1989

STATE OF CONNECTICUT

ANNUAL AIR QUALITY SUMMARY

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I. INTRODUCTION

The 1989 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 1989. 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 1989 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. Nevertheless, the 24-hour standards were violated because the "expected number of exceedances" for the most recent 3 years exceeded one per year at the New Haven 018 site (see Table 1-2). The annual standards, moreover, were not violated at New Haven 018 because the "expected annual mean" for the most recent 3 years at the 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 1989. 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 exceeded many times at each of the DEP ozone monitoring sites in 1989 (see Table 1-2). Consequently, the standard was violated at each site.

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 1989.

5. **CARBON MONOXIDE (CO)**

Compliance Assessment - The primary eight-hour standard of 9 ppm was exceeded at one of the five carbon monoxide monitoring sites in Connecticut during 1989. The standard was exceeded once at Hartford 017 (see Table 1-2). Two exceedances at a particular site are required for a standard to be violated. This means that the eight-hour standard was not violated at Hartford 017 in 1989. Violations of the standard had occurred at Hartford 017 since 1984.

There were no exceedances and, therefore, no violations of the primary one-hour standard of 35 ppm at any carbon monoxide monitoring site in 1989.

6. LEAD (Pb)

Compliance Assessment - The primary and secondary ambient air quality standard for lead is 1.5 μg/m³, 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 1989.

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 1989 consisted of the following:

- 44 Particulate matter (PM_{10}) hi-vol samplers
- 4 Particulate matter (PM_{10}) analyzers
- 2 Lead hi-vol samplers
- 6 Lead lo-vol samplers
- 18 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 1989 is available from the Department of Environmental Protection, Bureau of Air Management, Ambient Monitoring Section, 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 1989, Connecticut reported the PM_{10} PSI for the towns of Bridgeport, Danbury, Greenwich, Groton, Hartford, Meriden, Milford, New Britain, New Haven, Norwalk, Norwich, Stamford, Wallingford, and Waterbury; 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. You can also reach a DEP representative with the same information at 566-5599. This information is also available to the public during weekday afternoons 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)

Duplicate strips are cut from the hi-vol sampler filters and individually analyzed for lead. The resulting concentration values are compared 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} and Lead)

Accuracy for PM_{10} and lead 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} and lead network samplers are audited each quarter.

b. **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 1989 BASED ON MEASURED CONCENTRATIONS

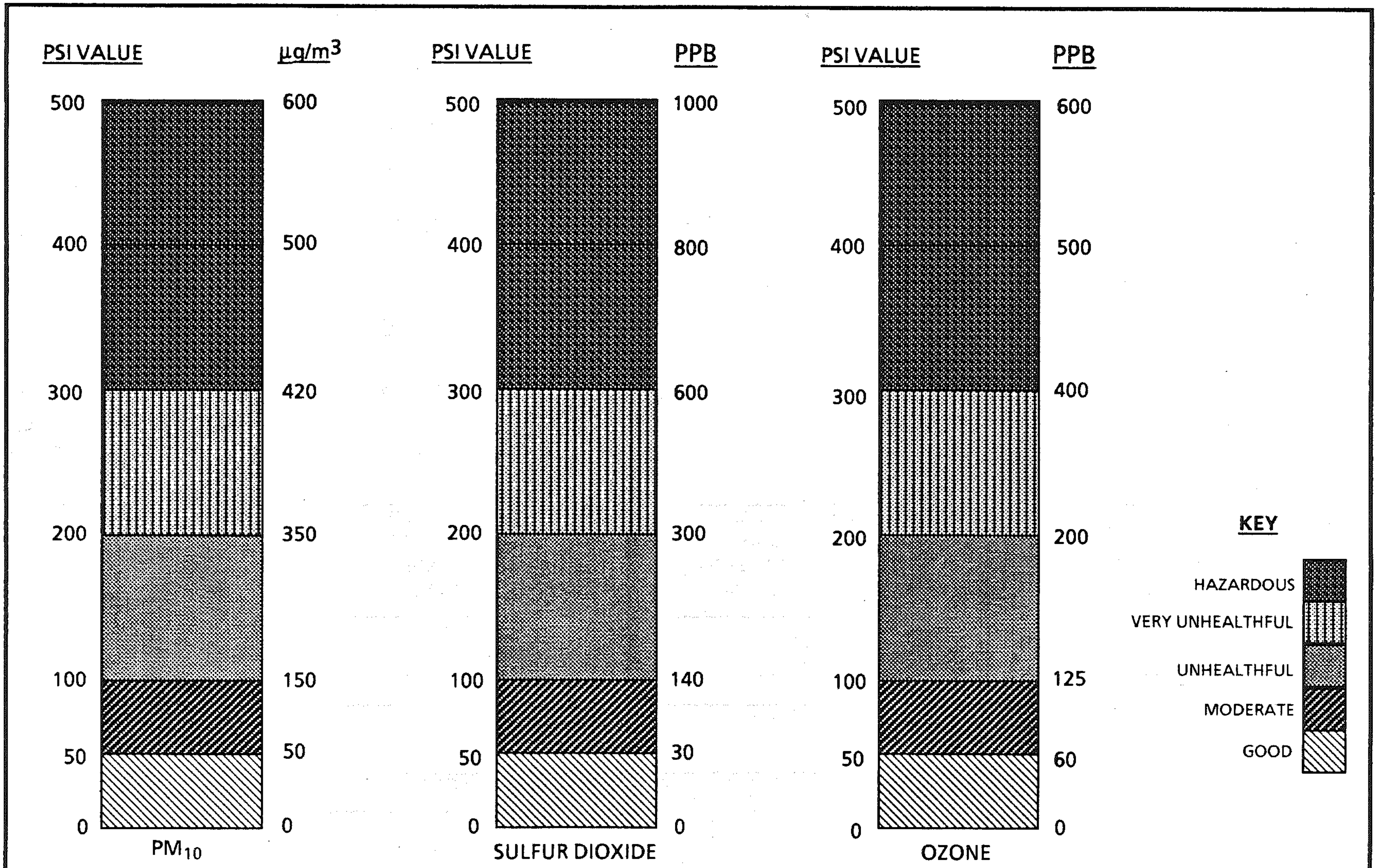
		OZONE		CARBON MONOXIDE		PM10	
		Level Exceeding 1-Hour Standard		Level Exceeding 8-Hour Standard		Level Exceeding 24-Hour Standard	
TOWN	SITE	Highest Observed Level (ppm)	Number of Days Standard Exceeded	Highest Observed Level 8-Hour (ppm)	Number of Times Standard Exceeded	Highest Observed Level (µg/m3)	Number of Times Standard Exceeded
Bridgeport	123	0.156	4	-	-	-	-
Danbury	123	0.134	2	-	-	-	-
East Hartford	003	0.166	5	-	-	-	-
Greenwich	017	0.187	7	-	-	-	-
Groton	008	0.145	6	-	-	-	-
Hartford	017	-	-	9.6	1	-	-
Madison	002	0.149	4	-	-	-	-
Middletown	007	0.172	5	-	-	-	-
New Haven	018	-	-	-	-	274[a]	3[a,b]
New Haven	123	0.156	3	-	-	-	-
Stafford	001	0.159	3	-	-	-	-
Stratford	007	0.202	11	-	-	-	-

- : The pollutant is not monitored at the site.

a During the period 1987-1989 inclusive.
b The number of times the standard is exceeded is used to calculate the "expected number of exceedances" which is 7.9.

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 risks of adverse effects associated with deposition of ambient fine and coarse particles in the thorax (tracheobronchial and alveolar regions of the respiratory tract) are markedly greater than for deposition in the extrathoracic (head) region. Maximum particle penetration to the thoracic regions occurs during oronasal or mouth breathing.

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 1989 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. However, the 24-hour standards were violated because the "expected number of exceedances" for the most recent 3 years exceeded one per year at the New Haven 018 site. The annual standards were 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 1989, 44 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 1989 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, Hartford 015/East Hartford 004, Hartford 016, New Haven 018 and Waterbury 123 (see Figure 7-3 in section VII. Lead).

Precision and Accuracy - Precision checks were conducted at two PM_{10} sampling sites which had co-located samplers. On the basis of 64 precision checks, the 95% probability limits for precision ranged from -8% to +1%. Accuracy is based on air flow through the monitor. The 95% probability limits for accuracy, based on 42 audits conducted on the PM_{10} monitoring system network, ranged from -7% to +8%. (See section I.D. of this Air Quality Summary for a discussion of precision and accuracy.)

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

Of the 44 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 (39 sites) was installed after the first calendar quarter of 1988.

A summary of annual average PM_{10} data for 1987 -1989 is presented in Table 2-1. This table also includes an indication of whether the aforementioned EPA minimum sampling criteria were met at each site for each year. If the sampling was insufficient to meet the EPA criteria, an asterisk appears next to the number of samples.

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

The statistical predictions of the number of days that would have seen an exceedance of the level of the 24-hour standards are based on the assumption of a lognormal distribution of the data. They indicate that more frequent PM_{10} sampling in 1986, 1987 and 1988 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 µg/m³ 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 µg/m³, 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 µg/m³, 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 µg/m³, 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 µg/m³, 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 40 sites that met the minimum sampling criteria in 1989. The results for the years 1987 and 1988 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 level of the primary and secondary 24-hour standards in 1989.

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 1989, there would have been one such site. The results for 1987 and 1988 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 and Waterbury 123. The 24-hour standards were violated at New Haven 018, where the "expected number of exceedances" of the 150 µg/m³ level of the 24-hour standards was determined to be greater 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 1989 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 1989. 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 50% 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. 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.

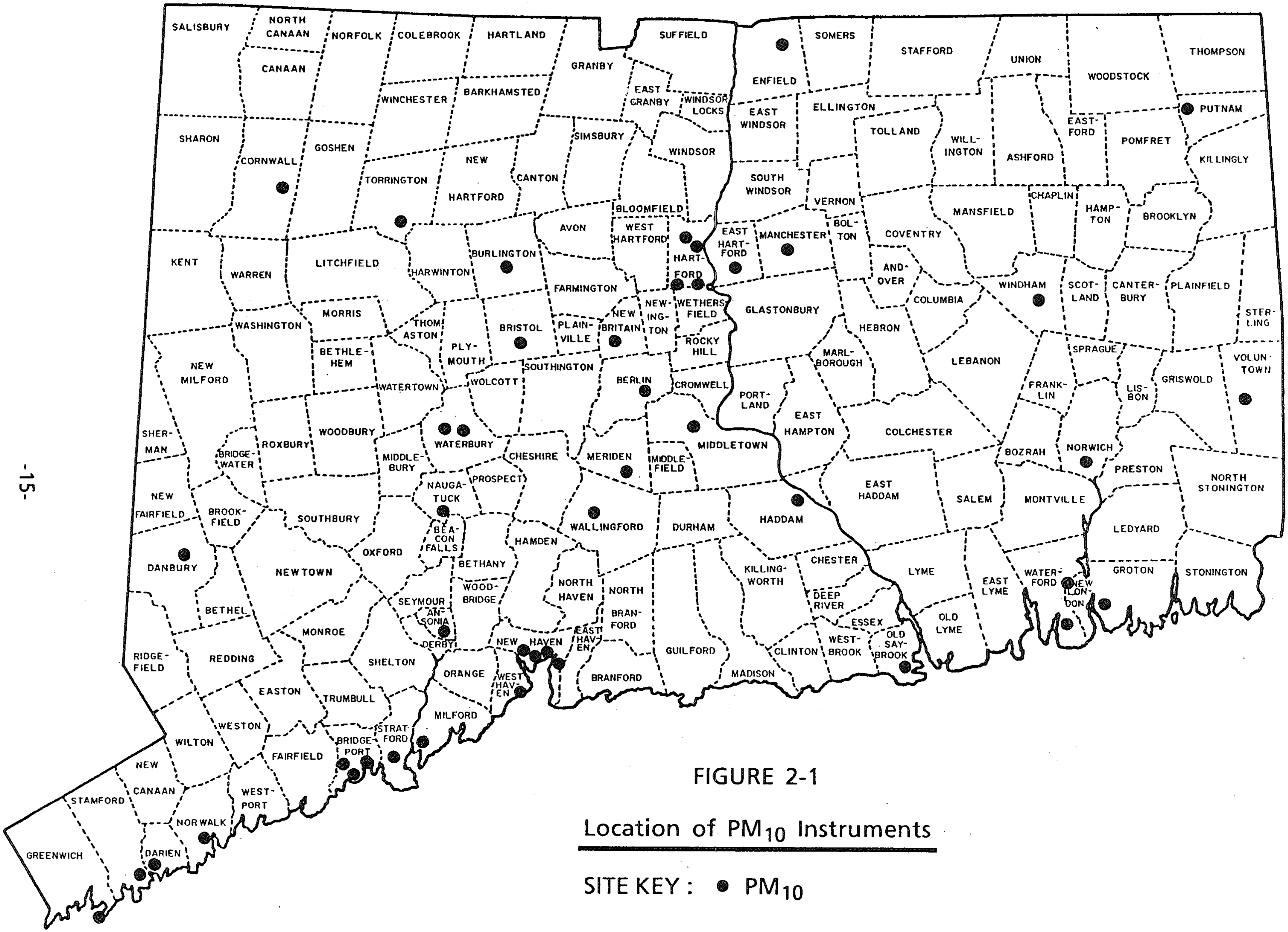


FIGURE 2-1

Location of PM_{10} Instruments

SITE KEY : ● PM_{10}

TABLE 2-1

1987-1989 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		
BERLIN	002	1989	59	22.4	19.9	24.9	10.325		
BRIDGEPORT	010	1987	59	30.6	27.4	33.7	13.190		
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	013	1988	33*	27.5	22.4	32.6	15.032		
BRIDGEPORT	013	1989	57	26.9	23.6	30.1	13.412		
BRIDGEPORT	014	1988	10*	33.1	27.4	38.8	8.031		
BRIDGEPORT	014	1989	59	36.5	33.0	40.0	14.737		
BRISTOL	001	1988	29*	22.9	18.7	27.2	11.730		
BRISTOL	001	1989	60	22.9	20.5	25.2	9.936		
BURLINGTON	001	1988	44*	17.7	13.6	21.8	14.312		
BURLINGTON	001	1989	59	15.2	13.5	16.9	7.171		
CORNWALL	005	1988	17*	10.8	7.4	14.2	6.723		
CORNWALL	005	1989	60	15.1	13.1	17.1	8.587		
DANBURY	123	1988	36*	25.8	21.2	30.4	14.363		
DANBURY	123	1989	57	25.4	22.6	28.3	11.743		
DARIEN	001	1989	45*	28.7	25.0	32.4	13.200		
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		
ENFIELD	005	1988	27*	20.3	16.6	24.1	9.832		
ENFIELD	005	1989	58	19.6	17.5	21.8	8.784		

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

TABLE 2-1, CONTINUED

1987–1989 PM10 ANNUAL AVERAGES AND STATISTICAL PROJECTIONS

TOWN NAME	SITE	YEAR	SAMPLES	ARITHMETIC MEAN	95-PCT-LIMITS LOWER	95-PCT-LIMITS UPPER	STANDARD DEVIATION	PREDICTED DAYS OVER 150 UG/M3	MEASURED DAYS OVER 150 UG/M3
GREENWICH	017	1988	34*	24.9	19.4	30.3	16.432		
GREENWICH	017	1989	56	21.4	18.7	24.1	11.003		
GROTON	006	1988	28*	21.6	17.2	26.1	11.860		
GROTON	006	1989	59	20.0	17.7	22.3	9.689		
HADDAM	002	1988	26*	17.6	13.8	21.4	9.688		
HADDAM	002	1989	59	18.5	16.4	20.5	8.468		
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	014	1988	25*	21.6	18.1	25.2	8.984		
HARTFORD	014	1989	58	24.4	21.4	27.4	12.352		
HARTFORD	015	1987	59	35.2	31.4	39.0	15.746		
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	018	1988	7*	25.7	16.4	35.0	10.124		
HARTFORD	018	1989	60	28.0	25.1	30.9	12.232		
MANCHESTER	001	1988	26*	19.6	15.6	23.5	10.150		
MANCHESTER	001	1989	58	21.2	18.8	23.5	9.687		
MERIDEN	002	1988	25*	22.7	18.7	26.7	10.027		
MERIDEN	002	1989	48*	24.3	21.4	27.2	10.722		
MIDDLETOWN	003	1988	26*	23.0	18.7	27.3	11.019		
MIDDLETOWN	003	1989	57	23.2	20.4	25.9	11.154		
MILFORD	010	1988	9*	19.1	14.6	23.6	5.934		
MILFORD	010	1989	58	22.0	19.6	24.4	9.861		

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

TABLE 2-1, CONTINUED

1987-1989 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
NAUGATUCK	001	1988	29*	25.8	21.1	30.5	12.957		
NAUGATUCK	001	1989	60	26.4	23.5	29.2	12.146		
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 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	018	1987	157	57.9	54.0	61.8	33.257	5	3
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	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	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 LONDON	004	1989	42*	21.7	18.6	24.8	10.615		
NORWALK	014	1988	13*	33.9	29.2	38.6	7.956		
NORWALK	014	1989	57	37.4	33.7	41.0	14.853		
NORWICH	002	1988	29*	24.4	19.9	28.8	12.138		
NORWICH	002	1989	60	23.5	21.0	25.9	10.509		
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		
STAMFORD	001	1988	25*	24.2	18.5	29.9	14.319		
STAMFORD	001	1989	59	26.0	23.0	29.0	12.567		

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

TABLE 2-1, CONTINUED

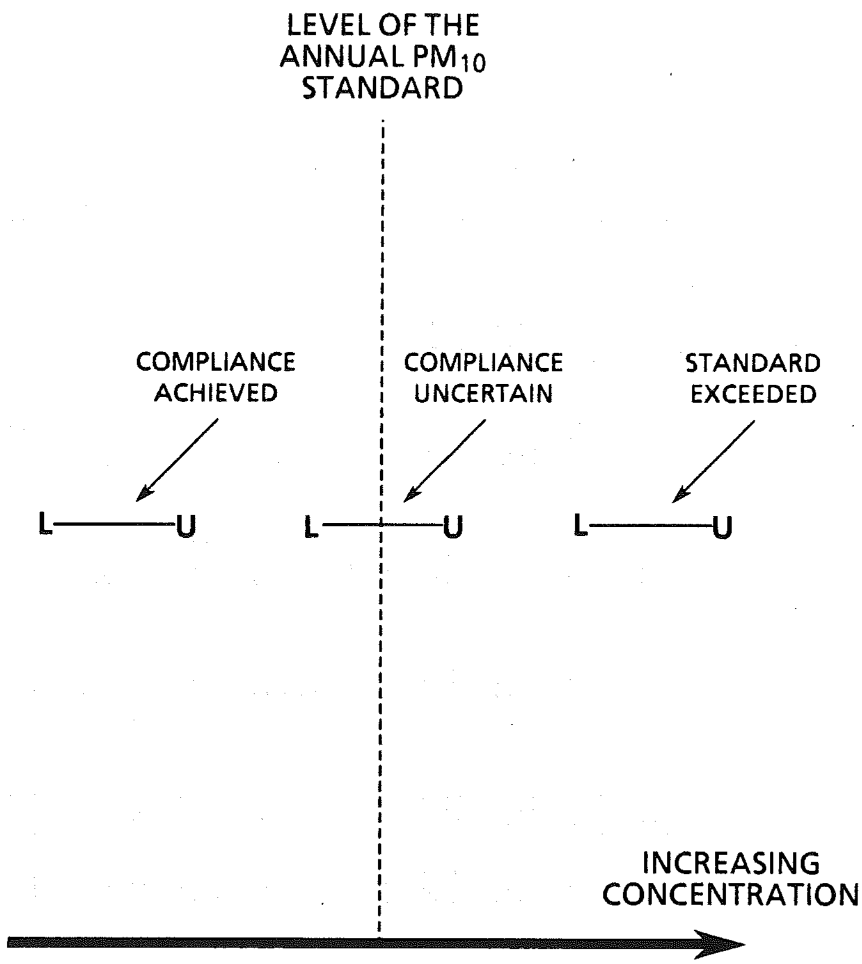
1987-1989 PM10 ANNUAL AVERAGES AND STATISTICAL PROJECTIONS

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
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		
TORRINGTON	001	1988	28*	21.5	17.5	25.5	10.675		
TORRINGTON	001	1989	60	22.9	20.4	25.4	10.474		
VOLUNTOWN	001	1988	40*	16.7	13.2	20.2	11.457		
VOLUNTOWN	001	1989	56	15.3	13.4	17.3	7.947		
WALLINGFORD	006	1988	9*	24.3	17.9	30.7	8.446		
WALLINGFORD	006	1989	58	22.2	19.9	24.5	9.510		
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	123	1987	59	33.4	30.0	36.8	14.235		
WATERBURY	123	1988	57	32.9	28.5	37.4	18.257		
WATERBURY	123	1989	59	33.0	29.1	36.9	16.235		
WATERFORD	001	1988	28*	20.9	15.9	25.8	13.255		
WATERFORD	001	1989	58	17.5	15.5	19.5	8.309		
WEST HAVEN	003	1987	55	30.9	27.7	34.1	12.862		
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		
WILLIMANTIC	002	1988	28*	20.5	17.2	23.7	8.736		
WILLIMANTIC	002	1989	60	21.0	18.8	23.2	9.174		

* THE NUMBER OF SAMPLES 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

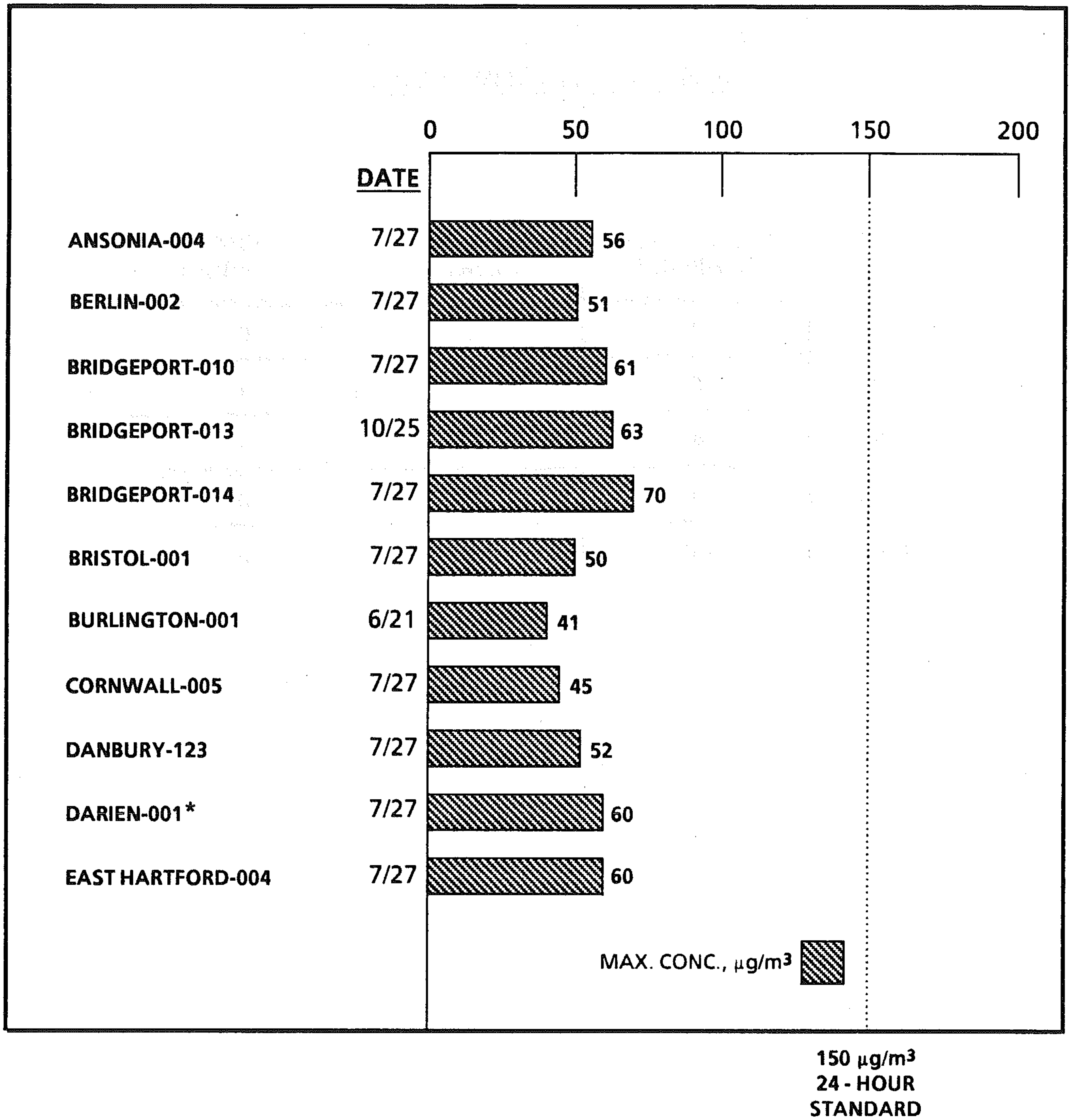
STATISTICALLY PREDICTED NUMBER OF SITES IN COMPLIANCE WITH THE LEVEL OF THE ANNUAL PM10 STANDARDS*

	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

* 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

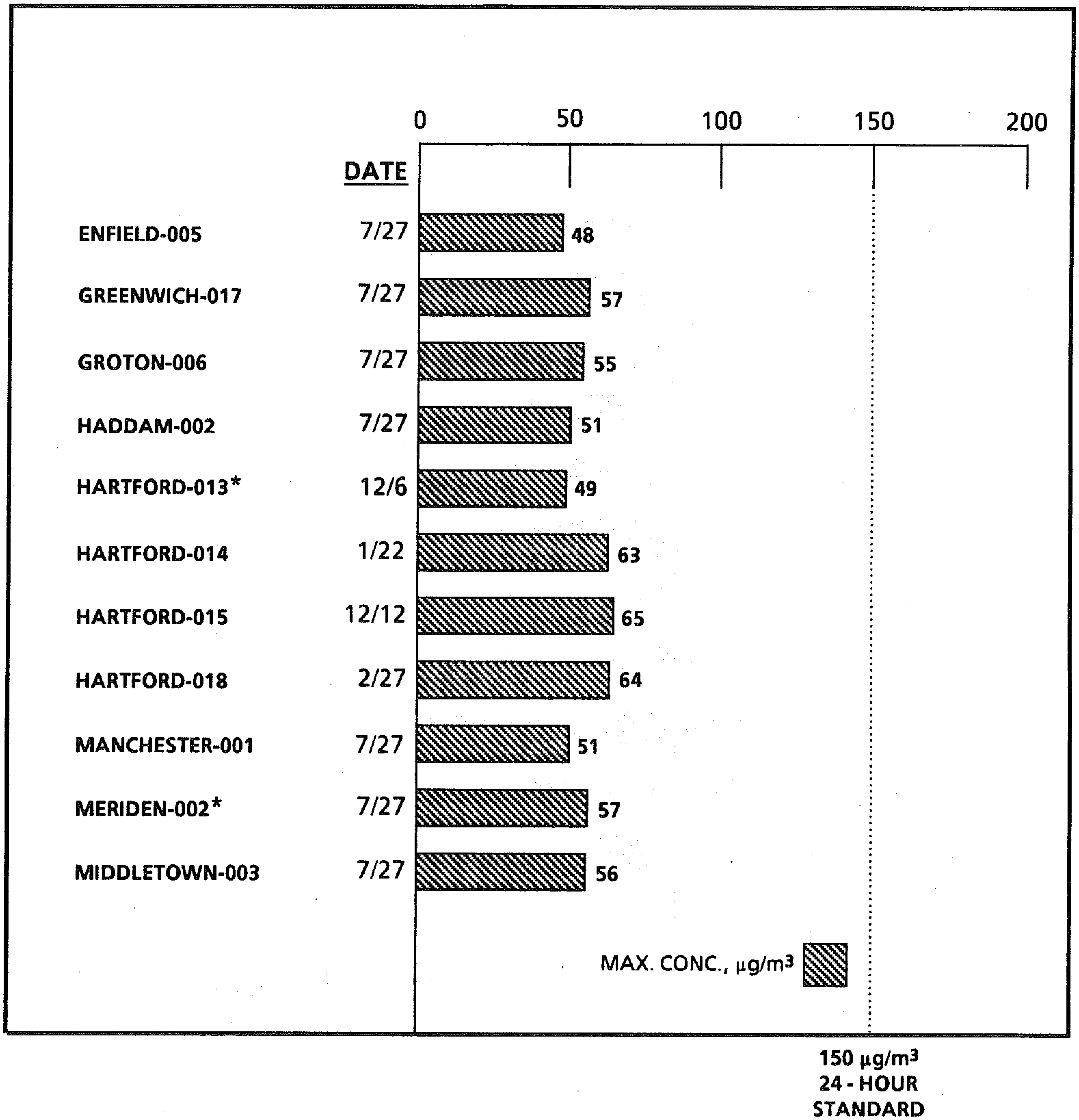
1989 MAXIMUM 24-HOUR PM10 CONCENTRATIONS



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

FIGURE 2-3, continued

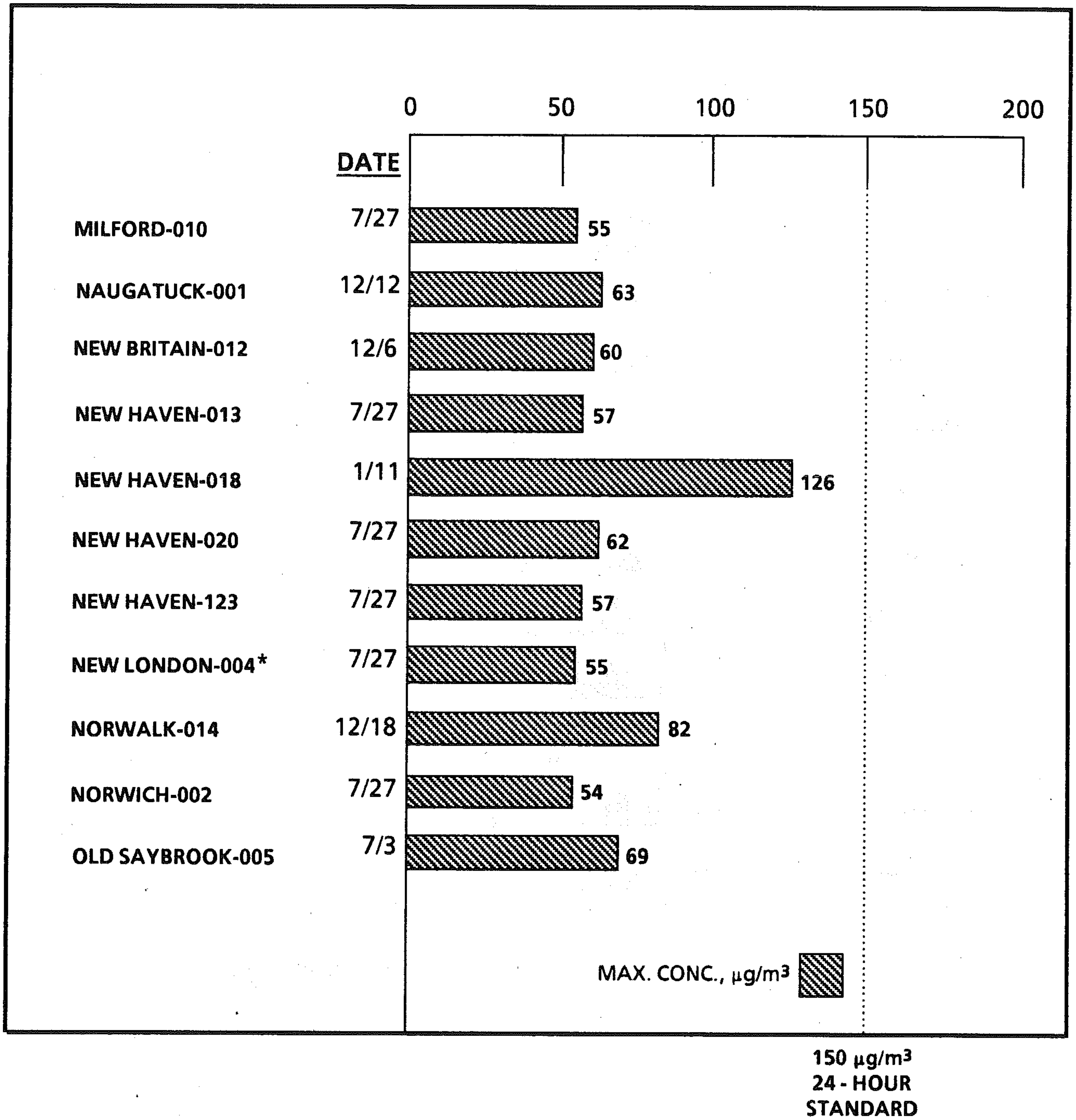
1989 MAXIMUM 24-HOUR PM10 CONCENTRATIONS



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

FIGURE 2-3, continued

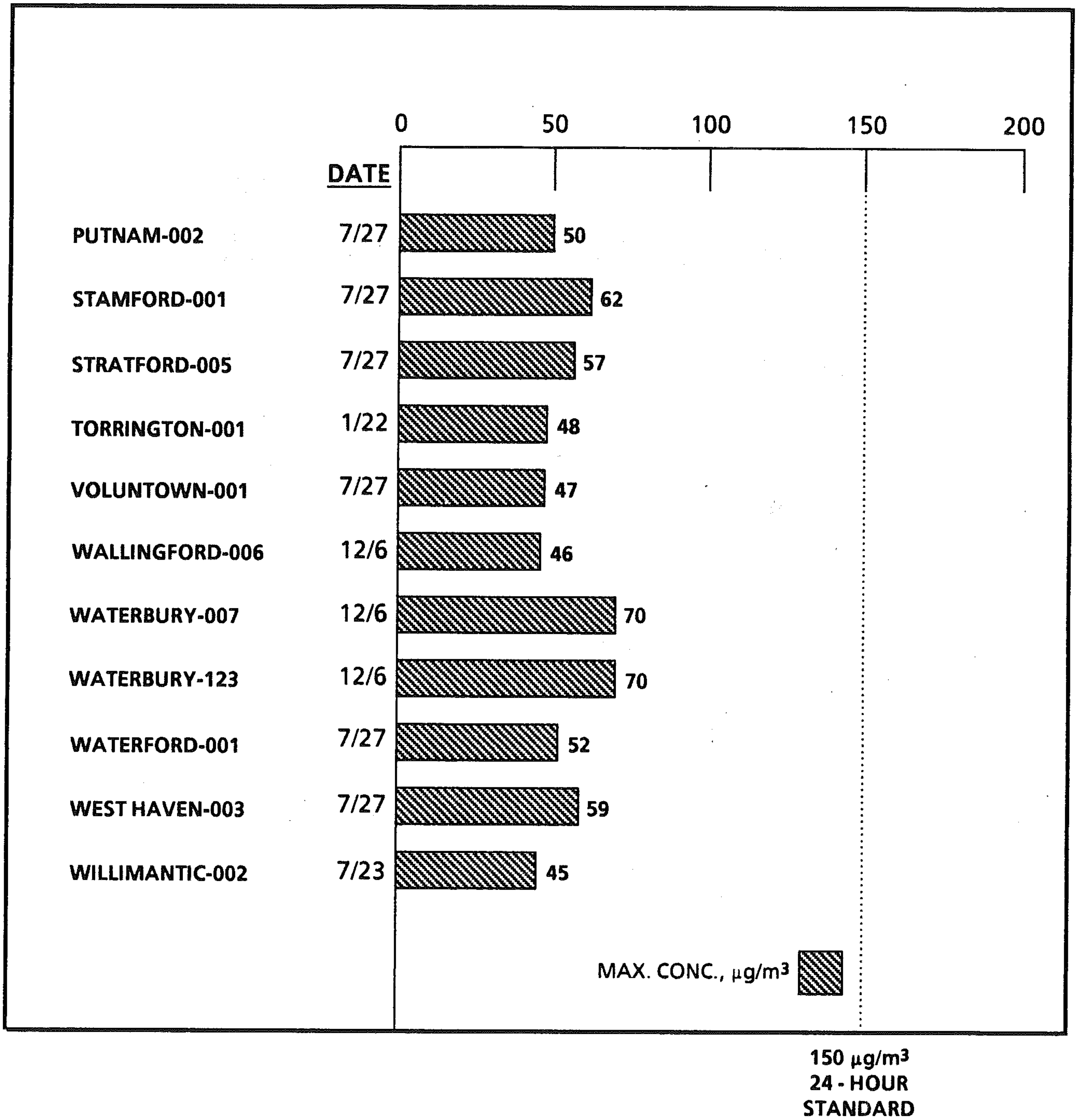
1989 MAXIMUM 24-HOUR PM10 CONCENTRATIONS



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

FIGURE 2-3, continued

1989 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

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

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

TABLE 2-4

MONTHLY CHEMICAL CHARACTERIZATION OF 1989 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	<0.1
CADMIUM	1.2	1.2	1.0	0.9	0.9	1.8	1.2	1.0	0.7	1.0	0.9	1.3	1.1
CHROMIUM	7	7	13	5	6	4	6	5	3	3	5	3	6
COPPER	30	20	40	20	20	20	30	20	20	10	20	20	20
IRON	1330	1300	2050	1300	1380	1460	1700	1180	1170	820	1010	870	1300
LEAD	70	50	100	40	50	60	170	40	30	30	40	30	60
MANGANESE	26	23	35	18	19	18	14	11	11	11	15	14	18
NICKEL	34	33	32	18	18	19	16	12	13	8	15	21	20
VANADIUM	70	50	80	30	20	30	20	20	20	10	30	40	40
ZINC	230	130	170	110	110	100	110	90	90	60	110	80	120
WATER SOLUBLES (ng/m³)													
NITRATE	3340	3970	3940	3420	1910	2570	2890	1610	3480	2550	4130	3750	3130
SULFATE	8970	8380	9040	7310	9010	10,850	9460	7790	6820	5810	6670	6790	8080
AMMONIUM	600	530	620	290	490	630	150	210	10	80	580	670	410
TSP (µg/m³)	71	66	95	53	65	59	58	51	48	35	48	52	58

TABLE 2-4, continued

MONTHLY CHEMICAL CHARACTERIZATION OF 1989 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/m^3)													
BERYLLIUM										<0.1	<0.1	<0.1	
CADMIUM										1.1	0.7	0.7	
CHROMIUM										5	3	3	
COPPER										10	10	10	
IRON										980	620	690	
LEAD										20	20	10	
MANGANESE										16	10	12	
NICKEL										13	8	10	
VANADIUM										10	10	20	
ZINC										80	70	70	
WATER SOLUBLES (ng/m^3)													
NITRATE										2150	2140	1770	
SULFATE										6950	5290	6080	
AMMONIUM										130	1500	220	
TSP (µg/m^3)										48	36	48	

TABLE 2-4, continued

MONTHLY CHEMICAL CHARACTERIZATION OF 1989 LO-VOL TSP

TOWN	AREA	SITE
Hartford	**0420**	**015**

	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								
CADMIUM	0.3	0.7	0.8	1.0	1.8								
CHROMIUM	2	3	3	5	4								
COPPER	3	4	10	10	20								
IRON	510	830	1170	1340	1440								
LEAD	10	20	20	50	40								
MANGANESE	8	14	18	17	20								
NICKEL	3	4	3	7	9								
VANADIUM	10	4	4	10	10								
ZINC	20	40	40	70	110								
WATER SOLUBLES (ng/m^3)													
NITRATE	290	850	600	1720	2490								
SULFATE	3490	3370	4520	5300	7300								
AMMONIUM	10	10	10	20	50								
TSP ($\mu g/m^3$)	25	45	54	48	61								

TABLE 2-4, continued

MONTHLY CHEMICAL CHARACTERIZATION OF 1989 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	<0.1	<0.1	<0.1	<0.1
CADMIUM	0.4	1.0	1.9	1.1	0.8	1.5	0.8	0.6	0.8	1.3	0.9	1.3	1.0
CHROMIUM	3	7	6	4	5	6	7	5	5	5	4	4	5
COPPER	10	20	20	20	20	20	20	30	20	30	20	20	20
IRON	950	1790	2040	1700	1840	2000	1700	1980	1710	1430	1280	1120	1630
LEAD	20	40	40	50	50	50	50	120	140	40	40	40	60
MANGANESE	16	38	36	22	25	24	20	24	17	22	19	20	24
NICKEL	8	22	14	11	10	11	10	9	6	8	10	15	11
VANADIUM	10	30	30	10	10	10	10	10	10	10	20	30	20
ZINC	50	110	90	160	130	120	100	120	100	100	100	100	110
WATER SOLUBLES (ng/m³)													
NITRATE	780	3340	2210	2440	2410	1220	2100	960	3110	2820	3290	2760	2290
SULFATE	4320	8390	6940	6770	7780	9620	9450	8130	6440	6470	6660	6570	7300
AMMONIUM	10	760	50	50	90	270	130	200	10	370	380	370	220
TSP (µg/m³)	37	94	95	61	80	66	59	57	52	54	58	65	65

TABLE 2-4, continued

MONTHLY CHEMICAL CHARACTERIZATION OF 1989 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/m³)													
BERYLLIUM	<0.1	<0.1	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1
CADMIUM	1.1	1.1	0.8		1.0	1.0	0.9	0.5	0.4	2.8			1.1
CHROMIUM	22	9	7		6	6	9	6	2	19			10
COPPER	50	50	40		80	100	60	30	70	80			60
IRON	6110	7310	6850		3940	5230	5940	3220	1010	6240			5090
LEAD	100	100	80		60	70	80	40	20	90			70
MANGANESE	75	81	72		44	52	45	21	7	63			51
NICKEL	36	26	11		20	15	13	5	3	23			17
VANADIUM	60	40	30		40	30	20	10	10	20			30
ZINC	200	180	120		120	180	180	120	40	290			160
WATER SOLUBLES (ng/m³)													
NITRATE	2090	1910	870		3000	3330	2690	1350	1140	2430			2090
SULFATE	8510	6180	7660		8130	9010	6880	3900	4610	6330			6800
AMMONIUM	570	230	4		10	100	10	4	5	740			190
TSP (µg/m³)	210	163	213		107	126	135	55	72	98			131

TABLE 2-4, continued

MONTHLY CHEMICAL CHARACTERIZATION OF 1989 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	<0.1
CADMIUM	1.7	0.7	1.1	2.1	2.6	2.0		1.3	1.7	1.7	1.9	1.3	1.6
CHROMIUM	23	8	8	14	8	12		15	17	26	13	18	15
COPPER	50	20	30	40	40	20		100	70	60	60	60	60
IRON	4000	1650	2000	1900	1320	970		3450	3490	3400	2670	2530	2490
LEAD	70	30	40	40	40	30		50	50	110	40	50	60
MANGANESE	49	30	39	23	19	13		46	72	76	51	51	43
NICKEL	28	9	12	15	10	8		9	9	11	10	16	12
VANADIUM	10	10	30	20	10	10		10	10	20	20	30	20
ZINC	270	80	140	160	200	140		210	180	260	170	170	180
WATER SOLUBLES (ng/m³)													
NITRATE	2860	1610	2560	2420	1560	1040		1430	3100	3120	2760	3290	2340
SULFATE	9220		7400	9100	8040	9300			7810	6330	7450	7890	8060
AMMONIUM	790	870	110	100	150	110		150	4	70	180	1050	3260
TSP (µg/m³)	116	76	93	61	63	48		93	95	110	100	125	89

TABLE 2-5

1989 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
ANSONIA-004 (0058)	PM10	56	53	46	44	44	42	40	40	39	38
	DATE	7/27/89	12/ 6/89	12/12/89	3/17/89	1/22/89	6/27/89	6/21/89	11/ 6/89	2/27/89	10/31/89
METEOROLOGICAL SITE	DIR (DEG)	240	230	10	210	230	250	100	220	250	50
NEWARK	VEL (MPH)	6.8	1.6	8.1	11.1	8.3	7.5	5.0	5.0	9.6	4.0
	SPD (MPH)	9.1	3.6	8.2	14.1	9.5	10.4	6.6	6.8	10.6	8.9
	RATIO	0.746	0.453	0.986	0.791	0.873	0.721	0.753	0.736	0.899	0.449
METEOROLOGICAL SITE	DIR (DEG)	220	200	20	170	190	230	130	200	300	30
BRADLEY	VEL (MPH)	6.2	4.2	4.1	9.3	7.8	4.5	2.0	5.0	4.6	3.1
	SPD (MPH)	7.8	6.8	4.6	12.4	9.3	6.0	5.0	6.8	5.8	4.6
	RATIO	0.793	0.625	0.894	0.752	0.836	0.743	0.404	0.738	0.808	0.673
METEOROLOGICAL SITE	DIR (DEG)	240	270	50	230	250	240	100	240	260	100
BRIDGEPORT	VEL (MPH)	5.6	1.9	3.9	7.0	6.2	5.7	6.0	6.9	4.6	10.0
	SPD (MPH)	5.8	4.5	4.2	7.2	6.2	5.8	6.0	7.8	4.7	10.6
	RATIO	0.972	0.416	0.924	0.969	0.999	0.996	0.992	0.889	0.967	0.936
METEOROLOGICAL SITE	DIR (DEG)	260	230	320	260	260	290	240	240	290	130
WORCESTER	VEL (MPH)	7.2	4.8	5.3	9.2	10.7	5.0	3.7	7.6	7.0	3.8
	SPD (MPH)	8.8	5.3	5.3	13.4	12.1	6.0	4.9	7.8	8.1	3.9
	RATIO	0.819	0.903	0.991	0.687	0.885	0.834	0.752	0.974	0.870	0.971
BERLIN-002 (0059)	PM10	51	48	46	42	37	36	36	34	34	33
	DATE	7/27/89	12/12/89	12/24/89	12/ 6/89	6/21/89	6/27/89	10/31/89	2/27/89	2/21/89	7/ 3/89
METEOROLOGICAL SITE	DIR (DEG)	240	10	10	230	100	250	50	250	210	90
NEWARK	VEL (MPH)	6.8	8.1	12.0	1.6	5.0	7.5	4.0	9.6	2.6	4.3
	SPD (MPH)	9.1	8.2	12.5	3.6	6.6	10.4	8.9	10.6	7.0	7.5
	RATIO	0.746	0.986	0.963	0.453	0.753	0.721	0.449	0.899	0.374	0.578
METEOROLOGICAL SITE	DIR (DEG)	220	20	350	200	130	230	30	300	170	120
BRADLEY	VEL (MPH)	6.2	4.1	5.0	4.2	2.0	4.5	3.1	4.6	4.4	3.1
	SPD (MPH)	7.8	4.6	5.6	6.8	5.0	6.0	4.6	5.8	6.9	6.5
	RATIO	0.793	0.894	0.894	0.625	0.404	0.743	0.673	0.808	0.635	0.473
METEOROLOGICAL SITE	DIR (DEG)	240	50	30	270	100	240	100	260	210	130
BRIDGEPORT	VEL (MPH)	5.6	3.9	7.8	1.9	6.0	5.7	10.0	4.6	5.0	6.2
	SPD (MPH)	5.8	4.2	8.1	4.5	6.0	5.8	10.6	4.7	7.8	6.2
	RATIO	0.972	0.924	0.969	0.416	0.992	0.996	0.936	0.967	0.645	0.996
METEOROLOGICAL SITE	DIR (DEG)	260	320	10	230	240	290	130	290	230	90
WORCESTER	VEL (MPH)	7.2	5.3	2.8	4.8	3.7	5.0	3.8	7.0	6.9	4.9
	SPD (MPH)	8.8	5.3	3.5	5.3	4.9	6.0	3.9	8.1	11.4	6.9
	RATIO	0.819	0.991	0.800	0.903	0.752	0.834	0.971	0.870	0.609	0.714
BRIDGEPORT-010 (0057)	PM10	61	56	56	54	50	47	46	44	40	38
	DATE	7/27/89	10/25/89	12/ 6/89	6/27/89	7/ 3/89	3/17/89	3/11/89	6/21/89	10/13/89	11/ 6/89
METEOROLOGICAL SITE	DIR (DEG)	240	10	230	250	90	210	170	100	270	220
NEWARK	VEL (MPH)	6.8	1.4	1.6	7.5	4.3	11.1	5.2	5.0	7.5	5.0
	SPD (MPH)	9.1	3.7	3.6	10.4	7.5	14.1	6.2	6.6	9.1	6.8
	RATIO	0.746	0.384	0.453	0.721	0.578	0.791	0.835	0.753	0.832	0.736
METEOROLOGICAL SITE	DIR (DEG)	220	360	200	230	120	170	190	130	270	200
BRADLEY	VEL (MPH)	6.2	3.5	4.2	4.5	3.1	9.3	6.7	2.0	4.7	5.0
	SPD (MPH)	7.8	4.6	6.8	6.0	6.5	12.4	7.9	5.0	6.6	6.8
	RATIO	0.793	0.759	0.625	0.743	0.473	0.752	0.848	0.404	0.713	0.738

