1995

STATE OF CONNECTICUT

ANNUAL AIR QUALITY SUMMARY

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Governor

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I. INTRODUCTION

The 1995 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 1995. 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 1995 did not exceed the 50 µg/m³ level of the primary and secondary annual standards or the 150 µg/m³ 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/m³.

2. SULFUR DIOXIDE (SO_2)

Compliance Assessment - None of the air quality standards for sulfur dioxide were exceeded in Connecticut in 1995. Measured concentrations were below the 80 µg/m³ primary annual standard, the 365 µg/m³ primary 24-hour standard, and the 1300 µg/m³ 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 1995 (see Table 1-2). Nonattainment of the standard remains a fact at all the sites in 1995 because the average number of annual exceedances at each site was greater than one per year over the period 1993-1995.

4. NITROGEN DIOXIDE (NO_2)

Compliance Assessment - The annual average NO_2 standard of 100 µg/m³ was not exceeded at any site in Connecticut in 1995.

5. CARBON MONOXIDE (CO)

Compliance Assessment - The primary 8-hour standard of 9 ppm was exceeded once at one of the five carbon monoxide monitoring sites in Connecticut during 1995. However, the 8-hour standard was not violated in 1995 because none of the sites experienced two exceedances.

There were no exceedances of the primary 1-hour standard of 35 ppm at any carbon monoxide monitoring site in Connecticut in 1995.

6. LEAD (Pb)

Compliance Assessment - The primary and secondary ambient air quality standard for lead is 1.5 $\mu g/m^3$, maximum arithmetic mean averaged over three consecutive calendar months. As has been the case since 1980, the lead standard was not exceeded at any site in Connecticut during 1995.

B. AIR MONITORING NETWORK

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

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

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 1995 consisted of the following:

29	Particulate matter (PM_{10}) hi-vol samplers
1	Particulate matter (PM_{10}) analyzer
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 1995 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 1995, Connecticut reported the PM_{10} PSI for the towns of Bridgeport, Danbury, East Hartford, Enfield, Greenwich, Groton, Hartford, Meriden, Middletown, New Britain, New Haven, Norwalk, Norwich, Stamford, Torrington, Voluntown, Wallingford, Waterbury and Willimantic; and reported the sulfur dioxide PSI for the towns of Bridgeport, Danbury, East Hartford, East Haven, Enfield, Greenwich, Groton, Hartford, Mansfield, New Haven, Stamford, and Waterbury. For the summer, the ozone PSI was reported for the towns of Bridgeport, Danbury, East Hartford, Greenwich, Groton, Madison, Middletown, New Haven, Stafford, Stratford and Torrington. Each day, the pollutant with the highest PSI value of all the pollutants being monitored is reported for each town, along with the dimensionless PSI number and a descriptor label to characterize the daily air quality. A descriptor label of each subsequent day's forecast is also included.

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

D. 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 acceptance testing
Equipment installation
Equipment calibration
Equipment operation
Sample analysis
Maintenance checks
Performance audits
Data handling
Data quality assessment

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

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

1. **PRECISION**

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

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

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

b. **Manual Samplers** (Lead)

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

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

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

2. **ACCURACY**

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

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

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

b. **Manual Methods** (Lead)

Accuracy for lead is assessed in two ways:

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

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

Accuracy measurements are obtained each quarter.

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

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

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

TABLE 1-1

ASSESSMENT OF AMBIENT AIR QUALITY

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

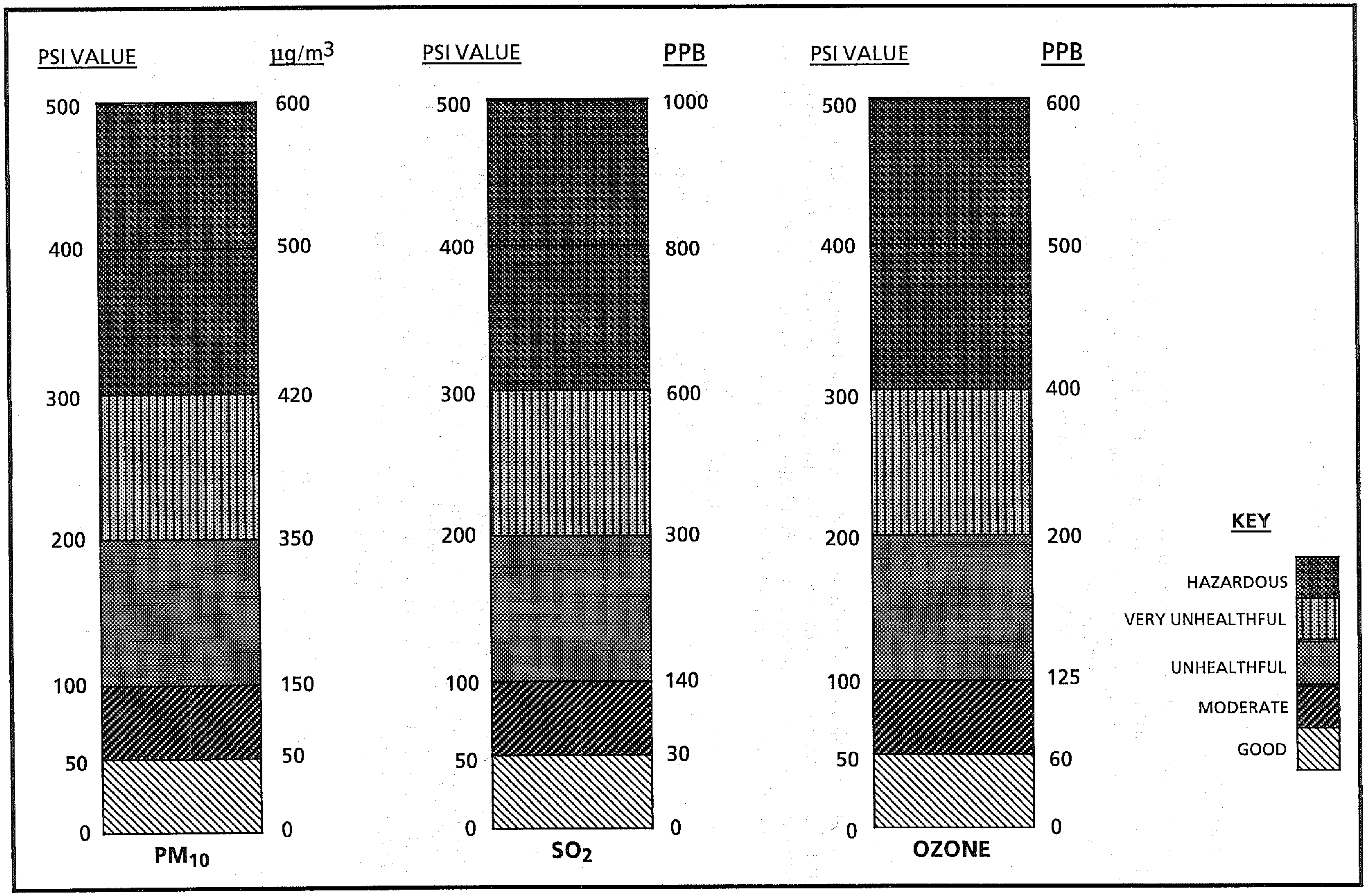
AIR QUALITY STANDARDS EXCEEDED IN CONNECTICUT IN 1995 BASED ON MEASURED CONCENTRATIONS

		OZONE		CARBON MONOXIDE	
		Level Exceeding 1-Hour Standard (0.12 PPM)		Level Exceeding 8-Hour Standard (9 PPM)	
TOWN	SITE	Highest Observed Level (ppm)	Number of Days Standard Exceeded	Highest Observed Level (ppm)	Number of Times Standard Exceeded
Bridgeport	013	0.146	1	-	-
Danbury	123	0.157	2	-	-
East Hartford	003	0.138	2	-	-
Greenwich	017	0.145	4	-	-
Groton	008	0.144	4	-	-
Hartford	017	-	-	10.1	1
Madison	002	0.175	8	-	-
Middletown	007	0.165	4	-	-
New Haven	123	0.128	1	-	-
Stafford	001	0.131	2	-	-
Stratford	007	0.164	7	-	-
Torrington	006	0.129	1	-	-

N.B. A dash "-" means that the pollutant is not monitored at the site.

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 1995 did not exceed the 50 $\mu g/m^3$ level of the primary and secondary annual standards or the 150 $\mu g/m^3$ level of the primary and secondary 24-hour standards at any site. Moreover, the 24-hour standards were not violated because the "expected number of exceedances" for the most recent 3 years at each site did not exceed one per year, and the annual standards were also not violated anywhere because the "expected annual mean" for the most recent 3 years at each site did not exceed 50 $\mu g/m^3$.

SAMPLE COLLECTION AND ANALYSIS

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

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

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

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

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

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

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

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

DISCUSSION OF DATA

Monitoring Network - In 1995, 30 PM_{10} sampling sites were operated in Connecticut (see Figure 2-1). As was mentioned earlier, the PM_{10} sampler at the Danbury 123 site employs TEOM technology. One TSP sampler was operated and it was located at the Stamford 001 site, which was the only designated TSP site in the State. EPA requires the operation of one TSP site in Connecticut for the sake of historical continuity. In addition, as part of the 1995 network for monitoring the airborne concentrations of lead, five hi-vol sampling sites were used to gather information on the chemical composition of TSP in the state. The locations were Bridgeport 010, East Hartford 004, Hartford 016, New Haven 018 and Waterbury 123.

Precision and Accuracy - Precision checks were conducted at three PM_{10} sampling sites which had co-located samplers. On the basis of 133 precision checks, the 95% probability limits for precision ranged from -8% to +11%. Accuracy is based on air flow through the monitor. The 95% probability limits for accuracy, based on 33 audits conducted on the PM_{10} monitoring system network, ranged from 0% to +8%. (See section I.D. of this Air Quality Summary for a discussion of precision and accuracy.)

Annual Averages - The Federal EPA has established minimum sampling criteria (see Table 1-1) for use in determining compliance with the primary and secondary annual NAAQS for PM_{10}. A site must have 75% of the scheduled samples in each calendar quarter for the the most recent 3 years. Using the EPA criteria, one finds that a determination of attainment or nonattainment of the 50 µg/m^3 primary and secondary annual standards could be obtained at 17 of the 30 PM_{10} monitoring sites in Connecticut in 1995. These 17 sites proved to be in attainment of the annual standards. A determination of attainment or nonattainment could not be obtained at Bridgeport 010, Bridgeport 014, Danbury 123, Greenwich 017, Hartford 015, Middletown 003, New Britain 012, New Haven 018, New London 004, Stamford 001, Torrington 001, Voluntown 001 and Waterbury 123, where there were insufficient data at each site in at least one calendar quarter during the most recent three years. The primary reason for the loss of data at many of the these sites was the existence of defects in the filters used in the particulate samplers. Nevertheless, given the 95 percent confidence limits about the annual mean at these sites (see Table 2-1), it is likely that attainment was achieved.

A summary of annual average PM_{10} data for 1993 -1995 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 1995 in descending order of magnitude.

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

The statistical predictions of the number of days that would have seen an exceedance of the level of the 24-hour standards are based on the assumption of a lognormal distribution of the data. They indicate that more frequent PM_{10} sampling at New Haven 018 and Norwalk 014 in 1994 might 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 East Hartford 004 in 1994, 59 samples were analyzed and an arithmetic mean of 21.9 $\mu g/m^3$ was then calculated. The columns labeled "95-PCT-LIMITS" show the lower and upper limits of the 95% confidence interval to be 18.7 and 25.2 $\mu g/m^3$, respectively. This means that, if sampling were done every day, there is a 95% chance that the true arithmetic mean would fall between these limits. Since the upper 95% limit is less than 50 $\mu g/m^3$, one can be confident that the level of the annual standards was not exceeded at the site. However, if the upper 95% limit were greater, and the lower limit less, than 50 $\mu g/m^3$, then one could not be confident that the standard was not exceeded at the site. And if both the upper and lower 95% limits were greater than 50 $\mu g/m^3$, then one could assume that the level of the standards was indeed exceeded sometime during the year. These three possibilities are illustrated in Figure 2-3.

Table 2-2 summarizes the statistical predictions from Table 2-1 regarding compliance with the level of the annual air quality standards, using the 95% confidence limit criteria. The table shows that the level of the primary and secondary annual standards was probably achieved at the 26 sites that met the minimum sampling criteria in 1995. 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 1995. Of the 23 sites that had sufficient data in both 1994 and 1995, 9 sites had higher maximum concentrations and 14 sites had lower maximum concentrations. The largest increase was 25 $\mu g/m^3$ at Darien 001; the largest decrease was 32 $\mu g/m^3$ at Willimantic 002

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 1995, 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 17 of the 30 sites in 1995. A determination of compliance could not be made for the 13 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 1995 and are presented in Table 2-4. Note that the annual averages have been weighted according to the sample count.

10 High Days with Wind Data - Table 2-5 lists the 10 highest 24-hour average PM_{10} readings with the dates of occurrence for each of the 26 PM_{10} hi-vol site in Connecticut which complied with EPA's minimum sampling criteria in 1995. 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 43% of the high PM_{10} days occur with winds out of the southwest quadrant and most of those days have relatively persistent winds. This relationship between southwest winds and high particulate levels has historically been more prevalent in southwestern Connecticut. However, many of the maximum levels at some urban sites do not occur with southwest winds, indicating that these sites are possibly influenced by local sources or transport from different out-of-state sources. As noted above, a large scale southwesterly air flow is often diverted into a southerly flow up the Connecticut River Valley. At sites in the Connecticut River Valley, many of the highest PM_{10} days occur when the winds at Bradley Airport are from the south.

Trends - Pollutant trends can be illustrated in a number of ways. We wish here to portray a PM_{10} trend that is both statewide in nature and relevant to one of the ambient air quality standards. Therefore, we have chosen to average the annual mean PM_{10} concentrations at a number of sites from 1989 -- the first full year of PM_{10} monitoring -- to the present (see Figure 2-5). In spite of the year-to-year changes, statewide PM_{10} levels appear to be trending down over the past 7 years.

Significant changes in annual PM_{10} levels can be caused by a number of things. Among these are simple changes of weather; changes in annual fuel use associated with conservation efforts or heating demand; the frequency of precipitation events, which wash out particulates from the atmosphere; changes in average wind speed, since higher winds result in greater dilution of emissions; and a change in the frequency of southwesterly winds, which affect the amount of particulate matter transported into

Connecticut from the New York City metropolitan area and from other sources of emissions located to the southwest. In illustrating a trend, these year-to-year effects can be diminished, if not eliminated, by using a moving average of three years or more. Figure 2-6 illustrates the trend of PM_{10} using a 3-year moving average. The trend is clearly down.

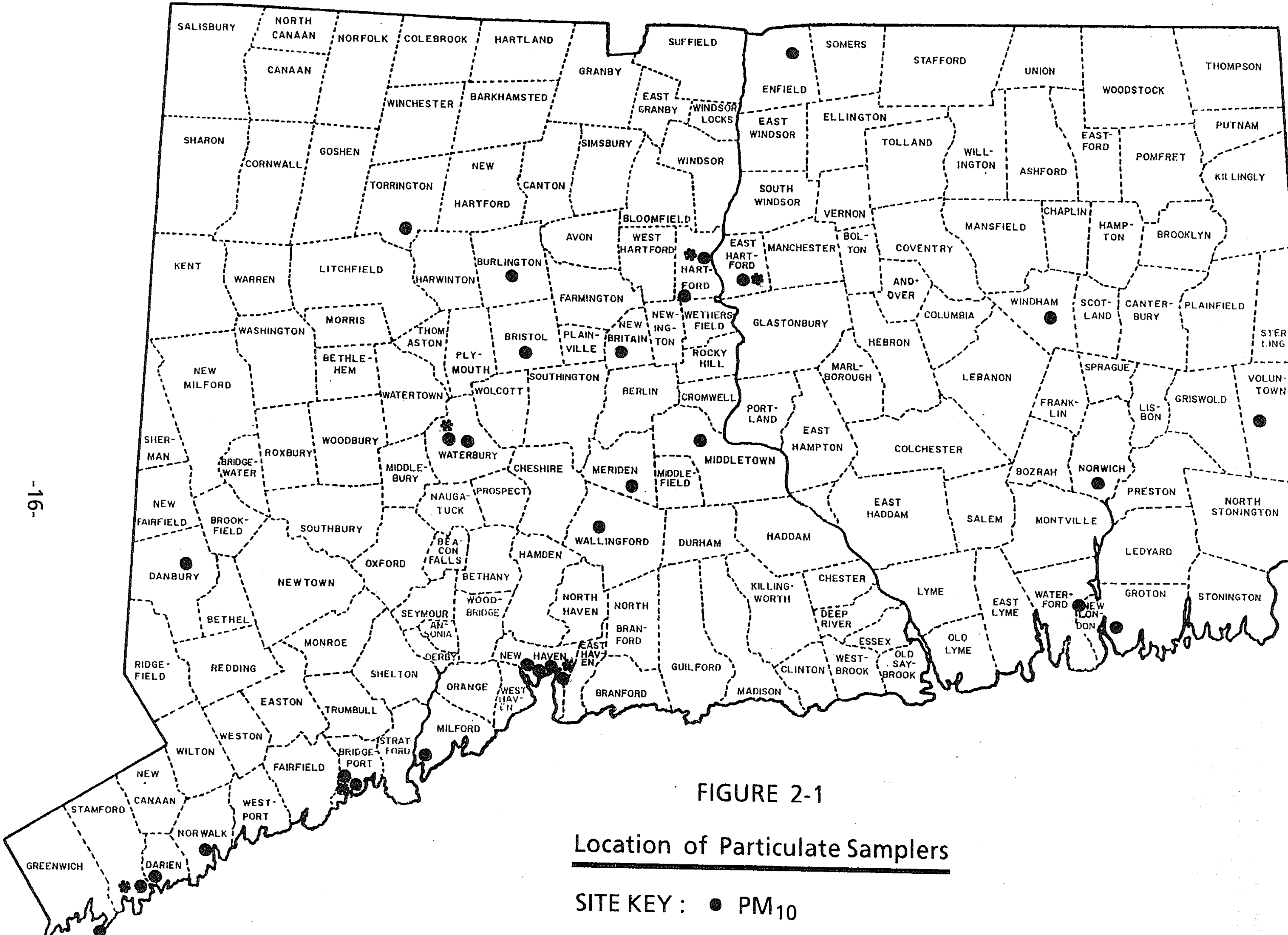


FIGURE 2-1

Location of Particulate Samplers

SITE KEY : ● PM_{10}

* TSP

TABLE 2-1

1993–1995 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	1993	57	20.8	18.0	23.7	11.814		
BRIDGEPORT	010	1994	50*	26.0	22.1	29.9	14.777		
BRIDGEPORT	010	1995	57	21.9	18.7	25.1	13.029		
BRIDGEPORT	014	1993	24*	27.3	22.6	32.1	11.707		
BRIDGEPORT	014	1994	56	30.2	27.0	33.4	13.034		
BRIDGEPORT	014	1995	59	28.7	25.4	32.0	13.938		
BRISTOL	001	1993	57	17.9	15.6	20.2	9.402		
BRISTOL	001	1994	58	18.3	15.7	20.9	10.770		
BRISTOL	001	1995	58	16.1	13.7	18.4	9.737		
BURLINGTON	001	1993	55	12.9	11.0	14.8	7.690		
BURLINGTON	001	1994	55	14.3	11.8	16.8	10.037		
BURLINGTON	001	1995	56	12.1	10.1	14.2	8.215		
CORNWALL	005	1993	52*	12.4	10.0	14.9	9.374		
DANBURY	123	1993	57	18.8	15.9	21.7	11.844		
DANBURY	123	1994	52*	22.1	18.9	25.3	12.517		
DANBURY	123	1995	56*	22.0	19.2	24.8	11.403		
DARIEN	001	1993	60	23.4	20.9	25.9	10.532		
DARIEN	001	1994	54	28.2	24.5	31.9	14.838		
DARIEN	001	1995	58	24.1	21.0	27.2	12.914		
EAST HARTFORD	004	1993	56	18.8	16.3	21.2	10.070		
EAST HARTFORD	004	1994	59	21.9	18.7	25.2	13.575		
EAST HARTFORD	004	1995	59	18.1	15.6	20.6	10.497		
ENFIELD	005	1993	59	15.4	13.5	17.4	8.152		
ENFIELD	005	1994	55	16.7	13.8	19.5	11.359		
ENFIELD	005	1995	60	13.9	11.8	16.0	8.893		

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

TABLE 2-1, CONTINUED

1993-1995 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	1993	37*	16.5	14.2	18.9	7.314		
GREENWICH	017	1994	55	20.1	17.0	23.3	12.476		
GREENWICH	017	1995	57	17.9	15.6	20.1	9.183		
GROTON	006	1993	57	17.0	15.0	19.0	8.238		
GROTON	006	1994	58	20.2	17.7	22.8	10.525		
GROTON	006	1995	57	16.8	14.2	19.3	10.317		
HARTFORD	013	1993	59	17.4	15.3	19.5	8.863		
HARTFORD	013	1994	57	19.7	16.9	22.6	11.666		
HARTFORD	013	1995	59	16.5	14.2	18.8	9.762		
HARTFORD	015	1993	53*	23.3	20.4	26.2	11.291		
HARTFORD	015	1994	52	25.6	22.1	29.1	13.492		
HARTFORD	015	1995	56	20.2	17.5	22.9	11.023		
MERIDEN	002	1993	57	19.3	16.7	21.8	10.322		
MERIDEN	002	1994	54	19.8	16.9	22.7	11.503		
MERIDEN	002	1995	59	18.4	15.9	20.8	10.351		
MIDDLETOWN	003	1993	56	18.7	16.5	21.0	9.186		
MIDDLETOWN	003	1994	53	21.6	18.5	24.8	12.315		
MIDDLETOWN	003	1995	55*	17.7	15.1	20.3	10.458		
MILFORD	010	1993	60	16.7	14.6	18.7	8.826		
MILFORD	010	1994	53	18.7	16.0	21.3	10.524		
MILFORD	010	1995	58	17.0	14.6	19.4	9.879		
NEW BRITAIN	012	1993	38*	19.9	16.3	23.5	11.600		
NEW BRITAIN	012	1994	56	20.1	17.2	22.9	11.566		
NEW BRITAIN	012	1995	14*	17.6	12.2	23.1	9.626		
NEW HAVEN	013	1993	59	19.8	17.3	22.3	10.448		
NEW HAVEN	013	1994	53	23.1	19.9	26.4	12.694		
NEW HAVEN	013	1995	57	20.4	17.6	23.2	11.506		

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

TABLE 2-1, CONTINUED

1993-1995 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	1993	57	34.4	30.1	38.8	17.801		
NEW HAVEN	018	1994	50*	41.2	36.0	46.3	19.444	1	
NEW HAVEN	018	1995	58	31.5	27.5	35.5	16.707		
NEW HAVEN	020	1993	57	24.0	20.9	27.0	12.470		
NEW HAVEN	020	1994	58	26.6	23.3	29.9	13.601		
NEW HAVEN	020	1995	61	22.8	20.1	25.6	11.683		
NEW HAVEN	123	1993	57	21.7	19.0	24.4	11.041		
NEW HAVEN	123	1994	56	27.8	23.8	31.7	15.932		
NEW HAVEN	123	1995	60	21.9	19.0	24.8	12.450		
NEW LONDON	004	1993	53*	17.5	15.3	19.7	8.710		
NEW LONDON	004	1994	58	21.6	18.9	24.3	11.126		
NEW LONDON	004	1995	57	16.7	14.5	19.0	9.089		
NORWALK	014	1993	55	29.7	26.5	33.0	12.875		
NORWALK	014	1994	52	36.6	32.2	41.0	17.132	1	
NORWALK	014	1995	56	32.2	28.3	36.1	15.707		
NORWICH	002	1993	57	18.9	16.6	21.2	9.362		
NORWICH	002	1994	55	22.4	19.4	25.3	11.868		
NORWICH	002	1995	58	17.6	15.2	20.0	10.128		
STAMFORD	001	1993	57	19.7	17.2	22.2	10.124		
STAMFORD	001	1994	51*	23.3	19.7	26.8	13.549		
STAMFORD	001	1995	59	20.8	18.4	23.3	10.412		
TORRINGTON	001	1993	56*	18.0	15.3	20.6	10.807		
TORRINGTON	001	1994	57	19.2	16.3	22.1	11.835		
TORRINGTON	001	1995	60	17.2	15.0	19.4	9.248		
VOLUNTOWN	001	1993	55*	12.2	10.5	13.9	6.787		
VOLUNTOWN	001	1994	55	15.3	12.9	17.8	9.855		
VOLUNTOWN	001	1995	56	12.6	10.4	14.9	9.153		

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

TABLE 2-1, CONTINUED

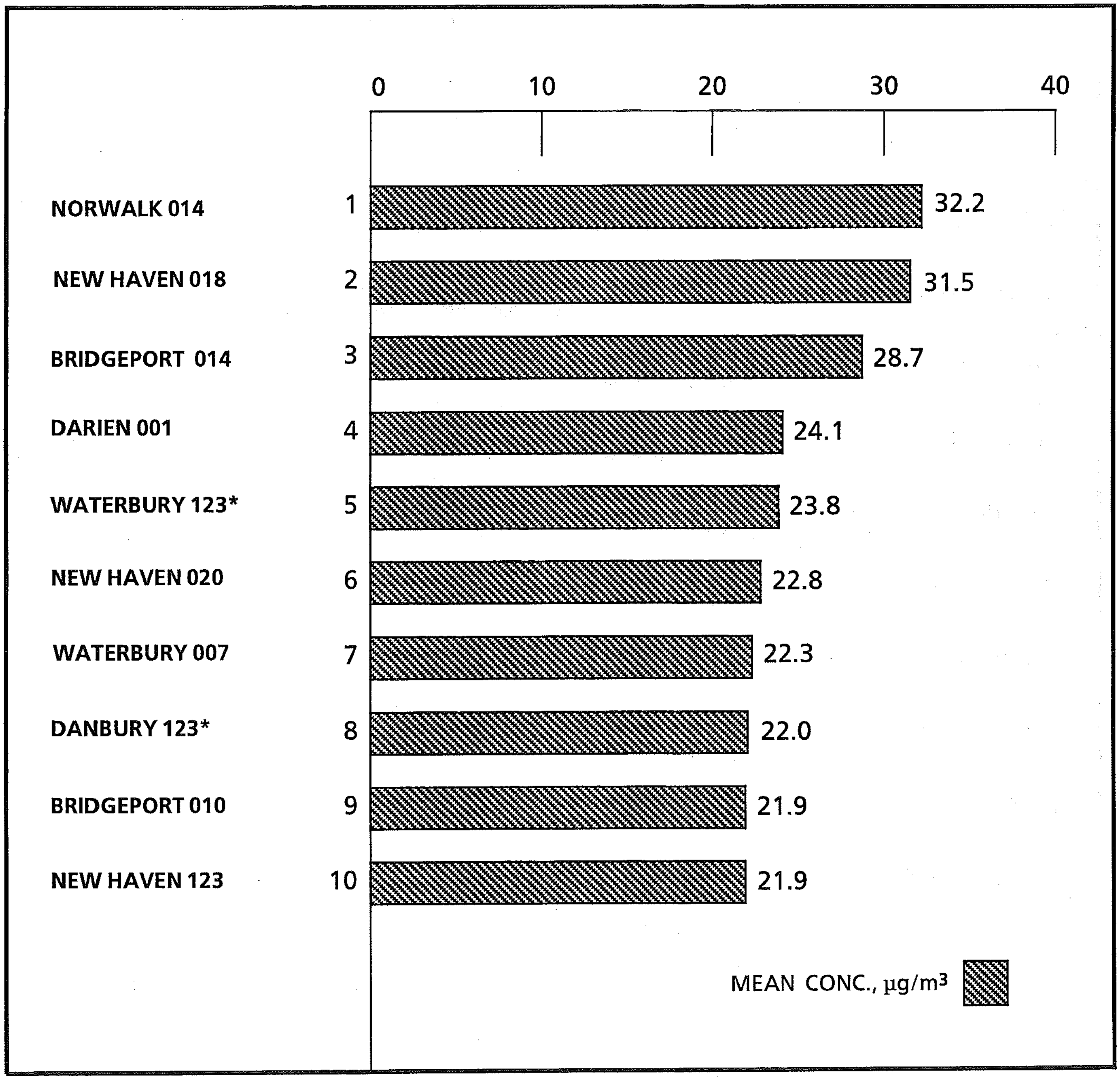
1993-1995 PM10 ANNUAL AVERAGES AND STATISTICAL PROJECTIONS

TOWN NAME	SITE	YEAR	SAMPLES	ARITHMETIC MEAN	95-PCT-LIMITS LOWER	95-PCT-LIMITS UPPER	STANDARD DEVIATION	PREDICTED DAYS OVER 150 UG/M3	MEASURED DAYS OVER 150 UG/M3
WALLINGFORD	006	1993	55	18.2	15.9	20.5	9.321		
WALLINGFORD	006	1994	56	20.5	17.3	23.7	12.881		
WALLINGFORD	006	1995	59	16.9	14.6	19.3	9.860		
WATERBURY	007	1993	57	21.6	18.6	24.7	12.584		
WATERBURY	007	1994	53	22.7	19.3	26.1	13.306		
WATERBURY	007	1995	58	22.3	19.0	25.5	13.474		
WATERBURY	123	1993	59	22.6	19.5	25.7	12.970		
WATERBURY	123	1994	54	25.0	22.0	27.9	11.701		
WATERBURY	123	1995	52*	23.8	20.4	27.1	12.990		
WILLIMANTIC	002	1993	60	18.2	15.8	20.5	9.920		
WILLIMANTIC	002	1994	58	19.9	16.9	22.8	12.196		
WILLIMANTIC	002	1995	57	15.3	13.3	17.3	8.264		

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

FIGURE 2-2

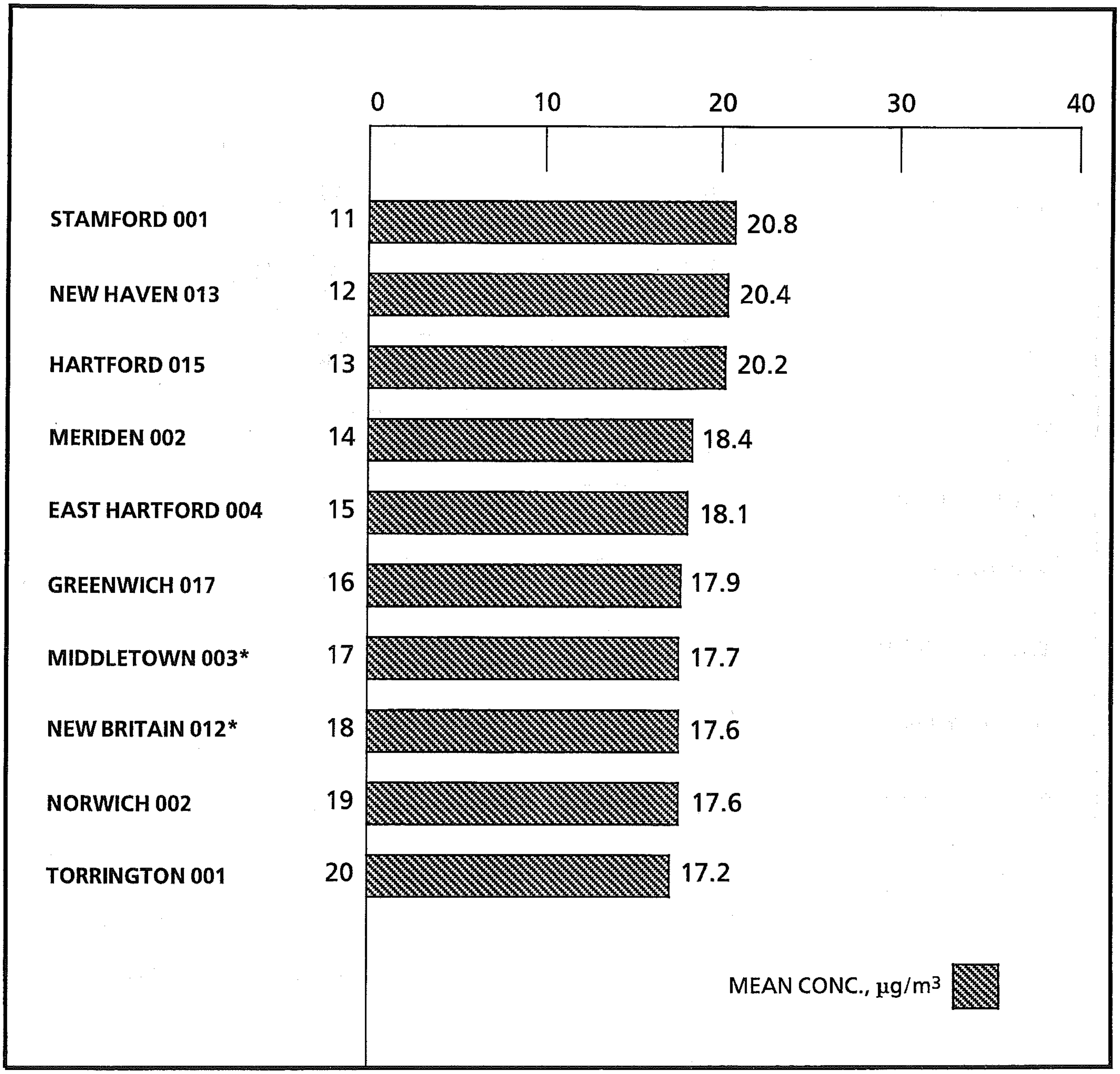
1995 ANNUAL AVERAGE PM10 CONCENTRATIONS



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

FIGURE 2-2, continued

1995 ANNUAL AVERAGE PM10 CONCENTRATIONS



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

FIGURE 2-2, continued

1995 ANNUAL AVERAGE PM10 CONCENTRATIONS

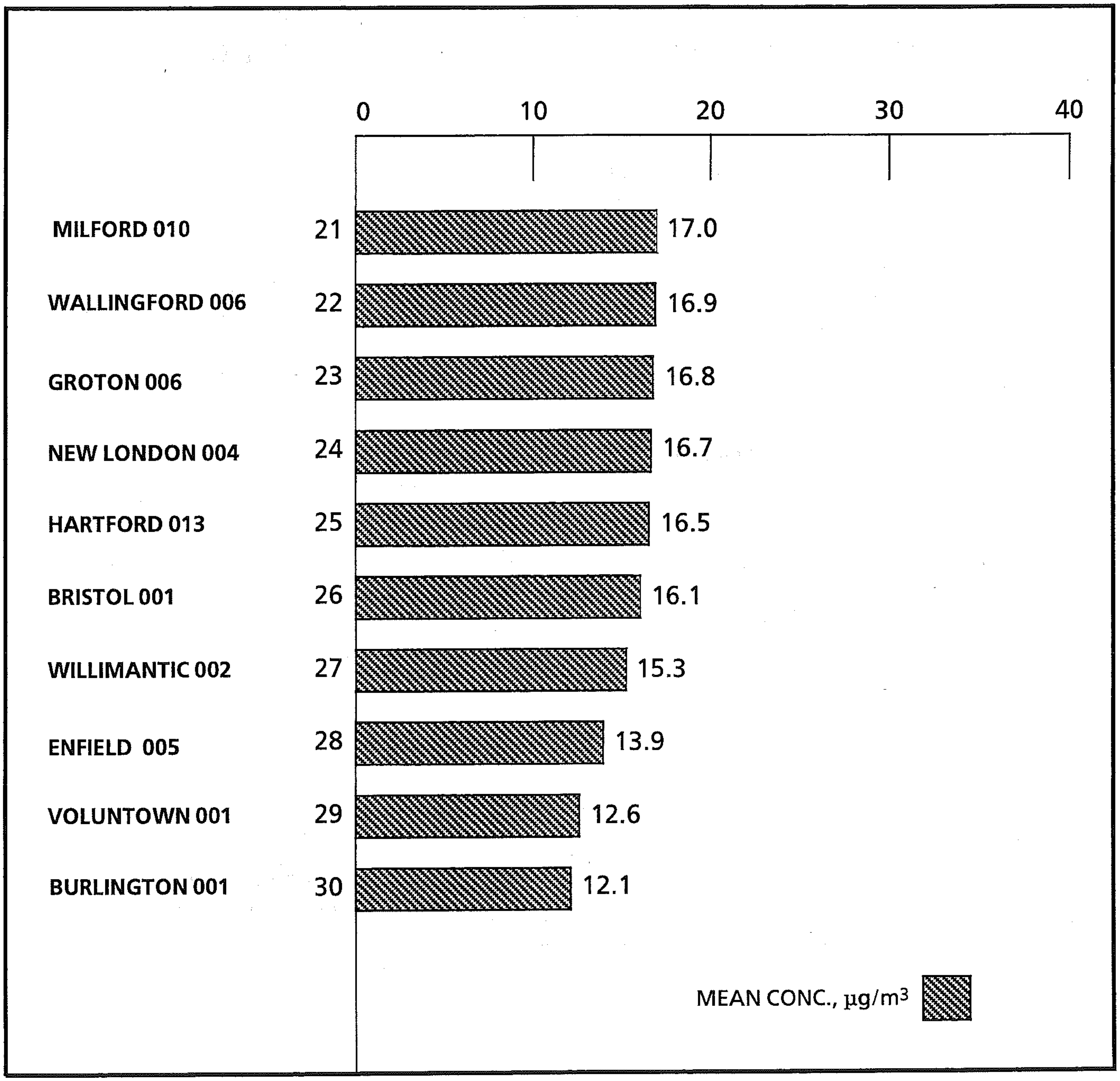
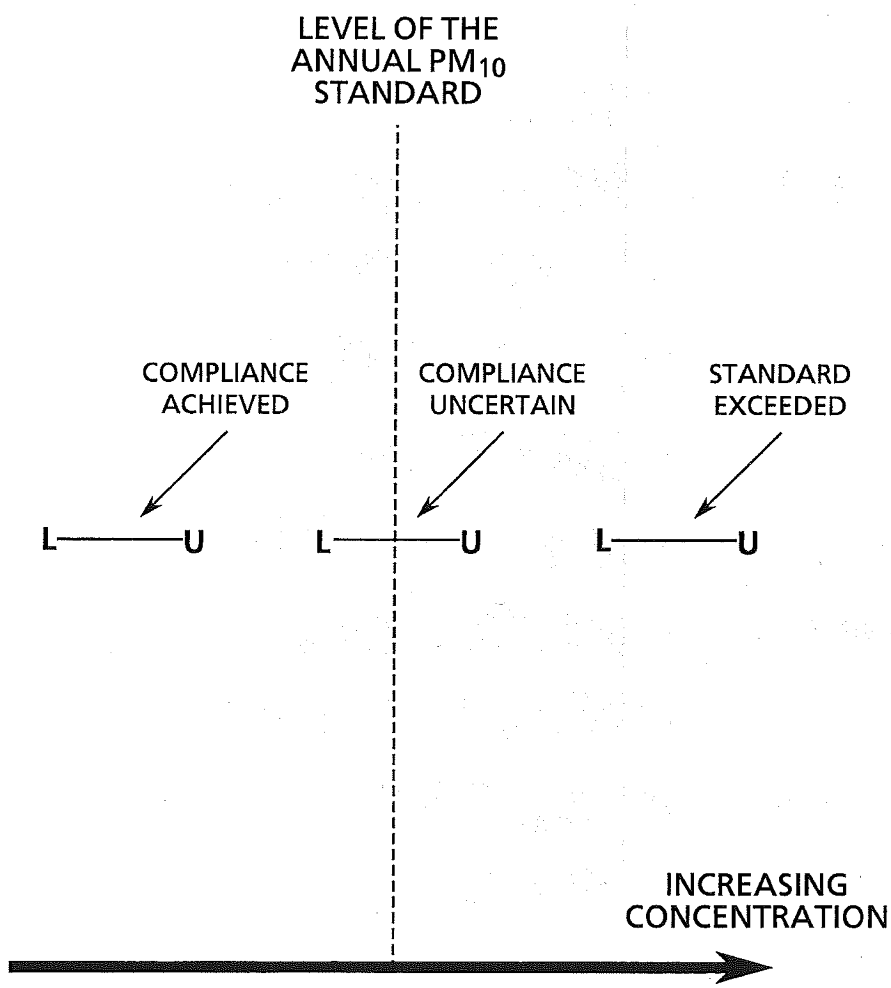


