Massachusetts 2012 Air Quality Report

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

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This 2012 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 throughout the Commonwealth. All samples are collected in a precise and scientifically sound manner in order to properly characterize the quality of the air in the state and to accurately assess the exposure of its citizens to airborne pollutants.

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The photo on the cover is a view of the Nantucket Airport lead monitoring station that operated as part of a special study from February 2012 to February 2013.

This report is available on MassDEP's web site at
www.mass.gov/eea/agencies/massdep/air/quality/air-monitoring-reports-and-studies.html

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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
RASS ..... Radio Acoustic Sounding System
RH ..... Relative Humidity
SIP..... State Implementation Plan
SO_2 ..... Sulfur Dioxide
SO_4 ..... Sulfate
Solar Rad..... Solar Radiation
SVOC.....Semi-Volatile Organic Compounds
TSP..... Total Suspended Particulates
$\mu g/m^3$..... micrograms per cubic meter
VOCs ..... Volatile Organic Compounds
WS/WD..... Wind Speed/Wind Direction

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 2012, MassDEP operated a network of 27 monitoring stations located in 19 cities and towns, and oversaw the operation of one source-oriented privately funded site in the Boston area. MassDEP also received data from the Wampanoag Tribe of Gay Head (Aquinnah), which operates an air monitoring station on Martha's Vineyard, and from the U.S. Environmental Protection Agency (EPA), New England Regional Laboratory, which operates an air monitoring station in Chelmsford.

MassDEP submits all ambient air quality data to the national Air Quality System (AQS) database that is administered by EPA. In addition, MassDEP *MassAir Online* website allows users to point and click on a map of the state to find current, near real-time air quality data for any location in the MassDEP air monitoring network that has a continuous air monitor. MassAir Online is found at www.mass.gov/eea/agencies/massdep/air/quality/

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 are subject to National Ambient Air Quality Standards (NAAQS). The criteria pollutants monitored are:

- sulfur dioxide (SO_2)
- ozone (O_3)
- carbon monoxide (CO)
- nitrogen dioxide (NO_2)
- lead (Pb)
- particulate matter $\leq$10 microns (PM_{10})
- particulate matter $\leq$ 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)
- total suspended particulates (TSP)
- 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

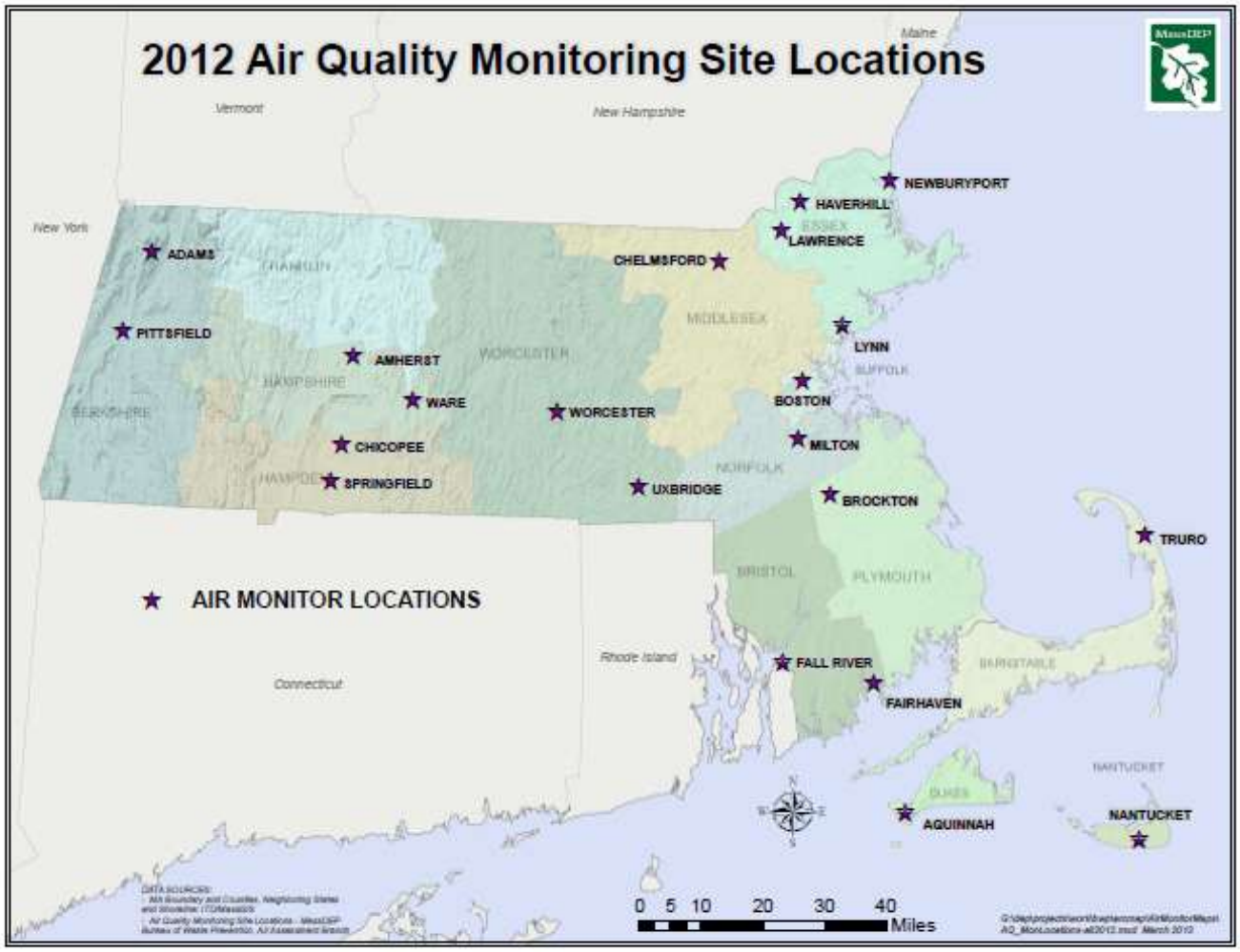
Meteorological parameters monitored include:

- wind speed/wind direction (WS/WD)
- relative humidity (RH)
- temperature (TEMP)
- barometric pressure (BP)
- solar radiation (Solar Rad)
- 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 located in areas that will provide data that is representative of larger geographical areas. Local topography and the location of pollutant sources are factors that determine how well a particular monitor's location will represent an area.

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 2012.


2012 Air Quality Monitoring Site Locations
Maine
Vermont
New Hampshire
New York
Connecticut
Rhode Island
ADAMS
PITTSFIELD
AMHERST
WARE
CHICOPEE
SPRINGFIELD
WORCESTER
CHELMSFORD
UXBRIDGE
NEWBURYPORT
HAVERHILL
LAWRENCE
LYNN
BOSTON
MILTON
BROCKTON
TRURO
FALL RIVER
FAIRHAVEN
AQUINNAH
NANTUCKET
AIR MONITOR LOCATIONS
0 5 10 20 30 40
Miles

National Ambient Air Quality Standards

Below are the most 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 µg/m^3	Not to be exceeded
Nitrogen Dioxide		primary	1-hour	100 ppb	98th percentile, averaged over 3 years
		primary and secondary	Annual	0.053 ppm	Annual Mean
Ozone		primary and secondary	8-hour	0.075 ppm	Annual fourth-highest daily maximum 8-hr concentration, averaged over 3 years
Particle Pollution	$PM_{2.5}$	primary	Annual	12 µg/m^3	annual mean, averaged over 3 years
		secondary	Annual	15 µg/m^3	annual mean, averaged over 3 years
		primary and secondary	24-hour	35 µg/m^3	98th percentile, averaged over 3 years
	PM_{10}	primary and secondary	24-hour	150 µg/m^3	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^3 = micrograms per cubic meter; ppm = parts per million; ppb = parts per billion

Pollutant Health Effects and Sources

Ozone (O_3)

- Ground-level, or Tropospheric O_3 and Stratospheric O3 in the upper atmosphere are the same chemical compound, just found at different places in the atmosphere. Stratospheric O_3 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 O_3 and increased risk of premature death.
- O_3 is toxic to vegetation, inhibiting growth and causing leaf damage.
- O_3 deteriorates materials such as rubber and fabrics.
- Ground-level O_3 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 O_3 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 (SO_2)

- SO_2 combines with water vapor to form acidic aerosols harmful to the respiratory tract, aggravating symptoms associated with lung diseases such as asthma and bronchitis.
- SO_2 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.
- SO_2 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 (NO_2)

- NO_2 lowers resistance to respiratory infections and aggravates symptoms associated with asthma and bronchitis.
- NO_2 contributes to acid deposition. Impacts of acid deposition include: acidification of lakes and streams, damage to vegetation, damage to materials, and diminution of visibility.
- NO_2 and NO contribute to the formation of ozone.
- NO_2 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 (PM_{10} 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 or less than that size), measured in microns, 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 mental retardation, 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 MassDEP operated in 2012.

Network Size

- 27 monitoring stations
- 19 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 3 trace-level CO monitors
  - 10 – NO_2 (nitrogen dioxide). NO (nitric oxide) and NO_x (total nitrogen oxides) also are measured by these monitors.
  - 15 – O_3 (ozone)
  - 6 – SO_2 (sulfur dioxide), which includes 3 trace-level SO_2 monitors

- Meteorological monitors track weather conditions.
  - 13 – BP (barometric pressure)
  - 13 – RH (relative humidity)
  - 13 – Solar Rad (solar radiation)
  - 13 – TEMP (temperature)
  - 13– WS/WD (wind speed/wind direction)
  - 2 – Precipitation

- Other Monitors
  - 3 – NO_y (Total Reactive Oxidized Nitrogen)
  - 4 – PAMS (photochemical assessment monitoring station). These monitors measure VOCs (volatile organic compounds) using automated gas chromatographs (GCs) on an hourly basis during the summer.
  - 10 – $PM_{2.5}$ (particulate matter – 2.5 microns) Beta Attenuation Monitors (BAMs)
  - 3 – 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 is averaged in 3-hour or 24-hour intervals.

- Criteria pollutant monitors measure pollutants that have National Ambient Air Quality Standards (NAAQS).
  - 3 – Pb (Lead)
  - 7 – PM_{10} (particulate matter – 10 microns)
  - 18 – $PM_{2.5}$ FRM (particulate matter – 2.5 microns Federal Reference Method)

- Non-criteria pollutant monitors measure pollutants that do not have NAAQS.
  - 4 – PAMS (photochemical assessment monitoring station). These monitors measure VOCs (volatile organic compounds) on a less intensive schedule than during the summer months.
  - 2 – Toxics. These monitors measure health-relevant VOCs.
  - 2 – Speciation. These monitors measure for $PM_{2.5}$, nitrates, and organics.
  - 1 – PM_{10} (particles for toxic metals)

In addition to MassDEP's monitoring network, MassDEP oversaw one private monitoring station located in Boston that submits data to MassDEP. The station monitors SO_2, SO_4, TSP, and NO_2 (as well as NO_x and NO) and wind speed/wind direction.

Section II
Attainment and Exceedances of Air Quality Standards

Attainment Status Summary

The Clean Air Act (CAA) contains timeframes and milestones for states to meet and maintain National Ambient Air Quality Standards (NAAQS) for criteria pollutants. EPA sets NAAQS at levels to protect public health and the environment. 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).

Massachusetts was designated as nonattainment with the 1997 8-hour ozone standard of 0.08 parts per million (ppm). However, all monitors now show that Massachusetts meets the 1997 ozone standard statewide. EPA updated the 8-hour ozone standard to 0.075 ppm in 2008, and designated Massachusetts as attainment statewide except for Dukes County in 2011. Massachusetts is designated as attainment or unclassifiable for the other criteria pollutants, including carbon monoxide, lead, nitrogen dioxide, particulate matter (including PM_{10} and $PM_{2.5}$), and sulfur dioxide.

Carbon Monoxide

Prior to the mid-1980s, Massachusetts was in violation of the CO standards. However, with the adoption of numerous control programs, CO emissions have significantly decreased. The last violation in the state of the CO standards occurred in 1986. In 2000, MassDEP formally requested that the EPA re-designate the cities of Lowell, Springfield, Waltham, and Worcester as attainment for CO since the CO monitoring data for those cities had been below the standard for many years. Those cites were the re-designated to CO attainment in April 2002, and the entire state is in attainment. In 2011, EPA established new near-road monitoring requirements for CO beginning in January 2015.

Lead

In October 2008, EPA lowered the lead standard from 1.5 µg/m³ to 0.15 µg/m³ averaged over a rolling 3-month period and established new monitoring requirements. In October 2009, Massachusetts recommended to EPA that Suffolk County be designated in attainment of the 2008 lead standard based on historic lead monitoring in Boston showing levels below the new standard, and that the remainder of the state be designated unclassifiable (since there were no lead monitors outside of Boston). In November 2011, EPA designated all of Massachusetts as unclassifiable/ attainment for the 2008 standard. In January 2011, MassDEP began monitoring lead in Boston (Harrison Avenue) in accordance with the new monitoring requirements, and also in Springfield (Main Street). In February 2012, MassDEP also began monitoring lead for a one year period at

[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 .

Nantucket Memorial Airport in accordance with the new monitoring requirements (completed in February 2013).

