1990

STATE OF CONNECTICUT
ANNUAL AIR QUALITY SUMMARY

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I. INTRODUCTION

The 1990 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 1990. 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. The state of Connecticut is in the process of adopting these standards.

Compliance Assessment - Measured PM_{10} concentrations during 1990 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. Futhermore, 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 1990. 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. 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 frequently exceeded at nine of the ten DEP ozone monitoring sites in 1990 (see Table 1-2). Consequently, the standard was violated at those sites.

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 1990.

5. CARBON MONOXIDE (CO)

Compliance Assessment - The primary eight-hour standard of 9 ppm was not exceeded at any of the five carbon monoxide monitoring sites in Connecticut during 1990. 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 1990.

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 1990.

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, Danbury, East Hartford, East Haven, Enfield, Greenwich, Groton, Hartford, Madison, Middletown, Milford, New Britain, New Haven, Stafford, Stamford, Stratford 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 1990 consisted of the following:

- 43 Particulate matter (PM_{10}) hi-vol samplers
- 4 Particulate matter (PM_{10}) analyzers
- 5 Lead lo-vol samplers
- 16 Sulfur dioxide analyzers
- 10 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 1990 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 1990, 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, Milford, New Britain, 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, and Stratford. 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. **Automated Analyzers** (SO_2, O_3, CO and NO_2)

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

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

TABLE 1-1

ASSESSMENT OF AMBIENT AIR QUALITY

POLLUTANT	SAMPLING PERIOD	DATA REDUCTION	STATISTICAL BASE	AMBIENT AIR QUALITY STANDARDS			
				PRIMARY		SECONDARY	
				μg/m³	ppm	μg/m³	ppm
Particulates (PM_{10})[a]	24 Hours (every sixth day)	24-Hour Average	Annual Arithmetic Mean[b]	50[c]		50[c]	
			24-Hour Average	150[d]		150[d]	
Sulfur Oxides (measured as sulfur dioxide)	Continuous	1-Hour Average	Annual Arithmetic Mean[e]	80	0.03		
			24-Hour Average[e]	365[f]	0.14[f]		
			3-Hour Average[e]			1300[f]	
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.

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

[g] Not to be exceeded more than an average of once per year in three years.

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

[i] Units are mg/m³, not μg/m³.

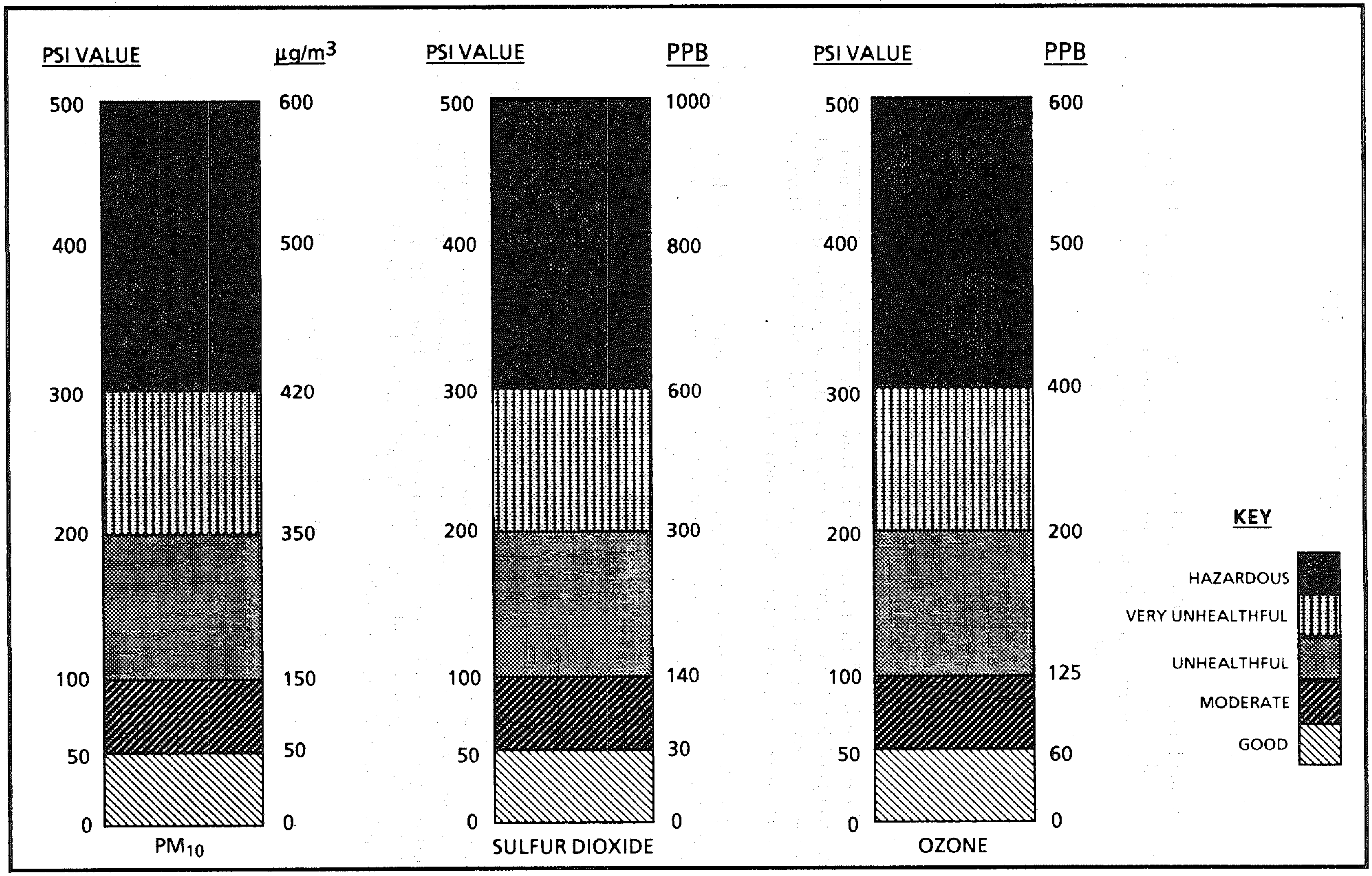
TABLE 1-2

AIR QUALITY STANDARDS EXCEEDED IN CONNECTICUT IN 1990 BASED ON MEASURED CONCENTRATIONS

		OZONE	
		Level Exceeding 1-Hour Standard	
TOWN	SITE	Highest Observed Level (ppm)	Number of Days Standard Exceeded
Bridgeport	013	0.182	3
Danbury	123	0.167	4
East Hartford	003	0.151	4
Greenwich	017	0.146	7
Groton	008	0.172	6
Madison	002	0.197	7
Middletown	007	0.158	3
Stafford	001	0.153	5
Stratford	007	0.126	4

FIGURE 1-1

POLLUTANT STANDARDS INDEX



II. PARTICULATE MATTER

HEALTH EFFECTS

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

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

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

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

REVISION OF THE PARTICULATE MATTER STANDARD

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

The TSP standard directs control efforts towards particles of lower risk to health because of its inclusion of large particles which can dominate the measured mass concentration, but which are deposited only in the extrathoracic region. Smaller particles penetrate furthest in the respiratory tract, settling in the tracheobronchial region and in the deepest portion of the lung, the alveolar region. Available evidence demonstrates that the risk of adverse health effects associated with depositon of typical ambient fine and coarse particles in the thorax are markedly greater than those associated with depositon 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 would place substantially greater emphasis on controlling smaller 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. The state of Connecticut is in the process of adopting these standards.

CONCLUSIONS

Measured PM_{10} concentrations during 1990 did not exceed the 50 $\mu g/m^3$ level of the primary and secondary annual standards or the 150 $\mu g/m^3$ level of the primary and secondary 24-hour standards at any site. Furthermore, the 24-hour standards were not violated because the "expected number of exceedances" for the most recent 3 years at each site did not exceed one per year. The annual standards were also not violated 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. These hi-vols resemble vacuum cleaners in their operation, with an 8" X 10" piece of fiberglass filter paper replacing the vacuum bag. 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 . The matter collected on the filter is analyzed for weight. 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.

Low Volume Sampler (Lo-vol) - The low volume sampler is a 30-day continuous sampler. It is enclosed in a shelter similar to a hi-vol, uses the same fiberglass filter paper, but operates at an air sampling flow rate approximately one-tenth that used by a standard hi-vol (i.e., 4 cfm as opposed to 40-60 cfm). The air flow through the lo-vol is measured by a temperature compensating dry gas meter. The lo-vol measurement is essentially an average for the 30-day sampling interval.

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

DISCUSSION OF DATA

Monitoring Network - In 1990, 43 PM_{10} samplers were operated in Connecticut (see Figure 2-1). It should be noted that this total includes one sampler for site New Haven 018 when, in fact, there are five samplers at the site, which are operated seqentially in order to facilitate a daily sampling schedule.

As part of the 1990 network for monitoring the airborne concentrations of lead, five lo-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 two PM_{10} sampling sites which had co-located samplers. On the basis of 110 precision checks, the 95% probability limits for precision ranged from -13% to +8%. Accuracy is based on air flow through the monitor. The 95% probability limits for accuracy, based on 43 audits conducted on the PM_{10} monitoring system network, ranged from -2% to +6%. (See section I.D. of this Air Quality Summary for a discussion of precision and accuracy.)

Annual Averages - The Federal EPA has established minimum sampling criteria (see Table 1-1) for use in determining compliance with the primary and secondary annual NAAQS for PM_{10}. A site must have 75% of the scheduled samples in each calendar quarter for the the most recent 3 years. Using the EPA criteria, one finds that a determination of attainment or nonattainment of the 50 $\mu g/m^3$ primary and secondary annual standards could be reached at only 3 of the 43 PM_{10} monitoring sites in Connecticut in 1990. Attainment of the annual standards was demonstrated at the Hartford 015, New Haven 018 and Waterbury 123 sites. Whereas the "expected annual mean" PM_{10} concentration at New Haven 018 equaled the 50 $\mu g/m^3$ level of the standard in 1989 and exceeded the level of the standard by 5 $\mu g/m^3$ in 1988, it was well below the level of the standard at 44 $\mu g/m^3$ in 1990.

Of the 43 sampling sites in the network, the above 3 sites were the only ones that could satisfy the minimum sampling criteria for the most recent 3 years. The reason for this is that a major part of the network was installed after the first calendar quarter of 1988.

A summary of annual average PM_{10} data for 1988 -1990 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 $\mu g/m^3$) would have been exceeded if sampling had been conducted every day. For comparison, Table 2-1 also shows the number of days at each site when the level of the primary and secondary 24-hour standards was actually exceeded, as demonstrated by actual measurements at the site.

The statistical predictions of the number of days that would have seen an exceedance of the level of the 24-hour standards are based on the assumption of a lognormal distribution of the data. They indicate that more frequent PM_{10} sampling in 1988 and 1989 at New Haven 018 might have resulted in measured violations (i.e., four or more exceedances in three years) 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 Bridgeport 014 in 1989, 59 samples were analyzed and an arithmetic mean of 36.5 $\mu g/m^3$ was then calculated. The columns labeled "95-PCT-LIMITS" show the lower and upper limits of the 95% confidence interval to be 33.0 and 40.0 $\mu g/m^3$, respectively. This means that 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 39 sites that met the minimum sampling criteria in 1990. The results for the years 1988 and 1989 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 1990.

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 1990, there would have been no such site. The results for 1988 and 1989 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 Hartford 015, New Haven 018 and Waterbury 123 in 1990. This was the first year that the 24-hour standards were not violated at New Haven 018, where the "expected number of exceedances" of the 150 $\mu g/m^3$ level of the 24-hour standards was determined to be less than one per year.

Lo-vol Averages - Monthly and annual averages of the chemical components from the lo-vol TSP monitors have been computed for 1990 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 in Connecticut which complied with EPA's minimum sampling criteria during 1990. 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 33% of the high PM_{10} days occur with winds out of the southwest quadrant and most of those days have relatively persistent winds. This relationship between southwest winds and high particulate levels has historically been more prevalent in southwestern Connecticut. However, many of the maximum levels at some urban sites do not occur with southwest winds, indicating that these sites are possibly influenced by local sources or transport from different out-of-state sources. As noted above, a large scale southwesterly air flow is often diverted into a southerly flow up the Connecticut River Valley. At sites in the Connecticut River Valley, many of the highest PM_{10} days occur when the winds at Bradley Airport are from the south.

Trends - 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 pollutant levels in Connecticut, 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 was a significant decrease in statewide PM_{10} levels from 1989 to 1990. 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.

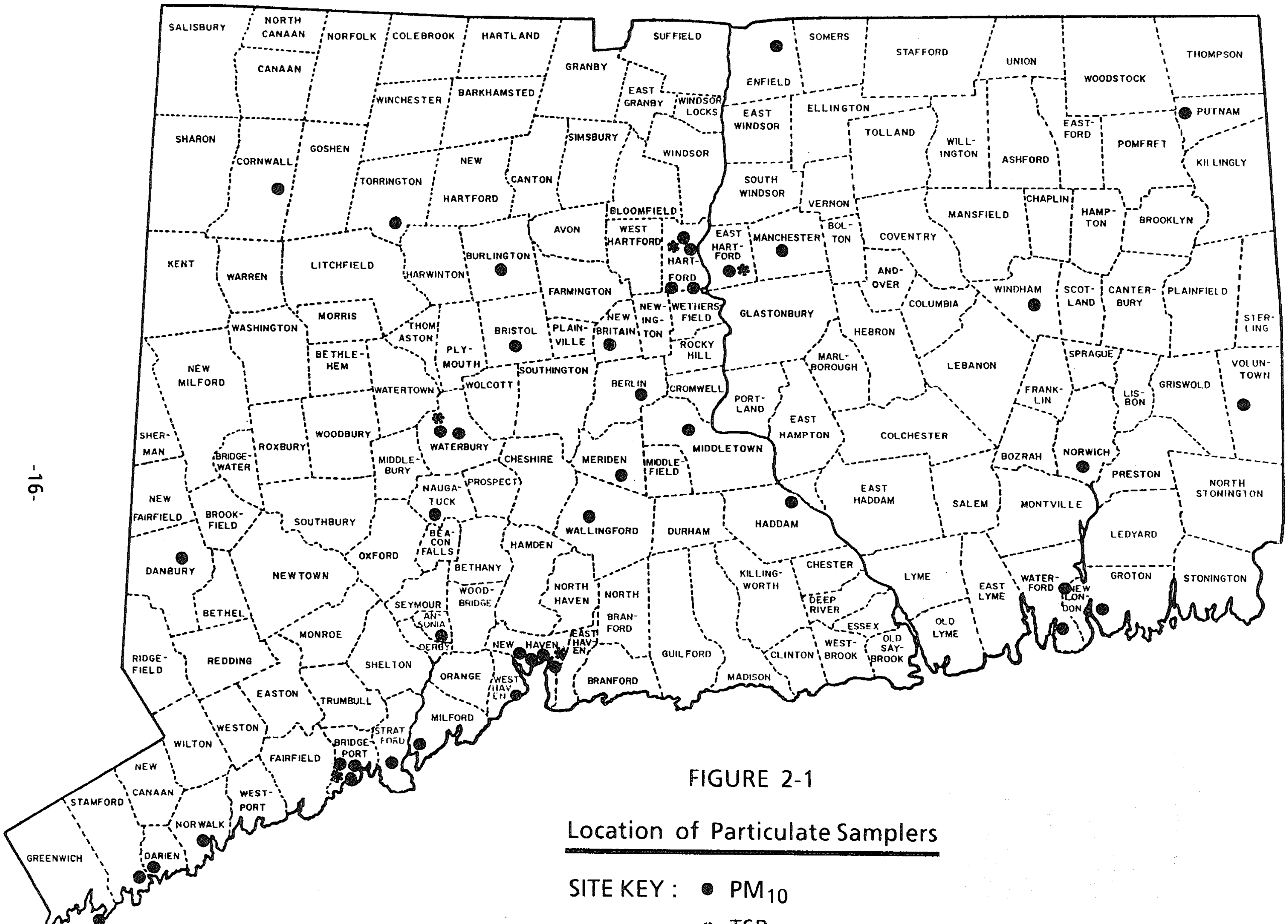


FIGURE 2-1

Location of Particulate Samplers

SITE KEY : ● PM_{10}

✱ TSP

TABLE 2-1

1988-1990 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	1988	37*	26.0	21.1	31.0	15.720		
ANSONIA	004	1989	58	25.3	22.5	28.1	11.597		
ANSONIA	004	1990	30*	21.1	16.6	25.7	12.780		
BERLIN	002	1989	59	22.4	19.9	24.9	10.325		
BERLIN	002	1990	55	18.8	16.3	21.2	9.800		
BRIDGEPORT	010	1988	53*	28.6	24.8	32.4	14.904		
BRIDGEPORT	010	1989	57	27.3	24.2	30.4	12.843		
BRIDGEPORT	010	1990	59	25.0	21.6	28.4	14.198		
BRIDGEPORT	013	1988	33*	27.5	22.4	32.6	15.032		
BRIDGEPORT	013	1989	57	26.9	23.6	30.1	13.412		
BRIDGEPORT	013	1990	58	24.6	21.3	27.8	13.451		
BRIDGEPORT	014	1988	10*	33.1	27.4	38.8	8.031		
BRIDGEPORT	014	1989	59	36.5	33.0	40.0	14.737		
BRIDGEPORT	014	1990	59	32.6	29.1	36.2	14.881		
BRISTOL	001	1988	29*	22.9	18.7	27.2	11.730		
BRISTOL	001	1989	60	22.9	20.5	25.2	9.936		
BRISTOL	001	1990	60	20.1	17.7	22.5	10.058		
BURLINGTON	001	1988	44*	17.7	13.6	21.8	14.312		
BURLINGTON	001	1989	59	15.2	13.5	16.9	7.171		
BURLINGTON	001	1990	59	14.8	12.7	16.8	8.573		
CORNWALL	005	1988	17*	10.8	7.4	14.2	6.723		
CORNWALL	005	1989	60	15.1	13.1	17.1	8.587		
CORNWALL	005	1990	58	16.0	13.4	18.7	10.949		
DANBURY	123	1988	36*	25.8	21.2	30.4	14.363		
DANBURY	123	1989	57	25.4	22.6	28.3	11.743		
DANBURY	123	1990	60	22.1	19.4	24.7	11.272		

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

TABLE 2-1, CONTINUED

1988–1990 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
DARIEN	001	1989	45*	28.7	25.0	32.4	13.200		
DARIEN	001	1990	58	31.0	27.6	34.3	13.869		
EAST HARTFORD	004	1988	27*	24.6	20.0	29.2	12.093		
EAST HARTFORD	004	1989	59	25.8	22.9	28.8	12.329		
EAST HARTFORD	004	1990	59	21.8	18.9	24.7	12.030		
ENFIELD	005	1988	27*	20.3	16.6	24.1	9.832		
ENFIELD	005	1989	58	19.6	17.5	21.8	8.784		
ENFIELD	005	1990	58	16.6	14.5	18.7	8.763		
GREENWICH	017	1988	34*	24.9	19.4	30.3	16.432		
GREENWICH	017	1989	56	21.4	18.7	24.1	11.003		
GREENWICH	017	1990	57	20.4	17.5	23.3	11.953		
GROTON	006	1988	28*	21.6	17.2	26.1	11.860		
GROTON	006	1989	59	20.0	17.7	22.3	9.689		
GROTON	006	1990	56	18.8	16.1	21.4	10.730		
HADDAM	002	1988	26*	17.6	13.8	21.4	9.688		
HADDAM	002	1989	59	18.5	16.4	20.5	8.468		
HADDAM	002	1990	53*	16.6	14.3	18.8	8.751		
HARTFORD	013	1988	38*	23.3	19.4	27.3	12.724		
HARTFORD	013	1989	57	23.3	20.8	25.8	10.299		
HARTFORD	013	1990	59	20.7	18.2	23.2	10.526		
HARTFORD	014	1988	25*	21.6	18.1	25.2	8.984		
HARTFORD	014	1989	58	24.4	21.4	27.4	12.352		
HARTFORD	014	1990	55	21.6	18.8	24.4	11.331		
HARTFORD	015	1988	54	29.9	26.1	33.8	15.261		
HARTFORD	015	1989	59	29.5	26.6	32.3	11.918		
HARTFORD	015	1990	58	24.9	22.0	27.8	11.864		

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

TABLE 2-1, CONTINUED

1988-1990 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
HARTFORD	018	1988	7*	25.7	16.4	35.0	10.124		
HARTFORD	018	1989	60	28.0	25.1	30.9	12.232		
HARTFORD	018	1990	60	24.1	21.1	27.0	12.684		
MANCHESTER	001	1988	26*	19.6	15.6	23.5	10.150		
MANCHESTER	001	1989	58	21.2	18.8	23.5	9.687		
MANCHESTER	001	1990	55	19.1	16.5	21.6	10.404		
MERIDEN	002	1988	25*	22.7	18.7	26.7	10.027		
MERIDEN	002	1989	48*	24.3	21.4	27.2	10.722		
MERIDEN	002	1990	37*	21.4	18.0	24.8	10.792		
MIDDLETOWN	003	1988	26*	23.0	18.7	27.3	11.019		
MIDDLETOWN	003	1989	57	23.2	20.4	25.9	11.154		
MIDDLETOWN	003	1990	58	20.5	18.0	23.0	10.360		
MILFORD	010	1988	9*	19.1	14.6	23.6	5.934		
MILFORD	010	1989	58	22.0	19.6	24.4	9.861		
MILFORD	010	1990	58	21.2	18.5	23.9	11.180		
NAUGATUCK	001	1988	29*	25.8	21.1	30.5	12.957		
NAUGATUCK	001	1989	60	26.4	23.5	29.2	12.146		
NAUGATUCK	001	1990	56	23.4	20.3	26.5	12.583		
NEW BRITAIN	012	1988	22*	19.9	16.7	23.1	7.397		
NEW BRITAIN	012	1989	61	24.2	21.5	26.9	11.676		
NEW BRITAIN	012	1990	58	21.3	18.6	24.0	11.223		
NEW HAVEN	013	1988	39*	26.2	21.9	30.4	13.873		
NEW HAVEN	013	1989	57	24.9	22.4	27.3	10.140		
NEW HAVEN	013	1990	60	23.7	20.8	26.5	12.172		
NEW HAVEN	018	1988	300	45.6	44.5	46.6	21.269	1	
NEW HAVEN	018	1989	351	44.1	43.7	44.5	20.213	1	
NEW HAVEN	018	1990	349	40.6	40.2	41.1	19.749		

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

TABLE 2-1, CONTINUED

1988-1990 PM10 ANNUAL AVERAGES AND STATISTICAL PROJECTIONS

TOWN NAME	SITE	YEAR	SAMPLES	ARITHMETIC MEAN	95-PCT-LIMITS LOWER	95-PCT-LIMITS UPPER	STANDARD DEVIATION	PREDICTED DAYS OVER 150 UG/M3	MEASURED DAYS OVER 150 UG/M3
NEW HAVEN	020	1988	31*	30.0	25.4	34.5	12.933		
NEW HAVEN	020	1989	59	28.8	26.0	31.6	11.659		
NEW HAVEN	020	1990	60	26.5	23.6	29.4	12.392		
NEW HAVEN	123	1988	37*	28.5	24.0	32.9	14.069		
NEW HAVEN	123	1989	59	27.9	25.1	30.6	11.561		
NEW HAVEN	123	1990	55	26.7	23.3	30.1	13.549		
NEW LONDON	004	1989	42*	21.7	18.6	24.8	10.615		
NEW LONDON	004	1990	58	20.6	18.1	23.0	10.210		
NORWALK	014	1988	13*	33.9	29.2	38.6	7.956		
NORWALK	014	1989	57	37.4	33.7	41.0	14.853		
NORWALK	014	1990	59	38.7	34.7	42.6	16.628		
NORWICH	002	1988	29*	24.4	19.9	28.8	12.138		
NORWICH	002	1989	60	23.5	21.0	25.9	10.509		
NORWICH	002	1990	59	20.7	18.2	23.2	10.378		
OLD SAYBROOK	005	1988	24*	21.3	17.9	24.6	8.278		
OLD SAYBROOK	005	1989	59	23.2	20.6	25.8	10.856		
PUTNAM	002	1988	27*	18.8	15.3	22.4	9.298		
PUTNAM	002	1989	59	20.2	18.0	22.4	9.224		
PUTNAM	002	1990	49*	19.2	16.6	21.8	9.623		
STAMFORD	001	1988	25*	24.2	18.5	29.9	14.319		
STAMFORD	001	1989	59	26.0	23.0	29.0	12.567		
STAMFORD	001	1990	59	24.0	20.8	27.2	13.461		
STAMFORD	026	1988	11*	26.3	16.7	35.8	14.461		
STRATFORD	005	1988	26*	24.1	19.4	28.8	12.071		
STRATFORD	005	1989	60	25.0	22.4	27.7	11.300		
STRATFORD	005	1990	55	24.3	20.8	27.7	13.678		

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

TABLE 2-1, CONTINUED

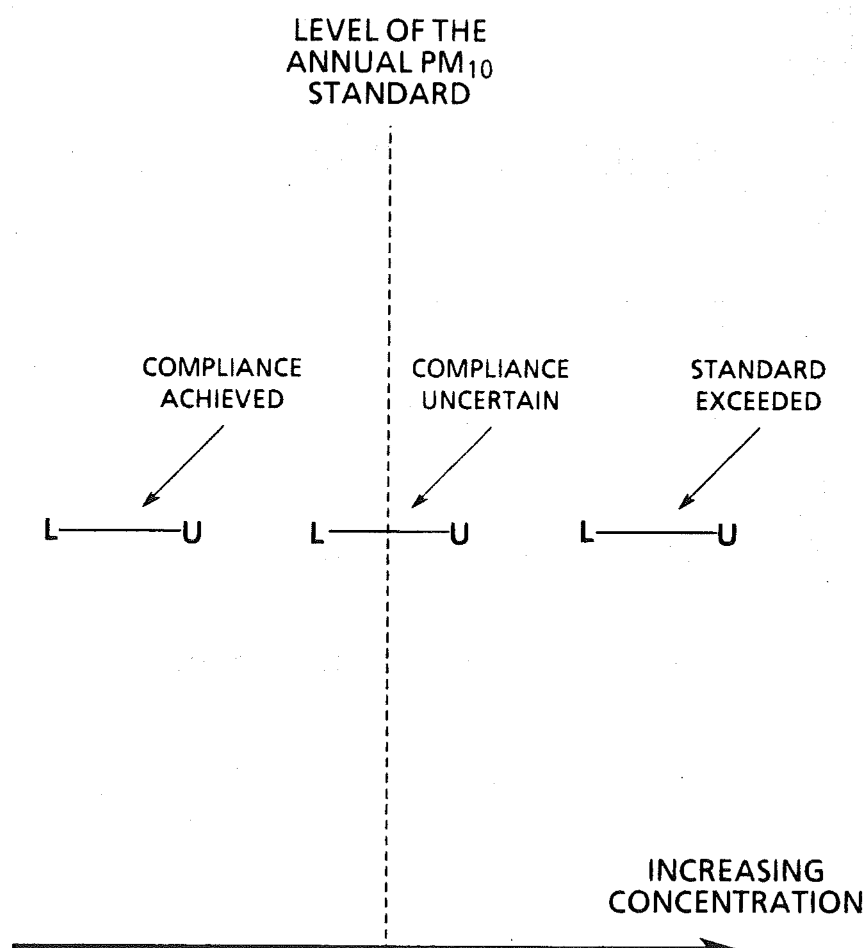
1988-1990 PM10 ANNUAL AVERAGES AND STATISTICAL PROJECTIONS

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
TORRINGTON	001	1988	28*	21.5	17.5	25.5	10.675		
TORRINGTON	001	1989	60	22.9	20.4	25.4	10.474		
TORRINGTON	001	1990	59	19.5	16.9	22.1	10.923		
VOLUNTOWN	001	1988	40*	16.7	13.2	20.2	11.457		
VOLUNTOWN	001	1989	56	15.3	13.4	17.3	7.947		
VOLUNTOWN	001	1990	60	14.3	12.4	16.3	8.292		
WALLINGFORD	006	1988	9*	24.3	17.9	30.7	8.446		
WALLINGFORD	006	1989	58	22.2	19.9	24.5	9.510		
WALLINGFORD	006	1990	53	19.5	16.8	22.1	10.291		
WATERBURY	007	1988	29*	27.2	22.6	31.9	12.792		
WATERBURY	007	1989	57	28.3	24.8	31.7	14.142		
WATERBURY	007	1990	59	25.6	22.1	29.1	14.752		
WATERBURY	123	1988	57	32.9	28.5	37.4	18.257		
WATERBURY	123	1989	59	33.0	29.1	36.9	16.235		
WATERBURY	123	1990	59	32.4	28.4	36.4	16.652		
WATERFORD	001	1988	28*	20.9	15.9	25.8	13.255		
WATERFORD	001	1989	58	17.5	15.5	19.5	8.309		
WATERFORD	001	1990	55	18.4	15.7	21.0	10.669		
WEST HAVEN	003	1988	41*	27.6	23.9	31.3	12.572		
WEST HAVEN	003	1989	60	27.9	25.3	30.5	11.109		
WEST HAVEN	003	1990	57	26.8	24.0	29.6	11.570		
WILLIMANTIC	002	1988	28*	20.5	17.2	23.7	8.736		
WILLIMANTIC	002	1989	60	21.0	18.8	23.2	9.174		
WILLIMANTIC	002	1990	60	18.5	16.3	20.7	9.318		

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

FIGURE 2-2

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



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

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

TABLE 2-2

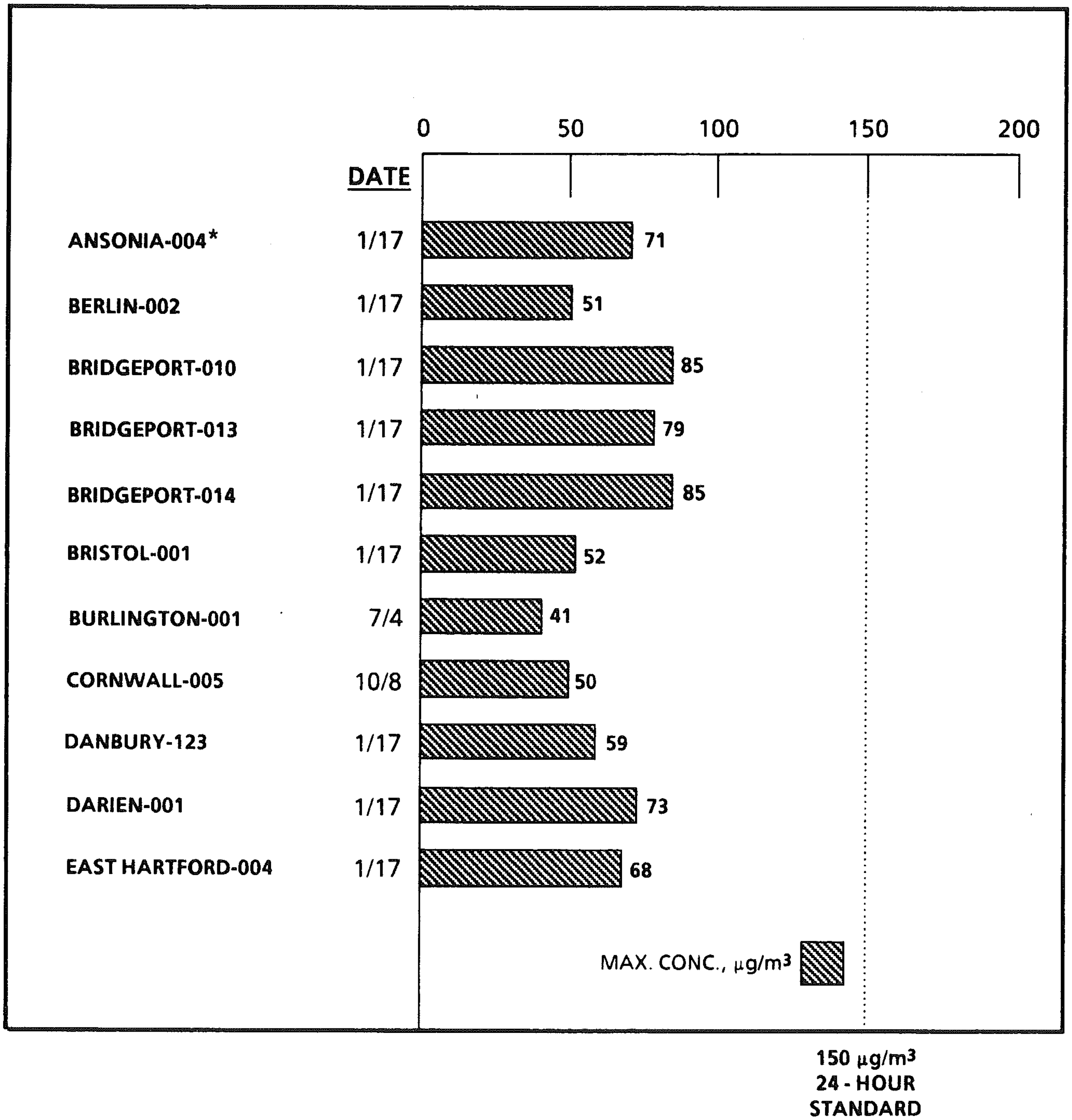
STATISTICALLY PREDICTED NUMBER OF SITES IN COMPLIANCE WITH THE LEVEL OF THE ANNUAL PM10 STANDARDS*

	COMPLIANCE ACHIEVED	COMPLIANCE UNCERTAIN	STANDARD EXCEEDED
1985	2	0	0
1986	4	0	1
1987	4	0	1
1988	3	0	0
1989	40	0	0
1990	39	0	0

* 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

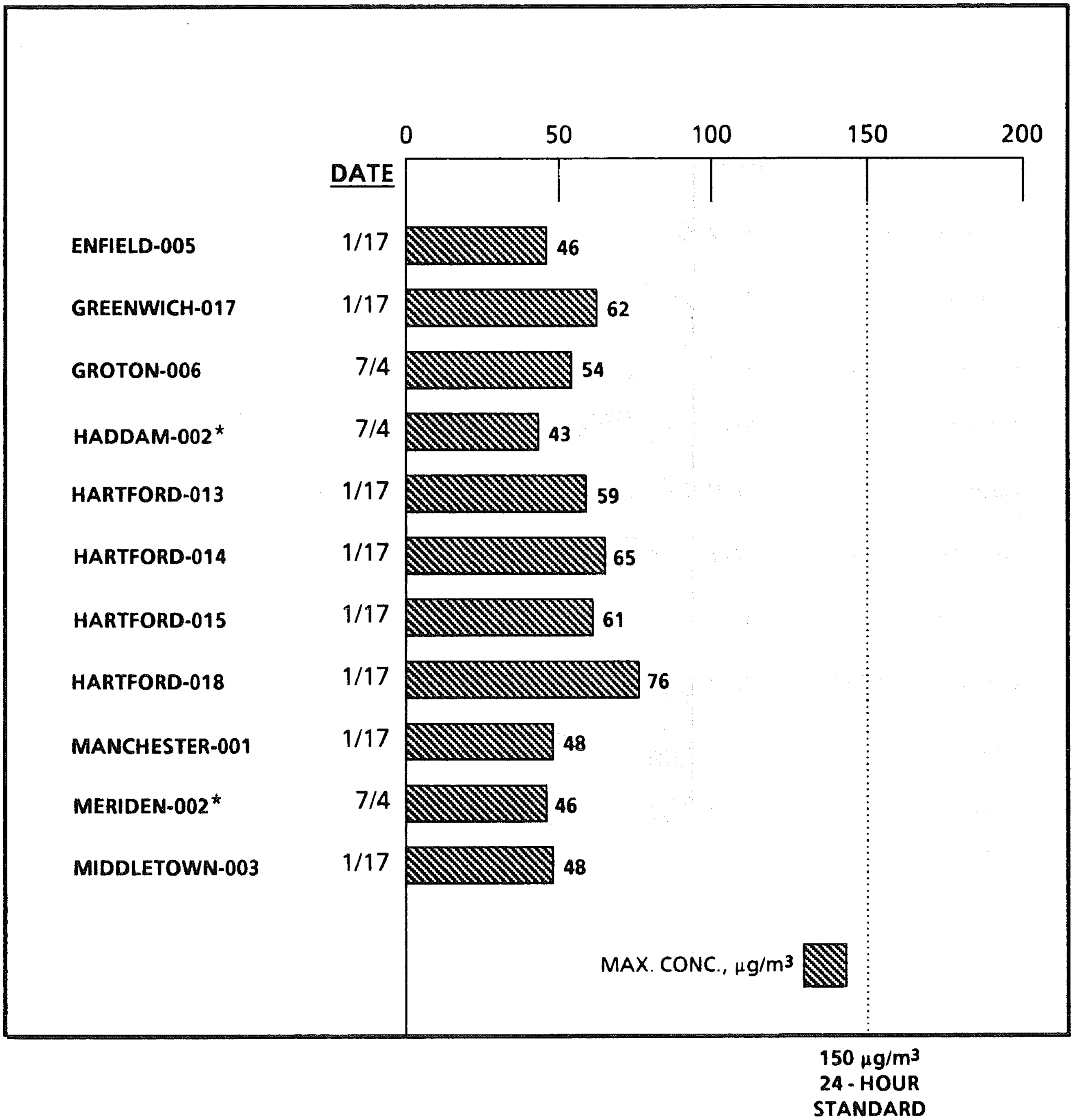
1990 MAXIMUM 24-HOUR PM10 CONCENTRATIONS



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

FIGURE 2-3, continued

1990 MAXIMUM 24-HOUR PM10 CONCENTRATIONS



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

FIGURE 2-3, continued

1990 MAXIMUM 24-HOUR PM10 CONCENTRATIONS

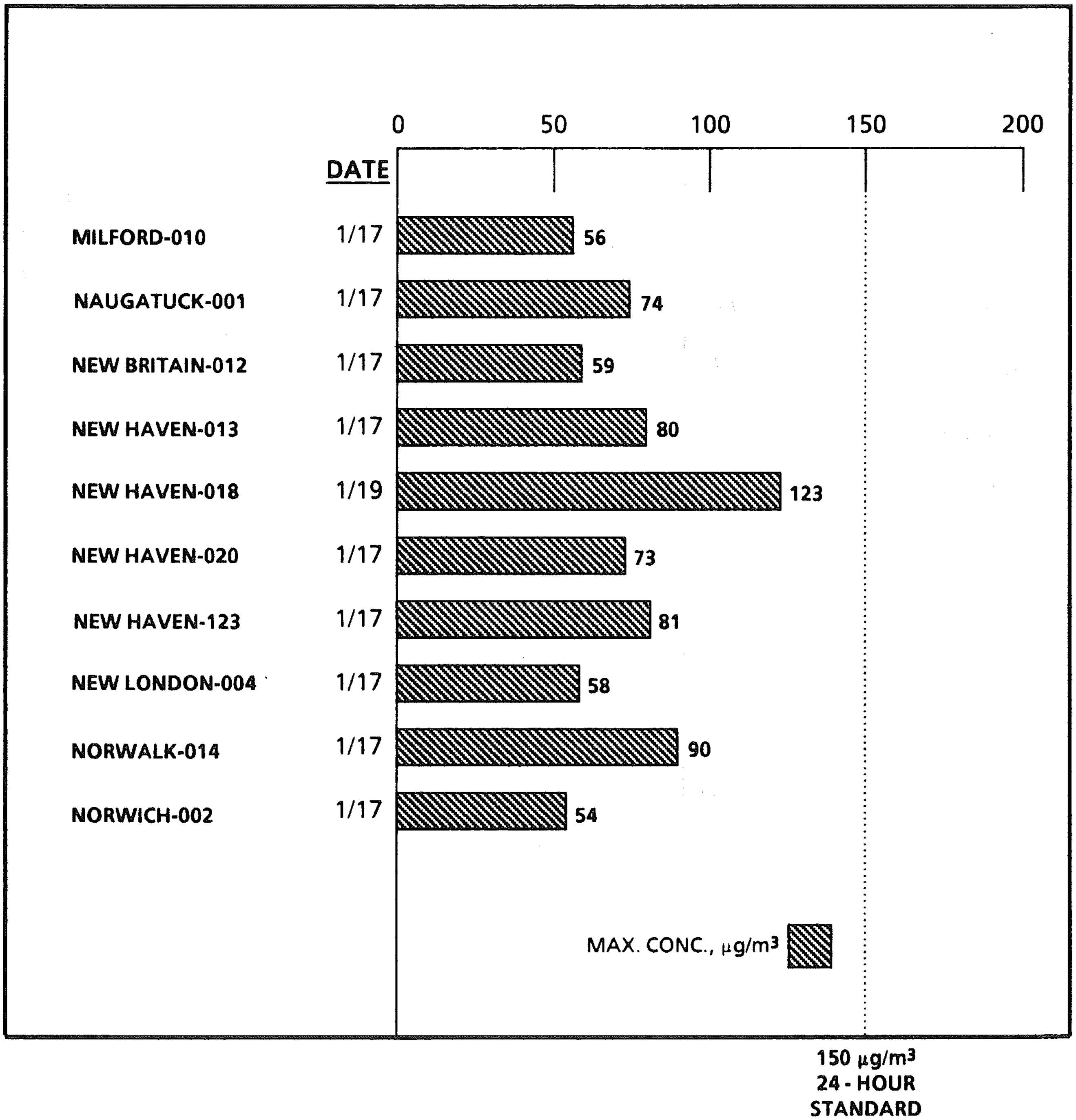
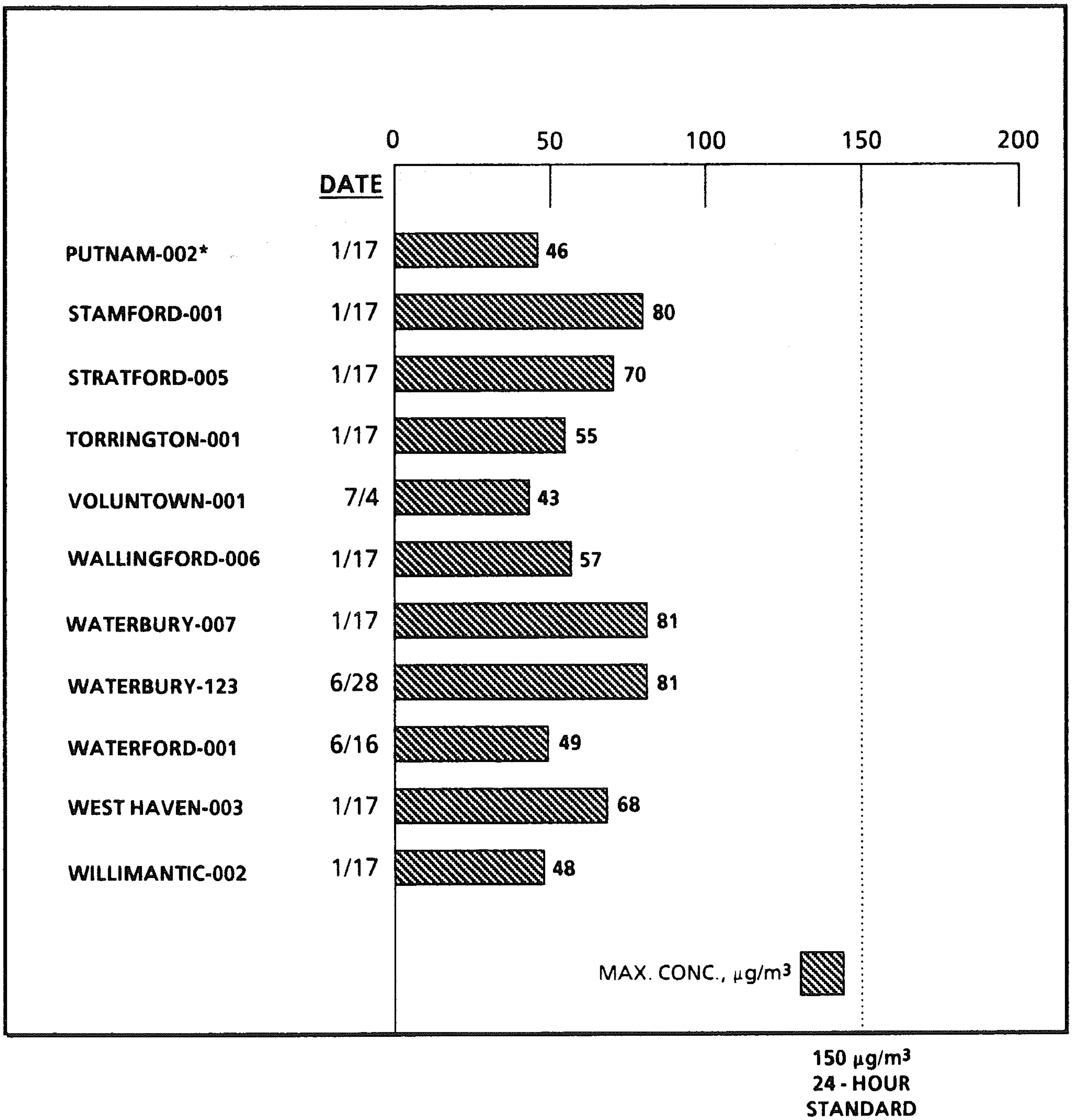


