EPA REGION III AIR QUALITY TRENDS REPORT

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1983-1988

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1983 - 1988

United States Environmental Protection Agency
Environmental Services Division
Philadelphia, PA 19107

This report has been reviewed by the United States Environmental Protection Agency: Environmental Services Division, Greene A. Jones, Director and Air Management Division, Thomas J. Maslany, Director, Region III; and each State and Local Air Pollution Control Agency in Region III, and has been approved for publication.

PREFACE

This report presents the status and trends in air quality from 1983 through 1988 for ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, particulates and lead in the Mid-Atlantic Region: Delaware, District of Columbia, Maryland, Pennsylvania, Virginia and West Virginia. Background information on air pollutant characteristics, health and welfare effects, trends, attainment status, monitoring requirements and comparisons with national statistics are also presented.

The content of this report is based on data collected in a nationwide monitoring network operated by state and local air pollution control agencies. We hope that this report will provide you with a better understanding of the progress that the state, local and federal governments have achieved in improving overall air quality. This progress can only be continued with the full cooperation and support of the various federal, state and local regulatory agencies and the general public.

This report was prepared by the United States Environmental Protection Agency, Region III, Environmental Services Division. The intent is to provide interested members of the air pollution control community, the private sector and the general public with current information on the status and trends in air quality within the Mid-Atlantic Region. The Division solicits comments on this report and welcomes suggestions on our techniques, interpretations, conclusions and methods of presentation.

Please forward any response to Victor Guide, Chief, Philadelphia Operations Section, Environmental Monitoring and Surveillance Branch, U. S. Environmental Protection Agency, 841 Chestnut Building, Philadelphia, PA 19107, manager of the publication process and principal author and contributor in researching, designing, writing and editing the report.

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FOREWORD

For the past 20 years, Americans have been concerned with the quality of the air we breathe, the water we drink and the land on which we live. This report presents a brief assessment of progress made in improving the quality of the air we breathe. Since the passage of the Clean Air Act in 1970 great strides have been made in improving and protecting air quality: reductions in the ambient concentrations of Lead, Carbon Monoxide, Particulates, Sulfur Dioxide and Nitrogen Dioxide have been realized. An extensive radon program has been developed in Region III with a home-testing database used to identify high risk areas. These results are even more impressive when you consider that 25% more people live in the United States today than did 20 years ago, there are thousands more automobiles traveling millions more miles and there are more manufacturing facilities producing a greater number of products.

Although great successes have been achieved through cooperation between EPA, state and local air quality programs, the challenges ahead are formidable and present no easy choices. We have significantly reduced the ambient lead concentration in the air, but ozone levels have increased. We regulate seven hazardous air pollutants, but there are thousands unregulated. The great American love affair with driving our cars everywhere without consideration for the effect on the environment needs to be reevaluated. We must address the issue of long range transport of pollutants. Each community must be concerned, not only with the local effects of its air pollution emissions and control efforts, but also with the impact of these actions on nearby and distant communities.

The problems of today are not the large smoke stack concerns of the 1970's: major sources of air pollution are being controlled. Now the difficult decisions must be made. We must recognize that our environment is finite and that continuous growth must give way to a more natural use of our resources and our environment. Unless we reduce the attack on our environment, air quality will deteriorate to the point that smog may threaten large land areas and acid precipitation could eliminate the fish in our lakes and streams and reduce crop production and forest growth.

We have done much to abate the most visible pollution but we still have much unfinished business. The problems of air toxics, ground level ozone, radon, acid precipitation, indoor air pollution, global warming, stratospheric ozone depletion and the acidification of lakes will require a cooperative effort by all of us. We need to work together as partners to further improve the environment in which we live if we are to be good stewards of this precious resource and leave a legacy of a healthy world for our children and their children.

EPA REGION III

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1.0 INTRODUCTION

Although considerable progress has been made improving the quality of the air we breathe, air pollution remains one of the greatest risks to the health and welfare of all of us. Pollutants create a multitude of health problems, attack and accelerate the aging of materials, reduce visibility, damage vegetation and produce odors. As directed by the Clean Air Act of 1970, National Ambient Air Quality Standards (NAAQS) were established for those pollutants commonly found throughout the country which posed the greatest threat to air quality.

The law provides for two types of standards, primary and secondary: Primary standards set limits protective of public health, including the health of sensitive populations such as asthmatics, children or the elderly; secondary standards set limits to protect vegetation, wildlife, and materials.

The Environmental Protection Agency (EPA) has established primary and secondary standards for six principal pollutants: Ozone (O_3), Carbon Monoxide (CO), Nitrogen Dioxide (NO_2), Sulfur Dioxide (SO_2), Particulate Matter (PM), and Lead (Pb). The deadline for meeting these standards was December 31, 1987, and many areas were able to meet the standards for all pollutants by that date.

As reflected in the national summary of long term air quality and emissions trends, the air we breathe today is demonstrably better for public health than it was 10 years ago. The latest measurements of air quality are encouraging. They show that levels of all six pollutants are lower, in some cases dramatically lower and that considerable progress has been made in reducing air pollution.

However, despite the remarkable successes of air pollution control programs, much work still needs to be done. Over 100 million people still live in areas throughout the country which, at least occasionally, are subjected to air pollution known to be harmful to public health (see Figure 1-1). In Region III, several major urban areas will not be able to meet the standards for one or more of the NAAQS pollutants.

ESTIMATED POPULATON EXPOSURE TO UNSAFE LEVELS OF AIR POLLUTANTS IN REGION III

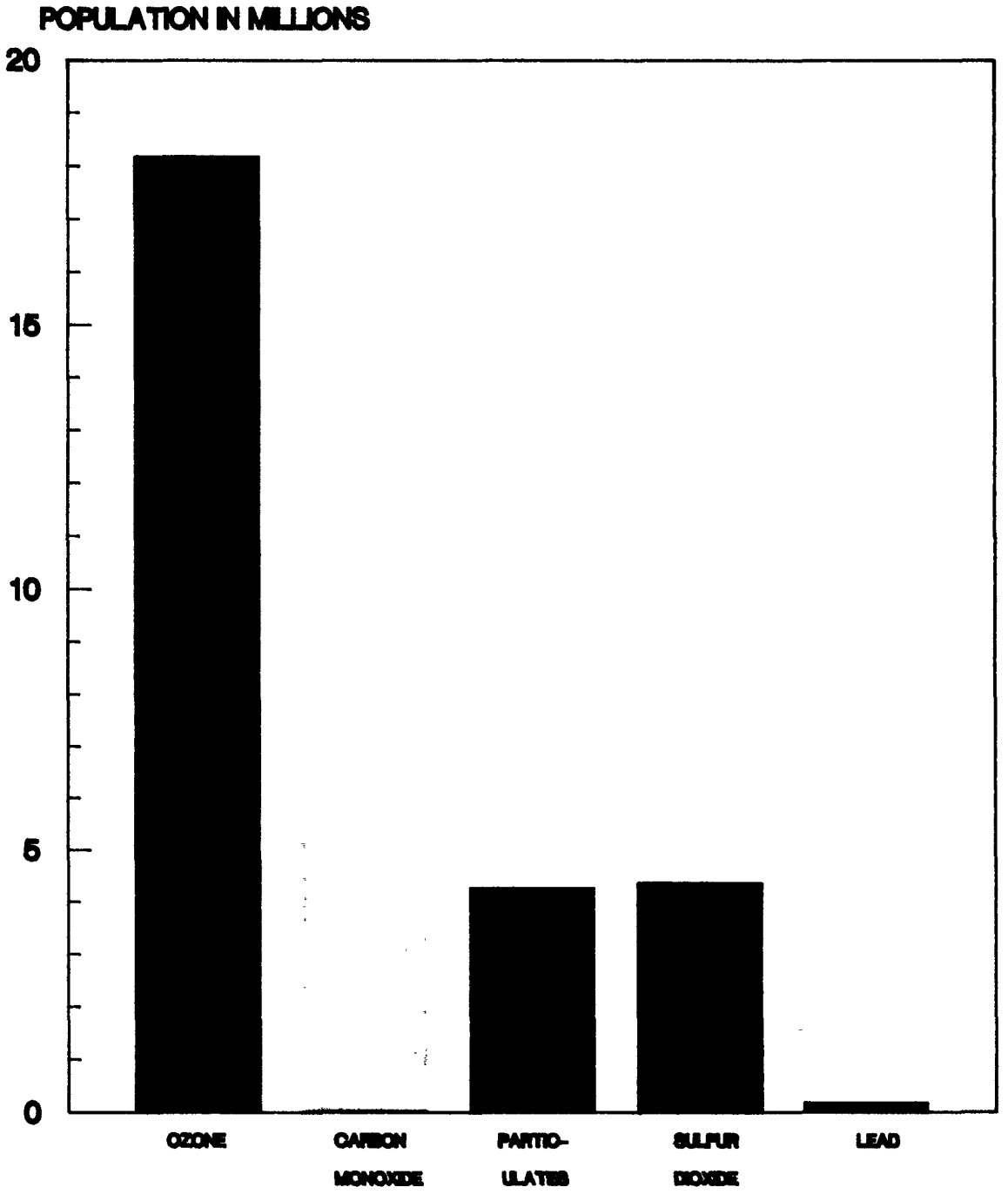


Figure 1-1

1.1 AIR POLLUTANTS

Air pollutants can generally be classified in two broad categories: natural and man made. Natural sources of air pollution include wind blown dust, volcanic ash and gases, smoke from forest fires, pollens and natural radioactivity.

Man made sources of air pollution cover a wide range of chemical and physical activities. Each year we generate billions of tons of air pollutants which come from a variety of mobile and stationary sources. More than half of the nation's air pollution comes from mobile sources which include cars, buses, motorcycles, boats and aircraft. Exhaust from mobile sources typically contain carbon monoxide, volatile organic compounds (VOC's), nitrogen oxides, particulates and lead.

Stationary sources contribute to the air pollution problem through the burning of fuel for energy and as by-products of industrial sources. Factories that burn coal, oil, gas and wood are major sources of air pollutants such as sulfur dioxide, nitrogen oxides, carbon monoxide, particulates, VOC's and lead. Almost 80% of SO_2, 50% of NO_x, 30-40% of particulates emitted in the United States comes from fossil fuel fired power plants, boilers and furnaces. Also associated with the burning of fossil fuels is acid rain which corrodes metals, weathers stone buildings and monuments, injures vegetation, and acidifies lakes, streams and soils.

In addition to the criteria pollutants, other pollutants that are produced by a limited number of industrial sources, but are believed to be very dangerous, also have federal standards. Standards which limit the pollution emitted by particular industrial processes are called National Emissions Standards for Hazardous Air Pollutants (NESHAPs). Incinerators, chemical plants, hazardous waste disposal facilities, smelters, refineries, acid plants and dry cleaners are some sources of toxic air pollutants.

1.2 HEALTH AND WELFARE EFFECTS

As our understanding of air pollution has changed over the years, we have come to realize that air pollution affects not only the local population around a given source, but that certain pollutants can be transported hundreds of miles to affect other cities, or even wilderness areas. In 1987, the entire Northeast was exposed to a graphic sample of atmospheric transport, as smoke from large forest fires in Kentucky and West Virginia blanketed cities to the north as far away as Maine.

Ozone and air toxics, as well as sulfur dioxide and nitrogen oxides in the form of acid rain are examples of pollutants which can be transported over long distances. Such transport dramatically increases the number of people exposed to a given pollutant, and increases the difficulty associated with solving the problem as well. The transport phenomenon demands that we work closely with air agencies and state legislatures throughout the Northeast as we move to improve air quality in the future.

Generally, when levels of criteria pollutants are at or above the NAAQS, individuals with respiratory problems are uncomfortable, and the performance of active individuals degrade. Each criteria pollutant has its own hazardous properties and a long list of health problems are initiated or aggravated by air pollution. Polluted air can do more than make you sneeze or cough, it can affect the respiratory, neurological and reproductive systems, the eyes, heart, lungs, liver and skin. Those most at risk to exposure of these pollutants are the very young, the elderly, smokers, workers exposed to toxic substances and people with heart or lung diseases.

These national standards were also established to protect the environment. Levels above the standard cause noticeable damage to buildings, crops, and forest. Levels below the standards also damage the environment, such as reducing visibility in national parks and causing acid rain damage to lakes, streams, and forests.

Some of the most prevalent and widely dispersed pollutants are further described in Appendix B.

1.3 AIR QUALITY DEPENDENCE ON TOPOGRAPHY AND WEATHER

Some areas of the country experience serious criteria air pollution problems, because the topography traps the air pollution emissions near the ground. Examples are Denver and Phoenix where the high elevation inhibits the natural tendency of the pollution to travel upward and disperse, and Los Angeles where the Sierra-Nevada mountain range traps the pollution along the coast.

Topography causes pollution problems in Region III where large air pollution emission sources are in deep river valleys which frequently experience late night, early morning inversions. High valley walls trap the pollution and residential areas that overlook the industrial sources may be severely affected by air pollution emissions.

Weather plays an important role in the ultimate severity of the pollution problem. Meteorological characteristics of urban areas (higher temperatures, lower relative humidities, greater cloudiness, more frequent fogs, lower wind speeds, greater precipitation) are important variables which govern the length of time and frequency to which receptors (humans, materials, vegetation, etc.) will be exposed to air pollutants.

The weather system to be concerned about, a stationary high pressure center, will inhibit the dispersion of pollution typically from one to four days. When the system occurs in cooler weather carbon monoxide, particulate, and sulfur dioxide levels are at their highest. When this weather system occurs in summer the ozone level will reach unhealthy levels. The summer of 1988 experienced the highest ozone levels in the 1980's, because of the unusually strong and frequent high pressure centers that occurred in June and July.

In Region III the most severely affected areas are the Washington, Baltimore, and Philadelphia metropolitan areas where the high temperatures, strong solar radiation, and emissions of organic compounds and nitrogen oxides are the ingredients for producing unhealthy levels of ozone from Washington, DC to Boston, MA.

