Commonwealth of Massachusetts
2002 Air Quality Report

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Division of Planning and Evaluation

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List of Abbreviations

AAB ..... Air Assessment Branch
AIRS ..... Aerometric Information Retrieval System
AQI……. Air Quality Index
BAM ..... Beta Attenuation Monitor
BP..... Barometric Pressure
CAA ..... Clean Air Act
CFR..... Code of Federal Regulations
CO..... Carbon Monoxide
CO_2..... Carbon Dioxide
DVMT..... Daily Vehicle Miles Traveled
EOEA..... Executive Office of Environmental Affairs
FRM ..... Federal Reference Method
IMPROVE ... Interagency Monitoring of Protected Visual Environments
MADEP..... Massachusetts Department of Environmental Protection
mg/m^3 ..... milligrams per cubic meter
micron……one-one millionth of an inch
NAAQS..... National Ambient Air Quality Standards
NADP..... National Atmospheric Deposition Program
NAMS..... National Air Monitoring Stations
NESCAUM.. Northeast States for Coordinated Air Use Management
NOAA ..... National Oceanic and Atmospheric Administration
NO..... Nitric Oxide
NO_x ..... Nitrogen Oxides
NO_y ..... Total Reactive Oxidized Nitrogen
NO_2 ..... Nitrogen Dioxide
NO_3 ..... Nitrate
O_3 ..... Ozone
PAMS..... Photochemical Assessment Monitoring Stations
Pb ..... Lead
PEI..... Periodic Emissions Inventory
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
PM_{10} ..... Particulate matter 10 microns
PSI..... Pollutant Standards Index
QA/QC ..... Quality Assurance and Quality Control
RH..... Relative Humidity
SIP..... State Implementation Plan
SLAMS ..... State and Local Air Monitoring Stations
SO_2 ..... Sulfur Dioxide
SO_4 ..... Sulfate
SUN……..Solar Radiation
TSP..... Total Suspended Particulates
ug/m^3 ..... micrograms per cubic meter
USEPA..... United States Environmental Protection Agency
VOC ..... Volatile Organic Compounds
WS/WD..... Wind Speed/Wind Direction

Section I
Ambient Air Monitoring Program

Program Overview

Introduction

Regulations set forth in the Code of Federal Regulations (Title 40, Part 58) require each state to establish an air monitoring network. A network of National Air Monitoring Stations (NAMS) located in urban areas and based on population provides a consistent nationwide database. The State and Local Air Monitoring Stations (SLAMS) network includes NAMS plus additional sites. This provides a comprehensive assessment of air quality.

The Air Assessment Branch (AAB) of the Massachusetts Department of Environmental Protection (MADEP) collects ambient air quality data from sites throughout Massachusetts. During 2002, AAB operated a monitoring network of 40 publicly funded stations located in 25 cities and towns. AAB also oversaw a separate privately funded industrial network of four stations located at industries in the Boston area.

MADEP submits ambient air quality data to the Aerometric Information Retrieval System (AIRS), a computer-based repository of national air quality information administered by the U.S. Environmental Protection Agency (USEPA).

Why is Air Quality Data Collected?

The ambient air quality data is used for the following purposes:

- to verify compliance with National Ambient Air Quality Standards;
- to support development of policies and regulations designed to reduce ambient air pollution;
- to assess the effectiveness of existing air pollution control strategies;
- to provide aerometric data for long-term trend analysis and special research; and
- to fulfill USEPA reporting requirements for ambient air quality data.

What is Monitored?

The parameters monitored by the Air Assessment Branch fall into the following categories:

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

- sulfur dioxide (SO_2)
- ozone (O_3)
- carbon monoxide (CO)
- nitrogen dioxide (NO_2)
- lead (Pb)
- particulate matter – 10 microns (PM10)
- particulate matter – 2.5 microns (PM2.5)

Non-criteria pollutants have no established national standards. These pollutants are:

- nitric oxide (NO)
- total nitrogen oxides (NO_x)
- total reactive oxidized nitrogen (NO_y)
- total suspended particulates (TSP)
- volatile organic compounds (VOC) – ozone precursors and reaction product chemicals
- black carbon

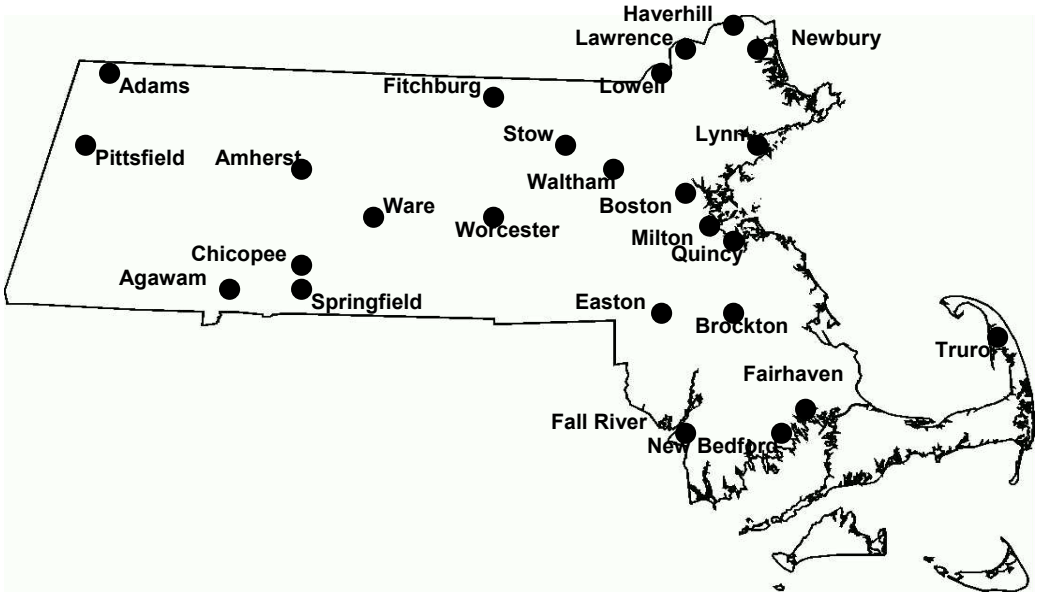
Meteorological parameters monitored are:

- wind speed/wind direction (WS/WD)
- relative humidity (RH)
- temperature (TEMP)
- barometric pressure (BP)
- solar radiation
- upper air wind and temperature
- total ultraviolet radiation
- precipitation

Monitoring Station Locations

The monitoring locations for the different pollutants are sited to provide data for various purposes. Some sites are located in "hot spots" where maximum concentrations are expected, while others provide data that is representative of larger land areas. The topography and the location of pollutant sources are factors that determine the scale of representation for a particular monitor location.

There is a network of monitors for each pollutant located throughout the state. These networks are designed to reflect pollutant concentrations accurately for all of Massachusetts. Section III contains data summaries for each pollutant and maps showing the monitor locations for each network. Also, the site directory in this section lists the different monitors located at each site. The map below shows Massachusetts cities and towns that had monitors during 2002.



For Further Information

For further information pertaining to this report, contact the Air Assessment Branch. For information about other air quality matters, please contact MADEP's Division of Planning and Evaluation in Boston, or a MADEP regional office. The addresses are listed below.

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Information about MADEP's various programs and this report are available on the internet from MADEP's web site (www.mass.gov/dep). The USEPA maintains a web site (www.epa.gov/air/data) that has air quality information from all the states.

National Ambient Air Quality Standards

Primary Standards – designed to protect public health against adverse health effects with a margin of safety.

Secondary Standards - designed to protect against damage to crops, vegetation, and buildings.

POLLUTANT	AVERAGING TIME*	PRIMARY	SECONDARY
SO_2	Annual Arithmetic Mean	0.03 ppm (80 ug/m³)	None
	24-Hour	0.14 ppm (365 ug/m³)	None
	3-Hour	None	0.50 ppm (1300 ug/m³)
CO	8-Hour	9 ppm (10 mg/m³)	Same as Primary Standard
	1-Hour	35 ppm (40 mg/m³)	Same as Primary Standard
O_3	1-Hour	0.12 ppm (235 ug/m³)	Same as Primary Standard
	8-Hour	0.08 ppm (157 ug/m³)	Same as Primary Standard
• The 1-hour standard is met when the daily maximum 1-hour concentration does not exceed 0.12 ppm at any one monitor on more than 3 days over any 3 year period. • The 8-hour standard is met when the 3-year average of the 4th-highest daily maximum 8-hour average does not exceed 0.08 ppm at any one monitor.			
Pb	Calendar Quarter Arithmetic Mean	1.5 ug/m³	Same as Primary Standard
NO_2	Annual Arithmetic Mean	0.053 ppm 100 ug/m³	Same as Primary Standard
$PM_{2.5}$ Particulates up to	Annual Arithmetic Mean	15.0 ug/m³	Same as Primary Standard
2.5 microns in size	24-Hour	65 ug/m³	Same as Primary Standard
• The annual standard is met when the annual average of the quarterly mean $PM_{2.5}$ concentrations is less than or equal to 15 ug/m³ (3-year average). If spatial averaging is used, the annual average from all monitors within the area may be averaged in the calculation of the 3-year mean. • The 24-hour standard is met when the 98th percentile value is less than or equal to 65 ug/m³ (3-year average).			
PM_{10} Particulates up to	Annual Arithmetic Mean	50 ug/m³	Same as Primary Standard
10 microns in size	24-Hour	150 ug/m³	Same as Primary Standard
• The PM_{10} standard is based upon estimated exceedance calculations described in 40 CFR Part 50, Appendix K. • The annual standard is met if the estimated annual arithmetic mean does not exceed 50 ug/m³. • The 24-hour standard is attained if the estimated number of days per calendar year above 150 ug/m³ does not exceed one per year.			

μg/m³ = micrograms per cubic meter ppm = parts per million mg/m³ = milligrams per cubic meter

***** Standards based upon averaging times other than the annual arithmetic mean must not be exceeded more than once a year.

Pollutant Health Effects and Sources

Ozone (O3)

- Ground-level and stratospheric O_3 are often confused. Stratospheric O_3 is beneficial because it filters out the sun's harmful ultraviolet radiation. However, ground-level O_3 is a health and environmental problem. This report pertains to ground-level O_3.
- O_3 irritates mucous membranes. This causes reduced lung function, nasal congestion, and throat irritation, and reduced resistance to infection.
- O_3 is toxic to vegetation, inhibiting growth and causing leaf damage.
- O_3 weakens materials such as rubber and fabrics.
- O_3 is unique in that it is formed by reactions between other pollutants in the presence of intense, high-energy sunlight occurring during the summer months. The complexity and subsequent time needed to complete these reactions results in the buildup of ground-level ozone concentrations far downwind from the original source of the precursors.
- Sources of ground-level O3 precursors, nitrogen oxides and hydrocarbons, include motor vehicles and power plants.

Carbon Monoxide (CO)

- CO reacts in the bloodstream with hemoglobin, reducing 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.
- High levels of CO are possible near parking lots and city streets with slow-moving cars, particularly during peak traffic times.
- Motor vehicle emissions are the largest source of CO, which is produced from incomplete combustion of carbon in fuels.

Sulfur Dioxide (SO2)

- 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, degradation of visibility.
- SO2 is a product of fuel combustion (e.g., burning coal and oil). Sources include heat and power generation facilities, and petroleum refineries.

Nitrogen Dioxide (NO2)

- NO_2 lowers resistance to respiratory infections and aggravates symptoms associated with asthma and bronchitis.
- NO_2 contributes to acid deposition. [See SO_2 listing above for the effects.]
- NO_2 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, heating and power plants, and motor vehicles.

Particulate Matter (PM10 and PM2.5)

- 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, 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 the particles allows entry into the human respiratory system. Long-term exposure allows the particles to accumulate in the lungs and affects breathing and produces respiratory symptoms. The smallest particulates 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 particles.
- Particulate matter causes soiling and corrosion of materials.
- Particulate matter contributes to atmospheric haze that degrades visibility.
- Sources include industrial process emissions, motor vehicles, incinerators, heat and power plants.

Lead (Pb)

- Lead is an elemental metal.
- The primary source for airborne lead used to be motor vehicles, but the use of unleaded gasoline has greatly reduced those emissions. Other sources are lead smelters and battery plants.
- Exposure to lead may occur by inhalation or ingestion of food, water, soil or dust particles.
- Children, infants, and fetuses are more 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.

Public and Industrial Network Descriptions

2002 Public Monitoring Network

The Air Assessment Branch operates a public ambient air monitoring network.

Network Size

- 40 monitoring stations
- 25 cities and towns with monitoring stations

Number of Continuous Monitors

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

- Criteria pollutant monitors measure pollutants for which National Ambient Air Quality Standards (NAAQS) have been set.
  - 9 – CO (carbon monoxide)
  - 15 – NO_2 (nitrogen dioxide). NO (nitrogen oxide) and NO_x (total nitrogen oxides) are also measured by these monitors.
  - 15 – O_3 (ozone)
  - 8 – SO_2 (sulfur dioxide)

- Meteorological monitors track weather conditions.
  - 10 – BP (barometric pressure)
  - 10 – RH (relative humidity)
  - 10 – SOLAR RAD (solar radiation)
  - 12 – TEMP (temperature)
  - 12 – WS/WD (wind speed/wind direction)
  - 1 – Upper Meteorology – this monitor measures WS/WD and TEMP at various altitudes. This aids in the analysis of pollutant transport.
  - 2 – Total Ultraviolet Radiation
  - 2 – Precipitation

- Other Monitors
  - 3 – NO_y (Total Reactive Oxidized Nitrogen)
  - 3 – PAMS (Photochemical Assessment Monitoring Station). These monitors measure VOCs (volatile organic compounds).
  - 3 – $PM_{2.5}$ (particulate matter – 2.5 microns, BAM)
  - 1– Black Carbon
  - 1 – Acid Deposition. Precipitation is collected and analyzed for conductivity and acidic compounds that are harmful to the environment. This monitor, located in Waltham, is part of the National Atmospheric Deposition Program (NADP). Two other monitors in Massachusetts are also part of the NADP. They are located in Truro and Ware and are not operated by MADEP.
  - 1– Mercury Deposition

Note: The number of public sites described above was consolidated to 28 stations in 21 communities after December 31, 2002, in response to the results of a network review that was driven by resource and data need considerations. Further network review is continuing in view of emerging nationwide monitoring initiatives.

Number of Intermittent Monitors

- Other 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).
  - 1 – Pb (Lead)
  - 8 – PM_{10} – (particulate matter – 10 microns)
  - 26 – $PM_{2.5}$ – (particulate matter – 2.5 microns)

- Non-criteria pollutant monitors – pollutants measured do not have NAAQS.
  - 3 – PAMS (photochemical assessment monitoring station). These monitors measure VOCs (volatile organic compounds).
  - 1 – TSP (total suspended particulates)
  - 2 – Toxics. These monitors measure health-relevant VOCs.
  - 2 – Speciation. These monitors measure for $PM_{2.5}$, nitrates, and organics.

2002 Industrial Monitoring Network

Industries monitor air quality and submit data under agreement with MADEP. The data must be collected using quality assurance requirements established by MADEP and USEPA.

Network Size

- 4 monitoring stations
- All are located in the Boston area

Number of Continuous Monitors

Continuous monitors measure the air quality 24 hours per day. The data is averaged to provide 1-hour averages.

- Criteria pollutant monitors measure pollutants that have National Ambient Air Quality Standards (NAAQS).
  - 1 – NO_2 (nitrogen dioxide). NO (nitrogen oxide) and NO_x (total nitrogen oxides) are also measured by this monitor.
  - 4 – SO_2 (sulfur dioxide)

- Meteorological monitors
  - 4– WS/WD (wind speed/wind direction)

Number of Intermittent Monitors

Intermittent monitors take discrete samples for a specific time period. These monitors sample every sixth day, and the data is averaged for a 24-hour interval.

