



Commonwealth of Massachusetts  
Executive Office of Energy & Environmental Affairs

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## Department of Environmental Protection

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# Massachusetts 2017 Air Monitoring Network Plan

## Air Assessment Branch Bureau of Air and Waste

**April 2018**

This is the Massachusetts 2017 Air Monitoring Network Plan, prepared by the Massachusetts Department of Environmental Protection (MassDEP) in accordance with Title 40 CFR Part 58.10. Each year, MassDEP is required to submit a Network Plan to the U.S. Environmental Protection Agency (EPA) for review and approval.

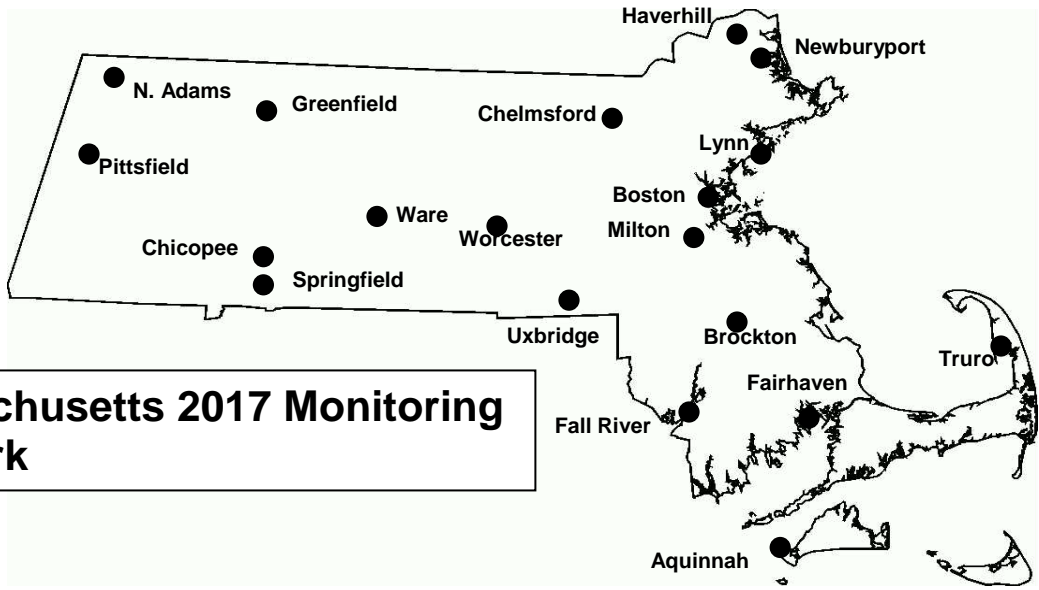
MassDEP operated a network of 23 ambient air quality monitoring stations in 18 communities located across the state. The Wampanoag Tribe of Gay Head (Aquinnah) on Martha's Vineyard operated an ozone monitoring station. MassDEP and the Wampanoag Tribe are members of the same Primary Quality Assurance Organization (PQAO), which ensures consistent quality assurance of ambient air quality data collected in Massachusetts.

The Massachusetts monitoring network is part of a comprehensive program to collect and provide information about air quality to the public and to determine compliance with National Ambient Air Quality Standards. This Draft Network Plan reviews MassDEP's ambient air monitoring network to determine that the requirements of 40 CFR Part 58 Appendices A, C, D and E are met, describes which pollutants and other parameters MassDEP measures at its various ambient air monitoring stations, and discusses recent and planned changes to the network. For detailed information on monitor locations, pollutants analyzed, and methods used, see Attachments 1 – 3.

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**Massachusetts 2017 Monitoring Network**



# 1. Criteria Pollutants

This section describes MassDEP’s network for monitoring criteria pollutants listed in the federal Clean Air Act for which EPA has set National Ambient Air Quality Standards (NAAQS), including ozone, sulfur dioxide, nitrogen dioxide, carbon monoxide, particulate matter (PM<sub>10</sub> and PM<sub>2.5</sub>) and lead. EPA periodically reviews and revises these standards based on new public health and scientific information. These revisions often require changes to air monitoring networks and methodologies.

National Ambient Air Quality Standards					
Pollutant	Primary/ Secondary	Averaging Time	Level	Form	
Carbon Monoxide	primary	8-hour	9 ppm	Not to be exceeded more than once per year	
		1-hour	35 ppm		
Lead	primary and secondary	Rolling 3 month average	0.15 µg/m <sup>3</sup>	Not to be exceeded	
Nitrogen Dioxide	primary	1-hour	100 ppb	98th percentile, averaged over 3 years	
	primary and secondary	Annual	53 ppb	Annual Mean	
Ozone	primary and secondary	8-hour	0.070 ppm	Annual fourth-highest daily maximum 8-hr concentration, averaged over 3 years	
Particle Pollution	PM <sub>2.5</sub>	primary	Annual	12 µg/m <sup>3</sup>	annual mean, averaged over 3 years
		secondary	Annual	15 µg/m <sup>3</sup>	annual mean, averaged over 3 years
		primary and secondary	24-hour	35 µg/m <sup>3</sup>	98th percentile, averaged over 3 years
	PM <sub>10</sub>	primary and secondary	24-hour	150 µg/m <sup>3</sup>	Not to be exceeded more than once per year on average over 3 years
Sulfur Dioxide	primary	1-hour	75 ppb	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years	
	secondary	3-hour	0.5 ppm	Not to be exceeded more than once per year	