Nitrogen Dioxide

In January 2010, EPA established a new 1-hour NO_2 standard of 100 parts per billion (ppb) and new near-road monitoring requirements beginning in January 2014. All eleven NO_2 monitors show levels that meet the new standard, and in January 2012, EPA designated all of Massachusetts as unclassifiable/attainment. MassDEP began near-road NO_2 monitoring in June 2013 in accordance with the new monitoring requirements.

Sulfur Dioxide

In June 2010, EPA established a new 1-hour SO_2 standard of 75 ppb and new monitoring requirements that began in January 2013. All six SO_2 monitors show levels that meet the new standard. EPA is developing rules for determining designations for areas where existing monitors meet the SO_2 standard that will focus on characterizing SO_2 levels around the largest sources of across the country.

Particulate Matter

There are currently two NAAQS particulate matter standards: PM_{10} and $PM_{2.5.}$ Massachusetts has been in attainment of the PM_{10} standard for several years. The $PM_{2.5}$ standards went into effect in 1997 and the daily $PM_{2.5}$ standards were revised in 2006. Massachusetts is designated as unclassifiable/attainment for the 1997/2006 $PM_{2.5}$ standards statewide. On December 14, 2012, EPA lowered the primary annual $PM_{2.5}$ standard to 12 $\mu g/m^3$ (from 15 $\mu g/m^3$) and established new near-road monitoring requirements beginning in January 2015 for the largest urban areas. Currently, all $PM_{2.5}$ monitors in Massachusetts measure levels below the new standard. EPA anticipates making final attainment/nonattainment designations for the new standard by December 2014.

Ozone

For decades, the NAAQS for ozone was based on the maximum 1-hour ozone concentration that occurred each day during the ozone monitoring season. 1-hour ozone concentrations are still tracked as an indicator but are no longer used for determining attainment.

In 1997, EPA promulgated a new 8-hour ozone standards that were designed to be more representative of exposure over time, rather than just the maximum concentration. Massachusetts was designated as nonattainment of these standards. However, ozone monitors currently show that Massachusetts meets the 1997 ozone standards statewide.

In 2008, EPA lowered the 8-hour ozone standards to 0.075 ppm. In April 2012, EPA designated Dukes County as nonattainment (marginal classification) of the 2008 ozone standards and designated the remainder of the state as unclassifiable/attainment.

Ozone Exceedances

What Determines an Exceedance?

An ozone exceedance occurs when monitored ozone concentrations exceed the National Ambient Air Quality Standards (NAAQS). Ozone 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 standard is an 8-hour averaged value that is greater than 0.075 ppm.

The Difference Between an Exceedance and a Violation

An ozone exceedance occurs when a monitor records ambient levels of ozone above the standard. A violation of an ozone standard (as opposed to an exceedance) is based on 3-year averages of data at each monitor, so monitoring an exceedance does not mean that a violation of the standard has occurred.

Violations of the 8-hour standard are determined using the annual 4^{th}-highest daily maximum 8-hour ozone value at each monitor. A violation requires a 3-year average of the annual 4^{th}-highest daily maximum 8-hour value that is greater than 0.075 ppm. In other words, the 8-hour values for each day during a year for a specific monitor are ranked from highest to lowest. Then, the 4^{th}-highest value for 3 consecutive years is averaged. If the 3-year average is greater than 0.075 ppm, a violation of the 8-hour standard has occurred at that monitoring site.

Ozone Exceedances and Violations During 2012

Exceedances

The Table below shows the 2012 ozone exceedances. There were 17 days when the 8-hour ozone standards of 0.075 ppm were exceeded at one or more monitoring stations. There were 41 exceedances during those 17 days (i.e., multiple monitors exceeded the standards on the same day).

Violations

Violations of the ozone standards are based on 3-year averages. Using data from 2010–2012, one site out of 15 violated the 8-hour standards of 0.075 ppm. This violation occurred at the Aquinnah Tribal Site on Martha's Vineyard, which had a 3-year average of 0.080 ppm.

2012 Ozone Exceedances (ppm)

DATE	SITE	**8-HOUR >0.075 ppm**	START HOUR	1-HOUR MAX (ppm) for the day
May 13, 2012	Ware	0.076	13	0.082
June 20, 2012	Truro	0.077	13	0.081
June 20, 2012	Aquinnah Tribal Site	0.094	16	0.106
June 21, 2012	Aquinnah Tribal Site	0.100	18	0.115
June 22, 2012	Fall River	0.078	9	0.084
June 22, 2012	Truro	0.080	10	0.083
June 22, 2012	Aquinnah Tribal Site	0.080	11	0.094
June 29, 2012	Fall River	0.090	16	0.102
June 29, 2012	Truro	0.079	16	0.099
June 29, 2012	Milton, Blue Hill	0.078	12	0.085
June 29, 2012	Aquinnah Tribal Site	0.083	16	0.090
June 30, 2012	Fall River	0.082	15	0.095
June 30, 2012	Truro	0.088	16	0.109
June 30, 2012	Aquinnah Tribal Site	0.077	16	0.089
July 1, 2012	Aquinnah Tribal Site	0.078	12	0.097
July 7, 2012	Aquinnah Tribal Site	0.076	11	0.090
July 13, 2012	Amherst	0.082	12	0.086
July 13, 2012	Chicopee	0.084	11	0.104
July 13, 2012	Haverhill	0.079	10	0.090
July 13, 2012	Newburyport	0.080	10	0.098
July 14, 2012	Fall River	0.077	14	0.084
July 14, 2012	Truro	0.077	13	0.081
July 14, 2012	Aquinnah Tribal Site	0.082	16	0.097
July 15, 2012	Lynn	0.076	9	0.081
July 17, 2012	Chicopee	0.076	15	0.102
July 17, 2012	Boston, Long Island	0.085	16	0.103
July 17, 2012	Lynn	0.091	16	0.114
July 17, 2012	Ware	0.079	15	0.107
July 17, 2012	Worcester	0.092	14	0.127
July 17, 2012	Boston, Harrison Ave.	0.080	16	0.106
July 17, 2012	Milton, Blue Hill	0.080	16	0.098
July 17, 2012	Haverhill	0.089	16	0.107
July 17, 2012	Uxbridge	0.086	16	0.111
July 17, 2012	Newburyport	0.082	16	0.096
July 17, 2012	Chelmsford EPA site	0.089	16	0.113
July 18, 2012	Fall River	0.080	8	0.104
August 9, 2012	Haverhill	0.079	10	0.099
August 17, 2012	Ware	0.077	12	0.094
August 31, 2012	Fall River	0.078	13	0.091
August 31, 2012	Truro	0.085	13	0.099
September 13, 2012	Ware	0.076	13	0.080

Exceedance Days and Total Exceedance Trends

Figures 1 and 2 show the trend in the number of 1-hour and 8-hour exceedance days and the total number of exceedances for each year.

Figure 1 shows a decline in the number of days in which ozone concentrations exceeded the former 1-hour standard of 0.12 ppm. Figure 2 shows that, under the 0.075 ppm 8-hour standard, there were a greater number of exceedances and exceedance days when compared to the former 1-hour standard. The 8-hour standard is designed to be more protective of public health by being more representative of exposure over time rather than a maximum concentration.

Figure 1
1-hr Ozone Exceedance Days and Total Exceedances 1987-2012
1-hour standard = 0.12 ppm (revoked June 15, 2005)

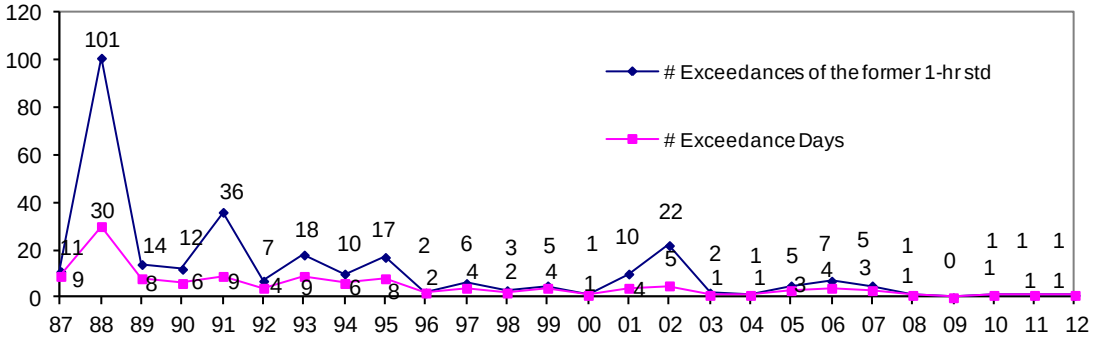
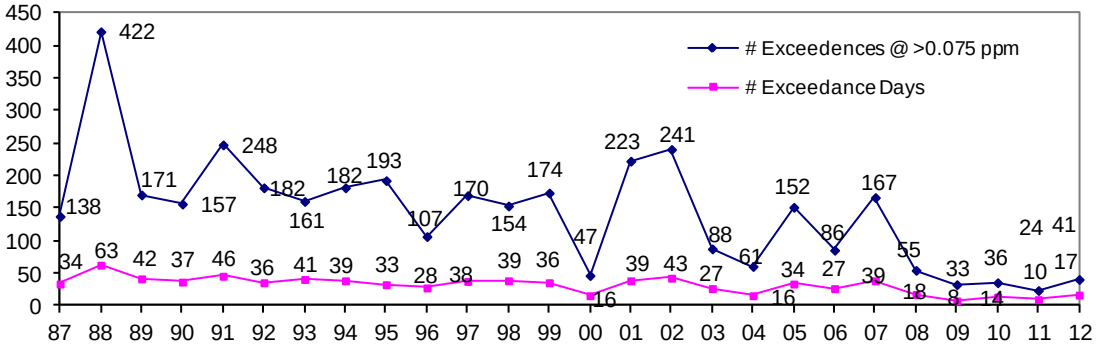


Figure 2
8-hr Ozone Exceedance Days and Total Exceedances 1987-2012
8-hour standard = 0.075 ppm
Years 1987-2007 show what exceedances
would have been with a 0.075 ppm 8-hour standard



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/ or by calling the Air Quality Hotline (1-800-882-1497). 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

Index Values	Levels of Health Concern	Cautionary Statements
0-50	Good	None
51-100*	Moderate	Unusually sensitive people should consider reducing prolonged or heavy exertion outdoors.
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.
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.
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.

* An AQI of 100 for ozone corresponds to an ozone level of 0.075 parts per million (averaged over 8 hours).

Air Quality Index (AQI): Particle Pollution

Index Values	Levels of Health Concern	Cautionary Statements
0-50	Good	None
51-100*	Moderate	Unusually sensitive people should consider reducing prolonged or heavy exertion.
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	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	People with heart or lung disease, older adults, and children should avoid all physical activity outdoors. Everyone else should avoid prolonged or heavy exertion.

*An AQI of 100 for particles up to 2.5 micrometers in diameter corresponds to a level of 35 micrograms per cubic meter (averaged over 24 hours). An AQI of 100 for particles up to 10 micrometers in diameter corresponds to a level of 150 micrograms per cubic meter (averaged over 24 hours).

