Commonwealth of Massachusetts
2001 Air Quality Report

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

Air Assessment Branch
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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 and Terms

AAB..... Air Assessment Branch
AIRS ..... Aerometric Information Retrieval System
AQI…… Air Quality Index
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
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 Standard
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..... Nitrogen 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 Department of Environmental Protection (MADEP) collects ambient air quality data from sites throughout Massachusetts. During 2001, 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 six stations located at industries in 3 municipalities.

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 (PM_{10})
- particulate matter 2.5 microns ($PM_{2.5}$)

Program Overview, (continued)

What is monitored? (continued)

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

- nitrogen 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 (Measured as part of the Photochemical Assessment Monitoring Stations (PAMS) program.)
- black carbon

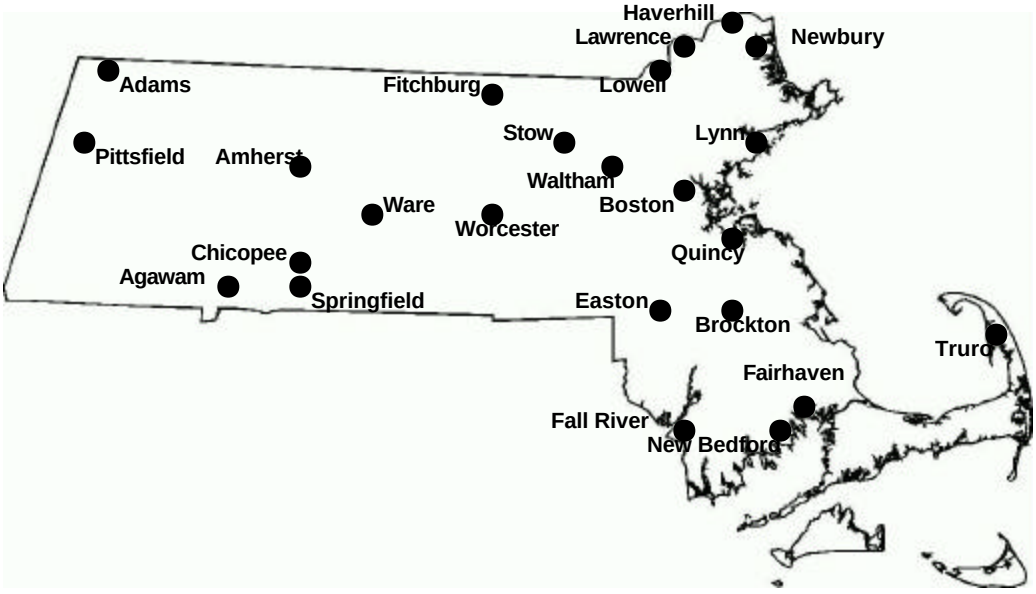
Meteorological parameters monitored are:

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

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 which 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.

Each pollutant has a network of monitors 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 2001.



Program Overview, (continued)

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. Maps showing the cities and towns covered by each regional office are on the following pages.

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 Douglas Fine: Acting Regional Director
MADEP - NERO (NORTHEAST/MET-BOSTON) 205A Lowell Street Wilmington, MA 01887 (978) 661-7600 William Gaughan: Regional Director	**MADEP - SERO (SOUTHEAST)** 20 Riverside Drive Lakeville, MA 02347 (508) 946-2700 Paul Taurasi: Regional Director
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Information about MADEP's various programs and this report are available on the internet from MADEP's web site (mass.gov/dep/). The USEPA maintains a web site (www.epa.gov/air/data/), which 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 2.5 microns in size	Annual Arithmetic Mean	15.0 ug/m³	Same as Primary Standard
	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 98th percentile value is less than or equal to 65 ug/m³ (3-year average).			
PM_{10} Particulates up to 10 microns in size	Annual Arithmetic Mean	50 ug/m³	Same as Primary Standard
	24-Hour	150 ug/m³	Same as Primary Standard
• The PM_{10} standard is based upon estimated exceedance calculations described in 40CFR 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.			

m**g/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.

Pollutant Health Effects and Sources, (continued)

Particulate Matter (PM10 and PM2.5)

- Particulate matter is tiny airborne particles or aerosols, which include dust, dirt, soot, smoke, and liquid droplets.
- 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.
- 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

2001 Public Monitoring Network

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

Network size

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

Number of continuous monitors

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

- Criteria pollutant monitors – these are pollutants for which National Ambient Air Quality Standards (NAAQS) have been set.
  - 9 – CO (carbon monoxide)
  - 13 – 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)
  - 13 – 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.

- Other Monitors
  - 3 – NO_y (Total Reactive Oxidized Nitrogen)
  - 4 - PAMS (Photochemical Assessment Monitoring Station). These monitors measure VOCs (volatile organic compounds).
  - 1 – $PM_{2.5}$ (particulate matter – 2.5 microns)
  - 1- Black Carbon
  - 1- Teom/Camms (particulate matter – 2.5 microns)
  - 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.

Public and Industrial Network Descriptions, (continued)

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 – these pollutants have National Ambient Air Quality Standards (NAAQS).
  - 1 – Pb (Lead)
  - 7 - PM_{10} – (particulate matter – 10 microns)
  - 27 – $PM_{2.5}$ – (particulate matter – 2.5 microns)
- Non-criteria pollutant monitors – these pollutants do not have NAAQS.
  - 8 - 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.
  - 1 – Speciation. This monitors for $PM_{2.5}$, nitrates, and organics.

2001 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

- 6 monitoring stations
- 3 cities and towns with monitoring stations

Number of continuous monitors

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

- Criteria pollutant monitors – these pollutants 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.
  - 6 – SO_2 (sulfur dioxide)
- Meteorological monitors
  - 6 – 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
National Ambient Air Quality Standards Attainment Status

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 redesignate the cities of Lowell, Springfield, Waltham, and Worcester to attainment for CO as the CO monitoring data for those cities had been below the standard for many years. With the redesignation 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, EPA set a new stricter ozone standard of 0.08 ppm averaged over an eight-hour period. Industry groups filed suit against EPA following promulgation of the standard. In February 2001, the U.S. Supreme Court upheld the EPA'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. The EPA has not yet designated ozone nonattainment areas for the new 8-hour standard however, 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 2001, Western Massachusetts was in attainment of the 1-hour standard based on ozone readings for the 1999-2001 period. However, during the same period, Eastern Massachusetts was in violation of the 1-hour standard due to exceedances at the Fairhaven and Truro monitors.

EPA is expected to designate areas attainment status for the new 8-hour ozone standard in 2003. Massachusetts is expected to be nonattainment for the 8-hour standard.

National Ambient Air Quality Standards Attainment Status, (continued)

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 EPA 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 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 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. EPA is not expected to designate areas attainment status under the PM2.5 standard until 2003 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, as explained below.

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 0.12 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 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 has occurred.

O_3 exceedances and violations during 2001

During 2001, there were four exceedance days and ten exceedances of the 1-hour standard. There were 27 exceedance days and 125 exceedances of the 8-hour standard.

Using data from 1999–2001, six out of 15 sites violated the 1-hour standard. The more stringent 8-hour standard was violated at 14 of the 15 sites for the 1999-2001 period.

Ozone formation requires a combination of intense sunlight, hot temperatures, southwesterly winds and chemicals such as VOCs and NOx. These were all present in the summer of 2001.

2001 O_3 Exceedances (ppm)

DATE	SITE	8-HOUR EXC	1-HOUR EXC	START HOUR
May 2, 2001	CHICOPEE	.090		12
	EASTON	.086		10
	FAIRHAVEN	.089		15
	STOW	.086		10
	TRURO	.094		15
	WARE	.089		12
May 3. 2001	ADAMS	.088		12
	CHICOPEE	.090		10
	EASTON	.087		13
	FAIRHAVEN	.095		12
	TRURO	.100		09
	WARE	.087		10
May 4.2001	ADAMS	.093		13
	CHICOPEE	.097		10
	EASTON	.086		12
	FAIRHAVEN	.109		11
	NEWBURY	.086		11
	STOW	.085		11
	TRURO	.113		11
	WARE	.093		10
May 11, 2001	TRURO	.086		15
May 12, 2001	EASTON	.088		09
	TRURO	.097		10
June 13, 2001	AMHERST	.085		10
	CHICOPEE	.086		11
	EASTON	.086		10
	WARE	.088		10
June 14, 2001	ADAMS	.092		19
	CHICOPEE	.085		11
	STOW	.089		11
June 15, 2001	ADAMS	.086		0
	BOSTON(Longls)	.088		9
	LYNN	.086		9
	NEWBURY	.095		10
June 19, 2001	ADAMS	.108		17
	AGAWAM	.091		13
	AMHERST	.102		14
	CHICOPEE	.105		13
	EASTON	.098		12
	BOSTON(Longls)	.107		13
	LYNN	.089		13
	NEWBURY	.099		16
	STOW	.105		14
	TRURO	.088		10
	WARE	.119		13
	WORCESTER	.102		13
June 19. 2001	AMHERST		.138	18
	CHICOPEE		.138	17
	WARE		.148	17
June 20. 2001	ADAMS	.099		0
	AMHERST	.086		9
	CHICOPEE	.098		10
	EASTON	.101		9
	BOSTON(Longls)	.111		8
	LYNN	.111		10
	NEWBURY	.117		9
	STOW	.098		10
	WARE	.116		11
	WORCESTER	.085		8
June 20, 2001	CHICOPEE		.125	16
	NEWBURY		.147	14
	WARE		.132	16
June 27, 2001	ADAMS	.091		19
	TRURO	.089		13
June 28, 2001	ADAMS	.086		0
June 30, 2001	EASTON	.091		9
	BOSTON(Longls)	.085		11
	LYNN	.092		11
	TRURO	.089		11
July 10,2001	FAIRHAVEN	.086		11
July 22, 2001	ADAMS	.092		19
	STOW	.085		11
	WARE	.087		12
July 23, 2001	ADAMS	.092		15
	AGAWAM	.086		12
	CHICOPEE	.090		12
	EASTON	.087		10
	BOSTON(Longls)	.089		11
	LYNN	.100		12
	NEWBURY	.089		11
	STOW	.101		12
	WARE	.099		12
	WORCESTER	.093		13
July 24. 2001	ADAMS	.087		0
	BOSTON(Longls)	.094		11
	LYNN	.101		12
	NEWBURY	.093		12
	STOW	.101		12
	WARE	.087		12
July 25, 2001	TRURO	.091		10
August 2, 2001	EASTON	.107		16
	FAIRHAVEN	.101		11
	BOSTON(Longls)	.100		16
	LYNN	.102		15
	STOW	.090		15
	TRURO	.105		11
	BOSTON(Harrison	.093		16
August 3, 2001	EASTON	.095		10
	BOSTON(Longls)	.091		11
	LYNN	.091		9
	WARE	.087		10
	WORCESTER	.087		11
August 7, 2001	FAIRHAVEN	.117		14
	LYNN	.086		9
	TRURO	.124		16
August 7, 2001	FAIRHAVEN		.142	16
	TRURO		.139	17
August 8, 2001	EASTON	.091		10
	FAIRHAVEN	.089		12
August 9, 2001	ADAMS	.088		23
	EASTON	.103		14
	FAIRHAVEN	.113		12
	BOSTON(Longls)	.093		15
	LYNN	.098		16
	NEWBURY	.088		19
	STOW	.097		16
	TRURO	.108		11
	WARE	.090		15
	WORCESTER	.091		14
	BOSTON(Harrison	.085		19
August 9. 2001	FAIRHAVEN		.136	14
	TRURO		.144	16
August 10, 2001	ADAMS	.087		00
August 16, 2001	ADAMS	.085		12
September 7. 2001	ADAMS	.092		16
	EASTON	.089		12
	STOW	.092		13
	TRURO	.087		12
September 8, 2001	ADAMS	.088		03
	CHICOPEE	.086		11
	LYNN	.086		11
	NEWBURY	.088		11
	STOW	.087		11
	WARE	.089		12
	WORCESTER	.087		10

