1992

STATE OF CONNECTICUT

ANNUAL AIR QUALITY SUMMARY

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I. INTRODUCTION

The 1992 Air Quality Summary of ambient air quality in Connecticut is a compilation of all air pollutant measurements made at the Department of Environmental Protection (DEP) air monitoring network sites.

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 1992. 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 1992 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 1992. 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 five of the eleven DEP ozone monitoring sites in 1992 (see Table 1-2). Nonattainment of the standard remains a fact at all the sites except one in 1992 because the average number of annual exceedances at each site was greater than one per year over the period 1990-1992. The exception, the Torrington 001 site, had only two years of data and averaged one exceedance per year.

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 1992.

5. CARBON MONOXIDE (CO)

Compliance Assessment - The primary eight-hour standard of 9 ppm was exceeded at one of the five carbon monoxide monitoring sites in Connecticut during 1992. The standard was exceeded once at Hartford 017 (see Table 1-2). Since two exceedances at a particular site are required for the standard to be violated, this means that the eight-hour standard was not violated at any of the sites.

There were no exceedances and, therefore, no violations of the primary one-hour standard of 35 ppm at any carbon monoxide monitoring site in Connecticut in 1992.

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 1992.

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 13 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 (3), Stafford, Stamford (2), Stratford, Torrington and Waterbury.

Continuously measured parameters include the pollutants sulfur dioxide, particulates (measured as PM_{10}), carbon monoxide, nitrous oxide, total nitrogen oxides and ozone. Meteorological data consists of wind speed and direction, wind horizontal sigma, temperature, precipitation, barometric pressure and dew point.

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 1992 consisted of the following:

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

A complete description of all permanent air monitoring sites in Connecticut operated by DEP in 1992 is available from the Department of Environmental Protection, Bureau of Air Management, Monitoring and Radiation Division, State Office Building, Hartford, Connecticut, 06106.

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 1992, Connecticut reported the PM_{10} PSI for the towns of Ansonia, Bridgeport, Danbury, East Hartford, Greenwich, Groton, Hartford, Meriden, Milford, Naugatuck, New Britain, New Haven, Norwalk, Norwich, Putnam, Stamford, Torrington, Wallingford, Waterbury and Willimantic; and reported the sulfur dioxide PSI for the towns of Bridgeport, Danbury, East Hartford, East Haven, Enfield, Greenwich, Groton, Hartford, Mansfield, New Haven, Stamford, and Waterbury. For the summer, the ozone PSI was reported for the towns of Bridgeport, Danbury, East Hartford, Greenwich, Groton, Madison, Middletown, New Haven, Stafford, Stratford and Torrington. Each day, the pollutant with the highest PSI value of all the pollutants being monitored is reported for each town, along with the dimensionless PSI number and a descriptor label to characterize the daily air quality. A descriptor label of each subsequent day's forecast is also included.

A telephone recording of the PSI is taped each afternoon at approximately 3 PM, five days a week, and can be heard by dialing 566-3449. Predictions for weekends are included on the Friday recordings. For answers to specific questions, you can call a DEP representative at 566-3310 . The PSI information, as well as health effects information, is also available to the public during weekdays from the American Lung Association of Connecticut in East Hartford. The number there is 289-5401 or 1-800-992-2263.

D. QUALITY ASSURANCE

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

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

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

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

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

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

1. **PRECISION**

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

a. Manual Samplers (PM_{10})

A second (co-located) PM_{10} hi-vol sampler is placed alongside a regular PM_{10} 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: 0.08 to 0.10 ppm for SO_2, O_3 and NO_2, and 8 to 10 ppm for CO. 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 by analyzing spiked samples and comparing the known spiked-sample concentrations with the measured concentrations. Accuracy measurements are obtained each quarter.

c. <u>Automated Analyzers</u> (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	
				$\mu g/m^3$	ppm	$\mu g/m^3$	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]	
Nitrogen Dioxide	Continuous	1-Hour Average	Annual Arithmetic Mean[e]	100	0.05	100	0.05
Ozone	Continuous	1-Hour Average	1-Hour Average	235[g]	0.12[g]	235[g]	0.12[g]
Lead	24 Hours (every sixth day)	Monthly Composite	Weighted 3-Month Average[h]	1.5		1.5	
Carbon Monoxide	Continuous	1-Hour Average	8-Hour Average[e]	10[f,i]	9[f]	10[f,i]	9[f]
			1-Hour Average	40[f]	35[f]	40[f]	35[f]

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

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

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

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

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

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

[g] Daily maximum not to be exceeded more than an average of once 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/m^3, not $\mu g/m^3$.

TABLE 1-2

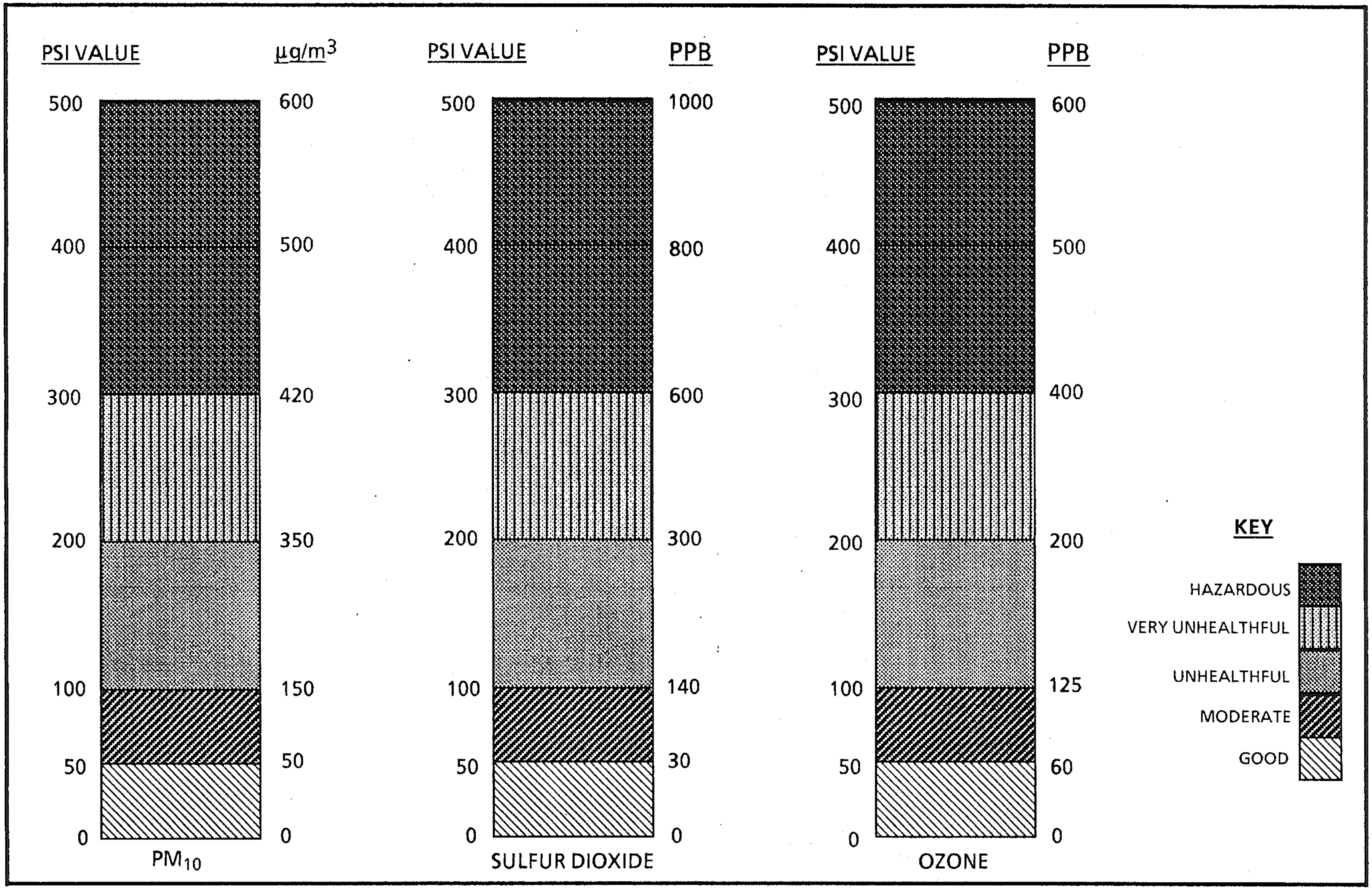
AIR QUALITY STANDARDS EXCEEDED IN CONNECTICUT IN 1992 BASED ON MEASURED CONCENTRATIONS

		OZONE		CARBON MONOXIDE	
		Level Exceeding 1-Hour Standard		Level Exceeding 8-Hour Standard	
TOWN	SITE	Highest Observed Level (ppm)	Number of Days Standard Exceeded	Highest Observed Level 8-Hour / 1-Hour (ppm)	Number of Times Standard Exceeded
Danbury	123	0.145	1	-	-
Groton	008	0.127	1	-	-
Hartford	017	-	-	10.2 / 22.3	1 / 0
Middletown	007	0.133	4	-	-
Stafford	001	0.142	2	-	-
Stratford	007	0.131	3	-	-

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. On July 7, 1993, the state of Connecticut adopted these new standards for particulate matter.

CONCLUSIONS

Measured PM_{10} concentrations during 1992 did not exceed the 50 $\mu g/m^3$ level of the primary and secondary annual standards or the 150 $\mu g/m^3$ level of the primary and secondary 24-hour standards at any site. Moreover, the 24-hour standards were not violated because the "expected number of exceedances" for the most recent 3 years at each site did not exceed one per year, and the annual standards were also not violated anywhere because the "expected annual mean" for the most recent 3 years at each site did not exceed 50 $\mu g/m^3$.

SAMPLE COLLECTION AND ANALYSIS

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

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

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

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

The matter collected on the filters is analyzed for weight in the case of the PM_{10} samplers and for both weight and chemical composition in the case of the hi-vol samplers. The chemical composition of the suspended particulate matter is determined at each hi-vol site as follows. Two standardized strips of every filter are cut out and prepared for two different analyses. In the first analysis, a sample is digested in acid and the resulting solution is analyzed for metals by means of an atomic absorption spectrophotometer. The results are reported for each individual metal in µg/m3. 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 µg/m3.

DISCUSSION OF DATA

Monitoring Network - In 1992, 31 PM_{10} samplers were operated in Connecticut (see Figure 2-1). One TSP sampler was operated and it was located at the Stamford 001 site, which was the only designated TSP site in the State. EPA requires the operation of one TSP site in Connecticut for the sake of historical continuity. In addition, as part of the 1992 network for monitoring the airborne concentrations of lead, five hi-vol samplers were used to gather information on the chemical composition of TSP in the state. These samplers were Bridgeport 010, East Hartford 004, Hartford 016, New Haven 018 and Waterbury 123.

Precision and Accuracy - Precision checks were conducted at three PM_{10} sampling sites which had co-located samplers. On the basis of 166 precision checks, the 95% probability limits for precision ranged from -11% to + 14%. Accuracy is based on air flow through the monitor. The 95% probability limits for accuracy, based on 22 audits conducted on the PM_{10} monitoring system network, ranged from -2% to + 9%. (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/m3 primary and secondary annual standards could be reached at 27 of the 31 PM_{10} monitoring sites in Connecticut in 1992. These 27 sites proved to be in attainment of the annual standards. A determination of attainment or nonattainment could not be reached at Danbury 123, Greenwich 017, Meriden 002 and New Britain 012, where there were insufficient data at each site in at least one calendar quarter during the most recent three years. 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 1990 -1992 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.

Statistical Projections - The statistical projections presented in Table 2-1 are prepared by a DEP computer program which analyzes data from all sites operated by DEP. Input to the program includes the site location, the year, the number of samples (usually a maximum of 61), the annual arithmetic and geometric mean concentrations, and the arithmetic and geometric standard deviations. For each site, the program lists the input, calculates the 95% confidence limits about the annual arithmetic mean, and predicts the number of days in each year that the level of the primary and secondary 24-hour standards (150 µg/m3) would have been exceeded if sampling had been conducted every day. For comparison, Table 2-1 also shows the number of days at each site when the level of the primary and secondary 24-hour standards was actually exceeded, as demonstrated by actual measurements at the site.

The statistical predictions of the number of days that would have seen an exceedance of the level of the 24-hour standards are based on the assumption of a lognormal distribution of the data. They indicate that more frequent PM_{10} sampling in the period from 1990 to 1992 at any site would not have resulted in an exceedance of the 24-hour standards.

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

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 28 sites that met the minimum sampling criteria in 1992. The results for the years through 1991 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 2-3 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 1992.

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 1992, 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 27 of the 31 sites in 1992. A determination of compliance could not be made for Danbury 123, Greenwich 017, Meriden 002 and New Britain 012 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 four sites.

Hi-vol Averages - Quarterly and annual averages of the chemical components from the hi-vol TSP/lead monitors have been computed for 1992 and are presented in Table 2-4.

10 High Days with Wind Data - Table 2-5 lists the 10 highest 24-hour average PM_{10} readings with the dates of occurrence for each PM_{10} hi-vol site operated in Connecticut in 1992, except Bridgeport 014 which is omitted due to insufficient data. 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 21% of the high PM_{10} days occur with winds out of the southwest quadrant and most of those days have relatively persistent winds. This stands in stark contrast to recent years when from 30% to 50% of high PM_{10} days occurred with winds out of the southwest. 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 - Any attempt to assess statewide trends in air pollution levels must account for the tendency of local changes to obscure the statewide pattern. In order to reach some statistically valid conclusions concerning trends in particulate matter levels in Connecticut as a whole, the DEP has applied a statistical test called a paired *t* test (referred to hereafter as the *t* test) to the annual average data for PM_{10}.

The *t* test is a parametric test which can ascertain a statistically significant change in the statewide annual average pollutant concentration in Connecticut. The *t* test makes it possible to overcome the trend analysis problems which arise due to the changes in the number and location of monitoring sites from year-to-year, as well as problems associated with making equitable comparisons among sites. The annual mean pollutant concentrations for consecutive years are compared at each site, and the difference is noted. There is no inter-site comparison. The mean and the standard deviation of the differences are used to calculate a *t* statistic, which is employed to determine the statistical significance of the apparent statewide change in pollutant level. For example, if a high proportion of sites experience an increase and/or if the magnitude of the increases at several sites is of much greater importance than the magnitude of the decreases at other sites, the *t* test will show that the increase was statistically significant for those two years.

The results of the *t* test for PM_{10} are presented in Table 2-6 . The analyses were performed only on data computed for sites at which the EPA's minimum sampling criteria were met. The first three columns of Table 2-6 show the years of data that were paired, the number of sites, and the average of the geometric mean pollutant concentrations at the sites in each year. The remaining columns show the average and standard deviation of the differences of the paired year means at each site, as well as the statistical significance of any change in the statewide pollutant average. The significance of a change is indicated by an arrow for each confidence limit, and is also given numerically as the number of chances in 10,000 that the change in the statewide PM_{10} level was not significant. For example, the statewide annual average for PM_{10} decreased between 1986 and 1987 from 37.7 to 34.0. This change represented a significant decrease at the 95% confidence level, but it did not represent a significant change at the 99% confidence level. The "probability that change is not significant" is given as 0.0148, meaning that there are only 148 chances in 10,000 that the apparent decrease in PM_{10} levels between 1986 and 1987 did not occur. The results of the *t* test show that the year-to-year PM_{10} levels in Connecticut apparently remained unchanged from 1985 to 1989, except for a decrease at the 95% confidence level from 1986 to 1987. However, there were significant changes in statewide PM_{10} levels each year from 1989 to 1992. The reader is advised that the results should be interpreted with caution when the number of paired sites is small, as is the case with the 1985-1989 data.

These trend analyses do not account for the uncertainty associated with the individual annual mean computed for each PM_{10} site. Most particulate sampling is conducted only every sixth day, producing a maximum possible total of 61 samples per year. Therefore, the *t* test really compares averages of the sampled concentrations, not actual annual averages. However, the every-sixth-day sampling schedule is believed to be sufficient to produce representative annual averages. The every-sixth-day schedule for particulate sampling began in 1971.

Significant changes in annual PM_{10} levels can be caused by a number of things. Among these are simple changes of weather, particularly the wind; 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.

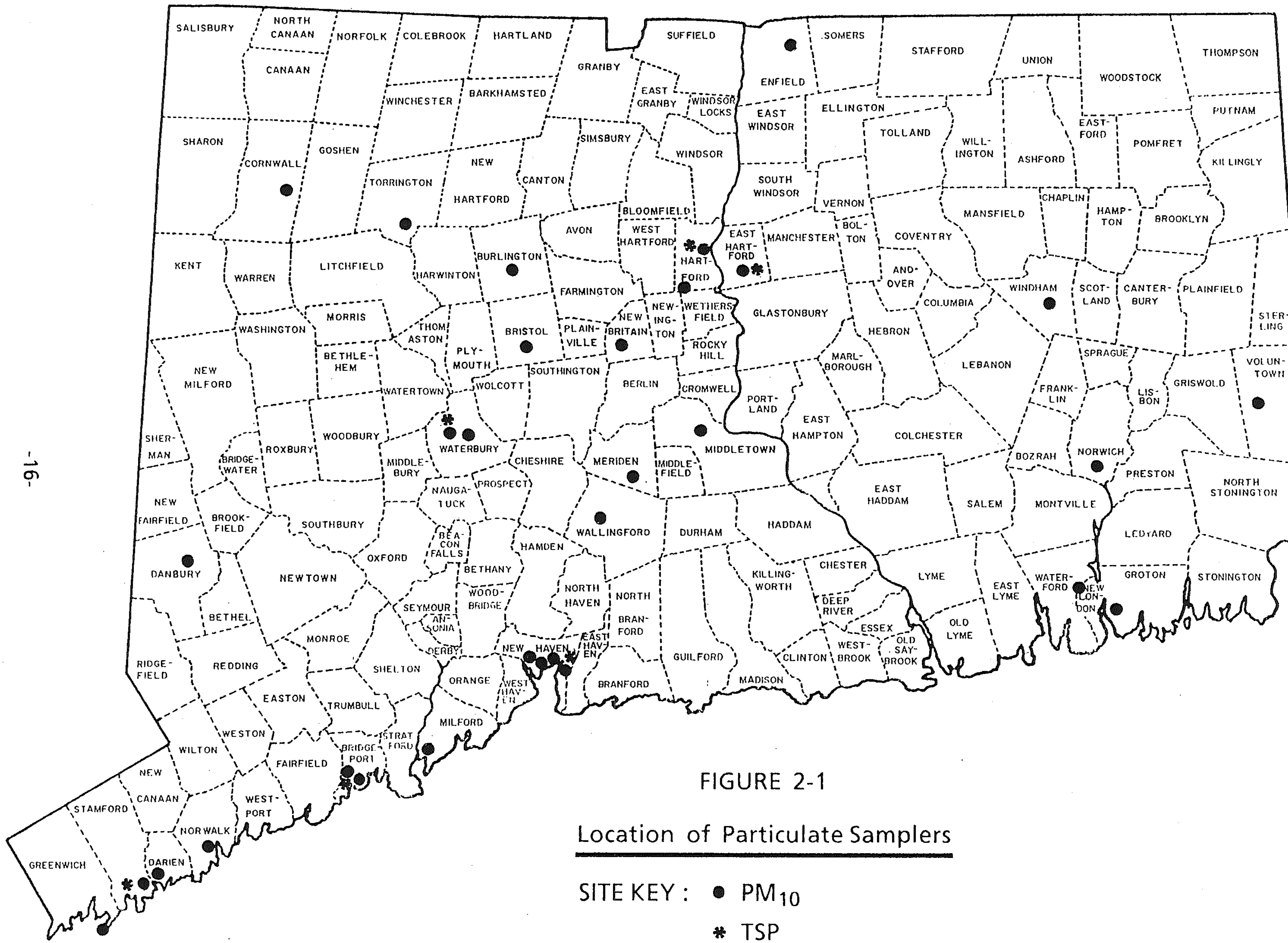


FIGURE 2-1

Location of Particulate Samplers

TABLE 2-1

1990-1992 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
ANSONIA	004	1990	30*	21.1	16.6	25.7	12.780		
BERLIN	002	1990	55	18.8	16.3	21.2	9.800		
BRIDGEPORT	010	1990	59	25.0	21.6	28.4	14.198		
BRIDGEPORT	010	1991	55	27.7	24.4	31.0	13.236		
BRIDGEPORT	010	1992	60	22.4	20.0	24.7	9.987		
BRIDGEPORT	013	1990	58	24.6	21.3	27.8	13.451		
BRIDGEPORT	014	1990	59	32.6	29.1	36.2	14.881		
BRIDGEPORT	014	1991	55	33.3	29.8	36.9	14.349		
BRIDGEPORT	014	1992	12*	29.7	21.5	37.9	13.098		
BRISTOL	001	1990	60	20.1	17.7	22.5	10.058		
BRISTOL	001	1991	58	22.6	20.0	25.2	10.696		
BRISTOL	001	1992	60	19.4	17.0	21.8	10.296		
BURLINGTON	001	1990	59	14.8	12.7	16.8	8.573		
BURLINGTON	001	1991	58	16.9	14.3	19.5	10.727		
BURLINGTON	001	1992	60	14.0	12.1	15.9	7.993		
CORNWALL	005	1990	58	16.0	13.4	18.7	10.949		
CORNWALL	005	1991	58	17.4	14.5	20.4	12.191		
CORNWALL	005	1992	49*	13.3	11.2	15.4	7.837		
DANBURY	123	1990	60	22.1	19.4	24.7	11.272		
DANBURY	123	1991	56	25.6	22.5	28.7	12.534		
DANBURY	123	1992	45*	21.8	18.5	25.2	11.879		
DARIEN	001	1990	58	31.0	27.6	34.3	13.869		
DARIEN	001	1991	56	35.3	29.9	40.8	22.068		
DARIEN	001	1992	59	24.5	22.3	26.7	9.149		

* THE NUMBER OF SAMPLES IS INSUFFICIENT TO COMPLY WITH THE MINIMUM SAMPLING CRITERIA.

TABLE 2-1, CONTINUED

1990-1992 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
EAST HARTFORD	004	1990	59	21.8	18.9	24.7	12.030		
EAST HARTFORD	004	1991	56	25.8	22.7	28.9	12.409		
EAST HARTFORD	004	1992	57	20.5	17.7	23.3	11.457		
ENFIELD	005	1990	58	16.6	14.5	18.7	8.763		
ENFIELD	005	1991	59	20.2	17.7	22.8	10.634		
ENFIELD	005	1992	59	19.1	15.5	22.6	15.037		
GREENWICH	017	1990	57	20.4	17.5	23.3	11.953		
GREENWICH	017	1991	58	24.7	21.6	27.8	12.971		
GREENWICH	017	1992	43*	18.2	15.8	20.5	8.151		
GROTON	006	1990	56	18.8	16.1	21.4	10.730		
GROTON	006	1991	58	21.9	18.6	25.3	13.888		
GROTON	006	1992	61	18.8	16.4	21.2	10.299		
HADDAM	002	1990	53*	16.6	14.3	18.8	8.751		
HARTFORD	013	1990	59	20.7	18.2	23.2	10.526		
HARTFORD	013	1991	59	22.3	19.7	24.8	10.762		
HARTFORD	013	1992	60	20.0	17.1	22.8	11.987		
HARTFORD	014	1990	55	21.6	18.8	24.4	11.331		
HARTFORD	015	1990	58	24.9	22.0	27.8	11.864		
HARTFORD	015	1991	57	27.8	24.9	30.7	11.824		
HARTFORD	015	1992	61	25.0	22.2	27.9	12.221		
HARTFORD	018	1990	60	24.1	21.1	27.0	12.684		
MANCHESTER	001	1990	55	19.1	16.5	21.6	10.404		
MERIDEN	002	1990	37*	21.4	18.0	24.8	10.792		
MERIDEN	002	1991	57	24.8	21.9	27.7	11.952		
MERIDEN	002	1992	58	21.1	18.2	23.9	11.807		

* THE NUMBER OF SAMPLES IS INSUFFICIENT TO COMPLY WITH THE MINIMUM SAMPLING CRITERIA.

TABLE 2-1, CONTINUED

1990-1992 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
MIDDLETOWN	003	1990	58	20.5	18.0	23.0	10.360		
MIDDLETOWN	003	1991	55	25.1	22.3	28.0	11.425		
MIDDLETOWN	003	1992	59	20.9	18.0	23.8	12.176		
MILFORD	010	1990	58	21.2	18.5	23.9	11.180		
MILFORD	010	1991	57	22.9	19.7	26.0	12.920		
MILFORD	010	1992	61	17.2	15.0	19.4	9.339		
NAUGATUCK	001	1990	56	23.4	20.3	26.5	12.583		
NEW BRITAIN	012	1990	58	21.3	18.6	24.0	11.223		
NEW BRITAIN	012	1991	56*	23.6	20.6	26.6	12.180		
NEW BRITAIN	012	1992	55*	20.0	17.1	22.9	11.578		
NEW HAVEN	013	1990	60	23.7	20.8	26.5	12.172		
NEW HAVEN	013	1991	55	26.4	23.0	29.9	13.961		
NEW HAVEN	013	1992	57	21.5	18.6	24.3	11.682		
NEW HAVEN	018	1990	349	40.6	40.2	41.1	19.749		
NEW HAVEN	018	1991	350	40.1	39.7	40.5	17.930		
NEW HAVEN	018	1992	57	33.6	29.8	37.4	15.606		
NEW HAVEN	020	1990	60	26.5	23.6	29.4	12.392		
NEW HAVEN	020	1991	59	30.4	27.4	33.4	12.539		
NEW HAVEN	020	1992	59	22.8	20.3	25.4	10.691		
NEW HAVEN	123	1990	55	26.7	23.3	30.1	13.549		
NEW HAVEN	123	1991	58	29.9	25.8	34.0	16.940		
NEW HAVEN	123	1992	57	23.5	20.6	26.4	11.986		
NEW LONDON	004	1990	58	20.6	18.1	23.0	10.210		
NEW LONDON	004	1991	58	23.4	20.4	26.3	12.194		
NEW LONDON	004	1992	59	20.3	17.8	22.8	10.534		

* THE NUMBER OF SAMPLES IS INSUFFICIENT TO COMPLY WITH THE MINIMUM SAMPLING CRITERIA.

TABLE 2-1, CONTINUED

1990-1992 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
NORWALK	014	1990	59	38.7	34.7	42.6	16.628		
NORWALK	014	1991	56	38.4	34.8	42.0	14.636		
NORWALK	014	1992	59	29.4	26.6	32.2	11.926		
NORWICH	002	1990	59	20.7	18.2	23.2	10.378		
NORWICH	002	1991	58	23.6	20.8	26.5	11.813		
NORWICH	002	1992	58	19.6	16.7	22.4	12.010		
PUTNAM	002	1990	49*	19.2	16.6	21.8	9.623		
STAMFORD	001	1990	59	24.0	20.8	27.2	13.461		
STAMFORD	001	1991	58	28.6	25.2	31.9	13.780		
STAMFORD	001	1992	59	21.1	18.7	23.4	9.897		
STRATFORD	005	1990	55	24.3	20.8	27.7	13.678		
TORRINGTON	001	1990	59	19.5	16.9	22.1	10.923		
TORRINGTON	001	1991	57	22.5	19.6	25.3	11.656		
TORRINGTON	001	1992	60	18.6	16.0	21.2	10.962		
VOLUNTOWN	001	1990	60	14.3	12.4	16.3	8.292		
VOLUNTOWN	001	1991	55	16.2	13.6	18.8	10.433		
VOLUNTOWN	001	1992	60	13.5	11.3	15.8	9.447		
WALLINGFORD	006	1990	53	19.5	16.8	22.1	10.291		
WALLINGFORD	006	1991	56	23.2	20.2	26.1	11.964		
WALLINGFORD	006	1992	58	20.8	17.9	23.7	11.923		
WATERBURY	007	1990	59	25.6	22.1	29.1	14.752		
WATERBURY	007	1991	59	27.0	23.8	30.2	13.538		
WATERBURY	007	1992	59	22.3	19.5	25.0	11.627		
WATERBURY	123	1990	59	32.4	28.4	36.4	16.652		
WATERBURY	123	1991	57	28.9	25.5	32.2	13.581		
WATERBURY	123	1992	59	22.5	19.8	25.1	11.038		

* THE NUMBER OF SAMPLES IS INSUFFICIENT TO COMPLY WITH THE MINIMUM SAMPLING CRITERIA.

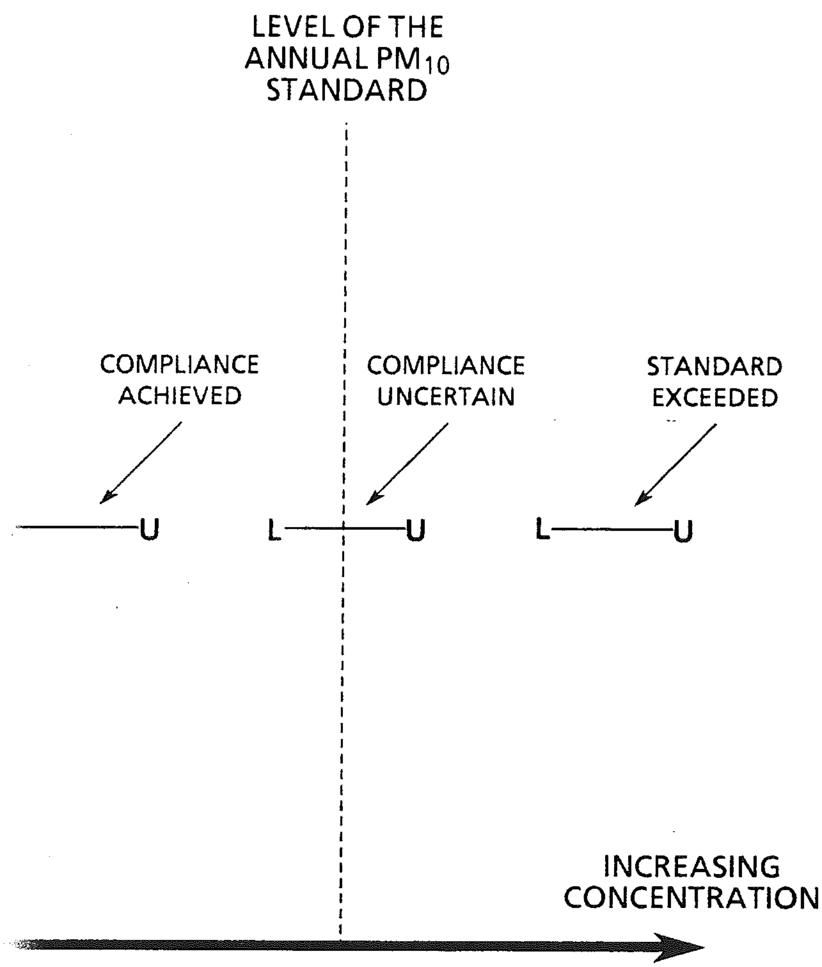
TABLE 2-1, CONTINUED

1990-1992 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
WATERFORD	001	1990	55	18.4	15.7	21.0	10.669		
WEST HAVEN	003	1990	57	26.8	24.0	29.6	11.570		
WILLIMANTIC	002	1990	60	18.5	16.3	20.7	9.318		
WILLIMANTIC	002	1991	54*	22.4	19.7	25.2	10.850		
WILLIMANTIC	002	1992	57	19.2	16.6	21.9	10.824		

FIGURE 2-2

COMPLIAN ITH THE LEVEL OF THE ANNUAL PM10 STANDARDS ING 95% CONFIDENCE LIMITS ABOUT THE NUAL ARITHMETIC MEAN CONCENTRATION



L = The low it of the 95% confidence interval about the annual arithme an concentration.

U = The up it of the 95% confidence interval about the annual arithme an concentration.

TABLE 2-2

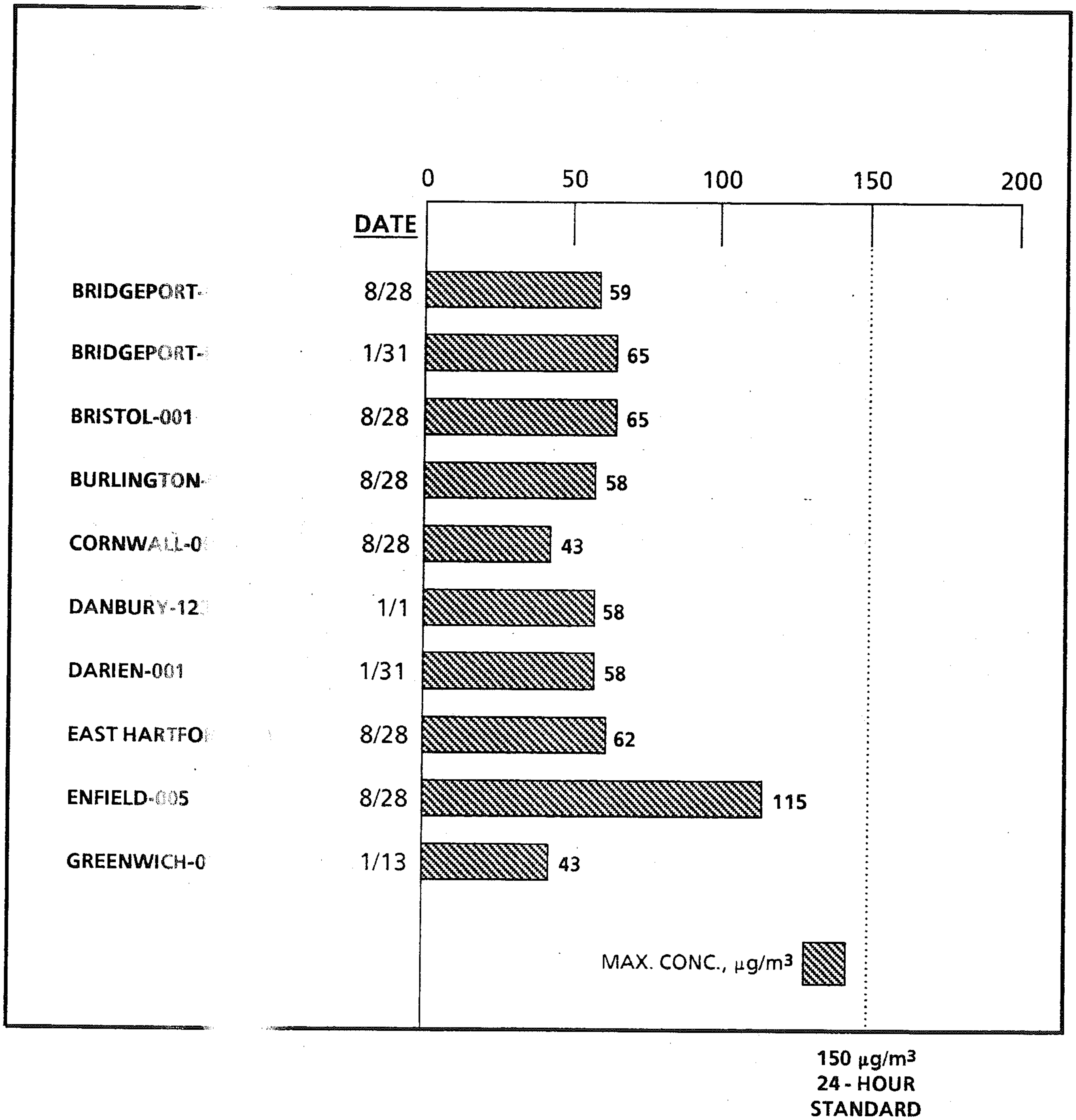
STATISTICALLY PREDICTED NUMBER OF SITES IN COMPLIANCE WITH THE LEVEL OF THE ANNUAL PM10 STANDARDS*

	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

* 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 2-3

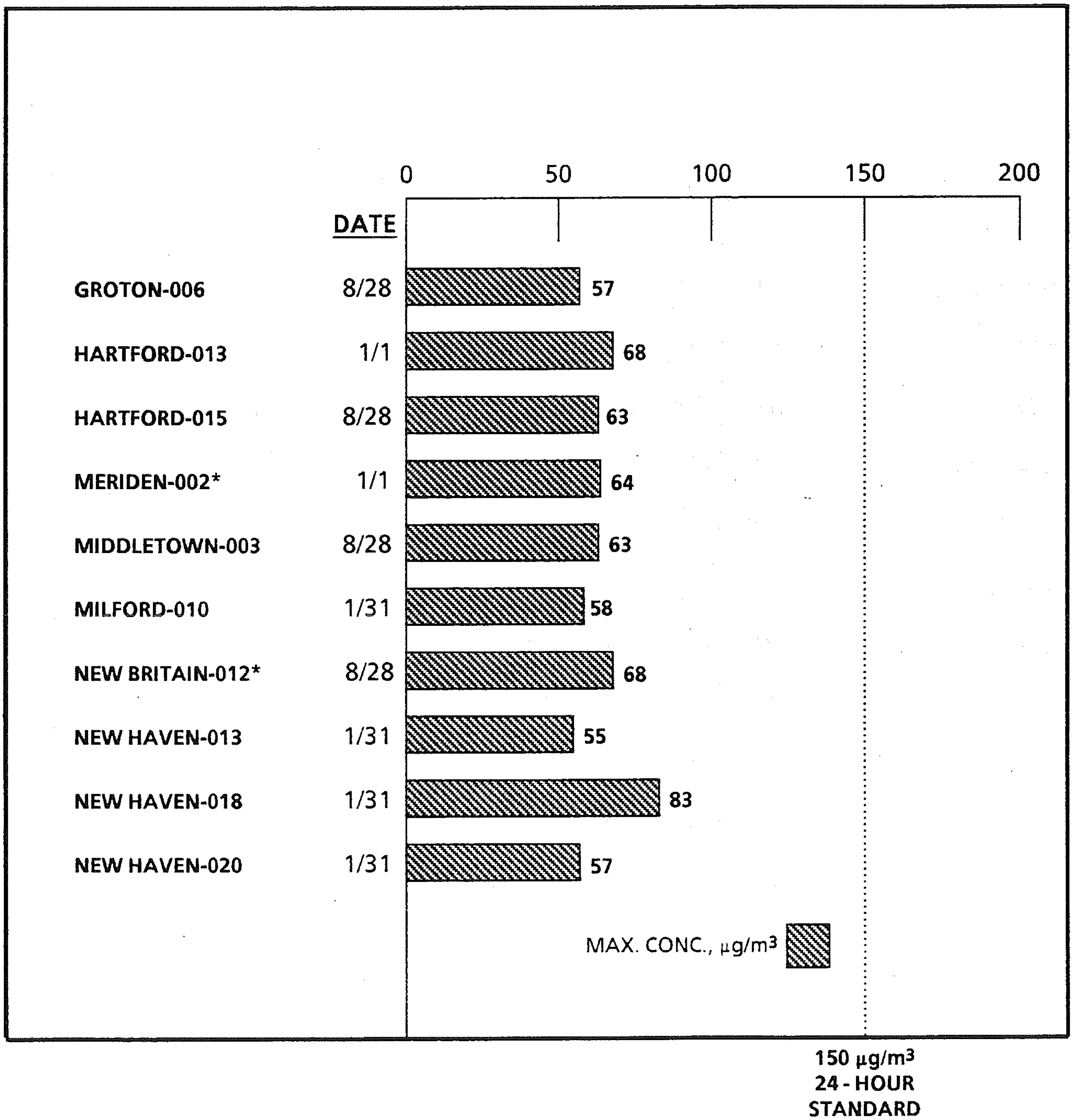
1 MAXIMUM 24-HOUR PM10 CONCENTRATIONS



* The site has insuffi data to satisfy the minimum sampling criteria.

