1994

STATE OF CONNECTICUT

ANNUAL AIR QUALITY SUMMARY

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I. INTRODUCTION

The 1994 Air Quality Summary of ambient air quality in Connecticut is a compilation of air pollutant measurements made at the official air monitoring network sites operated by the Department of Environmental Protection (DEP).

A. OVERVIEW OF AIR POLLUTANT CONCENTRATIONS IN CONNECTICUT

The assessment of ambient air quality in Connecticut is made by comparing the measured concentrations of a pollutant to each of two Federal air quality standards. The first is the primary standard which is established to protect public health with an adequate margin of safety. The second is the secondary standard which is established to protect plants and animals and to prevent economic damage. The specific air quality standards are listed in Table 1-1 along with the time and data constraints imposed on each.

The following section briefly describes the status of Connecticut's air quality for the year 1994. More detailed discussions of each of the six pollutants are provided in subsequent sections of this Air Quality Summary.

1. PARTICULATE MATTER (PM_{10})

Revision of the Particulate Matter Standard - In 1971, the federal Environmental Protection Agency (EPA) promulgated primary and secondary national ambient air quality standards for particulate matter, measured as total suspended particulates or "TSP." The primary standards were set at 260 $\mu g/m^3$, 24-hour average not to be exceeded more than once per year, and 75 $\mu g/m^3$, annual geometric mean. The secondary standard was set at 150 $\mu g/m^3$, 24-hour average not to be exceeded more than once per year. These standards were adopted by the state of Connecticut in 1972.

In accordance with sections 108 and 109 of the Clean Air Act, EPA has reviewed and revised the health and welfare criteria upon which these primary and secondary particulate matter standards were based. EPA found that a size-specific indicator for primary standards representing small particles was warranted and that it should include particles of diameter less than or equal to a nominal 10 micrometers "cut point." Such a standard would place substantially greater emphasis on controlling small particles than does a TSP indicator, but would not completely exclude larger particles from all control.

On March 20, 1984, EPA proposed changes in the standards for particulate matter based on its review and revision of the health and welfare criteria. On July 1, 1987, EPA announced its final decisions regarding these changes. They include: (1) replacing TSP as the indicator for particulate matter for the ambient standards with a new indicator that includes only those particles with an aerodynamic diameter less than or equal to a nominal 10 micrometers (PM_{10}); (2) replacing the 24-hour primary TSP standard with a 24-hour PM_{10} standard of 150 $\mu g/m^3$ with no more than one expected exceedance per year; (3) replacing the annual primary TSP standard with a PM_{10} standard of 50 $\mu g/m^3$, expected annual arithmetic mean; and (4) replacing the secondary TSP standard with 24-hour and annual PM_{10} standards that are identical in all respects to the primary standards. On July 7, 1993 the state of Connecticut adopted these new standards for particulate matter.

Compliance Assessment - Measured PM_{10} concentrations during 1994 did not exceed the 50 $\mu g/m^3$ level of the primary and secondary annual standards or the 150 $\mu g/m^3$ level of the primary and secondary 24-hour standards at any site. Furthermore, the 24-hour standards were not violated because the "expected number of exceedances" for the most recent 3 years at each site did not exceed one per year. The annual standards were also not violated because the "expected annual mean" for the most recent 3 years at each site did not exceed 50 $\mu g/m^3$.

2. SULFUR DIOXIDE (SO_2)

Compliance Assessment - None of the air quality standards for sulfur dioxide were exceeded in Connecticut in 1994. Measured concentrations were below the 80 $\mu g/m^3$ primary annual standard, the 365 $\mu g/m^3$ primary 24-hour standard, and the 1300 $\mu g/m^3$ secondary 3-hour standard at all monitoring sites.

3. OZONE (O_3)

National Ambient Air Quality Standard (NAAQS) - On February 8, 1979, the U.S. Environmental Protection Agency (EPA) established an ambient air quality standard for ozone of 0.12 ppm for a one-hour average. That level is not to be exceeded more than once per year. Furthermore, in order to determine compliance with the 0.12 ppm ozone standard, EPA directs the states to record the number of daily exceedances of 0.12 ppm at a given monitoring site over a consecutive 3-year period and then calculate the average number of daily exceedances for this interval. If the resulting average value is less than or equal to 1.0, (that is, if the fourth highest daily value in a consecutive 3-year period is less than or equal to 0.12 ppm), the ozone standard is considered to be attained at that site. The definition of the pollutant was also changed, along with the numerical value of the standard, partly because the instruments used to measure photochemical oxidants in the air really measure only ozone. Ozone is one of a group of chemicals which are formed photochemically in the air and are called photochemical oxidants. In the past, the two terms have often been used interchangeably. This Air Quality Summary uses the term "ozone" in conjunction with the new NAAQS to reflect the changes in both the numerical value of the NAAQS and the definition of the pollutant.

Compliance Assessment - The primary 1-hour ozone standard was exceeded at all eleven DEP ozone monitoring sites in 1994 (see Table 1-2). Nonattainment of the standard remains a fact at all the sites in 1994 because the average number of annual exceedances at each site was greater than one per year over the period 1992-1994.

4. NITROGEN DIOXIDE (NO_2)

Compliance Assessment - The annual average NO_2 standard of 100 $\mu g/m^3$ was not exceeded at any site in Connecticut in 1994.

5. CARBON MONOXIDE (CO)

Compliance Assessment - The primary eight-hour standard of 9 ppm was not exceeded at any of the five carbon monoxide monitoring sites in Connecticut during 1994.

There were no exceedances of the primary one-hour standard of 35 ppm at any carbon monoxide monitoring site in Connecticut in 1994.

6. **LEAD (Pb)**

Compliance Assessment - The primary and secondary ambient air quality standard for lead is 1.5 $\mu g/m^3$, maximum arithmetic mean averaged over three consecutive calendar months. As has been the case since 1980, the lead standard was not exceeded at any site in Connecticut during 1994.

B. AIR MONITORING NETWORK

A computerized Air Monitoring Network consisting of an IBM System 7 computer and numerous telemetered monitoring sites has operated in Connecticut for several years. In 1985, this data acquisition system was modernized by installing new data loggers at the monitoring sites and replacing the dedicated IBM System 7 computer with a non-dedicated Data General Eclipse MV10000 computer, which was replaced in 1988 with a MV15000 model. This essentially improved both data accuracy and data capture. As many as 14 measurement parameters are transmitted from a site via telephone lines to the Data General unit located in the DEP Hartford office. The data are then compiled three times daily into 24-hour summaries. The telemetered sites are located in the towns of Bridgeport (3), Danbury, East Hartford (2), East Haven, Enfield, Greenwich, Groton (2), Hartford (3), Madison, Mansfield, Middletown, New Haven (2), Stafford, Stamford (2), Stratford, Torrington and Waterbury.

Continuously measured parameters include the pollutants sulfur dioxide, particulates (measured as PM_{10}), carbon monoxide, nitric oxide, total nitrogen oxides and ozone. Meteorological data consists of wind speed and direction, wind horizontal sigma, temperature, precipitation, barometric pressure, solar radiation and dew point. Other parameters used for quality assurance and troubleshooting are room temperature, calibrator oven temperature and line voltage.

The real-time capabilities of the telemetry network have enabled the Air Monitoring Unit to report the Pollutant Standards Index for a number of towns on a daily basis while continuously keeping a close watch for high pollution levels which may occur during adverse weather conditions.

The complete monitoring network used in 1994 consisted of the following:

31 Particulate matter (PM_{10}) hi-vol samplers
4 Particulate matter (PM_{10}) analyzers
5 Lead hi-vol samplers
13 Sulfur dioxide analyzers
11 Ozone analyzers
3 Nitrogen dioxide analyzers
5 Carbon monoxide analyzers

A complete description of all permanent air monitoring sites in Connecticut operated by DEP in 1994 is available from the Department of Environmental Protection, Bureau of Air Management, Monitoring and Radiation Division, 79 Elm Street, Hartford, Connecticut, 06106-5127.

C. POLLUTANT STANDARDS INDEX

The Pollutant Standards Index (PSI) is a daily air quality index recommended for common use in state and local agencies by the U.S. Environmental Protection Agency. Starting on November 15, 1976, Connecticut began reporting the PSI on a 7-day basis, but is currently reporting the PSI on a 5-day basis (i.e., with predictions for the weekends). The PSI incorporates three pollutants : sulfur dioxide, PM_{10} and ozone. The index converts each air pollutant concentration into a normalized number where the National Ambient Air Quality Standard for each pollutant corresponds to PSI = 100 and the Significant Harm Level corresponds to PSI = 500.

Figure 1-1 shows the breakdown of index values for the commonly reported pollutants (PM_{10}, SO_2, and O_3) in Connecticut. For the winter of 1994, Connecticut reported the PM_{10} PSI for the towns of Ansonia, Bridgeport, Danbury, East Hartford, Greenwich, Groton, Hartford, Meriden, Milford, Naugatuck, New Britain, New Haven, Norwalk, Norwich, Putnam, Stamford, Torrington, Wallingford, Waterbury and Willimantic; and reported the sulfur dioxide PSI for the towns of Bridgeport, Danbury, East Hartford, East Haven, Enfield, Greenwich, Groton, Hartford, Mansfield, New Haven, Stamford, and Waterbury. For the summer, the ozone PSI was reported for the towns of Bridgeport, Danbury, East Hartford, Greenwich, Groton, Madison, Middletown, New Haven, Stafford, Stratford and Torrington. Each day, the pollutant with the highest PSI value of all the pollutants being monitored is reported for each town, along with the dimensionless PSI number and a descriptor label to characterize the daily air quality. A descriptor label of each subsequent day's forecast is also included.

A telephone recording of the PSI is available each afternoon at approximately 3 PM, five days a week, and can be heard by dialing 424-4167. Predictions for weekends are included on the Friday recordings. For answers to specific questions, you can call a DEP representative at 424-3029 . The PSI information, as well as health effects information, is also available to the public during weekdays from the American Lung Association of Connecticut in East Hartford. The number there is 289-5401 or 1-800-992-2263.

D. <u>QUALITY ASSURANCE</u>

Quality Assurance requirements for State and Local Air Monitoring Stations (SLAMS) and the National Air Monitoring Stations (NAMS), as part of the SLAMS network, are specified by the code of Federal Regulations, Title 40, Part 58, Appendix A.

The regulations were enacted to provide a consistent approach to Quality Assurance activities across the country so that ambient data with a defined precision and accuracy is produced.

A Quality Assurance program was initiated in Connecticut with written procedures covering, but not limited to, the following:

Equipment procurement
Equipment installation
Equipment calibration
Equipment operation
Sample analysis
Maintenance checks
Performance audits
Data handling
Data quality assessment

Quality assurance procedures for the above activities were fully operational on January 1, 1981 for all NAMS monitoring sites. On January 1, 1983 the above procedures were fully operational for all SLAMS monitoring sites.

Data precision and accuracy values are reported in the form of 95% probability limits as defined by equations found in Appendix A of the Federal regulations cited above.

1. **PRECISION**

Precision is a measure of data repeatability (grouping) and is determined as follows:

a. **Manual Samplers** (PM_{10})

A second (co-located) PM_{10} hi-vol sampler is placed alongside the regular network sampler and operated concurrently. The concentration values from the co-located hi-vol sampler are compared to the network sampler and precision values are generated from the comparison.

b. **Manual Samplers** (Lead)

A second (co-located) hi-vol sampler is placed alongside a regular network hi-vol sampler and operated concurrently. The concentration values from the co-located hi-vol sampler are compared to those from the network sampler, and precision values are generated from the comparison.

c. **Automated Analyzers** (SO_2, O_3, CO and NO_2)

All NAMS and SLAMS analyzers are challenged with a low level pollutant concentration a minimum of once every two weeks: 8 to 10 ppm for CO and 0.08 to 0.10 ppm for SO_2, O_3 and NO_2. The comparison of analyzer response to input concentration is used to generate automated analyzer precision values.

2. **ACCURACY**

Accuracy is an estimate of the closeness of a measured value to a known value and is determined in the following manner:

a. **Manual Methods** (PM_{10})

Accuracy for PM_{10} is assessed by auditing the flow measurement phase of the sampling method. In Connecticut, this is accomplished by attaching a secondary standard calibrated orifice to the hi-vol inlet and comparing the flow rates. A minimum of 25% of the PM_{10} network samplers is audited each quarter.

b. **Manual Methods** (Lead)

Accuracy for lead is assessed in two ways:

(1) By analyzing spiked samples and comparing the known spiked-sample concentrations with the measured concentrations, and

(2) By auditing the flow, as in 2.a. above.

Accuracy measurements are obtained each quarter.

c. **Automated Analyzers** (SO_2, O_3, CO and NO_2)

Automated analyzer data accuracy is determined by challenging each analyzer with three predetermined concentration levels (four for NO_2). Each quarter, accuracy values are calculated for approximately 25% of the analyzers in a pollutant sampling network, at each concentration level. The results for each concentration of a particular pollutant are used to assess automated analyzer accuracy. The audit concentration levels are as follows:

SO_2, O_3, and NO_2 (PPM)	**CO** (PPM)
0.03 to 0.08	3 to 8
0.15 to 0.20	15 to 20
0.35 to 0.45	35 to 45
0.80 to 0.90 (NO_2 only)	

TABLE 1-1

ASSESSMENT OF AMBIENT AIR QUALITY

POLLUTANT	SAMPLING PERIOD	DATA REDUCTION	STATISTICAL BASE	AMBIENT AIR QUALITY STANDARDS			
				PRIMARY		SECONDARY	
				μg/m³	ppm	μg/m³	ppm
Particulates (PM_{10})[a]	24 Hours (every sixth day)	24-Hour Average	Annual Arithmetic Mean[b]	50[c]		50[c]	
			24-Hour Average	150[d]		150[d]	
Sulfur Oxides (measured as sulfur dioxide)	Continuous	1-Hour Average	Annual Arithmetic Mean[e]	80	0.03		
			24-Hour Average[e]	365[f]	0.14[f]		
			3-Hour Average[e]			1300[f]	0.5[f]
Nitrogen Dioxide	Continuous	1-Hour Average	Annual Arithmetic Mean[e]	100	0.053	100	0.053
Ozone	Continuous	1-Hour Average	1-Hour Average	235[g]	0.12[g]	235[g]	0.12[g]
Lead	24 Hours (every sixth day)	Monthly Composite	Weighted 3-Month Average[h]	1.5		1.5	
Carbon Monoxide	Continuous	1-Hour Average	8-Hour Average[e]	10[f,i]	9[f]	10[f,i]	9[f]
			1-Hour Average	40[f]	35[f]	40[f]	35[f]

[a] Particulate matter with an aerodynamic diameter not greater than a nominal 10 micrometers.

[b] EPA assessment criteria require 4 calendar quarters of data per year and at least 75% of the scheduled samples per calendar quarter in each of the most recent 3 years.

[c] The "expected annual mean" for the most recent 3 years.

[d] The "expected number of exceedances" per calendar year should be less than or equal to one, for the most recent 3 years.

[e] EPA assessment criteria require at least 75% of the possible data to compute a valid average. For the annual mean, 9 months of data are required, and each calendar quarter must have at least 2 months of data. Furthermore, a valid month must have at least 21 days of data, and a valid day must have at least 18 hours of data.

[f] Not to be exceeded more than once per year.

[g] Daily maximum. The expected number of days that exceed the standard is not to average more than one per year in three years at a site.

[h] State of Connecticut assessment criteria require at least 75% of the scheduled samples to compute a valid average.

[i] Units are mg/m³, not μg/m³.

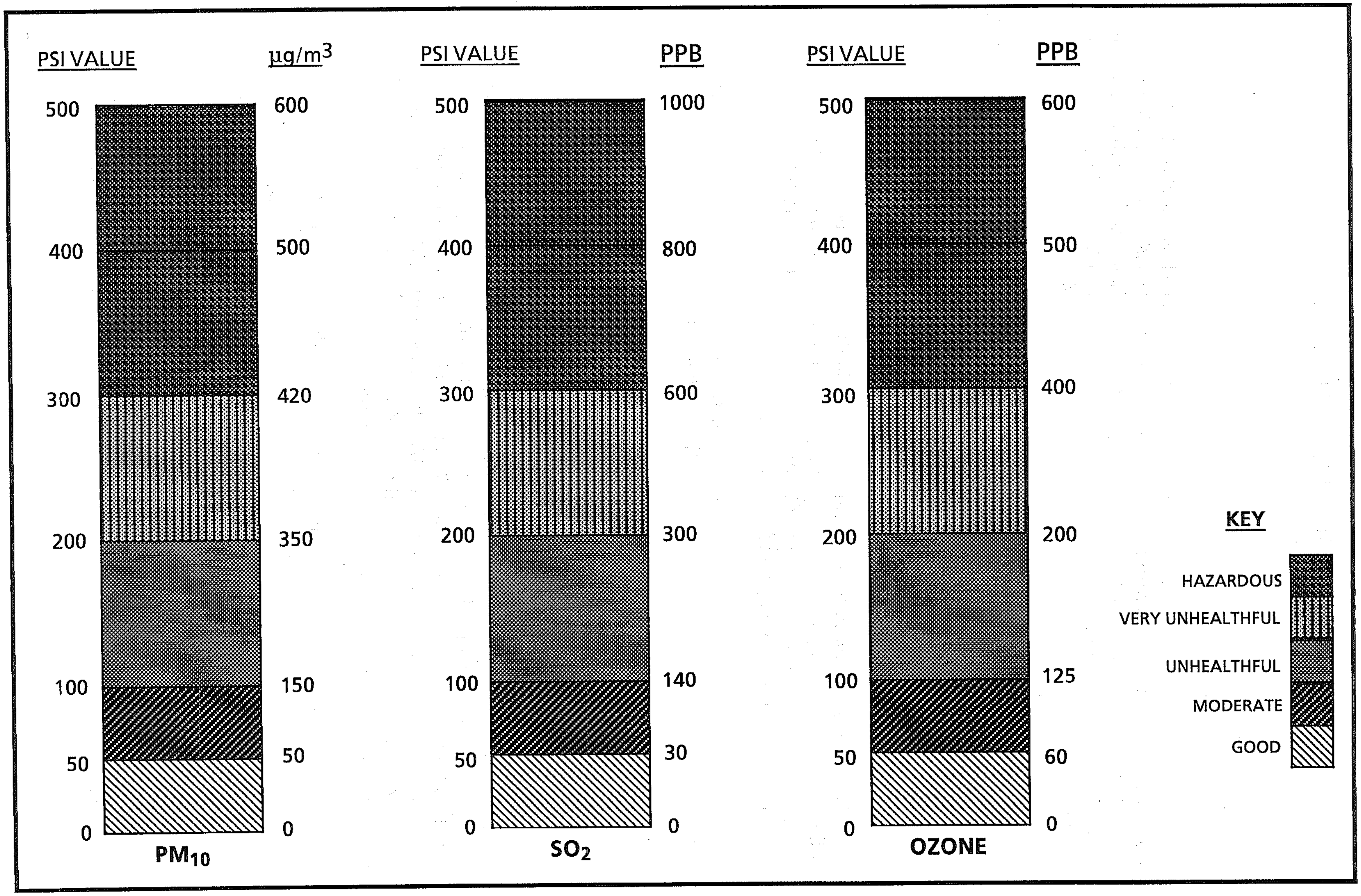
TABLE 1-2

AIR QUALITY STANDARDS EXCEEDED IN CONNECTICUT IN 1994 BASED ON MEASURED CONCENTRATIONS

		OZONE – Level Exceeding 1-Hour Standard (0.12 PPM)	
TOWN	SITE	Highest Observed Level (ppm)	Number of Days Standard Exceeded
Bridgeport	013	0.160	3
Danbury	123	0.141	2
East Hartford	003	0.169	2
Greenwich	017	0.155	4
Groton	008	0.132	1
Madison	002	0.149	2
Middletown	007	0.161	4
New Haven	123	0.151	3
Stafford	001	0.129	1
Stratford	007	0.187	4
Torrington	006	0.127	1

FIGURE 1-1

POLLUTANT STANDARDS INDEX



II. PARTICULATE MATTER

HEALTH EFFECTS

Particulate matter is the generic term for a broad class of chemically and physically diverse substances that exist as discrete particles (liquid droplets or solids) over a wide range of sizes. Particles originate from a variety of stationary and mobile sources. They may be emitted directly or formed in the atmosphere by transformations of gaseous emissions such as sulfur oxides, nitrogen oxides, and volatile organic substances. The chemical and physical properties of particulate matter vary greatly with time, region, meteorology and source category.

The major effects associated with high exposures to particulate matter include reduced lung function; interference with respiratory mechanics; aggravation or potentiation of existing respiratory and cardiovascular disease, such as chronic bronchitis and emphysema; increased susceptibility to infection; interference with clearance and other host defense mechanisms; damage to lung tissues; carcinogenesis and mortality.

Harm may also occur in the form of changes in the human body caused by chemical reactions with pollution particles that pass through the lung membranes to poison the blood or be carried by the blood to other organs. This can happen with inhaled lead, cadmium, beryllium, and other metals, and with certain complex organic compounds that can cause cancer.

Population subgroups that appear likely to be most sensitive to the effects of particulate matter include individuals with chronic obstructive pulmonary or cardiovascular disease, individuals with influenza, asthmatics, the elderly, children, smokers, and mouth or oronasal breathers.

REVISION OF THE PARTICULATE MATTER STANDARD

In 1971, the federal Environmental Protection Agency (EPA) promulgated primary and secondary national ambient air quality standards for particulate matter, measured as total suspended particulates or "TSP." The primary standards were set at 260 $\mu g/m^3$, 24-hour average not to be exceeded more than once per year, and 75 $\mu g/m^3$, annual geometric mean. The secondary standard, also measured as TSP, was set at 150 $\mu g/m^3$, 24-hour average not to be exceeded more than once per year. These standards were adopted by the state of Connecticut in 1972. In accordance with sections 108 and 109 of the Clean Air Act, EPA has reviewed and revised the health and welfare criteria upon which these primary and secondary particulate matter standards were based.

The TSP standard directs control efforts towards particles of lower risk to health because of its inclusion of large particles which can dominate the measured mass concentration, but which are deposited only in the extrathoracic region. Smaller particles penetrate furthest in the respiratory tract, settling in the tracheobronchial region and in the deepest portion of the lung, the alveolar region. Available evidence demonstrates that the risk of adverse health effects associated with deposition of typical ambient fine and coarse particles in the thorax are markedly greater than those associated with deposition in the extrathoracic region. EPA found that a size-specific indicator for primary standards representing small particles was warranted and that it should include particles of diameter less than or equal to a nominal 10 micrometers "cut point." Such a standard places substantially greater emphasis on controlling smaller particles than does a TSP indicator, but doesn't completely exclude larger particles from all control.

On March 20, 1984, EPA proposed changes in the standards for particulate matter based on its review and revision of the health and welfare criteria. On July 1, 1987, EPA announced its final decisions regarding these changes. They include: (1) replacing TSP as the indicator for particulate matter for the ambient standards with a new indicator that includes only those particles with an aerodynamic diameter less than or equal to a nominal 10 micrometers (PM_{10}); (2) replacing the 24-hour primary TSP standard with a 24-hour PM_{10} standard of 150 $\mu g/m^3$ with no more than one expected exceedance per year; (3) replacing the annual primary TSP standard with a PM_{10} standard of 50 $\mu g/m^3$, expected annual arithmetic mean; and (4) replacing the secondary TSP standard with 24-hour and annual PM_{10} standards that are identical in all respects to the primary standards. The federal standards became effective on July 31, 1987. On July 7, 1993, the state of Connecticut adopted these new standards for particulate matter.

CONCLUSIONS

Measured PM_{10} concentrations during 1994 did not exceed the 50 $\mu g/m^3$ level of the primary and secondary annual standards or the 150 $\mu g/m^3$ level of the primary and secondary 24-hour standards at any site. Moreover, the 24-hour standards were not violated because the "expected number of exceedances" for the most recent 3 years at each site did not exceed one per year, and the annual standards were also not violated anywhere because the "expected annual mean" for the most recent 3 years at each site did not exceed 50 $\mu g/m^3$.

SAMPLE COLLECTION AND ANALYSIS

High Volume Sampler (Hi-vol) - The high volume sampler resembles a vacuum cleaner in its operation, with an 8" X 10" piece of fiberglass filter paper replacing the vacuum bag. Hi-vols are equipped with retractable lids in order to eliminate the passive sampling error. The sampler normally operates every sixth day (midnight to midnight, standard time).

The matter collected on the filters is analyzed for weight in the case of the PM_{10} samplers and for both weight and chemical composition in the case of the hi-vol samplers. The chemical composition of the suspended particulate matter is determined at each hi-vol site as follows. Two standardized strips of every filter are cut out and prepared for two different analyses. In the first analysis, a sample is digested in acid and the resulting solution is analyzed for metals by means of an atomic absorption spectrophotometer. The results are reported for each individual metal in $\mu g/m^3$. In the second analysis, a sample is dissolved in water, filtered and the resulting solution is analyzed by means of wet chemistry techniques to determine the concentration of certain water soluble components. The results are reported for each individual constituent of the water soluble fraction in $\mu g/m^3$.

PM_{10} Sampler - Before 1988, Connecticut's particulate sampling network was comprised of standard high-volume (hi-vol) samplers, whose function was to measure TSP. With the promulgation of a PM_{10} standard, hi-vol samplers were needed that could screen out most particles larger than 10 microns. The samplers also had to be omnidirectional and have a constant inlet velocity so that wind direction and speed would not affect the amount of material collected.

In anticipation of a PM_{10} standard being promulgated, Connecticut installed a small number of PM_{10} samplers in 1985. The samplers, manufactured by Sierra-Andersen, were the first PM_{10} samplers on the market. These early samplers were found to have relatively high maintenance requirements and to be biased towards particles larger than 10 microns. To remedy these problems, the samplers were physically modified after 1986. In 1987, PM_{10} samplers by Wedding & Associates came on the market. These samplers replaced the Andersen samplers in the sampling network in 1988. The Wedding samplers have demonstrated lower maintenance requirements and greater precision (repeatability) and accuracy than the Andersen samplers they replaced.

The PM_{10} samplers, like the standard hi-vol samplers, operate from midnight to midnight (standard time) at least every sixth day at all sites. However, PM_{10} samplers use quartz fiber filters instead of fiberglass filters, in order to eliminate sulfate artifact formation. And the matter collected on the filter is analyzed only for weight and sulfates at the present time. The air flow is recorded during sampling. The weight in micrograms (µg) divided by the volume of air in standard cubic meters (m^3) yields the concentration of PM_{10} for the day in micrograms per cubic meter.

TEOM Sampler - In addition to the hi-vol samplers for TSP and PM_{10} monitoring, Connecticut operates at the Danbury 123 site a real-time PM_{10} monitor that employs tapered element oscillating microbalance (TEOM) technology. The TEOM technique utilizes an exchangeable filter cartridge on the end of a hollow tapered tube. The other (wider) end of the tube is fixed. Air is passed through the filter, on which particulate matter deposits, and the filtered air passes through the tapered tube to a flow controller.

The tapered tube is maintained in oscillation. The frequency of oscillation is dependent upon the physical characteristics of the tapered tube and the mass on its free end. As particulate matter lands on the filter, the filter mass change is detected as a frequency change in the oscillation of the tube. The mass of the particulate matter is then determined directly and inertially. When this mass change is combined with the flow rate through the system, the device yields an accurate measurement of the particulate concentration in real time.

Such a continuous particulate monitoring system has advantages over manual systems like the hi-vol. Not only does TEOM technology provide more detailed information than a 24-hour average, but it also reduces the amount of labor required for these measurements, since the filter handling procedures are significantly reduced.

DISCUSSION OF DATA

Monitoring Network - In 1994, 30 PM_{10} sampling sites were operated in Connecticut (see Figure 2-1). As was mentioned earlier, the PM_{10} sampler at the Danbury 123 site employs TEOM technology. One TSP sampler was operated and it was located at the Stamford 001 site, which was the only designated TSP site in the State. EPA requires the operation of one TSP site in Connecticut for the sake of historical continuity. In addition, as part of the 1994 network for monitoring the airborne concentrations of lead, five hi-vol sampling sites were used to gather information on the chemical composition of TSP in the state. The locations were Bridgeport 010, East Hartford 004, Hartford 016, New Haven 018 and Waterbury 123.

Precision and Accuracy - Precision checks were conducted at three PM_{10} sampling sites which had co-located samplers. On the basis of 148 precision checks, the 95% probability limits for precision ranged from -7% to +9%. Accuracy is based on air flow through the monitor. The 95% probability limits for accuracy, based on 31 audits conducted on the PM_{10} monitoring system network, ranged from 0% to +8%. (See section I.D. of this Air Quality Summary for a discussion of precision and accuracy.)

Annual Averages - The Federal EPA has established minimum sampling criteria (see Table 1-1) for use in determining compliance with the primary and secondary annual NAAQS for PM_{10}. A site must have 75% of the scheduled samples in each calendar quarter for the the most recent 3 years. Using the EPA criteria, one finds that a determination of attainment or nonattainment of the 50 µg/m^3 primary and secondary annual standards could be obtained at 19 of the 30 PM_{10} monitoring sites in Connecticut in 1994. These 19 sites proved to be in attainment of the annual standards. A determination of attainment or nonattainment could not be obtained at Bridgeport 010, Bridgeport 014, Danbury 123, Greenwich 017, Hartford 015, New Britain 012, New Haven 018, New London 004, Stamford 001, Torrington 001, and Voluntown 001, where there were insufficient data at each site in at least one calendar quarter during the most recent three years. The primary reason for the loss of data at many of the these sites was the existence of defects in the filters used in the particulate samplers. Nevertheless, given the 95 percent confidence limits about the annual mean at these sites (see Table 2-1), it is likely that attainment was achieved.

A summary of annual average PM_{10} data for 1992 -1994 is presented in Table 2-1. This table also includes an indication of whether the aforementioned EPA minimum sampling criteria were met at each site for each year. If the sampling was insufficient to meet the EPA criteria, an asterisk appears next to the number of samples. Figure 2-2 illustrates the annual average PM_{10} concentrations at each site in 1994 in descending order of magnitude.

Statistical Projections - The statistical projections presented in Table 2-1 are prepared by a DEP computer program which analyzes data from all sites operated by DEP. Inputs to the program include the site location, the year, the number of samples (usually a maximum of 61), the annual arithmetic and geometric mean concentrations, and the arithmetic and geometric standard deviations. For each site, the program lists the inputs, calculates the 95% confidence limits about the annual arithmetic mean, and predicts the number of days in each year that the level of the primary and secondary 24-hour standards (i.e., 150 $\mu g/m^3$) would have been exceeded if sampling had been conducted every day. For comparison, Table 2-1 also shows the number of days at each site when the level of the primary and secondary 24-hour standards was actually exceeded, if any, as demonstrated by actual measurements at the site.

The statistical predictions of the number of days that would have seen an exceedance of the level of the 24-hour standards are based on the assumption of a lognormal distribution of the data. They indicate that more frequent PM_{10} sampling in the period from 1992 to 1994 at any site would not have resulted in an exceedance of the 24-hour standards.

Because manpower and economic limitations dictate that PM_{10} sampling for particulate matter cannot be conducted every day, a degree of uncertainty is introduced as to whether the air quality at a site has either met or exceeded the level of the annual standards. This uncertainty can be expressed by means of a statistic called a confidence limit. Assuming a normal distribution of the pollutant data, 95% confidence limits were calculated about the annual arithmetic mean at each site. For example (see Table 2-1), at Norwalk 014 in 1992, 59 samples were analyzed and an arithmetic mean of 29.4 $\mu g/m^3$ was then calculated. The columns labeled "95-PCT-LIMITS" show the lower and upper limits of the 95% confidence interval to be 26.6 and 32.2 $\mu g/m^3$, respectively. This means that, if sampling were done every day, there is a 95% chance that the true arithmetic mean would fall between these limits. Since the upper 95% limit is less than 50 $\mu g/m^3$, one can be confident that the level of the annual standards was not exceeded at the site. However, if the upper 95% limit were greater, and the lower limit less, than 50 $\mu g/m^3$, then one could not be confident that the standard was not exceeded at the site. And if both the upper and lower 95% limits were greater than 50 $\mu g/m^3$, then one could assume that the level of the standards was indeed exceeded sometime during the year. These three possibilities are illustrated in Figure 2-3.

Table 2-2 summarizes the statistical predictions from Table 2-1 regarding compliance with the level of the annual air quality standards, using the 95% confidence limit criteria. The table shows that the level of the primary and secondary annual standards was probably achieved at the 26 sites that met the minimum sampling criteria in 1994. The results for previous years are also tabulated.

It should be noted that the above discussion of statistics does not affect the actual determination of attainment or nonattainment of the PM_{10} standards. The promulgated regulations specify the requirements for making an attainment determination. Those requirements, mentioned in a limited way in Table 1-1, address the projection of exceedances and the calculation and use of arithmetic means in ways that are different from the foregoing discussion.

24-Hour Averages - Figure 2-4 presents the maximum 24-hour concentrations recorded at each site. There were no PM_{10} concentrations at any site that exceeded the 150 $\mu g/m^3$ level of the primary and secondary 24-hour standards in 1994. Of the 19 sites that had sufficient data in both 1993 and 1994, 18 sites had higher maximum concentrations and 1 site had a lower maximum concentration. The largest increase was 25 $\mu g/m^3$ at East Hartford 004 and Willimantic 002; the one decrease was 8 $\mu g/m^3$ at Waterbury 123.

Table 2-3 summarizes the statistical predictions from Table 2-1 regarding the number of sites that would have seen PM_{10} concentrations exceeding the level of the 24-hour standards, if sampling had been conducted every day. In 1994, there were no such sites. The results for the preceding years are also given. In all cases, results are presented only for those sites that met the minimum sampling criteria for the year.

A determination of actual compliance with the primary and secondary 24-hour standards can be made for a site only when the minimum sampling criteria are met in each calendar quarter for the most recent 3 years. Based on these criteria, compliance was achieved at 19 of the 30 sites in 1994. A determination of compliance could not be made for the 11 sites mentioned earlier because there were insufficient data at each site in at least one calendar quarter during the most recent three years. But based upon the data that is available, it is highly improbable that an exceedance would have occurred at any of these sites.

Hi-vol Averages - Quarterly and annual averages of the chemical components from the hi-vol TSP/lead monitors have been computed for 1994 and are presented in Table 2-4.

10 High Days with Wind Data - Table 2-5 lists the 10 highest 24-hour average PM_{10} readings with the dates of occurrence for each of the 26 PM_{10} hi-vol site in Connecticut which complied with EPA's minimum sampling criteria in 1994. This table also shows the average wind conditions which occurred on each of these dates. The resultant wind direction (DIR, in compass degrees clockwise from true north) and velocity (VEL, in mph), the average wind speed (SPD, in mph), and the ratio between the velocity and the speed are presented for each of four National Weather Service stations located in or near Connecticut. The resultant wind direction and velocity are vector quantities and are computed from the individual wind direction and speed readings in each day. The closer the wind speed ratio is to 1.000, the more persistent the wind. It should be noted that the Connecticut stations have local influences which change the speed and shift the direction of the near-surface air flow (e.g., the Bradley Field air flow is channeled north-south by the Connecticut River Valley and the Bridgeport air flow is frequently subject to sea breezes).

On a statewide basis, this table shows that approximately 53% of the high PM_{10} days occur with winds out of the southwest quadrant and most of those days have relatively persistent winds. This relationship between southwest winds and high particulate levels has historically been more prevalent in southwestern Connecticut. However, many of the maximum levels at some urban sites do not occur with southwest winds, indicating that these sites are possibly influenced by local sources or transport from different out-of-state sources. As noted above, a large scale southwesterly air flow is often diverted into a southerly flow up the Connecticut River Valley. At sites in the Connecticut River Valley, many of the highest PM_{10} days occur when the winds at Bradley Airport are from the south.

Trends - Pollutant trends can be illustrated in a number of ways. We wish here to portray a PM_{10} trend that is both statewide in nature and relevant to one of the ambient air quality standards. Therefore, we have chosen to average the annual mean PM_{10} concentrations at a number of sites from 1989 -- the first full year of PM_{10} monitoring -- to the present (see Figure 2-5). In spite of the year-to-year changes, statewide PM_{10} levels appear to be trending down over the past 6 years.

Significant changes in annual PM_{10} levels can be caused by a number of things. Among these are simple changes of weather; changes in annual fuel use associated with conservation efforts or heating demand; the frequency of precipitation events, which wash out particulates from the atmosphere; changes in average wind speed, since higher winds result in greater dilution of emissions; and a change in the frequency of southwesterly winds, which affect the amount of particulate matter transported into Connecticut from the New York City metropolitan area and from other sources of emissions located to the southwest. In illustrating a trend, these year-to-year effects can be diminished, if not eliminated, by using a moving average of three years or more. Figure 2-6 illustrates the trend of PM_{10} using a 3-year moving average. The trend is clearly down.

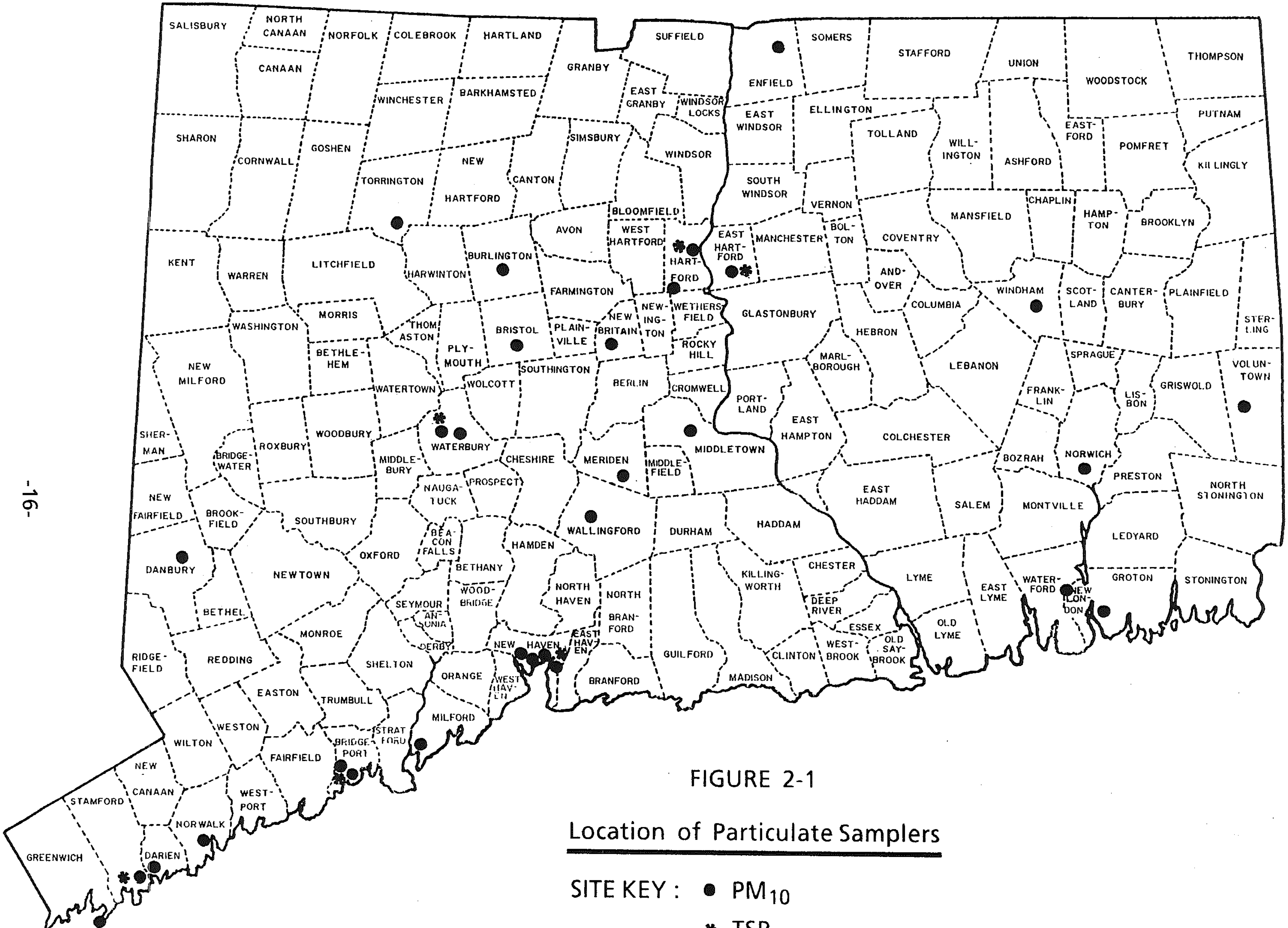


FIGURE 2-1

Location of Particulate Samplers

SITE KEY : ● PM_{10}

✱ TSP

TABLE 2-1

1992-1994 PM10 ANNUAL AVERAGES AND STATISTICAL PROJECTIONS

TOWN NAME	SITE	YEAR	SAMPLES	ARITHMETIC MEAN	95-PCT-LIMITS LOWER	95-PCT-LIMITS UPPER	STANDARD DEVIATION	PREDICTED DAYS OVER 150 UG/M3	MEASURED DAYS OVER 150 UG/M3
BRIDGEPORT	010	1992	60	22.4	20.0	24.7	9.987		
BRIDGEPORT	010	1993	57	20.8	18.0	23.7	11.814		
BRIDGEPORT	010	1994	50*	26.0	22.1	29.9	14.777		
BRIDGEPORT	014	1992	12*	29.7	21.5	37.9	13.098		
BRIDGEPORT	014	1993	24*	27.3	22.6	32.1	11.707		
BRIDGEPORT	014	1994	56	30.2	27.0	33.4	13.034		
BRISTOL	001	1992	60	19.4	17.0	21.8	10.296		
BRISTOL	001	1993	57	17.9	15.6	20.2	9.402		
BRISTOL	001	1994	58	18.3	15.7	20.9	10.770		
BURLINGTON	001	1992	60	14.0	12.1	15.9	7.993		
BURLINGTON	001	1993	55	12.9	11.0	14.8	7.690		
BURLINGTON	001	1994	55	14.3	11.8	16.8	10.037		
CORNWALL	005	1992	49*	13.3	11.2	15.4	7.837		
CORNWALL	005	1993	52*	12.4	10.0	14.9	9.374		
DANBURY	123	1992	45*	21.8	18.5	25.2	11.879		
DANBURY	123	1993	57	18.8	15.9	21.7	11.844		
DANBURY	123	1994	52*	22.1	18.9	25.3	12.517		
DARIEN	001	1992	59	24.5	22.3	26.7	9.149		
DARIEN	001	1993	60	23.4	20.9	25.9	10.532		
DARIEN	001	1994	54	28.2	24.5	31.9	14.838		
EAST HARTFORD	004	1992	57	20.5	17.7	23.3	11.457		
EAST HARTFORD	004	1993	56	18.8	16.3	21.2	10.070		
EAST HARTFORD	004	1994	59	21.9	18.7	25.2	13.575		
ENFIELD	005	1992	59	19.1	15.5	22.6	15.037		
ENFIELD	005	1993	59	15.4	13.5	17.4	8.152		
ENFIELD	005	1994	55	16.7	13.8	19.5	11.359		

* THE NUMBER OF SAMPLES IS NOT SUFFICIENT TO COMPLY WITH THE MINIMUM SAMPLING CRITERIA.

TABLE 2-1, CONTINUED

1992-1994 PM10 ANNUAL AVERAGES AND STATISTICAL PROJECTIONS

TOWN NAME	SITE	YEAR	SAMPLES	ARITHMETIC MEAN	95-PCT-LIMITS LOWER	95-PCT-LIMITS UPPER	STANDARD DEVIATION	PREDICTED DAYS OVER 150 UG/M3	MEASURED DAYS OVER 150 UG/M3
GREENWICH	017	1992	43*	18.2	15.8	20.5	8.151		
GREENWICH	017	1993	37*	16.5	14.2	18.9	7.314		
GREENWICH	017	1994	55	20.1	17.0	23.3	12.476		
GROTON	006	1992	61	18.8	16.4	21.2	10.299		
GROTON	006	1993	57	17.0	15.0	19.0	8.238		
GROTON	006	1994	58	20.2	17.7	22.8	10.525		
HARTFORD	013	1992	60	20.0	17.1	22.8	11.987		
HARTFORD	013	1993	59	17.4	15.3	19.5	8.863		
HARTFORD	013	1994	57	19.7	16.9	22.6	11.666		
HARTFORD	015	1992	61	25.0	22.2	27.9	12.221		
HARTFORD	015	1993	53*	23.3	20.4	26.2	11.291		
HARTFORD	015	1994	52	25.6	22.1	29.1	13.492		
MERIDEN	002	1992	58	21.1	18.2	23.9	11.807		
MERIDEN	002	1993	57	19.3	16.7	21.8	10.322		
MERIDEN	002	1994	54	19.8	16.9	22.7	11.503		
MIDDLETOWN	003	1992	59	20.9	18.0	23.8	12.176		
MIDDLETOWN	003	1993	56	18.7	16.5	21.0	9.186		
MIDDLETOWN	003	1994	53	21.6	18.5	24.8	12.315		
MILFORD	010	1992	61	17.2	15.0	19.4	9.339		
MILFORD	010	1993	60	16.7	14.6	18.7	8.826		
MILFORD	010	1994	53	18.7	16.0	21.3	10.524		
NEW BRITAIN	012	1992	55*	20.0	17.1	22.9	11.578		
NEW BRITAIN	012	1993	38*	19.9	16.3	23.5	11.600		
NEW BRITAIN	012	1994	56	20.1	17.2	22.9	11.566		
NEW HAVEN	013	1992	57	21.5	18.6	24.3	11.682		
NEW HAVEN	013	1993	59	19.8	17.3	22.3	10.448		
NEW HAVEN	013	1994	53	23.1	19.9	26.4	12.694		

* THE NUMBER OF SAMPLES IS NOT SUFFICIENT TO COMPLY WITH THE MINIMUM SAMPLING CRITERIA.

TABLE 2-1, CONTINUED

1992-1994 PM10 ANNUAL AVERAGES AND STATISTICAL PROJECTIONS

TOWN NAME	SITE	YEAR	SAMPLES	ARITHMETIC MEAN	95-PCT-LIMITS LOWER	95-PCT-LIMITS UPPER	STANDARD DEVIATION	PREDICTED DAYS OVER 150 UG/M3	MEASURED DAYS OVER 150 UG/M3
NEW HAVEN	018	1992	57	33.6	29.8	37.4	15.606		
NEW HAVEN	018	1993	57	34.4	30.1	38.8	17.801		
NEW HAVEN	018	1994	50*	41.2	36.0	46.3	19.444	1	
NEW HAVEN	020	1992	59	22.8	20.3	25.4	10.691		
NEW HAVEN	020	1993	57	24.0	20.9	27.0	12.470		
NEW HAVEN	020	1994	58	26.6	23.3	29.9	13.601		
NEW HAVEN	123	1992	57	23.5	20.6	26.4	11.986		
NEW HAVEN	123	1993	57	21.7	19.0	24.4	11.041		
NEW HAVEN	123	1994	56	27.8	23.8	31.7	15.932		
NEW LONDON	004	1992	59	20.3	17.8	22.8	10.534		
NEW LONDON	004	1993	53*	17.5	15.3	19.7	8.710		
NEW LONDON	004	1994	58	21.6	18.9	24.3	11.126		
NORWALK	014	1992	59	29.4	26.6	32.2	11.926		
NORWALK	014	1993	55	29.7	26.5	33.0	12.875		
NORWALK	014	1994	52	36.6	32.2	41.0	17.132	1	
NORWICH	002	1992	58	19.6	16.7	22.4	12.010		
NORWICH	002	1993	57	18.9	16.6	21.2	9.362		
NORWICH	002	1994	55	22.4	19.4	25.3	11.868		
STAMFORD	001	1992	59	21.1	18.7	23.4	9.897		
STAMFORD	001	1993	57	19.7	17.2	22.2	10.124		
STAMFORD	001	1994	51*	23.3	19.7	26.8	13.549		
TORRINGTON	001	1992	60	18.6	16.0	21.2	10.962		
TORRINGTON	001	1993	56*	18.0	15.3	20.6	10.807		
TORRINGTON	001	1994	57	19.2	16.3	22.1	11.835		
VOLUNTOWN	001	1992	60	13.5	11.3	15.8	9.447		
VOLUNTOWN	001	1993	55*	12.2	10.5	13.9	6.787		
VOLUNTOWN	001	1994	55	15.3	12.9	17.8	9.855		

* THE NUMBER OF SAMPLES IS NOT SUFFICIENT TO COMPLY WITH THE MINIMUM SAMPLING CRITERIA.