Section III
Massachusetts Air Quality Data Summaries

Ozone Summary

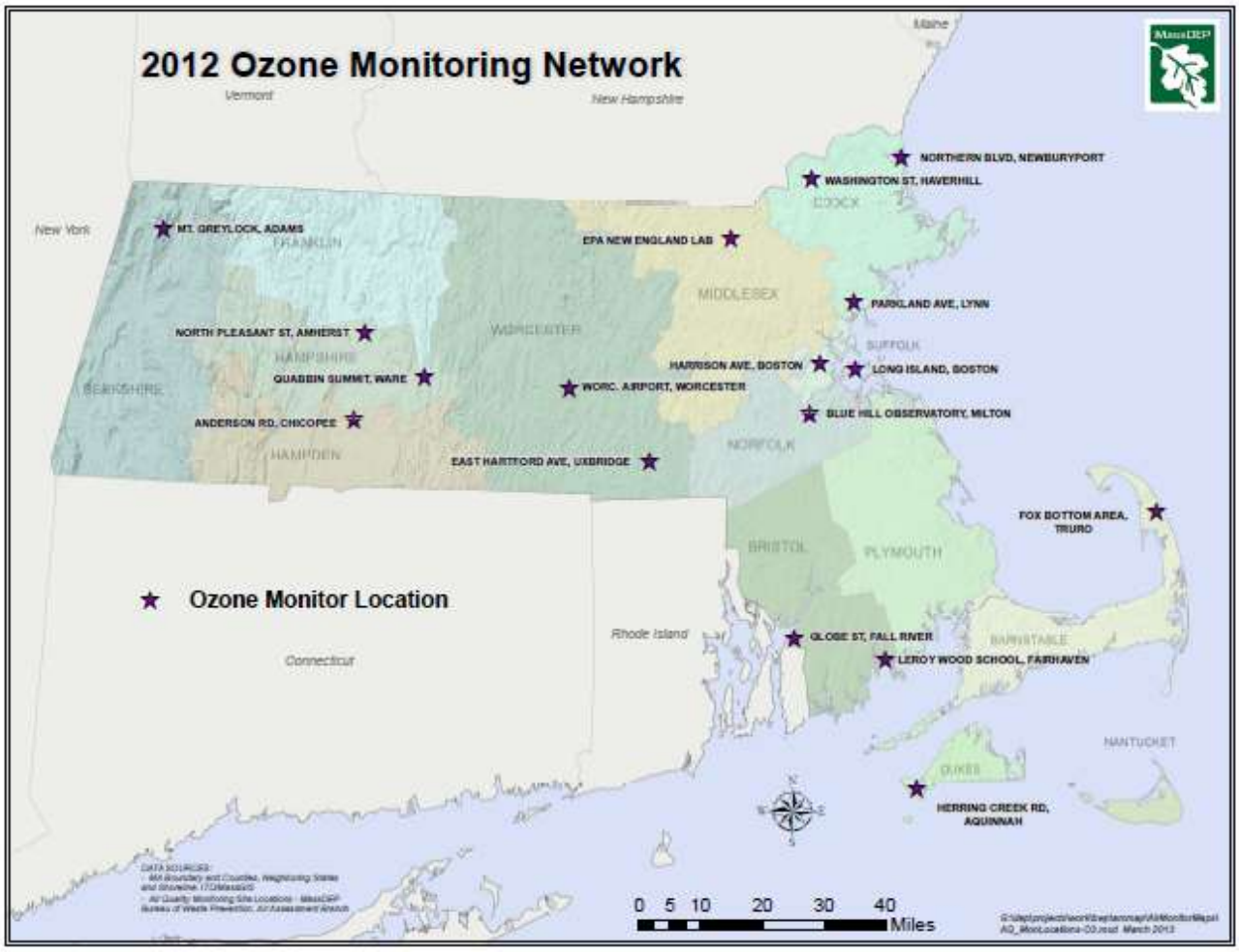
2012 Ozone Data Summary

A summary of the data collected during the 2012 ozone season (April 1 – Sept. 30) is shown below (in parts per million). MassDEP operated 15 ozone sites during 2012. EPA operated a site in Chelmsford and the Wampanoag Tribe operated a site in Aquinnah on Martha's Vineyard. All sites except Fairhaven achieved the requirement of 75% or greater data capture for the year. The Fairhaven site was temporarily closed due to construction on the site, and MassDEP added an ozone monitor to the Fall River site to account for the temporary loss of Fairhaven.

SITE ID	CITY	COUNTY	ADDRESS	% OBS	VALID DAYS MEAS	NUM DAYS REQ	1ST MAX 1-HR	2ND MAX 1-HR	DAY MAX> STD	1ST MAX 8-HR	2ND MAX 8-HR	3RD MAX 8-HR	4TH MAX 8-HR	DAY MAX > STD
25-003-4002	Adams	Berkshire	ROUTE 8 ADAMS	99	181	183	0.084	0.081	0	0.074	0.074	0.080	0.079	0
25-007-0001	Aquinnah/Tribal Site	Dukes	1 HERRING CREEK	97	178	183	0.115	0.106	0	0.100	0.094	0.073	0.073	8
25-025-0041	Boston	Suffolk	LONG ISLAND	97	178	183	0.103	0.088	0	0.085	0.070	0.056	0.056	1
25-025-0042	Boston	Suffolk	HARRISON AVE	99	181	183	0.106	0.077	0	0.080	0.064	0.080	0.078	1
25-017-0009	Chelmsford	Middlesex	11 TECHNOLOGY (USEPA)	100	183	183	0.113	0.091	0	0.089	0.075	0.083	0.082	1
25-013-0008	Chicopee	Hampden	ANDERSON RD AFB	99	182	183	0.104	0.102	0	0.084	0.076	0.074	0.072	2
25-005-1002	Fairhaven	Bristol	60 SCONTICUT	16	29	183	0.062	0.060	0	0.059	0.058	0.075	0.074	0
25-005-1004	Fall River	Bristol	659 GLOBE ST	99	181	183	0.104	0.102	0	0.090	0.082	0.079	0.074	6
25-009-5005	Haverhill	Essex	685 WASHINGTON	100	183	183	0.107	0.099	0	0.089	0.079	0.075	0.074	3
25-009-2006	Lynn	Essex	390 PARKLAND	98	180	183	0.114	0.091	0	0.091	0.076	0.068	0.068	2
25-021-3003	Milton	Norfolk	695 HILLSIDE ST	99	181	183	0.098	0.092	0	0.080	0.078	0.076	0.076	2
25-009-4005	Newburyport	Essex	HARBOR STREET	98	179	183	0.098	0.096	0	0.082	0.080	0.073	0.072	2
25-015-0103	North Amherst	Hampshire	N PLEASANT ST	99	181	183	0.090	0.086	0	0.082	0.073	0.075	0.074	1
25-001-0002	Truro	Barnstable	FOX BOTTOM AREA	97	177	183	0.109	0.099	0	0.088	0.085	0.069	0.067	6
25-027-0024	Uxbridge	Worcester	366 E HARTFORD	97	178	183	0.111	0.080	0	0.086	0.071	0.062	0.062	1
25-015-4002	Ware	Hampshire	QUABBIN SUMMIT	97	178	183	0.107	0.094	1	0.079	0.077	0.072	0.070	4
25-027-0015	Worcester	Worcester	375 AIRPORT	98	180	183	0.127	0.085	0	0.092	0.074	0.070	0.070	1

Standards: 8-hour = 0.075 ppm

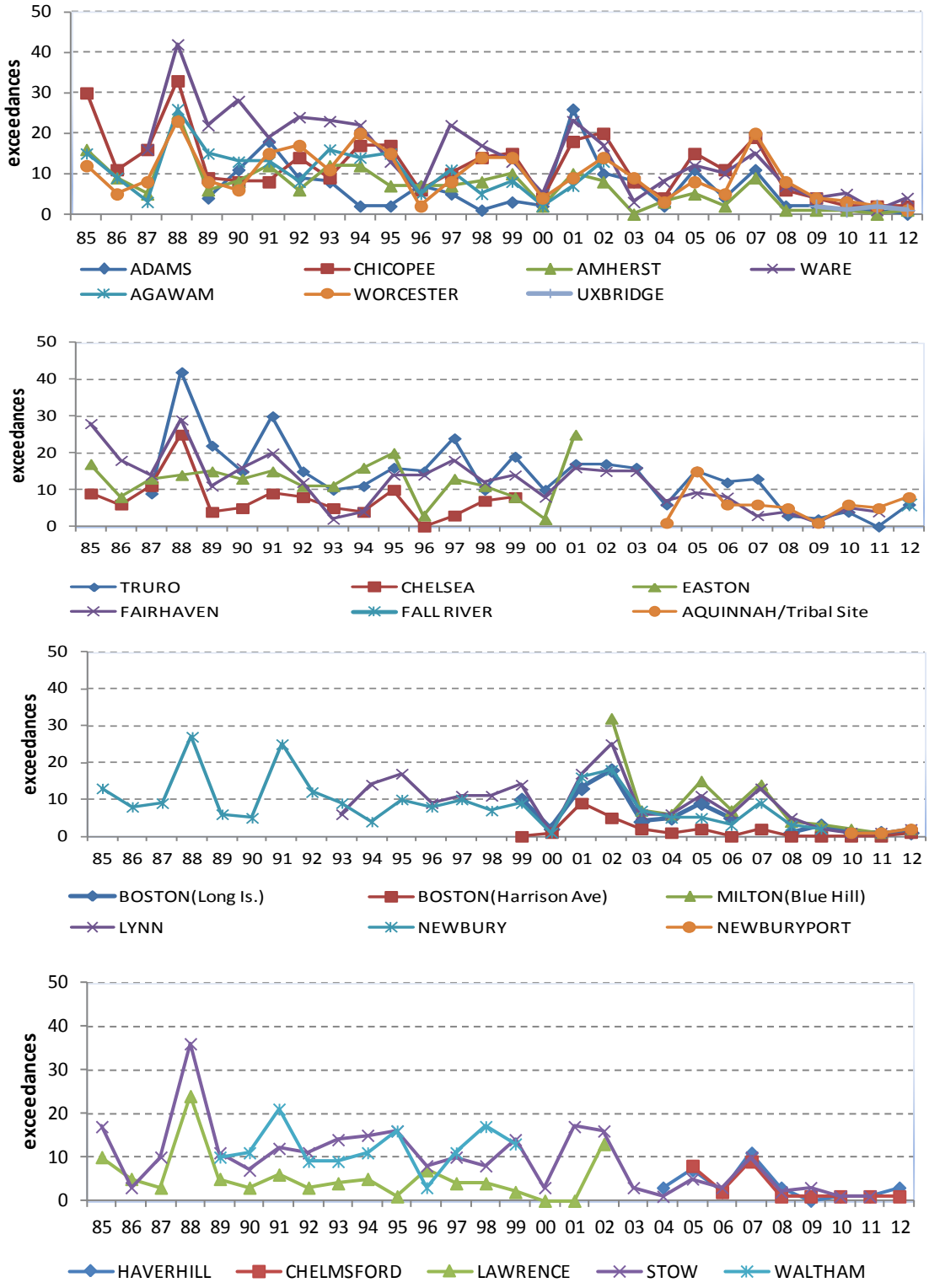
ABBREVIATIONS AND SYMBOLS USED IN TABLE
SITE ID = AIRS SITE IDENTIFICATION NUMBER **% OBS** = PERCENTAGE OF VALID DAYS MONITORED DURING O3 SEASON **1ST, 2ND MAX 1-HR** = MAXIMUM 1-HR VALUE FOR THE 1ST & 2ND HIGHEST DAY **DAY MAX > 0.125** = NUMBER OF MEASURED DAILY 1-HOUR MAXIMUM VALUES GREATER THAN 0.12 PPM (1-HR STANDARD) **1ST, 2ND, 3RD & 4TH MAX 8-HR** = MAXIMUM 8-HR VALUE FOR THE 1ST, 2ND, 3RD & 4TH HIGHEST DAY **DAY MAX > 0.075** = NUMBER OF MEASURED DAILY 8-HOUR MAXIMUM VALUES GREATER THAN 0.075 PPM (8-HR STANDARD)


2012 Ozone Monitoring Network
Vermont
New Hampshire
Maine
New York
Connecticut
Rhode Island
MT. GREYLOCK, ADAMS
NORTH PLEASANT ST, AMHERST
QUABBIN SUMMIT, WARE
ANDERSON RD, CHICOPEE
EAST HARTFORD AVE, UXBRIDGE
EPA NEW ENGLAND LAB
WORC. AIRPORT, WORCESTER
NORTHERN BLVD, NEWBURYPORT
WASHINGTON ST, HAVERHILL
PARKLAND AVE, LYNN
HARRISON AVE, BOSTON
LONG ISLAND, BOSTON
BLUE HILL OBSERVATORY, MILTON
FOX BOTTOM AREA, TRURO
GLOBE ST, FALL RIVER
LEROY WOOD SCHOOL, FAIRHAVEN
HERRING CREEK RD, AQUINNAH
Ozone Monitor Location
FRANKLIN
HAMPSHIRE
BERKSHIRE
HAMPDEN
WORCESTER
MIDDLESEX
ESSEX
SUFFOLK
NORFOLK
BRISTOL
PLYMOUTH
BARNSTABLE
NANTUCKET
DUKES
0 5 10 20 30 40
Miles

8-hour Ozone Exceedance Trends

Shown below are the long-term trends of 8-hour ozone exceedances for each site based on the 2008 standard of 0.075 ppm.