FIGURE 2-3, continued

1990 MAXIMUM 24-HOUR PM10 CONCENTRATIONS



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

TABLE 2-3

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

YEAR	NO. OF SITES[1]	SITES WITH ≧ 1 DAY EXCEEDING 150 μg/m^3	
		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%

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

TABLE 2-4

MONTHLY CHEMICAL CHARACTERIZATION OF 1990 LO-VOL TSP

TOWN	AREA	SITE
Bridgeport	**0060**	**010**

	MONTHLY AVERAGE												ANNUAL AVG
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
METALS (ng/m³)													
BERYLLIUM	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
CADMIUM	1.3	1.4	1.1	1.2	0.8	0.6		1.8	0.9	0.8	1.6	1.2	1.2
CHROMIUM	15	8	6	6	4	4		3	3	6	6	4	6
COPPER	30	30	30	20	20	20		10	10	10	10	20	20
IRON	2030	1070	1920	1540	1110	1190		1060	960	550	410	480	1120
LEAD	50	30	40	40	30	30		30	10	10	30	10	30
MANGANESE	20	14	20	16	14	14		12	13	11	16	9	14
NICKEL	26	18	19	13	9	8		8	6	7	12	11	12
VANADIUM	40	30	30	20	10	10		10	10	20	20	20	20
ZINC	110	110	110	60	50	80		80	80	40	30	60	70
WATER SOLUBLES (ng/m³)													
NITRATE	4240	3270	4580	3000	3700	4160		3290	3430	2530	2540	2250	3360
SULFATE	8090	8570	7540	8310	8290	9080		9540	6780	5470	7360	6270	7750
AMMONIUM	1180	310	410	100	10	20		190	50	60	220	420	270
TSP (µg/m³)	90	58	87	55	53	51		50	44	36	46	38	55

TABLE 2-4, continued

MONTHLY CHEMICAL CHARACTERIZATION OF 1990 LO-VOL TSP

TOWN	AREA	SITE
East Hartford	**0220**	**004**

	MONTHLY AVERAGE												ANNUAL AVG
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
METALS (ng/m³)													
BERYLLIUM	<0.1	<0.1			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		
CADMIUM	1.1	1.3			2.1	0.7	0.2	0.8	0.7	0.8	0.5		
CHROMIUM	6	5			2	3	0	1	3	4	2		
COPPER	40	30			10	10	0	5	10	10	10		
IRON	1160	920			800	1110	300	550	730	850	320		
LEAD	40	30			20	20	4	10	20	30	30		
MANGANESE	14	14			12	17	4	7	8	11	5		
NICKEL	18	12			6	11	1	6	7	9	3		
VANADIUM	30	20			10	10	1	4	4	10	4		
ZINC	100	80			40	50	10	70	100	170	80		
WATER SOLUBLES (ng/m³)													
NITRATE	2900	2770			2510	3670	1030	2470	2450	2580	1210		
SULFATE	7070	8440			8970	8690	3780	6530	5760	5650	3680		
AMMONIUM	470	30			10	70	10	10	60	50	260		
TSP (µg/m³)	68	57			44	55	17	32	33	41	19		

TABLE 2-4, continued

MONTHLY CHEMICAL CHARACTERIZATION OF 1990 LO-VOL TSP

TOWN	AREA	SITE
Hartford	**0420**	**016**

	MONTHLY AVERAGE												ANNUAL AVG
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
METALS (ng/m³)													
BERYLLIUM	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1				
CADMIUM	1.3	1.1	1.0	0.7	0.6	1.5	1.0	0.8	0.6				
CHROMIUM	7	7	6	4	4	5	3	3	4				
COPPER	20	20	20	20	20	20	10	10	10				
IRON	1720	2120	2580	1530	1840	1920	1160	1000	1010				
LEAD	40	50	50	30	50	40	30	20	20				
MANGANESE	18	24	26	18	23	24	14	12	13				
NICKEL	18	17	15	8	6	11	6	6	6				
VANADIUM	30	30	20	10	10	10	10	10	10				
ZINC	100	130	120	70	70	110	80	80	80				
WATER SOLUBLES (ng/m³)													
NITRATE	2610	3170	3390	2480	2460	2430	1230	1760	3120				
SULFATE	5890	9070	7760	7630	8470	9140	10,040	9000	8060				
AMMONIUM	680	350	220	20	4	110	210	50	40				
TSP (µg/m³)	80	103	113	67	65	81	50	47	46				

TABLE 2-4, continued

MONTHLY CHEMICAL CHARACTERIZATION OF 1990 LO-VOL TSP

TOWN	AREA	SITE
New Haven	**0700**	**018**

	MONTHLY AVERAGE												ANNUAL AVG
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
METALS (ng/m^3)													
BERYLLIUM	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
CADMIUM	2.1	1.9	2.4	2.1	1.5	1.4	2.1	2.8	1.2	1.5	2.0	1.0	1.8
CHROMIUM	10	10	7	11	4	6	8	4	5	7	10	8	8
COPPER	90	100	60	70	40	60	60	60	70	60	60	50	70
IRON	4600	5120	6090	7330	3450	4650	6850	3590	4810	4400	7520	4720	5260
LEAD	100	80	70	80	40	60	80	50	70	80	90	100	80
MANGANESE	40	43	50	78	32	41	63	30	37	48	99	37	50
NICKEL	30	24	20	8	8	12	17	11	11	14	15	16	16
VANADIUM	60	50	40	40	10	20	20	10	20	20	30	30	30
ZINC	210	200	180	180	80	120	230	120	170	160	220	150	170
WATER SOLUBLES (ng/m^3)													
NITRATE	3340	2980	3280	3040	1350	2720	3530	2570	3170	2420	1250	920	2550
SULFATE	7690	10,190	7410	8770	7490	7650	8540	7180	7060	4460	4380	2220	6920
AMMONIUM	750	240	130	70	2	40	330	90	100	140	90	200	180
TSP ($\mu g/m^3$)	129	149	157	163	79	144	121	90	104	117	132	112	125

TABLE 2-4, continued

MONTHLY CHEMICAL CHARACTERIZATION OF 1990 LO-VOL TSP

TOWN	AREA	SITE
Waterbury	**1240**	**123**

	MONTHLY AVERAGE												ANNUAL AVG
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
METALS (ng/m³)													
BERYLLIUM	<0.1	<0.1	<0.1	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1
CADMIUM	1.7	1.6	2.1	2.2		2.3	1.2	1.7	1.3	1.4	1.1		1.7
CHROMIUM	17	20	20	6		23	17	7	20	20	18		17
COPPER	60	50	120	40		50	50	70	60	80	50		60
IRON	2990	4300	5050	2540		6760	4950	2290	2660	2630	1790		3600
LEAD	50	60	50	40		560	230	70	50	70	60		120
MANGANESE	38	62	71	43		96	81	35	41	36	29		53
NICKEL	22	20	21	12		13	9	7	7	8	8		13
VANADIUM	50	40	50	20		30	10	10	10	10	10		20
ZINC	200	230	210	90		310	200	330	360	300	310		220
WATER SOLUBLES (ng/m³)													
NITRATE	3270	2880	3550	2760		3190	3080	2660	3020	2330	2200		2900
SULFATE	7120	9480	8500	9540		11,610	11,610	10,070	9430	7650	7020		9200
AMMONIUM	1550	400	320	10		5	10	10	10	70	10		240
TSP (µg/m³)	109	144	165	97		171	134	104	103	85	80		119

TABLE 2-5

1990 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
BERLIN-002 (0055)	PM10	51	42	40	38	34	32	30	28	27	27
	DATE	1/17/90	7/ 4/90	9/ 2/90	8/27/90	11/ 1/90	12/ 7/90	12/13/90	6/22/90	10/ 8/90	9/14/90
METEOROLOGICAL SITE	DIR (DEG)	190	230	280	340	200	330	280	200	170	140
NEWARK	VEL (MPH)	5.8	14.0	4.8	5.0	2.7	1.7	9.0	6.4	2.8	6.6
	SPD (MPH)	6.3	16.2	7.2	7.2	5.5	5.0	11.9	8.3	5.0	7.5
	RATIO	0.912	0.861	0.670	0.694	0.501	0.334	0.750	0.773	0.560	0.881
METEOROLOGICAL SITE	DIR (DEG)	180	220	240	320	80	330	280	210	190	160
BRADLEY	VEL (MPH)	6.2	8.0	1.4	4.8	.6	1.6	5.1	6.9	4.9	5.5
	SPD (MPH)	8.1	10.2	4.9	6.6	3.3	4.3	9.3	8.5	7.0	8.1
	RATIO	0.772	0.781	0.279	0.727	0.183	0.375	0.541	0.819	0.701	0.681
METEOROLOGICAL SITE	DIR (DEG)	170	260	250	300	260	100	290	230	210	160
BRIDGEPORT	VEL (MPH)	1.4	8.2	6.7	3.5	1.9	1.3	7.1	5.5	1.3	6.1
	SPD (MPH)	4.6	8.3	6.9	5.8	3.9	2.7	8.1	5.6	2.9	6.6
	RATIO	0.306	0.979	0.967	0.602	0.489	0.466	0.876	0.974	0.460	0.922
METEOROLOGICAL SITE	DIR (DEG)	210	260	280	300	280	260	270	260	240	170
WORCESTER	VEL (MPH)	5.0	9.3	6.6	4.0	5.9	3.4	8.9	6.3	2.5	4.3
	SPD (MPH)	5.8	9.3	7.0	4.2	6.2	4.3	10.4	6.8	5.5	4.3
	RATIO	0.864	0.997	0.932	0.957	0.960	0.794	0.858	0.934	0.458	0.989
BRIDGEPORT-010 (0059)	PM10	85	52	52	50	49	41	41	41	39	38
	DATE	1/17/90	7/ 4/90	11/ 1/90	9/ 2/90	12/13/90	6/22/90	3/12/90	8/27/90	7/22/90	12/ 7/90
METEOROLOGICAL SITE	DIR (DEG)	190	230	200	280	280	200	90	340	110	330
NEWARK	VEL (MPH)	5.8	14.0	2.7	4.8	9.0	6.4	3.5	5.0	2.4	1.7
	SPD (MPH)	6.3	16.2	5.5	7.2	11.9	8.3	4.7	7.2	5.0	5.0
	RATIO	0.912	0.861	0.501	0.670	0.750	0.773	0.734	0.694	0.486	0.334
METEOROLOGICAL SITE	DIR (DEG)	180	220	80	240	280	210	360	320	130	330
BRADLEY	VEL (MPH)	6.2	8.0	.6	1.4	5.1	6.9	4.3	4.8	3.0	1.6
	SPD (MPH)	8.1	10.2	3.3	4.9	9.3	8.5	4.3	6.6	6.5	4.3
	RATIO	0.772	0.781	0.183	0.279	0.541	0.819	0.992	0.727	0.468	0.375
METEOROLOGICAL SITE	DIR (DEG)	170	260	260	250	290	230	100	300	110	100
BRIDGEPORT	VEL (MPH)	1.4	8.2	1.9	6.7	7.1	5.5	6.8	3.5	5.4	1.3
	SPD (MPH)	4.6	8.3	3.9	6.9	8.1	5.6	6.9	5.8	5.5	2.7
	RATIO	0.306	0.979	0.489	0.967	0.876	0.974	0.983	0.602	0.987	0.466
METEOROLOGICAL SITE	DIR (DEG)	210	260	280	280	270	260	130	300	140	260
WORCESTER	VEL (MPH)	5.0	9.3	5.9	6.6	8.9	6.3	1.8	4.0	3.6	3.4
	SPD (MPH)	5.8	9.3	6.2	7.0	10.4	6.8	2.0	4.2	3.6	4.3
	RATIO	0.864	0.997	0.960	0.932	0.858	0.934	0.889	0.957	0.992	0.794
BRIDGEPORT-013 (0058)	PM10	79	49	47	46	46	45	43	39	39	38
	DATE	1/17/90	7/ 4/90	11/ 1/90	12/13/90	9/ 2/90	6/22/90	8/27/90	7/22/90	6/28/90	1/23/90
METEOROLOGICAL SITE	DIR (DEG)	190	230	200	280	280	200	340	110	260	270
NEWARK	VEL (MPH)	5.8	14.0	2.7	9.0	4.8	6.4	5.0	2.4	2.4	4.8
	SPD (MPH)	6.3	16.2	5.5	11.9	7.2	8.3	7.2	5.0	5.2	8.9
	RATIO	0.912	0.861	0.501	0.750	0.670	0.773	0.694	0.486	0.464	0.538
METEOROLOGICAL SITE	DIR (DEG)	180	220	80	280	240	210	320	130	320	220
BRADLEY	VEL (MPH)	6.2	8.0	.6	5.1	1.4	6.9	4.8	3.0	6.9	2.4
	SPD (MPH)	8.1	10.2	3.3	9.3	4.9	8.5	6.6	6.5	7.5	4.5
	RATIO	0.772	0.781	0.183	0.541	0.279	0.819	0.727	0.468	0.926	0.541

TABLE 2-5, CONTINUED

1990 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)	170	260	260	290	250	230	300	110	260	280
BRIDGEPORT	VEL (MPH)	1.4	8.2	1.9	7.1	6.7	5.5	3.5	5.4	5.2	3.6
	SPD (MPH)	4.6	8.3	3.9	8.1	6.9	5.6	5.8	5.5	5.9	6.0
	RATIO	0.306	0.979	0.489	0.876	0.967	0.974	0.602	0.987	0.883	0.603
METEOROLOGICAL SITE	DIR (DEG)	210	260	280	270	280	260	300	140	300	280
WORCESTER	VEL (MPH)	5.0	9.3	5.9	8.9	6.6	6.3	4.0	3.6	7.0	4.9
	SPD (MPH)	5.8	9.3	6.2	10.4	7.0	6.8	4.2	3.6	7.5	5.3
	RATIO	0.864	0.997	0.960	0.858	0.932	0.934	0.957	0.992	0.934	0.922
BRIDGEPORT-014 (0059)	PM10	85	60	57	56	54	54	53	52	51	51
	DATE	1/17/90	12/13/90	8/27/90	11/ 1/90	9/ 2/90	6/22/90	7/ 4/90	6/28/90	3/12/90	1/23/90
METEOROLOGICAL SITE	DIR (DEG)	190	280	340	200	280	200	230	260	90	270
NEWARK	VEL (MPH)	5.8	9.0	5.0	2.7	4.8	6.4	14.0	2.4	3.5	4.8
	SPD (MPH)	6.3	11.9	7.2	5.5	7.2	8.3	16.2	5.2	4.7	8.9
	RATIO	0.912	0.750	0.694	0.501	0.670	0.773	0.861	0.464	0.734	0.538
METEOROLOGICAL SITE	DIR (DEG)	180	280	320	80	240	210	220	320	360	220
BRADLEY	VEL (MPH)	6.2	5.1	4.8	.6	1.4	6.9	8.0	6.9	4.3	2.4
	SPD (MPH)	8.1	9.3	6.6	3.3	4.9	8.5	10.2	7.5	4.3	4.5
	RATIO	0.772	0.541	0.727	0.183	0.279	0.819	0.781	0.926	0.992	0.541
METEOROLOGICAL SITE	DIR (DEG)	170	290	300	260	250	230	260	260	100	280
BRIDGEPORT	VEL (MPH)	1.4	7.1	3.5	1.9	6.7	5.5	8.2	5.2	6.8	3.6
	SPD (MPH)	4.6	8.1	5.8	3.9	6.9	5.6	8.3	5.9	6.9	6.0
	RATIO	0.306	0.876	0.602	0.489	0.967	0.974	0.979	0.883	0.983	0.603
METEOROLOGICAL SITE	DIR (DEG)	210	270	300	280	280	260	260	300	130	280
WORCESTER	VEL (MPH)	5.0	8.9	4.0	5.9	6.6	6.3	9.3	7.0	1.8	4.9
	SPD (MPH)	5.8	10.4	4.2	6.2	7.0	6.8	9.3	7.5	2.0	5.3
	RATIO	0.864	0.858	0.957	0.960	0.932	0.934	0.997	0.934	0.889	0.922
BRISTOL-001 (0060)	PM10	52	44	43	39	36	36	34	32	32	31
	DATE	1/17/90	7/ 4/90	9/ 2/90	8/27/90	11/ 1/90	12/13/90	9/14/90	10/ 8/90	7/22/90	6/22/90
METEOROLOGICAL SITE	DIR (DEG)	190	230	280	340	200	280	140	170	110	200
NEWARK	VEL (MPH)	5.8	14.0	4.8	5.0	2.7	9.0	6.6	2.8	2.4	6.4
	SPD (MPH)	6.3	16.2	7.2	7.2	5.5	11.9	7.5	5.0	5.0	8.3
	RATIO	0.912	0.861	0.670	0.694	0.501	0.750	0.881	0.560	0.486	0.773
METEOROLOGICAL SITE	DIR (DEG)	180	220	240	320	80	280	160	190	130	210
BRADLEY	VEL (MPH)	6.2	8.0	1.4	4.8	.6	5.1	5.5	4.9	3.0	6.9
	SPD (MPH)	8.1	10.2	4.9	6.6	3.3	9.3	8.1	7.0	6.5	8.5
	RATIO	0.772	0.781	0.279	0.727	0.183	0.541	0.681	0.701	0.468	0.819
METEOROLOGICAL SITE	DIR (DEG)	170	260	250	300	260	290	160	210	110	230
BRIDGEPORT	VEL (MPH)	1.4	8.2	6.7	3.5	1.9	7.1	6.1	1.3	5.4	5.5
	SPD (MPH)	4.6	8.3	6.9	5.8	3.9	8.1	6.6	2.9	5.5	5.6
	RATIO	0.306	0.979	0.967	0.602	0.489	0.876	0.922	0.460	0.987	0.974
METEOROLOGICAL SITE	DIR (DEG)	210	260	280	300	280	270	170	240	140	260
WORCESTER	VEL (MPH)	5.0	9.3	6.6	4.0	5.9	8.9	4.3	2.5	3.6	6.3
	SPD (MPH)	5.8	9.3	7.0	4.2	6.2	10.4	4.3	5.5	3.6	6.8
	RATIO	0.864	0.997	0.932	0.957	0.960	0.858	0.989	0.458	0.992	0.934

TABLE 2-5, CONTINUED

1990 TEN HIGHEST 24-HOUR AVERAGE PM10 DAYS WITH WIND DATA

UNITS : MICROGRAMS PER CUBIC METER

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
BURLINGTON-001 (0059)	PM10	41	39	36	33	30	30	30	24	23	21
	DATE	7/ 4/90	9/ 2/90	8/27/90	1/17/90	9/14/90	10/ 8/90	7/22/90	6/22/90	12/13/90	8/ 9/90
METEOROLOGICAL SITE	DIR (DEG)	230	280	340	190	140	170	110	200	280	20
NEWARK	VEL (MPH)	14.0	4.8	5.0	5.8	6.6	2.8	2.4	6.4	9.0	5.8
	SPD (MPH)	16.2	7.2	7.2	6.3	7.5	5.0	5.0	8.3	11.9	7.8
	RATIO	0.861	0.670	0.694	0.912	0.881	0.560	0.486	0.773	0.750	0.744
METEOROLOGICAL SITE	DIR (DEG)	220	240	320	180	160	190	130	210	280	10
BRADLEY	VEL (MPH)	8.0	1.4	4.8	6.2	5.5	4.9	3.0	6.9	5.1	3.8
	SPD (MPH)	10.2	4.9	6.6	8.1	8.1	7.0	6.5	8.5	9.3	6.0
	RATIO	0.781	0.279	0.727	0.772	0.681	0.701	0.468	0.819	0.541	0.637
METEOROLOGICAL SITE	DIR (DEG)	260	250	300	170	160	210	110	230	290	50
BRIDGEPORT	VEL (MPH)	8.2	6.7	3.5	1.4	6.1	1.3	5.4	5.5	7.1	1.2
	SPD (MPH)	8.3	6.9	5.8	4.6	6.6	2.9	5.5	5.6	8.1	5.2
	RATIO	0.979	0.967	0.602	0.306	0.922	0.460	0.987	0.974	0.876	0.230
METEOROLOGICAL SITE	DIR (DEG)	260	280	300	210	170	240	140	260	270	80
WORCESTER	VEL (MPH)	9.3	6.6	4.0	5.0	4.3	2.5	3.6	6.3	8.9	2.8
	SPD (MPH)	9.3	7.0	4.2	5.8	4.3	5.5	3.6	6.8	10.4	4.6
	RATIO	0.997	0.932	0.957	0.864	0.989	0.458	0.992	0.934	0.858	0.600
CORNWALL-005 (0058)	PM10	50	47	43	40	38	36	27	26	26	25
	DATE	10/ 8/90	2/22/90	9/ 2/90	7/ 4/90	8/27/90	1/17/90	11/ 1/90	7/16/90	9/14/90	7/22/90
METEOROLOGICAL SITE	DIR (DEG)	170	210	280	230	340	190	200	260	140	110
NEWARK	VEL (MPH)	2.8	8.0	4.8	14.0	5.0	5.8	2.7	7.2	6.6	2.4
	SPD (MPH)	5.0	10.8	7.2	16.2	7.2	6.3	5.5	9.2	7.5	5.0
	RATIO	0.560	0.738	0.670	0.861	0.694	0.912	0.501	0.788	0.881	0.486
METEOROLOGICAL SITE	DIR (DEG)	190	190	240	220	320	180	80	280	160	130
BRADLEY	VEL (MPH)	4.9	10.0	1.4	8.0	4.8	6.2	.6	6.6	5.5	3.0
	SPD (MPH)	7.0	13.8	4.9	10.2	6.6	8.1	3.3	9.9	8.1	6.5
	RATIO	0.701	0.727	0.279	0.781	0.727	0.772	0.183	0.663	0.681	0.468
METEOROLOGICAL SITE	DIR (DEG)	210	240	250	260	300	170	260	270	160	110
BRIDGEPORT	VEL (MPH)	1.3	8.1	6.7	8.2	3.5	1.4	1.9	7.7	6.1	5.4
	SPD (MPH)	2.9	8.2	6.9	8.3	5.8	4.6	3.9	8.1	6.6	5.5
	RATIO	0.460	0.986	0.967	0.979	0.602	0.306	0.489	0.954	0.922	0.987
METEOROLOGICAL SITE	DIR (DEG)	240	240	280	260	300	210	280	270	170	140
WORCESTER	VEL (MPH)	2.5	14.1	6.6	9.3	4.0	5.0	5.9	7.2	4.3	3.6
	SPD (MPH)	5.5	14.2	7.0	9.3	4.2	5.8	6.2	7.8	4.3	3.6
	RATIO	0.458	0.991	0.932	0.997	0.957	0.864	0.960	0.929	0.989	0.992
DANBURY-123 (0060)	PM10	59	44	44	43	39	38	38	37	37	34
	DATE	1/17/90	11/ 1/90	7/ 4/90	8/27/90	7/22/90	1/ 5/90	9/ 2/90	10/ 8/90	12/13/90	6/28/90
METEOROLOGICAL SITE	DIR (DEG)	190	200	230	340	110	320	280	170	280	260
NEWARK	VEL (MPH)	5.8	2.7	14.0	5.0	2.4	7.2	4.8	2.8	9.0	2.4
	SPD (MPH)	6.3	5.5	16.2	7.2	5.0	9.8	7.2	5.0	11.9	5.2
	RATIO	0.912	0.501	0.861	0.694	0.486	0.733	0.670	0.560	0.750	0.464
METEOROLOGICAL SITE	DIR (DEG)	180	80	220	320	130	320	240	190	280	320
BRADLEY	VEL (MPH)	6.2	.6	8.0	4.8	3.0	8.1	1.4	4.9	5.1	6.9
	SPD (MPH)	8.1	3.3	10.2	6.6	6.5	8.8	4.9	7.0	9.3	7.5
	RATIO	0.772	0.183	0.781	0.727	0.468	0.920	0.279	0.701	0.541	0.926

TABLE 2-5, CONTINUED

1990 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)	170	260	260	300	110	300	250	210	290	260
BRIDGEPORT	VEL (MPH)	1.4	1.9	8.2	3.5	5.4	3.2	6.7	1.3	7.1	5.2
	SPD (MPH)	4.6	3.9	8.3	5.8	5.5	4.0	6.9	2.9	8.1	5.9
	RATIO	0.306	0.489	0.979	0.602	0.987	0.785	0.967	0.460	0.876	0.883
METEOROLOGICAL SITE	DIR (DEG)	210	280	260	300	140	290	280	240	270	300
WORCESTER	VEL (MPH)	5.0	5.9	9.3	4.0	3.6	6.3	6.6	2.5	8.9	7.0
	SPD (MPH)	5.8	6.2	9.3	4.2	3.6	6.6	7.0	5.5	10.4	7.5
	RATIO	0.864	0.960	0.997	0.957	0.992	0.954	0.932	0.458	0.858	0.934
DARIEN-001 (0058)	PM10	73	65	55	54	52	51	49	48	47	44
	DATE	1/17/90	8/27/90	12/13/90	4/23/90	11/ 1/90	7/ 4/90	6/28/90	9/ 2/90	5/11/90	8/15/90
METEOROLOGICAL SITE	DIR (DEG)	190	340	280	360	200	230	260	280	280	270
NEWARK	VEL (MPH)	5.8	5.0	9.0	6.2	2.7	14.0	2.4	4.8	11.9	4.5
	SPD (MPH)	6.3	7.2	11.9	7.9	5.5	16.2	5.2	7.2	16.2	7.6
	RATIO	0.912	0.694	0.750	0.786	0.501	0.861	0.464	0.670	0.734	0.590
METEOROLOGICAL SITE	DIR (DEG)	180	320	280	10	80	220	320	240	280	290
BRADLEY	VEL (MPH)	6.2	4.8	5.1	6.9	.6	8.0	6.9	1.4	13.7	4.8
	SPD (MPH)	8.1	6.6	9.3	8.8	3.3	10.2	7.5	4.9	15.4	5.6
	RATIO	0.772	0.727	0.541	0.784	0.183	0.781	0.926	0.279	0.888	0.863
METEOROLOGICAL SITE	DIR (DEG)	170	300	290	10	260	260	260	250	280	250
BRIDGEPORT	VEL (MPH)	1.4	3.5	7.1	7.2	1.9	8.2	5.2	6.7	9.8	2.7
	SPD (MPH)	4.6	5.8	8.1	8.1	3.9	8.3	5.9	6.9	10.5	4.0
	RATIO	0.306	0.602	0.876	0.890	0.489	0.979	0.883	0.967	0.932	0.664
METEOROLOGICAL SITE	DIR (DEG)	210	300	270	360	280	260	300	280	280	280
WORCESTER	VEL (MPH)	5.0	4.0	8.9	6.4	5.9	9.3	7.0	6.6	11.1	5.5
	SPD (MPH)	5.8	4.2	10.4	8.2	6.2	9.3	7.5	7.0	11.4	5.8
	RATIO	0.864	0.957	0.858	0.785	0.960	0.997	0.934	0.932	0.980	0.958
EAST HARTFORD-004 (0059)	PM10	68	50	43	41	40	36	35	35	35	34
	DATE	1/17/90	11/ 1/90	7/ 4/90	8/27/90	9/ 2/90	7/22/90	1/23/90	12/ 7/90	2/16/90	6/22/90
METEOROLOGICAL SITE	DIR (DEG)	190	200	230	340	280	110	270	330	50	200
NEWARK	VEL (MPH)	5.8	2.7	14.0	5.0	4.8	2.4	4.8	1.7	3.1	6.4
	SPD (MPH)	6.3	5.5	16.2	7.2	7.2	5.0	8.9	5.0	5.3	8.3
	RATIO	0.912	0.501	0.861	0.694	0.670	0.486	0.538	0.334	0.578	0.773
METEOROLOGICAL SITE	DIR (DEG)	180	80	220	320	240	130	220	330	20	210
BRADLEY	VEL (MPH)	6.2	.6	8.0	4.8	1.4	3.0	2.4	1.6	1.2	6.9
	SPD (MPH)	8.1	3.3	10.2	6.6	4.9	6.5	4.5	4.3	3.2	8.5
	RATIO	0.772	0.183	0.781	0.727	0.279	0.468	0.541	0.375	0.377	0.819
METEOROLOGICAL SITE	DIR (DEG)	170	260	260	300	250	110	280	100	140	230
BRIDGEPORT	VEL (MPH)	1.4	1.9	8.2	3.5	6.7	5.4	3.6	1.3	1.0	5.5
	SPD (MPH)	4.6	3.9	8.3	5.8	6.9	5.5	6.0	2.7	2.7	5.6
	RATIO	0.306	0.489	0.979	0.602	0.967	0.987	0.603	0.466	0.383	0.974
METEOROLOGICAL SITE	DIR (DEG)	210	280	260	300	280	140	280	260	10	260
WORCESTER	VEL (MPH)	5.0	5.9	9.3	4.0	6.6	3.6	4.9	3.4	1.9	6.3
	SPD (MPH)	5.8	6.2	9.3	4.2	7.0	3.6	5.3	4.3	2.4	6.8
	RATIO	0.864	0.960	0.997	0.957	0.932	0.992	0.922	0.794	0.779	0.934

TABLE 2-5, CONTINUED

1990 TEN HIGHEST 24-HOUR AVERAGE PM10 DAYS WITH WIND DATA

UNITS : MICROGRAMS PER CUBIC METER

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
ENFIELD-005 (0058)	PM10	46	43	37	30	29	28	27	26	25	25
	DATE	1/17/90	7/ 4/90	7/22/90	8/27/90	6/22/90	10/ 8/90	12/13/90	7/16/90	8/ 9/90	11/ 1/90
METEOROLOGICAL SITE	DIR (DEG)	190	230	110	340	200	170	280	260	20	200
NEWARK	VEL (MPH)	5.8	14.0	2.4	5.0	6.4	2.8	9.0	7.2	5.8	2.7
	SPD (MPH)	6.3	16.2	5.0	7.2	8.3	5.0	11.9	9.2	7.8	5.5
	RATIO	0.912	0.861	0.486	0.694	0.773	0.560	0.750	0.788	0.744	0.501
METEOROLOGICAL SITE	DIR (DEG)	180	220	130	320	210	190	280	280	10	80
BRADLEY	VEL (MPH)	6.2	8.0	3.0	4.8	6.9	4.9	5.1	6.6	3.8	.6
	SPD (MPH)	8.1	10.2	6.5	6.6	8.5	7.0	9.3	9.9	6.0	3.3
	RATIO	0.772	0.781	0.468	0.727	0.819	0.701	0.541	0.663	0.637	0.183
METEOROLOGICAL SITE	DIR (DEG)	170	260	110	300	230	210	290	270	50	260
BRIDGEPORT	VEL (MPH)	1.4	8.2	5.4	3.5	5.5	1.3	7.1	7.7	1.2	1.9
	SPD (MPH)	4.6	8.3	5.5	5.8	5.6	2.9	8.1	8.1	5.2	3.9
	RATIO	0.306	0.979	0.987	0.602	0.974	0.460	0.876	0.954	0.230	0.489
METEOROLOGICAL SITE	DIR (DEG)	210	260	140	300	260	240	270	270	80	280
WORCESTER	VEL (MPH)	5.0	9.3	3.6	4.0	6.3	2.5	8.9	7.2	2.8	5.9
	SPD (MPH)	5.8	9.3	3.6	4.2	6.8	5.5	10.4	7.8	4.6	6.2
	RATIO	0.864	0.997	0.992	0.957	0.934	0.458	0.858	0.929	0.600	0.960
GREENWICH-017 (0057)	PM10	62	53	48	42	39	37	35	34	32	32
	DATE	1/17/90	7/ 4/90	9/ 2/90	12/13/90	6/28/90	6/22/90	7/22/90	8/27/90	7/16/90	10/ 8/90
METEOROLOGICAL SITE	DIR (DEG)	190	230	280	280	260	200	110	340	260	170
NEWARK	VEL (MPH)	5.8	14.0	4.8	9.0	2.4	6.4	2.4	5.0	7.2	2.8
	SPD (MPH)	6.3	16.2	7.2	11.9	5.2	8.3	5.0	7.2	9.2	5.0
	RATIO	0.912	0.861	0.670	0.750	0.464	0.773	0.486	0.694	0.788	0.560
METEOROLOGICAL SITE	DIR (DEG)	180	220	240	280	320	210	130	320	280	190
BRADLEY	VEL (MPH)	6.2	8.0	1.4	5.1	6.9	6.9	3.0	4.8	6.6	4.9
	SPD (MPH)	8.1	10.2	4.9	9.3	7.5	8.5	6.5	6.6	9.9	7.0
	RATIO	0.772	0.781	0.279	0.541	0.926	0.819	0.468	0.727	0.663	0.701
METEOROLOGICAL SITE	DIR (DEG)	170	260	250	290	260	230	110	300	270	210
BRIDGEPORT	VEL (MPH)	1.4	8.2	6.7	7.1	5.2	5.5	5.4	3.5	7.7	1.3
	SPD (MPH)	4.6	8.3	6.9	8.1	5.9	5.6	5.5	5.8	8.1	2.9
	RATIO	0.306	0.979	0.967	0.876	0.883	0.974	0.987	0.602	0.954	0.460
METEOROLOGICAL SITE	DIR (DEG)	210	260	280	270	300	260	140	300	270	240
WORCESTER	VEL (MPH)	5.0	9.3	6.6	8.9	7.0	6.3	3.6	4.0	7.2	2.5
	SPD (MPH)	5.8	9.3	7.0	10.4	7.5	6.8	3.6	4.2	7.8	5.5
	RATIO	0.864	0.997	0.932	0.858	0.934	0.934	0.992	0.957	0.929	0.458
GROTON-006 (0056)	PM10	54	48	40	39	39	38	30	29	28	27
	DATE	7/ 4/90	1/17/90	9/ 2/90	6/22/90	7/16/90	8/27/90	6/28/90	8/15/90	8/ 3/90	4/23/90
METEOROLOGICAL SITE	DIR (DEG)	230	190	280	200	260	340	260	270	170	360
NEWARK	VEL (MPH)	14.0	5.8	4.8	6.4	7.2	5.0	2.4	4.5	1.0	6.2
	SPD (MPH)	16.2	6.3	7.2	8.3	9.2	7.2	5.2	7.6	4.2	7.9
	RATIO	0.861	0.912	0.670	0.773	0.788	0.694	0.464	0.590	0.233	0.786
METEOROLOGICAL SITE	DIR (DEG)	220	180	240	210	280	320	320	290	290	10
BRADLEY	VEL (MPH)	8.0	6.2	1.4	6.9	6.6	4.8	6.9	4.8	2.5	6.9
	SPD (MPH)	10.2	8.1	4.9	8.5	9.9	6.6	7.5	5.6	5.0	8.8
	RATIO	0.781	0.772	0.279	0.819	0.663	0.727	0.926	0.863	0.492	0.784

TABLE 2-5, CONTINUED

1990 TEN HIGHEST 24-HOUR AVERAGE PM10 DAYS WITH WIND DATA

UNITS : MICROGRAMS PER CUBIC METER

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
METEOROLOGICAL SITE	DIR (DEG)	260	170	250	230	270	300	260	250	240	10
BRIDGEPORT	VEL (MPH)	8.2	1.4	6.7	5.5	7.7	3.5	5.2	2.7	5.0	7.2
	SPD (MPH)	8.3	4.6	6.9	5.6	8.1	5.8	5.9	4.0	5.0	8.1
	RATIO	0.979	0.306	0.967	0.974	0.954	0.602	0.883	0.664	0.996	0.890
METEOROLOGICAL SITE	DIR (DEG)	260	210	280	260	270	300	300	280	300	360
WORCESTER	VEL (MPH)	9.3	5.0	6.6	6.3	7.2	4.0	7.0	5.5	5.6	6.4
	SPD (MPH)	9.3	5.8	7.0	6.8	7.8	4.2	7.5	5.8	5.9	8.2
	RATIO	0.997	0.864	0.932	0.934	0.929	0.957	0.934	0.958	0.944	0.785
HARTFORD-013 (0059)	PM10	59	48	41	40	36	36	33	32	30	29
	DATE	1/17/90	11/ 1/90	9/ 2/90	7/ 4/90	12/ 7/90	8/27/90	7/22/90	9/14/90	6/22/90	8/ 9/90
METEOROLOGICAL SITE	DIR (DEG)	190	200	280	230	330	340	110	140	200	20
NEWARK	VEL (MPH)	5.8	2.7	4.8	14.0	1.7	5.0	2.4	6.6	6.4	5.8
	SPD (MPH)	6.3	5.5	7.2	16.2	5.0	7.2	5.0	7.5	8.3	7.8
	RATIO	0.912	0.501	0.670	0.861	0.334	0.694	0.486	0.881	0.773	0.744
METEOROLOGICAL SITE	DIR (DEG)	180	80	240	220	330	320	130	160	210	10
BRADLEY	VEL (MPH)	6.2	.6	1.4	8.0	1.6	4.8	3.0	5.5	6.9	3.8
	SPD (MPH)	8.1	3.3	4.9	10.2	4.3	6.6	6.5	8.1	8.5	6.0
	RATIO	0.772	0.183	0.279	0.781	0.375	0.727	0.468	0.681	0.819	0.637
METEOROLOGICAL SITE	DIR (DEG)	170	260	250	260	100	300	110	160	230	50
BRIDGEPORT	VEL (MPH)	1.4	1.9	6.7	8.2	1.3	3.5	5.4	6.1	5.5	1.2
	SPD (MPH)	4.6	3.9	6.9	8.3	2.7	5.8	5.5	6.6	5.6	5.2
	RATIO	0.306	0.489	0.967	0.979	0.466	0.602	0.987	0.922	0.974	0.230
METEOROLOGICAL SITE	DIR (DEG)	210	280	280	260	260	300	140	170	260	80
WORCESTER	VEL (MPH)	5.0	5.9	6.6	9.3	3.4	4.0	3.6	4.3	6.3	2.8
	SPD (MPH)	5.8	6.2	7.0	9.3	4.3	4.2	3.6	4.3	6.8	4.6
	RATIO	0.864	0.960	0.932	0.997	0.794	0.957	0.992	0.989	0.934	0.600
HARTFORD-014 (0055)	PM10	65	51	42	41	38	36	34	32	32	31
	DATE	1/17/90	11/ 1/90	7/ 4/90	9/ 2/90	8/27/90	7/22/90	12/ 7/90	2/16/90	9/14/90	12/13/90
METEOROLOGICAL SITE	DIR (DEG)	190	200	230	280	340	110	330	50	140	280
NEWARK	VEL (MPH)	5.8	2.7	14.0	4.8	5.0	2.4	1.7	3.1	6.6	9.0
	SPD (MPH)	6.3	5.5	16.2	7.2	7.2	5.0	5.0	5.3	7.5	11.9
	RATIO	0.912	0.501	0.861	0.670	0.694	0.486	0.334	0.578	0.881	0.750
METEOROLOGICAL SITE	DIR (DEG)	180	80	220	240	320	130	330	20	160	280
BRADLEY	VEL (MPH)	6.2	.6	8.0	1.4	4.8	3.0	1.6	1.2	5.5	5.1
	SPD (MPH)	8.1	3.3	10.2	4.9	6.6	6.5	4.3	3.2	8.1	9.3
	RATIO	0.772	0.183	0.781	0.279	0.727	0.468	0.375	0.377	0.681	0.541
METEOROLOGICAL SITE	DIR (DEG)	170	260	260	250	300	110	100	140	160	290
BRIDGEPORT	VEL (MPH)	1.4	1.9	8.2	6.7	3.5	5.4	1.3	1.0	6.1	7.1
	SPD (MPH)	4.6	3.9	8.3	6.9	5.8	5.5	2.7	2.7	6.6	8.1
	RATIO	0.306	0.489	0.979	0.967	0.602	0.987	0.466	0.383	0.922	0.876
METEOROLOGICAL SITE	DIR (DEG)	210	280	260	280	300	140	260	10	170	270
WORCESTER	VEL (MPH)	5.0	5.9	9.3	6.6	4.0	3.6	3.4	1.9	4.3	8.9
	SPD (MPH)	5.8	6.2	9.3	7.0	4.2	3.6	4.3	2.4	4.3	10.4
	RATIO	0.864	0.960	0.997	0.932	0.957	0.992	0.794	0.779	0.989	0.858