Ozone Exceedances, (continued)

Exceedance days and total exceedance trends

The following figures 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 Figure1 shows a decline in the number of exceedances and exceedance days over the period. The trend in Figure2 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.

1-hr O_3 Exceedance Days & Total Exceedances 1987-2001
Ozone exceeded the 1-hour standard (0.125 ppm)

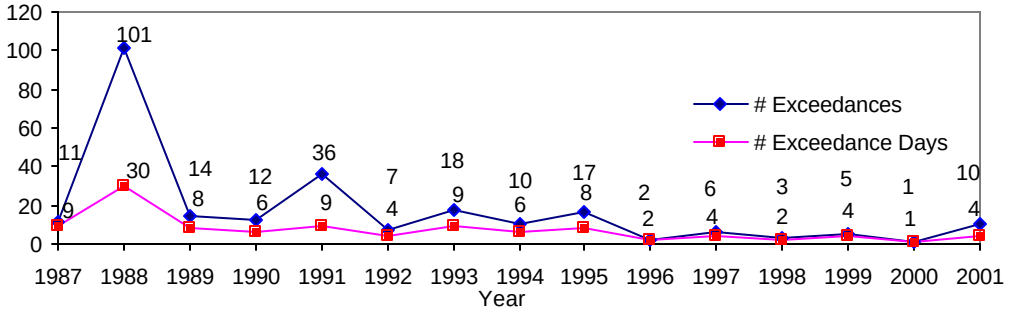


Figure1

8-hr O_3 Exceedance Days & Total Exceedances 1987-2001
Ozone exceeded the 8-hour standard (0.085 ppm)

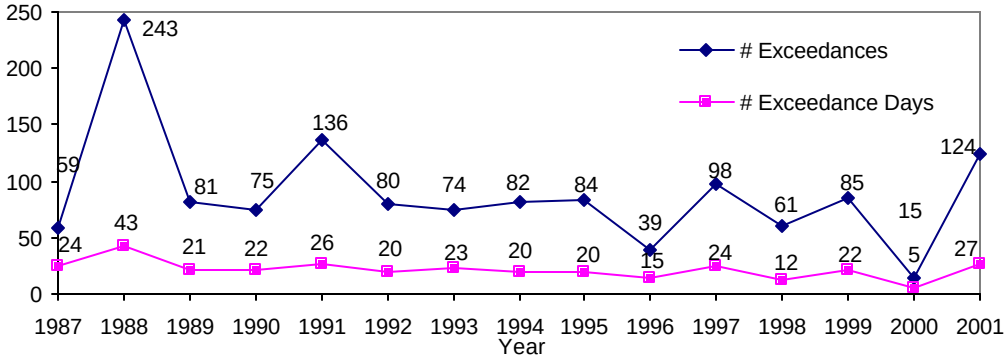


Figure 2

Daily Ozone (O_3) Forecast

Introduction

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.

Determining the air quality level rating

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 air quality ratings

The table below gives information about 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 (mass.gov/dep/) 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/eco/dailyozone/ozone) and (www.epa.gov/airnow/ozone).

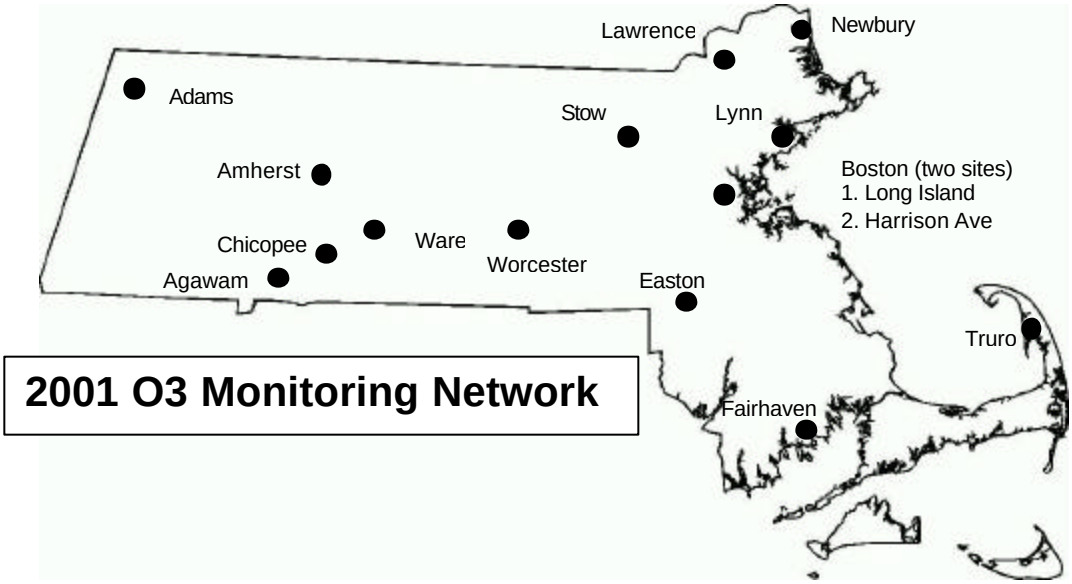
Section III
Massachusetts Air Quality Data Summaries

Ozone (O_3) Summary

2001 O_3 data summary - A summary of the 2001 data during O_3 season (April 1 – Sept. 30) is listed below. There were 15 O_3 sites during 2001 in the state-operated monitoring network. All of the sites achieved the requirement of 75% or greater data capture for the year.

	P				UNITS: PPM				VALS				VALS
	O	M				%	-1 HR MAX-			-8-HR MAX			
SITE ID	C	T	CITY	COUNTY	ADDRESS	OBS	1ST	2ND	>.125	1ST	2ND	4TH	>.085
25-003-4002	1	2	ADAMS	BERKSHIRE	MT. GREYLOCK	81	.113	.112	0	.108	.099.	.092	16
25-013-0003	1	8	AGAWAM	HAMPDEN	152 S. WESTFIELD	91	.120	.101	0	.091	.086	.081	2
25-015-0103	1	2	AMHERST	HAMPSHIRE	NORTH PLEASANT	96	.138	.104	1	.102	.086	.084	3
25-025-0041	1	2	BOSTON	SUFFOLK	LONG IS. HOSPITAL	90	.122	.119	0	.111	.107	.094	9
25-025-0042	1	2	BOSTON	SUFFOLK	HARRISON AVE	99	.109	.109	0	.093	.085	.080	2
25-013-0008	1	7	CHICOPEE	HAMPDEN	ANDERSON ROAD	97	.138	.125	2	.105	.098	.090	9
25-005-1005	1	7	EASTON	BRISTOL	BORDERLAND PARK	92	.124	.116	0	.107	.103	.098	14
25-005-1002	1	2	FAIRHAVEN	BRISTOL	L. WOOD SCHOOL	84	.142	.136	2	.117	.113	.101	8
25-009-0005	1	1	LAWRENCE	ESSEX	HIGH STREET	85	.081	.081	0	.073	.066	.062	0
25-009-2006	1	8	LYNN	ESSEX	390 PARKLAND AVE	97	.124	.122	0	.111	.102	.100	11
25-009-4004	1	7	NEWBURY	ESSEX	SUNSET BOULEVARD	85	.147	.112	1	.117	.099	.093	8
25-017-1102	1	2	STOW	MIDDLESEX	US MILITARY RESERV.	98	.123	.122	0	.105	.101	.098	12
25-001-0002	1	2	TRURO	BARNSTABLE	FOX BOTTOM AREA	99	.144	.139	2	.124	.113	.105	13
25-015-4002	1	7	WARE	HAMPSHIRE	QUABBIN SUMMIT	99	.148	.132	2	.119	.116	.093	12
25-027-0015	1	1	WORCESTER	WORCESTER	WORCESTER AIRPORT	98	.122	.118	0	.102	.093	.088	6

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 MAXIMA** = MAXIMUM 8-HR VALUE FOR THE 1ST, 2ND & 4TH HIGHEST DAY **VALS > 0.O85** = NUMBER OF MEASURED DAILY 8-HR MAXIMUM VALUES GREATER THAN OR EQUAL TO 0.085 PPM (8-HR STANDARD)



Ozone (O_3) Summary, (continued)