Figure 3
8-hour Ozone Exceedance Trends 1985 – 2012
Standard = 0.075 ppm



Sulfur Dioxide (SO_2) Summary

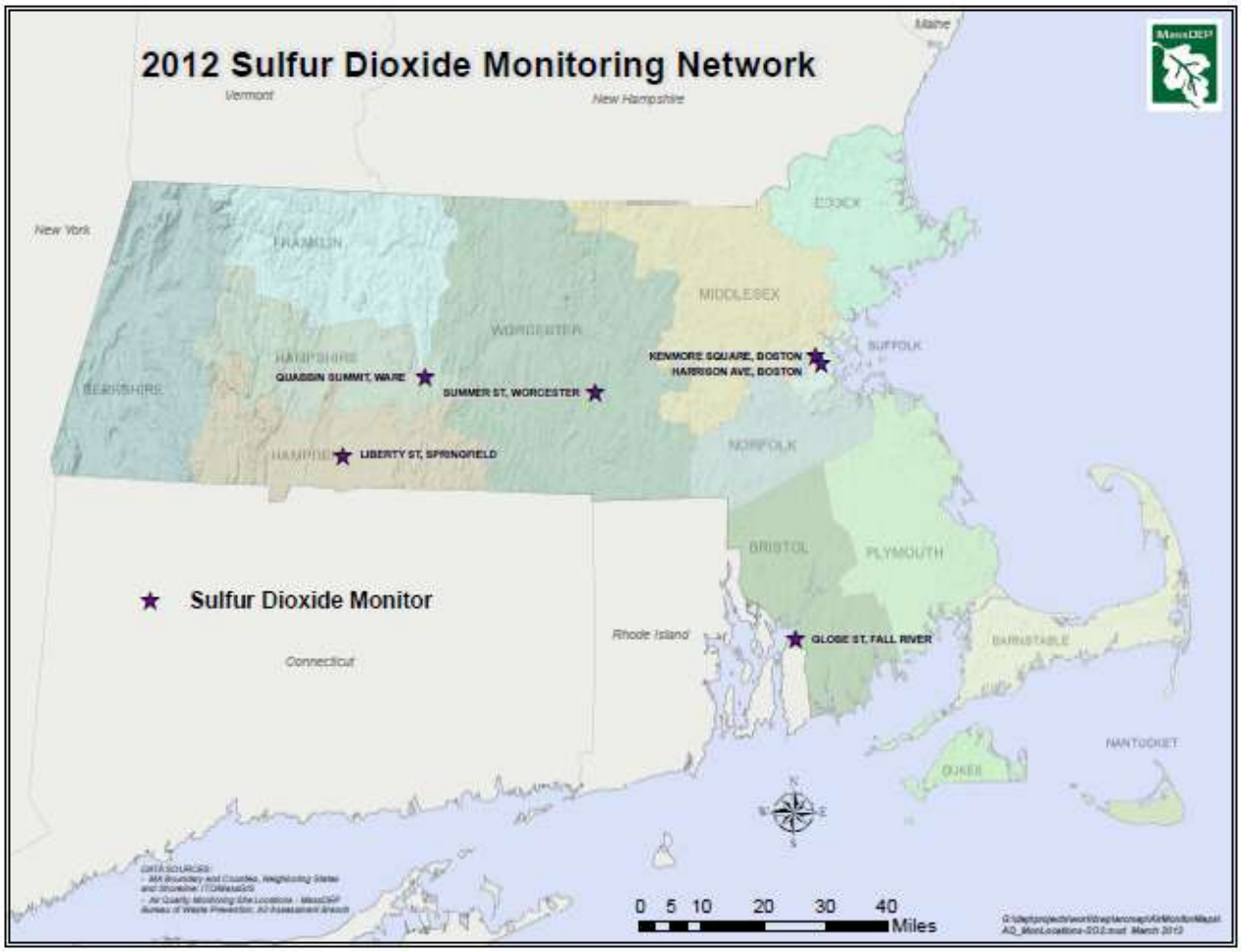
2012 SO_2 Data Summary

A summary of the 2012 SO_2 data is shown below (in parts per billion). MassDEP operated six SO_2 sites during 2012. All of the sites achieved the requirement of 75% or greater data capture for the year. SO_2 monitors at Boston (Harrison Avenue), Ware and Boston (Kenmore Sq) are trace-level instruments that are specifically configured to measure at a lower concentration range than the standard instrument in order to obtain better ongoing concentration resolution and to more precisely track trends in SO_2 concentrations.

SITE ID	CITY	COUNTY	ADDRESS	# OBS	% OBS	COMPLETED QTRS	1ST MAX 1-HR	2ND MAX 1-HR	99TH PERCENTILE 1-HR	1ST MAX 24-HR	2ND MAX 24-HR	ARITH MEAN
25-025-0002	Boston	Suffolk	KENMORE SQ	8222	94	4	15.8	13.8	13.2	6	5.4	1.87
25-025-0042	Boston	Suffolk	HARRISON	8347	95	4	21.3	13.4	12.1	7.9	5	1.12
25-005-1004	Fall River	Bristol	659 GLOBE	8538	97	4	86.3	77.5	65.4	23.6	20.3	2.4
25-013-0016	Springfield	Hampden	LIBERTY	8559	97	4	29.8	22.1	13.9	7.2	5.7	1.66
25-015-4002	Ware	Hampshire	QUABBIN	8541	97	4	6.6	6.2	5.4	3.2	2.9	0.86
25-027-0023	Worcester	Worcester	SUMMER ST	8464	96	4	10.3	9.1	8.7	6.9	6.4	3.21

Standards: 1-hour = 75 ppb 3-hour = 0.5 ppm

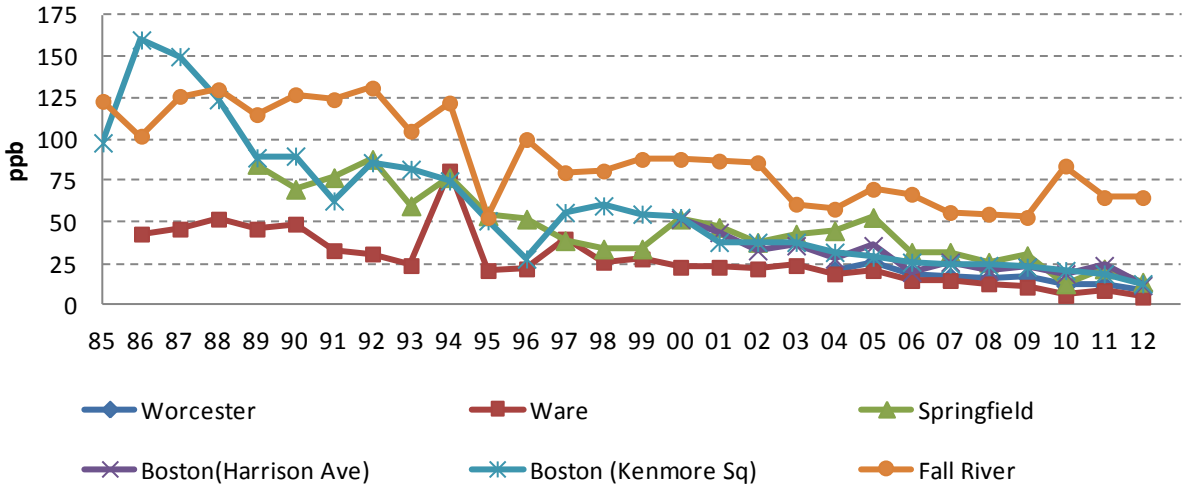
ABBREVIATIONS AND SYMBOLS USED IN TABLE
SITE ID = AIRS SITE IDENTIFICATION NUMBER, **# OBS**, # Observations. **% OBS** = PERCENT OBSERVATIONS, **COMP QTRS** = COMPLETE QUARTERS, **1ST, 2ND MAX 1-HOUR** = FIRST AND SECOND HIGHEST 1-HOUR VALUE, **99TH PERCENTILE 1-HR** = 99th PERCENTILE OF THE 1-HOUR MAX, **1st & 2nd 24-HR MAX** = FIRST AND SECOND HIGHEST 24-HOUR VALUE, **ARITH MEAN** = ANNUAL ARITHMETIC MEAN



SO_2 Trends

The long-term trends of the 1-hour 99th percentile for each SO_2 site are shown below. The trend has been downward and Massachusetts currently is below the 1-hour standard.

Figure 4
SO_2 Trends 1985 – 2012
1-hour 99th Percentile Annual Average
Standard = 75 ppb (effective June 2010)



Nitrogen Dioxide (NO_2) Summary

2012 NO_2 Data Summary

A summary of the 2012 NO_2 data is shown below (in parts per billion). MassDEP operated 11 NO_2 sites during 2012, 8 of which are operated year-round and 3 of which are operated June-August (Newburyport, Milton and Long Island). All of the year-round sites met the requirement of 75% data capture for the year.

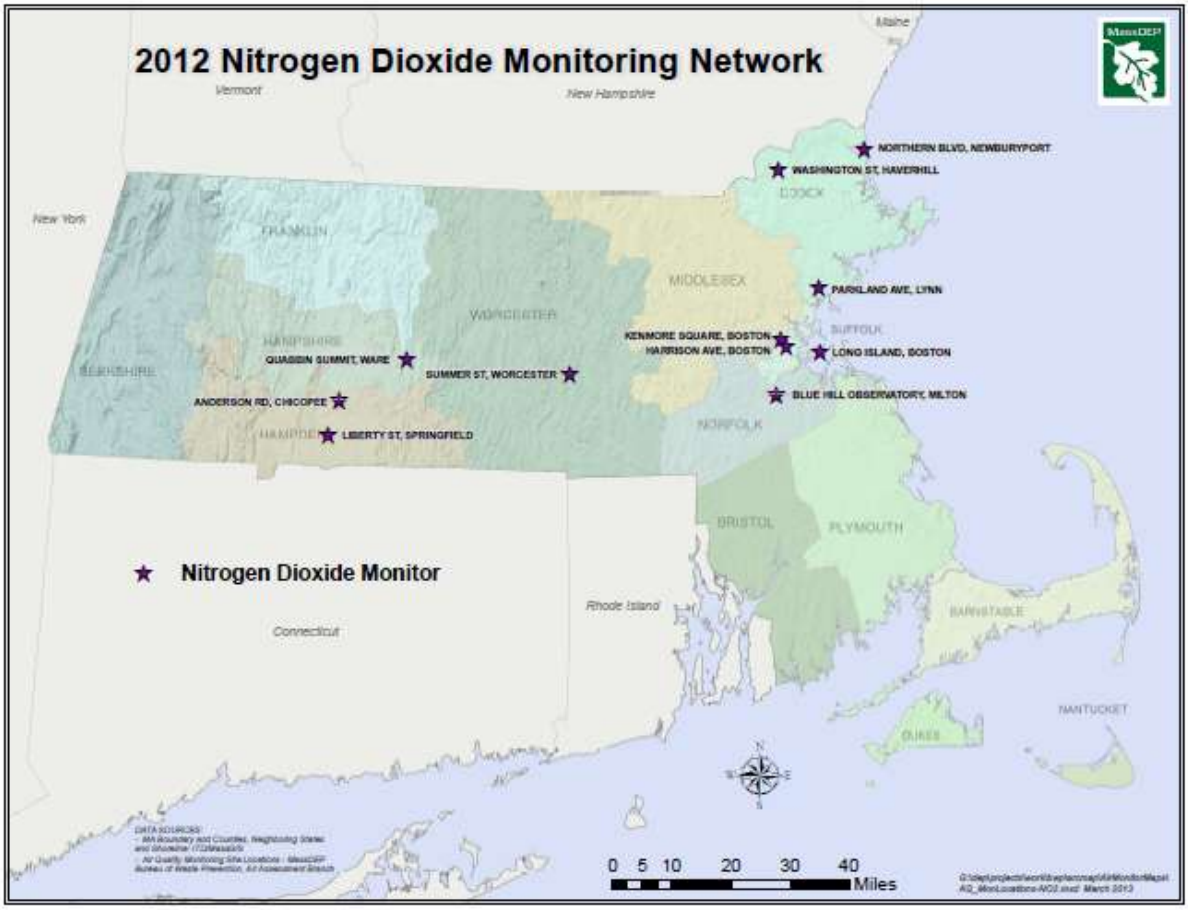
SITE ID	CITY	COUNTY	ADDRESS	# OBS	% OBS	COMPLETED QTRS	1ST MAX 1-HR	2ND MAX 1-HR	98TH PERCENTILE VALUE	ARITH MEAN
25-025-0002	Boston	Suffolk	KENMORE SQ	7928	90	4	61	54	49	19.1
25-025-0041	Boston	Suffolk	LONG ISLAND	5276	60	2	41	38	33	6.65*
25-025-0042	Boston	Suffolk	HARRISON AVE	7897	90	4	67	52	44	15.8
25-013-0008	Chicopee	Hampden	ANDERSON RD AFB	8220	94	4	38	38	36	6.72
25-009-5005	Haverhill	Essex	685 WASHINGTON	8244	94	4	36	35	32	6.59
25-009-2006	Lynn	Essex	390 PARKLAND	8280	94	4	51	48	42	8.31
25-021-3003	Milton	Norfolk	695 HILLSIDE ST	4963	57	2	30	25	23	3.94*
25-009-4005	Newburyport	Essex	HARBOR STREET	6642	76	3	29	28	23	3.49
25-013-0016	Springfield	Hampden	LIBERTY STREET	8319	95	4	74	45	40	13.79
25-015-4002	Ware	Hampshire	QUABBIN SUMMIT	8371	95	4	19	19	14	2.06
25-027-0023	Worcester	Worcester	SUMMER ST	8266	94	4	52	51	45	12.78

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

Note: * indicates that the mean does not satisfy summary criteria.

