MID-COURSE REVIEW

Progress Towards Attainment of the 1-Hour Ozone Standard for the Connecticut Portion of the New York-Northern New Jersey-Long Island Area and the Greater Connecticut 1-Hour Ozone Nonattainment Area

Connecticut Department of Environmental Protection
January 10, 2005

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1.0 INTRODUCTION

The Connecticut Department of Environmental Protection (CTDEP) has prepared this mid-course review report to demonstrate to the U.S. Environmental Protection Agency (EPA) that the State has met its obligations under the Clean Air Act, as amended in 1990 (CAA), for planning related to the 1-hour ozone national ambient air quality standard (NAAQS). The review includes a summary of the adoption of all emission control programs committed to in Connecticut's State Implementation Plan (SIP), estimated emission reductions achieved through these programs and an assessment of ozone air quality trends as they relate to the 2007 attainment date. Finally, emission reductions from upwind states are an important element of the improvement in Connecticut's air quality. Progress in reducing ozone levels is expected to continue as a result of programs that have been adopted to meet the 1-hour ozone NAAQS and programs under development to assure attainment of the 8-hour ozone NAAQS by 2010.

1.1 Background

Pursuant to the CAA, 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 nonattainment area, with a severe classification and associated attainment date of 2007. The remainder of Connecticut, known as the Greater Connecticut nonattainment area, was classified as serious nonattainment with a required attainment date of 1999.

CTDEP submitted initial attainment demonstrations for both the Southwest Connecticut and Greater Connecticut ozone nonattainment areas on September 16, 1998. The attainment demonstrations relied on photochemical grid modeling, air quality trends and other corroborating weight of evidence 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.*, volatile organic compounds (VOC) and nitrogen oxides (NOx)) from upwind areas precluded compliance by that area's required 1999 attainment date and requested an extension to 2007. EPA published proposed rulemakings regarding CTDEP's attainment demonstrations on December 16, 1999 (64 FR 70332 and 64 FR 70348).

For Greater Connecticut, EPA proposed (in the December 16, 1999 rulemaking) to approve both the 2007 attainment date extension request and the attainment demonstration for the area, contingent upon submittal of an adequate motor vehicle emissions budget that was consistent with attainment. CTDEP submitted the required motor vehicle budgets for Greater Connecticut in February 2000, which were found adequate by EPA on June 16, 2000 (65 FR 37778). As a result, EPA issued final approvals for the 2007 attainment date extension, motor vehicle budgets and attainment demonstration for Greater Connecticut on January 3, 2001 (66 FR 634).

EPA's December 16, 1999 rulemaking also proposed to approve conditionally the ozone attainment SIP for the Southwest Connecticut portion of the New York-Northern New Jersey-

Long Island nonattainment area, contingent upon the satisfaction of certain specified conditions. Such conditions for SIP approval included: 1) submittal of an adequate 2007 motor vehicle emissions budget consistent with attainment; 2) submittal of measures achieving additional emission reductions identified by EPA as necessary for attainment by 2007 (i.e., the "attainment shortfall"); 3) submittal of an emission reduction rate-of-progress plan for the period from 1999 through 2007; and 4) a commitment to submit the results of a mid-course review of attainment progress by the end of 2003. On July 28, 2000, EPA issued a supplemental notice to the December 16, 1999 rulemaking indicating that a state for which the SIP includes the benefits of EPA's Tier 2/Low Sulfur Gasoline program must commit to revise the 2007 motor vehicle emissions budgets within one year after the official release of EPA's MOBILE6 emissions model (65 FR 46383). Also, EPA subsequently modified the date for submitting the mid-course review to December 31, 2004, in order to allow inclusion of regional emission reductions resulting from EPA's NOx SIP Call.

CTDEP addressed EPA's conditional approval of the Southwest Connecticut attainment demonstration with SIP revisions submitted on February 8, 2000 and October 15, 2001, as follows:

- The February 8, 2000 revision included 2007 mobile source budgets, which were subsequently found to be adequate by EPA on June 16, 2000 (65 FR 37778), as well as commitments to adopt tighter limits on municipal waste combustor units, submit additional control measures to address the EPA-identified attainment shortfalls, revise motor vehicle emission budgets within one year after release of MOBILE6 and perform a mid-course review by the end of 2003.
- The October 15, 2001 revision included Connecticut's post-1999 rate-of-progress (ROP) plan and associated ROP contingency measures, additional NOx limits applicable to municipal waste combustors adopted in October 2000, a commitment to pursue the adoption of additional control measures to eliminate the EPA-identified shortfall needed to attain the 1-hour ozone standard by November 2007 and a commitment to submit a mid-course review for the Southwest Connecticut and Greater Connecticut nonattainment areas by December 31, 2004.

On December 11, 2001 (66 FR 63921), EPA published final approval of the September 16, 1998 attainment demonstration for Southwest Connecticut, as modified on February 8, 2000, and the additional elements submitted on October 15, 2001 (the Attainment Demonstration Approval).

Two subsequent SIP revisions addressed additional commitments for the nonattainment areas, as follows:

- A June 17, 2003 submission included 2007 MOBILE6.2 motor vehicle emissions budgets for the Southwest Connecticut and Greater Connecticut nonattainment areas. EPA approved these budgets on December 18, 2003 (68 FR 70437) and found them adequate for conformity purposes on January 20, 2004 (69 FR 2711).
- A December 1, 2004 submission included additional "shortfall" control measures adopted in 2002, 2003 and 2004 and calculations of the emissions reductions associated with those measures.

1.2 Summary

The submission of this mid-course review for the Southwest Connecticut and Greater Connecticut nonattainment areas satisfies the final outstanding commitment contained in the Attainment Demonstration Approval. This review presents an assessment on a statewide basis of recent trends in monitored air quality data, emissions estimates and other corroborating analyses to demonstrate that Connecticut's and other states' strategies are resulting in emissions reductions and air quality improvements needed to attain the 1-hour ozone standard by November 2007.

As a result of CTDEP's planning and regulatory efforts combined with emissions reductions from upwind states, Connecticut appears to be on-target to achieve the necessary design value of less than 125 ppb[1] by 2007. The rate-of-progress towards the attainment goal is summarized in Figure 1. The highest 1-hour ozone design value (defined as the fourth highest value over three years) in the New York-Northern New Jersey-Long Island nonattainment area was 201 ppb as defined by the CAA for the base year of 1989. Assuming reductions are achieved at an even rate over the 18-year period from 1989 to 2007, ozone levels would need to decline by 4.28 ppb per year to achieve attainment by 2007. Over the fifteen-year period from 1989 to 2004, this would require total reductions of 64.2 ppb, corresponding to a design value goal of 136.8 ppb in 2004. The highest design value measured in 2004 was 137 ppb. The conclusion from this simple analysis is that Connecticut is on-target for attainment in 2007. The more detailed emissions and air quality analyses presented in Sections 2 and 3 supplement this analysis.

Figure 1. 1-Hour Ozone Mid-Course Review Rate-of-Progress Analysis Using Air Quality Data for the New York-Northern New Jersey-Long Island Nonattainment Area

1. **Base Year (1989):** DV (87-89) = 201 ppb (Measured in Stratford, CT)
2. **Target Year Goal (2007):** DV $\leq$ 124 ppb
3. **Desired ROP to Meet Target (Assumes Even Rate):** 2007-1989 = 18 yrs
   201-124 = 77 ppb
   77 ppb/18yr = 4.28 ppb/yr
4. **Goal for 2004:** 2004-1989 = 15 yrs
   4.28 ppb/yr x 15 yrs = 64.2 ppb (Ozone improvement goal)
   Ozone goal (2004) = 136.8 ppb (= 201- 64.2)
5. **Status for 2004:** Highest measured DV = 137 ppb
   (Greenwich and Madison, CT; and Holtsville, NY)
6. **Conclusion:** On-target for attainment in 2007

[1] The NAAQS of 0.12 parts per million (ppm) is interpreted as 125 parts per billion (ppb).

2.0 EMISSION REDUCTION REGULATION REVIEW

CTDEP has implemented all emission control programs mandated by the 1990 CAA, as well as other measures necessary to ensure adequate progress towards compliance with the 1-hour ozone NAAQS. Additional control measures have also been adopted and submitted to EPA to offset the EPA-identified shortfall in emissions reductions necessary to attain the 1-hour ozone standard by November 2007. This section reviews the measures adopted to meet CAA mandates and Connecticut's rate-of-progress (ROP) requirements and describes the additional control measures adopted to offset the EPA-identified emissions reduction shortfall.

2.1 Measures Initially Adopted for 1-Hour Ozone Standard Attainment

A list of measures adopted to meet CAA mandates and ROP requirements is provided in Table 1. The emissions reductions benefits from the listed measures are expected to increase beyond the reductions achieved at initial implementation for some stationary source strategies due to phase-in of standards and equipment turnover. With the exception of the one-time benefit for the enhanced motor vehicle inspection and maintenance program and reformulated gasoline, all mobile source programs identified in Table 1 result in increasing levels of emissions reductions through and beyond 2007 due to fleet turnover. The decreasing trend in statewide emissions resulting from these programs is discussed in Section 3.1.

2.2 Additional Control Measures to Address the EPA-Identified Emissions Shortfall

In the Attainment Demonstration Approval, EPA approved a commitment by CTDEP to pursue adoption of several additional control measures. In fulfillment of that commitment, CTDEP has adopted and submitted to EPA as SIP revisions four additional control measures:

- NOx reductions at municipal waste combustor facilities;
- VOC restrictions for automotive refinishing operations;
- Stage II vapor recovery at gasoline pumps; and
- Spillage and permeation controls on portable fuel containers.

Table 2 identifies the estimated emissions benefits in tons per day for each of these additional control measures. Total NOx reductions of 1.3 tons/day to 1.6 tons/day and VOC reductions of 6.7 tons/day to 9.8 tons/day are projected for 2007 due to these measures, depending on the level of rule effectiveness assumed. These combined reductions are greater than the EPA-identified shortfall of 0.5 tpsd for NOx and 5.4 tpsd for VOCs (Attainment Demonstration Approval; 66 FR 63924).

These four additional control measures are different in part from the measures identified for potential adoption in previous SIP revision submittals. CTDEP indicated in its October 15, 2001 SIP revision that it would fill a portion of the EPA-identified emissions reduction shortfall by pursuing the adoption of the following two control measures based on model rules developed by the Ozone Transport Commission (OTC): (1) additional restrictions on VOC emissions from mobile equipment refinishing and repair operations; and (2) requirements to reduce VOC emissions from certain consumer products. The Department reserved the option to pursue adoption of other OTC model rule measures producing equivalent emissions reductions.