µg/m<sup>3</sup> = micrograms per cubic meter; ppm = parts per million; ppb = parts per billion

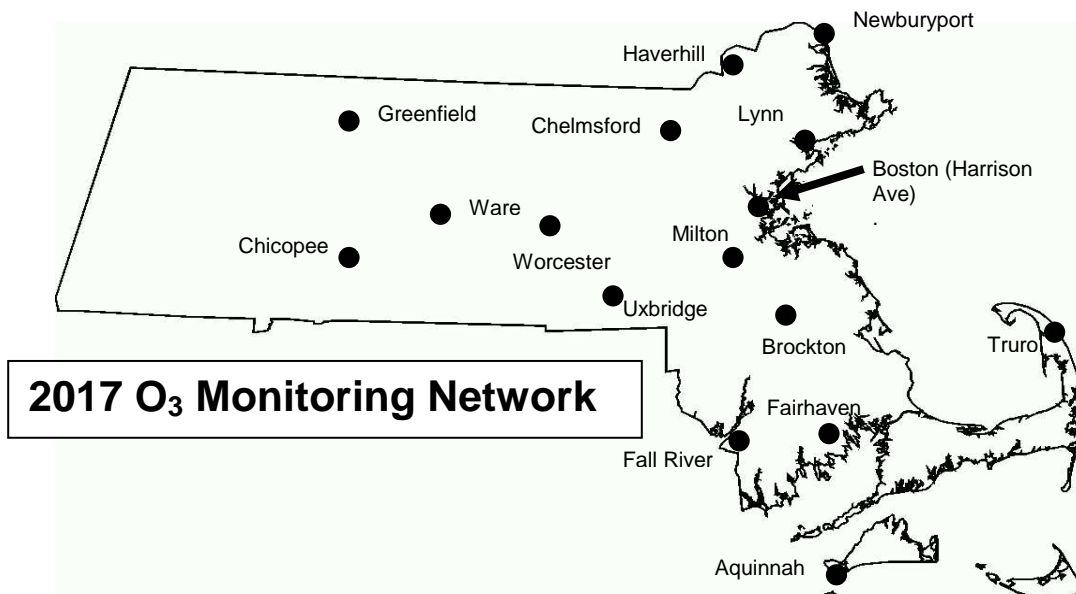
## A. OZONE

MassDEP operated 15 ozone monitors at the locations listed below (including the Site Identification Number). The Wampanoag Tribe of Gay Head (Aquinnah) on Martha's Vineyard also operates an ozone monitor.

Boston – Harrison Ave (25-025-0042)  
Brockton (25-023-0005)  
Chelmsford (25-017-0009)  
Chicopee (25-013-0008)  
Fairhaven (25-005-1006)  
Fall River (25-005-1004)  
Greenfield (25-011-2005)  
Haverhill (25-009-5005)

Lynn (25-009-2006)  
Milton (25-021-3003)  
Newburyport (25-009-4005)  
Aquinnah – Tribal Site (25-007-0001)  
Truro (25-001-0002)  
Uxbridge (25-027-0024)  
Ware (25-015-4002)  
Worcester – Airport (25-027-0015)

The existing ozone monitoring network meets EPA monitoring requirements for the ozone NAAQS, except for an ozone monitor in the Pittsfield Consolidated Metropolitan Statistical Area (CMSA). MassDEP is in the process of installing an ozone monitoring station in Pittsfield that will begin operating this summer. MassDEP closed the Newburyport monitoring station (25-009-4005) at the end of 2017. The Newburyport station originally was established as a Photochemical Assessment Monitoring Station (PAMS). However, EPA's new ozone monitoring regulations reduce the number of required PAMS sites in Massachusetts from four to one, so it is no longer needed (see Page 12 for additional information on PAMS), and the Haverhill ozone monitoring station is sufficient for ozone monitoring in this area of the state. MassDEP is planning to operate an ozone monitor at a new near-road site in Chelmsford that has been installed and will begin operating this summer, which will provide a useful comparison to levels monitored at the existing ozone monitoring site in Chelmsford.