FIGURE 2-3

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



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

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

TABLE 2-2

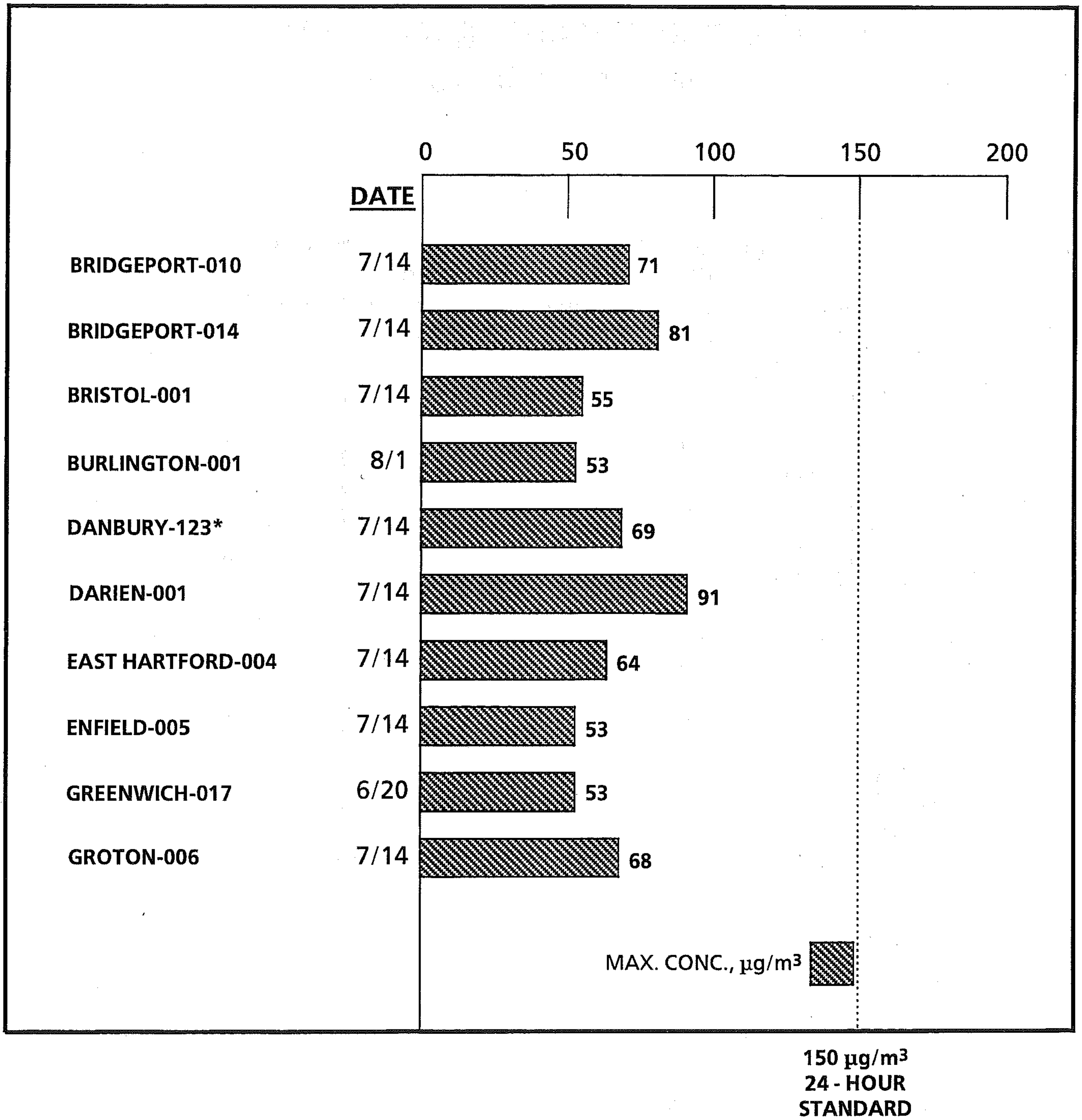
STATISTICALLY PREDICTED NUMBER OF SITES IN COMPLIANCE WITH THE LEVEL OF THE ANNUAL PM10 STANDARDS*

	COMPLIANCE ACHIEVED	COMPLIANCE UNCERTAIN	STANDARD EXCEEDED
1985	2	0	0
1986	4	0	1
1987	4	0	1
1988	3	0	0
1989	40	0	0
1990	39	0	0
1991	30	0	0
1992	28	0	0
1993	23	0	0
1994	26	0	0
1995	26	0	0

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

FIGURE 2-4

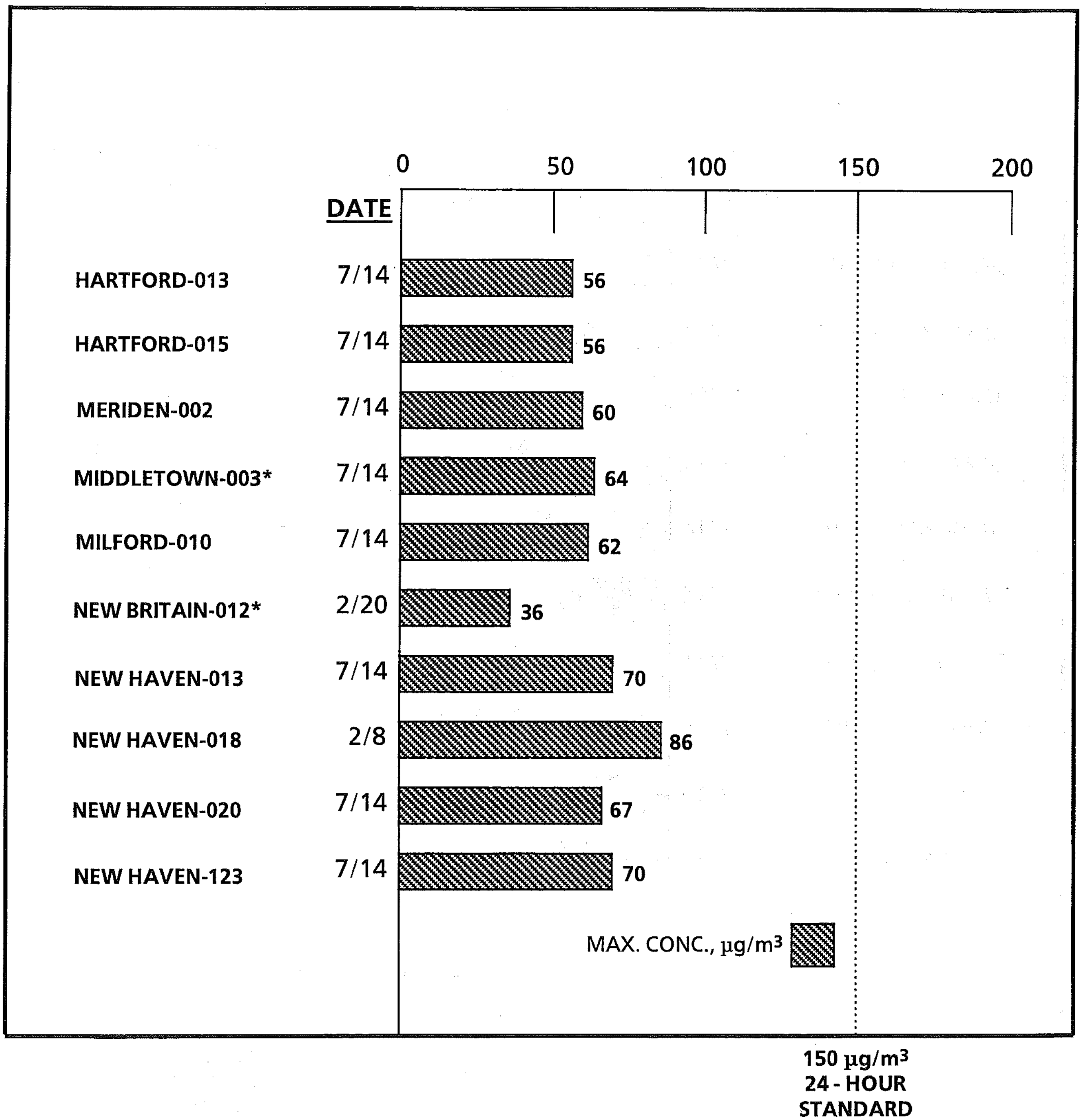
1995 MAXIMUM 24-HOUR PM10 CONCENTRATIONS



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

FIGURE 2-4, continued

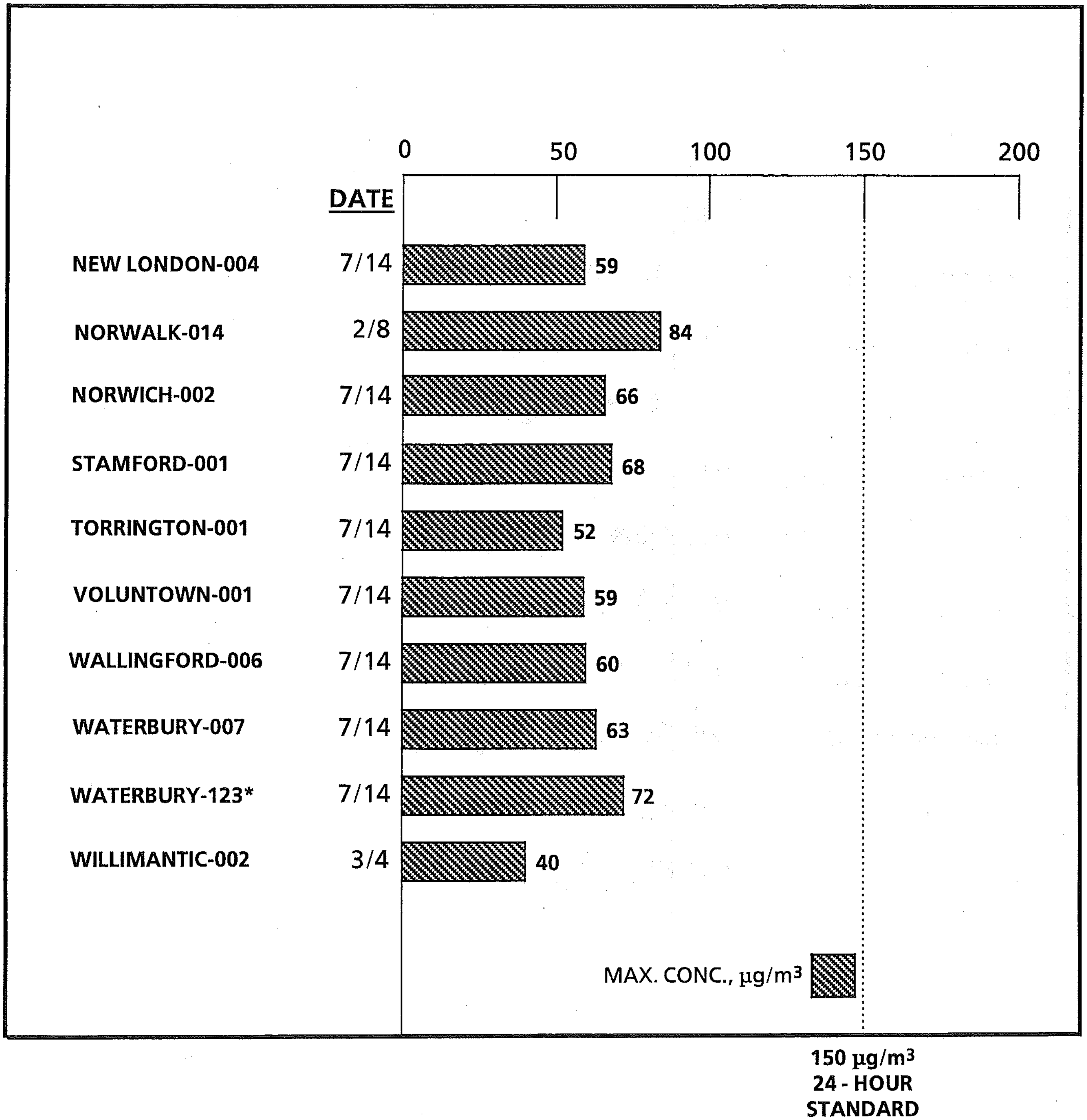
1995 MAXIMUM 24-HOUR PM10 CONCENTRATIONS



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

FIGURE 2-4, continued

1995 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%
1994	26	0	0%
1995	26	0	0%

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

TABLE 2-4

QUARTERLY CHEMICAL CHARACTERIZATION OF 1995 HI-VOL TSP

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

	QUARTERLY AVG				ANNUAL AVG
	1ST	2ND	3RD	4TH	
METALS (ng/m^3)					
BERYLLIUM	<.1	<.1	<.1	<.1	<.1
CADMIUM	1.1	1.5	1.5	1.6	1.5
CHROMIUM	2	3	2	1	2
COPPER	40	50	70	80	60
IRON	680	880	690	250	620
LEAD	20	20	20	10	20
MANGANESE	12	16	12	7	12
NICKEL	5	5	6	4	5
VANADIUM	10	10	<10	<10	10[a]
ZINC	50	60	40	30	50
WATER SOLUBLES (ng/m^3)					
NITRATE	2990	4510	3840	2320	3460
SULFATE	9170	10010	8630	8610	9100
AMMONIUM	150	90	<10	<10	50[a]
TSP (µg/m^3)	45	56	50	34	47
SAMPLE COUNT	10[b]	14[c]	15[d]	14	

[a] The annual average was calculated using one-half the detectable limit in the 3rd and 4th quarters.
[b] The sample counts were 12 for sulfate and 13 for TSP.
[c] The sample count was 15 for sulfate and TSP.
[d] The sample count was 16 for sulfate and TSP.

TABLE 2-4, CONTINUED

QUARTERLY CHEMICAL CHARACTERIZATION OF 1995 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	0.8	1.0	1.1	0.4	0.8
CHROMIUM	2	3	<1	2	2[a]
COPPER	50	90	80	80	70
IRON	510	450	420	270	410
LEAD	10	10	10	10	10
MANGANESE	11	11	8	9	10
NICKEL	5	4	5	5	5
VANADIUM	10	<10	10	<10	10[b]
ZINC	30	40	20	30	30
WATER SOLUBLES (ng/m^3)					
NITRATE	2560	3270	3090	2120	2730
SULFATE	7980	8410	8850	7740	8250
AMMONIUM	110	<10	<10	<10	30[c]
TSP ($\mu g/m^3$)	34	45	40	33	38
SAMPLE COUNT	15[d]	13[e]	13[f]	15[e]	

[a] The annual average was calculated using one-half the detectable limit in the 3rd quarter.
[b] The annual average was calculated using one-half the detectable limit in the 2nd and 4th quarters.
[c] The annual average was calculated using one-half the detectable limit in the 2nd, 3rd and 4th quarters.
[d] The sample count was 14 for TSP.
[e] The sample count was 14 for sulfate and TSP
[f] The sample count was 15 for sulfate and TSP

TABLE 2-4, CONTINUED

QUARTERLY CHEMICAL CHARACTERIZATION OF 1995 HI-VOL TSP

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

	QUARTERLY AVG				ANNUAL AVG
	1ST	2ND	3RD	4TH	
METALS (ng/m^3)					
BERYLLIUM	<.1	<.1	<.1	<.1	<.1
CADMIUM	0.6	0.9	0.4	0.0	0.5
CHROMIUM	3	4	2	2	3
COPPER	70	60	60	80	70
IRON	970	1040	790	540	850
LEAD	20	20	10	20	20
MANGANESE	16	19	12	13	15
NICKEL	6	5	4	5	5
VANADIUM	10	10	10	10	10
ZINC	40	60	40	40	50
WATER SOLUBLES (ng/m^3)					
NITRATE	2570	3420	2760	1910	2690
SULFATE	7840	8680	9670	8080	8520
AMMONIUM	140	<10	<10	<10	40[a]
TSP ($\mu g/m^3$)	60	63	58	42	56
SAMPLE COUNT	15[b]	15	15[c]	13[d]	

[a] The annual average was calculated using one-half the detectable limit in the 2nd, 3rd and 4th quarters.
[b] The sample count was 14 for sulfate and TSP.
[c] The sample count was 12 for sulfate and TSP.
[c] The sample count was 15 for sulfate and TSP.

TABLE 2-4, CONTINUED

QUARTERLY CHEMICAL CHARACTERIZATION OF 1995 HI-VOL TSP

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

	QUARTERLY AVG				ANNUAL AVG
	1ST	2ND	3RD	4TH	
METALS (ng/m³)					
BERYLLIUM	<.1	<.1	<.1	<.1	<.1
CADMIUM	1.9	0.8	0.7	0.5	1.0
CHROMIUM	11	4	4	5	6
COPPER	100	70	100	100	90
IRON	1680	2090	1490	1680	1740
LEAD	70	50	40	30	50
MANGANESE	63	43	28	36	43
NICKEL	17	7	8	12	11
VANADIUM	20	10	20	30	20
ZINC	80	130	90	120	110
WATER SOLUBLES (ng/m³)					
NITRATE	2840	4160	3610	2420	3250
SULFATE	9130	9040	9880	8590	9170
AMMONIUM	210	130	<10	<10	90[a]
TSP (µg/m³)	145	110	88	96	110
SAMPLE COUNT	15[b]	15	13[c]	15[b]	

[a] The annual average was calculated using one-half the detectable limit in the 3rd and 4th quarters.
[b] The sample count was 13 for sulfate and TSP.
[c] The sample count was 14 for sulfate and TSP.

TABLE 2-4, CONTINUED

QUARTERLY CHEMICAL CHARACTERIZATION OF 1995 HI-VOL TSP

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

	QUARTERLY AVG				ANNUAL AVG
	1ST	2ND	3RD	4TH	
METALS (ng/m³)					
BERYLLIUM	<.1	<.1	<.1	<.1	<.1
CADMIUM	1.6	2.9	1.7	0.5	1.7
CHROMIUM	4	7	2	2	4
COPPER	230	210	140	100	170
IRON	1500	1240	1350	750	1220
LEAD	20	20	20	10	20
MANGANESE	31	29	27	18	27
NICKEL	9	6	5	4	6
VANADIUM	10	10	10	10	10
ZINC	90	80	70	70	80
WATER SOLUBLES (ng/m³)					
NITRATE	2490	3060	2640	1950	2550
SULFATE	8880	8030	8990	7920	8450
AMMONIUM	160	<10	<10	<10	40[a]
TSP (μg/m³)	75	70	67	50	65
SAMPLE COUNT	15[b]	15	13[c]	13[b]	

[a] The annual average was calculated using one-half the detectable limit in the 2nd, 3rd and 4th quarters.
[b] The sample count was 14 for sulfate and TSP.
[c] The sample count was 16 for sulfate and TSP.

TABLE 2-5

1995 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	71	57	54	43	38	37	36	36	33	31
	DATE	7/14/95	6/20/95	6/ 8/95	2/20/95	7/26/95	8/ 1/95	3/16/95	4/27/95	7/20/95	2/14/95
METEOROLOGICAL SITE	DIR (DEG)	270	300	350	70	230	250	120	170	270	290
NEWARK	VEL (MPH)	9.3	3.6	9.1	4.6	6.3	8.6	2.8	7.3	6.5	7.5
	SPD (MPH)	11.6	9.3	10.6	6.3	9.1	10.5	6.0	9.9	8.1	10.8
	RATIO	0.797	0.388	0.852	0.732	0.699	0.824	0.456	0.740	0.804	0.699
METEOROLOGICAL SITE	DIR (DEG)	240	20	350	30	190	230	180	190	230	300
BRADLEY	VEL (MPH)	4.5	4.1	4.2	7.0	2.2	3.4	7.5	4.7	3.9	3.1
	SPD (MPH)	7.6	4.3	4.7	7.6	3.2	5.3	9.8	4.9	5.5	4.6
	RATIO	0.586	0.951	0.885	0.913	0.705	0.635	0.763	0.957	0.706	0.683
METEOROLOGICAL SITE	DIR (DEG)	250	230	350	90	220	240	100	200	250	300
BRIDGEPORT	VEL (MPH)	6.9	3.7	4.9	7.6	5.1	5.9	7.0	3.3	5.4	5.9
	SPD (MPH)	7.0	5.8	7.0	8.3	5.2	6.0	7.2	5.5	5.6	6.2
	RATIO	0.974	0.652	0.697	0.918	0.983	0.981	0.974	0.601	0.971	0.959
BRIDGEPORT-014 (0059)	PM10	81	64	61	60	56	49	40	39	39	38
	DATE	7/14/95	2/ 8/95	6/20/95	2/14/95	6/ 8/95	2/20/95	7/26/95	12/29/95	8/ 1/95	8/31/95
METEOROLOGICAL SITE	DIR (DEG)	270	320	300	290	350	70	230	320	250	240
NEWARK	VEL (MPH)	9.3	12.0	3.6	7.5	9.1	4.6	6.3	9.4	8.6	9.2
	SPD (MPH)	11.6	12.4	9.3	10.8	10.6	6.3	9.1	10.4	10.5	10.8
	RATIO	0.797	0.968	0.388	0.699	0.852	0.732	0.699	0.911	0.824	0.854
METEOROLOGICAL SITE	DIR (DEG)	240	320	20	300	350	30	190	320	230	180
BRADLEY	VEL (MPH)	4.5	8.7	4.1	3.1	4.2	7.0	2.2	7.3	3.4	4.5
	SPD (MPH)	7.6	10.1	4.3	4.6	4.7	7.6	3.2	7.8	5.3	4.6
	RATIO	0.586	0.861	0.951	0.683	0.885	0.913	0.705	0.944	0.635	0.977
METEOROLOGICAL SITE	DIR (DEG)	250	340	230	300	350	90	220	320	240	230
BRIDGEPORT	VEL (MPH)	6.9	8.5	3.7	5.9	4.9	7.6	5.1	5.0	5.9	4.7
	SPD (MPH)	7.0	8.8	5.8	6.2	7.0	8.3	5.2	5.8	6.0	6.6
	RATIO	0.974	0.968	0.652	0.959	0.697	0.918	0.983	0.874	0.981	0.718
BRISTOL-001 (0058)	PM10	55	39	38	34	33	31	27	27	25	23
	DATE	7/14/95	3/ 4/95	6/20/95	7/26/95	2/20/95	8/ 1/95	3/16/95	2/14/95	6/ 8/95	10/12/95
METEOROLOGICAL SITE	DIR (DEG)	270	30	300	230	70	250	120	290	350	260
NEWARK	VEL (MPH)	9.3	6.8	3.6	6.3	4.6	8.6	2.8	7.5	9.1	6.1
	SPD (MPH)	11.6	7.2	9.3	9.1	6.3	10.5	6.0	10.8	10.6	7.3
	RATIO	0.797	0.951	0.388	0.699	0.732	0.824	0.456	0.699	0.852	0.826
METEOROLOGICAL SITE	DIR (DEG)	240	350	20	190	30	230	180	300	350	270
BRADLEY	VEL (MPH)	4.5	.8	4.1	2.2	7.0	3.4	7.5	3.1	4.2	2.9
	SPD (MPH)	7.6	2.6	4.3	3.2	7.6	5.3	9.8	4.6	4.7	5.9
	RATIO	0.586	0.310	0.951	0.705	0.913	0.635	0.763	0.683	0.885	0.492
METEOROLOGICAL SITE	DIR (DEG)	250	80	230	220	90	240	100	300	350	260
BRIDGEPORT	VEL (MPH)	6.9	7.3	3.7	5.1	7.6	5.9	7.0	5.9	4.9	5.8
	SPD (MPH)	7.0	8.2	5.8	5.2	8.3	6.0	7.2	6.2	7.0	5.9
	RATIO	0.974	0.887	0.652	0.983	0.918	0.981	0.974	0.959	0.697	0.980

TABLE 2-5, CONTINUED

1995 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
BURLINGTON-001 (0056)	PM10	53	30	27	25	22	19	19	18	18	18
	DATE	8/ 1/95	6/20/95	7/26/95	6/ 8/95	2/20/95	8/31/95	3/ 4/95	7/ 8/95	6/ 2/95	4/27/95
METEOROLOGICAL SITE	DIR (DEG)	250	300	230	350	70	240	30	290	150	170
NEWARK	VEL (MPH)	8.6	3.6	6.3	9.1	4.6	9.2	6.8	8.1	5.2	7.3
	SPD (MPH)	10.5	9.3	9.1	10.6	6.3	10.8	7.2	9.5	8.1	9.9
	RATIO	0.824	0.388	0.699	0.852	0.732	0.854	0.951	0.853	0.643	0.740
METEOROLOGICAL SITE	DIR (DEG)	230	20	190	350	30	180	350	290	210	190
BRADLEY	VEL (MPH)	3.4	4.1	2.2	4.2	7.0	4.5	.8	1.1	3.8	4.7
	SPD (MPH)	5.3	4.3	3.2	4.7	7.6	4.6	2.6	5.9	4.9	4.9
	RATIO	0.635	0.951	0.705	0.885	0.913	0.977	0.310	0.193	0.773	0.957
METEOROLOGICAL SITE	DIR (DEG)	240	230	220	350	90	230	80	260	230	200
BRIDGEPORT	VEL (MPH)	5.9	3.7	5.1	4.9	7.6	4.7	7.3	3.6	5.4	3.3
	SPD (MPH)	6.0	5.8	5.2	7.0	8.3	6.6	8.2	6.0	5.6	5.5
	RATIO	0.981	0.652	0.983	0.697	0.918	0.718	0.887	0.590	0.971	0.601
DARIEN-001 (0058)	PM10	91	56	44	37	37	37	36	36	35	35
	DATE	7/14/95	6/20/95	2/ 8/95	8/ 1/95	6/ 8/95	2/20/95	4/ 9/95	2/14/95	7/26/95	11/17/95
METEOROLOGICAL SITE	DIR (DEG)	270	300	320	250	350	70	50	290	230	320
NEWARK	VEL (MPH)	9.3	3.6	12.0	8.6	9.1	4.6	4.3	7.5	6.3	4.7
	SPD (MPH)	11.6	9.3	12.4	10.5	10.6	6.3	7.6	10.8	9.1	4.9
	RATIO	0.797	0.388	0.968	0.824	0.852	0.732	0.570	0.699	0.699	0.957
METEOROLOGICAL SITE	DIR (DEG)	240	20	320	230	350	30	20	300	190	290
BRADLEY	VEL (MPH)	4.5	4.1	8.7	3.4	4.2	7.0	1.1	3.1	2.2	4.9
	SPD (MPH)	7.6	4.3	10.1	5.3	4.7	7.6	3.2	4.6	3.2	6.9
	RATIO	0.586	0.951	0.861	0.635	0.885	0.913	0.334	0.683	0.705	0.716
METEOROLOGICAL SITE	DIR (DEG)	250	230	340	240	350	90	320	300	220	290
BRIDGEPORT	VEL (MPH)	6.9	3.7	8.5	5.9	4.9	7.6	1.6	5.9	5.1	3.3
	SPD (MPH)	7.0	5.8	8.8	6.0	7.0	8.3	5.8	6.2	5.2	5.3
	RATIO	0.974	0.652	0.968	0.981	0.697	0.918	0.276	0.959	0.983	0.629
EAST HARTFORD-004 (0059)	PM10	64	43	40	35	35	30	27	27	26	26
	DATE	7/14/95	6/20/95	7/26/95	3/ 4/95	8/ 1/95	2/20/95	8/31/95	1/ 9/95	7/20/95	3/16/95
METEOROLOGICAL SITE	DIR (DEG)	270	300	230	30	250	70	240	290	270	120
NEWARK	VEL (MPH)	9.3	3.6	6.3	6.8	8.6	4.6	9.2	5.0	6.5	2.8
	SPD (MPH)	11.6	9.3	9.1	7.2	10.5	6.3	10.8	7.9	8.1	6.0
	RATIO	0.797	0.388	0.699	0.951	0.824	0.732	0.854	0.628	0.804	0.456
METEOROLOGICAL SITE	DIR (DEG)	240	20	190	350	230	30	180	300	230	180
BRADLEY	VEL (MPH)	4.5	4.1	2.2	.8	3.4	7.0	4.5	2.9	3.9	7.5
	SPD (MPH)	7.6	4.3	3.2	2.6	5.3	7.6	4.6	4.6	5.5	9.8
	RATIO	0.586	0.951	0.705	0.310	0.635	0.913	0.977	0.633	0.706	0.763
METEOROLOGICAL SITE	DIR (DEG)	250	230	220	80	240	90	230	320	250	100
BRIDGEPORT	VEL (MPH)	6.9	3.7	5.1	7.3	5.9	7.6	4.7	5.6	5.4	7.0
	SPD (MPH)	7.0	5.8	5.2	8.2	6.0	8.3	6.6	6.3	5.6	7.2
	RATIO	0.974	0.652	0.983	0.887	0.981	0.918	0.718	0.878	0.971	0.974

TABLE 2-5, CONTINUED

1995 TEN HIGHEST 24-HOUR AVERAGE PM10 DAYS WITH WIND DATA

UNITS : MICROGRAMS PER CUBIC METER

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
ENFIELD-005 (0060)	PM10	53	35	35	30	25	24	23	22	22	22
	DATE	7/14/95	6/20/95	7/26/95	8/ 1/95	2/20/95	3/16/95	3/ 4/95	5/21/95	6/ 8/95	4/ 9/95
METEOROLOGICAL SITE	DIR (DEG)	270	300	230	250	70	120	30	240	350	50
NEWARK	VEL (MPH)	9.3	3.6	6.3	8.6	4.6	2.8	6.8	10.4	9.1	4.3
	SPD (MPH)	11.6	9.3	9.1	10.5	6.3	6.0	7.2	10.6	10.6	7.6
	RATIO	0.797	0.388	0.699	0.824	0.732	0.456	0.951	0.981	0.852	0.570
METEOROLOGICAL SITE	DIR (DEG)	240	20	190	230	30	180	350	190	350	20
BRADLEY	VEL (MPH)	4.5	4.1	2.2	3.4	7.0	7.5	.8	6.7	4.2	1.1
	SPD (MPH)	7.6	4.3	3.2	5.3	7.6	9.8	2.6	8.8	4.7	3.2
	RATIO	0.586	0.951	0.705	0.635	0.913	0.763	0.310	0.759	0.885	0.334
METEOROLOGICAL SITE	DIR (DEG)	250	230	220	240	90	100	80	200	350	320
BRIDGEPORT	VEL (MPH)	6.9	3.7	5.1	5.9	7.6	7.0	7.3	4.7	4.9	1.6
	SPD (MPH)	7.0	5.8	5.2	6.0	8.3	7.2	8.2	6.5	7.0	5.8
	RATIO	0.974	0.652	0.983	0.981	0.918	0.974	0.887	0.726	0.697	0.276
GREENWICH-017 (0057)	PM10	53	34	34	31	31	31	31	30	28	28
	DATE	6/20/95	1/ 9/95	8/ 1/95	10/12/95	7/26/95	2/20/95	8/31/95	7/20/95	4/ 9/95	6/ 8/95
METEOROLOGICAL SITE	DIR (DEG)	300	290	250	260	230	70	240	270	50	350
NEWARK	VEL (MPH)	3.6	5.0	8.6	6.1	6.3	4.6	9.2	6.5	4.3	9.1
	SPD (MPH)	9.3	7.9	10.5	7.3	9.1	6.3	10.8	8.1	7.6	10.6
	RATIO	0.388	0.628	0.824	0.826	0.699	0.732	0.854	0.804	0.570	0.852
METEOROLOGICAL SITE	DIR (DEG)	20	300	230	270	190	30	180	230	20	350
BRADLEY	VEL (MPH)	4.1	2.9	3.4	2.9	2.2	7.0	4.5	3.9	1.1	4.2
	SPD (MPH)	4.3	4.6	5.3	5.9	3.2	7.6	4.6	5.5	3.2	4.7
	RATIO	0.951	0.633	0.635	0.492	0.705	0.913	0.977	0.706	0.334	0.885
METEOROLOGICAL SITE	DIR (DEG)	230	320	240	260	220	90	230	250	320	350
BRIDGEPORT	VEL (MPH)	3.7	5.6	5.9	5.8	5.1	7.6	4.7	5.4	1.6	4.9
	SPD (MPH)	5.8	6.3	6.0	5.9	5.2	8.3	6.6	5.6	5.8	7.0
	RATIO	0.652	0.878	0.981	0.980	0.983	0.918	0.718	0.971	0.276	0.697
GROTON-006 (0057)	PM10	68	47	33	32	31	29	26	24	24	22
	DATE	7/14/95	6/20/95	10/12/95	8/ 1/95	6/ 8/95	2/20/95	7/20/95	5/21/95	7/26/95	2/14/95
METEOROLOGICAL SITE	DIR (DEG)	270	300	260	250	350	70	270	240	230	290
NEWARK	VEL (MPH)	9.3	3.6	6.1	8.6	9.1	4.6	6.5	10.4	6.3	7.5
	SPD (MPH)	11.6	9.3	7.3	10.5	10.6	6.3	8.1	10.6	9.1	10.8
	RATIO	0.797	0.388	0.826	0.824	0.852	0.732	0.804	0.981	0.699	0.699
METEOROLOGICAL SITE	DIR (DEG)	240	20	270	230	350	30	230	190	190	300
BRADLEY	VEL (MPH)	4.5	4.1	2.9	3.4	4.2	7.0	3.9	6.7	2.2	3.1
	SPD (MPH)	7.6	4.3	5.9	5.3	4.7	7.6	5.5	8.8	3.2	4.6
	RATIO	0.586	0.951	0.492	0.635	0.885	0.913	0.706	0.759	0.705	0.683
METEOROLOGICAL SITE	DIR (DEG)	250	230	260	240	350	90	250	200	220	300
BRIDGEPORT	VEL (MPH)	6.9	3.7	5.8	5.9	4.9	7.6	5.4	4.7	5.1	5.9
	SPD (MPH)	7.0	5.8	5.9	6.0	7.0	8.3	5.6	6.5	5.2	6.2
	RATIO	0.974	0.652	0.980	0.981	0.697	0.918	0.971	0.726	0.983	0.959