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

Control Strategy	Pollutant		Federal Program	State Program	Rule Approval Date[2]	Initial Year of Implementation[3]
	VOC	NOx				
Stationary Sources[4]						
Consumer Products	●		●		09/11/98	1999
Architectural & Industrial Maintenance Coatings	●		●		09/11/98	2000
Autobody Refinishing VOC Limits	●		●		09/11/98	1999
Stage I Vapor Recovery at Gasoline Service Stations	●			●	10/18/91	1992
Stage II Vapor Recovery at Gasoline Service Stations	●			●	12/17/93	1994
VOC RACT	●			●	03/21/84	1984
Cutback Asphalt: Increased Rule Effectiveness	●			●	10/24/97	1998
Gasoline Loading Racks: Increased Rule Effectiveness	●			●	10/24/97	1998
CT NOx "RACT" Regulation		●		●	10/06/97	1994
OTC Phase II NOx Controls		●		●	09/28/99	1999
NOx Budget Program (EPA NOx SIP Call)		●		●	12/27/00	2003
Municipal Waste Combustor Controls		●		●	04/21/00;12/06/01[5]	2000, 2003
Mobile Sources						
Enhanced I/M (ASM 2525 phase-in cutpoints)	●	●		●	03/10/99	2000
Enhanced I/M (ASM 2525 final cutpoints)	●	●		●	10/27/00	2004
OBD-II Enhanced I/M	●	●		●	[6]	2004
Reformulated Gasoline - Phase I[4]	●	●	●		12/23/91[7]	1995
Reformulated Gasoline - Phase II[4]	●	●	●		02/16/94[7]	2000
Tier 1 Motor Vehicle Controls	●	●	●		06/05/91	1994
On-board Refueling Vapor Recovery	●		●		04/06/94	1997-2005
National Low Emission Vehicle Program	●	●	●		03/02/98[8]	1998 (in CT)
Tier 2 Motor Vehicle Controls/Low Sulfur Gasoline	●	●	●		2/10/00	2004-2008
California Low Emission Vehicle Phase 2 (CALEV2)	●	●	●	●	[9]	2007
Heavy-Duty Diesel Vehicle Controls and Fuels	●	●	●		10/06/00	2004-2005
Non-Road Engine Standards[10]	●	●	●		1994-2000[11]	1996-2008

Footnotes to Table 1

[1] Does not include measures adopted to meet the EPA-identified shortfall. See Table 2 for a list of those measures.

[2] 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.

[3] 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.

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

[5] These are the approval dates of MWC state plan submissions were published in the Federal Register. The associated reductions were approved for attainment purposes on 12/1/01.

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

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

[8] EPA Administrator Browner 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.

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

[10] The initial implementation date for non-road vehicle standards varies by category (e.g., small gasoline engines, locomotives, construction equipment, etc). Does not include EPA's June 29, 2004 final Tier 4 rule requiring additional reductions from new non-road engines beginning in 2008.

[11] Federal rule approval dates for on-road engine standards vary by category.

Table 2. Estimated Emission Benefits from Implementation of Connecticut's Emissions Reduction Shortfall Measures.

Shortfall Measure	Pollutant Reduced	Estimated Reduction at 100% Rule Effectiveness (tons/summer day)	Estimated Reduction at 80% Rule Effectiveness (tons/summer day)
Municipal Waste Combustors	NOx	1.6	1.3
Automotive Refinishing Operations	VOC	3.8	3.0
Gasoline Service Station Pressure-Vent Valves	VOC	1.8	1.4
Portable Fuel Containers	VOC*	2.9 to 4.2	2.3 to 3.4
Total Reductions	**NOx VOC**	**1.6 8.5 to 9.8**	**1.3 6.7 to 7.8**
Required Reductions	**NOx VOC**	**0.5 5.4**	

* The first value listed for each level of rule effectiveness assumes no compliant PFCs are sold during the allowed 1-year sell-through period (May 1, 2004 through April 30, 2005). The second value listed for each level of rule effectiveness assumes all PFCs sold beginning May 1, 2004 comply with the new regulation. Actual reductions are likely to be somewhere between those two extremes. VOC reductions from PFCs will continue to increase throughout the assumed 10-year product turnover period, with a total reduction of about 13 tons/summer day at full turnover (by 2015).

Requirements for mobile equipment refinishing and repair operations, referred to as "automotive refinishing operations" in Connecticut, were adopted in 2002. However, while CTDEP prepared several iterations of a draft of a consumer product VOC regulation in 2001 and 2002, that regulation has not been adopted. Based on the barriers that other states were experiencing adopting similar consumer products regulations and an on-going evaluation of the other OTC model rule options available, CTDEP chose to place a hold on the adoption of a consumer products regulation and instead pursue the adoption of Stage II vapor recovery and portable fuel container requirements. As these efforts did not face significant opposition, CTDEP had more confidence in their eventual adoption and realization of the associated emissions reductions. This confidence was well placed; an amendment to CTDEP's Stage II vapor recovery regulation and a new regulation for portable fuel containers were adopted on May 10, 2004 and submitted to EPA as a revision to the Connecticut SIP on December 1, 2004.

Details of the expected emission reductions for each of the adopted shortfall measures are discussed below.

2.2.1 Municipal Waste Combustor NOx Reductions

An amendment to Regulations of Connecticut State Agencies (R.C.S.A.) section 22a-174-38 to reduce emissions of NOx from municipal waste combustors below previously required levels was adopted on October 26, 2000. The amended regulation and the calculation of the associated emissions reductions were submitted to EPA in the October 15, 2001 SIP revision submission and approved in the Attainment Demonstration Approval. Since those additional NOx emissions reductions were not assumed in the attainment demonstration modeling, EPA approved the use of those reductions to fill a portion of the emission reduction shortfall. As indicated in Table 2, NOx emission reductions from affected municipal waste combustors are estimated to be between 1.3 tons/day (assuming 80% rule effectiveness) and 1.6 tons/day (assuming 100% rule effectiveness). Municipal waste combustors in Connecticut are equipped with continuous emission monitors; therefore, rule effectiveness is expected to be close to 100 percent.

2.2.2 VOC Reductions from Automotive Refinishing Operations

On March 15, 2002, CTDEP adopted a new regulation, R.C.S.A. Section 22a-174-3b, to satisfy the commitment to achieve a portion of the EPA-identified emission reduction shortfall by adopting requirements to reduce emissions from automotive refinishing operations. R.C.S.A. Section 22a-174-3b includes emission limitations, operating practices and record keeping requirements for automotive refinishing operations, as well as other source categories, to restrict emissions to levels that are not significant contributions to localized air pollution. Through these requirements, R.C.S.A. section 22a-174-3b functions as a "permit by rule" and removes the owners and operators of subject sources from the duty to apply for and obtain individual operating permits. Requirements for automotive refinishing operations are consistent with those in the OTC model rule, including the use of high transfer efficiency spray guns (or equivalent) and enclosed spray gun cleaners.

On December 1, 2004, CTDEP submitted a SIP revision package to EPA that included R.C.S.A. section 22a-174-3b, documentation of its adoption according to state law and the calculated emissions reductions. As summarized in Table 2, estimated VOC emission reductions range

from 3.0 tons/day (assuming 80% rule effectiveness) to 3.8 tons/day (assuming 100% rule effectiveness).

2.2.3 VOC Reductions from Stage II Vapor Recovery Enhancements at Gasoline Pumps

On May 10, 2004, Connecticut adopted a regulatory amendment to R.C.S.A. section 22a-174-30 regarding Stage II vapor recovery at gasoline pumps, requiring pressure-vacuum vent valves and fill adaptors to limit VOC emissions.

In the SIP revision submittal dated December 1, 2004, CTDEP included amended R.C.S.A. section 22a-174-30, documentation of its adoption in accordance with state law and a calculation of the emissions reductions expected. As summarized in Table 2, VOC emission reductions for the pressure-vacuum vent valve requirement at gasoline stations are estimated to range from 1.4 tons/day (at 80% rule effectiveness) to 1.8 tons/day (at 100% rule effectiveness). Additional testing requirements are expected to enhance overall rule effectiveness.

2.2.4 VOC Reductions from Portable Fuel Containers

On May 10, 2004, Connecticut adopted a new regulation, R.C.S.A. section 22a-174-43 requiring spillage control and reduced permeation from new portable fuel containers sold in Connecticut. Connecticut's portable fuel container regulation is consistent with OTC's model rule for that source category, although the May 2004 effective date in Connecticut's regulation is about two years later than the effective date of the model rule.

In the SIP revision submittal dated December 1, 2004, CTDEP included new R.C.S.A. section 22a-174-43, documentation of its adoption in accordance with state law and a calculation of the emissions reductions expected. As summarized in Table 2, VOC emission reductions in 2007 from the portable fuel container rule are estimated to range from 2.3 tons/day (at 80% rule effectiveness and assuming retailers take full advantage of the allowed one year pass-through provision) to 4.2 tons/day (at 100% rule effectiveness and assuming retailers do not use the pass-through provision). VOC reductions from portable fuel containers will continue to increase throughout the assumed 10-year product turnover period, with a total reduction of about 13 tons/summer day at full turnover (by 2015).

2.3 The NOx Budget Program

Connecticut has participated in two distinct NOx Budget Programs (NBPs): the OTC NBP and the Federal NBP. Both programs are market-based emission cap-and-trade plans created to reduce emissions of NOx from power plants and other large combustion sources in the eastern United States. NBPs involve an allowance trading system that harnesses free market forces to reduce pollution. Under a NBP, each state is assigned a cap on the amount of NOx that may be emitted during the summer ozone season from May through September. Based on this statewide cap, each state government then allocates allowances to budget sources within the state. Each allowance permits a source to emit one ton of NOx during the control period (May through September) for which it is allocated and may be banked for later control periods. Allowances may be bought, sold or banked. Any person may acquire allowances and participate in the trading system. Each budget source must comply with the program by demonstrating at the end of each control period that actual emissions do not exceed the amount of allowances held for that

period. However, regardless of the number of allowances a source holds, it cannot emit at levels that would exceed other federal or state limits.

Connecticut and seven other states in the OTC[2] implemented the original OTC NBP from 1999 through 2002 and the Federal NBP beginning in 2003; eleven non-OTC states began compliance with the Federal NBP in 2004. A brief summary of the evolution of Connecticut's program and the anticipated impact of the implementation of the program in non-OTC states is provided in the following paragraphs.

On September 27, 1994 Connecticut and other states in the OTC entered into a Memorandum of Understanding to develop a regional program to achieve significant reductions in NOx emissions from large combustion sources. This program called for the establishment of a NOx cap-and-trade program with an emissions cap or "budget" that must not be exceeded by the combined emissions from all sources subject to the program during each summer ozone season, May 1 to September 30 of each year. The program was implemented from 1999 through 2002.

