1993

STATE OF CONNECTICUT

ANNUAL AIR QUALITY SUMMARY

Lowell P. Weicker, Jr.
Governor

Timothy R. E. Keeney
Commissioner

TABLE OF CONTENTS

LIST OF TABLES

LIST OF TABLES

LIST OF FIGURES

LIST OF FIGURES

I. INTRODUCTION

The 1993 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 1993. 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 1993 did not exceed the 50 µg/m^3 level of the primary and secondary annual standards or the 150 µg/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 µg/m^3.

2. SULFUR DIOXIDE (SO_2)

Compliance Assessment - None of the air quality standards for sulfur dioxide were exceeded in Connecticut in 1993. Measured concentrations were below the 80 µg/m^3 primary annual standard, the 365 µg/m^3 primary 24-hour standard, and the 1300 µg/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 1993 (see Table 1-2). Nonattainment of the standard remains a fact at all the sites in 1993 because the average number of annual exceedances at each site was greater than one per year over the period 1991-1993.

4. NITROGEN DIOXIDE (NO_2)

Compliance Assessment - The annual average NO_2 standard of 100 µg/m^3 was not exceeded at any site in Connecticut in 1993.

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 1993.

There were no exceedances of the primary one-hour standard of 35 ppm at any carbon monoxide monitoring site in Connecticut in 1993.

6. LEAD (Pb)

Compliance Assessment - The primary and secondary ambient air quality standard for lead is 1.5 µg/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 1993.

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, nitrous oxide, total nitrogen oxides and ozone. Meteorological data consists of wind speed and direction, wind horizontal sigma, temperature, precipitation, barometric pressure 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 1993 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 1993 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 1993, 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 taped each afternoon at approximately 3 PM, five days a week, and can be heard by dialing 566-3449. 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. QUALITY ASSURANCE

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 COand 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	0.05	100	0.05
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.

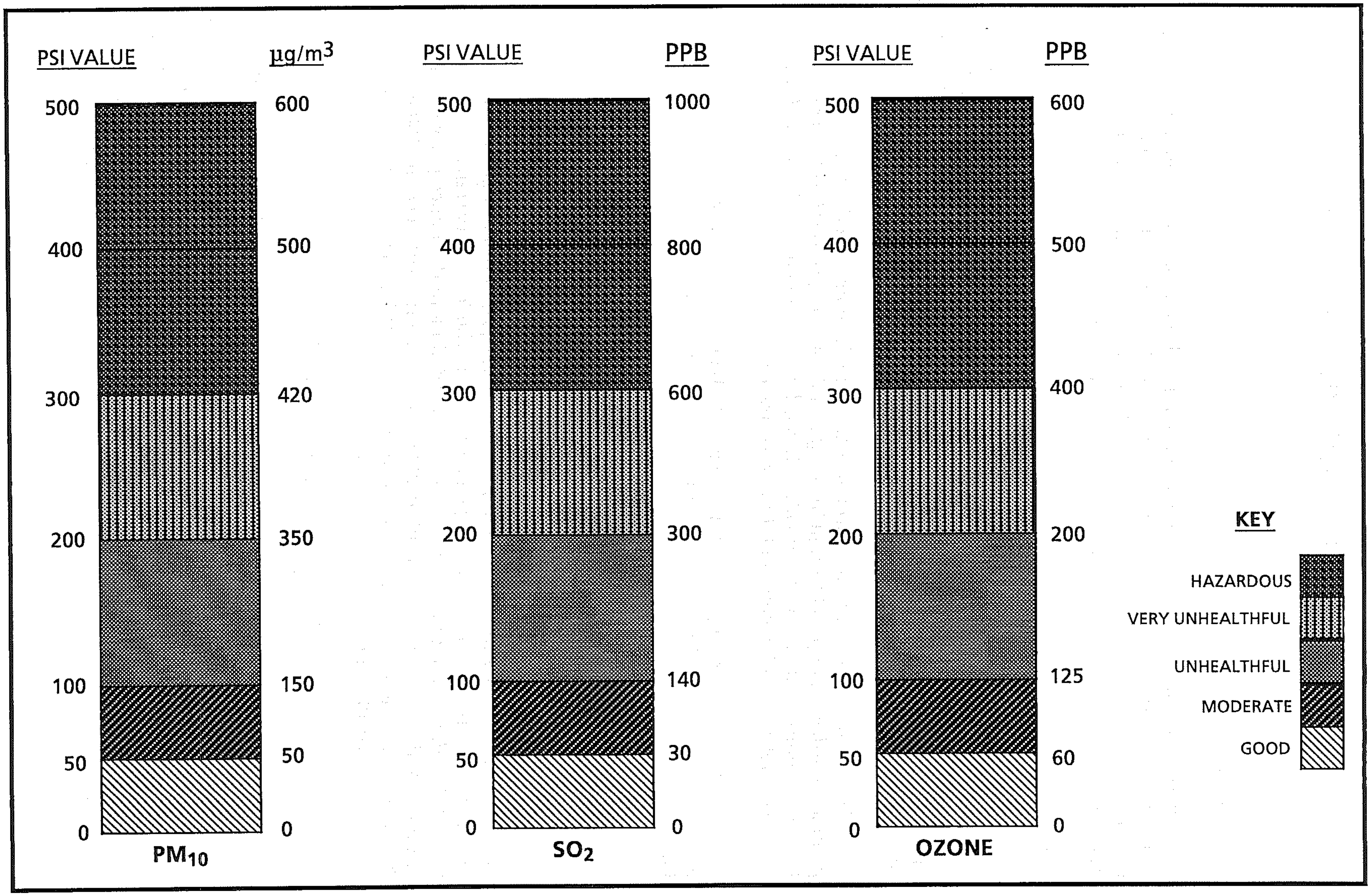
TABLE 1-2

AIR QUALITY STANDARDS EXCEEDED IN CONNECTICUT IN 1993 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	0.155	4
Danbury	123	0.140	4
East Hartford	003	0.156	3
Greenwich	017	0.151	4
Groton	008	0.139	2
Madison	002	0.149	5
Middletown	007	0.153	5
New Haven	123	0.153	2
Stafford	001	0.163	3
Stratford	007	0.170	6
Torrington	006	0.134	4

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 1993 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

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 PM_{10} concentration for the day in micrograms per cubic meter.

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 $\mu g/m^3$.

DISCUSSION OF DATA

Monitoring Network - In 1993, 31 PM_{10} samplers were operated in Connecticut (see Figure 2-1). 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 1993 network for monitoring the airborne concentrations of lead, five hi-vol samplers were used to gather information on the chemical composition of TSP in the state. These samplers 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 160 precision checks, the 95% probability limits for precision ranged from -12% to +17%. Accuracy is based on air flow through the monitor. The 95% probability limits for accuracy, based on 27 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 $\mu g/m^3$ primary and secondary annual standards could be obtained at 23 of the 31 PM_{10} monitoring sites in Connecticut in 1993. These 23 sites proved to be in attainment of the annual standards. A determination of attainment or nonattainment could not be obtained at Bridgeport 014, Cornwall 005, Greenwich 017, Hartford 015, New Britain 012, New London 004, 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 in 1993. 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 1991 -1993 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 1993 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. Input to the program includes 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 input, 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 (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, 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 1991 to 1993 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 23 sites that met the minimum sampling criteria in 1993. 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 1993. Of the 22 sites that had sufficient data in both 1992 and 1993, 17 sites showed lower maximums and 5 sites showed higher maximums. The largest decrease was 72 $\mu g/m^3$ at Enfield 005, and the largest increase was 7 $\mu g/m^3$ at New Haven 020.

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 1993, 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 23 of the 31 sites in 1993. A determination of compliance could not be made for the 8 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 1993 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 23 PM_{10} hi-vol site in Connecticut which complied with EPA's minimum sampling criteria in 1993. 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 55% 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). It is clear that the statewide PM_{10} trend is down over the past 5 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. As we acquire more PM_{10} data, we will also be able to portray the statewide PM_{10} trend by means of a moving average.

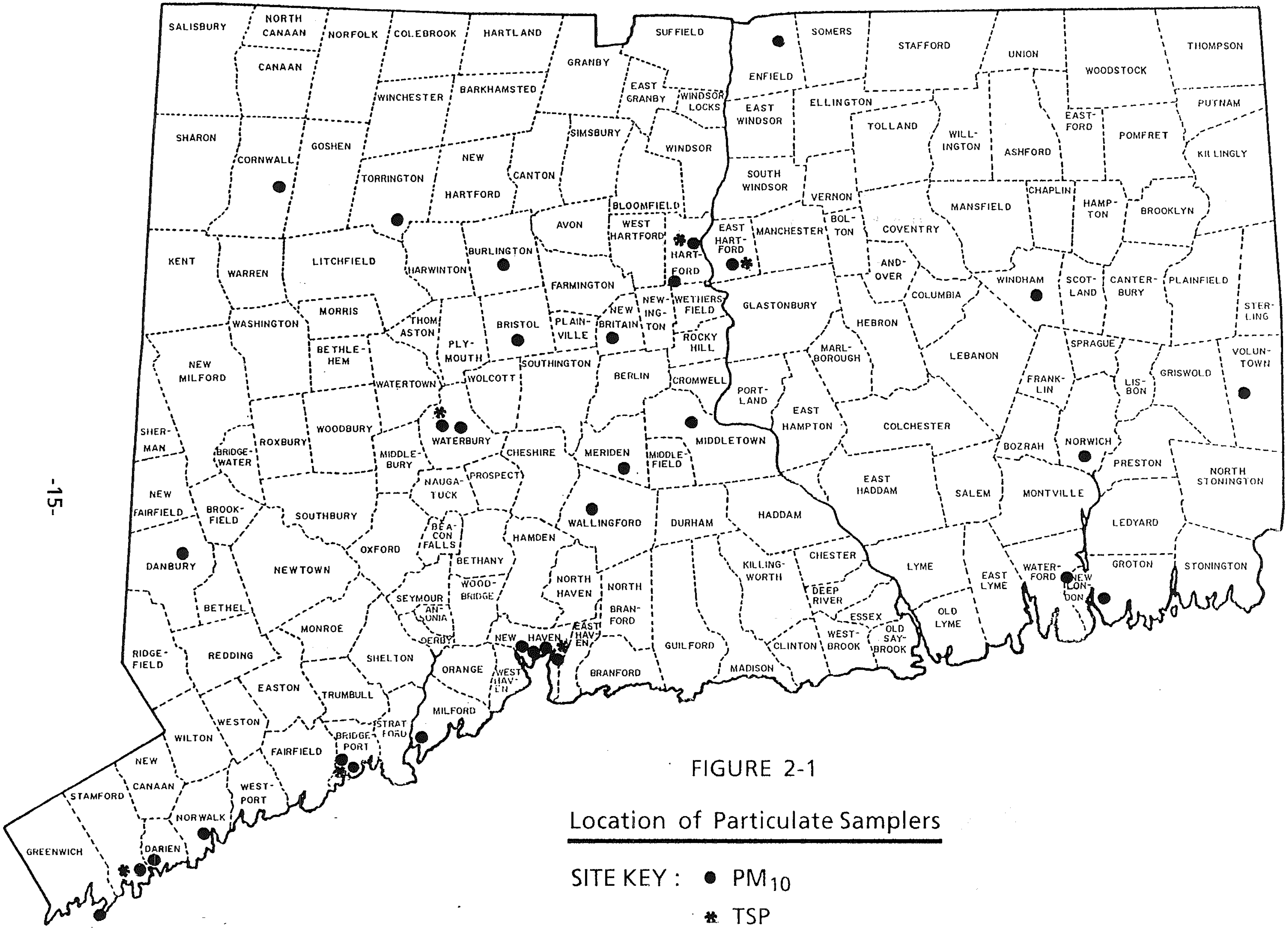


FIGURE 2-1

Location of Particulate Samplers

SITE KEY : ● PM_{10}

✱ TSP

TABLE 2-1

1991-1993 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	1991	55	27.7	24.4	31.0	13.236		
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	014	1991	55	33.3	29.8	36.9	14.349		
BRIDGEPORT	014	1992	12*	29.7	21.5	37.9	13.098		
BRIDGEPORT	014	1993	24*	27.3	22.6	32.1	11.707		
BRISTOL	001	1991	58	22.6	20.0	25.2	10.696		
BRISTOL	001	1992	60	19.4	17.0	21.8	10.296		
BRISTOL	001	1993	57	17.9	15.6	20.2	9.402		
BURLINGTON	001	1991	58	16.9	14.3	19.5	10.727		
BURLINGTON	001	1992	60	14.0	12.1	15.9	7.993		
BURLINGTON	001	1993	55	12.9	11.0	14.8	7.690		
CORNWALL	005	1991	58	17.4	14.5	20.4	12.191		
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	1991	56	25.6	22.5	28.7	12.534		
DANBURY	123	1992	45*	21.8	18.5	25.2	11.879		
DANBURY	123	1993	57	18.8	15.9	21.7	11.844		
DARIEN	001	1991	56	35.3	29.9	40.8	22.068		
DARIEN	001	1992	59	24.5	22.3	26.7	9.149		
DARIEN	001	1993	60	23.4	20.9	25.9	10.532		
EAST HARTFORD	004	1991	56	25.8	22.7	28.9	12.409		
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		
ENFIELD	005	1991	59	20.2	17.7	22.8	10.634		
ENFIELD	005	1992	59	19.1	15.5	22.6	15.037		
ENFIELD	005	1993	59	15.4	13.5	17.4	8.152		

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

TABLE 2-1, CONTINUED

1991-1993 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	1991	58	24.7	21.6	27.8	12.971		
GREENWICH	017	1992	43*	18.2	15.8	20.5	8.151		
GREENWICH	017	1993	37*	16.5	14.2	18.9	7.314		
GROTON	006	1991	58	21.9	18.6	25.3	13.888		
GROTON	006	1992	61	18.8	16.4	21.2	10.299		
GROTON	006	1993	57	17.0	15.0	19.0	8.238		
HARTFORD	013	1991	59	22.3	19.7	24.8	10.762		
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	015	1991	57	27.8	24.9	30.7	11.824		
HARTFORD	015	1992	61	25.0	22.2	27.9	12.221		
HARTFORD	015	1993	53*	23.3	20.4	26.2	11.291		
MERIDEN	002	1991	57	24.8	21.9	27.7	11.952		
MERIDEN	002	1992	58	21.1	18.2	23.9	11.807		
MERIDEN	002	1993	57	19.3	16.7	21.8	10.322		
MIDDLETOWN	003	1991	55	25.1	22.3	28.0	11.425		
MIDDLETOWN	003	1992	59	20.9	18.0	23.8	12.176		
MIDDLETOWN	003	1993	56	18.7	16.5	21.0	9.186		
MILFORD	010	1991	57	22.9	19.7	26.0	12.920		
MILFORD	010	1992	61	17.2	15.0	19.4	9.339		
MILFORD	010	1993	60	16.7	14.6	18.7	8.826		
NEW BRITAIN	012	1991	56*	23.6	20.6	26.6	12.180		
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 HAVEN	013	1991	55	26.4	23.0	29.9	13.961		
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		

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

TABLE 2-1, CONTINUED

1991-1993 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	1991	350	40.1	39.7	40.5	17.930		
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	020	1991	59	30.4	27.4	33.4	12.539		
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	123	1991	58	29.9	25.8	34.0	16.940		
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 LONDON	004	1991	58	23.4	20.4	26.3	12.194		
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		
NORWALK	014	1991	56	38.4	34.8	42.0	14.636		
NORWALK	014	1992	59	29.4	26.6	32.2	11.926		
NORWALK	014	1993	55	29.7	26.5	33.0	12.875		
NORWICH	002	1991	58	23.6	20.8	26.5	11.813		
NORWICH	002	1992	58	19.6	16.7	22.4	12.010		
NORWICH	002	1993	57	18.9	16.6	21.2	9.362		
STAMFORD	001	1991	58	28.6	25.2	31.9	13.780		
STAMFORD	001	1992	59	21.1	18.7	23.4	9.897		
STAMFORD	001	1993	57	19.7	17.2	22.2	10.124		
TORRINGTON	001	1991	57	22.5	19.6	25.3	11.656		
TORRINGTON	001	1992	60	18.6	16.0	21.2	10.962		
TORRINGTON	001	1993	56*	18.0	15.3	20.6	10.807		

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

TABLE 2-1, CONTINUED

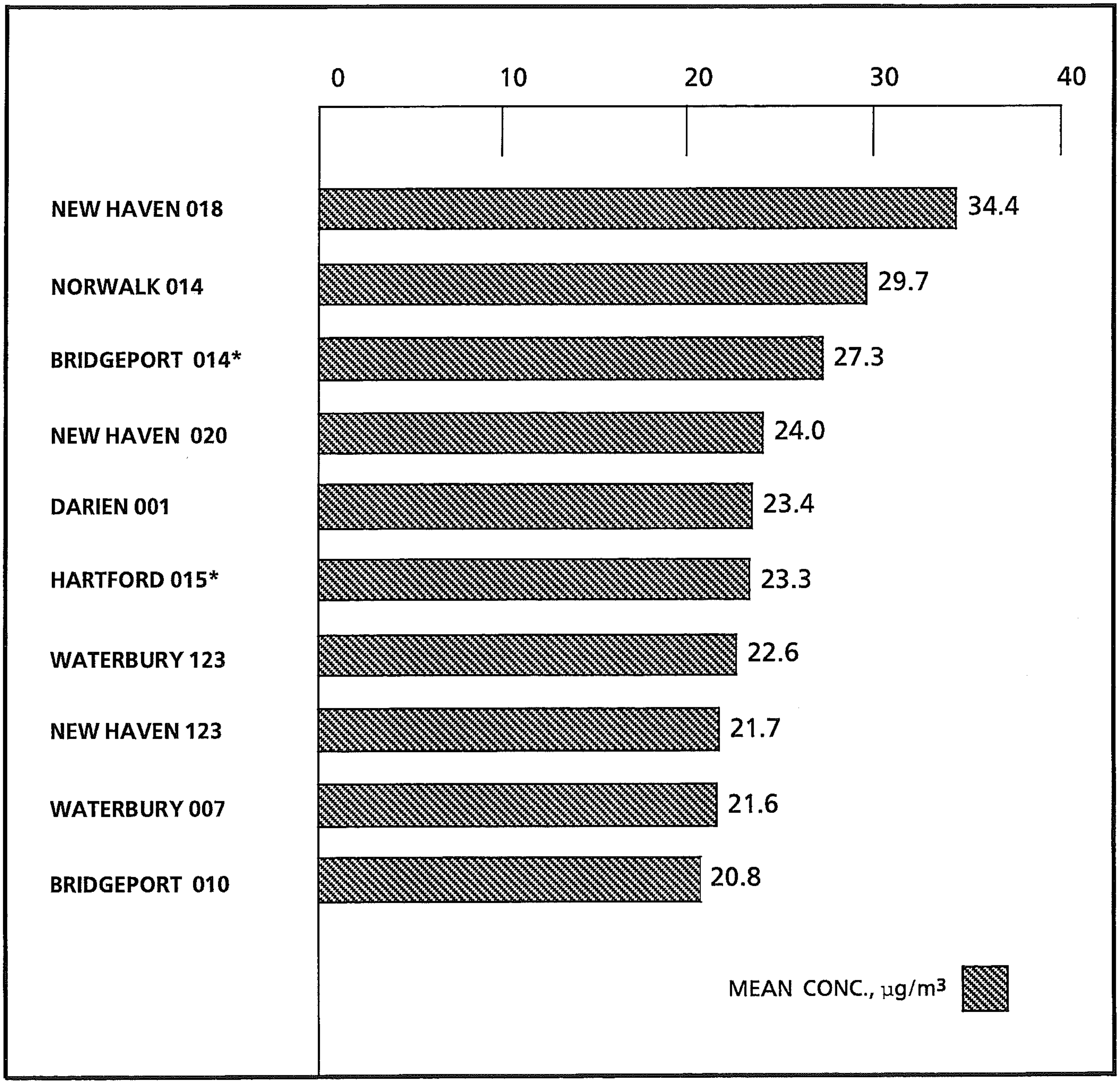
1991-1993 PM10 ANNUAL AVERAGES AND STATISTICAL PROJECTIONS

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
VOLUNTOWN	001	1991	55	16.2	13.6	18.8	10.433		
VOLUNTOWN	001	1992	60	13.5	11.3	15.8	9.447		
VOLUNTOWN	001	1993	55*	12.2	10.5	13.9	6.787		
WALLINGFORD	006	1991	56	23.2	20.2	26.1	11.964		
WALLINGFORD	006	1992	58	20.8	17.9	23.7	11.923		
WALLINGFORD	006	1993	55	18.2	15.9	20.5	9.321		
WATERBURY	007	1991	59	27.0	23.8	30.2	13.538		
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	123	1991	57	28.9	25.5	32.2	13.581		
WATERBURY	123	1992	59	22.5	19.8	25.1	11.038		
WATERBURY	123	1993	59	22.6	19.5	25.7	12.970		
WILLIMANTIC	002	1991	54*	22.4	19.7	25.2	10.850		
WILLIMANTIC	002	1992	57	19.2	16.6	21.9	10.824		
WILLIMANTIC	002	1993	60	18.2	15.8	20.5	9.920		

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

FIGURE 2-2

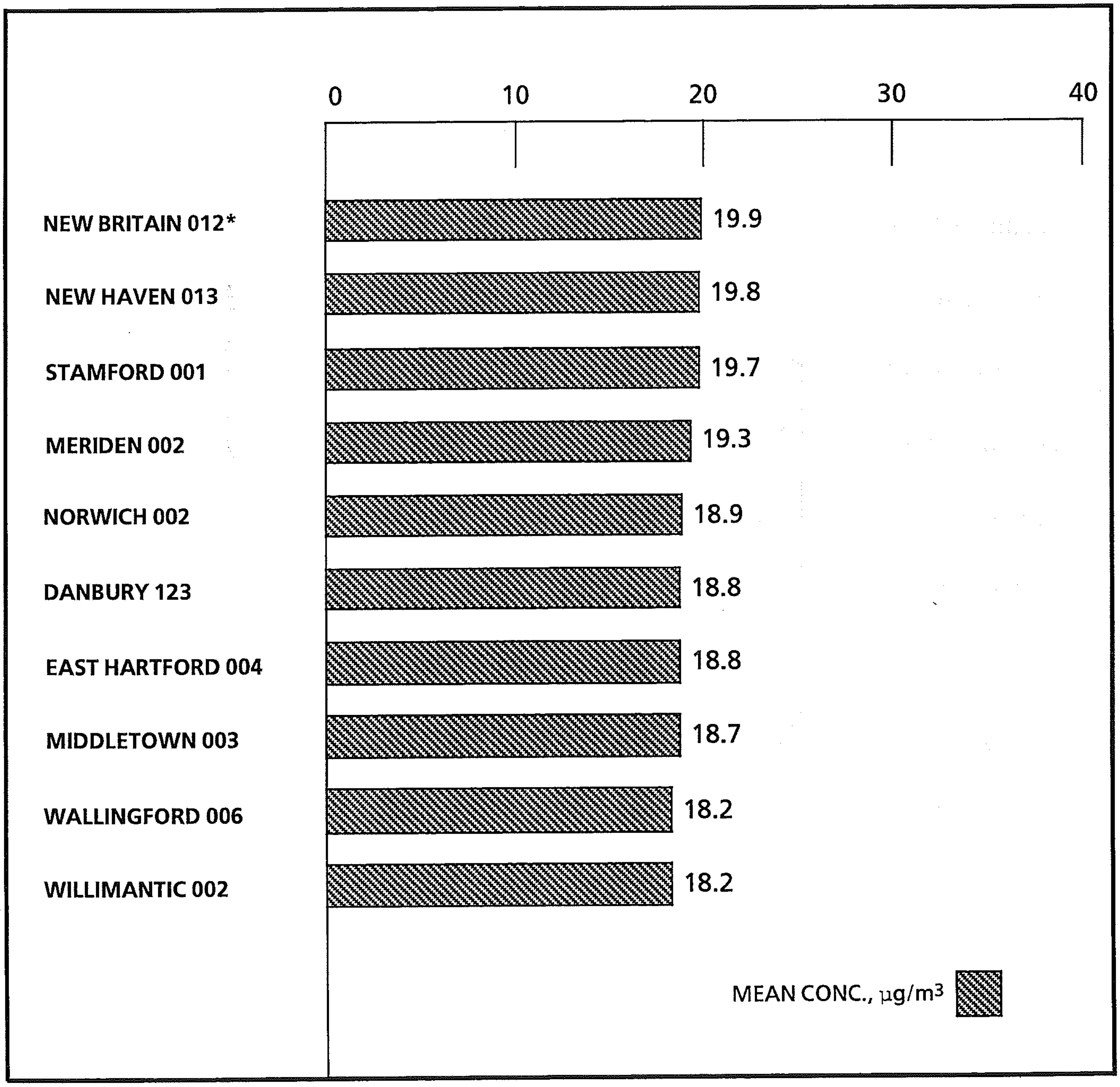
1993 ANNUAL AVERAGE PM10 CONCENTRATIONS



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

FIGURE 2-2, continued

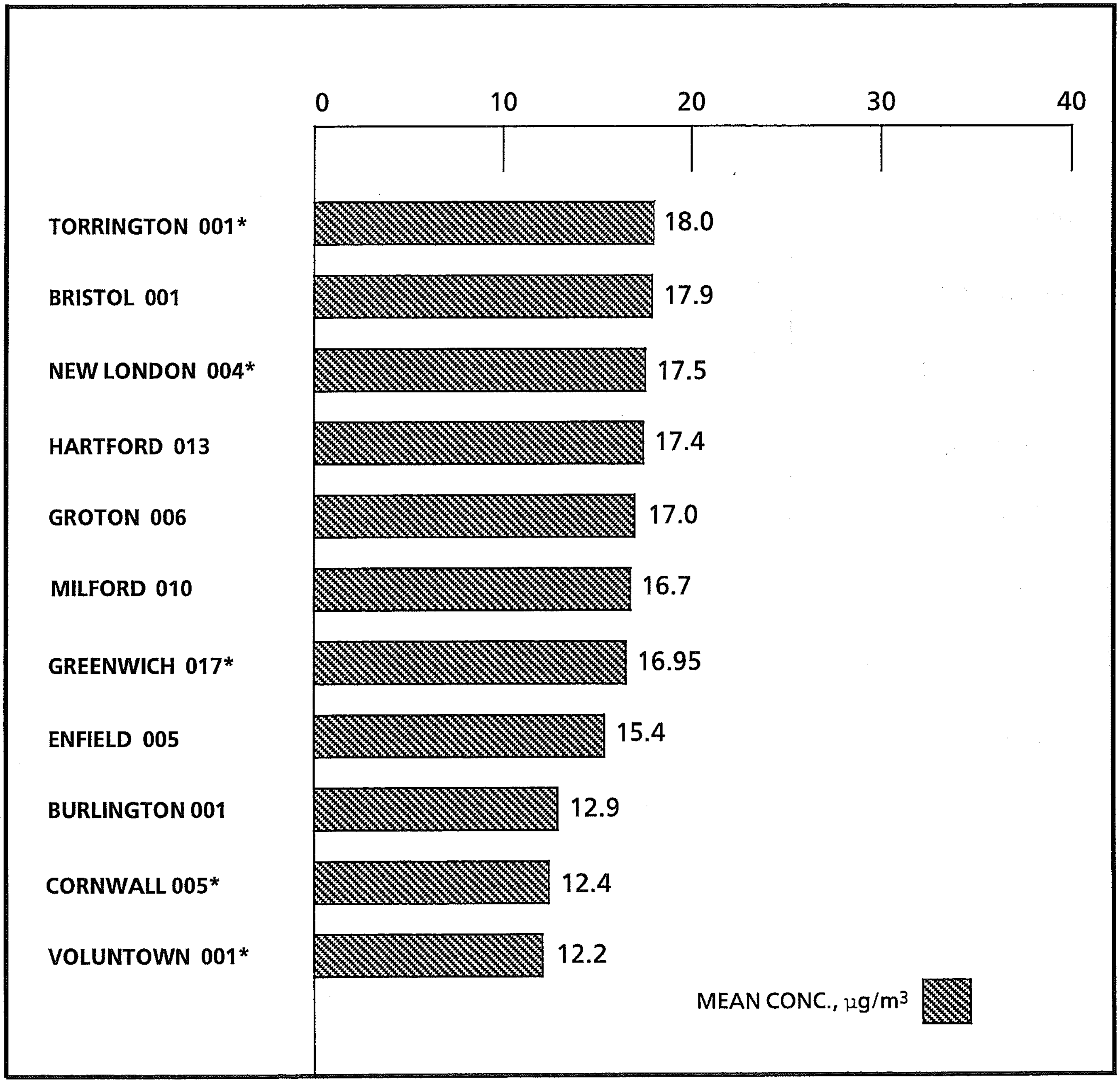
1993 ANNUAL AVERAGE PM10 CONCENTRATIONS



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

FIGURE 2-2, continued

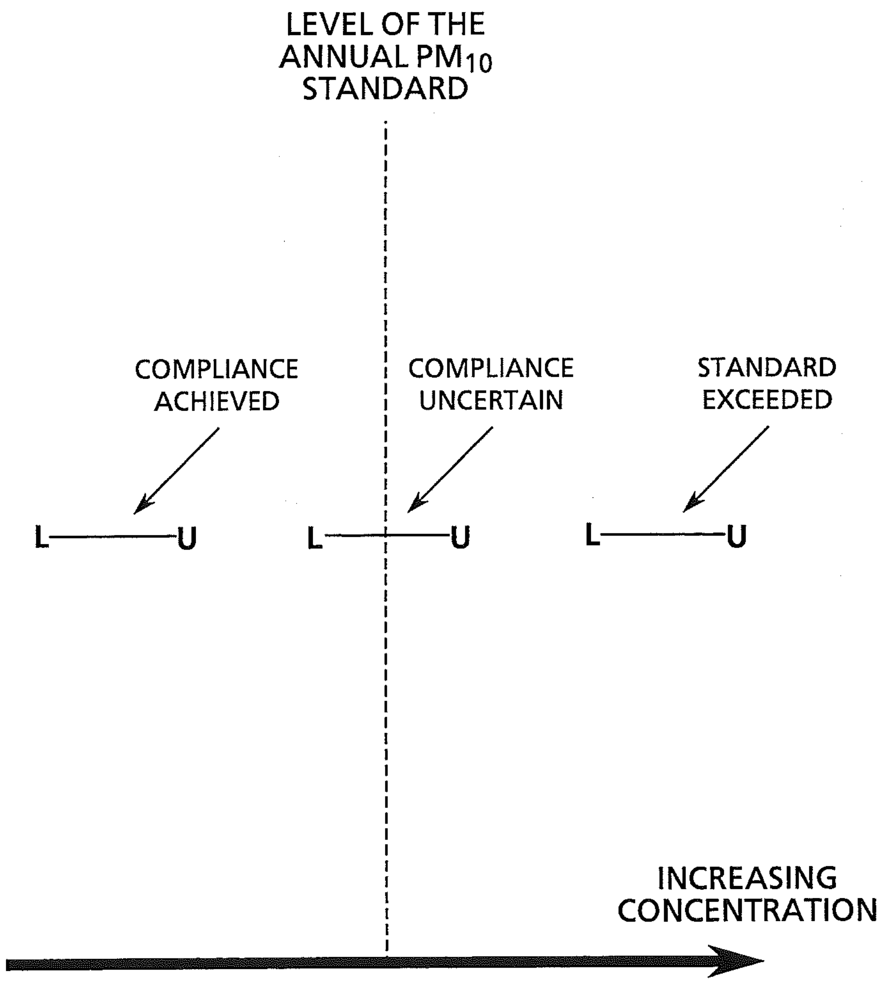
1993 ANNUAL AVERAGE PM10 CONCENTRATIONS



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

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

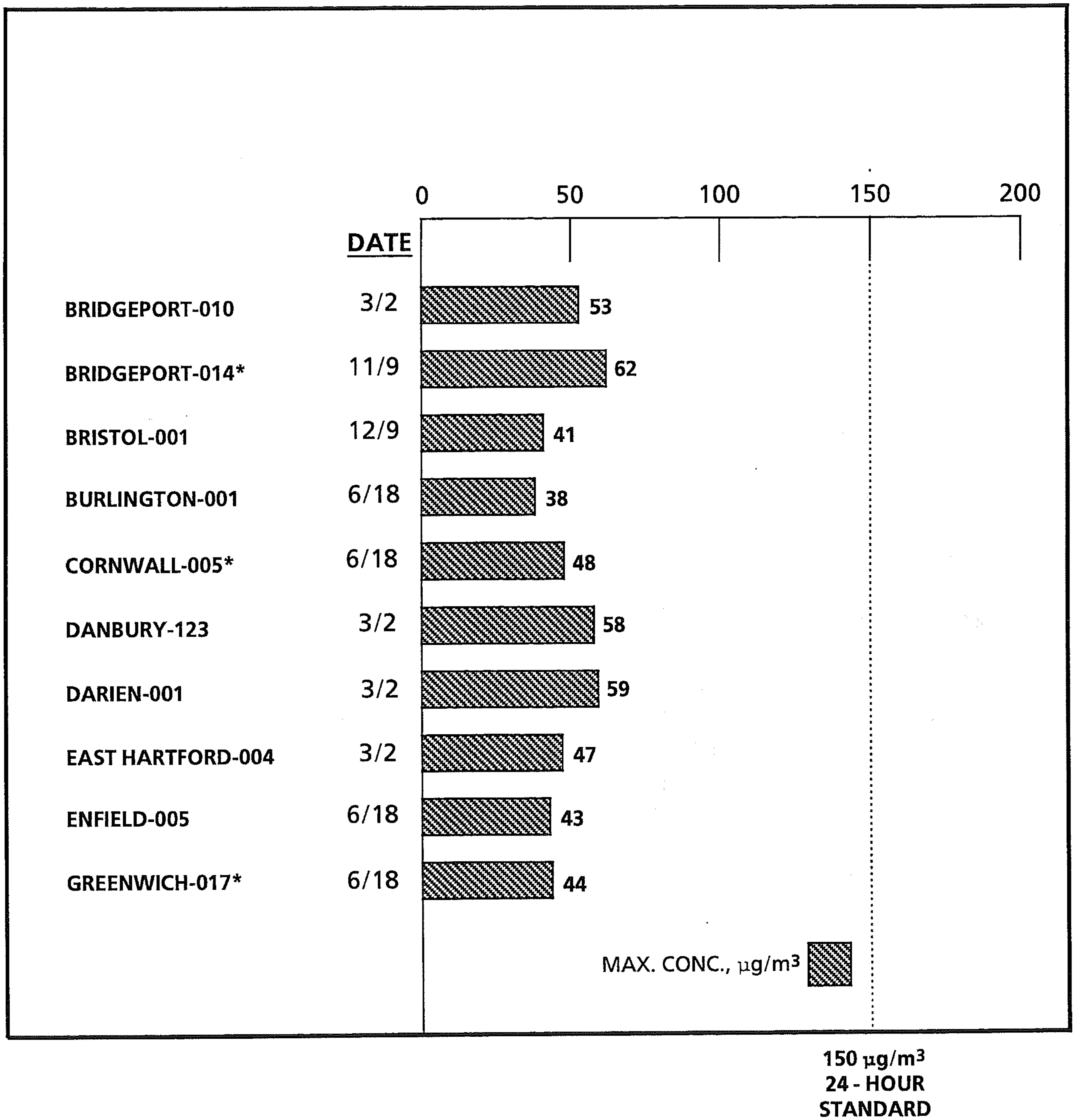
STATISTICALLY PREDICTED NUMBER OF SITES IN COMPLIANCE WITH THE LEVEL OF THE ANNUAL PM10 STANDARDS*

	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

* 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

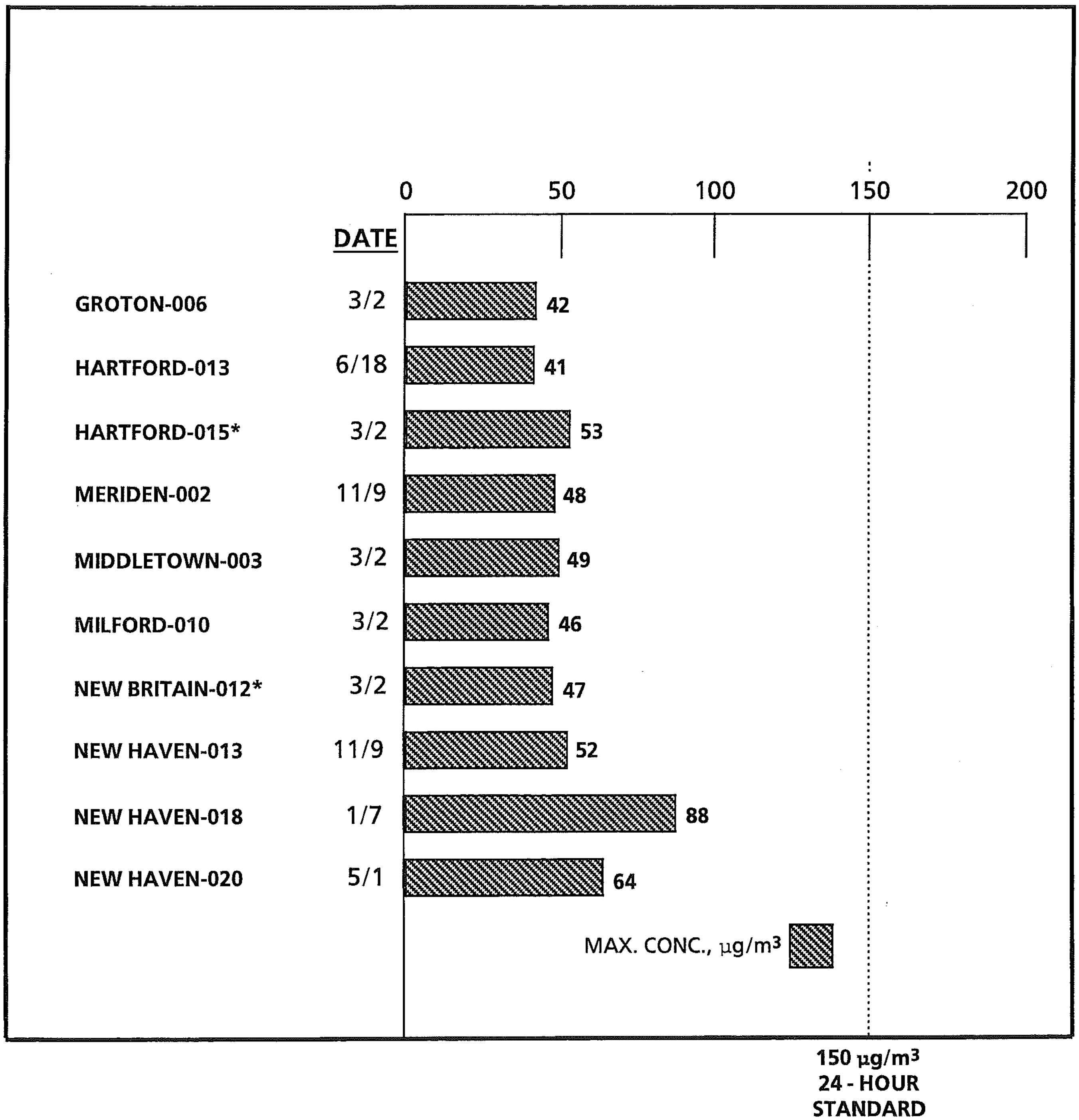
1993 MAXIMUM 24-HOUR PM10 CONCENTRATIONS



