 Projected Emissions (% Reduction Projected to be Achieved)	167.6 (18.3%)	140.5 (19.5%)
Combined VOC + NO_X Reduction	37.8%	
Excess Reduction Beyond 15% Requirement	22.8%	

E.6 Reasonably Available Controls Measures (RACM)

In accordance with CAA Section 172(c)(1), the "Final Rule To Implement the 8-Hour Ozone National Ambient Air Quality Standard" (the Implementation Rule) requires a state to apply all reasonably available control measures (RACM) that will assist the state in timely attainment of the ozone standard. A RACM analysis traditionally focuses on area, mobile and non-major point sources, and the measures that are considered RACM are those readily implemented measures that are economically and technologically feasible and that contribute to the advancement of attainment in a manner that is "as expeditious as practicable." RACM requires an area-specific analysis, in which the State considers the application of RACM for any source of VOCs or NO_X within the state borders. The plan to implement these RACM was due June 15, 2007, and is therefore included with this demonstration of attainment.

Because atmospheric transport overwhelms the ability of Connecticut to advance its 8-hour ozone attainment date solely using in-state strategies, Connecticut's attainment demonstration relies heavily on emission reductions from upwind states to increase the probability of attainment of the 8-hour NAAQS by June 15, 2010. While none of the potential measures discussed meet the criteria to be considered RACM because they cannot advance our attainment date, CTDEP has pursued in-state emissions reductions in acknowledgement of the importance of coordinated actions by groups of states throughout the eastern U.S. to better position all states for attainment by the designated attainment date.

RACT. A subset of RACM is the reasonably available control technology (RACT) requirement. EPA has defined RACT as the lowest emission limitation that a particular source is capable of meeting by the application of control technology that is reasonably available considering technological and economic feasibility. Unlike RACM, RACT is limited to sources for which EPA has developed Control Technique Guidelines (CTGs) and major non-CTG sources. As the analytical work for implementing the CTGs is readily available, and because the RACT sources are, *a priori*, a significant focus for implementing control strategies, EPA expects requirements limiting emissions from RACT sources to be addressed more readily than the other control options. Connecticut submitted its RACT SIP to EPA on December 8, 2006. In recognition of Connecticut's longstanding efforts to improve air quality with respect to ozone and its precursor emissions, that SIP submittal included measures that went beyond RACT.

OTC RACM Process. As a member of the OTC, Connecticut has worked jointly with the other eleven member states and the District of Columbia to assess the nature and magnitude of the ozone problem in the region, evaluate potential new control approaches and recommend regional control measures to ensure attainment and maintenance of the ozone NAAQS. The OTC staff and staff from member states formed several workgroups to identify and evaluate candidate control measures. Initially, the workgroups compiled and reviewed a list of over 1,000 candidate control measures. These control measures were identified through published sources such as EPA's Control Technique Guidelines, STAPPA/ALAPCO "Menu of Options" documents, the AirControlNET database, emission control initiatives in other states including California, state/regional consultations, and stakeholder input. The workgroups developed a preliminary list of approximately fifty candidate control measures to be considered for more detailed analysis with respect to the potential for emissions reductions, cost effectiveness, and ease of

implementation. These measures were anticipated to be most effective in reducing ozone air quality levels in the Northeastern and Mid-Atlantic States.

TCMs. The RACM analysis also consists of an evaluation of transportation control measures (TCMs) and their contribution to transportation and air quality planning in Connecticut. It is customary that the statewide transportation planning process in Connecticut includes the identification, evaluation, selection, and implementation of appropriate TCMs. The Connecticut Department of Transportation (CTDOT) produces annual updates to the Statewide Transportation Improvement Program (STIP), documenting projects to be funded under federal transportation programs for a three-year period.