TABLE 2-5, CONTINUED

1989 TEN HIGHEST 24-HOUR AVERAGE PM10 DAYS WITH WIND DATA

UNITS : MICROGRAMS PER CUBIC METER

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
METEOROLOGICAL SITE	DIR (DEG)	240	300	270	240	130	230	220	100	270	240
BRIDGEPORT	VEL (MPH)	5.6	1.4	1.9	5.7	6.2	7.0	2.8	6.0	4.5	6.9
	SPD (MPH)	5.8	3.3	4.5	5.8	6.2	7.2	3.2	6.0	4.7	7.8
	RATIO	0.972	0.412	0.416	0.996	0.996	0.969	0.897	0.992	0.941	0.889
METEOROLOGICAL SITE	DIR (DEG)	260	50	230	290	90	260	250	240	280	240
WORCESTER	VEL (MPH)	7.2	3.1	4.8	5.0	4.9	9.2	6.3	3.7	8.2	7.6
	SPD (MPH)	8.8	3.5	5.3	6.0	6.9	13.4	7.5	4.9	8.3	7.8
	RATIO	0.819	0.898	0.903	0.834	0.714	0.687	0.842	0.752	0.978	0.974
BRIDGEPORT-013 (0057)	PM10	63	61	54	53	49	49	42	41	41	38
	DATE	10/25/89	7/27/89	12/ 6/89	6/27/89	10/13/89	3/17/89	7/ 3/89	3/11/89	6/21/89	8/20/89
METEOROLOGICAL SITE	DIR (DEG)	10	240	230	250	270	210	90	170	100	230
NEWARK	VEL (MPH)	1.4	6.8	1.6	7.5	7.5	11.1	4.3	5.2	5.0	6.0
	SPD (MPH)	3.7	9.1	3.6	10.4	9.1	14.1	7.5	6.2	6.6	8.8
	RATIO	0.384	0.746	0.453	0.721	0.832	0.791	0.578	0.835	0.753	0.686
METEOROLOGICAL SITE	DIR (DEG)	360	220	200	230	270	170	120	190	130	210
BRADLEY	VEL (MPH)	3.5	6.2	4.2	4.5	4.7	9.3	3.1	6.7	2.0	6.8
	SPD (MPH)	4.6	7.8	6.8	6.0	6.6	12.4	6.5	7.9	5.0	8.2
	RATIO	0.759	0.793	0.625	0.743	0.713	0.752	0.473	0.848	0.404	0.835
METEOROLOGICAL SITE	DIR (DEG)	300	240	270	240	270	230	130	220	100	260
BRIDGEPORT	VEL (MPH)	1.4	5.6	1.9	5.7	4.5	7.0	6.2	2.8	6.0	4.8
	SPD (MPH)	3.3	5.8	4.5	5.8	4.7	7.2	6.2	3.2	6.0	4.9
	RATIO	0.412	0.972	0.416	0.996	0.941	0.969	0.996	0.897	0.992	0.986
METEOROLOGICAL SITE	DIR (DEG)	50	260	230	290	280	260	90	250	240	240
WORCESTER	VEL (MPH)	3.1	7.2	4.8	5.0	8.2	9.2	4.9	6.3	3.7	9.9
	SPD (MPH)	3.5	8.8	5.3	6.0	8.3	13.4	6.9	7.5	4.9	10.9
	RATIO	0.898	0.819	0.903	0.834	0.978	0.687	0.714	0.842	0.752	0.908
BRIDGEPORT-014 (0059)	PM10	70	69	68	67	67	63	56	55	53	52
	DATE	7/27/89	12/ 6/89	12/18/89	2/27/89	6/27/89	10/25/89	10/13/89	6/21/89	7/ 3/89	3/11/89
METEOROLOGICAL SITE	DIR (DEG)	240	230	300	250	250	10	270	100	90	170
NEWARK	VEL (MPH)	6.8	1.6	8.7	9.6	7.5	1.4	7.5	5.0	4.3	5.2
	SPD (MPH)	9.1	3.6	9.6	10.6	10.4	3.7	9.1	6.6	7.5	6.2
	RATIO	0.746	0.453	0.903	0.899	0.721	0.384	0.832	0.753	0.578	0.835
METEOROLOGICAL SITE	DIR (DEG)	220	200	310	300	230	360	270	130	120	190
BRADLEY	VEL (MPH)	6.2	4.2	7.9	4.6	4.5	3.5	4.7	2.0	3.1	6.7
	SPD (MPH)	7.8	6.8	8.8	5.8	6.0	4.6	6.6	5.0	6.5	7.9
	RATIO	0.793	0.625	0.906	0.808	0.743	0.759	0.713	0.404	0.473	0.848
METEOROLOGICAL SITE	DIR (DEG)	240	270	340	260	240	300	270	100	130	220
BRIDGEPORT	VEL (MPH)	5.6	1.9	5.1	4.6	5.7	1.4	4.5	6.0	6.2	2.8
	SPD (MPH)	5.8	4.5	5.5	4.7	5.8	3.3	4.7	6.0	6.2	3.2
	RATIO	0.972	0.416	0.932	0.967	0.996	0.412	0.941	0.992	0.996	0.897
METEOROLOGICAL SITE	DIR (DEG)	260	230	300	290	290	50	280	240	90	250
WORCESTER	VEL (MPH)	7.2	4.8	8.6	7.0	5.0	3.1	8.2	3.7	4.9	6.3
	SPD (MPH)	8.8	5.3	8.8	8.1	6.0	3.5	8.3	4.9	6.9	7.5
	RATIO	0.819	0.903	0.986	0.870	0.834	0.898	0.978	0.752	0.714	0.842

TABLE 2-5, CONTINUED

1989 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
BRISTOL-001 (0060)	PM10	50	44	44	40	39	36	36	35	34	33
	DATE	7/27/89	12/ 6/89	6/21/89	12/12/89	2/27/89	3/11/89	1/10/89	6/27/89	1/22/89	7/ 3/89
METEOROLOGICAL SITE	DIR (DEG)	240	230	100	10	250	170	120	250	230	90
NEWARK	VEL (MPH)	6.8	1.6	5.0	8.1	9.6	5.2	2.0	7.5	8.3	4.3
	SPD (MPH)	9.1	3.6	6.6	8.2	10.6	6.2	5.0	10.4	9.5	7.5
	RATIO	0.746	0.453	0.753	0.986	0.899	0.835	0.392	0.721	0.873	0.578
METEOROLOGICAL SITE	DIR (DEG)	220	200	130	20	300	190	160	230	190	120
BRADLEY	VEL (MPH)	6.2	4.2	2.0	4.1	4.6	6.7	4.1	4.5	7.8	3.1
	SPD (MPH)	7.8	6.8	5.0	4.6	5.8	7.9	7.8	6.0	9.3	6.5
	RATIO	0.793	0.625	0.404	0.894	0.808	0.848	0.525	0.743	0.836	0.473
METEOROLOGICAL SITE	DIR (DEG)	240	270	100	50	260	220	140	240	250	130
BRIDGEPORT	VEL (MPH)	5.6	1.9	6.0	3.9	4.6	2.8	2.0	5.7	6.2	6.2
	SPD (MPH)	5.8	4.5	6.0	4.2	4.7	3.2	2.2	5.8	6.2	6.2
	RATIO	0.972	0.416	0.992	0.924	0.967	0.897	0.932	0.996	0.999	0.996
METEOROLOGICAL SITE	DIR (DEG)	260	230	240	320	290	250	230	290	260	90
WORCESTER	VEL (MPH)	7.2	4.8	3.7	5.3	7.0	6.3	4.8	5.0	10.7	4.9
	SPD (MPH)	8.8	5.3	4.9	5.3	8.1	7.5	6.5	6.0	12.1	6.9
	RATIO	0.819	0.903	0.752	0.991	0.870	0.842	0.736	0.834	0.885	0.714
BURLINGTON-001 (0059)	PM10	41	32	29	28	26	26	25	24	22	22
	DATE	6/21/89	6/27/89	12/ 6/89	8/20/89	7/ 3/89	8/14/89	3/17/89	3/11/89	11/ 6/89	2/27/89
METEOROLOGICAL SITE	DIR (DEG)	100	250	230	230	90	170	210	170	220	250
NEWARK	VEL (MPH)	5.0	7.5	1.6	6.0	4.3	3.5	11.1	5.2	5.0	9.6
	SPD (MPH)	6.6	10.4	3.6	8.8	7.5	5.6	14.1	6.2	6.8	10.6
	RATIO	0.753	0.721	0.453	0.686	0.578	0.624	0.791	0.835	0.736	0.899
METEOROLOGICAL SITE	DIR (DEG)	130	230	200	210	120	200	170	190	200	300
BRADLEY	VEL (MPH)	2.0	4.5	4.2	6.8	3.1	3.6	9.3	6.7	5.0	4.6
	SPD (MPH)	5.0	6.0	6.8	8.2	6.5	5.6	12.4	7.9	6.8	5.8
	RATIO	0.404	0.743	0.625	0.835	0.473	0.644	0.752	0.848	0.738	0.808
METEOROLOGICAL SITE	DIR (DEG)	100	240	270	260	130	230	230	220	240	260
BRIDGEPORT	VEL (MPH)	6.0	5.7	1.9	4.8	6.2	3.0	7.0	2.8	6.9	4.6
	SPD (MPH)	6.0	5.8	4.5	4.9	6.2	3.6	7.2	3.2	7.8	4.7
	RATIO	0.992	0.996	0.416	0.986	0.996	0.844	0.969	0.897	0.889	0.967
METEOROLOGICAL SITE	DIR (DEG)	240	290	230	240	90	250	260	250	240	290
WORCESTER	VEL (MPH)	3.7	5.0	4.8	9.9	4.9	5.3	9.2	6.3	7.6	7.0
	SPD (MPH)	4.9	6.0	5.3	10.9	6.9	7.3	13.4	7.5	7.8	8.1
	RATIO	0.752	0.834	0.903	0.908	0.714	0.718	0.687	0.842	0.974	0.870
CORNWALL-005 (0060)	PM10	45	33	31	30	28	26	26	26	25	24
	DATE	7/27/89	6/27/89	7/ 3/89	6/21/89	12/ 6/89	8/14/89	9/ 7/89	11/ 6/89	10/25/89	8/20/89
METEOROLOGICAL SITE	DIR (DEG)	240	250	90	100	230	170	180	220	10	230
NEWARK	VEL (MPH)	6.8	7.5	4.3	5.0	1.6	3.5	2.0	5.0	1.4	6.0
	SPD (MPH)	9.1	10.4	7.5	6.6	3.6	5.6	4.6	6.8	3.7	8.8
	RATIO	0.746	0.721	0.578	0.753	0.453	0.624	0.440	0.736	0.384	0.686
METEOROLOGICAL SITE	DIR (DEG)	220	230	120	130	200	200	180	200	360	210
BRADLEY	VEL (MPH)	6.2	4.5	3.1	2.0	4.2	3.6	2.2	5.0	3.5	6.8
	SPD (MPH)	7.8	6.0	6.5	5.0	6.8	5.6	4.2	6.8	4.6	8.2
	RATIO	0.793	0.743	0.473	0.404	0.625	0.644	0.519	0.738	0.759	0.835

TABLE 2-5, CONTINUED

1989 TEN HIGHEST 24-HOUR AVERAGE PM10 DAYS WITH WIND DATA

UNITS : MICROGRAMS PER CUBIC METER

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
METEOROLOGICAL SITE	DIR (DEG)	240	240	130	100	270	230	160	240	300	260
BRIDGEPORT	VEL (MPH)	5.6	5.7	6.2	6.0	1.9	3.0	3.5	6.9	1.4	4.8
	SPD (MPH)	5.8	5.8	6.2	6.0	4.5	3.6	3.6	7.8	3.3	4.9
	RATIO	0.972	0.996	0.996	0.992	0.416	0.844	0.975	0.889	0.412	0.986
METEOROLOGICAL SITE	DIR (DEG)	260	290	90	240	230	250	260	240	50	240
WORCESTER	VEL (MPH)	7.2	5.0	4.9	3.7	4.8	5.3	2.5	7.6	3.1	9.9
	SPD (MPH)	8.8	6.0	6.9	4.9	5.3	7.3	4.3	7.8	3.5	10.9
	RATIO	0.819	0.834	0.714	0.752	0.903	0.718	0.591	0.974	0.898	0.908
DANBURY-123 (0057)	PM10	52	48	48	47	46	45	39	39	39	38
	DATE	7/27/89	12/ 6/89	12/12/89	12/18/89	3/11/89	6/27/89	2/27/89	1/10/89	10/25/89	11/ 6/89
METEOROLOGICAL SITE	DIR (DEG)	240	230	10	300	170	250	250	120	10	220
NEWARK	VEL (MPH)	6.8	1.6	8.1	8.7	5.2	7.5	9.6	2.0	1.4	5.0
	SPD (MPH)	9.1	3.6	8.2	9.6	6.2	10.4	10.6	5.0	3.7	6.8
	RATIO	0.746	0.453	0.986	0.903	0.835	0.721	0.899	0.392	0.384	0.736
METEOROLOGICAL SITE	DIR (DEG)	220	200	20	310	190	230	300	160	360	200
BRADLEY	VEL (MPH)	6.2	4.2	4.1	7.9	6.7	4.5	4.6	4.1	3.5	5.0
	SPD (MPH)	7.8	6.8	4.6	8.8	7.9	6.0	5.8	7.8	4.6	6.8
	RATIO	0.793	0.625	0.894	0.906	0.848	0.743	0.808	0.525	0.759	0.738
METEOROLOGICAL SITE	DIR (DEG)	240	270	50	340	220	240	260	140	300	240
BRIDGEPORT	VEL (MPH)	5.6	1.9	3.9	5.1	2.8	5.7	4.6	2.0	1.4	6.9
	SPD (MPH)	5.8	4.5	4.2	5.5	3.2	5.8	4.7	2.2	3.3	7.8
	RATIO	0.972	0.416	0.924	0.932	0.897	0.996	0.967	0.932	0.412	0.889
METEOROLOGICAL SITE	DIR (DEG)	260	230	320	300	250	290	290	230	50	240
WORCESTER	VEL (MPH)	7.2	4.8	5.3	8.6	6.3	5.0	7.0	4.8	3.1	7.6
	SPD (MPH)	8.8	5.3	5.3	8.8	7.5	6.0	8.1	6.5	3.5	7.8
	RATIO	0.819	0.903	0.991	0.986	0.842	0.834	0.870	0.736	0.898	0.974
DARIEN-001 (0045)	PM10	60	60	52	49	47	46	46	43	42	41
	DATE	12/ 6/89	7/27/89	12/18/89	11/24/89	6/27/89	10/13/89	7/ 3/89	10/25/89	12/12/89	6/21/89
METEOROLOGICAL SITE	DIR (DEG)	230	240	300	260	250	270	90	10	10	100
NEWARK	VEL (MPH)	1.6	6.8	8.7	7.2	7.5	7.5	4.3	1.4	8.1	5.0
	SPD (MPH)	3.6	9.1	9.6	9.5	10.4	9.1	7.5	3.7	8.2	6.6
	RATIO	0.453	0.746	0.903	0.756	0.721	0.832	0.578	0.384	0.986	0.753
METEOROLOGICAL SITE	DIR (DEG)	200	220	310	240	230	270	120	360	20	130
BRADLEY	VEL (MPH)	4.2	6.2	7.9	2.6	4.5	4.7	3.1	3.5	4.1	2.0
	SPD (MPH)	6.8	7.8	8.8	4.5	6.0	6.6	6.5	4.6	4.6	5.0
	RATIO	0.625	0.793	0.906	0.587	0.743	0.713	0.473	0.759	0.894	0.404
METEOROLOGICAL SITE	DIR (DEG)	270	240	340	300	240	270	130	300	50	100
BRIDGEPORT	VEL (MPH)	1.9	5.6	5.1	7.0	5.7	4.5	6.2	1.4	3.9	6.0
	SPD (MPH)	4.5	5.8	5.5	7.2	5.8	4.7	6.2	3.3	4.2	6.0
	RATIO	0.416	0.972	0.932	0.974	0.996	0.941	0.996	0.412	0.924	0.992
METEOROLOGICAL SITE	DIR (DEG)	230	260	300	280	290	280	90	50	320	240
WORCESTER	VEL (MPH)	4.8	7.2	8.6	5.1	5.0	8.2	4.9	3.1	5.3	3.7
	SPD (MPH)	5.3	8.8	8.8	5.5	6.0	8.3	6.9	3.5	5.3	4.9
	RATIO	0.903	0.819	0.986	0.937	0.834	0.978	0.714	0.898	0.991	0.752

TABLE 2-5, CONTINUED

1989 TEN HIGHEST 24-HOUR AVERAGE PM10 DAYS WITH WIND DATA

UNITS : MICROGRAMS PER CUBIC METER

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
EAST HARTFORD-004 (0059)	PM10	60	57	53	51	45	44	40	37	37	37
	DATE	7/27/89	2/27/89	12/ 6/89	12/12/89	6/27/89	10/31/89	6/21/89	11/24/89	3/11/89	8/14/89
METEOROLOGICAL SITE	DIR (DEG)	240	250	230	10	250	50	100	260	170	170
NEWARK	VEL (MPH)	6.8	9.6	1.6	8.1	7.5	4.0	5.0	7.2	5.2	3.5
	SPD (MPH)	9.1	10.6	3.6	8.2	10.4	8.9	6.6	9.5	6.2	5.6
	RATIO	0.746	0.899	0.453	0.986	0.721	0.449	0.753	0.756	0.835	0.624
METEOROLOGICAL SITE	DIR (DEG)	220	300	200	20	230	30	130	240	190	200
BRADLEY	VEL (MPH)	6.2	4.6	4.2	4.1	4.5	3.1	2.0	2.6	6.7	3.6
	SPD (MPH)	7.8	5.8	6.8	4.6	6.0	4.6	5.0	4.5	7.9	5.6
	RATIO	0.793	0.808	0.625	0.894	0.743	0.673	0.404	0.587	0.848	0.644
METEOROLOGICAL SITE	DIR (DEG)	240	260	270	50	240	100	100	300	220	230
BRIDGEPORT	VEL (MPH)	5.6	4.6	1.9	3.9	5.7	10.0	6.0	7.0	2.8	3.0
	SPD (MPH)	5.8	4.7	4.5	4.2	5.8	10.6	6.0	7.2	3.2	3.6
	RATIO	0.972	0.967	0.416	0.924	0.996	0.936	0.992	0.974	0.897	0.844
METEOROLOGICAL SITE	DIR (DEG)	260	290	230	320	290	130	240	280	250	250
WORCESTER	VEL (MPH)	7.2	7.0	4.8	5.3	5.0	3.8	3.7	5.1	6.3	5.3
	SPD (MPH)	8.8	8.1	5.3	5.3	6.0	3.9	4.9	5.5	7.5	7.3
	RATIO	0.819	0.870	0.903	0.991	0.834	0.971	0.752	0.937	0.842	0.718
ENFIELD-005 (0058)	PM10	48	40	36	36	34	31	31	31	29	29
	DATE	7/27/89	6/21/89	12/ 6/89	12/12/89	6/27/89	7/ 3/89	12/24/89	2/27/89	8/14/89	7/21/89
METEOROLOGICAL SITE	DIR (DEG)	240	100	230	10	250	90	10	250	170	60
NEWARK	VEL (MPH)	6.8	5.0	1.6	8.1	7.5	4.3	12.0	9.6	3.5	4.6
	SPD (MPH)	9.1	6.6	3.6	8.2	10.4	7.5	12.5	10.6	5.6	6.8
	RATIO	0.746	0.753	0.453	0.986	0.721	0.578	0.963	0.899	0.624	0.681
METEOROLOGICAL SITE	DIR (DEG)	220	130	200	20	230	120	350	300	200	360
BRADLEY	VEL (MPH)	6.2	2.0	4.2	4.1	4.5	3.1	5.0	4.6	3.6	3.6
	SPD (MPH)	7.8	5.0	6.8	4.6	6.0	6.5	5.6	5.8	5.6	5.3
	RATIO	0.793	0.404	0.625	0.894	0.743	0.473	0.894	0.808	0.644	0.668
METEOROLOGICAL SITE	DIR (DEG)	240	100	270	50	240	130	30	260	230	120
BRIDGEPORT	VEL (MPH)	5.6	6.0	1.9	3.9	5.7	6.2	7.8	4.6	3.0	3.8
	SPD (MPH)	5.8	6.0	4.5	4.2	5.8	6.2	8.1	4.7	3.6	4.3
	RATIO	0.972	0.992	0.416	0.924	0.996	0.996	0.969	0.967	0.844	0.878
METEOROLOGICAL SITE	DIR (DEG)	260	240	230	320	290	90	10	290	250	60
WORCESTER	VEL (MPH)	7.2	3.7	4.8	5.3	5.0	4.9	2.8	7.0	5.3	3.6
	SPD (MPH)	8.8	4.9	5.3	5.3	6.0	6.9	3.5	8.1	7.3	4.5
	RATIO	0.819	0.752	0.903	0.991	0.834	0.714	0.800	0.870	0.718	0.797
GREENWICH-017 (0056)	PM10	57	48	48	44	38	37	33	32	32	32
	DATE	7/27/89	6/27/89	12/ 6/89	7/ 3/89	3/17/89	8/20/89	11/ 6/89	3/11/89	1/22/89	10/25/89
METEOROLOGICAL SITE	DIR (DEG)	240	250	230	90	210	230	220	170	230	10
NEWARK	VEL (MPH)	6.8	7.5	1.6	4.3	11.1	6.0	5.0	5.2	8.3	1.4
	SPD (MPH)	9.1	10.4	3.6	7.5	14.1	8.8	6.8	6.2	9.5	3.7
	RATIO	0.746	0.721	0.453	0.578	0.791	0.686	0.736	0.835	0.873	0.384
METEOROLOGICAL SITE	DIR (DEG)	220	230	200	120	170	210	200	190	190	360
BRADLEY	VEL (MPH)	6.2	4.5	4.2	3.1	9.3	6.8	5.0	6.7	7.8	3.5
	SPD (MPH)	7.8	6.0	6.8	6.5	12.4	8.2	6.8	7.9	9.3	4.6
	RATIO	0.793	0.743	0.625	0.473	0.752	0.835	0.738	0.848	0.836	0.759

TABLE 2-5, CONTINUED

1989 TEN HIGHEST 24-HOUR AVERAGE PM10 DAYS WITH WIND DATA

UNITS : MICROGRAMS PER CUBIC METER

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
METEOROLOGICAL SITE	DIR (DEG)	240	240	270	130	230	260	240	220	250	300
BRIDGEPORT	VEL (MPH)	5.6	5.7	1.9	6.2	7.0	4.8	6.9	2.8	6.2	1.4
	SPD (MPH)	5.8	5.8	4.5	6.2	7.2	4.9	7.8	3.2	6.2	3.3
	RATIO	0.972	0.996	0.416	0.996	0.969	0.986	0.889	0.897	0.999	0.412
METEOROLOGICAL SITE	DIR (DEG)	260	290	230	90	260	240	240	250	260	50
WORCESTER	VEL (MPH)	7.2	5.0	4.8	4.9	9.2	9.9	7.6	6.3	10.7	3.1
	SPD (MPH)	8.8	6.0	5.3	6.9	13.4	10.9	7.8	7.5	12.1	3.5
	RATIO	0.819	0.834	0.903	0.714	0.687	0.908	0.974	0.842	0.885	0.898
GROTON-006 (0059)	PM10	55	41	38	37	32	32	32	31	30	30
	DATE	7/27/89	6/27/89	10/13/89	12/ 6/89	2/27/89	6/21/89	8/20/89	12/12/89	10/25/89	3/17/89
METEOROLOGICAL SITE	DIR (DEG)	240	250	270	230	250	100	230	10	10	210
NEWARK	VEL (MPH)	6.8	7.5	7.5	1.6	9.6	5.0	6.0	8.1	1.4	11.1
	SPD (MPH)	9.1	10.4	9.1	3.6	10.6	6.6	8.8	8.2	3.7	14.1
	RATIO	0.746	0.721	0.832	0.453	0.899	0.753	0.686	0.986	0.384	0.791
METEOROLOGICAL SITE	DIR (DEG)	220	230	270	200	300	130	210	20	360	170
BRADLEY	VEL (MPH)	6.2	4.5	4.7	4.2	4.6	2.0	6.8	4.1	3.5	9.3
	SPD (MPH)	7.8	6.0	6.6	6.8	5.8	5.0	8.2	4.6	4.6	12.4
	RATIO	0.793	0.743	0.713	0.625	0.808	0.404	0.835	0.894	0.759	0.752
METEOROLOGICAL SITE	DIR (DEG)	240	240	270	270	260	100	260	50	300	230
BRIDGEPORT	VEL (MPH)	5.6	5.7	4.5	1.9	4.6	6.0	4.8	3.9	1.4	7.0
	SPD (MPH)	5.8	5.8	4.7	4.5	4.7	6.0	4.9	4.2	3.3	7.2
	RATIO	0.972	0.996	0.941	0.416	0.967	0.992	0.986	0.924	0.412	0.969
METEOROLOGICAL SITE	DIR (DEG)	260	290	280	230	290	240	240	320	50	260
WORCESTER	VEL (MPH)	7.2	5.0	8.2	4.8	7.0	3.7	9.9	5.3	3.1	9.2
	SPD (MPH)	8.8	6.0	8.3	5.3	8.1	4.9	10.9	5.3	3.5	13.4
	RATIO	0.819	0.834	0.978	0.903	0.870	0.752	0.908	0.991	0.898	0.687
HADDAM-002 (0059)	PM10	51	39	36	34	31	29	28	27	27	27
	DATE	7/27/89	6/27/89	6/21/89	8/20/89	12/12/89	12/ 6/89	10/31/89	8/14/89	3/17/89	7/ 3/89
METEOROLOGICAL SITE	DIR (DEG)	240	250	100	230	10	230	50	170	210	90
NEWARK	VEL (MPH)	6.8	7.5	5.0	6.0	8.1	1.6	4.0	3.5	11.1	4.3
	SPD (MPH)	9.1	10.4	6.6	8.8	8.2	3.6	8.9	5.6	14.1	7.5
	RATIO	0.746	0.721	0.753	0.686	0.986	0.453	0.449	0.624	0.791	0.578
METEOROLOGICAL SITE	DIR (DEG)	220	230	130	210	20	200	30	200	170	120
BRADLEY	VEL (MPH)	6.2	4.5	2.0	6.8	4.1	4.2	3.1	3.6	9.3	3.1
	SPD (MPH)	7.8	6.0	5.0	8.2	4.6	6.8	4.6	5.6	12.4	6.5
	RATIO	0.793	0.743	0.404	0.835	0.894	0.625	0.673	0.644	0.752	0.473
METEOROLOGICAL SITE	DIR (DEG)	240	240	100	260	50	270	100	230	230	130
BRIDGEPORT	VEL (MPH)	5.6	5.7	6.0	4.8	3.9	1.9	10.0	3.0	7.0	6.2
	SPD (MPH)	5.8	5.8	6.0	4.9	4.2	4.5	10.6	3.6	7.2	6.2
	RATIO	0.972	0.996	0.992	0.986	0.924	0.416	0.936	0.844	0.969	0.996
METEOROLOGICAL SITE	DIR (DEG)	260	290	240	240	320	230	130	250	260	90
WORCESTER	VEL (MPH)	7.2	5.0	3.7	9.9	5.3	4.8	3.8	5.3	9.2	4.9
	SPD (MPH)	8.8	6.0	4.9	10.9	5.3	5.3	3.9	7.3	13.4	6.9
	RATIO	0.819	0.834	0.752	0.908	0.991	0.903	0.971	0.718	0.687	0.714

TABLE 2-5, CONTINUED

1989 TEN HIGHEST 24-HOUR AVERAGE PM10 DAYS WITH WIND DATA

UNITS : MICROGRAMS PER CUBIC METER

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
HARTFORD-013 (0057)	PM10	49	47	47	46	44	36	35	34	33	33
	DATE	12/ 6/89	2/27/89	10/31/89	7/27/89	12/12/89	12/24/89	3/11/89	11/24/89	10/25/89	2/21/89
METEOROLOGICAL SITE	DIR (DEG)	230	250	50	240	10	10	170	260	10	210
NEWARK	VEL (MPH)	1.6	9.6	4.0	6.8	8.1	12.0	5.2	7.2	1.4	2.6
	SPD (MPH)	3.6	10.6	8.9	9.1	8.2	12.5	6.2	9.5	3.7	7.0
	RATIO	0.453	0.899	0.449	0.746	0.986	0.963	0.835	0.756	0.384	0.374
METEOROLOGICAL SITE	DIR (DEG)	200	300	30	220	20	350	190	240	360	170
BRADLEY	VEL (MPH)	4.2	4.6	3.1	6.2	4.1	5.0	6.7	2.6	3.5	4.4
	SPD (MPH)	6.8	5.8	4.6	7.8	4.6	5.6	7.9	4.5	4.6	6.9
	RATIO	0.625	0.808	0.673	0.793	0.894	0.894	0.848	0.587	0.759	0.635
METEOROLOGICAL SITE	DIR (DEG)	270	260	100	240	50	30	220	300	300	210
BRIDGEPORT	VEL (MPH)	1.9	4.6	10.0	5.6	3.9	7.8	2.8	7.0	1.4	5.0
	SPD (MPH)	4.5	4.7	10.6	5.8	4.2	8.1	3.2	7.2	3.3	7.8
	RATIO	0.416	0.967	0.936	0.972	0.924	0.969	0.897	0.974	0.412	0.645
METEOROLOGICAL SITE	DIR (DEG)	230	290	130	260	320	10	250	280	50	230
WORCESTER	VEL (MPH)	4.8	7.0	3.8	7.2	5.3	2.8	6.3	5.1	3.1	6.9
	SPD (MPH)	5.3	8.1	3.9	8.8	5.3	3.5	7.5	5.5	3.5	11.4
	RATIO	0.903	0.870	0.971	0.819	0.991	0.800	0.842	0.937	0.898	0.609
HARTFORD-014 (0058)	PM10	63	54	52	50	48	46	38	37	36	36
	DATE	1/22/89	7/27/89	12/12/89	2/27/89	10/31/89	12/ 6/89	6/21/89	6/27/89	11/24/89	2/21/89
METEOROLOGICAL SITE	DIR (DEG)	230	240	10	250	50	230	100	250	260	210
NEWARK	VEL (MPH)	8.3	6.8	8.1	9.6	4.0	1.6	5.0	7.5	7.2	2.6
	SPD (MPH)	9.5	9.1	8.2	10.6	8.9	3.6	6.6	10.4	9.5	7.0
	RATIO	0.873	0.746	0.986	0.899	0.449	0.453	0.753	0.721	0.756	0.374
METEOROLOGICAL SITE	DIR (DEG)	190	220	20	300	30	200	130	230	240	170
BRADLEY	VEL (MPH)	7.8	6.2	4.1	4.6	3.1	4.2	2.0	4.5	2.6	4.4
	SPD (MPH)	9.3	7.8	4.6	5.8	4.6	6.8	5.0	6.0	4.5	6.9
	RATIO	0.836	0.793	0.894	0.808	0.673	0.625	0.404	0.743	0.587	0.635
METEOROLOGICAL SITE	DIR (DEG)	250	240	50	260	100	270	100	240	300	210
BRIDGEPORT	VEL (MPH)	6.2	5.6	3.9	4.6	10.0	1.9	6.0	5.7	7.0	5.0
	SPD (MPH)	6.2	5.8	4.2	4.7	10.6	4.5	6.0	5.8	7.2	7.8
	RATIO	0.999	0.972	0.924	0.967	0.936	0.416	0.992	0.996	0.974	0.645
METEOROLOGICAL SITE	DIR (DEG)	260	260	320	290	130	230	240	290	280	230
WORCESTER	VEL (MPH)	10.7	7.2	5.3	7.0	3.8	4.8	3.7	5.0	5.1	6.9
	SPD (MPH)	12.1	8.8	5.3	8.1	3.9	5.3	4.9	6.0	5.5	11.4
	RATIO	0.885	0.819	0.991	0.870	0.971	0.903	0.752	0.834	0.937	0.609
HARTFORD-015 (0059)	PM10	65	59	54	47	47	46	46	44	39	38
	DATE	12/12/89	7/27/89	2/27/89	10/25/89	12/ 6/89	6/27/89	12/24/89	6/21/89	7/21/89	2/21/89
METEOROLOGICAL SITE	DIR (DEG)	10	240	250	10	230	250	10	100	60	210
NEWARK	VEL (MPH)	8.1	6.8	9.6	1.4	1.6	7.5	12.0	5.0	4.6	2.6
	SPD (MPH)	8.2	9.1	10.6	3.7	3.6	10.4	12.5	6.6	6.8	7.0
	RATIO	0.986	0.746	0.899	0.384	0.453	0.721	0.963	0.753	0.681	0.374
METEOROLOGICAL SITE	DIR (DEG)	20	220	300	360	200	230	350	130	360	170
BRADLEY	VEL (MPH)	4.1	6.2	4.6	3.5	4.2	4.5	5.0	2.0	3.6	4.4
	SPD (MPH)	4.6	7.8	5.8	4.6	6.8	6.0	5.6	5.0	5.3	6.9
	RATIO	0.894	0.793	0.808	0.759	0.625	0.743	0.894	0.404	0.668	0.635

TABLE 2-5, CONTINUED

1989 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)	50	240	260	300	270	240	30	100	120	210
BRIDGEPORT	VEL (MPH)	3.9	5.6	4.6	1.4	1.9	5.7	7.8	6.0	3.8	5.0
	SPD (MPH)	4.2	5.8	4.7	3.3	4.5	5.8	8.1	6.0	4.3	7.8
	RATIO	0.924	0.972	0.967	0.412	0.416	0.996	0.969	0.992	0.878	0.645
METEOROLOGICAL SITE	DIR (DEG)	320	260	290	50	230	290	10	240	60	230
WORCESTER	VEL (MPH)	5.3	7.2	7.0	3.1	4.8	5.0	2.8	3.7	3.6	6.9
	SPD (MPH)	5.3	8.8	8.1	3.5	5.3	6.0	3.5	4.9	4.5	11.4
	RATIO	0.991	0.819	0.870	0.898	0.903	0.834	0.800	0.752	0.797	0.609
HARTFORD-018 (0060)	PM10	64	58	57	55	50	42	41	39	39	38
	DATE	2/27/89	12/12/89	7/27/89	10/31/89	12/ 6/89	10/25/89	6/21/89	6/27/89	12/24/89	10/13/89
METEOROLOGICAL SITE	DIR (DEG)	250	10	240	50	230	10	100	250	10	270
NEWARK	VEL (MPH)	9.6	8.1	6.8	4.0	1.6	1.4	5.0	7.5	12.0	7.5
	SPD (MPH)	10.6	8.2	9.1	8.9	3.6	3.7	6.6	10.4	12.5	9.1
	RATIO	0.899	0.986	0.746	0.449	0.453	0.384	0.753	0.721	0.963	0.832
METEOROLOGICAL SITE	DIR (DEG)	300	20	220	30	200	360	130	230	350	270
BRADLEY	VEL (MPH)	4.6	4.1	6.2	3.1	4.2	3.5	2.0	4.5	5.0	4.7
	SPD (MPH)	5.8	4.6	7.8	4.6	6.8	4.6	5.0	6.0	5.6	6.6
	RATIO	0.808	0.894	0.793	0.673	0.625	0.759	0.404	0.743	0.894	0.713
METEOROLOGICAL SITE	DIR (DEG)	260	50	240	100	270	300	100	240	30	270
BRIDGEPORT	VEL (MPH)	4.6	3.9	5.6	10.0	1.9	1.4	6.0	5.7	7.8	4.5
	SPD (MPH)	4.7	4.2	5.8	10.6	4.5	3.3	6.0	5.8	8.1	4.7
	RATIO	0.967	0.924	0.972	0.936	0.416	0.412	0.992	0.996	0.969	0.941
METEOROLOGICAL SITE	DIR (DEG)	290	320	260	130	230	50	240	290	10	280
WORCESTER	VEL (MPH)	7.0	5.3	7.2	3.8	4.8	3.1	3.7	5.0	2.8	8.2
	SPD (MPH)	8.1	5.3	8.8	3.9	5.3	3.5	4.9	6.0	3.5	8.3
	RATIO	0.870	0.991	0.819	0.971	0.903	0.898	0.752	0.834	0.800	0.978
MANCHESTER-001 (0058)	PM10	51	50	38	36	36	36	35	31	31	29
	DATE	7/27/89	12/24/89	12/12/89	6/21/89	6/27/89	12/ 6/89	2/27/89	7/ 3/89	8/20/89	10/25/89
METEOROLOGICAL SITE	DIR (DEG)	240	10	10	100	250	230	250	90	230	10
NEWARK	VEL (MPH)	6.8	12.0	8.1	5.0	7.5	1.6	9.6	4.3	6.0	1.4
	SPD (MPH)	9.1	12.5	8.2	6.6	10.4	3.6	10.6	7.5	8.8	3.7
	RATIO	0.746	0.963	0.986	0.753	0.721	0.453	0.899	0.578	0.686	0.384
METEOROLOGICAL SITE	DIR (DEG)	220	350	20	130	230	200	300	120	210	360
BRADLEY	VEL (MPH)	6.2	5.0	4.1	2.0	4.5	4.2	4.6	3.1	6.8	3.5
	SPD (MPH)	7.8	5.6	4.6	5.0	6.0	6.8	5.8	6.5	8.2	4.6
	RATIO	0.793	0.894	0.894	0.404	0.743	0.625	0.808	0.473	0.835	0.759
METEOROLOGICAL SITE	DIR (DEG)	240	30	50	100	240	270	260	130	260	300
BRIDGEPORT	VEL (MPH)	5.6	7.8	3.9	6.0	5.7	1.9	4.6	6.2	4.8	1.4
	SPD (MPH)	5.8	8.1	4.2	6.0	5.8	4.5	4.7	6.2	4.9	3.3
	RATIO	0.972	0.969	0.924	0.992	0.996	0.416	0.967	0.996	0.986	0.412
METEOROLOGICAL SITE	DIR (DEG)	260	10	320	240	290	230	290	90	240	50
WORCESTER	VEL (MPH)	7.2	2.8	5.3	3.7	5.0	4.8	7.0	4.9	9.9	3.1
	SPD (MPH)	8.8	3.5	5.3	4.9	6.0	5.3	8.1	6.9	10.9	3.5
	RATIO	0.819	0.800	0.991	0.752	0.834	0.903	0.870	0.714	0.908	0.898

TABLE 2-5, CONTINUED

1989 TEN HIGHEST 24-HOUR AVERAGE PM10 DAYS WITH WIND DATA

UNITS : MICROGRAMS PER CUBIC METER

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
MERIDEN-002 (0048)	PM10	57	50	42	42	37	36	35	35	35	34
	DATE	7/27/89	2/27/89	6/27/89	3/11/89	1/16/89	3/17/89	6/21/89	8/20/89	7/ 3/89	10/13/89
METEOROLOGICAL SITE	DIR (DEG)	240	250	250	170	290	210	100	230	90	270
NEWARK	VEL (MPH)	6.8	9.6	7.5	5.2	8.8	11.1	5.0	6.0	4.3	7.5
	SPD (MPH)	9.1	10.6	10.4	6.2	10.8	14.1	6.6	8.8	7.5	9.1
	RATIO	0.746	0.899	0.721	0.835	0.812	0.791	0.753	0.686	0.578	0.832
METEOROLOGICAL SITE	DIR (DEG)	220	300	230	190	290	170	130	210	120	270
BRADLEY	VEL (MPH)	6.2	4.6	4.5	6.7	7.9	9.3	2.0	6.8	3.1	4.7
	SPD (MPH)	7.8	5.8	6.0	7.9	8.9	12.4	5.0	8.2	6.5	6.6
	RATIO	0.793	0.808	0.743	0.848	0.891	0.752	0.404	0.835	0.473	0.713
METEOROLOGICAL SITE	DIR (DEG)	240	260	240	220	280	230	100	260	130	270
BRIDGEPORT	VEL (MPH)	5.6	4.6	5.7	2.8	5.5	7.0	6.0	4.8	6.2	4.5
	SPD (MPH)	5.8	4.7	5.8	3.2	5.8	7.2	6.0	4.9	6.2	4.7
	RATIO	0.972	0.967	0.996	0.897	0.962	0.969	0.992	0.986	0.996	0.941
METEOROLOGICAL SITE	DIR (DEG)	260	290	290	250	300	260	240	240	90	280
WORCESTER	VEL (MPH)	7.2	7.0	5.0	6.3	6.5	9.2	3.7	9.9	4.9	8.2
	SPD (MPH)	8.8	8.1	6.0	7.5	7.3	13.4	4.9	10.9	6.9	8.3
	RATIO	0.819	0.870	0.834	0.842	0.882	0.687	0.752	0.908	0.714	0.978
MIDDLETOWN-003 (0057)	PM10	56	52	51	43	42	37	36	36	33	33
	DATE	7/27/89	12/24/89	12/30/89	6/27/89	2/27/89	10/31/89	6/21/89	7/ 3/89	8/20/89	10/25/89
METEOROLOGICAL SITE	DIR (DEG)	240	10	10	250	250	50	100	90	230	10
NEWARK	VEL (MPH)	6.8	12.0	10.2	7.5	9.6	4.0	5.0	4.3	6.0	1.4
	SPD (MPH)	9.1	12.5	10.4	10.4	10.6	8.9	6.6	7.5	8.8	3.7
	RATIO	0.746	0.963	0.984	0.721	0.899	0.449	0.753	0.578	0.686	0.384
METEOROLOGICAL SITE	DIR (DEG)	220	350	360	230	300	30	130	120	210	360
BRADLEY	VEL (MPH)	6.2	5.0	8.7	4.5	4.6	3.1	2.0	3.1	6.8	3.5
	SPD (MPH)	7.8	5.6	8.8	6.0	5.8	4.6	5.0	6.5	8.2	4.6
	RATIO	0.793	0.894	0.988	0.743	0.808	0.673	0.404	0.473	0.835	0.759
METEOROLOGICAL SITE	DIR (DEG)	240	30	70	240	260	100	100	130	260	300
BRIDGEPORT	VEL (MPH)	5.6	7.8	9.8	5.7	4.6	10.0	6.0	6.2	4.8	1.4
	SPD (MPH)	5.8	8.1	9.9	5.8	4.7	10.6	6.0	6.2	4.9	3.3
	RATIO	0.972	0.969	0.992	0.996	0.967	0.936	0.992	0.996	0.986	0.412
METEOROLOGICAL SITE	DIR (DEG)	260	10	50	290	290	130	240	90	240	50
WORCESTER	VEL (MPH)	7.2	2.8	5.3	5.0	7.0	3.8	3.7	4.9	9.9	3.1
	SPD (MPH)	8.8	3.5	5.3	6.0	8.1	3.9	4.9	6.9	10.9	3.5
	RATIO	0.819	0.800	0.993	0.834	0.870	0.971	0.752	0.714	0.908	0.898
MILFORD-010 (0058)	PM10	55	40	39	38	36	36	36	35	34	34
	DATE	7/27/89	6/27/89	10/25/89	6/21/89	12/12/89	7/ 3/89	10/13/89	8/20/89	2/27/89	3/11/89
METEOROLOGICAL SITE	DIR (DEG)	240	250	10	100	10	90	270	230	250	170
NEWARK	VEL (MPH)	6.8	7.5	1.4	5.0	8.1	4.3	7.5	6.0	9.6	5.2
	SPD (MPH)	9.1	10.4	3.7	6.6	8.2	7.5	9.1	8.8	10.6	6.2
	RATIO	0.746	0.721	0.384	0.753	0.986	0.578	0.832	0.686	0.899	0.835
METEOROLOGICAL SITE	DIR (DEG)	220	230	360	130	20	120	270	210	300	190
BRADLEY	VEL (MPH)	6.2	4.5	3.5	2.0	4.1	3.1	4.7	6.8	4.6	6.7
	SPD (MPH)	7.8	6.0	4.6	5.0	4.6	6.5	6.6	8.2	5.8	7.9
	RATIO	0.793	0.743	0.759	0.404	0.894	0.473	0.713	0.835	0.808	0.848

TABLE 2-5, CONTINUED

1989 TEN HIGHEST 24-HOUR AVERAGE PM10 DAYS WITH WIND DATA

UNITS : MICROGRAMS PER CUBIC METER

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
METEOROLOGICAL SITE	DIR (DEG)	240	240	300	100	50	130	270	260	260	220
BRIDGEPORT	VEL (MPH)	5.6	5.7	1.4	6.0	3.9	6.2	4.5	4.8	4.6	2.8
	SPD (MPH)	5.8	5.8	3.3	6.0	4.2	6.2	4.7	4.9	4.7	3.2
	RATIO	0.972	0.996	0.412	0.992	0.924	0.996	0.941	0.986	0.967	0.897
METEOROLOGICAL SITE	DIR (DEG)	260	290	50	240	320	90	280	240	290	250
WORCESTER	VEL (MPH)	7.2	5.0	3.1	3.7	5.3	4.9	8.2	9.9	7.0	6.3
	SPD (MPH)	8.8	6.0	3.5	4.9	5.3	6.9	8.3	10.9	8.1	7.5
	RATIO	0.819	0.834	0.898	0.752	0.991	0.714	0.978	0.908	0.870	0.842
NAUGATUCK-001 (0060)	PM10	63	52	50	48	44	41	41	40	38	37
	DATE	12/12/89	7/27/89	12/ 6/89	2/27/89	12/24/89	3/11/89	6/27/89	11/ 6/89	10/31/89	1/22/89
METEOROLOGICAL SITE	DIR (DEG)	10	240	230	250	10	170	250	220	50	230
NEWARK	VEL (MPH)	8.1	6.8	1.6	9.6	12.0	5.2	7.5	5.0	4.0	8.3
	SPD (MPH)	8.2	9.1	3.6	10.6	12.5	6.2	10.4	6.8	8.9	9.5
	RATIO	0.986	0.746	0.453	0.899	0.963	0.835	0.721	0.736	0.449	0.873
METEOROLOGICAL SITE	DIR (DEG)	20	220	200	300	350	190	230	200	30	190
BRADLEY	VEL (MPH)	4.1	6.2	4.2	4.6	5.0	6.7	4.5	5.0	3.1	7.8
	SPD (MPH)	4.6	7.8	6.8	5.8	5.6	7.9	6.0	6.8	4.6	9.3
	RATIO	0.894	0.793	0.625	0.808	0.894	0.848	0.743	0.738	0.673	0.836
METEOROLOGICAL SITE	DIR (DEG)	50	240	270	260	30	220	240	240	100	250
BRIDGEPORT	VEL (MPH)	3.9	5.6	1.9	4.6	7.8	2.8	5.7	6.9	10.0	6.2
	SPD (MPH)	4.2	5.8	4.5	4.7	8.1	3.2	5.8	7.8	10.6	6.2
	RATIO	0.924	0.972	0.416	0.967	0.969	0.897	0.996	0.889	0.936	0.999
METEOROLOGICAL SITE	DIR (DEG)	320	260	230	290	10	250	290	240	130	260
WORCESTER	VEL (MPH)	5.3	7.2	4.8	7.0	2.8	6.3	5.0	7.6	3.8	10.7
	SPD (MPH)	5.3	8.8	5.3	8.1	3.5	7.5	6.0	7.8	3.9	12.1
	RATIO	0.991	0.819	0.903	0.870	0.800	0.842	0.834	0.974	0.971	0.885
NEW BRITAIN-012 (0061)	PM10	60	54	53	45	40	38	37	36	36	35
	DATE	12/ 6/89	2/27/89	7/27/89	3/11/89	6/21/89	6/27/89	10/13/89	11/ 6/89	1/22/89	10/31/89
METEOROLOGICAL SITE	DIR (DEG)	230	250	240	170	100	250	270	220	230	50
NEWARK	VEL (MPH)	1.6	9.6	6.8	5.2	5.0	7.5	7.5	5.0	8.3	4.0
	SPD (MPH)	3.6	10.6	9.1	6.2	6.6	10.4	9.1	6.8	9.5	8.9
	RATIO	0.453	0.899	0.746	0.835	0.753	0.721	0.832	0.736	0.873	0.449
METEOROLOGICAL SITE	DIR (DEG)	200	300	220	190	130	230	270	200	190	30
BRADLEY	VEL (MPH)	4.2	4.6	6.2	6.7	2.0	4.5	4.7	5.0	7.8	3.1
	SPD (MPH)	6.8	5.8	7.8	7.9	5.0	6.0	6.6	6.8	9.3	4.6
	RATIO	0.625	0.808	0.793	0.848	0.404	0.743	0.713	0.738	0.836	0.673
METEOROLOGICAL SITE	DIR (DEG)	270	260	240	220	100	240	270	240	250	100
BRIDGEPORT	VEL (MPH)	1.9	4.6	5.6	2.8	6.0	5.7	4.5	6.9	6.2	10.0
	SPD (MPH)	4.5	4.7	5.8	3.2	6.0	5.8	4.7	7.8	6.2	10.6
	RATIO	0.416	0.967	0.972	0.897	0.992	0.996	0.941	0.889	0.999	0.936
METEOROLOGICAL SITE	DIR (DEG)	230	290	260	250	240	290	280	240	260	130
WORCESTER	VEL (MPH)	4.8	7.0	7.2	6.3	3.7	5.0	8.2	7.6	10.7	3.8
	SPD (MPH)	5.3	8.1	8.8	7.5	4.9	6.0	8.3	7.8	12.1	3.9
	RATIO	0.903	0.870	0.819	0.842	0.752	0.834	0.978	0.974	0.885	0.971