FIGURE 2-3, continued

1992 MAXIMUM 24-HOUR PM10 CONCENTRATIONS



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

FIGURE 2-3, continued

1992 MAXIMUM 24-HOUR PM10 CONCENTRATIONS

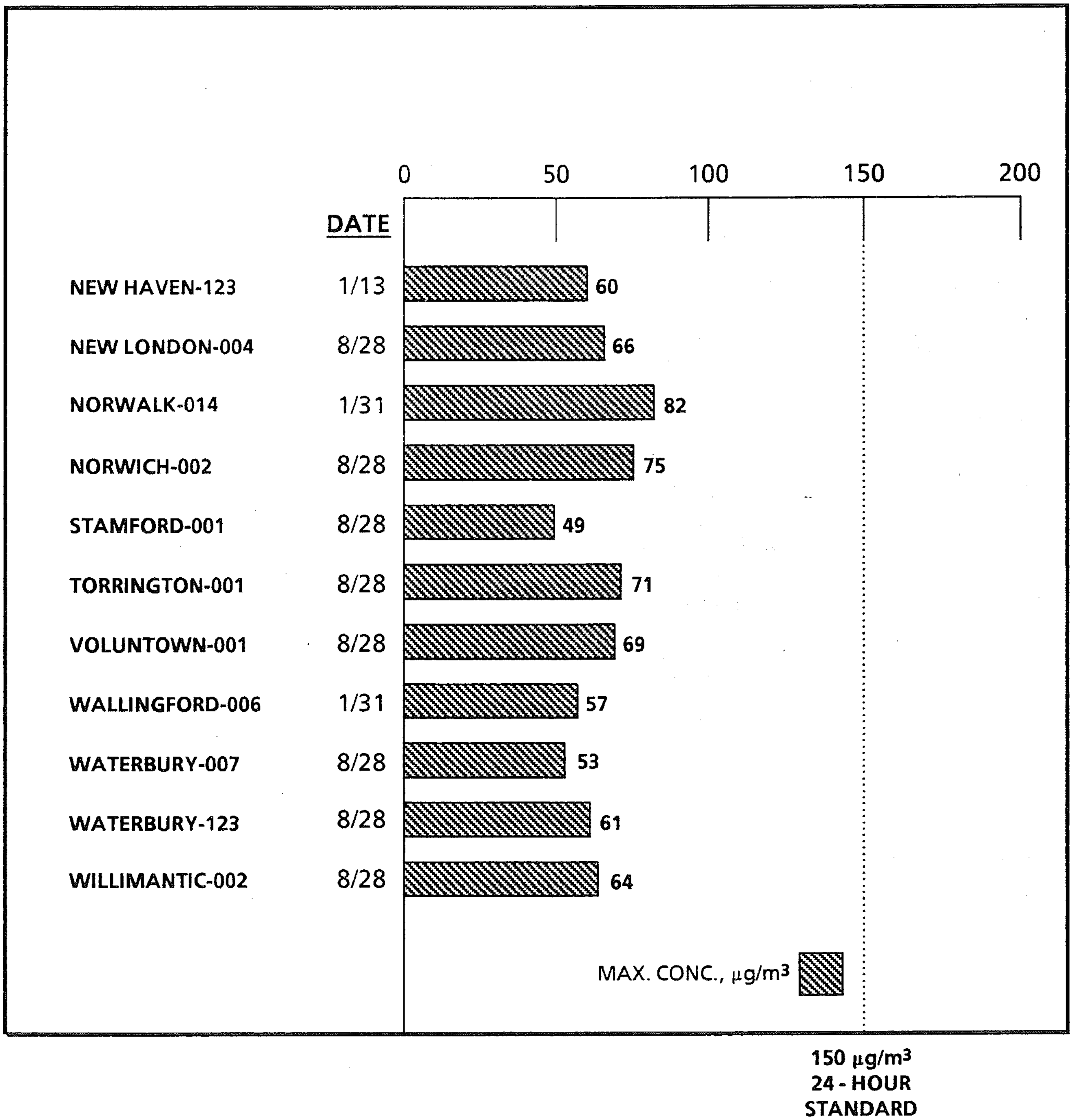


TABLE 2-3

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

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

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

TABLE 2-4

QUARTERLY CHEMICAL CHARACTERIZATION OF 1992 HI-VOL TSP

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

	QUARTERLY AVG				ANNUAL AVG
	1ST	2ND	3RD	4TH	
METALS (ng/m³)					
BERYLLIUM	<.1	<.1	<.1	<.1	<.1
CADMIUM	0.7	1.0	1.0	3.0	1.4
CHROMIUM	6	7	6	5	6
COPPER	40	50	50	40	40
IRON	600	930	720	620	710
LEAD	20	10	10	20	20
MANGANESE	9	9	6	9	8
NICKEL	26	4	5	10	11
VANADIUM	20	10	10	10	10
ZINC	80	80	20	110	70
WATER SOLUBLES (ng/m³)					
NITRATE	2730	3980	4150	2120	3220
SULFATE	7680	8020	10230	7700	8370
AMMONIUM	210	10	360	60	160
TSP (µg/m³)	39	52	41	35	41
SAMPLE COUNT	15[a]	14	14	15	

[a] The sample count for sulfate and TSP is 16.

TABLE 2-4, CONTINUED

QUARTERLY CHEMICAL CHARACTERIZATION OF 1992 HI-VOL TSP

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

	QUARTERLY AVG				ANNUAL AVG
	1ST	2ND	3RD	4TH	
METALS (ng/m³)					
BERYLLIUM	<.1	<.1	<.1	<.1	<.1
CADMIUM	1.0	1.0	1.3	4.3	1.9
CHROMIUM	6	5	5	6	6
COPPER	240	150	210	90	170
IRON	460	500	350	630	490
LEAD	10	<10	10	30	10[a]
MANGANESE	9	7	4	9	7
NICKEL	35	5	11	14	16
VANADIUM	10	10	10	10	10
ZINC	70	50	20	70	50
WATER SOLUBLES (ng/m³)					
NITRATE	2230	2510	3030	2770	2630
SULFATE	6940	5920	10060	7440	7580
AMMONIUM	200	<10	310	220	180[a]
TSP (μg/m³)	34	38	33	34	35
SAMPLE COUNT	15[b]	15	14	15	

[a] The annual average was calculated using one-half the detectable limit in the 2nd quarter.
[b] The sample count for sulfate and TSP is 12.

TABLE 2-4, CONTINUED

QUARTERLY CHEMICAL CHARACTERIZATION OF 1992 HI-VOL TSP

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

	QUARTERLY AVG				ANNUAL AVG
	1ST	2ND	3RD	4TH	
METALS (ng/m3)					
BERYLLIUM	<.1	<.1	<.1	<.1	<.1
CADMIUM	1.0	0.9	0.6	1.1	0.9
CHROMIUM	7	7	5	5	6
COPPER	50	220	120	80	120
IRON	1360	1210	890	870	1100
LEAD	30	10	10	20	20
MANGANESE	20	14	8	11	14
NICKEL	28	5	5	7	12
VANADIUM	10	10	10	10	10
ZINC	100	50	270	100	130
WATER SOLUBLES (ng/m3)					
NITRATE	2630	3380	3250	2830	3020
SULFATE	6940	6660	10190	7350	7720
AMMONIUM	260	60	560	380	300
TSP (µg/m3)	70	74	44	43	59
SAMPLE COUNT	15	15	13	12	

TABLE 2-4, CONTINUED

QUARTERLY CHEMICAL CHARACTERIZATION OF 1992 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	2.0	2.8	1.6	2.8	2.3
CHROMIUM	9	13	9	9	10
COPPER	90	90	100	80	90
IRON	4740	7580	1720	4070	4580
LEAD	90	150	70	130	110
MANGANESE	62	91	36	50	60
NICKEL	29	15	13	22	20
VANADIUM	40	30	20	30	30
ZINC	220	210	20	220	170
WATER SOLUBLES (ng/m³)					
NITRATE	3080	3560	3000	3080	3180
SULFATE	8490	9580	10290	8660	9220
AMMONIUM	430	140	220	300	270
TSP (µg/m³)	173	200	93	134	151
SAMPLE COUNT	15[a]	15	14	15	

[a] The sample count for sulfate and TSP is 16.

TABLE 2-4, CONTINUED

QUARTERLY CHEMICAL CHARACTERIZATION OF 1992 HI-VOL TSP

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

	QUARTERLY AVG				ANNUAL AVG
	1ST	2ND	3RD	4TH	
METALS (ng/m³)					
BERYLLIUM	<.1	<.1	<.1	<.1	<.1
CADMIUM	1.2	2.0	2.2	3.4	2.2
CHROMIUM	14	26	16	10	16
COPPER	140	180	250	620	290
IRON	1100	1520	710	800	1030
LEAD	20	200	30	20	70
MANGANESE	18	18	8	14	15
NICKEL	24	5	3	7	10
VANADIUM	20	10	10	10	10
ZINC	120	120	300	50	150
WATER SOLUBLES (ng/m³)					
NITRATE	2200	2990	2650	2330	2540
SULFATE	6610	6230	9390	7200	7360
AMMONIUM	170	<10	250	170	150[a]
TSP (µg/m³)	59	55	37	40	48
SAMPLE COUNT	15	14[b]	14	14	

[a] The annual average was calculated using one-half the detectable limit in the 2nd quarter.
[b] The sample count for sulfate and TSP is 13.

TABLE 2-5

1992 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 (0060)	PM10	59	44	41	40	38	38	37	36	33	32
	DATE	8/28/92	1/31/92	10/ 3/92	3/25/92	1/ 1/92	1/13/92	6/29/92	12/ 2/92	10/15/92	2/18/92
METEOROLOGICAL SITE	DIR (DEG)	160	320	240	140	230	220	200	140	200	40
NEWARK	VEL (MPH)	9.0	9.7	9.7	5.0	3.6	3.7	5.6	.8	2.6	7.1
	SPD (MPH)	10.6	10.2	12.9	6.8	4.0	6.0	8.6	4.3	5.5	7.3
	RATIO	0.847	0.952	0.753	0.745	0.888	0.611	0.646	0.185	0.471	0.975
METEOROLOGICAL SITE	DIR (DEG)	160	350	250	170	10	210	200	30	350	360
BRADLEY	VEL (MPH)	9.8	7.5	3.9	5.2	1.8	3.7	4.7	1.8	4.0	5.1
	SPD (MPH)	12.2	7.6	7.5	7.6	2.7	5.5	6.8	4.7	5.3	5.3
	RATIO	0.798	0.985	0.515	0.684	0.661	0.682	0.701	0.379	0.759	0.960
METEOROLOGICAL SITE	DIR (DEG)	190	350	270	150	270	230	220	80	80	90
BRIDGEPORT	VEL (MPH)	9.3	6.2	9.8	3.0	.9	4.0	3.3	4.6	2.7	8.3
	SPD (MPH)	9.6	7.0	9.9	3.9	2.4	5.9	3.5	5.8	4.0	8.8
	RATIO	0.964	0.886	0.983	0.784	0.355	0.672	0.950	0.802	0.667	0.947
METEOROLOGICAL SITE	DIR (DEG)	190	320	280	240	310	250	250	130	70	100
WORCESTER	VEL (MPH)	8.7	5.6	10.5	5.9	4.0	5.4	6.0	3.9	4.7	4.7
	SPD (MPH)	9.3	6.2	10.6	6.6	4.5	6.9	6.6	4.9	4.7	5.2
	RATIO	0.926	0.905	0.991	0.886	0.895	0.776	0.900	0.792	0.985	0.905
BRISTOL-001 (0060)	PM10	65	46	42	38	36	32	32	30	29	26
	DATE	8/28/92	2/18/92	1/ 1/92	1/13/92	10/ 3/92	12/ 2/92	1/31/92	3/25/92	5/24/92	6/29/92
METEOROLOGICAL SITE	DIR (DEG)	160	40	230	220	240	140	320	140	20	200
NEWARK	VEL (MPH)	9.0	7.1	3.6	3.7	9.7	.8	9.7	5.0	11.9	5.6
	SPD (MPH)	10.6	7.3	4.0	6.0	12.9	4.3	10.2	6.8	12.1	8.6
	RATIO	0.847	0.975	0.888	0.611	0.753	0.185	0.952	0.745	0.988	0.646
METEOROLOGICAL SITE	DIR (DEG)	160	360	10	210	250	30	350	170	10	200
BRADLEY	VEL (MPH)	9.8	5.1	1.8	3.7	3.9	1.8	7.5	5.2	11.2	4.7
	SPD (MPH)	12.2	5.3	2.7	5.5	7.5	4.7	7.6	7.6	11.4	6.8
	RATIO	0.798	0.960	0.661	0.682	0.515	0.379	0.985	0.684	0.990	0.701
METEOROLOGICAL SITE	DIR (DEG)	190	90	270	230	270	80	350	150	40	220
BRIDGEPORT	VEL (MPH)	9.3	8.3	.9	4.0	9.8	4.6	6.2	3.0	6.6	3.3
	SPD (MPH)	9.6	8.8	2.4	5.9	9.9	5.8	7.0	3.9	6.8	3.5
	RATIO	0.964	0.947	0.355	0.672	0.983	0.802	0.886	0.784	0.980	0.950
METEOROLOGICAL SITE	DIR (DEG)	190	100	310	250	280	130	320	240	30	250
WORCESTER	VEL (MPH)	8.7	4.7	4.0	5.4	10.5	3.9	5.6	5.9	6.9	6.0
	SPD (MPH)	9.3	5.2	4.5	6.9	10.6	4.9	6.2	6.6	7.2	6.6
	RATIO	0.926	0.905	0.895	0.776	0.991	0.792	0.905	0.886	0.965	0.900
BURLINGTON-001 (0060)	PM10	58	29	26	23	23	23	22	21	20	20
	DATE	8/28/92	10/ 3/92	2/18/92	3/25/92	9/15/92	6/29/92	5/24/92	9/ 9/92	12/ 2/92	6/17/92
METEOROLOGICAL SITE	DIR (DEG)	160	240	40	140	220	200	20	150	140	180
NEWARK	VEL (MPH)	9.0	9.7	7.1	5.0	3.7	5.6	11.9	3.8	.8	6.3
	SPD (MPH)	10.6	12.9	7.3	6.8	6.6	8.6	12.1	7.2	4.3	9.1
	RATIO	0.847	0.753	0.975	0.745	0.564	0.646	0.988	0.524	0.185	0.695
METEOROLOGICAL SITE	DIR (DEG)	160	250	360	170	210	200	10	220	30	190
BRADLEY	VEL (MPH)	9.8	3.9	5.1	5.2	6.0	4.7	11.2	2.7	1.8	3.9
	SPD (MPH)	12.2	7.5	5.3	7.6	7.9	6.8	11.4	6.9	4.7	7.0
	RATIO	0.798	0.515	0.960	0.684	0.758	0.701	0.990	0.394	0.379	0.556

TABLE 2-5, CONTINUED

1992 TEN HIGHEST 24-HOUR AVERAGE PM10 DAYS WITH WIND DATA

UNITS : MICROGRAMS PER CUBIC METER

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
METEOROLOGICAL SITE	DIR (DEG)	190	270	90	150	240	220	40	230	80	210
BRIDGEPORT	VEL (MPH)	9.3	9.8	8.3	3.0	4.7	3.3	6.6	4.0	4.6	3.3
	SPD (MPH)	9.6	9.9	8.8	3.9	5.9	3.5	6.8	4.5	5.8	3.6
	RATIO	0.964	0.983	0.947	0.784	0.798	0.950	0.980	0.898	0.802	0.911
METEOROLOGICAL SITE	DIR (DEG)	190	280	100	240	250	250	30	240	130	170
WORCESTER	VEL (MPH)	8.7	10.5	4.7	5.9	7.9	6.0	6.9	4.9	3.9	2.2
	SPD (MPH)	9.3	10.6	5.2	6.6	8.1	6.6	7.2	5.8	4.9	4.3
	RATIO	0.926	0.991	0.905	0.886	0.980	0.900	0.965	0.856	0.792	0.520
CORNWALL-005 (0049)	PM10	43	33	26	25	23	22	22	20	19	18
	DATE	8/28/92	10/ 3/92	9/15/92	10/15/92	6/29/92	5/24/92	3/25/92	1/13/92	1/31/92	7/23/92
METEOROLOGICAL SITE	DIR (DEG)	160	240	220	200	200	20	140	220	320	50
NEWARK	VEL (MPH)	9.0	9.7	3.7	2.6	5.6	11.9	5.0	3.7	9.7	6.2
	SPD (MPH)	10.6	12.9	6.6	5.5	8.6	12.1	6.8	6.0	10.2	7.5
	RATIO	0.847	0.753	0.564	0.471	0.646	0.988	0.745	0.611	0.952	0.827
METEOROLOGICAL SITE	DIR (DEG)	160	250	210	350	200	10	170	210	350	30
BRADLEY	VEL (MPH)	9.8	3.9	6.0	4.0	4.7	11.2	5.2	3.7	7.5	4.7
	SPD (MPH)	12.2	7.5	7.9	5.3	6.8	11.4	7.6	5.5	7.6	5.5
	RATIO	0.798	0.515	0.758	0.759	0.701	0.990	0.684	0.682	0.985	0.864
METEOROLOGICAL SITE	DIR (DEG)	190	270	240	80	220	40	150	230	350	110
BRIDGEPORT	VEL (MPH)	9.3	9.8	4.7	2.7	3.3	6.6	3.0	4.0	6.2	7.4
	SPD (MPH)	9.6	9.9	5.9	4.0	3.5	6.8	3.9	5.9	7.0	9.2
	RATIO	0.964	0.983	0.798	0.667	0.950	0.980	0.784	0.672	0.886	0.808
METEOROLOGICAL SITE	DIR (DEG)	190	280	250	70	250	30	240	250	320	80
WORCESTER	VEL (MPH)	8.7	10.5	7.9	4.7	6.0	6.9	5.9	5.4	5.6	3.4
	SPD (MPH)	9.3	10.6	8.1	4.7	6.6	7.2	6.6	6.9	6.2	5.8
	RATIO	0.926	0.991	0.980	0.985	0.900	0.965	0.886	0.776	0.905	0.586
DANBURY-123 (0045)	PM10	58	57	50	44	38	34	33	29	29	28
	DATE	1/ 1/92	8/28/92	1/13/92	1/31/92	10/ 3/92	12/ 2/92	10/15/92	6/17/92	6/29/92	9/15/92
METEOROLOGICAL SITE	DIR (DEG)	230	160	220	320	240	140	200	180	200	220
NEWARK	VEL (MPH)	3.6	9.0	3.7	9.7	9.7	.8	2.6	6.3	5.6	3.7
	SPD (MPH)	4.0	10.6	6.0	10.2	12.9	4.3	5.5	9.1	8.6	6.6
	RATIO	0.888	0.847	0.611	0.952	0.753	0.185	0.471	0.695	0.646	0.564
METEOROLOGICAL SITE	DIR (DEG)	10	160	210	350	250	30	350	190	200	210
BRADLEY	VEL (MPH)	1.8	9.8	3.7	7.5	3.9	1.8	4.0	3.9	4.7	6.0
	SPD (MPH)	2.7	12.2	5.5	7.6	7.5	4.7	5.3	7.0	6.8	7.9
	RATIO	0.661	0.798	0.682	0.985	0.515	0.379	0.759	0.556	0.701	0.758
METEOROLOGICAL SITE	DIR (DEG)	270	190	230	350	270	80	80	210	220	240
BRIDGEPORT	VEL (MPH)	.9	9.3	4.0	6.2	9.8	4.6	2.7	3.3	3.3	4.7
	SPD (MPH)	2.4	9.6	5.9	7.0	9.9	5.8	4.0	3.6	3.5	5.9
	RATIO	0.355	0.964	0.672	0.886	0.983	0.802	0.667	0.911	0.950	0.798
METEOROLOGICAL SITE	DIR (DEG)	310	190	250	320	280	130	70	170	250	250
WORCESTER	VEL (MPH)	4.0	8.7	5.4	5.6	10.5	3.9	4.7	2.2	6.0	7.9
	SPD (MPH)	4.5	9.3	6.9	6.2	10.6	4.9	4.7	4.3	6.6	8.1
	RATIO	0.895	0.926	0.776	0.905	0.991	0.792	0.985	0.520	0.900	0.980

TABLE 2-5, CONTINUED

1992 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
DARIEN-001 (0059)	PM10	58	48	45	43	43	36	33	33	32	32
	DATE	1/31/92	1/13/92	8/28/92	10/ 3/92	1/ 1/92	3/25/92	12/ 2/92	6/29/92	5/24/92	10/15/92
METEOROLOGICAL SITE	DIR (DEG)	320	220	160	240	230	140	140	200	20	200
NEWARK	VEL (MPH)	9.7	3.7	9.0	9.7	3.6	5.0	.8	5.6	11.9	2.6
	SPD (MPH)	10.2	6.0	10.6	12.9	4.0	6.8	4.3	8.6	12.1	5.5
	RATIO	0.952	0.611	0.847	0.753	0.888	0.745	0.185	0.646	0.988	0.471
METEOROLOGICAL SITE	DIR (DEG)	350	210	160	250	10	170	30	200	10	350
BRADLEY	VEL (MPH)	7.5	3.7	9.8	3.9	1.8	5.2	1.8	4.7	11.2	4.0
	SPD (MPH)	7.6	5.5	12.2	7.5	2.7	7.6	4.7	6.8	11.4	5.3
	RATIO	0.985	0.682	0.798	0.515	0.661	0.684	0.379	0.701	0.990	0.759
METEOROLOGICAL SITE	DIR (DEG)	350	230	190	270	270	150	80	220	40	80
BRIDGEPORT	VEL (MPH)	6.2	4.0	9.3	9.8	.9	3.0	4.6	3.3	6.6	2.7
	SPD (MPH)	7.0	5.9	9.6	9.9	2.4	3.9	5.8	3.5	6.8	4.0
	RATIO	0.886	0.672	0.964	0.983	0.355	0.784	0.802	0.950	0.980	0.667
METEOROLOGICAL SITE	DIR (DEG)	320	250	190	280	310	240	130	250	30	70
WORCESTER	VEL (MPH)	5.6	5.4	8.7	10.5	4.0	5.9	3.9	6.0	6.9	4.7
	SPD (MPH)	6.2	6.9	9.3	10.6	4.5	6.6	4.9	6.6	7.2	4.7
	RATIO	0.905	0.776	0.926	0.991	0.895	0.886	0.792	0.900	0.965	0.985
EAST HARTFORD-004 (0057)	PM10	62	61	42	41	40	39	31	31	29	29
	DATE	8/28/92	1/ 1/92	1/13/92	2/18/92	12/ 2/92	10/ 3/92	6/29/92	11/20/92	10/15/92	3/25/92
METEOROLOGICAL SITE	DIR (DEG)	160	230	220	40	140	240	200	50	200	140
NEWARK	VEL (MPH)	9.0	3.6	3.7	7.1	.8	9.7	5.6	5.3	2.6	5.0
	SPD (MPH)	10.6	4.0	6.0	7.3	4.3	12.9	8.6	7.3	5.5	6.8
	RATIO	0.847	0.888	0.611	0.975	0.185	0.753	0.646	0.724	0.471	0.745
METEOROLOGICAL SITE	DIR (DEG)	160	10	210	360	30	250	200	330	350	170
BRADLEY	VEL (MPH)	9.8	1.8	3.7	5.1	1.8	3.9	4.7	1.9	4.0	5.2
	SPD (MPH)	12.2	2.7	5.5	5.3	4.7	7.5	6.8	4.9	5.3	7.6
	RATIO	0.798	0.661	0.682	0.960	0.379	0.515	0.701	0.395	0.759	0.684
METEOROLOGICAL SITE	DIR (DEG)	190	270	230	90	80	270	220	100	80	150
BRIDGEPORT	VEL (MPH)	9.3	.9	4.0	8.3	4.6	9.8	3.3	4.7	2.7	3.0
	SPD (MPH)	9.6	2.4	5.9	8.8	5.8	9.9	3.5	6.2	4.0	3.9
	RATIO	0.964	0.355	0.672	0.947	0.802	0.983	0.950	0.754	0.667	0.784
METEOROLOGICAL SITE	DIR (DEG)	190	310	250	100	130	280	250	180	70	240
WORCESTER	VEL (MPH)	8.7	4.0	5.4	4.7	3.9	10.5	6.0	1.7	4.7	5.9
	SPD (MPH)	9.3	4.5	6.9	5.2	4.9	10.6	6.6	3.7	4.7	6.6
	RATIO	0.926	0.895	0.776	0.905	0.792	0.991	0.900	0.459	0.985	0.886
ENFIELD-005 (0059)	PM10	115	42	37	36	34	30	29	29	27	27
	DATE	8/28/92	1/ 1/92	12/ 2/92	1/13/92	10/ 3/92	1/31/92	6/17/92	2/18/92	6/29/92	9/ 9/92
METEOROLOGICAL SITE	DIR (DEG)	160	230	140	220	240	320	180	40	200	150
NEWARK	VEL (MPH)	9.0	3.6	.8	3.7	9.7	9.7	6.3	7.1	5.6	3.8
	SPD (MPH)	10.6	4.0	4.3	6.0	12.9	10.2	9.1	7.3	8.6	7.2
	RATIO	0.847	0.888	0.185	0.611	0.753	0.952	0.695	0.975	0.646	0.524
METEOROLOGICAL SITE	DIR (DEG)	160	10	30	210	250	350	190	360	200	220
BRADLEY	VEL (MPH)	9.8	1.8	1.8	3.7	3.9	7.5	3.9	5.1	4.7	2.7
	SPD (MPH)	12.2	2.7	4.7	5.5	7.5	7.6	7.0	5.3	6.8	6.9
	RATIO	0.798	0.661	0.379	0.682	0.515	0.985	0.556	0.960	0.701	0.394

TABLE 2-5, CONTINUED

1992 TEN HIGHEST 24-HOUR AVERAGE PM10 DAYS WITH WIND DATA

UNITS : MICROGRAMS PER CUBIC METER

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
METEOROLOGICAL SITE	DIR (DEG)	190	270	80	230	270	350	210	90	220	230
BRIDGEPORT	VEL (MPH)	9.3	.9	4.6	4.0	9.8	6.2	3.3	8.3	3.3	4.0
	SPD (MPH)	9.6	2.4	5.8	5.9	9.9	7.0	3.6	8.8	3.5	4.5
	RATIO	0.964	0.355	0.802	0.672	0.983	0.886	0.911	0.947	0.950	0.898
METEOROLOGICAL SITE	DIR (DEG)	190	310	130	250	280	320	170	100	250	240
WORCESTER	VEL (MPH)	8.7	4.0	3.9	5.4	10.5	5.6	2.2	4.7	6.0	4.9
	SPD (MPH)	9.3	4.5	4.9	6.9	10.6	6.2	4.3	5.2	6.6	5.8
	RATIO	0.926	0.895	0.792	0.776	0.991	0.905	0.520	0.905	0.900	0.856
GREENWICH-017 (0043)	PM10	43	33	33	32	32	30	26	26	25	24
	DATE	1/13/92	1/ 1/92	1/31/92	6/29/92	5/24/92	10/15/92	7/29/92	3/25/92	2/24/92	6/17/92
METEOROLOGICAL SITE	DIR (DEG)	220	230	320	200	20	200	240	140	60	180
NEWARK	VEL (MPH)	3.7	3.6	9.7	5.6	11.9	2.6	7.9	5.0	9.7	6.3
	SPD (MPH)	6.0	4.0	10.2	8.6	12.1	5.5	9.1	6.8	10.2	9.1
	RATIO	0.611	0.888	0.952	0.646	0.988	0.471	0.874	0.745	0.946	0.695
METEOROLOGICAL SITE	DIR (DEG)	210	10	350	200	10	350	190	170	20	190
BRADLEY	VEL (MPH)	3.7	1.8	7.5	4.7	11.2	4.0	5.9	5.2	8.1	3.9
	SPD (MPH)	5.5	2.7	7.6	6.8	11.4	5.3	8.1	7.6	8.2	7.0
	RATIO	0.682	0.661	0.985	0.701	0.990	0.759	0.730	0.684	0.986	0.556
METEOROLOGICAL SITE	DIR (DEG)	230	270	350	220	40	80	240	150	80	210
BRIDGEPORT	VEL (MPH)	4.0	.9	6.2	3.3	6.6	2.7	7.1	3.0	9.0	3.3
	SPD (MPH)	5.9	2.4	7.0	3.5	6.8	4.0	7.3	3.9	9.5	3.6
	RATIO	0.672	0.355	0.886	0.950	0.980	0.667	0.973	0.784	0.953	0.911
METEOROLOGICAL SITE	DIR (DEG)	250	310	320	250	30	70	260	240	70	170
WORCESTER	VEL (MPH)	5.4	4.0	5.6	6.0	6.9	4.7	8.2	5.9	5.3	2.2
	SPD (MPH)	6.9	4.5	6.2	6.6	7.2	4.7	8.6	6.6	5.5	4.3
	RATIO	0.776	0.895	0.905	0.900	0.965	0.985	0.950	0.886	0.969	0.520
GROTON-006 (0061)	PM10	57	49	40	39	37	37	32	30	29	28
	DATE	8/28/92	10/ 3/92	5/12/92	1/31/92	1/13/92	1/ 1/92	7/11/92	5/24/92	6/29/92	3/ 1/92
METEOROLOGICAL SITE	DIR (DEG)	160	240	60	320	220	230	290	20	200	240
NEWARK	VEL (MPH)	9.0	9.7	5.1	9.7	3.7	3.6	9.3	11.9	5.6	8.5
	SPD (MPH)	10.6	12.9	7.9	10.2	6.0	4.0	11.5	12.1	8.6	11.6
	RATIO	0.847	0.753	0.650	0.952	0.611	0.888	0.807	0.988	0.646	0.726
METEOROLOGICAL SITE	DIR (DEG)	160	250	50	350	210	10	310	10	200	220
BRADLEY	VEL (MPH)	9.8	3.9	4.9	7.5	3.7	1.8	9.4	11.2	4.7	6.1
	SPD (MPH)	12.2	7.5	6.8	7.6	5.5	2.7	11.2	11.4	6.8	9.1
	RATIO	0.798	0.515	0.719	0.985	0.682	0.661	0.839	0.990	0.701	0.677
METEOROLOGICAL SITE	DIR (DEG)	190	270	110	350	230	270	330	40	220	260
BRIDGEPORT	VEL (MPH)	9.3	9.8	3.3	6.2	4.0	.9	5.3	6.6	3.3	9.5
	SPD (MPH)	9.6	9.9	4.5	7.0	5.9	2.4	5.6	6.8	3.5	11.2
	RATIO	0.964	0.983	0.740	0.886	0.672	0.355	0.942	0.980	0.950	0.851
METEOROLOGICAL SITE	DIR (DEG)	190	280	70	320	250	310	310	30	250	250
WORCESTER	VEL (MPH)	8.7	10.5	5.2	5.6	5.4	4.0	9.3	6.9	6.0	11.6
	SPD (MPH)	9.3	10.6	5.5	6.2	6.9	4.5	9.5	7.2	6.6	11.8
	RATIO	0.926	0.991	0.955	0.905	0.776	0.895	0.976	0.965	0.900	0.983

TABLE 2-5, CONTINUED

1992 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 (0060)	PM10	68	62	44	42	36	35	34	33	31	30
	DATE	1/ 1/92	8/28/92	12/ 2/92	2/18/92	10/ 3/92	11/20/92	1/31/92	1/13/92	6/29/92	5/24/92
METEOROLOGICAL SITE	DIR (DEG)	230	160	140	40	240	50	320	220	200	20
NEWARK	VEL (MPH)	3.6	9.0	.8	7.1	9.7	5.3	9.7	3.7	5.6	11.9
	SPD (MPH)	4.0	10.6	4.3	7.3	12.9	7.3	10.2	6.0	8.6	12.1
	RATIO	0.888	0.847	0.185	0.975	0.753	0.724	0.952	0.611	0.646	0.988
METEOROLOGICAL SITE	DIR (DEG)	10	160	30	360	250	330	350	210	200	10
BRADLEY	VEL (MPH)	1.8	9.8	1.8	5.1	3.9	1.9	7.5	3.7	4.7	11.2
	SPD (MPH)	2.7	12.2	4.7	5.3	7.5	4.9	7.6	5.5	6.8	11.4
	RATIO	0.661	0.798	0.379	0.960	0.515	0.395	0.985	0.682	0.701	0.990
METEOROLOGICAL SITE	DIR (DEG)	270	190	80	90	270	100	350	230	220	40
BRIDGEPORT	VEL (MPH)	.9	9.3	4.6	8.3	9.8	4.7	6.2	4.0	3.3	6.6
	SPD (MPH)	2.4	9.6	5.8	8.8	9.9	6.2	7.0	5.9	3.5	6.8
	RATIO	0.355	0.964	0.802	0.947	0.983	0.754	0.886	0.672	0.950	0.980
METEOROLOGICAL SITE	DIR (DEG)	310	190	130	100	280	180	320	250	250	30
WORCESTER	VEL (MPH)	4.0	8.7	3.9	4.7	10.5	1.7	5.6	5.4	6.0	6.9
	SPD (MPH)	4.5	9.3	4.9	5.2	10.6	3.7	6.2	6.9	6.6	7.2
	RATIO	0.895	0.926	0.792	0.905	0.991	0.459	0.905	0.776	0.900	0.965
HARTFORD-015 (0061)	PM10	63	59	57	52	46	43	39	38	37	37
	DATE	8/28/92	1/ 1/92	8/10/92	2/18/92	1/31/92	12/ 2/92	11/20/92	1/13/92	10/15/92	10/ 3/92
METEOROLOGICAL SITE	DIR (DEG)	160	230	110	40	320	140	50	220	200	240
NEWARK	VEL (MPH)	9.0	3.6	1.7	7.1	9.7	.8	5.3	3.7	2.6	9.7
	SPD (MPH)	10.6	4.0	5.6	7.3	10.2	4.3	7.3	6.0	5.5	12.9
	RATIO	0.847	0.888	0.303	0.975	0.952	0.185	0.724	0.611	0.471	0.753
METEOROLOGICAL SITE	DIR (DEG)	160	10	330	360	350	30	330	210	350	250
BRADLEY	VEL (MPH)	9.8	1.8	2.1	5.1	7.5	1.8	1.9	3.7	4.0	3.9
	SPD (MPH)	12.2	2.7	6.8	5.3	7.6	4.7	4.9	5.5	5.3	7.5
	RATIO	0.798	0.661	0.312	0.960	0.985	0.379	0.395	0.682	0.759	0.515
METEOROLOGICAL SITE	DIR (DEG)	190	270	210	90	350	80	100	230	80	270
BRIDGEPORT	VEL (MPH)	9.3	.9	2.2	8.3	6.2	4.6	4.7	4.0	2.7	9.8
	SPD (MPH)	9.6	2.4	5.2	8.8	7.0	5.8	6.2	5.9	4.0	9.9
	RATIO	0.964	0.355	0.416	0.947	0.886	0.802	0.754	0.672	0.667	0.983
METEOROLOGICAL SITE	DIR (DEG)	190	310	270	100	320	130	180	250	70	280
WORCESTER	VEL (MPH)	8.7	4.0	1.7	4.7	5.6	3.9	1.7	5.4	4.7	10.5
	SPD (MPH)	9.3	4.5	4.3	5.2	6.2	4.9	3.7	6.9	4.7	10.6
	RATIO	0.926	0.895	0.404	0.905	0.905	0.792	0.459	0.776	0.985	0.991
MERIDEN-002 (0058)	PM10	64	60	40	40	39	38	37	37	33	33
	DATE	1/ 1/92	8/28/92	1/13/92	1/31/92	2/18/92	11/20/92	12/ 2/92	10/ 3/92	5/24/92	3/25/92
METEOROLOGICAL SITE	DIR (DEG)	230	160	220	320	40	50	140	240	20	140
NEWARK	VEL (MPH)	3.6	9.0	3.7	9.7	7.1	5.3	.8	9.7	11.9	5.0
	SPD (MPH)	4.0	10.6	6.0	10.2	7.3	7.3	4.3	12.9	12.1	6.8
	RATIO	0.888	0.847	0.611	0.952	0.975	0.724	0.185	0.753	0.988	0.745
METEOROLOGICAL SITE	DIR (DEG)	10	160	210	350	360	330	30	250	10	170
BRADLEY	VEL (MPH)	1.8	9.8	3.7	7.5	5.1	1.9	1.8	3.9	11.2	5.2
	SPD (MPH)	2.7	12.2	5.5	7.6	5.3	4.9	4.7	7.5	11.4	7.6
	RATIO	0.661	0.798	0.682	0.985	0.960	0.395	0.379	0.515	0.990	0.684

TABLE 2-5, CONTINUED

1992 TEN HIGHEST 24-HOUR AVERAGE PM10 DAYS WITH WIND DATA

UNITS : MICROGRAMS PER CUBIC METER

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
METEOROLOGICAL SITE	DIR (DEG)	270	190	230	350	90	100	80	270	40	150
BRIDGEPORT	VEL (MPH)	.9	9.3	4.0	6.2	8.3	4.7	4.6	9.8	6.6	3.0
	SPD (MPH)	2.4	9.6	5.9	7.0	8.8	6.2	5.8	9.9	6.8	3.9
	RATIO	0.355	0.964	0.672	0.886	0.947	0.754	0.802	0.983	0.980	0.784
METEOROLOGICAL SITE	DIR (DEG)	310	190	250	320	100	180	130	280	30	240
WORCESTER	VEL (MPH)	4.0	8.7	5.4	5.6	4.7	1.7	3.9	10.5	6.9	5.9
	SPD (MPH)	4.5	9.3	6.9	6.2	5.2	3.7	4.9	10.6	7.2	6.6
	RATIO	0.895	0.926	0.776	0.905	0.905	0.459	0.792	0.991	0.965	0.886
MIDDLETOWN-003 (0059)	PM10	63	58	54	43	42	38	37	37	31	30
	DATE	8/28/92	1/ 1/92	11/ 2/92	12/ 2/92	1/31/92	2/18/92	3/25/92	10/ 3/92	1/13/92	11/20/92
METEOROLOGICAL SITE	DIR (DEG)	160	230	70	140	320	40	140	240	220	50
NEWARK	VEL (MPH)	9.0	3.6	7.8	.8	9.7	7.1	5.0	9.7	3.7	5.3
	SPD (MPH)	10.6	4.0	9.6	4.3	10.2	7.3	6.8	12.9	6.0	7.3
	RATIO	0.847	0.888	0.814	0.185	0.952	0.975	0.745	0.753	0.611	0.724
METEOROLOGICAL SITE	DIR (DEG)	160	10	360	30	350	360	170	250	210	330
BRADLEY	VEL (MPH)	9.8	1.8	4.8	1.8	7.5	5.1	5.2	3.9	3.7	1.9
	SPD (MPH)	12.2	2.7	4.9	4.7	7.6	5.3	7.6	7.5	5.5	4.9
	RATIO	0.798	0.661	0.987	0.379	0.985	0.960	0.684	0.515	0.682	0.395
METEOROLOGICAL SITE	DIR (DEG)	190	270	100	80	350	90	150	270	230	100
BRIDGEPORT	VEL (MPH)	9.3	.9	9.7	4.6	6.2	8.3	3.0	9.8	4.0	4.7
	SPD (MPH)	9.6	2.4	10.9	5.8	7.0	8.8	3.9	9.9	5.9	6.2
	RATIO	0.964	0.355	0.891	0.802	0.886	0.947	0.784	0.983	0.672	0.754
METEOROLOGICAL SITE	DIR (DEG)	190	310	80	130	320	100	240	280	250	180
WORCESTER	VEL (MPH)	8.7	4.0	3.5	3.9	5.6	4.7	5.9	10.5	5.4	1.7
	SPD (MPH)	9.3	4.5	4.0	4.9	6.2	5.2	6.6	10.6	6.9	3.7
	RATIO	0.926	0.895	0.860	0.792	0.905	0.905	0.886	0.991	0.776	0.459
MILFORD-010 (0061)	PM10	58	46	38	32	30	30	28	27	26	25
	DATE	1/31/92	8/28/92	10/ 3/92	1/ 1/92	6/29/92	3/25/92	3/ 1/92	5/24/92	12/ 2/92	2/24/92
METEOROLOGICAL SITE	DIR (DEG)	320	160	240	230	200	140	240	20	140	60
NEWARK	VEL (MPH)	9.7	9.0	9.7	3.6	5.6	5.0	8.5	11.9	.8	9.7
	SPD (MPH)	10.2	10.6	12.9	4.0	8.6	6.8	11.6	12.1	4.3	10.2
	RATIO	0.952	0.847	0.753	0.888	0.646	0.745	0.726	0.988	0.185	0.946
METEOROLOGICAL SITE	DIR (DEG)	350	160	250	10	200	170	220	10	30	20
BRADLEY	VEL (MPH)	7.5	9.8	3.9	1.8	4.7	5.2	6.1	11.2	1.8	8.1
	SPD (MPH)	7.6	12.2	7.5	2.7	6.8	7.6	9.1	11.4	4.7	8.2
	RATIO	0.985	0.798	0.515	0.661	0.701	0.684	0.677	0.990	0.379	0.986
METEOROLOGICAL SITE	DIR (DEG)	350	190	270	270	220	150	260	40	80	80
BRIDGEPORT	VEL (MPH)	6.2	9.3	9.8	.9	3.3	3.0	9.5	6.6	4.6	9.0
	SPD (MPH)	7.0	9.6	9.9	2.4	3.5	3.9	11.2	6.8	5.8	9.5
	RATIO	0.886	0.964	0.983	0.355	0.950	0.784	0.851	0.980	0.802	0.953
METEOROLOGICAL SITE	DIR (DEG)	320	190	280	310	250	240	250	30	130	70
WORCESTER	VEL (MPH)	5.6	8.7	10.5	4.0	6.0	5.9	11.6	6.9	3.9	5.3
	SPD (MPH)	6.2	9.3	10.6	4.5	6.6	6.6	11.8	7.2	4.9	5.5
	RATIO	0.905	0.926	0.991	0.895	0.900	0.886	0.983	0.965	0.792	0.969