TABLE 2-5, CONTINUED

1995 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
HARTFORD-013 (0059)	PM10	56	43	36	35	32	31	25	25	24	24
	DATE	7/14/95	3/ 4/95	6/20/95	7/26/95	2/20/95	8/ 1/95	6/ 8/95	8/31/95	5/21/95	2/ 8/95
METEOROLOGICAL SITE	DIR (DEG)	270	30	300	230	70	250	350	240	240	320
NEWARK	VEL (MPH)	9.3	6.8	3.6	6.3	4.6	8.6	9.1	9.2	10.4	12.0
	SPD (MPH)	11.6	7.2	9.3	9.1	6.3	10.5	10.6	10.8	10.6	12.4
	RATIO	0.797	0.951	0.388	0.699	0.732	0.824	0.852	0.854	0.981	0.968
METEOROLOGICAL SITE	DIR (DEG)	240	350	20	190	30	230	350	180	190	320
BRADLEY	VEL (MPH)	4.5	.8	4.1	2.2	7.0	3.4	4.2	4.5	6.7	8.7
	SPD (MPH)	7.6	2.6	4.3	3.2	7.6	5.3	4.7	4.6	8.8	10.1
	RATIO	0.586	0.310	0.951	0.705	0.913	0.635	0.885	0.977	0.759	0.861
METEOROLOGICAL SITE	DIR (DEG)	250	80	230	220	90	240	350	230	200	340
BRIDGEPORT	VEL (MPH)	6.9	7.3	3.7	5.1	7.6	5.9	4.9	4.7	4.7	8.5
	SPD (MPH)	7.0	8.2	5.8	5.2	8.3	6.0	7.0	6.6	6.5	8.8
	RATIO	0.974	0.887	0.652	0.983	0.918	0.981	0.697	0.718	0.726	0.968
HARTFORD-015 (0056)	PM10	56	45	43	43	41	38	33	33	32	32
	DATE	7/14/95	2/20/95	3/ 4/95	6/20/95	2/14/95	2/ 8/95	6/ 8/95	7/26/95	8/ 1/95	3/16/95
METEOROLOGICAL SITE	DIR (DEG)	270	70	30	300	290	320	350	230	250	120
NEWARK	VEL (MPH)	9.3	4.6	6.8	3.6	7.5	12.0	9.1	6.3	8.6	2.8
	SPD (MPH)	11.6	6.3	7.2	9.3	10.8	12.4	10.6	9.1	10.5	6.0
	RATIO	0.797	0.732	0.951	0.388	0.699	0.968	0.852	0.699	0.824	0.456
METEOROLOGICAL SITE	DIR (DEG)	240	30	350	20	300	320	350	190	230	180
BRADLEY	VEL (MPH)	4.5	7.0	.8	4.1	3.1	8.7	4.2	2.2	3.4	7.5
	SPD (MPH)	7.6	7.6	2.6	4.3	4.6	10.1	4.7	3.2	5.3	9.8
	RATIO	0.586	0.913	0.310	0.951	0.683	0.861	0.885	0.705	0.635	0.763
METEOROLOGICAL SITE	DIR (DEG)	250	90	80	230	300	340	350	220	240	100
BRIDGEPORT	VEL (MPH)	6.9	7.6	7.3	3.7	5.9	8.5	4.9	5.1	5.9	7.0
	SPD (MPH)	7.0	8.3	8.2	5.8	6.2	8.8	7.0	5.2	6.0	7.2
	RATIO	0.974	0.918	0.887	0.652	0.959	0.968	0.697	0.983	0.981	0.974
MERIDEN-002 (0059)	PM10	60	41	40	37	36	33	30	29	29	29
	DATE	7/14/95	6/20/95	3/ 4/95	2/20/95	2/14/95	7/26/95	8/ 1/95	1/ 9/95	10/12/95	6/ 8/95
METEOROLOGICAL SITE	DIR (DEG)	270	300	30	70	290	230	250	290	260	350
NEWARK	VEL (MPH)	9.3	3.6	6.8	4.6	7.5	6.3	8.6	5.0	6.1	9.1
	SPD (MPH)	11.6	9.3	7.2	6.3	10.8	9.1	10.5	7.9	7.3	10.6
	RATIO	0.797	0.388	0.951	0.732	0.699	0.699	0.824	0.628	0.826	0.852
METEOROLOGICAL SITE	DIR (DEG)	240	20	350	30	300	190	230	300	270	350
BRADLEY	VEL (MPH)	4.5	4.1	.8	7.0	3.1	2.2	3.4	2.9	2.9	4.2
	SPD (MPH)	7.6	4.3	2.6	7.6	4.6	3.2	5.3	4.6	5.9	4.7
	RATIO	0.586	0.951	0.310	0.913	0.683	0.705	0.635	0.633	0.492	0.885
METEOROLOGICAL SITE	DIR (DEG)	250	230	80	90	300	220	240	320	260	350
BRIDGEPORT	VEL (MPH)	6.9	3.7	7.3	7.6	5.9	5.1	5.9	5.6	5.8	4.9
	SPD (MPH)	7.0	5.8	8.2	8.3	6.2	5.2	6.0	6.3	5.9	7.0
	RATIO	0.974	0.652	0.887	0.918	0.959	0.983	0.981	0.878	0.980	0.697

TABLE 2-5, CONTINUED

1995 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
MILFORD-010 (0058)	PM10	62	45	34	32	30	28	28	27	26	24
	DATE	7/14/95	6/20/95	2/20/95	8/ 1/95	7/26/95	5/21/95	10/12/95	6/ 8/95	7/20/95	2/14/95
METEOROLOGICAL SITE	DIR (DEG)	270	300	70	250	230	240	260	350	270	290
NEWARK	VEL (MPH)	9.3	3.6	4.6	8.6	6.3	10.4	6.1	9.1	6.5	7.5
	SPD (MPH)	11.6	9.3	6.3	10.5	9.1	10.6	7.3	10.6	8.1	10.8
	RATIO	0.797	0.388	0.732	0.824	0.699	0.981	0.826	0.852	0.804	0.699
METEOROLOGICAL SITE	DIR (DEG)	240	20	30	230	190	190	270	350	230	300
BRADLEY	VEL (MPH)	4.5	4.1	7.0	3.4	2.2	6.7	2.9	4.2	3.9	3.1
	SPD (MPH)	7.6	4.3	7.6	5.3	3.2	8.8	5.9	4.7	5.5	4.6
	RATIO	0.586	0.951	0.913	0.635	0.705	0.759	0.492	0.885	0.706	0.683
METEOROLOGICAL SITE	DIR (DEG)	250	230	90	240	220	200	260	350	250	300
BRIDGEPORT	VEL (MPH)	6.9	3.7	7.6	5.9	5.1	4.7	5.8	4.9	5.4	5.9
	SPD (MPH)	7.0	5.8	8.3	6.0	5.2	6.5	5.9	7.0	5.6	6.2
	RATIO	0.974	0.652	0.918	0.981	0.983	0.726	0.980	0.697	0.971	0.959
NEW HAVEN-013 (0057)	PM10	70	53	44	35	34	33	33	31	30	28
	DATE	7/14/95	6/20/95	2/20/95	2/ 8/95	6/ 8/95	8/ 1/95	7/26/95	10/12/95	2/14/95	7/20/95
METEOROLOGICAL SITE	DIR (DEG)	270	300	70	320	350	250	230	260	290	270
NEWARK	VEL (MPH)	9.3	3.6	4.6	12.0	9.1	8.6	6.3	6.1	7.5	6.5
	SPD (MPH)	11.6	9.3	6.3	12.4	10.6	10.5	9.1	7.3	10.8	8.1
	RATIO	0.797	0.388	0.732	0.968	0.852	0.824	0.699	0.826	0.699	0.804
METEOROLOGICAL SITE	DIR (DEG)	240	20	30	320	350	230	190	270	300	230
BRADLEY	VEL (MPH)	4.5	4.1	7.0	8.7	4.2	3.4	2.2	2.9	3.1	3.9
	SPD (MPH)	7.6	4.3	7.6	10.1	4.7	5.3	3.2	5.9	4.6	5.5
	RATIO	0.586	0.951	0.913	0.861	0.885	0.635	0.705	0.492	0.683	0.706
METEOROLOGICAL SITE	DIR (DEG)	250	230	90	340	350	240	220	260	300	250
BRIDGEPORT	VEL (MPH)	6.9	3.7	7.6	8.5	4.9	5.9	5.1	5.8	5.9	5.4
	SPD (MPH)	7.0	5.8	8.3	8.8	7.0	6.0	5.2	5.9	6.2	5.6
	RATIO	0.974	0.652	0.918	0.968	0.697	0.981	0.983	0.980	0.959	0.971
NEW HAVEN-018 (0058)	PM10	86	74	69	69	67	57	56	51	44	41
	DATE	2/ 8/95	7/14/95	2/ 2/95	2/14/95	6/20/95	6/ 8/95	2/20/95	3/ 4/95	12/29/95	10/12/95
METEOROLOGICAL SITE	DIR (DEG)	320	270	320	290	300	350	70	30	320	260
NEWARK	VEL (MPH)	12.0	9.3	13.4	7.5	3.6	9.1	4.6	6.8	9.4	6.1
	SPD (MPH)	12.4	11.6	13.9	10.8	9.3	10.6	6.3	7.2	10.4	7.3
	RATIO	0.968	0.797	0.960	0.699	0.388	0.852	0.732	0.951	0.911	0.826
METEOROLOGICAL SITE	DIR (DEG)	320	240	330	300	20	350	30	350	320	270
BRADLEY	VEL (MPH)	8.7	4.5	10.0	3.1	4.1	4.2	7.0	.8	7.3	2.9
	SPD (MPH)	10.1	7.6	10.6	4.6	4.3	4.7	7.6	2.6	7.8	5.9
	RATIO	0.861	0.586	0.939	0.683	0.951	0.885	0.913	0.310	0.944	0.492
METEOROLOGICAL SITE	DIR (DEG)	340	250	350	300	230	350	90	80	320	260
BRIDGEPORT	VEL (MPH)	8.5	6.9	10.9	5.9	3.7	4.9	7.6	7.3	5.0	5.8
	SPD (MPH)	8.8	7.0	11.8	6.2	5.8	7.0	8.3	8.2	5.8	5.9
	RATIO	0.968	0.974	0.921	0.959	0.652	0.697	0.918	0.887	0.874	0.980

TABLE 2-5, CONTINUED

1995 TEN HIGHEST 24-HOUR AVERAGE PM10 DAYS WITH WIND DATA

UNITS : MICROGRAMS PER CUBIC METER

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
NEW HAVEN-020 (0061)	PM10	67	52	51	48	38	36	36	33	33	33
	DATE	7/14/95	2/ 8/95	6/20/95	2/20/95	2/14/95	6/ 8/95	8/ 1/95	7/26/95	10/12/95	7/20/95
METEOROLOGICAL SITE	DIR (DEG)	270	320	300	70	290	350	250	230	260	270
NEWARK	VEL (MPH)	9.3	12.0	3.6	4.6	7.5	9.1	8.6	6.3	6.1	6.5
	SPD (MPH)	11.6	12.4	9.3	6.3	10.8	10.6	10.5	9.1	7.3	8.1
	RATIO	0.797	0.968	0.388	0.732	0.699	0.852	0.824	0.699	0.826	0.804
METEOROLOGICAL SITE	DIR (DEG)	240	320	20	30	300	350	230	190	270	230
BRADLEY	VEL (MPH)	4.5	8.7	4.1	7.0	3.1	4.2	3.4	2.2	2.9	3.9
	SPD (MPH)	7.6	10.1	4.3	7.6	4.6	4.7	5.3	3.2	5.9	5.5
	RATIO	0.586	0.861	0.951	0.913	0.683	0.885	0.635	0.705	0.492	0.706
METEOROLOGICAL SITE	DIR (DEG)	250	340	230	90	300	350	240	220	260	250
BRIDGEPORT	VEL (MPH)	6.9	8.5	3.7	7.6	5.9	4.9	5.9	5.1	5.8	5.4
	SPD (MPH)	7.0	8.8	5.8	8.3	6.2	7.0	6.0	5.2	5.9	5.6
	RATIO	0.974	0.968	0.652	0.918	0.959	0.697	0.981	0.983	0.980	0.971
NEW HAVEN-123 (0060)	PM10	70	56	55	46	39	37	35	34	32	31
	DATE	7/14/95	2/20/95	6/20/95	2/ 8/95	2/14/95	7/26/95	8/ 1/95	6/ 8/95	3/16/95	5/21/95
METEOROLOGICAL SITE	DIR (DEG)	270	70	300	320	290	230	250	350	120	240
NEWARK	VEL (MPH)	9.3	4.6	3.6	12.0	7.5	6.3	8.6	9.1	2.8	10.4
	SPD (MPH)	11.6	6.3	9.3	12.4	10.8	9.1	10.5	10.6	6.0	10.6
	RATIO	0.797	0.732	0.388	0.968	0.699	0.699	0.824	0.852	0.456	0.981
METEOROLOGICAL SITE	DIR (DEG)	240	30	20	320	300	190	230	350	180	190
BRADLEY	VEL (MPH)	4.5	7.0	4.1	8.7	3.1	2.2	3.4	4.2	7.5	6.7
	SPD (MPH)	7.6	7.6	4.3	10.1	4.6	3.2	5.3	4.7	9.8	8.8
	RATIO	0.586	0.913	0.951	0.861	0.683	0.705	0.635	0.885	0.763	0.759
METEOROLOGICAL SITE	DIR (DEG)	250	90	230	340	300	220	240	350	100	200
BRIDGEPORT	VEL (MPH)	6.9	7.6	3.7	8.5	5.9	5.1	5.9	4.9	7.0	4.7
	SPD (MPH)	7.0	8.3	5.8	8.8	6.2	5.2	6.0	7.0	7.2	6.5
	RATIO	0.974	0.918	0.652	0.968	0.959	0.983	0.981	0.697	0.974	0.726
NEW LONDON-004 (0057)	PM10	59	42	32	31	28	26	26	25	24	23
	DATE	7/14/95	6/20/95	2/20/95	6/ 8/95	8/ 1/95	7/20/95	1/ 9/95	5/21/95	10/12/95	2/14/95
METEOROLOGICAL SITE	DIR (DEG)	270	300	70	350	250	270	290	240	260	290
NEWARK	VEL (MPH)	9.3	3.6	4.6	9.1	8.6	6.5	5.0	10.4	6.1	7.5
	SPD (MPH)	11.6	9.3	6.3	10.6	10.5	8.1	7.9	10.6	7.3	10.8
	RATIO	0.797	0.388	0.732	0.852	0.824	0.804	0.628	0.981	0.826	0.699
METEOROLOGICAL SITE	DIR (DEG)	240	20	30	350	230	230	300	190	270	300
BRADLEY	VEL (MPH)	4.5	4.1	7.0	4.2	3.4	3.9	2.9	6.7	2.9	3.1
	SPD (MPH)	7.6	4.3	7.6	4.7	5.3	5.5	4.6	8.8	5.9	4.6
	RATIO	0.586	0.951	0.913	0.885	0.635	0.706	0.633	0.759	0.492	0.683
METEOROLOGICAL SITE	DIR (DEG)	250	230	90	350	240	250	320	200	260	300
BRIDGEPORT	VEL (MPH)	6.9	3.7	7.6	4.9	5.9	5.4	5.6	4.7	5.8	5.9
	SPD (MPH)	7.0	5.8	8.3	7.0	6.0	5.6	6.3	6.5	5.9	6.2
	RATIO	0.974	0.652	0.918	0.697	0.981	0.971	0.878	0.726	0.980	0.959

TABLE 2-5, CONTINUED

1995 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
NORWALK-014 (0056)	PM10	84	76	65	65	62	56	52	52	51	45
	DATE	2/ 8/95	7/14/95	12/29/95	2/14/95	6/20/95	2/20/95	12/23/95	12/17/95	10/18/95	7/26/95
METEOROLOGICAL SITE	DIR (DEG)	320	270	320	290	300	70	330	340	230	230
NEWARK	VEL (MPH)	12.0	9.3	9.4	7.5	3.6	4.6	12.0	11.5	7.6	6.3
	SPD (MPH)	12.4	11.6	10.4	10.8	9.3	6.3	12.4	11.6	8.9	9.1
	RATIO	0.968	0.797	0.911	0.699	0.388	0.732	0.968	0.985	0.851	0.699
METEOROLOGICAL SITE	DIR (DEG)	320	240	320	300	20	30	330	330	200	190
BRADLEY	VEL (MPH)	8.7	4.5	7.3	3.1	4.1	7.0	10.8	8.1	8.7	2.2
	SPD (MPH)	10.1	7.6	7.8	4.6	4.3	7.6	11.6	9.1	9.1	3.2
	RATIO	0.861	0.586	0.944	0.683	0.951	0.913	0.928	0.890	0.966	0.705
METEOROLOGICAL SITE	DIR (DEG)	340	250	320	300	230	90	330	360	250	220
BRIDGEPORT	VEL (MPH)	8.5	6.9	5.0	5.9	3.7	7.6	5.1	6.2	7.7	5.1
	SPD (MPH)	8.8	7.0	5.8	6.2	5.8	8.3	6.0	6.9	8.5	5.2
	RATIO	0.968	0.974	0.874	0.959	0.652	0.918	0.849	0.905	0.906	0.983
NORWICH-002 (0058)	PM10	66	41	35	32	31	31	30	28	25	25
	DATE	7/14/95	6/20/95	2/20/95	7/26/95	2/ 8/95	1/ 9/95	8/ 1/95	6/ 8/95	7/20/95	3/ 4/95
METEOROLOGICAL SITE	DIR (DEG)	270	300	70	230	320	290	250	350	270	30
NEWARK	VEL (MPH)	9.3	3.6	4.6	6.3	12.0	5.0	8.6	9.1	6.5	6.8
	SPD (MPH)	11.6	9.3	6.3	9.1	12.4	7.9	10.5	10.6	8.1	7.2
	RATIO	0.797	0.388	0.732	0.699	0.968	0.628	0.824	0.852	0.804	0.951
METEOROLOGICAL SITE	DIR (DEG)	240	20	30	190	320	300	230	350	230	350
BRADLEY	VEL (MPH)	4.5	4.1	7.0	2.2	8.7	2.9	3.4	4.2	3.9	.8
	SPD (MPH)	7.6	4.3	7.6	3.2	10.1	4.6	5.3	4.7	5.5	2.6
	RATIO	0.586	0.951	0.913	0.705	0.861	0.633	0.635	0.885	0.706	0.310
METEOROLOGICAL SITE	DIR (DEG)	250	230	90	220	340	320	240	350	250	80
BRIDGEPORT	VEL (MPH)	6.9	3.7	7.6	5.1	8.5	5.6	5.9	4.9	5.4	7.3
	SPD (MPH)	7.0	5.8	8.3	5.2	8.8	6.3	6.0	7.0	5.6	8.2
	RATIO	0.974	0.652	0.918	0.983	0.968	0.878	0.981	0.697	0.971	0.887
STAMFORD-001 (0059)	PM10	68	38	36	35	35	32	32	32	32	31
	DATE	7/14/95	8/ 1/95	7/26/95	2/20/95	3/16/95	4/21/95	7/20/95	6/ 8/95	8/31/95	2/ 8/95
METEOROLOGICAL SITE	DIR (DEG)	270	250	230	70	120	130	270	350	240	320
NEWARK	VEL (MPH)	9.3	8.6	6.3	4.6	2.8	3.8	6.5	9.1	9.2	12.0
	SPD (MPH)	11.6	10.5	9.1	6.3	6.0	5.5	8.1	10.6	10.8	12.4
	RATIO	0.797	0.824	0.699	0.732	0.456	0.697	0.804	0.852	0.854	0.968
METEOROLOGICAL SITE	DIR (DEG)	240	230	190	30	180	160	230	350	180	320
BRADLEY	VEL (MPH)	4.5	3.4	2.2	7.0	7.5	3.2	3.9	4.2	4.5	8.7
	SPD (MPH)	7.6	5.3	3.2	7.6	9.8	5.8	5.5	4.7	4.6	10.1
	RATIO	0.586	0.635	0.705	0.913	0.763	0.556	0.706	0.885	0.977	0.861
METEOROLOGICAL SITE	DIR (DEG)	250	240	220	90	100	100	250	350	230	340
BRIDGEPORT	VEL (MPH)	6.9	5.9	5.1	7.6	7.0	6.6	5.4	4.9	4.7	8.5
	SPD (MPH)	7.0	6.0	5.2	8.3	7.2	6.8	5.6	7.0	6.6	8.8
	RATIO	0.974	0.981	0.983	0.918	0.974	0.983	0.971	0.697	0.718	0.968

TABLE 2-5, CONTINUED

1995 TEN HIGHEST 24-HOUR AVERAGE PM10 DAYS WITH WIND DATA

UNITS : MICROGRAMS PER CUBIC METER

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
TORRINGTON-001 (0060)	PM10	52	36	34	33	32	31	30	29	29	27
	DATE	7/14/95	8/ 1/95	2/20/95	6/20/95	7/26/95	3/16/95	3/ 4/95	2/14/95	10/12/95	1/ 9/95
METEOROLOGICAL SITE	DIR (DEG)	270	250	70	300	230	120	30	290	260	290
NEWARK	VEL (MPH)	9.3	8.6	4.6	3.6	6.3	2.8	6.8	7.5	6.1	5.0
	SPD (MPH)	11.6	10.5	6.3	9.3	9.1	6.0	7.2	10.8	7.3	7.9
	RATIO	0.797	0.824	0.732	0.388	0.699	0.456	0.951	0.699	0.826	0.628
METEOROLOGICAL SITE	DIR (DEG)	240	230	30	20	190	180	350	300	270	300
BRADLEY	VEL (MPH)	4.5	3.4	7.0	4.1	2.2	7.5	.8	3.1	2.9	2.9
	SPD (MPH)	7.6	5.3	7.6	4.3	3.2	9.8	2.6	4.6	5.9	4.6
	RATIO	0.586	0.635	0.913	0.951	0.705	0.763	0.310	0.683	0.492	0.633
METEOROLOGICAL SITE	DIR (DEG)	250	240	90	230	220	100	80	300	260	320
BRIDGEPORT	VEL (MPH)	6.9	5.9	7.6	3.7	5.1	7.0	7.3	5.9	5.8	5.6
	SPD (MPH)	7.0	6.0	8.3	5.8	5.2	7.2	8.2	6.2	5.9	6.3
	RATIO	0.974	0.981	0.918	0.652	0.983	0.974	0.887	0.959	0.980	0.878
VOLUNTOWN-001 (0056)	PM10	59	37	30	27	25	20	20	20	18	17
	DATE	7/14/95	6/20/95	8/ 1/95	7/26/95	6/ 8/95	7/20/95	2/20/95	5/21/95	3/16/95	8/31/95
METEOROLOGICAL SITE	DIR (DEG)	270	300	250	230	350	270	70	240	120	240
NEWARK	VEL (MPH)	9.3	3.6	8.6	6.3	9.1	6.5	4.6	10.4	2.8	9.2
	SPD (MPH)	11.6	9.3	10.5	9.1	10.6	8.1	6.3	10.6	6.0	10.8
	RATIO	0.797	0.388	0.824	0.699	0.852	0.804	0.732	0.981	0.456	0.854
METEOROLOGICAL SITE	DIR (DEG)	240	20	230	190	350	230	30	190	180	180
BRADLEY	VEL (MPH)	4.5	4.1	3.4	2.2	4.2	3.9	7.0	6.7	7.5	4.5
	SPD (MPH)	7.6	4.3	5.3	3.2	4.7	5.5	7.6	8.8	9.8	4.6
	RATIO	0.586	0.951	0.635	0.705	0.885	0.706	0.913	0.759	0.763	0.977
METEOROLOGICAL SITE	DIR (DEG)	250	230	240	220	350	250	90	200	100	230
BRIDGEPORT	VEL (MPH)	6.9	3.7	5.9	5.1	4.9	5.4	7.6	4.7	7.0	4.7
	SPD (MPH)	7.0	5.8	6.0	5.2	7.0	5.6	8.3	6.5	7.2	6.6
	RATIO	0.974	0.652	0.981	0.983	0.697	0.971	0.918	0.726	0.974	0.718
WALLINGFORD-006 (0059)	PM10	60	42	36	32	32	31	28	28	26	26
	DATE	7/14/95	6/20/95	2/20/95	3/ 4/95	7/26/95	8/ 1/95	2/14/95	10/12/95	6/ 8/95	5/21/95
METEOROLOGICAL SITE	DIR (DEG)	270	300	70	30	230	250	290	260	350	240
NEWARK	VEL (MPH)	9.3	3.6	4.6	6.8	6.3	8.6	7.5	6.1	9.1	10.4
	SPD (MPH)	11.6	9.3	6.3	7.2	9.1	10.5	10.8	7.3	10.6	10.6
	RATIO	0.797	0.388	0.732	0.951	0.699	0.824	0.699	0.826	0.852	0.981
METEOROLOGICAL SITE	DIR (DEG)	240	20	30	350	190	230	300	270	350	190
BRADLEY	VEL (MPH)	4.5	4.1	7.0	.8	2.2	3.4	3.1	2.9	4.2	6.7
	SPD (MPH)	7.6	4.3	7.6	2.6	3.2	5.3	4.6	5.9	4.7	8.8
	RATIO	0.586	0.951	0.913	0.310	0.705	0.635	0.683	0.492	0.885	0.759
METEOROLOGICAL SITE	DIR (DEG)	250	230	90	80	220	240	300	260	350	200
BRIDGEPORT	VEL (MPH)	6.9	3.7	7.6	7.3	5.1	5.9	5.9	5.8	4.9	4.7
	SPD (MPH)	7.0	5.8	8.3	8.2	5.2	6.0	6.2	5.9	7.0	6.5
	RATIO	0.974	0.652	0.918	0.887	0.983	0.981	0.959	0.980	0.697	0.726

TABLE 2-5, CONTINUED

1995 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 (0058)	PM10	63	53	49	43	42	42	40	39	39	39
	DATE	7/14/95	4/ 3/95	2/14/95	6/20/95	2/20/95	6/ 2/95	3/ 4/95	7/26/95	10/12/95	8/ 1/95
METEOROLOGICAL SITE	DIR (DEG)	270	150	290	300	70	150	30	230	260	250
NEWARK	VEL (MPH)	9.3	5.3	7.5	3.6	4.6	5.2	6.8	6.3	6.1	8.6
	SPD (MPH)	11.6	9.5	10.8	9.3	6.3	8.1	7.2	9.1	7.3	10.5
	RATIO	0.797	0.558	0.699	0.388	0.732	0.643	0.951	0.699	0.826	0.824
METEOROLOGICAL SITE	DIR (DEG)	240	170	300	20	30	210	350	190	270	230
BRADLEY	VEL (MPH)	4.5	5.3	3.1	4.1	7.0	3.8	.8	2.2	2.9	3.4
	SPD (MPH)	7.6	8.2	4.6	4.3	7.6	4.9	2.6	3.2	5.9	5.3
	RATIO	0.586	0.645	0.683	0.951	0.913	0.773	0.310	0.705	0.492	0.635
METEOROLOGICAL SITE	DIR (DEG)	250	180	300	230	90	230	80	220	260	240
BRIDGEPORT	VEL (MPH)	6.9	4.1	5.9	3.7	7.6	5.4	7.3	5.1	5.8	5.9
	SPD (MPH)	7.0	6.3	6.2	5.8	8.3	5.6	8.2	5.2	5.9	6.0
	RATIO	0.974	0.645	0.959	0.652	0.918	0.971	0.887	0.983	0.980	0.981
WILLIMANTIC-002 (0057)	PM10	40	38	34	31	30	29	29	29	26	25
	DATE	3/ 4/95	6/20/95	7/26/95	3/16/95	1/ 9/95	2/ 8/95	8/ 1/95	2/20/95	2/14/95	6/ 8/95
METEOROLOGICAL SITE	DIR (DEG)	30	300	230	120	290	320	250	70	290	350
NEWARK	VEL (MPH)	6.8	3.6	6.3	2.8	5.0	12.0	8.6	4.6	7.5	9.1
	SPD (MPH)	7.2	9.3	9.1	6.0	7.9	12.4	10.5	6.3	10.8	10.6
	RATIO	0.951	0.388	0.699	0.456	0.628	0.968	0.824	0.732	0.699	0.852
METEOROLOGICAL SITE	DIR (DEG)	350	20	190	180	300	320	230	30	300	350
BRADLEY	VEL (MPH)	.8	4.1	2.2	7.5	2.9	8.7	3.4	7.0	3.1	4.2
	SPD (MPH)	2.6	4.3	3.2	9.8	4.6	10.1	5.3	7.6	4.6	4.7
	RATIO	0.310	0.951	0.705	0.763	0.633	0.861	0.635	0.913	0.683	0.885
METEOROLOGICAL SITE	DIR (DEG)	80	230	220	100	320	340	240	90	300	350
BRIDGEPORT	VEL (MPH)	7.3	3.7	5.1	7.0	5.6	8.5	5.9	7.6	5.9	4.9
	SPD (MPH)	8.2	5.8	5.2	7.2	6.3	8.8	6.0	8.3	6.2	7.0
	RATIO	0.887	0.652	0.983	0.974	0.878	0.968	0.981	0.918	0.959	0.697

FIGURE 2-5

AVERAGES OF THE ANNUAL PM_{10} CONCENTRATIONS*

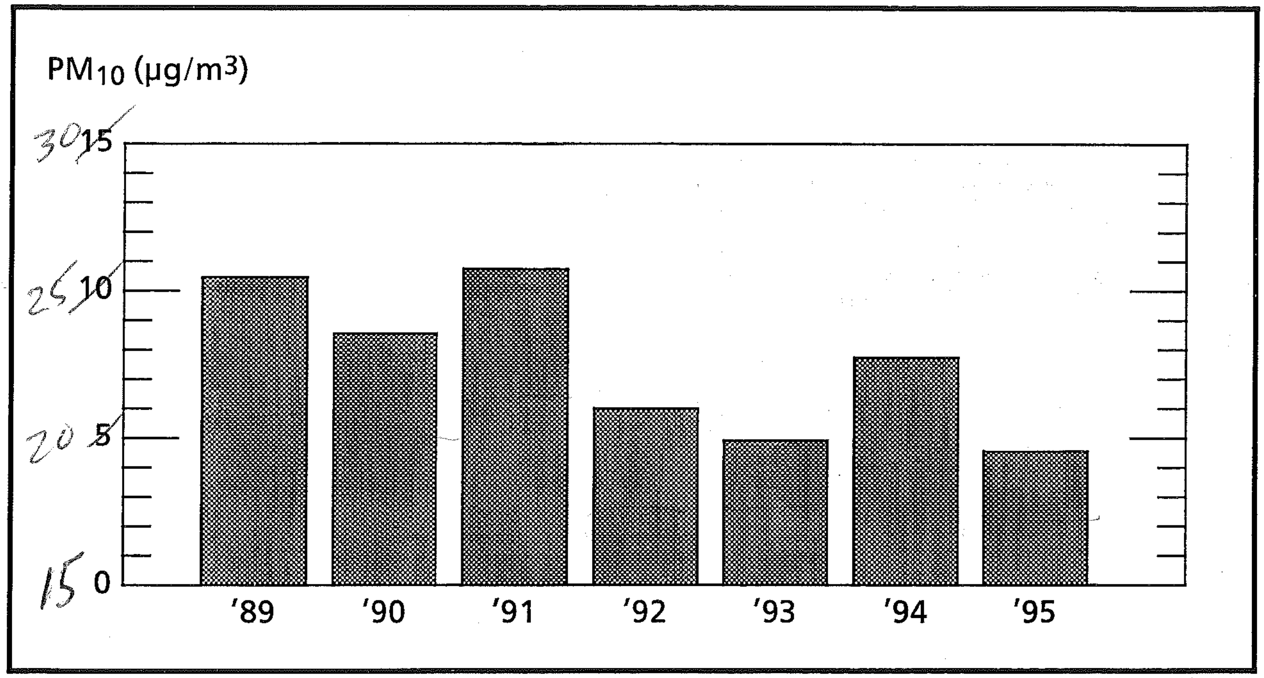
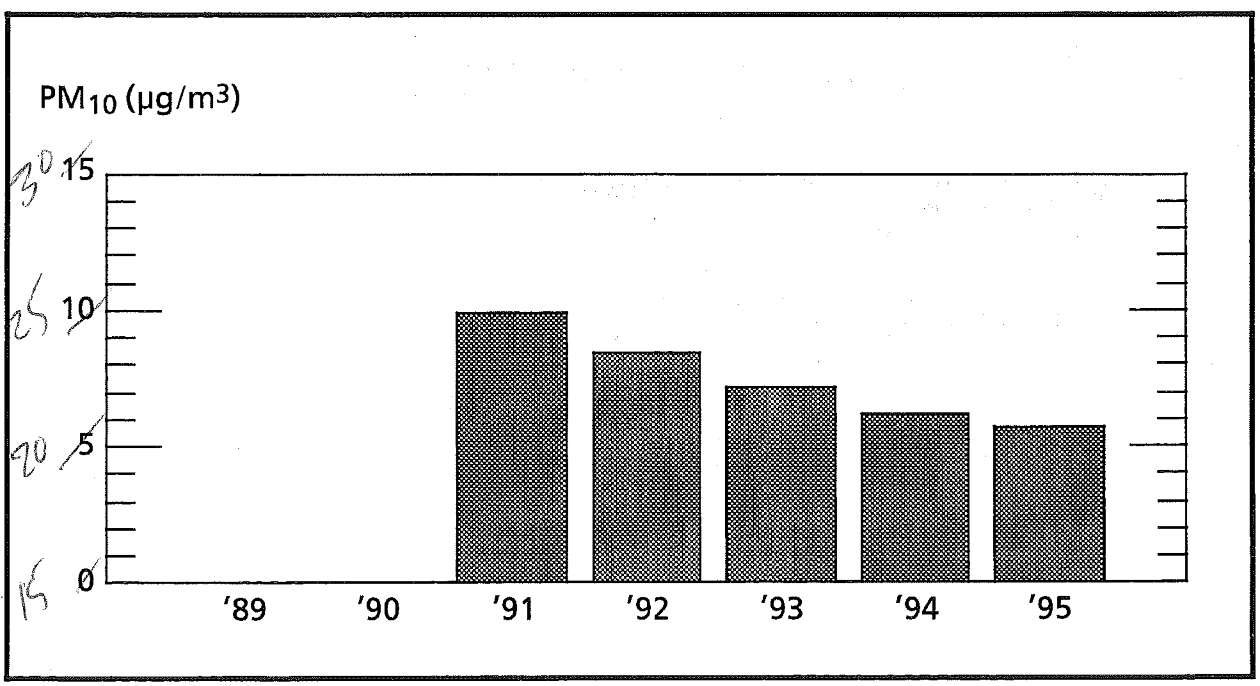


FIGURE 2-6

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



* At the 15 sites that met the minimum sampling criteria in each year of the seven-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 1995 did not exceed any federal primary or secondary standards. Measured concentrations were substantially below the 365 $\mu g/m^3$ primary 24-hour standard and well below both the 80 $\mu g/m^3$ primary annual standard and the 1300 $\mu g/m^3$ secondary 3-hour standard.

METHOD OF MEASUREMENT

The DEP Air Monitoring Unit used the pulsed fluorescence method to continuously measure sulfur dioxide levels at all 13 sites in 1995.