TABLE 2-5, CONTINUED

1989 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-013 (0057)	PM10	57	43	42	42	41	39	38	37	37	36
	DATE	7/27/89	12/ 6/89	10/13/89	12/12/89	6/27/89	7/ 3/89	3/11/89	3/17/89	10/25/89	11/ 6/89
METEOROLOGICAL SITE	DIR (DEG)	240	230	270	10	250	90	170	210	10	220
NEWARK	VEL (MPH)	6.8	1.6	7.5	8.1	7.5	4.3	5.2	11.1	1.4	5.0
	SPD (MPH)	9.1	3.6	9.1	8.2	10.4	7.5	6.2	14.1	3.7	6.8
	RATIO	0.746	0.453	0.832	0.986	0.721	0.578	0.835	0.791	0.384	0.736
METEOROLOGICAL SITE	DIR (DEG)	220	200	270	20	230	120	190	170	360	200
BRADLEY	VEL (MPH)	6.2	4.2	4.7	4.1	4.5	3.1	6.7	9.3	3.5	5.0
	SPD (MPH)	7.8	6.8	6.6	4.6	6.0	6.5	7.9	12.4	4.6	6.8
	RATIO	0.793	0.625	0.713	0.894	0.743	0.473	0.848	0.752	0.759	0.738
METEOROLOGICAL SITE	DIR (DEG)	240	270	270	50	240	130	220	230	300	240
BRIDGEPORT	VEL (MPH)	5.6	1.9	4.5	3.9	5.7	6.2	2.8	7.0	1.4	6.9
	SPD (MPH)	5.8	4.5	4.7	4.2	5.8	6.2	3.2	7.2	3.3	7.8
	RATIO	0.972	0.416	0.941	0.924	0.996	0.996	0.897	0.969	0.412	0.889
METEOROLOGICAL SITE	DIR (DEG)	260	230	280	320	290	90	250	260	50	240
WORCESTER	VEL (MPH)	7.2	4.8	8.2	5.3	5.0	4.9	6.3	9.2	3.1	7.6
	SPD (MPH)	8.8	5.3	8.3	5.3	6.0	6.9	7.5	13.4	3.5	7.8
	RATIO	0.819	0.903	0.978	0.991	0.834	0.714	0.842	0.687	0.898	0.974
NEW HAVEN-018 (0351)	PM10	126	112	109	109	107	102	100	99	98	98
	DATE	1/11/89	3/28/89	4/18/89	8/ 4/89	6/23/89	1/23/89	2/ 1/89	3/ 9/89	6/27/89	4/20/89
METEOROLOGICAL SITE	DIR (DEG)	350	230	300	230	80	160	240	10	250	320
NEWARK	VEL (MPH)	8.3	10.6	7.3	7.3	.6	1.8	7.7	11.7	7.5	7.1
	SPD (MPH)	10.1	13.2	9.8	9.3	5.8	3.9	9.8	11.8	10.4	9.1
	RATIO	0.822	0.804	0.747	0.786	0.101	0.461	0.788	0.991	0.721	0.781
METEOROLOGICAL SITE	DIR (DEG)	340	200	330	200	280	160	230	10	230	310
BRADLEY	VEL (MPH)	6.2	7.0	8.8	6.3	1.8	1.1	4.5	7.7	4.5	8.9
	SPD (MPH)	9.2	10.9	9.5	8.2	5.6	4.7	8.5	7.9	6.0	9.6
	RATIO	0.678	0.645	0.925	0.763	0.325	0.236	0.527	0.976	0.743	0.924
METEOROLOGICAL SITE	DIR (DEG)	340	250	280	230	160	220	240	60	240	300
BRIDGEPORT	VEL (MPH)	5.6	5.3	3.7	7.0	2.8	.9	6.7	5.1	5.7	4.3
	SPD (MPH)	6.0	5.5	4.2	7.3	4.2	.9	6.8	5.5	5.8	5.9
	RATIO	0.931	0.965	0.879	0.960	0.683	0.999	0.989	0.941	0.996	0.734
METEOROLOGICAL SITE	DIR (DEG)	330	270	310	230	300	260	280	40	290	310
WORCESTER	VEL (MPH)	8.0	11.3	6.0	5.5	2.2	6.6	9.4	6.3	5.0	9.7
	SPD (MPH)	11.1	15.5	8.2	6.9	4.2	8.6	12.9	7.0	6.0	10.8
	RATIO	0.722	0.729	0.727	0.801	0.524	0.763	0.728	0.901	0.834	0.899
NEW HAVEN-020 (0059)	PM10	62	57	50	49	48	48	45	44	42	40
	DATE	7/27/89	2/27/89	12/ 6/89	10/13/89	6/27/89	12/12/89	12/18/89	3/11/89	10/25/89	11/ 6/89
METEOROLOGICAL SITE	DIR (DEG)	240	250	230	270	250	10	300	170	10	220
NEWARK	VEL (MPH)	6.8	9.6	1.6	7.5	7.5	8.1	8.7	5.2	1.4	5.0
	SPD (MPH)	9.1	10.6	3.6	9.1	10.4	8.2	9.6	6.2	3.7	6.8
	RATIO	0.746	0.899	0.453	0.832	0.721	0.986	0.903	0.835	0.384	0.736
METEOROLOGICAL SITE	DIR (DEG)	220	300	200	270	230	20	310	190	360	200
BRADLEY	VEL (MPH)	6.2	4.6	4.2	4.7	4.5	4.1	7.9	6.7	3.5	5.0
	SPD (MPH)	7.8	5.8	6.8	6.6	6.0	4.6	8.8	7.9	4.6	6.8
	RATIO	0.793	0.808	0.625	0.713	0.743	0.894	0.906	0.848	0.759	0.738

TABLE 2-5, CONTINUED

1989 TEN HIGHEST 24-HOUR AVERAGE PM10 DAYS WITH WIND DATA

UNITS : MICROGRAMS PER CUBIC METER

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
METEOROLOGICAL SITE	DIR (DEG)	240	260	270	270	240	50	340	220	300	240
BRIDGEPORT	VEL (MPH)	5.6	4.6	1.9	4.5	5.7	3.9	5.1	2.8	1.4	6.9
	SPD (MPH)	5.8	4.7	4.5	4.7	5.8	4.2	5.5	3.2	3.3	7.8
	RATIO	0.972	0.967	0.416	0.941	0.996	0.924	0.932	0.897	0.412	0.889
METEOROLOGICAL SITE	DIR (DEG)	260	290	230	280	290	320	300	250	50	240
WORCESTER	VEL (MPH)	7.2	7.0	4.8	8.2	5.0	5.3	8.6	6.3	3.1	7.6
	SPD (MPH)	8.8	8.1	5.3	8.3	6.0	5.3	8.8	7.5	3.5	7.8
	RATIO	0.819	0.870	0.903	0.978	0.834	0.991	0.986	0.842	0.898	0.974
NEW HAVEN-123 (0059)	PM10	57	52	52	47	45	45	43	42	42	42
	DATE	7/27/89	12/ 6/89	6/27/89	2/27/89	1/16/89	12/12/89	11/ 6/89	3/11/89	10/13/89	6/21/89
METEOROLOGICAL SITE	DIR (DEG)	240	230	250	250	290	10	220	170	270	100
NEWARK	VEL (MPH)	6.8	1.6	7.5	9.6	8.8	8.1	5.0	5.2	7.5	5.0
	SPD (MPH)	9.1	3.6	10.4	10.6	10.8	8.2	6.8	6.2	9.1	6.6
	RATIO	0.746	0.453	0.721	0.899	0.812	0.986	0.736	0.835	0.832	0.753
METEOROLOGICAL SITE	DIR (DEG)	220	200	230	300	290	20	200	190	270	130
BRADLEY	VEL (MPH)	6.2	4.2	4.5	4.6	7.9	4.1	5.0	6.7	4.7	2.0
	SPD (MPH)	7.8	6.8	6.0	5.8	8.9	4.6	6.8	7.9	6.6	5.0
	RATIO	0.793	0.625	0.743	0.808	0.891	0.894	0.738	0.848	0.713	0.404
METEOROLOGICAL SITE	DIR (DEG)	240	270	240	260	280	50	240	220	270	100
BRIDGEPORT	VEL (MPH)	5.6	1.9	5.7	4.6	5.5	3.9	6.9	2.8	4.5	6.0
	SPD (MPH)	5.8	4.5	5.8	4.7	5.8	4.2	7.8	3.2	4.7	6.0
	RATIO	0.972	0.416	0.996	0.967	0.962	0.924	0.889	0.897	0.941	0.992
METEOROLOGICAL SITE	DIR (DEG)	260	230	290	290	300	320	240	250	280	240
WORCESTER	VEL (MPH)	7.2	4.8	5.0	7.0	6.5	5.3	7.6	6.3	8.2	3.7
	SPD (MPH)	8.8	5.3	6.0	8.1	7.3	5.3	7.8	7.5	8.3	4.9
	RATIO	0.819	0.903	0.834	0.870	0.882	0.991	0.974	0.842	0.978	0.752
NEW LONDON-004 (0042)	PM10	55	39	39	37	37	36	34	34	34	30
	DATE	7/27/89	6/27/89	6/21/89	12/ 6/89	10/13/89	10/25/89	12/12/89	7/ 3/89	8/20/89	12/18/89
METEOROLOGICAL SITE	DIR (DEG)	240	250	100	230	270	10	10	90	230	300
NEWARK	VEL (MPH)	6.8	7.5	5.0	1.6	7.5	1.4	8.1	4.3	6.0	8.7
	SPD (MPH)	9.1	10.4	6.6	3.6	9.1	3.7	8.2	7.5	8.8	9.6
	RATIO	0.746	0.721	0.753	0.453	0.832	0.384	0.986	0.578	0.686	0.903
METEOROLOGICAL SITE	DIR (DEG)	220	230	130	200	270	360	20	120	210	310
BRADLEY	VEL (MPH)	6.2	4.5	2.0	4.2	4.7	3.5	4.1	3.1	6.8	7.9
	SPD (MPH)	7.8	6.0	5.0	6.8	6.6	4.6	4.6	6.5	8.2	8.8
	RATIO	0.793	0.743	0.404	0.625	0.713	0.759	0.894	0.473	0.835	0.906
METEOROLOGICAL SITE	DIR (DEG)	240	240	100	270	270	300	50	130	260	340
BRIDGEPORT	VEL (MPH)	5.6	5.7	6.0	1.9	4.5	1.4	3.9	6.2	4.8	5.1
	SPD (MPH)	5.8	5.8	6.0	4.5	4.7	3.3	4.2	6.2	4.9	5.5
	RATIO	0.972	0.996	0.992	0.416	0.941	0.412	0.924	0.996	0.986	0.932
METEOROLOGICAL SITE	DIR (DEG)	260	290	240	230	280	50	320	90	240	300
WORCESTER	VEL (MPH)	7.2	5.0	3.7	4.8	8.2	3.1	5.3	4.9	9.9	8.6
	SPD (MPH)	8.8	6.0	4.9	5.3	8.3	3.5	5.3	6.9	10.9	8.8
	RATIO	0.819	0.834	0.752	0.903	0.978	0.898	0.991	0.714	0.908	0.986

TABLE 2-5, CONTINUED

1989 TEN HIGHEST 24-HOUR AVERAGE PM10 DAYS WITH WIND DATA

UNITS : MICROGRAMS PER CUBIC METER

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
NORWALK-014 (0057)	PM10	82	69	68	63	62	60	55	54	53	50
	DATE	12/18/89	12/ 6/89	7/27/89	3/11/89	10/25/89	2/27/89	6/27/89	6/21/89	3/17/89	12/12/89
METEOROLOGICAL SITE	DIR (DEG)	300	230	240	170	10	250	250	100	210	10
NEWARK	VEL (MPH)	8.7	1.6	6.8	5.2	1.4	9.6	7.5	5.0	11.1	8.1
	SPD (MPH)	9.6	3.6	9.1	6.2	3.7	10.6	10.4	6.6	14.1	8.2
	RATIO	0.903	0.453	0.746	0.835	0.384	0.899	0.721	0.753	0.791	0.986
METEOROLOGICAL SITE	DIR (DEG)	310	200	220	190	360	300	230	130	170	20
BRADLEY	VEL (MPH)	7.9	4.2	6.2	6.7	3.5	4.6	4.5	2.0	9.3	4.1
	SPD (MPH)	8.8	6.8	7.8	7.9	4.6	5.8	6.0	5.0	12.4	4.6
	RATIO	0.906	0.625	0.793	0.848	0.759	0.808	0.743	0.404	0.752	0.894
METEOROLOGICAL SITE	DIR (DEG)	340	270	240	220	300	260	240	100	230	50
BRIDGEPORT	VEL (MPH)	5.1	1.9	5.6	2.8	1.4	4.6	5.7	6.0	7.0	3.9
	SPD (MPH)	5.5	4.5	5.8	3.2	3.3	4.7	5.8	6.0	7.2	4.2
	RATIO	0.932	0.416	0.972	0.897	0.412	0.967	0.996	0.992	0.969	0.924
METEOROLOGICAL SITE	DIR (DEG)	300	230	260	250	50	290	290	240	260	320
WORCESTER	VEL (MPH)	8.6	4.8	7.2	6.3	3.1	7.0	5.0	3.7	9.2	5.3
	SPD (MPH)	8.8	5.3	8.8	7.5	3.5	8.1	6.0	4.9	13.4	5.3
	RATIO	0.986	0.903	0.819	0.842	0.898	0.870	0.834	0.752	0.687	0.991
NORWICH-002 (0060)	PM10	54	47	45	44	42	41	40	35	35	34
	DATE	7/27/89	12/ 6/89	2/27/89	6/27/89	12/12/89	6/21/89	10/31/89	7/ 3/89	12/24/89	8/20/89
METEOROLOGICAL SITE	DIR (DEG)	240	230	250	250	10	100	50	90	10	230
NEWARK	VEL (MPH)	6.8	1.6	9.6	7.5	8.1	5.0	4.0	4.3	12.0	6.0
	SPD (MPH)	9.1	3.6	10.6	10.4	8.2	6.6	8.9	7.5	12.5	8.8
	RATIO	0.746	0.453	0.899	0.721	0.986	0.753	0.449	0.578	0.963	0.686
METEOROLOGICAL SITE	DIR (DEG)	220	200	300	230	20	130	30	120	350	210
BRADLEY	VEL (MPH)	6.2	4.2	4.6	4.5	4.1	2.0	3.1	3.1	5.0	6.8
	SPD (MPH)	7.8	6.8	5.8	6.0	4.6	5.0	4.6	6.5	5.6	8.2
	RATIO	0.793	0.625	0.808	0.743	0.894	0.404	0.673	0.473	0.894	0.835
METEOROLOGICAL SITE	DIR (DEG)	240	270	260	240	50	100	100	130	30	260
BRIDGEPORT	VEL (MPH)	5.6	1.9	4.6	5.7	3.9	6.0	10.0	6.2	7.8	4.8
	SPD (MPH)	5.8	4.5	4.7	5.8	4.2	6.0	10.6	6.2	8.1	4.9
	RATIO	0.972	0.416	0.967	0.996	0.924	0.992	0.936	0.996	0.969	0.986
METEOROLOGICAL SITE	DIR (DEG)	260	230	290	290	320	240	130	90	10	240
WORCESTER	VEL (MPH)	7.2	4.8	7.0	5.0	5.3	3.7	3.8	4.9	2.8	9.9
	SPD (MPH)	8.8	5.3	8.1	6.0	5.3	4.9	3.9	6.9	3.5	10.9
	RATIO	0.819	0.903	0.870	0.834	0.991	0.752	0.971	0.714	0.800	0.908
OLD SAYBROOK-005 (0059)	PM10	69	45	45	44	43	39	36	34	32	32
	DATE	7/ 3/89	7/27/89	6/27/89	2/27/89	12/18/89	12/ 6/89	12/12/89	10/13/89	8/20/89	8/ 2/89
METEOROLOGICAL SITE	DIR (DEG)	90	240	250	250	300	230	10	270	230	240
NEWARK	VEL (MPH)	4.3	6.8	7.5	9.6	8.7	1.6	8.1	7.5	6.0	8.7
	SPD (MPH)	7.5	9.1	10.4	10.6	9.6	3.6	8.2	9.1	8.8	10.1
	RATIO	0.578	0.746	0.721	0.899	0.903	0.453	0.986	0.832	0.686	0.868
METEOROLOGICAL SITE	DIR (DEG)	120	220	230	300	310	200	20	270	210	210
BRADLEY	VEL (MPH)	3.1	6.2	4.5	4.6	7.9	4.2	4.1	4.7	6.8	3.5
	SPD (MPH)	6.5	7.8	6.0	5.8	8.8	6.8	4.6	6.6	8.2	5.6
	RATIO	0.473	0.793	0.743	0.808	0.906	0.625	0.894	0.713	0.835	0.628

TABLE 2-5, CONTINUED

1989 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)	130	240	240	260	340	270	50	270	260	260
BRIDGEPORT	VEL (MPH)	6.2	5.6	5.7	4.6	5.1	1.9	3.9	4.5	4.8	6.3
	SPD (MPH)	6.2	5.8	5.8	4.7	5.5	4.5	4.2	4.7	4.9	6.3
	RATIO	0.996	0.972	0.996	0.967	0.932	0.416	0.924	0.941	0.986	0.992
METEOROLOGICAL SITE	DIR (DEG)	90	260	290	290	300	230	320	280	240	290
WORCESTER	VEL (MPH)	4.9	7.2	5.0	7.0	8.6	4.8	5.3	8.2	9.9	4.2
	SPD (MPH)	6.9	8.8	6.0	8.1	8.8	5.3	5.3	8.3	10.9	5.6
	RATIO	0.714	0.819	0.834	0.870	0.986	0.903	0.991	0.978	0.908	0.751
PUTNAM-002 (0059)	PM10	50	40	39	37	36	35	31	29	29	27
	DATE	7/27/89	12/ 6/89	6/21/89	12/12/89	12/24/89	6/27/89	2/27/89	8/20/89	10/31/89	7/21/89
METEOROLOGICAL SITE	DIR (DEG)	240	230	100	10	10	250	250	230	50	60
NEWARK	VEL (MPH)	6.8	1.6	5.0	8.1	12.0	7.5	9.6	6.0	4.0	4.6
	SPD (MPH)	9.1	3.6	6.6	8.2	12.5	10.4	10.6	8.8	8.9	6.8
	RATIO	0.746	0.453	0.753	0.986	0.963	0.721	0.899	0.686	0.449	0.681
METEOROLOGICAL SITE	DIR (DEG)	220	200	130	20	350	230	300	210	30	360
BRADLEY	VEL (MPH)	6.2	4.2	2.0	4.1	5.0	4.5	4.6	6.8	3.1	3.6
	SPD (MPH)	7.8	6.8	5.0	4.6	5.6	6.0	5.8	8.2	4.6	5.3
	RATIO	0.793	0.625	0.404	0.894	0.894	0.743	0.808	0.835	0.673	0.668
METEOROLOGICAL SITE	DIR (DEG)	240	270	100	50	30	240	260	260	100	120
BRIDGEPORT	VEL (MPH)	5.6	1.9	6.0	3.9	7.8	5.7	4.6	4.8	10.0	3.8
	SPD (MPH)	5.8	4.5	6.0	4.2	8.1	5.8	4.7	4.9	10.6	4.3
	RATIO	0.972	0.416	0.992	0.924	0.969	0.996	0.967	0.986	0.936	0.878
METEOROLOGICAL SITE	DIR (DEG)	260	230	240	320	10	290	290	240	130	60
WORCESTER	VEL (MPH)	7.2	4.8	3.7	5.3	2.8	5.0	7.0	9.9	3.8	3.6
	SPD (MPH)	8.8	5.3	4.9	5.3	3.5	6.0	8.1	10.9	3.9	4.5
	RATIO	0.819	0.903	0.752	0.991	0.800	0.834	0.870	0.908	0.971	0.797
STAMFORD-001 (0059)	PM10	62	57	51	49	46	45	45	44	42	37
	DATE	7/27/89	12/ 6/89	10/25/89	6/27/89	3/11/89	7/ 3/89	3/17/89	6/21/89	11/ 6/89	8/20/89
METEOROLOGICAL SITE	DIR (DEG)	240	230	10	250	170	90	210	100	220	230
NEWARK	VEL (MPH)	6.8	1.6	1.4	7.5	5.2	4.3	11.1	5.0	5.0	6.0
	SPD (MPH)	9.1	3.6	3.7	10.4	6.2	7.5	14.1	6.6	6.8	8.8
	RATIO	0.746	0.453	0.384	0.721	0.835	0.578	0.791	0.753	0.736	0.686
METEOROLOGICAL SITE	DIR (DEG)	220	200	360	230	190	120	170	130	200	210
BRADLEY	VEL (MPH)	6.2	4.2	3.5	4.5	6.7	3.1	9.3	2.0	5.0	6.8
	SPD (MPH)	7.8	6.8	4.6	6.0	7.9	6.5	12.4	5.0	6.8	8.2
	RATIO	0.793	0.625	0.759	0.743	0.848	0.473	0.752	0.404	0.738	0.835
METEOROLOGICAL SITE	DIR (DEG)	240	270	300	240	220	130	230	100	240	260
BRIDGEPORT	VEL (MPH)	5.6	1.9	1.4	5.7	2.8	6.2	7.0	6.0	6.9	4.8
	SPD (MPH)	5.8	4.5	3.3	5.8	3.2	6.2	7.2	6.0	7.8	4.9
	RATIO	0.972	0.416	0.412	0.996	0.897	0.996	0.969	0.992	0.889	0.986
METEOROLOGICAL SITE	DIR (DEG)	260	230	50	290	250	90	260	240	240	240
WORCESTER	VEL (MPH)	7.2	4.8	3.1	5.0	6.3	4.9	9.2	3.7	7.6	9.9
	SPD (MPH)	8.8	5.3	3.5	6.0	7.5	6.9	13.4	4.9	7.8	10.9
	RATIO	0.819	0.903	0.898	0.834	0.842	0.714	0.687	0.752	0.974	0.908

TABLE 2-5, CONTINUED

1989 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 (0060)	PM10	57	52	46	44	43	42	40	39	38	38
	DATE	7/27/89	12/ 6/89	2/27/89	6/27/89	12/18/89	10/25/89	3/17/89	6/21/89	12/12/89	3/11/89
METEOROLOGICAL SITE	DIR (DEG)	240	230	250	250	300	10	210	100	10	170
NEWARK	VEL (MPH)	6.8	1.6	9.6	7.5	8.7	1.4	11.1	5.0	8.1	5.2
	SPD (MPH)	9.1	3.6	10.6	10.4	9.6	3.7	14.1	6.6	8.2	6.2
	RATIO	0.746	0.453	0.899	0.721	0.903	0.384	0.791	0.753	0.986	0.835
METEOROLOGICAL SITE	DIR (DEG)	220	200	300	230	310	360	170	130	20	190
BRADLEY	VEL (MPH)	6.2	4.2	4.6	4.5	7.9	3.5	9.3	2.0	4.1	6.7
	SPD (MPH)	7.8	6.8	5.8	6.0	8.8	4.6	12.4	5.0	4.6	7.9
	RATIO	0.793	0.625	0.808	0.743	0.906	0.759	0.752	0.404	0.894	0.848
METEOROLOGICAL SITE	DIR (DEG)	240	270	260	240	340	300	230	100	50	220
BRIDGEPORT	VEL (MPH)	5.6	1.9	4.6	5.7	5.1	1.4	7.0	6.0	3.9	2.8
	SPD (MPH)	5.8	4.5	4.7	5.8	5.5	3.3	7.2	6.0	4.2	3.2
	RATIO	0.972	0.416	0.967	0.996	0.932	0.412	0.969	0.992	0.924	0.897
METEOROLOGICAL SITE	DIR (DEG)	260	230	290	290	300	50	260	240	320	250
WORCESTER	VEL (MPH)	7.2	4.8	7.0	5.0	8.6	3.1	9.2	3.7	5.3	6.3
	SPD (MPH)	8.8	5.3	8.1	6.0	8.8	3.5	13.4	4.9	5.3	7.5
	RATIO	0.819	0.903	0.870	0.834	0.986	0.898	0.687	0.752	0.991	0.842
TORRINGTON-001 (0060)	PM10	48	48	44	43	40	40	39	38	34	33
	DATE	12/ 6/89	1/22/89	6/21/89	7/27/89	2/27/89	3/11/89	3/17/89	10/31/89	6/27/89	7/ 3/89
METEOROLOGICAL SITE	DIR (DEG)	230	230	100	240	250	170	210	50	250	90
NEWARK	VEL (MPH)	1.6	8.3	5.0	6.8	9.6	5.2	11.1	4.0	7.5	4.3
	SPD (MPH)	3.6	9.5	6.6	9.1	10.6	6.2	14.1	8.9	10.4	7.5
	RATIO	0.453	0.873	0.753	0.746	0.899	0.835	0.791	0.449	0.721	0.578
METEOROLOGICAL SITE	DIR (DEG)	200	190	130	220	300	190	170	30	230	120
BRADLEY	VEL (MPH)	4.2	7.8	2.0	6.2	4.6	6.7	9.3	3.1	4.5	3.1
	SPD (MPH)	6.8	9.3	5.0	7.8	5.8	7.9	12.4	4.6	6.0	6.5
	RATIO	0.625	0.836	0.404	0.793	0.808	0.848	0.752	0.673	0.743	0.473
METEOROLOGICAL SITE	DIR (DEG)	270	250	100	240	260	220	230	100	240	130
BRIDGEPORT	VEL (MPH)	1.9	6.2	6.0	5.6	4.6	2.8	7.0	10.0	5.7	6.2
	SPD (MPH)	4.5	6.2	6.0	5.8	4.7	3.2	7.2	10.6	5.8	6.2
	RATIO	0.416	0.999	0.992	0.972	0.967	0.897	0.969	0.936	0.996	0.996
METEOROLOGICAL SITE	DIR (DEG)	230	260	240	260	290	250	260	130	290	90
WORCESTER	VEL (MPH)	4.8	10.7	3.7	7.2	7.0	6.3	9.2	3.8	5.0	4.9
	SPD (MPH)	5.3	12.1	4.9	8.8	8.1	7.5	13.4	3.9	6.0	6.9
	RATIO	0.903	0.885	0.752	0.819	0.870	0.842	0.687	0.971	0.834	0.714
VOLUNTOWN-001 (0056)	PM10	47	36	30	29	28	24	24	23	22	22
	DATE	7/27/89	6/27/89	7/ 3/89	8/20/89	6/21/89	12/ 6/89	7/21/89	2/27/89	8/ 2/89	10/13/89
METEOROLOGICAL SITE	DIR (DEG)	240	250	90	230	100	230	60	250	240	270
NEWARK	VEL (MPH)	6.8	7.5	4.3	6.0	5.0	1.6	4.6	9.6	8.7	7.5
	SPD (MPH)	9.1	10.4	7.5	8.8	6.6	3.6	6.8	10.6	10.1	9.1
	RATIO	0.746	0.721	0.578	0.686	0.753	0.453	0.681	0.899	0.868	0.832
METEOROLOGICAL SITE	DIR (DEG)	220	230	120	210	130	200	360	300	210	270
BRADLEY	VEL (MPH)	6.2	4.5	3.1	6.8	2.0	4.2	3.6	4.6	3.5	4.7
	SPD (MPH)	7.8	6.0	6.5	8.2	5.0	6.8	5.3	5.8	5.6	6.6
	RATIO	0.793	0.743	0.473	0.835	0.404	0.625	0.668	0.808	0.628	0.713

TABLE 2-5, CONTINUED

1989 TEN HIGHEST 24-HOUR AVERAGE PM10 DAYS WITH WIND DATA

UNITS : MICROGRAMS PER CUBIC METER

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
METEOROLOGICAL SITE	DIR (DEG)	240	240	130	260	100	270	120	260	260	270
BRIDGEPORT	VEL (MPH)	5.6	5.7	6.2	4.8	6.0	1.9	3.8	4.6	6.3	4.5
	SPD (MPH)	5.8	5.8	6.2	4.9	6.0	4.5	4.3	4.7	6.3	4.7
	RATIO	0.972	0.996	0.996	0.986	0.992	0.416	0.878	0.967	0.992	0.941
METEOROLOGICAL SITE	DIR (DEG)	260	290	90	240	240	230	60	290	290	280
WORCESTER	VEL (MPH)	7.2	5.0	4.9	9.9	3.7	4.8	3.6	7.0	4.2	8.2
	SPD (MPH)	8.8	6.0	6.9	10.9	4.9	5.3	4.5	8.1	5.6	8.3
	RATIO	0.819	0.834	0.714	0.908	0.752	0.903	0.797	0.870	0.751	0.978
WALLINGFORD-006 (0058)	PM10	46	45	44	37	35	35	34	33	33	33
	DATE	12/ 6/89	12/12/89	6/27/89	2/27/89	7/ 3/89	12/24/89	3/11/89	8/20/89	1/22/89	3/17/89
METEOROLOGICAL SITE	DIR (DEG)	230	10	250	250	90	10	170	230	230	210
NEWARK	VEL (MPH)	1.6	8.1	7.5	9.6	4.3	12.0	5.2	6.0	8.3	11.1
	SPD (MPH)	3.6	8.2	10.4	10.6	7.5	12.5	6.2	8.8	9.5	14.1
	RATIO	0.453	0.986	0.721	0.899	0.578	0.963	0.835	0.686	0.873	0.791
METEOROLOGICAL SITE	DIR (DEG)	200	20	230	300	120	350	190	210	190	170
BRADLEY	VEL (MPH)	4.2	4.1	4.5	4.6	3.1	5.0	6.7	6.8	7.8	9.3
	SPD (MPH)	6.8	4.6	6.0	5.8	6.5	5.6	7.9	8.2	9.3	12.4
	RATIO	0.625	0.894	0.743	0.808	0.473	0.894	0.848	0.835	0.836	0.752
METEOROLOGICAL SITE	DIR (DEG)	270	50	240	260	130	30	220	260	250	230
BRIDGEPORT	VEL (MPH)	1.9	3.9	5.7	4.6	6.2	7.8	2.8	4.8	6.2	7.0
	SPD (MPH)	4.5	4.2	5.8	4.7	6.2	8.1	3.2	4.9	6.2	7.2
	RATIO	0.416	0.924	0.996	0.967	0.996	0.969	0.897	0.986	0.999	0.969
METEOROLOGICAL SITE	DIR (DEG)	230	320	290	290	90	10	250	240	260	260
WORCESTER	VEL (MPH)	4.8	5.3	5.0	7.0	4.9	2.8	6.3	9.9	10.7	9.2
	SPD (MPH)	5.3	5.3	6.0	8.1	6.9	3.5	7.5	10.9	12.1	13.4
	RATIO	0.903	0.991	0.834	0.870	0.714	0.800	0.842	0.908	0.885	0.687
WATERBURY-007 (0057)	PM10	70	60	56	55	51	49	44	42	41	40
	DATE	12/ 6/89	2/27/89	7/27/89	12/12/89	11/ 6/89	3/11/89	12/18/89	10/25/89	11/24/89	6/27/89
METEOROLOGICAL SITE	DIR (DEG)	230	250	240	10	220	170	300	10	260	250
NEWARK	VEL (MPH)	1.6	9.6	6.8	8.1	5.0	5.2	8.7	1.4	7.2	7.5
	SPD (MPH)	3.6	10.6	9.1	8.2	6.8	6.2	9.6	3.7	9.5	10.4
	RATIO	0.453	0.899	0.746	0.986	0.736	0.835	0.903	0.384	0.756	0.721
METEOROLOGICAL SITE	DIR (DEG)	200	300	220	20	200	190	310	360	240	230
BRADLEY	VEL (MPH)	4.2	4.6	6.2	4.1	5.0	6.7	7.9	3.5	2.6	4.5
	SPD (MPH)	6.8	5.8	7.8	4.6	6.8	7.9	8.8	4.6	4.5	6.0
	RATIO	0.625	0.808	0.793	0.894	0.738	0.848	0.906	0.759	0.587	0.743
METEOROLOGICAL SITE	DIR (DEG)	270	260	240	50	240	220	340	300	300	240
BRIDGEPORT	VEL (MPH)	1.9	4.6	5.6	3.9	6.9	2.8	5.1	1.4	7.0	5.7
	SPD (MPH)	4.5	4.7	5.8	4.2	7.8	3.2	5.5	3.3	7.2	5.8
	RATIO	0.416	0.967	0.972	0.924	0.889	0.897	0.932	0.412	0.974	0.996
METEOROLOGICAL SITE	DIR (DEG)	230	290	260	320	240	250	300	50	280	290
WORCESTER	VEL (MPH)	4.8	7.0	7.2	5.3	7.6	6.3	8.6	3.1	5.1	5.0
	SPD (MPH)	5.3	8.1	8.8	5.3	7.8	7.5	8.8	3.5	5.5	6.0
	RATIO	0.903	0.870	0.819	0.991	0.974	0.842	0.986	0.898	0.937	0.834

TABLE 2-5, CONTINUED

1989 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	70	68	68	66	65	58	56	56	52	47
	DATE	12/ 6/89	12/18/89	2/27/89	12/12/89	11/ 6/89	10/25/89	10/13/89	7/27/89	12/24/89	3/11/89
METEOROLOGICAL SITE	DIR (DEG)	230	300	250	10	220	10	270	240	10	170
NEWARK	VEL (MPH)	1.6	8.7	9.6	8.1	5.0	1.4	7.5	6.8	12.0	5.2
	SPD (MPH)	3.6	9.6	10.6	8.2	6.8	3.7	9.1	9.1	12.5	6.2
	RATIO	0.453	0.903	0.899	0.986	0.736	0.384	0.832	0.746	0.963	0.835
METEOROLOGICAL SITE	DIR (DEG)	200	310	300	20	200	360	270	220	350	190
BRADLEY	VEL (MPH)	4.2	7.9	4.6	4.1	5.0	3.5	4.7	6.2	5.0	6.7
	SPD (MPH)	6.8	8.8	5.8	4.6	6.8	4.6	6.6	7.8	5.6	7.9
	RATIO	0.625	0.906	0.808	0.894	0.738	0.759	0.713	0.793	0.894	0.848
METEOROLOGICAL SITE	DIR (DEG)	270	340	260	50	240	300	270	240	30	220
BRIDGEPORT	VEL (MPH)	1.9	5.1	4.6	3.9	6.9	1.4	4.5	5.6	7.8	2.8
	SPD (MPH)	4.5	5.5	4.7	4.2	7.8	3.3	4.7	5.8	8.1	3.2
	RATIO	0.416	0.932	0.967	0.924	0.889	0.412	0.941	0.972	0.969	0.897
METEOROLOGICAL SITE	DIR (DEG)	230	300	290	320	240	50	280	260	10	250
WORCESTER	VEL (MPH)	4.8	8.6	7.0	5.3	7.6	3.1	8.2	7.2	2.8	6.3
	SPD (MPH)	5.3	8.8	8.1	5.3	7.8	3.5	8.3	8.8	3.5	7.5
	RATIO	0.903	0.986	0.870	0.991	0.974	0.898	0.978	0.819	0.800	0.842
WATERFORD-001 (0058)	PM10	52	35	33	31	30	30	28	27	25	25
	DATE	7/27/89	6/27/89	6/21/89	10/13/89	7/ 3/89	8/20/89	12/ 6/89	12/12/89	2/27/89	7/21/89
METEOROLOGICAL SITE	DIR (DEG)	240	250	100	270	90	230	230	10	250	60
NEWARK	VEL (MPH)	6.8	7.5	5.0	7.5	4.3	6.0	1.6	8.1	9.6	4.6
	SPD (MPH)	9.1	10.4	6.6	9.1	7.5	8.8	3.6	8.2	10.6	6.8
	RATIO	0.746	0.721	0.753	0.832	0.578	0.686	0.453	0.986	0.899	0.681
METEOROLOGICAL SITE	DIR (DEG)	220	230	130	270	120	210	200	20	300	360
BRADLEY	VEL (MPH)	6.2	4.5	2.0	4.7	3.1	6.8	4.2	4.1	4.6	3.6
	SPD (MPH)	7.8	6.0	5.0	6.6	6.5	8.2	6.8	4.6	5.8	5.3
	RATIO	0.793	0.743	0.404	0.713	0.473	0.835	0.625	0.894	0.808	0.668
METEOROLOGICAL SITE	DIR (DEG)	240	240	100	270	130	260	270	50	260	120
BRIDGEPORT	VEL (MPH)	5.6	5.7	6.0	4.5	6.2	4.8	1.9	3.9	4.6	3.8
	SPD (MPH)	5.8	5.8	6.0	4.7	6.2	4.9	4.5	4.2	4.7	4.3
	RATIO	0.972	0.996	0.992	0.941	0.996	0.986	0.416	0.924	0.967	0.878
METEOROLOGICAL SITE	DIR (DEG)	260	290	240	280	90	240	230	320	290	60
WORCESTER	VEL (MPH)	7.2	5.0	3.7	8.2	4.9	9.9	4.8	5.3	7.0	3.6
	SPD (MPH)	8.8	6.0	4.9	8.3	6.9	10.9	5.3	5.3	8.1	4.5
	RATIO	0.819	0.834	0.752	0.978	0.714	0.908	0.903	0.991	0.870	0.797
WEST HAVEN-003 (0060)	PM10	59	50	49	47	46	46	41	40	40	38
	DATE	7/27/89	2/27/89	12/12/89	6/27/89	12/18/89	12/ 6/89	10/13/89	11/ 6/89	10/25/89	8/20/89
METEOROLOGICAL SITE	DIR (DEG)	240	250	10	250	300	230	270	220	10	230
NEWARK	VEL (MPH)	6.8	9.6	8.1	7.5	8.7	1.6	7.5	5.0	1.4	6.0
	SPD (MPH)	9.1	10.6	8.2	10.4	9.6	3.6	9.1	6.8	3.7	8.8
	RATIO	0.746	0.899	0.986	0.721	0.903	0.453	0.832	0.736	0.384	0.686
METEOROLOGICAL SITE	DIR (DEG)	220	300	20	230	310	200	270	200	360	210
BRADLEY	VEL (MPH)	6.2	4.6	4.1	4.5	7.9	4.2	4.7	5.0	3.5	6.8
	SPD (MPH)	7.8	5.8	4.6	6.0	8.8	6.8	6.6	6.8	4.6	8.2
	RATIO	0.793	0.808	0.894	0.743	0.906	0.625	0.713	0.738	0.759	0.835

TABLE 2-5, CONTINUED

1989 TEN HIGHEST 24-HOUR AVERAGE PM10 DAYS WITH WIND DATA

UNITS : MICROGRAMS PER CUBIC METER

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
METEOROLOGICAL SITE	DIR (DEG)	240	260	50	240	340	270	270	240	300	260
BRIDGEPORT	VEL (MPH)	5.6	4.6	3.9	5.7	5.1	1.9	4.5	6.9	1.4	4.8
	SPD (MPH)	5.8	4.7	4.2	5.8	5.5	4.5	4.7	7.8	3.3	4.9
	RATIO	0.972	0.967	0.924	0.996	0.932	0.416	0.941	0.889	0.412	0.986
METEOROLOGICAL SITE	DIR (DEG)	260	290	320	290	300	230	280	240	50	240
WORCESTER	VEL (MPH)	7.2	7.0	5.3	5.0	8.6	4.8	8.2	7.6	3.1	9.9
	SPD (MPH)	8.8	8.1	5.3	6.0	8.8	5.3	8.3	7.8	3.5	10.9
	RATIO	0.819	0.870	0.991	0.834	0.986	0.903	0.978	0.974	0.898	0.908
WILLIMANTIC-002 (0060)	PM10	45	43	41	38	38	35	35	30	30	30
	DATE	7/27/89	6/21/89	2/27/89	12/ 6/89	12/12/89	6/27/89	12/24/89	3/17/89	8/20/89	1/22/89
METEOROLOGICAL SITE	DIR (DEG)	240	100	250	230	10	250	10	210	230	230
NEWARK	VEL (MPH)	6.8	5.0	9.6	1.6	8.1	7.5	12.0	11.1	6.0	8.3
	SPD (MPH)	9.1	6.6	10.6	3.6	8.2	10.4	12.5	14.1	8.8	9.5
	RATIO	0.746	0.753	0.899	0.453	0.986	0.721	0.963	0.791	0.686	0.873
METEOROLOGICAL SITE	DIR (DEG)	220	130	300	200	20	230	350	170	210	190
BRADLEY	VEL (MPH)	6.2	2.0	4.6	4.2	4.1	4.5	5.0	9.3	6.8	7.8
	SPD (MPH)	7.8	5.0	5.8	6.8	4.6	6.0	5.6	12.4	8.2	9.3
	RATIO	0.793	0.404	0.808	0.625	0.894	0.743	0.894	0.752	0.835	0.836
METEOROLOGICAL SITE	DIR (DEG)	240	100	260	270	50	240	30	230	260	250
BRIDGEPORT	VEL (MPH)	5.6	6.0	4.6	1.9	3.9	5.7	7.8	7.0	4.8	6.2
	SPD (MPH)	5.8	6.0	4.7	4.5	4.2	5.8	8.1	7.2	4.9	6.2
	RATIO	0.972	0.992	0.967	0.416	0.924	0.996	0.969	0.969	0.986	0.999
METEOROLOGICAL SITE	DIR (DEG)	260	240	290	230	320	290	10	260	240	260
WORCESTER	VEL (MPH)	7.2	3.7	7.0	4.8	5.3	5.0	2.8	9.2	9.9	10.7
	SPD (MPH)	8.8	4.9	8.1	5.3	5.3	6.0	3.5	13.4	10.9	12.1
	RATIO	0.819	0.752	0.870	0.903	0.991	0.834	0.800	0.687	0.908	0.885

TABLE 2-6

PM10 TRENDS: 1985-1989
(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

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 1989 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 18 sites in 1989.

DISCUSSION OF DATA

Monitoring Network - Eighteen continuous SO_2 monitors were used to record data in 13 towns during 1989 (see Figure 3-1):

Bridgeport 012
Bridgeport 013
Danbury 123
East Hartford 005
East Hartford 006
East Haven 003
Enfield 005
Greenwich 017
Groton 007
Hartford 018
Milford 010
New Britain 011
New Haven 017
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 - 656 precision checks were made on SO_2 monitors in 1989, yielding 95% probability limits ranging from -6% to +6%. Accuracy is determined by introducing a known amount of SO_2 into each of the monitors. Three different concentration levels are tested: low, medium, and high. The 95% probability limits for accuracy based on 12 audits were: low, -15% to +9%; medium, -10% to 0%; and high, -9% to +4%.

Annual Averages - SO_2 levels were below the primary annual standard of 80 $\mu g/m^3$ at all sites in 1989 (see Table 3-1). The annual average SO_2 levels decreased at 9, and increased at 2, of the 14 monitoring sites that had adequate data in both 1988 and 1989 to produce valid annual averages. The largest decrease was 3 $\mu g/m^3$, which occurred at East Haven 003, Groton 007, and New Haven 123 . The largest annual average increase was 3 $\mu g/m^3$, which occurred at Waterbury 008.

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 1989 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 13 of the 14 monitoring sites that had a sufficient distribution and quantity of data in both 1988 and 1989. The decreases ranged from 5 $\mu g/m^3$ at Greenwich 017 to 71 $\mu g/m^3$ at New Britain 011. New Haven 123 had a higher second high concentration of 24 $\mu g/m^3$ and was the only site to experience an increase.

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 maximum 24-hour SO_2 readings from both the running averages and the calendar day averages for comparison. The maximum 24-hour running averages are all higher than the maximum calendar day averages except at Groton 007, and the differences range up to 39 $\mu g/m^3$, which occurred at Hartford 018.

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 μg/m³ at all DEP monitoring sites in 1989. Of the 14 sites that had a sufficient distribution and quantity of data in both 1988 and 1989, 8 had lower second high concentrations in 1989. The decreases ranged from 3 μg/m³ at Danbury 123 to 68 μg/m³ at New Britain 011. Six sites had higher second high concentrations in 1989. The increases ranged from 7 μg/m³ at Stamford 123 and Waterbury 008 to 162 μg/m³ at New Haven 123.

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 1989. Only those 15 sites were used which had a sufficient distribution and quantity of data to produce a valid annual average. The table also shows the average wind conditions that occurred on each of these dates. (The origin and use of these wind data are described in the discussion of Table 2-5 in the particulate matter section of this Air Quality Summary.)

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

The data in Table 3-4 also suggest another reason for high SO_2 levels. Approximately 60% of the tabulated days occurred during the winter, and 40% 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 concemntrations.

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, avilable 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 is 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%.) One would have expected measured SO_2 levels to increase in 1982 and subsequent years, as compared to 1981, due to the use of 1.0% sulfur oil. 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 (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 $\mu g/m^3$. Table 3-5 shows the year-to-year trend in ambient SO_2 levels. A decrease in SO_2 concentrations is evident from 1982 to 1983. However, no significant change in SO_2 levels is evident since 1983.

The results of continuous SO_2 monitoring indicate that sulfur dioxide levels in 1989 were not significantly different from those in 1988 (see Table 3-5). Temperature is an important factor in determining SO_2 emissions. The lack of change in measured SO_2 levels may have been due to the fact that for Connecticut 1989 was not appreciably cooler than 1988. 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 increases, the amount of fuel that must be burned to heat buildings also increases. Consequently, as more fuel is burned, the emissions of sulfur dioxide are proportonately increased. There was approximately a 1% decrease in degrees days for Connecticut from 1988 to 1989.

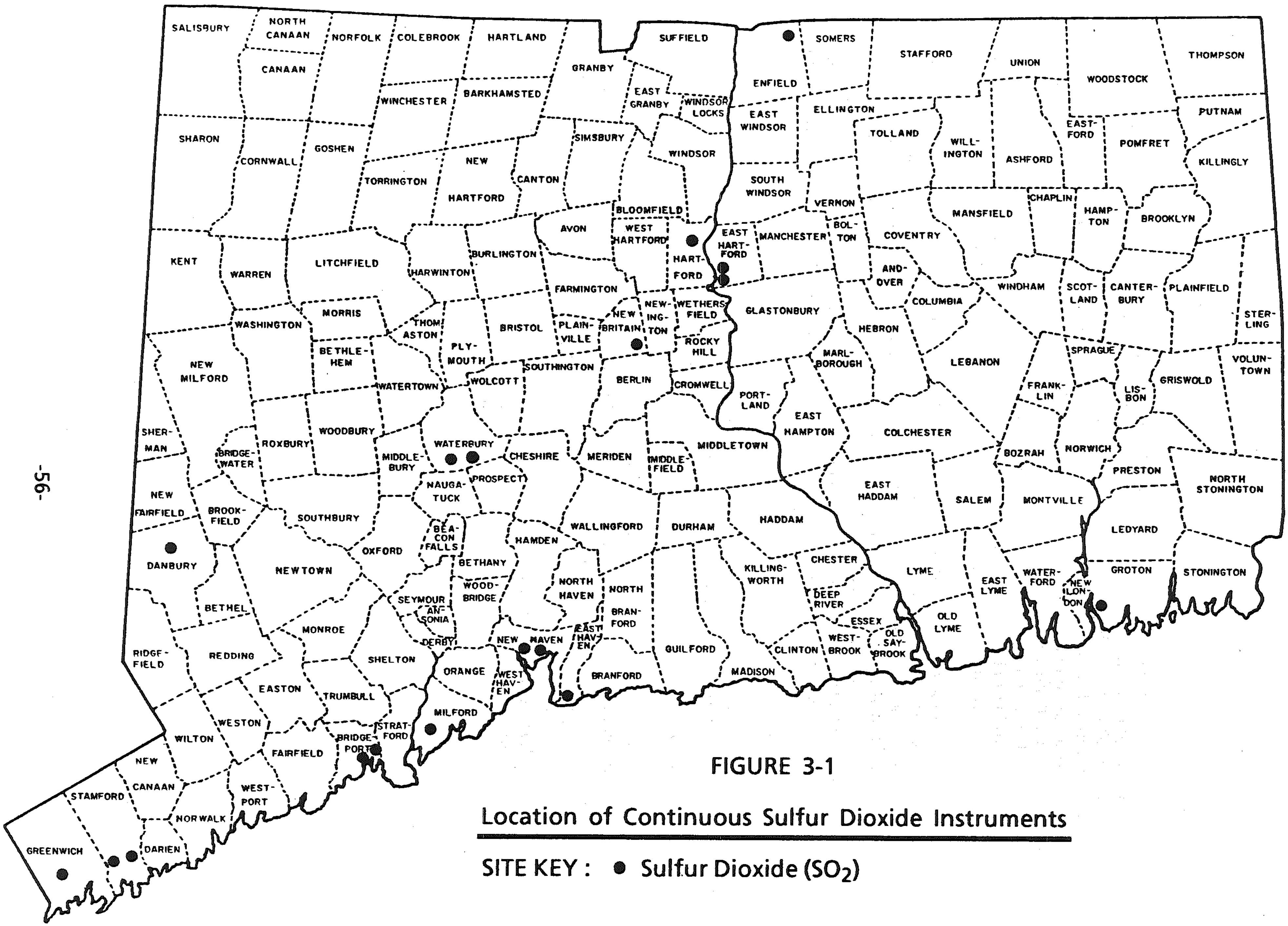


FIGURE 3-1

Location of Continuous Sulfur Dioxide Instruments

SITE KEY : ● Sulfur Dioxide (SO_2)

TABLE 3-1

1989 ANNUAL ARITHMETIC AVERAGES OF SULFUR DIOXIDE

(PRIMARY STANDARD: 80 µg/m^3)

TOWN-SITE	SITE NAME	ANNUAL AVG (µg/m^3)
Bridgeport 012	Edison School	36
Bridgeport 013	Hallett Street	26
Danbury 123	Western CT State College	22
East Hartford 005	Fire House - Engine Co. #5	27*
East Hartford 006	High Street	28*
East Haven 003	Animal Shelter	22
Enfield 005	Department of Corrections	18
Greenwich 017	Greenwich Point Park	16
Groton 007	Fire Headquarters	20
Hartford 018	State Office Building	28
Milford 010	Devon Community Center	26
New Britain 011	Armory	24
New Haven 017	Lombard St. Fire House	29*
New Haven 123	State Street	41
Stamford 025	Recreation Center	28
Stamford 123	Health Department	25
Waterbury 008	Armory	30
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

1987-1989 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	1987	351	33.4	32.9	33.9	25.564	
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	013	1988	363	28.1	27.9	28.3	23.821	
BRIDGEPORT	013	1989	348	26.0	25.5	26.4	19.517	
BRIDGEPORT	123	1987	306	28.3	27.3	29.3	22.802	
DANBURY	123	1987	345	20.9	20.5	21.3	16.253	
DANBURY	123	1988	341	23.1	22.6	23.7	20.905	
DANBURY	123	1989	362	22.1	21.9	22.2	17.365	
EAST HARTFORD	005	1987	327	26.3	25.5	27.0	21.715	
EAST HARTFORD	005	1988	225*	26.8	25.4	28.1	16.646	
EAST HARTFORD	005	1989	152*	26.6	24.0	29.2	21.299	
EAST HARTFORD	006	1989	139*	27.5	24.7	30.2	21.076	
EAST HAVEN	003	1987	346	25.1	24.6	25.6	20.861	
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	
ENFIELD	005	1987	343	16.8	16.3	17.2	16.057	
ENFIELD	005	1988	344	18.9	18.5	19.4	16.213	
ENFIELD	005	1989	356	17.4	17.2	17.7	13.374	
GREENWICH	017	1987	346	12.2	11.9	12.4	10.825	
GREENWICH	017	1988	356	16.1	15.9	16.3	12.034	
GREENWICH	017	1989	360	15.8	15.7	16.0	13.551	
GROTON	007	1987	353	18.9	18.6	19.1	13.858	
GROTON	007	1988	357	22.7	22.4	22.9	16.958	
GROTON	007	1989	341	19.9	19.6	20.2	12.749	

* 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

1987-1989 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
HARTFORD	018	1989	339	27.5	26.9	28.0	19.595	
HARTFORD	123	1987	341	26.0	25.4	26.6	21.972	
HARTFORD	123	1988	304	26.8	25.7	28.0	24.517	
MILFORD	010	1987	332	25.1	24.4	25.8	21.359	
MILFORD	010	1988	280	27.2	25.8	28.7	25.024	
MILFORD	010	1989	323	25.5	24.7	26.3	22.218	
NEW BRITAIN	011	1987	364	25.9	25.8	26.1	21.866	
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 HAVEN	017	1987	327	36.3	35.2	37.4	31.847	
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	1987	348	39.7	39.0	40.5	31.906	
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	
NORWALK	013	1987	344	23.1	22.5	23.7	23.071	
NORWALK	013	1988	81*	28.5	22.6	34.4	30.490	
STAMFORD	025	1987	319	29.2	28.3	30.1	23.574	
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	123	1987	357	29.4	29.0	29.7	23.767	
STAMFORD	123	1988	360	24.5	24.2	24.9	23.560	
STAMFORD	123	1989	364	25.1	25.0	25.2	22.175	
WATERBURY	008	1987	343	30.6	30.0	31.3	23.874	
WATERBURY	008	1988	343	26.7	26.0	27.5	27.919	
WATERBURY	008	1989	360	29.9	29.5	30.2	29.408	

