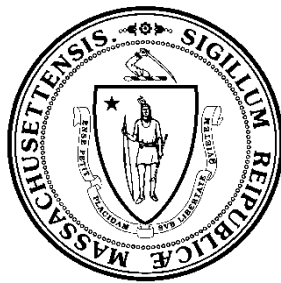


Massachusetts 2017 Air Quality Report



Department of Environmental Protection
Bureau of Air and Waste
Division of Air and Climate Programs

Air Assessment Branch
Wall Experiment Station
37 Shattuck Street
Lawrence, Massachusetts 01843

October 2018

ACKNOWLEDGEMENTS

This 2017 Air Quality Report was prepared by the Massachusetts Department of Environmental Protection (MassDEP), Air Assessment Branch (AAB), which collects representative samples of ambient air for a number of pollutants at monitoring stations located across the Commonwealth. All samples are collected in a scientifically sound manner in order to properly characterize the quality of the air in the Commonwealth.

The photo on the cover is a view of the air monitoring station on Holden St. in North Adams.

This report is available on MassDEP's web site at

www.mass.gov/eea/agencies/massdep/air/quality/air-monitoring-reports-and-studies.html

Questions about this report may be directed to:

Thomas McGrath
Air Assessment Branch
Wall Experiment Station
Lawrence, MA 01843-1343
(978) 242-1318

email: Thomas.McGrath@state.ma.us

TABLE OF CONTENTS

LIST OF FIGURES	ii
-----------------------	----

LIST OF ABBREVIATIONS	iii
-----------------------------	-----

SECTION I – AMBIENT AIR MONITORING PROGRAM

Program Overview	1
National Ambient Air Quality Standards.....	4
Pollutant Health Effects and Sources.....	5
Monitoring Network Description.....	7

SECTION II – ATTAINMENT OF AIR QUALITY STANDARDS

Attainment Status Summary	9
2017 Ozone Season.....	11
Daily Ozone and PM Forecast	13

SECTION III – MASSACHUSETTS AIR QUALITY DATA SUMMARIES

Ozone Summary.....	14
Sulfur Dioxide (SO ₂) Summary	18
Nitrogen Dioxide (NO ₂) Summary	20
Carbon Monoxide (CO) Summary.....	22
Particulate Matter 10 Microns (PM ₁₀) Summary.....	24
Particulate Matter 2.5 Microns (PM _{2.5}) Summary	26
Speciation.....	31
IMPROVE.....	31
Quality Control and Quality Assurance	31

SECTION IV – PAMS/AIR TOXICS MONITORING

PAMS Monitoring	32
Air Toxics Monitoring	33

APPENDIX A – 2017 Monitoring Station Locations	35
------------------------------------------------------	----

List of Figures

Section II – Attainment of Air Quality Standards

Figure 1	8-hour Ozone Exceedance Days and Total Exceedances 2008-2017	12
----------	--------------------------------------------------------------------	----

Section III – Massachusetts Air Quality Data Summaries

Figure 2	8-hour Ozone Exceedance Day Trends 2008-2017	16
Figure 3	Sulfur Dioxide Trends 2008-2017	19
Figure 4	Nitrogen Dioxide Trends 2008-2017	21
Figure 5	Carbon Monoxide Trends 2008-2017	23
Figure 6	Particulate Matter 10 Microns (PM ₁₀) Trends 2008-2017	25
Figure 7	Particulate Matter 2.5 Microns (PM _{2.5}) FRM Trends 2008-2017	28
Figure 8	Particulate Matter 2.5 Microns (PM _{2.5}) FEM Trends 2008-2017	30

Section IV – PAMS/Air Toxics Monitoring

Figure 9	Lynn Toxics VOC Summary 2008-2017	33
----------	-----------------------------------------	----

List of Abbreviations

AAB	Air Assessment Branch
AQS	Air Quality System
AQI.....	Air Quality Index
BAM	Beta Attenuation Monitor
BC	Black Carbon
BP.....	Barometric Pressure
CAA	Clean Air Act
CFR.....	Code of Federal Regulations
CO	Carbon Monoxide
CO ₂	Carbon Dioxide
FEM	Federal Equivalent Method
FRM	Federal Reference Method
EPA	United States Environmental Protection Agency
IMPROVE	Interagency Monitoring of Protected Visual Environments
MassDEP	Massachusetts Department of Environmental Protection
NAAQS.....	National Ambient Air Quality Standards (for criteria pollutants)
NATTS.....	National Air Toxics Trends Station
NCore	National Core Monitoring Network
NO.....	Nitric Oxide
NO _x	Nitrogen Oxides
NO _y	Total Reactive Oxidized Nitrogen
NO ₂	Nitrogen Dioxide
NO ₃	Nitrate
O ₃	Ozone
PAH	Polycyclic Aromatic Hydrocarbon
PAMS.....	Photochemical Assessment Monitoring Stations
Pb	Lead
pH.....	Concentration of hydrogen cations (H ⁺) in solution (an indicator of acidity)
ppb	parts per billion by volume
ppm	parts per million by volume
PM _{2.5}	Particulate matter ≤ 2.5 microns aerodynamic diameter
PM ₁₀	Particulate matter ≤ 10 microns aerodynamic diameter
QA/QC	Quality Assurance and Quality Control
RH.....	Relative Humidity
SIP	State Implementation Plan
SO ₂	Sulfur Dioxide
SO ₄	Sulfate
SR.....	Solar Radiation
SVOC	Semi-Volatile Organic Compounds
TEMP	Temperature
TSA	Technical Systems Audit
TSP.....	Total Suspended Particulates
µg/m ³	micrograms per cubic meter
VOCs	Volatile Organic Compounds
WS/WD.....	Wind Speed/Wind Direction
WSv/WDv.....	Wind Speed/Wind Direction Vector

Section I

Ambient Air Monitoring Program

Program Overview

Introduction

The Massachusetts Department of Environmental Protection (MassDEP) is the state agency responsible for monitoring outdoor air quality in Massachusetts and developing plans and regulatory programs to reduce emissions of pollutants that adversely affect public health, welfare, and the environment.

MassDEP's Air Assessment Branch (AAB) operates an extensive network of air monitoring stations throughout the Commonwealth. During 2017, MassDEP operated a network of 23 monitoring stations located in 18 cities and towns. MassDEP also received data from the Wampanoag Tribe of Gay Head (Aquinnah), which operates an air monitoring station on Martha's Vineyard.

MassDEP submits all ambient air quality data to the national Air Quality System (AQS) database that is administered by the U.S. Environmental Protection Agency (EPA). Real time data is sent to AIRNOW, which reports all U.S. sites. MassDEP's MassAir Online website provides air quality information and allows users to point and click on a map of the state to find current air quality data from the MassDEP continuous air monitoring network. MassAir Online is found at www.mass.gov/eea/agencies/massdep/air/quality/. EPA also makes historical AQS data for all U.S. sites available at <https://www.epa.gov/outdoor-air-quality-data>.

Why is Air Quality Data Collected?

Ambient air quality data is used for a number of purposes, including to:

- Provide information about air quality to the public;
- Provide short-term and long-term information regarding air pollution and public health;
- Verify compliance with National Ambient Air Quality Standards;
- Assess the effectiveness of current air pollution control regulations and initiatives;
- Support development of policies and regulations aimed at reducing air pollution;
- Support long-term trend analysis and special research; and
- Fulfill requirements to report ambient air quality data to EPA.

What is Monitored?

MassDEP monitors parameters in the following categories:

Criteria pollutants for which EPA has established National Ambient Air Quality Standards (NAAQS). The criteria pollutants monitored are:

- sulfur dioxide (SO₂)
- ozone (O₃)
- carbon monoxide (CO)
- nitrogen dioxide (NO₂)
- lead (Pb)
- particulate matter ≤10 microns (PM₁₀)
- particulate matter ≤2.5 microns (PM_{2.5})

Non-criteria pollutants do not have National Ambient Air Quality Standards, but can contribute to the formation of ozone and particulate matter and/or be toxic. The non-criteria pollutants monitored include:

- nitric oxide (NO)
- total nitrogen oxides (NO_x)
- total reactive oxidized nitrogen (NO_y)
- volatile organic compounds (VOCs) – ozone precursors and reaction product chemicals
- black carbon (i.e., soot)
- toxics – health-relevant VOCs, semi-volatile organic compounds (SVOCs), carbonyls and metals

Meteorological parameters monitored include:

- wind speed/wind direction (WS/WD) and vector (WSv/WDv)
- relative humidity (REL)
- temperature (TEM)
- barometric pressure (BP)
- solar radiation (SUN)
- precipitation (PRECIP)

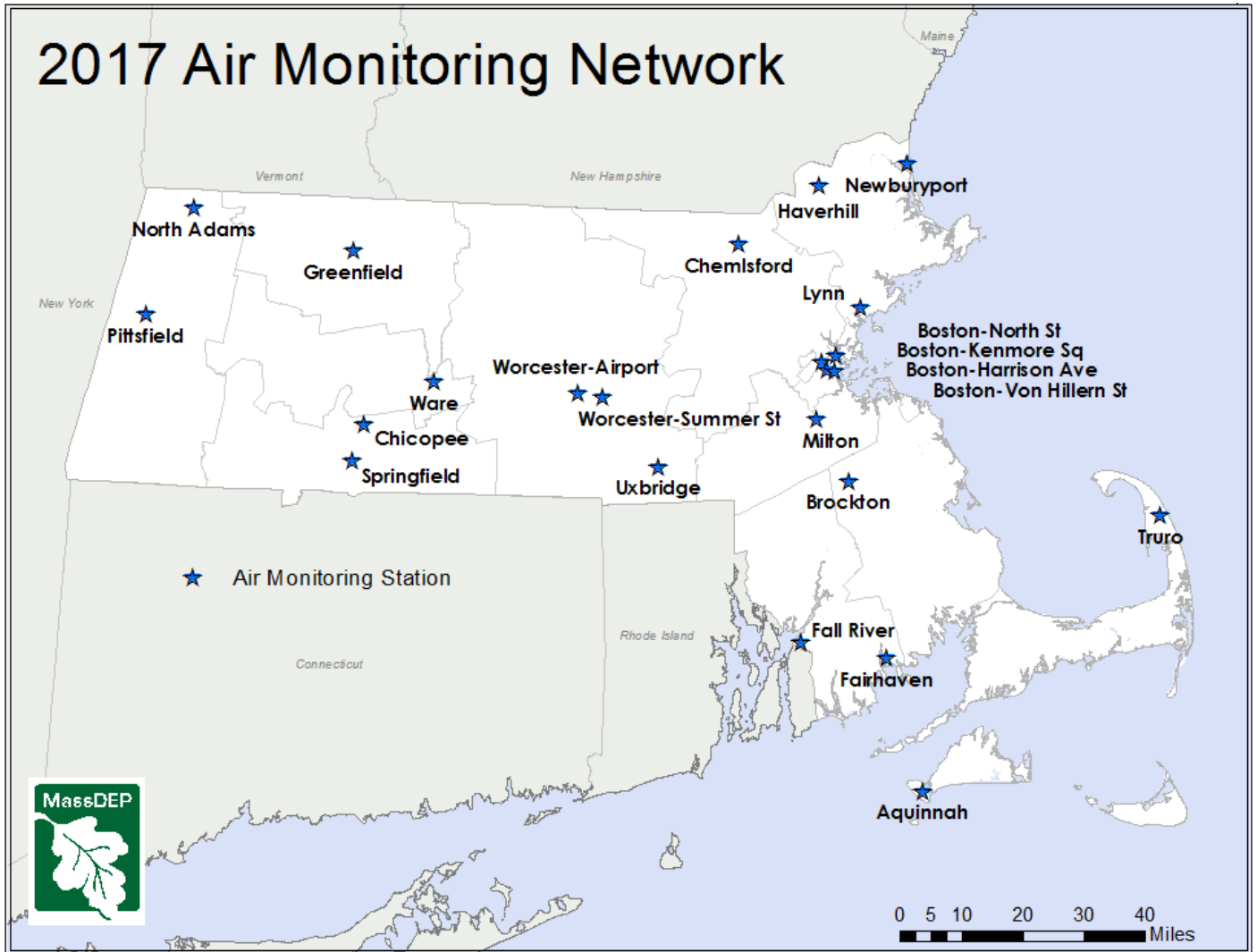
Monitoring Station Locations

Monitoring stations are sited to provide data for various purposes. Some are located where maximum pollutant concentrations are expected, while others are positioned in areas that will provide data that is representative of larger geographical areas. Local topography and pollutant source areas are factors that determine how well a particular monitor's location will represent a region.

Networks of monitors are located throughout the state. These networks are designed to reflect pollutant concentrations for all of Massachusetts. Section III of this report contains data summaries for each pollutant measured and maps showing the monitor locations for each network. Appendix A contains a list of monitor locations.

The map on page 3 shows Massachusetts cities and towns where air monitors were located during 2017.

2017 Air Monitoring Network



National Ambient Air Quality Standards

Below are the current National Ambient Air Quality Standards for criteria pollutants set by EPA.

Primary Standards are designed to protect public health, including the health of sensitive populations such as asthmatics, children, and the elderly. **Secondary Standards** are designed to protect public welfare, including protection against decreased visibility, damage to crops, vegetation, and buildings.

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 $\mu\text{g}/\text{m}^3$	Not to be exceeded
Nitrogen Dioxide		Primary	1-hour	100 ppb	98 th percentile, averaged over 3 years
		Primary and secondary	Annual	0.053 ppm	Annual Mean
Ozone		Primary and secondary	8-hour	0.070 ppm	Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years
Particle Pollution	PM _{2.5}	Primary	Annual	12 $\mu\text{g}/\text{m}^3$	Annual mean, averaged over 3 years
		Secondary	Annual	15 $\mu\text{g}/\text{m}^3$	Annual mean, averaged over 3 years
		Primary and secondary	24-hour	35 $\mu\text{g}/\text{m}^3$	98 th percentile, averaged over 3 years
	PM ₁₀	Primary and secondary	24-hour	150 $\mu\text{g}/\text{m}^3$	Not to be exceeded more than once per year on average over 3 years
Sulfur Dioxide		Primary	1-hour	75 ppb	99 th 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

$\mu\text{g}/\text{m}^3$ = micrograms per cubic meter; ppm = parts per million; ppb = parts per billion

Pollutant Health Effects and Sources

Ozone (O₃)

- Tropospheric O₃ (ground-level) and Stratospheric O₃ (upper atmosphere) are the same chemical compound, just found at different places in the atmosphere. Stratospheric O₃ found at greater than 30,000 feet above the surface of the earth is beneficial to all life because it filters out the sun's harmful UV radiation before it reaches the earth's surface. Ground-Level O₃ on the other hand is a health and environmental problem. This report pertains exclusively to ground-level O₃.
- O₃ is a respiratory irritant and can reduce lung function and cause asthma attacks, nasal congestion, and throat irritation, and reduce resistance to infection. It can inflame and damage (possibly permanently) cells that line the lungs, and aggravate chronic lung diseases. In addition, a number of studies have found a strong link between increases in ground-level O₃ and increased risk of premature death.
- O₃ is toxic to vegetation, inhibiting growth and causing leaf damage.
- O₃ deteriorates materials such as rubber and fabrics.
- Ground-level O₃ is unique in that it is formed by the reactions that occur between certain pollutants in the presence of intense, high-energy sunlight during the hot summer months. The complexity of the reactions and the amount of time needed to complete these reactions can result in the buildup of ground-level ozone concentrations far downwind from the original source of the precursors.
- Sources of ground-level O₃ precursors, i.e., nitrogen oxides and hydrocarbons, include motor vehicles, lawn and garden equipment, power plants and other industrial sources.