DISCUSSION OF DATA

Monitoring Network - Thirteen continuous SO_2 monitors were used to record data in 12 towns during 1995 (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 - 741 precision checks were made on SO_2 monitors in 1995, yielding 95% probability limits ranging from -4% to +4%. Accuracy is determined by introducing a known amount of SO_2 into each of the monitors. Three different concentration levels are tested: low, medium, and high. The 95% probability limits for accuracy based on 16 audits were: low, -5% to +6%; medium, -5% to +3%; 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 1995 (see Table 3-1). The annual average SO_2 levels decreased at twelve of the thirteen monitoring sites . The largest decrease was 8 $\mu g/m^3$, which occurred at Bridgeport 012. The one increase was 4 $\mu g/m^3$, which occurred at Stamford 124.

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 1995. 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 all thirteen monitoring sites from 1994 to 1995. The decreases ranged from 12 $\mu g/m^3$ at Greenwich 017 to 66 $\mu g/m^3$ at Stamford 124.

Current EPA policy bases compliance with the primary 24-hour SO_2 standard on calendar day averages. Assessment of compliance is based on the second highest calendar day average in the year. Running averages are averages computed for the 24-hour periods ending at every hour. If running averages were used, assessment of compliance would be based on the value of the second highest of the two highest non-overlapping 24-hour periods in the year. There has been some contention over which average is the more appropriate one on which to base compliance. Table 3-3 contains the two highest 24-hour SO_2 readings at each site in terms of both the running averages and the calendar day averages. The first high 24-hour running averages are all higher than the first high calendar day averages by up to 25 $\mu g/m^3$. The second high 24-hour running averages are all higher by up to 23 $\mu g/m^3$.

3-Hour Averages - Figure 3-3 presents the first and second high 3-hour concentrations recorded at each monitoring site. Measured SO_2 concentrations were far below the federal secondary 3-hour standard of 1300 $\mu g/m^3$ at all DEP monitoring sites in 1995. All thirteen sites had lower second high concentrations in 1995. The decreases ranged from 10 $\mu g/m^3$ at East Hartford 006 to 102 $\mu g/m^3$ at Bridgeport 012.

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 1995. 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., 40%) 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 maximum SO_2 days. Approximately 72% of the tabulated days occurred during the winter, and 21% occurred in late autumn. This phenomenon can be attributed to the fact that more fuel oil is burned during cold weather resulting in greater SO_2 emissions. In addition, temperature inversions, in which mixing heights are reduced, are more prevalent in autumn and winter.

In summary, high levels of SO_2 in Connecticut seem to be caused by a number of related factors. First, Connecticut experiences its highest SO_2 levels during the late fall and winter months, when there is an increased amount of fuel combustion. Second, the New York City metropolitan area, a large emission source, is located to the southwest of Connecticut, and southwest winds occur relatively often in this region in comparison to other wind directions. Also, adverse meteorological conditions are often associated with southwest winds. The net effect is that during the colder months when a persistent southwesterly wind occurs, an air mass picks up increased amounts of SO_2 over the New York City metropolitan area and transports this SO_2 into Connecticut, adding to Connecticut's own contribution to ambient levels. 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 1986 to 1995 is presented in Figure 3-4. The trend is clearly down in the last several years.

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

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

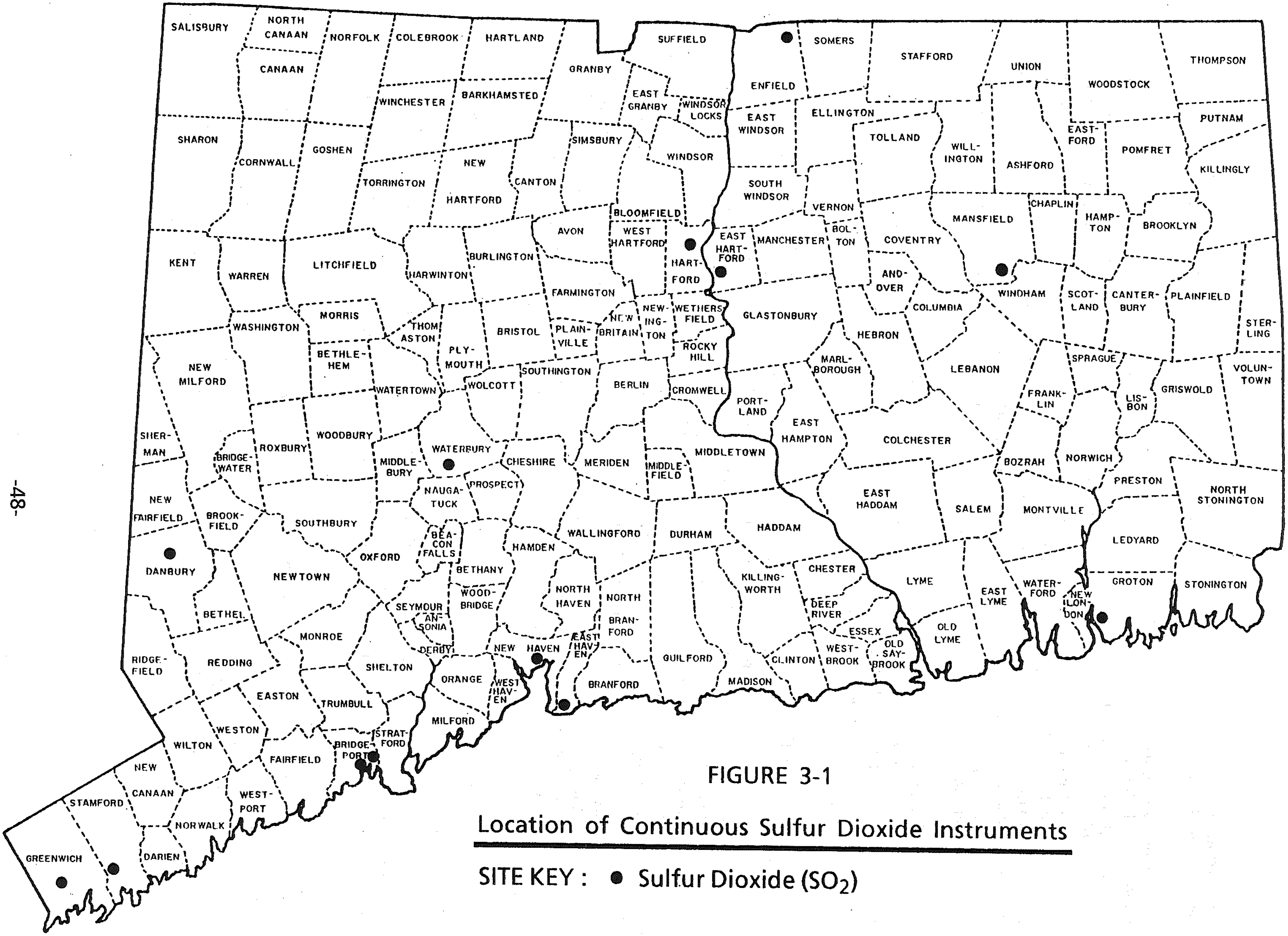


FIGURE 3-1

Location of Continuous Sulfur Dioxide Instruments

SITE KEY : ● Sulfur Dioxide (SO_2)

TABLE 3-1

1995 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	17
Bridgeport 013	Congress Street	16
Danbury 123	Western CT State University	11
East Hartford 006	High Street	13
East Haven 003	Animal Shelter	10
Enfield 005	Department of Corrections	10
Greenwich 017	Greenwich Point Park	11
Groton 007	Fire Headquarters	12
Hartford 018	Sheldon Street	14
Mansfield 003	Dept. of Transportation	8
New Haven 123	State Street	21
Stamford 124	Health Department	29
Waterbury 123	Bank Street	12

TABLE 3-2

1993-1995 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	1993	355	25.8	25.5	26.1	18.826	
BRIDGEPORT	012	1994	362	25.2	24.9	25.4	24.681	
BRIDGEPORT	012	1995	357	17.4	17.2	17.6	14.293	
BRIDGEPORT	013	1993	361	22.5	22.3	22.7	16.616	
BRIDGEPORT	013	1994	339	22.2	21.5	22.9	23.189	
BRIDGEPORT	013	1995	356	16.2	16.0	16.4	13.361	
DANBURY	123	1993	354	14.7	14.5	14.9	12.467	
DANBURY	123	1994	343	16.7	16.3	17.2	17.789	
DANBURY	123	1995	344	11.4	11.1	11.6	9.792	
EAST HARTFORD	006	1993	361	15.4	15.3	15.5	11.098	
EAST HARTFORD	006	1994	355	17.2	16.9	17.4	14.033	
EAST HARTFORD	006	1995	353	13.4	13.2	13.6	10.959	
EAST HAVEN	003	1993	365	16.6	16.6	16.6	13.277	
EAST HAVEN	003	1994	360	15.6	15.4	15.8	16.644	
EAST HAVEN	003	1995	365	10.3	10.3	10.3	10.368	
ENFIELD	005	1993	340	11.3	11.0	11.6	9.419	
ENFIELD	005	1994	342	11.4	11.0	11.7	11.397	
ENFIELD	005	1995	359	10.3	10.2	10.4	7.265	
GREENWICH	017	1993	239*	12.1	11.5	12.7	8.408	
GREENWICH	017	1994	364	14.9	14.9	15.0	12.123	
GREENWICH	017	1995	357	11.0	10.9	11.1	8.931	
GROTON	007	1993	353	16.4	16.3	16.6	9.895	
GROTON	007	1994	365	14.2	14.2	14.2	11.549	
GROTON	007	1995	362	12.4	12.3	12.5	8.583	
HARTFORD	018	1993	360	17.3	17.2	17.5	11.503	
HARTFORD	018	1994	347	18.4	18.1	18.7	14.280	
HARTFORD	018	1995	358	12.3	12.1	12.4	9.324	

* 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

1993-1995 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	1993	354	8.6	8.5	8.7	5.974	
MANSFIELD	003	1994	363	11.8	11.7	11.8	7.575	
MANSFIELD	003	1995	356	7.7	7.7	7.8	5.484	
NEW HAVEN	123	1993	356	24.1	23.8	24.5	20.539	
NEW HAVEN	123	1994	357	26.6	26.2	26.9	22.910	
NEW HAVEN	123	1995	354	21.2	20.9	21.5	16.612	
STAMFORD	124	1993	282*	19.8	19.0	20.7	14.738	
STAMFORD	124	1994	357	24.9	24.5	25.4	27.204	
STAMFORD	124	1995	345	28.7	28.2	29.2	19.182	
WATERBURY	123	1993	358	15.9	15.7	16.1	11.583	
WATERBURY	123	1994	359	17.0	16.8	17.2	15.349	
WATERBURY	123	1995	358	12.3	12.1	12.4	9.324	

* 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

1995 MAXIMUM CALENDAR DAY AVERAGE SO2 CONCENTRATIONS

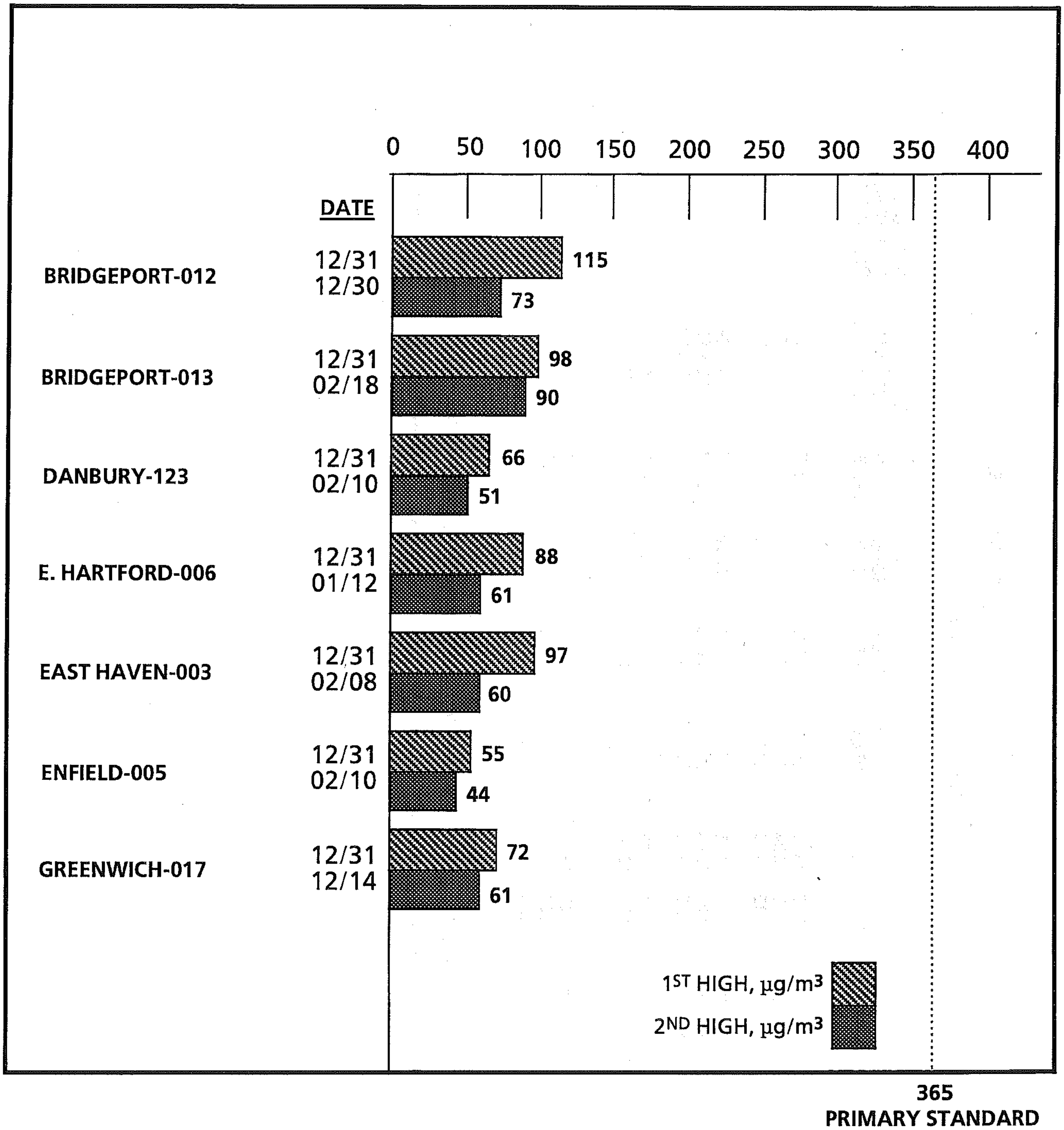


FIGURE 3-2, CONTINUED

1995 MAXIMUM CALENDAR DAY AVERAGE SO2 CONCENTRATIONS

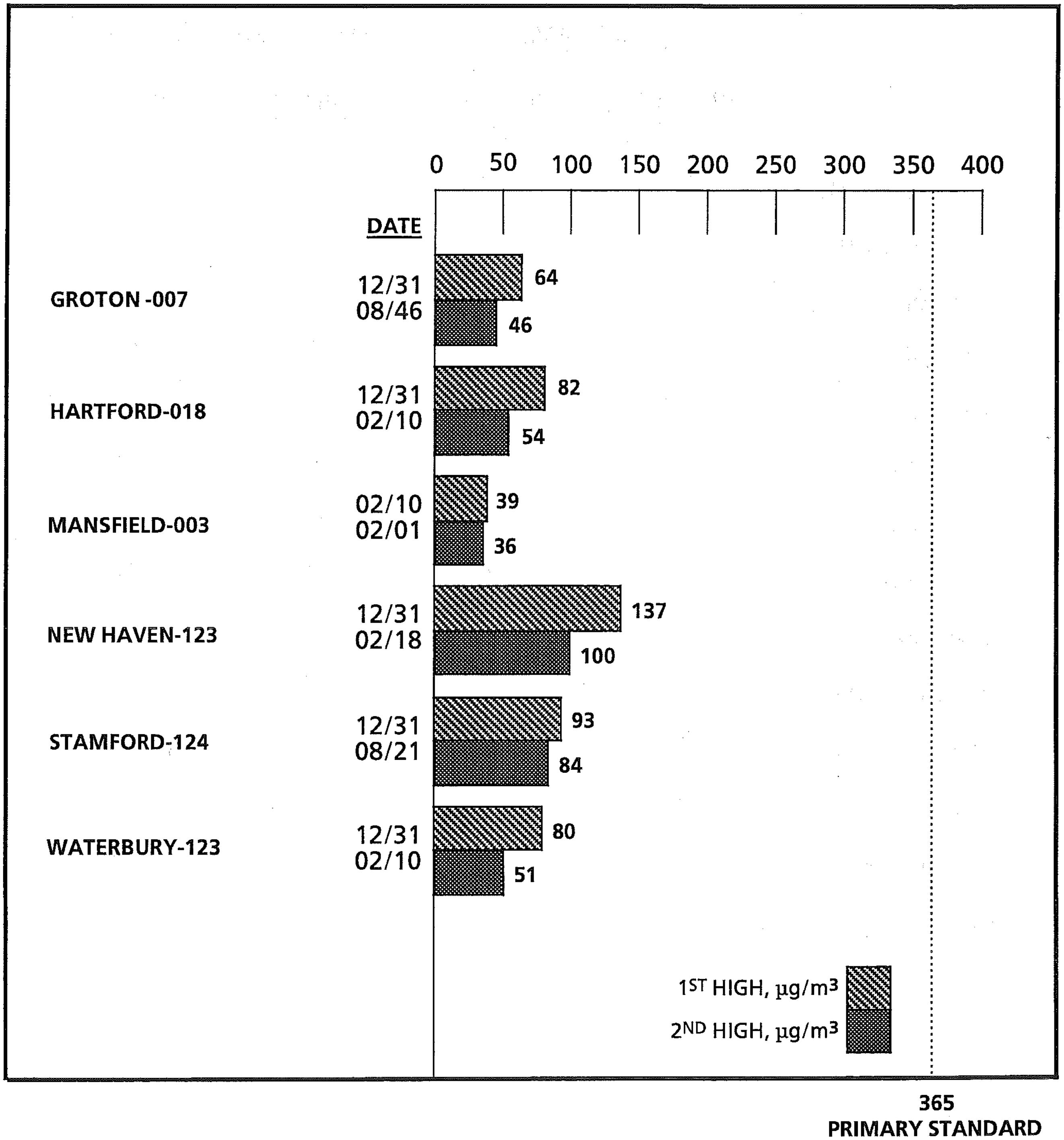


TABLE 3-3

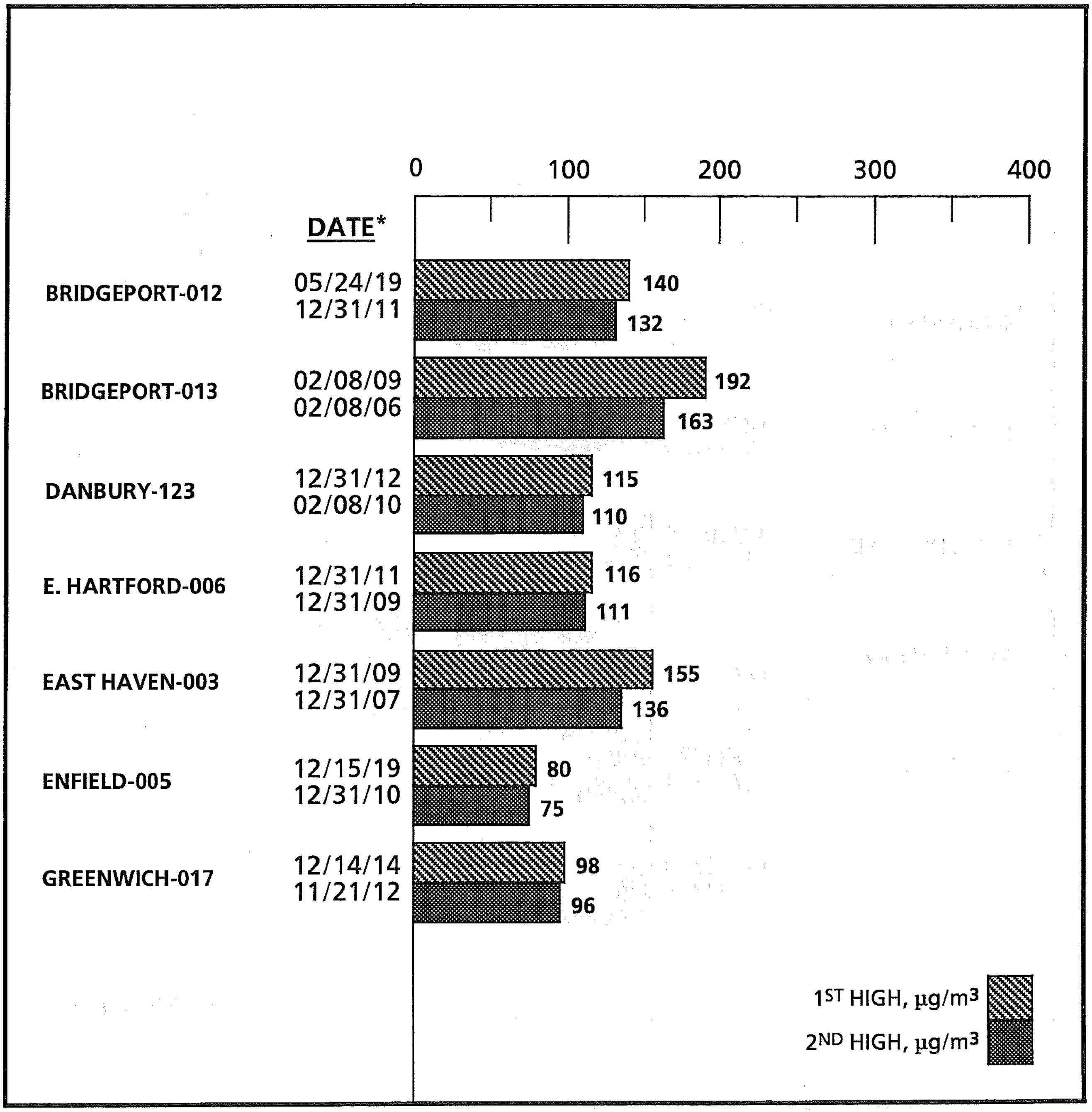
COMPARISONS OF FIRST AND SECOND HIGH CALENDAR DAY AND RUNNING 24-HOUR SO2 AVERAGES IN 1995

SITE	FIRST HIGH AVERAGE		SECOND HIGH AVERAGE	
	RUNNING 24-HOUR	CALENDAR DAY	RUNNING 24-HOUR	CALENDAR DAY
Bridgeport-012	116	115	96	73
Bridgeport-013	100	98	98	90
Danbury-123	69	66	59	51
E. Hartford-006	88	88	75	61
East Haven-003	98	97	83	60
Enfield-005	55	55	48	44
Greenwich-017	74	72	66	61
Groton-007	65	64	53	46
Hartford-018	83	82	65	54
Mansfield-003	40	39	36	36
New Haven-123	137	137	112	100
Stamford-124	97	93	97	84
Waterbury-123	81	80	68	51

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

FIGURE 3-3

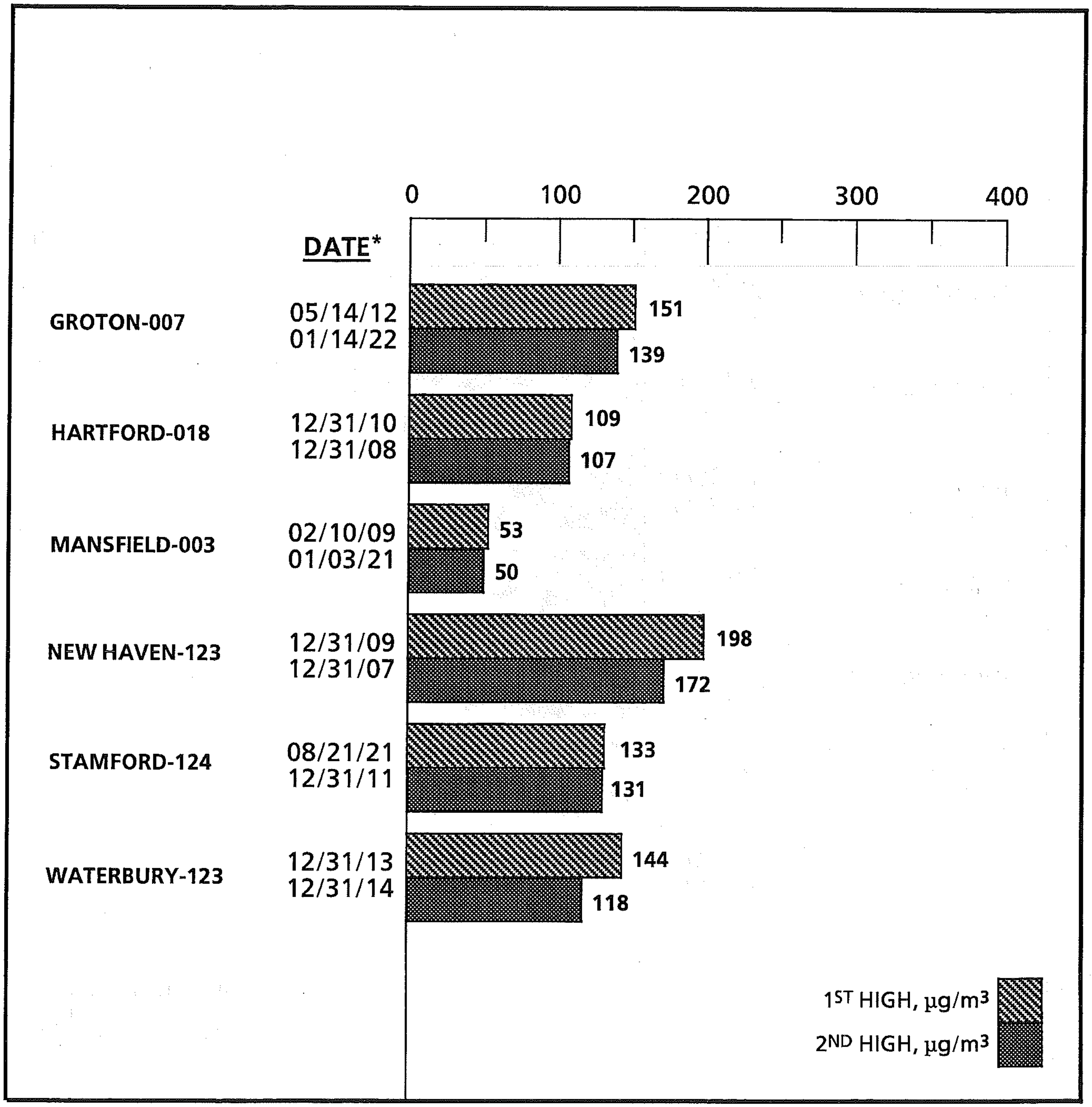
1995 MAXIMUM 3-HOUR RUNNING AVERAGE SO2 CONCENTRATIONS



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

FIGURE 3-3, CONTINUED

1995 MAXIMUM 3-HOUR RUNNING AVERAGE SO2 CONCENTRATIONS



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

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

TABLE 3-4

1995 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 (0357)		SO2	115	73	69	67	67	64	62	62	61	60
		DATE	12/31/95	12/30/95	1/13/95	2/18/95	2/19/95	12/14/95	1/11/95	2/10/95	1/30/95	2/ 8/95
	METEOROLOGICAL SITE	DIR (DEG)	210	250	200	120	240	20	20	210	10	320
	NEWARK	VEL (MPH)	2.7	6.1	2.8	2.3	3.5	4.2	7.7	4.3	4.7	12.0
		SPD (MPH)	4.0	7.5	4.9	4.0	6.0	6.8	8.1	8.1	5.2	12.4
		RATIO	0.683	0.815	0.583	0.568	0.579	0.628	0.956	0.536	0.899	0.968
	METEOROLOGICAL SITE	DIR (DEG)	180	270	180	180	200	360	360	220	260	320
	BRADLEY	VEL (MPH)	2.2	3.8	6.8	3.3	3.8	6.9	5.6	4.1	2.1	8.7
		SPD (MPH)	4.7	6.8	7.3	4.6	5.0	7.0	5.6	7.0	4.6	10.1
		RATIO	0.469	0.569	0.932	0.718	0.746	0.985	0.990	0.578	0.449	0.861
	METEOROLOGICAL SITE	DIR (DEG)	50	270	330	140	220	50	60	240	290	340
	BRIDGEPORT	VEL (MPH)	.9	4.5	.5	1.3	1.4	8.0	10.1	6.0	2.6	8.5
		SPD (MPH)	.9	4.9	3.5	2.6	2.3	8.6	10.2	7.0	5.0	8.8
		RATIO	0.992	0.923	0.148	0.489	0.619	0.932	0.993	0.856	0.507	0.968
BRIDGEPORT-013 (0356)		SO2	98	90	87	78	66	60	60	57	57	55
		DATE	12/31/95	2/18/95	2/ 8/95	2/19/95	1/30/95	2/14/95	2/10/95	12/30/95	1/13/95	12/14/95
	METEOROLOGICAL SITE	DIR (DEG)	210	120	320	240	10	290	210	250	200	20
	NEWARK	VEL (MPH)	2.7	2.3	12.0	3.5	4.7	7.5	4.3	6.1	2.8	4.2
		SPD (MPH)	4.0	4.0	12.4	6.0	5.2	10.8	8.1	7.5	4.9	6.8
		RATIO	0.683	0.568	0.968	0.579	0.899	0.699	0.536	0.815	0.583	0.628
	METEOROLOGICAL SITE	DIR (DEG)	180	180	320	200	260	300	220	270	180	360
	BRADLEY	VEL (MPH)	2.2	3.3	8.7	3.8	2.1	3.1	4.1	3.8	6.8	6.9
		SPD (MPH)	4.7	4.6	10.1	5.0	4.6	4.6	7.0	6.8	7.3	7.0
		RATIO	0.469	0.718	0.861	0.746	0.449	0.683	0.578	0.569	0.932	0.985
	METEOROLOGICAL SITE	DIR (DEG)	50	140	340	220	290	300	240	270	330	50
	BRIDGEPORT	VEL (MPH)	.9	1.3	8.5	1.4	2.6	5.9	6.0	4.5	.5	8.0
		SPD (MPH)	.9	2.6	8.8	2.3	5.0	6.2	7.0	4.9	3.5	8.6
		RATIO	0.992	0.489	0.968	0.619	0.507	0.959	0.856	0.923	0.148	0.932
DANBURY-123 (0344)		SO2	66	51	48	48	45	42	42	40	38	37
		DATE	12/31/95	2/10/95	2/ 8/95	2/ 1/95	2/14/95	1/ 6/95	2/18/95	12/30/95	2/15/95	2/19/95
	METEOROLOGICAL SITE	DIR (DEG)	210	210	320	250	290	220	120	250	40	240
	NEWARK	VEL (MPH)	2.7	4.3	12.0	9.0	7.5	6.5	2.3	6.1	2.1	3.5
		SPD (MPH)	4.0	8.1	12.4	11.5	10.8	9.8	4.0	7.5	6.3	6.0
		RATIO	0.683	0.536	0.968	0.783	0.699	0.668	0.568	0.815	0.325	0.579
	METEOROLOGICAL SITE	DIR (DEG)	180	220	320	220	300	210	180	270	190	200
	BRADLEY	VEL (MPH)	2.2	4.1	8.7	4.4	3.1	7.6	3.3	3.8	2.5	3.8
		SPD (MPH)	4.7	7.0	10.1	6.0	4.6	10.6	4.6	6.8	5.5	5.0
		RATIO	0.469	0.578	0.861	0.722	0.683	0.712	0.718	0.569	0.449	0.746
	METEOROLOGICAL SITE	DIR (DEG)	50	240	340	260	300	260	140	270	140	220
	BRIDGEPORT	VEL (MPH)	.9	6.0	8.5	11.2	5.9	11.6	1.3	4.5	3.7	1.4
		SPD (MPH)	.9	7.0	8.8	11.4	6.2	11.9	2.6	4.9	6.3	2.3
		RATIO	0.992	0.856	0.968	0.987	0.959	0.974	0.489	0.923	0.584	0.619

TABLE 3-4, CONTINUED

1995 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
EAST HARTFORD-006 (0353)	SO2	88	61	56	54	54	49	45	44	43	42
	DATE	12/31/95	1/12/95	12/15/95	12/13/95	12/14/95	2/ 8/95	2/10/95	11/27/95	2/15/95	2/ 1/95
METEOROLOGICAL SITE	DIR (DEG)	210	20	360	20	20	320	210	50	40	250
NEWARK	VEL (MPH)	2.7	5.6	3.4	6.7	4.2	12.0	4.3	.8	2.1	9.0
	SPD (MPH)	4.0	5.8	4.2	7.0	6.8	12.4	8.1	4.0	6.3	11.5
	RATIO	0.683	0.979	0.814	0.955	0.628	0.968	0.536	0.206	0.325	0.783
METEOROLOGICAL SITE	DIR (DEG)	180	360	10	10	360	320	220	360	190	220
BRADLEY	VEL (MPH)	2.2	3.2	4.2	3.0	6.9	8.7	4.1	3.1	2.5	4.4
	SPD (MPH)	4.7	3.3	4.5	3.6	7.0	10.1	7.0	3.2	5.5	6.0
	RATIO	0.469	0.963	0.935	0.834	0.985	0.861	0.578	0.991	0.449	0.722
METEOROLOGICAL SITE	DIR (DEG)	50	50	360	350	50	340	240	150	140	260
BRIDGEPORT	VEL (MPH)	.9	4.5	1.8	4.5	8.0	8.5	6.0	1.9	3.7	11.2
	SPD (MPH)	.9	4.7	3.0	4.7	8.6	8.8	7.0	4.7	6.3	11.4
	RATIO	0.992	0.959	0.602	0.953	0.932	0.968	0.856	0.404	0.584	0.987
EAST HAVEN-003 (0365)	SO2	97	60	48	46	46	44	43	42	42	40
	DATE	12/31/95	2/ 8/95	2/18/95	12/30/95	1/30/95	12/14/95	12/15/95	2/19/95	12/20/95	12/13/95
METEOROLOGICAL SITE	DIR (DEG)	210	320	120	250	10	20	360	240	350	20
NEWARK	VEL (MPH)	2.7	12.0	2.3	6.1	4.7	4.2	3.4	3.5	14.0	6.7
	SPD (MPH)	4.0	12.4	4.0	7.5	5.2	6.8	4.2	6.0	14.8	7.0
	RATIO	0.683	0.968	0.568	0.815	0.899	0.628	0.814	0.579	0.945	0.955
METEOROLOGICAL SITE	DIR (DEG)	180	320	180	270	260	360	10	200	340	10
BRADLEY	VEL (MPH)	2.2	8.7	3.3	3.8	2.1	6.9	4.2	3.8	12.4	3.0
	SPD (MPH)	4.7	10.1	4.6	6.8	4.6	7.0	4.5	5.0	13.7	3.6
	RATIO	0.469	0.861	0.718	0.569	0.449	0.985	0.935	0.746	0.909	0.834
METEOROLOGICAL SITE	DIR (DEG)	50	340	140	270	290	50	360	220	350	350
BRIDGEPORT	VEL (MPH)	.9	8.5	1.3	4.5	2.6	8.0	1.8	1.4	15.3	4.5
	SPD (MPH)	.9	8.8	2.6	4.9	5.0	8.6	3.0	2.3	16.0	4.7
	RATIO	0.992	0.968	0.489	0.923	0.507	0.932	0.602	0.619	0.956	0.953
ENFIELD-005 (0359)	SO2	55	44	44	37	36	34	32	31	31	31
	DATE	12/31/95	2/10/95	12/15/95	12/14/95	2/ 1/95	1/ 6/95	11/27/95	12/13/95	2/ 8/95	11/26/95
METEOROLOGICAL SITE	DIR (DEG)	210	210	360	20	250	220	50	20	320	310
NEWARK	VEL (MPH)	2.7	4.3	3.4	4.2	9.0	6.5	.8	6.7	12.0	5.8
	SPD (MPH)	4.0	8.1	4.2	6.8	11.5	9.8	4.0	7.0	12.4	7.8
	RATIO	0.683	0.536	0.814	0.628	0.783	0.668	0.206	0.955	0.968	0.744
METEOROLOGICAL SITE	DIR (DEG)	180	220	10	360	220	210	360	10	320	320
BRADLEY	VEL (MPH)	2.2	4.1	4.2	6.9	4.4	7.6	3.1	3.0	8.7	5.4
	SPD (MPH)	4.7	7.0	4.5	7.0	6.0	10.6	3.2	3.6	10.1	6.5
	RATIO	0.469	0.578	0.935	0.985	0.722	0.712	0.991	0.834	0.861	0.833
METEOROLOGICAL SITE	DIR (DEG)	50	240	360	50	260	260	150	350	340	330
BRIDGEPORT	VEL (MPH)	.9	6.0	1.8	8.0	11.2	11.6	1.9	4.5	8.5	5.8
	SPD (MPH)	.9	7.0	3.0	8.6	11.4	11.9	4.7	4.7	8.8	6.8
	RATIO	0.992	0.856	0.602	0.932	0.987	0.974	0.404	0.953	0.968	0.861

