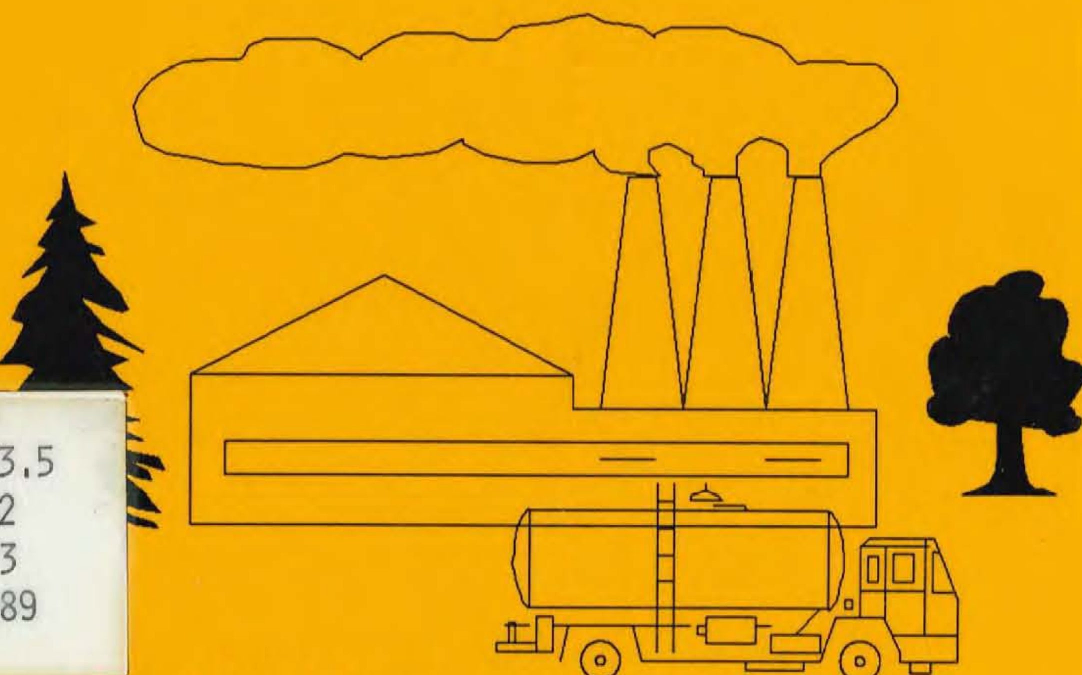
Annual Report on Air Quality 1989



MAINE

Department of Environmental Protection

1989 ANNUAL REPORT ON AIR QUALITY IN THE STATE OF MAINE

Prepared by
Jeffrey C. Emery
Environmental Specialist

Maine Department of Environmental Protection
Bureau of Air Quality Control
Division of Field Services

Leighton E. Carver, Division Director
Dennis L. Keschl, Bureau Director
Dean C. Marriott, Commissioner

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1. INTRODUCTION

1.1 Purpose and Overview

The purpose of this report is to present the air quality monitoring data generated by and for the Maine Department of Environmental Protection, Bureau of Air Quality Control, and to provide a historical perspective from which the significance of that data can be interpreted. Air Quality monitoring measures the concentrations of various pollutants in the ambient air. The monitoring is in response to State and Federal requirements to determine whether the air we breathe is attaining and maintaining National and State Ambient Air Quality Standards which are designed to protect the health and welfare of the public. Federal Primary Standards are intended to protect public health. Federal Secondary Standards are intended to protect public welfare. The State Standards are at least as strict as Federal Standards and in some cases are more strict. The reasoning behind establishing more stringent standards is that generally air quality in Maine is significantly cleaner than in other areas and should remain cleaner. The current Federal and State Standards are presented in Tables 1-1 and 1-2. Table 1-3 is a summary indicating all the violations of ambient air quality standards in the State by regions. Later on in this report those violations will be listed by the sites at which they occurred.

A significant portion of the data collected in the State is collected by industry. The Department has required industry to establish monitoring programs primarily when there are air quality problems associated with the industry, or when an industry is planning to build or expand causing a potential increase in air emissions. The State is still collecting monitoring data for long term trends, special studies and for compliance determinations. Ambient air monitoring by both industry and the State will continue in various regions where necessary until such time as standards are being met.

Included in this section are some figures which depict some of the results of air quality monitoring and control in the State. Figures 1-1 through 1-7 display trends or the lack of a trend which have been occurring at several long term key sites around the State.

Figures 1-1A and 1-1B depict the annual geometric means for total suspended particulates at several long term sites. Two sites, the Research Building site in Westbrook and the Kenduskeag Pump Station site in Bangor, continue to have very high annual concentrations of Total Suspended Particulates. The high concentrations in Westbrook appear to be continuing as a result of increased development, fugitive emissions from the S. D. Warren facility and a street sweeping program that hasn't been comprehensive enough. The reduction that occurred in 1988 continued into 1989 but the annual geometric mean remains at an elevated level and has been there for the last six years. The Westbrook area will need increased control efforts to reduce the total suspended particulate levels. Bangors high total suspended particulate

TABLE 1-1
NATIONAL AMBIENT AIR QUALITY STANDARDS
(1989)

Pollutant	Averaging Time	Concentration
Particulates (PM10)	Expected Annual Arithmetic Mean:	
	Primary	50 ug/m3
	Secondary	50 ug/m3
	Twenty-Four Hour:***	
	Primary	150 ug/m3
	Secondary	150 ug/m3
Lead (Pb)	Calendar Quarter	1.5 ug/m3
Carbon Monoxide (CO)	One Hour**	35 ppm
	Eight Hour**	9 ppm
Ozone (O3)	One Hour***	0.12 ppm
Nitrogen Dioxide (NO2)	Annual Arithmetic Mean	0.05 ppm
Sulfur Dioxide (SO2)	Annual Arithmetic Mean	0.03 ppm
	Twenty-Four Hour**	0.14 ppm
	Three-Hour**	
	Secondary	0.50 ppm
Hydrocarbon	Three Hour**	160 ug/m3

* = Federal Guideline Only.
** = Not to be exceeded more than once per year.
*** = Statistically estimated number of days with exceedances is not to be more than 1 per year.
ppm = Parts of pollutant per million parts of air.
ug/m3 = Micrograms of pollutant per cubic meter of air.

TABLE 1-2
STATE OF MAINE AMBIENT AIR QUALITY STANDARDS
(1989)

Pollutant	Averaging Time	Concentration
Particulates (TSP)	Annual Geometric Mean	60 ug/m3
	Twenty-Four Hour	150 ug/m3
Particulates (PM10) (Effective 9-30-89)	Annual Arithmetic Mean	40 ug/m3
	Twenty-Four Hour**	150 ug/m3
Lead (Pb)	Twenty-Four Hour*	1.5 ug/m3
Carbon Monoxide (CO)	One Hour*	35 ppm(40 mg/m3)
	Eight Hour*	9 ppm(10 mg/m3)
Ozone (O3)	One Hour*	.081 ppm(160 ug/m3)
Nitrogen Dioxide (NO2)	Annual Arithmetic Mean	.053 ppm(100 ug/m3)
Sulfur Dioxide (SO2)	Annual Arithmetic Mean	.022 ppm(57 ug/m3)
	Twenty-Four Hour*	.088 ppm(230 ug/m3)
	Three Hour*	.439 ppm(1150 ug/m3)
Hydrocarbon	Three Hour*	160 ug/m3

* = Not to be exceeded more than once per year.
** = Statistically estimated number of days with exceedances is not to be more than 1 per year.
PPM = Parts of pollutant per million parts of air.
ug/m3 = Micrograms of pollutant per cubic meter of air.
mg/m3 = Milligrams of pollutant per cubic meter of air.

TABLE 1-3
NUMBER OF AMBIENT AIR QUALITY VIOLATIONS BY REGIONS
(1989)

POLLUTANT	REGIONS 107	108	109	110	111	TOTALS
Total Suspended Particulates						
Annual Geometric Mean*						
State	0	0	0	1	?	1
Twenty-four Hour						
State	10	2	11	7	?	30
Fine Particulate(PM10)						
Annual Arithmetic Mean						
State	0	0	0	0	?	0
Federal	0	0	0	0	?	0
Twenty-four Hour						
State	0	0	0	0	?	0
Federal	0	0	0	0	?	0
Lead						
Twenty-four Hour						
State	0	0	0	0	?	0
Federal	0	0	0	0	?	0
Carbon Monoxide						
One Hour	?	?	?	0	?	0
Eight Hour	?	?	?	0	?	0
Ozone						
One Hour						
State	151	0	82	184	?	417
Days						
Federal	2	0	1	6	?	9
Nitrogen Dioxide						
Annual Arithmetic Mean	?	?	?	?	?	?
Sulfur Dioxide						
Annual Arithmetic Mean						
State	0	0	0	0	?	0
Federal	0	0	0	0	?	0
Twenty-four Hour						
State	0	0	0	0	?	0
Federal	0	0	0	0	?	0
Three Hour						
State	0	0	0	0	?	0
Federal	0	0	0	0	?	0

* Annual Means generated by only a few samples are not included in this summary.
? No monitoring done for this pollutant within this region during 1989.

FIGURE 1-1A

TSP TRENDS – NORTHERN MAINE

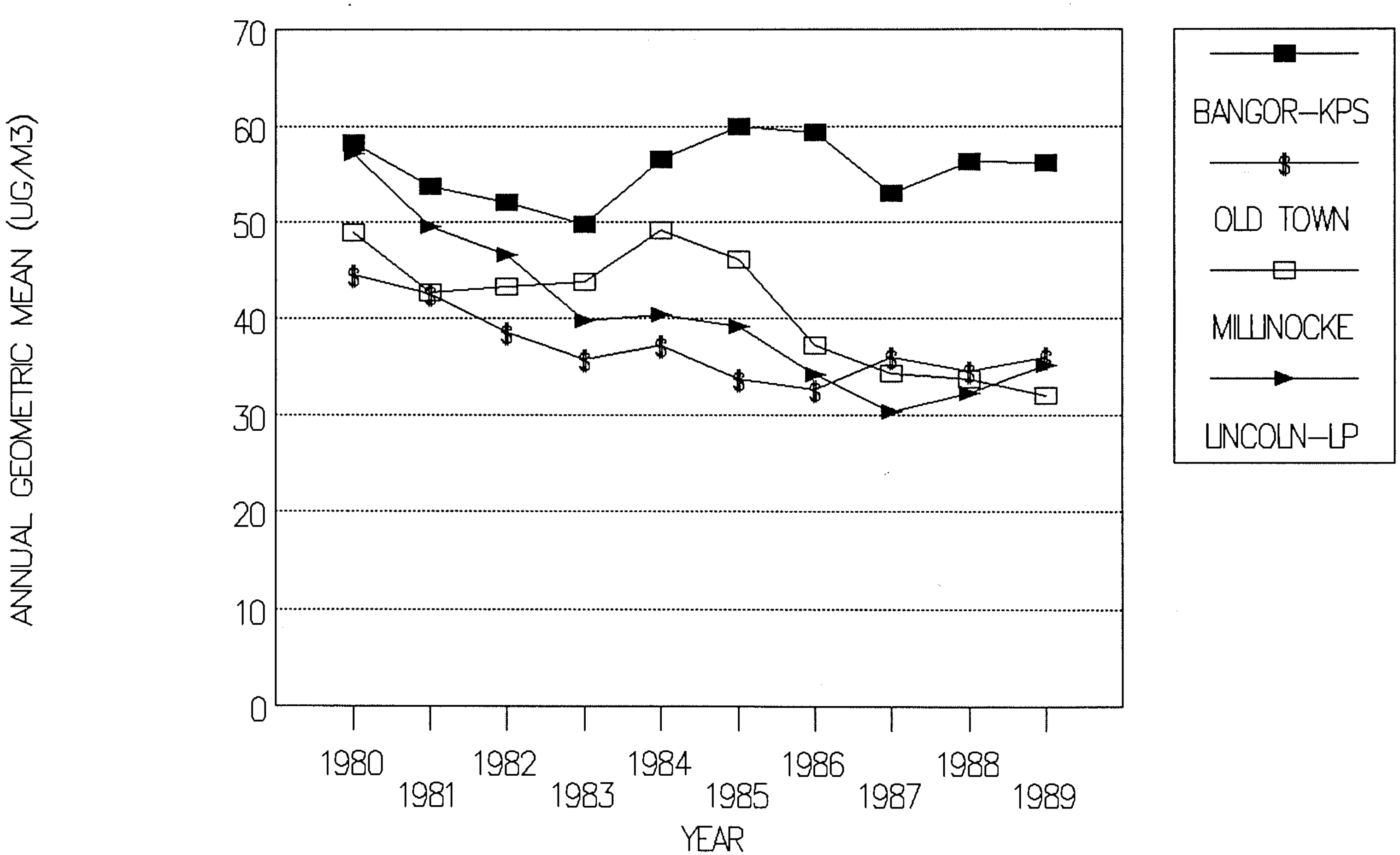
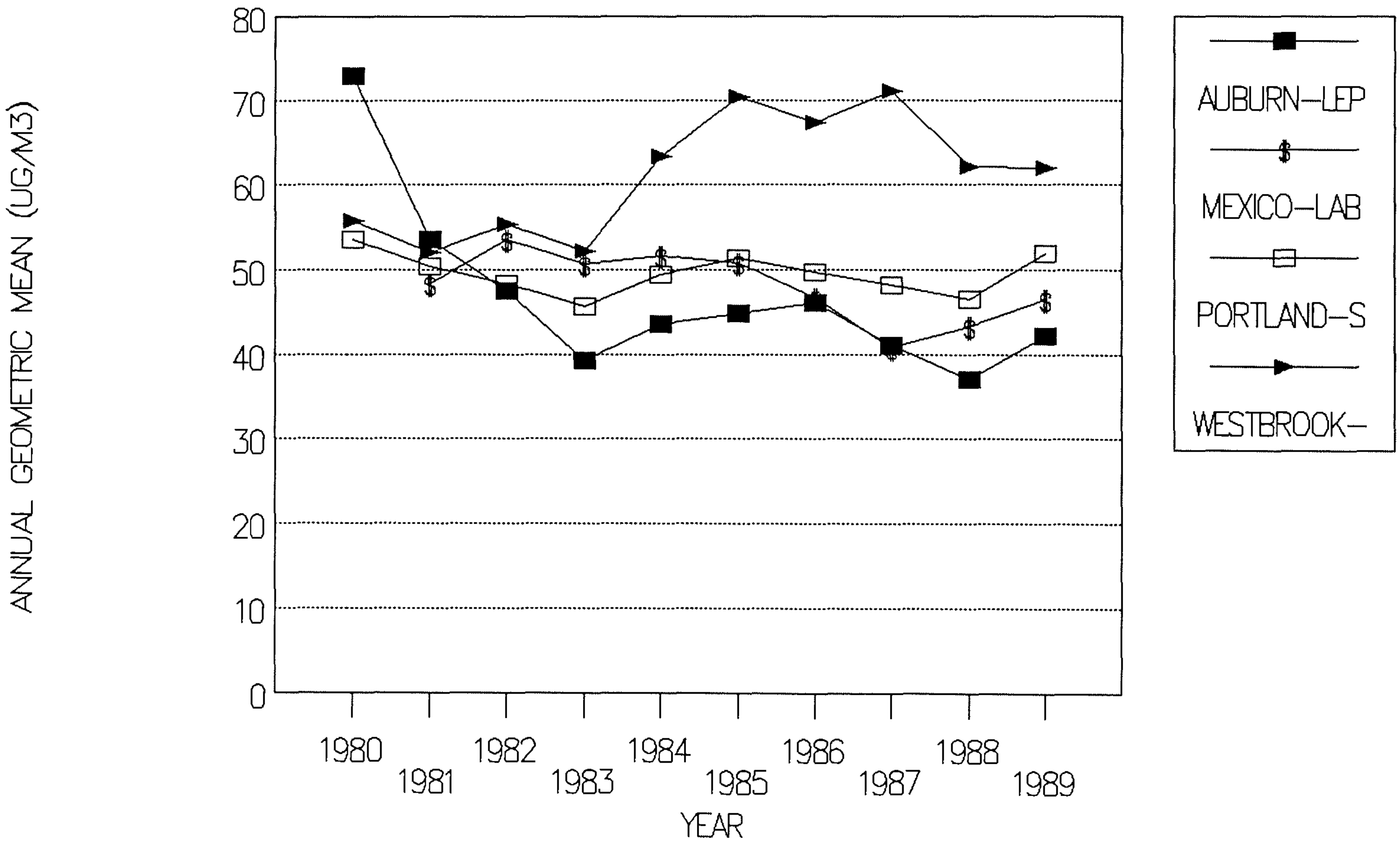


FIGURE 1-1B

TSP TRENDS - SOUTHERN MAINE



levels are probably due to increased development and construction activity as well as the impact from the winter salting and sanding of roads in the Bangor area. Closer attention to the control of fugitives and as prudent an application of salt and sand while still maintaining safe driving conditions is the only reasonable approach to reducing total suspended particulates in the Bangor area.