TABLE 2-5, CONTINUED

1992 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 BRITAIN-012 (0055)	PM10	68	63	36	36	34	34	33	29	28	27
	DATE	8/28/92	1/ 1/92	10/ 3/92	12/ 2/92	1/13/92	3/25/92	1/31/92	2/18/92	6/29/92	11/20/92
METEOROLOGICAL SITE	DIR (DEG)	160	230	240	140	220	140	320	40	200	50
NEWARK	VEL (MPH)	9.0	3.6	9.7	.8	3.7	5.0	9.7	7.1	5.6	5.3
	SPD (MPH)	10.6	4.0	12.9	4.3	6.0	6.8	10.2	7.3	8.6	7.3
	RATIO	0.847	0.888	0.753	0.185	0.611	0.745	0.952	0.975	0.646	0.724
METEOROLOGICAL SITE	DIR (DEG)	160	10	250	30	210	170	350	360	200	330
BRADLEY	VEL (MPH)	9.8	1.8	3.9	1.8	3.7	5.2	7.5	5.1	4.7	1.9
	SPD (MPH)	12.2	2.7	7.5	4.7	5.5	7.6	7.6	5.3	6.8	4.9
	RATIO	0.798	0.661	0.515	0.379	0.682	0.684	0.985	0.960	0.701	0.395
METEOROLOGICAL SITE	DIR (DEG)	190	270	270	80	230	150	350	90	220	100
BRIDGEPORT	VEL (MPH)	9.3	.9	9.8	4.6	4.0	3.0	6.2	8.3	3.3	4.7
	SPD (MPH)	9.6	2.4	9.9	5.8	5.9	3.9	7.0	8.8	3.5	6.2
	RATIO	0.964	0.355	0.983	0.802	0.672	0.784	0.886	0.947	0.950	0.754
METEOROLOGICAL SITE	DIR (DEG)	190	310	280	130	250	240	320	100	250	180
WORCESTER	VEL (MPH)	8.7	4.0	10.5	3.9	5.4	5.9	5.6	4.7	6.0	1.7
	SPD (MPH)	9.3	4.5	10.6	4.9	6.9	6.6	6.2	5.2	6.6	3.7
	RATIO	0.926	0.895	0.991	0.792	0.776	0.886	0.905	0.905	0.900	0.459
NEW HAVEN-013 (0057)	PM10	55	55	53	50	41	39	38	35	30	29
	DATE	8/28/92	1/31/92	1/ 1/92	1/13/92	10/ 3/92	3/25/92	2/18/92	6/29/92	5/24/92	10/15/92
METEOROLOGICAL SITE	DIR (DEG)	160	320	230	220	240	140	40	200	20	200
NEWARK	VEL (MPH)	9.0	9.7	3.6	3.7	9.7	5.0	7.1	5.6	11.9	2.6
	SPD (MPH)	10.6	10.2	4.0	6.0	12.9	6.8	7.3	8.6	12.1	5.5
	RATIO	0.847	0.952	0.888	0.611	0.753	0.745	0.975	0.646	0.988	0.471
METEOROLOGICAL SITE	DIR (DEG)	160	350	10	210	250	170	360	200	10	350
BRADLEY	VEL (MPH)	9.8	7.5	1.8	3.7	3.9	5.2	5.1	4.7	11.2	4.0
	SPD (MPH)	12.2	7.6	2.7	5.5	7.5	7.6	5.3	6.8	11.4	5.3
	RATIO	0.798	0.985	0.661	0.682	0.515	0.684	0.960	0.701	0.990	0.759
METEOROLOGICAL SITE	DIR (DEG)	190	350	270	230	270	150	90	220	40	80
BRIDGEPORT	VEL (MPH)	9.3	6.2	.9	4.0	9.8	3.0	8.3	3.3	6.6	2.7
	SPD (MPH)	9.6	7.0	2.4	5.9	9.9	3.9	8.8	3.5	6.8	4.0
	RATIO	0.964	0.886	0.355	0.672	0.983	0.784	0.947	0.950	0.980	0.667
METEOROLOGICAL SITE	DIR (DEG)	190	320	310	250	280	240	100	250	30	70
WORCESTER	VEL (MPH)	8.7	5.6	4.0	5.4	10.5	5.9	4.7	6.0	6.9	4.7
	SPD (MPH)	9.3	6.2	4.5	6.9	10.6	6.6	5.2	6.6	7.2	4.7
	RATIO	0.926	0.905	0.895	0.776	0.991	0.886	0.905	0.900	0.965	0.985
NEW HAVEN-018 (0057)	PM10	83	82	71	64	64	55	51	51	49	44
	DATE	1/31/92	6/17/92	3/25/92	8/28/92	1/13/92	2/18/92	9/ 9/92	12/ 2/92	6/29/92	2/12/92
METEOROLOGICAL SITE	DIR (DEG)	320	180	140	160	220	40	150	140	200	340
NEWARK	VEL (MPH)	9.7	6.3	5.0	9.0	3.7	7.1	3.8	.8	5.6	10.1
	SPD (MPH)	10.2	9.1	6.8	10.6	6.0	7.3	7.2	4.3	8.6	12.1
	RATIO	0.952	0.695	0.745	0.847	0.611	0.975	0.524	0.185	0.646	0.834
METEOROLOGICAL SITE	DIR (DEG)	350	190	170	160	210	360	220	30	200	340
BRADLEY	VEL (MPH)	7.5	3.9	5.2	9.8	3.7	5.1	2.7	1.8	4.7	12.0
	SPD (MPH)	7.6	7.0	7.6	12.2	5.5	5.3	6.9	4.7	6.8	13.1
	RATIO	0.985	0.556	0.684	0.798	0.682	0.960	0.394	0.379	0.701	0.916

TABLE 2-5, CONTINUED

1992 TEN HIGHEST 24-HOUR AVERAGE PM10 DAYS WITH WIND DATA

UNITS : MICROGRAMS PER CUBIC METER

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
METEOROLOGICAL SITE BRIDGEPORT	DIR (DEG)	350	210	150	190	230	90	230	80	220	360
	VEL (MPH)	6.2	3.3	3.0	9.3	4.0	8.3	4.0	4.6	3.3	9.7
	SPD (MPH)	7.0	3.6	3.9	9.6	5.9	8.8	4.5	5.8	3.5	9.9
	RATIO	0.886	0.911	0.784	0.964	0.672	0.947	0.898	0.802	0.950	0.982
METEOROLOGICAL SITE WORCESTER	DIR (DEG)	320	170	240	190	250	100	240	130	250	330
	VEL (MPH)	5.6	2.2	5.9	8.7	5.4	4.7	4.9	3.9	6.0	9.0
	SPD (MPH)	6.2	4.3	6.6	9.3	6.9	5.2	5.8	4.9	6.6	9.5
	RATIO	0.905	0.520	0.886	0.926	0.776	0.905	0.856	0.792	0.900	0.946
NEW HAVEN-020 (0059)	PM10	57	54	53	42	42	41	35	33	33	32
	DATE	1/31/92	1/ 1/92	8/28/92	3/25/92	10/ 3/92	2/18/92	2/24/92	5/24/92	6/17/92	10/15/92
METEOROLOGICAL SITE NEWARK	DIR (DEG)	320	230	160	140	240	40	60	20	180	200
	VEL (MPH)	9.7	3.6	9.0	5.0	9.7	7.1	9.7	11.9	6.3	2.6
	SPD (MPH)	10.2	4.0	10.6	6.8	12.9	7.3	10.2	12.1	9.1	5.5
	RATIO	0.952	0.888	0.847	0.745	0.753	0.975	0.946	0.988	0.695	0.471
METEOROLOGICAL SITE BRADLEY	DIR (DEG)	350	10	160	170	250	360	20	10	190	350
	VEL (MPH)	7.5	1.8	9.8	5.2	3.9	5.1	8.1	11.2	3.9	4.0
	SPD (MPH)	7.6	2.7	12.2	7.6	7.5	5.3	8.2	11.4	7.0	5.3
	RATIO	0.985	0.661	0.798	0.684	0.515	0.960	0.986	0.990	0.556	0.759
METEOROLOGICAL SITE BRIDGEPORT	DIR (DEG)	350	270	190	150	270	90	80	40	210	80
	VEL (MPH)	6.2	.9	9.3	3.0	9.8	8.3	9.0	6.6	3.3	2.7
	SPD (MPH)	7.0	2.4	9.6	3.9	9.9	8.8	9.5	6.8	3.6	4.0
	RATIO	0.886	0.355	0.964	0.784	0.983	0.947	0.953	0.980	0.911	0.667
METEOROLOGICAL SITE WORCESTER	DIR (DEG)	320	310	190	240	280	100	70	30	170	70
	VEL (MPH)	5.6	4.0	8.7	5.9	10.5	4.7	5.3	6.9	2.2	4.7
	SPD (MPH)	6.2	4.5	9.3	6.6	10.6	5.2	5.5	7.2	4.3	4.7
	RATIO	0.905	0.895	0.926	0.886	0.991	0.905	0.969	0.965	0.520	0.985
NEW HAVEN-123 (0057)	PM10	60	60	56	54	43	40	39	36	35	30
	DATE	1/13/92	1/31/92	1/ 1/92	8/28/92	3/25/92	10/ 3/92	2/18/92	12/ 2/92	6/29/92	10/15/92
METEOROLOGICAL SITE NEWARK	DIR (DEG)	220	320	230	160	140	240	40	140	200	200
	VEL (MPH)	3.7	9.7	3.6	9.0	5.0	9.7	7.1	.8	5.6	2.6
	SPD (MPH)	6.0	10.2	4.0	10.6	6.8	12.9	7.3	4.3	8.6	5.5
	RATIO	0.611	0.952	0.888	0.847	0.745	0.753	0.975	0.185	0.646	0.471
METEOROLOGICAL SITE BRADLEY	DIR (DEG)	210	350	10	160	170	250	360	30	200	350
	VEL (MPH)	3.7	7.5	1.8	9.8	5.2	3.9	5.1	1.8	4.7	4.0
	SPD (MPH)	5.5	7.6	2.7	12.2	7.6	7.5	5.3	4.7	6.8	5.3
	RATIO	0.682	0.985	0.661	0.798	0.684	0.515	0.960	0.379	0.701	0.759
METEOROLOGICAL SITE BRIDGEPORT	DIR (DEG)	230	350	270	190	150	270	90	80	220	80
	VEL (MPH)	4.0	6.2	.9	9.3	3.0	9.8	8.3	4.6	3.3	2.7
	SPD (MPH)	5.9	7.0	2.4	9.6	3.9	9.9	8.8	5.8	3.5	4.0
	RATIO	0.672	0.886	0.355	0.964	0.784	0.983	0.947	0.802	0.950	0.667
METEOROLOGICAL SITE WORCESTER	DIR (DEG)	250	320	310	190	240	280	100	130	250	70
	VEL (MPH)	5.4	5.6	4.0	8.7	5.9	10.5	4.7	3.9	6.0	4.7
	SPD (MPH)	6.9	6.2	4.5	9.3	6.6	10.6	5.2	4.9	6.6	4.7
	RATIO	0.776	0.905	0.895	0.926	0.886	0.991	0.905	0.792	0.900	0.985

TABLE 2-5, CONTINUED

1992 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 LONDON-004 (0059)	PM10	66	50	41	41	40	30	30	29	29	29
	DATE	8/28/92	1/31/92	1/13/92	1/ 1/92	10/ 3/92	12/ 2/92	6/29/92	5/24/92	2/12/92	3/25/92
METEOROLOGICAL SITE	DIR (DEG)	160	320	220	230	240	140	200	20	340	140
NEWARK	VEL (MPH)	9.0	9.7	3.7	3.6	9.7	.8	5.6	11.9	10.1	5.0
	SPD (MPH)	10.6	10.2	6.0	4.0	12.9	4.3	8.6	12.1	12.1	6.8
	RATIO	0.847	0.952	0.611	0.888	0.753	0.185	0.646	0.988	0.834	0.745
METEOROLOGICAL SITE	DIR (DEG)	160	350	210	10	250	30	200	10	340	170
BRADLEY	VEL (MPH)	9.8	7.5	3.7	1.8	3.9	1.8	4.7	11.2	12.0	5.2
	SPD (MPH)	12.2	7.6	5.5	2.7	7.5	4.7	6.8	11.4	13.1	7.6
	RATIO	0.798	0.985	0.682	0.661	0.515	0.379	0.701	0.990	0.916	0.684
METEOROLOGICAL SITE	DIR (DEG)	190	350	230	270	270	80	220	40	360	150
BRIDGEPORT	VEL (MPH)	9.3	6.2	4.0	.9	9.8	4.6	3.3	6.6	9.7	3.0
	SPD (MPH)	9.6	7.0	5.9	2.4	9.9	5.8	3.5	6.8	9.9	3.9
	RATIO	0.964	0.886	0.672	0.355	0.983	0.802	0.950	0.980	0.982	0.784
METEOROLOGICAL SITE	DIR (DEG)	190	320	250	310	280	130	250	30	330	240
WORCESTER	VEL (MPH)	8.7	5.6	5.4	4.0	10.5	3.9	6.0	6.9	9.0	5.9
	SPD (MPH)	9.3	6.2	6.9	4.5	10.6	4.9	6.6	7.2	9.5	6.6
	RATIO	0.926	0.905	0.776	0.895	0.991	0.792	0.900	0.965	0.946	0.886
NORWALK-014 (0059)	PM10	82	64	57	53	45	42	41	38	37	37
	DATE	1/31/92	1/13/92	1/ 1/92	8/28/92	10/ 3/92	10/15/92	12/ 2/92	3/31/92	12/14/92	2/18/92
METEOROLOGICAL SITE	DIR (DEG)	320	220	230	160	240	200	140	360	20	40
NEWARK	VEL (MPH)	9.7	3.7	3.6	9.0	9.7	2.6	.8	12.7	7.4	7.1
	SPD (MPH)	10.2	6.0	4.0	10.6	12.9	5.5	4.3	13.2	8.3	7.3
	RATIO	0.952	0.611	0.888	0.847	0.753	0.471	0.185	0.959	0.891	0.975
METEOROLOGICAL SITE	DIR (DEG)	350	210	10	160	250	350	30	350	20	360
BRADLEY	VEL (MPH)	7.5	3.7	1.8	9.8	3.9	4.0	1.8	7.8	6.2	5.1
	SPD (MPH)	7.6	5.5	2.7	12.2	7.5	5.3	4.7	8.8	8.1	5.3
	RATIO	0.985	0.682	0.661	0.798	0.515	0.759	0.379	0.886	0.771	0.960
METEOROLOGICAL SITE	DIR (DEG)	350	230	270	190	270	80	80	40	70	90
BRIDGEPORT	VEL (MPH)	6.2	4.0	.9	9.3	9.8	2.7	4.6	7.9	6.1	8.3
	SPD (MPH)	7.0	5.9	2.4	9.6	9.9	4.0	5.8	8.3	6.9	8.8
	RATIO	0.886	0.672	0.355	0.964	0.983	0.667	0.802	0.952	0.882	0.947
METEOROLOGICAL SITE	DIR (DEG)	320	250	310	190	280	70	130	20	90	100
WORCESTER	VEL (MPH)	5.6	5.4	4.0	8.7	10.5	4.7	3.9	5.5	4.5	4.7
	SPD (MPH)	6.2	6.9	4.5	9.3	10.6	4.7	4.9	5.9	5.2	5.2
	RATIO	0.905	0.776	0.895	0.926	0.991	0.985	0.792	0.941	0.861	0.905
NORWICH-002 (0058)	PM10	75	57	45	43	38	34	29	29	27	25
	DATE	8/28/92	1/31/92	1/13/92	1/ 1/92	3/25/92	12/ 2/92	6/29/92	2/18/92	10/15/92	6/17/92
METEOROLOGICAL SITE	DIR (DEG)	160	320	220	230	140	140	200	40	200	180
NEWARK	VEL (MPH)	9.0	9.7	3.7	3.6	5.0	.8	5.6	7.1	2.6	6.3
	SPD (MPH)	10.6	10.2	6.0	4.0	6.8	4.3	8.6	7.3	5.5	9.1
	RATIO	0.847	0.952	0.611	0.888	0.745	0.185	0.646	0.975	0.471	0.695
METEOROLOGICAL SITE	DIR (DEG)	160	350	210	10	170	30	200	360	350	190
BRADLEY	VEL (MPH)	9.8	7.5	3.7	1.8	5.2	1.8	4.7	5.1	4.0	3.9
	SPD (MPH)	12.2	7.6	5.5	2.7	7.6	4.7	6.8	5.3	5.3	7.0
	RATIO	0.798	0.985	0.682	0.661	0.684	0.379	0.701	0.960	0.759	0.556

TABLE 2-5, CONTINUED

1992 TEN HIGHEST 24-HOUR AVERAGE PM10 DAYS WITH WIND DATA

UNITS : MICROGRAMS PER CUBIC METER

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
METEOROLOGICAL SITE BRIDGEPORT	DIR (DEG)	190	350	230	270	150	80	220	90	80	210
	VEL (MPH)	9.3	6.2	4.0	.9	3.0	4.6	3.3	8.3	2.7	3.3
	SPD (MPH)	9.6	7.0	5.9	2.4	3.9	5.8	3.5	8.8	4.0	3.6
	RATIO	0.964	0.886	0.672	0.355	0.784	0.802	0.950	0.947	0.667	0.911
METEOROLOGICAL SITE WORCESTER	DIR (DEG)	190	320	250	310	240	130	250	100	70	170
	VEL (MPH)	8.7	5.6	5.4	4.0	5.9	3.9	6.0	4.7	4.7	2.2
	SPD (MPH)	9.3	6.2	6.9	4.5	6.6	4.9	6.6	5.2	4.7	4.3
	RATIO	0.926	0.905	0.776	0.895	0.886	0.792	0.900	0.905	0.985	0.520
STAMFORD-001 (0059)	PM10	49	47	45	42	40	37	34	33	31	31
	DATE	8/28/92	1/13/92	1/ 1/92	1/31/92	10/ 3/92	3/25/92	10/15/92	4/24/92	12/ 2/92	6/29/92
METEOROLOGICAL SITE NEWARK	DIR (DEG)	160	220	230	320	240	140	200	240	140	200
	VEL (MPH)	9.0	3.7	3.6	9.7	9.7	5.0	2.6	8.0	.8	5.6
	SPD (MPH)	10.6	6.0	4.0	10.2	12.9	6.8	5.5	8.5	4.3	8.6
	RATIO	0.847	0.611	0.888	0.952	0.753	0.745	0.471	0.938	0.185	0.646
METEOROLOGICAL SITE BRADLEY	DIR (DEG)	160	210	10	350	250	170	350	340	30	200
	VEL (MPH)	9.8	3.7	1.8	7.5	3.9	5.2	4.0	1.6	1.8	4.7
	SPD (MPH)	12.2	5.5	2.7	7.6	7.5	7.6	5.3	9.1	4.7	6.8
	RATIO	0.798	0.682	0.661	0.985	0.515	0.684	0.759	0.177	0.379	0.701
METEOROLOGICAL SITE BRIDGEPORT	DIR (DEG)	190	230	270	350	270	150	80	90	80	220
	VEL (MPH)	9.3	4.0	.9	6.2	9.8	3.0	2.7	3.5	4.6	3.3
	SPD (MPH)	9.6	5.9	2.4	7.0	9.9	3.9	4.0	5.8	5.8	3.5
	RATIO	0.964	0.672	0.355	0.886	0.983	0.784	0.667	0.613	0.802	0.950
METEOROLOGICAL SITE WORCESTER	DIR (DEG)	190	250	310	320	280	240	70	100	130	250
	VEL (MPH)	8.7	5.4	4.0	5.6	10.5	5.9	4.7	6.5	3.9	6.0
	SPD (MPH)	9.3	6.9	4.5	6.2	10.6	6.6	4.7	8.2	4.9	6.6
	RATIO	0.926	0.776	0.895	0.905	0.991	0.886	0.985	0.791	0.792	0.900
TORRINGTON-001 (0060)	PM10	71	41	37	37	36	34	33	30	29	28
	DATE	8/28/92	1/ 1/92	3/25/92	1/31/92	1/13/92	10/ 3/92	2/18/92	12/ 2/92	9/15/92	10/ 9/92
METEOROLOGICAL SITE NEWARK	DIR (DEG)	160	230	140	320	220	240	40	140	220	170
	VEL (MPH)	9.0	3.6	5.0	9.7	3.7	9.7	7.1	.8	3.7	6.1
	SPD (MPH)	10.6	4.0	6.8	10.2	6.0	12.9	7.3	4.3	6.6	7.6
	RATIO	0.847	0.888	0.745	0.952	0.611	0.753	0.975	0.185	0.564	0.806
METEOROLOGICAL SITE BRADLEY	DIR (DEG)	160	10	170	350	210	250	360	30	210	150
	VEL (MPH)	9.8	1.8	5.2	7.5	3.7	3.9	5.1	1.8	6.0	3.8
	SPD (MPH)	12.2	2.7	7.6	7.6	5.5	7.5	5.3	4.7	7.9	7.6
	RATIO	0.798	0.661	0.684	0.985	0.682	0.515	0.960	0.379	0.758	0.501
METEOROLOGICAL SITE BRIDGEPORT	DIR (DEG)	190	270	150	350	230	270	90	80	240	200
	VEL (MPH)	9.3	.9	3.0	6.2	4.0	9.8	8.3	4.6	4.7	5.8
	SPD (MPH)	9.6	2.4	3.9	7.0	5.9	9.9	8.8	5.8	5.9	6.6
	RATIO	0.964	0.355	0.784	0.886	0.672	0.983	0.947	0.802	0.798	0.883
METEOROLOGICAL SITE WORCESTER	DIR (DEG)	190	310	240	320	250	280	100	130	250	200
	VEL (MPH)	8.7	4.0	5.9	5.6	5.4	10.5	4.7	3.9	7.9	7.9
	SPD (MPH)	9.3	4.5	6.6	6.2	6.9	10.6	5.2	4.9	8.1	8.6
	RATIO	0.926	0.895	0.886	0.905	0.776	0.991	0.905	0.792	0.980	0.921

TABLE 2-5, CONTINUED

1992 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
VOLUNTOWN-001 (0060)		PM10	69	34	34	23	22	21	20	19	19	18
		DATE	8/28/92	1/31/92	10/ 3/92	5/24/92	6/29/92	3/25/92	1/13/92	6/17/92	7/11/92	1/ 1/92
	METEOROLOGICAL SITE NEWARK	DIR (DEG)	160	320	240	20	200	140	220	180	290	230
		VEL (MPH)	9.0	9.7	9.7	11.9	5.6	5.0	3.7	6.3	9.3	3.6
		SPD (MPH)	10.6	10.2	12.9	12.1	8.6	6.8	6.0	9.1	11.5	4.0
		RATIO	0.847	0.952	0.753	0.988	0.646	0.745	0.611	0.695	0.807	0.888
	METEOROLOGICAL SITE BRADLEY	DIR (DEG)	160	350	250	10	200	170	210	190	310	10
		VEL (MPH)	9.8	7.5	3.9	11.2	4.7	5.2	3.7	3.9	9.4	1.8
		SPD (MPH)	12.2	7.6	7.5	11.4	6.8	7.6	5.5	7.0	11.2	2.7
		RATIO	0.798	0.985	0.515	0.990	0.701	0.684	0.682	0.556	0.839	0.661
	METEOROLOGICAL SITE BRIDGEPORT	DIR (DEG)	190	350	270	40	220	150	230	210	330	270
		VEL (MPH)	9.3	6.2	9.8	6.6	3.3	3.0	4.0	3.3	5.3	.9
		SPD (MPH)	9.6	7.0	9.9	6.8	3.5	3.9	5.9	3.6	5.6	2.4
		RATIO	0.964	0.886	0.983	0.980	0.950	0.784	0.672	0.911	0.942	0.355
	METEOROLOGICAL SITE WORCESTER	DIR (DEG)	190	320	280	30	250	240	250	170	310	310
		VEL (MPH)	8.7	5.6	10.5	6.9	6.0	5.9	5.4	2.2	9.3	4.0
		SPD (MPH)	9.3	6.2	10.6	7.2	6.6	6.6	6.9	4.3	9.5	4.5
		RATIO	0.926	0.905	0.991	0.965	0.900	0.886	0.776	0.520	0.976	0.895
WALLINGFORD-006 (0058)		PM10	57	57	53	47	42	39	37	34	30	29
		DATE	8/28/92	1/31/92	1/ 1/92	6/17/92	2/18/92	10/ 3/92	1/13/92	12/ 2/92	6/29/92	10/15/92
	METEOROLOGICAL SITE NEWARK	DIR (DEG)	160	320	230	180	40	240	220	140	200	200
		VEL (MPH)	9.0	9.7	3.6	6.3	7.1	9.7	3.7	.8	5.6	2.6
		SPD (MPH)	10.6	10.2	4.0	9.1	7.3	12.9	6.0	4.3	8.6	5.5
		RATIO	0.847	0.952	0.888	0.695	0.975	0.753	0.611	0.185	0.646	0.471
	METEOROLOGICAL SITE BRADLEY	DIR (DEG)	160	350	10	190	360	250	210	30	200	350
		VEL (MPH)	9.8	7.5	1.8	3.9	5.1	3.9	3.7	1.8	4.7	4.0
		SPD (MPH)	12.2	7.6	2.7	7.0	5.3	7.5	5.5	4.7	6.8	5.3
		RATIO	0.798	0.985	0.661	0.556	0.960	0.515	0.682	0.379	0.701	0.759
	METEOROLOGICAL SITE BRIDGEPORT	DIR (DEG)	190	350	270	210	90	270	230	80	220	80
		VEL (MPH)	9.3	6.2	.9	3.3	8.3	9.8	4.0	4.6	3.3	2.7
		SPD (MPH)	9.6	7.0	2.4	3.6	8.8	9.9	5.9	5.8	3.5	4.0
		RATIO	0.964	0.886	0.355	0.911	0.947	0.983	0.672	0.802	0.950	0.667
	METEOROLOGICAL SITE WORCESTER	DIR (DEG)	190	320	310	170	100	280	250	130	250	70
		VEL (MPH)	8.7	5.6	4.0	2.2	4.7	10.5	5.4	3.9	6.0	4.7
		SPD (MPH)	9.3	6.2	4.5	4.3	5.2	10.6	6.9	4.9	6.6	4.7
		RATIO	0.926	0.905	0.895	0.520	0.905	0.991	0.776	0.792	0.900	0.985
WATERBURY-007 (0059)		PM10	53	52	52	49	48	41	39	34	34	32
		DATE	8/28/92	3/25/92	1/ 1/92	1/13/92	1/31/92	10/ 3/92	2/18/92	10/ 9/92	12/ 2/92	11/20/92
	METEOROLOGICAL SITE NEWARK	DIR (DEG)	160	140	230	220	320	240	40	170	140	50
		VEL (MPH)	9.0	5.0	3.6	3.7	9.7	9.7	7.1	6.1	.8	5.3
		SPD (MPH)	10.6	6.8	4.0	6.0	10.2	12.9	7.3	7.6	4.3	7.3
		RATIO	0.847	0.745	0.888	0.611	0.952	0.753	0.975	0.806	0.185	0.724
	METEOROLOGICAL SITE BRADLEY	DIR (DEG)	160	170	10	210	350	250	360	150	30	330
		VEL (MPH)	9.8	5.2	1.8	3.7	7.5	3.9	5.1	3.8	1.8	1.9
		SPD (MPH)	12.2	7.6	2.7	5.5	7.6	7.5	5.3	7.6	4.7	4.9
		RATIO	0.798	0.684	0.661	0.682	0.985	0.515	0.960	0.501	0.379	0.395

TABLE 2-5, CONTINUED

1992 TEN HIGHEST 24-HOUR AVERAGE PM10 DAYS WITH WIND DATA

UNITS : MICROGRAMS PER CUBIC METER

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
METEOROLOGICAL SITE	DIR (DEG)	190	150	270	230	350	270	90	200	80	100
BRIDGEPORT	VEL (MPH)	9.3	3.0	.9	4.0	6.2	9.8	8.3	5.8	4.6	4.7
	SPD (MPH)	9.6	3.9	2.4	5.9	7.0	9.9	8.8	6.6	5.8	6.2
	RATIO	0.964	0.784	0.355	0.672	0.886	0.983	0.947	0.883	0.802	0.754
METEOROLOGICAL SITE	DIR (DEG)	190	240	310	250	320	280	100	200	130	180
WORCESTER	VEL (MPH)	8.7	5.9	4.0	5.4	5.6	10.5	4.7	7.9	3.9	1.7
	SPD (MPH)	9.3	6.6	4.5	6.9	6.2	10.6	5.2	8.6	4.9	3.7
	RATIO	0.926	0.886	0.895	0.776	0.905	0.991	0.905	0.921	0.792	0.459
WATERBURY-123 (0059)	PM10	61	50	45	44	42	42	39	36	35	32
	DATE	8/28/92	1/13/92	1/31/92	3/25/92	2/18/92	1/ 1/92	10/ 3/92	12/ 2/92	10/ 9/92	11/20/92
METEOROLOGICAL SITE	DIR (DEG)	160	220	320	140	40	230	240	140	170	50
NEWARK	VEL (MPH)	9.0	3.7	9.7	5.0	7.1	3.6	9.7	.8	6.1	5.3
	SPD (MPH)	10.6	6.0	10.2	6.8	7.3	4.0	12.9	4.3	7.6	7.3
	RATIO	0.847	0.611	0.952	0.745	0.975	0.888	0.753	0.185	0.806	0.724
METEOROLOGICAL SITE	DIR (DEG)	160	210	350	170	360	10	250	30	150	330
BRADLEY	VEL (MPH)	9.8	3.7	7.5	5.2	5.1	1.8	3.9	1.8	3.8	1.9
	SPD (MPH)	12.2	5.5	7.6	7.6	5.3	2.7	7.5	4.7	7.6	4.9
	RATIO	0.798	0.682	0.985	0.684	0.960	0.661	0.515	0.379	0.501	0.395
METEOROLOGICAL SITE	DIR (DEG)	190	230	350	150	90	270	270	80	200	100
BRIDGEPORT	VEL (MPH)	9.3	4.0	6.2	3.0	8.3	.9	9.8	4.6	5.8	4.7
	SPD (MPH)	9.6	5.9	7.0	3.9	8.8	2.4	9.9	5.8	6.6	6.2
	RATIO	0.964	0.672	0.886	0.784	0.947	0.355	0.983	0.802	0.883	0.754
METEOROLOGICAL SITE	DIR (DEG)	190	250	320	240	100	310	280	130	200	180
WORCESTER	VEL (MPH)	8.7	5.4	5.6	5.9	4.7	4.0	10.5	3.9	7.9	1.7
	SPD (MPH)	9.3	6.9	6.2	6.6	5.2	4.5	10.6	4.9	8.6	3.7
	RATIO	0.926	0.776	0.905	0.886	0.905	0.895	0.991	0.792	0.921	0.459
WILLIMANTIC-002 (0057)	PM10	64	47	44	37	36	35	34	31	27	27
	DATE	8/28/92	1/31/92	1/13/92	3/25/92	1/ 1/92	2/18/92	10/ 3/92	12/ 2/92	2/ 6/92	3/ 1/92
METEOROLOGICAL SITE	DIR (DEG)	160	320	220	140	230	40	240	140	140	240
NEWARK	VEL (MPH)	9.0	9.7	3.7	5.0	3.6	7.1	9.7	.8	3.4	8.5
	SPD (MPH)	10.6	10.2	6.0	6.8	4.0	7.3	12.9	4.3	5.5	11.6
	RATIO	0.847	0.952	0.611	0.745	0.888	0.975	0.753	0.185	0.630	0.726
METEOROLOGICAL SITE	DIR (DEG)	160	350	210	170	10	360	250	30	80	220
BRADLEY	VEL (MPH)	9.8	7.5	3.7	5.2	1.8	5.1	3.9	1.8	2.0	6.1
	SPD (MPH)	12.2	7.6	5.5	7.6	2.7	5.3	7.5	4.7	5.5	9.1
	RATIO	0.798	0.985	0.682	0.684	0.661	0.960	0.515	0.379	0.360	0.677
METEOROLOGICAL SITE	DIR (DEG)	190	350	230	150	270	90	270	80	180	260
BRIDGEPORT	VEL (MPH)	9.3	6.2	4.0	3.0	.9	8.3	9.8	4.6	2.8	9.5
	SPD (MPH)	9.6	7.0	5.9	3.9	2.4	8.8	9.9	5.8	7.3	11.2
	RATIO	0.964	0.886	0.672	0.784	0.355	0.947	0.983	0.802	0.379	0.851
METEOROLOGICAL SITE	DIR (DEG)	190	320	250	240	310	100	280	130	50	250
WORCESTER	VEL (MPH)	8.7	5.6	5.4	5.9	4.0	4.7	10.5	3.9	.9	11.6
	SPD (MPH)	9.3	6.2	6.9	6.6	4.5	5.2	10.6	4.9	4.9	11.8
	RATIO	0.926	0.905	0.776	0.886	0.895	0.905	0.991	0.792	0.184	0.983

TABLE 2-6

PM10 TRENDS: 1985-1992
(PAIRED *t* TEST)

PAIRED YEARS	AVERAGE OF ANNUAL GEOMETRIC MEANS (µg/m3)	NO. OF SITES[1]	DIFFERENCES OF THE PAIRED YEAR MEANS		SIGNIFICANCE LEVEL[1]		
					TREND AT		PROBABILITY THAT CHANGE IS NOT SIGNIFICANT
			AVG.	STD. DEV.	95% LEVEL	99% LEVEL	
85 86	36.3 35.2	2 2	-1.10	0.57	N.C.	N.C.	0.2220
86 87	37.7 34.0	5 5	-3.72	2.03	↓	N.C.	0.0148
87 88	37.8 32.3	3 3	-5.50	4.20	N.C.	N.C.	0.1514
88 89	32.3 31.9	3 3	-0.40	0.87	N.C.	N.C.	0.4808
89 90	22.4 20.1	37 37	-2.38	1.35	↓	↓	0.0001
90 91	20.7 23.1	28 28	2.38	1.53	↑	↑	0.0001
91 92	23.2 19.0	25 25	-4.22	1.90	↓	↓	0.0001

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

[1] When the number of paired sites is small, the results should be interpreted with caution.

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 1992 did not exceed any federal primary or secondary standards. Measured concentrations were substantially below the 365 $\mu g/m^3$ primary 24-hour standard and well below both the 80 $\mu g/m^3$ primary annual standard and the 1300 $\mu g/m^3$ secondary 3-hour standard.

METHOD OF MEASUREMENT

The DEP Air Monitoring Unit used the pulsed fluorescence method (TECo instruments) to continuously measure sulfur dioxide levels at all 13 sites in 1992.

DISCUSSION OF DATA

Monitoring Network - Thirteen continuous SO_2 monitors were used to record data in 12 towns during 1992 (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 123
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 - 600 precision checks were made on SO_2 monitors in 1992, yielding 95% probability limits ranging from -5% to +6%. 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 12 audits were: low, -10% to +12%; medium, -9% to +8%; and high, -9% to +7%.

Annual Averages - SO_2 levels were below the primary annual standard of 80 $\mu g/m^3$ at all sites in 1992 (see **Table 3-1**). The annual average SO_2 levels decreased at all 11 of the monitoring sites that had sufficient data in both 1991 and 1992 to produce valid annual averages. The largest decrease was 5 $\mu g/m^3$, which occurred at East Hartford 006. No site experienced an increase in the annual average.

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

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

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

24-Hour Averages - Figure 3-2 presents the first and second high calendar day average concentrations recorded at each monitoring site in 1992. 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 10 of the 11 monitoring sites that had adequate data in both 1991 and 1992. The decreases ranged from 1 $\mu g/m^3$ at Stamford 123 to 38 $\mu g/m^3$ at East Haven 003. There was only 1 increase in the second high concentration from 1991 to 1992. The increase occurred at Enfield 005 and amounted to 3 $\mu g/m^3$.

Current EPA policy bases compliance with the primary 24-hour SO_2 standard on calendar day averages. Assessment of compliance is based on the second highest calendar day average in the year. Running averages are averages computed for the 24-hour periods ending at every hour. If running averages were used, assessment of compliance would be based on the value of the second highest of the two highest non-overlapping 24-hour periods in the year. There has been some contention over which average is the more appropriate one on which to base compliance. Table 3-3 contains the two highest 24-hour SO_2 readings at each site in terms of both the running averages and the calendar day averages. The first high 24-hour running averages are all larger than the first high calendar day averages. The differences vary in magnitude up to 18 $\mu g/m^3$.

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 1992. Of the 11 sites that had a sufficient quantity of data in both 1991 and 1992, 9 had lower second high concentrations in 1992. The decreases ranged from 11 $\mu g/m^3$ at Enfield 005 to 160 $\mu g/m^3$ at New Haven 123. Groton 007 had a second high concentration in 1992 that was 17 $\mu g/m^3$ higher than in 1991. East Hartford 006 experienced no change in its second high concentration.

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 1992. Only the 12 sites were used which had sufficient data to produce a valid annual average. The table also shows the average wind conditions that occurred on each of these dates. (The origin and use of these wind data are described in the discussion of Table 2-5 in the particulate matter section of this Air Quality Summary.)

Once again, as with particulate matter, many (i.e., 33%) of the highest SO_2 days occurred with winds out of the southwest quadrant, and most of these days had relatively persistent winds. This relationship is caused, at least in part, by SO_2 transport, but any transport is limited by the chemical instability of SO_2. In the atmosphere, SO_2 reacts with other gases to produce, among other things, sulfate particulates. Therefore, SO_2 is not likely to be transported very long distances. Previous studies conducted by the DEP have shown that, during periods of southwest winds, levels of SO_2 in Connecticut decrease with distance from the New York City metropolitan area. This relationship tends to support the transport hypothesis. On the other hand, these studies also revealed that certain meteorological parameters, most notably mixing height and wind speed, are more conducive to high SO_2 levels on days when there are southwesterly winds than on other days.

The data in Table 3-4 also suggest another reason for high SO_2 levels. Approximately 88% of the tabulated days occurred during the winter, and 12% occurred in late autumn. This phenomenon can be attributed to the fact that more fuel oil is burned during cold weather resulting in greater SO_2 emissions.