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

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

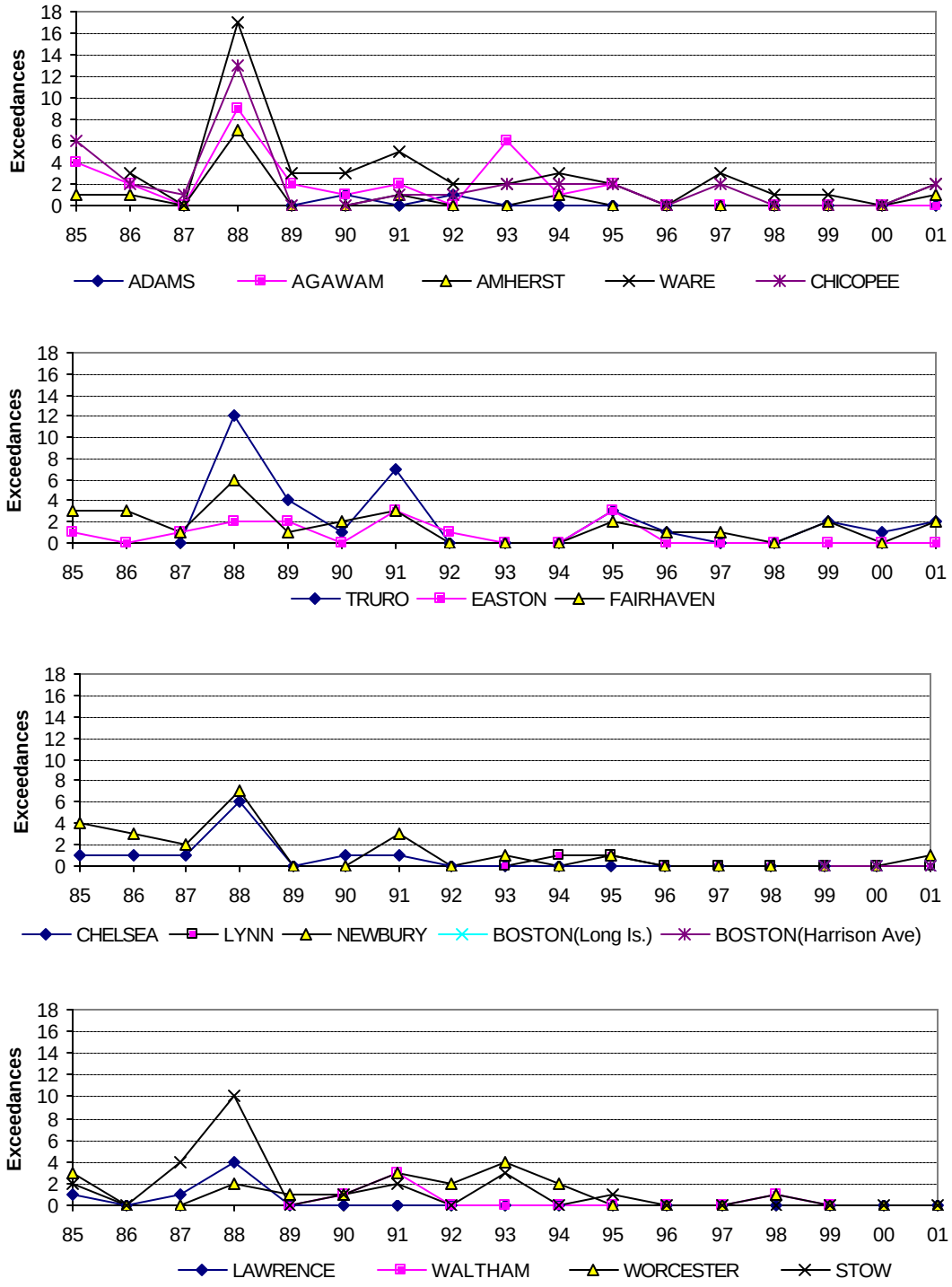


Figure 3

Ozone (O_3) Summary, (continued)

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

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

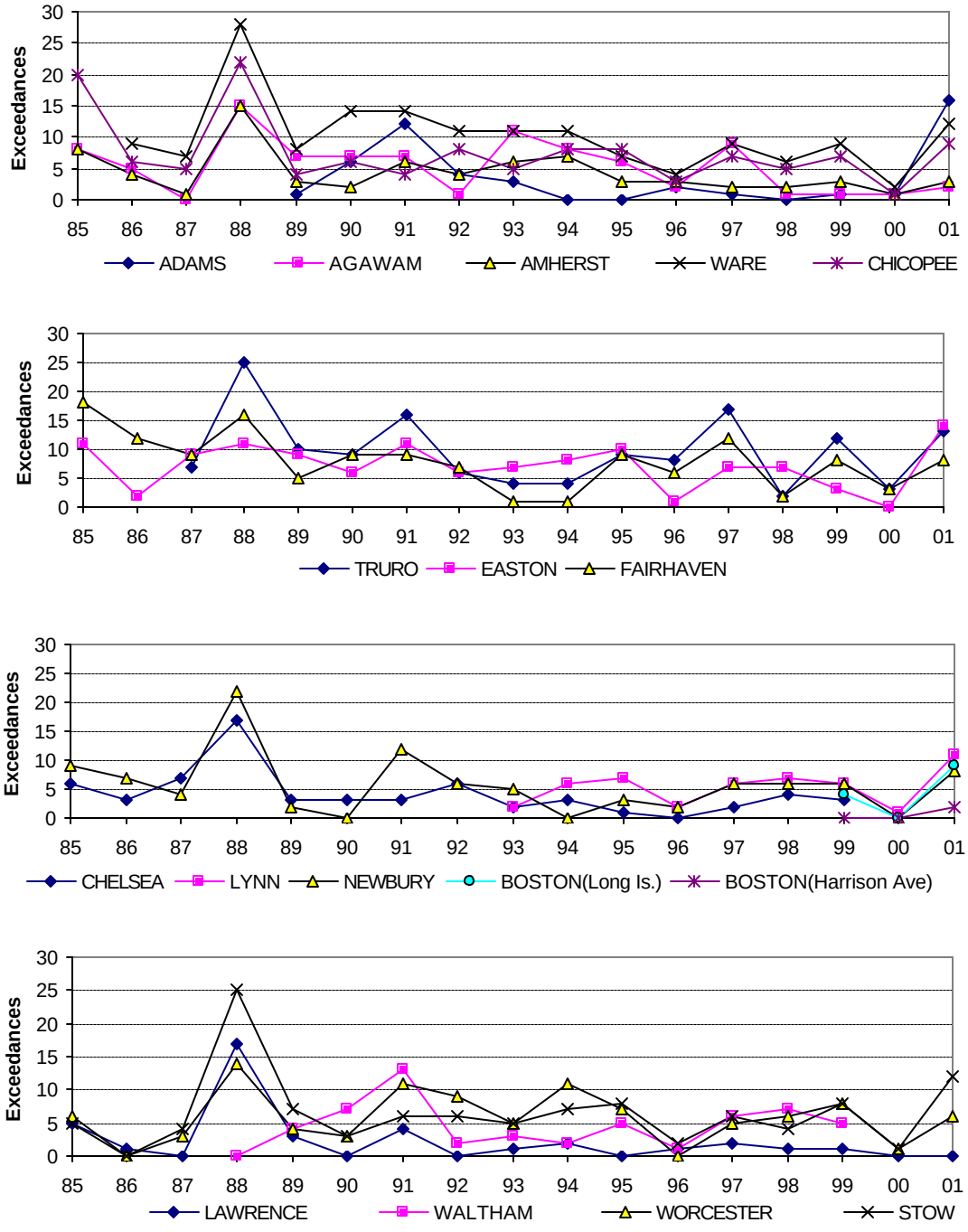


Figure 4

Sulfur Dioxide (SO_2) Summary

2001 SO_2 data summary

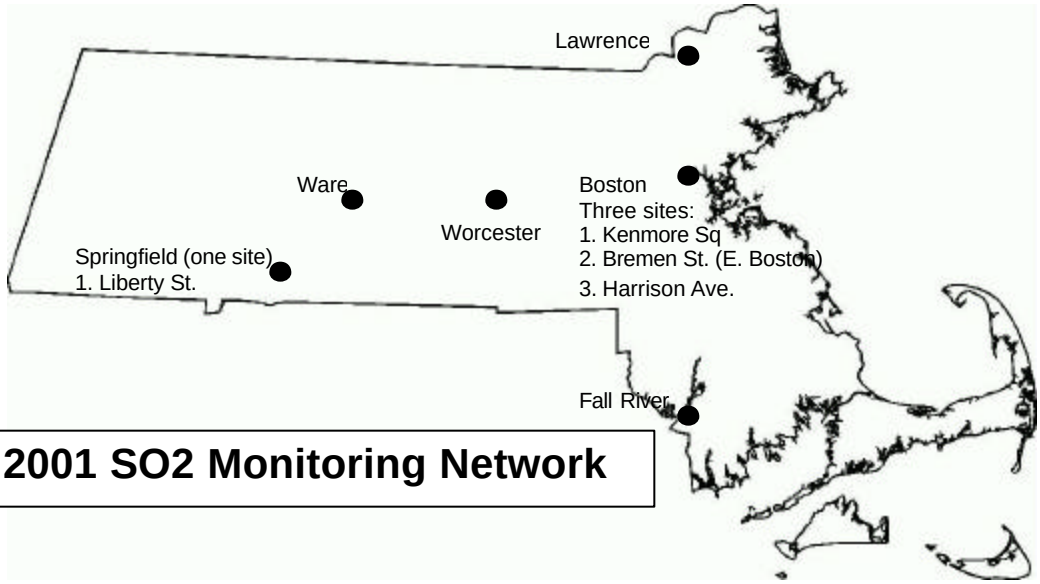
A summary of the 2001 data is listed below. There were eight SO_2 sites during 2001 in the state-operated monitoring network. All of the sites achieved the requirement of 75% or greater data capture for the year.