* 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

1987-1989 SO2 ANNUAL AVERAGES AND STATISTICAL PROJECTIONS

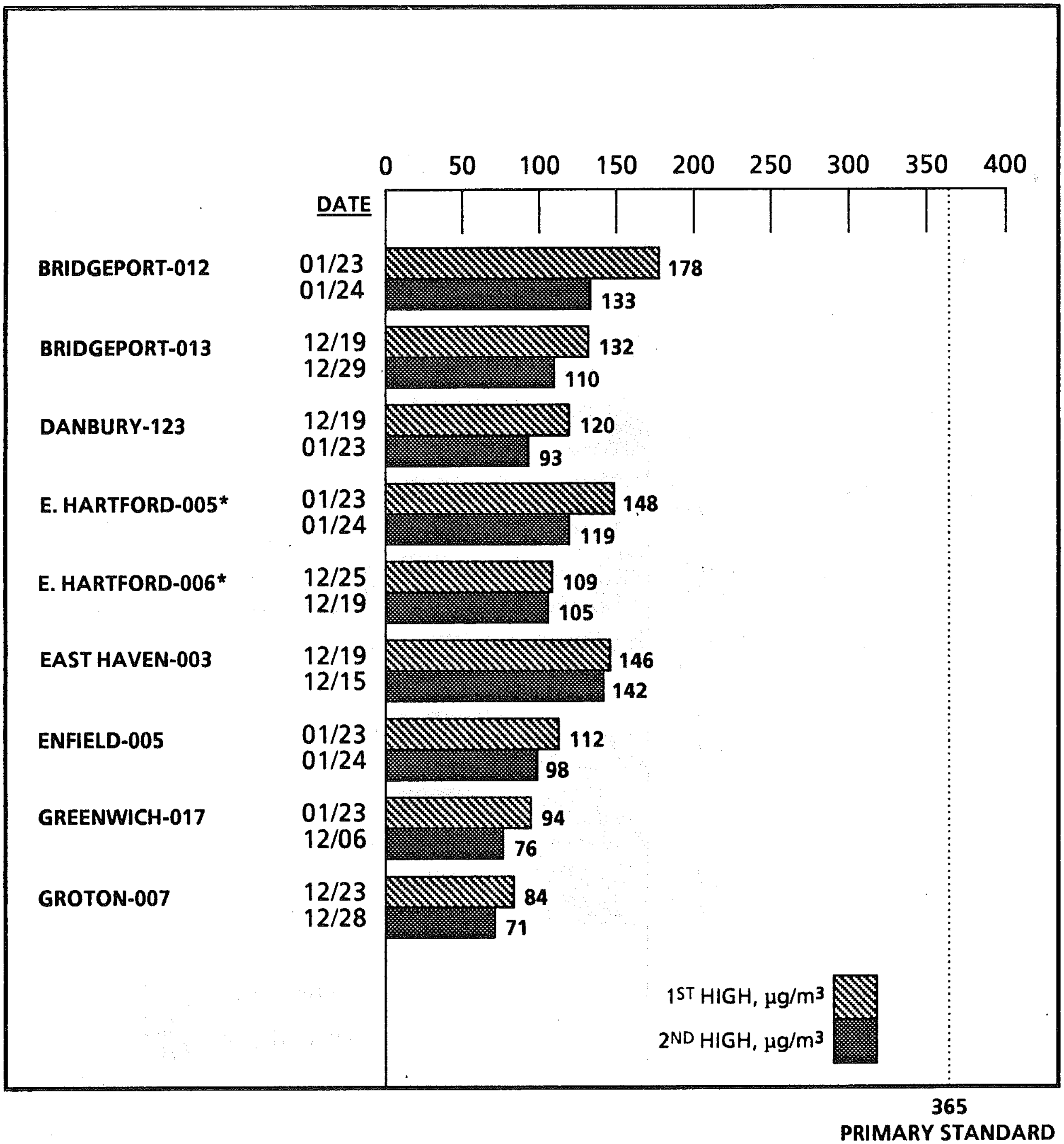
TOWN NAME	SITE	YEAR	SAMPLES	ARITHMETIC MEAN	95-PCT-LIMITS LOWER	95-PCT-LIMITS UPPER	STANDARD DEVIATION	PREDICTED DAYS OVER 365 UG/M3
WATERBURY	123	1987	349	21.5	21.1	21.8	17.693	
WATERBURY	123	1988	351	26.2	25.7	26.6	22.552	
WATERBURY	123	1989	341	25.4	24.8	26.0	21.647	

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

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

FIGURE 3-2

1989 MAXIMUM CALENDAR DAY AVERAGE SO2 CONCENTRATIONS

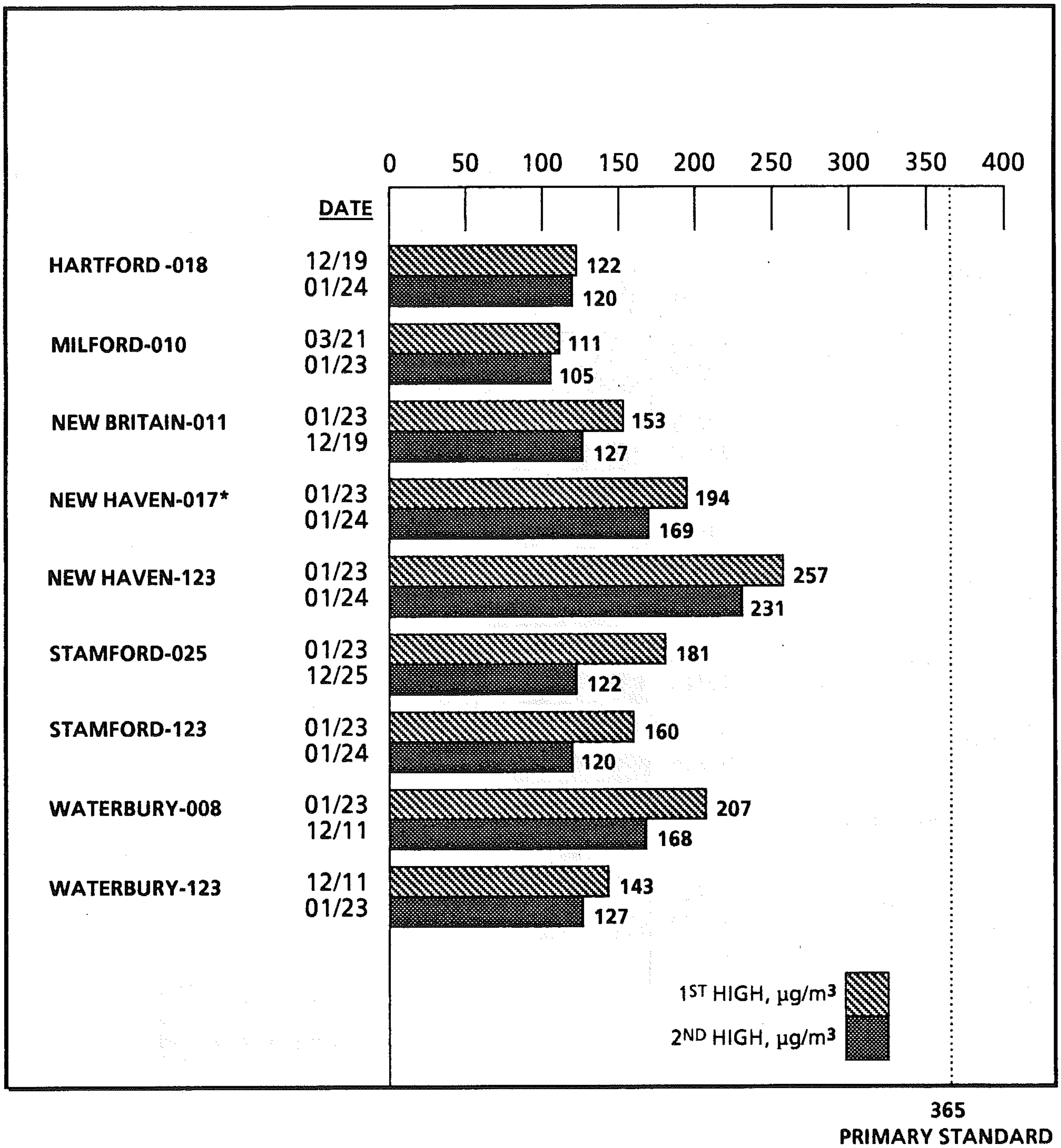


* The site has insufficient data to satisfy the minimum sampling criteria.

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

FIGURE 3-2, CONTINUED

1989 MAXIMUM CALENDAR DAY AVERAGE SO2 CONCENTRATIONS



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

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

TABLE 3-3

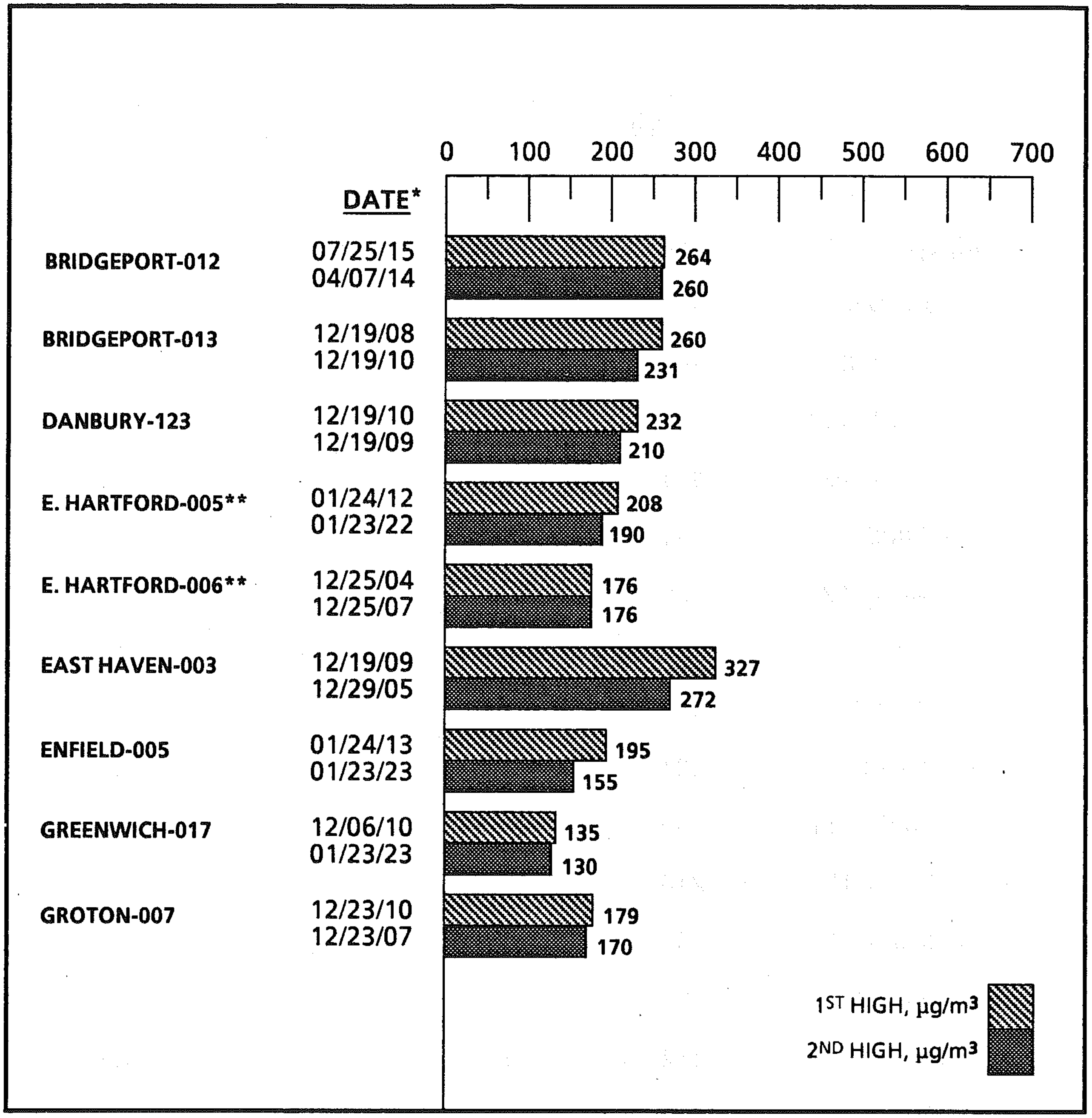
COMPARISONS OF FIRST AND SECOND HIGH CALENDAR DAY AND 24-HOUR RUNNING SO2 AVERAGES FOR 1989

SITE	FIRST HIGH AVERAGE RUNNING 24-HOUR	FIRST HIGH AVERAGE CALENDAR DAY	SECOND HIGH AVERAGE RUNNING 24-HOUR	SECOND HIGH AVERAGE CALENDAR DAY
Bridgeport-012	179	178	156	133
Bridgeport-013	158	132	117	110
Danbury-123	131	120	104	93
E. Hartford-005*	163	148	135	119
E. Hartford-006*	117	109	105	105
East Haven-003	151	146	148	142
Enfield-005	131	112	106	98
Greenwich-017	98	94	82	76
Groton-007	84	84	80	71
Hartford-018	161	122	122	120
Milford-010	121	111	114	105
New Britain-011	159	153	134	127
New Haven-017*	210	194	183	169
New Haven-123	285	257	246	231
Stamford-025	183	181	140	122
Stamford-123	162	160	140	120
Waterbury-008	211	207	186	168
Waterbury-123	153	143	127	127

* 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

1989 MAXIMUM 3-HOUR RUNNING AVERAGE SO2 CONCENTRATIONS

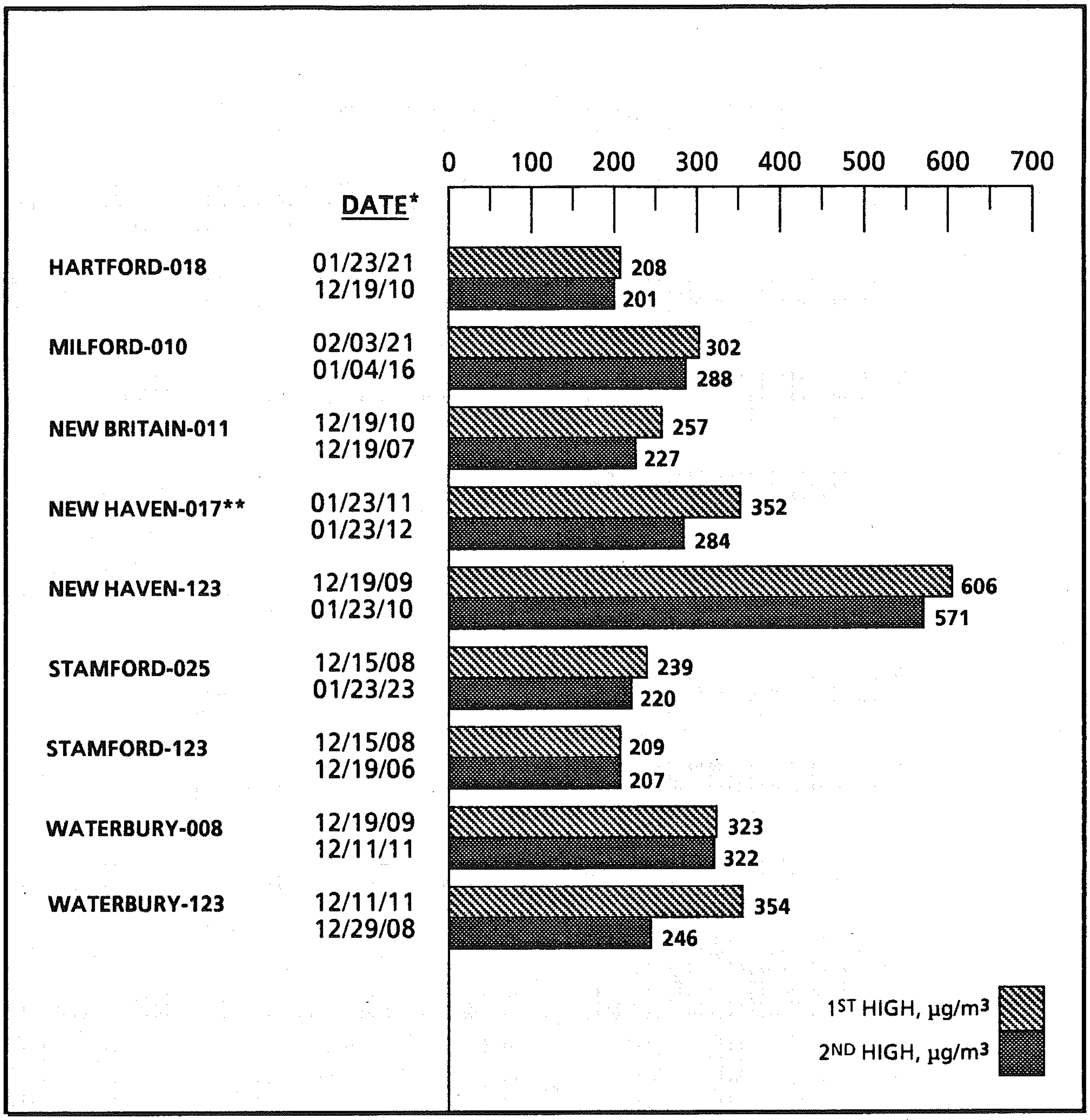


* The date is the month/day/ending hour of occurrence.
** The site has insufficient data to satisfy the minimum sampling criteria.
N.B. When a listed concentration occurs more than once at a site, the earliest date of occurrence is given first.

Secondary standard = 1300 µg/m^3.

FIGURE 3-3, CONTINUED

1989 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 µg/m^3.

TABLE 3-4

1989 TEN HIGHEST 24-HOUR AVERAGE SO2 DAYS WITH WIND DATA

UNITS : MICROGRAMS PER CUBIC METER

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
BRIDGEPORT-012 (0362)	SO2	178	133	129	120	118	112	108	107	105	103
	DATE	1/23/89	1/24/89	1/17/89	12/ 6/89	2/19/89	12/19/89	12/29/89	2/20/89	1/22/89	3/17/89
METEOROLOGICAL SITE	DIR (DEG)	160	290	220	230	240	10	50	170	230	210
NEWARK	VEL (MPH)	1.8	4.4	11.1	1.6	6.0	3.5	3.2	3.7	8.3	11.1
	SPD (MPH)	3.9	5.0	13.1	3.6	7.2	5.0	5.8	6.3	9.5	14.1
	RATIO	0.461	0.884	0.851	0.453	0.835	0.690	0.558	0.591	0.873	0.791
METEOROLOGICAL SITE	DIR (DEG)	160	350	190	200	230	160	10	180	190	170
BRADLEY	VEL (MPH)	1.1	4.2	8.3	4.2	5.1	2.2	5.6	5.0	7.8	9.3
	SPD (MPH)	4.7	5.0	9.5	6.8	7.3	3.9	5.9	6.8	9.3	12.4
	RATIO	0.236	0.838	0.871	0.625	0.690	0.567	0.953	0.736	0.836	0.752
METEOROLOGICAL SITE	DIR (DEG)	220	290	240	270	240	10	80	220	250	230
BRIDGEPORT	VEL (MPH)	.9	3.0	7.5	1.9	4.5	2.2	5.6	3.2	6.2	7.0
	SPD (MPH)	.9	3.5	7.6	4.5	4.6	2.3	6.5	4.0	6.2	7.2
	RATIO	0.999	0.862	0.990	0.416	0.981	0.977	0.872	0.789	0.999	0.969
METEOROLOGICAL SITE	DIR (DEG)	260	330	240	230	250	300	40	250	260	260
WORCESTER	VEL (MPH)	6.6	6.3	7.0	4.8	6.3	3.9	2.9	7.5	10.7	9.2
	SPD (MPH)	8.6	7.0	8.6	5.3	6.9	4.0	3.2	9.2	12.1	13.4
	RATIO	0.763	0.897	0.816	0.903	0.907	0.981	0.908	0.811	0.885	0.687
BRIDGEPORT-013 (0348)	SO2	132	110	106	103	99	88	78	76	75	74
	DATE	12/19/89	12/29/89	12/ 6/89	12/15/89	12/18/89	12/25/89	11/25/89	2/19/89	2/ 8/89	2/ 6/89
METEOROLOGICAL SITE	DIR (DEG)	10	50	230	170	300	220	220	240	250	280
NEWARK	VEL (MPH)	3.5	3.2	1.6	2.8	8.7	7.8	7.4	6.0	11.1	5.1
	SPD (MPH)	5.0	5.8	3.6	6.0	9.6	9.3	9.1	7.2	12.7	6.8
	RATIO	0.690	0.558	0.453	0.459	0.903	0.839	0.821	0.835	0.879	0.752
METEOROLOGICAL SITE	DIR (DEG)	160	10	200	90	310	210	200	230	240	270
BRADLEY	VEL (MPH)	2.2	5.6	4.2	1.1	7.9	5.7	6.5	5.1	7.4	2.6
	SPD (MPH)	3.9	5.9	6.8	5.6	8.8	6.8	8.9	7.3	10.8	5.2
	RATIO	0.567	0.953	0.625	0.202	0.906	0.842	0.731	0.690	0.689	0.505
METEOROLOGICAL SITE	DIR (DEG)	10	80	270	140	340	260	260	240	250	260
BRIDGEPORT	VEL (MPH)	2.2	5.6	1.9	3.8	5.1	9.0	12.6	4.5	8.1	3.0
	SPD (MPH)	2.3	6.5	4.5	4.5	5.5	9.2	12.9	4.6	8.2	3.3
	RATIO	0.977	0.872	0.416	0.846	0.932	0.983	0.977	0.981	0.989	0.910
METEOROLOGICAL SITE	DIR (DEG)	300	40	230	290	300	260	240	250	260	270
WORCESTER	VEL (MPH)	3.9	2.9	4.8	4.1	8.6	7.7	8.7	6.3	9.4	5.6
	SPD (MPH)	4.0	3.2	5.3	7.2	8.8	8.1	8.8	6.9	10.9	6.8
	RATIO	0.981	0.908	0.903	0.565	0.986	0.954	0.997	0.907	0.865	0.831
DANBURY-123 (0362)	SO2	120	93	92	88	88	88	86	73	71	70
	DATE	12/19/89	1/23/89	1/24/89	12/18/89	12/15/89	12/11/89	12/ 6/89	2/ 6/89	12/29/89	12/25/89
METEOROLOGICAL SITE	DIR (DEG)	10	160	290	300	170	280	230	280	50	220
NEWARK	VEL (MPH)	3.5	1.8	4.4	8.7	2.8	4.0	1.6	5.1	3.2	7.8
	SPD (MPH)	5.0	3.9	5.0	9.6	6.0	5.9	3.6	6.8	5.8	9.3
	RATIO	0.690	0.461	0.884	0.903	0.459	0.679	0.453	0.752	0.558	0.839
METEOROLOGICAL SITE	DIR (DEG)	160	160	350	310	90	320	200	270	10	210
BRADLEY	VEL (MPH)	2.2	1.1	4.2	7.9	1.1	4.9	4.2	2.6	5.6	5.7
	SPD (MPH)	3.9	4.7	5.0	8.8	5.6	6.6	6.8	5.2	5.9	6.8
	RATIO	0.567	0.236	0.838	0.906	0.202	0.747	0.625	0.505	0.953	0.842

TABLE 3-4, CONTINUED

1989 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)	10	220	290	340	140	310	270	260	80	260
BRIDGEPORT	VEL (MPH)	2.2	.9	3.0	5.1	3.8	2.8	1.9	3.0	5.6	9.0
	SPD (MPH)	2.3	.9	3.5	5.5	4.5	3.5	4.5	3.3	6.5	9.2
	RATIO	0.977	0.999	0.862	0.932	0.846	0.798	0.416	0.910	0.872	0.983
METEOROLOGICAL SITE	DIR (DEG)	300	260	330	300	290	270	230	270	40	260
WORCESTER	VEL (MPH)	3.9	6.6	6.3	8.6	4.1	3.3	4.8	5.6	2.9	7.7
	SPD (MPH)	4.0	8.6	7.0	8.8	7.2	3.5	5.3	6.8	3.2	8.1
	RATIO	0.981	0.763	0.897	0.986	0.565	0.943	0.903	0.831	0.908	0.954
EAST HAVEN-003 (0349)	SO2	146	142	130	124	116	112	91	91	86	83
	DATE	12/19/89	12/15/89	1/24/89	12/11/89	1/23/89	12/29/89	2/ 8/89	12/12/89	12/28/89	12/ 6/89
METEOROLOGICAL SITE	DIR (DEG)	10	170	290	280	160	50	250	10	290	230
NEWARK	VEL (MPH)	3.5	2.8	4.4	4.0	1.8	3.2	11.1	8.1	8.0	1.6
	SPD (MPH)	5.0	6.0	5.0	5.9	3.9	5.8	12.7	8.2	9.1	3.6
	RATIO	0.690	0.459	0.884	0.679	0.461	0.558	0.879	0.986	0.886	0.453
METEOROLOGICAL SITE	DIR (DEG)	160	90	350	320	160	10	240	20	310	200
BRADLEY	VEL (MPH)	2.2	1.1	4.2	4.9	1.1	5.6	7.4	4.1	4.7	4.2
	SPD (MPH)	3.9	5.6	5.0	6.6	4.7	5.9	10.8	4.6	5.6	6.8
	RATIO	0.567	0.202	0.838	0.747	0.236	0.953	0.689	0.894	0.836	0.625
METEOROLOGICAL SITE	DIR (DEG)	10	140	290	310	220	80	250	50	320	270
BRIDGEPORT	VEL (MPH)	2.2	3.8	3.0	2.8	.9	5.6	8.1	3.9	6.5	1.9
	SPD (MPH)	2.3	4.5	3.5	3.5	.9	6.5	8.2	4.2	7.2	4.5
	RATIO	0.977	0.846	0.862	0.798	0.999	0.872	0.989	0.924	0.906	0.416
METEOROLOGICAL SITE	DIR (DEG)	300	290	330	270	260	40	260	320	300	230
WORCESTER	VEL (MPH)	3.9	4.1	6.3	3.3	6.6	2.9	9.4	5.3	6.2	4.8
	SPD (MPH)	4.0	7.2	7.0	3.5	8.6	3.2	10.9	5.3	6.2	5.3
	RATIO	0.981	0.565	0.897	0.943	0.763	0.908	0.865	0.991	0.999	0.903
ENFIELD-005 (0356)	SO2	112	98	72	63	60	58	58	54	53	52
	DATE	1/23/89	1/24/89	1/12/89	12/25/89	2/20/89	1/22/89	12/19/89	11/25/89	1/30/89	1/17/89
METEOROLOGICAL SITE	DIR (DEG)	160	290	180	220	170	230	10	220	270	220
NEWARK	VEL (MPH)	1.8	4.4	1.9	7.8	3.7	8.3	3.5	7.4	4.0	11.1
	SPD (MPH)	3.9	5.0	6.3	9.3	6.3	9.5	5.0	9.1	6.9	13.1
	RATIO	0.461	0.884	0.293	0.839	0.591	0.873	0.690	0.821	0.575	0.851
METEOROLOGICAL SITE	DIR (DEG)	160	350	20	210	180	190	160	200	290	190
BRADLEY	VEL (MPH)	1.1	4.2	2.9	5.7	5.0	7.8	2.2	6.5	3.5	8.3
	SPD (MPH)	4.7	5.0	4.0	6.8	6.8	9.3	3.9	8.9	7.2	9.5
	RATIO	0.236	0.838	0.731	0.842	0.736	0.836	0.567	0.731	0.491	0.871
METEOROLOGICAL SITE	DIR (DEG)	220	290	140	260	220	250	10	260	250	240
BRIDGEPORT	VEL (MPH)	.9	3.0	2.4	9.0	3.2	6.2	2.2	12.6	3.8	7.5
	SPD (MPH)	.9	3.5	2.6	9.2	4.0	6.2	2.3	12.9	4.3	7.6
	RATIO	0.999	0.862	0.911	0.983	0.789	0.999	0.977	0.977	0.881	0.990
METEOROLOGICAL SITE	DIR (DEG)	260	330	210	260	250	260	300	240	270	240
WORCESTER	VEL (MPH)	6.6	6.3	4.4	7.7	7.5	10.7	3.9	8.7	8.6	7.0
	SPD (MPH)	8.6	7.0	6.9	8.1	9.2	12.1	4.0	8.8	10.4	8.6
	RATIO	0.763	0.897	0.636	0.954	0.811	0.885	0.981	0.997	0.829	0.816

TABLE 3-4, CONTINUED

1989 TEN HIGHEST 24-HOUR AVERAGE SO2 DAYS WITH WIND DATA

UNITS : MICROGRAMS PER CUBIC METER

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
GREENWICH-017 (0360)	SO2	94	76	73	64	64	61	56	55	54	54
	DATE	1/23/89	12/ 6/89	12/25/89	12/11/89	1/24/89	12/30/89	12/15/89	1/22/89	12/10/89	12/19/89
METEOROLOGICAL SITE	DIR (DEG)	160	230	220	280	290	10	170	230	280	10
NEWARK	VEL (MPH)	1.8	1.6	7.8	4.0	4.4	10.2	2.8	8.3	5.3	3.5
	SPD (MPH)	3.9	3.6	9.3	5.9	5.0	10.4	6.0	9.5	8.6	5.0
	RATIO	0.461	0.453	0.839	0.679	0.884	0.984	0.459	0.873	0.619	0.690
METEOROLOGICAL SITE	DIR (DEG)	160	200	210	320	350	360	90	190	190	160
BRADLEY	VEL (MPH)	1.1	4.2	5.7	4.9	4.2	8.7	1.1	7.8	2.0	2.2
	SPD (MPH)	4.7	6.8	6.8	6.6	5.0	8.8	5.6	9.3	5.9	3.9
	RATIO	0.236	0.625	0.842	0.747	0.838	0.988	0.202	0.836	0.348	0.567
METEOROLOGICAL SITE	DIR (DEG)	220	270	260	310	290	70	140	250	300	10
BRIDGEPORT	VEL (MPH)	.9	1.9	9.0	2.8	3.0	9.8	3.8	6.2	4.3	2.2
	SPD (MPH)	.9	4.5	9.2	3.5	3.5	9.9	4.5	6.2	6.3	2.3
	RATIO	0.999	0.416	0.983	0.798	0.862	0.992	0.846	0.999	0.683	0.977
METEOROLOGICAL SITE	DIR (DEG)	260	230	260	270	330	50	290	260	250	300
WORCESTER	VEL (MPH)	6.6	4.8	7.7	3.3	6.3	5.3	4.1	10.7	2.6	3.9
	SPD (MPH)	8.6	5.3	8.1	3.5	7.0	5.3	7.2	12.1	3.6	4.0
	RATIO	0.763	0.903	0.954	0.943	0.897	0.993	0.565	0.885	0.714	0.981
GROTON-007 (0341)	SO2	84	71	66	66	66	53	53	52	52	50
	DATE	12/23/89	12/28/89	12/11/89	1/24/89	1/23/89	12/20/89	12/30/89	12/ 6/89	2/11/89	1/29/89
METEOROLOGICAL SITE	DIR (DEG)	360	290	280	290	160	300	10	230	250	260
NEWARK	VEL (MPH)	10.9	8.0	4.0	4.4	1.8	9.3	10.2	1.6	9.8	8.0
	SPD (MPH)	11.2	9.1	5.9	5.0	3.9	11.4	10.4	3.6	13.1	9.8
	RATIO	0.968	0.886	0.679	0.884	0.461	0.823	0.984	0.453	0.752	0.817
METEOROLOGICAL SITE	DIR (DEG)	10	310	320	350	160	310	360	200	250	270
BRADLEY	VEL (MPH)	7.3	4.7	4.9	4.2	1.1	7.8	8.7	4.2	6.3	2.8
	SPD (MPH)	8.1	5.6	6.6	5.0	4.7	8.5	8.8	6.8	9.5	7.0
	RATIO	0.907	0.836	0.747	0.838	0.236	0.919	0.988	0.625	0.663	0.396
METEOROLOGICAL SITE	DIR (DEG)	10	320	310	290	220	320	70	270	250	260
BRIDGEPORT	VEL (MPH)	7.4	6.5	2.8	3.0	.9	7.7	9.8	1.9	6.1	3.8
	SPD (MPH)	7.5	7.2	3.5	3.5	.9	7.9	9.9	4.5	6.2	3.9
	RATIO	0.984	0.906	0.798	0.862	0.999	0.969	0.992	0.416	0.991	0.986
METEOROLOGICAL SITE	DIR (DEG)	340	300	270	330	260	300	50	230	270	290
WORCESTER	VEL (MPH)	4.8	6.2	3.3	6.3	6.6	7.1	5.3	4.8	10.7	11.0
	SPD (MPH)	4.9	6.2	3.5	7.0	8.6	7.2	5.3	5.3	12.5	12.9
	RATIO	0.985	0.999	0.943	0.897	0.763	0.981	0.993	0.903	0.856	0.849
HARTFORD-018 (0339)	SO2	122	120	100	95	93	88	86	83	83	80
	DATE	12/19/89	1/24/89	12/25/89	12/ 6/89	12/28/89	12/11/89	12/15/89	1/17/89	12/12/89	1/12/89
METEOROLOGICAL SITE	DIR (DEG)	10	290	220	230	290	280	170	220	10	180
NEWARK	VEL (MPH)	3.5	4.4	7.8	1.6	8.0	4.0	2.8	11.1	8.1	1.9
	SPD (MPH)	5.0	5.0	9.3	3.6	9.1	5.9	6.0	13.1	8.2	6.3
	RATIO	0.690	0.884	0.839	0.453	0.886	0.679	0.459	0.851	0.986	0.293
METEOROLOGICAL SITE	DIR (DEG)	160	350	210	200	310	320	90	190	20	20
BRADLEY	VEL (MPH)	2.2	4.2	5.7	4.2	4.7	4.9	1.1	8.3	4.1	2.9
	SPD (MPH)	3.9	5.0	6.8	6.8	5.6	6.6	5.6	9.5	4.6	4.0
	RATIO	0.567	0.838	0.842	0.625	0.836	0.747	0.202	0.871	0.894	0.731

TABLE 3-4, CONTINUED

1989 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)	10	290	260	270	320	310	140	240	50	140
BRIDGEPORT	VEL (MPH)	2.2	3.0	9.0	1.9	6.5	2.8	3.8	7.5	3.9	2.4
	SPD (MPH)	2.3	3.5	9.2	4.5	7.2	3.5	4.5	7.6	4.2	2.6
	RATIO	0.977	0.862	0.983	0.416	0.906	0.798	0.846	0.990	0.924	0.911
METEOROLOGICAL SITE	DIR (DEG)	300	330	260	230	300	270	290	240	320	210
WORCESTER	VEL (MPH)	3.9	6.3	7.7	4.8	6.2	3.3	4.1	7.0	5.3	4.4
	SPD (MPH)	4.0	7.0	8.1	5.3	6.2	3.5	7.2	8.6	5.3	6.9
	RATIO	0.981	0.897	0.954	0.903	0.999	0.943	0.565	0.816	0.991	0.636
MILFORD-010 (0323)	SO2	111	105	98	93	93	91	91	91	90	89
	DATE	3/21/89	1/23/89	11/20/89	12/19/89	1/24/89	12/11/89	2/ 3/89	2/25/89	2/10/89	12/25/89
METEOROLOGICAL SITE	DIR (DEG)	320	160	250	10	290	280	360	320	270	220
NEWARK	VEL (MPH)	11.9	1.8	8.8	3.5	4.4	4.0	10.9	12.3	9.5	7.8
	SPD (MPH)	12.8	3.9	12.4	5.0	5.0	5.9	11.1	13.1	11.5	9.3
	RATIO	0.933	0.461	0.716	0.690	0.884	0.679	0.983	0.944	0.823	0.839
METEOROLOGICAL SITE	DIR (DEG)	310	160	200	160	350	320	330	330	250	210
BRADLEY	VEL (MPH)	8.4	1.1	6.3	2.2	4.2	4.9	7.8	12.1	4.4	5.7
	SPD (MPH)	9.2	4.7	10.2	3.9	5.0	6.6	8.3	13.4	7.3	6.8
	RATIO	0.909	0.236	0.620	0.567	0.838	0.747	0.934	0.905	0.604	0.842
METEOROLOGICAL SITE	DIR (DEG)	330	220	270	10	290	310	360	350	290	260
BRIDGEPORT	VEL (MPH)	5.4	.9	14.4	2.2	3.0	2.8	6.2	6.0	6.1	9.0
	SPD (MPH)	5.9	.9	14.7	2.3	3.5	3.5	6.3	6.0	6.8	9.2
	RATIO	0.914	0.999	0.984	0.977	0.862	0.798	0.980	0.997	0.899	0.983
METEOROLOGICAL SITE	DIR (DEG)	330	260	250	300	330	270	360	340	290	260
WORCESTER	VEL (MPH)	9.5	6.6	12.5	3.9	6.3	3.3	5.3	10.2	7.6	7.7
	SPD (MPH)	10.1	8.6	12.9	4.0	7.0	3.5	6.5	11.1	9.1	8.1
	RATIO	0.941	0.763	0.967	0.981	0.897	0.943	0.817	0.926	0.844	0.954
NEW BRITAIN-011 (0355)	SO2	153	127	105	98	98	96	93	90	79	77
	DATE	1/23/89	12/19/89	1/24/89	12/ 6/89	12/28/89	12/15/89	12/25/89	2/20/89	12/11/89	1/22/89
METEOROLOGICAL SITE	DIR (DEG)	160	10	290	230	290	170	220	170	280	230
NEWARK	VEL (MPH)	1.8	3.5	4.4	1.6	8.0	2.8	7.8	3.7	4.0	8.3
	SPD (MPH)	3.9	5.0	5.0	3.6	9.1	6.0	9.3	6.3	5.9	9.5
	RATIO	0.461	0.690	0.884	0.453	0.886	0.459	0.839	0.591	0.679	0.873
METEOROLOGICAL SITE	DIR (DEG)	160	160	350	200	310	90	210	180	320	190
BRADLEY	VEL (MPH)	1.1	2.2	4.2	4.2	4.7	1.1	5.7	5.0	4.9	7.8
	SPD (MPH)	4.7	3.9	5.0	6.8	5.6	5.6	6.8	6.8	6.6	9.3
	RATIO	0.236	0.567	0.838	0.625	0.836	0.202	0.842	0.736	0.747	0.836
METEOROLOGICAL SITE	DIR (DEG)	220	10	290	270	320	140	260	220	310	250
BRIDGEPORT	VEL (MPH)	.9	2.2	3.0	1.9	6.5	3.8	9.0	3.2	2.8	6.2
	SPD (MPH)	.9	2.3	3.5	4.5	7.2	4.5	9.2	4.0	3.5	6.2
	RATIO	0.999	0.977	0.862	0.416	0.906	0.846	0.983	0.789	0.798	0.999
METEOROLOGICAL SITE	DIR (DEG)	260	300	330	230	300	290	260	250	270	260
WORCESTER	VEL (MPH)	6.6	3.9	6.3	4.8	6.2	4.1	7.7	7.5	3.3	10.7
	SPD (MPH)	8.6	4.0	7.0	5.3	6.2	7.2	8.1	9.2	3.5	12.1
	RATIO	0.763	0.981	0.897	0.903	0.999	0.565	0.954	0.811	0.943	0.885

TABLE 3-4, CONTINUED

1989 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 (0345)	SO2	257	231	208	176	164	149	147	145	144	139
	DATE	1/23/89	1/24/89	12/19/89	1/20/89	12/15/89	12/29/89	12/11/89	12/ 6/89	12/28/89	2/ 8/89
METEOROLOGICAL SITE	DIR (DEG)	160	290	10	280	170	50	280	230	290	250
NEWARK	VEL (MPH)	1.8	4.4	3.5	9.7	2.8	3.2	4.0	1.6	8.0	11.1
	SPD (MPH)	3.9	5.0	5.0	12.2	6.0	5.8	5.9	3.6	9.1	12.7
	RATIO	0.461	0.884	0.690	0.795	0.459	0.558	0.679	0.453	0.886	0.879
METEOROLOGICAL SITE	DIR (DEG)	160	350	160	270	90	10	320	200	310	240
BRADLEY	VEL (MPH)	1.1	4.2	2.2	5.8	1.1	5.6	4.9	4.2	4.7	7.4
	SPD (MPH)	4.7	5.0	3.9	8.2	5.6	5.9	6.6	6.8	5.6	10.8
	RATIO	0.236	0.838	0.567	0.711	0.202	0.953	0.747	0.625	0.836	0.689
METEOROLOGICAL SITE	DIR (DEG)	220	290	10	280	140	80	310	270	320	250
BRIDGEPORT	VEL (MPH)	.9	3.0	2.2	5.1	3.8	5.6	2.8	1.9	6.5	8.1
	SPD (MPH)	.9	3.5	2.3	5.5	4.5	6.5	3.5	4.5	7.2	8.2
	RATIO	0.999	0.862	0.977	0.937	0.846	0.872	0.798	0.416	0.906	0.989
METEOROLOGICAL SITE	DIR (DEG)	260	330	300	270	290	40	270	230	300	260
WORCESTER	VEL (MPH)	6.6	6.3	3.9	9.7	4.1	2.9	3.3	4.8	6.2	9.4
	SPD (MPH)	8.6	7.0	4.0	12.2	7.2	3.2	3.5	5.3	6.2	10.9
	RATIO	0.763	0.897	0.981	0.792	0.565	0.908	0.943	0.903	0.999	0.865
STAMFORD-025 (0357)	SO2	181	122	121	110	110	109	104	91	89	87
	DATE	1/23/89	12/25/89	12/ 6/89	1/22/89	12/19/89	12/11/89	12/15/89	12/28/89	11/25/89	12/29/89
METEOROLOGICAL SITE	DIR (DEG)	160	220	230	230	10	280	170	290	220	50
NEWARK	VEL (MPH)	1.8	7.8	1.6	8.3	3.5	4.0	2.8	8.0	7.4	3.2
	SPD (MPH)	3.9	9.3	3.6	9.5	5.0	5.9	6.0	9.1	9.1	5.8
	RATIO	0.461	0.839	0.453	0.873	0.690	0.679	0.459	0.886	0.821	0.558
METEOROLOGICAL SITE	DIR (DEG)	160	210	200	190	160	320	90	310	200	10
BRADLEY	VEL (MPH)	1.1	5.7	4.2	7.8	2.2	4.9	1.1	4.7	6.5	5.6
	SPD (MPH)	4.7	6.8	6.8	9.3	3.9	6.6	5.6	5.6	8.9	5.9
	RATIO	0.236	0.842	0.625	0.836	0.567	0.747	0.202	0.836	0.731	0.953
METEOROLOGICAL SITE	DIR (DEG)	220	260	270	250	10	310	140	320	260	80
BRIDGEPORT	VEL (MPH)	.9	9.0	1.9	6.2	2.2	2.8	3.8	6.5	12.6	5.6
	SPD (MPH)	.9	9.2	4.5	6.2	2.3	3.5	4.5	7.2	12.9	6.5
	RATIO	0.999	0.983	0.416	0.999	0.977	0.798	0.846	0.906	0.977	0.872
METEOROLOGICAL SITE	DIR (DEG)	260	260	230	260	300	270	290	300	240	40
WORCESTER	VEL (MPH)	6.6	7.7	4.8	10.7	3.9	3.3	4.1	6.2	8.7	2.9
	SPD (MPH)	8.6	8.1	5.3	12.1	4.0	3.5	7.2	6.2	8.8	3.2
	RATIO	0.763	0.954	0.903	0.885	0.981	0.943	0.565	0.999	0.997	0.908
STAMFORD-123 (0364)	SO2	160	120	107	107	105	101	92	89	86	85
	DATE	1/23/89	1/24/89	12/25/89	12/19/89	12/ 6/89	12/15/89	1/22/89	2/ 6/89	12/11/89	11/25/89
METEOROLOGICAL SITE	DIR (DEG)	160	290	220	10	230	170	230	280	280	220
NEWARK	VEL (MPH)	1.8	4.4	7.8	3.5	1.6	2.8	8.3	5.1	4.0	7.4
	SPD (MPH)	3.9	5.0	9.3	5.0	3.6	6.0	9.5	6.8	5.9	9.1
	RATIO	0.461	0.884	0.839	0.690	0.453	0.459	0.873	0.752	0.679	0.821
METEOROLOGICAL SITE	DIR (DEG)	160	350	210	160	200	90	190	270	320	200
BRADLEY	VEL (MPH)	1.1	4.2	5.7	2.2	4.2	1.1	7.8	2.6	4.9	6.5
	SPD (MPH)	4.7	5.0	6.8	3.9	6.8	5.6	9.3	5.2	6.6	8.9
	RATIO	0.236	0.838	0.842	0.567	0.625	0.202	0.836	0.505	0.747	0.731

TABLE 3-4, CONTINUED

1989 TEN HIGHEST 24-HOUR AVERAGE SO2 DAYS WITH WIND DATA

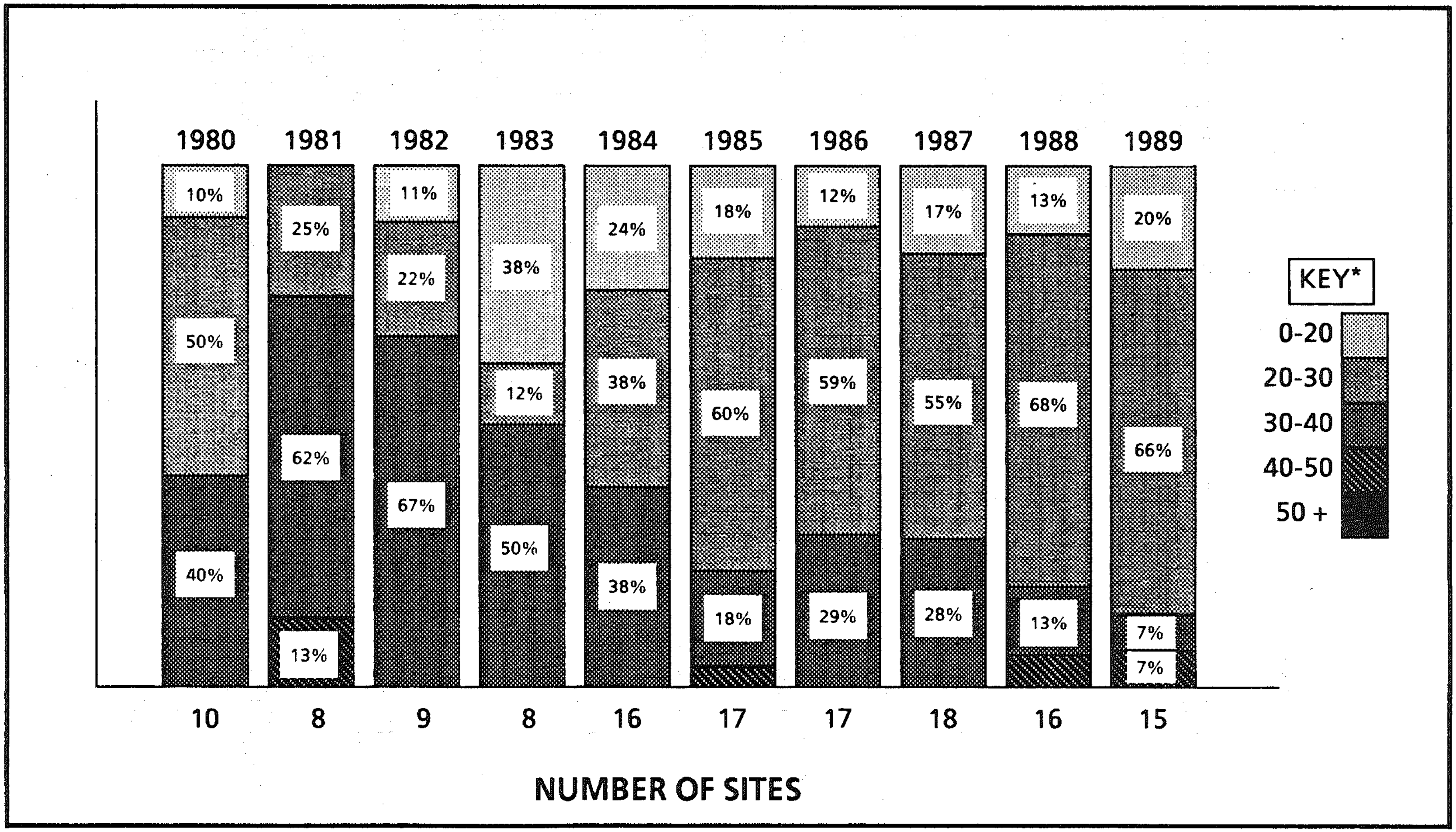
UNITS : MICROGRAMS PER CUBIC METER

TOWN-SITE (SAMPLES)	RANK	1	2	3	4	5	6	7	8	9	10
METEOROLOGICAL SITE	DIR (DEG)	220	290	260	10	270	140	250	260	310	260
BRIDGEPORT	VEL (MPH)	.9	3.0	9.0	2.2	1.9	3.8	6.2	3.0	2.8	12.6
	SPD (MPH)	.9	3.5	9.2	2.3	4.5	4.5	6.2	3.3	3.5	12.9
	RATIO	0.999	0.862	0.983	0.977	0.416	0.846	0.999	0.910	0.798	0.977
METEOROLOGICAL SITE	DIR (DEG)	260	330	260	300	230	290	260	270	270	240
WORCESTER	VEL (MPH)	6.6	6.3	7.7	3.9	4.8	4.1	10.7	5.6	3.3	8.7
	SPD (MPH)	8.6	7.0	8.1	4.0	5.3	7.2	12.1	6.8	3.5	8.8
	RATIO	0.763	0.897	0.954	0.981	0.903	0.565	0.885	0.831	0.943	0.997
WATERBURY-008 (0360)	SO2	207	168	160	150	144	141	140	121	116	112
	DATE	1/23/89	12/11/89	12/19/89	12/ 6/89	12/15/89	1/24/89	12/25/89	12/12/89	12/29/89	1/18/89
METEOROLOGICAL SITE	DIR (DEG)	160	280	10	230	170	290	220	10	50	150
NEWARK	VEL (MPH)	1.8	4.0	3.5	1.6	2.8	4.4	7.8	8.1	3.2	3.8
	SPD (MPH)	3.9	5.9	5.0	3.6	6.0	5.0	9.3	8.2	5.8	5.3
	RATIO	0.461	0.679	0.690	0.453	0.459	0.884	0.839	0.986	0.558	0.719
METEOROLOGICAL SITE	DIR (DEG)	160	320	160	200	90	350	210	20	10	180
BRADLEY	VEL (MPH)	1.1	4.9	2.2	4.2	1.1	4.2	5.7	4.1	5.6	5.0
	SPD (MPH)	4.7	6.6	3.9	6.8	5.6	5.0	6.8	4.6	5.9	7.2
	RATIO	0.236	0.747	0.567	0.625	0.202	0.838	0.842	0.894	0.953	0.690
METEOROLOGICAL SITE	DIR (DEG)	220	310	10	270	140	290	260	50	80	170
BRIDGEPORT	VEL (MPH)	.9	2.8	2.2	1.9	3.8	3.0	9.0	3.9	5.6	2.7
	SPD (MPH)	.9	3.5	2.3	4.5	4.5	3.5	9.2	4.2	6.5	3.9
	RATIO	0.999	0.798	0.977	0.416	0.846	0.862	0.983	0.924	0.872	0.683
METEOROLOGICAL SITE	DIR (DEG)	260	270	300	230	290	330	260	320	40	250
WORCESTER	VEL (MPH)	6.6	3.3	3.9	4.8	4.1	6.3	7.7	5.3	2.9	3.0
	SPD (MPH)	8.6	3.5	4.0	5.3	7.2	7.0	8.1	5.3	3.2	4.5
	RATIO	0.763	0.943	0.981	0.903	0.565	0.897	0.954	0.991	0.908	0.671
WATERBURY-123 (0341)	SO2	143	127	108	107	104	99	95	91	86	83
	DATE	12/11/89	1/23/89	12/ 6/89	12/29/89	12/25/89	2/20/89	12/28/89	12/15/89	1/22/89	12/19/89
METEOROLOGICAL SITE	DIR (DEG)	280	160	230	50	220	170	290	170	230	10
NEWARK	VEL (MPH)	4.0	1.8	1.6	3.2	7.8	3.7	8.0	2.8	8.3	3.5
	SPD (MPH)	5.9	3.9	3.6	5.8	9.3	6.3	9.1	6.0	9.5	5.0
	RATIO	0.679	0.461	0.453	0.558	0.839	0.591	0.886	0.459	0.873	0.690
METEOROLOGICAL SITE	DIR (DEG)	320	160	200	10	210	180	310	90	190	160
BRADLEY	VEL (MPH)	4.9	1.1	4.2	5.6	5.7	5.0	4.7	1.1	7.8	2.2
	SPD (MPH)	6.6	4.7	6.8	5.9	6.8	6.8	5.6	5.6	9.3	3.9
	RATIO	0.747	0.236	0.625	0.953	0.842	0.736	0.836	0.202	0.836	0.567
METEOROLOGICAL SITE	DIR (DEG)	310	220	270	80	260	220	320	140	250	10
BRIDGEPORT	VEL (MPH)	2.8	.9	1.9	5.6	9.0	3.2	6.5	3.8	6.2	2.2
	SPD (MPH)	3.5	.9	4.5	6.5	9.2	4.0	7.2	4.5	6.2	2.3
	RATIO	0.798	0.999	0.416	0.872	0.983	0.789	0.906	0.846	0.999	0.977
METEOROLOGICAL SITE	DIR (DEG)	270	260	230	40	260	250	300	290	260	300
WORCESTER	VEL (MPH)	3.3	6.6	4.8	2.9	7.7	7.5	6.2	4.1	10.7	3.9
	SPD (MPH)	3.5	8.6	5.3	3.2	8.1	9.2	6.2	7.2	12.1	4.0
	RATIO	0.943	0.763	0.903	0.908	0.954	0.811	0.999	0.565	0.885	0.981

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: 1980-1989

(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	
80 81	21.1 20.9	8 8	-0.20	4.83	N.C.	N.C.	0.9100
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

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 1989. Levels in excess of the one-hour NAAQS of 0.12 ppm were frequently recorded at all ten monitored sites. One site experienced levels greater than 0.20 ppm in 1989, compared to nine sites in

1988 and one site in 1987. All ten sites operated in both 1988 and 1989, and all had lower high and second high one-hour concentrations in 1989 than in 1988.

