Commonwealth of Massachusetts
2004 Air Quality Report

Executive Office of Environmental Affairs
Department of Environmental Protection
Bureau of Waste Prevention
Division of Planning and Evaluation

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

ACKNOWLEDGEMENTS

This 2004 Air Quality Report was prepared by the Massachusetts Department of Environmental Protection (MADEP), 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.

The following MADEP AAB staff are acknowledged for their efforts in the operation and maintenance of air monitoring equipment and stations: Laurel Carlson, Diana Conti, Mark Ducomb, Kevin Dufour, Vincent Ferlisi, Charlene Flynn, Dennis Flynn, Dan Herman, Jose Kemperman, Mark Lally, Iva Nesin, Jenmina Ojuka, John Paino, Tony Pikul, Paul Sanborn, Lisa Shore, Sharri Tyas, Kathy E. Webber, Greg Warner and Bradley Webber.

The following MADEP staff contributed to the publication of this report: Leslie Collyer, Richard Fields, Glenn Keith, Barbara Kwetz, Thomas McGrath, Sue Ann Richardson, Paul Sanborn, Ann Sorensen, and Sharon Weber.

This document is available in Adobe Acrobat PDF format from the MADEP web site at www.mass.gov/dep/bwp/daqc.

Questions about this report may be directed to:
Thomas McGrath
Air Assessment Branch
Wall Experiment Station
Lawrence, MA 01843-1343
(978) 975-1138
email: Thomas.McGrath@state.ma.us

TABLE OF CONTENTS

List of Figures

Section II – Attainment and Exceedances of Air Quality Standards

Section III – Massachusetts Air Quality Data Summaries

Section IV – PAMS/Air Toxics Monitoring

List of Abbreviations

AAB ..... Air Assessment Branch
AQS..... Air Quality 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
NAAQS..... National Ambient Air Quality Standards
NADP..... National Atmospheric Deposition Program
NAMS ..... National Air Monitoring Stations
NATTS..... National Air Toxics Trends Station
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
NPN..... NOAA Profiler Network
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
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 (MADEP) monitors outdoor air quality and requires emissions controls, as necessary, for pollutants that adversely affect public health, welfare, and the environment.

MADEP's Air Assessment Branch (AAB) collects ambient air quality data from monitoring sites throughout Massachusetts. During 2004, AAB operated a network of 27 monitoring stations located in 20 cities and towns, and oversaw a separate privately funded industrial network of four monitoring stations located at industrial facilities in the Boston area. AAB also received data from the Wampanoag Tribe, which began operating an ozone monitor in 2003 on Martha's Vineyard. The tribal website is listed in Appendix B.

MADEP submits ambient air quality data to the national Air Quality System (AQS) database that is administered by the U.S. Environmental Protection Agency (USEPA).

Why is Air Quality Data Collected?

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

- 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 information about air quality to the public;
- to support long-term trend analysis and special research; and
- to fulfill USEPA reporting requirements for ambient air quality data.

What is Monitored?

AAB 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 – 10 microns (PM10)
- particulate matter – 2.5 microns (PM2.5)

Non-criteria pollutants have no established national ambient air quality standards; however, some of these pollutants are subject to emissions limits in facility permits issued by DEP. The non-criteria pollutants monitored are:

- 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
- acid deposition – measured as pH and conductivity of precipitation
- mercury deposition – measured from collected precipitation and analysis of air filters
- toxics – health relevant VOCs, aldehydes and metals

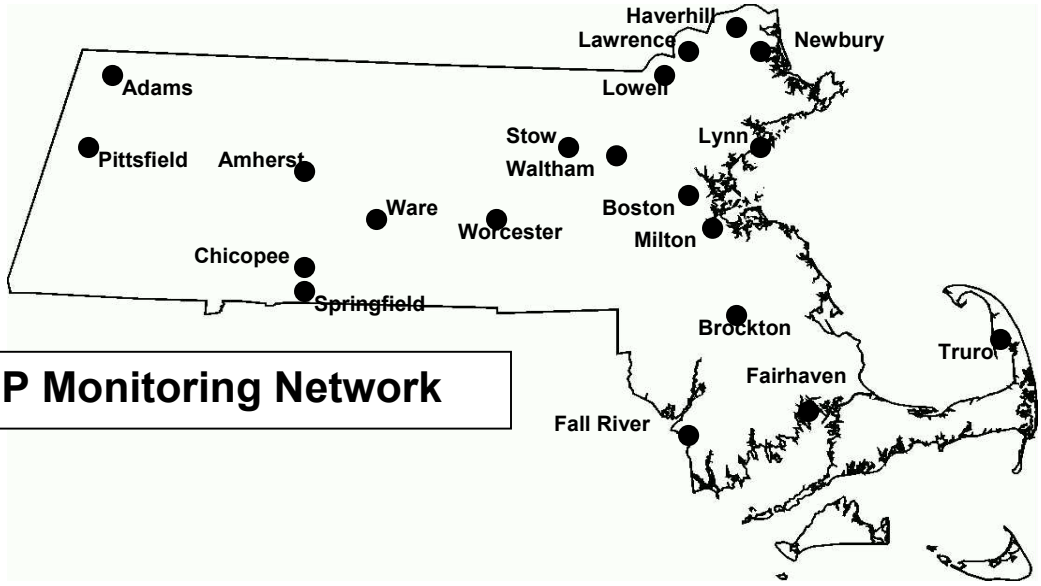
Meteorological parameters monitored are:

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

Monitoring Station Locations

Monitoring stations are sited to provide data for various purposes. Some are located in "hot spots" where maximum pollutant concentrations are expected, while others are located in areas that will provide data that is representative of larger geographic areas. Local topography and the location of pollutant sources are factors that determine how well a particular monitor location will represent an area.

A network of monitors for each pollutant is located throughout the state. These networks are designed to reflect pollutant concentrations for all of Massachusetts. Section III contains data summaries for each pollutant and maps showing the monitor locations for each network. Appendix A contains a list of the monitor locations. The map below shows Massachusetts cities and towns where air monitors were located during 2004.



2004 DEP Monitoring Network

For Further Information

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

MADEP – WERO (WESTERN) 436 Dwight Street Springfield, MA 01103 (413) 784-1100 Michael Gorski, Regional Director	**MADEP - CERO (CENTRAL)** 627 Main Street Worcester, MA 01608 (508) 792-7650 Martin Suuberg, Regional Director
MADEP - NERO (NORTHEAST/METRO BOSTON) One Winter Street Boston, MA 02108 (617) 292-5500 Richard Chalpin, Regional Director	**MADEP - SERO (SOUTHEAST)** 20 Riverside Drive Lakeville, MA 02347 (508) 946-2700 Gary Moran, Regional Director
BUREAU OF WASTE PREVENTION Division of Planning and Evaluation One Winter Street Boston, MA 02108 (617) 292-5500 James C. Colman, Assistant Commissioner	**AIR ASSESSMENT BRANCH** William X. Wall Experiment Station Lawrence, MA 01843 (978) 975-1138 Thomas McGrath, Acting Branch Chief

Information about MADEP's various programs is available on MADEP's web site at www.mass.gov/dep. The USEPA maintains a web site at 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 g/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/m^3. • The 24-hour standard is attained if the estimated number of days per calendar year above 150 ug/m^3 does not exceed one per year.			

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

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

Pollutant Health Effects and Sources

Ozone (O3)

- Ground-level ozone and stratospheric ozone are the same chemical compound but are often confused. Stratospheric ozone at >30,000 feet above the surface of the earth is beneficial because it filters out the sun's harmful ultraviolet radiation. However, ground-level ozone is a health and environmental problem. This report pertains to ground-level ozone.
- Ozone irritates mucous membranes. This causes reduced lung function, nasal congestion, and throat irritation, and reduced resistance to infection.
- Ozone is toxic to vegetation, inhibiting growth and causing leaf damage.
- Ozone deteriorates materials such as rubber and fabrics.
- Ground level ozone is unique in that it is formed by reactions between certain pollutants in the presence of intense, high-energy sunlight occurring during the summer months. The complexity of the reactions and the amount of 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 ozone precursors, nitrogen oxides and hydrocarbons, include motor vehicles and power plants.

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.
- 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, and diminution 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 acid deposition effects).
- 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, 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, 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 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 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, 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 with 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

2004 Public Monitoring Network

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

Network Size

- 27 monitoring stations
- 20 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.
  - 5 – CO (carbon monoxide)
  - 12 – NO_2 (nitrogen dioxide). NO (nitrogen oxide) and NO_x (total nitrogen oxides) are also measured by these monitors.
  - 14 – O_3 (ozone)
  - 6 – 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)
  - 11– 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
  - 4 – NO_y (Total Reactive Oxidized Nitrogen)
  - 6 – PAMS (Photochemical Assessment Monitoring Station). These monitors measure VOCs (volatile organic compounds).
  - 7 – $PM_{2.5}$ (particulate matter – 2.5 microns, BAM)
  - 2– 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.

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).
  - 1 – Pb (Lead)
  - 6 – PM_{10} (particulate matter – 10 microns)
  - 16 – $PM_{2.5}$ (particulate matter – 2.5 microns)

- Non-criteria pollutant monitors measure pollutants that do not have NAAQS.
  - 6 – PAMS (photochemical assessment monitoring station). These monitors measure VOCs (volatile organic compounds).
  - 1 – TSP (total suspended particulates) used for lead analysis
  - 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)

2004 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

The Clean Air Act (CAA) established timeframes and milestones in order for states to meet and maintain National Ambient Air Quality Standards (NAAQS) for criteria pollutants. USEPA sets the NAAQS levels to protect public health. USEPA must review the NAAQS every five years and may update the standards based on that review. Each state is required to monitor the ambient air to determine whether it meets each standard. If 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).

Ozone is the only pollutant for which Massachusetts monitors indicate violations of a NAAQS. Massachusetts is in attainment for the other criteria pollutants, including carbon monoxide, lead, nitrogen dioxide, sulfur dioxide, and particulate matter (including PM_{10} and $PM_{2.5}$).

Sulfur Dioxide, Nitrogen Dioxide, and Lead

Massachusetts has been in attainment for sulfur dioxide, nitrogen dioxide, and lead for a number of years based on decades of monitoring.

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 have significantly 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 as 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.

Particulate Matter

There are two NAAQS particulate matter standards: An older PM_{10} and a newer $PM_{2.5}$ standard. Massachusetts has been in attainment of the PM_{10} standard for several years. In December 2004, USEPA designated Massachusetts "Attainment/Unclassifiable" for $PM_{2.5}$ statewide based on monitoring data.

The particulate matter standard has evolved over the years as more has been learned about the health effects of particulate matter. As more and more studies have linked exposure to fine particles with adverse health effects, the standard has become more stringent requiring control of particulates of smaller sizes and at lower concentrations. The following is a brief description of the historical development of the standards for particulates:

- 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).
- 2005 – As part of its 5-year review of the particulate matter standards, USEPA released its final staff paper with recommendations for strengthening the $PM_{2.5}$ standard and creating an indicator for coarse particles in urban areas (i.e., particles larger than 2.5 microns but smaller than 10 microns, with a focus on urban areas). USEPA is required to propose a new $PM_{2.5}$ standard by December 20, 2005. A new more stringent $PM_{2.5}$ standard may result in Massachusetts being designated as nonattainment for $PM_{2.5}$ in the future.

Ozone

There are two NAAQS ozone standards: a 1-hour ozone standard and a newer 8-hour standard. MADEP monitors for both 1-hour and 8-hour ozone levels throughout the state.

The 1-hour ozone standard (0.12 parts per million (ppm) averaged over one hour) has been in place for almost two decades. Massachusetts has been classified as "serious nonattainment" for the 1-hour ozone standard since the early 1990s. However, with the adoption of numerous control programs, Massachusetts has made great progress in reducing the number and severity of 1-hour ozone exceedances.

