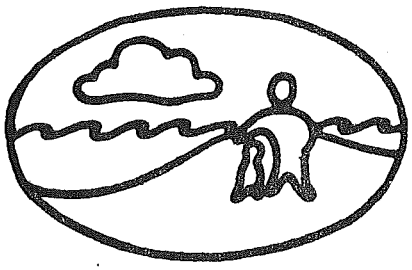
CONNECTICUT AIR QUALITY SUMMARY 1971 - 1973



Department of Environmental Protection

ABSTRACT

The Connecticut Air Quality Summary, 1971-1973 is a presentation of historical data as it was observed; no attempt is made to project future air quality values.

Part I, Introduction, contains comments on air quality trends observed between 1971 and 1973, comments on air pollution stagnation episodes in 1973, and comments on state and federal air quality standards.

Part II, Aerometric Data contains statistics on the ambient or outdoor air. Air pollution concentrations for Sulfur Oxides, Nitrogen Oxides, Particulate Matter, Photochemical Oxidants or Ozone, and Carbon Monoxide are reported. Seven year wind roses showing the frequency of each wind direction are included. Each section starts by describing how the large quantities of raw data have been summarized and organized.

Part III, Air Monitoring Sites contains a narrative describing the development of the air monitoring network, and a comprehensive directory of air sampling sites operating in 1973.

CONNECTICUT

AIR QUALITY SUMMARY

1971 - 1973

PART I

INTRODUCTION

ANNUAL ARITHMETIC AVERAGES OF SULFUR OXIDES AT CONTINUOUSLY MONITORED SITES

Secondary Connecticut Standard 60 ug/m^3
Primary NAAQS Standard 80 ug/m^3

		1973	1972	1971
Bridgeport	01	44	61.5	76
	02	31	54	--
	03	50	50	--
East Hampton	01	47	49	43
Greenwich	01	53	45	62
	04	29	33	43
	08	55	43	71
Hartford	03	69	61	91
	Maple Avenue	82	108	--
Middletown	Sumner Street	52	79	97
Milford	02	25	--	49
Montville	Depot Road	44	53	--
New Britain	02	80.3	120	96
New Haven	04	54	79	84
	08	38	41	51
Norwalk	05	50	61.5	65
	Harbor Avenue	59	79	--
Stamford	03	78	90	119
Stratford	Reeds Lane	50	60	--
Waterbury	01	84	93	103

PARTICULATES

The 1971-1973 historical trend also shows substantial reduction in the concentration of Particulate Matter in the ambient air over Connecticut. The Secondary annual average NAAQS is 60 ug/m^3, and the Primary NAAQS is 75 ug/m^3.

ANNUAL ARITHMETIC AVERAGES AT
CONTINUOUSLY MONITORED PARTICULATES SITES

Year	Under Secondary	Under Primary Not Under Secondary	Not Under Primary	Number of Sites
1971	15	14	36	65
1972	22	15	23	60
1973	38	22	8	68

From 1971 to 1973 the number of sites under the secondary standard increased by 153%; the number over the primary decreased by 77%.

The eight sites in 1973 still exceeding the primary annual average standard are: Hartford 003, New Britain 002, Meriden 002, Naugatuck 001, Stamford 001, Stamford 004, and Waterbury 001.

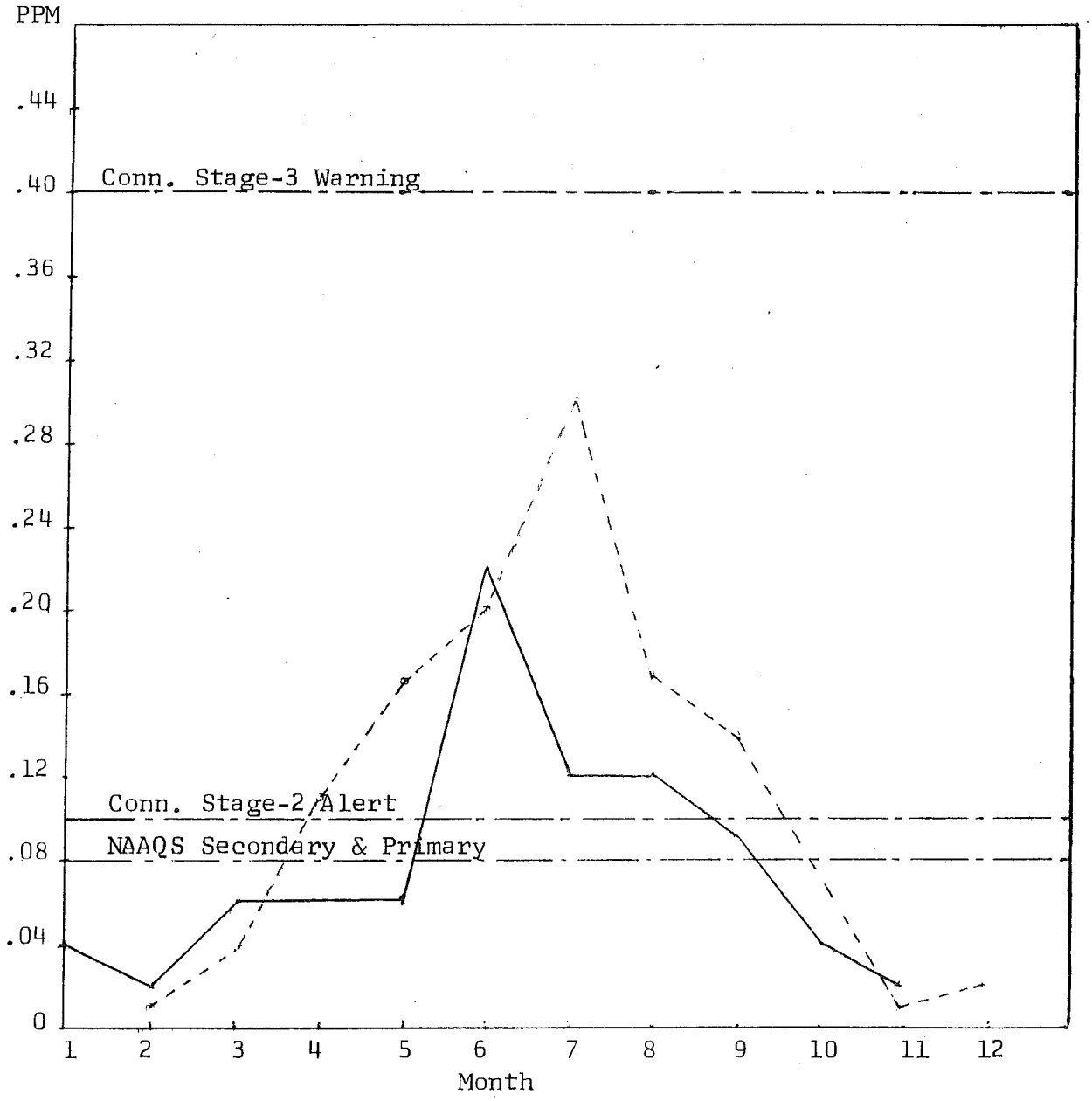
OZONE

Connecticut has a considerable problem with Photochemical oxidants. A graph of the maximum hourly concentration for Hartford follows; It is the only site for which almost two complete years of data are available. Throughout the year, the monthly maximum one-hour concentration of ozone is less in 1973 than in 1972 except for the month of June. A table summarizing 1973 ozone data is also included.

SITE Hartford

OZONE

MAXIMUM HOURLY AVERAGE (PPM)



OZONE CONCENTRATIONS IN CONNECTICUT, 1973

IN PARTS PER MILLION

City	JUNE		JULY		AUGUST	
	% of Days Over Standard*	Maximum 1-hour	% of Days Over Standard*	Maximum 1-hour	% of Days Over Standard*	Maximum 1-hour
Bridgeport	---	---	65.0	.30	65.0	.245
Greenwich	---	---	82.0	.25	68.0	.24
Hartford	6.6	.22	9.6	.12	22.5	.12
New Haven	---	---	41.9	.225	54.8	.314
Stamford	---	---	----	----	81.8	.202
Windsor	---	---	9.6	.11	16.1	.125

* Each day reported either has the property that all one-hour average concentrations are below the .08 ug/m^3 NAAQS standard or it does not. The percent of readings without this property is tabulated.

B. STAGNATIONS

In 1973 the Air Compliance Unit received six air stagnation advisories from the National Weather Service (via the Interstate Sanitation Commission) for the following dates:

June 26-28
August 17-19
September 4-6
October 9-10
October 24-25
November 23-24

In each instance, internal watch procedures were implemented immediately upon receipt of the air stagnation advisory, and pollutant levels were carefully monitored for rising trends. On June 26, August 17, September 4 and October 24, pollutant concentrations continued to rise, and the Commissioner declared a Stage I Advisory. As required by the regulations, all open burning was banned and all sources of air pollution which had filed preplanned abatement strategies were notified to prepare to implement the strategies necessary for Stage II Alert. In none of these instances, however, did pollutant concentrations rise to Stage II levels before the stagnation advisory was terminated. During the October 9-10 and November 23-24 stagnations the arrival of a frontal system brought an end to the advisory before significant pollutant concentrations were reached, and Stage I Advisory was not declared.

C. AMBIENT AIR QUALITY STANDARDS

All ambient air quality standards observed by the State of Connecticut are summarized in this section. National Ambient Air Quality Standards (NAAQS) are specified by the Clean Air Act of 1970 and its amendments; the Connecticut Ambient Air Quality Standards (CAAQS) are specified in section 19-508-6 of the Abatement of Air Pollution Administrative Regulations for the Department of Environmental Protection.

Primary standards are set at levels that ensure the protection of public health; the Secondary standards are set at levels which protect property, vegetation, and aesthetic values.

The Connecticut administrative regulations specify actions that can be taken in an air pollution emergency episode depending on the stage of emergency. For an emergency episode there must be first, a stagnation advisory from the National Weather Service, and second, high air pollution concentrations. The Commissioner, in deciding what actions to take, is guided by the CAAQS Standards defining the stage of emergency.

	ug/m^3	COHS
1. Particulate Matter		
(a) Annual Geometric Average		
(1) NAAQS Secondary	60	
(2) NAAQS Primary	75	
(b) 24-hour Concentration		
(1) NAAQS Secondary*	150	
(2) NAAQS Primary*	260	
(3) Conn. Stage-2 Alert	375	3.0
(4) Conn. Stage-3 Warning	625	5.0
(5) Conn. Stage-4 Extreme Emergency	875	7.0

* Standard not to be exceeded more frequently than one time per year.

		ug/m3	ppm
2.	Sulfur Oxides		
(a)	Annual Arithmetic Average		
(1)	Conn. Secondary	60	.02
(2)	NAAQS Primary	80	.03
(b)	Daily Average Concentration		
(1)	Conn. Secondary*	260	.10
(2)	NAAQS Primary*	365	.14
(3)	Conn. Stage-2 Alert	800	.30
(4)	Conn. Stage-3 Warning	1600	.60
(5)	Conn. Stage-4 Extreme Emergency	2100	.80
(c)	Running 3-hour average		
(1)	NAAQS Secondary*	1300	.50
3.	Sulfur Oxide and Particulates Combined		
(a)	Product of SO_2 ppm, 24-hour average and COHs		
(1)	Conn. Stage-2 Alert	0.2	
(2)	Conn. Stage-3 Warning	0.8	
(3)	Conn. Stage-4 Extreme Emergency	1.2	
(b)	Product of Sulfur Oxide ug/m3, 24-hour average, and Particulate ug/m3, 24-hour average		
(1)	Conn. Stage-2 Alert	65,000	
(2)	Conn. Stage-3 Warning	261,000	
(3)	Conn. Stage-4 Extreme Emergency	393,000	

		ug/m3	ppm
4.	Carbon Monoxide (CO)		
(a)	Running 8-hour Average		
(1)	NAAQS Primary*	10	9
(2)	Conn. Stage-2 Alert	17	15
(3)	Conn. Stage-3 Warning	34	30
(4)	Conn. Stage-4 Extreme Emergency	46	40
(b)	One-hour Concentration		
(1)	NAAQS Secondary*	40	35
(2)	NAAQS Primary*	40	35

* Standard not to be exceeded more frequently than one time per year.

		ug/m3	ppm
5.	Photochemical Oxidants		
	(a) One-hour Concentrations		
	(1) NAAQS Secondary*	160	.08
	(2) NAAQS Primary*	160	.08
	(3) Conn. Stage-2 Alert	200	.10
	(4) Conn. Stage-3 Warning	800	.40
	(5) Conn. Stage-4 Extreme Emergency	1600	.60
6.	Hydrocarbons		
	(a) 6:00 - 9:00 A.M. Average Concentrations		
	(1) NAAQS Secondary Guide*	160	.08
	(2) NAAQS Primary Guide*	160	.08
7.	Nitrogen Oxides		
	(a) Annual Arithmetic Average		
	(1) NAAQS Secondary	100	
	(2) NAAQS Primary	100	
8.	Nitrogen Dioxide (NO_2)		
	(b) 24-hour average concentration		
	(1) Conn. Stage-2 Alert	282	.15
	(2) Conn. Stage-3 Warning	565	.30
	(3) Conn. Stage-4 Extreme Emergency	750	.40
	(c) One-hour average concentration		
	(1) Conn. Stage-2 Alert	1130	0.6
	(2) Conn. Stage-3 Warning	2260	1.2
	(3) Conn. Stage-4 Extreme Emergency	3000	1.6

* Standard not to be exceeded more frequently than one time per year.

CONNECTICUT

AIR QUALITY SUMMARY

1971 - 1973

PART II

AEROMETRIC DATA

A. SULFUR OXIDE CONCENTRATIONS

The comprehensive set of graphs following, displays the Sulfur Oxide data available in Connecticut, 1971-1973.

There is one page for each site. The graphs are in alphabetic order by town name, and by site number within the town. Permanent site numbers are assigned by the Environmental Protection Agency for identification purposes. A description of the Connecticut Department Environmental Protection sites is included in Section III of this publication. The Northeast Utilities monitored sites are marked as such.

Data were collected continuously and reported as one-hour average concentrations. On the average there were 600-700 readings per month reported. From these, three summary statistics were developed for the three graphs on each page.

The first statistic was the monthly average concentration: the sum of all the one hour concentrations reported, divided by the number reported. This statistic is graphed on the left side of each page as the"Monthly Average Concentration."

The second statistic was the "Monthly Maximum One-Hour Concentration". This is the highest reading in each month and is graphed in the middle of each page.

The third statistic developed, the "Monthly Maximum Daily Average", appears in the graph on the right side of each page. The first step was to calculate the average daily concentration for each day of the month. The second step was to pick out the highest of these daily averages and report it as the maximum.

Each of the graphs has a numbered horizontal scale representing the months of the year: "1" for January through "12" for December. For each month three sulfur oxide concentration values are recorded. The last digit of the year is used to mark the data point for the month: the number "1" indicates the concentration in 1971, "2" indicates the concentration in 1972, and "3" in 1973. Thus seasonal trends are readily apparent. Some sites have started up since January 1971 and others have been discontinued but available data has been graphed.

The State and National Ambient Air Quality Standards have been marked on each graph. Although the annual arithmetic average of 60 ug/m^3 is no longer a National Secondary Standard, it remains a Connecticut Secondary Standard. The center graph of Maximum one-hour concentrations locates the maximum three-hour running average NAAQS of 1300 ug/m^3. This standard is seldom exceeded. If the maximum one-hour concentration indicated is less than the standard, then any three-hour running average of these one-hour concentrations in that month must also be under the three-hour standard, so the standard was not violated.[1]

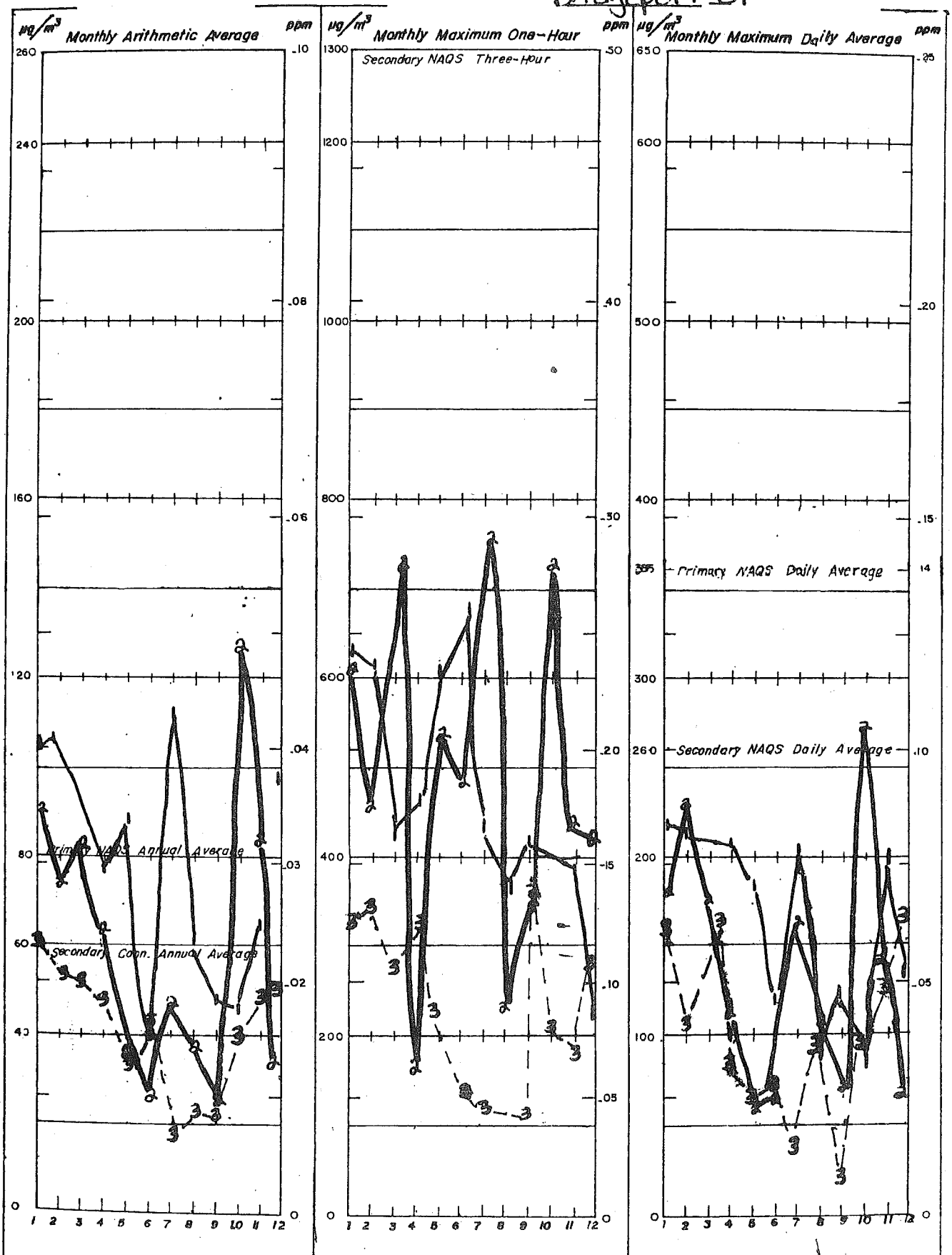
The units of concentration are marked on the vertical axis on both sides of each graph: in micrograms per cubic meter (ug/m^3) on the left, and in parts per million (ppm) on the right. The conversion factor for Sulfur Oxides is 2620 ug/m^3 equals one ppm.

[1] Each running three-hour arithmetic average for a month is, by the definition of "maximum", less than or equal to the maximum running three-hour arithmetic average for the month, which is in turn less than or equal to the arithmetic average of the three highest hourly readings for the month, which is in turn less than or equal to the maximum one-hour reading for the month.