					UNITS:PPM							ANN
	POC	MT	CITY	COUNTY	ADDRESS	% OBS	MAX 24-HR 1ST	MAX 24-HR 2ND	MAX 3-HR 1ST	MAX 3-HR 2ND	MAX 1-HR 1ST	MAX 1-HR 2ND	ARITH MEAN
SITE ID													
25-025-0002	1	1	BOSTON	SUFFOLK	KENMORE SQUARE	96	.026	.019	.047	.038	.062	.046	.005
25-025-0021	1	1	BOSTON	SUFFOLK	340 BREMEN ST.	97	.013	.013	.028	.025	.035	.033	.003
25-025-0042	1	1	BOSTON	SUFFOLK	HARRISON AVENUE	97	.028	.024	.051	.041	.056	.050	.007
25-005-1004	1	1	FALL RIVER	BRISTOL	GLOBE STREET	97	.032	.024	.062	.061	.097	.096	.005
25-009-0005	1	1	LAWRENCE	ESSEX	HIGH STREET	94	.021	.021	.053	.052	.073	.071	.004
25-013-0016	1	1	SPRINGFIELD	HAMPDEN	LIBERTY STREET	97	.022	.022	.066	.051	.077	.073	.006
25-015-4002	1	2	WARE	HAMPSHIRE	QUABBIN SUMMIT	97	.017	.017	.026	.026	.030	.028	.004
25-027-0020	1	1	WORCESTER	WORCESTER	CENTRAL STREET	96	.022	.022	.048	.038	.052	.049	.005

? 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) **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 **OBS > .14** = NUMBER OF 24-HR AVG. GREATER THAN 0.14 PPM (24-HR STANDARD) **OBS > .50** = NUMBER OF 3-HR AVG. GREATER THAN 0.50 PPM (3-HR STANDARD) **ANN ARITH MEAN** = ANNUAL ARITHMETIC MEAN (STANDARD = 0.03 PPM)



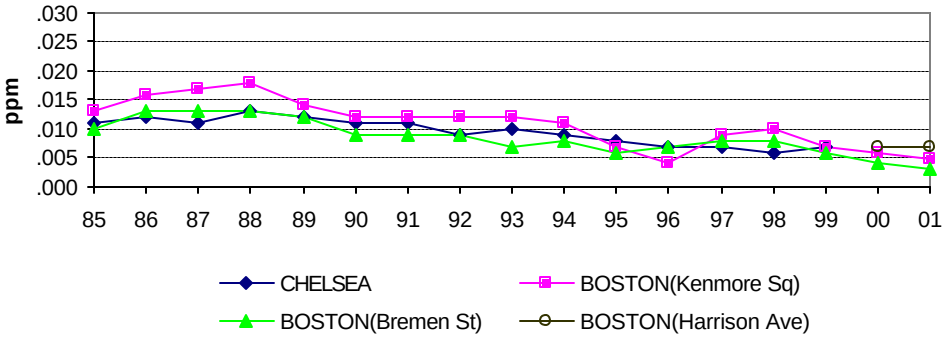
2001 SO2 Monitoring Network

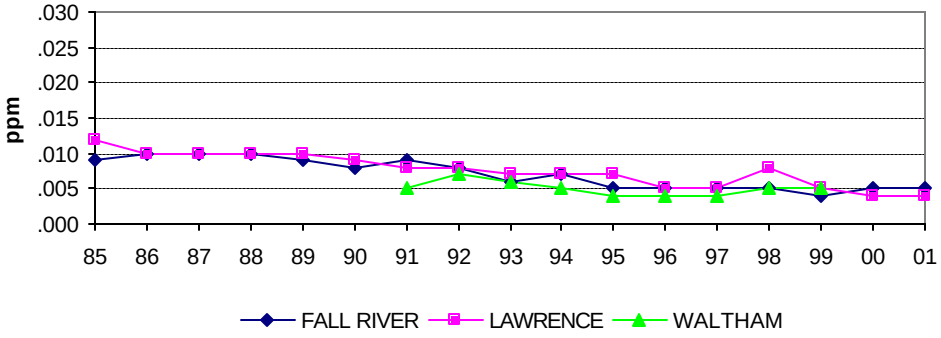
Sulfur Dioxide (SO_2) Summary, (continued)

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.

SO2 Trends 1985 – 2001
Annual Arithmetic Means
Standard = 0.03 ppm





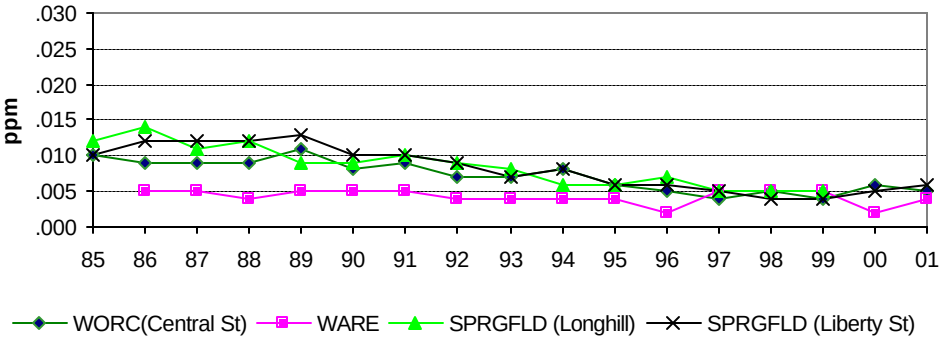


Figure 5

Nitrogen Dioxide (NO_2) Summary

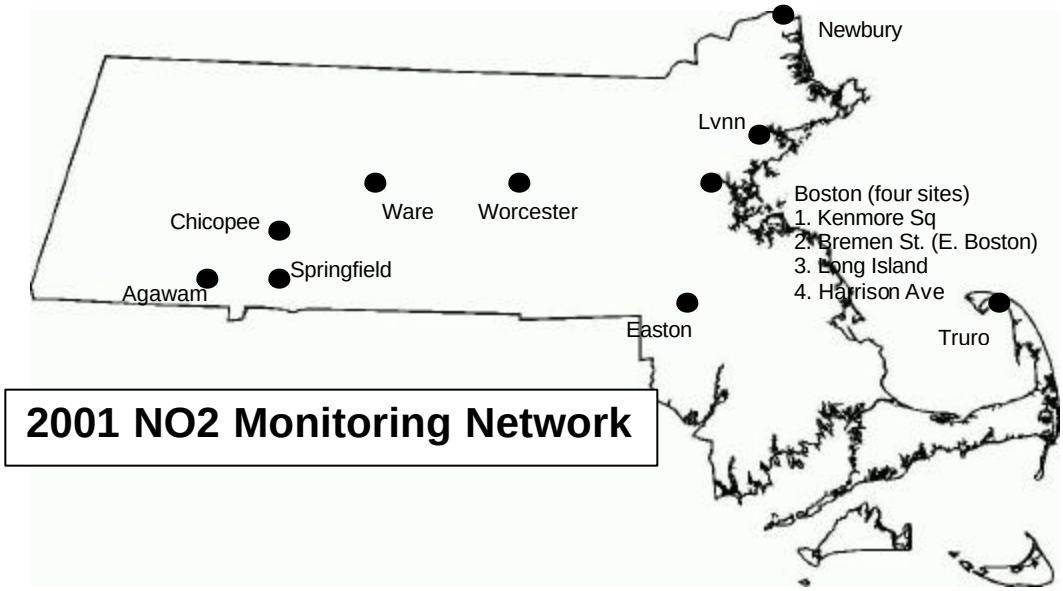
2001 NO_2 data summary

There were 13 NO_2 sites during 2001 in the state-operated monitoring network. All but one site met the requirement of 75% data capture for the year. Easton closed September 19, 2001.
A summary of the 2001 data is listed below.

					UNITS: PPM				
SITE ID	POC	MT	CITY	COUNTY	ADDRESS	% OBS	MAX 1ST	1-HR 2ND	ARITH MEAN
25-013-0003	1	8	AGAWAM	HAMPDEN	152 SOUTH WESTFIELD STREET	94	.054	.053	.010
25-025-0002	1	3	BOSTON	SUFFOLK	KENMORE SQUARE	93	.114	.097	.030
25-025-0021	1	1	BOSTON	SUFFOLK	340 BREMEN STREET, EAST BOSTON	89	.064	.059	.021
25-025-0041	1	8	BOSTON	SUFFOLK	LONG ISLAND HOSPITAL ROAD	94	.081	.080	.012
25-025-0042	1	1	BOSTON	SUFFOLK	HARRISON AVE	91	.079	.074	.025
25-013-0008	1	8	CHICOPEE	HAMPDEN	ANDERSON ROAD AIR FORCE BASE	93	.077	.070	.014
25-005-1005	1	8	EASTON	BRISTOL	1 BORDERLAND ST.	68	.067	.041	.008
25-009-2006	1	8	LYNN	ESSEX	390 PARKLAND AVE.	92	.063	.054	.012
25-009-4004	1	8	NEWBURY	ESSEX	SUNSET BOULEVARD	96	.045	.043	.007
25-013-0016	1	2	SPRINGFIELD	HAMPDEN	LIBERTY STREET PARKING LOT	95	.095	.084	.023
25-001-0002	1	8	TRURO	BARNSTABLE	FOX BOTTOM AREA-CAPE COD	95	.043	.043	.004
25-015-4002	1	8	WARE	HAMPSHIRE	QUABBIN SUMMIT	94	.058	.051	.007
25-027-0020	1	2	WORCESTER	WORCESTER	CENTRAL STREET FIRE STATION	95	.090	.075	.020

? 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 1880
Standard: Annual Arithmetic Mean = 0.053

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) **REP ORG** = REPORTING ORGANIZATION **% OBS** = DATA CAPTURE PERCENTAGE **MAX 1-HR 1ST 2ND** = FIRST AND SECOND HIGHEST VALUE FOR TIME PERIOD INDICATED **ARITH MEAN** = ANNUAL ARITHMETIC MEAN



Nitrogen Dioxide (NO_2) Summary, (continued)

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.