TABLE 2-1, CONTINUED

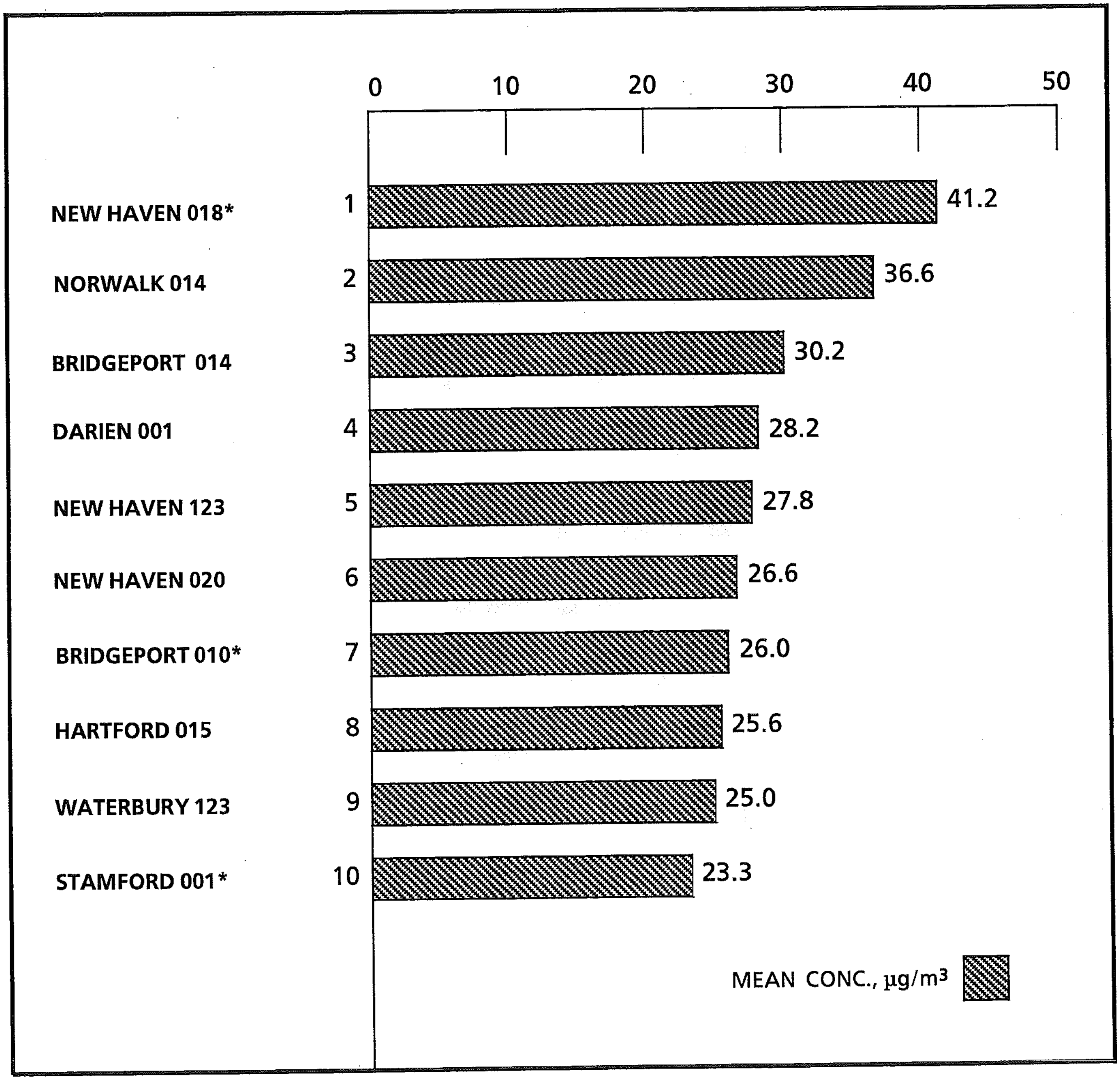
1992-1994 PM10 ANNUAL AVERAGES AND STATISTICAL PROJECTIONS

TOWN NAME	SITE	YEAR	SAMPLES	ARITHMETIC MEAN	95-PCT-LIMITS LOWER	95-PCT-LIMITS UPPER	STANDARD DEVIATION	PREDICTED DAYS OVER 150 UG/M3	MEASURED DAYS OVER 150 UG/M3
WALLINGFORD	006	1992	58	20.8	17.9	23.7	11.923		
WALLINGFORD	006	1993	55	18.2	15.9	20.5	9.321		
WALLINGFORD	006	1994	56	20.5	17.3	23.7	12.881		
WATERBURY	007	1992	59	22.3	19.5	25.0	11.627		
WATERBURY	007	1993	57	21.6	18.6	24.7	12.584		
WATERBURY	007	1994	53	22.7	19.3	26.1	13.306		
WATERBURY	123	1992	59	22.5	19.8	25.1	11.038		
WATERBURY	123	1993	59	22.6	19.5	25.7	12.970		
WATERBURY	123	1994	54	25.0	22.0	27.9	11.701		
WILLIMANTIC	002	1992	57	19.2	16.6	21.9	10.824		
WILLIMANTIC	002	1993	60	18.2	15.8	20.5	9.920		
WILLIMANTIC	002	1994	58	19.9	16.9	22.8	12.196		

* THE NUMBER OF SAMPLES IS NOT SUFFICIENT TO COMPLY WITH THE MINIMUM SAMPLING CRITERIA.

FIGURE 2-2

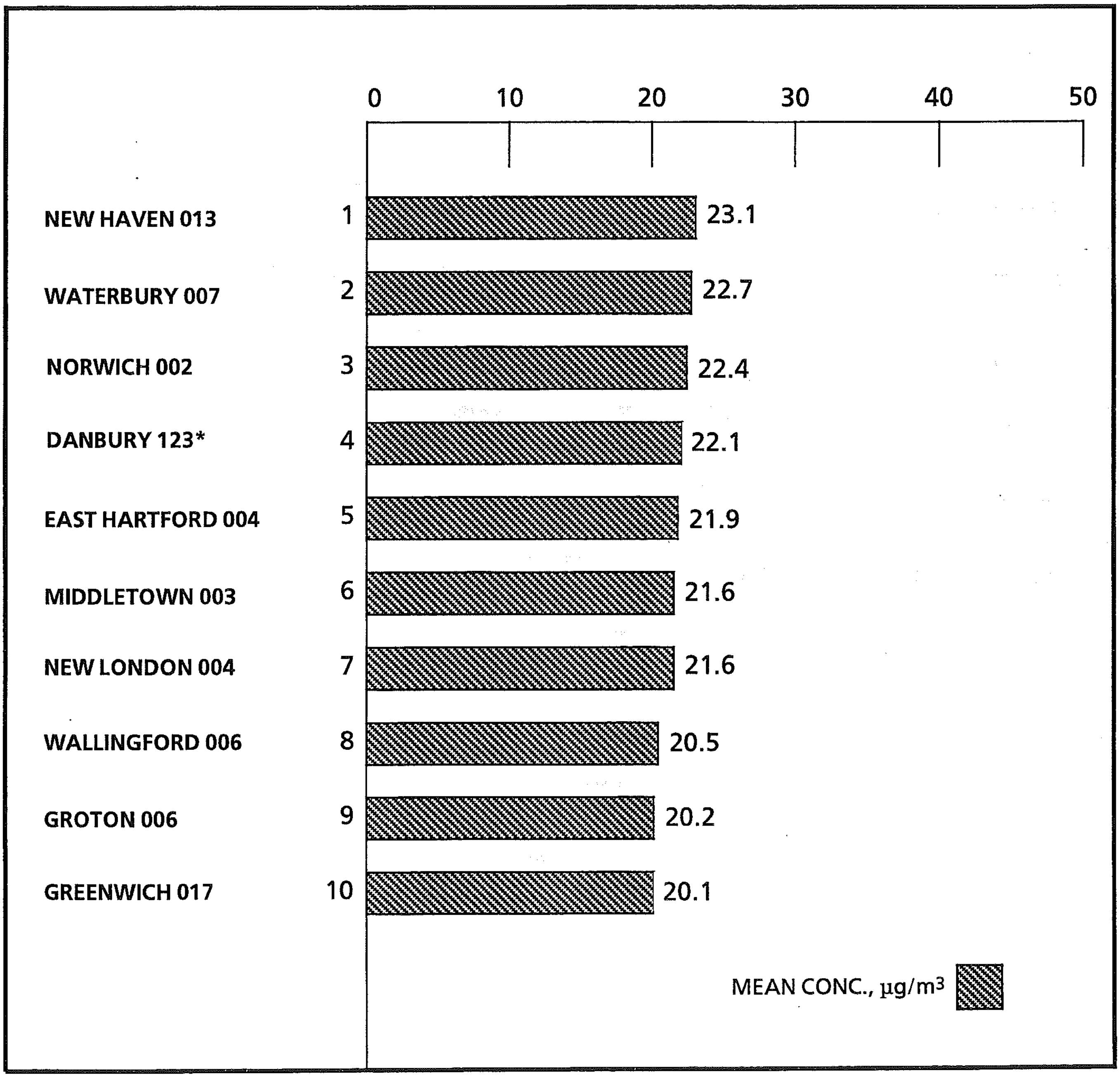
1994 ANNUAL AVERAGE PM10 CONCENTRATIONS



* The site has insufficient data to satisfy the minimum sampling criteria for the year.

FIGURE 2-2, continued

1994 ANNUAL AVERAGE PM10 CONCENTRATIONS



* The site has insufficient data to satisfy the minimum sampling criteria for the year.

FIGURE 2-2, continued

1994 ANNUAL AVERAGE PM10 CONCENTRATIONS

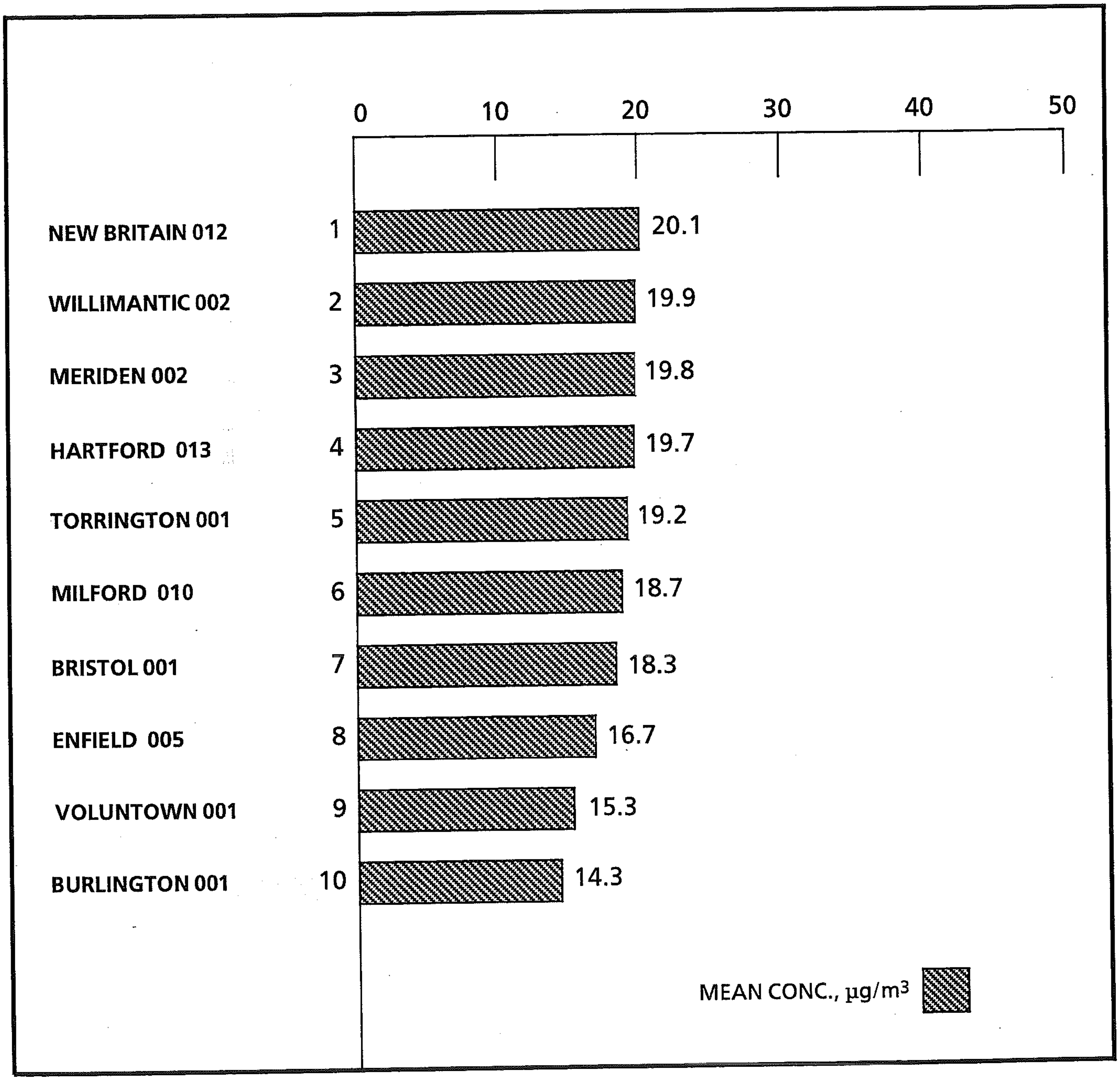
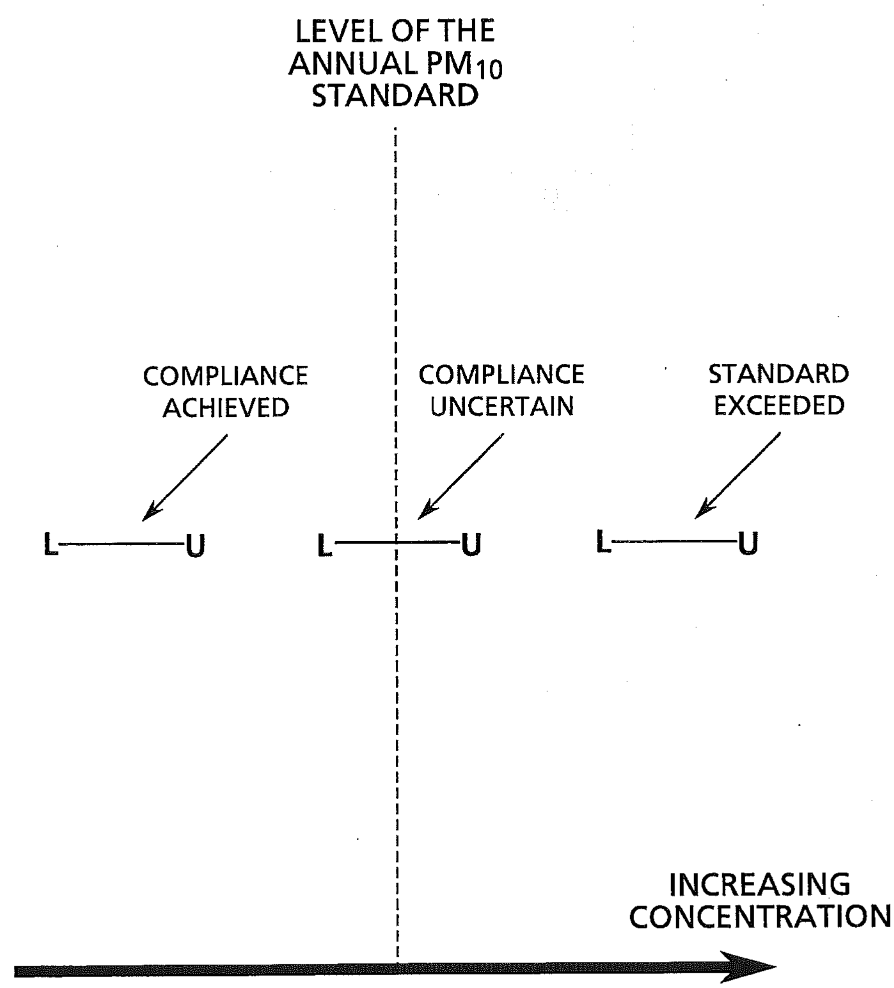


FIGURE 2-3

COMPLIANCE WITH THE LEVEL OF THE ANNUAL PM10 STANDARDS USING 95% CONFIDENCE LIMITS ABOUT THE ANNUAL ARITHMETIC MEAN CONCENTRATION



L = The lower limit of the 95% confidence interval about the annual arithmetic mean concentration.

U = The upper limit of the 95% confidence interval about the annual arithmetic mean concentration.

TABLE 2-2

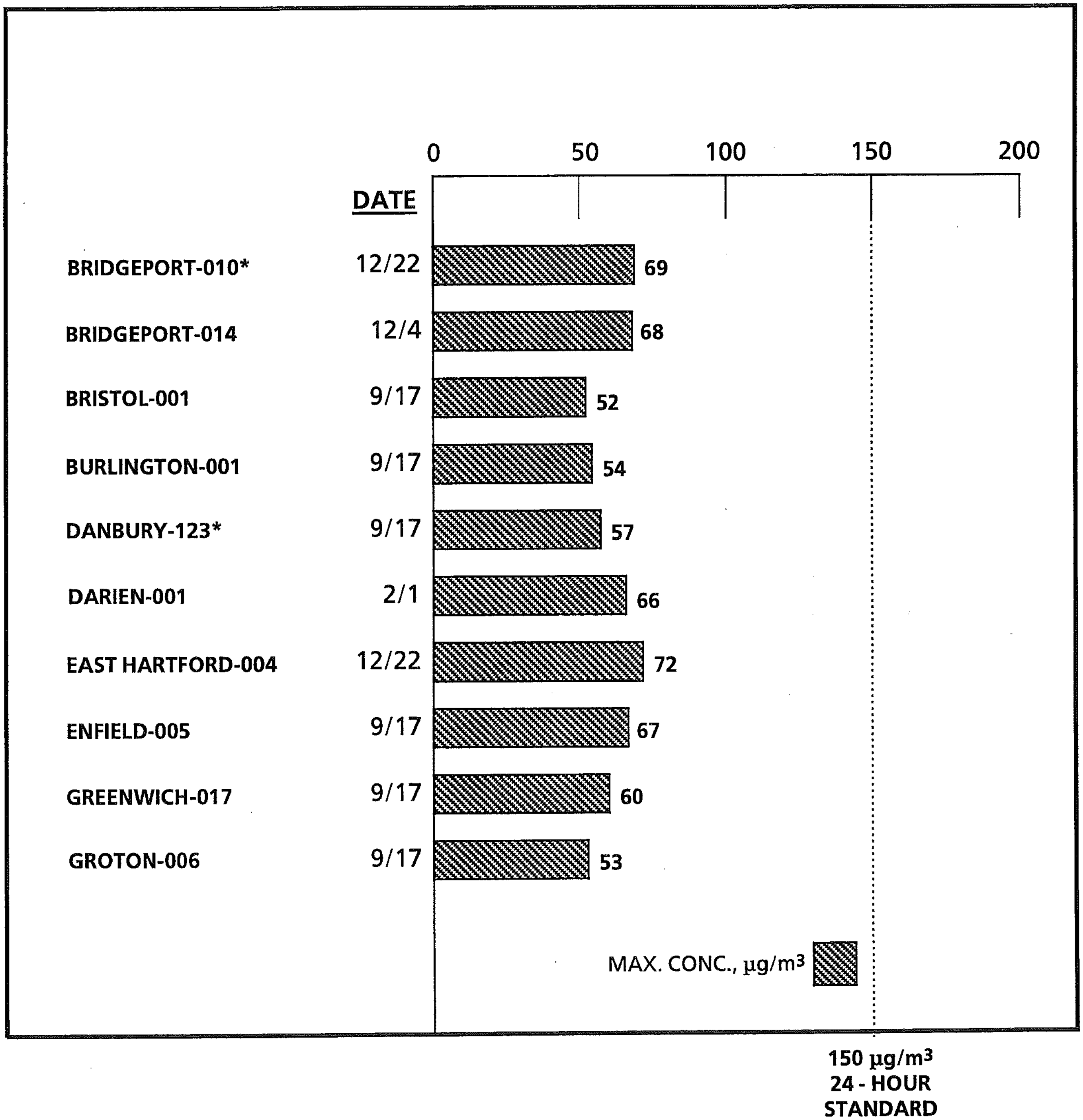
STATISTICALLY PREDICTED NUMBER OF SITES IN COMPLIANCE WITH THE LEVEL OF THE ANNUAL PM10 STANDARDS*

	COMPLIANCE ACHIEVED	COMPLIANCE UNCERTAIN	STANDARD EXCEEDED
1985	2	0	0
1986	4	0	1
1987	4	0	1
1988	3	0	0
1989	40	0	0
1990	39	0	0
1991	30	0	0
1992	28	0	0
1993	23	0	0
1994	26	0	0

* Using 95% confidence limits about the arithmetic mean concentration at only those sites which had sufficient data to satisfy the minimum sampling criteria for the year.

FIGURE 2-4

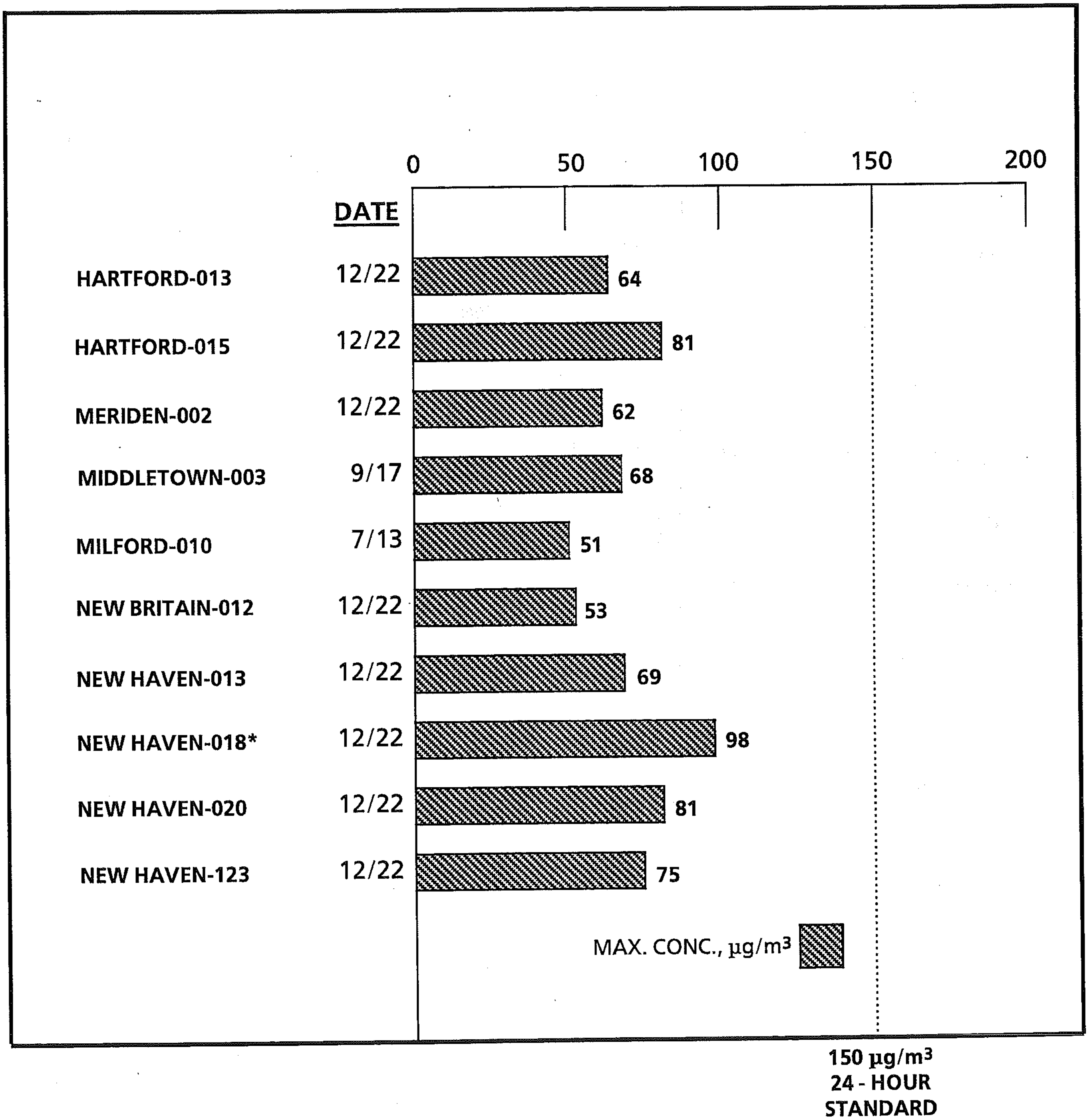
1994 MAXIMUM 24-HOUR PM10 CONCENTRATIONS



* The site has insufficient data to satisfy the minimum sampling criteria for the year.

FIGURE 2-4, continued

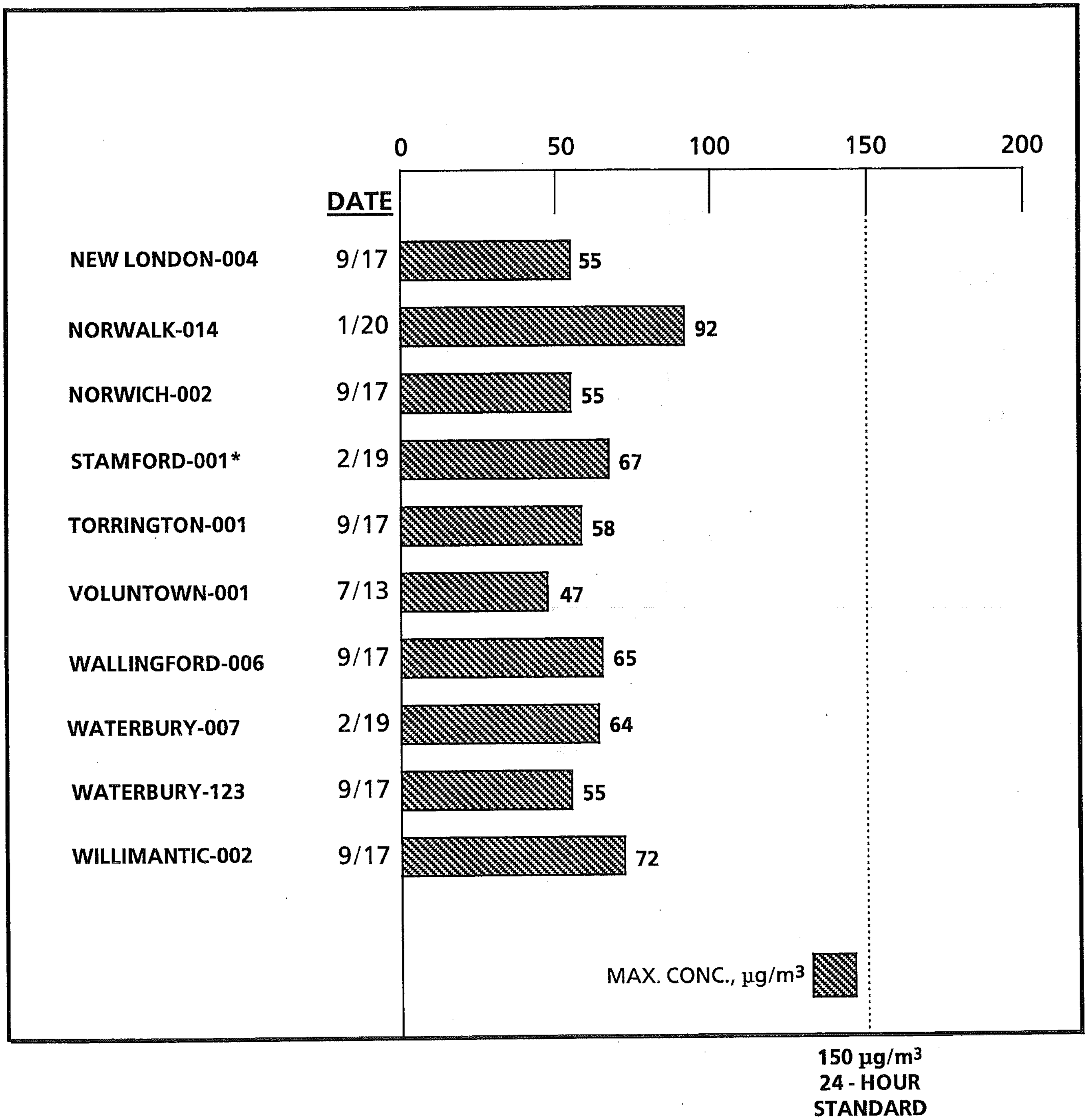
1994 MAXIMUM 24-HOUR PM10 CONCENTRATIONS



* The site has insufficient data to satisfy the minimum sampling criteria for the year.

FIGURE 2-4, continued

1994 MAXIMUM 24-HOUR PM10 CONCENTRATIONS



* The site has insufficient data to satisfy the minimum sampling criteria for the year.

TABLE 2-3

SUMMARY OF THE STATISTICALLY PREDICTED NUMBER OF PM10 SITES EXCEEDING THE LEVEL OF THE 24-HOUR STANDARDS

		SITES WITH ≥ 1 DAY EXCEEDING 150 μg/m³	
YEAR	NO. OF SITES[1]	No. of Sites	Percentage of All Sites
1985	2	0	0%
1986	5	2	40%
1987	5	1	20%
1988	3	1	33%
1989	40	1	3%
1990	39	0	0%
1991	30	0	0%
1992	28	0	0%
1993	23	0	0%
1994	26	0	0%

[1] Only those sites which had sufficient data to satisfy the minimum sampling criteria for the year.

TABLE 2-4

QUARTERLY CHEMICAL CHARACTERIZATION OF 1994 HI-VOL TSP

TOWN	AREA	SITE
BRIDGEPORT	**0060**	**010**

	QUARTERLY AVG				ANNUAL AVG
	1ST	2ND	3RD	4TH	
METALS (ng/m^3)					
BERYLLIUM	<.1	<.1	<.1	<.1	<.1
CADMIUM	1.1	1.3	3.1	0.8	1.6
CHROMIUM	5	17	<1	1	6[a]
COPPER	50	30	50	10	40
IRON	1280	780	580	580	770
LEAD	20	20	10	10	20
MANGANESE	20	12	8	9	12
NICKEL	13	5	6	9	8
VANADIUM	20	10	<10	10	10[a]
ZINC	50	110	50	30	60
WATER SOLUBLES (ng/m^3)					
NITRATE	4410	3620	4090	3300	3820
SULFATE	9520	10870	12960	9420	10860
AMMONIUM	90	<10	<10	290	90[b]
TSP ($\mu g/m^3$)	60	52	45	42	49
SAMPLE COUNT	10	14	15[c]	14	

[a] The annual average was calculated using one-half the detectable limit in the 3rd quarter.
[b] The annual average was calculated using one-half the detectable limit in the 2nd and 3rd quarters.
[c] The sample count for sulfate and TSP is 16 in the 3rd quarter.

TABLE 2-4, CONTINUED

QUARTERLY CHEMICAL CHARACTERIZATION OF 1994 HI-VOL TSP

TOWN	AREA	SITE
EAST HARTFORD	**0220**	**004**

	QUARTERLY AVG				ANNUAL AVG
	1ST	2ND	3RD	4TH	
METALS (ng/m³)					
BERYLLIUM	<.1	<.1	<.1	<.1	<.1
CADMIUM	1.0	0.8	1.0	1.0	1.0
CHROMIUM	3	3	<1	2	2[a]
COPPER	50	60	100	10	50
IRON	540	580	470	650	560
LEAD	10	10	10	10	10
MANGANESE	11	10	7	10	10
NICKEL	10	3	5	9	7
VANADIUM	20	<10	<10	10	10[b]
ZINC	30	30	40	40	40
WATER SOLUBLES (ng/m³)					
NITRATE	3520	3020	2370	2580	2890
SULFATE	8740	8620	11470	8090	9250
AMMONIUM	150	<10	2520	110	660[c]
TSP (µg/m³)	41	38	39	33	38
SAMPLE COUNT	15	13	13[d]	15	

[a] The annual average was calculated using one-half the detectable limit in the 3rd quarter.
[b] The annual average was calculated using one-half the detectable limit in the 2nd and 3rd quarters.
[c] The annual average was calculated using one-half the detectable limit in the 2nd quarter.
[d] The sample count for sulfate and TSP is 15 in the 3rd quarter.

TABLE 2-4, CONTINUED

QUARTERLY CHEMICAL CHARACTERIZATION OF 1994 HI-VOL TSP

TOWN	AREA	SITE
HARTFORD	**0420**	**016**

	QUARTERLY AVG				ANNUAL AVG
	1ST	2ND	3RD	4TH	
METALS (ng/m³)					
BERYLLIUM	<.1	<.1	<.1	<.1	<.1
CADMIUM	0.8	0.7	1.8	1.3	1.1
CHROMIUM	5	3	2	3	3
COPPER	50	40	90	10	50
IRON	1060	1180	990	1070	1080
LEAD	20	10	10	20	20
MANGANESE	20	17	12	13	16
NICKEL	10	4	4	9	7
VANADIUM	20	<10	<10	10	10[a]
ZINC	40	40	50	60	50
WATER SOLUBLES (ng/m³)					
NITRATE	3980	2960	2640	2900	3130
SULFATE	8650	8820	10570	8600	9150
AMMONIUM	360	50	<10	230	160[b]
TSP (μg/m³)	71	64	51	53	60
SAMPLE COUNT	15	15	15[c]	13	

[a] The annual average was calculated using one-half the detectable limit in the 2nd and 3rd quarters.
[b] The annual average was calculated using one-half the detectable limit in the 3rd quarter.
[c] The sample count for sulfate and TSP is 14 in the 3rd quarter.

TABLE 2-4, CONTINUED

QUARTERLY CHEMICAL CHARACTERIZATION OF 1994 HI-VOL TSP

TOWN	AREA	SITE
NEW HAVEN	**0700**	**018**

	QUARTERLY AVG				ANNUAL AVG
	1ST	2ND	3RD	4TH	
METALS (ng/m^3)					
BERYLLIUM	<.1	<.1	<.1	<.1	<.1
CADMIUM	1.6	1.4	1.2	1.4	1.4
CHROMIUM	8	8	4	8	7
COPPER	50	70	130	10	60
IRON	3740	6250	3830	3320	4300
LEAD	110	180	100	30	110
MANGANESE	57	95	53	45	63
NICKEL	18	17	12	15	16
VANADIUM	40	30	20	20	30
ZINC	120	170	140	150	150
WATER SOLUBLES (ng/m^3)					
NITRATE	4720	3380	3850	3080	3750
SULFATE	11130	9600	12900	9770	10880
AMMONIUM	490	70	3220	370	960
TSP ($\mu g/m^3$)	184	227	131	120	165
SAMPLE COUNT	15	15	13[a]	15	

[a] The sample count for sulfate and TSP is 16 in the 3rd quarter.

TABLE 2-4, CONTINUED

QUARTERLY CHEMICAL CHARACTERIZATION OF 1994 HI-VOL TSP

TOWN	AREA	SITE
WATERBURY	**1240**	**123**

	QUARTERLY AVG				ANNUAL AVG
	1ST	2ND	3RD	4TH	
METALS (ng/m3)					
BERYLLIUM	<.1	<.1	<.1	<.1	<.1
CADMIUM	1.2	1.1	1.5	1.3	1.3
CHROMIUM	4	5	3	2	4
COPPER	110	260	100	10	130
IRON	930	1880	1400	1310	1380
LEAD	20	20	20	20	20
MANGANESE	16	36	27	25	26
NICKEL	13	4	5	8	8
VANADIUM	20	<10	<10	10	10[a]
ZINC	70	60	70	80	70
WATER SOLUBLES (ng/m3)					
NITRATE	3400	2280	2260	2170	2550
SULFATE	8880	8170	11090	9110	9350
AMMONIUM	320	30	1990	170	600
TSP (µg/m3)	60	74	60	56	62
SAMPLE COUNT	15	15[b]	13[c]	13	

[a] The annual average was calculated using one-half the detectable limit in the 2nd and 3rd quarters.
[b] The sample count for TSP is 14 in the 2nd quarter.
[c] The sample count for sulfate and TSP is 16 in the 3rd quarter.

TABLE 2-5

1994 TEN HIGHEST 24-HOUR AVERAGE PM10 DAYS WITH WIND DATA

UNITS : MICROGRAMS PER CUBIC METER

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
BRIDGEPORT-014 (0056)	PM10	68	61	61	52	51	49	48	45	45	43
	DATE	12/ 4/94	7/13/94	9/17/94	2/19/94	2/ 1/94	12/28/94	3/15/94	7/19/94	1/14/94	5/26/94
METEOROLOGICAL SITE	DIR (DEG)	150	250	260	170	330	250	220	170	280	210
NEWARK	VEL (MPH)	1.4	6.9	8.2	2.9	4.5	8.3	4.5	5.0	6.8	4.7
	SPD (MPH)	4.0	8.8	11.2	4.2	6.3	10.5	7.9	6.0	9.5	9.3
	RATIO	0.352	0.789	0.731	0.705	0.714	0.794	0.574	0.821	0.716	0.504
METEOROLOGICAL SITE	DIR (DEG)	360	250	210	170	210	230	180	220	310	190
BRADLEY	VEL (MPH)	2.0	2.8	5.6	4.8	.1	4.1	5.1	2.5	3.8	5.4
	SPD (MPH)	3.5	3.7	6.9	4.9	3.3	7.3	5.2	2.6	6.0	6.0
	RATIO	0.581	0.755	0.809	0.976	0.028	0.562	0.988	0.962	0.621	0.893
METEOROLOGICAL SITE	DIR (DEG)	280	240	270	110	360	270	210	230	310	230
BRIDGEPORT	VEL (MPH)	3.0	6.2	7.1	.8	1.7	8.8	3.2	5.8	3.5	4.8
	SPD (MPH)	4.5	6.5	8.6	1.3	3.5	9.6	4.3	6.3	4.7	5.3
	RATIO	0.677	0.960	0.820	0.648	0.490	0.918	0.741	0.915	0.748	0.911
METEOROLOGICAL SITE	DIR (DEG)	280	270	250	230	280	250	230	230	280	160
WORCESTER	VEL (MPH)	7.1	7.4	8.8	8.5	4.9	9.7	6.2	6.6	1.9	3.5
	SPD (MPH)	7.3	8.2	10.1	8.6	5.3	10.6	6.3	6.9	3.6	5.2
	RATIO	0.969	0.902	0.872	0.990	0.926	0.913	0.972	0.954	0.528	0.681
BRISTOL-001 (0058)	PM10	52	42	41	40	38	32	32	31	29	28
	DATE	9/17/94	7/19/94	2/19/94	7/13/94	12/22/94	7/ 7/94	3/15/94	8/12/94	12/28/94	5/26/94
METEOROLOGICAL SITE	DIR (DEG)	260	170	170	250	60	290	220	130	250	210
NEWARK	VEL (MPH)	8.2	5.0	2.9	6.9	2.2	4.2	4.5	2.9	8.3	4.7
	SPD (MPH)	11.2	6.0	4.2	8.8	3.3	8.1	7.9	5.6	10.5	9.3
	RATIO	0.731	0.821	0.705	0.789	0.657	0.518	0.574	0.518	0.794	0.504
METEOROLOGICAL SITE	DIR (DEG)	210	220	170	250	360	90	180	180	230	190
BRADLEY	VEL (MPH)	5.6	2.5	4.8	2.8	1.1	.1	5.1	2.5	4.1	5.4
	SPD (MPH)	6.9	2.6	4.9	3.7	3.5	2.2	5.2	2.7	7.3	6.0
	RATIO	0.809	0.962	0.976	0.755	0.326	0.040	0.988	0.930	0.562	0.893
METEOROLOGICAL SITE	DIR (DEG)	270	230	110	240	160	220	210	130	270	230
BRIDGEPORT	VEL (MPH)	7.1	5.8	.8	6.2	.9	4.4	3.2	4.6	8.8	4.8
	SPD (MPH)	8.6	6.3	1.3	6.5	2.6	5.5	4.3	5.0	9.6	5.3
	RATIO	0.820	0.915	0.648	0.960	0.353	0.799	0.741	0.921	0.918	0.911
METEOROLOGICAL SITE	DIR (DEG)	250	230	230	270	280	160	230	230	250	160
WORCESTER	VEL (MPH)	8.8	6.6	8.5	7.4	6.2	1.8	6.2	3.1	9.7	3.5
	SPD (MPH)	10.1	6.9	8.6	8.2	6.3	3.5	6.3	3.9	10.6	5.2
	RATIO	0.872	0.954	0.990	0.902	0.981	0.528	0.972	0.803	0.913	0.681
BURLINGTON-001 (0055)	PM10	54	43	39	29	25	25	25	24	22	21
	DATE	9/17/94	7/19/94	7/13/94	2/19/94	8/12/94	7/25/94	7/31/94	5/26/94	6/13/94	6/ 7/94
METEOROLOGICAL SITE	DIR (DEG)	260	170	250	170	130	260	160	210	160	280
NEWARK	VEL (MPH)	8.2	5.0	6.9	2.9	2.9	4.3	1.9	4.7	5.8	7.7
	SPD (MPH)	11.2	6.0	8.8	4.2	5.6	8.3	5.9	9.3	7.8	13.1
	RATIO	0.731	0.821	0.789	0.705	0.518	0.518	0.319	0.504	0.751	0.588
METEOROLOGICAL SITE	DIR (DEG)	210	220	250	170	180	250	290	190	190	290
BRADLEY	VEL (MPH)	5.6	2.5	2.8	4.8	2.5	4.9	.5	5.4	6.7	4.8
	SPD (MPH)	6.9	2.6	3.7	4.9	2.7	6.0	.9	6.0	7.9	7.8
	RATIO	0.809	0.962	0.755	0.976	0.930	0.809	0.574	0.893	0.852	0.622

TABLE 2-5, CONTINUED

1994 TEN HIGHEST 24-HOUR AVERAGE PM10 DAYS WITH WIND DATA

UNITS : MICROGRAMS PER CUBIC METER

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
METEOROLOGICAL SITE	DIR (DEG)	270	230	240	110	130	240	160	230	210	280
BRIDGEPORT	VEL (MPH)	7.1	5.8	6.2	.8	4.6	3.4	1.3	4.8	4.9	6.3
	SPD (MPH)	8.6	6.3	6.5	1.3	5.0	5.0	1.6	5.3	5.5	7.2
	RATIO	0.820	0.915	0.960	0.648	0.921	0.674	0.834	0.911	0.897	0.882
METEOROLOGICAL SITE	DIR (DEG)	250	230	270	230	230	230	270	160	220	280
WORCESTER	VEL (MPH)	8.8	6.6	7.4	8.5	3.1	5.7	4.3	3.5	7.5	8.2
	SPD (MPH)	10.1	6.9	8.2	8.6	3.9	5.9	4.9	5.2	7.8	9.9
	RATIO	0.872	0.954	0.902	0.990	0.803	0.959	0.888	0.681	0.970	0.823
DARIEN-001 (0054)	PM10	66	64	62	59	56	56	53	45	43	41
	DATE	2/ 1/94	9/17/94	12/22/94	7/13/94	2/19/94	1/14/94	12/ 4/94	7/19/94	1/20/94	3/15/94
METEOROLOGICAL SITE	DIR (DEG)	330	260	60	250	170	280	150	170	300	220
NEWARK	VEL (MPH)	4.5	8.2	2.2	6.9	2.9	6.8	1.4	5.0	6.5	4.5
	SPD (MPH)	6.3	11.2	3.3	8.8	4.2	9.5	4.0	6.0	7.8	7.9
	RATIO	0.714	0.731	0.657	0.789	0.705	0.716	0.352	0.821	0.841	0.574
METEOROLOGICAL SITE	DIR (DEG)	210	210	360	250	170	310	360	220	270	180
BRADLEY	VEL (MPH)	.1	5.6	1.1	2.8	4.8	3.8	2.0	2.5	3.0	5.1
	SPD (MPH)	3.3	6.9	3.5	3.7	4.9	6.0	3.5	2.6	3.7	5.2
	RATIO	0.028	0.809	0.326	0.755	0.976	0.621	0.581	0.962	0.808	0.988
METEOROLOGICAL SITE	DIR (DEG)	360	270	160	240	110	310	280	230	310	210
BRIDGEPORT	VEL (MPH)	1.7	7.1	.9	6.2	.8	3.5	3.0	5.8	4.5	3.2
	SPD (MPH)	3.5	8.6	2.6	6.5	1.3	4.7	4.5	6.3	5.6	4.3
	RATIO	0.490	0.820	0.353	0.960	0.648	0.748	0.677	0.915	0.800	0.741
METEOROLOGICAL SITE	DIR (DEG)	280	250	280	270	230	280	280	230	270	230
WORCESTER	VEL (MPH)	4.9	8.8	6.2	7.4	8.5	1.9	7.1	6.6	6.4	6.2
	SPD (MPH)	5.3	10.1	6.3	8.2	8.6	3.6	7.3	6.9	6.8	6.3
	RATIO	0.926	0.872	0.981	0.902	0.990	0.528	0.969	0.954	0.953	0.972
EAST HARTFORD-004 (0059)	PM10	72	67	49	45	39	38	36	35	35	34
	DATE	12/22/94	9/17/94	7/19/94	7/13/94	2/19/94	3/15/94	7/25/94	12/28/94	12/ 4/94	7/31/94
METEOROLOGICAL SITE	DIR (DEG)	60	260	170	250	170	220	260	250	150	160
NEWARK	VEL (MPH)	2.2	8.2	5.0	6.9	2.9	4.5	4.3	8.3	1.4	1.9
	SPD (MPH)	3.3	11.2	6.0	8.8	4.2	7.9	8.3	10.5	4.0	5.9
	RATIO	0.657	0.731	0.821	0.789	0.705	0.574	0.518	0.794	0.352	0.319
METEOROLOGICAL SITE	DIR (DEG)	360	210	220	250	170	180	250	230	360	290
BRADLEY	VEL (MPH)	1.1	5.6	2.5	2.8	4.8	5.1	4.9	4.1	2.0	.5
	SPD (MPH)	3.5	6.9	2.6	3.7	4.9	5.2	6.0	7.3	3.5	.9
	RATIO	0.326	0.809	0.962	0.755	0.976	0.988	0.809	0.562	0.581	0.574
METEOROLOGICAL SITE	DIR (DEG)	160	270	230	240	110	210	240	270	280	160
BRIDGEPORT	VEL (MPH)	.9	7.1	5.8	6.2	.8	3.2	3.4	8.8	3.0	1.3
	SPD (MPH)	2.6	8.6	6.3	6.5	1.3	4.3	5.0	9.6	4.5	1.6
	RATIO	0.353	0.820	0.915	0.960	0.648	0.741	0.674	0.918	0.677	0.834
METEOROLOGICAL SITE	DIR (DEG)	280	250	230	270	230	230	230	250	280	270
WORCESTER	VEL (MPH)	6.2	8.8	6.6	7.4	8.5	6.2	5.7	9.7	7.1	4.3
	SPD (MPH)	6.3	10.1	6.9	8.2	8.6	6.3	5.9	10.6	7.3	4.9
	RATIO	0.981	0.872	0.954	0.902	0.990	0.972	0.959	0.913	0.969	0.888

TABLE 2-5, CONTINUED

1994 TEN HIGHEST 24-HOUR AVERAGE PM10 DAYS WITH WIND DATA

UNITS : MICROGRAMS PER CUBIC METER

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
ENFIELD-005 (0055)	PM10	67	45	34	34	33	32	27	27	26	25
	DATE	9/17/94	7/19/94	7/25/94	12/22/94	2/19/94	8/12/94	3/15/94	6/19/94	2/ 1/94	6/25/94
METEOROLOGICAL SITE	DIR (DEG)	260	170	260	60	170	130	220	350	330	260
NEWARK	VEL (MPH)	8.2	5.0	4.3	2.2	2.9	2.9	4.5	9.7	4.5	5.4
	SPD (MPH)	11.2	6.0	8.3	3.3	4.2	5.6	7.9	11.6	6.3	10.9
	RATIO	0.731	0.821	0.518	0.657	0.705	0.518	0.574	0.836	0.714	0.492
METEOROLOGICAL SITE	DIR (DEG)	210	220	250	360	170	180	180	350	210	330
BRADLEY	VEL (MPH)	5.6	2.5	4.9	1.1	4.8	2.5	5.1	6.0	.1	2.0
	SPD (MPH)	6.9	2.6	6.0	3.5	4.9	2.7	5.2	6.5	3.3	6.2
	RATIO	0.809	0.962	0.809	0.326	0.976	0.930	0.988	0.935	0.028	0.330
METEOROLOGICAL SITE	DIR (DEG)	270	230	240	160	110	130	210	340	360	160
BRIDGEPORT	VEL (MPH)	7.1	5.8	3.4	.9	.8	4.6	3.2	3.9	1.7	4.2
	SPD (MPH)	8.6	6.3	5.0	2.6	1.3	5.0	4.3	8.6	3.5	8.2
	RATIO	0.820	0.915	0.674	0.353	0.648	0.921	0.741	0.447	0.490	0.518
METEOROLOGICAL SITE	DIR (DEG)	250	230	230	280	230	230	230	330	280	50
WORCESTER	VEL (MPH)	8.8	6.6	5.7	6.2	8.5	3.1	6.2	5.4	4.9	3.8
	SPD (MPH)	10.1	6.9	5.9	6.3	8.6	3.9	6.3	6.0	5.3	3.9
	RATIO	0.872	0.954	0.959	0.981	0.990	0.803	0.972	0.892	0.926	0.984
GREENWICH-017 (0055)	PM10	60	56	45	38	38	36	35	34	34	32
	DATE	9/17/94	7/13/94	12/ 4/94	7/25/94	7/19/94	2/19/94	12/28/94	7/31/94	6/19/94	10/29/94
METEOROLOGICAL SITE	DIR (DEG)	260	250	150	260	170	170	250	160	350	230
NEWARK	VEL (MPH)	8.2	6.9	1.4	4.3	5.0	2.9	8.3	1.9	9.7	8.2
	SPD (MPH)	11.2	8.8	4.0	8.3	6.0	4.2	10.5	5.9	11.6	10.2
	RATIO	0.731	0.789	0.352	0.518	0.821	0.705	0.794	0.319	0.836	0.805
METEOROLOGICAL SITE	DIR (DEG)	210	250	360	250	220	170	230	290	350	190
BRADLEY	VEL (MPH)	5.6	2.8	2.0	4.9	2.5	4.8	4.1	.5	6.0	7.8
	SPD (MPH)	6.9	3.7	3.5	6.0	2.6	4.9	7.3	.9	6.5	8.8
	RATIO	0.809	0.755	0.581	0.809	0.962	0.976	0.562	0.574	0.935	0.886
METEOROLOGICAL SITE	DIR (DEG)	270	240	280	240	230	110	270	160	340	250
BRIDGEPORT	VEL (MPH)	7.1	6.2	3.0	3.4	5.8	.8	8.8	1.3	3.9	8.3
	SPD (MPH)	8.6	6.5	4.5	5.0	6.3	1.3	9.6	1.6	8.6	8.8
	RATIO	0.820	0.960	0.677	0.674	0.915	0.648	0.918	0.834	0.447	0.945
METEOROLOGICAL SITE	DIR (DEG)	250	270	280	230	230	230	250	270	330	230
WORCESTER	VEL (MPH)	8.8	7.4	7.1	5.7	6.6	8.5	9.7	4.3	5.4	9.8
	SPD (MPH)	10.1	8.2	7.3	5.9	6.9	8.6	10.6	4.9	6.0	9.9
	RATIO	0.872	0.902	0.969	0.959	0.954	0.990	0.913	0.888	0.892	0.991
GROTON-006 (0058)	PM10	53	46	40	39	37	36	36	33	31	31
	DATE	9/17/94	12/22/94	7/25/94	12/ 4/94	5/26/94	7/19/94	2/ 7/94	2/ 1/94	3/15/94	7/31/94
METEOROLOGICAL SITE	DIR (DEG)	260	60	260	150	210	170	340	330	220	160
NEWARK	VEL (MPH)	8.2	2.2	4.3	1.4	4.7	5.0	7.8	4.5	4.5	1.9
	SPD (MPH)	11.2	3.3	8.3	4.0	9.3	6.0	9.3	6.3	7.9	5.9
	RATIO	0.731	0.657	0.518	0.352	0.504	0.821	0.835	0.714	0.574	0.319
METEOROLOGICAL SITE	DIR (DEG)	210	360	250	360	190	220	330	210	180	290
BRADLEY	VEL (MPH)	5.6	1.1	4.9	2.0	5.4	2.5	6.5	.1	5.1	.5
	SPD (MPH)	6.9	3.5	6.0	3.5	6.0	2.6	7.0	3.3	5.2	.9
	RATIO	0.809	0.326	0.809	0.581	0.893	0.962	0.927	0.028	0.988	0.574