SULFUR OXIDE CONCENTRATIONS

AIR COMPLIANCE MONITORING

SITE: Bridgeport-01

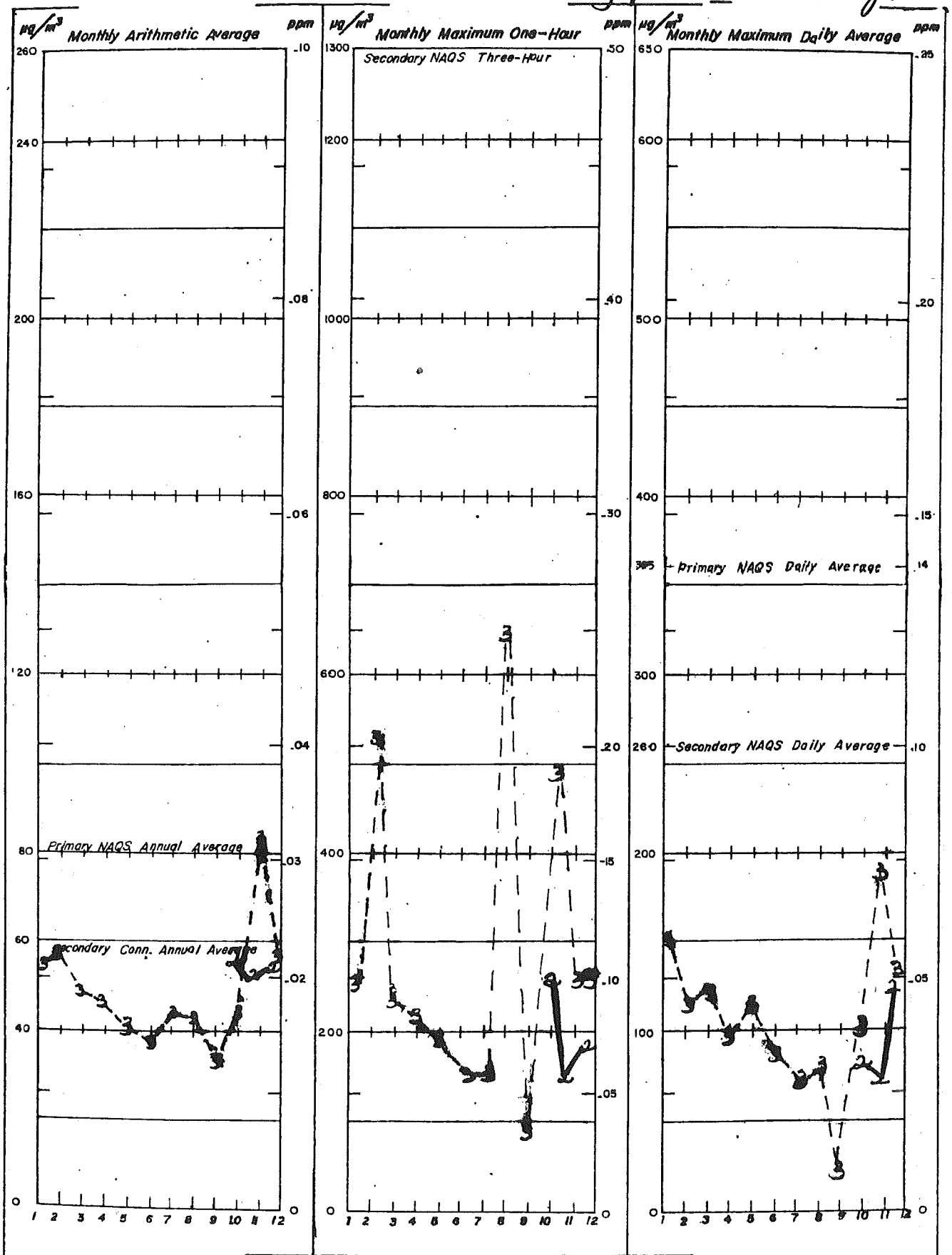


DATA POINT SYMBOLS: 1 = 1971, 2 = 1972, 3 = 1973

SULFUR OXIDE CONCENTRATIONS

AIR COMPLIANCE MONITORING

SITE: Bridgeport 03



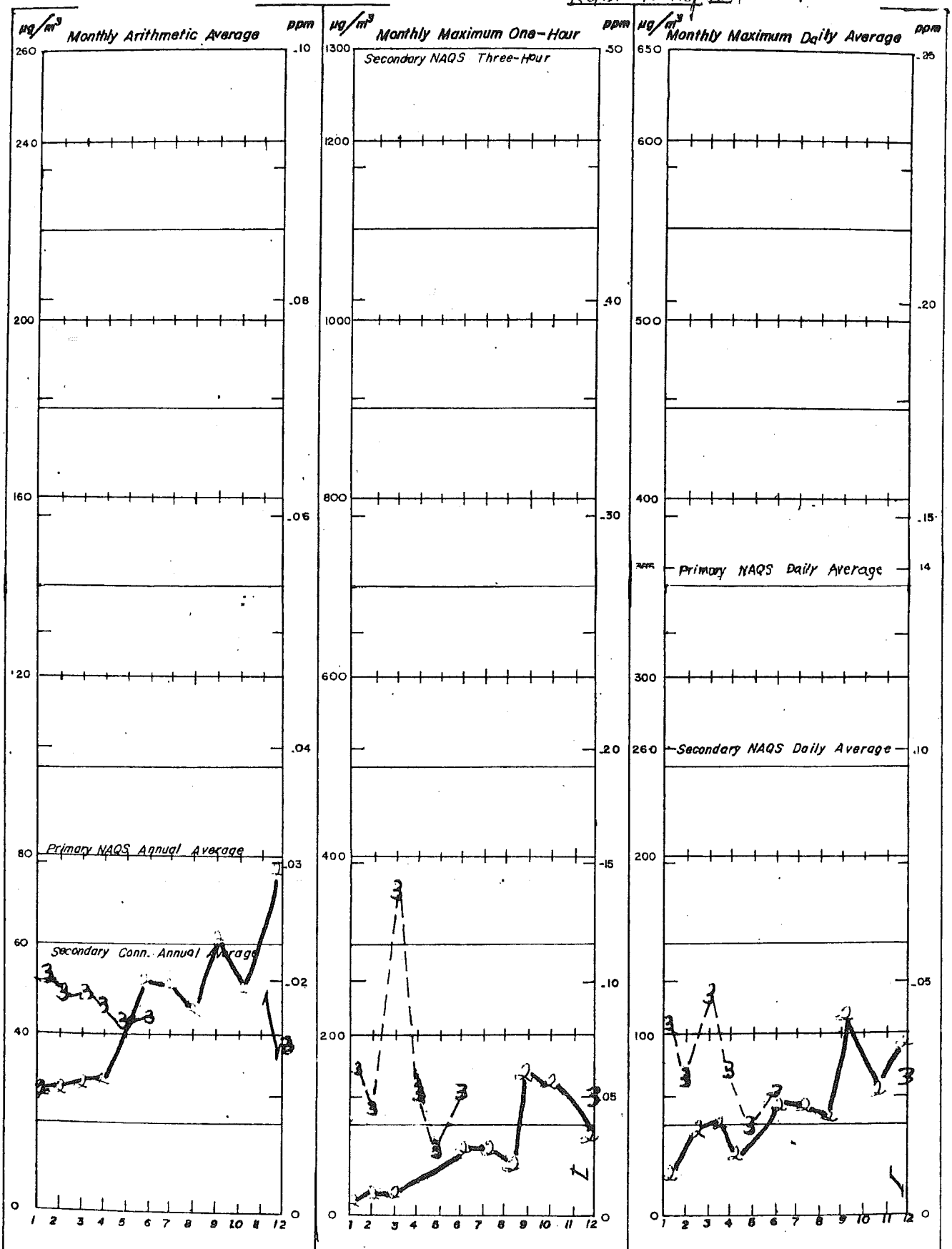
DATA POINT SYMBOLS: 1 = 1971, 2 = 1972, 3 = 1973