TABLE 3-4, CONTINUED

1995 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
GREENWICH-017 (0357)	SO2	72	61	60	44	44	38	35	35	32	31
	DATE	12/31/95	12/14/95	1/11/95	12/30/95	2/10/95	1/ 6/95	2/ 1/95	11/21/95	1/12/95	12/ 9/95
METEOROLOGICAL SITE	DIR (DEG)	210	20	20	250	210	220	250	290	20	10
NEWARK	VEL (MPH)	2.7	4.2	7.7	6.1	4.3	6.5	9.0	7.0	5.6	8.2
	SPD (MPH)	4.0	6.8	8.1	7.5	8.1	9.8	11.5	8.2	5.8	10.9
	RATIO	0.683	0.628	0.956	0.815	0.536	0.668	0.783	0.851	0.979	0.755
METEOROLOGICAL SITE	DIR (DEG)	180	360	360	270	220	210	220	240	360	360
BRADLEY	VEL (MPH)	2.2	6.9	5.6	3.8	4.1	7.6	4.4	2.6	3.2	8.5
	SPD (MPH)	4.7	7.0	5.6	6.8	7.0	10.6	6.0	5.3	3.3	8.8
	RATIO	0.469	0.985	0.990	0.569	0.578	0.712	0.722	0.486	0.963	0.969
METEOROLOGICAL SITE	DIR (DEG)	50	50	60	270	240	260	260	280	50	40
BRIDGEPORT	VEL (MPH)	.9	8.0	10.1	4.5	6.0	11.6	11.2	5.8	4.5	8.9
	SPD (MPH)	.9	8.6	10.2	4.9	7.0	11.9	11.4	6.9	4.7	11.4
	RATIO	0.992	0.932	0.993	0.923	0.856	0.974	0.987	0.839	0.959	0.780
GROTON-007 (0362)	SO2	64	46	45	42	42	40	35	33	33	33
	DATE	12/31/95	3/ 8/95	2/ 1/95	2/10/95	2/18/95	1/14/95	12/15/95	2/19/95	2/ 8/95	2/14/95
METEOROLOGICAL SITE	DIR (DEG)	210	230	250	210	120	120	360	240	320	290
NEWARK	VEL (MPH)	2.7	3.6	9.0	4.3	2.3	2.7	3.4	3.5	12.0	7.5
	SPD (MPH)	4.0	13.1	11.5	8.1	4.0	4.9	4.2	6.0	12.4	10.8
	RATIO	0.683	0.273	0.783	0.536	0.568	0.544	0.814	0.579	0.968	0.699
METEOROLOGICAL SITE	DIR (DEG)	180	190	220	220	180	180	10	200	320	300
BRADLEY	VEL (MPH)	2.2	8.6	4.4	4.1	3.3	2.2	4.2	3.8	8.7	3.1
	SPD (MPH)	4.7	12.4	6.0	7.0	4.6	2.3	4.5	5.0	10.1	4.6
	RATIO	0.469	0.696	0.722	0.578	0.718	0.947	0.935	0.746	0.861	0.683
METEOROLOGICAL SITE	DIR (DEG)	50	230	260	240	140	130	360	220	340	300
BRIDGEPORT	VEL (MPH)	.9	8.6	11.2	6.0	1.3	1.9	1.8	1.4	8.5	5.9
	SPD (MPH)	.9	11.2	11.4	7.0	2.6	4.2	3.0	2.3	8.8	6.2
	RATIO	0.992	0.771	0.987	0.856	0.489	0.466	0.602	0.619	0.968	0.959
HARTFORD-018 (0358)	SO2	82	54	54	50	45	45	45	44	43	41
	DATE	12/31/95	2/10/95	12/15/95	12/13/95	12/14/95	2/ 8/95	11/27/95	2/ 1/95	1/30/95	2/18/95
METEOROLOGICAL SITE	DIR (DEG)	210	210	360	20	20	320	50	250	10	120
NEWARK	VEL (MPH)	2.7	4.3	3.4	6.7	4.2	12.0	.8	9.0	4.7	2.3
	SPD (MPH)	4.0	8.1	4.2	7.0	6.8	12.4	4.0	11.5	5.2	4.0
	RATIO	0.683	0.536	0.814	0.955	0.628	0.968	0.206	0.783	0.899	0.568
METEOROLOGICAL SITE	DIR (DEG)	180	220	10	10	360	320	360	220	260	180
BRADLEY	VEL (MPH)	2.2	4.1	4.2	3.0	6.9	8.7	3.1	4.4	2.1	3.3
	SPD (MPH)	4.7	7.0	4.5	3.6	7.0	10.1	3.2	6.0	4.6	4.6
	RATIO	0.469	0.578	0.935	0.834	0.985	0.861	0.991	0.722	0.449	0.718
METEOROLOGICAL SITE	DIR (DEG)	50	240	360	350	50	340	150	260	290	140
BRIDGEPORT	VEL (MPH)	.9	6.0	1.8	4.5	8.0	8.5	1.9	11.2	2.6	1.3
	SPD (MPH)	.9	7.0	3.0	4.7	8.6	8.8	4.7	11.4	5.0	2.6
	RATIO	0.992	0.856	0.602	0.953	0.932	0.968	0.404	0.987	0.507	0.489

TABLE 3-4, CONTINUED

1995 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
MANSFIELD-003 (0356)	SO2	39	36	32	32	30	26	24	24	23	23
	DATE	2/10/95	2/ 1/95	12/31/95	2/11/95	1/ 6/95	1/ 4/95	12/14/95	1/31/95	2/ 9/95	2/14/95
METEOROLOGICAL SITE	DIR (DEG)	210	250	210	250	220	280	20	260	270	290
NEWARK	VEL (MPH)	4.3	9.0	2.7	8.3	6.5	11.6	4.2	9.6	11.4	7.5
	SPD (MPH)	8.1	11.5	4.0	10.4	9.8	13.7	6.8	12.7	14.7	10.8
	RATIO	0.536	0.783	0.683	0.803	0.668	0.852	0.628	0.755	0.776	0.699
METEOROLOGICAL SITE	DIR (DEG)	220	220	180	240	210	290	360	210	280	300
BRADLEY	VEL (MPH)	4.1	4.4	2.2	6.9	7.6	7.1	6.9	3.9	6.3	3.1
	SPD (MPH)	7.0	6.0	4.7	11.2	10.6	10.5	7.0	6.5	9.6	4.6
	RATIO	0.578	0.722	0.469	0.612	0.712	0.678	0.985	0.598	0.652	0.683
METEOROLOGICAL SITE	DIR (DEG)	240	260	50	260	260	300	50	250	270	300
BRIDGEPORT	VEL (MPH)	6.0	11.2	.9	11.2	11.6	10.6	8.0	9.5	12.7	5.9
	SPD (MPH)	7.0	11.4	.9	11.5	11.9	11.5	8.6	9.6	12.9	6.2
	RATIO	0.856	0.987	0.992	0.970	0.974	0.921	0.932	0.985	0.981	0.959
NEW HAVEN-123 (0354)	SO2	137	100	88	76	76	74	69	68	63	60
	DATE	12/31/95	2/18/95	2/19/95	2/ 8/95	1/30/95	12/13/95	12/30/95	11/27/95	11/17/95	12/14/95
METEOROLOGICAL SITE	DIR (DEG)	210	120	240	320	10	20	250	50	320	20
NEWARK	VEL (MPH)	2.7	2.3	3.5	12.0	4.7	6.7	6.1	.8	4.7	4.2
	SPD (MPH)	4.0	4.0	6.0	12.4	5.2	7.0	7.5	4.0	4.9	6.8
	RATIO	0.683	0.568	0.579	0.968	0.899	0.955	0.815	0.206	0.957	0.628
METEOROLOGICAL SITE	DIR (DEG)	180	180	200	320	260	10	270	360	290	360
BRADLEY	VEL (MPH)	2.2	3.3	3.8	8.7	2.1	3.0	3.8	3.1	4.9	6.9
	SPD (MPH)	4.7	4.6	5.0	10.1	4.6	3.6	6.8	3.2	6.9	7.0
	RATIO	0.469	0.718	0.746	0.861	0.449	0.834	0.569	0.991	0.716	0.985
METEOROLOGICAL SITE	DIR (DEG)	50	140	220	340	290	350	270	150	290	50
BRIDGEPORT	VEL (MPH)	.9	1.3	1.4	8.5	2.6	4.5	4.5	1.9	3.3	8.0
	SPD (MPH)	.9	2.6	2.3	8.8	5.0	4.7	4.9	4.7	5.3	8.6
	RATIO	0.992	0.489	0.619	0.968	0.507	0.953	0.923	0.404	0.629	0.932
STAMFORD-124 (0345)	SO2	93	84	83	77	74	72	70	70	69	69
	DATE	12/31/95	8/21/95	8/12/95	8/14/95	8/ 4/95	12/30/95	8/16/95	8/15/95	8/11/95	9/13/95
METEOROLOGICAL SITE	DIR (DEG)	210	280	270	180	280	250	90	150	190	240
NEWARK	VEL (MPH)	2.7	6.9	5.7	4.3	6.6	6.1	3.3	4.1	4.7	8.6
	SPD (MPH)	4.0	8.2	7.3	6.8	10.5	7.5	6.6	5.3	7.0	10.9
	RATIO	0.683	0.836	0.780	0.638	0.628	0.815	0.504	0.772	0.668	0.786
METEOROLOGICAL SITE	DIR (DEG)	180	270	240	170	220	270	190	170	200	190
BRADLEY	VEL (MPH)	2.2	2.7	2.6	1.8	1.4	3.8	1.6	3.3	4.3	6.4
	SPD (MPH)	4.7	4.0	3.7	3.2	4.5	6.8	2.9	4.6	5.3	8.2
	RATIO	0.469	0.668	0.700	0.570	0.308	0.569	0.541	0.708	0.817	0.786
METEOROLOGICAL SITE	DIR (DEG)	50	250	250	150	270	270	110	110	240	250
BRIDGEPORT	VEL (MPH)	.9	5.2	6.2	1.9	6.3	4.5	4.0	4.4	4.9	5.7
	SPD (MPH)	.9	5.6	6.5	4.2	7.2	4.9	4.7	4.9	5.0	5.8
	RATIO	0.992	0.931	0.955	0.453	0.877	0.923	0.849	0.896	0.967	0.990

TABLE 3-4, CONTINUED

1995 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	80	51	44	41	40	40	39	39	38	38
	DATE	12/31/95	2/10/95	1/12/95	2/ 1/95	12/30/95	11/27/95	2/23/95	2/19/95	12/13/95	1/ 6/95
METEOROLOGICAL SITE	DIR (DEG)	210	210	20	250	250	50	160	240	20	220
NEWARK	VEL (MPH)	2.7	4.3	5.6	9.0	6.1	.8	3.2	3.5	6.7	6.5
	SPD (MPH)	4.0	8.1	5.8	11.5	7.5	4.0	5.9	6.0	7.0	9.8
	RATIO	0.683	0.536	0.979	0.783	0.815	0.206	0.536	0.579	0.955	0.668
METEOROLOGICAL SITE	DIR (DEG)	180	220	360	220	270	360	180	200	10	210
BRADLEY	VEL (MPH)	2.2	4.1	3.2	4.4	3.8	3.1	5.1	3.8	3.0	7.6
	SPD (MPH)	4.7	7.0	3.3	6.0	6.8	3.2	6.0	5.0	3.6	10.6
	RATIO	0.469	0.578	0.963	0.722	0.569	0.991	0.839	0.746	0.834	0.712
METEOROLOGICAL SITE	DIR (DEG)	50	240	50	260	270	150	180	220	350	260
BRIDGEPORT	VEL (MPH)	.9	6.0	4.5	11.2	4.5	1.9	2.5	1.4	4.5	11.6
	SPD (MPH)	.9	7.0	4.7	11.4	4.9	4.7	4.2	2.3	4.7	11.9
	RATIO	0.992	0.856	0.959	0.987	0.923	0.404	0.593	0.619	0.953	0.974

FIGURE 3-4

AVERAGES OF THE ANNUAL SO_2 CONCENTRATIONS AT SIX SITES

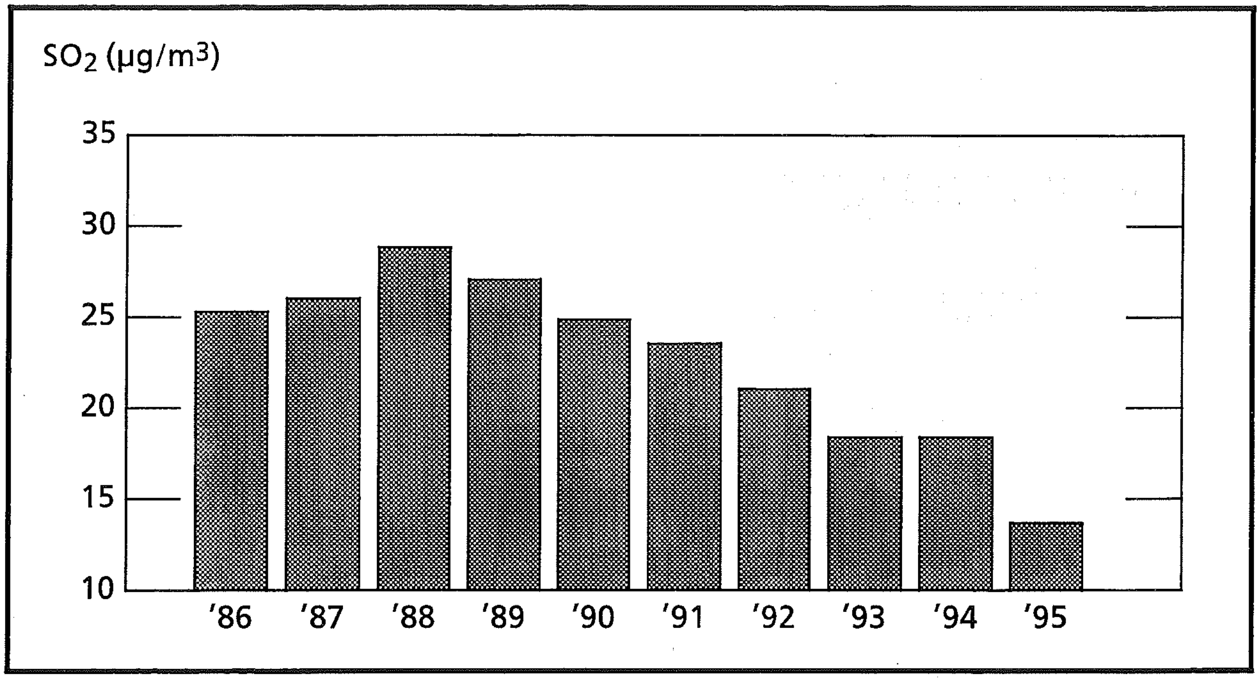
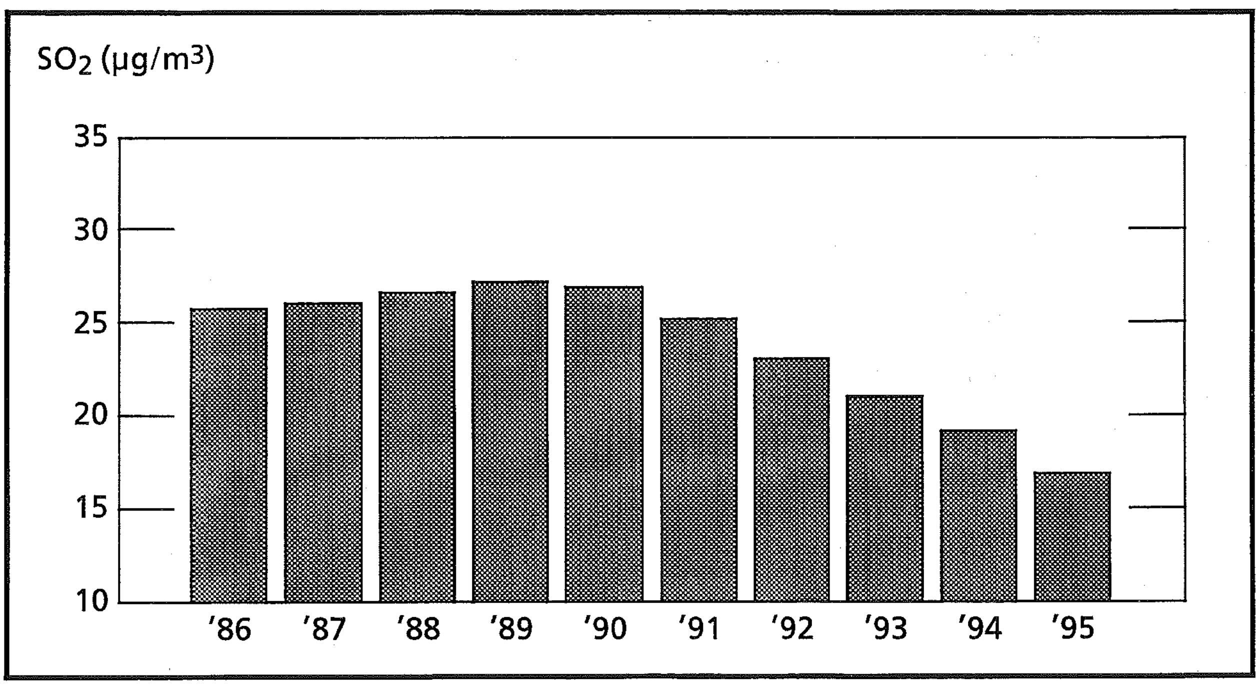


FIGURE 3-5

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



IV. OZONE

HEALTH EFFECTS

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

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

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

NATIONAL AMBIENT AIR QUALITY STANDARD

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

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

CONCLUSIONS

As in past years, Connecticut experienced high concentrations of ozone in the summer months of 1995. Levels in excess of the one-hour NAAQS of 0.12 ppm were recorded at all eleven ozone monitoring sites. The highest concentration was 0.175 ppm, which occurred at the Madison 002 site. Moreover, the

1-hour ozone standard was violated at all eleven sites because the "expected number of exceedances" for the most recent 3 years at each site exceeded one.

The incidence of hourly ozone concentrations in excess of the 1-hour 0.12 ppm standard was significantly higher in 1995 than in 1994 (see Table 4-1). There was a total of 67 hourly exceedances in 1994 and 90 hourly exceedances in 1995 at the eleven monitoring sites. This represents an increase in the frequency of such exceedances from 1.3 per 1000 sampling hours in 1994 to 1.7 per 1000 sampling hours in 1995: a 31% increase. The actual number of hours when the ozone standard was exceeded in the state increased from 32 in 1994 to 47 in 1995.

The number of site-days on which the ozone monitors experienced ozone levels in excess of the 1-hour standard increased from 27 in 1994 to 36 in 1995 at the eleven monitoring sites (see Table 4-2). This represents an increase in the frequency of such occurrences from 1.25 per 100 sampling days in 1994 to 1.64 per 100 sampling days in 1995: a 31% increase. The actual number of days on which the ozone standard was exceeded in the state increased from 9 in 1994 to 12 in 1995.

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 frequency of winds out of the southwest would help to explain the increase in the number of ozone exceedances from 1994 to 1995. However, the percentage of southwest winds during the "ozone season" decreased from 38% in 1994 to 33% in 1995, as is shown by the wind roses from Newark (Figures 4-1 and 4-2). The magnitude of high ozone levels can be partly associated with yearly variations in temperature, since ozone production is greatest at high temperatures and in strong sunlight. The summer season's daily high temperatures were higher in 1995 than in 1994. This is demonstrated by the number of days exceeding 90° F which increased from eleven in 1994 to thirteen in 1995 at Sikorsky Airport in Bridgeport, and from fourteen in 1994 to twenty-two in 1995 at Bradley International Airport. The incidence of high ozone levels is also dependent on the percentage of possible sunshine, since sunlight is essential to the creation of ozone. According to National Weather Service local climatological data recorded at Bradley Airport, the percentage of sunshine increased from 57% in 1994 to 67% in 1995 for the months April through September. The average for these summer months at Bradley is usually 60%. Of the meteorological parameters discussed above, both temperature and percentage of possible sunshine can be seen as contributing to the increase in ozone levels from 1994 to 1995.

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 reformulated gasoline, which was initiated in January of 1995, reduces vehicle hydrocarbon emissions by 15-17% and lowers the vapor pressure of gasoline in the summer months, reducing evaporative emissions. In addition, the state's inspection and maintenance program for motor vehicles, as well as the Stage I and Stage II vapor recovery requirements, also lessen the emissions of hydrocarbons into the air.

METHOD OF MEASUREMENT

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

DISCUSSION OF DATA

Monitoring Network - In order to gather information which will further the understanding of ozone production and transport, DEP operated a state-wide ozone monitoring network consisting of four types of sites in 1995 (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 264 precision checks during 1995. The resulting 95% probability limits were -8% to +6%. 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 12 audits conducted on the monitoring system, were: low, -7% to +4%; medium, -5% to +4%; and high, -5% to +3%.

1-Hour Average - The 1-hour ozone standard was exceeded at all eleven DEP monitoring sites in 1995. Between 1994 and 1995, the maximum 1-hour concentration increased at four sites and decreased at seven sites; the second high 1-hour concentration increased at four sites and decreased at six sites.

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

10 High Days with Wind Data - Table 4-3 lists the ten highest 1-hour ozone averages and their dates of occurrence for each ozone site in 1995. 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., 75%) of the tabulated high ozone levels occurred on days with winds out of the southwest. This is due to the special features of a southwest wind blowing over Connecticut. The first feature is that, during the summer, southwest winds are usually accompanied by high temperatures and bright sunshine, which are important to the production of ozone. The second feature of a southwest wind is that it will transport precursor emissions from New York City and other urban areas to the southwest of Connecticut. It is the combination of these factors that often produces unhealthful ozone levels in Connecticut.

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

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

Figure 4-5 shows the unweighted average of the annual means of the maximum daily concentrations at ten ozone sites from 1986 to 1995. There is a lot of variation in the statistic from one year to the next. The importance of meteorology in the formation of ozone explains much of this variation. However, unless the effect of meteorology can be factored out, one cannot judge the effect of emission control measures on ozone production. A regression line through the data in Figure 4-5 would trend down, but the reason for this would not be evident.

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

TABLE 4-1

NUMBER OF HOURS WHEN THE 1-HOUR OZONE STANDARD WAS EXCEEDED IN 1995

SITE	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	1995	1994
Bridgeport 013	0	0	0	0	1	0	0	1	6
Danbury 123	0	0	0	5	0	0	0	5	4
E. Hartford 003	0	0	1	3	0	0	0	4	8
Greenwich 017	0	0	2	4	3	0	0	9	12
Groton 008	0	0	3	3	3	0	0	9	3
Madison 002	0	0	9	8	9	0	0	26	7
Middletown 007	0	0	0	5	5	0	0	10	6
New Haven 123	0	0	0	2	0	0	0	2	6
Stafford 001	0	0	2	2	0	0	0	4	2
Stratford 007	0	0	7	5	7	0	0	19	12
Torrington 006	0	0	0	1	0	0	0	1	1
TOTAL SITE HOURS	0	0	24	38	28	0	0	90	67

TABLE 4-2

NUMBER OF DAYS WHEN THE 1-HOUR OZONE STANDARD WAS EXCEEDED IN 1995

SITE	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	1995	1994
Bridgeport 013	0	0	0	0	1	0	0	1	3
Danbury 123	0	0	0	2	0	0	0	2	2
E. Hartford 003	0	0	1	1	0	0	0	2	2
Greenwich 017	0	0	1	1	2	0	0	4	4
Groton 008	0	0	1	2	1	0	0	4	1
Madison 002	0	0	3	2	3	0	0	8	2
Middletown 007	0	0	0	2	2	0	0	4	4
New Haven 123	0	0	0	1	0	0	0	1	3
Stafford 001	0	0	1	1	0	0	0	2	1
Stratford 007	0	0	3	2	2	0	0	7	4
Torrington 006	0	0	0	1	0	0	0	1	1
TOTAL SITE DAYS	0	0	10	15	11	0	0	36	27

FIGURE 4-1

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

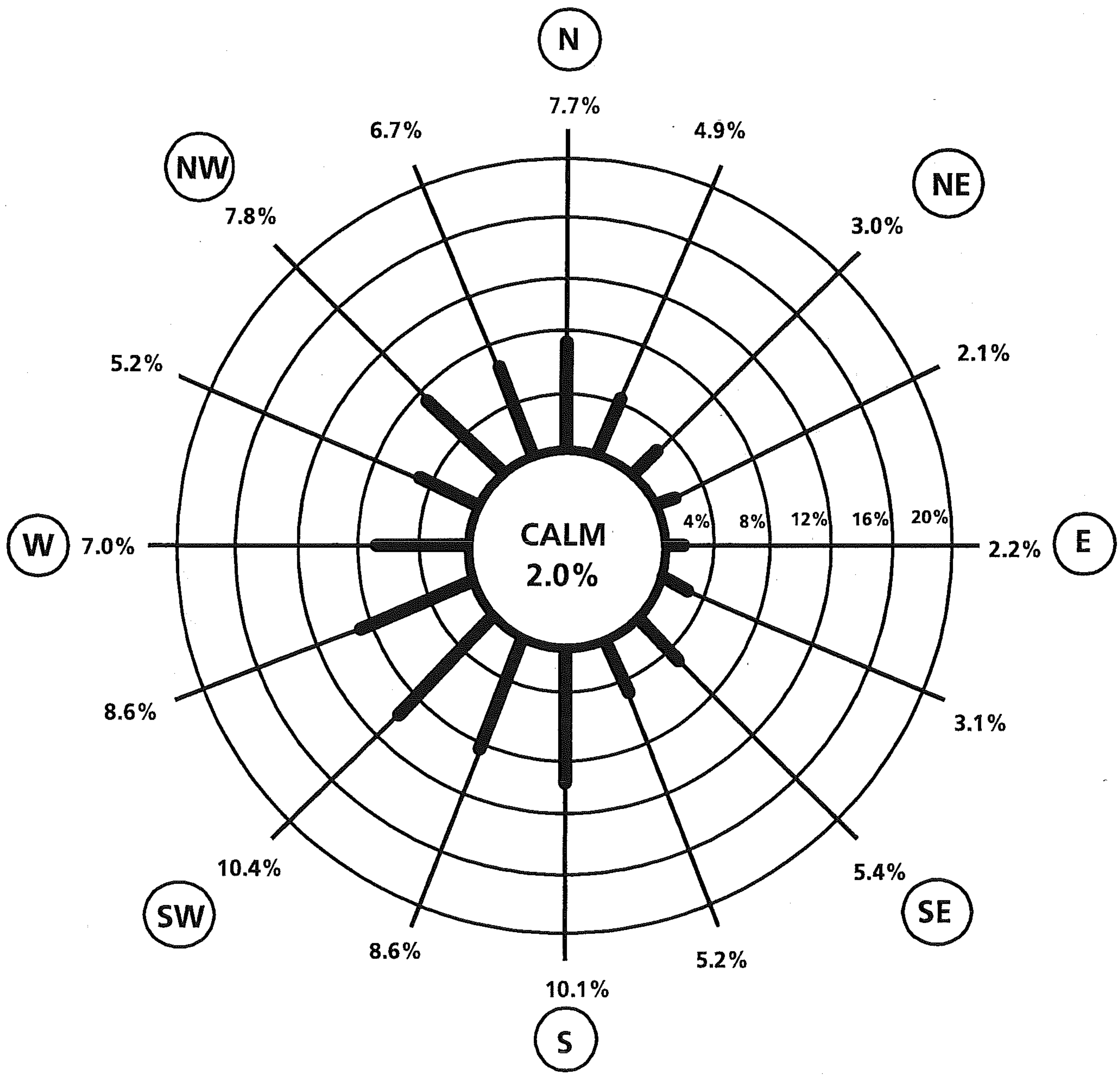
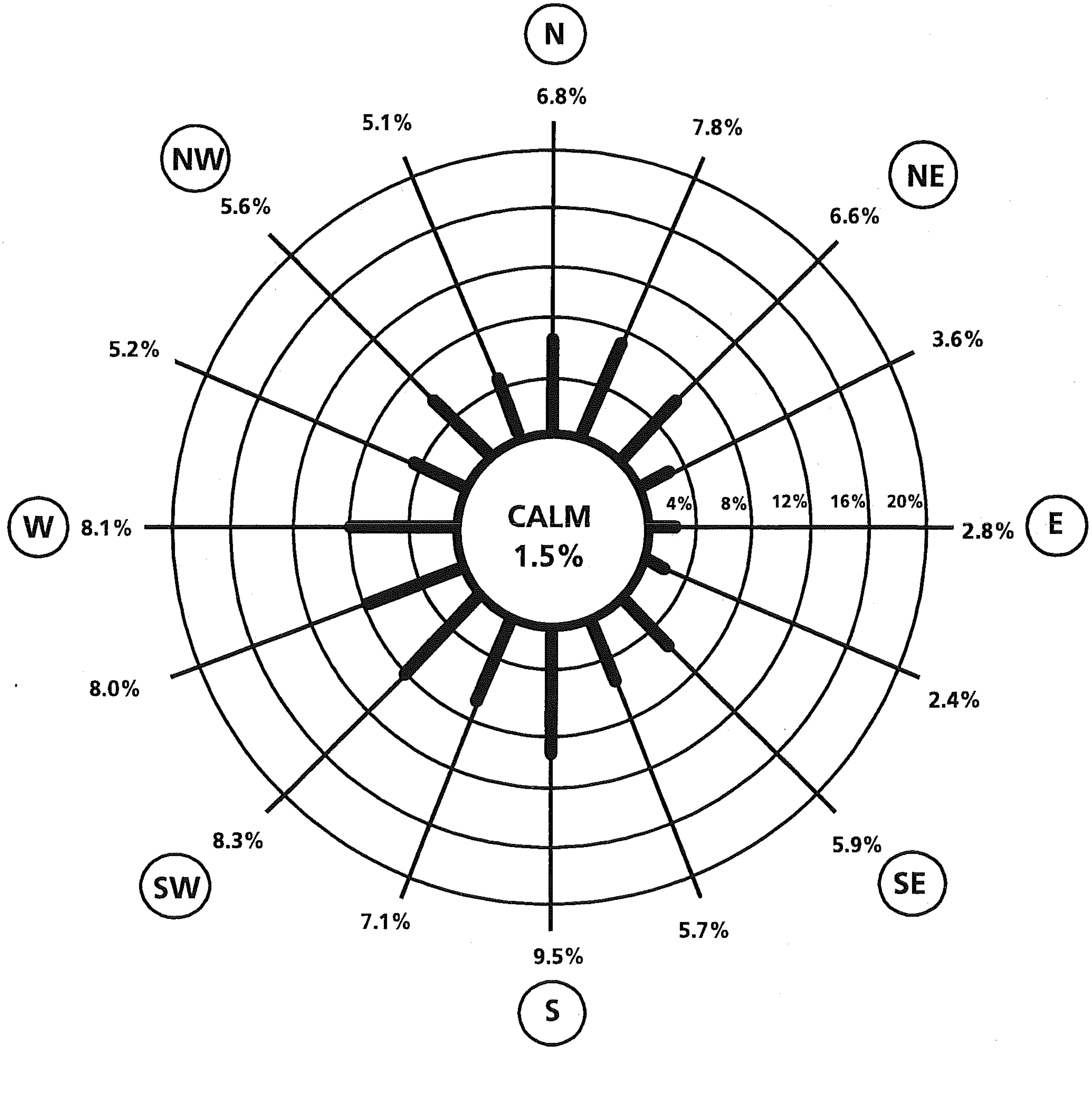


FIGURE 4-2

WIND ROSE FOR APRIL - OCTOBER 1995
NEWARK INTERNATIONAL AIRPORT
NEWARK, NEW JERSEY



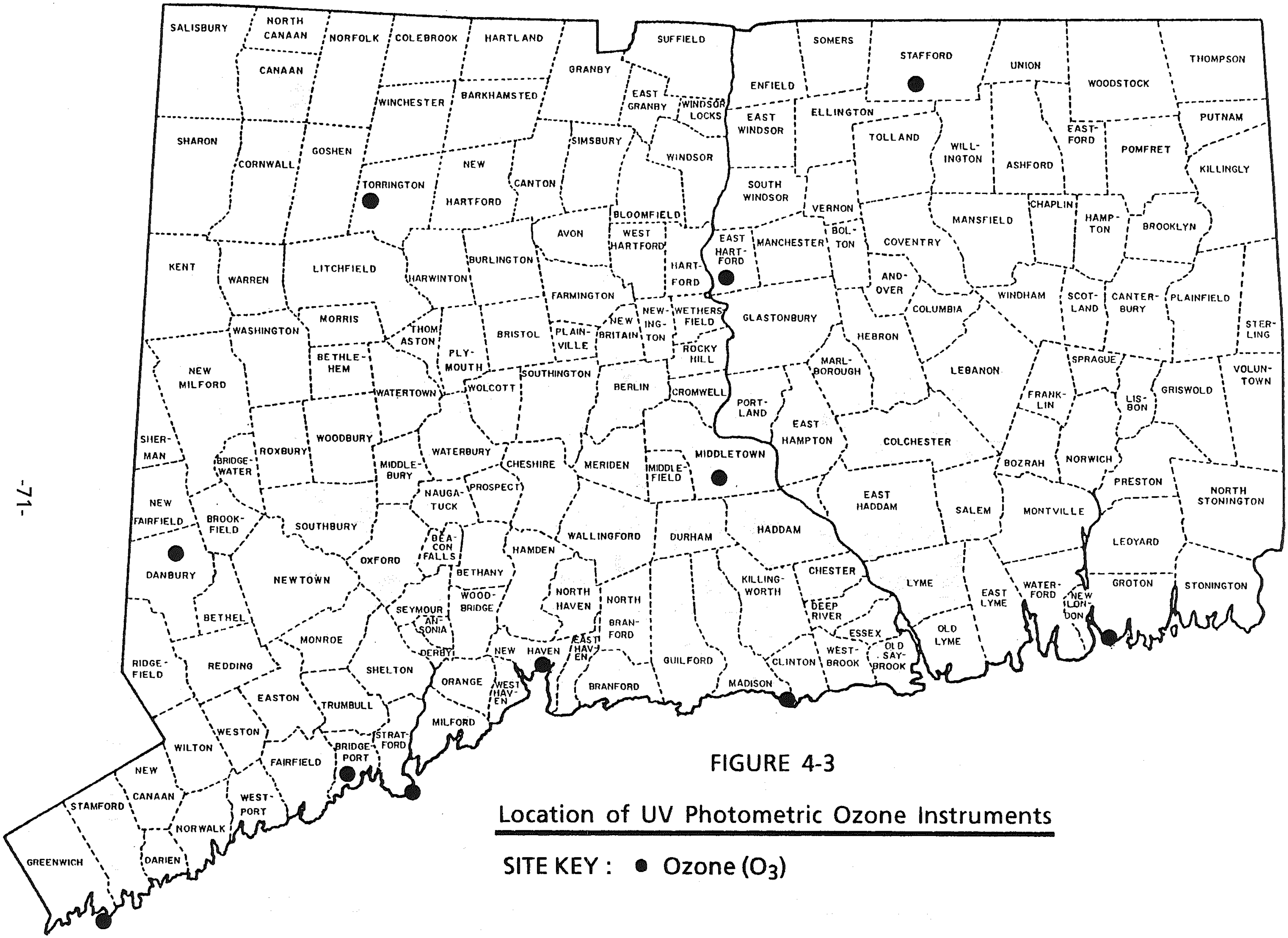


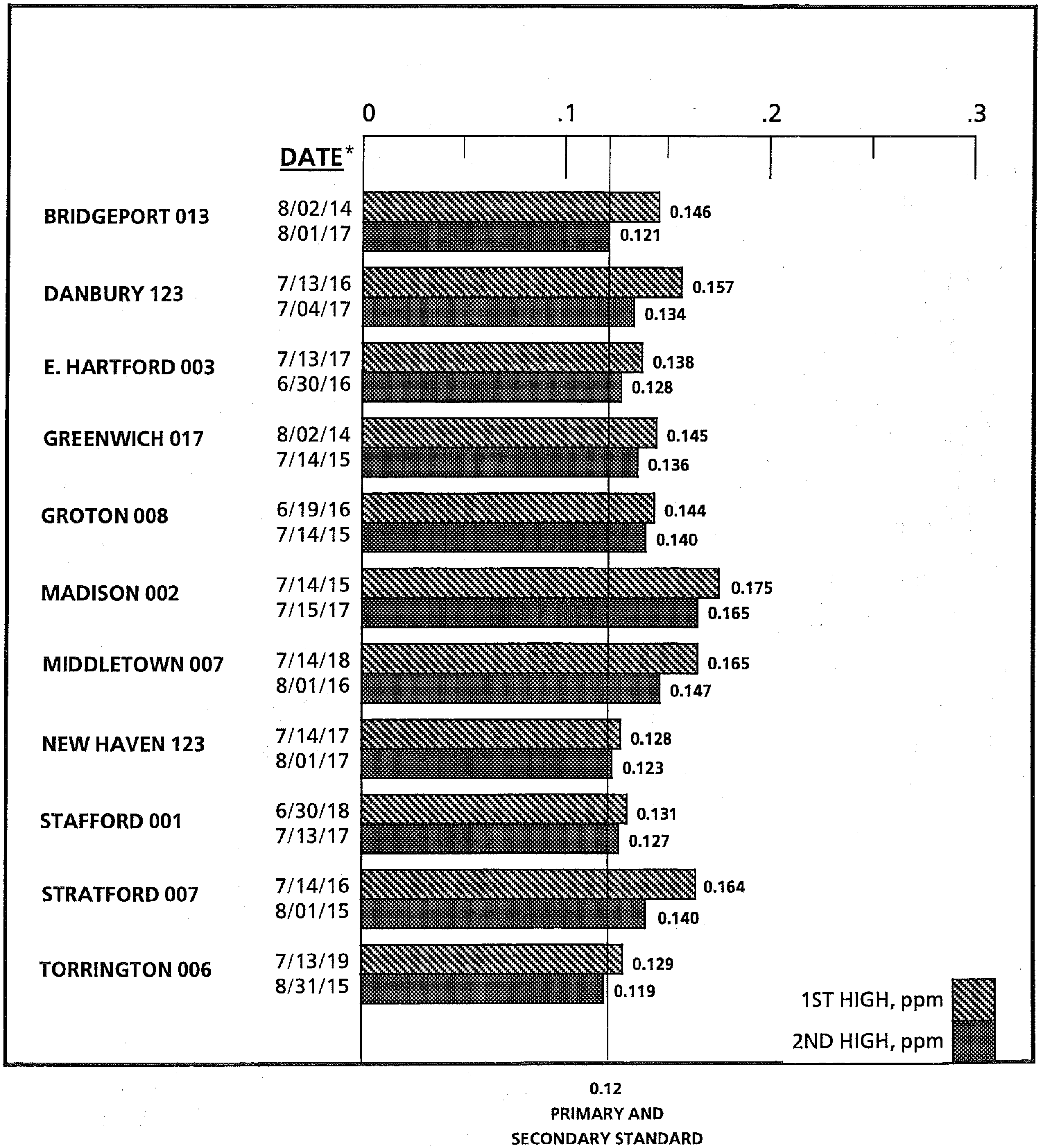
FIGURE 4-3

Location of UV Photometric Ozone Instruments

SITE KEY : ● Ozone (O_3)