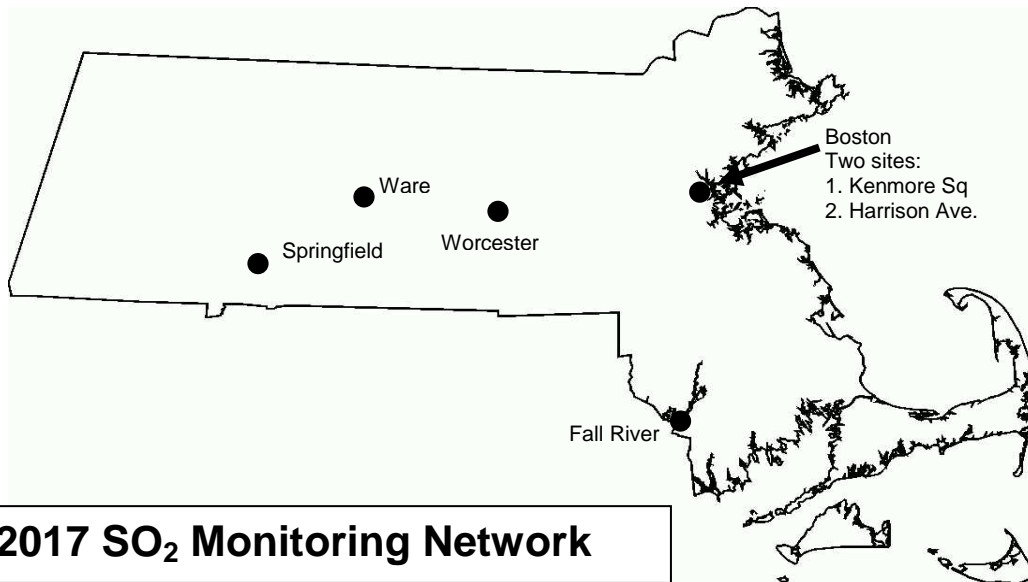
## B. SULFUR DIOXIDE

MassDEP operated six sulfur dioxide (SO<sub>2</sub>) monitors, which includes three full-scale monitors and three trace-level (i.e., very low concentration) monitors. SO<sub>2</sub> monitors are at the following locations:

Boston – Harrison Ave (25-025-0042) *trace*  
Boston – Kenmore Square (25-025-0002) *trace*  
Fall River (25-005-1004)

Springfield – Liberty Street (25-013-0016)  
Ware (25-015-4002) *trace*  
Worcester – Summer Street (25-027-0023)

The existing SO<sub>2</sub> monitoring network meets EPA monitoring requirements for the SO<sub>2</sub> NAAQS. MassDEP plans to re-locate the Springfield – Liberty Street monitoring station (25-013-0016) to a nearby location in Springfield due to potential sale of the Liberty Street property.

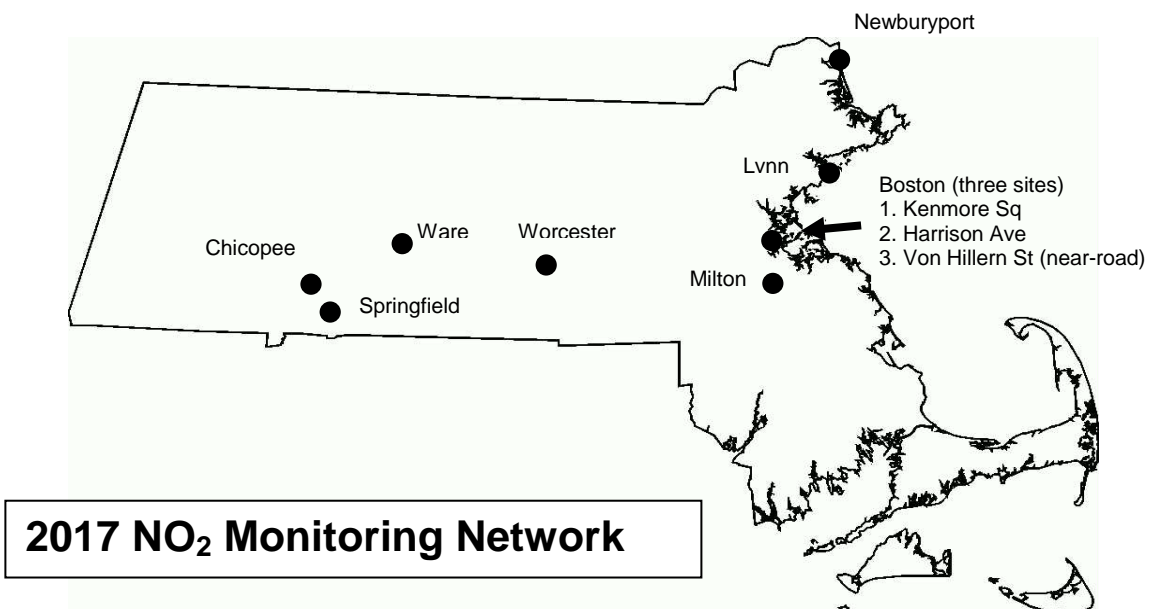


### C. NITROGEN DIOXIDE

MassDEP operated 10 nitrogen dioxide (NO<sub>2</sub>) monitors. These monitors measure NO<sub>2</sub> and nitrogen oxides [NO<sub>x</sub>, which is NO<sub>2</sub> plus NO (nitric oxide)]. NO<sub>2</sub> is monitored as an NAAQS pollutant and as an ozone precursor. MassDEP operates six NO<sub>2</sub> monitors to determine compliance with the NAAQS, including a near-road monitor on Von Hillern Street in Boston. EPA has designated three monitors (Boston - Harrison Ave. and Kenmore Square, and Springfield - Liberty Street) as representing susceptible and vulnerable populations. MassDEP also operated four additional monitors to measure ozone precursors as part of the Photochemical Assessment Monitoring Sites (PAMS) network. NO<sub>2</sub> monitors are at the following locations:

- |  |   |
|--|---|
| Boston – Harrison Ave (25-025-0042)                        | Milton (25-021-3003)                            |
| Boston – Kenmore Square (25-025-0002)                      | Newburyport (25-009-4005) <i>PAMS, yr-round</i> |
| Boston – Von Hillern Street (25-025-0044) <i>Near-road</i> | Springfield – Liberty Street (25-013-0016)      |
| Chicopee (25-013-0008) <i>PAMS, year-round</i>             | Ware (25-015-4002) <i>PAMS, summer only</i>     |
| Lynn (25-009-2006) <i>PAMS, year-round</i>                 | Worcester – Summer Street (25-027-0023)         |

The existing NO<sub>2</sub> monitoring network meets EPA monitoring requirements for the NO<sub>2</sub> NAAQS, except for a second Boston-area near-road monitoring station. MassDEP has installed a second near-road NO<sub>2</sub> monitoring station in Chelmsford and plans to begin operating it this summer. As noted on Page 5 in the Ozone section, MassDEP closed the Newburyport monitoring station (25-009-4005) at end of 2017, which had monitored NO<sub>2</sub> as a PAMS site.

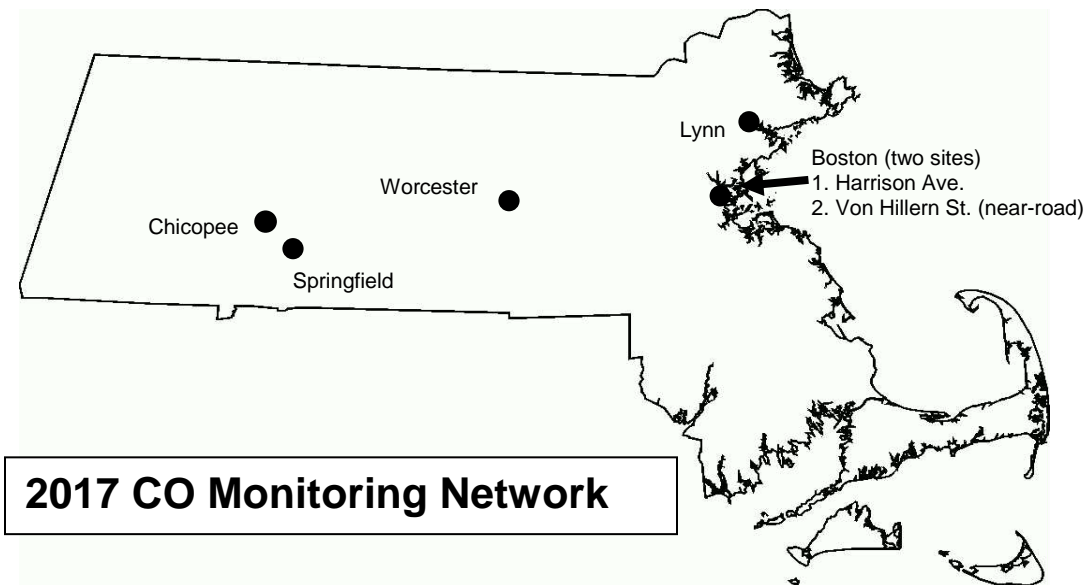


## D. CARBON MONOXIDE

MassDEP operated six carbon monoxide (CO) monitors, including one at the Boston near-road site. CO monitors are at the following locations:

- Boston – Harrison Ave (25-025-0042) *trace*
- Boston – Von Hillern Street (25-025-0044) *trace*
- Chicopee (25-013-0008) *trace*
- Lynn (25-009-2006) *trace*
- Springfield – Liberty Street (25-013-0016)
- Worcester – Summer Street (25-027-0023) *trace*

MassDEP has measured very low concentrations well below the CO NAAQS at all locations for many years and the CO network exceeds EPA requirements for the CO NAAQS. MassDEP discontinued PAMS-related CO monitoring at the Lynn and Chicopee monitoring stations at the end of 2017 due to changes in EPA's PAMS requirements (see Page 12 for additional information on PAMS) and due to the very low concentrations being measured. MassDEP is planning to install a trace-level CO monitor at the re-located Springfield monitoring station when Chicopee CO monitoring is discontinued.