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

FIGURE 2-4, continued

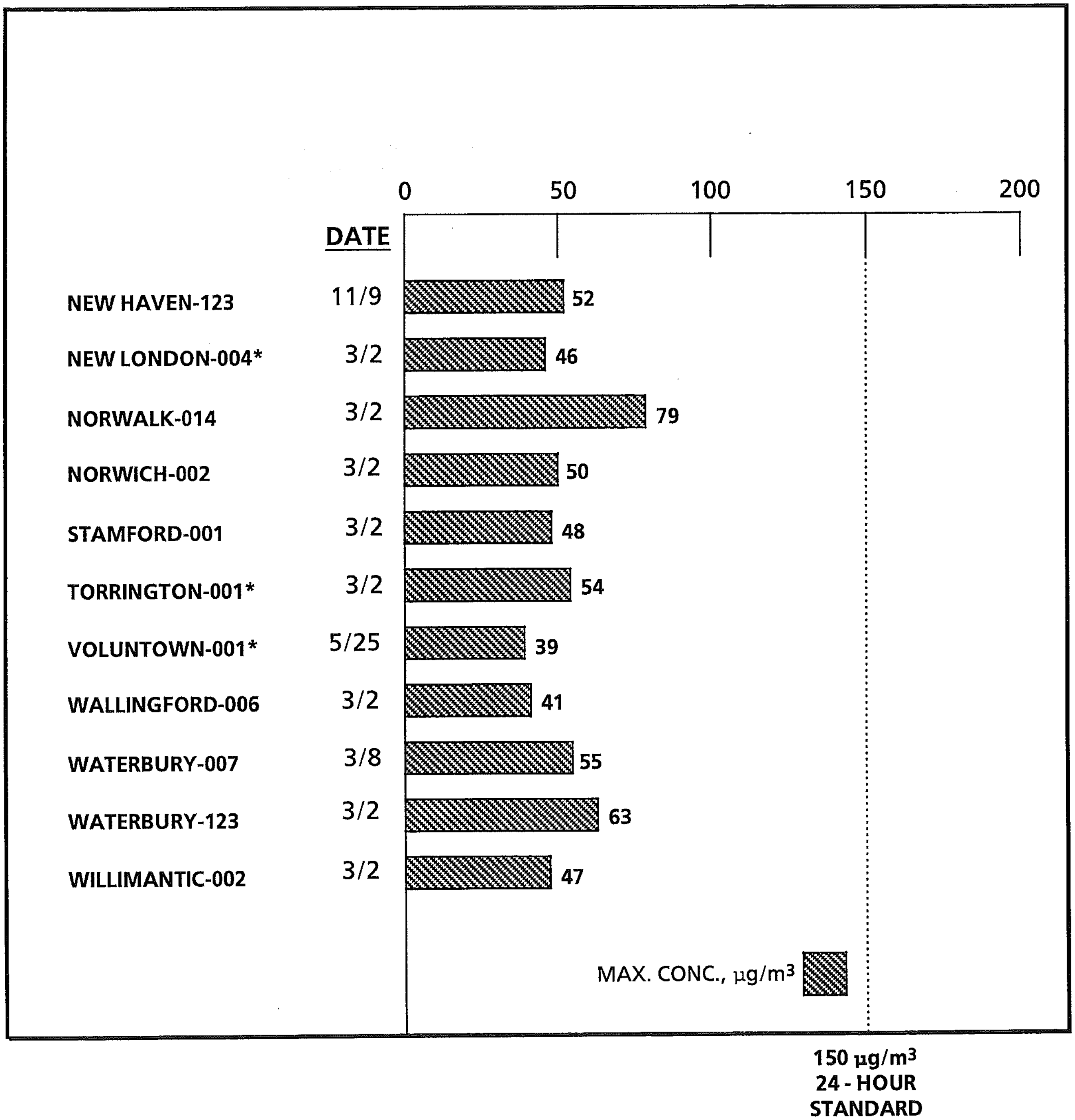
1993 MAXIMUM 24-HOUR PM10 CONCENTRATIONS



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

FIGURE 2-4, continued

1993 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/m^3	
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%

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

TABLE 2-4

QUARTERLY CHEMICAL CHARACTERIZATION OF 1993 HI-VOL TSP

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

	QUARTERLY AVG				ANNUAL AVG
	1ST	2ND	3RD	4TH	
METALS (ng/m3)					
BERYLLIUM	<.1	<.1	<.1	<.1	<.1
CADMIUM	1.6	1.1	2.0	2.1	1.7
CHROMIUM	9	9	10	6	9
COPPER	40	50	60	50	50
IRON	1040	1090	610	690	860
LEAD	30	20	20	20	20
MANGANESE	15	14	8	9	12
NICKEL	1	1	1	15	4
VANADIUM	20	10	<10	10	10[a]
ZINC	<10	80	240	100	110[b]
WATER SOLUBLES (ng/m3)					
NITRATE	3240	3510	3480	2720	3240
SULFATE	8420	8570	9800	9610	9090
AMMONIUM	380	90	10	160	160
TSP (µg/m3)	55	59	36	39	47
SAMPLE COUNT	15	16	15	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 1st quarter.

TABLE 2-4, CONTINUED

QUARTERLY CHEMICAL CHARACTERIZATION OF 1993 HI-VOL TSP

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

	QUARTERLY AVG				ANNUAL AVG
	1ST	2ND	3RD	4TH	
METALS (ng/m^3)					
BERYLLIUM	<.1	<.1	<.1	<.1	<.1
CADMIUM	1.6	0.7	1.1	1.9	1.3
CHROMIUM	8	3	5	4	5
COPPER	70	100	100	60	80
IRON	810	520	380	590	580
LEAD	20	10	10	10	10
MANGANESE	14	10	6	10	10
NICKEL	1	1	1	12	4
VANADIUM	10	10	<10	10	10[a]
ZINC	60	50	70	50	60
WATER SOLUBLES (ng/m^3)					
NITRATE	3080	2560	1860	2330	2480
SULFATE	7910	7600	6850	8100	7640
AMMONIUM	370	120	10	120	160
TSP (µg/m^3)	50	45	23	34	38
SAMPLE COUNT	15	16	13	15	

[a] The annual average was calculated using one-half the detectable limit in the 3rd quarter.

TABLE 2-4, CONTINUED

QUARTERLY CHEMICAL CHARACTERIZATION OF 1993 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	0.5	0.9	1.3	1.5	1.0
CHROMIUM	4	6	6	5	5
COPPER	20	70	40	40	40
IRON	500	1540	950	1120	1030
LEAD	10	30	20	20	20
MANGANESE	8	17	10	15	12
NICKEL	1	1	1	12	4
VANADIUM	<10	10	10	10	10[a]
ZINC	<10	80	70	70	60[a]
WATER SOLUBLES (ng/m³)					
NITRATE	3400	2610	2350	2140	2650
SULFATE	7760	6730	7710	8730	7660
AMMONIUM	540	210	10	190	240
TSP (µg/m³)	78	77	37	48	61
SAMPLE COUNT	15	16	15	12	

[a] The annual average was calculated using one-half the detectable limit in the 1st quarter.

TABLE 2-4, CONTINUED

QUARTERLY CHEMICAL CHARACTERIZATION OF 1993 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	3.6	1.2	2.0	1.9	2.2
CHROMIUM	26	7	11	11	14
COPPER	130	90	140	110	120
IRON	8940	4210	5430	5770	6110
LEAD	160	20	290	310	190
MANGANESE	123	53	71	78	82
NICKEL	3	1	2	21	7
VANADIUM	50	20	30	30	30
ZINC	330	150	210	250	240
WATER SOLUBLES (ng/m^3)					
NITRATE	3250	3290	3070	2690	3080
SULFATE	9370	7460	10710	9820	9290
AMMONIUM	530	210	130	230	280
TSP ($\mu g/m^3$)	236	158	165	167	182
SAMPLE COUNT	15	15	13	15	

TABLE 2-4, CONTINUED

QUARTERLY CHEMICAL CHARACTERIZATION OF 1993 HI-VOL TSP

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

	QUARTERLY AVG				ANNUAL AVG
	1ST	2ND	3RD	4TH	
METALS (ng/m^3)					
BERYLLIUM	<.1	<.1	<.1	<.1	<.1
CADMIUM	2.5	3.0	2.3	2.2	2.5
CHROMIUM	20	8	8	3	10
COPPER	340	190	190	160	220
IRON	1800	1190	730	1020	1200
LEAD	30	20	20	20	20
MANGANESE	34	20	12	17	21
NICKEL	1	1	1	12	4
VANADIUM	10	10	10	10	10
ZINC	100	80	90	80	90
WATER SOLUBLES (ng/m^3)					
NITRATE	2690	2170	2010	1930	2210
SULFATE	7520	6200	6880	8240	7210
AMMONIUM	490	90	10	60	170
TSP ($\mu g/m^3$)	81	57	32	50	56
SAMPLE COUNT	15	16	13	15	

TABLE 2-5

1993 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-010 (0057)	PM10	53	50	49	45	45	43	36	36	35	32
	DATE	3/ 2/93	6/18/93	1/ 7/93	3/20/93	3/ 8/93	11/ 9/93	4/19/93	1/31/93	12/ 9/93	10/16/93
METEOROLOGICAL SITE	DIR (DEG)	300	230	100	180	240	240	220	250	190	110
NEWARK	VEL (MPH)	6.2	7.6	2.1	4.8	4.1	4.8	10.8	8.2	2.0	3.3
	SPD (MPH)	8.1	9.6	4.9	6.8	6.0	4.9	12.1	9.9	5.9	5.0
	RATIO	0.769	0.790	0.431	0.711	0.678	0.976	0.894	0.827	0.346	0.659
METEOROLOGICAL SITE	DIR (DEG)	320	220	190	190	200	220	200	10	140	210
BRADLEY	VEL (MPH)	6.0	4.3	3.6	5.6	2.1	1.6	8.4	3.5	2.1	2.1
	SPD (MPH)	6.9	5.2	5.6	6.6	5.9	2.7	11.2	4.3	3.5	3.6
	RATIO	0.869	0.836	0.642	0.840	0.351	0.586	0.750	0.807	0.608	0.598
METEOROLOGICAL SITE	DIR (DEG)	320	240	100	180	90	260	230	290	200	110
BRIDGEPORT	VEL (MPH)	4.2	6.7	2.8	3.1	1.8	3.9	8.5	4.2	2.9	3.4
	SPD (MPH)	5.0	6.9	3.6	3.6	6.2	4.2	8.6	5.3	4.5	5.5
	RATIO	0.836	0.970	0.781	0.865	0.293	0.939	0.988	0.797	0.659	0.631
METEOROLOGICAL SITE	DIR (DEG)	300	250	250	210	210	250	240	10	220	200
WORCESTER	VEL (MPH)	7.1	8.0	4.3	5.5	4.8	6.3	11.7	1.6	2.8	5.5
	SPD (MPH)	7.2	8.3	4.7	6.3	5.6	6.5	12.1	3.9	4.5	6.2
	RATIO	0.991	0.965	0.912	0.876	0.852	0.969	0.970	0.399	0.636	0.897
BRISTOL-001 (0057)	PM10	41	40	39	36	35	34	34	31	30	29
	DATE	12/ 9/93	1/19/93	3/ 2/93	6/24/93	3/ 8/93	3/20/93	1/ 7/93	6/18/93	1/31/93	11/ 9/93
METEOROLOGICAL SITE	DIR (DEG)	190	320	300	300	240	180	100	230	250	240
NEWARK	VEL (MPH)	2.0	8.4	6.2	1.0	4.1	4.8	2.1	7.6	8.2	4.8
	SPD (MPH)	5.9	9.9	8.1	7.3	6.0	6.8	4.9	9.6	9.9	4.9
	RATIO	0.346	0.852	0.769	0.136	0.678	0.711	0.431	0.790	0.827	0.976
METEOROLOGICAL SITE	DIR (DEG)	140	300	320	360	200	190	190	220	10	220
BRADLEY	VEL (MPH)	2.1	3.7	6.0	3.4	2.1	5.6	3.6	4.3	3.5	1.6
	SPD (MPH)	3.5	6.3	6.9	3.7	5.9	6.6	5.6	5.2	4.3	2.7
	RATIO	0.608	0.591	0.869	0.914	0.351	0.840	0.642	0.836	0.807	0.586
METEOROLOGICAL SITE	DIR (DEG)	200	340	320	250	90	180	100	240	290	260
BRIDGEPORT	VEL (MPH)	2.9	6.5	4.2	4.8	1.8	3.1	2.8	6.7	4.2	3.9
	SPD (MPH)	4.5	7.2	5.0	8.1	6.2	3.6	3.6	6.9	5.3	4.2
	RATIO	0.659	0.908	0.836	0.596	0.293	0.865	0.781	0.970	0.797	0.939
METEOROLOGICAL SITE	DIR (DEG)	220	310	300	310	210	210	250	250	10	250
WORCESTER	VEL (MPH)	2.8	7.7	7.1	5.5	4.8	5.5	4.3	8.0	1.6	6.3
	SPD (MPH)	4.5	8.6	7.2	5.6	5.6	6.3	4.7	8.3	3.9	6.5
	RATIO	0.636	0.890	0.991	0.990	0.852	0.876	0.912	0.965	0.399	0.969
BURLINGTON-001 (0055)	PM10	38	34	33	29	27	22	22	22	19	18
	DATE	6/18/93	4/25/93	3/ 2/93	12/27/93	5/25/93	3/ 8/93	10/16/93	3/20/93	8/17/93	4/19/93
METEOROLOGICAL SITE	DIR (DEG)	230	200	300	330	270	240	110	180	120	220
NEWARK	VEL (MPH)	7.6	8.7	6.2	5.1	9.6	4.1	3.3	4.8	5.5	10.8
	SPD (MPH)	9.6	11.2	8.1	8.1	12.5	6.0	5.0	6.8	8.2	12.1
	RATIO	0.790	0.779	0.769	0.631	0.767	0.678	0.659	0.711	0.670	0.894
METEOROLOGICAL SITE	DIR (DEG)	220	180	320	300	260	200	210	190	30	200
BRADLEY	VEL (MPH)	4.3	9.7	6.0	3.6	7.6	2.1	2.1	5.6	1.5	8.4
	SPD (MPH)	5.2	11.9	6.9	5.0	11.1	5.9	3.6	6.6	5.9	11.2
	RATIO	0.836	0.812	0.869	0.707	0.684	0.351	0.598	0.840	0.260	0.750

TABLE 2-5, CONTINUED

1993 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)	240	220	320	350	240	90	110	180	130	230
		VEL	(MPH)	6.7	7.5	4.2	3.7	7.7	1.8	3.4	3.1	4.9	8.5
		SPD	(MPH)	6.9	7.6	5.0	4.7	8.1	6.2	5.5	3.6	5.9	8.6
		RATIO		0.970	0.984	0.836	0.772	0.962	0.293	0.631	0.865	0.830	0.988
	METEOROLOGICAL SITE WORCESTER	DIR	(DEG)	250	210	300	280	250	210	200	210	160	240
		VEL	(MPH)	8.0	11.0	7.1	9.5	9.3	4.8	5.5	5.5	3.7	11.7
		SPD	(MPH)	8.3	11.5	7.2	9.6	9.6	5.6	6.2	6.3	4.5	12.1
		RATIO		0.965	0.954	0.991	0.983	0.962	0.852	0.897	0.876	0.835	0.970
DANBURY-123 (0057)		PM10		58	46	45	43	42	40	33	30	29	29
		DATE		3/ 2/93	6/18/93	1/ 7/93	11/ 9/93	3/20/93	3/ 8/93	5/25/93	12/ 9/93	1/19/93	11/ 3/93
	METEOROLOGICAL SITE NEWARK	DIR	(DEG)	300	230	100	240	180	240	270	190	320	210
		VEL	(MPH)	6.2	7.6	2.1	4.8	4.8	4.1	9.6	2.0	8.4	4.9
		SPD	(MPH)	8.1	9.6	4.9	4.9	6.8	6.0	12.5	5.9	9.9	6.3
		RATIO		0.769	0.790	0.431	0.976	0.711	0.678	0.767	0.346	0.852	0.775
	METEOROLOGICAL SITE BRADLEY	DIR	(DEG)	320	220	190	220	190	200	260	140	300	200
		VEL	(MPH)	6.0	4.3	3.6	1.6	5.6	2.1	7.6	2.1	3.7	3.0
		SPD	(MPH)	6.9	5.2	5.6	2.7	6.6	5.9	11.1	3.5	6.3	3.9
		RATIO		0.869	0.836	0.642	0.586	0.840	0.351	0.684	0.608	0.591	0.765
	METEOROLOGICAL SITE BRIDGEPORT	DIR	(DEG)	320	240	100	260	180	90	240	200	340	260
		VEL	(MPH)	4.2	6.7	2.8	3.9	3.1	1.8	7.7	2.9	6.5	6.9
		SPD	(MPH)	5.0	6.9	3.6	4.2	3.6	6.2	8.1	4.5	7.2	9.1
		RATIO		0.836	0.970	0.781	0.939	0.865	0.293	0.962	0.659	0.908	0.758
	METEOROLOGICAL SITE WORCESTER	DIR	(DEG)	300	250	250	250	210	210	250	220	310	220
		VEL	(MPH)	7.1	8.0	4.3	6.3	5.5	4.8	9.3	2.8	7.7	8.4
		SPD	(MPH)	7.2	8.3	4.7	6.5	6.3	5.6	9.6	4.5	8.6	8.5
		RATIO		0.991	0.965	0.912	0.969	0.876	0.852	0.962	0.636	0.890	0.995
DARIEN-001 (0060)		PM10		59	48	47	46	42	40	37	34	33	33
		DATE		3/ 2/93	11/ 9/93	6/18/93	3/ 8/93	5/25/93	3/20/93	2/ 6/93	10/16/93	11/ 3/93	12/ 3/93
	METEOROLOGICAL SITE NEWARK	DIR	(DEG)	300	240	230	240	270	180	20	110	210	340
		VEL	(MPH)	6.2	4.8	7.6	4.1	9.6	4.8	15.8	3.3	4.9	6.1
		SPD	(MPH)	8.1	4.9	9.6	6.0	12.5	6.8	16.0	5.0	6.3	8.1
		RATIO		0.769	0.976	0.790	0.678	0.767	0.711	0.988	0.659	0.775	0.757
	METEOROLOGICAL SITE BRADLEY	DIR	(DEG)	320	220	220	200	260	190	10	210	200	300
		VEL	(MPH)	6.0	1.6	4.3	2.1	7.6	5.6	13.8	2.1	3.0	2.9
		SPD	(MPH)	6.9	2.7	5.2	5.9	11.1	6.6	14.2	3.6	3.9	4.6
		RATIO		0.869	0.586	0.836	0.351	0.684	0.840	0.968	0.598	0.765	0.633
	METEOROLOGICAL SITE BRIDGEPORT	DIR	(DEG)	320	260	240	90	240	180	50	110	260	300
		VEL	(MPH)	4.2	3.9	6.7	1.8	7.7	3.1	11.5	3.4	6.9	1.8
		SPD	(MPH)	5.0	4.2	6.9	6.2	8.1	3.6	11.8	5.5	9.1	5.2
		RATIO		0.836	0.939	0.970	0.293	0.962	0.865	0.972	0.631	0.758	0.351
	METEOROLOGICAL SITE WORCESTER	DIR	(DEG)	300	250	250	210	250	210	40	200	220	290
		VEL	(MPH)	7.1	6.3	8.0	4.8	9.3	5.5	5.9	5.5	8.4	5.4
		SPD	(MPH)	7.2	6.5	8.3	5.6	9.6	6.3	6.0	6.2	8.5	7.5
		RATIO		0.991	0.969	0.965	0.852	0.962	0.876	0.984	0.897	0.995	0.717

TABLE 2-5, CONTINUED

1993 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
EAST HARTFORD-004 (0056)	PM10	47	45	42	39	36	36	33	32	28	27
	DATE	3/ 2/93	6/18/93	3/ 8/93	11/ 9/93	12/ 9/93	5/25/93	1/ 7/93	3/20/93	1/31/93	3/26/93
METEOROLOGICAL SITE	DIR (DEG)	300	230	240	240	190	270	100	180	250	50
NEWARK	VEL (MPH)	6.2	7.6	4.1	4.8	2.0	9.6	2.1	4.8	8.2	4.5
	SPD (MPH)	8.1	9.6	6.0	4.9	5.9	12.5	4.9	6.8	9.9	5.6
	RATIO	0.769	0.790	0.678	0.976	0.346	0.767	0.431	0.711	0.827	0.795
METEOROLOGICAL SITE	DIR (DEG)	320	220	200	220	140	260	190	190	10	20
BRADLEY	VEL (MPH)	6.0	4.3	2.1	1.6	2.1	7.6	3.6	5.6	3.5	1.7
	SPD (MPH)	6.9	5.2	5.9	2.7	3.5	11.1	5.6	6.6	4.3	3.5
	RATIO	0.869	0.836	0.351	0.586	0.608	0.684	0.642	0.840	0.807	0.483
METEOROLOGICAL SITE	DIR (DEG)	320	240	90	260	200	240	100	180	290	270
BRIDGEPORT	VEL (MPH)	4.2	6.7	1.8	3.9	2.9	7.7	2.8	3.1	4.2	2.1
	SPD (MPH)	5.0	6.9	6.2	4.2	4.5	8.1	3.6	3.6	5.3	4.2
	RATIO	0.836	0.970	0.293	0.939	0.659	0.962	0.781	0.865	0.797	0.497
METEOROLOGICAL SITE	DIR (DEG)	300	250	210	250	220	250	250	210	10	80
WORCESTER	VEL (MPH)	7.1	8.0	4.8	6.3	2.8	9.3	4.3	5.5	1.6	1.0
	SPD (MPH)	7.2	8.3	5.6	6.5	4.5	9.6	4.7	6.3	3.9	4.0
	RATIO	0.991	0.965	0.852	0.969	0.636	0.962	0.912	0.876	0.399	0.242
ENFIELD-005 (0059)	PM10	43	36	32	29	28	26	26	25	22	22
	DATE	6/18/93	3/ 2/93	5/25/93	11/ 9/93	3/ 8/93	1/ 7/93	7/30/93	3/20/93	4/25/93	11/ 3/93
METEOROLOGICAL SITE	DIR (DEG)	230	300	270	240	240	100	260	180	200	210
NEWARK	VEL (MPH)	7.6	6.2	9.6	4.8	4.1	2.1	9.5	4.8	8.7	4.9
	SPD (MPH)	9.6	8.1	12.5	4.9	6.0	4.9	10.8	6.8	11.2	6.3
	RATIO	0.790	0.769	0.767	0.976	0.678	0.431	0.879	0.711	0.779	0.775
METEOROLOGICAL SITE	DIR (DEG)	220	320	260	220	200	190	220	190	180	200
BRADLEY	VEL (MPH)	4.3	6.0	7.6	1.6	2.1	3.6	2.7	5.6	9.7	3.0
	SPD (MPH)	5.2	6.9	11.1	2.7	5.9	5.6	3.6	6.6	11.9	3.9
	RATIO	0.836	0.869	0.684	0.586	0.351	0.642	0.757	0.840	0.812	0.765
METEOROLOGICAL SITE	DIR (DEG)	240	320	240	260	90	100	250	180	220	260
BRIDGEPORT	VEL (MPH)	6.7	4.2	7.7	3.9	1.8	2.8	5.8	3.1	7.5	6.9
	SPD (MPH)	6.9	5.0	8.1	4.2	6.2	3.6	6.8	3.6	7.6	9.1
	RATIO	0.970	0.836	0.962	0.939	0.293	0.781	0.852	0.865	0.984	0.758
METEOROLOGICAL SITE	DIR (DEG)	250	300	250	250	210	250	220	210	210	220
WORCESTER	VEL (MPH)	8.0	7.1	9.3	6.3	4.8	4.3	7.1	5.5	11.0	8.4
	SPD (MPH)	8.3	7.2	9.6	6.5	5.6	4.7	7.5	6.3	11.5	8.5
	RATIO	0.965	0.991	0.962	0.969	0.852	0.912	0.945	0.876	0.954	0.995
GROTON-006 (0057)	PM10	42	41	36	31	30	28	25	25	25	24
	DATE	3/ 2/93	5/25/93	7/30/93	6/18/93	1/19/93	7/12/93	9/28/93	12/ 3/93	4/19/93	9/10/93
METEOROLOGICAL SITE	DIR (DEG)	300	270	260	230	320	300	260	340	220	280
NEWARK	VEL (MPH)	6.2	9.6	9.5	7.6	8.4	7.6	10.7	6.1	10.8	7.5
	SPD (MPH)	8.1	12.5	10.8	9.6	9.9	9.3	13.8	8.1	12.1	10.4
	RATIO	0.769	0.767	0.879	0.790	0.852	0.811	0.774	0.757	0.894	0.725
METEOROLOGICAL SITE	DIR (DEG)	320	260	220	220	300	320	230	300	200	200
BRADLEY	VEL (MPH)	6.0	7.6	2.7	4.3	3.7	.9	4.3	2.9	8.4	2.0
	SPD (MPH)	6.9	11.1	3.6	5.2	6.3	1.0	6.6	4.6	11.2	6.3
	RATIO	0.869	0.684	0.757	0.836	0.591	0.908	0.652	0.633	0.750	0.314

TABLE 2-5, CONTINUED

1993 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)	320	240	250	240	340	320	270	300	230	270
BRIDGEPORT	VEL (MPH)	4.2	7.7	5.8	6.7	6.5	5.0	10.5	1.8	8.5	4.7
	SPD (MPH)	5.0	8.1	6.8	6.9	7.2	5.9	11.2	5.2	8.6	6.8
	RATIO	0.836	0.962	0.852	0.970	0.908	0.856	0.937	0.351	0.988	0.701
METEOROLOGICAL SITE	DIR (DEG)	300	250	220	250	310	240	250	290	240	270
WORCESTER	VEL (MPH)	7.1	9.3	7.1	8.0	7.7	5.3	9.7	5.4	11.7	7.7
	SPD (MPH)	7.2	9.6	7.5	8.3	8.6	5.8	9.9	7.5	12.1	9.3
	RATIO	0.991	0.962	0.945	0.965	0.890	0.930	0.973	0.717	0.970	0.819
HARTFORD-013 (0059)	PM10	41	39	39	35	32	31	30	30	29	24
	DATE	6/18/93	3/ 2/93	11/ 9/93	12/ 9/93	5/25/93	3/ 8/93	1/ 7/93	1/31/93	3/20/93	12/ 3/93
METEOROLOGICAL SITE	DIR (DEG)	230	300	240	190	270	240	100	250	180	340
NEWARK	VEL (MPH)	7.6	6.2	4.8	2.0	9.6	4.1	2.1	8.2	4.8	6.1
	SPD (MPH)	9.6	8.1	4.9	5.9	12.5	6.0	4.9	9.9	6.8	8.1
	RATIO	0.790	0.769	0.976	0.346	0.767	0.678	0.431	0.827	0.711	0.757
METEOROLOGICAL SITE	DIR (DEG)	220	320	220	140	260	200	190	10	190	300
BRADLEY	VEL (MPH)	4.3	6.0	1.6	2.1	7.6	2.1	3.6	3.5	5.6	2.9
	SPD (MPH)	5.2	6.9	2.7	3.5	11.1	5.9	5.6	4.3	6.6	4.6
	RATIO	0.836	0.869	0.586	0.608	0.684	0.351	0.642	0.807	0.840	0.633
METEOROLOGICAL SITE	DIR (DEG)	240	320	260	200	240	90	100	290	180	300
BRIDGEPORT	VEL (MPH)	6.7	4.2	3.9	2.9	7.7	1.8	2.8	4.2	3.1	1.8
	SPD (MPH)	6.9	5.0	4.2	4.5	8.1	6.2	3.6	5.3	3.6	5.2
	RATIO	0.970	0.836	0.939	0.659	0.962	0.293	0.781	0.797	0.865	0.351
METEOROLOGICAL SITE	DIR (DEG)	250	300	250	220	250	210	250	10	210	290
WORCESTER	VEL (MPH)	8.0	7.1	6.3	2.8	9.3	4.8	4.3	1.6	5.5	5.4
	SPD (MPH)	8.3	7.2	6.5	4.5	9.6	5.6	4.7	3.9	6.3	7.5
	RATIO	0.965	0.991	0.969	0.636	0.962	0.852	0.912	0.399	0.876	0.717
MERIDEN-002 (0057)	PM10	48	44	43	43	40	35	34	34	32	31
	DATE	11/ 9/93	3/ 2/93	6/18/93	3/20/93	1/ 7/93	3/26/93	7/12/93	3/ 8/93	1/31/93	1/19/93
METEOROLOGICAL SITE	DIR (DEG)	240	300	230	180	100	50	300	240	250	320
NEWARK	VEL (MPH)	4.8	6.2	7.6	4.8	2.1	4.5	7.6	4.1	8.2	8.4
	SPD (MPH)	4.9	8.1	9.6	6.8	4.9	5.6	9.3	6.0	9.9	9.9
	RATIO	0.976	0.769	0.790	0.711	0.431	0.795	0.811	0.678	0.827	0.852
METEOROLOGICAL SITE	DIR (DEG)	220	320	220	190	190	20	320	200	10	300
BRADLEY	VEL (MPH)	1.6	6.0	4.3	5.6	3.6	1.7	.9	2.1	3.5	3.7
	SPD (MPH)	2.7	6.9	5.2	6.6	5.6	3.5	1.0	5.9	4.3	6.3
	RATIO	0.586	0.869	0.836	0.840	0.642	0.483	0.908	0.351	0.807	0.591
METEOROLOGICAL SITE	DIR (DEG)	260	320	240	180	100	270	320	90	290	340
BRIDGEPORT	VEL (MPH)	3.9	4.2	6.7	3.1	2.8	2.1	5.0	1.8	4.2	6.5
	SPD (MPH)	4.2	5.0	6.9	3.6	3.6	4.2	5.9	6.2	5.3	7.2
	RATIO	0.939	0.836	0.970	0.865	0.781	0.497	0.856	0.293	0.797	0.908
METEOROLOGICAL SITE	DIR (DEG)	250	300	250	210	250	80	240	210	10	310
WORCESTER	VEL (MPH)	6.3	7.1	8.0	5.5	4.3	1.0	5.3	4.8	1.6	7.7
	SPD (MPH)	6.5	7.2	8.3	6.3	4.7	4.0	5.8	5.6	3.9	8.6
	RATIO	0.969	0.991	0.965	0.876	0.912	0.242	0.930	0.852	0.399	0.890

TABLE 2-5, CONTINUED

1993 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
MIDDLETOWN-003 (0056)	PM10	49	41	39	37	32	31	30	29	29	28
	DATE	3/ 2/93	6/18/93	5/25/93	11/ 9/93	3/ 8/93	12/ 9/93	1/19/93	11/27/93	7/30/93	3/20/93
METEOROLOGICAL SITE	DIR (DEG)	300	230	270	240	240	190	320	100	260	180
NEWARK	VEL (MPH)	6.2	7.6	9.6	4.8	4.1	2.0	8.4	10.8	9.5	4.8
	SPD (MPH)	8.1	9.6	12.5	4.9	6.0	5.9	9.9	12.8	10.8	6.8
	RATIO	0.769	0.790	0.767	0.976	0.678	0.346	0.852	0.843	0.879	0.711
METEOROLOGICAL SITE	DIR (DEG)	320	220	260	220	200	140	300	100	220	190
BRADLEY	VEL (MPH)	6.0	4.3	7.6	1.6	2.1	2.1	3.7	5.0	2.7	5.6
	SPD (MPH)	6.9	5.2	11.1	2.7	5.9	3.5	6.3	6.9	3.6	6.6
	RATIO	0.869	0.836	0.684	0.586	0.351	0.608	0.591	0.729	0.757	0.840
METEOROLOGICAL SITE	DIR (DEG)	320	240	240	260	90	200	340	120	250	180
BRIDGEPORT	VEL (MPH)	4.2	6.7	7.7	3.9	1.8	2.9	6.5	11.8	5.8	3.1
	SPD (MPH)	5.0	6.9	8.1	4.2	6.2	4.5	7.2	12.5	6.8	3.6
	RATIO	0.836	0.970	0.962	0.939	0.293	0.659	0.908	0.947	0.852	0.865
METEOROLOGICAL SITE	DIR (DEG)	300	250	250	250	210	220	310	100	220	210
WORCESTER	VEL (MPH)	7.1	8.0	9.3	6.3	4.8	2.8	7.7	6.5	7.1	5.5
	SPD (MPH)	7.2	8.3	9.6	6.5	5.6	4.5	8.6	7.2	7.5	6.3
	RATIO	0.991	0.965	0.962	0.969	0.852	0.636	0.890	0.910	0.945	0.876
MILFORD-010 (0060)	PM10	46	39	37	36	36	31	30	26	26	23
	DATE	3/ 2/93	11/ 9/93	4/ 7/93	6/18/93	5/25/93	3/ 8/93	1/ 7/93	3/20/93	7/12/93	7/30/93
METEOROLOGICAL SITE	DIR (DEG)	300	240	50	230	270	240	100	180	300	260
NEWARK	VEL (MPH)	6.2	4.8	5.7	7.6	9.6	4.1	2.1	4.8	7.6	9.5
	SPD (MPH)	8.1	4.9	9.9	9.6	12.5	6.0	4.9	6.8	9.3	10.8
	RATIO	0.769	0.976	0.580	0.790	0.767	0.678	0.431	0.711	0.811	0.879
METEOROLOGICAL SITE	DIR (DEG)	320	220	10	220	260	200	190	190	320	220
BRADLEY	VEL (MPH)	6.0	1.6	5.1	4.3	7.6	2.1	3.6	5.6	.9	2.7
	SPD (MPH)	6.9	2.7	7.0	5.2	11.1	5.9	5.6	6.6	1.0	3.6
	RATIO	0.869	0.586	0.724	0.836	0.684	0.351	0.642	0.840	0.908	0.757
METEOROLOGICAL SITE	DIR (DEG)	320	260	90	240	240	90	100	180	320	250
BRIDGEPORT	VEL (MPH)	4.2	3.9	6.3	6.7	7.7	1.8	2.8	3.1	5.0	5.8
	SPD (MPH)	5.0	4.2	8.2	6.9	8.1	6.2	3.6	3.6	5.9	6.8
	RATIO	0.836	0.939	0.769	0.970	0.962	0.293	0.781	0.865	0.856	0.852
METEOROLOGICAL SITE	DIR (DEG)	300	250	90	250	250	210	250	210	240	220
WORCESTER	VEL (MPH)	7.1	6.3	5.1	8.0	9.3	4.8	4.3	5.5	5.3	7.1
	SPD (MPH)	7.2	6.5	6.0	8.3	9.6	5.6	4.7	6.3	5.8	7.5
	RATIO	0.991	0.969	0.845	0.965	0.962	0.852	0.912	0.876	0.930	0.945
NEW HAVEN-013 (0059)	PM10	52	43	43	41	39	39	36	35	34	29
	DATE	11/ 9/93	5/25/93	6/18/93	3/ 2/93	3/20/93	1/31/93	12/ 9/93	1/ 7/93	3/ 8/93	10/16/93
METEOROLOGICAL SITE	DIR (DEG)	240	270	230	300	180	250	190	100	240	110
NEWARK	VEL (MPH)	4.8	9.6	7.6	6.2	4.8	8.2	2.0	2.1	4.1	3.3
	SPD (MPH)	4.9	12.5	9.6	8.1	6.8	9.9	5.9	4.9	6.0	5.0
	RATIO	0.976	0.767	0.790	0.769	0.711	0.827	0.346	0.431	0.678	0.659
METEOROLOGICAL SITE	DIR (DEG)	220	260	220	320	190	10	140	190	200	210
BRADLEY	VEL (MPH)	1.6	7.6	4.3	6.0	5.6	3.5	2.1	3.6	2.1	2.1
	SPD (MPH)	2.7	11.1	5.2	6.9	6.6	4.3	3.5	5.6	5.9	3.6
	RATIO	0.586	0.684	0.836	0.869	0.840	0.807	0.608	0.642	0.351	0.598