One of the federal funding sources for the STIP is the Federal Highway Administration's Congestion Mitigation and Air Quality (FHWA CMAQ) Program. Funds are used for projects that reduce emissions from vehicles, improve traffic congestion, and/or improve air quality. A detailed list of projects is provided in Section 6 and Appendix 6A. Some examples of projects eligible for FHWA CMAQ funding are:

- Programs for improved public transit;
- Restriction of certain roads or lanes to, or construction of such roads or lanes for use by, passenger buses or high-occupancy vehicles (HOV);
- Employer-based transportation management plans, including incentives;
- Traffic flow improvement programs that achieve emission reductions;
- Fringe and transportation corridor parking facilities serving multiple-occupancy vehicle programs or transit service;
- Programs for the provision of all forms of high-occupancy, shared-ride services;
- Sections of the metropolitan area to the use of non-motorized vehicles or pedestrian use, both as to time and place;
- Programs for secure bicycle storage facilities and other facilities, including bicycle lanes, for the convenience and protection of cyclists, in both public and private areas; and
- Employer-sponsored programs to permit flexible work schedules.

E.7 Transportation Conformity

Transportation conformity is a CAA requirement that serves as a bridge to connect air quality and transportation planning activities. Transportation conformity is required under the CAA to ensure that highway and transit project activities receiving federal funds are consistent with ("conform to") the purpose of the SIP. Conformity to a SIP is achieved if transportation programs or transit project activities do not cause or contribute to any new air quality violations, do not worsen existing violations, and do not delay timely attainment of the relevant NAAQS.

Projected future emission levels in Connecticut resulting from the various control strategies were summarized previously. The on-road portion of these emission estimates will serve as transportation conformity emission budgets for the 8-hour ozone NAAQS, as listed in Table E.9. Emission budgets are being established for the RFP milestone year of 2008, the required attainment year of 2009 and a future year of 2012. The 2012 budget, although not required by

the CAA or EPA regulation, provides an enforceable mechanism to ensure continued reduction in on-road emissions beyond the required attainment year.

Table E.9: Transportation Conformity Emission Budgets (tons per summer day)

Area	2008		2009		2012	
	VOC	NO_X	VOC	NOx	VOC	NOx
SWCT Portion NY/NJ/CT	29.7	60.5	27.4	54.6	20.6	38.2
Greater Connecticut	28.5	54.3	26.3	49.2	19.8	34.8
Statewide Total	58.1	114.8	53.7	103.8	40.4	73.0

E.8 Attainment Demonstration: Modeling and Weight of Evidence

EPA requires that states with moderate (and above) ozone nonattainment areas 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. Because the June 15, 2010 deadline occurs in the middle of the 2010 ozone season, Connecticut and other states with moderate nonattainment areas must demonstrate NAAQS compliance for the preceding ozone season of 2009.

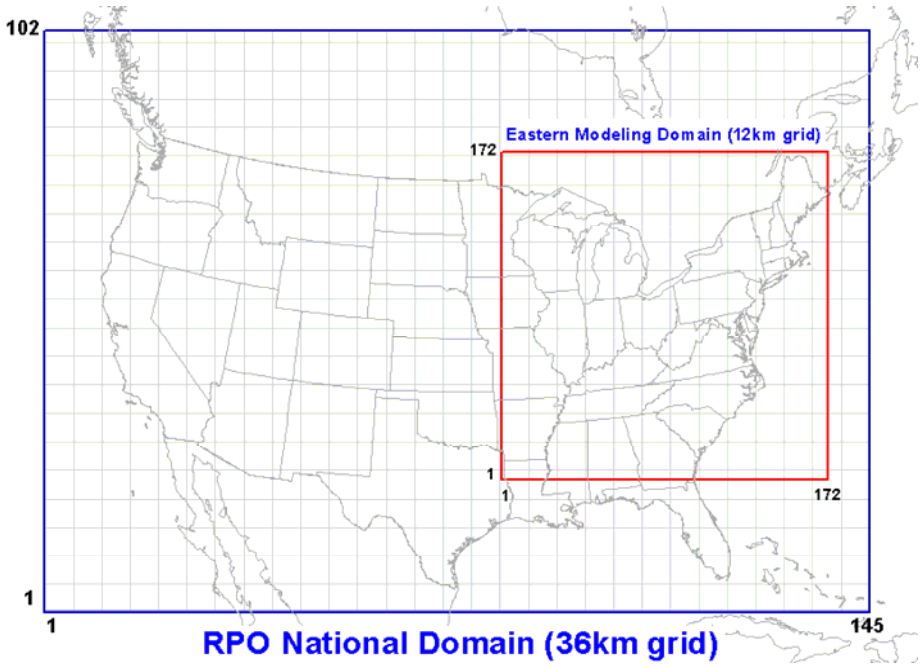
Grid Modeling. Sections 8.1 through 8.4 of this document describe the procedures followed, data inputs and results of the regional photochemical grid modeling exercise. Section 8.5 describes various WOE analyses that supplement the modeling results in assessing the likelihood of attaining the 8-hour NAAQS in both the Greater Connecticut nonattainment area and the Southwest Connecticut portion of the NY/NJ/CT nonattainment area. Figure E.8 shows the geographic domains used for the OTR modeling, including an outer grid with a grid resolution of 36 km for the national domain and an imbedded 12 km grid for the eastern domain. The modeling platform was EPA's Community Model for Air Quality (the CMAQ Model).