In summary, high levels of SO_2 in Connecticut seem to be caused by a number of related factors. First, Connecticut experiences its highest SO_2 levels during the late fall and winter months, when there is an increased amount of fuel combustion. Second, the New York City metropolitan area, a large emission source, is located to the southwest of Connecticut, and southwest winds occur relatively often in this region in comparison to other wind directions. Also, adverse meteorological conditions are often associated with southwest winds. The net effect is that during the colder months when a persistent southwesterly wind occurs, an air mass picks up increased amounts of SO_2 over the New York City metropolitan area and transports this SO_2 into Connecticut, where the SO_2 levels are already relatively high. In addition, relatively low mixing heights are associated with warm air advection (i.e., southwest wind flow), which inhibits vertical mixing and contributes to the enhanced SO_2 concentrations.

The levels of transported SO_2 eventually decline with increasing distance from New York City, as the SO_2 is dispersed and as it slowly reacts to produce sulfate particulates. These sulfate particulates may fall to the ground in either a dry state (dry deposition) or in a wet state after combination with water droplets (wet deposition or "acid rain").

Trends - The SO_2 trend analysis results are summarized in Figure 3-4 and Table 3-5. (For a discussion of the paired *t* test used in Table 3-5, see the discussion of Table 2-6 in the particulate matter section of this Air Quality Summary.)

The long-term trend of SO_2 concentrations is shown in graphical form in Figure 3-4. An improvement in SO_2 levels is demonstrated by the decrease over time of concentrations in excess of 30 $\mu g/m^3$. The year-to-year trends in ambient SO_2 levels are illustrated in Table 3-5 and show significant decreases from 1989 to 1990 and from 1991 to 1992.

The results of the paired *t* test indicate that sulfur dioxide levels in 1992 were significantly different from those in 1991 (see Table 3-5). The apparent decrease in annual average SO_2 levels from 1991 to 1992 were judged to be statistically significant at both the 95% and the 99% confidence levels.

Year-to-year changes in SO_2 levels may be attributable to year-to-year fluctuations in meteorology, or changes in fuel use due to fuel price fluctuations and/or increased fuel efficiency (i.e., 'tighter' buildings). Temperature can be an important factor in determining SO_2 emissions. This is normally reflected in the number of "degree days" -- a measure of the heating/cooling requirement. As the number of degree days of heating and cooling increases, the amount of fuel that must be burned to heat and cool buildings also increases. Consequently, as more fuel is burned, the emissions of sulfur dioxide are proportionately increased.

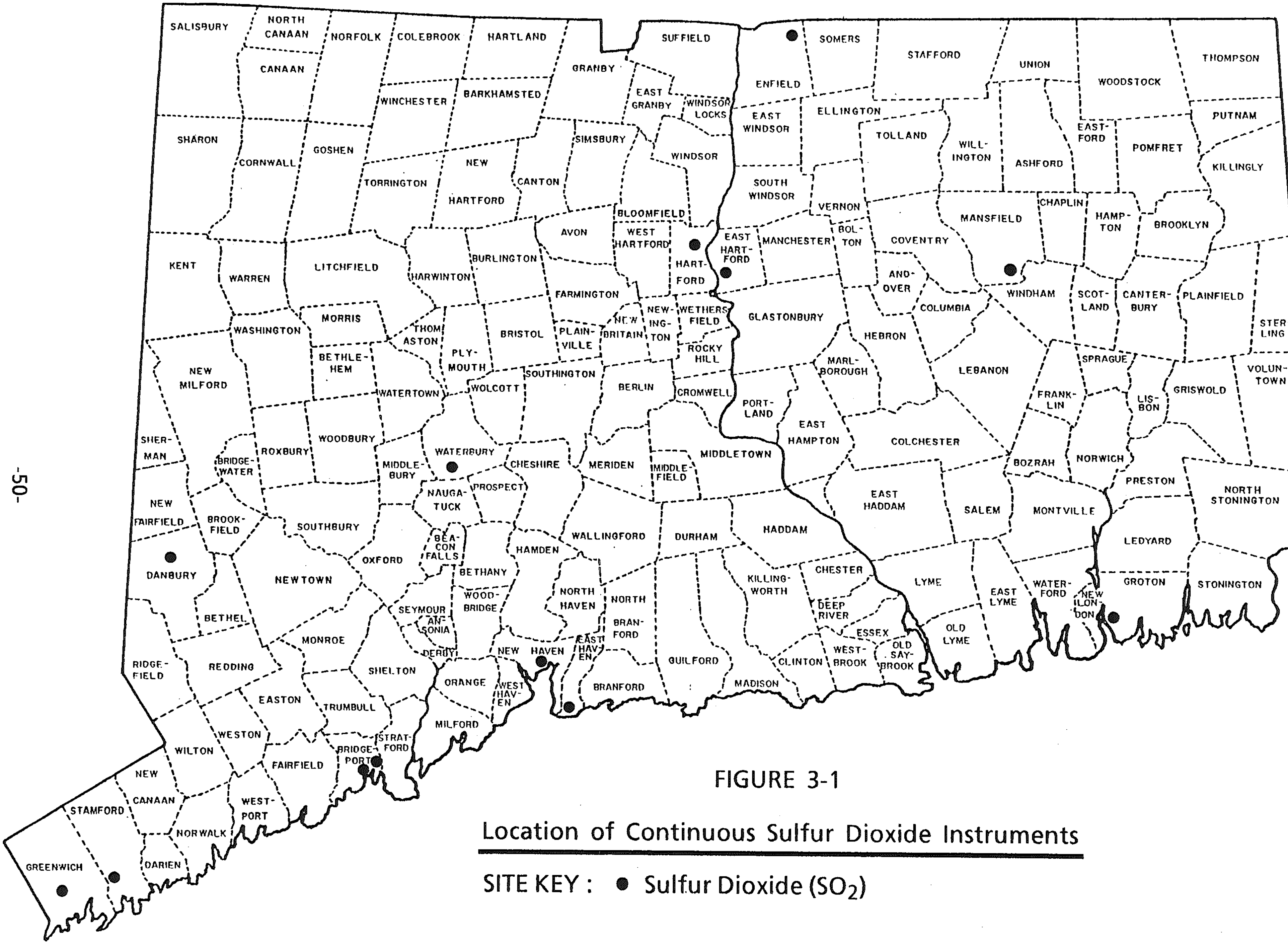


FIGURE 3-1

Location of Continuous Sulfur Dioxide Instruments

SITE KEY : ● Sulfur Dioxide (SO_2)

TABLE 3-1

1992 ANNUAL ARITHMETIC AVERAGES OF SULFUR DIOXIDE

(PRIMARY STANDARD: 80 μg/m^3)

TOWN-SITE	SITE NAME	ANNUAL AVG (μg/m^3)
Bridgeport 012	Edison School	28
Bridgeport 013	Congress Street	22
Danbury 123	Western CT State University	17*
East Hartford 006	High Street	18
East Haven 003	Animal Shelter	17
Enfield 005	Department of Corrections	14
Greenwich 017	Greenwich Point Park	12
Groton 007	Fire Headquarters	16
Hartford 018	Sheldon Street	20
Mansfield 003	Dept. of Transportation	12
New Haven 123	State Street	32
Stamford 123	Health Department	24
Waterbury 123	Bank Street	19

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

TABLE 3-2

1990-1992 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	1990	358	32.9	32.5	33.3	27.329	
BRIDGEPORT	012	1991	363	32.0	31.9	32.2	22.387	
BRIDGEPORT	012	1992	355	27.5	27.1	27.8	20.302	
BRIDGEPORT	013	1990	362	25.5	25.3	25.7	20.468	
BRIDGEPORT	013	1991	345	23.4	22.9	23.8	18.108	
BRIDGEPORT	013	1992	360	22.6	22.3	22.8	17.715	
DANBURY	123	1990	345	19.4	19.0	19.8	16.290	
DANBURY	123	1991	358	19.7	19.5	19.9	13.741	
DANBURY	123	1992	313*	17.5	16.9	18.1	13.436	
EAST HARTFORD	006	1990	364	21.0	20.9	21.1	17.149	
EAST HARTFORD	006	1991	354	23.1	22.8	23.4	16.843	
EAST HARTFORD	006	1992	334	18.3	17.9	18.8	14.660	
EAST HAVEN	003	1990	365	18.8	18.8	18.8	16.076	
EAST HAVEN	003	1991	363	19.4	19.3	19.5	16.553	
EAST HAVEN	003	1992	350	17.1	16.7	17.4	15.663	
ENFIELD	005	1990	352	15.6	15.3	15.8	11.994	
ENFIELD	005	1991	361	14.5	14.4	14.6	10.755	
ENFIELD	005	1992	360	13.7	13.6	13.8	10.541	
GREENWICH	017	1990	364	12.5	12.4	12.6	10.371	
GREENWICH	017	1991	354	16.1	15.9	16.3	11.217	
GREENWICH	017	1992	312	11.9	11.5	12.4	10.660	
GROTON	007	1990	357	20.4	20.1	20.6	14.369	
GROTON	007	1991	335	18.9	18.5	19.2	12.339	
GROTON	007	1992	362	16.2	16.1	16.3	11.961	
HARTFORD	018	1990	362	24.2	24.0	24.4	18.618	
HARTFORD	018	1991	348	23.7	23.3	24.1	16.998	
HARTFORD	018	1992	345	19.6	19.2	20.0	15.157	

* 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

1990-1992 SO_2 ANNUAL AVERAGES AND STATISTICAL PROJECTIONS

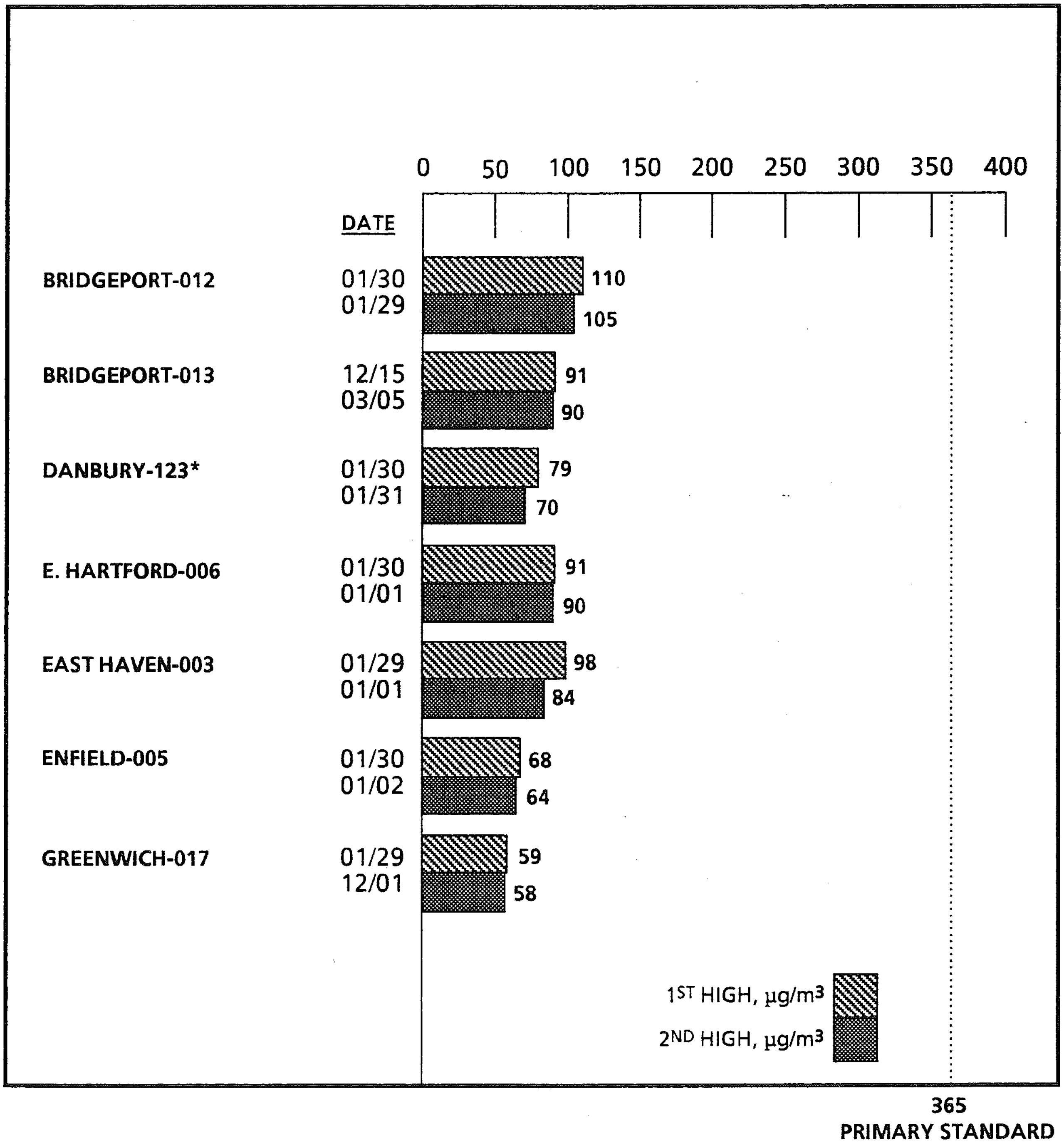
TOWN NAME	SITE	YEAR	SAMPLES	ARITHMETIC MEAN	95-PCT-LIMITS LOWER	95-PCT-LIMITS UPPER	STANDARD DEVIATION	PREDICTED DAYS OVER 365 UG/M3
MANSFIELD	003	1991	294*	10.5	10.1	10.9	7.686	
MANSFIELD	003	1992	360	11.9	11.8	12.0	7.718	
MILFORD	010	1990	283	23.3	22.2	24.4	20.582	
NEW BRITAIN	011	1990	316	21.2	20.4	21.9	18.814	
NEW HAVEN	123	1990	353	35.7	35.2	36.2	27.077	
NEW HAVEN	123	1991	355	33.3	32.8	33.8	29.708	
NEW HAVEN	123	1992	351	31.6	31.1	32.1	23.404	
STAMFORD	025	1990	315	21.9	21.0	22.7	20.806	
STAMFORD	123	1990	354	23.1	22.8	23.5	19.813	
STAMFORD	123	1991	358	26.2	25.9	26.5	21.775	
STAMFORD	123	1992	365	23.8	23.8	23.8	18.893	
WATERBURY	008	1990	317	22.3	21.4	23.2	22.754	
WATERBURY	123	1990	358	24.9	24.7	25.2	17.648	
WATERBURY	123	1991	356	22.9	22.6	23.1	15.782	
WATERBURY	123	1992	351	19.1	18.8	19.4	15.362	

* 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

1992 MAXIMUM CALENDAR DAY AVERAGE SO2 CONCENTRATIONS

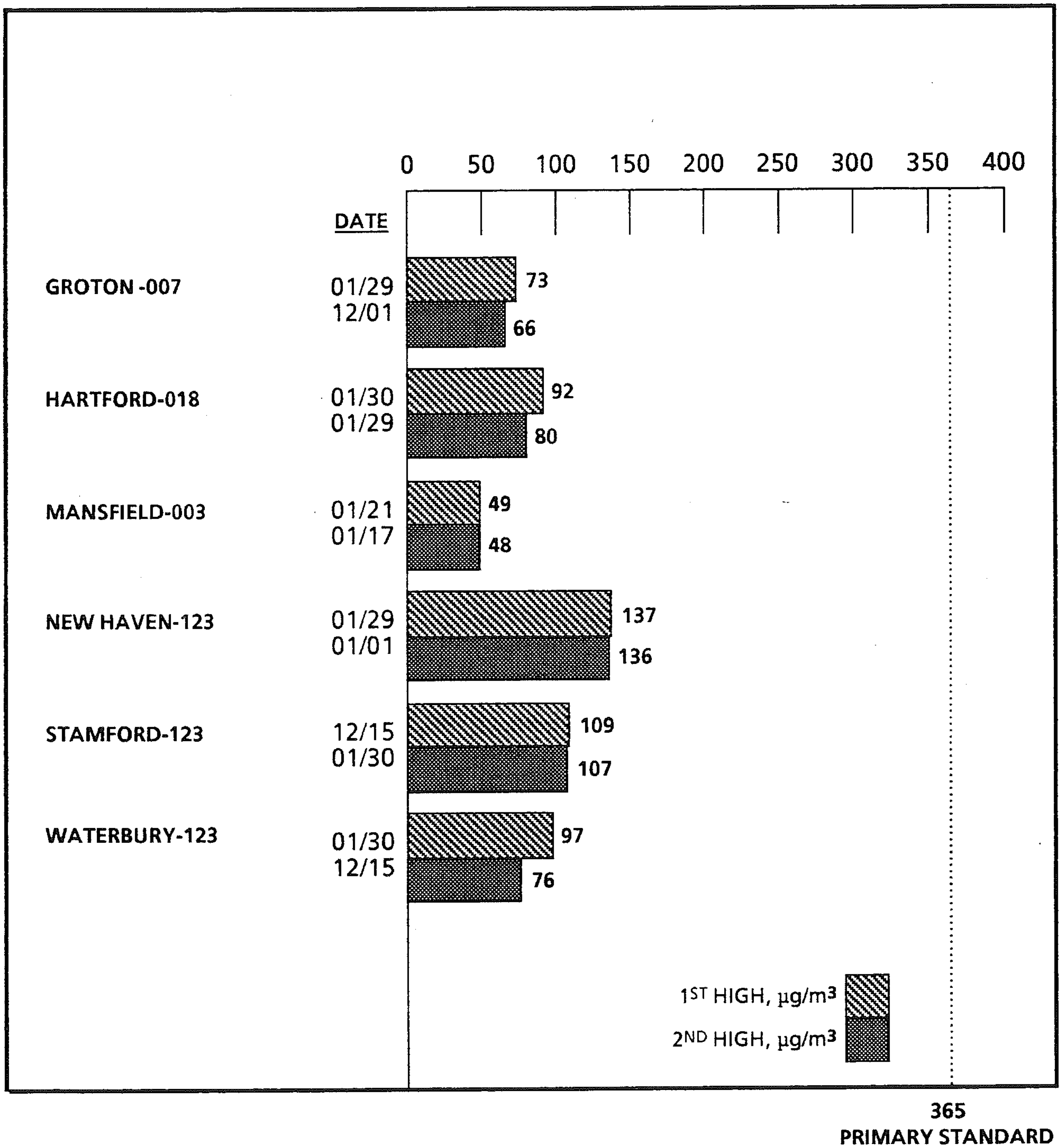


* The site has insufficient data to satisfy the minimum sampling criteria for a valid annual average.

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

FIGURE 3-2, CONTINUED

1992 MAXIMUM CALENDAR DAY AVERAGE SO2 CONCENTRATIONS



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

TABLE 3-3

COMPARISONS OF FIRST AND SECOND HIGH CALENDAR DAY AND 24-HOUR RUNNING SO2 AVERAGES FOR 1992

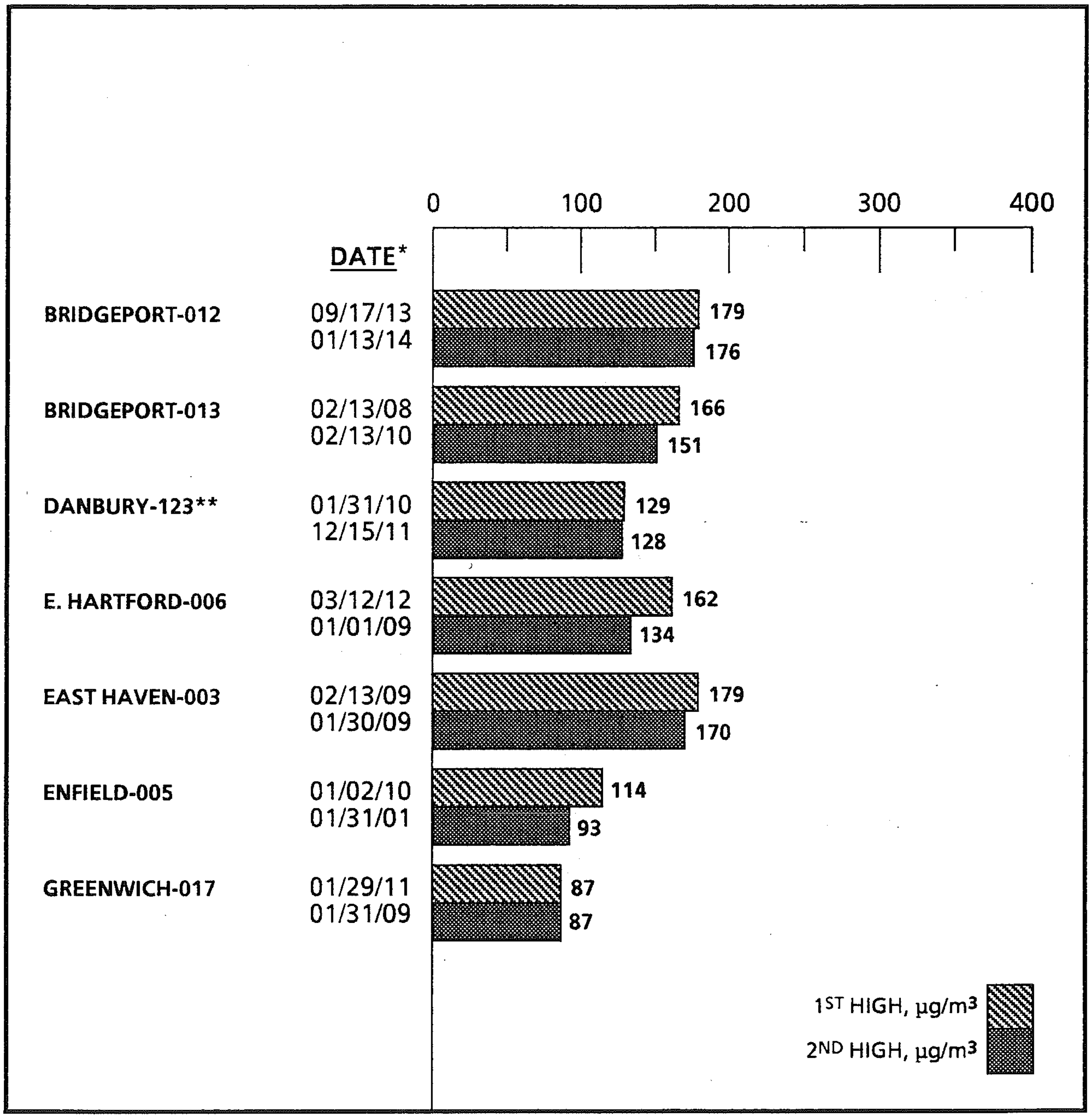
SITE	FIRST HIGH AVERAGE		SECOND HIGH AVERAGE	
	RUNNING 24-HOUR	CALENDAR DAY	RUNNING 24-HOUR	CALENDAR DAY
Bridgeport-012	127	110	111	105
Bridgeport-013	109	91	96	90
Danbury-123*	96	79	77	70
E. Hartford-006	101	91	90	90
East Haven-003	100	98	90	84
Enfield-005	81	68	64	64
Greenwich-017	64	59	62	58
Groton-007	75	73	70	66
Hartford-018	104	92	88	80
Mansfield-003	50	49	49	48
New Haven-123	150	137	143	136
Stamford-123	117	109	110	107
Waterbury-123	115	97	86	76

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

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

FIGURE 3-3

1992 MAXIMUM 3-HOUR RUNNING AVERAGE SO2 CONCENTRATIONS



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

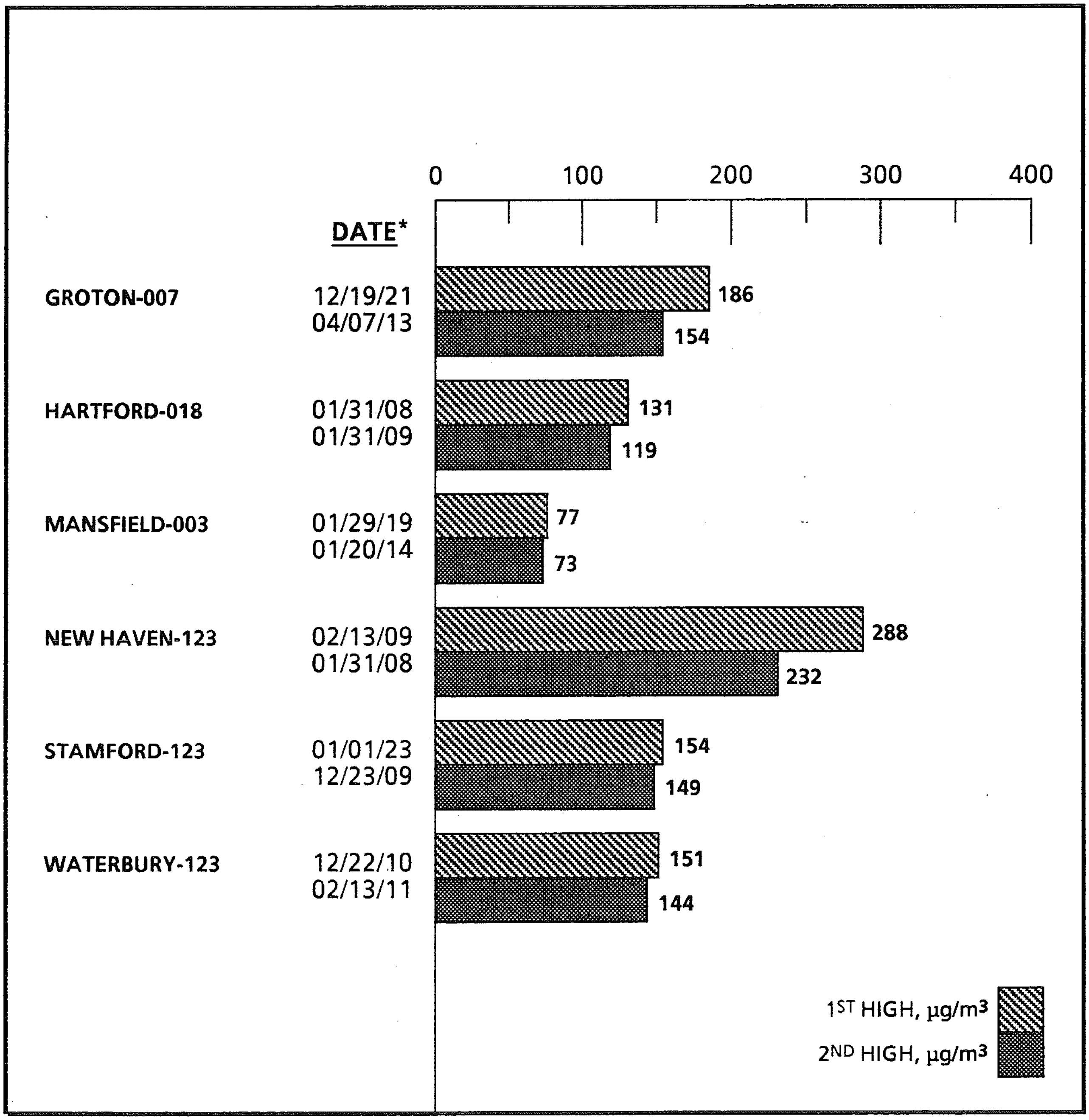
** The site has insufficient data to satisfy the minimum sampling criteria for a valid annual average.

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

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

FIGURE 3-3, CONTINUED

1992 MAXIMUM 3-HOUR RUNNING AVERAGE SO2 CONCENTRATIONS



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

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

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

TABLE 3-4

1992 TEN HIGHEST 24-HOUR AVERAGE SO2 DAYS WITH WIND DATA

UNITS : MICROGRAMS PER CUBIC METER

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
BRIDGEPORT-012 (0355)	SO2	110	105	105	102	100	88	88	87	86	86
	DATE	1/30/92	12/15/92	1/29/92	3/ 5/92	1/13/92	2/13/92	12/ 1/92	12/22/92	1/20/92	1/ 2/92
METEOROLOGICAL SITE	DIR (DEG)	230	190	250	230	220	190	320	310	290	30
NEWARK	VEL (MPH)	5.6	4.7	5.6	7.2	3.7	3.2	2.7	4.1	7.5	3.1
	SPD (MPH)	7.8	5.2	6.0	8.5	6.0	6.6	6.3	6.5	10.8	3.9
	RATIO	0.726	0.915	0.922	0.843	0.611	0.487	0.430	0.638	0.696	0.802
METEOROLOGICAL SITE	DIR (DEG)	190	310	290	210	210	180	60	300	280	70
BRADLEY	VEL (MPH)	5.2	1.2	3.6	1.7	3.7	5.9	2.3	3.8	2.7	1.0
	SPD (MPH)	6.5	3.9	5.5	5.3	5.5	6.8	4.3	4.7	6.6	2.9
	RATIO	0.797	0.312	0.653	0.315	0.682	0.867	0.531	0.798	0.401	0.338
METEOROLOGICAL SITE	DIR (DEG)	250	240	270	260	230	230	290	340	320	60
BRIDGEPORT	VEL (MPH)	2.6	1.3	6.1	5.1	4.0	2.8	2.7	2.5	5.5	1.6
	SPD (MPH)	4.3	3.5	6.8	6.0	5.9	4.7	3.6	4.2	6.3	3.6
	RATIO	0.594	0.369	0.905	0.836	0.672	0.593	0.765	0.605	0.873	0.448
METEOROLOGICAL SITE	DIR (DEG)	250	290	280	280	250	240	290	270	290	250
WORCESTER	VEL (MPH)	5.3	4.4	8.0	7.4	5.4	9.0	3.7	6.5	5.1	8.3
	SPD (MPH)	5.8	4.7	8.3	7.8	6.9	9.3	5.0	7.3	5.8	8.5
	RATIO	0.923	0.929	0.961	0.951	0.776	0.963	0.733	0.881	0.884	0.974
BRIDGEPORT-013 (0360)	SO2	91	90	86	85	83	82	80	79	79	78
	DATE	12/15/92	3/ 5/92	12/ 1/92	1/20/92	12/22/92	2/13/92	1/31/92	1/30/92	1/27/92	1/ 1/92
METEOROLOGICAL SITE	DIR (DEG)	190	230	320	290	310	190	320	230	210	230
NEWARK	VEL (MPH)	4.7	7.2	2.7	7.5	4.1	3.2	9.7	5.6	4.7	3.6
	SPD (MPH)	5.2	8.5	6.3	10.8	6.5	6.6	10.2	7.8	6.2	4.0
	RATIO	0.915	0.843	0.430	0.696	0.638	0.487	0.952	0.726	0.764	0.888
METEOROLOGICAL SITE	DIR (DEG)	310	210	60	280	300	180	350	190	180	10
BRADLEY	VEL (MPH)	1.2	1.7	2.3	2.7	3.8	5.9	7.5	5.2	3.1	1.8
	SPD (MPH)	3.9	5.3	4.3	6.6	4.7	6.8	7.6	6.5	5.9	2.7
	RATIO	0.312	0.315	0.531	0.401	0.798	0.867	0.985	0.797	0.520	0.661
METEOROLOGICAL SITE	DIR (DEG)	240	260	290	320	340	230	350	250	240	270
BRIDGEPORT	VEL (MPH)	1.3	5.1	2.7	5.5	2.5	2.8	6.2	2.6	2.6	.9
	SPD (MPH)	3.5	6.0	3.6	6.3	4.2	4.7	7.0	4.3	5.3	2.4
	RATIO	0.369	0.836	0.765	0.873	0.605	0.593	0.886	0.594	0.487	0.355
METEOROLOGICAL SITE	DIR (DEG)	290	280	290	290	270	240	320	250	240	310
WORCESTER	VEL (MPH)	4.4	7.4	3.7	5.1	6.5	9.0	5.6	5.3	4.8	4.0
	SPD (MPH)	4.7	7.8	5.0	5.8	7.3	9.3	6.2	5.8	5.8	4.5
	RATIO	0.929	0.951	0.733	0.884	0.881	0.963	0.905	0.923	0.829	0.895
EAST HARTFORD-006 (0334)	SO2	91	90	82	68	66	65	60	60	57	56
	DATE	1/30/92	1/ 1/92	1/ 2/92	1/29/92	1/17/92	1/21/92	3/17/92	1/20/92	1/31/92	12/ 1/92
METEOROLOGICAL SITE	DIR (DEG)	230	230	30	250	250	280	260	290	320	320
NEWARK	VEL (MPH)	5.6	3.6	3.1	5.6	8.8	8.1	8.8	7.5	9.7	2.7
	SPD (MPH)	7.8	4.0	3.9	6.0	12.7	9.5	11.1	10.8	10.2	6.3
	RATIO	0.726	0.888	0.802	0.922	0.699	0.855	0.793	0.696	0.952	0.430
METEOROLOGICAL SITE	DIR (DEG)	190	10	70	290	200	260	250	280	350	60
BRADLEY	VEL (MPH)	5.2	1.8	1.0	3.6	5.9	3.5	8.0	2.7	7.5	2.3
	SPD (MPH)	6.5	2.7	2.9	5.5	8.5	7.0	11.9	6.6	7.6	4.3
	RATIO	0.797	0.661	0.338	0.653	0.692	0.499	0.670	0.401	0.985	0.531

TABLE 3-4, CONTINUED

1992 TEN HIGHEST 24-HOUR AVERAGE SO2 DAYS WITH WIND DATA

UNITS : MICROGRAMS PER CUBIC METER

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
METEOROLOGICAL SITE	DIR (DEG)	250	270	60	270	280	300	270	320	350	290
BRIDGEPORT	VEL (MPH)	2.6	.9	1.6	6.1	12.9	7.4	11.4	5.5	6.2	2.7
	SPD (MPH)	4.3	2.4	3.6	6.8	13.1	7.6	12.4	6.3	7.0	3.6
	RATIO	0.594	0.355	0.448	0.905	0.989	0.977	0.926	0.873	0.886	0.765
METEOROLOGICAL SITE	DIR (DEG)	250	310	250	280	250	280	240	290	320	290
WORCESTER	VEL (MPH)	5.3	4.0	8.3	8.0	10.0	7.1	10.9	5.1	5.6	3.7
	SPD (MPH)	5.8	4.5	8.5	8.3	10.1	7.5	10.9	5.8	6.2	5.0
	RATIO	0.923	0.895	0.974	0.961	0.992	0.956	0.996	0.884	0.905	0.733
EAST HAVEN-003 (0350)	SO2	98	84	80	73	71	68	67	66	66	64
	DATE	1/29/92	1/ 1/92	1/30/92	2/13/92	12/22/92	12/28/92	1/20/92	12/15/92	1/17/92	1/28/92
METEOROLOGICAL SITE	DIR (DEG)	250	230	230	190	310	20	290	190	250	60
NEWARK	VEL (MPH)	5.6	3.6	5.6	3.2	4.1	7.7	7.5	4.7	8.8	4.5
	SPD (MPH)	6.0	4.0	7.8	6.6	6.5	7.8	10.8	5.2	12.7	4.9
	RATIO	0.922	0.888	0.726	0.487	0.638	0.991	0.696	0.915	0.699	0.929
METEOROLOGICAL SITE	DIR (DEG)	290	10	190	180	300	350	280	310	200	360
BRADLEY	VEL (MPH)	3.6	1.8	5.2	5.9	3.8	2.8	2.7	1.2	5.9	6.4
	SPD (MPH)	5.5	2.7	6.5	6.8	4.7	3.3	6.6	3.9	8.5	6.6
	RATIO	0.653	0.661	0.797	0.867	0.798	0.843	0.401	0.312	0.692	0.966
METEOROLOGICAL SITE	DIR (DEG)	270	270	250	230	340	60	320	240	280	70
BRIDGEPORT	VEL (MPH)	6.1	.9	2.6	2.8	2.5	4.7	5.5	1.3	12.9	5.3
	SPD (MPH)	6.8	2.4	4.3	4.7	4.2	4.7	6.3	3.5	13.1	6.9
	RATIO	0.905	0.355	0.594	0.593	0.605	0.991	0.873	0.369	0.989	0.766
METEOROLOGICAL SITE	DIR (DEG)	280	310	250	240	270	200	290	290	250	50
WORCESTER	VEL (MPH)	8.0	4.0	5.3	9.0	6.5	3.3	5.1	4.4	10.0	4.5
	SPD (MPH)	8.3	4.5	5.8	9.3	7.3	3.9	5.8	4.7	10.1	4.6
	RATIO	0.961	0.895	0.923	0.963	0.881	0.842	0.884	0.929	0.992	0.981
ENFIELD-005 (0360)	SO2	68	64	51	50	49	49	48	48	47	44
	DATE	1/30/92	1/ 2/92	1/20/92	12/16/92	1/31/92	1/17/92	12/23/92	1/29/92	1/21/92	1/13/92
METEOROLOGICAL SITE	DIR (DEG)	230	30	290	250	320	250	230	250	280	220
NEWARK	VEL (MPH)	5.6	3.1	7.5	5.4	9.7	8.8	4.3	5.6	8.1	3.7
	SPD (MPH)	7.8	3.9	10.8	7.6	10.2	12.7	7.3	6.0	9.5	6.0
	RATIO	0.726	0.802	0.696	0.707	0.952	0.699	0.583	0.922	0.855	0.611
METEOROLOGICAL SITE	DIR (DEG)	190	70	280	190	350	200	190	290	260	210
BRADLEY	VEL (MPH)	5.2	1.0	2.7	6.8	7.5	5.9	3.9	3.6	3.5	3.7
	SPD (MPH)	6.5	2.9	6.6	6.9	7.6	8.5	6.0	5.5	7.0	5.5
	RATIO	0.797	0.338	0.401	0.981	0.985	0.692	0.646	0.653	0.499	0.682
METEOROLOGICAL SITE	DIR (DEG)	250	60	320	250	350	280	250	270	300	230
BRIDGEPORT	VEL (MPH)	2.6	1.6	5.5	6.2	6.2	12.9	3.8	6.1	7.4	4.0
	SPD (MPH)	4.3	3.6	6.3	6.3	7.0	13.1	5.0	6.8	7.6	5.9
	RATIO	0.594	0.448	0.873	0.977	0.886	0.989	0.752	0.905	0.977	0.672
METEOROLOGICAL SITE	DIR (DEG)	250	250	290	240	320	250	260	280	280	250
WORCESTER	VEL (MPH)	5.3	8.3	5.1	11.7	5.6	10.0	7.2	8.0	7.1	5.4
	SPD (MPH)	5.8	8.5	5.8	11.8	6.2	10.1	8.6	8.3	7.5	6.9
	RATIO	0.923	0.974	0.884	0.992	0.905	0.992	0.831	0.961	0.956	0.776