TABLE 2-5, CONTINUED

1993 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)	260	240	240	320	180	290	200	100	90	110
BRIDGEPORT	VEL (MPH)	3.9	7.7	6.7	4.2	3.1	4.2	2.9	2.8	1.8	3.4
	SPD (MPH)	4.2	8.1	6.9	5.0	3.6	5.3	4.5	3.6	6.2	5.5
	RATIO	0.939	0.962	0.970	0.836	0.865	0.797	0.659	0.781	0.293	0.631
METEOROLOGICAL SITE	DIR (DEG)	250	250	250	300	210	10	220	250	210	200
WORCESTER	VEL (MPH)	6.3	9.3	8.0	7.1	5.5	1.6	2.8	4.3	4.8	5.5
	SPD (MPH)	6.5	9.6	8.3	7.2	6.3	3.9	4.5	4.7	5.6	6.2
	RATIO	0.969	0.962	0.965	0.991	0.876	0.399	0.636	0.912	0.852	0.897
NEW HAVEN-018 (0057)	PM10	88	86	70	61	56	55	54	53	53	52
	DATE	1/ 7/93	3/ 2/93	12/ 9/93	7/30/93	7/ 6/93	5/25/93	12/ 3/93	11/ 3/93	7/12/93	8/23/93
METEOROLOGICAL SITE	DIR (DEG)	100	300	190	260	150	270	340	210	300	190
NEWARK	VEL (MPH)	2.1	6.2	2.0	9.5	4.3	9.6	6.1	4.9	7.6	6.2
	SPD (MPH)	4.9	8.1	5.9	10.8	7.2	12.5	8.1	6.3	9.3	7.0
	RATIO	0.431	0.769	0.346	0.879	0.603	0.767	0.757	0.775	0.811	0.886
METEOROLOGICAL SITE	DIR (DEG)	190	320	140	220	190	260	300	200	320	160
BRADLEY	VEL (MPH)	3.6	6.0	2.1	2.7	5.9	7.6	2.9	3.0	.9	2.0
	SPD (MPH)	5.6	6.9	3.5	3.6	6.9	11.1	4.6	3.9	1.0	3.3
	RATIO	0.642	0.869	0.608	0.757	0.856	0.684	0.633	0.765	0.908	0.600
METEOROLOGICAL SITE	DIR (DEG)	100	320	200	250	220	240	300	260	320	230
BRIDGEPORT	VEL (MPH)	2.8	4.2	2.9	5.8	5.4	7.7	1.8	6.9	5.0	5.0
	SPD (MPH)	3.6	5.0	4.5	6.8	5.9	8.1	5.2	9.1	5.9	5.3
	RATIO	0.781	0.836	0.659	0.852	0.916	0.962	0.351	0.758	0.856	0.933
METEOROLOGICAL SITE	DIR (DEG)	250	300	220	220	230	250	290	220	240	250
WORCESTER	VEL (MPH)	4.3	7.1	2.8	7.1	10.2	9.3	5.4	8.4	5.3	5.1
	SPD (MPH)	4.7	7.2	4.5	7.5	10.4	9.6	7.5	8.5	5.8	5.5
	RATIO	0.912	0.991	0.636	0.945	0.985	0.962	0.717	0.995	0.930	0.939
NEW HAVEN-020 (0057)	PM10	64	61	59	44	41	39	38	37	36	34
	DATE	5/ 1/93	3/ 2/93	11/ 9/93	1/ 7/93	5/25/93	1/31/93	3/20/93	12/ 9/93	6/18/93	3/ 8/93
METEOROLOGICAL SITE	DIR (DEG)	170	300	240	100	270	250	180	190	230	240
NEWARK	VEL (MPH)	3.0	6.2	4.8	2.1	9.6	8.2	4.8	2.0	7.6	4.1
	SPD (MPH)	5.5	8.1	4.9	4.9	12.5	9.9	6.8	5.9	9.6	6.0
	RATIO	0.543	0.769	0.976	0.431	0.767	0.827	0.711	0.346	0.790	0.678
METEOROLOGICAL SITE	DIR (DEG)	30	320	220	190	260	10	190	140	220	200
BRADLEY	VEL (MPH)	.5	6.0	1.6	3.6	7.6	3.5	5.6	2.1	4.3	2.1
	SPD (MPH)	3.6	6.9	2.7	5.6	11.1	4.3	6.6	3.5	5.2	5.9
	RATIO	0.130	0.869	0.586	0.642	0.684	0.807	0.840	0.608	0.836	0.351
METEOROLOGICAL SITE	DIR (DEG)	220	320	260	100	240	290	180	200	240	90
BRIDGEPORT	VEL (MPH)	4.8	4.2	3.9	2.8	7.7	4.2	3.1	2.9	6.7	1.8
	SPD (MPH)	5.0	5.0	4.2	3.6	8.1	5.3	3.6	4.5	6.9	6.2
	RATIO	0.960	0.836	0.939	0.781	0.962	0.797	0.865	0.659	0.970	0.293
METEOROLOGICAL SITE	DIR (DEG)	300	300	250	250	250	10	210	220	250	210
WORCESTER	VEL (MPH)	1.5	7.1	6.3	4.3	9.3	1.6	5.5	2.8	8.0	4.8
	SPD (MPH)	4.2	7.2	6.5	4.7	9.6	3.9	6.3	4.5	8.3	5.6
	RATIO	0.369	0.991	0.969	0.912	0.962	0.399	0.876	0.636	0.965	0.852

TABLE 2-5, CONTINUED

1993 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-123 (0057)	PM10	52	48	45	44	43	41	39	34	33	32
	DATE	11/ 9/93	3/ 2/93	5/25/93	1/ 7/93	3/ 8/93	6/18/93	12/ 9/93	10/16/93	3/20/93	3/26/93
METEOROLOGICAL SITE	DIR (DEG)	240	300	270	100	240	230	190	110	180	50
NEWARK	VEL (MPH)	4.8	6.2	9.6	2.1	4.1	7.6	2.0	3.3	4.8	4.5
	SPD (MPH)	4.9	8.1	12.5	4.9	6.0	9.6	5.9	5.0	6.8	5.6
	RATIO	0.976	0.769	0.767	0.431	0.678	0.790	0.346	0.659	0.711	0.795
METEOROLOGICAL SITE	DIR (DEG)	220	320	260	190	200	220	140	210	190	20
BRADLEY	VEL (MPH)	1.6	6.0	7.6	3.6	2.1	4.3	2.1	2.1	5.6	1.7
	SPD (MPH)	2.7	6.9	11.1	5.6	5.9	5.2	3.5	3.6	6.6	3.5
	RATIO	0.586	0.869	0.684	0.642	0.351	0.836	0.608	0.598	0.840	0.483
METEOROLOGICAL SITE	DIR (DEG)	260	320	240	100	90	240	200	110	180	270
BRIDGEPORT	VEL (MPH)	3.9	4.2	7.7	2.8	1.8	6.7	2.9	3.4	3.1	2.1
	SPD (MPH)	4.2	5.0	8.1	3.6	6.2	6.9	4.5	5.5	3.6	4.2
	RATIO	0.939	0.836	0.962	0.781	0.293	0.970	0.659	0.631	0.865	0.497
METEOROLOGICAL SITE	DIR (DEG)	250	300	250	250	210	250	220	200	210	80
WORCESTER	VEL (MPH)	6.3	7.1	9.3	4.3	4.8	8.0	2.8	5.5	5.5	1.0
	SPD (MPH)	6.5	7.2	9.6	4.7	5.6	8.3	4.5	6.2	6.3	4.0
	RATIO	0.969	0.991	0.962	0.912	0.852	0.965	0.636	0.897	0.876	0.242
NORWALK-014 (0055)	PM10	79	61	57	52	48	44	44	41	41	41
	DATE	3/ 2/93	3/ 8/93	11/ 9/93	6/18/93	3/26/93	12/ 3/93	5/25/93	3/20/93	1/ 7/93	10/16/93
METEOROLOGICAL SITE	DIR (DEG)	300	240	240	230	50	340	270	180	100	110
NEWARK	VEL (MPH)	6.2	4.1	4.8	7.6	4.5	6.1	9.6	4.8	2.1	3.3
	SPD (MPH)	8.1	6.0	4.9	9.6	5.6	8.1	12.5	6.8	4.9	5.0
	RATIO	0.769	0.678	0.976	0.790	0.795	0.757	0.767	0.711	0.431	0.659
METEOROLOGICAL SITE	DIR (DEG)	320	200	220	220	20	300	260	190	190	210
BRADLEY	VEL (MPH)	6.0	2.1	1.6	4.3	1.7	2.9	7.6	5.6	3.6	2.1
	SPD (MPH)	6.9	5.9	2.7	5.2	3.5	4.6	11.1	6.6	5.6	3.6
	RATIO	0.869	0.351	0.586	0.836	0.483	0.633	0.684	0.840	0.642	0.598
METEOROLOGICAL SITE	DIR (DEG)	320	90	260	240	270	300	240	180	100	110
BRIDGEPORT	VEL (MPH)	4.2	1.8	3.9	6.7	2.1	1.8	7.7	3.1	2.8	3.4
	SPD (MPH)	5.0	6.2	4.2	6.9	4.2	5.2	8.1	3.6	3.6	5.5
	RATIO	0.836	0.293	0.939	0.970	0.497	0.351	0.962	0.865	0.781	0.631
METEOROLOGICAL SITE	DIR (DEG)	300	210	250	250	80	290	250	210	250	200
WORCESTER	VEL (MPH)	7.1	4.8	6.3	8.0	1.0	5.4	9.3	5.5	4.3	5.5
	SPD (MPH)	7.2	5.6	6.5	8.3	4.0	7.5	9.6	6.3	4.7	6.2
	RATIO	0.991	0.852	0.969	0.965	0.242	0.717	0.962	0.876	0.912	0.897
NORWICH-002 (0057)	PM10	50	41	38	35	34	32	30	30	30	30
	DATE	3/ 2/93	5/25/93	6/18/93	11/ 9/93	12/ 3/93	12/ 9/93	1/ 7/93	7/30/93	3/20/93	2/18/93
METEOROLOGICAL SITE	DIR (DEG)	300	270	230	240	340	190	100	260	180	300
NEWARK	VEL (MPH)	6.2	9.6	7.6	4.8	6.1	2.0	2.1	9.5	4.8	9.7
	SPD (MPH)	8.1	12.5	9.6	4.9	8.1	5.9	4.9	10.8	6.8	11.1
	RATIO	0.769	0.767	0.790	0.976	0.757	0.346	0.431	0.879	0.711	0.878
METEOROLOGICAL SITE	DIR (DEG)	320	260	220	220	300	140	190	220	190	350
BRADLEY	VEL (MPH)	6.0	7.6	4.3	1.6	2.9	2.1	3.6	2.7	5.6	3.7
	SPD (MPH)	6.9	11.1	5.2	2.7	4.6	3.5	5.6	3.6	6.6	5.2
	RATIO	0.869	0.684	0.836	0.586	0.633	0.608	0.642	0.757	0.840	0.708

TABLE 2-5, CONTINUED

1993 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)	320	240	240	260	300	200	100	250	180	360
BRIDGEPORT	VEL (MPH)	4.2	7.7	6.7	3.9	1.8	2.9	2.8	5.8	3.1	3.2
	SPD (MPH)	5.0	8.1	6.9	4.2	5.2	4.5	3.6	6.8	3.6	5.9
	RATIO	0.836	0.962	0.970	0.939	0.351	0.659	0.781	0.852	0.865	0.545
METEOROLOGICAL SITE	DIR (DEG)	300	250	250	250	290	220	250	220	210	280
WORCESTER	VEL (MPH)	7.1	9.3	8.0	6.3	5.4	2.8	4.3	7.1	5.5	4.0
	SPD (MPH)	7.2	9.6	8.3	6.5	7.5	4.5	4.7	7.5	6.3	4.6
	RATIO	0.991	0.962	0.965	0.969	0.717	0.636	0.912	0.945	0.876	0.861
STAMFORD-001 (0057)	PM10	48	48	42	38	36	35	33	32	31	29
	DATE	3/ 2/93	6/18/93	3/ 8/93	5/25/93	10/16/93	3/20/93	1/ 7/93	1/25/93	12/ 9/93	3/26/93
METEOROLOGICAL SITE	DIR (DEG)	300	230	240	270	110	180	100	310	190	50
NEWARK	VEL (MPH)	6.2	7.6	4.1	9.6	3.3	4.8	2.1	14.6	2.0	4.5
	SPD (MPH)	8.1	9.6	6.0	12.5	5.0	6.8	4.9	15.4	5.9	5.6
	RATIO	0.769	0.790	0.678	0.767	0.659	0.711	0.431	0.946	0.346	0.795
METEOROLOGICAL SITE	DIR (DEG)	320	220	200	260	210	190	190	310	140	20
BRADLEY	VEL (MPH)	6.0	4.3	2.1	7.6	2.1	5.6	3.6	13.5	2.1	1.7
	SPD (MPH)	6.9	5.2	5.9	11.1	3.6	6.6	5.6	14.4	3.5	3.5
	RATIO	0.869	0.836	0.351	0.684	0.598	0.840	0.642	0.939	0.608	0.483
METEOROLOGICAL SITE	DIR (DEG)	320	240	90	240	110	180	100	300	200	270
BRIDGEPORT	VEL (MPH)	4.2	6.7	1.8	7.7	3.4	3.1	2.8	8.2	2.9	2.1
	SPD (MPH)	5.0	6.9	6.2	8.1	5.5	3.6	3.6	8.3	4.5	4.2
	RATIO	0.836	0.970	0.293	0.962	0.631	0.865	0.781	0.983	0.659	0.497
METEOROLOGICAL SITE	DIR (DEG)	300	250	210	250	200	210	250	300	220	80
WORCESTER	VEL (MPH)	7.1	8.0	4.8	9.3	5.5	5.5	4.3	10.9	2.8	1.0
	SPD (MPH)	7.2	8.3	5.6	9.6	6.2	6.3	4.7	11.1	4.5	4.0
	RATIO	0.991	0.965	0.852	0.962	0.897	0.876	0.912	0.986	0.636	0.242
WALLINGFORD-006 (0055)	PM10	41	40	39	38	35	33	32	32	29	27
	DATE	3/ 2/93	5/25/93	6/18/93	11/ 9/93	1/ 7/93	3/20/93	1/31/93	12/ 9/93	3/ 8/93	7/12/93
METEOROLOGICAL SITE	DIR (DEG)	300	270	230	240	100	180	250	190	240	300
NEWARK	VEL (MPH)	6.2	9.6	7.6	4.8	2.1	4.8	8.2	2.0	4.1	7.6
	SPD (MPH)	8.1	12.5	9.6	4.9	4.9	6.8	9.9	5.9	6.0	9.3
	RATIO	0.769	0.767	0.790	0.976	0.431	0.711	0.827	0.346	0.678	0.811
METEOROLOGICAL SITE	DIR (DEG)	320	260	220	220	190	190	10	140	200	320
BRADLEY	VEL (MPH)	6.0	7.6	4.3	1.6	3.6	5.6	3.5	2.1	2.1	.9
	SPD (MPH)	6.9	11.1	5.2	2.7	5.6	6.6	4.3	3.5	5.9	1.0
	RATIO	0.869	0.684	0.836	0.586	0.642	0.840	0.807	0.608	0.351	0.908
METEOROLOGICAL SITE	DIR (DEG)	320	240	240	260	100	180	290	200	90	320
BRIDGEPORT	VEL (MPH)	4.2	7.7	6.7	3.9	2.8	3.1	4.2	2.9	1.8	5.0
	SPD (MPH)	5.0	8.1	6.9	4.2	3.6	3.6	5.3	4.5	6.2	5.9
	RATIO	0.836	0.962	0.970	0.939	0.781	0.865	0.797	0.659	0.293	0.856
METEOROLOGICAL SITE	DIR (DEG)	300	250	250	250	250	210	10	220	210	240
WORCESTER	VEL (MPH)	7.1	9.3	8.0	6.3	4.3	5.5	1.6	2.8	4.8	5.3
	SPD (MPH)	7.2	9.6	8.3	6.5	4.7	6.3	3.9	4.5	5.6	5.8
	RATIO	0.991	0.962	0.965	0.969	0.912	0.876	0.399	0.636	0.852	0.930

TABLE 2-5, CONTINUED

1993 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
WATERBURY-007 (0057)	PM10	55	49	48	44	44	42	42	40	38	37
	DATE	3/ 8/93	6/18/93	1/ 7/93	3/20/93	1/31/93	11/ 9/93	1/19/93	3/26/93	12/ 9/93	12/27/93
METEOROLOGICAL SITE	DIR (DEG)	240	230	100	180	250	240	320	50	190	330
NEWARK	VEL (MPH)	4.1	7.6	2.1	4.8	8.2	4.8	8.4	4.5	2.0	5.1
	SPD (MPH)	6.0	9.6	4.9	6.8	9.9	4.9	9.9	5.6	5.9	8.1
	RATIO	0.678	0.790	0.431	0.711	0.827	0.976	0.852	0.795	0.346	0.631
METEOROLOGICAL SITE	DIR (DEG)	200	220	190	190	10	220	300	20	140	300
BRADLEY	VEL (MPH)	2.1	4.3	3.6	5.6	3.5	1.6	3.7	1.7	2.1	3.6
	SPD (MPH)	5.9	5.2	5.6	6.6	4.3	2.7	6.3	3.5	3.5	5.0
	RATIO	0.351	0.836	0.642	0.840	0.807	0.586	0.591	0.483	0.608	0.707
METEOROLOGICAL SITE	DIR (DEG)	90	240	100	180	290	260	340	270	200	350
BRIDGEPORT	VEL (MPH)	1.8	6.7	2.8	3.1	4.2	3.9	6.5	2.1	2.9	3.7
	SPD (MPH)	6.2	6.9	3.6	3.6	5.3	4.2	7.2	4.2	4.5	4.7
	RATIO	0.293	0.970	0.781	0.865	0.797	0.939	0.908	0.497	0.659	0.772
METEOROLOGICAL SITE	DIR (DEG)	210	250	250	210	10	250	310	80	220	280
WORCESTER	VEL (MPH)	4.8	8.0	4.3	5.5	1.6	6.3	7.7	1.0	2.8	9.5
	SPD (MPH)	5.6	8.3	4.7	6.3	3.9	6.5	8.6	4.0	4.5	9.6
	RATIO	0.852	0.965	0.912	0.876	0.399	0.969	0.890	0.242	0.636	0.983
WATERBURY-123 (0059)	PM10	63	50	50	49	47	43	42	41	41	38
	DATE	3/ 2/93	12/27/93	3/ 8/93	1/19/93	6/18/93	1/ 7/93	3/20/93	1/31/93	11/ 9/93	5/25/93
METEOROLOGICAL SITE	DIR (DEG)	300	330	240	320	230	100	180	250	240	270
NEWARK	VEL (MPH)	6.2	5.1	4.1	8.4	7.6	2.1	4.8	8.2	4.8	9.6
	SPD (MPH)	8.1	8.1	6.0	9.9	9.6	4.9	6.8	9.9	4.9	12.5
	RATIO	0.769	0.631	0.678	0.852	0.790	0.431	0.711	0.827	0.976	0.767
METEOROLOGICAL SITE	DIR (DEG)	320	300	200	300	220	190	190	10	220	260
BRADLEY	VEL (MPH)	6.0	3.6	2.1	3.7	4.3	3.6	5.6	3.5	1.6	7.6
	SPD (MPH)	6.9	5.0	5.9	6.3	5.2	5.6	6.6	4.3	2.7	11.1
	RATIO	0.869	0.707	0.351	0.591	0.836	0.642	0.840	0.807	0.586	0.684
METEOROLOGICAL SITE	DIR (DEG)	320	350	90	340	240	100	180	290	260	240
BRIDGEPORT	VEL (MPH)	4.2	3.7	1.8	6.5	6.7	2.8	3.1	4.2	3.9	7.7
	SPD (MPH)	5.0	4.7	6.2	7.2	6.9	3.6	3.6	5.3	4.2	8.1
	RATIO	0.836	0.772	0.293	0.908	0.970	0.781	0.865	0.797	0.939	0.962
METEOROLOGICAL SITE	DIR (DEG)	300	280	210	310	250	250	210	10	250	250
WORCESTER	VEL (MPH)	7.1	9.5	4.8	7.7	8.0	4.3	5.5	1.6	6.3	9.3
	SPD (MPH)	7.2	9.6	5.6	8.6	8.3	4.7	6.3	3.9	6.5	9.6
	RATIO	0.991	0.983	0.852	0.890	0.965	0.912	0.876	0.399	0.969	0.962
WILLIMANTIC-002 (0060)	PM10	47	41	38	37	37	37	35	34	31	29
	DATE	3/ 2/93	3/26/93	3/ 8/93	5/25/93	6/18/93	3/20/93	1/ 7/93	1/19/93	11/ 9/93	12/27/93
METEOROLOGICAL SITE	DIR (DEG)	300	50	240	270	230	180	100	320	240	330
NEWARK	VEL (MPH)	6.2	4.5	4.1	9.6	7.6	4.8	2.1	8.4	4.8	5.1
	SPD (MPH)	8.1	5.6	6.0	12.5	9.6	6.8	4.9	9.9	4.9	8.1
	RATIO	0.769	0.795	0.678	0.767	0.790	0.711	0.431	0.852	0.976	0.631
METEOROLOGICAL SITE	DIR (DEG)	320	20	200	260	220	190	190	300	220	300
BRADLEY	VEL (MPH)	6.0	1.7	2.1	7.6	4.3	5.6	3.6	3.7	1.6	3.6
	SPD (MPH)	6.9	3.5	5.9	11.1	5.2	6.6	5.6	6.3	2.7	5.0
	RATIO	0.869	0.483	0.351	0.684	0.836	0.840	0.642	0.591	0.586	0.707

TABLE 2-5, CONTINUED

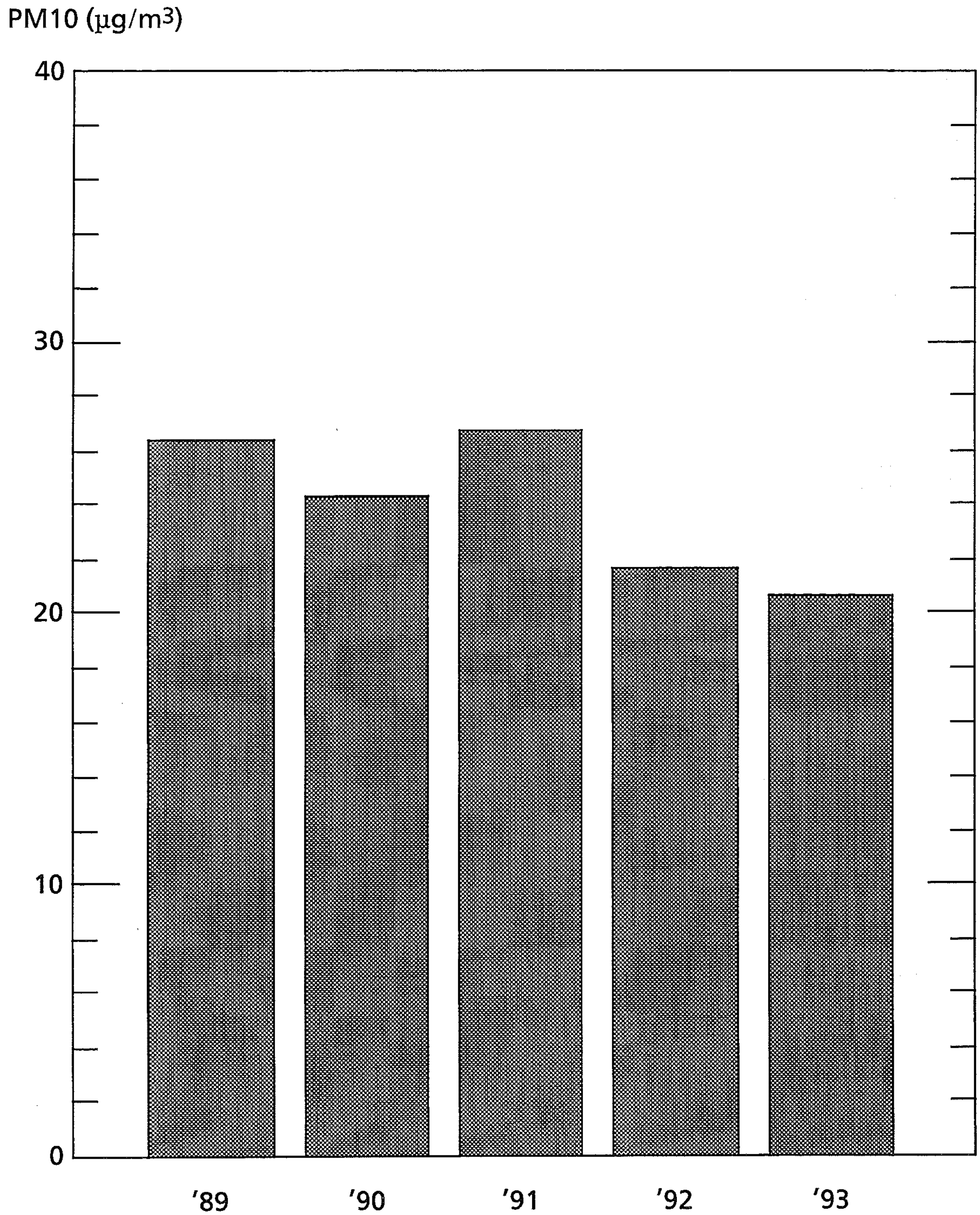
1993 TEN HIGHEST 24-HOUR AVERAGE PM10 DAYS WITH WIND DATA

UNITS : MICROGRAMS PER CUBIC METER

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
METEOROLOGICAL SITE	DIR (DEG)	320	270	90	240	240	180	100	340	260	350
BRIDGEPORT	VEL (MPH)	4.2	2.1	1.8	7.7	6.7	3.1	2.8	6.5	3.9	3.7
	SPD (MPH)	5.0	4.2	6.2	8.1	6.9	3.6	3.6	7.2	4.2	4.7
	RATIO	0.836	0.497	0.293	0.962	0.970	0.865	0.781	0.908	0.939	0.772
METEOROLOGICAL SITE	DIR (DEG)	300	80	210	250	250	210	250	310	250	280
WORCESTER	VEL (MPH)	7.1	1.0	4.8	9.3	8.0	5.5	4.3	7.7	6.3	9.5
	SPD (MPH)	7.2	4.0	5.6	9.6	8.3	6.3	4.7	8.6	6.5	9.6
	RATIO	0.991	0.242	0.852	0.962	0.965	0.876	0.912	0.890	0.969	0.983

FIGURE 2-5

AVERAGES OF THE ANNUAL PM10 CONCENTRATIONS[1]



[1] At the 19 sites that met the minimum sampling criteria in each year of the five-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 1993 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 (TECo instruments) to continuously measure sulfur dioxide levels at all 13 sites in 1993.

DISCUSSION OF DATA

Monitoring Network - Thirteen continuous SO_2 monitors were used to record data in 12 towns during 1993 (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 - 551 precision checks were made on SO_2 monitors in 1993, yielding 95% probability limits ranging from -6% to +5%. 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 13 audits were: low, -6% to +4%; medium, -5% to +5%; and high, -5% to +4%.

Annual Averages - SO_2 levels were below the primary annual standard of 80 $\mu g/m^3$ at all sites in 1993 (see Table 3-1). The annual average SO_2 levels decreased at seven of the ten monitoring sites that had sufficient data in both 1992 and 1993 to produce valid annual averages. The largest decrease was 8 $\mu g/m^3$, which occurred at New Haven 123. Three of the ten sites -- Bridgeport 013, East Haven 003 and Groton 007 -- showed no change in the annual average. Danbury 123 and Greenwich 017 had insufficent data in 1992 and 1993, respectively. Stamford 124 replaced Stamford 123 in 1993.

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 1993. 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 decreased at 9 of the 10 monitoring sites that had adequate data in both 1992 and 1993. The decreases ranged from 11 $\mu g/m^3$ at Bridgeport 013 to 31 $\mu g/m^3$ at East Hartford 006. There was no change in the second high concentration at East Haven 003.

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 larger than the first high calendar day averages by up to 13 $\mu g/m^3$, except at Hartford 018 where there was no difference.

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 1993. Of the 10 sites that had a sufficient quantity of data in both 1992 and 1993, 9 had lower second high concentrations in 1993. The decreases ranged from 16 µg/m³ at East Haven 003 to 36 µg/m³ at both New Haven 123 and Waterbury 123. Bridgeport 013 had a second high concentration in 1993 that was 45 µg/m³ higher than in 1992.

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., 45%) 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 58% of the tabulated days occurred during the winter, and 36% 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 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 1984 to 1993 is presented in Figure 3-4. The trend is clearly down in the last five 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, Bridgeport 123 / 013, East Haven 003, Enfield 005, Groton 007, New Haven 123, Stamford 123 / 124, and Waterbury 123. These sites were the only sites that had sufficient data and valid annual averages over a ten 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 level appears to trend down over the last four years, after a period of little or no variation.

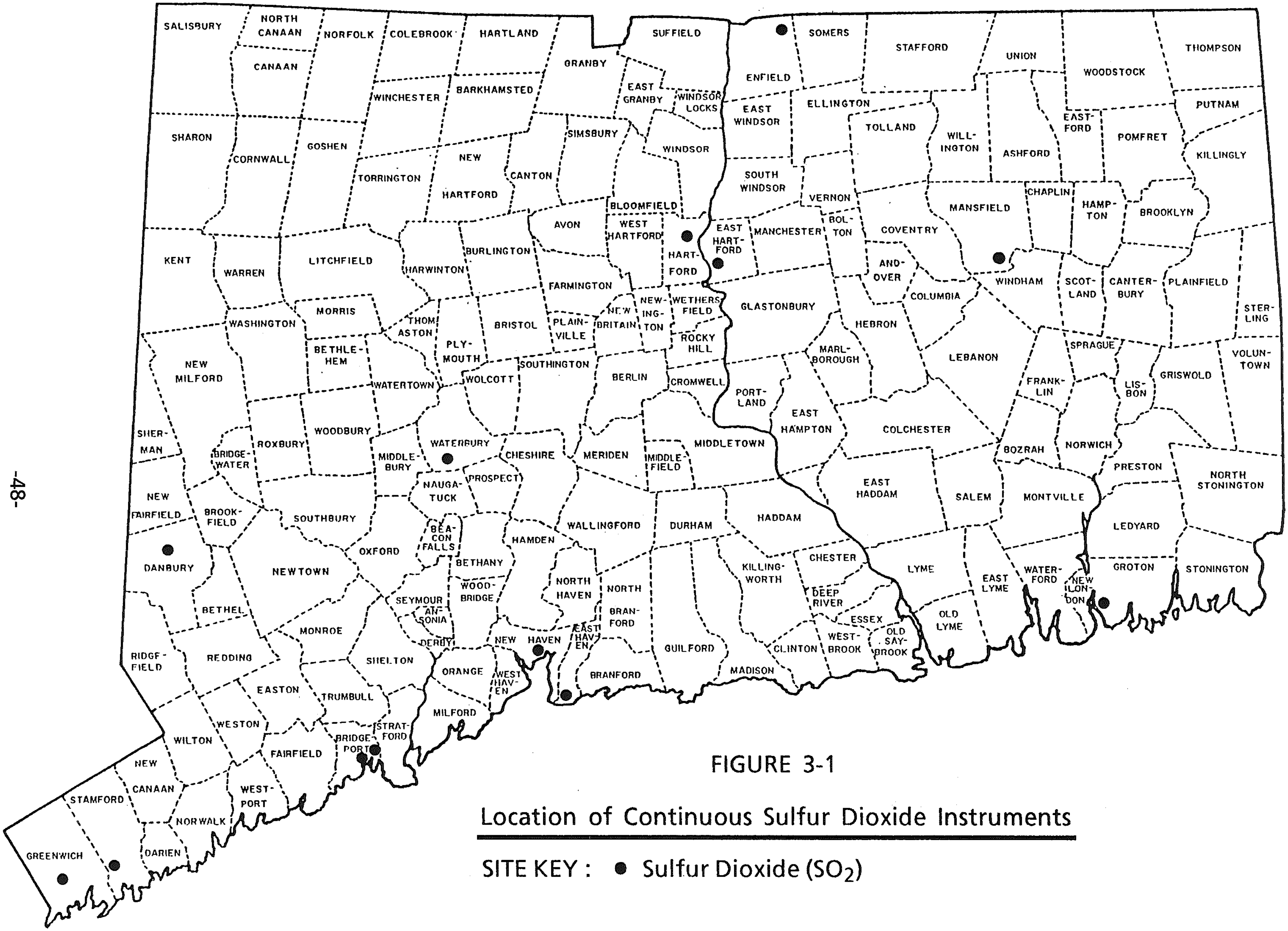


FIGURE 3-1

Location of Continuous Sulfur Dioxide Instruments

SITE KEY : ● Sulfur Dioxide (SO_2)

TABLE 3-1

1993 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	26
Bridgeport 013	Congress Street	22
Danbury 123	Western CT State University	15
East Hartford 006	High Street	15
East Haven 003	Animal Shelter	17
Enfield 005	Department of Corrections	11
Greenwich 017	Greenwich Point Park	12*
Groton 007	Fire Headquarters	16
Hartford 018	Sheldon Street	17
Mansfield 003	Dept. of Transportation	9
New Haven 123	State Street	24
Stamford 124	Health Department	20*
Waterbury 123	Bank Street	16

* A valid annual average cannot be calculated because the site has insufficient data to satisfy the minimum sampling criteria.

TABLE 3-2

1991-1993 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	1991	363	32.0	31.8	32.2	22.387	
BRIDGEPORT	012	1992	355	27.5	27.1	27.8	20.302	
BRIDGEPORT	012	1993	355	25.8	25.4	26.1	18.826	
BRIDGEPORT	013	1991	345	23.4	22.9	23.8	18.108	
BRIDGEPORT	013	1992	360	22.6	22.3	22.8	17.715	
BRIDGEPORT	013	1993	361	22.5	22.3	22.7	16.616	
DANBURY	123	1991	358	19.7	19.5	19.9	13.741	
DANBURY	123	1992	313*	17.5	16.9	18.1	13.436	
DANBURY	123	1993	354	14.7	14.4	14.9	12.467	
EAST HARTFORD	006	1991	354	23.1	22.8	23.4	16.843	
EAST HARTFORD	006	1992	334	18.3	17.9	18.8	14.660	
EAST HARTFORD	006	1993	361	15.4	15.2	15.5	11.098	
EAST HAVEN	003	1991	363	19.4	19.2	19.5	16.553	
EAST HAVEN	003	1992	350	17.1	16.7	17.4	15.663	
EAST HAVEN	003	1993	365	16.6	16.5	16.6	13.277	
ENFIELD	005	1991	361	14.5	14.4	14.7	10.755	
ENFIELD	005	1992	360	13.7	13.6	13.8	10.541	
ENFIELD	005	1993	340	11.3	11.0	11.6	9.419	
GREENWICH	017	1991	354	16.1	15.9	16.3	11.217	
GREENWICH	017	1992	312	11.9	11.5	12.4	10.660	
GREENWICH	017	1993	239*	12.1	11.5	12.7	8.408	
GROTON	007	1991	335	18.9	18.5	19.2	12.339	
GROTON	007	1992	362	16.2	16.1	16.3	11.961	
GROTON	007	1993	353	16.4	16.2	16.6	9.895	
HARTFORD	018	1991	348	23.7	23.3	24.1	16.998	
HARTFORD	018	1992	345	19.6	19.2	20.0	15.157	
HARTFORD	018	1993	360	17.3	17.2	17.5	11.503	

* 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

1991–1993 SO2 ANNUAL AVERAGES AND STATISTICAL PROJECTIONS

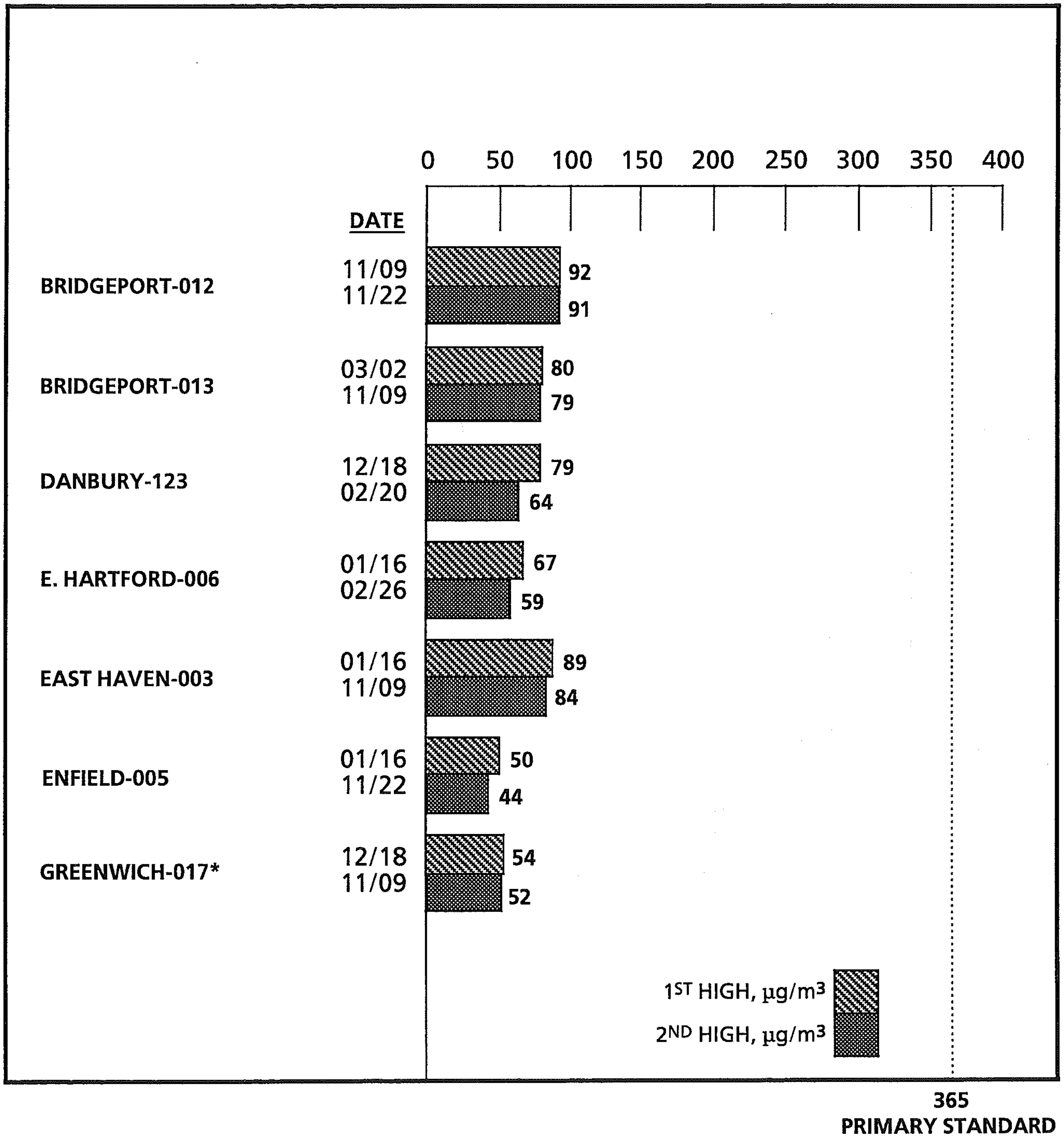
TOWN NAME	SITE	YEAR	SAMPLES	ARITHMETIC MEAN	95-PCT-LIMITS LOWER	95-PCT-LIMITS UPPER	STANDARD DEVIATION	PREDICTED DAYS OVER 365 UG/M3
MANSFIELD	003	1991	294*	10.5	10.1	10.9	7.686	
MANSFIELD	003	1992	360	11.9	11.8	12.0	7.718	
MANSFIELD	003	1993	354	8.6	8.5	8.7	5.974	
NEW HAVEN	123	1991	355	33.3	32.8	33.9	29.708	
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	
STAMFORD	123	1991	358	26.2	25.9	26.6	21.775	
STAMFORD	123	1992	366	23.8	23.8	23.8	18.893	
STAMFORD	124	1993	282*	19.8	19.0	20.7	14.738	
WATERBURY	123	1991	356	22.9	22.6	23.2	15.782	
WATERBURY	123	1992	351	19.1	18.8	19.4	15.362	
WATERBURY	123	1993	358	15.9	15.7	16.1	11.583	

* 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

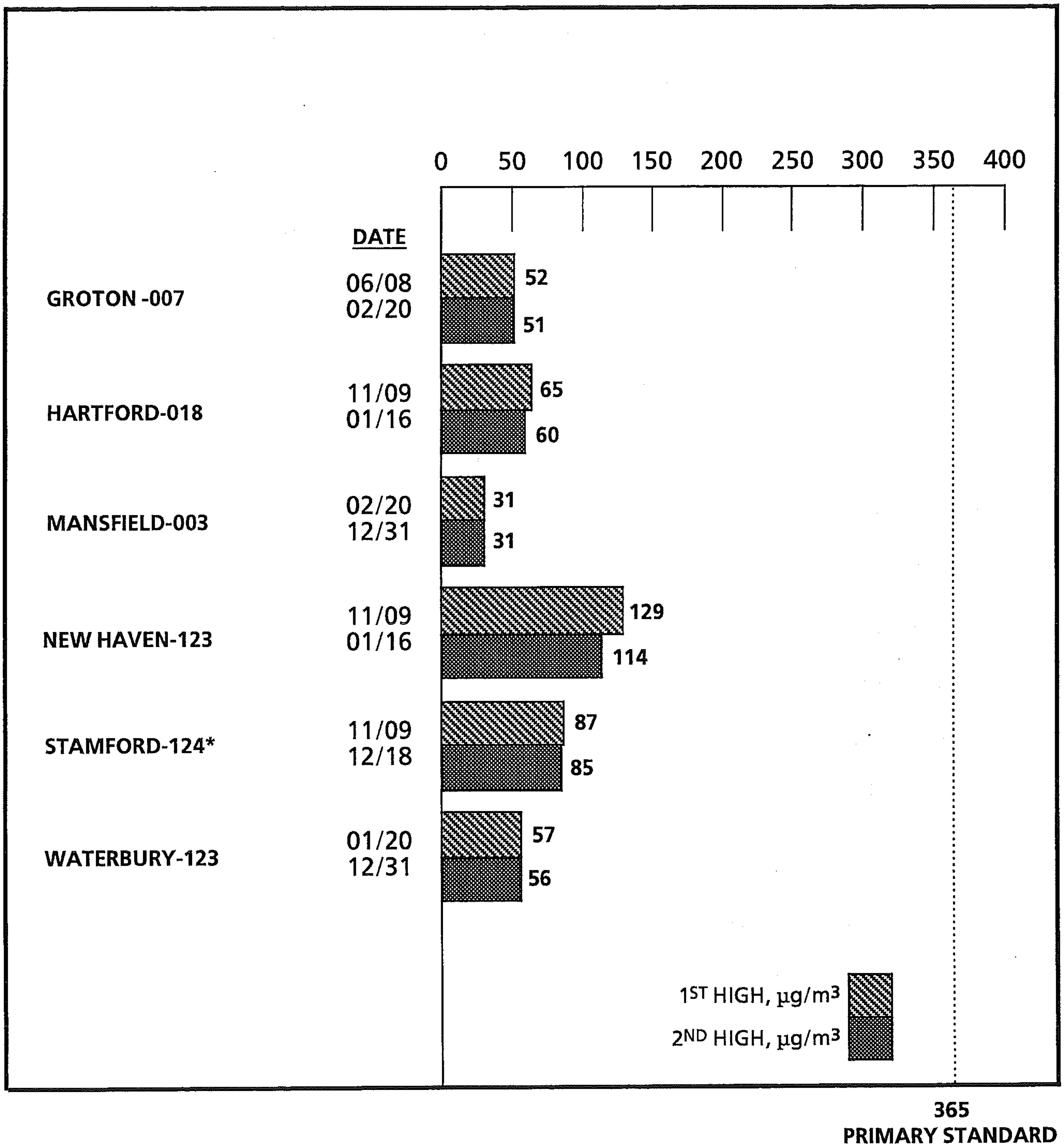
1993 MAXIMUM CALENDAR DAY AVERAGE SO2 CONCENTRATIONS



* The site has insufficient data to satisfy the minimum sampling criteria for a valid annual average.
N.B. When a listed concentration occurs more than once at a site, the earliest date of occurrence is given first.