The incidence of ozone concentrations in excess of the 1-hour 0.12 ppm standard was lower in 1989 than in 1988 (see Table 4-1). There was a total of 485 exceedances in 1988 and 145 exceedances in 1989 at the ten monitored sites. This represents a decrease in the frequency of such exceedances from 10.2 per 1000 sampling hours in 1988 to 3.2 per 1000 sampling hours in 1989: a 69% decrease.

The number of site-days on which the ozone monitors experienced ozone levels in excess of the 1-hour standard decreased from 143 in 1988 to 50 in 1989 at the ten monitoring sites (see Table 4-2). This represents a decrease in the frequency of such occurrences from 7.2 per 100 sampling days in 1988 to 2.6 per 100 sampling days in 1989: a 64% decrease.

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> helps to explain the decrease in the number of ozone exceedances from 1988 to 1989. The percentage of southwest winds during the "ozone season" decreased from 35% in 1988 to 31% in 1989, as is shown by the wind roses from Newark (Figures 4-1 and 4-2). The magnitude of high ozone levels can be partly associated with yearly <u>variations in temperature</u>, since ozone production is greatest at high temperatures and in strong sunlight. The summer season's daily high temperatures were lower in 1989 than in 1988. This is demonstrated by the number of days exceeding 90° F which decreased from fifteen in 1988 to three in 1989 at Sikorsky Airport in Bridgeport, and from thirty in 1988 to eleven in 1989 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 65% in 1988 to 57% in 1989 for the months June through September. The average for the summer months at Bradley is usually 61%. Each of the above three meteorological parameters can be invoked as major contributors to explain the decrease in ozone levels from 1988 to 1989.

In additon, calculations based on a recent study (see publication no. 30 in section XIII. Publications) suggest that most of the decrease in the ozone levels between 1988 and 1989 can be attributed to the decreased incidence of ozone "exceedance conducive days." Such days reflect <u>both</u> high maximum daily temperatures and the frequency of winds out of the southwest.

An additional factor contributing to the decrease in ozone concentrations in 1989 is 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, which was initiated this year for the summer months, 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 1989 (see Figure 4-5):

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 233 precision checks during 1989. The resulting 95% probability limits were -5% to +5%. 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, -5% to +3%; medium, -7% to +2%; and high, -7% to +2%.

1-Hour Average - The 1-hour ozone standard was exceeded at all ten DEP monitoring sites in 1989. Moreover, the highest 1-hour average ozone concentrations were lower in 1989 than in 1988 at all the sites. Danbury 123 had the largest decrease of 0.088 ppm.

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 4-6 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 1989. 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., 90%) 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 4-7 shows the unweighted average of the annual means of the maximum daily concentrations at ten ozone sites from 1981 to 1989. 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 4-7 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 4-8 illustrates five year averages of the data that is presented in Figure 4-7. 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 1989

SITE	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	THIS YEAR	LAST YEAR
Bridgeport-013	0	0	0	4	4	3	0	11	56
Danbury-123	0	0	0	3	0	0	0	3	79
E. Hartford-003	0	0	0	4	6	0	0	10	35
Greenwich-017	0	0	3	9	3	6	0	21	56
Groton-008	0	0	3	12	3	1	0	19	28
Madison-002	0	0	2	7	0	0	0	9	32
Middletown-007	0	0	0	9	4	3	0	16	43
New Haven-123	0	0	0	4	4	0	0	8	29
Stafford-001	0	0	0	2	5	0	0	7	48
Stratford-007	0	0	3	17	11	10	0	41	79
							TOTAL SITE HOURS	145	485

TABLE 4-2

NUMBER OF DAYS WHEN THE 1-HOUR OZONE STANDARD WAS EXCEEDED IN 1989

SITE	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	THIS YEAR	LAST YEAR
Bridgeport-013	0	0	0	1	2	1	0	4	18
Danbury-123	0	0	0	2	0	0	0	2	20
E. Hartford-003	0	0	0	3	2	0	0	5	10
Greenwich-017	0	0	1	3	1	2	0	7	17
Groton-008	0	0	2	2	1	1	0	6	9
Madison-002	0	0	2	2	0	0	0	4	12
Middletown-007	0	0	0	2	2	1	0	5	13
New Haven-123	0	0	0	1	2	0	0	3	10
Stafford-001	0	0	0	1	2	0	0	3	13
Stratford-007	0	0	1	4	4	2	0	11	21
							TOTAL SITE DAYS	50	143

FIGURE 4-1

WIND ROSE FOR APRIL - OCTOBER 1988
NEWARK INTERNATIONAL AIRPORT
NEWARK, NEW JERSEY

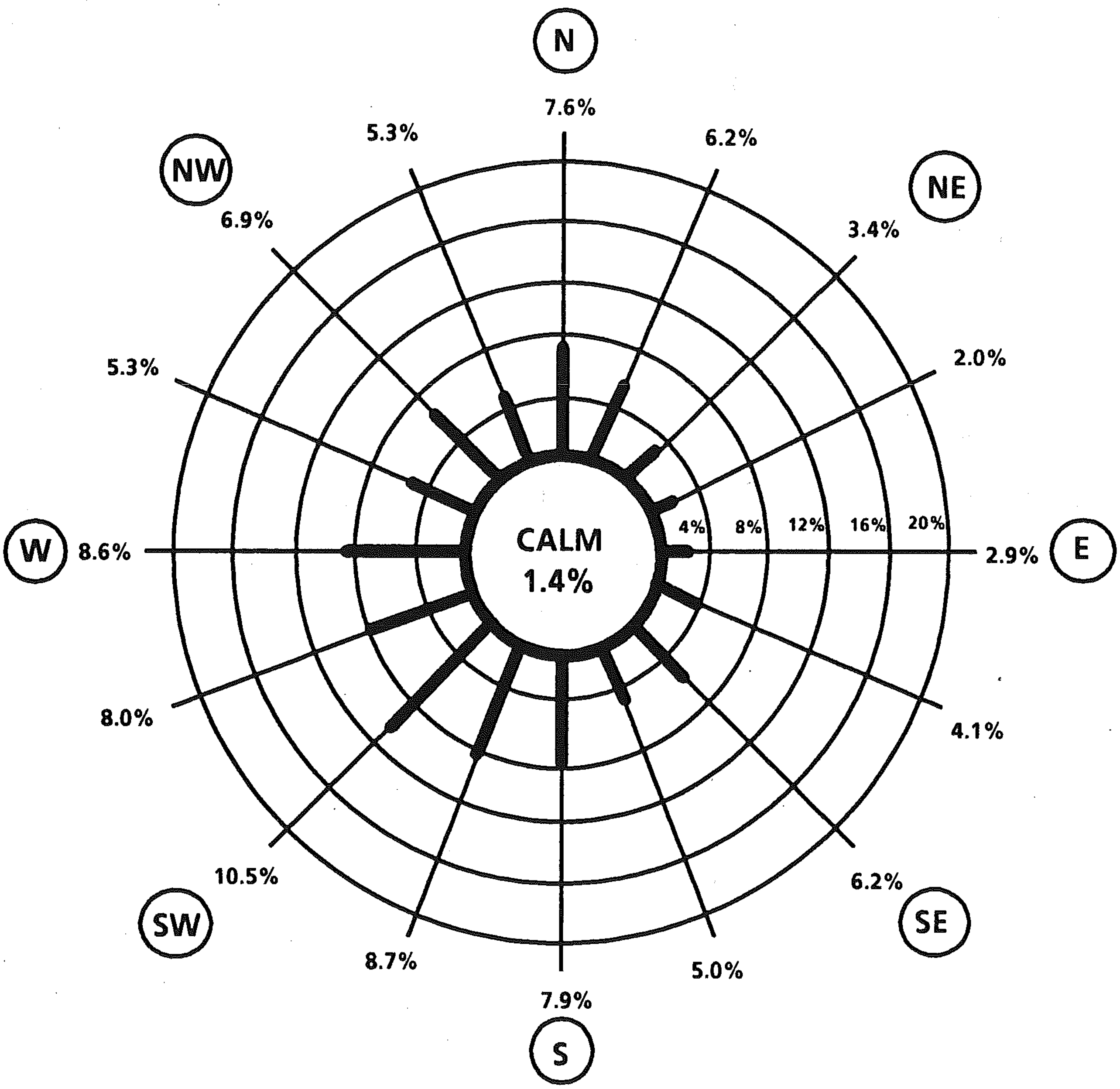
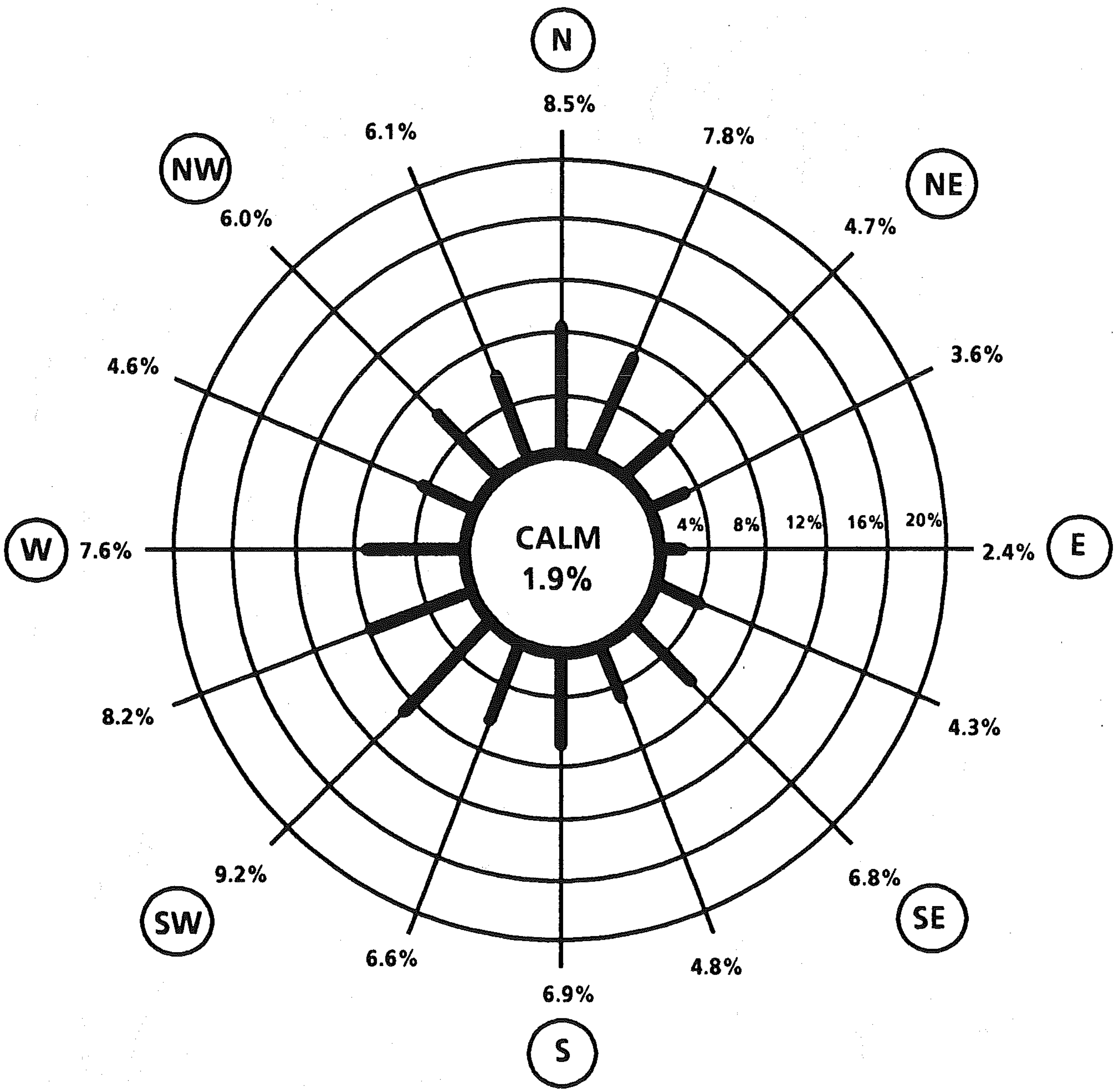


FIGURE 4-2

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



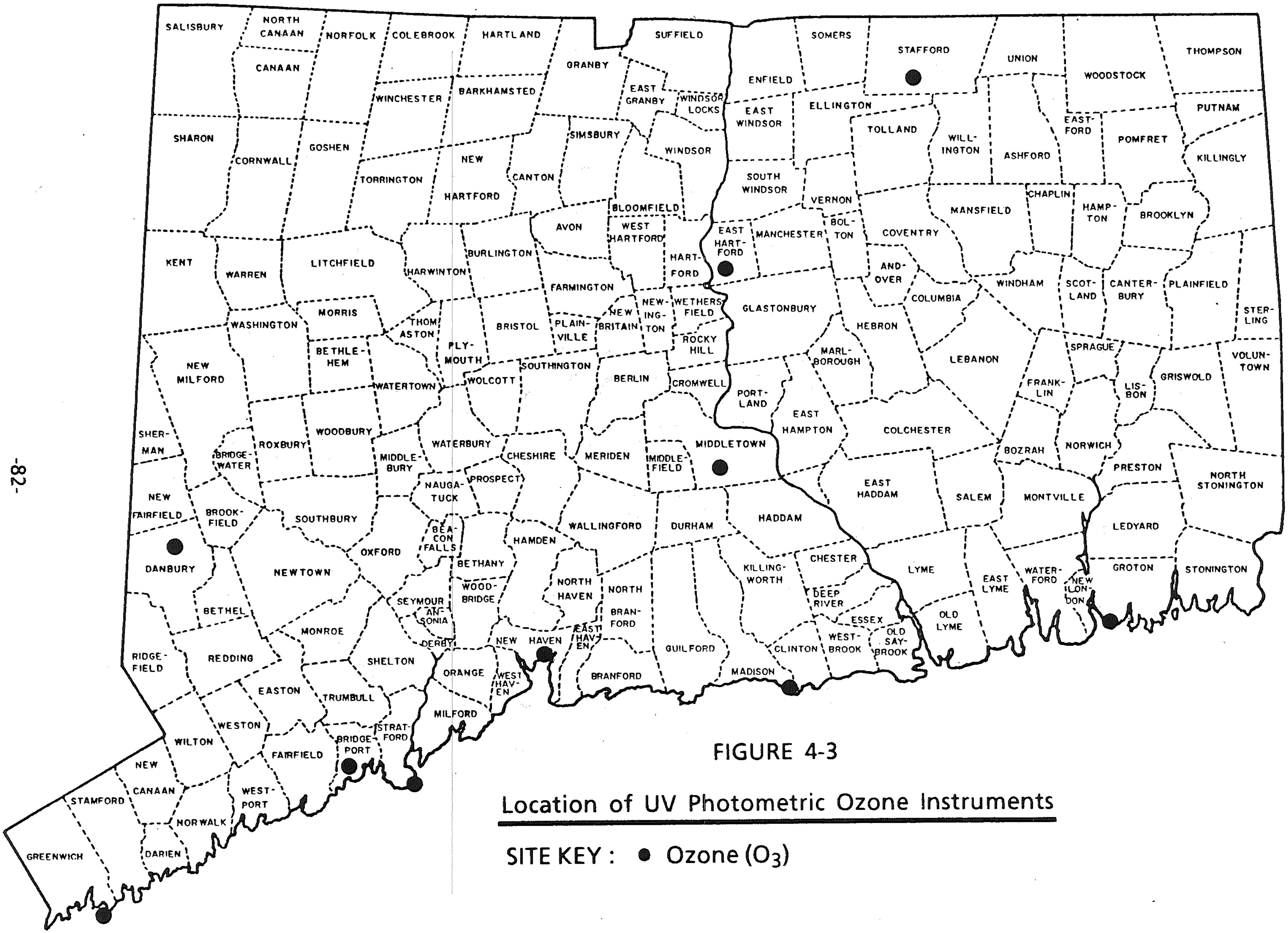


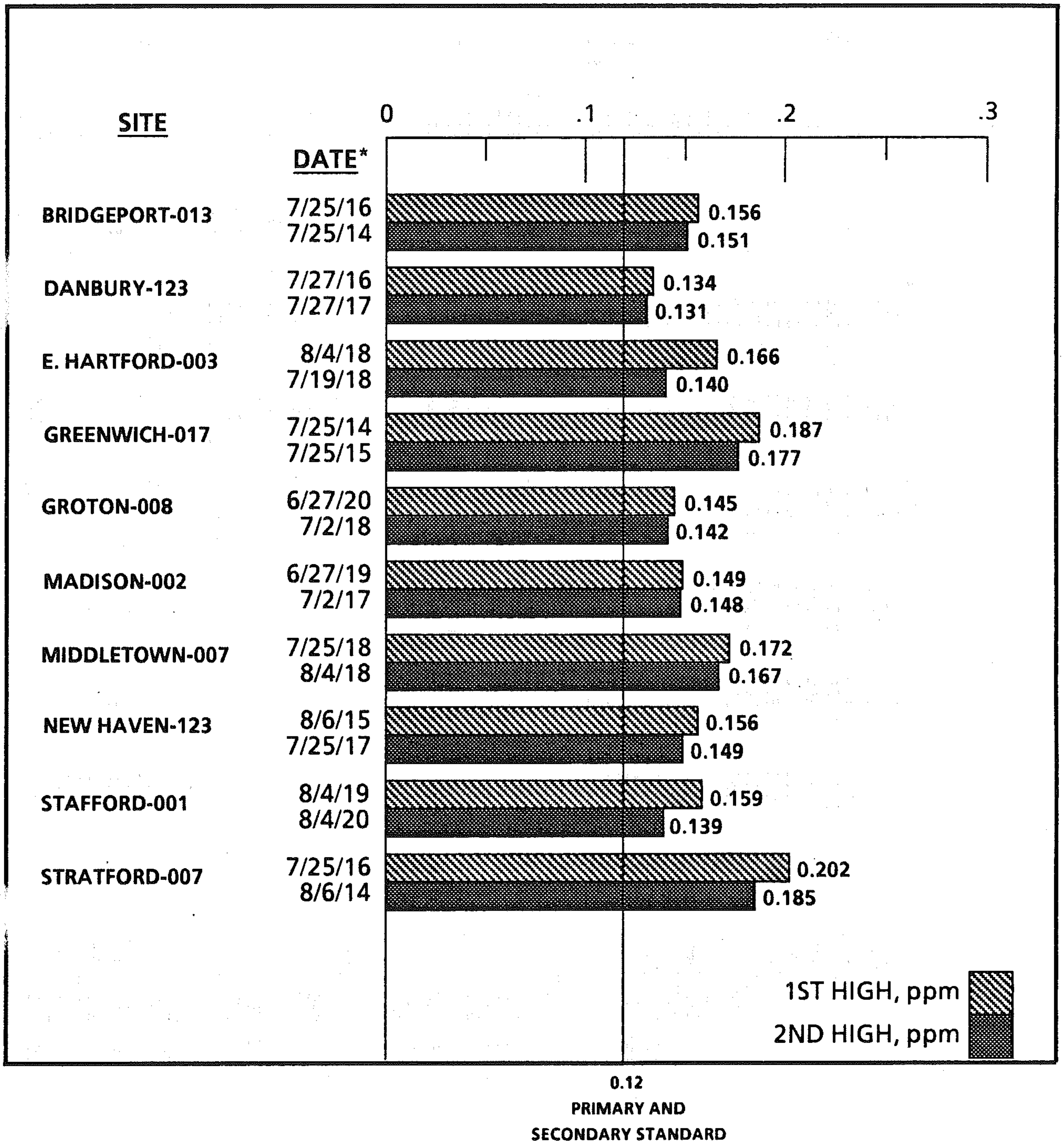
FIGURE 4-3

Location of UV Photometric Ozone Instruments

SITE KEY : ● Ozone (O_3)

FIGURE 4-4

1989 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

1989 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 (4837)	OZONE	.156	.147	.145	.131	.121	.120	.118	.116	.101	.097
	DATE	7/25/89	9/ 9/89	8/ 4/89	8/ 6/89	7/ 2/89	6/27/89	7/19/89	9/10/89	7/ 3/89	6/18/89
METEOROLOGICAL SITE	DIR (DEG)	240	240	230	220	240	250	190	260	90	260
NEWARK	VEL (MPH)	5.6	4.6	7.3	5.5	7.8	7.5	4.9	4.9	4.3	8.0
	SPD (MPH)	8.2	6.2	9.3	7.8	9.9	10.4	6.8	6.6	7.5	9.9
	RATIO	0.680	0.750	0.786	0.712	0.784	0.721	0.725	0.741	0.578	0.807
METEOROLOGICAL SITE	DIR (DEG)	250	180	200	250	260	230	190	220	120	240
BRADLEY	VEL (MPH)	3.2	3.8	6.3	5.1	4.5	4.5	5.0	1.2	3.1	5.5
	SPD (MPH)	6.0	6.0	8.2	7.5	5.8	6.0	7.5	5.2	6.5	7.5
	RATIO	0.525	0.629	0.763	0.687	0.786	0.743	0.672	0.236	0.473	0.732
METEOROLOGICAL SITE	DIR (DEG)	250	250	230	250	260	240	250	250	130	250
BRIDGEPORT	VEL (MPH)	4.2	3.1	7.0	4.5	5.5	5.7	6.3	3.5	6.2	4.2
	SPD (MPH)	4.3	3.3	7.3	4.6	5.5	5.8	6.3	3.5	6.2	4.2
	RATIO	0.985	0.938	0.960	0.986	0.999	0.996	0.996	0.999	0.996	0.999
METEOROLOGICAL SITE	DIR (DEG)	300	290	230	220	290	290	270	310	90	270
WORCESTER	VEL (MPH)	6.2	4.5	5.5	5.1	8.3	5.0	4.6	4.7	4.9	8.3
	SPD (MPH)	7.3	5.5	6.9	7.3	9.3	6.0	6.3	5.3	6.9	9.5
	RATIO	0.840	0.827	0.801	0.698	0.890	0.834	0.720	0.891	0.714	0.874
DANBURY-123 (4857)	OZONE	.134	.127	.124	.123	.120	.118	.114	.108	.108	.104
	DATE	7/27/89	7/19/89	8/ 6/89	5/20/89	8/ 4/89	7/ 3/89	7/ 1/89	6/27/89	7/25/89	9/ 9/89
METEOROLOGICAL SITE	DIR (DEG)	240	190	220	210	230	90	170	250	240	240
NEWARK	VEL (MPH)	6.8	4.9	5.5	5.5	7.3	4.3	6.4	7.5	5.6	4.6
	SPD (MPH)	9.1	6.8	7.8	6.6	9.3	7.5	8.1	10.4	8.2	6.2
	RATIO	0.746	0.725	0.712	0.834	0.786	0.578	0.790	0.721	0.680	0.750
METEOROLOGICAL SITE	DIR (DEG)	220	190	250	170	200	120	190	230	250	180
BRADLEY	VEL (MPH)	6.2	5.0	5.1	4.5	6.3	3.1	3.5	4.5	3.2	3.8
	SPD (MPH)	7.8	7.5	7.5	7.0	8.2	6.5	6.2	6.0	6.0	6.0
	RATIO	0.793	0.672	0.687	0.641	0.763	0.473	0.565	0.743	0.525	0.629
METEOROLOGICAL SITE	DIR (DEG)	240	250	250	230	230	130	190	240	250	250
BRIDGEPORT	VEL (MPH)	5.6	6.3	4.5	1.9	7.0	6.2	3.0	5.7	4.2	3.1
	SPD (MPH)	5.8	6.3	4.6	2.7	7.3	6.2	3.2	5.8	4.3	3.3
	RATIO	0.972	0.996	0.986	0.682	0.960	0.996	0.957	0.996	0.985	0.938
METEOROLOGICAL SITE	DIR (DEG)	260	270	220	250	230	90	250	290	300	290
WORCESTER	VEL (MPH)	7.2	4.6	5.1	3.1	5.5	4.9	2.3	5.0	6.2	4.5
	SPD (MPH)	8.8	6.3	7.3	7.8	6.9	6.9	4.3	6.0	7.3	5.5
	RATIO	0.819	0.720	0.698	0.399	0.801	0.714	0.533	0.834	0.840	0.827
EAST HARTFORD-003 (4756)	OZONE	.166	.140	.134	.133	.129	.122	.120	.112	.103	.098
	DATE	8/ 4/89	7/19/89	8/ 6/89	7/25/89	7/27/89	9/ 9/89	7/ 1/89	5/20/89	9/10/89	5/21/89
METEOROLOGICAL SITE	DIR (DEG)	230	190	220	240	240	240	170	210	260	310
NEWARK	VEL (MPH)	7.3	4.9	5.5	5.6	6.8	4.6	6.4	5.5	4.9	4.7
	SPD (MPH)	9.3	6.8	7.8	8.2	9.1	6.2	8.1	6.6	6.6	9.5
	RATIO	0.786	0.725	0.712	0.680	0.746	0.750	0.790	0.834	0.741	0.501
METEOROLOGICAL SITE	DIR (DEG)	200	190	250	250	220	180	190	170	220	180
BRADLEY	VEL (MPH)	6.3	5.0	5.1	3.2	6.2	3.8	3.5	4.5	1.2	4.0
	SPD (MPH)	8.2	7.5	7.5	6.0	7.8	6.0	6.2	7.0	5.2	6.5
	RATIO	0.763	0.672	0.687	0.525	0.793	0.629	0.565	0.641	0.236	0.622

TABLE 4-3, CONTINUED

1989 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)	230	250	250	250	240	250	190	230	250	220
BRIDGEPORT	VEL (MPH)	7.0	6.3	4.5	4.2	5.6	3.1	3.0	1.9	3.5	3.0
	SPD (MPH)	7.3	6.3	4.6	4.3	5.8	3.3	3.2	2.7	3.5	3.0
	RATIO	0.960	0.996	0.986	0.985	0.972	0.938	0.957	0.682	0.999	0.979
METEOROLOGICAL SITE	DIR (DEG)	230	270	220	300	260	290	250	250	310	270
WORCESTER	VEL (MPH)	5.5	4.6	5.1	6.2	7.2	4.5	2.3	3.1	4.7	8.0
	SPD (MPH)	6.9	6.3	7.3	7.3	8.8	5.5	4.3	7.8	5.3	10.8
	RATIO	0.801	0.720	0.698	0.840	0.819	0.827	0.533	0.399	0.891	0.742
GREENWICH-017 (4473)	OZONE	.187	.162	.150	.149	.149	.136	.133	.124	.122	.121
	DATE	7/25/89	9/ 9/89	7/ 2/89	6/27/89	8/ 4/89	9/10/89	7/26/89	7/27/89	7/18/89	7/19/89
METEOROLOGICAL SITE	DIR (DEG)	240	240	240	250	230	260	310	240	150	190
NEWARK	VEL (MPH)	5.6	4.6	7.8	7.5	7.3	4.9	4.9	6.8	4.6	4.9
	SPD (MPH)	8.2	6.2	9.9	10.4	9.3	6.6	7.2	9.1	6.0	6.8
	RATIO	0.680	0.750	0.784	0.721	0.786	0.741	0.680	0.746	0.759	0.725
METEOROLOGICAL SITE	DIR (DEG)	250	180	260	230	200	220	310	220	190	190
BRADLEY	VEL (MPH)	3.2	3.8	4.5	4.5	6.3	1.2	3.3	6.2	4.7	5.0
	SPD (MPH)	6.0	6.0	5.8	6.0	8.2	5.2	5.2	7.8	6.5	7.5
	RATIO	0.525	0.629	0.786	0.743	0.763	0.236	0.643	0.793	0.730	0.672
METEOROLOGICAL SITE	DIR (DEG)	250	250	260	240	230	250	260	240	200	250
BRIDGEPORT	VEL (MPH)	4.2	3.1	5.5	5.7	7.0	3.5	4.2	5.6	2.9	6.3
	SPD (MPH)	4.3	3.3	5.5	5.8	7.3	3.5	4.3	5.8	3.6	6.3
	RATIO	0.985	0.938	0.999	0.996	0.960	0.999	0.974	0.972	0.801	0.996
METEOROLOGICAL SITE	DIR (DEG)	300	290	290	290	230	310	310	260	250	270
WORCESTER	VEL (MPH)	6.2	4.5	8.3	5.0	5.5	4.7	7.4	7.2	6.2	4.6
	SPD (MPH)	7.3	5.5	9.3	6.0	6.9	5.3	8.1	8.8	8.2	6.3
	RATIO	0.840	0.827	0.890	0.834	0.801	0.891	0.914	0.819	0.751	0.720
GROTON-008 (4805)	OZONE	.145	.142	.137	.132	.130	.128	.120	.116	.116	.115
	DATE	6/27/89	7/ 2/89	7/26/89	8/ 4/89	9/10/89	6/26/89	6/19/89	7/27/89	9/ 9/89	8/ 2/89
METEOROLOGICAL SITE	DIR (DEG)	250	240	310	230	260	270	180	240	240	240
NEWARK	VEL (MPH)	7.5	7.8	4.9	7.3	4.9	3.7	5.3	6.8	4.6	8.7
	SPD (MPH)	10.4	9.9	7.2	9.3	6.6	7.0	7.5	9.1	6.2	10.1
	RATIO	0.721	0.784	0.680	0.786	0.741	0.523	0.709	0.746	0.750	0.868
METEOROLOGICAL SITE	DIR (DEG)	230	260	310	200	220	330	310	220	180	210
BRADLEY	VEL (MPH)	4.5	4.5	3.3	6.3	1.2	2.8	.9	6.2	3.8	3.5
	SPD (MPH)	6.0	5.8	5.2	8.2	5.2	5.9	3.5	7.8	6.0	5.6
	RATIO	0.743	0.786	0.643	0.763	0.236	0.477	0.269	0.793	0.629	0.628
METEOROLOGICAL SITE	DIR (DEG)	240	260	260	230	250	210	230	240	250	260
BRIDGEPORT	VEL (MPH)	5.7	5.5	4.2	7.0	3.5	3.2	3.3	5.6	3.1	6.3
	SPD (MPH)	5.8	5.5	4.3	7.3	3.5	3.7	3.5	5.8	3.3	6.3
	RATIO	0.996	0.999	0.974	0.960	0.999	0.851	0.952	0.972	0.938	0.992
METEOROLOGICAL SITE	DIR (DEG)	290	290	310	230	310	300	320	260	290	290
WORCESTER	VEL (MPH)	5.0	8.3	7.4	5.5	4.7	4.7	3.5	7.2	4.5	4.2
	SPD (MPH)	6.0	9.3	8.1	6.9	5.3	5.8	4.6	8.8	5.5	5.6
	RATIO	0.834	0.890	0.914	0.801	0.891	0.826	0.768	0.819	0.827	0.751

TABLE 4-3, CONTINUED

1989 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 (4396)	OZONE	.149	.148	.136	.126	.122	.121	.119	.113	.112	.110
	DATE	6/27/89	7/ 2/89	7/25/89	6/26/89	9/ 9/89	8/ 4/89	9/10/89	8/ 2/89	8/ 6/89	7/26/89
METEOROLOGICAL SITE	DIR (DEG)	250	240	240	270	240	230	260	240	220	310
NEWARK	VEL (MPH)	7.5	7.8	5.6	3.7	4.6	7.3	4.9	8.7	5.5	4.9
	SPD (MPH)	10.4	9.9	8.2	7.0	6.2	9.3	6.6	10.1	7.8	7.2
	RATIO	0.721	0.784	0.680	0.523	0.750	0.786	0.741	0.868	0.712	0.680
METEOROLOGICAL SITE	DIR (DEG)	230	260	250	330	180	200	220	210	250	310
BRADLEY	VEL (MPH)	4.5	4.5	3.2	2.8	3.8	6.3	1.2	3.5	5.1	3.3
	SPD (MPH)	6.0	5.8	6.0	5.9	6.0	8.2	5.2	5.6	7.5	5.2
	RATIO	0.743	0.786	0.525	0.477	0.629	0.763	0.236	0.628	0.687	0.643
METEOROLOGICAL SITE	DIR (DEG)	240	260	250	210	250	230	250	260	250	260
BRIDGEPORT	VEL (MPH)	5.7	5.5	4.2	3.2	3.1	7.0	3.5	6.3	4.5	4.2
	SPD (MPH)	5.8	5.5	4.3	3.7	3.3	7.3	3.5	6.3	4.6	4.3
	RATIO	0.996	0.999	0.985	0.851	0.938	0.960	0.999	0.992	0.986	0.974
METEOROLOGICAL SITE	DIR (DEG)	290	290	300	300	290	230	310	290	220	310
WORCESTER	VEL (MPH)	5.0	8.3	6.2	4.7	4.5	5.5	4.7	4.2	5.1	7.4
	SPD (MPH)	6.0	9.3	7.3	5.8	5.5	6.9	5.3	5.6	7.3	8.1
	RATIO	0.834	0.890	0.840	0.826	0.827	0.801	0.891	0.751	0.698	0.914
MIDDLETOWN-007 (4705)	OZONE	.172	.167	.149	.128	.127	.124	.123	.120	.120	.116
	DATE	7/25/89	8/ 4/89	7/19/89	8/ 6/89	9/ 9/89	7/27/89	6/27/89	7/ 1/89	6/18/89	7/10/89
METEOROLOGICAL SITE	DIR (DEG)	240	230	190	220	240	240	250	170	260	240
NEWARK	VEL (MPH)	5.6	7.3	4.9	5.5	4.6	6.8	7.5	6.4	8.0	10.6
	SPD (MPH)	8.2	9.3	6.8	7.8	6.2	9.1	10.4	8.1	9.9	13.1
	RATIO	0.680	0.786	0.725	0.712	0.750	0.746	0.721	0.790	0.807	0.809
METEOROLOGICAL SITE	DIR (DEG)	250	200	190	250	180	220	230	190	240	190
BRADLEY	VEL (MPH)	3.2	6.3	5.0	5.1	3.8	6.2	4.5	3.5	5.5	5.7
	SPD (MPH)	6.0	8.2	7.5	7.5	6.0	7.8	6.0	6.2	7.5	7.6
	RATIO	0.525	0.763	0.672	0.687	0.629	0.793	0.743	0.565	0.732	0.752
METEOROLOGICAL SITE	DIR (DEG)	250	230	250	250	250	240	240	190	250	260
BRIDGEPORT	VEL (MPH)	4.2	7.0	6.3	4.5	3.1	5.6	5.7	3.0	4.2	6.5
	SPD (MPH)	4.3	7.3	6.3	4.6	3.3	5.8	5.8	3.2	4.2	6.6
	RATIO	0.985	0.960	0.996	0.986	0.938	0.972	0.996	0.957	0.999	0.981
METEOROLOGICAL SITE	DIR (DEG)	300	230	270	220	290	260	290	250	270	250
WORCESTER	VEL (MPH)	6.2	5.5	4.6	5.1	4.5	7.2	5.0	2.3	8.3	7.9
	SPD (MPH)	7.3	6.9	6.3	7.3	5.5	8.8	6.0	4.3	9.5	9.6
	RATIO	0.840	0.801	0.720	0.698	0.827	0.819	0.834	0.533	0.874	0.822
NEW HAVEN-123 (3571)	OZONE	.156	.149	.141	.118	.110	.107	.099	.098	.097	.094
	DATE	8/ 6/89	7/25/89	8/ 4/89	6/27/89	7/ 1/89	7/19/89	7/ 9/89	8/ 2/89	6/18/89	7/10/89
METEOROLOGICAL SITE	DIR (DEG)	220	240	230	250	170	190	250	240	260	240
NEWARK	VEL (MPH)	5.5	5.6	7.3	7.5	6.4	4.9	8.6	8.7	8.0	10.6
	SPD (MPH)	7.8	8.2	9.3	10.4	8.1	6.8	10.2	10.1	9.9	13.1
	RATIO	0.712	0.680	0.786	0.721	0.790	0.725	0.846	0.868	0.807	0.809
METEOROLOGICAL SITE	DIR (DEG)	250	250	200	230	190	190	300	210	240	190
BRADLEY	VEL (MPH)	5.1	3.2	6.3	4.5	3.5	5.0	3.3	3.5	5.5	5.7
	SPD (MPH)	7.5	6.0	8.2	6.0	6.2	7.5	5.6	5.6	7.5	7.6
	RATIO	0.687	0.525	0.763	0.743	0.565	0.672	0.580	0.628	0.732	0.752

TABLE 4-3, CONTINUED

1989 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	230	240	190	250	250	260	250	260
BRIDGEPORT	VEL (MPH)	4.5	4.2	7.0	5.7	3.0	6.3	4.6	6.3	4.2	6.5
	SPD (MPH)	4.6	4.3	7.3	5.8	3.2	6.3	4.6	6.3	4.2	6.6
	RATIO	0.986	0.985	0.960	0.996	0.957	0.996	0.996	0.992	0.999	0.981
METEOROLOGICAL SITE	DIR (DEG)	220	300	230	290	250	270	300	290	270	250
WORCESTER	VEL (MPH)	5.1	6.2	5.5	5.0	2.3	4.6	5.1	4.2	8.3	7.9
	SPD (MPH)	7.3	7.3	6.9	6.0	4.3	6.3	5.9	5.6	9.5	9.6
	RATIO	0.698	0.840	0.801	0.834	0.533	0.720	0.865	0.751	0.874	0.822
STAFFORD-001 (4746)	OZONE	.159	.128	.126	.124	.123	.116	.115	.115	.103	.102
	DATE	8/ 4/89	8/ 6/89	7/19/89	7/27/89	7/25/89	9/ 9/89	7/ 1/89	5/20/89	6/20/89	9/10/89
METEOROLOGICAL SITE	DIR (DEG)	230	220	190	240	240	240	170	210	130	260
NEWARK	VEL (MPH)	7.3	5.5	4.9	6.8	5.6	4.6	6.4	5.5	6.6	4.9
	SPD (MPH)	9.3	7.8	6.8	9.1	8.2	6.2	8.1	6.6	7.8	6.6
	RATIO	0.786	0.712	0.725	0.746	0.680	0.750	0.790	0.834	0.850	0.741
METEOROLOGICAL SITE	DIR (DEG)	200	250	190	220	250	180	190	170	170	220
BRADLEY	VEL (MPH)	6.3	5.1	5.0	6.2	3.2	3.8	3.5	4.5	5.0	1.2
	SPD (MPH)	8.2	7.5	7.5	7.8	6.0	6.0	6.2	7.0	7.3	5.2
	RATIO	0.763	0.687	0.672	0.793	0.525	0.629	0.565	0.641	0.688	0.236
METEOROLOGICAL SITE	DIR (DEG)	230	250	250	240	250	250	190	230	140	250
BRIDGEPORT	VEL (MPH)	7.0	4.5	6.3	5.6	4.2	3.1	3.0	1.9	3.9	3.5
	SPD (MPH)	7.3	4.6	6.3	5.8	4.3	3.3	3.2	2.7	4.6	3.5
	RATIO	0.960	0.986	0.996	0.972	0.985	0.938	0.957	0.682	0.849	0.999
METEOROLOGICAL SITE	DIR (DEG)	230	220	270	260	300	290	250	250	220	310
WORCESTER	VEL (MPH)	5.5	5.1	4.6	7.2	6.2	4.5	2.3	3.1	3.6	4.7
	SPD (MPH)	6.9	7.3	6.3	8.8	7.3	5.5	4.3	7.8	4.5	5.3
	RATIO	0.801	0.698	0.720	0.819	0.840	0.827	0.533	0.399	0.799	0.891
STRATFORD-007 (4800)	OZONE	.202	.185	.175	.165	.156	.155	.142	.137	.136	.132
	DATE	7/25/89	8/ 6/89	8/ 4/89	7/ 2/89	9/ 9/89	6/27/89	9/10/89	7/19/89	7/26/89	8/ 2/89
METEOROLOGICAL SITE	DIR (DEG)	240	220	230	240	240	250	260	190	310	240
NEWARK	VEL (MPH)	5.6	5.5	7.3	7.8	4.6	7.5	4.9	4.9	4.9	8.7
	SPD (MPH)	8.2	7.8	9.3	9.9	6.2	10.4	6.6	6.8	7.2	10.1
	RATIO	0.680	0.712	0.786	0.784	0.750	0.721	0.741	0.725	0.680	0.868
METEOROLOGICAL SITE	DIR (DEG)	250	250	200	260	180	230	220	190	310	210
BRADLEY	VEL (MPH)	3.2	5.1	6.3	4.5	3.8	4.5	1.2	5.0	3.3	3.5
	SPD (MPH)	6.0	7.5	8.2	5.8	6.0	6.0	5.2	7.5	5.2	5.6
	RATIO	0.525	0.687	0.763	0.786	0.629	0.743	0.236	0.672	0.643	0.628
METEOROLOGICAL SITE	DIR (DEG)	250	250	230	260	250	240	250	250	260	260
BRIDGEPORT	VEL (MPH)	4.2	4.5	7.0	5.5	3.1	5.7	3.5	6.3	4.2	6.3
	SPD (MPH)	4.3	4.6	7.3	5.5	3.3	5.8	3.5	6.3	4.3	6.3
	RATIO	0.985	0.986	0.960	0.999	0.938	0.996	0.999	0.996	0.974	0.992
METEOROLOGICAL SITE	DIR (DEG)	300	220	230	290	290	290	310	270	310	290
WORCESTER	VEL (MPH)	6.2	5.1	5.5	8.3	4.5	5.0	4.7	4.6	7.4	4.2
	SPD (MPH)	7.3	7.3	6.9	9.3	5.5	6.0	5.3	6.3	8.1	5.6
	RATIO	0.840	0.698	0.801	0.890	0.827	0.834	0.891	0.720	0.914	0.751

FIGURE 4-5

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

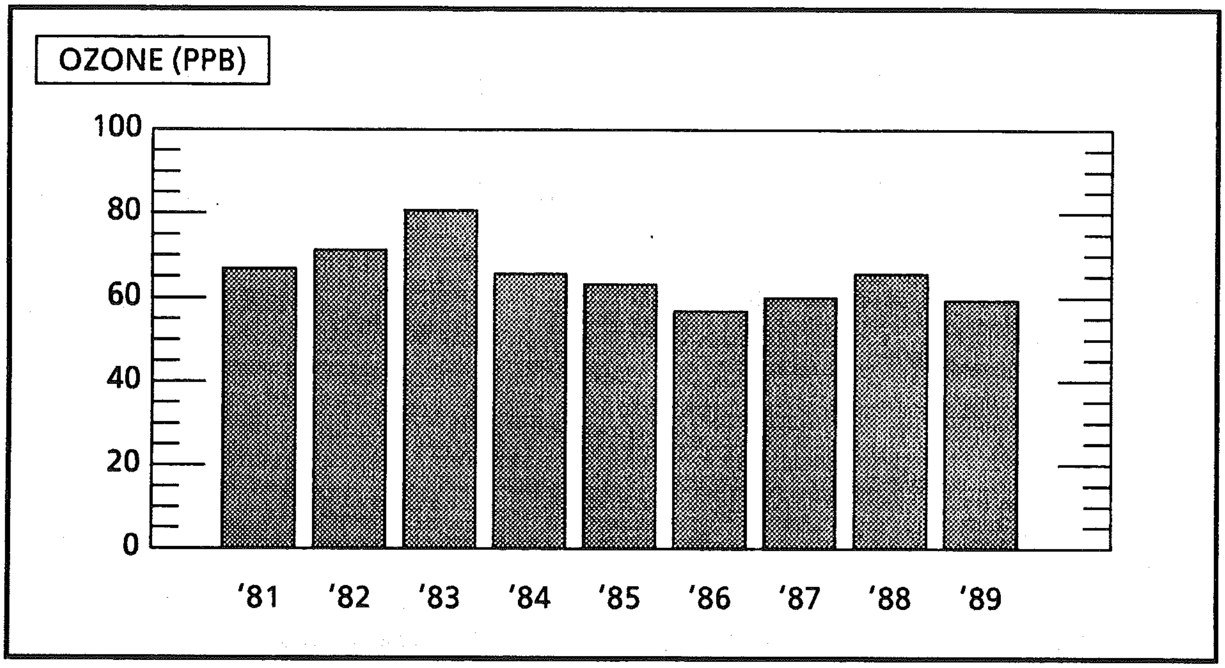
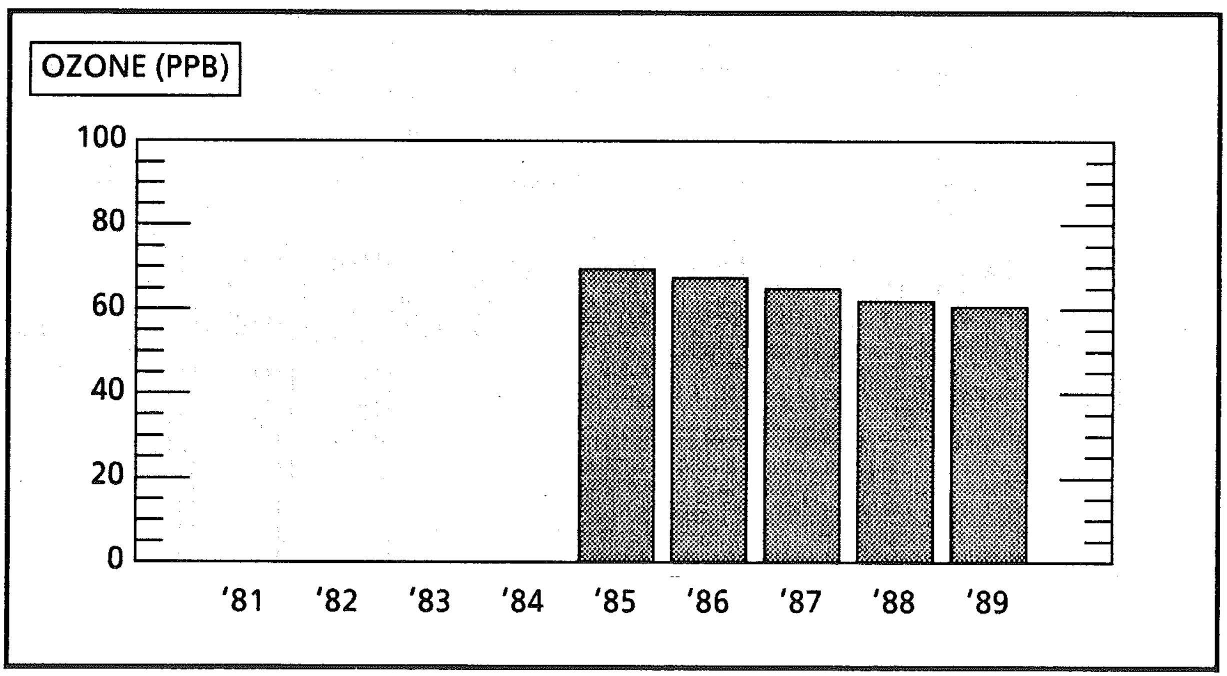


FIGURE 4-6

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 conversion of nitric oxide (NO) to NO_2 by means of the photochemical interaction between nitrogen oxide compounds and hydrocarbons. 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 1989. The annual arithmetic mean NO_2 concentration at each site was well below the federal standard of 100 $\mu g/m^3$.

