

Connecticut 2018 Annual Air Monitoring Network Plan



Connecticut Department of Energy and Environmental Protection
Bureau of Air Management

July 2018

The Department of Energy and Environmental Protection (DEEP) is an affirmative action/equal opportunity employer and service provider. In conformance with the Americans with Disabilities Act, DEEP makes every effort to provide equally effective services for persons with disabilities. Individuals with disabilities who need this information in an alternative format, to allow them to benefit and/or participate in the agency's programs and services, should call 860-424-3035 or e-mail the ADA Coordinator, at DEEP.aao@CT.Gov. Persons who are hearing impaired should call the State of Connecticut relay number 711.

Table of Contents

Table of Contents	2
Introduction	4
Background	4
Network Overview	4
Proposed Network Changes	5
Monitoring Site Information	6
National Ambient Air Quality Standards (NAAQS)	8
PM _{2.5} Annual Design Values (2017)	9
PM _{2.5} Daily Design Values (2017)	9
Ozone Design Values (2017)	10
CO, SO ₂ , NO ₂ , PM ₁₀ and Pb NAAQS Comparisons (2017)	10
Overview of Network Operation	12
PM _{2.5} Monitoring	12
PM ₁₀ /PM _{10-2.5} Monitoring	15
PM Speciation Monitoring	15
Ozone Monitoring	16
NO ₂ and NO/NO _y Monitoring	18
CO Monitoring	18
SO ₂ Monitoring	19
Detailed Site Information	20
Appendix A PM _{2.5} FRM vs. Continuous Correlation Charts	A-1
Appendix B Connecticut Enhanced Monitoring Plan	B-1
Appendix C Network Plan Public Comments and Responses	C-1
Figure 1: Connecticut DEEP Air Monitoring Network	5
Figure 2: CT PM _{2.5} FEM Comparison with EPA Performance Standards (2015-2017 data)	14
Figure 3: Comparison of Middletown Shew Hall and New Monitoring Shed Hourly Ozone Data	17
Table 1: Monitoring Network Summary	7
Table 2: National Ambient Air Quality Standards	8
Table 3: PM _{2.5} FRM/FEM Network Summary	13
Table 4: CT PM _{2.5} FEM Performance Criteria Evaluation Summary (2015-2017 Data)	13
Table 5: Population Weighted Emissions Index (PWEI) Values for Connecticut CBSAs	19

Acronyms and Abbreviations

AQI – Air Quality Index
AQS – Air Quality System
BAM – Beta Attenuation Monitor
BC – Black Carbon (Aethalometer)
CAA – Clean Air Act
CBSA – Core-Based Statistical area
CFR – Code of Federal Regulations
CO – carbon monoxide
CSA – combined statistical area
CSN – Chemical Speciation Network
DEEP – Connecticut Department of Energy and Environmental Protection
DAS – data acquisition system
EC/OC – Elemental Carbon/Organic Carbon
EMP – Enhanced Monitoring Plan for ozone
EPA – Environmental Protection Agency
FEM – Federal Equivalent Method
FRM – Federal Reference Method
GC – gas chromatography
GC/MS – gas chromatography/mass spectrometry
HAP – hazardous air pollutant
IMPROVE – Interagency Monitoring of Protected Visual Environments
LC – local conditions of temperature and pressure
LISTOS – Long Island Sound Tropospheric Ozone Study
LMP – limited maintenance plan
MPA – monitoring planning area
MSA – metropolitan statistical area
NAAQS – National Ambient Air Quality Standards
NCore – National Core Monitoring Stations
NOAA – National Oceanic and Atmospheric Administration
NOx – nitrogen oxides
NOy – reactive oxides of nitrogen
OAQPS – Office of Air Quality Planning and Standards
OTR – Ozone Transport Region
PAMS – Photochemical Assessment Monitoring Stations
PM_{2.5} – fine particulate matter (<2.5 microns)
PM₁₀ – respirable particulate matter (<10 microns)
PM_{10-2.5} – coarse particulate matter (PM₁₀ – PM_{2.5})
QA – quality assurance
QA/QC – quality assurance/quality control
QAPP – quality assurance project plan
QMP – quality management plan
RH – relative humidity
SIP – State Implementation Plan
SLAMS – state and local monitoring stations
SO₂ – sulfur dioxide
SOP – standard operating procedure
STP – standard conditions of temperature and pressure (40 CFR 50.3: 25°C and 760 mm Hg)
TSA – technical system audit
TSP – total suspended particulate
UVC – Ultra-violet carbon (aethalometer)
VOC – volatile organic compound

Introduction

This document is the Connecticut 2018 Air Monitoring Network Plan (Network Plan), prepared by the Connecticut Department of Energy and Environmental Protection (DEEP) in accordance with 40 CFR 58.10. This plan meets the requirement to develop and submit to the Environmental Protection Agency (EPA) an annual air quality monitoring network plan to describe the air monitoring network and propose any changes to air quality monitoring sites and monitored air pollutants planned in the 18 months following submittal.

The draft Network Plan is posted on DEEP's website at [DEEP: Air Monitoring Network](#). DEEP accepted public comments on this draft Network Plan from June 21, 2018 to July 21, 2018. Comments were submitted to:

Randall Semagin
Air Management, Planning and Standards Division
Connecticut Department of Energy and Environmental Protection
79 Elm Street, Hartford, CT 06106
P: 860.424.3255 | F: 860.706.5339 | E: randall.semagin@ct.gov

Background

The Clean Air Act of 1970 (CAA) established the EPA as the principal administrative body to enact regulations to meet the requirements of the CAA and subsequent amendments thereto. One such requirement directed EPA to set primary and secondary air quality standards, known as the National Ambient Air Quality Standards (NAAQS) for the six "criteria pollutants" that Congress determined presented serious negative impacts to human health and welfare. For areas within Connecticut that do not meet a NAAQS, DEEP develops State Implementation Plans (SIPs) to detail the steps to be taken to bring air quality into attainment. Ambient air quality monitoring is essential to track progress towards meeting clean air goals and demonstrate attainment.

While DEEP monitors ambient air quality in Connecticut primarily for comparison with the NAAQS, there are other important objectives to ambient air quality monitoring. This monitoring provides local air quality data to the public, supports air quality forecasting and the Air Quality Index (AQI), supports long-term health assessments and other scientific research, assists with air permitting and identifying long-term air quality trends to gauge effectiveness of air pollution control strategies and serves as an accuracy check on computer based air quality models.

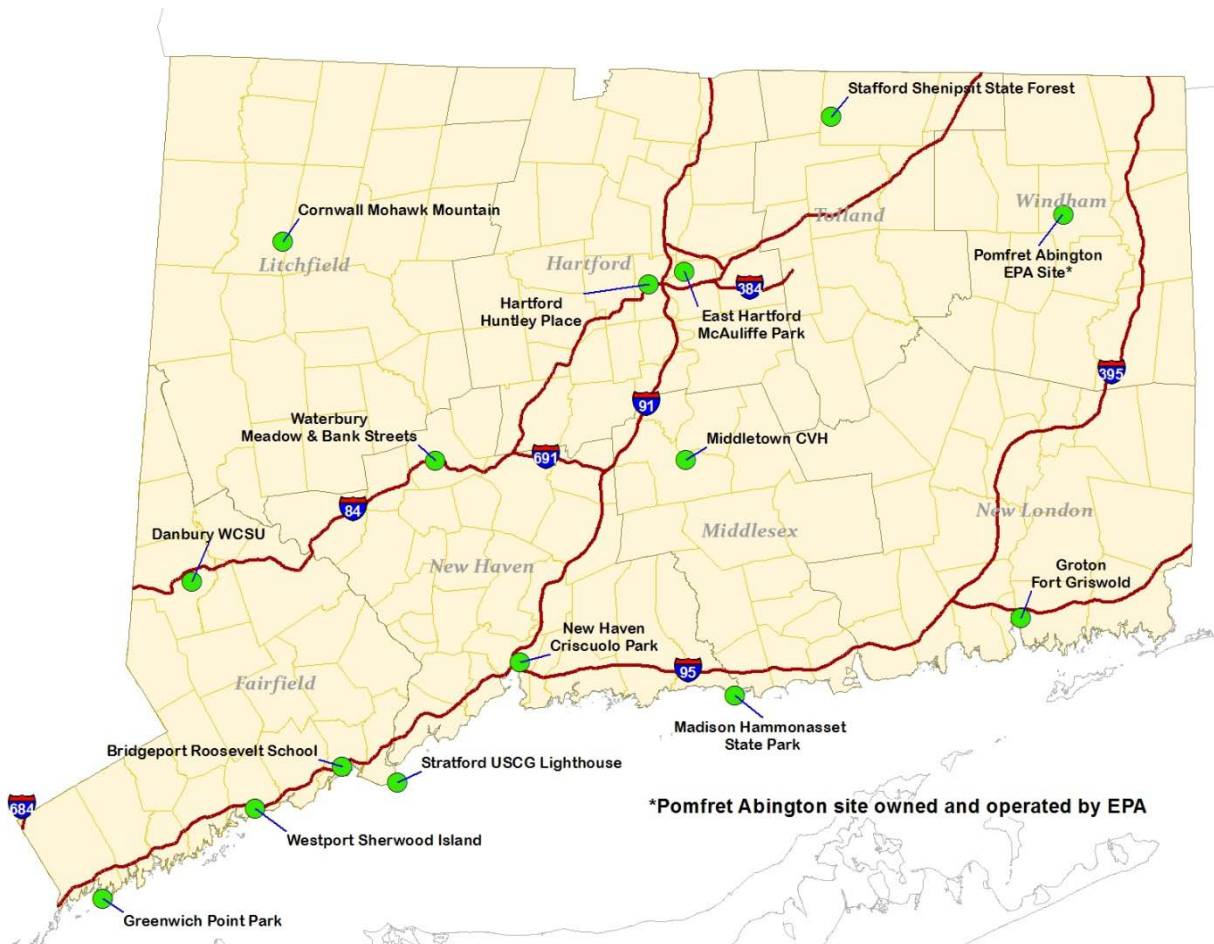
DEEP's ability to manage the air quality monitoring network greatly depends on federal grant support from EPA. In previous years, Connecticut supported air monitoring operating expenses with state funds, specifically, a portion of the Clean Air Act fee collected pursuant to Conn. Gen. Stat. 14-49b. As the state budget challenges have continued to impact DEEP, all general fund revenue is now used to support staff costs. Therefore, the air network operation is totally dependent on federal funds. Future federal funding levels for air monitoring programs continue to remain uncertain and many indications are that federal funding will be reduced during the time period covered by this plan. In addition, as with state governmental operations everywhere, state resources allocated to ambient air quality monitoring are unable to keep pace with rising costs. DEEP will strive to provide an acceptable level of service within these constraints by continually improving operations and focusing its efforts to ensure the completion of the most critical ambient air quality monitoring. As operating costs and federal monitoring requirements increase, DEEP must operate within its means by either improving operational efficiencies or reducing other aspects of the air monitoring network. Efficiencies being employed and expanded include improving data acquisition software and hardware, streamlining access to the public thorough DEEP's website, and reducing the number of monitoring sites or parameters measured by increasing multi-pollutant monitoring or terminating duplicative or unnecessary monitors.

Network Overview

DEEP currently operates 14 stations in its air monitoring network (Figure 1). Given continuously evolving standards, this Plan assumes the current level of staffing and federal funding will be maintained through federal FY19. Should EPA monitoring requirements increase, federal funding be reduced, or DEEP be impacted by staff attrition or a significant reduction in funding, the level of effort proposed in this Plan will be adjusted accordingly.

In October 2006, EPA established a network of core multi-pollutant sites. These sites are known as the National Core (NCore) network, the primary purpose of which is to consolidate monitoring of multiple pollutants at fewer sites for efficiency and cost savings. In addition, the NCore sites provide a comprehensive suite of high-resolution pollutant data for NAAQS compliance assessment, research studies and long-term trends analysis. There are two NCore sites located in Connecticut: Criscoolo Park in New Haven, and Mohawk Mountain in Cornwall.

Figure 1: Connecticut DEEP Air Monitoring Network



Proposed Network Changes

Details of the proposed monitoring network configuration are described in the following site information pages. In addition to infrastructure maintenance and improvements, DEEP proposes the following changes to the monitoring network during the period 2018-2019:

- Commence seasonal ozone (O_3) monitoring on at least one (1) and as many as two (2) Long Island ferries that operate between Bridgeport, CT and Port Jefferson, NY, during the spring of 2018.
- Commence mixing height (MH) monitoring at the Westport Sherwood Island site during 2019.
- Commence automated continuous FEM PM_{10} and $PM_{10-2.5}$ sampling at five (5) sites during 2018: Bridgeport, Danbury, East Hartford, Groton and Waterbury.
- Discontinue manual FRM PM_{10} monitoring at the Bridgeport Roosevelt School site on December 31, 2018.
- Commence support of total column nitrogen dioxide (NO_2), O_3 and (and potentially formaldehyde) monitoring at three sites, Madison, New Haven and Westport, during 2018. The instruments, Pandora spectrophotometers, are owned and primarily operated by EPA and NASA.
- Commence support of multiple monitoring activities and research projects aimed at further understanding ozone fate and transport mechanisms in the Long Island Sound region, as described in detail in the attached Enhanced Monitoring Plan for ozone (Appendix B).

DEEP maintains its air monitoring network to fulfill critical data needs. Recent EPA NAAQS rule revisions have mandated additional monitoring, reporting and analysis associated with the SLAMS networks, and, consistent with the LEAN¹ culture embraced by DEEP, this Network Plan calls for continued efforts to critically examine business practices to streamline data handling, while also looking for opportunities to identify and address low value added monitoring sites and related activities. If limited opportunities exist to disinvest from low value added monitoring sites, efficiencies nonetheless will occur by eliminating lower value data collection. Such efficiencies will be necessary to enable limited staff resources to focus on competing priorities, which may not be limited to air quality monitoring. If efficiencies alone are insufficient, either additional resources will be required or the scope of the monitoring program will need to be revisited.

Monitoring Site Information

The ambient air monitoring sites currently operated by DEEP are listed in the Table 1 below. Detailed information for each monitoring site is provided in a later section of this plan.

¹ <https://www.lean.org/>

Table 1: Monitoring Network Summary

Town	Site	PM2.5 (FRM)	PM2.5 (FRM, Collocated)	PM2.5 (Continuous - FEM)	PM10 / PM -Coarse (FRM)	PM10 / PM -Coarse (FRM, Collocated)	PM10 / PM -Coarse (Continuous)	PM Speciation (CSN)	PM Speciation (IMPROVE)	PM2.5 Carbon (BC /UVC, Continuous)	Ozone	SO2	CO	NO ₂	NO /NO ₂ /NOx	NO /NOy	VOCs (PAMS)	Traffic Count	Wind Speed	Wind Direction	Temperature	Dew Point / Rel. Humidity	Barometric Pressure	Solar Radiation	Mixing Height	
Bridgeport	Roosevelt School	1/6	X	T		P						X	X									X				
Bridgeport LIS Ferry	Park City Vessel										P															
Bridgeport LIS Ferry	Second Vessel										P															
Cornwall	Mohawk Mountain	1/3	X			X		1/3	X	X	X	X	X			X				X	X	X	X	X	X	
Danbury	Western Connecticut State University	1/6	X			P				X	X									X	X	X		X		
East Hartford	McAuliffe Park	1/6	X	1/6		P				X	X			X						X	X	X	X	X	X	
Greenwich	Point Park										X									X	X	X				
Groton	Fort Griswold		1/6	X			P				X											X				
Hartford	Huntley Place	1/3	X			X				X			X	X				X	X	X	X		X			
Madison	Hammonasset State Park										X									X	X	X				
Middletown	Connecticut Valley Hospital										X									X	X	X		X		
New Haven	Criscuolo Park	1/3	1/6	X	1/3	1/6	X	1/3		X	X	X	X	X		X				X	X	X	X	X	X	X
Stafford	Shenipsit State Forest										X									X	X	X				
Stratford	Stratford Lighthouse										X											X				
Waterbury	Meadow & Bank Street	1/6	X				P													X	X	X				
Westport	Sherwood Island State Park										X			X						X	X	X		X		X

X=Existing P = Planned in 2019/2020 T = Terminate in 2019/2020

National Ambient Air Quality Standards (NAAQS)

The EPA's Office of Air Quality Planning and Standards (OAQPS) has set NAAQS for six principal pollutants, known as the criteria pollutants. Table 2, reprinted here from EPA's website², summarizes the current NAAQS compliance requirements for the criteria pollutants.

Table 2: National Ambient Air Quality Standards

Pollutant [links to historical tables of NAAQS reviews]		Primary / Secondary	Averaging Time	Level	Form
Carbon Monoxide (CO)		primary	8 hours	9 ppm	Not to be exceeded more than once per year
			1 hour	35 ppm	
Lead (Pb)		primary and secondary	Rolling 3 month average	0.15 µg/m ³ ^(a)	Not to be exceeded
Nitrogen Dioxide (NO₂)		primary	1 hour	100 ppb	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		primary and secondary	1 year	53 ppb ^(b)	Annual Mean
Ozone (O₃)		primary and secondary	8 hours	0.070 ppm ^(c)	Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years
Particle Pollution (PM)	PM _{2.5}	primary	1 year	12.0 µg/m ³	annual mean, averaged over 3 years
		secondary	1 year	15.0 µg/m ³	annual mean, averaged over 3 years
		primary and secondary	24 hours	35 µg/m ³	98th percentile, averaged over 3 years
	PM ₁₀	primary and secondary	24 hours	150 µg/m ³	Not to be exceeded more than once per year on average over 3 years
Sulfur Dioxide (SO₂)		primary	1 hour	75 ppb ^(d)	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		secondary	3 hours	0.5 ppm	Not to be exceeded more than once per year

Notes for Table 2:

^a In areas designated nonattainment for the Pb standards prior to the promulgation of the current (2008) standards, and for which implementation plans to attain or maintain the current (2008) standards have not been submitted and approved, the previous standards (1.5 µg/m³ as a calendar quarter average) also remain in effect.