## E. PARTICULATE MATTER

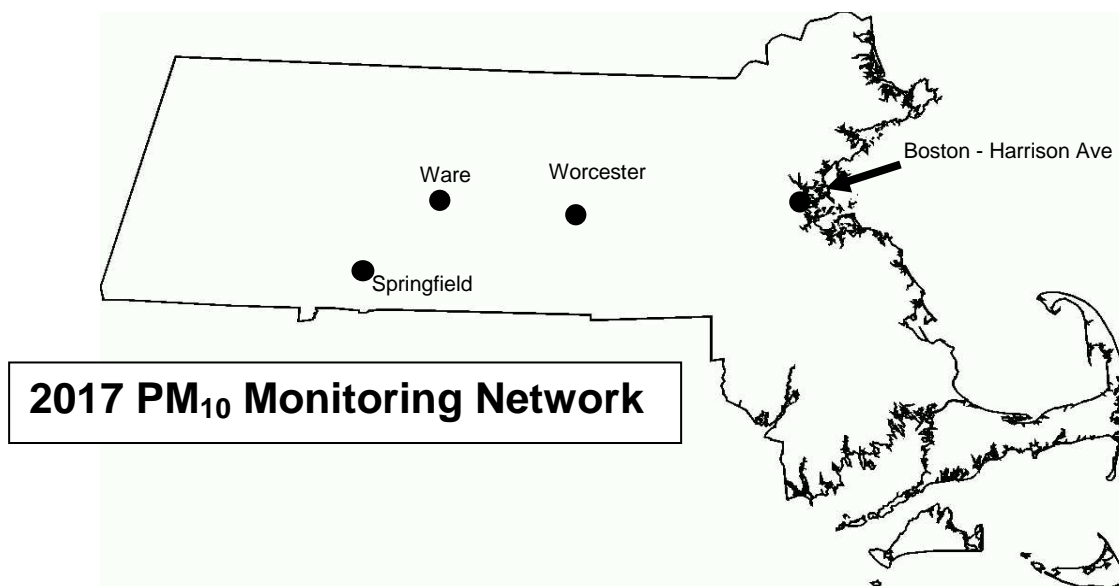
### PM<sub>10</sub>

MassDEP operated six PM<sub>10</sub> monitors (low volume instruments), including two monitors collocated at the Boston - Harrison Avenue NCore site for quality assurance purposes. PM<sub>10</sub> monitors are at the following locations:

Boston – Harrison Avenue (25-025-0042) 2 monitors  
Springfield – Liberty Street (25-013-0016)  
Ware – Quabbin Summit (25-015-4002)  
Worcester – Summer Street (25-027-0023)<sup>1</sup>

Samples from the Boston - Harrison Avenue PM<sub>10</sub> monitors are used in association with samples from collocated PM<sub>2.5</sub> monitors at the site to calculate PM<sub>coarse</sub> concentrations, which is required for NCore sites. These samples also are used for PM<sub>10</sub>-based lead monitoring and NATTS metals.

The PM<sub>10</sub> network exceeds EPA requirements for the PM<sub>10</sub> NAAQS. MassDEP is planning to discontinue PM<sub>10</sub> monitoring at Springfield – Liberty Street (25-013-0016) when the monitoring station is re-located.



<sup>1</sup> MassDEP also operates a continuous atmospheric radiation sampler (TSP-based) at the Worcester - Summer Street station (25-027-0023) in cooperation with the EPA's National Air and Radiation Environmental Laboratory.

## PM<sub>2.5</sub>

### Filter-Based Monitors

MassDEP's operated 16 fine particulate matter (PM<sub>2.5</sub>) Federal Reference Method (FRM) monitors at 13 locations. MassDEP collected samples at the Boston - North Street collocated monitors on a daily basis and sampled the remaining monitors on an every third day schedule. Collocated monitors also are located at Brockton and Chicopee for quality assurance purposes. PM<sub>2.5</sub> monitors were operated at the following locations:

Boston – Harrison Avenue (25-025-0042)	Greenfield (25-011-2005)
Boston – North St (25-025-0043) <i>2 monitors</i>	Haverhill – Consentino School (25-009-5005)
Boston – Kenmore Square (25-025-0002)	Lynn – Water Treatment Plant (25-009-2006)
Boston – Von Hillern Street (25-025-0044)	Chicopee (25-013-0008) <i>2 monitors</i>
Brockton – Buckley (25-023-0005) <i>2 monitors</i>	Pittsfield (25-003-5001)
Fall River – Globe Street (25-005-1004)	Springfield – Liberty St (25-013-0016)
	Worcester – Summer Street (25-027-0023)