1.4 MONITORING NETWORKS

EPA and the states use a nationwide monitoring network, State and Local Air Monitoring Stations (SLAMS),to measure levels of criteria air pollutants in the ambient air. Current air monitoring efforts center on the six pollutants for which NAAQS exist: ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, particulates and lead.

The overall air pollutant measurement program is a cooperative effort between the respective state agency and the EPA Regional Office. Each year EPA Region III works with each state agency on planning where measurements will be collected. The monitoring networks follow the national guidance on network design, with consideration for local conditions. Region III's Environmental Services Division works with these agencies throughout the year to assure that reliable measurements are collected when and where they are needed. The state and local agencies in Region III continuously operate about 600 monitors.

A portion of the SLAMS networks are designated National Air Monitoring Stations (NAMS) which produce measurements of pollution levels among major metropolitan areas for the tracking of long term trends at the national level. This report uses the data collected by all the criteria pollutant monitoring stations in Region III, because many of the higher pollution levels are detected at stations that are not part of the NAMS program.

The goals of the ambient monitoring program are to judge compliance with air quality standards, to provide real time monitoring of air pollution episodes, to provide data for trend analysis, regulation evaluation and planning, and to provide information to the public on a daily basis concerning the quality of the air.

A brief description of the air quality monitoring conducted in Region III is presented in the following sections of this report.

1.4.1 State of Delaware, Department of Natural Resources

The Delaware Ambient Air Monitoring Network consists of thirteen sites located throughout the state for monitoring pollutant gases (SO_2, NO_X, CO, O_3), particulates (TSP, PM10, lead), acid precipitation, and one special purpose monitor for vinyl chloride. Most monitors are located in the more densely populated urban/commercial areas of northern Delaware. The criteria gaseous pollutants are monitored on a continuous basis with hourly averages transmitted via the telemetry system to the central data acquisition system. The Pollution Standard Index is computed daily and reported to the public via the American Lung Association and local media. See Appendix C for a brief discussion of PSI.

1.4.2 District of Columbia, Department of Consumer and Regulatory Affairs

The District of Columbia's Ambient Air Monitoring Network consists of nine sampling sites located throughout the District, monitoring for a total of eighteen air pollutants. The criteria gaseous pollutants are monitored on a continuous basis with hourly averages transmitted via telemetry lines to the central computer system.

Pollutant Standard Index readings are gathered three times a day and reported to the Council of Governments (COG). COG collects the same type data from the other agencies in the metro area, and reports the PSI for the Metro DC area.

1.4.3 State of Maryland Department of the Environment, Air Management Administration

The Maryland Air Quality Surveillance System consists of a network of 56 air monitoring stations operated by the Division of Air Monitoring and cooperating local agencies. Continuous monitoring is performed at 22 stations for ozone, carbon monoxide, sulfur dioxide, nitrogen dioxide, and wind speed/direction. Particulate monitoring is performed for total suspended particulate (TSP) at 34 sites; at 4 of these sites, PM10 monitoring is performed. At six of the TSP sites, samples are also analyzed for lead content.

Additional particulate measurements are performed for sulfate, nitrate, benzo-a-pyrene, arsenic, and chromium. At two sites, weekly acid deposition samples are collected.

In addition to criteria pollutant monitoring, Maryland has been performing the non-methane organic compound monitoring analyses for Region III since 1987. In 1989, analyses were performed for eleven (11) sites.

1.4.4 Commonwealth of Pennsylvania, Department of Environmental Resources

Air quality monitoring in Pennsylvania is conducted by three agencies: Pennsylvania Department of Environmental Resources (PADER), Allegheny County Health Department, Philadelphia Air Management Services. The majority of all monitoring efforts take place in the "air basins" of the Commonwealth. These "air basins" have been defined in the Bureau's regulations and consist of the following areas: Allegheny County; Allentown, Bethlehem, Easton; Erie; Harrisburg; Johnstown; Lancaster; Lower Beaver Valley; Monongahela Valley; Reading; Scranton; Wilkes Barre; Southeast Pennsylvania; Upper Beaver Valley; and York.

Of these air basins, the PADER conducts surveillance in all but Allegheny County which conducts a separate monitoring program. Philadelphia, which also conducts a distinct monitoring program, is a part of the Southeast Pennsylvania Air Basin which also includes the counties of Bucks, Chester, Delaware, and Montgomery.

In addition, there are three non-air basin areas which have significant monitoring programs: Altoona, the Shenango Valley, and Williamsport.

The Pennsylvania Bureau of Air Quality Control operates two air monitoring networks in the Commonwealth: the discrete particulate (high volume sampling) network and the Commonwealth of Pennsylvania Air Monitoring System (COPAMS).

The particulate network consisted of 56 stations in 1988. Each station sampled total suspended particulates on a schedule of once every six days. Selected filters were also analyzed for sulfates, nitrates, lead, beryllium, and benzo(a)pyrene. In addition, sampling was also conducted at nine (9) sites for PM10 in 1988, with filters also analyzed for sulfates and nitrates.

The COPAMS network is a totally automatic, microprocessor controlled system which consists of 41 remote stations throughout the Commonwealth. These remote stations are connected to a central computer system in Harrisburg which collects the raw data. Each station measures selected parameters, such as sulfur dioxide, hydrogen sulfide, ozone, carbon monoxide, nitrogen dioxide, oxides of nitrogen, soiling (measure of particulates), wind speed, wind direction , ambient temperature, dew point temperature, and temperature difference between 4 meters and 16 meters above ground.

1.4.5 Allegheny County Bureau of Air Pollution Control

The network in 1988 consisted of 35 sites monitoring seven (7) gaseous pollutants and three (3) measures of particulates. In addition, concentrations of three (3) constituents of particulates were determined at 6 to 18 sites. Three Huey plates and five dustfall buckets rounded out the network. Some benzene monitoring was also done. A summary by pollutant of monitoring conducted in Allegheny County by site is: ozone - 4, CO - 3, NO_2 - 2, SO_2 - 6, TSP - 21, PM10 - 11, Lead - 4.

The gases and fine particulates are monitored continuously and telemetered to a central computer. The computer programs also calculate the Pollutant Standard Index every hour for purposes of air pollution episode control and reporting air quality to the public.

1.4.6 City of Philadelphia, Air Management Services

The Philadelphia Ambient Monitoring Network consists of 10 continuous air monitoring stations, measuring gaseous and aerosol pollutants, and a recently revised system of fourteen (14) sites measuring total suspended particulate (TSP). Real-time pollutant measurements obtained at the continuous air monitoring stations are telemetered to a central computer located at the Air Management Services Laboratory. The PSI is reported daily to the Clean Air Council of Philadelphia.

1.4.7 Commonwealth of Virginia, Department of Air Pollution Control

The Virginia Air Quality Monitoring Network, comprising seven (7) control regions, monitored at seventy-four (74) locations throughout the Commonwealth during 1988. One hundred and twenty-one (121) air quality monitors were used at these sites to measure the levels of total suspended particulates (TSP), particulate matter <10 micrometers (PM10), lead (Pb), carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), and ozone (O_3). The sites contained sixty-one (61) TSP high volume samplers, fourteen (14) PM10 samplers, twelve (12) carbon monoxide monitors, ten (10) sulfur dioxide monitors, nine (9) nitrogen dioxide monitors, and fifteen (15) ozone monitors. The eight (8) lead stations use the same high volume samplers as the total suspended particulate.

1.4.8 State of West Virginia, Air Pollution Control Commission

The West Virginia Air Monitoring Network consists of 43 sites located throughout the state and the 10 Air Quality Control Regions.

Sixty-six (66) monitors were used to measure the air quality in the state: TSP - 27, PM10 - 5, Pb - 11, SO_2 - 11, CO - 3, O_3 - 5 and NO_2 - 4.

WVAPCC also monitors for acid precipitation at eight (8) monitoring stations and air toxics for 23 chemical compounds at five (5) locations throughout the state.

1.5 AIR POLLUTION CONTROL

The Air Quality Act of 1967 as amended in 1970 and 1977 is the legal basis for air pollution control throughout the United States. The Environmental Protection Agency (EPA) has primary responsibility for carrying out the requirements of the Act, which specifies that air quality standards be established for hazardous substances. These standards are in

the form of concentration levels that are believed to be low enough to protect public health. Source emission standards are also specified to limit the discharge of pollutants into the air so that air quality standards will be achieved. The Act was also designed to prevent significant deterioration of air quality in areas where the air is currently cleaner than the standards require. EPA works with state and local governments to determine and enforce safer pollution levels.

On June 12, 1989 the President announced proposals for the first major revision of the Clean Air Act in over a decade. A comprehensive clean air bill was submitted to Congress on July 21, 1989. Currently, Amendments to the Clean Air Act are under debate in Congress with expectations for final Congressional action by the fall of 1990.

The Amendments include proposals to reduce emissions which cause acid rain, urban ozone and toxic air pollution: a 10 billion ton reduction in SO_2 emissions, a 2 million ton reduction in NO_x emissions, a 40 percent reduction in emissions of volatile organic compounds which cause urban smog, and a reduction of 75 to 90 percent in air toxics emissions. These reductions will in turn help curb an increase in global warming resulting from fossil fuel combustion. Other highlights of the Clean Air Bill include:

- Use of alternative fuels
- A Clean Coal Technology Program
- Proposal to improve fuel efficiency
- Asbestos ban which will prohibit importation, manufacture and processing of asbestos by 1997.
- Air toxic emission standard for Benzene
- A call for a worldwide phase-out of chlorofluorocarbons by year 2000.

2.0 REGIONAL AIR QUALITY TRENDS

Ambient air quality trends are discussed for the period 1983 through 1988 in each state within Region III for the NAAQS pollutants Ozone (O_3), Carbon Monoxide (CO), Nitrogen Dioxide (NO_2), Sulfur Dioxide (SO_2), Particulates (TSP, PM-10) and Lead (Pb). Each pollutant will be discussed as to specific characteristics and sources, health and welfare effects and state-by-state evaluation of air quality trends. Comparisons are made with the NAAQS to examine changes or trends in air pollution levels. All air quality data used for trend analysis were

obtained from the EPA Aerometric Information Retrieval System (AIRS) with additional data extracted from state annual reports. The ambient air quality data are based on actual direct measurements collected by the State and Local Air Pollution Control Agencies in Region III. All stations meet uniform criteria for siting, quality assurance, equivalent analytical methodology, sampling intervals and instrument selection to assure consistent data reporting among the States. The data are displayed in a variety of formats:

- Graphs showing the average level of pollutant concentration in each state along with the highest and lowest levels measured during specific years.
- For 1983 through 1988, the range (maximum/minimum) and the composite pollutant specific average of the sites used are shown. When only one site is available, or when the range is too narrow to plot, the range is not plotted.
- Three dimensional maps that provide comparisons of pollution levels between areas in Region III for 1988.
- Various graphs, charts and tables that characterize the severity of the ozone problem which does not lend itself to conventional trend plotting.
- Pollutant profile maps that depict the attainment and non-attainment status within Region III.

In order to provide the reader with as much useful information as possible, the report includes specific trend information from state prepared air quality data reports and as such will vary as to (1) timeframes (i.e., Commonwealth of Pennsylvania trend graphs for 1979 to 1988, Allegheny County 1984-1988, etc.) (2) narrative format and (3) graphic presentation.

In order for a monitoring site to have been included in the Regional 6-year trend analysis, the site had to contain data for at least 4 of the 6 years from 1983 to 1988. Data for each year also had to satisfy certain annual data completeness criteria appropriate to pollutant and measurement methodology. For continuous hourly data (O_3, SO_2, NO_2, CO) and for non-continuous data (TSP, PM10, Pb) a valid trends analyses required at least 50 percent data capture during any year. In a majority of instances data capture was 75 percent.

Also provided in the trends report are information about changes in air pollution emissions. The changes in yearly emissions from industrial and mobile sources within the Region were compared to changes in national emissions. These are basically estimates of the amount and different types of pollution emitted

from factories, automobiles and other sources. The trend data were extracted from the EPA publication, National Air Pollutant Emission Estimates, 1940-1987 and the National Air Quality and Emissions Trends Report, 1987. Any reference to emission trends within Region III were obtained from best available information at the time of publication. Use of state emission inventories, the National Emission Data System, the above referenced documents and information obtained directly from the States were all utilized in arriving at emission trends for Region III.

2.1 REGIONAL PROFILES OF POLLUTANT VARIABILITY

Sections 3 through 8 of the report will discuss the specific status and trends of NAAQS pollutants by state within Region III. As a lead into the state by state summaries, regional profiles of pollutant variability are presented in three dimensional maps for 1988 in Figures 2-1 through 2-7.

In each map, a spike is plotted at the pollutant site location on the map surface. This represents the highest pollutant concentration recorded in 1988, corresponding to the air quality standard. Each spike is projected onto a back-drop for comparison with the level of the standard. The back-drop also provides a regional profile of pollutant concentration variability.

OZONE

Ozone, a pollutant not directly emitted into the atmosphere, is formed by complex chemical reactions in the presence of sunlight. Exposure to ground level ozone is the most widespread air pollution problem facing the nation today. In the United States, the highest concentrations are observed in Southern California, the Texas Gulf Coast and the Northeast Corridor. In Region III, the ozone problems of 1983 and 1988 were severe because the summers were unusually hot and dry. Ozone levels recorded in 1988 were higher than in 1983 with more excedances of the standard recorded. A detailed discussion of ozone characteristics, sources of the pollutant, effects and air quality trends is presented in Section 3.0 of this report.

The annual second daily maximum 1-hour average ozone concentration recorded in 1988 in Region III is shown in Figure 2-1. This map shows at a glance how ozone air quality varies within the Region by site.