^b The level of the annual NO₂ standard is 0.053 ppm. It is shown here in terms of ppb for the purposes of clearer comparison to the 1-hour standard level.

^c Final rule signed October 1, 2015, and effective December 28, 2015. The previous (2008) O₃ standards additionally remain in effect in some areas. Revocation of the previous (2008) O₃ standards and transitioning to the current (2015) standards will be addressed in the implementation rule for the current standards.

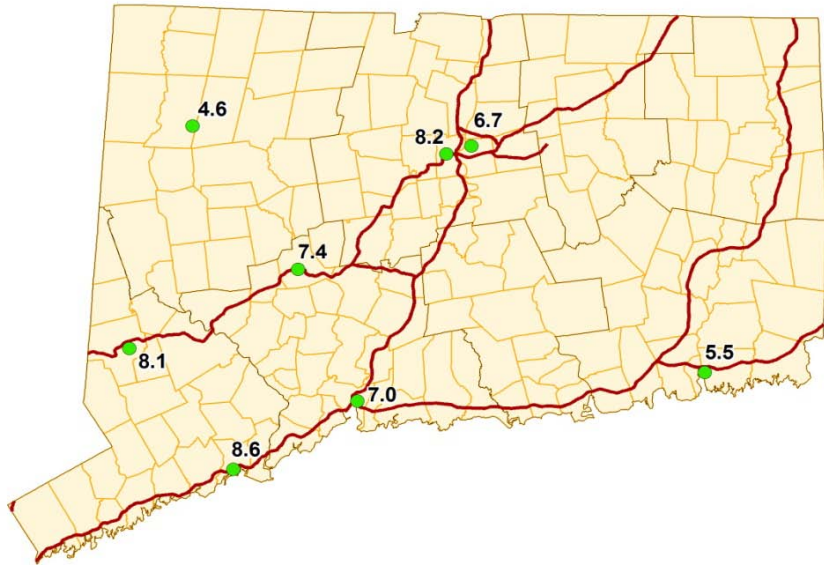
^d The previous SO₂ standards (0.14 ppm 24-hour and 0.03 ppm annual) will additionally remain in effect in certain areas: (1) any area for which it is not yet 1 year since the effective date of designation under the current (2010) standards, and (2) any area for which implementation plans providing for attainment of the current (2010) standard have not been submitted and approved and which is designated nonattainment under the previous SO₂ standards or is not meeting the requirements of a SIP call under the previous SO₂ standards (40 CFR 50.4(3)). A SIP call is an EPA action requiring a state to resubmit all or part of its State Implementation Plan to demonstrate attainment of the required NAAQS.

² <https://www.epa.gov/criteria-air-pollutants/naaqs-table>

PM_{2.5} Annual Design Values (2017)

The 2017 annual design values for PM_{2.5}, based on 2015 through 2017 data, are presented in the table and figure below. PM_{2.5} annual design values are calculated using the 3-year average of the respective annual weighted averages. The current annual PM_{2.5} NAAQS is 12.0 µg/m³. All Connecticut monitors demonstrate compliance with the design value for the annual PM_{2.5} NAAQS.

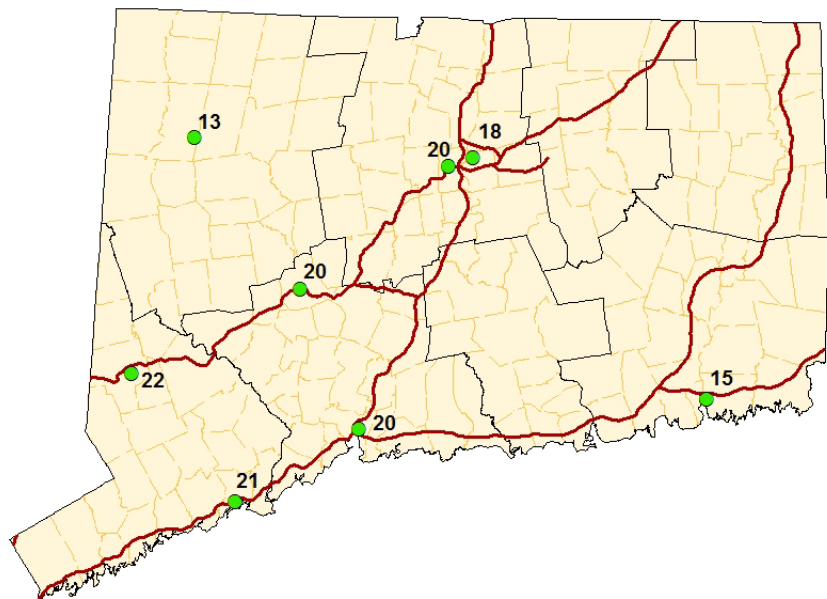
Site	Design Value (µg / m ³)
Bridgeport	8.6
Cornwall	4.6
Danbury	8.1
East Hartford	6.7
Groton	5.5
Hartford	8.2
New Haven	7.0
Waterbury	7.4
NAAQS	12.0



PM_{2.5} Daily Design Values (2017)

Daily design values for PM_{2.5} using 2015 through 2017 data are given below. PM_{2.5} daily design values are calculated using the 3-year average of the annual 98th percentile values. The daily PM_{2.5} NAAQS is 35 µg/m³. Final designations relative to the 2006 24-hour PM_{2.5} NAAQS were finalized by EPA in November 2009 (effective as of December 14, 2009), based upon measured data from 2006 through 2008. All Connecticut monitors demonstrate compliance with the design value for the 24-hour PM_{2.5} NAAQS.

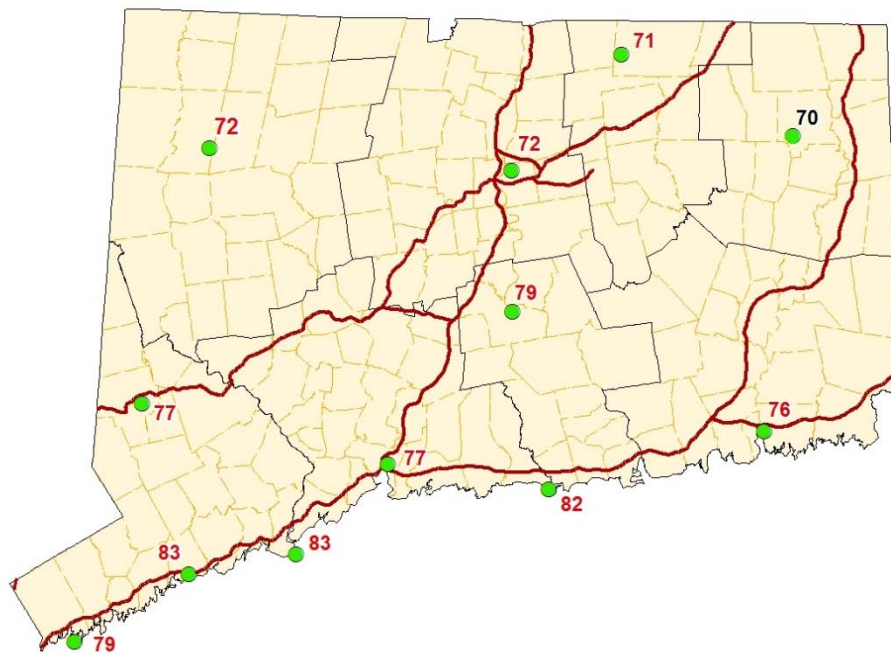
Site	Design Value (µg / m ³)
Bridgeport	21
Cornwall	13
Danbury	22
East Hartford	18
Groton	15
Hartford	20
New Haven	20
Waterbury	20
NAAQS	35



Ozone Design Values (2017)

The 2017 ozone 8-hour design values are given in the table below. Ozone design values are derived by averaging three consecutive annual fourth highest daily maximum 8-hour ozone values. Based on both the 2008 ozone standard of 0.075 ppm (75 ppb) and the October 2015 revised ozone standard of 0.070 ppm (70 ppb), 11 out of 12 sites indicate nonattainment, shown in red font below. Starting in 2017, the ozone monitoring season in Connecticut is extended by a month, beginning March 1 and ending September 30.

Site	Design Value (ppb)
Abington	70
Cornwall	72
Danbury	77
East Hartford	72
Greenwich	79
Groton	76
Madison	82
Middletown	79
New Haven	77
Stafford	71
Stratford	83
Westport	83
NAAQS	70



CO, SO₂, NO₂, PM₁₀ and Pb NAAQS Comparisons (2017)

Comparisons of ambient levels of CO, SO₂, NO₂, PM₁₀ and Pb to the primary NAAQS are provided in the tables below. The design values for each pollutant were derived in accordance with 40 CFR 50. For PM₁₀, the 3-year fourth-high value, rounded to the tens place, is given to indicate the ambient level relative to the standard, as the actual design value is the expected number of annual exceedances of the standard, averaged over a 3-year period, which is in attainment with a value of less than or equal to one.

CO NAAQS Comparison

Site	1-Hr Design Value (ppm)	8-Hr Design Value (ppm)
Bridgeport	1.7	1.2
Cornwall	3.5	0.6
East Hartford	1.1	0.9
Hartford	1.7	1.1
New Haven	1.4	0.9
NAAQS	35	9

SO₂ NAAQS Comparison

Site	1-Hr Design Value (ppb)
Bridgeport*	4
Cornwall	3
East Hartford	3
New Haven	4
NAAQS	75

*Bridgeport sites combined

NO₂ NAAQS Comparison

Site	1-Hr Design Value (ppb)	Annual Design Value (ppb)
East Hartford	45	9
Hartford	52	16
New Haven	53	14
Westport*	-	-
NAAQS	100	53

*

PM₁₀ NAAQS Comparison

Site	Daily Design Value ($\mu\text{g} / \text{m}^3$ STP)
Bridgeport	40
Cornwall	30
East Hartford	30
Hartford	60
New Haven	30
NAAQS	150

Overview of Network Operation

DEEP operates a network of 14 State and Local Air Monitoring Stations (SLAMS) sites throughout Connecticut used for monitoring air pollutants and meteorological parameters. This section contains information about monitoring methods and sampling frequencies, as well as monitoring network maps for each pollutant parameter. Network changes planned before the end of 2018 are discussed as are any anticipated network changes beyond that period.

PM_{2.5} Monitoring

Network Design The DEEP PM_{2.5} network consists of Thermo Partisol®-Plus 2025i sequential FRM air samplers with BGI VSCC (RFPS-0498-118) and Met One BAM 1020 continuous air samplers (EQPM-0798-122) for NAAQS compliance at eight air monitoring stations. The distribution of PM_{2.5} sampling methods in the network and their applicability to NAAQS attainment are shown in Table 3. Valid data from collocated and supplemental monitors, respectively, are used to fill in any missing or invalidated scheduled or nonscheduled days for the primary monitor data used for computing the design values.



The filter-based FRM monitors operate at a one-in-six day frequency, except for at the two NCore sites, New Haven and Cornwall, and the near road site in Hartford, all of which run on a one-in-three day schedule. As shown in Table 3, there are six primary PM_{2.5} FRM monitors, so the collocated monitor in New Haven meets the collocation requirement of 15 percent of the network³. The FEM monitor in Bridgeport is designated as primary, with an FRM monitor collocated, to meet collocation requirements for the FEM network⁴.

DEEP operated a Teledyne API T640X PM₁₀/PM_{2.5}/PM_{10-2.5} FEM continuous analyzer (EQPM-0516-240) at the New Haven Criscuolo Park site, on a trial basis, starting in November 2017. Results were promising, and DEEP intends to replace the MetOne BAM 1020 samplers with Teledyne API T640X PM₁₀/PM_{2.5}/PM_{10-2.5} FEM analyzers at all sites during 2018 into 2019. As such, any site with only a continuous PM_{2.5} will be upgraded to also monitor levels of PM₁₀/PM_{10-2.5} after the replacements.

In addition to the NAAQS compliance monitors discussed above, PM_{2.5} is monitored at the Hartford Adriaen's Landing Village Green community monitoring station (not shown on map above). The data from the Village Green site is intended for public informational purposes only, and is not used to determine NAAQS compliance.

³ 40 CFR 58 Appendix A 3.2.3

⁴ Ibid.

Table 3: PM_{2.5} FRM/FEM Network Summary

Site	Primary (NAAQS)	Collocated (NAAQS)	Supplemental (NAAQS)
Bridgeport-Roosevelt Sch.	Continuous FEM	1-in-6 FRM	
Cornwall-Mohawk Mt.	1-in-3 FRM		Continuous FEM
Danbury-WCSU	1-in-6 FRM		Continuous FEM
East Hartford-McAuliffe Pk.	1-in-6 FRM		Continuous FEM
Groton-Ft. Griswold	Continuous FEM		1-in-6 FRM
Hartford-Huntley Pl.	1-in-3 FRM		Continuous FEM
New Haven-Criscuolo Pk.	1-in-3 FRM	1-in-6 FRM	Continuous FEM
Waterbury-Bank St.	1-in-6 FRM		Continuous FEM

PM_{2.5} FEM Performance Assessment The continuous FEM monitors are evaluated by correlation with the FRM monitors on a site by site basis each calendar quarter. As part of this plan, correlations were completed using three years of data as presented in this section.

DEEP compared the continuous FEM PM_{2.5} data with PM_{2.5} FRM data for the 3-year period 2015-2017. Hourly BAM data was aggregated to valid 24-hour averages when at least 75 percent of the hours in each day were valid. Linear regressions performed on the correlation plots are given in Appendix A. The slopes and intercepts of the regression lines are summarized in Table 4. Figure 2 shows the results of these correlations graphically, where slope/intercept points enclosed by the polygon comply with EPA FEM performance criteria⁵.

Table 4: CT PM_{2.5} FEM Performance Criteria Evaluation Summary (2015-2017 Data)

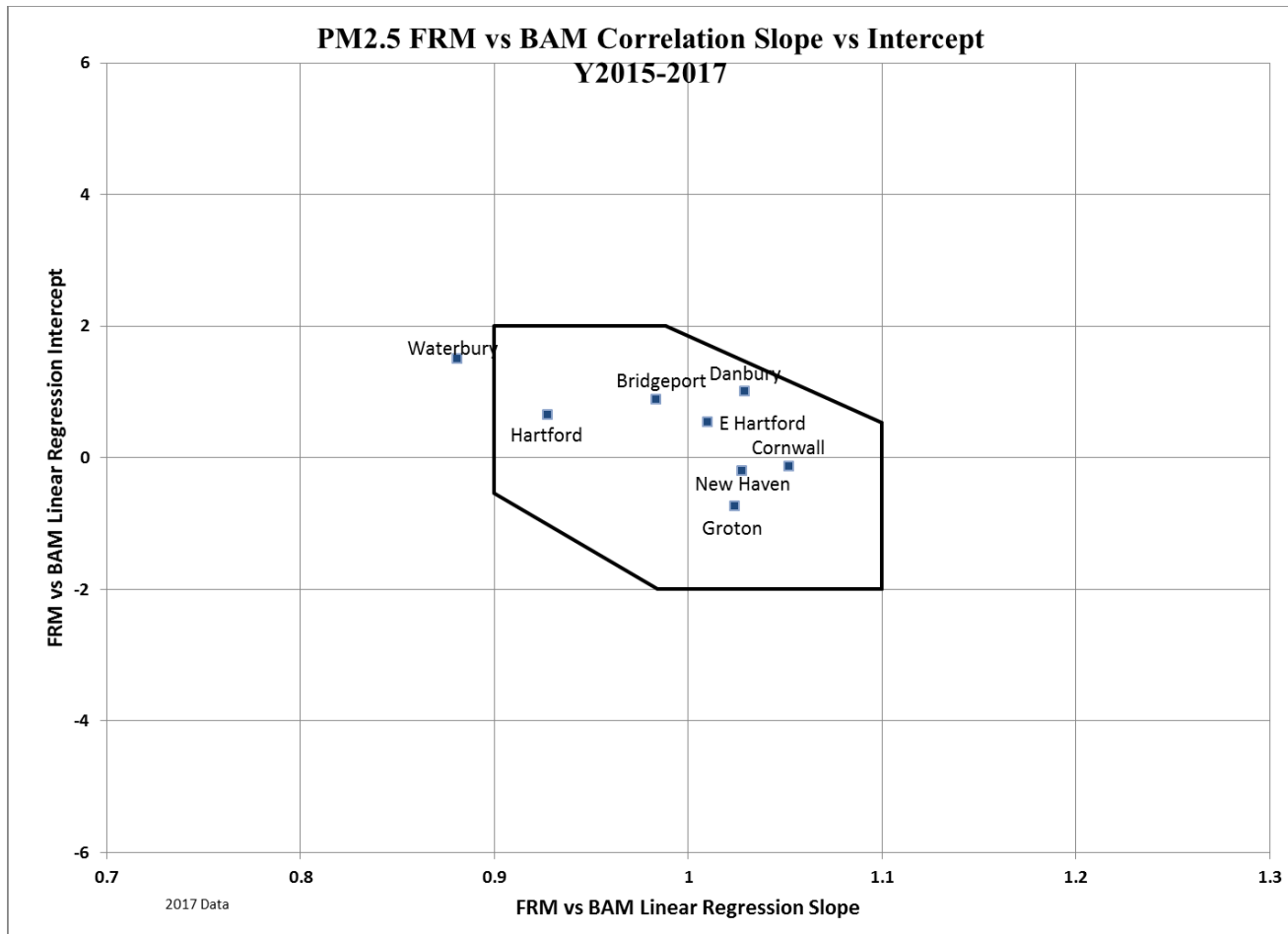
Correlation Summary							Evaluation Summary*			
Site Name	AQS ID	Slope	Intercept	R ²	No. Data Pairs	Meets FEM Performance Criteria	Slope at ≥0.9 and ≤1.1	Intercept at ≤ 2 and ≥ -2	Intercept linear condition#	Meets all performance conditions
Bridgeport Roosevelt School	09-001-0010	0.9835	0.8903	0.785	191	Y	1	1	1	1
Cornwall Mohawk Mt	09-005-0005	1.0518	-0.1293	0.667	319	Y	1	1	1	1
Danbury WCSU	09-001-1123	1.0292	1.0178	0.87	212	Y	1	1	1	1
East Hartford McAuliffe Park	09-003-1003	1.0099	1.1909	0.548	443	Y	1	1	1	1
Groton Fort Griswold	0--003-2006	1.0239	-0.724	0.627	165	Y	1	1	1	1
Hartford Huntley Place	0--003-0025	0.9274	0.6574	0.802	332	Y	1	1	1	1
New Haven Criscuolo Park	09-009-0027	1.0278	-0.1968	0.825	511	Y	1	1	1	1
Waterbury Bank Street	09-009-2123	0.8806	1.514	0.619	196	N	0	1	1	0

*A value of 1 indicates condition satisfied, 0 indicates condition not satisfied

#Intercept between 15.05-(17.32*Slope) and 15.05-(13.20*Slope)

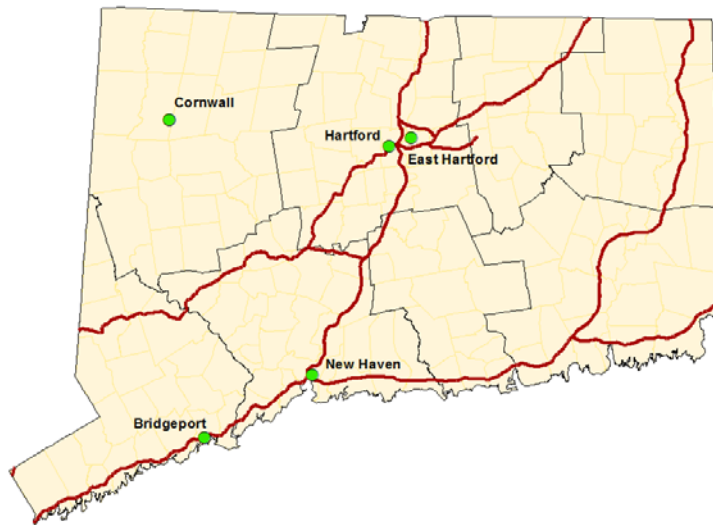
The data indicate that all sites except, Waterbury Bank Street currently meet FEM criteria, although the Waterbury site is very close to meeting these criteria. DEEP will continue evaluating FEM performance through FEM-FRM comparisons on a quarterly basis as part of data validation.