TABLE 2-5, CONTINUED

1994 TEN HIGHEST 24-HOUR AVERAGE PM10 DAYS WITH WIND DATA

UNITS : MICROGRAMS PER CUBIC METER

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
METEOROLOGICAL SITE	DIR (DEG)	270	160	240	280	230	230	310	360	210	160
BRIDGEPORT	VEL (MPH)	7.1	.9	3.4	3.0	4.8	5.8	5.3	1.7	3.2	1.3
	SPD (MPH)	8.6	2.6	5.0	4.5	5.3	6.3	8.5	3.5	4.3	1.6
	RATIO	0.820	0.353	0.674	0.677	0.911	0.915	0.629	0.490	0.741	0.834
METEOROLOGICAL SITE	DIR (DEG)	250	280	230	280	160	230	290	280	230	270
WORCESTER	VEL (MPH)	8.8	6.2	5.7	7.1	3.5	6.6	11.3	4.9	6.2	4.3
	SPD (MPH)	10.1	6.3	5.9	7.3	5.2	6.9	11.4	5.3	6.3	4.9
	RATIO	0.872	0.981	0.959	0.969	0.681	0.954	0.998	0.926	0.972	0.888
HARTFORD-013 (0057)	PM10	64	52	42	39	37	36	33	31	30	29
	DATE	12/22/94	9/17/94	7/19/94	7/13/94	12/ 4/94	2/19/94	7/ 7/94	12/28/94	3/15/94	5/26/94
METEOROLOGICAL SITE	DIR (DEG)	60	260	170	250	150	170	290	250	220	210
NEWARK	VEL (MPH)	2.2	8.2	5.0	6.9	1.4	2.9	4.2	8.3	4.5	4.7
	SPD (MPH)	3.3	11.2	6.0	8.8	4.0	4.2	8.1	10.5	7.9	9.3
	RATIO	0.657	0.731	0.821	0.789	0.352	0.705	0.518	0.794	0.574	0.504
METEOROLOGICAL SITE	DIR (DEG)	360	210	220	250	360	170	90	230	180	190
BRADLEY	VEL (MPH)	1.1	5.6	2.5	2.8	2.0	4.8	.1	4.1	5.1	5.4
	SPD (MPH)	3.5	6.9	2.6	3.7	3.5	4.9	2.2	7.3	5.2	6.0
	RATIO	0.326	0.809	0.962	0.755	0.581	0.976	0.040	0.562	0.988	0.893
METEOROLOGICAL SITE	DIR (DEG)	160	270	230	240	280	110	220	270	210	230
BRIDGEPORT	VEL (MPH)	.9	7.1	5.8	6.2	3.0	.8	4.4	8.8	3.2	4.8
	SPD (MPH)	2.6	8.6	6.3	6.5	4.5	1.3	5.5	9.6	4.3	5.3
	RATIO	0.353	0.820	0.915	0.960	0.677	0.648	0.799	0.918	0.741	0.911
METEOROLOGICAL SITE	DIR (DEG)	280	250	230	270	280	230	160	250	230	160
WORCESTER	VEL (MPH)	6.2	8.8	6.6	7.4	7.1	8.5	1.8	9.7	6.2	3.5
	SPD (MPH)	6.3	10.1	6.9	8.2	7.3	8.6	3.5	10.6	6.3	5.2
	RATIO	0.981	0.872	0.954	0.902	0.969	0.990	0.528	0.913	0.972	0.681
HARTFORD-015 (0052)	PM10	81	53	51	47	41	40	40	38	37	35
	DATE	12/22/94	9/17/94	2/ 1/94	7/19/94	2/19/94	7/13/94	12/ 4/94	1/14/94	3/15/94	4/26/94
METEOROLOGICAL SITE	DIR (DEG)	60	260	330	170	170	250	150	280	220	70
NEWARK	VEL (MPH)	2.2	8.2	4.5	5.0	2.9	6.9	1.4	6.8	4.5	3.3
	SPD (MPH)	3.3	11.2	6.3	6.0	4.2	8.8	4.0	9.5	7.9	6.0
	RATIO	0.657	0.731	0.714	0.821	0.705	0.789	0.352	0.716	0.574	0.542
METEOROLOGICAL SITE	DIR (DEG)	360	210	210	220	170	250	360	310	180	20
BRADLEY	VEL (MPH)	1.1	5.6	.1	2.5	4.8	2.8	2.0	3.8	5.1	2.3
	SPD (MPH)	3.5	6.9	3.3	2.6	4.9	3.7	3.5	6.0	5.2	3.0
	RATIO	0.326	0.809	0.028	0.962	0.976	0.755	0.581	0.621	0.988	0.751
METEOROLOGICAL SITE	DIR (DEG)	160	270	360	230	110	240	280	310	210	90
BRIDGEPORT	VEL (MPH)	.9	7.1	1.7	5.8	.8	6.2	3.0	3.5	3.2	9.3
	SPD (MPH)	2.6	8.6	3.5	6.3	1.3	6.5	4.5	4.7	4.3	9.3
	RATIO	0.353	0.820	0.490	0.915	0.648	0.960	0.677	0.748	0.741	0.990
METEOROLOGICAL SITE	DIR (DEG)	280	250	280	230	230	270	280	280	230	90
WORCESTER	VEL (MPH)	6.2	8.8	4.9	6.6	8.5	7.4	7.1	1.9	6.2	4.8
	SPD (MPH)	6.3	10.1	5.3	6.9	8.6	8.2	7.3	3.6	6.3	5.3
	RATIO	0.981	0.872	0.926	0.954	0.990	0.902	0.969	0.528	0.972	0.895

TABLE 2-5, CONTINUED

1994 TEN HIGHEST 24-HOUR AVERAGE PM10 DAYS WITH WIND DATA

UNITS : MICROGRAMS PER CUBIC METER

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
MERIDEN-002 (0054)	PM10	62	46	43	37	35	34	33	33	32	32
	DATE	12/22/94	7/13/94	7/19/94	2/19/94	7/ 7/94	3/15/94	12/28/94	5/26/94	7/25/94	2/ 1/94
METEOROLOGICAL SITE	DIR (DEG)	60	250	170	170	290	220	250	210	260	330
NEWARK	VEL (MPH)	2.2	6.9	5.0	2.9	4.2	4.5	8.3	4.7	4.3	4.5
	SPD (MPH)	3.3	8.8	6.0	4.2	8.1	7.9	10.5	9.3	8.3	6.3
	RATIO	0.657	0.789	0.821	0.705	0.518	0.574	0.794	0.504	0.518	0.714
METEOROLOGICAL SITE	DIR (DEG)	360	250	220	170	90	180	230	190	250	210
BRADLEY	VEL (MPH)	1.1	2.8	2.5	4.8	.1	5.1	4.1	5.4	4.9	.1
	SPD (MPH)	3.5	3.7	2.6	4.9	2.2	5.2	7.3	6.0	6.0	3.3
	RATIO	0.326	0.755	0.962	0.976	0.040	0.988	0.562	0.893	0.809	0.028
METEOROLOGICAL SITE	DIR (DEG)	160	240	230	110	220	210	270	230	240	360
BRIDGEPORT	VEL (MPH)	.9	6.2	5.8	.8	4.4	3.2	8.8	4.8	3.4	1.7
	SPD (MPH)	2.6	6.5	6.3	1.3	5.5	4.3	9.6	5.3	5.0	3.5
	RATIO	0.353	0.960	0.915	0.648	0.799	0.741	0.918	0.911	0.674	0.490
METEOROLOGICAL SITE	DIR (DEG)	280	270	230	230	160	230	250	160	230	280
WORCESTER	VEL (MPH)	6.2	7.4	6.6	8.5	1.8	6.2	9.7	3.5	5.7	4.9
	SPD (MPH)	6.3	8.2	6.9	8.6	3.5	6.3	10.6	5.2	5.9	5.3
	RATIO	0.981	0.902	0.954	0.990	0.528	0.972	0.913	0.681	0.959	0.926
MIDDLETOWN-003 (0053)	PM10	68	45	45	41	40	37	36	34	33	31
	DATE	9/17/94	7/19/94	7/13/94	12/22/94	7/ 7/94	7/25/94	5/26/94	2/19/94	8/12/94	12/ 4/94
METEOROLOGICAL SITE	DIR (DEG)	260	170	250	60	290	260	210	170	130	150
NEWARK	VEL (MPH)	8.2	5.0	6.9	2.2	4.2	4.3	4.7	2.9	2.9	1.4
	SPD (MPH)	11.2	6.0	8.8	3.3	8.1	8.3	9.3	4.2	5.6	4.0
	RATIO	0.731	0.821	0.789	0.657	0.518	0.518	0.504	0.705	0.518	0.352
METEOROLOGICAL SITE	DIR (DEG)	210	220	250	360	90	250	190	170	180	360
BRADLEY	VEL (MPH)	5.6	2.5	2.8	1.1	.1	4.9	5.4	4.8	2.5	2.0
	SPD (MPH)	6.9	2.6	3.7	3.5	2.2	6.0	6.0	4.9	2.7	3.5
	RATIO	0.809	0.962	0.755	0.326	0.040	0.809	0.893	0.976	0.930	0.581
METEOROLOGICAL SITE	DIR (DEG)	270	230	240	160	220	240	230	110	130	280
BRIDGEPORT	VEL (MPH)	7.1	5.8	6.2	.9	4.4	3.4	4.8	.8	4.6	3.0
	SPD (MPH)	8.6	6.3	6.5	2.6	5.5	5.0	5.3	1.3	5.0	4.5
	RATIO	0.820	0.915	0.960	0.353	0.799	0.674	0.911	0.648	0.921	0.677
METEOROLOGICAL SITE	DIR (DEG)	250	230	270	280	160	230	160	230	230	280
WORCESTER	VEL (MPH)	8.8	6.6	7.4	6.2	1.8	5.7	3.5	8.5	3.1	7.1
	SPD (MPH)	10.1	6.9	8.2	6.3	3.5	5.9	5.2	8.6	3.9	7.3
	RATIO	0.872	0.954	0.902	0.981	0.528	0.959	0.681	0.990	0.803	0.969
MILFORD-010 (0053)	PM10	51	46	36	36	35	35	34	32	29	28
	DATE	7/13/94	12/ 4/94	7/25/94	7/19/94	2/19/94	5/26/94	12/28/94	3/15/94	7/31/94	2/ 1/94
METEOROLOGICAL SITE	DIR (DEG)	250	150	260	170	170	210	250	220	160	330
NEWARK	VEL (MPH)	6.9	1.4	4.3	5.0	2.9	4.7	8.3	4.5	1.9	4.5
	SPD (MPH)	8.8	4.0	8.3	6.0	4.2	9.3	10.5	7.9	5.9	6.3
	RATIO	0.789	0.352	0.518	0.821	0.705	0.504	0.794	0.574	0.319	0.714
METEOROLOGICAL SITE	DIR (DEG)	250	360	250	220	170	190	230	180	290	210
BRADLEY	VEL (MPH)	2.8	2.0	4.9	2.5	4.8	5.4	4.1	5.1	.5	.1
	SPD (MPH)	3.7	3.5	6.0	2.6	4.9	6.0	7.3	5.2	.9	3.3
	RATIO	0.755	0.581	0.809	0.962	0.976	0.893	0.562	0.988	0.574	0.028

TABLE 2-5, CONTINUED

1994 TEN HIGHEST 24-HOUR AVERAGE PM10 DAYS WITH WIND DATA

UNITS : MICROGRAMS PER CUBIC METER

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
METEOROLOGICAL SITE	DIR (DEG)	240	280	240	230	110	230	270	210	160	360
BRIDGEPORT	VEL (MPH)	6.2	3.0	3.4	5.8	.8	4.8	8.8	3.2	1.3	1.7
	SPD (MPH)	6.5	4.5	5.0	6.3	1.3	5.3	9.6	4.3	1.6	3.5
	RATIO	0.960	0.677	0.674	0.915	0.648	0.911	0.918	0.741	0.834	0.490
METEOROLOGICAL SITE	DIR (DEG)	270	280	230	230	230	160	250	230	270	280
WORCESTER	VEL (MPH)	7.4	7.1	5.7	6.6	8.5	3.5	9.7	6.2	4.3	4.9
	SPD (MPH)	8.2	7.3	5.9	6.9	8.6	5.2	10.6	6.3	4.9	5.3
	RATIO	0.902	0.969	0.959	0.954	0.990	0.681	0.913	0.972	0.888	0.926
NEW BRITAIN-012 (0056)	PM10	53	52	47	40	37	33	33	33	32	32
	DATE	12/22/94	9/17/94	2/19/94	7/13/94	3/15/94	7/ 7/94	5/26/94	7/25/94	12/28/94	1/14/94
METEOROLOGICAL SITE	DIR (DEG)	60	260	170	250	220	290	210	260	250	280
NEWARK	VEL (MPH)	2.2	8.2	2.9	6.9	4.5	4.2	4.7	4.3	8.3	6.8
	SPD (MPH)	3.3	11.2	4.2	8.8	7.9	8.1	9.3	8.3	10.5	9.5
	RATIO	0.657	0.731	0.705	0.789	0.574	0.518	0.504	0.518	0.794	0.716
METEOROLOGICAL SITE	DIR (DEG)	360	210	170	250	180	90	190	250	230	310
BRADLEY	VEL (MPH)	1.1	5.6	4.8	2.8	5.1	.1	5.4	4.9	4.1	3.8
	SPD (MPH)	3.5	6.9	4.9	3.7	5.2	2.2	6.0	6.0	7.3	6.0
	RATIO	0.326	0.809	0.976	0.755	0.988	0.040	0.893	0.809	0.562	0.621
METEOROLOGICAL SITE	DIR (DEG)	160	270	110	240	210	220	230	240	270	310
BRIDGEPORT	VEL (MPH)	.9	7.1	.8	6.2	3.2	4.4	4.8	3.4	8.8	3.5
	SPD (MPH)	2.6	8.6	1.3	6.5	4.3	5.5	5.3	5.0	9.6	4.7
	RATIO	0.353	0.820	0.648	0.960	0.741	0.799	0.911	0.674	0.918	0.748
METEOROLOGICAL SITE	DIR (DEG)	280	250	230	270	230	160	160	230	250	280
WORCESTER	VEL (MPH)	6.2	8.8	8.5	7.4	6.2	1.8	3.5	5.7	9.7	1.9
	SPD (MPH)	6.3	10.1	8.6	8.2	6.3	3.5	5.2	5.9	10.6	3.6
	RATIO	0.981	0.872	0.990	0.902	0.972	0.528	0.681	0.959	0.913	0.528
NEW HAVEN-013 (0053)	PM10	69	55	47	47	43	39	37	37	36	33
	DATE	12/22/94	9/17/94	2/19/94	3/15/94	7/19/94	7/25/94	7/ 7/94	5/26/94	1/14/94	12/28/94
METEOROLOGICAL SITE	DIR (DEG)	60	260	170	220	170	260	290	210	280	250
NEWARK	VEL (MPH)	2.2	8.2	2.9	4.5	5.0	4.3	4.2	4.7	6.8	8.3
	SPD (MPH)	3.3	11.2	4.2	7.9	6.0	8.3	8.1	9.3	9.5	10.5
	RATIO	0.657	0.731	0.705	0.574	0.821	0.518	0.518	0.504	0.716	0.794
METEOROLOGICAL SITE	DIR (DEG)	360	210	170	180	220	250	90	190	310	230
BRADLEY	VEL (MPH)	1.1	5.6	4.8	5.1	2.5	4.9	.1	5.4	3.8	4.1
	SPD (MPH)	3.5	6.9	4.9	5.2	2.6	6.0	2.2	6.0	6.0	7.3
	RATIO	0.326	0.809	0.976	0.988	0.962	0.809	0.040	0.893	0.621	0.562
METEOROLOGICAL SITE	DIR (DEG)	160	270	110	210	230	240	220	230	310	270
BRIDGEPORT	VEL (MPH)	.9	7.1	.8	3.2	5.8	3.4	4.4	4.8	3.5	8.8
	SPD (MPH)	2.6	8.6	1.3	4.3	6.3	5.0	5.5	5.3	4.7	9.6
	RATIO	0.353	0.820	0.648	0.741	0.915	0.674	0.799	0.911	0.748	0.918
METEOROLOGICAL SITE	DIR (DEG)	280	250	230	230	230	230	160	160	280	250
WORCESTER	VEL (MPH)	6.2	8.8	8.5	6.2	6.6	5.7	1.8	3.5	1.9	9.7
	SPD (MPH)	6.3	10.1	8.6	6.3	6.9	5.9	3.5	5.2	3.6	10.6
	RATIO	0.981	0.872	0.990	0.972	0.954	0.959	0.528	0.681	0.528	0.913

TABLE 2-5, CONTINUED

1994 TEN HIGHEST 24-HOUR AVERAGE PM10 DAYS WITH WIND DATA

UNITS : MICROGRAMS PER CUBIC METER

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
NEW HAVEN-020 (0058)	PM10	81	62	58	47	46	46	41	41	41	40
	DATE	12/22/94	7/13/94	9/17/94	7/19/94	1/20/94	7/25/94	2/ 1/94	1/14/94	2/19/94	3/15/94
METEOROLOGICAL SITE	DIR (DEG)	60	250	260	170	300	260	330	280	170	220
NEWARK	VEL (MPH)	2.2	6.9	8.2	5.0	6.5	4.3	4.5	6.8	2.9	4.5
	SPD (MPH)	3.3	8.8	11.2	6.0	7.8	8.3	6.3	9.5	4.2	7.9
	RATIO	0.657	0.789	0.731	0.821	0.841	0.518	0.714	0.716	0.705	0.574
METEOROLOGICAL SITE	DIR (DEG)	360	250	210	220	270	250	210	310	170	180
BRADLEY	VEL (MPH)	1.1	2.8	5.6	2.5	3.0	4.9	.1	3.8	4.8	5.1
	SPD (MPH)	3.5	3.7	6.9	2.6	3.7	6.0	3.3	6.0	4.9	5.2
	RATIO	0.326	0.755	0.809	0.962	0.808	0.809	0.028	0.621	0.976	0.988
METEOROLOGICAL SITE	DIR (DEG)	160	240	270	230	310	240	360	310	110	210
BRIDGEPORT	VEL (MPH)	.9	6.2	7.1	5.8	4.5	3.4	1.7	3.5	.8	3.2
	SPD (MPH)	2.6	6.5	8.6	6.3	5.6	5.0	3.5	4.7	1.3	4.3
	RATIO	0.353	0.960	0.820	0.915	0.800	0.674	0.490	0.748	0.648	0.741
METEOROLOGICAL SITE	DIR (DEG)	280	270	250	230	270	230	280	280	230	230
WORCESTER	VEL (MPH)	6.2	7.4	8.8	6.6	6.4	5.7	4.9	1.9	8.5	6.2
	SPD (MPH)	6.3	8.2	10.1	6.9	6.8	5.9	5.3	3.6	8.6	6.3
	RATIO	0.981	0.902	0.872	0.954	0.953	0.959	0.926	0.528	0.990	0.972
NEW HAVEN-123 (0056)	PM10	75	71	62	58	57	55	46	43	42	42
	DATE	12/22/94	12/ 4/94	3/15/94	2/19/94	9/17/94	7/13/94	7/19/94	7/25/94	1/14/94	5/26/94
METEOROLOGICAL SITE	DIR (DEG)	60	150	220	170	260	250	170	260	280	210
NEWARK	VEL (MPH)	2.2	1.4	4.5	2.9	8.2	6.9	5.0	4.3	6.8	4.7
	SPD (MPH)	3.3	4.0	7.9	4.2	11.2	8.8	6.0	8.3	9.5	9.3
	RATIO	0.657	0.352	0.574	0.705	0.731	0.789	0.821	0.518	0.716	0.504
METEOROLOGICAL SITE	DIR (DEG)	360	360	180	170	210	250	220	250	310	190
BRADLEY	VEL (MPH)	1.1	2.0	5.1	4.8	5.6	2.8	2.5	4.9	3.8	5.4
	SPD (MPH)	3.5	3.5	5.2	4.9	6.9	3.7	2.6	6.0	6.0	6.0
	RATIO	0.326	0.581	0.988	0.976	0.809	0.755	0.962	0.809	0.621	0.893
METEOROLOGICAL SITE	DIR (DEG)	160	280	210	110	270	240	230	240	310	230
BRIDGEPORT	VEL (MPH)	.9	3.0	3.2	.8	7.1	6.2	5.8	3.4	3.5	4.8
	SPD (MPH)	2.6	4.5	4.3	1.3	8.6	6.5	6.3	5.0	4.7	5.3
	RATIO	0.353	0.677	0.741	0.648	0.820	0.960	0.915	0.674	0.748	0.911
METEOROLOGICAL SITE	DIR (DEG)	280	280	230	230	250	270	230	230	280	160
WORCESTER	VEL (MPH)	6.2	7.1	6.2	8.5	8.8	7.4	6.6	5.7	1.9	3.5
	SPD (MPH)	6.3	7.3	6.3	8.6	10.1	8.2	6.9	5.9	3.6	5.2
	RATIO	0.981	0.969	0.972	0.990	0.872	0.902	0.954	0.959	0.528	0.681
NEW LONDON-004 (0058)	PM10	55	53	44	42	39	37	36	35	32	32
	DATE	9/17/94	7/13/94	12/22/94	7/25/94	12/ 4/94	11/22/94	7/ 7/94	7/19/94	2/19/94	8/12/94
METEOROLOGICAL SITE	DIR (DEG)	260	250	60	260	150	290	290	170	170	130
NEWARK	VEL (MPH)	8.2	6.9	2.2	4.3	1.4	14.4	4.2	5.0	2.9	2.9
	SPD (MPH)	11.2	8.8	3.3	8.3	4.0	16.5	8.1	6.0	4.2	5.6
	RATIO	0.731	0.789	0.657	0.518	0.352	0.872	0.518	0.821	0.705	0.518
METEOROLOGICAL SITE	DIR (DEG)	210	250	360	250	360	310	90	220	170	180
BRADLEY	VEL (MPH)	5.6	2.8	1.1	4.9	2.0	10.2	.1	2.5	4.8	2.5
	SPD (MPH)	6.9	3.7	3.5	6.0	3.5	10.5	2.2	2.6	4.9	2.7
	RATIO	0.809	0.755	0.326	0.809	0.581	0.975	0.040	0.962	0.976	0.930

TABLE 2-5, CONTINUED

1994 TEN HIGHEST 24-HOUR AVERAGE PM10 DAYS WITH WIND DATA

UNITS : MICROGRAMS PER CUBIC METER

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
METEOROLOGICAL SITE BRIDGEPORT	DIR (DEG)	270	240	160	240	280	310	220	230	110	130
	VEL (MPH)	7.1	6.2	.9	3.4	3.0	9.8	4.4	5.8	.8	4.6
	SPD (MPH)	8.6	6.5	2.6	5.0	4.5	10.2	5.5	6.3	1.3	5.0
	RATIO	0.820	0.960	0.353	0.674	0.677	0.957	0.799	0.915	0.648	0.921
METEOROLOGICAL SITE WORCESTER	DIR (DEG)	250	270	280	230	280	290	160	230	230	230
	VEL (MPH)	8.8	7.4	6.2	5.7	7.1	15.0	1.8	6.6	8.5	3.1
	SPD (MPH)	10.1	8.2	6.3	5.9	7.3	15.2	3.5	6.9	8.6	3.9
	RATIO	0.872	0.902	0.981	0.959	0.969	0.983	0.528	0.954	0.990	0.803
NORWALK-014 (0052)	PM10	92	76	68	67	63	58	56	56	53	53
	DATE	1/20/94	2/ 1/94	12/22/94	7/13/94	2/19/94	2/ 7/94	12/28/94	12/ 4/94	3/15/94	7/19/94
METEOROLOGICAL SITE NEWARK	DIR (DEG)	300	330	60	250	170	340	250	150	220	170
	VEL (MPH)	6.5	4.5	2.2	6.9	2.9	7.8	8.3	1.4	4.5	5.0
	SPD (MPH)	7.8	6.3	3.3	8.8	4.2	9.3	10.5	4.0	7.9	6.0
	RATIO	0.841	0.714	0.657	0.789	0.705	0.835	0.794	0.352	0.574	0.821
METEOROLOGICAL SITE BRADLEY	DIR (DEG)	270	210	360	250	170	330	230	360	180	220
	VEL (MPH)	3.0	.1	1.1	2.8	4.8	6.5	4.1	2.0	5.1	2.5
	SPD (MPH)	3.7	3.3	3.5	3.7	4.9	7.0	7.3	3.5	5.2	2.6
	RATIO	0.808	0.028	0.326	0.755	0.976	0.927	0.562	0.581	0.988	0.962
METEOROLOGICAL SITE BRIDGEPORT	DIR (DEG)	310	360	160	240	110	310	270	280	210	230
	VEL (MPH)	4.5	1.7	.9	6.2	.8	5.3	8.8	3.0	3.2	5.8
	SPD (MPH)	5.6	3.5	2.6	6.5	1.3	8.5	9.6	4.5	4.3	6.3
	RATIO	0.800	0.490	0.353	0.960	0.648	0.629	0.918	0.677	0.741	0.915
METEOROLOGICAL SITE WORCESTER	DIR (DEG)	270	280	280	270	230	290	250	280	230	230
	VEL (MPH)	6.4	4.9	6.2	7.4	8.5	11.3	9.7	7.1	6.2	6.6
	SPD (MPH)	6.8	5.3	6.3	8.2	8.6	11.4	10.6	7.3	6.3	6.9
	RATIO	0.953	0.926	0.981	0.902	0.990	0.998	0.913	0.969	0.972	0.954
NORWICH-002 (0055)	PM10	55	48	44	42	42	40	39	39	38	35
	DATE	9/17/94	7/13/94	7/25/94	1/20/94	12/22/94	7/ 7/94	7/19/94	12/ 4/94	5/26/94	2/ 7/94
METEOROLOGICAL SITE NEWARK	DIR (DEG)	260	250	260	300	60	290	170	150	210	340
	VEL (MPH)	8.2	6.9	4.3	6.5	2.2	4.2	5.0	1.4	4.7	7.8
	SPD (MPH)	11.2	8.8	8.3	7.8	3.3	8.1	6.0	4.0	9.3	9.3
	RATIO	0.731	0.789	0.518	0.841	0.657	0.518	0.821	0.352	0.504	0.835
METEOROLOGICAL SITE BRADLEY	DIR (DEG)	210	250	250	270	360	90	220	360	190	330
	VEL (MPH)	5.6	2.8	4.9	3.0	1.1	.1	2.5	2.0	5.4	6.5
	SPD (MPH)	6.9	3.7	6.0	3.7	3.5	2.2	2.6	3.5	6.0	7.0
	RATIO	0.809	0.755	0.809	0.808	0.326	0.040	0.962	0.581	0.893	0.927
METEOROLOGICAL SITE BRIDGEPORT	DIR (DEG)	270	240	240	310	160	220	230	280	230	310
	VEL (MPH)	7.1	6.2	3.4	4.5	.9	4.4	5.8	3.0	4.8	5.3
	SPD (MPH)	8.6	6.5	5.0	5.6	2.6	5.5	6.3	4.5	5.3	8.5
	RATIO	0.820	0.960	0.674	0.800	0.353	0.799	0.915	0.677	0.911	0.629
METEOROLOGICAL SITE WORCESTER	DIR (DEG)	250	270	230	270	280	160	230	280	160	290
	VEL (MPH)	8.8	7.4	5.7	6.4	6.2	1.8	6.6	7.1	3.5	11.3
	SPD (MPH)	10.1	8.2	5.9	6.8	6.3	3.5	6.9	7.3	5.2	11.4
	RATIO	0.872	0.902	0.959	0.953	0.981	0.528	0.954	0.969	0.681	0.998

TABLE 2-5, CONTINUED

1994 TEN HIGHEST 24-HOUR AVERAGE PM10 DAYS WITH WIND DATA

UNITS : MICROGRAMS PER CUBIC METER

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
TORRINGTON-001 (0057)	PM10	58	48	46	38	37	35	34	33	31	31
	DATE	9/17/94	2/19/94	7/19/94	7/13/94	12/22/94	3/15/94	2/ 1/94	2/ 7/94	12/28/94	8/12/94
METEOROLOGICAL SITE	DIR (DEG)	260	170	170	250	60	220	330	340	250	130
NEWARK	VEL (MPH)	8.2	2.9	5.0	6.9	2.2	4.5	4.5	7.8	8.3	2.9
	SPD (MPH)	11.2	4.2	6.0	8.8	3.3	7.9	6.3	9.3	10.5	5.6
	RATIO	0.731	0.705	0.821	0.789	0.657	0.574	0.714	0.835	0.794	0.518
METEOROLOGICAL SITE	DIR (DEG)	210	170	220	250	360	180	210	330	230	180
BRADLEY	VEL (MPH)	5.6	4.8	2.5	2.8	1.1	5.1	.1	6.5	4.1	2.5
	SPD (MPH)	6.9	4.9	2.6	3.7	3.5	5.2	3.3	7.0	7.3	2.7
	RATIO	0.809	0.976	0.962	0.755	0.326	0.988	0.028	0.927	0.562	0.930
METEOROLOGICAL SITE	DIR (DEG)	270	110	230	240	160	210	360	310	270	130
BRIDGEPORT	VEL (MPH)	7.1	.8	5.8	6.2	.9	3.2	1.7	5.3	8.8	4.6
	SPD (MPH)	8.6	1.3	6.3	6.5	2.6	4.3	3.5	8.5	9.6	5.0
	RATIO	0.820	0.648	0.915	0.960	0.353	0.741	0.490	0.629	0.918	0.921
METEOROLOGICAL SITE	DIR (DEG)	250	230	230	270	280	230	280	290	250	230
WORCESTER	VEL (MPH)	8.8	8.5	6.6	7.4	6.2	6.2	4.9	11.3	9.7	3.1
	SPD (MPH)	10.1	8.6	6.9	8.2	6.3	6.3	5.3	11.4	10.6	3.9
	RATIO	0.872	0.990	0.954	0.902	0.981	0.972	0.926	0.998	0.913	0.803
VOLUNTOWN-001 (0055)	PM10	47	38	38	36	35	30	29	27	25	24
	DATE	7/13/94	7/ 7/94	7/25/94	5/26/94	7/19/94	8/12/94	7/31/94	6/25/94	7/ 1/94	8/18/94
METEOROLOGICAL SITE	DIR (DEG)	250	290	260	210	170	130	160	260	180	220
NEWARK	VEL (MPH)	6.9	4.2	4.3	4.7	5.0	2.9	1.9	5.4	3.3	6.5
	SPD (MPH)	8.8	8.1	8.3	9.3	6.0	5.6	5.9	10.9	5.9	11.4
	RATIO	0.789	0.518	0.518	0.504	0.821	0.518	0.319	0.492	0.557	0.568
METEOROLOGICAL SITE	DIR (DEG)	250	90	250	190	220	180	290	330	220	350
BRADLEY	VEL (MPH)	2.8	.1	4.9	5.4	2.5	2.5	.5	2.0	4.1	2.4
	SPD (MPH)	3.7	2.2	6.0	6.0	2.6	2.7	.9	6.2	5.5	3.6
	RATIO	0.755	0.040	0.809	0.893	0.962	0.930	0.574	0.330	0.750	0.670
METEOROLOGICAL SITE	DIR (DEG)	240	220	240	230	230	130	160	160	230	220
BRIDGEPORT	VEL (MPH)	6.2	4.4	3.4	4.8	5.8	4.6	1.3	4.2	5.5	8.2
	SPD (MPH)	6.5	5.5	5.0	5.3	6.3	5.0	1.6	8.2	6.0	8.3
	RATIO	0.960	0.799	0.674	0.911	0.915	0.921	0.834	0.518	0.913	0.985
METEOROLOGICAL SITE	DIR (DEG)	270	160	230	160	230	230	270	50	260	50
WORCESTER	VEL (MPH)	7.4	1.8	5.7	3.5	6.6	3.1	4.3	3.8	6.2	5.9
	SPD (MPH)	8.2	3.5	5.9	5.2	6.9	3.9	4.9	3.9	6.6	6.2
	RATIO	0.902	0.528	0.959	0.681	0.954	0.803	0.888	0.984	0.938	0.960
WALLINGFORD-006 (0056)	PM10	65	51	49	42	41	38	36	33	33	33
	DATE	9/17/94	12/22/94	7/13/94	12/ 4/94	7/19/94	7/ 7/94	2/19/94	8/12/94	5/26/94	1/14/94
METEOROLOGICAL SITE	DIR (DEG)	260	60	250	150	170	290	170	130	210	280
NEWARK	VEL (MPH)	8.2	2.2	6.9	1.4	5.0	4.2	2.9	2.9	4.7	6.8
	SPD (MPH)	11.2	3.3	8.8	4.0	6.0	8.1	4.2	5.6	9.3	9.5
	RATIO	0.731	0.657	0.789	0.352	0.821	0.518	0.705	0.518	0.504	0.716
METEOROLOGICAL SITE	DIR (DEG)	210	360	250	360	220	90	170	180	190	310
BRADLEY	VEL (MPH)	5.6	1.1	2.8	2.0	2.5	.1	4.8	2.5	5.4	3.8
	SPD (MPH)	6.9	3.5	3.7	3.5	2.6	2.2	4.9	2.7	6.0	6.0
	RATIO	0.809	0.326	0.755	0.581	0.962	0.040	0.976	0.930	0.893	0.621

TABLE 2-5, CONTINUED

1994 TEN HIGHEST 24-HOUR AVERAGE PM10 DAYS WITH WIND DATA

UNITS : MICROGRAMS PER CUBIC METER

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
METEOROLOGICAL SITE	DIR (DEG)	270	160	240	280	230	220	110	130	230	310
BRIDGEPORT	VEL (MPH)	7.1	.9	6.2	3.0	5.8	4.4	.8	4.6	4.8	3.5
	SPD (MPH)	8.6	2.6	6.5	4.5	6.3	5.5	1.3	5.0	5.3	4.7
	RATIO	0.820	0.353	0.960	0.677	0.915	0.799	0.648	0.921	0.911	0.748
METEOROLOGICAL SITE	DIR (DEG)	250	280	270	280	230	160	230	230	160	280
WORCESTER	VEL (MPH)	8.8	6.2	7.4	7.1	6.6	1.8	8.5	3.1	3.5	1.9
	SPD (MPH)	10.1	6.3	8.2	7.3	6.9	3.5	8.6	3.9	5.2	3.6
	RATIO	0.872	0.981	0.902	0.969	0.954	0.528	0.990	0.803	0.681	0.528
WATERBURY-007 (0053)	PM10	64	57	56	46	44	38	35	34	33	33
	DATE	2/19/94	12/22/94	9/17/94	3/15/94	7/13/94	12/28/94	11/ 4/94	5/26/94	8/12/94	2/ 7/94
METEOROLOGICAL SITE	DIR (DEG)	170	60	260	220	250	250	200	210	130	340
NEWARK	VEL (MPH)	2.9	2.2	8.2	4.5	6.9	8.3	4.9	4.7	2.9	7.8
	SPD (MPH)	4.2	3.3	11.2	7.9	8.8	10.5	7.6	9.3	5.6	9.3
	RATIO	0.705	0.657	0.731	0.574	0.789	0.794	0.641	0.504	0.518	0.835
METEOROLOGICAL SITE	DIR (DEG)	170	360	210	180	250	230	190	190	180	330
BRADLEY	VEL (MPH)	4.8	1.1	5.6	5.1	2.8	4.1	5.4	5.4	2.5	6.5
	SPD (MPH)	4.9	3.5	6.9	5.2	3.7	7.3	6.6	6.0	2.7	7.0
	RATIO	0.976	0.326	0.809	0.988	0.755	0.562	0.818	0.893	0.930	0.927
METEOROLOGICAL SITE	DIR (DEG)	110	160	270	210	240	270	240	230	130	310
BRIDGEPORT	VEL (MPH)	.8	.9	7.1	3.2	6.2	8.8	5.3	4.8	4.6	5.3
	SPD (MPH)	1.3	2.6	8.6	4.3	6.5	9.6	5.8	5.3	5.0	8.5
	RATIO	0.648	0.353	0.820	0.741	0.960	0.918	0.920	0.911	0.921	0.629
METEOROLOGICAL SITE	DIR (DEG)	230	280	250	230	270	250	220	160	230	290
WORCESTER	VEL (MPH)	8.5	6.2	8.8	6.2	7.4	9.7	7.2	3.5	3.1	11.3
	SPD (MPH)	8.6	6.3	10.1	6.3	8.2	10.6	7.3	5.2	3.9	11.4
	RATIO	0.990	0.981	0.872	0.972	0.902	0.913	0.978	0.681	0.803	0.998
WATERBURY-123 (0054)	PM10	55	51	49	42	41	41	41	39	38	36
	DATE	9/17/94	7/19/94	12/22/94	3/15/94	12/28/94	1/14/94	1/20/94	12/ 4/94	2/ 1/94	2/ 7/94
METEOROLOGICAL SITE	DIR (DEG)	260	170	60	220	250	280	300	150	330	340
NEWARK	VEL (MPH)	8.2	5.0	2.2	4.5	8.3	6.8	6.5	1.4	4.5	7.8
	SPD (MPH)	11.2	6.0	3.3	7.9	10.5	9.5	7.8	4.0	6.3	9.3
	RATIO	0.731	0.821	0.657	0.574	0.794	0.716	0.841	0.352	0.714	0.835
METEOROLOGICAL SITE	DIR (DEG)	210	220	360	180	230	310	270	360	210	330
BRADLEY	VEL (MPH)	5.6	2.5	1.1	5.1	4.1	3.8	3.0	2.0	.1	6.5
	SPD (MPH)	6.9	2.6	3.5	5.2	7.3	6.0	3.7	3.5	3.3	7.0
	RATIO	0.809	0.962	0.326	0.988	0.562	0.621	0.808	0.581	0.028	0.927
METEOROLOGICAL SITE	DIR (DEG)	270	230	160	210	270	310	310	280	360	310
BRIDGEPORT	VEL (MPH)	7.1	5.8	.9	3.2	8.8	3.5	4.5	3.0	1.7	5.3
	SPD (MPH)	8.6	6.3	2.6	4.3	9.6	4.7	5.6	4.5	3.5	8.5
	RATIO	0.820	0.915	0.353	0.741	0.918	0.748	0.800	0.677	0.490	0.629
METEOROLOGICAL SITE	DIR (DEG)	250	230	280	230	250	280	270	280	280	290
WORCESTER	VEL (MPH)	8.8	6.6	6.2	6.2	9.7	1.9	6.4	7.1	4.9	11.3
	SPD (MPH)	10.1	6.9	6.3	6.3	10.6	3.6	6.8	7.3	5.3	11.4
	RATIO	0.872	0.954	0.981	0.972	0.913	0.528	0.953	0.969	0.926	0.998

TABLE 2-5, CONTINUED

1994 TEN HIGHEST 24-HOUR AVERAGE PM10 DAYS WITH WIND DATA

UNITS : MICROGRAMS PER CUBIC METER

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
WILLIMANTIC-002 (0058)	PM10	72	41	40	40	37	36	35	34	33	31
	DATE	9/17/94	7/13/94	7/ 7/94	2/19/94	7/25/94	7/19/94	5/26/94	3/15/94	12/28/94	2/ 7/94
METEOROLOGICAL SITE	DIR (DEG)	260	250	290	170	260	170	210	220	250	340
NEWARK	VEL (MPH)	8.2	6.9	4.2	2.9	4.3	5.0	4.7	4.5	8.3	7.8
	SPD (MPH)	11.2	8.8	8.1	4.2	8.3	6.0	9.3	7.9	10.5	9.3
	RATIO	0.731	0.789	0.518	0.705	0.518	0.821	0.504	0.574	0.794	0.835
METEOROLOGICAL SITE	DIR (DEG)	210	250	90	170	250	220	190	180	230	330
BRADLEY	VEL (MPH)	5.6	2.8	.1	4.8	4.9	2.5	5.4	5.1	4.1	6.5
	SPD (MPH)	6.9	3.7	2.2	4.9	6.0	2.6	6.0	5.2	7.3	7.0
	RATIO	0.809	0.755	0.040	0.976	0.809	0.962	0.893	0.988	0.562	0.927
METEOROLOGICAL SITE	DIR (DEG)	270	240	220	110	240	230	230	210	270	310
BRIDGEPORT	VEL (MPH)	7.1	6.2	4.4	.8	3.4	5.8	4.8	3.2	8.8	5.3
	SPD (MPH)	8.6	6.5	5.5	1.3	5.0	6.3	5.3	4.3	9.6	8.5
	RATIO	0.820	0.960	0.799	0.648	0.674	0.915	0.911	0.741	0.918	0.629
METEOROLOGICAL SITE	DIR (DEG)	250	270	160	230	230	230	160	230	250	290
WORCESTER	VEL (MPH)	8.8	7.4	1.8	8.5	5.7	6.6	3.5	6.2	9.7	11.3
	SPD (MPH)	10.1	8.2	3.5	8.6	5.9	6.9	5.2	6.3	10.6	11.4
	RATIO	0.872	0.902	0.528	0.990	0.959	0.954	0.681	0.972	0.913	0.998

FIGURE 2-5

AVERAGES OF THE ANNUAL PM_{10} CONCENTRATIONS*

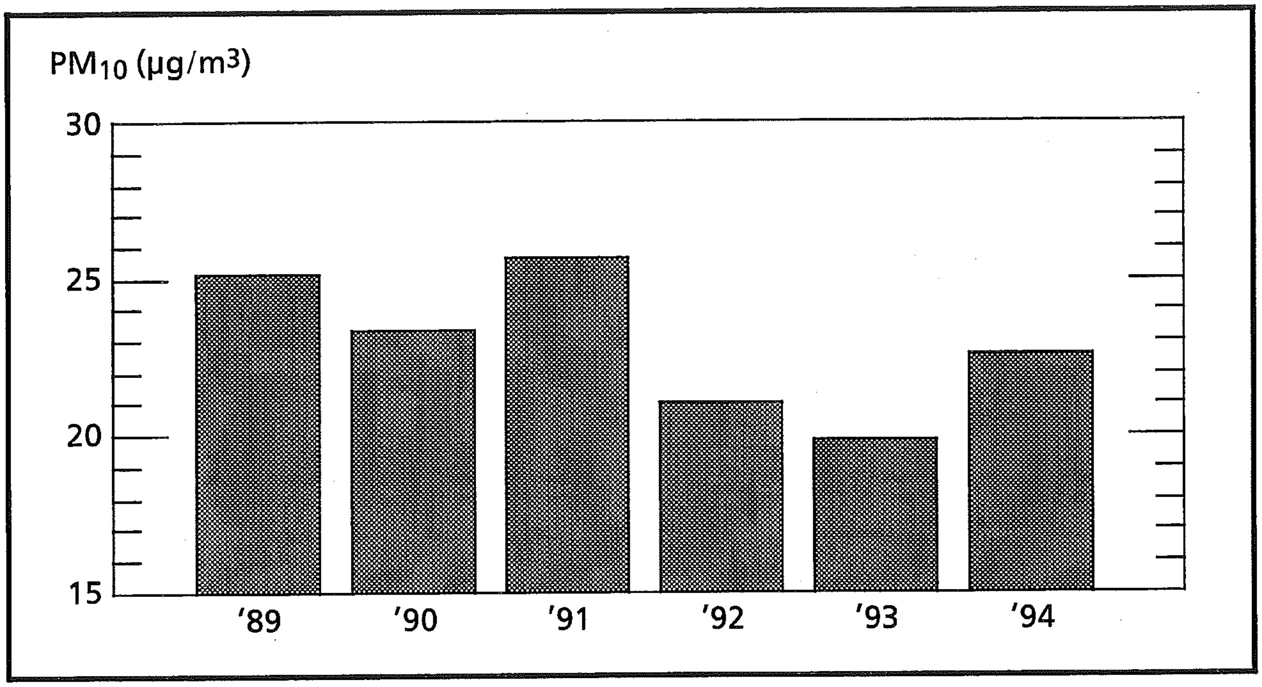
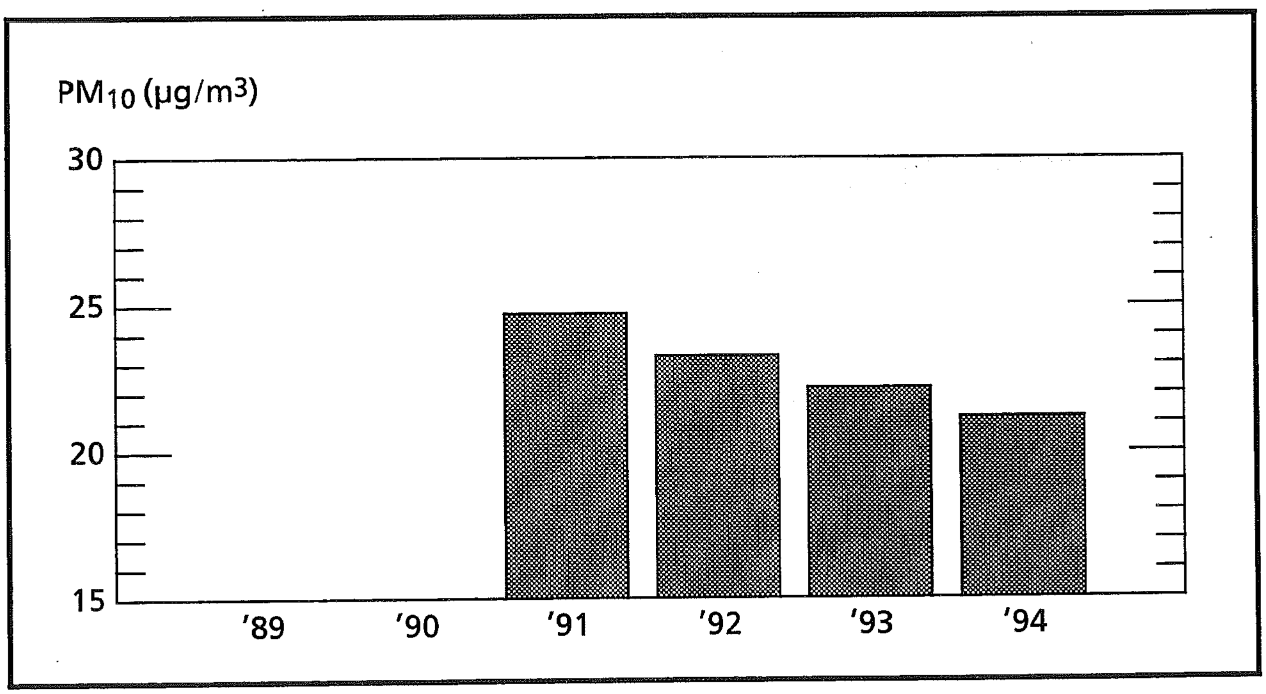


FIGURE 2-6

3-YEAR AVERAGES OF THE ANNUAL PM_{10} CONCENTRATIONS*



* At the 16 sites that met the minimum sampling criteria in each year of the six-year period.

III. SULFUR DIOXIDE

HEALTH EFFECTS

Sulfur oxides are heavy, pungent, yellowish gases that come from the burning of sulfur-containing fuel, mainly coal and oil-derived fuels, and also from the smelting of metals and from certain industrial processes. They have a distinctive odor. Sulfur dioxide (SO_2) comprises about 95 percent of these gases, so scientists use a test for SO_2 alone as a measure of all sulfur oxides.

Exposure to high levels of sulfur oxides can cause an obstruction of breathing that doctors call "pulmonary flow resistance." The amount of breathing obstruction has a direct relation to the amount of sulfur compounds in the air. Moreover, the effect of sulfur pollution is enhanced by the presence of other pollutants, especially particulates and oxidants. The action of two or more pollutants is synergistic: each pollutant augments the other and the combined effect is greater than the sum of the effects that each alone would have.

Many types of respiratory disease are associated with sulfur oxides: coughs and colds, asthma, bronchitis, and emphysema. Some researchers believe that the harm is due not only to the sulfur oxide gases but also to other sulfur compounds that accompany the oxides.

CONCLUSIONS

Sulfur dioxide concentrations in 1994 did not exceed any federal primary or secondary standards. Measured concentrations were substantially below the 365 $\mu g/m^3$ primary 24-hour standard and well below both the 80 $\mu g/m^3$ primary annual standard and the 1300 $\mu g/m^3$ secondary 3-hour standard.

METHOD OF MEASUREMENT

The DEP Air Monitoring Unit used the pulsed fluorescence method to continuously measure sulfur dioxide levels at all 13 sites in 1994.

DISCUSSION OF DATA

Monitoring Network - Thirteen continuous SO_2 monitors were used to record data in 12 towns during 1994 (see Figure 3-1):

Bridgeport 012
Bridgeport 013
Danbury 123
East Hartford 006
East Haven 003
Enfield 005
Greenwich 017
Groton 007
Hartford 018
Mansfield 003
New Haven 123
Stamford 124
Waterbury 123

All of these sites telemetered their data to the central computer in Hartford three times each day (i.e., at 0700, 1400, and 2400 hours local time).

Precision and Accuracy - 685 precision checks were made on SO_2 monitors in 1994, yielding 95% probability limits ranging from -4% to +4%. Accuracy is determined by introducing a known amount of SO_2 into each of the monitors. Three different concentration levels are tested: low, medium, and high. The 95% probability limits for accuracy based on 17 audits were: low, -7% to +4%; medium, -5% to +5%; and high, -6% to +5%.