ABBREVIATIONS AND SYMBOLS USED IN TABLE

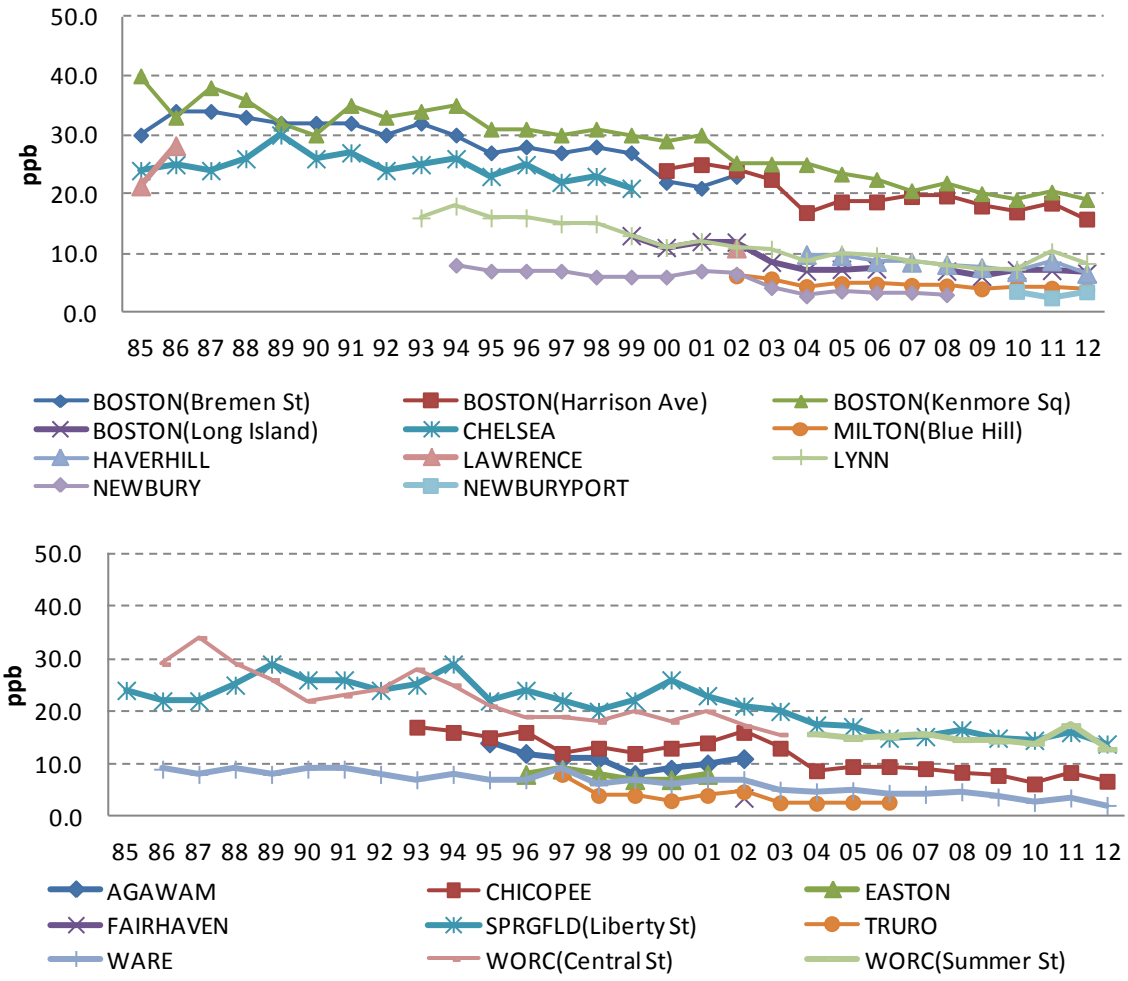
SITE ID = AIRS SITE IDENTIFICATION NUMBER **# OBS** # Observations, **% OBS** percentage of completed observations, **COMP QTRS =** COMPLETE QUARTERS, **1ST, 2ND MAX 1-HR** = FIRST AND SECOND HIGHEST VALUE FOR TIME PERIOD INDICATED, **98TH PCTL** = 98TH PERCENTILE, **ARITH MEAN** = ANNUAL ARITHMETIC MEAN



NO_2 Trends

The long-term trends of the annual arithmetic means for each NO_2 site are shown below. The trend has been stable the last few years and downward for the entire period. Massachusetts is below the annual standard.

Figure 5
NO_2 Trends 1985 – 2012
Annual Arithmetic Mean
Standard = 53 ppb



Carbon Monoxide (CO) Summary

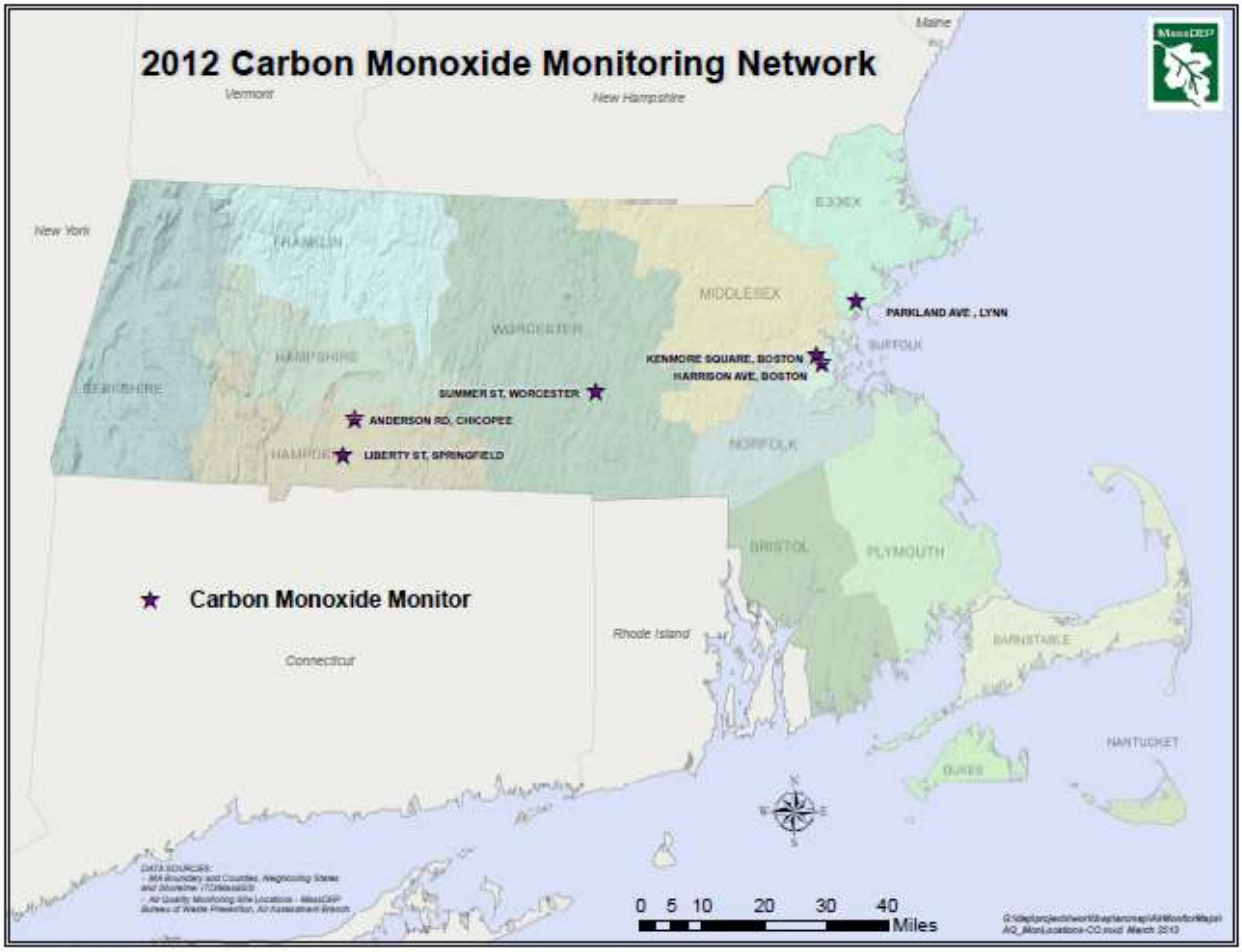
2012 CO Data Summary

A summary of the 2012 CO data is shown below (in parts per million). MassDEP operated six sites during 2012. All of the sites achieved the requirement of 75% or greater data capture for the year. The CO monitors at Boston (Harrison Avenue), Lynn and Chicopee are trace-level instruments that measure a lower concentration range than standard instruments to obtain better concentration resolution and to more precisely track trends in CO concentrations.

SITE ID	CITY	COUNTY	ADDRESS	# OBS	% OBS	1ST MAX 1-HR	2ND MAX 1-HR	OBS > 1HR STD	1ST MAX 8-HR	2ND MAX 8-HR	OBS > 8HR STD
25-025-0002	Boston	Suffolk	KENMORE SQ	8211	93	1.4	1.3	0	1.1	0.9	0
25-025-0042	Boston	Suffolk	HARRISON AVE	8190	93	2.3	2.2	0	1.9	1.6	0
25-013-0008	Chicopee	Hampden	ANDERSON RD AFB	8113	92	1.0	0.9	0	0.8	0.7	0
25-009-2006	Lynn	Essex	390 PARKLAND	7192	82	1.0	1.0	0	0.7	0.6	0
25-013-0016	Springfield	Hampden	LIBERTY STREET	8118	92	2.0	2.0	0	1.7	1.5	0
25-027-0023	Worcester	Worcester	SUMMER ST	8219	94	2.3	2.3	0	2	1.7	0

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

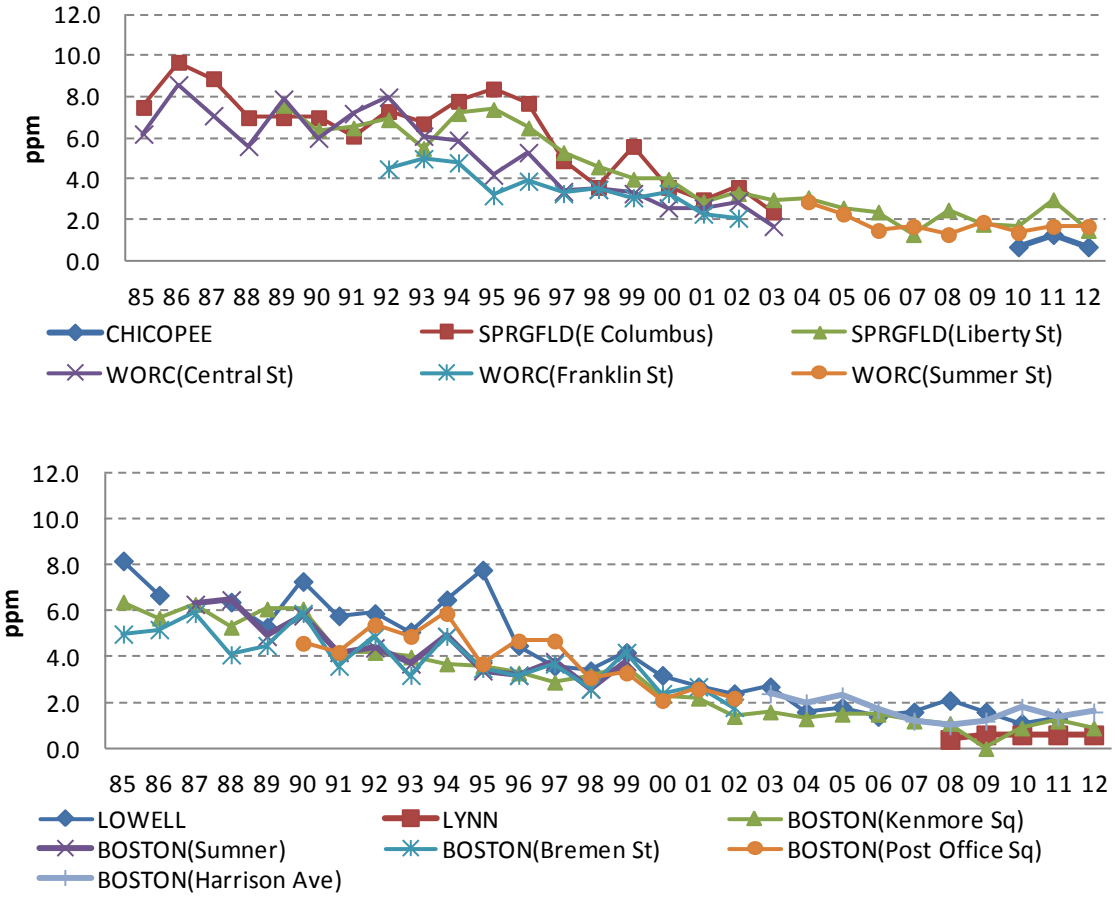
ABBREVIATIONS AND SYMBOLS USED IN TABLE
SITE ID = AIRS SITE IDENTIFICATION NUMBER **# OBS** = #Observations **% OBS** = PERCENT OBSERVATIONS, **1ST, 2ND MAX 1-HR** = FIRST AND SECOND HIGHEST VALUE FOR TIME PERIOD INDICATED, **OBS > 1 HR STD** = NUMBER OF 1-HR AVERAGES GREATER THAN 35 PPM (1-HR STANDARD), **1ST, 2ND MAX 8-HR** = FIRST AND SECOND HIGHEST VALUE FOR TIME PERIOD INDICATED, **OBS > 8 HR STD** = NUMBER OF 8-HR AVERAGES GREATER THAN 9 PPM (8-HR STANDARD)



CO Trends

The long-term trends for each CO site are shown below. The 2nd maximum value is displayed because it is the value to which the standard applies. Massachusetts is well below the 1-hour and 8-hour standards.