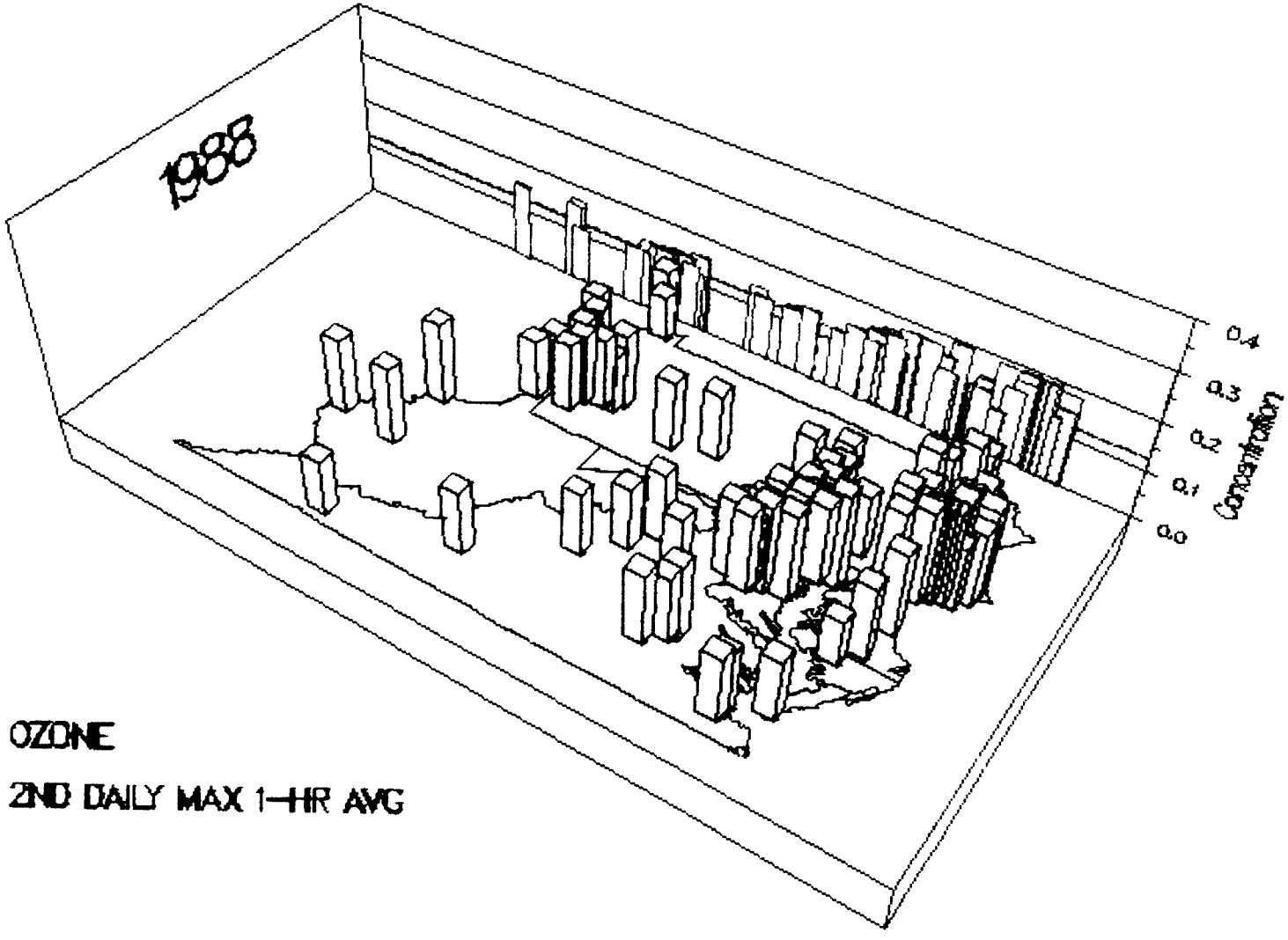


Figure 2-1. Regional three dimensional map of the annual second daily maximum 1-hour average ozone concentration,1988.

CARBON MONOXIDE

Carbon monoxide is a poisonous gas produced by incomplete fuel combusion. The major source of this pollutant is from motor vehicle exhaust. The general ambient air quality trend throughout the country has been an overall decrease even though the number of automobiles and miles travelled has increased. Nationally, ambient levels of carbon monoxide decreased between 1978 and 1987 as measured at 198 trend sites. In Region III, CO levels decreased nearly 18 percent between 1983 and 1988. A more thorough discussion of this pollutant is presented in Section 4.0 of this report.

The highest second maximum non-overlapping 8-hour average carbon monoxide concentration recorded in 1988 in Region III is shown in Figure 2-2. The profile shows most of the Region below the 9 ppm level of the standard.

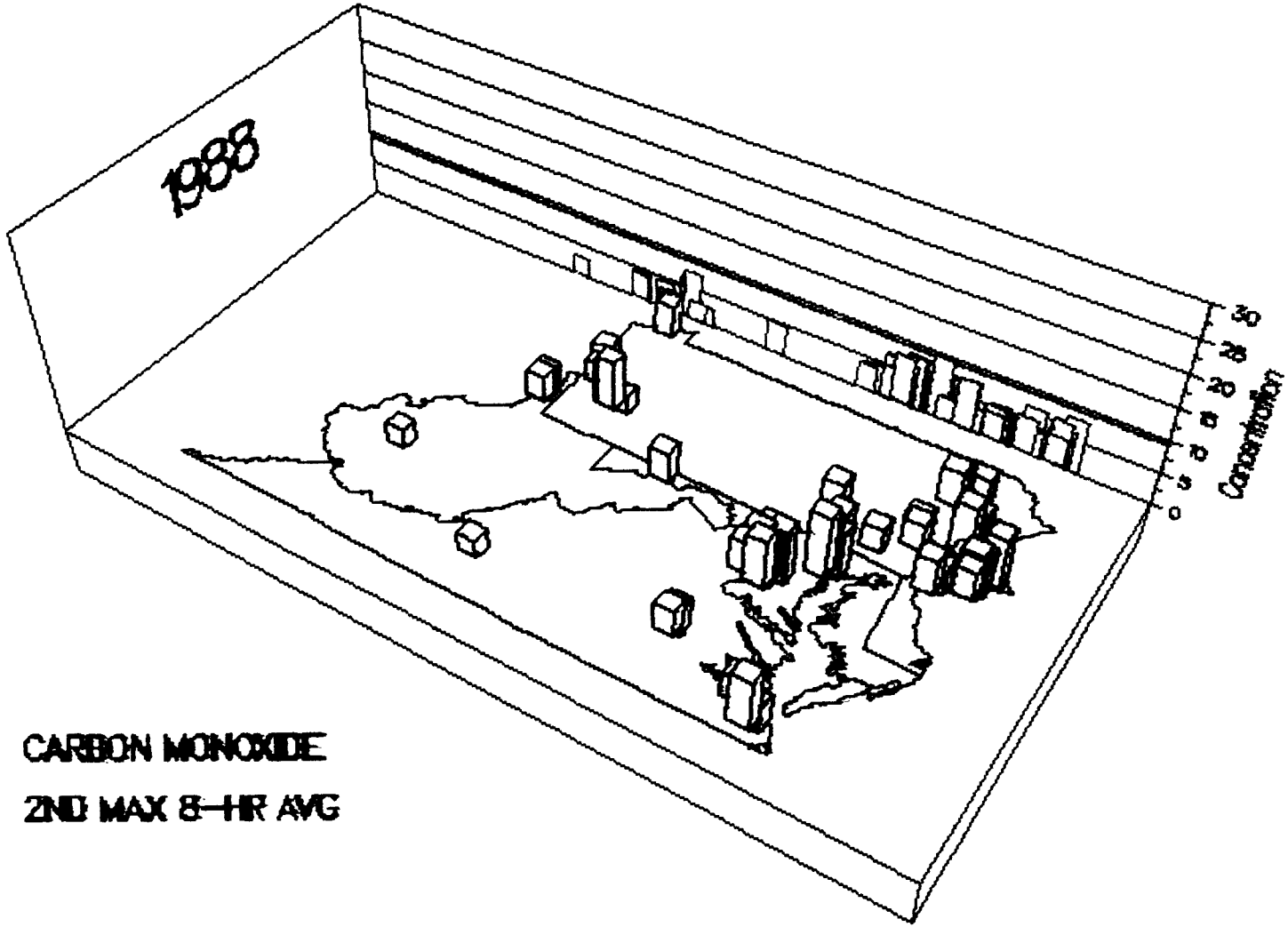


Figure 2-2. Regional three dimensional map of the second maximum nonoverlapping 8-hour average carbon monoxide concentration, 1988.

NITROGEN DIOXIDE

Nitrogen dioxide is a toxic gas emitted primarily from the combusion of fuels by stationary and mobile sources. At the present time nitrogen dioxide does not present a significant air quality problem for most areas of the country. A detailed discussion of characteristics, sources of the pollutant, effects and air quality trends is presented in Section 5.0 of this report.

The highest annual arithmetic mean nitrogen dioxide concentration recorded in 1988 in Region III is shown in Figure 2-3. The map shows at a glance that nitrogen dioxide levels in 1988 were well below the NAAQS.

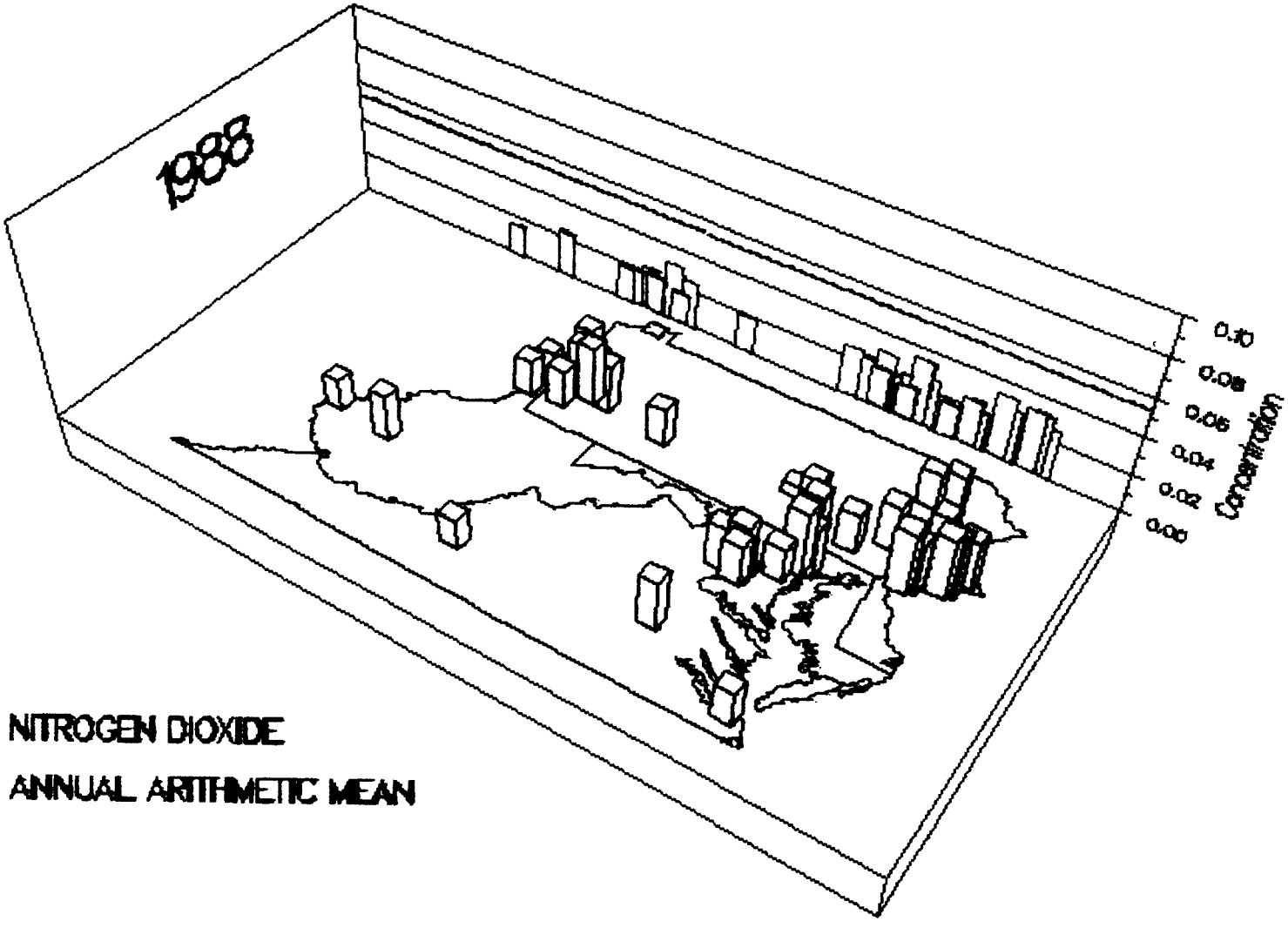


Figure 2-3. Regional three dimensional map of the highest annual arithmetic mean nitrogen dioxide concentration,1988.

SULFUR DIOXIDE

Sulfur dioxide is a poisonous gas emitted primarily from combustion processes, petroleum refining and non-ferrous smelters. Several areas in the country still exceed ambient air quality standards for sulfur dioxide. Nationally, average SO_2 levels measured at 347 trend sites declined 35 percent from 1978 to 1987. Highest concentrations are generally observed in the Midwest and Northeast. In Region III, ambient SO_2 levels remained relatively constant between 1983 and 1988. In Region III, Pittsburgh, PA was the only major urban area in the United States violating the 24 hour SO_2 standard in 1988. A thorough discussion of this pollutant is presented in Section 6.0 of this report.

The three dimensional map shown in Figure 2-4 depicts the highest annual arithmetic mean sulfur dioxide concentration recorded in 1988 in Region III.