Carbon Monoxide (CO)

- CO binds with hemoglobin in the blood, reducing the amount of oxygen carried to organs and tissues.
- Symptoms of high CO exposure include shortness of breath, chest pain, headaches, confusion, and loss of coordination. The health threat is most severe for those with cardiovascular disease.
- Motor vehicle emissions are the largest source of CO, which is produced from incomplete combustion of carbon in fuels.
- Industrial processes and non-transportation fuel combustion (e.g., boilers, lawn and garden equipment) also are sources of CO.

Sulfur Dioxide (SO₂)

- SO₂ combines with water vapor to form acidic aerosols harmful to the respiratory tract, aggravating symptoms associated with lung diseases such as asthma and bronchitis.
- SO₂ is a primary contributor to acid deposition. Impacts of acid deposition include: acidification of lakes and streams, damage to vegetation, damage to materials, and diminution of visibility.
- SO₂ is a product of fuel combustion (e.g., the burning of coal and oil that contains sulfur). Sources include power plants and business and residential sources burning heating oil.

Nitrogen Dioxide (NO₂)

- NO₂ lowers resistance to respiratory infections and aggravates symptoms associated with asthma and bronchitis.
- NO₂ contributes to acid deposition. Impacts of acid deposition include: acidification of lakes and streams, damage to vegetation, damage to materials, and diminution of visibility.
- NO₂ and NO contribute to the formation of ozone.
- NO₂ is formed from the oxidation of nitric oxide (NO). Major sources of NO are fuel combustion, space heating, power plants and motor vehicles.

Particulate Matter (PM₁₀ and PM_{2.5})

- Particulate matter is tiny airborne particles or aerosols, which include dust, dirt, soot, smoke, and liquid droplets. Fine particulate matter (mostly below 2.5 microns in size) are not only the result of direct emissions, but can be formed in the atmosphere by chemical reactions involving gaseous pollutants.
- The numbers 2.5 and 10 refer to the particle size (actually the particles equal to or less than that size), measured in microns, which are collected by the monitors. Several thousand PM_{2.5} particles could fit on the period at the end of this sentence.
- The small size of these particles allows easy entry into the human respiratory system. Long-term exposure causes the particles to accumulate in the lungs and affects breathing and produces respiratory symptoms. The small particles can migrate through the lungs and into the circulatory system and potentially produce cardio-vascular symptoms, as well as impacts from toxic components contained in the particulate matter.
- Particulate matter causes soiling and corrosion of materials.
- Particulate matter contributes to atmospheric haze that degrades visibility.
- Sources of particulates include industrial process emissions, motor vehicles, incinerators, power plants, and other fuel combustion sources.

Lead (Pb)

- Lead is an elemental metal that is found in nature.
- Exposure to lead can occur by inhalation or ingestion with food, water, soil or dust particles.
- Children, infants, and fetuses are the most susceptible to the effects of lead exposure.
- Lead causes intellectual disability, brain damage, and liver disease. It may be a factor in high blood pressure and damages the nervous system.
- Lead enters the atmosphere from the incineration of lead containing materials and from the manufacture and processing of lead containing products or materials like storage batteries, smelting and removal of paint that contained lead.

Monitoring Network Description

The following describes the ambient air monitoring network in 2017.

Network Size

- 23 monitoring stations
- 18 cities and towns with monitoring stations

Number of Continuous Monitors

Continuous monitors measure air quality 24 hours per day. The data are reported as hourly means.

- Criteria pollutant monitors measure pollutants for which National Ambient Air Quality Standards (NAAQS) have been set.
 - ❑ 6 – CO (carbon monoxide), which includes 5 trace-level CO monitors
 - ❑ 10 – NO₂ (nitrogen dioxide). NO (nitric oxide) and NO_x (total nitrogen oxides) also are measured by these monitors
 - ❑ 16 – O₃ (ozone)
 - ❑ 6 – SO₂ (sulfur dioxide), which includes 4 trace-level SO₂ monitors
 - ❑ 13 – PM_{2.5} (particulate matter – 2.5 microns) Beta Attenuation Monitors (BAMs)
- Meteorological monitors track weather conditions.
 - ❑ 13 – BP (barometric pressure)
 - ❑ 13 – RH (relative humidity)
 - ❑ 13 – SUN (solar radiation)
 - ❑ 13 – TEMP (temperature)
 - ❑ 13 – WS/WD (wind speed/wind direction)
 - ❑ 1 – WSV/WDV (wind speed vector/wind direction vector)
 - ❑ 2 – Precipitation
- Other Monitors
 - ❑ 3 – NO/NO_y (Total Reactive Oxidized Nitrogen)
 - ❑ 2 – PAMS (photochemical assessment monitoring station) These monitors measure VOCs (volatile organic compounds) using automated gas chromatographs (GCs) on an hourly basis during the summer
 - ❑ 6 – Black Carbon

**Number of
Intermittent
Monitors**

Intermittent monitors take discrete samples for a specific time period. The samples are taken every day, every third day, or every sixth day. The data are averaged in 3-hour or 24-hour intervals.

- Criteria pollutant monitors measure pollutants that have National Ambient Air Quality Standards (NAAQS).
 - 5 – PM₁₀ (particulate matter – 10 microns)
 - 16 – PM_{2.5} FRM (particulate matter – 2.5 microns Federal Reference Method)
- Non-criteria pollutant monitors measure pollutants that do not have NAAQS.
 - 2 – PAMS (photochemical assessment monitoring station). These monitors measure volatile organic compounds (VOCs), which lead to ozone formation.
 - 2 – Toxics. These monitors measure health-relevant VOCs.
 - 2 – Speciation. These monitors measure for PM_{2.5}, nitrates, and organics
 - 1 – PM₁₀ (particulate matter – 10 microns) for metals analysis

Section II

Attainment of Air Quality Standards

Attainment Status Summary

The federal Clean Air Act (CAA) contains timeframes and milestones for states to meet and maintain National Ambient Air Quality Standards (NAAQS) for criteria pollutants, which include carbon monoxide, lead, nitrogen dioxide, ozone, particulate matter, and sulfur dioxide. EPA sets NAAQS at levels to protect public health and the environment. The EPA must review each NAAQS every five years and may update the standards based on new scientific information as well as establish new monitoring requirements. Each state is required to monitor the ambient air to determine whether it meets each standard.¹ If monitoring shows that the air quality does not meet a standard, the state must develop and implement pollution control strategies to attain that standard. Once air quality meets a standard, a state must develop a plan to maintain that standard while accounting for future economic and emissions growth. Taken together, these plans and control strategies constitute the State Implementation Plan (SIP).

Carbon Monoxide

Monitored levels of CO in Massachusetts meet the CO standards. Prior to the mid-1980s, Massachusetts was in nonattainment of the CO standards. However, with the adoption of numerous control programs, CO emissions significantly decreased and monitored levels of CO met the standards beginning in 1987. Massachusetts is designated as Attainment for the CO standards. Based on EPA's most recent review of the CO standards, in August 2011, EPA retained the existing primary CO standards of 9 ppm measured over 8 hours, and 35 ppm measured over 1 hour. Since EPA did not change the standards, no new designation process was triggered.

Lead

Monitored levels of lead in Massachusetts meet the lead standards. In October 2008, EPA lowered the lead standards (primary and secondary) from 1.5 µg/m³ to 0.15 µg/m³ averaged over a rolling 3-month period. In November 2011, EPA designated all of Massachusetts as Unclassifiable/Attainment for the 2008 standards. Based on EPA's most recent review of the lead standards, in September 2016, EPA retained the existing lead standards. Since EPA did not change the standards, no new designation process was triggered.

Nitrogen Dioxide

Monitored levels of NO₂ in Massachusetts meet the NO₂ standards. Based on EPA's most recent review of the NO₂ standards, in January 2010, EPA established a new 1-hour NO₂ primary standard of 100 ppb and new near-road monitoring requirements. In January 2012, EPA designated all of Massachusetts as Unclassifiable/Attainment for the 2010 standard.

¹ MassDEP develops an annual Ambient Air Monitoring Network Plan that describes recent and planned changes to the statewide monitoring network, available at www.mass.gov/eea/agencies/massdep/air/reports/annual-ambient-air-quality-monitoring-network-plan.html.

Sulfur Dioxide

Monitored levels of SO₂ in Massachusetts meet the SO₂ standards. Based on EPA's most recent review of the SO₂ standards, in June 2010, EPA established a new 1-hour SO₂ primary standard of 75 ppb. In December 2017, EPA designated all of Massachusetts as Unclassifiable/Attainment for the 2010 standard.

Particulate Matter

There are standards for two types of particulate matter: PM₁₀ and PM_{2.5}. Monitored levels of PM₁₀ and PM_{2.5} in Massachusetts meet the respective standards.

Based on EPA's most recent review of the PM_{2.5} standards, in December 2012, EPA lowered the primary annual PM_{2.5} standard to 12 µg/m³. In December 2014, EPA designated all of Massachusetts as Unclassifiable/Attainment for the 2012 standard.

Ozone

In 1979, EPA established ozone standards (primary and secondary) set at 0.12 ppm based on the maximum 1-hour ozone concentration that occurred each day during the ozone monitoring season. Massachusetts was designated as Nonattainment with the 1979 standards.

In 1997, EPA established new 8-hour ozone standards (primary and secondary) set at 0.08 ppm that were designed to be more representative of exposure over time, rather than just the maximum concentration (the 1-hour standards were revoked in 2005). Massachusetts was designated as Nonattainment for the 8-hour standards at that time. Through a combination of state and regional controls, Massachusetts' air quality attained the 1997 standards by the 2009 attainment deadline.

In 2008, EPA lowered the 8-hour ozone standards (primary and secondary) to 0.075 ppm. In April 2012, EPA designated Dukes County as Nonattainment for the 2008 ozone standards and designated the remainder of Massachusetts as Unclassifiable/Attainment. Dukes County attained the 2008 ozone standards by the 2015 attainment deadline.

Based on EPA's most recent review of the ozone standards, in October 2015, EPA lowered the 8-hour ozone standards (primary and secondary) to 0.070 ppm. EPA has designated all of Massachusetts as Attainment/Unclassifiable for the 2015 standards.

2017 Ozone Season

In 2017, there were 12 days when the 8-hour ozone standards of 0.070 ppm were exceeded in Massachusetts. Based on the most recent three years of data (2015–2017), two monitors (Chicopee and Fall River) violated the 0.070 ppm standards.

While ozone concentrations have trended downward over the past several decades due to air pollution control programs, ozone concentrations vary each year due to varying weather patterns. In general, the chemical reactions that produce elevated ozone concentrations occur when high energy sunlight (present on hot summer days) facilitates the react of ozone “precursor” pollutants – VOCs and NO_x – which results in ozone formation. Typically, Massachusetts ozone exceedances occur when there is a south or southwesterly airflow that transports elevated levels of ozone, VOCs and NO_x up the coastal urban corridor.

Difference Between Ozone Exceedances and Violations

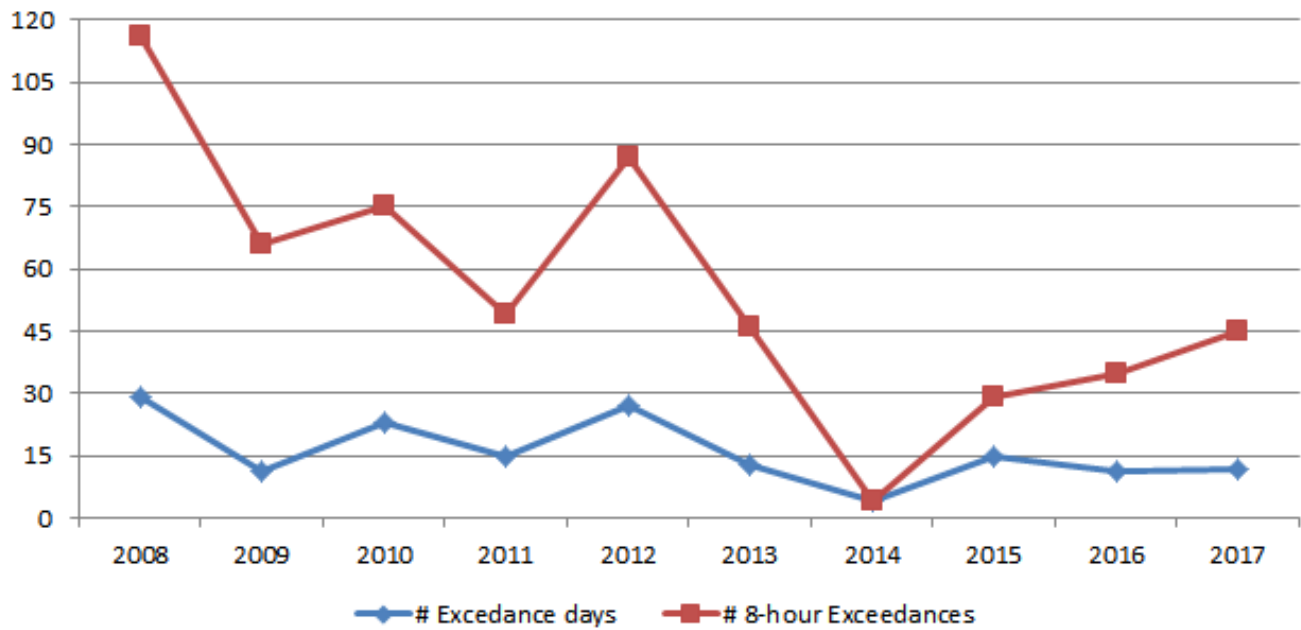
An ozone exceedance occurs when monitored ozone concentrations exceed the ozone NAAQS. Ozone monitoring data is collected as an hourly average of continuous data which is then used to determine the highest 8-hour average value for the day. An exceedance of the 8-hour NAAQS is an 8-hour averaged value that is greater than 0.070 ppm. An ozone exceedance occurs when a monitor records ambient levels of ozone above the NAAQS. Monitoring an ozone exceedance does not mean that a violation of the ozone NAAQS has occurred, because a violation of an ozone NAAQS (as opposed to an exceedance) is based on three-year averages of data at each monitor.