In 1997, USEPA set a new stricter ozone standard of 0.08 ppm averaged over an eight-hour period, but implementation was delayed due to legal challenges to the standard. USEPA designated Massachusetts as "moderate nonattainment" for the 8-hour standard effective June 15, 2004. USEPA revoked the 1-hour standard effective June 15, 2005, and MADEP will no longer report 1-hour ozone exceedances but will only report 8-hour exceedances. Programs that were put in place to attain the 1-hour standard will continue as part of MADEP's strategy to attain the new 8-hour standard. Massachusetts is working with the Ozone Transport Commission member states to develop a regional strategy for attaining the 8-hour ozone standard by 2010.

Ozone Exceedances

What Determines an Exceedance?

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

The Difference Between an Exceedance and a Violation

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

Violations of the 1-hour standard are determined using the number of expected exceedance days. An exceedance day is a day that records an ozone 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 ozone 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 ozone 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.

Ozone Exceedances and Violations During 2004

Exceedances

The Table below shows the 2004 ozone exceedances. During 2004, there was one day when the 1-hour ozone standard was exceeded at one site. There were 8 days during the season when the 8-hour ozone standard was exceeded. There were 19 exceedances during those 8 days.

Violations

Violations of the ozone standard are based on 3-year averages. Using data from 2002–2004, one site out of 14 violated the 1-hour standard. For the more stringent 8-hour standard, during the same period, six sites out of 14 violated the 8-hour standard

2004 Ozone Exceedances (ppm)

DATE	SITE	8-HOUR EXC	1-HOUR EXC	START HOUR
May 11, 2004	Truro	.085		14
June 8, 2004	Boston (Harrison Ave)	.088		16
June 8, 2004	Boston(Long Is)	.094		16
June 8, 2004	Lynn	.092		17
June 8, 2004	Milton(Blue Hill)	.100		16
June 8, 2004	Stow	.085		16
June 8, 2004	Truro	.089		16
June 9, 2004	Fairhaven	.099		13
June 9, 2004	Truro	.107		13
June 9, 2004	Truro		.130	19
June 17, 2004	Blue Hill	.095		11
July 22, 2004	Adams	.086		17
July 22, 2004	Amherst	.088		11
July 22, 2004	Chicopee	.093		10
July 22, 2004	Ware	.090		10
July 22, 2004	Haverhill	.091		10
July 30, 2004	Lynn	.088		10
July 30, 2004	Newbury	.085		11
August 3, 2004	Ware	.086		11
August 10, 2004	Ware	.091		11

Exceedance Days and Total Exceedance Trends

Figures 1 and 2 show the trends in number of 1-hour and 8-hour exceedance days and the total number of 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 covered. The trend in Figure 2 shows that, under the new more stringent 8-hour standard, there were a greater number of exceedances and exceedance days compared to the 1-hour standard.

Figure 1
1-hr Ozone Exceedance Days and Total Exceedances 1987-2004
1-hour standard = 0.125 ppm

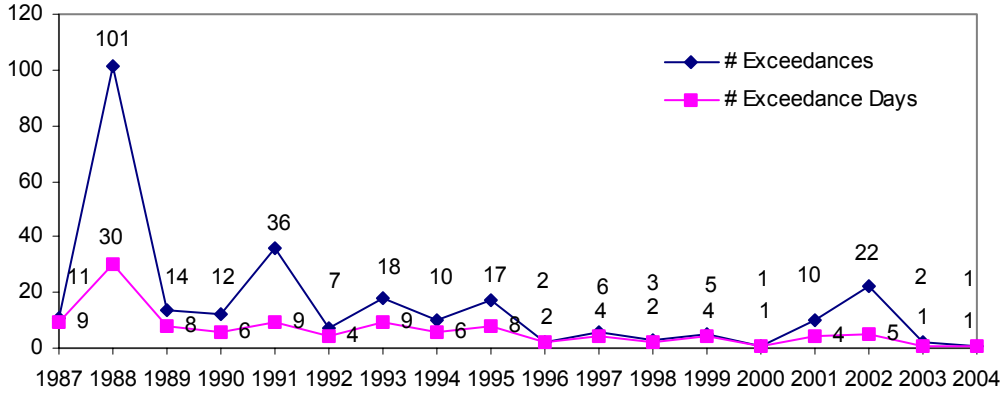
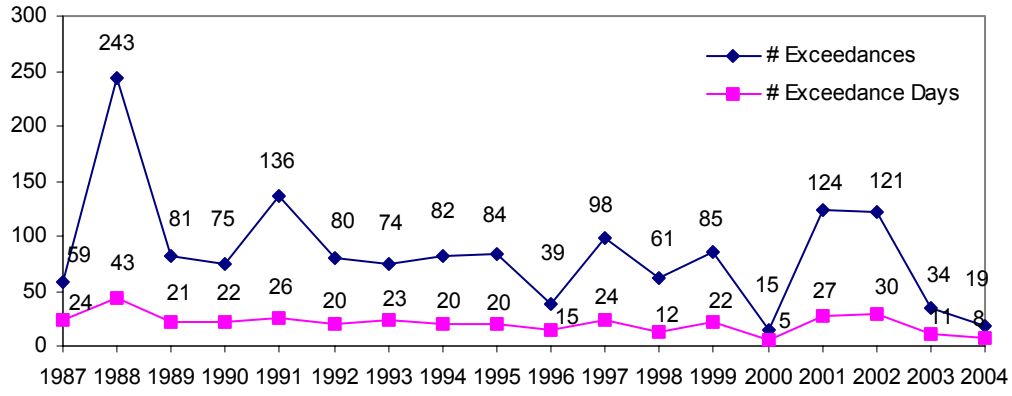


Figure 2
8-hr Ozone Exceedance Days and Total Exceedances 1987-2004
8-hour standard = 0.085 ppm



Daily Ozone Forecasts

Air Quality Ratings

MADEP makes daily air quality forecasts for ozone from May through September using weather maps and meteorological conditions to predict whether or not conditions are favorable for the production of elevated ozone levels. Each day during these months, MADEP predicts when the air quality will be good, moderate or unhealthful.

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

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).

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	Ozone 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 ozone levels are usually the highest.
Unhealthy	As ozone 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 to note that individuals react differently when exposed to various ozone 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 ozone levels are usually the highest. You should consider scheduling outdoor exercise and children's outdoor activities in the morning hours, when ozone levels are generally lower. If you are particularly sensitive to ozone, 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.

Ozone Maps

USEPA maintains web sites containing current and archived ozone maps and "real-time" ozone movies using ozone 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

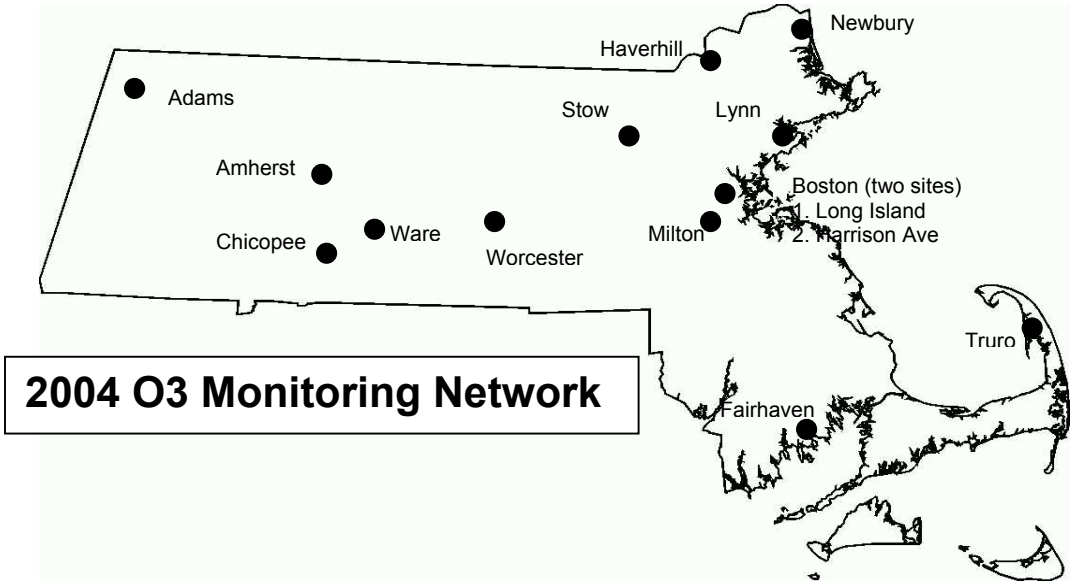
Ozone Summary

2004 Ozone Data Summary

A summary of the 2004 data collected during ozone season (April 1 – Sept. 30) is shown below. There were 14 ozone sites in operation during 2004 in the state-operated monitoring network. All of the sites achieved the requirement of 75% or greater data capture for the year.

SITE ID	CITY	COUNTY	ADDRESS	% OBS	1ST MAX 1-HR	2ND MAX 1-HR	DAY MAX>/= 0.125	1ST MAX 8-HR	2ND MAX 8-HR	3RD MAX 8-HR	4TH MAX 8-HR	DAY MAX>/= 0.085
25-003-4002	Adams	Berkshire	MT. GREYLOCK	83	0.096	0.096	0	0.086	0.081	0.075	0.071	1
25-015-0103	Amherst	Hampshire	NORTH PLEASANT	98	0.099	0.096	0	0.088	0.079	0.076	0.062	1
25-025-0041	Boston	Suffolk	LONG ISLAND	98	0.106	0.098	0	0.094	0.081	0.080	0.079	1
25-025-0042	Boston	Suffolk	HARRISON AVENUE	98	0.106	0.081	0	0.088	0.068	0.066	0.064	1
25-013-0008	Chicopee	Hampden	ANDERSON ROAD	97	0.104	0.101	0	0.093	0.083	0.080	0.078	1
25-005-1002	Fairhaven	Bristol	LEROY WOOD	97	0.116	0.096	0	0.099	0.084	0.082	0.080	1
25-009-5005	Haverhill	Essex	WASHINGTON ST	93	0.110	0.089	0	0.091	0.078	0.078	0.072	1
25-009-2006	Lynn	Essex	390 PARKLAND	98	0.105	0.105	0	0.092	0.088	0.083	0.083	2
25-021-3003	Milton	Norfolk	MILTON MA	99	0.112	0.110	0	0.100	0.095	0.084	0.078	2
25-009-4004	Newbury	Essex	SUNSET BOULEVARD	98	0.100	0.098	0	0.085	0.084	0.079	0.077	1
25-017-1102	Stow	Middlesex	US MILITARY	91	0.102	0.088	0	0.085	0.075	0.071	0.070	1
25-001-0002	Truro	Barnstable	FOX BOTTOM AREA	99	0.130	0.100	1	0.107	0.089	0.085	0.083	3
25-015-4002	Ware	Hampshire	QUABBIN SUMMIT	99	0.114	0.104	0	0.091	0.090	0.086	0.083	3
25-027-0015	Worcester	Worcester	WORCESTER	97	0.101	0.090	0	0.082	0.082	0.076	0.074	0