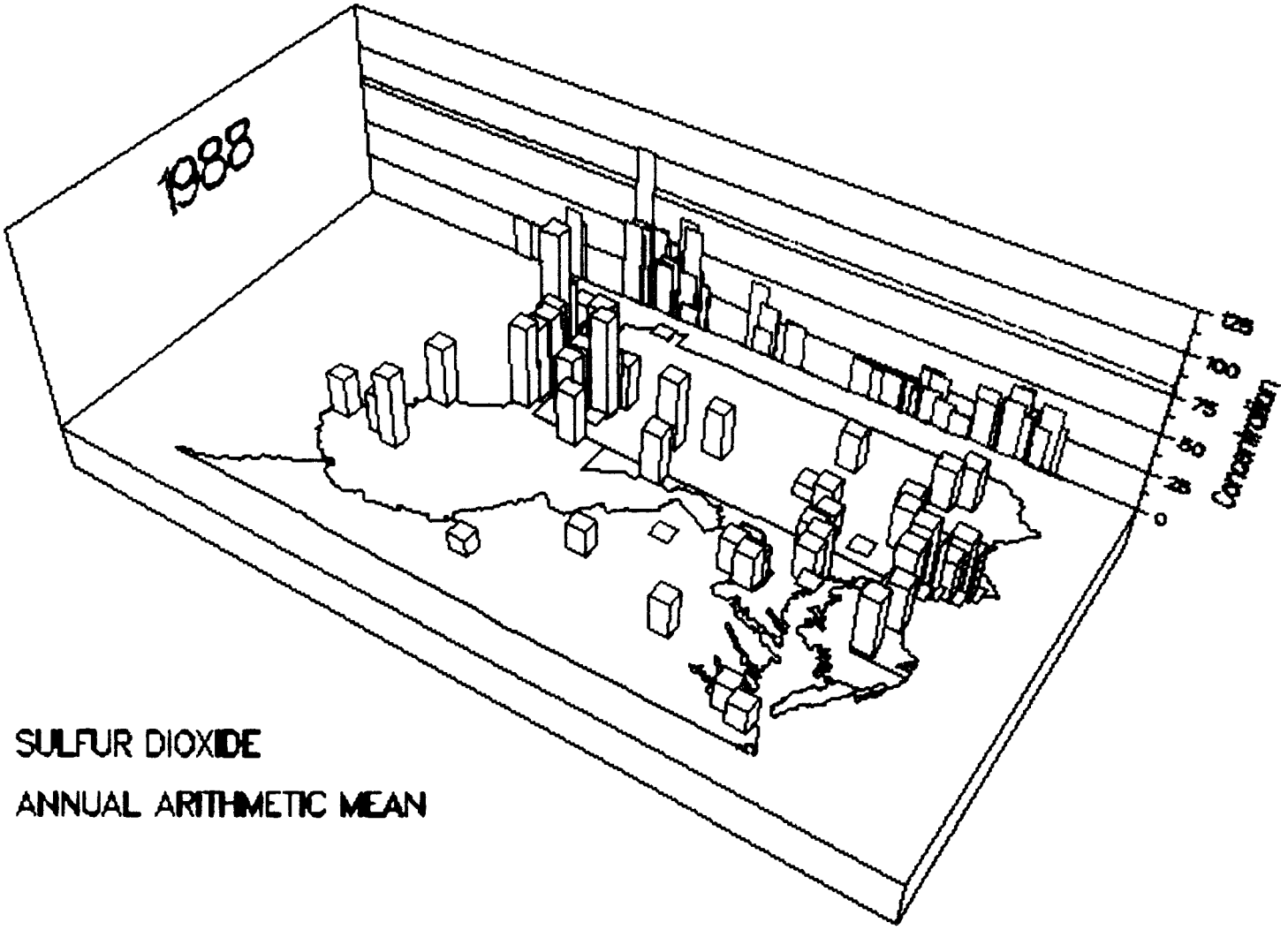


Figure 2-4. Regional three dimensional map of the highest annual arithmetic mean sulfur dioxide concentration,1988.

TOTAL SUSPENDED PARTICULATE MATTER

Particulate matter is the general term for particles found in the atmosphere. Some sources include steel mills, power plants, factories and motor vehicles. The total suspended particulate matter standard was replaced in 1987 with a new standard based on particulate matter smaller than ten microns in size (PM10). See Section 7.0 for a more detailed discussion of this pollutant.

The three dimensional map shown in Figure 2-5 depicts the Region III profile for the highest annual mean total suspended particulate matter concentration recorded in 1988.

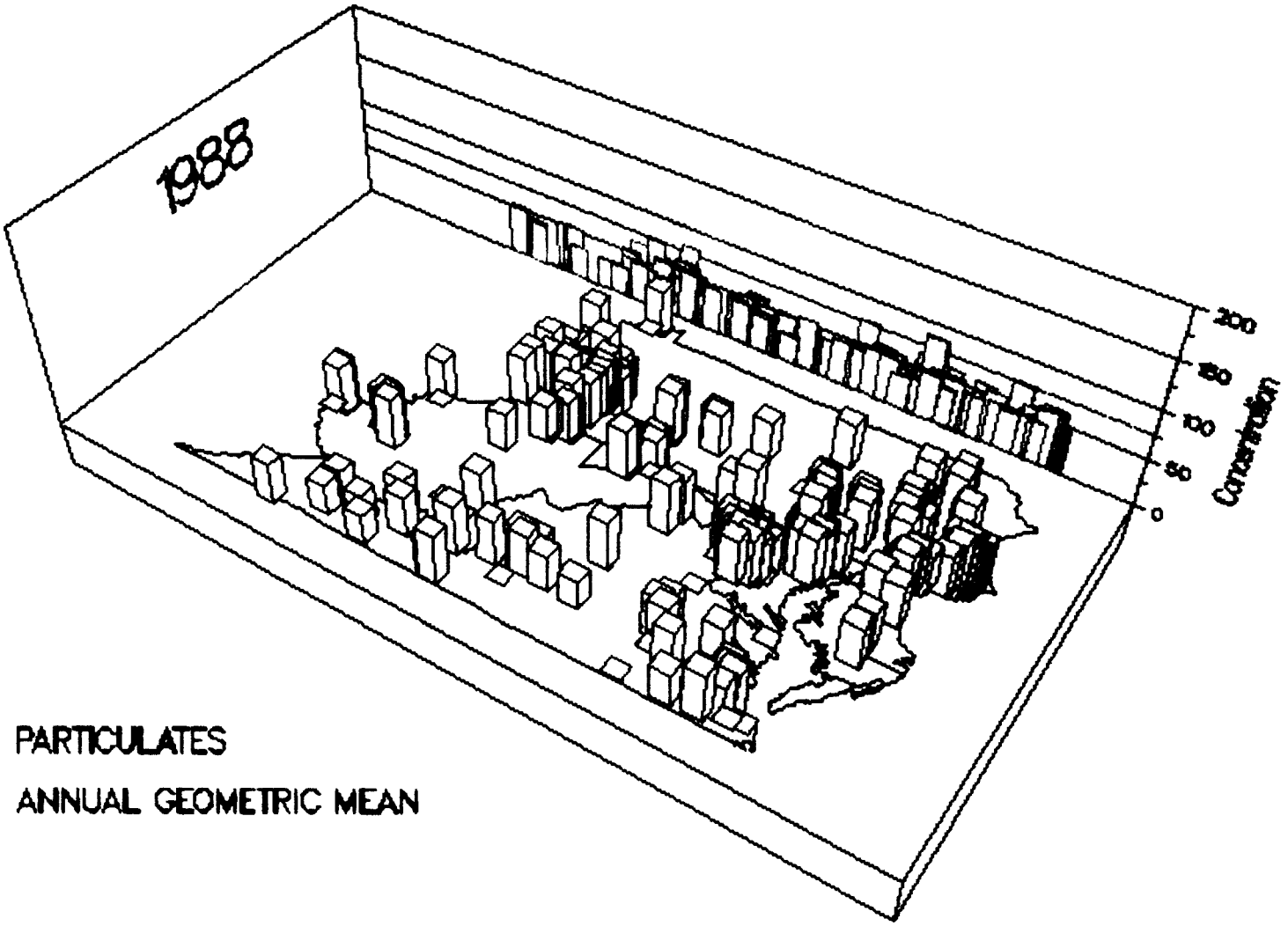


Figure 2-5. Regional three dimensional map of the highest annual mean total suspended particulate concentration,1988.

PM10

Particulate matter with aerodynamic diameters smaller than 10 micrometers, PM10, are responsible for adverse health effects because of their ability to reach the thoracic or lower regions of the respiratory tract. See Section 7.0 for a more detailed discussion of this pollutant.

The three dimensional map shown in Figure 2-6 depicts the Region III profile for the highest annual mean PM10 concentration recorded in 1988.

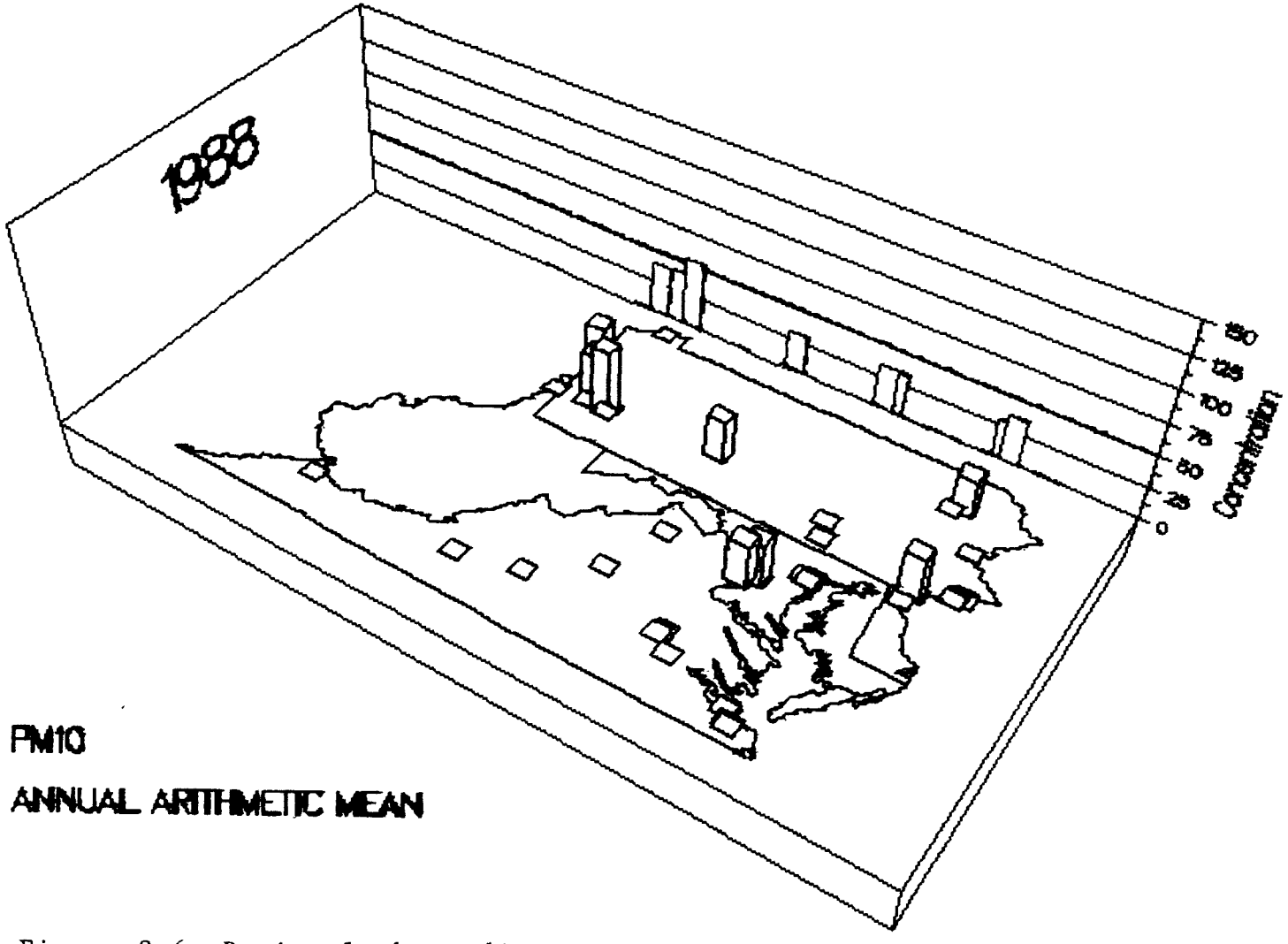


Figure 2-6. Regional three dimensional map of the annual arithmetic mean PM10 concentration,1988.

LEAD

Lead is a highly toxic metal and can accumulate in the body when ingested or inhaled. The primary sources of this pollutant are lead smelters, battery plants and the combustion of leaded fuel. See Section 8.0 for a more detailed discussion of this pollutant.

The regional profile for the maximum quarterly mean lead concentration recorded in 1988 is shown in Figure 2-7.