SAMPLE COLLECTION AND ANALYSIS

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

DISCUSSION OF DATA

Monitoring Network - There were three nitrogen dioxide monitoring sites in 1989 (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 - Forty-six precision checks were made on the NO_2 monitors in 1989, yielding 95% probability limits ranging from -5% to +12%. 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 1989. 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 -3% to +12%; those for the low/medium level test ranged from -11% to +16%; those for the medium/high level test ranged from -9% to +9%; and those for the high level test ranged from -15% to +12%.

Annual Averages - The annual average NO_2 standard of 100 $\mu g/m^3$ was not exceeded in 1989 at any site in Connecticut (see Table 5-1). In 1989, all three sites had sufficient data to compute valid arithmetic means. This permits comparisons with the 1987 and 1988 annual averages - except for Bridgeport 013 which replaced Bridgeport 123 in 1988. The annual average NO_2 concentrations decreased at all three sites between 1988 and 1989.

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 1989.

10-High Days with Wind Data - Table 5-2 presents for each site the ten days in 1989 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, 17 of the 20 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 53% 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 and up slightly 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 five years.

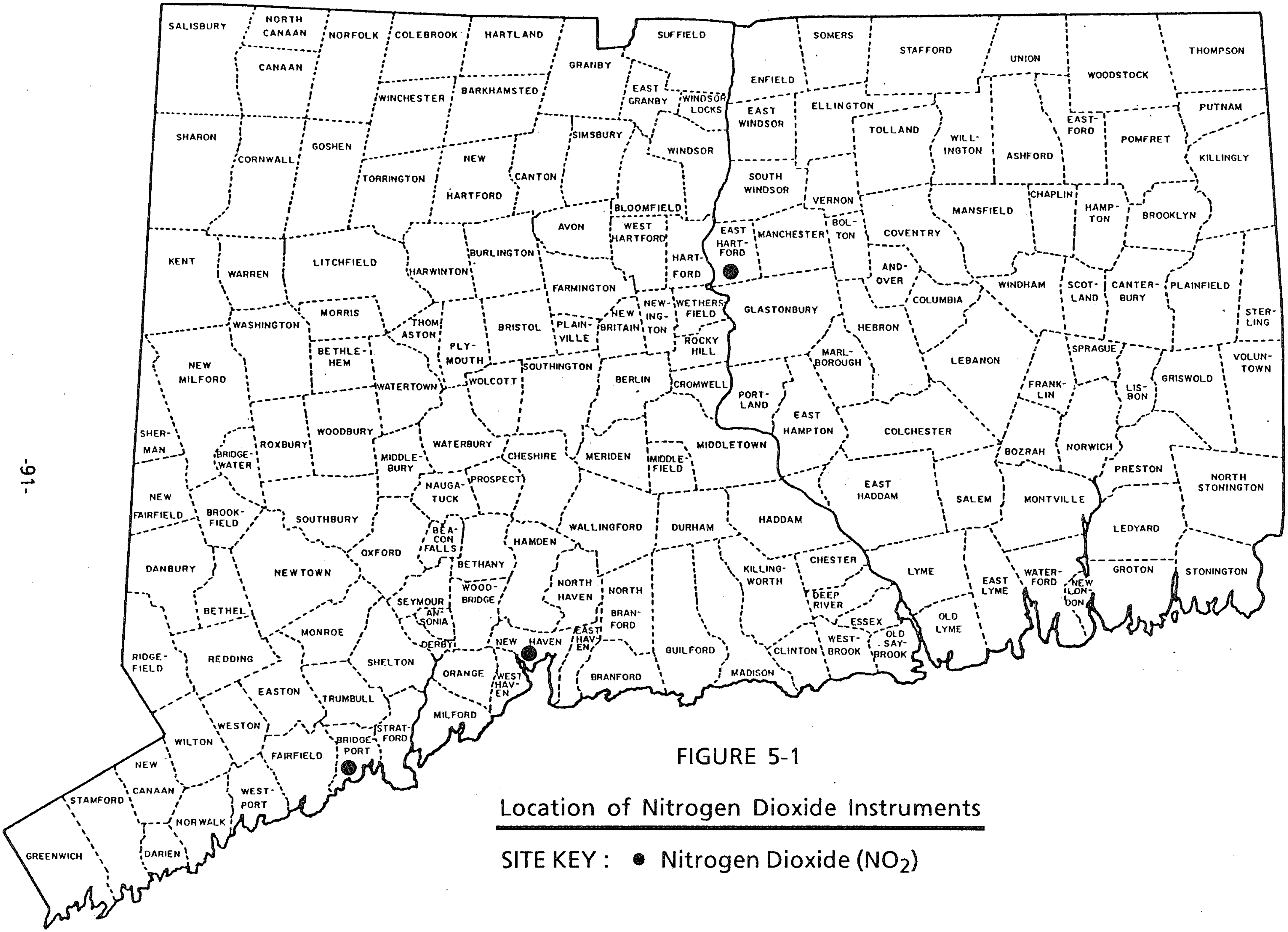


FIGURE 5-1

Location of Nitrogen Dioxide Instruments

SITE KEY : ● Nitrogen Dioxide (NO_2)

TABLE 5-1

1987 -1989 NITROGEN DIOXIDE ANNUAL AVERAGES

Town Name	Site	Year	Samples	Arithmetic Mean	95-Percent-Limits Lower	95-Percent-Limits Upper	Standard Deviation
Bridgeport	123	1987	7701	48.43	48.21	48.64	28.02
Bridgeport	013	1988	8674	51.03	50.97	51.10	27.18
Bridgeport	013	1989	7886	48.10	47.92	48.28	25.58
East Hartford	003	1987	8522	38.70	38.62	38.78	23.85
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
New Haven	123	1987	7887	53.70	53.51	53.89	27.42
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

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

TABLE 5-2

1989 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 (7886)	NO2	.121	.117	.100	.097	.083	.078	.078	.077	.076	.076
	DATE	10/27/89	6/ 1/89	5/31/89	10/30/89	4/17/89	10/16/89	10/26/89	3/28/89	10/29/89	10/13/89
METEOROLOGICAL SITE	DIR (DEG)	190	290	260	120	220	170	360	230	90	270
NEWARK	VEL (MPH)	1.6	5.7	7.2	2.6	8.2	2.9	2.4	10.6	1.0	7.5
	SPD (MPH)	4.0	7.8	9.6	4.7	9.5	5.9	2.6	13.2	2.9	9.1
	RATIO	0.394	0.734	0.750	0.556	0.865	0.486	0.908	0.804	0.356	0.832
METEOROLOGICAL SITE	DIR (DEG)	360	230	230	190	210	190	350	200	50	270
BRADLEY	VEL (MPH)	1.0	1.2	1.2	4.3	4.9	6.2	3.3	7.0	1.5	4.7
	SPD (MPH)	3.3	5.0	5.2	5.8	7.6	7.3	4.6	10.9	2.3	6.6
	RATIO	0.314	0.236	0.239	0.747	0.649	0.848	0.720	0.645	0.644	0.713
METEOROLOGICAL SITE	DIR (DEG)	250	130	260	170	220	220	260	250	310	270
BRIDGEPORT	VEL (MPH)	2.9	2.7	3.7	.8	5.1	2.8	.8	5.3	.7	4.5
	SPD (MPH)	2.9	2.7	4.3	3.5	5.2	2.9	2.9	5.5	2.6	4.7
	RATIO	0.997	0.996	0.848	0.245	0.976	0.967	0.272	0.965	0.285	0.941
METEOROLOGICAL SITE	DIR (DEG)	310	300	70	250	280	230	70	270	240	280
WORCESTER	VEL (MPH)	5.0	5.4	2.0	7.8	6.4	7.3	1.9	11.3	1.0	8.2
	SPD (MPH)	5.2	7.6	5.0	8.1	9.1	7.5	4.0	15.5	3.3	8.3
	RATIO	0.974	0.711	0.407	0.963	0.708	0.980	0.480	0.729	0.315	0.978
EAST HARTFORD-003 (8002)	NO2	.075	.074	.071	.066	.064	.064	.064	.062	.060	.057
	DATE	1/24/89	2/ 1/89	1/23/89	3/28/89	12/25/89	9/29/89	11/14/89	10/30/89	10/27/89	4/28/89
METEOROLOGICAL SITE	DIR (DEG)	290	240	160	230	220	240	210	120	190	340
NEWARK	VEL (MPH)	4.4	7.7	1.8	10.6	7.8	10.2	6.5	2.6	1.6	2.9
	SPD (MPH)	5.0	9.8	3.9	13.2	9.3	12.4	8.6	4.7	4.0	10.9
	RATIO	0.884	0.788	0.461	0.804	0.839	0.822	0.755	0.556	0.394	0.262
METEOROLOGICAL SITE	DIR (DEG)	350	230	160	200	210	220	210	190	360	350
BRADLEY	VEL (MPH)	4.2	4.5	1.1	7.0	5.7	5.9	7.6	4.3	1.0	5.6
	SPD (MPH)	5.0	8.5	4.7	10.9	6.8	9.1	10.6	5.8	3.3	6.2
	RATIO	0.838	0.527	0.236	0.645	0.842	0.655	0.712	0.747	0.314	0.904
METEOROLOGICAL SITE	DIR (DEG)	290	240	220	250	260	270	260	170	250	270
BRIDGEPORT	VEL (MPH)	3.0	6.7	.9	5.3	9.0	9.2	5.7	.8	2.9	5.2
	SPD (MPH)	3.5	6.8	.9	5.5	9.2	9.2	6.5	3.5	2.9	6.6
	RATIO	0.862	0.989	0.999	0.965	0.983	0.997	0.878	0.245	0.997	0.792
METEOROLOGICAL SITE	DIR (DEG)	330	280	260	270	260	260	240	250	310	340
WORCESTER	VEL (MPH)	6.3	9.4	6.6	11.3	7.7	11.7	9.1	7.8	5.0	7.2
	SPD (MPH)	7.0	12.9	8.6	15.5	8.1	14.1	9.2	8.1	5.2	8.2
	RATIO	0.897	0.728	0.763	0.729	0.954	0.832	0.990	0.963	0.974	0.877
NEW HAVEN-123 (8221)	NO2	.119	.096	.094	.087	.085	.084	.084	.078	.077	.076
	DATE	1/24/89	9/10/89	6/ 1/89	10/30/89	1/23/89	10/27/89	4/18/89	4/30/89	3/28/89	10/13/89
METEOROLOGICAL SITE	DIR (DEG)	290	260	290	120	160	190	300	30	230	270
NEWARK	VEL (MPH)	4.4	4.9	5.7	2.6	1.8	1.6	7.3	2.4	10.6	7.5
	SPD (MPH)	5.0	6.6	7.8	4.7	3.9	4.0	9.8	6.5	13.2	9.1
	RATIO	0.884	0.741	0.734	0.556	0.461	0.394	0.747	0.375	0.804	0.832
METEOROLOGICAL SITE	DIR (DEG)	350	220	230	190	160	360	330	10	200	270
BRADLEY	VEL (MPH)	4.2	1.2	1.2	4.3	1.1	1.0	8.8	4.0	7.0	4.7
	SPD (MPH)	5.0	5.2	5.0	5.8	4.7	3.3	9.5	6.6	10.9	6.6
	RATIO	0.838	0.236	0.236	0.747	0.236	0.314	0.925	0.602	0.645	0.713

TABLE 5-2, CONTINUED

1989 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)	290	250	130	170	220	250	280	270	250	270
BRIDGEPORT	VEL (MPH)	3.0	3.5	2.7	.8	.9	2.9	3.7	2.2	5.3	4.5
	SPD (MPH)	3.5	3.5	2.7	3.5	.9	2.9	4.2	3.7	5.5	4.7
	RATIO	0.862	0.999	0.996	0.245	0.999	0.997	0.879	0.585	0.965	0.941
METEOROLOGICAL SITE	DIR (DEG)	330	310	300	250	260	310	310	50	270	280
WORCESTER	VEL (MPH)	6.3	4.7	5.4	7.8	6.6	5.0	6.0	5.7	11.3	8.2
	SPD (MPH)	7.0	5.3	7.6	8.1	8.6	5.2	8.2	6.3	15.5	8.3
	RATIO	0.897	0.891	0.711	0.963	0.763	0.974	0.727	0.893	0.729	0.978

FIGURE 5-2

AVERAGES OF THE ANNUAL NO_2 CONCENTRATIONS AT THREE SITES

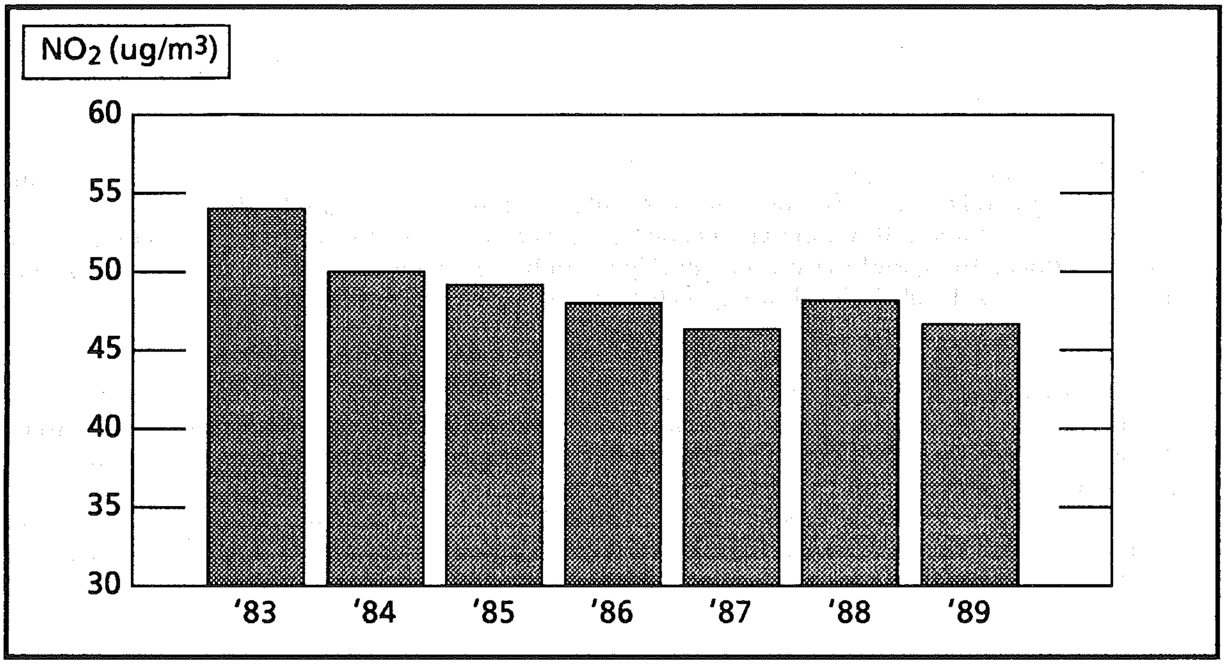
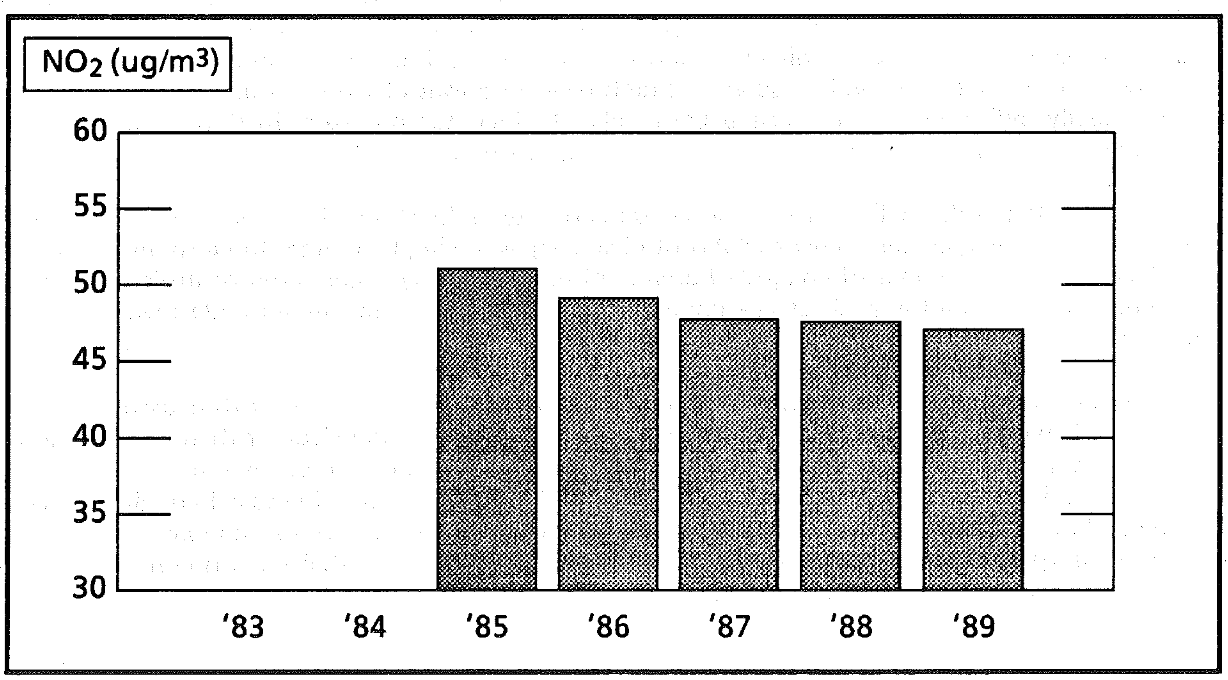


FIGURE 5-3

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 exceeded once at one of the five carbon monoxide monitoring sites in Connecticut during 1989. The site was Hartford 017 and since two exceedances are required for a violation, the 8-hour standard was not violated at this site. No exceedance of the 35 ppm one-hour standard was measured at any site in 1989.

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 1989 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 202 precision checks during 1989. The resulting 95% probability limits were -3% to +6%. 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 1989. Three different concentration levels were tested on each monitor: low, medium and high. The 95% probability limits ranged from -19% to +9% for the low level test; -11% to +3% for the medium level test; and -11% to +3% for the high level test.

8-Hour and 1-Hour Averages - An 8-hour concentration is said to exceed the standard of 9 ppm if it is equal to or greater than 9.5 ppm. No site had a second high CO concentration exceeding the 8-hour standard, which means that the standard was not violated in Connecticut in 1989 (see Table 6-1). This was the first year that Hartford 017 did not violate the 8-hour standard since it began operation in 1984.

Regarding the maximum 8-hour running average at each site, there were decreases from 1988 to 1989 at at all the sites except Hartford 013, which had an increase. The second highest 8-hour running average decreased from 1988 to 1989 at Hartford 017, New Haven 019 and Stamford 020 and increased at Bridgeport 004. There was no change at Hartford 013.

As for 1-hour averages, no site in the state recorded a value exceeding the primary 1-hour standard of 35 ppm. All the sites recorded maximum 1-hour values that were lower than the year before, except for Hartford 017 which had a slightly higher value. Second high 1-hour values were lower in 1989 at all five sites.

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

Trends - Due to the local nature of CO emissions, it is not appropriate to give an estimate of widespread CO trends. However, local CO trends can be addressed in a number of ways. Exceedances of the 8-hour standard can be tracked in order to determine if a CO problem is worsening or abating at a site. This is illustrated in Table 6-3 and in Figure 6-2. One can see that over the past five years the Hartford-017 site has shown a higher frequency of exceedances relative to the other sites, albeit with no established trend. The number of exceedances shows a downward trend at Stamford 020. No exceedances are evident at Bridgeport 004, Hartford 013 or New Haven 019, and 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 Bridgeport 004, Hartford 017 and Stamford 020. 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 the New Haven 019 sites are not included here because they lack sufficient data.

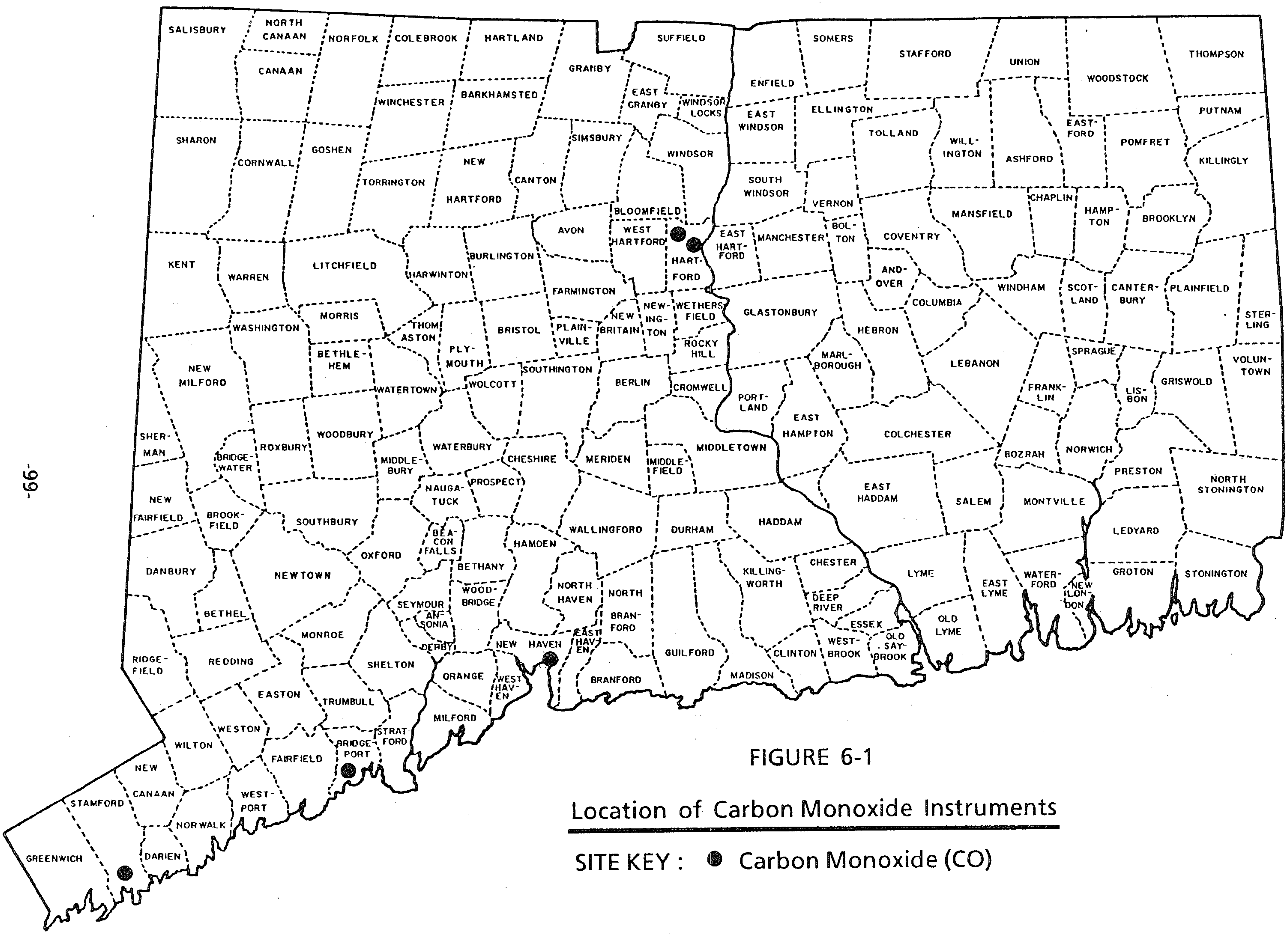


FIGURE 6-1

Location of Carbon Monoxide Instruments

SITE KEY : ● Carbon Monoxide (CO)

TABLE 6-1

1989 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	5.9	01/24/01	5.2	01/12/21	8.3	01/20/09	8.3	10/25/07
Hartford-013	4.9	01/12/23	4.4	10/26/02	7.2	01/12/20	6.3	01/12/19
Hartford-017	9.6	12/06/23	9.0	~~12~~ 10/26/22	21.3	10/26/18	15.3	02/14/18
New Haven-019	6.4	10/27/24	6.0	12/06/24	10.1	01/12/20	9.2	12/28/18
Stamford-020	6.4	11/06/24	6.0	01/23/23	9.6	01/12/18	9.4	11/06/20

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

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

TABLE 6-2

1989 CARBON MONOXIDE SEASONAL FEATURES

TOWN-SITE		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Bridgeport-004	Max. 1-Hour	8.3	4.0	5.5	3.4	2.9	3.9	3.1	3.7	4.6	8.3	4.1	6.9
	Max. Running 8-Hour	5.9	2.7	4.0	2.9	2.3	3.0	2.4	2.5	2.9	5.1	3.5	4.9
	No. of 8-Hour Exceedances	0	0	0	0	0	0	0	0	0	0	0	0
Hartford-013	Max. 1-Hour	7.2	4.1	3.5	2.5	2.7	1.8	2.1	3.4	5.7	6.1	4.2	5.1
	Max. Running 8-Hour	4.9	2.9	2.1	1.9	2.3	1.4	1.8	2.8	4.0	4.4	3.3	4.2
	No. of 8-Hour Exceedances	0	0	0	0	0	0	0	0	0	0	0	0
Hartford-017	Max. 1-Hour	13.6	15.3	11.1	7.8	7.8	5.5	5.0	6.0	11.3	21.3	9.6	13.0
	Max. Running 8-Hour	8.2	8.1	6.6	4.1	5.0	4.3	3.8	4.3	8.6	9.0	5.6	9.6
	No. of 8-Hour Exceedances	0	0	0	0	0	0	0	0	0	0	0	1
New Haven-019	Max. 1-Hour	10.1	8.8	5.5	3.8	5.1	5.1	4.8	4.8	6.0	8.1	8.6	9.2
	Max. Running 8-Hour	5.6	5.9	3.9	2.9	3.9	3.7	3.9	3.7	4.3	6.4	5.3	6.0
	No. of 8-Hour Exceedances	0	0	0	0	0	0	0	0	0	0	0	0
Stamford-020	Max. 1-Hour	9.6	6.9	5.7	5.4	5.1	4.7	4.2	4.0	4.4	9.3	9.4	8.2
	Max. Running 8-Hour	6.0	4.7	3.7	3.2	3.4	3.4	3.1	3.2	2.9	4.8	6.4	5.8
	No. of 8-Hour Exceedances	0	0	0	0	0	0	0	0	0	0	0	0

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

TABLE 6-3

EXCEEDANCES OF THE 8-HOUR CO STANDARD FOR 1985 -1989

SITE	1985	1986	1987	1988	1989
Bridgeport-004	0	0	0	0	0
Hartford-013	-	-	0[a]	0	0
Hartford-017	5	3	8	3	1
New Haven-019	-	0[b]	0	0	0
Stamford-020	1	1	0	0	0

[a] Data is missing for January and February.
[b] Data is missing for January through March.

FIGURE 6-2

EXCEEDANCES OF THE 8-HOUR CO STANDARD FOR 1985-1989

SITE: HARTFORD-017

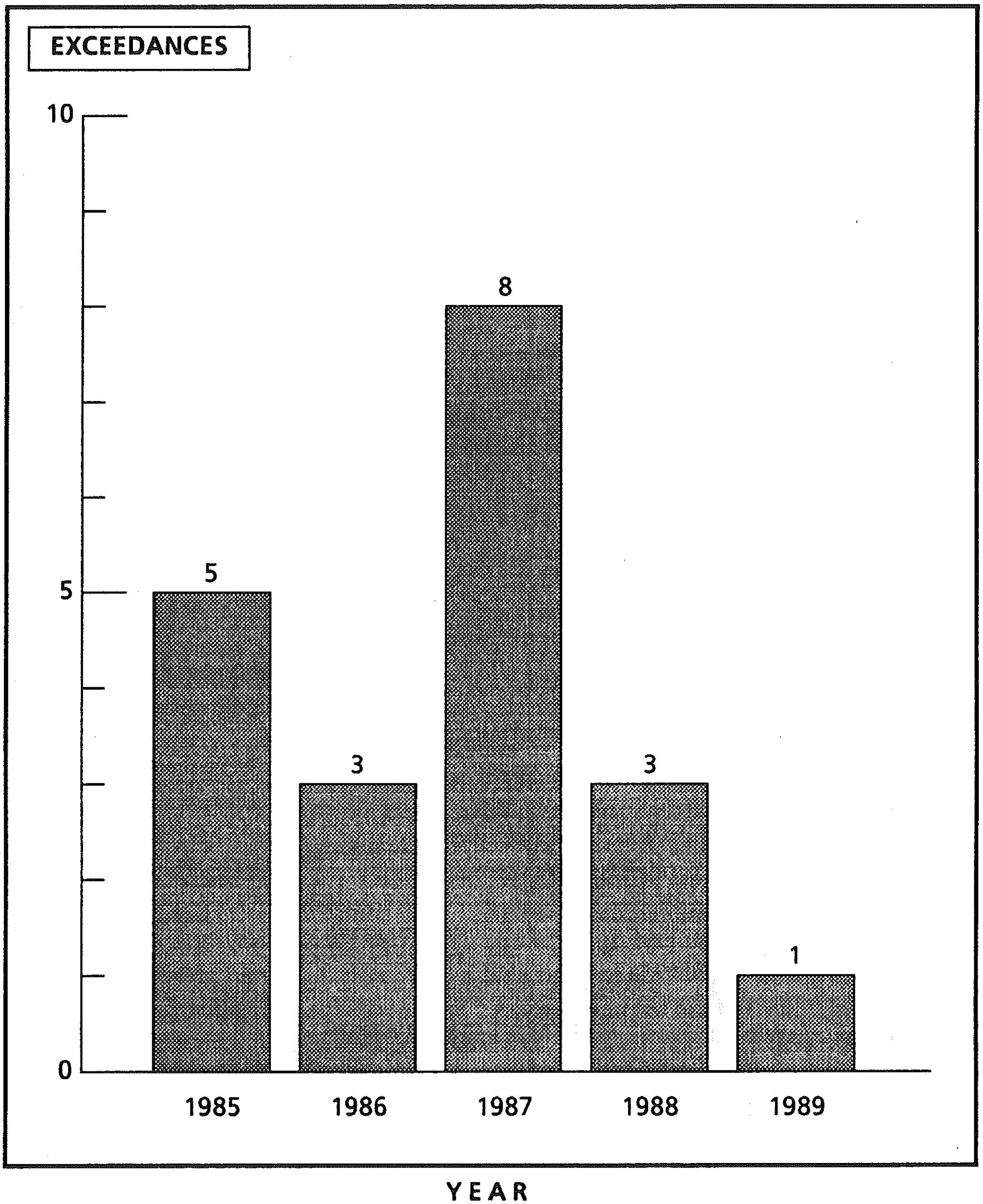
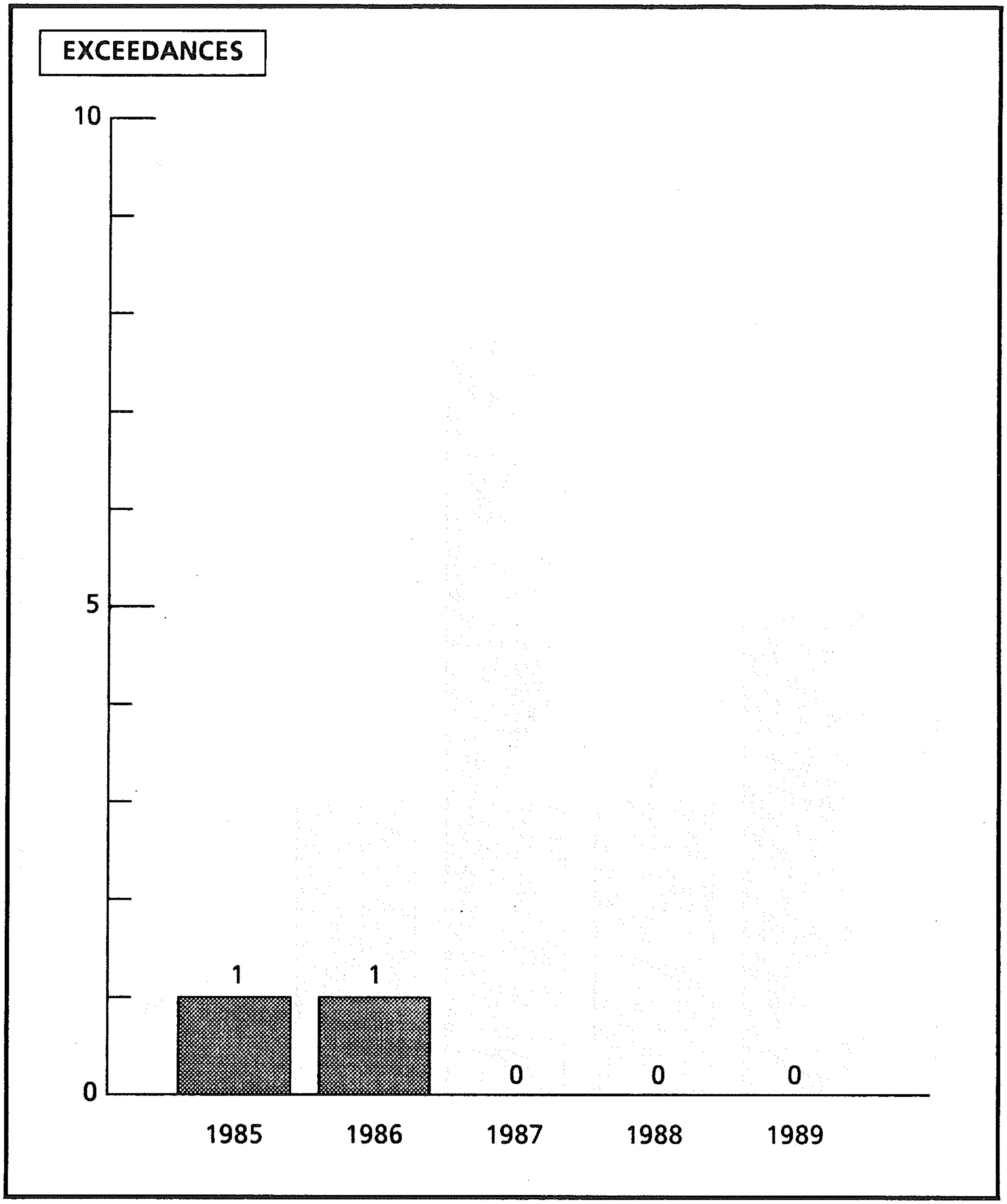


FIGURE 6-2, CONTINUED

EXCEEDANCES OF THE 8-HOUR CO STANDARD FOR 1985-1989

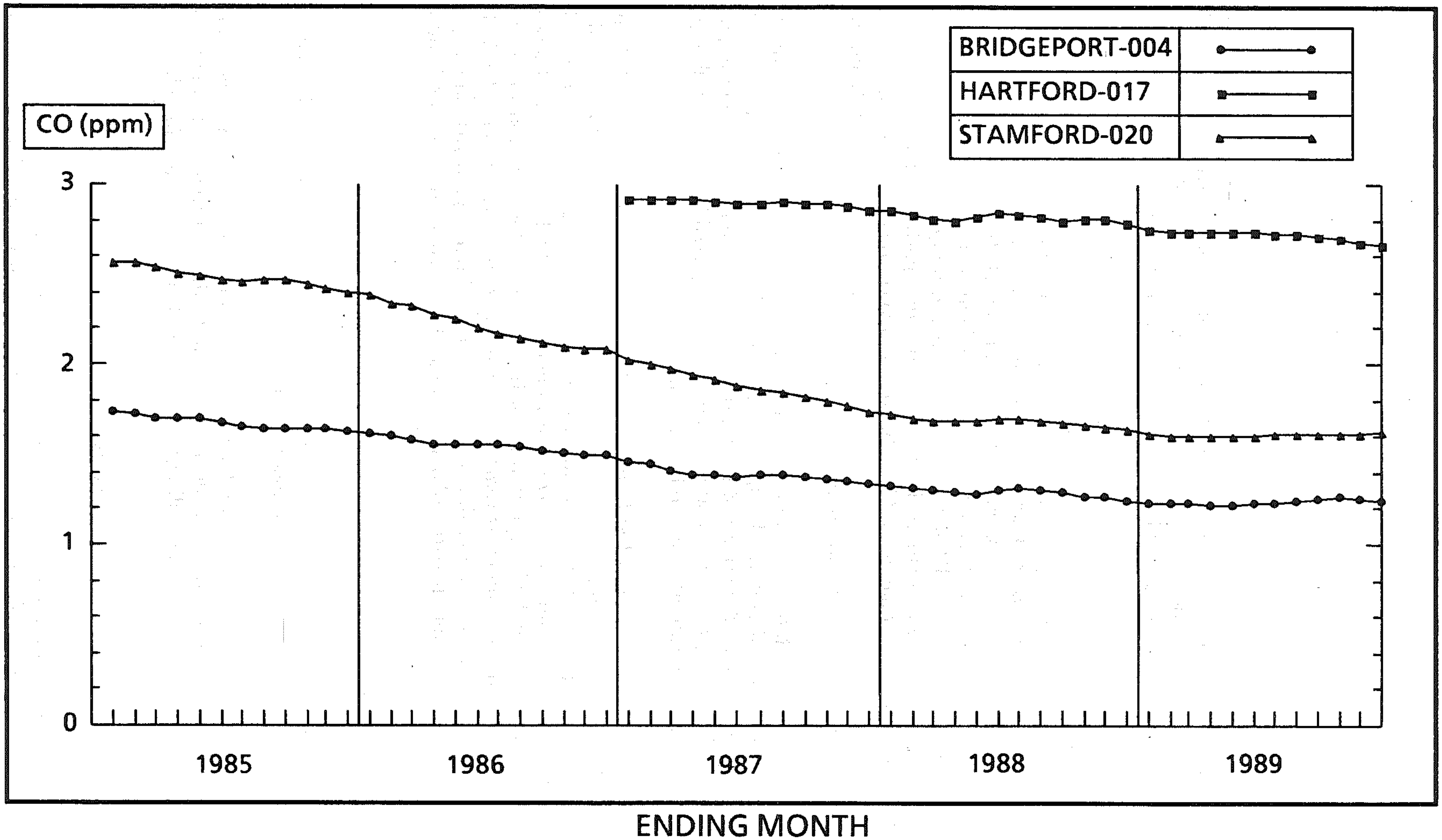
SITE: STAMFORD-020



YEAR

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 1989, these source categories contributed 32%, 32% 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, for the first time, 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 1989.

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

SAMPLE COLLECTION AND ANALYSIS

The Air Monitoring Unit used hi-vol and lo-vol samplers in 1989 to obtain ambient concentrations of lead. These samplers are used to collect particulate matter onto fiberglass filters. The particulate matter collected on the filters is subsequently analyzed for its chemical composition. Wet chemistry techniques are used to separate the particulate matter into various components. The lead content of the particulate matter is determined using an atomic absorption spectrophotometer.

Unlike hi-vol particulate samples which are analyzed separately, the hi-vol lead sample is a composite of all the individual samples obtained at a site in a single month. That is, a cutting is taken from each filter during the month and these cuttings are collectively chemically analyzed for lead. The lo-vol sampler is similar to the hi-vol sampler, except that it operates continuously, at a reduced flow rate, for an entire month. Because this results in a one month integrated sample, compositing is not required.

DISCUSSION OF DATA

Monitoring Network - In 1989, both hi-vol and lo-vol samplers were operated in Connecticut to monitor lead levels (see Figure 7-1). There were 2 hi-vol samplers and 5 lo-vol samplers operated at 8 sites throughout the state -- Hartford 015 was moved to East Hartford 004 in the middle of the year. The DEP operated the samplers in areas with populations of 200,000 or more: Bridgeport, Hartford, New Haven and Waterbury . The samplers are situated near some of the busiest city streets and highways in order to monitor "worst-case" lead concentrations. 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. One audit for flow accuracy was conducted on the monitoring network in 1989, which was an insufficient number to yield 95% probability limits. 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 -5% to + 6%; those for the high level ranged from -8% to + 10%.

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 1989 are given in Table 7-1. All are significantly below the primary and secondary standard of 1.5 $\mu g/m^3$. However, for the first time, the lead concentrations at the listed sites are not significantly different from those of the previous year.

Trends - A downward trend in measured concentrations of lead has been observed since 1977. This is probably 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).

The downward trend in airborne lead concentrations can be expected to level off at some point in the near future and then begin to increase. Judging by the 3-month running averages, a leveling off appears to have begun in 1989. This is due to the likelihood that, as the use of leaded gasoline is phased out, gasoline combustion will no longer be the major source of lead emissions in the state. The small amounts of lead remaining in Connecticut's atmosphere will be primarily associated with incineration, demolition, reentrainment, coal burning, and removal of old paint from bridges, buildings and other structures. The increased processing of solid wastes and the construction of new solid waste incineration plants will begin to add moderate amounts of lead to the admittedly low prevalent airborne concentrations.

This can be illustrated by the changes in lead emissions that occurred from 1986 to 1989. Lead emissions from gasoline decreased from 96 metric tons to 25 metric tons, while emissions from stationary point sources increased from 10 metric tons to 20 metric tons in the same period. The increased point source emissions were largely the result of solid waste incineration plants that went into operation in Bridgeport, Bristol and Hartford.

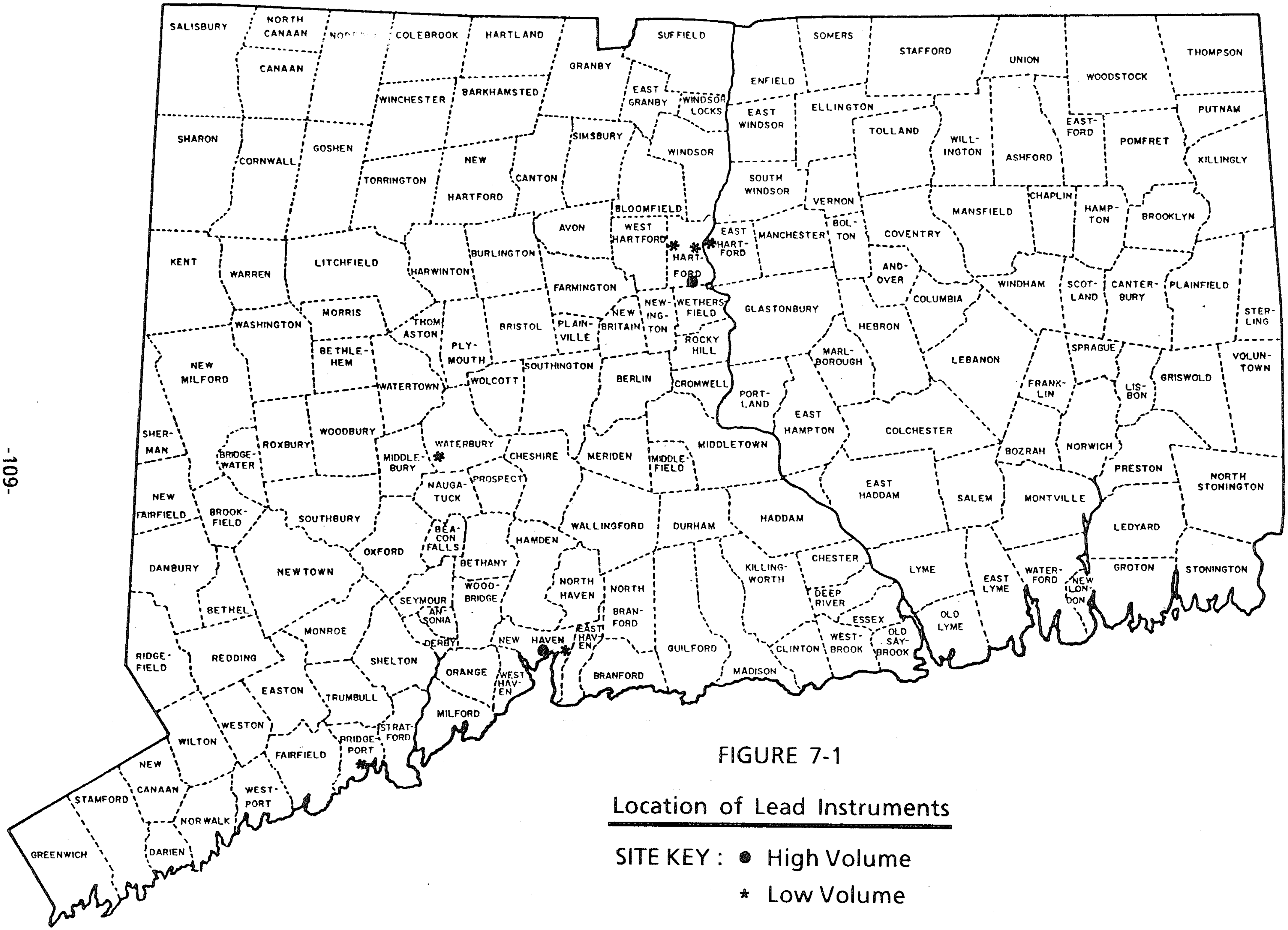


FIGURE 7-1

Location of Lead Instruments

SITE KEY : ● High Volume
* Low Volume

TABLE 7-1

1989 3-MONTH RUNNING AVERAGE LEAD CONCENTRATIONS[a]

TOWN-SITE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Bridgeport-010	0.047	0.047	0.063	0.057	0.057	0.043	0.077	0.073	0.067	0.030	0.030	0.030
East Hartford-004[b]							------	------	------	------	------	0.013
Hartford-013	0.053	0.026	0.030	0.026	0.023	0.018						
Hartford-015[b]	0.043	0.033	0.017	0.027	0.030							
Hartford-016	0.043	0.033	0.033	0.040	0.040	0.040	0.040	0.060	0.087	0.083	0.060	0.033
New Haven-013	------	------	0.023	0.023	0.030	0.030						
New Haven-018	0.083	0.077	0.080	------	------	------	0.060	0.053	0.040	0.047	------	------
Waterbury-123	0.060	0.047	0.040	0.033	0.037	0.037	------	------	------	0.063	0.060	0.060

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

[b] A lo-vol sampler was operated from January through May at Hartford 015 and was then moved to East Hartford 004.

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

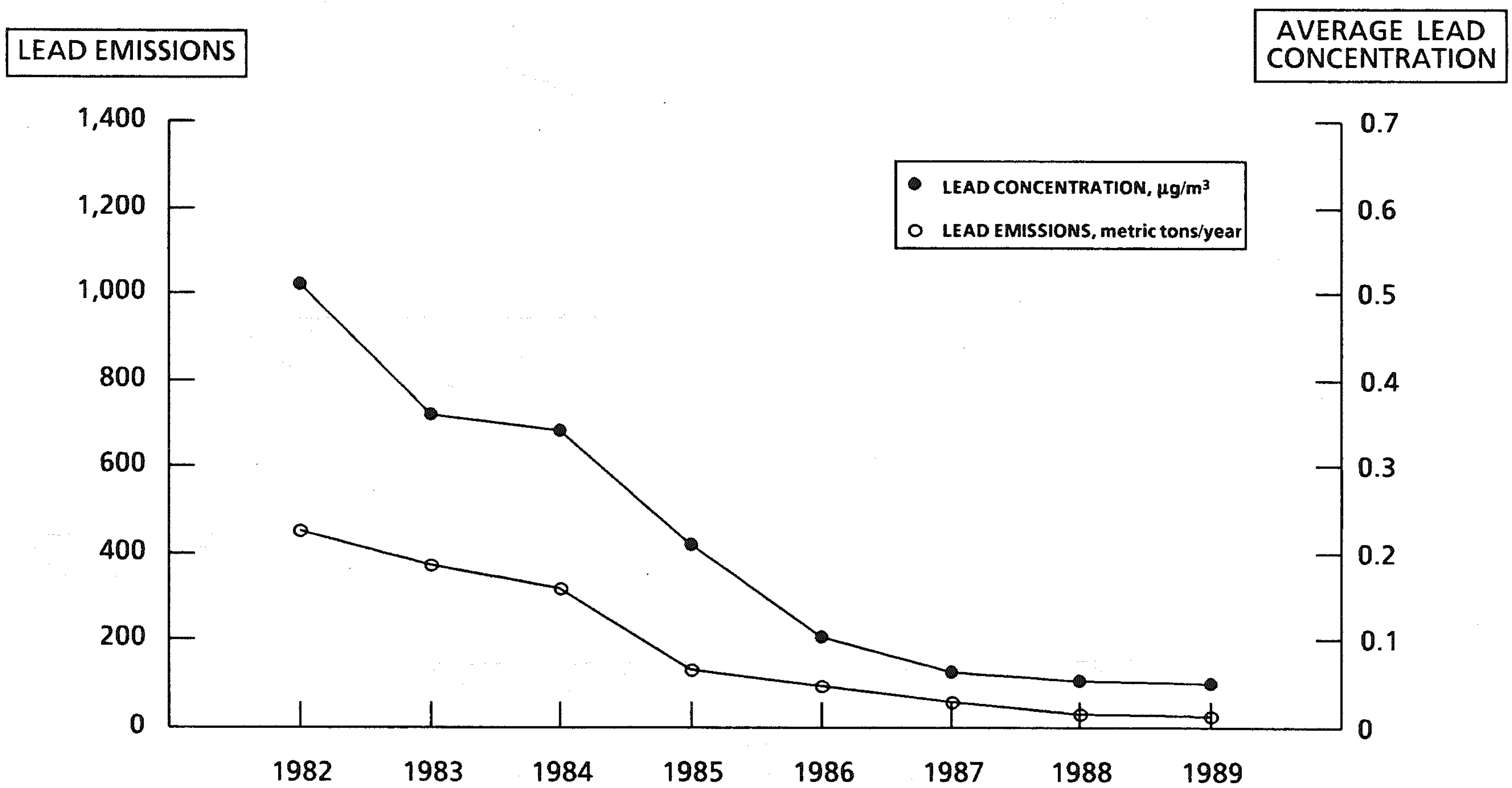
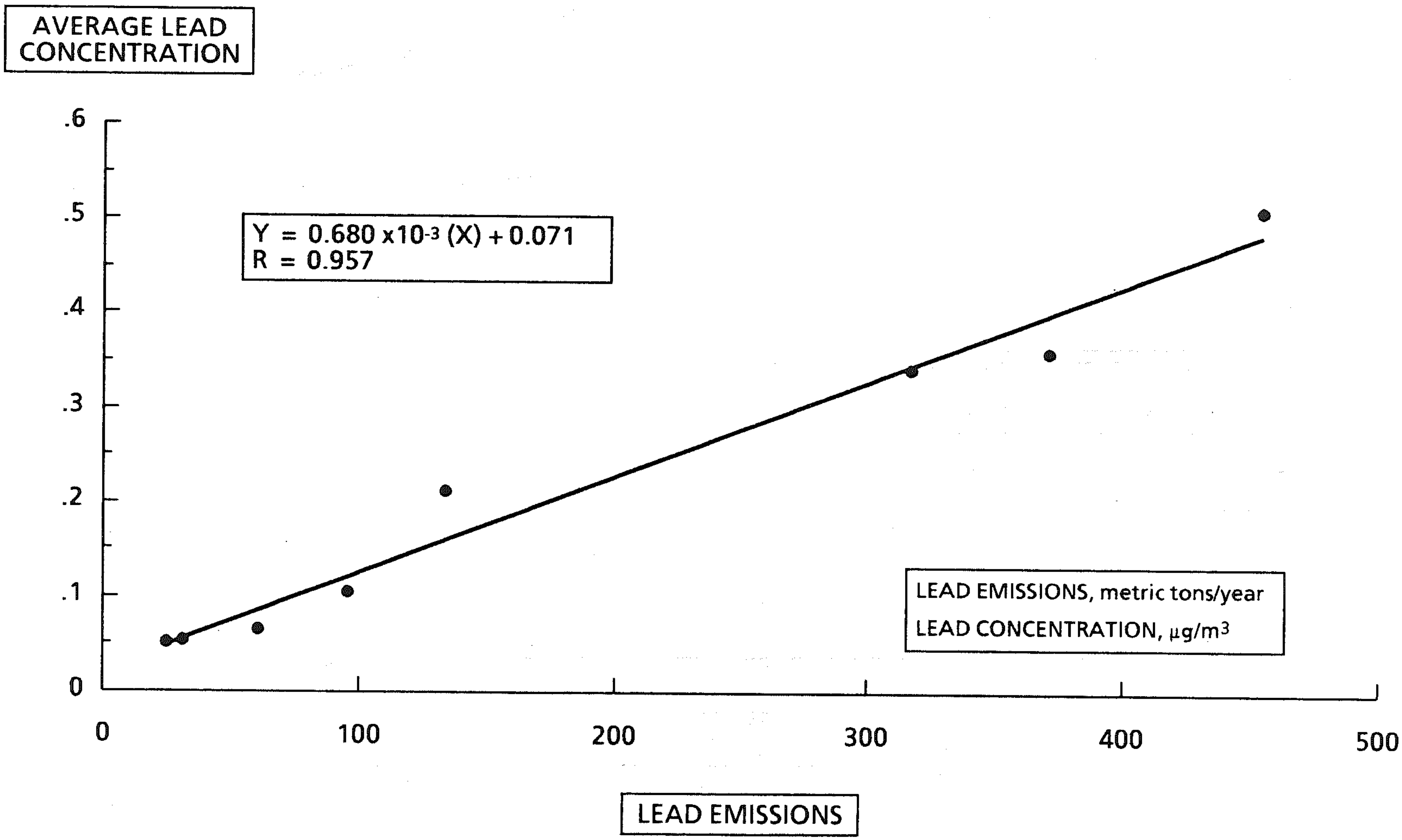


FIGURE 7-3

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 1989. 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.