⁵ 40 CFR 53 Table C-4

Figure 2: CT PM2.5 FEM Comparison with EPA Performance Standards (2015-2017 data)

PM₁₀ / PM_{10-2.5} Monitoring

DEEP operates three PM₁₀/PM_{10-2.5} FRM sites in the air monitoring network using Thermo Partisol®-Plus 2025i sequential air samplers (RFPS-1298-127). The New Haven NCore site operates on a 1-in-3 day sample schedule, while Bridgeport and East Hartford are operated on a 1-in-6 day sample schedule. The New Haven site has a collocated PM₁₀ FRM sampler operating on a 1-in-6 day sample schedule. All primary and collocated PM₁₀ FRM samplers are paired with PM_{2.5} FRM samplers for coarse PM (PM_{10-2.5}). The New Haven site has PM_{10-2.5} collocated FRM monitors, as requested by EPA as part of a minimum number of PM_{10-2.5} collocated sites for data quality assessment.



In addition to the FRM PM₁₀ monitors, three sites, Cornwall Mohawk Mountain, New Haven Criscuolo Park and Hartford Huntley Place, have FEM Met One BAM 1020 continuous PM₁₀ monitors (EQPM-0798-122). All FEM PM₁₀ analyzers are paired with FEM PM_{2.5} analyzers for continuous PM_{10-2.5}. Coarse PM is defined as thoracic PM having particle aerodynamic diameters between 2.5 and 10 microns, operationally defined as the difference PM₁₀ minus PM_{2.5} from co-located monitors.

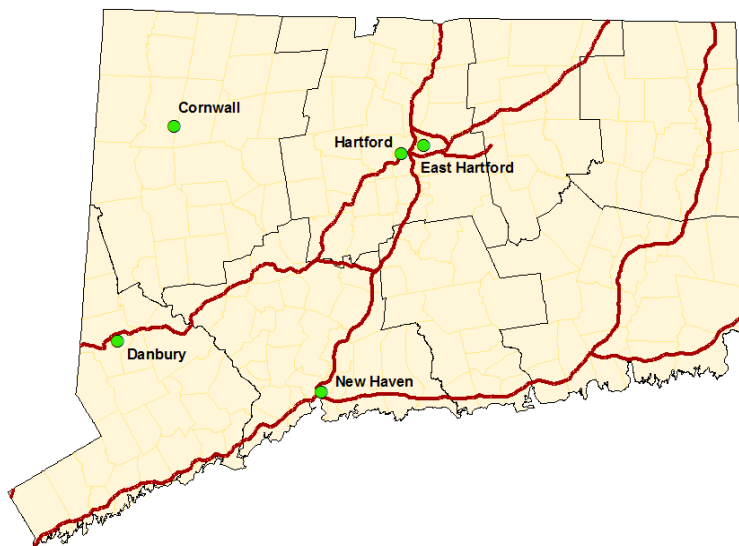
DEEP operated a Teledyne API T640X PM₁₀/PM_{2.5}/PM_{10-2.5} FEM continuous analyzer (EQPM-0516-240) at the New Haven Criscuolo Park site, on a trial basis, starting in November 2017. Based on the favorable results of the trial comparison with FRM methods, DEEP plans to replace all the MetOne BAM 1020 PM_{2.5} analyzers with the Teledyne API T640X PM₁₀/PM_{2.5}/PM_{10-2.5} FEM analyzers and remove the MetOne BAM 2010 PM₁₀ samplers. Given the enhanced capabilities of the new Teledyne monitors, DEEP will collect hourly PM₁₀/PM_{10-2.5} data and report it to AQS for five additional sites: Bridgeport, Danbury, East Hartford, Groton and Waterbury.

PM Speciation Monitoring

PM_{2.5} chemical speciation measurements are obtained at five sites in the DEEP air monitoring network. These include filter-based daily composite 1-in-3 day samples at the 2 NCore sites, and continuous hourly black carbon at five sites.

The Interagency Monitoring of Protected Visual Environments (IMPROVE) monitor is located at the Cornwall site and the Chemical Speciation Network (CSN) monitor is at the New Haven Criscuolo Park site. Both sites are operated on the standard EPA 1-in-3 day PM sample schedule and provide 24-hour integrated filter-base measurements.

Black carbon (BC) and ultra-violet channel carbon (UVC), a wood smoke PM surrogate, are monitored at the Criscuolo Park, Cornwall, Hartford, East

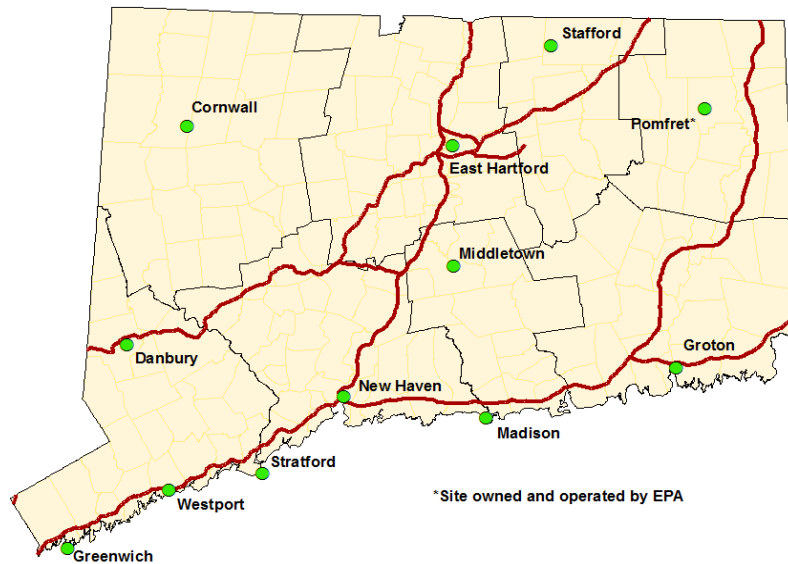


Hartford McAuliffe Park and Danbury WCSU sites using 7-channel TAPI Model 633 aethalometers. No changes are proposed to the PM speciation network during 2018-2019.

Ozone Monitoring

DEEP operates eleven ozone sites in the air monitoring network for NAAQS compliance. The ozone analyzers at the Cornwall Mohawk Mountain, East Hartford McAuliffe Park and New Haven Criscuolo Park sites are operated year-round, while the remaining sites are operated during the EPA ozone season for Connecticut, which is from March 1 to September 30. In addition to the DEEP network, EPA operates an ozone monitor in Abington (Pomfret) during the ozone season as part of its Clean Air Status and Trends (CASTNET) network.

NAAQS compliance ozone monitoring in the DEEP network is conducted using Teledyne-API Model T400 UV photometric ozone analyzers (method EQOA-992-087). Ozone measurements are sent to the EPA AIRNow website for AQI purposes on an hourly basis.



In the fall of 2017, DEEP relocated the Middletown Connecticut Valley Hospital (CVH) site from the sixth floor Shew Hall location to a dedicated shelter in a flat open area 435 meters to the southwest. Figure 3 shows a comparison of the hourly O_3 data between the two sites for the period 9/13/2017 through 10/23/2017, which indicates the O_3 levels are generally comparable.

In addition to the NAAQS compliance monitors discussed above, DEEP has installed a portable ozone monitor (Teledyne API model 430) on a ferry operating between Bridgeport and Port Jefferson, NY. The ferry crosses Long Island Sound several times each day during daytime hours. The monitor will operate during the ozone season (see the Connecticut Enhanced Monitoring Plan, attached as Appendix B of this Network Plan, for more information). If DEEP receives additional permissions, an identical portable ozone monitor will be installed on a second ferry operating on the same route. These monitors are for scientific study and not used to determine NAAQS compliance in Connecticut.

Ozone is also monitored year-round at the Hartford Adriaen's Landing Village Green community monitoring station (not shown on map above). The data from the Village Green site is for public informational purposes only, and is not used to determine NAAQS compliance.

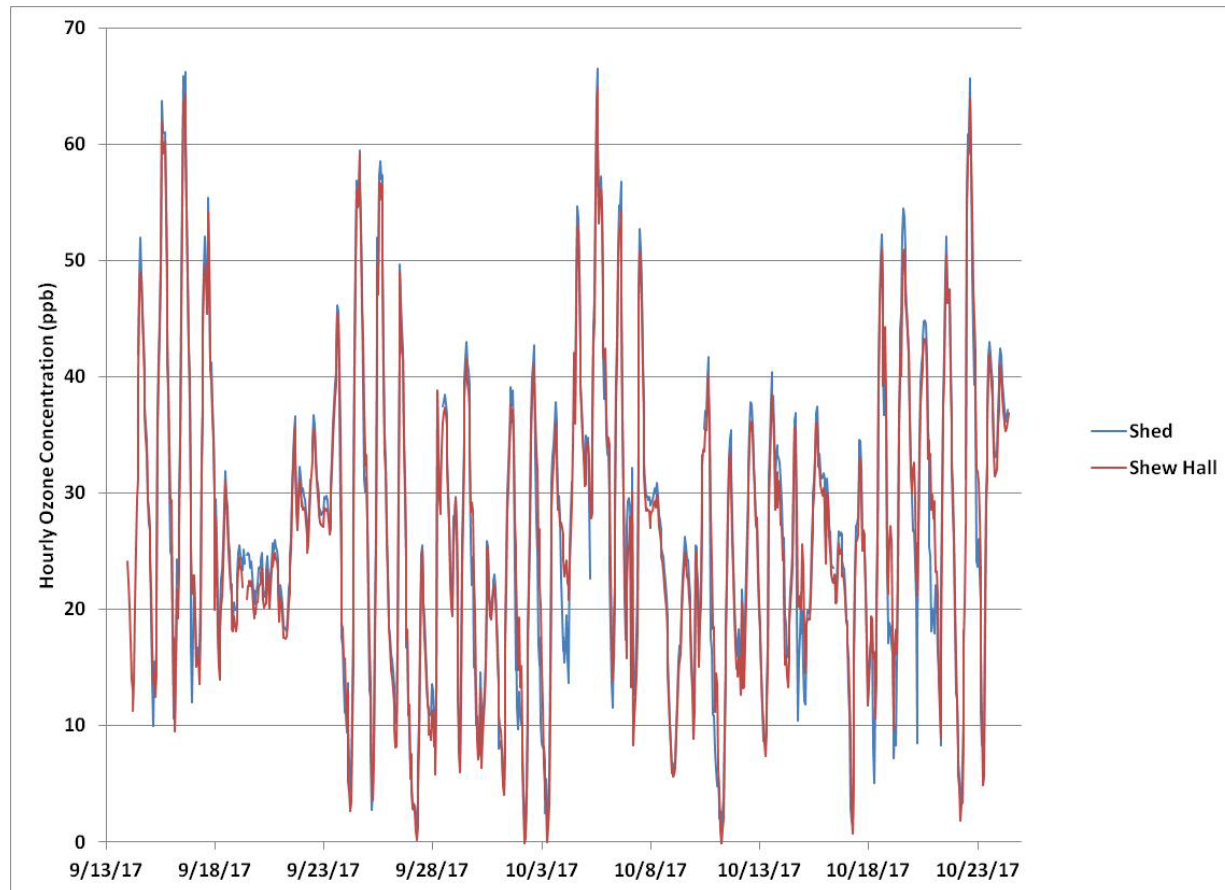


Figure 3: Comparison of Middletown Shew Hall and New Monitoring Shed Hourly Ozone Data

PAMS Monitoring and Enhanced Monitoring Plan

DEEP formerly operated two Photochemical Assessment Monitoring Stations (PAMS) sites in the air monitoring network in 2015, at the New Haven Criscuolo Park and East Hartford McAuliffe Park sites. The recently revised ozone NAAQS rule⁶ requires PAMS measurements at NCore sites that are located in CBSAs with populations of 1,000,000 or more. Since Connecticut's NCore sites are located in CBSAs with populations less than one million, this requirement does not apply. However, the rule requires that states located within the Ozone Transport Region (OTR) and/or states with O₃ nonattainment areas classified moderate and above develop and implement Enhanced Monitoring Plans (EMPs) proposing additional O₃, O₃ precursor and/or meteorological monitoring activities. Connecticut's EMP is included in Appendix B of this Network Plan.

⁶ [80 FR 65292; October 26, 2015](#)

NO₂ and NO/NO_y Monitoring

DEEP operates three nitrogen dioxide (NO₂) sites in the monitoring network using Teledyne-API Model T500U (EQNA-0514-212), which are capable of directly measuring NO₂ using cavity attenuated phase shift (CAPS) spectroscopy methodology.

The NO₂ monitors are maintained at three sites, Hartford Huntley Place, East Hartford McAuliffe Park and New Haven Criscuolo Park, for regulatory compliance.

DEEP also operates two nitrogen oxide/total reactive oxides of nitrogen (NO/NO_y) TAPI model T200U/501 monitors, at Cornwall Mohawk Mountain and New Haven Criscuolo Park, to comply with NCore requirements. NO_y is defined as NO+NO₂+NO_z, where NO_z represents higher oxides of nitrogen.

The NO₂ and NO/NO_y networks fulfill requirements for NCore and SLAMS monitoring of these parameters. These requirements include: near road and area wide NO₂ monitoring in a Core-based statistical area (CBSA) with a population greater than 1,000,000 (Hartford and East Hartford sites, respectively); nationwide NO₂ monitoring for susceptible and vulnerable populations at site selected by EPA (New Haven) and NCore NO/NO_y monitoring (Cornwall and New Haven).

DEEP is proposing to commence direct NO₂ sampling at the Westport Sherwood Island site during the spring of 2017. NO₂ measures at this site will be useful for validating and complementing data collected in aircraft monitoring of ozone episodes planned during the 2017 ozone season.



CO Monitoring

DEEP operates four carbon monoxide (CO) sites in the air monitoring network. All CO samplers are operated year-round and employ TEI 48i-TLE analyzers (RFCA-0981-054). Of the 4 sites, New Haven and Cornwall comply with the requirement for CO monitoring at NCore sites, Bridgeport monitors under a CO limited maintenance plan (through 2020), and Hartford fulfills near road requirements.⁷ The Hartford area is no longer subject to a CO limited maintenance plan (LMP), which ended in 2015, while the New Haven LMP is in effect through



⁷ [76 FR 54294; August 31, 2011](#)

2018.⁸ The EPA Regional Administrator has not indicated any locations in the state for additional CO monitoring aimed at susceptible and vulnerable populations.

SO₂ Monitoring

DEEP currently operates three sulfur dioxide (SO₂) sites in the air monitoring network

All samplers are TEI 43i-TLE SO₂ analyzers (EQSA-0486-060) and are operated year-round. Both 1-hour average and 5-minute block average SO₂ data are validated and reported to EPA.

The network requirements for SO₂ monitoring include NCore, population-weighted emissions index (PWEI) and Regional Administrator-required monitoring.⁹ The Cornwall and New Haven sites satisfy the NCore SO₂ requirement.