- Other Monitors
  - 4 – TSP (total suspended particulates)
  - 4 – SO_4 (sulfate)

Section II
Attainment and Exceedances of Air Quality Standards

Attainment Status Summary

Carbon Monoxide

Prior to the mid-1980s, Massachusetts was in violation of the carbon monoxide (CO) standard. However, with the adoption of numerous control programs, CO emissions decreased. The last violation in the state of the CO NAAQS occurred in 1986. In 2000, MADEP formally requested that the USEPA re-designate the cities of Lowell, Springfield, Waltham, and Worcester to attainment for CO since the CO monitoring data for those cities had been below the standard for many years. With the re-designation of these cities to CO attainment in April 2002, the entire state is now in attainment of the CO standard.

Ozone

As noted on page 4, there are two NAAQS for ozone. For almost two decades prior to 1997, the standard for ozone had been 0.12 parts per million (ppm) averaged over one hour. In 1997, USEPA set a new stricter ozone standard of 0.08 ppm averaged over an eight-hour period. Industry groups filed suit against USEPA following promulgation of the standard. In February 2001, the U.S. Supreme Court upheld the USEPA's authority for setting the new health-based ozone and particulate matter standards. In March 2002, the U.S. Court of Appeals for the District of Columbia upheld the standards themselves. However, the USEPA has not yet designated ozone nonattainment areas for the new 8-hour standard due to the delay in implementation of the new standard caused by the industry litigation.

MADEP monitors for both 1-hour and 8-hour ozone levels throughout the state.

Massachusetts has violated the 1-hour ozone standard for many years. However, with the adoption of numerous control programs, progress has been made. The number and severity of the 1-hour ozone exceedances has declined significantly in recent years. As of 2002, the entire state was in violation of the 1-hour and 8-hour standards based on ozone readings for the 1999-2002 period.

USEPA is expected to designate the attainment status of the state for the new 8-hour ozone standard in 2004. Massachusetts is expected to be nonattainment for the 8-hour standard.

PM2.5 - The Evolution of the Particulate Standard

On a periodic basis USEPA conducts a review of the national ambient air quality standards (NAAQS). The process includes a compilation and scientific assessment of all the health and environmental effects information available. The information that is gathered undergoes detailed reviews by the scientific community, industry, public interest groups, the general public, and the Clean Air Scientific Advisory Committee (CASAC) – a Congressionally mandated group of independent scientific and technical experts. Based on the scientific assessments and taking into account the recommendations of CASAC, the USEPA administrator decides whether or not it is appropriate to revise the standards.

The particulate matter standard has evolved over the years as new studies have been published on the health effects of particulate matter. The trend has been to control particulates of smaller sizes and to more stringent concentrations, as studies have linked exposure to fine particles with adverse health effects.

- 1970 – The standard was based on Total Suspended Particulates (TSP). The standards were set at 260 ug/m^3 (24-hours) and 75 ug/m^3 (annual geometric mean).
- 1987 – The TSP standard was replaced by the PM_{10} standard (particulate matter equal to or less than 10 microns in size). The PM_{10} standards were set at 150 ug/m^3 (24-hours) and 50 ug/m^3 (annual arithmetic mean).
- 1997 – The $PM_{2.5}$ standard (particulate matter equal to or less than 2.5 microns) was promulgated in addition to the PM_{10} standard. The $PM_{2.5}$ standards are set at 65 ug/m^3 (24-hours) and 15 ug/m^3 (annual arithmetic mean).

Following promulgation of the new PM2.5 standard industry groups filed suit challenging the standard. While the courts have upheld the standard, implementation has been delayed. USEPA is not expected to designate attainment status for areas under the PM2.5 standard until 2004 or later. It is not clear whether Massachusetts will attain the PM2.5 standard.

Ozone Exceedances

What Determines an Exceedance?

An O_3 exceedance occurs when a daily O_3 concentration exceeds the National Ambient Air Quality Standards (NAAQS). There are two O_3 standards based on different averaging times, 1 hour and 8 hours. An exceedance of the 1-hour standard is an hourly value during a day that is equal to or greater than 0.125 ppm. An exceedance of the 8-hour standard is an 8-hour averaged value during a day that is equal to or greater than 0.085 ppm.

The Difference Between an Exceedance and a Violation

Recording an exceedance of the O_3 standards does not necessarily mean that a violation of the standard has occurred. Violations of the 1-hour and 8-hour standards are based upon 3-year averages of O_3 data.

Violations of the 1-hour standard are determined using the number of expected exceedance days. An exceedance day is a day that records an O_3 1-hour average greater than the standard of 0.125 ppm. A monitoring site can only have one reported exceedance per day – the hour with the highest average is used. The term "expected exceedance days" is used to account for both actual exceedance days and missing data.

A violation of the 1-hour standard requires a 3-year average that is greater than one expected exceedance day. In other words, if there are 4 or more days during a 3-year period with O_3 1-hour values that are equal to or greater than 0.125 ppm, a violation of the 1-hour standard (at that specific site) has occurred.

Violations of the 8-hour standard are determined using the annual 4th-highest daily maximum 8-hour O_3 value. A violation requires a 3-year average of the annual 4th-highest daily maximum 8-hour value that is equal to or greater than 0.085 ppm. In other words, the 8-hour values for each day during a year are ranked from highest to lowest. Then, the 4th-highest value for 3 consecutive years is averaged. If the 3-year average is 0.085 ppm or greater, a violation of the 8-hour standard (again at that specific site) has occurred.

O_3 Exceedances and Violations During 2002

During 2002, there were five exceedance days and 22 exceedances of the 1-hour standard. There were 30 exceedance days and 121 exceedances of the 8-hour standard.

Using data from 2000–2002, five out of 15 sites violated the 1-hour standard. The more stringent 8-hour standard was violated at nine of the 15 sites for the 2000-2002 period.

Robust ozone formation requires a combination of intense sunlight (UV), hot temperatures and chemicals such as VOCs and NOx. This combination occurred often in the summer of 2002.

2002 O_3 Exceedances (ppm)

DATE	SITE	8-HOUR EXC	1-HOUR EXC	START HOUR
May 24, 2002	Blue Hill	.088		11
June 11, 2002	Chicopee	.092		12
June 11, 2002	Ware	.089		12
June 21, 2002	Agawam	.090		12
	Amherst	.086		12
	Blue Hill	.090		10
	Chicopee	.097		12
	Lawrence	.088		11
	Boston(LongIs)	.089		11
	Lynn	.089		10
	Newbury	.094		10
	Stow	.092		11
	Ware	.095		12
June 23, 2002	Stow	.087		16
	Blue Hill	.092		16
June 26, 2002	Chicopee	.088		10
	Blue Hill	.102		12
	Boston(LongIs)	.097		12
	Lynn	.109		11
	Newbury	.091		11
	Stow	.096		11
	Ware	.085		10
July 1, 2002	Truro	.086		15
	Fairhaven	.087		13
July 2, 2002	Fairhaven	.105		13
	Truro	.105		13
July 3, 2002	Fairhaven	.086		10
	Boston(LongIs)	.102		10
	Lynn	.098		10
	Truro	.093		11
July 3, 2002	Boston(LongIs)		.126	12
July 4, 2002	Truro	.086		14
July, 8 2002	Truro	.086		20
	Blue Hill	.088		19
July 9, 2002	Boston(LongIs)	.086		9
	Lynn	.100		9
	Blue Hill	.103		8
July 14, 2002	Lynn	.086		11
	Newbury	.088		11
	Blue Hill	.089		11
July 18, 2002	Fairhaven	.102		16
	Truro	.105		11
July 22, 2002	Agawam	.097		12
	Amherst	.091		12
	Chicopee	.108		12
	Ware	.095		12
	Worcester	.089		12
July 22, 2002	Chicopee		.132	16
July 30, 2002	Truro	.088		11
August 3, 2002	Blue Hill	.086		10
August 4, 2002	Chicopee	.092		13
	Lynn	.088		10
August 10, 2002	Blue Hill	.086		16
August 11, 2002	Adams	.086		17
	Agawam	.093		13
	Chicopee	.095		13
	Lawrence	.086		11
	Boston(HarrisonAve)	.089		10
	Boston(LongIs)	.087		10
	Lynn	.097		11
	Newbury	.088		11
	Stow	.087		13
	Ware	.096		16
	Worcester	.091		13
	Blue Hill	.103		11
August 12, 2002	Adams	.091		22
	Agawam	.101		11
	Chicopee	.115		11
	Boston(LongIs)	.092		11
	Lawrence	.109		10
	Lynn	.097		12
	Newbury	.103		9
August 12, 2002	Stow	.107		9
	Ware	.094		12
	Worcester	.102		23
	Blue Hill	.116		10
August 12, 2002	Chicopee		.131	13
	Lawrence		.125	12
	Blue Hill		.133	13
August 13, 2002	Adams	.096		22
	Agawam	.112		15
	Amherst	.096		10
	Chicopee	.108		13
	Lawrence	.105		10
	Boston(HarrisonAve)	.092		9
	Boston(LongIs)	.126		10
	Lynn	.123		9
	Newbury	.119		11
	Stow	.110		10
	Truro	.112		9
	Ware	.107		12
	Worcester	.118		16
	Blue Hill	.134		9
August 13, 2002	Agawam		.142	20
	Chicopee		.128	11
	Boston(LongIs)		.136	12
	Lynn		.145	12
	Newbury		.145	14
	Truro		.130	10
	Ware		.139	13
	Worcester		.127	16
	Blue Hill		.150	14
August 14, 2002	Adams	.101		13
	Agawam	.118		11
	Amherst	.107		11
	Chicopee	.118		11
	Lawrence	.102		9
	Boston(LongIs)	.117		8
	Lynn	.122		9
	Newbury	.126		10
	Stow	.106		10
	Truro	.091		9
	Ware	.110		11
	Blue Hill	.112		9
August 14, 2002	Agawam		.145	16
	Amherst		.131	17
	Chicopee		.139	16
	Boston(LongIs)		.138	11
	Lynn		.152	12
	Newbury		.148	13
	Ware		.134	15
	Worcester		.131	16
August 15, 2002	Chicopee	.085		11
August 16, 2002	Worcester	.085		11
August 18, 2002	Lynn	.087		10
	Worcester	.087		14
	Blue Hill	.093		11
August 19, 2002	Fairhaven	.087		13
September 8, 2002	Ware	.087		14
September 9, 2002	Lawrence	.086		11
	Boston(LongIs)	.102		11
	Lynn	.091		11
	Newbury	.089		11
	Blue Hill	.107		12
September 10, 2002	Boston(LongIs)	.094		10
	Lynn	.097		10
	Newbury	.092		11
	Stow	.086		11
	Ware	.091		11
	Worcester	.097		11
	Blue Hill	.091		10
September 14, 2002	Worcester	.087		10
	Blue Hill	.085		10

Exceedance Days and Total Exceedance Trends

Figures 1 and 2 show the recent trends in exceedance days and the total number of 1-hour and 8-hour exceedances.

The trend for the 1-hour data in Figure 1 shows a decline in the number of exceedances and exceedance days over the period. The trend in Figure 2 shows that, under the new more stringent 8-hour standard, there are a greater number of exceedances and exceedance days compared to the 1-hour standard.

Figure 1
1-hr O_3 Exceedance Days and Total Exceedances 1987-2002
Ozone exceeded the 1-hour standard (0.125 ppm)

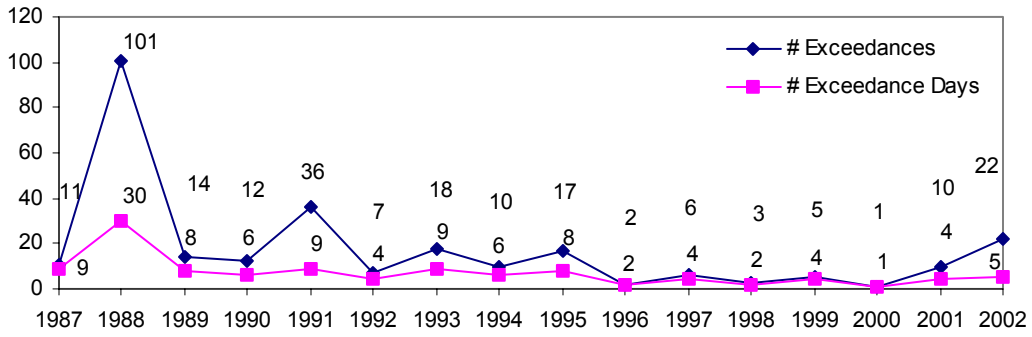
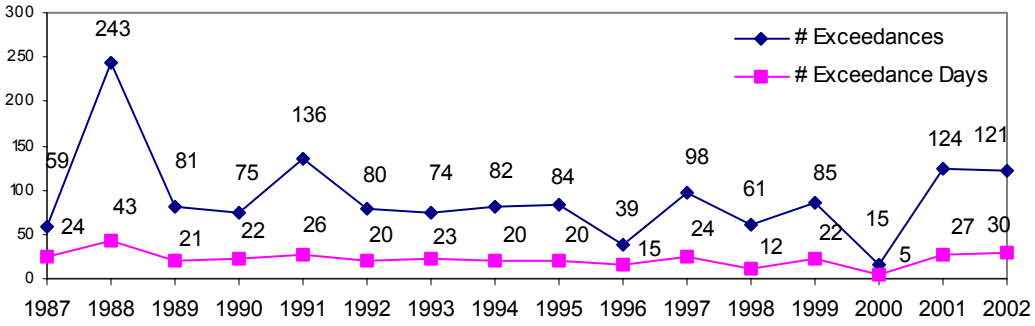


Figure 2
8-hr O_3 Exceedance Days and Total Exceedances 1987-2002
Ozone exceeded the 8-hour standard (0.085 ppm)



Daily Ozone (O_3) Forecast

Air Quality Ratings

MADEP forecasts air quality daily, based on O_3, from May through September. Each day during that period, MADEP predicts the air quality as good, moderate, or unhealthy.

The air quality rating is determined through analysis of National Weather Service observations and modeled predictions. Meteorological, O_3, and nitrogen oxides data from the statewide and regional monitoring networks are also used.

The table below describes the ratings used in the daily air quality forecasts.

Air Quality Rating	Adverse Health Effects	Ways to Protect Your Health
Good	None expected.	No precautions necessary.
Moderate	O_3 levels in the upper part of this range may cause respiratory problems in some children and adults engaged in outdoor activities. These effects are of particular concern for those with existing lung problems.	People with respiratory diseases, such as asthma, and other sensitive individuals should consider limiting outdoor exercise and strenuous activities during the afternoon and early evening hours, when O_3 levels are highest.
Unhealthy	As O_3 levels increase, both the severity of the health effects and the number of people affected increase. Health effects include nose and throat irritation; chest pain; decreased lung function; shortness of breath; increased susceptibility to respiratory infection, and aggravation of asthma. It is important note that individuals react differently when exposed to various O_3 levels in the unhealthy range; some people experience problems at lower unhealthy levels, while others may not be affected until higher levels are reached.	In general, everyone should limit strenuous outdoor activity during the afternoon and early evening hours, when O_3 levels are usually the highest. If you are particularly sensitive to O_3, or if you have asthma or other respiratory problems, stay in an area where it is cool and, if possible, where it is air-conditioned. If you want to take action to minimize exposure to unhealthy O_3 levels, you should consider scheduling outdoor exercise and children's outdoor activities in the morning hours, when O_3 levels are generally lower.