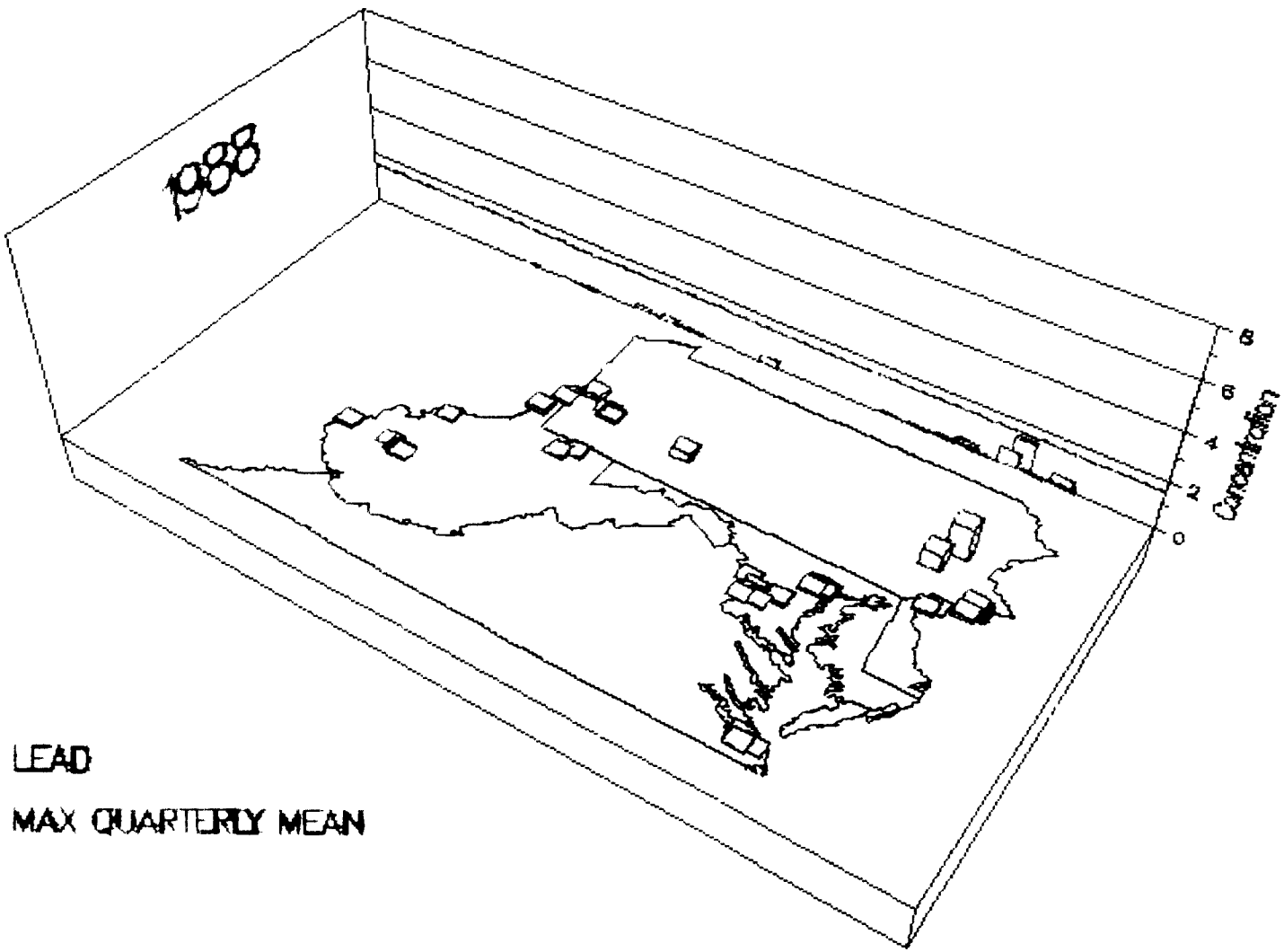


Figure 2-7. Regional three dimensional map of the highest annual maximum quarterly mean lead concentration,1988.

Table 2-1. AIR QUALITY TREND STATISTICS AND ASSOCIATED NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS)

POLLUTANT	TRENDS STATISTICS	PRIMARY NAAQS CONCENTRATION
Total Suspended Particulate*	annual geometric mean	75 ug/m^3
Sulfur Dioxide	annual arithmetic mean	0.03 ppm (80 ug/m^3)
Carbon Monoxide	second highest nonoverlapping 8-hour average	9 ppm (10 ug/m^3)
Nitrogen Dioxide	annual arithmetic mean	0.053 ppm (100 ug/m^3)
Ozone	second highest daily maximum 1-hour average	0.12 ppm (235 ug/m^3)
Lead	maximum quarterly average	(1.5 ug/m^3)

ug/m^3 = micrograms per cubic meter
ppm = parts per million

* TSP was the indicator pollutant for the original particulate matter (PM) standards. This standard has been replaced with the new PM-10 standard and it is no longer in effect.

New PM standards were promulgated in 1987, using PM-10 (particles less than 10 micrograms in diameter) as the new indicator pollutant. The 24-hour standard is attained when the expected number of days per calendar year above 150 ug/m^3 is equal to or less than 1, as determined in accordance with Appendix K.

3.0 TRENDS IN OZONE

This section will describe and characterize some of the most widespread and severe of environmental problems: exposure to ground level ozone, a photochemical oxidant and major component of smog. Ozone is a colorless, odorless gas that adversely affects far more people than does any other kind of air pollutant.

Following a discussion on characteristics and sources of the pollutant, health effects and national air quality trends, regional air quality trends for ozone will be discussed on a state-by-state basis. Methods of presentation are varied and include:

- Regional ozone profile map depicting ozone severity by county

- National map depicting all areas in the United States exceeding the ozone NAAQS based on 1986-1988 data

- State-by-state evaluation of ozone air quality (Allegheny County and the City of Philadelphia are discussed separately)

- Graphs to depict ozone trends for the composite mean and range for the annual second daily maximum 1-hour average for specific sites within each state

- Selected state use of graphs and three dimensional plots to depict ozone violation day trends

- Graph to depict the seasonal trend in ozone exceedances in Region III

3.1 CHARACTERISTICS AND SOURCES OF THE POLLUTANT

Ozone is a secondary pollutant that is not directly emitted into the atmosphere but rather is formed by complex chemical reactions in the presence of sunlight. Nitrogen oxides (produced by combustion sources) react with volatile organic compounds (VOC's, which include gasoline vapor, chemical solvents, paint thinners, industrial chemicals, etc.) in the sunlight to produce ozone. The most favorable meteorological conditions for the formation of ozone occurs when a high pressure system with elevated temperatures and mild to calm wind speeds dominate an area. Since ozone reactions are stimulated by sunlight and temperature, peak ozone levels occur during the warmer times of the year. In Region III the ozone season extends from April 1 through October 31.

A variety of factors affect the production of ozone: the quantity of reactive gases present, the volume of air available for dilution, air temperature and the amount of sunlight. Ozone will typically build up in large, stagnant air masses and then become transported downwind. Thus, high ozone levels in the northeast can originate hundreds of miles away.

The problem with controlling ozone is that it is caused by emissions of air pollutants from a very wide range of sources: large sources (refineries), small sources (gas stations, dry cleaners, cars, trucks, paint and solvent uses). As such, no single control technology can be applied.

State inspection and maintenance programs for automobiles currently operating in most urban areas of the Region help control emissions of pollutants which lead to ozone formation. Adoption of regulations to control the volatility of gasoline, for example, will reduce emissions from automobiles, gas stations and oil refineries. The current proposed Clean Air Legislation will address gasoline volatility, a measure of how easily it evaporates, by requiring special controls on gasoline pumps such as those currently being installed throughout New Jersey.

3.2 EFFECTS

Human exposure to ozone concentrations at or above the NAAQS is a serious health concern. It can impair lung functions in those with existing respiratory problems and people with good health can be affected with chest pains and shortness of breath. Permanent lung damage can occur from chronic exposure. Ozone also affects lung tissue, mucous membranes and it interferes with the autoimmune system. Ozone reduces the ability to perform physical exercise and effects those most who have asthma, chronic lung disease and allergies. Chest pains, coughing, wheezing, pulmonary and nasal congestion, sore throat, nausea, labored breathing are all symptoms of high levels of ozone pollution. In general, the longer the exposure, the longer it takes to get back to normal.

In addition to health concerns, ozone also affects trees, vegetation and crops. In general, ozone has a tendency to accelerate the aging of materials (rubber cracks, dye fades and paint erodes).

Ozone effects on agriculture as studied by EPA through the National Crop Loss Assessment Network (NCLAN) is immense. The agricultural loss from ozone pollution is estimated at 2-3 billion dollars annually. Even levels below the NAAQS reduce several cash crops by up to 10% per year. High ozone levels have reduced national plant yields in tomatoes (33%), beans (26%) soybeans (20%) and snapbeans (22%). Ozone is also linked to a decline in the growth of many species of trees and the loss of some forests. Some effects on trees include injury to foliage, premature leaf drop, decreased radial growth and photosynthetic capacity. Ozone is implicated in the white pine damage in the eastern United States and Canada and reduced growth rates for red spruce in Appalachia.

OZONE DESIGN VALUES, 1986-88

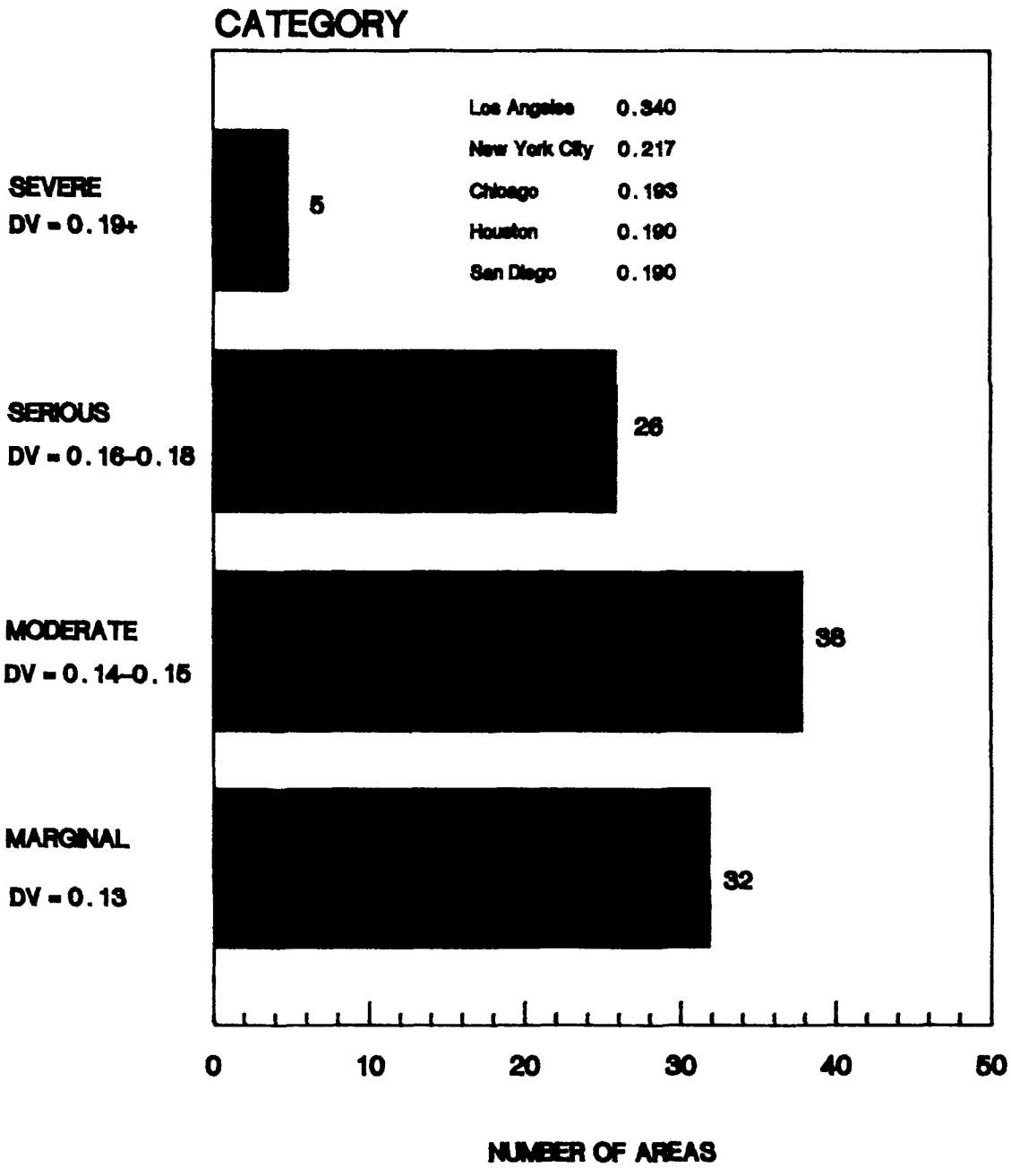


Figure 3-1 Ozone design values, 1986-1988 for severe, serious, moderate, and marginal areas in the United States.