An ozone violation of the 8-hour NAAQS is determined using the annual 4th-highest daily maximum eight-hour ozone value at each monitor. A violation requires a three-year average of the annual 4th-highest daily maximum eight-hour value that is greater than 0.070 ppm. In other words, the eight-hour values for each day during a year for a specific monitor are ranked from highest to lowest. Then, the 4th-highest value for three consecutive years is averaged. If the three-year average is greater than 0.070 ppm, a violation of the 8-hour NAAQS has occurred at that monitoring site.

Exceedance Days and Total Exceedance Trends

Figure 1 shows the trend in the number of 8-hour exceedance days and the total number of exceedances for the past ten years. Note that years 2008-2015 show what exceedances would have been had the 0.070 ppm 8-hour standards been in effect.

Figure 1
8-hour Ozone Exceedance Days and Total Exceedances 2008-2017
Exceedances Based on 0.070 ppm 8-hour Standards



Daily Ozone and PM Forecasts

MassDEP provides the public with daily air quality forecasts for ozone from April through September and for fine particles all year round using weather maps and meteorological factors to predict whether or not conditions will result in elevated pollution levels. The daily air quality forecasts are available from www.mass.gov/eea/agencies/massdep/air/quality/. EPA web sites that contain regional and national pollution forecasts using data that is provided by participating states are located at www.epa.gov/region01/airquality/forecast.html and <http://airnow.gov/>. The table below describes the ratings used in the daily air quality forecasts.

Air Quality Index (AQI): Ozone			Air Quality Index (AQI): Particle Pollution		
Index Values	Levels of Health Concern	Cautionary Statements	Index Values	Levels of Health Concern	Cautionary Statements
0-50	Good	None	0-50	Good	None
51-100	Moderate	Unusually sensitive people should consider reducing prolonged or heavy exertion outdoors.	51-100	Moderate	Unusually sensitive people should consider reducing prolonged or heavy exertion.
101-150	Unhealthy for Sensitive Groups	Active children and adults, and people with lung disease, such as asthma, should reduce prolonged or heavy exertion outdoors.	101-150	Unhealthy for Sensitive Groups	People with heart or lung disease, older adults, and children should reduce prolonged or heavy exertion.
151-200	Unhealthy	Active children and adults, and people with lung disease, such as asthma, should avoid prolonged or heavy exertion outdoors. Everyone else, especially children, should reduce prolonged or heavy exertion outdoors.	151-200	Unhealthy	People with heart or lung disease, older adults, and children should avoid prolonged or heavy exertion. Everyone else should reduce prolonged or heavy exertion.
201-300	Very Unhealthy	Active children and adults, and people with lung disease, such as asthma, should avoid all outdoor exertion. Everyone else, especially children, should avoid prolonged or heavy exertion outdoors.	201-300	Very Unhealthy	People with heart or lung disease, older adults, and children should avoid all physical activity outdoors. Everyone else should avoid prolonged or heavy exertion.

Section III

Massachusetts Air Quality Data Summaries

Ozone Summary

2017 Ozone Data Summary

A summary of the data collected during the 2017 ozone season (March 1 – September 30) is shown below (in parts per million). MassDEP operated 15 ozone sites during 2017. The Wampanoag Tribe operated one site in Aquinnah on Martha's Vineyard.

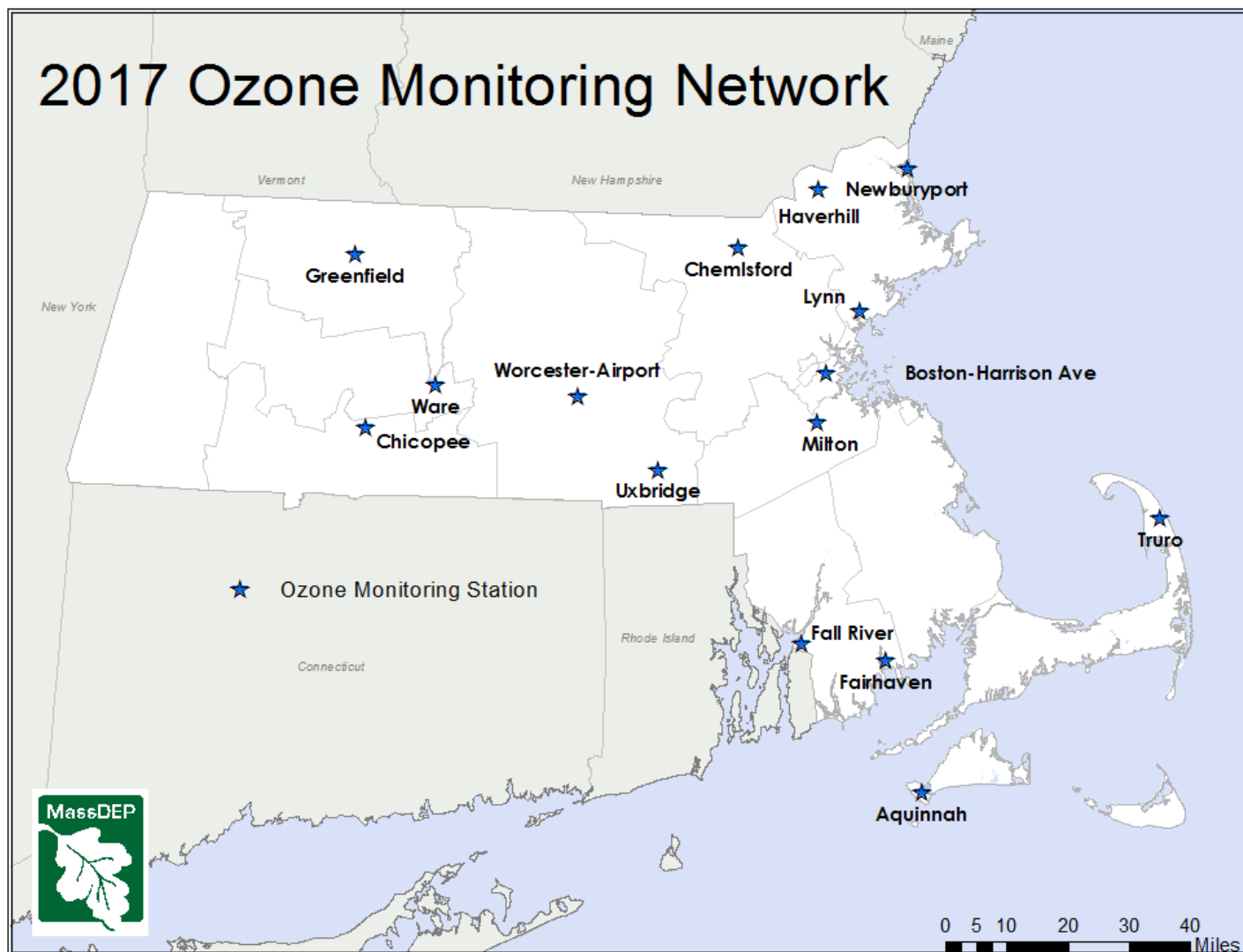
Ozone 2017				1ST MAX	2ND MAX	3RD MAX	4TH MAX	8-HR MAX>.070	1ST MAX	2ND MAX
SITE ID	CITY	COUNTY	ADDRESS	8-HR	8-HR	8-HR	8-HR	STD	1-HR	1-HR
25-007-0001	Aquinnah	Dukes	1 HERRING CREEK RD	0.096	0.095	0.083	0.076	4	0.115	0.113
25-025-0042	Boston	Suffolk	HARRISON AVE	0.076	0.072	0.072	0.069	3	0.099	0.086
25-023-0005	Brockton	Plymouth	1 CLINTON ST	0.084	0.074	0.073	0.072	4	0.103	0.089
25-017-0009	Chelmsford	Middlesex	11 TECHNOLOGY	0.072	0.067	0.065	0.065	1	0.093	0.088
25-013-0008	Chicopee	Hampden	ANDERSON RD AFB	0.074	0.072	0.072	0.072	4	0.104	0.094
25-005-1006	Fairhaven	Bristol	30 SCHOOL ST	0.083	0.082	0.074	0.073	4	0.103	0.101
25-005-1004	Fall River	Bristol	659 GLOBE ST	0.086	0.078	0.076	0.073	5	0.103	0.089
25-011-2005	Greenfield	Franklin	VETERANS FIELD	0.067	0.066	0.064	0.064	0	0.077	0.074
25-009-5005	Haverhill	Essex	685 WASHINGTON	0.069	0.067	0.065	0.065	0	0.095	0.083
25-009-2006	Lynn	Essex	390 PARKLAND	0.081	0.074	0.071	0.069	3	0.099	0.084
25-021-3003	Milton	Norfolk	BLUE HILL OBSERV	0.084	0.083	0.076	0.075	4	0.104	0.095
25-009-4005	Newburyport	Essex	HARBOR STREET	0.069	0.068	0.067	0.066	0	0.092	0.083
25-001-0002	Truro	Barnstable	FOX BOTTOM AREA	0.085	0.081	0.079	0.072	5	0.101	0.095
25-027-0024	Uxbridge	Worcester	366 E HARTFORD DR	0.083	0.077	0.070	0.069	2	0.110	0.095
25-015-4002	Ware	Hampshire	QUABBIN SUMMIT	0.077	0.073	0.072	0.069	3	0.110	0.100
25-027-0015	Worcester	Worcester	375 AIRPORT	0.076	0.073	0.072	0.068	3	0.100	0.094

STANDARDS: 8-hour = 0.070 ppm

ABBREVIATIONS AND SYMBOLS USED IN TABLE

SITE ID = AIRS SITE IDENTIFICATION NUMBER; **1ST, 2ND, 3RD, 4TH MAX 8-HR** = MAXIMUM 8-HOUR VALUE FOR THE 1ST, 2ND, 3RD AND 4TH HIGHEST DAY; **8-HR MAX > .070 STD** = NUMBER OF MEASURED DAILY 8-HOUR MAXIMUM VALUES GREATER THAN THE 0.070 PPM 8-HOUR STANDARD; **1ST, 2ND MAX 1-HR** = MAXIMUM 1-HOUR VALUE FOR THE 1ST AND 2ND HIGHEST DAY

2017 Ozone Monitoring Network



8-hour Ozone Exceedance Trends

Figure 2 shows the trend for each monitor for the past ten years based on the 0.070 ppm 8-hour standards.

Figure 2
8-hour Ozone Exceedance Trends 2008 – 2017
 Based on the 0.070 ppm 8-hour Standards