Forecast Availability

The daily air quality forecast is available May through September from MADEP's website (www.mass.gov/air) or by calling the Air Quality Hotline (1-800-882-1497).

Ozone Maps

USEPA maintains internet web sites containing current and archived O_3 maps and "real-time" O_3 movies using O_3 data that is provided by participating states: (www.epa.gov/region01/topics/air/) and (www.epa.gov/airnow).

Section III
Massachusetts Air Quality Data Summaries

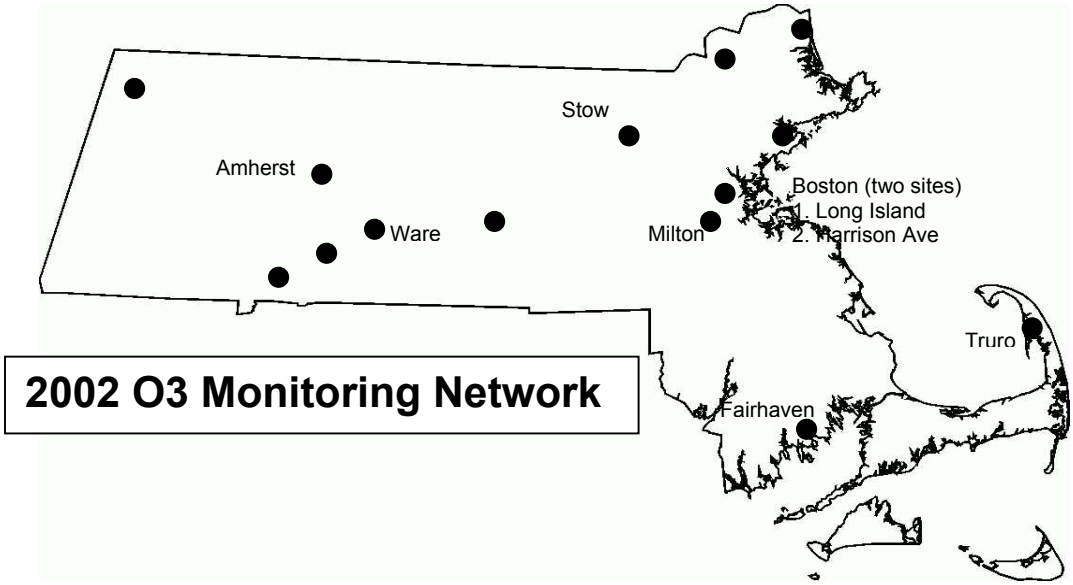
Ozone (O_3) Summary

2002 O_3 Data Summary

A summary of the 2002 data during O_3 season (April 1 – Sept. 30) is listed below. There were 15 O_3 sites during 2002 in the state-operated monitoring network. All of the sites except Worcester achieved the requirement of 75% or greater data capture for the year.

	P				UNITS: PPM								VALS
SIT	OC	MT	CITY	COUNTY	ADDRESS	% OBS	-1 HR 1ST	MAX-2ND	>.125	-8HR 1ST	MAX 2ND	4TH	>.085
25-003-4002	1	2	ADAMS	BERKSHIRE	MT GREYLOCK	86	.120	.103	0	.101	.096	.086	4
2 003	1		AGAWAM	HAMPDEN	152 S. WESTFIELD		.145	.142	2	.118	.112	.097	6
25-015-0103	1	2	AMHERST	HAMPSHIRE	NORTH PLEASANT	98	.131	.118	1	.107	.096	.086	4
25-025-0041	1		BOSTON	SUFFOLK	LONG IS.HOSPITAL	99	.138	.136	3	.126	.117	.102	10
25-025-0042	1	2	BOSTON	SUFFOLK	HARRISON AVE	91	.097	.090	0	.092	.089	.076	2
25-013-0008	1		CHICOPEE	HAMPDEN	ANDERSON ROAD	97	.139	.132	4	.118	.115	.108	10
25-005-1002	1	2	FAIRHAVEN	BRISTOL	L.WOOD SCHOOL	95	.115	.113	0	.105	.102	.087	5
25-009-0005	1		LAWRENCE	ESSEX	HIGH STREET	95	.125	.124	1	.109	.105	.088	6
25-009-2006	1	8	LYNN	ESSEX	390 PARKLAND AVE	97	.152	.145	2	.123	.122	.100	13
2	1		MILTON	NORFOLK	BLUE HILL RESERV.	99	.150	.133	2	.134	.116	.107	17
25-009-4004	1	7	NEWBURY	ESSEX	SUNSET BOULEVARD	98	.148	.145	2	.126	.120	.094	9
25-017-1102	1		STOW	MIDDLESEX	US MILITARY RESERV.	89	.123	.122	0	.110	.107	.096	8
25-001-0002	1	2	TRURO	BARNSTABLE	FOX BOTTOM AREA	95	.130	.118	1	.112	.105	.093	9
25-015-4002	1		WARE	HAMPSHIRE	QUABBIN SUMMIT	98	.139	.134	2	.110	.107	.095	10
25-027-0015	1	1	WORCESTER	WORCESTER	WORCESTER AIRPORT	60	.131	.127	2	.118	.102	.091	8

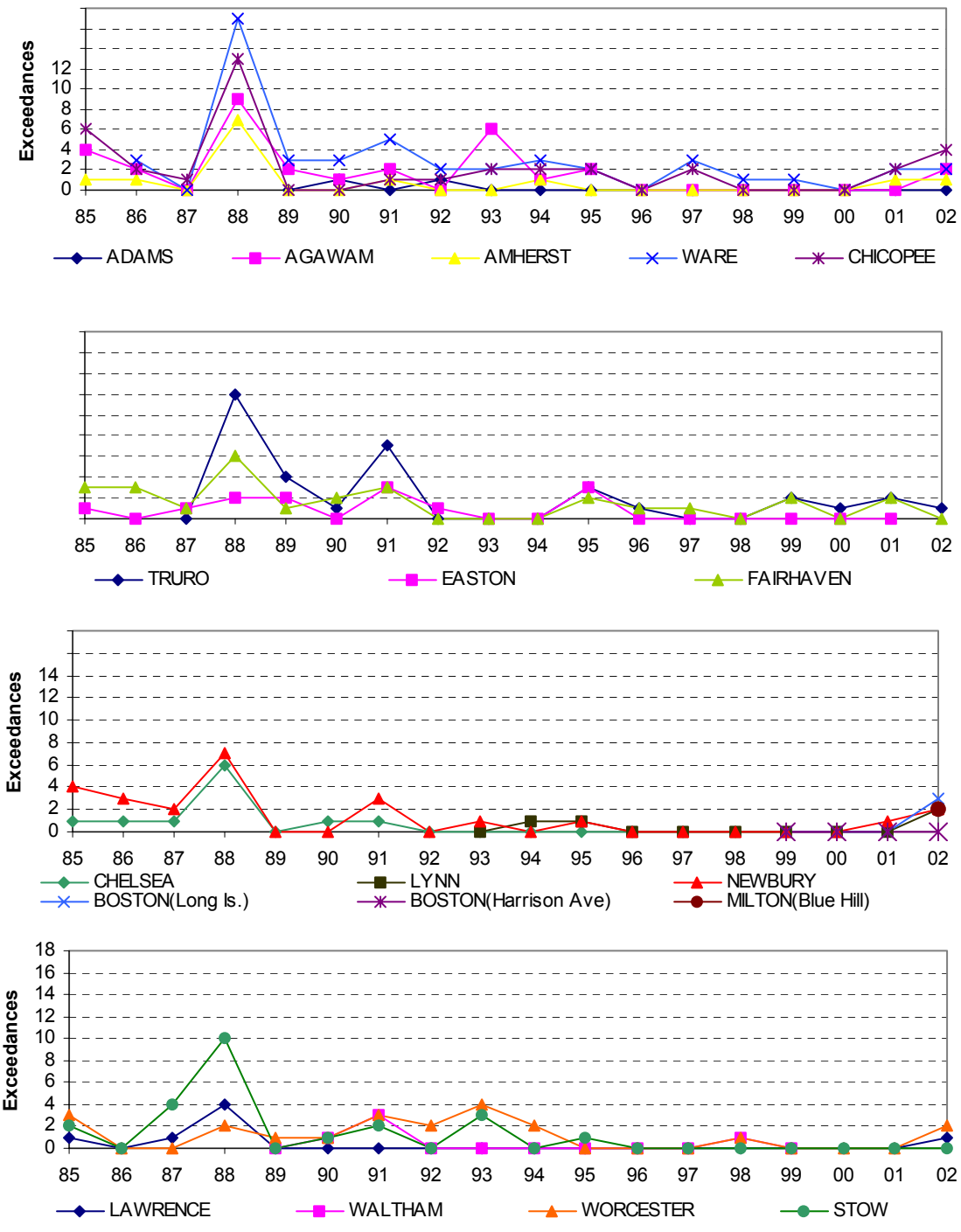
ABBREVIATIONS AND SYMBOLS USED IN TABLE
SITE ID = AIRS SITE IDENTIFICATION NUMBER **POC** = PARAMETER OCCURRENCE CODE (DIFFERENTIATES BETWEEN MONITORS AT A SITE) .**MT** = MONITOR TYPE (1 = NAMS, 2 = SLAMS, 3 = OTHER; 7 = PAMS/NAMS; 8 = PAMS/SLAMS) **% OBS** = PERCENTAGE OF VALID DAYS MONITORED DURING O3 SEASON **1ST, 2ND 1-HR MAX** = MAXIMUM 1-HR VALUE FOR THE 1ST & 2ND HIGHEST DAY **VALS > 0.125** = NUMBER OF MEASURED DAILY 1-HR MAXIMUM VALUES GREATER THAN OR EQUAL TO 0.125 PPM (1-HR STANDARD) **1ST, 2ND, 4TH 8-HR MAX** = MAXIMUM 8-HR VALUE FOR THE 1ST, 2ND & 4TH HIGHEST DAY **VALS > 0.085** = NUMBER OF MEASURED DAILY 8-HR MAXIMUM VALUES GREATER THAN OR EQUAL TO 0.085 PPM (8-HR STANDARD)



1-hour Exceedance Trends

The long term trends of 1-hour O_3 exceedances for each site are shown below.

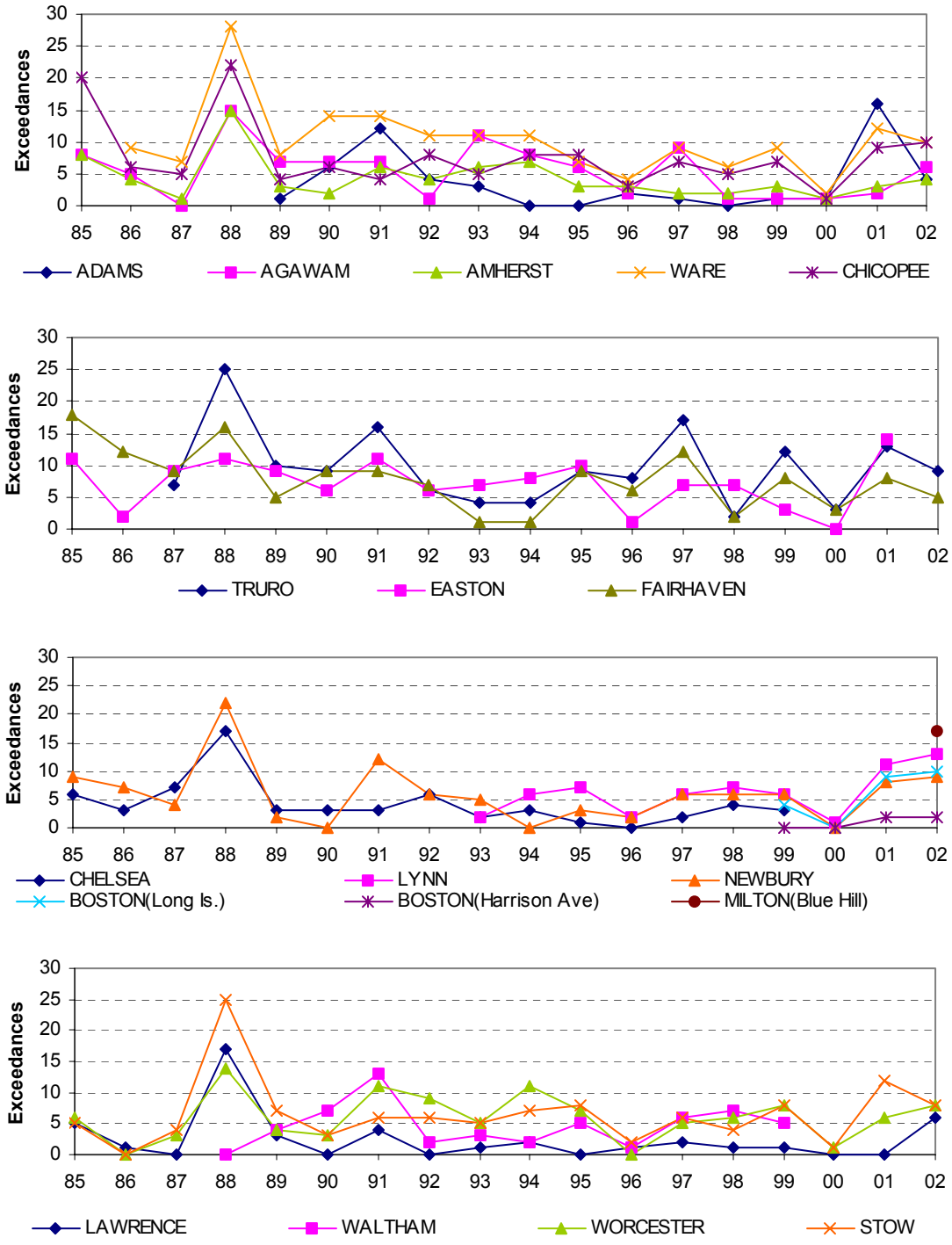
Figure 3
O_3 1-hour Exceedance Trends
Number of O_3 exceedances of the standard (0.125 ppm)



8-hour O_3 Exceedance Trends

The long-term trends of 8-hour O_3 exceedances for each site are shown below.

Figure 4
O_3 8-hour Exceedance Trends
Number of O_3 exceedances of the standard (0.085 ppm)



Sulfur Dioxide (SO_2) Summary

2002 SO_2 Data Summary

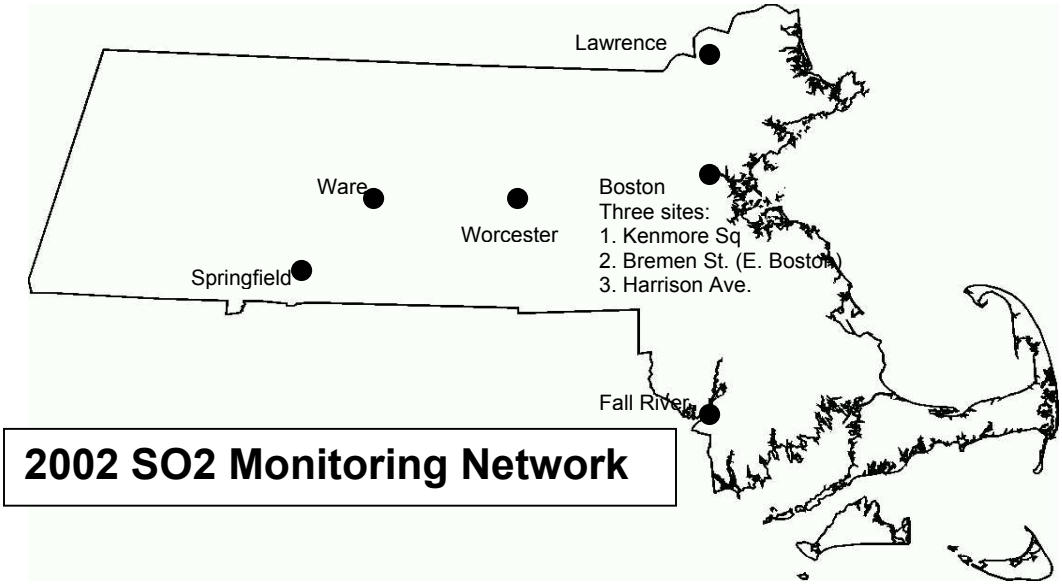
A summary of the 2002 SO2 data is listed below. There were eight SO_2 sites during 2002 in the state-operated monitoring network. All of the sites achieved the requirement of 75% or greater data capture for the year. The Lawrence site closed down in September 2002.