Figures E.9, E.10 and E.11 show the modeling results for Connecticut for 2002, 2009 and 2012, respectively. The plotted results for 2002 are based on the five-year average of fourth highest monitored ozone concentrations each year for the period centered on 2002 (i.e., 2000-2004). For 2009 and 2012 plots, the 2002 values are multiplied times the relative response factors (RRF) derived from the ratio of modeled ozone in the future year divided by the modeled ozone in the base year.

CTDEP's primary conclusions based on the results of the photochemical modeling and WOE analyses are:

1) There is a high level of probability that the **Greater Connecticut** area will achieve attainment of the 8-hour ozone NAAQS by the end of the 2009 ozone season; and
2) A credible case has been made that **Southwest Connecticut** will attain by the end of the 2009 ozone season. The probability of attainment increases as additional emission reductions occur in each subsequent year, such that attainment by 2012 is highly probable. Expeditious additional emission reductions from upwind states will also enhance the probability of earlier attainment in Southwest Connecticut.

Figure E.8: Modeling Domain Used for OTC Modeling



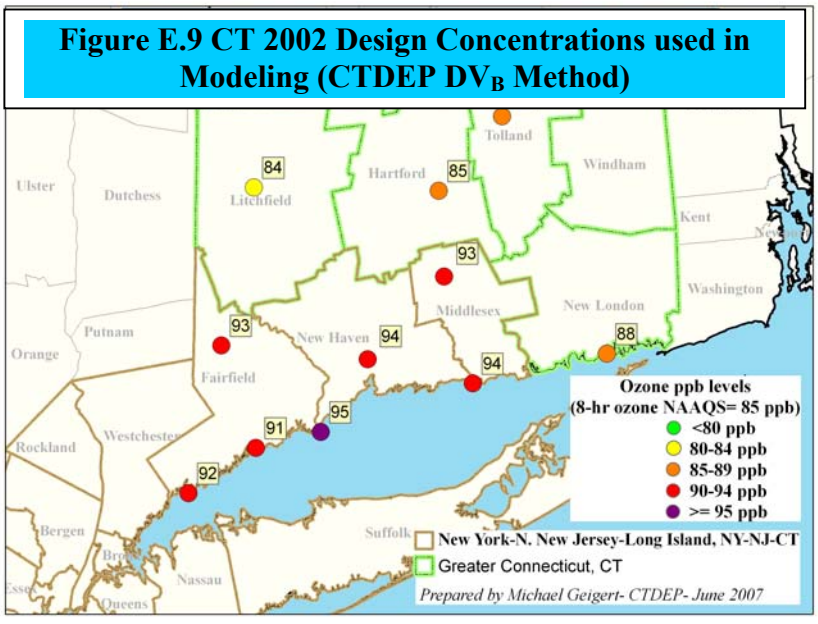


Figure E.10 CT 2009 Ozone Modeling Results (CTDEP DV_B Method)