TABLE 2-5, CONTINUED

1990 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-015 (0058)	PM10	61	61	46	46	45	41	41	37	36	35
	DATE	1/17/90	11/ 1/90	12/ 7/90	8/27/90	2/16/90	3/12/90	9/ 2/90	8/ 9/90	9/14/90	3/ 6/90
METEOROLOGICAL SITE	DIR (DEG)	190	200	330	340	50	90	280	20	140	10
NEWARK	VEL (MPH)	5.8	2.7	1.7	5.0	3.1	3.5	4.8	5.8	6.6	11.3
	SPD (MPH)	6.3	5.5	5.0	7.2	5.3	4.7	7.2	7.8	7.5	11.5
	RATIO	0.912	0.501	0.334	0.694	0.578	0.734	0.670	0.744	0.881	0.987
METEOROLOGICAL SITE	DIR (DEG)	180	80	330	320	20	360	240	10	160	10
BRADLEY	VEL (MPH)	6.2	.6	1.6	4.8	1.2	4.3	1.4	3.8	5.5	8.2
	SPD (MPH)	8.1	3.3	4.3	6.6	3.2	4.3	4.9	6.0	8.1	8.3
	RATIO	0.772	0.183	0.375	0.727	0.377	0.992	0.279	0.637	0.681	0.979
METEOROLOGICAL SITE	DIR (DEG)	170	260	100	300	140	100	250	50	160	30
BRIDGEPORT	VEL (MPH)	1.4	1.9	1.3	3.5	1.0	6.8	6.7	1.2	6.1	9.8
	SPD (MPH)	4.6	3.9	2.7	5.8	2.7	6.9	6.9	5.2	6.6	9.9
	RATIO	0.306	0.489	0.466	0.602	0.383	0.983	0.967	0.230	0.922	0.993
METEOROLOGICAL SITE	DIR (DEG)	210	280	260	300	10	130	280	80	170	50
WORCESTER	VEL (MPH)	5.0	5.9	3.4	4.0	1.9	1.8	6.6	2.8	4.3	3.7
	SPD (MPH)	5.8	6.2	4.3	4.2	2.4	2.0	7.0	4.6	4.3	3.7
	RATIO	0.864	0.960	0.794	0.957	0.779	0.889	0.932	0.600	0.989	0.992
HARTFORD-018 (0060)	PM10	76	56	44	43	41	40	40	36	36	35
	DATE	1/17/90	11/ 1/90	7/ 4/90	8/27/90	9/ 2/90	12/ 7/90	2/16/90	9/14/90	7/22/90	3/12/90
METEOROLOGICAL SITE	DIR (DEG)	190	200	230	340	280	330	50	140	110	90
NEWARK	VEL (MPH)	5.8	2.7	14.0	5.0	4.8	1.7	3.1	6.6	2.4	3.5
	SPD (MPH)	6.3	5.5	16.2	7.2	7.2	5.0	5.3	7.5	5.0	4.7
	RATIO	0.912	0.501	0.861	0.694	0.670	0.334	0.578	0.881	0.486	0.734
METEOROLOGICAL SITE	DIR (DEG)	180	80	220	320	240	330	20	160	130	360
BRADLEY	VEL (MPH)	6.2	.6	8.0	4.8	1.4	1.6	1.2	5.5	3.0	4.3
	SPD (MPH)	8.1	3.3	10.2	6.6	4.9	4.3	3.2	8.1	6.5	4.3
	RATIO	0.772	0.183	0.781	0.727	0.279	0.375	0.377	0.681	0.468	0.992
METEOROLOGICAL SITE	DIR (DEG)	170	260	260	300	250	100	140	160	110	100
BRIDGEPORT	VEL (MPH)	1.4	1.9	8.2	3.5	6.7	1.3	1.0	6.1	5.4	6.8
	SPD (MPH)	4.6	3.9	8.3	5.8	6.9	2.7	2.7	6.6	5.5	6.9
	RATIO	0.306	0.489	0.979	0.602	0.967	0.466	0.383	0.922	0.987	0.983
METEOROLOGICAL SITE	DIR (DEG)	210	280	260	300	280	260	10	170	140	130
WORCESTER	VEL (MPH)	5.0	5.9	9.3	4.0	6.6	3.4	1.9	4.3	3.6	1.8
	SPD (MPH)	5.8	6.2	9.3	4.2	7.0	4.3	2.4	4.3	3.6	2.0
	RATIO	0.864	0.960	0.997	0.957	0.932	0.794	0.779	0.989	0.992	0.889
MANCHESTER-001 (0055)	PM10	48	47	43	41	37	35	32	29	28	27
	DATE	1/17/90	8/27/90	7/ 4/90	9/ 2/90	7/22/90	11/ 1/90	9/14/90	12/ 7/90	6/22/90	12/13/90
METEOROLOGICAL SITE	DIR (DEG)	190	340	230	280	110	200	140	330	200	280
NEWARK	VEL (MPH)	5.8	5.0	14.0	4.8	2.4	2.7	6.6	1.7	6.4	9.0
	SPD (MPH)	6.3	7.2	16.2	7.2	5.0	5.5	7.5	5.0	8.3	11.9
	RATIO	0.912	0.694	0.861	0.670	0.486	0.501	0.881	0.334	0.773	0.750
METEOROLOGICAL SITE	DIR (DEG)	180	320	220	240	130	80	160	330	210	280
BRADLEY	VEL (MPH)	6.2	4.8	8.0	1.4	3.0	.6	5.5	1.6	6.9	5.1
	SPD (MPH)	8.1	6.6	10.2	4.9	6.5	3.3	8.1	4.3	8.5	9.3
	RATIO	0.772	0.727	0.781	0.279	0.468	0.183	0.681	0.375	0.819	0.541

TABLE 2-5, CONTINUED

1990 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)	170	300	260	250	110	260	160	100	230	290
BRIDGEPORT	VEL (MPH)	1.4	3.5	8.2	6.7	5.4	1.9	6.1	1.3	5.5	7.1
	SPD (MPH)	4.6	5.8	8.3	6.9	5.5	3.9	6.6	2.7	5.6	8.1
	RATIO	0.306	0.602	0.979	0.967	0.987	0.489	0.922	0.466	0.974	0.876
METEOROLOGICAL SITE	DIR (DEG)	210	300	260	280	140	280	170	260	260	270
WORCESTER	VEL (MPH)	5.0	4.0	9.3	6.6	3.6	5.9	4.3	3.4	6.3	8.9
	SPD (MPH)	5.8	4.2	9.3	7.0	3.6	6.2	4.3	4.3	6.8	10.4
	RATIO	0.864	0.957	0.997	0.932	0.992	0.960	0.989	0.794	0.934	0.858
MIDDLETOWN-003 (0058)	PM10	48	44	43	39	37	37	37	33	30	30
	DATE	1/17/90	7/ 4/90	9/ 2/90	8/27/90	1/ 5/90	7/22/90	6/28/90	6/22/90	2/16/90	12/ 7/90
METEOROLOGICAL SITE	DIR (DEG)	190	230	280	340	320	110	260	200	50	330
NEWARK	VEL (MPH)	5.8	14.0	4.8	5.0	7.2	2.4	2.4	6.4	3.1	1.7
	SPD (MPH)	6.3	16.2	7.2	7.2	9.8	5.0	5.2	8.3	5.3	5.0
	RATIO	0.912	0.861	0.670	0.694	0.733	0.486	0.464	0.773	0.578	0.334
METEOROLOGICAL SITE	DIR (DEG)	180	220	240	320	320	130	320	210	20	330
BRADLEY	VEL (MPH)	6.2	8.0	1.4	4.8	8.1	3.0	6.9	6.9	1.2	1.6
	SPD (MPH)	8.1	10.2	4.9	6.6	8.8	6.5	7.5	8.5	3.2	4.3
	RATIO	0.772	0.781	0.279	0.727	0.920	0.468	0.926	0.819	0.377	0.375
METEOROLOGICAL SITE	DIR (DEG)	170	260	250	300	300	110	260	230	140	100
BRIDGEPORT	VEL (MPH)	1.4	8.2	6.7	3.5	3.2	5.4	5.2	5.5	1.0	1.3
	SPD (MPH)	4.6	8.3	6.9	5.8	4.0	5.5	5.9	5.6	2.7	2.7
	RATIO	0.306	0.979	0.967	0.602	0.785	0.987	0.883	0.974	0.383	0.466
METEOROLOGICAL SITE	DIR (DEG)	210	260	280	300	290	140	300	260	10	260
WORCESTER	VEL (MPH)	5.0	9.3	6.6	4.0	6.3	3.6	7.0	6.3	1.9	3.4
	SPD (MPH)	5.8	9.3	7.0	4.2	6.6	3.6	7.5	6.8	2.4	4.3
	RATIO	0.864	0.997	0.932	0.957	0.954	0.992	0.934	0.934	0.779	0.794
MILFORD-010 (0058)	PM10	56	51	44	41	41	39	35	35	34	31
	DATE	1/17/90	7/ 4/90	8/27/90	12/13/90	9/ 2/90	11/ 1/90	7/22/90	6/28/90	6/22/90	7/16/90
METEOROLOGICAL SITE	DIR (DEG)	190	230	340	280	280	200	110	260	200	260
NEWARK	VEL (MPH)	5.8	14.0	5.0	9.0	4.8	2.7	2.4	2.4	6.4	7.2
	SPD (MPH)	6.3	16.2	7.2	11.9	7.2	5.5	5.0	5.2	8.3	9.2
	RATIO	0.912	0.861	0.694	0.750	0.670	0.501	0.486	0.464	0.773	0.788
METEOROLOGICAL SITE	DIR (DEG)	180	220	320	280	240	80	130	320	210	280
BRADLEY	VEL (MPH)	6.2	8.0	4.8	5.1	1.4	.6	3.0	6.9	6.9	6.6
	SPD (MPH)	8.1	10.2	6.6	9.3	4.9	3.3	6.5	7.5	8.5	9.9
	RATIO	0.772	0.781	0.727	0.541	0.279	0.183	0.468	0.926	0.819	0.663
METEOROLOGICAL SITE	DIR (DEG)	170	260	300	290	250	260	110	260	230	270
BRIDGEPORT	VEL (MPH)	1.4	8.2	3.5	7.1	6.7	1.9	5.4	5.2	5.5	7.7
	SPD (MPH)	4.6	8.3	5.8	8.1	6.9	3.9	5.5	5.9	5.6	8.1
	RATIO	0.306	0.979	0.602	0.876	0.967	0.489	0.987	0.883	0.974	0.954
METEOROLOGICAL SITE	DIR (DEG)	210	260	300	270	280	280	140	300	260	270
WORCESTER	VEL (MPH)	5.0	9.3	4.0	8.9	6.6	5.9	3.6	7.0	6.3	7.2
	SPD (MPH)	5.8	9.3	4.2	10.4	7.0	6.2	3.6	7.5	6.8	7.8
	RATIO	0.864	0.997	0.957	0.858	0.932	0.960	0.992	0.934	0.934	0.929

TABLE 2-5, CONTINUED

1990 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
NAUGATUCK-001 (0056)	PM10	74	47	45	43	41	40	37	36	35	35
	DATE	1/17/90	7/ 4/90	11/ 1/90	9/ 2/90	8/27/90	7/22/90	12/13/90	12/ 1/90	6/22/90	10/ 8/90
METEOROLOGICAL SITE	DIR (DEG)	190	230	200	280	340	110	280	250	200	170
NEWARK	VEL (MPH)	5.8	14.0	2.7	4.8	5.0	2.4	9.0	7.7	6.4	2.8
	SPD (MPH)	6.3	16.2	5.5	7.2	7.2	5.0	11.9	8.8	8.3	5.0
	RATIO	0.912	0.861	0.501	0.670	0.694	0.486	0.750	0.884	0.773	0.560
METEOROLOGICAL SITE	DIR (DEG)	180	220	80	240	320	130	280	190	210	190
BRADLEY	VEL (MPH)	6.2	8.0	.6	1.4	4.8	3.0	5.1	7.6	6.9	4.9
	SPD (MPH)	8.1	10.2	3.3	4.9	6.6	6.5	9.3	9.9	8.5	7.0
	RATIO	0.772	0.781	0.183	0.279	0.727	0.468	0.541	0.768	0.819	0.701
METEOROLOGICAL SITE	DIR (DEG)	170	260	260	250	300	110	290	260	230	210
BRIDGEPORT	VEL (MPH)	1.4	8.2	1.9	6.7	3.5	5.4	7.1	7.6	5.5	1.3
	SPD (MPH)	4.6	8.3	3.9	6.9	5.8	5.5	8.1	8.2	5.6	2.9
	RATIO	0.306	0.979	0.489	0.967	0.602	0.987	0.876	0.931	0.974	0.460
METEOROLOGICAL SITE	DIR (DEG)	210	260	280	280	300	140	270	250	260	240
WORCESTER	VEL (MPH)	5.0	9.3	5.9	6.6	4.0	3.6	8.9	11.1	6.3	2.5
	SPD (MPH)	5.8	9.3	6.2	7.0	4.2	3.6	10.4	11.2	6.8	5.5
	RATIO	0.864	0.997	0.960	0.932	0.957	0.992	0.858	0.989	0.934	0.458
NEW BRITAIN-012 (0058)	PM10	59	45	43	43	42	37	34	34	34	33
	DATE	1/17/90	11/ 1/90	9/ 2/90	8/27/90	7/ 4/90	12/ 7/90	12/13/90	7/22/90	6/22/90	9/14/90
METEOROLOGICAL SITE	DIR (DEG)	190	200	280	340	230	330	280	110	200	140
NEWARK	VEL (MPH)	5.8	2.7	4.8	5.0	14.0	1.7	9.0	2.4	6.4	6.6
	SPD (MPH)	6.3	5.5	7.2	7.2	16.2	5.0	11.9	5.0	8.3	7.5
	RATIO	0.912	0.501	0.670	0.694	0.861	0.334	0.750	0.486	0.773	0.881
METEOROLOGICAL SITE	DIR (DEG)	180	80	240	320	220	330	280	130	210	160
BRADLEY	VEL (MPH)	6.2	.6	1.4	4.8	8.0	1.6	5.1	3.0	6.9	5.5
	SPD (MPH)	8.1	3.3	4.9	6.6	10.2	4.3	9.3	6.5	8.5	8.1
	RATIO	0.772	0.183	0.279	0.727	0.781	0.375	0.541	0.468	0.819	0.681
METEOROLOGICAL SITE	DIR (DEG)	170	260	250	300	260	100	290	110	230	160
BRIDGEPORT	VEL (MPH)	1.4	1.9	6.7	3.5	8.2	1.3	7.1	5.4	5.5	6.1
	SPD (MPH)	4.6	3.9	6.9	5.8	8.3	2.7	8.1	5.5	5.6	6.6
	RATIO	0.306	0.489	0.967	0.602	0.979	0.466	0.876	0.987	0.974	0.922
METEOROLOGICAL SITE	DIR (DEG)	210	280	280	300	260	260	270	140	260	170
WORCESTER	VEL (MPH)	5.0	5.9	6.6	4.0	9.3	3.4	8.9	3.6	6.3	4.3
	SPD (MPH)	5.8	6.2	7.0	4.2	9.3	4.3	10.4	3.6	6.8	4.3
	RATIO	0.864	0.960	0.932	0.957	0.997	0.794	0.858	0.992	0.934	0.989
NEW HAVEN-013 (0060)	PM10	80	48	47	46	42	38	37	35	35	33
	DATE	1/17/90	7/ 4/90	11/ 1/90	12/13/90	9/ 2/90	7/22/90	6/22/90	6/28/90	12/ 7/90	3/12/90
METEOROLOGICAL SITE	DIR (DEG)	190	230	200	280	280	110	200	260	330	90
NEWARK	VEL (MPH)	5.8	14.0	2.7	9.0	4.8	2.4	6.4	2.4	1.7	3.5
	SPD (MPH)	6.3	16.2	5.5	11.9	7.2	5.0	8.3	5.2	5.0	4.7
	RATIO	0.912	0.861	0.501	0.750	0.670	0.486	0.773	0.464	0.334	0.734
METEOROLOGICAL SITE	DIR (DEG)	180	220	80	280	240	130	210	320	330	360
BRADLEY	VEL (MPH)	6.2	8.0	.6	5.1	1.4	3.0	6.9	6.9	1.6	4.3
	SPD (MPH)	8.1	10.2	3.3	9.3	4.9	6.5	8.5	7.5	4.3	4.3
	RATIO	0.772	0.781	0.183	0.541	0.279	0.468	0.819	0.926	0.375	0.992

TABLE 2-5, CONTINUED

1990 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)	170	260	260	290	250	110	230	260	100	100
BRIDGEPORT	VEL (MPH)	1.4	8.2	1.9	7.1	6.7	5.4	5.5	5.2	1.3	6.8
	SPD (MPH)	4.6	8.3	3.9	8.1	6.9	5.5	5.6	5.9	2.7	6.9
	RATIO	0.306	0.979	0.489	0.876	0.967	0.987	0.974	0.883	0.466	0.983
METEOROLOGICAL SITE	DIR (DEG)	210	260	280	270	280	140	260	300	260	130
WORCESTER	VEL (MPH)	5.0	9.3	5.9	8.9	6.6	3.6	6.3	7.0	3.4	1.8
	SPD (MPH)	5.8	9.3	6.2	10.4	7.0	3.6	6.8	7.5	4.3	2.0
	RATIO	0.864	0.997	0.960	0.858	0.932	0.992	0.934	0.934	0.794	0.889
NEW HAVEN-018 (0349)	PM10	123	121	119	116	105	103	101	99	97	89
	DATE	1/19/90	11/20/90	11/21/90	1/17/90	8/17/90	11/14/90	3/ 9/90	2/13/90	3/13/90	2/ 8/90
METEOROLOGICAL SITE	DIR (DEG)	320	330	360	190	190	300	230	180	270	180
NEWARK	VEL (MPH)	10.5	9.6	5.4	5.8	5.8	11.5	3.2	7.5	7.8	3.4
	SPD (MPH)	11.9	10.2	5.8	6.3	7.6	14.4	6.0	8.6	8.9	5.3
	RATIO	0.877	0.944	0.943	0.912	0.757	0.801	0.538	0.869	0.873	0.631
METEOROLOGICAL SITE	DIR (DEG)	320	340	360	180	210	300	220	190	350	170
BRADLEY	VEL (MPH)	9.1	9.3	5.5	6.2	3.1	7.3	1.5	10.5	3.7	6.1
	SPD (MPH)	10.6	9.9	6.0	8.1	6.0	9.2	4.5	10.6	6.2	7.2
	RATIO	0.855	0.942	0.911	0.772	0.508	0.796	0.327	0.990	0.596	0.855
METEOROLOGICAL SITE	DIR (DEG)	350	360	350	170	210	330	180	240	280	250
BRIDGEPORT	VEL (MPH)	4.4	7.6	3.3	1.4	3.4	6.0	1.1	6.7	3.4	4.9
	SPD (MPH)	4.7	7.8	3.7	4.6	3.7	6.2	2.3	6.8	5.2	5.6
	RATIO	0.933	0.985	0.891	0.306	0.897	0.968	0.470	0.996	0.657	0.875
METEOROLOGICAL SITE	DIR (DEG)	310	330	350	210	260	310	200	230	290	250
WORCESTER	VEL (MPH)	7.8	9.0	4.3	5.0	5.0	9.2	1.1	8.3	7.9	7.2
	SPD (MPH)	8.3	9.1	4.7	5.8	5.5	9.5	3.9	8.6	8.3	7.6
	RATIO	0.930	0.992	0.904	0.864	0.923	0.975	0.293	0.968	0.952	0.947
NEW HAVEN-020 (0060)	PM10	73	53	51	47	44	41	41	40	40	40
	DATE	1/17/90	11/ 1/90	12/13/90	7/ 4/90	9/ 2/90	8/27/90	6/28/90	12/ 7/90	6/22/90	2/28/90
METEOROLOGICAL SITE	DIR (DEG)	190	200	280	230	280	340	260	330	200	320
NEWARK	VEL (MPH)	5.8	2.7	9.0	14.0	4.8	5.0	2.4	1.7	6.4	10.8
	SPD (MPH)	6.3	5.5	11.9	16.2	7.2	7.2	5.2	5.0	8.3	12.1
	RATIO	0.912	0.501	0.750	0.861	0.670	0.694	0.464	0.334	0.773	0.891
METEOROLOGICAL SITE	DIR (DEG)	180	80	280	220	240	320	320	330	210	320
BRADLEY	VEL (MPH)	6.2	.6	5.1	8.0	1.4	4.8	6.9	1.6	6.9	10.1
	SPD (MPH)	8.1	3.3	9.3	10.2	4.9	6.6	7.5	4.3	8.5	11.5
	RATIO	0.772	0.183	0.541	0.781	0.279	0.727	0.926	0.375	0.819	0.882
METEOROLOGICAL SITE	DIR (DEG)	170	260	290	260	250	300	260	100	230	340
BRIDGEPORT	VEL (MPH)	1.4	1.9	7.1	8.2	6.7	3.5	5.2	1.3	5.5	7.0
	SPD (MPH)	4.6	3.9	8.1	8.3	6.9	5.8	5.9	2.7	5.6	7.2
	RATIO	0.306	0.489	0.876	0.979	0.967	0.602	0.883	0.466	0.974	0.979
METEOROLOGICAL SITE	DIR (DEG)	210	280	270	260	280	300	300	260	260	300
WORCESTER	VEL (MPH)	5.0	5.9	8.9	9.3	6.6	4.0	7.0	3.4	6.3	7.9
	SPD (MPH)	5.8	6.2	10.4	9.3	7.0	4.2	7.5	4.3	6.8	8.1
	RATIO	0.864	0.960	0.858	0.997	0.932	0.957	0.934	0.794	0.934	0.986

TABLE 2-5, CONTINUED

1990 TEN HIGHEST 24-HOUR AVERAGE PM10 DAYS WITH WIND DATA

UNITS : MICROGRAMS PER CUBIC METER

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
NEW HAVEN-123 (0055)	PM10	81	53	53	49	45	45	41	38	37	37
	DATE	1/17/90	6/22/90	8/27/90	7/ 4/90	9/ 2/90	12/13/90	8/ 3/90	12/ 7/90	7/22/90	10/ 8/90
METEOROLOGICAL SITE	DIR (DEG)	190	200	340	230	280	280	170	330	110	170
NEWARK	VEL (MPH)	5.8	6.4	5.0	14.0	4.8	9.0	1.0	1.7	2.4	2.8
	SPD (MPH)	6.3	8.3	7.2	16.2	7.2	11.9	4.2	5.0	5.0	5.0
	RATIO	0.912	0.773	0.694	0.861	0.670	0.750	0.233	0.334	0.486	0.560
METEOROLOGICAL SITE	DIR (DEG)	180	210	320	220	240	280	290	330	130	190
BRADLEY	VEL (MPH)	6.2	6.9	4.8	8.0	1.4	5.1	2.5	1.6	3.0	4.9
	SPD (MPH)	8.1	8.5	6.6	10.2	4.9	9.3	5.0	4.3	6.5	7.0
	RATIO	0.772	0.819	0.727	0.781	0.279	0.541	0.492	0.375	0.468	0.701
METEOROLOGICAL SITE	DIR (DEG)	170	230	300	260	250	290	240	100	110	210
BRIDGEPORT	VEL (MPH)	1.4	5.5	3.5	8.2	6.7	7.1	5.0	1.3	5.4	1.3
	SPD (MPH)	4.6	5.6	5.8	8.3	6.9	8.1	5.0	2.7	5.5	2.9
	RATIO	0.306	0.974	0.602	0.979	0.967	0.876	0.996	0.466	0.987	0.460
METEOROLOGICAL SITE	DIR (DEG)	210	260	300	260	280	270	300	260	140	240
WORCESTER	VEL (MPH)	5.0	6.3	4.0	9.3	6.6	8.9	5.6	3.4	3.6	2.5
	SPD (MPH)	5.8	6.8	4.2	9.3	7.0	10.4	5.9	4.3	3.6	5.5
	RATIO	0.864	0.934	0.957	0.997	0.932	0.858	0.944	0.794	0.992	0.458
NEW LONDON-004 (0058)	PM10	58	47	41	39	34	34	33	30	30	29
	DATE	1/17/90	7/ 4/90	9/ 2/90	8/27/90	3/12/90	6/22/90	7/22/90	6/28/90	12/13/90	2/28/90
METEOROLOGICAL SITE	DIR (DEG)	190	230	280	340	90	200	110	260	280	320
NEWARK	VEL (MPH)	5.8	14.0	4.8	5.0	3.5	6.4	2.4	2.4	9.0	10.8
	SPD (MPH)	6.3	16.2	7.2	7.2	4.7	8.3	5.0	5.2	11.9	12.1
	RATIO	0.912	0.861	0.670	0.694	0.734	0.773	0.486	0.464	0.750	0.891
METEOROLOGICAL SITE	DIR (DEG)	180	220	240	320	360	210	130	320	280	320
BRADLEY	VEL (MPH)	6.2	8.0	1.4	4.8	4.3	6.9	3.0	6.9	5.1	10.1
	SPD (MPH)	8.1	10.2	4.9	6.6	4.3	8.5	6.5	7.5	9.3	11.5
	RATIO	0.772	0.781	0.279	0.727	0.992	0.819	0.468	0.926	0.541	0.882
METEOROLOGICAL SITE	DIR (DEG)	170	260	250	300	100	230	110	260	290	340
BRIDGEPORT	VEL (MPH)	1.4	8.2	6.7	3.5	6.8	5.5	5.4	5.2	7.1	7.0
	SPD (MPH)	4.6	8.3	6.9	5.8	6.9	5.6	5.5	5.9	8.1	7.2
	RATIO	0.306	0.979	0.967	0.602	0.983	0.974	0.987	0.883	0.876	0.979
METEOROLOGICAL SITE	DIR (DEG)	210	260	280	300	130	260	140	300	270	300
WORCESTER	VEL (MPH)	5.0	9.3	6.6	4.0	1.8	6.3	3.6	7.0	8.9	7.9
	SPD (MPH)	5.8	9.3	7.0	4.2	2.0	6.8	3.6	7.5	10.4	8.1
	RATIO	0.864	0.997	0.932	0.957	0.889	0.934	0.992	0.934	0.858	0.986
NORWALK-014 (0059)	PM10	90	82	74	71	63	58	57	56	54	51
	DATE	1/17/90	1/23/90	11/ 1/90	8/27/90	1/ 5/90	10/ 2/90	3/12/90	6/28/90	9/ 2/90	10/14/90
METEOROLOGICAL SITE	DIR (DEG)	190	270	200	340	320	300	90	260	280	300
NEWARK	VEL (MPH)	5.8	4.8	2.7	5.0	7.2	8.2	3.5	2.4	4.8	4.5
	SPD (MPH)	6.3	8.9	5.5	7.2	9.8	10.1	4.7	5.2	7.2	6.9
	RATIO	0.912	0.538	0.501	0.694	0.733	0.820	0.734	0.464	0.670	0.648
METEOROLOGICAL SITE	DIR (DEG)	180	220	80	320	320	300	360	320	240	310
BRADLEY	VEL (MPH)	6.2	2.4	.6	4.8	8.1	12.3	4.3	6.9	1.4	5.6
	SPD (MPH)	8.1	4.5	3.3	6.6	8.8	13.5	4.3	7.5	4.9	6.8
	RATIO	0.772	0.541	0.183	0.727	0.920	0.912	0.992	0.926	0.279	0.824

TABLE 2-5, CONTINUED

1990 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)	170	280	260	300	300	320	100	260	250	340
	BRIDGEPORT	VEL (MPH)	1.4	3.6	1.9	3.5	3.2	8.8	6.8	5.2	6.7	4.5
		SPD (MPH)	4.6	6.0	3.9	5.8	4.0	9.3	6.9	5.9	6.9	4.6
		RATIO	0.306	0.603	0.489	0.602	0.785	0.942	0.983	0.883	0.967	0.977
	METEOROLOGICAL SITE	DIR (DEG)	210	280	280	300	290	300	130	300	280	340
	WORCESTER	VEL (MPH)	5.0	4.9	5.9	4.0	6.3	13.1	1.8	7.0	6.6	5.4
		SPD (MPH)	5.8	5.3	6.2	4.2	6.6	13.5	2.0	7.5	7.0	5.9
		RATIO	0.864	0.922	0.960	0.957	0.954	0.967	0.889	0.934	0.932	0.915
NORWICH-002 (0059)		PM10	54	48	43	38	35	35	33	32	32	30
		DATE	1/17/90	7/ 4/90	9/ 2/90	8/27/90	12/ 7/90	7/22/90	1/23/90	6/22/90	12/13/90	7/16/90
	METEOROLOGICAL SITE	DIR (DEG)	190	230	280	340	330	110	270	200	280	260
	NEWARK	VEL (MPH)	5.8	14.0	4.8	5.0	1.7	2.4	4.8	6.4	9.0	7.2
		SPD (MPH)	6.3	16.2	7.2	7.2	5.0	5.0	8.9	8.3	11.9	9.2
		RATIO	0.912	0.861	0.670	0.694	0.334	0.486	0.538	0.773	0.750	0.788
	METEOROLOGICAL SITE	DIR (DEG)	180	220	240	320	330	130	220	210	280	280
	BRADLEY	VEL (MPH)	6.2	8.0	1.4	4.8	1.6	3.0	2.4	6.9	5.1	6.6
		SPD (MPH)	8.1	10.2	4.9	6.6	4.3	6.5	4.5	8.5	9.3	9.9
		RATIO	0.772	0.781	0.279	0.727	0.375	0.468	0.541	0.819	0.541	0.663
	METEOROLOGICAL SITE	DIR (DEG)	170	260	250	300	100	110	280	230	290	270
	BRIDGEPORT	VEL (MPH)	1.4	8.2	6.7	3.5	1.3	5.4	3.6	5.5	7.1	7.7
		SPD (MPH)	4.6	8.3	6.9	5.8	2.7	5.5	6.0	5.6	8.1	8.1
		RATIO	0.306	0.979	0.967	0.602	0.466	0.987	0.603	0.974	0.876	0.954
	METEOROLOGICAL SITE	DIR (DEG)	210	260	280	300	260	140	280	260	270	270
	WORCESTER	VEL (MPH)	5.0	9.3	6.6	4.0	3.4	3.6	4.9	6.3	8.9	7.2
		SPD (MPH)	5.8	9.3	7.0	4.2	4.3	3.6	5.3	6.8	10.4	7.8
		RATIO	0.864	0.997	0.932	0.957	0.794	0.992	0.922	0.934	0.858	0.929
STAMFORD-001 (0059)		PM10	80	48	48	47	44	44	40	37	37	36
		DATE	1/17/90	7/ 4/90	9/ 2/90	11/ 1/90	12/13/90	10/ 8/90	6/28/90	2/16/90	6/22/90	12/ 1/90
	METEOROLOGICAL SITE	DIR (DEG)	190	230	280	200	280	170	260	50	200	250
	NEWARK	VEL (MPH)	5.8	14.0	4.8	2.7	9.0	2.8	2.4	3.1	6.4	7.7
		SPD (MPH)	6.3	16.2	7.2	5.5	11.9	5.0	5.2	5.3	8.3	8.8
		RATIO	0.912	0.861	0.670	0.501	0.750	0.560	0.464	0.578	0.773	0.884
	METEOROLOGICAL SITE	DIR (DEG)	180	220	240	80	280	190	320	20	210	190
	BRADLEY	VEL (MPH)	6.2	8.0	1.4	.6	5.1	4.9	6.9	1.2	6.9	7.6
		SPD (MPH)	8.1	10.2	4.9	3.3	9.3	7.0	7.5	3.2	8.5	9.9
		RATIO	0.772	0.781	0.279	0.183	0.541	0.701	0.926	0.377	0.819	0.768
	METEOROLOGICAL SITE	DIR (DEG)	170	260	250	260	290	210	260	140	230	260
	BRIDGEPORT	VEL (MPH)	1.4	8.2	6.7	1.9	7.1	1.3	5.2	1.0	5.5	7.6
		SPD (MPH)	4.6	8.3	6.9	3.9	8.1	2.9	5.9	2.7	5.6	8.2
		RATIO	0.306	0.979	0.967	0.489	0.876	0.460	0.883	0.383	0.974	0.931
	METEOROLOGICAL SITE	DIR (DEG)	210	260	280	280	270	240	300	10	260	250
	WORCESTER	VEL (MPH)	5.0	9.3	6.6	5.9	8.9	2.5	7.0	1.9	6.3	11.1
		SPD (MPH)	5.8	9.3	7.0	6.2	10.4	5.5	7.5	2.4	6.8	11.2
		RATIO	0.864	0.997	0.932	0.960	0.858	0.458	0.934	0.779	0.934	0.989

TABLE 2-5, CONTINUED

1990 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
STRATFORD-005 (0055)	PM10	70	52	49	49	47	44	44	44	43	38
	DATE	1/17/90	7/ 4/90	12/13/90	1/23/90	1/ 5/90	11/ 1/90	9/ 2/90	8/27/90	6/22/90	7/22/90
METEOROLOGICAL SITE	DIR (DEG)	190	230	280	270	320	200	280	340	200	110
NEWARK	VEL (MPH)	5.8	14.0	9.0	4.8	7.2	2.7	4.8	5.0	6.4	2.4
	SPD (MPH)	6.3	16.2	11.9	8.9	9.8	5.5	7.2	7.2	8.3	5.0
	RATIO	0.912	0.861	0.750	0.538	0.733	0.501	0.670	0.694	0.773	0.486
METEOROLOGICAL SITE	DIR (DEG)	180	220	280	220	320	80	240	320	210	130
BRADLEY	VEL (MPH)	6.2	8.0	5.1	2.4	8.1	.6	1.4	4.8	6.9	3.0
	SPD (MPH)	8.1	10.2	9.3	4.5	8.8	3.3	4.9	6.6	8.5	6.5
	RATIO	0.772	0.781	0.541	0.541	0.920	0.183	0.279	0.727	0.819	0.468
METEOROLOGICAL SITE	DIR (DEG)	170	260	290	280	300	260	250	300	230	110
BRIDGEPORT	VEL (MPH)	1.4	8.2	7.1	3.6	3.2	1.9	6.7	3.5	5.5	5.4
	SPD (MPH)	4.6	8.3	8.1	6.0	4.0	3.9	6.9	5.8	5.6	5.5
	RATIO	0.306	0.979	0.876	0.603	0.785	0.489	0.967	0.602	0.974	0.987
METEOROLOGICAL SITE	DIR (DEG)	210	260	270	280	290	280	280	300	260	140
WORCESTER	VEL (MPH)	5.0	9.3	8.9	4.9	6.3	5.9	6.6	4.0	6.3	3.6
	SPD (MPH)	5.8	9.3	10.4	5.3	6.6	6.2	7.0	4.2	6.8	3.6
	RATIO	0.864	0.997	0.858	0.922	0.954	0.960	0.932	0.957	0.934	0.992
TORRINGTON-001 (0059)	PM10	55	44	39	39	37	35	34	33	32	31
	DATE	1/17/90	7/ 4/90	9/ 2/90	8/27/90	10/ 8/90	12/13/90	9/14/90	2/22/90	6/22/90	7/22/90
METEOROLOGICAL SITE	DIR (DEG)	190	230	280	340	170	280	140	210	200	110
NEWARK	VEL (MPH)	5.8	14.0	4.8	5.0	2.8	9.0	6.6	8.0	6.4	2.4
	SPD (MPH)	6.3	16.2	7.2	7.2	5.0	11.9	7.5	10.8	8.3	5.0
	RATIO	0.912	0.861	0.670	0.694	0.560	0.750	0.881	0.738	0.773	0.486
METEOROLOGICAL SITE	DIR (DEG)	180	220	240	320	190	280	160	190	210	130
BRADLEY	VEL (MPH)	6.2	8.0	1.4	4.8	4.9	5.1	5.5	10.0	6.9	3.0
	SPD (MPH)	8.1	10.2	4.9	6.6	7.0	9.3	8.1	13.8	8.5	6.5
	RATIO	0.772	0.781	0.279	0.727	0.701	0.541	0.681	0.727	0.819	0.468
METEOROLOGICAL SITE	DIR (DEG)	170	260	250	300	210	290	160	240	230	110
BRIDGEPORT	VEL (MPH)	1.4	8.2	6.7	3.5	1.3	7.1	6.1	8.1	5.5	5.4
	SPD (MPH)	4.6	8.3	6.9	5.8	2.9	8.1	6.6	8.2	5.6	5.5
	RATIO	0.306	0.979	0.967	0.602	0.460	0.876	0.922	0.986	0.974	0.987
METEOROLOGICAL SITE	DIR (DEG)	210	260	280	300	240	270	170	240	260	140
WORCESTER	VEL (MPH)	5.0	9.3	6.6	4.0	2.5	8.9	4.3	14.1	6.3	3.6
	SPD (MPH)	5.8	9.3	7.0	4.2	5.5	10.4	4.3	14.2	6.8	3.6
	RATIO	0.864	0.997	0.932	0.957	0.458	0.858	0.989	0.991	0.934	0.992
VOLUNTOWN-001 (0060)	PM10	43	39	33	29	27	27	25	25	24	23
	DATE	7/ 4/90	9/ 2/90	7/22/90	1/17/90	9/14/90	7/16/90	8/ 9/90	8/27/90	6/22/90	10/ 8/90
METEOROLOGICAL SITE	DIR (DEG)	230	280	110	190	140	260	20	340	200	170
NEWARK	VEL (MPH)	14.0	4.8	2.4	5.8	6.6	7.2	5.8	5.0	6.4	2.8
	SPD (MPH)	16.2	7.2	5.0	6.3	7.5	9.2	7.8	7.2	8.3	5.0
	RATIO	0.861	0.670	0.486	0.912	0.881	0.788	0.744	0.694	0.773	0.560
METEOROLOGICAL SITE	DIR (DEG)	220	240	130	180	160	280	10	320	210	190
BRADLEY	VEL (MPH)	8.0	1.4	3.0	6.2	5.5	6.6	3.8	4.8	6.9	4.9
	SPD (MPH)	10.2	4.9	6.5	8.1	8.1	9.9	6.0	6.6	8.5	7.0
	RATIO	0.781	0.279	0.468	0.772	0.681	0.663	0.637	0.727	0.819	0.701

TABLE 2-5, CONTINUED

1990 TEN HIGHEST 24-HOUR AVERAGE PM10 DAYS WITH WIND DATA

UNITS : MICROGRAMS PER CUBIC METER

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
METEOROLOGICAL SITE	DIR (DEG)	260	250	110	170	160	270	50	300	230	210
BRIDGEPORT	VEL (MPH)	8.2	6.7	5.4	1.4	6.1	7.7	1.2	3.5	5.5	1.3
	SPD (MPH)	8.3	6.9	5.5	4.6	6.6	8.1	5.2	5.8	5.6	2.9
	RATIO	0.979	0.967	0.987	0.306	0.922	0.954	0.230	0.602	0.974	0.460
METEOROLOGICAL SITE	DIR (DEG)	260	280	140	210	170	270	80	300	260	240
WORCESTER	VEL (MPH)	9.3	6.6	3.6	5.0	4.3	7.2	2.8	4.0	6.3	2.5
	SPD (MPH)	9.3	7.0	3.6	5.8	4.3	7.8	4.6	4.2	6.8	5.5
	RATIO	0.997	0.932	0.992	0.864	0.989	0.929	0.600	0.957	0.934	0.458
WALLINGFORD-006 (0053)	PM10	57	42	41	37	34	32	31	29	29	27
	DATE	1/17/90	7/ 4/90	9/ 2/90	8/27/90	7/22/90	1/ 5/90	6/22/90	8/ 9/90	12/ 1/90	1/23/90
METEOROLOGICAL SITE	DIR (DEG)	190	230	280	340	110	320	200	20	250	270
NEWARK	VEL (MPH)	5.8	14.0	4.8	5.0	2.4	7.2	6.4	5.8	7.7	4.8
	SPD (MPH)	6.3	16.2	7.2	7.2	5.0	9.8	8.3	7.8	8.8	8.9
	RATIO	0.912	0.861	0.670	0.694	0.486	0.733	0.773	0.744	0.884	0.538
METEOROLOGICAL SITE	DIR (DEG)	180	220	240	320	130	320	210	10	190	220
BRADLEY	VEL (MPH)	6.2	8.0	1.4	4.8	3.0	8.1	6.9	3.8	7.6	2.4
	SPD (MPH)	8.1	10.2	4.9	6.6	6.5	8.8	8.5	6.0	9.9	4.5
	RATIO	0.772	0.781	0.279	0.727	0.468	0.920	0.819	0.637	0.768	0.541
METEOROLOGICAL SITE	DIR (DEG)	170	260	250	300	110	300	230	50	260	280
BRIDGEPORT	VEL (MPH)	1.4	8.2	6.7	3.5	5.4	3.2	5.5	1.2	7.6	3.6
	SPD (MPH)	4.6	8.3	6.9	5.8	5.5	4.0	5.6	5.2	8.2	6.0
	RATIO	0.306	0.979	0.967	0.602	0.987	0.785	0.974	0.230	0.931	0.603
METEOROLOGICAL SITE	DIR (DEG)	210	260	280	300	140	290	260	80	250	280
WORCESTER	VEL (MPH)	5.0	9.3	6.6	4.0	3.6	6.3	6.3	2.8	11.1	4.9
	SPD (MPH)	5.8	9.3	7.0	4.2	3.6	6.6	6.8	4.6	11.2	5.3
	RATIO	0.864	0.997	0.932	0.957	0.992	0.954	0.934	0.600	0.989	0.922
WATERBURY-007 (0059)	PM10	81	59	47	46	45	45	44	44	43	43
	DATE	1/17/90	11/ 1/90	2/16/90	1/23/90	12/13/90	7/ 4/90	9/ 2/90	12/ 1/90	12/ 7/90	8/27/90
METEOROLOGICAL SITE	DIR (DEG)	190	200	50	270	280	230	280	250	330	340
NEWARK	VEL (MPH)	5.8	2.7	3.1	4.8	9.0	14.0	4.8	7.7	1.7	5.0
	SPD (MPH)	6.3	5.5	5.3	8.9	11.9	16.2	7.2	8.8	5.0	7.2
	RATIO	0.912	0.501	0.578	0.538	0.750	0.861	0.670	0.884	0.334	0.694
METEOROLOGICAL SITE	DIR (DEG)	180	80	20	220	280	220	240	190	330	320
BRADLEY	VEL (MPH)	6.2	.6	1.2	2.4	5.1	8.0	1.4	7.6	1.6	4.8
	SPD (MPH)	8.1	3.3	3.2	4.5	9.3	10.2	4.9	9.9	4.3	6.6
	RATIO	0.772	0.183	0.377	0.541	0.541	0.781	0.279	0.768	0.375	0.727
METEOROLOGICAL SITE	DIR (DEG)	170	260	140	280	290	260	250	260	100	300
BRIDGEPORT	VEL (MPH)	1.4	1.9	1.0	3.6	7.1	8.2	6.7	7.6	1.3	3.5
	SPD (MPH)	4.6	3.9	2.7	6.0	8.1	8.3	6.9	8.2	2.7	5.8
	RATIO	0.306	0.489	0.383	0.603	0.876	0.979	0.967	0.931	0.466	0.602
METEOROLOGICAL SITE	DIR (DEG)	210	280	10	280	270	260	280	250	260	300
WORCESTER	VEL (MPH)	5.0	5.9	1.9	4.9	8.9	9.3	6.6	11.1	3.4	4.0
	SPD (MPH)	5.8	6.2	2.4	5.3	10.4	9.3	7.0	11.2	4.3	4.2
	RATIO	0.864	0.960	0.779	0.922	0.858	0.997	0.932	0.989	0.794	0.957