CONNECTICUT DEPARTMENT OF
ENVIRONMENTAL PROTECTION

SULFUR OXIDE CONCENTRATIONS Northeast Utilities Midwood Farm Road

AIR COMPLIANCE MONITORING

SITE: East Hampton 01

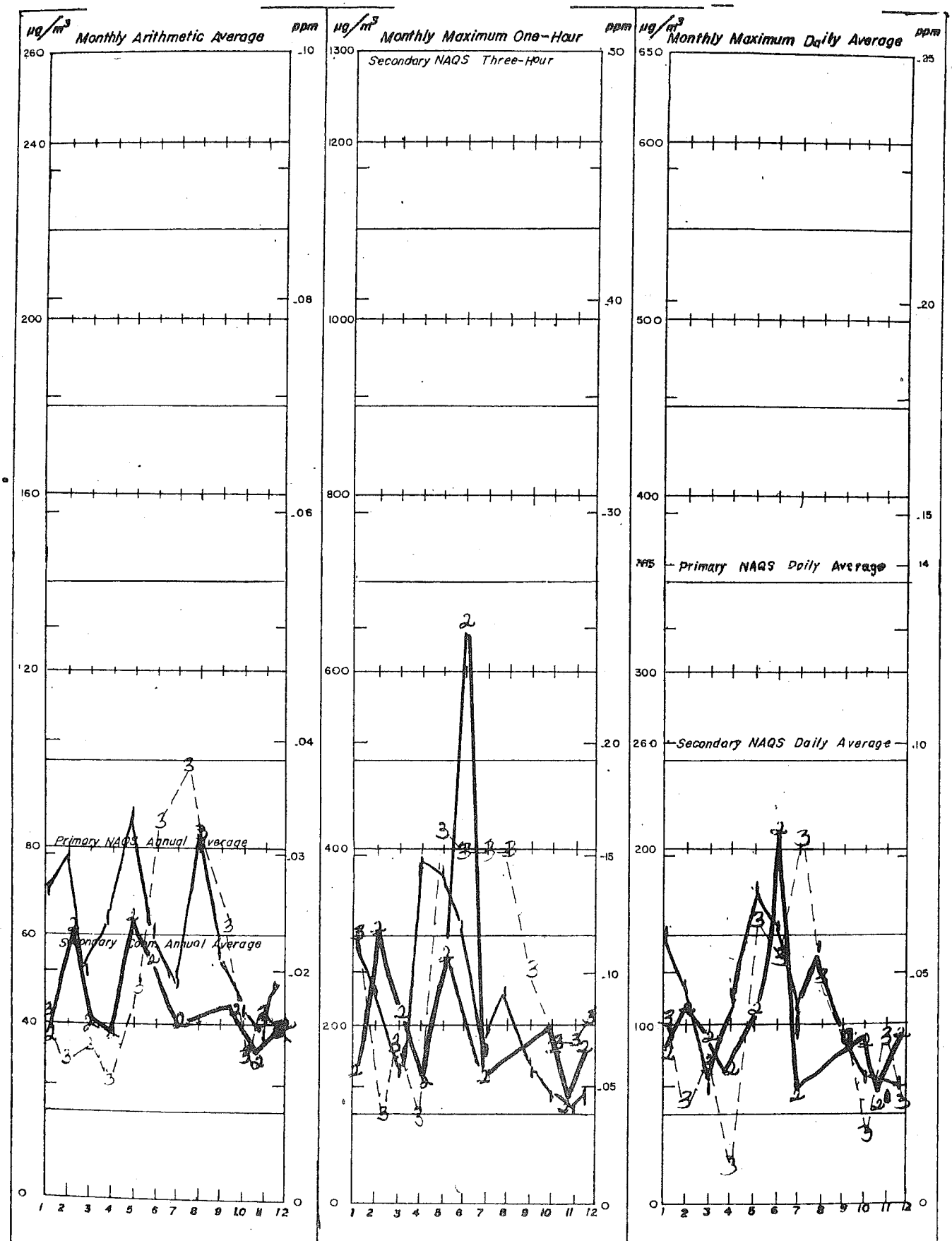


DATA POINT SYMBOLS: 1 = 1971, 2 = 1972, 3 = 1973

SULFUR OXIDE CONCENTRATIONS

AIR COMPLIANCE MONITORING

SITE: Greenwich 01

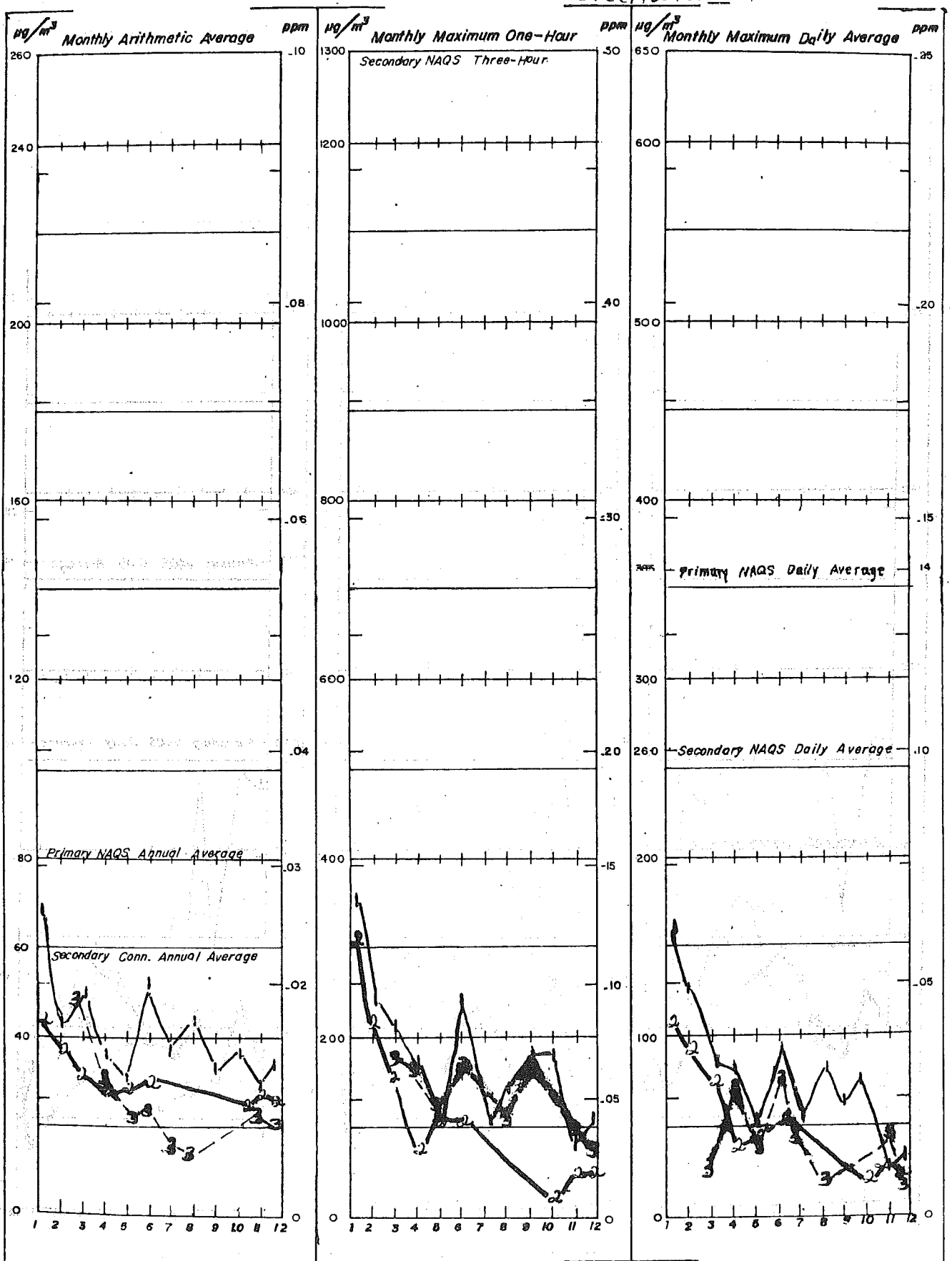


DATA POINT SYMBOLS: 1 = 1971, 2 = 1972, 3 = 1973

SULFUR OXIDE CONCENTRATIONS

AIR COMPLIANCE MONITORING

SITE: Greenwich 04

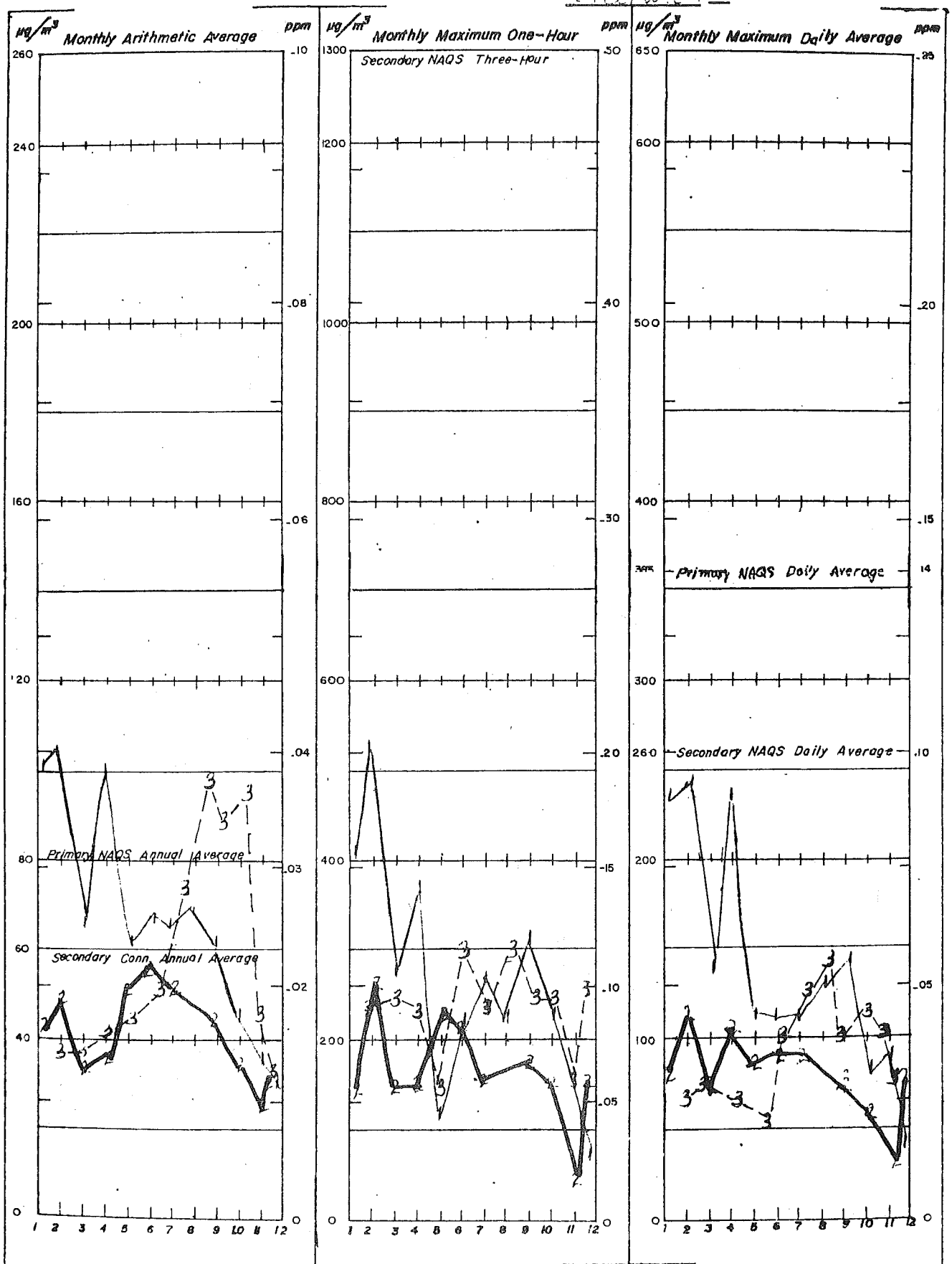


DATA POINT SYMBOLS: 1 = 1971, 2 = 1972, 3 = 1973

SULFUR OXIDE CONCENTRATIONS

AIR COMPLIANCE MONITORING

SITE: Greenwich 08

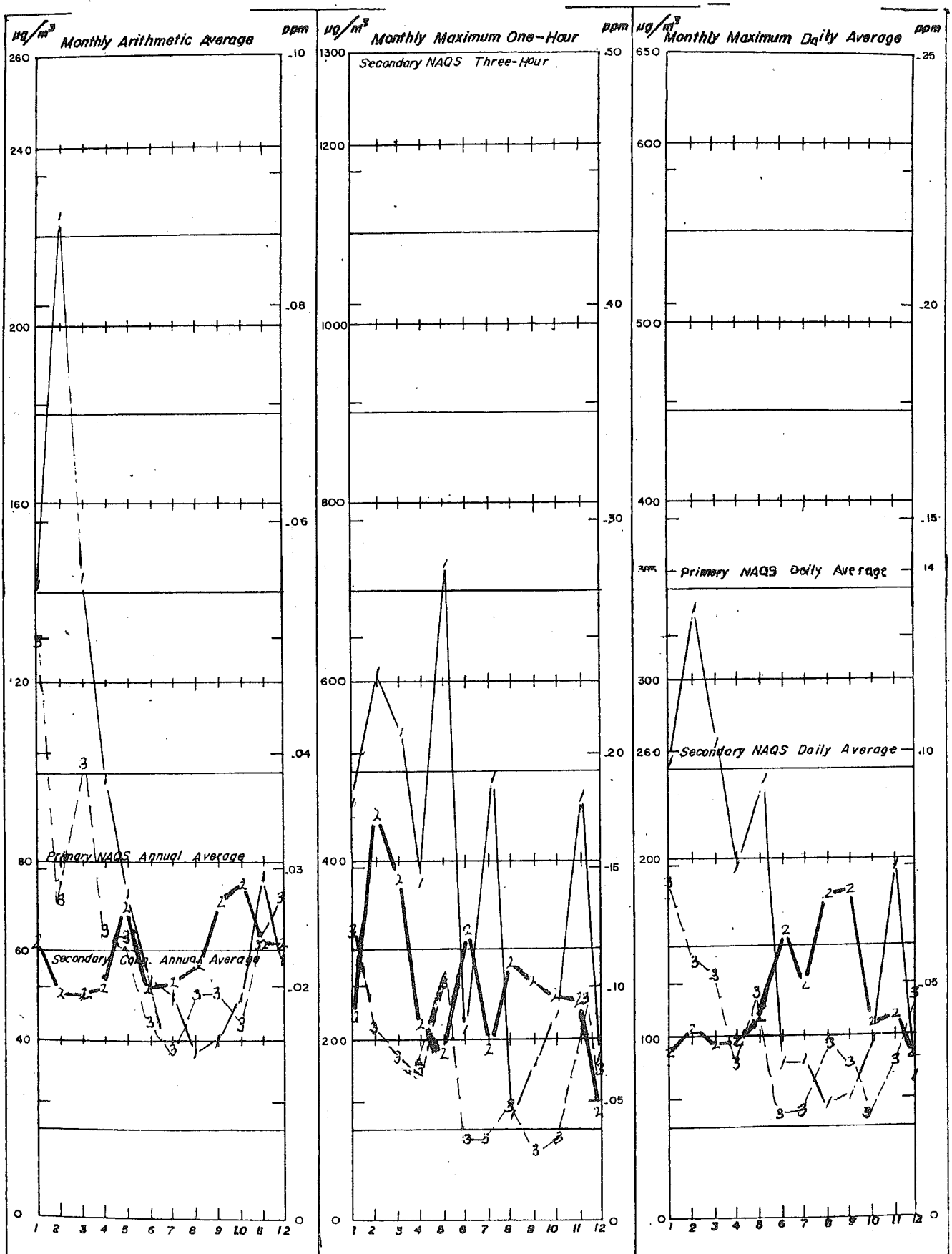


DATA POINT SYMBOLS: 1 = 1971, 2 = 1972, 3 = 1973

SULFUR OXIDE CONCENTRATIONS

AIR COMPLIANCE MONITORING

SITE: Hartford-03

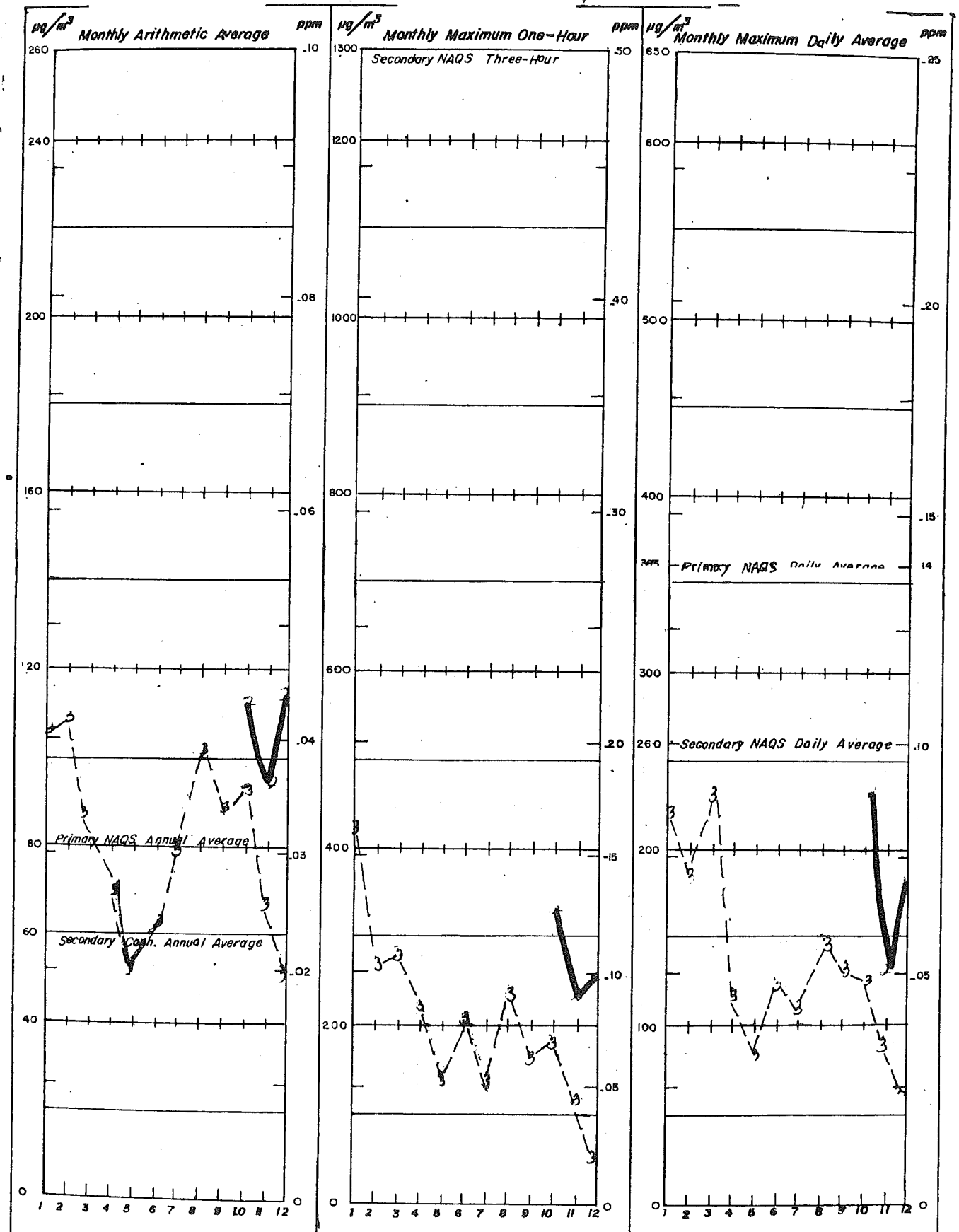


DATA POINT SYMBOLS: 1 = 1971, 2 = 1972, 3 = 1973

SULFUR OXIDE CONCENTRATIONS

AIR COMPLIANCE MONITORING

SITE: Hartford Northeast Utilities

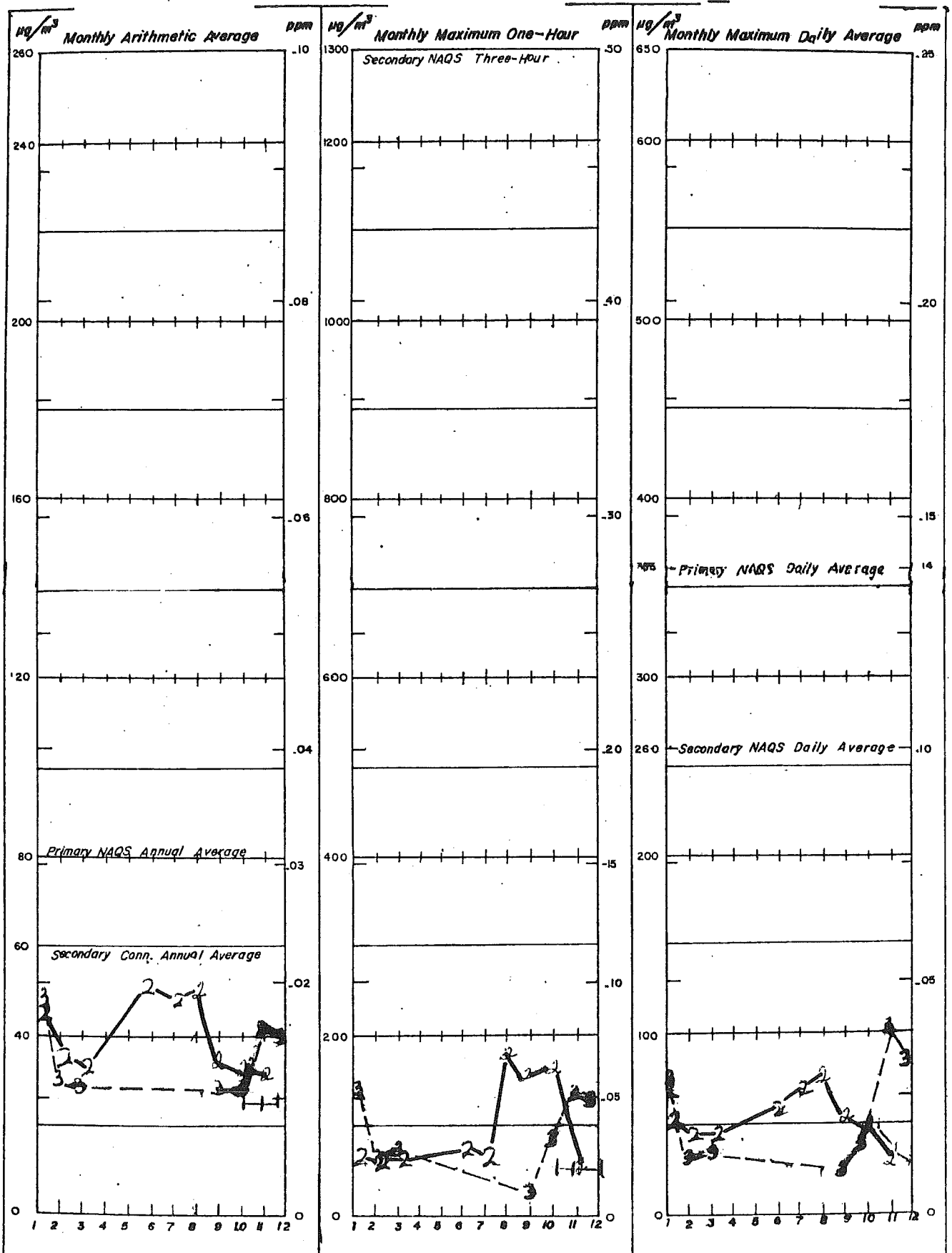


DATA POINT SYMBOLS: 1 = 1971, 2 = 1972, 3 = 1973

SULFUR OXIDE CONCENTRATIONS Northeast Utilities

AIR COMPLIANCE MONITORING

SITE: Middle Haddam School House Lane

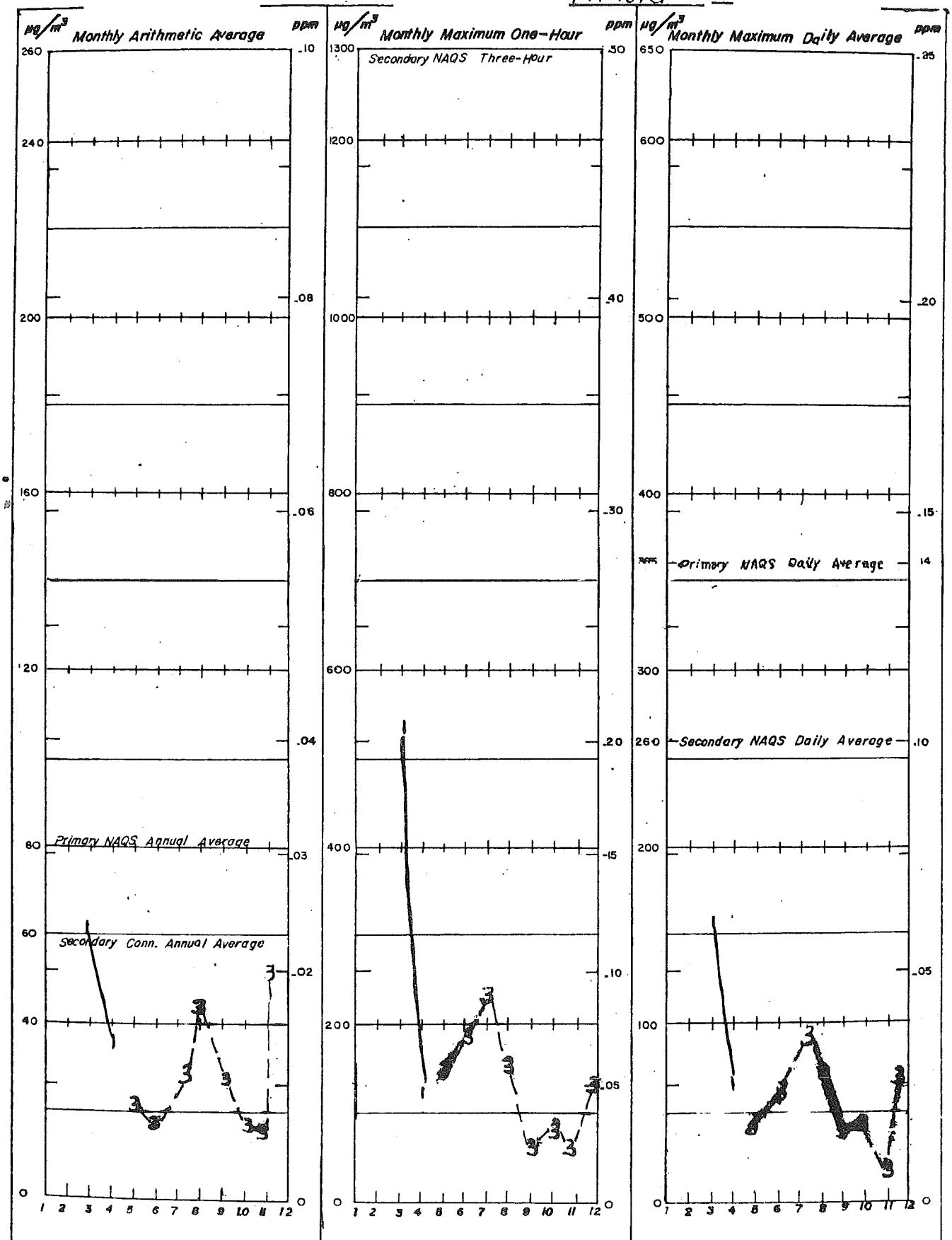


DATA POINT SYMBOLS: 1 = 1971, 2 = 1972, 3 = 1973

SULFUR OXIDE CONCENTRATIONS

AIR COMPLIANCE MONITORING

SITE: Milford C2

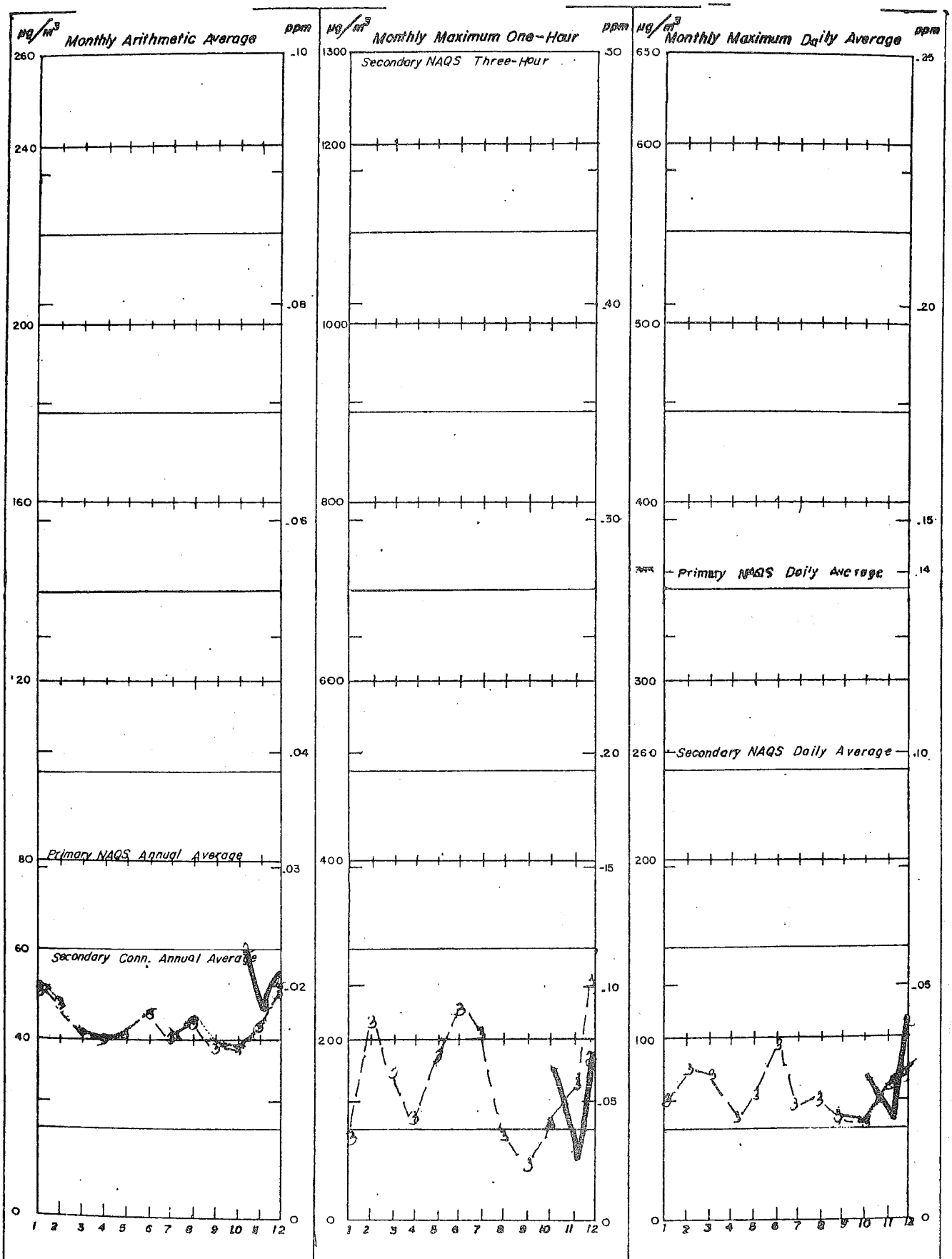


DATA POINT SYMBOLS: 1 = 1971, 2 = 1972, 3 = 1973

SULFUR OXIDE CONCENTRATIONS

AIR COMPLIANCE MONITORING

SITE: Montville Northeast Utilities



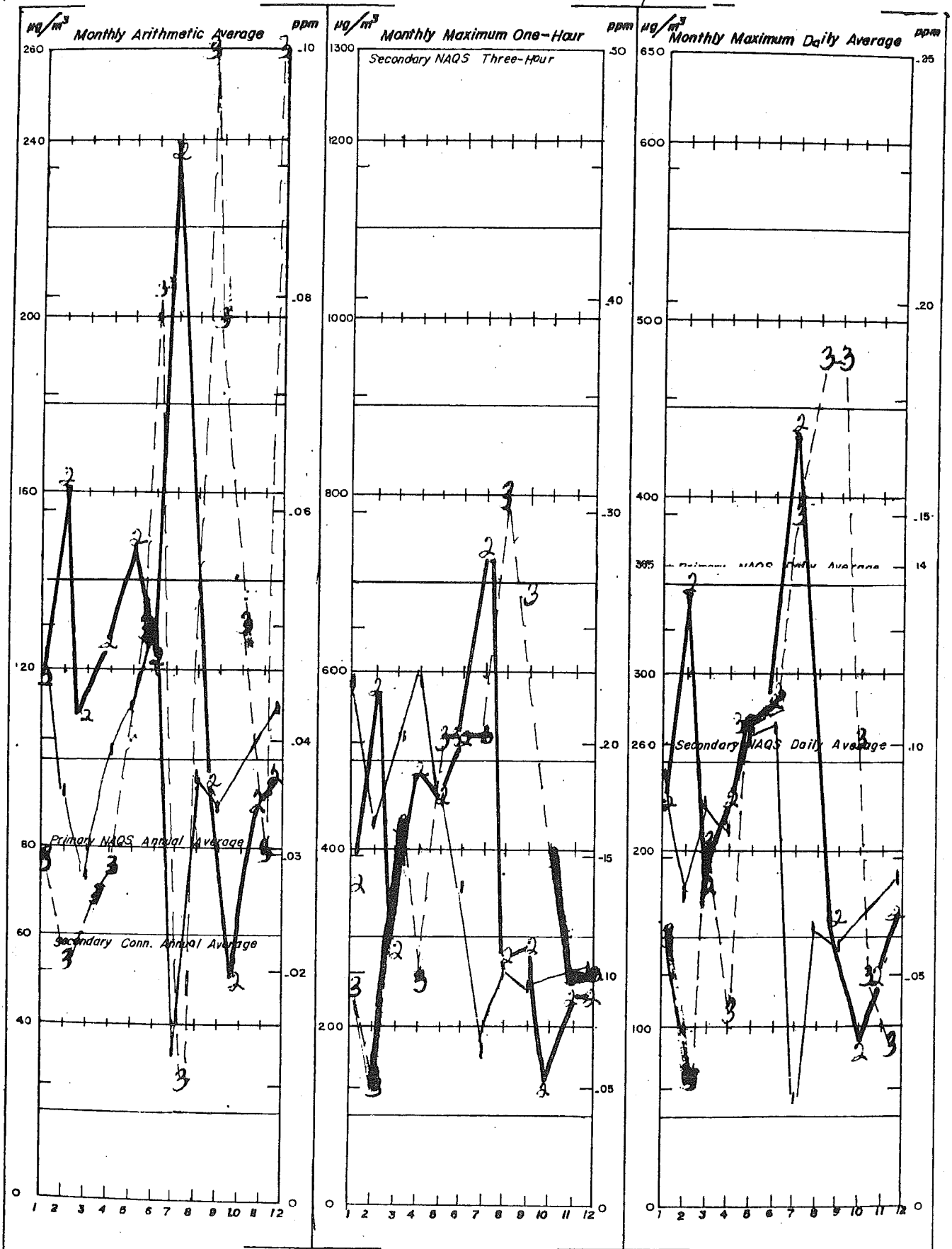
DATA POINT SYMBOLS: 1 = 1971, 2 = 1972, 3 = 1973

CONNECTICUT DEPARTMENT OF
ENVIRONMENTAL PROTECTION

SULFUR OXIDE CONCENTRATIONS

AIR COMPLIANCE MONITORING

SITE: New Britain 02

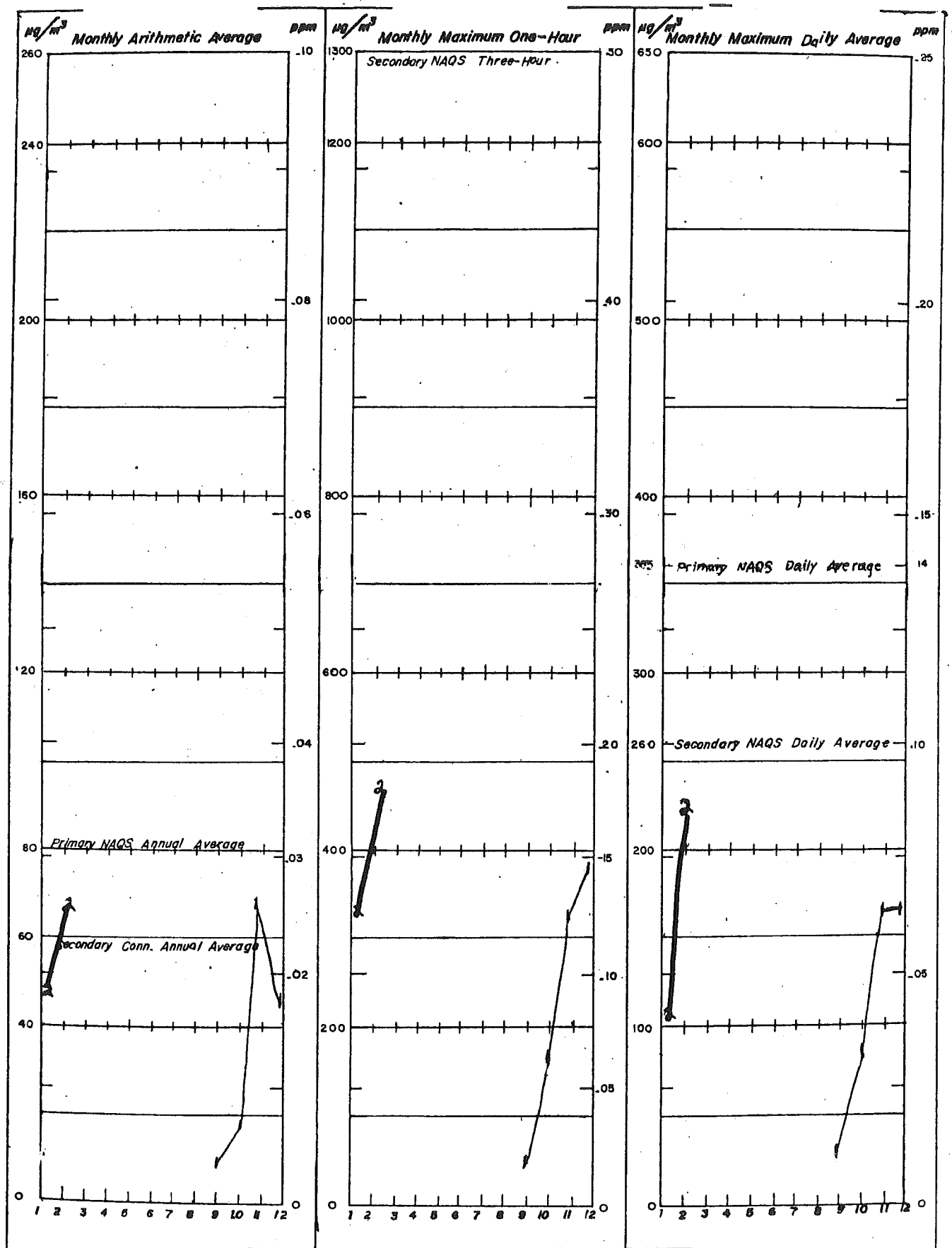


DATA POINT SYMBOLS: 1 = 1971, 2 = 1972, 3 = 1973

SULFUR OXIDE CONCENTRATIONS

AIR COMPLIANCE MONITORING

SITE: New Haven - 04.