MassDEP discontinued FRM monitoring at the Fall River (25-005-1004) and Lynn (25-009-2006) monitoring stations at the end of 2017. Both monitoring stations have continuous PM<sub>2.5</sub> monitors and regularly measure low PM<sub>2.5</sub> values. MassDEP discontinued one of the two FRM monitors at the Brockton (25-023-0005) monitoring station at the end of 2017 (Brockton will continue to have one FRM and one continuous monitor). MassDEP also has closed the roof-top Boston – North Street monitoring station (25-025-0043) due to a re-roofing project. In the 2016 Network Plan MassDEP proposed to discontinue FRM monitoring at the Boston – Kenmore Square (25-025-0002) monitoring station at the end of 2016; however, MassDEP plans to continue monitoring at this site during 2018 due to the loss of the Boston – North St (25-025-0043) station. MassDEP also is considering installing a PM<sub>2.5</sub> FRM monitor at the relocated Springfield. This monitor would operate concurrently with the monitor at the Springfield – Liberty Street (25-013-0016) station to determine a PM<sub>2.5</sub> concentration relationship between the two locations. The FRM monitors at the Liberty Street and relocated site would be discontinued once the PM<sub>2.5</sub> relationship has been determined.

### Continuous Monitors

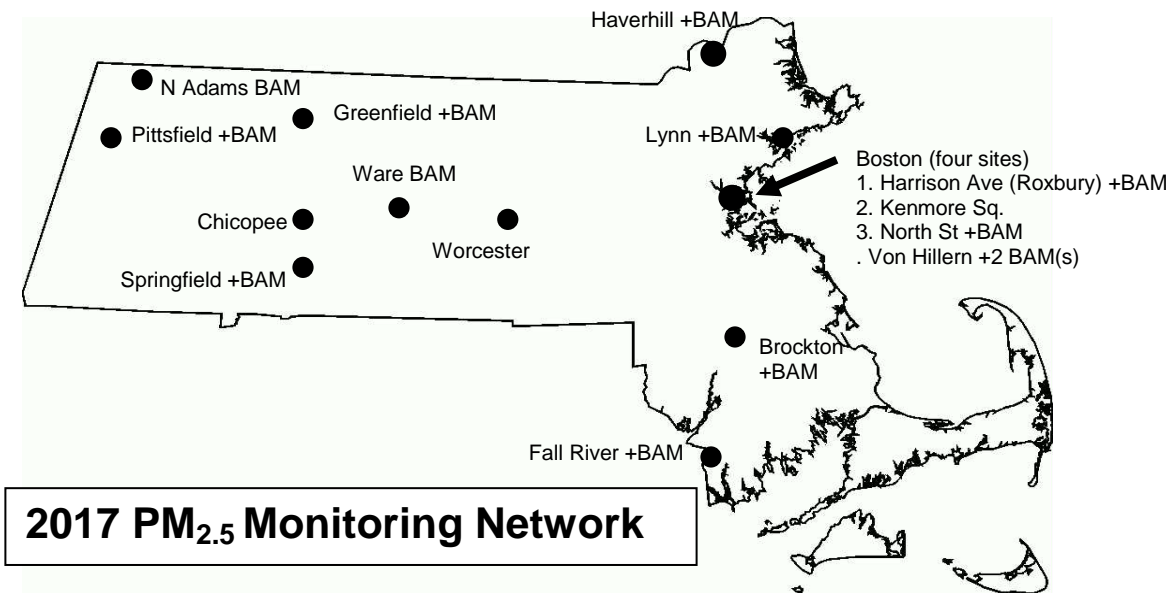
MassDEP has equipped 12 monitoring stations with continuous PM<sub>2.5</sub> monitors (Beta Attenuation Monitors or BAMs) at the following locations:

Boston – Harrison Avenue (25-025-0042)	Haverhill – Consentino School (25-009-5005)
Boston – North St (25-025-0043)	Lynn – Water Treatment Plant (25-009-2006)
Boston – Von Hillern Street (25-025-0044)*	Pittsfield (25-003-0006)
Brockton – Buckley Playground (25-023-0005)	Springfield – Liberty Street (25-013-0016)
Fall River – Globe Street (25-005-1004)	Ware – Quabbin Summit (25-015-4002)
Greenfield – Veterans Field (25-011-2005)	Worcester – Summer Street (25-027-0023)

\* *2 monitors*

All of MassDEP's continuous PM<sub>2.5</sub> monitors have a Federal Equivalent Method (FEM) designation. FEM monitors provide the hourly PM<sub>2.5</sub> data that appears on MassDEP's MassAir website. MassDEP will use data from all of its FEM monitors for comparison to the PM<sub>2.5</sub> NAAQS.

MassDEP recently installed a site in North Adams to measure continuous PM<sub>2.5</sub> and black carbon to represent a valley affected by wood smoke. MassDEP is in the process of installing a new ozone monitoring station in Pittsfield that also will have FEM PM<sub>2.5</sub> monitoring. The monitor at this site would be operated concurrently with the monitor at the existing Pittsfield (25-003-0006) site to determine a PM<sub>2.5</sub> concentration relationship between the two locations. The existing monitor will be discontinued once the PM<sub>2.5</sub> relationship has been determined. If resources allow, MassDEP also may operate a FEM monitor at the Springfield – Liberty St (25-013-0016) site concurrently with the relocated Springfield site. The second NO<sub>2</sub> near-road site in Chelmsford also will have an FEM PM<sub>2.5</sub> monitor.