TABLE 2-5, CONTINUED

1990 TEN HIGHEST 24-HOUR AVERAGE PM10 DAYS WITH WIND DATA

UNITS : MICROGRAMS PER CUBIC METER

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
WATERBURY-123 (0059)	PM10	81	77	65	64	59	59	52	48	46	46
	DATE	6/28/90	1/17/90	8/ 3/90	6/22/90	8/27/90	2/16/90	11/ 1/90	7/16/90	1/23/90	7/ 4/90
METEOROLOGICAL SITE	DIR (DEG)	260	190	170	200	340	50	200	260	270	230
NEWARK	VEL (MPH)	2.4	5.8	1.0	6.4	5.0	3.1	2.7	7.2	4.8	14.0
	SPD (MPH)	5.2	6.3	4.2	8.3	7.2	5.3	5.5	9.2	8.9	16.2
	RATIO	0.464	0.912	0.233	0.773	0.694	0.578	0.501	0.788	0.538	0.861
METEOROLOGICAL SITE	DIR (DEG)	320	180	290	210	320	20	80	280	220	220
BRADLEY	VEL (MPH)	6.9	6.2	2.5	6.9	4.8	1.2	.6	6.6	2.4	8.0
	SPD (MPH)	7.5	8.1	5.0	8.5	6.6	3.2	3.3	9.9	4.5	10.2
	RATIO	0.926	0.772	0.492	0.819	0.727	0.377	0.183	0.663	0.541	0.781
METEOROLOGICAL SITE	DIR (DEG)	260	170	240	230	300	140	260	270	280	260
BRIDGEPORT	VEL (MPH)	5.2	1.4	5.0	5.5	3.5	1.0	1.9	7.7	3.6	8.2
	SPD (MPH)	5.9	4.6	5.0	5.6	5.8	2.7	3.9	8.1	6.0	8.3
	RATIO	0.883	0.306	0.996	0.974	0.602	0.383	0.489	0.954	0.603	0.979
METEOROLOGICAL SITE	DIR (DEG)	300	210	300	260	300	10	280	270	280	260
WORCESTER	VEL (MPH)	7.0	5.0	5.6	6.3	4.0	1.9	5.9	7.2	4.9	9.3
	SPD (MPH)	7.5	5.8	5.9	6.8	4.2	2.4	6.2	7.8	5.3	9.3
	RATIO	0.934	0.864	0.944	0.934	0.957	0.779	0.960	0.929	0.922	0.997
WATERFORD-001 (0055)	PM10	49	46	43	40	39	37	37	31	29	26
	DATE	6/16/90	6/22/90	7/ 4/90	1/17/90	9/ 2/90	6/28/90	8/27/90	8/21/90	7/16/90	4/23/90
METEOROLOGICAL SITE	DIR (DEG)	120	200	230	190	280	260	340	20	260	360
NEWARK	VEL (MPH)	2.7	6.4	14.0	5.8	4.8	2.4	5.0	11.1	7.2	6.2
	SPD (MPH)	4.9	8.3	16.2	6.3	7.2	5.2	7.2	11.4	9.2	7.9
	RATIO	0.562	0.773	0.861	0.912	0.670	0.464	0.694	0.976	0.788	0.786
METEOROLOGICAL SITE	DIR (DEG)	170	210	220	180	240	320	320	20	280	10
BRADLEY	VEL (MPH)	2.9	6.9	8.0	6.2	1.4	6.9	4.8	8.8	6.6	6.9
	SPD (MPH)	5.9	8.5	10.2	8.1	4.9	7.5	6.6	9.3	9.9	8.8
	RATIO	0.489	0.819	0.781	0.772	0.279	0.926	0.727	0.939	0.663	0.784
METEOROLOGICAL SITE	DIR (DEG)	140	230	260	170	250	260	300	70	270	10
BRIDGEPORT	VEL (MPH)	3.2	5.5	8.2	1.4	6.7	5.2	3.5	8.3	7.7	7.2
	SPD (MPH)	3.2	5.6	8.3	4.6	6.9	5.9	5.8	8.6	8.1	8.1
	RATIO	0.997	0.974	0.979	0.306	0.967	0.883	0.602	0.963	0.954	0.890
METEOROLOGICAL SITE	DIR (DEG)	170	260	260	210	280	300	300	60	270	360
WORCESTER	VEL (MPH)	3.0	6.3	9.3	5.0	6.6	7.0	4.0	4.8	7.2	6.4
	SPD (MPH)	3.0	6.8	9.3	5.8	7.0	7.5	4.2	4.9	7.8	8.2
	RATIO	0.989	0.934	0.997	0.864	0.932	0.934	0.957	0.991	0.929	0.785
WEST HAVEN-003 (0057)	PM10	68	47	44	44	44	43	43	40	39	39
	DATE	1/17/90	7/ 4/90	9/ 2/90	11/ 1/90	6/28/90	8/27/90	1/23/90	6/22/90	12/13/90	12/ 7/90
METEOROLOGICAL SITE	DIR (DEG)	190	230	280	200	260	340	270	200	280	330
NEWARK	VEL (MPH)	5.8	14.0	4.8	2.7	2.4	5.0	4.8	6.4	9.0	1.7
	SPD (MPH)	6.3	16.2	7.2	5.5	5.2	7.2	8.9	8.3	11.9	5.0
	RATIO	0.912	0.861	0.670	0.501	0.464	0.694	0.538	0.773	0.750	0.334
METEOROLOGICAL SITE	DIR (DEG)	180	220	240	80	320	320	220	210	280	330
BRADLEY	VEL (MPH)	6.2	8.0	1.4	.6	6.9	4.8	2.4	6.9	5.1	1.6
	SPD (MPH)	8.1	10.2	4.9	3.3	7.5	6.6	4.5	8.5	9.3	4.3
	RATIO	0.772	0.781	0.279	0.183	0.926	0.727	0.541	0.819	0.541	0.375

TABLE 2-5, CONTINUED

1990 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)	170	260	250	260	260	300	280	230	290	100
BRIDGEPORT	VEL (MPH)	1.4	8.2	6.7	1.9	5.2	3.5	3.6	5.5	7.1	1.3
	SPD (MPH)	4.6	8.3	6.9	3.9	5.9	5.8	6.0	5.6	8.1	2.7
	RATIO	0.306	0.979	0.967	0.489	0.883	0.602	0.603	0.974	0.876	0.466
METEOROLOGICAL SITE	DIR (DEG)	210	260	280	280	300	300	280	260	270	260
WORCESTER	VEL (MPH)	5.0	9.3	6.6	5.9	7.0	4.0	4.9	6.3	8.9	3.4
	SPD (MPH)	5.8	9.3	7.0	6.2	7.5	4.2	5.3	6.8	10.4	4.3
	RATIO	0.864	0.997	0.932	0.960	0.934	0.957	0.922	0.934	0.858	0.794
WILLIMANTIC-002 (0060)	PM10	48	41	35	33	32	31	31	30	28	27
	DATE	1/17/90	7/ 4/90	9/ 2/90	7/22/90	8/27/90	12/ 7/90	9/14/90	11/ 1/90	12/ 1/90	1/23/90
METEOROLOGICAL SITE	DIR (DEG)	190	230	280	110	340	330	140	200	250	270
NEWARK	VEL (MPH)	5.8	14.0	4.8	2.4	5.0	1.7	6.6	2.7	7.7	4.8
	SPD (MPH)	6.3	16.2	7.2	5.0	7.2	5.0	7.5	5.5	8.8	8.9
	RATIO	0.912	0.861	0.670	0.486	0.694	0.334	0.881	0.501	0.884	0.538
METEOROLOGICAL SITE	DIR (DEG)	180	220	240	130	320	330	160	80	190	220
BRADLEY	VEL (MPH)	6.2	8.0	1.4	3.0	4.8	1.6	5.5	.6	7.6	2.4
	SPD (MPH)	8.1	10.2	4.9	6.5	6.6	4.3	8.1	3.3	9.9	4.5
	RATIO	0.772	0.781	0.279	0.468	0.727	0.375	0.681	0.183	0.768	0.541
METEOROLOGICAL SITE	DIR (DEG)	170	260	250	110	300	100	160	260	260	280
BRIDGEPORT	VEL (MPH)	1.4	8.2	6.7	5.4	3.5	1.3	6.1	1.9	7.6	3.6
	SPD (MPH)	4.6	8.3	6.9	5.5	5.8	2.7	6.6	3.9	8.2	6.0
	RATIO	0.306	0.979	0.967	0.987	0.602	0.466	0.922	0.489	0.931	0.603
METEOROLOGICAL SITE	DIR (DEG)	210	260	280	140	300	260	170	280	250	280
WORCESTER	VEL (MPH)	5.0	9.3	6.6	3.6	4.0	3.4	4.3	5.9	11.1	4.9
	SPD (MPH)	5.8	9.3	7.0	3.6	4.2	4.3	4.3	6.2	11.2	5.3
	RATIO	0.864	0.997	0.932	0.992	0.957	0.794	0.989	0.960	0.989	0.922

TABLE 2-6

PM10 TRENDS: 1985-1990
(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

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 1990 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 16 sites in 1990.

DISCUSSION OF DATA

Monitoring Network - Sixteen continuous SO_2 monitors were used to record data in 13 towns during 1990 (see Figure 3-1):

Bridgeport 012
Bridgeport 013
Danbury 123
East Hartford 006
East Haven 003
Enfield 005
Greenwich 017
Groton 007
Hartford 018
Milford 010
New Britain 011
New Haven 123
Stamford 025
Stamford 123
Waterbury 008
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).

Precision and Accuracy - 580 precision checks were made on SO_2 monitors in 1990, yielding 95% probability limits ranging from -6% to +5%. Accuracy is determined by introducing a known amount of SO_2 into each of the monitors. Three different concentration levels are tested: low, medium, and high. The 95% probability limits for accuracy based on 17 audits were: low, -12% to +9%; medium, -9% to +8%; and high, -8% to +7%.

Annual Averages - SO_2 levels were below the primary annual standard of 80 $\mu g/m^3$ at all sites in 1990 (see Table 3-1). The annual average SO_2 levels decreased at 12 of the 14 monitoring sites that had adequate data in both 1989 and 1990 to produce valid annual averages. The largest decrease was 8 $\mu g/m^3$, which occurred at Waterbury 008. No change was evident at Groton 007 and Waterbury 123.

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 data indicate that there were no violations of the primary SO_2 standard at any site in Connecticut in the last three years. However, statistical predictions of one day exceeding the primary 24-hour standard of 365 $\mu g/m^3$ did occur during this period at New Haven 017 in 1988. This implies that a slight increase in SO_2 emissions might have jeopardized the attainment of the standard at this site. Two days over the standard are required for the standard to be violated at a site.

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 1990. 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 12 of the 14 monitoring sites that had a sufficient distribution and quantity of data in both 1989 and 1990. The decreases ranged from 1 $\mu g/m^3$ at Stamford 025 to 85 $\mu g/m^3$ at New Haven 123. Increases in the second high concentration were experienced at Bridgeport 013 and Groton 007 and were less than 10 $\mu g/m^3$.

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 except at Greenwich 017 where it was the same. The differences vary in magnitude up to 25 $\mu g/m^3$, which occurred at Waterbury 123.

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 1990. Of the 14 sites that had a sufficient distribution and quantity of data in both 1989 and 1990, 13 had lower second high concentrations in 1990. The decreases ranged from 1 $\mu g/m^3$ at Groton 007 to 292 $\mu g/m^3$ at New Haven 123. Bridgeport 012 had a second high concentration in 1990 that was higher than 1989 by 18 $\mu g/m^3$.

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 1990. Only those 15 sites were used which had a sufficient distribution and quantity of data to produce a valid annual average in 1990. 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., 70%) 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 86% of the tabulated days occurred during the winter, and 13% 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 - In order to perform a valid trend analysis, the data for the period of interest must be adequate, reliable and from similar sampling methods. Up until 1978, the only monitoring method for SO_2 that was thought to consistently fit these criteria was the sulfation plate. Between 1978 and 1982 there were approximately three times as much sulfation rate data as continuous SO_2 data and the former method was used for the purpose of analyzing SO_2 trends. However, available information now indicates that sulfation rate-derived SO_2 values may not be as accurate as once thought. Sulfation rate data are dependent on relative humidity and wind speed -- being extremely sensitive to the latter -- and the precision of the data suffers even under uniform conditions. Furthermore, EPA has requested that DEP use continuous SO_2 data in order to analyze SO_2 trends. Consequently, the SO_2 trend analysis now uses only continuous SO_2 data. The 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.)

In response to the skyrocketing prices of low sulfur fuels in the late 1970's, most states relaxed their sulfur-in-fuel requirements to the full extent the law allowed, creating considerable pressure on Connecticut to follow suit. This caused Connecticut to reevaluate its philosophy for controlling sulfur oxide emissions in 1981. To meet the challenge of increased costs of fuel in the economy, DEP restructured its air pollution control requirements for fuel burning sources. Under this new "three-pronged" program, Connecticut's businesses and industries are (1) now allowed (effective November 1981) to burn a less expensive grade of oil with a higher sulfur content -- one percent (1.0%) sulfur oil, and (2) allowed to burn higher sulfur content oil in exchange for reductions in energy use. The third aspect of the program was the repeal of the 24-hour secondary air quality standard for sulfur oxides.

This action increased statewide allowable sulfur oxide emissions by almost 60%. Sulfur oxide emissions were not doubled by going from 0.5% to 1.0% sulfur-in-fuel since residential fuel users, which account for almost one-third of annual statewide sulfur oxide emissions, use distillate fuel oil with a sulfur content of less than 0.5%. Nevertheless, given this increase in allowable SO_2 emissions, one would have expected measured SO_2 levels to increase in 1982 and subsequent years, as compared to 1981. However, no significant trend was apparent in 1982; SO_2 levels actually declined in 1983; and since 1983, there has been no significant change in SO_2 levels until 1990 (see Table 3-5). This development may be attributable to year-to-year fluctuations in meteorology or decreased fuel use caused by increased fuel prices and/or increased fuel efficiency (i.e., 'tighter' buildings).

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 changes only from 1982 to 1983 and from 1989 to 1990.

The results of continuous SO_2 monitoring indicate that sulfur dioxide levels in 1990 were significantly lower than those in 1989 (see Table 3-5). Temperature is an important factor in determining SO_2 emissions. The change in measured SO_2 levels may have been due to the fact that for Connecticut 1990 was appreciably cooler than 1989. This is normally reflected in the number of "degree days" -- a measure of heating requirement (see Tables 9-1 and 9-2). As the number of degree days decreases, the amount of fuel that must be burned to heat buildings also decreases. Consequently, as less fuel is burned, the emissions of sulfur dioxide are proportonately decreased. There was approximately a 3% decrease in degrees days for Connecticut from 1989 to 1990.

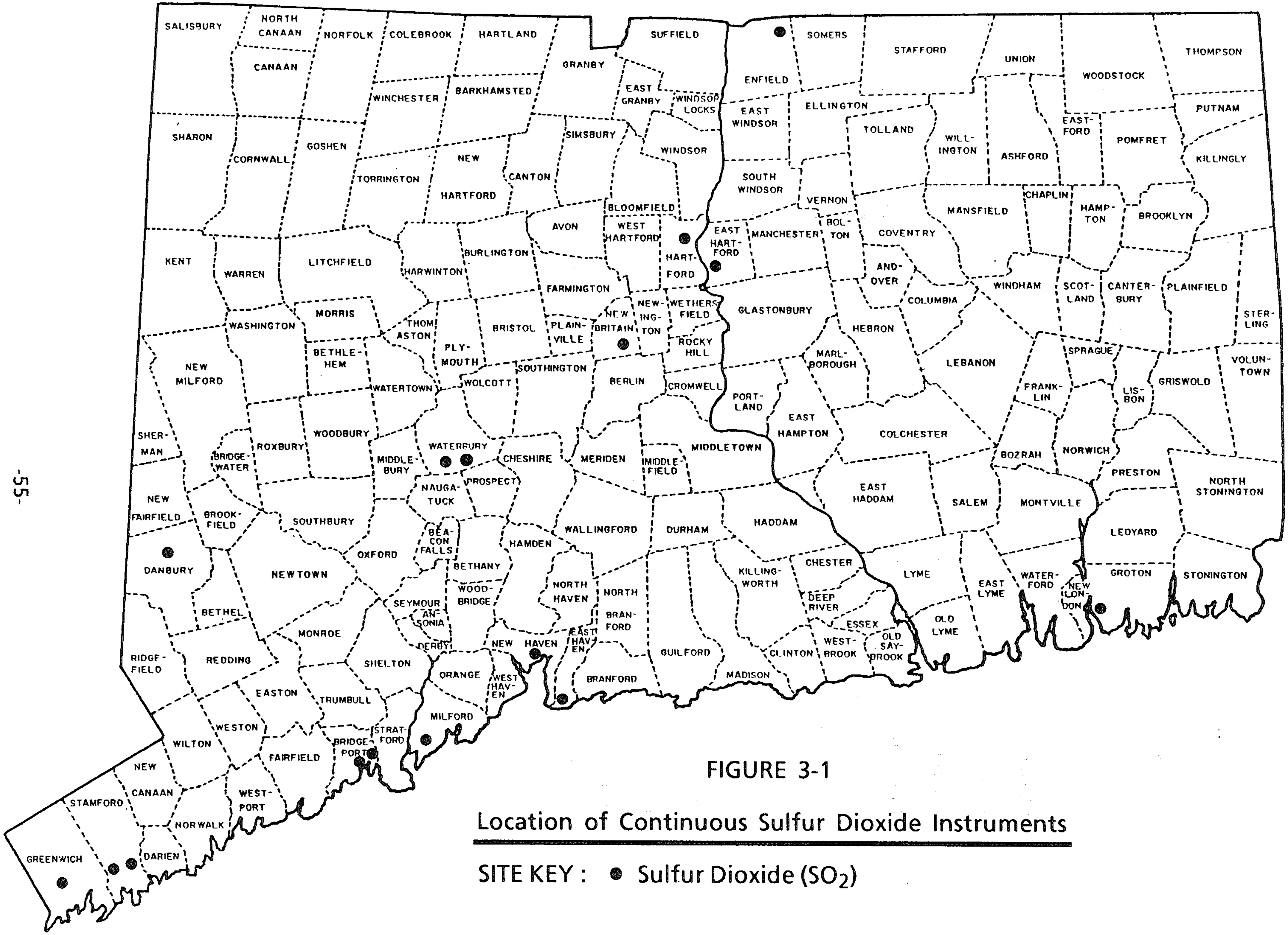


FIGURE 3-1

Location of Continuous Sulfur Dioxide Instruments

SITE KEY : ● Sulfur Dioxide (SO_2)

TABLE 3-1

1990 ANNUAL ARITHMETIC AVERAGES OF SULFUR DIOXIDE

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

TOWN-SITE	SITE NAME	ANNUAL AVG ($\mu g/m^3$)
Bridgeport 012	Edison School	33
Bridgeport 013	Hallett Street	25
Danbury 123	Western CT State College	19
East Hartford 006	High Street	21
East Haven 003	Animal Shelter	19
Enfield 005	Department of Corrections	16
Greenwich 017	Greenwich Point Park	12
Groton 007	Fire Headquarters	20
Hartford 018	Sheldon Street	24
Milford 010	Devon Community Center	23*
New Britain 011	Armory	21
New Haven 123	State Street	36
Stamford 025	Recreation Center	22
Stamford 123	Health Department	23
Waterbury 008	Armory	22
Waterbury 123	Bank Street	25

* A valid annual average cannot be calculated because either the sampling was not random or the number of observations does not satisfy the minimum sampling criteria.

TABLE 3-2

1988-1990 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	1988	363	35.5	35.3	35.7	28.269	
BRIDGEPORT	012	1989	362	35.8	35.5	36.0	26.908	
BRIDGEPORT	012	1990	358	32.9	32.5	33.3	27.329	
BRIDGEPORT	013	1988	363	28.1	27.9	28.3	23.821	
BRIDGEPORT	013	1989	348	26.0	25.5	26.4	19.517	
BRIDGEPORT	013	1990	362	25.5	25.3	25.7	20.468	
DANBURY	123	1988	341	23.1	22.6	23.7	20.905	
DANBURY	123	1989	362	22.1	21.9	22.2	17.365	
DANBURY	123	1990	345	19.4	19.0	19.8	16.290	
EAST HARTFORD	006	1989	139*	27.5	24.7	30.2	21.076	
EAST HARTFORD	006	1990	364	21.0	20.9	21.1	17.149	
EAST HAVEN	003	1988	347	25.0	24.5	25.6	24.503	
EAST HAVEN	003	1989	349	22.2	21.7	22.7	22.662	
EAST HAVEN	003	1990	365	18.8	18.8	18.8	16.076	
ENFIELD	005	1988	344	18.9	18.5	19.4	16.213	
ENFIELD	005	1989	356	17.4	17.2	17.7	13.374	
ENFIELD	005	1990	352	15.6	15.3	15.8	11.994	
GREENWICH	017	1988	356	16.1	15.9	16.3	12.034	
GREENWICH	017	1989	360	15.8	15.7	16.0	13.551	
GREENWICH	017	1990	364	12.5	12.4	12.6	10.371	
GROTON	007	1988	357	22.7	22.4	22.9	16.958	
GROTON	007	1989	341	19.9	19.6	20.2	12.749	
GROTON	007	1990	357	20.4	20.1	20.6	14.369	
HARTFORD	018	1989	339	27.5	26.9	28.0	19.595	
HARTFORD	018	1990	362	24.2	24.0	24.4	18.618	

* THE RANDOMNESS OR QUANTITY OF DATA IS NOT SUFFICIENT FOR REPRESENTATIVE ANNUAL STATISTICS.

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

TABLE 3-2, CONTINUED

1988-1990 SO2 ANNUAL AVERAGES AND STATISTICAL PROJECTIONS

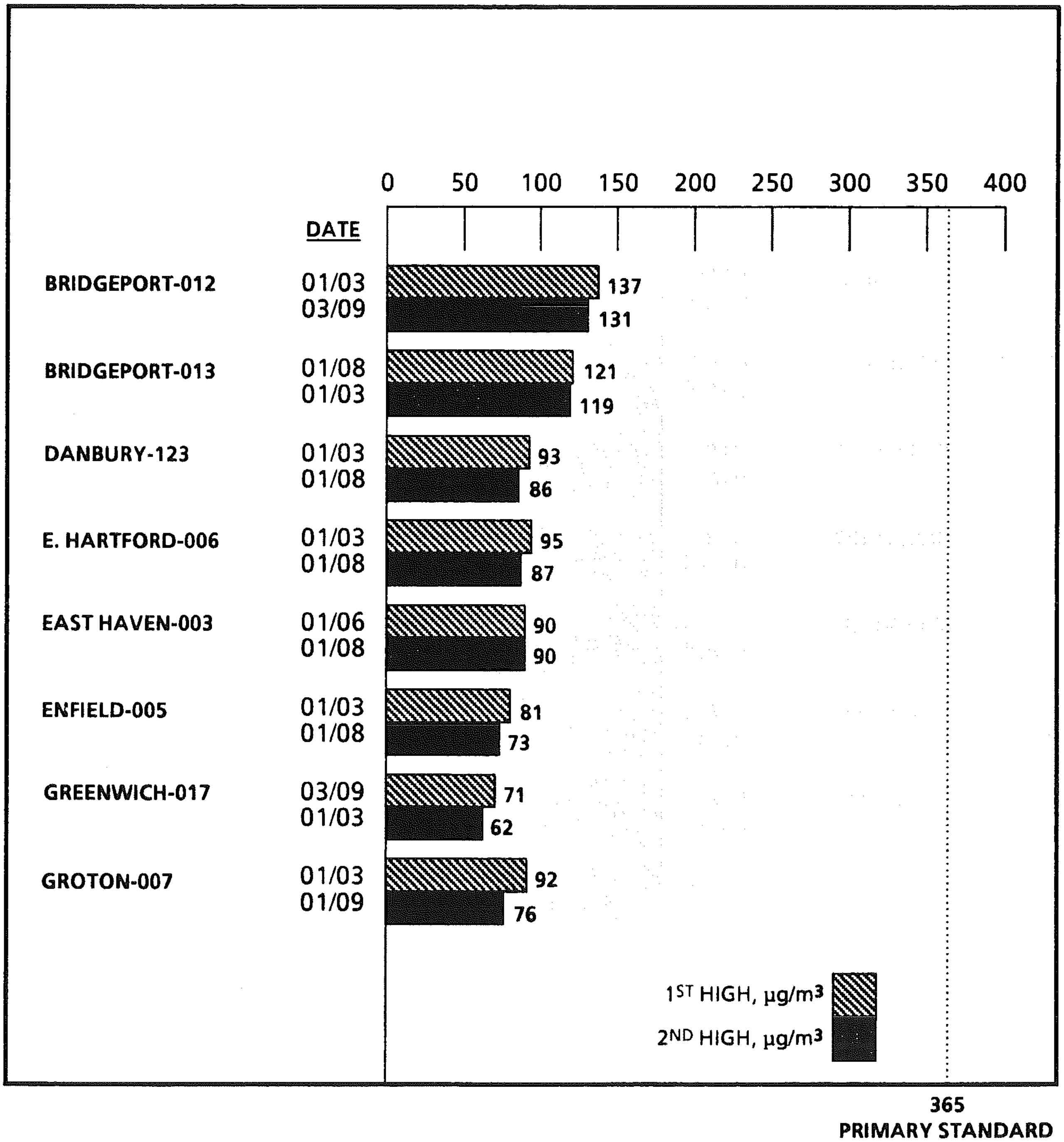
TOWN NAME	SITE	YEAR	SAMPLES	ARITHMETIC MEAN	95-PCT-LIMITS LOWER	95-PCT-LIMITS UPPER	STANDARD DEVIATION	PREDICTED DAYS OVER 365 UG/M3
MILFORD	010	1988	280	27.2	25.8	28.7	25.024	
MILFORD	010	1989	323	25.5	24.7	26.3	22.218	
MILFORD	010	1990	283*	23.3	22.2	24.4	20.582	
NEW BRITAIN	011	1988	359	25.1	24.7	25.5	27.279	
NEW BRITAIN	011	1989	355	23.9	23.6	24.3	21.577	
NEW BRITAIN	011	1990	316	21.2	20.4	21.9	18.814	
NEW HAVEN	017	1988	303	40.3	38.7	42.0	35.247	1
NEW HAVEN	017	1989	249*	29.5	27.5	31.4	27.983	
NEW HAVEN	123	1988	362	43.9	43.5	44.3	37.280	
NEW HAVEN	123	1989	345	41.1	40.2	42.0	35.953	
NEW HAVEN	123	1990	353	35.7	35.2	36.2	27.077	
STAMFORD	025	1988	338	27.6	26.8	28.3	25.278	
STAMFORD	025	1989	357	28.2	27.8	28.5	22.593	
STAMFORD	025	1990	315	21.9	21.0	22.7	20.806	
STAMFORD	123	1988	360	24.5	24.2	24.9	23.560	
STAMFORD	123	1989	364	25.1	25.0	25.2	22.175	
STAMFORD	123	1990	354	23.1	22.8	23.5	19.813	
WATERBURY	008	1988	343	26.7	26.0	27.5	27.919	
WATERBURY	008	1989	360	29.9	29.5	30.2	29.408	
WATERBURY	008	1990	317	22.3	21.4	23.2	22.754	
WATERBURY	123	1988	351	26.2	25.7	26.6	22.552	
WATERBURY	123	1989	341	25.4	24.8	26.0	21.647	
WATERBURY	123	1990	358	24.9	24.7	25.2	17.648	

* THE RANDOMNESS OR QUANTITY OF DATA IS NOT SUFFICIENT FOR REPRESENTATIVE ANNUAL STATISTICS.

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

FIGURE 3-2

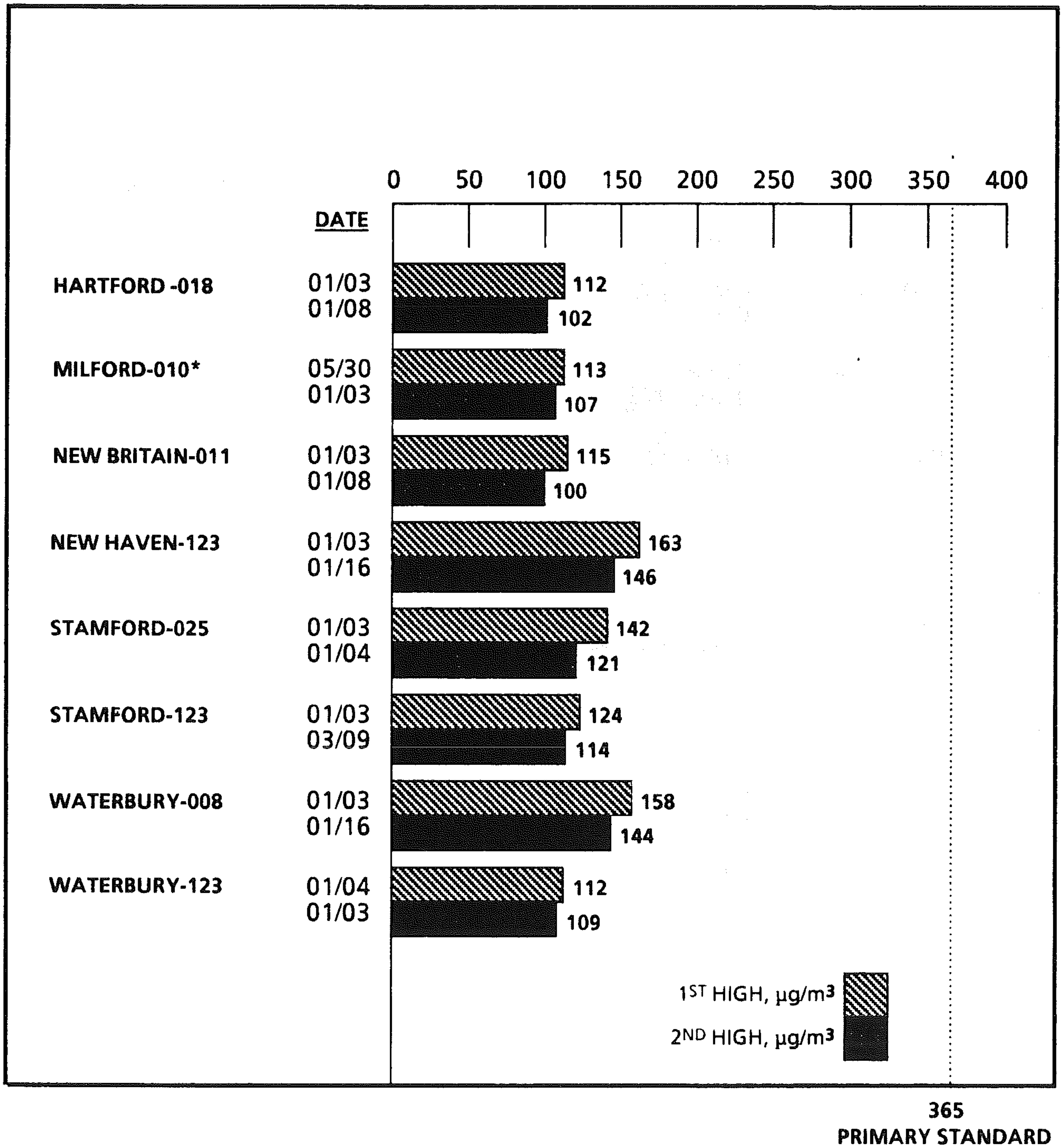
1990 MAXIMUM CALENDAR DAY AVERAGE SO2 CONCENTRATIONS



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

FIGURE 3-2, CONTINUED

1990 MAXIMUM CALENDAR DAY AVERAGE SO2 CONCENTRATIONS



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

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

TABLE 3-3

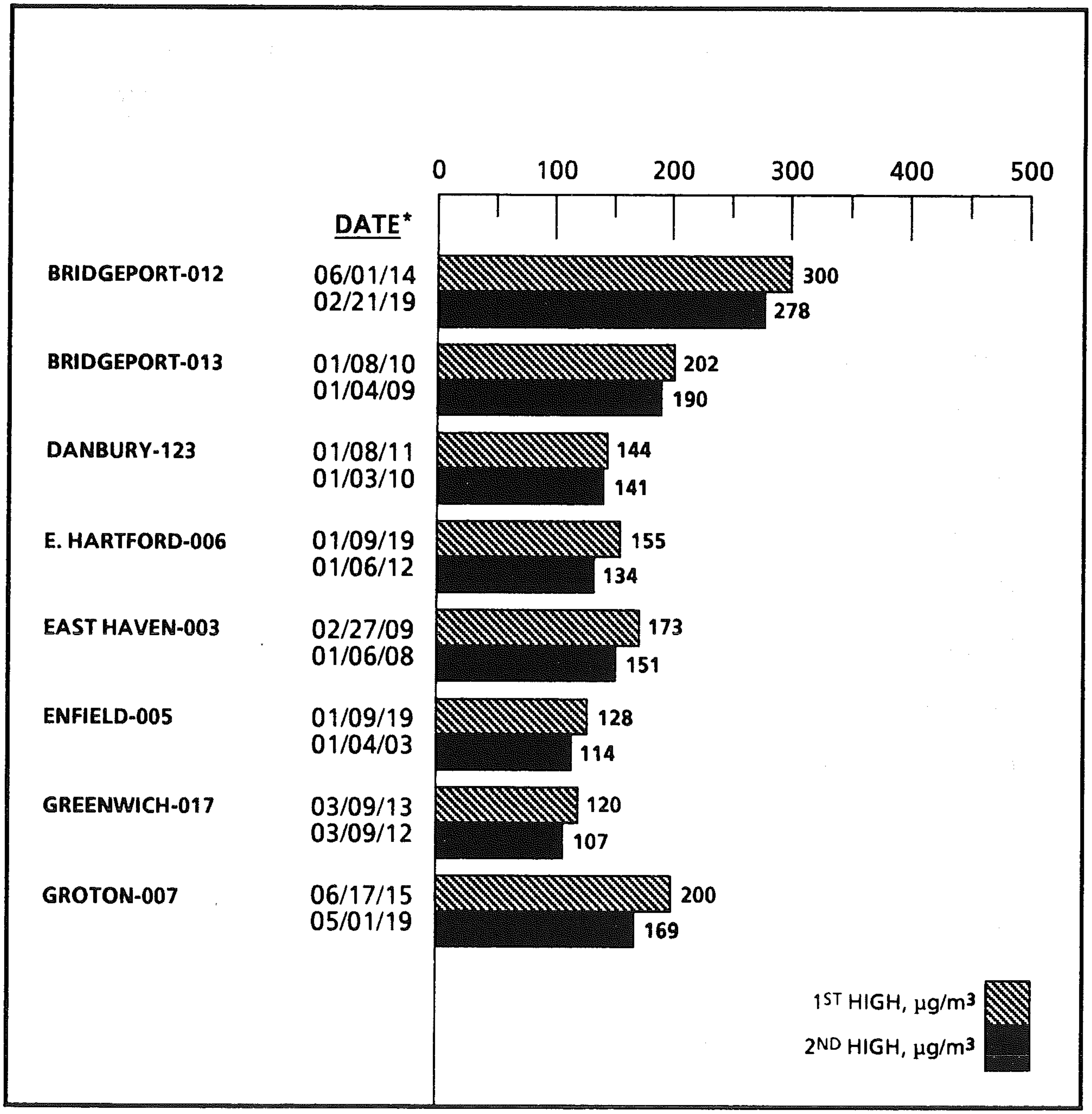
COMPARISONS OF FIRST AND SECOND HIGH CALENDAR DAY AND 24-HOUR RUNNING SO2 AVERAGES FOR 1990

SITE	FIRST HIGH AVERAGE		SECOND HIGH AVERAGE	
	RUNNING 24-HOUR	CALENDAR DAY	RUNNING 24-HOUR	CALENDAR DAY
Bridgeport-012	150	137	133	131
Bridgeport-013	138	121	130	119
Danbury-123	98	93	89	86
E. Hartford-006	106	95	90	87
East Haven-003	95	90	95	90
Enfield-005	92	81	77	73
Greenwich-017	71	71	71	62
Groton-007	93	92	82	76
Hartford-018	128	112	111	102
Milford-010*	114	113	114	107
New Britain-011	128	115	108	100
New Haven-123	186	163	163	146
Stamford-025	158	142	135	121
Stamford-123	137	124	117	114
Waterbury-008	170	158	144	144
Waterbury-123	137	112	115	109

* The site has insufficient data to satisfy the minimum sampling criteria.
N.B. The averages have units of $\mu g/m^3$.

FIGURE 3-3

1990 MAXIMUM 3-HOUR RUNNING AVERAGE SO2 CONCENTRATIONS



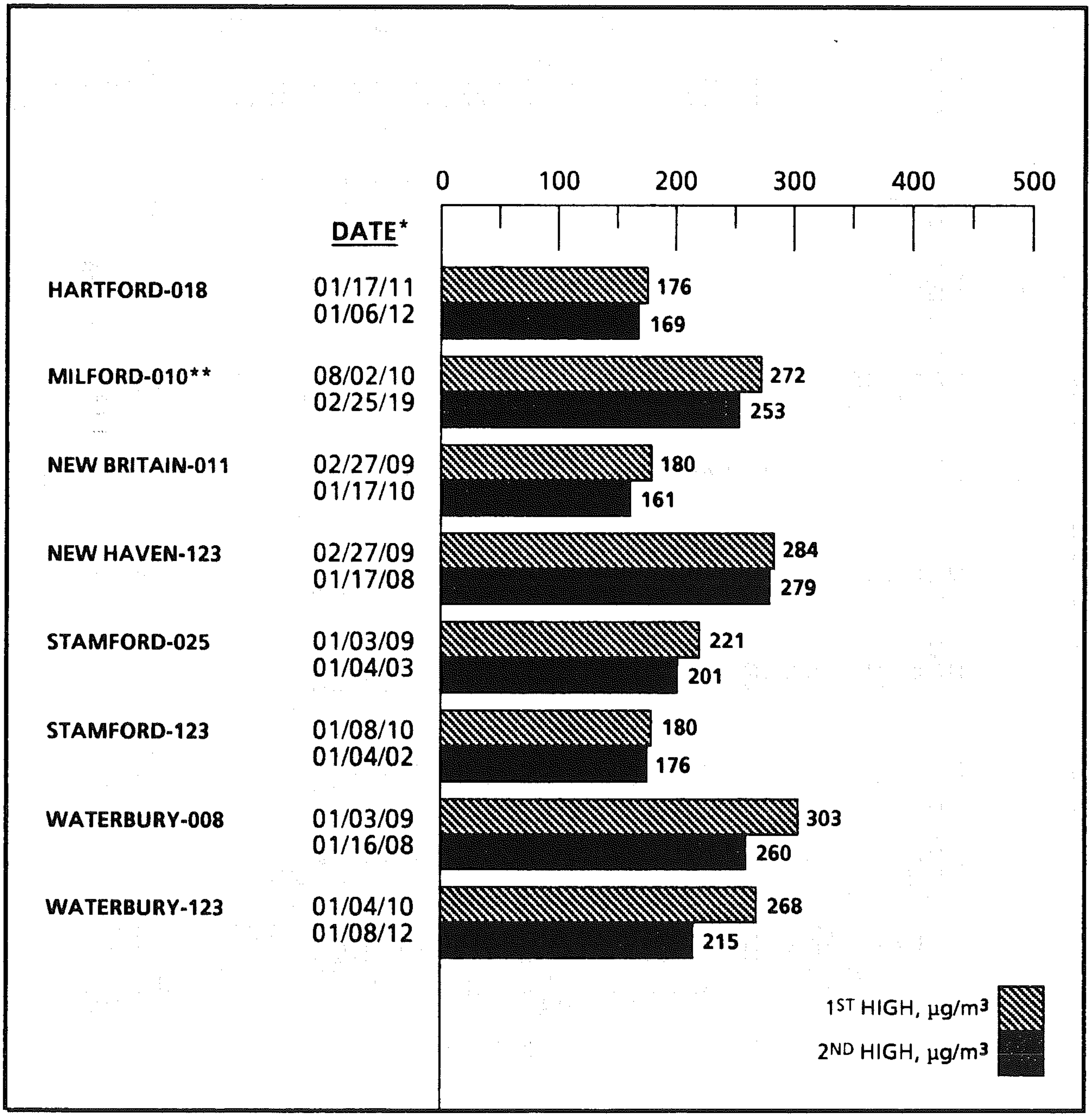
* The date is the month/day/ending hour of occurrence.

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

Secondary standard = 1300 µg/m^3.

FIGURE 3-3, CONTINUED

1990 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.