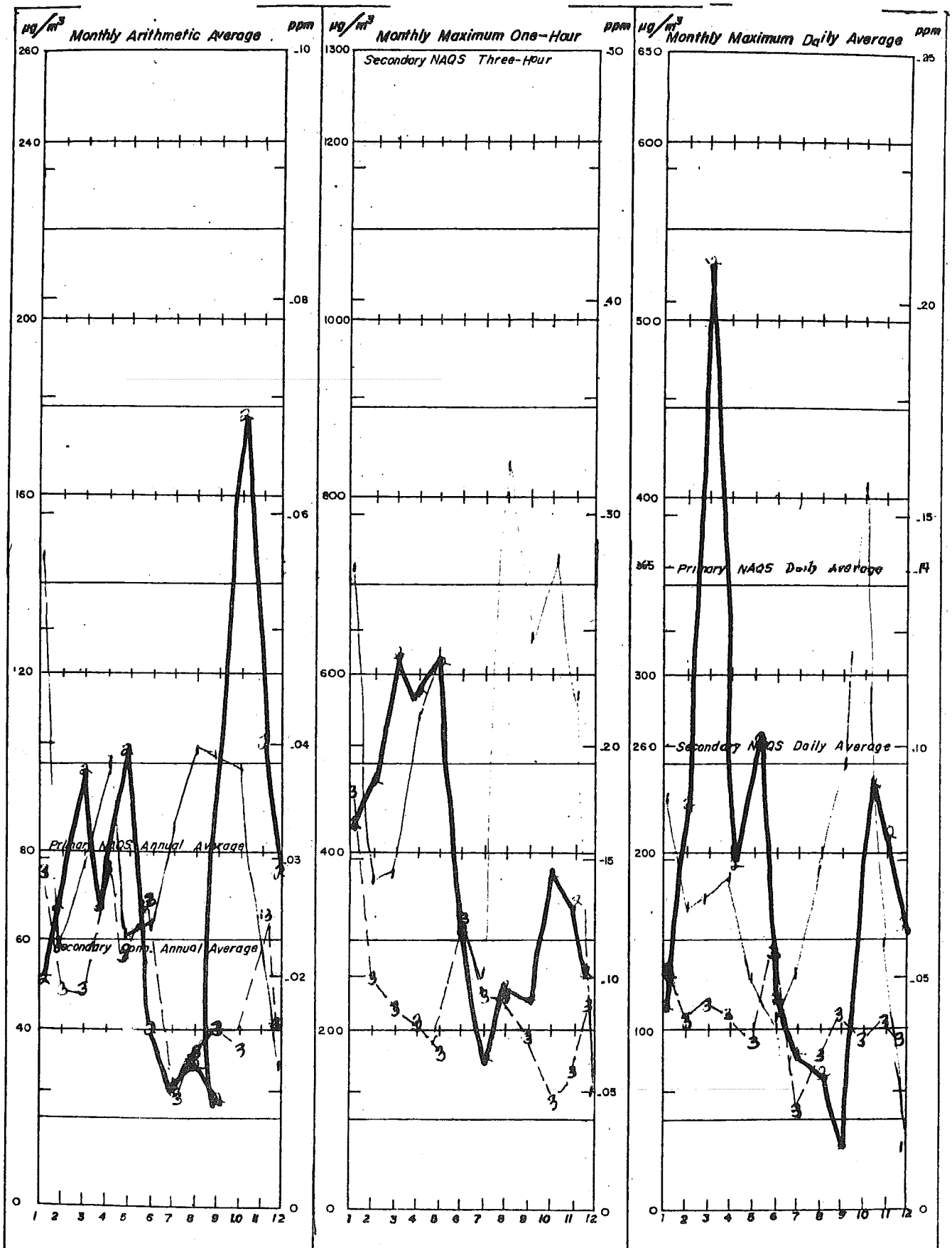


DATA POINT SYMBOLS: 1 = 1971, 2 = 1972, 3 = 1973

SULFUR OXIDE CONCENTRATIONS

AIR COMPLIANCE MONITORING

SITE: New Haven 04

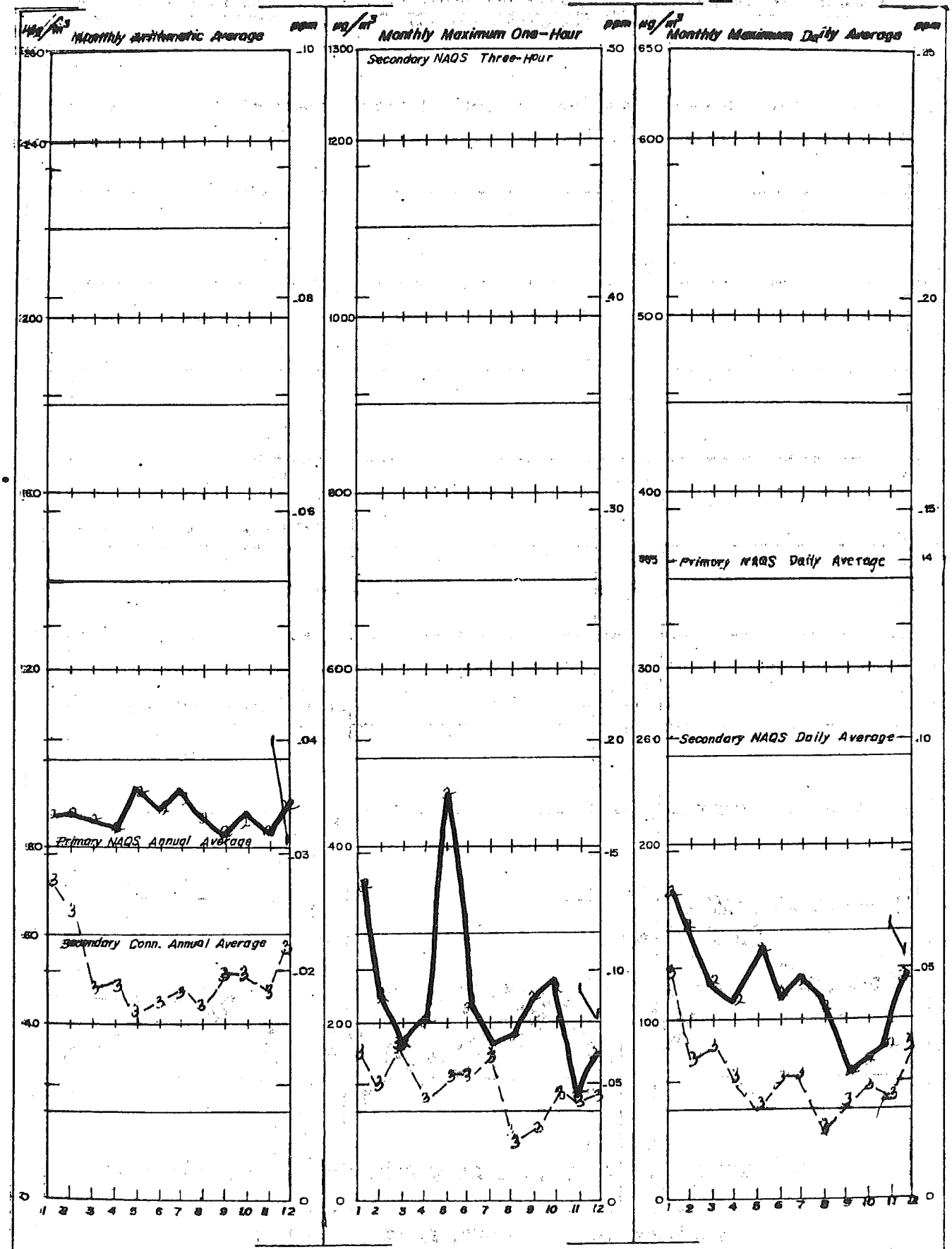


DATA POINT SYMBOLS: 1 = 1971, 2 = 1972, 3 = 1973

SULFUR OXIDE CONCENTRATIONS Northeast Utilities

SITE: Middletown Summer St

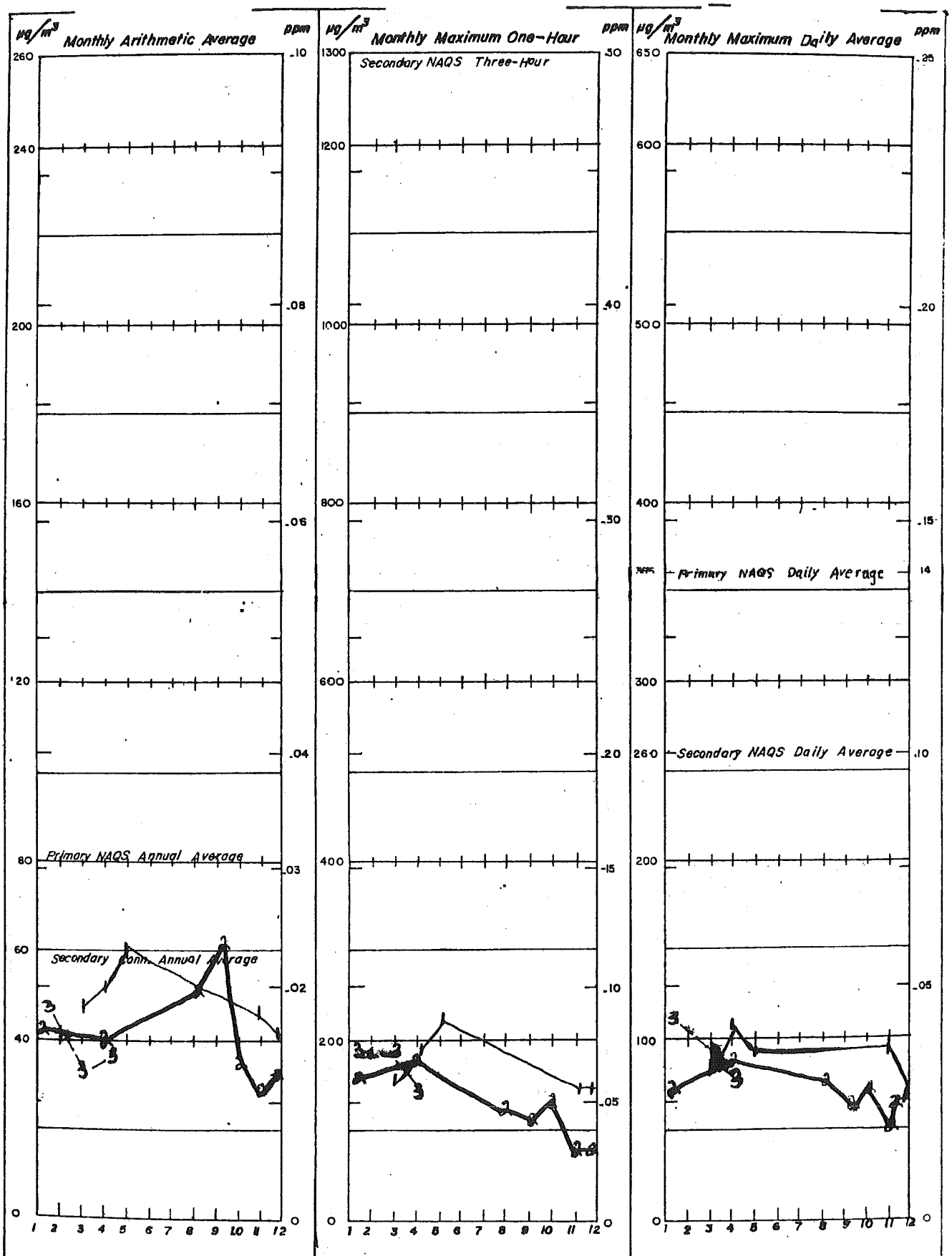
AIR COMPLIANCE MONITORING



SULFUR OXIDE CONCENTRATIONS

AIR COMPLIANCE MONITORING

SITE: New Haven - 08

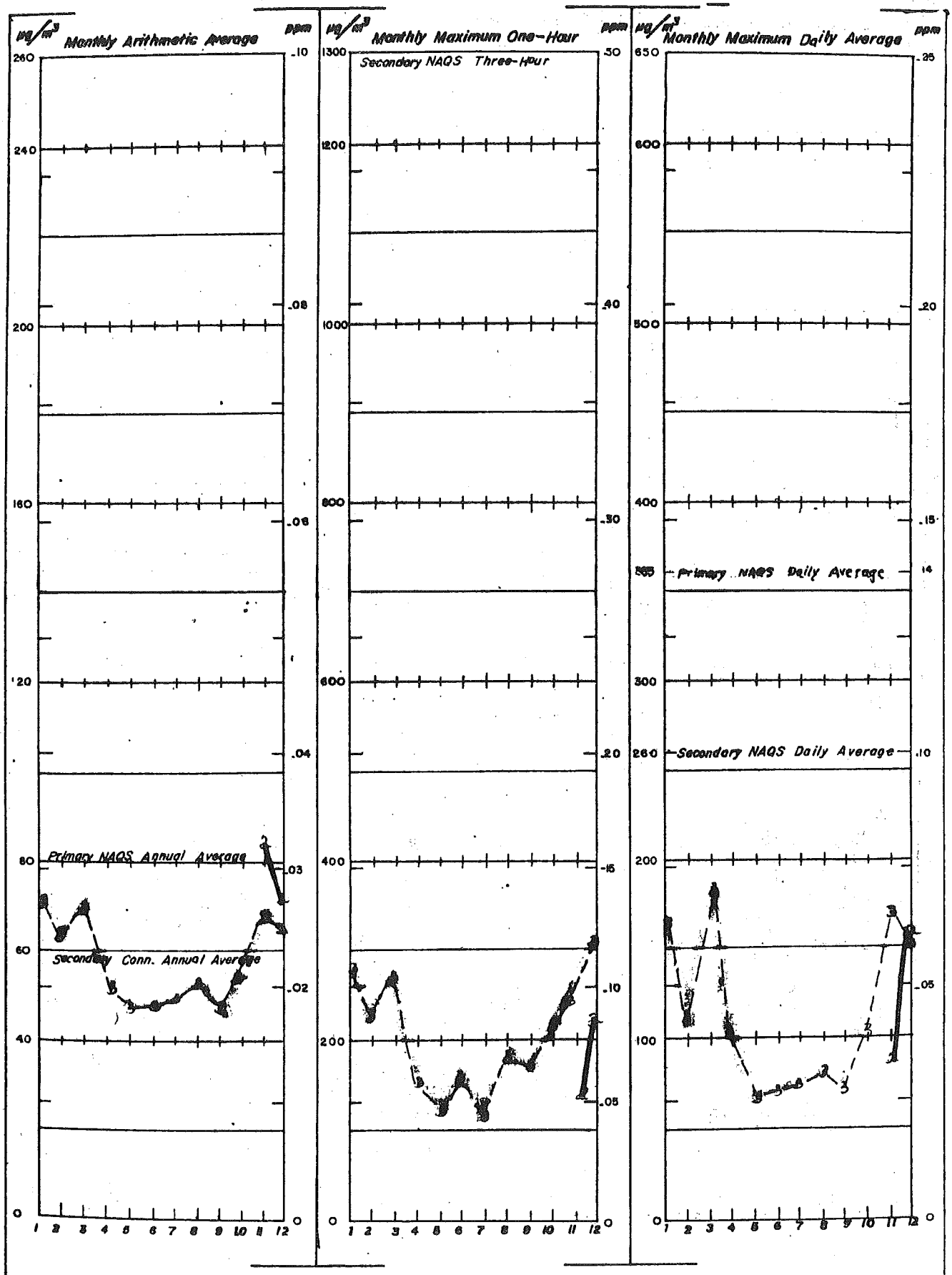


DATA POINT SYMBOLS: 1 = 1971, 2 = 1972, 3 = 1973

SULFUR OXIDE CONCENTRATIONS

AIR COMPLIANCE MONITORING

SITE: Norwalk Northeast Utilities

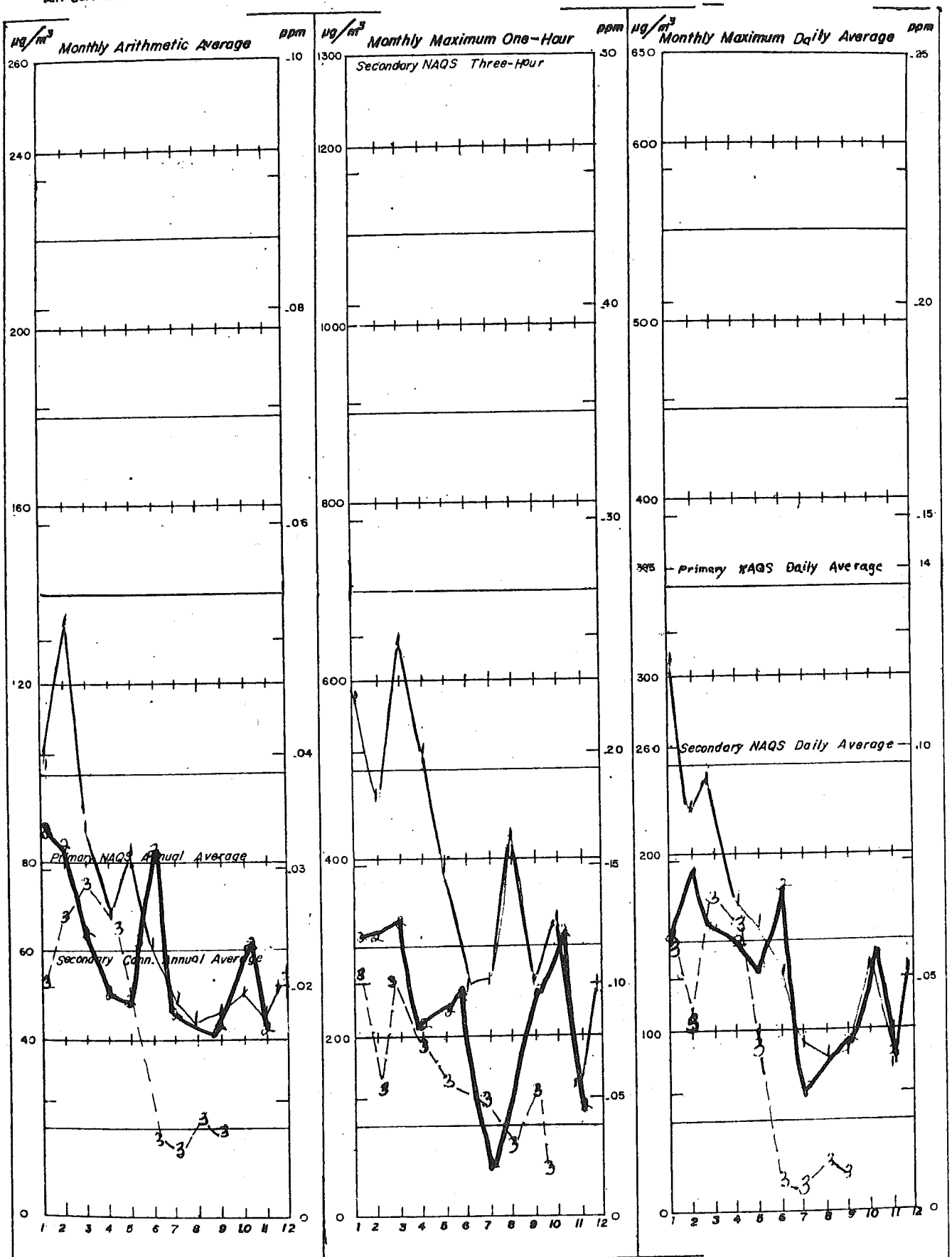


DATA POINT SYMBOLS: 1 = 1971, 2 = 1972, 3 = 1973

SULFUR OXIDE CONCENTRATIONS

AIR COMPLIANCE MONITORING

SITE: Norwalk 05

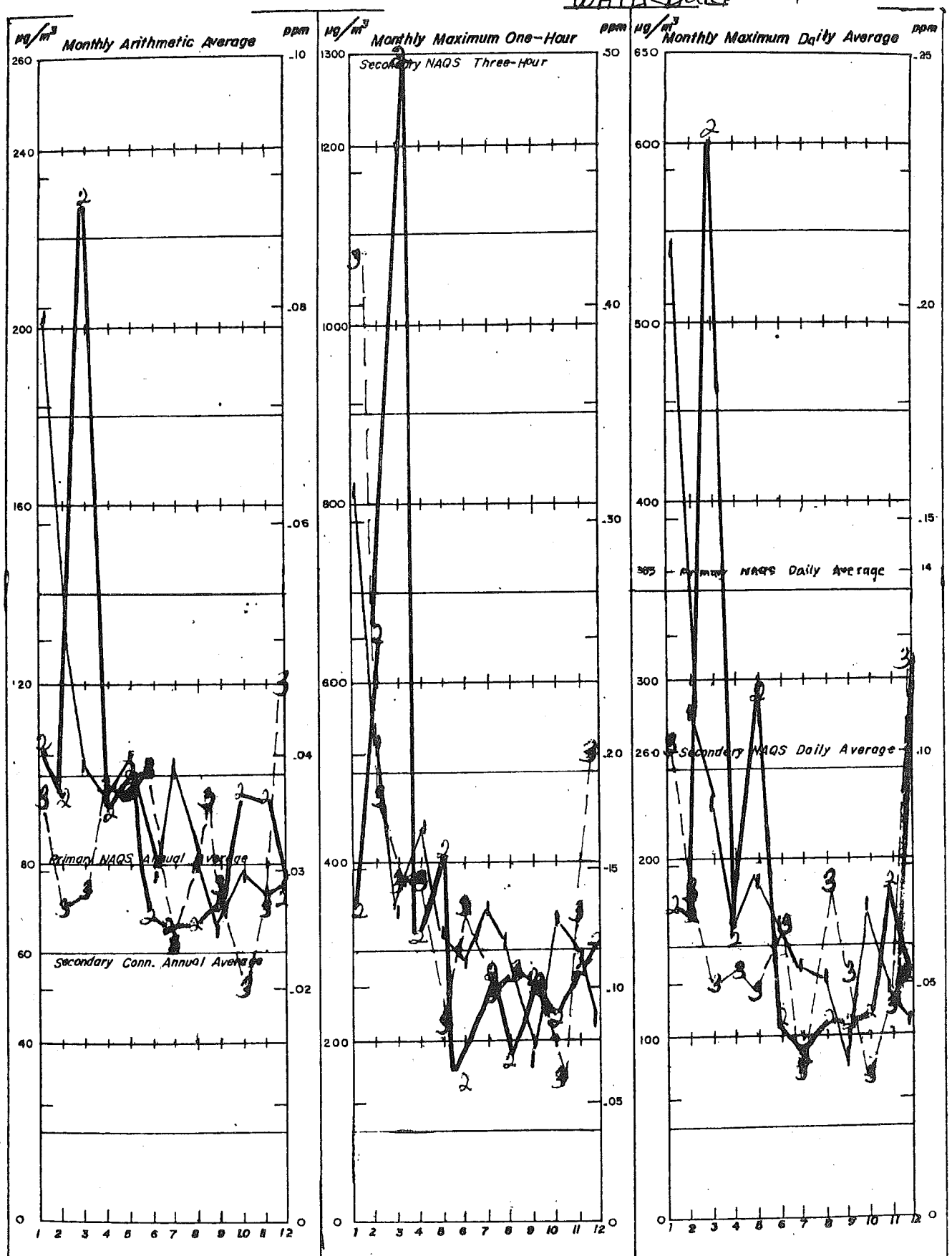


DATA POINT SYMBOLS: 1 = 1971, 2 = 1972, 3 = 1973

SULFUR OXIDE CONCENTRATIONS

AIR COMPLIANCE MONITORING

SITE: WATERBURY 01

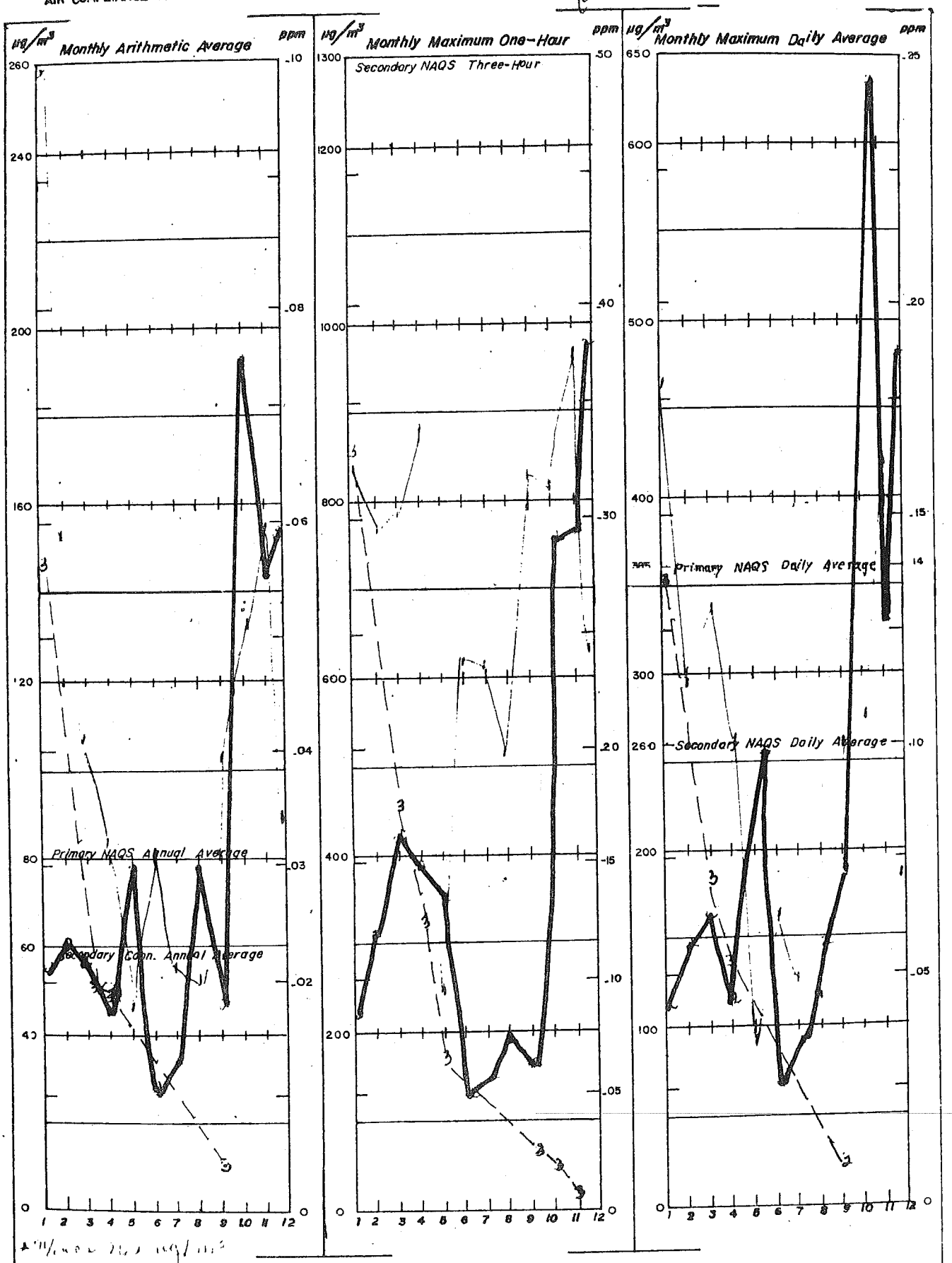


DATA POINT SYMBOLS: 1 = 1971, 2 = 1972, 3 = 1973

SULFUR OXIDE CONCENTRATIONS

AIR COMPLIANCE MONITORING

SITE: Stamford 03 Dellmitted

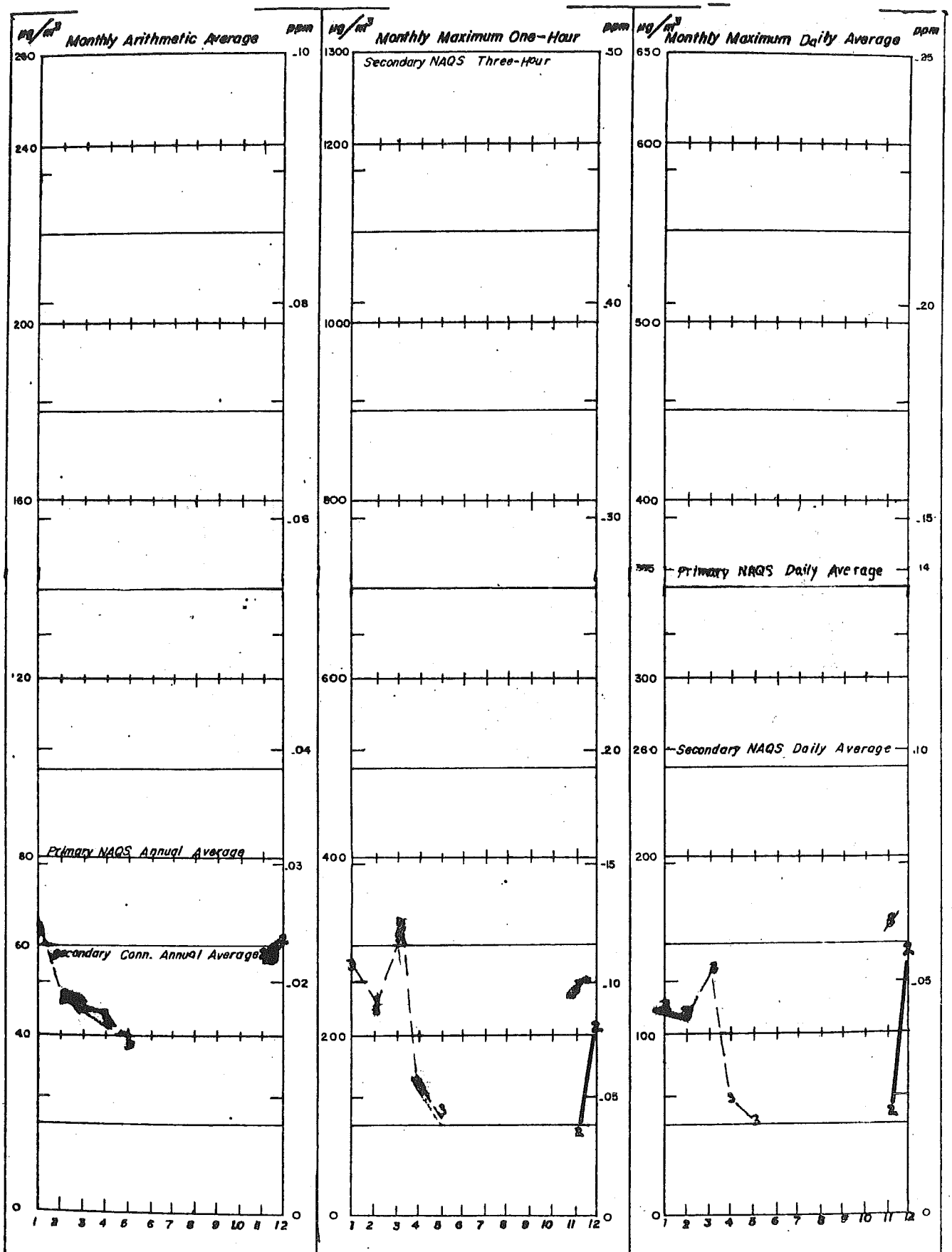


DATA POINT SYMBOLS: 1 = 1971, 2 = 1972, 3 = 1973

SULFUR OXIDE CONCENTRATIONS

AIR COMPLIANCE MONITORING

SITE: Stratford Northeast Utilities

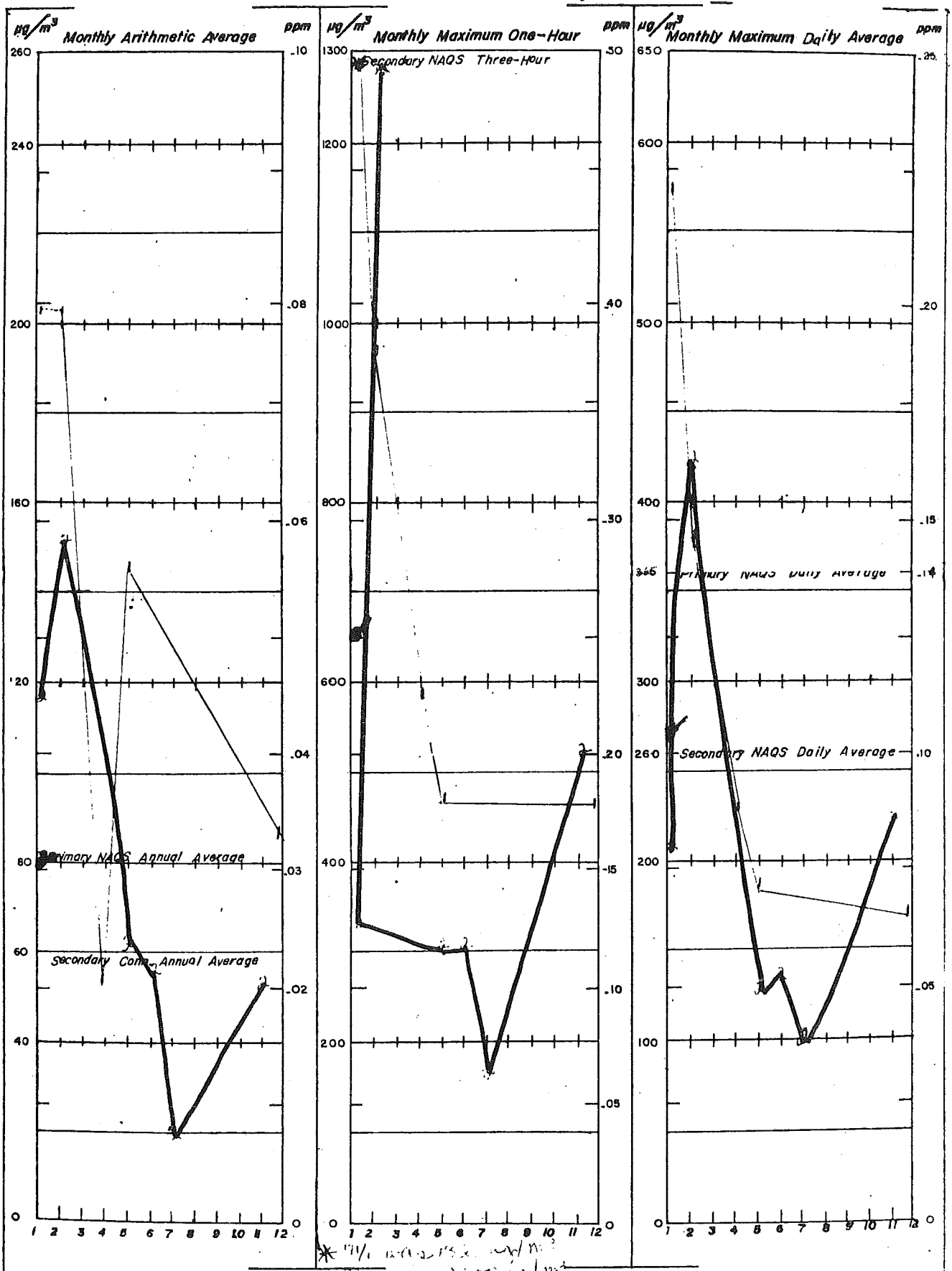


DATA POINT SYMBOLS: 1 = 1971, 2 = 1972, 3 = 1973

SULFUR OXIDE CONCENTRATIONS

AIR COMPLIANCE MONITORING

SITE: Stamford 03 Mill



DATA POINT SYMBOLS: 1 = 1971, 2 = 1972, 3 = 1973

B. NITROGEN OXIDES

In early 1973, the Connecticut Department of Environmental Protection began an extensive oxides of nitrogen monitoring program. The equipment used is a "bubbler" mechanism which draws ambient air through a solution of NaOH for twenty-four hours. The sample is later analyzed in the laboratory (Christie method) to give a twenty-four hour average concentration. The samplers are operated every sixth day at thirty-five locations around the state. At only three locations - one each in Bridgeport, Norwalk, and Greenwich - were NO_x levels near or above the annual average standard of 100 ug/m^3.

The data is summarized and an estimate of the mean and standard geometric deviation is made. Under the assumption of a lognormal probability distribution function the probability of exceeding the Connecticut 24-hour emergency episode standards was calculated. The Connecticut Nitrogen Oxide, Stage-2 Warning standard is 282 ug/m^3, and the Stage-3 Alert standard is 565 ug/m^3.

The probability calculation is further explained in Appendix A. On the following report, it is expressed as a percent.

AIR COMPLIANCE MONITORING

POLLUTANT-- NITROGEN OXIDES DISTRIBUTION-- LOGNORMAL

TOWN	SITE	YEAR	MEAN	STD GEOM DEV	PERCENT OVER 282 UG/M3	PERCENT OVER 565 UG/M3
BRIDGEPORT	003	73	103.9655	1.3877	.1299	.0000