Annual Averages - SO_2 levels were below the primary annual standard of 80 $\mu g/m^3$ at all sites in 1994 (see Table 3-1). The annual average SO_2 levels increased at six of the eleven monitoring sites that had sufficient data in both 1993 and 1994 to produce valid annual averages. The largest increase was 3 $\mu g/m^3$, which occurred at Mansfield 003 and New Haven 123. The largest decrease was 2 $\mu g/m^3$, which occurred at Groton 007. Bridgeport 013 and Enfield 005 showed no change in the annual average.

Statistical Projections - A statistical analysis of the sulfur dioxide data is presented in Table 3-2. This analysis is produced by a DEP computer program and provides information to compensate for any loss of data caused by instrumentation problems. The format of Table 3-2 is the same as that used to present the statistical projections for particulate matter (see Table 2-1). Since the statistical projections are made for the 24-hour standard, the hourly SO_2 data are first converted to 24-hour block averages. These 24-hour "samples" form the basis for the annual arithmetic and geometric means and the arithmetic and geometric standard deviations employed by the DEP computer program to make the statistical projections and calculate the 95% confidence limits.

The monitored data indicate that there were no violations of the primary 24-hour SO_2 standard at any site in Connecticut in the last three years. The statistical projections confirm that no days exceeding the primary 24-hour standard of 365 $\mu g/m^3$ would have occurred during this period at any site, if sampling were complete.

The annual averages in Table 3-2 differ slightly from those in Table 3-1 due to the manner in which they were derived. The averages in Table 3-1 are based on the available hourly readings, while those in Table 3-2 are based on valid calendar day 24-hour averages. (At least 18 hourly readings are required to produce a valid 24-hour average.)

24-Hour Averages - Figure 3-2 presents the first and second high calendar day average concentrations recorded at each monitoring site in 1994. No site recorded SO_2 levels in excess of the 24-hour primary standard of 365 $\mu g/m^3$. Second high calendar day SO_2 average concentrations increased at all eleven of the monitoring sites that had adequate data in both 1993 and 1994. The increases ranged from 17 $\mu g/m^3$ at Mansfield 003 to 54 $\mu g/m^3$ at Bridgeport 013.

Current EPA policy bases compliance with the primary 24-hour SO_2 standard on calendar day averages. Assessment of compliance is based on the second highest calendar day average in the year. Running averages are averages computed for the 24-hour periods ending at every hour. If running averages were used, assessment of compliance would be based on the value of the second highest of the two highest non-overlapping 24-hour periods in the year. There has been some contention over which average is the more appropriate one on which to base compliance. Table 3-3 contains the two highest 24-hour SO_2 readings at each site in terms of both the running averages and the calendar day averages. The first high 24-hour running averages are all higher than the first high calendar day averages by up to 16 $\mu g/m^3$. The second high 24-hour running averages are all higher by up to 27 $\mu g/m^3$.

3-Hour Averages - Figure 3-3 presents the first and second high 3-hour concentrations recorded at each monitoring site. Measured SO_2 concentrations were far below the federal secondary 3-hour standard of 1300 $\mu g/m^3$ at all DEP monitoring sites in 1994. Of the 11 sites that had a sufficient quantity of data in both 1993 and 1994, all had higher second high concentrations in 1994. The increases ranged from 10 $\mu g/m^3$ at East Hartford 006 to 119 $\mu g/m^3$ at Bridgeport 013.

10-High Days with Wind Data - Table 3-4 lists the ten highest 24-hour calendar day SO_2 averages and the dates of occurrence for each SO_2 site in Connecticut in 1993. Only the 12 sites were used which had sufficient data in 1993 to produce a valid annual average. The table also shows the average wind conditions that occurred on each of these dates. (The origin and use of these wind data are described in the discussion of Table 2-5 in the particulate matter section of this Air Quality Summary.)

Once again, as with particulate matter, many (i.e., 34%) of the highest SO_2 days occurred with winds out of the southwest quadrant, and most of these days had relatively persistent winds. This relationship is caused, at least in part, by SO_2 transport, but any transport is limited by the chemical instability of SO_2. In the atmosphere, SO_2 reacts with other gases to produce, among other things, sulfate particulates. Therefore, SO_2 is not likely to be transported very long distances. Previous studies conducted by the DEP have shown that, during periods of southwest winds, levels of SO_2 in Connecticut decrease with distance from the New York City metropolitan area. This relationship tends to support the transport hypothesis. On the other hand, these studies also revealed that certain meteorological parameters, most notably mixing height and wind speed, are more conducive to high SO_2 levels on days when there are southwesterly winds than on other days.

The data in Table 3-4 also suggest another reason for high SO_2 levels. Approximately 96% of the tabulated days occurred during the winter, and 4% occurred in late autumn. This phenomenon can be attributed to the fact that more fuel oil is burned during cold weather resulting in greater SO_2 emissions. In addition, temperature inversions, in which mixing heights are reduced, are more prevalent in autumn and winter.

In summary, high levels of SO_2 in Connecticut seem to be caused by a number of related factors. First, Connecticut experiences its highest SO_2 levels during the late fall and winter months, when there is an increased amount of fuel combustion. Second, the New York City metropolitan area, a large emission source, is located to the southwest of Connecticut, and southwest winds occur relatively often in this region in comparison to other wind directions. Also, adverse meteorological conditions are often associated with southwest winds. The net effect is that during the colder months when a persistent southwesterly wind occurs, an air mass picks up increased amounts of SO_2 over the New York City metropolitan area and transports this SO_2 into Connecticut, where the SO_2 levels are already relatively high. In addition, relatively low mixing heights are associated with warm air advection (i.e., southwest wind flow), which inhibits vertical mixing and contributes to the enhanced SO_2 concentrations. The levels of transported SO_2 eventually decline with increasing distance from New York City, as the SO_2 is dispersed and as it slowly reacts to produce sulfate particulates. These sulfate particulates may fall to the ground in either a dry state (dry deposition) or in a wet state after combination with water droplets (wet deposition or "acid rain").

Trends - The SO_2 trend over the ten year period from 1985 to 1994 is presented in Figure 3-4. The trend is clearly down in the last several years.

As was the case with the particulate matter trend, we wanted to portray an SO_2 trend that is both statewide in nature and relevant to one of the ambient air quality standards for SO_2. We chose to average the annual SO_2 concentrations at a number of sites: Bridgeport 012, East Haven 003, Enfield 005, Groton 007, New Haven 123 and Waterbury 123. These sites were the only sites that had sufficient data and valid annual averages over an eleven year period.

Annual SO_2 levels can be dramatically affected by a number of factors, some of which are annual fuel use, frequency of precipitation events, and changes in wind speed and direction. The importance of these relatively short term factors can be diminished in the portrayal of a pollution trend by means of multiple year averaging. Figure 3-5 employs a three year average of the data in Figure 3-4 and shows a smoother year-to-year transition as a result. The SO_2 trend is significantly down over the last five years, after a period of slight increases.

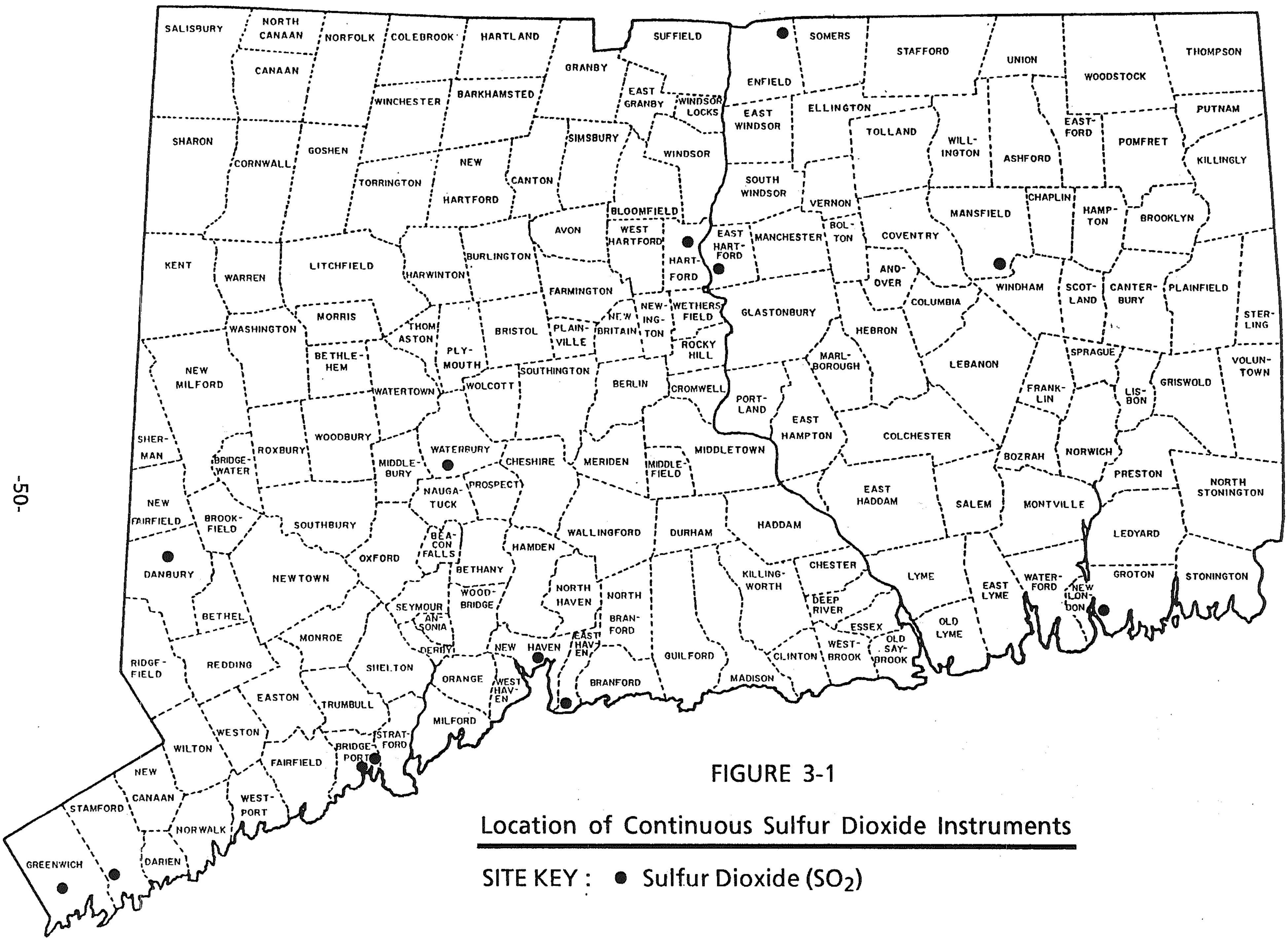


FIGURE 3-1

Location of Continuous Sulfur Dioxide Instruments

SITE KEY : ● Sulfur Dioxide (SO_2)

TABLE 3-1

1994 ANNUAL ARITHMETIC AVERAGES OF SULFUR DIOXIDE

(PRIMARY STANDARD: 80 $\mu g/m^3$)

TOWN-SITE	SITE NAME	ANNUAL AVG ($\mu g/m^3$)
Bridgeport 012	Edison School	25
Bridgeport 013	Congress Street	22
Danbury 123	Western CT State University	17
East Hartford 006	High Street	17
East Haven 003	Animal Shelter	16
Enfield 005	Department of Corrections	11
Greenwich 017	Greenwich Point Park	15
Groton 007	Fire Headquarters	14
Hartford 018	Sheldon Street	18
Mansfield 003	Dept. of Transportation	12
New Haven 123	State Street	27
Stamford 124	Health Department	25
Waterbury 123	Bank Street	17

TABLE 3-2

1992-1994 SO2 ANNUAL AVERAGES AND STATISTICAL PROJECTIONS

TOWN NAME	SITE	YEAR	SAMPLES	ARITHMETIC MEAN	95-PCT-LIMITS LOWER	95-PCT-LIMITS UPPER	STANDARD DEVIATION	PREDICTED DAYS OVER 365 UG/M3
BRIDGEPORT	012	1992	355	27.5	27.1	27.8	20.302	
BRIDGEPORT	012	1993	355	25.8	25.5	26.1	18.826	
BRIDGEPORT	012	1994	362	25.2	24.9	25.4	24.681	
BRIDGEPORT	013	1992	360	22.6	22.3	22.8	17.715	
BRIDGEPORT	013	1993	361	22.5	22.3	22.7	16.616	
BRIDGEPORT	013	1994	339	22.2	21.5	22.9	23.189	
DANBURY	123	1992	313*	17.5	16.9	18.1	13.436	
DANBURY	123	1993	354	14.7	14.5	14.9	12.467	
DANBURY	123	1994	343	16.7	16.3	17.2	17.789	
EAST HARTFORD	006	1992	334	18.3	17.9	18.8	14.660	
EAST HARTFORD	006	1993	361	15.4	15.3	15.5	11.098	
EAST HARTFORD	006	1994	355	17.2	16.9	17.4	14.033	
EAST HAVEN	003	1992	350	17.1	16.7	17.4	15.663	
EAST HAVEN	003	1993	365	16.6	16.6	16.6	13.277	
EAST HAVEN	003	1994	360	15.6	15.4	15.8	16.644	
ENFIELD	005	1992	360	13.7	13.6	13.8	10.541	
ENFIELD	005	1993	340	11.3	11.0	11.6	9.419	
ENFIELD	005	1994	342	11.4	11.0	11.7	11.397	
GREENWICH	017	1992	312	11.9	11.5	12.4	10.660	
GREENWICH	017	1993	239*	12.1	11.5	12.7	8.408	
GREENWICH	017	1994	364	14.9	14.9	15.0	12.123	
GROTON	007	1992	362	16.2	16.1	16.3	11.961	
GROTON	007	1993	353	16.4	16.3	16.6	9.895	
GROTON	007	1994	365	14.2	14.2	14.2	11.549	
HARTFORD	018	1992	345	19.6	19.2	20.0	15.157	
HARTFORD	018	1993	360	17.3	17.2	17.5	11.503	
HARTFORD	018	1994	347	18.4	18.1	18.7	14.280	

* THE RANDOMNESS OR QUANTITY OF DATA IS INSUFFICIENT FOR REPRESENTATIVE ANNUAL STATISTICS.

N.B. THE ARITHMETIC MEAN AND STANDARD DEVIATION HAVE UNITS OF MICROGRAMS PER CUBIC METER.

TABLE 3-2, CONTINUED

1992-1994 SO2 ANNUAL AVERAGES AND STATISTICAL PROJECTIONS

TOWN NAME	SITE	YEAR	SAMPLES	ARITHMETIC MEAN	95-PCT-LIMITS LOWER	95-PCT-LIMITS UPPER	STANDARD DEVIATION	PREDICTED DAYS OVER 365 UG/M3
MANSFIELD	003	1992	360	11.9	11.8	12.0	7.718	
MANSFIELD	003	1993	354	8.6	8.5	8.7	5.974	
MANSFIELD	003	1994	363	11.8	11.7	11.8	7.575	
NEW HAVEN	123	1992	351	31.6	31.1	32.1	23.404	
NEW HAVEN	123	1993	356	24.1	23.8	24.5	20.539	
NEW HAVEN	123	1994	357	26.6	26.2	26.9	22.910	
STAMFORD	123	1992	365	23.8	23.8	23.8	18.893	
STAMFORD	124	1993	282*	19.8	19.0	20.7	14.738	
STAMFORD	124	1994	357	24.9	24.5	25.4	27.204	
WATERBURY	123	1992	351	19.1	18.8	19.4	15.362	
WATERBURY	123	1993	358	15.9	15.7	16.1	11.583	
WATERBURY	123	1994	359	17.0	16.8	17.2	15.349	

* THE RANDOMNESS OR QUANTITY OF DATA IS INSUFFICIENT FOR REPRESENTATIVE ANNUAL STATISTICS.

N.B. THE ARITHMETIC MEAN AND STANDARD DEVIATION HAVE UNITS OF MICROGRAMS PER CUBIC METER.

FIGURE 3-2

1994 MAXIMUM CALENDAR DAY AVERAGE SO2 CONCENTRATIONS

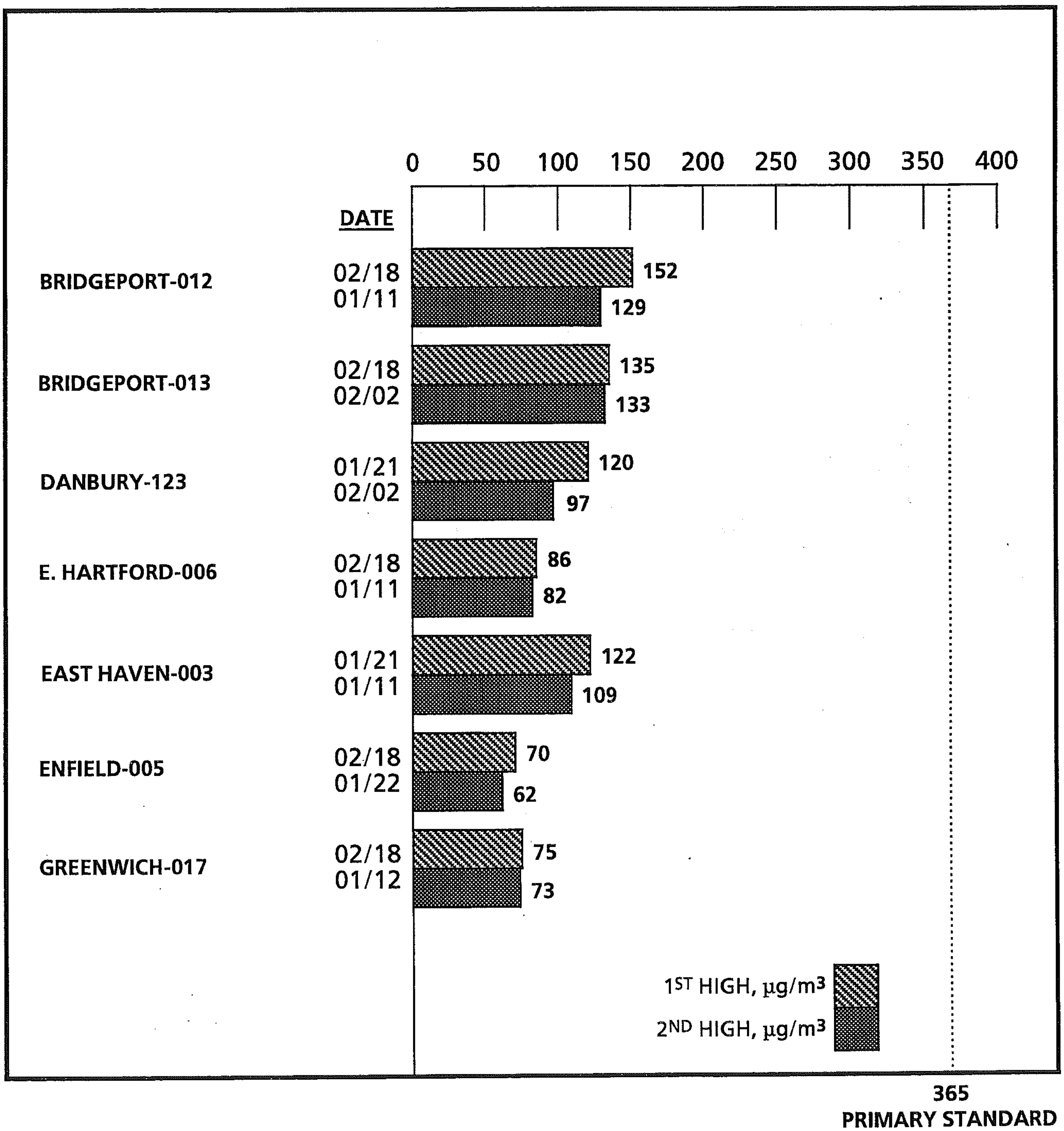


FIGURE 3-2, CONTINUED

1994 MAXIMUM CALENDAR DAY AVERAGE SO2 CONCENTRATIONS

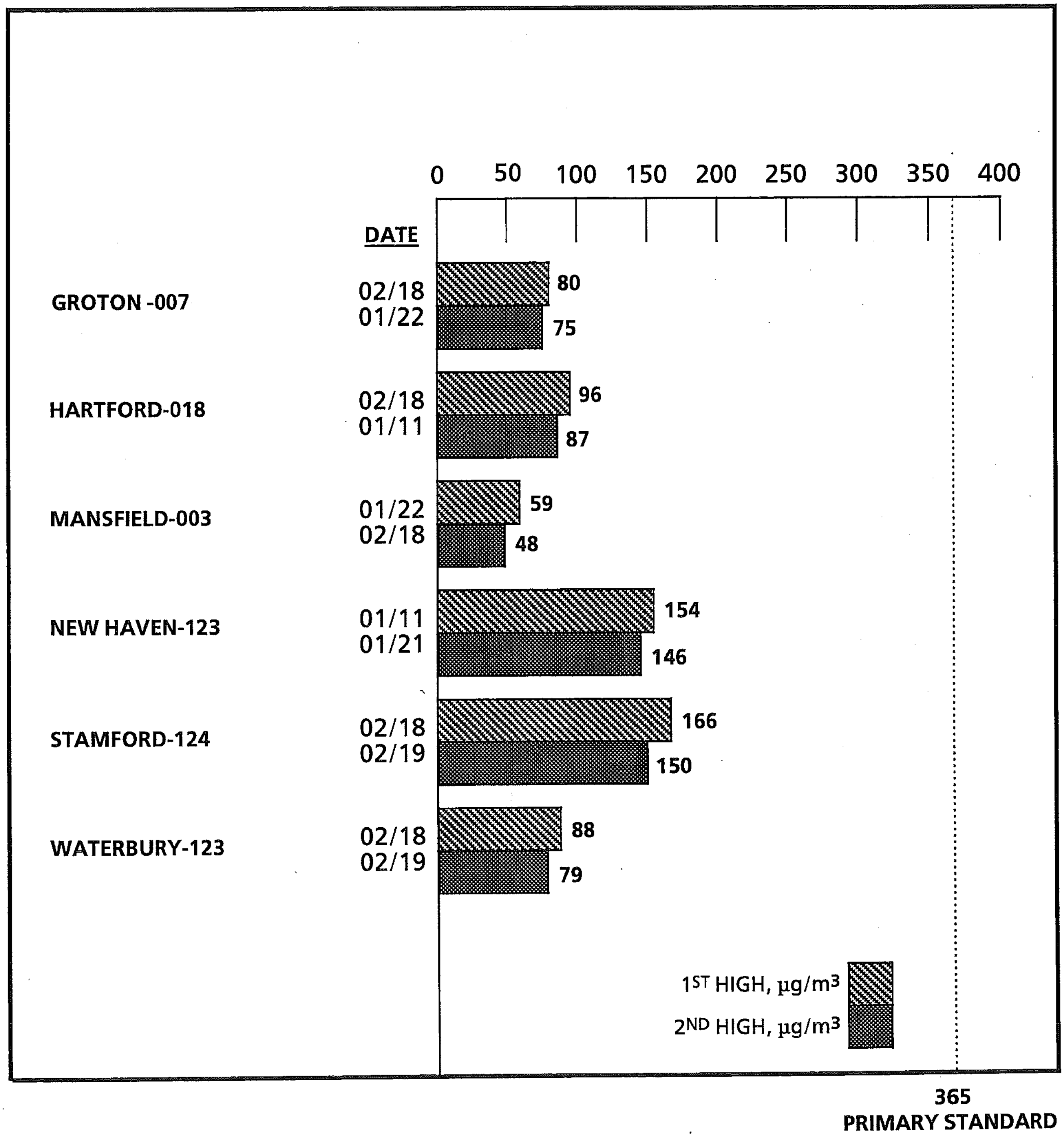


TABLE 3-3

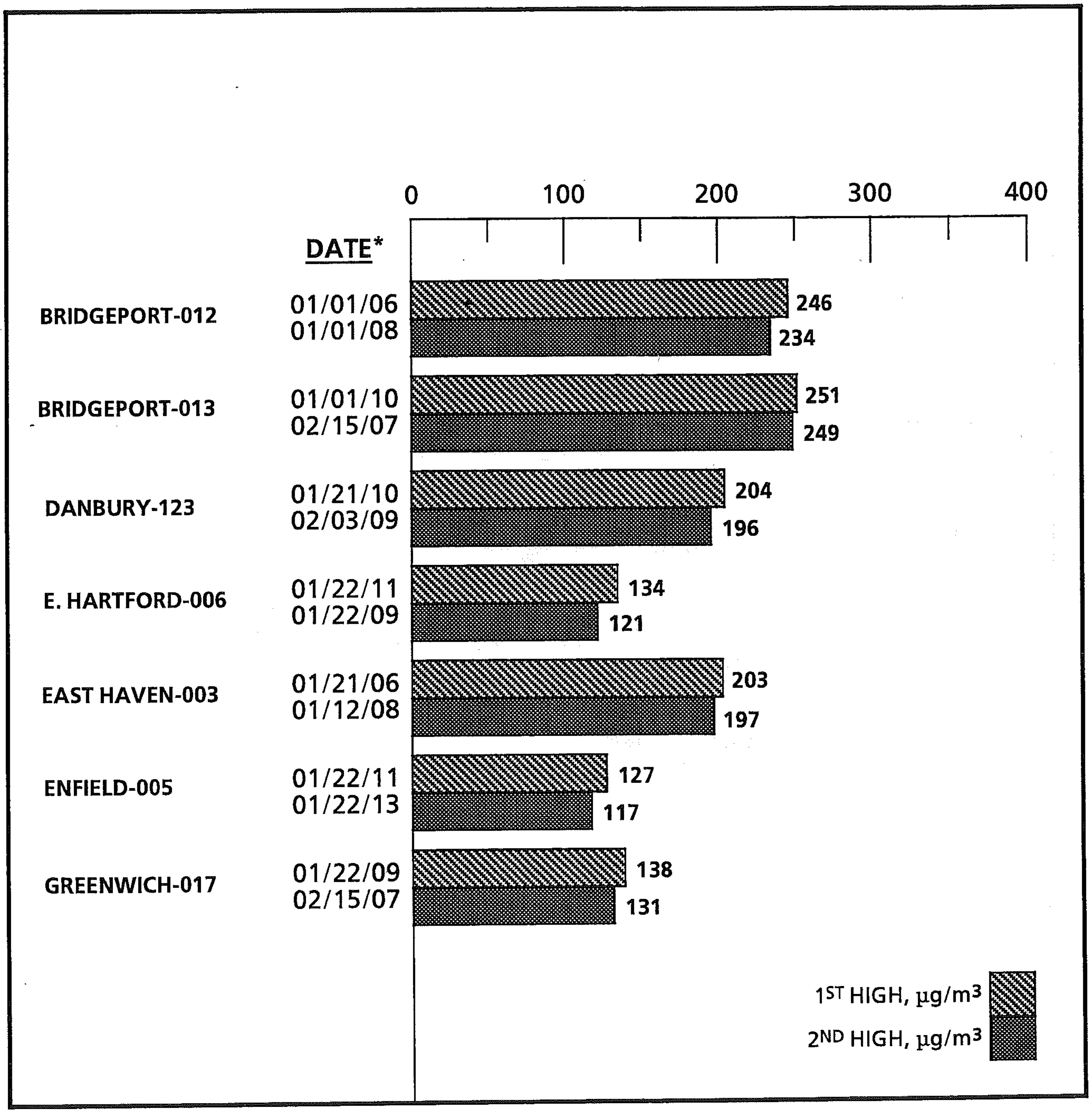
COMPARISONS OF FIRST AND SECOND HIGH CALENDAR DAY AND RUNNING 24-HOUR SO2 AVERAGES IN 1994

SITE	FIRST HIGH AVERAGE		SECOND HIGH AVERAGE	
	RUNNING 24-HOUR	CALENDAR DAY	RUNNING 24-HOUR	CALENDAR DAY
Bridgeport-012	154	152	140	129
Bridgeport-013	143	135	138	133
Danbury-123	136	120	124	97
E. Hartford-006	93	86	83	82
East Haven-003	127	122	126	109
Enfield-005	76	70	71	62
Greenwich-017	87	75	85	73
Groton-007	89	80	80	75
Hartford-018	98	96	93	87
Mansfield-003	71	59	61	48
New Haven-123	158	154	156	146
Stamford-124	178	166	163	150
Waterbury-123	90	88	89	79

N.B. The averages have units of $\mu g/m^3$.

FIGURE 3-3

1994 MAXIMUM 3-HOUR RUNNING AVERAGE SO2 CONCENTRATIONS

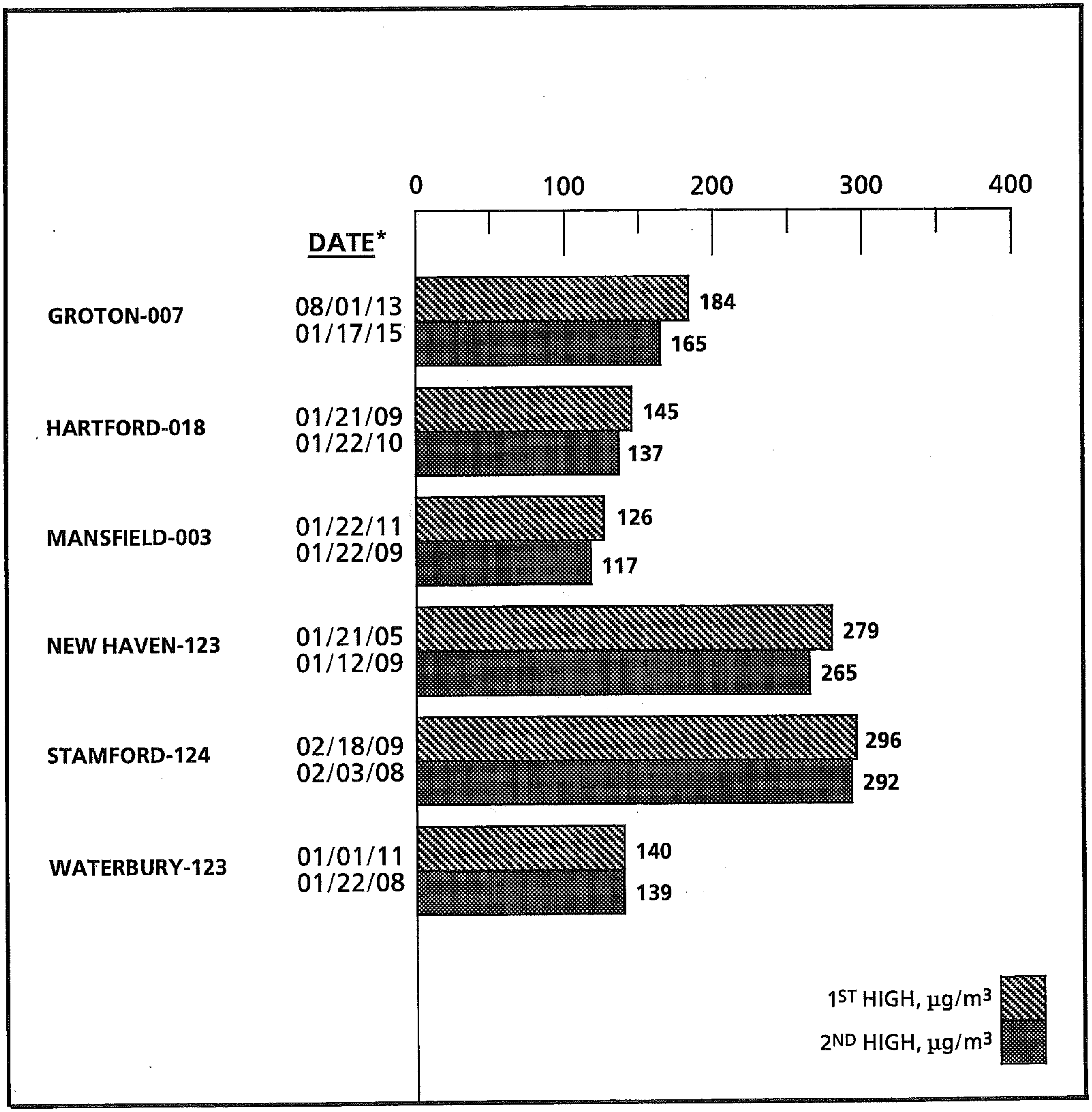


* The date is the month/day/ending hour of occurrence.

Secondary standard = 1300 $\mu g/m^3$.

FIGURE 3-3, CONTINUED

1994 MAXIMUM 3-HOUR RUNNING AVERAGE SO2 CONCENTRATIONS



* The date is the month/day/ending hour of occurrence.
Secondary standard = 1300 $\mu g/m^3$.

TABLE 3-4

1994 TEN HIGHEST 24-HOUR AVERAGE SO2 DAYS WITH WIND DATA

UNITS : MICROGRAMS PER CUBIC METER

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
BRIDGEPORT-012 (0362)	SO2	152	129	119	116	112	110	108	107	103	103
	DATE	2/18/94	1/11/94	2/ 2/94	1/12/94	2/ 5/94	1/21/94	1/ 1/94	2/21/94	12/ 3/94	2/ 3/94
METEOROLOGICAL SITE	DIR (DEG)	190	250	280	30	210	270	200	300	200	270
NEWARK	VEL (MPH)	1.3	5.9	5.9	6.4	4.3	6.3	7.5	3.4	3.1	7.2
	SPD (MPH)	4.7	6.9	7.2	6.5	4.6	7.8	7.6	4.5	5.9	9.3
	RATIO	0.270	0.856	0.828	0.983	0.937	0.813	0.988	0.768	0.520	0.773
METEOROLOGICAL SITE	DIR (DEG)	160	190	90	350	190	180	190	320	100	250
BRADLEY	VEL (MPH)	1.2	3.4	.8	3.5	4.7	4.0	9.0	2.3	1.8	3.2
	SPD (MPH)	2.4	4.3	2.0	4.5	6.9	4.2	9.3	3.5	4.6	5.3
	RATIO	0.476	0.785	0.416	0.777	0.682	0.968	0.964	0.658	0.399	0.603
METEOROLOGICAL SITE	DIR (DEG)	210	280	300	60	250	290	240	290	250	280
BRIDGEPORT	VEL (MPH)	.5	4.2	2.2	5.9	.6	6.0	7.4	1.5	2.7	8.1
	SPD (MPH)	3.5	4.9	3.9	6.2	2.3	6.9	7.9	1.9	4.6	9.5
	RATIO	0.136	0.850	0.566	0.955	0.263	0.869	0.940	0.801	0.590	0.858
METEOROLOGICAL SITE	DIR (DEG)	290	230	190	10	230	260	230	270	250	260
WORCESTER	VEL (MPH)	2.8	8.6	4.4	2.1	7.2	6.9	9.7	7.6	6.1	8.6
	SPD (MPH)	4.7	8.6	4.6	4.3	7.6	7.3	9.9	7.8	6.6	9.2
	RATIO	0.591	0.994	0.946	0.496	0.949	0.948	0.976	0.973	0.925	0.932
BRIDGEPORT-013 (0339)	SO2	135	133	124	119	114	113	108	107	100	97
	DATE	2/18/94	2/ 2/94	1/11/94	2/15/94	2/ 5/94	1/ 1/94	1/12/94	1/21/94	2/17/94	2/19/94
METEOROLOGICAL SITE	DIR (DEG)	190	280	250	40	210	200	30	270	220	170
NEWARK	VEL (MPH)	1.3	5.9	5.9	2.5	4.3	7.5	6.4	6.3	5.5	2.9
	SPD (MPH)	4.7	7.2	6.9	2.7	4.6	7.6	6.5	7.8	6.8	4.2
	RATIO	0.270	0.828	0.856	0.904	0.937	0.988	0.983	0.813	0.820	0.705
METEOROLOGICAL SITE	DIR (DEG)	160	90	190	200	190	190	350	180	200	170
BRADLEY	VEL (MPH)	1.2	.8	3.4	2.7	4.7	9.0	3.5	4.0	5.2	4.8
	SPD (MPH)	2.4	2.0	4.3	4.2	6.9	9.3	4.5	4.2	6.2	4.9
	RATIO	0.476	0.416	0.785	0.637	0.682	0.964	0.777	0.968	0.845	0.976
METEOROLOGICAL SITE	DIR (DEG)	210	300	280	70	250	240	60	290	240	110
BRIDGEPORT	VEL (MPH)	.5	2.2	4.2	3.8	.6	7.4	5.9	6.0	5.4	.8
	SPD (MPH)	3.5	3.9	4.9	4.2	2.3	7.9	6.2	6.9	5.5	1.3
	RATIO	0.136	0.566	0.850	0.915	0.263	0.940	0.955	0.869	0.989	0.648
METEOROLOGICAL SITE	DIR (DEG)	290	190	230	220	230	230	10	260	240	230
WORCESTER	VEL (MPH)	2.8	4.4	8.6	4.0	7.2	9.7	2.1	6.9	8.4	8.5
	SPD (MPH)	4.7	4.6	8.6	5.3	7.6	9.9	4.3	7.3	8.5	8.6
	RATIO	0.591	0.946	0.994	0.751	0.949	0.976	0.496	0.948	0.993	0.990
DANBURY-123 (0343)	SO2	120	97	94	88	83	81	81	75	75	75
	DATE	1/21/94	2/ 2/94	1/11/94	2/ 3/94	2/19/94	1/22/94	2/18/94	1/12/94	1/20/94	2/ 5/94
METEOROLOGICAL SITE	DIR (DEG)	270	280	250	270	170	300	190	30	300	210
NEWARK	VEL (MPH)	6.3	5.9	5.9	7.2	2.9	11.0	1.3	6.4	6.5	4.3
	SPD (MPH)	7.8	7.2	6.9	9.3	4.2	14.2	4.7	6.5	7.8	4.6
	RATIO	0.813	0.828	0.856	0.773	0.705	0.770	0.270	0.983	0.841	0.937
METEOROLOGICAL SITE	DIR (DEG)	180	90	190	250	170	290	160	350	270	190
BRADLEY	VEL (MPH)	4.0	.8	3.4	3.2	4.8	8.1	1.2	3.5	3.0	4.7
	SPD (MPH)	4.2	2.0	4.3	5.3	4.9	10.9	2.4	4.5	3.7	6.9
	RATIO	0.968	0.416	0.785	0.603	0.976	0.744	0.476	0.777	0.808	0.682

TABLE 3-4, CONTINUED

1994 TEN HIGHEST 24-HOUR AVERAGE SO2 DAYS WITH WIND DATA

UNITS : MICROGRAMS PER CUBIC METER

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
METEOROLOGICAL SITE	DIR (DEG)	290	300	280	280	110	300	210	60	310	250
BRIDGEPORT	VEL (MPH)	6.0	2.2	4.2	8.1	.8	10.8	.5	5.9	4.5	.6
	SPD (MPH)	6.9	3.9	4.9	9.5	1.3	11.9	3.5	6.2	5.6	2.3
	RATIO	0.869	0.566	0.850	0.858	0.648	0.905	0.136	0.955	0.800	0.263
METEOROLOGICAL SITE	DIR (DEG)	260	190	230	260	230	290	290	10	270	230
WORCESTER	VEL (MPH)	6.9	4.4	8.6	8.6	8.5	11.8	2.8	2.1	6.4	7.2
	SPD (MPH)	7.3	4.6	8.6	9.2	8.6	12.4	4.7	4.3	6.8	7.6
	RATIO	0.948	0.946	0.994	0.932	0.990	0.953	0.591	0.496	0.953	0.949
EAST HARTFORD-006 (0355)	SO2	86	82	77	72	67	67	63	57	57	56
	DATE	2/18/94	1/11/94	1/12/94	12/22/94	1/22/94	1/21/94	2/19/94	2/ 5/94	12/ 3/94	12/28/94
METEOROLOGICAL SITE	DIR (DEG)	190	250	30	60	300	270	170	210	200	250
NEWARK	VEL (MPH)	1.3	5.9	6.4	2.2	11.0	6.3	2.9	4.3	3.1	8.3
	SPD (MPH)	4.7	6.9	6.5	3.3	14.2	7.8	4.2	4.6	5.9	10.5
	RATIO	0.270	0.856	0.983	0.657	0.770	0.813	0.705	0.937	0.520	0.794
METEOROLOGICAL SITE	DIR (DEG)	160	190	350	360	290	180	170	190	100	230
BRADLEY	VEL (MPH)	1.2	3.4	3.5	1.1	8.1	4.0	4.8	4.7	1.8	4.1
	SPD (MPH)	2.4	4.3	4.5	3.5	10.9	4.2	4.9	6.9	4.6	7.3
	RATIO	0.476	0.785	0.777	0.326	0.744	0.968	0.976	0.682	0.399	0.562
METEOROLOGICAL SITE	DIR (DEG)	210	280	60	160	300	290	110	250	250	270
BRIDGEPORT	VEL (MPH)	.5	4.2	5.9	.9	10.8	6.0	.8	.6	2.7	8.8
	SPD (MPH)	3.5	4.9	6.2	2.6	11.9	6.9	1.3	2.3	4.6	9.6
	RATIO	0.136	0.850	0.955	0.353	0.905	0.869	0.648	0.263	0.590	0.918
METEOROLOGICAL SITE	DIR (DEG)	290	230	10	280	290	260	230	230	250	250
WORCESTER	VEL (MPH)	2.8	8.6	2.1	6.2	11.8	6.9	8.5	7.2	6.1	9.7
	SPD (MPH)	4.7	8.6	4.3	6.3	12.4	7.3	8.6	7.6	6.6	10.6
	RATIO	0.591	0.994	0.496	0.981	0.953	0.948	0.990	0.949	0.925	0.913
EAST HAVEN-003 (0360)	SO2	122	109	105	88	88	86	75	63	62	60
	DATE	1/21/94	1/11/94	1/12/94	1/22/94	2/ 2/94	2/18/94	1/20/94	12/22/94	2/ 5/94	2/17/94
METEOROLOGICAL SITE	DIR (DEG)	270	250	30	300	280	190	300	60	210	220
NEWARK	VEL (MPH)	6.3	5.9	6.4	11.0	5.9	1.3	6.5	2.2	4.3	5.5
	SPD (MPH)	7.8	6.9	6.5	14.2	7.2	4.7	7.8	3.3	4.6	6.8
	RATIO	0.813	0.856	0.983	0.770	0.828	0.270	0.841	0.657	0.937	0.820
METEOROLOGICAL SITE	DIR (DEG)	180	190	350	290	90	160	270	360	190	200
BRADLEY	VEL (MPH)	4.0	3.4	3.5	8.1	.8	1.2	3.0	1.1	4.7	5.2
	SPD (MPH)	4.2	4.3	4.5	10.9	2.0	2.4	3.7	3.5	6.9	6.2
	RATIO	0.968	0.785	0.777	0.744	0.416	0.476	0.808	0.326	0.682	0.845
METEOROLOGICAL SITE	DIR (DEG)	290	280	60	300	300	210	310	160	250	240
BRIDGEPORT	VEL (MPH)	6.0	4.2	5.9	10.8	2.2	.5	4.5	.9	.6	5.4
	SPD (MPH)	6.9	4.9	6.2	11.9	3.9	3.5	5.6	2.6	2.3	5.5
	RATIO	0.869	0.850	0.955	0.905	0.566	0.136	0.800	0.353	0.263	0.989
METEOROLOGICAL SITE	DIR (DEG)	260	230	10	290	190	290	270	280	230	240
WORCESTER	VEL (MPH)	6.9	8.6	2.1	11.8	4.4	2.8	6.4	6.2	7.2	8.4
	SPD (MPH)	7.3	8.6	4.3	12.4	4.6	4.7	6.8	6.3	7.6	8.5
	RATIO	0.948	0.994	0.496	0.953	0.946	0.591	0.953	0.981	0.949	0.993

TABLE 3-4, CONTINUED

1994 TEN HIGHEST 24-HOUR AVERAGE SO2 DAYS WITH WIND DATA

UNITS : MICROGRAMS PER CUBIC METER

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
ENFIELD-005 (0342)	SO2	70	62	62	61	57	53	51	48	48	47
	DATE	2/18/94	1/22/94	2/19/94	1/21/94	2/ 5/94	2/ 3/94	1/24/94	2/ 2/94	2/ 4/94	2/17/94
METEOROLOGICAL SITE	DIR (DEG)	190	300	170	270	210	270	250	280	180	220
NEWARK	VEL (MPH)	1.3	11.0	2.9	6.3	4.3	7.2	6.5	5.9	3.8	5.5
	SPD (MPH)	4.7	14.2	4.2	7.8	4.6	9.3	7.9	7.2	6.5	6.8
	RATIO	0.270	0.770	0.705	0.813	0.937	0.773	0.824	0.828	0.591	0.820
METEOROLOGICAL SITE	DIR (DEG)	160	290	170	180	190	250	280	90	230	200
BRADLEY	VEL (MPH)	1.2	8.1	4.8	4.0	4.7	3.2	4.0	.8	2.0	5.2
	SPD (MPH)	2.4	10.9	4.9	4.2	6.9	5.3	6.0	2.0	5.2	6.2
	RATIO	0.476	0.744	0.976	0.968	0.682	0.603	0.669	0.416	0.390	0.845
METEOROLOGICAL SITE	DIR (DEG)	210	300	110	290	250	280	280	300	260	240
BRIDGEPORT	VEL (MPH)	.5	10.8	.8	6.0	.6	8.1	8.2	2.2	8.2	5.4
	SPD (MPH)	3.5	11.9	1.3	6.9	2.3	9.5	9.1	3.9	8.8	5.5
	RATIO	0.136	0.905	0.648	0.869	0.263	0.858	0.906	0.566	0.933	0.989
METEOROLOGICAL SITE	DIR (DEG)	290	290	230	260	230	260	250	190	240	240
WORCESTER	VEL (MPH)	2.8	11.8	8.5	6.9	7.2	8.6	9.6	4.4	8.2	8.4
	SPD (MPH)	4.7	12.4	8.6	7.3	7.6	9.2	9.8	4.6	8.5	8.5
	RATIO	0.591	0.953	0.990	0.948	0.949	0.932	0.987	0.946	0.971	0.993
GREENWICH-017 (0364)	SO2	75	73	71	66	63	62	59	56	55	55
	DATE	2/18/94	1/12/94	1/22/94	1/21/94	1/11/94	1/20/94	2/15/94	2/19/94	12/21/94	12/ 3/94
METEOROLOGICAL SITE	DIR (DEG)	190	30	300	270	250	300	40	170	230	200
NEWARK	VEL (MPH)	1.3	6.4	11.0	6.3	5.9	6.5	2.5	2.9	5.5	3.1
	SPD (MPH)	4.7	6.5	14.2	7.8	6.9	7.8	2.7	4.2	7.2	5.9
	RATIO	0.270	0.983	0.770	0.813	0.856	0.841	0.904	0.705	0.763	0.520
METEOROLOGICAL SITE	DIR (DEG)	160	350	290	180	190	270	200	170	190	100
BRADLEY	VEL (MPH)	1.2	3.5	8.1	4.0	3.4	3.0	2.7	4.8	3.8	1.8
	SPD (MPH)	2.4	4.5	10.9	4.2	4.3	3.7	4.2	4.9	5.0	4.6
	RATIO	0.476	0.777	0.744	0.968	0.785	0.808	0.637	0.976	0.748	0.399
METEOROLOGICAL SITE	DIR (DEG)	210	60	300	290	280	310	70	110	270	250
BRIDGEPORT	VEL (MPH)	.5	5.9	10.8	6.0	4.2	4.5	3.8	.8	5.6	2.7
	SPD (MPH)	3.5	6.2	11.9	6.9	4.9	5.6	4.2	1.3	5.8	4.6
	RATIO	0.136	0.955	0.905	0.869	0.850	0.800	0.915	0.648	0.975	0.590
METEOROLOGICAL SITE	DIR (DEG)	290	10	290	260	230	270	220	230	270	250
WORCESTER	VEL (MPH)	2.8	2.1	11.8	6.9	8.6	6.4	4.0	8.5	11.6	6.1
	SPD (MPH)	4.7	4.3	12.4	7.3	8.6	6.8	5.3	8.6	12.1	6.6
	RATIO	0.591	0.496	0.953	0.948	0.994	0.953	0.751	0.990	0.960	0.925
GROTON-007 (0365)	SO2	80	75	66	64	60	57	55	52	48	46
	DATE	2/18/94	1/22/94	12/21/94	1/12/94	1/11/94	1/17/94	12/22/94	1/21/94	2/ 2/94	12/ 3/94
METEOROLOGICAL SITE	DIR (DEG)	190	300	230	30	250	250	60	270	280	200
NEWARK	VEL (MPH)	1.3	11.0	5.5	6.4	5.9	3.4	2.2	6.3	5.9	3.1
	SPD (MPH)	4.7	14.2	7.2	6.5	6.9	5.8	3.3	7.8	7.2	5.9
	RATIO	0.270	0.770	0.763	0.983	0.856	0.584	0.657	0.813	0.828	0.520
METEOROLOGICAL SITE	DIR (DEG)	160	290	190	350	190	230	360	180	90	100
BRADLEY	VEL (MPH)	1.2	8.1	3.8	3.5	3.4	2.5	1.1	4.0	.8	1.8
	SPD (MPH)	2.4	10.9	5.0	4.5	4.3	4.6	3.5	4.2	2.0	4.6
	RATIO	0.476	0.744	0.748	0.777	0.785	0.549	0.326	0.968	0.416	0.399