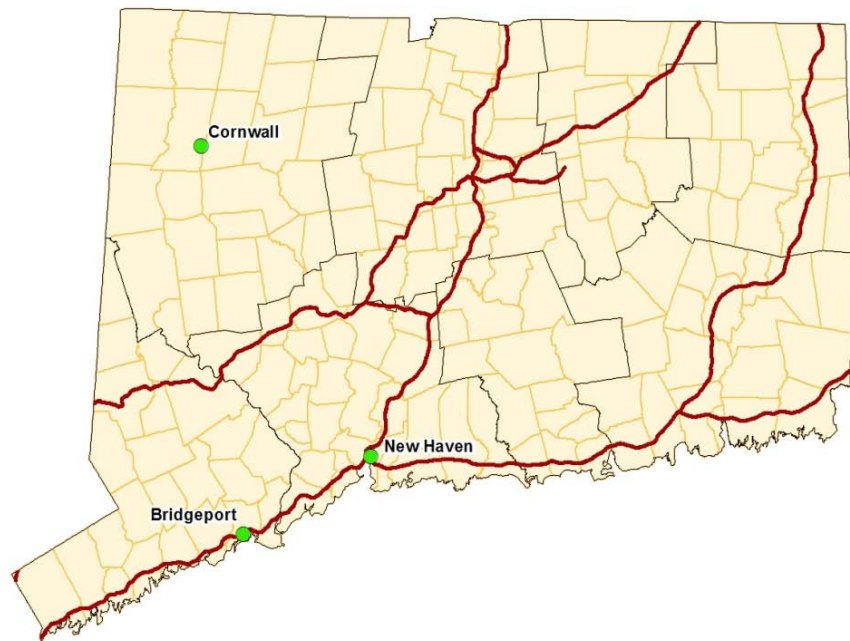


Table 5 shows the PWEI values for CBSAs that are within or intersecting Connecticut, based on the 2014 National Emissions Inventory and US Census Bureau 2015 county population estimates. The SO₂ NAAQS monitoring requirements based on PWEI values state that a monitor is required in areas having PWEI values greater than or equal to 5,000 MMperson-tons/yr. Therefore, no PWEI SO₂ monitors are currently required in the state. Also, the Regional Administrator has not indicated any additional SO₂ monitors in areas having the potential to violate the NAAQS, areas where vulnerable or sensitive populations may be impacted, or near large sources not conducive to modeling. We also note that the SO₂ design values, as provided in an earlier section of this Network Plan, range from 5 to 9 ppb, and are well below the 1-hour NAAQS of 75 ppb.

Although not covered by PWEI requirements, DEEP intends to continue SO₂ monitoring at Bridgeport Roosevelt School at this time, given that it is located in an area of higher concentrations, vulnerable and sensitive populations and a large emission source. The source, Bridgeport Harbor Unit 3, is scheduled for a complete shut-down in 2021.

Table 5: Population Weighted Emissions Index (PWEI) Values for Connecticut CBSAs

Core-Based Statistical Area (CBSA)	SO ₂ (tpy)	Population	PWEI (MMperson-tons/yr)
Bridgeport-Stamford-Norwalk, CT	3573.11	948053	3387
Hartford-West Hartford-East Hartford, CT	3762.76	1211324	4558
Torrington, CT	731.01	183603	134
New Haven-Milford, CT	2690.13	859470	2312
Norwich-New London, CT	1209.38	271863	329
Worcester, MA-CT	2258.63	935536	2113

⁸ [69 FR 50071; August 12, 2004](#)

⁹ [75 FR 35520; June 22, 2010](#)

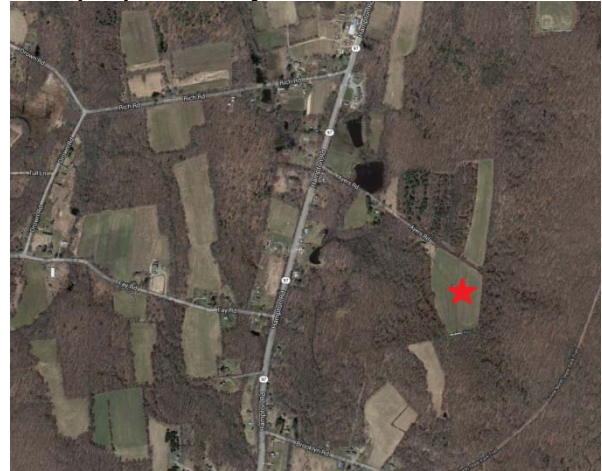
Detailed Site Information

The following section presents detailed information for each monitoring site, such as: identification code, location, history, monitored parameters, monitoring objectives, history and descriptive information.

Town – Site: **Pomfret – Abington**
 County: **Windham** Latitude: **41.84046°**
 Address: **80 Ayers Road** Longitude: **-72.010368°**
 AQS Site ID: **09-015-9991** Elevation: **209 m (686 ft)**
 Spatial Scale: **Regional** Year Established: **1993**
 Statistical Area: **CBSA Willimantic, CT**



This site is not under the operational control or purview of DEEP and is included in this Network Plan for informational purposes only



PM2.5 (FRM)	PM2.5 (FRM, Collocated)	PM2.5 (Continuous - FEM)	PM10/PM-Coarse (FRM)	PM10/PM-Coarse (FRM, Collocated)	PM10/PM-Coarse (Continuous)	Lead-PM10	Lead-PM10 (Collocated)	PM Speciation (CSN)	PM Speciation (IMPROVE)	PM2.5 Carbon (BC/UVC, Continuous)	Ozone	SO2	CO	Direct NO ₂	NO/NO ₂ /NOx	NO/NOy	VOCs (PAMS)	Traffic Count	Wind Speed	Wind Direction	Temperature	Dew Point / Rel. Humidity	Barometric Pressure	Solar Radiation
											X													

X=Existing



= Planned in 2018/19



= Proposed to terminate in 2018/2019

Site Description: The Abington site is a regional-scale site located in a rural/agricultural area in northeast Connecticut in the town of Pomfret. This site is operated by the National Park Service under the direction of EPA as part of their Clean Air Status and Trends Network (CASTNET). It is located on a hilltop approximately 2.3 km south of State Route (SR) 44 and 0.6 km east of SR 97. The site includes a portable shed located in the center of an agricultural field that is surrounded by forest. DEEP tracks ambient air quality and quality assurance data from the site but is not responsible for site operations and planning.

Monitoring Objectives: The Abington monitoring site objective is to collect ozone measurements to assess long-term trends as part of the national CASTNET network. The site will also be used to determine compliance with the ozone NAAQS in Windham County.

Planned changes for 2018-2019: This site is not under the operational control or purview of DEEP and is included in this Network Plan for informational purposes only.

Town – Site: **Bridgeport – Roosevelt School**
 County: **Fairfield** Latitude: **41.17086°**
 Address: **Park Avenue** Longitude: **-73.19476°**
 AQS Site ID: **09-001-0010** Elevation: **7 m (23 ft)**
 Spatial Scale: **Neighborhood** Year Established: **1982**
 Statistical Area: **CSA (New York-Newark-Bridgeport)**



PM2.5 (FRM)	PM2.5 (FRM, Collocated)	PM2.5 (Continuous - FEM)	PM10/PM-Coarse (FRM)	PM10/PM-Coarse (FRM, Collocated)	PM10/PM-Coarse (Continuous)	Lead-PM10	Lead-PM10 (Collocated)	PM Speciation (CSN)	PM Speciation (IMPROVE)	PM2.5 Carbon (BC/UVC, Continuous)	Ozone	SO2	CO	Direct NO2	NO/NO2/NOx	NO/NOy	VOCs (PAMS)	Traffic Count	Wind Speed	Wind Direction	Temperature	Dew Point / Rel. Humidity	Barometric Pressure	Solar Radiation
	1/6	X	T		P							X	X								X			

X=Existing P = Planned in 2018/19 T = Proposed to terminate in 2018/2019

Site Description: The Roosevelt School site is a neighborhood-scale site located in southwestern Connecticut in the city of Bridgeport. This site is located 50 m to the north of I-95 and 200 m to the west of the I-95 and Rte 8 interchange. This coastal site is located in a schoolyard and residential neighborhoods are present in every direction of the site. This site meets all siting requirements and criteria and has been approved internally by DEEP and independently by EPA Region I.

Monitoring Objectives: The Bridgeport Roosevelt School monitoring site objectives include collecting PM_{2.5} FRM measurements for compliance purposes and continuous PM_{2.5} for AQI and forecasting purposes. The PM_{2.5} FEM is designated as the primary sampler to for NAAQS.

Planned changes for 2018-2019: DEEP plans to replace the BAM PM_{2.5} analyzer with a Teledyne API T640X PM₁₀/PM_{2.5}/PM_{10-2.5} FEM continuous analyzer during 2018 - 2019. The PM₁₀ FRM sampler will be terminated on January 1, 2019.

Town – Site: **Cornwall – Mohawk Mountain**
 County: **Litchfield** Latitude: **41.82140°**
 Address: **Mohawk Mountain** Longitude: **-73.29733°**
 AQS Site ID: **09-005-0005** Elevation: **505 m (1656 ft)**
 Spatial Scale: **Regional** Year Established: **1988**
 Statistical Area: **CSA (New York-Newark-Bridgeport)**



PM2.5 (FRM)	PM2.5 (FRM, Collocated)	PM2.5 (Continuous - FEM)	PM10/PM-Coarse (FRM)	PM10/PM-Coarse (FRM, Collocated)	PM10/PM-Coarse (Continuous)	Lead-PM10	Lead-PM10 (Collocated)	PM Speciation (CSN)	PM Speciation (IMPROVE)	PM2.5 Carbon (BC/UVC, Continuous)	Ozone	SO2	CO	Direct NO ₂	NO/NO ₂ /NOx	NO/NOy	VOCs (PAMS)	Traffic Count	Wind Speed	Wind Direction	Temperature	Dew Point / Rel. Humidity	Barometric Pressure	Solar Radiation
1/3		X		X	X				1/3	X	X	X	X			X			X	X	X	X	X	X

X=Existing **P** = Planned in 2017/18 **T** = Proposed to terminate in 2017/2018

Site Description: The Mohawk Mountain site is a rural regional-scale site located in northwestern Connecticut in the town of Cornwall. The site is located at the summit of Mohawk Mountain with an elevation of 505 m (1656 ft), and is approximately 17 km to the east of the New York border and 25 km to the south of the Massachusetts border. This site meets all siting requirements and criteria and has been approved by EPA as an NCore site.

Monitoring Objectives: The primary monitoring objectives are to meet NCore requirements for O₃, CO, SO₂, NO, NOy, PM_{2.5} FRM, PM₁₀ FRM, PM_{10-2.5} FRM, PM_{2.5} speciation, continuous PM_{2.5} and surface meteorology. PM_{2.5} chemical speciation measurements are collected through the IMPROVE network as one-in-three day 24-hour samples and by continuous analyzers for fine particulate carbon parameters (BC/UVC).

Planned changes for 2018-2019: DEEP plans to replace the PM_{2.5} and PM₁₀ continuous FEM analyzers with a Teledyne API T640X PM₁₀/PM_{2.5}/PM_{10-2.5} continuous FEM analyzer during 2018 - 2019.

Town – Site: **Danbury – Western Connecticut State University**
 County: **Fairfield** Latitude: **41.398692°**
 Address: **White Street** Longitude: **-73.443148°**
 AQS Site ID: **09-001-1123** Elevation: **116 m (380 ft)**
 Spatial Scale: **Neighborhood** Year Established: **1974**
 Statistical Area: **CSA (New York-Newark-Bridgeport)**



PM2.5 (FRM)	PM2.5 (FRM, Collocated)	PM2.5 (Continuous - FEM)	PM10/PM-Coarse (FRM)	PM10/PM-Coarse (FRM, Collocated)	PM10/PM-Coarse (Continuous)	Lead-PM10	Lead-PM10 (Collocated)	PM Speciation (CSN)	PM Speciation (IMPROVE)	PM2.5 Carbon (BC/UVC, Continuous)	Ozone	SO2	CO	Direct NO2	NO/NO2/NOx	NO/NOy	VOCs (PAMS)	Traffic Count	Wind Speed	Wind Direction	Temperature	Dew Point / Rel. Humidity	Barometric Pressure	Solar Radiation
1/6		X		P						X	X								X	X	X		X	

X=Existing

P

= Planned in 2018/19

T

= Proposed to terminate in 2018/2019

Site Description: The Western Connecticut State University (WCSU) site is a neighborhood-scale site for PM_{2.5} and an urban-scale site for O₃, located in western Connecticut in the city of Danbury. This site is located on the top level of a parking garage on the WCSU campus. This site is located approximately 140 m to the southeast of I-84 on White Street. Residential neighborhoods are located in all directions of the site. This site meets all siting requirements and criteria and has been approved by EPA Region I. The downtown area of Danbury has a generally bowl-shaped topography, and therefore is subject to occasional high PM_{2.5} events during the winter.

Monitoring Objectives: The Danbury WCSU monitoring site objectives include collecting PM_{2.5} measurements for NAAQS compliance and for AQI forecasting purposes. Ozone is measured at the Danbury site for compliance assessment and AQI forecast reporting. Black carbon (BC/UVC) aethalometer monitoring is included to track the wood smoke contribution to PM pollution.

Planned changes for 2018-2019: DEEP plans to replace the BAM PM_{2.5} analyzer with a Teledyne API T640X PM₁₀/PM_{2.5}/PM_{10-2.5} FEM continuous analyzer during 2018 - 2019.

Town – Site: **East Hartford – McAuliffe Park**
 County: **Hartford** Latitude: **41.78471°**
 Address: **McAuliffe Park** Longitude: **-72.63158°**
 AQS Site ID: **09-003-1003** Elevation: **15 m (50 ft)**
 Spatial Scale: **Neighborhood** Year Established: **1981**
 Statistical Area: **CSA (Hartford-West Hartford-Willimantic)**



PM _{2.5} (FRM)	PM _{2.5} (FRM, Collocated)	PM _{2.5} (Continuous - FEM)	PM ₁₀ /PM-Coarse (FRM)	PM ₁₀ /PM-Coarse (FRM, Collocated)	PM ₁₀ /PM-Coarse (Continuous)	Lead-PM ₁₀	Lead-PM ₁₀ (Collocated)	PM Speciation (CSN)	PM Speciation (IMPROVE)	PM _{2.5} Carbon (BC/UVC, Continuous)	Ozone	SO ₂	CO	Direct NO ₂	NO/NO ₂ /NO _x	NO/NO _y	VOCs (PAMS)	Traffic Count	Wind Speed	Wind Direction	Temperature	Dew Point / Rel. Humidity	Barometric Pressure	Solar Radiation
1/6		X	1/6		P					X	X			X					X	X	X	X	X	

X=Existing **P** = Planned in 2018/19 **T** = Proposed to terminate in 2018/2019

Site Description: The McAuliffe Park site is neighborhood-scale site located in central Connecticut in the town of East Hartford. The site is located approximately 120 m to the east of Rte 5, 2.0 km to the east of I-91 and 2.5 km to the south of I-291. This site is located 3.7 km to the northeast of the city of Hartford. Residential neighborhoods are located in all directions of this site. This site meets all siting requirements and criteria and has been approved internally by DEEP and independently by EPA Region I.

Monitoring Objectives: The East Hartford McAuliffe Park monitoring site objectives include collecting PM_{2.5} measurements for NAAQS compliance and AQI forecasting purposes. A PM₁₀ FRM is operated for SLAMS compliance purposes, as well as to gather PM_{10-2.5} measurements. Ozone is measured at the McAuliffe Park site for compliance assessment and AQI and forecast reporting.

Planned changes for 2018-2019: DEEP plans to replace the BAM PM_{2.5} analyzer with a Teledyne API T640X PM₁₀/PM_{2.5}/PM_{10-2.5} FEM continuous analyzer during 2018 - 2019.

Town – Site: **Greenwich – Point Park**
 County: **Fairfield** Latitude: **41.005047°**
 Address: **Point Park** Longitude: **-73.58382°**
 AQS Site ID: **09-001-0017** Elevation: **3 m (10 ft)**
 Spatial Scale: **Urban** Year Established: **1978**
 Statistical Area: **CSA (New York-Newark-Bridgeport)**



PM2.5 (FRM)	PM2.5 (FRM, Collocated)	PM2.5 (Continuous - FEM)	PM10/PM-Coarse (FRM)	PM10/PM-Coarse (FRM, Collocated)	PM10/PM-Coarse (Continuous)	Lead-PM10	Lead-PM10 (Collocated)	PM Speciation (CSN)	PM Speciation (IMPROVE)	PM2.5 Carbon (BC/UVC, Continuous)	Ozone	SO2	CO	Direct NO ₂	NO/NO ₂ /NOx	NO/NOy	VOCs (PAMS)	Traffic Count	Wind Speed	Wind Direction	Temperature	Dew Point / Rel. Humidity	Barometric Pressure	Solar Radiation
											X								X	X	X			

X=Existing **P** = Planned in 2018/19 **T** = Proposed to terminate in 2018/2019

Site Description: The Greenwich Point Park site is an urban-scale site located in southwestern Connecticut on the Long Island Sound in the town of Greenwich. This is a coastal site located approximately 3.0 km to the southeast and 5.0 km to the northeast of the New York border. This site meets all siting requirements and criteria and has been approved internally by DEEP and independently by EPA Region I.

Monitoring Objectives: The Greenwich Point Park monitoring site objectives include collecting ozone measurements for compliance assessment and AQI and forecast reporting.

Planned changes for 2018-2019: There are no changes planned for the period 2018 - 2019.

Town – Site: **Groton – Fort Griswold**
 County: **New London** Latitude: **41.35362°**
 Address: **141 Smith Street** Longitude: **-72.07882°**
 AQS Site ID: **09-011-0124** Elevation: **37 m (120 ft)**
 Spatial Scale: **Neighborhood** Year Established: **2007**
 Statistical Area: **MSA (Norwich-New London)**



PM _{2.5} (FRM)	PM _{2.5} (FRM, Collocated)	PM _{2.5} (Continuous - FEM)	PM ₁₀ /PM-Coarse (FRM)	PM ₁₀ /PM-Coarse (FRM, Collocated)	PM ₁₀ /PM-Coarse (Continuous)	Lead-PM ₁₀	Lead-PM ₁₀ (Collocated)	PM Speciation (CSN)	PM Speciation (IMPROVE)	PM _{2.5} Carbon (BC/UVC, Continuous)	Ozone	SO ₂	CO	Direct NO ₂	NO/NO ₂ /NO _x	NO/NO _y	VOCs (PAMS)	Traffic Count	Wind Speed	Wind Direction	Temperature	Dew Point / Rel. Humidity	Barometric Pressure	Solar Radiation
	1/6	X			P						X											X		

X=Existing **P** = Planned in 2018/19 **T** = Proposed to terminate in 2018/2019

Site Description: The Fort Griswold site is a neighborhood-scale site located in southeastern Connecticut in the town of Groton. This site is located approximately 1.1 km to the south of I-95 and 0.5 km to the east of the New London Harbor. Residential neighborhoods are located in all directions of this site. This site meets all siting requirements and criteria and has been approved internally by DEEP and independently by EPA Region I.