NO2 Trends 1985-2001
Annual Arithmetic Means
Standard = 0.05 ppm

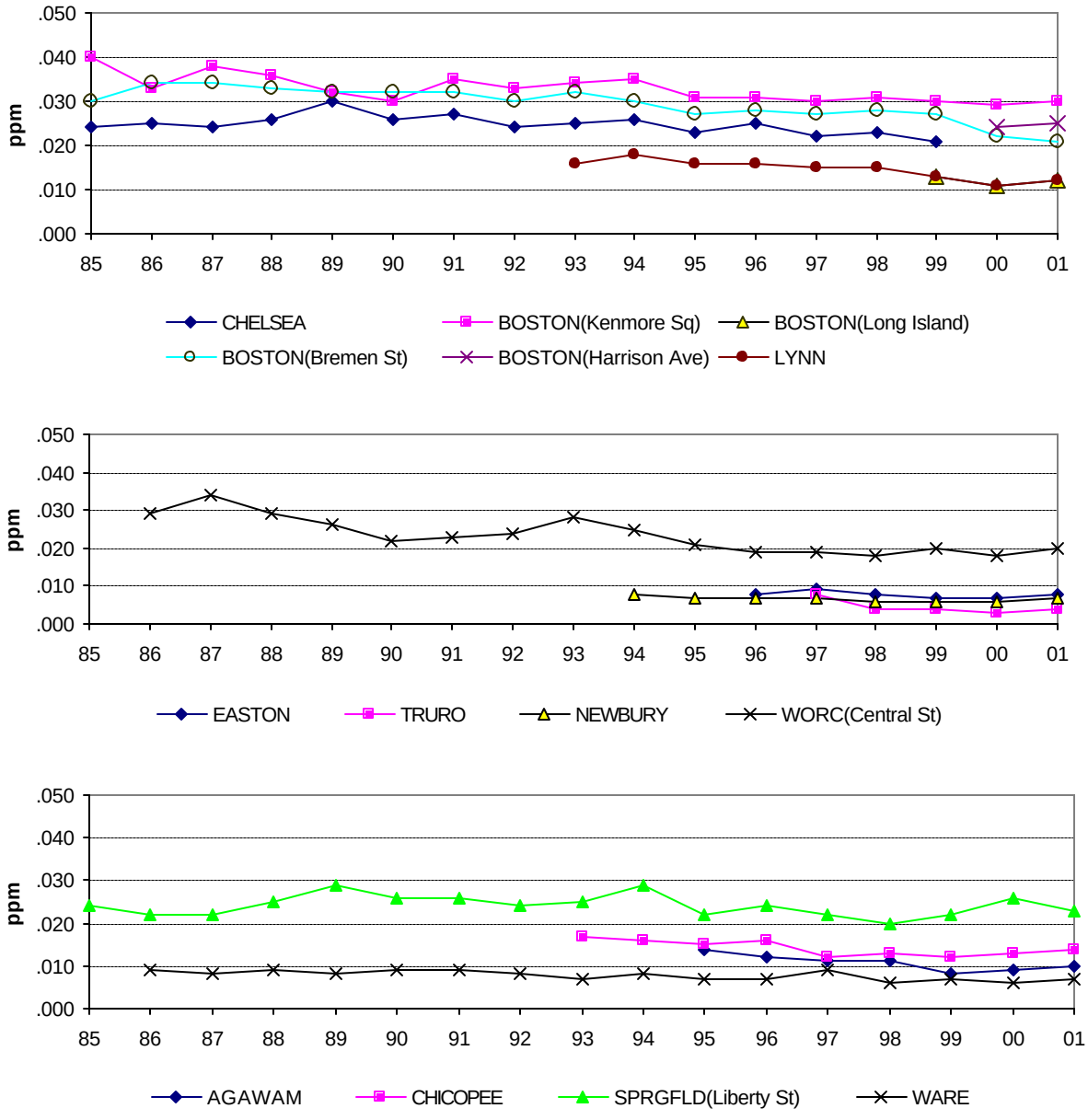


Figure 6

Carbon Monoxide (CO) Summary

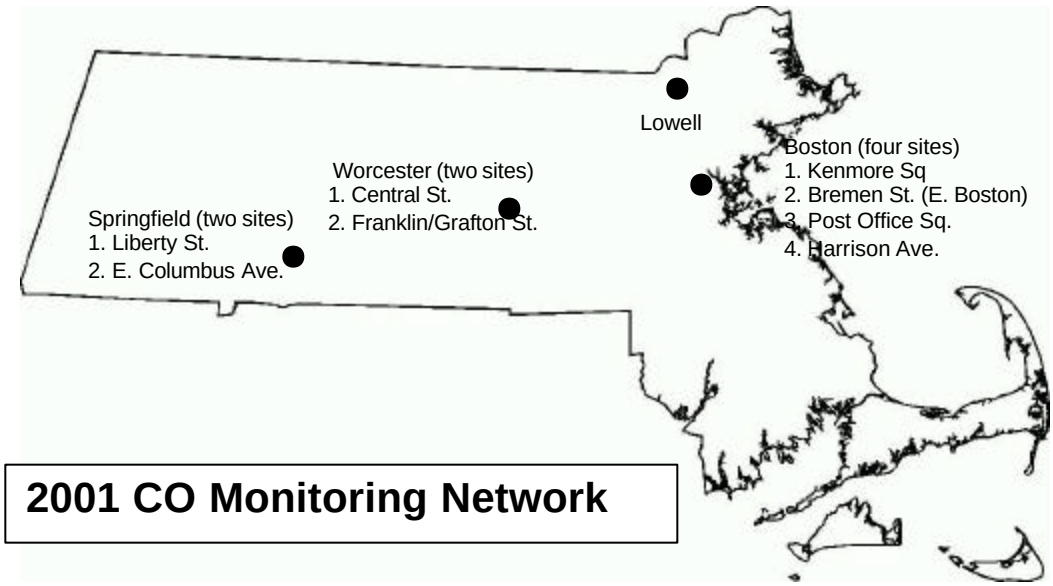
2001 CO data summary

There were nine CO sites during 2001 in the state-operated monitoring network. All but Harrison Ave achieved the requirement of 75% or greater data capture for the year. Harrison Ave started monitoring CO in April 2001. A summary of the 2001 data is listed below.

	P				UNITS: PPM				OBS			OBS >
	O	M				%	MAX 1-HR		>	MAX 8-HR		
SITE ID	C	T	CITY	COUNTY	ADDRESS	OBS	1ST	2ND	35	1ST	2ND	9
25-025-0002	1	2	BOSTON	SUFFOLK	KENMORE SQ., 590 COMM. AVE	92	3.2	2.8	0	2.3	2.2	0
25-025-0021	1	1	BOSTON	SUFFOLK	340 BREMEN ST., E. BOSTON	89	4.3	3.9	0	2.9	2.7	0
25-025-0038	1	1	BOSTON	SUFFOLK	FEDERAL POST OFFICE BLDG	85	4.1	3.6	0	2.7	2.6	0
25-025-0042	1	2	BOSTON	SUFFOLK	HARRISON AVE	68	5.6	4.9	0	3.1	2.8	0
25-017-0007	1	2	LOWELL	MIDDLESEX	OLD CITY HALL, MERRIMACK ST	93	4.2	4.2	0	2.7	2.7	0
25-013-0016	1	1	SPRINGFIELD	HAMPDEN	LIBERTY STREET PARKING LOT	94	4	4	0	3.1	2.9	0
25-013-2007	1	1	SPRINGFIELD	HAMPDEN	EAST COLUMBUS AVENUE	91	5.5	4.9	0	3.9	3	0
25-027-0020	1	2	WORCESTER	WORCESTER	CENTRAL STREET FIRE STATION	89	6.6	5.9	0	2.6	2.6	0
25-027-0022	1	2	WORCESTER	WORCESTER	FRANKLIN/GRAFTON STREETS	91	4	3.9	0	2.4	2.3	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) **OBS > 9** = NUMBER OF 8-HR AVG. GREATER THAN 9 PPM (8-HR STD)



Carbon Monoxide (CO) Summary, (continued)

CO data summary

The figures below present the 2001data 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 value occurred in Worcester and the highest 8-hour value occurred in Springfield. Both were well within the standard.

CO Trends 1985-2001
2nd Maximum 8-hour Values
Standard = 9 ppm

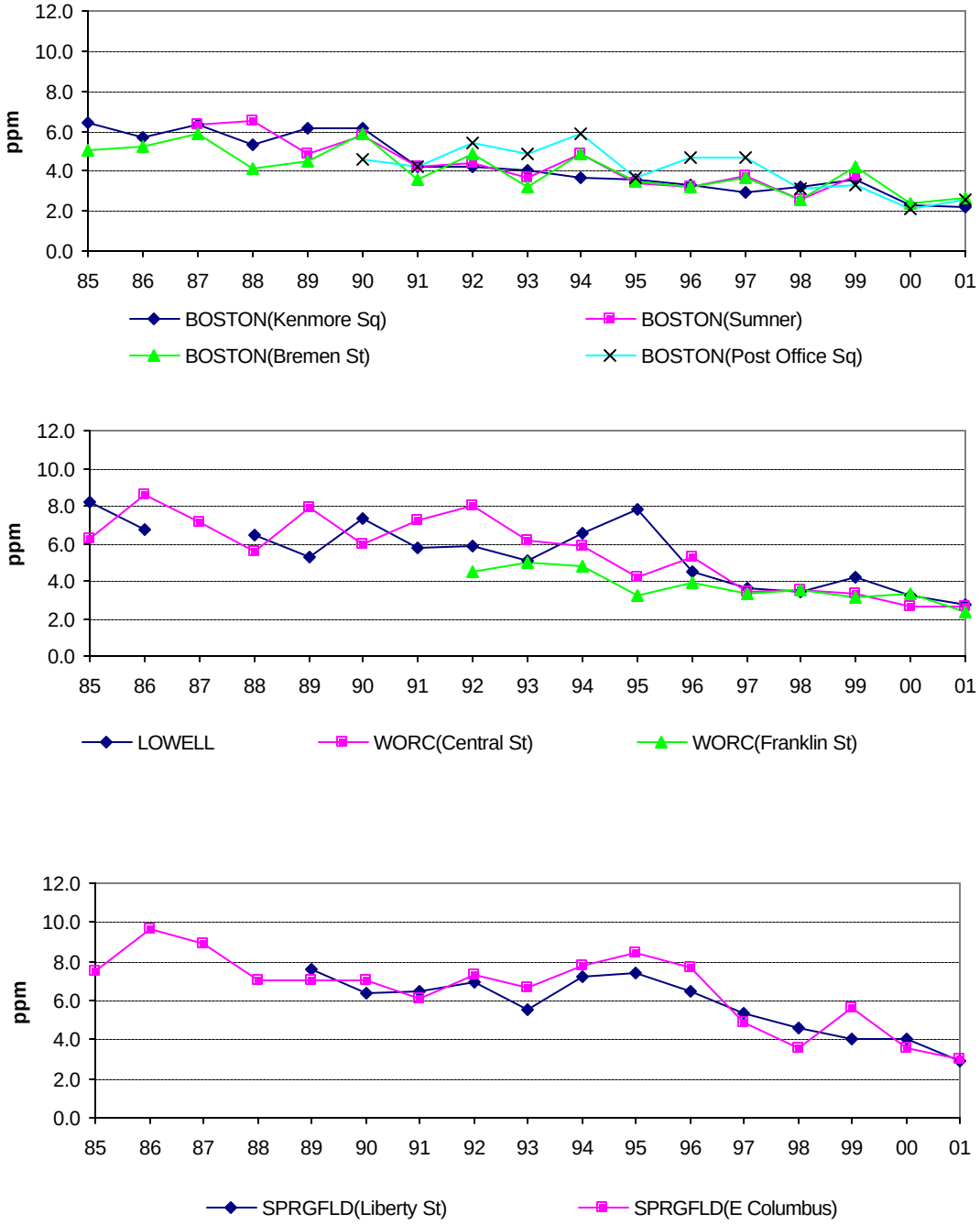


Figure 7

Particulate Matter 10-Microns (PM_{10}) Summary

Introduction

There were seven PM_{10} sites (three sites had collocated monitors-two of the same sampler for precision purposes) during 2001 in the state-operated monitoring network. The network was trimmed from the 16 sites operated during 1998. Those areas that had sites closed are now represented in the $PM_{2.5}$ network.