	P				UNITS:PPM							ANN
	C	M				%	MAX 24-HR		MAX 3-HR		MAX 1-HR		ARITH
SITE ID	C	T	CITY	COUNTY	ADDRESS	OBS	1ST	2ND	1ST	2ND	1ST	2ND	MEAN
25-025-0002	1	1	BOSTON	SUFFOLK	KENMORE SQUARE	83	.022	.020	.042	.038	.060	.049	.0058
25-025-0021	1	1	BOSTON	SUFFOLK	340 BREMEN STREET	91	.014	.014	.032	.029	.042	.033	.0018
25-005-1004	1	1	BOSTON	SUFFOLK	HARRISON AVENUE	93	.017	.016	.031	.030	.040	.036	.0050
25-005-1004	1	1	FALL RIVER	BRISTOL	GLOBE STREET	84	027	.027	.107	.080	.126	.114	.0037
25-009-0005	1	1	LAWRENCE	ESSEX	HIGH STREET	97	.016	.015	.037	.034	.045	.040	.0036
25-013-0016	1	1	SPRINGFIELD	HAMPDEN	LIBERTY STREET	97	.025	.025	.039	.038	.053	.051	.0054
25-015-4002	1	2	WARE	HAMPSHIRE	QUABBIN SUMMIT	97	.020	.018	.021	.021	.022	.022	.0032
25-027-0020	1	1	WORCESTER	WORCESTER	CENTRAL STREET	95	.018	.018	.027	.025	.032	.030	.0052

? INDICATES THAT THE MEAN DOES NOT SATISFY SUMMARY CRITERIA (NUMBER OF OBSERVATIONS FOR AT LEAST 1 QUARTER LESS THAN 75%)
TO CONVERT UNITS FROM PPM TO uG/M³ at standard conditions (25 celsius, 760 mmhg) MULTIPLY PPM x 2620

Standards: Annual Mean = 0.03 ppm 24-hour = 0.14 ppm 3-hour = 0.50 ppm

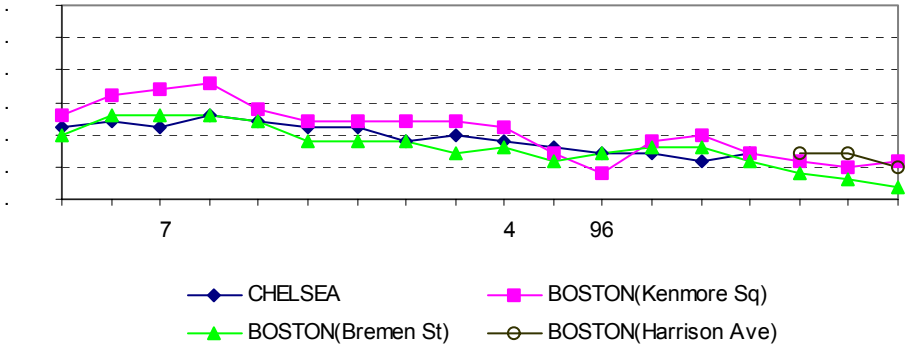
ABBREVIATIONS AND SYMBOLS USED IN TABLE
SITE ID = AIRS SITE IDENTIFICATION NUMBER **POC** = PARAMETER OCCURRENCE CODE (DIFFERENTIATES BETWEEN MONITORS AT A SITE) **MT** = MONITOR TYPE (1 = NAMS, 2 = SLAMS, 3 = OTHER) **% OBS** = DATA CAPTURE PERCENTAGE **MAX 24-HR, MAX 3-HR, MAX 1-HR 1ST 2ND** = FIRST AND SECOND HIGHEST VALUE FOR TIME PERIOD INDICATED **ANN ARITH MEAN** = ANNUAL ARITHMETIC MEAN (STANDARD = 0.03 PPM)

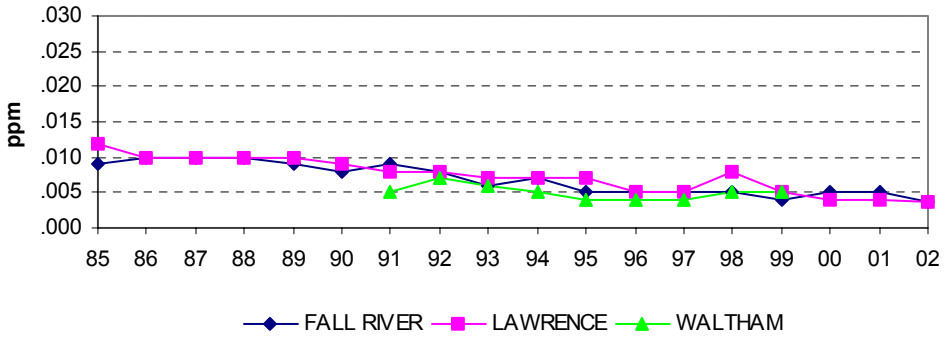


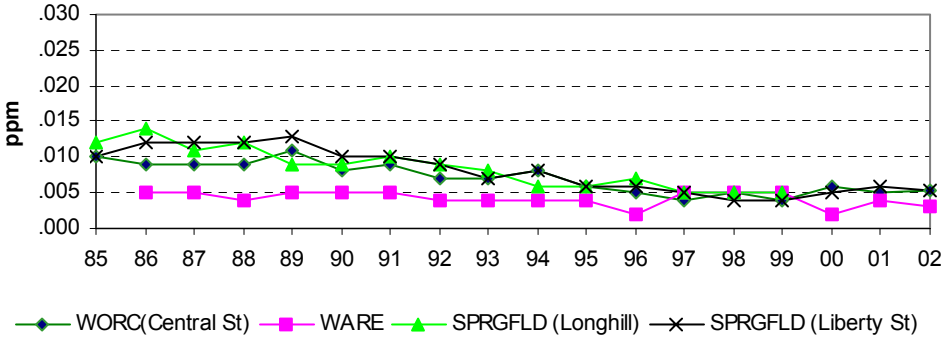
SO_2 Trends

The long-term trends of the annual arithmetic mean for each SO_2 site are shown below. The trend has been stable the last few years and downward for the entire period. Massachusetts is well below the standard.

Figure 5
SO2 Trends 1985 – 2002
Annual Arithmetic Means
Standard = 0.03 ppm







Nitrogen Dioxide (NO_2) Summary

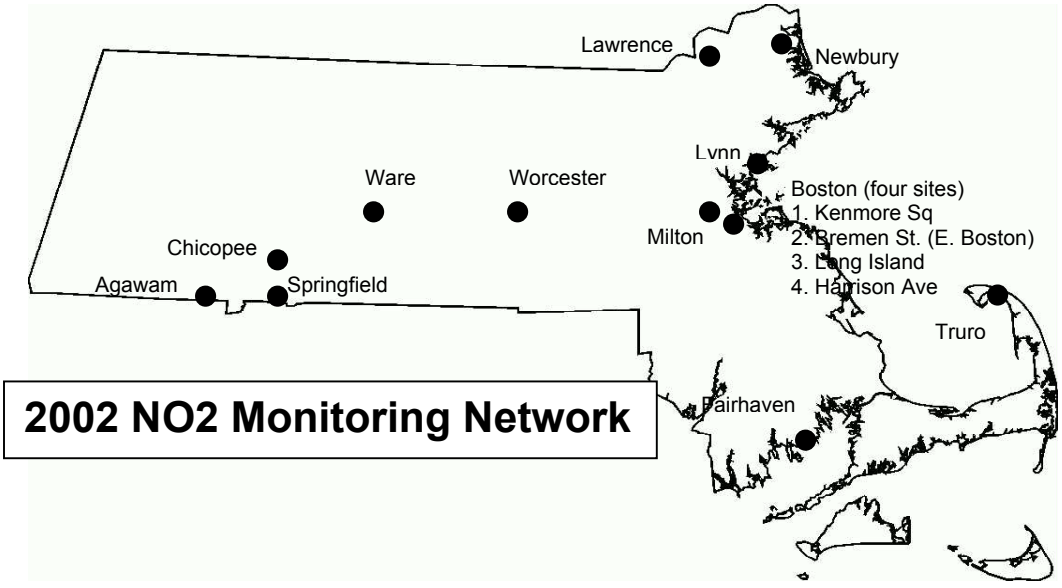
2002 NO_2 Data Summary

There were 15 NO_2 sites during 2002 in the state-operated monitoring network. All sites met the requirement of 75% data capture for the year. A summary of the 2002 data is listed below.

	P				UNITS: PPM				
SITE ID	C	M T	CITY	COUNTY	ADDRESS	% OBS	MAX 1ST	1-HR 2ND	ARITH MEAN
25-013-0003	1	8	AGAWAM	HAMPDEN	152 SOUTH WESTFIELD STREET	95	.044	.043	.0112
25-025-0002	1	3	BOSTON	SUFFOLK	KENMORE SQUARE	77	.071	.068	.0253
25-025-0021	1	1	BOSTON	SUFFOLK	340 BREMEN STREET, EAST BOSTON	83	.081	.081	.0230
25-025-0041	1	8	BOSTON	SUFFOLK	LONG ISLAND HOSPITAL ROAD	91	.069	.066	.0119
25-025-0042	1	1	BOSTON	SUFFOLK	HARRISON AVENUE	85	.079	.077	.0241
25-013-0008	1	8	CHICOPEE	HAMPDEN	ANDERSON ROAD AIR FORCE BASE	96	.060	.060	.0159
25-005-1002	1	2	FAIRHAVEN	BRISTOL	LEROY WOOD SCHOOL	91	.026	.026	.0042
25-009-0005	1	1	LAWRENCE	ESSEX	HIGH STREET	81	.050	.049	.0109
25-009-2006	1	8	LYNN	ESSEX	390 PARKLAND AVENUE	93	.068	.063	.0109
25-021-3003	1	U	MILTON	NORFOLK	BLUE HILL RESERVATION	95	.039	.035	.0062
25-009-4004	1	8	NEWBURY	ESSEX	SUNSET BOULEVARD	88	.036	.036	.0065
25-013-0016	1	2	SPRINGFIELD	HAMPDEN	LIBERTY STREET PARKING LOT	96	.073	.071	.0213
25-001-0002	1	8	TRURO	BARNSTABLE	FOX BOTTOM AREA-CAPE COD	88	.038	.036	.0047
25-015-4002	1	8	WARE	HAMPSHIRE	QUABBIN SUMMIT	76	.048	.048	.0065
25-027-0020	1	2	WORCESTER	WORCESTER	CENTRAL STREET FIRE STATION	94	.092	.078	.0172

TO CONVERT UNITS FROM PPM TO uG/M³ at standard conditions (25 celsius, 760 mmhg) MULTIPLY PPM x 1880
Standard: Annual Arithmetic Mean = 0.053 ppm

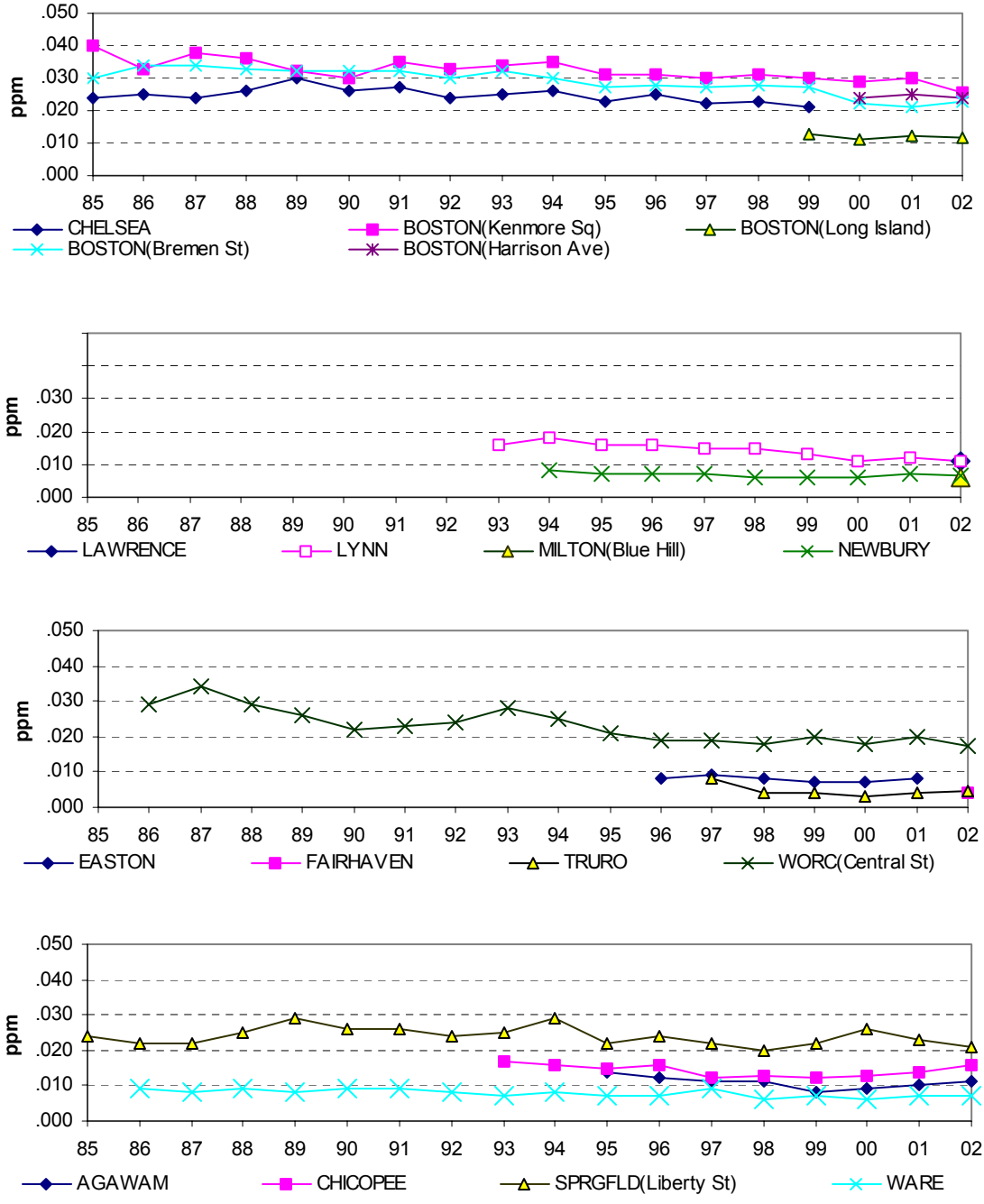
ABBREVIATIONS AND SYMBOLS USED IN TABLE
SITE ID = AIRS SITE IDENTIFICATION NUMBER **POC** = PARAMETER OCCURRENCE CODE (DIFFERENTIATES BETWEEN MONITORS AT A SITE) **MT** = MONITOR TYPE (1 = NAMS, 2 = SLAMS, 3 = OTHER; 7 = PAMS/NAMS; 8 = PAMS/SLAMS) **% OBS** = DATA CAPTURE PERCENTAGE **MAX 1-HR 1ST 2ND** = FIRST AND SECOND HIGHEST VALUE FOR TIME PERIOD INDICATED **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 standard.