Figure 6
CO Trends 1985-2012
2nd Maximum 8-hour Values
Standard = 9 ppm



Particulate Matter 10 Microns (PM_{10}) Summary

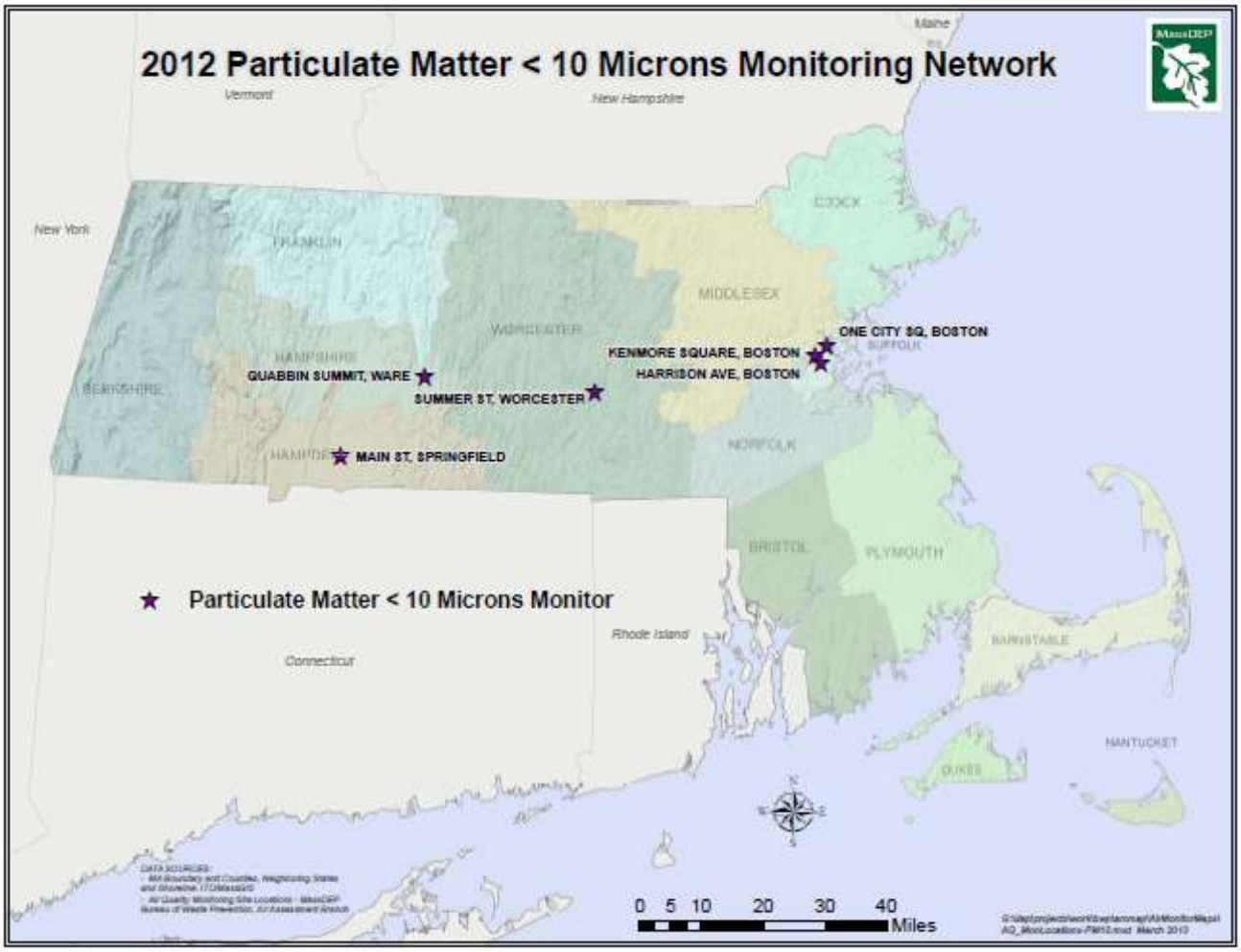
2012 PM_{10} Data Summary

A summary of the 2012 PM_{10} data is shown below (in $\mu g/m^3$). MassDEP operated six PM_{10} sites in 2012. All of the sites achieved data capture requirements for the year.

SITE ID		CITY	COUNTY	ADDRESS	# OBS	NUM REQ	VALID DAYS	% OBS	1ST MAX VALUE	2ND MAX VALUE	3RD MAX VALUE	4TH MAX VALUE	DAY MAX > STD	EST DAYS > STD	ARITH MEAN
25-025-0002	lo vol	Boston	Suffolk	KENMORE SQ	60	61	60	98	37	28	27	23	0	0	15.7
25-025-0027	lo vol	Boston	Suffolk	ONE CITY SQ	60	61	59	97	41	37	33	33	0	0	16.8
25-025-0042	hi vol	Boston	Suffolk	HARRISON AVE	59	61	59	97	25	25	21	21	0	0	12.1
25-025-0042	hi vol co-loc	Boston	Suffolk	HARRISON AVE	57	61	57	93	72	25	23	21	0	0	13.1
25-025-0042	lo vol	Boston	Suffolk	HARRISON AVE	120	61	61	100	37	32	27	27	0	0	14.1
25-025-0042	lo vol co-loc	Boston	Suffolk	HARRISON AVE	117	61	61	100	37	31	27	27	0	0	13.7
25-013-2009	lo vol	Springfield	Hampden	1860 MAIN ST	59	61	59	97	28	28	27	24	0	0	13.7
25-015-4002	lo vol	Ware	Hampshire	QUABBIN	60	61	60	98	24	21	20	20	0	0	9.2
25-027-0023	lo vol	Worcester	Worcester	SUMMER ST	61	61	61	100	42	38	34	29	0	0	17.8

Standards: 24-hour = 150 $\mu g/m^3$

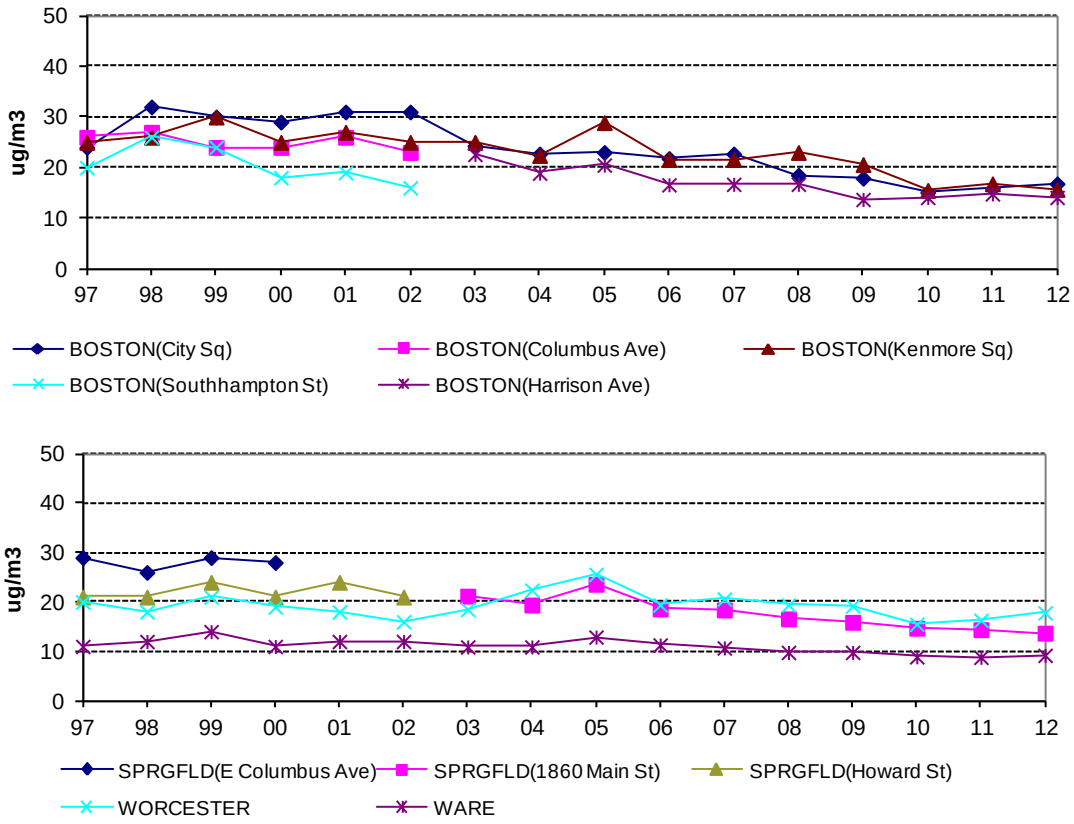
ABBREVIATIONS AND SYMBOLS USED IN TABLE
SITE ID = AIRS SITE IDENTIFICATION NUMBER, **% OBS** = PERCENT OBSERVATIONS, **1^{ST}, 2^{ND}, 3^{RD}, 4^{TH} MAX** = 1^{ST}, 2^{ND}, 3^{RD}, AND 4^{TH} HIGHEST 24-HOUR VALUES FOR THE YEAR, **DAY MAX > 150** = DAILY MAXIMUM VALUE GREATER THAN STANDARD OF 150 $\mu g/m^3$, **EST DAYS > STD** = # days > standard, **ARITH MEAN** = ANNUAL ARITHMETIC MEAN



PM_{10} Trends

Long-term trends for each PM_{10} site are shown below using the annual arithmetic mean as an indicator. The data shows an overall downward trend.

Figure 7
PM_{10} Trends 1997-2012
Annual Arithmetic Mean



Particulate Matter 2.5 Microns ($PM_{2.5}$) Summary

MassDEP operated 15 Federal Reference Method (FRM) filter-based $PM_{2.5}$ sites during 2012, and operated 10 Beta Attenuation Monitors (BAMs) $PM_{2.5}$ samplers that provide near real-time data on MassDEP's MassAir Online website (www.mass.gov/eea/agencies/massdep/air/quality/) and on EPA's AirNOW website (www.epa.gov/airnow/).

2012 $PM_{2.5}$ FRM Data Summary

A summary of the 2012 FRM $PM_{2.5}$ data is shown below (in $\mu g/m^3$).

SITE ID		CITY	COUNTY	ADDRESS	# OBS	1ST MAX VALUE	2ND MAX VALUE	3RD MAX VALUE	4TH MAX VALUE	98TH PERCENTILE VALUE	ARITH MEAN
25-025-0002		Boston	Suffolk	KENMORE SQ	120	23	22.6	22.1	18.2	22.1	9.03
25-025-0027		Boston	Suffolk	ONE CITY SQ	118	24.7	24.7	22.6	20.4	22.6	8.76
25-025-0042		Boston	Suffolk	HARRISON AVE	116	23.2	22.5	20.6	19.7	20.6	8.27
25-025-0043		Boston	Suffolk	174 NORTH ST	363	27.9	26.7	23.1	23	20.1	9.47
25-025-0043	co-loc	Boston	Suffolk	174 NORTH ST	343	27.2	26.1	25.8	22.4	20.9	9.17
25-023-0004		Brockton	Plymouth	COMMERCIAL ST	121	22.5	22.2	17.3	17.1	17.3	7.69
25-023-0004	co-loc	Brockton	Plymouth	COMMERCIAL ST	114	23.7	22.8	21.5	17.2	21.5	7.91
25-013-0008		Chicopee	Hampden	ANDERSON RD	121	18.8	17.3	17.1	16	17.1	7.61
25-013-0008	co-loc	Chicopee	Hampden	ANDERSON RD	106	19.3	17.6	17.2	16	17.2	7.88*
25-005-1004		Fall River	Bristol	659 GLOBE ST	117	20.8	19.6	17.1	16.7	17.1	7.13
25-009-5005		Haverhill	Essex	685 WASHINGTON ST	120	22.4	19.8	18.4	17.9	18.4	7.25
25-009-6001		Lawrence	Essex	37 SHATTUCK	119	23.1	19.1	18.1	17.8	18.1	7.82
25-009-2006		Lynn	Essex	390 PARKLAND	122	26	19.4	19.2	17.2	19.2	7.18
25-003-5001		Pittsfield	Berkshire	78 CENTER ST	121	22.2	21.7	19.8	19.6	19.8	8.48
25-013-0016		Springfield	Hampden	LIBERTY	115	22.4	21.8	21	20	21	8.96
25-013-2009		Springfield	Hampden	1860 MAIN ST	119	20.5	19.7	19.2	19	19.2	8.5
25-027-0016		Worcester	Worcester	WASHINGTON ST	120	20.6	20.2	19.9	18.1	19.9	8.21
25-027-0023		Worcester	Worcester	SUMMER ST	117	26.5	21	20.4	19.1	20.4	8.8

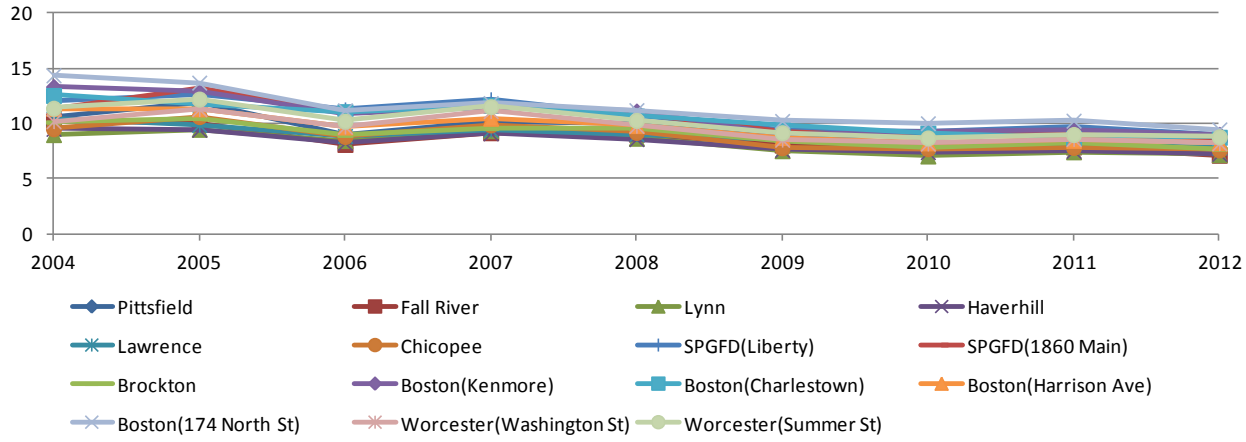
Standards: Annual = 12.0 $\mu g/m^3$ (primary) 24-hour = 35 $\mu g/m^3$

Note: *indicates that the mean does not satisfy summary criteria

$PM_{2.5}$ Trends

Long-term trends for each $PM_{2.5}$ site are shown below using the annual arithmetic mean as an indicator. The data shows an overall downward trend.