2001 PM_{10} data summary

Five out of the seven 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 2001 data is listed below.

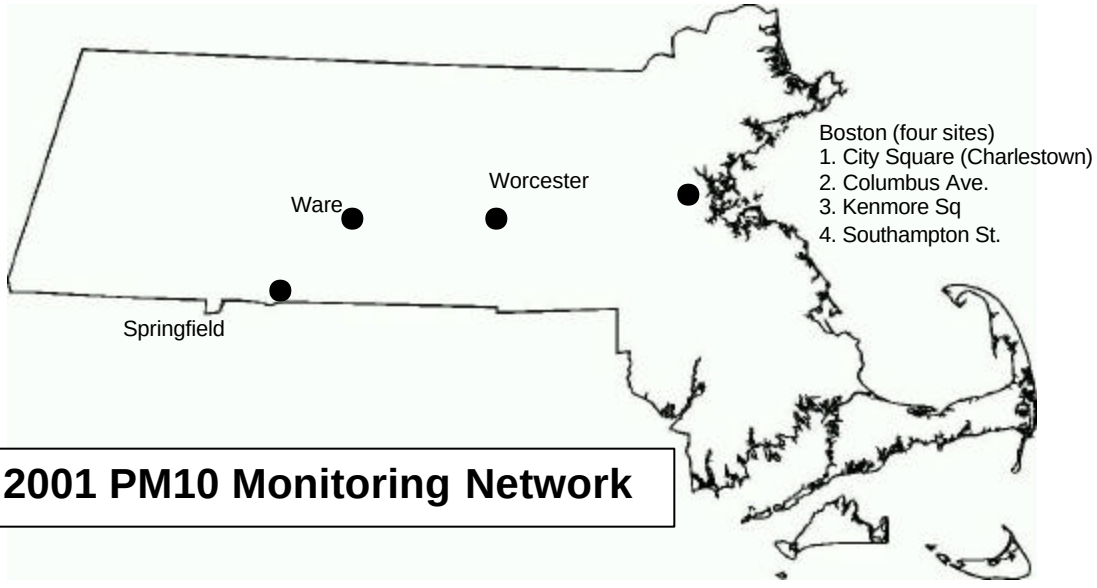
Site ID	POC	MT	City	County	Address	% Obs	Highest Value	2nd Highest Value	3rd Highest Value	4th Highest Value	Wtd. Arith. Mean
25-013-0011	2	2	SPRINGFIELD	HAMPDEN	59 HOWARD STREET	90	62	51	47	43	24?
25-013-0011	3	3	SPRINGFIELD	HAMPDEN	59 HOWARD STREET	64	63	59	45	43	25?
25-015-4002	1	2	WARE	HAMPSHIRE	QUABBIN SUMMIT	97	38	35	29	28	12
25-025-0002	1	1	BOSTON	SUFFOLK	KENMORE SQUARE	82	52	47	47	45	27?
25-025-0012	1	1	BOSTON	SUFFOLK	115 SOUTHAMPTON	75	50	43	40	35	19?
25-025-0012	2	3	BOSTON	SUFFOLK	115 SOUTHAMPTON	0	-	-	-	-	?
25-025-0024	1	1	BOSTON	SUFFOLK	200 COLUMBUS	66	60	53	42	41	26?
25-025-0027	1	1	BOSTON	SUFFOLK	ONE CITY SQUARE	49	87	61	49	48	31?
25-025-0027	3	3	BOSTON	SUFFOLK	ONE CITY SQUARE	30	48	44	43	37	28?
25-027-0016	1	1	WORCESTER	WORCESTER	2 WASHINGTON	95	43	41	39	36	18

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

Standards: 24-hour = 150 µg/m³ Annual Arithmetic Mean = 50 µg/m³

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 **MAXIMUM VALUE 1ST, 2ND, 3RD, 4TH** = 1ST, 2ND, 3RD, AND 4TH HIGHEST 24-HOUR VALUES FOR THE YEAR **VALS > 150 MEAS** = NUMBER OF VALUES GREATER THAN 150 µg/m³ (PM-10 STANDARD) **VALS > 150 EST** = NUMBER OF EXPECTED VIOLATIONS **WTD ARITH MEAN** = WEIGHTED ANNUAL ARITHMETIC MEAN (STANDARD = 50 µg/m³) **?** = INDICATES THAT NUMBER OF OBSERVATIONS WERE INSUFFICIENT TO CALCULATE MEAN. THE DATA CAPTURE AT A SITE MUST EXCEED 75% FOR EACH QUARTER.



Particulate Matter 10-Microns (PM10) Summary, (continued)

PM_{10} trends

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

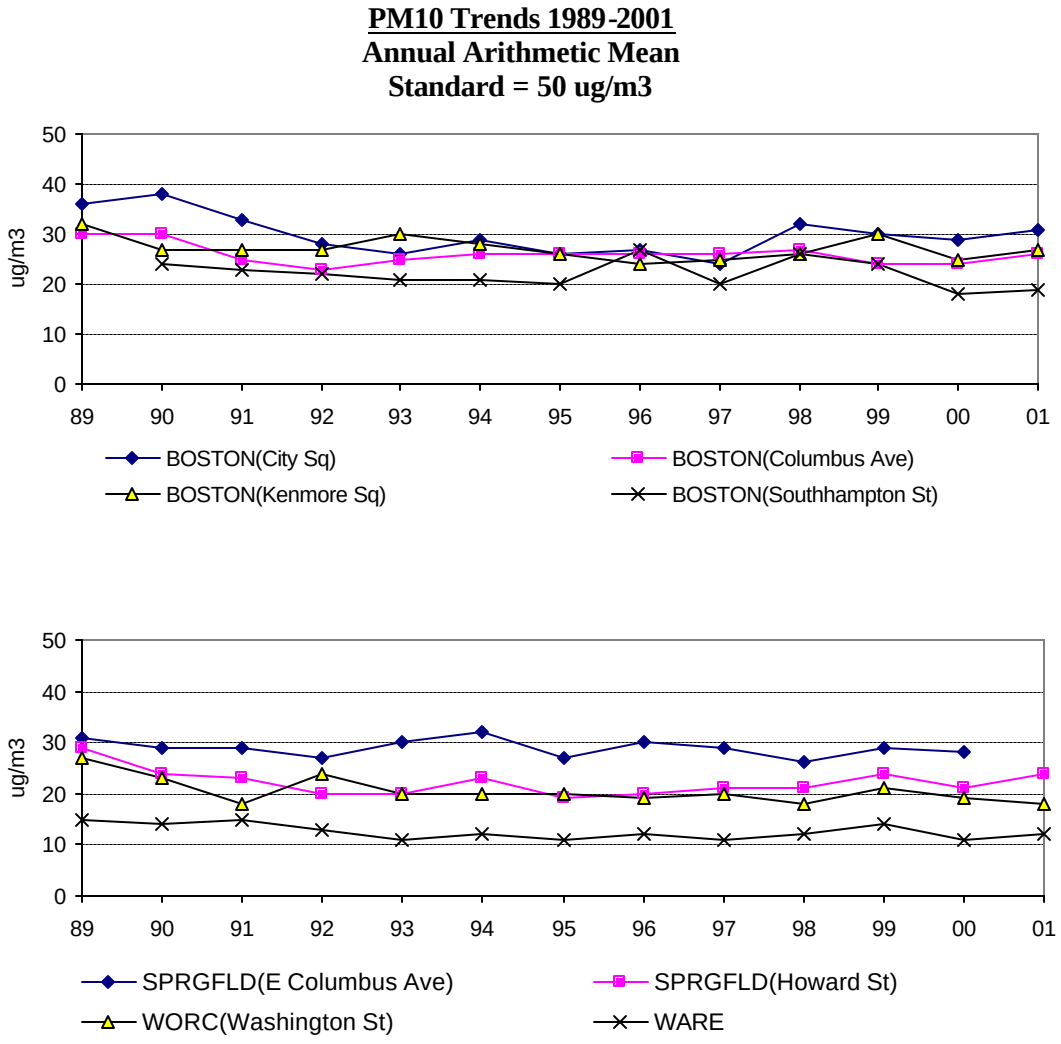


Figure 8

Particulate Matter 2.5-Microns (PM2.5) Summary

Introduction

The $PM_{2.5}$ monitoring network was set up during late 1998 and monitoring began in January 1999. There were 20 $PM_{2.5}$ sites (five sites had collocated monitors) during 2001 in the state-operated monitoring network.

2001 $PM_{2.5}$ data capture problems

The year 2001 saw significant changes and improvements in PM2.5 monitoring. Research, conducted by AAB, revealed the cases of, and solutions to, several key problem areas in methodology, sampling, and data collection. Research into field blanks and instrument mechanics has yielded improvements in data capture. Greatly improved repair response time and laboratory automation is largely responsible for data capture improvements.

Machine malfunctions still comprise the greatest percentage of voided samples. However, the dedicated attention of field operators, coupled with better training and equipment have reduced malfunction related voids from 67% in 2000 to 41% in 2001.

In the second half of 2001, MA DEP AAB instituted a stringent instrument overhaul protocol and deployed a full time PM 2.5 field repair analyst. This has resulted, between the first and second halves of 2001, in a 260% drop in voids related to machine breakdowns and has reduced voids due to prolonged down time by 228%.

The second half of 2001 also saw improvements in laboratory support operations. A new robotic filter weighing system has been installed. Initially, problems with the lab facilities caused a 13% increase in voids due to lab errors. This rise was anticipated as a result of the changes in operations.

For the entire year – data capture remained virtually unchanged from 2000 to 2001. The changes instituted in the latter half of 2001 have resulted in significant improvements. The questions surrounding data quality and data capture, while reduced in 2001, remain a continuing concern.