The Federal NBP originated from EPA's determination in the late 1990s that NOx emissions from large stationary sources in twenty-three jurisdictions significantly contribute to nonattainment of the 1-hour ozone NAAQS in one or more downwind states in the eastern portions of the United States.[3] EPA issued the NOx SIP Call in 1998, requiring affected states to amend their SIPs and limit NOx emissions during each ozone season beginning in 2003. Due to legal challenges, the initial deadline for emission reductions under the NOx SIP Call was delayed until May 31, 2004. However, the OTC states, except for New Hampshire and Virginia, did implement the Federal NBP on May 1, 2003.

Connecticut's NOx Budget Program was modified slightly to reflect the Federal NBP requirements. It was among the stationary source controls reflected in CTDEP's October 15, 2001 Post-1999 Rate of Progress Plan. The underlying regulation, R.C.S.A. section 22a-174-22b, was approved by EPA as a SIP-strengthening measure on December 27, 2000 (65 FR 81743). R.C.S.A. section 22a-174-22b established a statewide NOx budget and NOx allowance trading program for large electric generators and other industrial sources beginning with the 2003 ozone season. The budget cap is consistent with EPA's NOx SIP Call and the September 1994 OTC Memorandum of Understanding establishing the OTC NOx Budget Program. In Connecticut, the OTC program was conducted pursuant to R.C.S.A. section 22a-174-22a. As a result of the OTC NOx Budget Program, the Acid Rain program and other CAA requirements, by 2000 the OTC states had already reduced NOx emissions by approximately 55% from 1990 levels, thereby reducing the level of reductions necessary to meet the federal NBP targets.[4] With the further implementation of the Federal NBP in 2003, the OTC states' ozone season NOx emissions from subject sources were reduced 30% from 2002 levels and were 18% less than the

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[2] The Ozone Transport Commission includes the states of Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia and the District of Columbia.

[3] 62 Fed. Reg. 60317 (November 7, 1997); 63 Fed. Reg. 25902 (May 11, 1998); 63 Fed. Reg. 57356 (October 27, 1998).

[4] "NOx Budget Trading Program 2003 Progress and Compliance Report." U.S. Environmental Protection Agency Office of Air and Radiation. 2004. Available at:H http://www.epa.gov/airmarkets/cmprpt/nox03/noxreport03.pdfH.*Hereafter referred to as the EPA NBP Report.*

number of NBP allowances allocated in 2003.[5] In addition, NOx highest daily emissions and average daily emissions in the OTC states have decreased approximately 25% and 35%, respectively, from 1997 to 2003.[6]

While Connecticut and seven other OTC states implemented the Federal NBP in 2003, eleven other states -- Alabama, Illinois, Indiana, Kentucky, Michigan, North Carolina, Ohio, South Carolina, Tennessee, Virginia and West Virginia -- did not implement budget caps until May 31, 2004. By 2000, these non-OTC states had made only a 27% reduction in NOx emissions from 1990 levels, in contrast to the 55% reduction achieved by the OTC states in the same period.[7] EPA's NBP Report states that:

> Due to litigation, the 2004 control period for these states began on May 31, instead of May 1. The allowance allocations for 2004, however, are based on a full five-month ozone season. Because of the shorter control period in 2004 and CSP [Compliance Supplement Pool] allowances distributed in 2004 to help sources comply with the program, EPA anticipates that these states will have to achieve only modest reductions in 2004 to comply with the program. In 2005 and subsequent years, the control period will begin May 1, and deeper reductions will be necessary.

No update for 2004 has been issued on the implementation of the NBP in the non-OTC states. However, given the EPA's statement that only modest reductions were expected in 2004 for these sources to comply with the NBP, it is unlikely that the OTC states saw much, if any, air quality benefit from the implementation of the NBP in the non-OTC states in 2004. Therefore, implementation of the NBP in the non-OTC states should provide measurable air quality benefits to Connecticut and other downwind states by reducing the contribution to ozone resulting from interstate transport.

2.4 Other Directionally Correct Measures

In addition to implementing all mandated and shortfall control measures, CTDEP has recently adopted three regulatory measures that are directionally consistent with the goal of attaining the 1-hour ozone NAAQS: 1) an amendment to source monitoring requirements; 2) an amendment to the requirements for operation of air pollution control and monitoring equipment; and 3) the adoption of new requirements for distributed generators and emergency engines. Also, the state's Energy Conservation Management Board has funded a number of successful energy efficiency projects. While CTDEP is not seeking SIP credit at this time for any of these measures, they are described here to add weight to the demonstration that Connecticut is making significant progress towards 1-hour ozone standard attainment.

2.4.1 Source Monitoring and Operation of Air Pollution Control Equipment

On April 1, 2004, CTDEP completed the adoption of amendments to its regulations concerning stationary source emissions monitoring (R.C.S.A. section 22a-174-4) and operation of air pollution control equipment and associated monitoring equipment (R.C.S.A. section 22a-174-7).

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[5] 2004, EPA, *NOx Budget Trading Program -- 2003 Progress and Compliance Report*, EPA-430-R-04-010.

[6] 1997 and 1998 data from the Acid Rain Program; 1999-2002 data from the OTC trading program; 2003 data from the NBP.

[7] "NOx Budget Trading Program 2003 Progress and Compliance Report" at 9.

These amendments were submitted to EPA in a SIP revision dated December 1, 2004. The amendment to R.C.S.A. section 22a-174-4 updates the continuous emissions monitoring equipment requirements to current federal requirements, incorporates relevant portions of CTDEP's Continuous Emission Monitoring Guideline and revises language for improved clarity as well as consistency with current practices. The amendment to R.C.S.A. Section 22a-174-7 clarifies notification, reporting and compliance requirements for operation of air pollution control equipment and monitoring equipment in conjunction with the amendment of Section 22a-174-4; removes redundant requirements in R.C.S.A. sections 22a-174-12 and 22a-174-38; and revises language for consistency with current practices. By improving the clarity of regulatory requirements, these amendments will enhance compliance and enforcement, thereby ensuring that stationary sources in Connecticut are achieving expected emissions reductions.

2.4.2 Distributed Generators and Emergency Engines

On November 1, 2004, CTDEP completed the adoption of a new regulation, R.C.S.A. section 22a-174-42, to regulate emissions from distributed generators, smaller-scale electric generator units distributed throughout an electrical system. The requirements, which became effective on January 1, 2005, include output-based standards for emissions of NOx, particulate matter, carbon monoxide and carbon dioxide as well as fuel sulfur content requirements. CTDEP also amended R.C.S.A. section 22a-174-3b to reduce the operating hours and fuel sulfur content requirements for emergency engines. This adoption and amendment augments and updates existing air quality regulations to ensure that clean distributed generators become available in the future and to limit the adverse impacts from existing distributed generators and emergency engines, particularly if the use of such generators and engines increases to supply an increasing demand for electricity. An increase in the use of distributed generators and emergency engines is particularly likely in southwestern Connecticut, which the Federal Energy Regulatory Commission has identified as the most congested transmission and distribution area in the country.

2.4.3 Energy Efficiency Projects

The Connecticut Conservation and Load Management Fund, which is administered by the Energy Conservation Management Board (on which CTDEP is a voting member), funds energy efficiency programs that reduce electrical demand and power production, thereby decreasing the amount of air pollution associated with electricity generation. It is estimated that the energy efficiency measures implemented in 2003 reduced NOx emissions by 73 tons annually beginning in 2003 and will reduce NOx emissions by 1,151 tons over the lifetime of the measures funded. The projected 2004 annual and lifetime NOx emissions reductions are 95 tons and 1,357 tons, respectively. *See* Table 3. Reductions of similar magnitude were also achieved in 2001 and 2002, the first two years of the program. Such efforts are consistent with and support CTDEP's initiatives to reduce ozone emissions.

Table 3. NOx reductions (tons) from energy efficiency measures funded by the Connecticut Conservation and Load Management Fund in 2003 and 2004.

	2003 Annual Actual	2003 Lifetime Actual	2004 Annual Projected	2004 Lifetime Projected
NOx	73	1,151	95	1,357

2.4.4 8-Hour Ozone Standard Attainment Planning

CTDEP is currently developing a strategy, including the identification of potential state and federal regulatory measures, to attain the 8-hour ozone standard statewide by 2010. This attainment demonstration plan is scheduled for submission to EPA in 2007. Emission reductions achieved to attain the 8-hour ozone standard will also reduce 1-hour ozone levels. In addition, emission reduction benefits from measures identified in this report plus other strategies that exceed those required for attainment of the 1-hour ozone standard may be submitted for approval toward 8-hour ozone standard attainment.

3.0 TREND ANALYSES OF EMISSIONS, AIR QUALITY AND OTHER DATA

Connecticut has made considerable progress since the CAA was amended in 1990 to achieve significant reductions in ozone precursor emissions and improvements in air quality. The degree of progress is particularly noteworthy since emissions reductions have occurred in the face of concurrent growth in vehicle miles traveled and various economic indicators.

3.1 Emission Trends

As described in Section 2, numerous ozone reduction strategies have been implemented in Connecticut since 1990 (*see* Tables 1 and 2), resulting in significant reductions in both VOC and NOx emissions, reductions that will continue to grow through 2007 and beyond. Figures 2 and 3 show that anthropogenic VOC and NOx emissions are expected to decline by 43% and 37%, respectively, between 1990 and 2007 (including reductions from shortfall measures). Emission estimates are consistent with those in EPA's December 18, 2003 approval of Connecticut's MOBILE6.2 transportation conformity budgets (68 FR 70442), after adjustment to reflect additional reductions expected from the shortfall measures described in Section 2.2.