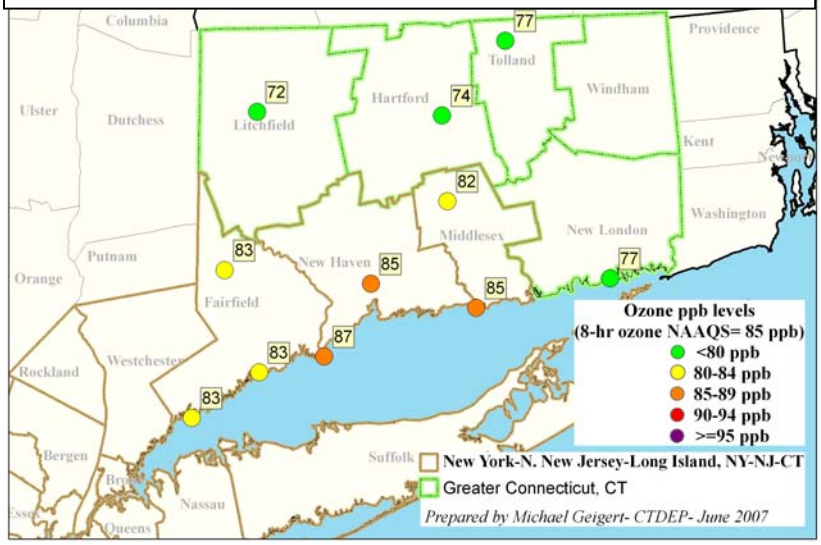
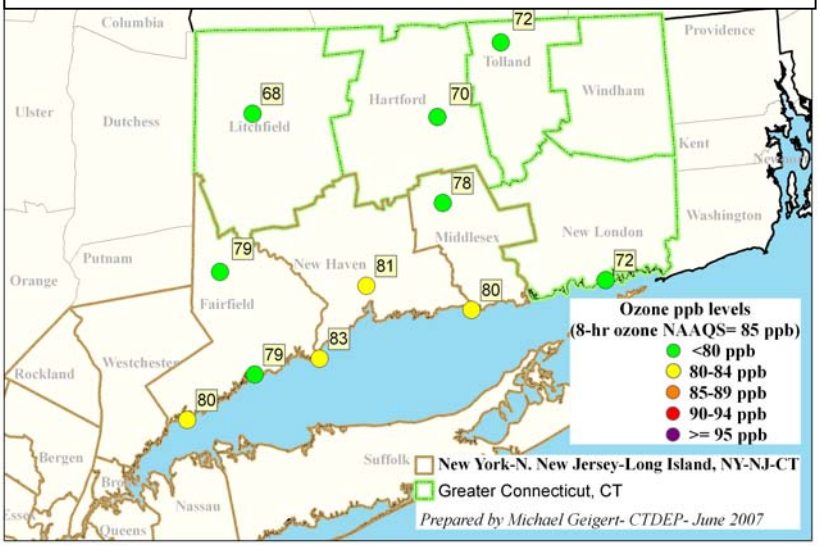


Figure E.11 CT 2012 Ozone Modeling Results (CTDEP DV_B Method)



Weight of Evidence. All seven Southwest Connecticut monitors are projected by the model to have 2009 design values within the "inconclusive" range (i.e., 82 ppb to 87 ppb) where EPA recommends the use of supplemental weight-of-evidence analysis techniques to better assess the probability of attaining by 2009. Several WOE analyses are presented in the main document. Included are discussions of uncertainty in model input data and formulations, variability in meteorology from year to year, observed air quality trends, comparison of modeled and monitored ozone levels, additional emission reductions not included in the CMAQ modeling and other relevant considerations. The results of these analyses support CTDEP's conclusion that there is a credible case for attainment throughout all of Southwest Connecticut by the end of the 2009 ozone season.

E.9 Contingency Measures

Section 172(c)(9) of the CAA and EPA's Phase 2 8-hour ozone implementation rule require states with 8-hour ozone nonattainment areas to include contingency measures in the SIP to be implemented if the area fails to satisfy a reasonable further progress milestone or fails to attain the 8-hour ozone NAAQS by the applicable attainment date. Such measures must be fully adopted rules that are ready for implementation quickly upon failure to achieve RFP or attainment.

As previously described in the document, the suite of control programs that have been adopted in each of Connecticut's nonattainment areas are projected to provide combined VOC and NO_X reductions that exceed the 15% RFP requirement by more than 20% relative to the 2002 adjusted base year inventory. These surpluses of emission reductions in 2008 will far exceed the additional 3% reduction required by the RFP contingency requirement in each area. As a result, any combination of these SIP measures providing a 3% VOC reduction can be specified for inclusion in the RFP contingency plan.