3.3 AIR QUALITY TRENDS

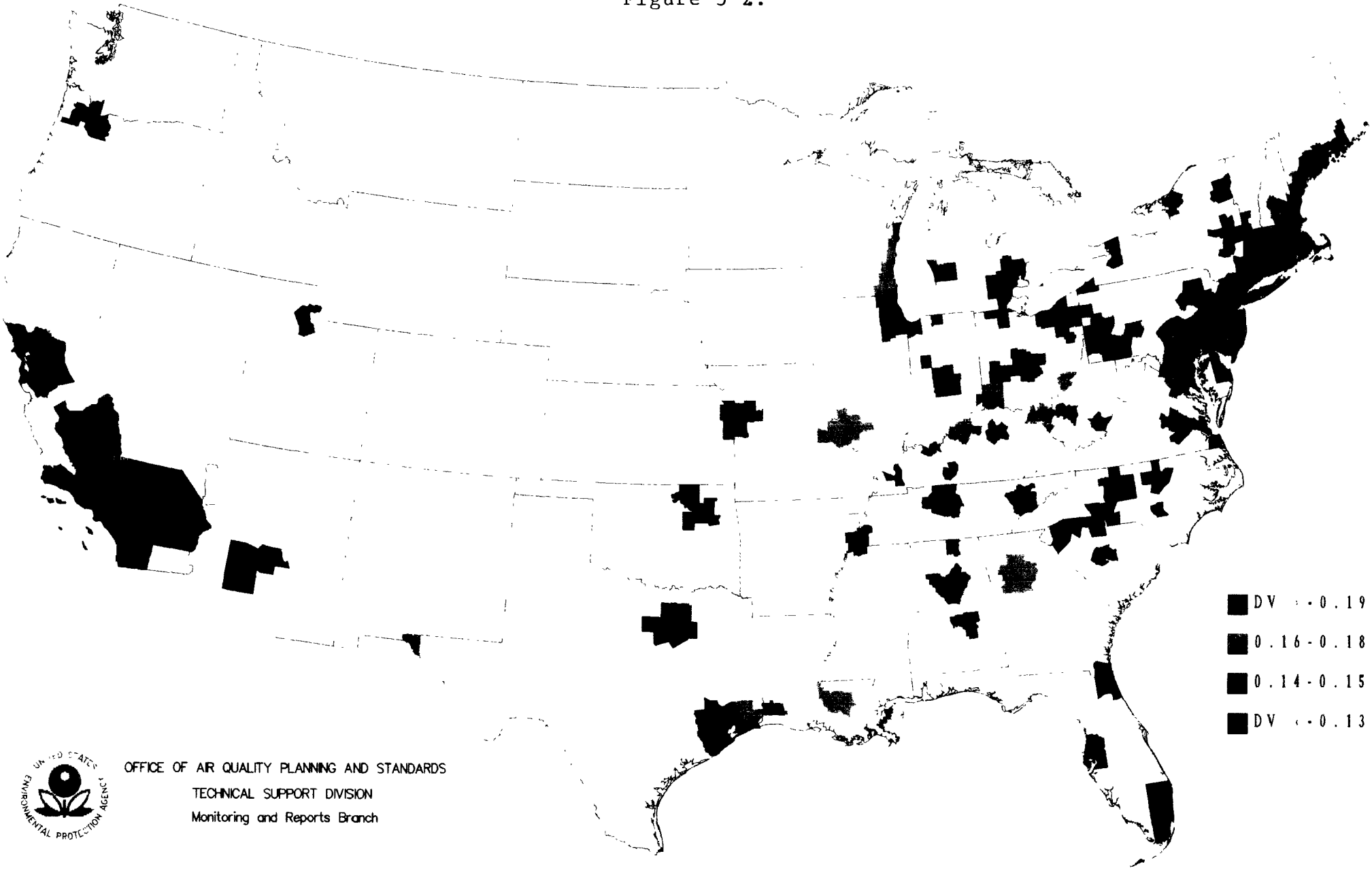
- Ozone is the most pervasive air pollution problem facing the nation today
- Nationally, 101 areas fail to attain federal health standards
- Regionally, 22 areas fail
- Over 100 million people live in 101 areas that exceed the health standard and are exposed to hazardous health conditions
- The highest concentrations are observed in Southern California but high levels also persist in the Texas Gulf Coast, the Northeast Corridor and most other heavily populated areas.
- Nationally, although ambient levels of ozone, measured at 274 trend sites, decreased 9 percent between 1979 and 1987 (1978 data not used due to instrument calibration change) 1988 levels were approximately 9 percent higher than 1987.
- In Region III the ozone problems of 1983 and 1988 were relatively severe because the summers were hot and dry when compared to average temperature and rain fall data for all summers on record. Ozone levels recorded in 1988 were nearly 10 percent higher than in 1983 with 22 percent more exceedances of the ozone standard recorded.

When attempting to describe the status of ozone conditions, the ozone design value for an area is used. For an ozone monitoring site with complete data for three years, the fourth highest daily maximum hourly average value is the design value. The highest design value for a given area is designated to represent that entire area. Areas are then classified as severe, serious, moderate or marginal depending on the magnitude of the ozone design value. (See Figure 3-1.)

AREAS EXCEEDING THE OZONE NAAQS

BASED ON 1986-88 DATA

Figure 3-2.



Areas in the United States exceeding the ozone NAAQS based on 1986 - 1988 air quality data are shown in Figure 3-2. Also, a comparison of 1985-87 areas with 1986-88 areas exceeding the ozone NAAQS is shown in Figure 3-3. In Region III, there are no areas classified as severe at this time.

Five (5) of the twenty-six (26) serious areas nationwide are located in Region III: Baltimore, MD, Huntington-Ashland, WV-KY-OH, Parkersburg-Marietta, WV-OH, Philadelphia-Wilmington-Trenton, PA-NJ-DE-MD, and Washington, DC-MD-VA.

Six (6) of the thirty-eight (38) moderate areas nationwide are located in Region III: Allentown-Bethlehem, PA-NJ, Charleston, WV, Harrisburg-Lebanon-Carlisle, PA, Pittsburgh-Beaver Valley, PA, Reading, PA and Richmond-Petersburg, VA.

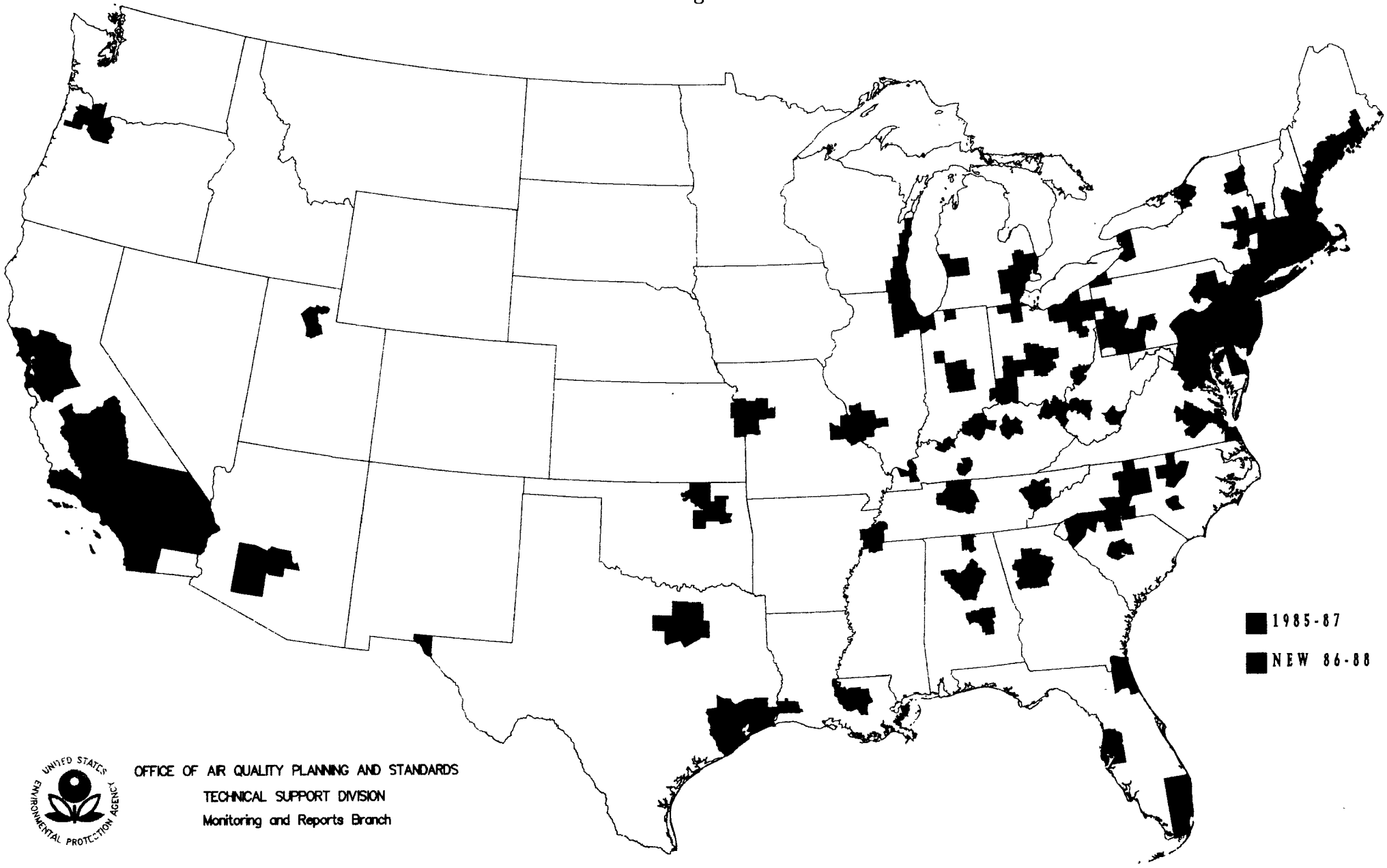
Nine (9) of the thirty-two (32) marginal areas nationwide are located in Region III: in Pennsylvania-Altoona, Erie, Johnstown, Lancaster, Scranton-Wilkes Barre, York, Sharon; Greenbriar Co., WV and Norfolk-Virginia Beach-Newport News, VA.

The severity of the ozone non-attainment problem varies widely among various states in Region III and is characterized by the Regional Ozone Profile Map in Figure 3-4. The attainment status of all counties in Region III can be seen at a glance.

AREAS EXCEEDING THE OZONE NAAQS

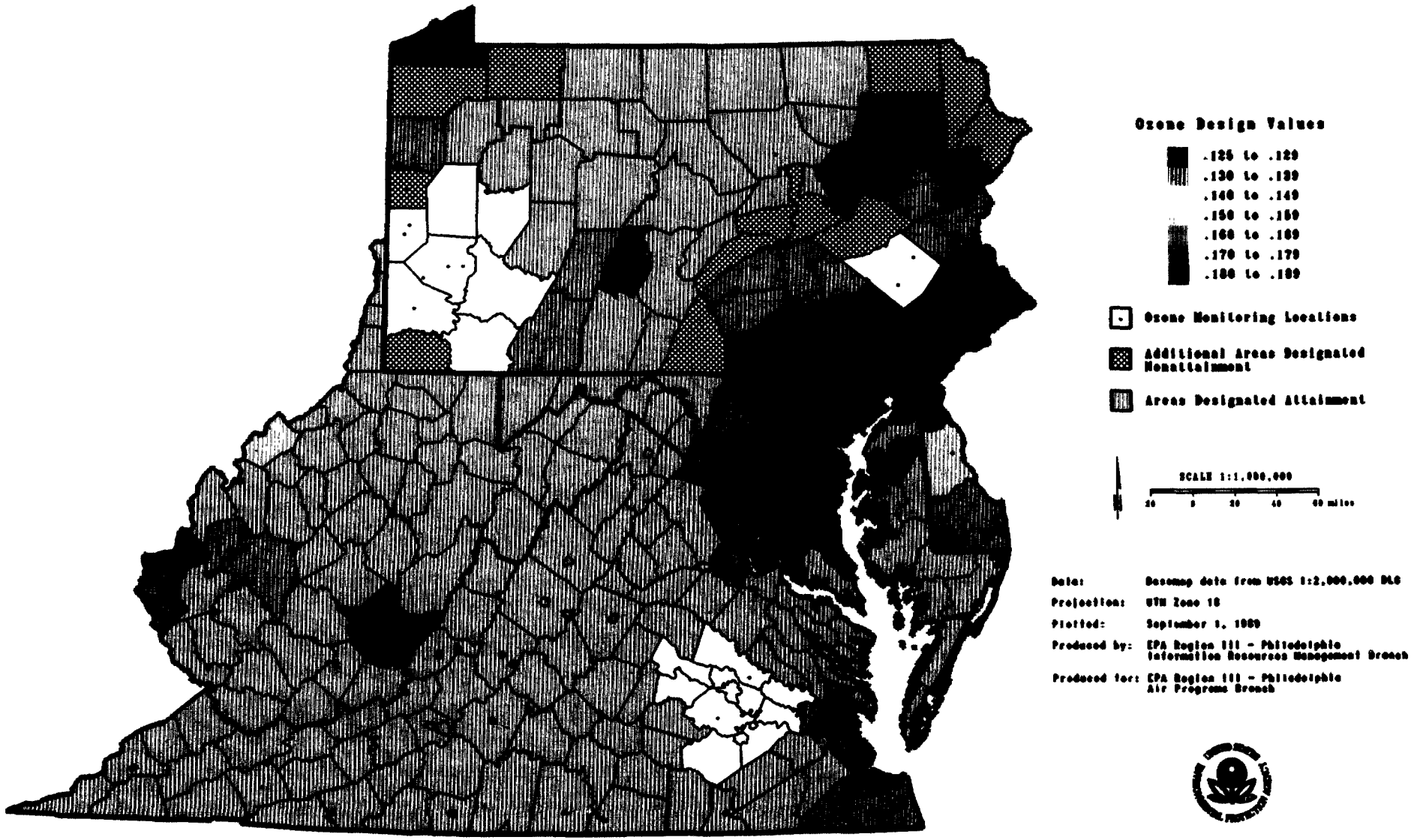
COMPARISON OF 1985-87 VS. 1986-88

Figure 3-3.



1986 - 1988 REGIONAL OZONE PROFILE
REGION III

Figure 3-4.



3.3.1 STATE OF DELAWARE

Ozone levels decreased nearly 25% from 1983 to 1986 and then rose in 1987 and 1988 to levels exceeding the 1983 averages in the State of Delaware. New Castle County is currently designated as non-attainment for ozone.

Average air quality trends for ozone in the State of Delaware are characterized by five (5) sites for the period 1983-1988.