Figure 2. Projected Anthropogenic VOC Emission Trends for Connecticut

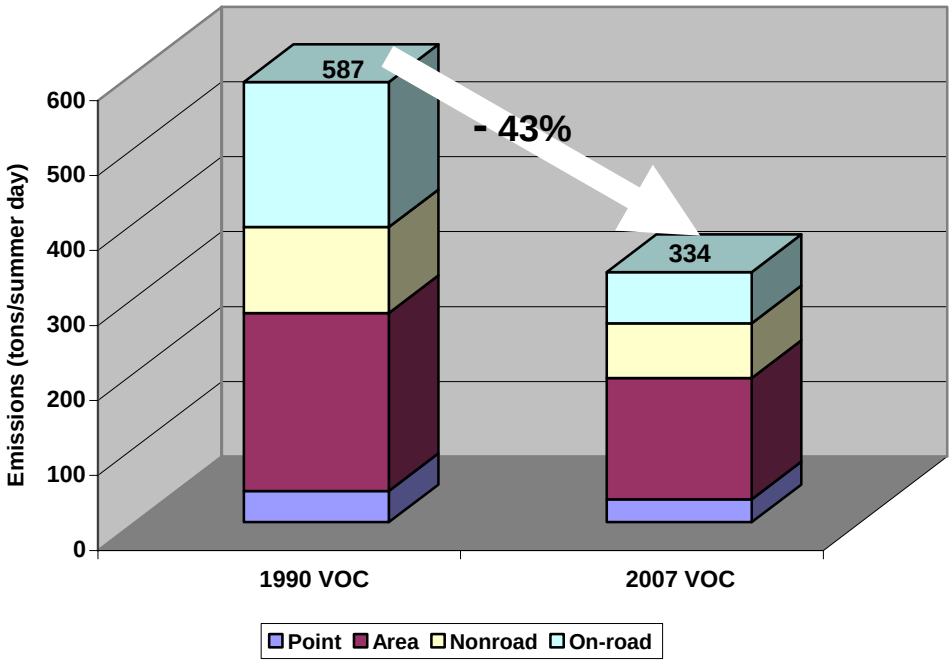
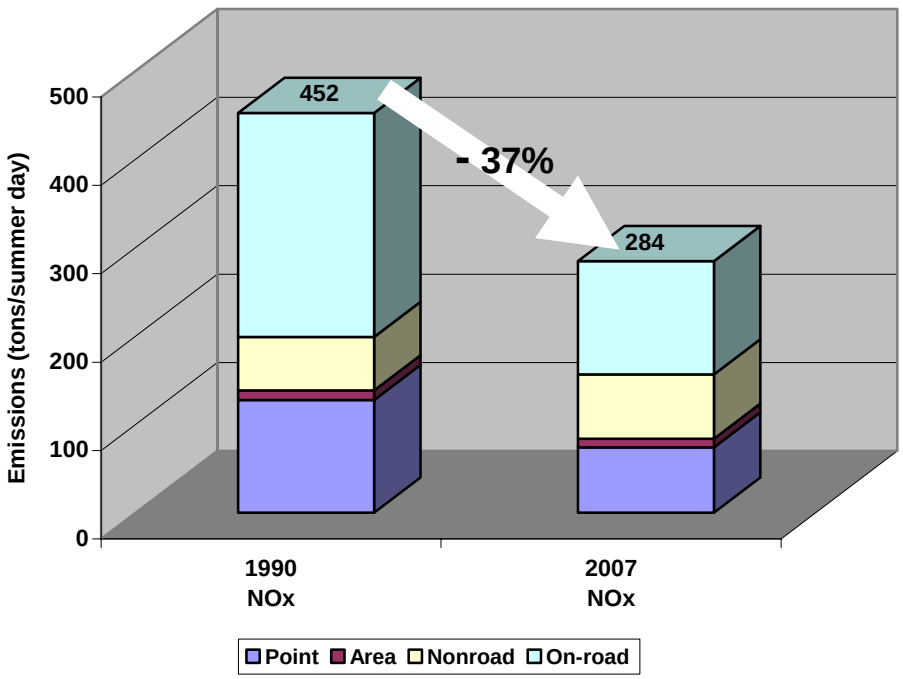


Figure 3. Projected NOx Emission Trends for Connecticut



Additional strategies that have been adopted, but not fully implemented (*e.g.*, Tier 2 and CAL LEV II vehicles, cleaner fuels beginning in 2006, heavy-duty diesel engine standards, non-road engine standards, portable fuel containers), will provide substantial further emissions reductions after 2007. For example, on-road control strategies are projected to provide additional VOC and NOx reductions of 45% and 55%, respectively, from that source sector between 2007 and 2015 even after consideration of expected growth in vehicle miles traveled. These programs should result in continued improvements in ambient ozone levels into the foreseeable future.

3.2 Air Quality Trends

CTDEP has been monitoring ambient ozone levels throughout the state since the early 1970's. The current network consists of the eleven sites mapped in Figure 4. Ozone levels over the period of record have improved dramatically, corresponding to the large decreases in ozone precursor emissions discussed earlier. This relationship is illustrated conceptually in Figure 5, which shows the decline from 1975 through 2004 in the annual frequency of days exceeding the ozone standard and indicates the year of implementation for each of Connecticut's major ozone control programs. Ozone trends are examined in more detail in the remainder of this section. Note that the ozone data set used in the analyses in this report does not include ozone levels recorded on July 9, 2002, which have been excluded due to the influence of a northern Quebec forest fire episode. Many other states in the Northeast have similarly flagged data during this episode as an exceptional event.

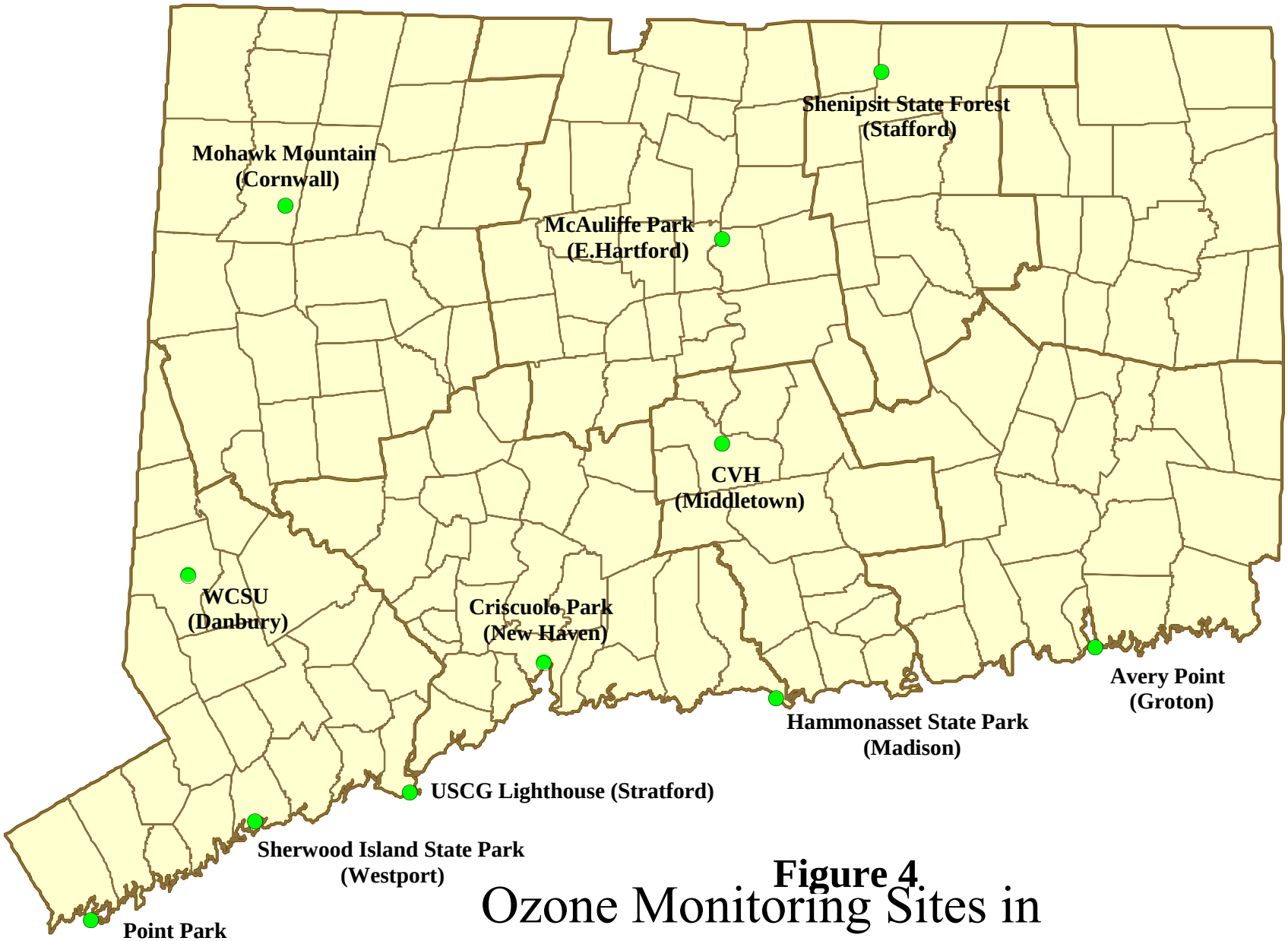
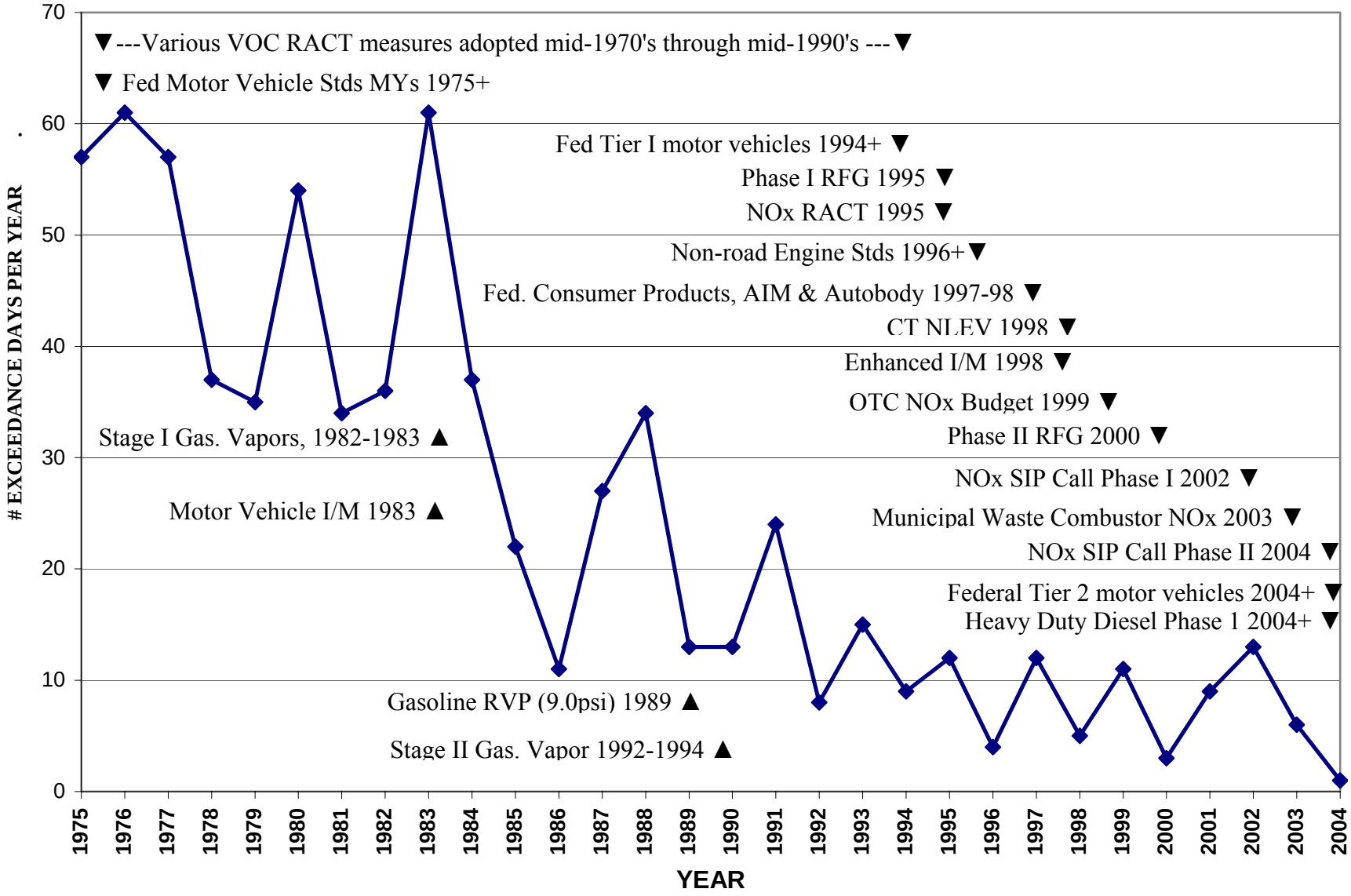