Figure 6
NO2 Trends 1985-2002
Annual Arithmetic Means
Standard = 0.05 ppm



Carbon Monoxide (CO) Summary

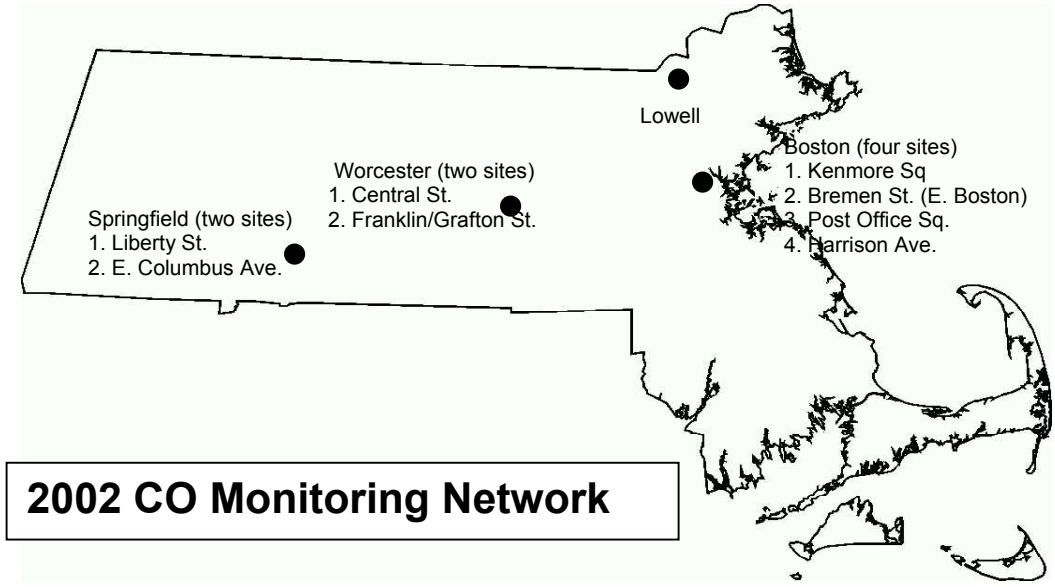
2002 CO Data Summary

There were nine CO sites during 2002 in the state-operated monitoring network. All of the sites achieved the requirement of 75% or greater data capture for the year. The Post Office Square site in Boston shut down in August 2002. A summary of the 2002 data is listed below.

					UNITS: PPM					OBS			OBS >
SITE ID	POC	MT	CITY	COUNTY	ADDRESS	% OBS	MAX 1-HR 1ST	MAX 1-HR 2ND	> 35	MAX 8-HR 1ST	MAX 8-HR 2ND	9
25-025-0002	1	2	BOSTON	SUFFOLK	KENMORE SQ. 590 COMM. AVE.	81	2.8	2.5	0	1.6	1.4	0
25-025-0021	1	1	BOSTON	SUFFOLK	340 BREMEN ST. E. BOSTON	87	3.5	2.7	0	2.0	1.8	0
25-025-0038	1	1	BOSTON	SUFFOLK	FEDERAL POST OFFICE BLDG.	94	3.9	3.7	0	3.1	2.2	0
25-025-0042	1	2	BOSTON	SUFFOLK	HARRISON AVENUE	92	2.7	2.6	0	2.3	1.8	0
25-017-0007	1	2	LOWELL	MIDDLESEX	OLD CITY HALL, MERRIMACK ST.	94	3.6	3.6	0	2.6	2.4	0
25-013-0016	1	1	SPRINGFIELD	HAMPDEN	LIBERTY STREET PARKING LOT	93	4.6	4.5	0	4.2	3.3	0
25-013-2007	1	1	SPRINGFIELD	HAMPDEN	EAST COLUMBUS AVENUE	90	6.5	5.5	0	4.0	3.6	0
25-027-0020	1	2	WORCESTER	WORCESTER	CENTRAL STREET FIRE STATION	91	4.6	4.5	0	3.3	2.9	0
25-027-0022	1	2	WORCESTER	WORCESTER	FRANKLIN/GRAFTON STREETS	88	3.3	3.2	0	2.6	2.1	0

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

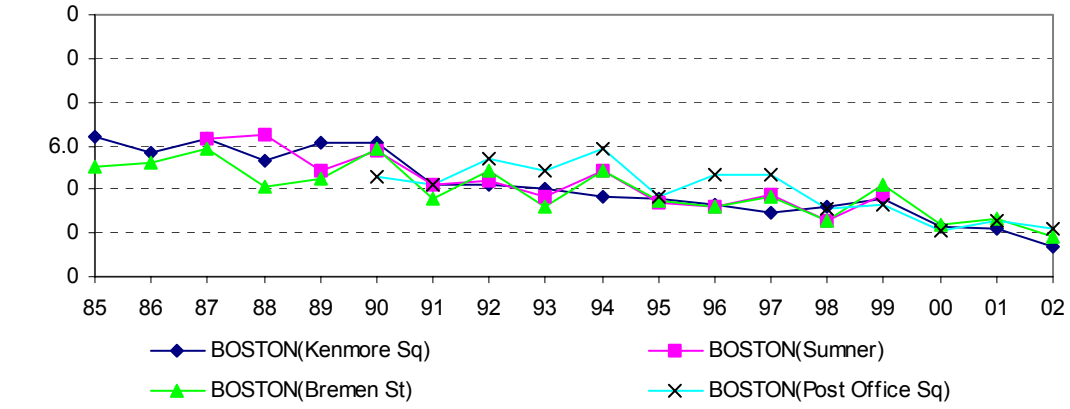
ABBREVIATIONS AND SYMBOLS USED IN TABLE 15
SITE ID = AIRS SITE IDENTIFICATION NUMBER **POC** = PARAMETER OCCURRENCE CODE (DIFFERENTIATES BETWEEN MONITORS AT A SITE) **MT** = MONITOR TYPE (1 = NAMS, 2 = SLAMS, 3 = OTHER) **% OBS** = DATA CAPTURE PERCENTAGE **MAX 1-HR 1ST 2ND** = FIRST AND SECOND HIGHEST VALUE FOR TIME PERIOD INDICATED **OBS > 35** = NUMBER OF 1-HR AVG. GREATER THAN 35 PPM (1-HR STANDARD) **MAX 8-HR 1ST 2ND** = FIRST AND SECOND HIGHEST VALUE FOR TIME PERIOD INDICATED **OBS > 9** = NUMBER OF 8-HR AVG. GREATER THAN 9 PPM (8-HR STD)

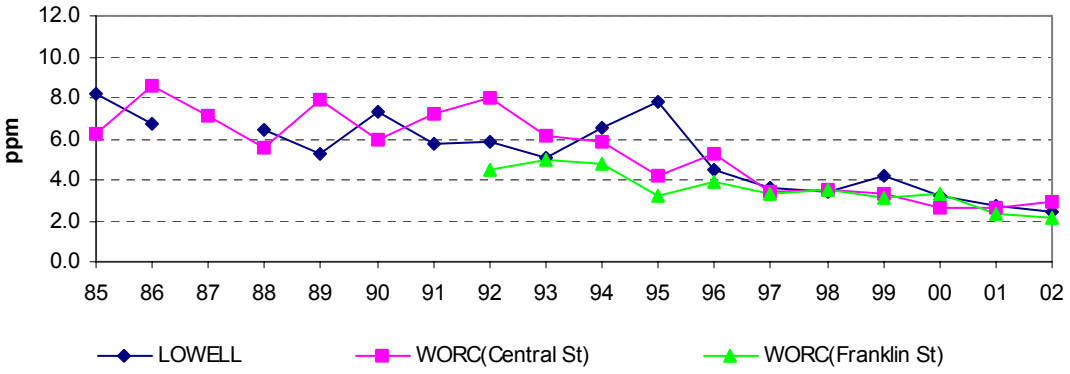


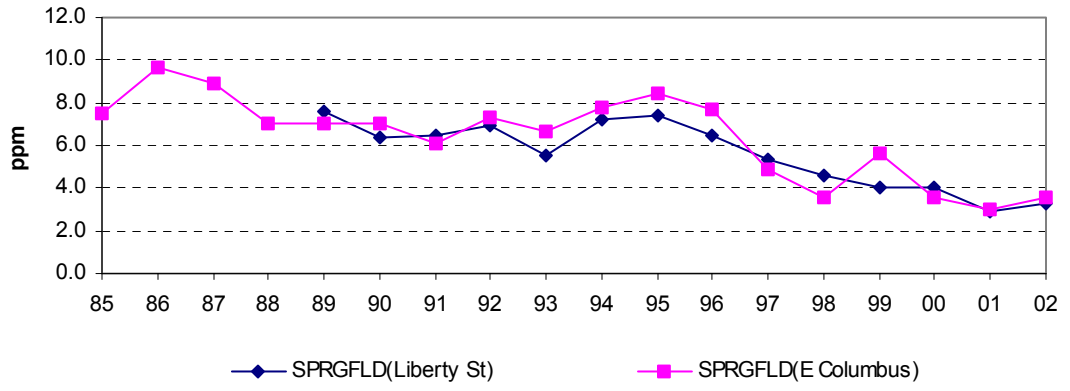
CO Data Summary

Figure 7 presents the 2002 data relative to the air quality standards. The 2nd-maximum value is displayed because it is the value to which the standards apply. The highest 1-hour and 8-hour values both occurred in Springfield. Both values were well below the standard.

Figure 7
CO Trends 1985-2002
2nd Maximum 8-hour Values
Standard = 9 ppm







Particulate Matter 10-Microns (PM10) Summary

2002 PM_{10} Data Summary

There were seven PM_{10} sites. Three sites had two samplers, which were operated simultaneously for precision purposes.

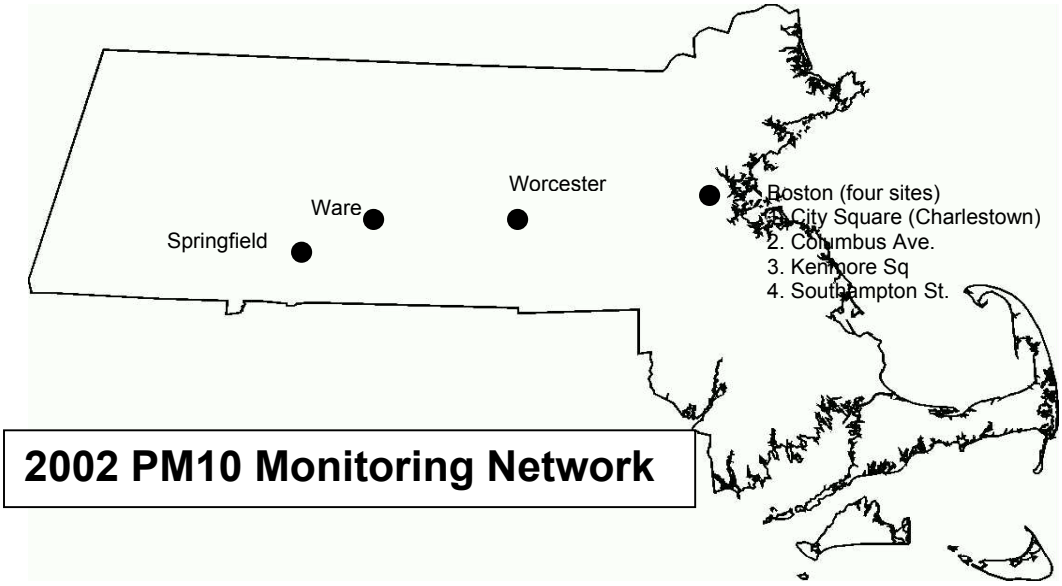
Four out of the eight sites achieved the requirement of 75% or greater data capture for each calendar quarter. Sampler failures caused Boston sites not to achieve the data capture requirement. A summary of the 2002 data is listed below.

Site ID	POC	MT	City	County	Address	% Obs	1st Highest Value	2nd Highest Value	3rd Highest Value	4th Highest Value	Wtd. Arith. Mean
25-013-0011	2	2	SPRINGFIELD	HAMPDEN	59 HOWARD STREET	84	54	45	37	36	20
25-013-0011	3	3	SPRINGFIELD	HAMPDEN	59 HOWARD STREET	84	56	52	38	38	21
25-013-2009	1	3	SPRINGFIELD	HAMPDEN	1860 MAIN STREET	95	46	45	43	43	20
25-015-4002	1	2	WARE	HAMPSHIRE	QUABBIN SUMMIT	95	36	32	28	23	11
25-025-0002	1	1	BOSTON	SUFFOLK	KENMORE SQUARE	75	58	49	45	44	25?
25-025-0012	1	1	BOSTON	SUFFOLK	115 SOUTHAMPTON	72	33	33	30	29	16?
25-025-0012	2	3	BOSTON	SUFFOLK	115 SOUTHAMPTON	62	48	40	33	33	23?
25-025-0024	1	1	BOSTON	SUFFOLK	200 COLUMBUS	66	54	53	40	37	22?
25-025-0027	1	1	BOSTON	SUFFOLK	ONE CITY SQUARE	23	59	59	49	39	31?
25-025-0027	3	3	BOSTON	SUFFOLK	ONE CITY SQUARE	13	69	46	35	27	30?
-25-027-0016	1	1	WORCESTER	WORCESTER	2 WASHINGTON	87	37	37	35	31	15

? INDICATES THAT THE MEAN DOES NOT SATISFY SUMMARY CRITERIA (NUMBER OF OBSERVATIONS FOR AT LEAST 1 QUARTER LESS THAN 75%)