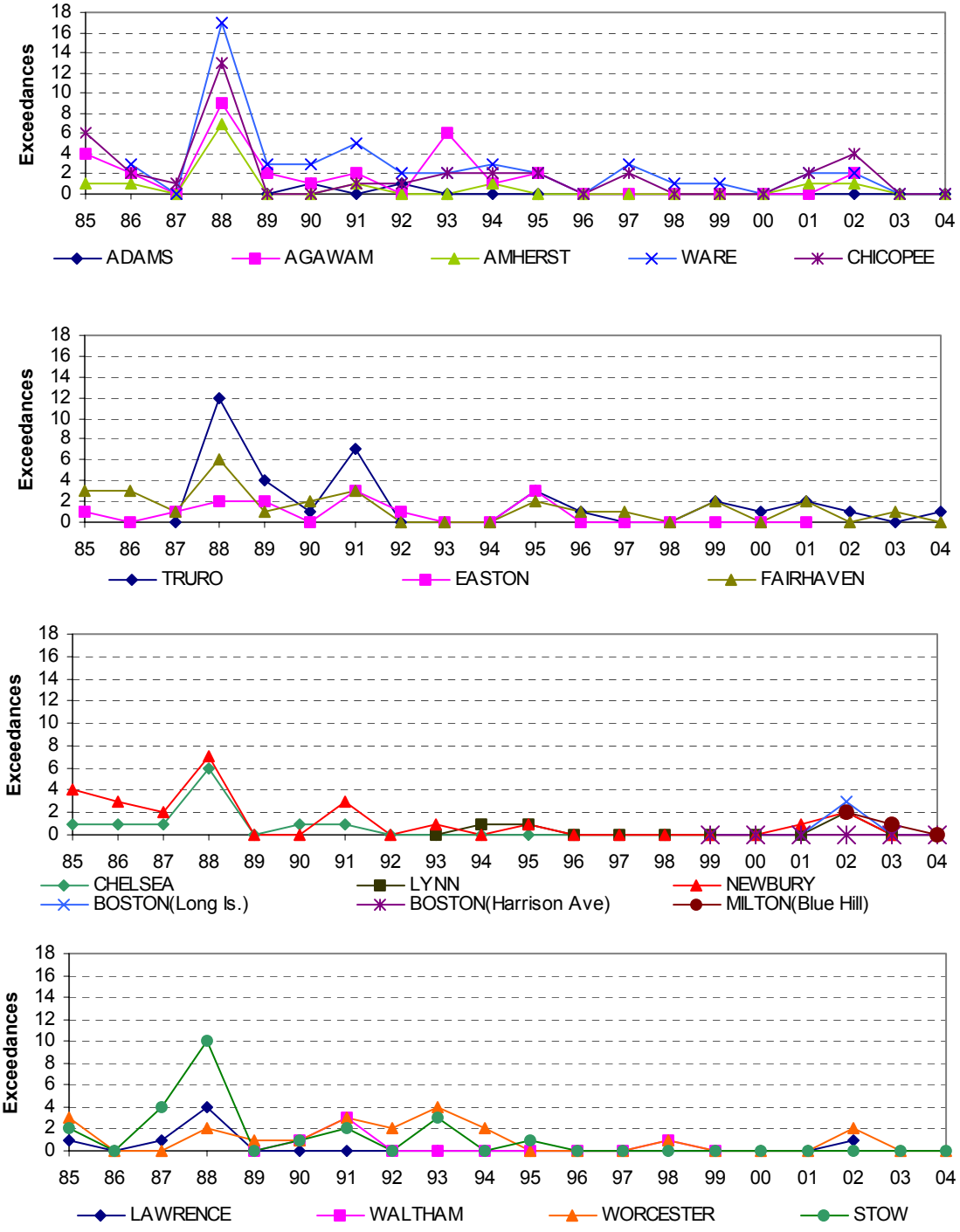
ABBREVIATIONS AND SYMBOLS USED IN TABLE
SITE ID = AIRS SITE IDENTIFICATION NUMBER **% OBS** = PERCENTAGE OF VALID DAYS MONITORED DURING O3 SEASON **1ST, 2ND 1-HR MAX** = MAXIMUM 1-HR VALUE FOR THE 1ST & 2ND HIGHEST DAY **MAX ≥ 0.125** = NUMBER OF MEASURED DAILY 1-HR MAXIMUM VALUES GREATER THAN OR EQUAL TO 0.125 PPM (1-HR STANDARD) **1ST, 2ND, 3RD & 4TH 8-HR MAX** = MAXIMUM 8-HR VALUE FOR THE 1ST, 2ND & 4TH HIGHEST DAY **MAX ≥ 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 ozone exceedances for each site are shown below.

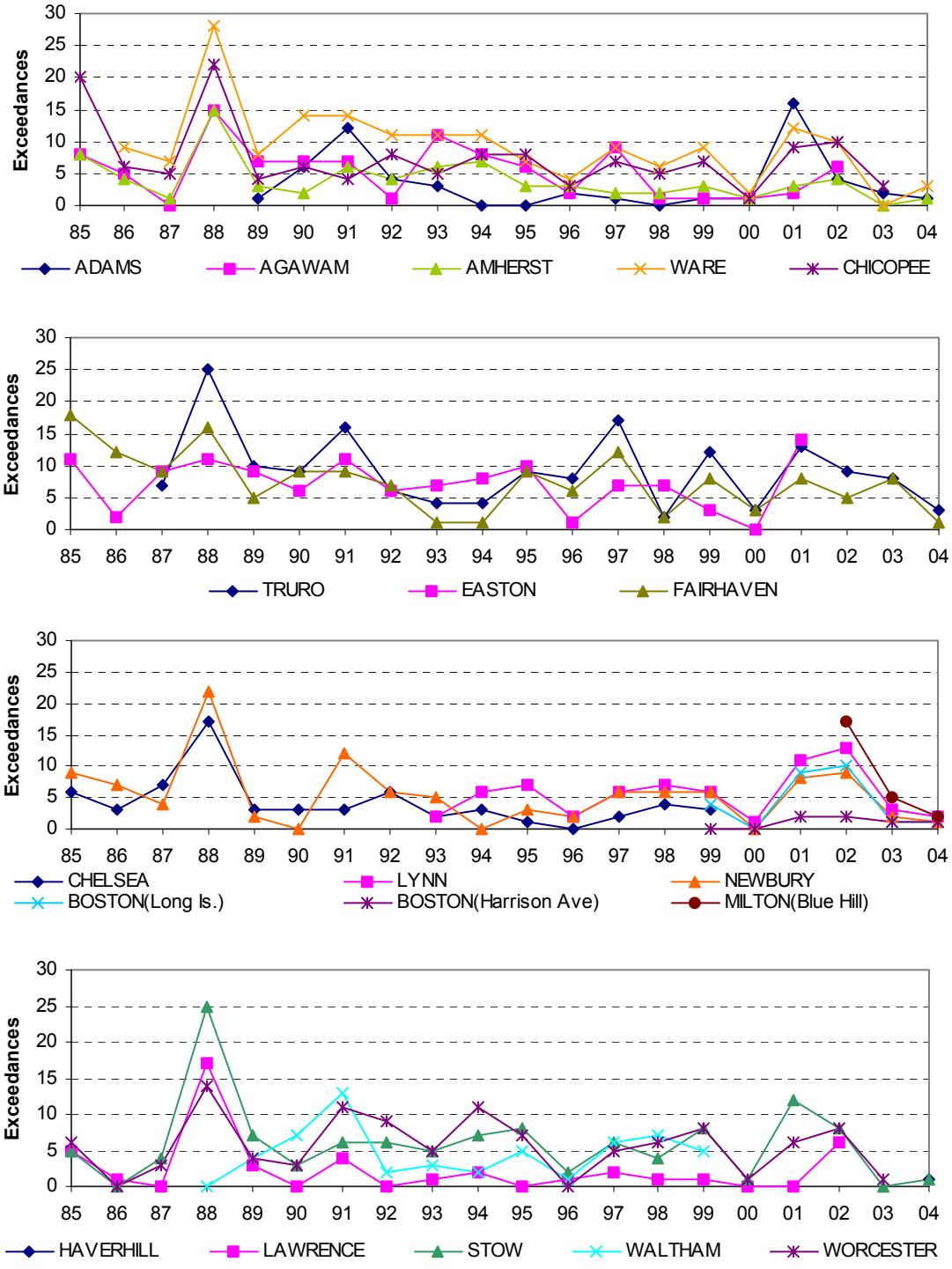
Figure 3
1-hour Ozone Exceedance Day Trends 1985 - 2004
Standard = 0.125 ppm



8-hour Ozone Exceedance Trends

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

Figure 4
8-hour Ozone Exceedance Day Trends 1985 - 2004
Standard = 0.085 ppm



Sulfur Dioxide (SO_2) Summary

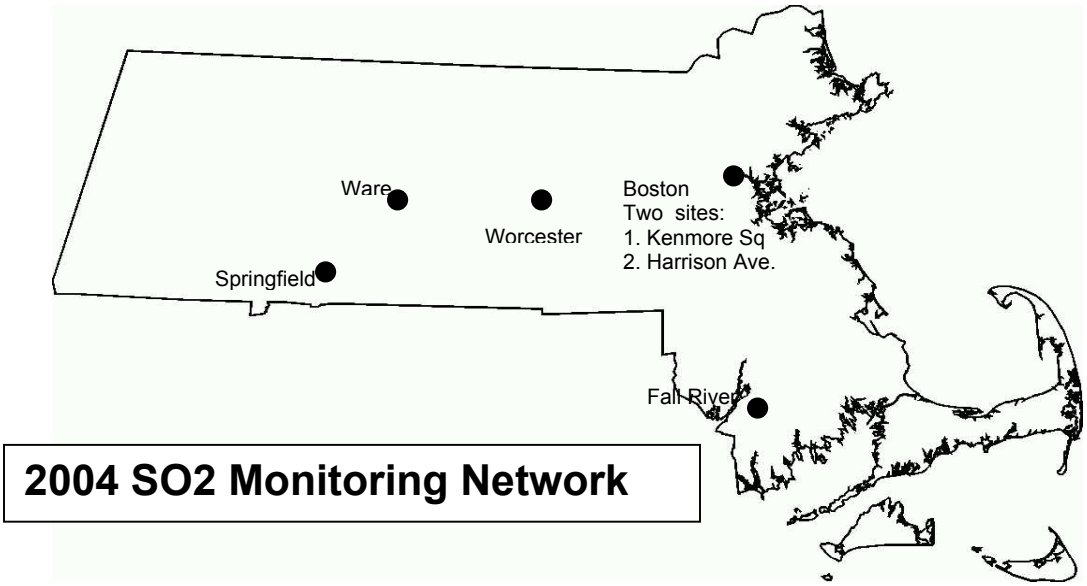
2004 SO_2 Data Summary

A summary of the 2004 SO2 data is shown below. There were six SO_2 sites in operation during 2004 in the state-operated monitoring network. All of the sites achieved the requirement of 75% or greater data capture for the year.

SITE ID	CITY	COUNTY	ADDRESS	YEAR	% OBS	1ST MAX 24-HR	2ND MAX 24-HR	#OBS >0.14	1ST MAX 3-HR	2ND MAX 3-HR	#OBS >0.5	1ST MAX 1-HR	2ND MAX 1-HR	ARITH MEAN
25-025-0002	Boston	Suffolk	KENMORE SQUARE	97	0.021	0.020	0	0.033	0.028	0	0.035	0.035	0.004
25-025-0042	Boston	Suffolk	HARRISON AVE	97	0.021	0.016	0	0.025	0.025	0	0.037	0.031	0.004
25-005-1004	Fall River	Bristol	GLOBE STREET	98	0.029	0.021	0	0.069	0.058	0	0.085	0.084	0.004
25-013-0016	Springfield	Hampden	LIBERTY STREET	97	0.026	0.023	0	0.040	0.038	0	0.048	0.046	0.006
25-015-4002	Ware	Hampshire	QUABBIN SUMMIT	98	0.014	0.012	0	0.020	0.019	0	0.021	0.021	0.002
25-027-0023	Worcester	Worcester	SUMMER STREET	96	0.014	0.013	0	0.019	0.018	0	0.027	0.025	0.003

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

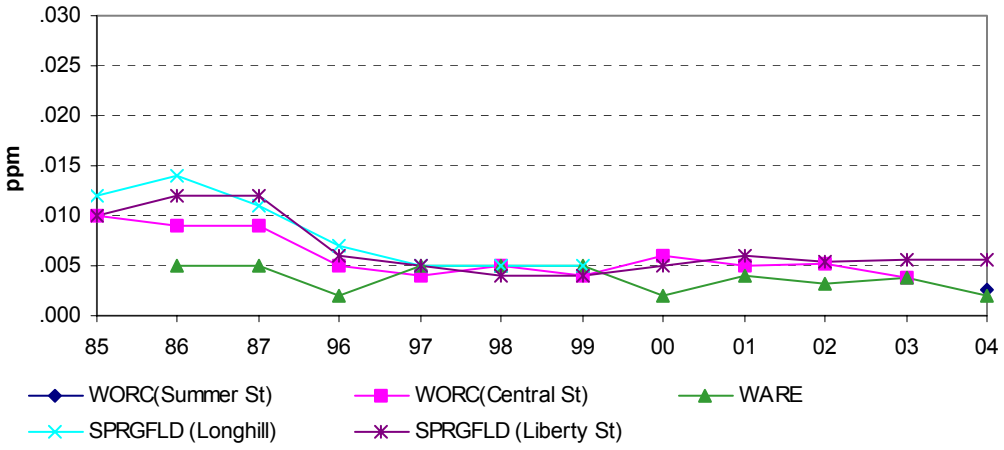
ABBREVIATIONS AND SYMBOLS USED IN TABLE
SITE ID = AIRS SITE IDENTIFICATION NUMBER **% OBS** = DATA CAPTURE PERCENTAGE **MAX 24-HR, MAX 3-HR, MAX 1-HR 1ST 2ND** = FIRST AND SECOND HIGHEST VALUE FOR TIME PERIOD INDICATED **# OBS > 0.14** = NUMBER OF OBSERVATIONS ABOVE THE 24-HOUR STANDARD OF 0.14 PPM **# OBS > 0.5** = NUMBER OF OBSERVATIONS ABOVE THE 3-HOUR STANDARD OF 0.5 PPM **ARITH MEAN** = ANNUAL ARITHMETIC MEAN (STANDARD = 0.03 PPM)