Figure 4
Ozone Monitoring Sites in (2004)

Figure 5. Connecticut 1-Hour Ozone Exceedance Day Trend and Implemented Control Strategies 1975 - 2004

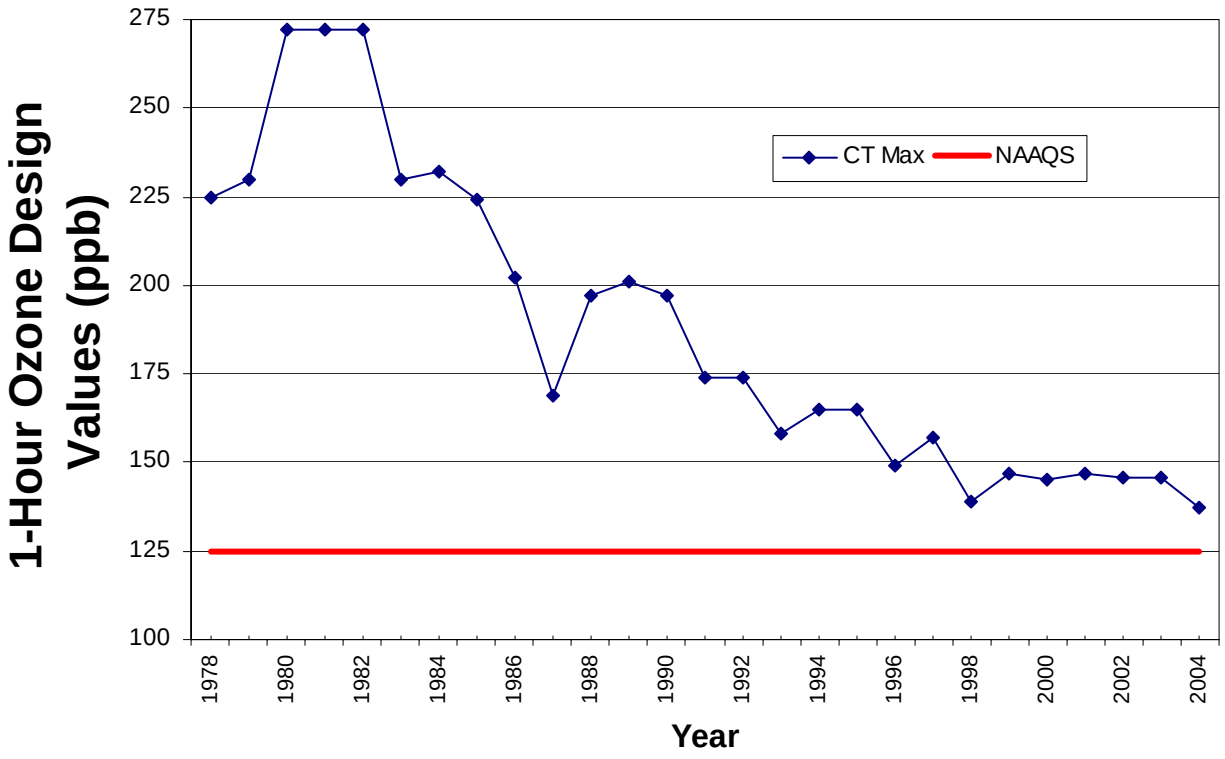


3.2.1 1-Hour Ozone Design Values

Compliance with the 1-hour ozone NAAQS is achieved when the highest design value for all monitors in a nonattainment area is less than 125 parts per billion (ppb). Design values at each monitor are defined as the 4th highest daily maximum 1-hour ozone concentration measured over a 3-year calendar period.

The trend in yearly maximum design values in Connecticut is plotted in Figure 6. Maximum design values in the state have decreased by nearly 50% since the early 1980's, from 272 ppb in 1980 to 137 ppb in 2004.

Figure 6. Connecticut 1-Hour Ozone Design Value Trends

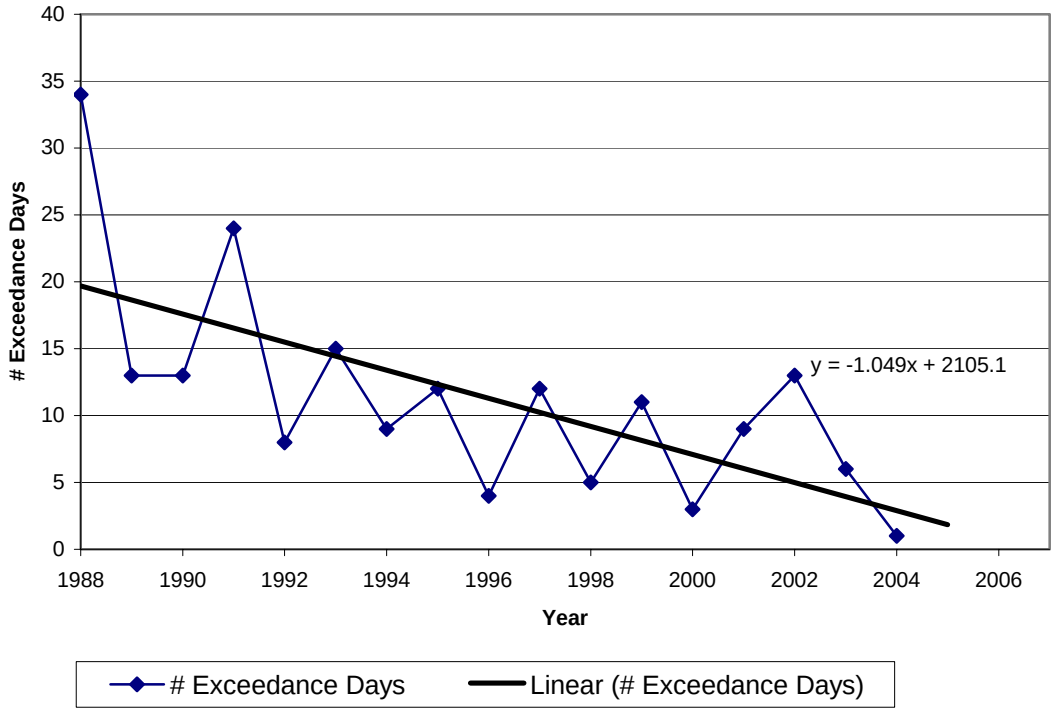


3.2.2 1-Hour Ozone Exceedance Days

An exceedance day of the 1-hour ozone NAAQS is defined as a day measured from midnight to midnight that any one or more monitors in the state record a 1-hour ozone concentration greater than or equal to 125 ppb. The total number of 1-hour ozone exceedance days in Connecticut for each year from 1975 through 2004 was displayed previously in Figure 5. Figure 5 shows that the number of exceedance days has decreased dramatically since the mid-1970's, from over 60 in 1976 and 1983 to a single day in 2004.

Ozone attainment designations made pursuant to the 1990 amendments to the Clean Air Act were based on measured ozone levels from the 1987 through 1989 baseline period (*i.e.*, 1989 design values). Figure 7 focuses on exceedance day trends in Connecticut since 1988 and includes a best-fit linear trend line through 2004. Assuming the downward trend continues at the same rate, projected annual exceedances drop to one by 2006 and are virtually eliminated by 2007. While the slope of the trend line is dependent on the years selected to develop it, and the future frequency of exceedance days will be highly dependent on meteorological conditions, trends since the designation baseline period indicate that compliance with the 1-hour ozone NAAQS is achievable in the 2007 timeframe. The likelihood of attainment with the 1-hour ozone NAAQS is heightened by the continuing emission reductions expected in Connecticut and upwind states from measures that are adopted and not fully implemented as well as those in the process of adoption.