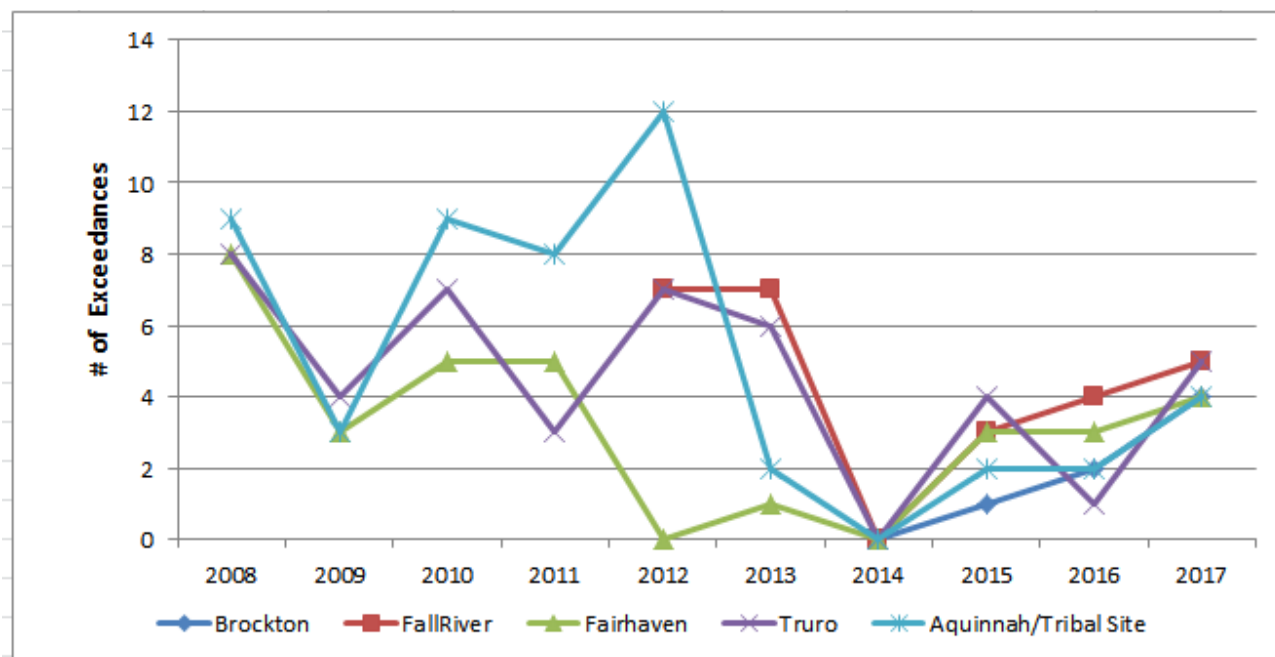
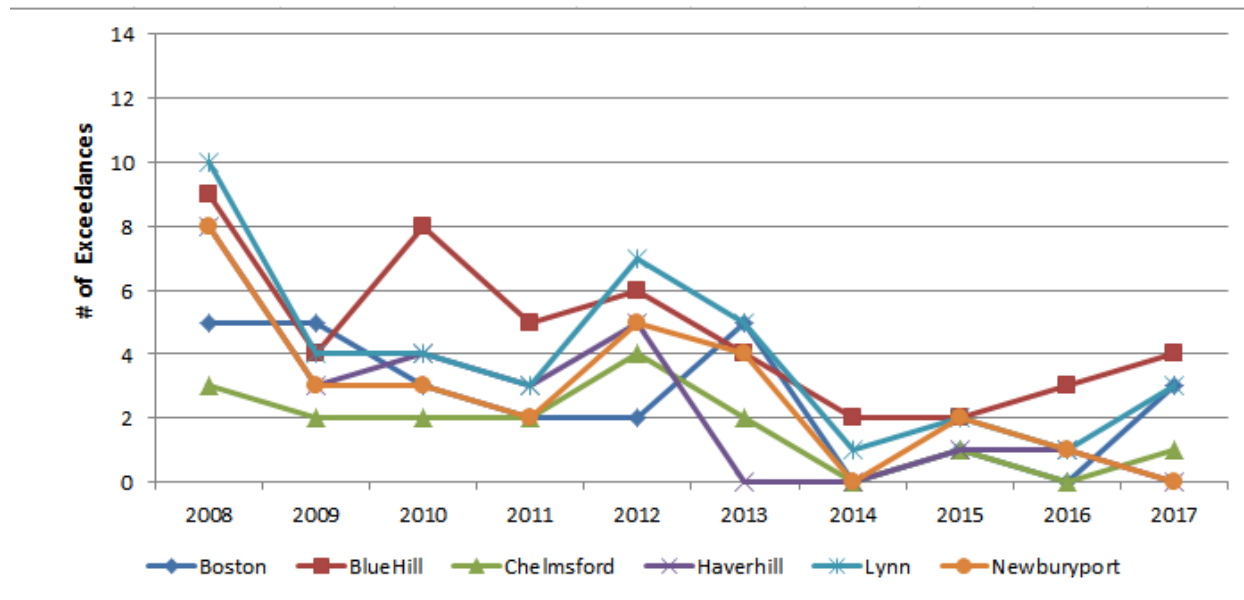
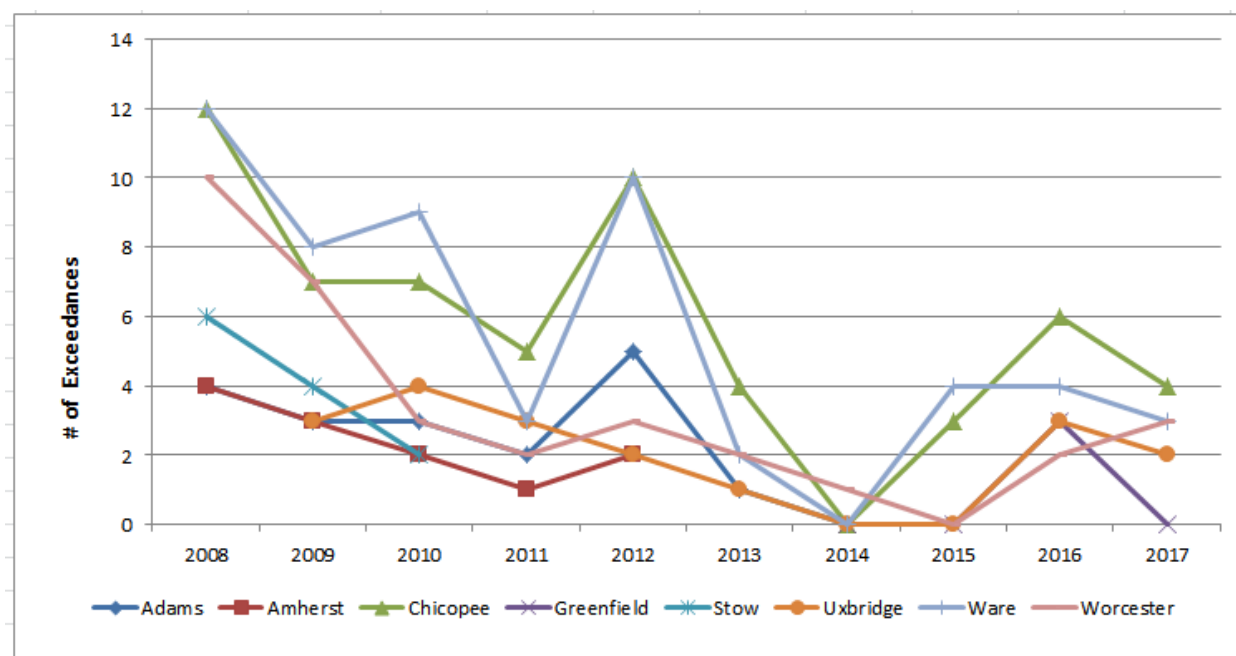


Figure 2 cont.
8-hour Ozone Exceedance Trends 2008 – 2017
 Based on the 0.070 ppm 8-hour Standards



Sulfur Dioxide (SO₂) Summary

2017 SO₂ Data Summary

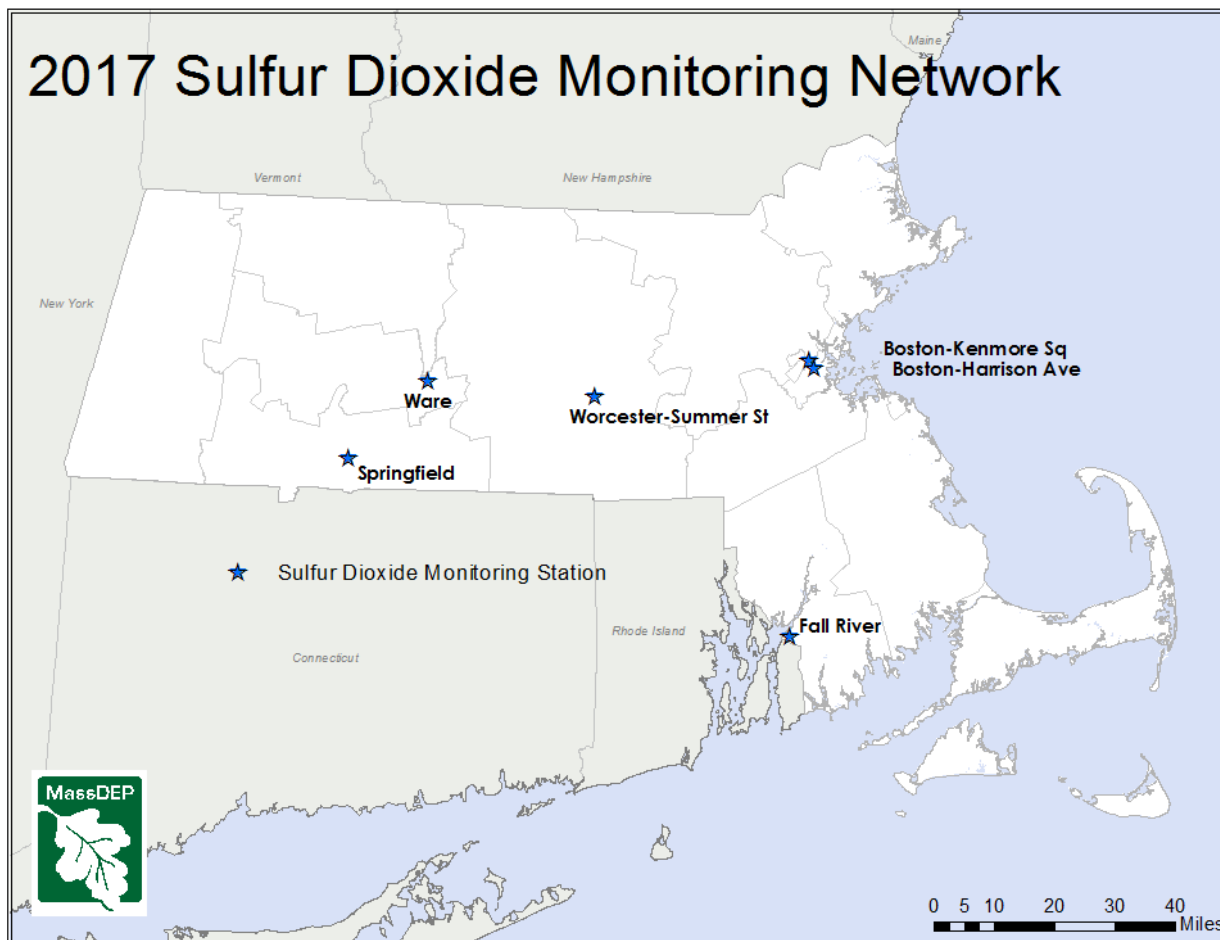
A summary of the 2017 SO₂ data is shown below (in parts per billion). MassDEP operated six SO₂ sites during 2017.

SO2 2017			1ST	2ND	99TH		1ST	2ND
CITY	COUNTY	ADDRESS	MAX	MAX	PCTL	ARITH	MAX	MAX
			1-HR	1-HR	1-HR	MEAN	24-HR	24-HR
Boston	Suffolk	KENMORE SQ	8.4	3.8	2.8	0.50	1.7	1.5
Boston	Suffolk	HARRISON AVE	5.1	4.2	4.0	0.58	2.0	1.9
Fall River	Bristol	659 GLOBE ST	12.6	12.6	11.2	0.67	4.9	4.7
Springfield	Hampden	LIBERTY ST	4.2	4.1	3.9	0.62	2.7	2.6
Ware	Hampshire	QUABBIN SUMMIT	3.5	1.7	1.6	0.63	1.8	1.3
Worcester	Worcester	SUMMER ST	4.5	4.3	3.9	0.85	2.1	2.1

STANDARDS: 1-hour = 75 ppb 3-hour = 0.5 ppm (500 ppb)

ABBREVIATIONS AND SYMBOLS USED IN TABLE

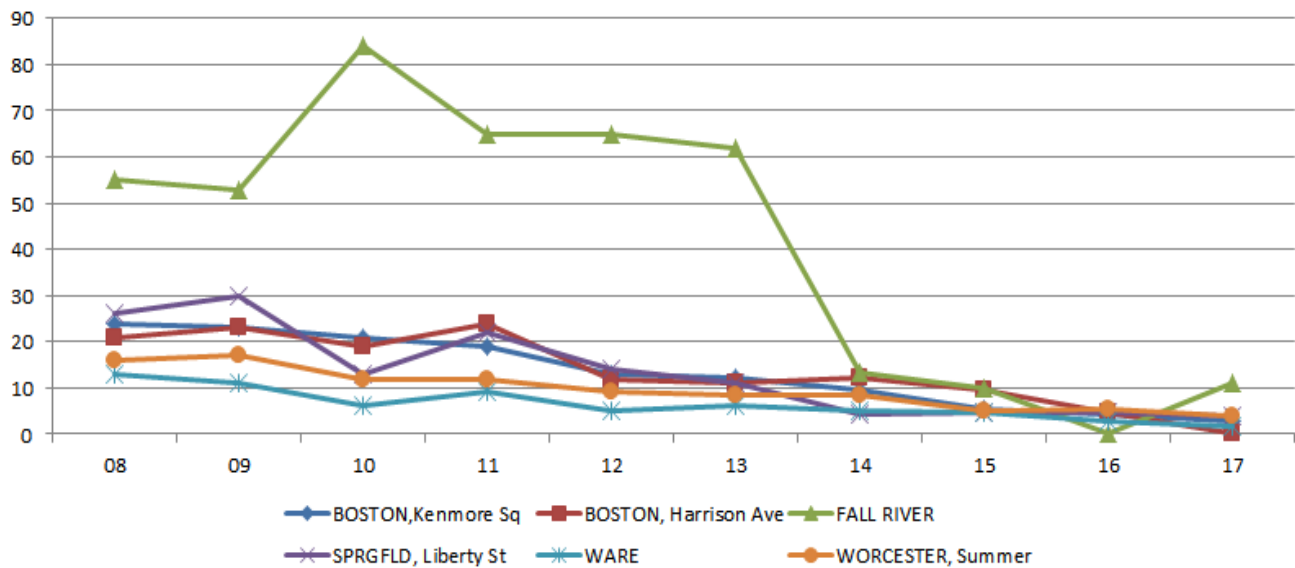
1ST, 2ND MAX 1-HR = FIRST AND SECOND HIGHEST 1-HOUR VALUE; 99TH PCTL 1-HR = 99th PERCENTILE OF THE 1-HOUR MAXIMUM VALUE; ARITH MEAN = ANNUAL ARITHMETIC MEAN; 1st, 2nd MAX 24-HR = FIRST AND SECOND HIGHEST 24-HOUR VALUE



SO₂ Trends

Figure 3 shows the trend of the 1-hour 99th percentile for each SO₂ site for the past 10 years. The current 1-hour standard is 75 ppb.

Figure 3
Sulfur Dioxide Trends 2008 – 2017
1-hour 99th Percentile Annual Average



Nitrogen Dioxide (NO₂) Summary

2017 NO₂ Data Summary

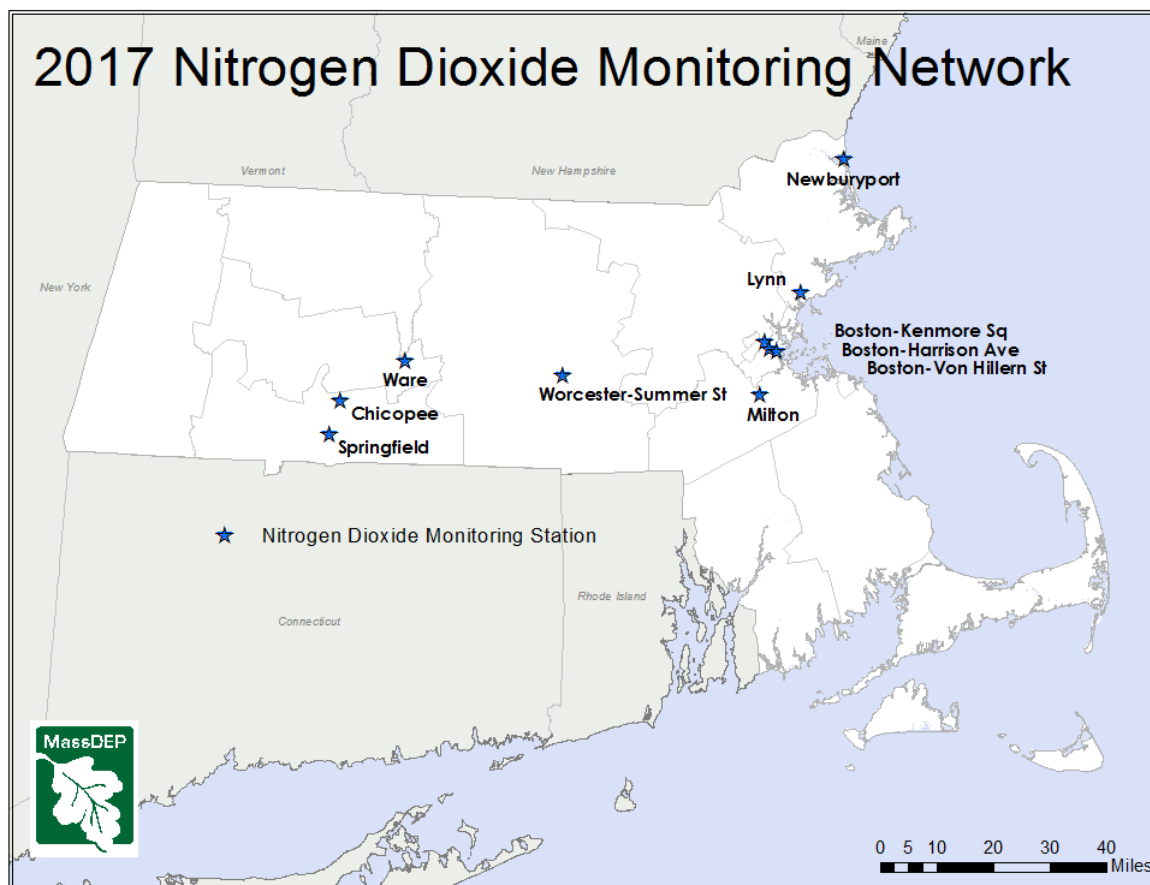
A summary of the 2017 NO₂ data is shown below (in parts per billion). MassDEP operated 10 NO₂ sites during 2017.