BRISTOL	001	73	50.5000	1.5333	.0000	.0000
BRISTOL	002	73	36.6842	1.1764	.0000	.0000
BRISTOL	003	73	43.2105	1.4047	.0000	.0000
BRISTOL	004	73	54.0000	1.1403	.0000	.0000
BURLINGTON	001	73	13.3877	2.7500	.1299	.0099
COLCHESTER	001	73	44.8181	1.6904	.0199	.0000
DANBURY	001	73	35.2800	1.6388	.0000	.0000
EASTHARTFORD	001	73	60.6000	1.1451	.0000	.0000
EASTHARTFORD	002	73	41.7500	1.1707	.0000	.0000
GREENWICH	001	73	98.6071	1.9375	5.4799	.4699
GREENWICH	004	73	69.3725	1.6140	.1899	.0000
GROTON	001	73	43.8461	1.8000	.0699	.0000
HARTFORD	002	73	63.0571	1.2222	.0000	.0000
KENT	001	73	15.0689	2.0000	.0000	.0000
LITCHFIELD	001	73	41.4313	1.7428	.0199	.0000
MANSFIELD	001	73	22.2222	1.6666	.0000	.0000
MIDDLETOWN	003	73	50.3000	1.5625	.0000	.0000
MILFORD	001	73	45.6666	2.7727	3.5899	.6199
MILFORD	002	73	83.0000	1.0000	.0000	.0000
MILFORD	006	73	38.5833	1.5405	.0000	.0000
NAUGATUCK	001	73	66.8541	1.6206	.1299	.0000
NEW BRITAIN	002	73	53.8750	1.1886	.0000	.0000
NEW HAVEN	001	73	61.9444	1.4354	.0000	.0000

POLLUTANT-- NITROGEN OXIDES DISTRIBUTION-- LOGNORMAL

TOWN	SITE	YEAR	MEAN	STD GEOM DEV	PERCENT OVER 282 UG/M3	PERCENT OVER 565 UG/M3
NORWALK	005	73	106.6833	1.5934	1.7899	.0199
NORWICH	001	73	59.5098	1.8148	.4699	.0099
OLD SAYBROOK	002	73	58.9375	1.3620	.0000	.0000
PUTNAM	002	73	42.6818	2.0857	.4699	.0199
STAMFORD	003	73	79.9433	2.5438	8.0799	1.7899
STRATFORD	005	73	74.9245	1.8500	1.3899	.0499
TORRINGTON	001	73	51.1568	1.8461	.2599	.0000
VOLUNTOWN	001	73	22.9607	2.3125	.1299	.0099
WATERBURY	001	73	61.7586	1.4032	.0000	.0000
WINDHAM	001	73	54.0000	1.4500	.0000	.0000

C. PARTICULATE MATTER

The suspended particulate network is the oldest and most stable of the pollutant measuring networks operated by the Connecticut DEP and its predecessor, the Environmental Health Services Division of the Department of Health. Current locations of the sampling units are listed in Part III. Annual means are reported for 66 sites in 1973, 53 sites in 1972, and 55 sites in 1971. Of the 53 sites reported in both 1972 and 1973, 43 sites showed improvement.

Sampling Method. Suspended particulate matter is collected by drawing ambient air through an 8" by 10" glass fiber filter by means of a high volume vacuum motor. The motor is operated for a 24-hour period, the total volume of air drawn through the filter is calculated, and the filter weighed in the laboratory. The increase in filter weight divided by the total volume of air equals the average ambient concentration of particulate matter in the area.

The instruments are operated every sixth day from midnight to midnight, the filter is removed the next day and either carried or mailed to the laboratory for analysis.

Particulate Report. The computer report that follows is further explained in Appendix A. The 24-hour National Ambient Air Quality Standards are for the Secondary, 150 $\mu g/m^3$, and for Primary, 260 $\mu g/m^3$. The units for the mean is also micrograms per cubic meter.