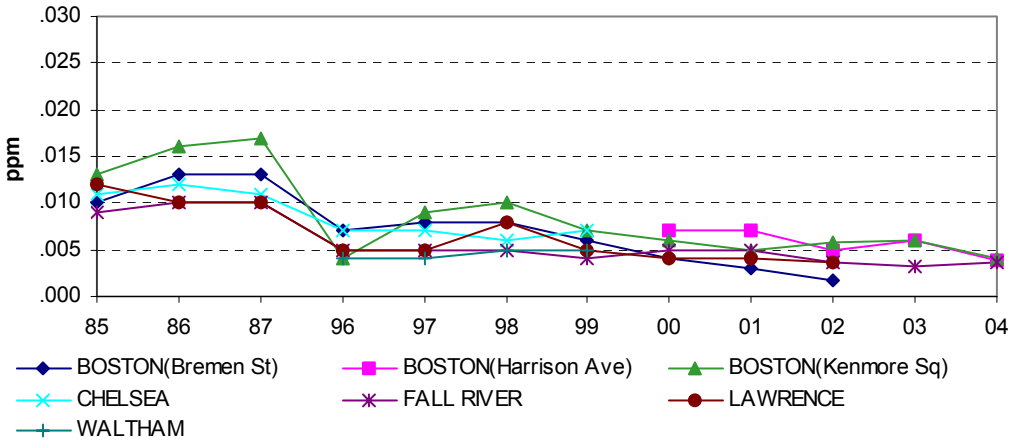


SO_2 Trends

The long-term trends of the annual arithmetic mean for each SO_2 site are shown below. The trend has been stable for the last few years and downward for the entire period. Massachusetts is well below the standard for SO2.

Figure 5
Sulfur Dioxide Trends 1985 -2004
Annual Arithmetic Means
Standard = 0.03 ppm





Nitrogen Dioxide (NO_2) Summary

2004 NO_2 Data Summary

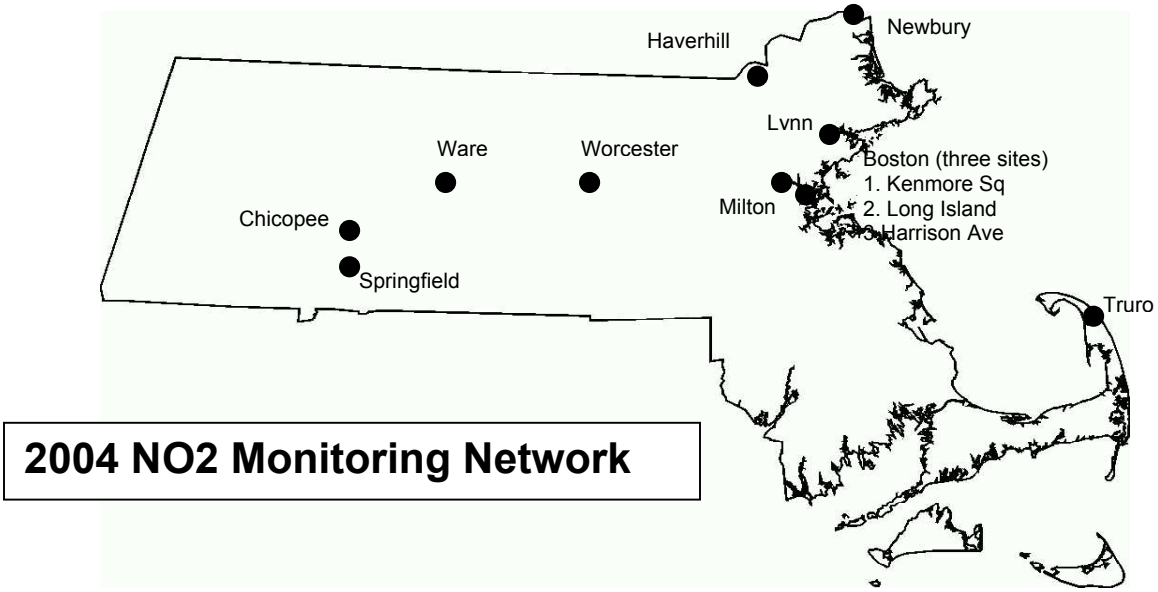
A summary of the 2004 NO_2 data is shown below. There were 12 NO_2 sites in operation during 2004 in the state-operated monitoring network. All of the sites met the requirement of 75% data capture for the year.

SITE ID	CITY	COUNTY	ADDRESS	% OBS	1ST MAX 1-HR	2ND MAX 1-HR	ARITH MEAN
25-025-0002	Boston	Suffolk	KENMORE SQUARE	94	0.080	0.076	0.025
25-025-0041	Boston	Suffolk	LONG ISLAND	91	0.044	0.041	.0070*
25-025-0042	Boston	Suffolk	HARRISON AVENUE	95	0.062	0.058	0.017
25-013-0008	Chicopee	Hampden	ANDERSON ROAD	87	0.069	0.061	0.009
25-009-5005	Haverhill	Essex	WASHINGTON ST	94	0.045	0.043	.0098*
25-009-2006	Lynn	Essex	390 PARKLAND	88	0.048	0.042	0.009
25-021-3003	Milton	Norfolk	MILTON MA	96	0.031	0.030	0.004
25-009-4004	Newbury	Essex	SUNSET BOULEVARD	97	0.019	0.019	.0028*
25-013-0016	Springfield	Hampden	LIBERTY STREET	96	0.064	0.064	0.017
25-001-0002	Truro	Barnstable	FOX BOTTOM AREA	96	0.011	0.009	0.003
25-015-4002	Ware	Hampshire	QUABBIN SUMMIT	93	0.043	0.042	0.005
25-027-0023	Worcester	Worcester	SUMMER ST	89	0.093	0.060	0.016

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

Standard: Annual Arithmetic Mean = 0.053 ppm

ABBREVIATIONS AND SYMBOLS USED IN TABLE
SITE ID = AIRS SITE IDENTIFICATION NUMBER **% OBS** = DATA CAPTURE PERCENTAGE **MAX 1-HR 1ST 2ND** = FIRST AND SECOND HIGHEST VALUE FOR TIME PERIOD INDICATED **ARITH MEAN** = ANNUAL ARITHMETIC MEAN

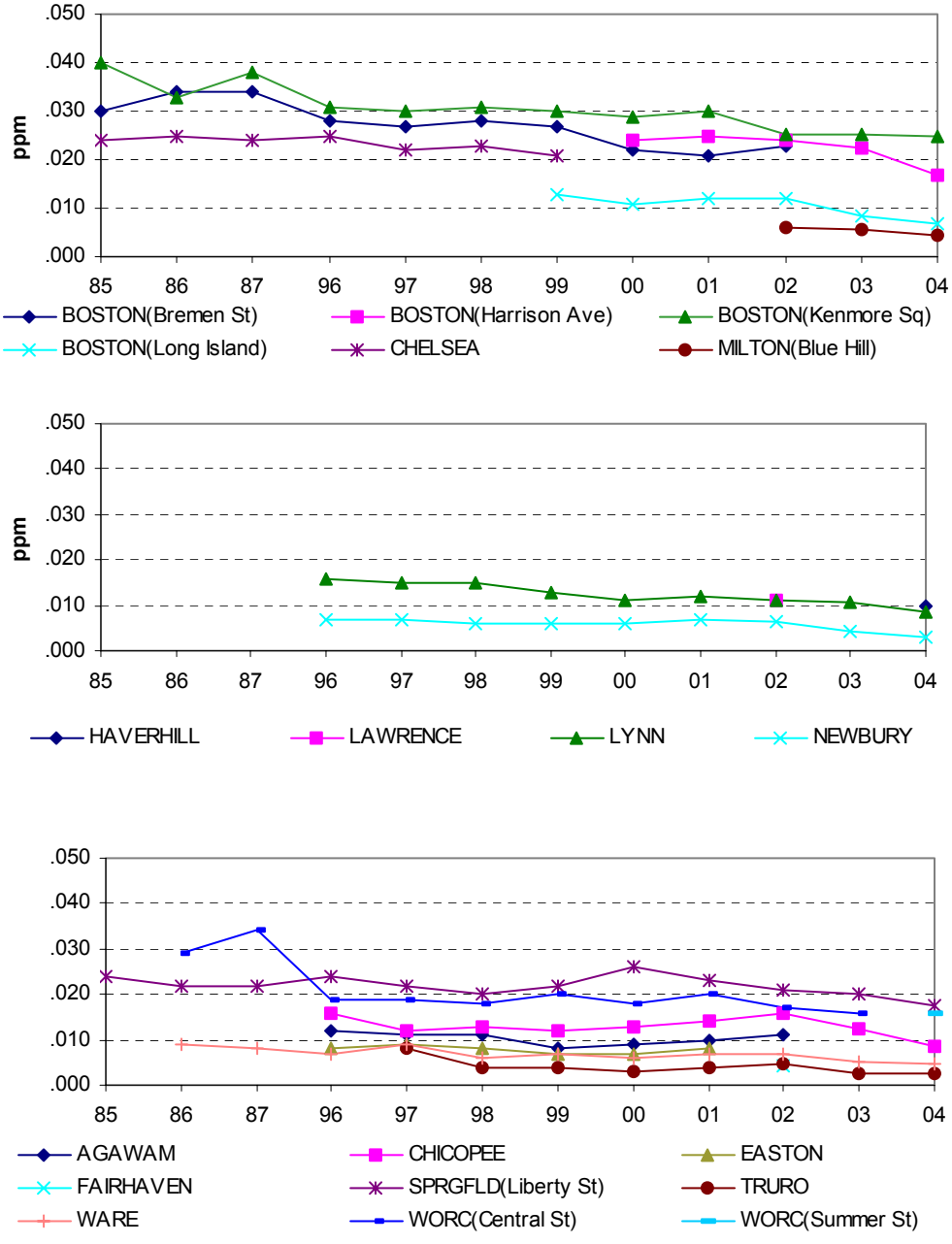


2004 NO2 Monitoring Network

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
Nitrogen Dioxide Trends 1985 - 2004
Annual Arithmetic Means
Standard = 0.05 ppm



Carbon Monoxide (CO) Summary

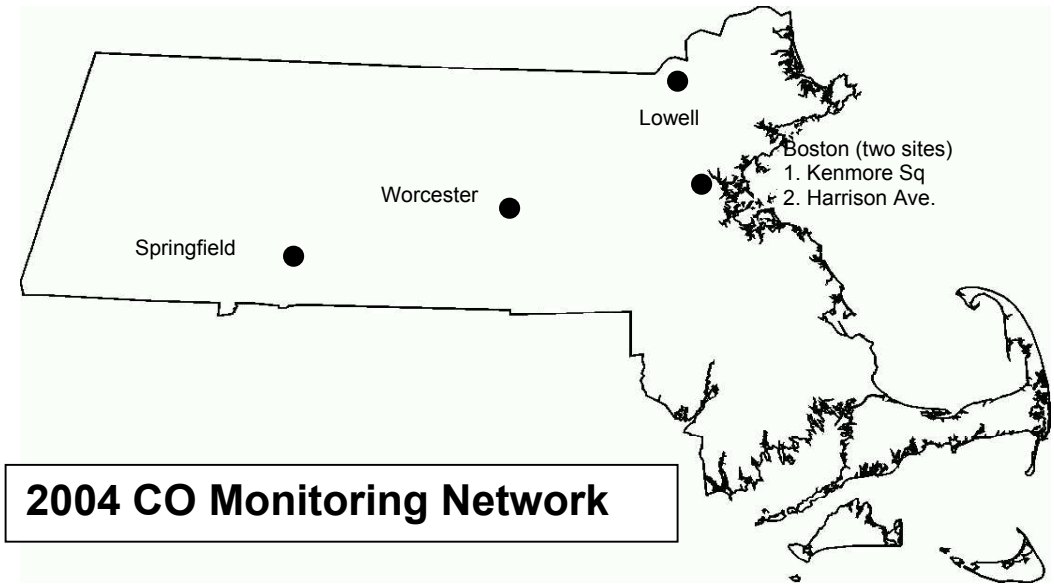
2004 CO Data Summary

A summary of the 2004 CO data is shown below. There were five CO sites in operation during 2004 in the state-operated monitoring network. All of the sites achieved the requirement of 75% or greater data capture for the year.