Figures 1-2A and 1-2B indicate trends over the last five years in the annual arithmetic mean for fine particulate. The majority of the sites collecting PM10 data over the last five years are showing either a downward trend or are low enough that they are probably recording regional background concentrations and are not indicating a significant trend in either direction. One exception appears to be the site in Madawaska which is recording concentrations in the 30-40 microgram range and is remaining relatively constant. These levels are probably due to a regional background level plus a relatively constant contribution from the winter sanding of the streets in Madawaska.

Figures 1-3 and 1-4 indicate the sulfur dioxide trends at five sites with a long term history. All five sites appear to indicate relatively stable sulfur dioxide levels since 1984 with no significant trend in either direction.

Figure 1-5 depicts the number of hourly violations of the State ozone standard. As can be seen from the graphs, the violations vary greatly from year to year and while showing a very significant increase in the number of violations during 1988 there is a significant decrease during 1989 at all of the sites. Weather conditions are responsible for a lot of the variability from year to year and the conditions during 1988 were very conducive to the formation of ozone while those of 1989 were not. Because of the significant effect weather has on the formation of ozone, Maine, as well as the rest of the northeast, will need to control emissions to such a level that even under ideal weather conditions ozone levels can be kept below the standards.

Figures 1-6 and 1-7 indicate the very significant reduction that has occurred in lead levels throughout the state in both short term concentrations and in the annual arithmetic means. These significant downward trends are primarily due to the decreased use of lead in gasoline. Current lead levels are less than 20% of the state standard and even less of the federal standard and are expected to remain at those levels.

Data summarized in this report is available for review in the Department headquarters in Augusta and copies can be obtained from that office for a nominal fee.

1.2 Monitoring Sites

Air quality data are developed using two basic methods; 1) the continuous monitoring of gaseous pollutants and; 2) the periodic sampling of particulate and gaseous pollutants. In addition to pollutant monitoring there is also the continuous monitoring of meteorological parameters.