FIGURE 3-2, CONTINUED

1993 MAXIMUM CALENDAR DAY AVERAGE SO2 CONCENTRATIONS



* The site has insufficient data to satisfy the minimum sampling criteria for a valid annual average.

N.B. When a listed concentration occurs more than once at a site, the earliest date of occurrence is given first.

TABLE 3-3

COMPARISONS OF FIRST AND SECOND HIGH CALENDAR DAY AND 24-HOUR RUNNING SO2 AVERAGES FOR 1993

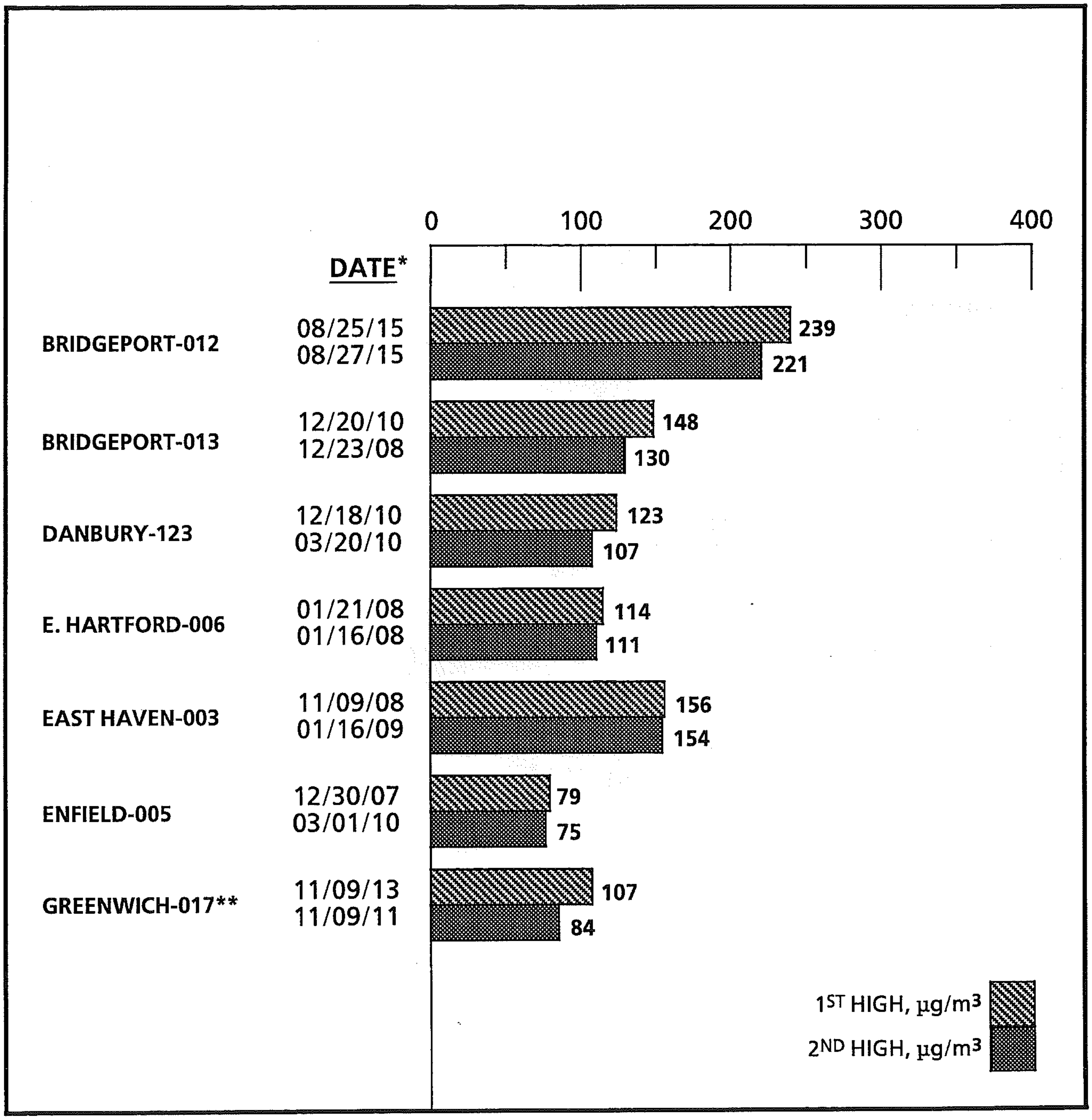
	FIRST HIGH AVERAGE		SECOND HIGH AVERAGE	
SITE	RUNNING 24-HOUR	CALENDAR DAY	RUNNING 24-HOUR	CALENDAR DAY
Bridgeport-012	96	92	92	91
Bridgeport-013	88	80	85	79
Danbury-123	81	79	65	64
E. Hartford-006	71	67	59	59
East Haven-003	96	89	94	84
Enfield-005	54	50	45	44
Greenwich-017*	55	54	53	52
Groton-007	65	52	52	51
Hartford-018	65	65	64	60
Mansfield-003	34	31	33	31
New Haven-123	132	129	120	114
Stamford-124*	90	87	89	85
Waterbury-123	58	57	56	56

* The site has insufficient data to satisfy the minimum sampling criteria for a valid annual average.

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

FIGURE 3-3

1993 MAXIMUM 3-HOUR RUNNING AVERAGE SO2 CONCENTRATIONS



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

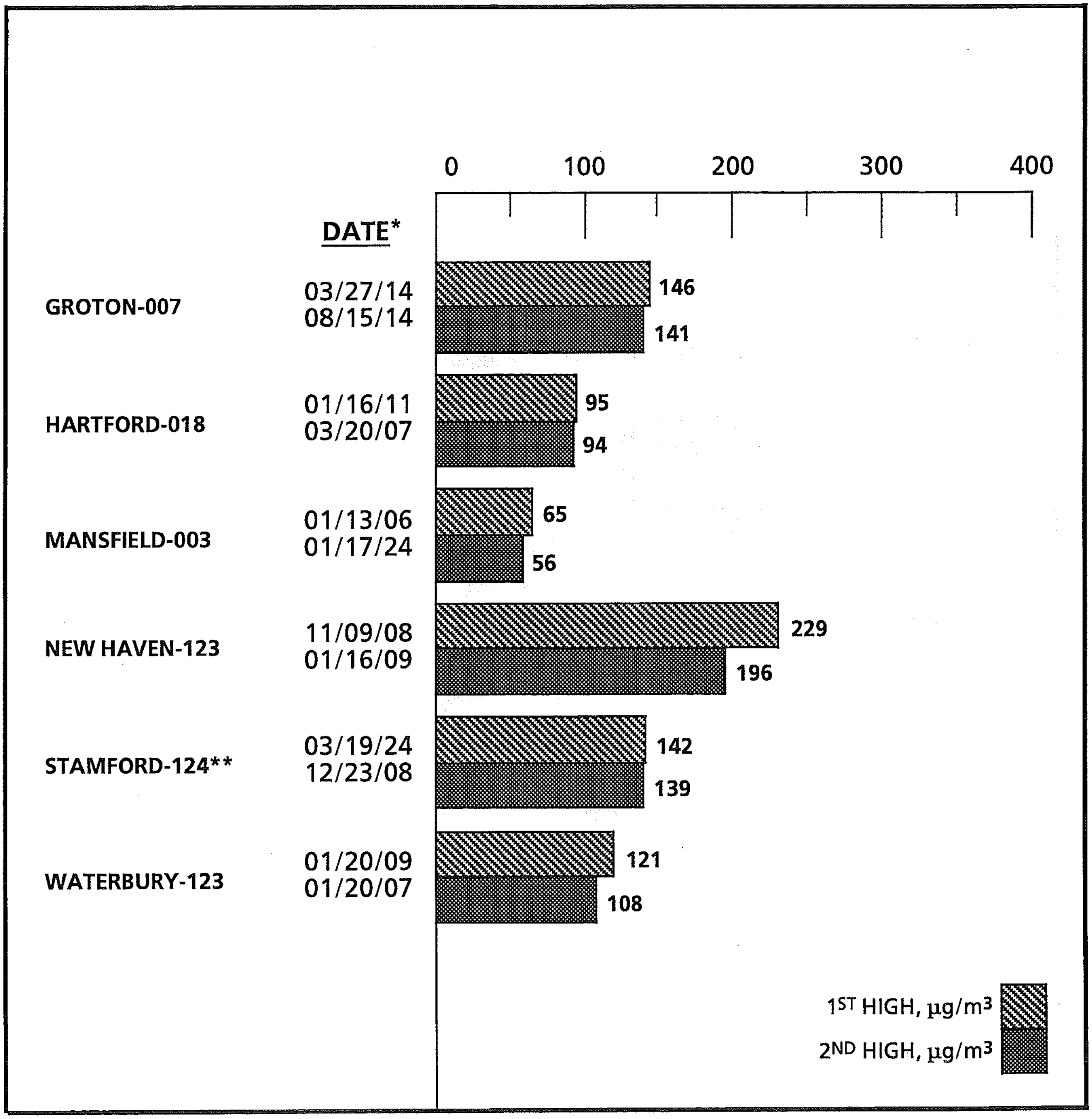
** The site has insufficient data to satisfy the minimum sampling criteria for a valid annual average.

N.B. When a listed concentration occurs more than once at a site, the earliest date of occurrence is given first.

Secondary standard = 1300 µg/m^3.

FIGURE 3-3, CONTINUED

1993 MAXIMUM 3-HOUR RUNNING AVERAGE SO2 CONCENTRATIONS



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

** The site has insufficient data to satisfy the minimum sampling criteria for a valid annual average.

N.B. When a listed concentration occurs more than once at a site, the earliest date of occurrence is given first.

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

TABLE 3-4

1993 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 (0355)	SO2	92	91	86	86	82	79	78	77	73	71
	DATE	11/ 9/93	11/22/93	2/20/93	12/18/93	12/31/93	12/20/93	2/10/93	3/ 2/93	1/15/93	8/27/93
METEOROLOGICAL SITE	DIR (DEG)	240	250	290	260	250	170	220	300	280	240
NEWARK	VEL (MPH)	4.8	6.9	6.3	2.6	9.0	2.9	6.1	6.2	4.7	6.3
	SPD (MPH)	4.9	8.9	8.5	4.9	11.4	5.8	7.3	8.1	6.5	7.9
	RATIO	0.976	0.771	0.738	0.541	0.796	0.506	0.834	0.769	0.721	0.802
METEOROLOGICAL SITE	DIR (DEG)	220	210	300	180	210	70	220	320	30	200
BRADLEY	VEL (MPH)	1.6	6.5	3.3	4.0	5.7	1.3	5.7	6.0	1.0	2.3
	SPD (MPH)	2.7	8.2	5.6	4.7	7.8	2.9	9.3	6.9	3.5	2.4
	RATIO	0.586	0.791	0.595	0.844	0.738	0.450	0.614	0.869	0.283	0.948
METEOROLOGICAL SITE	DIR (DEG)	260	270	280	260	270	330	230	320	300	240
BRIDGEPORT	VEL (MPH)	3.9	7.4	4.5	5.6	10.6	1.0	4.9	4.2	2.0	5.2
	SPD (MPH)	4.2	7.9	6.8	6.0	10.9	3.7	4.9	5.0	3.7	5.3
	RATIO	0.939	0.942	0.661	0.935	0.970	0.261	0.997	0.836	0.539	0.976
METEOROLOGICAL SITE	DIR (DEG)	250	240	280	230	240	240	260	300	280	260
WORCESTER	VEL (MPH)	6.3	9.9	6.7	7.0	9.0	4.5	10.0	7.1	1.6	5.4
	SPD (MPH)	6.5	10.1	6.8	7.2	9.1	4.7	10.6	7.2	3.9	6.0
	RATIO	0.969	0.982	0.987	0.969	0.996	0.938	0.938	0.991	0.424	0.899
BRIDGEPORT-013 (0361)	SO2	80	79	77	76	75	73	71	70	70	68
	DATE	3/ 2/93	11/ 9/93	2/20/93	1/16/93	12/20/93	11/22/93	12/31/93	2/10/93	12/18/93	11/ 8/93
METEOROLOGICAL SITE	DIR (DEG)	300	240	290	20	170	250	250	220	260	230
NEWARK	VEL (MPH)	6.2	4.8	6.3	5.6	2.9	6.9	9.0	6.1	2.6	5.4
	SPD (MPH)	8.1	4.9	8.5	5.8	5.8	8.9	11.4	7.3	4.9	6.5
	RATIO	0.769	0.976	0.738	0.966	0.506	0.771	0.796	0.834	0.541	0.832
METEOROLOGICAL SITE	DIR (DEG)	320	220	300	20	70	210	210	220	180	260
BRADLEY	VEL (MPH)	6.0	1.6	3.3	1.3	1.3	6.5	5.7	5.7	4.0	1.6
	SPD (MPH)	6.9	2.7	5.6	2.7	2.9	8.2	7.8	9.3	4.7	4.6
	RATIO	0.869	0.586	0.595	0.459	0.450	0.791	0.738	0.614	0.844	0.339
METEOROLOGICAL SITE	DIR (DEG)	320	260	280	50	330	270	270	230	260	270
BRIDGEPORT	VEL (MPH)	4.2	3.9	4.5	3.3	1.0	7.4	10.6	4.9	5.6	5.4
	SPD (MPH)	5.0	4.2	6.8	4.3	3.7	7.9	10.9	4.9	6.0	6.6
	RATIO	0.836	0.939	0.661	0.767	0.261	0.942	0.970	0.997	0.935	0.810
METEOROLOGICAL SITE	DIR (DEG)	300	250	280	290	240	240	240	260	230	260
WORCESTER	VEL (MPH)	7.1	6.3	6.7	5.5	4.5	9.9	9.0	10.0	7.0	8.1
	SPD (MPH)	7.2	6.5	6.8	5.6	4.7	10.1	9.1	10.6	7.2	8.5
	RATIO	0.991	0.969	0.987	0.982	0.938	0.982	0.996	0.938	0.969	0.952
DANBURY-123 (0354)	SO2	79	64	57	54	53	52	51	51	51	48
	DATE	12/18/93	2/20/93	1/16/93	11/ 9/93	11/11/93	3/ 2/93	12/31/93	3/20/93	12/25/93	2/26/93
METEOROLOGICAL SITE	DIR (DEG)	260	290	20	240	210	300	250	180	220	30
NEWARK	VEL (MPH)	2.6	6.3	5.6	4.8	6.3	6.2	9.0	4.8	3.7	6.4
	SPD (MPH)	4.9	8.5	5.8	4.9	7.5	8.1	11.4	6.8	5.6	6.8
	RATIO	0.541	0.738	0.966	0.976	0.842	0.769	0.796	0.711	0.669	0.952
METEOROLOGICAL SITE	DIR (DEG)	180	300	20	220	180	320	210	190	160	40
BRADLEY	VEL (MPH)	4.0	3.3	1.3	1.6	6.6	6.0	5.7	5.6	.9	1.6
	SPD (MPH)	4.7	5.6	2.7	2.7	6.6	6.9	7.8	6.6	2.0	5.2
	RATIO	0.844	0.595	0.459	0.586	0.993	0.869	0.738	0.840	0.450	0.316

TABLE 3-4, CONTINUED

1993 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)	260	280	50	260	240	320	270	180	280	80
BRIDGEPORT	VEL (MPH)	5.6	4.5	3.3	3.9	9.2	4.2	10.6	3.1	3.8	2.8
	SPD (MPH)	6.0	6.8	4.3	4.2	9.2	5.0	10.9	3.6	5.2	3.6
	RATIO	0.935	0.661	0.767	0.939	0.997	0.836	0.970	0.865	0.742	0.783
METEOROLOGICAL SITE	DIR (DEG)	230	280	290	250	220	300	240	210	280	280
WORCESTER	VEL (MPH)	7.0	6.7	5.5	6.3	8.6	7.1	9.0	5.5	1.6	3.1
	SPD (MPH)	7.2	6.8	5.6	6.5	8.6	7.2	9.1	6.3	3.7	4.6
	RATIO	0.969	0.987	0.982	0.969	0.996	0.991	0.996	0.876	0.429	0.673
EAST HARTFORD-006 (0361)	SO2	67	59	56	55	51	50	48	48	46	46
	DATE	1/16/93	2/26/93	1/21/93	2/23/93	2/20/93	1/12/93	1/ 8/93	2/ 5/93	11/26/93	12/18/93
METEOROLOGICAL SITE	DIR (DEG)	20	30	60	270	290	20	20	230	360	260
NEWARK	VEL (MPH)	5.6	6.4	4.2	12.0	6.3	6.4	8.1	11.6	3.0	2.6
	SPD (MPH)	5.8	6.8	6.8	14.4	8.5	6.5	8.2	11.6	4.5	4.9
	RATIO	0.966	0.952	0.623	0.833	0.738	0.984	0.989	0.996	0.671	0.541
METEOROLOGICAL SITE	DIR (DEG)	20	40	40	260	300	10	360	250	30	180
BRADLEY	VEL (MPH)	1.3	1.6	1.6	7.3	3.3	4.3	5.1	4.9	2.1	4.0
	SPD (MPH)	2.7	5.2	3.7	8.5	5.6	4.5	5.5	8.3	3.9	4.7
	RATIO	0.459	0.316	0.438	0.855	0.595	0.969	0.927	0.592	0.541	0.844
METEOROLOGICAL SITE	DIR (DEG)	50	80	100	270	280	60	50	270	60	260
BRIDGEPORT	VEL (MPH)	3.3	2.8	4.3	10.5	4.5	4.7	4.1	11.0	2.1	5.6
	SPD (MPH)	4.3	3.6	4.5	11.2	6.8	5.3	4.5	11.4	5.0	6.0
	RATIO	0.767	0.783	0.966	0.932	0.661	0.885	0.924	0.973	0.427	0.935
METEOROLOGICAL SITE	DIR (DEG)	290	280	180	270	280	140	350	250	340	230
WORCESTER	VEL (MPH)	5.5	3.1	2.5	3.4	6.7	1.7	4.0	10.4	2.6	7.0
	SPD (MPH)	5.6	4.6	4.2	6.3	6.8	1.9	4.7	10.5	3.9	7.2
	RATIO	0.982	0.673	0.611	0.538	0.987	0.931	0.852	0.989	0.664	0.969
EAST HAVEN-003 (0365)	SO2	89	84	67	66	56	54	53	53	51	50
	DATE	1/16/93	11/ 9/93	11/10/93	2/20/93	11/26/93	2/26/93	1/ 8/93	3/20/93	12/ 9/93	11/ 8/93
METEOROLOGICAL SITE	DIR (DEG)	20	240	20	290	360	30	20	180	190	230
NEWARK	VEL (MPH)	5.6	4.8	5.0	6.3	3.0	6.4	8.1	4.8	2.0	5.4
	SPD (MPH)	5.8	4.9	5.3	8.5	4.5	6.8	8.2	6.8	5.9	6.5
	RATIO	0.966	0.976	0.935	0.738	0.671	0.952	0.989	0.711	0.346	0.832
METEOROLOGICAL SITE	DIR (DEG)	20	220	10	300	30	40	360	190	140	260
BRADLEY	VEL (MPH)	1.3	1.6	1.8	3.3	2.1	1.6	5.1	5.6	2.1	1.6
	SPD (MPH)	2.7	2.7	2.2	5.6	3.9	5.2	5.5	6.6	3.5	4.6
	RATIO	0.459	0.586	0.851	0.595	0.541	0.316	0.927	0.840	0.608	0.339
METEOROLOGICAL SITE	DIR (DEG)	50	260	360	280	60	80	50	180	200	270
BRIDGEPORT	VEL (MPH)	3.3	3.9	3.4	4.5	2.1	2.8	4.1	3.1	2.9	5.4
	SPD (MPH)	4.3	4.2	4.2	6.8	5.0	3.6	4.5	3.6	4.5	6.6
	RATIO	0.767	0.939	0.816	0.661	0.427	0.783	0.924	0.865	0.659	0.810
METEOROLOGICAL SITE	DIR (DEG)	290	250	320	280	340	280	350	210	220	260
WORCESTER	VEL (MPH)	5.5	6.3	5.5	6.7	2.6	3.1	4.0	5.5	2.8	8.1
	SPD (MPH)	5.6	6.5	5.8	6.8	3.9	4.6	4.7	6.3	4.5	8.5
	RATIO	0.982	0.969	0.963	0.987	0.664	0.673	0.852	0.876	0.636	0.952

TABLE 3-4, CONTINUED

1993 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 (0340)	SO2	50	44	43	41	41	39	38	37	36	36
	DATE	1/16/93	11/22/93	12/31/93	11/ 9/93	12/18/93	1/17/93	1/12/93	2/20/93	3/ 2/93	2/26/93
METEOROLOGICAL SITE	DIR (DEG)	20	250	250	240	260	260	20	290	300	30
NEWARK	VEL (MPH)	5.6	6.9	9.0	4.8	2.6	8.8	6.4	6.3	6.2	6.4
	SPD (MPH)	5.8	8.9	11.4	4.9	4.9	10.1	6.5	8.5	8.1	6.8
	RATIO	0.966	0.771	0.796	0.976	0.541	0.876	0.984	0.738	0.769	0.952
METEOROLOGICAL SITE	DIR (DEG)	20	210	210	220	180	240	10	300	320	40
BRADLEY	VEL (MPH)	1.3	6.5	5.7	1.6	4.0	5.1	4.3	3.3	6.0	1.6
	SPD (MPH)	2.7	8.2	7.8	2.7	4.7	6.2	4.5	5.6	6.9	5.2
	RATIO	0.459	0.791	0.738	0.586	0.844	0.818	0.969	0.595	0.869	0.316
METEOROLOGICAL SITE	DIR (DEG)	50	270	270	260	260	280	60	280	320	80
BRIDGEPORT	VEL (MPH)	3.3	7.4	10.6	3.9	5.6	6.4	4.7	4.5	4.2	2.8
	SPD (MPH)	4.3	7.9	10.9	4.2	6.0	7.0	5.3	6.8	5.0	3.6
	RATIO	0.767	0.942	0.970	0.939	0.935	0.914	0.885	0.661	0.836	0.783
METEOROLOGICAL SITE	DIR (DEG)	290	240	240	250	230	280	140	280	300	280
WORCESTER	VEL (MPH)	5.5	9.9	9.0	6.3	7.0	6.2	1.7	6.7	7.1	3.1
	SPD (MPH)	5.6	10.1	9.1	6.5	7.2	7.3	1.9	6.8	7.2	4.6
	RATIO	0.982	0.982	0.996	0.969	0.969	0.845	0.931	0.987	0.991	0.673
GROTON-007 (0353)	SO2	52	51	49	46	44	43	43	43	43	42
	DATE	6/ 8/93	2/20/93	1/16/93	12/10/93	3/23/93	12/31/93	4/ 5/93	2/ 3/93	1/24/93	3/27/93
METEOROLOGICAL SITE	DIR (DEG)	130	290	20	170	100	250	80	270	210	100
NEWARK	VEL (MPH)	5.5	6.3	5.6	5.1	3.0	9.0	2.5	8.2	8.7	4.5
	SPD (MPH)	7.6	8.5	5.8	7.5	5.6	11.4	6.2	9.2	11.5	6.5
	RATIO	0.718	0.738	0.966	0.688	0.532	0.796	0.410	0.891	0.757	0.697
METEOROLOGICAL SITE	DIR (DEG)	190	300	20	190	160	210	40	250	190	100
BRADLEY	VEL (MPH)	3.3	3.3	1.3	6.9	3.3	5.7	.9	4.6	9.1	.8
	SPD (MPH)	5.5	5.6	2.7	8.1	5.8	7.8	5.8	6.0	9.9	3.9
	RATIO	0.599	0.595	0.459	0.851	0.565	0.738	0.149	0.759	0.915	0.214
METEOROLOGICAL SITE	DIR (DEG)	180	280	50	210	120	270	170	270	220	120
BRIDGEPORT	VEL (MPH)	3.4	4.5	3.3	9.6	4.7	10.6	2.7	4.2	8.1	5.8
	SPD (MPH)	4.6	6.8	4.3	9.8	5.0	10.9	6.5	5.5	9.1	6.2
	RATIO	0.729	0.661	0.767	0.980	0.925	0.970	0.411	0.768	0.899	0.936
METEOROLOGICAL SITE	DIR (DEG)	250	280	290	200	260	240	20	270	210	160
WORCESTER	VEL (MPH)	4.0	6.7	5.5	8.8	3.1	9.0	2.5	7.6	8.9	2.3
	SPD (MPH)	6.2	6.8	5.6	9.1	4.3	9.1	4.7	7.6	9.5	5.2
	RATIO	0.650	0.987	0.982	0.974	0.718	0.996	0.534	0.991	0.942	0.441
HARTFORD-018 (0360)	SO2	65	60	57	55	51	51	50	49	48	47
	DATE	11/ 9/93	1/16/93	12/18/93	2/20/93	12/31/93	11/22/93	11/11/93	1/ 8/93	11/10/93	1/12/93
METEOROLOGICAL SITE	DIR (DEG)	240	20	260	290	250	250	210	20	20	20
NEWARK	VEL (MPH)	4.8	5.6	2.6	6.3	9.0	6.9	6.3	8.1	5.0	6.4
	SPD (MPH)	4.9	5.8	4.9	8.5	11.4	8.9	7.5	8.2	5.3	6.5
	RATIO	0.976	0.966	0.541	0.738	0.796	0.771	0.842	0.989	0.935	0.984
METEOROLOGICAL SITE	DIR (DEG)	220	20	180	300	210	210	180	360	10	10
BRADLEY	VEL (MPH)	1.6	1.3	4.0	3.3	5.7	6.5	6.6	5.1	1.8	4.3
	SPD (MPH)	2.7	2.7	4.7	5.6	7.8	8.2	6.6	5.5	2.2	4.5
	RATIO	0.586	0.459	0.844	0.595	0.738	0.791	0.993	0.927	0.851	0.969

TABLE 3-4, CONTINUED

1993 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)	260	50	260	280	270	270	240	50	360	60
BRIDGEPORT	VEL (MPH)	3.9	3.3	5.6	4.5	10.6	7.4	9.2	4.1	3.4	4.7
	SPD (MPH)	4.2	4.3	6.0	6.8	10.9	7.9	9.2	4.5	4.2	5.3
	RATIO	0.939	0.767	0.935	0.661	0.970	0.942	0.997	0.924	0.816	0.885
METEOROLOGICAL SITE	DIR (DEG)	250	290	230	280	240	240	220	350	320	140
WORCESTER	VEL (MPH)	6.3	5.5	7.0	6.7	9.0	9.9	8.6	4.0	5.5	1.7
	SPD (MPH)	6.5	5.6	7.2	6.8	9.1	10.1	8.6	4.7	5.8	1.9
	RATIO	0.969	0.982	0.969	0.987	0.996	0.982	0.996	0.852	0.963	0.931
MANSFIELD-003 (0354)	SO2	31	31	28	27	27	26	26	26	25	25
	DATE	12/31/93	2/20/93	11/22/93	3/ 2/93	2/23/93	2/10/93	1/13/93	1/31/93	12/18/93	2/21/93
METEOROLOGICAL SITE	DIR (DEG)	250	290	250	300	270	220	30	250	260	70
NEWARK	VEL (MPH)	9.0	6.3	6.9	6.2	12.0	6.1	7.4	8.2	2.6	7.3
	SPD (MPH)	11.4	8.5	8.9	8.1	14.4	7.3	8.1	9.9	4.9	8.9
	RATIO	0.796	0.738	0.771	0.769	0.833	0.834	0.915	0.827	0.541	0.819
METEOROLOGICAL SITE	DIR (DEG)	210	300	210	320	260	220	10	10	180	10
BRADLEY	VEL (MPH)	5.7	3.3	6.5	6.0	7.3	5.7	6.9	3.5	4.0	5.1
	SPD (MPH)	7.8	5.6	8.2	6.9	8.5	9.3	6.9	4.3	4.7	5.9
	RATIO	0.738	0.595	0.791	0.869	0.855	0.614	0.993	0.807	0.844	0.865
METEOROLOGICAL SITE	DIR (DEG)	270	280	270	320	270	230	80	290	260	120
BRIDGEPORT	VEL (MPH)	10.6	4.5	7.4	4.2	10.5	4.9	7.2	4.2	5.6	13.0
	SPD (MPH)	10.9	6.8	7.9	5.0	11.2	4.9	8.9	5.3	6.0	13.5
	RATIO	0.970	0.661	0.942	0.836	0.932	0.997	0.812	0.797	0.935	0.965
METEOROLOGICAL SITE	DIR (DEG)	240	280	240	300	270	260	60	10	230	60
WORCESTER	VEL (MPH)	9.0	6.7	9.9	7.1	3.4	10.0	8.1	1.6	7.0	7.5
	SPD (MPH)	9.1	6.8	10.1	7.2	6.3	10.6	8.5	3.9	7.2	7.9
	RATIO	0.996	0.987	0.982	0.991	0.538	0.938	0.953	0.399	0.969	0.949
NEW HAVEN-123 (0356)	SO2	129	114	100	91	86	86	85	82	81	80
	DATE	11/ 9/93	1/16/93	11/10/93	1/ 7/93	12/ 9/93	12/18/93	11/23/93	11/ 8/93	11/22/93	11/26/93
METEOROLOGICAL SITE	DIR (DEG)	240	20	20	100	190	260	50	230	250	360
NEWARK	VEL (MPH)	4.8	5.6	5.0	2.1	2.0	2.6	3.4	5.4	6.9	3.0
	SPD (MPH)	4.9	5.8	5.3	4.9	5.9	4.9	4.5	6.5	8.9	4.5
	RATIO	0.976	0.966	0.935	0.431	0.346	0.541	0.756	0.832	0.771	0.671
METEOROLOGICAL SITE	DIR (DEG)	220	20	10	190	140	180	40	260	210	30
BRADLEY	VEL (MPH)	1.6	1.3	1.8	3.6	2.1	4.0	.5	1.6	6.5	2.1
	SPD (MPH)	2.7	2.7	2.2	5.6	3.5	4.7	3.2	4.6	8.2	3.9
	RATIO	0.586	0.459	0.851	0.642	0.608	0.844	0.166	0.339	0.791	0.541
METEOROLOGICAL SITE	DIR (DEG)	260	50	360	100	200	260	110	270	270	60
BRIDGEPORT	VEL (MPH)	3.9	3.3	3.4	2.8	2.9	5.6	3.6	5.4	7.4	2.1
	SPD (MPH)	4.2	4.3	4.2	3.6	4.5	6.0	5.3	6.6	7.9	5.0
	RATIO	0.939	0.767	0.816	0.781	0.659	0.935	0.682	0.810	0.942	0.427
METEOROLOGICAL SITE	DIR (DEG)	250	290	320	250	220	230	60	260	240	340
WORCESTER	VEL (MPH)	6.3	5.5	5.5	4.3	2.8	7.0	4.6	8.1	9.9	2.6
	SPD (MPH)	6.5	5.6	5.8	4.7	4.5	7.2	5.5	8.5	10.1	3.9
	RATIO	0.969	0.982	0.963	0.912	0.636	0.969	0.834	0.952	0.982	0.664

TABLE 3-4, CONTINUED

1993 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
WATERBURY-123 (0358)	SO2	57	56	54	53	53	50	48	47	47	47
	DATE	1/20/93	12/31/93	2/20/93	12/20/93	12/18/93	11/11/93	3/ 2/93	12/ 9/93	11/23/93	12/28/93
METEOROLOGICAL SITE	DIR (DEG)	300	250	290	170	260	210	300	190	50	360
NEWARK	VEL (MPH)	8.7	9.0	6.3	2.9	2.6	6.3	6.2	2.0	3.4	8.8
	SPD (MPH)	10.6	11.4	8.5	5.8	4.9	7.5	8.1	5.9	4.5	8.9
	RATIO	0.819	0.796	0.738	0.506	0.541	0.842	0.769	0.346	0.756	0.992
METEOROLOGICAL SITE	DIR (DEG)	300	210	300	70	180	180	320	140	40	330
BRADLEY	VEL (MPH)	5.0	5.7	3.3	1.3	4.0	6.6	6.0	2.1	.5	2.5
	SPD (MPH)	8.9	7.8	5.6	2.9	4.7	6.6	6.9	3.5	3.2	3.5
	RATIO	0.562	0.738	0.595	0.450	0.844	0.993	0.869	0.608	0.166	0.723
METEOROLOGICAL SITE	DIR (DEG)	330	270	280	330	260	240	320	200	110	10
BRIDGEPORT	VEL (MPH)	4.8	10.6	4.5	1.0	5.6	9.2	4.2	2.9	3.6	5.3
	SPD (MPH)	5.5	10.9	6.8	3.7	6.0	9.2	5.0	4.5	5.3	6.2
	RATIO	0.875	0.970	0.661	0.261	0.935	0.997	0.836	0.659	0.682	0.859
METEOROLOGICAL SITE	DIR (DEG)	290	240	280	240	230	220	300	220	60	290
WORCESTER	VEL (MPH)	8.1	9.0	6.7	4.5	7.0	8.6	7.1	2.8	4.6	7.9
	SPD (MPH)	8.3	9.1	6.8	4.7	7.2	8.6	7.2	4.5	5.5	8.1
	RATIO	0.970	0.996	0.987	0.938	0.969	0.996	0.991	0.636	0.834	0.986