TABLE 3-4, CONTINUED

1994 TEN HIGHEST 24-HOUR AVERAGE SO2 DAYS WITH WIND DATA

UNITS : MICROGRAMS PER CUBIC METER

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
METEOROLOGICAL SITE	DIR (DEG)	210	300	270	60	280	250	160	290	300	250
BRIDGEPORT	VEL (MPH)	.5	10.8	5.6	5.9	4.2	3.7	.9	6.0	2.2	2.7
	SPD (MPH)	3.5	11.9	5.8	6.2	4.9	10.2	2.6	6.9	3.9	4.6
	RATIO	0.136	0.905	0.975	0.955	0.850	0.362	0.353	0.869	0.566	0.590
METEOROLOGICAL SITE	DIR (DEG)	290	290	270	10	230	200	280	260	190	250
WORCESTER	VEL (MPH)	2.8	11.8	11.6	2.1	8.6	11.6	6.2	6.9	4.4	6.1
	SPD (MPH)	4.7	12.4	12.1	4.3	8.6	12.1	6.3	7.3	4.6	6.6
	RATIO	0.591	0.953	0.960	0.496	0.994	0.959	0.981	0.948	0.946	0.925
HARTFORD-018 (0347)	SO2	96	87	75	72	71	69	66	65	59	58
	DATE	2/18/94	1/11/94	1/21/94	1/12/94	1/22/94	2/ 5/94	2/19/94	12/22/94	2/ 3/94	2/ 2/94
METEOROLOGICAL SITE	DIR (DEG)	190	250	270	30	300	210	170	60	270	280
NEWARK	VEL (MPH)	1.3	5.9	6.3	6.4	11.0	4.3	2.9	2.2	7.2	5.9
	SPD (MPH)	4.7	6.9	7.8	6.5	14.2	4.6	4.2	3.3	9.3	7.2
	RATIO	0.270	0.856	0.813	0.983	0.770	0.937	0.705	0.657	0.773	0.828
METEOROLOGICAL SITE	DIR (DEG)	160	190	180	350	290	190	170	360	250	90
BRADLEY	VEL (MPH)	1.2	3.4	4.0	3.5	8.1	4.7	4.8	1.1	3.2	.8
	SPD (MPH)	2.4	4.3	4.2	4.5	10.9	6.9	4.9	3.5	5.3	2.0
	RATIO	0.476	0.785	0.968	0.777	0.744	0.682	0.976	0.326	0.603	0.416
METEOROLOGICAL SITE	DIR (DEG)	210	280	290	60	300	250	110	160	280	300
BRIDGEPORT	VEL (MPH)	.5	4.2	6.0	5.9	10.8	.6	.8	.9	8.1	2.2
	SPD (MPH)	3.5	4.9	6.9	6.2	11.9	2.3	1.3	2.6	9.5	3.9
	RATIO	0.136	0.850	0.869	0.955	0.905	0.263	0.648	0.353	0.858	0.566
METEOROLOGICAL SITE	DIR (DEG)	290	230	260	10	290	230	230	280	260	190
WORCESTER	VEL (MPH)	2.8	8.6	6.9	2.1	11.8	7.2	8.5	6.2	8.6	4.4
	SPD (MPH)	4.7	8.6	7.3	4.3	12.4	7.6	8.6	6.3	9.2	4.6
	RATIO	0.591	0.994	0.948	0.496	0.953	0.949	0.990	0.981	0.932	0.946
MANSFIELD-003 (0363)	SO2	59	48	43	42	39	39	38	37	36	35
	DATE	1/22/94	2/18/94	1/12/94	1/11/94	1/21/94	12/ 2/94	2/ 5/94	2/ 4/94	12/ 3/94	2/17/94
METEOROLOGICAL SITE	DIR (DEG)	300	190	30	250	270	220	210	180	200	220
NEWARK	VEL (MPH)	11.0	1.3	6.4	5.9	6.3	8.9	4.3	3.8	3.1	5.5
	SPD (MPH)	14.2	4.7	6.5	6.9	7.8	10.1	4.6	6.5	5.9	6.8
	RATIO	0.770	0.270	0.983	0.856	0.813	0.889	0.937	0.591	0.520	0.820
METEOROLOGICAL SITE	DIR (DEG)	290	160	350	190	180	210	190	230	100	200
BRADLEY	VEL (MPH)	8.1	1.2	3.5	3.4	4.0	8.4	4.7	2.0	1.8	5.2
	SPD (MPH)	10.9	2.4	4.5	4.3	4.2	10.4	6.9	5.2	4.6	6.2
	RATIO	0.744	0.476	0.777	0.785	0.968	0.813	0.682	0.390	0.399	0.845
METEOROLOGICAL SITE	DIR (DEG)	300	210	60	280	290	260	250	260	250	240
BRIDGEPORT	VEL (MPH)	10.8	.5	5.9	4.2	6.0	13.6	.6	8.2	2.7	5.4
	SPD (MPH)	11.9	3.5	6.2	4.9	6.9	13.7	2.3	8.8	4.6	5.5
	RATIO	0.905	0.136	0.955	0.850	0.869	0.994	0.263	0.933	0.590	0.989
METEOROLOGICAL SITE	DIR (DEG)	290	290	10	230	260	230	230	240	250	240
WORCESTER	VEL (MPH)	11.8	2.8	2.1	8.6	6.9	10.7	7.2	8.2	6.1	8.4
	SPD (MPH)	12.4	4.7	4.3	8.6	7.3	10.8	7.6	8.5	6.6	8.5
	RATIO	0.953	0.591	0.496	0.994	0.948	0.996	0.949	0.971	0.925	0.993

TABLE 3-4, CONTINUED

1994 TEN HIGHEST 24-HOUR AVERAGE SO2 DAYS WITH WIND DATA

UNITS : MICROGRAMS PER CUBIC METER

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
NEW HAVEN-123 (0357)	SO2	154	146	135	118	109	108	106	105	104	97
	DATE	1/11/94	1/21/94	1/12/94	12/22/94	1/22/94	2/ 2/94	2/ 5/94	2/19/94	1/17/94	1/20/94
METEOROLOGICAL SITE	DIR (DEG)	250	270	30	60	300	280	210	170	250	300
NEWARK	VEL (MPH)	5.9	6.3	6.4	2.2	11.0	5.9	4.3	2.9	3.4	6.5
	SPD (MPH)	6.9	7.8	6.5	3.3	14.2	7.2	4.6	4.2	5.8	7.8
	RATIO	0.856	0.813	0.983	0.657	0.770	0.828	0.937	0.705	0.584	0.841
METEOROLOGICAL SITE	DIR (DEG)	190	180	350	360	290	90	190	170	230	270
BRADLEY	VEL (MPH)	3.4	4.0	3.5	1.1	8.1	.8	4.7	4.8	2.5	3.0
	SPD (MPH)	4.3	4.2	4.5	3.5	10.9	2.0	6.9	4.9	4.6	3.7
	RATIO	0.785	0.968	0.777	0.326	0.744	0.416	0.682	0.976	0.549	0.808
METEOROLOGICAL SITE	DIR (DEG)	280	290	60	160	300	300	250	110	250	310
BRIDGEPORT	VEL (MPH)	4.2	6.0	5.9	.9	10.8	2.2	.6	.8	3.7	4.5
	SPD (MPH)	4.9	6.9	6.2	2.6	11.9	3.9	2.3	1.3	10.2	5.6
	RATIO	0.850	0.869	0.955	0.353	0.905	0.566	0.263	0.648	0.362	0.800
METEOROLOGICAL SITE	DIR (DEG)	230	260	10	280	290	190	230	230	200	270
WORCESTER	VEL (MPH)	8.6	6.9	2.1	6.2	11.8	4.4	7.2	8.5	11.6	6.4
	SPD (MPH)	8.6	7.3	4.3	6.3	12.4	4.6	7.6	8.6	12.1	6.8
	RATIO	0.994	0.948	0.496	0.981	0.953	0.946	0.949	0.990	0.959	0.953
STAMFORD-124 (0357)	SO2	166	150	144	144	143	135	134	118	110	106
	DATE	2/18/94	2/19/94	2/ 2/94	2/ 5/94	1/11/94	2/17/94	2/15/94	2/ 3/94	1/12/94	2/ 1/94
METEOROLOGICAL SITE	DIR (DEG)	190	170	280	210	250	220	40	270	30	330
NEWARK	VEL (MPH)	1.3	2.9	5.9	4.3	5.9	5.5	2.5	7.2	6.4	4.5
	SPD (MPH)	4.7	4.2	7.2	4.6	6.9	6.8	2.7	9.3	6.5	6.3
	RATIO	0.270	0.705	0.828	0.937	0.856	0.820	0.904	0.773	0.983	0.714
METEOROLOGICAL SITE	DIR (DEG)	160	170	90	190	190	200	200	250	350	210
BRADLEY	VEL (MPH)	1.2	4.8	.8	4.7	3.4	5.2	2.7	3.2	3.5	.1
	SPD (MPH)	2.4	4.9	2.0	6.9	4.3	6.2	4.2	5.3	4.5	3.3
	RATIO	0.476	0.976	0.416	0.682	0.785	0.845	0.637	0.603	0.777	0.028
METEOROLOGICAL SITE	DIR (DEG)	210	110	300	250	280	240	70	280	60	360
BRIDGEPORT	VEL (MPH)	.5	.8	2.2	.6	4.2	5.4	3.8	8.1	5.9	1.7
	SPD (MPH)	3.5	1.3	3.9	2.3	4.9	5.5	4.2	9.5	6.2	3.5
	RATIO	0.136	0.648	0.566	0.263	0.850	0.989	0.915	0.858	0.955	0.490
METEOROLOGICAL SITE	DIR (DEG)	290	230	190	230	230	240	220	260	10	280
WORCESTER	VEL (MPH)	2.8	8.5	4.4	7.2	8.6	8.4	4.0	8.6	2.1	4.9
	SPD (MPH)	4.7	8.6	4.6	7.6	8.6	8.5	5.3	9.2	4.3	5.3
	RATIO	0.591	0.990	0.946	0.949	0.994	0.993	0.751	0.932	0.496	0.926
WATERBURY-123 (0359)	SO2	88	79	76	75	75	74	68	67	66	63
	DATE	2/18/94	2/19/94	1/22/94	1/11/94	1/17/94	1/21/94	2/17/94	2/ 5/94	1/ 1/94	1/12/94
METEOROLOGICAL SITE	DIR (DEG)	190	170	300	250	250	270	220	210	200	30
NEWARK	VEL (MPH)	1.3	2.9	11.0	5.9	3.4	6.3	5.5	4.3	7.5	6.4
	SPD (MPH)	4.7	4.2	14.2	6.9	5.8	7.8	6.8	4.6	7.6	6.5
	RATIO	0.270	0.705	0.770	0.856	0.584	0.813	0.820	0.937	0.988	0.983
METEOROLOGICAL SITE	DIR (DEG)	160	170	290	190	230	180	200	190	190	350
BRADLEY	VEL (MPH)	1.2	4.8	8.1	3.4	2.5	4.0	5.2	4.7	9.0	3.5
	SPD (MPH)	2.4	4.9	10.9	4.3	4.6	4.2	6.2	6.9	9.3	4.5
	RATIO	0.476	0.976	0.744	0.785	0.549	0.968	0.845	0.682	0.964	0.777

TABLE 3-4, CONTINUED

1994 TEN HIGHEST 24-HOUR AVERAGE SO2 DAYS WITH WIND DATA

UNITS : MICROGRAMS PER CUBIC METER

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
METEOROLOGICAL SITE	DIR (DEG)	210	110	300	280	250	290	240	250	240	60
BRIDGEPORT	VEL (MPH)	.5	.8	10.8	4.2	3.7	6.0	5.4	.6	7.4	5.9
	SPD (MPH)	3.5	1.3	11.9	4.9	10.2	6.9	5.5	2.3	7.9	6.2
	RATIO	0.136	0.648	0.905	0.850	0.362	0.869	0.989	0.263	0.940	0.955
METEOROLOGICAL SITE	DIR (DEG)	290	230	290	230	200	260	240	230	230	10
WORCESTER	VEL (MPH)	2.8	8.5	11.8	8.6	11.6	6.9	8.4	7.2	9.7	2.1
	SPD (MPH)	4.7	8.6	12.4	8.6	12.1	7.3	8.5	7.6	9.9	4.3
	RATIO	0.591	0.990	0.953	0.994	0.959	0.948	0.993	0.949	0.976	0.496

FIGURE 3-4

AVERAGES OF THE ANNUAL SO_2 CONCENTRATIONS AT SIX SITES

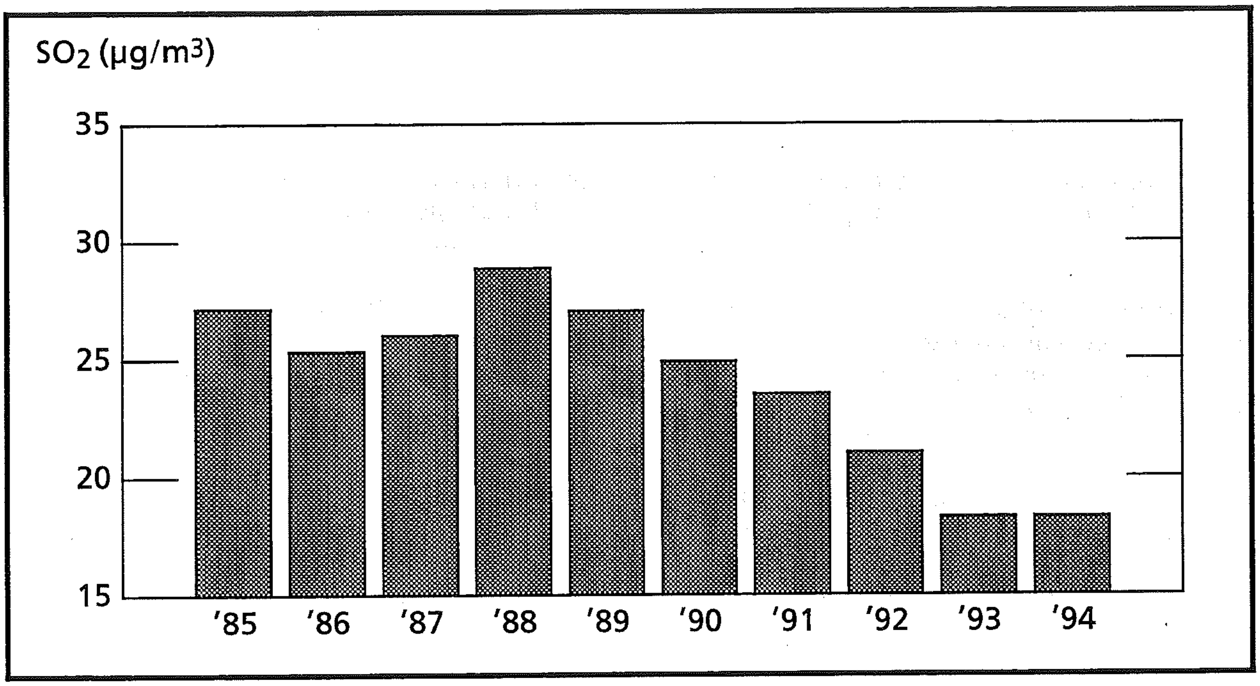
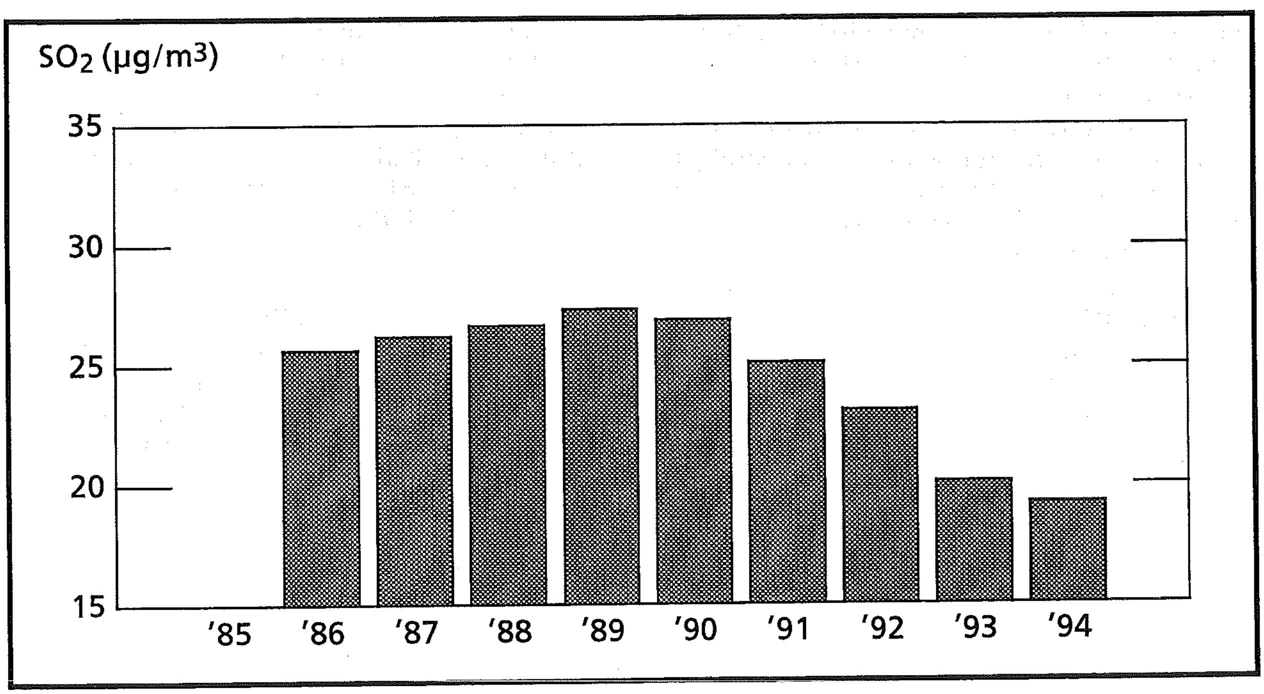


FIGURE 3-5

3-YEAR AVERAGES OF THE ANNUAL SO_2 CONCENTRATIONS AT SIX SITES



IV. OZONE

HEALTH EFFECTS

Ozone is a highly reactive form of oxygen and the principal component of modern smog. Until recently, EPA called this type of pollution "photochemical oxidants." The name has been changed to ozone because ozone is the only oxidant actually measured and is the most plentiful.

Ozone and other oxidants -- including peroxyacetal nitrates (PAN), formaldehyde and peroxides -- are not usually emitted into the air directly. They are formed by chemical reactions in the air from two other pollutants: hydrocarbons and nitrogen oxides. Energy from sunlight is needed for these chemical reactions. This accounts for the term photochemical smog and the daily variation in ozone levels, which increase during the day and decrease at night.

Ozone is a pungent gas with a faintly bluish color. It irritates the mucous membranes of the respiratory system, causing coughing, choking and impaired lung function. It aggravates chronic respiratory diseases like asthma and bronchitis and is believed capable of hastening the death, by pneumonia, of persons in already weakened health. PAN and the other oxidants that accompany ozone are powerful eye irritants.

NATIONAL AMBIENT AIR QUALITY STANDARD

On February 8, 1979 the EPA established a national ambient air quality standard (NAAQS) for ozone of 0.12 ppm for a one-hour average. Compliance with this standard is determined by summing the number of days at each monitoring site over a consecutive three-year period when the 1-hour standard is exceeded and then computing the average number of exceedances over this interval. If the resulting average value is less than or equal to 1.0 (that is, if the fourth highest daily value in a consecutive three-year period is less than or equal to 0.12 ppm) the ozone standard is considered attained at the site. This standard replaces the old photochemical oxidant standard of 0.08 ppm. The definition of the pollutant was changed along with the numerical value of the standard, partly because the instruments used to measure photochemical oxidants in the air really measure only ozone. Ozone is one of a group of chemicals which are formed photochemically in the air and are called photochemical oxidants. In the past, the two terms have often been used interchangeably. This Air Quality Summary uses the term "ozone" in conjunction with the NAAQS to reflect the change in both the numerical value of the NAAQS and the definition of the pollutant.

The EPA defines the ozone standard to two decimal places. Therefore, the standard is considered exceeded when a level of 0.13 ppm is reached. However, since the DEP still measures ozone levels to three decimal places, any one-hour average ozone reading which equals or is greater than 0.125 ppm is considered an exceedance of the 0.12 ppm standard in Connecticut. This interpretation of the ozone standard differs from the one used by the DEP before 1982, when a one-hour ozone concentration of 0.121 ppm was considered an exceedance of the standard.

CONCLUSIONS

As in past years, Connecticut experienced high concentrations of ozone in the summer months of 1994. Levels in excess of the one-hour NAAQS of 0.12 ppm were recorded at all eleven ozone monitoring sites. The highest concentration was 0.187 ppm, which occurred at the Stratford 007 site.

The incidence of hourly ozone concentrations in excess of the 1-hour 0.12 ppm standard was significantly lower in 1994 than in 1993 (see Table 4-1). There was a total of 84 hourly exceedances in 1993 and 67 hourly exceedances in 1994 at the eleven monitoring sites. This represents a decrease in the frequency of such exceedances from 1.6 per 1000 sampling hours in 1993 to 1.3 per 1000 sampling hours in 1994: a 19% decrease. The actual number of hours when the ozone standard was exceeded in the state decreased from 45 in 1993 to 32 in 1994.

The number of site-days on which the ozone monitors experienced ozone levels in excess of the 1-hour standard decreased from 42 in 1993 to 27 in 1994 at the eleven monitoring sites (see Table 4-2). This represents a decrease in the frequency of such occurrences from 1.9 per 100 sampling days in 1993 to 1.25 per 100 sampling days in 1994: a 34% decrease. The actual number of days on which the ozone standard was exceeded in the state decreased from 15 in 1993 to 9 in 1994.

The yearly changes in ozone concentrations can be attributed primarily to year-to-year variations in regional weather conditions, especially wind direction, temperature and the amount of sunlight. A large portion of the peak ozone concentrations in Connecticut is caused by the transport of ozone and/or precursors (i.e., hydrocarbons and nitrogen oxides) from the New York City area and other points to the west and southwest. Therefore, a decrease in the frequency of winds out of the southwest would help to explain the decrease in the number of ozone exceedances from 1993 to 1994. The percentage of southwest winds during the "ozone season" increased from 32% in 1993 to 38% in 1994, as is shown by the wind roses from Newark (Figures 4-1 and 4-2). The magnitude of high ozone levels can be partly associated with yearly variations in temperature, since ozone production is greatest at high temperatures and in strong sunlight. The summer season's daily high temperatures were significantly lower in 1994 than in 1993. This is demonstrated by the number of days exceeding 90° F which decreased from seventeen in 1993 to eleven in 1994 at Sikorsky Airport in Bridgeport, and from nineteen in 1993 to fourteen in 1994 at Bradley International Airport. The incidence of high ozone levels is dependent on the percentage of possible sunshine, since sunlight is essential to the creation of ozone. According to National Weather Service local climatological data recorded at Bradley Airport, the percentage of sunshine decreased from 65% in 1993 to 49% in 1994 for the months April through October. The average for these summer months at Bradley is usually 60%. Of the meteorological parameters discussed above, both temperature and percentage of possible sunshine can be seen as contributing to the decrease in ozone levels from 1993 to 1994.

The meteorological influences notwithstanding, additional and important factors contributing to the decrease in ozone concentrations over time are the continuing efforts of the EPA and the state Department of Environmental Protection to control the emissions of nitrogen oxides and hydrocarbons. Newer automobiles continue to be less polluting and the use of lower vapor pressure gasoline in the summer months, which was initiated in 1989, is a major effective control strategy.

METHOD OF MEASUREMENT

The DEP Air Monitoring Unit uses UV photometry to measure and record instantaneous concentrations of ozone continuously by means of a UV absorption technique. Properly calibrated, instruments of this type are shown to be remarkably reliable and stable.

DISCUSSION OF DATA

Monitoring Network - In order to gather information which will further the understanding of ozone production and transport, DEP operated a state-wide ozone monitoring network consisting of four types of sites in 1994 (see Figure 4-3):

Urban - East Hartford, Middletown

Advection from Southwest	- Greenwich, Groton, Madison, Stratford
Urban and advection from Southwest	- Bridgeport, Danbury, New Haven
Rural	- Stafford, Torrington

Precision and Accuracy - The ozone monitors had a total of 327 precision checks during 1994. The resulting 95% probability limits were -7% to +3%. Accuracy is determined by introducing a known amount of ozone into each of the monitors. Three different concentration levels are tested: low, medium, and high. The 95% probability limits, based on 11 audits conducted on the monitoring system, were: low, -7% to +6%; medium, -5% to +4%; and high, -5% to +2%.

1-Hour Average - The 1-hour ozone standard was exceeded at all eleven DEP monitoring sites in 1994. Between 1993 and 1994, the maximum 1-hour concentration increased at six sites and decreased at four sites; the second high 1-hour concentration decreased at seven sites and increased at three sites.

The number of hours when the ozone standard was exceeded at each site during the summertime "ozone season" is presented in Table 4-1. The number of days on which the 1-hour standard was exceeded at each site is presented in Table 4-2. Figure 4-4 shows the year's high and second high concentrations at each site.

10 High Days with Wind Data - Table 4-3 lists the ten highest 1-hour ozone averages and their dates of occurrence for each ozone site in 1994. The wind data associated with these high readings are also presented. (See the discussion of Table 2-5 in the particulate matter section of this Air Quality Summary for a description of the origin and use of these wind data.)

Most (i.e., 83%) of the tabulated high ozone levels occurred on days with winds out of the southwest. This is due to the special features of a southwest wind blowing over Connecticut. The first feature is that, during the summer, southwest winds are usually accompanied by high temperatures and bright sunshine, which are important to the production of ozone. The second feature of a southwest wind is that it will transport precursor emissions from New York City and other urban areas to the southwest of Connecticut. It is the combination of these factors that often produces unhealthful ozone levels in Connecticut.

There are also instances of high ozone levels on non-southwest wind days. This suggests that pollution control programs currently being implemented in this state are needed to protect the public health of Connecticut's citizenry on days when Connecticut is responsible for its own pollution.

Trends - Ozone trends can be illustrated in a number of ways by using various statistics: daily mean concentration, daily maximum concentration, number of hourly exceedances, number of daily exceedances, etc. Each has its merits. The daily maximum ozone concentration is used here as the basis for a trend analysis because (1) it represents a more robust data set than hourly or daily exceedances, and (2) a maximum concentration is more relevant to the NAAQS for ozone.

Figure 4-5 shows the unweighted average of the annual means of the maximum daily concentrations at ten ozone sites from 1985 to 1994. There is a lot of variation in the statistic from one year to the next. The importance of meteorology in the formation of ozone explains much of this variation. However, unless the effect of meteorology can be factored out, one cannot judge the effect of emission control measures on ozone production. A regression line through the data in Figure 4-5 would trend down, but the reason for this would not be evident.

The effect of meteorology on an ozone trend can be diminished by multiple year averaging. Periods of multiple years exhibit much less meteorological variability than do single years, and a trend analysis based on multiple years should more clearly reveal the effect of emission controls on ambient ozone concentrations. Figure 4-6 illustrates five year running averages of the data that is presented in Figure 4-5. With the variability of the weather minimized, it is evident that ozone is trending downward.

TABLE 4-1

NUMBER OF HOURS WHEN THE 1-HOUR OZONE STANDARD WAS EXCEEDED IN 1994

SITE	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	1994	1993
Bridgeport 013	0	0	4	2	0	0	0	6	8
Danbury 123	0	0	0	3	1	0	0	4	5
E. Hartford 003	0	0	6	2	0	0	0	8	5
Greenwich 017	0	0	4	8	0	0	0	12	10
Groton 008	0	0	0	3	0	0	0	3	5
Madison 002	0	0	3	4	0	0	0	7	10
Middletown 007	0	0	2	3	1	0	0	6	11
New Haven 123	0	0	4	2	0	0	0	6	3
Stafford 001	0	0	0	2	0	0	0	2	8
Stratford 007	0	0	4	8	0	0	0	12	14
Torrington 006	0	0	0	0	1	0	0	1	5
TOTAL SITE HOURS	0	0	27	37	3	0	0	67	84

TABLE 4-2

NUMBER OF DAYS WHEN THE 1-HOUR OZONE STANDARD WAS EXCEEDED IN 1994

SITE	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	1994	1993
Bridgeport 013	0	0	1	2	0	0	0	3	4
Danbury 123	0	0	0	1	1	0	0	2	4
E. Hartford 003	0	0	1	1	0	0	0	2	3
Greenwich 017	0	0	1	3	0	0	0	4	4
Groton 008	0	0	0	1	0	0	0	1	2
Madison 002	0	0	1	1	0	0	0	2	5
Middletown 007	0	0	1	2	1	0	0	4	5
New Haven 123	0	0	1	2	0	0	0	3	2
Stafford 001	0	0	0	1	0	0	0	1	3
Stratford 007	0	0	1	3	0	0	0	4	6
Torrington 006	0	0	0	0	1	0	0	1	4
TOTAL SITE DAYS	0	0	7	17	3	0	0	27	42

FIGURE 4-1

WIND ROSE FOR APRIL - OCTOBER 1993
NEWARK INTERNATIONAL AIRPORT
NEWARK, NEW JERSEY

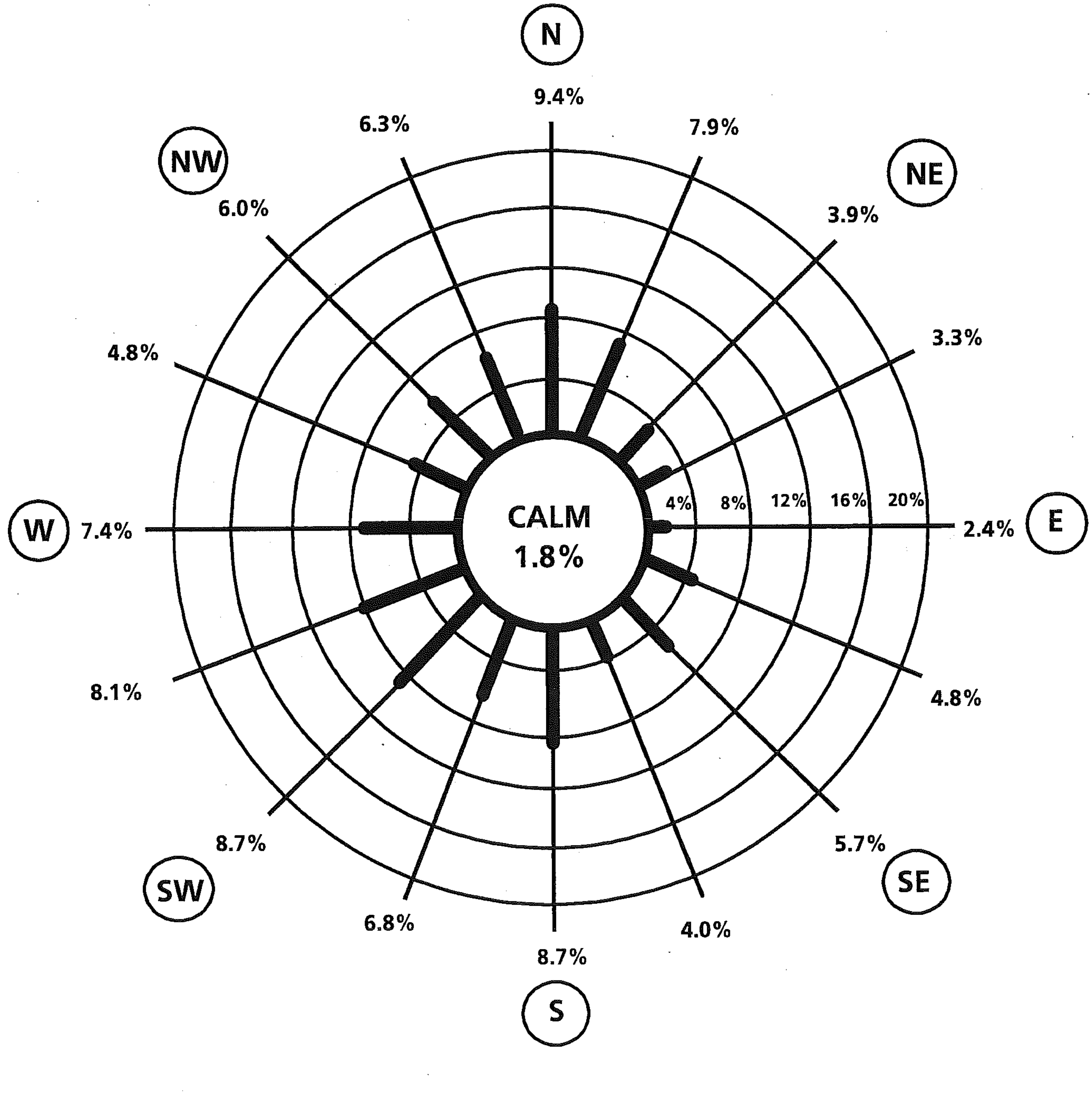
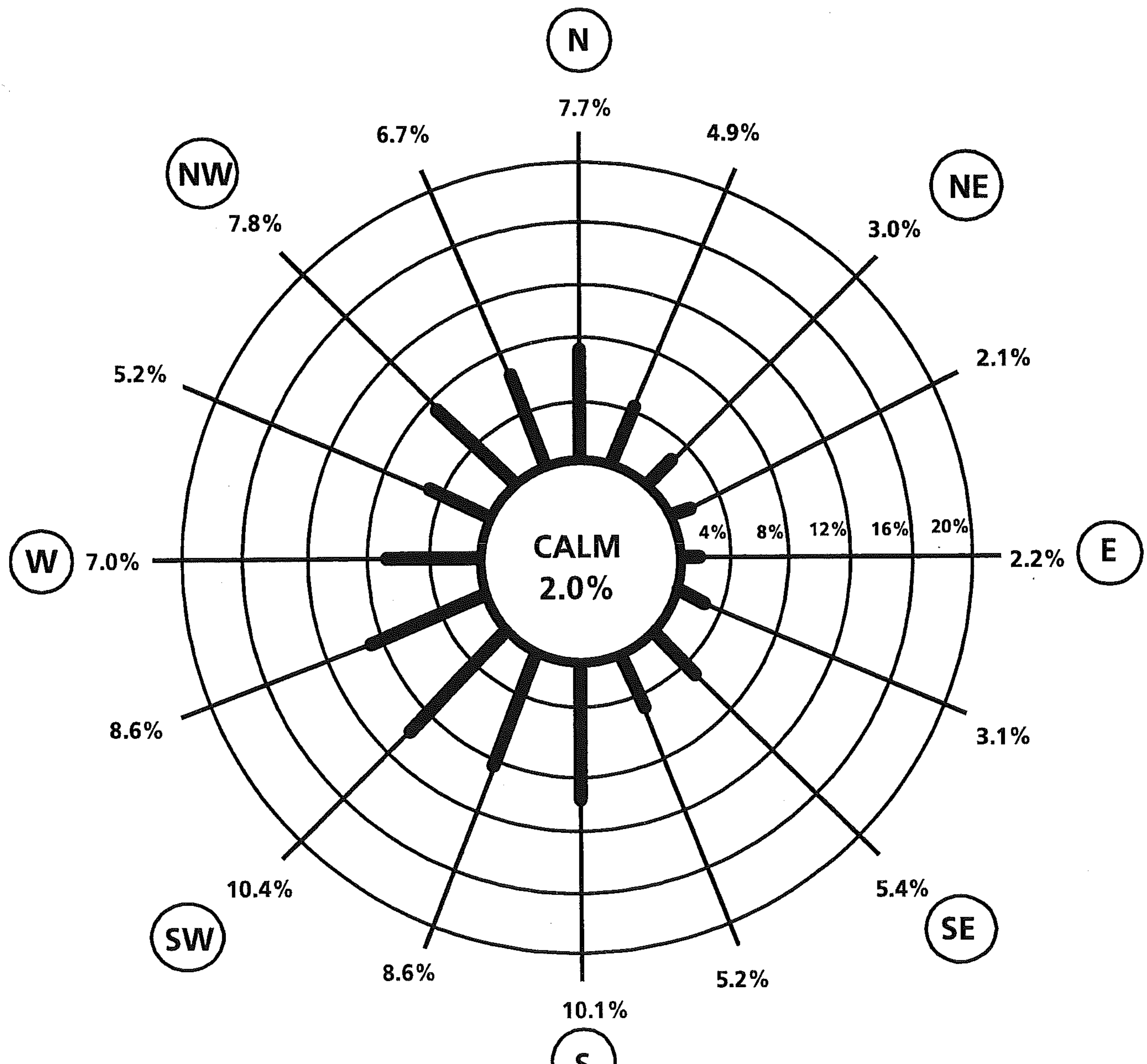


FIGURE 4-2

WIND ROSE FOR APRIL - OCTOBER 1994
NEWARK INTERNATIONAL AIRPORT
NEWARK, NEW JERSEY



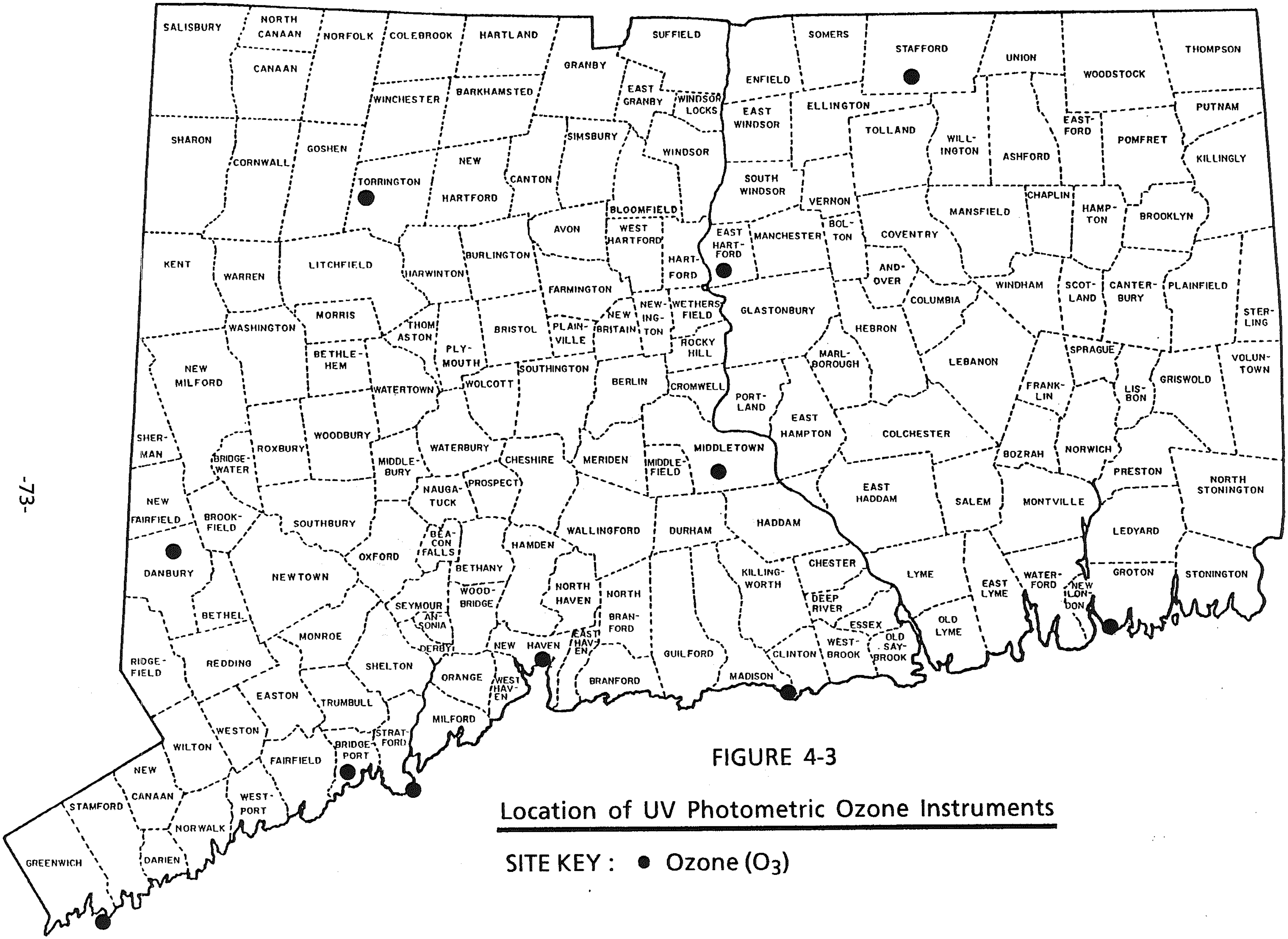


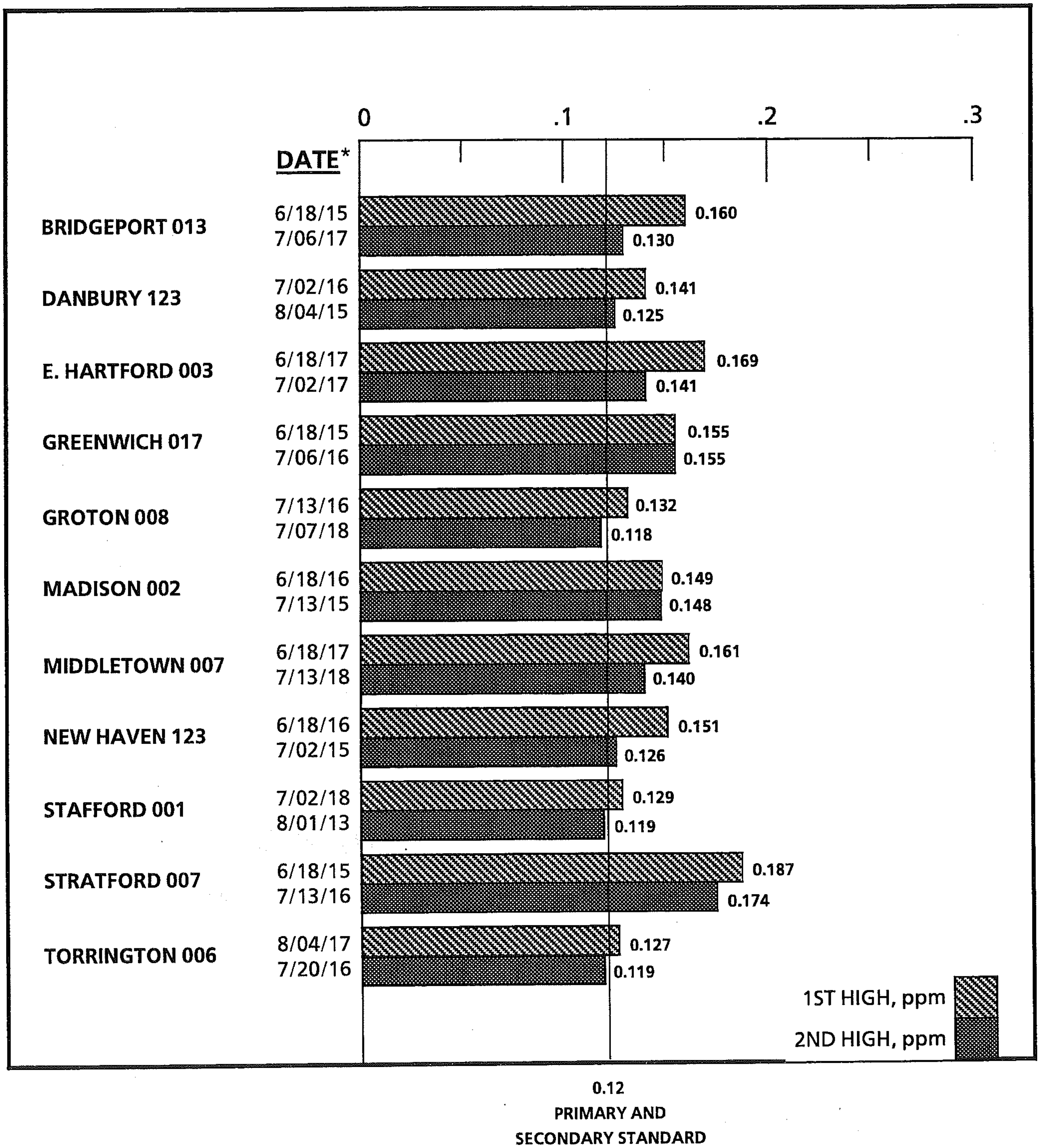
FIGURE 4-3

Location of UV Photometric Ozone Instruments

SITE KEY : ● Ozone (O_3)

FIGURE 4-4

1ST AND 2ND HIGH 1-HOUR OZONE CONCENTRATIONS IN 1994



* The date is the month/day/ending hour (standard time) of occurrence.

N.B. To be consistent with the requirements of the NAAQS for ozone, only the highest hourly concentration per day per site is considered.