NO2 2017				1ST MAX 1-HR	2ND MAX 1-HR	98TH PERCENTILE VALUE	ARITH MEAN
SITE ID	CITY	COUNTY	ADDRESS				
25-025-0002	Boston	Suffolk	KENMORE SQ	57	56	46	13.23
25-025-0042	Boston	Suffolk	HARRISON AVE	49	48	46	11.22
25-025-0044	Boston	Suffolk	19 VON HILLERN	56	54	44	13.76
25-013-0008	Chicopee	Hampden	ANDERSON RD AFB	43	40	37	5.34
25-009-2006	Lynn	Essex	390 PARKLAND	40	38	32	4.40
25-021-3003	Milton	Norfolk	695 HILLSIDE ST	33	33	29	3.72
25-009-4005	Newburyport	Essex	HARBOR STREET	41	39	21	2.50
25-013-0016	Springfield	Hampden	LIBERTY STREET	55	52	44	12.01
25-015-4002	Ware	Hampshire	QUABBIN SUMMIT	29	28	20	2.17
25-027-0023	Worcester	Worcester	SUMMER ST	59	53	49	11.45

STANDARDS: Annual Arithmetic Mean = 53 ppb 1-hour = 100 ppb

ABBREVIATIONS AND SYMBOLS USED IN TABLE

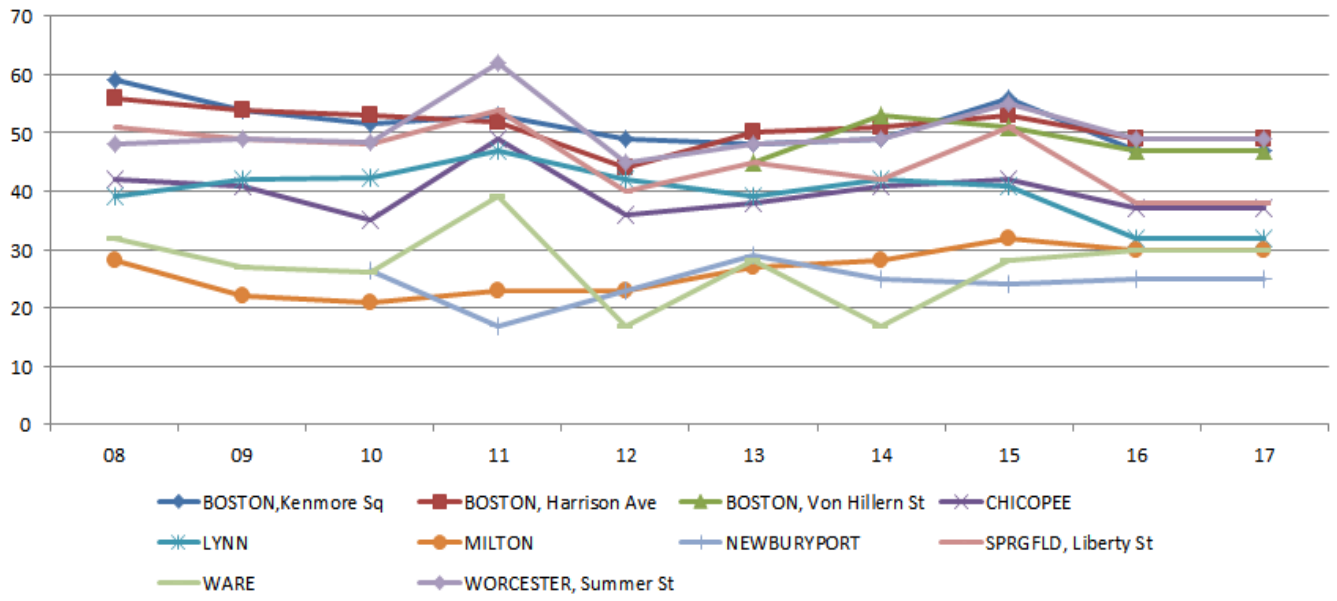
SITE ID = AIRS SITE IDENTIFICATION NUMBER; **1ST**, **2ND** **MAX 1-HR** = FIRST AND SECOND HIGHEST 1-HOUR VALUE; **ARITH MEAN** = ANNUAL ARITHMETIC MEAN



NO₂ Trends

Figure 4 shows the trend of the 1-hour 98th percentile annual average for each NO₂ site over the past 10 years. The current 1-hour standard is 100 ppb.

Figure 4
Nitrogen Dioxide Trends 2008 - 2017
 1-hour 98th Percentile Annual Average



Carbon Monoxide (CO) Summary

2017 CO Data Summary

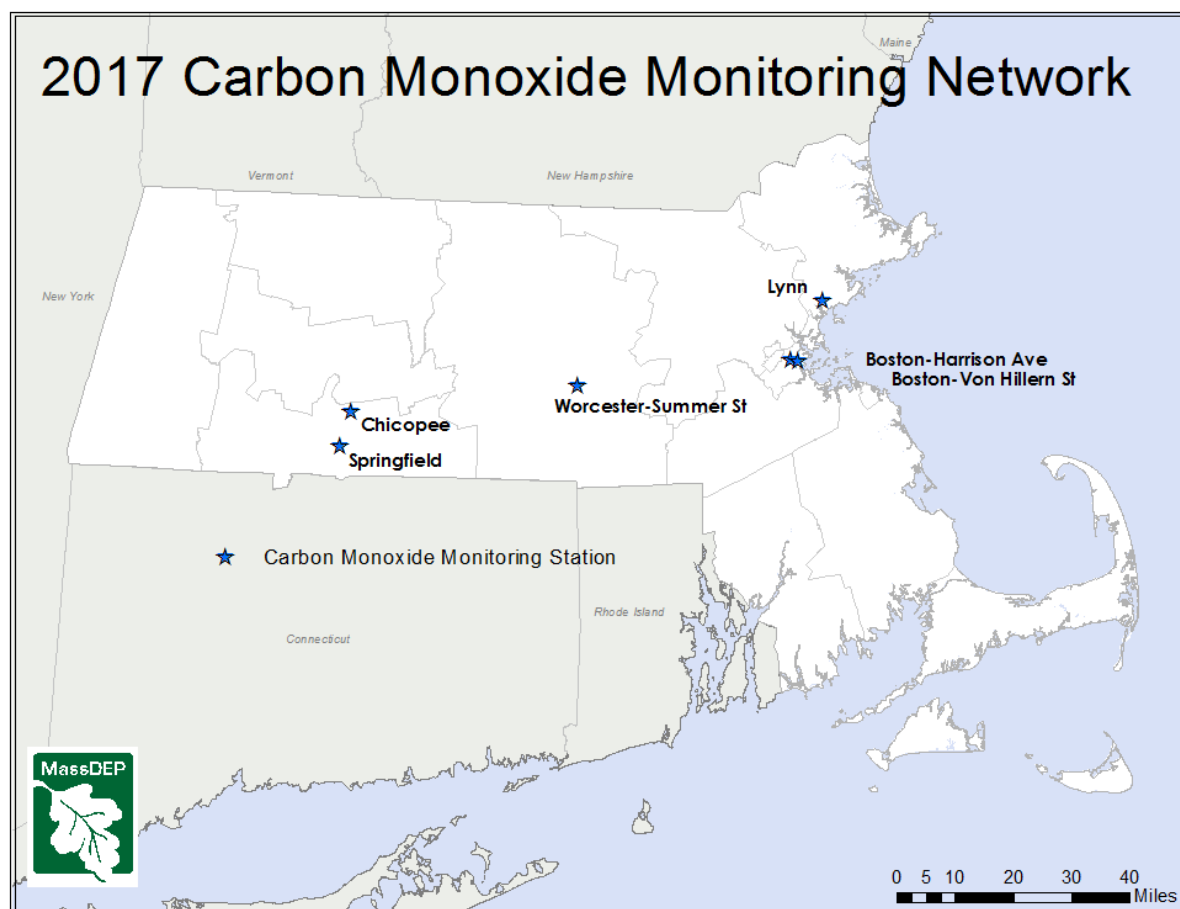
A summary of the 2017 CO data is shown below (in parts per million). MassDEP operated six CO sites during 2017.

CO 2017				1ST MAX 1-HR	2ND MAX 1-HR	1ST MAX 8-HR	2ND MAX 8-HR
SITE ID	CITY	COUNTY	ADDRESS				
25-025-0042	Boston	Suffolk	HARRISON AVE	1.472	1.320	1.260	1.256
25-025-0044	Boston	Suffolk	19 VON HILLERN	1.674	1.624	1.324	1.237
25-013-0008	Chicopee	Hampden	ANDERSON RD AFB	0.936	0.767	0.753	0.728
25-009-2006	Lynn	Essex	390 PARKLAND	1.059	1.043	0.943	0.612
25-013-0016	Springfield	Hampden	LIBERTY STREET	2.100	1.300	1.300	1.200
25-027-0023	Worcester	Worcester	SUMMER ST	1.217	1.149	1.1	1.1

STANDARDS: 1-hour = 35 ppm 8-hour = 9 ppm

ABBREVIATIONS AND SYMBOLS USED IN TABLE

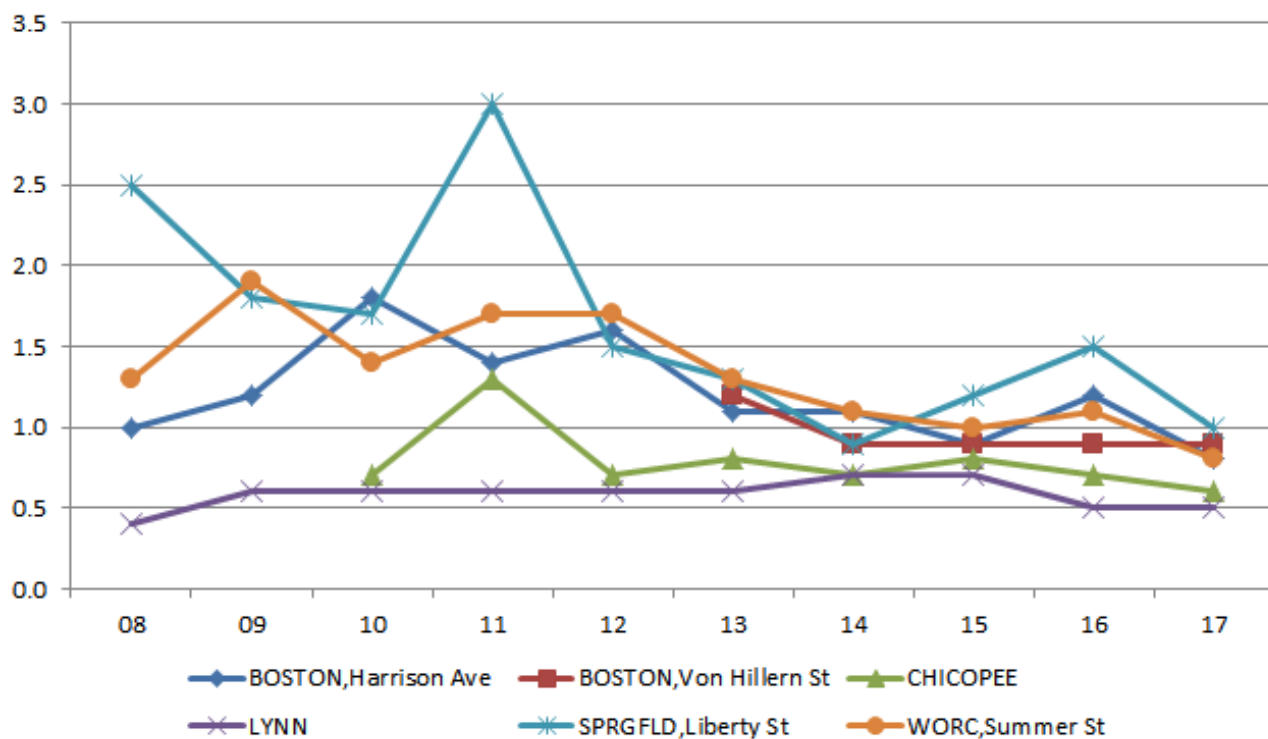
SITE ID = AIRS SITE IDENTIFICATION NUMBER; **1ST, 2ND MAX 1-HR** = FIRST AND SECOND HIGHEST 1-HOUR VALUE; **1ST, 2ND MAX 8-HR** = FIRST AND SECOND HIGHEST 8-HOUR VALUE



CO Trends

Figure 5 shows the trend of the 2nd maximum 8-hour average for each CO site over the past 10 years. The current 8-hour standard is 9 ppm.