SITE ID	CITY	COUNTY	ADDRESS	% OBS	1ST MAX 1-HR	2ND MAX 1-HR	OBS >35	1ST MAX 8-HR	2ND MAX 8-HR	OBS >9
25-025-0002	Boston	Suffolk	KENMORE SQUARE	94	2.2	2.1	0	1.3	1.3	0
25-025-0042	Boston	Suffolk	HARRISON AVENUE	83	3.1	2.8	0	2.0	1.5	0
25-017-0007	Lowell	Middlesex	OLD CITY HALL	94	2.7	2.5	0	1.9	1.6	0
25-013-0016	Springfield	Hampden	LIBERTY STREET	90	6.2	4.7	0	4.1	3.1	0
25-027-0023	Worcester	Worcester	SUMMER ST	92	4.1	3.9	0	2.9	1.9	0

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

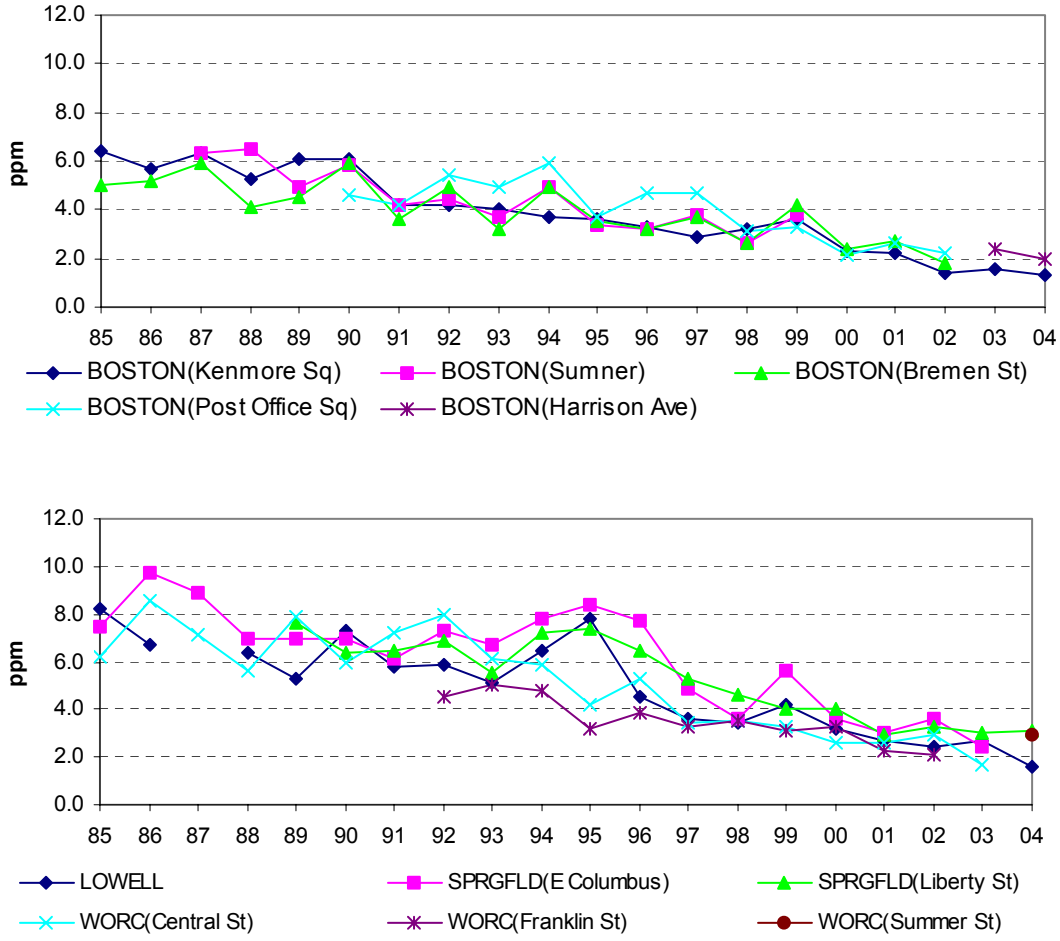
ABBREVIATIONS AND SYMBOLS USED IN TABLE
SITE ID = AIRS SITE IDENTIFICATION NUMBER **% OBS** = DATA CAPTURE PERCENTAGE **MAX 1-HR 1ST 2ND** = FIRST AND SECOND HIGHEST VALUE FOR TIME PERIOD INDICATED **OBS > 35** = NUMBER OF 1-HR AVG. GREATER THAN 35 PPM (1-HR STANDARD) **MAX 8-HR 1ST 2ND** = FIRST AND SECOND HIGHEST VALUE FOR TIME PERIOD INDICATED **OBS > 9** = NUMBER OF 8-HR AVG. GREATER THAN 9 PPM (8-HR STD)



CO 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. The highest 8-hour values occurred in Springfield. Massachusetts is well below both the 1-hour and 8-hour standards.

Figure 7
Carbon Monoxide Trends 1985-2004
2nd Maximum 8-hour Values
Standard = 9 ppm



Particulate Matter 10 Microns (PM_{10}) Summary

2004 PM_{10} Data Summary

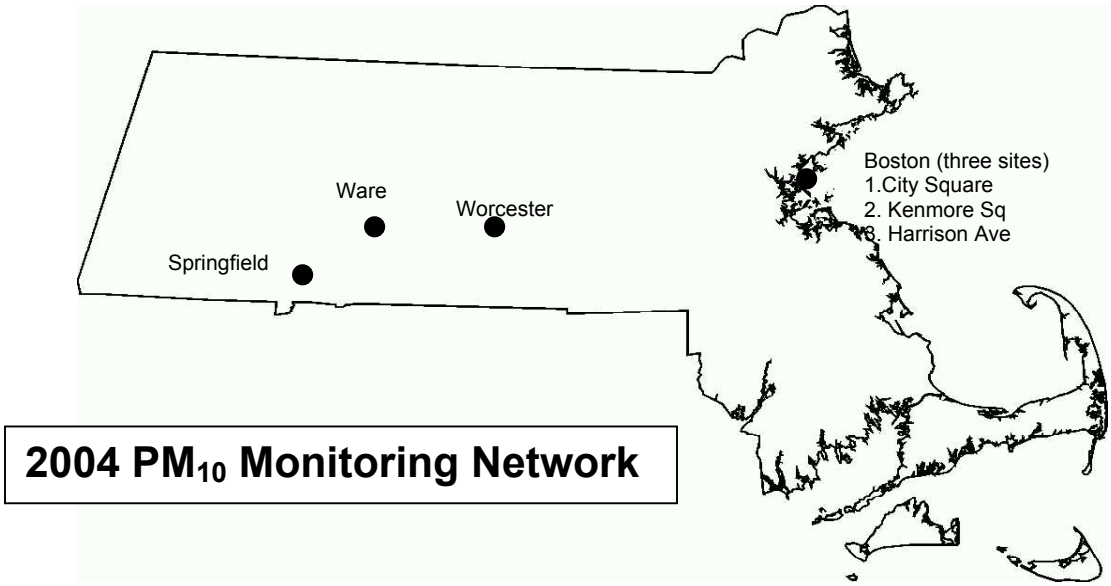
A summary of the 2004 PM_{10} data is shown below. There were six PM_{10} sites in operation during 2004 in the state-operated monitoring network. All of the sites achieved the requirement of 75% or greater data capture for the year.

SITE ID	TYPE	CITY	COUNTY	ADDRESS YEAR	% OBS	1ST MAX	2ND MAX	3RD MAX	4TH MAX	DAY MAX >150	EST DAYS >150	WTD ARITH MEAN
25-025-0002	Lo-Vol	Boston	Suffolk	KENMORE SQUARE	100	88	58	50	46	0	0	22.4
25-025-0027	Lo-Vol	Boston	Suffolk	ONE CITY SQUARE	87	47	42	39	39	0	0	22.7
25-025-0027	Lo-Vol Co-loc	Boston	Suffolk	ONE CITY SQUARE	85	68	52	52	44	0	0	25.3*
25-025-0042	Lo-Vol	Boston	Suffolk	HARRISON AVENUE	84	44	42	35	30	0	0	18.9*
25-025-0042	Hi-Vol	Boston	Suffolk	HARRISON AVENUE	84	42	38	31	29	0	0	17.9*
25-025-0042	Hi-Vol Co-loc	Boston	Suffolk	HARRISON AVENUE	77	67	40	38	32	0	0	20.1*
25-013-2009	Lo-Vol	Springfield	Hampden	1860 MAIN STREET	95	80	48	45	45	0	0	19.4
25-015-4002	Lo-Vol	Ware	Hampshire	QUABBIN SUMMIT	93	41	33	27	23	0	0	10.9
25-027-0023	Lo-Vol	Worcester	Worcester	SUMMER STREET	87	64	57	49	43	0	0	22.4*

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

PM_{10} Hi Vol Standards: 24-hour = 150 $\mu g/m^3$ PM_{10} Hi Vol Annual Arithmetic Mean = 50 $\mu g/m^3$

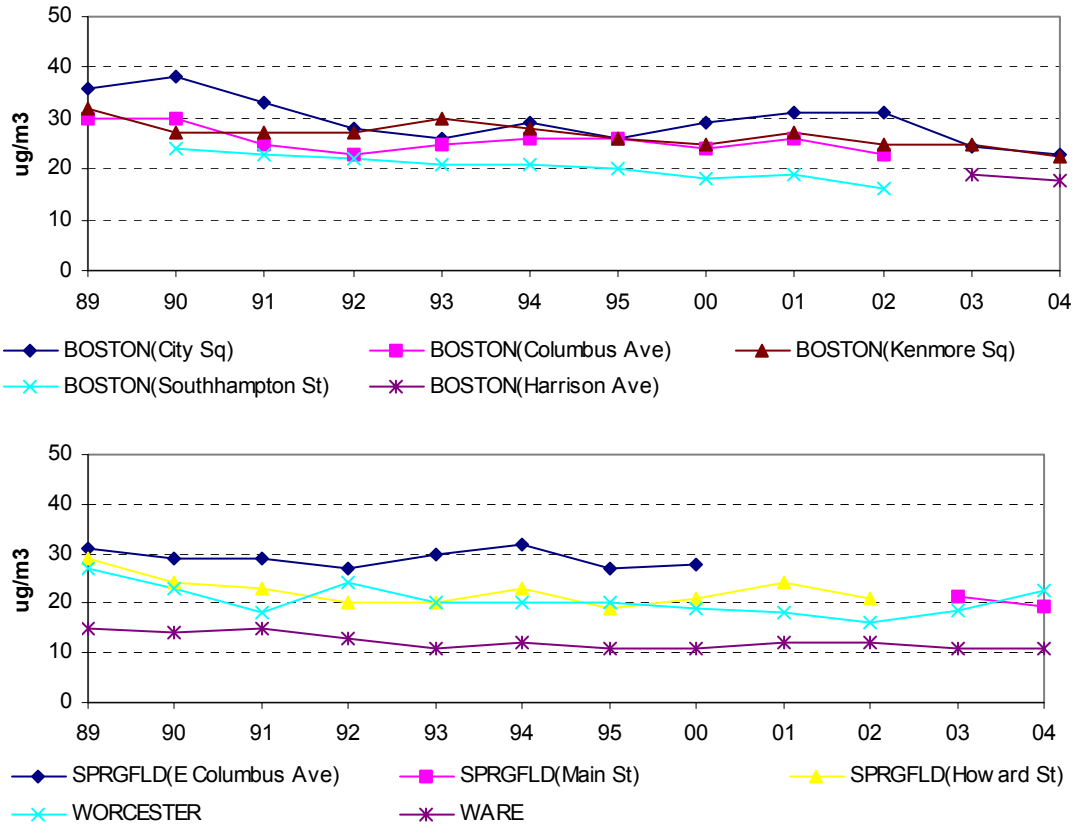
ABBREVIATIONS AND SYMBOLS USED IN TABLE
SITE ID = AIRS SITE IDENTIFICATION NUMBER **% OBS** = DATA CAPTURE PERCENTAGE **24-HR MAX 1ST, 2ND, 3RD, 4TH** = 1ST, 2ND, 3RD, AND 4TH HIGHEST 24-HOUR VALUES FOR THE YEAR **DAY MAX > 150** = DAILY MAXIMUM VALUE GREATER THAN STANDARD OF 150 $\mu g/m^3$ **WTD ARITH MEAN** = WEIGHTED ANNUAL ARITHMETIC MEAN (STANDARD = 50 $\mu g/m^3$)