TABLE 3-4, CONTINUED

1992 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 (0312)	SO2	59	58	56	54	52	51	48	42	42	39
	DATE	1/29/92	12/ 1/92	1/20/92	1/31/92	1/28/92	1/30/92	1/17/92	1/ 1/92	10/24/92	1/ 2/92
METEOROLOGICAL SITE	DIR (DEG)	250	320	290	320	60	230	250	230	250	30
NEWARK	VEL (MPH)	5.6	2.7	7.5	9.7	4.5	5.6	8.8	3.6	5.8	3.1
	SPD (MPH)	6.0	6.3	10.8	10.2	4.9	7.8	12.7	4.0	8.6	3.9
	RATIO	0.922	0.430	0.696	0.952	0.929	0.726	0.699	0.888	0.668	0.802
METEOROLOGICAL SITE	DIR (DEG)	290	60	280	350	360	190	200	10	220	70
BRADLEY	VEL (MPH)	3.6	2.3	2.7	7.5	6.4	5.2	5.9	1.8	5.1	1.0
	SPD (MPH)	5.5	4.3	6.6	7.6	6.6	6.5	8.5	2.7	8.1	2.9
	RATIO	0.653	0.531	0.401	0.985	0.966	0.797	0.692	0.661	0.638	0.338
METEOROLOGICAL SITE	DIR (DEG)	270	290	320	350	70	250	280	270	240	60
BRIDGEPORT	VEL (MPH)	6.1	2.7	5.5	6.2	5.3	2.6	12.9	.9	6.8	1.6
	SPD (MPH)	6.8	3.6	6.3	7.0	6.9	4.3	13.1	2.4	6.9	3.6
	RATIO	0.905	0.765	0.873	0.886	0.766	0.594	0.989	0.355	0.987	0.448
METEOROLOGICAL SITE	DIR (DEG)	280	290	290	320	50	250	250	310	250	250
WORCESTER	VEL (MPH)	8.0	3.7	5.1	5.6	4.5	5.3	10.0	4.0	10.3	8.3
	SPD (MPH)	8.3	5.0	5.8	6.2	4.6	5.8	10.1	4.5	10.4	8.5
	RATIO	0.961	0.733	0.884	0.905	0.981	0.923	0.992	0.895	0.998	0.974
GROTON-007 (0362)	SO2	73	66	60	57	57	55	55	54	50	49
	DATE	1/29/92	12/ 1/92	1/30/92	1/21/92	1/17/92	12/19/92	1/20/92	1/ 1/92	1/31/92	1/ 2/92
METEOROLOGICAL SITE	DIR (DEG)	250	320	230	280	250	160	290	230	320	30
NEWARK	VEL (MPH)	5.6	2.7	5.6	8.1	8.8	1.7	7.5	3.6	9.7	3.1
	SPD (MPH)	6.0	6.3	7.8	9.5	12.7	4.3	10.8	4.0	10.2	3.9
	RATIO	0.922	0.430	0.726	0.855	0.699	0.399	0.696	0.888	0.952	0.802
METEOROLOGICAL SITE	DIR (DEG)	290	60	190	260	200	240	280	10	350	70
BRADLEY	VEL (MPH)	3.6	2.3	5.2	3.5	5.9	.7	2.7	1.8	7.5	1.0
	SPD (MPH)	5.5	4.3	6.5	7.0	8.5	3.0	6.6	2.7	7.6	2.9
	RATIO	0.653	0.531	0.797	0.499	0.692	0.223	0.401	0.661	0.985	0.338
METEOROLOGICAL SITE	DIR (DEG)	270	290	250	300	280	170	320	270	350	60
BRIDGEPORT	VEL (MPH)	6.1	2.7	2.6	7.4	12.9	3.1	5.5	.9	6.2	1.6
	SPD (MPH)	6.8	3.6	4.3	7.6	13.1	4.9	6.3	2.4	7.0	3.6
	RATIO	0.905	0.765	0.594	0.977	0.989	0.630	0.873	0.355	0.886	0.448
METEOROLOGICAL SITE	DIR (DEG)	280	290	250	280	250	200	290	310	320	250
WORCESTER	VEL (MPH)	8.0	3.7	5.3	7.1	10.0	6.0	5.1	4.0	5.6	8.3
	SPD (MPH)	8.3	5.0	5.8	7.5	10.1	6.5	5.8	4.5	6.2	8.5
	RATIO	0.961	0.733	0.923	0.956	0.992	0.923	0.884	0.895	0.905	0.974
HARTFORD-018 (0345)	SO2	92	80	69	69	67	66	64	64	62	62
	DATE	1/30/92	1/29/92	12/23/92	1/ 1/92	1/ 2/92	1/31/92	1/21/92	1/ 3/92	1/17/92	1/28/92
METEOROLOGICAL SITE	DIR (DEG)	230	250	230	230	30	320	280	50	250	60
NEWARK	VEL (MPH)	5.6	5.6	4.3	3.6	3.1	9.7	8.1	11.3	8.8	4.5
	SPD (MPH)	7.8	6.0	7.3	4.0	3.9	10.2	9.5	11.6	12.7	4.9
	RATIO	0.726	0.922	0.583	0.888	0.802	0.952	0.855	0.972	0.699	0.929
METEOROLOGICAL SITE	DIR (DEG)	190	290	190	10	70	350	260	10	200	360
BRADLEY	VEL (MPH)	5.2	3.6	3.9	1.8	1.0	7.5	3.5	8.1	5.9	6.4
	SPD (MPH)	6.5	5.5	6.0	2.7	2.9	7.6	7.0	8.2	8.5	6.6
	RATIO	0.797	0.653	0.646	0.661	0.338	0.985	0.499	0.988	0.692	0.966

TABLE 3-4, CONTINUED

1992 TEN HIGHEST 24-HOUR AVERAGE SO2 DAYS WITH WIND DATA

UNITS : MICROGRAMS PER CUBIC METER

TOWN-SITE (SAMPLES)		RANK	1	2	3	4	5	6	7	8	9	10
	METEOROLOGICAL SITE	DIR (DEG)	250	270	250	270	60	350	300	90	280	70
	BRIDGEPORT	VEL (MPH)	2.6	6.1	3.8	.9	1.6	6.2	7.4	11.8	12.9	5.3
		SPD (MPH)	4.3	6.8	5.0	2.4	3.6	7.0	7.6	12.8	13.1	6.9
		RATIO	0.594	0.905	0.752	0.355	0.448	0.886	0.977	0.921	0.989	0.766
	METEOROLOGICAL SITE	DIR (DEG)	250	280	260	310	250	320	280	80	250	50
	WORCESTER	VEL (MPH)	5.3	8.0	7.2	4.0	8.3	5.6	7.1	5.8	10.0	4.5
		SPD (MPH)	5.8	8.3	8.6	4.5	8.5	6.2	7.5	6.0	10.1	4.6
		RATIO	0.923	0.961	0.831	0.895	0.974	0.905	0.956	0.962	0.992	0.981
MANSFIELD-003 (0360)		SO2	49	48	43	43	43	41	39	36	36	35
		DATE	1/21/92	1/17/92	1/30/92	1/29/92	1/20/92	1/ 2/92	2/11/92	12/ 1/92	3/17/92	1/13/92
	METEOROLOGICAL SITE	DIR (DEG)	280	250	230	250	290	30	270	320	260	220
	NEWARK	VEL (MPH)	8.1	8.8	5.6	5.6	7.5	3.1	6.8	2.7	8.8	3.7
		SPD (MPH)	9.5	12.7	7.8	6.0	10.8	3.9	10.1	6.3	11.1	6.0
		RATIO	0.855	0.699	0.726	0.922	0.696	0.802	0.671	0.430	0.793	0.611
	METEOROLOGICAL SITE	DIR (DEG)	260	200	190	290	280	70	250	60	250	210
	BRADLEY	VEL (MPH)	3.5	5.9	5.2	3.6	2.7	1.0	7.5	2.3	8.0	3.7
		SPD (MPH)	7.0	8.5	6.5	5.5	6.6	2.9	11.9	4.3	11.9	5.5
		RATIO	0.499	0.692	0.797	0.653	0.401	0.338	0.633	0.531	0.670	0.682
	METEOROLOGICAL SITE	DIR (DEG)	300	280	250	270	320	60	290	290	270	230
	BRIDGEPORT	VEL (MPH)	7.4	12.9	2.6	6.1	5.5	1.6	6.3	2.7	11.4	4.0
		SPD (MPH)	7.6	13.1	4.3	6.8	6.3	3.6	8.6	3.6	12.4	5.9
		RATIO	0.977	0.989	0.594	0.905	0.873	0.448	0.735	0.765	0.926	0.672
	METEOROLOGICAL SITE	DIR (DEG)	280	250	250	280	290	250	250	290	240	250
	WORCESTER	VEL (MPH)	7.1	10.0	5.3	8.0	5.1	8.3	11.5	3.7	10.9	5.4
		SPD (MPH)	7.5	10.1	5.8	8.3	5.8	8.5	11.6	5.0	10.9	6.9
		RATIO	0.956	0.992	0.923	0.961	0.884	0.974	0.983	0.733	0.996	0.776
NEW HAVEN-123 (0351)		SO2	137	136	135	127	125	111	111	107	103	96
		DATE	1/29/92	1/ 1/92	12/22/92	1/ 2/92	1/30/92	12/23/92	1/31/92	1/20/92	2/13/92	1/27/92
	METEOROLOGICAL SITE	DIR (DEG)	250	230	310	30	230	230	320	290	190	210
	NEWARK	VEL (MPH)	5.6	3.6	4.1	3.1	5.6	4.3	9.7	7.5	3.2	4.7
		SPD (MPH)	6.0	4.0	6.5	3.9	7.8	7.3	10.2	10.8	6.6	6.2
		RATIO	0.922	0.888	0.638	0.802	0.726	0.583	0.952	0.696	0.487	0.764
	METEOROLOGICAL SITE	DIR (DEG)	290	10	300	70	190	190	350	280	180	180
	BRADLEY	VEL (MPH)	3.6	1.8	3.8	1.0	5.2	3.9	7.5	2.7	5.9	3.1
		SPD (MPH)	5.5	2.7	4.7	2.9	6.5	6.0	7.6	6.6	6.8	5.9
		RATIO	0.653	0.661	0.798	0.338	0.797	0.646	0.985	0.401	0.867	0.520
	METEOROLOGICAL SITE	DIR (DEG)	270	270	340	60	250	250	350	320	230	240
	BRIDGEPORT	VEL (MPH)	6.1	.9	2.5	1.6	2.6	3.8	6.2	5.5	2.8	2.6
		SPD (MPH)	6.8	2.4	4.2	3.6	4.3	5.0	7.0	6.3	4.7	5.3
		RATIO	0.905	0.355	0.605	0.448	0.594	0.752	0.886	0.873	0.593	0.487
	METEOROLOGICAL SITE	DIR (DEG)	280	310	270	250	250	260	320	290	240	240
	WORCESTER	VEL (MPH)	8.0	4.0	6.5	8.3	5.3	7.2	5.6	5.1	9.0	4.8
		SPD (MPH)	8.3	4.5	7.3	8.5	5.8	8.6	6.2	5.8	9.3	5.8
		RATIO	0.961	0.895	0.881	0.974	0.923	0.831	0.905	0.884	0.963	0.829

TABLE 3–4, CONTINUED

1992 TEN HIGHEST 24–HOUR AVERAGE SO2 DAYS WITH WIND DATA

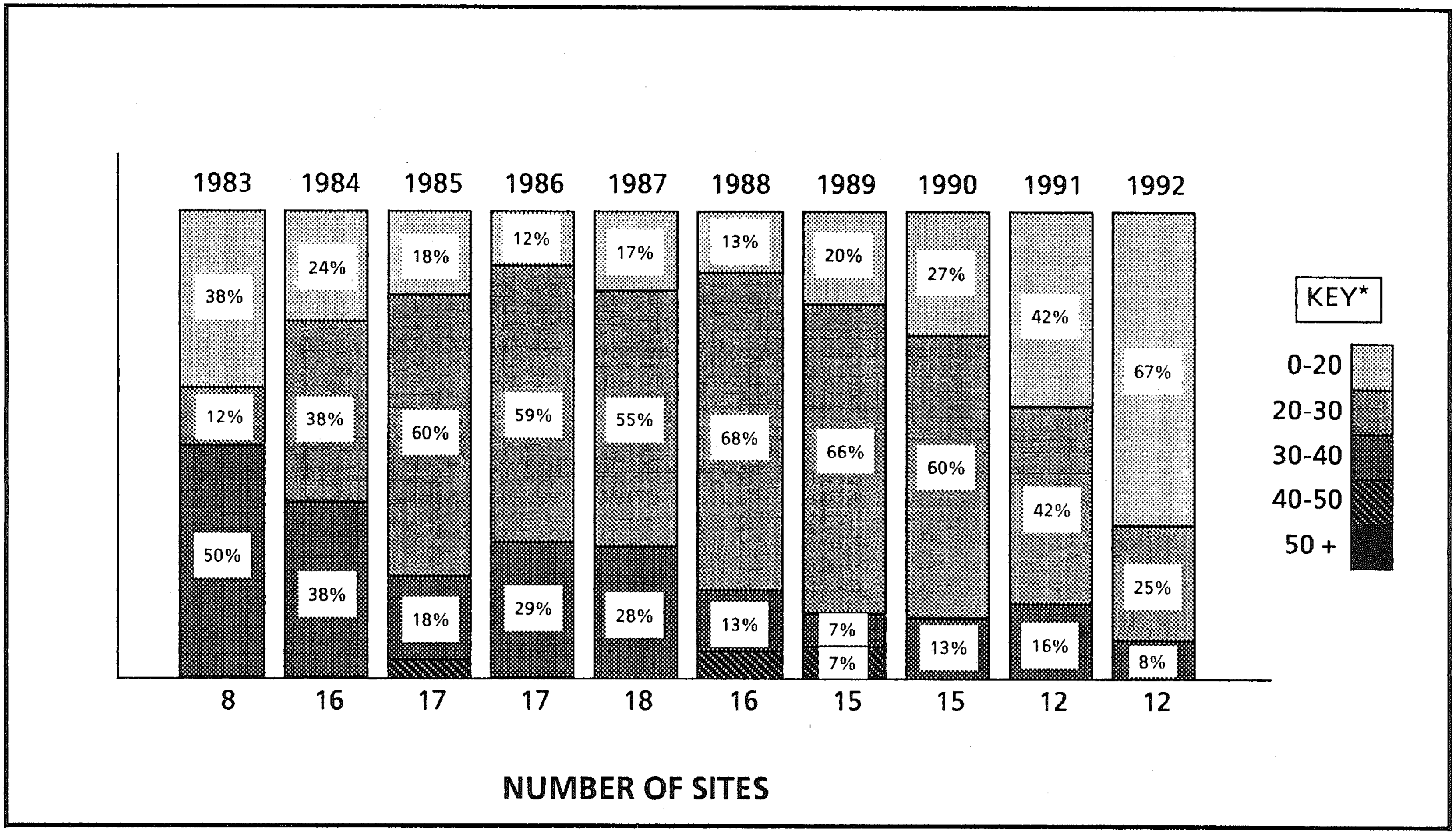
UNITS : MICROGRAMS PER CUBIC METER

TOWN–SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
STAMFORD–123 (0366)	SO2	109	107	104	91	89	89	89	88	86	83
	DATE	12/15/92	1/30/92	1/29/92	12/22/92	1/31/92	1/ 1/92	12/23/92	1/20/92	12/ 1/92	3/ 5/92
METEOROLOGICAL SITE	DIR (DEG)	190	230	250	310	320	230	230	290	320	230
NEWARK	VEL (MPH)	4.7	5.6	5.6	4.1	9.7	3.6	4.3	7.5	2.7	7.2
	SPD (MPH)	5.2	7.8	6.0	6.5	10.2	4.0	7.3	10.8	6.3	8.5
	RATIO	0.915	0.726	0.922	0.638	0.952	0.888	0.583	0.696	0.430	0.843
METEOROLOGICAL SITE	DIR (DEG)	310	190	290	300	350	10	190	280	60	210
BRADLEY	VEL (MPH)	1.2	5.2	3.6	3.8	7.5	1.8	3.9	2.7	2.3	1.7
	SPD (MPH)	3.9	6.5	5.5	4.7	7.6	2.7	6.0	6.6	4.3	5.3
	RATIO	0.312	0.797	0.653	0.798	0.985	0.661	0.646	0.401	0.531	0.315
METEOROLOGICAL SITE	DIR (DEG)	240	250	270	340	350	270	250	320	290	260
BRIDGEPORT	VEL (MPH)	1.3	2.6	6.1	2.5	6.2	.9	3.8	5.5	2.7	5.1
	SPD (MPH)	3.5	4.3	6.8	4.2	7.0	2.4	5.0	6.3	3.6	6.0
	RATIO	0.369	0.594	0.905	0.605	0.886	0.355	0.752	0.873	0.765	0.836
METEOROLOGICAL SITE	DIR (DEG)	290	250	280	270	320	310	260	290	290	280
WORCESTER	VEL (MPH)	4.4	5.3	8.0	6.5	5.6	4.0	7.2	5.1	3.7	7.4
	SPD (MPH)	4.7	5.8	8.3	7.3	6.2	4.5	8.6	5.8	5.0	7.8
	RATIO	0.929	0.923	0.961	0.881	0.905	0.895	0.831	0.884	0.733	0.951
WATERBURY–123 (0351)	SO2	97	76	74	73	73	72	67	66	64	64
	DATE	1/30/92	12/15/92	1/29/92	1/ 2/92	12/22/92	1/17/92	1/21/92	2/13/92	12/16/92	1/20/92
METEOROLOGICAL SITE	DIR (DEG)	230	190	250	30	310	250	280	190	250	290
NEWARK	VEL (MPH)	5.6	4.7	5.6	3.1	4.1	8.8	8.1	3.2	5.4	7.5
	SPD (MPH)	7.8	5.2	6.0	3.9	6.5	12.7	9.5	6.6	7.6	10.8
	RATIO	0.726	0.915	0.922	0.802	0.638	0.699	0.855	0.487	0.707	0.696
METEOROLOGICAL SITE	DIR (DEG)	190	310	290	70	300	200	260	180	190	280
BRADLEY	VEL (MPH)	5.2	1.2	3.6	1.0	3.8	5.9	3.5	5.9	6.8	2.7
	SPD (MPH)	6.5	3.9	5.5	2.9	4.7	8.5	7.0	6.8	6.9	6.6
	RATIO	0.797	0.312	0.653	0.338	0.798	0.692	0.499	0.867	0.981	0.401
METEOROLOGICAL SITE	DIR (DEG)	250	240	270	60	340	280	300	230	250	320
BRIDGEPORT	VEL (MPH)	2.6	1.3	6.1	1.6	2.5	12.9	7.4	2.8	6.2	5.5
	SPD (MPH)	4.3	3.5	6.8	3.6	4.2	13.1	7.6	4.7	6.3	6.3
	RATIO	0.594	0.369	0.905	0.448	0.605	0.989	0.977	0.593	0.977	0.873
METEOROLOGICAL SITE	DIR (DEG)	250	290	280	250	270	250	280	240	240	290
WORCESTER	VEL (MPH)	5.3	4.4	8.0	8.3	6.5	10.0	7.1	9.0	11.7	5.1
	SPD (MPH)	5.8	4.7	8.3	8.5	7.3	10.1	7.5	9.3	11.8	5.8
	RATIO	0.923	0.929	0.961	0.974	0.881	0.992	0.956	0.963	0.992	0.884

FIGURE 3-4

SULFUR DIOXIDE TREND FROM CONTINUOUS DATA

"PERCENT OF SITES WITHIN EACH RANGE"



PRIMARY ANNUAL STANDARD = 80 μg/m³

* ANNUAL ARITHMETIC MEAN (μg/m³)

TABLE 3-5

SO2 TRENDS FROM CONTINUOUS DATA: 1983-1992

(PAIRED *t* TEST)

PAIRED YEARS	AVERAGE OF ANNUAL GEOMETRIC MEANS (µg/m3)	NO. OF SITES	DIFFERENCES OF THE PAIRED YEAR MEANS		SIGNIFICANCE LEVEL		
					TREND AT		PROBABILITY THAT CHANGE IS NOT SIGNIFICANT
			AVG.	STD. DEV.	95% LEVEL	99% LEVEL	
83 84	18.1 18.2	8 8	0.11	3.20	N.C.	N.C.	0.9237
84 85	16.4 16.5	15 15	0.04	3.51	N.C.	N.C.	0.9654
85 86	14.6 15.5	16 16	0.86	3.76	N.C.	N.C.	0.3772
86 87	15.6 16.1	16 16	0.47	2.65	N.C.	N.C.	0.4899
87 88	16.5 16.4	15 15	-0.13	3.06	N.C.	N.C.	0.8784
88 89	15.8 16.3	14 14	0.51	1.51	N.C.	N.C.	0.2245
89 90	16.7 14.7	14 14	-2.03	2.01	↓	↓	0.0023
90 91	14.9 15.7	12 12	0.77	0.63	N.C.	N.C.	0.2486
91 92	15.8 13.5	12 12	-2.25	1.96	↓	↓	0.0034

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

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 1992. Levels in excess of the one-hour NAAQS of 0.12 ppm were recorded at five of the eleven ozone monitoring sites. The highest concentration was 0.145 ppm, which occurred at the Danbury 123 site.

The incidence of hourly ozone concentrations in excess of the 1-hour 0.12 ppm standard was significantly lower in 1992 than in 1991 (see Table 4-1). There was a total of 19 hourly exceedances in 1992 and 198 hourly exceedances in 1991 at the eleven monitoring sites. This represents a decrease in the frequency of such exceedances from 4.1 per 1000 sampling hours in 1991 to 0.4 per 1000 sampling hours in 1992: a 90% decrease. The actual number of hours when the ozone standard was exceeded in the state decreased markedly from 84 in 1991 to 17 in 1992.

The number of site-days on which the ozone monitors experienced ozone levels in excess of the 1-hour standard decreased from 79 in 1991 to 11 in 1992 at the eleven monitoring sites (see Table 4-2). This represents a decrease in the frequency of such occurrences from 3.8 per 100 sampling days in 1991 to 0.5 per 100 sampling days in 1992: an 87% decrease. The actual number of days on which the ozone standard was exceeded in the state decreased from 24 in 1991 to 8 in 1992.

The yearly changes in ozone concentrations can be attributed primarily to year-to-year variations in regional weather conditions, especially wind direction, temperature and the amount of sunlight. A large portion of the peak ozone concentrations in Connecticut is caused by the transport of ozone and/or precursors (i.e., hydrocarbons and nitrogen oxides) from the New York City area and other points to the west and southwest. Therefore, a decrease in the frequency of winds out of the southwest would help to explain the decrease in the number of ozone exceedances from 1991 to 1992. The percentage of southwest winds during the "ozone season" was decreased from 36% in 1991 to 31% in 1992, as is shown by the wind roses from Newark (Figures 4-1 and 4-2). The magnitude of high ozone levels can be partly associated with yearly variations in temperature, since ozone production is greatest at high temperatures and in strong sunlight. The summer season's daily high temperatures were significantly lower in 1992 than in 1991. This is demonstrated by the number of days exceeding 90° F which decreased from seventeen in 1991 to one in 1992 at Sikorsky Airport in Bridgeport, and from thirty-one in 1991 to seven in 1992 at Bradley International Airport. The incidence of high ozone levels is dependent on the percentage of possible sunshine, since sunlight is essential to the creation of ozone. According to National Weather Service local climatological data recorded at Bradley Airport, the percentage of sunshine decreased from 59% in 1991 to 49% in 1992 for the months April through October. The average for these summer months at Bradley is usually 60%. Of the meteorological parameters discussed above, all three can be seen as contributing to the decrease in ozone levels from 1991 to 1992.

The meteorological influences notwithstanding, additional and important factors contributing to the decrease in ozone concentrations in 1992 are the continuing efforts of the EPA and the state Department of Environmental Protection to control the emissions of nitrogen oxides and hydrocarbons. Newer automobiles continue to be less polluting and the use of lower vapor pressure gasoline in the summer months, which was initiated in 1989, is a major effective control strategy.

METHOD OF MEASUREMENT

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

DISCUSSION OF DATA

Monitoring Network - In order to gather information which will further the understanding of ozone production and transport, and to provide real-time data for the daily Pollutant Standards Index, DEP operated a state-wide ozone monitoring network consisting of four types of sites in 1992 (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 258 precision checks during 1992. The resulting 95% probability limits were -6% to +3%. Accuracy is determined by introducing a known amount of ozone into each of the monitors. Three different concentration levels are tested: low, medium, and high. The 95% probability limits, based on 11 audits conducted on the monitoring system, were: low, -2% to + 10%; medium, -3% to + 5%; and high, -3% to + 4%.

1-Hour Average - The 1-hour ozone standard was exceeded at only five of the eleven DEP monitoring sites in 1992. Furthermore, all eleven sites had maximum concentrations that were lower in 1992 than in 1991. All eleven sites also had lower second high concentrations.

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 1992. 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., 69%) of the tabulated high ozone levels occurred on days with winds out of the southwest. This is due to the special features of a southwest wind blowing over Connecticut. The first feature is that, during the summer, southwest winds are usually accompanied by high temperatures and bright sunshine, which are important to the production of ozone. The second feature of a southwest wind is that it will transport precursor emissions from New York City and other urban areas to the southwest of Connecticut. It is the combination of these factors that often produces unhealthful ozone levels in Connecticut.

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

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

Figure 4-5 shows the unweighted average of the annual means of the maximum daily concentrations at ten ozone sites from 1983 to 1992. There is a lot of variation in the statistic from one year to the next. The importance of meteorology in the formation of ozone explains much of this variation. However, unless the effect of meteorology can be factored out, one cannot judge the effect of emission control measures on ozone production. A regression line through the data in Figure 4-5 would trend down, but the reason for this would not be evident.

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

TABLE 4-1

NUMBER OF HOURS WHEN THE 1-HOUR OZONE STANDARD WAS EXCEEDED IN 1992

SITE	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	THIS YEAR	LAST YEAR
Bridgeport 013	0	0	0	0	0	0	0	0	11
Danbury 123	0	2	0	0	0	0	0	2	10
E. Hartford 003	0	0	0	0	0	0	0	0	9
Greenwich 017	0	0	0	0	0	0	0	0	20
Groton 008	0	0	1	0	0	0	0	1	19
Madison 002	0	0	0	0	0	0	0	0	43
Middletown 007	0	1	2	2	1	0	0	6	29
New Haven 123	0	0	0	0	0	0	0	0	16
Stafford 001	0	0	5	0	0	0	0	5	8
Stratford 007	0	0	2	0	3	0	0	5	30
Torrington 006	0	0	0	0	0	0	0	0	3
TOTAL SITE HOURS	0	3	10	2	4	0	0	19	198

TABLE 4-2

NUMBER OF DAYS WHEN THE 1-HOUR OZONE STANDARD WAS EXCEEDED IN 1992

SITE	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	THIS YEAR	LAST YEAR
Bridgeport 013	0	0	0	0	0	0	0	0	6
Danbury 123	0	1	0	0	0	0	0	1	6
E. Hartford 003	0	0	0	0	0	0	0	0	4
Greenwich 017	0	0	0	0	0	0	0	0	9
Groton 008	0	0	1	0	0	0	0	1	8
Madison 002	0	0	0	0	0	0	0	0	17
Middletown 007	0	1	1	1	1	0	0	4	8
New Haven 123	0	0	0	0	0	0	0	0	7
Stafford 001	0	0	2	0	0	0	0	2	2
Stratford 007	0	0	1	0	2	0	0	3	10
Torrington 006	0	0	0	0	0	0	0	0	2
TOTAL SITE DAYS	0	2	5	1	3	0	0	11	79

[a] The Torrington 006 monitoring site did not exist in 1990.

FIGURE 4-1

WIND ROSE FOR APRIL - OCTOBER 1991
NEWARK INTERNATIONAL AIRPORT
NEWARK, NEW JERSEY

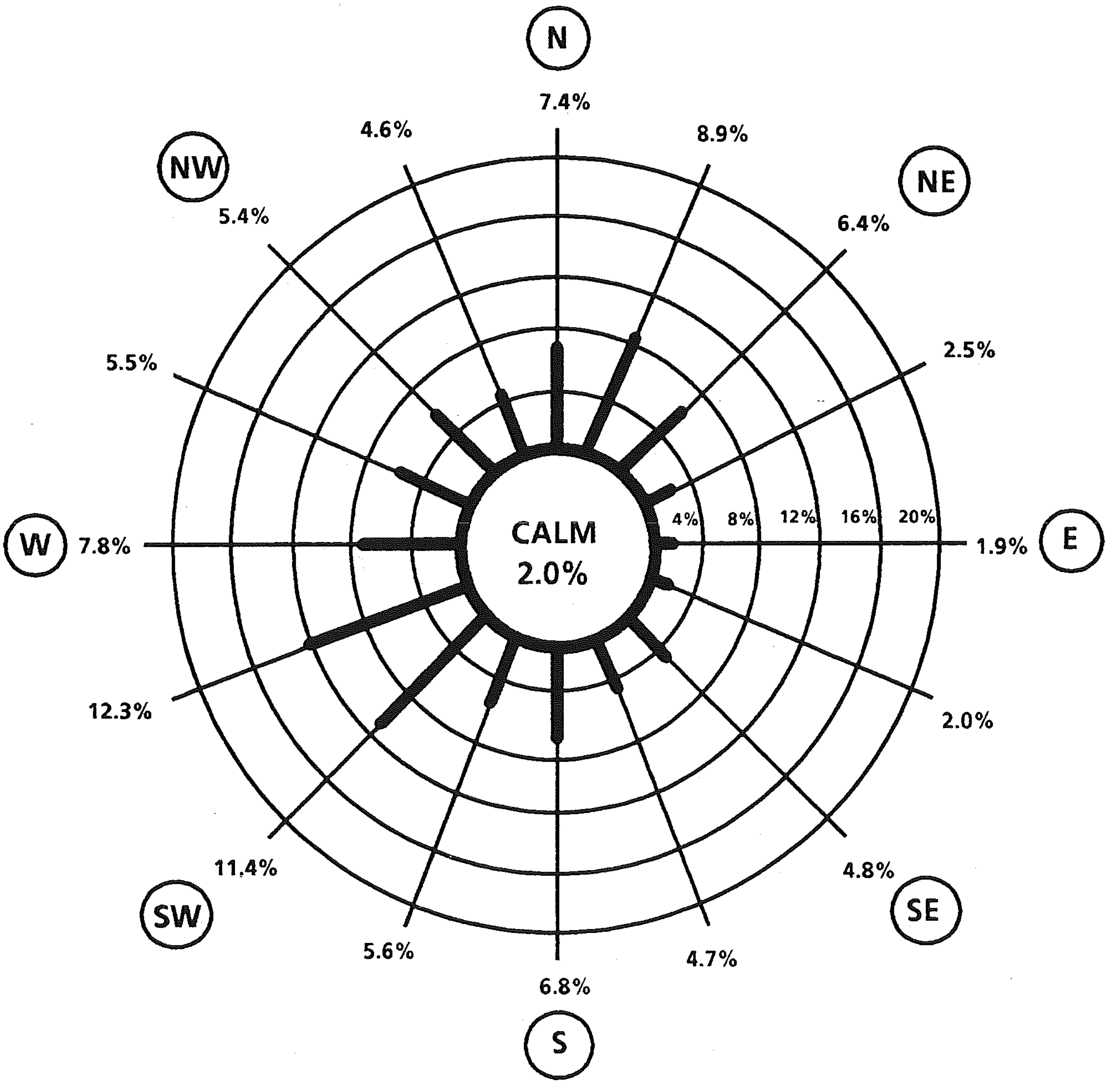
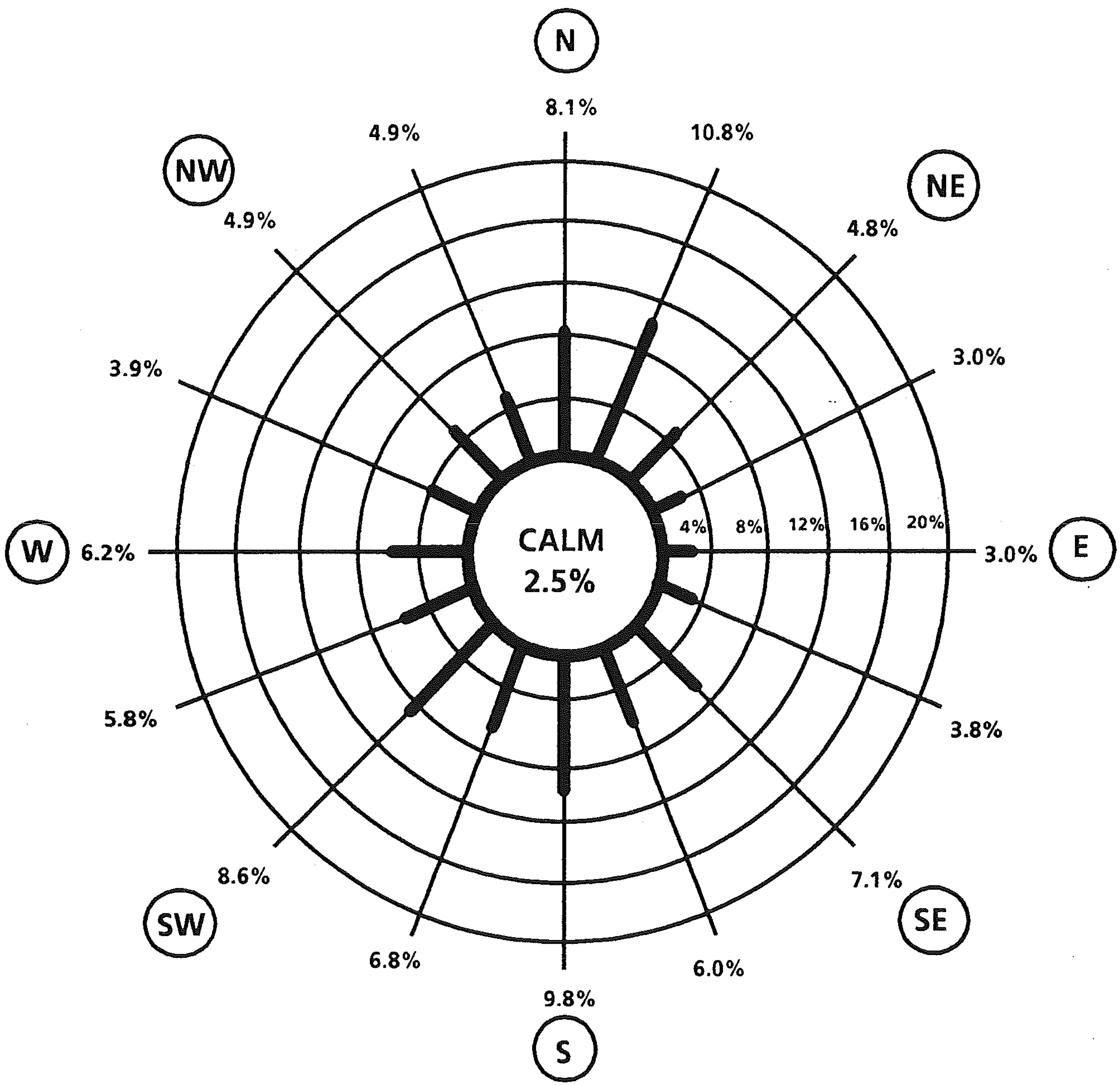


FIGURE 4-2

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



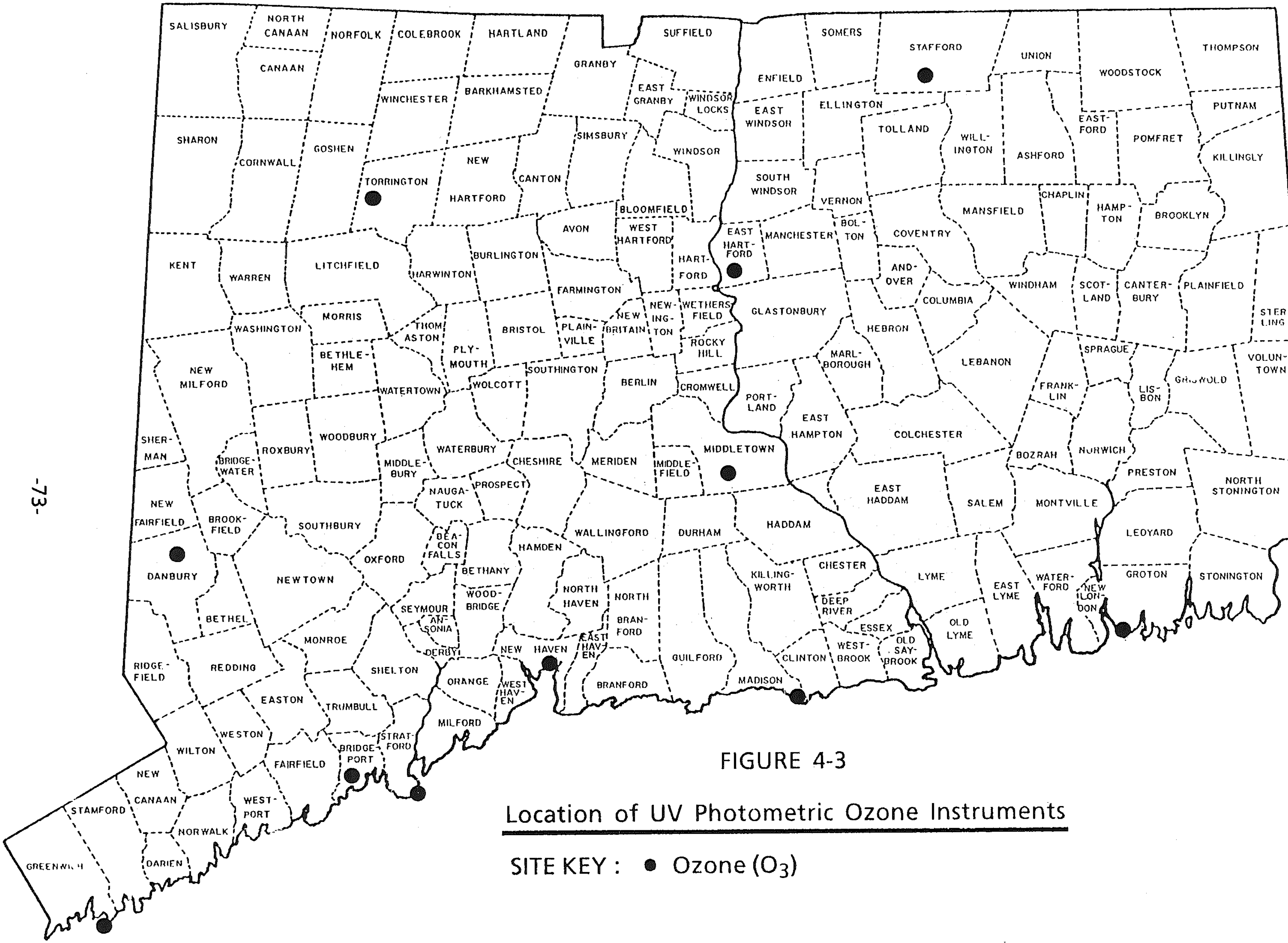


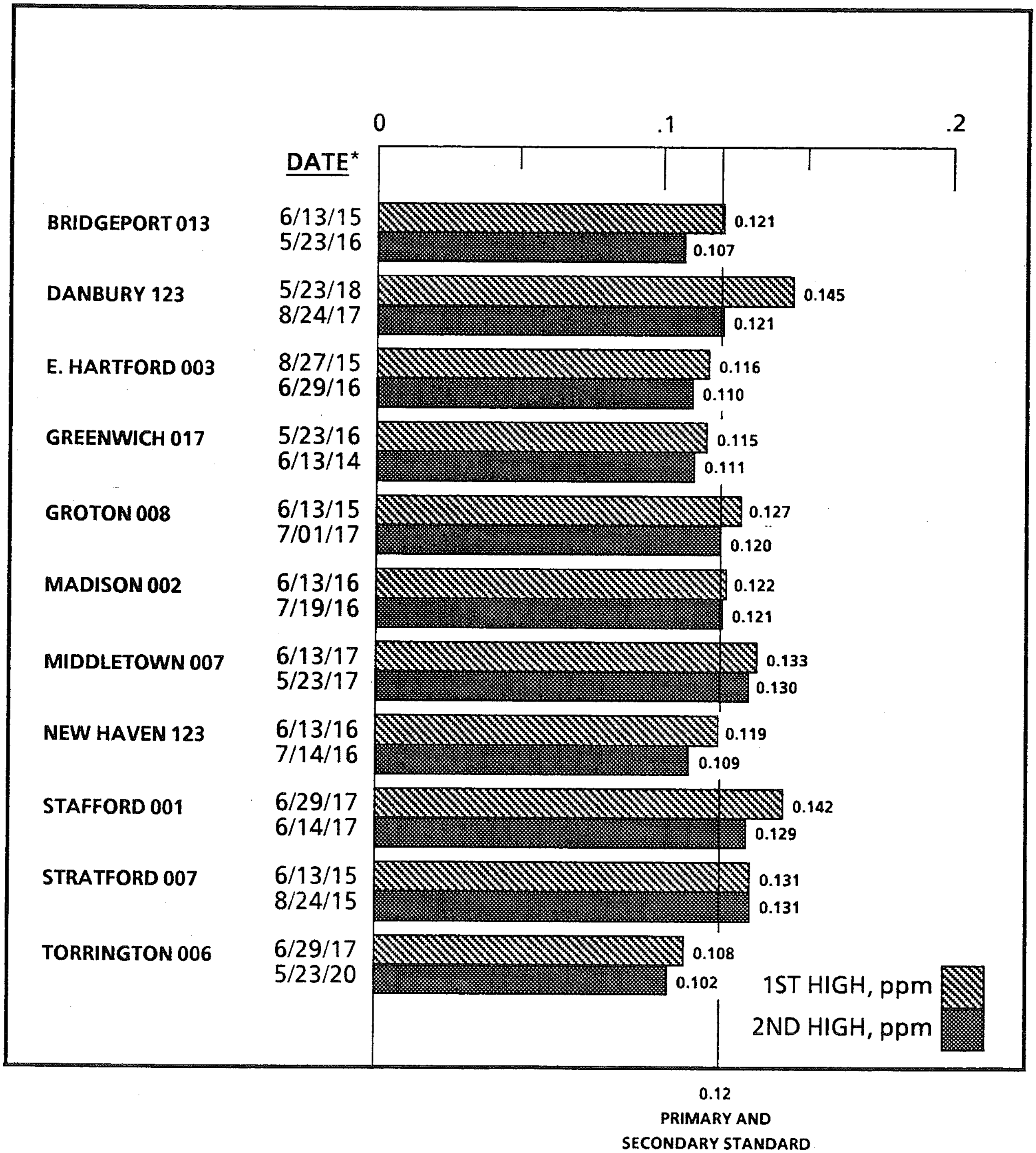
FIGURE 4-3

Location of UV Photometric Ozone Instruments

SITE KEY : ● Ozone (O_3)