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

1990 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 (0358)	SO2	137	131	126	122	121	120	118	118	116	116
	DATE	1/ 3/90	3/ 9/90	1/16/90	2/13/90	1/17/90	1/ 8/90	2/22/90	2/ 1/90	2/ 8/90	1/ 4/90
METEOROLOGICAL SITE	DIR (DEG)	220	230	240	180	190	360	210	200	180	240
NEWARK	VEL (MPH)	3.4	3.2	5.3	7.5	5.8	3.6	8.0	5.9	3.4	6.3
	SPD (MPH)	6.6	6.0	6.6	8.6	6.3	6.0	10.8	7.0	5.3	9.2
	RATIO	0.520	0.538	0.809	0.869	0.912	0.602	0.738	0.841	0.631	0.687
METEOROLOGICAL SITE	DIR (DEG)	180	220	180	190	180	10	190	200	170	180
BRADLEY	VEL (MPH)	4.3	1.5	4.1	10.5	6.2	1.8	10.0	8.7	6.1	6.5
	SPD (MPH)	7.6	4.5	6.5	10.6	8.1	5.6	13.8	8.9	7.2	8.5
	RATIO	0.565	0.327	0.631	0.990	0.772	0.316	0.727	0.972	0.855	0.770
METEOROLOGICAL SITE	DIR (DEG)	260	180	260	240	170	90	240	230	250	250
BRIDGEPORT	VEL (MPH)	3.1	1.1	4.6	6.7	1.4	2.4	8.1	4.3	4.9	5.3
	SPD (MPH)	3.2	2.3	4.7	6.8	4.6	3.6	8.2	5.0	5.6	5.6
	RATIO	0.987	0.470	0.969	0.996	0.306	0.681	0.986	0.850	0.875	0.946
METEOROLOGICAL SITE	DIR (DEG)	280	200	290	230	210	250	240	240	250	240
WORCESTER	VEL (MPH)	6.9	1.1	5.9	8.3	5.0	2.3	14.1	9.3	7.2	8.2
	SPD (MPH)	7.0	3.9	6.0	8.6	5.8	4.5	14.2	9.5	7.6	8.8
	RATIO	0.975	0.293	0.980	0.968	0.864	0.517	0.991	0.985	0.947	0.932
BRIDGEPORT-013 (0362)	SO2	121	119	108	106	101	92	91	90	87	87
	DATE	1/ 8/90	1/ 3/90	1/ 4/90	3/ 9/90	1/16/90	1/17/90	2/ 7/90	1/ 7/90	1/ 9/90	11/15/90
METEOROLOGICAL SITE	DIR (DEG)	360	220	240	230	240	190	360	220	200	220
NEWARK	VEL (MPH)	3.6	3.4	6.3	3.2	5.3	5.8	4.6	6.2	5.0	8.1
	SPD (MPH)	6.0	6.6	9.2	6.0	6.6	6.3	6.6	8.8	6.2	9.5
	RATIO	0.602	0.520	0.687	0.538	0.809	0.912	0.701	0.711	0.806	0.853
METEOROLOGICAL SITE	DIR (DEG)	10	180	180	220	180	180	160	190	170	170
BRADLEY	VEL (MPH)	1.8	4.3	6.5	1.5	4.1	6.2	.7	6.4	5.6	6.3
	SPD (MPH)	5.6	7.6	8.5	4.5	6.5	8.1	4.2	9.2	7.0	7.5
	RATIO	0.316	0.565	0.770	0.327	0.631	0.772	0.169	0.698	0.790	0.836
METEOROLOGICAL SITE	DIR (DEG)	90	260	250	180	260	170	90	250	240	260
BRIDGEPORT	VEL (MPH)	2.4	3.1	5.3	1.1	4.6	1.4	2.9	5.3	5.4	8.7
	SPD (MPH)	3.6	3.2	5.6	2.3	4.7	4.6	5.3	5.5	5.9	9.1
	RATIO	0.681	0.987	0.946	0.470	0.969	0.306	0.554	0.971	0.909	0.965
METEOROLOGICAL SITE	DIR (DEG)	250	280	240	200	290	210	240	240	230	270
WORCESTER	VEL (MPH)	2.3	6.9	8.2	1.1	5.9	5.0	6.7	7.8	6.1	10.6
	SPD (MPH)	4.5	7.0	8.8	3.9	6.0	5.8	6.9	8.2	6.5	10.6
	RATIO	0.517	0.975	0.932	0.293	0.980	0.864	0.970	0.955	0.938	0.998
DANBURY-123 (0345)	SO2	93	86	80	77	72	71	71	68	67	66
	DATE	1/ 3/90	1/ 8/90	1/ 9/90	3/ 9/90	1/ 4/90	3/10/90	1/17/90	1/31/90	2/ 1/90	1/16/90
METEOROLOGICAL SITE	DIR (DEG)	220	360	200	230	240	160	190	310	200	240
NEWARK	VEL (MPH)	3.4	3.6	5.0	3.2	6.3	2.8	5.8	.8	5.9	5.3
	SPD (MPH)	6.6	6.0	6.2	6.0	9.2	3.2	6.3	3.2	7.0	6.6
	RATIO	0.520	0.602	0.806	0.538	0.687	0.877	0.912	0.263	0.841	0.809
METEOROLOGICAL SITE	DIR (DEG)	180	10	170	220	180	180	180	360	200	180
BRADLEY	VEL (MPH)	4.3	1.8	5.6	1.5	6.5	4.6	6.2	.9	8.7	4.1
	SPD (MPH)	7.6	5.6	7.0	4.5	8.5	6.6	8.1	3.7	8.9	6.5
	RATIO	0.565	0.316	0.790	0.327	0.770	0.696	0.772	0.229	0.972	0.631

TABLE 3-4, CONTINUED

1990 TEN HIGHEST 24-HOUR AVERAGE SO2 DAYS WITH WIND DATA

UNITS : MICROGRAMS PER CUBIC METER

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
METEOROLOGICAL SITE	DIR (DEG)	260	90	240	180	250	110	170	230	230	260
BRIDGEPORT	VEL (MPH)	3.1	2.4	5.4	1.1	5.3	.5	1.4	.3	4.3	4.6
	SPD (MPH)	3.2	3.6	5.9	2.3	5.6	2.4	4.6	1.7	5.0	4.7
	RATIO	0.987	0.681	0.909	0.470	0.946	0.190	0.306	0.188	0.850	0.969
METEOROLOGICAL SITE	DIR (DEG)	280	250	230	200	240	220	210	270	240	290
WORCESTER	VEL (MPH)	6.9	2.3	6.1	1.1	8.2	4.7	5.0	3.1	9.3	5.9
	SPD (MPH)	7.0	4.5	6.5	3.9	8.8	5.5	5.8	3.9	9.5	6.0
	RATIO	0.975	0.517	0.938	0.293	0.932	0.867	0.864	0.793	0.985	0.980
EAST HARTFORD-006 (0364)	SO2	95	87	82	77	76	75	74	72	71	67
	DATE	1/ 3/90	1/ 8/90	1/ 9/90	1/ 4/90	1/ 6/90	11/15/90	1/31/90	1/16/90	1/17/90	11/16/90
METEOROLOGICAL SITE	DIR (DEG)	220	360	200	240	310	220	310	240	190	210
NEWARK	VEL (MPH)	3.4	3.6	5.0	6.3	6.0	8.1	.8	5.3	5.8	6.8
	SPD (MPH)	6.6	6.0	6.2	9.2	7.6	9.5	3.2	6.6	6.3	8.5
	RATIO	0.520	0.602	0.806	0.687	0.782	0.853	0.263	0.809	0.912	0.803
METEOROLOGICAL SITE	DIR (DEG)	180	10	170	180	310	170	360	180	180	180
BRADLEY	VEL (MPH)	4.3	1.8	5.6	6.5	3.4	6.3	.9	4.1	6.2	7.0
	SPD (MPH)	7.6	5.6	7.0	8.5	5.3	7.5	3.7	6.5	8.1	9.9
	RATIO	0.565	0.316	0.790	0.770	0.638	0.836	0.229	0.631	0.772	0.701
METEOROLOGICAL SITE	DIR (DEG)	260	90	240	250	310	260	230	260	170	260
BRIDGEPORT	VEL (MPH)	3.1	2.4	5.4	5.3	3.3	8.7	.3	4.6	1.4	5.6
	SPD (MPH)	3.2	3.6	5.9	5.6	5.0	9.1	1.7	4.7	4.6	5.9
	RATIO	0.987	0.681	0.909	0.946	0.653	0.965	0.188	0.969	0.306	0.951
METEOROLOGICAL SITE	DIR (DEG)	280	250	230	240	280	270	270	290	210	250
WORCESTER	VEL (MPH)	6.9	2.3	6.1	8.2	6.0	10.6	3.1	5.9	5.0	8.6
	SPD (MPH)	7.0	4.5	6.5	8.8	6.5	10.6	3.9	6.0	5.8	8.8
	RATIO	0.975	0.517	0.938	0.932	0.924	0.998	0.793	0.980	0.864	0.985
EAST HAVEN-003 (0365)	SO2	90	90	89	79	75	69	68	66	64	62
	DATE	1/ 6/90	1/ 8/90	1/ 3/90	2/27/90	3/ 9/90	12/ 7/90	11/15/90	1/16/90	12/15/90	2/21/90
METEOROLOGICAL SITE	DIR (DEG)	310	360	220	230	230	330	220	240	310	230
NEWARK	VEL (MPH)	6.0	3.6	3.4	8.7	3.2	1.7	8.1	5.3	4.0	8.3
	SPD (MPH)	7.6	6.0	6.6	10.2	6.0	5.0	9.5	6.6	6.2	9.8
	RATIO	0.782	0.602	0.520	0.853	0.538	0.334	0.853	0.809	0.639	0.849
METEOROLOGICAL SITE	DIR (DEG)	310	10	180	200	220	330	170	180	360	210
BRADLEY	VEL (MPH)	3.4	1.8	4.3	6.1	1.5	1.6	6.3	4.1	3.1	7.7
	SPD (MPH)	5.3	5.6	7.6	8.5	4.5	4.3	7.5	6.5	3.5	8.8
	RATIO	0.638	0.316	0.565	0.724	0.327	0.375	0.836	0.631	0.894	0.882
METEOROLOGICAL SITE	DIR (DEG)	310	90	260	260	180	100	260	260	270	260
BRIDGEPORT	VEL (MPH)	3.3	2.4	3.1	8.4	1.1	1.3	8.7	4.6	1.9	9.9
	SPD (MPH)	5.0	3.6	3.2	9.6	2.3	2.7	9.1	4.7	5.0	10.1
	RATIO	0.653	0.681	0.987	0.877	0.470	0.466	0.965	0.969	0.372	0.980
METEOROLOGICAL SITE	DIR (DEG)	280	250	280	220	200	260	270	290	250	270
WORCESTER	VEL (MPH)	6.0	2.3	6.9	8.5	1.1	3.4	10.6	5.9	4.3	11.9
	SPD (MPH)	6.5	4.5	7.0	8.8	3.9	4.3	10.6	6.0	7.3	11.9
	RATIO	0.924	0.517	0.975	0.967	0.293	0.794	0.998	0.980	0.587	0.998

TABLE 3-4, CONTINUED

1990 TEN HIGHEST 24-HOUR AVERAGE SO2 DAYS WITH WIND DATA

UNITS : MICROGRAMS PER CUBIC METER

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
ENFIELD-005 (0352)	SO2	81	73	71	62	54	53	50	50	47	45
	DATE	1/ 3/90	1/ 8/90	1/ 4/90	1/ 9/90	2/ 1/90	1/25/90	1/16/90	3/ 2/90	3/10/90	2/ 8/90
METEOROLOGICAL SITE	DIR (DEG)	220	360	240	200	200	90	240	230	160	180
NEWARK	VEL (MPH)	3.4	3.6	6.3	5.0	5.9	3.7	5.3	7.7	2.8	3.4
	SPD (MPH)	6.6	6.0	9.2	6.2	7.0	5.3	6.6	10.2	3.2	5.3
	RATIO	0.520	0.602	0.687	0.806	0.841	0.697	0.809	0.755	0.877	0.631
METEOROLOGICAL SITE	DIR (DEG)	180	10	180	170	200	340	180	200	180	170
BRADLEY	VEL (MPH)	4.3	1.8	6.5	5.6	8.7	3.8	4.1	9.7	4.6	6.1
	SPD (MPH)	7.6	5.6	8.5	7.0	8.9	4.3	6.5	11.9	6.6	7.2
	RATIO	0.565	0.316	0.770	0.790	0.972	0.892	0.631	0.812	0.696	0.855
METEOROLOGICAL SITE	DIR (DEG)	260	90	250	240	230	80	260	260	110	250
BRIDGEPORT	VEL (MPH)	3.1	2.4	5.3	5.4	4.3	3.0	4.6	10.6	.5	4.9
	SPD (MPH)	3.2	3.6	5.6	5.9	5.0	6.5	4.7	10.6	2.4	5.6
	RATIO	0.987	0.681	0.946	0.909	0.850	0.467	0.969	0.992	0.190	0.875
METEOROLOGICAL SITE	DIR (DEG)	280	250	240	230	240	130	290	250	220	250
WORCESTER	VEL (MPH)	6.9	2.3	8.2	6.1	9.3	1.5	5.9	12.3	4.7	7.2
	SPD (MPH)	7.0	4.5	8.8	6.5	9.5	3.2	6.0	12.4	5.5	7.6
	RATIO	0.975	0.517	0.932	0.938	0.985	0.462	0.980	0.996	0.867	0.947
GREENWICH-017 (0364)	SO2	71	62	57	44	43	43	42	41	41	39
	DATE	3/ 9/90	1/ 3/90	11/15/90	1/ 8/90	12/ 1/90	1/ 4/90	1/16/90	11/16/90	12/12/90	12/ 6/90
METEOROLOGICAL SITE	DIR (DEG)	230	220	220	360	250	240	240	210	220	260
NEWARK	VEL (MPH)	3.2	3.4	8.1	3.6	7.7	6.3	5.3	6.8	.8	8.5
	SPD (MPH)	6.0	6.6	9.5	6.0	8.8	9.2	6.6	8.5	3.7	10.2
	RATIO	0.538	0.520	0.853	0.602	0.884	0.687	0.809	0.803	0.221	0.837
METEOROLOGICAL SITE	DIR (DEG)	220	180	170	10	190	180	180	180	130	230
BRADLEY	VEL (MPH)	1.5	4.3	6.3	1.8	7.6	6.5	4.1	7.0	2.0	8.4
	SPD (MPH)	4.5	7.6	7.5	5.6	9.9	8.5	6.5	9.9	5.2	10.9
	RATIO	0.327	0.565	0.836	0.316	0.768	0.770	0.631	0.701	0.396	0.770
METEOROLOGICAL SITE	DIR (DEG)	180	260	260	90	260	250	260	260	120	270
BRIDGEPORT	VEL (MPH)	1.1	3.1	8.7	2.4	7.6	5.3	4.6	5.6	2.6	7.4
	SPD (MPH)	2.3	3.2	9.1	3.6	8.2	5.6	4.7	5.9	3.5	7.5
	RATIO	0.470	0.987	0.965	0.681	0.931	0.946	0.969	0.951	0.747	0.991
METEOROLOGICAL SITE	DIR (DEG)	200	280	270	250	250	240	290	250	180	260
WORCESTER	VEL (MPH)	1.1	6.9	10.6	2.3	11.1	8.2	5.9	8.6	2.8	7.1
	SPD (MPH)	3.9	7.0	10.6	4.5	11.2	8.8	6.0	8.8	4.9	7.2
	RATIO	0.293	0.975	0.998	0.517	0.989	0.932	0.980	0.985	0.567	0.986
GROTON-007 (0357)	SO2	92	76	75	72	71	67	64	60	60	59
	DATE	1/ 3/90	1/ 9/90	1/ 8/90	3/ 9/90	1/16/90	2/ 8/90	1/17/90	3/22/90	1/31/90	12/ 6/90
METEOROLOGICAL SITE	DIR (DEG)	220	200	360	230	240	180	190	160	310	260
NEWARK	VEL (MPH)	3.4	5.0	3.6	3.2	5.3	3.4	5.8	7.6	.8	8.5
	SPD (MPH)	6.6	6.2	6.0	6.0	6.6	5.3	6.3	8.9	3.2	10.2
	RATIO	0.520	0.806	0.602	0.538	0.809	0.631	0.912	0.856	0.263	0.837
METEOROLOGICAL SITE	DIR (DEG)	180	170	10	220	180	170	180	190	360	230
BRADLEY	VEL (MPH)	4.3	5.6	1.8	1.5	4.1	6.1	6.2	8.8	.9	8.4
	SPD (MPH)	7.6	7.0	5.6	4.5	6.5	7.2	8.1	10.1	3.7	10.9
	RATIO	0.565	0.790	0.316	0.327	0.631	0.855	0.772	0.878	0.229	0.770

TABLE 3-4, CONTINUED

1990 TEN HIGHEST 24-HOUR AVERAGE SO2 DAYS WITH WIND DATA

UNITS : MICROGRAMS PER CUBIC METER

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
METEOROLOGICAL SITE	DIR (DEG)	260	240	90	180	260	250	170	220	230	270
BRIDGEPORT	VEL (MPH)	3.1	5.4	2.4	1.1	4.6	4.9	1.4	5.8	.3	7.4
	SPD (MPH)	3.2	5.9	3.6	2.3	4.7	5.6	4.6	7.3	1.7	7.5
	RATIO	0.987	0.909	0.681	0.470	0.969	0.875	0.306	0.787	0.188	0.991
METEOROLOGICAL SITE	DIR (DEG)	280	230	250	200	290	250	210	210	270	260
WORCESTER	VEL (MPH)	6.9	6.1	2.3	1.1	5.9	7.2	5.0	7.1	3.1	7.1
	SPD (MPH)	7.0	6.5	4.5	3.9	6.0	7.6	5.8	7.6	3.9	7.2
	RATIO	0.975	0.938	0.517	0.293	0.980	0.947	0.864	0.928	0.793	0.986
HARTFORD-018 (0362)	SO2	112	102	100	95	95	92	88	83	81	78
	DATE	1/ 3/90	1/ 8/90	1/ 4/90	1/ 9/90	1/17/90	1/ 6/90	1/16/90	1/24/90	11/15/90	1/31/90
METEOROLOGICAL SITE	DIR (DEG)	220	360	240	200	190	310	240	230	220	310
NEWARK	VEL (MPH)	3.4	3.6	6.3	5.0	5.8	6.0	5.3	2.7	8.1	.8
	SPD (MPH)	6.6	6.0	9.2	6.2	6.3	7.6	6.6	5.2	9.5	3.2
	RATIO	0.520	0.602	0.687	0.806	0.912	0.782	0.809	0.521	0.853	0.263
METEOROLOGICAL SITE	DIR (DEG)	180	10	180	170	180	310	180	220	170	360
BRADLEY	VEL (MPH)	4.3	1.8	6.5	5.6	6.2	3.4	4.1	2.1	6.3	.9
	SPD (MPH)	7.6	5.6	8.5	7.0	8.1	5.3	6.5	6.2	7.5	3.7
	RATIO	0.565	0.316	0.770	0.790	0.772	0.638	0.631	0.336	0.836	0.229
METEOROLOGICAL SITE	DIR (DEG)	260	90	250	240	170	310	260	110	260	230
BRIDGEPORT	VEL (MPH)	3.1	2.4	5.3	5.4	1.4	3.3	4.6	1.0	8.7	.3
	SPD (MPH)	3.2	3.6	5.6	5.9	4.6	5.0	4.7	4.9	9.1	1.7
	RATIO	0.987	0.681	0.946	0.909	0.306	0.653	0.969	0.210	0.965	0.188
METEOROLOGICAL SITE	DIR (DEG)	280	250	240	230	210	280	290	220	270	270
WORCESTER	VEL (MPH)	6.9	2.3	8.2	6.1	5.0	6.0	5.9	5.7	10.6	3.1
	SPD (MPH)	7.0	4.5	8.8	6.5	5.8	6.5	6.0	7.6	10.6	3.9
	RATIO	0.975	0.517	0.932	0.938	0.864	0.924	0.980	0.750	0.998	0.793
NEW BRITAIN-011 (0316)	SO2	115	100	97	96	89	87	81	80	77	77
	DATE	1/ 3/90	1/ 8/90	1/ 4/90	1/ 9/90	2/27/90	1/17/90	1/ 6/90	3/ 9/90	11/15/90	1/16/90
METEOROLOGICAL SITE	DIR (DEG)	220	360	240	200	230	190	310	230	220	240
NEWARK	VEL (MPH)	3.4	3.6	6.3	5.0	8.7	5.8	6.0	3.2	8.1	5.3
	SPD (MPH)	6.6	6.0	9.2	6.2	10.2	6.3	7.6	6.0	9.5	6.6
	RATIO	0.520	0.602	0.687	0.806	0.853	0.912	0.782	0.538	0.853	0.809
METEOROLOGICAL SITE	DIR (DEG)	180	10	180	170	200	180	310	220	170	180
BRADLEY	VEL (MPH)	4.3	1.8	6.5	5.6	6.1	6.2	3.4	1.5	6.3	4.1
	SPD (MPH)	7.6	5.6	8.5	7.0	8.5	8.1	5.3	4.5	7.5	6.5
	RATIO	0.565	0.316	0.770	0.790	0.724	0.772	0.638	0.327	0.836	0.631
METEOROLOGICAL SITE	DIR (DEG)	260	90	250	240	260	170	310	180	260	260
BRIDGEPORT	VEL (MPH)	3.1	2.4	5.3	5.4	8.4	1.4	3.3	1.1	8.7	4.6
	SPD (MPH)	3.2	3.6	5.6	5.9	9.6	4.6	5.0	2.3	9.1	4.7
	RATIO	0.987	0.681	0.946	0.909	0.877	0.306	0.653	0.470	0.965	0.969
METEOROLOGICAL SITE	DIR (DEG)	280	250	240	230	220	210	280	200	270	290
WORCESTER	VEL (MPH)	6.9	2.3	8.2	6.1	8.5	5.0	6.0	1.1	10.6	5.9
	SPD (MPH)	7.0	4.5	8.8	6.5	8.8	5.8	6.5	3.9	10.6	6.0
	RATIO	0.975	0.517	0.932	0.938	0.967	0.864	0.924	0.293	0.998	0.980

TABLE 3-4, CONTINUED

1990 TEN HIGHEST 24-HOUR AVERAGE SO2 DAYS WITH WIND DATA

UNITS : MICROGRAMS PER CUBIC METER

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
NEW HAVEN-123 (0353)	SO2	163	146	137	128	125	122	116	112	110	110
	DATE	1/ 3/90	1/16/90	1/ 4/90	2/27/90	1/ 8/90	3/ 9/90	1/17/90	2/ 8/90	1/ 6/90	1/ 9/90
METEOROLOGICAL SITE	DIR (DEG)	220	240	240	230	360	230	190	180	310	200
NEWARK	VEL (MPH)	3.4	5.3	6.3	8.7	3.6	3.2	5.8	3.4	6.0	5.0
	SPD (MPH)	6.6	6.6	9.2	10.2	6.0	6.0	6.3	5.3	7.6	6.2
	RATIO	0.520	0.809	0.687	0.853	0.602	0.538	0.912	0.631	0.782	0.806
METEOROLOGICAL SITE	DIR (DEG)	180	180	180	200	10	220	180	170	310	170
BRADLEY	VEL (MPH)	4.3	4.1	6.5	6.1	1.8	1.5	6.2	6.1	3.4	5.6
	SPD (MPH)	7.6	6.5	8.5	8.5	5.6	4.5	8.1	7.2	5.3	7.0
	RATIO	0.565	0.631	0.770	0.724	0.316	0.327	0.772	0.855	0.638	0.790
METEOROLOGICAL SITE	DIR (DEG)	260	260	250	260	90	180	170	250	310	240
BRIDGEPORT	VEL (MPH)	3.1	4.6	5.3	8.4	2.4	1.1	1.4	4.9	3.3	5.4
	SPD (MPH)	3.2	4.7	5.6	9.6	3.6	2.3	4.6	5.6	5.0	5.9
	RATIO	0.987	0.969	0.946	0.877	0.681	0.470	0.306	0.875	0.653	0.909
METEOROLOGICAL SITE	DIR (DEG)	280	290	240	220	250	200	210	250	280	230
WORCESTER	VEL (MPH)	6.9	5.9	8.2	8.5	2.3	1.1	5.0	7.2	6.0	6.1
	SPD (MPH)	7.0	6.0	8.8	8.8	4.5	3.9	5.8	7.6	6.5	6.5
	RATIO	0.975	0.980	0.932	0.967	0.517	0.293	0.864	0.947	0.924	0.938
STAMFORD-025 (0315)	SO2	142	121	119	118	100	94	81	81	79	77
	DATE	1/ 3/90	1/ 4/90	1/16/90	3/ 9/90	1/17/90	11/15/90	11/16/90	2/ 8/90	3/ 2/90	2/ 7/90
METEOROLOGICAL SITE	DIR (DEG)	220	240	240	230	190	220	210	180	230	360
NEWARK	VEL (MPH)	3.4	6.3	5.3	3.2	5.8	8.1	6.8	3.4	7.7	4.6
	SPD (MPH)	6.6	9.2	6.6	6.0	6.3	9.5	8.5	5.3	10.2	6.6
	RATIO	0.520	0.687	0.809	0.538	0.912	0.853	0.803	0.631	0.755	0.701
METEOROLOGICAL SITE	DIR (DEG)	180	180	180	220	180	170	180	170	200	160
BRADLEY	VEL (MPH)	4.3	6.5	4.1	1.5	6.2	6.3	7.0	6.1	9.7	.7
	SPD (MPH)	7.6	8.5	6.5	4.5	8.1	7.5	9.9	7.2	11.9	4.2
	RATIO	0.565	0.770	0.631	0.327	0.772	0.836	0.701	0.855	0.812	0.169
METEOROLOGICAL SITE	DIR (DEG)	260	250	260	180	170	260	260	250	260	90
BRIDGEPORT	VEL (MPH)	3.1	5.3	4.6	1.1	1.4	8.7	5.6	4.9	10.6	2.9
	SPD (MPH)	3.2	5.6	4.7	2.3	4.6	9.1	5.9	5.6	10.6	5.3
	RATIO	0.987	0.946	0.969	0.470	0.306	0.965	0.951	0.875	0.992	0.554
METEOROLOGICAL SITE	DIR (DEG)	280	240	290	200	210	270	250	250	250	240
WORCESTER	VEL (MPH)	6.9	8.2	5.9	1.1	5.0	10.6	8.6	7.2	12.3	6.7
	SPD (MPH)	7.0	8.8	6.0	3.9	5.8	10.6	8.8	7.6	12.4	6.9
	RATIO	0.975	0.932	0.980	0.293	0.864	0.998	0.985	0.947	0.996	0.970
STAMFORD-123 (0354)	SO2	124	114	107	105	90	88	80	77	74	73
	DATE	1/ 3/90	3/ 9/90	1/ 8/90	1/ 4/90	3/ 2/90	11/15/90	1/ 9/90	12/ 1/90	1/20/90	1/ 7/90
METEOROLOGICAL SITE	DIR (DEG)	220	230	360	240	230	220	200	250	130	220
NEWARK	VEL (MPH)	3.4	3.2	3.6	6.3	7.7	8.1	5.0	7.7	1.0	6.2
	SPD (MPH)	6.6	6.0	6.0	9.2	10.2	9.5	6.2	8.8	3.3	8.8
	RATIO	0.520	0.538	0.602	0.687	0.755	0.853	0.806	0.884	0.308	0.711
METEOROLOGICAL SITE	DIR (DEG)	180	220	10	180	200	170	170	190	150	190
BRADLEY	VEL (MPH)	4.3	1.5	1.8	6.5	9.7	6.3	5.6	7.6	3.3	6.4
	SPD (MPH)	7.6	4.5	5.6	8.5	11.9	7.5	7.0	9.9	5.5	9.2
	RATIO	0.565	0.327	0.316	0.770	0.812	0.836	0.790	0.768	0.600	0.698

TABLE 3-4, CONTINUED

1990 TEN HIGHEST 24-HOUR AVERAGE SO2 DAYS WITH WIND DATA

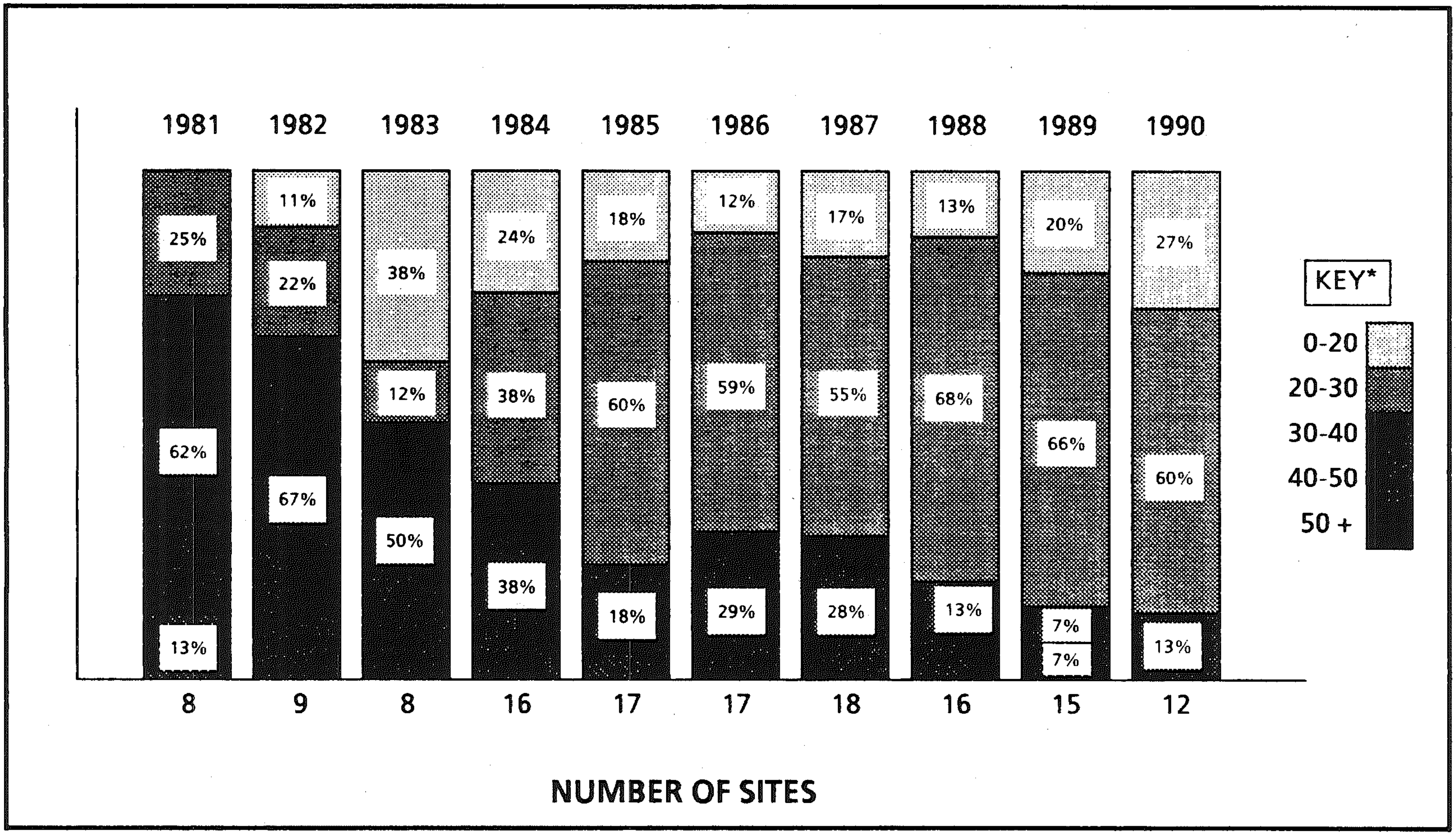
UNITS : MICROGRAMS PER CUBIC METER

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
METEOROLOGICAL SITE	DIR (DEG)	260	180	90	250	260	260	240	260	120	250
BRIDGEPORT	VEL (MPH)	3.1	1.1	2.4	5.3	10.6	8.7	5.4	7.6	1.5	5.3
	SPD (MPH)	3.2	2.3	3.6	5.6	10.6	9.1	5.9	8.2	1.6	5.5
	RATIO	0.987	0.470	0.681	0.946	0.992	0.965	0.909	0.931	0.930	0.971
METEOROLOGICAL SITE	DIR (DEG)	280	200	250	240	250	270	230	250	240	240
WORCESTER	VEL (MPH)	6.9	1.1	2.3	8.2	12.3	10.6	6.1	11.1	5.4	7.8
	SPD (MPH)	7.0	3.9	4.5	8.8	12.4	10.6	6.5	11.2	5.5	8.2
	RATIO	0.975	0.293	0.517	0.932	0.996	0.998	0.938	0.989	0.993	0.955
WATERBURY-008 (0317)	SO2	158	144	116	109	103	101	92	90	88	78
	DATE	1/ 3/90	1/16/90	1/ 4/90	3/ 9/90	1/17/90	2/ 8/90	11/15/90	2/27/90	1/31/90	1/23/90
METEOROLOGICAL SITE	DIR (DEG)	220	240	240	230	190	180	220	230	310	270
NEWARK	VEL (MPH)	3.4	5.3	6.3	3.2	5.8	3.4	8.1	8.7	.8	4.8
	SPD (MPH)	6.6	6.6	9.2	6.0	6.3	5.3	9.5	10.2	3.2	8.9
	RATIO	0.520	0.809	0.687	0.538	0.912	0.631	0.853	0.853	0.263	0.538
METEOROLOGICAL SITE	DIR (DEG)	180	180	180	220	180	170	170	200	360	220
BRADLEY	VEL (MPH)	4.3	4.1	6.5	1.5	6.2	6.1	6.3	6.1	.9	2.4
	SPD (MPH)	7.6	6.5	8.5	4.5	8.1	7.2	7.5	8.5	3.7	4.5
	RATIO	0.565	0.631	0.770	0.327	0.772	0.855	0.836	0.724	0.229	0.541
METEOROLOGICAL SITE	DIR (DEG)	260	260	250	180	170	250	260	260	230	280
BRIDGEPORT	VEL (MPH)	3.1	4.6	5.3	1.1	1.4	4.9	8.7	8.4	.3	3.6
	SPD (MPH)	3.2	4.7	5.6	2.3	4.6	5.6	9.1	9.6	1.7	6.0
	RATIO	0.987	0.969	0.946	0.470	0.306	0.875	0.965	0.877	0.188	0.603
METEOROLOGICAL SITE	DIR (DEG)	280	290	240	200	210	250	270	220	270	280
WORCESTER	VEL (MPH)	6.9	5.9	8.2	1.1	5.0	7.2	10.6	8.5	3.1	4.9
	SPD (MPH)	7.0	6.0	8.8	3.9	5.8	7.6	10.6	8.8	3.9	5.3
	RATIO	0.975	0.980	0.932	0.293	0.864	0.947	0.998	0.967	0.793	0.922
WATERBURY-123 (0358)	SO2	112	109	108	100	100	80	79	75	67	67
	DATE	1/ 4/90	1/ 3/90	1/ 8/90	3/ 9/90	1/ 9/90	11/15/90	1/16/90	3/10/90	1/17/90	1/ 7/90
METEOROLOGICAL SITE	DIR (DEG)	240	220	360	230	200	220	240	160	190	220
NEWARK	VEL (MPH)	6.3	3.4	3.6	3.2	5.0	8.1	5.3	2.8	5.8	6.2
	SPD (MPH)	9.2	6.6	6.0	6.0	6.2	9.5	6.6	3.2	6.3	8.8
	RATIO	0.687	0.520	0.602	0.538	0.806	0.853	0.809	0.877	0.912	0.711
METEOROLOGICAL SITE	DIR (DEG)	180	180	10	220	170	170	180	180	180	190
BRADLEY	VEL (MPH)	6.5	4.3	1.8	1.5	5.6	6.3	4.1	4.6	6.2	6.4
	SPD (MPH)	8.5	7.6	5.6	4.5	7.0	7.5	6.5	6.6	8.1	9.2
	RATIO	0.770	0.565	0.316	0.327	0.790	0.836	0.631	0.696	0.772	0.698
METEOROLOGICAL SITE	DIR (DEG)	250	260	90	180	240	260	260	110	170	250
BRIDGEPORT	VEL (MPH)	5.3	3.1	2.4	1.1	5.4	8.7	4.6	.5	1.4	5.3
	SPD (MPH)	5.6	3.2	3.6	2.3	5.9	9.1	4.7	2.4	4.6	5.5
	RATIO	0.946	0.987	0.681	0.470	0.909	0.965	0.969	0.190	0.306	0.971
METEOROLOGICAL SITE	DIR (DEG)	240	280	250	200	230	270	290	220	210	240
WORCESTER	VEL (MPH)	8.2	6.9	2.3	1.1	6.1	10.6	5.9	4.7	5.0	7.8
	SPD (MPH)	8.8	7.0	4.5	3.9	6.5	10.6	6.0	5.5	5.8	8.2
	RATIO	0.932	0.975	0.517	0.293	0.938	0.998	0.980	0.867	0.864	0.955

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: 1981-1990

(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	
81 82	20.9 21.0	8 8	0.09	3.98	N.C.	N.C.	0.9522
82 83	20.0 18.1	8 8	-1.96	0.79	↓	↓	0.0002
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

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 very high concentrations of ozone in the summer months of 1990. Levels in excess of the one-hour NAAQS of 0.12 ppm were frequently recorded at nine of the ten monitored sites. No site experienced levels greater than 0.20 ppm in 1990, compared to one site in 1989 and nine sites in 1988. All ten sites operated in both 1989 and 1990.

There was no clear trend in the high and second high concentrations at the monitoring sites from 1989 to 1990. Six sites had lower high concentrations in 1990, and the differences ranged up to 0.076 ppm, which occurred at Stratford 007. Of the four sites with higher high concentrations in 1990, Madison 002 had the largest increase: 0.048 ppm. Six sites had higher second high concentrations in 1990, and four had lower second high concentrations. The increases ranged up to 0.047 ppm at Madison 002, and the largest decrease was 0.059 ppm at Stratford 007.

The incidence of ozone concentrations in excess of the 1-hour 0.12 ppm standard was lower in 1990 than in 1989 (see Table 4-1). There was a total of 145 exceedances in 1989 and 96 exceedances in 1990 at the ten monitored sites. This represents a decrease in the frequency of such exceedances from 3.2 per 1000 sampling hours in 1989 to 2.4 per 1000 sampling hours in 1990: a 34% decrease. The actual number of hours when the ozone standard was exceeded in the state decreased only moderately from 65 in 1989 to 59 in 1990.

The number of site-days on which the ozone monitors experienced ozone levels in excess of the 1-hour standard decreased from 50 in 1989 to 43 in 1990 at the ten monitoring sites (see Table 4-2). This represents a decrease in the frequency of such occurrences from 2.6 per 100 sampling days in 1989 to 2.2 per 100 sampling days in 1990: a 15% decrease. The actual number of days on which the ozone standard was exceeded in the state stayed constant at 13 from 1989 to 1990.

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 <u>frequency of winds out of the southwest</u> would help to explain the decrease in the number of ozone exceedances from 1989 to 1990. However, the percentage of southwest winds during the "ozone season" actually increased from 31% in 1989 to 38% in 1990, as is shown by the wind roses from Newark (Figures 4-1 and 4-2). The magnitude of high ozone levels can be partly associated with yearly <u>variations in temperature</u>, since ozone production is greatest at high temperatures and in strong sunlight. However, the summer season's daily high temperatures were actually higher in 1990 than in 1989. This is demonstrated by the number of days exceeding 90° F which increased from three in 1989 to four in 1990 at Sikorsky Airport in Bridgeport, and from eleven in 1989 to fourteen in 1990 at Bradley International Airport (see Tables 9-1 and 9-2). The incidence of high ozone levels is dependent on the <u>percentage of possible sunshine</u>, since sunlight is essential to the creation of ozone. According to National Weather Service local climatological data recorded at Bradley Airport, the percentage of sunshine decreased from 57% in 1989 to 53% in 1990 for the months June through September. The average for the summer months at Bradley is usually 61%. Of the three meteorological parameters, only the percentage of possible sunshine can be invoked as a contributor to explain the decrease in ozone levels from 1989 to 1990.

The meteorological influences notwithstanding, additional and important factors contributing to the decrease in ozone concentrations in 1990 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 1990 (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

Precision and Accuracy - The ozone monitors had a total of 166 precision checks during 1990. The resulting 95% probability limits were -6% to +7%. 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 9 audits conducted on the monitoring system, were: low, +2% to +11%; medium, -2% to +12%; and high, -2% to +11%.

1-Hour Average - The 1-hour ozone standard was exceeded at all the DEP monitoring sites in 1990, except at New Haven 123. There was no clear trend in the values of the high and second high ozone concentrations from 1989 to 1990.

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 1990. 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., 88%) 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 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 dataset 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 1981 to 1990. 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 averages of the data that is presented in Figure 4-5. It is evident that the ozone trend, freed from meteorological effects, is down over the past five years.

TABLE 4-1

NUMBER OF EXCEEDANCES OF THE 1-HOUR OZONE STANDARD IN 1990

SITE	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	THIS YEAR	LAST YEAR
Bridgeport-013	0	0	0	3	2	0	0	5	11
Danbury-123	0	0	3	2	4	0	0	9	3
E. Hartford-003	0	0	0	4	3	0	0	7	10
Greenwich-017	0	0	0	9	3	3	0	15	21
Groton-008	0	0	0	15	1	0	0	16	19
Madison-002	0	0	0	14	10	0	0	24	9
Middletown-007	0	0	0	6	0	0	0	6	16
New Haven-123	0	0	0	0	0	0	0	0	8
Stafford-001	0	0	1	3	4	0	0	8	7
Stratford-007	0	0	0	6	0	0	0	6	41
					TOTAL SITE HOURS			96	145

TABLE 4-2

NUMBER OF DAYS WHEN THE 1-HOUR OZONE STANDARD WAS EXCEEDED IN 1990

SITE	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	THIS YEAR	LAST YEAR
Bridgeport-013	0	0	0	2	1	0	0	3	4
Danbury-123	0	0	1	1	2	0	0	4	2
E. Hartford-003	0	0	0	2	2	0	0	4	5
Greenwich-017	0	0	0	4	2	1	0	7	7
Groton-008	0	0	0	5	1	0	0	6	6
Madison-002	0	0	0	4	3	0	0	7	4
Middletown-007	0	0	0	3	0	0	0	3	5
New Haven-123	0	0	0	0	0	0	0	0	3
Stafford-001	0	0	1	2	2	0	0	5	3
Stratford-007	0	0	0	4	0	0	0	4	11
						TOTAL SITE DAYS		43	50

FIGURE 4-1

WIND ROSE FOR APRIL - OCTOBER 1989
NEWARK INTERNATIONAL AIRPORT
NEWARK, NEW JERSEY

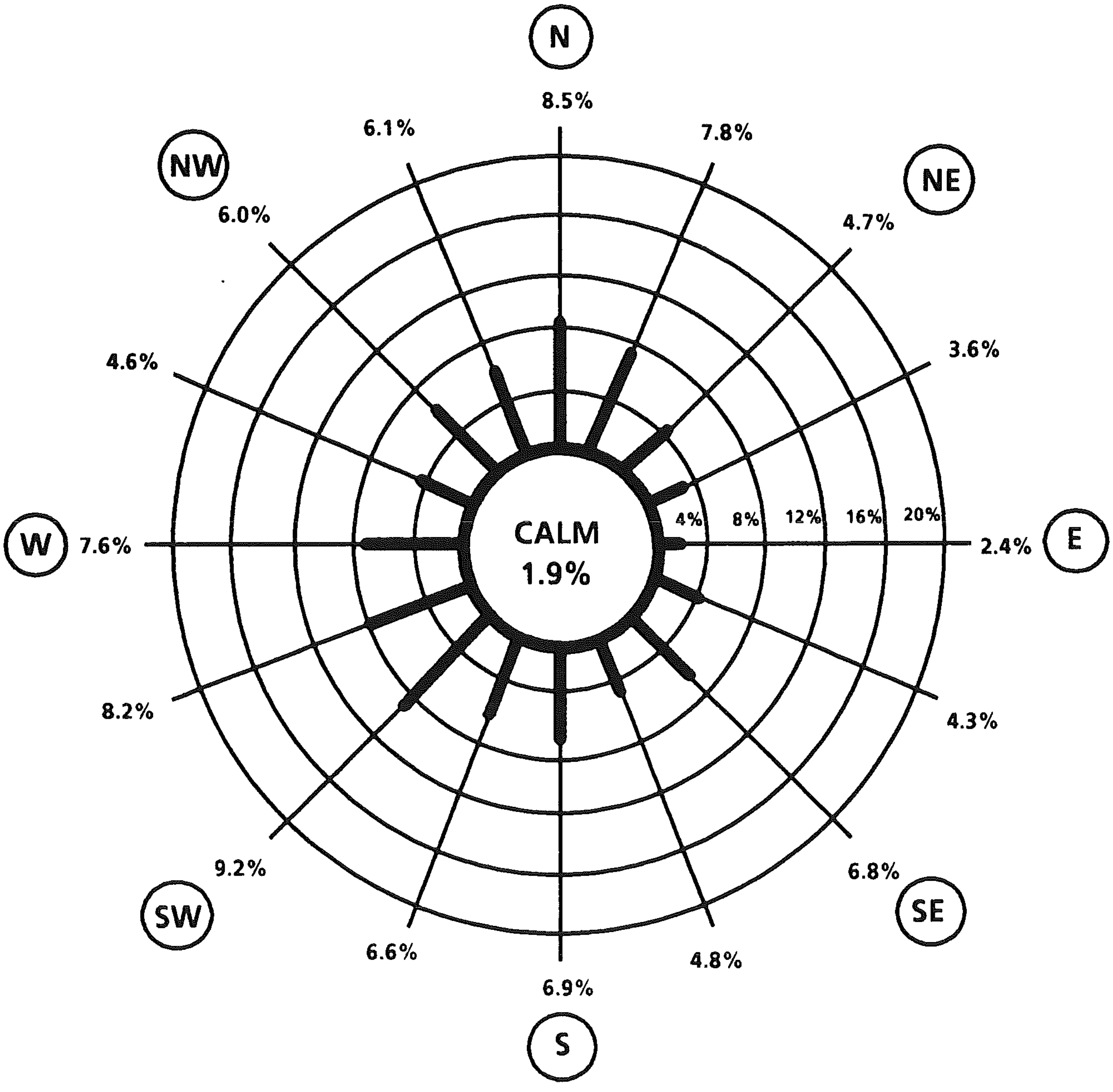
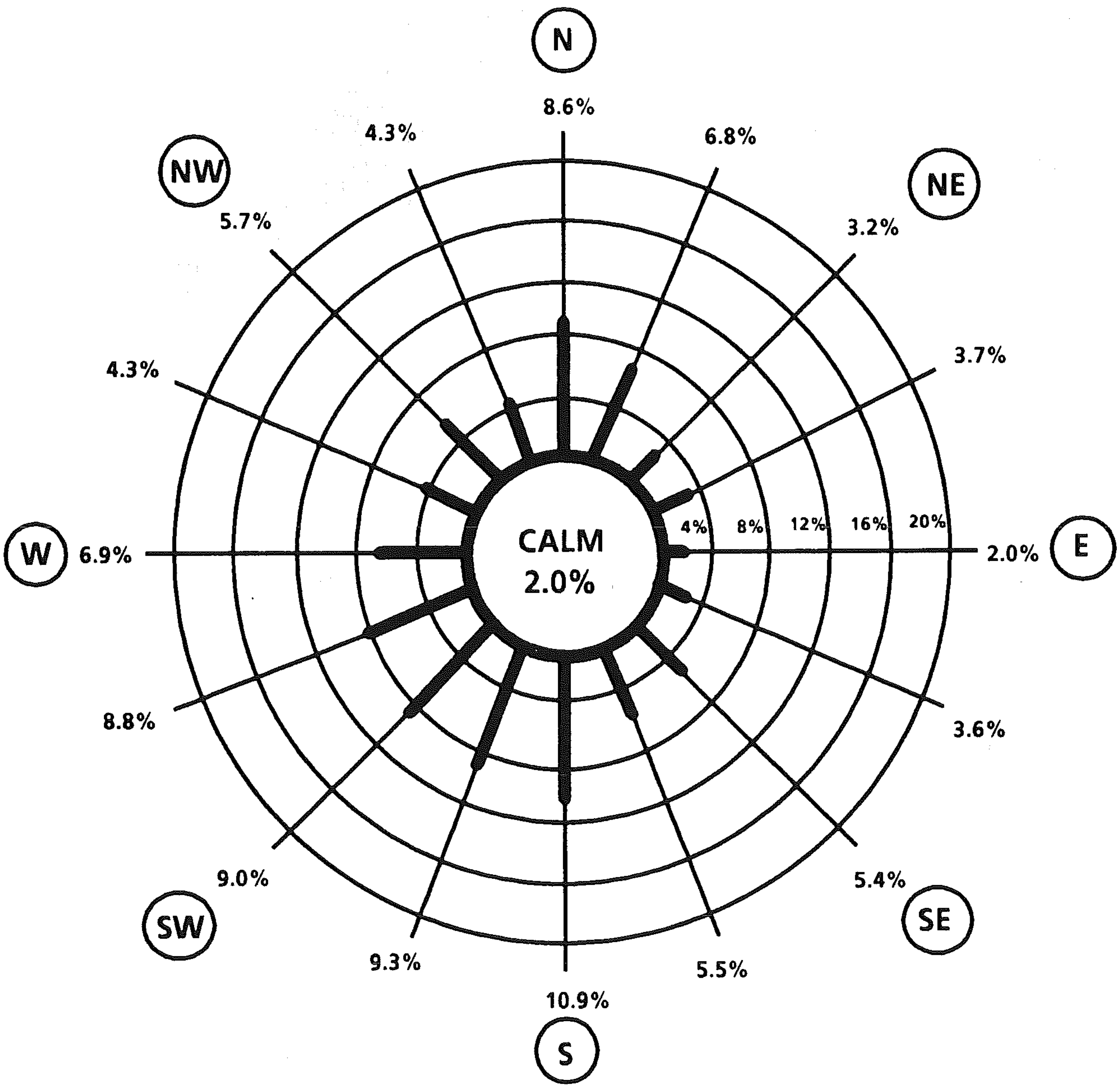