Figure 5
Carbon Monoxide Trends 2008-2017
2nd Maximum 8-hour Values



Particulate Matter 10 Microns (PM₁₀) Summary

2017 PM₁₀ Data Summary

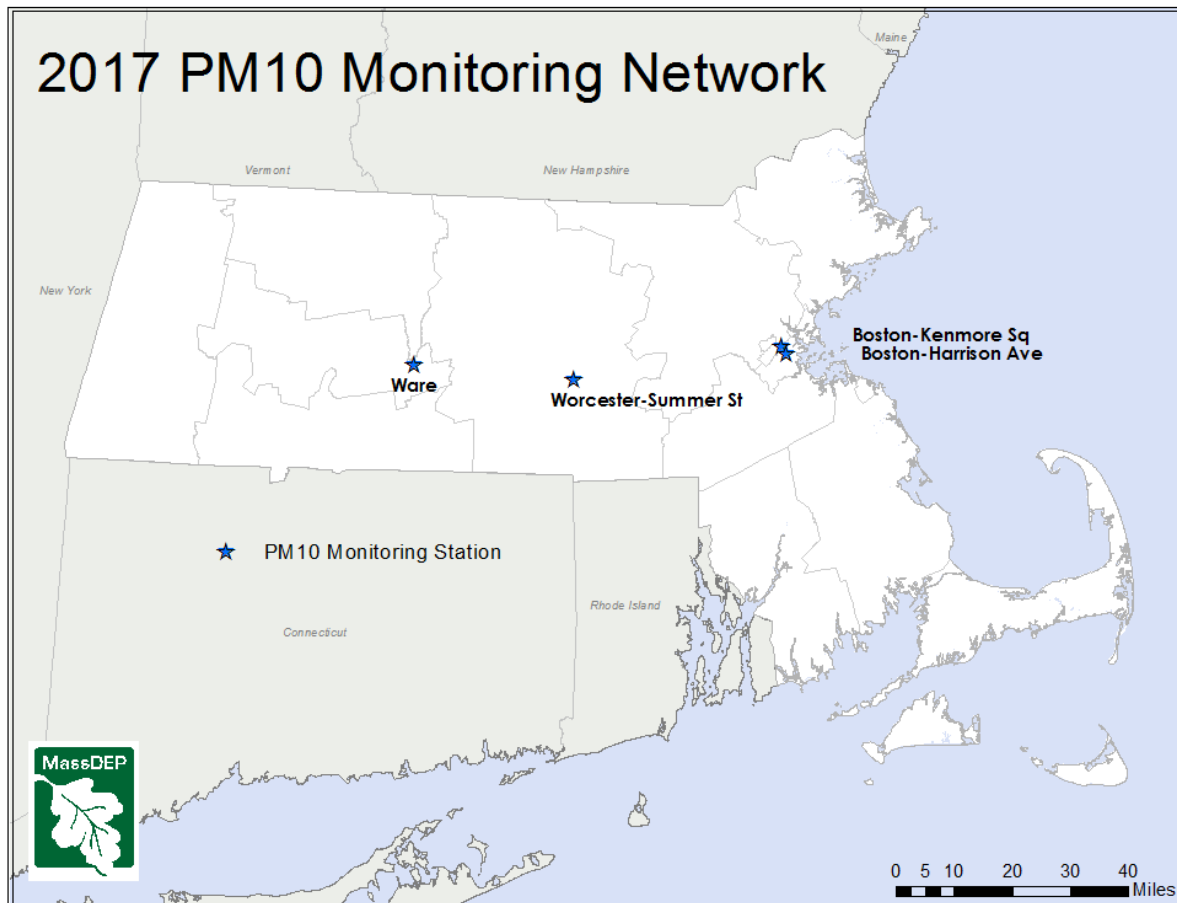
A summary of the 2017 PM₁₀ data is shown below (in $\mu\text{g}/\text{m}^3$). MassDEP operated five PM₁₀ monitors in 2017.

PM10 2017				1ST MAX 24-HR	2ND MAX 24-HR	3RD MAX 24-HR	4TH MAX 24-HR	DAYS MAX >STD	ARITH MEAN
SITE ID		CITY	COUNTY	ADDRESS					
25-013-0016		Springfield	Hampden	LIBERTY	22	21	19	18	0
25-015-4002		Ware	Hampshire	QUABBIN SUMMIT	18	18	16	15	0
25-025-0042		Boston	Suffolk	HARRISON AVE	36	27	26	22	0
25-025-0042	colloc	Boston	Suffolk	HARRISON AVE	26	22	21	20	0
25-027-0023		Worcester	Worcester	SUMMER ST	40	37	34	27	0

STANDARDS: 24-hour = 150 $\mu\text{g}/\text{m}^3$

ABBREVIATIONS AND SYMBOLS USED IN TABLE

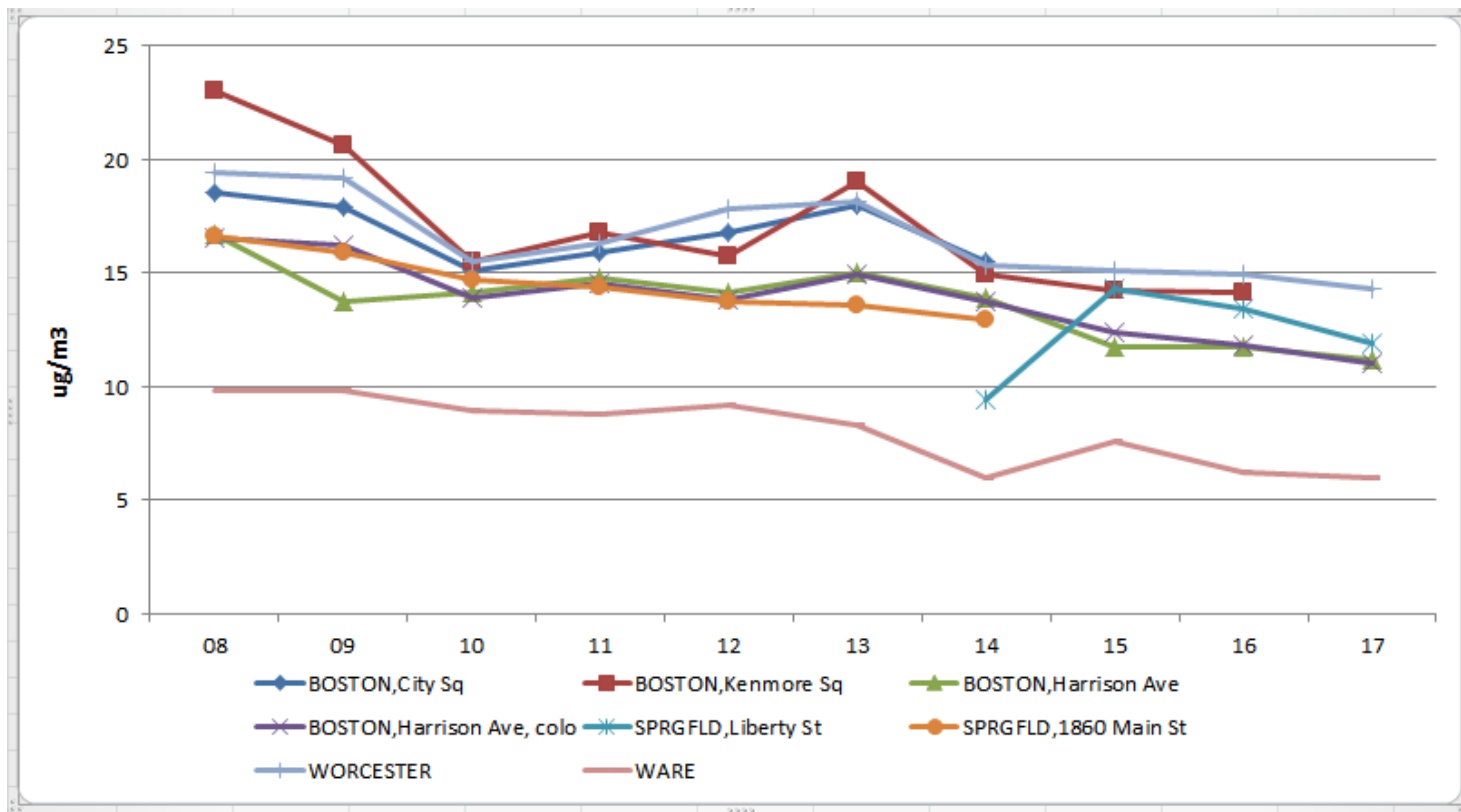
SITE ID = AIRS SITE IDENTIFICATION NUMBER; **COLLOC** = COLLOCATED; **1ST, 2ND, 3RD, 4TH 24-HR MAX** = 1ST, 2ND, 3RD, AND 4TH HIGHEST 24-HOUR VALUES FOR THE YEAR; **ARITH MEAN** = ANNUAL ARITHMETIC MEAN



PM₁₀ Trends

Figure 6 shows the trend of for each PM₁₀ site over the past 10 years using the annual arithmetic mean as an indicator.

Figure 6
PM₁₀ Trends 2008-2017
Annual Arithmetic Mean



Particulate Matter 2.5 Microns (PM_{2.5}) Summary

During 2017, MassDEP operated 16 Federal Reference Method (FRM) filter-based PM_{2.5} monitors and 14 Federal Equivalence Method (FEM) continuous PM_{2.5} monitors. FRM monitors require the manual set-up and collection of filters that collect 24-hour samples every three or six days. The filters are weighed prior to placement in the field and then weighed again after the sample is collected to determine the amount of PM_{2.5} collected on the filter. FEM monitors measure PM_{2.5} on an hourly basis. MassDEP operates FRM and FEM monitors side-by-side at some locations for comparison. In general, FEM monitors provide slightly higher values than FRM monitors, which may be due to measurement of fresh hourly PM_{2.5} samples with FEM versus slightly aged 24-hour samples with the FRM filter method.

2017 PM_{2.5} FRM Data Summary

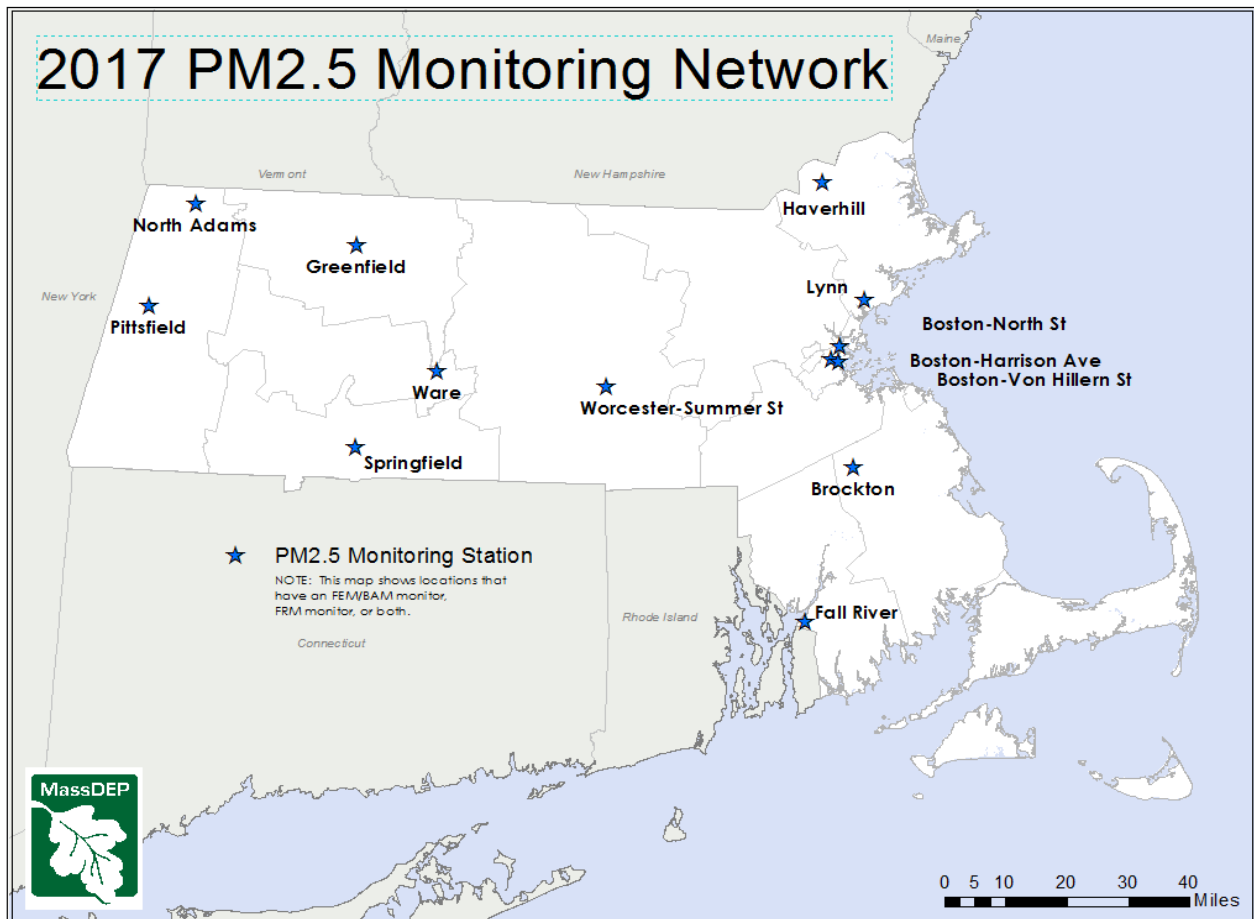
A summary of the 2017 PM_{2.5} FRM data is shown below (in µg/m³).