Monitoring Objectives: The Groton Fort Griswold monitoring site objectives include monitoring of the two key pollutants, ozone and PM_{2.5}, for the southeastern part of Connecticut. Ozone is measured at the Fort Griswold site for compliance assessment and AQI and forecast reporting. PM_{2.5} is currently monitored NAAQS compliance and AQI reporting. The FEM monitor is designated as primary and the FRM sample is designated as collocated for FEM network quality assurance data.

Planned changes for 2018-2019: DEEP plans to replace the BAM PM_{2.5} analyzer with a Teledyne API T640X PM₁₀/PM_{2.5}/PM_{10-2.5} FEM continuous analyzer during 2018 - 2019.

Town – Site: **Hartford – Huntley Place**
 County: **Hartford** Latitude: **41.771444°**
 Address: **10 Huntley Place** Longitude: **-72.679923°**
 AQS Site ID: **09-003-0025** Elevation: **57.2 m (187.7 ft)**
 Spatial Scale: **Near Road** Year Established: **2013**
 Statistical Area: **CSA (Hartford-West Hartford-Willimantic)**



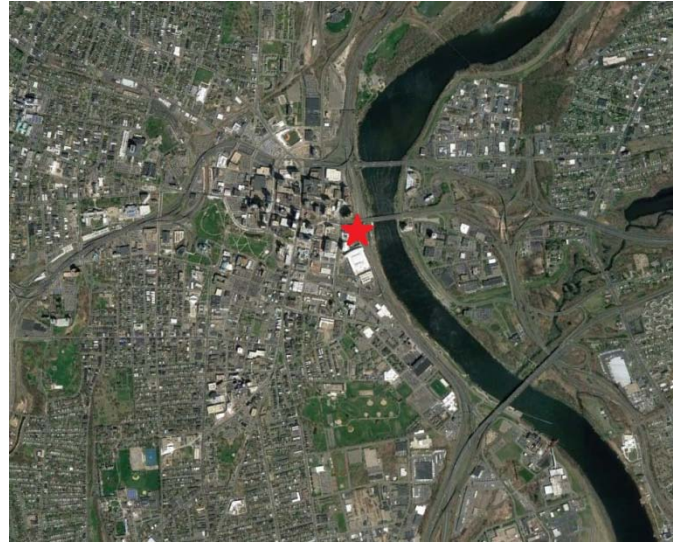
PM2.5 (FRM)	PM2.5 (FRM, Collocated)	PM2.5 (Continuous - FEM)	PM10/PM-Coarse (FRM)	PM10/PM-Coarse (FRM, Collocated)	PM10/PM-Coarse (Continuous)	Lead-PM10	Lead-PM10 (Collocated)	PM Speciation (CSN)	PM Speciation (IMPROVE)	PM2.5 Carbon (BC/UVC, Continuous)	Ozone	SO2	CO	Direct NO ₂	NO/NO ₂ /NOx	NO/NOy	VOCs (PAMS)	Traffic Count	Wind Speed	Wind Direction	Temperature	Dew Point / Rel. Humidity	Barometric Pressure	Solar Radiation
1/3		X			X					X			X	X				X	X	X	X		X	

X=Existing **P** = Planned in 2018/19 **T** = Proposed to terminate in 2018/2019

Site Description: The Huntley Place site is a near-road site located in north central Hartford. The site, located on the north west side of US I-84, is approximately 0.25 km to the west of the US I-91 corridor and the Founders and Buckley Bridges over the Connecticut River. Residential neighborhoods are located to the north, east and west of the site. This site meets all siting requirements for a near-road NO₂ site, and has been approved by EPA.

Monitoring Objectives: The primary monitoring objectives for the site are to capture NO₂ concentrations near heavily trafficked roads, to assess area-wide NO₂ concentrations, and to assess NO₂ concentrations for vulnerable and susceptible populations in adjacent neighborhoods. The data will be also used to help determine compliance with the 1-hour NO₂ NAAQS as established by EPA in 2010. This site also collects CO, continuous PM_{2.5} & PM₁₀ (BAM), BC/UVC and traffic counts.

Planned changes for 2018-2019: DEEP plans to replace the BAM PM_{2.5} and PM₁₀ analyzers with a Teledyne API T640X PM₁₀/PM_{2.5}/PM_{10-2.5} FEM continuous analyzer during 2018 - 2019.



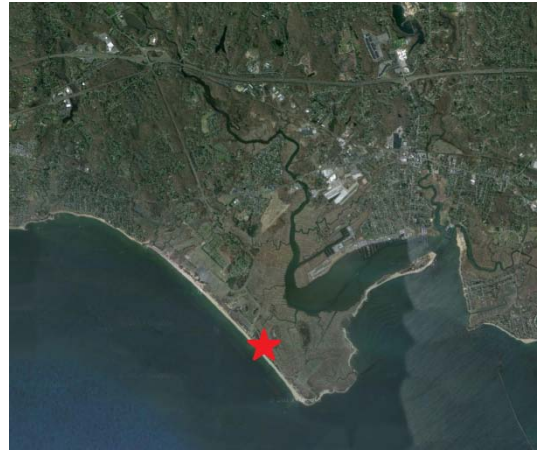
	PM2.5 (FRM)
	PM2.5 (FRM, Collocated)
×	PM2.5 (Continuous)
	PM10/PM-Coarse (FRM)
	PM10/PM-Coarse (FRM, Collocated)
	PM10/PM-Coarse (Continuous)
	Lead-PM10
	Lead-PM10 (Collocated)
	PM Speciation (CSN)
	PM Speciation (IMPROVE)
	PM2.5 Carbon (BC/UVC, Continuous)
×	Ozone
	SO2
	CO
	Direct NO ₂
	NO/NO ₂ /NO _x
	NO/NO _y
	VOCs (PAMS)
	Traffic Count
×	Wind Speed
×	Wind Direction
×	Temperature
×	Dew Point / Rel. Humidity
×	Barometric Pressure
	Solar Radiation

X=Existing **P** = Planned in 2017/2018 **T** = Proposed to terminate in 2017/2018

Monitoring Objectives: The Hartford Adriaen's Landing Village Green monitoring objectives are to collect ozone measurements for research purposes, engage communities in air pollution awareness, and increase air pollution monitoring coverage. Ozone, PM_{2.5}, wind speed and direction, temperature, barometric pressure and relative humidity are measured.

Planned changes for 2018-2019: No changes are planned during 2018 - 2019.

Town – Site: **Madison – Hammonasset State Park**
 County: **New Haven** Latitude: **41.25984°**
 Address: **Hammonasset SP** Longitude: **-72.55018°**
 AQS Site ID: **09-009-9002** Elevation: **3 m (10 ft)**
 Spatial Scale: **Regional** Year Established: **1981**
 Statistical Area: **CSA (New York-Newark-Bridgeport)**



PM2.5 (FRM)	PM2.5 (FRM, Collocated)	PM2.5 (Continuous - FEM)	PM10/PM-Coarse (FRM)	PM10/PM-Coarse (FRM, Collocated)	PM10/PM-Coarse (Continuous)	Lead-PM10	Lead-PM10 (Collocated)	PM Speciation (CSN)	PM Speciation (IMPROVE)	PM2.5 Carbon (BC/UVC, Continuous)	Ozone	SO2	CO	Direct NO ₂	NO/NO ₂ /NOx	NO/NOy	VOCs (PAMS)	Total Column NO ₂ /HCHO	Wind Speed	Wind Direction	Temperature	Dew Point / Rel. Humidity	Barometric Pressure	Solar Radiation
											X							X	X	X	X			

X=Existing **P** = Planned in 2017/18

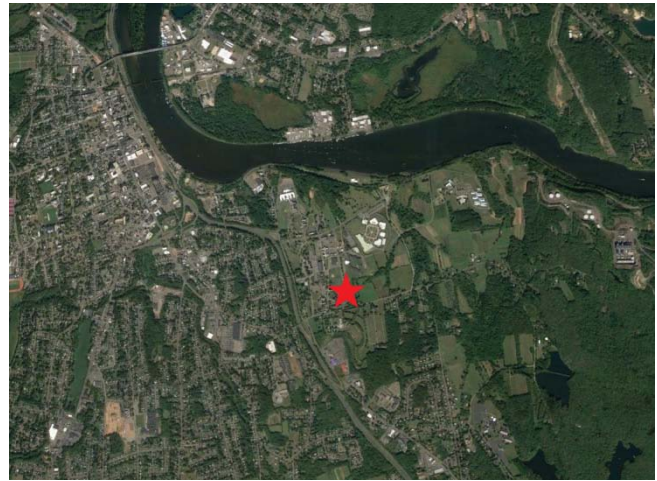
T = Proposed to terminate in 2017/2018

Site Description: The Hammonasset State Park site is a regional-scale site located in central coastal Connecticut in the town of Madison. This site is located approximately 1.5 km to the south of Rte 1 and 3.0 km to the south of I-95 on the Long Island Sound. Residential neighborhoods are located primarily to the northeast, north and northwest of the site. This site meets all siting requirements and criteria and has been approved internally by DEEP and independently by EPA Region I.

Monitoring Objectives: The Madison Hammonasset State Park monitoring site objective is to collect ozone measurements for compliance assessment and AQI forecast reporting. A second objective is to collect data in support of the Enhanced Monitoring Plan (Appendix B of this Network Plan) for research on regional ozone transport.

Planned changes for 2018-2019: A total column trace gas spectrometer (Pandora), operated by EPA, was installed in May, 2018 (see EMP, Appendix B).

Town – Site: **Middletown – Connecticut Valley Hospital**
 County: **Middlesex** Latitude: **41.55224°**
 Address: **Shew Hall** Longitude: **-72.63004°**
 AQS Site ID: **09-007-9007** Elevation: **58 m (190 ft)**
 Spatial Scale: **Neighborhood** Year Established: **1980**
 Statistical Area: **CSA (Hartford-West Hartford-Willimantic)**



PM2.5 (FRM)	PM2.5 (FRM, Collocated)	PM2.5 (Continuous - FEM)	PM10/PM-Coarse (FRM)	PM10/PM-Coarse (FRM, Collocated)	PM10/PM-Coarse (Continuous)	Lead-PM10	Lead-PM10 (Collocated)	PM Speciation (CSN)	PM Speciation (IMPROVE)	PM2.5 Carbon (BC/UVC, Continuous)	Ozone	SO2	CO	Direct NO ₂	NO/NO ₂ /NOx	NO/NOy	VOCs (PAMS)	Traffic Count	Wind Speed	Wind Direction	Temperature	Dew Point / Rel. Humidity	Barometric Pressure	Solar Radiation
											X								X	X	X		X	

X=Existing **P** = Planned in 2017/18

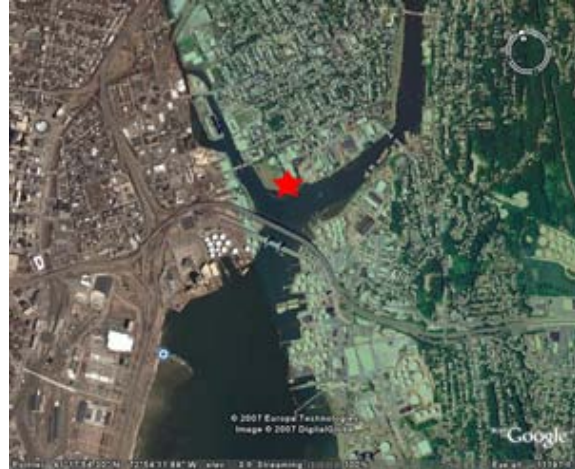
T = Proposed to terminate in 2017/2018

Site Description: The Middletown Connecticut Valley Hospital (CVH) site is an urban-scale ozone site located in central Connecticut. This site is located approximately 0.2 km to the east of Rte 9. Residential neighborhoods are located to the west, north and south of this site. This site meets all siting requirements. DEEP relocated the site within the CVH campus to a shed near Battelle Hall in 2017.

Monitoring Objectives: The CVH monitoring site objective is to collect ozone measurements for compliance assessment and AQI forecast reporting.

Planned changes for 2018-2019: There are no changes planned through 2019.

Town – Site: **New Haven – Criscuolo Park**
 County: **New Haven** Latitude: **41.30117°**
 Address: **1 James Street** Longitude: **-72.90288°**
 AQS Site ID: **09-009-0027** Elevation: **3 m (10 ft)**
 Spatial Scale: **Neighborhood** Year Established: **2004**
 Statistical Area: **CSA (New York-Newark-Bridgeport)**



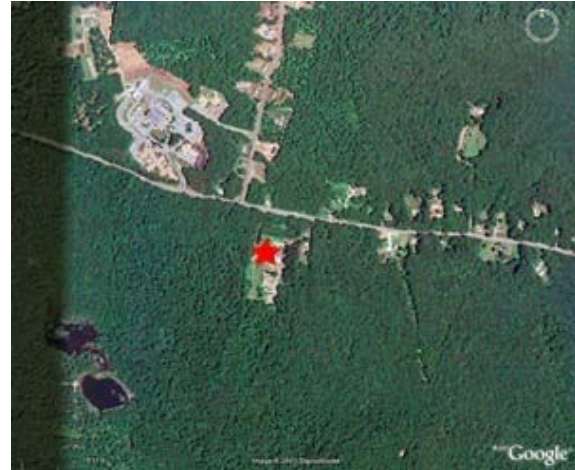
PM2.5 (FRM)	PM2.5 (FRM, Collocated)	PM2.5 (Continuous - FEM)	PM10/PM-Coarse (FRM)	PM10/PM-Coarse (FRM, Collocated)	PM10/PM-Coarse (Continuous)	Lead-PM10	Lead-PM10 (Collocated)	PM Speciation (CSN)	PM Speciation (IMPROVE)	PM2.5 Carbon (BC/UVC, Continuous)	Ozone	SO2	CO	Direct NO2	NO/NO2/NOx	NO/NOy	VOCs (PAMS)	Total Column NO2/HCOC	Wind Speed	Wind Direction	Temperature	Dew Point / Rel. Humidity	Barometric Pressure	Solar Radiation	Mixing Height
1/3	1/6	X	1/3	1/6	X			1/3		X	X	X	X	X		X		P	X	X	X	X	X	X	X

X=Existing **P** = Planned in 2018/19 **T** = Proposed to terminate in 2018/2019

Site Description: The Criscuolo Park site is a neighborhood-scale site located on the western side of the city of New Haven. The site is approximately 0.25 km to the north of the I-95 Quinnipiac River Bridge. The site is approximately 1.0 km to the east of the I-91 and I-95 interchange. Bulk gasoline transfer stations are located 0.3 to 2.0 km to the south of the site. Residential neighborhoods are located to the west, north and east of the site.

Monitoring Objectives: The primary monitoring objectives are to meet NCore requirements for O₃, CO, SO₂, PM_{2.5}, PM₁₀, PM_{10-2.5}, PM_{2.5} speciation, NO/NO_y and surface meteorology. NO₂ monitoring is conducted in fulfillment of the requirement for NO₂ monitoring of vulnerable and sensitive populations 40 nationwide sites selected by the Regional Administrators. PM_{2.5} chemical speciation measurements are collected through the Chemical Speciation Network (CSN) as one-in-three day 24-hour samples and by continuous analyzers for fine particulate carbon parameters (BC/UVC and EC/OC) and sulfate.

Planned changes for 2018-2019: DEEP installed a Teledyne API T640X PM₁₀/PM_{2.5}/PM_{10-2.5} FEM continuous analyzer in November 2017 and will remove the BAM PM_{2.5} analyzer and BAM PM₁₀ analyzer in late 2018. In addition, DEEP plans to install a second Teledyne API T640X PM₁₀/PM_{2.5}/PM_{10-2.5} FEM continuous analyzer on date. A total column trace gas spectrometer, operated by EPA, was installed in May, 2018 (see EMP, Appendix B).



	PM2.5 (FRM)
	PM2.5 (FRM, Collocated)
	PM2.5 (Continuous - FEM)
	PM10/PM-Coarse (FRM)
	PM10/PM-Coarse (FRM, Collocated)
	PM10/PM-Coarse (Continuous)
	Lead-PM10
	Lead-PM10 (Collocated)
	PM Speciation (CSN)
	PM Speciation (IMPROVE)
	PM2.5 Carbon (BC/UVC, Continuous)
X	Ozone
	SO2
	CO
	Direct NO ₂
	NO/NO ₂ /NO _x
	NO/NO _y
	VOCs (PAMS)
	Traffic Count
X	Wind Speed
X	Wind Direction
X	Temperature
	Dew Point / Rel. Humidity
	Barometric Pressure
	Solar Radiation

P

Planned changes for 2018-2019: None.