FIGURE 4-2

WIND ROSE FOR APRIL - OCTOBER 1990
NEWARK INTERNATIONAL AIRPORT
NEWARK, NEW JERSEY



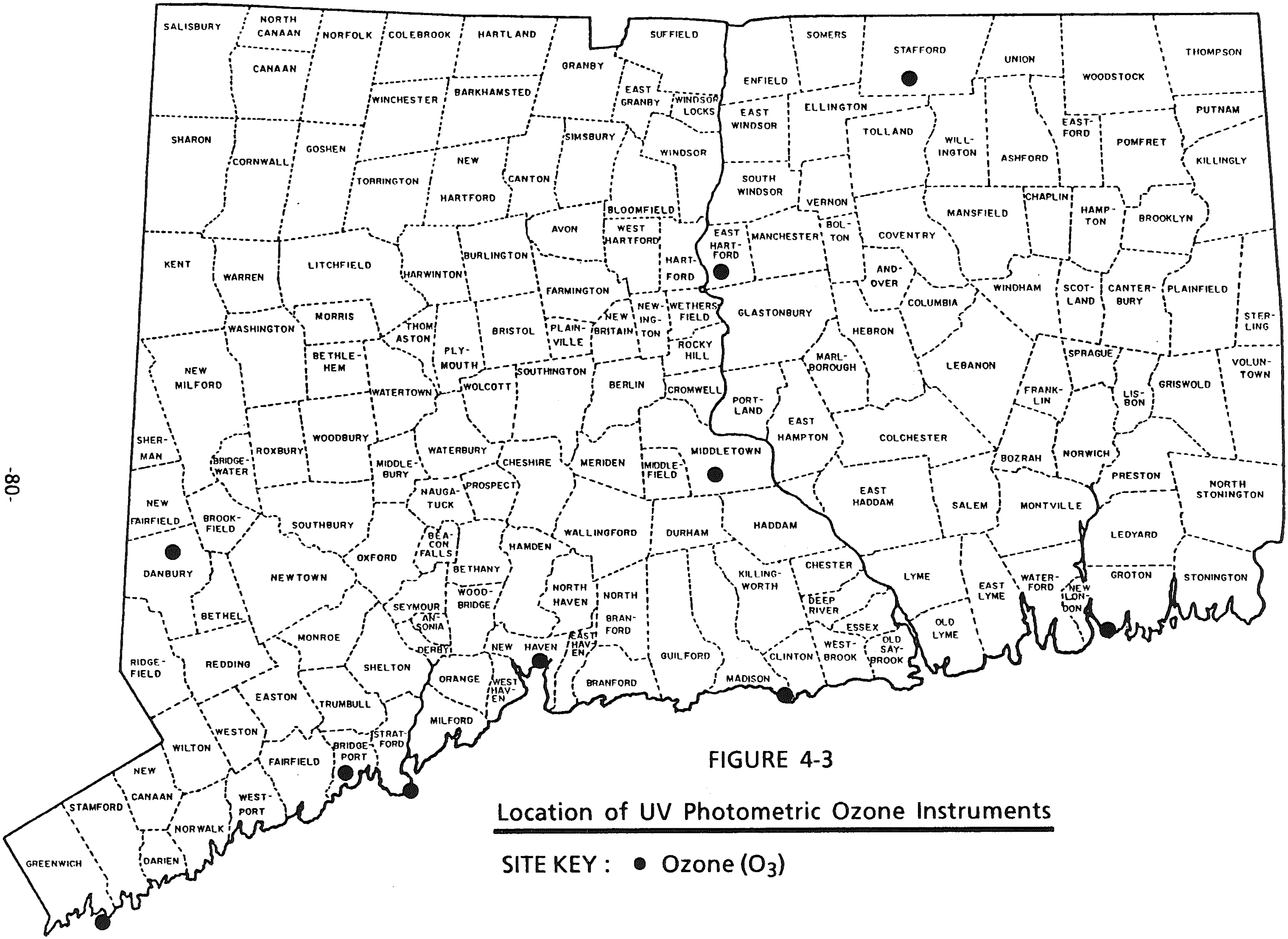


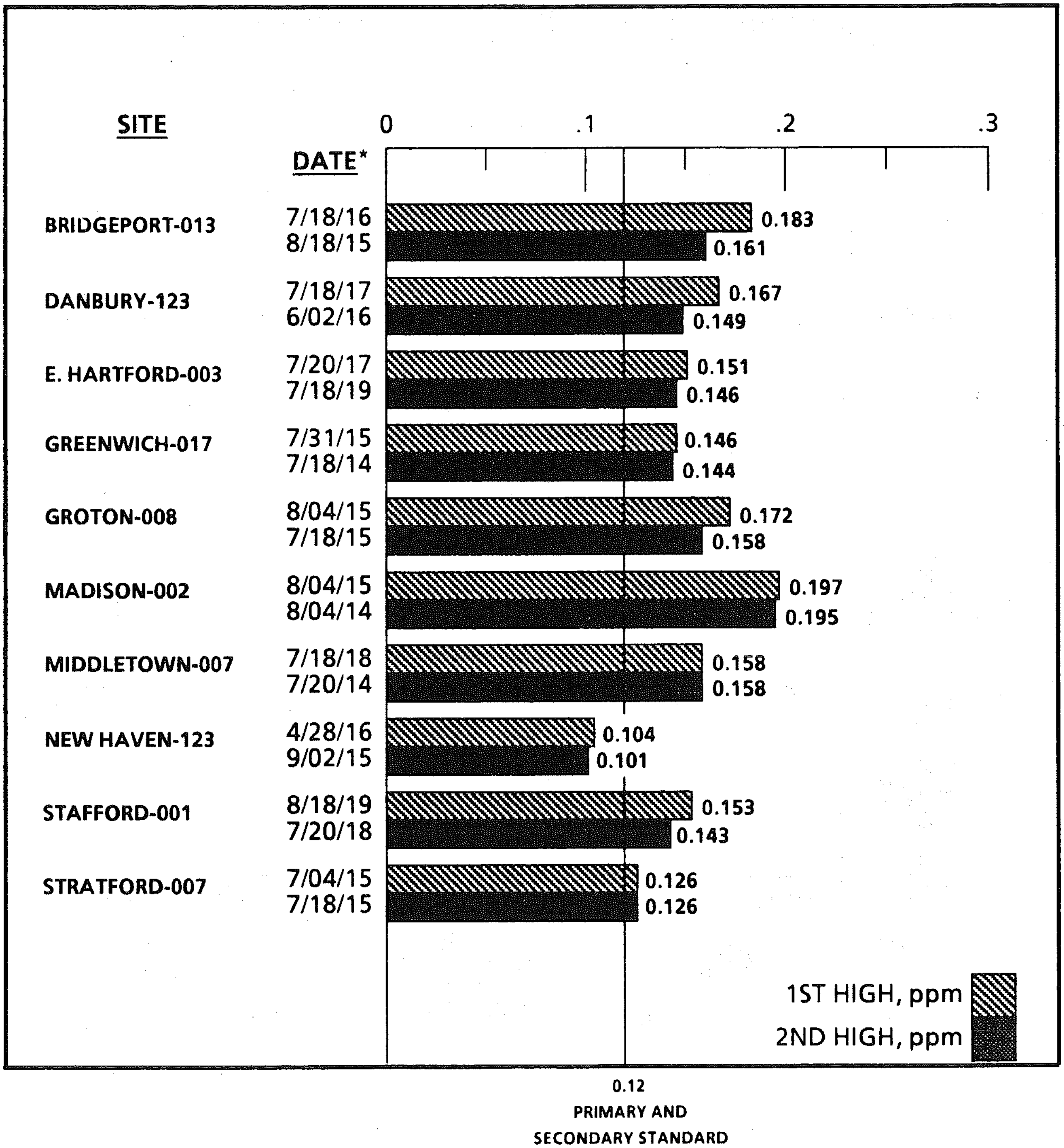
FIGURE 4-3

Location of UV Photometric Ozone Instruments

SITE KEY : ● Ozone (O_3)

FIGURE 4-4

1990 MAXIMUM 1-HOUR OZONE 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 is given first.

TABLE 4–3

1990 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 (4878)	OZONE	.183	.161	.134	.117	.111	.106	.105	.105	.099	.094
	DATE	7/18/90	8/18/90	7/20/90	7/ 4/90	7/31/90	8/ 4/90	7/17/90	9/ 2/90	8/17/90	7/19/90
METEOROLOGICAL SITE	DIR (DEG)	230	230	230	230	290	150	230	280	190	260
NEWARK	VEL (MPH)	5.2	7.0	7.3	14.0	4.1	3.8	7.2	4.8	5.8	5.6
	SPD (MPH)	7.6	9.5	10.1	16.2	7.5	7.8	8.6	7.2	7.6	7.8
	RATIO	0.685	0.734	0.723	0.861	0.548	0.485	0.833	0.670	0.757	0.722
METEOROLOGICAL SITE	DIR (DEG)	240	200	240	220	310	190	220	240	210	250
BRADLEY	VEL (MPH)	6.0	5.9	5.3	8.0	5.1	2.7	4.5	1.4	3.1	6.0
	SPD (MPH)	8.5	7.8	8.6	10.2	6.2	5.8	7.3	4.9	6.0	8.3
	RATIO	0.704	0.764	0.613	0.781	0.831	0.478	0.614	0.279	0.508	0.723
METEOROLOGICAL SITE	DIR (DEG)	240	250	240	260	220	200	260	250	210	260
BRIDGEPORT	VEL (MPH)	5.4	7.4	7.2	8.2	1.8	3.8	6.2	6.7	3.4	6.4
	SPD (MPH)	5.6	7.6	7.3	8.3	4.0	4.0	6.9	6.9	3.7	6.5
	RATIO	0.966	0.974	0.976	0.979	0.448	0.936	0.897	0.967	0.897	0.996
METEOROLOGICAL SITE	DIR (DEG)	270	260	260	260	40	220	270	280	260	280
WORCESTER	VEL (MPH)	6.2	5.7	7.5	9.3	3.9	1.4	6.5	6.6	5.0	6.7
	SPD (MPH)	6.3	6.0	8.2	9.3	4.3	3.5	6.8	7.0	5.5	6.9
	RATIO	0.983	0.948	0.913	0.997	0.907	0.418	0.967	0.932	0.923	0.971
DANBURY–123 (4816)	OZONE	.167	.149	.134	.129	.123	.118	.116	.115	.113	.111
	DATE	7/18/90	6/ 2/90	8/17/90	8/18/90	6/27/90	7/20/90	6/22/90	8/13/90	8/ 4/90	4/28/90
METEOROLOGICAL SITE	DIR (DEG)	230	210	190	230	220	230	200	170	150	150
NEWARK	VEL (MPH)	5.2	8.7	5.8	7.0	5.7	7.3	6.4	6.8	3.8	4.7
	SPD (MPH)	7.6	10.4	7.6	9.5	9.5	10.1	8.3	8.5	7.8	6.8
	RATIO	0.685	0.841	0.757	0.734	0.597	0.723	0.773	0.801	0.485	0.698
METEOROLOGICAL SITE	DIR (DEG)	240	210	210	200	200	240	210	190	190	130
BRADLEY	VEL (MPH)	6.0	7.3	3.1	5.9	5.2	5.3	6.9	7.1	2.7	1.3
	SPD (MPH)	8.5	10.1	6.0	7.8	8.1	8.6	8.5	8.9	5.8	6.6
	RATIO	0.704	0.722	0.508	0.764	0.651	0.613	0.819	0.797	0.478	0.190
METEOROLOGICAL SITE	DIR (DEG)	240	240	210	250	230	240	230	230	200	250
BRIDGEPORT	VEL (MPH)	5.4	6.2	3.4	7.4	6.1	7.2	5.5	6.7	3.8	3.3
	SPD (MPH)	5.6	6.6	3.7	7.6	6.2	7.3	5.6	8.3	4.0	4.2
	RATIO	0.966	0.940	0.897	0.974	0.980	0.976	0.974	0.799	0.936	0.784
METEOROLOGICAL SITE	DIR (DEG)	270	260	260	260	240	260	260	210	220	360
WORCESTER	VEL (MPH)	6.2	8.9	5.0	5.7	8.5	7.5	6.3	5.8	1.4	2.8
	SPD (MPH)	6.3	9.2	5.5	6.0	8.6	8.2	6.8	6.0	3.5	7.0
	RATIO	0.983	0.966	0.923	0.948	0.990	0.913	0.934	0.961	0.418	0.392
EAST HARTFORD–003 (4739)	OZONE	.151	.146	.140	.130	.118	.114	.109	.101	.097	.097
	DATE	7/20/90	7/18/90	8/18/90	8/17/90	6/22/90	7/ 4/90	8/ 4/90	6/27/90	4/28/90	8/13/90
METEOROLOGICAL SITE	DIR (DEG)	230	230	230	190	200	230	150	220	150	170
NEWARK	VEL (MPH)	7.3	5.2	7.0	5.8	6.4	14.0	3.8	5.7	4.7	6.8
	SPD (MPH)	10.1	7.6	9.5	7.6	8.3	16.2	7.8	9.5	6.8	8.5
	RATIO	0.723	0.685	0.734	0.757	0.773	0.861	0.485	0.597	0.698	0.801
METEOROLOGICAL SITE	DIR (DEG)	240	240	200	210	210	220	190	200	130	190
BRADLEY	VEL (MPH)	5.3	6.0	5.9	3.1	6.9	8.0	2.7	5.2	1.3	7.1
	SPD (MPH)	8.6	8.5	7.8	6.0	8.5	10.2	5.8	8.1	6.6	8.9
	RATIO	0.613	0.704	0.764	0.508	0.819	0.781	0.478	0.651	0.190	0.797

TABLE 4-3, CONTINUED

1990 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	240	250	210	230	260	200	230	250	230
BRIDGEPORT	VEL (MPH)	7.2	5.4	7.4	3.4	5.5	8.2	3.8	6.1	3.3	6.7
	SPD (MPH)	7.3	5.6	7.6	3.7	5.6	8.3	4.0	6.2	4.2	8.3
	RATIO	0.976	0.966	0.974	0.897	0.974	0.979	0.936	0.980	0.784	0.799
METEOROLOGICAL SITE	DIR (DEG)	260	270	260	260	260	260	220	240	360	210
WORCESTER	VEL (MPH)	7.5	6.2	5.7	5.0	6.3	9.3	1.4	8.5	2.8	5.8
	SPD (MPH)	8.2	6.3	6.0	5.5	6.8	9.3	3.5	8.6	7.0	6.0
	RATIO	0.913	0.983	0.948	0.923	0.934	0.997	0.418	0.990	0.392	0.961
GREENWICH-017 (4873)	OZONE	.146	.144	.143	.139	.130	.128	.127	.124	.118	.109
	DATE	7/31/90	7/18/90	9/ 2/90	8/17/90	7/19/90	7/20/90	8/16/90	8/18/90	7/ 4/90	7/ 9/90
METEOROLOGICAL SITE	DIR (DEG)	290	230	280	190	260	230	250	230	230	230
NEWARK	VEL (MPH)	4.1	5.2	4.8	5.8	5.6	7.3	4.1	7.0	14.0	10.1
	SPD (MPH)	7.5	7.6	7.2	7.6	7.8	10.1	6.2	9.5	16.2	13.1
	RATIO	0.548	0.685	0.670	0.757	0.722	0.723	0.666	0.734	0.861	0.775
METEOROLOGICAL SITE	DIR (DEG)	310	240	240	210	250	240	230	200	220	230
BRADLEY	VEL (MPH)	5.1	6.0	1.4	3.1	6.0	5.3	3.0	5.9	8.0	7.0
	SPD (MPH)	6.2	8.5	4.9	6.0	8.3	8.6	6.0	7.8	10.2	10.6
	RATIO	0.831	0.704	0.279	0.508	0.723	0.613	0.505	0.764	0.781	0.656
METEOROLOGICAL SITE	DIR (DEG)	220	240	250	210	260	240	230	250	260	250
BRIDGEPORT	VEL (MPH)	1.8	5.4	6.7	3.4	6.4	7.2	3.8	7.4	8.2	4.2
	SPD (MPH)	4.0	5.6	6.9	3.7	6.5	7.3	4.6	7.6	8.3	4.6
	RATIO	0.448	0.966	0.967	0.897	0.996	0.976	0.819	0.974	0.979	0.918
METEOROLOGICAL SITE	DIR (DEG)	40	270	280	260	280	260	280	260	260	250
WORCESTER	VEL (MPH)	3.9	6.2	6.6	5.0	6.7	7.5	4.6	5.7	9.3	8.3
	SPD (MPH)	4.3	6.3	7.0	5.5	6.9	8.2	4.9	6.0	9.3	8.5
	RATIO	0.907	0.983	0.932	0.923	0.971	0.913	0.950	0.948	0.997	0.982
GROTON-008 (4813)	OZONE	.172	.158	.149	.140	.135	.127	.119	.116	.115	.113
	DATE	8/ 4/90	7/18/90	7/19/90	7/ 4/90	7/17/90	7/20/90	6/22/90	9/ 2/90	7/31/90	8/17/90
METEOROLOGICAL SITE	DIR (DEG)	150	230	260	230	230	230	200	280	290	190
NEWARK	VEL (MPH)	3.8	5.2	5.6	14.0	7.2	7.3	6.4	4.8	4.1	5.8
	SPD (MPH)	7.8	7.6	7.8	16.2	8.6	10.1	8.3	7.2	7.5	7.6
	RATIO	0.485	0.685	0.722	0.861	0.833	0.723	0.773	0.670	0.548	0.757
METEOROLOGICAL SITE	DIR (DEG)	190	240	250	220	220	240	210	240	310	210
BRADLEY	VEL (MPH)	2.7	6.0	6.0	8.0	4.5	5.3	6.9	1.4	5.1	3.1
	SPD (MPH)	5.8	8.5	8.3	10.2	7.3	8.6	8.5	4.9	6.2	6.0
	RATIO	0.478	0.704	0.723	0.781	0.614	0.613	0.819	0.279	0.831	0.508
METEOROLOGICAL SITE	DIR (DEG)	200	240	260	260	260	240	230	250	220	210
BRIDGEPORT	VEL (MPH)	3.8	5.4	6.4	8.2	6.2	7.2	5.5	6.7	1.8	3.4
	SPD (MPH)	4.0	5.6	6.5	8.3	6.9	7.3	5.6	6.9	4.0	3.7
	RATIO	0.936	0.966	0.996	0.979	0.897	0.976	0.974	0.967	0.448	0.897
METEOROLOGICAL SITE	DIR (DEG)	220	270	280	260	270	260	260	280	40	260
WORCESTER	VEL (MPH)	1.4	6.2	6.7	9.3	6.5	7.5	6.3	6.6	3.9	5.0
	SPD (MPH)	3.5	6.3	6.9	9.3	6.8	8.2	6.8	7.0	4.3	5.5
	RATIO	0.418	0.983	0.971	0.997	0.967	0.913	0.934	0.932	0.907	0.923

TABLE 4-3, CONTINUED

1990 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 (4388)	OZONE	.197	.157	.153	.151	.133	.129	.129	.121	.119	.116
	DATE	8/ 4/90	8/17/90	7/ 4/90	8/18/90	7/19/90	7/20/90	7/18/90	7/31/90	6/22/90	7/17/90
METEOROLOGICAL SITE	DIR (DEG)	150	190	230	230	260	230	230	290	200	230
NEWARK	VEL (MPH)	3.8	5.8	14.0	7.0	5.6	7.3	5.2	4.1	6.4	7.2
	SPD (MPH)	7.8	7.6	16.2	9.5	7.8	10.1	7.6	7.5	8.3	8.6
	RATIO	0.485	0.757	0.861	0.734	0.722	0.723	0.685	0.548	0.773	0.833
METEOROLOGICAL SITE	DIR (DEG)	190	210	220	200	250	240	240	310	210	220
BRADLEY	VEL (MPH)	2.7	3.1	8.0	5.9	6.0	5.3	6.0	5.1	6.9	4.5
	SPD (MPH)	5.8	6.0	10.2	7.8	8.3	8.6	8.5	6.2	8.5	7.3
	RATIO	0.478	0.508	0.781	0.764	0.723	0.613	0.704	0.831	0.819	0.614
METEOROLOGICAL SITE	DIR (DEG)	200	210	260	250	260	240	240	220	230	260
BRIDGEPORT	VEL (MPH)	3.8	3.4	8.2	7.4	6.4	7.2	5.4	1.8	5.5	6.2
	SPD (MPH)	4.0	3.7	8.3	7.6	6.5	7.3	5.6	4.0	5.6	6.9
	RATIO	0.936	0.897	0.979	0.974	0.996	0.976	0.966	0.448	0.974	0.897
METEOROLOGICAL SITE	DIR (DEG)	220	260	260	260	280	260	270	40	260	270
WORCESTER	VEL (MPH)	1.4	5.0	9.3	5.7	6.7	7.5	6.2	3.9	6.3	6.5
	SPD (MPH)	3.5	5.5	9.3	6.0	6.9	8.2	6.3	4.3	6.8	6.8
	RATIO	0.418	0.923	0.997	0.948	0.971	0.913	0.983	0.907	0.934	0.967
MIDDLETOWN-007 (4250)	OZONE	.158	.158	.125	.123	.119	.104	.098	.096	.095	.092
	DATE	7/20/90	7/18/90	7/17/90	8/ 4/90	7/ 4/90	7/ 9/90	7/31/90	7/19/90	6/29/90	6/ 2/90
METEOROLOGICAL SITE	DIR (DEG)	230	230	230	150	230	230	290	260	190	210
NEWARK	VEL (MPH)	7.3	5.2	7.2	3.8	14.0	10.1	4.1	5.6	1.7	8.7
	SPD (MPH)	10.1	7.6	8.6	7.8	16.2	13.1	7.5	7.8	8.3	10.4
	RATIO	0.723	0.685	0.833	0.485	0.861	0.775	0.548	0.722	0.205	0.841
METEOROLOGICAL SITE	DIR (DEG)	240	240	220	190	220	230	310	250	210	210
BRADLEY	VEL (MPH)	5.3	6.0	4.5	2.7	8.0	7.0	5.1	6.0	1.4	7.3
	SPD (MPH)	8.6	8.5	7.3	5.8	10.2	10.6	6.2	8.3	5.8	10.1
	RATIO	0.613	0.704	0.614	0.478	0.781	0.656	0.831	0.723	0.248	0.722
METEOROLOGICAL SITE	DIR (DEG)	240	240	260	200	260	250	220	260	120	240
BRIDGEPORT	VEL (MPH)	7.2	5.4	6.2	3.8	8.2	4.2	1.8	6.4	5.0	6.2
	SPD (MPH)	7.3	5.6	6.9	4.0	8.3	4.6	4.0	6.5	6.2	6.6
	RATIO	0.976	0.966	0.897	0.936	0.979	0.918	0.448	0.996	0.809	0.940
METEOROLOGICAL SITE	DIR (DEG)	260	270	270	220	260	250	40	280	140	260
WORCESTER	VEL (MPH)	7.5	6.2	6.5	1.4	9.3	8.3	3.9	6.7	3.6	8.9
	SPD (MPH)	8.2	6.3	6.8	3.5	9.3	8.5	4.3	6.9	4.0	9.2
	RATIO	0.913	0.983	0.967	0.418	0.997	0.982	0.907	0.971	0.893	0.966
NEW HAVEN-123 (4880)	OZONE	.104	.101	.099	.097	.097	.096	.089	.089	.088	.084
	DATE	4/28/90	9/ 2/90	7/18/90	7/17/90	8/ 4/90	8/18/90	7/20/90	8/17/90	9/29/90	9/ 6/90
METEOROLOGICAL SITE	DIR (DEG)	150	280	230	230	150	230	230	190	210	180
NEWARK	VEL (MPH)	4.7	4.8	5.2	7.2	3.8	7.0	7.3	5.8	5.0	4.4
	SPD (MPH)	6.8	7.2	7.6	8.6	7.8	9.5	10.1	7.6	6.9	5.3
	RATIO	0.698	0.670	0.685	0.833	0.485	0.734	0.723	0.757	0.722	0.820
METEOROLOGICAL SITE	DIR (DEG)	130	240	240	220	190	200	240	210	190	200
BRADLEY	VEL (MPH)	1.3	1.4	6.0	4.5	2.7	5.9	5.3	3.1	5.5	2.9
	SPD (MPH)	6.6	4.9	8.5	7.3	5.8	7.8	8.6	6.0	7.5	6.3
	RATIO	0.190	0.279	0.704	0.614	0.478	0.764	0.613	0.508	0.734	0.461

TABLE 4-3, CONTINUED

1990 TEN HIGHEST 1-HOUR AVERAGE OZONE DAYS WITH WIND DATA

UNITS : PARTS PER MILLION

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
METEOROLOGICAL SITE	DIR (DEG)	250	250	240	260	200	250	240	210	250	160
BRIDGEPORT	VEL (MPH)	3.3	6.7	5.4	6.2	3.8	7.4	7.2	3.4	4.8	3.3
	SPD (MPH)	4.2	6.9	5.6	6.9	4.0	7.6	7.3	3.7	4.9	4.0
	RATIO	0.784	0.967	0.966	0.897	0.936	0.974	0.976	0.897	0.983	0.827
METEOROLOGICAL SITE	DIR (DEG)	360	280	270	270	220	260	260	260	250	220
WORCESTER	VEL (MPH)	2.8	6.6	6.2	6.5	1.4	5.7	7.5	5.0	5.7	2.6
	SPD (MPH)	7.0	7.0	6.3	6.8	3.5	6.0	8.2	5.5	5.9	3.7
	RATIO	0.392	0.932	0.983	0.967	0.418	0.948	0.913	0.923	0.968	0.688
STAFFORD-001 (4704)	OZONE	.153	.143	.139	.127	.126	.119	.114	.111	.100	.099
	DATE	8/18/90	7/20/90	7/18/90	6/22/90	8/17/90	7/ 4/90	8/ 4/90	6/27/90	7/17/90	9/ 1/90
METEOROLOGICAL SITE	DIR (DEG)	230	230	230	200	190	230	150	220	230	230
NEWARK	VEL (MPH)	7.0	7.3	5.2	6.4	5.8	14.0	3.8	5.7	7.2	2.1
	SPD (MPH)	9.5	10.1	7.6	8.3	7.6	16.2	7.8	9.5	8.6	5.0
	RATIO	0.734	0.723	0.685	0.773	0.757	0.861	0.485	0.597	0.833	0.419
METEOROLOGICAL SITE	DIR (DEG)	200	240	240	210	210	220	190	200	220	190
BRADLEY	VEL (MPH)	5.9	5.3	6.0	6.9	3.1	8.0	2.7	5.2	4.5	1.8
	SPD (MPH)	7.8	8.6	8.5	8.5	6.0	10.2	5.8	8.1	7.3	5.3
	RATIO	0.764	0.613	0.704	0.819	0.508	0.781	0.478	0.651	0.614	0.341
METEOROLOGICAL SITE	DIR (DEG)	250	240	240	230	210	260	200	230	260	180
BRIDGEPORT	VEL (MPH)	7.4	7.2	5.4	5.5	3.4	8.2	3.8	6.1	6.2	2.0
	SPD (MPH)	7.6	7.3	5.6	5.6	3.7	8.3	4.0	6.2	6.9	3.7
	RATIO	0.974	0.976	0.966	0.974	0.897	0.979	0.936	0.980	0.897	0.533
METEOROLOGICAL SITE	DIR (DEG)	260	260	270	260	260	260	220	240	270	250
WORCESTER	VEL (MPH)	5.7	7.5	6.2	6.3	5.0	9.3	1.4	8.5	6.5	3.3
	SPD (MPH)	6.0	8.2	6.3	6.8	5.5	9.3	3.5	8.6	6.8	4.0
	RATIO	0.948	0.913	0.983	0.934	0.923	0.997	0.418	0.990	0.967	0.829
STRATFORD-007 (3724)	OZONE	.126	.126	.125	.125	.122	.115	.114	.107	.107	.104
	DATE	7/ 4/90	7/18/90	7/19/90	7/17/90	8/17/90	8/18/90	7/20/90	6/ 2/90	4/28/90	7/ 9/90
METEOROLOGICAL SITE	DIR (DEG)	230	230	260	230	190	230	230	210	150	230
NEWARK	VEL (MPH)	14.0	5.2	5.6	7.2	5.8	7.0	7.3	8.7	4.7	10.1
	SPD (MPH)	16.2	7.6	7.8	8.6	7.6	9.5	10.1	10.4	6.8	13.1
	RATIO	0.861	0.685	0.722	0.833	0.757	0.734	0.723	0.841	0.698	0.775
METEOROLOGICAL SITE	DIR (DEG)	220	240	250	220	210	200	240	210	130	230
BRADLEY	VEL (MPH)	8.0	6.0	6.0	4.5	3.1	5.9	5.3	7.3	1.3	7.0
	SPD (MPH)	10.2	8.5	8.3	7.3	6.0	7.8	8.6	10.1	6.6	10.6
	RATIO	0.781	0.704	0.723	0.614	0.508	0.764	0.613	0.722	0.190	0.656
METEOROLOGICAL SITE	DIR (DEG)	260	240	260	260	210	250	240	240	250	250
BRIDGEPORT	VEL (MPH)	8.2	5.4	6.4	6.2	3.4	7.4	7.2	6.2	3.3	4.2
	SPD (MPH)	8.3	5.6	6.5	6.9	3.7	7.6	7.3	6.6	4.2	4.6
	RATIO	0.979	0.966	0.996	0.897	0.897	0.974	0.976	0.940	0.784	0.918
METEOROLOGICAL SITE	DIR (DEG)	260	270	280	270	260	260	260	260	360	250
WORCESTER	VEL (MPH)	9.3	6.2	6.7	6.5	5.0	5.7	7.5	8.9	2.8	8.3
	SPD (MPH)	9.3	6.3	6.9	6.8	5.5	6.0	8.2	9.2	7.0	8.5
	RATIO	0.997	0.983	0.971	0.967	0.923	0.948	0.913	0.966	0.392	0.982

FIGURE 4-5

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

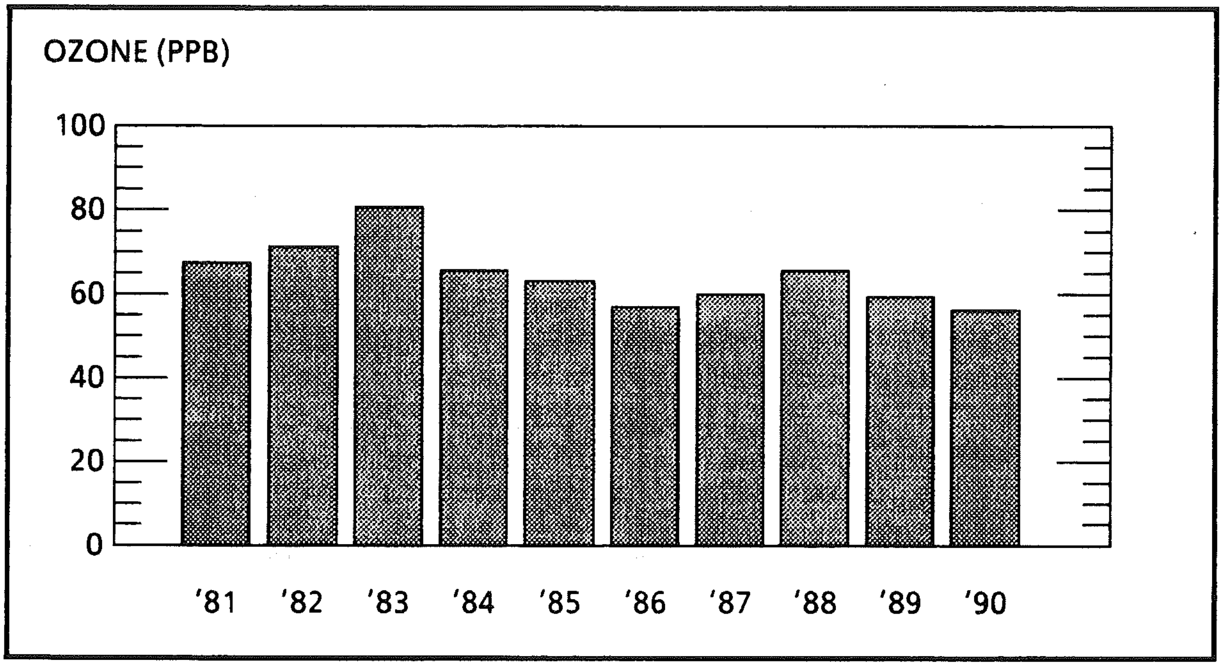
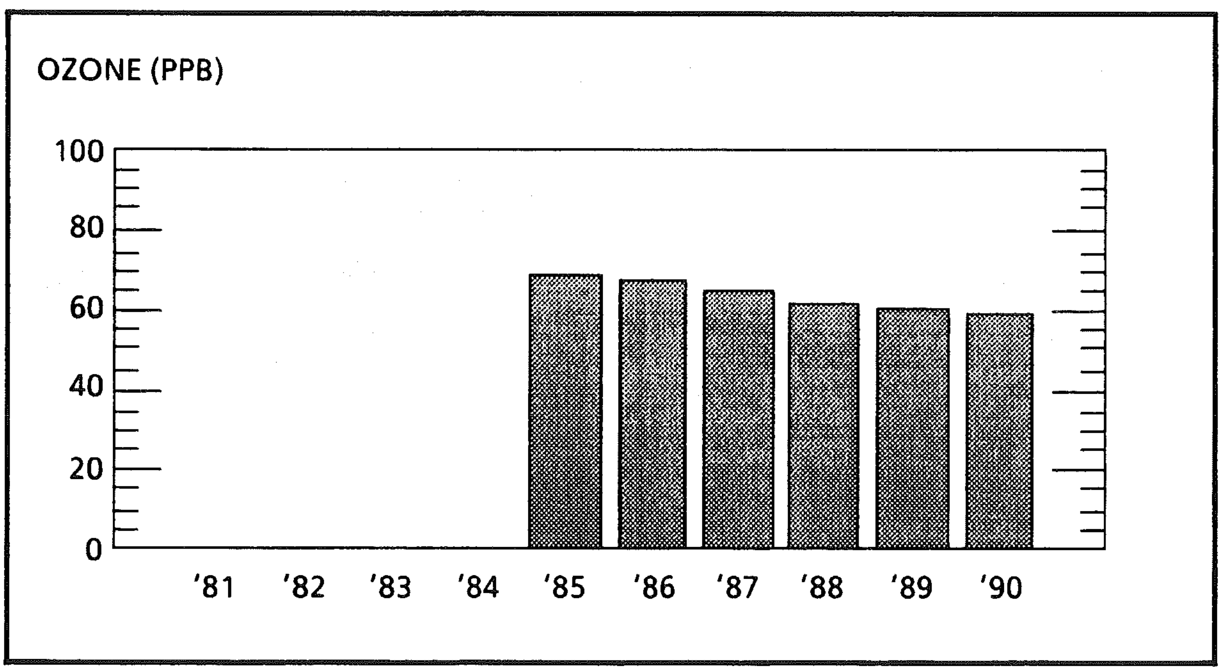


FIGURE 4-6

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 1990. 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 51 $\mu g/m^3$ 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 1990 (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 - Twenty precision checks were made on the NO_2 monitors in 1990, yielding 95% probability limits ranging from -23% to +14%. 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 1990. 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 -8% to +10%; those for the low/medium level test ranged from +3% to +5%; those for the medium/high level test ranged from -6% to +5%; and those for the high level test ranged from -3% to +1%.

Annual Averages - The annual average NO_2 standard of 100 $\mu g/m^3$ was not exceeded in 1990 at any site in Connecticut (see Table 5-1). In 1990, all three sites had sufficient data to compute valid arithmetic means. This permits comparisons with the 1988 and 1989 annual averages. The annual average NO_2 concentrations decreased at all three sites between 1988 and 1990.

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 1990.

10-High Days with Wind Data - Table 5-2 presents for each site the ten days in 1990 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, 13 of the 17 days listed in the table had at least 50% of the possible sunshine. This 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 over 76% 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 and down thereafter.

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 the 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 six years.