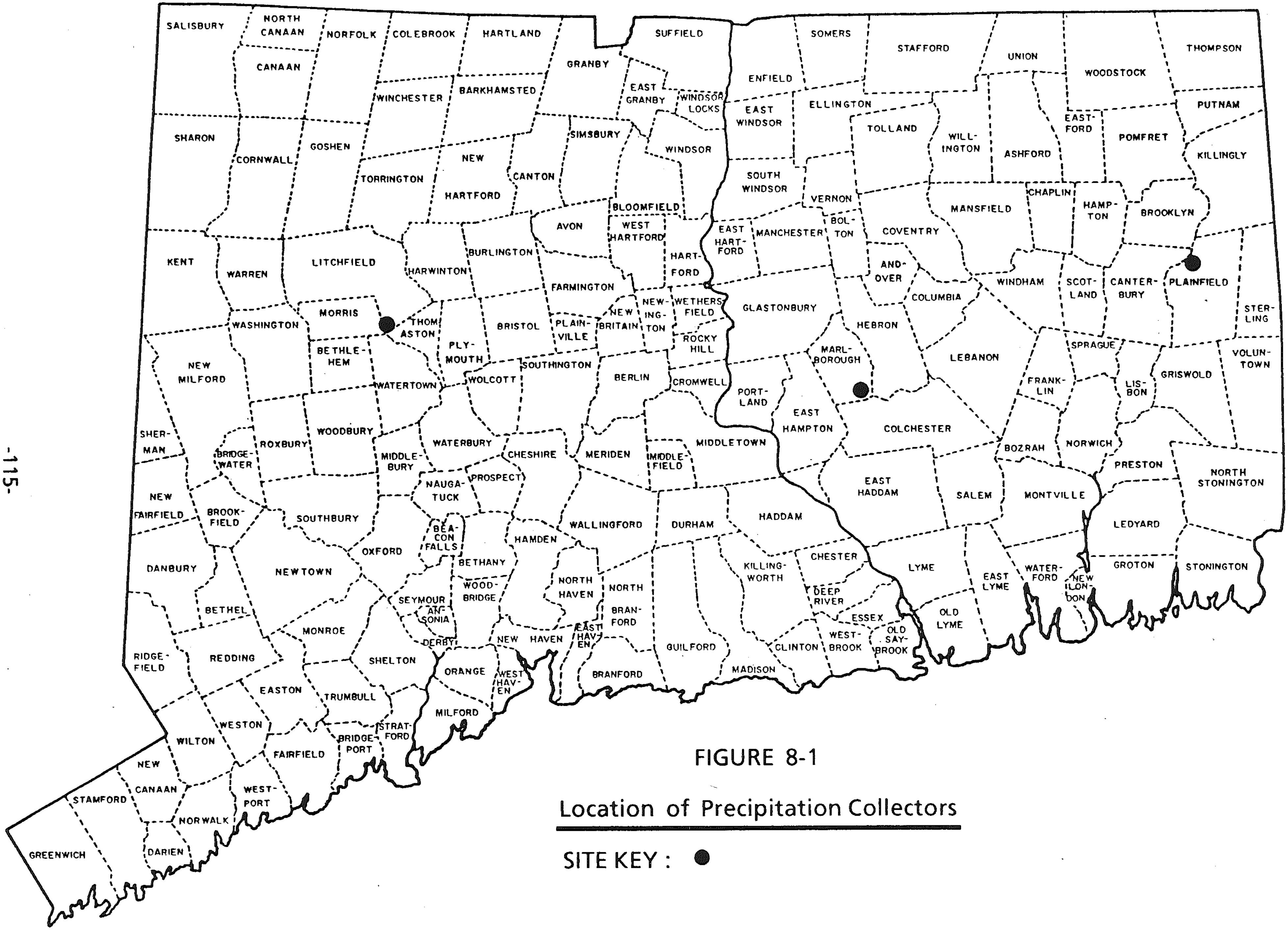


FIGURE 8-1

Location of Precipitation Collectors

SITE KEY : ●

TABLE 8-1

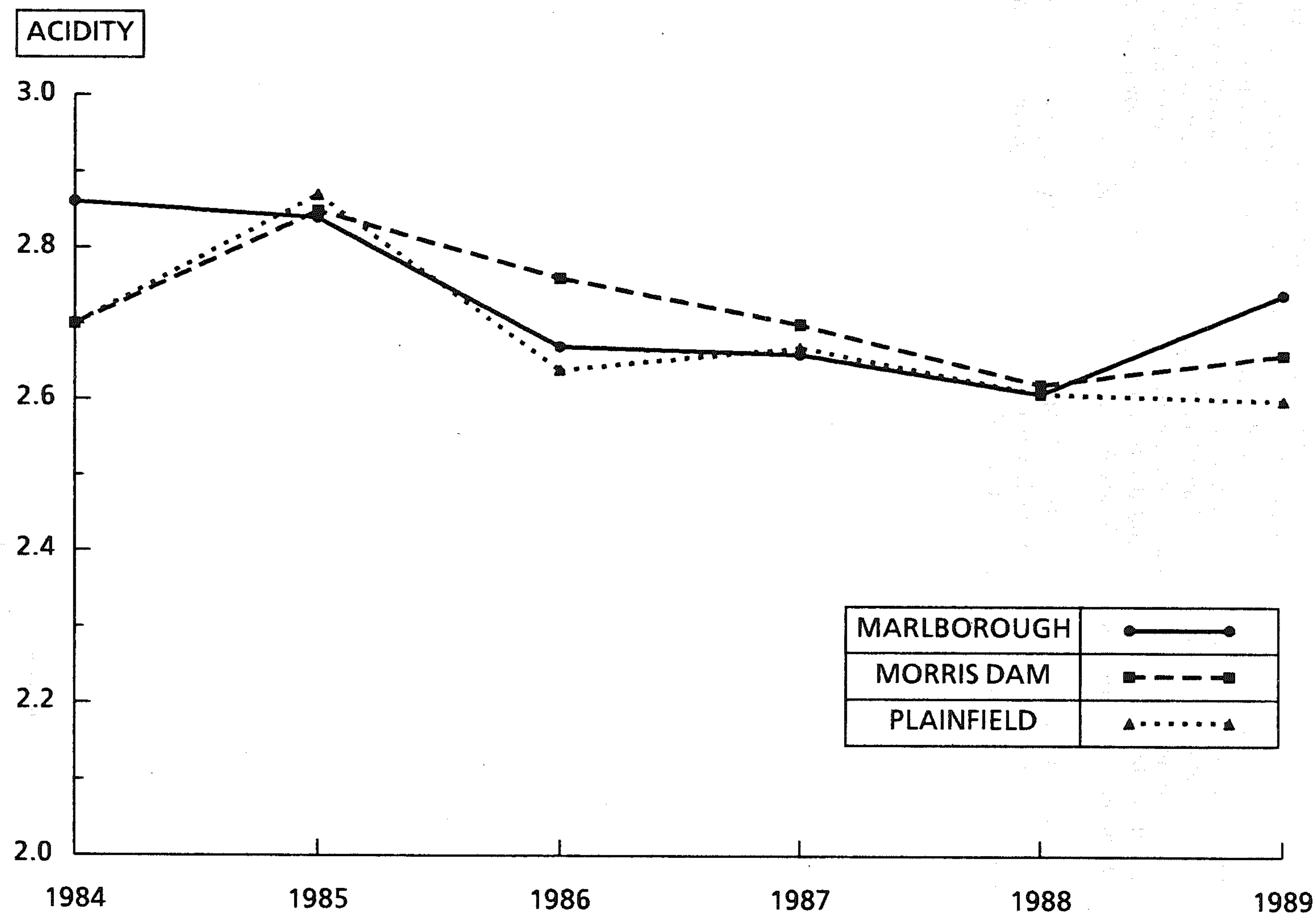
ANNUAL MEAN ACIDITY OF PRECIPITATION AT 3 SITES[1]

	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

[1] Acidity = 7 - pH

FIGURE 8-2

ANNUAL MEAN ACIDITY OF PRECIPITATION AT 3 SITES[1]



[1] ACIDITY = 7 - pH

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 1988 and 1989. 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 1989 National Weather Service surface observations and are shown in Figures 9-2 and 9-4, respectively. Wind roses from these stations for 1988 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.

TABLE 9-1

1988 AND 1989 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)		
	1988	1989	Mean[a]	1988	1989	Mean[b]	1988	1989	Normal[c]	1988	1989	Mean[a]	1988	1989	Mean[d]	1988	1989	Mean[d]
Jan	23.1	30.8	26.6	0	0	0.0	1292	1054	1234	3.36	0.88	3.53	9	10	10.6	8.6	9.4	9.0
Feb	28.3	28.6	27.7	0	0	0.0	1057	1012	1047	3.99	1.85	3.20	9	11	10.2	9.4	9.4	9.4
Mar	38.5	37.4	37.1	0	0	0.0	817	847	874	2.06	3.02	3.71	8	12	11.3	10.4	10.0	10.0
Apr	47.4	46.5	48.2	0	0	0.2	523	553	486	2.35	3.33	3.75	9	13	11 1	10.4	8.6	10.0
May	59.7	60.4	59.2	0	0	1.1	186	175	197	3.46	12.00	3.69	16	16	11.8	8.5	8.0	8.8
Jun	66.7	68.3	67.8	6	1	3.5	75	31	20	0.67	6.65	3.59	7	16	11.5	8.8	6.8	8.1
Jul	75.2	72.6	73.2	10	6	7.9	9	0	0	8.43	3.40	3.57	16	9	9.7	7.5	6.6	7.5
Aug	74.5	71.4	71.0	14	3	4.7	23	22	8	2.12	6.81	3.83	5	10	9.8	8.1	6.9	7.2
Sep	62.2	63.9	63.5	0	1	1.4	112	103	102	1.88	4.67	3.61	6	11	9.4	7.8	7.2	7.3
Oct	47.6	53.4	53.0	0	0	*	539	354	391	2.29	7.62	3.20	7	10	8.3	8.6	8.2	7.7
Nov	42.3	40.9	42.0	0	0	0.0	672	715	702	7.84	2.89	3.83	11	12	11.2	9.3	10.5	8.5
Dec	29.3	18.1	30.3	0	0	0.0	1101	1444	1113	1.35	1.49	3.69	6	8	11.9	9.4	8.8	8.6
YEAR	49.6	49.4	49.9	30	11	18.9	6406	6310	6174	39.80	54.61	43.18	109	138	126.8	8.9	8.4	8.5

* Less than 0.05
[a] 1905-1989
[b] 1960-1989
[c] 1951-1980
[d] 1955-1989

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

TABLE 9-2

1988 AND 1989 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)		
	1988	1989	Mean[a]	1988	1989	Mean[b]	1988	1989	Normal[c]	1988	1989	Mean[d]	1988	1989	Mean[e]	1988	1989	Mean[f]
Jan	26.4	33.8	28.4	0	0	0.0	1186	958	1101	2.65	1.44	3.55	10	9	10.6	---	---	13.2
Feb	31.2	31.0	30.5	0	0	0.0	974	945	963	3.64	2.40	3.26	12	12	9.6	---	---	13.6
Mar	39.4	38.8	38.0	0	0	0.0	787	804	831	2.36	4.06	3.93	11	10	11.2	---	---	13.5
Apr	48.1	47.9	48.0	0	0	0.0	499	505	492	1.59	3.15	3.84	7	12	10.5	---	---	13.0
May	59.4	59.6	58.4	1	0	0.2	195	180	220	2.65	9.53	3.73	13	13	11.0	---	---	11.6
Jun	68.2	68.5	67.8	5	0	1.0	45	19	20	0.79	5.60	3.36	5	18	9.6	---	---	10.5
Jul	75.5	71.8	73.3	4	0	3.0	6	0	0	8.53	3.44	3.74	16	9	8.5	---	---	10.0
Aug	75.6	71.6	71.9	5	3	1.7	3	7	0	1.86	6.57	3.96	5	7	9.2	---	---	10.1
Sep	64.6	65.2	65.2	0	0	0.4	62	88	49	2.26	3.21	3.46	6	9	8.5	---	---	11.2
Oct	50.5	54.9	54.6	0	0	0.0	449	305	285	3.26	7.02	3.36	7	10	7.2	---	---	11.9
Nov	45.9	43.2	44.2	0	0	0.0	569	648	585	7.58	3.27	3.82	9	13	10.2	---	---	12.7
Dec	32.7	23.3	33.1	0	0	0.0	995	1285	955	1.63	0.83	3.61	6	9	11.2	---	---	13.0
YEAR	51.5	50.8	51.1	15	3	6.1	5770	5744	5501	38.80	50.52	43.63	107	131	117.2	---	---	12.0

[a] 1903-1989
[b] 1966-1989
[c] 1951-1980
[d] 1894-1989
[e] 1949-1989
[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 1988
BRADLEY INTERNATIONAL AIRPORT
WINDSOR LOCKS, CONNECTICUT

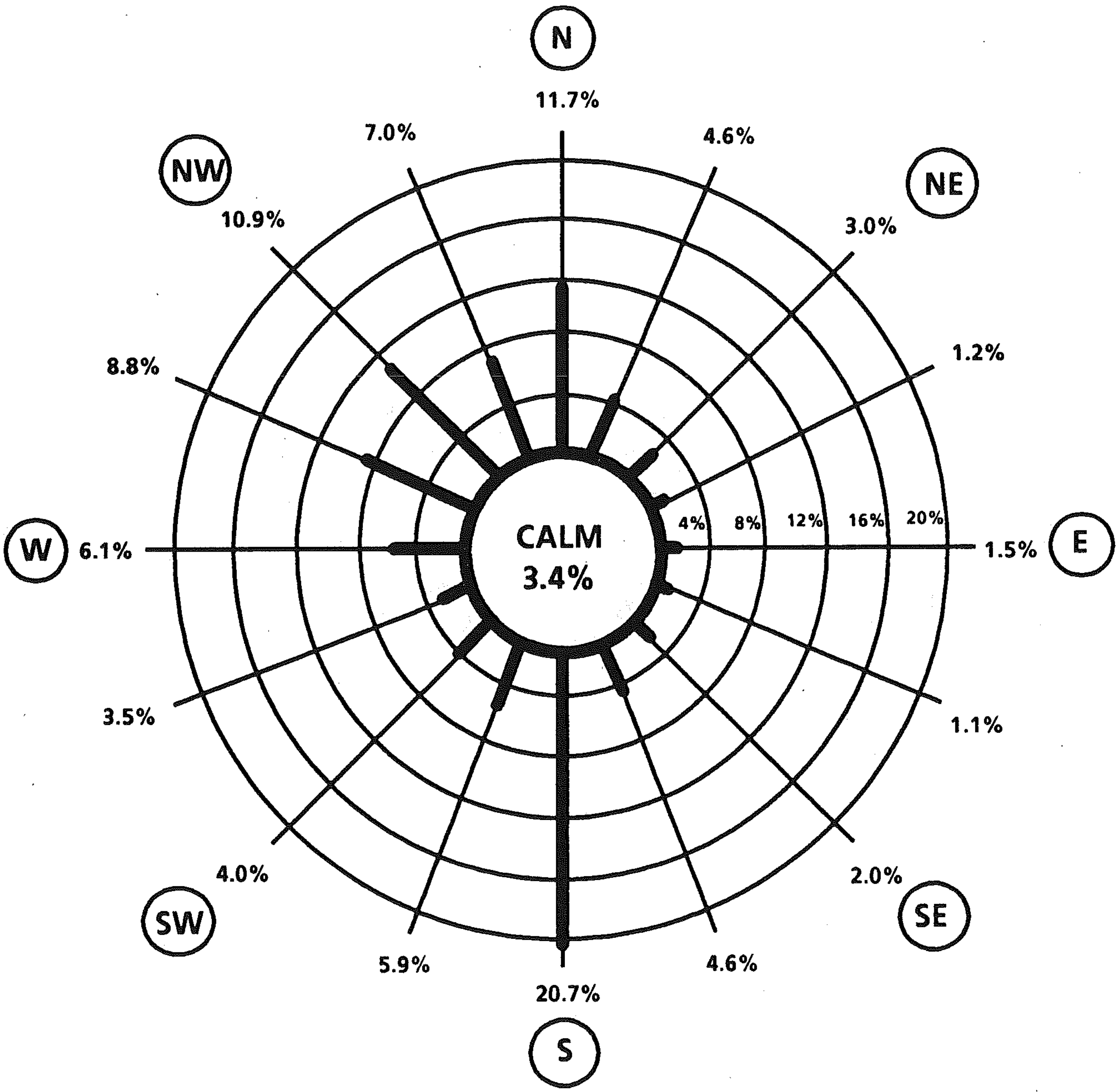


FIGURE 9-2

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

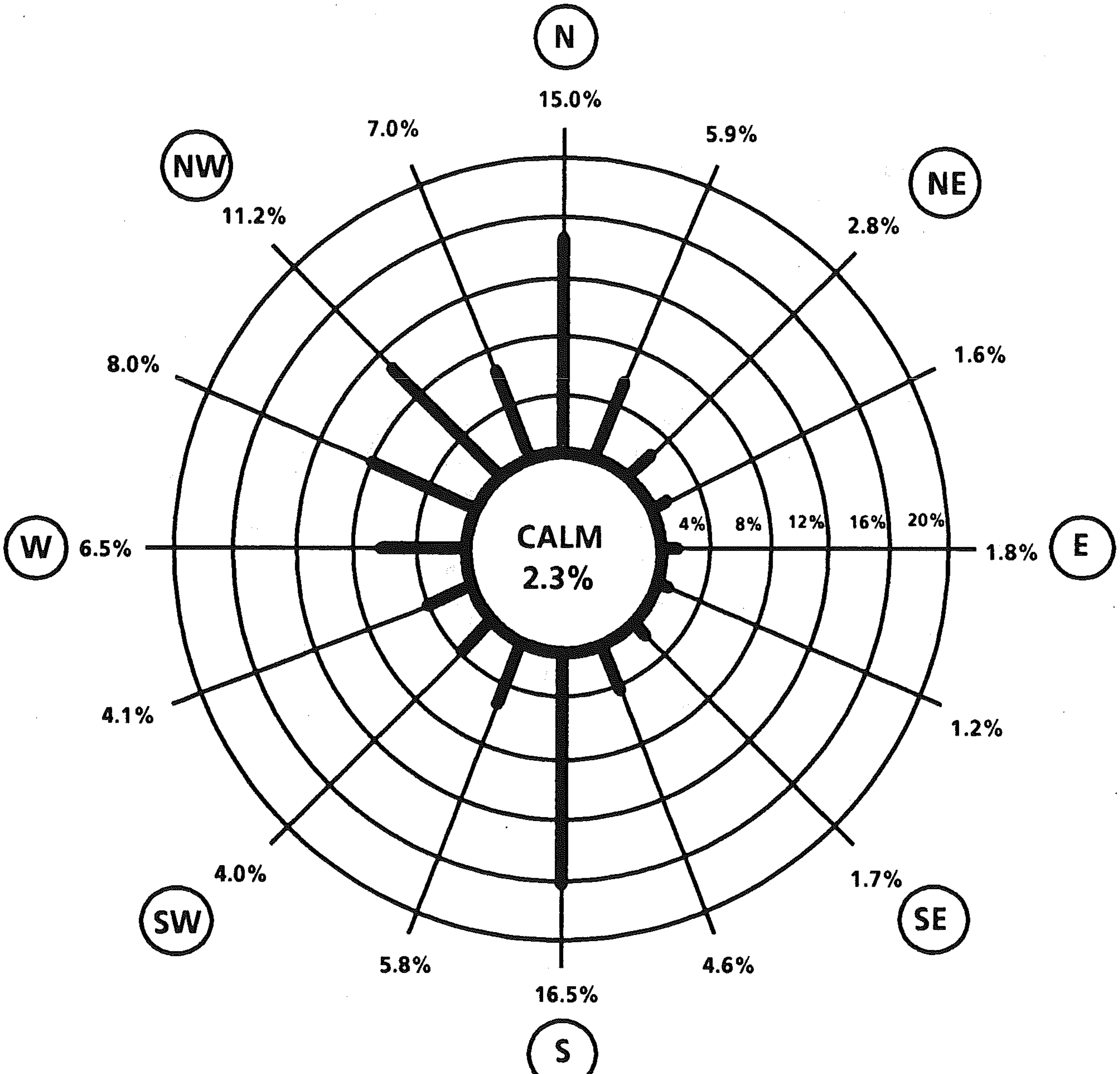


FIGURE 9-3

ANNUAL WIND ROSE FOR 1988
NEWARK INTERNATIONAL AIRPORT
NEWARK, NEW JERSEY

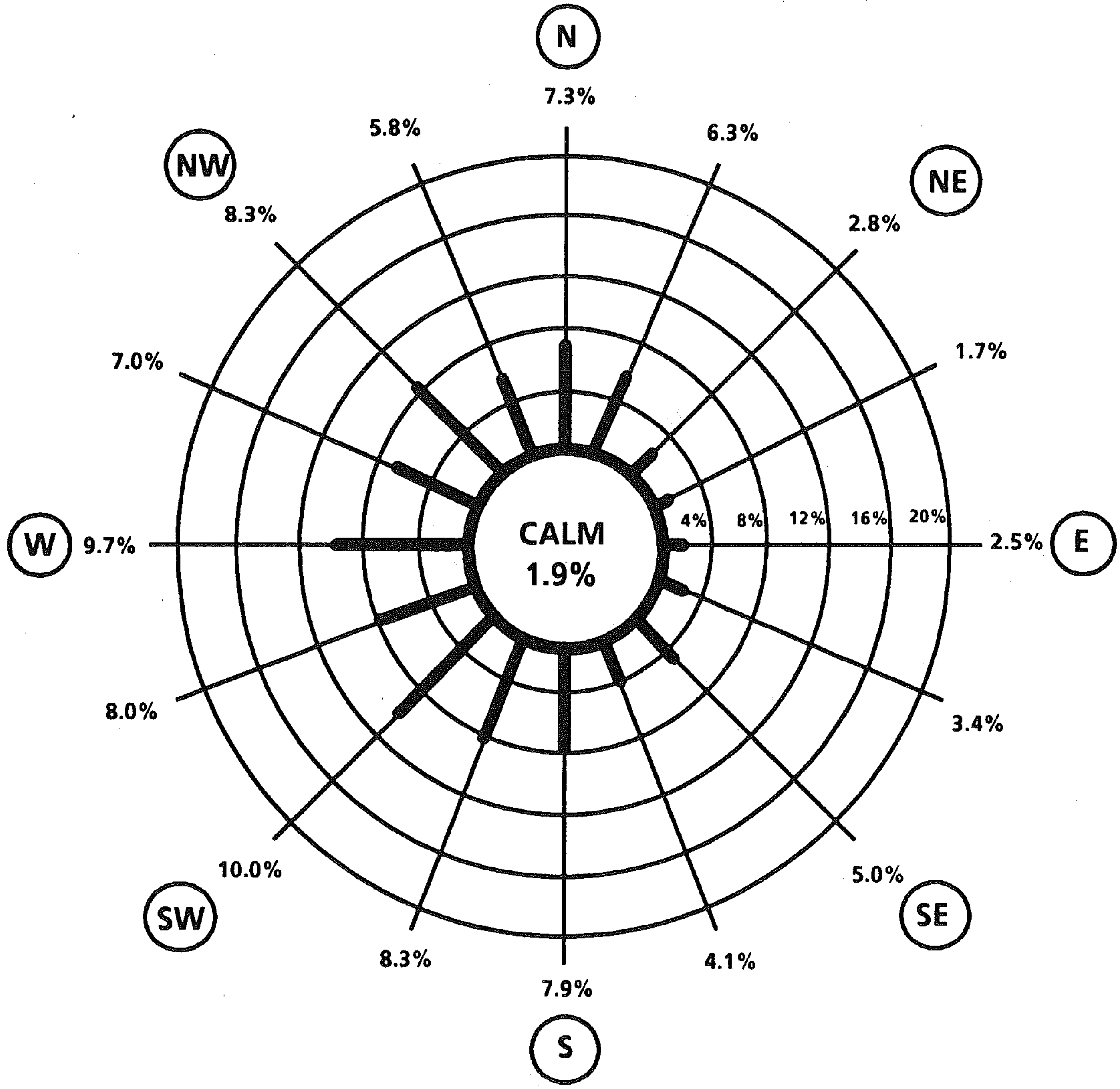
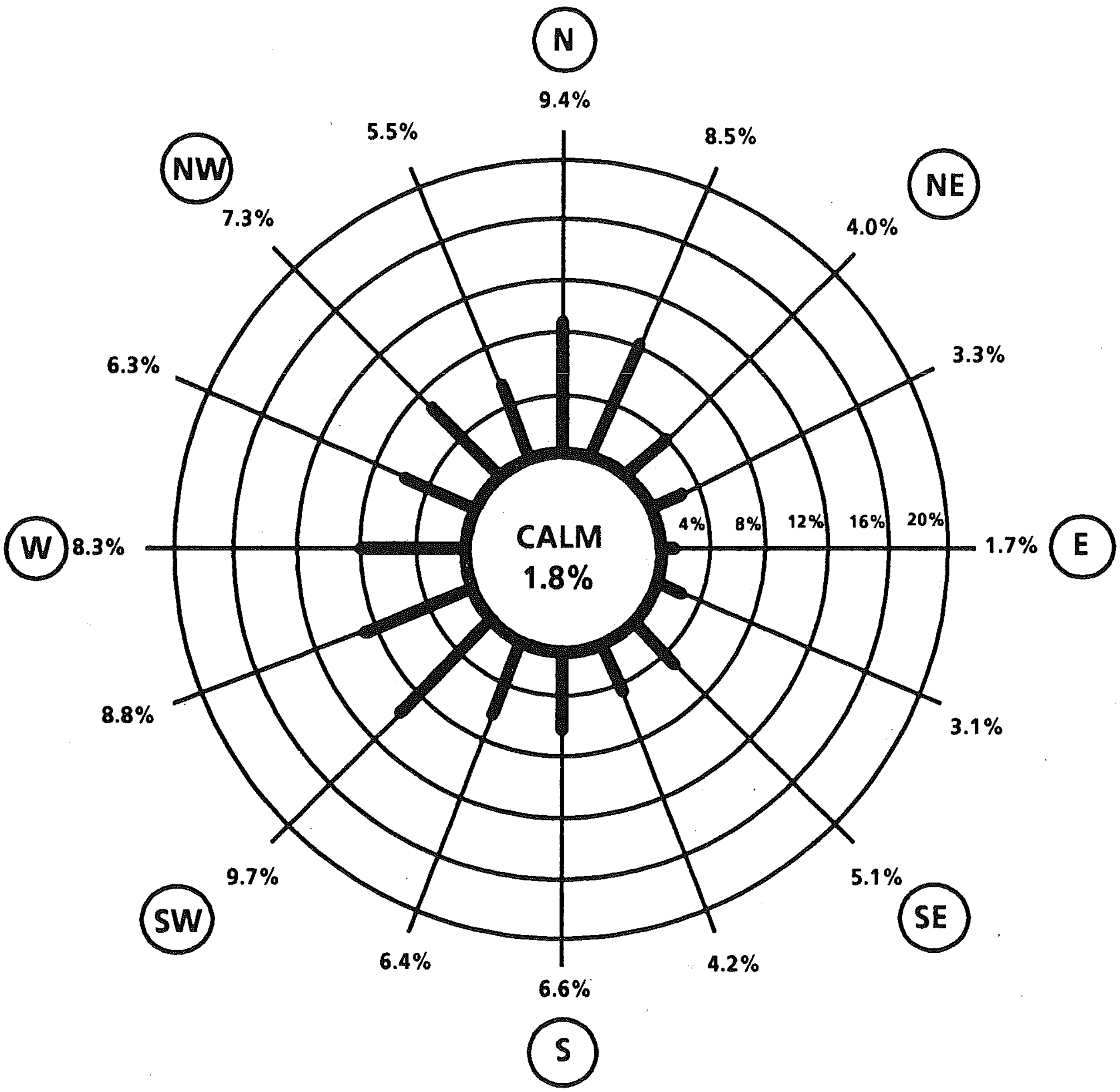


FIGURE 9-4

ANNUAL WIND ROSE FOR 1989
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 1989 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.

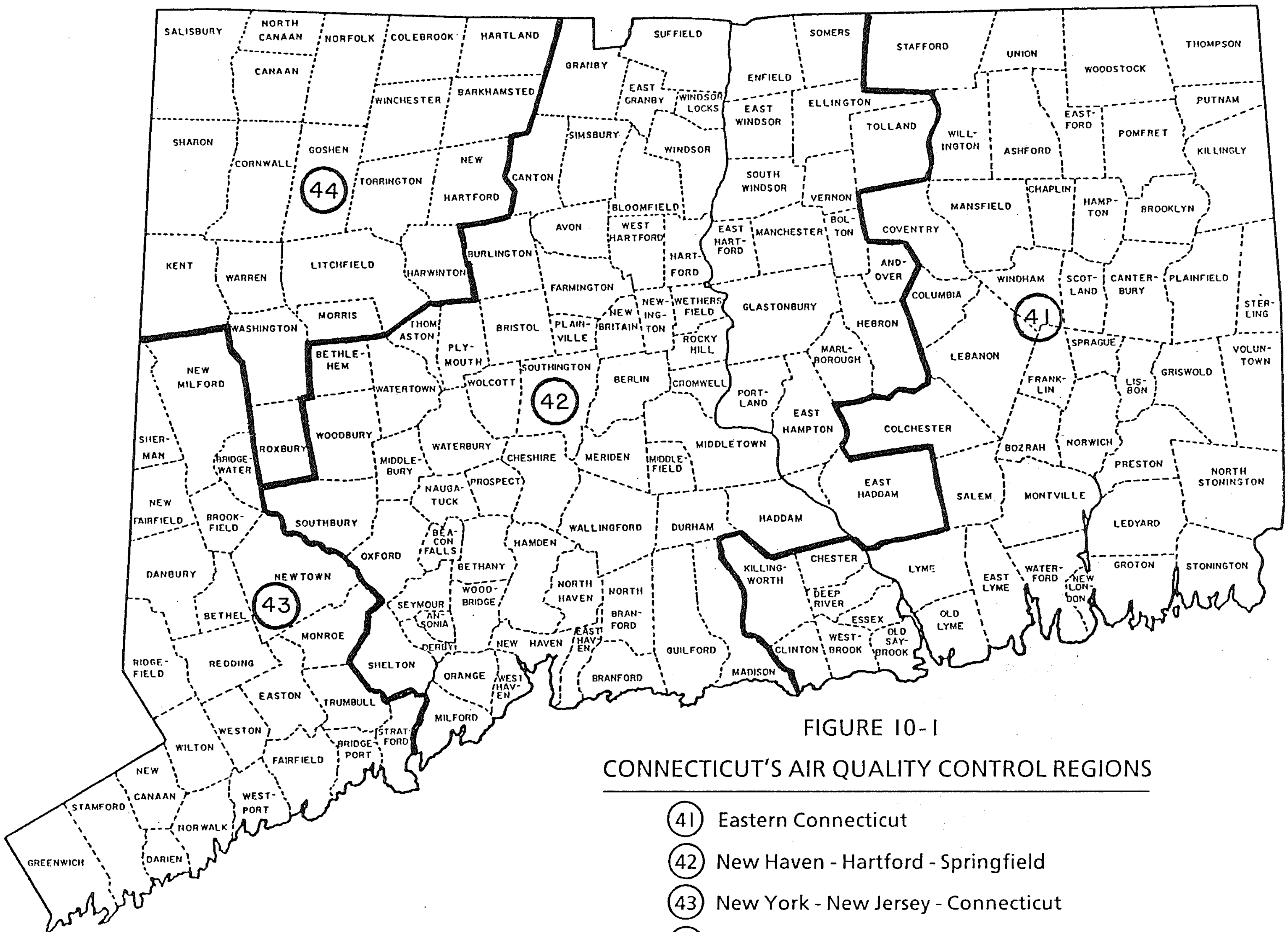


FIGURE 10-1

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 1989

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, National Air Monitoring Stations (NAMS) networks, and Prevention of Significant Deterioration (PSD) air monitoring. 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 E 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 addition, precision checks for lead are also accomplished by analysis of duplicate strips. In 1989, Connecticut maintained two co-located PM_{10} monitors (New Haven 123 and Waterbury 123) and one co-located lead monitor (New Haven 018). In addition, duplicate strip analyses for lead were also performed from the New Haven 018 site samples.

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. Each PSD analyzer must be audited at least once each calendar quarter.

All precision and accuracy data are derived through calculation methods specified by the regulations, with the results reported quarterly on Data Assessment Report Forms. 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. Installation of equipment,
2. Selection of methods, analyzers, or samplers,
3. Zero/span checks and analyzer adjustments,
4. Calibration,
5. Control limits for zero/span and other control checks, and respective corrective actions when such limits are exceeded,
6. Control checks and their frequency,
7. Preventive and remedial maintenance,
8. Calibration and zero/span checks for multi-range analyzers,
9. Recording and validating data, and
10. Documentation of quality control information.

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 1989 which were on the EPA-approved list as of April 12, 1988. 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 networks and for choosing general locations for new monitors. Criteria are also presented for determining the location and number of monitors. These criteria serve as the framework for all State Implementation Plan (SIP) monitoring networks that were to be complete and in operation by January 1, 1984.

The SLAMS network is 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 1989 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 1989

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

1989 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	Neighborhood
Berlin	New Britain	002	S	Hi-Vol	Gravimetric	6th day	Population	Neighborhood
Bridgeport	Bridgeport	010	N	Hi-Vol	Gravimetric	6th day	High Concentration	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	Population	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	N	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	Population	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	Population	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	N	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	Population	Neighborhood
Meriden	Meriden	002	N	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

1989 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	Population	Neighborhood
Milford	Bridgeport	010	S	Hi-Vol	Gravimetric	6th day	Population	Neighborhood
Naugatuck	Waterbury	001	S	Hi-Vol	Gravimetric	6th day	Population	Neighborhood
New Britain	New Britain	012	N	Hi-Vol	Gravimetric	6th day	High Concentration	Middle
New Haven	New Haven	013	N	Hi-Vol	Gravimetric	6th day	Population	Neighborhood
New Haven	New Haven	018	N	Hi-Vol	Gravimetric	6th day	High Concentration	Middle
New Haven	New Haven	020	N	Hi-Vol	Gravimetric	6th day	High Concentration	Middle
New Haven	New Haven	123	N	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
Old Saybrook	NONE	005	S	Hi-Vol	Gravimetric	6th day	High Concentration	Micro
Putnam	NONE	002	S	Hi-Vol	Gravimetric	6th day	Population	Neighborhood
Stamford	Stamford	001	N	Hi-Vol	Gravimetric	6th day	High Concentration	Neighborhood
Stratford	Bridgeport	005	S	Hi-Vol	Gravimetric	6th day	Population	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	N	Hi-Vol	Gravimetric	6th day	High Concentration	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	Population	Neighborhood

TABLE 11-2, CONTINUED

1989 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	Population	Neighborhood
Danbury	Danbury	123	S	Pulsed Fluorescence	Continuous	Population	Neighborhood
E. Hartford	Hartford	005	N	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	Source	Neighborhood
New Britain	New Britain	011	S	Pulsed Fluorescence	Continuous	High Concentration	Neighborhood
New Haven	New Haven	017	S	Pulsed Fluorescence	Continuous	Population	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

1989 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	Hartford	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

1989 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	013	S	Hi-Vol	Atomic Abs.	6th day	Population	Neighborhood
Hartford	Hartford	015	N	Lo-Vol	Atomic Abs.	1 month	High Concentration	Micro
Hartford	Hartford	016	N	Lo-Vol	Atomic Abs.	1 month	High Concentration	Micro
New Haven	New Haven	013	S	Hi-Vol	Atomic Abs.	6th day	Population	Neighborhood
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. EMISSIONS INVENTORY

The State of Connecticut maintains a computerized emissions inventory which contains a point source file of approximately 7,000 stationary industrial, commercial and institutional sources of air pollution. Emissions from these sources are determined from actual operating data and pollutant emission factors. Actual operating data consist of information like annual fuel use and annual material throughputs. Emission factors normally specify the weight of pollutant emissions per unit of fuel use or per unit of material throughput, and are contained in the Compilation of Air Pollutant Emission Factors, designated as EPA publication AP-42.

This inventory does not account for all the pollution sources in the state, however. There are a host of other industrial, commercial, agricultural, and human activities that account for most of the pollution emitted into Connecticut's air. These sources cannot be individually inventoried due to their nature, or large numbers, or widespread occurrence, etc. In spite of this, the emissions from these so-called area souces can be quantified by various means. For example, motor vehicle emissions can be determined from Connecticut Department of Transportation figures on vehicle-miles travelled (VMT's) on interstate and local roads, and from EPA MOBILE 4 emission factors; commercial and residential fuel-burning emissions can be determined from U. S. Department of Energy data, census figures, and AP-42 emission factors; national per capita emissions, which are available from EPA for a number of pollution-causing activities, can be used in conjunction with census figures to calculate emissions by town, county, etc.

The computerized point source inventory and the more indirectly arrived at, but much larger, area source inventory together provide a good picture of the pollutants that are emitted into Connecticut's air each year. Table 12-1 summarizes the actual in-state emissions of each of the five major air pollutants in Connecticut -- TSP, SO_2, CO, NO_2, and volatile organic compounds or VOC's, -- by county, for 1989. The table reveals two things. First, the most populous counties have the largest pollutant totals; second, excluding SO_2, which is largely generated by utilities, area sources (mobile sources in particular) account for the bulk of the total emissions.

County names and geographic locations are displayed in Figure 12-1, which also serves as a reference for the charts that follow.

Figures 12-2 through 12-16 give various visual displays of the level of emissions for each of the major air pollutants. The pie charts show the percent of each air pollutant contributed by each of Connecticut's eight counties. The shaded maps are pictorial displays of emissions by county, where the darker areas indicate higher emission levels. The 3-dimensional maps also display each county's contribution to statewide emissions.

It should be noted that the motor vehicle portion of the area source emissions (primarily CO, VOC's and NO_x) will automatically increase from year to year due to a built-in 2% projected increase in annual VMT's. Non-VMT area source emissions are assumed to increase proportionately with population growth. Nevertheless, these effects were overshadowed in 1989 by the state-mandated use of lower Reid vapor pressure (RVP) gasoline in the summer months to control the production of ozone in the atmosphere. As a result, area source emissions in Connecticut decreased from 1988 to 1989 by nearly 14% for CO, 13% for VOC's, and 9% for NO_2, while TSP and SO_2 emissions experienced marginal increases.

Regarding point source emissions, significant increases from 1988 to 1989 occurred in Hartford county due to the resident resource recovery facility, and in New London county due to the resident electric utility plant.

These and other factors caused statewide emissions from 1988 to 1989 to increase by approximately 3% for TSP and 6% for SO_2, and to decrease by approximately 14% for CO, 12% for VOC's and 2% for NO_2.

TABLE 12-1

1989 CONNECTICUT EMISSIONS INVENTORY BY COUNTY

County	Sources	TSP	SO_2	CO	VOC's	NO_x[1]
		TONS PER YEAR OF EMISSIONS				
Fairfield	Area	11,108	5,180	160,774	29,647	26,296
	Point	2,387	33,098	4,420	3,579	18,457
	All	13,495	38,278	165,194	33,226	44,753
Hartford	Area	11,708	5,415	164,673	29,306	27,795
	Point	1,129	7,218	5,237	3,746	10,567
	All	12,837	12,633	169,910	33,052	38,362
Litchfield	Area	2,346	1,061	31,045	6,047	5,232
	Point	180	638	69	655	279
	All	2,526	1,699	31,114	6,702	5,511
Middlesex	Area	2,175	1,036	26,845	5,164	5,086
	Point	776	8,231	784	722	8,797
	All	2,951	9,267	27,629	5,886	13,883
New Haven	Area	10,066	4,677	127,868	26,334	21,811
	Point	1,164	26,291	1,446	3,905	9,171
	All	11,230	30,968	129,314	30,239	30,982
New London	Area	3,672	1,729	49,785	9,643	8,540
	Point	1,156	15,302	553	3,105	4,863
	All	4,828	17,031	50,338	12,748	13,403
Tolland	Area	1,997	833	25,227	4,803	4,786
	Point	132	877	36	93	299
	All	2,129	1,710	25,263	4,896	5,085
Windham	Area	1,505	631	20,105	3,610	3,295
	Point	250	493	625	264	308
	All	1,755	1,124	20,730	3,874	3,603
TOTAL	Area	44,577	20,562	606,322	114,554	102,842
	Point	7,174	92,148	13,170	16,068	52,739
	All	51,751	112,710	619,492	130,622	155,581

[1] NO_x emissions are expressed as NO_2.