FIGURE 4-4

1ST AND 2ND HIGH 1-HOUR OZONE CONCENTRATIONS IN 1995



* 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

1995 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 (4757)	OZONE	.146	.121	.120	.119	.109	.108	.104	.099	.094	.093
	DATE	8/ 2/95	8/ 1/95	6/18/95	7/14/95	7/29/95	8/21/95	6/17/95	7/22/95	7/15/95	6/19/95
METEOROLOGICAL SITE	DIR (DEG)	240	250	250	270	250	280	250	160	290	250
NEWARK	VEL (MPH)	1.3	8.6	8.3	9.3	7.9	6.9	8.2	4.6	10.4	8.8
	SPD (MPH)	6.9	10.5	10.2	11.6	9.3	8.2	10.1	5.6	11.1	11.1
	RATIO	0.183	0.824	0.815	0.797	0.849	0.836	0.820	0.814	0.936	0.794
METEOROLOGICAL SITE	DIR (DEG)	200	230	240	240	220	270	280	130	340	240
BRADLEY	VEL (MPH)	.5	3.4	3.1	4.5	3.8	2.7	2.1	.6	5.2	3.2
	SPD (MPH)	3.0	5.3	3.2	7.6	4.7	4.0	2.3	4.0	8.1	4.7
	RATIO	0.163	0.635	0.969	0.586	0.809	0.668	0.908	0.150	0.642	0.679
METEOROLOGICAL SITE	DIR (DEG)	260	240	250	250	230	250	240	110	260	250
BRIDGEPORT	VEL (MPH)	2.6	5.9	6.4	6.9	7.7	5.2	6.6	4.4	5.2	7.1
	SPD (MPH)	6.0	6.0	6.5	7.0	7.8	5.6	6.6	4.9	5.3	7.2
	RATIO	0.427	0.981	0.989	0.974	0.996	0.931	0.997	0.907	0.972	0.992
DANBURY-123 (4690)	OZONE	.157	.134	.110	.108	.108	.107	.107	.106	.105	.104
	DATE	7/13/95	7/ 4/95	8/14/95	6/30/95	7/31/95	8/ 1/95	8/31/95	9/ 7/95	7/18/95	7/22/95
METEOROLOGICAL SITE	DIR (DEG)	230	170	180	140	160	250	240	230	250	160
NEWARK	VEL (MPH)	5.1	5.0	4.3	4.5	3.4	8.6	9.2	7.9	5.9	4.6
	SPD (MPH)	6.8	7.0	6.8	6.3	7.5	10.5	10.8	9.6	8.1	5.6
	RATIO	0.750	0.705	0.638	0.705	0.453	0.824	0.854	0.822	0.733	0.814
METEOROLOGICAL SITE	DIR (DEG)	220	190	170	180	260	230	180	200	150	130
BRADLEY	VEL (MPH)	6.4	2.5	1.8	2.8	1.7	3.4	4.5	8.5	.9	.6
	SPD (MPH)	8.1	2.7	3.2	3.7	2.3	5.3	4.6	10.9	2.6	4.0
	RATIO	0.797	0.918	0.570	0.751	0.740	0.635	0.977	0.783	0.338	0.150
METEOROLOGICAL SITE	DIR (DEG)	220	180	150	220	170	240	230	230	130	110
BRIDGEPORT	VEL (MPH)	3.9	2.4	1.9	4.6	2.0	5.9	4.7	6.6	3.4	4.4
	SPD (MPH)	4.7	4.6	4.2	5.0	4.6	6.0	6.6	6.8	3.9	4.9
	RATIO	0.828	0.516	0.453	0.923	0.433	0.981	0.718	0.976	0.877	0.907
EAST HARTFORD-003 (4732)	OZONE	.138	.128	.123	.114	.111	.111	.108	.105	.098	.098
	DATE	7/13/95	6/30/95	7/14/95	9/ 7/95	8/31/95	8/ 2/95	8/ 1/95	7/ 4/95	6/20/95	7/28/95
METEOROLOGICAL SITE	DIR (DEG)	230	140	270	230	240	240	250	170	300	220
NEWARK	VEL (MPH)	5.1	4.5	9.3	7.9	9.2	1.3	8.6	5.0	3.6	5.6
	SPD (MPH)	6.8	6.3	11.6	9.6	10.8	6.9	10.5	7.0	9.3	9.9
	RATIO	0.750	0.705	0.797	0.822	0.854	0.183	0.824	0.705	0.388	0.563
METEOROLOGICAL SITE	DIR (DEG)	220	180	240	200	180	200	230	190	20	190
BRADLEY	VEL (MPH)	6.4	2.8	4.5	8.5	4.5	.5	3.4	2.5	4.1	2.8
	SPD (MPH)	8.1	3.7	7.6	10.9	4.6	3.0	5.3	2.7	4.3	3.2
	RATIO	0.797	0.751	0.586	0.783	0.977	0.163	0.635	0.918	0.951	0.901
METEOROLOGICAL SITE	DIR (DEG)	220	220	250	230	230	260	240	180	230	200
BRIDGEPORT	VEL (MPH)	3.9	4.6	6.9	6.6	4.7	2.6	5.9	2.4	3.7	3.0
	SPD (MPH)	4.7	5.0	7.0	6.8	6.6	6.0	6.0	4.6	5.8	4.9
	RATIO	0.828	0.923	0.974	0.976	0.718	0.427	0.981	0.516	0.652	0.605

TABLE 4–3, CONTINUED

1995 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
GREENWICH–017 (4732)	OZONE	.145	.136	.129	.126	.121	.116	.113	.105	.103	.100
	DATE	8/ 2/95	7/14/95	8/ 1/95	6/20/95	7/27/95	6/18/95	6/19/95	8/27/95	7/ 4/95	7/22/95
METEOROLOGICAL SITE	DIR (DEG)	240	270	250	300	260	250	250	20	170	160
NEWARK	VEL (MPH)	1.3	9.3	8.6	3.6	5.7	8.3	8.8	2.1	5.0	4.6
	SPD (MPH)	6.9	11.6	10.5	9.3	8.2	10.2	11.1	9.5	7.0	5.6
	RATIO	0.183	0.797	0.824	0.388	0.698	0.815	0.794	0.220	0.705	0.814
METEOROLOGICAL SITE	DIR (DEG)	200	240	230	20	300	240	240	10	190	130
BRADLEY	VEL (MPH)	.5	4.5	3.4	4.1	1.3	3.1	3.2	3.1	2.5	.6
	SPD (MPH)	3.0	7.6	5.3	4.3	1.6	3.2	4.7	3.3	2.7	4.0
	RATIO	0.163	0.586	0.635	0.951	0.847	0.969	0.679	0.946	0.918	0.150
METEOROLOGICAL SITE	DIR (DEG)	260	250	240	230	150	250	250	150	180	110
BRIDGEPORT	VEL (MPH)	2.6	6.9	5.9	3.7	1.4	6.4	7.1	1.0	2.4	4.4
	SPD (MPH)	6.0	7.0	6.0	5.8	4.3	6.5	7.2	5.3	4.6	4.9
	RATIO	0.427	0.974	0.981	0.652	0.318	0.989	0.992	0.187	0.516	0.907
GROTON–008 (4773)	OZONE	.144	.140	.131	.126	.120	.111	.110	.108	.102	.096
	DATE	6/19/95	7/14/95	8/21/95	7/15/95	8/ 1/95	6/17/95	6/18/95	8/ 2/95	6/20/95	7/ 4/95
METEOROLOGICAL SITE	DIR (DEG)	250	270	280	290	250	250	250	240	300	170
NEWARK	VEL (MPH)	8.8	9.3	6.9	10.4	8.6	8.2	8.3	1.3	3.6	5.0
	SPD (MPH)	11.1	11.6	8.2	11.1	10.5	10.1	10.2	6.9	9.3	7.0
	RATIO	0.794	0.797	0.836	0.936	0.824	0.820	0.815	0.183	0.388	0.705
METEOROLOGICAL SITE	DIR (DEG)	240	240	270	340	230	280	240	200	20	190
BRADLEY	VEL (MPH)	3.2	4.5	2.7	5.2	3.4	2.1	3.1	.5	4.1	2.5
	SPD (MPH)	4.7	7.6	4.0	8.1	5.3	2.3	3.2	3.0	4.3	2.7
	RATIO	0.679	0.586	0.668	0.642	0.635	0.908	0.969	0.163	0.951	0.918
METEOROLOGICAL SITE	DIR (DEG)	250	250	250	260	240	240	250	260	230	180
BRIDGEPORT	VEL (MPH)	7.1	6.9	5.2	5.2	5.9	6.6	6.4	2.6	3.7	2.4
	SPD (MPH)	7.2	7.0	5.6	5.3	6.0	6.6	6.5	6.0	5.8	4.6
	RATIO	0.992	0.974	0.931	0.972	0.981	0.997	0.989	0.427	0.652	0.516
MADISON–002 (4697)	OZONE	.175	.165	.157	.148	.135	.129	.128	.128	.116	.115
	DATE	7/14/95	7/15/95	6/19/95	8/21/95	8/ 1/95	6/17/95	6/18/95	8/ 2/95	8/10/95	8/ 4/95
METEOROLOGICAL SITE	DIR (DEG)	270	290	250	280	250	250	250	240	180	280
NEWARK	VEL (MPH)	9.3	10.4	8.8	6.9	8.6	8.2	8.3	1.3	4.6	6.6
	SPD (MPH)	11.6	11.1	11.1	8.2	10.5	10.1	10.2	6.9	5.9	10.5
	RATIO	0.797	0.936	0.794	0.836	0.824	0.820	0.815	0.183	0.773	0.628
METEOROLOGICAL SITE	DIR (DEG)	240	340	240	270	230	280	240	200	210	220
BRADLEY	VEL (MPH)	4.5	5.2	3.2	2.7	3.4	2.1	3.1	.5	3.3	1.4
	SPD (MPH)	7.6	8.1	4.7	4.0	5.3	2.3	3.2	3.0	3.5	4.5
	RATIO	0.586	0.642	0.679	0.668	0.635	0.908	0.969	0.163	0.960	0.308
METEOROLOGICAL SITE	DIR (DEG)	250	260	250	250	240	240	250	260	240	270
BRIDGEPORT	VEL (MPH)	6.9	5.2	7.1	5.2	5.9	6.6	6.4	2.6	4.6	6.3
	SPD (MPH)	7.0	5.3	7.2	5.6	6.0	6.6	6.5	6.0	5.3	7.2
	RATIO	0.974	0.972	0.992	0.931	0.981	0.997	0.989	0.427	0.868	0.877

TABLE 4-3, CONTINUED

1995 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
MIDDLETOWN-007 (4734)	OZONE	.165	.147	.127	.126	.123	.120	.113	.111	.109	.106
	DATE	7/14/95	8/ 1/95	8/ 2/95	7/13/95	8/ 4/95	6/30/95	8/21/95	9/ 7/95	8/31/95	7/ 4/95
METEOROLOGICAL SITE	DIR (DEG)	270	250	240	230	280	140	280	230	240	170
NEWARK	VEL (MPH)	9.3	8.6	1.3	5.1	6.6	4.5	6.9	7.9	9.2	5.0
	SPD (MPH)	11.6	10.5	6.9	6.8	10.5	6.3	8.2	9.6	10.8	7.0
	RATIO	0.797	0.824	0.183	0.750	0.628	0.705	0.836	0.822	0.854	0.705
METEOROLOGICAL SITE	DIR (DEG)	240	230	200	220	220	180	270	200	180	190
BRADLEY	VEL (MPH)	4.5	3.4	.5	6.4	1.4	2.8	2.7	8.5	4.5	2.5
	SPD (MPH)	7.6	5.3	3.0	8.1	4.5	3.7	4.0	10.9	4.6	2.7
	RATIO	0.586	0.635	0.163	0.797	0.308	0.751	0.668	0.783	0.977	0.918
METEOROLOGICAL SITE	DIR (DEG)	250	240	260	220	270	220	250	230	230	180
BRIDGEPORT	VEL (MPH)	6.9	5.9	2.6	3.9	6.3	4.6	5.2	6.6	4.7	2.4
	SPD (MPH)	7.0	6.0	6.0	4.7	7.2	5.0	5.6	6.8	6.6	4.6
	RATIO	0.974	0.981	0.427	0.828	0.877	0.923	0.931	0.976	0.718	0.516
NEW HAVEN-123 (4843)	OZONE	.128	.123	.119	.110	.110	.099	.098	.095	.092	.088
	DATE	7/14/95	8/ 1/95	8/ 2/95	8/ 4/95	6/18/95	6/17/95	8/21/95	7/29/95	7/ 4/95	6/19/95
METEOROLOGICAL SITE	DIR (DEG)	270	250	240	280	250	250	280	250	170	250
NEWARK	VEL (MPH)	9.3	8.6	1.3	6.6	8.3	8.2	6.9	7.9	5.0	8.8
	SPD (MPH)	11.6	10.5	6.9	10.5	10.2	10.1	8.2	9.3	7.0	11.1
	RATIO	0.797	0.824	0.183	0.628	0.815	0.820	0.836	0.849	0.705	0.794
METEOROLOGICAL SITE	DIR (DEG)	240	230	200	220	240	280	270	220	190	240
BRADLEY	VEL (MPH)	4.5	3.4	.5	1.4	3.1	2.1	2.7	3.8	2.5	3.2
	SPD (MPH)	7.6	5.3	3.0	4.5	3.2	2.3	4.0	4.7	2.7	4.7
	RATIO	0.586	0.635	0.163	0.308	0.969	0.908	0.668	0.809	0.918	0.679
METEOROLOGICAL SITE	DIR (DEG)	250	240	260	270	250	240	250	230	180	250
BRIDGEPORT	VEL (MPH)	6.9	5.9	2.6	6.3	6.4	6.6	5.2	7.7	2.4	7.1
	SPD (MPH)	7.0	6.0	6.0	7.2	6.5	6.6	5.6	7.8	4.6	7.2
	RATIO	0.974	0.981	0.427	0.877	0.989	0.997	0.931	0.996	0.516	0.992
STAFFORD-001 (4839)	OZONE	.131	.127	.120	.119	.107	.100	.099	.099	.099	.098
	DATE	6/30/95	7/13/95	8/31/95	9/ 7/95	8/ 1/95	6/ 1/95	5/21/95	5/24/95	8/10/95	8/ 2/95
METEOROLOGICAL SITE	DIR (DEG)	140	230	240	230	250	190	240	230	180	240
NEWARK	VEL (MPH)	4.5	5.1	9.2	7.9	8.6	4.8	10.4	12.5	4.6	1.3
	SPD (MPH)	6.3	6.8	10.8	9.6	10.5	8.8	10.6	14.7	5.9	6.9
	RATIO	0.705	0.750	0.854	0.822	0.824	0.548	0.981	0.850	0.773	0.183
METEOROLOGICAL SITE	DIR (DEG)	180	220	180	200	230	200	190	200	210	200
BRADLEY	VEL (MPH)	2.8	6.4	4.5	8.5	3.4	5.6	6.7	5.6	3.3	.5
	SPD (MPH)	3.7	8.1	4.6	10.9	5.3	5.8	8.8	6.9	3.5	3.0
	RATIO	0.751	0.797	0.977	0.783	0.635	0.974	0.759	0.813	0.960	0.163
METEOROLOGICAL SITE	DIR (DEG)	220	220	230	230	240	230	200	240	240	260
BRIDGEPORT	VEL (MPH)	4.6	3.9	4.7	6.6	5.9	6.5	4.7	7.7	4.6	2.6
	SPD (MPH)	5.0	4.7	6.6	6.8	6.0	7.0	6.5	8.1	5.3	6.0
	RATIO	0.923	0.828	0.718	0.976	0.981	0.926	0.726	0.951	0.868	0.427

TABLE 4-3, CONTINUED

1995 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
STRATFORD-007 (4880)	OZONE	.164	.140	.135	.134	.131	.130	.125	.124	.121	.107
	DATE	7/14/95	8/ 1/95	8/21/95	6/19/95	6/20/95	7/15/95	6/18/95	8/ 2/95	8/ 4/95	6/17/95
METEOROLOGICAL SITE	DIR (DEG)	270	250	280	250	300	290	250	240	280	250
NEWARK	VEL (MPH)	9.3	8.6	6.9	8.8	3.6	10.4	8.3	1.3	6.6	8.2
	SPD (MPH)	11.6	10.5	8.2	11.1	9.3	11.1	10.2	6.9	10.5	10.1
	RATIO	0.797	0.824	0.836	0.794	0.388	0.936	0.815	0.183	0.628	0.820
METEOROLOGICAL SITE	DIR (DEG)	240	230	270	240	20	340	240	200	220	280
BRADLEY	VEL (MPH)	4.5	3.4	2.7	3.2	4.1	5.2	3.1	.5	1.4	2.1
	SPD (MPH)	7.6	5.3	4.0	4.7	4.3	8.1	3.2	3.0	4.5	2.3
	RATIO	0.586	0.635	0.668	0.679	0.951	0.642	0.969	0.163	0.308	0.908
METEOROLOGICAL SITE	DIR (DEG)	250	240	250	250	230	260	250	260	270	240
BRIDGEPORT	VEL (MPH)	6.9	5.9	5.2	7.1	3.7	5.2	6.4	2.6	6.3	6.6
	SPD (MPH)	7.0	6.0	5.6	7.2	5.8	5.3	6.5	6.0	7.2	6.6
	RATIO	0.974	0.981	0.931	0.992	0.652	0.972	0.989	0.427	0.877	0.997
TORRINGTON-006 (4869)	OZONE	.129	.119	.117	.111	.109	.106	.104	.101	.099	.099
	DATE	7/13/95	8/31/95	7/ 4/95	6/30/95	9/ 7/95	7/28/95	6/ 1/95	5/24/95	6/ 6/95	8/ 1/95
METEOROLOGICAL SITE	DIR (DEG)	230	240	170	140	230	220	190	230	120	250
NEWARK	VEL (MPH)	5.1	9.2	5.0	4.5	7.9	5.6	4.8	12.5	5.0	8.6
	SPD (MPH)	6.8	10.8	7.0	6.3	9.6	9.9	8.8	14.7	6.0	10.5
	RATIO	0.750	0.854	0.705	0.705	0.822	0.563	0.548	0.850	0.831	0.824
METEOROLOGICAL SITE	DIR (DEG)	220	180	190	180	200	190	200	200	170	230
BRADLEY	VEL (MPH)	6.4	4.5	2.5	2.8	8.5	2.8	5.6	5.6	3.0	3.4
	SPD (MPH)	8.1	4.6	2.7	3.7	10.9	3.2	5.8	6.9	4.2	5.3
	RATIO	0.797	0.977	0.918	0.751	0.783	0.901	0.974	0.813	0.730	0.635
METEOROLOGICAL SITE	DIR (DEG)	220	230	180	220	230	200	230	240	100	240
BRIDGEPORT	VEL (MPH)	3.9	4.7	2.4	4.6	6.6	3.0	6.5	7.7	3.4	5.9
	SPD (MPH)	4.7	6.6	4.6	5.0	6.8	4.9	7.0	8.1	5.0	6.0
	RATIO	0.828	0.718	0.516	0.923	0.976	0.605	0.926	0.951	0.685	0.981

FIGURE 4-5

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

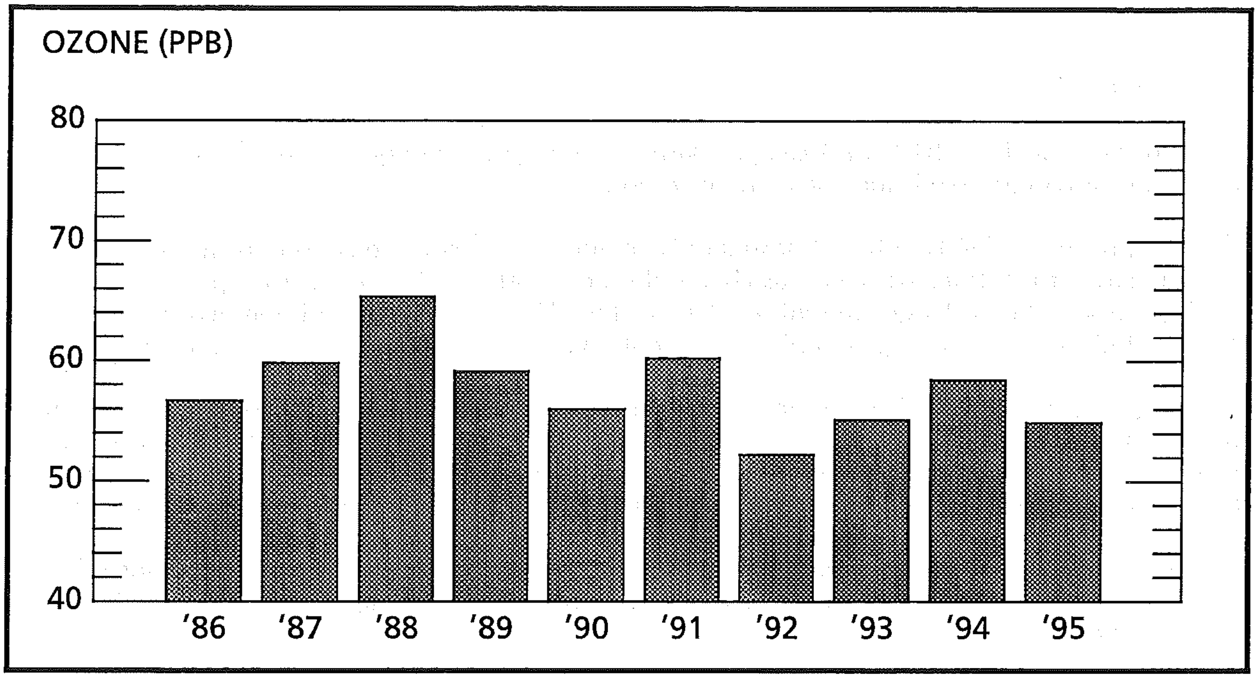
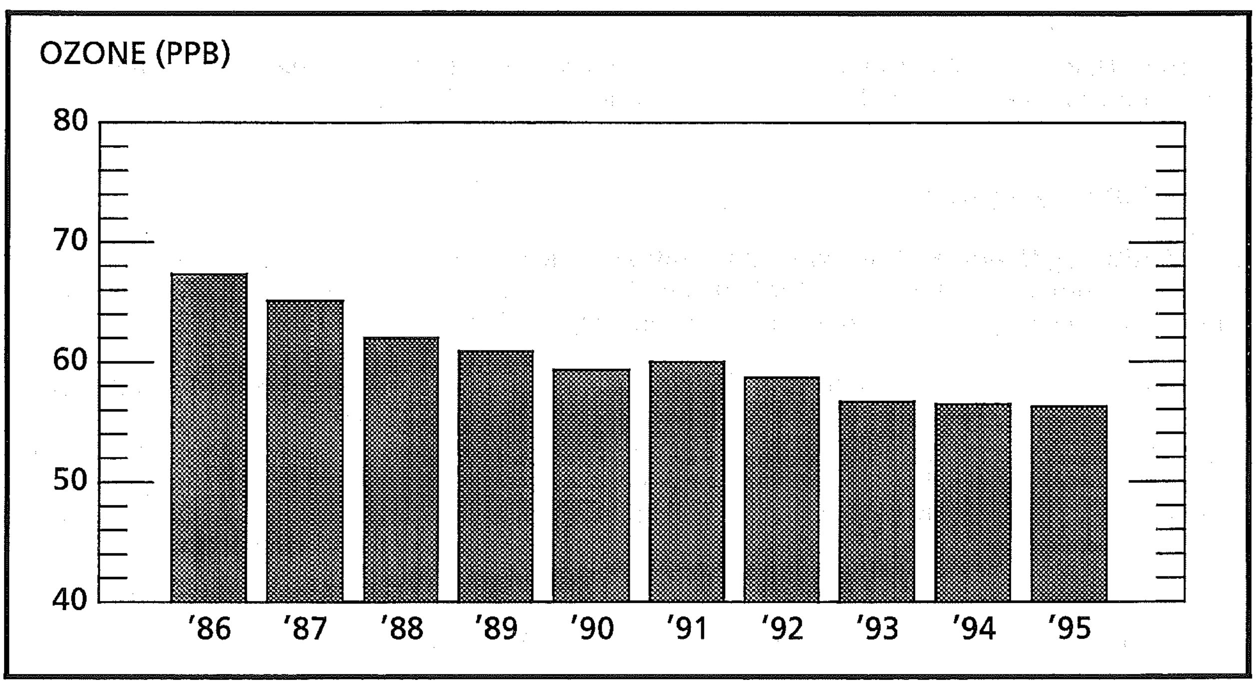


FIGURE 4-6

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 1995. 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 48 $\mu g/m^3$, 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 1995 (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 - Eighty precision checks were made on the NO_2 monitors in 1995, yielding 95% probability limits ranging from -13% to +8%. Accuracy is determined by introducing a known amount of NO_2 into each of the monitors. Eight audits for accuracy were conducted on the monitoring network in 1995. 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 -6% to +3%; those for the low/medium level test ranged from -6% to +1%; those for the medium/high level test ranged from -6% to +3%; and those for the high level test ranged from -5% to +4%.

Annual Averages - The annual average NO_2 standard of 100 $\mu g/m^3$ was not exceeded in 1995 at any site in Connecticut (see Table 5-1). In addition, all three sites had sufficient data to compute valid arithmetic means. This permits comparisons with the 1993 and 1994 annual averages. There was no trend in the annual average NO_2 concentrations at the three sites between 1993 and 1995.

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 1995.

10-High Days with Wind Data - Table 5-2 presents for each site the ten days in 1995 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.) The NO_2 concentrations have units of parts per million. Concentrations in units of $\mu g/m^3$ can be calculated by multiplying parts per million by the factor 1880.

According to National Weather Service local climatological data recorded at Bradley Airport, 15 of the 18 days listed in the table had at least 50% of the possible sunshine. A high percentage of the possible sunshine is interpreted to confirm the importance of photochemical oxidation in the formation of NO_2.

Using the National Weather Service data from the Bridgeport meteorological site for Bridgeport 013 and New Haven 123 sites, and using the data from Bradley for East Hartford 003 site, one finds that 70% of the days have persistent winds out of the southwest. This is not unexpected since the NO_2 sites were deliberately located to the north and east of major expressways and interchanges, which are major sources of nitrogen oxide emissions. Moreover, high NO_2 levels coincident with southwest winds confirm the importance of pollution transport into Connecticut from the southwest.

Trends - The weighted averages of the annual NO_2 concentrations at the three monitoring sites are illustrated in Figure 5-2. The year-to-year variation appears to be quite choppy. In spite of this, there appears to be a slight 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 5-year average NO_2 concentration, with the influence of meteorology minimized, has been trending downward over the past nine years.

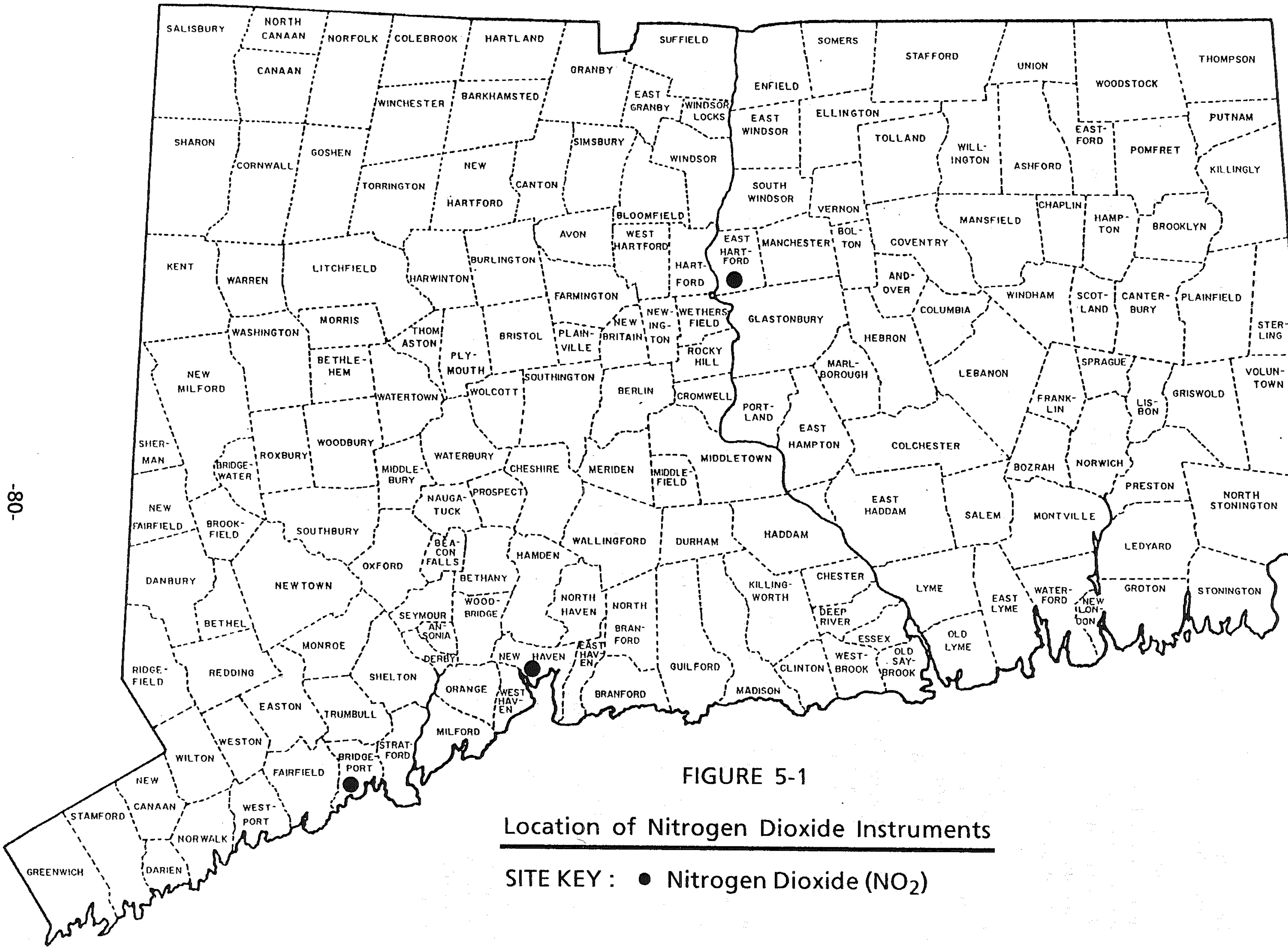


FIGURE 5-1

Location of Nitrogen Dioxide Instruments

SITE KEY : ● Nitrogen Dioxide (NO_2)

TABLE 5-1

1993 -1995 NITROGEN DIOXIDE ANNUAL AVERAGES

Town Name	Site	Year	Samples	Arithmetic Mean	95-Percent-Limits Lower	95-Percent-Limits Upper	Standard Deviation
Bridgeport	013	1993	8347	45.64	45.53	45.76	23.80
Bridgeport	013	1994	8390	49.33	49.21	49.46	28.25
Bridgeport	013	1995	8520	45.68	45.59	45.77	25.16
East Hartford	003	1993	8505	34.65	34.57	34.73	22.45
East Hartford	003	1994	8355	38.25	38.12	38.37	27.04
East Hartford	003	1995	8496	31.21	31.13	31.29	22.05
New Haven	123	1993	8326	48.98	48.86	49.10	24.47
New Haven	123	1994	7694	56.48	56.26	56.70	27.80
New Haven	123	1995	8262	47.67	47.54	47.79	23.58