POLLUTANT-- PARTICULATES DISTRIBUTION-- LOGNORMAL

TOWN	SITE	YEAR	MEAN	STD GEOM DEV	PERCENT OVER 150 UG/M3	PERCENT OVER 260 UG/M3
ANSONIA	001	71	151.8181	1.3805	50.0000	4.4599
ANSONIA	003	71	123.3000	1.5940	34.4599	5.4799
ANSONIA	003	72	89.6610	1.3483	4.4599	.0199
ANSONIA	003	73	66.2982	1.8148	8.0799	1.0699
BERLIN	001	73	42.8727	1.5833	.3499	.0000
BRIDGEPORT	001	71	62.6666	1.5471	2.2699	.0499
BRIDGEPORT	001	72	63.8500	1.4655	1.3899	.0099
BRIDGEPORT	001	73	48.8813	1.6046	.8199	.0199
BRIDGEPORT	002	72	121.7000	2.5538	42.0699	21.1899
BRIDGEPORT	002	73	62.8474	1.7307	5.4799	.4699
BRISTOL	001	71	56.5600	1.3333	.0299	.0000
BRISTOL	001	72	56.8035	1.3962	.1899	.0000
BRISTOL	001	73	59.0000	1.6981	3.5899	.2599
BRISTOL	002	71	89.0000	1.0000	.0000	.0000
BRISTOL	002	72	98.0000	1.2528	2.8699	.0000
BRISTOL	002	73	31.8421	1.9583	1.0699	.0999
BRISTOL	003	73	42.2105	1.6500	.6199	.0199
BRISTOL	004	73	56.4444	1.6458	2.2699	.0999
BRISTOL	009	72	50.0000	1.4390	.1299	.0000
BURLINGTON	001	73	34.9259	2.1481	2.8699	.4699
DANBURY	001	71	89.0000	2.2363	27.4299	9.6799
DANBURY	001	72	91.0000	1.4431	8.0799	.1899
DANBURY	001	73	67.7368	2.0943	13.5699	3.5899
ENFIELD	001	71	90.5909	1.6250	15.8699	1.3899
ENFIELD	001	72	88.3157	1.5925	13.5699	1.0699
ENFIELD	001	73	62.3000	1.8363	8.0799	.8199
ENFIELD	002	72	51.0000	1.1600	.0000	.0000
ENFIELD	004	72	53.5000	3.1153	18.4099	8.0799
ENFIELD	004	73	46.5000	1.5833	.6199	.0099
FAIRFIELD	002	71	86.4528	1.6969	15.8699	1.7899
FAIRFIELD	002	72	47.8269	1.3809	.0199	.0000
FAIRFIELD	002	73	45.1111	1.1860	.0000	.0000

POLLUTANT-- PARTICULATES DISTRIBUTION-- LOGNORMAL

TOWN	SITE	YEAR	MEAN	STD GEOM DEV	PERCENT OVER 150 UG/M3	PERCENT OVER 260 UG/M3
GREENWICH	001	72	65.4000	1.5384	2.8699	.0699
GREENWICH	001	73	50.9090	1.6511	1.3899	.0499
GREENWICH	002	71	65.2692	1.5666	2.8699	.0999
GREENWICH	002	72	70.0500	1.6949	8.0799	.6199
GREENWICH	002	73	64.9824	1.6727	5.4799	.3499
GREENWICH	003	71	61.6181	1.4067	.4699	.0000
GREENWICH	003	72	62.0166	1.4098	.4699	.0000
GREENWICH	003	73	56.7758	1.7500	4.4599	.3499
GREENWICH	004	73	49.4680	1.6904	1.7899	.0699
GREENWICH	007	71	50.2857	1.3265	.0000	.0000
GREENWICH	007	72	46.1833	1.6585	1.0699	.0299
GREENWICH	007	73	40.6250	1.7575	1.0699	.0499
GREENWICH	008	71	81.4400	1.6231	9.6799	.8199
GREENWICH	008	72	77.4210	1.4189	2.8699	.0199
GREENWICH	008	73	70.5932	1.5081	3.5899	.0699
GROTON	001	71	95.9622	1.7058	21.1899	2.8699
GROTON	001	72	53.2142	1.8222	4.4599	.4699
GROTON	001	73	38.8888	1.7666	.8199	.0499
HARTFORD	002	71	86.0000	1.0000	.0000	.0000
HARTFORD	002	73	56.4000	1.5000	.8199	.0099
HARTFORD	003	71	89.9500	1.3647	5.4799	.0299
HARTFORD	003	73	86.8787	1.3255	2.8699	.0000
HARTFORD	004	71	127.3333	1.7573	38.2099	9.6799
HARTFORD	004	72	56.4390	1.6458	2.2699	.0999
HARTFORD	004	73	55.6734	1.4444	.3499	.0000
HARTFORD	005	71	140.0000	2.4725	46.0199	24.1999
HARTFORD	005	73	55.0000	1.0000	.0000	.0000
HARTFORD	006	73	61.0000	1.0000	.0000	.0000
KENT	001	73	46.0357	3.0000	13.5699	5.4799
MANCHESTER	001	71	90.7600	1.4431	8.0799	.1899
MANCHESTER	001	73	50.5600	1.8536	3.5899	.3499
MANSFIELD	001	71	49.1657	1.5555	.6199	.0099
MANSFIELD	001	72	56.7407	2.3953	13.5699	4.4599
MANSFIELD	001	73	23.4000	1.2608	.0000	.0000

POLLUTANT-- PARTICULATES DISTRIBUTION-- LOGNORMAL

TOWN	SITE	YEAR	MEAN	SIG GEOM DEV	PERCENT OVER 150 UG/M3	PERCENT OVER 260 UG/M3
MERIDEN	001	71	44.7843	1.7567	1.7899	.0999
MERIDEN	001	72	78.3888	1.3513	1.3899	.0000
MERIDEN	001	73	69.5555	1.8214	9.6799	1.3899
MERIDEN	002	71	120.7931	1.4408	27.4299	1.7899
MERIDEN	002	72	91.8166	1.6913	18.4099	2.2699
MERIDEN	002	73	77.5892	1.8906	15.8699	2.8699
MERIDEN	003	71	101.6666	1.6575	21.1899	2.8699
MERIDEN	003	72	68.1296	1.5517	3.5899	.1299
MERIDEN	003	73	67.2631	1.8518	9.6799	1.3899
MERIDEN	005	71	185.9818	2.3430	61.7900	34.4599
MERIDEN	005	72	92.3137	1.7777	21.1899	3.5899
MERIDEN	005	73	71.8076	1.6551	6.6799	.4699
MERIDEN	006	71	123.9807	1.8571	38.2099	11.5099
MERIDEN	006	72	137.6981	2.4326	46.0199	24.1999
MERIDEN	006	73	61.1568	2.2888	13.5699	4.4599
MIDDLETOWN	001	71	40.2807	1.6216	.3499	.0000
MIDDLETOWN	001	72	54.6000	1.5306	.8199	.0099
MIDDLETOWN	001	73	61.1666	1.3606	.1899	.0000
MIDDLETOWN	002	72	17.0000	1.4375	.0000	.0000
MIDDLETOWN	003	71	74.6896	1.5072	4.4599	.1299
MIDDLETOWN	003	72	66.1583	1.4827	1.7899	.0199
MIDDLETOWN	003	73	62.9818	1.5000	1.7899	.0199
MIDDLETOWN	004	73	69.3265	2.3703	18.4099	6.6799
MIDDLETOWN	006	71	79.0000	1.0000	.0000	.0000
MILFORD	001	71	61.8363	1.7169	5.4799	.3499
MILFORD	001	72	57.6037	1.4905	.8199	.0099
MILFORD	001	73	47.2040	1.3333	.0000	.0000
MILFORD	002	71	72.8909	1.5151	4.4599	.0999
MILFORD	002	72	65.9622	1.3529	.3499	.0000
MILFORD	002	73	53.3888	1.4583	.3499	.0000
MILFORD	005	71	48.7800	1.6250	1.0699	.0299
MILFORD	006	71	45.8974	1.5365	.2599	.0000
MILFORD	006	72	55.8703	1.4423	.3499	.0000
MILFORD	006	73	46.2203	1.8000	2.2699	.1899

POLLUTANT-- PARTICULATES DISTRIBUTION-- LOGNORMAL

TOWN	SITE	YEAR	MEAN	STD GEOM DEV	PERCENT OVER 150 UG/M3	PERCENT OVER 260 UG/M3
MORRIS	001	72	39.7692	1.7058	.6199	.0199
MORRIS	001	73	36.7833	2.2142	3.5899	.6199
NAUGATUCK	001	71	93.8679	1.4193	9.6799	.1899
NAUGATUCK	001	72	86.3833	1.4868	8.0799	.2599
NAUGATUCK	001	73	80.9230	1.6575	11.5099	1.0699
NEW BRITAIN	001	71	82.1454	1.3902	3.5899	.0199
NEW BRITAIN	001	72	83.3888	1.4400	5.4799	.0999
NEW BRITAIN	001	73	72.5652	1.6792	8.0799	.6199
NEW BRITAIN	002	71	103.2631	1.3535	11.5099	.0999
NEW BRITAIN	002	72	96.3166	1.5357	15.8699	1.0699
NEW BRITAIN	002	73	88.1964	1.5000	9.6799	.3499
NEW BRITAIN	003	71	98.3793	1.6666	21.1899	2.8699
NEW BRITAIN	003	72	81.3500	1.8656	15.8699	2.8699
NEW BRITAIN	003	73	86.7719	1.7571	15.8699	2.8699
NEW BRITAIN	004	71	52.5090	1.4200	.1299	.0000
NEW BRITAIN	004	72	58.6000	1.5185	1.0699	.0199
NEW BRITAIN	004	73	59.1525	1.7551	4.4599	.4699
NEW BRITAIN	005	71	54.1403	1.3725	.0699	.0000
NEW BRITAIN	005	72	50.3333	2.0256	6.6799	1.0699
NEW BRITAIN	005	73	51.3448	1.6818	1.7899	.0999
NEW HAVEN	001	71	87.4833	1.4444	6.6799	.1299
NEW HAVEN	001	72	71.7833	1.3582	.8199	.0000
NEW HAVEN	001	73	58.4629	1.3157	.0299	.0000
NEW HAVEN	002	71	84.5833	1.4810	6.6799	.1899
NEW HAVEN	002	72	92.2166	1.5783	13.5699	1.0699
NEW HAVEN	002	73	72.2857	1.5735	5.4799	.2599
NEW HAVEN	003	71	56.4800	1.4444	.3499	.0000
NEW HAVEN	003	72	58.3333	1.4363	.4699	.0000
NEW HAVEN	003	73	46.9500	1.4772	.1299	.0000
NEW HAVEN	005	71	74.0500	1.4328	2.2699	.0199
NEW HAVEN	005	72	61.8000	1.4642	1.0699	.0099
NEW HAVEN	005	73	65.0000	1.6034	3.5899	.1899
NEW HAVEN	006	72	56.5000	1.3653	.0999	.0000
NEW HAVEN	007	71	57.0000	1.0000	.0000	.0000
NEW HAVEN	009	71	64.0166	1.3166	.0999	.0000

POLLUTANT-- PARTICULATES DISTRIBUTION-- LOGNORMAL

TOWN	SITE	YEAR	MEAN	STD GEOM DEV	PERCENT OVER 150 UG/M3	PERCENT OVER 260 UG/M3
NEW HAVEN	009	73	52.6666	1.6041	1.3899	.0299
NORWALK	001	71	64.7333	1.5438	2.8699	.0699
NORWALK	001	72	60.1500	1.4821	1.0699	.0099
NORWALK	001	73	58.1886	1.6600	2.8699	.1299
NORWALK	005	71	76.6666	1.3200	.8199	.0000
NORWALK	005	72	70.0166	1.4307	1.7899	.0099
NORWALK	005	73	69.8500	1.9074	11.5099	2.2699
NORWICH	001	71	70.3636	1.3043	.2599	.0000
NORWICH	001	72	67.5000	1.5079	2.8699	.0499
NORWICH	001	73	65.1132	1.7547	6.6799	.6199
OLD SAYBROOK	002	73	60.1333	1.2631	.0000	.0000
ORANGE	001	71	44.4186	1.3571	.0000	.0000
ORANGE	003	72	54.6600	2.0000	6.6799	1.3899
ORANGE	003	73	52.2500	1.8444	4.4599	.4699
PUTNAM	001	71	83.6666	1.5540	9.6799	.4699
PUTNAM	002	71	114.3269	1.4711	24.1999	1.7899
PUTNAM	002	72	59.4363	1.6862	3.5899	.2599
PUTNAM	002	73	51.2600	1.8292	3.5899	.3499
STAMFORD	001	71	98.4909	1.6516	21.1899	2.8699
STAMFORD	001	72	150.2708	1.8015	50.0000	18.4099
STAMFORD	001	73	107.4705	1.3980	15.8699	.4699
STAMFORD	003	71	146.1794	1.7481	50.0000	15.8699
STAMFORD	003	72	132.0833	1.5000	38.2099	4.4599
STAMFORD	004	71	65.1521	2.1730	13.5699	3.5899
STAMFORD	004	72	85.8510	1.4871	8.0799	.2599
STAMFORD	004	73	101.2187	2.1250	30.8499	9.6799
STAMFORD	010	71	126.7777	1.6929	38.2099	8.0799
STAMFORD	010	72	90.1914	1.6857	15.8699	2.2699
STAMFORD	010	73	68.7222	1.9655	11.5099	2.2699
STRATFORD	001	71	64.9375	2.0588	11.5099	2.8699
STRATFORD	001	72	52.2000	1.6041	1.3899	.0299
STRATFORD	001	73	58.1538	1.6041	2.2699	.0699
STRATFORD	002	71	82.7368	1.7424	13.5699	1.7899

POLLUTANT-- PARTICULATES DISTRIBUTION-- LOGNORMAL

TOWN	SITE	YEAR	MEAN	STD GEOM DEV	PERCENT OVER 150 UG/M3	PERCENT OVER 260 UG/M3
STRATFORD	005	73	62.6000	1.4655	1.0699	.0099
THOMASTON	001	71	23.0000	1.0000	.0000	.0000
THOMASTON	001	72	86.0000	1.0000	.0000	.0000
THOMASTON	003	71	86.7551	1.6883	15.8699	1.7899
THOMASTON	003	72	72.5333	1.5223	4.4599	.1299
THOMASTON	003	73	44.7543	1.7368	1.3899	.0699
TORRINGTON	001	71	105.1578	1.6875	24.1999	4.4599
TORRINGTON	001	72	75.5689	1.5217	5.4799	.1899
TORRINGTON	001	73	53.3220	2.0697	8.0799	1.3899
TORRINGTON	003	72	86.0000	1.0000	.0000	.0000
VERNON	001	71	45.0000	1.4117	.0199	.0000
VERNON	001	72	31.8571	1.0833	.0000	.0000
VOLUNTOWN	001	73	30.7458	2.0416	1.3899	.1299
WALLINGFORD	001	71	125.0000	1.0000	.0000	.0000
WALLINGFORD	001	72	97.0000	1.0000	.0000	.0000
WATERBURY	001	71	95.6140	1.5730	15.8699	1.3899
WATERBURY	001	72	88.6833	1.4705	8.0799	.2599
WATERBURY	001	73	85.7307	1.4933	8.0799	.2599
WATERBURY	002	71	70.2857	1.7118	8.0799	.8199
WATERBURY	005	71	77.5000	1.3898	2.2699	.0099
WATERBURY	009	71	49.6428	1.4545	.1299	.0000
WINCHESTER	001	71	62.6034	1.4561	1.0699	.0099
WINCHESTER	001	72	58.2708	1.4038	.2599	.0000
WINCHESTER	001	73	46.6428	1.9000	3.5899	.3499
WINDHAM	001	73	49.1600	1.2500	.0000	.0000

D. OZONE

Ozone (O_3), a major constituent of smog, has concentrations that are proportional to the intensity of incoming solar radiation. The concentrations are therefore higher in the summer with more direct sunlight, and higher during hours of the day closer to noon.

During the winter, the .08 ppm NAAQS standard is rarely approached; consequently some of the ozone monitoring instruments are not operated then. Generally, if the standard is exceeded on a given day, it is exceeded in early afternoon. On a monthly basis, the percent of days with one or more hourly averages over .08 ppm has been reported because it will give larger percents and a more accurate picture than the percent of one-hour averages over .08ppm.

The number of one-hour average Ozone concentrations in each of four ranges is tabulated. The endpoints of the ranges are based on the Ambient Air Quality Standards of .08 ppm for the NAAQS, Secondary and Primary Standard, of .10 ppm for the Connecticut Stage-2 Alert, and of .40 ppm for the Connecticut Stage-3 Warning. The .60 ppm Stage-4 Warning Standard was not exceeded in the data from 1971 to 1973.

In past years the neutral potassium iodide method for measurement of total oxidants was used to evaluate photochemical oxidant levels. The technique involves the drawing of ambient air through a solution of potassium iodide, the reaction of any oxidants in the air to form various potassium compounds, the concurrent releasing of free iodine. The free iodine causes current flow at a rate proportional to the amount of reaction of oxidants with potassium atoms.

It has become apparent that this method is subject to interference from both reducing agents and oxidizing agents and the data recorded is questionable. In 1972, therefore, the Connecticut DEP began using instruments employing the chemiluminescent method. First in Hartford in 1972, and then in several other suspected high oxidant regions around the state in 1973, Bendix chemiluminescent monitors were employed. These instruments react specifically to ozone. Ambient air is passed in the dark across the surface of a chemiluminescent or fluorescent substance such as Rhodamine B and light is emitted at an intensity proportional to ozone concentration. Numerous tests have shown this method to be a very accurate measure of oxidant levels.

CONNECTICUT DEPARTMENT OF ENVIRONMENTAL PROTECTION
Air Compliance - Monitoring Section

OZONE DATA

SITE Bridgeport 001

YEAR 1973

Number of 1-hour readings in each range

MONTH	# READINGS RECORDED	.00 to .079 PPM	.08 to .099 PPM	.10 to .399 PPM	.40 PPM or above	Max. 1-hour	% of days with any one hour reading over primary std. (.08 ppm)
01	0						
02	0						
03	0						
04	0						
05	0						
06	0						
07	108	92	4	12		.300	65%
08	684	578	31	75		.245	65%
09	694	675	10	9		.172	20%
10	225	225	0	0		.078	0%
11	0						
12	0						
The Year	1711	1570	45	96		.300	48%
		91.76%	2.63%	5.61%			

CONNECTICUT DEPARTMENT OF ENVIRONMENTAL PROTECTION
Air Compliance - Monitoring Section

OZONE DATA

SITE Greenwich 004

YEAR 1973

Number of 1-hour readings in each range

MONTH	# READINGS RECORDED	.00 to .079 PPM	.08 to .099 PPM	.10 to .399 PPM	.40 PPM or above	Max. 1-hour	% of days with any one hour reading over primary std. (.08 ppm)
01	0						
02	0						
03	0						
04	0						
05	0						
06	0						
07	516	389	37	90		.250	81.8%
08	744	617	35	92		.240	67.7%
09	708	663	25	20		.180	20.0%
10	646	636	10	0		.090	17.8%
11	490	490	0	0		.030	0%
12	563	563	0	0		.070	0%
The Year	3667	3358	107	202		.250	37.0%
		91.57%	2.91%	5.51%			

CONNECTICUT DEPARTMENT OF ENVIRONMENTAL PROTECTION
Air Compliance - Monitoring Section

OZONE DATA

SITE Hartford 002

YEAR 1973

Number of 1-hour readings in each range

MONTH	# READINGS RECORDED	.00 to .079 PPM	.08 to .099 PPM	.10 to .399 PPM	.40 PPM or above	Max. 1-hour	% of days with any one hour reading over primary std. (.08 ppm)
01	720	720				.04	0%
02	672	672				.02	0%
03	732	732				.06	0%
04	0						
05	732	732				.06	0%
06	720	716	3	1		.22	6.6%
07	744	739	3	2		.12	9.6%
08	648	633	15			12	22.5%
09	624	622	2			.09	6.6%
10	744	744				.04	0%
11	672	672				.02	0%
12	0						
The Year	7008	6982	23	3		.22	7.1%
		99.6%	.36%	.04%			

CONNECTICUT DEPARTMENT OF ENVIRONMENTAL PROTECTION
Air Compliance - Monitoring Section

OZONE DATA

SITE Middletown 004

YEAR 1973

Number of 1-hour readings in each range

MONTH	# READINGS RECORDED	.00 to .079 PPM	.08 to .099 PPM	.10 to .399 PPM	.40 PPM or above	Max. 1-hour	% of days with any one hour reading over primary std. (.08 ppm)
01	0						
02	0						
03	0						
04	0						
05	0						
06	0						
07	0						
08	0						
09	556	554	2			.090	6.6%
10	216	216	0			.060	0%
11	0						
12	0						
The Year	772	770	2			.090	3.3%
		99.74%	.26%				

CONNECTICUT DEPARTMENT OF ENVIRONMENTAL PROTECTION
Air Compliance - Monitoring Section

OZONE DATA

SITE New Haven 008

YEAR 1973

Number of 1-hour readings in each range

MONTH	# READINGS RECORDED	.00 to .079 PPM	.08 to .099 PPM	.10 to .399 PPM	.40 PPM or above	Max. 1-hour	% of days with any one hour reading over primary std. (.08 ppm)
01	0						
02	0						
03	0						
04	0						
05	0						
06	0						
07	432	353	32	47		.225	52.6%
08	660	493	39	128		.314	64.2%
09	718	695	9	14		.175	13.3%
10	227	227				.061	0%
11	0						
12	0						
The Year	2037	1768	80	189		.314	
		86.79%	3.93%	9.28%			

CONNECTICUT DEPARTMENT OF ENVIRONMENTAL PROTECTION
Air Compliance - Monitoring Section

OZONE DATA

SITE Stamford 019

YEAR 1973

Number of 1-hour readings in each range

MONTH	# READINGS RECORDED	.00 to .079 PPM	.08 to .099 PPM	.10 to .399 PPM	.40 PPM or above	Max. 1-hour	% of days with any one hour reading over primary std. (.08 ppm)
01	0						
02	0						
03	0						
04	0						
05	0						
06	0						
07	0						
08	254	183	27	44		.202	81.8%
09	719	675	24	20		.140	20.0%
10	742	737	5			.084	6.4%
11	253	253				.036	0%
12	0						
The Year	1968	1848	56	64		.202	23.6%
		93.90%	2.85%	3.25%			

CONNECTICUT DEPARTMENT OF ENVIRONMENTAL PROTECTION
Air Compliance - Monitoring Section

OZONE DATA

SITE Windsor 001

YEAR 1973

Number of 1-hour readings in each range

MONTH	# READINGS RECORDED	.00 to .079 PPM	.08 to .099 PPM	.10 to .399 PPM	.40 PPM or above	Max. 1-hour	% of days with any one hour reading over primary std. (.08 ppm)
01	0						
02	0						
03	0						
04	0						
05	0						
06	0						
07	738	725	10	3		.110	9.6%
08	732	716	9	7		.125	16.1%
09	720	718	2			.095	3.3%
10	254	254				.043	0%
11	0						
12	0						
The Year	2444	2413	21	10		.125	9.8%
		98.72%	.86%	.42%			

E. CARBON MONOXIDE

Data on carbon monoxide levels is relatively scant in Connecticut. Until very recently the air pollution agencies in Connecticut have concentrated on particulates and SO_x. Beginning in 1973 and reaching full strength in 1974, the carbon monoxide network is being expanded to twelve fixed sites plus several mobile units.