	PM2.5 (FRM)
	PM2.5 (FRM, Collocated)
	PM2.5 (Continuous - FEM)
	PM10 / PM-Coarse (FRM)
	PM10 / PM-Coarse (FRM, Collocated)
	PM10 / PM-Coarse (Continuous)
	Lead-PM10
	Lead-PM10 (Collocated)
	PM Speciation (CSN)
	PM Speciation (IMPROVE)
	PM2.5 Carbon (BC/UVC, Continuous)
×	Ozone
	SO2
	CO
	Direct NO ₂
	NO/NO ₂ / NO _x
	NO/NO _y
	VOCs (PAMS)
	Traffic Count
	Wind Speed
	Wind Direction
×	Temperature
	Dew Point / Rel. Humidity
	Barometric Pressure
	Solar Radiation

X=Existing **P** = Planned in 2018/19 **T** = Proposed to terminate in 2018/2019

Planned changes for 2018-2019: None

Town – Site: **Waterbury – Meadow & Bank Street**
 County: **New Haven** Latitude: **41.55046°**
 Address: **Meadow & Bank** Longitude: **-73.04365°**
 AQS Site ID: **09-009-2123** Elevation: **80 m (269 ft)**
 Spatial Scale: **Neighborhood** Year Established: **1975**
 Statistical Area: **CSA (New York-Newark-Bridgeport)**



PM2.5 (FRM)	PM2.5 (FRM, Collocated)	PM2.5 (Continuous - FEM)	PM10 / PM-Coarse (FRM)	PM10 / PM-Coarse (FRM, Collocated)	PM10 / PM-Coarse (Continuous)	Lead-PM10	Lead-PM10 (Collocated)	PM Speciation (CSN)	PM Speciation (IMPROVE)	PM2.5 Carbon (BC/UVC, Continuous)	Ozone	SO2	CO	Direct NO ₂	NO / NO ₂ / NOx	NO / NOy	VOCs (PAMS)	Traffic Count	Wind Speed	Wind Direction	Temperature	Dew Point / Rel. Humidity	Barometric Pressure	Solar Radiation
1/6		X			P														X	X	X			

X=Existing

P = Planned in 2018/19

T = Proposed to terminate in 2018/2019

Site Description: The Waterbury site is a neighborhood-scale site located in western Connecticut at Meadow Street and Bank Street in the Naugatuck River Valley. This site is approximately 170 m to the south of I-84, 300 m to the east of Rte 8 and 0.75 km to the east of the I-84 and Rte 8 interchange. Residential neighborhoods are located in all directions of the site. This site meets all siting requirements and criteria and has been approved internally by DEEP and independently by EPA Region I.

Monitoring Objectives: The Waterbury Meadow & Bank Street site monitoring objectives include collecting PM_{2.5} FRM measurements for compliance purposes and continuous PM_{2.5} for AQI forecast reporting. The PM_{2.5} BAM and has been designated as an FEM to be used to determine NAAQS compliance as well.

Planned changes for 2018-2019: DEEP plans to replace the BAM PM_{2.5} analyzer with a Teledyne API T640X PM₁₀/PM_{2.5}/PM_{10-2.5} FEM continuous analyzer during 2018 - 2019.

Town – Site: **Westport – Sherwood Island State Park**
 County: **Fairfield** Latitude: **41.11822°**
 Address: **Sherwood Island SP** Longitude: **-73.33681°**
 AQS Site ID: **09-001-9003** Elevation: **4 m (13 ft)**
 Spatial Scale: **Regional** Year Established: **1996**
 Statistical Area: **CSA (New York-Newark-Bridgeport)**



PM2.5 (FRM)	PM2.5 (FRM, Collocated)	PM2.5 (Continuous - FEM)	PM10/PM-Coarse (FRM)	PM10/PM-Coarse (FRM, Collocated)	PM10/PM-Coarse (Continuous)	Lead-PM10	Lead-PM10 (Collocated)	PM Speciation (CSN)	PM Speciation (IMPROVE)	PM2.5 Carbon (BC/UVC, Continuous)	Ozone	SO2	CO	Direct NO ₂	NO/NO ₂ /NOx	NO/NOy	VOCs (PAMS)	Total Column NO ₂ /HCOC	Wind Speed	Wind Direction	Temperature	Dew Point / Rel. Humidity	Barometric Pressure	Solar Radiation
											X			X				P	X	X	X			

X=Existing **P** = Planned in 2018/19 **T** = Proposed to terminate in 2017/2018

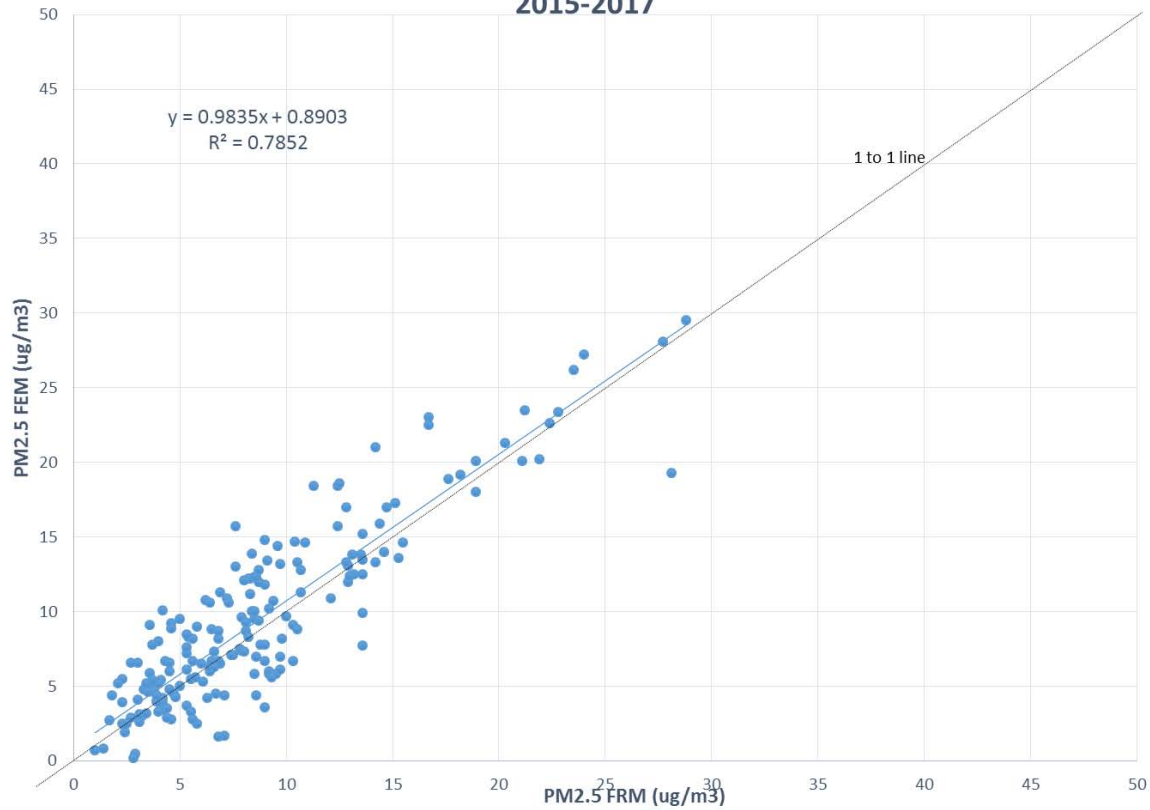
Site Description: The Westport Sherwood Island State Park site is a regional-scale site located in southwestern Connecticut. This is a coastal site that is approximately 0.5 km to the south of I-95 on the Long Island Sound. This site meets all siting requirements and criteria and has been approved internally by DEEP and independently by EPA Region I.

Monitoring Objectives: Ozone is measured at the Westport site for compliance assessment and AQI forecast reporting. Both surface level and total column NO₂ (and possibly HCHO) will be monitored as part of the Enhanced Monitoring Plan (Appendix B of this Network Plan).

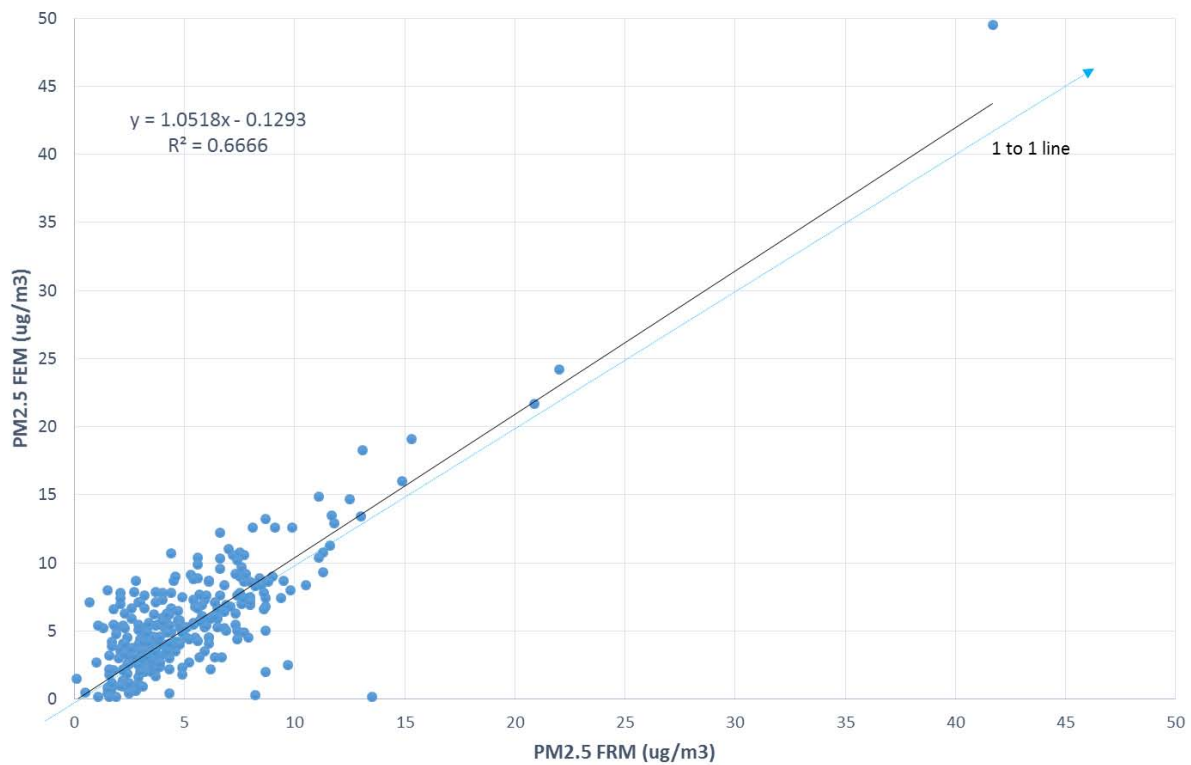
Planned changes for 2018-2019: A total column NO₂ (and other trace gas) analyzer, operated by EPA, was installed in May 2018 to support studies of ozone fate and transport in the Long Island Sound/Coastal Connecticut region. In addition, several instruments have been installed in support of an intensive monitoring study (LISTOS) during the 2018 ozone season (see Appendix B of this document for the Enhanced Monitoring Plan).

Appendix A $PM_{2.5}$ FRM vs. Continuous Correlation Charts

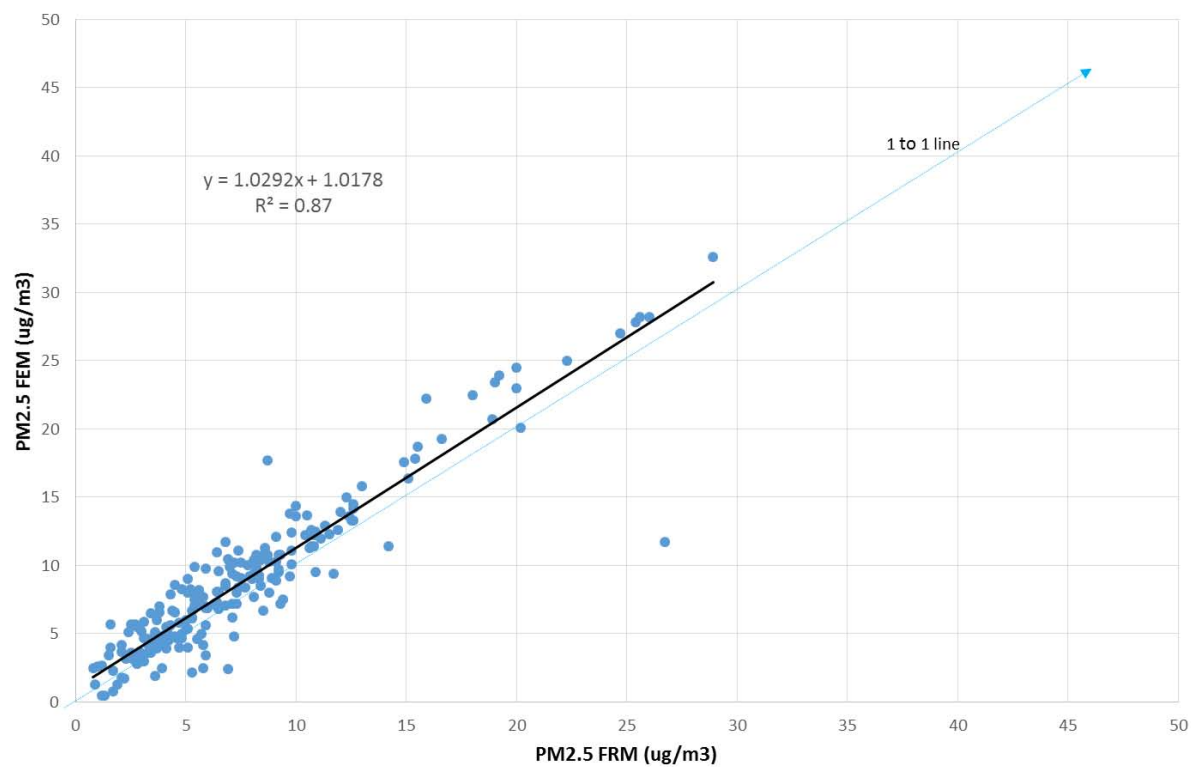
Bridgeport PM2.5 Continuous FEM vs. FRM
2015-2017



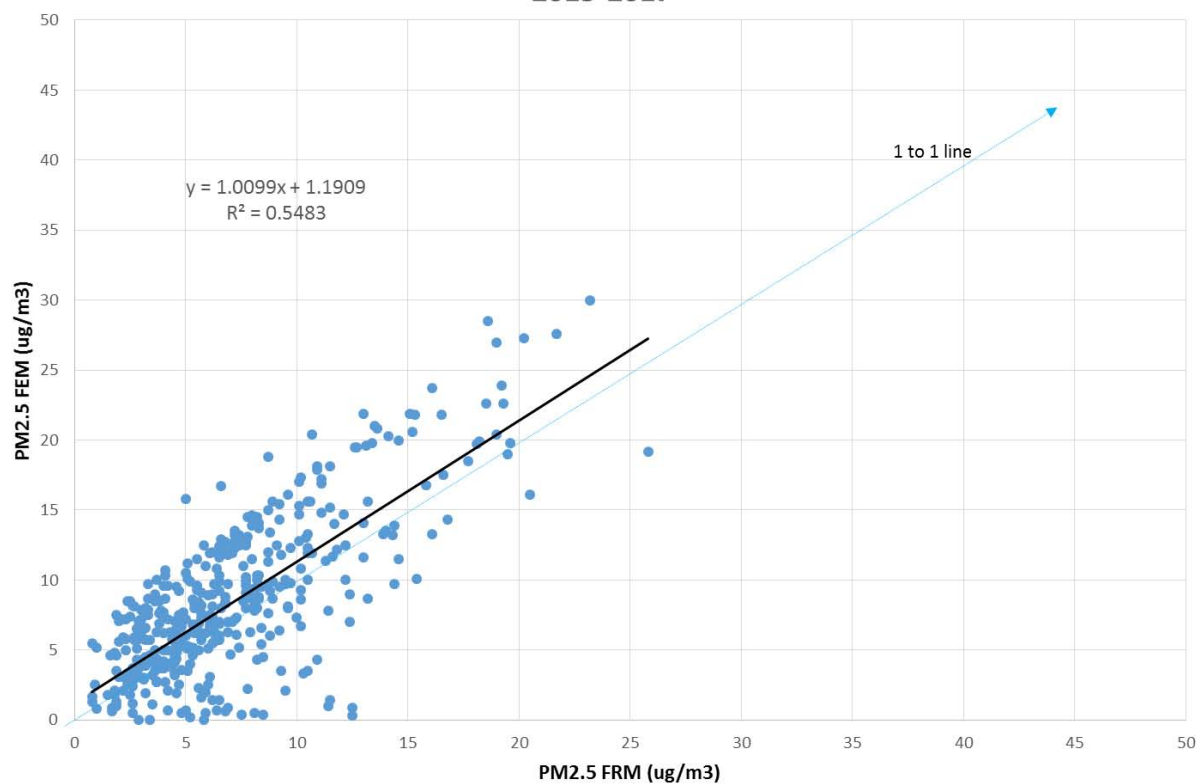
Cornwall PM2.5 Continuous FEM vs. FRM
2015-2017



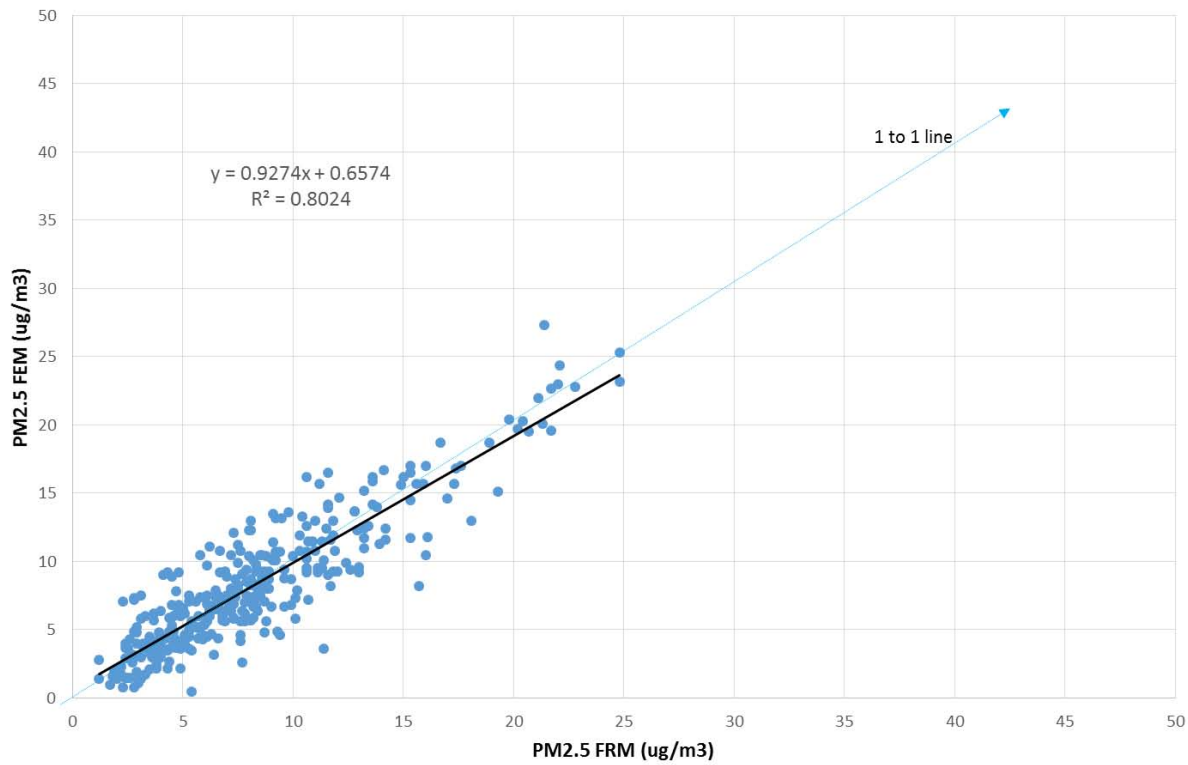
Danbury PM2.5 Continuous FEM vs. FRM
2015-2017