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

TABLE 5-2

1995 TEN HIGHEST 1-HOUR AVERAGE NO2 DAYS WITH WIND DATA

UNITS : MICROGRAMS PER CUBIC METER

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
BRIDGEPORT-013 (8520)	NO2	.099	.095	.095	.085	.084	.084	.082	.082	.081	.080
	DATE	1/13/95	2/15/95	2/19/95	3/13/95	6/19/95	10/13/95	8/21/95	10/19/95	2/ 8/95	2/20/95
METEOROLOGICAL SITE	DIR (DEG)	200	40	240	270	250	230	280	200	320	70
NEWARK	VEL (MPH)	2.8	2.1	3.5	3.8	8.8	4.0	6.9	3.4	12.0	4.6
	SPD (MPH)	4.9	6.3	6.0	6.8	11.1	6.0	8.2	6.0	12.4	6.3
	RATIO	0.583	0.325	0.579	0.566	0.794	0.656	0.836	0.570	0.968	0.732
METEOROLOGICAL SITE	DIR (DEG)	180	190	200	100	240	180	270	250	320	30
BRADLEY	VEL (MPH)	6.8	2.5	3.8	.6	3.2	4.8	2.7	1.3	8.7	7.0
	SPD (MPH)	7.3	5.5	5.0	5.0	4.7	5.8	4.0	3.0	10.1	7.6
	RATIO	0.932	0.449	0.746	0.125	0.679	0.839	0.668	0.424	0.861	0.913
METEOROLOGICAL SITE	DIR (DEG)	330	140	220	240	250	260	250	230	340	90
BRIDGEPORT	VEL (MPH)	.5	3.7	1.4	2.1	7.1	3.8	5.2	3.6	8.5	7.6
	SPD (MPH)	3.5	6.3	2.3	3.2	7.2	4.2	5.6	4.2	8.8	8.3
	RATIO	0.148	0.584	0.619	0.670	0.992	0.921	0.931	0.857	0.968	0.918
EAST HARTFORD-003 (8496)	NO2	.076	.067	.066	.065	.064	.063	.059	.059	.057	.054
	DATE	1/13/95	3/13/95	10/12/95	2/ 8/95	10/11/95	1/14/95	7/21/95	10/13/95	10/19/95	10/23/95
METEOROLOGICAL SITE	DIR (DEG)	200	270	260	320	270	120	160	230	200	220
NEWARK	VEL (MPH)	2.8	3.8	6.1	12.0	5.2	2.7	2.9	4.0	3.4	5.2
	SPD (MPH)	4.9	6.8	7.3	12.4	5.9	4.9	5.5	6.0	6.0	6.5
	RATIO	0.583	0.566	0.826	0.968	0.888	0.544	0.532	0.656	0.570	0.804
METEOROLOGICAL SITE	DIR (DEG)	180	100	270	320	210	180	240	180	250	200
BRADLEY	VEL (MPH)	6.8	.6	2.9	8.7	3.2	2.2	3.0	4.8	1.3	3.5
	SPD (MPH)	7.3	5.0	5.9	10.1	5.0	2.3	4.6	5.8	3.0	5.6
	RATIO	0.932	0.125	0.492	0.861	0.641	0.947	0.657	0.839	0.424	0.627
METEOROLOGICAL SITE	DIR (DEG)	330	240	260	340	250	130	230	260	230	250
BRIDGEPORT	VEL (MPH)	.5	2.1	5.8	8.5	4.7	1.9	3.8	3.8	3.6	5.0
	SPD (MPH)	3.5	3.2	5.9	8.8	4.7	4.2	4.0	4.2	4.2	6.0
	RATIO	0.148	0.670	0.980	0.968	0.993	0.466	0.949	0.921	0.857	0.835
NEW HAVEN-123 (8262)	NO2	.092	.090	.089	.084	.082	.082	.082	.079	.077	.075
	DATE	10/13/95	10/23/95	6/19/95	3/13/95	1/13/95	10/11/95	7/14/95	10/12/95	8/12/95	10/ 2/95
METEOROLOGICAL SITE	DIR (DEG)	230	220	250	270	200	270	270	260	270	290
NEWARK	VEL (MPH)	4.0	5.2	8.8	3.8	2.8	5.2	9.3	6.1	5.7	5.6
	SPD (MPH)	6.0	6.5	11.1	6.8	4.9	5.9	11.6	7.3	7.3	7.5
	RATIO	0.656	0.804	0.794	0.566	0.583	0.888	0.797	0.826	0.780	0.747
METEOROLOGICAL SITE	DIR (DEG)	180	200	240	100	180	210	240	270	240	260
BRADLEY	VEL (MPH)	4.8	3.5	3.2	.6	6.8	3.2	4.5	2.9	2.6	1.6
	SPD (MPH)	5.8	5.6	4.7	5.0	7.3	5.0	7.6	5.9	3.7	3.6
	RATIO	0.839	0.627	0.679	0.125	0.932	0.641	0.586	0.492	0.700	0.451
METEOROLOGICAL SITE	DIR (DEG)	260	250	250	240	330	250	250	260	250	240
BRIDGEPORT	VEL (MPH)	3.8	5.0	7.1	2.1	.5	4.7	6.9	5.8	6.2	4.3
	SPD (MPH)	4.2	6.0	7.2	3.2	3.5	4.7	7.0	5.9	6.5	4.3
	RATIO	0.921	0.835	0.992	0.670	0.148	0.993	0.974	0.980	0.955	0.999

FIGURE 5-2

AVERAGE OF THE ANNUAL NO_2 CONCENTRATIONS AT THREE SITES

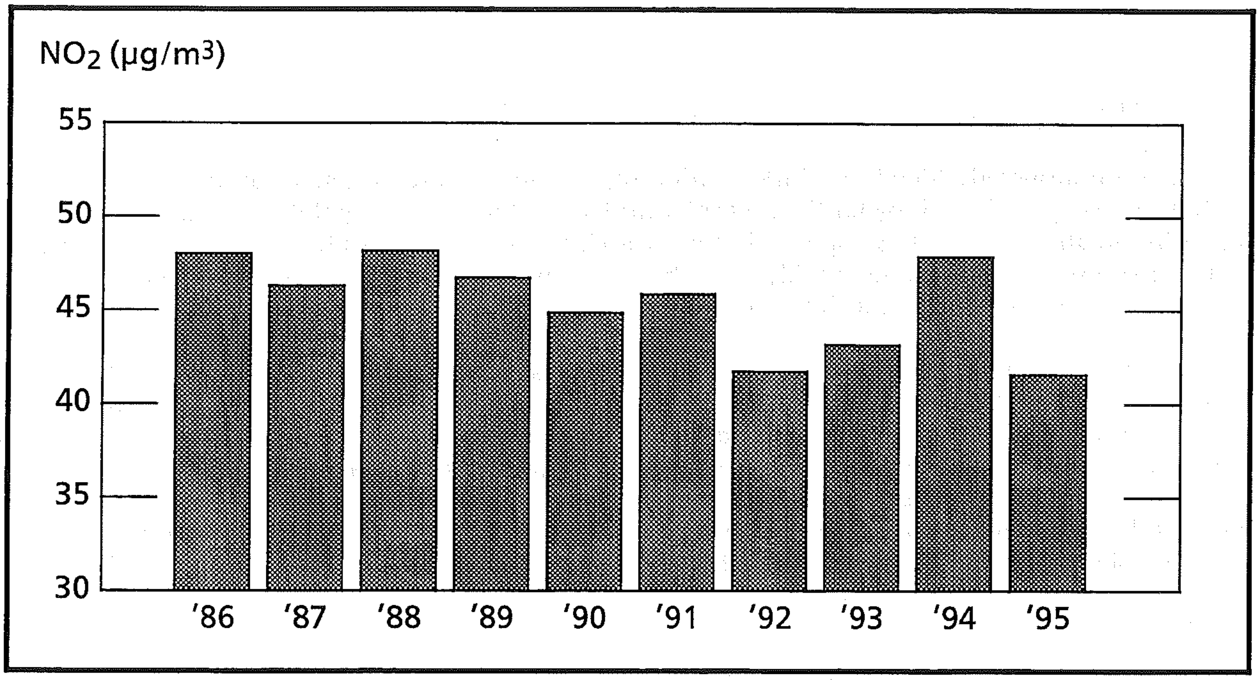
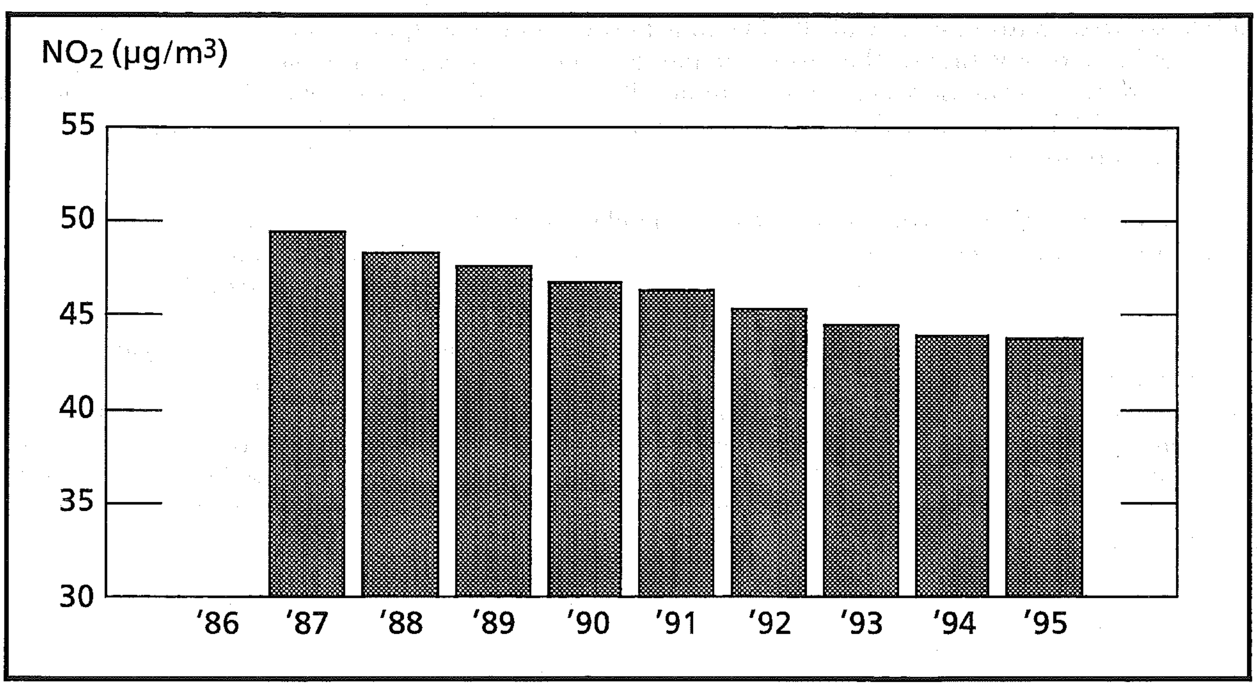


FIGURE 5-3

5-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 1995. However, there was one exceedance of the 9 ppm eight-hour standard at the Hartford 017 site..

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, ambient levels of CO should continue to decline.

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

METHOD OF MEASUREMENT

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

DISCUSSION OF DATA

Monitoring Network - The network in 1995 consisted of five carbon monoxide monitors: Bridgeport 004, Hartford 013, Hartford 017, New Haven 025, 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). The New Haven 025 site replaced the New Haven 019 site, which was shut down in April of 1994.

Precision and Accuracy - The carbon monoxide monitors had a total of 192 precision checks during 1995. The resulting 95% probability limits were -2% to +5%. Accuracy is determined by introducing a known amount of CO into each of the monitors. Eight audits for accuracy were conducted on the monitoring network in 1995. Three different concentration levels were tested on each monitor: low, medium and high. The 95% probability limits ranged from -7% to +4% for the low level test; -6% to +1% for the medium level test; and -3% 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. One site, Hartford 017, had a single exceedance of the 8-hour CO standard. This means that the 8-hour standard was not violated in Connecticut in 1995, since two exceedances are required at a site in order for the standard to be violated. The maximum 8-hour running average decreased at Bridgeport 004, Hartford 013 and Stamford 020 from 1994 to 1995, and increased at Hartford 017. The decreases ranged from 1.6 ppm at Stamford 020 to 2.7 ppm at Bridgeport 004 and Hartford 013. The second highest 8-hour running average decreased from 1994 to 1995 at each of the four sites that were in operation in both of those years. The decreases ranged from 0.3 ppm at Hartford 013 to 0.9 ppm at Bridgeport 004.

As for 1-hour averages, no site in the state recorded a value exceeding the primary 1-hour standard of 35 ppm. All four sites that were in operation in both 1994 and 1995 recorded maximum 1-hour values that were lower in 1995. The decreases ranged from 0.4 ppm at Stamford 020 to 3.6 ppm at Bridgeport 004. The second high 1-hour values at all these sites were also lower in 1995. The decreases ranged from 2.0 ppm at Stamford 020 to 2.8 ppm at Hartford 013.

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

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

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

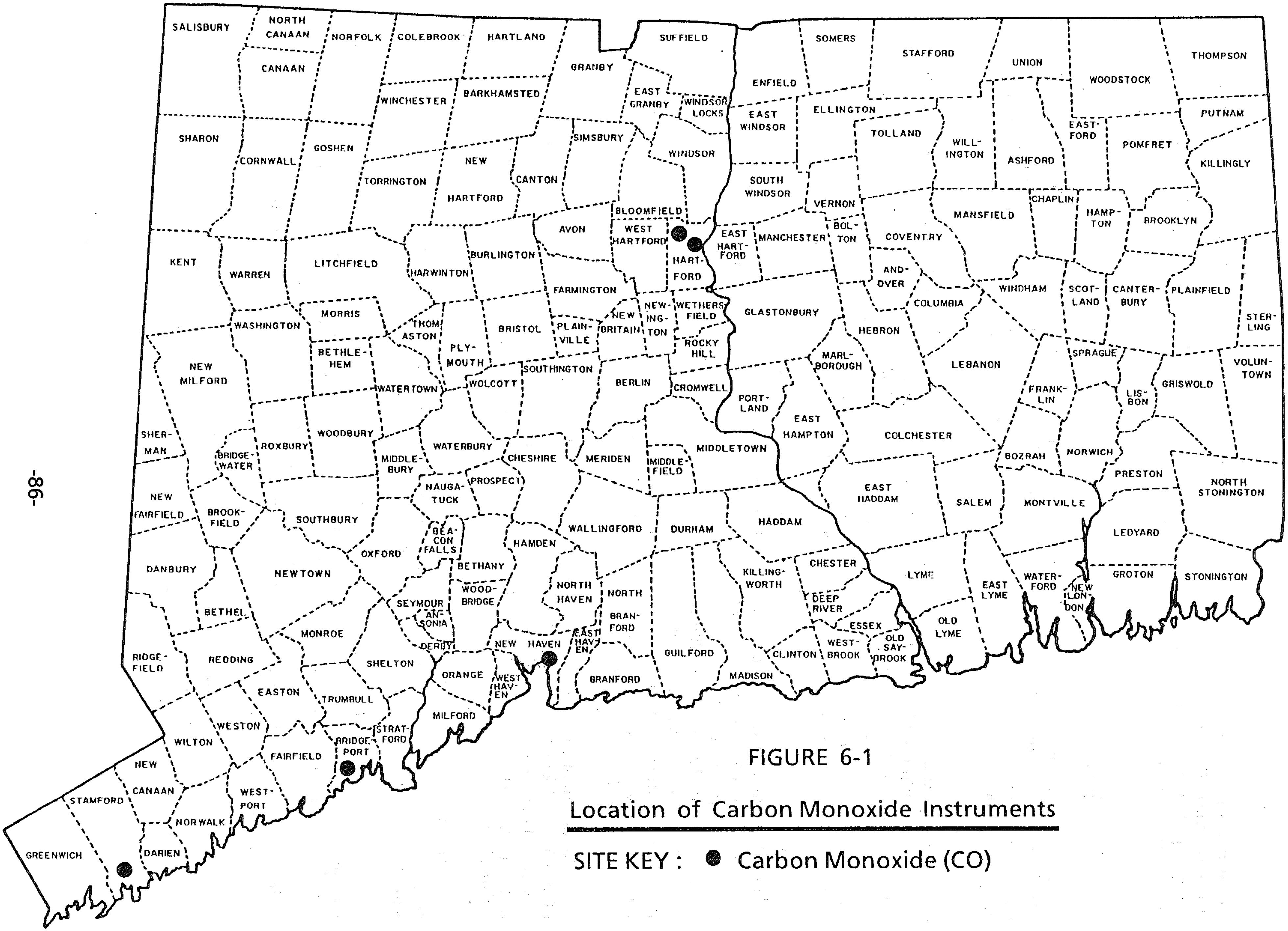


FIGURE 6-1

Location of Carbon Monoxide Instruments

SITE KEY : ● Carbon Monoxide (CO)

TABLE 6-1

1995 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	5.0	01/13/24	4.9	11/01/24	7.5	11/02/16	7.0	01/30/19
Hartford 013	4.8	01/14/01	4.5	01/14/12	6.5	01/13/22	5.6	01/13/23
Hartford 017	10.1	01/13/23	7.0	01/14/03	17.3	01/13/18	13.6	03/15/18
New Haven 25[3]	4.5	03/14/02	3.7	12/15/21	7.0	03/13/22	5.5	03/13/23
Stamford 020	5.5	01/13/14	5.4	01/14/01	9.5	01/13/09	7.6	01/30/19

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.
3 This is a new site. The monitor was installed in February of 1995.

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

TABLE 6-2

1995 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	7.0	5.9	5.5	2.2	2.9	3.5	3.3	3.7	2.7	4.4	7.5	4.7
	Max. Running 8-Hour	5.0	4.0	3.2	1.4	2.0	2.4	2.3	2.3	1.6	2.8	4.9	3.4
	Month	1.2	1.2	0.9	0.7	0.9	1.0	1.1	1.0	0.9	1.1	1.2	0.9
Hartford 013	Max. 1-Hour	6.5	3.3	3.3	3.0	2.8	1.8	2.2	2.1	2.4	3.3	3.4	5.2
	Max. Running 8-Hour	4.8	2.1	2.4	1.5	1.8	1.4	1.7	1.4	1.7	2.2	2.8	3.4
	Month	0.8	0.7	0.7	0.6	0.7	0.8	0.8	0.8	0.7	0.9	0.9	0.7
Hartford 017	Max. 1-Hour	17.3	8.7	13.6	7.1	6.3	4.4	4.5	5.3	5.3	6.2	8.2	7.5
	Max. Running 8-Hour	10.1	4.7	5.7	3.3	3.4	2.7	2.8	3.1	3.2	3.8	5.3	5.3
	Month	2.0	1.7	1.5	1.4	1.3	1.0	1.2	1.4	1.5	1.6	1.7	1.7
New Haven 025*	Max. 1-Hour		4.3	7.0	2.2	2.6	2.7	2.8	2.6	2.4	4.2	4.5	5.3
	Max. Running 8-Hour		3.3	4.5	2.0	2.1	1.6	2.0	1.7	1.7	2.4	3.2	3.7
	Month		1.2	1.0	0.9	0.8	0.9	0.9	0.8	0.9	1.1	1.1	1.0
Stamford 020	Max. 1-Hour	9.5	5.8	7.5	3.6	4.5	3.1	3.3	2.9	3.9	6.2	7.0	5.5
	Max. Running 8-Hour	5.5	4.6	4.4	2.8	3.2	2.5	2.3	2.2	2.6	3.9	5.3	5.0
	Month	1.9	1.9	1.4	1.1	1.3	1.2	1.2	1.1	1.2	1.5	1.7	2.0
NETWORK	Month	1.5	1.3	1.1	0.9	1.0	1.0	1.0	1.0	1.0	1.2	1.3	1.3

* This is a new site. The monitor was installed in February.
N.B. The CO concentrations are in terms of parts per million (ppm).

TABLE 6-3

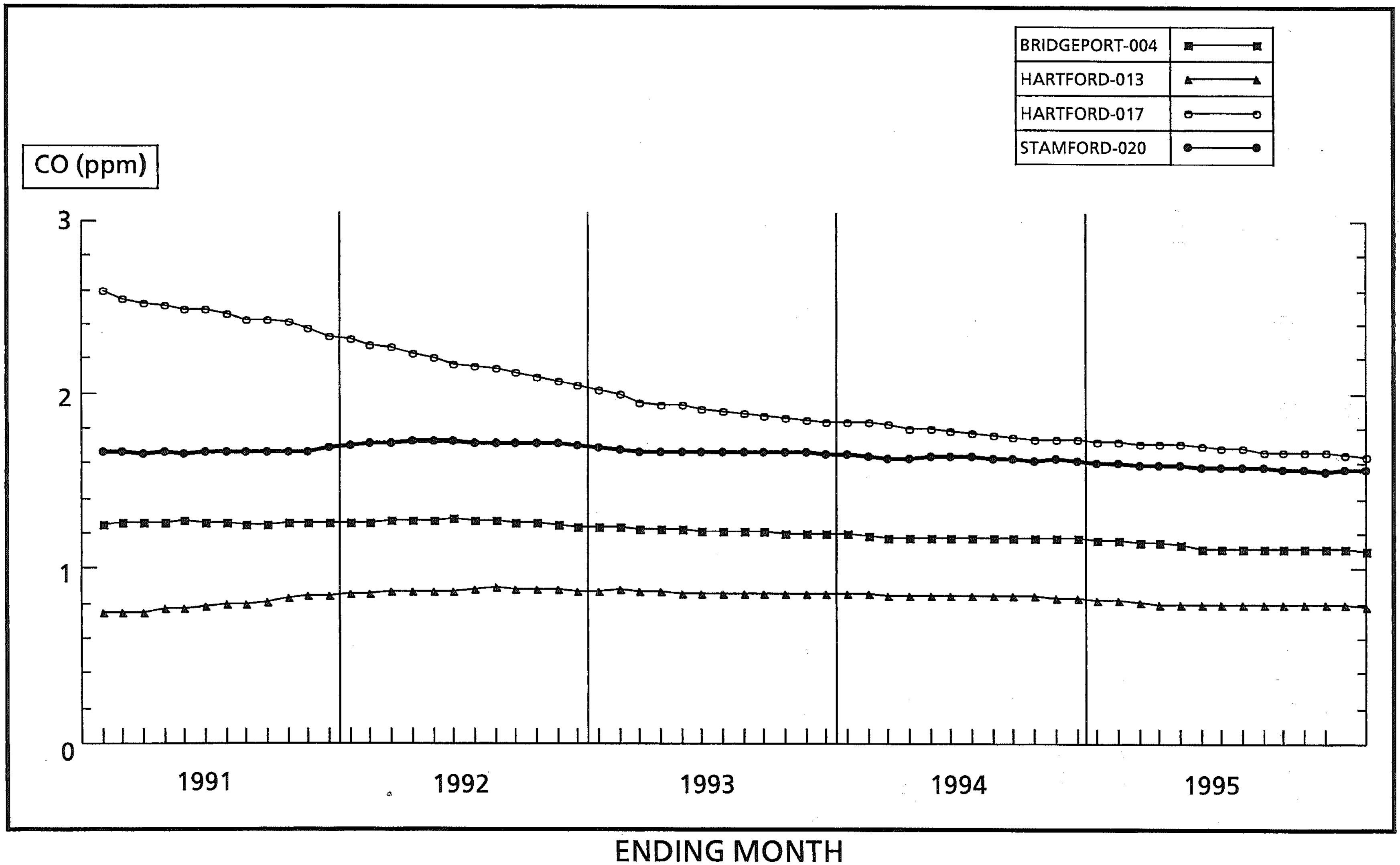
EXCEEDANCES OF THE 8-HOUR CO STANDARD FOR 1991-1995

SITE	1991	1992	1993	1994	1995
Bridgeport 004	0	0	0	0	0
Hartford 013	0	0	0	0	0
Hartford 017	1	1	0	0	1
New Haven 019/025[a]	0	0	0	0	0
Stamford 020	0	0	0	0	0

[a] Site 025 replaced site 019 in February of 1995.

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 recent years, these source categories contributed 41%, 17% and 32%, respectively, of the atmospheric lead. The motor vehicle contribution, while still a large source of airborne lead emissions, has decreased significantly over the years and, since 1988, is no longer the largest source of nationwide airborne lead emissions. These emissions are in the form of fine-to-course particulate matter and are comprised of lead sulfate, ammonium lead halides, and lead halides, of which the chief component is lead bromochloride. The halide compounds appear to undergo chemical changes over a period of hours and are converted to lead carbonate, oxide and oxycarbonate.

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

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

CONCLUSIONS

The Connecticut primary and secondary ambient air quality standard for lead and its compounds is 1.5 $\mu g/m^3$, weighted 3-month average. This standard was not exceeded at any site in Connecticut during 1995.

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 1995 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 1995, only hi-vol samplers were operated in Connecticut to determine lead levels. There were 5 such samplers operated by the DEP in the heavily populated counties of Fairfield, Hartford and New Haven (see Figure 7-1). The samplers are situated near some of the busiest city streets and highways in order to monitor "worst-case" lead concentrations.

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

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

Precision and Accuracy - Due to the very low airborne lead concentrations, precision checks yield 95% probability limits that are statistically unrealistic. Accuracy for lead can be assessed in two ways. One is by auditing the air flow through the monitors. Six audits for flow accuracy were conducted on the monitoring network in 1995. The probability limits ranged from -9% to +9%. Accuracy can also be defined as the accuracy of the analysis method. This is determined by the chemical analysis of known lead samples. On this basis, 4 audits were performed on the network. Two different concentration levels were tested: high and low. The 95% probability limits for the low level ranged from -1% to +10%; those for the high level ranged from -3% to +4%.

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 1995 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.

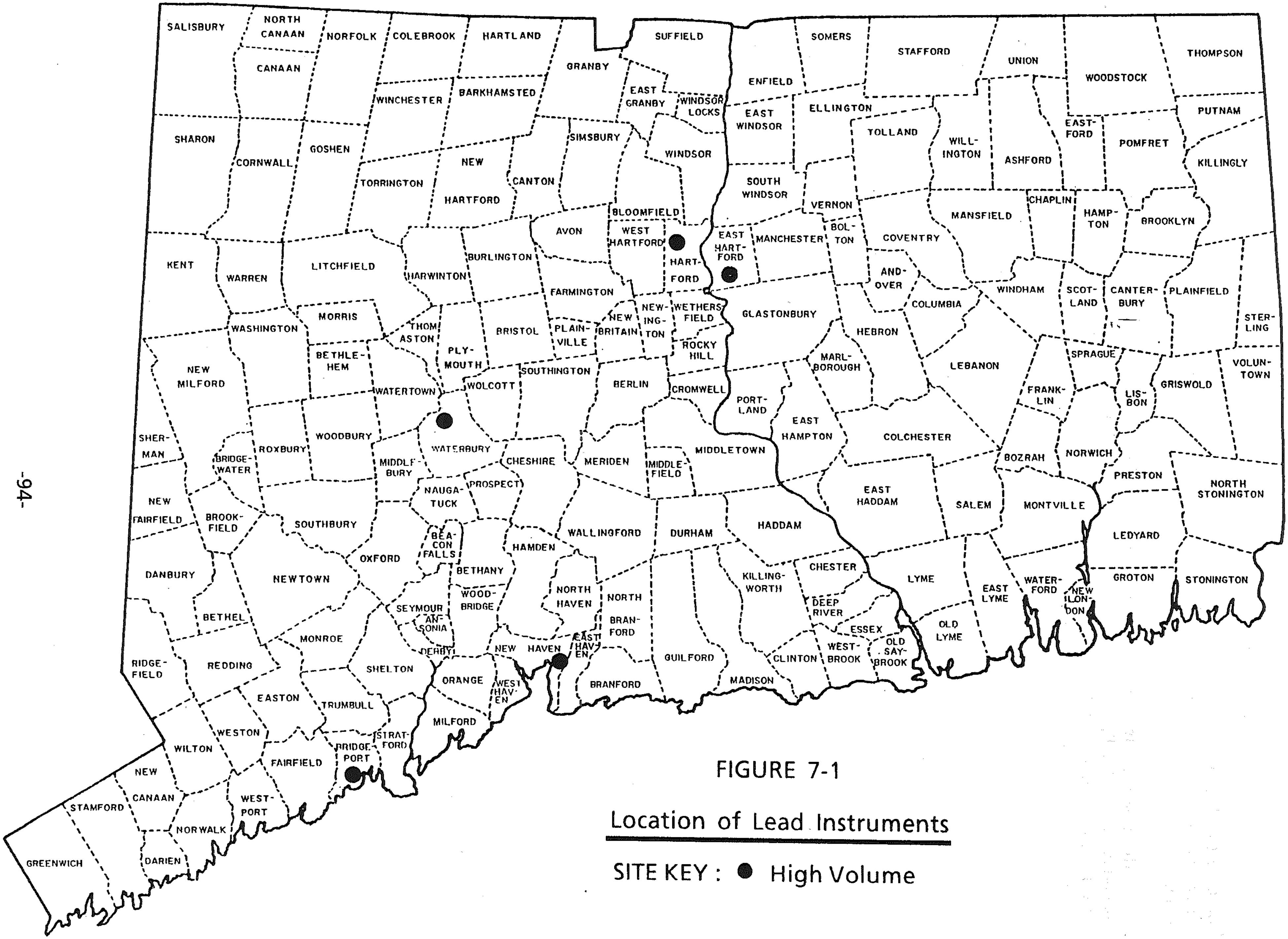


FIGURE 7-1

Location of Lead Instruments

SITE KEY : ● High Volume

TABLE 7-1

1995 3-MONTH RUNNING AVERAGE LEAD CONCENTRATIONS[a]

TOWN-SITE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Bridgeport 010	0.02	0.02	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02
East Hartford 004	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02
Hartford 016	0.02	0.02	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03
New Haven 018	0.05	0.07	0.06	0.06	0.05	0.05	0.04	0.04	0.04	0.05	0.05	0.05
Waterbury 123	0.01	0.01	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.04

a The lead concentrations are in terms of micrograms per cubic meter (μg/m^3).

FIGURE 7-2

STATEWIDE ANNUAL LEAD EMISSIONS FROM GASOLINE

AND

STATEWIDE ANNUAL AVERAGE LEAD CONCENTRATIONS

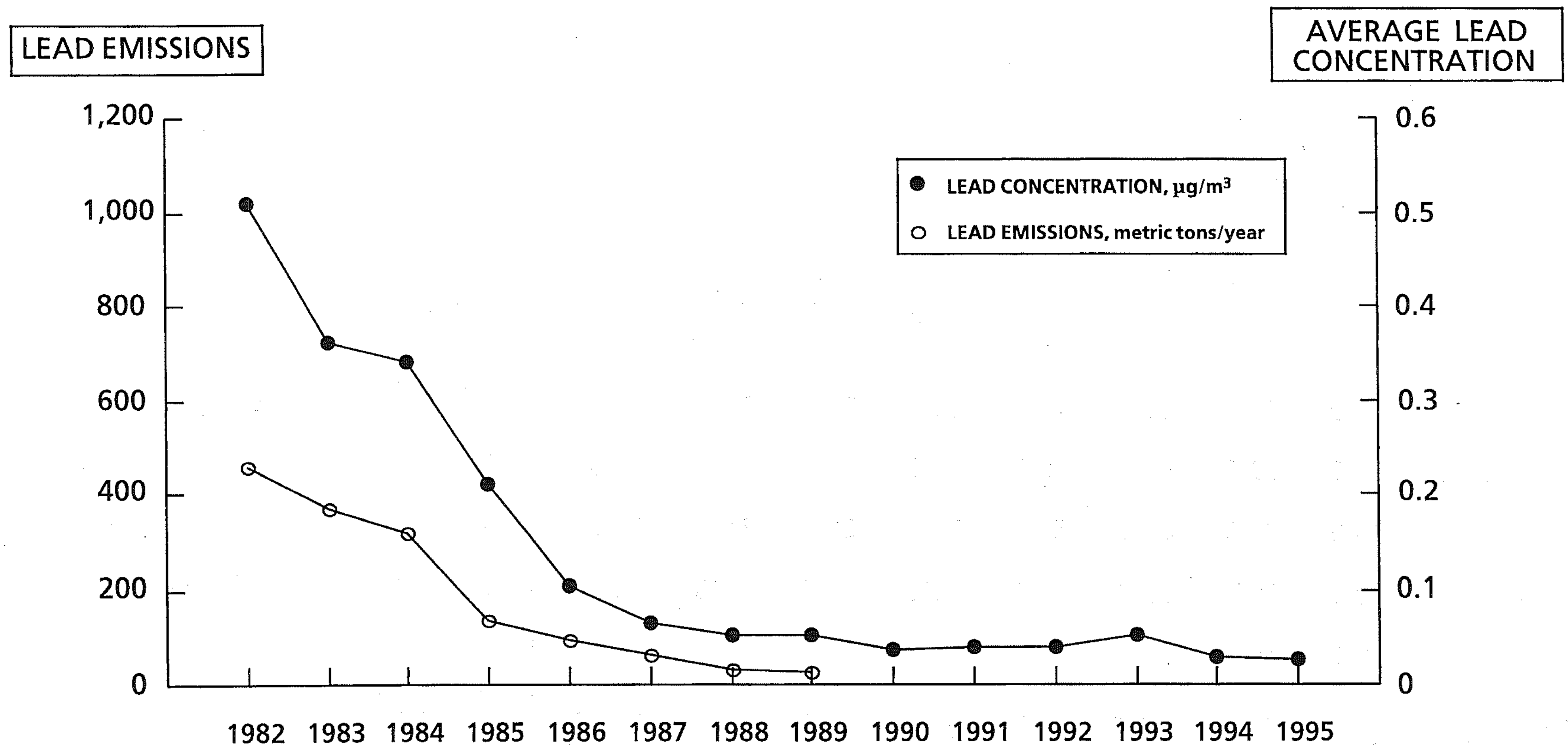
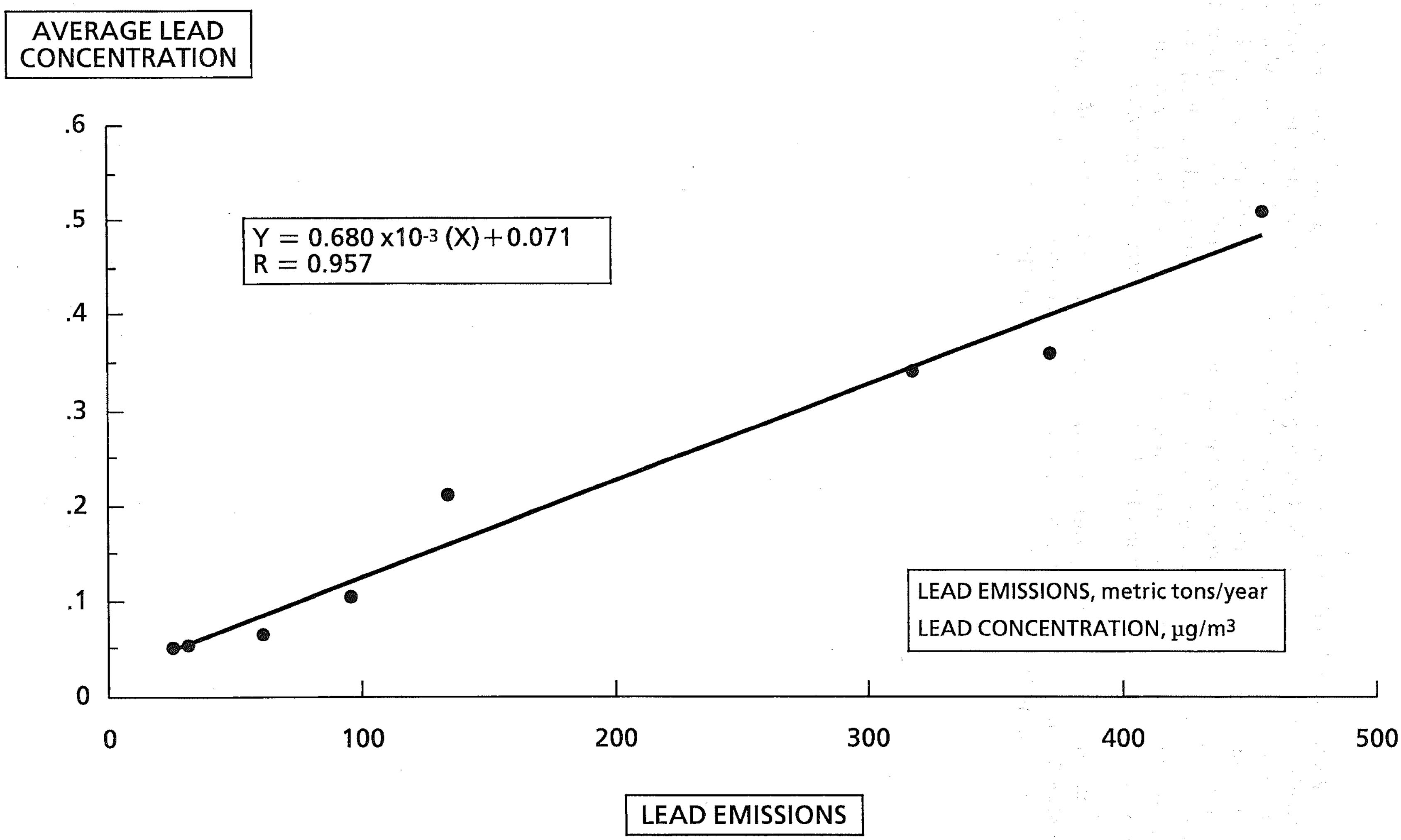


FIGURE 7-3

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 1994 and 1995. 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 1995 National Weather Service surface observations and are shown in Figures 8-2 and 8-4, respectively. Wind roses from these stations for 1994 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