FIGURE 3-4

AVERAGES OF THE ANNUAL SO_2 CONCENTRATIONS AT EIGHT SITES

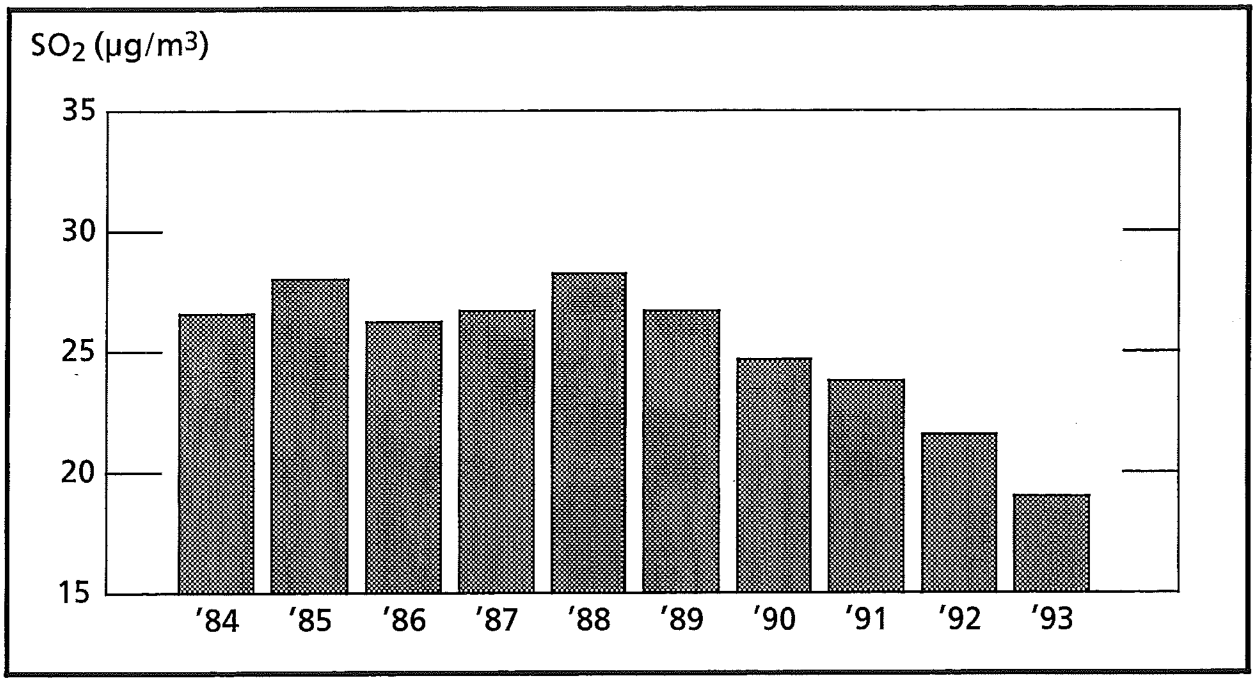
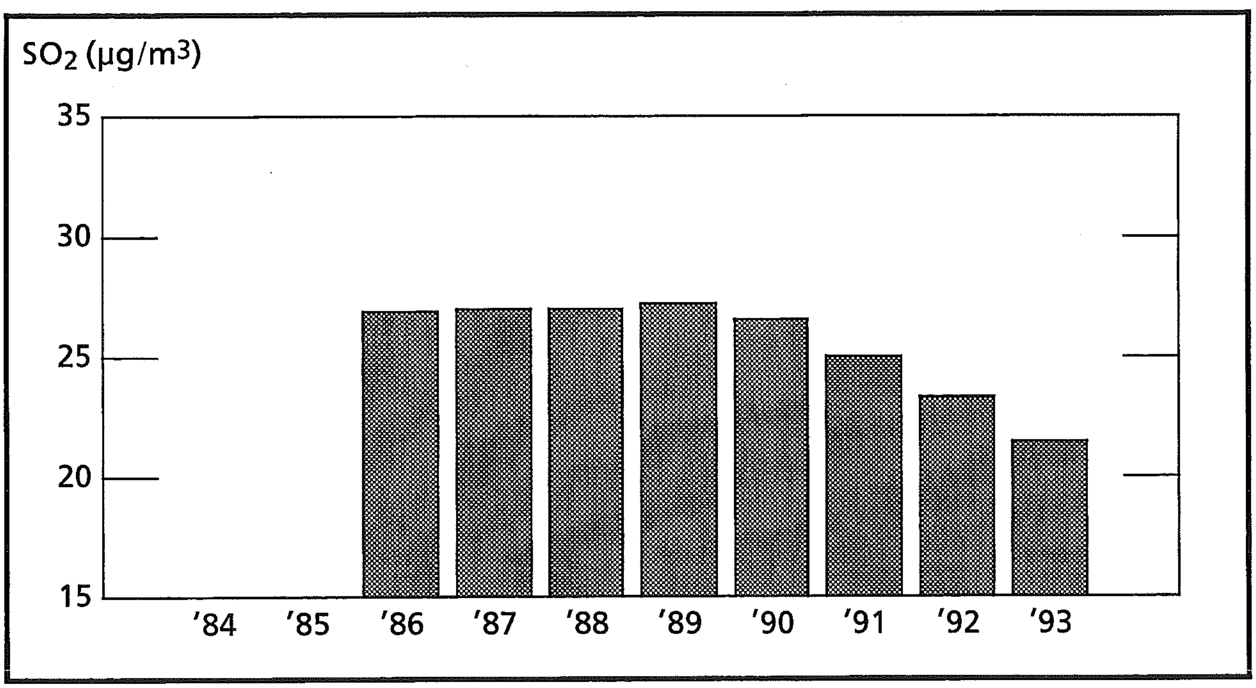


FIGURE 3-5

3-YEAR AVERAGES OF THE ANNUAL SO_2 CONCENTRATIONS AT EIGHT 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 1993. Levels in excess of the one-hour NAAQS of 0.12 ppm were recorded at all eleven ozone monitoring sites. The highest concentration was 0.170 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 higher in 1993 than in 1992 (see Table 4-1). There was a total of 84 hourly exceedances in 1993 and 19 hourly exceedances in 1992 at the eleven monitoring sites. This represents an increase in the frequency of such exceedances from 0.4 per 1000 sampling hours in 1992 to 1.6 per 1000 sampling hours in 1993: a 300% increase. The actual number of hours when the ozone standard was exceeded in the state increased from 17 in 1992 to 45 in 1993.

The number of site-days on which the ozone monitors experienced ozone levels in excess of the 1-hour standard increased from 11 in 1992 to 42 in 1993 at the eleven monitoring sites (see Table 4-2). This represents an increase in the frequency of such occurrences from 0.5 per 100 sampling days in 1992 to 1.9 per 100 sampling days in 1993: a 280% increase. The actual number of days on which the ozone standard was exceeded in the state increased from 8 in 1992 to 15 in 1993.

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, an increase in the <u>frequency of winds out of the southwest</u> would help to explain the increase in the number of ozone exceedances from 1992 to 1993. The percentage of southwest winds during the "ozone season" increased slightly from 31% in 1992 to 32% in 1993, 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 <u>variations in temperature</u>, since ozone production is greatest at high temperatures and in strong sunlight. The summer season's daily high temperatures were significantly higher in 1993 than in 1992. This is demonstrated by the number of days exceeding 90° F which increased from one in 1992 to seventeen in 1993 at Sikorsky Airport in Bridgeport, and from seven in 1992 to nineteen in 1993 at Bradley International Airport. The incidence of high ozone levels is dependent on the <u>percentage of possible sunshine</u>, 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 increased from 49% in 1992 to 65% in 1993 for the months April through October. The average for these summer months at Bradley is usually 60%. Of the meteorological parameters discussed above, all three can be seen as contributing to the increase in ozone levels from 1992 to 1993.

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, and to provide real-time data for the daily Pollutant Standards Index, DEP operated a state-wide ozone monitoring network consisting of four types of sites in 1993 (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 231 precision checks during 1993. 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 15 audits conducted on the monitoring system, were: low, -14% to +5%; medium, -7% to +3%; and high, -6% to +5%.

1-Hour Average - The 1-hour ozone standard was exceeded at all eleven DEP monitoring sites in 1993. Every site had a maximum concentration that was higher in 1993 than in 1992. Each site also had a higher second high concentration.

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 1993. 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., 62%) 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 many 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 1984 to 1993. 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. It is evident that the ozone trend, uninfluenced by the weather's variability, is down.

TABLE 4-1

NUMBER OF HOURS WHEN THE 1-HOUR OZONE STANDARD WAS EXCEEDED IN 1993

SITE	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	1993	1992
Bridgeport 013	0	0	0	5	3	0	0	8	0
Danbury 123	0	0	1	2	2	0	0	5	2
E. Hartford 003	0	0	3	1	1	0	0	5	0
Greenwich 017	0	0	0	4	6	0	0	10	0
Groton 008	0	0	1	4	0	0	0	5	1
Madison 002	0	0	2	4	4	0	0	10	0
Middletown 007	0	0	3	2	6	0	0	11	6
New Haven 123	0	0	0	1	2	0	0	3	0
Stafford 001	0	0	7	1	0	0	0	8	5
Stratford 007	0	0	2	4	8	0	0	14	5
Torrington 006	0	0	1	2	2	0	0	5	0
TOTAL SITE HOURS	0	0	20	30	34	0	0	84	19

TABLE 4-2

NUMBER OF DAYS WHEN THE 1-HOUR OZONE STANDARD WAS EXCEEDED IN 1993

SITE	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	1993	1992
Bridgeport 013	0	0	0	2	2	0	0	4	0
Danbury 123	0	0	1	2	1	0	0	4	1
E. Hartford 003	0	0	1	1	1	0	0	3	0
Greenwich 017	0	0	0	1	3	0	0	4	0
Groton 008	0	0	1	1	0	0	0	2	1
Madison 002	0	0	1	3	1	0	0	5	0
Middletown 007	0	0	1	1	3	0	0	5	4
New Haven 123	0	0	0	1	1	0	0	2	0
Stafford 001	0	0	2	1	0	0	0	3	2
Stratford 007	0	0	1	2	3	0	0	6	3
Torrington 006	0	0	1	2	1	0	0	4	0
TOTAL SITE DAYS	0	0	9	17	16	0	0	42	11

FIGURE 4-1

WIND ROSE FOR APRIL - OCTOBER 1992
NEWARK INTERNATIONAL AIRPORT
NEWARK, NEW JERSEY

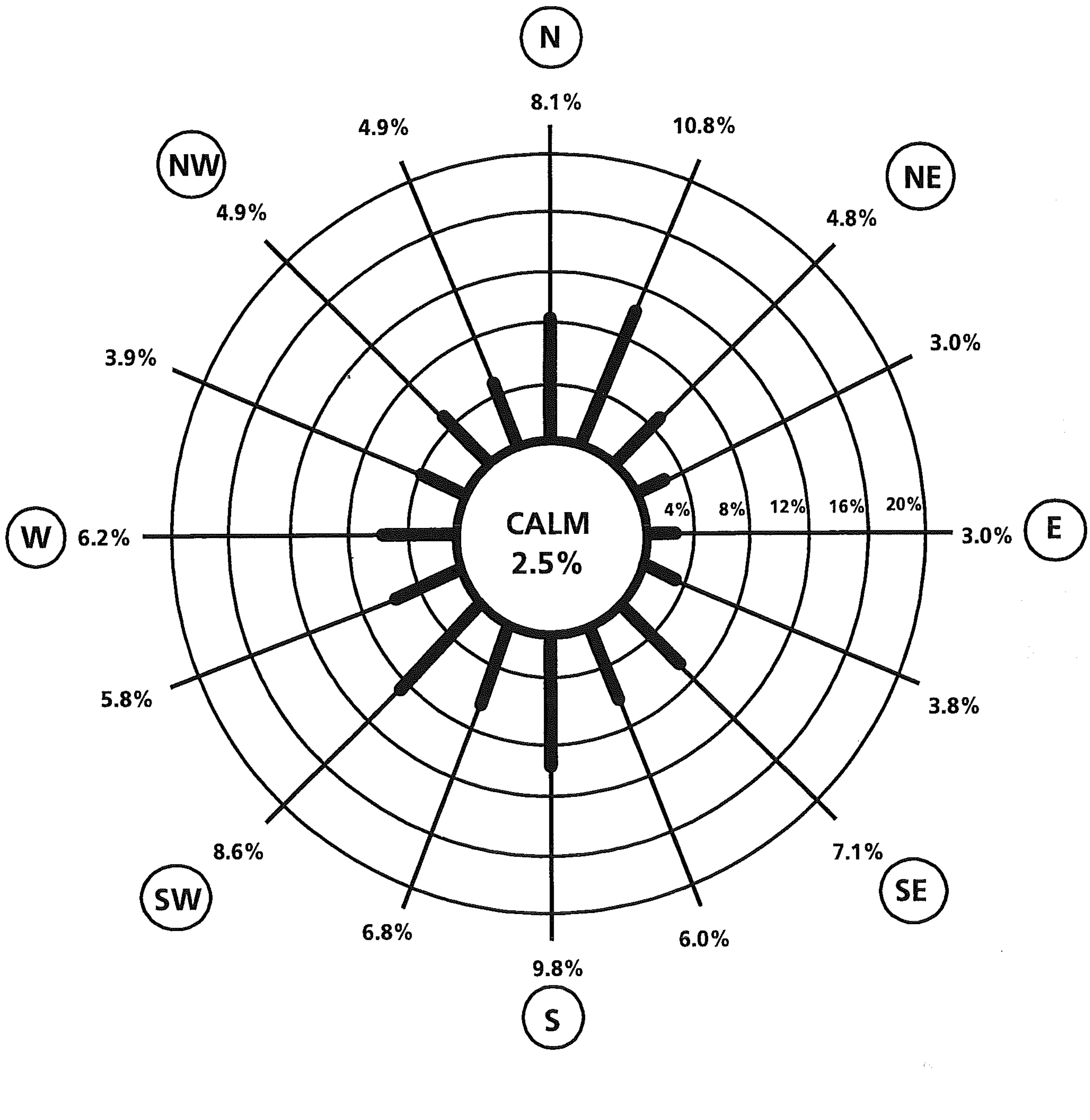
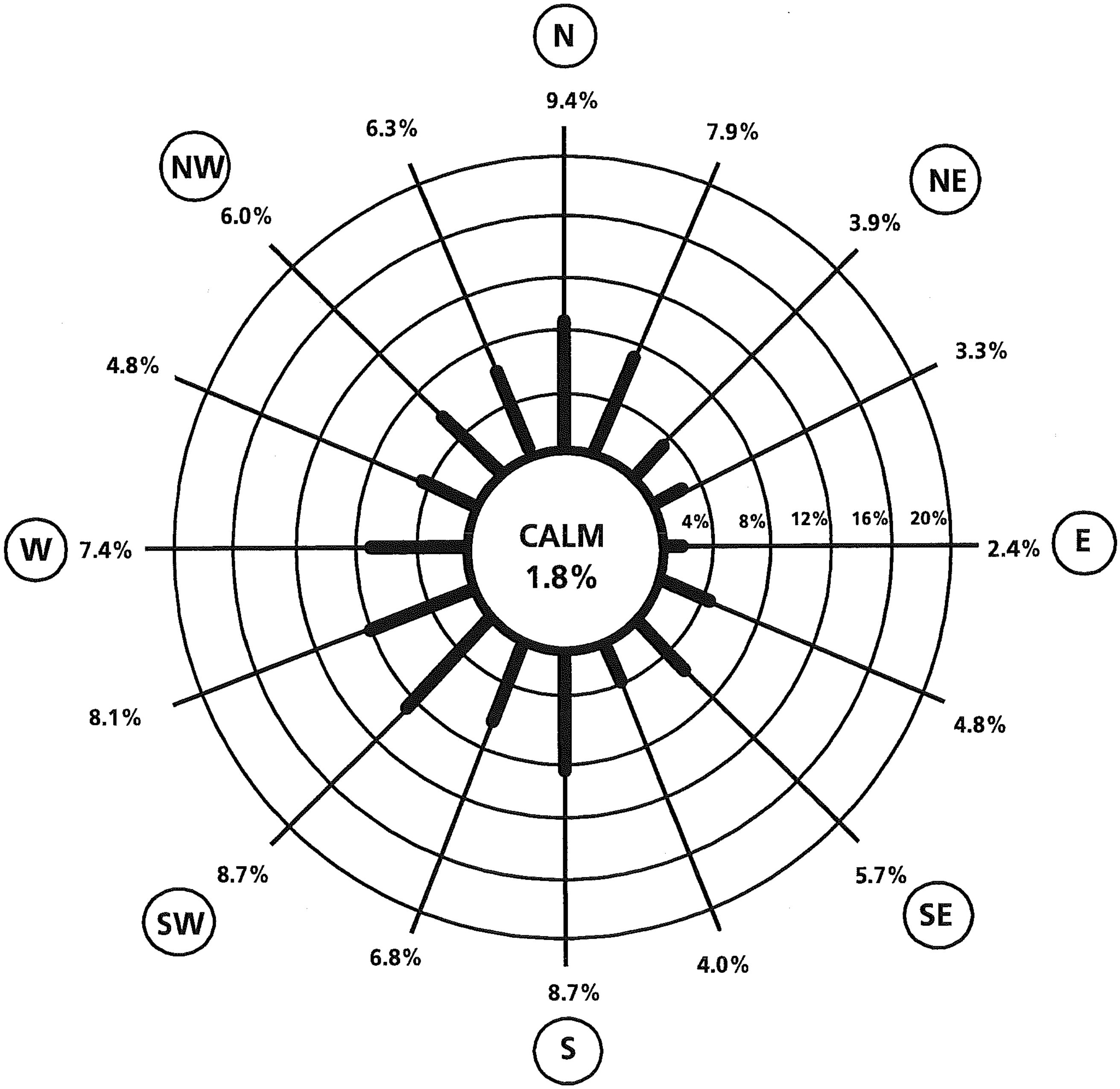


FIGURE 4-2

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



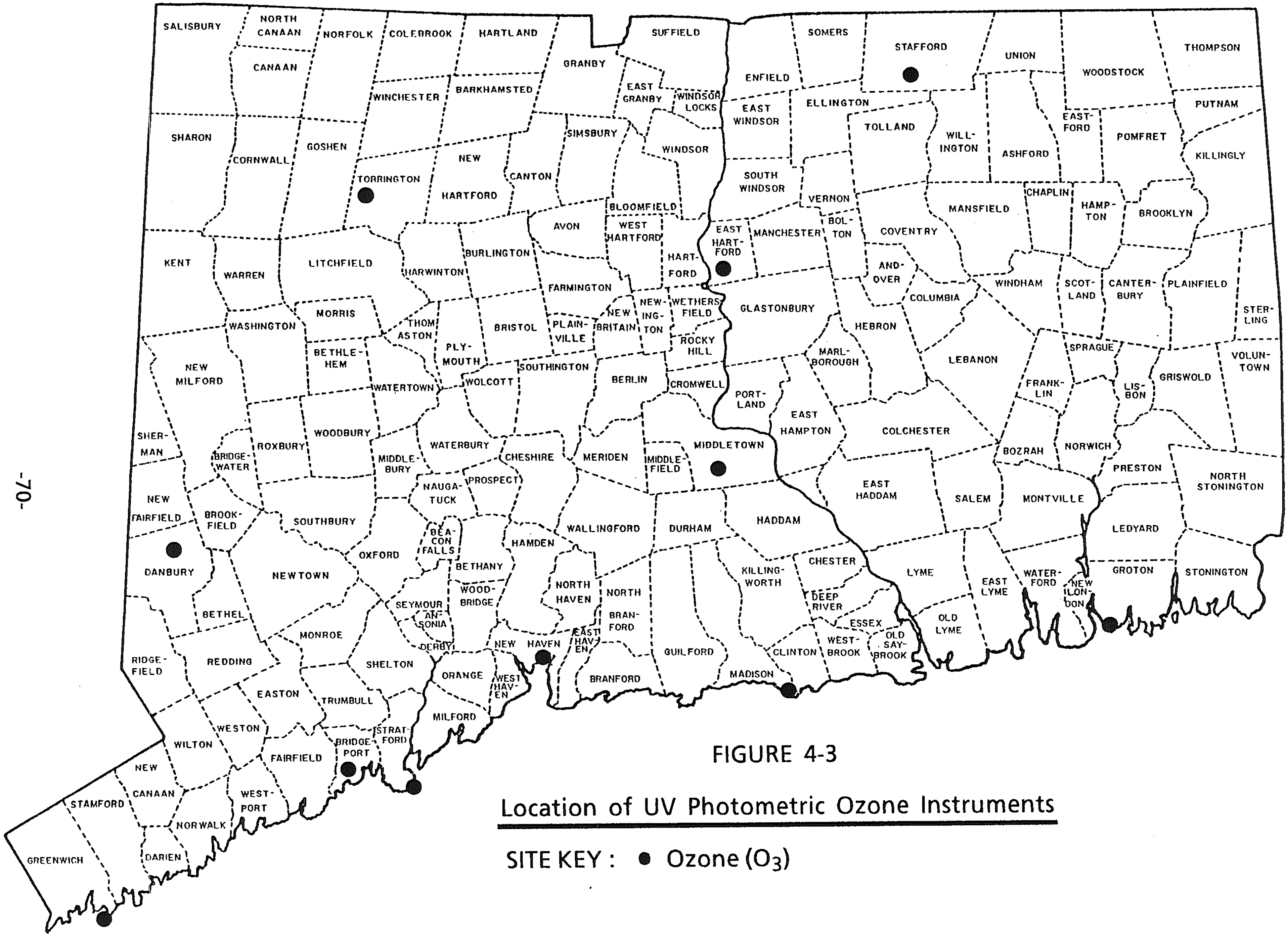


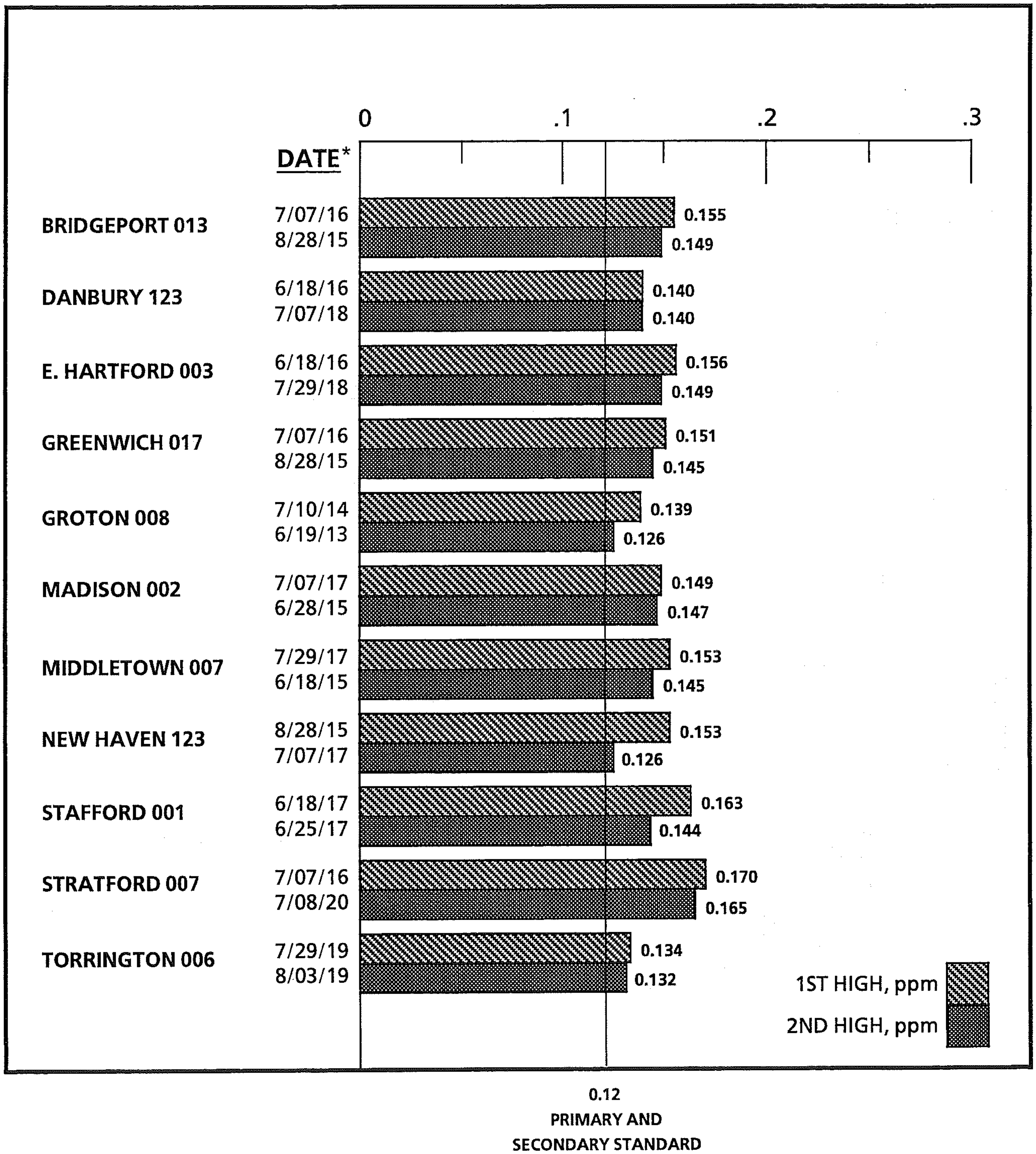
FIGURE 4-3

Location of UV Photometric Ozone Instruments

SITE KEY : ● Ozone (O_3)

FIGURE 4-4

1ST AND 2ND HIGH 1-HOUR OZONE CONCENTRATIONS IN 1993



* 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

1993 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 (4831)	OZONE	.155	.149	.128	.128	.114	.104	.101	.095	.095	.094
	DATE	7/ 7/93	8/28/93	8/27/93	7/ 8/93	6/28/93	7/ 9/93	7/28/93	7/10/93	6/18/93	8/ 3/93
METEOROLOGICAL SITE	DIR (DEG)	280	250	240	300	270	300	270	300	230	250
NEWARK	VEL (MPH)	5.7	8.0	6.3	7.1	8.6	7.5	2.8	8.8	7.6	3.9
	SPD (MPH)	7.6	10.5	7.9	8.6	9.9	8.6	9.1	9.9	9.6	7.6
	RATIO	0.742	0.765	0.802	0.821	0.867	0.874	0.309	0.885	0.790	0.515
METEOROLOGICAL SITE	DIR (DEG)	230	220	200	200	230	320	210	290	220	240
BRADLEY	VEL (MPH)	2.0	3.4	2.3	1.7	3.1	3.2	1.7	3.2	4.3	1.5
	SPD (MPH)	4.6	5.8	2.4	4.5	5.8	4.0	2.4	3.9	5.2	2.7
	RATIO	0.437	0.590	0.948	0.386	0.533	0.794	0.708	0.820	0.836	0.546
METEOROLOGICAL SITE	DIR (DEG)	250	250	240	180	250	230	230	290	240	220
BRIDGEPORT	VEL (MPH)	5.7	7.7	5.2	2.3	6.3	3.3	5.5	5.7	6.7	4.6
	SPD (MPH)	6.2	7.8	5.3	3.5	6.6	3.3	6.3	7.8	6.9	5.5
	RATIO	0.918	0.997	0.976	0.671	0.959	0.996	0.866	0.737	0.970	0.836
METEOROLOGICAL SITE	DIR (DEG)	250	260	260	280	270	290	290	270	250	260
WORCESTER	VEL (MPH)	6.0	7.4	5.4	3.0	6.0	6.1	3.3	7.6	8.0	4.7
	SPD (MPH)	6.6	7.8	6.0	5.5	6.6	6.6	5.5	8.2	8.3	5.3
	RATIO	0.914	0.950	0.899	0.551	0.906	0.917	0.604	0.932	0.965	0.889
DANBURY-123 (4851)	OZONE	.140	.140	.138	.136	.120	.113	.112	.112	.110	.110
	DATE	7/ 7/93	6/18/93	8/ 3/93	7/29/93	7/14/93	6/25/93	8/28/93	6/26/93	8/27/93	8/23/93
METEOROLOGICAL SITE	DIR (DEG)	280	230	250	260	190	210	250	220	240	190
NEWARK	VEL (MPH)	5.7	7.6	3.9	10.2	4.3	5.8	8.0	9.3	6.3	6.2
	SPD (MPH)	7.6	9.6	7.6	11.6	9.3	9.6	10.5	11.9	7.9	7.0
	RATIO	0.742	0.790	0.515	0.873	0.455	0.602	0.765	0.781	0.802	0.886
METEOROLOGICAL SITE	DIR (DEG)	230	220	240	180	170	220	220	220	200	160
BRADLEY	VEL (MPH)	2.0	4.3	1.5	4.2	4.4	2.3	3.4	5.7	2.3	2.0
	SPD (MPH)	4.6	5.2	2.7	5.8	4.5	4.7	5.8	7.3	2.4	3.3
	RATIO	0.437	0.836	0.546	0.726	0.984	0.495	0.590	0.771	0.948	0.600
METEOROLOGICAL SITE	DIR (DEG)	250	240	220	210	130	230	250	240	240	230
BRIDGEPORT	VEL (MPH)	5.7	6.7	4.6	4.0	2.3	7.1	7.7	8.8	5.2	5.0
	SPD (MPH)	6.2	6.9	5.5	5.3	4.2	7.3	7.8	9.1	5.3	5.3
	RATIO	0.918	0.970	0.836	0.757	0.552	0.963	0.997	0.973	0.976	0.933
METEOROLOGICAL SITE	DIR (DEG)	250	250	260	200	270	250	260	250	260	250
WORCESTER	VEL (MPH)	6.0	8.0	4.7	7.2	3.5	6.5	7.4	11.1	5.4	5.1
	SPD (MPH)	6.6	8.3	5.3	7.6	4.7	7.5	7.8	11.4	6.0	5.5
	RATIO	0.914	0.965	0.889	0.939	0.734	0.876	0.950	0.979	0.899	0.939
EAST HARTFORD-003 (4728)	OZONE	.156	.149	.127	.123	.123	.117	.111	.106	.106	.099
	DATE	6/18/93	7/29/93	8/ 3/93	7/ 7/93	6/25/93	6/26/93	8/ 4/93	8/28/93	8/27/93	7/30/93
METEOROLOGICAL SITE	DIR (DEG)	230	260	250	280	210	220	270	250	240	260
NEWARK	VEL (MPH)	7.6	10.2	3.9	5.7	5.8	9.3	7.7	8.0	6.3	9.5
	SPD (MPH)	9.6	11.6	7.6	7.6	9.6	11.9	8.8	10.5	7.9	10.8
	RATIO	0.790	0.873	0.515	0.742	0.602	0.781	0.884	0.765	0.802	0.879
METEOROLOGICAL SITE	DIR (DEG)	220	180	240	230	220	220	340	220	200	220
BRADLEY	VEL (MPH)	4.3	4.2	1.5	2.0	2.3	5.7	1.9	3.4	2.3	2.7
	SPD (MPH)	5.2	5.8	2.7	4.6	4.7	7.3	3.9	5.8	2.4	3.6
	RATIO	0.836	0.726	0.546	0.437	0.495	0.771	0.497	0.590	0.948	0.757

TABLE 4-3, CONTINUED

1993 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)	240	210	220	250	230	240	190	250	240	250
BRIDGEPORT	VEL (MPH)	6.7	4.0	4.6	5.7	7.1	8.8	1.3	7.7	5.2	5.8
	SPD (MPH)	6.9	5.3	5.5	6.2	7.3	9.1	4.5	7.8	5.3	6.8
	RATIO	0.970	0.757	0.836	0.918	0.963	0.973	0.291	0.997	0.976	0.852
METEOROLOGICAL SITE	DIR (DEG)	250	200	260	250	250	250	260	260	260	220
WORCESTER	VEL (MPH)	8.0	7.2	4.7	6.0	6.5	11.1	3.2	7.4	5.4	7.1
	SPD (MPH)	8.3	7.6	5.3	6.6	7.5	11.4	5.9	7.8	6.0	7.5
	RATIO	0.965	0.939	0.889	0.914	0.876	0.979	0.541	0.950	0.899	0.945
GREENWICH-017 (3976)	OZONE	.151	.145	.140	.126	.122	.115	.109	.109	.107	.105
	DATE	7/ 7/93	8/28/93	8/27/93	8/ 3/93	7/29/93	8/25/93	7/ 9/93	8/ 4/93	7/28/93	6/28/93
METEOROLOGICAL SITE	DIR (DEG)	280	250	240	250	260	330	300	270	270	270
NEWARK	VEL (MPH)	5.7	8.0	6.3	3.9	10.2	5.0	7.5	7.7	2.8	8.6
	SPD (MPH)	7.6	10.5	7.9	7.6	11.6	7.3	8.6	8.8	9.1	9.9
	RATIO	0.742	0.765	0.802	0.515	0.873	0.681	0.874	0.884	0.309	0.867
METEOROLOGICAL SITE	DIR (DEG)	230	220	200	240	180	320	320	340	210	230
BRADLEY	VEL (MPH)	2.0	3.4	2.3	1.5	4.2	3.0	3.2	1.9	1.7	3.1
	SPD (MPH)	4.6	5.8	2.4	2.7	5.8	5.3	4.0	3.9	2.4	5.8
	RATIO	0.437	0.590	0.948	0.546	0.726	0.567	0.794	0.497	0.708	0.533
METEOROLOGICAL SITE	DIR (DEG)	250	250	240	220	210	240	230	190	230	250
BRIDGEPORT	VEL (MPH)	5.7	7.7	5.2	4.6	4.0	5.1	3.3	1.3	5.5	6.3
	SPD (MPH)	6.2	7.8	5.3	5.5	5.3	5.3	3.3	4.5	6.3	6.6
	RATIO	0.918	0.997	0.976	0.836	0.757	0.963	0.996	0.291	0.866	0.959
METEOROLOGICAL SITE	DIR (DEG)	250	260	260	260	200	280	290	260	290	270
WORCESTER	VEL (MPH)	6.0	7.4	5.4	4.7	7.2	7.3	6.1	3.2	3.3	6.0
	SPD (MPH)	6.6	7.8	6.0	5.3	7.6	7.6	6.6	5.9	5.5	6.6
	RATIO	0.914	0.950	0.899	0.889	0.939	0.960	0.917	0.541	0.604	0.906
GROTON-008 (4509)	OZONE	.139	.126	.121	.117	.115	.114	.113	.098	.098	.096
	DATE	7/10/93	6/19/93	8/27/93	5/11/93	7/ 9/93	8/25/93	8/ 3/93	6/28/93	7/ 7/93	7/ 8/93
METEOROLOGICAL SITE	DIR (DEG)	300	280	240	250	300	330	250	270	280	300
NEWARK	VEL (MPH)	8.8	7.4	6.3	7.3	7.5	5.0	3.9	8.6	5.7	7.1
	SPD (MPH)	9.9	9.8	7.9	9.9	8.6	7.3	7.6	9.9	7.6	8.6
	RATIO	0.885	0.758	0.802	0.739	0.874	0.681	0.515	0.867	0.742	0.821
METEOROLOGICAL SITE	DIR (DEG)	290	310	200	280	320	320	240	230	230	200
BRADLEY	VEL (MPH)	3.2	4.9	2.3	5.9	3.2	3.0	1.5	3.1	2.0	1.7
	SPD (MPH)	3.9	5.9	2.4	8.8	4.0	5.3	2.7	5.8	4.6	4.5
	RATIO	0.820	0.827	0.948	0.670	0.794	0.567	0.546	0.533	0.437	0.386
METEOROLOGICAL SITE	DIR (DEG)	290	290	240	260	230	240	220	250	250	180
BRIDGEPORT	VEL (MPH)	5.7	4.5	5.2	9.5	3.3	5.1	4.6	6.3	5.7	2.3
	SPD (MPH)	7.8	7.5	5.3	9.5	3.3	5.3	5.5	6.6	6.2	3.5
	RATIO	0.737	0.606	0.976	0.996	0.996	0.963	0.836	0.959	0.918	0.671
METEOROLOGICAL SITE	DIR (DEG)	270	310	260	290	290	280	260	270	250	280
WORCESTER	VEL (MPH)	7.6	7.5	5.4	12.1	6.1	7.3	4.7	6.0	6.0	3.0
	SPD (MPH)	8.2	8.9	6.0	12.2	6.6	7.6	5.3	6.6	6.6	5.5
	RATIO	0.932	0.840	0.899	0.989	0.917	0.960	0.889	0.906	0.914	0.551