FIGURE 4-4

1ST AND 2ND HIGH 1-HOUR OZONE CONCENTRATIONS IN 1992



* 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

1992 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 (4737)	OZONE	.121	.107	.098	.097	.095	.093	.093	.084	.083	.079
	DATE	6/13/92	5/23/92	8/24/92	8/25/92	7/19/92	6/14/92	8/27/92	7/29/92	6/29/92	8/19/92
METEOROLOGICAL SITE	DIR (DEG)	220	140	180	270	210	220	130	240	200	290
NEWARK	VEL (MPH)	8.8	2.9	4.9	5.5	5.8	6.6	4.4	7.9	5.6	5.2
	SPD (MPH)	11.5	5.6	6.3	6.8	7.9	9.5	4.6	9.1	8.6	8.9
	RATIO	0.768	0.511	0.770	0.807	0.730	0.696	0.949	0.874	0.646	0.585
METEOROLOGICAL SITE	DIR (DEG)	210	230	200	270	200	180	210	190	200	240
BRADLEY	VEL (MPH)	8.1	3.9	5.5	2.1	2.9	7.7	4.7	5.9	4.7	4.0
	SPD (MPH)	10.9	6.6	7.6	6.0	7.8	10.1	7.3	8.1	6.8	8.5
	RATIO	0.741	0.593	0.716	0.350	0.376	0.760	0.638	0.730	0.701	0.477
METEOROLOGICAL SITE	DIR (DEG)	240	250	250	250	260	240	170	240	220	280
BRIDGEPORT	VEL (MPH)	6.4	3.9	4.7	4.3	3.9	5.5	2.5	7.1	3.3	5.3
	SPD (MPH)	6.8	4.0	5.3	4.5	4.0	6.0	4.2	7.3	3.5	7.2
	RATIO	0.954	0.961	0.882	0.960	0.963	0.904	0.608	0.973	0.950	0.738
METEOROLOGICAL SITE	DIR (DEG)	260	280	250	290	240	240	210	260	250	280
WORCESTER	VEL (MPH)	8.8	6.6	7.0	4.6	5.7	7.9	4.7	8.2	6.0	7.8
	SPD (MPH)	9.1	7.0	7.0	4.9	6.3	8.2	4.9	8.6	6.6	8.8
	RATIO	0.968	0.944	0.988	0.936	0.899	0.969	0.966	0.950	0.900	0.887
DANBURY-123 (4608)	OZONE	.145	.121	.102	.098	.094	.094	.093	.091	.088	.087
	DATE	5/23/92	8/24/92	8/ 2/92	6/14/92	6/29/92	6/13/92	7/20/92	6/17/92	8/ 1/92	8/ 7/92
METEOROLOGICAL SITE	DIR (DEG)	140	180	220	220	200	220	180	180	310	130
NEWARK	VEL (MPH)	2.9	4.9	6.1	6.6	5.6	8.8	6.5	6.3	12.4	4.8
	SPD (MPH)	5.6	6.3	7.5	9.5	8.6	11.5	7.9	9.1	13.7	7.0
	RATIO	0.511	0.770	0.820	0.696	0.646	0.768	0.816	0.695	0.905	0.684
METEOROLOGICAL SITE	DIR (DEG)	230	200	200	180	200	210	210	190	310	150
BRADLEY	VEL (MPH)	3.9	5.5	7.7	7.7	4.7	8.1	6.0	3.9	10.7	2.8
	SPD (MPH)	6.6	7.6	9.2	10.1	6.8	10.9	7.0	7.0	11.8	6.5
	RATIO	0.593	0.716	0.834	0.760	0.701	0.741	0.848	0.556	0.906	0.426
METEOROLOGICAL SITE	DIR (DEG)	250	250	240	240	220	240	210	210	330	140
BRIDGEPORT	VEL (MPH)	3.9	4.7	5.7	5.5	3.3	6.4	3.0	3.3	8.4	4.3
	SPD (MPH)	4.0	5.3	5.8	6.0	3.5	6.8	3.9	3.6	8.9	5.0
	RATIO	0.961	0.882	0.992	0.904	0.950	0.954	0.764	0.911	0.937	0.859
METEOROLOGICAL SITE	DIR (DEG)	280	250	240	240	250	260	260	170	300	230
WORCESTER	VEL (MPH)	6.6	7.0	7.6	7.9	6.0	8.8	6.5	2.2	10.1	3.6
	SPD (MPH)	7.0	7.0	7.9	8.2	6.6	9.1	7.2	4.3	10.4	4.9
	RATIO	0.944	0.988	0.956	0.969	0.900	0.968	0.904	0.520	0.977	0.731
EAST HARTFORD-003 (4323)	OZONE	.116	.110	.109	.102	.098	.098	.098	.095	.094	.090
	DATE	8/27/92	6/29/92	8/24/92	5/23/92	8/11/92	7/20/92	9/15/92	7/14/92	8/25/92	6/17/92
METEOROLOGICAL SITE	DIR (DEG)	130	200	180	140	250	180	220	240	270	180
NEWARK	VEL (MPH)	4.4	5.6	4.9	2.9	8.0	6.5	3.7	8.6	5.5	6.3
	SPD (MPH)	4.6	8.6	6.3	5.6	9.2	7.9	6.6	9.8	6.8	9.1
	RATIO	0.949	0.646	0.770	0.511	0.865	0.816	0.564	0.882	0.807	0.695
METEOROLOGICAL SITE	DIR (DEG)	210	200	200	230	250	210	210	200	270	190
BRADLEY	VEL (MPH)	4.7	4.7	5.5	3.9	4.3	6.0	6.0	3.6	2.1	3.9
	SPD (MPH)	7.3	6.8	7.6	6.6	9.3	7.0	7.9	7.5	6.0	7.0
	RATIO	0.638	0.701	0.716	0.593	0.456	0.848	0.758	0.477	0.350	0.556

TABLE 4-3, CONTINUED

1992 TEN HIGHEST 1-HOUR AVERAGE OZONE DAYS WITH WIND DATA

UNITS : PARTS PER MILLION

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
METEOROLOGICAL SITE	DIR (DEG)	170	220	250	250	270	210	240	250	250	210
BRIDGEPORT	VEL (MPH)	2.5	3.3	4.7	3.9	4.8	3.0	4.7	3.8	4.3	3.3
	SPD (MPH)	4.2	3.5	5.3	4.0	7.6	3.9	5.9	4.6	4.5	3.6
	RATIO	0.608	0.950	0.882	0.961	0.636	0.764	0.798	0.823	0.960	0.911
METEOROLOGICAL SITE	DIR (DEG)	210	250	250	280	260	260	250	230	290	170
WORCESTER	VEL (MPH)	4.7	6.0	7.0	6.6	7.9	6.5	7.9	4.8	4.6	2.2
	SPD (MPH)	4.9	6.6	7.0	7.0	8.5	7.2	8.1	6.6	4.9	4.3
	RATIO	0.966	0.900	0.988	0.944	0.926	0.904	0.980	0.730	0.936	0.520
GREENWICH-017 (4225)	OZONE	.115	.111	.111	.108	.102	.101	.099	.097	.096	.095
	DATE	5/23/92	6/13/92	6/29/92	7/ 1/92	7/29/92	8/ 7/92	5/22/92	7/20/92	6/14/92	6/17/92
METEOROLOGICAL SITE	DIR (DEG)	140	220	200	10	240	130	80	180	220	180
NEWARK	VEL (MPH)	2.9	8.8	5.6	4.1	7.9	4.8	.6	6.5	6.6	6.3
	SPD (MPH)	5.6	11.5	8.6	7.0	9.1	7.0	5.3	7.9	9.5	9.1
	RATIO	0.511	0.768	0.646	0.579	0.874	0.684	0.115	0.816	0.696	0.695
METEOROLOGICAL SITE	DIR (DEG)	230	210	200	330	190	150	270	210	180	190
BRADLEY	VEL (MPH)	3.9	8.1	4.7	6.3	5.9	2.8	2.8	6.0	7.7	3.9
	SPD (MPH)	6.6	10.9	6.8	7.3	8.1	6.5	5.0	7.0	10.1	7.0
	RATIO	0.593	0.741	0.701	0.853	0.730	0.426	0.547	0.848	0.760	0.556
METEOROLOGICAL SITE	DIR (DEG)	250	240	220	290	240	140	250	210	240	210
BRIDGEPORT	VEL (MPH)	3.9	6.4	3.3	1.7	7.1	4.3	3.0	3.0	5.5	3.3
	SPD (MPH)	4.0	6.8	3.5	3.5	7.3	5.0	3.7	3.9	6.0	3.6
	RATIO	0.961	0.954	0.950	0.487	0.973	0.859	0.792	0.764	0.904	0.911
METEOROLOGICAL SITE	DIR (DEG)	280	260	250	290	260	230	300	260	240	170
WORCESTER	VEL (MPH)	6.6	8.8	6.0	5.1	8.2	3.6	5.4	6.5	7.9	2.2
	SPD (MPH)	7.0	9.1	6.6	6.0	8.6	4.9	5.6	7.2	8.2	4.3
	RATIO	0.944	0.968	0.900	0.850	0.950	0.731	0.970	0.904	0.969	0.520
GROTON-008 (4891)	OZONE	.127	.120	.116	.114	.111	.102	.101	.100	.097	.097
	DATE	6/13/92	7/ 1/92	7/ 9/92	8/25/92	5/23/92	5/24/92	7/14/92	5/22/92	7/29/92	8/24/92
METEOROLOGICAL SITE	DIR (DEG)	220	10	270	270	140	20	240	80	240	180
NEWARK	VEL (MPH)	8.8	4.1	9.7	5.5	2.9	11.9	8.6	.6	7.9	4.9
	SPD (MPH)	11.5	7.0	12.4	6.8	5.6	12.1	9.8	5.3	9.1	6.3
	RATIO	0.768	0.579	0.784	0.807	0.511	0.988	0.882	0.115	0.874	0.770
METEOROLOGICAL SITE	DIR (DEG)	210	330	270	270	230	10	200	270	190	200
BRADLEY	VEL (MPH)	8.1	6.3	4.9	2.1	3.9	11.2	3.6	2.8	5.9	5.5
	SPD (MPH)	10.9	7.3	9.2	6.0	6.6	11.4	7.5	5.0	8.1	7.6
	RATIO	0.741	0.853	0.533	0.350	0.593	0.990	0.477	0.547	0.730	0.716
METEOROLOGICAL SITE	DIR (DEG)	240	290	260	250	250	40	250	250	240	250
BRIDGEPORT	VEL (MPH)	6.4	1.7	4.8	4.3	3.9	6.6	3.8	3.0	7.1	4.7
	SPD (MPH)	6.8	3.5	4.9	4.5	4.0	6.8	4.6	3.7	7.3	5.3
	RATIO	0.954	0.487	0.987	0.960	0.961	0.980	0.823	0.792	0.973	0.882
METEOROLOGICAL SITE	DIR (DEG)	260	290	260	290	280	30	230	300	260	250
WORCESTER	VEL (MPH)	8.8	5.1	9.6	4.6	6.6	6.9	4.8	5.4	8.2	7.0
	SPD (MPH)	9.1	6.0	10.6	4.9	7.0	7.2	6.6	5.6	8.6	7.0
	RATIO	0.968	0.850	0.905	0.936	0.944	0.965	0.730	0.970	0.950	0.988

TABLE 4-3, CONTINUED

1992 TEN HIGHEST 1-HOUR AVERAGE OZONE DAYS WITH WIND DATA

UNITS : PARTS PER MILLION

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
MADISON-002 (4882)	OZONE	.122	.121	.120	.118	.118	.117	.114	.110	.109	.108
	DATE	6/13/92	7/19/92	8/11/92	8/24/92	7/ 1/92	8/26/92	8/25/92	5/24/92	7/29/92	5/23/92
METEOROLOGICAL SITE	DIR (DEG)	220	210	250	180	10	240	270	20	240	140
NEWARK	VEL (MPH)	8.8	5.8	8.0	4.9	4.1	.7	5.5	11.9	7.9	2.9
	SPD (MPH)	11.5	7.9	9.2	6.3	7.0	5.9	6.8	12.1	9.1	5.6
	RATIO	0.768	0.730	0.865	0.770	0.579	0.126	0.807	0.988	0.874	0.511
METEOROLOGICAL SITE	DIR (DEG)	210	200	250	200	330	240	270	10	190	230
BRADLEY	VEL (MPH)	8.1	2.9	4.3	5.5	6.3	2.0	2.1	11.2	5.9	3.9
	SPD (MPH)	10.9	7.8	9.3	7.6	7.3	6.2	6.0	11.4	8.1	6.6
	RATIO	0.741	0.376	0.456	0.716	0.853	0.325	0.350	0.990	0.730	0.593
METEOROLOGICAL SITE	DIR (DEG)	240	260	270	250	290	190	250	40	240	250
BRIDGEPORT	VEL (MPH)	6.4	3.9	4.8	4.7	1.7	2.0	4.3	6.6	7.1	3.9
	SPD (MPH)	6.8	4.0	7.6	5.3	3.5	4.2	4.5	6.8	7.3	4.0
	RATIO	0.954	0.963	0.636	0.882	0.487	0.482	0.960	0.980	0.973	0.961
METEOROLOGICAL SITE	DIR (DEG)	260	240	260	250	290	270	290	30	260	280
WORCESTER	VEL (MPH)	8.8	5.7	7.9	7.0	5.1	2.5	4.6	6.9	8.2	6.6
	SPD (MPH)	9.1	6.3	8.5	7.0	6.0	3.3	4.9	7.2	8.6	7.0
	RATIO	0.968	0.899	0.926	0.988	0.850	0.746	0.936	0.965	0.950	0.944
MIDDLETOWN-007 (4876)	OZONE	.133	.130	.130	.126	.124	.124	.122	.120	.108	.106
	DATE	6/13/92	5/23/92	7/14/92	8/27/92	6/29/92	7/19/92	7/29/92	6/14/92	8/11/92	8/24/92
METEOROLOGICAL SITE	DIR (DEG)	220	140	240	130	200	210	240	220	250	180
NEWARK	VEL (MPH)	8.8	2.9	8.6	4.4	5.6	5.8	7.9	6.6	8.0	4.9
	SPD (MPH)	11.5	5.6	9.8	4.6	8.6	7.9	9.1	9.5	9.2	6.3
	RATIO	0.768	0.511	0.882	0.949	0.646	0.730	0.874	0.696	0.865	0.770
METEOROLOGICAL SITE	DIR (DEG)	210	230	200	210	200	200	190	180	250	200
BRADLEY	VEL (MPH)	8.1	3.9	3.6	4.7	4.7	2.9	5.9	7.7	4.3	5.5
	SPD (MPH)	10.9	6.6	7.5	7.3	6.8	7.8	8.1	10.1	9.3	7.6
	RATIO	0.741	0.593	0.477	0.638	0.701	0.376	0.730	0.760	0.456	0.716
METEOROLOGICAL SITE	DIR (DEG)	240	250	250	170	220	260	240	240	270	250
BRIDGEPORT	VEL (MPH)	6.4	3.9	3.8	2.5	3.3	3.9	7.1	5.5	4.8	4.7
	SPD (MPH)	6.8	4.0	4.6	4.2	3.5	4.0	7.3	6.0	7.6	5.3
	RATIO	0.954	0.961	0.823	0.608	0.950	0.963	0.973	0.904	0.636	0.882
METEOROLOGICAL SITE	DIR (DEG)	260	280	230	210	250	240	260	240	260	250
WORCESTER	VEL (MPH)	8.8	6.6	4.8	4.7	6.0	5.7	8.2	7.9	7.9	7.0
	SPD (MPH)	9.1	7.0	6.6	4.9	6.6	6.3	8.6	8.2	8.5	7.0
	RATIO	0.968	0.944	0.730	0.966	0.900	0.899	0.950	0.969	0.926	0.988
NEW HAVEN-123 (4897)	OZONE	.119	.109	.104	.102	.100	.098	.098	.096	.094	.085
	DATE	6/13/92	7/14/92	7/19/92	8/24/92	5/23/92	7/29/92	8/25/92	8/11/92	8/27/92	6/14/92
METEOROLOGICAL SITE	DIR (DEG)	220	240	210	180	140	240	270	250	130	220
NEWARK	VEL (MPH)	8.8	8.6	5.8	4.9	2.9	7.9	5.5	8.0	4.4	6.6
	SPD (MPH)	11.5	9.8	7.9	6.3	5.6	9.1	6.8	9.2	4.6	9.5
	RATIO	0.768	0.882	0.730	0.770	0.511	0.874	0.807	0.865	0.949	0.696
METEOROLOGICAL SITE	DIR (DEG)	210	200	200	200	230	190	270	250	210	180
BRADLEY	VEL (MPH)	8.1	3.6	2.9	5.5	3.9	5.9	2.1	4.3	4.7	7.7
	SPD (MPH)	10.9	7.5	7.8	7.6	6.6	8.1	6.0	9.3	7.3	10.1
	RATIO	0.741	0.477	0.376	0.716	0.593	0.730	0.350	0.456	0.638	0.760

TABLE 4-3, CONTINUED

1992 TEN HIGHEST 1-HOUR AVERAGE OZONE DAYS WITH WIND DATA

UNITS : PARTS PER MILLION

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
METEOROLOGICAL SITE	DIR (DEG)	240	250	260	250	250	240	250	270	170	240
BRIDGEPORT	VEL (MPH)	6.4	3.8	3.9	4.7	3.9	7.1	4.3	4.8	2.5	5.5
	SPD (MPH)	6.8	4.6	4.0	5.3	4.0	7.3	4.5	7.6	4.2	6.0
	RATIO	0.954	0.823	0.963	0.882	0.961	0.973	0.960	0.636	0.608	0.904
METEOROLOGICAL SITE	DIR (DEG)	260	230	240	250	280	260	290	260	210	240
WORCESTER	VEL (MPH)	8.8	4.8	5.7	7.0	6.6	8.2	4.6	7.9	4.7	7.9
	SPD (MPH)	9.1	6.6	6.3	7.0	7.0	8.6	4.9	8.5	4.9	8.2
	RATIO	0.968	0.730	0.899	0.988	0.944	0.950	0.936	0.926	0.966	0.969
STAFFORD-001 (4873)	OZONE	.142	.129	.123	.122	.119	.114	.106	.105	.101	.100
	DATE	6/29/92	6/14/92	6/13/92	5/23/92	8/24/92	7/14/92	7/20/92	9/15/92	6/ 4/92	6/17/92
METEOROLOGICAL SITE	DIR (DEG)	200	220	220	140	180	240	180	220	120	180
NEWARK	VEL (MPH)	5.6	6.6	8.8	2.9	4.9	8.6	6.5	3.7	5.6	6.3
	SPD (MPH)	8.6	9.5	11.5	5.6	6.3	9.8	7.9	6.6	7.9	9.1
	RATIO	0.646	0.696	0.768	0.511	0.770	0.882	0.816	0.564	0.702	0.695
METEOROLOGICAL SITE	DIR (DEG)	200	180	210	230	200	200	210	210	190	190
BRADLEY	VEL (MPH)	4.7	7.7	8.1	3.9	5.5	3.6	6.0	6.0	5.5	3.9
	SPD (MPH)	6.8	10.1	10.9	6.6	7.6	7.5	7.0	7.9	8.1	7.0
	RATIO	0.701	0.760	0.741	0.593	0.716	0.477	0.848	0.758	0.686	0.556
METEOROLOGICAL SITE	DIR (DEG)	220	240	240	250	250	250	210	240	230	210
BRIDGEPORT	VEL (MPH)	3.3	5.5	6.4	3.9	4.7	3.8	3.0	4.7	5.6	3.3
	SPD (MPH)	3.5	6.0	6.8	4.0	5.3	4.6	3.9	5.9	5.9	3.6
	RATIO	0.950	0.904	0.954	0.961	0.882	0.823	0.764	0.798	0.947	0.911
METEOROLOGICAL SITE	DIR (DEG)	250	240	260	280	250	230	260	250	240	170
WORCESTER	VEL (MPH)	6.0	7.9	8.8	6.6	7.0	4.8	6.5	7.9	3.6	2.2
	SPD (MPH)	6.6	8.2	9.1	7.0	7.0	6.6	7.2	8.1	5.8	4.3
	RATIO	0.900	0.969	0.968	0.944	0.988	0.730	0.904	0.980	0.633	0.520
STRATFORD-007 (4758)	OZONE	.131	.131	.129	.124	.122	.120	.117	.117	.110	.109
	DATE	8/24/92	6/13/92	8/25/92	8/26/92	7/ 1/92	5/23/92	7/19/92	7/29/92	7/14/92	8/ 7/92
METEOROLOGICAL SITE	DIR (DEG)	180	220	270	240	10	140	210	240	240	130
NEWARK	VEL (MPH)	4.9	8.8	5.5	.7	4.1	2.9	5.8	7.9	8.6	4.8
	SPD (MPH)	6.3	11.5	6.8	5.9	7.0	5.6	7.9	9.1	9.8	7.0
	RATIO	0.770	0.768	0.807	0.126	0.579	0.511	0.730	0.874	0.882	0.684
METEOROLOGICAL SITE	DIR (DEG)	200	210	270	240	330	230	200	190	200	150
BRADLEY	VEL (MPH)	5.5	8.1	2.1	2.0	6.3	3.9	2.9	5.9	3.6	2.8
	SPD (MPH)	7.6	10.9	6.0	6.2	7.3	6.6	7.8	8.1	7.5	6.5
	RATIO	0.716	0.741	0.350	0.325	0.853	0.593	0.376	0.730	0.477	0.426
METEOROLOGICAL SITE	DIR (DEG)	250	240	250	190	290	250	260	240	250	140
BRIDGEPORT	VEL (MPH)	4.7	6.4	4.3	2.0	1.7	3.9	3.9	7.1	3.8	4.3
	SPD (MPH)	5.3	6.8	4.5	4.2	3.5	4.0	4.0	7.3	4.6	5.0
	RATIO	0.882	0.954	0.960	0.482	0.487	0.961	0.963	0.973	0.823	0.859
METEOROLOGICAL SITE	DIR (DEG)	250	260	290	270	290	280	240	260	230	230
WORCESTER	VEL (MPH)	7.0	8.8	4.6	2.5	5.1	6.6	5.7	8.2	4.8	3.6
	SPD (MPH)	7.0	9.1	4.9	3.3	6.0	7.0	6.3	8.6	6.6	4.9
	RATIO	0.988	0.968	0.936	0.746	0.850	0.944	0.899	0.950	0.730	0.731

TABLE 4-3, CONTINUED

1992 TEN HIGHEST 1-HOUR AVERAGE OZONE DAYS WITH WIND DATA

UNITS : PARTS PER MILLION

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
TORRINGTON-006 (4872)	OZONE	.108	.102	.097	.097	.097	.096	.095	.094	.085	.084
	DATE	6/29/92	5/23/92	6/30/92	7/20/92	6/13/92	6/17/92	6/14/92	8/24/92	9/15/92	6/ 4/92
METEOROLOGICAL SITE	DIR (DEG)	200	140	210	180	220	180	220	180	220	120
NEWARK	VEL (MPH)	5.6	2.9	5.4	6.5	8.8	6.3	6.6	4.9	3.7	5.6
	SPD (MPH)	8.6	5.6	8.6	7.9	11.5	9.1	9.5	6.3	6.6	7.9
	RATIO	0.646	0.511	0.630	0.816	0.768	0.695	0.696	0.770	0.564	0.702
METEOROLOGICAL SITE	DIR (DEG)	200	230	190	210	210	190	180	200	210	190
BRADLEY	VEL (MPH)	4.7	3.9	6.7	6.0	8.1	3.9	7.7	5.5	6.0	5.5
	SPD (MPH)	6.8	6.6	10.9	7.0	10.9	7.0	10.1	7.6	7.9	8.1
	RATIO	0.701	0.593	0.616	0.848	0.741	0.556	0.760	0.716	0.758	0.686
METEOROLOGICAL SITE	DIR (DEG)	220	250	230	210	240	210	240	250	240	230
BRIDGEPORT	VEL (MPH)	3.3	3.9	4.6	3.0	6.4	3.3	5.5	4.7	4.7	5.6
	SPD (MPH)	3.5	4.0	4.9	3.9	6.8	3.6	6.0	5.3	5.9	5.9
	RATIO	0.950	0.961	0.943	0.764	0.954	0.911	0.904	0.882	0.798	0.947
METEOROLOGICAL SITE	DIR (DEG)	250	280	250	260	260	170	240	250	250	240
WORCESTER	VEL (MPH)	6.0	6.6	8.9	6.5	8.8	2.2	7.9	7.0	7.9	3.6
	SPD (MPH)	6.6	7.0	9.3	7.2	9.1	4.3	8.2	7.0	8.1	5.8
	RATIO	0.900	0.944	0.954	0.904	0.968	0.520	0.969	0.988	0.980	0.633

FIGURE 4-5

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

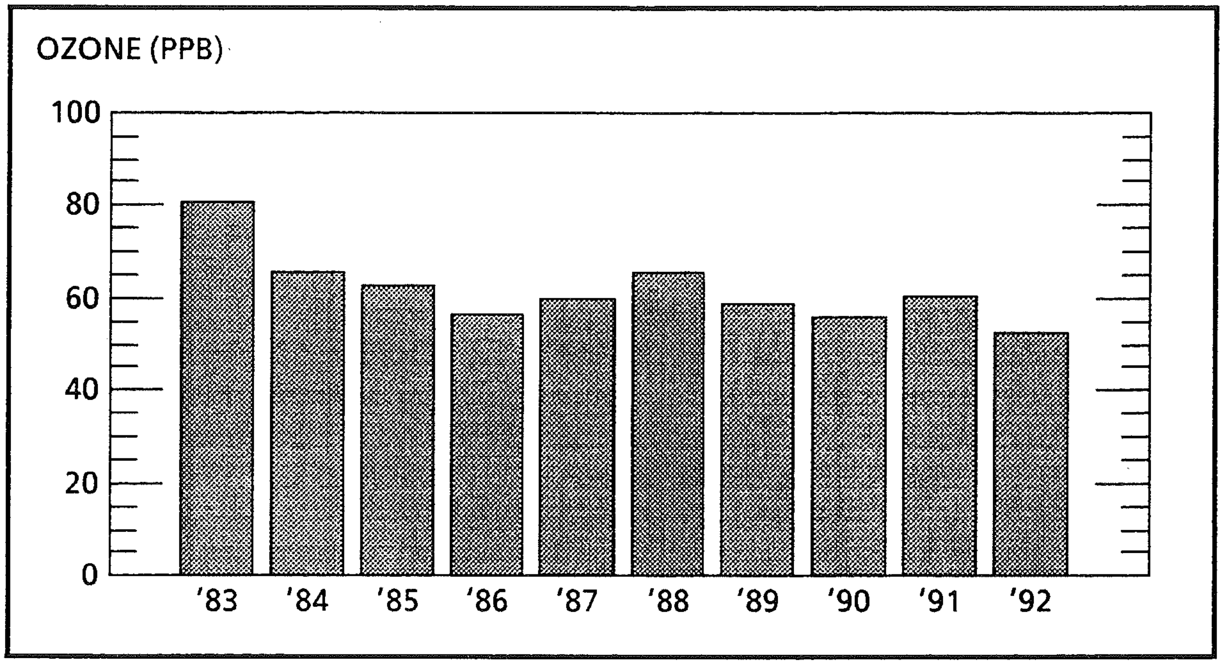
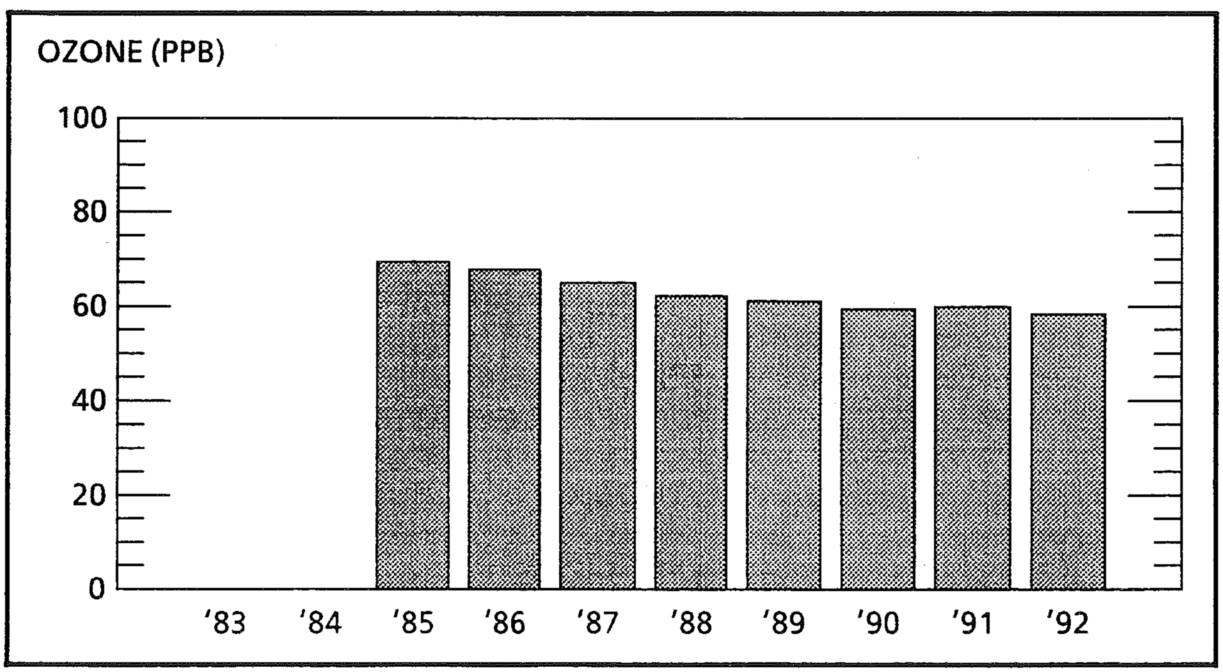


FIGURE 4-6

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 1992. 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 47 $\mu g/m^3$, 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 1992 (see Figure 5-1). The sites -- Bridgeport 013, East Hartford 003 and New Haven 123 -- were located in three urban areas near major expressways in order to obtain maximum NO_2 readings.

Precision and Accuracy - Seventy precision checks were made on the NO_2 monitors in 1992, yielding 95% probability limits ranging from -10% to +6%. Accuracy is determined by introducing a known amount of NO_2 into each of the monitors. Four audits for accuracy were conducted on the monitoring network in 1992. 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 -10% to +10%; those for the low/medium level test ranged from -8% to +10%; those for the medium/high level test ranged from -6% to +9%; and those for the high level test ranged from -4% to +10%.

Annual Averages - The annual average NO_2 standard of 100 $\mu g/m^3$ was not exceeded in 1992 at any site in Connecticut (see Table 5-1). In 1992, all three sites had sufficient data to compute valid arithmetic means. This permits comparisons with the 1990 and 1991 annual averages. Notwithstanding an increase from 1990 to 1991 at East Hartford and New Haven, the annual average NO_2 concentrations decreased at all three sites between 1990 and 1992.

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 1992.

10-High Days with Wind Data - Table 5-2 presents for each site the ten days in 1992 when the highest hourly NO_2 readings occurred, along with the associated wind conditions for each day. (See the discussion of Table 2-5 in the particulate matter section for a description of the origin and use of the wind data.)

According to National Weather Service local climatological data recorded at Bradley Airport, 12 of the 20 days listed in the table had at least 50% of the possible sunshine. A high percentage of the possible sunshine is interpreted to confirm the importance of photochemical oxidation in the formation of NO_2.

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

Trends - The weighted average of the annual NO_2 concentrations at the three monitoring sites is illustrated in Figure 5-2. The year-to-year trend appears to be down through 1987, up in 1988, down until 1991 when levels rose again, and then down again in 1992.

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

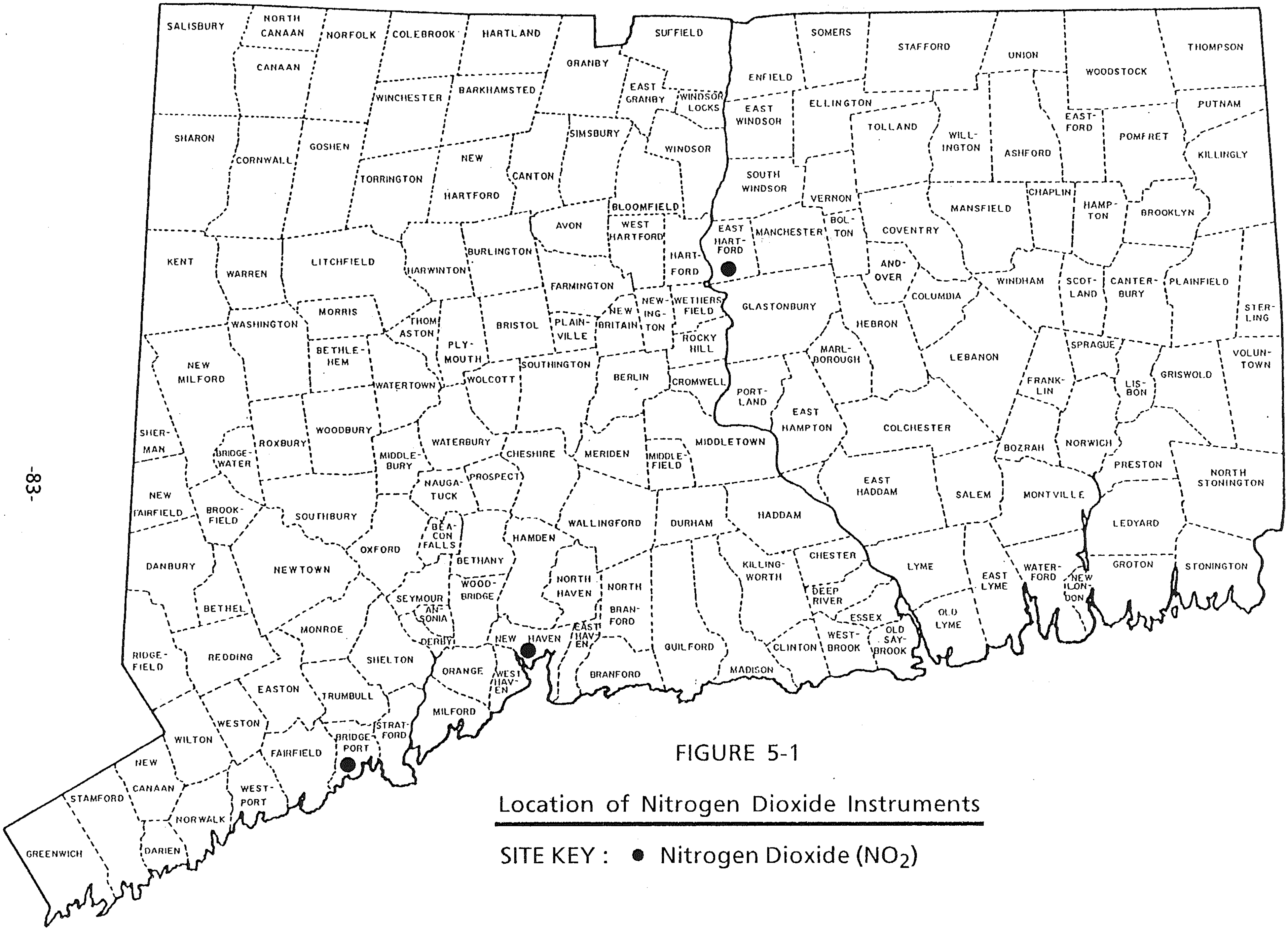


FIGURE 5-1

Location of Nitrogen Dioxide Instruments

SITE KEY : ● Nitrogen Dioxide (NO_2)

TABLE 5-1

1990 -1992 NITROGEN DIOXIDE ANNUAL AVERAGES

Town Name	Site	Year	Samples	Arithmetic Mean	95-Percent-Limits Lower	95-Percent-Limits Upper	Standard Deviation
Bridgeport	013	1990	8137	47.97	47.82	48.12	25.98
Bridgeport	013	1991	8500	46.72	46.63	46.82	24.88
Bridgeport	013	1992	8595	44.86	44.78	44.93	24.14
East Hartford	003	1990	8287	35.92	35.81	36.03	21.71
East Hartford	003	1991	7541	38.21	38.03	38.40	21.75
East Hartford	003	1992	7384	31.99	31.81	32.17	20.06
New Haven	123	1990	8343	50.73	50.61	50.84	24.42
New Haven	123	1991	8575	51.98	51.91	52.06	25.06
New Haven	123	1992	8186	47.15	47.03	47.27	21.69