Standards: 24-hour = 150 $\mu g/m^3$ Annual Arithmetic Mean = 50 $\mu g/m^3$

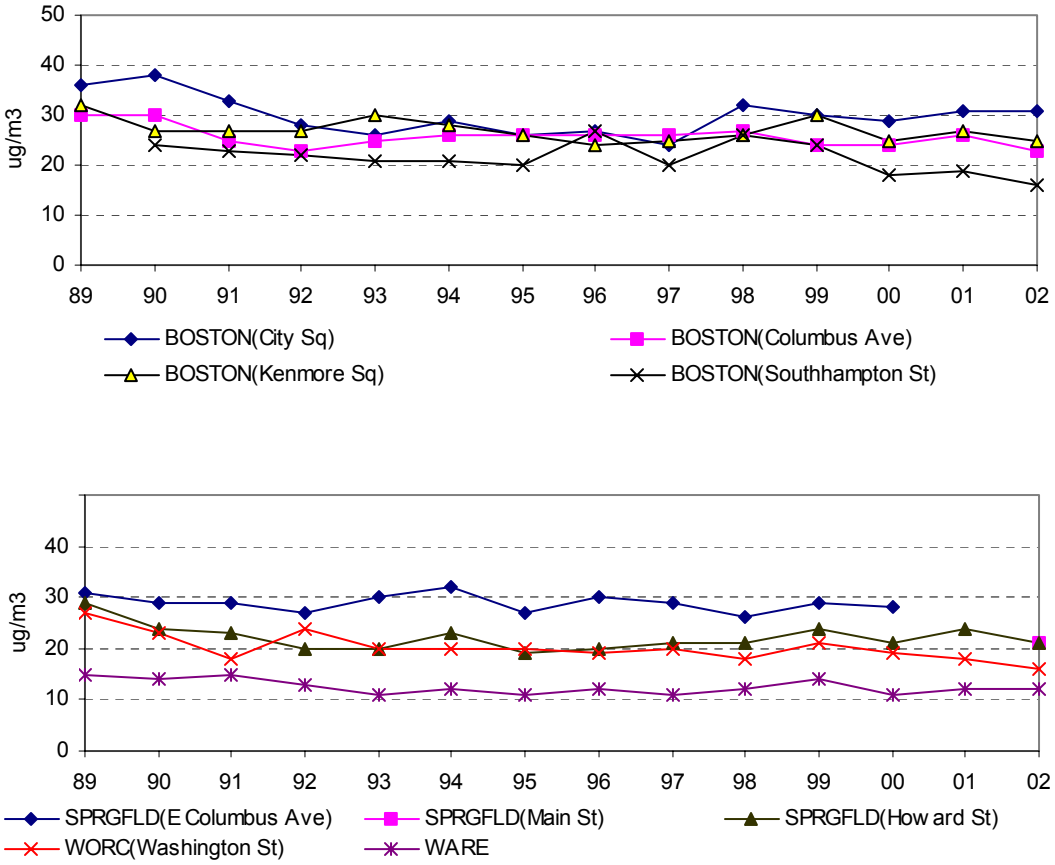
ABBREVIATIONS AND SYMBOLS USED IN TABLE
SITE ID = AIRS SITE IDENTIFICATION NUMBER **POC** = PARAMETER OCCURRENCE CODE (DIFFERENTIATES BETWEEN MONITORS AT A SITE) **MT** = MONITOR TYPE (1 = NAMS, 2 = SLAMS, 3 = OTHER) **% OBS** = DATA CAPTURE PERCENTAGE **HIGHEST VALUE 1ST, 2ND, 3RD, 4TH** = 1ST, 2ND, 3RD, AND 4TH HIGHEST 24-HOUR VALUES FOR THE YEAR **WTD ARITH MEAN** = WEIGHTED ANNUAL ARITHMETIC MEAN (STANDARD = 50 $\mu g/m^3$) **?** = INDICATES THAT NUMBER OF OBSERVATIONS WERE INSUFFICIENT TO CALCULATE MEAN. THE DATA CAPTURE AT A SITE MUST EXCEED 75% FOR EACH QUARTER.



PM_{10} trends

PM_{10} long-term trends are shown for the annual arithmetic mean for each PM_{10} site. The data shows a yearly variability at most sites, with the overall trend being downward.

Figure 8
PM10 Trends 1989-2002
Annual Arithmetic Mean
Standard = 50 ug/m3



Particulate Matter 2.5-Microns (PM2.5) Summary

2002 $PM_{2.5}$ Operations

The $PM_{2.5}$ monitoring network was set up during late 1998 and monitoring began in January 1999. There were 21 $PM_{2.5}$ sites (seven sites had collocated monitors) during 2002 in the state-operated monitoring network.

Improvements and changes in the PM 2.5 program have continued throughout 2002. Recent software upgrades and mechanical improvements to the samplers have enhanced instrument performance. Changes in filter distribution methods and lab automation have improved field efficiency and have enabled the field staff to be more responsive to mechanical problems.

Machine malfunctions are still an area of concern. Because of the compounding of sample loss when equipment is down for any significant duration, MADEP has implemented the expensive and unusual step of dedicating a staff member to constant field calibration and repair of PM2.5 monitors. Improvement in data capture is partly attributable to this strategy. However, a continuing drop in staffing levels has put pressure on the MADEP's ability to continue dedicating this person to these responsibilities alone.

The overall network-wide data capture for the year 2002 is 78.8%. This is a 15% improvement over the previous year and is the highest yearly average to date. However, individual sites are still experiencing widely varying data capture. In addition, seasonal variations in data capture are affecting the ability to consistently produce results over 75%.

Semi-Continuous PM2.5 Measurement

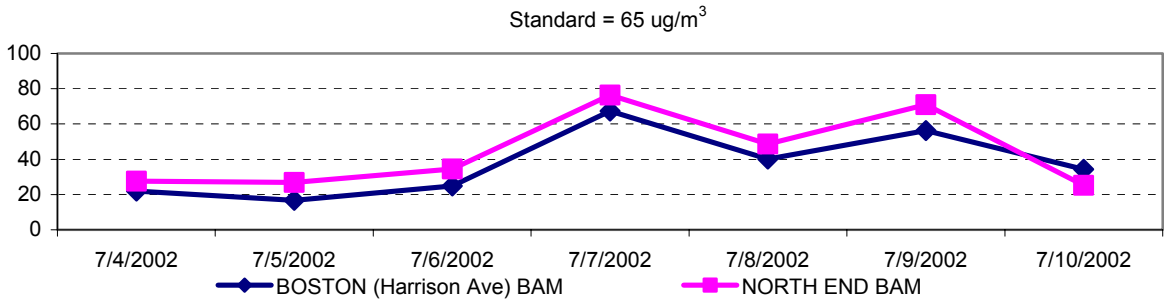
After several years of evaluating methodologies and manufacturers, Massachusetts started the deployment of a Semi-Continuous PM2.5 monitoring network in the Fall of 2001. This emerging network of sites employs Beta Attenuation Monitoring (BAM) technology to conduct hourly measurements of PM2.5 particulate concentrations. The method is referred to as semi-continuous because one analysis is performed and one concentration is generated every hour, in contrast to hourly averages of second-to-second measurements generated by truly continuous NAAQS gaseous pollutant monitors.

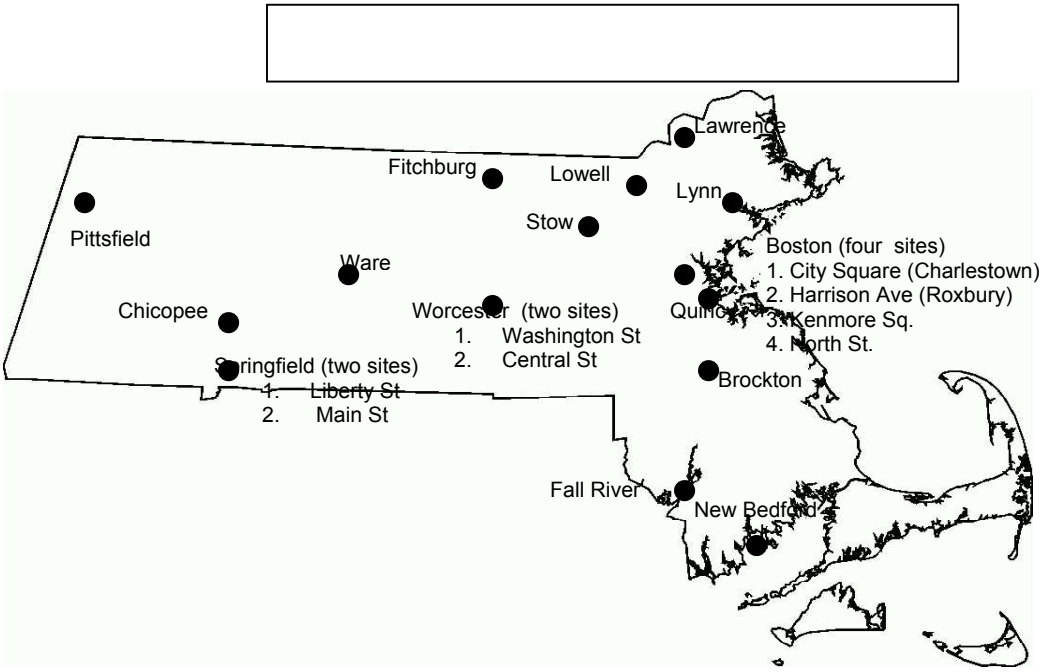
Although an eventual goal is to augment and perhaps replace the non-continuous Federal Reference Method (FRM) PM2.5 samplers, reliable and accurate hourly PM2.5 measurements offer current benefits not offered by the 24-hour technique. These include the immediate awareness of high particulate concentration events, the mechanism and timing of such events, data for those days not included on the standard USEPA every third day sampling schedule, and the ultimate savings of staff resources. The USEPA and NESCAUM are working on a mapping system for Semi-Continuous PM2.5 monitors that will provide real-time concentrations and concentration predictions to the public.

MADEP deployed its first BAM instrument at the Roxbury site in November 2001, followed by the North End (Boston) site in May 2002. Worcester Fire Station received an instrument in October 2002, and a Springfield site (Liberty Street) will follow in May 2003. Current plans call for the operation of a BAM instrument at Blue Hill (Milton) and the Haverhill site (Merrimack Valley) by the end of 2003.

Figure 9 demonstrates the type of information that can be obtained from a semi-continuous $PM_{2.5}$ monitor for a well documented regional elevated particulate concentration event that occurred during the Summer of 2002. This type of event would be difficult to characterize using the traditional intermittent 24-hour sampling network.

Figure 9
July 2002 BAM Data - Quebec Forest Fire





2002 proved to be a shakedown period for the BAM network and equipment, although data from all three sites were submitted. The first significant pay back from the BAM method was the tracking of the Quebec forest fire incident during the first part of July 2002. The true validation for the BAM Semi–Continuous technology will come when long-term concentration data proves that it is analogous to the current FRM method and when the machinery is found to be rugged, reliable and accurate over a lengthy deployment period.

2002 $PM_{2.5}$ data summary

A summary of the 2002 data is listed below.

Site ID	POC	MT	City	County	Address	Units: ug/cu meter 1st Highest Value	2nd Highest Value	3rd Highest Value	4th Highest Value	T	Wtd. Arith. Mean
25-025-0002	1	2	BOSTON	SUFFOLK	KENMORE SQUARE	47.4	29.6	29.4	28.2	F	13.0
25-025-0027	1	2	BOSTON	SUFFOLK	ONE CITY SQUARE	54.1	50.8	47.6	36.6	F	13.4?
25-025-0027	2	3	BOSTON	SUFFOLK	ONE CITY SQUARE	29.3	27.9	27.1	26.2	F	9.9?
25-025-0042	1	2	BOSTON	SUFFOLK	HARRISON AVENUE	52.4	51.2	44.0	33.0	F	11.1?
25-025-0042	2	2	BOSTON	SUFFOLK	HARRISON AVENUE	63.5	58.0	56.3	48.0	B	14.6?
25-025-0043	1	2	BOSTON	SUFFOLK	174 NORTH STREET	29.8	28.2	27.3	27.1	F	13.1?
25-025-0043	2	2	BOSTON	SUFFOLK	174 NORTH STREET	77.8	70.9	65.6	51.9	B	14.5?
25-023-0004	1	2	BROCKTON	PLYMOUTH	120 COMMERCIAL ST	60.3	37.2	35.9	28.2	F	11.6
25-023-0004	1	3	BROCKTON	PLYMOUTH	120 COMMERCIAL ST	36.7	26.5	26.4	25.2	F	11.2
25-013-0008	1	2	CHICOPEE	HAMPDEN	ANDERSON ROAD AIR	56.0	49.7	44.8	36.8	F	10.9?
25-005-3001	1	2	FALL RIVER	BRISTOL	CENTRAL FIRE STATION	36.3	29.5	27.8	26.8	F	11.1
25-027-0024	1	2	FITCHBURG	WORCESTER	67 RINDGE ROAD	33.4	27.3	25.6	24.8	F	9.4
25-009-5005	1	2	HAVERHILL	ESSEX	WASHINGTON ST	51.8	28.9	28.3	23.7	F	9.4?
25-009-6001	1	2	LAWRENCE	ESSEX	WALL EXPERIMENT	30.3	26.8	26.0	23.1	F	10.4?
25-017-0008	1	2	LOWELL	MIDDLESEX	50 FRENCH STREET	30.6	29.2	28.5	27.6	F	10.6?
25-009-2006	1	2	LYNN	ESSEX	390 PARKLAND AVENUE	52.9	29.3	26.2	25.6	F	10.1?
25-005-2004	1	2	NEW BEDFORD	BRISTOL	YMCA, 25 S. WATER ST	37.2	25.5	23.1	23.1	F	10.3
25-003-5001	1	2	PITTSFIELD	BERKSHIRE	78 CENTER STREET	36	31.5	30.5	28.8	F	11.4?
25-021-0007	1	2	QUINCY	NORFOLK	HANCOCK STREET	66.9	48.1	33.8	33.2	F	11.8
25-021-0007	2	3	QUINCY	NORFOLK	T	75	52.8	25.6	25.6	F	11.8
25-013-0016	1	2	SPRINGFIELD	HAMPDEN	LIBERTY STREET	78.4	56.0	52.3	46.8	F	13.5
25-013-0016	2	3	SPR	HAMPDEN	LIBERTY STREET	57.4	34.1	34.1	29.4	F	13.5
25-013-2009	1	3	UNION NEWS	HAMPDEN	1860 MAIN STREET	37.5	37.1	34.8	33.1	F	12.8
25-017-1102	1	2	STOW	MIDDLESEX	US MILITARY	29.9	27.4	26.1	25.9	F	9.2?
25-015-4002	1	2	WARE	HAMPSHIRE	QUABBIN SUMMIT	33.7	25.0	24.3	24.2	F	8.3
25-027-0016	1	2	WORCESTER	WORCESTER	2 WASHINGTON STREET	33.7	29.5	28.1	27.7	F	10.9?
25-027-0020	1	2	WORCESTER	WORCESTER	CENTRAL STREET FIRE STA	56.2	46.8	45.5	39.2	F	11.6?
25-027-0020	2	3	WORCESTER	WORCESTER	CENTRAL STREET FIRE STA	33.6	33.0	31.1	29.5	F	12.2
25-027-0020	3	2	WORCESTER	WORCESTER	CENTRAL STREET FIRE STA	33.3	23.5	21.7	20.5	B	7.5?

? INDICATES THAT THE MEAN DOES NOT SATISFY SUMMARY CRITERIA (NUMBER OF OBSERVATIONS FOR AT LEAST 1 QUARTER LESS THAN 75%)

Standards (based on 3-year averages): 24-hours = 65 $\mu g/m^3$ Annual Arithmetic Mean = 15.0 $\mu g/m^3$

ABBREVIATIONS AND SYMBOLS USED IN TABLE
SITE ID = AIRS SITE IDENTIFICATION NUMBER **POC** = PARAMETER OCCURRENCE CODE (DIFFERENTIATES BETWEEN MONITORS AT A SITE) **MT** = MONITOR TYPE (1 = NAMS, 2 = SLAMS, 3 = OTHER) **HIGHEST VALUE 1ST, 2ND, 3RD, 4TH** = 1ST, 2ND, 3RD, AND 4TH HIGHEST 24-HOUR VALUES FOR THE YEAR **T** = TYPE OF INSTRUMENT: F=FRM; B=BAM. **WTD ARITH MEAN** = WEIGHTED ANNUAL ARITHMETIC MEAN (STANDARD = 15.0 $\mu g/m^3$)

Speciation

Since 2000, MADEP has taken samples for PM 2.5 Speciation at the Roxbury site. Speciation is the analysis of particulate filters for chemical components. The results can be used to determine levels of some toxic air pollutants, as well as provide information about the nature and identity of air pollution sources which impact the sampler area. During each sampling event, three different filters composed of different materials are collected and shipped to an out of state national contract laboratory for analysis. Each different filter medium is analyzed for a different category of pollutant. These include Elements (Metals), Sulfates and Nitrates, and Carbon (total and organic).

A second Speciation sampler was set up at the Chicopee site in 2001. Because of the complexity of the sampler design and operational procedures, data capture rates for this site have been relatively low.