TABLE 4–3, CONTINUED

1993 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 (4721)	OZONE	.149	.147	.139	.127	.125	.124	.115	.114	.114	.113
	DATE	7/ 7/93	6/28/93	8/27/93	7/10/93	7/ 9/93	8/25/93	5/11/93	6/18/93	8/ 4/93	6/19/93
METEOROLOGICAL SITE	DIR (DEG)	280	270	240	300	300	330	250	230	270	280
NEWARK	VEL (MPH)	5.7	8.6	6.3	8.8	7.5	5.0	7.3	7.6	7.7	7.4
	SPD (MPH)	7.6	9.9	7.9	9.9	8.6	7.3	9.9	9.6	8.8	9.8
	RATIO	0.742	0.867	0.802	0.885	0.874	0.681	0.739	0.790	0.884	0.758
METEOROLOGICAL SITE	DIR (DEG)	230	230	200	290	320	320	280	220	340	310
BRADLEY	VEL (MPH)	2.0	3.1	2.3	3.2	3.2	3.0	5.9	4.3	1.9	4.9
	SPD (MPH)	4.6	5.8	2.4	3.9	4.0	5.3	8.8	5.2	3.9	5.9
	RATIO	0.437	0.533	0.948	0.820	0.794	0.567	0.670	0.836	0.497	0.827
METEOROLOGICAL SITE	DIR (DEG)	250	250	240	290	230	240	260	240	190	290
BRIDGEPORT	VEL (MPH)	5.7	6.3	5.2	5.7	3.3	5.1	9.5	6.7	1.3	4.5
	SPD (MPH)	6.2	6.6	5.3	7.8	3.3	5.3	9.5	6.9	4.5	7.5
	RATIO	0.918	0.959	0.976	0.737	0.996	0.963	0.996	0.970	0.291	0.606
METEOROLOGICAL SITE	DIR (DEG)	250	270	260	270	290	280	290	250	260	310
WORCESTER	VEL (MPH)	6.0	6.0	5.4	7.6	6.1	7.3	12.1	8.0	3.2	7.5
	SPD (MPH)	6.6	6.6	6.0	8.2	6.6	7.6	12.2	8.3	5.9	8.9
	RATIO	0.914	0.906	0.899	0.932	0.917	0.960	0.989	0.965	0.541	0.840
MIDDLETOWN–007 (4821)	OZONE	.153	.145	.139	.134	.129	.124	.117	.114	.110	.105
	DATE	7/29/93	6/18/93	8/28/93	8/27/93	8/ 4/93	8/ 3/93	6/25/93	6/28/93	7/ 7/93	9/ 3/93
METEOROLOGICAL SITE	DIR (DEG)	260	230	250	240	270	250	210	270	280	230
NEWARK	VEL (MPH)	10.2	7.6	8.0	6.3	7.7	3.9	5.8	8.6	5.7	9.4
	SPD (MPH)	11.6	9.6	10.5	7.9	8.8	7.6	9.6	9.9	7.6	11.5
	RATIO	0.873	0.790	0.765	0.802	0.884	0.515	0.602	0.867	0.742	0.814
METEOROLOGICAL SITE	DIR (DEG)	180	220	220	200	340	240	220	230	230	220
BRADLEY	VEL (MPH)	4.2	4.3	3.4	2.3	1.9	1.5	2.3	3.1	2.0	6.5
	SPD (MPH)	5.8	5.2	5.8	2.4	3.9	2.7	4.7	5.8	4.6	8.1
	RATIO	0.726	0.836	0.590	0.948	0.497	0.546	0.495	0.533	0.437	0.810
METEOROLOGICAL SITE	DIR (DEG)	210	240	250	240	190	220	230	250	250	220
BRIDGEPORT	VEL (MPH)	4.0	6.7	7.7	5.2	1.3	4.6	7.1	6.3	5.7	7.4
	SPD (MPH)	5.3	6.9	7.8	5.3	4.5	5.5	7.3	6.6	6.2	7.8
	RATIO	0.757	0.970	0.997	0.976	0.291	0.836	0.963	0.959	0.918	0.957
METEOROLOGICAL SITE	DIR (DEG)	200	250	260	260	260	260	250	270	250	230
WORCESTER	VEL (MPH)	7.2	8.0	7.4	5.4	3.2	4.7	6.5	6.0	6.0	9.3
	SPD (MPH)	7.6	8.3	7.8	6.0	5.9	5.3	7.5	6.6	6.6	9.8
	RATIO	0.939	0.965	0.950	0.899	0.541	0.889	0.876	0.906	0.914	0.954
NEW HAVEN–123 (4846)	OZONE	.153	.126	.123	.106	.104	.100	.095	.095	.089	.085
	DATE	8/28/93	7/ 7/93	8/27/93	6/28/93	7/ 9/93	7/10/93	8/ 4/93	7/29/93	7/11/93	6/18/93
METEOROLOGICAL SITE	DIR (DEG)	250	280	240	270	300	300	270	260	290	230
NEWARK	VEL (MPH)	8.0	5.7	6.3	8.6	7.5	8.8	7.7	10.2	8.2	7.6
	SPD (MPH)	10.5	7.6	7.9	9.9	8.6	9.9	8.8	11.6	9.3	9.6
	RATIO	0.765	0.742	0.802	0.867	0.874	0.885	0.884	0.873	0.878	0.790
METEOROLOGICAL SITE	DIR (DEG)	220	230	200	230	320	290	340	180	310	220
BRADLEY	VEL (MPH)	3.4	2.0	2.3	3.1	3.2	3.2	1.9	4.2	3.5	4.3
	SPD (MPH)	5.8	4.6	2.4	5.8	4.0	3.9	3.9	5.8	4.0	5.2
	RATIO	0.590	0.437	0.948	0.533	0.794	0.820	0.497	0.726	0.866	0.836

TABLE 4-3, CONTINUED

1993 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	250	240	250	230	290	190	210	270	240
BRIDGEPORT	VEL (MPH)	7.7	5.7	5.2	6.3	3.3	5.7	1.3	4.0	6.4	6.7
	SPD (MPH)	7.8	6.2	5.3	6.6	3.3	7.8	4.5	5.3	7.5	6.9
	RATIO	0.997	0.918	0.976	0.959	0.996	0.737	0.291	0.757	0.856	0.970
METEOROLOGICAL SITE	DIR (DEG)	260	250	260	270	290	270	260	200	270	250
WORCESTER	VEL (MPH)	7.4	6.0	5.4	6.0	6.1	7.6	3.2	7.2	7.4	8.0
	SPD (MPH)	7.8	6.6	6.0	6.6	6.6	8.2	5.9	7.6	7.6	8.3
	RATIO	0.950	0.914	0.899	0.906	0.917	0.932	0.541	0.939	0.970	0.965
STAFFORD-001 (4809)	OZONE	.163	.144	.130	.124	.123	.121	.120	.118	.106	.106
	DATE	6/18/93	6/25/93	7/29/93	6/26/93	8/28/93	8/27/93	8/ 4/93	8/ 3/93	7/14/93	9/ 3/93
METEOROLOGICAL SITE	DIR (DEG)	230	210	260	220	250	240	270	250	190	230
NEWARK	VEL (MPH)	7.6	5.8	10.2	9.3	8.0	6.3	7.7	3.9	4.3	9.4
	SPD (MPH)	9.6	9.6	11.6	11.9	10.5	7.9	8.8	7.6	9.3	11.5
	RATIO	0.790	0.602	0.873	0.781	0.765	0.802	0.884	0.515	0.455	0.814
METEOROLOGICAL SITE	DIR (DEG)	220	220	180	220	220	200	340	240	170	220
BRADLEY	VEL (MPH)	4.3	2.3	4.2	5.7	3.4	2.3	1.9	1.5	4.4	6.5
	SPD (MPH)	5.2	4.7	5.8	7.3	5.8	2.4	3.9	2.7	4.5	8.1
	RATIO	0.836	0.495	0.726	0.771	0.590	0.948	0.497	0.546	0.984	0.810
METEOROLOGICAL SITE	DIR (DEG)	240	230	210	240	250	240	190	220	130	220
BRIDGEPORT	VEL (MPH)	6.7	7.1	4.0	8.8	7.7	5.2	1.3	4.6	2.3	7.4
	SPD (MPH)	6.9	7.3	5.3	9.1	7.8	5.3	4.5	5.5	4.2	7.8
	RATIO	0.970	0.963	0.757	0.973	0.997	0.976	0.291	0.836	0.552	0.957
METEOROLOGICAL SITE	DIR (DEG)	250	250	200	250	260	260	260	260	270	230
WORCESTER	VEL (MPH)	8.0	6.5	7.2	11.1	7.4	5.4	3.2	4.7	3.5	9.3
	SPD (MPH)	8.3	7.5	7.6	11.4	7.8	6.0	5.9	5.3	4.7	9.8
	RATIO	0.965	0.876	0.939	0.979	0.950	0.899	0.541	0.889	0.734	0.954
STRATFORD-007 (4894)	OZONE	.170	.165	.146	.139	.137	.133	.122	.119	.117	.111
	DATE	7/ 7/93	7/ 8/93	8/27/93	6/28/93	8/28/93	8/25/93	7/ 9/93	7/28/93	8/ 4/93	8/ 3/93
METEOROLOGICAL SITE	DIR (DEG)	280	300	240	270	250	330	300	270	270	250
NEWARK	VEL (MPH)	5.7	7.1	6.3	8.6	8.0	5.0	7.5	2.8	7.7	3.9
	SPD (MPH)	7.6	8.6	7.9	9.9	10.5	7.3	8.6	9.1	8.8	7.6
	RATIO	0.742	0.821	0.802	0.867	0.765	0.681	0.874	0.309	0.884	0.515
METEOROLOGICAL SITE	DIR (DEG)	230	200	200	230	220	320	320	210	340	240
BRADLEY	VEL (MPH)	2.0	1.7	2.3	3.1	3.4	3.0	3.2	1.7	1.9	1.5
	SPD (MPH)	4.6	4.5	2.4	5.8	5.8	5.3	4.0	2.4	3.9	2.7
	RATIO	0.437	0.386	0.948	0.533	0.590	0.567	0.794	0.708	0.497	0.546
METEOROLOGICAL SITE	DIR (DEG)	250	180	240	250	250	240	230	230	190	220
BRIDGEPORT	VEL (MPH)	5.7	2.3	5.2	6.3	7.7	5.1	3.3	5.5	1.3	4.6
	SPD (MPH)	6.2	3.5	5.3	6.6	7.8	5.3	3.3	6.3	4.5	5.5
	RATIO	0.918	0.671	0.976	0.959	0.997	0.963	0.996	0.866	0.291	0.836
METEOROLOGICAL SITE	DIR (DEG)	250	280	260	270	260	280	290	290	260	260
WORCESTER	VEL (MPH)	6.0	3.0	5.4	6.0	7.4	7.3	6.1	3.3	3.2	4.7
	SPD (MPH)	6.6	5.5	6.0	6.6	7.8	7.6	6.6	5.5	5.9	5.3
	RATIO	0.914	0.551	0.899	0.906	0.950	0.960	0.917	0.604	0.541	0.889

TABLE 4-3, CONTINUED

1993 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 (4851)	OZONE	.134	.132	.128	.125	.118	.113	.108	.105	.105	.100
	DATE	7/29/93	8/ 3/93	7/14/93	6/25/93	6/18/93	6/14/93	6/26/93	7/ 6/93	8/ 2/93	8/24/93
METEOROLOGICAL SITE	DIR (DEG)	260	250	190	210	230	180	220	150	210	200
NEWARK	VEL (MPH)	10.2	3.9	4.3	5.8	7.6	5.7	9.3	4.3	7.0	7.1
	SPD (MPH)	11.6	7.6	9.3	9.6	9.6	8.6	11.9	7.2	10.8	9.3
	RATIO	0.873	0.515	0.455	0.602	0.790	0.661	0.781	0.603	0.654	0.760
METEOROLOGICAL SITE	DIR (DEG)	180	240	170	220	220	200	220	190	190	190
BRADLEY	VEL (MPH)	4.2	1.5	4.4	2.3	4.3	4.1	5.7	5.9	3.9	6.7
	SPD (MPH)	5.8	2.7	4.5	4.7	5.2	5.2	7.3	6.9	7.3	7.9
	RATIO	0.726	0.546	0.984	0.495	0.836	0.798	0.771	0.856	0.528	0.848
METEOROLOGICAL SITE	DIR (DEG)	210	220	130	230	240	230	240	220	220	240
BRIDGEPORT	VEL (MPH)	4.0	4.6	2.3	7.1	6.7	7.5	8.8	5.4	7.4	8.6
	SPD (MPH)	5.3	5.5	4.2	7.3	6.9	7.9	9.1	5.9	7.5	8.6
	RATIO	0.757	0.836	0.552	0.963	0.970	0.949	0.973	0.916	0.990	0.997
METEOROLOGICAL SITE	DIR (DEG)	200	260	270	250	250	270	250	230	210	210
WORCESTER	VEL (MPH)	7.2	4.7	3.5	6.5	8.0	6.1	11.1	10.2	5.5	9.2
	SPD (MPH)	7.6	5.3	4.7	7.5	8.3	7.0	11.4	10.4	8.3	9.3
	RATIO	0.939	0.889	0.734	0.876	0.965	0.870	0.979	0.985	0.654	0.985

FIGURE 4-5

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

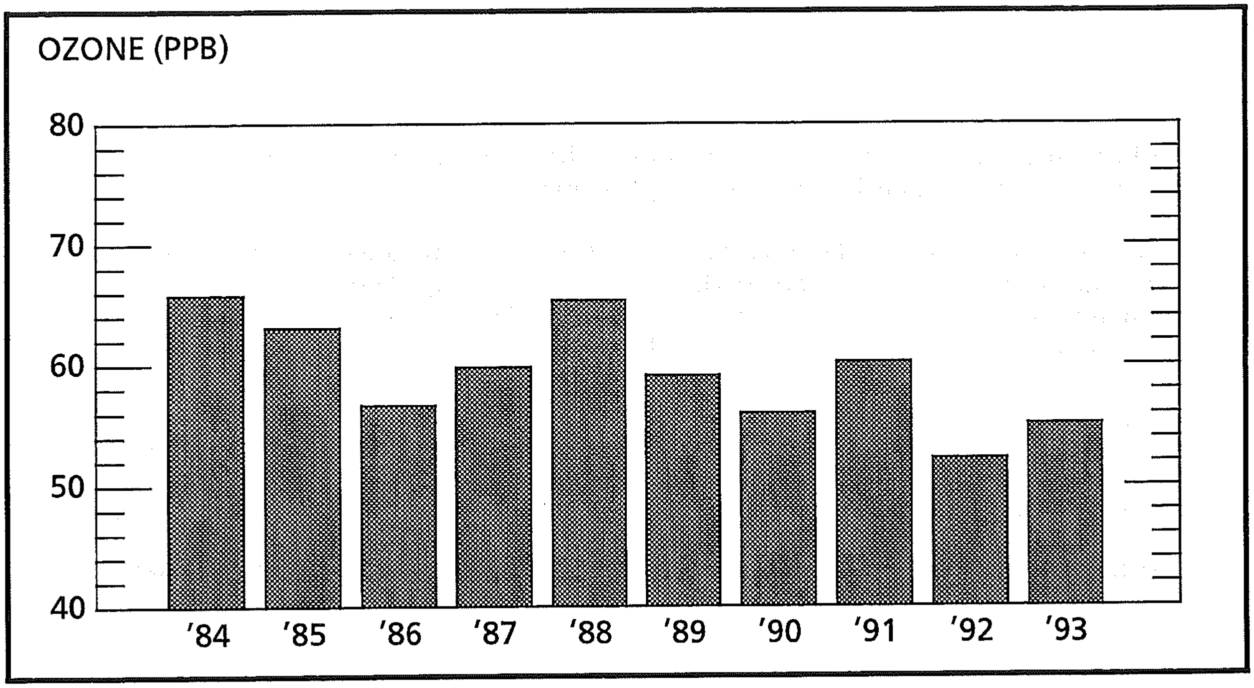
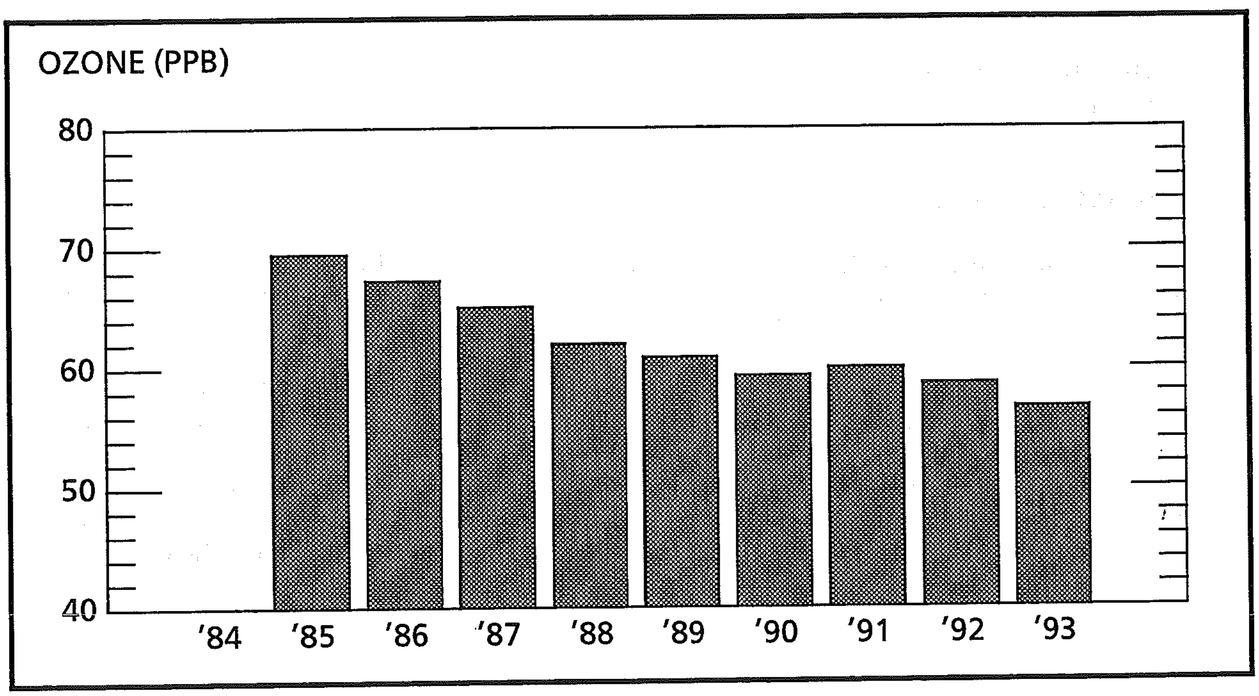


FIGURE 4-6

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 1993. 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 1993 (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 - Seventy-six precision checks were made on the NO_2 monitors in 1993, yielding 95% probability limits ranging from -11% to +12%. Accuracy is determined by introducing a known amount of NO_2 into each of the monitors. Five audits for accuracy were conducted on the monitoring network in 1993. 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 0% to +3%; those for the low/medium level test ranged from -7% to +5%; those for the medium/high level test ranged from -5% to +6%; and those for the high level test ranged from -6% to +6%.

Annual Averages - The annual average NO_2 standard of 100 $\mu g/m^3$ was not exceeded in 1993 at any site in Connecticut (see Table 5-1). In 1993, all three sites had sufficient data to compute valid arithmetic means. This permits comparisons with the 1991 and 1992 annual averages. Notwithstanding an increase from 1992 to 1993 at all three sites, the annual average NO_2 concentrations were down at all three sites between 1991 and 1993.

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 1993.

10-High Days with Wind Data - Table 5-2 presents for each site the ten days in 1993 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, 19 of the 22 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, and using the data from Bradley for East Hartford 003, one finds that 63% 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 average of the annual NO_2 concentrations at the three monitoring sites is 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 in 1993. In spite of the choppiness, there does appear to be a downward trend 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 nine years.

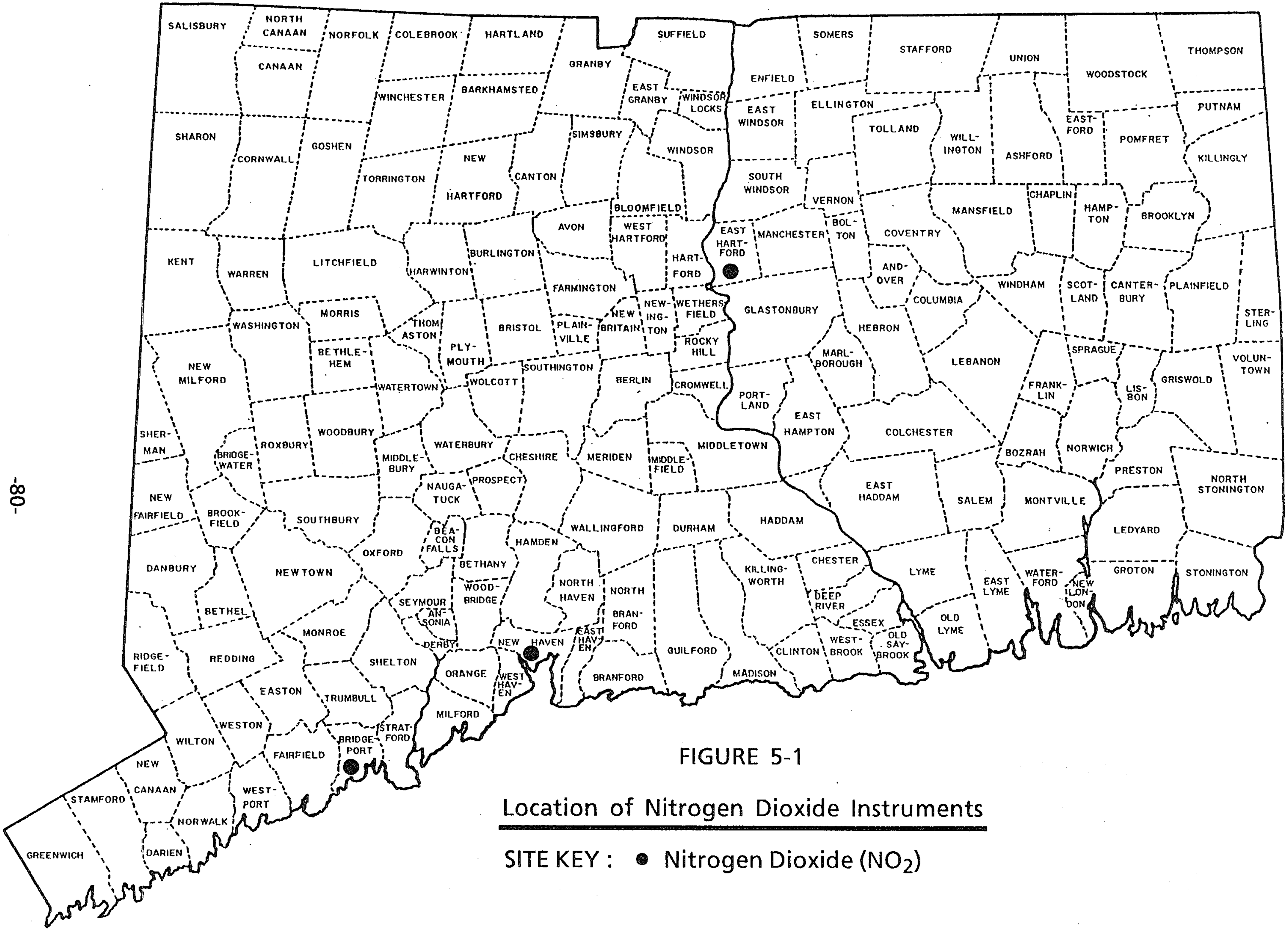


FIGURE 5-1

Location of Nitrogen Dioxide Instruments

SITE KEY : ● Nitrogen Dioxide (NO_2)

TABLE 5-1

1991 -1993 NITROGEN DIOXIDE ANNUAL AVERAGES

Town Name	Site	Year	Samples	Arithmetic Mean	95-Percent-Limits Lower	95-Percent-Limits Upper	Standard Deviation
Bridgeport	013	1991	8500	46.72	46.63	46.82	24.88
Bridgeport	013	1992	8595	44.86	44.78	44.93	24.14
Bridgeport	013	1993	8347	45.64	45.53	45.76	23.80
East Hartford	003	1991	7541	38.21	38.03	38.40	21.75
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
New Haven	123	1991	8575	51.98	51.91	52.06	25.06
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

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

TABLE 5-2

1993 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 (8347)	NO2	.087	.085	.081	.079	.076	.074	.071	.071	.070	.070
	DATE	5/11/93	5/23/93	3/ 2/93	3/ 3/93	5/ 9/93	7/ 9/93	10/ 8/93	5/24/93	2/10/93	6/ 9/93
METEOROLOGICAL SITE	DIR (DEG)	250	300	300	50	230	300	220	230	220	240
NEWARK	VEL (MPH)	7.3	9.4	6.2	3.4	6.9	7.5	4.8	7.2	6.1	4.2
	SPD (MPH)	9.9	13.4	8.1	5.0	8.2	8.6	6.9	9.6	7.3	8.3
	RATIO	0.739	0.702	0.769	0.675	0.845	0.874	0.700	0.753	0.834	0.501
METEOROLOGICAL SITE	DIR (DEG)	280	320	320	30	30	320	180	190	220	150
BRADLEY	VEL (MPH)	5.9	6.3	6.0	4.3	2.3	3.2	3.8	6.3	5.7	2.8
	SPD (MPH)	8.8	7.5	6.9	5.8	3.5	4.0	6.0	6.5	9.3	4.9
	RATIO	0.670	0.841	0.869	0.743	0.680	0.794	0.634	0.974	0.614	0.577
METEOROLOGICAL SITE	DIR (DEG)	260	320	320	240	250	230	270	230	230	220
BRIDGEPORT	VEL (MPH)	9.5	4.1	4.2	1.3	5.5	3.3	6.0	5.7	4.9	2.3
	SPD (MPH)	9.5	9.5	5.0	1.3	5.8	3.3	6.3	5.9	4.9	2.9
	RATIO	0.996	0.428	0.836	0.985	0.955	0.996	0.941	0.974	0.997	0.813
METEOROLOGICAL SITE	DIR (DEG)	290	330	300	320	350	290	220	220	260	230
WORCESTER	VEL (MPH)	12.1	8.2	7.1	5.1	3.1	6.1	5.5	6.0	10.0	6.0
	SPD (MPH)	12.2	8.9	7.2	5.5	4.7	6.6	5.6	6.5	10.6	6.2
	RATIO	0.989	0.919	0.991	0.938	0.648	0.917	0.972	0.931	0.938	0.977
EAST HARTFORD-003 (8505)	NO2	.067	.067	.064	.064	.063	.062	.060	.059	.059	.058
	DATE	3/ 3/93	3/ 2/93	2/10/93	3/26/93	6/ 3/93	3/ 4/93	11/22/93	3/ 7/93	3/19/93	3/ 1/93
METEOROLOGICAL SITE	DIR (DEG)	50	300	220	50	270	50	250	270	30	280
NEWARK	VEL (MPH)	3.4	6.2	6.1	4.5	4.2	18.5	6.9	9.1	6.3	5.8
	SPD (MPH)	5.0	8.1	7.3	5.6	6.9	19.4	8.9	11.9	9.6	8.5
	RATIO	0.675	0.769	0.834	0.795	0.612	0.955	0.771	0.767	0.655	0.689
METEOROLOGICAL SITE	DIR (DEG)	30	320	220	20	260	30	210	250	340	320
BRADLEY	VEL (MPH)	4.3	6.0	5.7	1.7	3.6	12.7	6.5	5.1	3.8	6.2
	SPD (MPH)	5.8	6.9	9.3	3.5	4.2	13.4	8.2	7.8	6.2	7.9
	RATIO	0.743	0.869	0.614	0.483	0.855	0.948	0.791	0.655	0.610	0.787
METEOROLOGICAL SITE	DIR (DEG)	240	320	230	270	250	80	270	250	60	340
BRIDGEPORT	VEL (MPH)	1.3	4.2	4.9	2.1	7.4	19.6	7.4	8.5	3.0	5.5
	SPD (MPH)	1.3	5.0	4.9	4.2	7.8	20.1	7.9	8.8	5.9	6.3
	RATIO	0.985	0.836	0.997	0.497	0.948	0.972	0.942	0.973	0.507	0.865
METEOROLOGICAL SITE	DIR (DEG)	320	300	260	80	280	70	240	270	60	310
WORCESTER	VEL (MPH)	5.1	7.1	10.0	1.0	8.6	13.8	9.9	7.6	3.4	8.5
	SPD (MPH)	5.5	7.2	10.6	4.0	8.8	13.9	10.1	8.2	4.9	8.8
	RATIO	0.938	0.991	0.938	0.242	0.978	0.993	0.982	0.929	0.700	0.974
NEW HAVEN-123 (8157)	NO2	.107	.100	.092	.089	.089	.083	.081	.081	.081	.078
	DATE	7/ 9/93	8/25/93	3/ 3/93	6/28/93	5/ 9/93	3/ 2/93	7/29/93	5/25/93	5/11/93	7/12/93
METEOROLOGICAL SITE	DIR (DEG)	300	330	50	270	230	300	260	270	250	300
NEWARK	VEL (MPH)	7.5	5.0	3.4	8.6	6.9	6.2	10.2	9.6	7.3	7.6
	SPD (MPH)	8.6	7.3	5.0	9.9	8.2	8.1	11.6	12.5	9.9	9.3
	RATIO	0.874	0.681	0.675	0.867	0.845	0.769	0.873	0.767	0.739	0.811
METEOROLOGICAL SITE	DIR (DEG)	320	320	30	230	30	320	180	260	280	320
BRADLEY	VEL (MPH)	3.2	3.0	4.3	3.1	2.3	6.0	4.2	7.6	5.9	.9
	SPD (MPH)	4.0	5.3	5.8	5.8	3.5	6.9	5.8	11.1	8.8	1.0
	RATIO	0.794	0.567	0.743	0.533	0.680	0.869	0.726	0.684	0.670	0.908

TABLE 5-2, CONTINUED

1993 TEN HIGHEST 1-HOUR AVERAGE NO_2 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	240	250	250	320	210	240	260	320
BRIDGEPORT	VEL (MPH)	3.3	5.1	1.3	6.3	5.5	4.2	4.0	7.7	9.5	5.0
	SPD (MPH)	3.3	5.3	1.3	6.6	5.8	5.0	5.3	8.1	9.5	5.9
	RATIO	0.996	0.963	0.985	0.959	0.955	0.836	0.757	0.962	0.996	0.856
METEOROLOGICAL SITE	DIR (DEG)	290	280	320	270	350	300	200	250	290	240
WORCESTER	VEL (MPH)	6.1	7.3	5.1	6.0	3.1	7.1	7.2	9.3	12.1	5.3
	SPD (MPH)	6.6	7.6	5.5	6.6	4.7	7.2	7.6	9.6	12.2	5.8
	RATIO	0.917	0.960	0.938	0.906	0.648	0.991	0.939	0.962	0.989	0.930

FIGURE 5-2

AVERAGES OF THE ANNUAL NO_2 CONCENTRATIONS AT THREE SITES

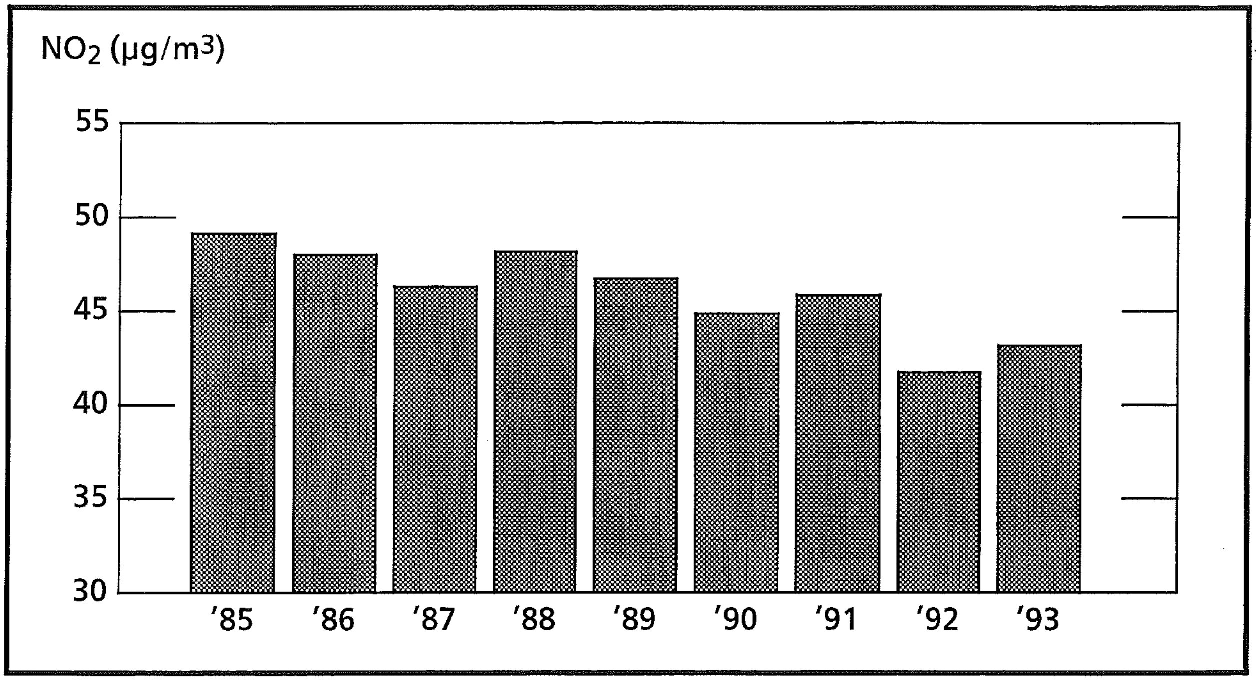
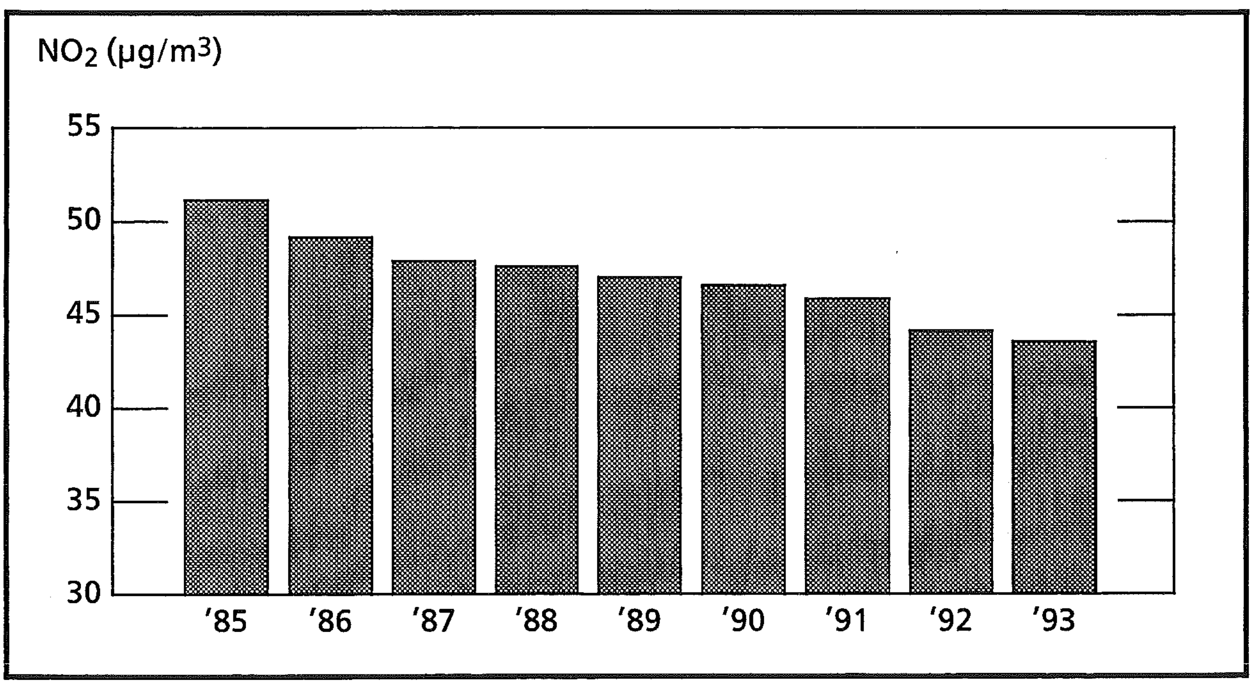


FIGURE 5-3

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 1993. 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 Unit 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 1993 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 201 precision checks during 1993. The resulting 95% probability limits were -3% to +5%. Accuracy is determined by introducing a known amount of CO into each of the monitors. Six audits for accuracy were conducted on the monitoring network in 1993. Three different concentration levels were tested on each monitor: low, medium and high. The 95% probability limits ranged from -7% to +7% for the low level test; -8% to +2% for the medium level test; and -8% to +3% 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 1993 (see Table 6-1).

Regarding the maximum 8-hour running average at each site, there were decreases from 1992 to 1993 at all five monitoring sites. The second highest 8-hour running average also decreased from 1992 to 1993 at each site.

As for 1-hour averages, no site in the state recorded a value exceeding the primary 1-hour standard of 35 ppm. However, Bridgeport 004 and New Haven 019 recorded maximum 1-hour values that were higher than the year before. And the second high 1-hour values at Hartford 013 and New Haven 019 were higher in 1993.

The maximum and second high CO concentrations at each site are presented in Table 6-1. Table 6-2 presents monthly highs and a monthly tally of the number of times the standards were exceeded 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.

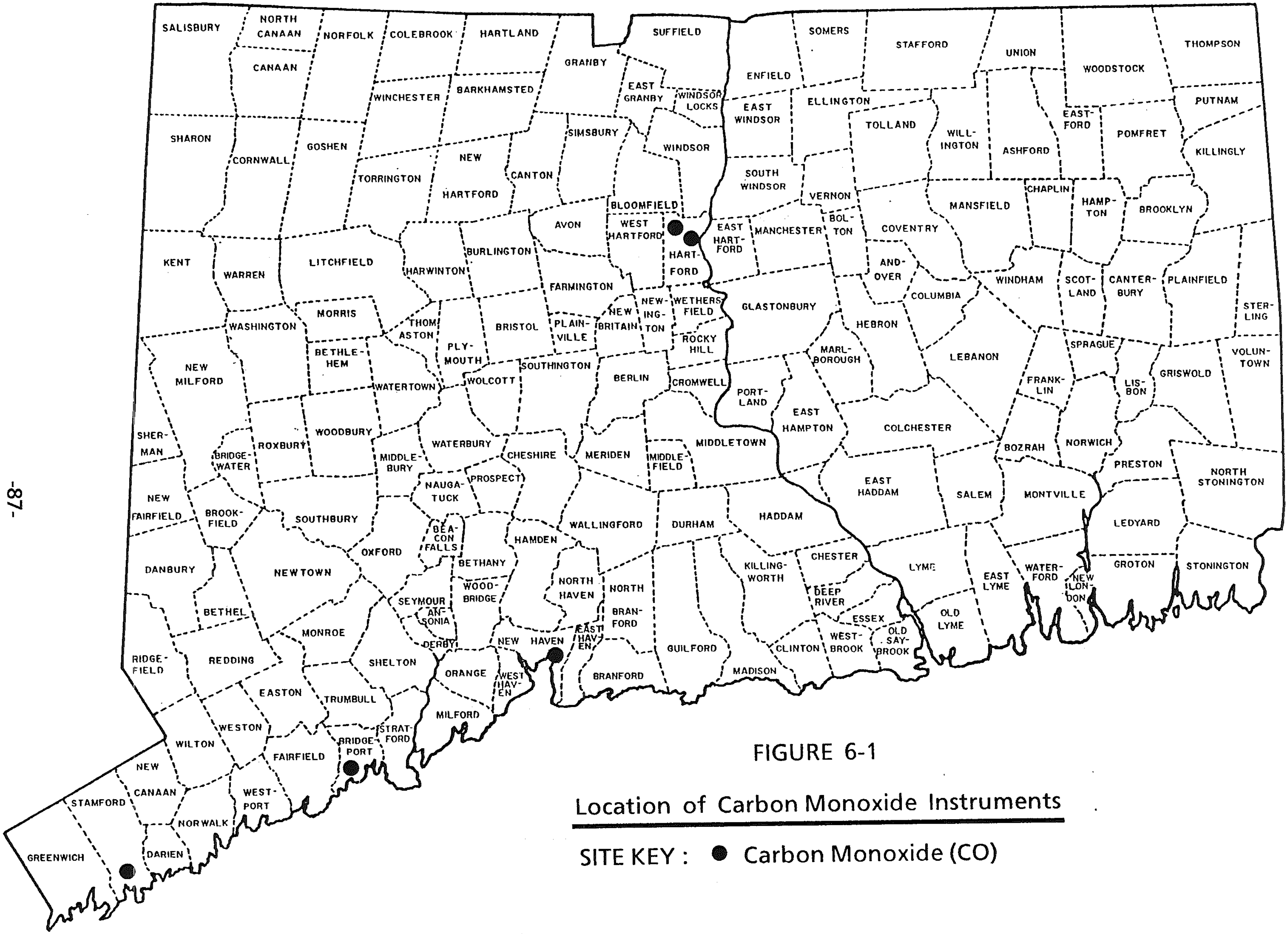


FIGURE 6-1

Location of Carbon Monoxide Instruments

SITE KEY : ● Carbon Monoxide (CO)

TABLE 6-1

1993 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	3.8	02/11/01	3.7	01/08/01	8.7	02/03/18	6.5	02/10/22
Hartford-013	4.2	11/11/02	3.9	01/22/23	5.8	01/22/21	5.6	01/22/20
Hartford-017	7.5	02/10/23	7.2	01/22/20	16.7	02/10/18	12.5	03/17/17
New Haven-019	6.6	02/03/23	4.9	02/01/01	9.8	02/03/18	8.9	02/03/19
Stamford-020	5.2	11/09/23	5.2	11/22/24	8.3	11/09/19	8.3	11/22/19

[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.