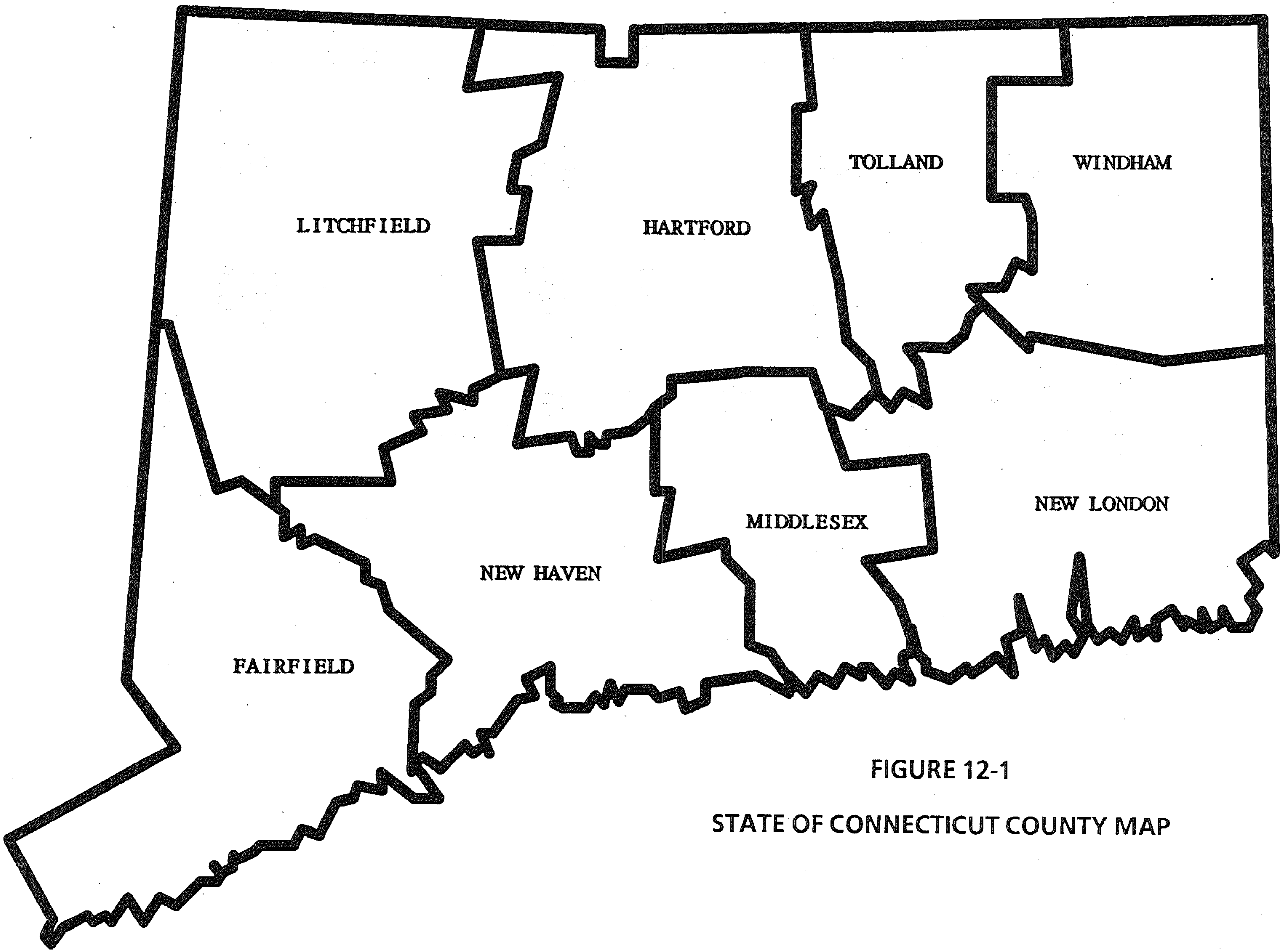


FIGURE 12-1

STATE OF CONNECTICUT COUNTY MAP

FIGURE 12-2

1989 CONNECTICUT EMISSIONS INVENTORY BY COUNTY TOTAL SUSPENDED PARTICULATES

(TOTAL TONS PER YEAR: 51,751)

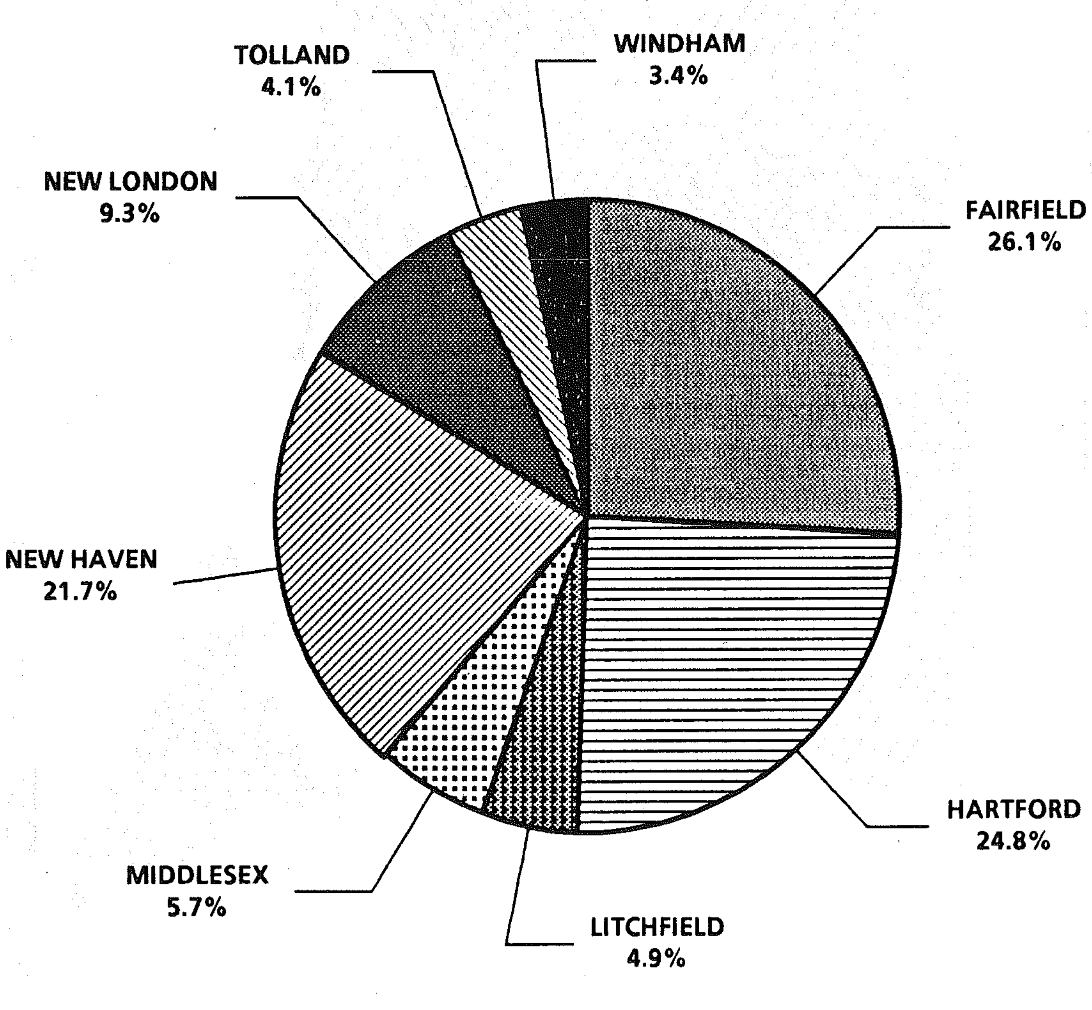


FIGURE 12–3

1989 TOTAL SUSPENDED PARTICULATES

Total Emissions by County

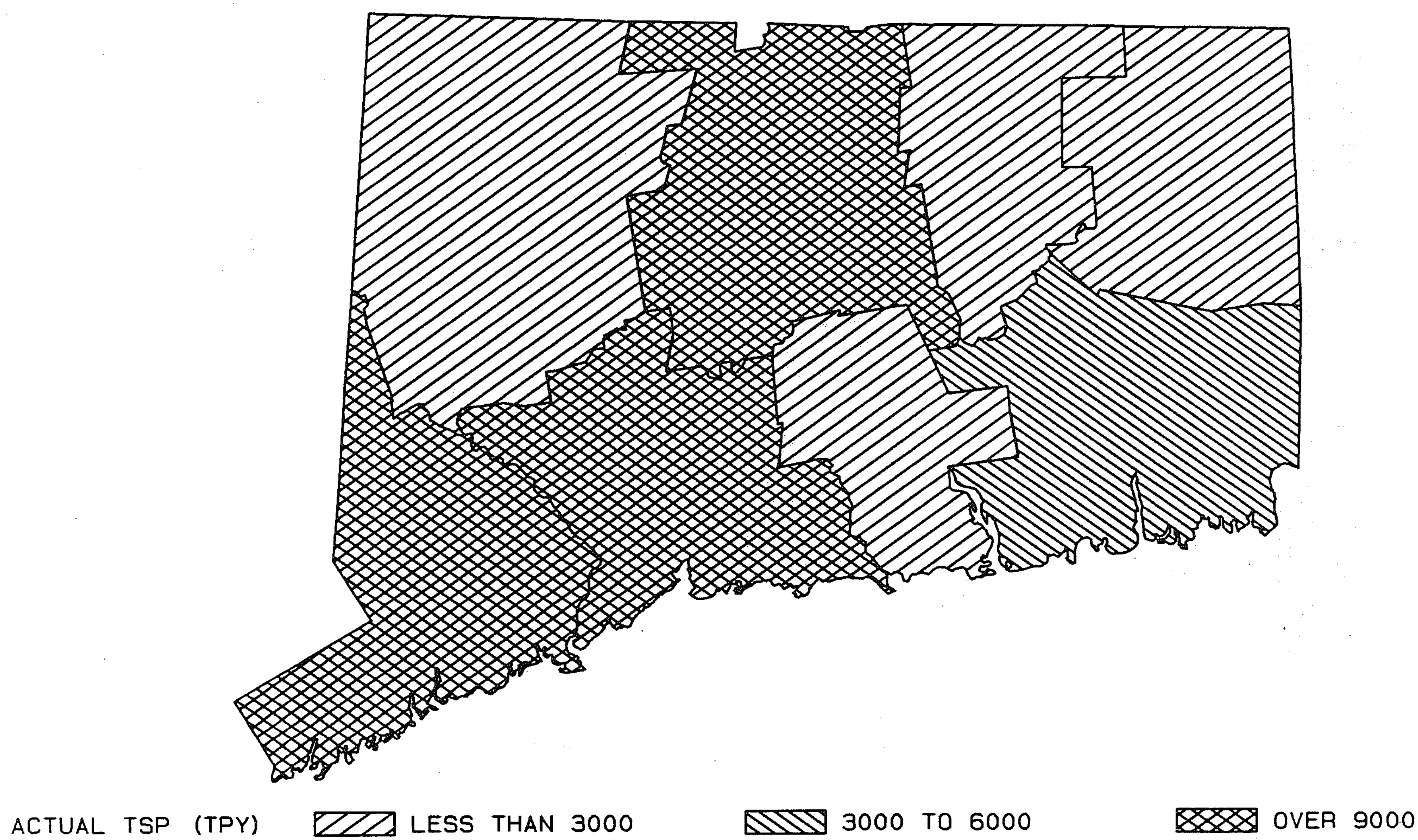
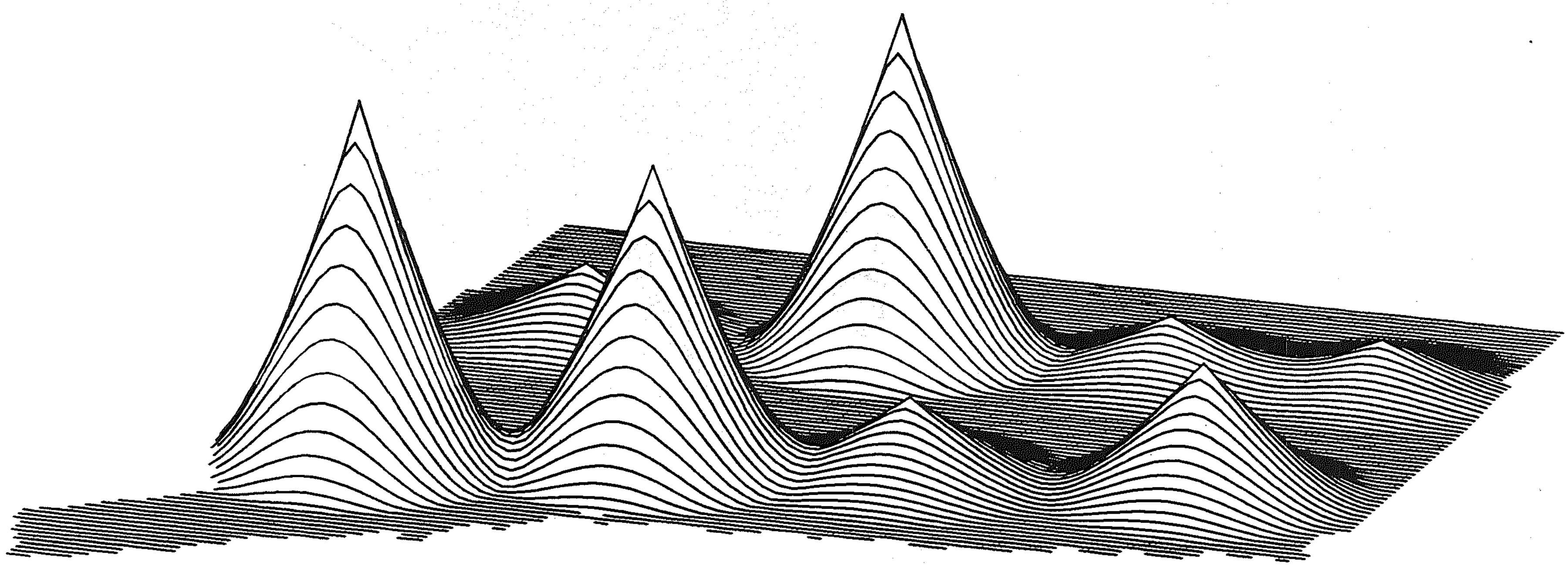


FIGURE 12–4

1989 TOTAL SUSPENDED PARTICULATES

Total Emissions by County



Three Dimensional View of TSP Emissions

FIGURE 12-5

1989 CONNECTICUT EMISSIONS INVENTORY BY COUNTY
SULFUR DIOXIDE

(TOTAL TONS PER YEAR : 112,710)

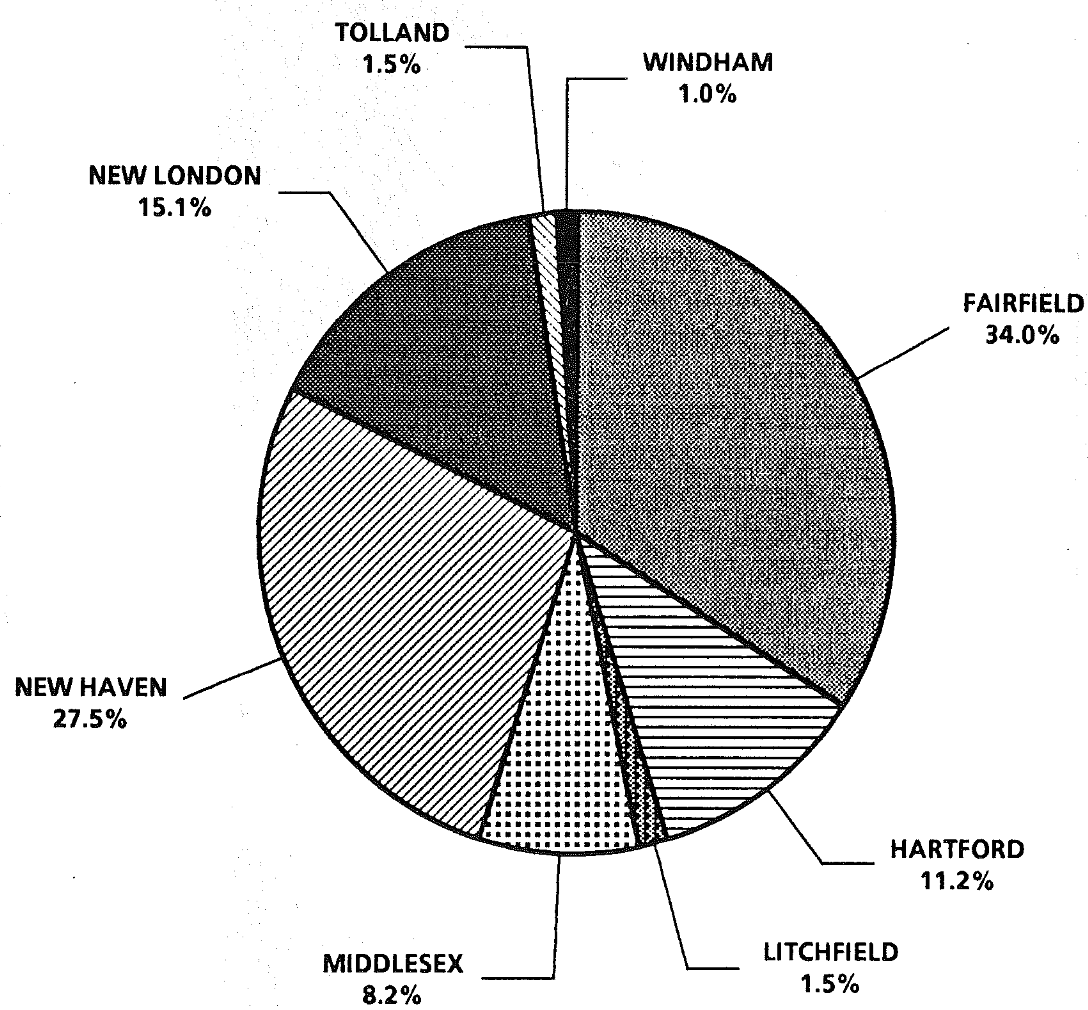


FIGURE 12-6

1989 SULFUR DIOXIDE

Total Emissions by County

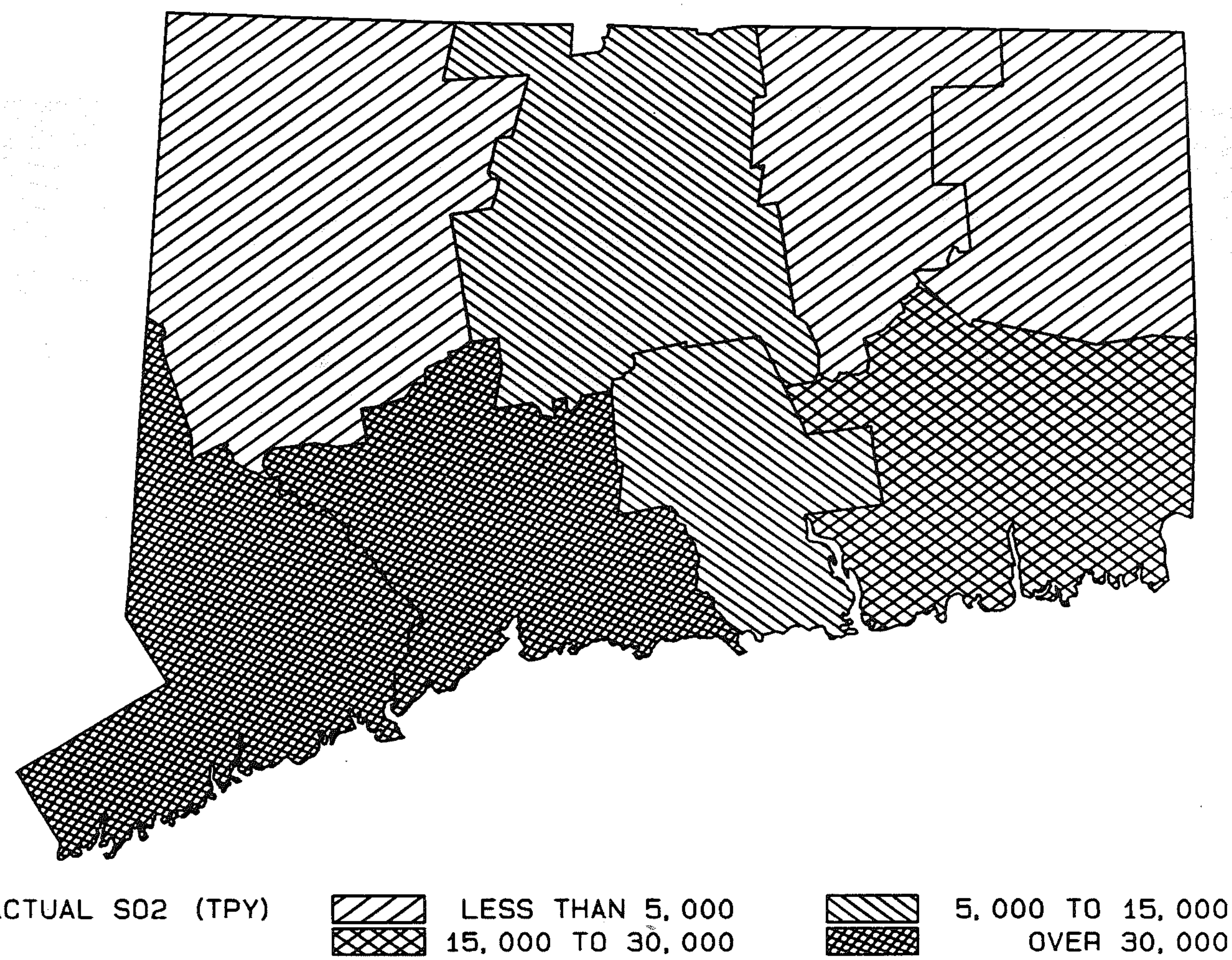
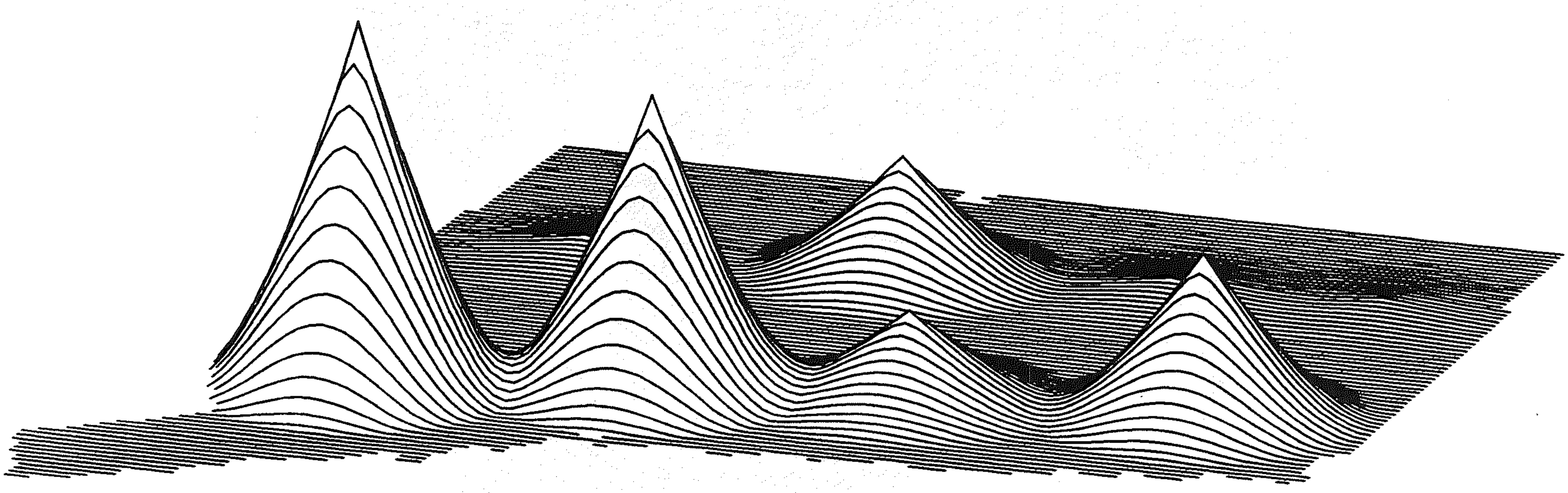


FIGURE 12–7

1989 SULFUR DIOXIDE

Total Emissions by County



Three Dimensional View of S02 Emissions

FIGURE 12-8

1989 CONNECTICUT EMISSIONS INVENTORY BY COUNTY CARBON MONOXIDE

(TOTAL TONS PER YEAR : 619,492)

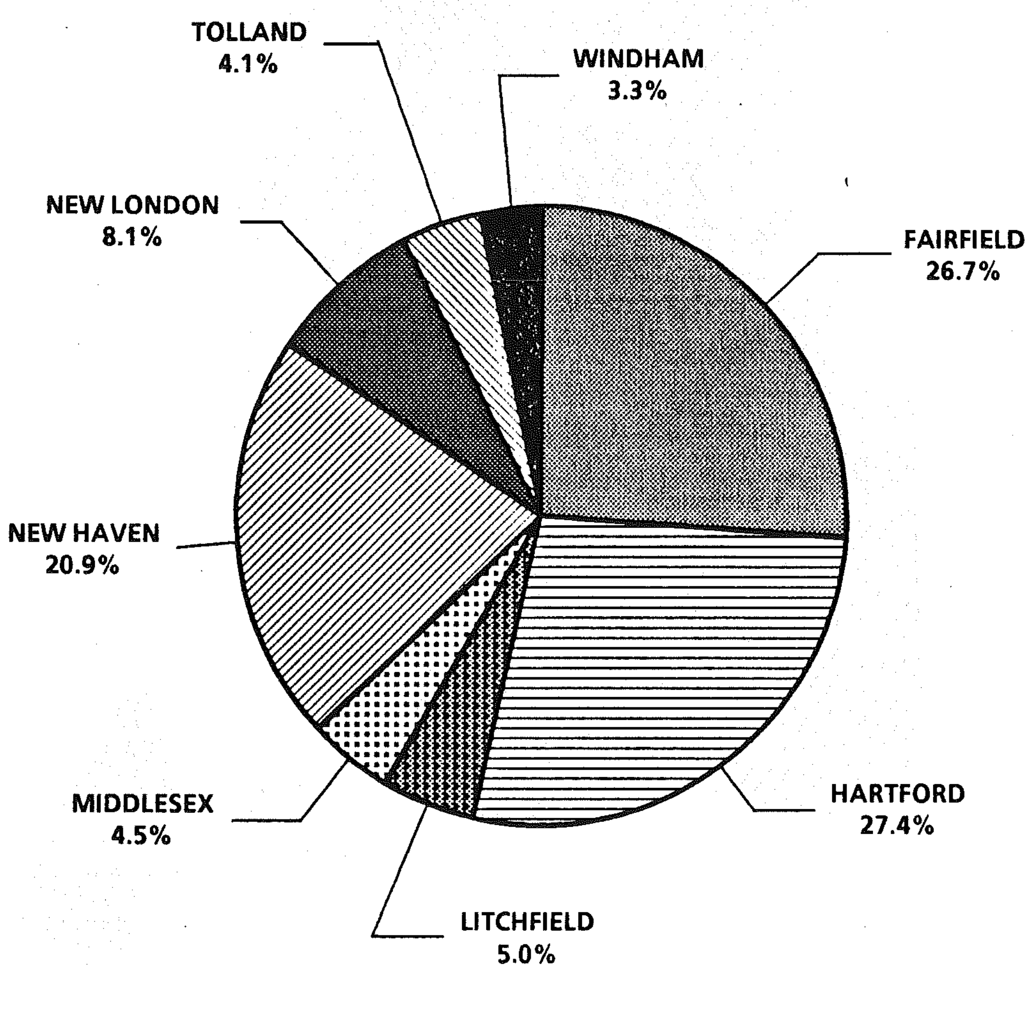


FIGURE 12–9

1989 CARBON MONOXIDE

Total Emissions by County

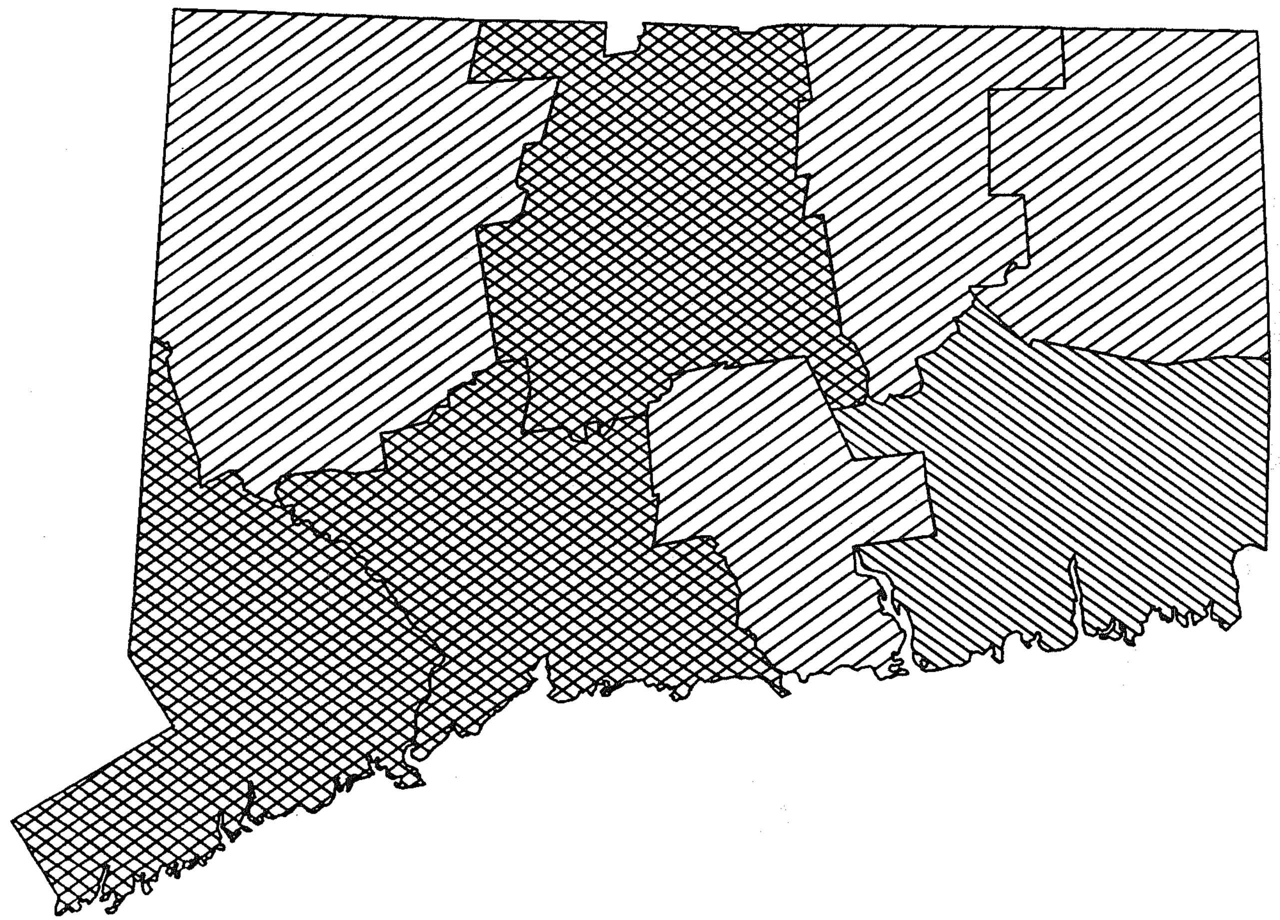
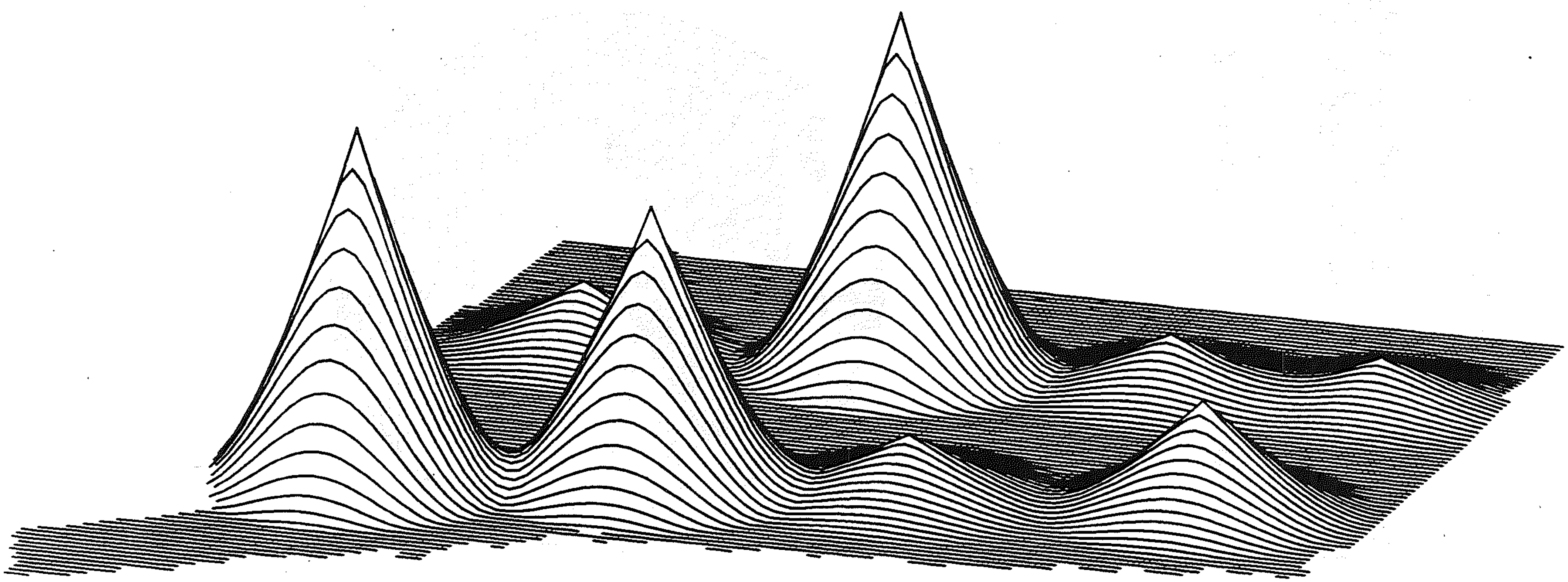


FIGURE 12–10

1989 CARBON MONOXIDE

Total Emissions by County



Three Dimensional View of CO Emissions

FIGURE 12-11

1989 CONNECTICUT EMISSIONS INVENTORY BY COUNTY VOLATILE ORGANIC COMPOUNDS

(TOTAL TONS PER YEAR :130,622)

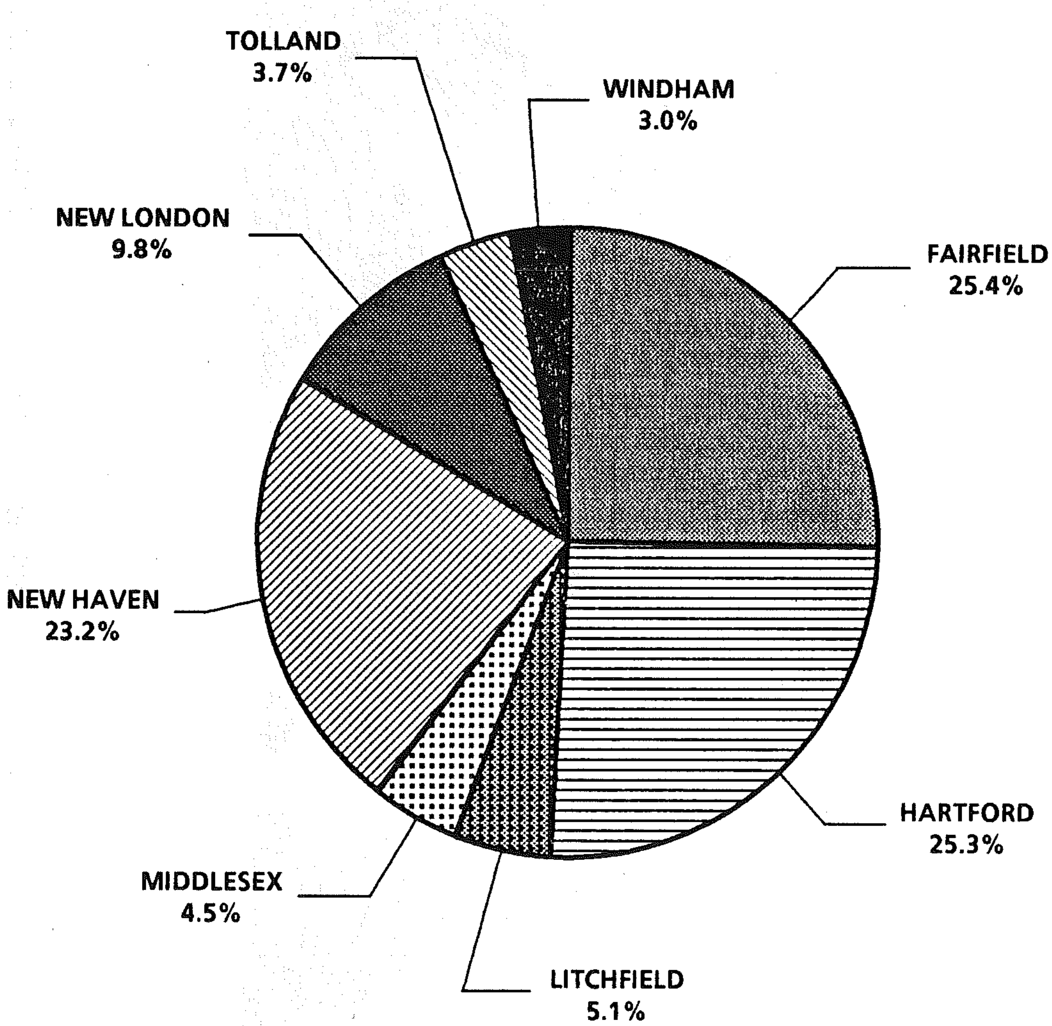


FIGURE 12-12

1989 VOLATILE ORGANIC COMPOUNDS

Total Emissions by County

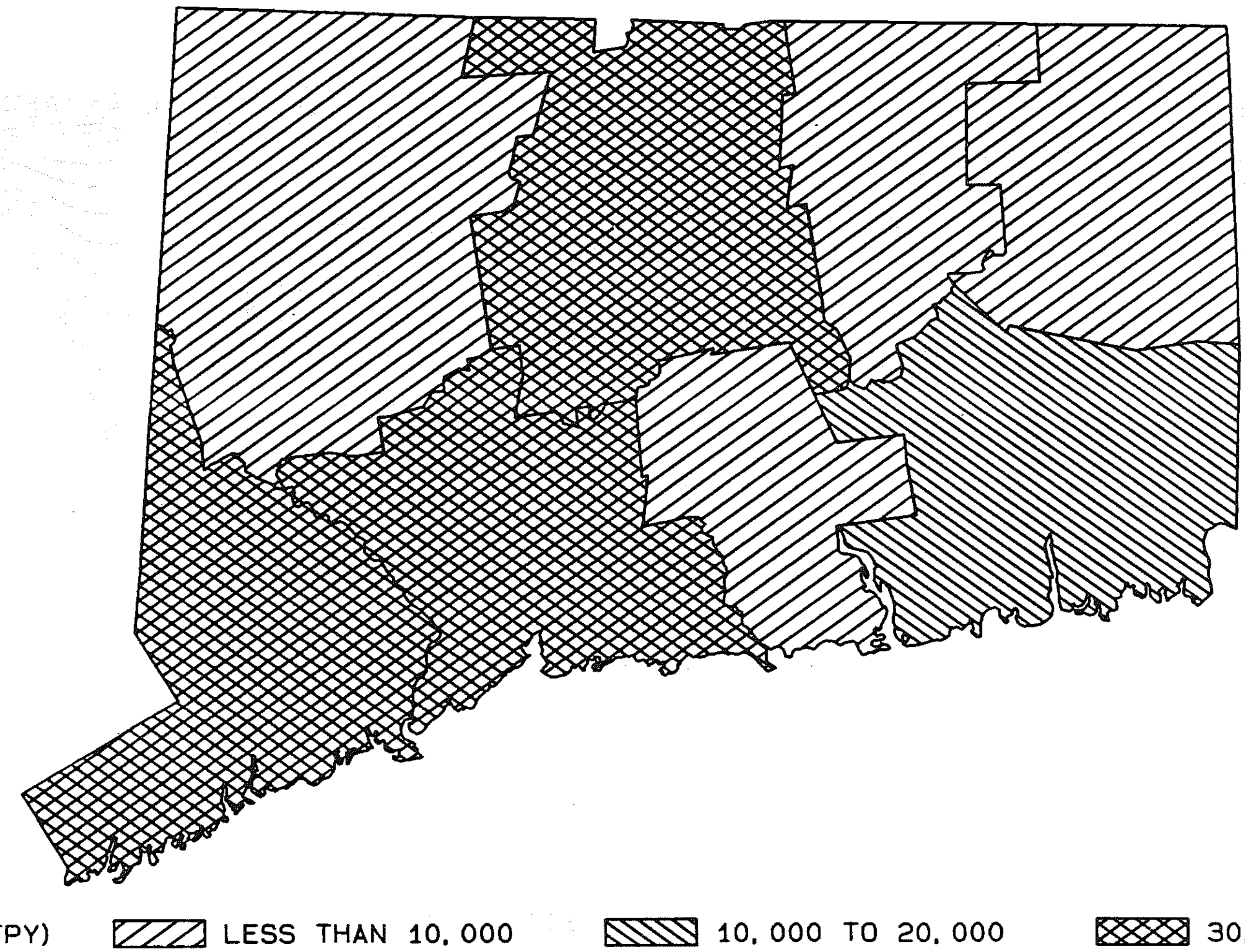
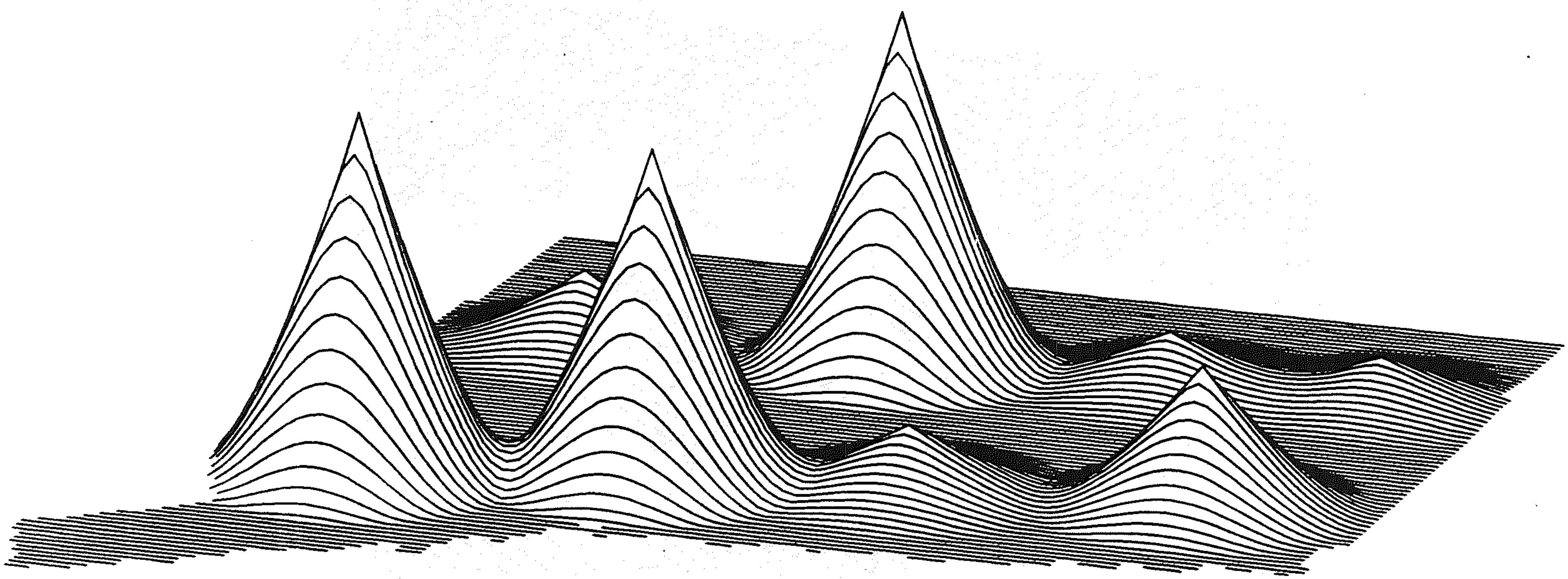


FIGURE 12-13

1989 VOLATILE ORGANIC COMPOUNDS

Total Emissions by County



Three Dimensional View of VOC Emissions

FIGURE 12-14

1989 CONNECTICUT EMISSIONS INVENTORY BY COUNTY NITROGEN OXIDES

(Expressed as Nitrogen Dioxide)

(TOTAL TONS PER YEAR :155,581)

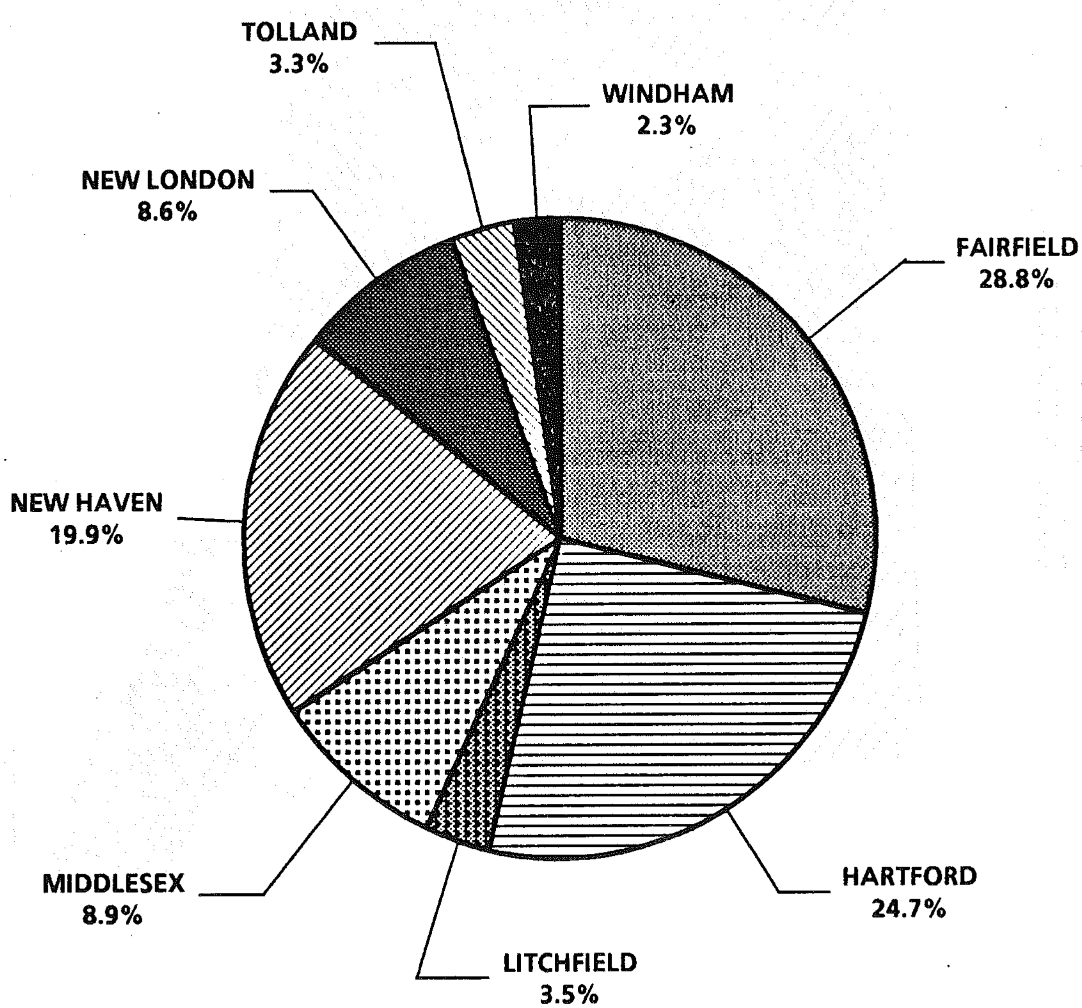


FIGURE 12–15

1989 NITROGEN OXIDES

(Expressed as Nitrogen Dioxide)

Total Emissions by County

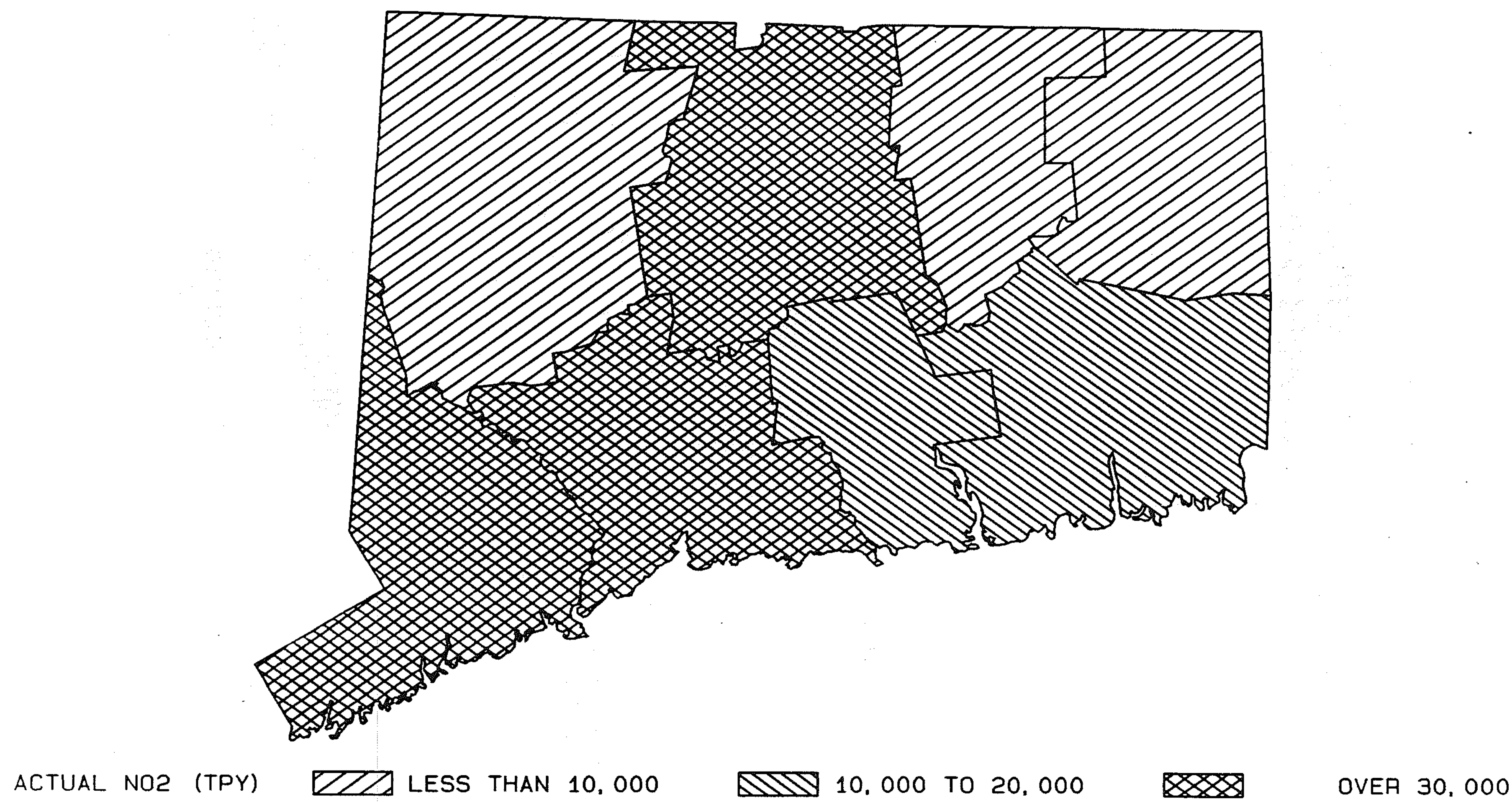
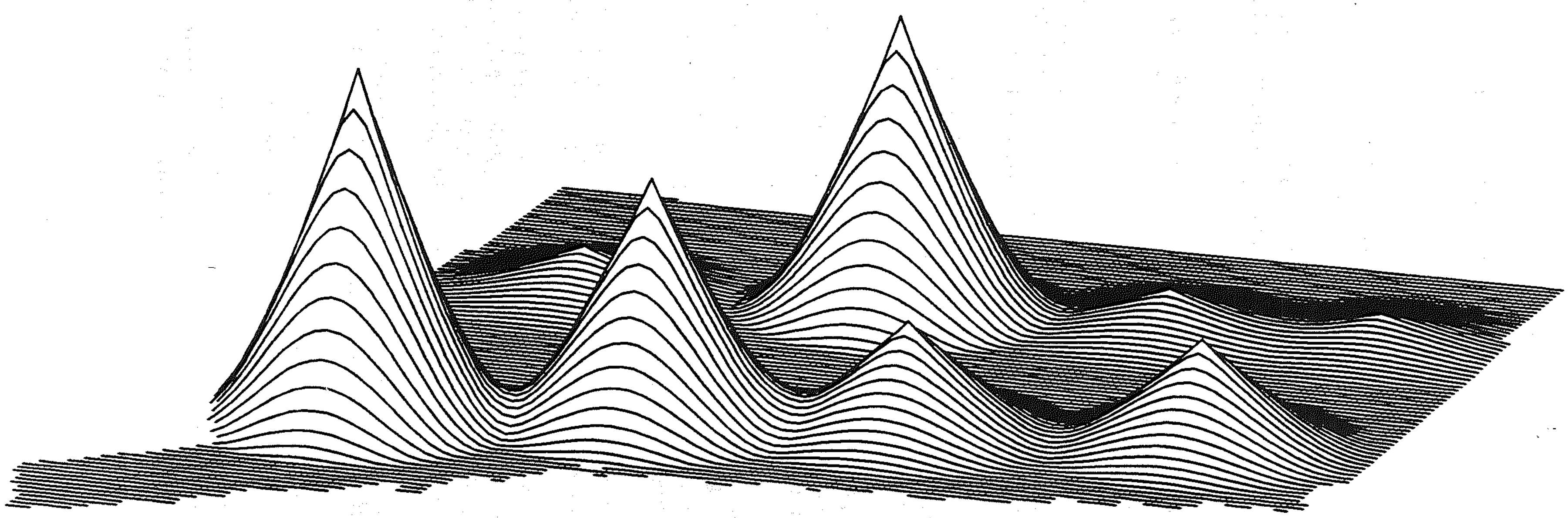


FIGURE 12–16

1989 NITROGEN OXIDES

(Expressed as Nitrogen Dioxide)

Total Emissions by County



Three Dimensional View of NOx Emissions

XIII. 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.

XIV. ERRATA

During the preparation of this Air Quality Summary, a number of errors were discovered in previous editions of this document. In order to inform the reader of these changes, the errors and corrections are presented below:

- Regarding the 1988 Air Quality Summary,

  1. In Section II, on page 13, in the last paragraph,

     a. The fourth sentence should read: "The remaining columns show the average and standard deviation of the *differences of the* paired year means..."

     b. The sixth sentence should read: "... the statewide annual average for PM_{10} decreased between 1986 and 1987 from *37.7 to 34.0.*"

     c. The eighth sentence should read: "The probability that change is not significant is given as *0.0148*, meaning that there are only *148* chances..."

  2. In Section II, on page 17, Table 2-1 should indicate for the site Middletown 003 that the year is 1988 (not 1983).

  3. In Section II, on page 18, Table 2-1 should show the site designation for Old Saybrook to be 005 (not 002).

  4. In Section II, on page 23, Figure 2-3 should show the site designation for Old Saybrook to be 005 (not 002).

  5. In Section II, on page 32, Table 2-6 should be corrected to show the paired year data for 1986 and 1987 to be as follows: the average of the annual geometric means are 37.7 and 34.0, respectively; the number of sites for each year is 5; and the probability that change is not significant is 0.0148.

  6. In Section IV, on page 58, the first paragraph should list New Haven (not North Haven) as a town whose ozone monitor is located to measure both urban pollution and advection from the southwest.

  7. In Section XI, on page 113, Table 11-2 should show the Old Saybrook PM_{10} site designation to be 005 (not 002).

  8. In Section XI, on page 115, the ozone monitoring site Madison 002 was omitted from Table 11-2. The pertinent information for this site is: the urban area is *none*; the SLAMS or NAMS designation is *S*; the sampling and analysis method is *chemiluminescent*; the operating schedule is *continuous*; the monitoring objective is *high concentration*; and the spatial scale of representiveness is *urban*.