PM2.5 FRM 2017					1ST MAX	2ND MAX	3RD MAX	4TH MAX	98TH PERCENTILE	ARITH MEAN
SITE ID		CITY	COUNTY	ADDRESS	24-HR	24-HR	24-HR	24-HR	24-HOUR	
25-025-0002		Boston	Suffolk	KENMORE	13.6	13.1	12.2	11.9	12.2	6.05
25-025-0042		Boston	Suffolk	HARRISON AVE	12.3	12.2	12.1	11.4	12.1	5.33
25-025-0043		Boston	Suffolk	174 NORTH ST	23.4	15.3	15.0	14.9	14.1	7.21
25-025-0043	colloc	Boston	Suffolk	174 NORTH ST	24.3	21.7	16.0	15.7	14.6	7.19
25-025-0044		Boston	Suffolk	19 VON HILLERN	15.3	12.7	12.1	11.8	12.1	6.37
25-023-0005		Brockton	Plymouth	170 CLINTON	16.3	14.9	13.4	12.7	13.4	5.67
25-023-0005	colloc	Brockton	Plymouth	170 CLINTON	15.0	11.8	11.4	11.3	11.41	5.32
25-013-0008		Chicopee	Hampden	ANDERSON RD AFB	15.2	11.5	11.3	11.2	11.3	5.04
25-013-0008	colloc	Chicopee	Hampden	ANDERSON RD AFB	18.9	12.6	12.5	10.7	12.5	5.05
25-005-1004		Fall River	Bristol	659 GLOBE ST	14.0	12.6	12.3	12.1	12.3	5.11
25-011-2005		Greenfield	Franklin	VETERANS FIELD	14.7	13.4	12.7	12.6	12.7	5.89
25-009-5005		Haverhill	Essex	685 WASHINGTON	13.6	12.3	12.0	11.8	12.0	5.14
25-009-2006		Lynn	Essex	390 PARKLAND	22.5	12.7	12.7	11.1	12.7	4.90
25-003-5001		Pittsfield	Berkshire	78 CENTER ST	15.2	14.3	14.1	13.3	14.3	5.77
25-013-0016		Springfield	Hampden	LIBERTY STREET	14.7	14.7	14.5	13.5	14.5	6.08
25-027-0023		Worcester	Worcester	SUMMER ST	24.2	14.8	13.7	12.4	13.7	5.85

STANDARDS: Annual Mean = 12.0 µg/m³ (primary) 24-hour (98th percentile) = 35 µg/m³

ABBREVIATIONS AND SYMBOLS USED IN TABLE

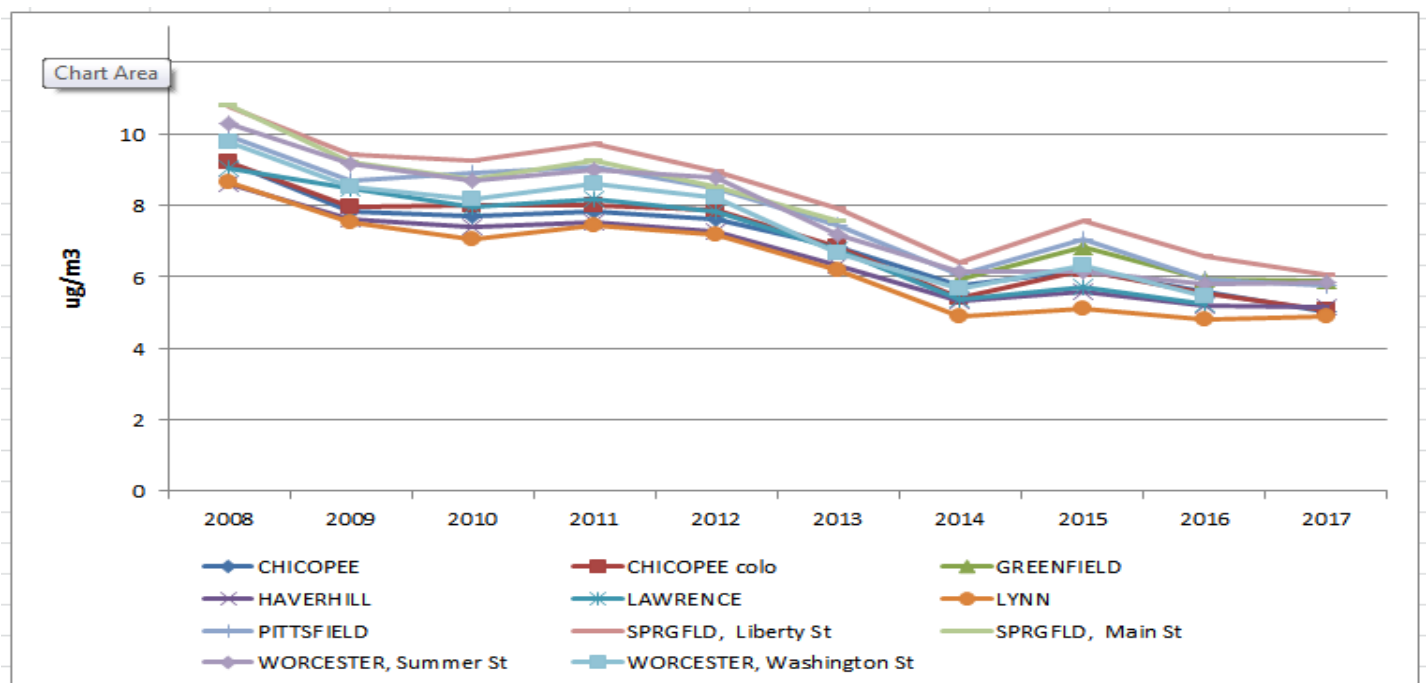
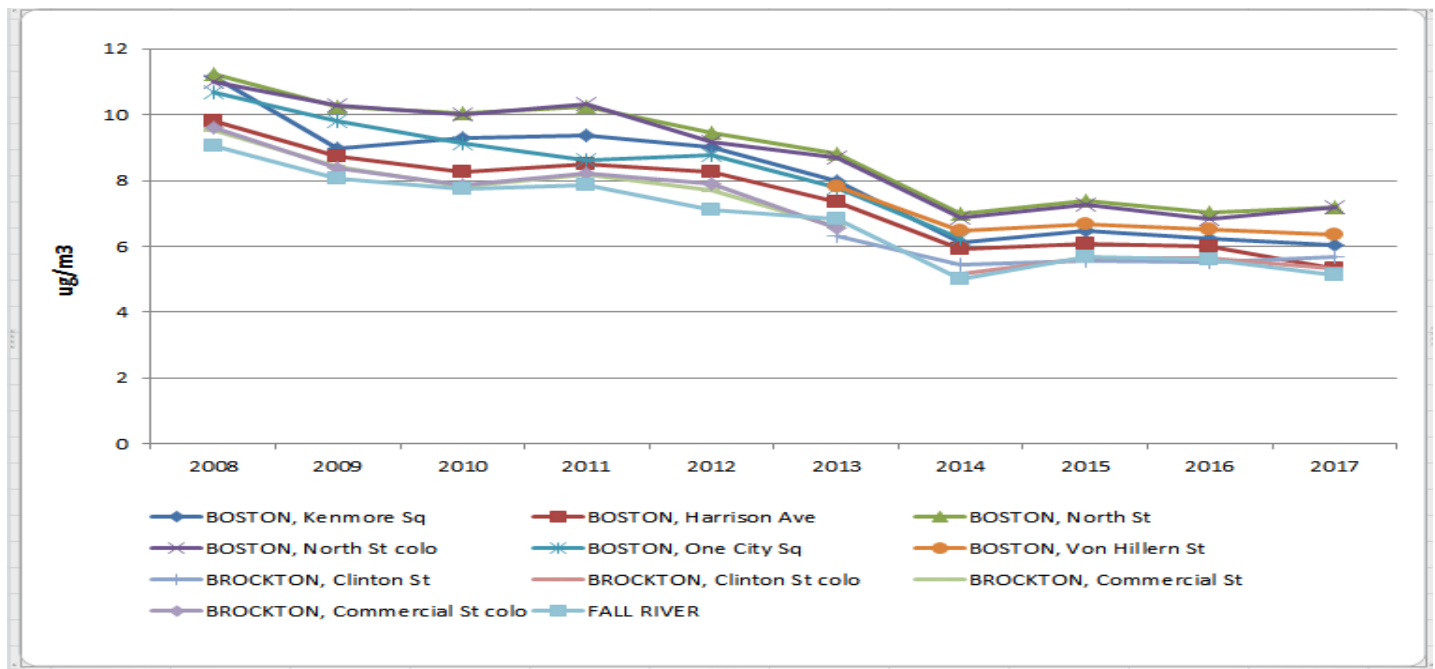
SITE ID = AIRS SITE IDENTIFICATION; **COLLOC** = COLLOCATED; **1ST, 2ND, 3RD, 4TH 24-HR MAX** = 1ST, 2ND, 3RD, AND 4TH HIGHEST 24-HOUR VALUES FOR THE YEAR; **98TH PERCENTILE 24-HR** = 98TH PERCENTILE VALUE FOR THE YEAR; **ARITH MEAN** = ANNUAL ARITHMETIC MEAN



PM_{2.5} FRM Trends

Figure 7 shows trends of the annual arithmetic mean for each PM_{2.5} FRM site over the past 10 years. The current annual primary standard is 12 µg/m³.

Figure 7
PM_{2.5} Trends 2008-2017
FRM Annual Arithmetic Mean



2017 PM_{2.5} FEM Data Summary

A summary of the 2017 PM_{2.5} FEM data is shown below (in µg/m³).

PM 2.5 FEM BAM 2017					1ST	2ND	3RD	4TH	98TH	
SITE ID		CITY	COUNTY	ADDRESS	MAX	MAX	MAX	MAX	PERCENTILE 24-HOUR	ARITH MEAN
25-025-0042		Boston	Suffolk	HARRISON AVE	30.0	18.0	17.9	17.4	16.4	7.61
25-025-0043		Boston	Suffolk	174 NORTH ST	22.2	18.1	17.7	17.5	16.6	8.79
24-025-0044		Boston	Suffolk	VON HILLERN ST	21.3	19.2	18.7	18.5	17.0	7.78
24-025-0044	colloc	Boston	Suffolk	VON HILLERN ST	26.1	24.2	24.2	24.1	25.0	10.79
25-023-0005		Brockton	Plymouth	1 CLINTON ST	17.6	17.5	17.3	17.2	15.5	4.51
25-005-1004		Fall River	Bristol	659 GLOBE ST	18.7	18.0	17.4	17.3	16.5	6.80
25-011-2005		Greenfield	Franklin	VETERANS FIELD	18.0	15.1	14.7	14.5	13.8	4.78
25-009-5005		Haverhill	Essex	685 WASHINGTON	14.9	14.8	14.7	14.2	12.7	5.25
25-009-2006		Lynn	Essex	390 PARKLAND	23.0	17.1	17.1	16.5	15.1	4.62
25-003-6001		North Adams	Berkshire	86 Holden ST	16.8	16.7	16.0	15.1	15.1	9.13
25-003-0006		Pittsfield	Berkshire	1 SOUTH ST	28.9	20.9	20.2	20.0	19.0	8.09
25-013-0016		Springfield	Hampden	LIBERTY ST	22.7	20.3	20.2	20.2	17.1	6.95
25-015-4002		Ware	Hampshire	QUABBIN SUMMIT	15.1	14.8	14.5	14.3	12.6	4.50
25-027-0023		Worcester	Worcester	SUMMER ST	16.2	15.5	15.4	14.7	14.2	5.10

STANDARDS: Annual Mean = 12.0 µg/m³ (primary) 24-hour (98th percentile) = 35 µg/m³

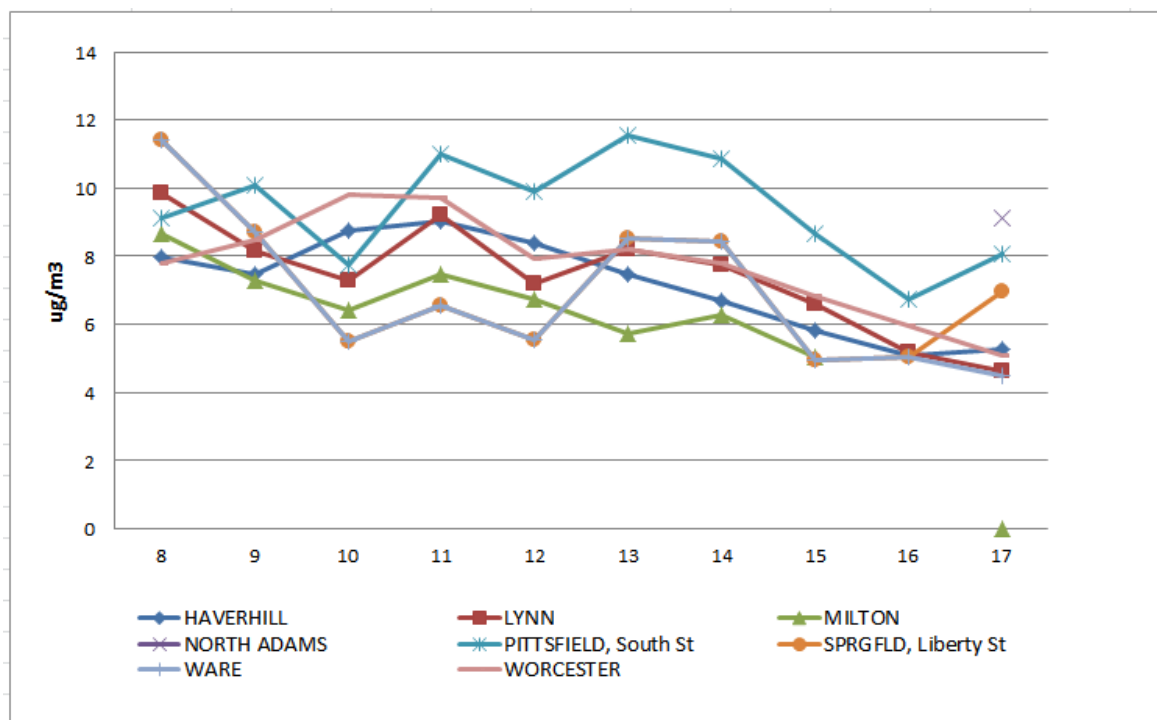
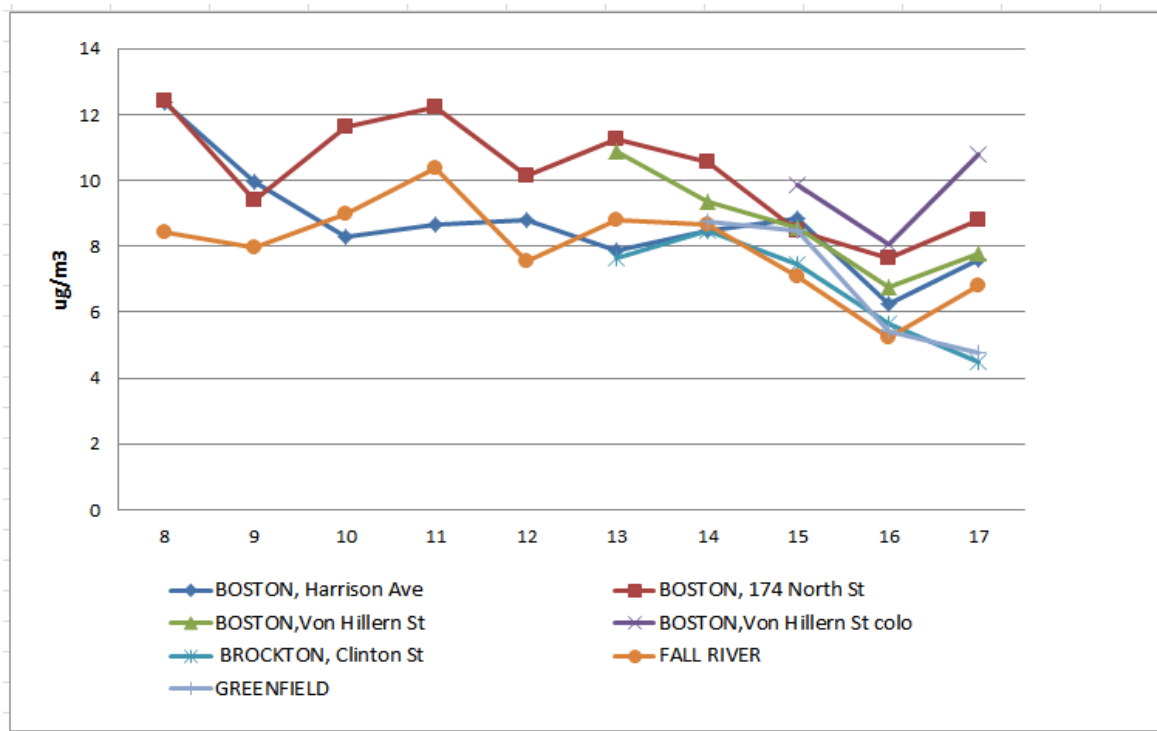
ABBREVIATIONS AND SYMBOLS USED IN TABLE

SITE ID = AIRS SITE IDENTIFICATION; **1ST, 2ND, 3RD, 4TH MAX** = 1ST, 2ND, 3RD, AND 4TH HIGHEST 24-HOUR VALUES FOR THE YEAR;
98TH PERCENTILE 24-HR = 98TH PERCENTILE VALUE FOR THE YEAR; **ARITH MEAN** = ANNUAL ARITHMETIC MEAN

PM_{2.5} FEM Trends

Figure 8 shows trends of the annual arithmetic mean for each PM_{2.5} FEM site over the past 10 years. The current annual primary standard is 12 $\mu\text{g}/\text{m}^3$.