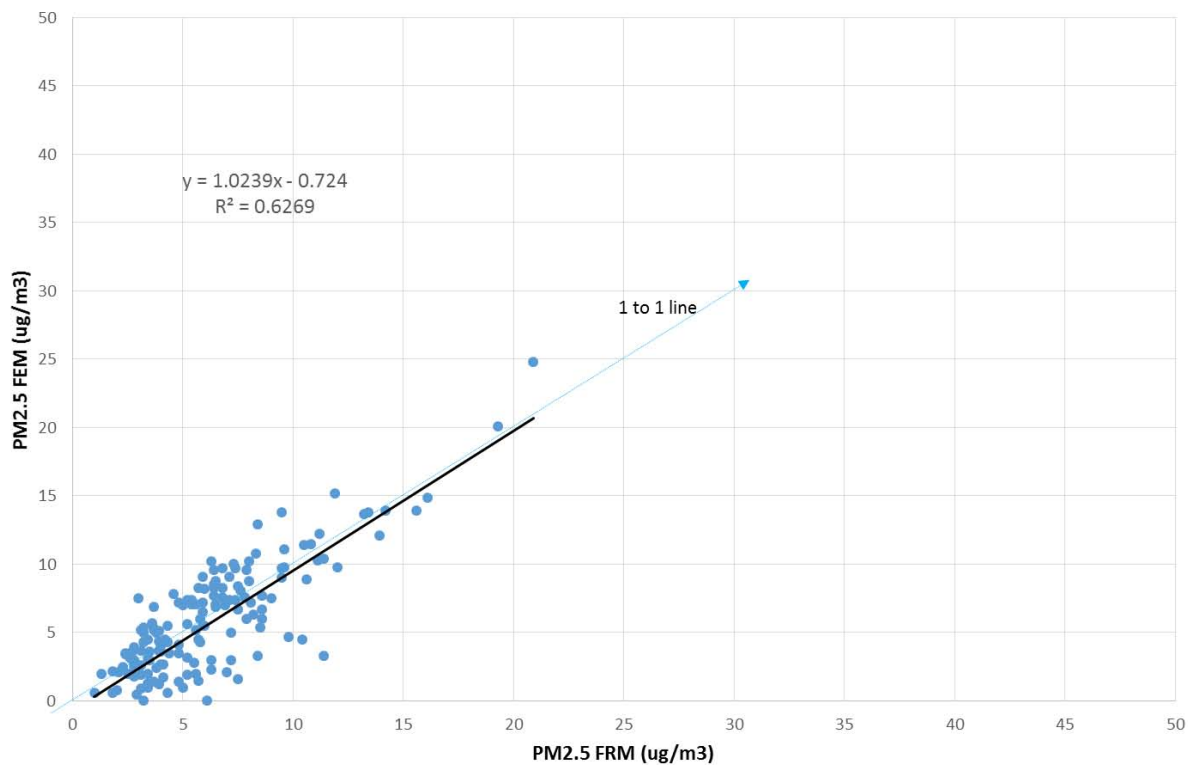
East Hartford PM2.5 Continuous FEM vs. FRM
2015-2017



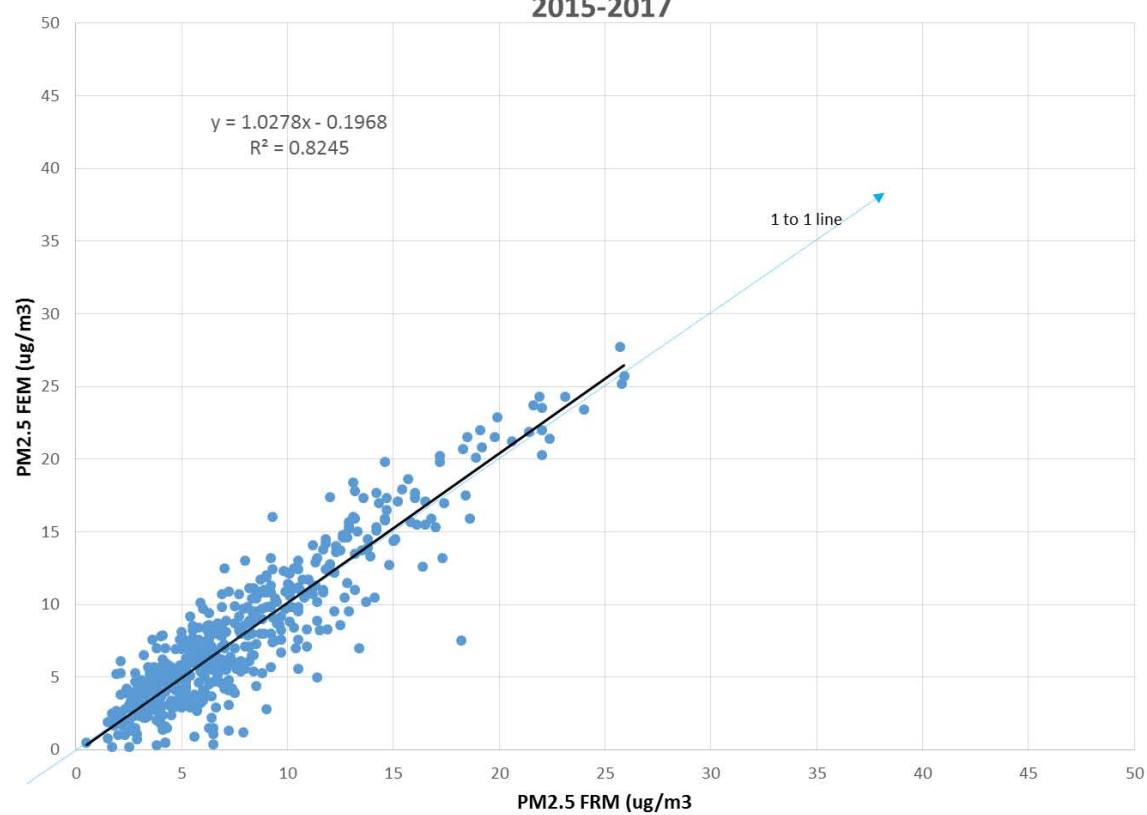
Hartford PM2.5 Continuous FEM vs. FRM
2015-2017



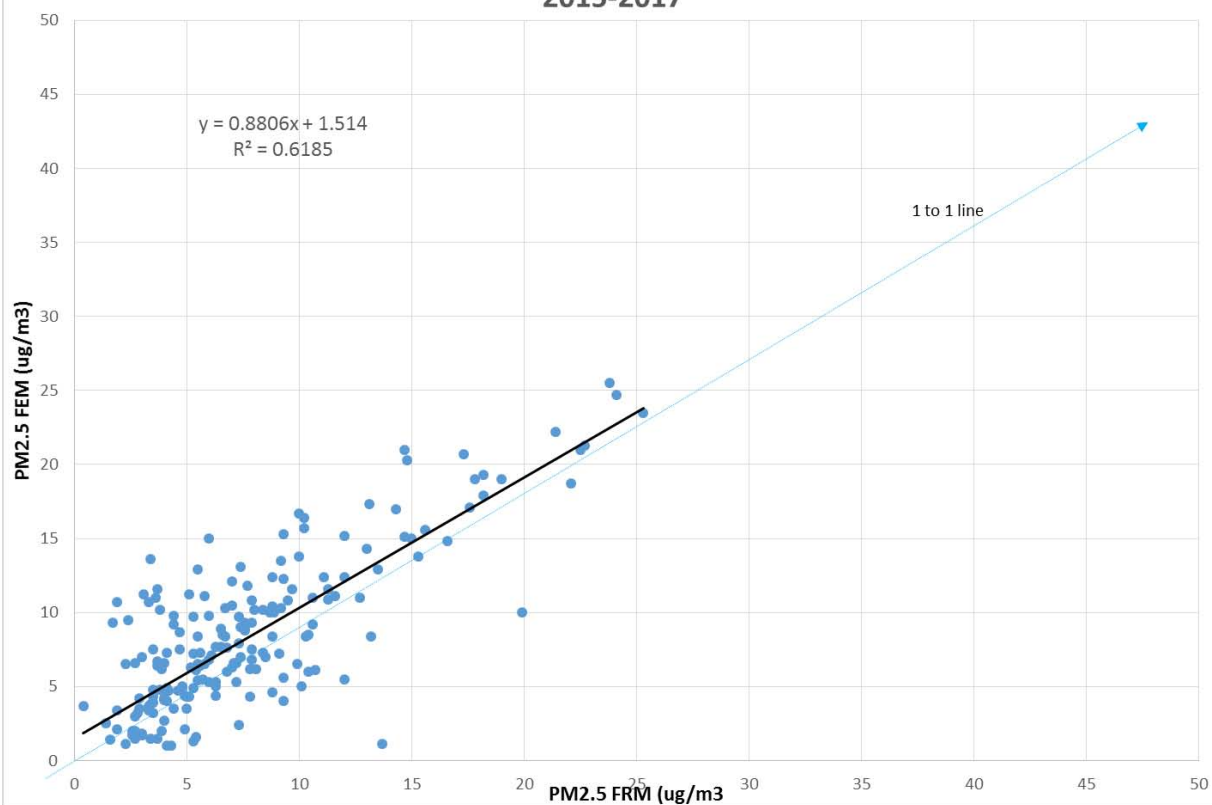
Groton PM2.5 Continuous FEM vs. FRM
2015-2017



New Haven PM2.5 Continuous FEM vs. FRM
2015-2017



Waterbury PM2.5 Continuous FEM vs. FRM
2015-2017



Appendix B Connecticut Enhanced Monitoring Plan

Connecticut Ozone Enhanced Monitoring Plan

Introduction

The Connecticut Department of Energy and Environmental Protection (DEEP) has prepared this Enhanced Monitoring Plan (EMP) in fulfillment of 40 CFR sections 58.10 (a) (11) and 58 App D 5(h). These federal regulations, revised under the 2015 National Ambient Air Quality Standards (NAAQS) for ozone¹, require that any states with any area designated moderate nonattainment or above, and any state within the Ozone Transport Region (OTR), submit an Enhanced Monitoring Plan for ozone (EMP) to the regional office of the Environmental Protection Agency (EPA) no later than October 1, 2019. In order to do so, DEEP has chosen to submit a draft EMP as part of the 2018 Annual Air Monitoring Network Plan.

Background

Recent ozone (O₃) levels in Connecticut are generally the highest in the eastern U.S, placing all regions of the state in moderate nonattainment for the 2008 ozone National Ambient Air Quality Standards (NAAQS), with a likely reclassification to serious nonattainment for the 2008 NAAQS in 2019. The southwestern three counties of the state (Connecticut portion of the New York-N. New Jersey-Long Island, NY-NJ-CT non-attainment area) have been designated moderate for the 2015 O₃ NAAQS, while the remainder of the state is designated marginal, under the 2015 O₃ NAAQS. These levels largely result from transport of ozone precursors into the state from the south-west direction along the northeast urban corridor. Modeling and other analyses have shown significant contributions from sources both inside and outside of the greater New York and greater Connecticut nonattainment areas².

Although DEEP has documented, through numerous submissions and communications with EPA³, that purposeful implementation of the interstate transport provisions of the Clean Air Act is needed before Connecticut can reasonably expect to comply with either the 2008 or 2015 ozone NAAQS, EPA continues to fail to either adopt sufficiently stringent national measures, such as was done for the acid rain problem, or enforce the tools EPA claims the states possess (CAA section 176A or 126 petitions). As such, DEEP is proposing monitoring activities under this EMP to increase the scientific knowledge and understanding of the fate and transport mechanisms of ozone and related pollutants in this region, with specific attention to impacts of the water-land boundary. DEEP expects the data from these enhanced monitoring activities will further clarify the critical role that long-range interstate transport plays in the Northern New Jersey-New York-Connecticut and Greater Connecticut nonattainment areas and inform the development and implementation of meaningful national programs that will protect public health and the environment.

¹ FR 80 65292, October 26, 2015

² FR 82 1733, January 6, 2017

³ [Greater CT Ozone Attainment Demonstration for the 2008 NAAQS](#)

The 2015 O₃ NAAQS amended monitoring requirements for the Photochemical Air Monitoring Stations (PAMS) network. Previously, Connecticut operated PAMS volatile organic compounds (VOC) monitors at three sites: East Hartford McAuliffe Park, New Haven Criscuolo Park and Westport Sherwood Island State Park. The revised rule now requires VOC monitoring at all National Core (NCore) monitoring sites in Core-Based Statistical Areas (CBSAs) having populations greater than 1 million. In addition, areas with moderate or higher levels of O₃ nonattainment, as well as all areas within the Ozone Transport Region (OTR), are required to develop Enhanced Monitoring Plans (EMPs). EMPs are required to provide for any additional monitoring beyond the minimum requirements for State and Local Air Monitoring Stations (SLAMS) that would be beneficial in identifying pollutant levels, sources, transport and progress towards attainment. The EMP mandate is intended to provide agencies an opportunity to implement additional monitoring beyond SLAMS that addresses the particular needs of nonattainment areas not explicitly covered under the revised PAMS network.

Strategic Approach and Objectives

State and local air quality agencies have conducted extensive surface monitoring of O₃, O₃ precursors [e.g.: nitrogen oxides (NO, NO₂, NO_x, NO_y) and volatile organic compounds (VOCs)] and meteorological parameters for many years as part SLAMS and PAMS networks. Current strategies for analyzing O₃ production and transport are typically based on computer modeling with source emissions and meteorological inputs, where high resolution speciated VOC data have limited usefulness in model development or validation.

PAMS monitoring programs also include, in addition to VOCs, three carbonyls that are more typically abundant: formaldehyde, acetaldehyde and acetone. The most significant of these, formaldehyde (HCHO), has been used extensively as a proxy for VOC free radical formation in research and analyses on tropospheric ozone⁴. Given the understanding that O₃ formation may be sensitive to changes in either VOCs (VOC limited regime) or NO_x (NO_x limited regime), as demonstrated with photochemical numeric computer models, the ratio of HCHO to NO₂ from ambient air monitoring during high O₃ events can be key in the validation of computer modeling scenarios.

In addition to monitoring strategies aimed at understanding aspects of the regional O₃ chemistry, collecting data that clearly show the spatial variability of surface O₃ concentrations is critical to developing approaches to mitigate non-attainment in Connecticut. DEEP maintains an extensive network of O₃ monitoring sites, particularly along its prevailing upwind (south-southwestern) border to effectively track plumes transported into the state, and these sites consistently show the highest concentrations.

⁴ Jin, X et. al, 2017, Evaluating a Space-Based Indicator of Surface Oxone-NO_x-VOC Sensitivity Over Midlatitude Source Regions and Application to Decadal Trends, J. of Geophysical Research, 122 (19) 10,439-10,461

Proposed Enhanced Monitoring Activities

Given the considerations in the above section, DEEP is proposing the following activities and resource commitments to meet the objectives for enhanced monitoring under this EMP. DEEP believes these proposed actions meet the requirements of the EMP and will assist DEEP's ongoing efforts toward assessing and understanding ozone nonattainment issues in Connecticut:

- Continued operation of two additional O₃ monitors beyond those minimally required for the State and Local Air Monitoring Station (SLAMS) in the Bridgeport-Stamford-Norwalk Core-Based Statistical Area (CBSA).
- Continued operation of one additional ozone monitor beyond those minimally required in the Hartford-West Hartford-East Hartford CBSA.
- Continued operation of one additional NO₂ monitor, located at the Westport Sherwood Island State Park site.
- Installation of one, or possibly two (as permissions allow), compact O₃ monitors, one each on two Bridgeport, CT – Port Jefferson, NY ferries crossing the Long Island Sound.
- Installation of one HCHO continuous monitor, located at the Westport site.
- Installation and operation of two ceilometers, at Westport and New Haven, for atmospheric mixing height (boundary layer depth).
- Provision of technical, logistical and staff support of enhanced monitoring for the Long Island Sound Tropospheric Ozone Study (LISTOS) research project, which began during the 2017 O₃ season. The project includes the following ground-based monitors at one or more sites: Pandora spectrophotometers for total column NO₂ and HCHO, continuous HCHO and NO₂, O₃ LIDAR vertical profiling, additional mixing height sensors, balloon sondes for vertical O₃ profiling, and mobile laboratory VOC measurements. In addition, high altitude flights conducted by the National Aeronautics and Space Administration (NASA) during the O₃ episodes will collect NO₂ reflectance spectrometer column data.
- Provision of support to multiple research efforts related to the LISTOS project. These include: (1) conducting three-dimensional boundary layer sampling for O₃, NO₂, VOCs, carbonyls and meteorological parameters conducted during selected high O₃ episodes. This aircraft-based sampling is conducted by the University of Maryland (UMD), beginning during the summer of 2017; (2) collecting aircraft based wind measurements from a Stony Brook University research aircraft across Long Island Sound, Long Island, and the coasts of Connecticut, Rhode Island, and Massachusetts, to inform a high resolution Weather Research and Forecasting (WRF) model to characterize the meteorological dynamics across the region; (3) deploying Stony Brook University's high resolution proton transfer time of flight mass spectrometer (HR-PTR-TOFMS) to the North Shore of Long Island for the duration of the study. The sampling will provide as a final product the identification of various species of interest, their concentrations, and the local meteorological conditions during each integrated measurement. Support may be in the form of providing additional state funding, if available.
- Assessment of the results of the above activities on a regular basis to determine if new activities would be warranted, and if current studies might be discontinued or enhanced.