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

TABLE 5-2

1992 TEN HIGHEST 1-HOUR AVERAGE NO2 DAYS WITH WIND DATA

UNITS : PARTS PER MILLION

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
BRIDGEPORT-013 (8595)	NO2	.110	.106	.105	.100	.093	.079	.077	.075	.074	.074
	DATE	5/22/92	5/21/92	5/23/92	3/ 5/92	12/15/92	5/24/92	9/17/92	10/23/92	9/15/92	8/11/92
METEOROLOGICAL SITE	DIR (DEG)	80	120	140	230	190	20	230	250	220	250
NEWARK	VEL (MPH)	.6	1.7	2.9	7.2	4.7	11.9	5.6	4.0	3.7	8.0
	SPD (MPH)	5.3	5.8	5.6	8.5	5.2	12.1	8.6	6.3	6.6	9.2
	RATIO	0.115	0.298	0.511	0.843	0.915	0.988	0.644	0.638	0.564	0.865
METEOROLOGICAL SITE	DIR (DEG)	270	70	230	210	310	10	220	170	210	250
BRADLEY	VEL (MPH)	2.8	.7	3.9	1.7	1.2	11.2	5.2	4.5	6.0	4.3
	SPD (MPH)	5.0	3.6	6.6	5.3	3.9	11.4	8.1	6.0	7.9	9.3
	RATIO	0.547	0.206	0.593	0.315	0.312	0.990	0.652	0.739	0.758	0.456
METEOROLOGICAL SITE	DIR (DEG)	250	240	250	260	240	40	250	240	240	270
BRIDGEPORT	VEL (MPH)	3.0	3.9	3.9	5.1	1.3	6.6	6.6	5.2	4.7	4.8
	SPD (MPH)	3.7	4.2	4.0	6.0	3.5	6.8	7.0	6.2	5.9	7.6
	RATIO	0.792	0.939	0.961	0.836	0.369	0.980	0.943	0.843	0.798	0.636
METEOROLOGICAL SITE	DIR (DEG)	300	300	280	280	290	30	260	270	250	260
WORCESTER	VEL (MPH)	5.4	5.8	6.6	7.4	4.4	6.9	7.4	6.6	7.9	7.9
	SPD (MPH)	5.6	6.3	7.0	7.8	4.7	7.2	7.5	7.0	8.1	8.5
	RATIO	0.970	0.916	0.944	0.951	0.929	0.965	0.990	0.933	0.980	0.926
EAST HARTFORD-003 (7384)	NO2	.067	.065	.060	.054	.053	.053	.051	.051	.050	.050
	DATE	3/ 5/92	5/21/92	10/ 8/92	5/22/92	10/24/92	10/23/92	9/17/92	3/20/92	9/15/92	4/ 7/92
METEOROLOGICAL SITE	DIR (DEG)	230	120	200	80	250	250	230	310	220	160
NEWARK	VEL (MPH)	7.2	1.7	4.8	.6	5.8	4.0	5.6	4.6	3.7	4.9
	SPD (MPH)	8.5	5.8	7.3	5.3	8.6	6.3	8.6	6.3	6.6	5.3
	RATIO	0.843	0.298	0.650	0.115	0.668	0.638	0.644	0.730	0.564	0.928
METEOROLOGICAL SITE	DIR (DEG)	210	70	160	270	220	170	220	310	210	190
BRADLEY	VEL (MPH)	1.7	.7	2.4	2.8	5.1	4.5	5.2	2.8	6.0	7.9
	SPD (MPH)	5.3	3.6	5.9	5.0	8.1	6.0	8.1	7.0	7.9	9.3
	RATIO	0.315	0.206	0.403	0.547	0.638	0.739	0.652	0.400	0.758	0.843
METEOROLOGICAL SITE	DIR (DEG)	260	240	250	250	240	240	250	230	240	240
BRIDGEPORT	VEL (MPH)	5.1	3.9	5.1	3.0	6.8	5.2	6.6	2.8	4.7	3.5
	SPD (MPH)	6.0	4.2	6.5	3.7	6.9	6.2	7.0	4.9	5.9	3.6
	RATIO	0.836	0.939	0.790	0.792	0.987	0.843	0.943	0.564	0.798	0.961
METEOROLOGICAL SITE	DIR (DEG)	280	300	200	300	250	270	260	260	250	250
WORCESTER	VEL (MPH)	7.4	5.8	2.5	5.4	10.3	6.6	7.4	3.1	7.9	5.8
	SPD (MPH)	7.8	6.3	5.2	5.6	10.4	7.0	7.5	4.6	8.1	6.6
	RATIO	0.951	0.916	0.484	0.970	0.998	0.933	0.990	0.679	0.980	0.872
NEW HAVEN-123 (8186)	NO2	.089	.087	.086	.082	.081	.075	.072	.072	.070	.070
	DATE	5/22/92	12/15/92	5/21/92	8/25/92	3/ 5/92	12/30/92	7/ 6/92	1/13/92	3/ 6/92	6/28/92
METEOROLOGICAL SITE	DIR (DEG)	80	190	120	270	230	210	330	220	90	300
NEWARK	VEL (MPH)	.6	4.7	1.7	5.5	7.2	1.6	6.2	3.7	8.6	3.9
	SPD (MPH)	5.3	5.2	5.8	6.8	8.5	4.0	7.2	6.0	9.8	8.1
	RATIO	0.115	0.915	0.298	0.807	0.843	0.400	0.858	0.611	0.875	0.487
METEOROLOGICAL SITE	DIR (DEG)	270	310	70	270	210	120	310	210	70	270
BRADLEY	VEL (MPH)	2.8	1.2	.7	2.1	1.7	2.6	6.0	3.7	4.8	2.3
	SPD (MPH)	5.0	3.9	3.6	6.0	5.3	2.9	7.0	5.5	7.8	5.0
	RATIO	0.547	0.312	0.206	0.350	0.315	0.890	0.853	0.682	0.615	0.458

TABLE 5-2, CONTINUED

1992 TEN HIGHEST 1-HOUR AVERAGE NO2 DAYS WITH WIND DATA

UNITS : PARTS PER MILLION

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
METEOROLOGICAL SITE	DIR (DEG)	250	240	240	250	260	310	250	230	120	270
BRIDGEPORT	VEL (MPH)	3.0	1.3	3.9	4.3	5.1	.3	2.3	4.0	11.1	3.0
	SPD (MPH)	3.7	3.5	4.2	4.5	6.0	3.0	4.9	5.9	11.6	5.3
	RATIO	0.792	0.369	0.939	0.960	0.836	0.095	0.469	0.672	0.957	0.559
METEOROLOGICAL SITE	DIR (DEG)	300	290	300	290	280	70	300	250	100	300
WORCESTER	VEL (MPH)	5.4	4.4	5.8	4.6	7.4	3.7	4.2	5.4	5.3	6.9
	SPD (MPH)	5.6	4.7	6.3	4.9	7.8	4.0	5.8	6.9	5.9	7.3
	RATIO	0.970	0.929	0.916	0.936	0.951	0.920	0.734	0.776	0.907	0.946

FIGURE 5-2

AVERAGES OF THE ANNUAL NO_2 CONCENTRATIONS AT THREE SITES

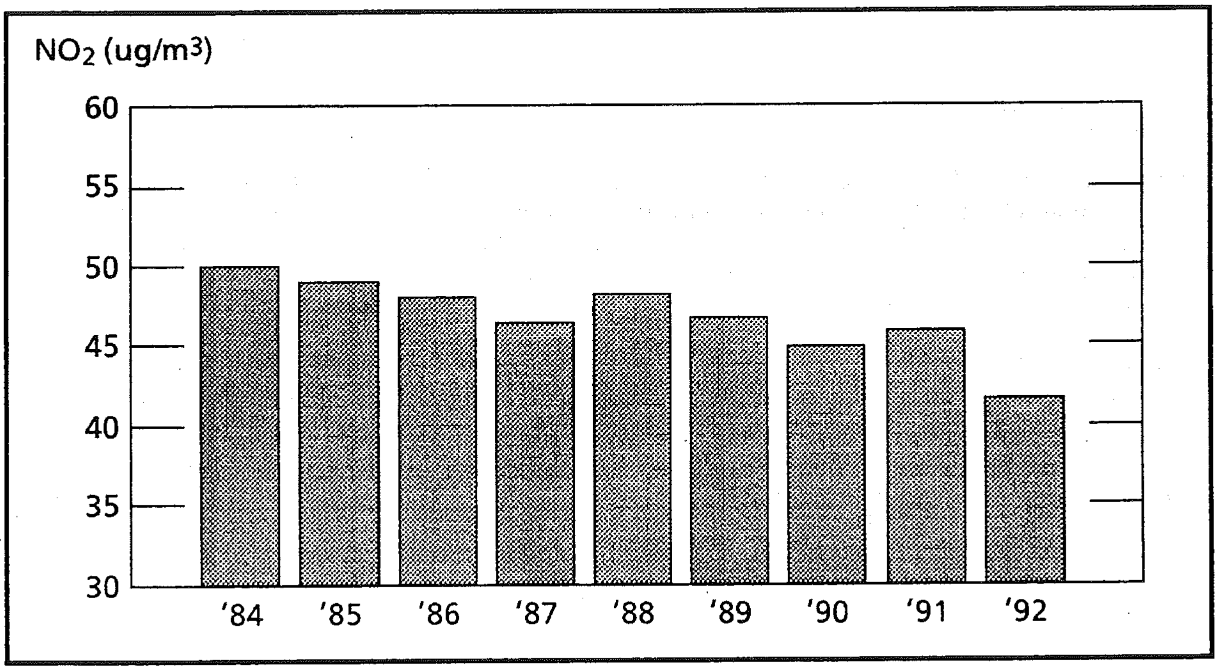
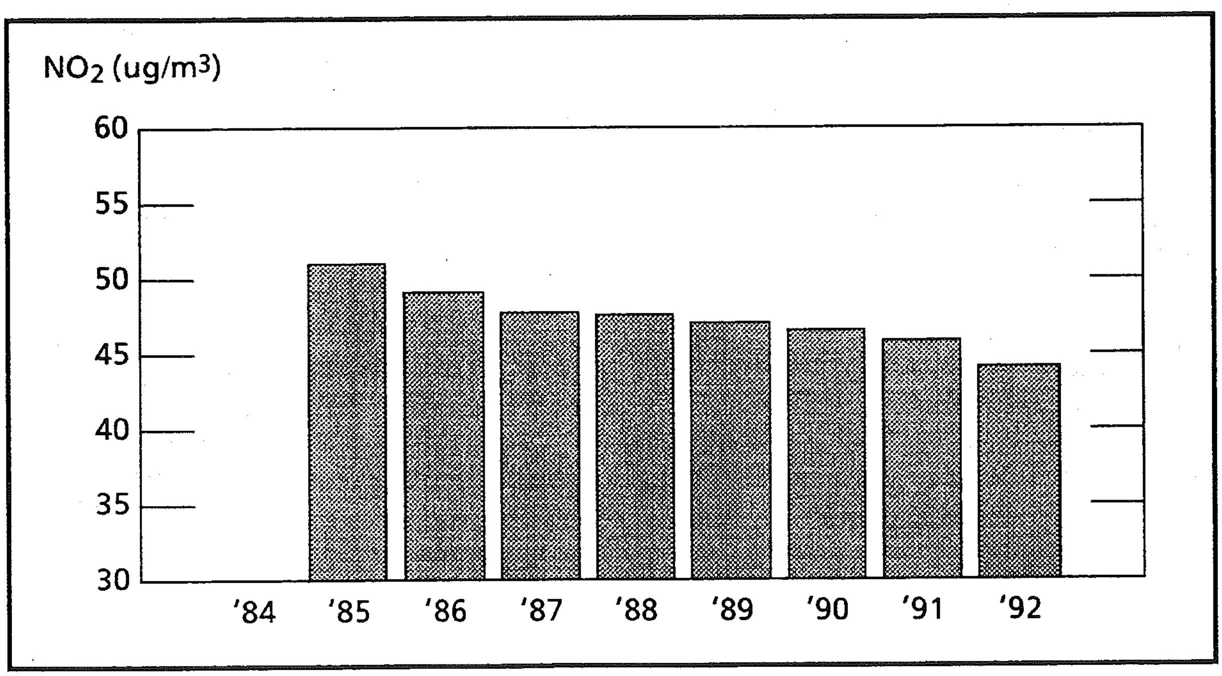


FIGURE 5-3

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



VI. CARBON MONOXIDE

HEALTH EFFECTS

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

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

CONCLUSIONS

The one-hour National Ambient Air Quality Standard of 35 parts per million (ppm) was not exceeded at any of the five carbon monoxide monitoring sites in Connecticut during 1992. There was one exceedance of the 9 ppm eight-hour standard in 1992 and it occurred 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. More than 95% of the CO emissions in Connecticut come from motor vehicles. Therefore, concentrations are greatest in areas of traffic congestion. The magnitude and frequency of high concentrations observed at any monitoring site are not necessarily indicative of widespread CO levels. 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 which reduce emissions from new motor vehicles are implemented, a reduction in ambient CO levels should be achieved.

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

METHOD OF MEASUREMENT

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

DISCUSSION OF DATA

Monitoring Network - The network in 1992 consisted of five carbon monoxide monitors: Bridgeport 004, Hartford 013, Hartford 017, New Haven 019, and Stamford 020. They are all located in urban areas. All the sites are also located west of the Connecticut River, with three of them in coastal towns (see Figure 6-1).

Precision and Accuracy - The carbon monoxide monitors had a total of 243 precision checks during 1992. The resulting 95% probability limits were -2% to +6%. Accuracy is determined by introducing a known amount of CO into each of the monitors. Four audits for accuracy were conducted on the monitoring network in 1992. Three different concentration levels were tested on each monitor: low, medium and high. The 95% probability limits ranged from -5% to +7% for the low level test; -2% to +3% for the medium level test; and -7% to +7% 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. Hartford 017 had one exceedance of the 8-hour CO standard, which means that the standard was not violated in Connecticut in 1992 (see Table 6-1).

Regarding the maximum 8-hour running average at each site, there were decreases from 1991 to 1992 at Bridgeport 004, Hartford 013 and Hartford 017; there was an increase at New Haven 019; and there was no change at Stamford 020. The second highest 8-hour running average decreased from 1991 to 1992 at all sites, except at Hartford 013 where there was an increase.

As for 1-hour averages, no site in the state recorded a value exceeding the primary 1-hour standard of 35 ppm. All sites recorded maximum 1-hour values that were lower than the year before, except Hartford 017 which had a higher value. Second high 1-hour values decreased in 1992 at all the sites.

The maximum and second high CO concentrations at each site are presented in Table 6-1. Table 6-2 presents monthly highs and a monthly tally of the number of times the standards were exceeded at each site. Seasonal variations in CO levels can be observed using this table.

Trends - Due to the local nature of CO emissions, it is not appropriate to give an estimate of widespread CO trends. However, local CO trends can be addressed in a number of ways. Exceedances of the 8-hour standard can be tracked in order to determine if a CO problem is worsening or abating at a site. This is illustrated in Table 6-3 and in Figure 6-2. One can see that over the past five years the Hartford-017 site has shown a higher frequency of exceedances relative to the other sites, with a downward trend since 1988. No exceedances are evident at any of the other sites during this period. For this reason, only Hartford 017 in included in Figure 6-2.

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 6-3 shows the 36-month running averages of the hourly CO concentrations at each monitoring site. CO levels are relatively flat at Bridgeport 004, New Haven 019 and Stamford 020, and they continue to fall at Hartford 017, while rising at Hartford 013.

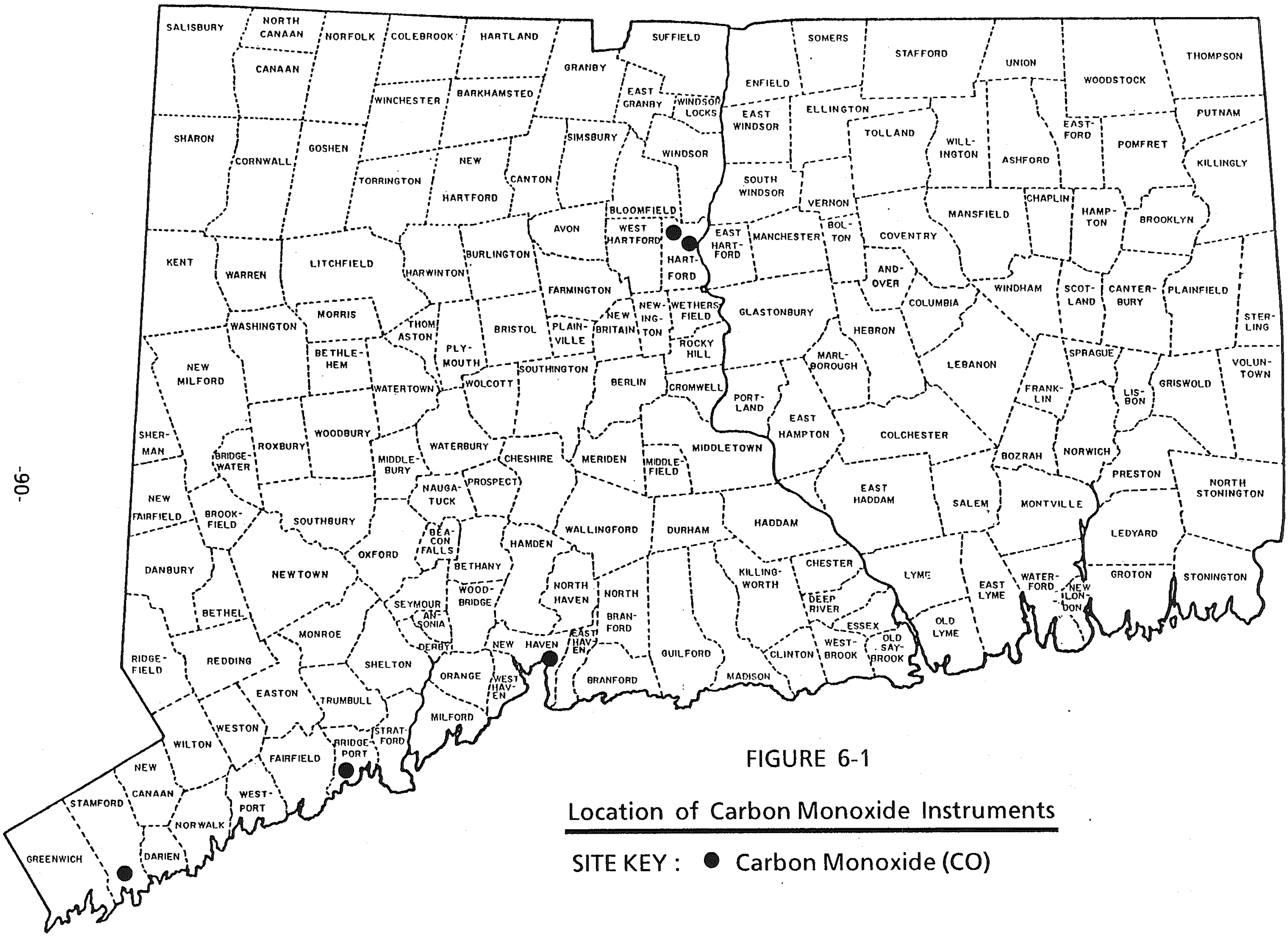


FIGURE 6-1

Location of Carbon Monoxide Instruments

SITE KEY : ● Carbon Monoxide (CO)

TABLE 6-1

1992 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	5.1	12/15/23	4.4	01/01/23	7.5	01/01/19	7.2	01/15/21
Hartford-013	4.9	12/16/02	4.4	01/02/01	6.6	01/01/02	5.5	01/01/01
Hartford-017	10.2	01/13/19	7.7	03/05/24	22.3	01/13/18	17.1	01/13/19
New Haven-019	7.4	12/15/24	5.2	03/01/23	8.6	11/04/22	8.3	12/15/18
Stamford-020	6.3	12/15/23	5.5	12/23/16	9.1	12/15/21	8.8	12/15/22

[1] The time of the 8-hour average is reported as follows: month/day/hour (EST), specifying the end of the 8-hour period.
[2] The time of the 1-hour average is reported as follows: month/day/hour (EST), specifying the end of the 1-hour period.

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

TABLE 6-2

1992 CARBON MONOXIDE SEASONAL FEATURES

TOWN-SITE		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Bridgeport-004	Max. 1-Hour	7.5	4.3	5.8	3.7	3.9	2.7	4.1	3.2	3.0	4.6	3.5	7.2
	Max. Running 8-Hour	4.4	3.4	3.7	2.4	3.0	2.1	1.8	2.6	2.1	2.9	2.4	5.1
	No. of 8-Hour Exceedances	0	0	0	0	0	0	0	0	0	0	0	0
Hartford-013	Max. 1-Hour	6.6	3.6	4.4	2.5	2.5	1.6	1.9	2.3	2.8	3.8	4.6	5.4
	Max. Running 8-Hour	4.4	2.5	3.5	1.5	1.9	1.3	1.4	1.6	1.6	2.9	4.0	4.9
	No. of 8-Hour Exceedances	0	0	0	0	0	0	0	0	0	0	0	0
Hartford-017	Max. 1-Hour	22.3	7.7	13.7	4.8	5.6	5.0	5.5	6.1	5.1	8.8	7.0	10.6
	Max. Running 8-Hour	10.2	5.2	7.7	3.8	4.6	3.1	3.8	4.0	3.6	5.3	4.6	6.6
	No. of 8-Hour Exceedances	1	0	0	0	0	0	0	0	0	0	0	0
New Haven-019	Max. 1-Hour	8.2	7.0	8.1	3.7	5.6	4.2	3.2	6.2	4.8	6.0	8.6	8.3
	Max. Running 8-Hour	4.7	4.9	5.2	2.7	3.9	2.6	2.5	3.8	4.0	4.8	4.4	7.4
	No. of 8-Hour Exceedances	0	0	0	0	0	0	0	0	0	0	0	0
Stamford-020	Max. 1-Hour	7.8	5.8	6.2	6.4	4.2	4.0	3.5	4.4	3.9	6.4	5.6	9.1
	Max. Running 8-Hour	5.1	3.9	4.8	3.3	3.1	3.1	2.9	2.7	3.0	3.7	4.2	6.3
	No. of 8-Hour Exceedances	0	0	0	0	0	0	0	0	0	0	0	0

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

TABLE 6-3

EXCEEDANCES OF THE 8-HOUR CO STANDARD FOR 1988 -1992

SITE	1988	1989	1990	1991	1992
Bridgeport-004	0	0	0	0	0
Hartford-013	0	0	0[a]	0	0
Hartford-017	3	1	0	1	1
New Haven-019	0	0	0	0	0
Stamford-020	0	0	0	0	0

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

FIGURE 6-2

EXCEEDANCES OF THE 8-HOUR CO STANDARD FOR 1988-1992

SITE: HARTFORD-017

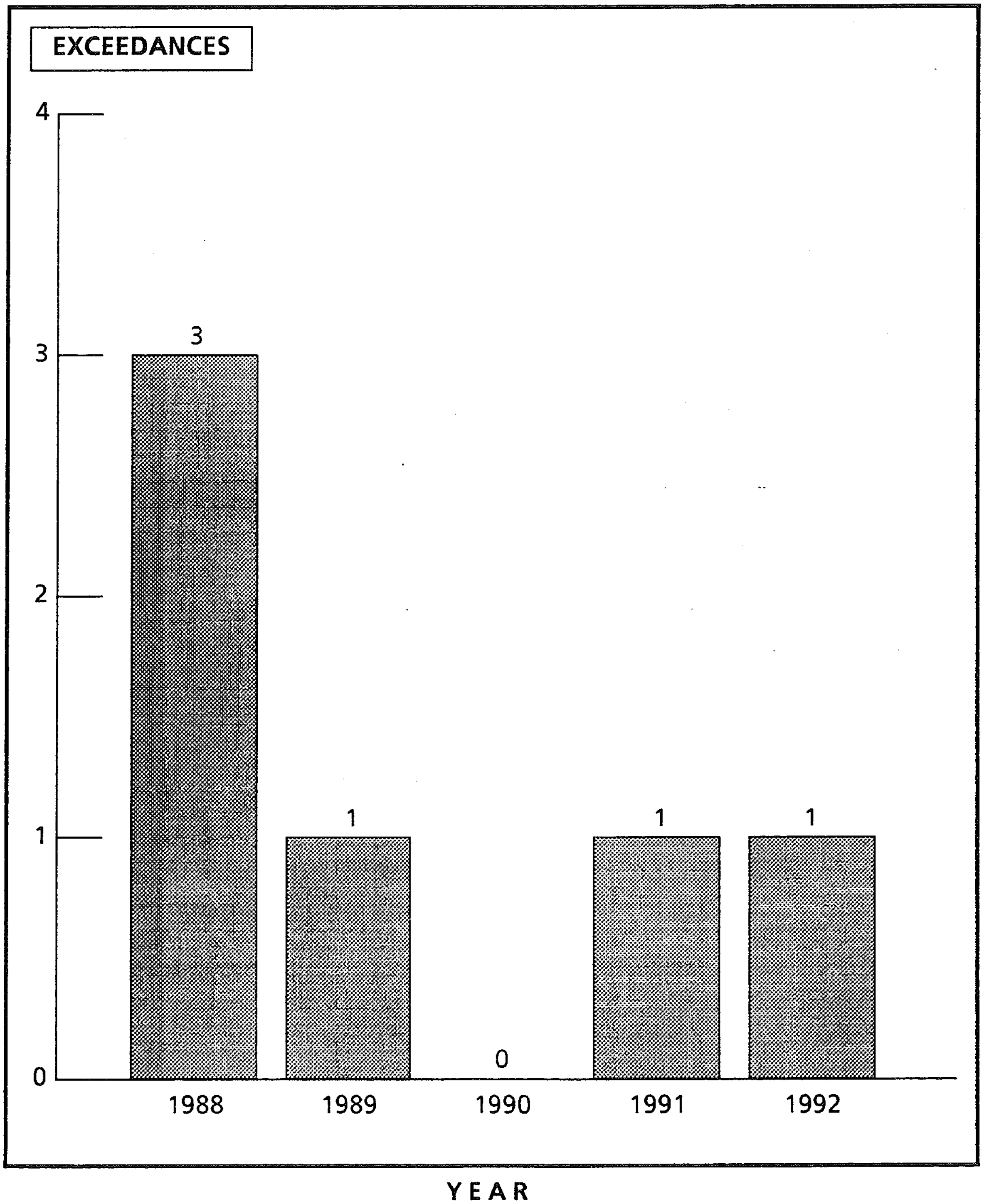
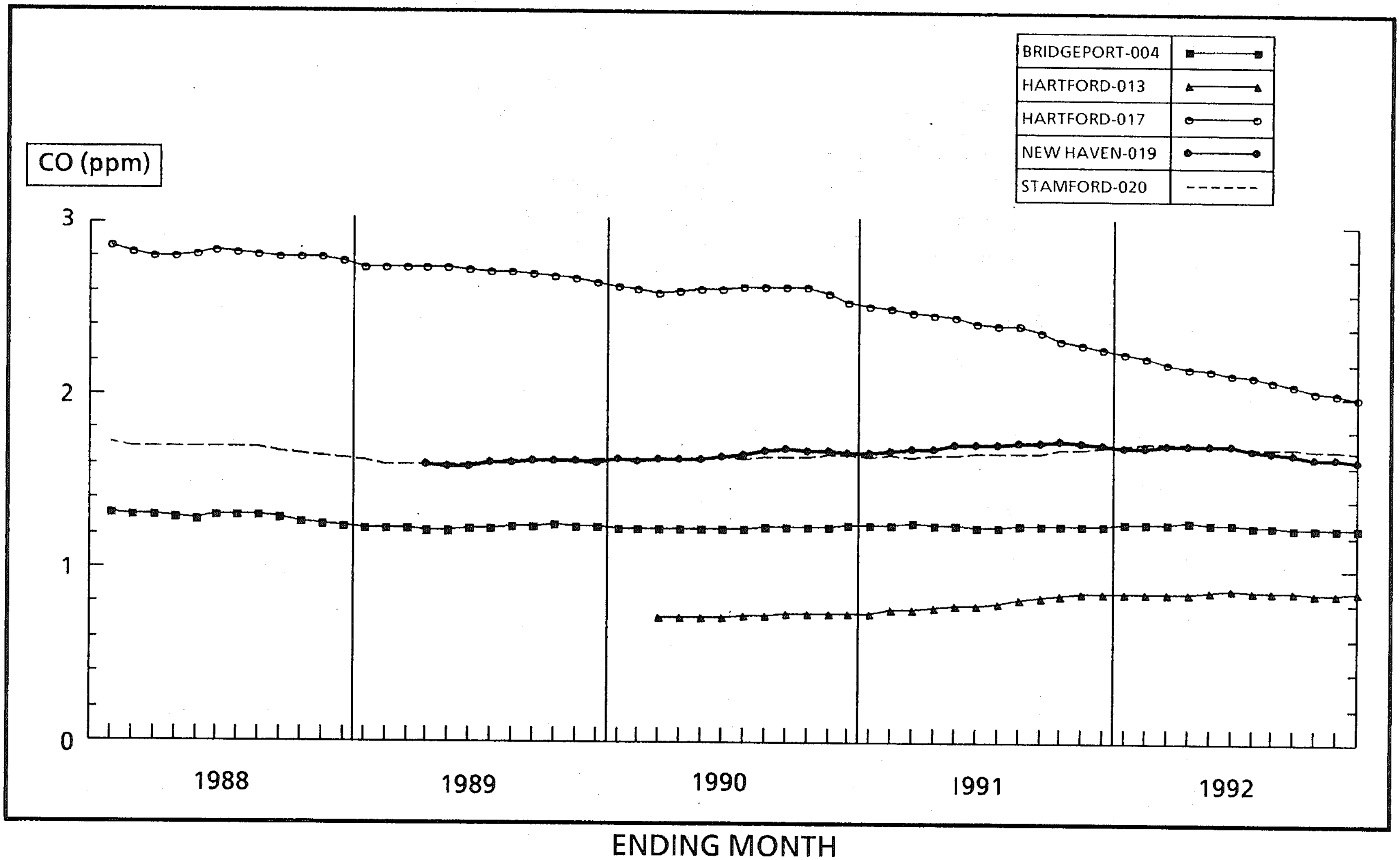


FIGURE 6-3

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 1992, these source categories contributed 45%, 14% and 31%, respectively, of the atmospheric lead. The motor vehicle contribution, while still a large source of airborne lead emissions, has decreased significantly over the years and, since 1988, is no longer the largest source of nationwide airborne lead emissions. These emissions are in the form of fine-to-course particulate matter and are comprised of lead sulfate, ammonium lead halides, and lead halides, of which the chief component is lead bromochloride. The halide compounds appear to undergo chemical changes over a period of hours and are converted to lead carbonate, oxide and oxycarbonate.

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

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

CONCLUSIONS

The Connecticut primary and secondary ambient air quality standard for lead and its compounds was not exceeded at any site in Connecticut during 1992.

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 1992 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 1992, only hi-vol samplers were operated in Connecticut to monitor lead levels (see Figure 7-1). There were 5 such samplers operated throughout the state by the DEP in areas with populations of 200,000 or more: Bridgeport, East Hartford, Hartford, New Haven and Waterbury. The samplers are situated near some of the busiest city streets and highways in order to monitor "worst-case" lead concentrations.

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

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

Precision and Accuracy - Due to the very low airborne lead concentrations, precision checks yield 95% probability limits that are too low to calculate. Accuracy for lead can be assessed in two ways. One is by auditing the air flow through the monitors. No audits for flow accuracy were conducted on the monitoring network in 1992. 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, 14 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 -7% to + 6%; those for the high level ranged from -14% to + 5%.

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 substantially 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 1992 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.

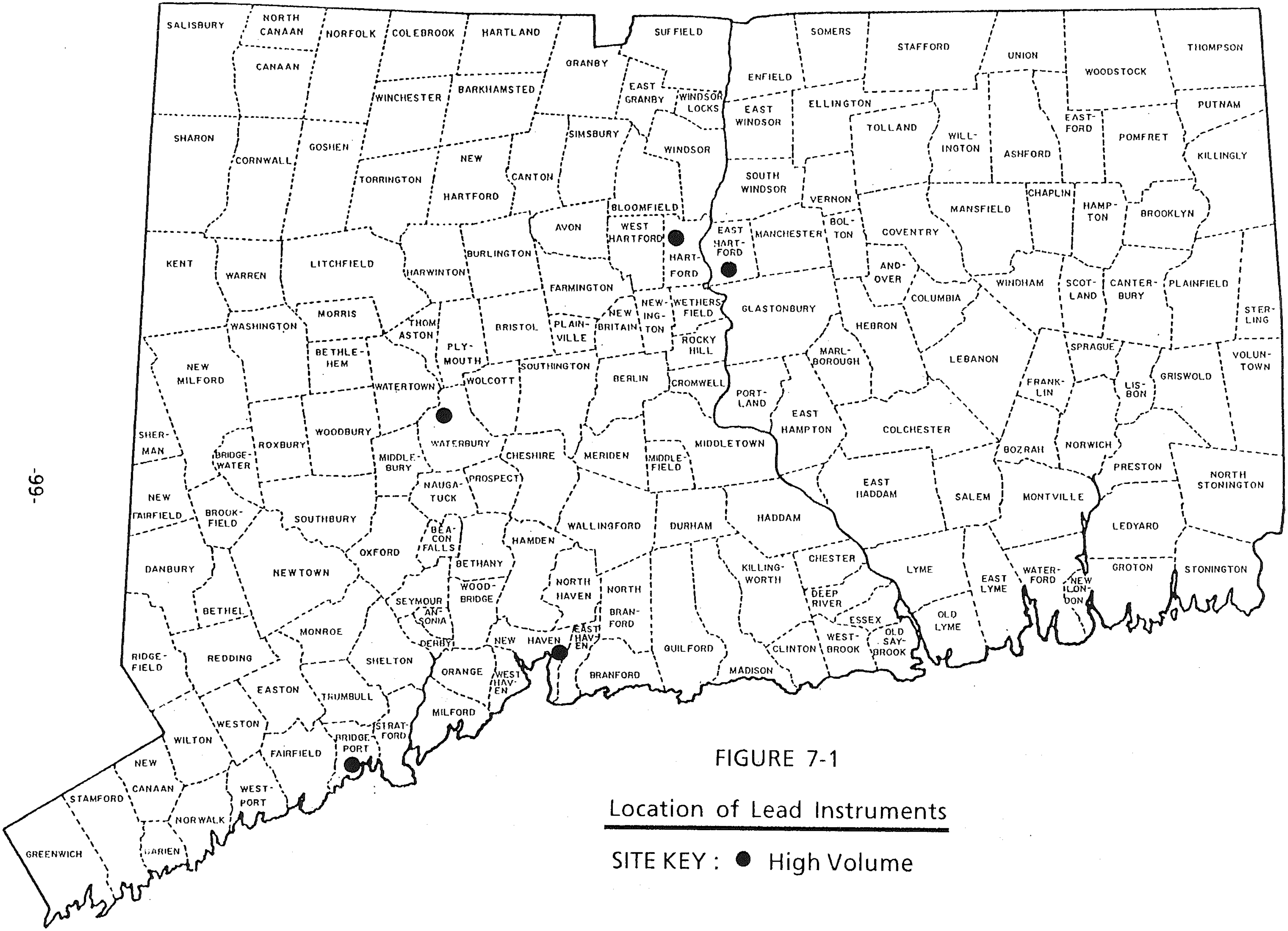


FIGURE 7-1

Location of Lead Instruments

SITE KEY : ● High Volume

TABLE 7-1

1992 3-MONTH RUNNING AVERAGE LEAD CONCENTRATIONS[a]

TOWN-SITE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Bridgeport-010	0.017	0.014	0.014	0.010	0.013	0.013	0.013	0.014	0.014	0.017	0.013	0.013
East Hartford-004	0.010	------	0.010	0.010	0.007	0.007	0.004	0.004	0.004	0.010	0.013	0.013
Hartford-016	0.024	0.024	0.024	0.020	0.020	0.020	0.017	0.014	0.010	0.012	0.012	0.012
New Haven-018	0.069	0.072	0.079	0.072	0.079	0.103	0.110	0.090	0.064	0.099	0.128	0.130
Waterbury-123	0.032	0.021	0.018	0.021	0.137	0.185	0.191	0.061	0.025	0.020	0.020	0.017

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

N.B. Dashes indicate insufficient data for a 3-month average.