Figure 7. Trends in Connecticut Exceedance Days 1988-2004



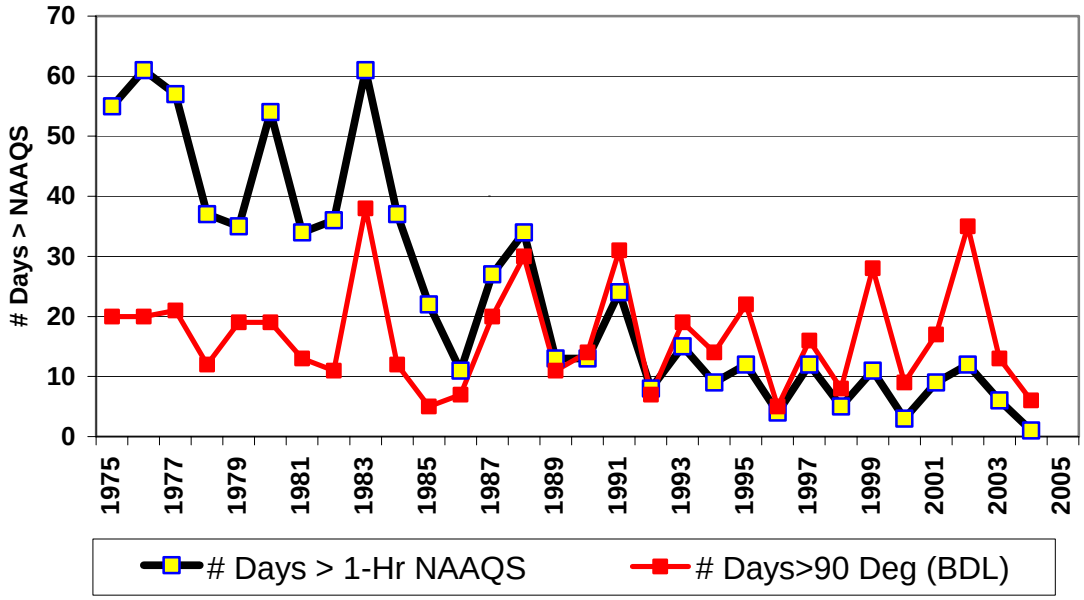
3.2.3 Meteorological Influences on Ozone Levels

Ozone is not emitted directly to the atmosphere, but is formed by photochemical reactions between VOCs and NOx in the presence of sunlight. High ozone days in Connecticut occur on hot summer days, typically with surface winds from the southwest and winds aloft from the west. The photochemical reactions that produce ozone are enhanced by the long summer days and elevated temperatures (which also lead to increased levels of evaporative VOC emissions), and transported ozone and precursor species are maximized by winds coming from areas with high emissions along the Interstate-95 corridor at the surface and midwestern power plants aloft. Hot

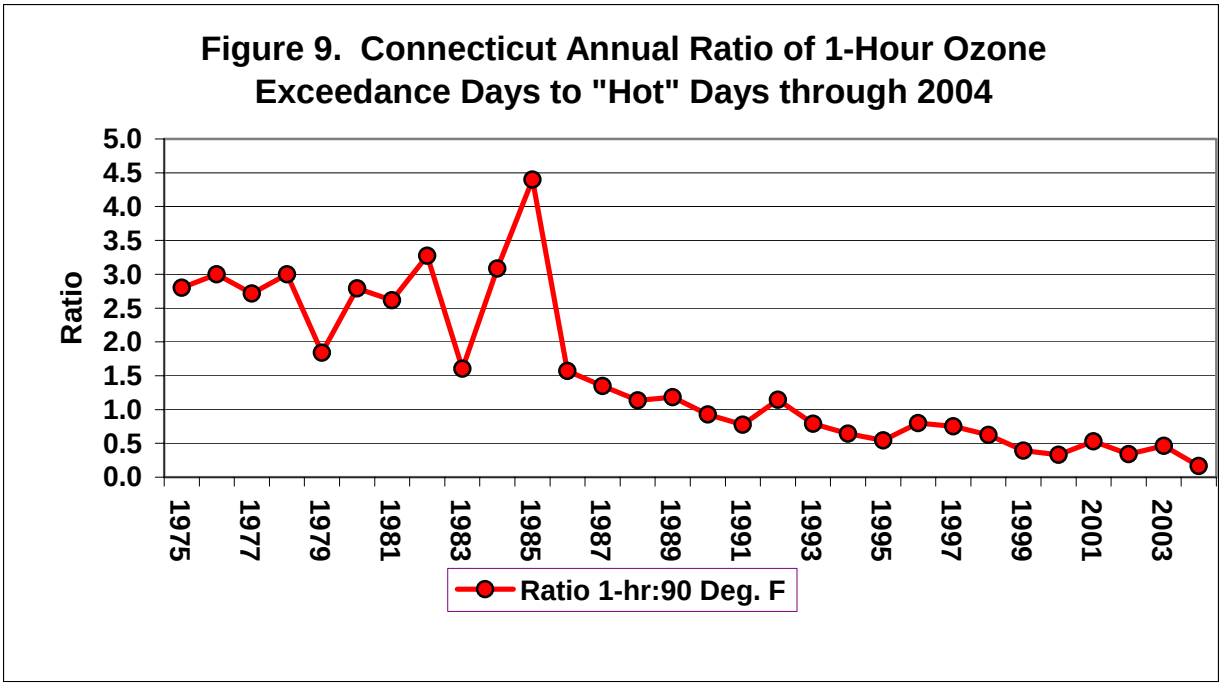
summers can result in several extended periods of elevated ozone production, while cooler summers typically are characterized by fewer days of elevated ozone levels.

Meteorological data from Bradley International Airport (Windsor Locks, CT) were obtained to examine the year-to-year relationship between the frequency of high ozone and high temperature days in Connecticut. Figure 8 is a plot of the number of exceedance days in Connecticut for the period from 1975 through 2004 superimposed with the number of "hot" days -- days with maximum temperatures of 90˚F or above. Although the number of high ozone days tends to track up and down with the number of hot days, the frequency of high ozone days has decreased over time, even for years with similar numbers of hot days. Compared to the 20-year average of 17 "hot days," the years 1983, 1988, 1991, 1999 and 2002 all were hot years with 28 to 38 days of 90˚F or higher temperatures. The declining number of exceedance days for those years was 61, 34, 24, 11 and 12, respectively.

Figure 8. 1-Hour Ozone Exceedance Days vs. "Hot" Days (90F or higher days at BDL)



The decline in ozone exceedances after adjusting for temperature effects is shown more clearly in Figure 9, which depicts the ratio of exceedance days to the number of hot days for each ozone season from 1975 through 2004. There were 1.5 to 4 times more exceedance days than hot days during the first ten years of the period (1975 to 1985). Ratios subsequently decreased to levels closer to one exceedance day per each hot day through the early 1990's and have continued to decline to 0.5 or lower since 1999. In 2004, the ratio was 0.17, with a single exceedance day versus six hot days during the ozone season.



3.2.4 VOC Species Trends

Ozone is formed when NOx and VOCs react in the presence of sunlight. Dozens of VOC species can be present in the atmosphere and influence the ozone formation process. CAA Section 182(c)(1) directed EPA to promulgate rules (40 CFR 58) that required states to establish Photochemical Assessment Monitoring Stations (PAMS) as part of their monitoring networks in serious, severe or extreme ozone nonattainment areas. CTDEP established PAMS sites during the mid-1990's that currently operate in Westport (Sherwood Island), New Haven and East Hartford (*see* Figure 4 for locations).

PAMS data collection includes ambient concentrations of 55 VOCs. The federal objectives of this program include providing a speciated ambient air database that is both representative and useful for ascertaining ambient profiles and distinguishing among various individual VOCs and characteristics of source emission impacts. In furtherance of these objectives, the Northeast States for Coordinated Air Use Management (NESCAUM) contracted with Sonoma Technology, Inc. in 2002 to collect, organize and validate data from 2000 for all the NESCAUM PAMS sites and evaluate control program effectiveness in the NESCAUM region. The results of this effort may be obtained at: http://www.nescaum.org/projects/pams/part2/index.html.

The New York Department of Environmental Conservation (NYDEC) provided CTDEP with an analysis of PAMS data from selected sites in New Jersey, New York and Connecticut. Figure 10 is a subset of the NYDEC data, and it shows summertime average values of various VOC species measured at the Westport site from 1998 through 2003. An overall trend is not discernable, especially given the relatively short period of record. Concentrations of some species appear to decline overall (*e.g.* toluene), while others appear to increase (*e.g.* propane). Many species show year-to-year variations with no apparent trend or correlation with the frequency of ozone exceedances.