FIGURE 1-2A

PM10 TRENDS – SOUTHERN MAINE

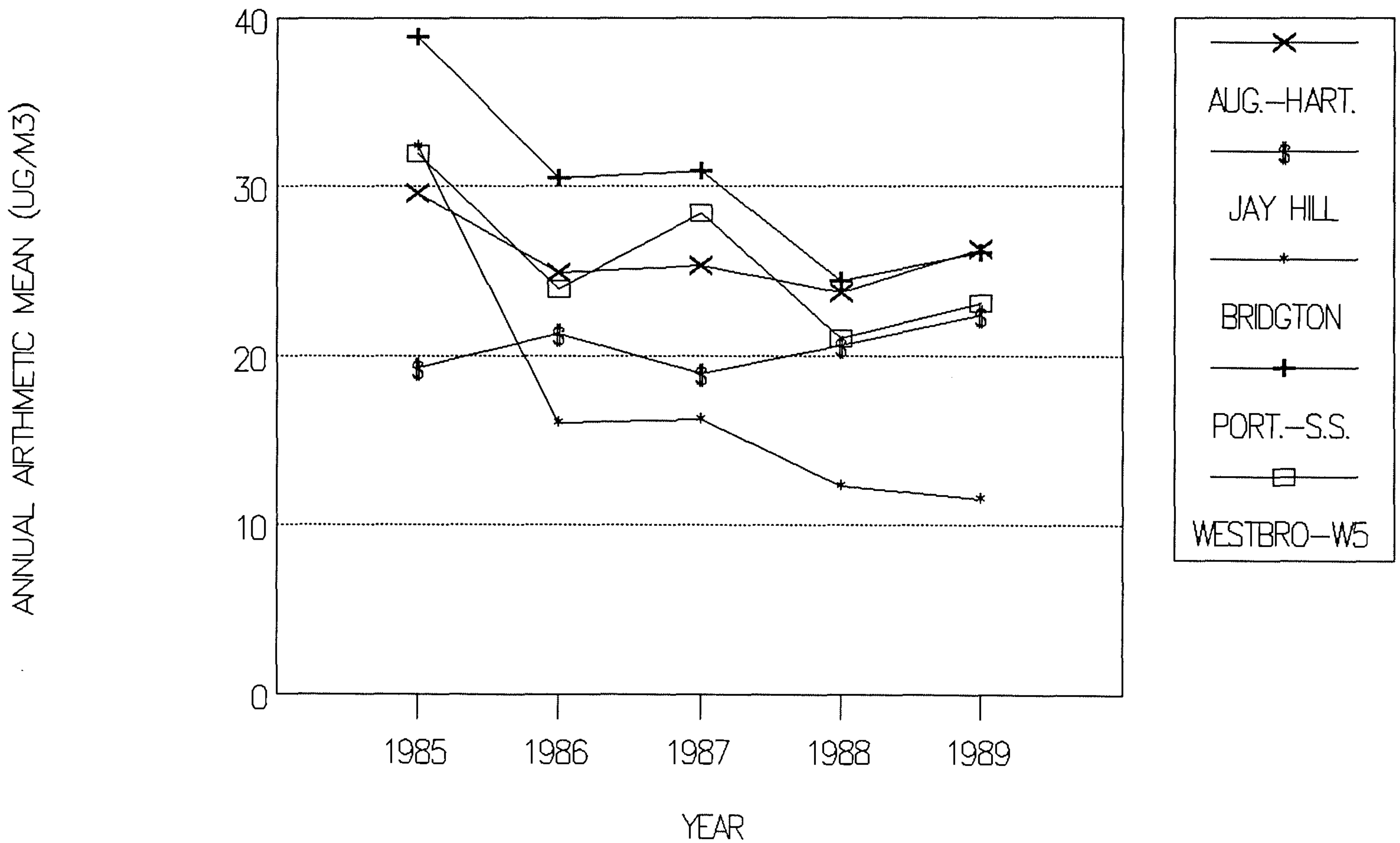


FIGURE 1-2B

PM10 TRENDS - NORTHERN MAINE

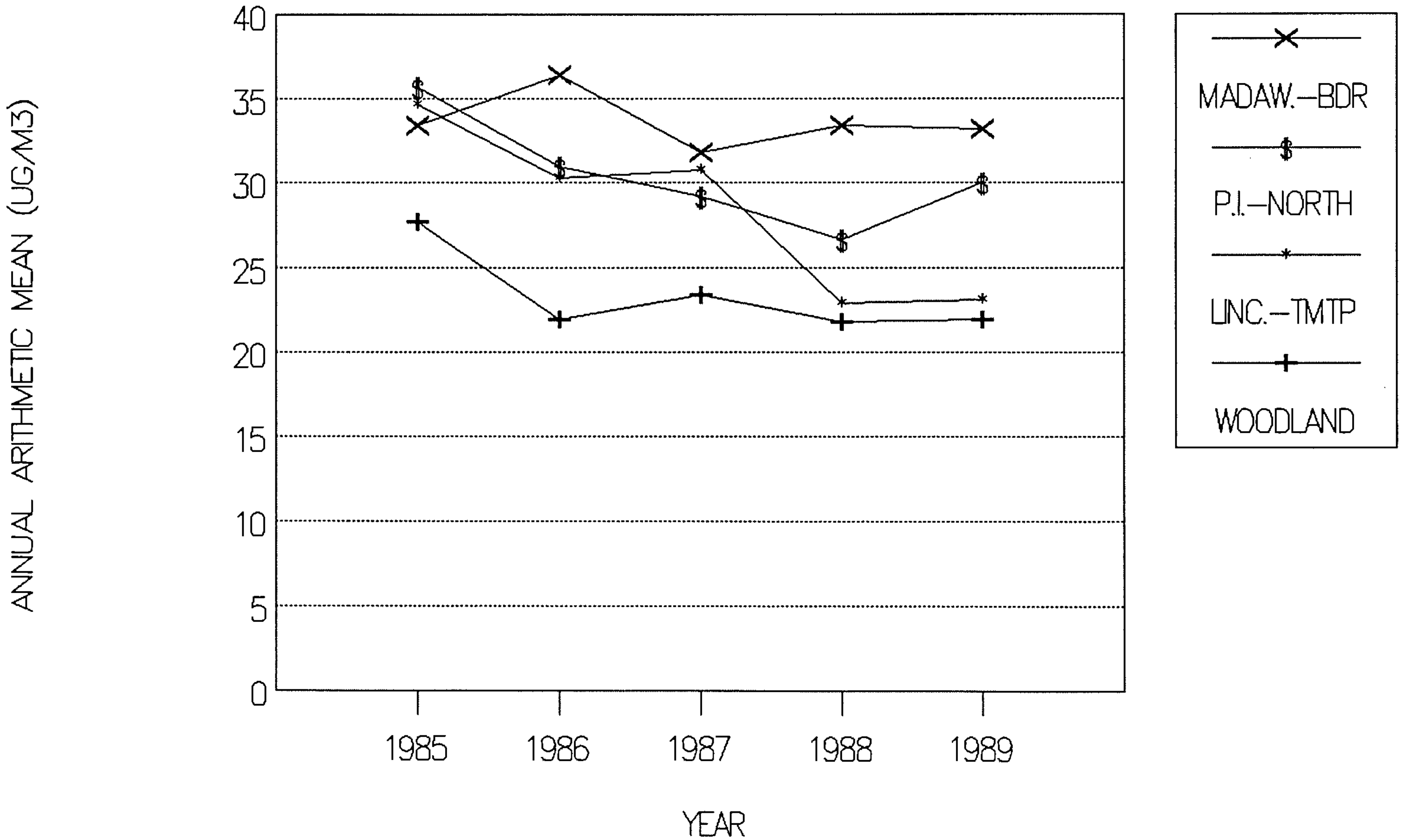


FIGURE 1-3

SULFUR DIOXIDE TRENDS - 24 HOUR

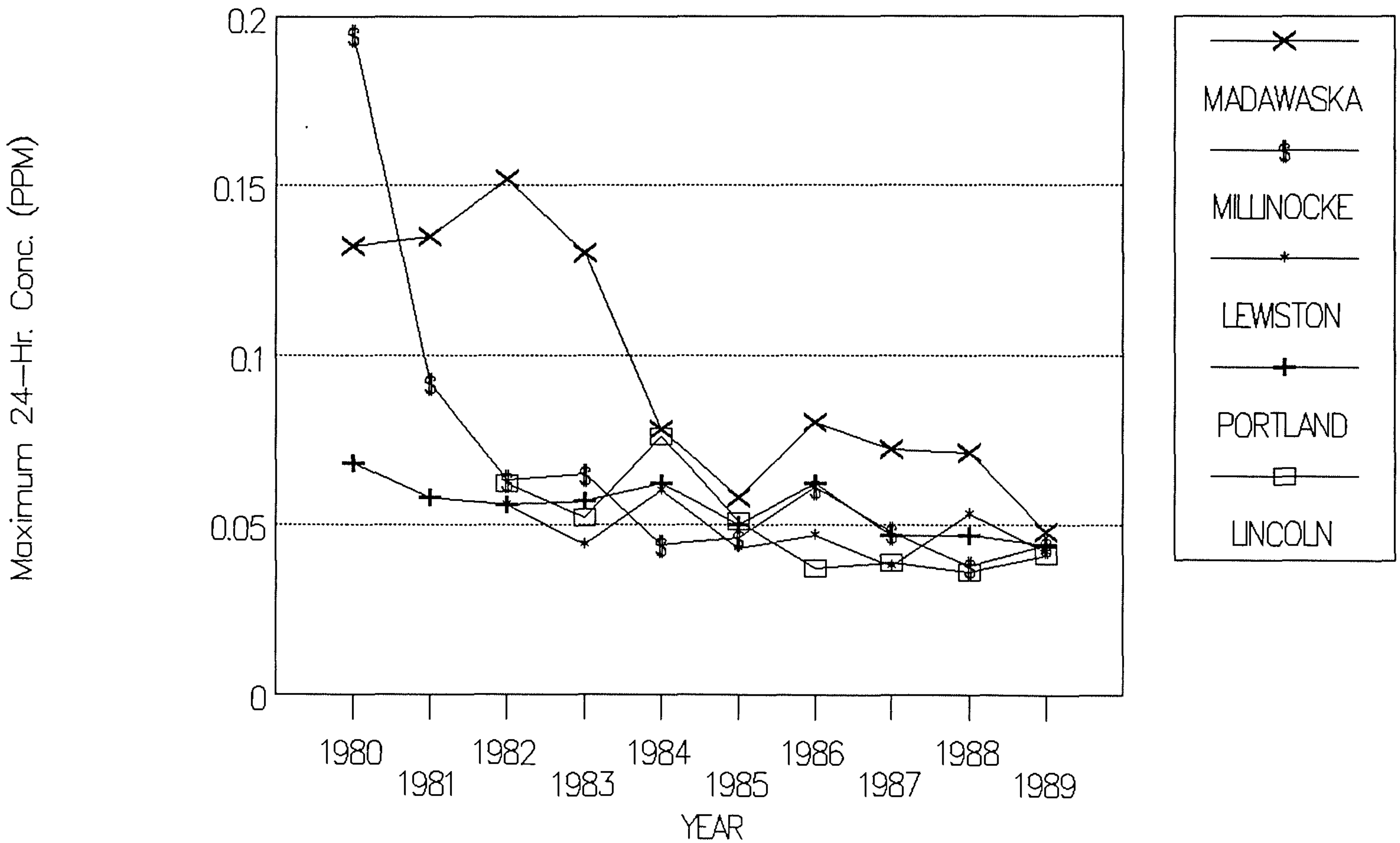


FIGURE 1-4

SULFUR DIOXIDE TRENDS - AAM

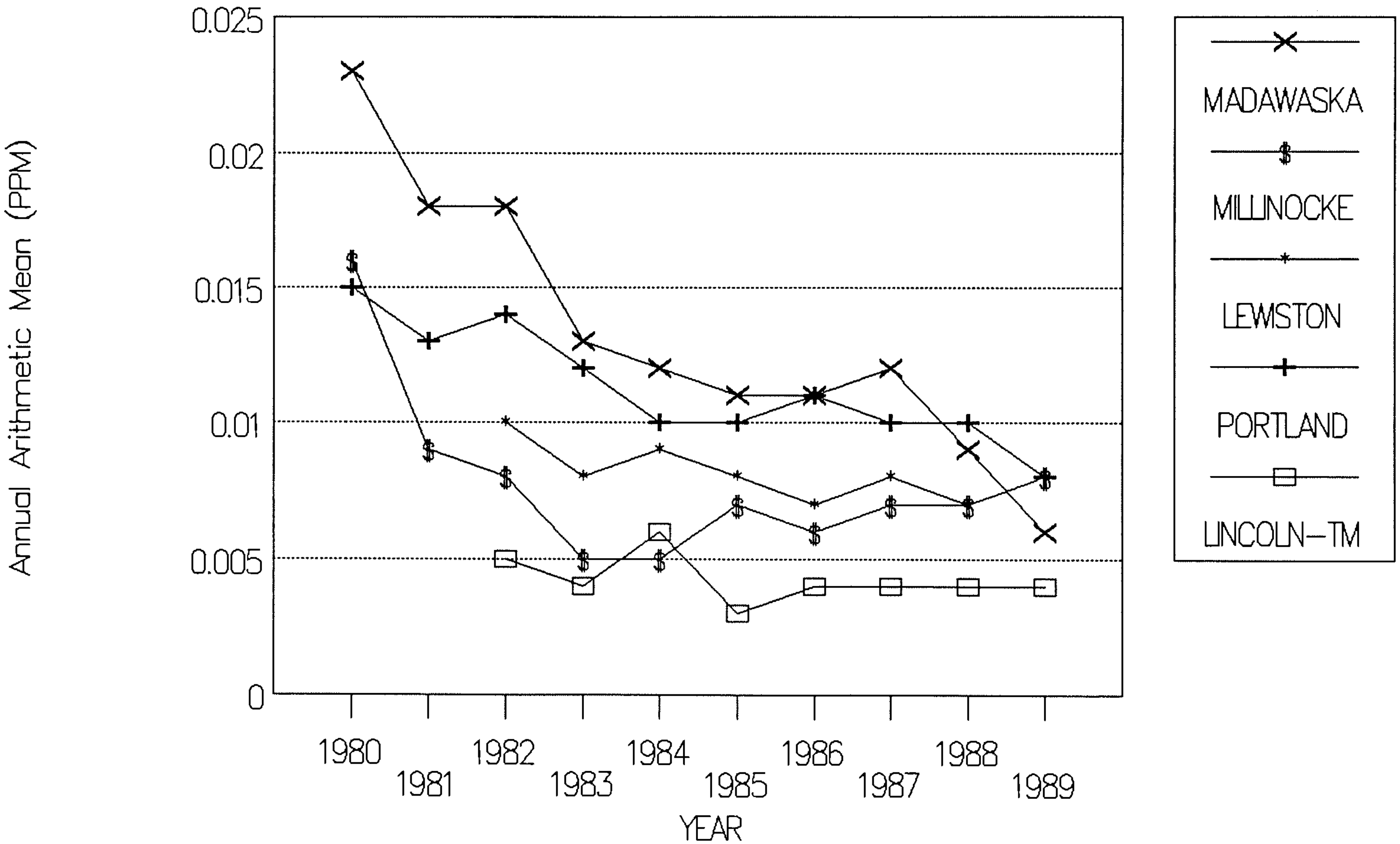


FIGURE 1-5

OZONE TRENDS - HOURS OF STATE VIOLATION

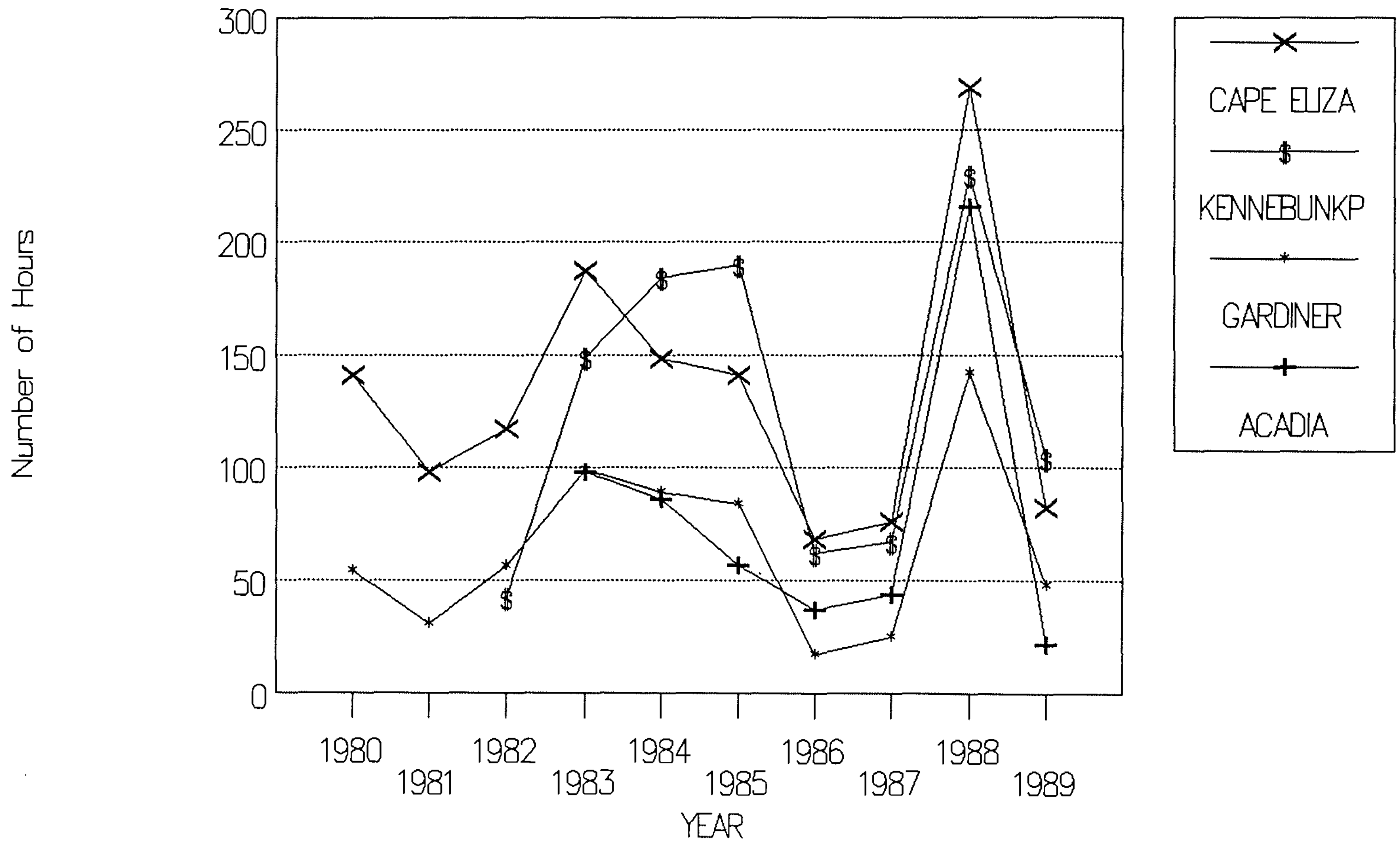


FIGURE 1-6

LEAD TRENDS – SECOND HIGH 24 HOUR

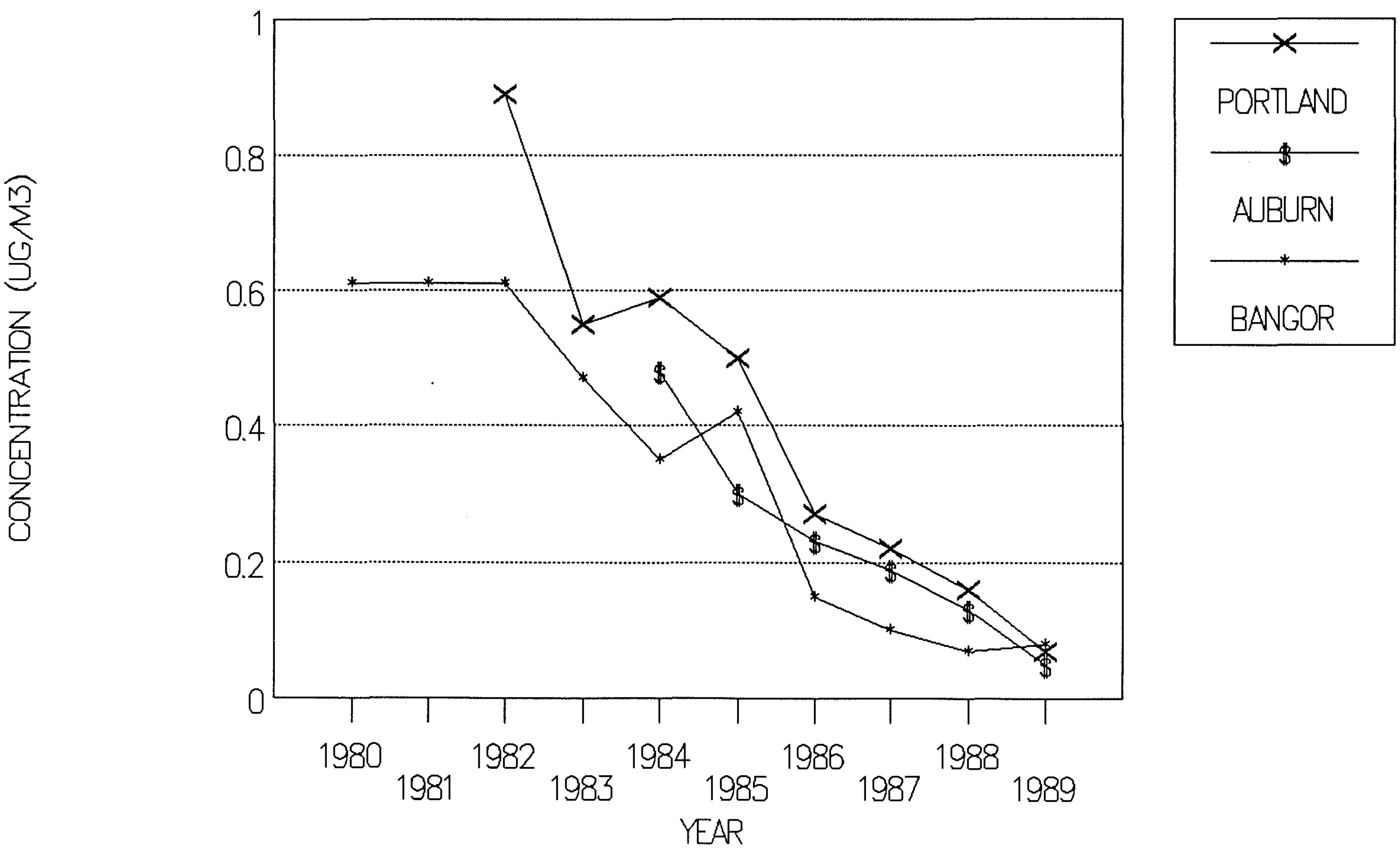
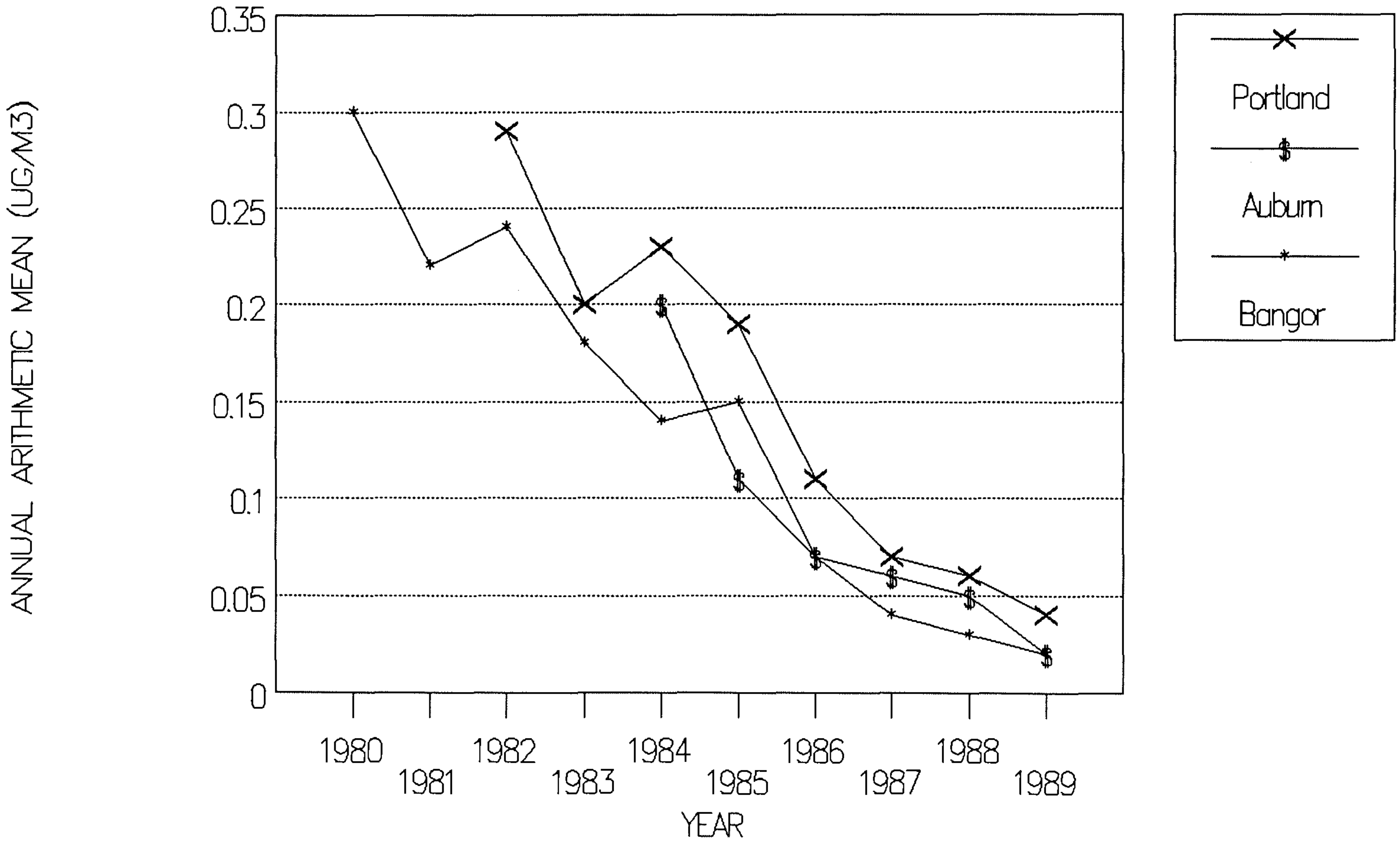


FIGURE 1-7

LEAD HISTORICAL TRENDS - AAM



Continuous gaseous monitoring was done at twenty-four sites in Maine during 1989. Carbon Monoxide was monitored at one of these stations, ozone at nine and sulfur dioxide at sixteen.

Particulate sampling was done at fifty-one sites in Maine during 1989. Forty-one of these stations monitored total suspended particulates. Thirty-two of these sites also collected fine particulate fractions. Also, lead monitoring was done at eight stations. Seven sites were analyzed for sulfates and nitrates. There were also two sites collecting acid rain data as part of the state monitoring network.

In addition to pollutant monitoring, wind speed and direction was recorded at twenty-one sites around the State during 1989. Some of these sites also recorded other meteorological parameters such as sigma (stability) and temperature, precipitation and solar radiation.

Table 1-4 presents all the monitoring sites in Maine that operated during 1989 and indicates which parameters were monitored at each site. The map in Figure 1-8 shows the Air Quality Control Regions within the State.