TABLE 4-3

1994 TEN HIGHEST 1-HOUR AVERAGE OZONE DAYS WITH WIND DATA

UNITS : PARTS PER MILLION

TOWN-SITE (SAMPLES)		RANK	1	2	3	4	5	6	7	8	9	10
BRIDGEPORT-013 (4754)		OZONE	.160	.130	.128	.121	.100	.099	.095	.095	.095	.093
		DATE	6/18/94	7/ 6/94	7/13/94	7/ 2/94	7/20/94	8/ 2/94	8/26/94	7/ 8/94	7/24/94	8/ 9/94
	METEOROLOGICAL SITE	DIR (DEG)	250	280	250	210	190	190	240	120	210	210
	NEWARK	VEL (MPH)	7.4	6.8	6.9	5.3	5.5	4.3	5.9	3.5	3.9	5.7
		SPD (MPH)	9.5	9.6	8.8	7.5	7.9	7.2	7.5	6.8	5.6	8.5
		RATIO	0.778	0.702	0.789	0.714	0.697	0.597	0.792	0.519	0.703	0.677
	METEOROLOGICAL SITE	DIR (DEG)	210	200	250	210	200	230	220	210	180	210
	BRADLEY	VEL (MPH)	3.2	1.8	2.8	4.6	1.6	.5	.9	3.1	3.8	4.4
		SPD (MPH)	3.5	3.7	3.7	6.8	3.3	1.3	2.4	4.2	6.5	5.5
		RATIO	0.919	0.472	0.755	0.682	0.478	0.370	0.350	0.752	0.584	0.815
	METEOROLOGICAL SITE	DIR (DEG)	250	240	240	240	160	230	230	130	190	230
	BRIDGEPORT	VEL (MPH)	5.7	5.5	6.2	5.2	2.8	4.8	4.1	1.7	2.0	6.6
		SPD (MPH)	5.8	5.6	6.5	5.9	3.9	5.0	4.9	3.9	2.9	6.8
		RATIO	0.992	0.979	0.960	0.877	0.726	0.947	0.834	0.427	0.702	0.982
	METEOROLOGICAL SITE	DIR (DEG)	260	250	270	240	240	250	270	260	220	240
	WORCESTER	VEL (MPH)	4.7	5.3	7.4	8.1	5.1	3.4	4.1	2.0	4.8	5.0
		SPD (MPH)	5.0	5.3	8.2	8.3	5.8	4.2	4.6	3.6	5.3	5.3
		RATIO	0.924	0.989	0.902	0.975	0.889	0.821	0.883	0.550	0.894	0.936
DANBURY-123 (4755)		OZONE	.141	.125	.123	.122	.116	.114	.111	.109	.107	.107
		DATE	7/ 2/94	8/ 4/94	6/17/94	8/ 9/94	6/14/94	7/ 9/94	7/19/94	8/ 8/94	8/ 3/94	8/ 2/94
	METEOROLOGICAL SITE	DIR (DEG)	210	240	150	210	220	180	170	150	200	190
	NEWARK	VEL (MPH)	5.3	8.0	4.1	5.7	7.1	4.6	5.0	4.1	4.1	4.3
		SPD (MPH)	7.5	9.8	6.0	8.5	10.1	7.2	6.0	6.3	7.9	7.2
		RATIO	0.714	0.814	0.682	0.677	0.710	0.646	0.821	0.646	0.521	0.597
	METEOROLOGICAL SITE	DIR (DEG)	210	200	200	210	170	200	220	170	220	230
	BRADLEY	VEL (MPH)	4.6	3.9	2.4	4.4	3.5	3.7	2.5	2.1	1.2	.5
		SPD (MPH)	6.8	4.6	4.0	5.5	6.2	4.0	2.6	3.2	2.0	1.3
		RATIO	0.682	0.843	0.606	0.815	0.572	0.911	0.962	0.679	0.604	0.370
	METEOROLOGICAL SITE	DIR (DEG)	240	230	230	230	220	140	230	200	220	230
	BRIDGEPORT	VEL (MPH)	5.2	5.7	5.6	6.6	6.0	4.0	5.8	3.6	5.0	4.8
		SPD (MPH)	5.9	6.3	5.9	6.8	6.3	5.6	6.3	4.9	5.5	5.0
		RATIO	0.877	0.901	0.943	0.982	0.956	0.710	0.915	0.737	0.909	0.947
	METEOROLOGICAL SITE	DIR (DEG)	240	210	270	240	240	150	230	200	230	250
	WORCESTER	VEL (MPH)	8.1	7.5	4.2	5.0	4.0	3.2	6.6	1.3	4.6	3.4
		SPD (MPH)	8.3	7.9	4.6	5.3	4.3	4.5	6.9	3.5	5.0	4.2
		RATIO	0.975	0.947	0.918	0.936	0.927	0.712	0.954	0.374	0.905	0.821
EAST HARTFORD-003 (4850)		OZONE	.169	.141	.120	.120	.111	.109	.109	.108	.106	.105
		DATE	6/18/94	7/ 2/94	8/ 4/94	7/20/94	8/ 9/94	8/28/94	7/19/94	8/ 3/94	8/ 1/94	7/ 8/94
	METEOROLOGICAL SITE	DIR (DEG)	250	210	240	190	210	220	170	200	210	120
	NEWARK	VEL (MPH)	7.4	5.3	8.0	5.5	5.7	9.0	5.0	4.1	5.4	3.5
		SPD (MPH)	9.5	7.5	9.8	7.9	8.5	10.2	6.0	7.9	7.0	6.8
		RATIO	0.778	0.714	0.814	0.697	0.677	0.882	0.821	0.521	0.767	0.519
	METEOROLOGICAL SITE	DIR (DEG)	210	210	200	200	210	200	220	220	220	210
	BRADLEY	VEL (MPH)	3.2	4.6	3.9	1.6	4.4	4.3	2.5	1.2	1.6	3.1
		SPD (MPH)	3.5	6.8	4.6	3.3	5.5	6.6	2.6	2.0	1.7	4.2
		RATIO	0.919	0.682	0.843	0.478	0.815	0.654	0.962	0.604	0.948	0.752

TABLE 4-3, CONTINUED

1994 TEN HIGHEST 1-HOUR AVERAGE OZONE DAYS WITH WIND DATA

UNITS : PARTS PER MILLION

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
METEOROLOGICAL SITE	DIR (DEG)	250	240	230	160	230	230	230	220	230	130
BRIDGEPORT	VEL (MPH)	5.7	5.2	5.7	2.8	6.6	7.2	5.8	5.0	4.5	1.7
	SPD (MPH)	5.8	5.9	6.3	3.9	6.8	7.5	6.3	5.5	4.7	3.9
	RATIO	0.992	0.877	0.901	0.726	0.982	0.959	0.915	0.909	0.950	0.427
METEOROLOGICAL SITE	DIR (DEG)	260	240	210	240	240	230	230	230	240	260
WORCESTER	VEL (MPH)	4.7	8.1	7.5	5.1	5.0	10.6	6.6	4.6	3.0	2.0
	SPD (MPH)	5.0	8.3	7.9	5.8	5.3	10.8	6.9	5.0	4.2	3.6
	RATIO	0.924	0.975	0.947	0.889	0.936	0.985	0.954	0.905	0.711	0.550
GREENWICH-017 (4859)	OZONE	.155	.155	.144	.128	.121	.121	.120	.119	.116	.115
	DATE	6/18/94	7/ 6/94	7/ 7/94	7/13/94	7/24/94	8/ 9/94	7/19/94	8/ 2/94	8/ 4/94	7/20/94
METEOROLOGICAL SITE	DIR (DEG)	250	280	290	250	210	210	170	190	240	190
NEWARK	VEL (MPH)	7.4	6.8	4.2	6.9	3.9	5.7	5.0	4.3	8.0	5.5
	SPD (MPH)	9.5	9.6	8.1	8.8	5.6	8.5	6.0	7.2	9.8	7.9
	RATIO	0.778	0.702	0.518	0.789	0.703	0.677	0.821	0.597	0.814	0.697
METEOROLOGICAL SITE	DIR (DEG)	210	200	90	250	180	210	220	230	200	200
BRADLEY	VEL (MPH)	3.2	1.8	.1	2.8	3.8	4.4	2.5	.5	3.9	1.6
	SPD (MPH)	3.5	3.7	2.2	3.7	6.5	5.5	2.6	1.3	4.6	3.3
	RATIO	0.919	0.472	0.040	0.755	0.584	0.815	0.962	0.370	0.843	0.478
METEOROLOGICAL SITE	DIR (DEG)	250	240	220	240	190	230	230	230	230	160
BRIDGEPORT	VEL (MPH)	5.7	5.5	4.4	6.2	2.0	6.6	5.8	4.8	5.7	2.8
	SPD (MPH)	5.8	5.6	5.5	6.5	2.9	6.8	6.3	5.0	6.3	3.9
	RATIO	0.992	0.979	0.799	0.960	0.702	0.982	0.915	0.947	0.901	0.726
METEOROLOGICAL SITE	DIR (DEG)	260	250	160	270	220	240	230	250	210	240
WORCESTER	VEL (MPH)	4.7	5.3	1.8	7.4	4.8	5.0	6.6	3.4	7.5	5.1
	SPD (MPH)	5.0	5.3	3.5	8.2	5.3	5.3	6.9	4.2	7.9	5.8
	RATIO	0.924	0.989	0.528	0.902	0.894	0.936	0.954	0.821	0.947	0.889
GROTON-008 (4357)	OZONE	.132	.118	.108	.107	.106	.104	.103	.100	.100	.098
	DATE	7/13/94	7/ 7/94	7/27/94	7/16/94	8/27/94	6/ 7/94	6/18/94	6/19/94	6/23/94	8/ 4/94
METEOROLOGICAL SITE	DIR (DEG)	250	290	50	320	280	280	250	350	240	240
NEWARK	VEL (MPH)	6.9	4.2	.4	6.7	3.6	7.7	7.4	9.7	1.4	8.0
	SPD (MPH)	8.8	8.1	7.8	6.9	5.8	13.1	9.5	11.6	6.9	9.8
	RATIO	0.789	0.518	0.048	0.977	0.632	0.588	0.778	0.836	0.203	0.814
METEOROLOGICAL SITE	DIR (DEG)	250	90	340	290	300	290	210	350	270	200
BRADLEY	VEL (MPH)	2.8	.1	2.0	2.7	2.8	4.8	3.2	6.0	3.7	3.9
	SPD (MPH)	3.7	2.2	2.3	2.7	3.5	7.8	3.5	6.5	4.0	4.6
	RATIO	0.755	0.040	0.874	0.977	0.807	0.622	0.919	0.935	0.908	0.843
METEOROLOGICAL SITE	DIR (DEG)	240	220	230	250	240	280	250	340	240	230
BRIDGEPORT	VEL (MPH)	6.2	4.4	1.5	3.4	4.4	6.3	5.7	3.9	7.0	5.7
	SPD (MPH)	6.5	5.5	4.6	4.3	4.5	7.2	5.8	8.6	7.2	6.3
	RATIO	0.960	0.799	0.327	0.780	0.981	0.882	0.992	0.447	0.979	0.901
METEOROLOGICAL SITE	DIR (DEG)	270	160	310	290	280	280	260	330	290	210
WORCESTER	VEL (MPH)	7.4	1.8	5.4	6.8	5.7	8.2	4.7	5.4	5.6	7.5
	SPD (MPH)	8.2	3.5	5.5	7.0	6.0	9.9	5.0	6.0	5.6	7.9
	RATIO	0.902	0.528	0.984	0.969	0.952	0.823	0.924	0.892	0.998	0.947

TABLE 4-3, CONTINUED

1994 TEN HIGHEST 1-HOUR AVERAGE OZONE DAYS WITH WIND DATA

UNITS : PARTS PER MILLION

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
MADISON-002 (4794)	OZONE	.149	.148	.120	.113	.111	.111	.110	.110	.108	.107
	DATE	6/18/94	7/13/94	8/ 9/94	7/25/94	7/ 6/94	8/ 4/94	7/ 2/94	7/12/94	5/23/94	7/19/94
METEOROLOGICAL SITE	DIR (DEG)	250	250	210	260	280	240	210	270	260	170
NEWARK	VEL (MPH)	7.4	6.9	5.7	4.3	6.8	8.0	5.3	7.2	3.4	5.0
	SPD (MPH)	9.5	8.8	8.5	8.3	9.6	9.8	7.5	8.6	6.5	6.0
	RATIO	0.778	0.789	0.677	0.518	0.702	0.814	0.714	0.836	0.524	0.821
METEOROLOGICAL SITE	DIR (DEG)	210	250	210	250	200	200	210	230	50	220
BRADLEY	VEL (MPH)	3.2	2.8	4.4	4.9	1.8	3.9	4.6	3.2	2.6	2.5
	SPD (MPH)	3.5	3.7	5.5	6.0	3.7	4.6	6.8	3.9	4.9	2.6
	RATIO	0.919	0.755	0.815	0.809	0.472	0.843	0.682	0.815	0.527	0.962
METEOROLOGICAL SITE	DIR (DEG)	250	240	230	240	240	230	240	220	270	230
BRIDGEPORT	VEL (MPH)	5.7	6.2	6.6	3.4	5.5	5.7	5.2	4.7	3.7	5.8
	SPD (MPH)	5.8	6.5	6.8	5.0	5.6	6.3	5.9	6.8	5.5	6.3
	RATIO	0.992	0.960	0.982	0.674	0.979	0.901	0.877	0.694	0.675	0.915
METEOROLOGICAL SITE	DIR (DEG)	260	270	240	230	250	210	240	270	20	230
WORCESTER	VEL (MPH)	4.7	7.4	5.0	5.7	5.3	7.5	8.1	6.9	3.5	6.6
	SPD (MPH)	5.0	8.2	5.3	5.9	5.3	7.9	8.3	7.2	5.0	6.9
	RATIO	0.924	0.902	0.936	0.959	0.989	0.947	0.975	0.963	0.691	0.954
MIDDLETOWN-007 (4668)	OZONE	.161	.140	.127	.126	.124	.122	.120	.120	.112	.111
	DATE	6/18/94	7/13/94	7/ 2/94	8/ 9/94	7/19/94	7/ 6/94	8/28/94	7/25/94	8/ 3/94	8/ 4/94
METEOROLOGICAL SITE	DIR (DEG)	250	250	210	210	170	280	220	260	200	240
NEWARK	VEL (MPH)	7.4	6.9	5.3	5.7	5.0	6.8	9.0	4.3	4.1	8.0
	SPD (MPH)	9.5	8.8	7.5	8.5	6.0	9.6	10.2	8.3	7.9	9.8
	RATIO	0.778	0.789	0.714	0.677	0.821	0.702	0.882	0.518	0.521	0.814
METEOROLOGICAL SITE	DIR (DEG)	210	250	210	210	220	200	200	250	220	200
BRADLEY	VEL (MPH)	3.2	2.8	4.6	4.4	2.5	1.8	4.3	4.9	1.2	3.9
	SPD (MPH)	3.5	3.7	6.8	5.5	2.6	3.7	6.6	6.0	2.0	4.6
	RATIO	0.919	0.755	0.682	0.815	0.962	0.472	0.654	0.809	0.604	0.843
METEOROLOGICAL SITE	DIR (DEG)	250	240	240	230	230	240	230	240	220	230
BRIDGEPORT	VEL (MPH)	5.7	6.2	5.2	6.6	5.8	5.5	7.2	3.4	5.0	5.7
	SPD (MPH)	5.8	6.5	5.9	6.8	6.3	5.6	7.5	5.0	5.5	6.3
	RATIO	0.992	0.960	0.877	0.982	0.915	0.979	0.959	0.674	0.909	0.901
METEOROLOGICAL SITE	DIR (DEG)	260	270	240	240	230	250	230	230	230	210
WORCESTER	VEL (MPH)	4.7	7.4	8.1	5.0	6.6	5.3	10.6	5.7	4.6	7.5
	SPD (MPH)	5.0	8.2	8.3	5.3	6.9	5.3	10.8	5.9	5.0	7.9
	RATIO	0.924	0.902	0.975	0.936	0.954	0.989	0.985	0.959	0.905	0.947
NEW HAVEN-123 (4753)	OZONE	.151	.126	.126	.121	.111	.107	.103	.102	.100	.096
	DATE	6/18/94	7/ 2/94	7/ 8/94	7/ 9/94	7/ 6/94	7/20/94	8/ 9/94	7/25/94	8/28/94	7/19/94
METEOROLOGICAL SITE	DIR (DEG)	250	210	120	180	280	190	210	260	220	170
NEWARK	VEL (MPH)	7.4	5.3	3.5	4.6	6.8	5.5	5.7	4.3	9.0	5.0
	SPD (MPH)	9.5	7.5	6.8	7.2	9.6	7.9	8.5	8.3	10.2	6.0
	RATIO	0.778	0.714	0.519	0.646	0.702	0.697	0.677	0.518	0.882	0.821
METEOROLOGICAL SITE	DIR (DEG)	210	210	210	200	200	200	210	250	200	220
BRADLEY	VEL (MPH)	3.2	4.6	3.1	3.7	1.8	1.6	4.4	4.9	4.3	2.5
	SPD (MPH)	3.5	6.8	4.2	4.0	3.7	3.3	5.5	6.0	6.6	2.6
	RATIO	0.919	0.682	0.752	0.911	0.472	0.478	0.815	0.809	0.654	0.962

TABLE 4-3, CONTINUED

1994 TEN HIGHEST 1-HOUR AVERAGE OZONE DAYS WITH WIND DATA

UNITS : PARTS PER MILLION

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
METEOROLOGICAL SITE	DIR (DEG)	250	240	130	140	240	160	230	240	230	230
BRIDGEPORT	VEL (MPH)	5.7	5.2	1.7	4.0	5.5	2.8	6.6	3.4	7.2	5.8
	SPD (MPH)	5.8	5.9	3.9	5.6	5.6	3.9	6.8	5.0	7.5	6.3
	RATIO	0.992	0.877	0.427	0.710	0.979	0.726	0.982	0.674	0.959	0.915
METEOROLOGICAL SITE	DIR (DEG)	260	240	260	150	250	240	240	230	230	230
WORCESTER	VEL (MPH)	4.7	8.1	2.0	3.2	5.3	5.1	5.0	5.7	10.6	6.6
	SPD (MPH)	5.0	8.3	3.6	4.5	5.3	5.8	5.3	5.9	10.8	6.9
	RATIO	0.924	0.975	0.550	0.712	0.989	0.889	0.936	0.959	0.985	0.954
STAFFORD-001 (4522)	OZONE	.129	.119	.118	.116	.115	.112	.109	.105	.103	.102
	DATE	7/ 2/94	8/ 1/94	8/ 9/94	8/ 4/94	8/28/94	6/18/94	8/25/94	7/20/94	7/19/94	8/ 3/94
METEOROLOGICAL SITE	DIR (DEG)	210	210	210	240	220	250	210	190	170	200
NEWARK	VEL (MPH)	5.3	5.4	5.7	8.0	9.0	7.4	7.1	5.5	5.0	4.1
	SPD (MPH)	7.5	7.0	8.5	9.8	10.2	9.5	9.1	7.9	6.0	7.9
	RATIO	0.714	0.767	0.677	0.814	0.882	0.778	0.784	0.697	0.821	0.521
METEOROLOGICAL SITE	DIR (DEG)	210	220	210	200	200	210	200	200	220	220
BRADLEY	VEL (MPH)	4.6	1.6	4.4	3.9	4.3	3.2	5.4	1.6	2.5	1.2
	SPD (MPH)	6.8	1.7	5.5	4.6	6.6	3.5	6.9	3.3	2.6	2.0
	RATIO	0.682	0.948	0.815	0.843	0.654	0.919	0.782	0.478	0.962	0.604
METEOROLOGICAL SITE	DIR (DEG)	240	230	230	230	230	250	240	160	230	220
BRIDGEPORT	VEL (MPH)	5.2	4.5	6.6	5.7	7.2	5.7	6.7	2.8	5.8	5.0
	SPD (MPH)	5.9	4.7	6.8	6.3	7.5	5.8	7.3	3.9	6.3	5.5
	RATIO	0.877	0.950	0.982	0.901	0.959	0.992	0.918	0.726	0.915	0.909
METEOROLOGICAL SITE	DIR (DEG)	240	240	240	210	230	260	220	240	230	230
WORCESTER	VEL (MPH)	8.1	3.0	5.0	7.5	10.6	4.7	5.9	5.1	6.6	4.6
	SPD (MPH)	8.3	4.2	5.3	7.9	10.8	5.0	6.0	5.8	6.9	5.0
	RATIO	0.975	0.711	0.936	0.947	0.985	0.924	0.985	0.889	0.954	0.905
STRATFORD-007 (4825)	OZONE	.187	.174	.127	.126	.119	.110	.107	.106	.104	.103
	DATE	6/18/94	7/13/94	7/ 2/94	7/25/94	7/19/94	8/ 9/94	8/ 1/94	8/26/94	5/25/94	8/28/94
METEOROLOGICAL SITE	DIR (DEG)	250	250	210	260	170	210	210	240	250	220
NEWARK	VEL (MPH)	7.4	6.9	5.3	4.3	5.0	5.7	5.4	5.9	7.4	9.0
	SPD (MPH)	9.5	8.8	7.5	8.3	6.0	8.5	7.0	7.5	9.8	10.2
	RATIO	0.778	0.789	0.714	0.518	0.821	0.677	0.767	0.792	0.761	0.882
METEOROLOGICAL SITE	DIR (DEG)	210	250	210	250	220	210	220	220	240	200
BRADLEY	VEL (MPH)	3.2	2.8	4.6	4.9	2.5	4.4	1.6	.9	4.5	4.3
	SPD (MPH)	3.5	3.7	6.8	6.0	2.6	5.5	1.7	2.4	8.2	6.6
	RATIO	0.919	0.755	0.682	0.809	0.962	0.815	0.948	0.350	0.545	0.654
METEOROLOGICAL SITE	DIR (DEG)	250	240	240	240	230	230	230	230	240	230
BRIDGEPORT	VEL (MPH)	5.7	6.2	5.2	3.4	5.8	6.6	4.5	4.1	5.3	7.2
	SPD (MPH)	5.8	6.5	5.9	5.0	6.3	6.8	4.7	4.9	5.5	7.5
	RATIO	0.992	0.960	0.877	0.674	0.915	0.982	0.950	0.834	0.964	0.959
METEOROLOGICAL SITE	DIR (DEG)	260	270	240	230	230	240	240	270	250	230
WORCESTER	VEL (MPH)	4.7	7.4	8.1	5.7	6.6	5.0	3.0	4.1	8.8	10.6
	SPD (MPH)	5.0	8.2	8.3	5.9	6.9	5.3	4.2	4.6	9.6	10.8
	RATIO	0.924	0.902	0.975	0.959	0.954	0.936	0.711	0.883	0.910	0.985

TABLE 4-3, CONTINUED

1994 TEN HIGHEST 1-HOUR AVERAGE OZONE DAYS WITH WIND DATA

UNITS : PARTS PER MILLION

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
TORRINGTON-006 (4708)	OZONE	.127	.119	.110	.109	.103	.102	.098	.097	.095	.095
	DATE	8/ 4/94	7/20/94	7/ 9/94	7/ 2/94	8/ 9/94	5/30/94	8/25/94	6/17/94	7/21/94	8/20/94
METEOROLOGICAL SITE	DIR (DEG)	240	190	180	210	210	210	210	150	180	180
NEWARK	VEL (MPH)	8.0	5.5	4.6	5.3	5.7	8.3	7.1	4.1	6.5	6.0
	SPD (MPH)	9.8	7.9	7.2	7.5	8.5	10.5	9.1	6.0	10.2	7.2
	RATIO	0.814	0.697	0.646	0.714	0.677	0.793	0.784	0.682	0.640	0.829
METEOROLOGICAL SITE	DIR (DEG)	200	200	200	210	210	190	200	200	240	190
BRADLEY	VEL (MPH)	3.9	1.6	3.7	4.6	4.4	9.0	5.4	2.4	2.8	2.8
	SPD (MPH)	4.6	3.3	4.0	6.8	5.5	11.4	6.9	4.0	4.0	2.9
	RATIO	0.843	0.478	0.911	0.682	0.815	0.790	0.782	0.606	0.695	0.989
METEOROLOGICAL SITE	DIR (DEG)	230	160	140	240	230	230	240	230	230	150
BRIDGEPORT	VEL (MPH)	5.7	2.8	4.0	5.2	6.6	7.3	6.7	5.6	7.8	3.1
	SPD (MPH)	6.3	3.9	5.6	5.9	6.8	7.5	7.3	5.9	8.1	3.9
	RATIO	0.901	0.726	0.710	0.877	0.982	0.974	0.918	0.943	0.965	0.795
METEOROLOGICAL SITE	DIR (DEG)	210	240	150	240	240	230	220	270	220	220
WORCESTER	VEL (MPH)	7.5	5.1	3.2	8.1	5.0	12.0	5.9	4.2	6.9	5.1
	SPD (MPH)	7.9	5.8	4.5	8.3	5.3	12.1	6.0	4.6	7.3	5.5
	RATIO	0.947	0.889	0.712	0.975	0.936	0.992	0.985	0.918	0.943	0.930

FIGURE 4-5

AVERAGES OF THE ANNUAL MEAN DAILY MAXIMUM OZONE CONCENTRATIONS AT TEN SITES

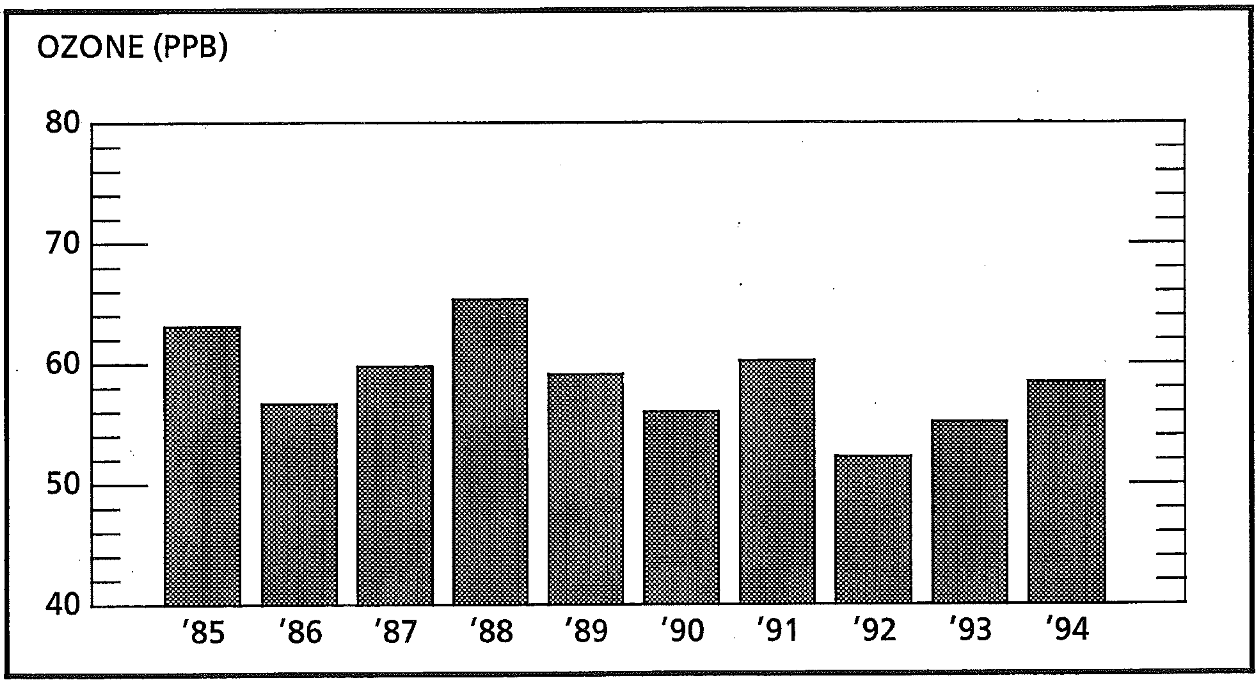
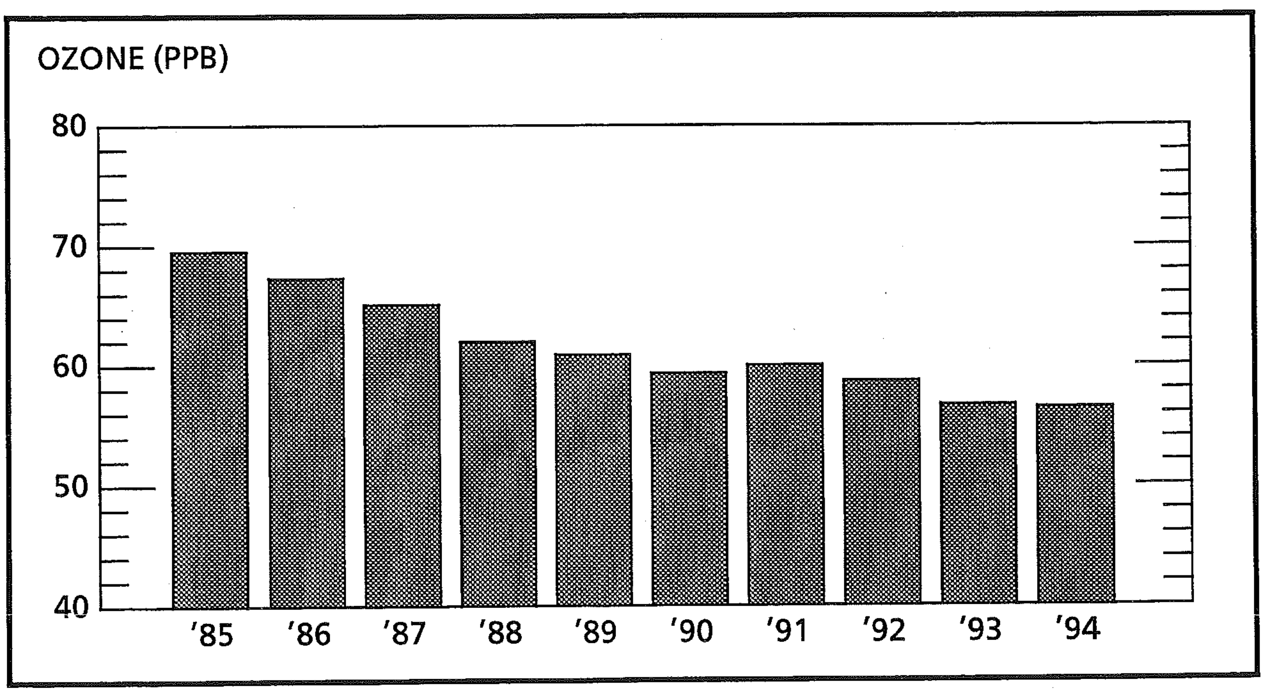


FIGURE 4-6

5-YEAR AVERAGES OF THE ANNUAL MEAN DAILY MAXIMUM OZONE CONCENTRATIONS AT TEN SITES



V. NITROGEN DIOXIDE

HEALTH EFFECTS

Nitrogen dioxide (NO_2) is a toxic gas with a characteristic pungent odor and a reddish-orange-brown color. It is highly oxidizing and extremely corrosive.

The presence of NO_2 in the atmosphere is accounted for by the oxidation of nitric oxide (NO) to NO_2 by means of reactions with various chemical species, principally ozone, hydroperoxyl radicals and organic peroxyl radicals. Large amounts of NO are emitted into the air by high temperature combustion processes. Industrial furnaces, power plants and motor vehicles are the primary sources of NO emissions.

Exposure to NO_2 is believed to increase the risks of acute respiratory disease and susceptibility to chronic respiratory infection. NO_2 also contributes to heart, lung, liver and kidney damage. At high concentrations, this pollutant can be fatal. At lower levels of 25 to 100 parts per million, it can cause acute bronchitis and pneumonia. Occasional exposure to low levels of NO_2 can irritate the eyes and skin.

Other effects of nitrogen dioxide are its toxicity to vegetation and its ability to combine with water vapor to form nitric acid. Furthermore, NO_2 is an essential ingredient, along with hydrocarbons, in the formation of ozone.

CONCLUSIONS

Nitrogen dioxide (NO_2) concentrations at all monitoring sites did not violate the NAAQS for NO_2 in 1994. The annual arithmetic mean NO_2 concentration at each site was well below the federal standard of 100 $\mu g/m^3$. The highest annual mean was 49 $\mu g/m^3$, which occurred at the New Haven 123 site.

SAMPLE COLLECTION AND ANALYSIS

The DEP Air Monitoring Unit used continuous electronic analyzers employing the chemiluminescent reference method to continuously monitor NO_2 levels.

DISCUSSION OF DATA

Monitoring Network - There were three nitrogen dioxide monitoring sites in 1994 (see Figure 5-1). The sites -- Bridgeport 013, East Hartford 003 and New Haven 123 -- were located in three urban areas near major expressways in order to obtain maximum NO_2 readings.

Precision and Accuracy - Fifty-four precision checks were made on the NO_2 monitors in 1994, yielding 95% probability limits ranging from -11% to +11%. Accuracy is determined by introducing a known amount of NO_2 into each of the monitors. Eight audits for accuracy were conducted on the monitoring network in 1994. Four different concentration levels were tested on each monitor: low, low/medium, medium/high and high. The 95% probability limits for the low level test ranged from -7% to +4%; those for the low/medium level test ranged from -5% to +5%; those for the medium/high level test ranged from -5% to +6%; and those for the high level test ranged from -5% to +6%.

Annual Averages - The annual average NO_2 standard of 100 $\mu g/m^3$ was not exceeded in 1994 at any site in Connecticut (see Table 5-1). In addition, all three sites had sufficient data to compute valid arithmetic means. This permits comparisons with the 1992 and 1993 annual averages. The annual average NO_2 concentrations were up at all three sites between 1992 and 1994.

Statistical Projections - The format of Table 5-1 is the same as that used to present the particulate matter and sulfur dioxide data, except that for NO_2 there are no 24-hour standards and, therefore, no projections of violations are possible. However, Table 5-1 gives the annual arithmetic mean of the hourly NO_2 concentrations in order to allow direct comparison to the annual NO_2 standard. The 95% confidence limits about the arithmetic mean for each site demonstrate that it is unlikely that any site exceeded the primary annual standard of 100 $\mu g/m^3$ in 1994.

10-High Days with Wind Data - Table 5-2 presents for each site the ten days in 1994 when the highest hourly NO_2 readings occurred, along with the associated wind conditions for each day. (See the discussion of Table 2-5 in the particulate matter section for a description of the origin and use of the wind data.)

According to National Weather Service local climatological data recorded at Bradley Airport, 16 of the 21 days listed in the table had at least 50% of the possible sunshine. A high percentage of the possible sunshine is interpreted to confirm the importance of photochemical oxidation in the formation of NO_2.

Using the National Weather Service data from the Bridgeport meteorological site for Bridgeport 013 and New Haven 123 sites, and using the data from Bradley for East Hartford 003 site, one finds that 67% of the days have persistent winds out of the southwest. This is not unexpected since the NO_2 sites were deliberately located to the north and east of major expressways and interchanges, which are major sources of nitrogen oxide emissions. Moreover, high NO_2 levels coincident with southwest winds confirm the importance of pollution transport into Connecticut from the southwest.

Trends - The weighted averages of the annual NO_2 concentrations at the three monitoring sites are illustrated in Figure 5-2. The year-to-year trend appears to be down through 1987, up in 1988, down until 1991 when levels rose, down again in 1992 and up through 1994. In spite of the choppiness, there appears to be an overall downward bias in the annual NO_2 concentrations.

Given the importance of meteorology -- sunlight, in general, and southwest winds in Connecticut, in particular -- on the formation of NO_2, a trend might best be illustrated by the averaging of data over multiple years. As was the case with ozone, a trend based on multiple years of data should diminish the effect of meteorology and, thereby, reveal the effect of nitrogen oxide and hydrocarbon emission controls on ambient concentrations of NO_2. Figure 5-3 shows that the 3-year average NO_2 concentration, unlinked from meteorology, has been trending downward over the past ten years.

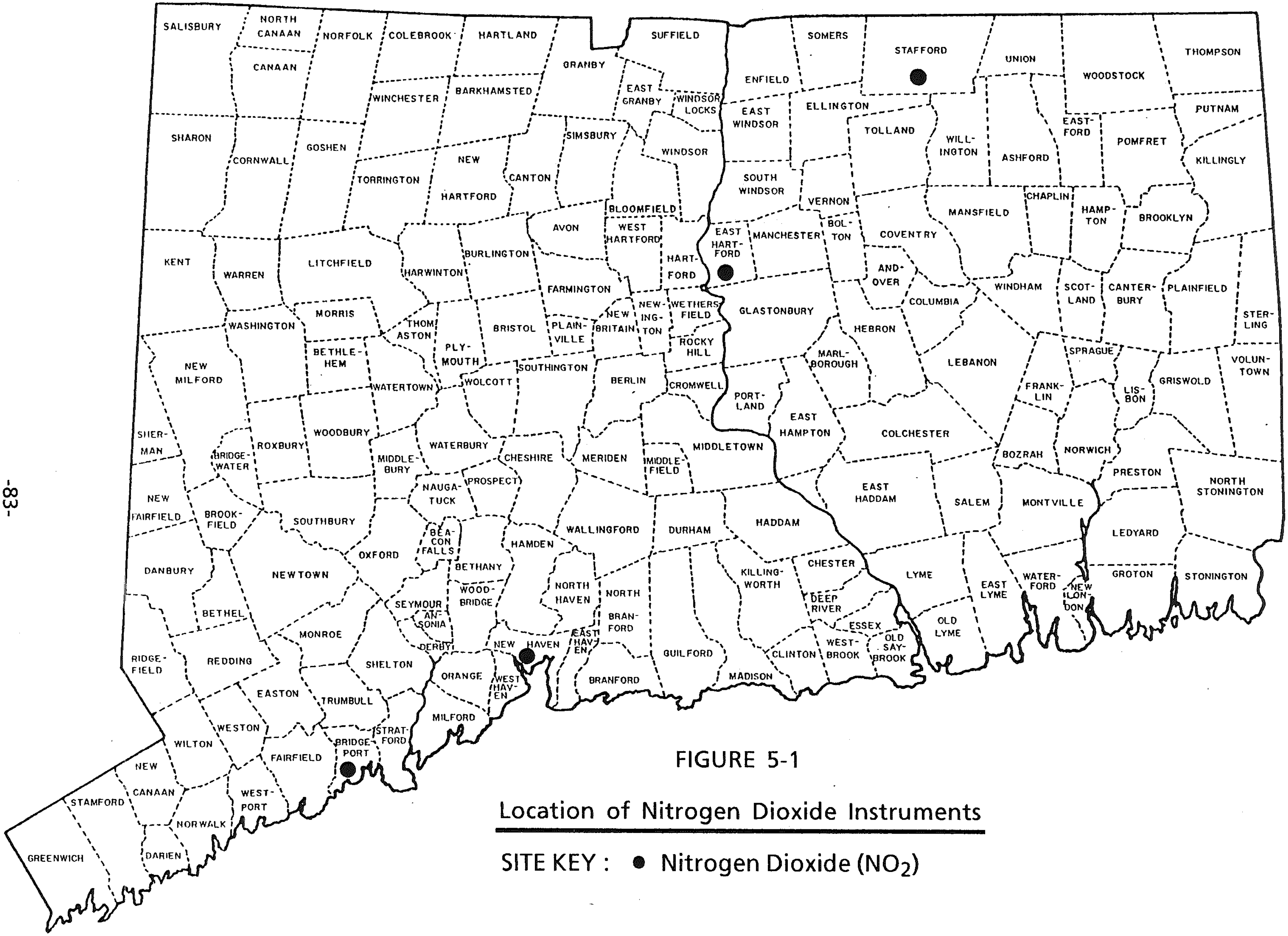


FIGURE 5-1

Location of Nitrogen Dioxide Instruments

SITE KEY : ● Nitrogen Dioxide (NO_2)

TABLE 5-1

1992 -1994 NITROGEN DIOXIDE ANNUAL AVERAGES

Town Name	Site	Year	Samples	Arithmetic Mean	95-Percent-Limits Lower	95-Percent-Limits Upper	Standard Deviation
Bridgeport	013	1992	8595	44.86	44.78	44.93	24.14
Bridgeport	013	1993	8347	45.64	45.53	45.76	23.80
Bridgeport	013	1994	8390	49.33	49.21	49.46	28.25
East Hartford	003	1992	7384	31.99	31.81	32.17	20.06
East Hartford	003	1993	8505	34.65	34.57	34.73	22.45
East Hartford	003	1994	8355	38.25	38.12	38.37	27.04
New Haven	123	1992	8186	47.15	47.03	47.27	21.69
New Haven	123	1993	8326	48.98	48.86	49.10	24.47
New Haven	123	1994	7694	56.48	56.26	56.70	27.80

N.B. The arithmetic mean and standard deviation have units of $\mu g/m^3$.

TABLE 5-2

1994 TEN HIGHEST 1-HOUR AVERAGE NO2 DAYS WITH WIND DATA

UNITS : PARTS PER MILLION

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
BRIDGEPORT-013 (4831)	NO2	.076	.073	.073	.072	.071	.070	.069	.068	.068	.068
	DATE	10/30/94	6/10/94	5/23/94	9/13/94	4/25/94	4/19/94	10/24/94	8/26/94	9/ 9/94	6/ 9/94
METEOROLOGICAL SITE	DIR (DEG)	220	90	260	270	110	260	230	240	250	280
NEWARK	VEL (MPH)	5.5	2.7	3.4	9.4	2.4	5.2	6.0	5.9	4.9	5.2
	SPD (MPH)	7.2	6.9	6.5	11.5	8.1	9.3	7.2	7.5	8.2	8.3
	RATIO	0.763	0.387	0.524	0.818	0.301	0.552	0.839	0.792	0.600	0.627
METEOROLOGICAL SITE	DIR (DEG)	210	330	50	280	100	180	250	220	200	260
BRADLEY	VEL (MPH)	4.4	1.4	2.6	4.0	3.1	2.4	3.9	.9	5.1	3.0
	SPD (MPH)	7.5	3.5	4.9	5.5	4.9	6.2	6.5	2.4	6.5	3.3
	RATIO	0.587	0.414	0.527	0.724	0.629	0.387	0.606	0.350	0.796	0.899
METEOROLOGICAL SITE	DIR (DEG)	240	180	270	280	110	210	240	230	250	250
BRIDGEPORT	VEL (MPH)	6.2	1.9	3.7	6.8	6.9	3.6	4.2	4.1	4.9	5.0
	SPD (MPH)	7.2	5.5	5.5	7.0	7.2	4.2	4.9	4.9	6.5	7.0
	RATIO	0.868	0.346	0.675	0.960	0.953	0.865	0.866	0.834	0.757	0.712
METEOROLOGICAL SITE	DIR (DEG)	250	350	20	290	70	230	260	270	240	270
WORCESTER	VEL (MPH)	6.3	3.7	3.5	8.2	7.2	7.4	5.0	4.1	6.2	7.9
	SPD (MPH)	6.5	4.5	5.0	8.5	7.5	8.5	5.5	4.6	6.5	8.2
	RATIO	0.980	0.838	0.691	0.972	0.966	0.876	0.908	0.883	0.965	0.966
EAST HARTFORD-003 (4928)	NO2	.077	.065	.061	.061	.059	.058	.058	.058	.058	.057
	DATE	10/30/94	10/13/94	10/31/94	4/25/94	10/28/94	10/24/94	9/13/94	9/21/94	4/14/94	10/18/94
METEOROLOGICAL SITE	DIR (DEG)	220	80	90	110	240	230	270	140	250	120
NEWARK	VEL (MPH)	5.5	1.4	2.9	2.4	6.3	6.0	9.4	2.9	8.1	1.9
	SPD (MPH)	7.2	5.6	5.0	8.1	8.1	7.2	11.5	4.0	10.1	5.3
	RATIO	0.763	0.256	0.570	0.301	0.788	0.839	0.818	0.710	0.803	0.361
METEOROLOGICAL SITE	DIR (DEG)	210	200	230	100	190	250	280	30	280	50
BRADLEY	VEL (MPH)	4.4	3.5	2.4	3.1	2.1	3.9	4.0	1.5	3.2	2.0
	SPD (MPH)	7.5	3.9	5.0	4.9	2.7	6.5	5.5	3.5	5.5	4.7
	RATIO	0.587	0.901	0.485	0.629	0.763	0.606	0.724	0.427	0.584	0.418
METEOROLOGICAL SITE	DIR (DEG)	240	240	110	110	250	240	280	200	260	110
BRIDGEPORT	VEL (MPH)	6.2	2.4	3.0	6.9	6.2	4.2	6.8	2.5	5.8	2.1
	SPD (MPH)	7.2	3.9	5.3	7.2	7.0	4.9	7.0	4.2	6.5	4.0
	RATIO	0.868	0.616	0.569	0.953	0.874	0.866	0.960	0.591	0.904	0.514
METEOROLOGICAL SITE	DIR (DEG)	250	250	190	70	250	260	290	220	270	290
WORCESTER	VEL (MPH)	6.3	6.1	4.8	7.2	7.1	5.0	8.2	.5	8.4	1.8
	SPD (MPH)	6.5	6.2	5.8	7.5	7.2	5.5	8.5	2.7	8.6	3.7
	RATIO	0.980	0.987	0.840	0.966	0.983	0.908	0.972	0.185	0.975	0.469
NEW HAVEN-123 (4218)	NO2	.080	.078	.077	.077	.076	.075	.073	.073	.070	.070
	DATE	8/ 1/94	8/27/94	9/21/94	5/23/94	9/ 9/94	4/19/94	9/20/94	10/30/94	4/ 4/94	5/28/94
METEOROLOGICAL SITE	DIR (DEG)	210	280	140	260	250	260	200	220	360	240
NEWARK	VEL (MPH)	5.4	3.6	2.9	3.4	4.9	5.2	4.8	5.5	4.3	9.7
	SPD (MPH)	7.0	5.8	4.0	6.5	8.2	9.3	7.0	7.2	8.8	11.4
	RATIO	0.767	0.632	0.710	0.524	0.600	0.552	0.680	0.763	0.491	0.852
METEOROLOGICAL SITE	DIR (DEG)	220	300	30	50	200	180	230	210	340	260
BRADLEY	VEL (MPH)	1.6	2.8	1.5	2.6	5.1	2.4	2.5	4.4	6.3	5.1
	SPD (MPH)	1.7	3.5	3.5	4.9	6.5	6.2	4.6	7.5	7.0	6.8
	RATIO	0.948	0.807	0.427	0.527	0.796	0.387	0.541	0.587	0.900	0.759

TABLE 5–2, CONTINUED

1994 TEN HIGHEST 1–HOUR AVERAGE NO2 DAYS WITH WIND DATA

UNITS : PARTS PER MILLION

TOWN–SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
METEOROLOGICAL SITE	DIR (DEG)	230	240	200	270	250	210	240	240	350	220
BRIDGEPORT	VEL (MPH)	4.5	4.4	2.5	3.7	4.9	3.6	5.0	6.2	3.3	9.1
	SPD (MPH)	4.7	4.5	4.2	5.5	6.5	4.2	5.9	7.2	6.9	9.5
	RATIO	0.950	0.981	0.591	0.675	0.757	0.865	0.847	0.868	0.471	0.957
METEOROLOGICAL SITE	DIR (DEG)	240	280	220	20	240	230	270	250	270	260
WORCESTER	VEL (MPH)	3.0	5.7	.5	3.5	6.2	7.4	5.8	6.3	.1	9.3
	SPD (MPH)	4.2	6.0	2.7	5.0	6.5	8.5	6.3	6.5	1.0	9.5
	RATIO	0.711	0.952	0.185	0.691	0.965	0.876	0.923	0.980	0.144	0.983

FIGURE 5-2

AVERAGE OF THE ANNUAL NO_2 CONCENTRATIONS AT THREE SITES

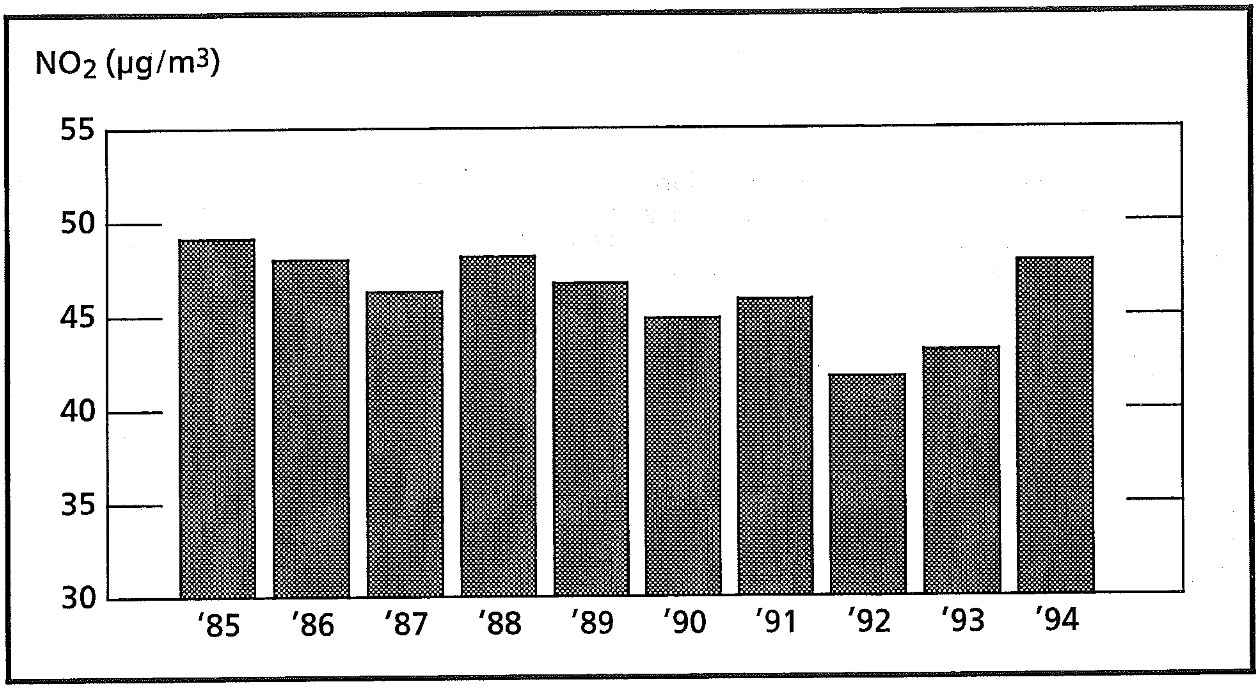
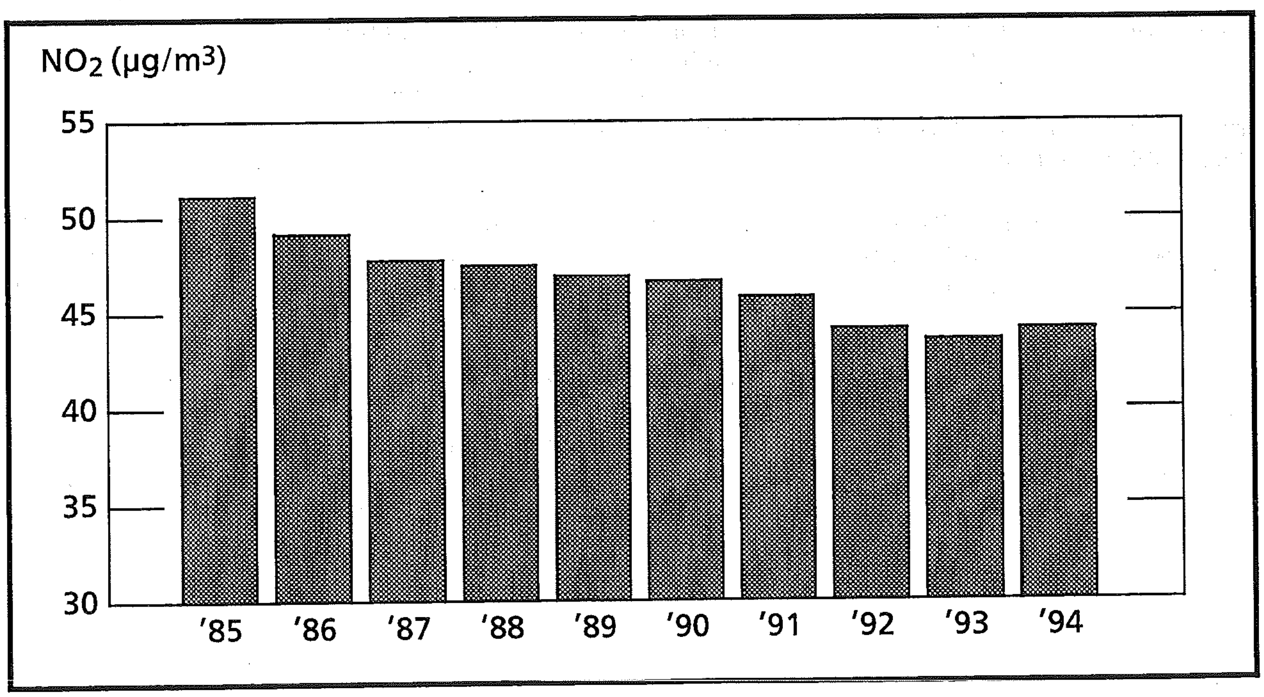


FIGURE 5-3

3-YEAR AVERAGES OF THE ANNUAL NO_2 CONCENTRATIONS AT THREE SITES



VI. CARBON MONOXIDE

HEALTH EFFECTS

Carbon monoxide (CO) is a colorless, odorless, poison gas formed when carbon-containing fuel is not burned completely. It is by far the most plentiful air pollutant. Fortunately, this deadly gas does not persist in the atmosphere. It is apparently converted by natural processes to carbon dioxide in ways not yet understood, and this is done quickly enough to prevent any general buildup. However, CO can reach dangerous levels in local areas, such as city-street canyons with heavy auto traffic and little wind.

Clinical experience with accidental CO poisoning has shown clearly how it affects the body. When the gas is breathed, CO replaces oxygen in the red blood cells, reducing the amount of oxygen that can reach the body cells and maintain life. Lack of oxygen affects the brain, and the first symptoms are impaired perception and thinking. Reflexes are slowed, judgement weakened, and drowsiness ensues. An auto driver breathing high levels of CO is more likely to have an accident; an athlete's performance and skill drop suddenly. Lack of oxygen then affects the heart. Death can come from heart failure or general asphyxiation if a person is exposed to very high levels of CO.

CONCLUSIONS

The one-hour National Ambient Air Quality Standard of 35 parts per million (ppm) was not exceeded at any of the five carbon monoxide monitoring sites in Connecticut during 1994. Nor was there an exceedance of the 9 ppm eight-hour standard.

In order to put the monitoring data into proper perspective, it must be realized that carbon monoxide concentrations vary greatly from place-to-place. The magnitude and frequency of high concentrations observed at any monitoring site are not necessarily indicative of widespread CO levels. Mobile sources contribute 83% of the CO emissions in Connecticut, and three quarters of this can be attributed to motor vehicles. Therefore, the highest concentrations occur in areas of traffic congestion. In fact, 4 of the 5 CO monitors in Connecticut are sited specifically to measure CO levels from high traffic areas. The fifth monitor (Hartford 013) is located in a populated area and represents background levels of a neighborhood scale.

As Connecticut's SIP control strategies are implemented, there should continue to be a decrease in the number of areas with traffic congestion. Also, as federal and state mandated controls continue to reduce emissions from new motor vehicles, a reduction in ambient CO levels should continue to be achieved.

Unlike SO_2, particulate matter, and O_3, elevated CO levels are not often associated with southwesterly winds, indicating that this pollutant is more of a local-scale, rather than a regional-scale, problem. Moreover, high CO levels tend to occur during the colder months when there are low atmospheric mixing heights, stable conditions and high CO auto emissions due to cold engine operation. Stable conditions, which are characterized by cold temperatures at the surface and warm temperatures aloft, discourage surface mixing and result in calm surface conditions. With little or no surface winds, CO emissions can accumulate to unhealthy levels.

METHOD OF MEASUREMENT

The DEP Air Monitoring Section uses instruments employing a non-dispersive infrared technique to continuously measure carbon monoxide levels. The instantaneous concentrations are electronically recorded at the site, averaged for each hour, and stored for transmission to the central computer in Hartford. Due to the relative inertness of CO, a long sampling line can be used without the danger of CO being depleted by chemical reactions within the lines. The most important consideration in the measurement of CO is the placement of the sampling probe inlet -- that is, its proximity to traffic lanes.

DISCUSSION OF DATA

Monitoring Network - The network in 1994 consisted of five carbon monoxide monitors: Bridgeport 004, Hartford 013, Hartford 017, New Haven 019, and Stamford 020. They are all located in urban areas. All the sites are also located west of the Connecticut River, with three of them in coastal towns (see Figure 6-1).