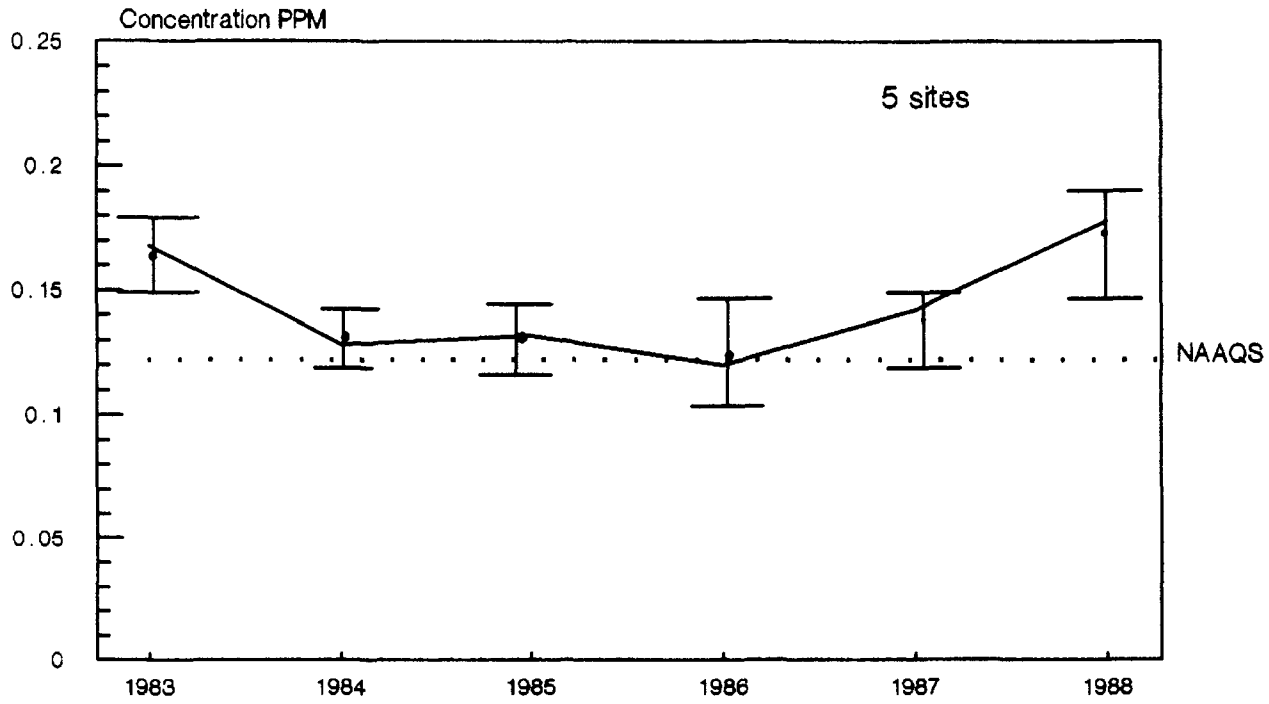


Figure 3-5 Trend in the composite mean and range for the annual second daily maximum 1-hour ozone concentration, State of Delaware, 1983-1988.

3.3.2 DISTRICT OF COLUMBIA

Ozone levels (as determined by the second highest annual maximum) decreased approximately 20% from 1983 to 1986 and then rose again in 1987 and 1988 to the 1983 levels. Exceedances of the standard dropped from twelve in 1983 to zero in 1986. There were fifteen exceedances of the ozone standard in 1988. The District of Columbia is currently in non-attainment for this pollutant.

Average air quality trends for ozone in the District are characterized by two (2) sites for the period 1983-1988.

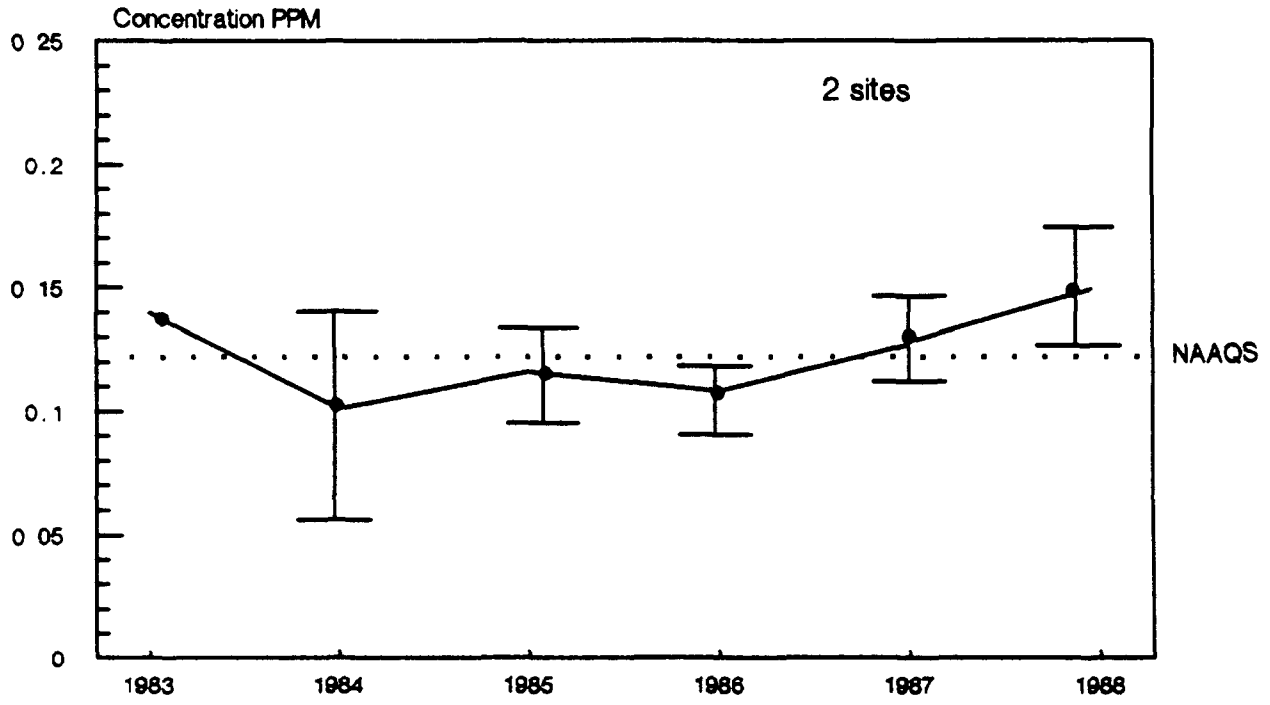


Figure 3-6 Trend in the composite mean and range for the annual second daily maximum 1-hour ozone concentration, District of Columbia, 1983-1988.

3.3.3 STATE OF MARYLAND

The present Maryland ozone monitoring network consists of 15 sites statewide: Baltimore metro (9); Washington metro (3); southern Maryland (1); Eastern Shore (1); and Western Maryland (1). The ozone levels in the Baltimore metropolitan area have shown a downward trend from 1984 to 1986, decreasing from 17 exceedances in 1984 to 13 in 1986. The Washington area showed a similar trend: decreasing from seven days in 1984 to four days in 1986. The last two years, however, have shown increases in both areas. The record setting temperatures in 1988 resulted in 36 exceedances of the ozone standard in Baltimore and 21 exceedances in the metro Washington area. See Figure 3-8 for ozone exceedance day trends for six (6) locations in the state.

Average air quality trends for ozone in the State of Maryland are characterized by fourteen (14) trend sites for the period 1983-1988.

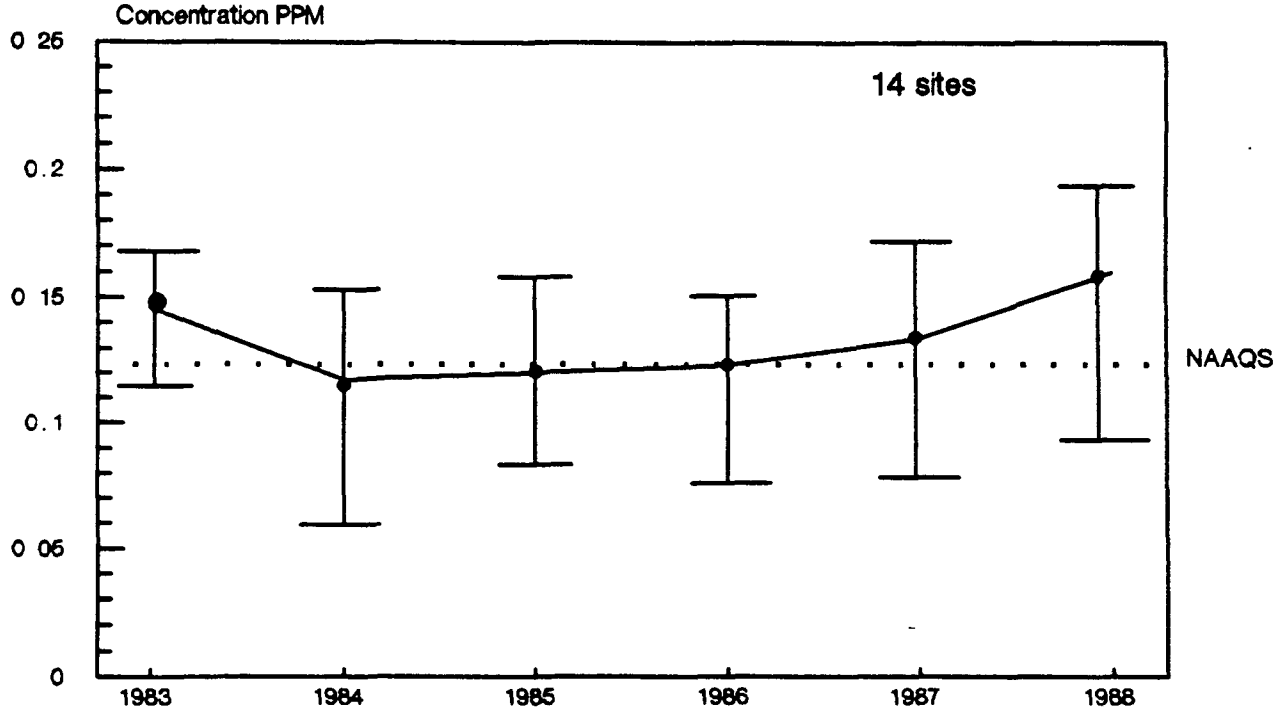
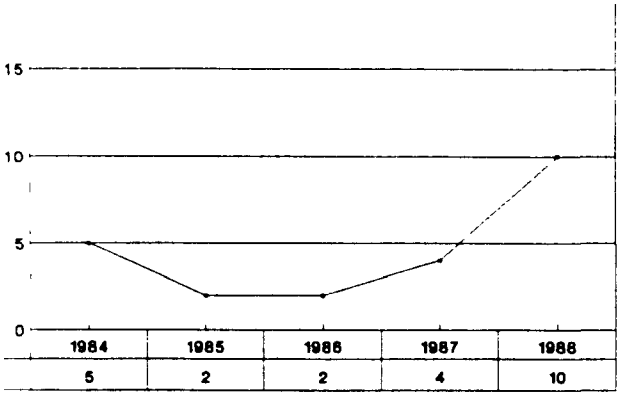


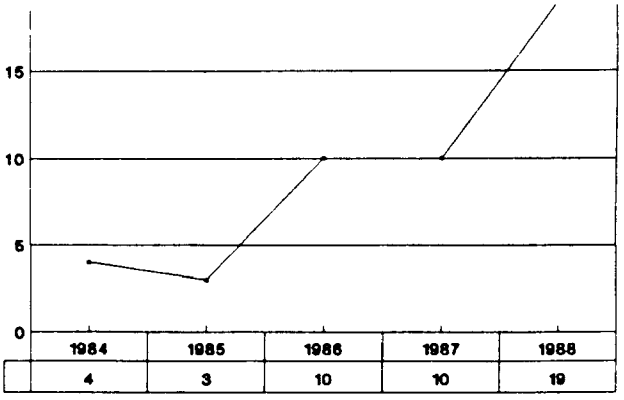
Figure 3-7 Trend in the composite mean and range for the annual second daily maximum 1-hour ozone concentration, State of Maryland, 1983-1988.

STATE OF MARYLAND
OZONE
Exceedances
1984____1988

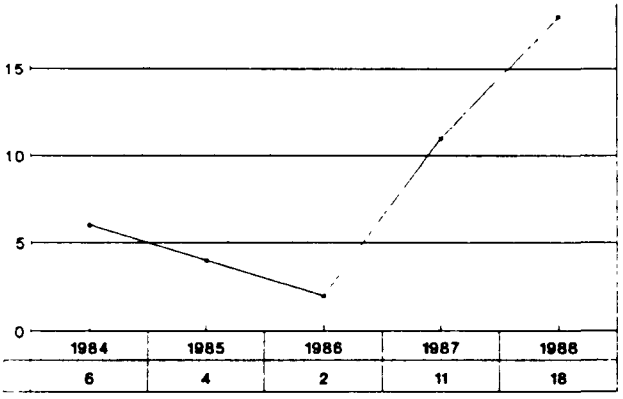
Figure 3-8.