PM_{10} Trends

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

Figure 8
PM_{10} Trends 1989-2004
Annual Arithmetic Mean
Standard = 50 ug/m3



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

2004 $PM_{2.5}$ Operations

The MADEP $PM_{2.5}$ sampling network has been operating since January 1999. In December 2004, USEPA designated the entire State of Massachusetts as "Attainment/Unclassifiable" on the basis of measured $PM_{2.5}$ concentrations, despite difficulties MADEP had in meeting the minimum data capture requirements set by USEPA. In 2004, MADEP significantly improved its $PM_{2.5}$ data capture through equipment purchases, increased back up of sampling equipment, and a more rigorous preventative maintenance program. In 2004, all 15 $PM_{2.5}$ FRM sites achieved greater than the required 75% minimum data capture for the year. An ambitious program of sampler replacement is planned for 2005 to solidify the 2004 improvements.

Semi-Continuous $PM_{2.5}$ Measurement

MADEP began deployment of a Semi-Continuous $PM_{2.5}$ monitoring network in Fall 2001. This emerging network of sites employs Beta Attenuation Monitoring (BAM) technology to conduct hourly measurements of $PM_{2.5}$ particulate concentrations. The method is referred to as semi-continuous because one measurement is generated every hour, in contrast to hourly averages of second-to-second measurements generated by truly continuous gaseous pollutant monitors.

In contrast to the Federal Reference Method (FRM) for measuring $PM_{2.5}$, where only one 24-hour value is generated for each sampling day and data is not immediately available because of the time required for collection, transport and weighing of individual filters, semi-continuous $PM_{2.5}$ measurement technology offers immediately available hourly concentration values. This type of data is preferable for tracking $PM_{2.5}$ events as they occur and for monitoring particulate concentrations on dates that are not covered by the USEPA's once-every-third-day sampling schedule. The current technical challenge is to demonstrate that data generated by semi-continuous instrumentation is indisputably comparable to data generated by the FRM method, which will enable USEPA to replace FRM 24-hour filter-based samplers with hourly semi-continuous monitors for measuring $PM_{2.5}$.

In October 2003, USEPA made available a new, online $PM_{2.5}$ concentration gradient map at www.epa.gov/airnow/ that incorporates the seven Massachusetts $PM_{2.5}$ BAM sites. Massachusetts added a seventh site in Haverhill during the Summer of 2004, bolstering the site network that also includes $PM_{2.5}$ BAM sites in Springfield, Milton, Fall River, Roxbury, Worcester and North Street in Boston. Several new sites also are planned for 2005.

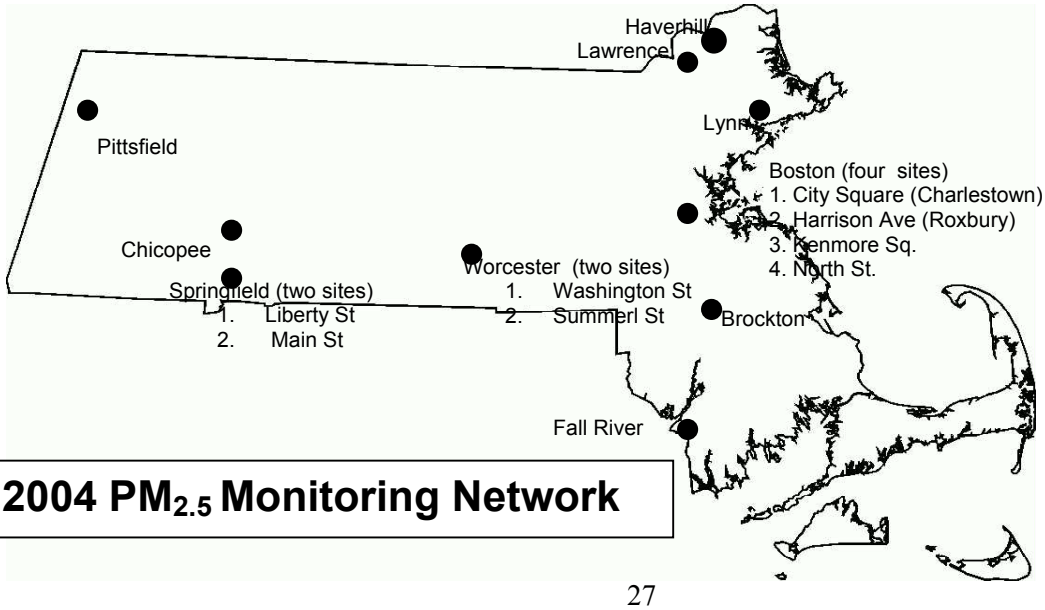
2004 $PM_{2.5}$ Data Summary

A summary of the 2004 $PM_{2.5}$ data is shown below.

SITE ID	CITY	COUNTY	ADDRESS	YEAR	TYPE	% OBS	1ST MAX	2ND MAX	3RD MAX	4TH MAX	98TH PERCENTILE VALUE	WTD ARITH MEAN
25-025-0002	Boston	Suffolk	KENMORE SQUARE		FRM	98	44.1	33.7	30	28.5	30	13.35
25-025-0027	Boston	Suffolk	ONE CITY SQUARE		FRM	92	41.8	36.4	32.1	31	29.8	12.55*
25-025-0027	Boston	Suffolk	ONE CITY SQUARE		FRM Co-loc	79	42.9	32.6	30	29.2	32.6	13.90*
25-025-0042	Boston	Suffolk	HARRISON AVENUE		FRM	92	40.2	30.6	30	29.9	28.3	11.38*
25-025-0042	Boston	Suffolk	HARRISON AVENUE		BAM	94	51.5	40.1	38.7	38.7	35.3	13.98*
25-025-0043	Boston	Suffolk	174 NORTH STREET		FRM	98	46.4	30.4	29.6	29.3	29.6	14.37
25-025-0043	Boston	Suffolk	174 NORTH STREET		BAM	98	51.2	39	37.4	36.7	34	13.73
25-023-0004	Brockton	Plymouth	120 COMMERCIAL		FRM	98	35	32.3	24.7	24.5	24.7	10.14
25-023-0004	Brockton	Plymouth	120 COMMERCIAL		FRM Co-loc	79	33	30.2	24.8	24.2	24.8	9.96*
25-013-0008	Chicopee	Hampden	ANDERSON ROAD		FRM	84	44.7	33.7	27.3	26.5	24.8	9.53
25-005-1004	Fall River	Bristol	GLOBE STREET		FRM	96	38.2	32.4	26.3	24.7	26.3	10.25
25-005-1004	Fall River	Bristol	GLOBE STREET		BAM	98	48.1	43.4	38.4	38.1	35.9	11.67
25-009-5005	Haverhill	Essex	WASHINGTON ST		FRM	96	41.2	27	27	22.7	27	9.52
25-009-5005	Haverhill	Essex	WASHINGTON ST		BAM	98	45.4	33	31.1	28.4	28.4	9.39*
25-009-6001	Lawrence	Essex	WALL EXPERIMENT STA		FRM	85	41.8	28.9	27.2	26.4	27.2	10.48*
25-009-2006	Lynn	Essex	390 PARKLAND		FRM	98	39.7	25.8	25.5	24.2	25.5	9
25-021-3003	Milton	Norfolk	MILTON MA		BAM	56	32.6	31.8	23.8	23.7	23.7	7.00*
25-003-5001	Pittsfield	Berkshire	78 CENTER STREET		FRM	93	39	30.3	29.8	28.7	29.8	10.54
25-013-0016	Springfield	Hampden	LIBERTY STREET		FRM	98	43.9	37.1	35.6	35.3	32	11.98
25-013-0016	Springfield	Hampden	LIBERTY STREET		FRM Co-loc	98	43.5	33.9	31	30.6	31	12.15
25-013-0016	Springfield	Hampden	LIBERTY STREET		BAM	98	65.1	49.3	42.1	41.4	34.3	12.87
25-013-2009	Springfield	Hampden	1860 MAIN STREET		FRM	93	42.7	33.1	31.4	27.7	31.4	11.28
25-027-0016	Worcester	Worcester	2 WASHINGTON		FRM	95	39.9	34.1	31.1	28.8	31.1	10.21
25-027-0023	Worcester	Worcester	SUMMER ST		FRM	83	36.2	33.5	32	31.2	30.9	11.39*
25-027-0023	Worcester	Worcester	SUMMER ST		BAM	74	46.5	35.2	33.6	33	30.3	11.68*

* INDICATES THAT THE MEAN DOES NOT SATISFY SUMMARY CRITERIA (NUMBER OF OBSERVATIONS FOR AT LEAST 1 QUARTER WAS LESS THAN 75%) (Currently BAM data has no standard.)
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 **TYPE** = TYPE OF INSTRUMENT - **FRM** = FEDERAL REFERENCE METHOD; **FRM COLOC** = FED. REF. METH. COLOCATED; **BAM** = BETA ATENUATION MONITOR **MAX 1ST, 2ND, 3RD, 4TH** = 1ST, 2ND, 3RD, AND 4TH HIGHEST 24-HOUR VALUES FOR THE YEAR **WTD ARITH MEAN** = WEIGHTED ANNUAL ARITHMETIC MEAN (STANDARD = 15.0 $\mu g/m^3$)



2004 $PM_{2.5}$ Monitoring Network

Speciation

MADEP has been collecting $PM_{2.5}$ samples for speciation at the air monitoring station in Roxbury since 2000 and in Chicopee since 2001. Speciation is the analysis of particulate matter collected on quartz filters to determine the chemical composition of the particulate matter collected. The results are used to determine the levels of specific toxic air pollutants present in the atmosphere, and to provide clues about the nature and identity of air pollution sources that impact the monitoring station area. During each sampling event, three separate filters made 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 (e.g., metals), sulfates, nitrates, and carbon (total and organic). Sampling equipment at both Roxbury and Chicopee was updated in 2004.

IMPROVE (Interagency Monitoring of Protected Visual Environments)

Massachusetts currently has two IMPROVE monitors at the Ware and Truro sites. The Wampanoag Indian Tribe operates a third IMPROVE sampler at their Martha's Vineyard site. These samplers acquire $PM_{2.5}$ 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 visibility over long distances (e.g., mountain ranges or scenic vistas). Data can be viewed at the IMPROVE web site at http://vista.cira.colostate.edu/improve/Data/data.htm.

Lead (Pb) Summary

2004 Pb Data Summary

MADEP operates a total suspended particulates (TSP) sampler at only one site to measure airborne lead levels. The concentrations monitored are low. Since 1975, the use of unleaded gasoline has greatly diminished lead emissions from automobiles, which in the past were the primary source of airborne lead in the atmosphere. A summary of the 2004 Pb data is shown below.