Figure 10: Westport Sherwood Island PAMS Summer Averages, 1998-2003

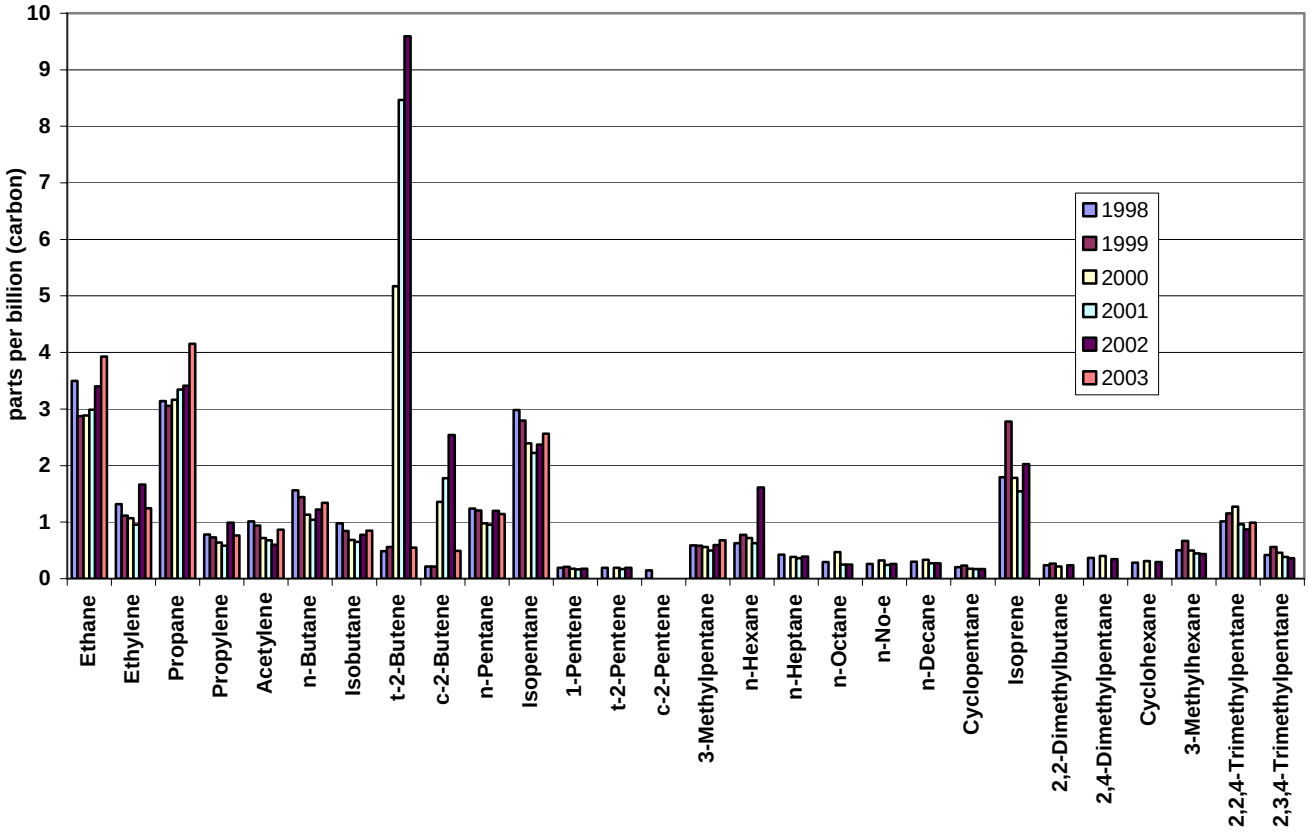
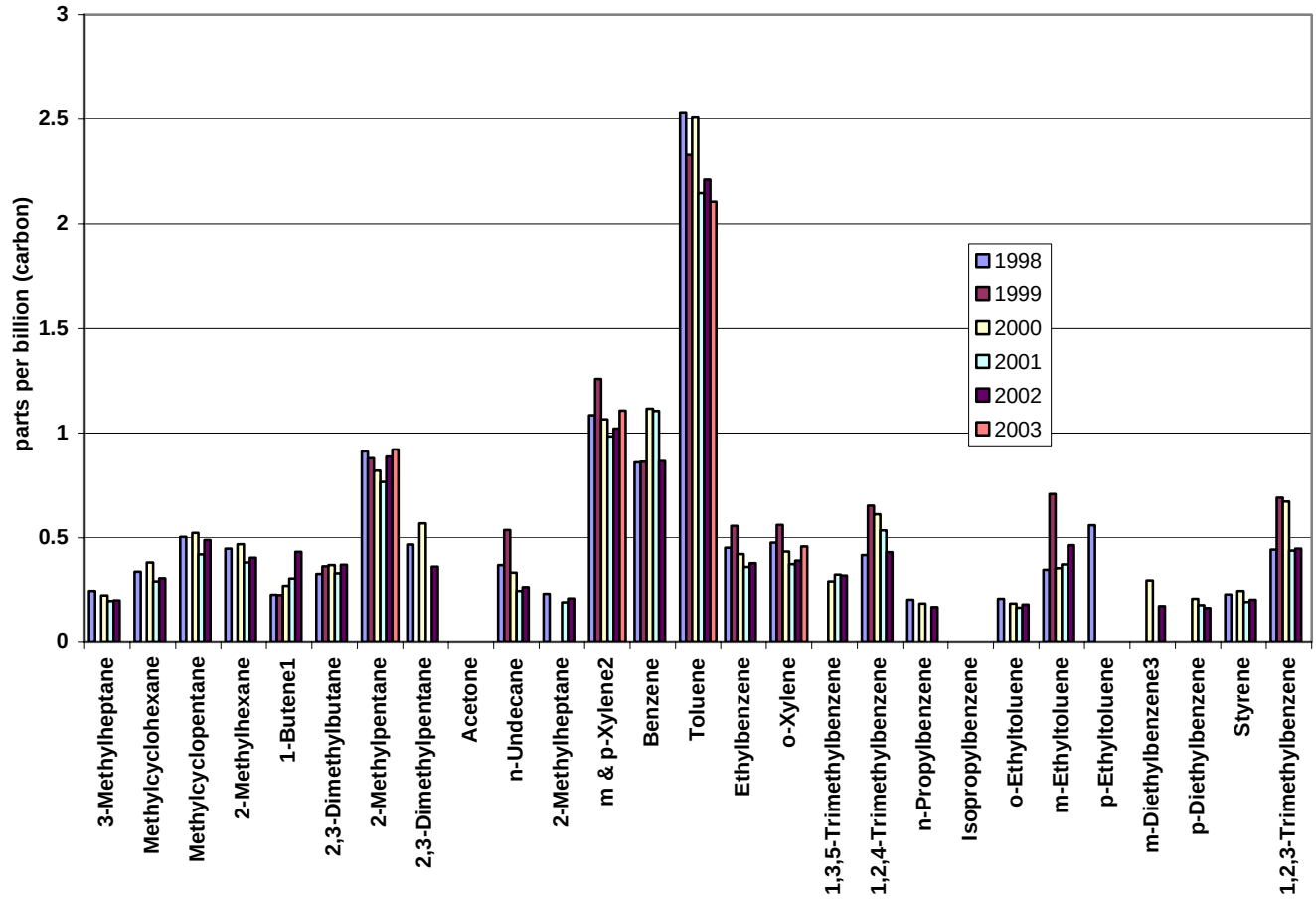


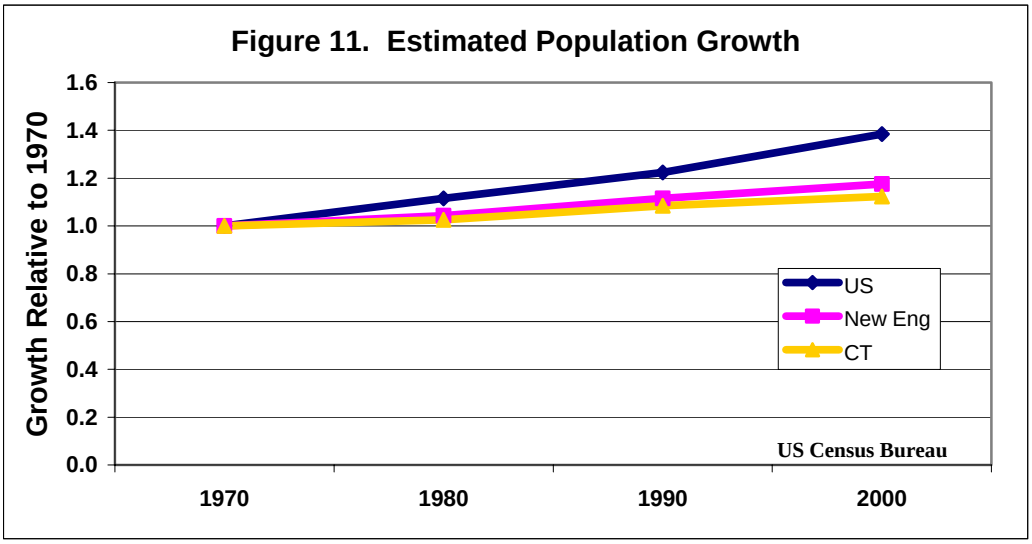
Figure 10 (continued): Westport Sherwood Island PAMS Summer Averages, 1998-2003



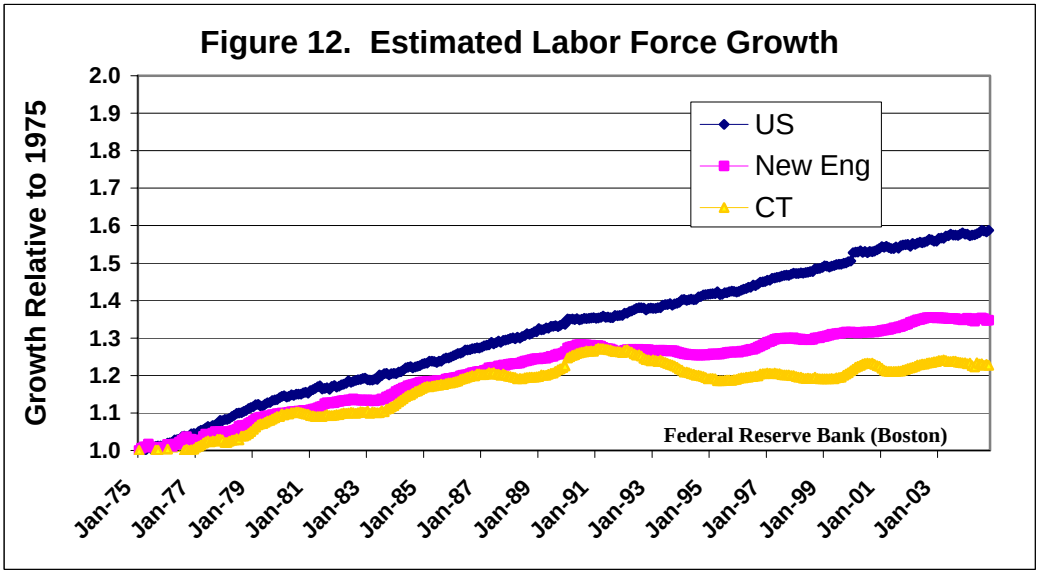
3.3 Growth Trends in the Economy and Vehicle Miles Traveled

The significant decline in emissions and ozone levels over the past several decades has occurred during a period of overall economic growth in Connecticut, New England and the country. In general, economic growth in Connecticut has lagged behind growth in the rest of the country, contributing, in part, to the degree of emission reductions achieved over the last 30 years. Figures 11 through 14 present historic growth estimates for population, total labor force, manufacturing employment and vehicle miles traveled (VMT).

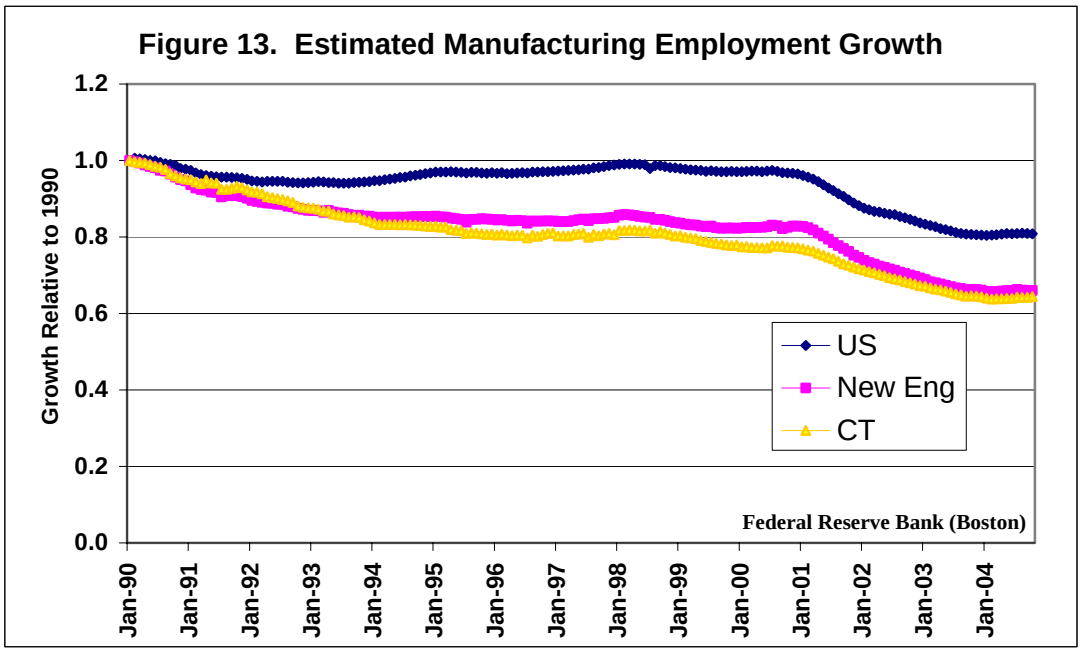
As shown in Figure 11, population increased 38% nationally, 18% throughout New England and 12% in Connecticut over the thirty year period from 1970 through 2000. Population growth throughout New England, and especially in Connecticut, has been significantly less than in the country as a whole.