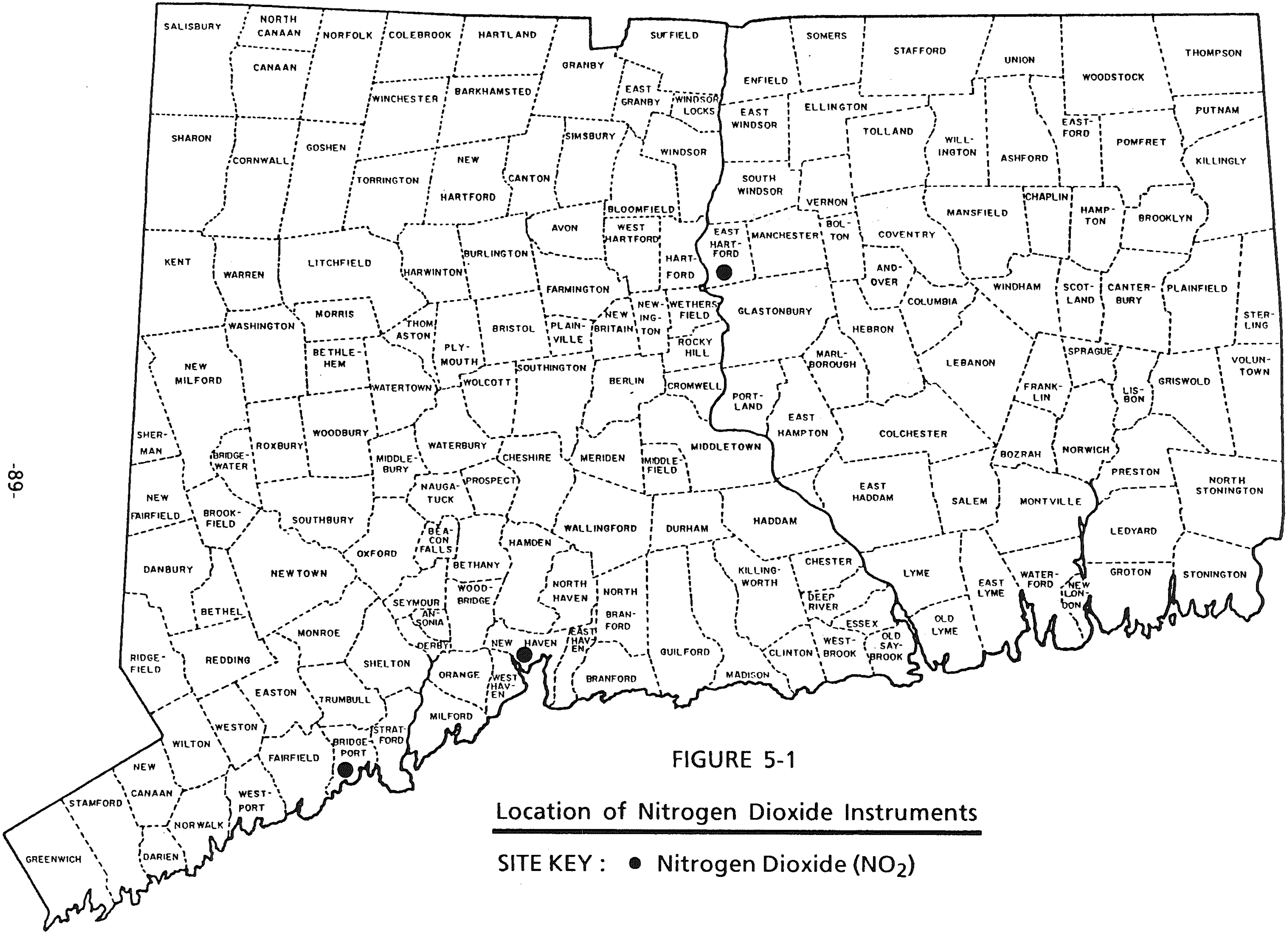


FIGURE 5-1

Location of Nitrogen Dioxide Instruments

SITE KEY : ● Nitrogen Dioxide (NO_2)

TABLE 5-1

1988 -1990 NITROGEN DIOXIDE ANNUAL AVERAGES

Town Name	Site	Year	Samples	Arithmetic Mean	95-Percent-Limits Lower	95-Percent-Limits Upper	Standard Deviation
Bridgeport	013	1988	8674	51.03	50.97	51.10	27.18
Bridgeport	013	1989	7886	48.10	47.92	48.28	25.58
Bridgeport	013	1990	8137	47.97	47.82	48.12	25.98
East Hartford	003	1988	8702	38.42	38.37	38.47	23.39
East Hartford	003	1989	8038	38.33	38.20	38.47	21.79
East Hartford	003	1990	8287	35.92	35.81	36.03	21.71
New Haven	123	1988	8695	55.26	55.21	55.32	26.38
New Haven	123	1989	8221	53.54	53.41	53.66	23.85
New Haven	123	1990	8343	50.73	50.61	50.84	24.42

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

TABLE 5-2

1990 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 (8137)	NO2	.147	.111	.105	.090	.088	.088	.086	.084	.083	.083
	DATE	3/15/90	11/ 2/90	4/27/90	3/11/90	1/17/90	3/ 9/90	4/28/90	1/16/90	3/13/90	5/ 9/90
METEOROLOGICAL SITE	DIR (DEG)	180	230	210	220	190	230	150	240	270	220
NEWARK	VEL (MPH)	1.4	6.8	4.5	3.3	5.8	3.2	4.7	5.3	7.8	6.6
	SPD (MPH)	4.9	8.5	6.5	5.3	6.3	6.0	6.8	6.6	8.9	8.9
	RATIO	0.284	0.805	0.692	0.618	0.912	0.538	0.698	0.809	0.873	0.739
METEOROLOGICAL SITE	DIR (DEG)	190	200	310	40	180	220	130	180	350	190
BRADLEY	VEL (MPH)	2.2	4.3	3.5	2.5	6.2	1.5	1.3	4.1	3.7	8.0
	SPD (MPH)	5.0	6.3	6.5	6.8	8.1	4.5	6.6	6.5	6.2	8.1
	RATIO	0.444	0.682	0.543	0.371	0.772	0.327	0.190	0.631	0.596	0.996
METEOROLOGICAL SITE	DIR (DEG)	250	260	260	260	170	180	250	260	280	230
BRIDGEPORT	VEL (MPH)	2.9	4.5	5.8	5.4	1.4	1.1	3.3	4.6	3.4	3.8
	SPD (MPH)	4.2	4.6	6.0	5.5	4.6	2.3	4.2	4.7	5.2	4.2
	RATIO	0.686	0.988	0.967	0.988	0.306	0.470	0.784	0.969	0.657	0.921
METEOROLOGICAL SITE	DIR (DEG)	260	260	310	280	210	200	360	290	290	250
WORCESTER	VEL (MPH)	2.8	7.6	6.4	7.2	5.0	1.1	2.8	5.9	7.9	8.0
	SPD (MPH)	4.2	8.2	6.6	7.8	5.8	3.9	7.0	6.0	8.3	8.3
	RATIO	0.675	0.926	0.967	0.928	0.864	0.293	0.392	0.980	0.952	0.959
EAST HARTFORD-003 (8287)	NO2	.091	.088	.088	.079	.071	.069	.068	.068	.067	.064
	DATE	3/15/90	1/17/90	11/ 2/90	1/23/90	11/16/90	5/ 9/90	11/ 1/90	3/ 9/90	11/15/90	4/27/90
METEOROLOGICAL SITE	DIR (DEG)	180	190	230	270	210	220	200	230	220	210
NEWARK	VEL (MPH)	1.4	5.8	6.8	4.8	6.8	6.6	2.7	3.2	8.1	4.5
	SPD (MPH)	4.9	6.3	8.5	8.9	8.5	8.9	5.5	6.0	9.5	6.5
	RATIO	0.284	0.912	0.805	0.538	0.803	0.739	0.501	0.538	0.853	0.692
METEOROLOGICAL SITE	DIR (DEG)	190	180	200	220	180	190	80	220	170	310
BRADLEY	VEL (MPH)	2.2	6.2	4.3	2.4	7.0	8.0	.6	1.5	6.3	3.5
	SPD (MPH)	5.0	8.1	6.3	4.5	9.9	8.1	3.3	4.5	7.5	6.5
	RATIO	0.444	0.772	0.682	0.541	0.701	0.996	0.183	0.327	0.836	0.543
METEOROLOGICAL SITE	DIR (DEG)	250	170	260	280	260	230	260	180	260	260
BRIDGEPORT	VEL (MPH)	2.9	1.4	4.5	3.6	5.6	3.8	1.9	1.1	8.7	5.8
	SPD (MPH)	4.2	4.6	4.6	6.0	5.9	4.2	3.9	2.3	9.1	6.0
	RATIO	0.686	0.306	0.988	0.603	0.951	0.921	0.489	0.470	0.965	0.967
METEOROLOGICAL SITE	DIR (DEG)	260	210	260	280	250	250	280	200	270	310
WORCESTER	VEL (MPH)	2.8	5.0	7.6	4.9	8.6	8.0	5.9	1.1	10.6	6.4
	SPD (MPH)	4.2	5.8	8.2	5.3	8.8	8.3	6.2	3.9	10.6	6.6
	RATIO	0.675	0.864	0.926	0.922	0.985	0.959	0.960	0.293	0.998	0.967
NEW HAVEN-123 (8343)	NO2	.122	.122	.116	.093	.089	.084	.083	.083	.081	.081
	DATE	3/15/90	11/ 2/90	3/13/90	11/ 3/90	11/ 1/90	2/ 8/90	1/17/90	11/16/90	4/27/90	1/ 9/90
METEOROLOGICAL SITE	DIR (DEG)	180	230	270	240	200	180	190	210	210	200
NEWARK	VEL (MPH)	1.4	6.8	7.8	5.3	2.7	3.4	5.8	6.8	4.5	5.0
	SPD (MPH)	4.9	8.5	8.9	7.6	5.5	5.3	6.3	8.5	6.5	6.2
	RATIO	0.284	0.805	0.873	0.696	0.501	0.631	0.912	0.803	0.692	0.806
METEOROLOGICAL SITE	DIR (DEG)	190	200	350	240	80	170	180	180	310	170
BRADLEY	VEL (MPH)	2.2	4.3	3.7	2.9	.6	6.1	6.2	7.0	3.5	5.6
	SPD (MPH)	5.0	6.3	6.2	7.2	3.3	7.2	8.1	9.9	6.5	7.0
	RATIO	0.444	0.682	0.596	0.402	0.183	0.855	0.772	0.701	0.543	0.790

TABLE 5-2, CONTINUED

1990 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	260	280	260	260	250	170	260	260	240
BRIDGEPORT	VEL (MPH)	2.9	4.5	3.4	5.4	1.9	4.9	1.4	5.6	5.8	5.4
	SPD (MPH)	4.2	4.6	5.2	5.5	3.9	5.6	4.6	5.9	6.0	5.9
	RATIO	0.686	0.988	0.657	0.989	0.489	0.875	0.306	0.951	0.967	0.909
METEOROLOGICAL SITE	DIR (DEG)	260	260	290	300	280	250	210	250	310	230
WORCESTER	VEL (MPH)	2.8	7.6	7.9	10.1	5.9	7.2	5.0	8.6	6.4	6.1
	SPD (MPH)	4.2	8.2	8.3	10.2	6.2	7.6	5.8	8.8	6.6	6.5
	RATIO	0.675	0.926	0.952	0.992	0.960	0.947	0.864	0.985	0.967	0.938

FIGURE 5-2

AVERAGES OF THE ANNUAL NO_2 CONCENTRATIONS AT THREE SITES

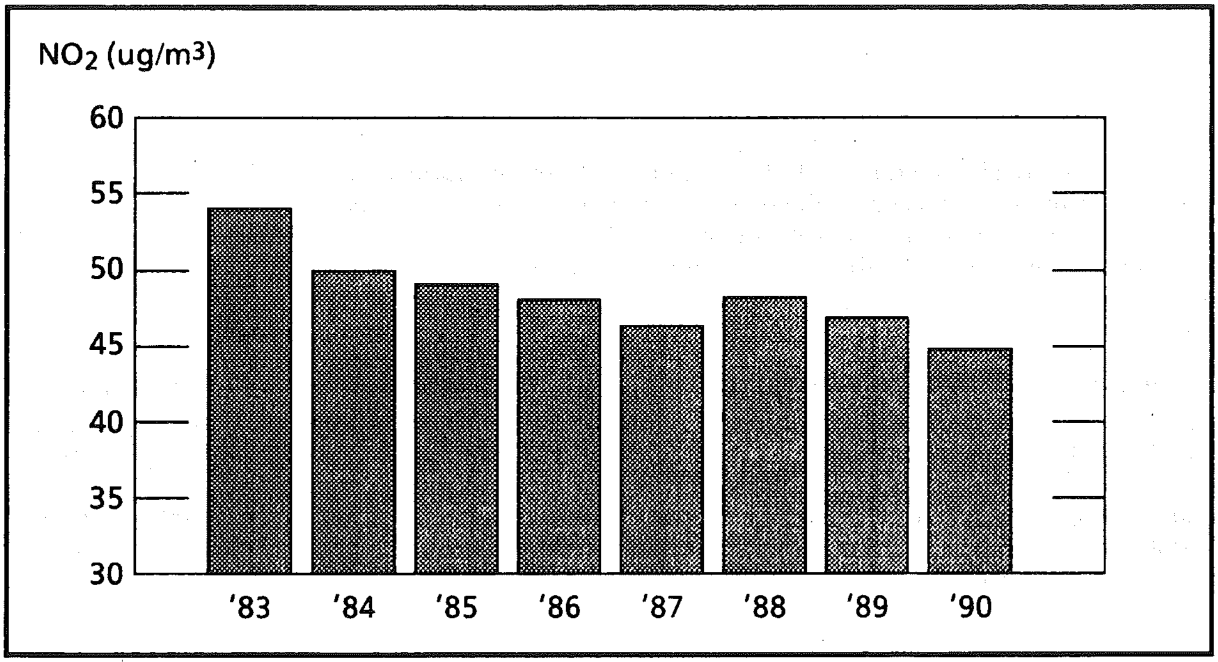
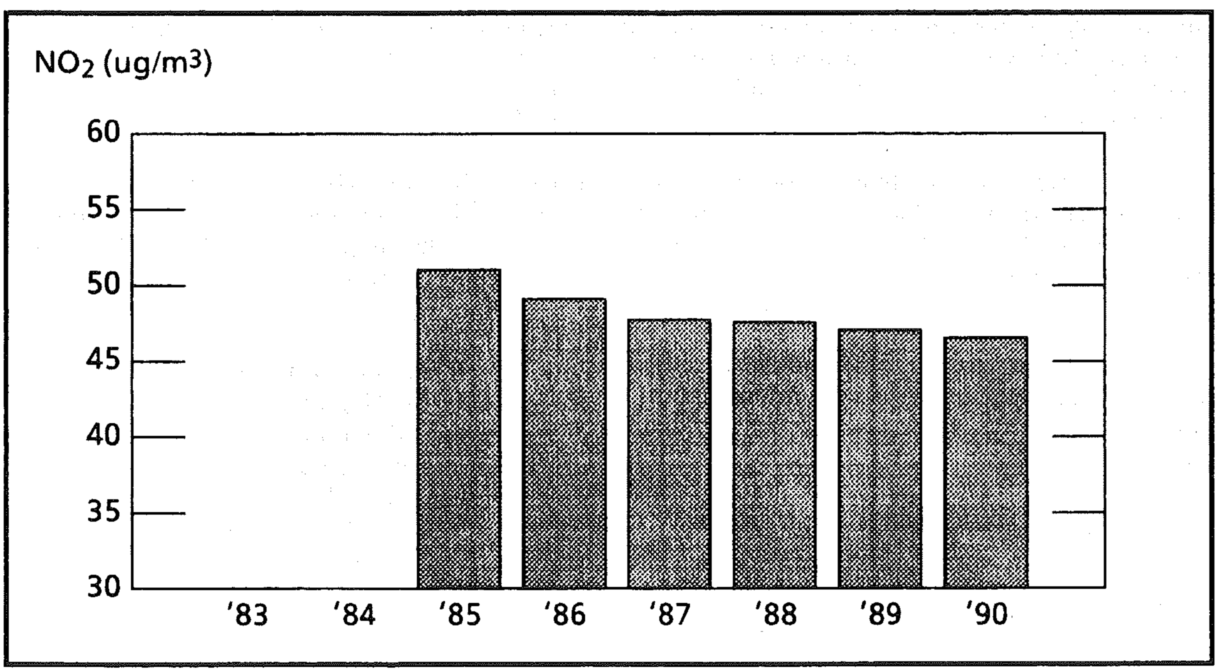


FIGURE 5-3

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 harmless 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 eight-hour National Ambient Air Quality Standard of 9 parts per million (ppm) was not exceeded at any of the five carbon monoxide monitoring sites in Connecticut during 1990. Nor was an exceedance of the 35 ppm one-hour standard measured at any site in 1990.

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, CO monitors in Connecticut are sited specifically to measure CO levels in neighborhoods and at traffic intersections.

The CO standards are likely to be exceeded in any city in the state where there are areas of traffic congestion. However, as Connecticut's SIP control strategies are implemented, there should continue to be a decrease in the number of congested areas. Also, as federally - 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 1990 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 210 precision checks during 1990. The resulting 95% probability limits were -3% to +7%. Accuracy is determined by introducing a known amount of CO into each of the monitors. Five audits for accuracy were conducted on the monitoring network in 1990. Three different concentration levels were tested on each monitor: low, medium and high. The 95% probability limits ranged from -6% to +11% for the low level test; -4% to +3% for the medium level test; and -4% to +5% for the high level test.

8-Hour and 1-Hour Averages - An 8-hour concentration is said to exceed the standard of 9 ppm if it is equal to or greater than 9.5 ppm. No site had a CO concentration exceeding the 8-hour standard, which means that the standard was not violated in Connecticut in 1990 (see Table 6-1).

Regarding the maximum 8-hour running average at each site, there were increases from 1989 to 1990 at Bridgeport 004, New Haven 019 and Stamford 020, and there were decreases at Hartford 013 and Hartford 017. The second highest 8-hour running average decreased from 1989 to 1990 at Bridgeport 004 and Hartford 017, and increased at Hartford 013 and New Haven 019. There was no change at Stamford 020.

As for 1-hour averages, no site in the state recorded a value exceeding the primary 1-hour standard of 35 ppm. Bridgeport 004, New Haven 019 and Stamford 020 recorded maximum 1-hour values that were higher than the year before, while Hartford 013 and Hartford 017 had lower values. Second high 1-hour values were higher in 1990 at all the sites except Hartford 013.

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 after 1987. No exceedances are evident at Bridgeport 004, Hartford 013 or New Haven 019, and there are no exceedances at Stamford 020 after 1986. For this reason, these sites are excluded from 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 appear to be flattening out at Bridgeport 004 and Stamford 020 after trending down for some years, while they continue to trend down at Hartford 017. The Hartford 013 and New Haven 019 sites have fewer data, and CO levels at these sites appear to be either flat or rising slightly.

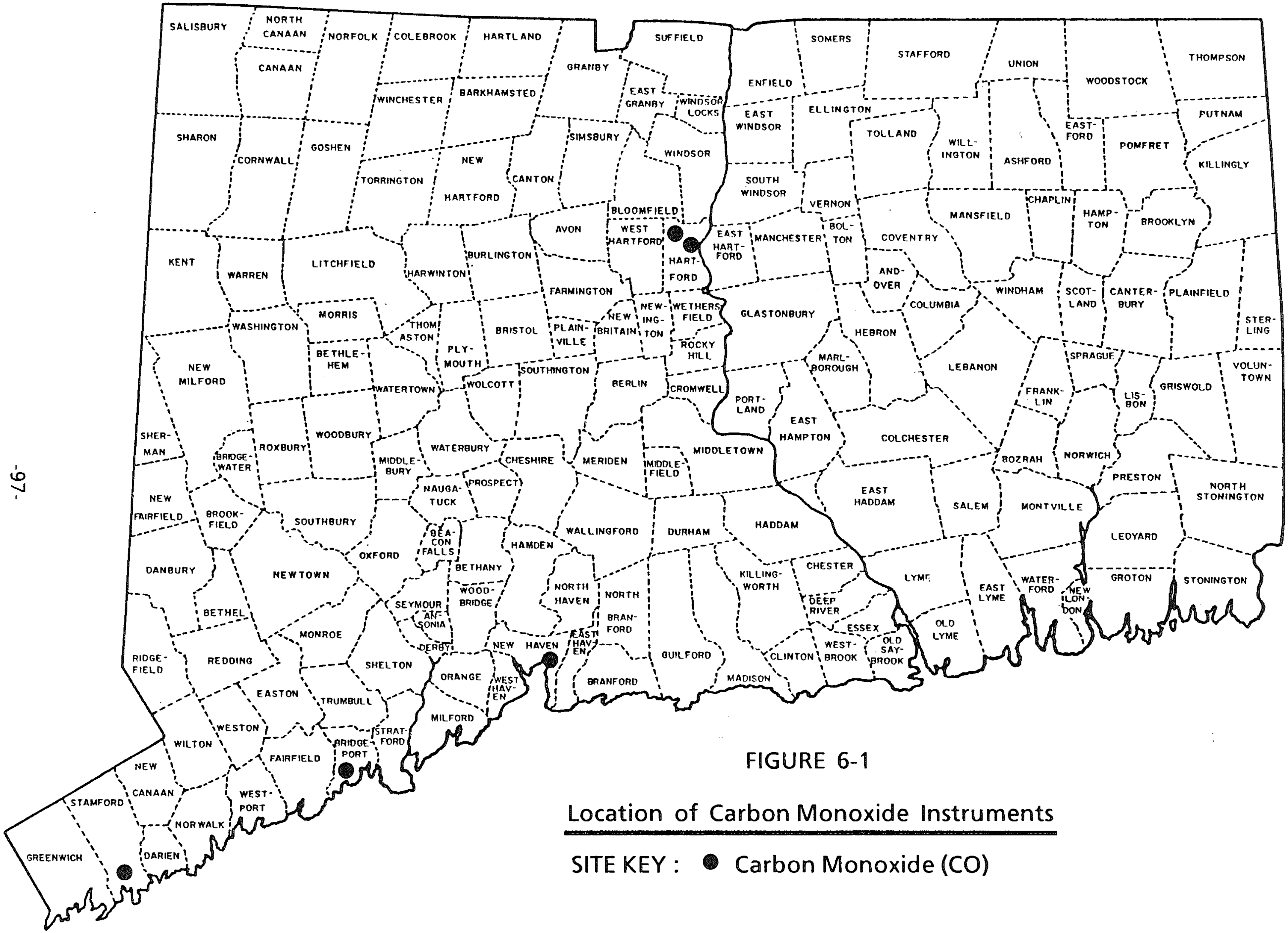


FIGURE 6-1

Location of Carbon Monoxide Instruments

SITE KEY : ● Carbon Monoxide (CO)

TABLE 6-1

1990 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 MAXIMUM 1-HOUR AVERAGE[2]
Bridgeport-004	6.1	01/17/01	5.0	11/02/03	9.3	01/16/23	8.5	01/16/18
Hartford-013	4.8	11/02/02	4.7	02/08/02	6.4	02/08/08	6.0	11/26/22
Hartford-017[3]	9.3	02/07/22	8.6	01/24/20	19.3	02/07/18	15.8	02/07/17
New Haven-019	7.2	01/16/24	6.8	03/11/24	11.8	01/16/18	9.9	11/02/15
Stamford-020	7.4	01/24/24	6.0	01/16/24	10.5	01/24/21	10.0	02/09/09

[1] The time of the 8-hour average is reported as follows: month/day/hour (EST), specifying the end of the 8-hour period.
[2] The time of the 1-hour average is reported as follows: month/day/hour (EST), specifying the end of the 1-hour period.
[3] No data exist for April through most of October due to road construction.

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

TABLE 6-2

1990 CARBON MONOXIDE SEASONAL FEATURES

TOWN-SITE		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Bridgeport-004	Max. 1-Hour	9.3	6.6	6.1	4.2	2.7	2.5	2.9	6.7	3.6	5.3	8.1	7.6
	Max. Running 8-Hour	6.1	4.0	3.8	3.2	2.3	2.0	2.0	3.5	2.8	3.0	5.0	4.9
	No. of 8-Hour Exceedances	0	0	0	0	0	0	0	0	0	0	0	0
Hartford-013	Max. 1-Hour	5.5	6.4	3.1	3.5	2.0	2.7	2.2	2.3	3.5	4.0	6.0	3.4
	Max. Running 8-Hour	4.0	4.7	2.2	1.8	1.1	2.1	1.2	1.7	1.9	2.7	4.8	2.7
	No. of 8-Hour Exceedances	0	0	0	0	0	0	0	0	0	0	0	0
Hartford-017*	Max. 1-Hour	15.4	19.3	11.6							8.0	10.5	8.9
	Max. Running 8-Hour	8.6	9.3	6.2							4.4	6.9	5.3
	No. of 8-Hour Exceedances	0	0	0							0	0	0
New Haven-019	Max. 1-Hour	11.8	7.0	9.5	6.1	4.2	4.3	4.0	4.3	4.4	9.5	9.9	6.7
	Max. Running 8-Hour	7.2	4.6	6.8	4.7	3.2	3.3	3.3	3.2	3.5	4.5	6.7	5.2
	No. of 8-Hour Exceedances	0	0	0	0	0	0	0	0	0	0	0	0
Stamford-020	Max. 1-Hour	10.5	10.0	6.1	4.8	4.7	4.3	4.3	4.0	5.6	7.4	9.0	9.3
	Max. Running 8-Hour	7.4	6.0	4.6	3.2	3.5	3.1	3.0	3.3	3.2	3.9	5.7	5.9
	No. of 8-Hour Exceedances	0	0	0	0	0	0	0	0	0	0	0	0

* No data exist for April through most of October due to road construction.

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

TABLE 6-3

EXCEEDANCES OF THE 8-HOUR CO STANDARD FOR 1986 -1990

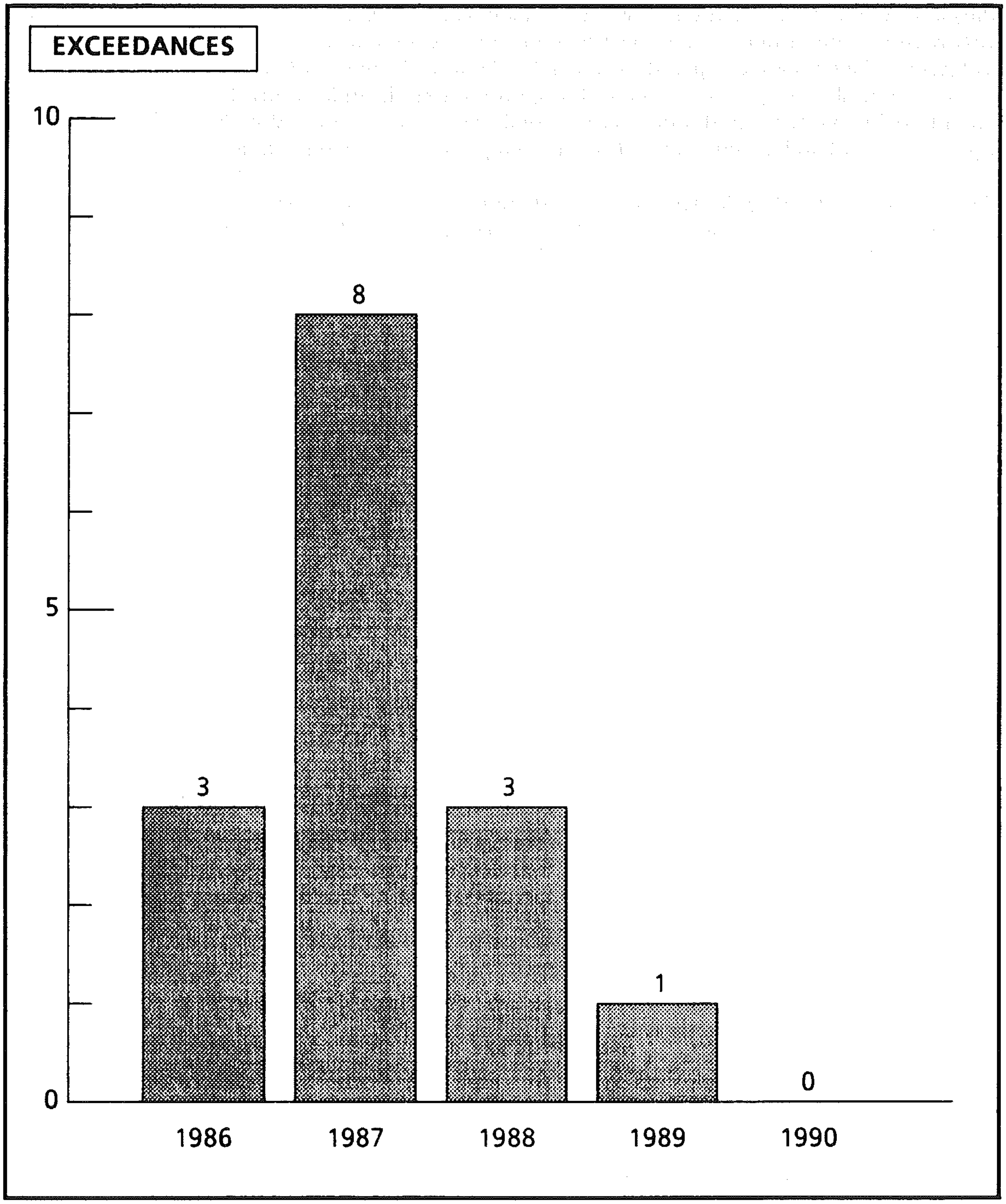
SITE	1986	1987	1988	1989	1990
Bridgeport-004	0	0	0	0	0
Hartford-013	-	0[a]	0	0	0[b]
Hartford-017	3	8	3	1	0
New Haven-019	0[c]	0	0	0	0
Stamford-020	1	0	0	0	0

[a] Data are missing for January and February.
[b] Data are missing for April through most of October due to road construction.
[c] Data are missing for January through March.

FIGURE 6-2

EXCEEDANCES OF THE 8-HOUR CO STANDARD FOR 1986-1990

SITE: HARTFORD-017



YEAR

IX. 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 9-1 for the years 1989 and 1990. Table 9-2 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.

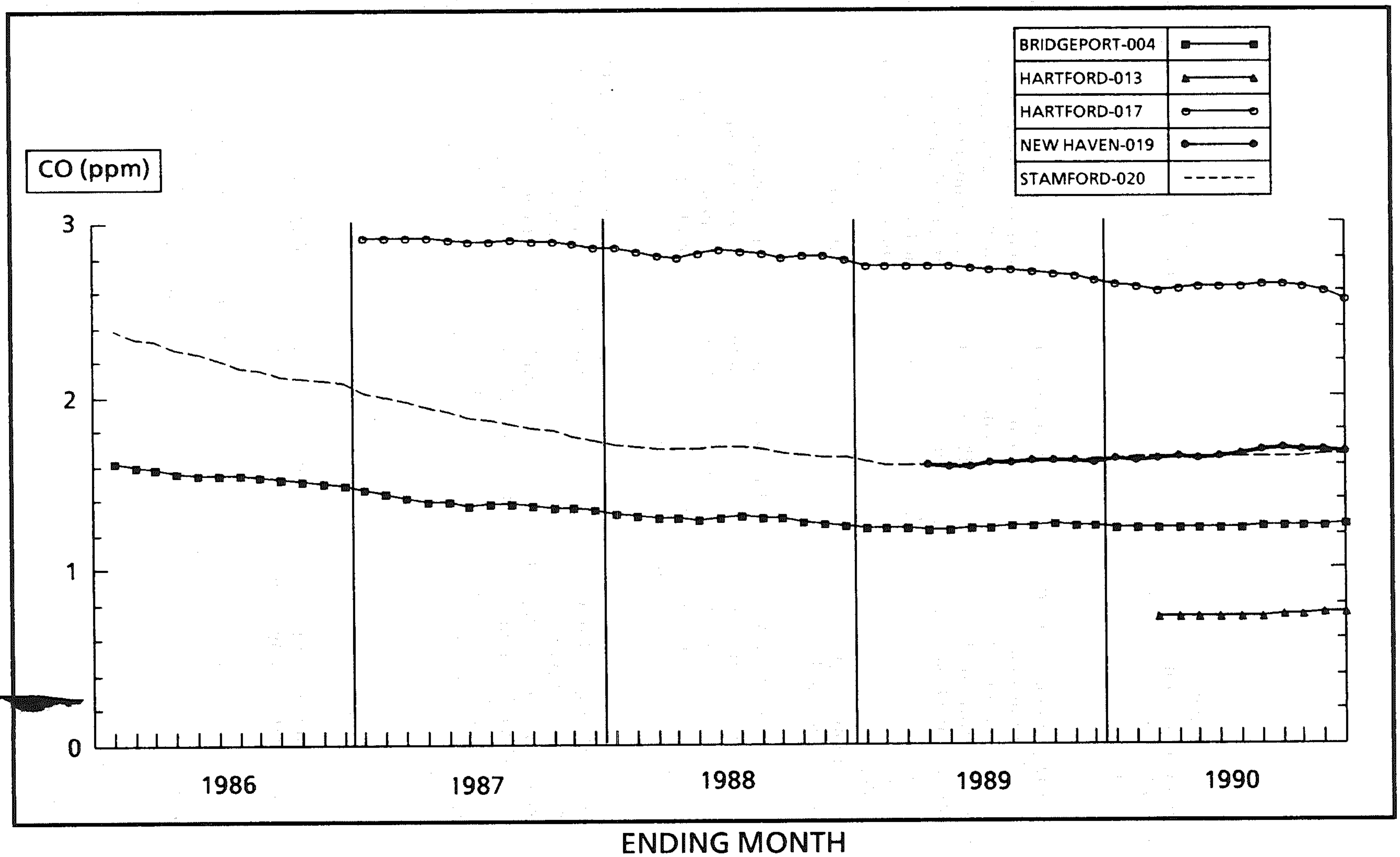
Wind roses for Bradley Airport and Newark Airport have been developed from 1990 National Weather Service surface observations and are shown in Figures 9-2 and 9-4, respectively. Wind roses from these stations for 1989 are shown in Figures 9-1 and 9-3, respectively.

[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.

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 1990, these source categories contributed 31%, 31% and 31%, respectively, of the atmospheric lead. The motor vehicle contribution, while still a large source of airborne lead emissions, has decreased significantly from a 71% share in 1985 to its current 31% and, since 1989, is no longer the largest source of 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 1990.

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 lo-vol samplers in 1990 to obtain ambient concentrations of lead. These samplers are used to collect particulate matter onto fiberglass filters. Compared to hi-vol samplers, lo-vols operate continuously at reduced flow rates, for an entire month. This results in a one month integrated sample. 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.

DISCUSSION OF DATA

Monitoring Network - In 1990, only lo-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, Hartford (2), 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. EPA approval for lo-vol samplers was granted in February 1984.

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 all of the hi-vol samplers were terminated.

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 1990. 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, 12 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 + 7%; those for the high level ranged from -7% to + 3%.

NAAQS - Connecticut's ambient air quality standard for lead and its compounds, measured as elemental lead, is: 1.5 micrograms per cubic meter ($\mu g/m^3$), maximum arithmetic mean averaged over three consecutive calendar months. This standard was enacted on November 2, 1981. Previously, Connecticut's lead standard was 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 be below the limiting concentration of 1.5 $\mu g/m^3$.

3-Month Running Averages - Three-month running average lead concentrations for 1990 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 no longer available; so lead emissions will no longer be updated in Figure 7-2. And Figure 7-3 will contain only pre-1990 data.

The downward trend in airborne lead concentrations can be expected to level off at some point in the near future, 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.

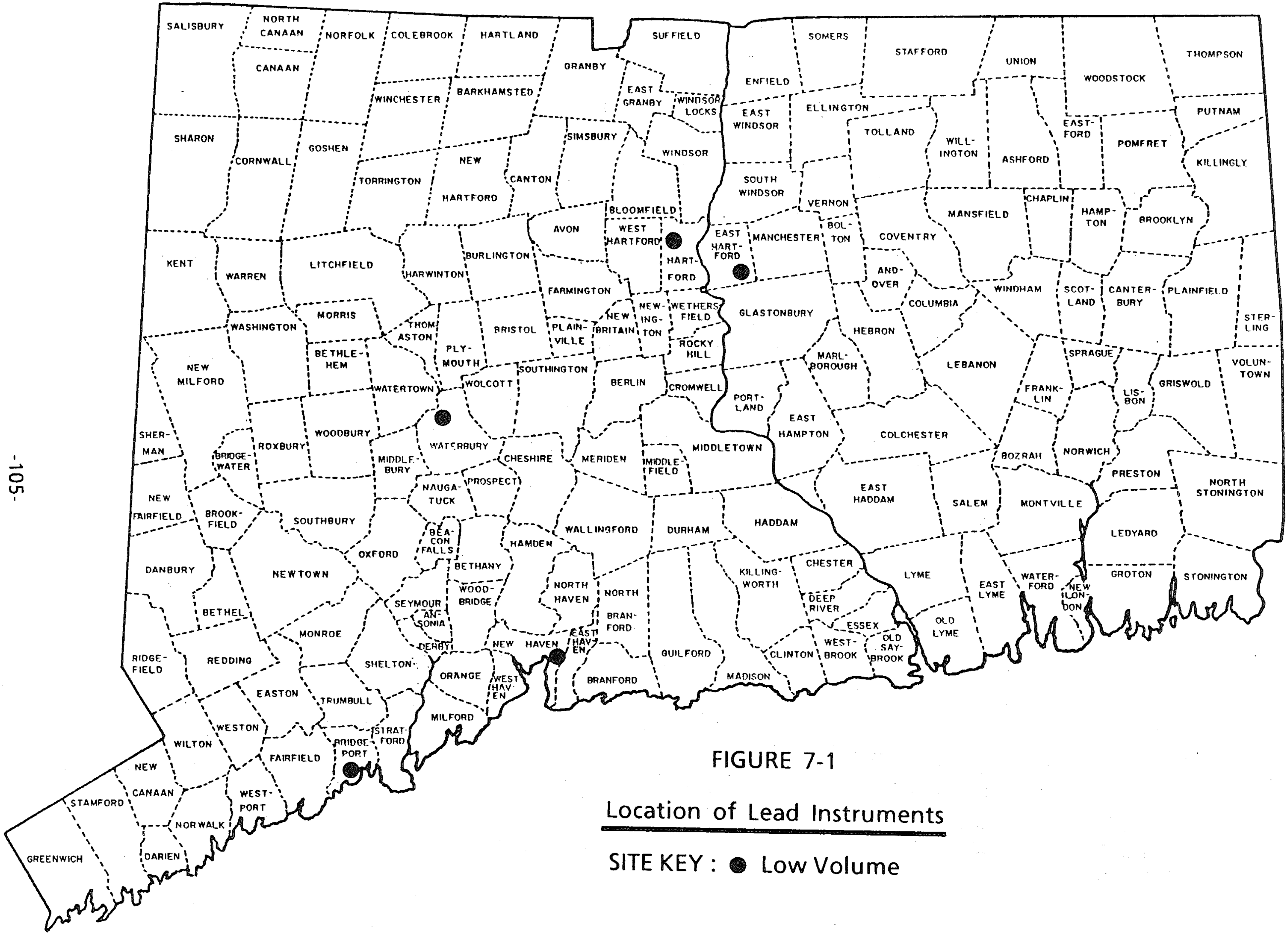


FIGURE 7-1

Location of Lead Instruments

SITE KEY : ● Low Volume

TABLE 7-1

1990 3-MONTH RUNNING AVERAGE LEAD CONCENTRATIONS[a]

TOWN-SITE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Bridgeport-010	0.033	0.033	0.037	0.033	0.030	0.027		------	------	0.023	0.023	0.020
East Hartford-004	0.013	0.017			------	------	0.013	0.013	0.013	0.017	0.013	
Hartford-016	0.033	0.037	0.037	0.033	0.027	0.027	0.030	0.030	0.023			
New Haven-018	------	------	0.073	0.067	0.057	0.047	0.053	0.057	0.060	0.060	0.063	0.077
Waterbury-123[b]	0.040	0.040	0.043	0.043		------	------			0.053	0.043	

[a] The lead concentrations are in terms of micrograms per cubic meter (μg/m³)

[b] The averages for August and September were omitted because they were affected by sandblasting on a local bridge

N.B. A blank area in the table indicates that a lead sampler was not in operation during the month at that site. Dashes indicate insufficient data for a 3-month average

FIGURE 7-2

STATEWIDE ANNUAL LEAD EMISSIONS FROM GASOLINE

AND

STATEWIDE ANNUAL AVERAGE LEAD CONCENTRATIONS

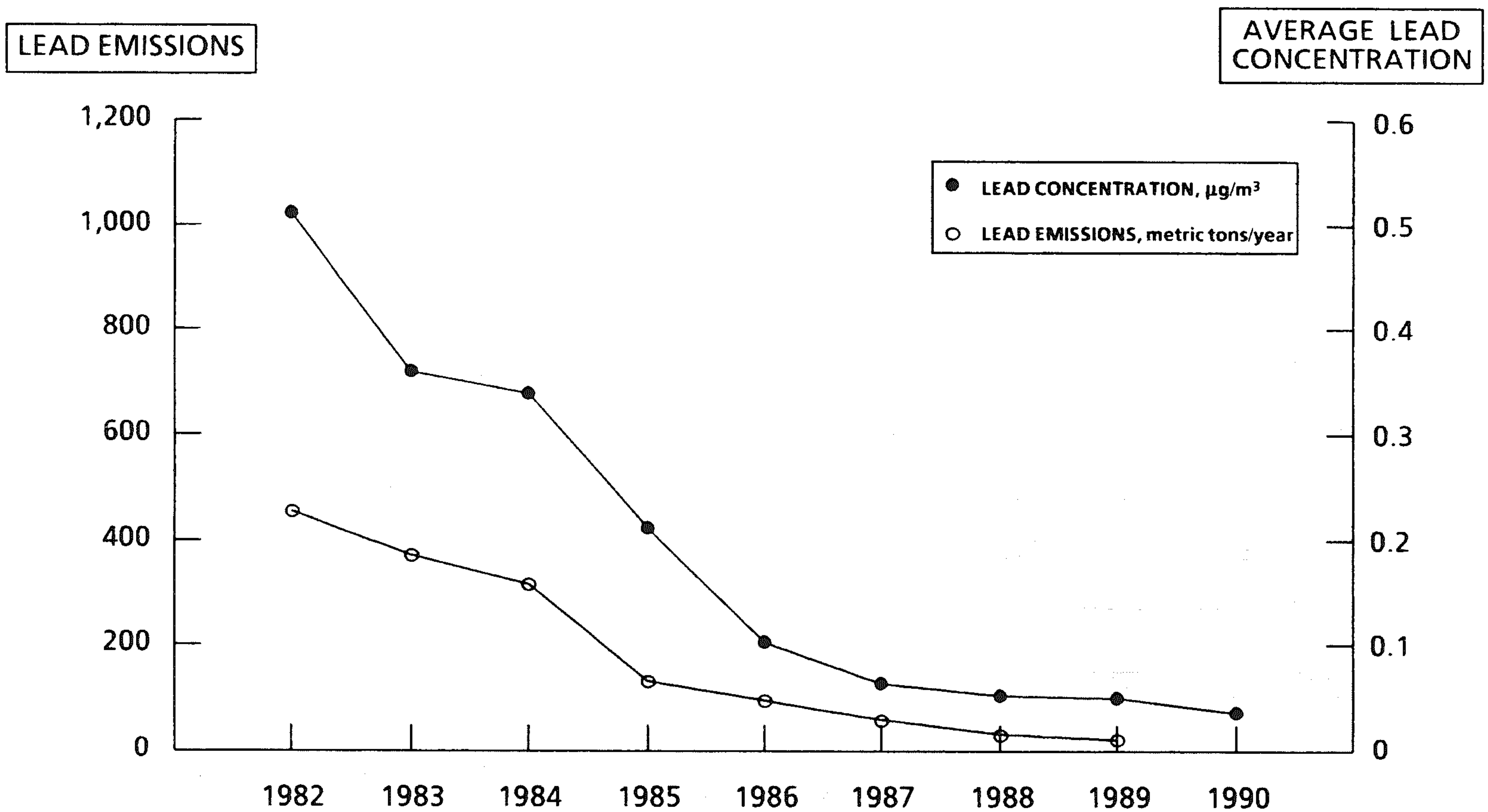
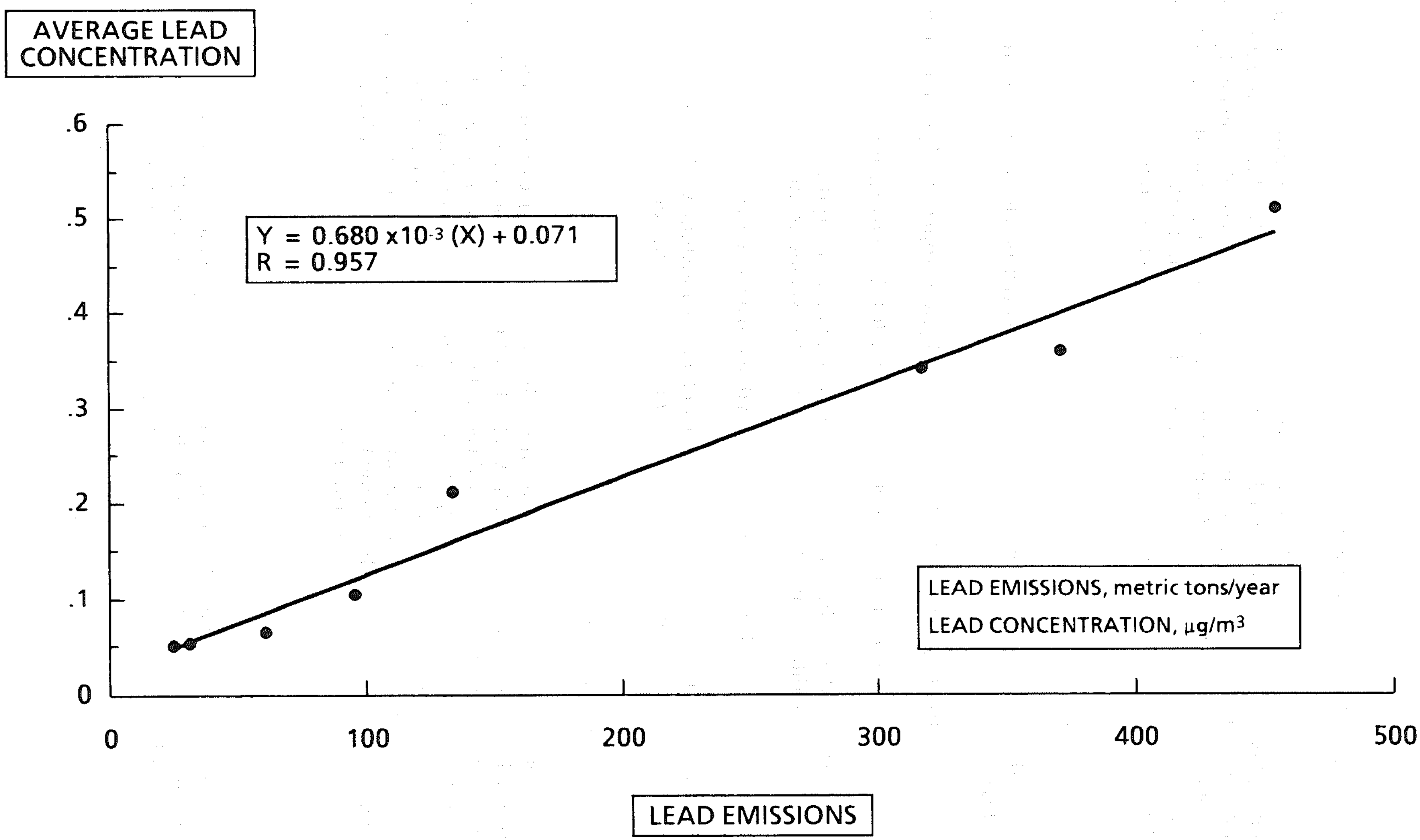


FIGURE 7-3

STATEWIDE ANNUAL AVERAGE LEAD CONCENTRATIONS

VS.

STATEWIDE ANNUAL LEAD EMISSIONS FROM GASOLINE



VIII. ACID PRECIPITATION

MONITORING PROGRAM

Recently, there has been a growing public concern about the occurrence and effects of atmospheric deposition, most notably acid precipitation or "acid rain." It has become apparent that, in order to address this concern, basic data need to be collected on the chemical properties of precipitation. Recognizing this, the State of Connecticut, through the Department of Environmental Protection, has agreed to cooperate with the Water Resources Division of the United States Geological Survey (USGS) to establish the Connecticut Atmospheric Deposition Monitoring Program.

PROGRAM OBJECTIVES

The program is designed to collect and analyze precipitation on an event basis and has the following objectives:

(1) to determine selected chemical and physical properties of precipitation in Connecticut;

(2) to determine the spatial and temporal distribution of precipitation chemistry in the State;

(3) to determine the relationships between precipitation chemistry and meteorological conditions, such as storm track and air mass movement;

(4) to provide baseline information that can be used to determine trends and estimate loads; and

(5) to use techniques and methodologies consistent with those of the national monitoring networks in order to provide comparative information.

DATA COLLECTION SITES

Data collection sites have been established according to siting criteria used in the National Atmospheric Deposition Program (NADP). Use of these criteria ensures the validity of comparisons made between data which are collected through Connecticut's program and data from other atmospheric deposition programs. Other objectives considered during the siting process were the collection of samples representative of different geographic areas of the State, and the sampling of precipitation representative of long-range transport and not merely local sources. Using these criteria, precipitation sampling sites were established in the towns of Plainfield, Marlborough and Litchfield (Morris Dam). The locations of these sites are shown in Figure 8-1.