IMPROVE

Massachusetts currently has two IMPROVE sampling systems at the Ware and Truro sites. These samplers acquire PM2.5 filter samples for speciation analysis using a different protocol than that of the Speciation program described above. IMPROVE is a nationwide program designed to assess air quality at rural locations where air pollution may impact atmospheric clarity. Data can be viewed at the IMPROVE web site (http://vista.cira.colostate.edu/improve/Data/data.htm).

Lead (Pb) Summary

2002 Pb data summary

MADEP operates one total suspended particulates (TSP) sampler to measure lead levels. The concentrations monitored are very low. Since 1975, the use of unleaded gasoline has greatly diminished lead emissions as the primary source for airborne lead. A summary of the 2002 data is listed below. Monitor malfunctions caused the data capture to be low.

	P				UNITS: UG/CU METER								
	O	M				%	-QUARTERLY ARITH MEANS				MEANS	MAX	VALUES
SITE ID	C	T	CITY	COUNTY	ADDRESS	OBS	1ST	2ND	3RD	4TH	>1.5	1ST	2ND
25-025-0002	1	1	BOSTON	SUFFOLK	KENMORE SQ.	50	.01	.01	.	.01	0	.02	.02

Standard: 1.5 μg/m^3 (Calendar Quarter Arithmetic Mean)

ABBREVIATIONS AND SYMBOLS USED IN TABLE
SITE ID = AIRS SITE IDENTIFICATION NUMBER **POC** = PARAMETER OCCURRENCE CODE (DIFFERENTIATES BETWEEN MONITORS AT A SITE) **MT** = MONITOR TYPE (2 = SLAMS, 3 = OTHER) **% OBS** = DATA CAPTURE PERCENTAGE **QUARTERLY ARITH MEANS 1ST,2ND,3RD,4TH** = THE MEANS FOR THE 1ST,2ND,3RD AND 4TH CALENDAR QUARTERS **MEANS > 1.5** = THE NUMBER OF CALENDAR QUARTER MEANS GREATER THAN THE STANDARD (1.5 UG/M3) **MAX VALUES 1ST, 2ND** = THE 1ST & 2ND MAXIMUM 24 HOUR VALUES

Industrial Network Summary

Introduction

The industrial ambient air quality network is comprised of monitoring stations operated by industries with facilities that may potentially emit large amounts of pollutants. An example would be a coal-burning power plant, which emits SO_2.

The monitoring stations in the industrial network are sited to measure the maximum values from the specific point source. When the pollutant SO_2 value reaches certain trigger values, the power plant switches to lower sulfur-content fuel.

The data from the industrial network is submitted to the Air Assessment Branch. It is submitted into the USEPA AIRS database after the quality assurance process has been completed.

The Continuous Emission Monitoring System (CEMS)

The ambient monitoring network is different from, and in addition to, the in-stack Continuous Emission Monitoring System (CEMS) equipment that is required at certain facilities by a MADEP-issued permit or other state and federal regulations. For example, the federal Acid Rain Program requires CEMS enabling calculation of SO_2, NO_x and CO_2 emissions from the nation's largest power generating facilities. The information on emissions collected by those monitors can be found on USEPA's web site (www.epa.gov/airmarkets/arp/).

Sulfur Dioxide (SO_2) summary

There were four SO_2 sites during 2002 in the industrial network. All of the sites achieved the requirement of 80% or greater data capture for the year. There were no known violations of the SO_2 air quality standards during the year in the reported data. A summary of the 2002 data is listed below.

	P			UNITS: PPM									
	O	M			REP	%	MAX	24-HR	MAX	3-HR	MAX	1-HR	ARIT
SITE ID	C	T	CITY	COUNTY	ADDRESS	ORG	OBS	1ST	2ND	1ST	2ND	1ST	2ND	MEAN
25-025-0019	1	4	BOSTON	SUFFOLK	LONG ISLAND	345	99	.014	.014	.027	.022	.038	.030	.0042
25-025-0020	1	4	BOSTON	SUFFOLK	DEWAR STREET	345	99	.016	.015	.037	.033	.063	.053	.0044
25-025-0021	2	4	BOSTON	SUFFOLK	340 BREMEN ST	345	99	.018	.018	.036	.035	.057	.050	.0052
25-025-0040	1	4	BOSTON	SUFFOLK	531A EAST FIRST	345	99	.045	.021	.192	.101	.227	.197	.0060

TO CONVERT UNITS FROM PPM TO mG/M³ MULTIPLY PPM x 2620

ABBREVIATIONS AND SYMBOLS USED IN TABLE
SITE ID = AIRS SITE IDENTIFICATION NUMBER **POC** = PARAMETER OCCURRENCE CODE (DIFFERENTIATES BETWEEN MONITORS AT A SITE) **MT** = MONITOR TYPE (4 = INDUSTRIAL) **REP ORG** = REPORTING ORGANIZATION **%OBS** = DATA CAPTURE PERCENTAGE **MAX 24-HR, MAX 3-HR, MAX 1-HR 1ST 2ND** = FIRST AND SECOND HIGHEST VALUE FOR TIME PERIOD INDICATED **ARIT MEAN** = ARITHMETIC MEAN (STANDARD = 0.030 PPM)

Nitrogen Dioxide (NO_2) summary

There was one NO_2 site during 2002 in the industrial network, operated by Sithe New England in Boston (East First St.). It met the requirement of 80% or greater data capture. There were no violations of the NO_2 air quality standard during the year. The annual arithmetic mean was 0.021 ppm, which is 40% of the standard.

A summary of the 2002 data is listed below.

	P					UNITS: PPM			
	O	M				%	MAX	1-HR	ARIT
SITE ID	C	T	CITY	COUNTY	ADDRESS	OBS	1ST	2ND	MEAN
25-025-0040	1	4	BOSTON	SUFFOLK	531A EAST FIRST ST	97	.093	.092	.0207

TO CONVERT UNITS FROM PPM TO uG/M³ MULTIPLY PPM x 1886.8

PRIMARY STANDARD: ANNUAL ARITHMETIC MEAN = 0.053 PPM

ABBREVIATIONS AND SYMBOLS USED IN TABLE
SITE ID = AIRS SITE IDENTIFICATION NUMBER **POC** = PARAMETER OCCURRENCE CODE (DIFFERENTIATES BETWEEN MONITORS AT A SITE) **MT** = MONITOR TYPE (4 = INDUSTRIAL) **%OBS** = DATA CAPTURE PERCENTAGE **MAX 1-HR 1ST 2ND** = FIRST AND SECOND HIGHEST VALUE FOR TIME PERIOD INDICATED **ARIT MEAN** = ARITHMETIC MEAN (STANDARD = 0.053 PPM)

Total Suspended Particulates (TSP) summary

There were four TSP sites during 2002 in the industrial network, all operated by Sithe New England in the city of Boston. All of the sites met the requirement of 80% or greater data capture.

TSP is not a criteria pollutant (PM_{10} replaced it as the particulate standard in 1987), so there is no longer a standard for it. A summary of the 2002 data is listed below.

	P					UNITS: UG/CU METER (25C)							
	O	M				%	MAXIMUM 24-HR VALUES				ARITH	GEO	GEO
SITE ID	C	T	CITY	COUNTY	ADDRESS	OBS	1ST	2ND	3RD	4TH	MEAN	MEAN	STD
25-025-0019	1	4	BOSTON	SUFFOLK	LONG ISLAND	98	68	49	42	41	23.6	21.7	1.50
25-025-0020	1	4	BOSTON	SUFFOLK	DEWAR STREET	98	102	87	81	72	39.2	35.8	1.50
25-025-0021	2	4	BOSTON	SUFFOLK	340 BREMEN ST	98	141	128	116	112	56.1	50.8	1.60
25-025-0040	1	4	BOSTON	SUFFOLK	531A EAST FIRST STREET	98	116	86	83	68	42.6	39.6	1.40
25-025-0040	2	4	BOSTON	SUFFOLK	531A EAST FIRST STREET	93	141	125	74	73	45.4	41.4	1.50

ABBREVIATIONS AND SYMBOLS USED IN TABLE
SITE ID = AIRS SITE IDENTIFICATION NUMBER **POC** = PARAMETER OCCURRENCE CODE (DIFFERENTIATES BETWEEN MONITORS AT A SITE) **MT** = MONITOR TYPE (4 = INDUSTRIAL) **% OBS** = DATA CAPTURE PERCENTAGE **MAXIMUM 24-HR VALUES 1ST,2ND,3RD,4TH** = 1ST,2ND,3RD AND 4TH HIGHEST 24-HOUR VALUES FOR THE YEAR **ARITH MEAN** = ARITHMETIC MEAN **GEO MEAN** = GEOMETRIC MEAN **GEO STD** = GEOMETRIC STANDARD DEVIATION

Sulfate (SO_4) summary

There were four SO_4 sites during 2002 in the industrial network, all operated by Sithe New England in the city of Boston. All sites met the requirement of 80% or greater data capture.

There are no standards for SO_4, since it is not a criteria pollutant. A summary of the 2002 data is listed below.

	P					UNITS: UG/CU METER (25C)					
	O	M				%	-MAXIMUM VALUES-				ARITH
SITE ID	C	T	CITY	COUNTY	ADDRESS	OBS	1ST	2ND	3RD	4TH	MEAN
25-025-0019	1	4	BOSTON	SUFFOLK	LONG ISLAND	98	11.0	10.0	9.0	9.0	5.7
25-025-0020	1	4	BOSTON	SUFFOLK	DEWAR STREET	98	18.0	13.0	11.0	10.0	6.5
25-025-0021	2	4	BOSTON	SUFFOLK	340 BREMEN STREET	98	13.0	13.0	12.0	12.0	7.4
25-025-0040	1	4	BOSTON	SUFFOLK	531A EAST FIRST STREET	98	14.0	12.0	11.0	11.0	7.1
25-025-0040	2	4	BOSTON	SUFFOLK	531A EAST FIRST STREET	93	13.0	11.0	11.0	11.0	7.1

ABBREVIATIONS AND SYMBOLS USED IN TABLE
SITE ID = AIRS SITE IDENTIFICATION NUMBER **POC** = PARAMETER OCCURRENCE CODE (DIFFERENTIATES BETWEEN MONITORS AT A SITE) **MT** = MONITOR TYPE (4 = INDUSTRIAL) **% OBS** = DATA CAPTURE PERCENTAGE **MAXIMUM VALUES 1ST,2ND,3RD,4TH** = 1ST,2ND,3RD AND 4TH HIGHEST 24-HOUR VALUES FOR THE YEAR **ARITH MEAN** = ARITHMETIC MEAN

Quality Control and Quality Assurance

Introduction

To ensure that the ambient air quality data are of high quality, MADEP has developed standard operating procedures (SOPs) that procedures include quality control and quality assurance techniques that assess the quality and document the activities performed in collecting the data.

Quality control

Quality control (QC) is comprised of those activities performed by personnel who are directly involved in the generation of the data. Examples of personnel who perform QC functions are site operators and laboratory support personnel. QC activities include calibrations, data validation procedures, and performance checks of the ambient air monitors to assess the precision of the data.

Data quality review

The AAB data group reviews data. All precision and accuracy activities are checked as well as raw data, quality assurance checks, and documentation. Report software also is utilized for data validation. The data group edits the data as required and it is then transferred into the USEPA AIRS Database.

Quality assurance

Quality assurance (QA) is comprised of those activities performed by personnel who are not directly involved in the generation of the data and who may therefore make an unbiased assessment of the data quality. QA activities include performance audit checks of the ambient air monitors to assess the accuracy of the data.

Precision and accuracy

Precision is defined as a measure of the repeatability of a measurement system. Accuracy is defined as a measure of the closeness of an observed measurement value to the actual value.

The QC and QA performance checks allow the precision and accuracy of ambient air monitors to be quantified. Testing the monitor's response to known inputs in order to assess the measurement error does this. The QC performance checks assess the precision, while the QA performance checks assess the accuracy.

The requirements and techniques for performing precision and accuracy performance checks are established in the Code of Federal Regulations (CFR), Title 40, Part 58, Appendix A.

How precision and accuracy is described

Precision and accuracy are given in the context of upper and lower 95-percentile probability limits for each pollutant parameter. The meaning of the 95-percentile limits is that 95% of the data for a parameter is estimated to be precise or accurate to within the percentage range defined by the upper and lower limits. As an example, if the upper and lower 95-percentile-limits for a parameter based upon precision checks are calculated to be +4.3% and –7.4%, then 95% of the data is precise within the range of +4.3 through –7.4%.

2002 precision and accuracy summary

As a goal, the 95-percentile probability limits for precision (all parameters) and PM_{10} and TSP accuracy should be less than ±15%. The 95 percentile probability limits for accuracy for all other parameters should be less than ±20%. Three response levels are audited; low (L1) 6-16% of full scale, mid (L2) 30- 40%, and high (L3) 70-90%. A summary of the data is listed below.

							PRECISION DATA				ACCURACY DATA						
PRECISION AND ACCURACY DATA KEY							# OF		PROB	LIM	# AUDITS	PROB	LIM	PROB	LIM	PROB	LIM
RG	ST	RO	TYP	CLASS	POLL	YEAR-Q	ANLYZRS		LO	UP	L1-3	LO-L1	-UP	LO-L2	-UP	LO-L3	-UP
01	25	001	C	A	CO	2002	9		-8.8	4.5	45	-11.5	12.4	-10.3	2.1	-10	1.2
CARBON MONOXIDE						2002-1	9		-6.7	4.9	12	-9.3	10.7	-8.6	.6	-9	1.3
						2002-2	9		-9.3	5.6	12	-5.8	20	-8.1	6.3	-12.9	4.5
						2002-3	9		-10	3	15	-8.4	.8	-9.8	-2.8	-10.4	.9
						2002-4	8		-6.9	2.6	6	-6.3	1	-7.5.	-3.3.	-5.1.	-4.5.
01	25	001	C	A	SO2	2002	8		-8	3	39	-12	13.4	-11.1	4.9	-8.7	2.5
SULFUR DIOXIDE						2002-1	8		-5	1.6	12	-2.7	5.9	-6.1	2.8	-9	2.7
						2002-2	8		-5.1	1.3	6	7.5	19.2	-.7	7.8	-3.9	4.4
						2002-3	8		-7.9	-.8	21	-8.4	1.5	-10.3	-1.2	-9	.9
						2002-4	7		-5.8	2	0						
01	25	001	C	A	NO2	2002	15		-13	10.8	51	-18	6.6	-15.7	-.4	-14.5	-1.3
NITROGEN DIOXIDE						2002-1	12		-5.3	9.9	12	-13.9	3.6	-13.6	-1.2	-13.9	-1.4
						2002-2	14		-12	8.7	15	-14.5	12.5	-13.2	2.1	-13.6	1.4
						2002-3	13		-13	7.1	12	-18.6	4.2	-14.9	-.5	-14.3	-.5
						2002-4	10		-13	6.3	12	-19.3	-2.1	-15.1	-9.5	-13.1	-8.6
01	25	001	C	A	O3	2002	15		-5.3	5.5	57	-8.8	10.6	-8	10.5	-7.4	10.4
OZONE						2002-1	5		-8	6.8	9	-9.9	5.4	-11.6	8.5	-12	9.4
						2002-2	15		-4.4	4.7	30	-5.8	5	-4.8	5.4	-4.5	6.1
						2002-3	15		-4.4	5.7	12	-8.3	16.7	-9	16.3	-7.8	15.4
						2002-4	4		-4.7	2.6	6	-13.1	23.8	-12.3	22.6	-10.9	20.9
							PRECISION DATA				ACCURACY DATA						
PRECISION AND ACCURACY DATA KEY								COLOC	PROB	LIM		#	PROB	LIM	PROB	LIM	
RG	ST	RO	TYP	CLASS	POLL	YEAR-Q		SITES	LO	UP		AUD	LO-L1	-UP	LO-L2	-UP	
01	25	001	I	F	PM2.5	2002		5	10.7	12.3		93			-1.1	-.3	
PM2.5 LOCAL CONDITIONS						2002-1		4	7.6	10.1		24			-2.1	-.5	
						2002-2		5	11.8	15.9		26			-1.4	-.2	
						2002-3		5	10.7	13.7		24			-1.3	.4	
						2002-4		5	9.9	12.8		19			-1	1.2	
01	25	001	I	F	PM10	2002		3	-20	28.6		2			5.1	6.2	
PM10 TOTAL 0-10UM						2002-1		1	-19	51.5		2			5.1	6.2	
						2002-2		2	-24	13.4		0					
						2002-3		2	-6.9	14.5		0					
						2002-4		3	-25	35.6		0					