Figure 8
$PM_{2.5}$ Annual Arithmetic Mean
Primary Standard = 12 μg/m^3



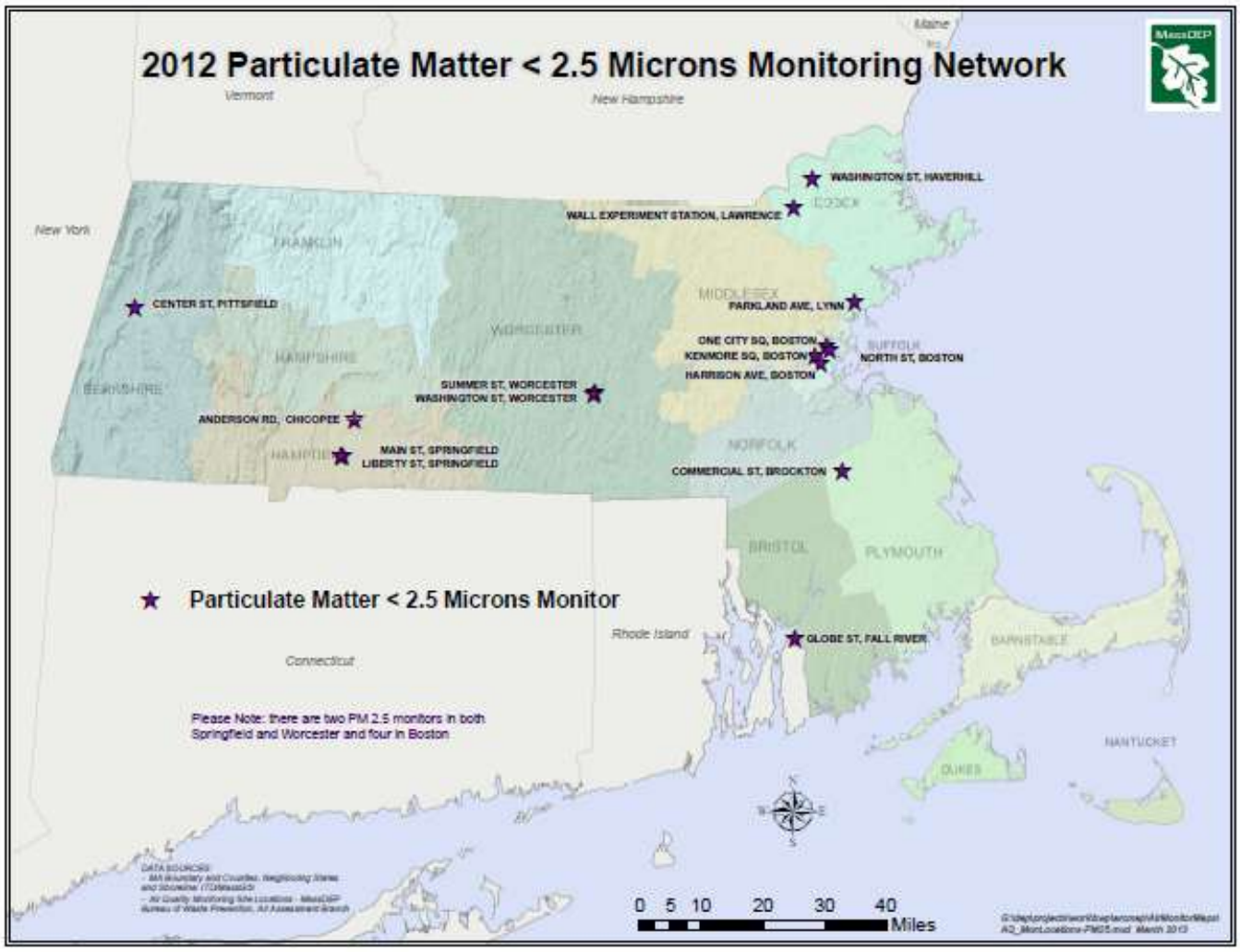
2012 $PM_{2.5}$ BAM Data Summary

A summary of the 2012 BAM $PM_{2.5}$ data is shown below (in μg/m^3).

SITE ID	CITY	COUNTY	ADDRESS	# DAYS	1ST MAX 24-HR BLK AVERAGE	2ND MAX 24-HR BLK AVERAGE	3RD MAX 24-HR BLK AVERAGE	4TH MAX 24-HR BLK AVERAGE	ARITH MEAN
25-025-0042	Boston	Suffolk	HARRISON AVE	350	27.6	22.8	22.5	22.4	8.81
25-025-0043	Boston	Suffolk	174 NORTH ST	352	32	25.4	25.3	23.9	9.32
25-005-1004	Fall River	Bristol	659 GLOBE ST	337	24.7	24.1	21.7	21	7.57
25-009-5005	Haverhill	Essex	685 WASHINGTON	361	25.2	24.1	24	23.6	8.4
25-009-2006	Lynn	Essex	390 PARKLAND	361	24.4	24	23.2	22.2	7.21
25-021-3003	Milton	Norfolk	695 HILLSIDE ST	357	18	17.4	17.1	16.4	6.72
25-003-0006	Pittsfield	Berkshire	1 WEST ST	337	30.6	28.6	28.4	28.1	9.92*
25-013-0016	Springfield	Hampden	LIBERTY ST	330	29	27.1	26.8	26.7	10.32
25-015-4002	Ware	Hampshire	QUABBIN SUMMIT	357	20.5	20.1	19.2	18.9	5.56
25-027-0023	Worcester	Worcester	SUMMER ST	288	24	22.7	21.9	20.7	7.94*

Note: *indicates that the mean does not satisfy summary criteria

ABBREVIATIONS AND SYMBOLS USED IN TABLE
SITE ID = AIRS SITE IDENTIFICATION **TYPE** = TYPE OF INSTRUMENT **FRM** = FEDERAL REFERENCE METHOD; **COLOC** = FED. REF. METH. COLOCATED **1ST, 2ND, 3RD, 4TH MAX** = 1ST, 2ND, 3RD, AND 4TH HIGHEST 24-HOUR VALUES FOR THE YEAR **ARITH MEAN** = ANNUAL ARITHMETIC MEAN (STANDARD = 15.0 μg/m³)



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 identity 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). Massachusetts currently has IMPROVE samplers at the Ware and Truro sites. The Wampanoag Tribe operates a third 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.

Lead (Pb) Summary

2012 Pb Data Summary

EPA's 2008 lead monitoring requirements allow the use of a low-volume PM_{10}-based methodology for measuring lead on particulates, which MassDEP began using at the beginning of 2012 in Boston (Harrison Avenue) and Springfield (Main Street). A summary of 2012 lead data using the PM_{10}-based method is shown in the first box below (in $\mu g/m^3$). MassDEP also conducted a one year study at the Nantucket Airport and using the TSP-based method (in $\mu g/m^3$). All samples (including 3-month rolling averages) were below the lead standard of 0.15 $\mu g/m^3$.

Lead from PM_{10}-based Method

SITE ID	CITY	COUNTY	ADDRESS		# OBS	1ST MAX VALUE	2ND MAX VALUE	3RD MAX VALUE	4TH MAX VALUE	ARITH MEAN
25-025-0042	Boston	Suffolk	HARRISON AVE		96	0.013	0.012	0.009	0.008	0.0031
25-025-0042	Boston	Suffolk	HARRISON AVE	co-loc	34	0.014	0.012	0.009	0.006	.0034*
25-013-2009	Springfield	Hampden	1860 MAIN ST		61	0.025	0.016	0.015	0.013	0.0044

Standard: 0.15 μg/m³ (rolling 3-month average)
Note: *indicates that the mean does not satisfy summary criteria

ABBREVIATIONS AND SYMBOLS USED IN TABLE
SITE ID = AIRS SITE IDENTIFICATION **% OBS** = PERCENT OBSERVATIONS; **1ST, 2ND, 3rd, 4th MAX** = THE 1ST, 2ND, 3rd, 4th MAXIMUM 24-HOUR VALUES
ARITH MEAN = THE MEAN

Lead from TSP-based Method

SITE ID	CITY	COUNTY	ADDRESS		# OBS	QTR 1 ARITH MEAN	QTR 2 ARITH MEAN	QTR 3 ARITH MEAN	QTR 4 ARITH MEAN	# MEANS > STD	1ST MAX VALUE	2ND MAX VALUE
25-019-0001	Nantucket	Nantucket	14 AIRPORT RD		52	.0057*	.0078	.0129	.0097	.0000	.0401	.0335
25-019-0001	Nantucket	Nantucket	14 AIRPORT RD	Co-loc	19	.0047*	.0087*	.0155*	.0209	.0000	.0413	.0305

Standard: 0.15 μg/m³ (rolling 3-month average)
Note: *indicates that the mean does not satisfy summary criteria

ABBREVIATIONS AND SYMBOLS USED IN TABLE
SITE ID = AIRS SITE IDENTIFICATION **% OBS** = PERCENT OBSERVATIONS **QTR1, QTR2, QTR3, QTR4 ARITH MEAN** = THE MEANS FOR THE 1ST, 2ND, 3RD AND 4TH CALENDAR QUARTERS **# MEANS > STD** = THE NUMBER OF CALENDAR QUARTER MEANS GREATER THAN THE STANDARD, **1ST, 2ND MAX** = THE 1ST AND 2ND MAXIMUM 24-HOUR VALUES

Private Monitoring Summary

In 2012, MassDEP oversaw one private monitoring station at East First Street in Boston, originally sited to measure ambient air impacts from specific power plants in the Boston area. The data from this monitoring site is submitted by a private company to MassDEP, which then submits the data to EPA after performing quality assurance.

Sulfur Dioxide (SO_2) Summary

There were no measured violations of the SO_2 air quality standards. A summary of the 2012 SO_2 data is shown below.

					COMPLETED QTRS	1ST MAX 1-HR	2ND MAX 1-HR	99TH PERCENTILE 1-HR	1ST MAX 24-HR	2ND MAX 24-HR	DAYS >24-HR STD	ARITH MEAN
25-025-0040		Boston	Suffolk	531A EAST FIRST ST	4	17	14	12	4.5	4.5	0	1.65

STANDARD: 1-Hour = 75 PPB

ABBREVIATIONS AND SYMBOLS USED IN TABLE
SITE ID = AIRS SITE IDENTIFICATION NUMBER **COMP QTRS** = COMPLETED QUARTERS, **1ST & 2ND MAX 1-HR and MAX 24-HR** = FIRST AND SECOND HIGHEST VALUE FOR TIME PERIOD INDICATED, **99th PCTL** = 99th PERCENTILE OF THE 1-HOUR MAX, **DAYS >24 HR STD** = NUMBER OF DAYS ABOVE THE 24-HOUR STANDARD, **ARITH MEAN** = ARITHMETIC MEAN

Nitrogen Dioxide (NO_2) Summary

There were no measured violations of the NO_2 air quality standards. A summary of the 2012 NO_2 data is shown below.

					COMPLETED QTRS	1ST MAX 1-HR	2ND MAX 1-HR	98TH PERCENTILE	ARITH MEAN
25-025-0040		Boston	Suffolk	531A EAST FIRST ST	4	57	51	43	9.73

STANDARD: 1-HOUR = 100 PPB

ABBREVIATIONS AND SYMBOLS USED IN TABLE
SITE ID = AIRS SITE IDENTIFICATION NUMBER, **# COMP QTRS** = NUMBER OF COMPLETED QUARTERS, **1ST AND 2ND MAX 1-HR** = FIRST AND SECOND HIGHEST VALUE FOR TIME PERIOD INDICATED, **98th PCTL** = 98th PERCENTILE OF 1 HOUR MAXIMUM, **#OBS** = OBSERVATIONS COMPLETED, **% COMP** = PERCENT COMPLETE, **ARITH MEAN** = ARITHMETIC MEAN (STANDARD = 0.053 PPM)

Total Suspended Particulates (TSP) Summary

TSP is no longer a criteria pollutant (PM_{10} replaced it as the course particulate standard in 1987), so there is no longer a standard for it. A summary of the 2012 TSP data is shown below.