Connecticut's RFP contingency plan requirement will be met by using a portion of the expected emission reductions occurring from state rules limiting VOC emissions from architectural and industrial maintenance coatings (AIM) and solvent cleaning. As more fully described in Section 4 these regulations will result in a combined VOC reduction exceeding 16 tons/summer day by 2009, providing more than a 4% reduction relative to the 2002 adjusted base year VOC inventory, thus satisfying the 3% reduction requirement.

The failure-to-attain contingency plan must identify control measures sufficient to secure an additional 3% reduction in ozone precursor emissions should a moderate nonattainment areas fail to attain the 8-hour ozone NAAQS by the June 2010 required attainment date. EPA will determine each moderate area's attainment status in 2010, using measured 2009 ozone design values. If EPA determines that an area has failed to attain, the contingency plan would be triggered for implementation beginning with the 2011 ozone season.

Connecticut's failure-to-attain contingency plan requirement will be met by using a portion of the expected emission reductions occurring from federal measures tightening engine and fuel standards for on-road vehicles and non-road equipment. As more fully described in Section 4, these adopted federal programs will continue to provide an increasing level of VOC and NO_X emission reductions through 2012 and beyond. Total VOC emission reductions from these two sectors are estimated to be 19.3 tons/summer day between 2009 and 2012 (i.e., 13.3 tons/summer day from on-road vehicles and 6.0 tons/summer day from non-road equipment; see Table 4.3.2). Assuming the reductions increase linearly between 2009 and 2012, VOC reductions between 2009 and 2011 would total 12.9 tons/summer day. This equates to a 3.3% VOC reduction relative to the 2002 adjusted base year VOC inventory, satisfying the 3% reduction requirement.

E.10 Commitments

The ultimate success of this attainment demonstration will be dependent upon the fulfillment of a number of commitments made by Connecticut, other states and EPA to adopt, implement and enforce a wide array of ozone precursor control measures and to comply with relevant CAA requirements. Section 10 summarizes the commitments CTDEP has made elsewhere in this SIP document and makes requests of EPA to pursue additional national control measures and to exercise its CAA authority to ensure that other states no longer contribute significantly to ozone violations in Connecticut.

As more fully described in Section 4, Connecticut has adopted, or is currently pursuing adoption of a number of new and revised regulations that will provide a significant level of ozone precursor emission reductions by the June 2010 attainment deadline. Connecticut has already adopted and initiated implementation of several post-2002 control strategies, including the enhanced motor vehicle emission inspection maintenance program and regulations restricting emissions from portable fuel containers, automotive refinishing operations, gasoline station pressure vent valves, and municipal waste combustion units. Table E.10 summarizes the status of the 8-hour ozone SIP regulations that CTDEP is committing to pursue through Connecticut's rulemaking process.

Table E.10: 8-hour ozone SIP regulations that CTDEP is committing to pursue

Control Measure	Pollutant	Section of the Regulations of Connecticut State Agencies
Standards for **Municipal Waste Combustion**	NO_X	22a-174-38 (In-Place)
Stage II Vapor Recovery – **Gasoline Service Station Pressure Vent Valves**	VOC	22a-174-30 (In-Place)
Automotive Refinishing Operations	VOC	22a-174-3b(d) (In-Place)
Design Improvements for **Portable Fuel Containers**	VOC	22a-174-43 (In-Place)
Reduced Vapor Pressure Limitation for **Solvent Cleaning**	VOC	22a-174-20(*l*) (In-Place)
NO_X Reductions from **ICI Boilers**	NO_X	22a-174-22 (Hearing Held)
CAIR NO_X Ozone Season Trading Program	NO_X	22a-174-22c (In-Place)
VOC Content Limits for **Architectural Coatings**	VOC	22a-174-41 (In-Place)
Restrictions on **Asphalt** in **Paving** Operations	VOC	22a-174-20(k) (Hearing Held)
VOC Content Limits for **Consumer Products**	VOC	22a-174-40 (In-Place)
Restrictions on the Manufacture and Use of **Adhesives and Sealants**	VOC	22a-174-44 (Hearing Held)

In addition to formal SIP commitments to pursue adoption of the regulations summarized in Table E.10, CTDEP and other state agencies are involved with several non-SIP initiatives that have or will produce ozone precursor emission reductions to further improve ozone levels. These non-SIP programs, which are described more fully in Section 8.5.5, include:

- **High Electric Demand Day** (HEDD) initiative: Currently, EGU emissions on hot summer days with peak power demand can be more than double the emissions on an average summer day. Four northeastern states have recently signed a memorandum of understanding (MOU) to pursue reductions of peak day emissions from electricity generation. Negotiations continue with other states and stakeholders to expand this initiative. In addition, the recent passage of a new comprehensive Connecticut law addressing electricity and energy efficiency (CT Energy Act) will also play a key role in shaping the final form of the HEDD initiative in Connecticut.
- The **Connecticut Energy Efficiency Fund** (CEEF) provides about $60 million each year to support energy efficiency projects for business, government and residences. Available estimates indicate that CEEF projects funded since 2001 have resulted in the avoidance of NO_X emissions on the order of two tons per day. Demand response programs are also being implemented; including a new initiative that provides discounted rates to residential customers who reduce peak summer electrical usage.
- **Connecticut's legislature** has committed $1 billion to programs designed to reduce traffic congestion, including development of a New Haven-Hartford-Springfield, MA commuter rail line, other expanded transit alternatives, increased telecommuting and flexible employee scheduling, and increased port and rail freight options.

New EPA Control Technique Guidelines. EPA is in the process of adopting several new Control Technique Guideline (CTG) requirements for various VOC source categories. Table E.11 provides a summary of the new EPA CTG categories. As appropriate, Connecticut will analyze the need to adopt requirements to address these CTGs for sources in the state and pursue adoption of such requirements in subsequent SIP submittals. Although emission reductions from

Table E.11: CTGs Scheduled for Adoption by EPA Since 2005

Control Techniques Guideline (CTG) Category
Lithographic Printing Materials
Letterpress Printing Materials
Flexible Packaging Printing Materials
Flat Wood Paneling Coatings
Industrial Cleaning Solvents
Paper, Film, and Foil Coatings
Metal Furniture Coatings
Large Appliance Coatings
Miscellaneous Metal Products Coatings
Fiberglass Boat Manufacturing Materials
Miscellaneous Industrial Adhesives
Plastic Parts Coatings
Auto and Light Duty Truck OEM Coatings

these categories are expected to occur prior to 2012, they are not included in the attainment demonstration modeling. As a result, future adoption of CTG-related rules will provide emission reductions beyond those modeled, increasing the likelihood of future attainment.

Connecticut's Reliance on Other States and EPA. Connecticut's recently submitted Section 110(a)(2)(D) SIP revision includes a discussion of EPA's CAIR modeling analysis, which identifies numerous upwind states as contributing significantly to 8-hour ozone NAAQS nonattainment in Connecticut. The analysis showed that Connecticut is the only state in the CAIR program subject to transport exceeding 90% of projected 2010 ozone levels, illustrating the unique and overwhelming influence upwind emissions have on Connecticut's prospects for achieving timely attainment. EPA's modeling also predicts that CAIR will provide minimal relief to Connecticut, reducing by less than one percent the ozone and precursor transport affecting the state on high ozone days.

EPA's CAIR modeling highlights the importance of securing sufficient upwind reductions to enable Connecticut to achieve timely attainment. As described in Section 8, the modeling used in this attainment demonstration is based on the OTC's "beyond-on-the-way" suite of control measures. CTDEP is pursuing adoption of these measures, and is dependent on upwind states doing the same.

Although the weight-of-evidence analyses included in Section 8 support CTDEP's conclusion that 8-hour ozone attainment is likely in Greater Connecticut by 2009 and may be achieved in Southwest Connecticut by 2009, the probability of attainment can be enhanced if additional non-modeled upwind reductions are secured. CTDEP requests that EPA, when reviewing ozone attainment demonstrations and other related SIP revisions, ensures that adequate emission controls are adopted and implemented by upwind states such that no other state continues to significantly contribute to ozone nonattainment in Connecticut.

CTDEP also requests that EPA adopt additional national and regional emission control programs to ensure equitable and cost-efficient progress can be made to achieve both the current and soon-to-be-revised 8-hour ozone NAAQS. To that end, EPA should follow through on timely promulgation of the CTGs listed in Table E.11, and ensure states comply in a timely manner. In addition, EPA should move forward to adopt the most stringent possible non-road and on-road emission standards for all mobile source categories and work with states to address HEDD emissions that exacerbate ozone air quality problems on hot summer days.