FIGURE 7-2

STATEWIDE ANNUAL LEAD EMISSIONS FROM GASOLINE

AND

STATEWIDE ANNUAL AVERAGE LEAD CONCENTRATIONS

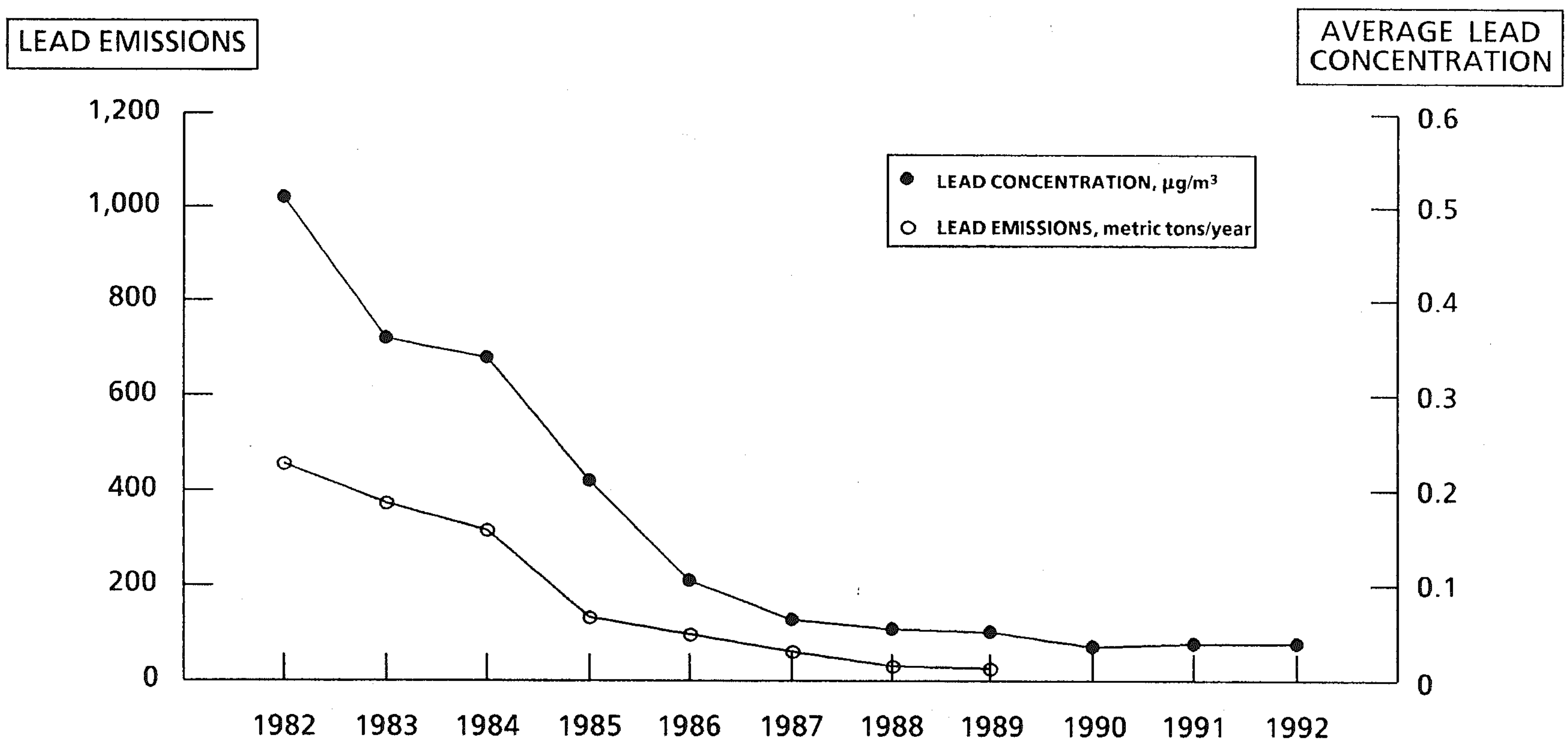
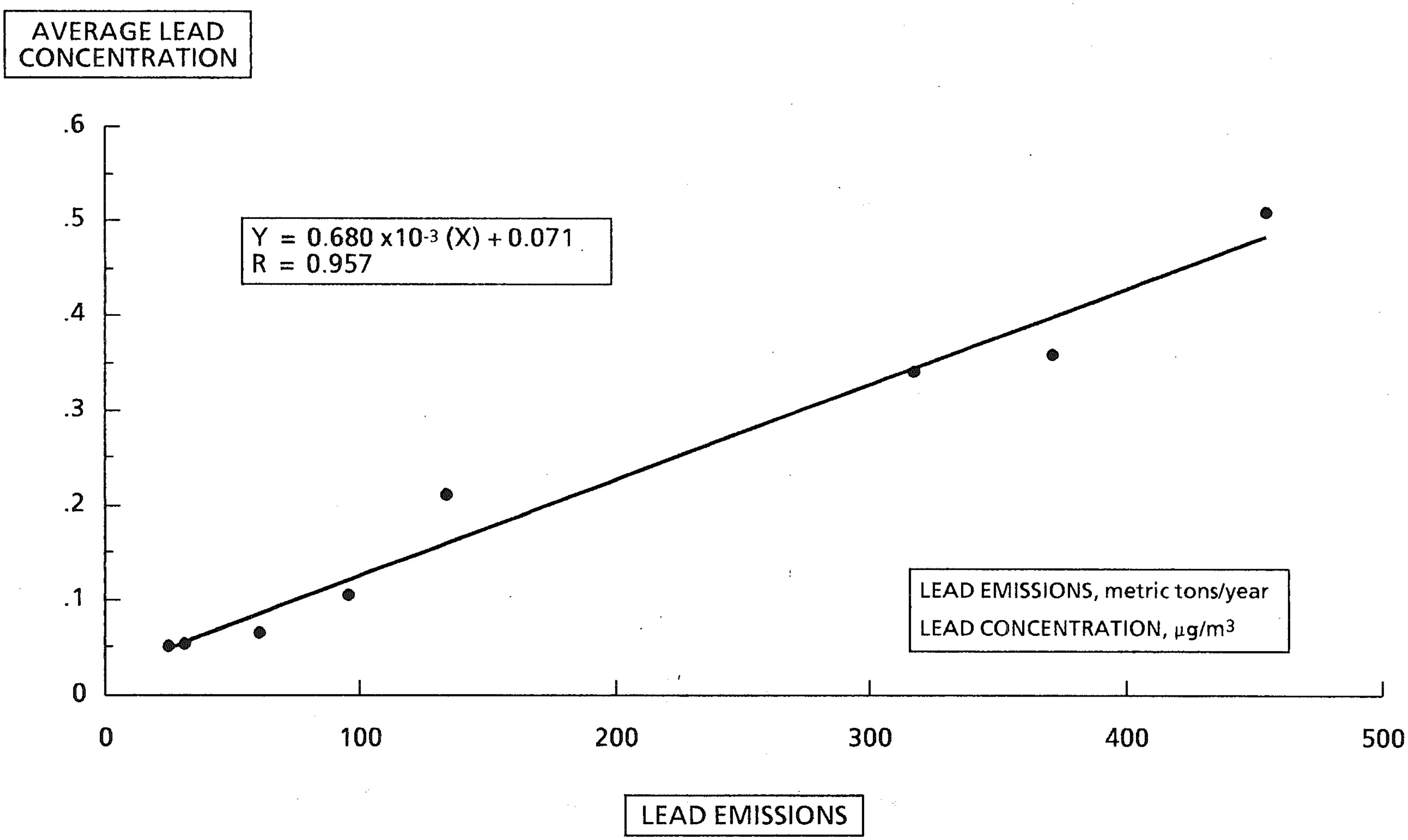


FIGURE 7-3

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 1991 and 1992. 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 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 1992 National Weather Service surface observations and are shown in Figures 8-2 and 8-4, respectively. Wind roses from these stations for 1991 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

1991 AND 1992 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)		
	1991	1992	Mean[a]	1991	1992	Mean[b]	1991	1992	Normal[c]	1991	1992	Mean[a]	1991	1992	Mean[d]	1991	1992	Mean[d]
Jan	27.0	28.6	26.6	0	0	0.0	1170	1122	1234	2.45	2.73	3.51	9	5	10.5	9.2	9.7	9.0
Feb	33.9	30.3	27.9	0	0	0.0	863	1002	1047	1.78	2.23	3.18	11	14	10.3	9.4	10.4	9.4
Mar	40.5	34.6	37.2	0	0	0.0	755	936	874	4.52	3.79	3.70	14	13	11.4	10.5	10.5	10.0
Apr	53.3	46.4	48.2	1	0	0.3	373	553	486	3.54	3.13	3.75	8	11	11.1	9.8	9.8	10.0
May	65.8	58.5	59.2	4	3	1.2	107	218	197	5.18	3.21	3.73	9	11	11.8	9.5	8.5	8.9
Jun	70.5	66.4	67.9	7	0	3.5	16	37	20	2.37	5.77	3.60	9	10	11.3	8.5	8.7	8.1
Jul	73.7	69.9	73.2	9	2	7.7	1	9	0	2.90	4.62	3.56	8	15	9.8	7.4	8.2	7.5
Aug	73.1	69.1	71.0	8	2	4.8	0	16	8	8.69	3.60	3.93	9	10	9.8	8.0	8.4	7.2
Sep	62.1	62.6	63.5	2	0	1.3	156	138	102	5.67	2.43	3.60	10	8	9.4	7.9	8.5	7.3
Oct	55.1	49.2	53.0	0	0	*	311	486	391	3.17	1.95	3.23	9	11	8.4	9.7	7.9	7.8
Nov	42.7	40.6	42.1	0	0	0.0	663	722	702	4.03	4.19	3.84	10	13	11.2	8.5	7.8	8.5
Dec	32.8	31.2	30.4	0	0	0.0	990	1042	1113	2.96	4.33	3.70	14	13	12.0	9.1	9.2	8.7
YEAR	52.5	49.0	50.0	31	7	18.8	5405	6281	6174	47.26	41.98	43.33	120	134	126.9	9.0	9.0	8.5

* Less than 0.05
[a] 1905-1992
[b] 1960-1992
[c] 1951-1980
[d] 1955-1992

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

TABLE 8-2

1991 AND 1992 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)		
	1991	1992	Mean[a]	1991	1992	Mean[b]	1991	1992	Normal[c]	1991	1992	Mean[d]	1991	1992	Mean[e]	1991	1992	Mean[f]
Jan	31.7	32.2	28.5	0	0	0.0	1023	1012	1101	2.86	1.92	3.53	11	8	10.5	---	---	13.2
Feb	36.2	33.8	30.6	0	0	0.0	799	895	963	1.83	2.12	3.21	11	13	9.8	---	---	13.6
Mar	42.2	37.1	38.0	0	0	0.0	700	859	831	4.07	3.64	3.91	15	11	11.2	---	---	13.5
Apr	51.8	46.5	48.1	0	0	*	396	548	492	3.19	1.89	3.82	10	10	10.5	---	---	13.0
May	64.5	58.0	58.5	2	0	0.2	106	225	220	3.83	2.85	3.76	9	11	11.1	---	---	11.6
Jun	70.3	67.1	67.8	4	0	1.0	14	23	20	2.29	5.13	3.35	8	8	9.6	---	---	10.5
Jul	75.5	71.1	73.3	8	1	3.0	0	4	0	2.17	3.76	3.71	9	14	8.6	---	---	10.0
Aug	74.8	70.4	72.0	3	0	1.6	0	3	0	7.84	8.38	4.09	9	10	9.3	---	---	10.1
Sep	65.1	65.0	65.1	0	0	0.3	91	80	49	3.47	5.32	3.46	9	10	8.5	---	---	11.2
Oct	56.7	52.1	54.7	0	0	0.0	268	393	285	1.88	2.42	3.36	9	11	7.3	---	---	11.9
Nov	45.9	44.7	44.2	0	0	0.0	566	599	585	2.82	4.46	3.80	9	11	10.1	---	---	12.7
Dec	36.7	36.0	33.3	0	0	0.0	871	892	955	4.27	4.30	3.63	14	11	11.3	---	---	13.0
YEAR	54.3	51.2	51.2	17	1	6.3	4834	5533	5501	40.48	46.19	43.63	123	128	117.8	---	---	12.0

* Less than 0.05
[a] 1903-1992
[b] 1966-1992
[c] 1951-1980
[d] 1894-1992
[e] 1949-1992
[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 1991
BRADLEY INTERNATIONAL AIRPORT
WINDSOR LOCKS, CONNECTICUT

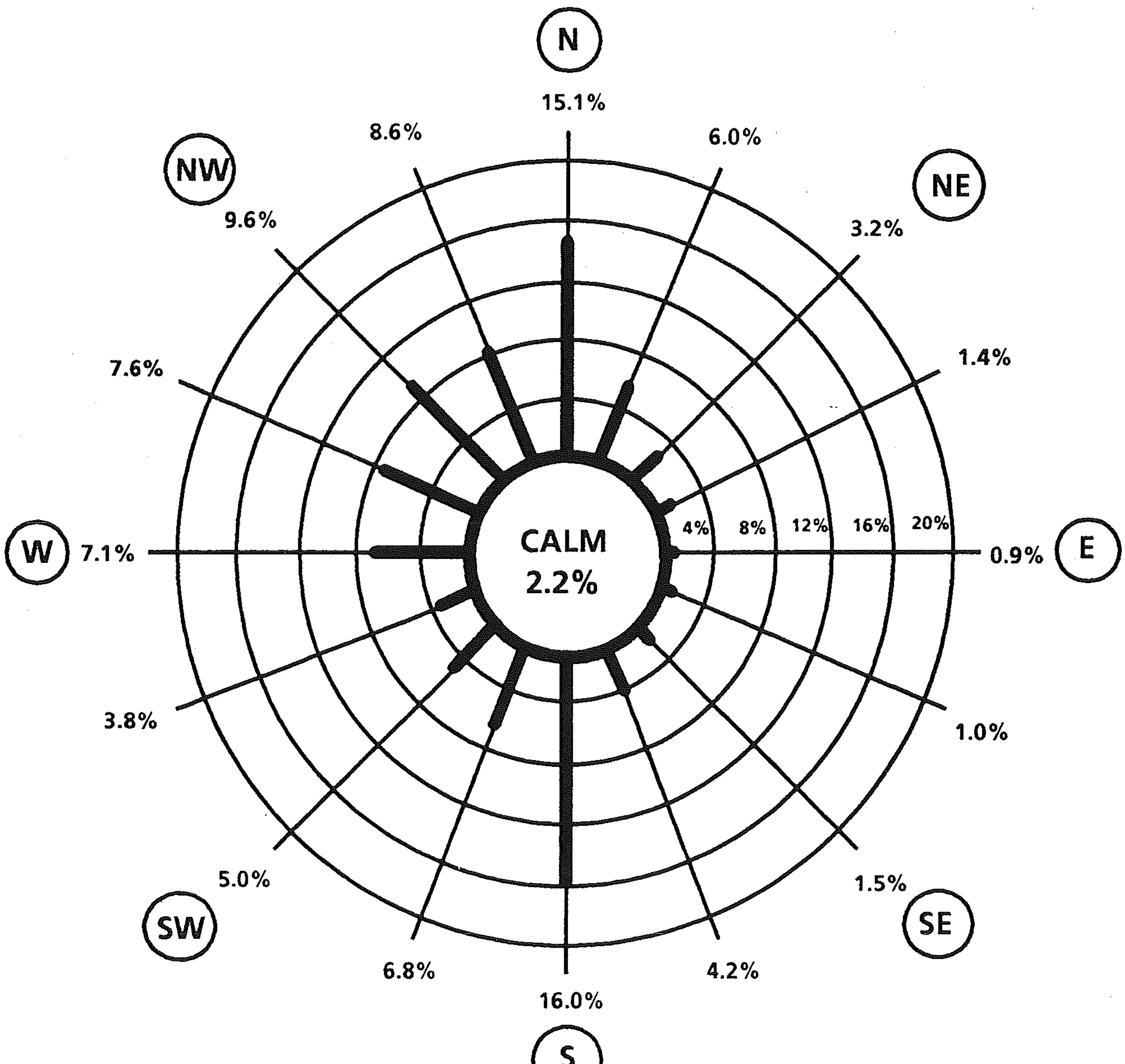


FIGURE 8-2

ANNUAL WIND ROSE FOR 1992
BRADLEY INTERNATIONAL AIRPORT
WINDSOR LOCKS, CONNECTICUT

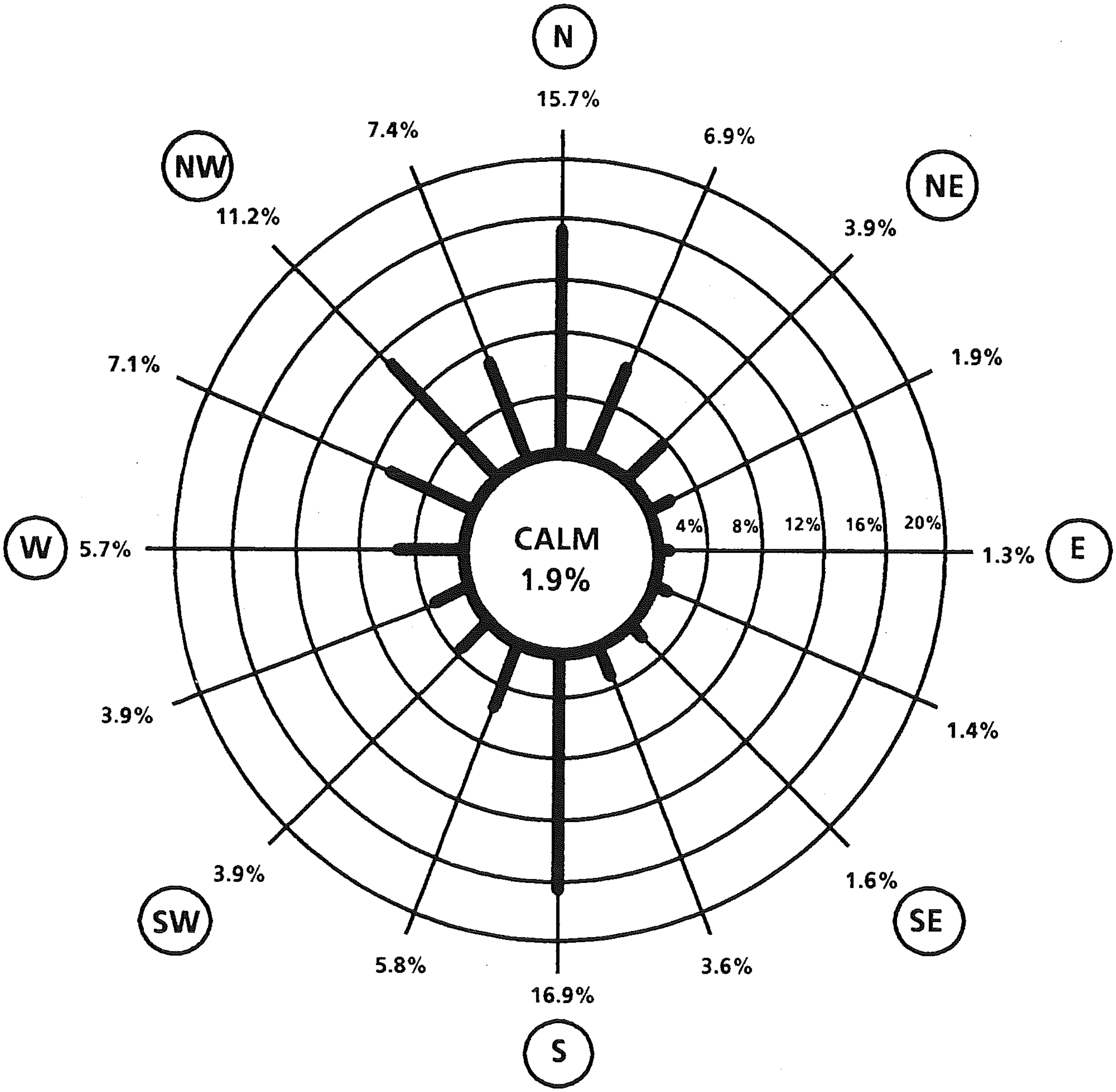


FIGURE 8-3

ANNUAL WIND ROSE FOR 1991
NEWARK INTERNATIONAL AIRPORT
NEWARK, NEW JERSEY

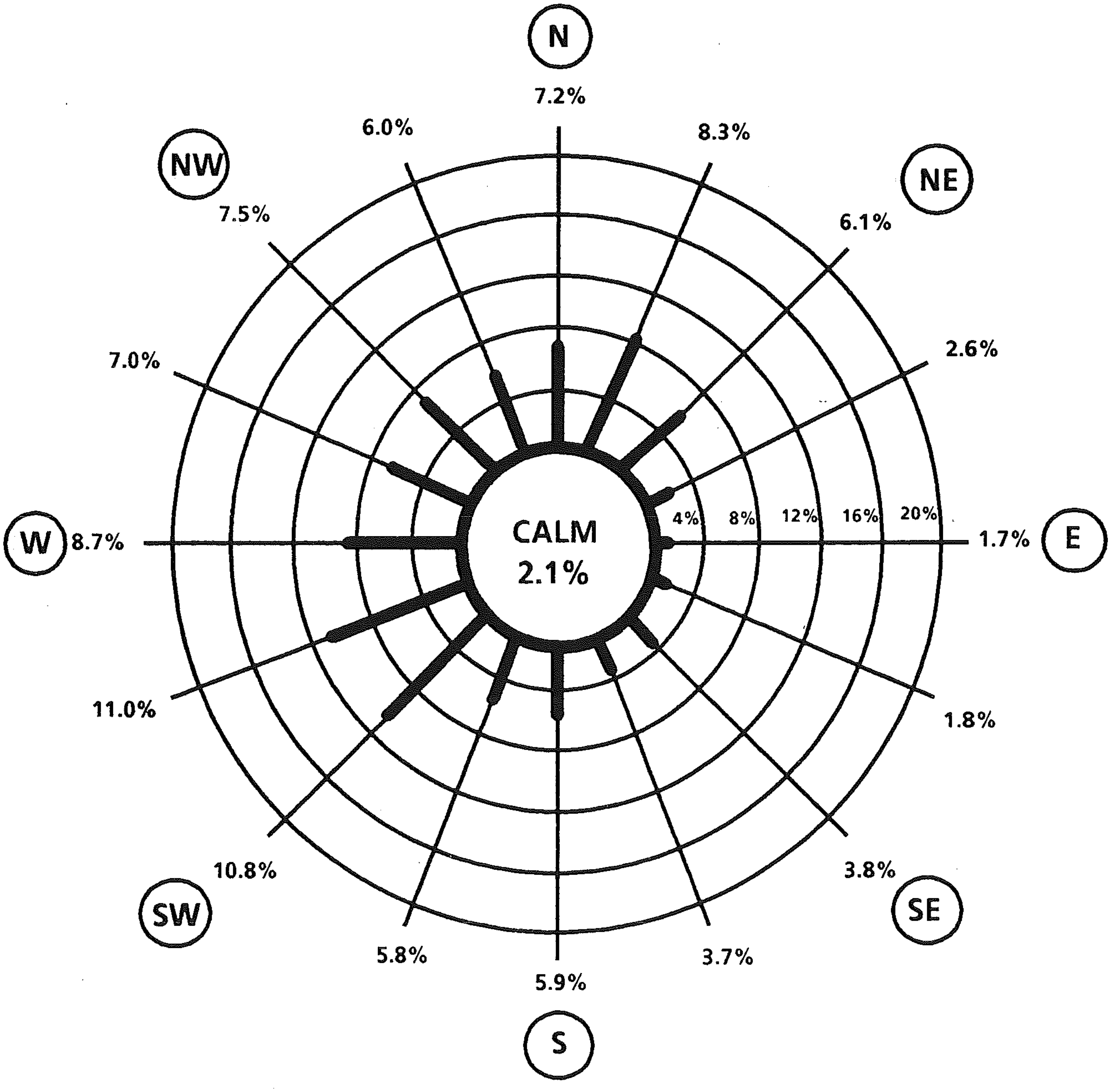
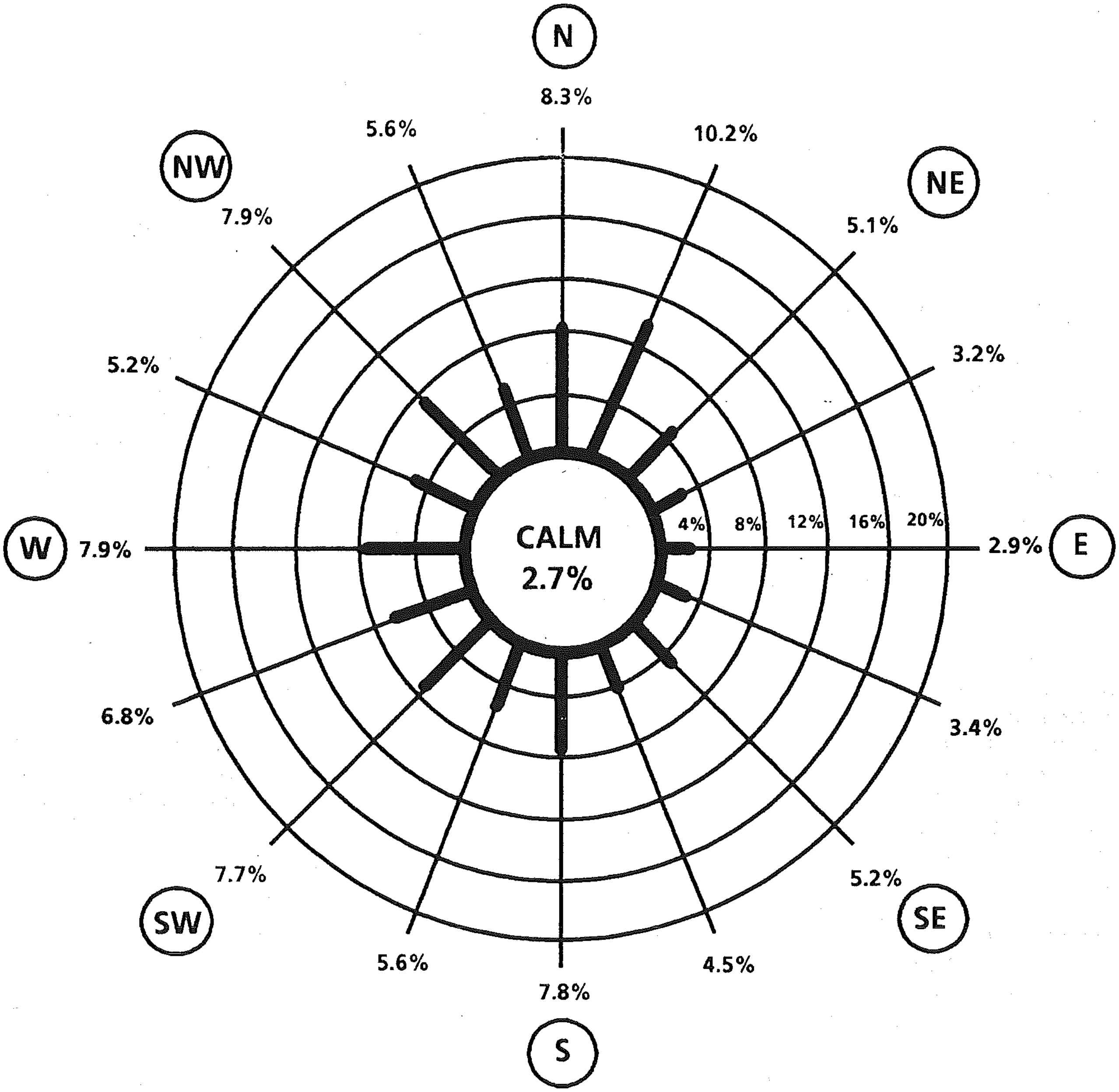


FIGURE 8-4

ANNUAL WIND ROSE FOR 1992
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 1992 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 has been violated in one or more regions of the State. The non-attainment designation that is subsequently applied to a region can reflect the "degree" of non-attainment depending upon a number of factors: the air pollution history in the region; previous designation of the region as either attainment or non-attainment; lack of air pollutant monitoring in the region; inferences made based on pollutant monitoring done in adjacent or similar regions, *et al.* For example, the whole state is designated as non-attainment for ozone, but the degree of non-attainment varies from region to region (see Figure 9-1). The region comprising Fairfield County (less Shelton), New Milford and Bridgewater is designated as "severe non-attainment" for ozone, while the rest of the State is designated as "serious non-attainment." The difference in the two designations is explained by higher ozone concentrations in exceedance of the 1-hour ozone standard in the Fairfield County region, which also contains portions of New York and New Jersey (not shown).

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

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

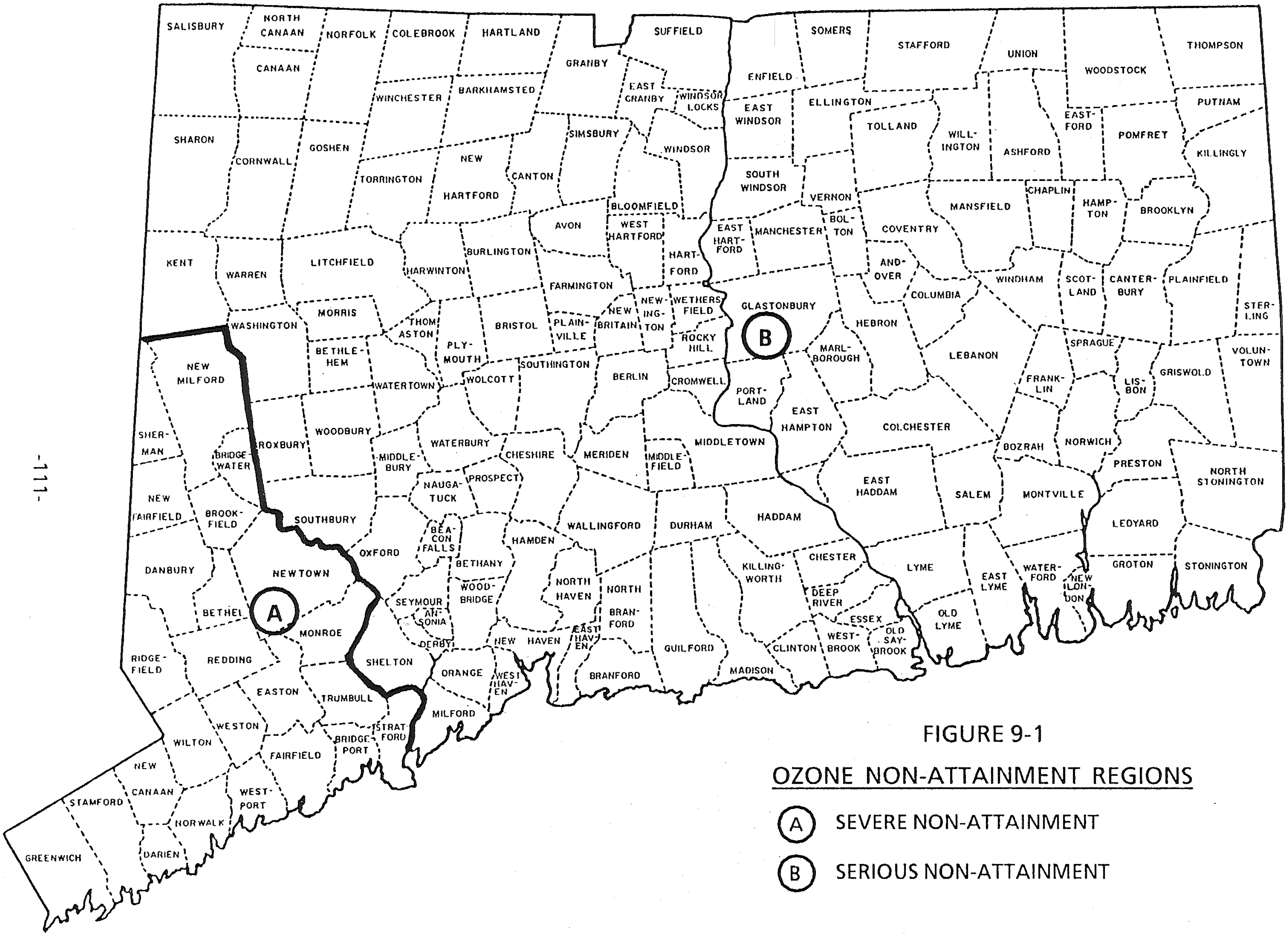


FIGURE 9-1

OZONE NON-ATTAINMENT REGIONS

(A) SEVERE NON-ATTAINMENT

(B) SERIOUS NON-ATTAINMENT

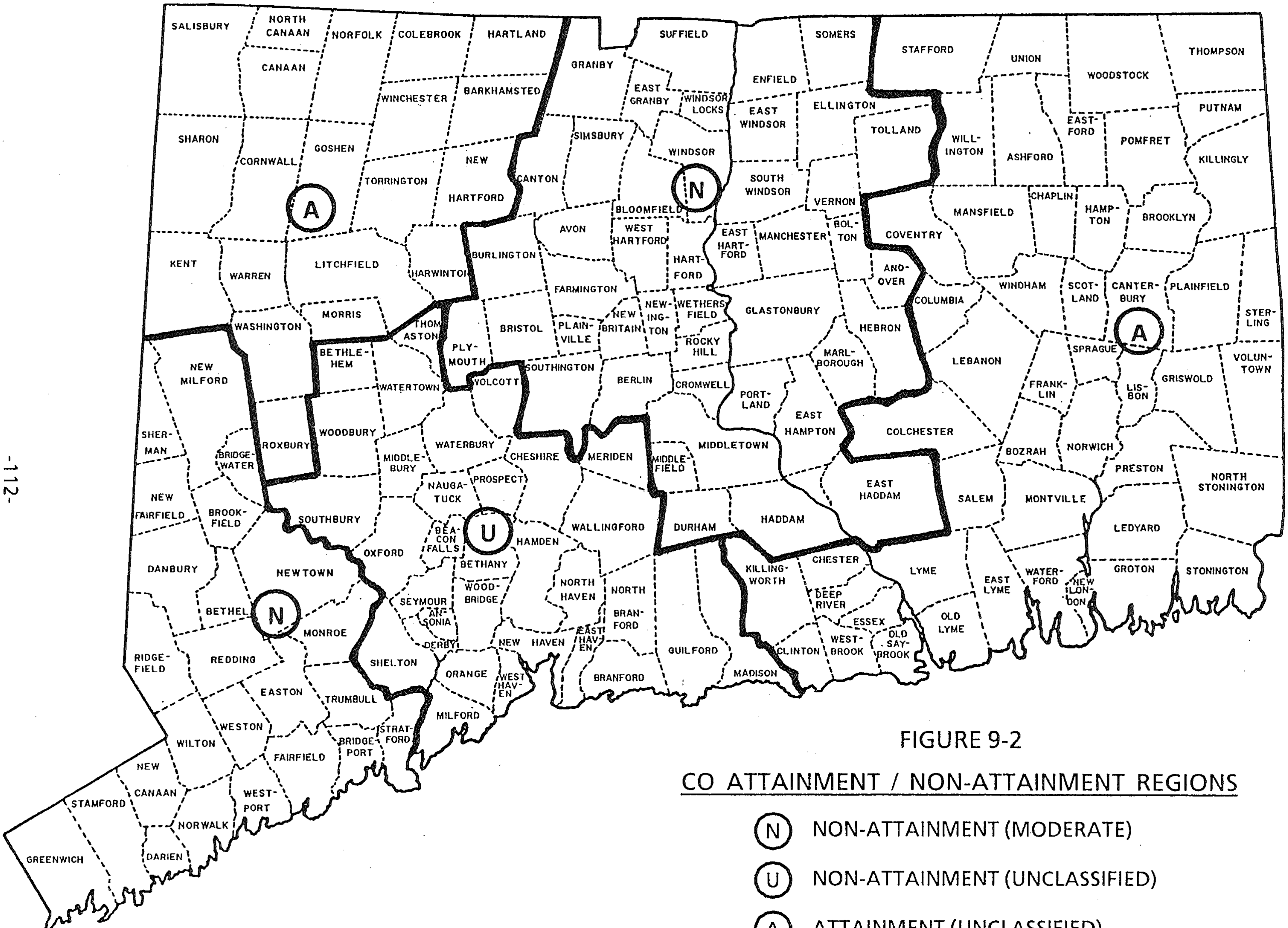


FIGURE 9-2

CO ATTAINMENT / NON-ATTAINMENT REGIONS

Ⓝ NON-ATTAINMENT (MODERATE)

Ⓤ NON-ATTAINMENT (UNCLASSIFIED)

Ⓐ ATTAINMENT (UNCLASSIFIED)

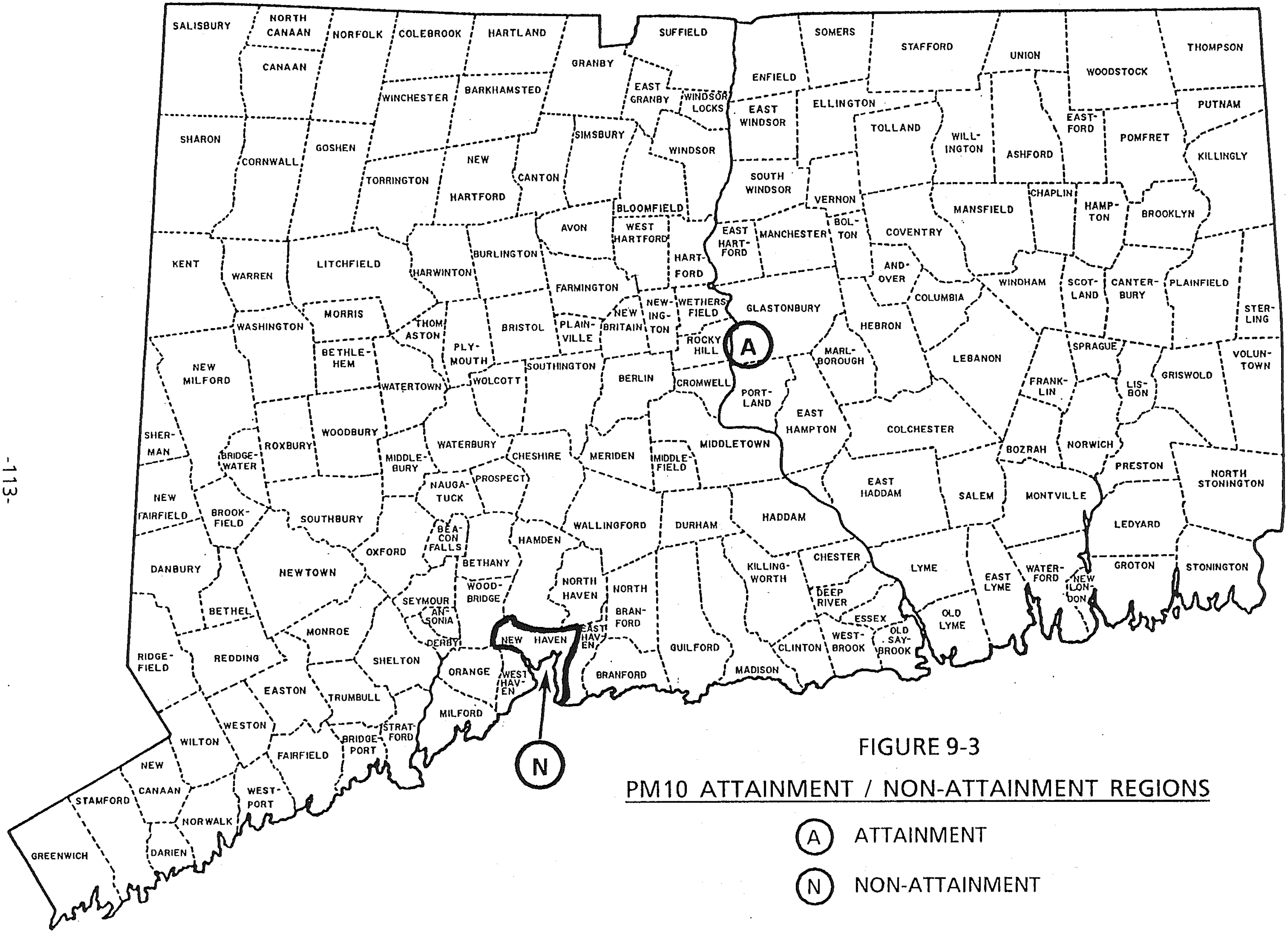


FIGURE 9-3

PM10 ATTAINMENT / NON-ATTAINMENT REGIONS

(A) ATTAINMENT

(N) NON-ATTAINMENT

X. CONNECTICUT SLAMS AND NAMS NETWORK

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

QUALITY ASSURANCE

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

The data assessment requirements entail the determination of precision and accuracy for both continuous and manual methods. A one-point precision check must be carried out at least once every other week on each automated analyzer used to measure SO_2, NO_2, CO and O_3. Standards from which the precision check test data are derived must meet specifications detailed in the regulations. For manual methods, precision checks are to be accomplished by operating co-located duplicate samplers. In 1992, Connecticut maintained three co-located PM_{10} monitors (Hartford 015, New Haven 123 and Waterbury 123) and one co-located lead monitor (Waterbury 123).

Accuracy determinations for automated analyzers (SO_2, NO_2, CO, O_3) are accomplished by audits performed by an independent auditor utilizing equipment and gases which are disassociated from the normal network operations. Accuracy determinations are accomplished via traceable standard flow devices for hi-vols and via spiked strip analyses for lead. For SLAMS analyzers, accuracy audits must be performed on each analyzer at least once per calendar year.

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

In order to control the quality of data, the monitoring program must have 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 1992 which were on the EPA-approved list as of October 30, 1990. 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 1992 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 1992

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

( ) = Approved range in ppm

TABLE 10-2

1992 SLAMS AND NAMS SITES IN CONNECTICUT

Town	Urban Area	Site	SLAMS or NAMS	Sampling Method	Analytic Method	Operating Schedule	Monitoring Objective	Spatial Scale of Representativeness
				PARTICULATE MATTER (PM_{10})				
Bridgeport	Bridgeport	010	N	Hi-Vol	Gravimetric	6th day	Population	Neighborhood
Bridgeport	Bridgeport	014	N	Hi-Vol	Gravimetric	6th day	High Concentration	Micro
Bristol	Bristol	001	S	Hi-Vol	Gravimetric	6th day	High Concentration	Neighborhood
Burlington	NONE	001	S	Hi-Vol	Gravimetric	6th day	Background	Regional
Cornwall	NONE	005	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

1992 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

1992 SLAMS AND NAMS SITES IN CONNECTICUT

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

1992 SLAMS AND NAMS SITES IN CONNECTICUT

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

TABLE 10-3

SUMMARY OF PROBE SITING CRITERIA

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

TABLE 10-3, CONTINUED

SUMMARY OF PROBE SITING CRITERIA

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

TABLE 10-3, CONTINUED

SUMMARY OF PROBE SITING CRITERIA

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

TABLE 10-3, CONTINUED

SUMMARY OF PROBE SITING CRITERIA

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

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

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

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

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

XI. PUBLICATIONS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

24. Wolff, G.T., P.J. Lioy, R.E. Meyers, R.T. Cederalll, 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&WA'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&WA's 86th Annual Meeting & Exhibition, Denver, Colorado, June 14-18, 1993.

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 1991 Air Quality Summary,

    1. In Section I, on page 3, the fourth paragraph under AIR MONITORING NETWORK should indicate that there were 5 lead hi-vol samplers, instead of lo-vol samplers.

    2. In Section II, on page 20, Table 2-1 should reflect the following changes for Wilimantic 002 in 1991: 54, not 59, samples; 22.4, not 23.1, is the arithmetic mean; 10.850, not 11.027, is the standard deviation; 19.7 and 25.2 are the lower and upper 95% limits, respectively.

    3. In Section II, on page 23, Table 2-2 should show that 29, not 30, sites achieved compliance in 1991.

    4. In Section II, on page 27, Table 2-3 should show 29, not 30, sites in 1991.

    5. In Section II, on page 44, Table 2-5 should reflect the following changes for Wilimantic 002: 54, not 59, samples; delete the fourth highest value (on 6/29/91) and the eighth highest value (on 7/23/91).

    6. In Section II, on page 45, Table 2-6 should reflect the following changes for the paired years 1990 and 1991: 20.7, not 20.5, is the average of the annual geometric means for 1990; 23.1, not 23.0, is the average of the annual geometric means for 1991; the number of sites is 28, not 29, for both years; 2.38, not 2.45, is the average of the differences of the paired year means; 1.53, not 1.54, is the standard deviation of the differences of the paired year means.

    7. In Section IV, on page 67, the last sentence in the first paragraph should read: "The actual number of hours when the ozone standard was exceeded in the state increased from 59 in 1990 to 84 in 1991."

    8. In Section IV, on page 67, the sentence in the third paragraph dealing with the frequency of winds out of the southwest should read: "However, the percentage of southwest winds ... was 38% in 1990 and 36% in 1991."

    9. In Section VII, on page 100, the site key in Figure 7-1 should read: "HIGH VOLUME".

- Regarding the 1985-1991 editions of the Air Quality Summary,

    1. In Table 24 of editions 1985, 1986 and 1987, and in Table 6-1 of editions 1988, 1989, 1990 and 1991, the last column of numbers should have the heading "TIME OF 2ND HIGH 1-HOUR AVERAGE".