1.3 Document Organization

This document is divided by pollutant into chapters. Each chapter contains: 1) a description of the nature and sources of that pollutant, 2) its health and welfare effects, 3) a discussion on the standards (current and proposed) for that pollutant, 4) a discussion of the monitoring methods for that pollutant, 5) a table presenting the 1989 monitored data, 6) in the case of some pollutants, historical tables presenting 1989 data along with data for previous years to show trends, effects of control strategy, or change in emission sources.

1.3.1 Explanation of Data Summary Tables

The Data Summary Tables were designed to facilitate comparing 1989 air quality monitoring data with the standards for each pollutant. Therefore, the data are presented for each averaging time for which standards exist for a pollutant.

An annual average concentration is presented for each pollutant that has a long-term, annual standard (NO2, SO2, PM10).

For pollutants that have short-term standards, the highest short-term values are presented. Some pollutants are allowed to exceed the standard once during the year so the second highest value would be used to determine whether there was a violation or not.

All of the data collected during 1989 has been presented in the Data Summary Tables. However, in making comparisons of the data, one should be aware that a site with only a few samples will not be a valid indicator of pollutant concentrations in the area.

TABLE 1 - 4
1989 AMBIENT AIR QUALITY MONITORING SITE DIRECTORY

SITE	ADDRESS	OPERATOR	PARAMETERS MEASURED
ANDROSCOGGIN INTERSTATE AIR QUALITY CONTROL REGION (107)			
Auburn (0060 005/001 0005)	Lewiston-Auburn Airport Lewiston Junction Road	DEP	WS/WD
Auburn(DISC) (0060 008/001 0008)	Lepage Bakery 60 Second Street	DEP	TSP,Pb
Augusta(DISC) (0080 005/011 0005)	Hartford Fire House Hartford Square	DEP	TSP,FP
Augusta (0080 008/011 0008)	Governor's Hangar State Airport	DEP	WS/WD
Gardiner (0460 001/011 2001)	Gardiner High School West Hill Road	DEP	Ozone(s)
Jay (0530 001/007 2001)	Weather Level I Lagoon Hill	International Paper	WS/WD,Temperature,Solar Radiation, Precipitation,TSP,FP
Jay (0530 003/007 0003)	Crash Road Gilbert Jewell Property	International Paper	TSP
Jay (0530 004/007 0004)	Jay Hill	International Paper	TSP,FP
Jay (0530 008/007 0008)	Burnham Site	International Paper	TSP
Port Clyde (0595 004/013 0004)	Port Clyde Ozone St. George	DEP	Ozone(s)
Isle Au Haut (0595 003/013 0003)	Isle Au Haut Fire Station	UM/DEP	Ozone(s)

TABLE 1 - 4 (continued)
1989 AMBIENT AIR QUALITY MONITORING SITE DIRECTORY

SITE	ADDRESS	OPERATOR	PARAMETERS MEASURED
Lewiston (0620 011/001 0011)	Country Kitchen Parking Lot Canal Street	DEP	SO2,TSP(n),Pb(n)
Mexico (0760 008/017 0008)	Labonville's Route #2	Boise Cascade	TSP,FP
Mexico (0760 011/017 0011)	Hunt's Property Route #2	Boise Cascade	SO2
Rumford (1020 002/017 2002)	Boise Cascade Weather II Swift River Pump House	Boise Cascade	WS/WD
Rumford (1020 005/017 2005)	Taylor Mountain I	Boise Cascade	TSP,SO2,Sulfate,Nitrate,WS/WD(n)
Rumford (1020 006/017 2006)	Taylor Mountain II	Boise Cascade	TSP,SO2
Rumford (1020 007/017 2007)	Village Green Site Route #108	DEP/Boise Cascade	TSP,SO2,FP
Rumford (1020 008/017 2008)	Taylor Hill 3	Boise Cascade	TSP
Rumford (1020 009/017 2009)	Taylor Hill 4	Boise Cascade	TSP
Skowhegan (1100 001/025 2001)	Hinckley Hinckley Farm School	S. D. Warren	TSP,FP
Skowhegan (1100 002/025 2002)	Eaton Ridge	S. D. Warren	TSP,FP
Thomaston (1150 001/013 2001)	Mitchell Property 2 Dexter Avenue	Dragon Products	TSP,FP

TABLE 1 - 4 (continued)
1989 AMBIENT AIR QUALITY MONITORING SITE DIRECTORY

SITE	ADDRESS	OPERATOR	PARAMETERS MEASURED
Thomaston (1150 005/013 1005)	Dragon Cement Weather Route #1	Dragon Products	WS/WD
Thomaston (1150 007/013 1007)	Marsh Road	Dragon Products	TSP,FP
Searsport(DISC) (1183 008/027 0008)	Turnpike Road	Delta Chemical	SO2,WS/WD
Waterville(DISC) (1220 003/011 1003)	Stern's Department Store Main Street	DEP	TSP
Winslow (1280 003/011 2003)	Gulley Hill Road	Scott Paper Company	TSP,FP

AROOSTOOK AIR QUALITY CONTROL REGION (108)

SITE	ADDRESS	OPERATOR	PARAMETERS MEASURED
Madawaska (0720 003/003 1003)	Madawaska High School 7th Avenue	Fraser Paper	SO2
Madawaska (0720 006/003 0006)	Fraser Paper Company Bridge Street	Fraser Paper	WS/WD,Temperature
Madawaska (0720 009/003 0009)	Albert Street	Fraser Paper	SO2,Precipitation
Madawaska(DISC) (0720 011/003 0011)	St. Jarre's 11th Avenue	DEP	TSP,Sulfate,Nitrate
Madawaska (0720 012/003 0012)	U. S. Post Office 430 E. Main Street	Fraser Paper	SO2,WS/WD
Madawaska (0720 013/003 0013)	Big Daddy's Restaurant 395 E. Main Street	DEP	FP

TABLE 1 - 4 (continued)
1989 AMBIENT AIR QUALITY MONITORING SITE DIRECTORY

SITE	ADDRESS	OPERATOR	PARAMETERS MEASURED
Presque Isle (0980 005/003 1005)	Northeastland Hotel 436 Main Street	DEP	FP
Presque Isle (0980 008/003 1008)	Regional Office 528 Central Drive	DEP	WS/WD,Ozone(s),FP
Presque Isle(DISC) (0980 010/003 1010)	Hayden-Perry Insurance Building	DEP	FP
DOWNEAST AIR QUALITY CONTROL REGION (109)			
Acadia National Park (0010 003/009 0003)	McFarland Hill Ranger Station Route #233	NPS/DEP	Acid Precipitation,Precipitation
Acadia NP(NEW) (/009 0101)	Acadia NP Route #233	NPS	Ozone,SO2
Bangor(DISC) (0100 001/019 0001)	Regional Office 31 Central Street	DEP	TSP,Sulfate,Nitrate
Bangor (0100 002/019 0002)	Kenduskeag Pump Station Washington Street	DEP	TSP,Pb,FP
Bangor (0100 010/019 0010)	BIA-Building #489 Air National Guard	DEP	WS/WD
Brewer (0180 002/019 1002)	Brewer Junior High School 5 Somerset Street	DEP	TSP
Bucksport (0205 005/009 1005)	Waste Disposal Site Route #15	Champion International	WS/WD,Temperature,Precipitation
East Millinocket (0315 003/019 2012)	Mill Entrance Main Street	Great Northern Paper Company	SO2

TABLE 1 - 4 (continued)
1989 AMBIENT AIR QUALITY MONITORING SITE DIRECTORY

SITE	ADDRESS	OPERATOR	PARAMETERS MEASURED
East Millinocket (0315 004/019 2011)	Library/Municipal Building 53 Main Street	Great Northern Paper Company	FP
Hampden (0485 001/019 8001)	McGraw School	Penobscot Energy Recovery Company	FP
Dedham (0495 003/009 2003)	Bald Mountain	DEP	Ozone(s),WS/WD(s),SO2(n)
Jonesport(NEW) (/029 0019)	Public Landing	DEP	Ozone(s)
Lincoln (0640 002/019 3002)	Vocational Education Building West Broadway	Lincoln Pulp & Paper Company	TSP
Lincoln (0640 003/019 2003)	Lincoln Post Office Building 50 Fleming Street	Lincoln Pulp & Paper Company	TSP
Lincoln (0640 007/019 1007)	Thomas Motel Trailer Park 39 West Broadway	Lincoln Pulp & Paper Company	TSP,SO2,FP
Lincoln (0640 010/019 1010)	Lincoln Airport	Lincoln Pulp & Paper Company	WS/WD
Millinocket (0780 007/019 2007)	Katahdin Nursing Home	Great Northern Paper Company	FP(n)
Millinocket (0780 009/019 2009)	York Street	Great Northern Paper Company	TSP,SO2,FP
Millinocket(DISC) (0780 011/019 0011)	Great Northern Paper Co. Office	Great Northern Paper Company	WS/WD
Millinocket(NEW) (/019 2013)	Mill Stone Dam	Great Northern Paper Company	WS/WD,Temperature

TABLE 1 - 4 (continued)
1989 AMBIENT AIR QUALITY MONITORING SITE DIRECTORY

SITE	ADDRESS	OPERATOR	PARAMETERS MEASURED
Old Town (0840 003/019 4003)	Marsh Island Apartments 100 South Main Street	DEP	TSP
Orrington (0845 005/019 8001)	Center Drive School	Penobscot Energy Recovery Company	FP
Newburgh (0907 005/019 4005)	Newburgh School Route #9	DEP	TSP
Milford (0907 007/019 3007)	Shumway Field Route #178	James River Corporation	TSP
Woodland (1205 007/029 0007)	Secondary Treatment Pipeline	Georgia Pacific Corporation	TSP,FP
Woodland (1205 008/029 0008)	Woodland High School	Georgia Pacific Corporation	TSP,FP
Woodland (1205 017/029 0017)	Woodyard Woodland Mill	Georgia Pacific Corporation	WS/WD
Woodland (1205 018/029 0018)	Background	Georgia Pacific Corporation	TSP,FP
Woodland (1205 019/029 0020)	100 Meter Tower	Georgia Pacific Corporation	WS/WD,Temperature

METROPOLITAN PORTLAND AIR QUALITY CONTROL REGION (110)

SITE	ADDRESS	OPERATOR	PARAMETERS MEASURED
Berwick(DISC) (0150 001/031 0001)	Berwick Fire Station Berwick	DEP	TSP
Biddeford (0160 002/031 0002)	Biddeford Treatment Plant Water Street	DEP	TSP,Pb(n),SO2(n),FP(n)

TABLE 1 - 4 (continued)
1989 AMBIENT AIR QUALITY MONITORING SITE DIRECTORY

SITE	ADDRESS	OPERATOR	PARAMETERS MEASURED
Bridgton (0190 002/005 0002)	Upper Ridge Road	DEP	Acid Precipitation,Sulfate,Nitrate,FP,Precipitation
Cape Elizabeth (0250 003/005 2003)	Shelter Site Two Lights State Park	DEP	Ozone(s),WS/WD
Portland (0960 010/005 0010)	Chevrus High School Ocean Avenue	DEP	WS/WD
Portland (0960 014/005 0014)	Shelter Site (P.E.O.P.L.) Elm Street	DEP	TSP,Pb,SO2,FP,Nitrate(n),Sulfate(n)
Portland (0960 015/005 0015)	Tukey's Bridge	DEP	Pb
Portland(DISC) (0960 018/005 0018)	Congress Street	DEP	CO
Portland (0960 020/005 0020)	Elks Lodge 1945 Congress Street	Regional Waste Systems	FP
South Portland (1140 002/005 6002)	SMVTI Vocational Drive	DEP	TSP,Sulfate,Nitrate
South Portland(NEW) (/005 0021)	Jordan Marsh Auto Center 100 Maine Mall Road	DEP	TSP,FP,Nitrate,Sulfate
Westbrook (1260 002/005 7002)	N. E. T.& T. Company Ash Street	S. D. Warren	TSP,FP
Westbrook (1260 008/005 1008)	Research Building S. D. Warren	S. D. Warren	TSP,FP
Westbrook (1260 009/005 1009)	S. D. Warren Company Wind S. D. Warren Property	S. D. Warren	WS/WD,Temperature

TABLE 1 - 4 (continued)
1989 AMBIENT AIR QUALITY MONITORING SITE DIRECTORY

SITE	ADDRESS	OPERATOR	PARAMETERS MEASURED
Westbrook (1260 012/005 1012)	S. D. Warren Warehouse #5 Main Street	S. D. Warren	TSP,FP
Kennebunkport (1325 002/031 2002)	Parson's Way	DEP	Ozone(s)

NORTHWEST MAINE AIR QUALITY CONTROL REGION (111)

SITE	ADDRESS	OPERATOR	PARAMETERS MEASURED
Greenville (0935 001/021 0001)	Squaw Brook Greenville	DEP	Acid Precipitation,Precipitation

(SAROAD #/AIRS #)

NEW - Site established in 1989
DISC - Site discontinued in 1989

TSP - Total Suspended Particulates
SO2 - Sulfur Dioxide
NO - Nitric Oxide
NOX - Oxides of Nitrogen

CO - Carbon Monoxide
Pb - Lead
WS/WD - Wind Speed and Direction
FP - Fine Particulate
NMHC - Nonmethane Hydrocarbons

n - Instrument installed during 1989
d - Instrument removed during 1989
s - Instrument operated seasonally during 1989
i - Instrument operated intermittently during 1989

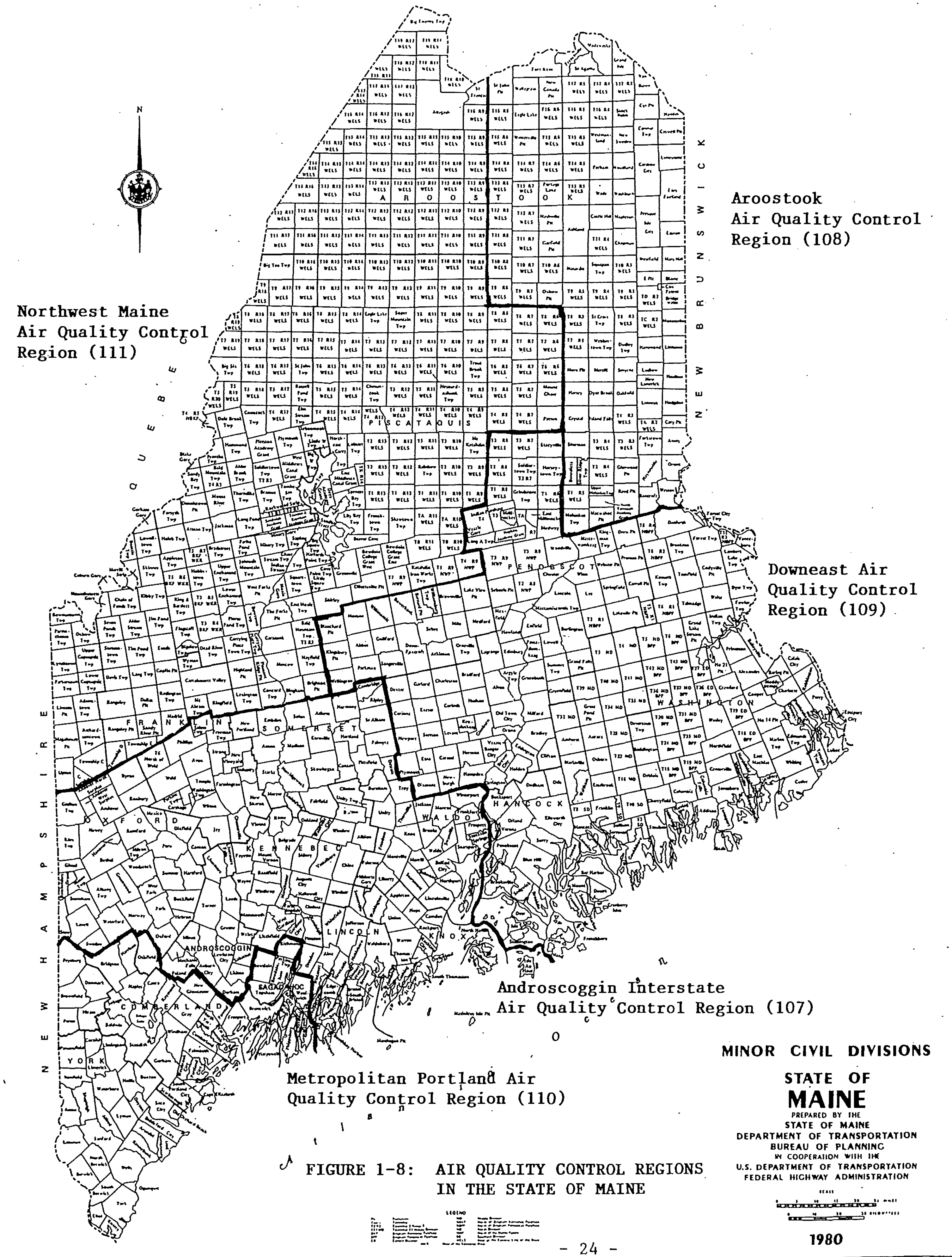


FIGURE 1-8: AIR QUALITY CONTROL REGIONS IN THE STATE OF MAINE

1.3.2 **Explanation of Historical Comparison Tables**

The Historical Comparison Tables present air quality data for 1989 and those years prior to 1989 when the same pollutant was monitored at the same site. The purpose of the Tables are to indicate the variations in air quality from year to year. The Tables in some cases represent maximum concentrations for specific time periods and in others the number of days in each year that the standards were violated.