Particulate Matter 2.5-Microns (PM2.5) Summary, (continued)

2001 $PM_{2.5}$ data summary

A summary of the 2001 data is listed below. Designation for the $PM_{2.5}$ standard requires 3 years of data. 1999 was the first year of monitoring.

Site ID	POC	MT	City	County	Units: ug/cu meter Address	1st Highest Value	2nd Highest Value	3rd Highest Value	4th Highest Value	Wtd. Arith. Mean
25-025-0002	1	2	BOSTON	SUFFOLK	KENMORE SQUARE	41.2	39.7	36.6	32.8	16.6 ?
25-025-0027	1	2	BOSTON	SUFFOLK	ONE CITY SQUARE	43.1	39.4	34	33.3	13.2 ?
25-025-0027	2	3	BOSTON	SUFFOLK	ONE CITY SQUARE	40.1	30.5	29.8	27.8	13.3 ?
25-025-0042	1	2	BOSTON	SUFFOLK	HARRISON AVENUE	42.2	38.4	33.1	32.3	14.7
25-025-0042	2	2	BOSTON	SUFFOLK	HARRISON AVENUE	27.2	26.1	25.2	23.4	10.2
25-025-0042	3	2	BOSTON	SUFFOLK	HARRISON AVENUE	55.8	50.6	45.0	41.2	8.4
25-025-0042	4	2	BOSTON	SUFFOLK	HARRISON AVENUE	63.9	62.0	60.4	60.0	15.3
25-025-0043	1	2	BOSTON	SUFFOLK	174 NORTH STREET	31.2	31.2	29.7	28.7	16 ?
25-023-0004	1	2	BROCKTON	PLYMOUTH	120 COMMERCIAL ST	34.6	32.2	31.9	31.7	12.2
25-023-0004	2	3	BROCKTON	PLYMOUTH	120 COMMERCIAL ST	32.3	30.7	30	28.7	11.8 ?
25-023-0004	3	2	BROCKTON	PLYMOUTH	120 COMMERCIAL ST	28.7	27.3	26.3	22.1	9.7 ?
25-013-0008	1	2	CHICOPEE	HAMPDEN	ANDERSON ROAD AIR	63.8	38.2	35.1	34.4	11.1 ?
25-005-3001	1	2	FALL RIVER	BRISTOL	CENTRAL FIRE STATION	40.1	37	36.7	31.6	13.3 ?
25-027-2004	1	2	FITCHBURG	WORCESTER	67 RINDGE ROAD	33	26	25.3	24.5	10.4 ?
25-009-5005	1	2	HAVERHILL	ESSEX	WASHINGTON ST.	28.9	27.2	24.1	23.6	13.7 ?
25-009-6001	1	2	LAWRENCE	ESSEX	WALL EXPERIMENT	33.4	32	27.5	27.2	11.1 ?
25-017-0008	1	2	LOWELL	MIDDLESEX	50 FRENCH STREET	31.8	27.2	27.1	25.2	11.3 ?
25-009-2006	1	2	LYNN	ESSEX	390 PARKLAND AVE.	57	31.5	27.4	27	12.1 ?
25-005-2004	1	2	NEW BEDFORD	BRISTOL	YMCA, 25 WATER	39.7	39.3	35.2	34	12.7 ?
25-003-5001	1	2	PITTSFIELD	BERKSHIRE	78 CENTER STREET	37.2	33.8	32.4	30.8	13.4 ?
25-021-0007	1	2	QUINCY	NORFOLK	HANCOCK STREET	30.4	27.9	27.3	27	13.1 ?
25-021-0007	2	3	QUINCY	NORFOLK	HANCOCK STREET	30.3	28	25.5	23.3	12.6 ?
25-013-0016	1	2	SPRINGFIELD	HAMPDEN	LIBERTY STREET	63.4	42.8	42.6	38.8	13.8
25-013-0016	2	3	SPRINGFIELD	HAMPDEN	LIBERTY STREET	42	37.2	36.8	30.2	14.2 ?
25-017-1102	1	2	STOW	MIDDLESEX	US MILITARY	27.8	27.2	24.8	23.9	10.8 ?
25-015-4002	1	2	WARE	HAMPSHIRE	QUABBIN SUMMIT	31.3	27.5	25.6	25.3	9.2 ?
25-027-0016	1	2	WORCESTER	WORCESTER	2 WASHINGTON ST	33.5	33.1	29.3	29	13.2 ?
25-027-0020	1	2	WORCESTER	WORCESTER	CENTRAL STREET FIRE	41.8	36.6	36.4	33.6	12.8
25-027-0020	2	3	WORCESTER	WORCESTER	CENTRAL STREET FIRE	35.8	31.4	31.1	27.6	12.3 ?

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

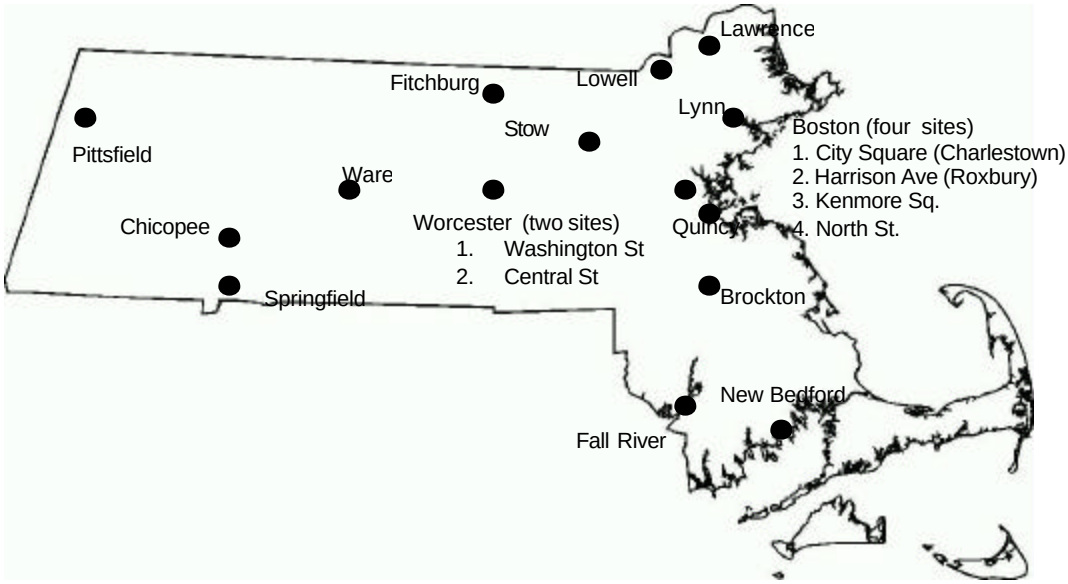
Standards (based on 3-year averages): 24-hours = 65 $\mu g/m^3$ Annual Arithmetic Mean = 15.0 $\mu g/m^3$

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) **% OBS** = DATA CAPTURE PERCENTAGE **MAXIMUM 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 = 15.0 $\mu g/m^3$) **?** = INDICATES THAT NUMBER OF OBSERVATIONS WERE INSUFFICIENT TO CALCULATE MEAN. THE DATA CAPTURE AT A SITE MUST EXCEED 75% FOR EACH QUARTER.

Particulate Matter 2.5-Microns (PM2.5) Summary, (continued)

2001 PM2.5 Monitoring Network



Lead (Pb) Summary

2001 Pb data summary

As required by USEPA, lead monitoring was reinstituted in 1998 after being discontinued in July 1995. The concentrations monitored are very low. The use of unleaded gasoline has greatly diminished lead emissions, since the primary source for airborne lead is motor vehicles. Lead monitoring was reinstated at the Kenmore Square, Boston, location in 1998 in an effort to continue the tracking of long-term lead concentration trends. A summary of the 2001 data is listed below. Monitor malfunctions caused the data capture to be low.

					UNITS: UG/CU METER								
	POC	MT	CITY	COUNTY	ADDRESS	% OBS	-QUARTERLY ARITH MEANS 1ST	2ND	3RD	4TH	MEANS >1.5	MAX VALUES 1ST	2ND
25-025-0002	1	1	BOSTON	SUFFOLK	KENMORE SQ.	50	.03	.01	.01	.01	0	.09	.07

? INDICATES THAT THE MEAN DOES NOT SATISFY SUMMARY CRITERIA (NUMBER OF OBSERVATIONS FOR AT LEAST 1 QUARTER LESS THAN 75%)
Standard: 1.5 µg/m³ (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 which 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/acidrain).

Sulfur Dioxide (SO_2) summary

There were five SO_2 sites during 2001 in the industrial network. Four of the sites achieved the requirement of 80% or greater data capture for the year. The Haverhill site reported through first quarter and was closed in September. There were no known violations of the SO_2 air quality standards during the year in the reported data. A summary of the 2001 data is listed below.

	POM			UNITS: PPM									
					REP	%	MAX	24-HR	MAX	3-HR	MAX	1-HR	ARIT
SITE ID	CT	CITY	COUNTY	ADDRESS	ORG	OBS	1ST	2ND	1ST	2ND	1ST	2ND	MEAN
25-025-0019	1 4	BOSTON	SUFFOLK	LONG ISLAND	5	99%	.021	.018	.040	.034	.063	.047	.005
25-025-0020	1 4	BOSTON	SUFFOLK	DEWAR STREET	5	99%	.025	.023	.046	.045	.059	.058	.005
25-025-0021	2 4	BOSTON	SUFFOLK	340 BREMEN ST.	5	99%	.024	.023	.044	.043	.059	.054	.006
25-025-0040	1 4	BOSTON	SUFFOLK	531A E. FIRST ST	5	98%	.027	.026	.062	.061	.105	.075	.007
25-009-5004	1 4	HAVERHILL	ESSEX	NETTLE SCHOOL	2	25%	.010	.010	.020	.013	.025	.024	.004?

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 **OBS > .14** = NUMBER OF 24-HR AVG. GREATER THAN 0.14 PPM (24-HR STANDARD) **OBS > .50** = NUMBER OF 3-HR AVG. GREATER THAN 0.50 PPM (3-HR STANDARD) **ARIT MEAN** = ARITHMETIC MEAN (STANDARD = 0.030 PPM)

Industrial Network Summary, (continued)

Nitrogen Dioxide (NO_2) summary

There was one NO_2 site during 2001 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 0.023 ppm, which is 43% of the standard.