1994 AND 1995 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)		
	1994	1995	Mean[a]	1994	1995	Mean[b]	1994	1995	Normal[c]	1994	1995	Mean[a]	1994	1995	Mean[d]	1994	1995	Mean[d]
Jan	18.8	32.4	26.6	0	0	0.0	1424	1005	1252	5.83	3.84	3.53	13	16	10.7	8.7	8.2	9.0
Feb	23.2	25.8	27.8	0	0	0.0	1163	1088	1050	3.38	3.24	3.18	12	8	10.2	7.6	8.8	9.4
Mar	36.1	41.1	37.2	0	0	0.0	888	737	853	5.70	1.89	3.74	18	8	11.5	8.3	7.6	9.9
Apr	50.9	46.8	48.2	0	0	0.3	417	539	489	2.51	2.60	3.73	12	10	11.2	6.9	7.0	9.8
May	58.3	58.0	59.2	1	0	1.2	226	224	194	4.12	2.63	3.70	14	15	11.8	8.0	6.3	8.7
Jun	71.1	69.3	67.9	4	4	3.5	15	13	20	3.84	1.02	3.56	12	9	11.3	6.9	4.4	8.0
Jul	77.1	76.5	73.2	9	12	7.8	0	0	0	5.32	2.58	3.58	12	11	9.8	4.3	4.9	7.3
Aug	70.0	72.1	71.0	0	6	4.7	8	4	6	5.33	3.81	3.92	15	5	9.8	4.5	4.5	7.0
Sep	63.7	62.2	63.5	0	0	1.2	77	130	96	5.47	3.15	3.64	10	5	9.4	6.5	7.0	7.3
Oct	52.6	55.8	53.0	0	0	*	379	283	397	1.53	9.46	3.29	8	9	8.5	6.1	7.7	7.8
Nov	46.1	38.1	42.1	0	0	0.0	561	802	693	4.57	4.38	3.84	8	14	11.2	7.9	8.6	8.4
Dec	35.0	27.1	30.4	0	0	0.0	923	1169	1101	5.38	2.32	3.71	10	10	11.8	8.7	9.7	8.7
YEAR	50.2	50.4	50.0	14	22	18.7	6081	5994	6151	52.98	40.92	43.43	144	120	127.3	7.0	7.1	8.4

* Less than 0.05
[a] 1905-1995
[b] 1960-1995
[c] 1961-1990
[d] 1955-1995

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

TABLE 8-2

1994 AND 1995 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)		
	1994	1995	Mean[a]	1994	1995	Mean[b]	1994	1995	Normal[c]	1994	1995	Mean[d]	1994	1995	Mean[e]	1994	1995	Mean[f]
Jan	23.4	35.6	28.6	0	0	0.0	1283	905	1119	5.12	2.98	3.53	13	13	10.7	---	---	13.2
Feb	26.2	29.4	30.6	0	0	0.0	1080	993	969	3.17	2.85	3.20	9	7	9.6	---	---	13.6
Mar	37.5	41.4	38.0	0	0	0.0	843	724	818	5.74	2.07	3.94	13	8	11.2	---	---	13.5
Apr	50.6	48.1	48.1	0	0	*	425	498	504	2.85	3.61	3.81	14	11	10.6	---	---	13.0
May	58.6	58.6	58.6	0	0	0.2	208	203	219	3.42	2.27	3.72	13	13	11.1	---	---	11.6
Jun	71.8	68.8	67.8	2	1	1.1	7	6	18	1.51	1.44	3.29	11	12	9.7	---	---	10.5
Jul	78.5	77.0	73.4	9	6	3.5	0	0	0	1.82	1.32	3.64	8	7	8.5	---	---	10.0
Aug	72.0	74.8	72.1	0	6	1.9	1	0	0	4.95	1.37	4.04	13	4	9.3	---	---	10.1
Sep	65.4	66.1	65.2	0	0	0.3	39	56	54	4.46	3.15	3.50	10	6	8.6	---	---	11.2
Oct	54.9	58.6	54.6	0	0	0.0	306	204	302	1.06	5.71	3.36	6	8	7.3	---	---	11.9
Nov	48.9	41.6	44.3	0	0	0.0	473	695	582	3.13	4.33	3.77	9	12	10.0	---	---	12.7
Dec	38.7	30.1	33.3	0	0	0.0	807	1075	952	3.73	1.94	3.62	11	10	11.2	---	---	13.0
YEAR	52.2	52.5	51.2	11	13	7.0	5472	5359	5537	40.96	33.04	43.43	130	112	117.8	---	---	12.0

* Less than 0.05
[a] 1903-1995
[b] 1966-1995
[c] 1961-1990
[d] 1894-1995
[e] 1949-1995
[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 1994
BRADLEY INTERNATIONAL AIRPORT
WINDSOR LOCKS, CONNECTICUT

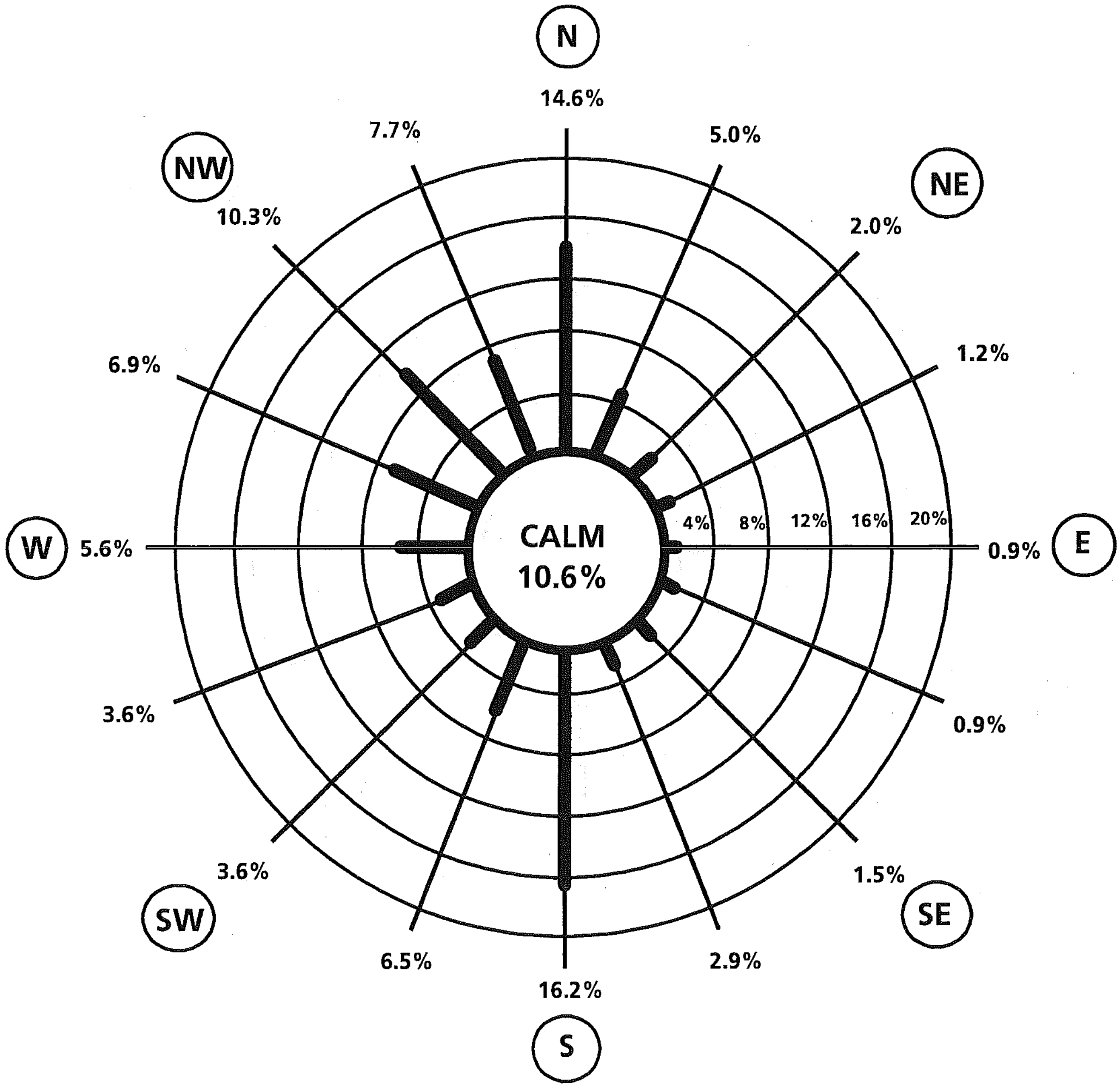


FIGURE 8-2

ANNUAL WIND ROSE FOR 1995
BRADLEY INTERNATIONAL AIRPORT
WINDSOR LOCKS, CONNECTICUT

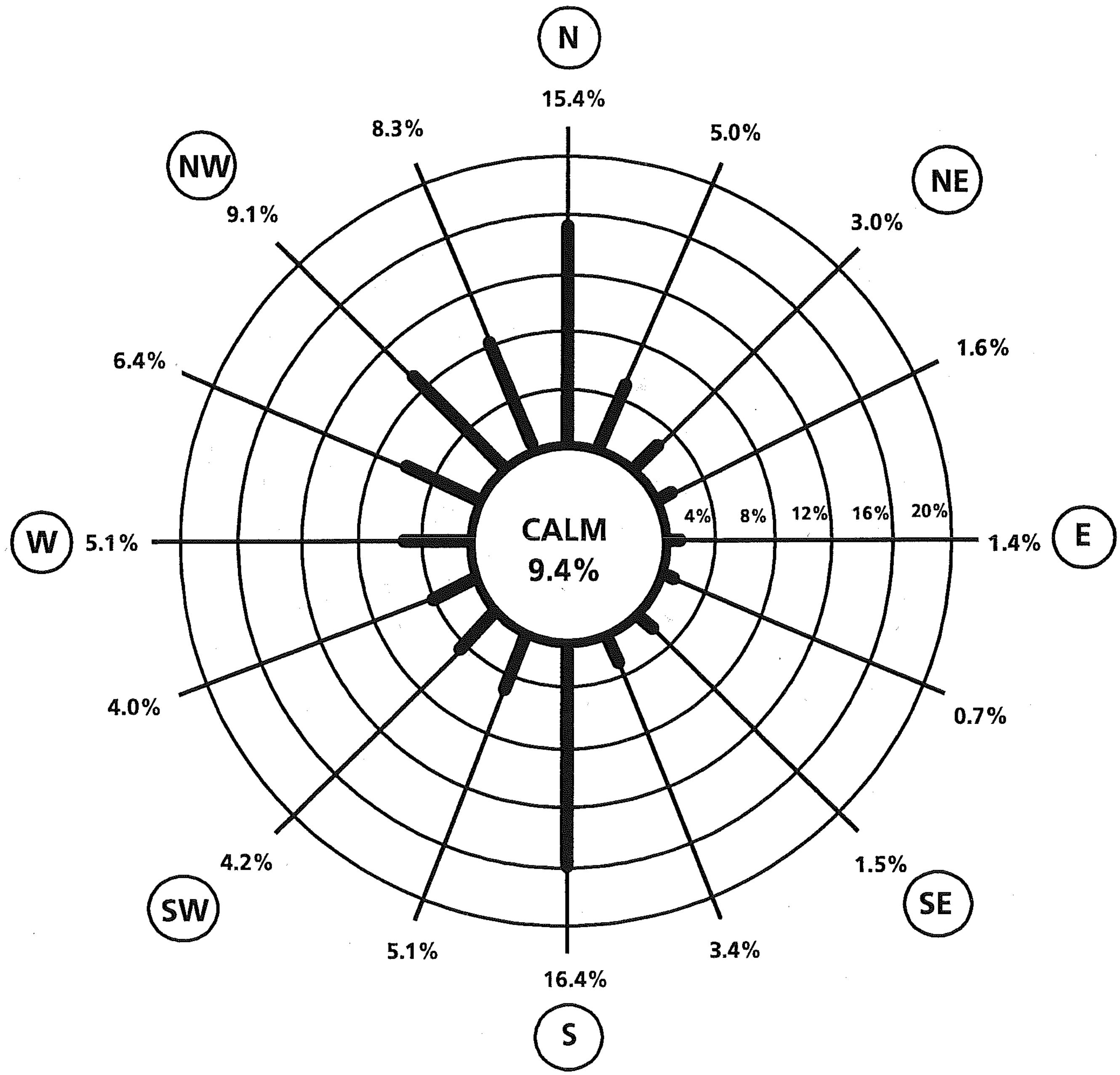


FIGURE 8-3

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

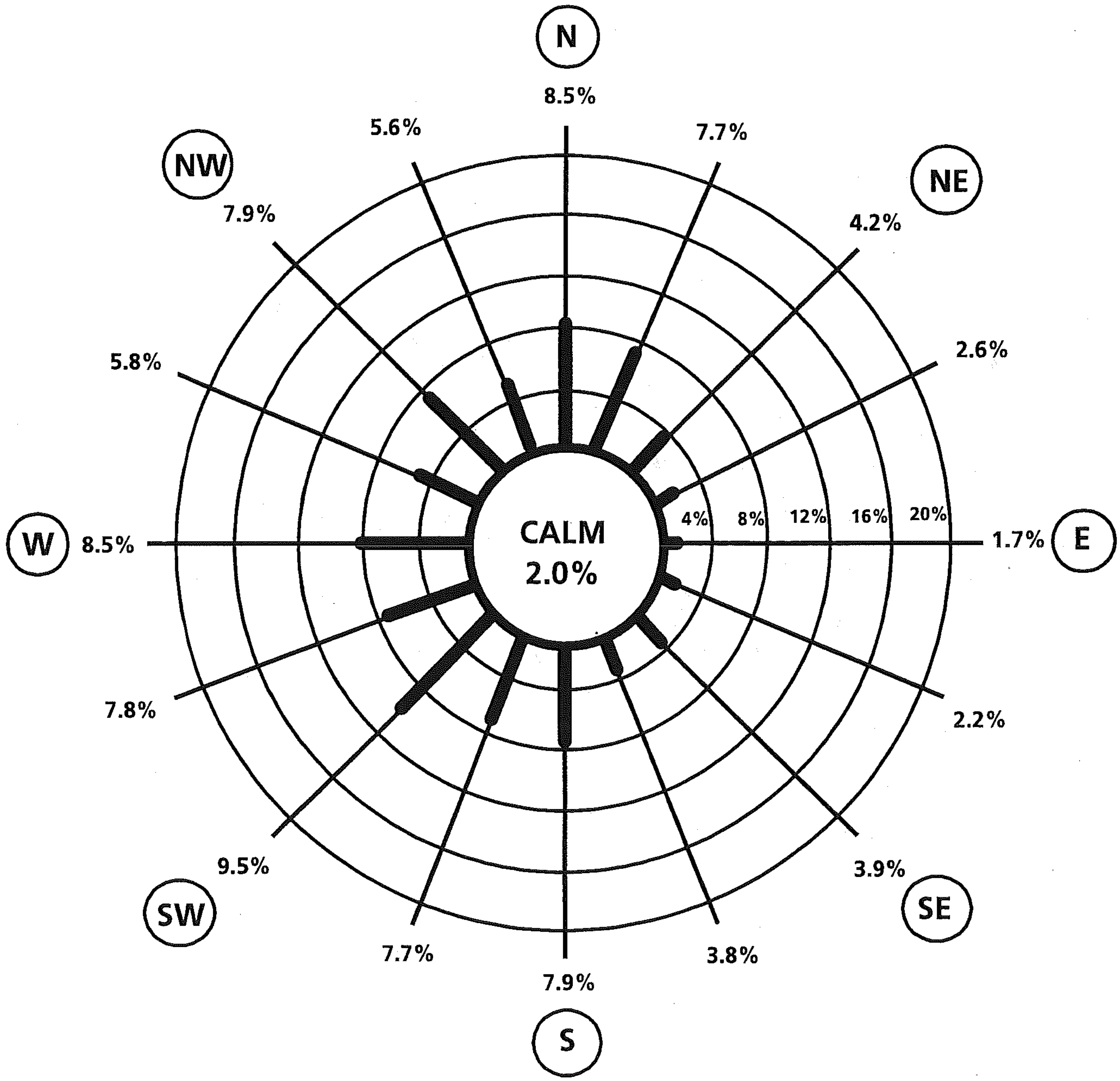
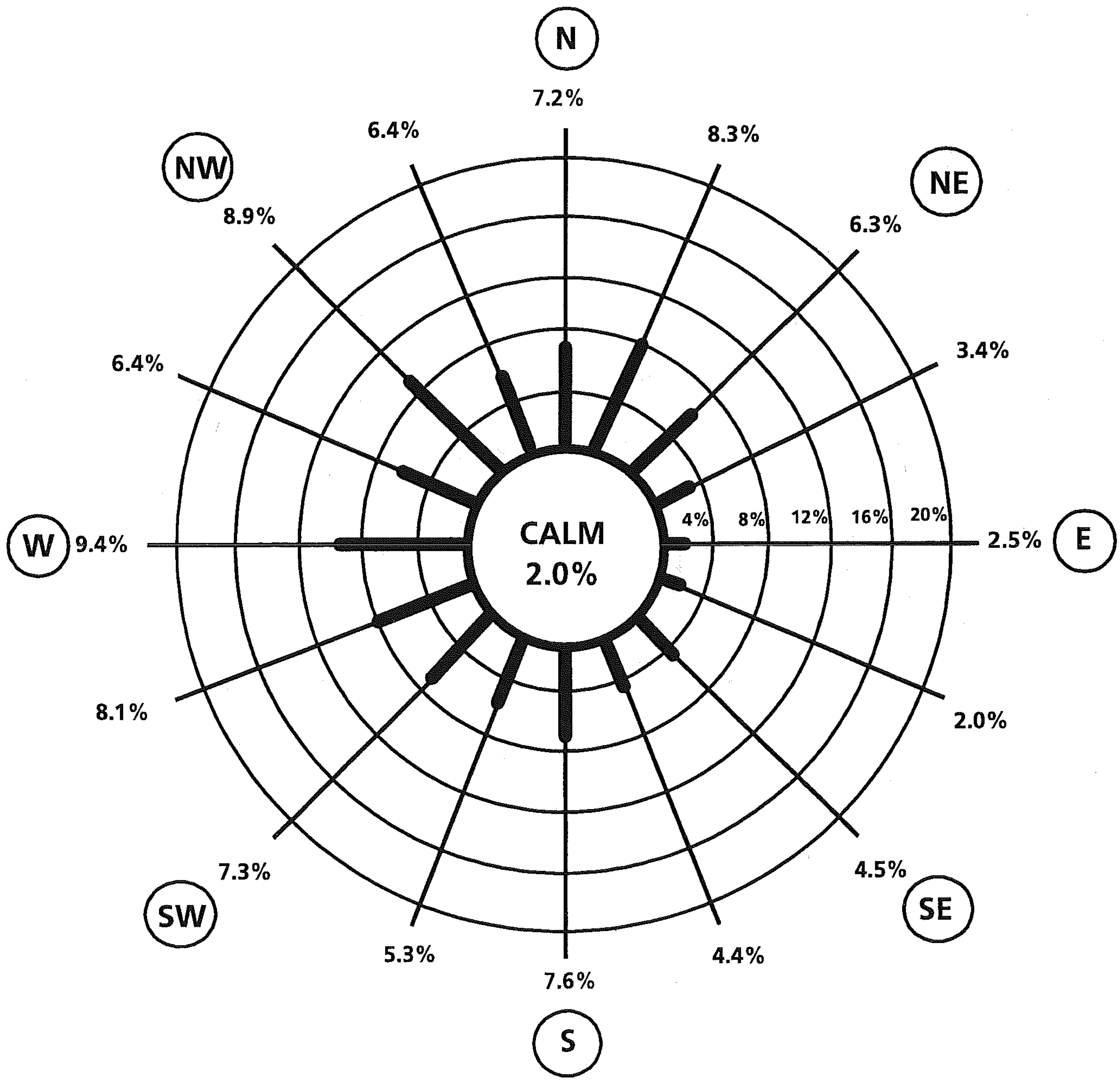


FIGURE 8-4

ANNUAL WIND ROSE FOR 1995
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 1995 designations are:

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

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

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

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

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

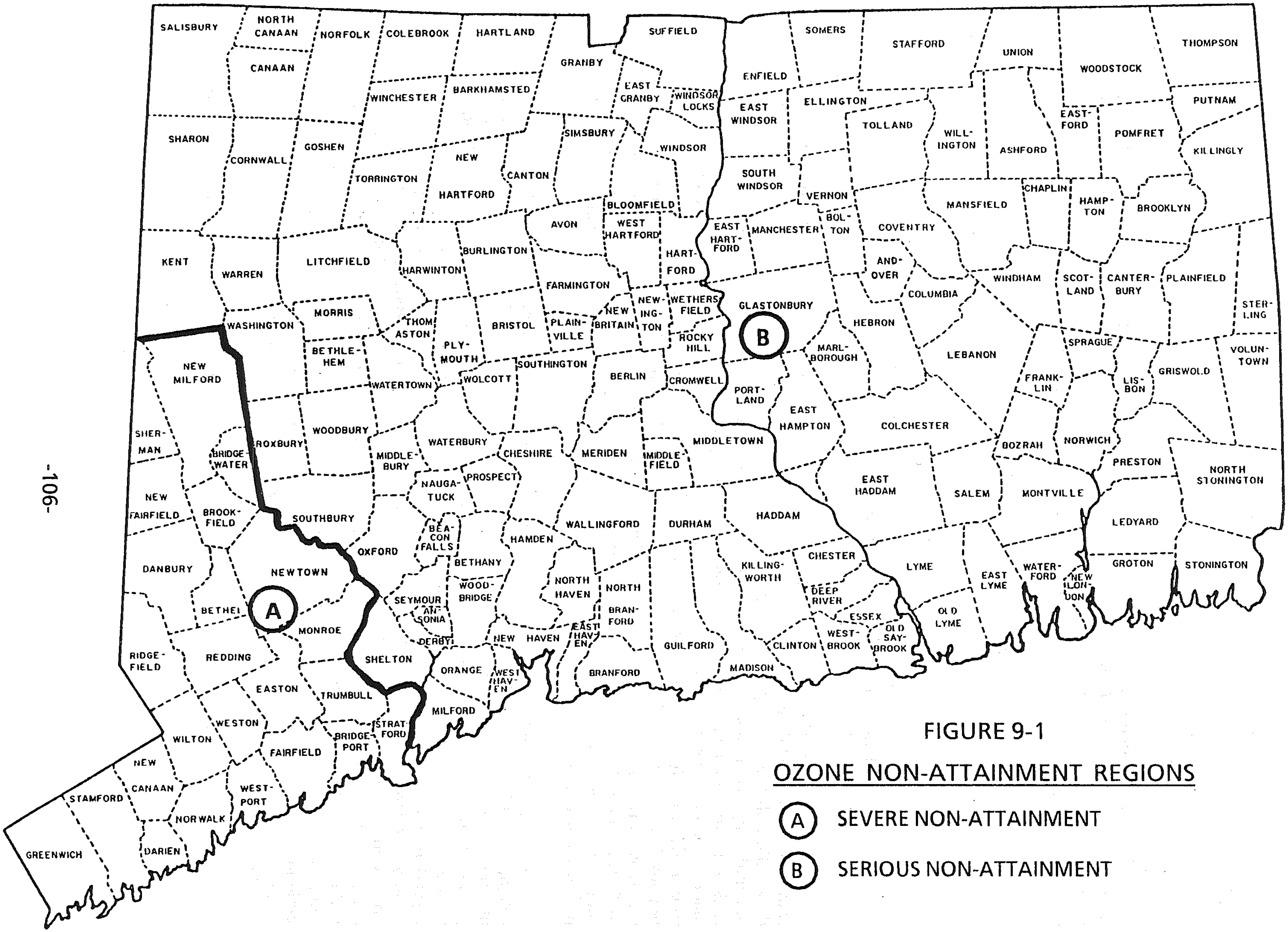


FIGURE 9-1

OZONE NON-ATTAINMENT REGIONS

(A) SEVERE NON-ATTAINMENT

(B) SERIOUS NON-ATTAINMENT

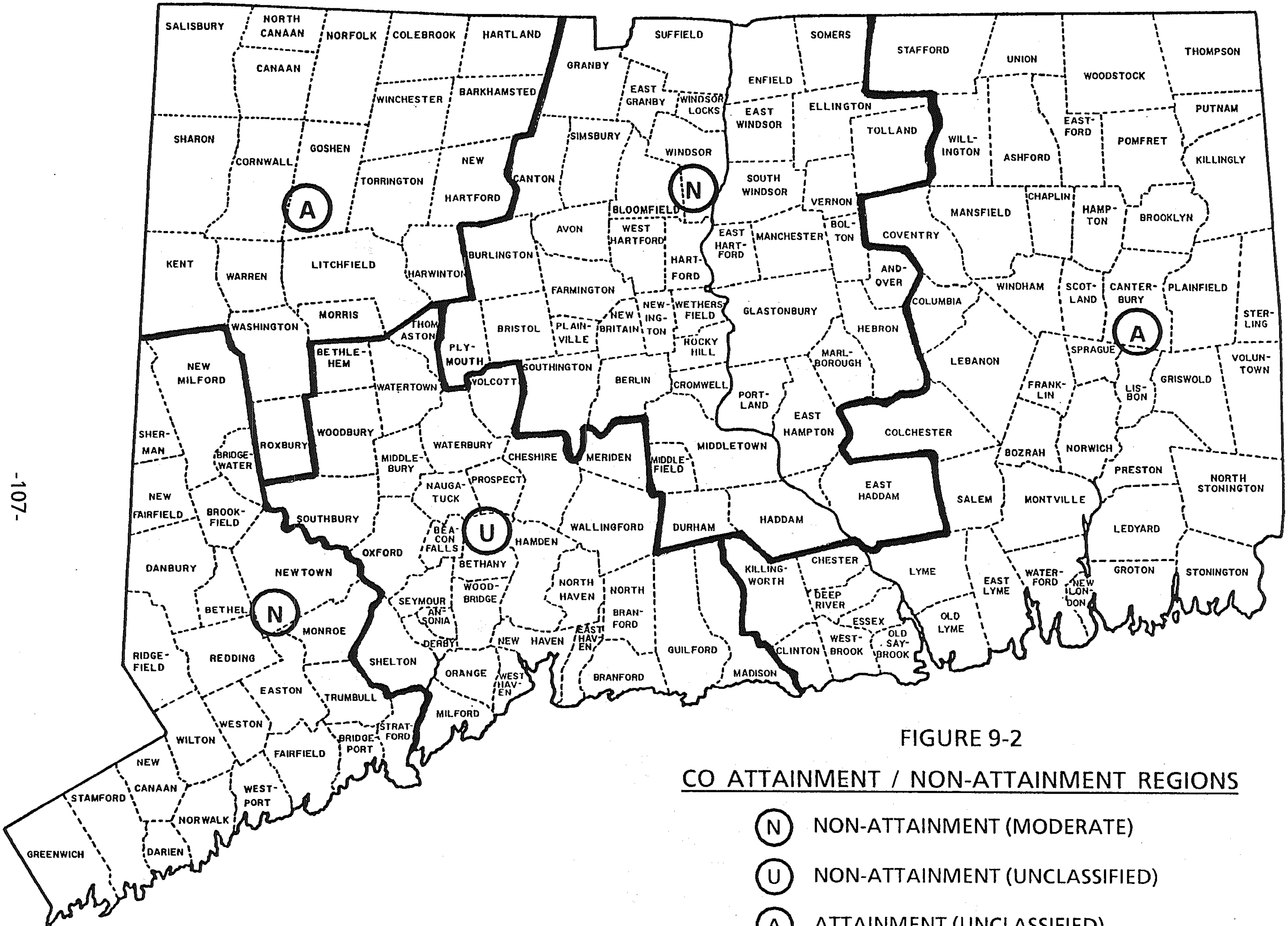


FIGURE 9-2

CO ATTAINMENT / NON-ATTAINMENT REGIONS

(N) NON-ATTAINMENT (MODERATE)

(U) NON-ATTAINMENT (UNCLASSIFIED)

(A) ATTAINMENT (UNCLASSIFIED)

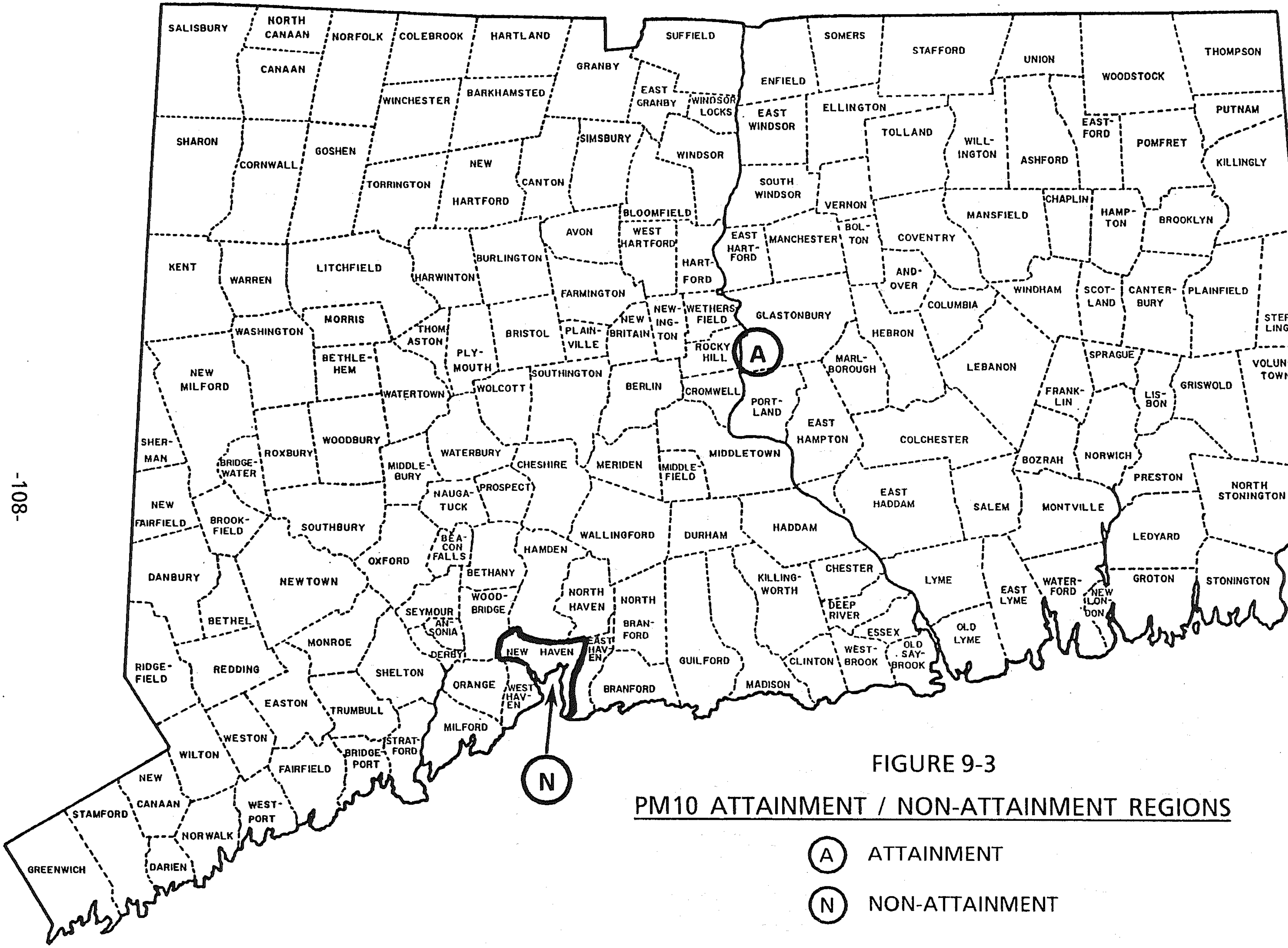


FIGURE 9-3

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 nationwide, the cost-effectiveness of monitoring networks, and timely data submission for assessment purposes. The regulations address a number of key areas including quality assurance, monitoring methodologies, network design, probe siting and data reporting. Detailed requirements and specific criteria are provided which form the framework for ambient air quality monitoring. These regulations apply to all parties conducting ambient air quality monitoring for the purpose of supporting or complying with environmental regulations. In particular, state/local control agencies and industrial/private concerns involved in air monitoring are directly influenced by specific requirements, compliance dates and recommended guidelines.

QUALITY ASSURANCE

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

The data assessment requirements entail the determination of precision and accuracy for both continuous and manual methods. A one-point precision check must be carried out at least once every other week on each automated analyzer used to measure SO_2, NO_2, CO and O_3. Standards from which the precision check test data are derived must meet specifications detailed in the regulations. For manual methods, precision checks are to be accomplished by operating co-located duplicate samplers. In 1995, Connecticut maintained three co-located PM_{10} samplers (Hartford 015, New Haven 123 and Waterbury 123) and one co-located lead sampler (Waterbury 123).

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

All precision and accuracy results are statistics derived through calculation methods specified by the regulations, with the data and results reported quarterly. The NAMS network is actually part of the SLAMS network; so the SLAMS accuracy determinations also apply to the NAMS network. The distinguishing characteristics of NAMS are: 1) the sites are located in high population, high pollution areas (i.e., urban areas); 2) only continuous instruments are used to monitor gaseous pollutants; 3) the regulations specify a minimum number and locations for them; and 4) the data 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 1995 which were on the EPA-approved list as of August 1, 1994. 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 1995 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 1995

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

( ) = Approved range in ppm

TABLE 10-2

1995 SLAMS AND NAMS SITES IN CONNECTICUT

PARTICULATE MATTER (PM_{10})

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

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

TABLE 10-2, CONTINUED

1995 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

1995 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
				SULFUR DIOXIDE			
Bridgeport	Bridgeport	012	S	Pulsed Fluorescence	Continuous	High Concentration	Neighborhood
Bridgeport	Bridgeport	013	N	Pulsed Fluorescence	Continuous	High Concentration	Neighborhood
Danbury	Danbury	123	S	Pulsed Fluorescence	Continuous	Population	Neighborhood
E. Hartford	Hartford	006	N	Pulsed Fluorescence	Continuous	High Concentration	Neighborhood
East Haven	New Haven	003	S	Pulsed Fluorescence	Continuous	Population	Neighborhood
Enfield	MA - CT*	005	S	Pulsed Fluorescence	Continuous	Background	Regional
Greenwich	Stamford	017	S	Pulsed Fluorescence	Continuous	Background	Urban
Groton	New London/ Norwich	007	S	Pulsed Fluorescence	Continuous	Population	Neighborhood
Hartford	Hartford	018	N	Pulsed Fluorescence	Continuous	Population	Neighborhood
Mansfield	NONE	003	S	Pulsed Fluorescence	Continuous	Population	Neighborhood
New Haven	New Haven	123	N	Pulsed Fluorescence	Continuous	High Concentration	Neighborhood
Stamford	Stamford	124	S	Pulsed Fluorescence	Continuous	High Concentration	Neighborhood
Waterbury	Waterbury	123	S	Pulsed Fluorescence	Continuous	Population	Neighborhood

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

TABLE 10-2, CONTINUED

1995 SLAMS AND NAMS SITES IN CONNECTICUT

Town	Urban Area	Site	SLAMS or NAMS	Sampling & Analytic Method	Operating Schedule	Monitoring Objective	Spatial Scale of Representativeness
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	025	S	NDIR	Continuous	High Concentration	Micro
Stamford	Stamford	020	S	NDIR	Continuous	High Concentration	Micro

TABLE 10-3

SUMMARY OF PROBE SITING CRITERIA

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

TABLE 10-3, CONTINUED

SUMMARY OF PROBE SITING CRITERIA

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

TABLE 10-3, CONTINUED

SUMMARY OF PROBE SITING CRITERIA

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

TABLE 10-3, CONTINUED

SUMMARY OF PROBE SITING CRITERIA

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

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

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

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

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

XI. PUBLICATIONS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

XII. ERRATA

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

- Regarding the 1994 edition of the Air Quality Summary,

    1. On page 7, in Table 1-1, the primary and secondary ambient air quality standards for the 1-hour average of carbon monoxide should appear as 40[f,i].

    2. On page 13, in the second paragraph under **Statistical Projections**, the last sentence should read: They indicate that more frequent PM_{10} sampling at the New Haven 018 and the Norwalk 014 sites in 1994 might have resulted in an exceedance of the 24-hour standards.

    3. On page 49, in the first paragraph under **10-High Days with Wind Data**, the first sentence should end with the year 1994, not 1993; the second sentence should be deleted.

    4. On page 67, in the fourth paragraph under **Conclusions**, the third sentence from the end should read in part: ... the percentage of sunshine decreased from 65% in 1993 to 57% in 1994 ...

    5. On page 111, in the second paragraph under **Network Design**, the last sentence should refer to the year 1994, not1993.

- Regarding the 1988 and 1989 editions of the Air Quality Summary,

    1. On page 6, in Table 1-1, the primary and secondary ambient air quality standards for the 1-hour average of carbon monoxide should appear as 40[f,i].

- Regarding the 1990-1993 editions of the Air Quality Summary,

    1. On page 7, in Table 1-1, the primary and secondary ambient air quality standards for the 1-hour average of carbon monoxide should appear as 40[f,i].