1.3.3 **Explanation of Trends Tables**

The highest hourly concentration in a year is not the best indicator of long-term air quality trends because it is an erratic value. Therefore, special trend tables are presented for carbon monoxide and ozone. The trend tables present the 10th, 50th, and 90th percentile values to represent the bulk of the air quality data for each year. Percentiles indicate the fraction, or percent, of the value that are below a particular level. For example, if the 90th percentile value for some set of CO observations is 5.0 ppm, it means that 90% of the time the concentrations of CO are less than 5.0 ppm. Conversely, it also means that 10% of the time the concentrations are above 5.0 ppm. Thus the existence or lack of long-term trends in overall air quality for CO and O3 can be more reliably determined using the Trends Tables, than by looking at just the Historical Comparison Tables.

2. CARBON MONOXIDE (CO)

2.1 Description and Sources

Carbon monoxide is colorless, odorless and tasteless gas. Therefore you do not even know you are breathing it until you feel its detrimental effects. It consititutes the largest single fraction of the pollutants found in urban atmospheres. It is produced primarily by the incomplete combustion of organic materials used as fuels for transportation and in the heating of buildings; it also results from industrial processes, refuse burning, and agricultural burning. Several natural sources of CO of both biological and non-biological origin have also been identified, but their contributions to urban atmospheric concentrations are thought to be small. Background levels of CO (resulting from natural and technological sources) found in relatively nonpolluted air range from 0.025 to 1.0 ppm. Urban carbon monoxide is produced primarily by motor vehicles.

Because motor vehicle traffic is the major source of CO, daily concentration peaks coincide with morning and evening rush hours. The worst carbon monoxide problems are found where large numbers of slow moving cars congregate. These problems are further aggravated when they occur in a "street canyon" situation. When there are large amounts of slow moving traffic in a street canyon situation, with the wind blowing perpendicular to the street, carbon monoxide can be trapped in the canyon and build up to unhealthful levels.

CO problems are usually worse in winter because: 1) cold weather makes motor vehicles run dirtier and requires more combustion for space heating; and 2) on winter nights a strong inversion layer develops in the atmosphere, that traps pollution near the ground, preventing it from mixing with cleaner air above.

2.2 Health and Welfare Effects

Carbon monoxide affects the central nervous system by depriving the body of the oxygen it needs. Tests of automobile drivers show exposure to carbon monoxide can impair driver's judgement and ability to respond rapidly in traffic. It can also impair vision and produce headaches.

Carbon monoxide enters the bloodstream by combining with hemoglobin, the substance that carries oxygen to the cells. Hemoglobin that is bound up with CO is called carboxyhemoglobin. This combination occurs 200 times more readily with CO than with oxygen, so the amount of oxygen being distributed throughout the body by the bloodstream is reduced in CO's presence. Blood laden with CO can weaken heart contractions, lowering the volume of blood distributed to various parts of the body. It can also significantly reduce a healthy person's ability to perform manual tasks, such as working, jogging and walking. A life-threatening situation exists in patients with heart disease, who can't compensate for the oxygen loss. The 4.2 million people in the U.S. suffering from angina pectoris (a heart disease characterized by brief spasmodic attacks of chest pain due to insufficient oxygen levels in the heart muscles) are especially susceptible. Carbon monoxide is also harmful to persons who have lung disease, anemia or cerebral-vascular disease. Others sensitive to carbon monoxide include the human fetus, and people exposed to long-term concentrations, such as traffic officers.

People who sit in idling cars over sustained periods risk harmful CO exposure, as do cigarette smokers. Since about two percent of cigarette smoke is carbon monoxide, if you or someone else smokes while driving in heavy traffic, you may both experience the harmful effects of CO from the cigarette smoke and the engine exhaust accumulated in streets. Even three or four hours after you're exposed, half the excess CO still remains in your bloodstream. Because it takes time for CO to build up in the bloodstream, the severity of health effects depends both on the concentration being breathed and the length of time the person is exposed.

2.3 Standards

The existing standards for carbon monoxide are currently set at 9 parts CO per million parts air (ppm), averaged over a period of 8 hours, and 35 ppm averaged over 1 hour, not to be exceeded more than once per year. As a result of a review and revision of the health criteria, EPA proposes to retain the existing primary 8-hour standard at 9 ppm and to lower the primary 1-hour standard to 25 ppm. The change in the 1-hour standard is being proposed because of the more rapid accumulation of blood carboxyhemoglobin in moderately exercising sensitive persons compared to resting individuals. The impact of exercise, which is greater for short-duration exposures, was not considered in the original standard.

2.4 Monitoring

Carbon monoxide was monitored at one site in Maine during 1989 using continuous monitoring equipment utilizing the non-dispersive infrared technique.

Table 2-1 is the 1989 Data Summary for CO. Tables 2-2 and 2-3 have been included for historical comparisons and trend analysis.

TABLE 2 - 1
1989 CARBON MONOXIDE DATA SUMMARY
(Parts Per Million)

SITE	ADDRESS	NUMBER OF OBSERVATIONS	1-HOUR CONCENTRATIONS HIGHEST	1-HOUR CONCENTRATIONS SECOND HIGHEST	8-HOUR CONCENTRATIONS HIGHEST	8-HOUR CONCENTRATIONS SECOND HIGHEST	ANNUAL ARITH. MEAN
METROPOLITAN PORTLAND AIR QUALITY CONTROL REGION (110)							
Portland	Congress Street	1610	10.5	6.4	4.2	4.2	1.30

TABLE 2 - 2
CARBON MONOXIDE HISTORICAL COMPARISONS

PORTLAND
Portland-Congress Street

YEAR	SECOND HIGH*	NUMBER OF VIOLATIONS
1984	6.9	0
1985	5.9	0
1986	5.1	0
1987	5.7	0
1988	4.9	0
1989	4.2	0

* Eight hour concentrations in ppm.

TABLE 2 - 3
CARBON MONOXIDE TRENDS

PORTLAND
Portland-Congress Street

YEAR	Percentiles* 10%	50%	90%
1984	0.2	1.0	2.9
1985	0.4	1.1	2.9
1986	0.3	1.1	2.7
1987	0.4	1.1	2.6
1988	0.3	1.1	2.4
1989	0.3	1.2	2.6

* Percentiles are one hour concentrations in ppm.

3. OZONE (O3)

3.1 Description and Sources

Ozone is a highly reactive form of oxygen which, at very high concentrations, is a blue unstable gas that has a characteristic pungent odor most commonly identified around an arcing electric motor, lightning storms, or other electrical discharges. However, at normal ambient concentrations, ozone is colorless and odorless. Ozone is the major component of photochemical "smog", but the haziness and odors of smog are primarily caused by other components.

Natural ground level ozone occurs in low concentrations (less than .05 ppm) due to natural physical and chemical phenomena. Occasionally, unique meteorological conditions can result in natural levels between .05 and .10 ppm.

Ozone is not emitted directly from a source as are other pollutants. It forms as secondary pollutant. Its precursors are hydrocarbons and nitrogen oxides, which chemically react in sunlight to form ozone. The hydrocarbons are emitted in automobile exhaust, from gasoline and oil storage and transfer, and from industrial use of paint solvents, degreasing agents, cleaning fluids, ink solvents, incompletely burned coal or wood and many other sources. Plants also give off hydrocarbons such as terpenes from pine trees. Nitrogen oxides are emitted by all combustion sources.

The highest ozone levels generally occur during summer afternoons when the high temperatures and strong sunlight promote photochemical reactions. Stagnant weather may cause smog to remain in an area for several days. The winds may also transport ozone many miles outside of the urban environment. For example, it is estimated that the majority of the ozone in the State of Maine is transported into the State from sources located outside the State. In addition a much smaller amount of the ozone is naturally occurring background concentrations, part of which is also transported into the State. The remaining ozone is assumed to be due to local sources within the State. Because of long-range transport, local control of emissions by itself may not solve the ozone problem. An effective national program may be necessary to achieve national compliance.

Ground-level ozone, discussed above, should not be confused with the stratospheric ozone layer, located about seven miles high in the atmosphere, which shields the earth from cancer-causing ultraviolet rays. Concentrations of ozone in this layer may reach as high as 10 ppm. Concern over potential reduction of the necessary levels of ozone in the stratosphere by reactions with fluorocarbons from aerosol cans has resulted in the removal of most of these propellants from the market. However, ozone at ground level, where it is breathed, is a pollutant.

3.2 **Health and Welfare Effects**

Ozone at low concentrations causes eye irritations and at higher concentrations difficulty in breathing for people with respiratory problems, the elderly, and children. Many plants, such as white pine, soybeans and alfalfa, are extremely sensitive to ozone, and ozone is known to weaken materials such as rubber and fabrics.

3.3 **Standards**

The existing National Ambient Air Quality Standard (NAAQS) for ozone is 0.12 ppm and will be attained when "the expected number of days per calender year with maximum hourly average concentrations above 0.12 ppm is equal to or less than one". This standard is new as of February 8, 1979 and replaces a more restrictive 0.08 ppm standard that was established April 10, 1971. The change was the result of a required assessment of existing NAAQS to include a review of new health effects data that have become available since 1970. As a result of this review and national public comments, the standard was changed to a level that is considered to be sufficient to protect the public health and welfare. Since then additional research has concluded that there is in fact damage being caused by ozone levels less than the existing Federal standard. Based on recent studies there appears to be significant vegetation damage at levels considerably below the Federal standard and some "adverse" health effects at the current Federal standard. As of the date this report was compiled no proposals have been made for changing the Federal standard. The current State Standard is .081 ppm. It was established at the same time the original Federal Standard was established and has not been changed. In the past the state standard was interpreted to be .080 ppm but a conversion of the actual 160 ug/m3 standard to ppm yields .081. Therefore, only hourly averages in excess of .081 ppm are considered exceedances of the state standard.

3.4 **Monitoring**

Ozone was monitored at nine sites in Maine during 1989 using continuous monitoring equipment of two kinds, either chemiluminescence or ultra-violet absorption analyzers. Maine's ozone monitoring season is limited to April through October due to the weather conditions which are not conducive to ozone formation at other times of the year.

Table 3-1 is the 1989 Data Summary for Ozone. Table 3-2 presents the Ozone Historical Comparisons and Table 3-3 presents the Ozone Trends.

TABLE 3 - 1

1989 OZONE DATA SUMMARY

(Parts Per Million)

SITE	ADDRESS	NUMBER OF OBSERVATIONS	HIGHEST CONCENTRATION	SECOND HIGHEST CONCENTRATION	NUMBER OF VIOLATIONS STATE*	FEDERAL**
ANDROSCOGGIN INTERSTATE AIR QUALITY CONTROL REGION (107)						
Gardiner	Gardiner High School	4836	.126	.118	47	1
Port Clyde	Port Clyde Ozone	4155	.134	.129	69	1
Isle Au Haut	Isle Au Haut Fire Station	3053	.118	.115	35	0
AROOSTOOK AIR QUALITY CONTROL REGION (108)						
Presque Isle	Regional Office	2367	.061	.060	0	0
DOWNEAST AIR QUALITY CONTROL REGION (109)						
Acadia National Park	McFarland Hill Ranger Station	4585	.130	.113	23	1
Dedham	Bald Mountain	3246	.108	.105	41	0
Jonesport	Public Landing	2879	.100	.099	18	0
METROPOLITAN PORTLAND AIR QUALITY CONTROL REGION (110)						
Cape Elizabeth	Shelter Site	4627	.146	.136	81	3
Kennebunkport	Parson's Way	3784	.154	.147	103	3

* Total number of hours minus one greater than .081 ppm.

** Number of days in violation. Not a statistical estimate.

TABLE 3 - 2
OZONE HISTORICAL COMPARISONS
(1-Hour Concentrations)

CAPE ELIZABETH
Shelter Site

YEAR	SECOND HIGH	# OF STATE VIOLATIONS
1978	.160 PPM	202
1979	.155 PPM	116
1980	.178 PPM	141
1981	.122 PPM	98
1982	.140 PPM	117
1983	.163 PPM	187
1984	.146 PPM	148
1985	.165 PPM	141
1986	.128 PPM	68
1987	.152 PPM	76
1988	.168 PPM	269
1989	.136 PPM	81

KENNEBUNKPORT
Parson's Way

YEAR	SECOND HIGH	# OF STATE VIOLATIONS
1982	.120 PPM	42
1983	.148 PPM	149
1984	.147 PPM	184
1985	.168 PPM	190
1986	.138 PPM	62
1987	.145 PPM	67
1988	.168 PPM	230
1989	.147 PPM	103

GARDINER
Gardiner High School

YEAR	SECOND HIGH	# OF STATE VIOLATIONS
1980	.117 PPM	54
1981	.122 PPM	31
1982	.120 PPM	56
1983	.140 PPM	99
1984	.112 PPM	89
1985	.133 PPM	84
1986	.110 PPM	17
1987	.112 PPM	25
1988	.145 PPM	142
1989	.118 PPM	47

ACADIA
McFarland Hill Ranger Station

YEAR	SECOND HIGH	# OF STATE VIOLATIONS
1982*	.055 PPM	0
1983	.135 PPM	98
1984	.130 PPM	86
1985	.117 PPM	57
1986	.108 PPM	37
1987	.126 PPM	44
1988	.153 PPM	216
1989	.113 PPM	23

* Not a complete year.