ABBREVIATIONS AND SYMBOLS USED IN TABLE
RG = EPA REGION **ST** = STATE **RO** = REPORTING ORGANIZATION **TYP** = ANALYZER TYPE (CONTINUOUS OR INTERMITTENT) **CLASS** = ANALYTICAL (A); FLOW (F) **YR** = YEAR **# OF ANLYZRS** = NUMBER OF ANALYZERS **PRECIS** CHECKS = NUMBER OF PRECISION CHECKS **PROB LIM LO/UP** = LOWER AND UPPER 95% PROBABILITY LIMITS **# AUDITS L1-3** = NUMBER OF AUDITS **PROB LIM LO-L1-UP** = LOWER AND UPPER 95% PROBABILITY LIMITS AT LOW RANGE **PROB LIM LO-L2-UP** = LOWER AND UPPER 95% PROBABILITY LIMITS AT MIDDLE RANGE **PROB LIM LO-L3-UP** = LOWER AND UPPER 95% PROBABILITY LIMITS AT HIGH RANGE **# OF SMPLS** =NUMBER OF SAMPLERS **COLOC SITES** = NUMBER OF COLLOCATED SITES **# AUD** = NUMBER OF AUDITS

Section IV
PAMS/Air Toxics Monitoring

PAMS Monitoring

Introduction

Ground level ozone is unique in that it is a secondary pollutant, formed by chemical reactions between other light sensitive pollutants many miles down wind from the original emission locations. These reactions can only result in the build up of ground level ozone in the presence of high intensity sun light, which is present during the hottest days during the summer. The PAMS program was conceived as part of the 1990 Clean Air Act Amendments as an accurate way to collect data for assessing NAAQS attainment progress independent of the meteorological variation between years and for identifying appropriate future pollutant control strategies.

PAMS (Photochemical Assessment Monitoring Stations) is a special designation for enhanced monitoring stations employed to measure pollutants and meteorological parameters, which are designed to shed light on the ozone formation process. In addition to some of the standard NAAQS pollutants (Ozone, NO_2) which are measured at other sites, non-criteria pollutants, including volatile organic compounds (VOCs), are measured at PAMS stations on either an hourly or a staggered regularly scheduled basis throughout the designated season (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 intensity and at some sites, total ultraviolet light and precipitation. MADEP has one PAMS associated Doppler Radar High Altitude Wind/Temperature Profiler at the Stow site (which is otherwise not a PAMS designated location).

Since the PAMS project started in 1993, Massachusetts has been required by the USEPA to conduct enhanced ozone precursor measurements in the Boston and Springfield Metropolitan Areas. The PAMS monitoring network was phased in throughout the 1990's and was ultimately designed to have a total of nine stations, including two which are partially designated as downwind sites in the Providence, Rhode Island network. However, in recent years the competition for shrinking resources and the overwhelming amount of complicated data generated by the PAMS program has led to a consolidation of the network.

Several changes in the Eastern Massachusetts network were made for the 2002 season. The upwind station for Boston, also serving as a down wind site for Providence, was relocated from Borderland State Park in Easton to the Blue Hill Observatory grounds in Milton, prior to the commencement of the PAMS season. VOC sample collection originally designated for the remote Truro station was reassigned to the newly renovated Fairhaven station, in an experiment to investigate whether the latter location is more relevant for this type of measurement. A review of the 2002 Fairhaven data suggests that the original site at Truro is more appropriate for VOC sampling, and therefore VOC sampling will be returned to Truro in 2003.

Boston	**Springfield**	**Providence**
Lynn	Chicopee	Truro
*Blue Hill (Milton)	Ware	*Borderland
Newbury		Fairhaven

*Parts of both Boston and Providence networks.

Because of the nature and complexity of PAMS data, no summaries are presented in this report. However, information on some of the health-relevant hydrocarbon data (benzene, toluene, ethyl benzene and xylene) from the PAMS program is presented elsewhere in this document.

PAMS Air Toxics Monitoring

Introduction

Toxic air pollutants are chemicals in the air that are capable of causing long-term health effects and include health-relevant volatile and semi-volatile organic compounds, toxic elements and toxic minerals (such as asbestos and silica). NAAQS criteria air pollutants, which are extensively described in previous sections of this report, are not generally referred to as toxic air pollutants.

In response to a USEPA initiative, MADEP resumed a modest program of monitoring for toxic volatile organic compounds (VOCs) in 1999.

During 2002, every sixth day, 24-hour canister samples were routinely collected at two air monitoring stations in the Boston Area. These samples were shipped to the Rhode Island State Department of Public Health Laboratory for gas chromatograph-mass spectrometer (GC-MS) analysis according to USEPA Method TO-15. This analysis determines concentrations of a number of target toxic volatile organic compounds in ambient air samples. During the spring of 2002, the Boston Area background site for air toxics was changed from Long Island to the Lynn Water Treatment Plant.

Below is a table that summarizes results from the analysis of 24-hour samples for selected target VOCs from the three sites for 2002. The central city sampling location is Harrison Ave., and the area background site for 2002 was on a Boston Harbor Island (Long Island) until April when the sampler was moved to Lynn.

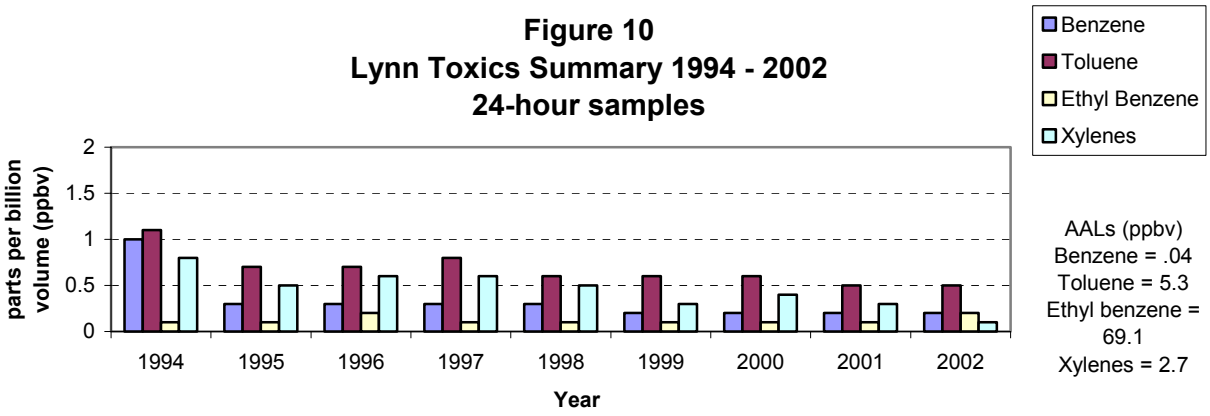
Compound	BOSTON(Harrison Ave)		BOSTON(Long Island)		LYNN	
	Max Value ppb	Mean ppb	Max Value Ppb	Mean ppb	Max Value ppb	Mean ppb
1,3-butadiene	0.2	0.06	0.08	0.02	0.08	0.02
1,1,1-trichloroethane	0.04	0.03	0.04	0.03	0.06	0.03
trichloroethylene	0.05	0.01	0.03	0.01	0.02	0.004
tetrachloroethylene	0.15	0.01	0.08	0.02	0.14	0.03
benzene	0.86	0.36	0.44	0.23	0.4	0.19
toluene	5.39	0.95	0.55	0.41	0.96	0.33
xylenes	4.03	0.47	0.4	0.25	0.22	0.09
ethylbenzene	1.38	0.23	0.23	0.13	0.14	0.05

Air Toxics Results from PAMS Monitoring

Sampling and analysis methods for the measurement of VOCs for the PAMS and Air Toxics projects are very similar. The analyses of 24-hour PAMS samples, taken at the Chicopee and Lynn sites, can yield concentrations of some health-relevant target compounds.

Figure 10 summarizes concentrations of 24-hour health-relevant PAMS target compounds for samples taken at the Lynn PAMS site from 1994 to 2002. Significant mean concentration decreases between 1994 and 1995 coincide with reformulation of gasoline content at the beginning of 1995. Allowable Ambient Limit (AAL) values are presented next to Figure 10 for reference. AALs are health-based air toxics guidelines developed by MADEP based on potential known or suspected carcinogenic and toxic health properties of individual compounds. Safety factors are incorporated into the AALs to account for exposures from pathways other than air. AALs are reviewed and updated periodically to reflect current toxicity information. AAL concentrations were developed for a 70-year lifetime exposure, but are frequently used for comparison with annual averages.

Figure 10
Lynn Toxics Summary 1994 - 2002
24-hour samples



Mercury Deposition Sampling

During 2002, the Air Assessment Branch participated in the collection of precipitation samples for the analysis of mercury. This study, partially sponsored by the DEP Office of Research and Standards, resulted in the collection of event-based precipitation samples at two locations in Massachusetts, including Ware and North Andover. This study was designed to collect information regarding the mechanism of wet mercury deposition. Samples are collected under meticulously controlled conditions and shipped to the University of Michigan for analysis. Final results from the analysis of samples collected so far have yet to be released.

Appendix A
Air Quality Related Web Sites

Web sites of interest: The table below has a listing of internet web sites that have air quality data or related information.

Web Address	Organization	Description
www.mass.gov/dep/	MADEP	Massachusetts DEP Home Page. Links to MADEP programs, regions and publications. Links to the Daily Ozone Forecast during ozone season (May1 through September 30).
www.mass.gov/dep/bwp/daqc/	MADEP	MADEP Air Program Planning Unit Home Page.
www.mass.gov/dep/bwp/dhm/tura	MADEP	Toxic Use Production Program – establishes toxics use reduction as the preferred means for achieving compliance with any federal or state law or regulation pertaining to toxics production and use.
www.airbeat.org	MADEP/EMPACT	Current AIR Quality in Roxbury – web page of MADEP and EMPACT's Roxbury monitor that shows current levels of ozone and particulates in the air.
www.turi.org	TURI	Toxics Use Reduction Institute –a multi-disciplinary research, education, and technical support center located at the University of Massachusetts/Lowell. Promotes reduction in the use of toxic chemicals and the generation of toxic by-products in industry and commerce in Massachusetts. The web site includes a link to TURAData, which makes information available to the public about toxics use in their communities.
www.epa.gov/airnow/ozone.html	USEPA	Ozone Mapping Project – color-coded animated maps using near real-time data that show how ozone is formed and transported downwind.
www.epa.gov/region01/eco/dailyozone/ozone.html	USEPA	Ozone maps of the Northeast U.S. using near real-time data.
www.epa.gov/region01/eco/ozone/smogalrt	USEPA	EPA Smog Alert System – sign up and receive e-mail alerts whenever Massachusetts predicts unhealthy ozone levels.
www.epa.gov/air/data/	USEPA	AIRSData - Access to air pollution data for the entire U.S.
www.epa.gov/eq/	USEPA	Center for Environmental Information and Statistics – a single convenient source for information on environmental quality.
www.epa.gov/oar/oaqps	USEPA	EPA's Office of Air and Radiation/Office of Air Quality Planning and Standards
www.epa.gov/region01/	USEPA	EPA Region 1 Home Page
www.epa.gov/ttn/	USEPA	EPA Technology Transfer Network - a collection of technical Web sites containing information about many areas of air pollution science, technology, regulation, measurement, and prevention.

Web Address	Organization	Description
www.epa.gov/enviro/ index_java.html	USEPA	EPA Envirofacts – data extracted from (4) major EPA databases: • PCS (Permit Compliance System) • RCRIS (Resource Conservation and Recovery Information System) • CERCLIS (Comprehensive Environmental Response, Compensation and Liability Information System) • TRIS (Toxic Release Inventory System)
es.epa.gov/index.html	USEPA	Enviroene Network - a free, public environmental information system. Provides users with pollution prevention/cleaner production solutions, compliance and enforcement assistance information, and innovative technology options.
www.epa.gov/docs/ ozone/index.html	USEPA	EPA Ozone Depletion Home Page – learn about the importance of the "good" ozone in the stratospheric ozone layer.
www.epa.gov/airmarkets/acidrain/	USEPA	The Acid Rain Program – overall goal is to achieve significant environmental and public health benefits through reductions in emissions of sulfur dioxide (SO2) and nitrogen oxides (NOX), the primary causes of acid rain. Emissions data from the nation's largest power generating facilities is available here.
Maine www.state.me.us/dep/air/ New Hampshire www.des.state.nh.us/ard/ozone.htm New York www.dec.state.ny.us/website/dar/bts/ozone/oz4cast.html New Jersey www.state.nj.us/dep/airmon/ Rhode Island www.state.ri.us/dem/ozone/ozoneday.htm		Ozone predictions and some real-time ozone data from neighboring states (some states report other pollutants, as well).

Web Address	Organization	Description
www.epa.gov/ttn/atw/	USEPA	Unified Air Toxics Website - This site is a central clearinghouse and repository for air toxics implementation information
www.epa.gov/airtrends	USEPA	AIRTrends - information on USEPA's evaluation of status and trends in the nation's outdoor air quality.
www.4cleanair.org/ scripts/us_temp.asp?id=307	STAPPA/ALAPCO	State and Territorial Air Pollution Program Administrators/Association of Local Air Pollution Control Officials – site has links to air quality related agencies and organizations.
www.nescaum.org/	NESCAUM	Northeast States for Coordinated Air Use Management – an interstate association of air quality control divisions from the six New England states, New York and New Jersey.
www.wunderground. com/	University of Michigan	The Weather Underground -. another good source of weather information in the US and world.
cirrus.sprl.umich.edu/ wxnet	University of Michigan	The WeatherNet – a good source of weather information. Also has a great list of weather links.
www.nws.noaa.gov/er/ box	NWS	The National Weather Service's Boston office provides local forecasts and climate information.
www.thebostonchannel.com/	WCVB	WCVB TV Pollen Count – provides the daily pollen and mold count.
www.hazecam.net/	NESCAUM (CAMNET)	Real-time Air Pollution Visibility Camera Network - live pictures and air quality conditions for urban and rural vistas across the Northeast U.S.
www.arb.ca.gov/homepage.htm	CARB	California Air Resources Board Home Page
www.awma.org/	AWMA	The Air & Waste Management Association - a nonprofit, nonpartisan professional organization that provides training, information, and networking opportunities to 12,000 environmental professionals in 65 countries.
nadp.sws.uiuc.edu/	NADP	National Atmospheric Deposition Program – maps and data from the nationwide precipitation monitoring network. Site also has data from the Mercury Deposition Network.
www.lungusa.org/ index	American Lung Association	American Lung Association – public health advocacy organization involved in public policy, research, and education mission is to prevent lung disease