### Speciated PM<sub>2.5</sub>

MassDEP collects speciated PM<sub>2.5</sub> samples at Boston – Harrison Avenue (25-025-0042) and Chicopee (25-013-0008). The speciated PM<sub>2.5</sub> program is designed to determine some of the chemical components (elements, sulfates/nitrates, carbon species) that are contained in PM<sub>2.5</sub>.

IMPROVE sampling sites also provide speciated PM<sub>2.5</sub> data. The IMPROVE program measures parameters that are similar to those measured by the speciation program, and is designed to measure species at rural locations to evaluate the contribution of fine particulates and their constituents to the degradation of visibility. The National Park Service operates an IMPROVE sampler at Truro – National Sea Shore (25-001-0002) and the Wampanoag Tribe on Martha’s Vineyard also operates an IMPROVE sampler.

### PM<sub>coarse</sub>

MassDEP uses the Federal Reference Method (FRM) for PM<sub>coarse</sub> in compliance with NCore requirements at the Boston - Harrison Avenue NCore site. This method consists of the subtraction of PM<sub>2.5</sub> values from PM<sub>10</sub> values at a site that has side-by-side samplers of each type sampling on the same dates.

## **F. LEAD**

MassDEP monitors lead at its Boston - Harrison Avenue NCore site using a low-volume PM<sub>10</sub> method. EPA allows states to discontinue lead monitoring at NCore sites that show concentrations below the NAAQS. MassDEP plans to continue lead monitoring at the NCore site since it obtains and reports lead data as part of the NATTS program, but will discontinue reporting lead concentration data as a NAAQS pollutant.

## **2. Photochemical Assessment Monitoring Stations**

MassDEP has operated enhanced ozone, Photochemical Assessment Monitoring Stations (PAMS) in the Boston and Springfield Metropolitan Areas since 1994. PAMS are designed to measure ozone precursors (ingredients) and meteorological parameters in order to provide data about ozone formation and the effect of precursor controls on ozone production. At these sites MassDEP measures nitrogen oxides and other ozone precursors, such as volatile organic compounds, including hydrocarbons and carbonyl compounds (e.g., formaldehyde, acetaldehyde). These are measured by taking discrete samples (carbonyls at Type 2 sites) and by operating hourly gas chromatographs that measure individual hydrocarbon compounds at PAMS locations. For several years now, MassDEP has just measured PAMS at Type 2 sites are at or near the downwind edge of the urban area, and Type 3 sites are downwind in a location of maximum ground-level ozone formation. MassDEP operated four PAMS sites in the Boston and Springfield areas at the following locations in 2017:

Chicopee (25-013-0008) *Type 2*  
Lynn (25-009-2006) *Type 2*  
Newburyport (25-009-4005) *Type 3*  
Ware (25-015-4002) *Type 3*

During the PAMS season, MassDEP operated automated hourly gas chromatography instruments at all four sites and collects carbonyl samples at Chicopee and Lynn. MassDEP also collects every sixth day 24-hour canister VOC and carbonyl samples throughout the year at Chicopee and Lynn, in compliance with the original PAMS regulations.

When EPA lowered the ozone NAAQS in October 2015, it adopted new ozone monitoring regulations that will reduce the number of required PAMS sites in Massachusetts from four to one in 2019. As part of the transition to PAMS under the new ozone monitoring regulations, and due to the age and reliability issues of the existing equipment, MassDEP plans to only measure PAMS parameters at the Type 2 sites in Chicopee and Lynn in 2017 and 2018. MassDEP will measure carbonyls according to the existing schedule and will collect canisters on an every sixth day schedule at the Type 2 sites during the PAMS season (June through August). Note that MassDEP closed the Newburyport (25-009-4005) monitoring station at the end of 2017.

### **PAMS Implementation Plan**

The 2015 ozone NAAQS monitoring regulations require a PAMS site to be located at the NCore site beginning in 2019 site, unless EPA approves an alternate site. MassDEP proposes to maintain the PAMS Site at Lynn (25-009-2006) rather than establish a new PAMS monitor at the NCore site on Harrison Avenue in Boston(25-025-0042). See Attachment 4 - PAMS Monitoring Implementation Plan.

In 2018, MassDEP plans to be an early adopter of new PAMS equipment required to be used in 2019. This will provide an opportunity for MassDEP to become familiar with the equipment for one year before the new data collection is required. MassDEP has begun the procurement process for a new gas chromatograph for VOC ozone precursor monitoring. MassDEP is considering continuing PAMS monitoring at the Chicopee Type 2 site beyond 2018 and will evaluate this option based on experience operating the new equipment at the Lynn site in 2018.

MassDEP has expanded its ozone monitoring in Southeastern Massachusetts in recent years to address higher ozone values that occur along the South Coast. This has included the adding ozone monitoring at the Fall River station (25-005-1004) in 2012, replacing the Fairhaven station (25-005-1006) in 2013, and establishing a new Brockton monitoring station (25-023-0005) in 2013.