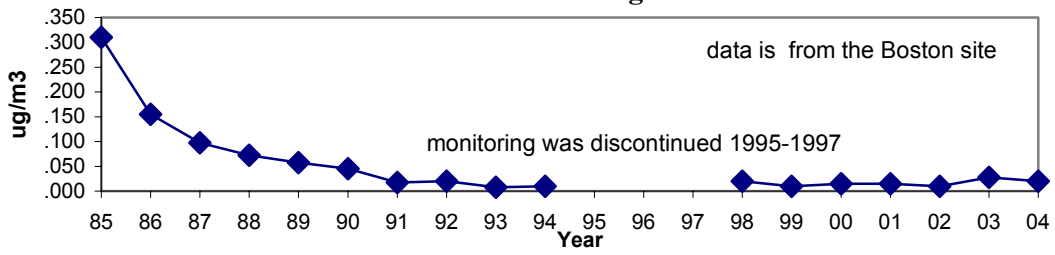
SITE ID	CITY	COUNTY	ADDRESS	# OBS	QTR1 ARITH MEAN	QTR2 ARITH MEAN	QTR3 ARITH MEAN	QTR4 ARITH MEAN	# MEANS > 1.5	1ST MAX	2ND MAX
25-025-0002	Boston	Suffolk	KENMORE SQUARE	51	0.02	.02*	.02	.02	0	0.03	0.03

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

Standard: 1.5 μg/m³ (Calendar Quarter Arithmetic Mean)

ABBREVIATIONS AND SYMBOLS USED IN TABLE
SITE ID = AIRS SITE IDENTIFICATION # **OBS** = # OBSERVATIONS **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 μg/m³) **MAX 1ST, 2ND** = THE 1ST AND 2ND MAXIMUM 24 HOUR VALUES

Figure 9
Lead Concentrations 1985-2004
Annual Arithmetic Mean
Standard = 1.5ug/m3



Industrial Network Summary

Introduction

The industrial ambient air quality network is comprised of monitoring stations operated by facilities that have the potential to emit large amounts of pollutants. An example would be a fossil fuel powered plant that has the potential to emit large quantities of 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. AAB submits the data to the USEPA AQS database after completing the quality assurance process.

Continuous Emission Monitoring System (CEMS)

In addition to the ambient monitoring network, in-stack Continuous Emission Monitoring System (CEMS) equipment 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 measurement of SO_2, NO_x and CO_2 emissions from the nation's largest power generating facilities. The information on emissions collected by CEMS monitors can be found on USEPA's web site at www.epa.gov/airmarkets/arp/.

Sulfur Dioxide (SO_2) summary

There were four SO_2 sites in operation during 2004 in the industrial network. All of the sites achieved the requirement of 80% or greater data capture for the year. There were no measured violations of the SO_2 air quality standards during the year in the reported data. A summary of the 2004 SO_2 data is shown below.

SITE ID	CITY	COUNTY	ADDRESS	YEAR	% OBS	1ST MAX 24-HR	2ND MAX 24-HR	#OBS >0.14	1ST MAX 3-HR	2ND MAX 3-HR	#OBS >0.5	1ST MAX 1-HR	2ND MAX 1-HR	ARITH MEAN
25-025-0019	Boston	Suffolk	LONG ISLAND		99	0.015	0.014	0	0.021	0.020	0	0.026	0.025	0.004
25-025-0020	Boston	Suffolk	DEWAR STREET		100	0.017	0.014	0	0.025	0.025	0	0.030	0.030	0.004
25-025-0021	Boston	Suffolk	340 BREMAN STREET		99	0.018	0.017	0	0.029	0.029	0	0.037	0.032	0.005
25-025-0040	Boston	Suffolk	531A EAST FIRST ST		100	0.041	0.019	0	0.124	0.102	0	0.162	0.126	0.006

ABBREVIATIONS AND SYMBOLS USED IN TABLE
SITE ID = AIRS SITE IDENTIFICATION NUMBER **%OBS** = DATA CAPTURE PERCENTAGE **MAX 24-HR, MAX 3-HR, MAX 1-HR 1ST, 2ND** = FIRST AND SECOND HIGHEST 24-HOUR, 3-HOUR, AND 1-HOUR VALUES FOR TIME PERIOD INDICATED # **OBS** > 0.14 = NUMBER OF OBSERVATIONS ABOVE THE 24-HOUR STANDARD OF 0.14 PPM # **OBS** > 0.5 = NUMBER OF OBSERVATIONS ABOVE THE 3-HOUR STANDARD OF 0.5 PPM **ARIT MEAN** = ARITHMETIC MEAN (STANDARD = 0.03 PPM)

Nitrogen Dioxide (NO_2) summary

There was one NO_2 site that operated during 2004 in the industrial network. The site was owned by Exelon Energy in Boston (East First St.) but was operated by ENSR International. It met the requirement of 80% or greater data capture. There were no reported violations of the NO_2 air quality standard during the year.

A summary of the 2004 NO_2 data is shown below.

SITE ID	CITY	COUNTY	ADDRESS	% OBS	1ST MAX 1-HR	2ND MAX 1-HR	ARITH MEAN
25-025-0040	Boston	Suffolk	531A EAST FIRST	97	0.096	0.081	0.016

PRIMARY STANDARD: ANNUAL ARITHMETIC MEAN = 0.053 PPM

ABBREVIATIONS AND SYMBOLS USED IN TABLE
SITE ID = AIRS SITE IDENTIFICATION NUMBER **%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 that operated during 2004 in the industrial network. The sites were owned by Exelon Energy in Boston but were operated by ENSR International. All of the sites met the requirement of 80% or greater data capture.

TSP is no longer 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 2004 TSP data is shown below.

SITE ID	TYPE	CITY	COUNTY	ADDRESS	# OBS	1ST MAX	2ND MAX	3RD MAX	4TH MAX	ARITH MEAN	GEO. MEAN	GEO. STD
25-025-0019	NC	Boston	Suffolk	LONG ISLAND	58	217	83	54	47	27.8	23.6	1.6
25-025-0020	NC	Boston	Suffolk	DEWAR STREET	61	480	460	306	245	114.6	90.7	1.9
25-025-0021	NC Co-loc	Boston	Suffolk	340 BREMAN STREET	57	145	119	119	102	59.4	53.2	1.6
25-025-0040	NC	Boston	Suffolk	531A EAST FIRST STREET	58	130	94	94	82	43.6	39.4	1.6
25-025-0040	NC Co-loc	Boston	Suffolk	531A EAST FIRST STREET	59	123	100	99	96	45	40.8	1.6

ABBREVIATIONS AND SYMBOLS USED IN TABLE
SITE ID = AIRS SITE IDENTIFICATION NUMBER **TYPE =** TYPE OF INSTRUMENT – **NC** = NON CONTINUOUS, **NC COLOC -** NON CONTINUOUS COLOCATED. **% OBS** = DATA CAPTURE PERCENTAGE **MAX 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 that operated during 2004 in the industrial network. The sites were owned by Exelon Energy in Boston but were operated by ENSR International. All of the sites met the requirement of 80% or greater data capture.

SO_4 is not a criteria pollutant so there are no ambient air quality standard for SO_4. A summary of the 2004 SO_4 data is shown below.

SITE ID	TYPE	CITY	COUNTY	ADDRESS	# OBS	1ST MAX	2ND MAX	3RD MAX	4TH MAX	ARITH MEAN
25-025-0019	NC	Boston	Suffolk	LONG ISLAND	58	13	13	13	10	5.97
25-025-0020	NC	Boston	Suffolk	DEWAR STREET	61	13	12	11	11	6.57
25-025-0021	NC Co-loc	Boston	Suffolk	340 BREMAN STREET	57	16	15	14	14	8.18
25-025-0040	NC	Boston	Suffolk	531A EAST FIRST STREET	59	16	14	13	12	7.27
25-025-0040	NC Co-loc	Boston	Suffolk	531A EAST FIRST STREET	59	15	14	14	12	7.58

ABBREVIATIONS AND SYMBOLS USED IN TABLE
SITE ID = AIRS SITE IDENTIFICATION NUMBER **TYPE** = TYPE OF INSTRUMENT – **NC** = NON CONTINUOUS, **NC COLOC** = NON CONTINUOUS COLOCATED **% OBS** = DATA CAPTURE PERCENTAGE **MAX VALUE 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 ambient air quality data is of high quality, MADEP has developed standard operating procedures (SOPs) that 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 (i.e., collection) of 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. Documentation of all activities and site information further augment accurate data collection.

Data Quality Review

MADEP AAB has a data group that reviews data. This group checks all precision and accuracy activities as well as raw data, quality assurance checks, and documentation. The group uses report software for data validation. The data group edits the data as required and transfers it to the USEPA AQS database where it undergoes further scrutiny before being moved into the permanent 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.

QC and QA performance checks allow the precision and accuracy of ambient air monitors to be quantified. This is accomplished by testing the monitor's response to known inputs in order to assess the measurement error. 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%.

2004 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 2004 precision and accuracy data is shown below.

							PRECISION DATA				ACCURACY DATA						
PRECISION AND ACCURACY DATA KEY							# OF	# PREC	PROB	LIM	# AUDITS	PROB	LIM	PROB	LIM	PROB	LIM
RG	ST	RO	TYP	CLASS	POLL	YEAR-Q	ANLYZRS	CHECKS	LO	UP	L1-3	LO-L1	-UP	LO-L2	-UP	LO-L3	-UP
01	25	001	C	A	CO	2004	5	122	-5.4	5.0	18	-9.3	-1.7	-10.8	-5.8	-10.2	-4.5
CARBON MONOXIDE						2004-1	5	29	-3.9	2.1	3						
						2004-2	5	32	-6.0	7.4	3	-5.0	-1.5	-8.0	-6.7	-7.5	-6.5
						2004-3	5	32	-3.1	2.2	6	-7.7	-4.1	-10.1	-7.3	-8.0	-5.2
						2004-4	5	29	-5.0	4.5	6	-9.1	-5.4	-13.1	-4.5	-13.2	-4.0
01	25	001	C	A	SO2	2004	6	151	-9.9	4.0	15	-8.6	7.0	-10.5	3.6	-8.6	5.0
SULFUR DIOXIDE						2004-1	6	37	-13.4	6.4							
						2004-2	6	38	-5.3	2.8	6	-9.0	6.2	-12.7	2.9	-10.2	3.7
						2004-3	6	39	-6.3	1.0	3						
						2004-4	6	37	-10.7	1.6	6	-10.0	9.1	-10.0	5.0	-8.1	6.6
01	25	001	C	A	NO2	2004	12	247	-9.1	6.2	3						
NITROGEN DIOXIDE						2004-1	7	46	-12.6	8.9							
						2004-2	12	74	-6.5	5.9							
						2004-3	12	78	-7.5	4.3							
						2004-4	8	49	-9.4	4.6	3						
01	25	001	C	A	O3	2004	14	226	-6.2	4.4	33	-1.5	14.1	.6	11.9	.3	10.9
OZONE						2004-1	4	25	-6.5	4.4	9	2.8	8.8	3.8	7.2	2.9	6.9
						2004-2	14	85	-5.2	3.9	9	2.7	7.9	4.0	6.3	2.6	6.9
						2004-3	14	89	-5.2	3.2	15	-4.4	18.8	-.9	15.6	-1.1	14.1
						2004-4	4	27	-7.8	4.9							

PRECISION AND ACCURACY DATA KEY							# OF	COLLOC	PROB	LIM	# AUDITS		PROB LIM			
RG	ST	RO	TYP	CLASS	POLL	YEAR-Q	SAMP	SITES	LO	UP	L1-L3	L4	LO-L2	UP		
01	25	001	I	F	PM2.5	2004	308	3	11.5	13.4	72	0	-0.7	0.0		
PM2.5 LOCAL CONDITIONS						2004-1	69	3	13.4	18.3	18	0	-0.9	0.5		
						2004-2	76	3	8.0	11.1	18	0	-1.4	0.0		
						2004-3	88	3	11.5	15.1	18	0	-1.5	-0.3		
						2004-4	75	3	9.4	12.6	18	0	-0.4	1.1		
01	25	001	I	F	PM10	2004	53	2	-13.3	15.7	22	0	-3.2	3.0		
PM10 TOTAL 0-10UM						2004-1	25	2	-9.7	17.5	5	0	-3.6	2.5		
						2004-2	12	1	-5.5	2.3	7	0	-3.8	3.5		
						2004-3	5	1	3.3	3.3	6	0	-3.7	3.6		
						2004-4	11	2	-21.0	15.2	4	0	-1.9	2.6		

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 **COLLOC SITES** = NUMBER OF COLLOCATED SITES **# AUD** = NUMBER OF AUDITS

Section IV
PAMS/Air Toxics Monitoring

PAMS Monitoring

Introduction

Unlike other pollutants, ground-level ozone is unique because it is a secondary pollutant and is not discharged directly to the atmosphere from a stack or flue, but rather forms in the atmosphere from the photochemical reactions of other pollutants such as volatile organic compounds (VOCs) and NOx. Ozone formation can occur many miles down wind from the original emissions source of the other pollutants. These reactions only occur in the presence of strong sunlight, which is present during the hottest days of 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 that occurs between years and for identifying appropriate pollution control strategies.