TABLE 3 - 3
OZONE TRENDS
(1-Hour Concentrations)

CAPE ELIZABETH
Shelter Site

	PERCENTILES		
Year	10%	50%	90%
1978	.015	.035	.065
1979	.018	.036	.070
1980	.019	.035	.065
1981	.015	.032	.056
1982	.018	.036	.058
1983	.018	.034	.061
1984	.019	.040	.064
1985	.022	.038	.062
1986	.016	.033	.055
1987	.018	.035	.055
1988	.033	.050	.106
1989	.034	.048	.070

KENNEBUNKPORT
Parson's Way

	PERCENTILES		
Year	10%	50%	90%
1983	.008	.027	.058
1984	.012	.032	.064
1985*	.015	.037	.072
1986	.013	.033	.053
1987	.013	.032	.054
1988	.035	.052	.119
1989	.036	.052	.085

* Percentiles calculated using 70% of the data.

GARDINER
Gardiner High School

	PERCENTILES		
YEAR	10%	50%	90%
1980	.008	.031	.056
1981	.009	.029	.050
1982	.009	.030	.053
1983	.009	.031	.056
1984	.007	.031	.055
1985	.012	.034	.057
1986	.009	.029	.047
1987	.008	.028	.048
1988	.027	.049	.087
1989	.034	.047	.073

ACADIA
McFarland Hill Ranger Station

	PERCENTILES		
YEAR	10%	50%	90%
1982*	.005	.020	.030
1983	.019	.032	.053
1984	.020	.032	.050
1985	.022	.032	.048
1986	.019	.032	.047
1987	.021	.033	.049
1988	.032	.051	.102
1989	.033	.046	.069

* Not a complete year.

4. NITROGEN DIOXIDE (NO2)

4.1 Description and Sources

In its pure state, nitrogen dioxide is a reddish-orange-brown gas with a characteristic pungent odor. It is corrosive and a strong oxidizing agent. Nitrogen dioxide comprises about 10% of the oxides of nitrogen (NOX) that are formed when nitrogen in the air combines with oxygen during high temperature combustion. Most of the rest of the NOX emitted by combustion sources is nitric oxide (NO). However, during the day most of the NO is photochemically transformed into NO2. Thus, essentially all the NOX emitted can be assumed to eventually become NO2.

4.2 Health and Welfare Effects

Exposure to NO2 affects the delicate structure of lung tissue. High levels cause lung irritation and potential lung damage. Lower levels have been associated with increased respiratory disease. Oxides of nitrogen can cause serious injury to vegetation, including bleaching or death of plant tissue, loss of leaves, and reduced growth rate. NOX also deteriorates fabrics and fades fabric dyes. Nitrate salts formed from nitrogen oxides have been associated with the corrosion of metals. Nitrogen oxides can also reduce visibility.

4.3 Standards

The current standard for NO2 is an annual arithmetic mean (average) value not to exceed .05 ppm. NO2 is the only gaseous pollutant for which only a long-term (annual average) standard has been established.

4.4 Monitoring

No monitoring for nitrogen dioxide was conducted during 1989.

5. SULFUR DIOXIDE (SO2)

5.1 Description and Sources

Sulfur dioxide is a colorless irritating gas having the same pungent odor as a struck match. Most people can detect its taste at a level of about 0.3 to 1 part per million. SO2 is highly soluble in water, forming sulfurous acid. On a worldwide basis, SO2 is considered to be one of the major pollution problems. It is emitted mainly from stationary sources that utilize fossil fuels (coal, oil) such as power plants, ore smelters, and refineries.

5.2 Health and Welfare Effects

The health effects of sulfur dioxide appear to be always associated with high levels of particulates or other pollutants. The world's major recorded air pollution disasters have been associated with high levels of sulfur dioxide and particulates. The excess deaths attributed to these pollutants were due to respiratory failures and occurred predominantly, but not exclusively, in the elderly and infirm. Atmospheres containing high levels of sulfur dioxide are associated with elevated concentrations of other sulfur compounds such as sulfates and sulfuric acid mists, which are corrosive and potentially carcinogenic.

The corrosiveness of SO2 and its derivatives also causes crop and material damage. Its transport and transformation into sulfurous and sulfuric acids contribute to acid precipitation, causing soils and lakes to become seriously acidified.

5.3 Standards

There are two existing Primary National Ambient Air Quality Standards for sulfur dioxide. The first is a long-term one year arithmetic average of 0.03 parts per million (ppm). The second is a short-term 24-hour average standard where concentrations are not to exceed 0.14 ppm more than once per year. The current Secondary NAAQS for SO2 is a 3-hour average concentration of 0.5 ppm not to be exceeded more than once per year.

In addition there are three state standards for sulfur dioxide. The first is a long-term one-year arithmetic average of .022 parts per million. The second was a short-term 24-hour average standard of .088 ppm not to be exceeded. The third was a short-term 3-hour average concentration of .439 ppm not to be exceeded. During 1987 both of the short-term standards were amended to allow for one exceedance per year.

5.4 Monitoring

Sulfur dioxide was monitored at sixteen sites in Maine during 1989 using continuous monitoring equipment utilizing either the pulsed fluorescent or coulometric methods.

Table 5-1 is the 1989 Data Summary for SO2. Tables 5-2 and 5-3 present the SO2 Historical Comparison Data. Table 5-3 in past years had indicated violations but because one exceedance was allowed per year beginning in 1987 this table now indicates exceedances of the standards rather than violations to maintain continuity for comparisons.

TABLE 5 - 1
1989 SULFUR DIOXIDE DATA SUMMARY
(Parts Per Million)

SITE	ADDRESS	NUMBER OF OBSERVATIONS	HIGHEST 3-HOUR AVERAGE	SECOND HIGHEST 3-HOUR AVERAGE	HIGHEST 24-HOUR AVERAGE	SECOND HIGHEST 24-HOUR AVERAGE	ANNUAL ARITH. MEAN
ANDROSCOGGIN INTERSTATE AIR QUALITY CONTROL REGION (107)							
Lewiston	Country Kitchen Parking Lot	7747	.076	.073	.042	.034	.008
Mexico	Hunt's Property	6753	.149	.138	.064	.051	.012
Rumford	Taylor Mountain I	6861	.126	.115	.044	.036	.012
Rumford	Taylor Mountain II	6832	.218	.122	.053	.040	.010
Rumford	Village Green Site	8227	.158	.111	.049	.037	.007
Searsport	Turnpike Road	6883	.087	.067	.028	.019	.005
AROOSTOOK AIR QUALITY CONTROL REGION (108)							
Madawaska	Madawaska High School	8225	.108	.081	.032	.030	.003
Madawaska	Albert Street	8253	.132	.115	.048	.040	.007
Madawaska	U. S. Post Office	8285	.177	.132	.069	.068	.008
DOWNEAST AIR QUALITY CONTROL REGION (109)							
Acadia National Park	McFarland Hill Ranger Station	5187	.016	.015	.011	.007	.001*
East Millinocket	Main Street	8693	.048	.019	.011	.010	.003
Dedham	Bald Mountain	1332	.029	.029	.022	.011	.004*
Lincoln	Thomas Motel Trailer Park	8109	.087	.080	.041	.039	.004
Millinocket	York Street	8342	.193	.083	.044	.043	.008
METROPOLITAN PORTLAND AIR QUALITY CONTROL REGION (110)							
Biddeford	Biddeford Treatment Plant	7979	077	.047	.032	.025	.007
Portland	Shelter Site	8257	.071	.067	.044	.041	.010

* Insufficient data collected for valid annual arithmetic mean.

TABLE 5 - 2
SULFUR DIOXIDE HISTORICAL COMPARISONS
(Maximum 24-Hour Concentrations of Sulfur Dioxide)

SITE	ADDRESS	MAXIMUM 24-HOUR CONCENTRATION (PPM) 1983	1984	1985	1986	1987	1988	1989
ANDROSCOGGIN INTERSTATE AIR QUALITY CONTROL REGION (107)								
Lewiston	Country Kitchen Parking Lot	.044	.060	.043	.047	.038	.053	.042
Mexico	Hunt's Property	.061	.071	.070	.068	.043	.067	.064
Rumford	Taylor Mountain I	.077	.096	.066	.086	.098	.125	.044
Rumford	Taylor Mountain II	.072	.071	.050	.067	.065	.074	.053
Rumford	Village Green Site	.054	.049	.031	.059	.042	.061	.049
Searsport	Turnpike Road	--	--	--	--	--	.020	.029
AROOSTOOK AIR QUALITY CONTROL REGION (108)								
Madawaska	Madawaska High School	.049	.066	.037	.046	.076	.057	.032
Madawaska	Albert Street	.130	.078	.058	.080	.072	.071	.048
Madawaska	U. S. Post Office	--	--	.061	.068	.084	.073	.069
DOWNEAST AIR QUALITY CONTROL REGION (109)								
East Millinocket	Main Street	--	--	--	--	--	.031	.011
Lincoln	Thomas Motel Trailer Park	.052	.076	.051	.037	.039	.036	.041
Millinocket	York Street	.065	.044	.046	.061	.048	.038	.044
METROPOLITAN PORTLAND AIR QUALITY CONTROL REGION (110)								
Biddeford	Biddeford Treatment Plant	--	--	--	--	--	.044	.032
Portland	Shelter Site	.056	.062	.050	.062	.047	.047	.044

* Not a complete year.

TABLE 5 - 3
SULFUR DIOXIDE HISTORICAL COMPARISONS
(Sites with exceedances of the standards in the past six years)

SITES	ADDRESS	TOTAL NUMBER OF EXCEEDANCES* 1983	1984	1985	1986	1987	1988	1989
ANDROSCOGGIN INTERSTATE AIR QUALITY CONTROL REGION (107)								
Rumford	Taylor Mountain I	0	1	0	0	1	1	0

* Includes 3-Hour and 24-Hour Exceedances.

6. PARTICULATES (TSP and PM10)

6.1 Description and Sources

Particulates is the term given to the tiny particles of solid or semi-solid material found in the atmosphere. It is this "dirt" in the air that is visible as a "Brown Cloud", haze or smog. The sources of particulates are many: wind-blown dust and sand from roadways, fields, and construction; coal dust, fly ash, and carbon black from various combustion sources; and automobile exhaust, to name a few. Particulates that range in size from less than 0.1 micrometer up to approximately 45 micrometers are called "total suspended particulates". Particles larger than that range tend to settle out of the air and not remain suspended, except in high winds.

6.2 Health and Welfare Effects

The human nose filters out 99 percent of the large and medium-sized particles. The rest enter the windpipe and lungs, where some, known as inhalable particulates, cling to protective mucous and are removed. Some of the smallest, called respirable particulates, are deposited in the lungs' tiny air sacs (alveoli).

In the lungs particulates slow down the exchange of oxygen with carbon dioxide in the blood, causing shortness of breath. The heart may be strained because it must work harder to compensate for oxygen loss. Usually the people most sensitive to these conditions have respiratory diseases like emphysema, bronchitis, asthma, or heart problems. The elderly and children are also sensitive.

Particles themselves may be poisonous if inhaled or absorbed, damaging remote organs like the kidneys or liver. Swallowed mucous that is laden with poisionous particulate matter may damage the stomach.

In addition, particulates may be carriers of poisonous liquid or gaseous substances. Sulfur dioxide, a major air pollutant in its own right, is frequently absorbed by particulates and can react with them to form sulfates. Sulfates react with moisture in the air or in the respiratory tract to form a corrosive liquid (sulfuric acid) that irritates delicate membranes and slows down the cleansing action of mucous. This effect can reduce the body's ability to remove harmful bacteria, increasing the possibility of infection.

Adverse health effects from particulate matter aren't always seen immediately. Particulates can accumulate in the lungs after repeated, long-term exposure, causing respiratory distress and other health problems that may be manifested later.

Particles in the air block out and scatter sunlight, reducing visibility. Particulates soil and corrode metals, masonry, and textiles. Irritating odors are often associated with particulates, also.

6.3 **Standards**

Primary:

At the beginning of 1987 the primary particulate standards were for total suspended particulates (TSP), independent of particle size or chemical composition. The long-term standard was an annual geometric mean not to exceed 75 micrograms of particulates per cubic meter of air (ug/m3). The short-term standard was a 24-hour average of 260 ug/m3 not to be exceeded more than once per year.

In July of 1987 EPA published revised particulate standards to account for the deeper inhalability of small particles and eliminated the total suspended particulate standards. The new standards, rather than applying to TSP, apply to inhalable or fine particulates. A particle size of 10 micrometers was selected as the upper size limit with a 24-hour concentration of 150 ug/m3 and an annual standard of 50 ug/m3 expressed as an expected annual arithmetic mean(AAM). The short term standard is attained when the expected number of exceedances is no more than one per year. The expected AAM is determined by averaging the annual arithmetic averages from three successive years of data.

Secondary:

The secondary TSP standard was a 24-hour average of 150 ug/m3 not to be exceeded more than once per year, designed to protect from soiling, corrosion, etc.

When EPA adopted the fine particulate standards they eliminated the secondary TSP standards and made the secondary fine particulate standards equal to the primary fine particulate standards.

State Standards:

As of the end of 1988 the State Standards for total suspended particulates still included an annual geometric mean of 60 micrograms per cubic meter and a 24-hour standard of 150 micrograms per cubic meter not to be exceeded. In addition, the Board of Environmental Protection adopted the federal fine particulate standards for both the short term twenty-four hour and the annual arithmetic mean.

In 1989 the State Legislature passed a more restrictive annual standard for fine particulates of 40 ug/m3. In addition, the TSP annual state standard was eliminated and the 24 hour standard was changed to be an indicator of a nuisance condition.

6.4 **Monitoring**

Particulates were monitored at 41 sites in Maine during 1989 using High-Volume Particulate Air Samplers (Hi-Vols).

Hi-Vols operate on the same principle as a vacuum cleaner in that the air is drawn through a filter to "catch the dust". The difference is that a Hi-Vol draws a calibrated volume of air through a pre-weighed filter pad (rather than a bag) for a twenty-four hour period. The change in weight of the filter pad is recorded as total suspended particulate or TSP in micrograms of particulates per cubic meter of air.

Table 6-1 is a summary of the TSP data collected in Maine during 1989. Table 6-2 is a historical comparison of the TSP Annual Geometric Means at sites which have been in existence over the last two years. Table 6-3 summarizes the number of exceedances of the TSP standard which have occurred over the last six years and the sites at which they occurred.

Fine particulate sampling increased again during 1989. By the end of the year thirty-two sites were operating with PM10 samplers. The increased sampling is being conducted to obtain data to evaluate the federal and state fine particulate standards and to document compliance with those standards. The sampling was conducted with size-selective hi-vols.

The data collected and the sites which were in operation during 1989 have been summarized in Table 6-4. Tables 6-5 and 6-6 provide some historical comparison data over the last few years these monitors have been in operation.