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

TABLE 6-2

1993 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	4.9	8.7	4.4	3.6	2.7	3.5	4.0	2.3	3.8	5.7	5.7	6.1
	Max. Running 8-Hour	3.7	3.8	3.1	2.4	2.0	1.9	2.6	2.0	3.0	3.2	3.6	3.5
	Month	1.2	1.0	1.2	1.0	1.1	1.0	1.1	1.2	1.1	1.1	1.2	1.1
Hartford-013	Max. 1-Hour	5.8	4.3	2.9	3.6	1.9	2.5	2.2	1.8	1.5	3.2	4.8	4.9
	Max. Running 8-Hour	3.9	3.1	2.5	1.6	1.4	1.5	1.6	1.5	1.4	2.1	4.2	3.8
	Month	1.0	0.8	0.8	0.6	0.5	0.6	0.6	0.6	0.7	0.8	1.1	1.1
Hartford-017	Max. 1-Hour	9.3	16.7	12.5	6.3	5.7	5.4	6.0	5.1	5.5	8.7	11.4	7.1
	Max. Running 8-Hour	7.2	7.5	5.2	3.7	3.5	3.1	3.7	3.5	4.0	4.8	7.1	5.8
	Month	2.0	2.0	1.9	1.4	1.3	1.5	1.5	1.4	1.5	1.7	2.1	2.2
New Haven-019	Max. 1-Hour	7.0	9.8	5.8	3.5	3.8	2.6	3.3	3.2	3.6	5.2	5.7	4.4
	Max. Running 8-Hour	4.5	6.6	4.4	2.6	2.9	2.2	2.5	2.4	2.7	3.7	4.1	3.1
	Month	1.5	1.5	1.5	1.2	1.2	1.1	1.0	1.1	1.1	1.2	1.5	1.2
Stamford-020	Max. 1-Hour	4.8	7.3	6.5	4.0	4.3	3.6	5.6	4.5	5.4	6.5	8.3	8.0
	Max. Running 8-Hour	3.8	4.8	4.4	2.7	3.0	2.5	2.6	2.7	3.0	3.9	5.2	5.0
	Month	1.7	1.8	1.7	1.2	1.4	1.4	1.5	1.3	1.4	1.6	2.0	1.9
NETWORK	Month	1.5	1.4	1.4	1.1	1.1	1.1	1.1	1.1	1.2	1.3	1.6	1.5

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

TABLE 6-3

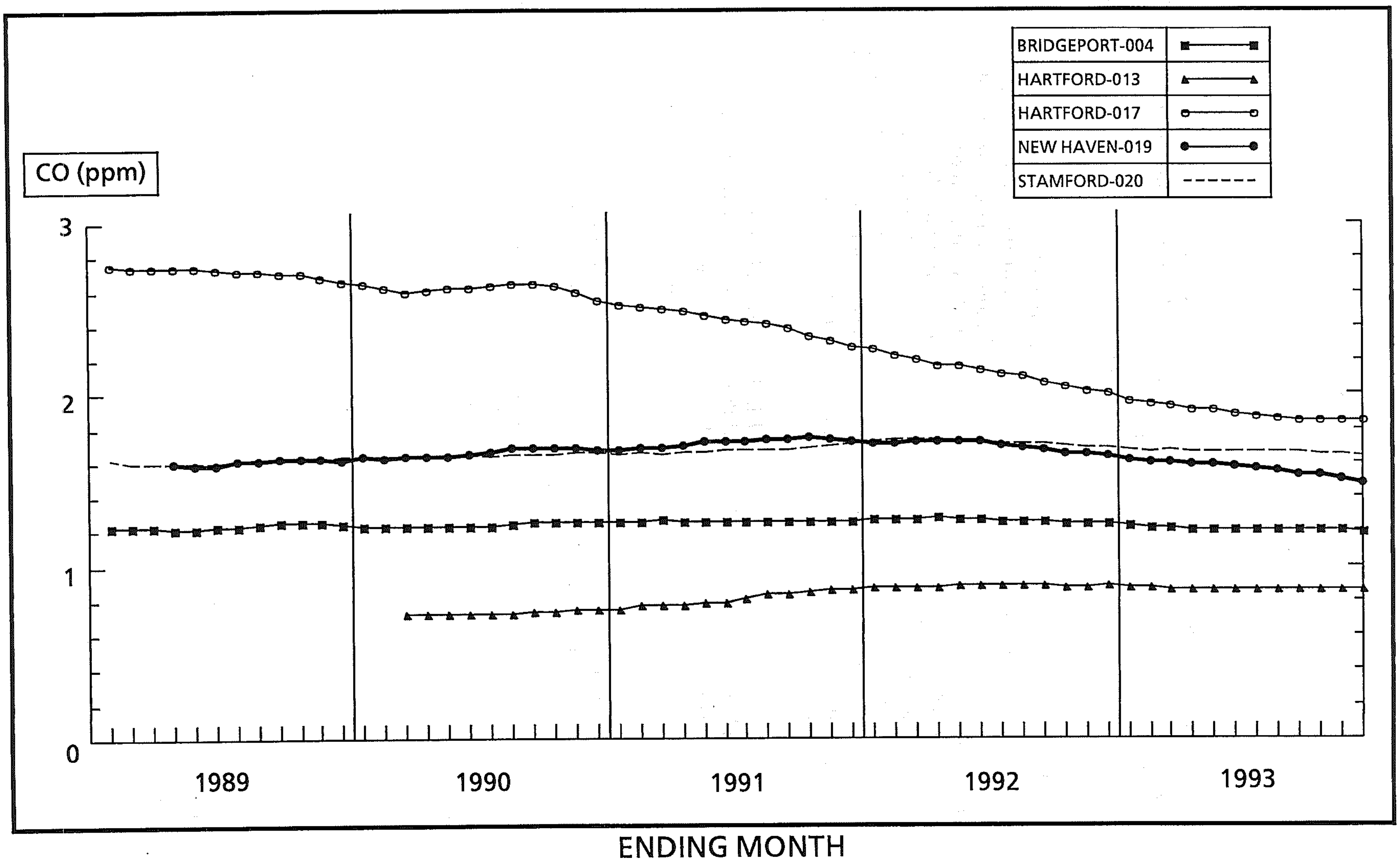
EXCEEDANCES OF THE 8-HOUR CO STANDARD FOR 1989 -1993

SITE	1989	1990	1991	1992	1993
Bridgeport-004	0	0	0	0	0
Hartford-013	0	0[a]	0	0	0
Hartford-017	1	0	1	1	0
New Haven-019	0	0	0	0	0
Stamford-020	0	0	0	0	0

[a] Data are missing for April through most of October due to road construction.

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 1993, these source categories contributed 47%, 11% and 33%, 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 1993.

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 1993 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 1993, only hi-vol samplers were operated in Connecticut to monitor lead levels. There were 5 such samplers operated throughout the state by the DEP in 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 samplers were terminated: Hartford 013 and New Haven 013. By the end of 1989, the two 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 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 realistic. Accuracy for lead can be assessed in two ways. One is by auditing the air flow through the monitors. Six audits for flow accuracy were conducted on the monitoring network in 1993. The probability limits ranged from -15% to +3%. 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, 9 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 -10% to +9%; those for the high level ranged from -4% to +1%.

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 1993 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.

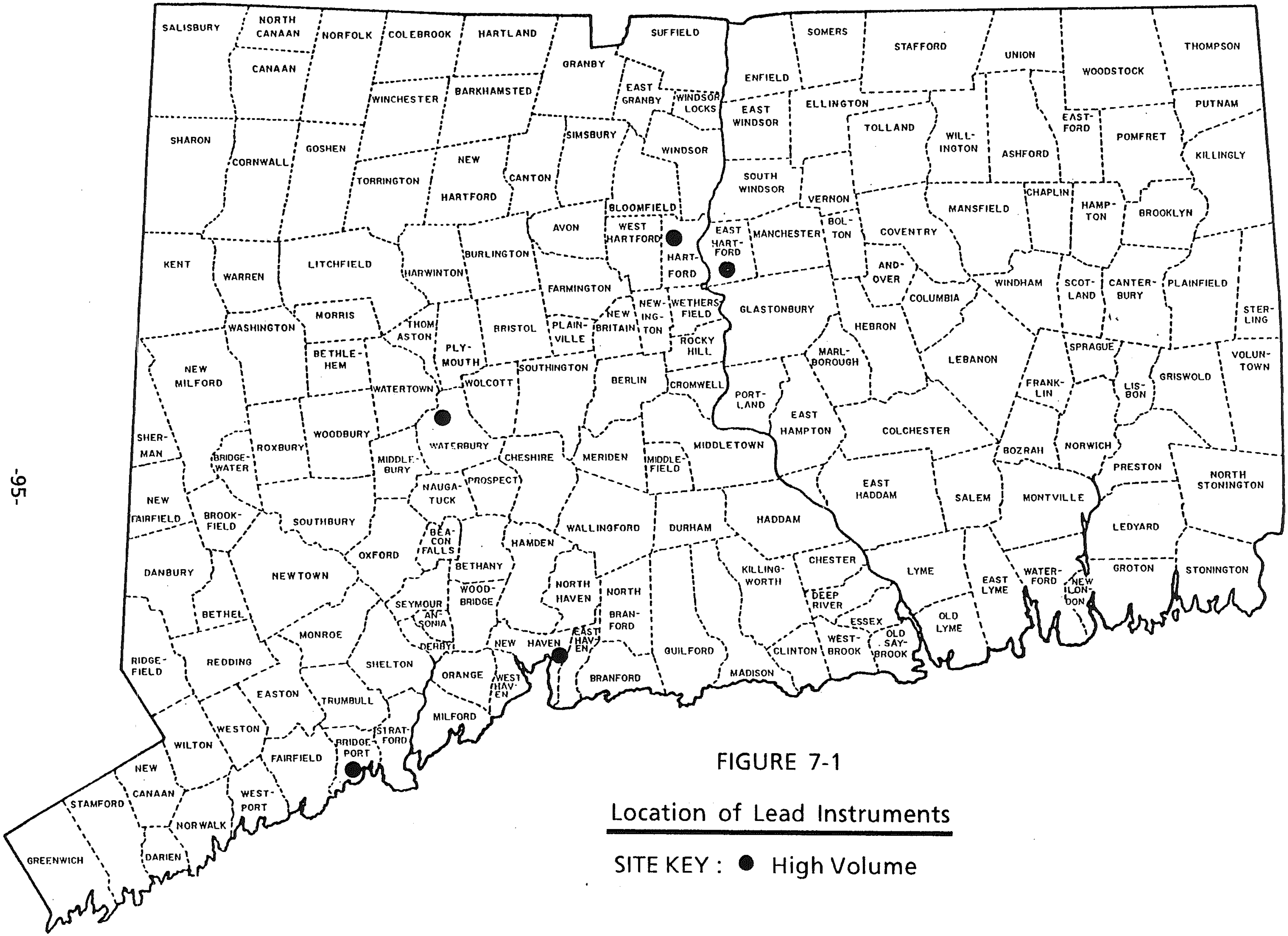


FIGURE 7-1

Location of Lead Instruments

SITE KEY : ● High Volume

TABLE 7-1

1993 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	0.01	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01
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	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01
New Haven-018	0.12	0.14	0.15	0.14	0.13	0.16	0.21	0.28	0.25	0.24	0.24	0.26
Waterbury-123	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01

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

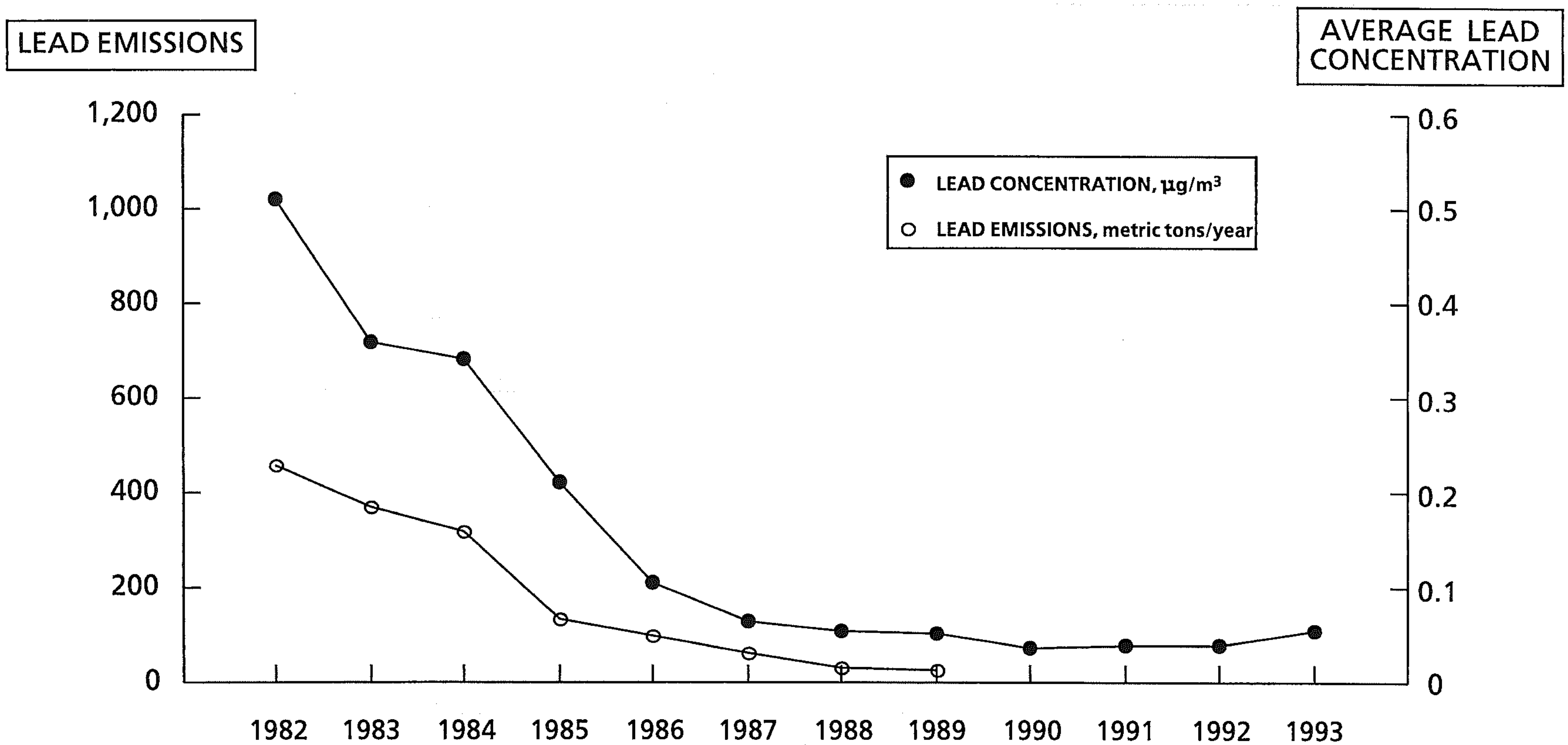
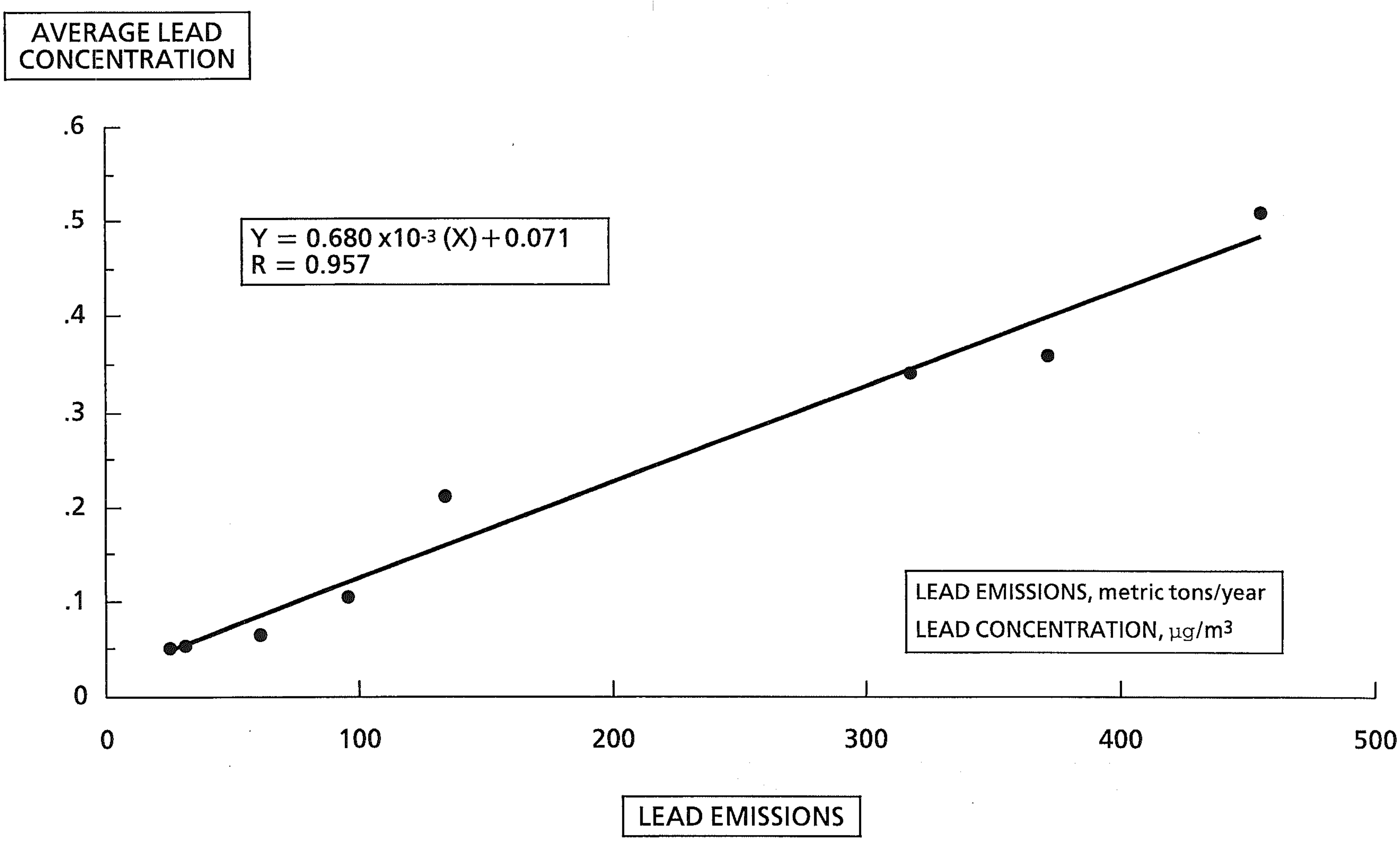


FIGURE 7-3

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 1992 and 1993. 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 1993 National Weather Service surface observations and are shown in Figures 8-2 and 8-4, respectively. Wind roses from these stations for 1992 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

1992 AND 1993 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)		
	1992	1993	Mean[a]	1992	1993	Mean[b]	1992	1993	Normal[c]	1992	1993	Mean[a]	1992	1993	Mean[d]	1992	1993	Mean[d]
Jan	28.6	28.8	26.6	0	0	0.0	1122	1114	1252	2.73	2.63	3.50	5	11	10.5	9.7	9.2	9.0
Feb	30.3	23.8	27.9	0	0	0.0	1002	1148	1050	2.23	2.90	3.17	14	7	10.3	10.4	10.5	9.5
Mar	34.6	34.5	37.2	0	0	0.0	936	935	853	3.79	6.67	3.74	13	14	11.4	10.5	10.2	10.0
Apr	46.4	49.6	48.2	0	0	0.3	553	454	489	3.13	4.71	3.76	11	15	11.2	9.8	9.3	10.0
May	58.5	61.2	59.3	3	1	1.2	218	139	194	3.21	1.92	3.71	11	8	11.7	8.5	6.9	8.8
Jun	66.4	68.6	67.9	0	3	3.4	37	43	20	5.77	2.63	3.59	10	11	11.3	8.7	6.2	8.1
Jul	69.9	74.3	73.2	2	7	7.6	9	3	0	4.62	4.90	3.57	15	9	9.7	8.2	4.7	7.4
Aug	69.1	73.4	71.0	2	7	4.8	16	4	6	3.60	1.80	3.91	10	8	9.8	8.4	4.5	7.2
Sep	62.6	63.0	63.5	0	1	1.3	138	142	96	2.43	5.35	3.62	8	13	9.5	8.5	5.6	7.3
Oct	49.2	49.8	53.0	0	0	*	486	464	397	1.95	4.15	3.24	11	12	8.5	7.9	7.1	7.8
Nov	40.6	40.8	42.1	0	0	0.0	722	722	693	4.19	3.27	3.83	13	12	11.2	7.8	7.0	8.5
Dec	31.2	30.9	30.4	0	0	0.0	1042	1049	1101	4.33	4.16	3.71	13	10	11.9	9.2	8.0	8.7
YEAR	49.0	49.9	50.0	7	19	18.8	6281	6217	6151	41.98	45.09	43.35	134	130	127.0	9.0	7.4	8.5

* Less than 0.05
[a] 1905-1993
[b] 1960-1993
[c] 1961-1990
[d] 1955-1993

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

TABLE 8-2

1992 AND 1993 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)		
	1992	1993	Mean[a]	1992	1993	Mean[b]	1992	1993	Normal[c]	1992	1993	Mean[d]	1992	1993	Mean[e]	1992	1993	Mean[f]
Jan	32.2	33.6	28.7	0	0	0.0	1012	966	1119	1.92	2.60	3.52	8	13	10.6	---	---	13.2
Feb	33.8	27.9	30.6	0	0	0.0	895	1036	969	2.12	2.60	3.21	13	8	9.7	---	---	13.6
Mar	37.1	36.7	38.0	0	0	0.0	859	871	818	3.64	6.75	3.94	11	12	11.2	---	---	13.5
Apr	46.5	49.2	48.1	0	0	*	548	465	504	1.89	3.50	3.82	10	13	10.6	---	---	13.0
May	58.0	61.4	58.5	0	0	0.2	225	127	219	2.85	2.25	3.74	11	8	11.0	---	---	11.6
Jun	67.1	70.0	67.8	0	2	1.0	23	27	18	5.13	1.42	3.33	8	10	9.6	---	---	10.5
Jul	71.1	76.7	73.4	1	8	3.2	4	2	0	3.76	1.58	3.69	14	5	8.5	---	---	10.0
Aug	70.4	75.3	72.1	0	6	1.8	3	0	0	8.38	1.58	4.06	10	9	9.3	---	---	10.1
Sep	65.0	65.7	65.2	0	1	0.4	80	89	54	5.32	6.60	3.49	10	14	8.6	---	---	11.2
Oct	52.1	53.3	54.6	0	0	0.0	393	358	302	2.42	4.00	3.36	11	8	7.3	---	---	11.9
Nov	44.7	45.0	44.2	0	0	0.0	599	597	582	4.46	1.71	3.78	11	5	10.0	---	---	12.7
Dec	36.0	35.5	33.3	0	0	0.0	892	909	952	4.30	4.54	3.64	11	9	11.2	---	---	13.0
YEAR	51.2	52.5	51.2	1	17	6.6	5533	5447	5537	46.19	39.13	43.58	128	114	117.7	---	---	12.0

* Less than 0.05
[a] 1903-1993
[b] 1966-1993
[c] 1961-1990
[d] 1894-1993
[e] 1949-1993
[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 1992
BRADLEY INTERNATIONAL AIRPORT
WINDSOR LOCKS, CONNECTICUT

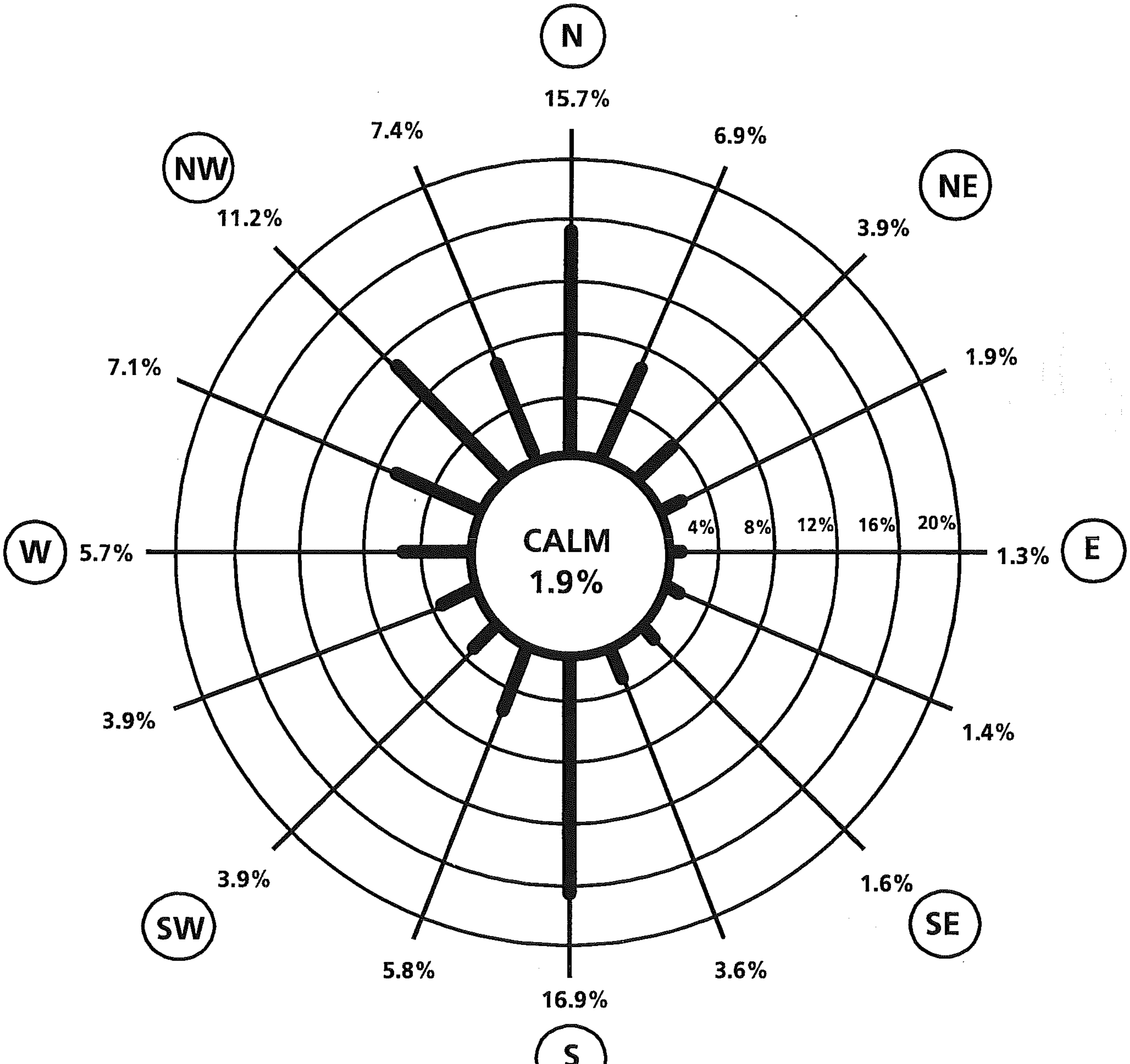


FIGURE 8-2

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

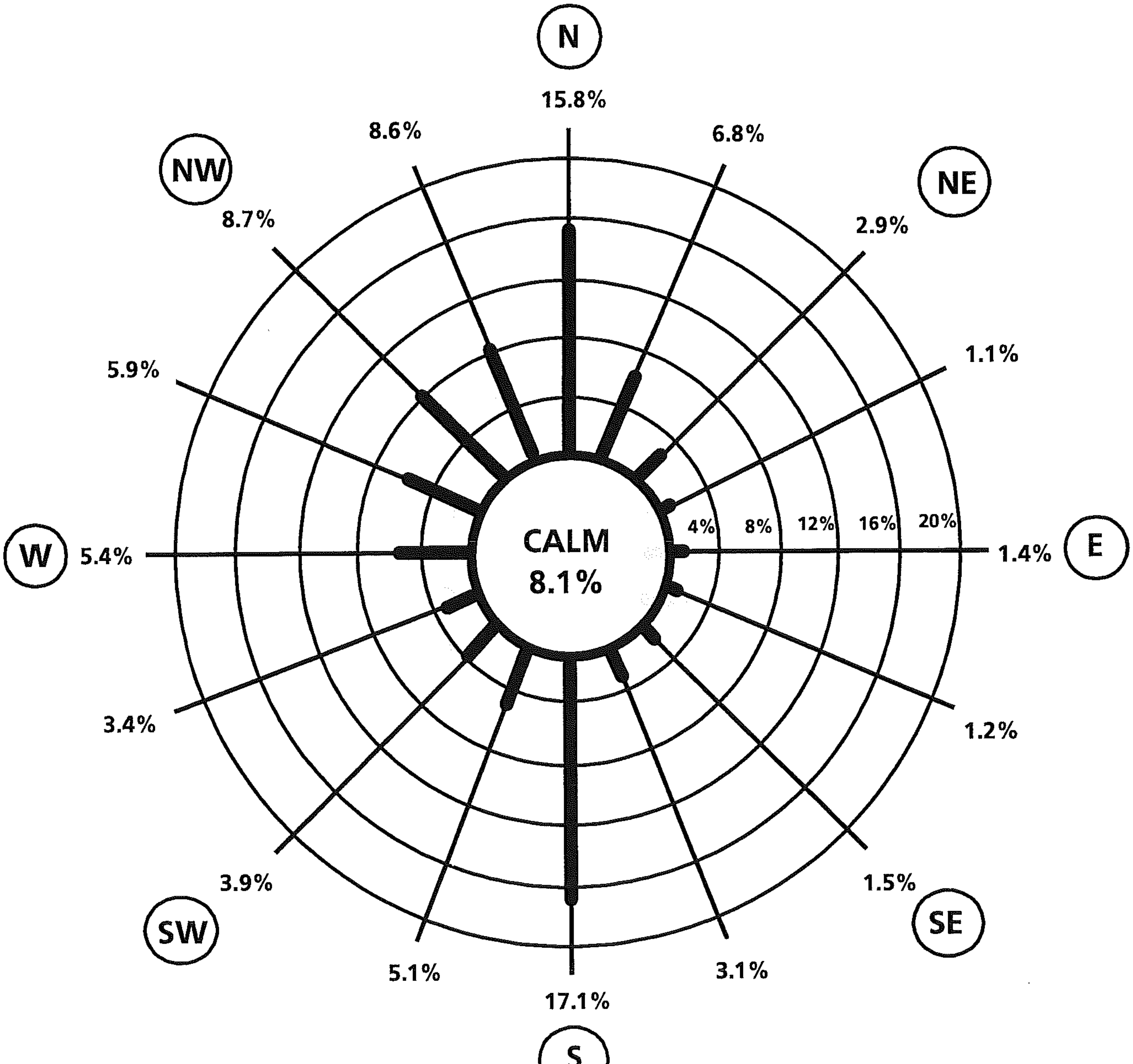


FIGURE 8-3

ANNUAL WIND ROSE FOR 1992
NEWARK INTERNATIONAL AIRPORT
NEWARK, NEW JERSEY

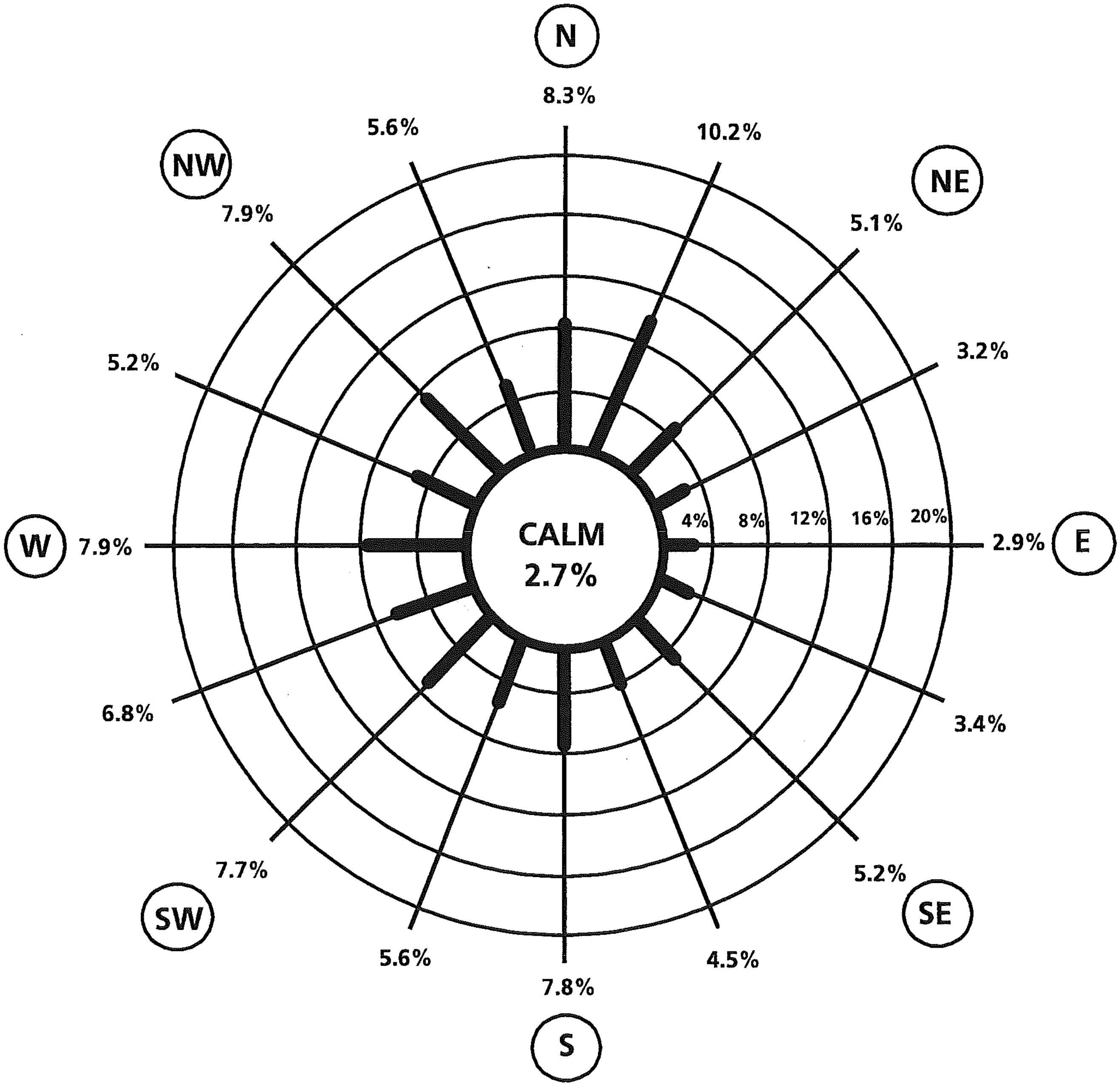
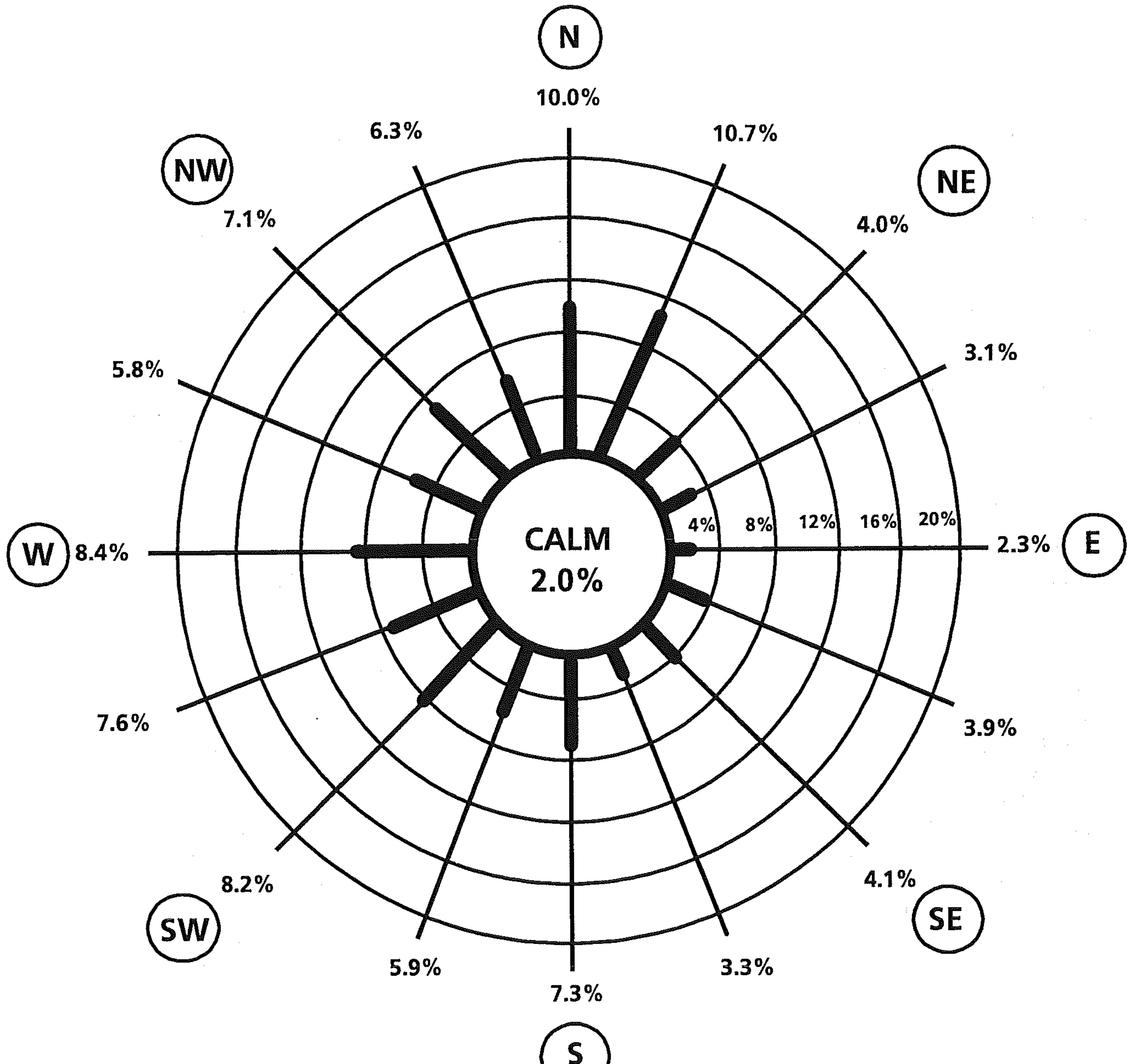


FIGURE 8-4

ANNUAL WIND ROSE FOR 1993
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 1993 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 from region to region (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 exceedance of the 1-hour ozone standard in the Fairfield County region, which also contains portions of New York and New Jersey (not shown).