Precision and Accuracy - The carbon monoxide monitors had a total of 192 precision checks during 1994. The resulting 95% probability limits were -2% to +4%. Accuracy is determined by introducing a known amount of CO into each of the monitors. Eight audits for accuracy were conducted on the monitoring network in 1994. Three different concentration levels were tested on each monitor: low, medium and high. The 95% probability limits ranged from -1% to +4% for the low level test; 0% to +2% for the medium level test; and -1% to +2% for the high level test.

8-Hour and 1-Hour Averages - An 8-hour concentration is said to exceed the standard of 9 ppm if it is equal to or greater than 9.5 ppm. No site had an exceedance of the 8-hour CO standard, which means that the standard was not violated in Connecticut in 1994 (see Table 6-1).The maximum 8-hour running average increased at each site from 1993 to 1994. The increases ranged from 1.1 ppm at Hartford 017 to 3.9 ppm at Bridgeport 004. The second highest 8-hour running average also increased from 1993 to 1994 at each site. The increases ranged from 0.7 ppm at Hartford 017 to 2.1 ppm at Bridgeport 004.

As for 1-hour averages, no site in the state recorded a value exceeding the primary 1-hour standard of 35 ppm. Again, all sites recorded maximum 1-hour values that were higher than the year before. The increases ranged from 1.6 ppm at Stamford 020 to 4.0 ppm at New Haven 019. And the second high 1-hour values at all the sites were also higher in 1994. The increases ranged from 1.3 ppm at Stamford 020 to 5.2 ppm at Hartford 017.

The maximum and second high CO concentrations at each site are presented in Table 6-1. Table 6-2 presents monthly high concentrations and the monthly average concentration at each site. Seasonal variations in CO levels can be observed using this table.

Trends - Due to the local nature of CO emissions, it is not appropriate to give an estimate of widespread CO trends. However, local CO trends can be addressed in a number of ways. Exceedances of the 8-hour standard can be tracked in order to determine if a CO problem is worsening or abating at a site. This is illustrated in Table 6-3. One can see that over the past five years the Hartford-017 site is the only monitoring site with an exceedance of the 8-hour CO standard. No exceedances were recorded at any of the other sites during this period.

Another way of illustrating local CO trends is to use running averages. Running averages have the advantage of smoothing out the abrupt, transitory changes in pollutant levels that are often evident in consecutive sampling periods and from one season to the next. Figure 6-2 shows the 36-month running averages of the hourly CO concentrations at each monitoring site. CO levels are relatively flat at Bridgeport 004, Hartford 013 and Stamford 020, and are falling at Hartford 017 and New Haven 019.

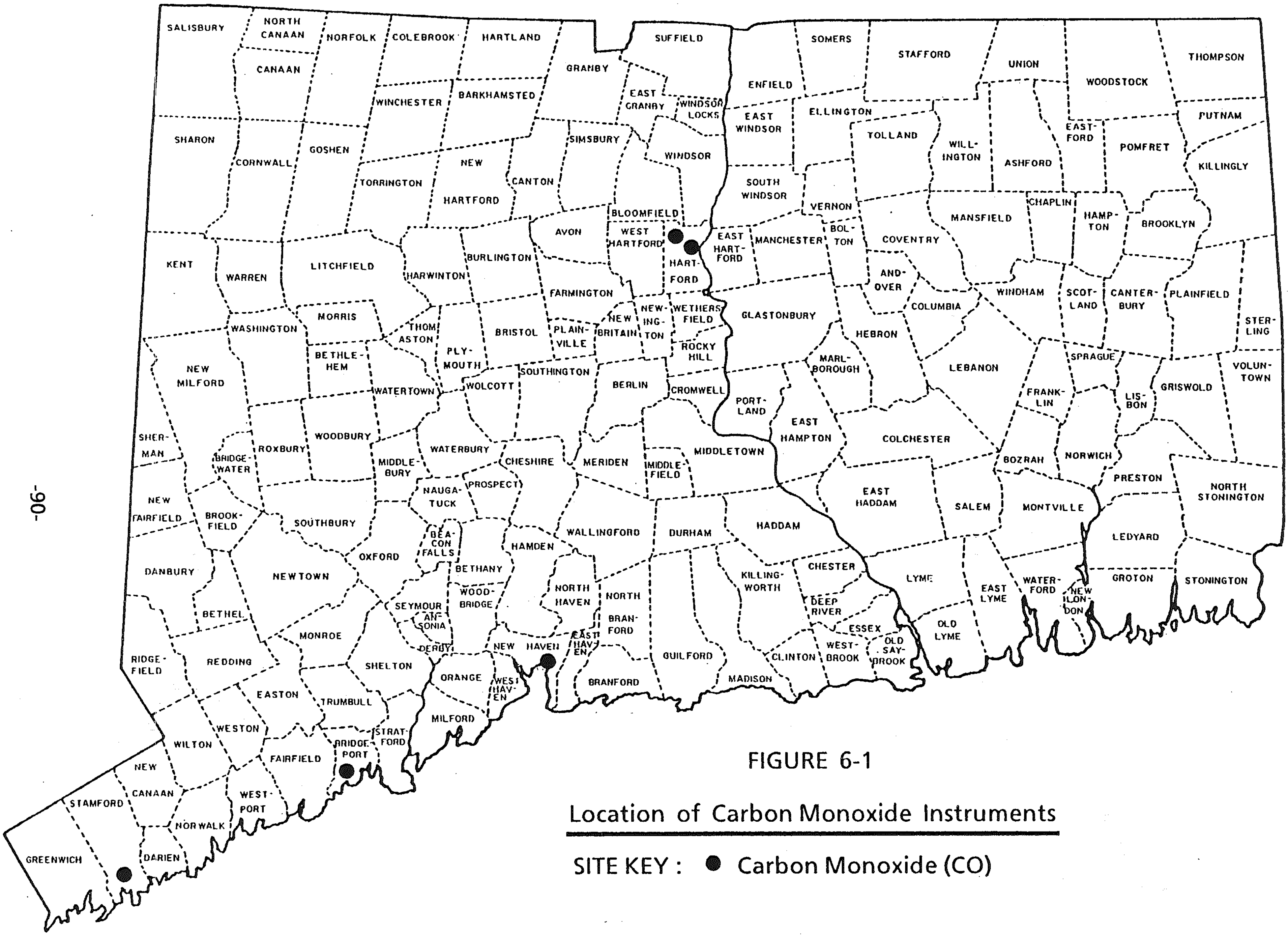


FIGURE 6-1

Location of Carbon Monoxide Instruments

SITE KEY : ● Carbon Monoxide (CO)

TABLE 6-1

1994 CARBON MONOXIDE STANDARDS ASSESSMENT SUMMARY

TOWN-SITE	MAXIMUM 8-HOUR RUNNING AVERAGE	TIME OF MAXIMUM 8-HOUR RUNNING AVERAGE[1]	2ND HIGH 8-HOUR RUNNING AVERAGE	TIME OF 2ND HIGH 8-HOUR RUNNING AVERAGE[1]	MAXIMUM 1-HOUR AVERAGE	TIME OF MAXIMUM 1-HOUR AVERAGE[2]	2ND HIGH 1-HOUR AVERAGE	TIME OF 2ND HIGH 1-HOUR AVERAGE[2]
Bridgeport-004	7.7	02/21/19	5.8	02/21/14	11.1	02/21/17	9.6	02/18/18
Hartford-013	7.5	12/23/01	4.8	12/22/21	8.9	12/22/23	8.4	12/22/21
Hartford-017	8.6	02/18/20	7.9	12/23/01	18.9	02/18/18	15.7	02/18/17
New Haven-019[3]	8.3	02/21/19	7.5	01/20/06	13.8	02/19/24	12.4	02/21/18
Stamford-020	7.1	12/22/01	6.2	02/19/01	9.9	12/21/20	9.6	12/21/21

[1] The time of the 8-hour average is reported as follows: month/day/hour (EST), specifying the end of the 8-hour period.
[2] The time of the 1-hour average is reported as follows: month/day/hour (EST), specifying the end of the 1-hour period.
[3] DEP was forced to vacate the site (first week of April). A new site is being sought.

N.B. The CO averages are expressed in terms of parts per million (ppm).

TABLE 6-2

1994 CARBON MONOXIDE SEASONAL FEATURES

TOWN-SITE	AVERAGING PERIOD	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Bridgeport-004	Max. 1-Hour	6.9	11.1	5.1	3.3	2.2	3.3	3.0	3.3	3.3	4.0	5.8	7.7
	Max. Running 8-Hour	3.7	7.7	3.2	1.9	2.0	2.6	2.2	2.6	2.4	2.4	3.9	4.9
	Month	1.1	1.5	1.1	1.0	0.9	1.1	1.3	1.3	1.2	1.2	1.0	1.4
Hartford-013	Max. 1-Hour	5.5	4.5	4.3	2.7	1.9	1.7	1.4	2.4	2.9	3.0	3.9	8.9
	Max. Running 8-Hour	3.4	3.6	3.0	2.1	1.4	1.3	1.1	1.9	2.0	2.4	3.4	7.5
	Month	0.8	1.0	0.9	0.8	0.5	0.6	0.7	0.7	0.8	0.9	0.7	1.0
Hartford-017	Max. 1-Hour	13.1	18.9	12.2	6.8	5.6	6.1	6.1	5.9	6.7	10.5	8.4	11.2
	Max. Running 8-Hour	6.7	8.6	7.3	5.3	3.6	3.2	3.9	3.8	4.0	5.4	4.9	7.9
	Month	1.9	2.0	2.0	1.6	1.2	1.3	1.3	1.5	1.7	1.9	1.8	2.2
New Haven-019	Max. 1-Hour	4.8	13.8	5.2	3.0								
	Max. Running 8-Hour	2.8	8.3	3.8	2.0								
	Month	1.3	1.7	1.3	1.1								
Stamford-020	Max. 1-Hour	6.5	7.9	5.9	3.9	4.3	3.0	4.1	4.0	4.7	6.6	6.0	9.9
	Max. Running 8-Hour	4.1	6.2	4.3	2.8	2.9	2.4	2.7	2.8	3.3	3.3	4.7	7.1
	Month	1.9	2.3	1.8	1.4	1.4	1.3	1.5	1.5	1.6	1.7	1.5	2.0
NETWORK	Month	1.4	1.7	1.4	1.2	1.0	1.1	1.2	1.3	1.3	1.4	1.3	1.7

N.B. The CO concentrations are in terms of parts per million (ppm).

TABLE 6-3

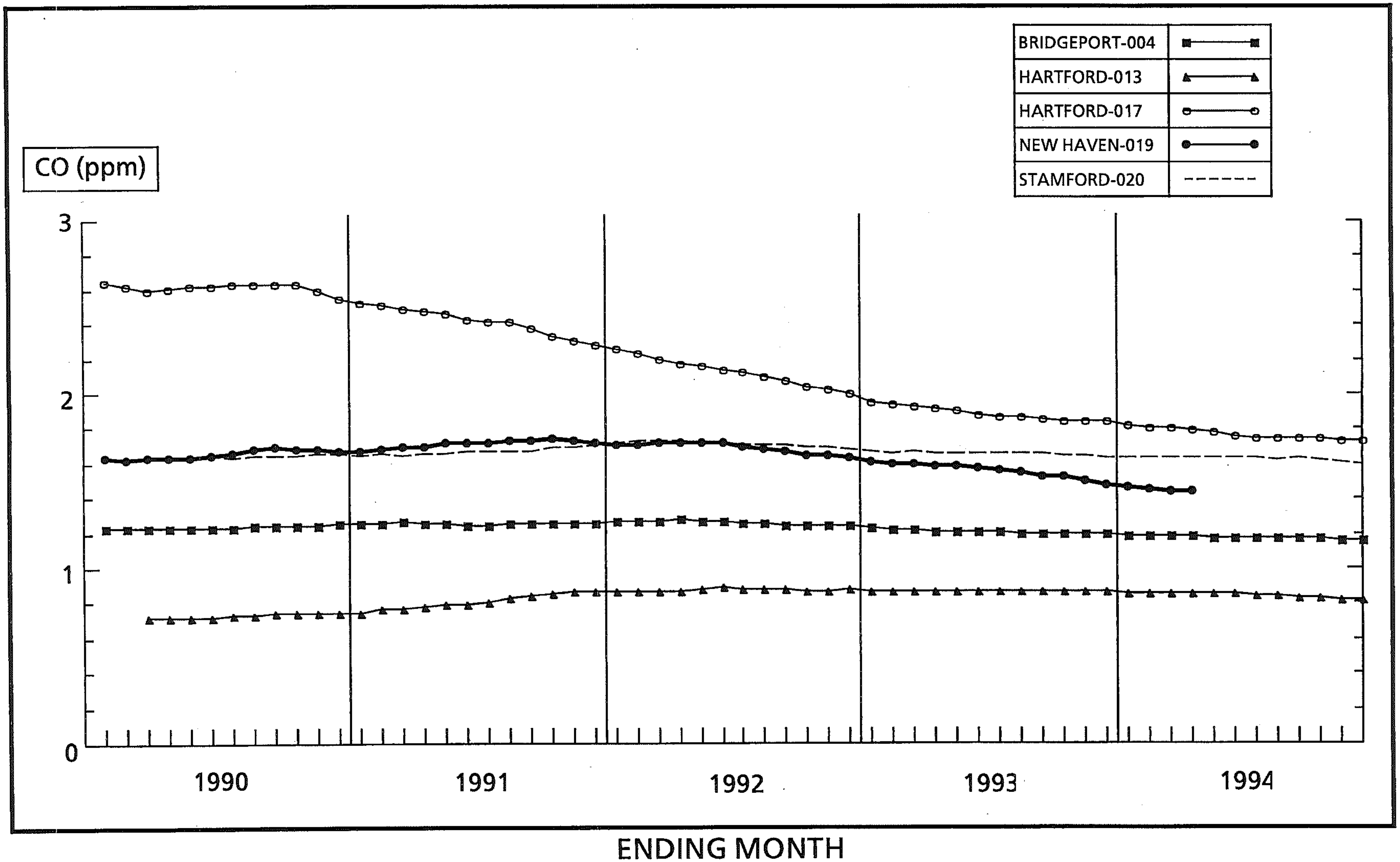
EXCEEDANCES OF THE 8-HOUR CO STANDARD FOR 1990 -1994

SITE	1990	1991	1992	1993	1994
Bridgeport-004	0	0	0	0	0
Hartford-013	0[a]	0	0	0	0
Hartford-017	0	1	1	0	0
New Haven-019	0	0	0	0	0[b]
Stamford-020	0	0	0	0	0

[a] Data are missing for April through most of October due to road construction.
[b] The site was shut down in the first week of April.

FIGURE 6-2

36-MONTH RUNNING AVERAGES OF THE HOURLY CO CONCENTRATIONS



VII. LEAD

HEALTH EFFECTS

Lead (Pb) is a soft, dull gray, odorless and tasteless heavy metal. It is a ubiquitous element that is widely distributed in small amounts, particularly in soil and in all living things. Although the metallic form of lead is reactive and rarely occurs in nature, lead is prevalent in the environment in the form of various inorganic compounds, and occasional concentrated deposits of lead compounds occur in the earth's crust.

The presence of lead in the atmosphere is primarily accounted for by the emissions of lead compounds from man-made processes, such as the extraction and processing of metallic ores, the incineration of solid wastes, and the operation of motor vehicles. Nationally, in 1994, these source categories contributed 41%, 17% and 32%, respectively, of the atmospheric lead. The motor vehicle contribution, while still a large source of airborne lead emissions, has decreased significantly over the years and, since 1988, is no longer the largest source of nationwide airborne lead emissions. These emissions are in the form of fine-to-course particulate matter and are comprised of lead sulfate, ammonium lead halides, and lead halides, of which the chief component is lead bromochloride. The halide compounds appear to undergo chemical changes over a period of hours and are converted to lead carbonate, oxide and oxycarbonate.

The most important sources of lead in humans and other animals are ingestion of foods and beverages, inhalation of airborne lead, and the eating of non-food substances. From the standpoint of the general population, the intake of lead into the body is primarily through ingestion. The airborne lead settles out on crops and water supplies and is then ingested by the general population. The direct intake of lead from the ambient air is relatively small.

Overexposure to lead in the United States is primarily a problem in children. Age, pica, diet, nutritional status, and multiple sources of exposure serve to increase the risk of lead poisoning in children. This is especially true in the inner cities where the prevalence of lead poisoning is greatest. Overexposure to lead compounds may result in undesirable biologic effects. These effects range from reversible clinical or metabolic symptoms, which disappear after cessation of exposure, to permanent damage or death from a single extreme dose or prolonged overexposure. Clinical lead poisoning is accompanied by symptoms of intestinal cramps, peripheral nerve paralysis, anemia, and severe fatigue. Very severe exposure results in permanent neurological, renal, or cardiovascular damage or death.

CONCLUSIONS

The Connecticut primary and secondary ambient air quality standard for lead and its compounds was not exceeded at any site in Connecticut during 1994.

The monitoring sites where the lead levels were highest were generally in urban locations with moderate to heavy traffic. In Connecticut, this is due to the fact that the primary source of lead to the atmosphere is the combustion of gasoline, which still contains trace amounts of lead.

SAMPLE COLLECTION AND ANALYSIS

The Air Monitoring Unit used hi-vol samplers in 1994 to obtain ambient concentrations of lead. These samplers are used to collect particulate matter onto fiberglass filters. The particulate matter collected on the filters is subsequently analyzed for its chemical composition. Wet chemistry techniques are used to separate the particulate matter into various components. The lead content of the particulate matter is determined using an atomic absorption spectrophotometer.

Unlike hi-vol particulate samples which are analyzed separately, the hi-vol lead sample is a composite of all the individual samples obtained at a site in a single month. That is, a cutting is taken from each filter during the month, and these cuttings are collectively chemically analyzed for lead.

DISCUSSION OF DATA

Monitoring Network - In 1994, only hi-vol samplers were operated in Connecticut to determine lead levels. There were 6 such samplers operated throughout the state by the DEP in five areas with populations of 200,000 or more: Bridgeport, East Hartford, Hartford, New Haven and Waterbury (see Figure 7-1). The samplers are situated near some of the busiest city streets and highways in order to monitor "worst-case" lead concentrations.

Much of the lead monitoring network was dismantled in 1988 due to the changeover from hi-vol to PM_{10} monitoring in the particulate matter network. By the end of that year, all but two of the hi-vol lead sampling sites were terminated: Hartford 013 and New Haven 013. By the end of 1989, the remaining hi-vol samplers were terminated and only lo-vol samplers were in use.

In 1991, the lo-vols were replaced by hi-vols. The primary reason for this has to do with data losses resulting from instrument problems or failures. With a lo-vol, an entire month of data is invalidated if an instrument fails because lo-vols operate continuously for a month. In the case of a hi-vol, instrument problems or failures result in the loss of only a single 24-hour sample.

Precision and Accuracy - Due to the very low airborne lead concentrations, precision checks yield 95% probability limits that are statistically unrealistic. Accuracy for lead can be assessed in two ways. One is by auditing the air flow through the monitors. Five audits for flow accuracy were conducted on the monitoring network in 1994. The probability limits ranged from -8% to +1%. Accuracy can also be defined as the accuracy of the analysis method. This is determined by the chemical analysis of known lead samples. On this basis, 4 audits were performed on the network. Two different concentration levels were tested: high and low. The 95% probability limits for the low level ranged from 0% to +4%; those for the high level ranged from -2% to +3%.

NAAQS - Connecticut's ambient air quality standard for lead and its compounds, measured as elemental lead, is: 1.5 micrograms per cubic meter ($\mu g/m^3$), maximum arithmetic mean averaged over three consecutive calendar months. This standard was enacted on November 2, 1981. Previously, Connecticut's lead standard was identical to the national standard: 1.5 $\mu g/m^3$ for a calendar quarter-year average. The change to a 3-month running average means that a more stringent standard applies in Connecticut, since there are three times as many data blocks within a calendar year which must not exceed the limiting concentration of 1.5 $\mu g/m^3$.

3-Month Running Averages - Three-month running average lead concentrations for 1994 are given in Table 7-1. All are significantly below the primary and secondary standard of 1.5 $\mu g/m^3$.

Trends - A downward trend in measured concentrations of lead has been observed since 1977. This is due to the increasing use of unleaded gasoline. Figure 7-2 shows that the decrease in statewide ambient average lead concentrations has been commensurate with a decrease in lead emissions from gasoline combustion from 1982 to 1989. In fact, this relationship is so close it has a correlation coefficient of 0.987 (see Figure 7-3). Reliable data on the sales of leaded gasoline in Connecticut are unavailable after 1989; so lead emissions are no longer updated in Figure 7-2, and Figure 7-3 contains only pre-1990 data.

The downward trend in airborne lead concentrations can be expected to level off when the use of leaded gasoline is finally phased out or minimized. Lead emissions will then rise and fall with the number of vehicle miles travelled (VMT's) by the population. This is due to the fact that so-called unleaded gasoline still contains a small proportion of lead.

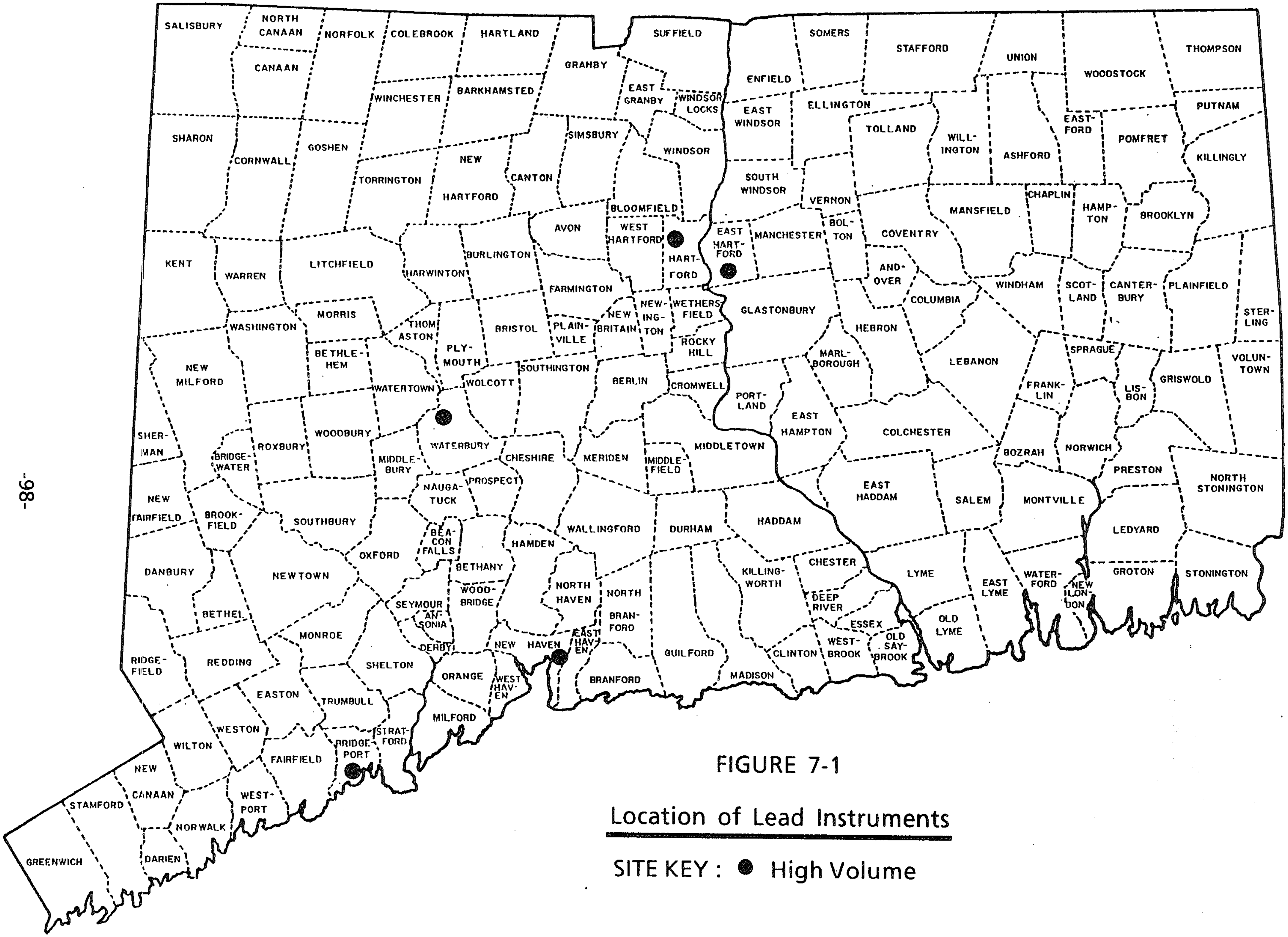


FIGURE 7-1

Location of Lead Instruments

SITE KEY : ● High Volume

TABLE 7-1

1994 3-MONTH RUNNING AVERAGE LEAD CONCENTRATIONS[a]

TOWN-SITE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Bridgeport-010	0.01	-----	-----	-----	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.02
East Hartford-004	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Hartford-016	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.01	-----	-----	0.02
New Haven-018	0.20	0.12	0.09	0.15	0.17	0.17	0.14	0.10	0.08	0.05	0.04	0.06
Waterbury-123	0.01	0.01	0.01	0.02	0.01	0.02	0.02	0.02	0.01	0.01	0.01	0.02

a The lead concentrations are in terms of micrograms per cubic meter ($\mu g/m^3$).

FIGURE 7-2

STATEWIDE ANNUAL LEAD EMISSIONS FROM GASOLINE

AND

STATEWIDE ANNUAL AVERAGE LEAD CONCENTRATIONS

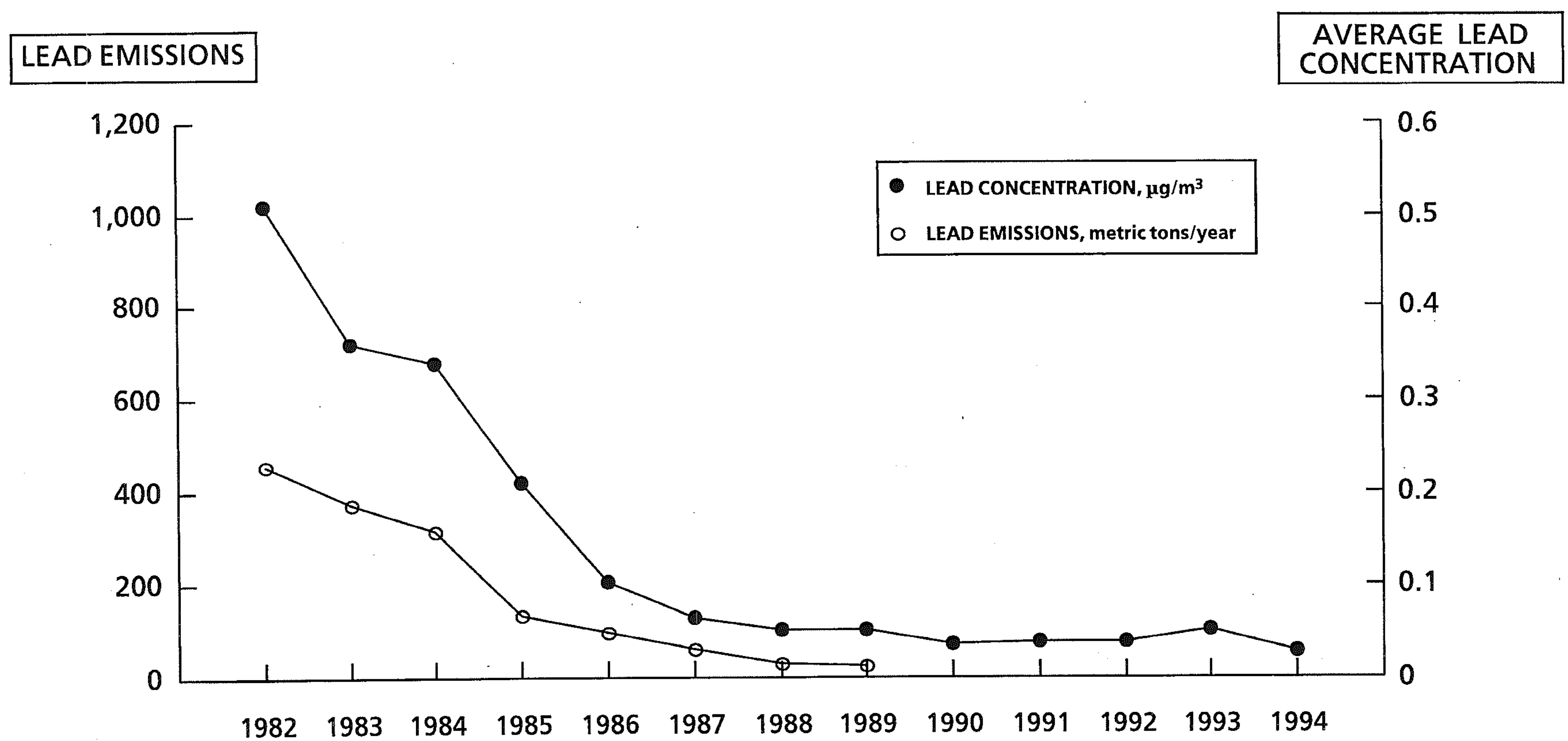
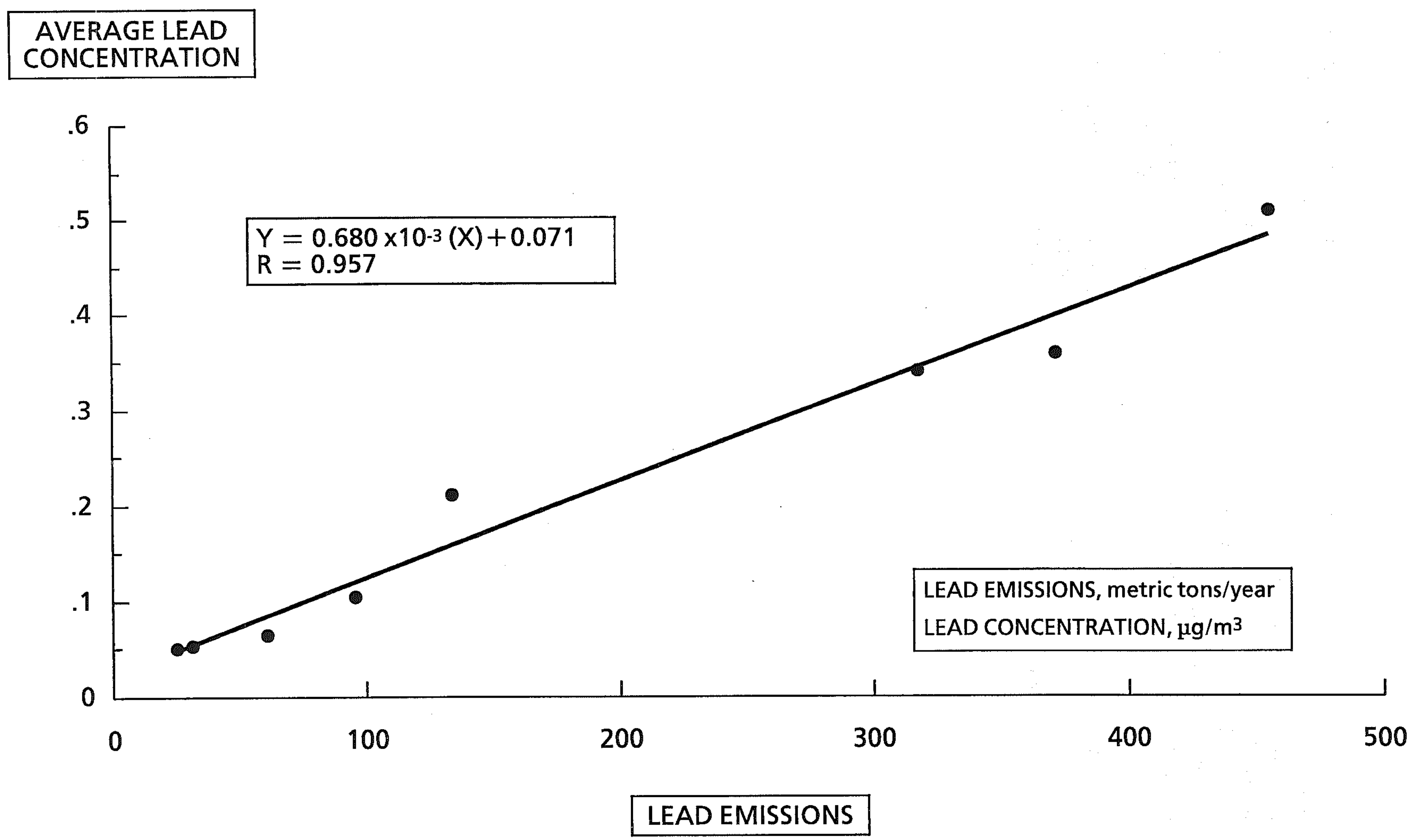


FIGURE 7-3

STATEWIDE ANNUAL AVERAGE LEAD CONCENTRATIONS

VS.

STATEWIDE ANNUAL LEAD EMISSIONS FROM GASOLINE



VIII. CLIMATOLOGICAL DATA

Weather is often the most significant factor influencing short-term changes in air quality. It also has an affect on long-term trends. Climatological information from the National Weather Service station at Bradley International Airport in Windsor Locks is shown in Table 8-1 for the years 1993 and 1994. Table 8-2 contains information from the National Weather Service station located at Sikorsky Memorial Airport near Bridgeport. All data are compared to "mean" or "normal" values. Wind speeds[1] and temperatures are shown as monthly and yearly averages. Precipitation data includes both the number of days with more than 0.01 inches of precipitation and the total water equivalent. Also shown are the number of degree days[2] (heating requirement) and the number of days with temperatures exceeding 90°F.

Wind roses for Bradley Airport and Newark Airport have been developed from 1994 National Weather Service surface observations and are shown in Figures 8-2 and 8-4, respectively. Wind roses from these stations for 1993 are shown in Figures 8-1 and 8-3, respectively.

1 The mean wind speed for a month or year is calculated from all the hourly wind speeds, regardless of the wind directions.

2 The degree day value for each day is arrived at by subtracting the average temperature of the day from 65°F. This number (65) is used as a base value because it is assumed that there is no heating requirement when the outside temperature is 65°F.

TABLE 8-1

1993 AND 1994 CLIMATOLOGICAL DATA
BRADLEY INTERNATIONAL AIRPORT, WINDSOR LOCKS

	AVERAGE TEMPERATURE °F			NO. OF DAYS WHEN MAX. TEMP. EXCEEDED 90 °F			DEGREE DAYS			PRECIPITATION IN EQUIVALENT INCHES OF WATER			NO. OF DAYS WITH MORE THAN 0.01 INCHES OF PRECIPITATION			AVERAGE WIND SPEED (MPH)		
	1993	1994	Mean[a]	1993	1994	Mean[b]	1993	1994	Normal[c]	1993	1994	Mean[a]	1993	1994	Mean[d]	1993	1994	Mean[d]
Jan	28.8	18.8	26.6	0	0	0.0	1114	1424	1252	2.63	5.83	3.53	11	13	10.6	9.2	8.7	9.0
Feb	23.8	23.2	27.8	0	0	0.0	1148	1163	1050	2.90	3.38	3.17	7	12	10.3	10.5	7.6	9.4
Mar	34.5	36.1	37.2	0	0	0.0	935	888	853	6.67	5.70	3.76	14	18	11.6	10.2	8.3	9.9
Apr	49.6	50.9	48.2	0	0	0.3	454	417	489	4.71	2.51	3.74	15	12	11.2	9.3	6.9	9.9
May	61.2	58.3	59.2	1	1	1.2	139	226	194	1.92	4.12	3.71	8	14	11.7	6.9	8.0	8.8
Jun	68.6	71.1	67.9	3	4	3.5	43	15	20	2.63	3.84	3.59	11	12	11.3	6.2	6.9	8.1
Jul	74.3	77.1	73.2	7	9	7.7	3	0	0	4.90	5.32	3.59	9	12	9.8	4.7	4.3	7.3
Aug	73.4	70.0	71.0	7	0	4.7	4	8	6	1.80	5.33	3.93	8	15	9.9	4.5	4.5	7.1
Sep	63.0	63.7	63.5	1	0	1.3	142	77	96	5.35	5.47	3.64	13	10	9.5	5.6	6.5	7.3
Oct	49.8	52.6	52.9	0	0	*	464	379	397	4.15	1.53	3.22	12	8	8.5	7.1	6.1	7.8
Nov	40.8	46.1	42.1	0	0	0.0	722	561	693	3.27	4.57	3.84	12	8	11.1	7.0	7.9	8.4
Dec	30.9	35.0	30.4	0	0	0.0	1049	923	1101	4.16	5.38	3.73	10	10	11.9	8.0	8.7	8.7
YEAR	49.9	50.2	50.0	19	14	18.6	6217	6081	6151	45.09	52.98	43.46	130	144	127.5	7.4	7.0	8.5

* Less than 0.05
[a] 1905-1994
[b] 1960-1994
[c] 1961-1990
[d] 1955-1994

Extracted From: Local Climatological Data Charts
U.S. Department of Commerce
National Oceanic and Atmospheric Administration
Environmental Data Service

TABLE 8-2

1993 AND 1994 CLIMATOLOGICAL DATA SIKORSKY INTERNATIONAL AIRPORT, STRATFORD

	AVERAGE TEMPERATURE °F			NO. OF DAYS WHEN MAX. TEMP. EXCEEDED 90 °F			DEGREE DAYS			PRECIPITATION IN EQUIVALENT INCHES OF WATER			NO. OF DAYS WITH MORE THAN 0.01 INCHES OF PRECIPITATION			AVERAGE WIND SPEED (MPH)		
	1993	1994	Mean[a]	1993	1994	Mean[b]	1993	1994	Normal[c]	1993	1994	Mean[d]	1993	1994	Mean[e]	1993	1994	Mean[f]
Jan	33.6	23.4	28.5	0	0	0.0	966	1283	1119	2.60	5.12	3.54	13	13	10.7	---	---	13.2
Feb	27.9	26.2	30.6	0	0	0.0	1036	1080	969	2.60	3.17	3.21	8	9	9.7	---	---	13.6
Mar	36.7	37.5	38.0	0	0	0.0	871	843	818	6.75	5.74	3.96	12	13	11.2	---	---	13.5
Apr	49.2	50.6	48.1	0	0	*	465	425	504	3.50	2.85	3.81	13	14	10.6	---	---	13.0
May	61.4	58.6	58.5	0	0	0.2	127	208	219	2.25	3.42	3.74	8	13	11.0	---	---	11.6
Jun	70.0	71.8	67.8	2	2	1.1	27	7	18	1.42	1.51	3.31	10	11	9.4	---	---	10.5
Jul	76.7	78.5	73.4	8	9	3.4	2	0	0	1.58	1.82	3.67	5	8	8.7	---	---	10.0
Aug	75.3	72.0	72.1	6	0	1.7	0	1	0	1.58	4.95	4.07	9	13	9.4	---	---	10.1
Sep	65.7	65.4	65.2	1	0	0.3	89	39	54	6.60	4.46	3.50	14	10	8.7	---	---	11.2
Oct	53.3	54.9	54.6	0	0	0.0	358	306	302	4.00	1.06	3.34	8	6	7.3	---	---	11.9
Nov	45.0	48.9	44.3	0	0	0.0	597	473	582	1.71	3.13	3.77	5	9	10.0	---	---	12.7
Dec	35.5	38.7	33.3	0	0	0.0	909	807	952	4.54	3.73	3.64	9	11	11.2	---	---	13.0
YEAR	52.5	52.2	51.2	17	11	6.8	5447	5472	5537	39.13	40.96	43.55	114	130	118.0	---	---	12.0

* Less than 0.05
a 1903-1994
b 1966-1994
c 1961-1990
d 1894-1994
e 1949-1994
f 1958-1980

Extracted From: Local Climatological Data Charts
U.S. Department of Commerce
National Oceanic and Atmospheric Administration
Environmental Data Service

FIGURE 8-1

ANNUAL WIND ROSE FOR 1993
BRADLEY INTERNATIONAL AIRPORT
WINDSOR LOCKS, CONNECTICUT

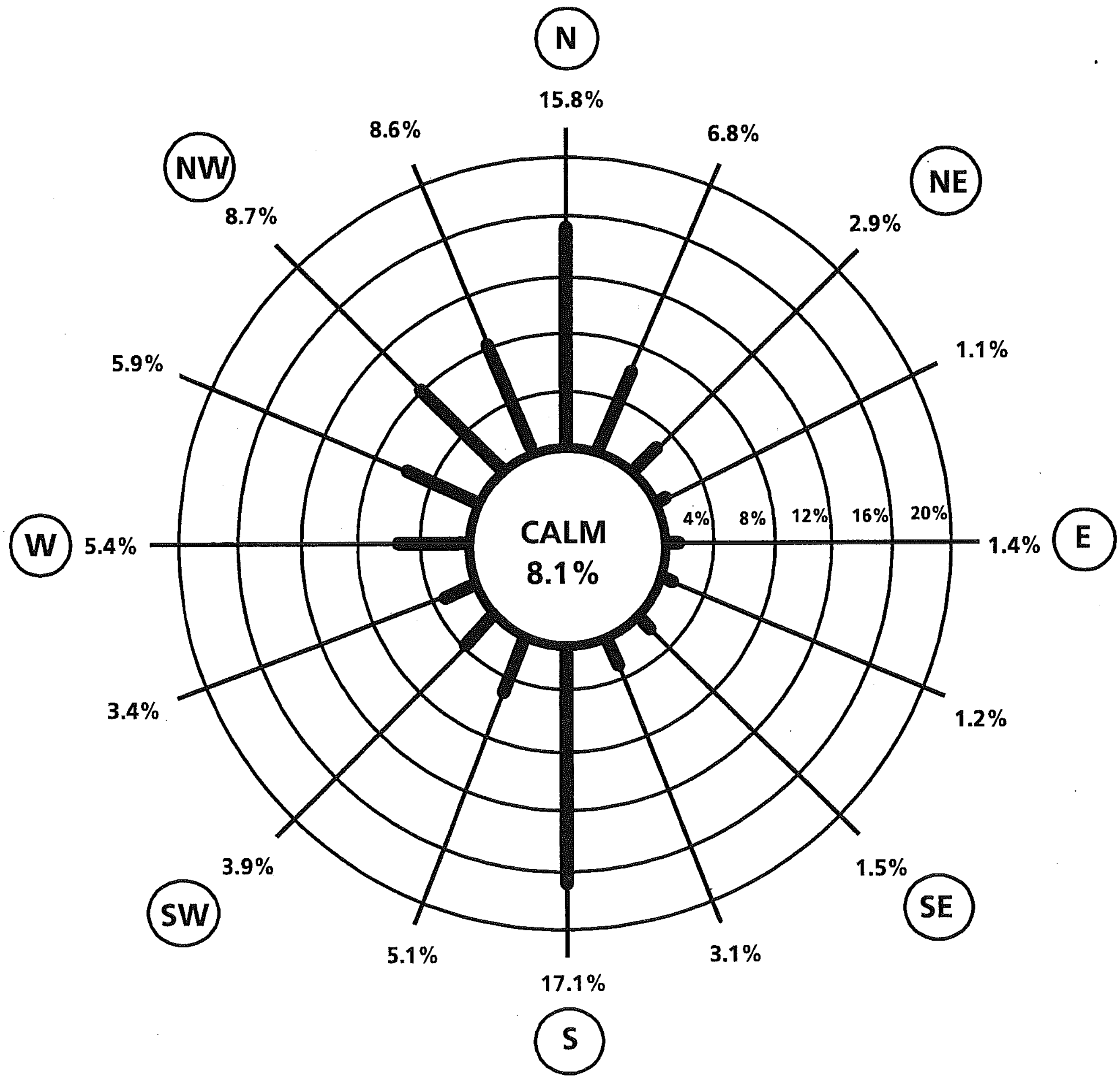


FIGURE 8-2

ANNUAL WIND ROSE FOR 1994
BRADLEY INTERNATIONAL AIRPORT
WINDSOR LOCKS, CONNECTICUT

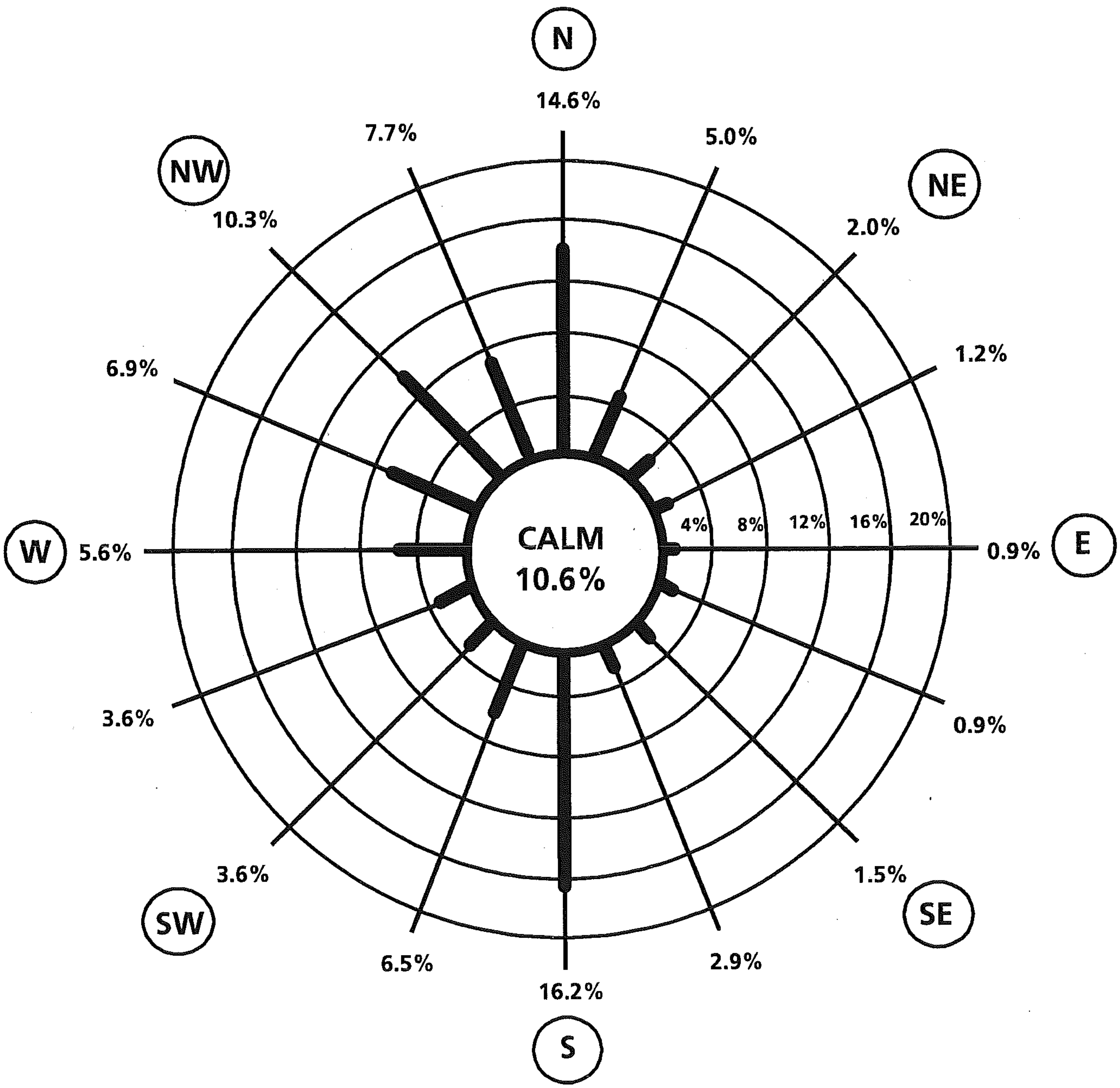


FIGURE 8-3

ANNUAL WIND ROSE FOR 1993
NEWARK INTERNATIONAL AIRPORT
NEWARK, NEW JERSEY

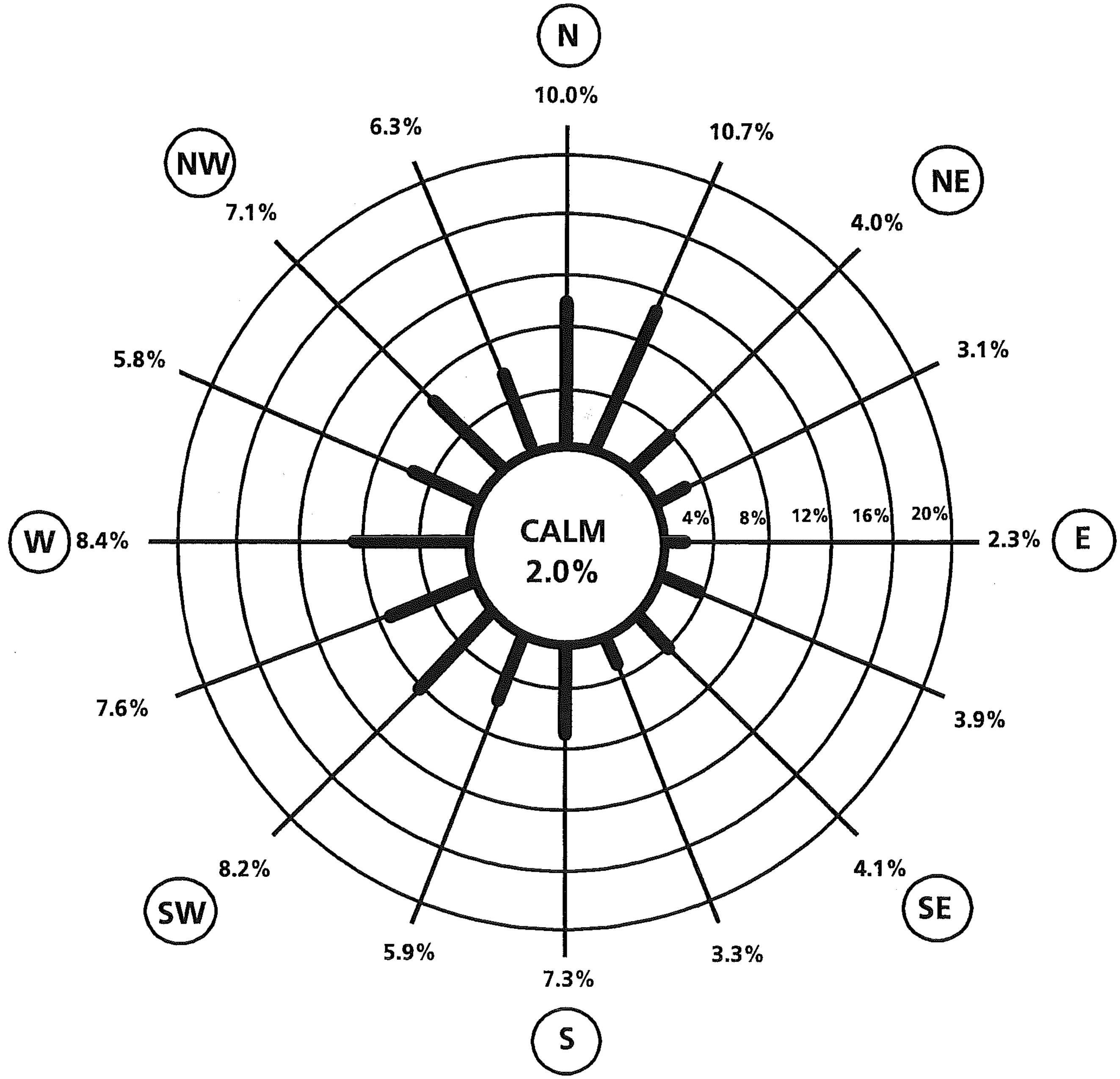
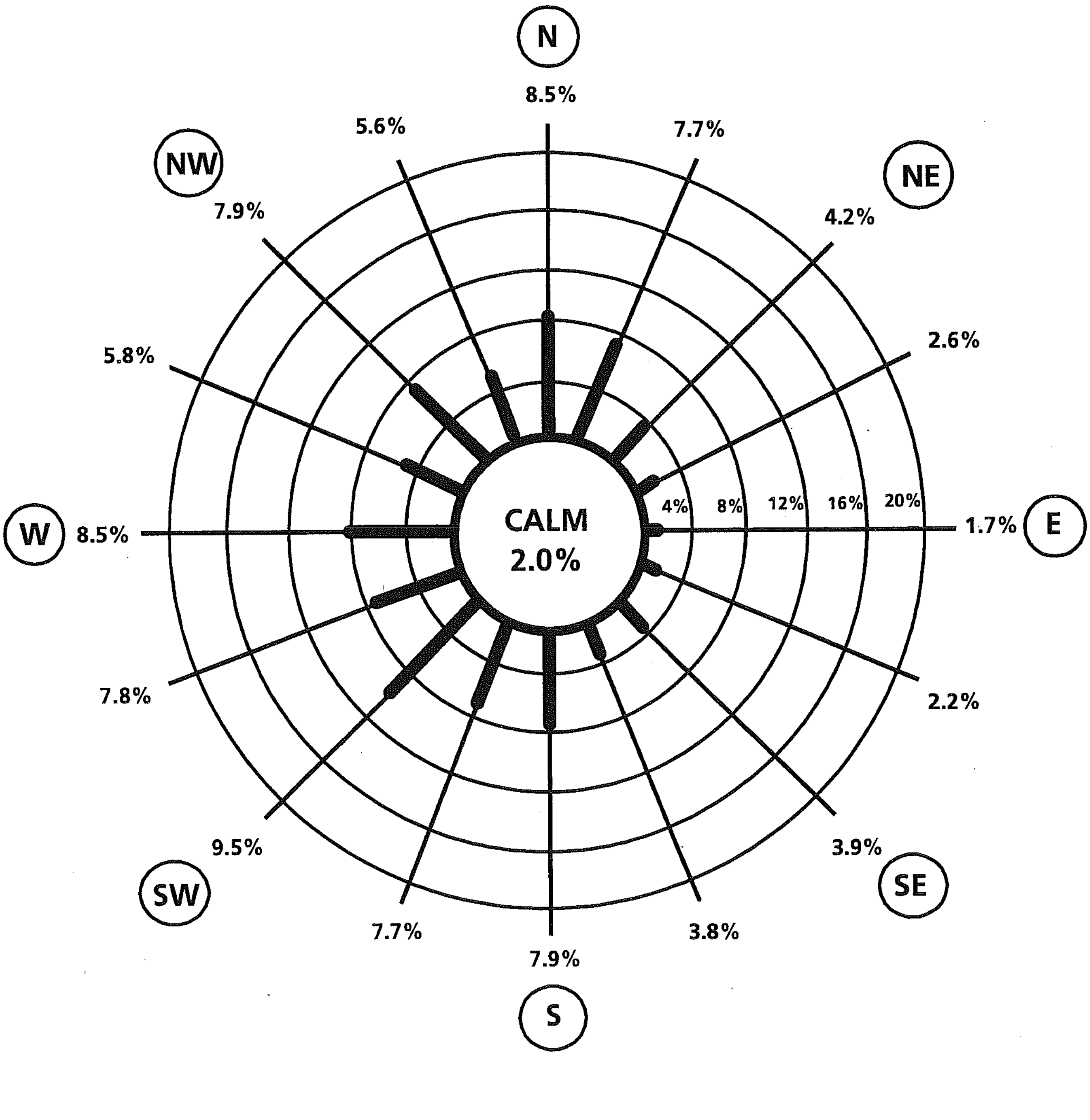


FIGURE 8-4

ANNUAL WIND ROSE FOR 1994
NEWARK INTERNATIONAL AIRPORT
NEWARK, NEW JERSEY



IX. ATTAINMENT AND NON-ATTAINMENT OF THE NAAQS IN CONNECTICUT

The State of Connecticut can be broadly designated as either attainment or non-attainment with respect to the National Ambient Air Quality Standards (NAAQS) for the following pollutants: particulate matter no greater than 10 micrometers in diameter (PM_{10}); sulfur dioxide (SO_2); ozone (O_3); nitrogen dioxide (NO_2); carbon monoxide (CO) ; and lead (Pb). The 1994 designations are:

Attainment	Non-attainment
NO_2	CO
Pb	Ozone
SO_2	PM_{10}

When the State has been designated as attainment for a pollutant, all regions of the State are in compliance with all the standards (i.e., short term and long term; primary and secondary) for the particular pollutant. This is the case for NO_2, Pb and SO_2.