TABLE 6 - 1
1989 TOTAL SUSPENDED PARTICULATES DATA SUMMARY
(Micrograms Per Cubic Meter)

SITE	ADDRESS	NUMBER OF OBSERVATIONS	HIGHEST 24-HOUR	SECOND HIGHEST	THIRD HIGHEST	ANNUAL GEOMETRIC MEAN
ANDROSCOGGIN INTERSTATE AIR QUALITY CONTROL REGION (107)						
Auburn	Lepage Bakery	52	115	111	80	42.1*
Augusta	Hartford Fire House	20	159	132	92	55.4*
Jay	Weather Level I	142	144	112	109	35.0
Jay	Crash Road	153	78	60	59	19.6
Jay	Jay Hill	148	105	97	86	25.2
Jay	Burnham	146	106	105	96	32.9
Lewiston	Country Kitchen Parking Lot	30	114	107	96	50.5*
Mexico	Labonville's	145	176	154	142	46.5
Rumford	Taylor Mountain I	173	118	108	98	33.8
Rumford	Taylor Mountain II	174	111	85	76	24.3
Rumford	Village Green Site	174	89	81	78	29.7
Rumford	Taylor Mountain III	171	110	98	77	25.1
Rumford	Taylor Mountain IV	174	122	109	94	30.4
Skowhegan	Hinckley	60	48	42	41	16.8
Skowhegan	Eaton Ridge	56	55	49	38	18.2
Thomaston	Mitchell Property	122	99	94	92	25.1
Thomaston	Marsh Road	119	73	67	61	23.4
Waterville	Stern's Department Store	59	167	143	118	41.4*
Winslow	Gulley Hill Road	131	195	162	161	51.9
AROOSTOOK AIR QUALITY CONTROL REGION (108)						
Madawaska	St. Jarres	93	268	166	136	48.0*
DOWNEAST AIR QUALITY CONTROL REGION (109)						
Bangor	Regional Office	19	143	125	125	61.3*
Bangor	Kenduskeag Pump Station	61	177	164	150	56.2
Brewer	Brewer Junior High School	59	92	82	80	36.8
Lincoln	Vocational Education Building	353	197	141	122	34.0
Lincoln	Lincoln Post Office Building	357	284	210	142	35.2

TABLE 6 - 1 (continued)
1989 TOTAL SUSPENDED PARTICULATES DATA SUMMARY
(Micrograms Per Cubic Meter)

SITE	ADDRESS	NUMBER OF OBSERVATIONS	HIGHEST 24-HOUR	SECOND HIGHEST	THIRD HIGHEST	ANNUAL GEOMETRIC MEAN
Lincoln	Thomas Motel Trailer Park	339	374	160	157	33.9
Millinocket	York Street	112	130	109	87	32.1
Old Town	Marsh Island Apartments	59	212	167	88	36.0
Newburgh	Newburgh School	323	103	74	72	19.4
Milford	Shumway Field	Data not available.				
Woodland	Secondary Treatment Pipeline	55	108	57	52	21.7
Woodland	Woodland High School	162	146	121	119	26.4
Woodland	Background	56	45	37	34	14.1

METROPOLITAN PORTLAND AIR QUALITY CONTROL REGION (110)

SITE	ADDRESS	NUMBER OF OBSERVATIONS	HIGHEST 24-HOUR	SECOND HIGHEST	THIRD HIGHEST	ANNUAL GEOMETRIC MEAN
Berwick	Berwick Fire Station	25	128	118	118	72.8*
Biddeford	Biddeford Treatment Plant	61	83	78	68	32.1
Portland	Shelter Site	45	105	97	91	51.9
South Portland	SMVTI	63	69	67	62	27.3
South Portland	Jordan Marsh Auto Center	37	256	196	97	43.9*
Westbrook	N. E. T. & T. Company	57	101	94	94	46.3
Westbrook	Research Building	104	196	187	182	62.0
Westbrook	Warehouse #5	56	201	136	133	59.3

* Insufficient data collected for valid annual geometric mean.

TABLE 6 - 2
TOTAL SUSPENDED PARTICULATES HISTORICAL COMPARISON
ANNUAL GEOMETRIC MEANS (UG/M3)

SITE	ADDRESS	ANNUAL GEOMETRIC MEANS (ug/m3) 1984	1985	1986	1987	1988	1989
ANDROSCOGGIN INTERSTATE AIR QUALITY CONTROL REGION (107)							
Auburn	Lepage Bakery	43.5	44.8	46.0	41.1	37.1	42.1*
Augusta	Hartford Fire House	45.9	44.3	41.0	39.6	40.1	55.4*
Jay	Weather Level I	36.4	36.6	33.5	34.1	38.3	35.0
Jay	Crash Road	22.1	18.7	18.9	19.4	20.7	19.6
Jay	Jay Hill	32.6	24.5	24.6	25.1	26.0	25.2
Jay	Burnham	--	--	--	--	36.0	32.9
Mexico	Labonville's	51.6	50.7	46.6	40.8	43.3	46.5
Rumford	Taylor Mountain I	37.5	35.8	33.0	30.0	30.7	33.8
Rumford	Taylor Mountain II	28.2	26.7	24.3	22.9	23.8	24.3
Rumford	Village Green Site	34.0	31.2	29.7	27.2	27.7	29.7
Rumford	Taylor Mountain III	--	--	--	--	23.0	25.1
Rumford	Taylor Mountain IV	--	--	--	--	27.3	30.4
Skowhegan	Hinckley	21.3	18.5	16.6	18.0	14.9	16.8
Skowhegan	Eaton Ridge	20.2	18.4	17.1	15.5	14.0	18.2
Thomaston	Mitchell Property	24.2	22.9	22.0	21.9	24.5	25.1
Thomaston	Marsh Road	25.9	24.0	23.5	23.4	23.9	23.4
Waterville	Sterns Department Store	35.5*	40.8	42.1	55.1	46.5	41.4*
Winslow	Gulley Hill Road	--	--	--	43.6	44.1	51.9*
AROOSTOOK AIR QUALITY CONTROL REGION (108)							
Madawaska	St. Jarres	50.7	46.9	44.7	44.9	58.2	48.0*
DOWNEAST AIR QUALITY CONTROL REGION (109)							
Bangor	Regional Office	46.5	44.8	42.3	43.9	39.0	61.3*
Bangor	Kenduskeag Pump Station	56.5	59.9	59.4	53.0	56.3	56.2
Brewer	Brewer Junior High School	41.5	38.1	36.5	37.0	37.4	36.8
Lincoln	Vocational Education Building	35.3	37.1	30.3	28.8	29.7	34.0
Lincoln	Lincoln Post Office Building	40.4	39.2	34.2	30.3	32.3	35.2

TABLE 6 - 2 (continued)
TOTAL SUSPENDED PARTICULATES HISTORICAL COMPARISON
ANNUAL GEOMETRIC MEANS (UG/M3)

SITE	ADDRESS	ANNUAL GEOMETRIC MEANS (ug/m3) 1984	1985	1986	1987	1988	1989
Lincoln	Thomas Motel Trailer Park	41.8	41.4	34.9	33.9	34.1	33.9
Millinocket	York Street	49.1	46.1	37.3	34.4	33.8	32.1
Old Town	Marsh Island Apartments	37.3	33.8	32.6	36.0	34.6	36.0
Newburgh	Newburgh School	16.1	15.1	16.9	15.1	17.0	19.4
Milford	Shumway Field	29.1	26.6	25.4	25.2	25.5	----
Woodland	Secondary Treatment Pipeline	--	--	28.2	24.1	23.1	21.7
Woodland	Woodland High School	--	--	33.2	29.0	26.5	26.4
Woodland	Background	--	--	12.0*	13.6	13.7	14.1
METROPOLITAN PORTLAND AIR QUALITY CONTROL REGION (110)							
Berwick	Berwick Fire Station	--	--	51.6*	59.9	68.6	72.8*
Biddeford	Biddeford Treatment Plant	43.3*	35.8	38.8	36.0	40.8	32.1
Portland	Shelter Site	49.4	51.3	49.7	48.1	46.5	51.9
South Portland	SMVTI	31.7*	30.7	29.8	28.7	28.8	27.3
Westbrook	N. E. T. & T. Company	40.8	44.7	39.2	38.2	44.8	46.3
Westbrook	Research Building	63.4	70.5	67.4	71.2	62.1*	62.0
Westbrook	Warehouse #5	60.6	62.5	57.4	60.1	61.6	59.0

* Insufficient data collected for valid annual geometric mean.

TABLE 6 - 3

TOTAL SUSPENDED PARTICULATES HISTORICAL COMPARISON

(Sites with exceedances of the 24-hour standard in the past six years)

		TOTAL NUMBER OF SHORT TERM EXCEEDANCES					
SITE	ADDRESS	1984	1985	1986	1987	1988	1989
ANDROSCOGGIN INTERSTATE AIR QUALITY CONTROL REGION (107)							
Auburn	Lepage Bakery	0	0	3	0	0	0
Augusta	Hartford Fire House	18	0	1	2	2	1
Jay	Weather Level I	2	0	0	1	0	0
Jay	Burnham	-	-	0	1	1	0
Mexico	Labonville's	0	1	0	0	0	2
Rumford	Village Green	1	0	0	0	0	0
Thomaston	Mitchell Property	0	0	0	2	3	0
Waterville	Sterns Department Store	-	-	-	1	0	1
Winslow	Gulley Hill Road	-	-	-	2	1	6
AROOSTOOK AIR QUALITY CONTROL REGION (108)							
Madawaska	St. Jarres	0	1	3	6	10	2
DOWNEAST AIR QUALITY CONTROL REGION (109)							
Bangor	Regional Office	0	2	1	1	0	0
Bangor	Kenduskeag Pump Station	1	5	6	2	1	2
Lincoln	Vocational Education Building	0	0	0	0	0	1
Lincoln	Lincoln Post Office Building	1	1	1	2	0	2
Lincoln	Thomas Motel Trailer Park	2	3	0	0	2	4
Millinocket	York Street	4	1	1	4	0	0
Old Town	Marsh Island Apartments	2	1	0	1	1	2
Woodland	Secondary Treatment Pipeline	1	1	2	3	0	0
Woodland	Woodland High School	11	0	8	5	0	0
Berwick	Berwick Fire Station	-	-	1	3	3	0
Portland	Shelter Site	0	1	0	1	0	0

TABLE 6 - 3 (continued)
TOTAL SUSPENDED PARTICULATES HISTORICAL COMPARISON
(Sites with exceedances of the 24-hour standard in the past six years)

SITE	ADDRESS	TOTAL NUMBER OF SHORT TERM EXCEEDANCES 1984	1985	1986	1987	1988	1989
METROPOLITAN PORTLAND AIR QUALITY CONTROL REGION (110)							
Westbrook	N. E. T. & T. Company	1	0	0	0	0	0
Westbrook	Research Building	2	8	15	11	0	4
Westbrook	Warehouse #5	1	0	2	4	3	1

TABLE 6 - 4
1989 FINE PARTICULATE DATA SUMMARY
(Micrograms Per Cubic Meter)

SITE	ADDRESS	NUMBER OF OBSERVATIONS	HIGHEST 24-HOUR	SECOND HIGHEST	THIRD HIGHEST	ANNUAL ARITH. MEAN	ANNUAL GEOM. MEAN
ANDROSCOGGIN INTERSTATE AIR QUALITY CONTROL REGION (107)							
Augusta	Hartford Fire House	19	46	46	42	26.3	26.8*
Jay	Weather Level I	129	46	45	38	18.1	16.1
Jay	Jay Hill	148	80	72	59	22.4	19.0
Mexico	Labonville's	144	135	87	76	30.3	26.3
Rumford	Village Green	126	56	55	55	23.4	19.7
Skowhegan	Hinckley	27	35	35	31	21.9	16.4*
Skowhegan	Eaton Ridge	57	39	35	35	15.5	13.8
Thomaston	Mitchell Property	114	73	59	51	18.2	15.8
Thomaston	Marsh Road	100	72	53	43	17.5	15.7
Winslow	Gulley Hill Road	62	77	75	67	28.2	25.5
AROOSTOOK AIR QUALITY CONTROL REGION (108)							
Madawaska	Big Daddy's Restaurant	183	118	90	86	33.2	29.4
Presque Isle	Northeastland Hotel	217	144	136	115	30.0	27.6
Presque Isle	Regional Office	37	44	36	35	15.8	13.1*
Presque Isle	Hayden-Perry Insurance Building	88	142	114	97	35.7	30.2*
DOWNEAST AIR QUALITY CONTROL REGION (109)							
Bangor	Kenduskeag Pump Station	61	108	59	54	27.3	23.9
Hampden	McGraw School	102	68	51	47	15.1	13.3
East Millinocket	Library/Municipal Building	110	82	60	53	20.0	16.4
Lincoln	Thomas Motel Trailer Park	172	81	72	68	23.1	19.8
Millinocket	Katahdin Nursing Home	39	62	37	34	18.3	15.9*
Millinocket	York Street	105	88	54	51	18.9	16.4
Orrington	Center Drive School	105	45	44	38	13.2	11.8
Woodland	Secondary Treatment Pipeline	51	46	35	33	17.7	16.3
Woodland	Woodland High School	154	139	78	71	21.9	18.9
Woodland	Background	52	32	28	27	12.7	11.6

TABLE 6 - 4 (continued)
1989 FINE PARTICULATE DATA SUMMARY
(Micrograms Per Cubic Meter)

SITE	ADDRESS	NUMBER OF OBSERVATIONS	HIGHEST 24-HOUR	SECOND HIGHEST	THIRD HIGHEST	ANNUAL ARITH. MEAN	ANNUAL GEOM. MEAN
METROPOLITAN PORTLAND AIR QUALITY CONTROL REGION (110)							
Biddeford	Biddeford Treatment Plant	41	53	50	48	26.9	23.8
Bridgton	Upper Ridge Road	53	29	29	24	11.5	10.1
Portland	Shelter Site	56	57	56	56	26.1	24.1
Portland	Elks Lodge	57	50	30	30	15.6	14.0*
South Portland	Jordan Marsh Auto Center	16	90	43	36	25.2	24.9
Westbrook	N. E. T.& T. Company	57	42	39	38	20.7	19.1
Westbrook	Research Building	331	66	64	58	24.0	21.8
Westbrook	Warehouse #5	54	58	54	49	23.1	20.6

* Insufficient data collected for valid annual geometric mean.

TABLE 6 - 5
FINE PARTICULATE HISTORICAL COMPARISON
ANNUAL ARITHMETIC MEANS (ug/m3)

SITE	ADDRESS	ANNUAL ARITHMETIC MEANS (ug/m3) 1985	1986	1987	1988	1989
ANDROSCOGGIN INTERSTATE AIR QUALITY CONTROL REGION (107)						
Augusta	Hartford Fire House	29.6	24.9	25.3	23.7	26.3
Jay	Weather Level I	--	--	--	17.7	18.1
Jay	Jay Hill	19.3	21.3	18.9	20.6	22.4
Mexico	Labonvilles	--	--	30.3	30.5	30.3
Rumford	Village Green	--	--	--	21.1	23.4
Skowhegan	Hinckley	--	--	--	22.3	21.9
Skowhegan	Eaton Ridge	--	--	--	14.5	15.5
Thomaston	Mitchell Property	--	--	--	22.5	18.2
Thomaston	Marsh Road	--	--	--	20.9	17.5
Winslow	Gulley Hill Road	--	24.8	28.6	24.9	28.2
AROOSTOOK AIR QUALITY CONTROL REGION (108)						
Madawaska	Big Daddy's Restaurant	33.4	36.4	31.8	33.4	33.2
Presque Isle	Northeastland Hotel	35.7	31.0	29.2	26.4	30.0
Presque Isle	Hayden-Perry Insurance Building	--	--	--	22.6	35.7
DOWNEAST AIR QUALITY CONTROL REGION (109)						
Bangor	Kenduskeag Pump Station	--	--	--	30.5	27.3
Hampden	McGraw School	--	--	15.3	15.7	15.1
East Millinocket	Library/Municipal Building	--	--	--	14.4	20.0
Lincoln	Thomas Motel Trailer Park	34.7	30.3	30.8	22.9	23.1
Millinocket	York street	--	--	--	16.0	18.9
Orrington	Center Drive school	--	--	13.9	14.0	13.2
Woodland	Secondary Treatment Pipeline	--	--	--	16.1	17.7
Woodland	Woodland High School	27.7	21.9	23.4	21.7	21.9
Woodland	Background	--	--	--	10.7	12.7

TABLE 6 - 5 (continued)
FINE PARTICULATE HISTORICAL COMPARISON
ANNUAL ARITHMETIC MEANS (ug/m3)

SITE	ADDRESS	ANNUAL ARITHMETIC MEANS (ug/m3) 1985	1986	1987	1988	1989
METROPOLITAN PORTLAND AIR QUALITY CONTROL REGION (110)						
Bridgton	Upper Ridge Road	32.4	16.0	16.2	12.3	11.5
Portland	Shelter Site	38.9	30.5	30.9	24.4	26.1
Portland	Elks Lodge	--	--	21.9	18.8	15.6
Westbrook	N. E. T.&T. Company	--	--	--	21.0	20.7
Westbrook	Research Building	--	--	--	25.0	24.0
Westbrook	Warehouse #5	32.0	23.9	28.4	21.0	23.1

TABLE 6 - 6
FINE PARTICULATE HISTORICAL COMPARISON
(Sites with samples greater than 150 ug/m3)

SITE	ADDRESS	TOTAL NUMBER OF SAMPLES GREATER THAN 150 UG/M3 1985	1986	1987	1988	1989
AROOSTOOK AIR QUALITY CONTROL REGION (108)						
Madawaska	Big Daddy's Restaurant	0	0	1	1	0
Presque Isle	Northeastland Hotel	0	1	3	0	0

7. LEAD (Pb)

7.1 Description and Sources

Lead in the ambient air exists primarily as particulate matter in the inhalable size range. The predominant source of atmospheric lead is from motor vehicles that burn "leaded" gasoline. The lead in gasoline is in the form of tetraethyl lead, an "anti-knock" compound. Other major sources of atmospheric lead are the extraction and processing of metallic ores.