EQUIPMENT

Each site is equipped with an automatic wet-dry sensing type of precipitation collector -- the same type used by the NADP and the National Trends Network (NTN). The collector operates when precipitation wets an electronic sensor, completing an electrical circuit. This activates a motor that opens a lid over the sample container when the precipitation event begins and closes the lid when the precipitation ceases. The purpose of the lid is to retard the loss of samples through evaporation and to prevent contamination by dry fallout.

Each site is also equipped with an automatic rain gage which provides a record of the quantity of rain at 15-minute intervals.

DATA COLLECTION

Samples of precipitation are gathered from the automatic collectors as soon as possible following the end of a precipitation event, in most cases within 24 hours. The samples are immediately tested for acidity through pH measurements. The samples are also tested for specific conductance. This is a measure of the ions (i.e., the dissolved solids) in solution and, therefore, of the pollutant load.

Samples from selected precipitation events are also sent to a USGS laboratory for further analyses to determine the concentrations of additional chemical constituents, including major anions, cations, nutrients and trace metals.

Through the Connecticut Atmospheric Deposition Monitoring Program, a network capable of providing uninterrupted baseline data on precipitation quality within the State has been developed. Data collected through the program is currently being published monthly by the USGS in its report, Water Resources Conditions in Connecticut. Historical data are available from the Water Resources Division of the USGS or from the Natural Resources Center of the DEP at the addresses provided below. When using the data, one should note that they are specific only to the time and place of their collection.

DISCUSSION OF DATA

Presently, the data that have been collected in the initial stages of the study are being analyzed to determine, on a preliminary basis, the distribution and magnitude of atmospheric deposition in Connecticut. Because precipitation chemistry is a function of air quality and climate, both of which fluctuate over time and space, several more years of continuous data collection will be necessary to develop an adequate baseline to determine trends accurately and to more fully define the controlling processes. However, a preliminary evaluation of the data indicates that the precipitation occurring within Connecticut has been chemically affected by man-made contaminants. Normal rain has a pH of 5.6, which already places it in the acidic range. The current data show that the annual mean pH of the precipitation at the 3 data collection sites has varied between 4.1 and 4.4 from 1984 through 1990. The annualized data are presented in Table 8-1 and illustrated in Figure 8-2. Further evaluation of the data may provide more information on the source of the contaminants and the effects upon the environment.

It is important to stress that it is presently difficult to forecast statewide trends in the chemical properties of precipitation, or to perform comparative analyses, because of a lack of a large long-term data base. Generally, a 20-year or greater period of record is an acceptable statistical data base. When performing comparative analyses, some hydrologic data bases use 60 years or more of record keeping. Therefore, it should be apparent that data collection under the Connecticut Atmospheric Deposition Monitoring Program must continue until a sufficient period of record has been obtained.

Further information is available from the Water Resources Division, United States Geological Survey, 450 Main Street, Hartford, Connecticut 06103 at (203) 240-3060, or from the Natural Resources Center, Department of Environmental Protection, 165 Capitol Avenue, Hartford, Connecticut 06106 at (203) 566-3540.

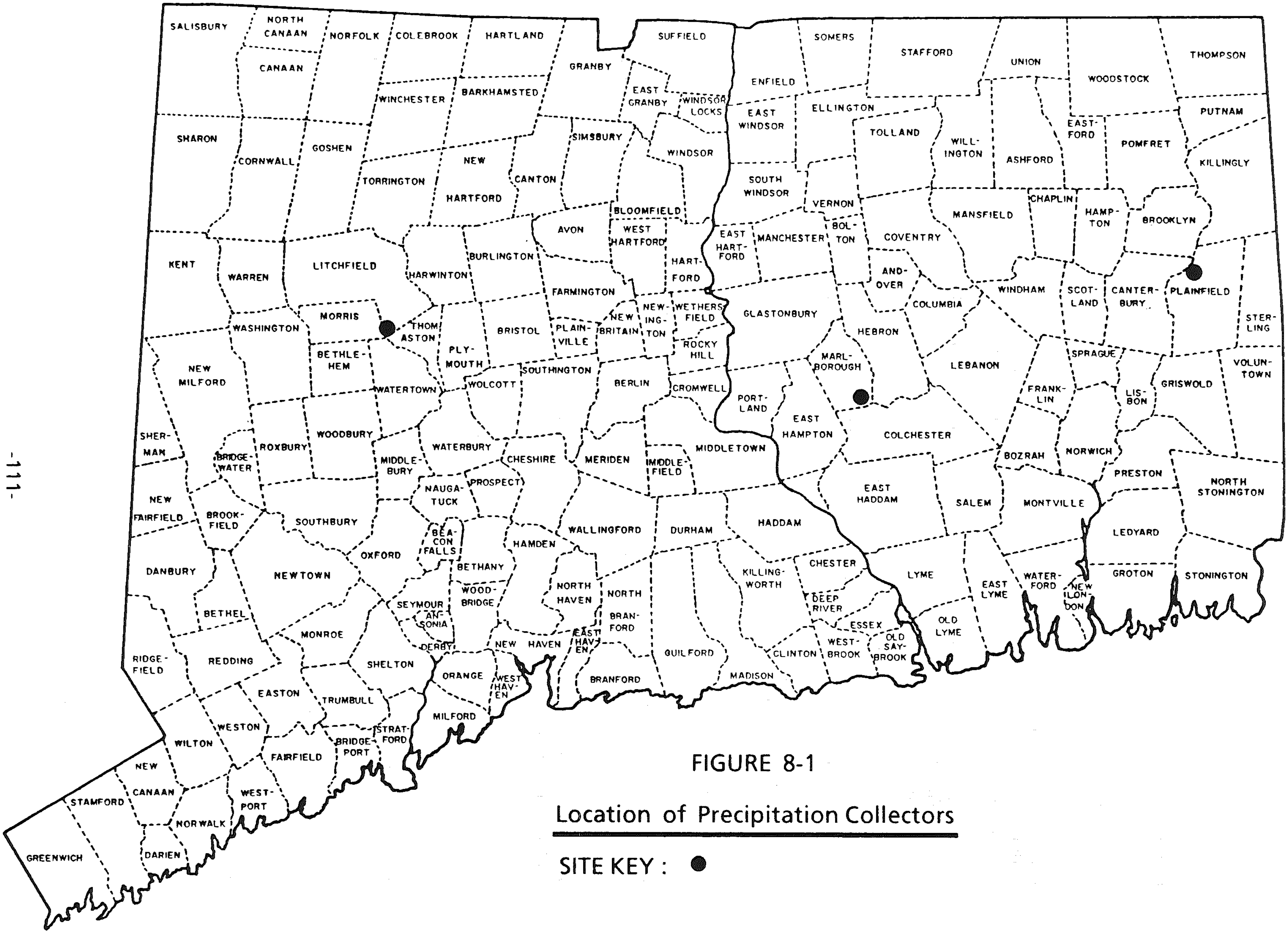


FIGURE 8-1

Location of Precipitation Collectors

SITE KEY : ●

TABLE 8-1

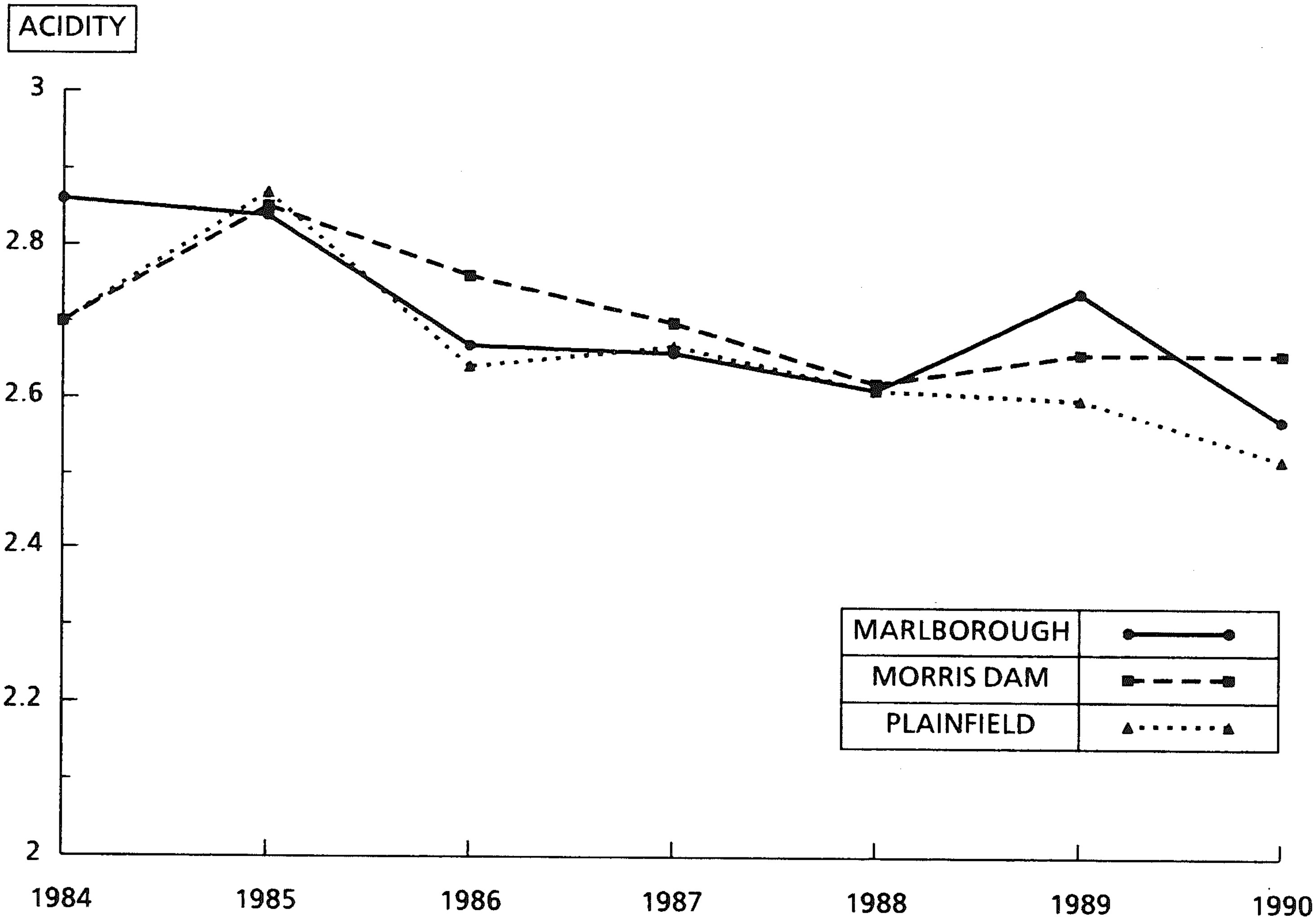
ANNUAL MEAN ACIDITY OF PRECIPITATION AT 3 SITES[1]

	Marlborough	Morris Dam	Plainfield
1984	2.86	2.70	2.70
1985	2.84	2.85	2.87
1986	2.67	2.76	2.64
1987	2.66	2.70	2.67
1988	2.61	2.62	2.61
1989	2.74	2.66	2.60
1990	2.57	2.66	2.52

[1] Acidity = 7 - pH

FIGURE 8-2

ANNUAL MEAN ACIDITY OF PRECIPITATION AT 3 SITES[1]



[1] ACIDITY = 7 - pH

TABLE 9-1

1989 AND 1990 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)		
	1989	1990	Mean[a]	1989	1990	Mean[b]	1989	1990	Normal[c]	1989	1990	Mean[a]	1989	1990	Mean[d]	1989	1990	Mean[d]
Jan	30.8	34.7	26.6	0	0	0.0	1054	935	1234	0.88	4.03	3.53	10	13	10.7	9.4	8.7	9.0
Feb	28.6	33.0	27.8	0	0	0.0	1012	890	1047	1.85	3.37	3.20	11	10	10.2	9.4	10.1	9.4
Mar	37.4	40.2	37.2	0	0	0.0	847	763	874	3.02	2.46	3.69	12	9	11.3	10.0	9.1	9.9
Apr	46.5	49.2	48.2	0	2	0.3	553	478	486	3.33	4.55	3.75	13	13	11.2	8.6	9.6	10.0
May	60.4	56.7	59.1	0	0	1.1	175	251	197	12.00	6.38	3.72	16	15	11.9	8.0	9.5	8.9
Jun	68.3	69.0	67.8	1	1	3.5	31	21	20	6.65	3.59	3.59	16	10	11.4	6.8	9.0	8.1
Jul	72.6	74.4	73.2	6	6	7.8	0	5	0	3.40	2.09	3.55	9	8	9.7	6.6	8.1	7.5
Aug	71.4	73.3	71.0	3	5	4.7	22	0	8	6.81	8.32	3.88	10	12	9.9	6.9	7.6	7.2
Sep	63.9	64.0	63.5	1	0	1.3	103	112	102	4.67	2.13	3.59	11	9	9.4	7.2	7.7	7.3
Oct	53.4	57.4	53.0	0	0	*	354	276	391	7.62	7.63	3.25	10	12	8.4	8.2	9.3	7.8
Nov	40.9	44.5	42.1	0	0	0.0	715	608	702	2.89	3.76	3.83	12	8	11.1	10.5	10.2	8.5
Dec	18.1	36.7	30.3	0	0	0.0	1444	873	1113	1.49	4.86	3.70	8	12	11.9	8.8	9.8	8.7
YEAR	49.4	52.8	50.0	11	14	18.7	6310	5212	6174	54.61	53.17	43.30	138	131	126.9	8.4	9.1	8.5

* Less than 0.05
[a] 1905-1990
[b] 1960-1990
[c] 1951-1980
[d] 1955-1990

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

TABLE 9-2

1989 AND 1990 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)		
	1989	1990	Mean[a]	1989	1990	Mean[b]	1989	1990	Normal[c]	1989	1990	Mean[d]	1989	1990	Mean[e]	1989	1990	Mean[f]
Jan	33.8	36.7	28.5	0	0	0.0	958	869	1101	1.44	4.01	3.56	9	11	10.6	---	---	13.2
Feb	31.0	35.0	30.5	0	0	0.0	945	836	963	2.40	1.94	3.24	12	11	9.6	---	---	13.6
Mar	38.8	40.1	38.0	0	0	0.0	804	766	831	4.06	2.10	3.91	10	8	11.1	---	---	13.5
Apr	47.9	49.2	48.0	0	1	*	505	476	492	3.15	4.87	3.85	12	12	10.5	---	---	13.0
May	59.6	56.9	58.4	0	0	0.2	180	243	220	9.53	6.89	3.77	13	15	11.1	---	---	11.6
Jun	68.5	69.1	67.8	0	0	0.9	19	12	20	5.60	1.91	3.34	18	10	9.6	---	---	10.5
Jul	71.8	73.9	73.3	0	2	2.9	0	5	0	3.44	2.83	3.73	9	8	8.5	---	---	10.0
Aug	71.6	73 9	72.0	3	1	1.6	7	1	0	6.57	6.47	3.99	7	14	9.3	---	---	10.1
Sep	65.2	65.6	65.2	0	0	0.4	88	77	49	3.21	1.75	3.44	7	8	8.5	---	---	11.2
Oct	54.9	59.6	54.7	0	0	0.0	305	208	285	7.02	5.72	3.38	10	8	7.2	---	---	11.9
Nov	43.2	46.6	44.2	0	0	0.0	648	546	585	3.27	1.89	3.80	13	9	10.2	---	---	12.7
Dec	23.3	40.0	33.2	0	0	0.0	1285	771	955	0.83	3.53	3.61	9	13	11.2	---	---	13.0
YEAR	50.8	53.9	51.2	3	4	6.0	5744	4810	5501	50.52	43.91	43.63	131	127	117.4	---	---	12.0

* Less than 0.05
[a] 1903-1990
[b] 1966-1990
[c] 1951-1980
[d] 1894-1990
[e] 1949-1990
[f] 1958-1980

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

FIGURE 9-1

ANNUAL WIND ROSE FOR 1989
BRADLEY INTERNATIONAL AIRPORT
WINDSOR LOCKS, CONNECTICUT

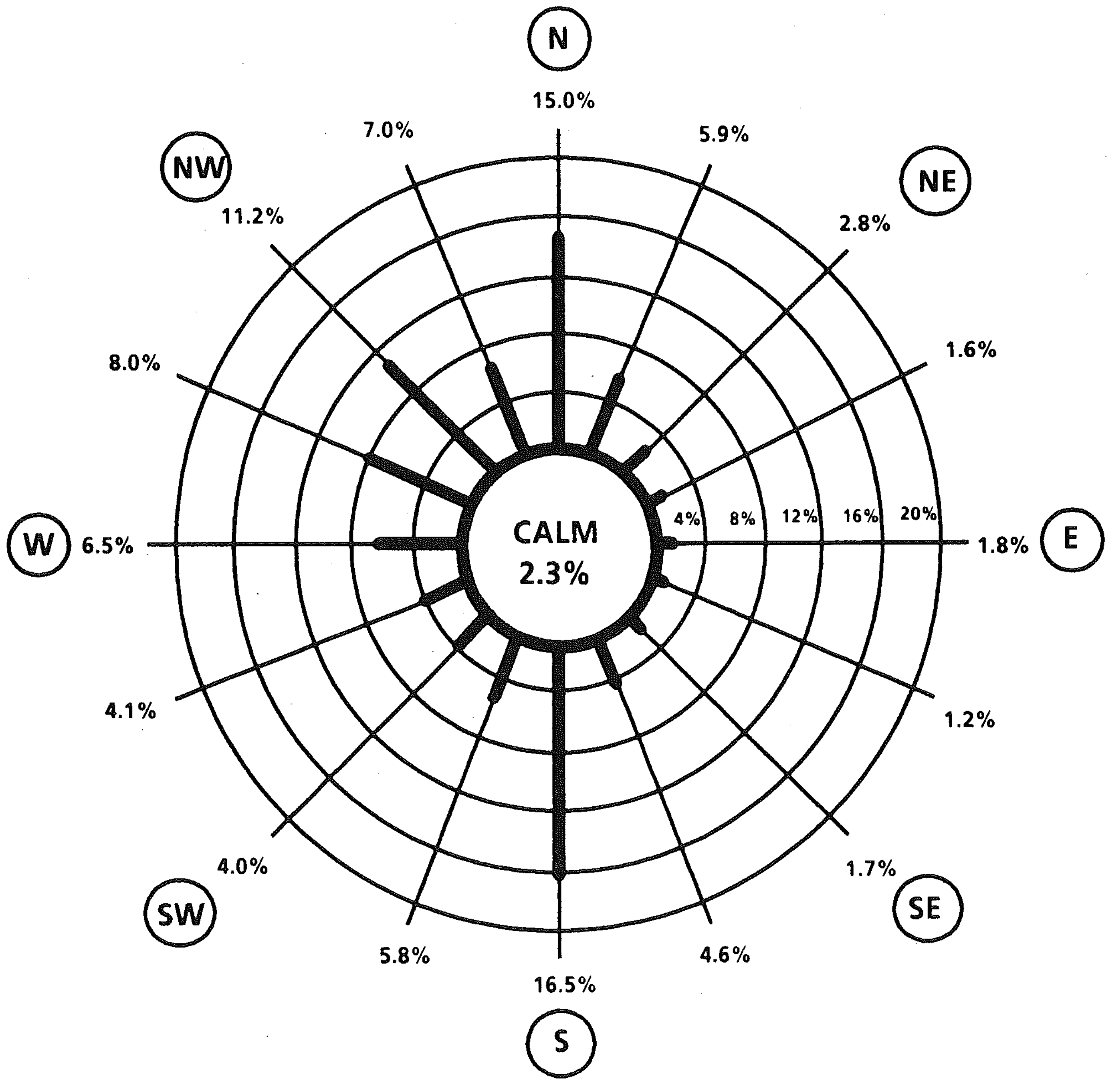


FIGURE 9-2

ANNUAL WIND ROSE FOR 1990
BRADLEY INTERNATIONAL AIRPORT
WINDSOR LOCKS, CONNECTICUT

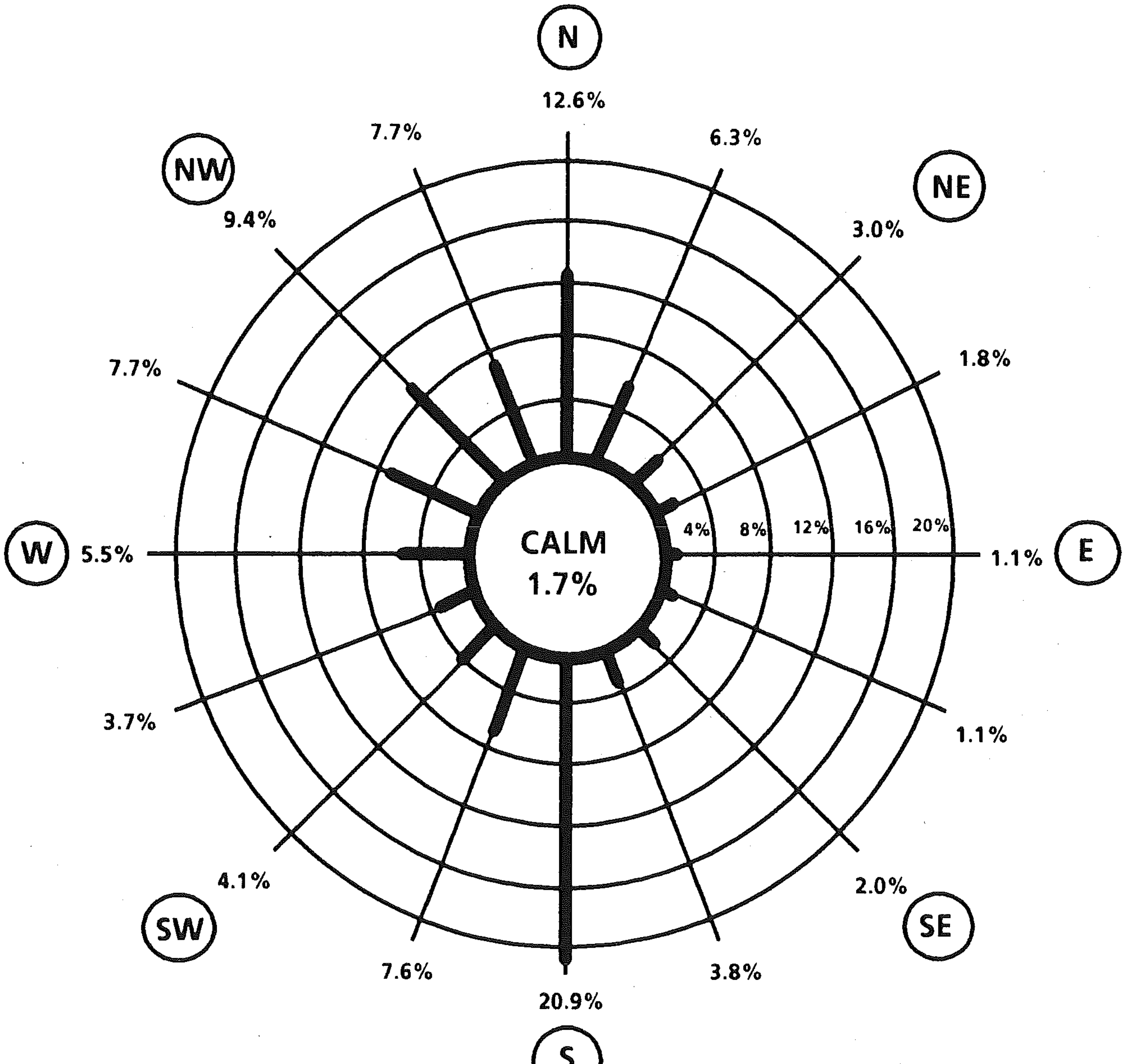


FIGURE 9-3

ANNUAL WIND ROSE FOR 1989
NEWARK INTERNATIONAL AIRPORT
NEWARK, NEW JERSEY

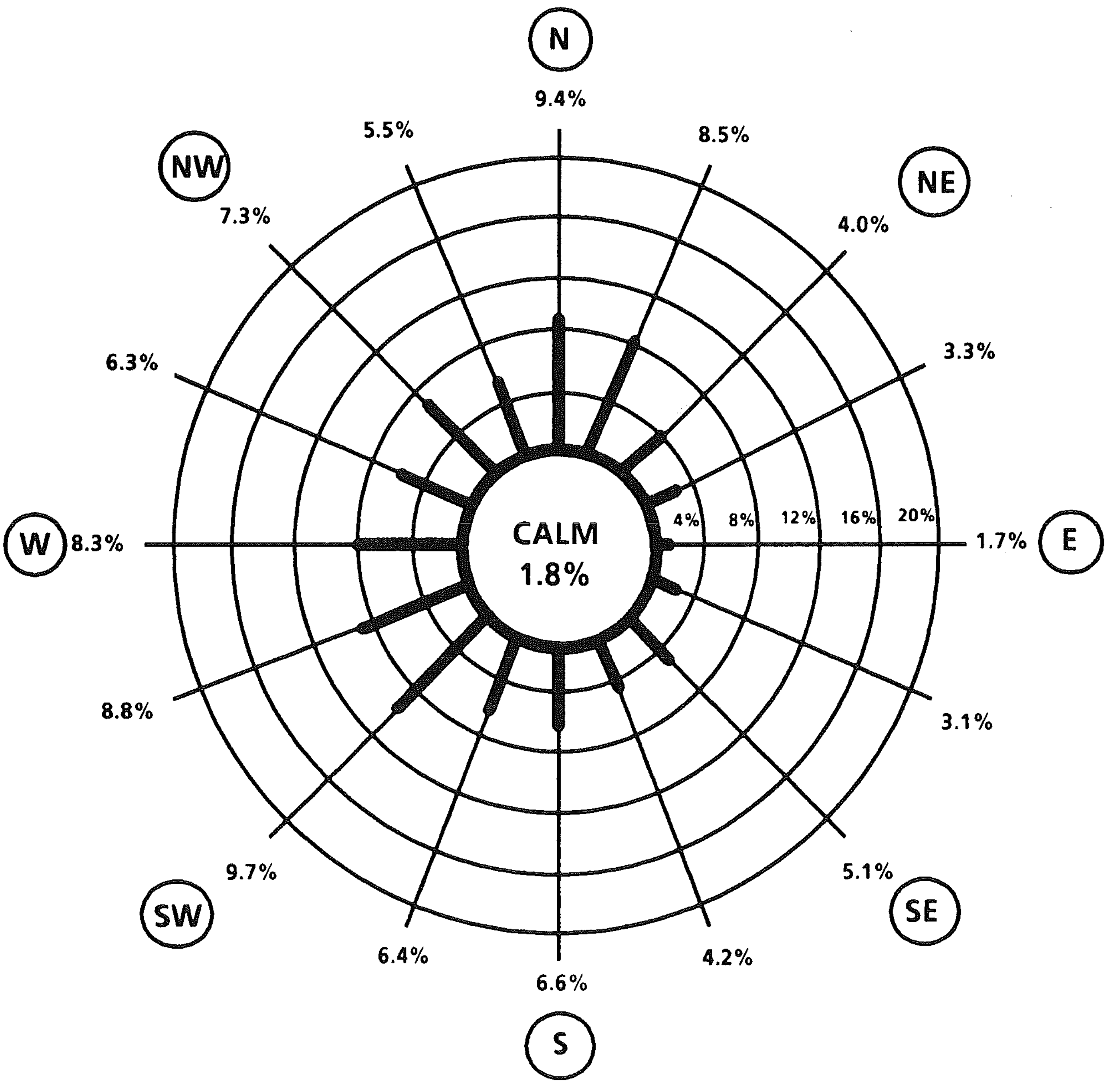
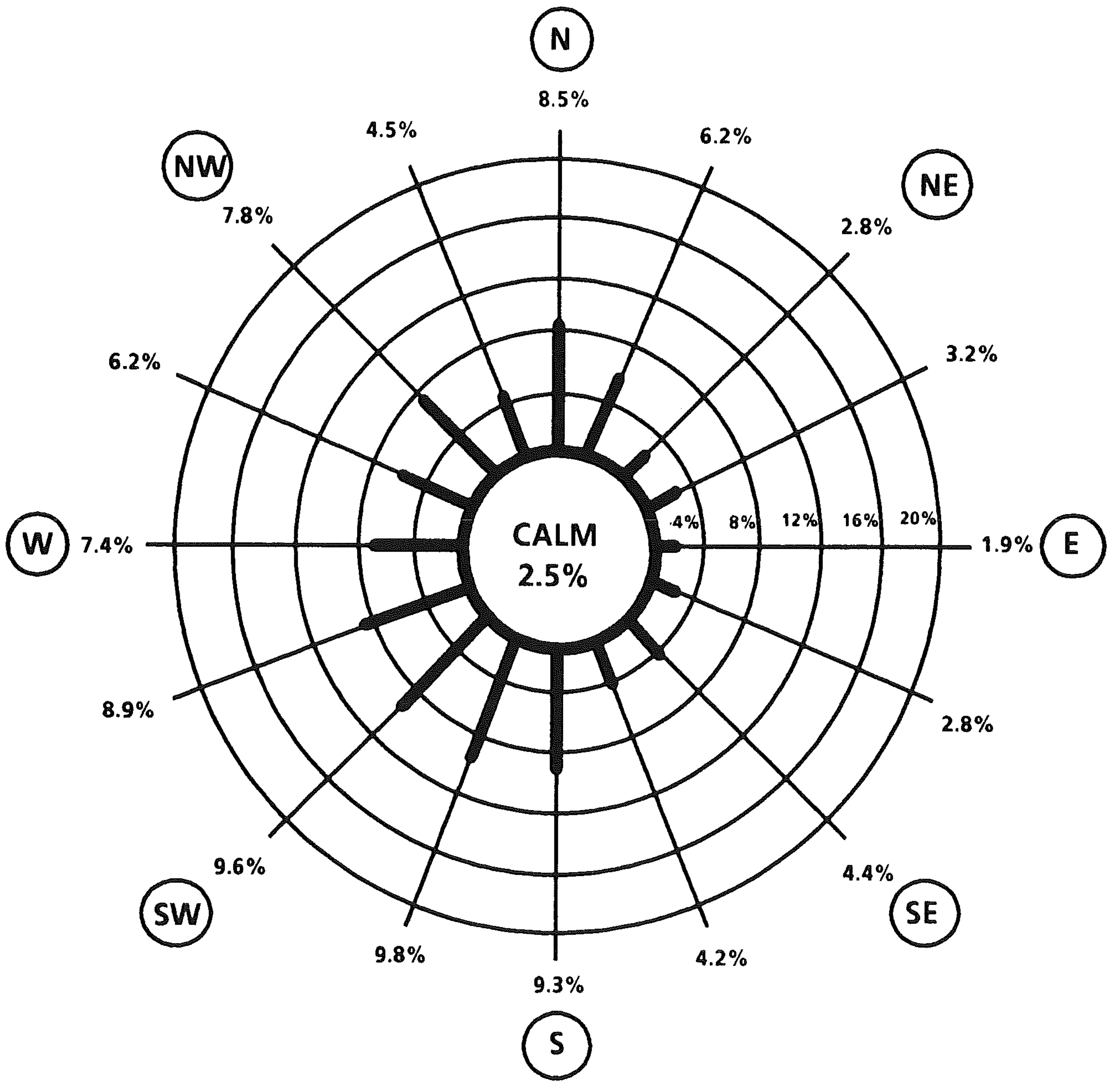


FIGURE 9-4

ANNUAL WIND ROSE FOR 1990
NEWARK INTERNATIONAL AIRPORT
NEWARK, NEW JERSEY



X. ATTAINMENT AND NON-ATTAINMENT OF NAAQS IN CONNECTICUT'S AQCR'S

The attainment status designations for Connecticut's four Air Quality Control Regions (AQCR's, see Figure 10-1) with regard to the National Ambient Air Quality Standards (NAAQS) have been determined for 1990 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). Table 10-1 shows the attainment status of each AQCR by pollutant. The AQCR's are classified as attainment, nonattainment or unclassifiable. These classifications conform to federal EPA guidelines and were applied in each case only after federal approval was granted. The federal EPA classifies an AQCR as attainment for a particular pollutant when all standards for the pollutant are attained (i.e., short term, long term, primary and secondary, wherever applicable). This notwithstanding, Table 10-1 contains the AQCR classifications with respect to each relevant short-term and long-term standard.

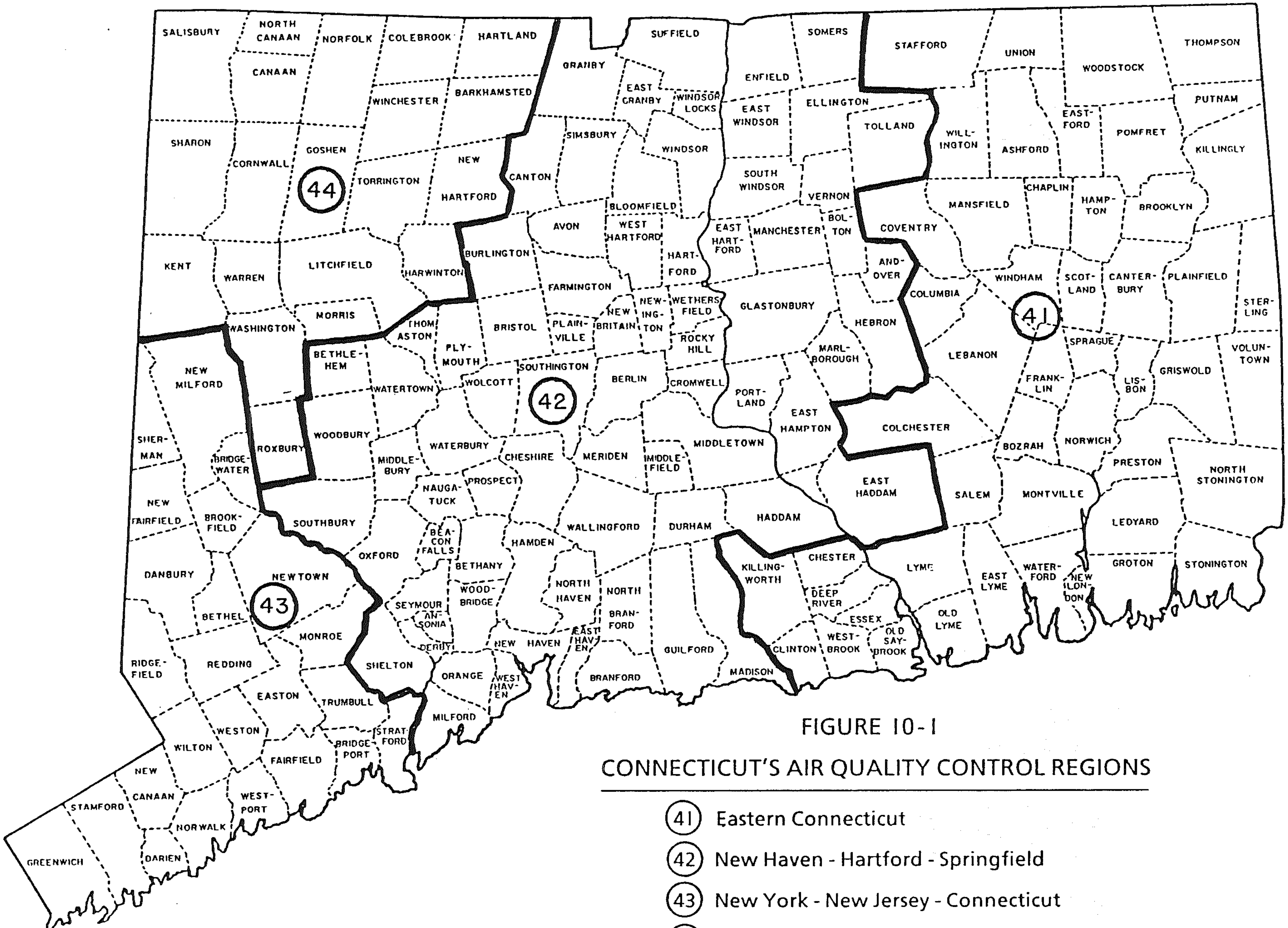


FIGURE 10-1

CONNECTICUT'S AIR QUALITY CONTROL REGIONS

(41) Eastern Connecticut
(42) New Haven - Hartford - Springfield
(43) New York - New Jersey - Connecticut
(44) Northwestern Connecticut

TABLE 10-1

CONNECTICUT'S COMPLIANCE BY AQCR WITH THE NAAQS IN 1990

Pollutant	Primary or Secondary	NAAQS	AQCR 41	AQCR 42	AQCR 43	AQCR 44
PM_{10}	Both	Annual	A	X	A	A
	Both	24-Hour	A	X	A	A
SO_2	Primary	Annual	A	A	A	A
		24-Hour	A	A	A	A
	Secondary	3-Hour	A	A	A	A
Ozone	Both	1-Hour	X	X	X	X
NO_2	Both	Annual	A	A	A	A
CO	Both	1-Hour	A	A	A	A
		8-Hour	U	X	X	U
Lead	Both	3-Month	A	A	A	A

X = Nonattainment
U = Unclassifiable
A = Attainment

XI. 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 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 and probe siting. 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 National Air Monitoring Stations (NAMS) networks. 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 1990, Connecticut maintained two co-located PM_{10} monitors (New Haven 123 and Waterbury 123) and one co-located lead monitor (New Haven 018).

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 11-1 lists methods used in Connecticut's network in 1990 which were on the EPA-approved list as of December 12, 1989. 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 usually includes a desired spatial scale of representativeness. The spatial scales of representativeness are specified in the regulations for all pollutants and monitoring objectives. The 1990 SLAMS and NAMS networks in Connecticut are presented and described in Table 11-2.

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 11-3. 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 11-1

U. S. EPA-APPROVED MONITORING METHODS USED IN CONNECTICUT IN 1990

Pollutant	Monitoring Methods		
	Reference Manual	Reference Automated	Equivalent Automated
PM_{10}	Wedding & Associates Critical Flow Hi-vol		
SO_2			Thermo Electron 43 (0.5)
O_3			DASIBI 1008-RS (0.5)
CO		Thermo Electron 48 (50)	
NO_2		Thermo Electron 14 B/E (0.5)	
Lead	High Volume Method Low Volume Method*		

* This is a modified reference method approved by EPA on 2/29/84.

( ) = Approved range in ppm

TABLE 11-2

1990 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})			
Ansonia	Bridgeport	004	S	Hi-Vol	Gravimetric	6th day	Population	Urban
Berlin	New Britain	002	S	Hi-Vol	Gravimetric	6th day	Population	Neighborhood
Bridgeport	Bridgeport	010	N	Hi-Vol	Gravimetric	6th day	Population	Neighborhood
Bridgeport	Bridgeport	013	S	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
Haddam	NONE	002	S	Hi-Vol	Gravimetric	6th day	Population	Regional
Hartford	Hartford	013	N	Hi-Vol	Gravimetric	6th day	Population	Neighborhood
Hartford	Hartford	014	S	Hi-Vol	Gravimetric	6th day	Population	Neighborhood
Hartford	Hartford	015	N	Hi-Vol	Gravimetric	6th day	High Concentration	Micro
Hartford	Hartford	018	S	Hi-Vol	Gravimetric	6th day	Population	Micro
Manchester	Hartford	001	S	Hi-Vol	Gravimetric	6th day	High Concentration	Neighborhood
Meriden	Meriden	002	S	Hi-Vol	Gravimetric	6th day	High Concentration	Neighborhood

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

TABLE 11-2, CONTINUED

1990 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})				
Middletown	Hartford	003	S	Hi-Vol	Gravimetric	6th day	High Concentration	Neighborhood
Milford	Bridgeport	010	S	Hi-Vol	Gravimetric	6th day	Population	Neighborhood
Naugatuck	Waterbury	001	S	Hi-Vol	Gravimetric	6th day	High Concentration	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
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
Putnam	NONE	002	S	Hi-Vol	Gravimetric	6th day	Population	Neighborhood
Stamford	Stamford	001	S	Hi-Vol	Gravimetric	6th day	High Concentration	Neighborhood
Stratford	Bridgeport	005	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
Waterford	New London/ Norwich	001	S	Hi-Vol	Gravimetric	6th day	Population	Neighborhood
West Haven	New Haven	003	S	Hi-Vol	Gravimetric	6th day	High Concentration	Middle
Willimantic	NONE	002	S	Hi-Vol	Gravimetric	6th day	High Concentration	Neighborhood

TABLE 11-2, CONTINUED

1990 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
Milford	Bridgeport	010	S	Pulsed Fluorescence	Continuous	High Concentration	Neighborhood
New Britain	New Britain	011	S	Pulsed Fluorescence	Continuous	High Concentration	Neighborhood
New Haven	New Haven	123	N	Pulsed Fluorescence	Continuous	High Concentration	Neighborhood
Stamford	Stamford	025	S	Pulsed Fluorescence	Continuous	Population	Neighborhood
Stamford	Stamford	123	S	Pulsed Fluorescence	Continuous	High Concentration	Neighborhood
Waterbury	Waterbury	008	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 11-2, CONTINUED

1990 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	Neighborhhod
E. Hartford	Hartford	003	S	Chemiluminescent	Continuous	High Concentration	Neighborhhod
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
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 11-2, CONTINUED

1990 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
					LEAD			
Bridgeport	Bridgeport	010	S	Lo-Vol	Atomic Abs.	1 month	High Concentration	Middle
E. Hartford	Hartford	004	N	Lo-Vol	Atomic Abs.	1 month	Population	Neighborhood
Hartford	Hartford	016	N	Lo-Vol	Atomic Abs.	1 month	High Concentration	Micro
New Haven	New Haven	018	S	Lo-Vol	Atomic Abs.	1 month	High Concentration	Middle
Waterbury	Waterbury	123	S	Lo-Vol	Atomic Abs.	1 month	High Concentration	Middle

TABLE 11-3

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 11-3, 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 11-3, 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 11-3, 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	3 + or -1/2	>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.

XII. 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.

XIII. 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 1989 Air Quality Summary,

  1. In Section II, on page 11, the third sentence in the first paragraph under **Annual Averages** should end with the year 1989 (not 1988).

  2. In Section II, on page 12, the second sentence in the second paragraph under **Statistical Projections** should read: "...more frequent PM_{10} sampling in 1987, 1988 and 1989..."

  3. In Section II, on page 32, Table 2-4 should show that the annual average for ammonium is 330 ng/m^3 (not 3260 ng/m^3).

  4. In Section III, on page 57, in Table 3-1, the site name for Hartford 018 should be changed from "State Ofice Building" to "Sheldon Street."

  5. In Section IV, due to last-minute changes, the deletion or renumbering of some figures was not reflected in the text:

     a. On page 76, under **Monitoring Network**, the reference to Figure 4-5 should be changed to Figure 4-3.

     b. On page 76, under **1-Hour Average**, the reference in the second paragraph to Figure 4-6 should be changed to Figure 4-4.

     c. On pages 76 and 77, under **Trends**, the two references in the second paragraph and the single reference in the third paragraph to Figure 4-7 should be changed to Figure 4-5. In addition, the reference in the third paragraph to Figure 4-8 should be changed to Figure 4-6.

  6. In Section VII, on page 108, miscalculated emissions from solid waste incineration led to erroneous conclusions regarding the trend of airborne lead concentrations. Consequently, the two paragraphs under **Trends** should be deleted and replaced by the following:

     The downward trend in airborne lead concentrations can be expected to level off at some point in the near future, 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 traveled by the population. This is due to the fact that so-called unleaded gasoline still contains a small proportion of lead.

  7. In Section XI, on page 128, the parenthetical sentence at the end of the first paragraph under **Quality Assurance** should reference Part D (not Part E).

- Regarding the 1988 Air Quality Summary,

  1. In Section VII, on page 88, for reasons explained in item 5 above, the last two paragraphs under **Trends** should be deleted and replaced by the paragraph in item 5.

2. In Section XI, on page 108, the parenthetical phrase at the end of the first paragraph under Quality Assurance should reference Part D.(not Part E).