PAMS (Photochemical Assessment Monitoring Stations) is a special designation for enhanced monitoring stations that measure pollutants and meteorological parameters that are designed to gather information on the ozone formation process. In addition to the standard NAAQS pollutants (Ozone, NO_2) that are measured at other sites, non-criteria pollutants, including VOCs, are measured at PAMS stations on either an hourly basis or at regularly scheduled intervals throughout the ozone monitoring 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, USEPA has required Massachusetts to conduct 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 down wind of Providence, RI. The PAMS monitoring network was phased in during the 1990's. Competition for attention and resources from newer monitoring initiatives (including $PM_{2.5}$) has halted the expansion of the program and led to a consolidation of the network over the last several years. Looking toward the future, a holistic strategy that includes PAMs measurements at fewer but more enhanced air monitoring stations is being developed by USEPA

During the 2004 ozone season, VOC sampling with canisters was conducted at the Long Island (Boston) site. Long Island was originally designated in 1998 to be a Boston Area PAMs site but was not deployed until 2004 due to resource constraints.

Coverage of PAMS Monitoring Sites

Boston	Springfield	Providence
*Blue Hill (Milton)	Chicopee	*Blue Hill (Milton)
Lynn	Ware	**Truro
Newbury		
Long Island		

* Provides data for both Boston and Providence networks.
** Designated PAMs site. No VOCs currently sampled.

Air Toxics Monitoring

Introduction

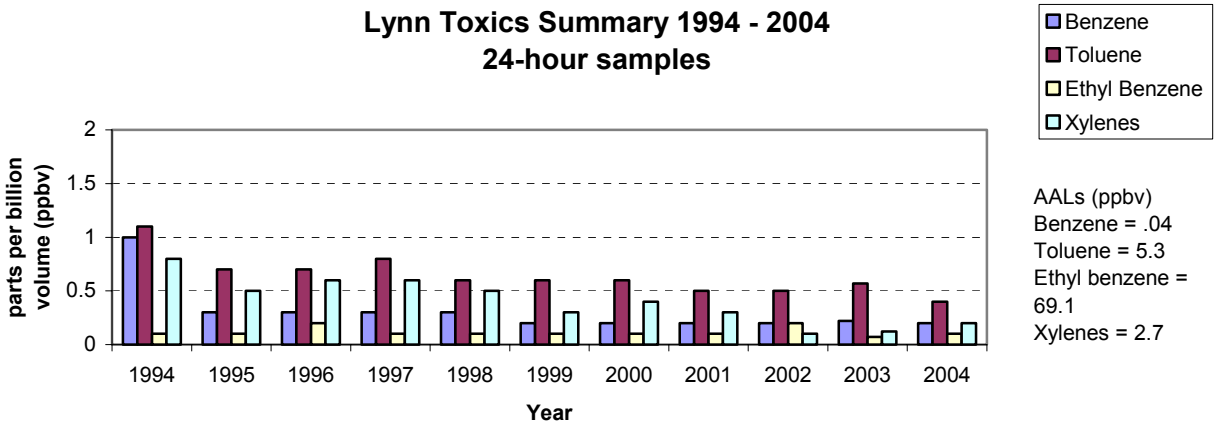
Toxic air pollutants are distinct from criteria air pollutants such as ozone and CO. They include pollutants known or suspected to cause cancer or other serious health effects, and include volatile organic compounds (VOCs) and toxic metals (e.g., mercury).

MADEP monitors VOCs as part of the PAMS monitoring program, many of which are air toxics. From June through August, VOCs are monitored at six PAMS sites. In addition, in 1999 MADEP added two monitors to measure specific health-relevant VOCs.

A new toxics monitoring project was started at the Harrison Avenue monitoring site in Roxbury in 2003 and has been designated as a National Air Toxics Trends Station (NATTS) designed to collect and quantify a number of toxic air pollutants including VOCs, metals, aldehydes and black carbon. Data from this site will be compared with data from a network of similar sites positioned across the country to identify transport, trends and site-specific characteristics of these pollutants. VOCs and black carbon have been collected at this site since 1999.

Figure 10 summarizes concentrations of 24-hour health-relevant PAMS target compounds for samples taken at the Lynn PAMS site from 1994 to 2004. Significant mean concentration decreases 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 MADEP based on 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



Below is a table that summarizes results from the analysis of 24-hour samples for selected target VOCs from the two sites for 2004. The central city sampling location is Harrison Avenue and the area background site was Lynn.

Compound	BOSTON (Harrison Ave)		LYNN	
	Max Value ppb	Mean ppb	Max Value ppb	Mean ppb
1,3-butadiene	.20	.04	.07	.00
1,1,1-trichloroethane	.05	.02	.05	.02
trichloroethylene	.05	.02	.05	.02
tetrachloroethylene	.30	.50	.20	.04
Benzene	.86	.28	.43	.15
Toluene	2.67	.76	9.70	.47
Xylenes	1.38	.42	1.88	.19
Ethylbenzene	.35	.10	1.32	.06

Mercury Deposition Sampling

MADEP continued to collect precipitation samples for mercury analysis at two locations in Massachusetts (Ware and North Andover) in 2004. This data collection supports a MADEP study on the mechanism of wet mercury deposition. Data analysis is currently ongoing and will be available in 2006.

Appendix A
2004 Monitoring Station Locations

SITE ID	CITY	COUNTY	ADDRESS	DATE SITE ESTABLISHED	LATITUDE	LONGITUDE
25-001-0002	ADAMS	BERKSHIRE	MT. GREYLOCK	5/1/1989	+42:38:12	-73:10:07
25-003-4002	AMHERST	HAMPSHIRE	NORTH PLEASANT	4/1/1988	+42:24:01	-72:31:25
25-025-0002	BOSTON	SUFFOLK	KENMORE SQUARE	1/1/1965	+42:20:54	-71:05:57
25-025-0027	BOSTON	SUFFOLK	ONE CITY SQUARE	1/1/1985	+42:22:22	-71:03:49
25-025-0041	BOSTON	SUFFOLK	LONG ISLAND	12/1/1998	+42:19:03	-70:58:12
25-025-0042	BOSTON	SUFFOLK	HARRISON AVENUE	12/15/1998	+42:19:46	-71:04:58
25-025-0043	BOSTON	SUFFOLK	174 NORTH STREET	1/1/2000	+42:21:46	-71:04:58
25-023-0004	BROCKTON	PLYMOUTH	120 COMMERCIAL ST	12/15/1998	+42:07:97	-71:01:52
25-013-0008	CHICOPEE	HAMPDEN	ANDERSON ROAD	1/1/1983	+42:11:39	-72:33:22
25-013-0008	FAIRHAVEN	BRISTOL	LEROY WOOD	1/1/1982	+41:38:07	-70:52:53
25-005-1004	FALL RIVER	BRISTOL	GLOBE STREET	2/1/1975	+41:41:07	-71:09:59
25-009-5005	HAVERHILL	ESSEX	WASHINGTON STREET	7/19/1994	+42:45:46	-71:06:21
25-009-6001	LAWRENCE	ESSEX	WALL EXPERIMENT STA	4/3/1999	+42:41:55	-71:09:57
25-017-0007	LOWELL	MIDDLESEX	OLD CITY HALL	7/17/1981	+42:38:42	-71:18:42
25-009-2006	LYNN	ESSEX	390 PARKLAND	1/1/1992	+42:28:28	-70:58:21
25-021-3003	MILTON	NORFOLK	BLUE HILL	4/2/2002	+42:21:22	-71:11:47
25-009-4004	NEWBURY	ESSEX	SUNSET BOULEVARD	8/1/1984	+42:47:22	-70:48:33
25-003-5001	PITTSFIELD	BERKSHIRE	78 CENTER STREET	12/1/1998	+42:27:06	-73:15:18
25-013-0016	SPRINGFIELD	HAMPDEN	LIBERTY STREET	4/1/1988	+42:06:32	-72:35:29
25-013-2009	SPRINGFIELD	HAMPDEN	1860 MAIN STREET	1/1/2002	+42:10:74	-72:59:74
25-021-3003	STOW	MIDDLESEX	US MILITARY	4/1/1998	+42:24:49	-71:29:09
25-001-0002	TRURO	BARNSTABLE	FOX BOTTOM AREA	4/1/1987	+41:58:33	-70:01:29
25-017-4003	WALTHAM	MIDDLESEX	BEAVER STREET	1/1/1971	+42:23:01	-71:12:50
25-015-4002	WARE	HAMPSHIRE	QUABBIN SUMMIT	6/1/1985	+42:17:54	-72:20:05
25-027-0015	WORCESTER	WORCESTER	WORC. AIRPORT	5/7/1979	+42:11:27	-71:52:34
25-027-0016	WORCESTER	WORCESTER	2 WASHINGTON STREET	12/31/2002	+42:15:33	-71:47:57
25-027-0023	WORCESTER	WORCESTER	SUMMER STREET	1/1/2004	+42:26:58	-71:79:48

2004 Industrial Monitoring Station Locations

SITE ID	CITY	COUNTY	ADDRESS	DATE SITE ESTABLISHED	LATITUDE	LONGITUDE
25-025-0019	BOSTON	SUFFOLK	LONG ISLAND	1/1/1978	+42:19:00	-70:58:15
25-025-0020	BOSTON	SUFFOLK	DEWAR STREET	1/1/1978	+42:18:34	-71:03:22
25-025-0021	BOSTON	SUFFOLK	BREMEN STREET	1/1/1979	+42:22:41	-71:01:42
25-025-0040	BOSTON	SUFFOLK	531A EAST FIRST ST	1/1/1993	+42:20:46	-71:02:28

Appendix B
Air Quality Web Sites

Below is a listing of 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 (May 1 through September 30).
www.mass.gov/dep/bwp/daqc/daqchome.htm	MADEP	MADEP Air Program Planning Unit Home Page.
www.mass.gov/dep/bwp/dhm/tura/turhome.htm	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/aqimaps.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/ne/aqi/index.html	USEPA	AQI New England Forecast and Real Time Ozone.
www.epa.gov/ne/airquality/index.html	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/bioindicators/	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.

Appendix B (continued)

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)
http://es.epa.gov/	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.
www.wampanoagtribe.net/Pages/index	Wampanoag Tribe	Air monitoring information is listed under Natural Resources.
Maine www.state.me.us/dep/air/ New Hampshire www.des.state.nh.us/airdata/air_quality_forecast.asp New York www.dec.state.ny.us/apps/aqi/aqi_forecast.cfm New Jersey www.state.nj.us/dep/airmon/ Rhode Island www.dem.ri.gov/programs/benviron/air/pm.htm		Ozone predictions and some real-time ozone data from neighboring states (some states report other pollutants, as well).

Appendix B (continued)

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.cleanairworld.org/	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.
www.cirrus.sprl.umich.edu/	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.
http://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.
http://profiler.noaa.gov/npn/profiler.jsp	NPN	NOAA Profiler Network provides hourly vertical wind profile data.
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
http://nh.water.usgs.gov/currentprojects/nawqa/nawaqaweb.htm	NACB	New England Coastal Basins Mercury Deposition Network – Atmospheric deposition