DEEP has participated as a joint effort with multiple state and federal agencies, academic researchers, non-governmental organizations and private businesses in the development, planning and implementation of these activities. Figure 1 shows the proposed DEEP monitoring network with EMP activities included.

SLAMS Ozone Monitoring

The ozone monitoring requirements in 40 CFR 58 for state and local air monitoring stations (SLAMS) set minimum numbers of monitors based on ozone NAAQS design values and population for each core-based statistical area (CBSA). In addition, the months of the ozone season are determined for each location, which for Connecticut is March through September. Ozone monitors at National Core (NCore) multipollutant sites operate year-round, using Teledyne API 400E analyzers (reference method ID EQOA-0992-087).

Minimum SLAMS ozone monitoring requirements are provided in Table D-2 of Appendix D, 40 CFR 58. An assessment for the Connecticut network, shown in Table 1 below, gives populations and design values for each CBSA. For both the Bridgeport-Stamford-Norwalk and Hartford-West Hartford-East Hartford CBSAs, a minimum of 2 monitors are required, while there are 4 and 3 monitors in each CBSA, respectively. We propose to consider these 3 additional monitors as part of this EMP.

Table 1: Summary of Connecticut Ozone Monitoring Network Design Compliance

CBSA	2016 Population (estimated)	Maximum 2017 design value	No. of required SLAMS monitors	Current no. of SLAMS monitors
Bridgeport-Stamford-Norwalk, CT	944,177	83	2	4
Hartford-West Hartford-East Hartford, CT	1,206,836	79	2	3
New Haven-Milford, CT	856,875	82	2	2
Norwich-New London, CT	269,801	76	1	1
Worcester, MA-CT	935,781	68	2	3
Torrington, CT	182,571	72	1	1

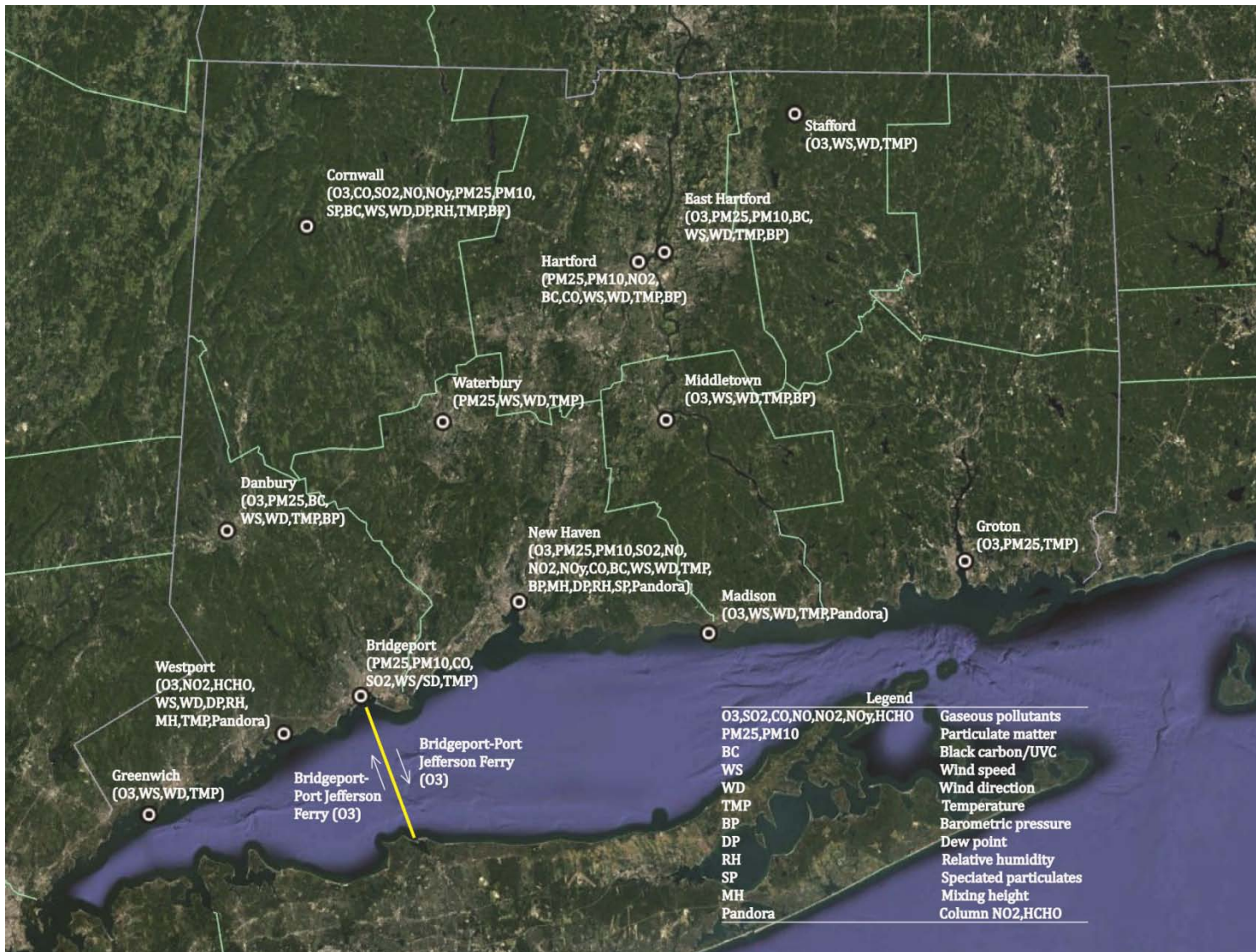


Figure 1: Map of CT DEEP SLAMS and Proposed EMP Monitoring

SLAMS NO₂ Monitoring

Connecticut meets its regulatory NO₂ monitoring requirements for near road and area-wide monitors with two monitors in the Hartford CBSA. An additional NO₂ monitor required by the Regional Administrators for the protection of sensitive and vulnerable populations is located at the New Haven NCore site. A fourth monitor, in Westport, is in excess of minimum SLAMS requirements. This fourth monitor is intended to provide further data to assist in understanding ozone precursor transport into Connecticut. All NO₂ monitors are Teledyne API T500U cavity attenuated phase shift spectroscopy (CAPS) (reference method ID EQNA-0514-212).

Long Island Sound Ferry-Based Monitoring

In an effort to collect surface data on Long Island Sound, DEEP is conducting ozone monitoring on a ferry operating continuously during daytime hours between Bridgeport, CT and Port Jefferson, NY during the ozone season. A second O₃ monitor will be added on another ferry as permissions from the operator allow. The monitors are Teledyne API model 430 analyzers, equipped with battery back-up, global positioning system (GPS) sensor and cellular data transmission equipment.

Formaldehyde Monitoring

DEEP proposes to deploy a continuous automated formaldehyde (HCHO) sensor at Westport during the ozone monitoring season. HCHO measurements will be a complement to NO₂ measurements, as the ratio is an important indicator to assess whether the ozone production regime is VOC or NO_x limited. The particular analyzer make or model is yet to be determined at this time.

Upper Air Measurements

The planetary boundary layer (PBL) is the near-surface portion of the troposphere that is generally considered to be well mixed, such that pollutants emitted or created are more or less mixed but confined within the PBL. As such, lower boundary layer heights are associated with higher pollutant concentrations. The different radiative and absorptive capacities of land and water can affect the PBL height, also known as the mixing height (MH). Thus, coastal areas downwind of large water bodies may have higher concentrations than inland levels where the mixing heights are increased. DEEP is proposing to operate two ceilometers, at New Haven and Westport, for automated mixing height measurements. The ceilometers are model CL51, manufactured by Vaisala, Oyj, that operate based on optical backscattering by fine particulate aerosols that tend to concentrate just below the mixing height. The New Haven ceilometer has been in operation since November 2015.

Long Island Sound Tropospheric Ozone Study

In 2017, DEEP began partnering with EPA, the National Aeronautic and Space Administration (NASA), the Northeast States for Coordinated Air Use Management (NESCAUM), other states and academic institutions to conduct field studies of O₃ atmospheric chemistry and transport in the greater New York – Long Island Sound – Connecticut area, with a particular focus on the mechanisms that result in the high

O₃ levels observed along the Connecticut coastline. This study, named the Long Island Tropospheric Ozone Study (LISTOS)⁵, will utilize, in addition to the enhanced monitoring conducted by DEEP as described above (fixed site and ferry O₃, NO₂ HCHO, MH), ground-based upper air monitoring, investigations into coastal meteorology, intensive upper air chemical and meteorological monitoring during high O₃ events, aircraft-based high resolution remote sensing of trace gases for source identification during high O₃ events, and ground-based episode monitoring of trace NO₂ and VOCs using a mobile laboratory.

LISTOS activities for which DEEP provides monetary or in-kind support include:

- Three Pandora spectrophotometers, located at the Madison, New Haven and Westport sites, for column NO₂ and HCHO.
- An O₃ Light Detection and Ranging (LIDAR) sensor, to be located at Westport from mid-July 2018 to the end of the O₃ season, for upper air ozone concentration vertical profiling.
- Multiple balloon sonde launches at Westport for upper air ozone and meteorological profiling. Ozone sonde data will allow for calibration of the O₃ LIDAR.
- Low altitude atmospheric meteorological and chemical monitoring with the University of Maryland (UMD) experimental light aircraft during several forecasted high O₃ events. This was first conducted in 2017, and is planned for the 2018 and 2019 ozone seasons.
- An intensive meteorological study of the Long Island Sound region conducted by Stony Brook University. The study will use measurements collected from ground-based and aircraft wind field monitoring, combined with computer modeling, to determine atmospheric transport characteristics typical of high ozone events.
- A monitoring study of reactive VOCs by Stony Brook University based at a site located on the north shore of Long Island, approximately forty miles east of New York City. Surface ambient air monitoring will be conducted during selected high ozone events for VOC, trace gas and meteorological parameters. VOC analysis will employ Stony Brook's high resolution proton transfer time of flight mass spectrometer.

Project Assessment and Future Planning

Assessment of the LISTOS project will be ongoing, and most of the activities described above are planned only for the period 2018 – 2019. Additional monitoring may be deployed in the future if the results and analysis of LISTOS indicate that new directions of investigation are warranted to further characterize the regional O₃ chemistry and transport.

⁵ <http://www.nescaum.org/documents/listos/>

Appendix C Network Plan Public Comments and Responses

Comments from EPA Region 1 (EPA)
(CT DEEP responses follow each comment)

1. EPA acknowledged the following overall changes to DEEP's network, on page 5:

- *Commence seasonal ozone (O_3) monitoring on at least one (1) and as many as two (2) Long Island ferries that operate between Bridgeport, CT and Port Jefferson, NY, during the spring of 2018.*
- *Commence mixing height (MH) monitoring at the Westport Sherwood Island site during 2019.*
- *Commence automated continuous FEM PM_{10} and $PM_{10-2.5}$ sampling at five (5) sites during 2018: Bridgeport, Danbury, East Hartford, Groton and Waterbury.*
- *Discontinue manual FRM PM_{10} monitoring at the Bridgeport Roosevelt School site on December 31, 2018.*
- *Commence support of total column nitrogen dioxide (NO_2), O_3 and (and potentially formaldehyde) monitoring at three sites, Madison, New Haven and Westport, during 2018. The instruments, Pandora spectrophotometers, are owned and primarily operated by EPA and NASA.*
- *Commence support of multiple monitoring activities and research projects aimed at further understanding ozone fate and transport mechanisms in the Long Island Sound region, as described in detail in the attached Enhanced Monitoring Plan for ozone (Appendix B).*

CT DEEP response: Comment acknowledged, no response required.

2. Pages 9-11. EPA expects to release design values for all criteria pollutants in July, 2018 which includes 2017 data for the entire country. EPA indicated they will work with DEEP to ensure the design values represented within this plan are consistent with the values EPA will release later this summer.

CT DEEP response: DEEP will work with EPA to ensure that 2017 design values listed in the final Network Plan are consistent with those released by EPA.

3. Pages 12-14 note that CT DEEP is utilizing all its continuous $PM_{2.5}$ monitors for NAAQS compliance purposes and coded as 88101 effective the beginning of 2016. EPA noted that all of CT DEEP's continuous $PM_{2.5}$ monitors, except one, meet FEM performance criteria. EPA is very pleased that CT has made this decision and supports CT in the other noted changes relative to collocated FRMs and sampling frequency at locations that have these continuous $PM_{2.5}$ monitors. We note that in 2 cases, CT is identifying the FEM as the primary monitor and in 6 others, the FRM remains the primary monitor. EPA noted that collocation requirements for quality assurance (QA) purposes are based on the primary monitor. EPA also noted that for purposes of establishing design values, data will be substituted from non-primary monitors reporting as 88101 for any day the primary monitor does not operate. There are a number of further potential resource-saving opportunities relative to the $PM_{2.5}$ network if the continuous FEM were considered the primary monitor, and EPA indicated their willingness to discuss those possibilities with DEEP. Further, EPA noted DEEP's intended transition to API T640 monitors. EPA noted DEEP should be aware of collocation and auditing obligations during this transition to avoid any issues with the data certification (AMP600) report next spring.

CT DEEP response: DEEP will comply with all collocation requirements for the continuous FEM $PM_{2.5}$ network at all times during the transition, since both primary FEM monitors are collocated with FRM monitors. As such, any non-primary T640x monitors operating before the primary monitors are designated in that network don't require collocation; likewise, any non-primary BAM monitors won't require collocation after the primary BAMs have been changed to T640x samplers.

DEEP will consider reducing operation of $PM_{2.5}$ FRM samplers in the network by replacement with T640x FEM monitors if FRM-FEM comparisons indicate good performance of the T640x samplers over the range of typical ambient concentrations.

4. Page 15. EPA notes and agrees with the following suggested changes: "*Based on the favorable results of the trial comparison with FRM methods, DEEP plans to replace all the MetOne BAM 1020 $PM_{2.5}$ analyzers with the Teledyne API T640X $PM_{10}/PM_{2.5}/PM_{10-2.5}$ FEM analyzers and remove the MetOne BAM 1020 PM_{10} samplers. Given the enhanced capabilities of the new Teledyne monitors, DEEP will collect hourly $PM_{10}/PM_{10-2.5}$ data and report it to AQS for five additional sites: Bridgeport, Danbury, East Hartford, Groton and Waterbury.*" (This includes the planned shutdown of the PM_{10} FRM at Bridgeport when the API T640X is deployed, as noted on page 5 and 21.)

CT DEEP response: Comment acknowledged, no response required.

5. On page 16, EPA noted an inconsistency in the identification of the ferry based ozone monitor. EPA requested clarification as to if such monitor is the API model 35 or the API model 430.

CT DEEP response: The correct model designation is 430, and the correction is made on page 16.

6. As noted on Pages 16, 17 and detailed in Appendix B, EPA noted the CT DEEP Proposed Enhanced Monitoring Activities as articulated below:

DEEP is proposing the following activities and resource commitments to meet the objectives for enhanced monitoring under this EMP. DEEP believes these proposed actions meet the requirements of the EMP and will assist DEEP's ongoing efforts toward assessing and understanding ozone nonattainment issues in Connecticut:

- *Continued operation of two additional O₃ monitors beyond those minimally required for the State and Local Air Monitoring Station (SLAMS) in the Bridgeport-Stamford-Norwalk Core-Based Statistical Area (CBSA).*
- *Continued operation of one additional O₃ monitor beyond those minimally required in the Hartford-West Hartford-East Hartford CBSA.*
- *Continued operation of one additional NO₂ monitor, located at the Westport Sherwood Island State Park site.*
- *The installation of one, or possibly two (as permissions allow), compact O₃ monitors, one each on two Bridgeport, CT - Port Jefferson, NY ferries crossing the Long Island Sound.*
- *The installation of one HCHO continuous monitor, located at the Westport site.*
- *The installation and operation of two ceilometers, at Westport and New Haven, for atmospheric mixing height (boundary layer depth).*
- *Provide technical, logistical and staff support of enhanced monitoring for the Long Island Sound Tropospheric Ozone Study (LISTOS) research project, which began during the 2017 O₃ season. The project includes the following ground-based monitors at one or more sites: Pandora spectrophotometers for total column NO₂ and HCHO, continuous HCHO and NO₂, O₃ LiDAR vertical profiling, additional mixing height sensors, balloon sondes for vertical O₃ profiling, and mobile laboratory VOC measurements. In addition, high altitude flights conducted by the National Aeronautics and Space Administration (NASA) during the O₃ episodes will collect NO₂ reflectance spectrometer column data.*
- *Provide support to multiple research efforts related to the LISTOS project. These include: (1) conducting three-dimensional boundary layer sampling for O₃, NO₂, VOCs, carbonyls and meteorological parameters conducted during selected high O₃ episodes. This aircraft-based sampling is conducted by the University of Maryland (UMD), beginning during the summer of 2017; (2) collecting aircraft based wind measurements from a Stony Brook University research aircraft across Long Island Sound, Long Island, and the coasts of Connecticut, Rhode Island, and Massachusetts, to inform a high resolution Weather Research and Forecasting (WRF) model to characterize the meteorological dynamics across the region; (3) deploying Stony Brook University's high resolution proton transfer time of flight mass spectrometer (HR-PTR-TOFMS) to the North Shore of Long Island for the duration of the study. The sampling will provide as a final product the identification of various species of interest, their concentrations, and the local meteorological conditions during each integrated measurement. Support may be in the form of providing additional state funding, if available.*
- *Assessment of the results of the above activities on a regular basis to determine if new activities would be warranted, and if current studies might be discontinued or enhanced.*

EPA noted their support of the overall description of the State EMP as articulated in this Plan. EPA noted their intent to address formal approval and funding, to the extent possible, in the subsequent Annual Network Plan approval upon formal submission of this Plan.

CT DEEP response: Comment acknowledged, no response required.