### **3. Total Reactive Nitrogen (NO<sub>y</sub>)**

MassDEP has operated NO<sub>y</sub> analyzers during the PAMS season at Ware (25-015-4002) and Newburyport (25-009-4005). MassDEP closed the Newburyport (25-009-4005) monitoring station at the end of 2017. MassDEP operates a NO<sub>y</sub> monitor at the NCore site at Boston - Harrison Avenue (25-025-0042) to fulfill NCore requirements. NO<sub>y</sub> measurement is very similar to NO<sub>x</sub>, except that the NO<sub>y</sub> instrument configuration monitors for a wider range of nitrogen species than a traditional NO<sub>x</sub> monitor. Compounds in this wider nitrogen compound group participate in ozone and particulate matter formation and can be pollutants themselves.

### **4. Air Toxics**

Boston - Harrison Avenue (25-025-0042) is a National Air Toxics Trends Site (NATTS), in addition to being an NCore site. NATTS is an EPA program comprised of monitoring sites across the country equipped to measure a wide range of toxic air pollutants, including metals, VOCs, carbonyls, black carbon and semi-volatile organic compounds (SVOCs). At the Harrison Avenue site, MassDEP monitors black carbon (using an aethalometer), toxic VOCs, carbonyls (formaldehyde and acetaldehyde), toxic metals (from PM<sub>10</sub> filters), and polycyclic aromatic hydrocarbons (PAHs).

In addition to the NATTS site, MassDEP collects 24-hour VOC canister samples every sixth day for toxics analysis from Lynn (which serves as a Boston Area background location) and sends the samples to the State of Rhode Island Department of Public Health Laboratory for VOC analysis. MassDEP also monitors black carbon at Springfield - Liberty Street (25-013-0016), North Adams (25-003-6001), Boston - Von Hillern Street (25-025-0044) and Greenfield - Veterans Field (25-011-2005). MassDEP plans to monitor black carbon at the new monitoring station being installed in Pittsfield.

MassDEP operated a gas chromatography / photoionization detector (GC/PID) at the Kenmore Square site (25-025-0002) for nearly two years to measure hourly concentrations of health-relevant hydrocarbon compounds (primarily from vehicle exhaust), which include benzene, toluene, xylenes and ethyl benzene. MassDEP moved the GC/PID to the Boston - Von Hillern Street near-road site (25-025-0044) in July 2016.

MassDEP plans in 2018 to conduct focused air toxics monitoring in the Fore River Basin area of Weymouth, Quincy, and Braintree, as directed by Governor Baker in July 2017 to work with the Massachusetts Department of Public Health to prepare health impact assessment that will document background air levels in the area and the health status of the community, and consider potential impacts of the proposed Atlantic Bridge natural gas compressor station project.

## 5. Summary of Network Changes

- MassDEP is in the process of installing an ozone monitoring station in the Pittsfield CMSA that should be operational for the second half of the 2018 ozone season.
- MassDEP installed a second near-road NO<sub>2</sub> monitoring station in Chelmsford near the Route 495/Route 3 interchange that will begin operation this summer. MassDEP plans to also measure continuous PM<sub>2.5</sub>, black carbon, and ozone at this site.
- MassDEP closed the Newburyport (25-009-4005) monitoring station at the end of 2017 and discontinue monitoring of VOCs (PAMS), NO<sub>x</sub>, NO<sub>y</sub>, ozone and meteorological parameters.
- MassDEP discontinued FRM PM<sub>2.5</sub> monitoring at the Lynn (25-009-2006) and Fall River (25-005-1004) monitoring stations at the end of 2107.
- MassDEP discontinued collocated FRM PM<sub>2.5</sub> monitoring at the Brockton (25-023-0005) monitoring station at the end of 2017. One FRM monitor (1-in-3 day schedule) and a continuous PM<sub>2.5</sub> monitor will continue operating at the site (along with ozone and black carbon).
- MassDEP closed the Boston – North Street PM<sub>2.5</sub> monitoring station (25-025-0043).
- MassDEP plans to relocate the Springfield – Liberty Street monitoring station (25-013-0016) to a new location in Springfield, and discontinue PM<sub>10</sub> monitoring.
- MassDEP plans to convert the full-scale CO monitor to a trace CO monitor at the relocated Springfield monitoring station once it begins operation in 2018.
- MassDEP began operating a continuous PM<sub>2.5</sub> and black carbon monitoring station in North Adams to measure the effects of wood smoke in a valley environment.
- MassDEP discontinued PAMS VOC measurements at Ware (25-015-4002) and Newburyport (25-009-4005).
- MassDEP discontinued PAMS-related trace CO monitoring at Chicopee (25-013-0008) and Lynn (25-009-2006).
- MassDEP plans to discontinue reporting lead concentration data as a NAAQS pollutant at Boston-Harrison Avenue (25-025-0042) but will continue to report the lead concentration results as part of the NATTS program.