The Air Compliance Unit is concentrating on areas of fairly high traffic density for fixed CO monitoring in most cases, with a few background stations. At the existing urban sites, carbon monoxide levels have occasionally exceeded the one hour standard (35 ppm). Early data from the new sites in Bridgeport and Hartford indicate that the eight hour standard (9 ppm) will be exceeded on a few occasions in 1974.

The tables that follow summarize continuously monitored carbon monoxide data at the monthly level. For each month the number of observations recorded and the maximum one hour reading are reported. The computer programs do not yet calculate the maximum running eight-hour standard.

CONNECTICUT DEPARTMENT OF
ENVIRONMENTAL PROTECTION

AIR COMPLIANCE - MONITORING SECTION

SITE Greenwich 01

UNITS PPM

(NAAQS 1-Hour Standard 35 ppm)

CARBON MONOXIDE DATA

MONTH	1972 # READINGS RECORDED	1972 MAX. 1-hr. CONCENTRATION	1973 # READINGS RECORDED	1973 MAX 1-hr. CONCENTRATION
01			734	15.0
02			672	20.0
03	336	10.8	733	55.5
04	686	10.5	717	12.0
05	704	10.0	693	11.0
06	650	15.0	720	11.0
07	690	8.0	741	10.0
08			192	9.0
09	706	15.0		
10	720	10.0		
11	730	11.0	682	22.0
12	744	10.0	744	35.0
THE YEAR	5,966	15.0	6,628	55.5

CONNECTICUT DEPARTMENT OF
ENVIRONMENTAL PROTECTION

SITE Norwalk 05

AIR COMPLIANCE - MONITORING SECTION

UNITS PPM

(NAAQS 1-Hour Standard 35 ppm)

CARBON MONOXIDE DATA

MONTH	1972		1973	
	# READINGS RECORDED	MAX. 1-hr. CONCENTRATION	# READINGS RECORDED	MAX 1-hr. CONCENTRATION
01			662	22.5
02			583	16.0
03	360	23	678	30.0
04	640	23	708	11.0
05	568	27	618	10.0
06	506	50	670	9.5
07	120	23	557	6.8
08			737	8.0
09	720	55	254	9.0
10	744	20		
11	546	13.5		
12	682	18.5		
THE YEAR	4,886	50	5,467	30.0

CONNECTICUT DEPARTMENT OF
ENVIRONMENTAL PROTECTION

SITE Bridgeport 099

AIR COMPLIANCE - MONITORING SECTION

UNITS PPM

(NAAQS 1-Hour Standard 35 ppm)

CARBON MONOXIDE DATA

MONTH	1972		1973	
	# READINGS RECORDED	MAX. 1-hr. CONCENTRATION	# READINGS RECORDED	MAX 1-hr. CONCENTRATION
01				
02				
03				
04				
05				
06				
07				
08				
09				
10				
11				
12			696	30.0
THE YEAR				

CONNECTICUT DEPARTMENT OF
ENVIRONMENTAL PROTECTION

SITE Hartford 07

AIR COMPLIANCE - MONITORING SECTION

UNITS PPM

(NAAQS 1-Hour Standard 35 ppm)

CARBON MONOXIDE DATA

MONTH	1972		1973	
	# READINGS RECORDED	MAX. 1-hr. CONCENTRATION	# READINGS RECORDED	MAX 1-hr. CONCENTRATION
01				
02				
03				
04				
05				
06				
07				
08				
09				
10				
11				
12			242	9.0
THE YEAR				

F. WIND ROSES 1965-1972

Bridgeport Airport and Bradley Airport have recorded wind direction and speed for the years 1965-1972. These wind roses represent the probability that the wind would be blowing in each of the sixteen directions. Of course the wind can only have one direction at a time so the wind rose does not say that the wind is blowing in all of these directions at the same time.

The chart says rather, that when the wind was measured it happened to be blowing from each direction in the proportion indicated. In the long run the chart can be used to estimate the probability that at a given time the wind will be blowing in a given direction.

This is how the figures were developed. Wind direction was measured at 10 meters above the ground at three hour intervals during the time indicated on the face of the graph.

Let:

i = a wind direction, say a number from 1 to 16 for the directions North, North North East, North East, etc.

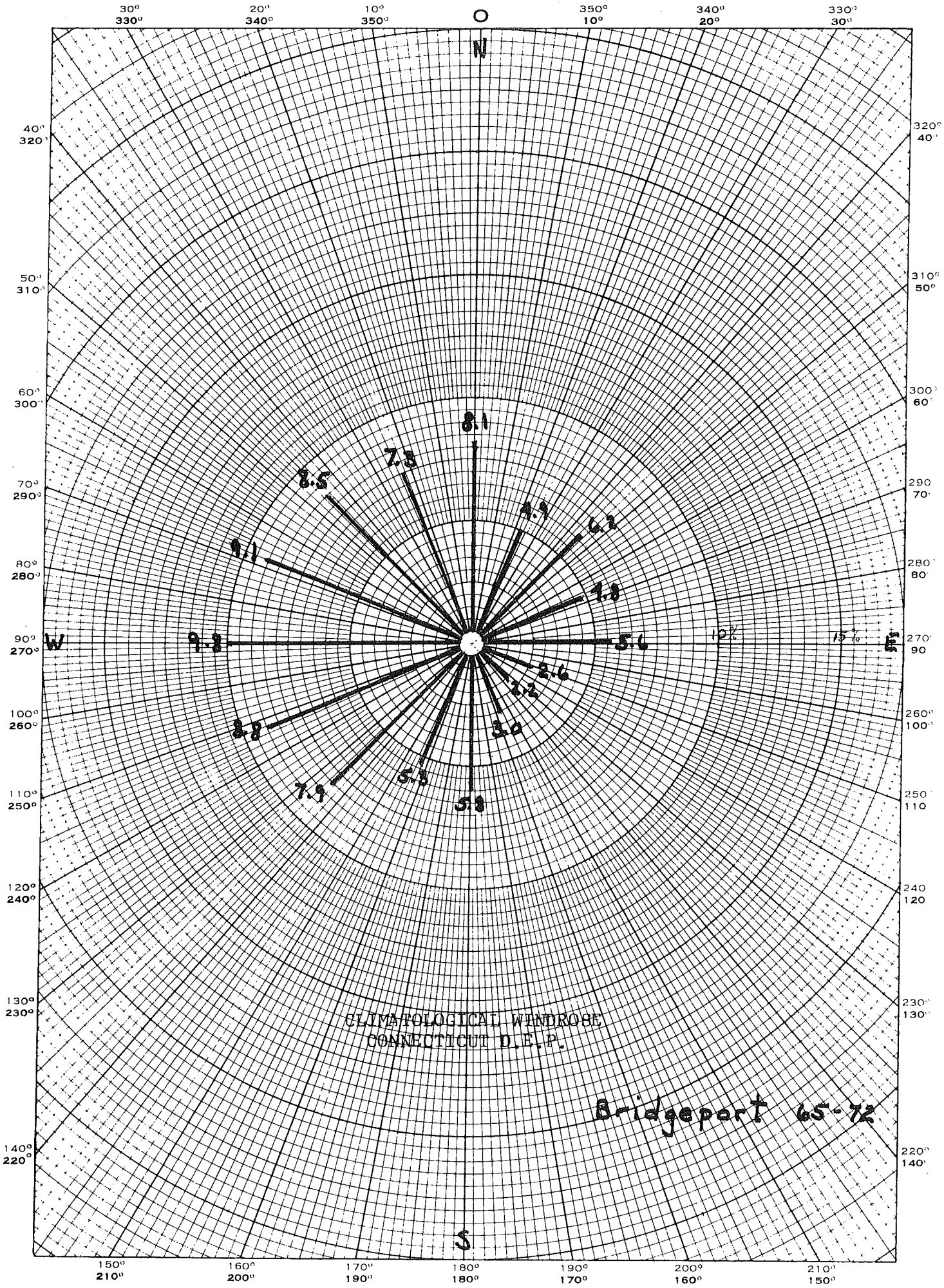
n_i = number of observations during the sample period in which the wind was blowing in direction i.

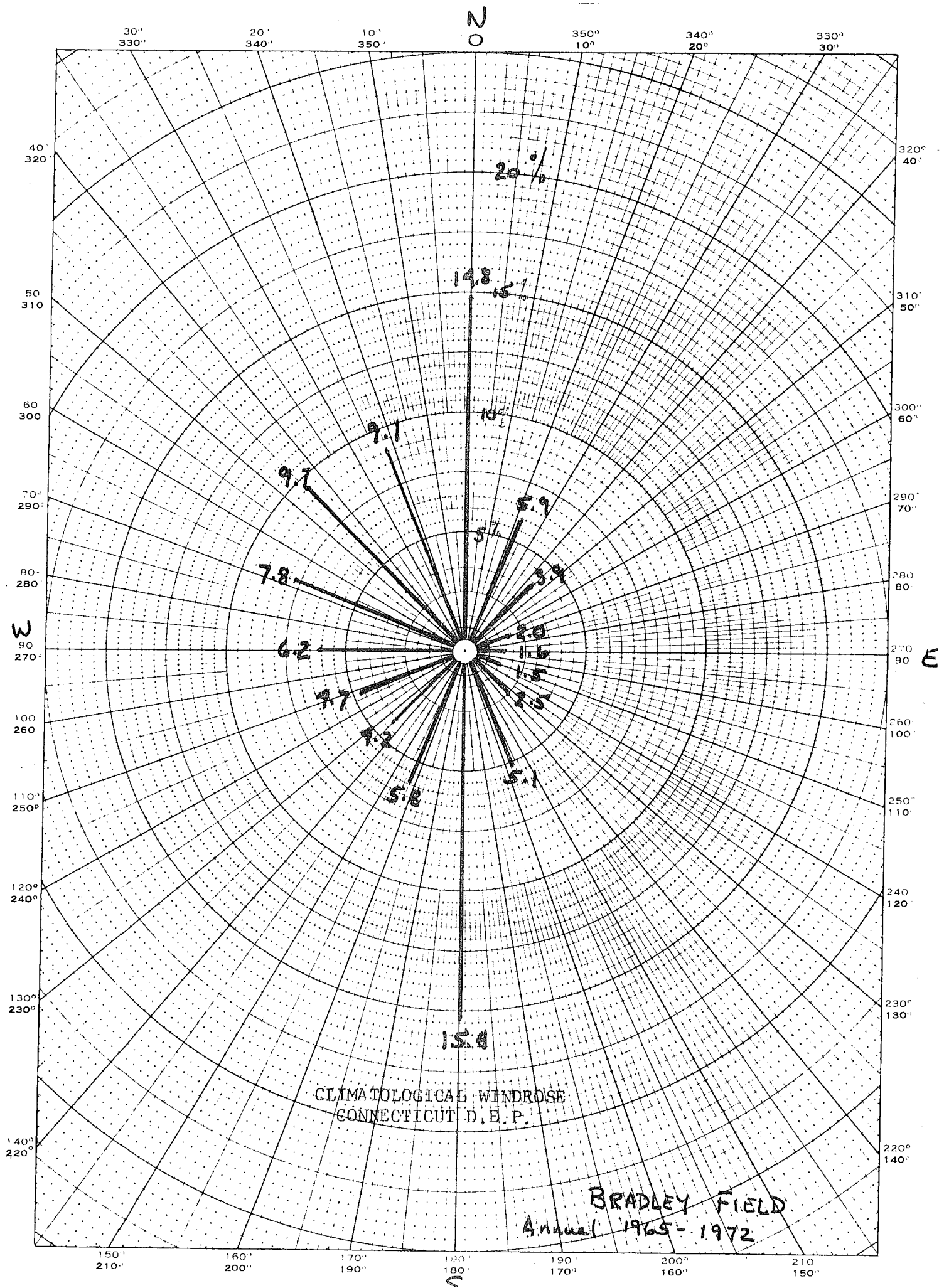
$N = n_1 + n_2 + \ldots + n_{16}$ = Total Number of observations.

$P = 100\left(\frac{n_i}{P}\right)$ = Percent of observations during which the wind was blowing in direction i.

The wind roses graph P_i for each direction i.

Note that $P_1 = P_2 = \ldots + P_{16} = 100\%$.


N
E
S
W
0°
30°
330°
20°
340°
10°
350°
40°
320°
50°
310°
60°
300°
70°
290°
80°
280°
90°
270°
100°
260°
110°
250°
120°
240°
130°
230°
140°
220°
150°
210°
160°
200°
170°
190°
180°
8.1
7.8
8.5
4.1
6.2
9.1
1.8
5.6
9.8
2.6
2.2
3.0
8.0
7.9
5.3
5.1
10%
15%
CLIMATOLOGICAL WINDROSE
CONNECTICUT D.E.P.
Bridgeport 65-72


N
O
E
S
W
20 %
14.8
10 %
9.1
9.7
5.9
5 %
7.8
3.4
2.0
1.6
1.5
2.5
6.2
7.7
7.2
5.8
5.1
15.4
CLIMATOLOGICAL WINDROSE
CONNECTICUT D.E.P.
BRADLEY FIELD
Annual 1965 - 1972
EUGENE DIETZGEN CO.
MADE IN U. S. A.
NO. 340R-P DIETZGEN GRAPH PAPER
POLAR CO-ORDINATE

CONNECTICUT

AIR QUALITY SUMMARY

1971 - 1973

PART III

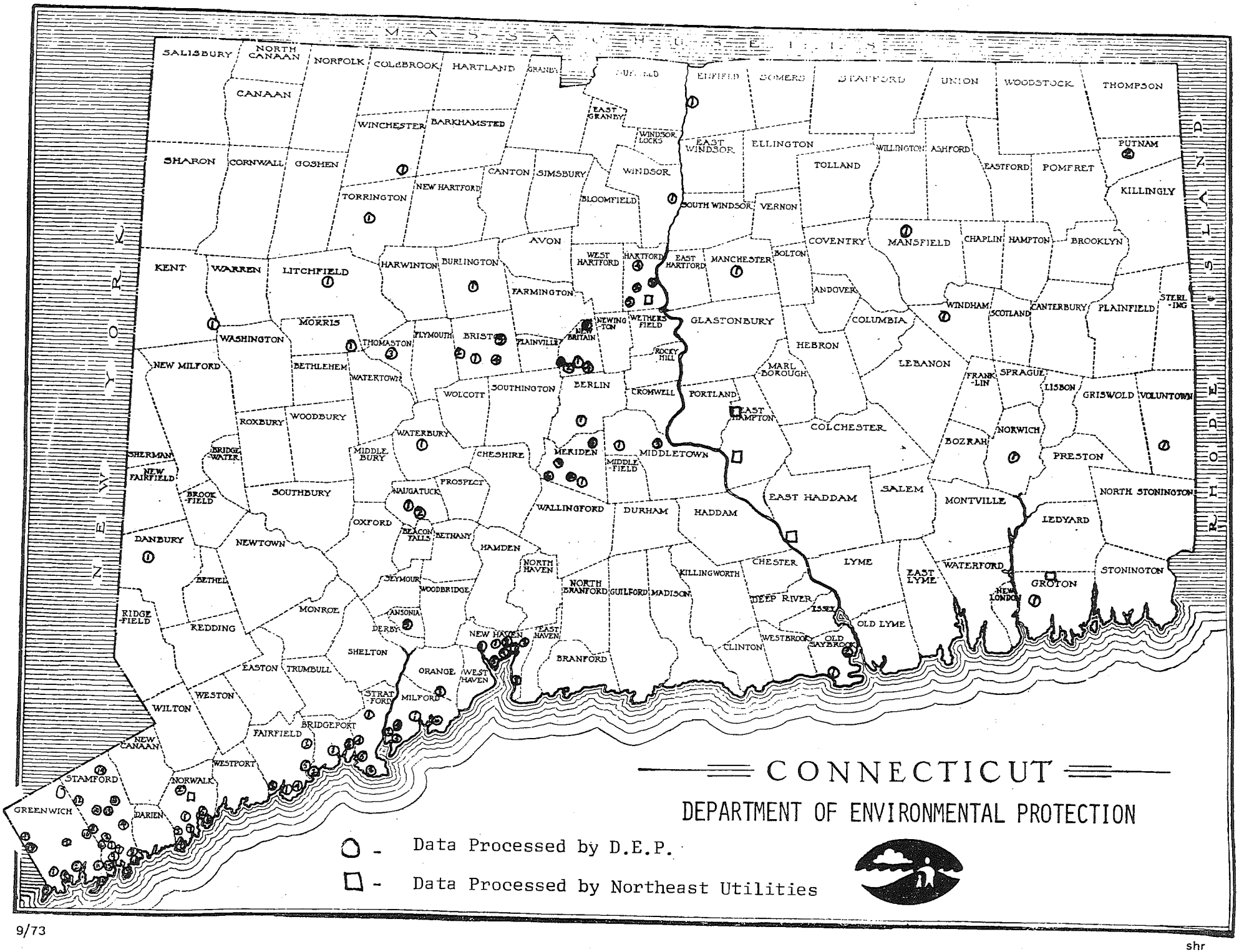
AIR MONITORING SITES

A. CURRENT NETWORK DEVELOPMENT

The Connecticut Air Monitoring Network is in the midst of substantial upgrading as twelve mobile trailer sites are added. Each site will have continuous monitoring instruments that will telemeter aerometric data into an IBM System/7 computer. This computer will compile the data, develop a data base, and perform the calculation necessary to signal air pollution episodes as they are actually occuring. The data collected can be passed to the IBM System/360 for the production of monthly reports.

The trailers are projected to be on-line by the end of 1974; for the most part these will supplement existing sites. In 1974 there will be twelve Carbon Monoxide and thirteen Chemiluminescent Ozone continuous monitoring instruments.

A map of the air sampling sites follows.


MASSACHUSETTS
RHODE ISLAND
NEW YORK
SALISBURY
NORTH CANAAN
NORFOLK
COLEBROOK
HARTLAND
GRANBY
SUFFIELD
ENFIELD
SOMERS
STAFFORD
UNION
WOODSTOCK
THOMPSON
CANAAN
EAST GRANBY
WINCHESTER
BARKHAMSTED
WINDSOR LOCKS
EAST WINDSOR
ELLINGTON
WILLINGTON
ASHFORD
PUTNAM
SHARON
CORNWALL
GOSHEN
CANTON
SIMSBURY
WINDSOR
TOLLAND
EASTFORD
POMFRET
KILLINGLY
TORRINGTON
NEW HARTFORD
BLOOMFIELD
SOUTH WINDSOR
VERNON
AVON
COVENTRY
MANSFIELD
CHAPLIN
HAMPTON
BROOKLYN
KENT
WARREN
LITCHFIELD
HARWINTON
BURLINGTON
WEST HARTFORD
HARTFORD
EAST HARTFORD
MANCHESTER
BOLTON
FARMINGTON
ANDOVER
WINDHAM
SCOTLAND
CANTERBURY
PLAINFIELD
STERLING
MORRIS
WASHINGTON
THOMASTON
PLYMOUTH
BRISTOL
PLAINVILLE
NEWINGTON
NEW BRITAIN
WETHERSFIELD
GLASTONBURY
COLUMBIA
HEBRON
ROCKY HILL
NEW MILFORD
BETHLEHEM
WATERTOWN
WOLCOTT
SOUTHINGTON
BERLIN
CROMWELL
PORTLAND
MARLBOROUGH
LEBANON
FRANKLIN
SPRAGUE
LISBON
GRISWOLD
VOLUNTOWN
ROXBURY
WOODBURY
WATERBURY
EAST HAMPTON
COLCHESTER
BOZRAH
NORWICH
PRESTON
SHERMAN
NEW FAIRFIELD
BRIDGEWATER
MIDDLEBURY
CHESHIRE
MERIDEN
MIDDLETOWN
MIDDLEFIELD
BROOKFIELD
SOUTHBURY
NAUGATUCK
PROSPECT
EAST HADDAM
SALEM
MONTVILLE
NORTH STONINGTON
WALLINGFORD
DURHAM
HADDAM
LEDYARD
OXFORD
BEACON FALLS
BETHANY
DANBURY
NEWTOWN
HAMDEN
NORTH HAVEN
CHESTER
LYME
WATERFORD
STONINGTON
SEYMOUR
KILLINGWORTH
EAST LYME
BETHEL
WOODBRIDGE
NORTH BRANFORD
GUILFORD
MADISON
DEEP RIVER
GROTON
NEW LONDON
RIDGEFIELD
MONROE
ANSONIA
ISSEX
REDDING
DERBY
NEW HAVEN
EAST HAVEN
OLD LYME
SHELTON
CLINTON
WESTBROOK
OLD SAYBROOK
EASTON
TRUMBULL
ORANGE
WEST HAVEN
BRANFORD
WESTON
STRATFORD
MILFORD
WILTON
BRIDGEPORT
FAIRFIELD
NEW CANAAN
WESTPORT
STAMFORD
NORWALK
GREENWICH
DARIEN
CONNECTICUT
DEPARTMENT OF ENVIRONMENTAL PROTECTION
- Data Processed by D.E.P.
- Data Processed by Northeast Utilities

9/73

shr

B. DIRECTORY OF AIR SAMPLING SITES: Guide to Codes

The Directory of Air Sampling Sites contains labeled columns of information. Some of the columns are self-explanatory, but each will be discussed proceeding from left to right across the page.

"TOWN" A Connecticut town name.

"SITE" Within a town the site number is unique and permanent. It is used to label the site as well as the data collected from the site. Numbers are not sequential, nor are they all assigned.

"STATION" and "TYPE" Describe two codes which defined by the Environmental Protection Agency to describe the general characteristics of the area surrounding an air monitoring site.