A summary of the 2001 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	98%	.092	.086	.023

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 2001 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 2001 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%	58	51	49	49	27	24	1.5
25-025-0020	1	4	BOSTON	SUFFOLK	DEWAR STREET	95%	111	110	90	78	44	40	1.5
25-025-0021	2	4	BOSTON	SUFFOLK	340 BREMEN ST	93%	117	106	99	95	56	51	1.5
25-025-0040	1	4	BOSTON	SUFFOLK	531A EAST FIRST STREET	98%	88	88	80	79	44	41	1.5
25-025-0040	2	4	BOSTON	SUFFOLK	531A EAST FIRST STREET	97%	91	87	82	80	45	43	1.4

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 **GEO MEAN** = GEOMETRIC MEAN **GEO STD** = GEOMETRIC STANDARD DEVIATION

Industrial Network Summary, (continued)

Sulfate (SO_4) summary

There were four SO_4 sites during 2001 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 2001 data is listed below.

						UNITS: UG/CU METER (25C)					
	POC	MT				%	-MAXIMUM VALUES-				ARITH
SITE ID			CITY	COUNTY	ADDRESS	OBS	1ST	2ND	3RD	4TH	MEAN
25-025-0019	1	4	BOSTON	SUFFOLK	LONG ISLAND	97%	19.0	16.0	14.0	14.0	8.3
25-025-0020	1	4	BOSTON	SUFFOLK	DEWAR STREET	95%	17.0	16.0	15.0	14.0	8.6
25-025-0021	2	4	BOSTON	SUFFOLK	340 BREMEN STREET	93%	17.0	16.0	15.0	15.0	9.3
25-025-0040	1	4	BOSTON	SUFFOLK	531A EAST FIRST STREET	98%	17.0	15.0	15.0	13.0	8.5
25-025-0040	2	4	BOSTON	SUFFOLK	531A EAST FIRST STREET	97%	17.0	15.0	15.0	14.0	8.7

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 is of high quality, MADEP has developed standard operating procedures (SOPs). These 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%.

Quality Control and Quality Assurance, (continued)

2001 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	2001	9		-7	3.4	36	-13	5	-17	5.3	-18	5.7
CARBON MONOXIDE						2001-1	8		-6	2.3	9	-13	-1	-16	-4	-19	-1
						2001-2	9		-7	3.9	12	-14	11	-17	13	-18	13
						2001-3	9		-7	3.0	6	-14	.7	-17	.4	-21	5.4
						2001-4	9		-6	1.2	9	-5	-.1	-12	1	-8	-3
01	25	001	C	A	SO2	2001	8		-8	3.6	42	-13	8.8	-14	10	-16	9.2
SULFUR DIOXIDE						2001-1	8		-10	2.6	9	-13	5.1	-10	4	-12	4
						2001-2	8		-7	1.8	15	-18	14	-22	15	-24	15
						2001-3	8		-5	2.3	9	-8	5.2	-7	6.4	-7	3.5
						2001-4	8		-5	2	9	-10	7.6	-11	9.7	-11	7.1
01	25	001	C	A	NO2	2001	13		-8	9.9	45	-20	7.7	-14	4.8	-13	8.3
NITROGEN DIOXIDE						2001-1	13		-7	7.4	12	-27	3.4	-13	-1	-17	8.8
						2001-2	13		-7	7.5	12	-21	10	-14	3.3	-13	8.1
						2001-3	13		-6	9.3	12	-14	6.6	-15	7.7	-14	11
						2001-4	12		-6	9.6	9	-14	8.3	-12	9.7	-9	8.7
01	25	001	C	A	O3	2001	15		-6	7.2	72	-10	10	-10	12	-10	13
OZONE						2001-1	4		1.5	8.5							
						2001-2	15		-5	6.7	21	-12	12	-13	14	-13	15
						2001-3	15		-6	5.3	30	-12	11	-11	13	-12	14
						2001-4	5		-5	3.4	18	-6	8.8	-4	10	-4	9.9

							PRECISION DATA				ACCURACY DATA						
PRECISION AND ACCURACY DATA KEY								COLLC	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	2000		5	7.3	8.4			34			-1	1.7
PM2.5 LOCAL CONDITIONS						2001-1		3	4.5	6.3			6			-9	13
						2001-2		5	7.5	10			28			-.9	.4
						2001-3		5	8.4	11							
						2001-4		5	5.6	7.4							
01	25	001	I	F	PM10	2001		2	-12	18			12			-5	12
PM10 TOTAL 0-10UM						2001-1		1	-23	18			4			-3	17
						2001-2		2	-12	19			5			-1	7.6
						2001-3		2	-10	18							
						2001-4		1	-8	15			2			-4	-1

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 **COLLC SITES** = NUMBER OF COLLOCATED SITES **VAL COLL DATA PRS** = NUMBER OF VALID COLLOCATED SAMPLES (ABOVE THE LIMIT USED FOR PRECISION CALCULATION) **# 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 Sites) is a special designation for enhanced monitoring stations employed to measure pollutants and meteorological parameters, which shed light on the ozone formation process. In addition to some of the standard NAAQS pollutants (Ozone, NOx) which are found at other sites, non-criteria pollutants, including volatile organic compounds (VOCs) are measured at PAMS stations on an hourly or a staggered regularly scheduled basis throughout the designated season (June, July and August). Meteorology is a critical parameter to understanding ozone formation and each PAMS site has a full complement of sensors including wind speed, wind direction, temperature, relative humidity, barometric pressure, solar intensity and at some sites, total ultraviolet light and precipitation. The Department 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 (9) stations, including two which are least 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.

Below is a table, which lists the PAMS sites operated in Massachusetts during the 2001 season (June, July and August) and their associated metropolitan area. Lynn and Chicopee are the most intensive monitoring stations in the Boston and Springfield Areas respectively, because of their close proximity to their "target" cities.

Boston	**Springfield**	**Providence**
Lynn	Chicopee	Truro
*Borderland	Ware	*Borderland
Newbury		

*Parts of both Boston and Springfield networks.

Because of the nature and complication of PAMS data, no summaries are presented in this report. However, graphs which present health relevant hydrocarbon data (benzene, toluene, ethyl benzene and xylene) from Chicopee and Lynn elsewhere in this document, are based on results from PAMS monitoring.

Air Toxics Monitoring

Introduction

Toxic air pollutants usually refers to chemicals 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 new USEPA initiative, the DEP resumed a modest program of monitoring for toxic volatile organic compounds (VOCs) in 1999. The DEP initially conducted pilot ambient air toxics monitoring surveys during the 1980s.

During 2001, every sixth day, 24 hour canister samples were routinely collected at two air monitoring stations in Boston (Harrison Avenue and Long Island). 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.

Below is a table, which summarizes results from the analysis of 24 hour samples for selected target VOCs from the two sites for 2001. The central city sampling location is Harrison Ave., and the area background site is on a Boston Harbor Island (Long Island).

	BOSTON (Harrison Ave)		BOSTON (Long Island)	
Compound	Max Value ppb	Mean ppb	Max Value ppb	Mean ppb
1,3-butadiene	0.40	0.06	0.12	0.02
1,1,1-trichloroethane	1.10	0.06	0.05	0.03
trichloroethylene	0.30	0.02	0.03	0.01
tetrachloroethylene	0.17	0.05	0.11	0.03
benzene	0.94	0.37	0.60	0.19
toluene	2.76	0.84	1.19	0.34
xylenes	0.90	0.16	0.23	0.06
ethylbenzene	0.80	0.15	0.19	0.06

Air Toxics Monitoring, (continued)

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.

Below is a chart summarizing concentrations of 24-hour health relevant PAMS target compounds for samples taken at the Lynn PAMS site from 1994 to 2001. Significant mean concentration decreases between 1994 and 1995 coincide with reformulation of gasoline content at the beginning of 1995. AAL values are presented next to the chart for reference. Allowable Ambient Limits (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.

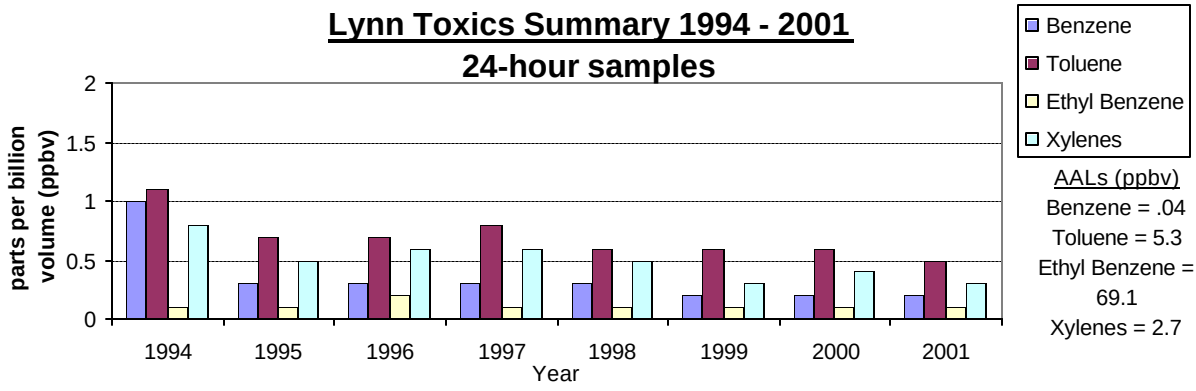


Figure 9

Mercury Deposition Sampling

During 2001, 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 three locations in Massachusetts, including Ware, North Andover and Freetown. This study was designed to collect information regarding the mechanism of wet mercury deposition. Samples are collected under meticulous 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.

This latest effort follows a regional study which was conducted in 1997 and 1998. That study involved the collection of wet deposition and ambient air mercury samples at the Ware site in coordination with the collection of similar samples at a number of other locations in New England.

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
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).
mass.gov/dep/ bwp/daqc/	MADEP	MADEP Air Program Planning Unit Home Page.
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/d ailyozone/ozone.html	USEPA	Ozone maps of the Northeast U.S. using near real-time data.
www.epa.gov/region01/eco/o zone/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/ceis/	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 A: Air Quality Related Web Sites, (continued)

Web sites of interest, continued

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

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/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 janus.state.me.us/dep/ air/ozone.htm 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).

Appendix A: Air Quality Related Web Sites, (continued)

Web sites of interest, continued

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

Web Address	Organization	Description
www.epa.gov/ttn/uatw/	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/ links.html	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.wcvb.com/ weather/pollencount/	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