SITE ID		CITY	COUNTY	ADDRESS	# OBS	1ST MAX	2ND MAX	3RD MAX	4TH MAX	ARITH MEAN	DURATION
25-025-0040		Boston	Suffolk	531A EAST FIRST ST	60	58	53	49	48	30	24 HOUR
25-025-0040	Co-Loc	Boston	Suffolk	531A EAST FIRST ST	60	60	53	49	49	28.9	24 HOUR

ABBREVIATIONS AND SYMBOLS USED IN TABLE
SITE ID = AIRS SITE IDENTIFICATION NUMBER, **TYPE** = TYPE OF MONITOR, **CO-LOC** = COLOCATED MONITOR, #**OBS** = NUMBER of OBSERVATIONS, **1ST, 2ND, 3RD, 4TH MAX** = 1ST, 2ND, 3RD AND 4TH HIGHEST 24-HOUR VALUES FOR THE YEAR, **ARITH MEAN** = ARITHMETIC MEAN, DURATION = 24-24-HOUR SAMPLING PERIOD

Sulfate (SO_4) Summary

SO_4 is not a criteria pollutant so there are no ambient air quality standards for SO_4. A summary of the 2012 SO_4 data is shown below.

SITE ID		CITY	COUNTY	ADDRESS	# OBS	1ST MAX	2ND MAX	3RD MAX	4TH MAX	ARITH MEAN	DURATION
25-025-0040		Boston	Suffolk	531A E FIRST ST	60	7.9	7.6	7.1	6.6	3.64	24 HOUR
25-025-0040	Co-Loc	Boston	Suffolk	531A E FIRST ST	60	7.7	7.5	7.3	7.1	3.58	24 HOUR

ABBREVIATIONS AND SYMBOLS USED IN TABLE
SITE ID = AIRS SITE IDENTIFICATION NUMBER , **TYPE** = TYPE OF MONITOR, **CO-LOC** = COLOCATED MONITOR, % **OBS = % OBSERVATIONS, 1ST, 2ND, 3RD, 4TH MAX** = 1ST, 2ND, 3RD AND 4TH HIGHEST 24-HOUR VALUES FOR THE YEAR, **ARITH MEAN** = ARITHMETIC MEAN, **DURATION** = 24-HOUR SAMPLING PERIOD

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 techniques that systematically assess the entire sample collection and data handling system on an ongoing basis. Quality Assurance requirements for ambient air monitoring 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 or utility of data. Examples of these data quality indicators are:

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

MassDEP's Air Assessment Branch in Lawrence maintains an independent Quality Assurance/ Data Management Group that reviews the monitoring data for quality, ensures that samples are collected correctly, and conducts performance audits throughout the air monitoring network to verify data validity. Another function of the Data Group is to process and report all of the Massachusetts air quality data to the EPA database in a timely manner. Computer software tools, report queries and "eyes on" data reviews are all used to detect and correct problems in the data before it is submitted to EPA.

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 volatile organic compounds (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.

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 standard NAAQS pollutants (ozone, NO_2, etc.) that are measured at other sites, 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.

Since the PAMS project started in 1993, Massachusetts has conducted enhanced ozone precursor measurements in the Boston and Springfield Metropolitan Areas and to assist Rhode Island in the measurement of ozone precursors and reactants at locations downwind of Providence, RI.

Because of resource and methodology considerations, VOC sampling was suspended at Blue Hill and Long Island during the 2012 season. Hourly VOC measurements were taken at Lynn, Newburyport, Chicopee and Ware.

PAMS Monitoring Areas

Boston	Springfield	Providence
Blue Hill (Milton)	Chicopee	Blue Hill (Milton)
Lynn	Ware	
Newburyport		
Long Island		

Note: Blue Hill provides data for Boston and Providence networks.

Air Toxics Monitoring

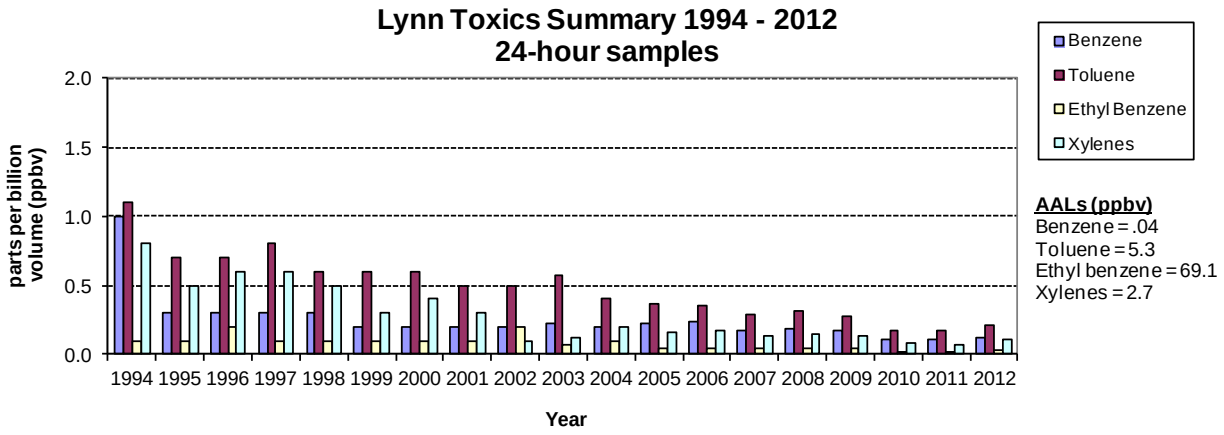
Toxic air pollutants are distinct from criteria air pollutants such as ozone and CO and are known or suspected to cause cancer or other serious health effects. Air toxics include certain volatile organic compounds (VOCs) and toxic metals (e.g., mercury).

MassDEP monitors VOCs as part of the PAMS monitoring program, some of which are classified as air toxics. MassDEP obtains health-relevant VOC concentration data throughout the year at the PAMS Type 2 sites.

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.

Figure 9 summarizes concentrations of 24-hour health-relevant target compounds for samples taken at the Lynn PAMS site from 1994 to 2012. Significant mean concentration decreases seen between 1994 and 1995 are likely due to the introduction of reformulated gasoline at the beginning of 1995. Allowable Ambient Limit (AAL) values are presented next to Figure 9 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



Below is a table that summarizes results from the analysis of 24-hour samples for target VOCs from the Boston (Harrison Ave) and Lynn sites for 2012. Harrison Avenue serves as the central city sampling location and Lynn serves as the area background site.

Compound	BOSTON (Harrison Ave)		LYNN	
	Max Value ppb	Mean ppb	Max Value ppb	Mean ppb
1,3-butadiene	0.096	0.028	0.066	0.012
1,1,1-trichloroethane	0.013	0.006	0.007	0.005
trichloroethylene	0.013	0.005	0.011	0.004
tetrachloroethylene	0.062	0.020	0.048	0.013
Benzene	0.627	0.194	0.477	0.129
Toluene	1.609	0.416	0.920	0.217
Xylenes	0.848	0.213	0.365	0.111
Ethylbenzene	0.182	0.061	0.105	0.035

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 2012 metals data.

BOSTON (Harrison Ave)			
Metal	# of Samples	Max Value ug/m^3	Mean ug/m^3
Chromium	60	.00355	.00265
Antimony	60	.00303	.00103
Arsenic	60	.00136	.00052
Berylium	60	.00001	.00001
Cadmium	60	.00026	.00012
Cobalt	60	.00026	.00010
Lead	60	.00970	.00347
Manganese	60	.01060	.00406
Nickle	60	.00834	.00141
Mercury	60	.00003	.00001
Selenium	60	.00103	.00029

Appendix A
2012 MassDEP Monitoring Station Locations

SITE ID	CITY	COUNTY	ADDRESS	DATE SITE ESTABLISHED	MONITORED
25-003-4002	ADAMS	BERKSHIRE	MT. GREYLOCK	5/1/1989	O3
25-015-0103	AMHERST	HAMPSHIRE	NORTH PLEASANT	4/1/1988	O3
TT-030-0001	AQUINNAH	DUKES	HERRING CREEK RD	4/1/2004	O3
25-025-0002	BOSTON	SUFFOLK	KENMORE SQUARE	1/1/1965	SO2 trace, NO, NO2, NOx, CO, PM2.5 FRM, PM10
25-025-0027	BOSTON	SUFFOLK	ONE CITY SQUARE	1/1/1985	PM2.5 FRM, PM10
25-025-0041	BOSTON	SUFFOLK	LONG ISLAND	12/1/1998	O3, NO, NO2, NOx, VOCs, WS/WD, TEMP, Solar Rad, RH, BP
25-025-0042	BOSTON	SUFFOLK	HARRISON AVENUE	12/15/1998	O3, SO2 trace, NO, NO2, NOx, NOy,CO trace, PM2.5 FRM, PM2.5 BAM, PM2.5 Speciation, PM10, Lead, Toxics, Black Carbon, WS/WD, TEMP, Solar Rad, RH, BP
25-025-0043	BOSTON	SUFFOLK	174 NORTH ST	1/1/2000	PM2.5 FRM, PM2.5 BAM, Black Carbon
25-023-0004	BROCKTON	PLYMOUTH	120 COMMERCIAL ST	12/15/1998	PM2.5 FRM
25-017-0009	CHELMSFORD	MIDDLESEX	11 TECHNOLOGY DR	4/1/2005	O3
25-013-0008	CHICOPEE	HAMPDEN	ANDERSON RD	1/1/1983	O3, NO, NO2, NOx, PM2.5 FRM, PM2.5 speciation, VOCs, TEMP, WS/WD, Solar Rad, RH, BP, CO trace
25-005-1002	FAIRHAVEN	BRISTOL	LEROY WOOD	1/1/1982	O3, WS/WD, TEMP, Solar Rad, RH, BP
25-005-1004	FALL RIVER	BRISTOL	GLOBE ST	2/1/1975	O3, PM2.5 FRM, PM2.5 BAM, SO2
25-009-5005	HAVERHILL	ESSEX	WASHINGTON ST	7/19/1994	O3, NO, NO2, NOx, PM2.5 FRM, PM2.5 BAM, WS/WD, TEMP, Solar Rad, RH, BP
25-009-6001	LAWRENCE	ESSEX	WALL EXPERIMENT STA.	4/3/1999	PM2.5 FRM
25-009-2006	LYNN	ESSEX	390 PARKLAND	1/1/1992	O3, NO, NO2, NOx, PM2.5 FRM, PM2.5 BAM, CO trace, VOCs, Toxics, WS/WD, TEMP, Solar Rad, RH, BP, PRECIP
25-021-3003	MILTON	NORFOLK	BLUE HILL	4/2/2002	O3, NO, NO2, NOx, PM2.5 BAM, VOCs, WS/WD, TEMP, Solar Rad, RH, BP
25-009-4005	NEWBURYPORT	ESSEX	HARBOR STREET	7/6/2010	O3, NO, NO2, NOx, NOy, VOCs, WS/WD, TEMP, Solar Rad, RH, BP
25-003-5001	PITTSFIELD	BERKSHIRE	78 CENTER STREET	11/6//98	PM2.5 FRM
25-003-0006	PITTSFIELD	BERKSHIRE	BERKSHIRE COMMONS	1/1/79	PM2.5 BAM
25-013-0016	SPRINGFIELD	HAMPDEN	LIBERTY STREET	4/1/1988	SO2, NO, NO2, NOx, CO, Black Carbon, PM2.5 FRM, PM2.5 BAM
25-013-2009	SPRINGFIELD	HAMPDEN	1860 MAIN STREET	1/1/2002	PM2.5 FRM, PM10, Lead
25-001-0002	TRURO	BARNSTABLE	FOX BOTTOM AREA	4/1/1987	O3, IMPROVE, WS/WD, TEMP, Solar Rad, RH, BP
25-027-0024	UXBRIDGE	WORCESTER	366 E HARTFORD AVE	11/13/2008	O3, WS/WD, TEMP, Solar Rad, RH, BP
25-015-4002	WARE	HAMPSHIRE	QUABBIN SUMMIT	6/1/1985	O3, SO2 trace, NO, NO2, NOx, NOy, PM10, VOCs, PM2.5 BAM, IMPROVE, WS/WD, TEMP, Solar Rad, RH, BP, PRECIP
25-027-0015	WORCESTER	WORCESTER	WORC. AIRPORT	5/7/1979	O3, WS/WD, TEMP, Solar Rad, RH, BP,
25-027-0016	WORCESTER	WORCESTER	2 WASHINGTON ST	12/31/2002	PM2.5 FRM
25-027-0023	WORCESTER	WORCESTER	SUMMER STREET	1/1/2004	SO2, NO, NO2, NOx, CO, PM2.5 FRM, PM2.5 BAM, PM10
25-019-0001	NANTUCKET	NANTUCKET	14 AIRPORT RD	1/10/12	Lead

2012 Private Monitoring Station Location

SITE ID	CITY	COUNTY	ADDRESS	DATE SITE ESTABLISHED	MONITORED
25-025-0040	BOSTON	SUFFOLK	531A EAST FIRST ST	1/1/1993	SO2, TSP, SO4, NO2, WS/WD