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).

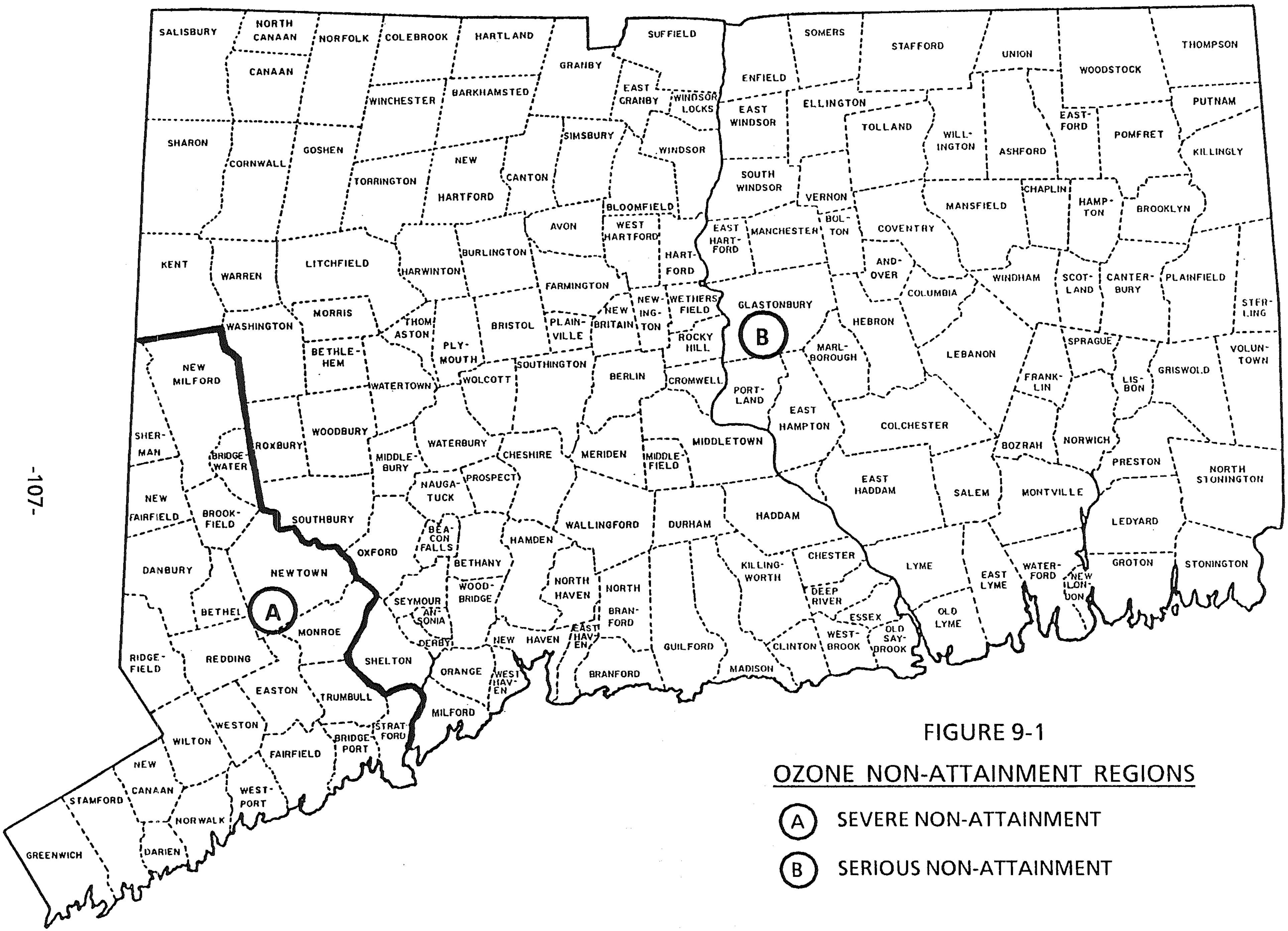


FIGURE 9-1

OZONE NON-ATTAINMENT REGIONS

(A) SEVERE NON-ATTAINMENT

(B) SERIOUS NON-ATTAINMENT

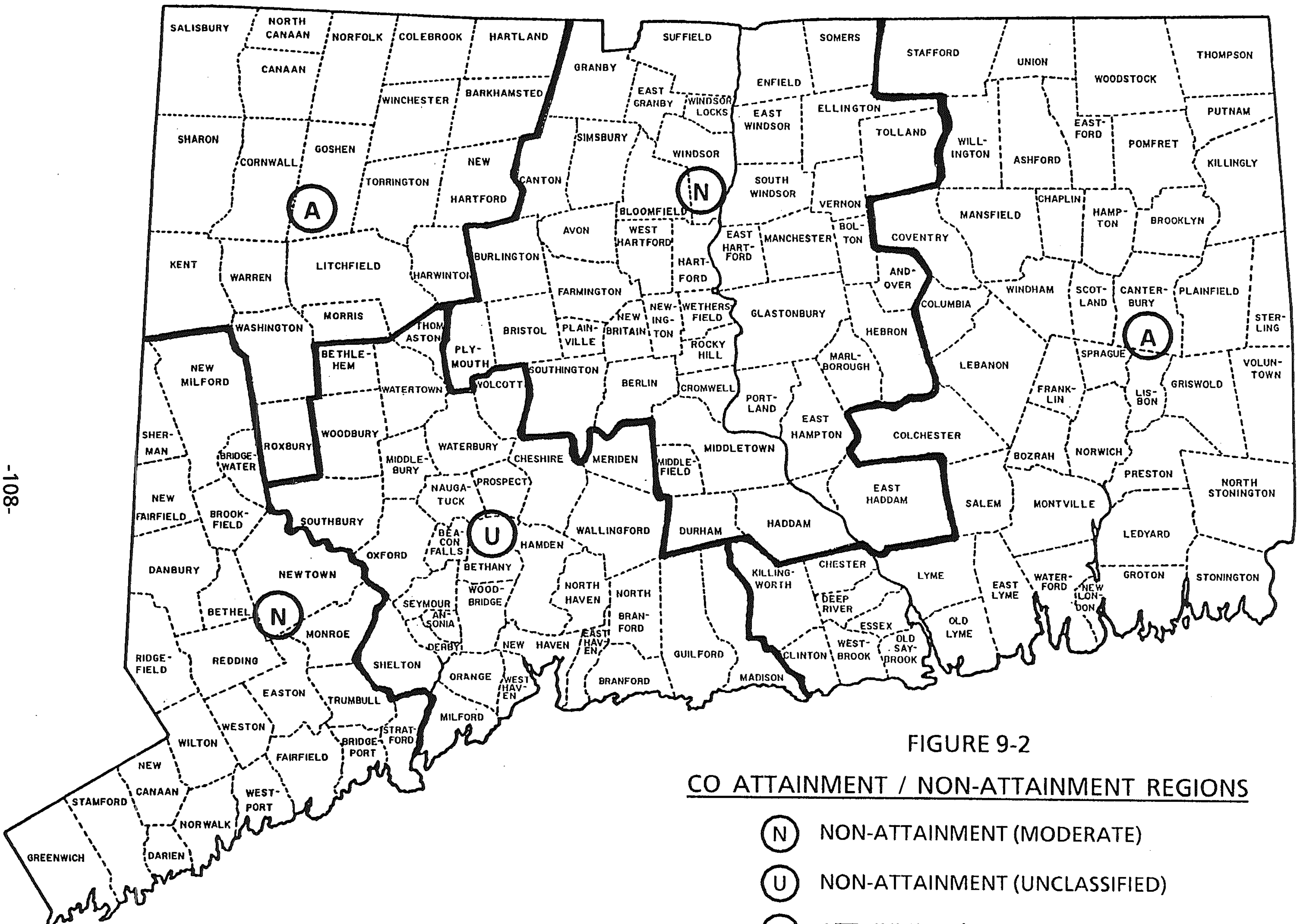


FIGURE 9-2

CO ATTAINMENT / NON-ATTAINMENT REGIONS

(N) NON-ATTAINMENT (MODERATE)

(U) NON-ATTAINMENT (UNCLASSIFIED)

(A) ATTAINMENT (UNCLASSIFIED)

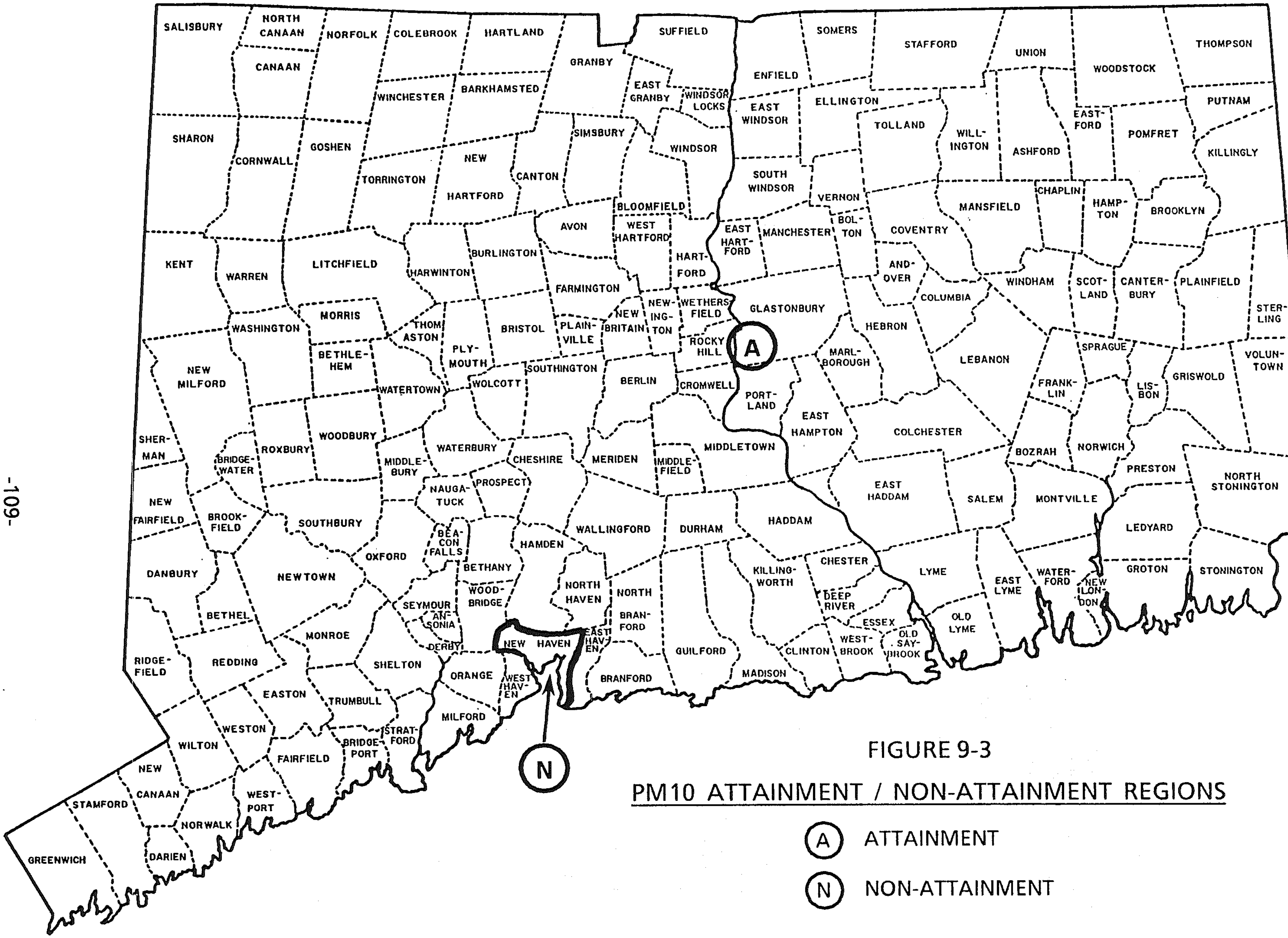


FIGURE 9-3

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, 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. (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 1993, Connecticut maintained three co-located PM_{10} monitors (Hartford 015, New Haven 123 and Waterbury 123) and one co-located lead monitor (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 via spiked strip analyses for lead. For SLAMS analyzers, accuracy audits must be performed on each analyzer at least once per calendar year.

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 1993 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 1993

	Monitoring Methods		
Pollutant	Reference Manual	Reference Automated	Equivalent Automated
PM_{10}	Wedding & Associates Critical Flow Hi-vol		
SO_2			Thermo Electron 43 (0.5) Thermo Electron 43A (0.5)
O_3			Monitor Labs 8810 (0.5)
CO		Thermo Electron 48 (50)	
NO_2		Thermo Electron 42 (1.0)	
Lead	High Volume Method		

( ) = Approved range in ppm

TABLE 10-2

1993 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	6^{th} day	Population	Neighborhood
Bridgeport	Bridgeport	014	N	Hi-Vol	Gravimetric	6^{th} day	High Concentration	Micro
Bristol	Bristol	001	S	Hi-Vol	Gravimetric	6^{th} day	High Concentration	Neighborhood
Burlington	NONE	001	S	Hi-Vol	Gravimetric	6^{th} day	Background	Regional
Cornwall	NONE	005	S	Hi-Vol	Gravimetric	6^{th} day	Background	Regional
Danbury	Danbury	123	S	Hi-Vol	Gravimetric	6^{th} day	Population	Neighborhood
Darien	Stamford	001	N	Hi-Vol	Gravimetric	6^{th} day	High Concentration	Micro
E. Hartford	Hartford	004	S	Hi-Vol	Gravimetric	6^{th} day	High Concentration	Neighborhood
Enfield	MA-CT*	005	S	Hi-Vol	Gravimetric	6^{th} day	Population	Regional
Greenwich	Stamford	017	S	Hi-Vol	Gravimetric	6^{th} day	Population	Neighborhood
Groton	New London/ Norwich	006	S	Hi-Vol	Gravimetric	6^{th} day	High Concentration	Neighborhood
Hartford	Hartford	013	N	Hi-Vol	Gravimetric	6^{th} day	Population	Neighborhood
Hartford	Hartford	015	N	Hi-Vol	Gravimetric	6^{th} day	High Concentration	Micro
Meriden	Meriden	002	S	Hi-Vol	Gravimetric	6^{th} day	High Concentration	Neighborhood
Middletown	Hartford	003	S	Hi-Vol	Gravimetric	6^{th} day	High Concentration	Neighborhood
Milford	Bridgeport	010	S	Hi-Vol	Gravimetric	6^{th} day	Population	Neighborhood
New Britain	New Britain	012	N	Hi-Vol	Gravimetric	6^{th} day	High Concentration	Middle
New Haven	New Haven	013	N	Hi-Vol	Gravimetric	6^{th} day	Population	Neighborhood
New Haven	New Haven	018	N	Hi-Vol	Gravimetric	6^{th} day	High Concentration	Middle
New Haven	New Haven	020	N	Hi-Vol	Gravimetric	6^{th} day	High Concentration	Middle
New Haven	New Haven	123	S	Hi-Vol	Gravimetric	6^{th} day	Population	Neighborhood

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

TABLE 10-2, CONTINUED

1993 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

1993 SLAMS AND NAMS SITES IN CONNECTICUT

SULFUR DIOXIDE

Town	Urban Area	Site	SLAMS or NAMS	Sampling & Analytic Method	Operating Schedule	Monitoring Objective	Spatial Scale of Representativeness
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	123/124[a]	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.

[a] The Stamford monitor operated at site 123 during January and February and was then moved permanently to site 124.

TABLE 10-2, CONTINUED

1993 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. In addition, a review of PM_{10} performance checks and audits has led to the rejection of data for some monitoring sites in the years 1991 and 1992. As a result, some of the statements made and statistics cited for those monitoring sites are now in error. For the benefit of the reader, the corrections are presented below:

- Regarding the 1992 edition of the Air Quality Summary,

  1. *On page 12, in the paragraph under* ***Precision and Accuracy****, the fourth sentence should read in part:* "The 95% probability limits for accuracy, based on 21 audits conducted on the...network, ranged from -1% to +9%."

  2. On page 12, in the first paragraph under **Annual Averages**, the third sentence should read in part: "...could be reached at 26 of the 31 PM_{10} monitoring sites in Connecticut in 1992." The fourth sentence should read in part: "These 26 sites proved to be..." The fifth sentence should read in part: "A determination of attainment or nonattainment could not be reached at Bridgeport 014, Cornwall 005, Danbury 123, Greenwich 017 and New Britain 012, where there were insufficient data ..."

  3. On page 13, in the fourth paragraph under **Statistical Projections**, the third sentence should read in part: "...was probably achieved at the 26 sites that met the minimum sampling criteria in 1992." The last sentence should read: "The results for the years 1990 and 1991 are also tabulated."

  4. On page 13, in the third paragraph under **24-Hour Averages**, the second sentence should read: "Based on these criteria, compliance was achieved at 26 of the 31 sites in 1992." The third sentence should read in part: "A determination of compliance could not be made for Bridgeport 014, Cornwall 005, Danbury 123, Greenwich 017 and New Britain 012..."

  5. On page 13, in the first paragraph under **10-High Days with Wind Data**, the first sentence should read in part: "...for each hi-vol PM_{10} site in Connecticut in 1992, except Bridgeport 014, Cornwall 005, Danbury 123, Greenwich 017 and New Britain 012, which were omitted due to their failure to meet the minimum sampling criteria, as described earlier."

  6. On page 23, in Table 2-2, the number of sites where compliance was achieved in 1992 should be 26, not 28.

  7. On pages 24-25, in Figure 2-3, put an asterisk next to the site names Bridgeport 014 and Cornwall 005; delete the asterisk next to the site name Meriden 002.

  8. On page 27, in Table 2-3, the number of sites that met the minimum sampling criteria in 1992 should be 26, not 28.

  9. On pages 34-39, in Table 2-5, the sites Cornwall 005, Danbury 123, Greenwich 017 and New Britain 012 should be deleted.

  10. On page 120, in Table 10-2, put "S" in the **SLAMS or NAMS** column for the Torrington 006 ozone site.

- Regarding the 1991 edition of the Air Quality Summary,

  1. *On page 12, in the paragraph under* ***Precision and Accuracy****, the second sentence should read: "On the basis of 152 precision checks, the 95% probability limits for precision ranged from -6% to +11%." The fourth sentence should read: "The 95% probability limits for accuracy, based on 36 audits conducted on the PM_{10} monitoring system network, ranged from -1% to +7%."*

  2. On page 12, in the first paragraph under **Annual Averages**, the third sentence should read in part: "...could be reached at 29 of the 31 PM_{10} monitoring sites in Connecticut in 1991." The fourth sentence should read in part: "These 29 sites proved to be..." The fifth sentence should read in part: "A determination of attainment or nonattainment could not be reached at New Britain 012 and Willimantic 002, where there were insufficient data..."

  3. On page 13, in the third paragraph under **24-Hour Averages**, the second sentence should read: "Based on these criteria, compliance was achieved at 29 of the 31 sites in 1991." The third sentence should read in part: "A determination of compliance could not be made for New Britain 012 and Willimantic 002..." The last sentence should read in part: "...it is highly improbable that an exceedence would have occurred at either of these two sites."

  4. On page 21, in Table 2-1, an asterisk should be placed next to the 1991 sample count for Willimantic 002.

  5. On page 26, in Figure 2-3, an asterisk should be placed next to the site name Willimantic 002; the following footnote should be placed at the bottom of page 26: "* The site has insufficient data to satisfy the minimum sampling criteria.".

  6. On page 44, in Table 2-5, the site Willimantic 002 should be deleted.

A review of the methodology used in determining data adequacy for annual average concentrations of SO_2 has revealed that errors were made in previous editions of this document. Moreover, those errors led to misstatements regarding various SO_2 sites and their annual statistics. The following corrections are being listed to remedy the errors and misstatements:

- Regarding Section III of the 1992 Air Quality Summary,

  1. On page 53, in Table 3-2, an asterisk should be placed next to the 1990 sample counts for New Britain 011 and Waterbury 008.

  2. On page 64, in Figure 3-4, the the numbers below and inside the bars for 1985-1990 should be changed as illustrated in Figure 12-1.

  3. On page 65, in Table 3-5, the statistics for the paired years in the period 1985-1990 should be changed as illustrated in Table 12-1.

- Regarding Section III of the 1991 Air Quality Summary,

  1. On page 53, in Table 3-2, an asterisk should be placed next to the 1990 sample counts for New Britain 011 and Waterbury 008.

2. On page 64, in Figure 3-4, the the numbers below and inside the bars for 1985-1990 should be changed as illustrated in Figure 12-1.

3. On page 65, in Table 3-5, the statistics for the paired years in the period 1985-1990 should be changed as illustrated in Table 12-1.

- Regarding Section III of the 1990 Air Quality Summary,

1. On page 52, in the paragraph under **Annual Averages**, the second sentence should read in part: "The annual average SO_2 levels decreased at 10 of the 12 monitoring sites..." The next sentence should read: "The largest decrease was 6 $\mu g/m^3$, which occurred at Stamford 025."

2. On page 52, in the first paragraph under **24-Hour Averages**, the third sentence should read in part: "Second high...concentrations decreased at 10 of the 12 monitoring sites..."

3. On pages 52-53, in the paragraph under **3-Hour Averages**, the third sentence should read: "Of the 12 sites that had a sufficient distribution and quantity of data in both 1989 and 1990, 11 had lower second high concentrations in 1990."

4. On page 53, in the first paragraph under **10-High Days with Wind Data**, the second sentence should read in part: "Only those 13 sites were used..." In the second paragraph, the first sentence should read in part: "...many (i.e., 71%) of the highest SO_2 days..."

5. On page 56, in Table 3-1, an asterisk should be placed next to the annual averages for New Britain 011 and Waterbury 008.

6. On page 58, in Table 3-2, an asterisk should be placed next to the 1990 sample counts for New Britain 011 and Waterbury 008 and the 1988 sample count for New Haven 017.

7. On page 60, in Figure 3-2, an asterisk should be placed next to the site names New Britain 011 and Waterbury 008.

8. On page 61, in Table 3-3, an asterisk should be placed next to the site names New Britain 011 and Waterbury 008.

9. On page 63, in Figure 3-3, two asterisks should be placed next to each of the site names New Britain 011 and Waterbury 008.

10. On pages 67 and 69, in Table 3-4, the sites New Britain 011 and Waterbury 008 should be deleted.

11. On page 70, in Figure 3-4, the the numbers below and inside the bars for 1985-1990 should be changed as illustrated in Figure 12-1.

12. On page 71, in Table 3-5, the statistics for the paired years in the period 1985-1990 should be changed as illustrated in Table 12-1.

- Regarding Section III of the 1989 Air Quality Summary,

1. On page 59, in Table 3-2, an asterisk should be placed next to the 1988 sample counts for Hartford 123 and New Haven 017, and the 1987 sample counts for New Haven 017 and Stamford 025.

2. On page 72, in Figure 3-4, the the numbers below and inside the bars for 1985-1988 should be changed as illustrated in Figure 12-1.

3. On page 73, in Table 3-5, the statistics for the paired years in the period 1985-1988 should be changed as illustrated in Table 12-1.

- Regarding Section III of the 1988 Air Quality Summary,

1. On page 34, in the paragraph under **Annual Averages**, the second sentence should read in part: "The annual average SO_2 levels increased at 8, and decreased at 3, of the 13 monitoring sites..." The next sentence should read: "The highest increase was 4 $\mu g/m^3$, which occurred at Greenwich, Groton, Waterbury 123 and New Haven 123."

2. On page 34, in the first paragraph under **24-Hour Averages,** the third sentence should read in part: "Second high...concentrations increased at all of the 13 monitoring sites..."

3. On page 35, in the paragraph under **3-Hour Averages**, the third sentence should read: "Of the 13 sites that had a sufficient distribution and quantity of data in both 1987 and 1988, 10 had higher second high concentrations in 1988." The fourth sentence should read: "Three sites had lower second high concentrations in 1988."

4. On page 35, in the first paragraph under **10-High Days with Wind Data**, the second sentence should read in part: "Only those 14 sites were used..." The first sentence in the second paragraph should read in part: "...many (i.e., 33%) of the highest SO_2 days..."

5. On page 38, in Table 3-1, an asterisk should be placed next to the annual averages for Hartford 123 and New Haven 017.

6. On pages 39-40, in Table 3-2, an asterisk should be placed next to the 1988 sample counts for Hartford 123 and New Haven 017; the 1987 sample counts for New Haven 017 and Stamford 025; and the 1986 sample count for East Hartford 005.

7. On pages 42 and 43, in Figure 3-2, an asterisk should be placed next to the site names Hartford 123 and New Haven 017.

8. On page 44, in Table 3-3, an asterisk should be placed next to the site names Hartford 123 and New Haven 017.

9. On pages 45 and 46, in Figure 3-3, two asterisks should be placed next to each of the site names Hartford 123 and New Haven 017.

10. On pages 49-51, in Table 3-4, the sites Hartford 123 and New Haven 017 should be deleted.

11. On page 54, in Figure 3-4, the the numbers below and inside the bars for 1985-1988 should be changed as illustrated in Figure 12-1.

12. On page 55, in Table 3-5, the statistics for the paired years in the period 1985-1988 should be changed as illustrated in Table 12-1.

- Regarding Section I and Section III of the 1987 Air Quality Summary,

1. On page 10, in Table 4, the statistics for the paired years in the period 1985-1987 should be changed as illustrated in Table 12-1.

2. On page 11, in Figure 2, the the numbers below and inside the bars for 1985-1987 should be changed as illustrated in Figure 12-1.

3. On page 96, in the paragraph under **Annual Averages**, the second sentence should read in part: "The annual average SO_2 levels increased at 6 of the 13 monitoring sites that had adequate data..." The next two sentences should read: "Four sites showed decreases from 1986 to 1987. East Haven 003 experienced the largest increase (3 $\mu g/m^3$)."

4. On page 96, in the second paragraph under **Statistical Projections**, the third sentence should read : "All of the 1987 monitoring sites, except New Haven 017 and Stamford 025, had sufficient data to produce valid annual average SO_2 concentrations."

5. On page 96, in the first paragraph under **24-Hour Averages**, the third sentence should read in part: "Second high...SO_2 concentrations decreased at 7 of the 13 SO_2 monitoring sites..." The fourth sentence should read: "The decreases ranged from 1 $\mu g/m^3$ at New Britain 011 to 23 $\mu g/m^3$ at Stamford 123." The next two sentences should read; "Five of the sites had second high concentrations that increased from 1986 to 1987. These increases ranged from 1 $\mu g/m^3$ at Hartford 123 to 19 $\mu g/m^3$ at Enfield 005."

   In the second paragraph, the last sentence should read in part: "...and the differences range up to 17$\mu g/m^3$ at Milford 010."

6. On pages 96-97, in the paragraph under **3-Hour Averages**, the third sentence should read: "Of the 13 sites that had a sufficient distribution and quantity of data in both 1986 and 1987, 7 had higher second high concentrations in 1987." The fourth sentence should read: "These increases ranged from 5 $\mu g/m^3$ at Waterbury 123 to 82 $\mu g/m^3$ at Danbury 123." The fifth sentence should read: "Six sites had lower second high concentrations in 1987."

7. On page 99, in Table 12, two asterisks should be placed next to each of the annual averages for New Haven 017and Stamford 025.

8. On pages 100-102, in Table 13, an asterisk should be placed next to the 1987 sample counts for New Haven 017 and Stamford 025; and the 1986 sample count for East Hartford 005.

9. On page 104, in Table 14, two asterisks should be placed next to each of the site names New Haven 017 and Stamford 025. In addition, the following footnote should be added to the bottom of the table: "** The database for the site is deficient in the number or distribution of observations."

10. On page 105, in Table 15, an asterisk should be placed next to the site names New Haven 017 and Stamford 025. In addition, the following footnote should be added to the bottom of the table: "* The number or distribution of observations is inadequate for the calculation of a valid annual average."

11. On page107, in Table 16, two asterisks should be placed next to each of the site names New Haven 017 and Stamford 025. In addition, the following footnote should be added to the bottom of the table: "** The database for the site is deficient in the number or distribution of observations."

- Regarding Section I and Section III of the 1986 Air Quality Summary,

1. On page 10, in Table 4, the statistics for the paired years 1985-1986 should be changed as illustrated in Table 12-1.

2. On page 11, in Figure 2, the the numbers below and inside the bars for the years 1985 and 1986 should be changed as illustrated in Figure 12-1.

3. On page 96, in the paragraph under **Annual Averages**, the second sentence should read in part: "The annual average SO_2 levels decreased at 9 of the 15 monitoring sites that had adequate data..." The third sentence should read: "Four sites showed increases from 1985 to 1986."

4. On page 96, in the second paragraph under **Statistical Projections**, the third sentence should read : "All of the 1986 monitoring sites, except East Hartford 005 and Waterbury 008, had sufficient data to produce valid annual average SO_2 concentrations."

5. On page 96, in the first paragraph under **24-Hour Averages**, the third sentence should read in part: "Second high...concentrations decreased at 10 of the 15 SO_2 monitoring sites..."

6. On pages 96-97, in the paragraph under **3-Hour Averages**, the third sentence should read in part: "Of the 15 sites that had a sufficient distribution and quantity of data in both 1985 and 1986..."

7. On page 99, in Table 12, two asterisks should be placed next to the annual average for East Hartford 005.

8. On page 100, in Table 13, an asterisk should be placed next to the 1986 and 1985 sample counts for East Hartford 005.

9. On page 103, in Table 14, two asterisks should be placed next to the site name East Hartford 005.

10. On page 105, in Table 15, an asterisk should be placed next to the site name East Hartford 005.

11. On page 106, in Table 16, two asterisks should be placed next to the site name East Hartford 005.

- Regarding Section I and Section III of the 1985 Air Quality Summary,

1. On page 7, in Table 4, the statistics for the paired years 1984-1985 should be changed as illustrated in Table 12-1.

2. On page 10, in Figure 2, the the numbers below and inside the bar for the year 1985 should be changed as illustrated in Figure 12-1.

3. On page 96, in the paragraph under **Annual Averages**, the second sentence should read in part: "The annual average SO_2 levels increased at 6 of the 14 monitoring sites that had adequate data..." The fourth sentence should read: "New Haven 017 experienced the highest increase of 11 $\mu g/m^3$."

4. On page 96, in the second paragraph under **Statistical Projections**, the third sentence should read : "All of the 1985 monitoring sites, except East Hartford 005 and Stamford 025, had sufficient data to produce valid annual average SO_2 concentrations."

5. On page 96, in the first paragraph under **24-Hour Averages**, the third sentence should read in part: "Second high...concentrations decreased at 13 of the 14 SO_2 monitoring sites..."

6. On page 96, in the paragraph under **3-Hour Averages**, the third sentence should read : "Of the 14 sites that had a sufficient distribution and quantity of data in both 1984 and 1985, all but 4 had lower 2nd high concentrations in 1985." The next sentence should be replaced by the following: "The decreases ranged from 6 $\mu g/m^3$ at Waterbury 123 to 124 $\mu g/m^3$ at Hartford 123." The last sentence should read in part: "Of the 4 sites with higher 2nd high concentrations in 1985..."

7. On page 99, in Table 12, two asterisks should be placed next to the annual average for East Hartford 005.

8. On page 100, in Table 13, an asterisk should be placed next to the 1985 sample count for East Hartford 005.

9. On page 102, in Table 14, two asterisks should be placed next to the site name East Hartford 005.

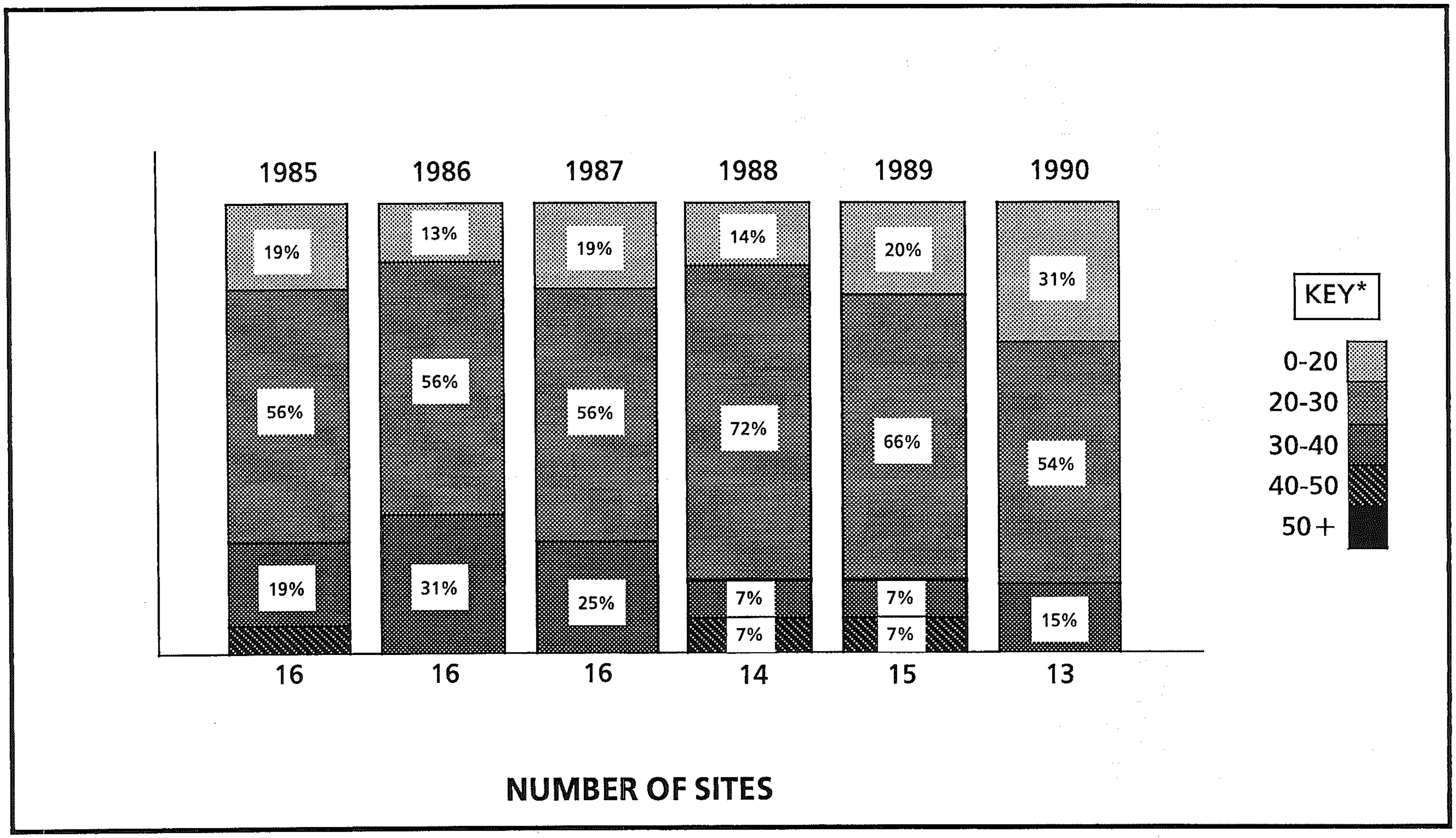
10. On page 104, in Table 15, two asterisks should be placed next to the site name East Hartford 005.

11. On page 105, in Table 16, two asterisks should be placed next to the site name East Hartford 005.

FIGURE 12-1

SULFUR DIOXIDE TREND FROM CONTINUOUS DATA

"PERCENT OF SITES WITHIN EACH RANGE"



PRIMARY ANNUAL STANDARD = 80 µg/m³

* ANNUAL ARITHMETIC MEAN (µg/m³)

TABLE 12-1

SO2 TRENDS FROM CONTINUOUS DATA: 1984-1990

(PAIRED *t* TEST)

PAIRED YEARS	AVERAGE OF ANNUAL GEOMETRIC MEANS ($\mu g/m^3$)	NO. OF SITES	DIFFERENCES OF THE PAIRED YEAR MEANS		SIGNIFICANCE LEVEL		
					TREND AT		PROBABILITY THAT CHANGE IS NOT SIGNIFICANT
			AVG.	STD. DEV.	95% LEVEL	99% LEVEL	
84 85	16.3 16.7	14 14	0.39	3.37	N.C.	N.C.	0.6753
85 86	14.9 15.7	15 15	0.74	3.87	N.C.	N.C.	0.4672
86 87	15.2 15.3	13 13	0.10	2.72	N.C.	N.C.	0.8966
87 88	15.7 15.6	12 12	-0.08	3.31	N.C.	N.C.	0.9389
88 89	15.8 16.3	14 14	0.51	1.51	N.C.	N.C.	0.2245
89 90	16.8 14.9	12 12	-1.88	1.94	↓	↓	0.0063

Key to Symbols :
↓ = Significant downward trend
↑ = Significant upward trend
N.C. = No significant change