When the State has been designated as non-attainment for a pollutant, one or more of the standards for the pollutant have been violated in one or more regions of the State. The non-attainment designation that is subsequently applied to a region can reflect the "degree" of non-attainment depending upon a number of factors: the air pollution history in the region; previous designation of the region as either attainment or non-attainment; lack of air pollutant monitoring in the region; inferences made based on pollutant monitoring done in adjacent or similar regions, *et al.* For example, the whole state is designated as non-attainment for ozone, but the degree of non-attainment varies between regions (see Figure 9-1). The region comprising Fairfield County (less Shelton), New Milford and Bridgewater is designated as "severe non-attainment" for ozone, while the rest of the State is designated as "serious non-attainment." The difference in the two designations is explained by higher ozone concentrations in excess of the 1-hour ozone standard in the Fairfield County portion of the NY-NJ-CT non-attainment area.

For CO, there is a mix of both attainment and non-attainment regions (see Figure 9-2). The region comprising Fairfield County (less Shelton), New Milford and Bridgewater is designated as "moderate non-attainment" primarily due to exceedances of the 8-hour CO standard in the New York / New Jersey portion of the region (not shown). The region comprising Hartford County (less Hartland), Tolland County, Middlesex County and Plymouth is designated as "moderate non-attainment" due to exceedances of the 8-hour CO standard in the city of Hartford. The region comprising New Haven County, Bethlehem, Watertown, Woodbury, Thomaston and Shelton is designated as "unclassified non-attainment." This designation reflects the fact that although no exceedances of the CO standards have been recorded there in the recent past, the region was previously part of the New Haven -- Hartford -- Springfield Air Quality Control Region which was designated as non-attainment due to exceedances of the 8-hour CO standard recorded in the city of Hartford. The two remaining regions of the State are designated as "unclassified attainment." This designation reflects the fact that although no CO monitoring has been done in these regions, their status as attainment areas can be inferred from population and traffic density data.

For PM_{10}, the entire State is designated as attainment, except for the city of New Haven (see Figure 9-3).

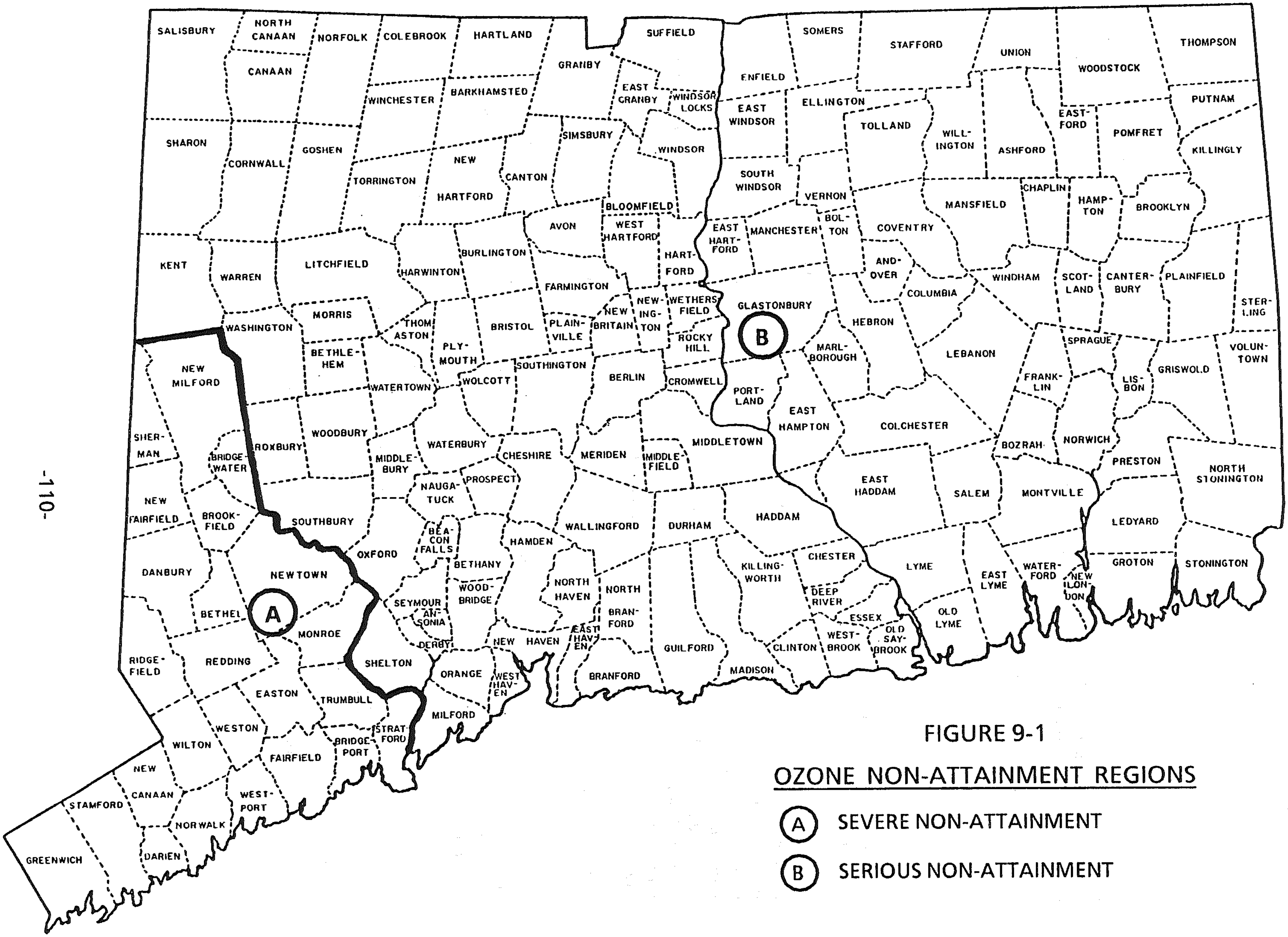


FIGURE 9-1

OZONE NON-ATTAINMENT REGIONS

Ⓐ SEVERE NON-ATTAINMENT

Ⓑ SERIOUS NON-ATTAINMENT

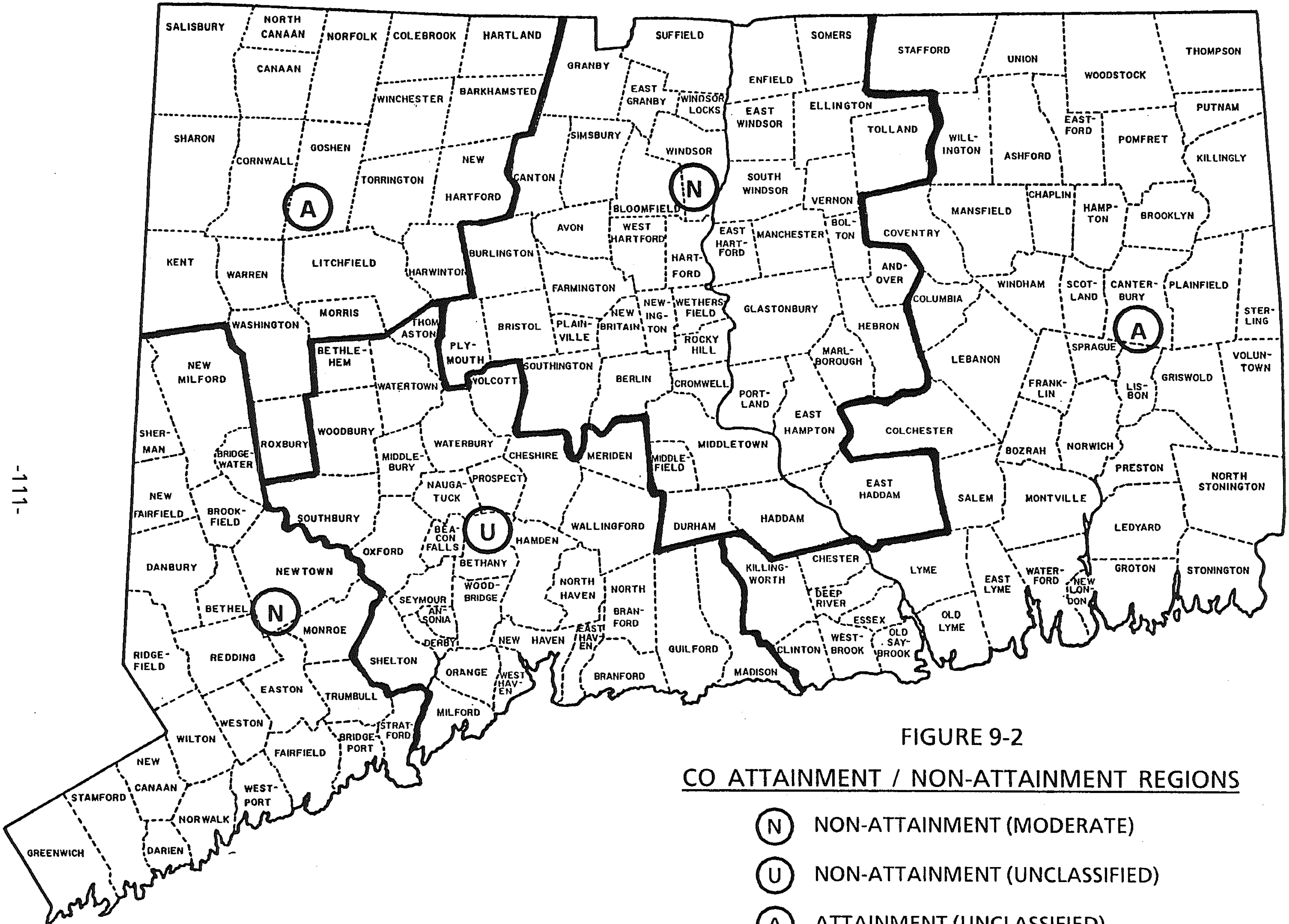


FIGURE 9-2

CO ATTAINMENT / NON-ATTAINMENT REGIONS

(N) NON-ATTAINMENT (MODERATE)

(U) NON-ATTAINMENT (UNCLASSIFIED)

(A) ATTAINMENT (UNCLASSIFIED)

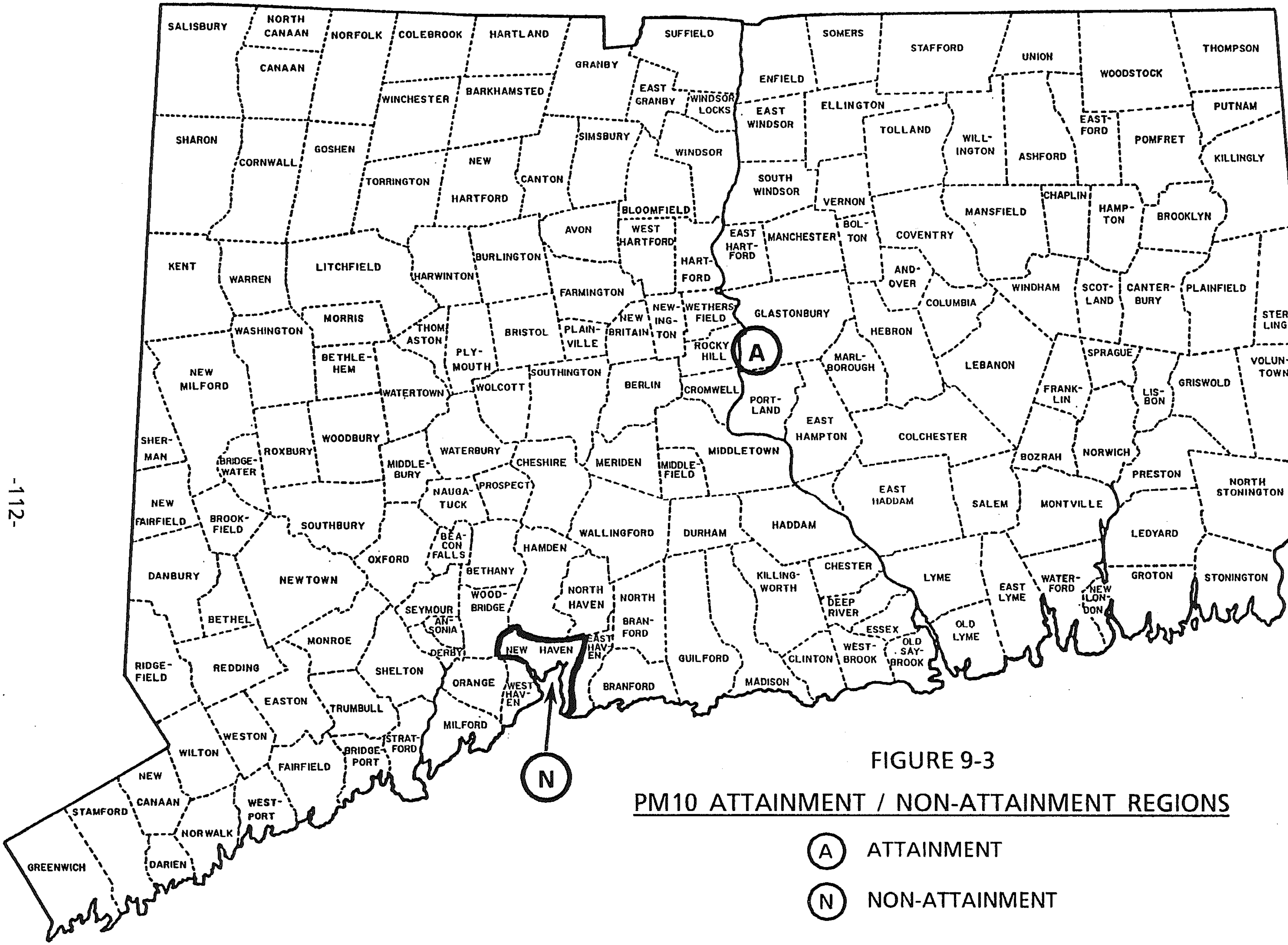


FIGURE 9-3

PM10 ATTAINMENT / NON-ATTAINMENT REGIONS

(A) ATTAINMENT

(N) NON-ATTAINMENT

X. CONNECTICUT SLAMS AND NAMS NETWORK

On May 10, 1979, the U.S. Environmental Protection Agency made public its final rulemaking for ambient air monitoring and data reporting requirements in the "Federal Register" (Vol. 44, No. 92). These regulations, which can also be found in Title 40 of the Code of Federal Regulations (CFR), Part 58, Appendix A through G, are meant to ensure the acceptability of air measurement data, the comparability of data from all monitoring stations nationwide, the cost-effectiveness of monitoring networks, and timely data submission for assessment purposes. The regulations address a number of key areas including quality assurance, monitoring methodologies, network design, probe siting and data reporting. Detailed requirements and specific criteria are provided which form the framework for ambient air quality monitoring. These regulations apply to all parties conducting ambient air quality monitoring for the purpose of supporting or complying with environmental regulations. In particular, state/local control agencies and industrial/private concerns involved in air monitoring are directly influenced by specific requirements, compliance dates and recommended guidelines.

QUALITY ASSURANCE

The regulations specify the minimum quality assurance requirements for State and Local Air Monitoring Stations (SLAMS) networks and for National Air Monitoring Stations (NAMS) networks, which are a subset of SLAMS. Two distinct and equally important functions make up the quality assurance program: assessment of the quality of monitoring data by statistically calculating their precision and accuracy, and control of the quality of the data by implementation of quality control policies, procedures and corrective actions, and by overseeing their proper implementation. (See Part D of Section I, Quality Assurance).

The data assessment requirements entail the determination of precision and accuracy for both continuous and manual methods. A one-point precision check must be carried out at least once every other week on each automated analyzer used to measure SO_2, NO_2, CO and O_3. Standards from which the precision check test data are derived must meet specifications detailed in the regulations. For manual methods, precision checks are to be accomplished by operating co-located duplicate samplers. In 1994, Connecticut maintained three co-located PM_{10} samplers (Hartford 015, New Haven 123 and Waterbury 123) and one co-located lead sampler (Waterbury 123).

Accuracy determinations for automated analyzers (SO_2, NO_2, CO, O_3) are accomplished by audits performed by an independent auditor utilizing equipment and gases which are disassociated from the normal network operations. Accuracy determinations are accomplished via traceable standard flow devices for hi-vols and also spiked strip analyses for lead. During each calendar quarter, at least 25% of each pollutant SLAMS network must be audited.

All precision and accuracy results are statistics derived through calculation methods specified by the regulations, with the data and results reported quarterly. The NAMS network is actually part of the SLAMS network; so the SLAMS accuracy determinations also apply to the NAMS network. The distinguishing characteristics of NAMS are: 1) the sites are located in high population, high pollution areas (i.e., urban areas); 2) only continuous instruments are used to monitor gaseous pollutants; 3) the regulations specify a minimum number and locations for them; and 4) the data, in addition to being included in the annual report, are required to be reported quarterly to EPA.

In order to control the quality of data, the monitoring program has operational procedures for each of the following activities:

1. Selection of methods, analyzers, and samplers,
2. Site selection and probe siting,
3. Equipment purchase, check-out and installation,
4. Instrument calibration,
5. Control checks and their frequency,
6. Control limits for control checks, and corrective actions when such limits are exceeded,
7. Preventive and remedial maintenance,
8. Documentation of quality control information, and
9. Data recording, reduction, validation and reporting.

MONITORING METHODOLOGIES

Except as otherwise stated within the regulations, the monitoring methods used must be "reference" or "equivalent," as designated by the EPA. Table 10-1 lists methods used in Connecticut's network in 1994 which were on the EPA-approved list as of February 8, 1993. Additional updates to these approved methods are provided through the "Federal Register."

NETWORK DESIGN

The regulations also describe monitoring objectives and general criteria to be applied in establishing the SLAMS and NAMS networks and for choosing general locations for new monitors. Criteria are also presented for determining the location and number of monitors. Since January 1, 1984, these criteria have served as the framework for all State Implementation Plan (SIP) monitoring networks.

The SLAMS and NAMS networks are designed to meet four basic monitoring objectives: (1) to determine the highest pollutant concentration in the area; (2) to determine representative concentrations in areas of high population density; (3) to determine the ambient impact of significant sources or source categories; and (4) to determine general background concentration levels. Proper siting of a monitor requires precise specification of the monitoring objectives, which includes a spatial scale of representativeness. The spatial scales of representativeness are specified in the regulations for all pollutants and monitoring objectives. The 1993 SLAMS and NAMS networks in Connecticut are presented and described in Table 10-2.

PROBE SITING

Location and exposure of monitoring probes are described in Title 40 of the Code of Federal Regulations, Part 58, Appendix E. The probe siting criteria promulgated in the regulations are specific. They are also sufficiently comprehensive to define the requirements for ensuring the uniform collection of compatible and comparable air quality data.

These criteria are detailed by pollutant and include vertical and horizontal probe placement, spacing from obstructions and trees, spacing from roadways, probe material and sample residence time, and various other considerations. A summary of the probe siting criteria is presented in Table 10-3. The siting criteria generally apply to all spatial scales except where noted. The most notable exception is spacing from roadways which is dependent on traffic volume.

For the chemically reactive gases SO_2, NO_2, and O_3, the regulations specify borosilicate glass, FEP teflon or their equivalent as the only acceptable sample train materials. Additionally, in order to minimize the effects of particulate deposition on probe walls, sample trains for reactive gases must have residence times of less than 20 seconds.

TABLE 10-1

U. S. EPA-APPROVED MONITORING METHODS USED IN CONNECTICUT IN 1994

Pollutant	Monitoring Methods		
	Reference Manual	Reference Automated	Equivalent Automated
PM_{10}	High Volume Method *[Wedding & Associates Critical Flow Hi-vol]*		Tapered Element Oscillating Microbalance *[Rupprecht & Patashnick TEOM Series 1400]*
SO_2			Pulsed Fluorescence *[Thermo Electron 43 (0.5) & Thermo Electron 43A (0.5)]*
O_3			UV Absorption *[Monitor Labs 8810 (0.5)]*
CO		Non-dispersive Infrared *[Thermo Electron 48 (50)]*	
NO_2		Chemiluminescence *[Thermo Electron 42 (1.0)]*	
Lead	High Volume Method *[General Metal Works GL 2000H]*		

( ) = Approved range in ppm

TABLE 10-2

1994 SLAMS AND NAMS SITES IN CONNECTICUT

Town	Urban Area	Site	SLAMS or NAMS	Sampling Method	Analytic Method	Operating Schedule	Monitoring Objective	Spatial Scale of Representativeness
PARTICULATE MATTER (PM_{10})								
Bridgeport	Bridgeport	010	N	Hi-Vol	Gravimetric	6th day	Population	Neighborhood
Bridgeport	Bridgeport	014	N	Hi-Vol	Gravimetric	6th day	High Concentration	Micro
Bristol	Bristol	001	S	Hi-Vol	Gravimetric	6th day	High Concentration	Neighborhood
Burlington	NONE	001	S	Hi-Vol	Gravimetric	6th day	Background	Regional
Danbury	Danbury	123	S	Hi-Vol	Gravimetric	6th day	Population	Neighborhood
Darien	Stamford	001	N	Hi-Vol	Gravimetric	6th day	High Concentration	Micro
E. Hartford	Hartford	004	S	Hi-Vol	Gravimetric	6th day	High Concentration	Neighborhood
Enfield	MA-CT*	005	S	Hi-Vol	Gravimetric	6th day	Population	Regional
Greenwich	Stamford	017	S	Hi-Vol	Gravimetric	6th day	Population	Neighborhood
Groton	New London/ Norwich	006	S	Hi-Vol	Gravimetric	6th day	High Concentration	Neighborhood
Hartford	Hartford	013	N	Hi-Vol	Gravimetric	6th day	Population	Neighborhood
Hartford	Hartford	015	N	Hi-Vol	Gravimetric	6th day	High Concentration	Micro
Meriden	Meriden	002	S	Hi-Vol	Gravimetric	6th day	High Concentration	Neighborhood
Middletown	Hartford	003	S	Hi-Vol	Gravimetric	6th day	High Concentration	Neighborhood
Milford	Bridgeport	010	S	Hi-Vol	Gravimetric	6th day	Population	Neighborhood
New Britain	New Britain	012	N	Hi-Vol	Gravimetric	6th day	High Concentration	Middle
New Haven	New Haven	013	N	Hi-Vol	Gravimetric	6th day	Population	Neighborhood
New Haven	New Haven	018	N	Hi-Vol	Gravimetric	6th day	High Concentration	Middle
New Haven	New Haven	020	N	Hi-Vol	Gravimetric	6th day	High Concentration	Middle
New Haven	New Haven	123	S	Hi-Vol	Gravimetric	6th day	Population	Neighborhood

* Includes Springfield, Chicopee, Holyoke in MA; East Windsor, Enfield, Suffield, Windsor Locks in CT.

TABLE 10-2, CONTINUED

1994 SLAMS AND NAMS SITES IN CONNECTICUT

Town	Urban Area	Site	SLAMS or NAMS	Sampling Method	Analytic Method	Operating Schedule	Monitoring Objective	Spatial Scale of Representativeness
PARTICULATE MATTER (PM_{10})								
New London	New London/ Norwich	004	N	Hi-Vol	Gravimetric	6th day	High Concentration	Middle
Norwalk	Norwalk	014	N	Hi-Vol	Gravimetric	6th day	High Concentration	Micro
Norwich	New London/ Norwich	002	S	Hi-Vol	Gravimetric	6th day	Population	Neighborhood
Stamford	Stamford	001	S	Hi-Vol	Gravimetric	6th day	High Concentration	Neighborhood
Torrington	NONE	001	S	Hi-Vol	Gravimetric	6th day	Population	Neighborhood
Voluntown	NONE	001	S	Hi-Vol	Gravimetric	6th day	Background	Regional
Wallingford	New Haven	006	S	Hi-Vol	Gravimetric	6th day	Population	Neighborhood
Waterbury	Waterbury	007	S	Hi-Vol	Gravimetric	6th day	Population	Neighborhood
Waterbury	Waterbury	123	N	Hi-Vol	Gravimetric	6th day	High Concentration	Middle
Willimantic	NONE	002	S	Hi-Vol	Gravimetric	6 th day	High Concentration	Neighborhood
LEAD								
Bridgeport	Bridgeport	010	S	Hi-Vol	Atomic Abs.	6th day	High Concentration	Middle
E. Hartford	Hartford	004	N	Hi-Vol	Atomic Abs.	6th day	Population	Neighborhood
Hartford	Hartford	016	N	Hi-Vol	Atomic Abs.	6th day	High Concentration	Micro
New Haven	New Haven	018	S	Hi-Vol	Atomic Abs.	6th day	High Concentration	Middle
Waterbury	Waterbury	123	S	Hi-Vol	Atomic Abs.	6th day	High Concentration	Middle

TABLE 10-2, CONTINUED

1994 SLAMS AND NAMS SITES IN CONNECTICUT

Town	Urban Area	Site	SLAMS or NAMS	Sampling & Analytic Method	Operating Schedule	Monitoring Objective	Spatial Scale of Representativeness
				SULFUR DIOXIDE			
Bridgeport	Bridgeport	012	S	Pulsed Fluorescence	Continuous	High Concentration	Neighborhood
Bridgeport	Bridgeport	013	N	Pulsed Fluorescence	Continuous	High Concentration	Neighborhood
Danbury	Danbury	123	S	Pulsed Fluorescence	Continuous	Population	Neighborhood
E. Hartford	Hartford	006	N	Pulsed Fluorescence	Continuous	High Concentration	Neighborhood
East Haven	New Haven	003	S	Pulsed Fluorescence	Continuous	Population	Neighborhood
Enfield	MA - CT*	005	S	Pulsed Fluorescence	Continuous	Background	Regional
Greenwich	Stamford	017	S	Pulsed Fluorescence	Continuous	Background	Urban
Groton	New London/ Norwich	007	S	Pulsed Fluorescence	Continuous	Population	Neighborhood
Hartford	Hartford	018	N	Pulsed Fluorescence	Continuous	Population	Neighborhood
Mansfield	NONE	003	S	Pulsed Fluorescence	Continuous	Population	Neighborhood
New Haven	New Haven	123	N	Pulsed Fluorescence	Continuous	High Concentration	Neighborhood
Stamford	Stamford	124	S	Pulsed Fluorescence	Continuous	High Concentration	Neighborhood
Waterbury	Waterbury	123	S	Pulsed Fluorescence	Continuous	Population	Neighborhood

* Includes Springfield, Chicopee, Holyoke in MA; East Windsor, Enfield, Suffield, Windsor Locks in CT.

TABLE 10-2, CONTINUED

1994 SLAMS AND NAMS SITES IN CONNECTICUT

Town	Urban Area	Site	SLAMS or NAMS	Sampling & Analytic Method	Operating Schedule	Monitoring Objective	Spatial Scale of Representativeness
NITROGEN OXIDES							
Bridgeport	Bridgeport	013	S	Chemiluminescent	Continuous	High Concentration	Neighborhood
E. Hartford	Hartford	003	S	Chemiluminescent	Continuous	High Concentration	Neighborhood
New Haven	New Haven	123	S	Chemiluminescent	Continuous	High Concentration	Neighborhood
OZONE							
Bridgeport	Bridgeport	013	N	Chemiluminescent	Continuous	Population	Neighborhood
Danbury	Danbury	123	S	Chemiluminescent	Continuous	High Concentration	Urban
E. Hartford	Hartford	003	N	Chemiluminescent	Continuous	Population	Neighborhood
Greenwich	Stamford	017	S	Chemiluminescent	Continuous	High Concentration	Urban
Groton	New London/ Norwich	008	S	Chemiluminescent	Continuous	High Concentration	Urban
Madison	NONE	002	S	Chemiluminescent	Continuous	High Concentration	Urban
Middletown	Hartford	007	N	Chemiluminescent	Continuous	High Concentration	Urban
New Haven	New Haven	123	N	Chemiluminescent	Continuous	Population	Neighborhood
Stafford	NONE	001	N	Chemiluminescent	Continuous	High Concentration	Urban
Stratford	Bridgeport	007	N	Chemiluminescent	Continuous	High Concentration	Urban
Torrington	NONE	006	S	Chemiluminescent	Continuous	High Concentration	Urban
CARBON MONOXIDE							
Bridgeport	Bridgeport	004	S	NDIR	Continuous	High Concentration	Micro
Hartford	Hartford	013	N	NDIR	Continuous	Population	Neighborhood
Hartford	Hartford	017	N	NDIR	Continuous	High Concentration	Micro
New Haven	New Haven	019	S	NDIR	Continuous	High Concentration	Micro
Stamford	Stamford	020	S	NDIR	Continuous	High Concentration	Micro

TABLE 10-3

SUMMARY OF PROBE SITING CRITERIA

Pollutant	Spatial Scale	Distance from Supporting Structure (meters)		Height Above Ground (meters)	Other Spacing Criteria
		Vertical	Horizontal[a]		
PM_{10}	Micro		>2	2 - 7	1. The sampler should be > 20 meters from the dripline and must be 10 meters from the dripline when any tree acts as an obstruction. 2. The distance from the sampler to an obstacle, such as a building, must be at least twice the height the obstacle protrudes above the sampler, except for street canyon sites.[b] 3. There must be unrestricted air flow 270 degrees around the sampler, except for street canyon sites. 4. No furnace or incineration flues should be nearby.[c] 5. The spacing from roads varies with traffic[d], except for street canyon sites which must be from 2 to 10 meters from the edge of the nearest traffic lane.
	Middle, neighborhood, urban and regional		>2	2 - 15	1. The sampler should be > 20 meters from the dripline and must be 10 meters from the dripline when any tree acts as an obstruction. 2. The distance from the sampler to an obstacle, such as a building, must be at least twice the height the obstacle protrudes above the sampler.[b] 3. There must be unrestricted air flow 270 degrees around the sampler. 4. No furnace or incineration flues should be nearby.[c] 5. The spacing from roads varies with traffic.[d]

TABLE 10-3, CONTINUED

SUMMARY OF PROBE SITING CRITERIA

Pollutant	Spatial Scale	Distance from Supporting Structure (meters)		Height Above Ground (meters)	Other Spacing Criteria
		Vertical	Horizontal[a]		
Pb	Micro		>2	2 - 7	1. The sampler should be > 20 meters from the dripline and must be 10 meters from the dripline when any tree acts as an obstruction. 2. The distance from the sampler to an obstacle, such as a building, must be at least twice the height the obstacle protrudes above the sampler.[b] 3. There must be unrestricted air flow 270 degrees around the sampler, except for street canyon sites. 4. No furnace or incineration flues should be nearby.[c] 5. The sampler must be 5 to 15 meters from a major roadway.
	Middle, neighborhood, urban and regional		>2	2 - 15	1. The sampler should be > 20 meters from the dripline and must be 10 meters from the dripline when any tree acts as an obstruction. 2. The distance from the sampler to an obstacle, such as a building, must be at least twice the height the obstacle protrudes above the sampler.[b] 3. There must be unrestricted air flow 270 degrees around the sampler. 4. No furnace or incineration flues should be nearby.[c] 5. The spacing from roads varies with traffic.[d]

TABLE 10-3, CONTINUED

SUMMARY OF PROBE SITING CRITERIA

Pollutant	Spatial Scale	Distance from Supporting Structure (meters)		Height Above Ground (meters)	Other Spacing Criteria
		Vertical	Horizontal[a]		
SO_2	All	3 - 15	>1	>1	1. The probe should be > 20 meters from the dripline and must be 10 from the dripline when a tree acts as an obstruction. 2. The distance from the inlet probe to an obstacle, such as a building, must be at least twice the height the obstacle protrudes above the inlet probe.[b] 3. There must be unrestricted air flow 270 degrees around the inlet probe, or 180 degrees if the probe is on the side of a building. 4. No furnace or incineration flues should be nearby.[c]
O_3	All	>1	>1	3 - 15	1. The probe should be > 20 meters from the dripline and must be 10 from the dripline when a tree acts as an obstruction. 2. The distance from the inlet probe to an obstacle, such as a building, must be at least twice the height the obstacle protrudes above the inlet probe. 3. There must be unrestricted air flow 270 degrees around the inlet probe, or 180 degrees if the probe is on the side of a building. 4. The spacing from roads varies with traffic.[d]

TABLE 10-3, CONTINUED

SUMMARY OF PROBE SITING CRITERIA

Pollutant	Spatial Scale	Distance from Supporting Structure (meters)		Height Above Ground (meters)	Other Spacing Criteria
		Vertical	Horizontal[a]		
CO	Micro	2.5 - 3.5	>1	>1	1. The probe must be >10 meters from the street intersection and should be at a midblock location. 2. The probe must be 2 to 10 meters from the edge of the nearest traffic lane. 3. There must be unrestricted airflow 180 degrees around the inlet probe.
	Middle neighborhood	3 - 15	>1	>1	1. There must be unrestricted airflow 270 degrees around the inlet probe, or 180 degrees if the probe is on the side of a building. 2. The spacing from roads varies with traffic.[d]
NO_2	All	3 - 15	>1	>1	1. The probe should be > 20 meters from the dripline and must be 10 from the dripline when a tree acts as an obstruction. 2. The distance from the inlet probe to an obstacle, such as a building, must be at least twice the height the obstacle protrudes above the inlet probe.[b] 3. There must be unrestricted air flow 270 degrees around the inlet probe, or 180 degrees if the probe is on the side of a building. 4. The spacing from roads varies with traffic.[d]

[a] When the probe is located on a rooftop, this separation distance is in reference to walls, parapets, or penthouses located on the roof.

[b] Sites not meeting this criterion would be classified as middle scale.

[c] Distance is dependent upon height of furnace or incineration flue, type of fuel or waste burned, and quality of fuel (sulfur and ash content). This is to avoid undue influences from minor pollutant sources.

[d] Distance is dependent upon traffic ADT, pollutant, and spatial scale.

XI. PUBLICATIONS

The following is a partial listing of technical papers and study reports dealing with various aspects of Connecticut air pollutant levels and air quality data.

1. Bruckman, L., ***Asbestos: An Evaluation of Its Environmental Impact in Connecticut***, internal report issued by the Connecticut Department of Environmental Protection, Hartford, Connecticut, March 12, 1976.

2. Lepow, M. L., L. Bruckman, R.A. Rubino, S. Markowitz, M. Gillette and J. Kapish, ***"Role of Airborne Lead in Increased Body Burden of Lead in Hartford Children,"*** Environ. Health Perspect., May, 1974, pp. 99-102.

3. Bruckman, L. and R.A. Rubino, ***"Rationale Behind a Proposed Asbestos Air Quality Standard,"*** paper presented at the 67th Annual Meeting of the Air Pollution Control Association, Denver, Colorado, June 9-11, 1974, J. Air Pollut. Cntr. Assoc., 25: 1207-15 (1975).

4. Rubino, R.A., L. Bruckman and J. Magyar, ***"Ozone Transport,"*** paper presented at the 68th Annual Meeting of the Air Pollution Control Association, Boston, Massachusetts, June 15-20, 1975, J. Air Pollut. Cntr. Assoc.: 26, 972-5 (1976).

5. Bruckman, L., R.A. Rubino and T. Helfgott, ***"Rationale Behind a Proposed Cadmium Air Quality Standard,"*** paper presented at the 68th Annual Meeting of the Air Pollution Control Association, Boston, Massachusetts, June 15-20, 1975.

6. Rubino, R.A., L. Bruckman, A. Kramar, W. Keever and P. Sullivan, ***"Population Density and Its Relationship to Airborne Pollutant Concentrations and Lung Cancer Incidence in Connecticut,"*** paper presented at the 68th Annual Meeting of the Air Pollution Control Association, Boston, Massachusetts, June 15-20, 1975.

7. Lepow, M.L., L. Bruckman, M. Gillette, R.A. Rubino and J. Kapish, ***"Investigations into Sources of Lead in the Environment of Urban Children,"*** Environ. Res., 10: 415-26 (1975).

8. Bruckman, L., E. Hyne and P. Norton, ***"A Low Volume Particulate Ambient Air Sampler,"*** paper presented at the APCA Specialty Conference entitled "Measurement Accuracy as it Relates to Regulation Compliance," New Orleans, Louisiana, October 26-28, 1975, APCA publication SP-16, Air Pollution Control Association, Pittsburgh, Pennsylvania, 1976.

9. Bruckman, L. and R.A. Rubino, ***"High Volume Sampling Errors Incurred During Passive Sample Exposure Periods,"*** J. Air Pollut. Cntr. Assoc., 26: 881-3 (1976).

10. Bruckman, L., R.A. Rubino and B. Christine, ***"Asbestos and Mesothelioma Incidence in Connecticut,"*** J. Air Pollut. Cntr. Assoc., 27: 121-6 (1977).

11. Bruckman, L., ***Suspended Particulate Transport in Connecticut: An Investigation Into the Relationship Between TSP Concentrations and Wind Direction in Connecticut***, internal report issued by the Connecticut Department of Environmental Protection, Hartford, Connecticut, December 24, 1976.

12. Bruckman, L. and R.A. Rubino, ***"Monitored Asbestos Concentrations in Connecticut,"*** paper presented at the 70th Annual Meeting of the Air Pollution Control Association, Toronto, Ontario, June 20-24, 1977.

13. Bruckman, L., ***"Suspended Particulate Transport,"*** paper presented at the 70th Annual Meeting of the Air Pollution Control Association, Toronto, Ontario, June 20-24, 1977.

14. Bruckman, L., ***"A Study of Airborne Asbestos Fibers in Connecticut,"*** paper presented at the "Workshop in Asbestos: Definitions and Measurement Methods" sponsored by the National Bureau of Standards/U.S. Department of Commerce, July 18-20, 1977.

15. Bruckman, L., ***"Monitored Asbestos Concentrations Indoors,"*** paper presented at The Fourth Joint Conference of Sensing Environmental Pollutants, New Orleans, Louisiana, November 6-11, 1977.

16. Bruckman, L., paper presented at the Joint Conference on Applications of Air Pollution Meteorology, Salt Lake City, Utah, November 28 - December 2, 1977.

17. Bruckman, L., E. Hyne, W. Keever, ***"A Comparison of Low Volume and High Volume Particulate Sampling,"*** internal report issued by the Connecticut Department of Environmental Protection, Hartford, Connecticut, 1976.

18. ***"Data Validation and Monitoring Site Review,"*** (part of the Air Quality Maintenance Planning Process), internal report issued by the Connecticut Department of Environmental Protection, Hartford, Connecticut, June 15, 1976.

19. ***"Air Quality Data Analysis,"*** (part of the Air Quality Maintenance Planning Process), internal report issued by the Connecticut Department of Environmental Protection, Hartford, Connecticut, August 16, 1976.

20. Bruckman, L., ***"Investigation into the Causes of Elevated SO2 Concentrations Prevalent Across Connecticut During Periods of SW Wind Flow,"*** paper presented at the 71st Annual Meeting of the Air Pollution Control Association, Paper #78-16.4, Houston, Texas, June 25-29, 1978.

21. Anderson, M.K., ***"Power Plant Impact on Ambient Air: Coal vs. Oil Combustion,"*** paper presented at the 68th Annual Meeting of the Air Pollution Control Association, Paper #75-33.5, Boston, MA, June 15-20, 1975.

22. Anderson, M.K., G. D. Wight, ***"New Source Review: An Ambient Assessment Technique,"*** paper presented at the 71st Annual Meeting of the Air Pollution Control Association, Paper #78-2.4, Houston, TX, June 25-29, 1978.

23. Wolff, G.T., P.J. Lioy, G.D. Wight, R.E. Pasceri, ***"Aerial Investigation of the Ozone Plume Phenomenon,"*** J. Air Pollut.8 Control Association, 27: 460-3 (1977).

24. Wolff, G.T., P.J. Lioy, R.E. Meyers, R.T. Cederwall, G.D. Wight, R.E. Pasceri, R.S. Taylor, ***"Anatomy of Two Ozone Transport Episodes in the Washington, D.C., to Boston, Mass., Corridor,"*** Environ. Sci. Technol., 11-506-10 (1977).

25. Wolff, G.T., P.J. Lioy, G.D. Wight, R.E. Meyers, and R.T Cederwall, ***"Transport of Ozone Associated With an Air Mass,"*** In: Proceed. 70 Annual Meeting APCA, Paper 377-20.3, Toronto, Canada, June, 1977.

26. Wight, G.D., G.T. Wolff, P.J. Lioy, R.E. Meyers, and R.T.Cederwall, ***"Formation and Transport of Ozone in the Northeast Quadrant of the U.S.,"*** In: Proceed. ASTM Sym. Air Quality and Atmos. Ozone, Boulder, Colo., Aug. 1977.

27. Wolff, G.T., P.J. Lioy, and G.D. Wight, ***"An Overview of the Current Ozone Problem in the Northeastern and Midwestern U.S.,"*** In: Proceed. Mid-Atlantic States APCA Conf. on Hydrocarbon Control Feasibility, p. 98, New York, N.Y., April, 1977.

28. Wolff, G.T., P.J. Lioy, G.D. Wight, R.E. Meyers, and R.T.Cederwall, ***"An Investigation of Long-Range Transport of Ozone Across the Midwestern and Eastern U.S.,"*** Atmos. Environ. 11:797 (1977).

29. Bruckman, L., R.A. Rubino, and J. Gove, ***"Connecticut's Approach to Controlling Toxic Air Pollutants,"*** paper presented at the STAPPA / ALAPCO Air Toxics Conference, Air Toxics Control: An Environmental Challenge, Washington, D. C., October 15-17, 1986.

30. Wackter, D.J., and P.V. Bayly, ***"The Effectiveness of Emission Controls on Reducing Ozone Levels in Connecticut from 1976 through 1987,"*** paper presented at the APCA Specialty Conference on: The Scientific and Technical Issues Facing Post-1987 Ozone Control Strategies, Hartford, Connecticut, November 17-19, 1987.

31. Wackter, D.J., ***"Sensitivity Analysis of Ozone Predictions by the Urban Airshed Model in the Northeast,"*** paper presented at the Air Pollution Control Association Conference on VOC and Ozone, Northampton, MA, November 1-2, 1988.

32. Leston, A.R., J. Catalano, K. Crossman, R. Pirolli, N. Rowe, G. Hunt and B. Maisel, ***"The Connecticut Department of Environmental Protection's Evaluation of Pre/Post Operational Dioxin Monitoring Conducted at Four Resources Recovery Facilities,"*** paper presented at the Dioxin '91 Conference, RTP, North Carolina, Sept., 1991.

33. Leston, A.R., and W. Ollison, ***"Estimated Accuracy of Ozone Design Values: Are They Compromised by Method Interference?,"*** In: Proceed. A&WMA's Conference "Troposheric Ozone: Nonattainment and Design Value Issues," Boston, Massachusetts, October 27-30, 1992.

34. Leston, A.R., and S.A. Bailey, ***"Preliminary Report on Establishing a Prototype PAMS Site in the Urban Northeast,"*** In: Proceed. A&WMA's 86th Annual Meeting & Exhibition, Denver, Colorado, June 14-18, 1993.

35. Hartman, R.M., and A. Leston, ***"Use of an OPSIS Open Path Monitor for Ambient Aldehyde Monitoring,"*** In: Proceed. A&WMA's Conference "Optical Sensing for Environmental and Process Monitoring," McLean, Virginia, November 7-10, 1994

XII. ERRATA

During the preparation of this Air Quality Summary, a number of errors were discovered in previous editions of this document. For the benefit of the reader, the corrections are presented below:

- Regarding the 1993 edition of the Air Quality Summary,

  1. On page 93, in the paragraph under **Precision and Accuracy**, the first sentence should end with the word 'unrealistic'.

- Regarding the 1991 edition of the Air Quality Summary,

  1. On page 92, in Table 6-1, the 2nd high 8-hour running average CO concentration at the New Haven 019 site is 6.3, not 6.2.

  2. On page 93, in Table 6-2, the maximum 1-hour CO concentration at the Hartford 017 site during February is 15.0, not 15.3.

- Regarding the 1990 edition of the Air Quality Summary,

  1. On page 98, in Table 6-1, the 2nd high 8-hour running average CO concentration at the Stamford 020 site is 6.3, not 6.0.

- Regarding the 1987 edition of the Air Quality Summary,

  1. On page 141, in Table 24, footnote #3 applies to Hartford 013, not Hartford 017.

- Regarding the 1985 edition of the Air Quality Summary,

  1. On page 140, in Table 24, the 2nd high 1-hour running average CO concentration at the Stamford 020 site is 17.1, not 15.3. And the time of occurrence is 1/28/8, not 1/14/18.