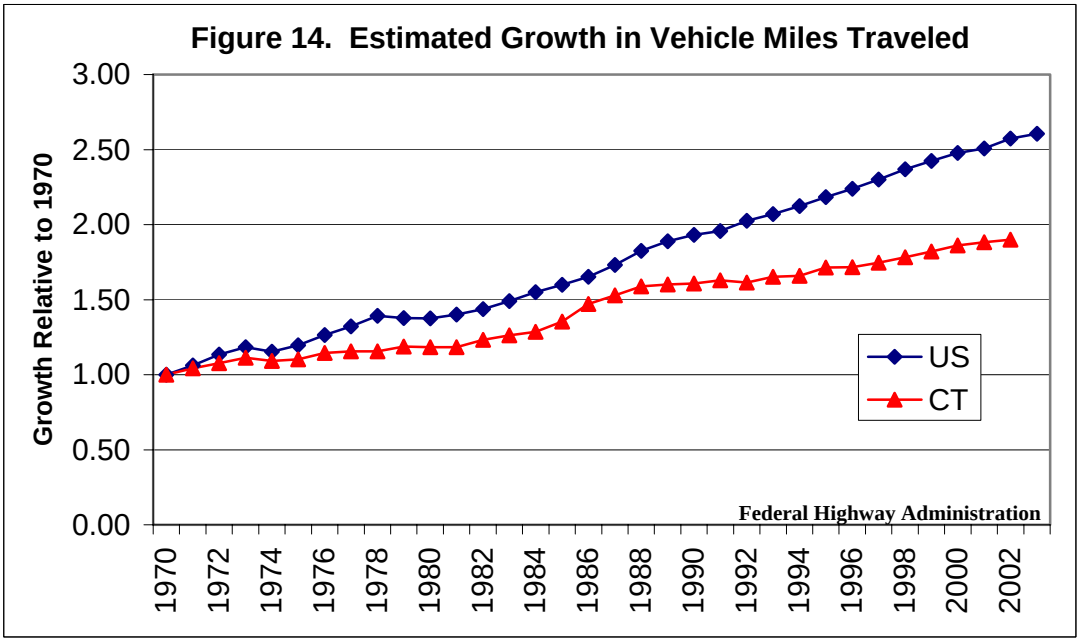
Similar trends are seen in labor force statistics (Figure 12). Nationally there has been a fairly steady increase in the labor force since 1970, with total growth of 59%. However, growth lagged in New England and Connecticut, especially during the 1990's, with total growth since 1970 of 35% and 23%, respectively. Labor force growth in Connecticut has been essentially stagnant since 1990.



Although the size of the labor force has increased overall since 1970, the typically higher polluting manufacturing sector has decreased in size (see Figure 13) due to overseas job shifting, manufacturing efficiencies and increased worker productivity. Total manufacturing employment nationally has decreased by 19%, with a more significant reduction in New England (34%) and Connecticut (36%).



Growth in the transportation sector has also lagged in Connecticut over the last several decades when compared to the national average. Figure 14 shows that VMT has increased by more than 150% nationally since 1970, with a smaller increase of about 90% in Connecticut over the same time period.



3.4 Ozone Transport

The Ozone Transport Commission was established under the CAA to mitigate interstate transport of ozone and its precursor emissions in the Northeast. As discussed in Section 2, eleven OTC states and the District of Columbia signed a Memorandum of Understanding (MOU) in September 1994 committing to reduce NOx emissions from large stationary sources throughout the region. In 1995, the OTC states agreed to require existing sources to meet Reasonably Available Control Technology (RACT) limits, and in 1999 through 2002, most of the OTC states achieved deep NOx reductions through an ozone season cap and trade program for NOx called the OTC NOx Budget Program.

Separate from the activity in the OTC, EPA and the Environmental Council of the States formed the Ozone Transport Assessment Group (OTAG) in 1995. This workgroup brought together interested states and other stakeholders, including industry and environmental groups. Its primary objective was to assess the ozone transport problem and develop a strategy for reducing ozone pollution throughout the eastern half of the U.S.

Based on the findings of OTAG, EPA proposed the NOx SIP call in 1997 and finalized it in 1998. In developing this rule, EPA concluded that NOx emissions in 22 states and the District of Columbia contribute to ozone nonattainment in downwind states. The rule required affected states to amend their state implementation plans (SIPs) to limit NOx emissions. EPA set ozone season NOx budgets for each affected state, essentially caps on emissions from May 1 to September 30 each year in covered portions of each state. The NOx SIP Call did not mandate which sources must reduce emissions but, rather, required states to meet an overall cap (or budget) and gave states flexibility to join the emissions trading program or develop control strategies to meet the cap.

All affected states elected to comply with the NOx SIP Call budgets through EPA's optional NOx Budget Program (NBP), a federal market-based emissions cap-and-trade program created to reduce emissions of NOx from power plants and other large combustion sources in the eastern United States. The first NBP control period was scheduled for the 2003 ozone season. Due to legal challenges, the initial deadline was delayed for many states until May 31, 2004. As explained in Section 2.3, most OTC states subject to the Federal NBP began to implement it on May 1, 2003 with the exception of New Hampshire and Virginia.

Figure 15 shows EPA's estimate of the trend in NOx emissions since 1990 from NBP-affected sources in the OTC and the non-OTC states.[8] Total emissions from affected sources in all of the NBP states are also shown. The 2003/2004 trading budget levels are presented with and without the Compliance Supplement Pool (CSP) allowances, which can be used during the initial two years of the program. The budgets for OTC states represent the 2003 budgets, while the budgets for the other states represent the first control period in 2004.

EPA's data show that 2003 NOx emissions from NBP sources were reduced by more than 50% compared to 1990 levels and 33% compared to 2000 levels. Significant additional reductions were expected in 2004, when the non-OTC states' NOx SIP Call budgets became effective.[9] The full extent of NOx SIP Call reductions will not occur until 2005 and beyond because:

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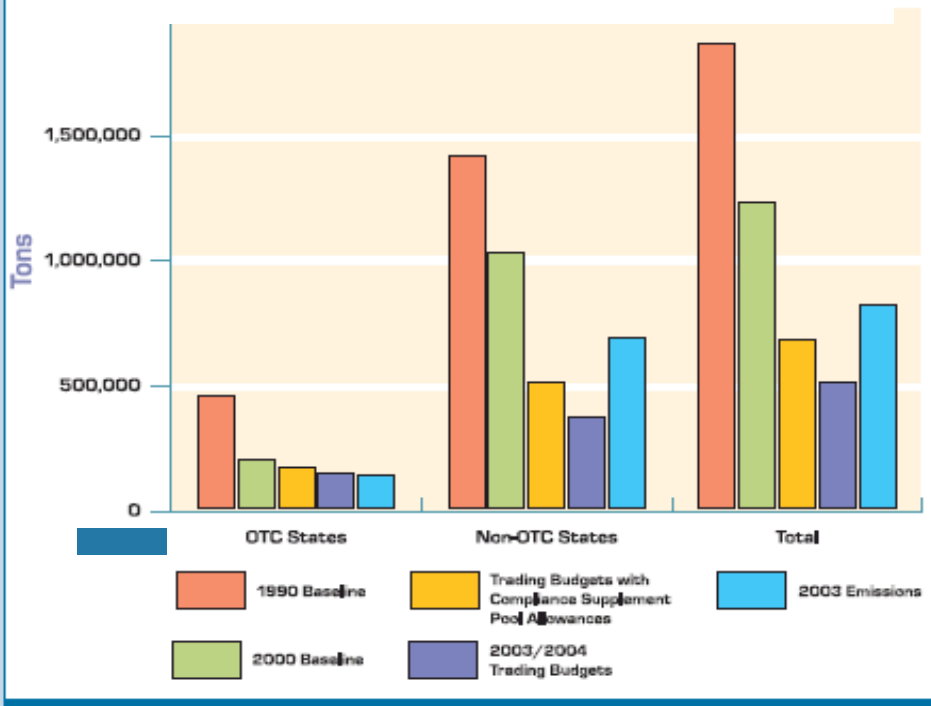
[8] Figure 15 is excerpted from EPA's "NOx Budget Trading Program: 2003 Progress and Compliance Report," (see Figure 7 of that report) available at:H
http://www.epa.gov/airmarkets/cmprpt/nox03/noxreport03.pdfH.

[9] 2004 NBP emission levels were not yet available when this document was prepared.

Figure 15. Regional Baselines, Trading Budgets and 2003 NOx Emissions



In 2003, ozone season NO_X emissions were down 56 percent from 1990 levels across the entire NBP region.

* Total emissions in the non-OTC states in 2003 were higher than the budget levels for those states because the first control period in those states did not begin until 2004. In the OTC states, 2003 emissions were lower than the budget with or without Compliance Supplement Pool (CSP) allowances.

Source: EPA

- The litigated start-up date for non-OTC states was May 31, instead of May 1, 2004. The allowance allocations for 2004, however, are based on a full five-month ozone season, providing a 25% "cushion" in allowances during the first year; and
- During the initial two years of the program, EPA is making additional allowances available through the CSP to assist sources with initial compliance.

As a result of these accommodations, EPA anticipated that the non-OTC NBP states would need to achieve only modest reductions in 2004 to comply with the program. In 2005 and subsequent years, the control period will begin on May 1, and CSP allowances will be depleted; therefore, deeper reductions can be expected. As a result, continued reductions in transported NOx and ozone to Connecticut should occur in a timeframe consistent with the required 2007 1-hour ozone attainment date. However, additional regional-level emission reductions will be necessary from a range of source categories to further reduce transported ozone to a level that allows Connecticut to comply with the new, more stringent, 8-hour ozone standard.

4.0 SUMMARY AND CONCLUSION

As described in Section 2 of this report, CTDEP has implemented all emission control programs mandated by the 1990 CAA, as well as other measures necessary to ensure adequate progress toward compliance with the 1-hour ozone standard. Additional emissions control measures have also been adopted and submitted to EPA as required to offset the EPA-identified shortfall in emissions reductions necessary to attain the 1-hour ozone standard by November 2007. In addition to the shortfall measures, other strategies that have been adopted but not fully implemented (such as vehicle turnover) will provide substantial further emissions reductions and continued improvements in ambient ozone levels through 2007 and beyond.

As a result of CTDEP's planning and regulatory efforts, all data presented in Section 3 demonstrate that CTDEP's efforts to reduce NOx and VOC emissions are being implemented successfully, resulting in reduced ambient ozone levels throughout the state. These reductions are expected to result in attainment of the 1-hour ozone NAAQS. Over the next several years, CTDEP will work aggressively to develop local and regional control measures, and influence national strategies to further reduce ozone levels as necessary to attain the 8-hour ozone NAAQS.