7.2 Health and Welfare Effects

When atmospheric lead is breathed in, it is absorbed into the bloodstream and distributed throughout the body along with lead from contaminated food and drinking water. Lead accumulation in the body can impair the production of hemoglobin. Clinical lead poisoning occurs when the body's accumulation of lead becomes too high. Symptoms of lead poisoning range from loss of appetite, fatigue, cramps and constipation, and pains in the ankles and wrists to loss of power in the arms andlegs, anemia, kidney disease, mental retardation, blindness and death. Lead concentrations in the ambient air are not sufficient to produce lead poisoning but they do increase the risk of harm when other sources of lead are present. And, indirectly, lead fallout from automotive exhaust onto soil and street surfaces can be ingested in considerable amounts by infants and young children.

7.3 Standards

The current National Ambient Air Quality Standard for lead is a 3-month (calendar quarter) average concentration not to exceed 1.5 micrograms of lead per cubic meter of air.

The current State Standard for lead is a 24-hour average concentration of 1.5 micrograms of lead per cubic meter of air not to be exceeded more than once per year.

7.4 Monitoring

Lead was monitored at eight sites in Maine during 1989 by taking samples of the Hi-Vol filters from those sites and analyzing the samples for lead content using an atomic absorption analyzer.

Tables 7-1 and 7-2 are the 1989 Data Summaries for Lead. Table 7-3 presents the Lead Historical Comparison Data.

TABLE 7 - 1
1989 LEAD DATA SUMMARY
(Micrograms Per Cubic Meter)

SITE	ADDRESS	NUMBER OF OBSERVATIONS	HIGHEST 24-HOUR	SECOND HIGHEST	THIRD HIGHEST	ANNUAL GEOMETRIC MEAN
ANDROSCOGGIN INTERSTATE AIR QUALITY CONTROL REGION (107)						
Auburn	Lepage Bakery	44	.06	.05	.04	.02
Lewiston	Country Kitchen Parking Lot	32	.12	.06	.06	.02
DOWNEAST AIR QUALITY CONTROL REGION (109)						
Bangor	Kenduskeag Pump Station	61	.09	.08	.07	.02
Hampden	McGraw School	87	.03	.02	.02	.01
Orrington	Center Drive School	89	.01	.01	.01	.01
METROPOLITAN PORTLAND AIR QUALITY CONTROL REGION (110)						
Biddeford	Biddeford Treatment Plant	51	.82	.74	.11	.02
Portland	Tukey's Bridge	44	.31	.14	.11	.03
Portland	Shelter Site	61	.10	.07	.07	.03

TABLE 7 - 2
1989 LEAD DATA SUMMARY BY QUARTERS
(Micrograms Per Cubic Meter)

SITE	ADDRESS	1989 QUARTERLY AVERAGES 1ST	2ND	3RD	4TH
ANDROSCOGGIN INTERSTATE AIR QUALITY CONTROL REGION (107)					
Auburn	Lepage Bakery	.03	.02	.02	---
Lewiston	Country Kitchen Parking Lot	---	.09	.02	.02
DOWNEAST AIR QUALITY CONTROL REGION (109)					
Bangor	Kenduskeag Pump Station	.04	.02	.01	.02
Hampden	Mcgraw School	.01	.01	.01	---
Orrington	Center Drive School	.01	.01	.01	---
METROPOLITAN PORTLAND AIR QUALITY CONTROL REGION (110)					
Biddeford	Biddeford Treatment Plant	.02	.12	.04	.03
Portland	Tukey's Bridge	---	.05	.03	.04
Portland	Shelter Site	.05	.04	.04	.04

TABLE 7 - 3
LEAD HISTORICAL COMPARISONS
(Micrograms Per Cubic meter)

SITE	ADDRESS	MAXIMUM 24-HOUR CONCENTRATION / AAM 1983	1984	1985	1986	1987	1988	1989
ANDROSCOGGIN INTERSTATE AIR QUALITY CONTROL REGION (107)								
Auburn	Lepage Bakery	---------	0.77/0.20	0.40/0.11	0.30/0.07	0.25/0.06	0.45/0.05	0.06/0.02
DOWNEAST AIR QUALITY CONTROL REGION (109)								
Bangor	Kenduskeag Pump Station	0.59/0.18	0.53/0.14	0.64/0.15	0.18/0.07	0.12/0.04	0.08/0.03	0.09/0.02
Hampden	McGraw School	---------	---------	---------	---------	0.02/0.01	0.02/0.01	0.03/0.01
Orrington	Center Drive School	---------	---------	---------	---------	0.02/0.01	0.02/0.01	0.01/0.01
METROPOLITAN PORTLAND AIR QUALITY CONTROL REGION (110)								
Portland	Shelter Site	0.56/0.20	0.71/0.23	0.53/0.19	0.33/0.11	0.27/0.07	0.17/0.06	0.10/0.04

8. SULFATES (SO4) AND NITRATES (NO3)

8.1 Description and Sources

Sulfates and Nitrates are compounds of varying harmfulness found everywhere in the atmosphere. They are produced by nature as well as man. Man-made sulfates have their origin in sulfur dioxide while nitrates have theirs in nitrogen oxides. Fine particulate compounds, including sulfates and nitrates are formed from chemical reactions between sulfur dioxide or nitrogen dioxide emitted into the air and other substances present there. These fine particulate compounds have a long atmospheric residence time, can be transported in the air for long distances, and are capable of penetrating deeply into the human respiratory tract.

8.2 Health and Welfare Effects

Epidemiological studies of populations exposed to particulate sulfates have shown that atmospheric sulfates, more than sulfur dioxide gas or total suspended particulates, are related to aggravation of asthma, aggravation of heart and lung disease in the elderly, and impairment of lung function in school children. This evidence was obtained from EPA's Community Health and Environmental Surveillance System (CHESS). From these studies, estimates of the sulfate threshold for adverse health effects have been derived, as shown in Table 8-1. However, these epidemiological studies have not been substantiated by laboratory studies.

Both sulfates and nitrates are considered to be contributors to the acid deposition problem.

8.3 Standards

There are currently no standards for levels of sulfates in ambient air. EPA is presently working on a standard and is expected to make a proposal in the future.

There are no standards for nitrates nor are there any proposed.

8.4 Monitoring

Sulfate levels were measured at seven sites in Maine during 1989 by taking samples of the Hi-Vol filters from those sites and analyzing the samples for sulfates using the Automated Technicon II Methylthymol Blue Procedure. There is no standard yet and the monitoring methodology is questionable but the data is being included in this report as an aid to those interested in further information about Maine's air quality. Table 8 -2 summarizes the sulfate data collected during 1989.

Nitrate levels were measured at seven sites in Maine during 1989 by also taking samples of the Hi-Vol filters from those sites and analyzing the samples using Method 353.1(Colorimetric, Automated, Hydrazine Reduction). This data, summarized in Table 8 - 3, is also being included in this report as an aid to those interested in further information about Maine's air quality. Nitrate data for 1986 had been reported incorrectly and consequently the table listing that data in the 1986 Annual Report on Air Quality is inaccurate. A corrected table has been printed and is available on request from the Bureau of Air Quality.

TABLE 8-1

SULFATE THRESHOLDS FOR ADVERSE HEALTH EFFECTS

HEALTH EFFECT	THRESHOLD CONCENTRATION FOR ADVERSE SUSPENDED SULFATES
Aggravation of Asthma	6 to 10 Micrograms Per Cubic Meter for 24 Hours.
Aggravation of Heart and Lung Disease in the Elderly	9 Micrograms Per Cubic Meter for 24 Hours
Subtle Decreases in Childhood Lung Function	9 to 13 Micrograms Per Cubic Meter for 1 Year.
Increase in Acute Respiratory Disease in Children	13 Micrograms Per Cubic Meter for 1 Year.

TABLE 8 - 2
1989 SULFATE DATA SUMMARY
(Micrograms Per Cubic Meter)

SITE	ADDRESS	NUMBER OF OBSERVATIONS	HIGHEST 24-HOUR	SECOND HIGHEST	THIRD HIGHEST	ANNUAL ARITHMETRIC MEAN
ANDROSCOGGIN INTERSTATE AIR QUALITY CONTROL REGION (107)						
Rumford	Taylor Mountain I	60	30.9	30.5	30.0	9.2
AROOSTOOK AIR QUALITY CONTROL REGION (108)						
Madawaska	St. Jarres	37	9.0	8.0	8.0	4.5
DOWNEAST AIR QUALITY CONTROL REGION (109)						
Bangor	Regional Office	5	8.6	5.7	5.7	6.2
METROPOLITAN PORTLAND AIR QUALITY CONTROL REGION (110)						
Bridgton	Upper Ridge Road	52	12.2	11.0	9.4	3.2
South Portland	SMVTI	58	16.2	15.4	13.5	5.0
South Portland	Jordan Marsh Auto Center	30	31.0	14.6	11.1	5.6
Portland	Shelter Site	55	22.2	16.2	13.5	5.3

TABLE 8 - 3
1989 NITRATE DATA SUMMARY
(Micrograms Per Cubic Meter)

SITE	ADDRESS	NUMBER OF OBSERVATIONS	HIGHEST 24-HOUR	SECOND HIGHEST	THIRD HIGHEST	ANNUAL ARITHMETIC MEAN
ANDROSCOGGIN INTERSTATE AIR QUALITY CONTROL REGION (107)						
Rumford	Taylor Mountain I	60	5.2	5.1	3.7	.65
AROOSTOOK AIR QUALITY CONTROL REGION (108)						
Madawaska	St. Jarres	41	1.0	1.0	1.0	0.34
DOWNEAST AIR QUALITY CONTROL REGION (109)						
Bangor	Regional Office	5	0.9	0.9	0.6	0.63
METROPOLITAN PORTLAND AIR QUALITY CONTROL REGION (110)						
Bridgton	Upper Ridge Road	53	0.6	0.5	0.4	0.16
South Portland	SMVTI	62	1.3	1.1	1.1	0.47
South Portland	Jordan Marsh Auto Center	30	2.0	1.8	1.8	0.56
Portland	Shelter Site	55	1.2	1.1	1.1	0.43

9. ATMOSPHERIC DEPOSITION

9.1 Description and Sources

As a result of the combustion of tremendous quantities of fossil fuels such as coal and oil, the United States annually discharges approximately 50 million metric tons of sulfur and nitrogen oxides into the atmosphere. Through a series of complex chemical reactions these pollutants can be converted into acids, which may return to earth as components of either rain or snow. This atmospheric deposition, more commonly known as acid rain, may have severe ecological impacts on widespread areas of the environment.

9.2 Health and Welfare Effects

While direct health effects from acid rain have not been documented there are numerous indirect effects which could have definite effect on mankind. Atmospheric deposition is known to leach heavy metals such as mercury from rocks causing possible contamination of water supplies. Hundreds of lakes in North America and Scandanavia have become so acidic that they can no longer support fish life. The rain falling on forests and other non-farmlands could, in time, cause extensive changes in the soil chemistry. There is not enough information yet to make it possible to say exactly what the results might be, but there is no reason to think the changes will be beneficial.

9.3 Standards

There are no standards in effect or proposed for atmospheric deposition. The only permanent solution to the acid rain problem is to keep the acid levels low. The only practical way of achieving this is by reducing emissions at their sources.

9.4 Monitoring

During 1989 there were four sites collecting data on atmospheric deposition. Those four sites included two Bureau maintained sites in Bridgton and Acadia National Park, a University of Maine maintained site in Greenville and a National Weather Service maintained site in Caribou. The samples from these four sites are normally collected every Tuesday morning at 9:00 a.m.. Consequently, the samples are not necessarily a single storm event but are more likely to be a composite of all storm events during the previous week. The samples, if there was a signficant storm, are used for field measurements of pH and conductivity and are then packaged up for shipment to the National Atmospheric Deposition Program central laboratory in Illinois. In the central laboratory they are also tested for pH and conductivity as well as additional components. Table 9-1 is a summary of the measurements taken at the central laboratory in Illinois from the DEP operated sites for the year 1989. The sulfate deposition figures were corrected for marine aerosol contribution.

TABLE 9 - 1
1989 ATMOSPHERIC DEPOSITION DATA SUMMARY

SITE	ADDRESS	pH MAXIMUM*	pH MINIMUM*	pH MEAN**	DEPOSITION (Kg/ha) SO4***	DEPOSITION (Kg/ha) NO3
DOWNEAST AIR QUALITY CONTROL REGION (109)						
Acadia National Park	McFarland Hill Ranger Station	5.5	3.6	4.5	21.0	12.3
METROPOLITAN PORTLAND AIR QUALITY CONTROL REGION (110)						
Bridgton	Upper Ridge Road	6.2	4.0	4.5	16.0	9.0
NORTHWEST MAINE AIR QUALITY CONTROL REGION (111)						
Greenville	Squaw Brook	6.6	4.0	4.6	13.0	11.0

* Lab measurements.
** Precipitation weighted mean.
*** Corrected for marine aerosol and normalized to 52 weeks.

10. HYDROCARBONS (HC)

10.1 Description and Sources

Hydrocarbons are a class of compounds containing carbon and hydrogen in various combinations. They are found especially in petroleum, natural gas and coal. Some are gaseous, some liquid and some are solid. There are in fact over a thousand hydrocarbon compounds. Many of the polluting hydrocarbons are discharged into the air by incomplete combustion of organic materials. A major source of this kind of hydrocarbon emission is the burning of gasoline in automobiles. Other major contributors are organic solvent evaporation, industrial processes, solid waste disposal and fuel combustion in stationary sources. The control of hydrocarbon emissions are accomplished by combustion process optimization, recovery by mass transfer principles, restriction of evaporative loss and process material and fuel substitution.

10.2 Health and Welfare Effects

Hydrocarbon air pollutants enter into and promote the formation of photochemical smog (ozone) and thus contribute to the development of eye irritation and respiratory tract problems. By themselves, hydrocarbons may induce adverse health effects, although there is relatively little quantitative data to relate individual hydrocarbons to the risk of human disease.

10.3 Standards

The present State and Federal Standard for non-methane hydrocarbons is a three hour average concentration of 160 ug/m3.

10.4 Monitoring

Hydrocarbons were not monitored as part of the state's continuous air monitoring program during 1989.