"BUILDING" Describes the type of building in which the monitoring site is located.

"LOC & ELEV" Tells the approximate location and elevation of the site within the building relative to the ground level.

"POLLUTANT" Contains a chemical formula or abbreviation decoded in the table below which tells what pollutants are being measured.

"METHOD" Contains an abbreviation of a standard chemical test for the pollutant being measured. Abbreviation are decoded below.

B. DIRECTORY OF AIR SAMPLING SITES
GUIDE TO CODES

Code	Station
CC	Central City
REM	Remote
RUR	Rural
SUB	Suburban

Code	Type
AGR	Agricultural
COM	Commercial
IND	Industrial
MOB	Mobile
NON	None
N.UR	Near Urban
RES	Residential

Code	Pollutant
CO	Carbon Monoxide
HC	Hydrocarbon
O_X	Ozone
NO_2	Nitrogen Oxides, Bubblers
NO_X	Nitrogen Oxides, Continuous
PART	Particulates
SO_2	Sulfur Oxides, Bubblers
SO_X	Sulfur Oxides, Continuous

Code	Method
B	Gas Bubblers
Chemi.	Chemiluminescence
Color.	Colorimetric
Cond.	Conductometric
Coul.	Coulometric
F.I.	Flame Ionization
Fl. Pho.	Flame Photometric
HiVol	High Volume
IR	Infra-red
Wind	Wind Speed & Direction

DIRECTORY OF AIR SAMPLING SITES OPERATING IN 1973

TOWN	SITE	STATION	TYPE	BUILDING	LOC & ELEV.	POLLUTANT	METHOD
Ansonia	03	CC	COM	Martin Bldg.	Roof 20'	Part.	HiVol
Berlin	01	RUR	AGR	State Fish Hatchery	Lawn 3'	Part. SO2 NO2	HiVol B B
Bridgeport	01	CC	COM	City Hall	Roof 50'	Part. SO2 NO2 Part. Ox SOx	HiVol B B Tape Chemi. Coul.
	02	SUB	COM	Fire House	Roof 40'	Part. Part. SOx	HiVol Tape Cond.
	03	CC	RES	McKinley School	Roof 40'	Part. SOx	Tape Coul.
	04	CC	COM	McLevy Hall	East Window 15'	CO	IR
Bristol	01	CC	COM	City Hall	Roof 35'	Part. SO2 NO2	HiVol B B
	02	RUR	N.UR	Water Dept.	Lawn 10'	Part. SO2 NO2	HiVol
	03	CC	COM	Stafford School	Roof 20'	Part. SO2 NO2	HiVol B B
	04	CC	IND	Callen School	Roof 27'	Part. SO2 NO2	HiVol B B
Burlington	01	REM	NON	State Fish Hatchery	Lawn 3'	Part. SO2 NO2	HiVol B B

DIRECTORY OF AIR SAMPLING SITES OPERATING IN 1973

TOWN	SITE	STATION	TYPE	BUILDING	LOC & ELEV.	POLLUTANT	METHOD
Colchester	01	RUR	AGR	Town Hall	Roof 14'	SO_2	B
						NO_2	B
Danbury	01	CC	COM	West Ct. State College Wiggins Hall	Roof 45'	Part.	HiVol
						SO_2	B
						NO_2	B
						Part.	Tape
East Hartford	02	SUB	RES	Hockanum School	Shed 6'	SO_2	B
						NO_2	B
Enfield	01	SUB	COM	Fire House	Roof 30'	Part.	HiVol
Fairfield	01	CC	COM	Fire House	Roof 30'	Part.	Tape
	02	SUB	RES	Warde High School	Roof 30'	Part.	HiVol
						Part.	Tape
	05	SUB	COM	SNETCO Bldg.	Roof 40'	Part.	Tape
Greenwich	01	CC	COM	Town Hall Annex	Roof 45'	Part.	HiVol
						SO_2	B
						NO_2	B
					West Window 15'	CO	IR
						NO_x	Color.
						SO_x	Cond.
						Part.	Tape
	02	SUB	COM	Cos Cob Fire House	Roof 30'	Part.	HiVol
	03	SUB	RES	Byram Fire House	Roof 30'	Part.	HiVol
	04	REM		Bruce Golf Course	Lawn 3'	Part.	HiVol
					Shed Roof 10'	SO_2	B
						NO_2	B
						O_x	Chem.
						SO_x	Cond.
						Part.	Tape

TOWN	SITE	STATION	TYPE	BUILDING	LOC & ELEV.	POLLUTANT	METHOD
Greenwich	07	RUR	NON	Witherell Hosp.	Roof 30'	Part.	HiVol
	08	SUB	RES	Cos Cob Pump	Roof 20'	Part.	HiVol
					West Window 8'	SO_x Part.	Cond. Tape
Groton	01	RUR	COM	City Hall	Lawn 3'	Part. SO_2 NO_2	HiVol B B
Hartford	02	CC	COM	State Health Dept.	Roof 50'	Part. SO_2 NO_2	HiVol B B
					South Window	O_x HC	Chemi. F.I.
	03	CC	COM	Library	Roof 30'	Part. Part. SO_x	HiVol Tape Coul.
	04	CC	RES	Hartford Health Dept.	Roof 30'	Part.	HiVol
Kent	01	REM		Lake Waramaung Park	Lawn 3'	Part. SO_2 NO_2	HiVol B B
Litchfield	01	RUR	COM	County Agr. Center	Roof 15'	SO_2 NO_2	B B
Manchester	01	CC	RES	Town Hall	Roof 40'	Part.	HiVol
Mansfield	01	RUR	AGR	Agr. Eng. Bldg.	Roof 60'	Part. Part.	HiVol Tape
	02	RUR	AGR	Ski First Aid Bldg.	East Window 15'	SO_2 NO_2	B B

TOWN	SITE	STATION	TYPE	BUILDING	LOC & ELEV.	POLLUTANT	METHOD
Meriden	01	SUB	COM	East Side Fire House	Lawn 3'	Part. Part.	HiVol Tape
	02	CC	IND	Stoddard Bldg.	Roof 30'	Part. Part.	HiVol Tape
	03	SUB	COM	Ben Franklin School	Roof 30'	Part. Part.	HiVol Tape
	05	SUB	COM	52 Hicks St.	Roof 15'	Part.	HiVol
	06	SUB	RES	Waste Treatment Plant	Stair Landing 6'	Part. Part.	HiVol Tape
Middletown	01	SUB	RES	Moody School	Roof 10'	Part.	HiVol
	03	CC	IND	City Hall	Roof 20'	Part. SO_2 NO_2 Part.	HiVol B B Tape
	04	REM	IND	P&WA Aircraft Pier	30' over river	Part. Part. O_x	HiVol Tape Chemi.
Milford	01	SUB	RES	Milford High School	Roof 30'	Part. Part. SO_2 NO_2	HiVol Tape B B
	02	SUB	IND	Devon Grammar	Roof 40'	Part. Part. SO_x	HiVol Tape Coul.
	06	RUR	AGR	Health Dept.	Roof 10'	Part.	HiVol
Morris	01	REM		Morris Dam	Lawn 3'	Part.	HiVol
Naugatuck	01	CC	COM	Town Hall	Roof 40'	Part. SO_2 NO_2	HiVol B B

DIRECTORY OF AIR SAMPLING SITES OPERATING IN 1973

TOWN	SITE	STATION	TYPE	BUILDING	LOC & ELEV.	POLLUTANT	METHOD
New Britain	01	CC	COM	Herald Bldg.	Roof 32'	Part.	HiVol
	02	CC	COM	City Hall	Roof 40'	Part. NO_2 SO_2 Part. SO_X NO_X	HiVol B B Tape Cond. Color.
	03	CC	COM	Mid-Atlantic Trans. Co.	Roof 25'	Part.	HiVol
	04	CC	RES	Smith School	Roof 20'	Part. Part.	HiVol Tape
	05	CC	RES	Pulaski High	Roof 20'	Part. Part.	HiVol Tape
New Haven	01	CC	COM	Bullard Bldg.	Roof 50'	Part. SO_2 NO_2	HiVol B B
	02	CC	IND	Clinton School	Roof 30'	Part.	HiVol
	03	SUB	RES	New Haven Airport	Roof 25'	Part.	HiVol
	04	CC	COM	C.S.B. Building	Roof 30'	Part. SO_X	Tape Coul.
	05	CC	IND	Truman School	Roof 45'	Part.	HiVol
	07	CC	COM	City Hall	Roof 40'	Part.	Tape
	08	SUB	RES	Agr. Expermental Station	Roof 40'	SO_X O_X	Cond. Chemi.
	09	CC	RES	Beecher School	Roof 30'	Part.	HiVol

DIRECTORY OF AIR SAMPLING SITES OPERATING IN 1973

TOWN	SITE	STATION	TYPE	BUILDING	LOC & ELEV.	POLLUTANT	METHOD
Norwalk	01	CC	COM	ASC Building	Roof 35'	Part. Part.	HiVol Tape
	02	SUB	COM	Winnipauk School	South Window 10'	Part.	Tape
	05	SUB	RES	Health Dept.	Roof 30	Part. SO_2 NO_2 Part. CO SO_x	HiVol B B Tape IR Cond.
Norwich	01	CC	COM	Norwich Savings & Loan Bank	Roof 65'	Part. SO_2 NO_2	HiVol B B
Old Saybrook	01	SUB	RES	Old Toll House	Roof 15'	Part. SO_2 NO_2	HiVol B B
Orange	03	REM		Nike Site	Lawn 3'	Part.	HiVol
Putnam	02	SUB	RES	Superior Court	Roof 40'	Part. SO_2 NO_2	HiVol B B
Stamford	01	CC	COM	Central Fire House	Roof 50'	Part.	HiVol
	02	CC	COM	American Cyanamid	Roof 25'	Part.	Tape
	03	CC	COM	Health Dept.	Roof 30'	Part. SO_2 NO_2	HiVol B B
	03					Part. SO_x	Tape Cond.
	04	CC	COM	Dolan School	Roof 55'	Part. Part.	HiVol Tape

DIRECTORY OF AIR SAMPLING SITES OPERATING IN 1973

TOWN	SITE	STATION	TYPE	BUILDING	LOC & ELEV.	POLLUTANT	METHOD
Stamford	06	SUB	RES	Museum	Roof 30'	Part.	Tape
	10	SUB	RES	Rippowam High School	Roof 30'	Part. Part.	HiVol Tape
	16	SUB	RES	Murphy School	Roof 70'	Part.	Tape
	19	SUB	RES	Sterling Golf Course	South Window 8'	O_x	Chemi.
Stratford	01	SUB	RES	Bunnell High	Roof 35'	Part.	HiVol
	05	CC	COM	Health Dept.	Roof 35'	Part. SO_2 NO_2 Part.	HiVol B B Tape
Thomaston	03	SUB	COM	St. Thomas School	Roof 30'	Part.	HiVol
Torrington	01	SUB	COM	City Hall	Roof 50'	Part. SO_2 NO_2	HiVol B B
Voluntown	01	REM		Pachaug State Forest	Lawn 3'	Part. SO_2 NO_2	HiVol B B
Waterbury	01	CC	COM	City Hall	Roof 55'	Part. SO_2 NO_2 Part. SO_x	HiVol B B Tape Coul.
Willimantic	01	CC	IND	Eastern Ct. State College	Roof 45'	Part. SO_2 NO_2	HiVol B B

DIRECTORY OF AIR SAMPLING SITES OPERATING IN 1973

TOWN	SITE	STATION	TYPE	BUILDING	LOC & ELEV.	POLLUTANT	METHOD
Winsted	01	SUB	COM	Northwest Comm. College	Roof 20'	Part.	HiVol
Windsor	01	SUB	AGR	Agr. Exp. Station	North Window 30'	O_x	Chemi.

CONNECTICUT

AIR QUALITY SUMMARY

1971 - 1973

APPENDIX A

How to Use the Computer Report
for Nitrogen Oxides and Particulates.

HOW TO USE THE COMPUTER REPORT FOR NITROGEN OXIDES AND PARTICULATES

By Andrew W. Godfrey

In Part II of this report, AEROMETRIC DATA, the Nitrogen Oxide and Particulate sections contain a computer program report that requires further explanation.

The report is in alphabetic and numeric order by town, site, and year. The column labeled "TOWN" contains the name of a Connecticut town. The "SITE" column contains the number of the site location within the town. A more detailed description of each site can be found in AIR MONITORING SITES, Part III of this report.

The column labeled "YEAR" specifies the annual summary report from which statistics were collected and for which they are calculated. There is one line of output on the report for each annual summary.

The name of the pollutant, "Nitrogen Oxides", "Particulates", or a five digit pollutant code appears in the page header. On the annual summary reports for each pollutant, site, and year two statistics were selected. The first appears in the "MEAN" column, and the second is an estimate of the standard geometric deviation appearing in the "STD GEOM DEV" column. This value was estimated by taking the ratio of the value of the concentration at the 84th percentile to the value of the concentration at the 50th percentile. The other method is to calculate the antilog of the standard deviation of the logarithms of the individual data points. The former is

available from existing computer software by the first method, although for greater precision the second method would be preferable. The last two columns of the computer listing relate the sampling data collected to the ambient air quality standards. The column label says "Percent over x ug/m^3" where x is one of the standards. Based on a probability distribution for the data, and based on all of the 24-hour samples taken during the year, a percentage is calculated to represent the proportion of 24-hour samples which will be expected, in the long run, to exceed the standard listed.

This is a handy number to know because it is independent of the number of observations taken, and can be used to estimate how many times in a whole year of 365 days, the standard will be exceeded.

As guidelines for reading the computer report there are two rules that may be used as alternatives. The Environmental Protection Agency says a standard can not be exceeded more frequently than one time per year - but how often must samples be taken?

If samples are taken once a day, for 365 days, then let

n = 365 days of sampling

D = 1 day/year allowed.

$$P = \frac{100 \cdot D}{n} = \frac{100}{365} = .274\%.$$

But if samples are taken every sixth day, then the highest percent of observations, P, allowed to exceed the standard becomes 1.67%:

n = 61 days of sampling

D = 1 day/year allowed.

$$P = \frac{100 \cdot D}{n} = \frac{100}{61} = 1.67\%$$

The first guidelines says if the number from the "Percent over" column of the table is greater than .274, then the standard will be violated. The second says if greater than 1.67, then it will be violated.

The .274% guidelines is of course stricter, and the percents reported should only be read to the first or second significant digit. Of major concern is the sites at which 10% or 20% of the observations are expected to exceed the standard.

Statistical Background.

The percents calculated used the lognormal distribution because Larsen states that ambient air concentrations of pollutants are log-normally distributed.[1]

The discussion is presented graphically and analytically by calculus. Variable names in both parts are consistent. Capital letters describe a random variable with the associated distribution as set forth in the table below. Corresponding lower case letters represent the values that random variable can take on as the result of an experiment. The letter "g" signifies "geometric" as in the geometric mean μ_g, or the standard geometric deviation σ_g, or an air quality standard K_g.

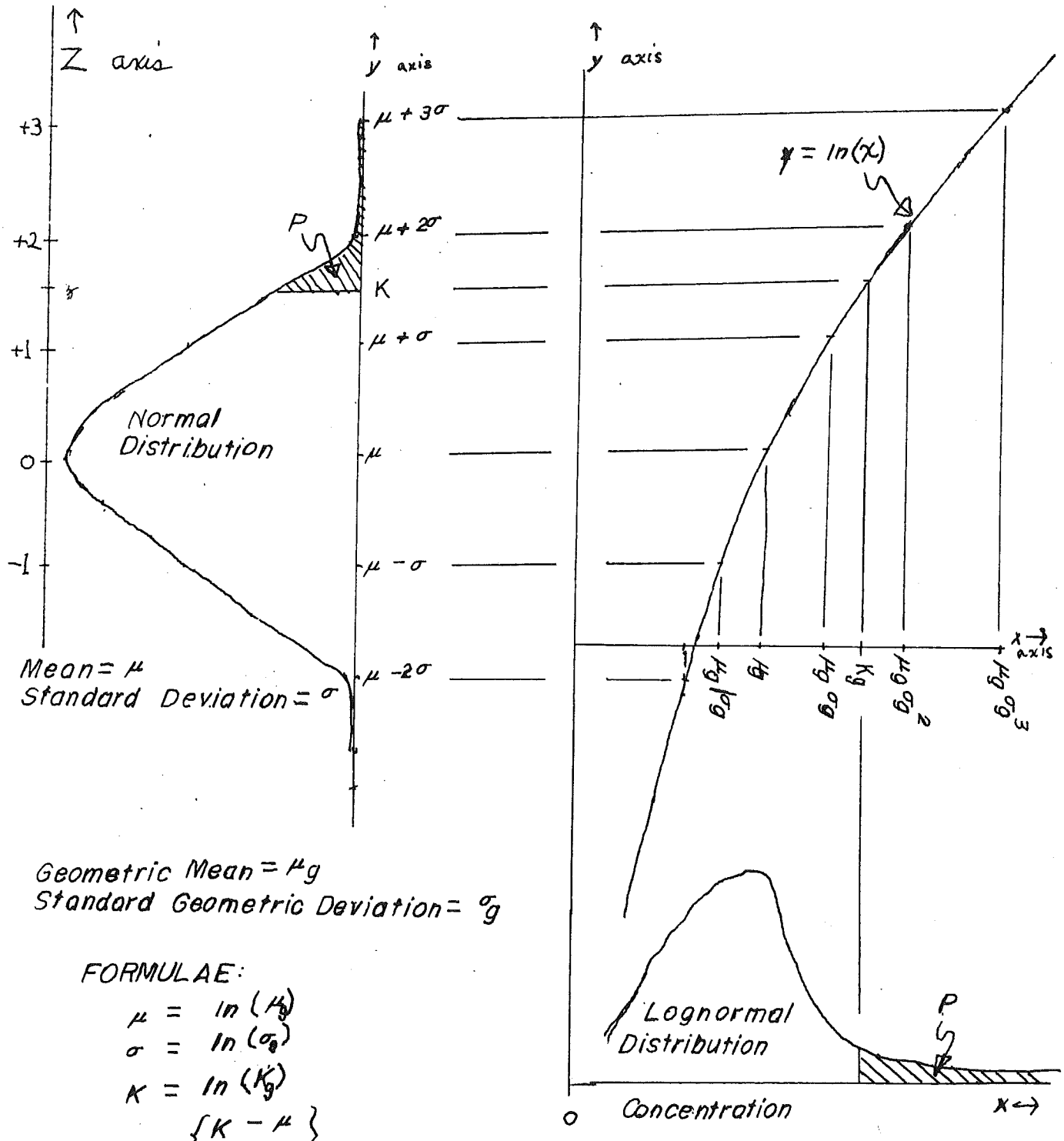
[1]Ralph I. Larsen, Ph.D. A Mathematical Model For Relating Air Quality Measurements to Air Quality Standards, Environmental Protection Agency, Pub. No. AP-89, 1971.

Distribution Name	Random Variable (r.v.)	Values r.v. takes on	Mean	Standard Deviation	Constant
Standard Unit Normal	Z	$-\infty < z < +\infty$	o	1	K_z
Normal	Y	$-\infty < y < +\infty$	μ	σ	K
Lognormal	X	$o < x < +\infty$	μ_g	σ_g	K_g

The upper left hand corner of Figure I shows a Normal Distribution curve with two axes.

The percent of time Y will exceed the standard K equals the percent of time X will exceed K_z. For any curve that percent, P, corresponds to the area of the shaded portion of the graph. Widely published statistical tables of P as a function of K_z can be used to determine the size of the shaded area.

The random variable X represents concentrations in the ambient air. To say that X is lognormally distributed means that the logarithm of the concentrations measured has a normal distribution. Figure I shows how each value x of X can be mapped one for one onto a corresponding value y of Y using the logarithm function. The relationships among the variables defined will now be stated analytically.



Geometric Mean = μ_g
Standard Geometric Deviation = σ_g

FORMULAE:

$$\mu = \ln(\mu_g)$$
$$\sigma = \ln(\sigma_g)$$
$$K = \ln(K_g)$$
$$Z = \left\{\frac{K - \mu}{\sigma}\right\}$$

The amount of shaded area, P, is the same under both distributions.

FIGURE I

A.W. GODFREY

Consider the relationship between the following three equations:

(1) For the standard unit normal.

$$P = \frac{100}{\sqrt{2\pi}} \int_{K_z}^{+\infty} \exp\left[-\frac{1}{2}(z)^2\right] dz$$

(2) For a Normal Distribution with mean μ standard deviation σ, air quality standard K.

$$P = \frac{100\sqrt{n}}{\sigma\sqrt{2\pi}} \int_{\left(\frac{k-\mu}{\sigma}\right)}^{+\infty} \exp\left[-\frac{n}{2}\left(\frac{y-\mu}{\sigma}\right)^2\right] dz .$$

Note: $K_z = \frac{k-u}{\sigma}$

$$z = \left(\frac{y-\mu}{\sigma}\right)\sqrt{n}$$

$$\frac{dy}{dz} = \frac{\sqrt{n}}{\sigma}$$

(3) For a Lognormal Distribution with geometric mean μg, standard geometric deviation σg, and air quality standard K.

$$P = \frac{100\sqrt{n}}{\ln(\sigma g)\sqrt{2\pi}} \int_{\left[\frac{\ln(K_g)-\ln(\mu_g)}{(\ln(\sigma g)/\sqrt{n})}\right]}^{+\infty} \exp\left[-\frac{n}{2}\frac{\ln(x)-\ln(\mu g)}{\ln(\sigma g)}^2\right]\left(\frac{1}{x}\right) dx$$

Note: $K_g = \frac{\ln(Kg) - \ln(\mu g)}{(\ln(\sigma g)/\sqrt{n})}$

$$z = \frac{\ln(x) - \ln(\mu g)}{(\ln(\sigma g)/\sqrt{n})}$$

$$dz = \frac{\sqrt{n}}{x \ \ln(\sigma g)}$$