Figure 8
PM_{2.5} Trends 2008-2017
FEM Annual Arithmetic Mean



Speciation

MassDEP collects PM_{2.5} samples for speciation in Boston (Harrison Avenue) and Chicopee. Speciation involves analysis of particulate matter to determine its chemical composition and to identify air pollution sources that affect the area around the monitoring station. Pollutants analyzed include elements (e.g., metals), sulfates, nitrates, and carbon (total and organic).

IMPROVE (Interagency Monitoring of Protected Visual Environments)

IMPROVE is a nationwide program designed to assess air quality at rural locations where air pollution may affect visibility over long distances (e.g., mountain ranges or scenic vistas). During 2017, the National Park Service operated an IMPROVE sampler at the Truro monitoring site, and the Wampanoag Tribe operated an IMPROVE sampler at its Martha's Vineyard monitoring site. These samplers acquire PM_{2.5} filter samples for speciation analysis to determine effects on visibility. Data can be viewed at the IMPROVE web site at <http://vista.cira.colostate.edu/improve/Data/data.htm>.

QUALITY CONTROL AND QUALITY ASSURANCE

In order to ensure that all air quality data is of acceptable and consistent quality, MassDEP has developed standard operating procedures (SOPs) based on federal requirements that include quality control and quality assurance protocols that systematically assess the entire sample collection and data handling system on an ongoing basis. Ambient air monitoring quality assurance requirements are contained in the Federal Regulations at 40 CFR Part 58, Appendix A – E. Each year MassDEP certifies that it is in compliance with the federal requirements. A few of the considerations that affect sample collection data quality are:

- Site Placement
- Intake Probe Material
- Intake Probe Height
- Spacing from roadways and trees

For data processing there are quantitative statistics and qualitative descriptors used to interpret the degree of acceptability and utility of data. Examples of these data quality indicators are:

- Representativeness
- Precision
- Bias
- Detectability
- Completeness
- Comparability

MassDEP's Air Assessment Branch maintains a Quality Assurance Group that ensures that samples are collected correctly and conducts performance audits throughout the air monitoring network to verify data validity. There also is a Quality Control Group that reviews daily monitored data for validity, tracks precision results, finalizes monthly values, and submits air quality data to EPA's database in a timely manner. Computer software tools, report queries, and "eyes on" data reviews all are used to validate data before it is submitted to EPA. EPA also conducts its own performance audits on MassDEP samplers and every three years conducts thorough Technical Systems Audit (TSA). The latest TSA was conducted in 2016.

Section IV

PAMS/Air Toxics Monitoring

PAMS Monitoring

Ground-level ozone is a secondary pollutant and is not discharged directly to the atmosphere from a stack or tailpipe, but forms in the atmosphere from the photochemical reactions of other pollutants such as VOCs and NO_x. Ozone formation can occur many miles downwind from the source of the original emissions. These reactions occur in the presence of strong sunlight and are most pronounced during the hottest days of the summer. The PAMS (Photochemical Assessment Monitoring Stations) program was established by the 1990 Clean Air Act Amendments as a way to collect data for assessing NAAQS attainment progress independent of the meteorological variation that occurs between years and for identifying appropriate pollution control strategies. MassDEP currently operates PAMS stations in Lynn and Chicopee.

PAMS is a special designation for enhanced monitoring stations that are designed to gather information on the ozone formation process. Instruments at these sites measure pollutants and meteorological parameters that are specific to the photochemical processes by which ozone is created in the atmosphere at ground level. In addition to the pertinent NAAQS pollutants (ozone, NO₂, etc.), non-criteria pollutants, including VOCs, are measured at PAMS stations on either an hourly basis or at regular intervals during the hottest part of the summer in June, July and August. Meteorology is a critical component of ozone formation and each PAMS site has a full complement of meteorological sensors including wind speed, wind direction, temperature, relative humidity, barometric pressure, solar radiation and at some sites, total ultraviolet light and precipitation.

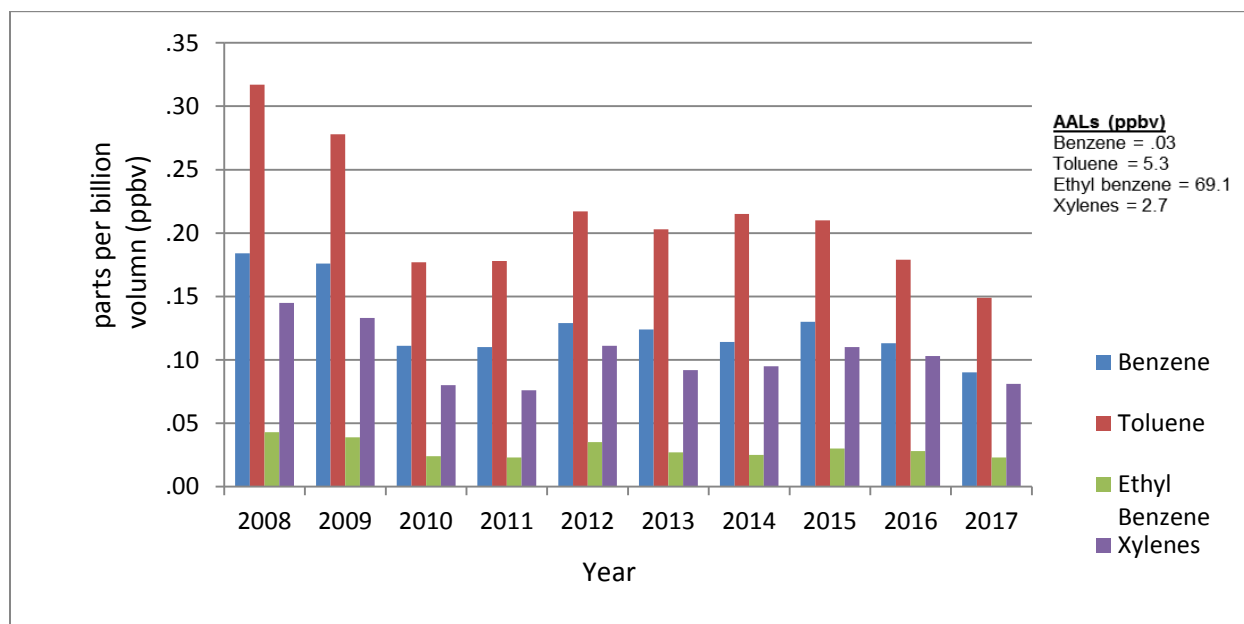
Air Toxics Monitoring

Toxic air pollutants are known or suspected to cause cancer or other serious health effects. Air toxics include certain volatile organic compounds (VOCs) and toxic metals (e.g., arsenic, cadmium).

The Boston (Harrison Avenue) monitoring site is designated as a National Air Toxics Trends Station (NATTS) designed to collect and quantify a number of toxic air pollutants, including VOCs, metals, carbonyls, black carbon and polycyclic aromatic hydrocarbons (PAHs). Data from this site is compared with data from a network of similar sites across the country to identify transport, trends and site-specific characteristics of these pollutants.

MassDEP also monitors VOCs as part of the PAMS monitoring program, some of which are classified as air toxics. Figure 9 summarizes concentrations health-relevant VOCs measured at the Lynn PAMS site for the past 10 years. Allowable Ambient Limit (AAL) values are presented for reference. AALs are health-based air toxics guidelines developed by MassDEP based on known or suspected carcinogenic and toxic health properties of individual compounds. AAL concentrations were developed for a 70-year lifetime exposure, but are used for comparison with annual averages.

Figure 9
Lynn Toxics VOC Summary 2008– 2017
24-hour samples



The table below summarizes 24-hour concentrations of target VOCs measured at the Boston (Harrison Ave) and Lynn sites for 2017. Harrison Avenue serves as the central city sampling location and Lynn serves as the area background site.

2017 Compound	BOSTON (Harrison Ave)		Lynn	
	Max Value ppb	Mean ppb	Max Value ppb	Mean ppb
1,3-butadiene	0.038	0.015	0.030	0.009
1,1,1-trichloroethane	0.000	0.000	0.000	0.000
trichloroethylene	0.000	0.000	0.000	0.000
tetrachloroethylene	0.050	0.000	0.050	0.005
Benzene	0.233	0.117	0.250	0.090
Toluene	0.871	0.210	0.514	0.149
Xylenes	0.288	0.125	0.238	0.081
Ethylbenzene	0.063	0.031	0.063	0.023

Samples collected at the Harrison Avenue site are analyzed for a suite of metals that are known to be toxic in the environment. The table below summarizes the 2017 metals data.

BOSTON (Harrison Ave)			
2017			
METAL	# of Samples	Max Value ug/m3	Mean ug/m3
Antimony	55	.00489	.00150
Arsenic	55	.00189	.00042
Beryllium	55	.00002	.00001
Cadmium	55	.00017	.00007
Chromium	55	.00635	.00442
Cobalt	55	.00020	.00008
Lead	52	.00600	.00206
Manganese	55	.00926	.00425
Mercury	55	.00009	.00001
Nickel	55	.03640	.00159
Selenium	55	.00064	.00022

Appendix A

2017 Monitoring Station Locations

SITE ID	CITY	COUNTY	ADDRESS	PARAMETERS MONITORED
25-007-0001	AQUINNAH*	DUKES	HERRING CREEK RD	O3, IMPROVE
25-025-0002	BOSTON	SUFFOLK	KENMORE SQUARE	NO, NO2, NOx, SO2, PM2.5
25-025-0042	BOSTON	SUFFOLK	HARRISON AVENUE	O3, NO, NO2, NOx, NOy, SO2, CO, PM2.5, PM10, PM Coarse, PM2.5 Speciation, Toxics, Carbonyls, Black Carbon, WS/WD, WSv/WDv, TEMP, SUN, REL, BP
25-025-0043	BOSTON	SUFFOLK	174 NORTH ST	PM2.5, Black Carbon
25-025-0044	BOSTON	SUFFOLK	VON HILLERN ST	NO, NO2, NOx, CO, PM2.5, Black Carbon, WS/WD, TEMP, SUN, REL, BP
25-023-0005	BROCKTON	PLYMOUTH	170 CLINTON ST	O3, PM2.5
25-017-0009	CHELMSFORD	MIDDLESEX	11 TECHNOLOGY DR	O3
25-013-0008	CHICOPEE	HAMPDEN	ANDERSON RD	O3, NO, NO2, NOx, CO, PM2.5, PM2.5 speciation, VOCs, Carbonyls, WS/WD, TEMP, SUN, REL, BP
25-005-1006	FAIRHAVEN	BRISTOL	HASTINGS SCHOOL	O3, WS/WD, TEMP, SUN, REL, BP
25-005-1004	FALL RIVER	BRISTOL	GLOBE ST	O3, SO2, PM2.5
25-011-2005	GREENFIELD	FRANKLIN	16 BARR AVE	O3, PM2.5, Black Carbon, WS/WD, TEMP, SUN, REL, BP
25-009-5005	HAVERHILL	ESSEX	WASHINGTON ST	O3, PM2.5, WS/WD, TEMP, SUN, REL, BP
25-009-2006	LYNN	ESSEX	390 PARKLAND	O3, NO, NO2, NOx, CO, PM2.5, VOCs, Toxics, Carbonyls, WS/WD, TEMP, SUN, REL, BP, PRECIP
25-021-3003	MILTON	NORFOLK	BLUE HILL	O3, NO, NO2, NOx, VOCs, WS/WD, TEMP, SUN, REL, BP
25-009-4005	NEWBURYPORT	ESSEX	HARBOR STREET	O3, NO, NO2, NOx, NOy, VOCs, WS/WD, TEMP, SUN, REL, BP
25-003-6001	NORTH ADAMS	BERKSHIRE	86 HOLDEN STREET	PM2.5, Black Carbon
25-003-5001	PITTSFIELD	BERKSHIRE	78 CENTER STREET	PM2.5
25-003-0006	PITTSFIELD	BERKSHIRE	BERKSHIRE COMMONS	PM2.5
25-013-0016	SPRINGFIELD	HAMPDEN	LIBERTY STREET	NO, NO2, NOx, SO2, CO, PM2.5, PM10, Black Carbon, Lead
25-001-0002	TRURO	BARNSTABLE	FOX BOTTOM AREA	O3, WS/WD, TEMP, SUN, REL, BP, IMPROVE
25-027-0024	UXBRIDGE	WORCESTER	366 E HARTFORD AVE	O3, WS/WD, TEMP, SUN, REL, BP
25-015-4002	WARE	HAMPSHIRE	QUABBIN SUMMIT	O3, NO, NO2, NOx, NOy, SO2, PM10, VOCs, PM2.5, WS/WD, TEMP, SUN, REL, BP, PRECIP
25-027-0015	WORCESTER	WORCESTER	WORC. AIRPORT	O3, WS/WD, TEMP, SUN, REL, BP
25-027-0023	WORCESTER	WORCESTER	SUMMER STREET	NO, NO2, NOx, SO2, CO, PM2.5, PM10

* Wampanoag Tribal Site