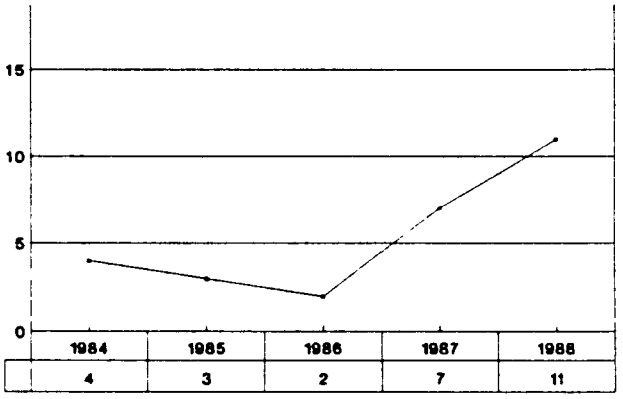
DAVIDSONVILLE



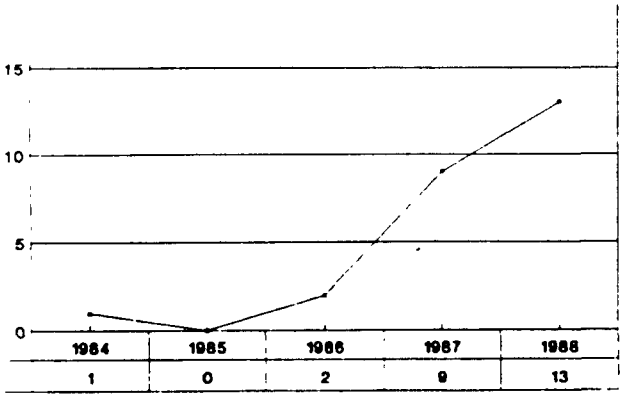
EDGEWOOD



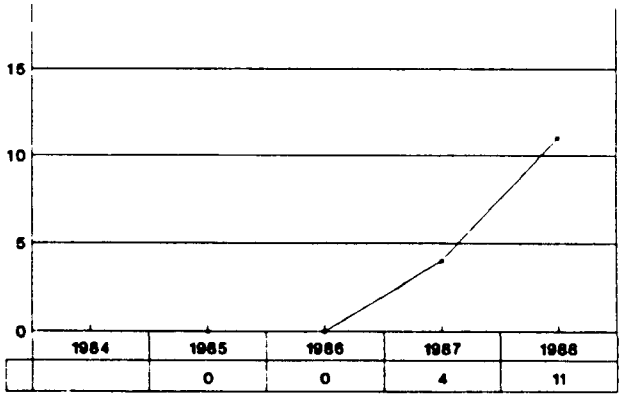
FORT MEADE



GREENBELT



SUITLAND



SOUTHERN MARYLAND

3.3.4 COMMONWEALTH OF PENNSYLVANIA

Figure 3-10 shows the ten year trend (1979-1988) of the number of days in the 12 air basins in which there was a daily value greater than 0.12 parts per million (ppm). The summer of 1988 was one of the hottest in recent years and all air basins in the Commonwealth exceeded the daily ozone standard. Over the last 3 years most air basins have seen an increase in the number of days that the ozone standard was exceeded. As can be seen from the trend data, all sites with the exception of Wilkes Barre, Carbondale, New Castle, Beaver Falls, and Williamsport have not been able to attain the air quality standard. Ozone exceedance days in 1988 for selected areas in the Commonwealth are depicted in Figure 3-11.

Average air quality trends for ozone in the Commonwealth (excluding Allegheny County and the City of Philadelphia) are characterized by twenty-seven (27) sites for the period 1983-1988.

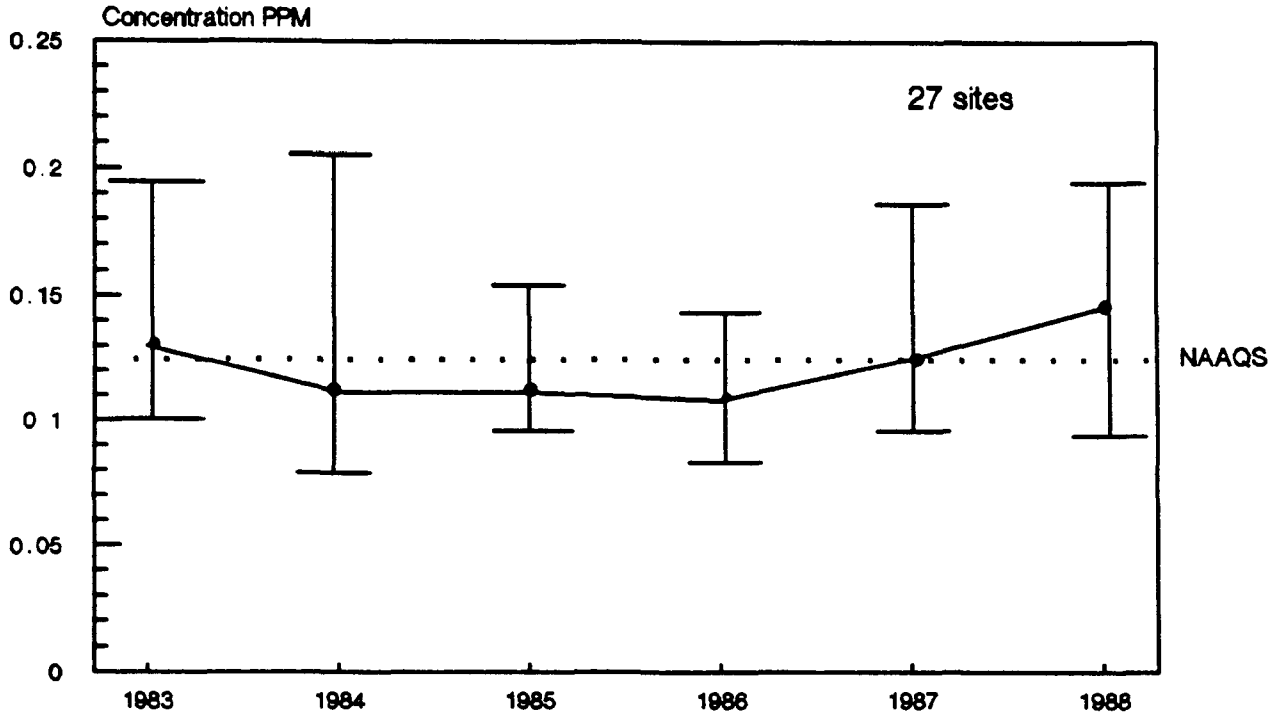


Figure 3-9 Trend in the composite mean and range for the annual second daily maximum 1-hour ozone concentration, Commonwealth of Pennsylvania, 1983-1988.

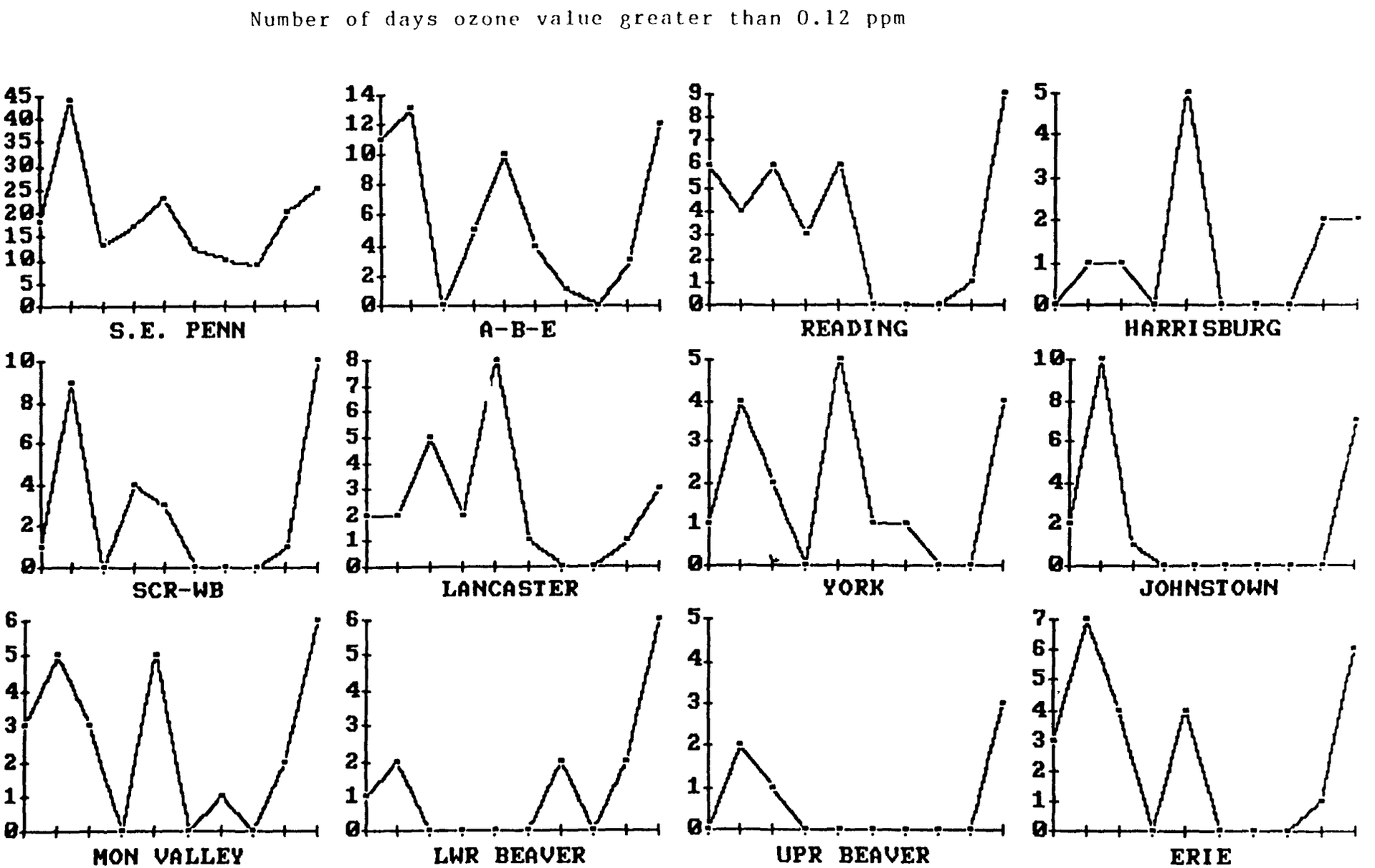


Figure 3-10. Ozone trends in the Commonwealth of Pennsylvania for twelve air basins, 1979-1988.

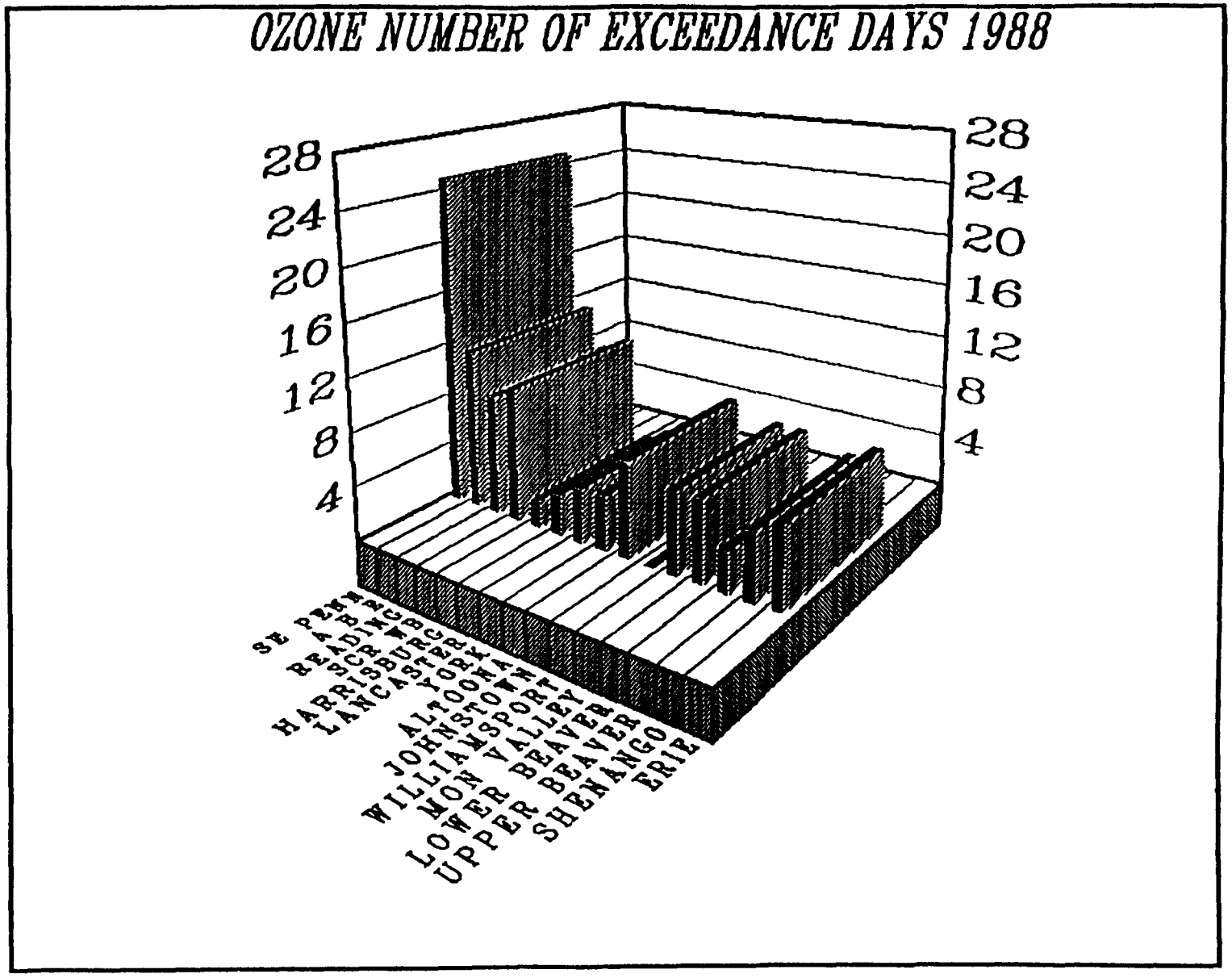


Figure 3-11. Number of ozone exceedance days, Commonwealth of Pennsylvania, 1988.

3.3.5 ALLEGHENY COUNTY

The 1988 ozone season (April-October) produced 16 days on which the 0.12 ppm hourly standard was exceeded at one or more sites. By site the actual exceedance day totals for 1987 and 1988 were:

	1987	1988
Brackenridge	4	13
Lawrenceville	1	6
South Fayette	2	4
Penn Hills	1	1
Total	8	24

On only one day in 1988 (July 6th) the standard was exceeded at all four sites. Also on this day all four had their maximum hourly value of the season. The largest of these was 0.170 ppm at Lawrenceville.

Ozone trends show that since 1984 and 1985, when there were none, total exceedance days climbed from 2 to 8 to 24 in 1986, 1987 and 1988, respectively. The network hourly maximum curve reflects this rise (Figure 3-12).

Average air quality trends for ozone in Allegheny County are characterized by four (4) sites for the period 1983-1988.

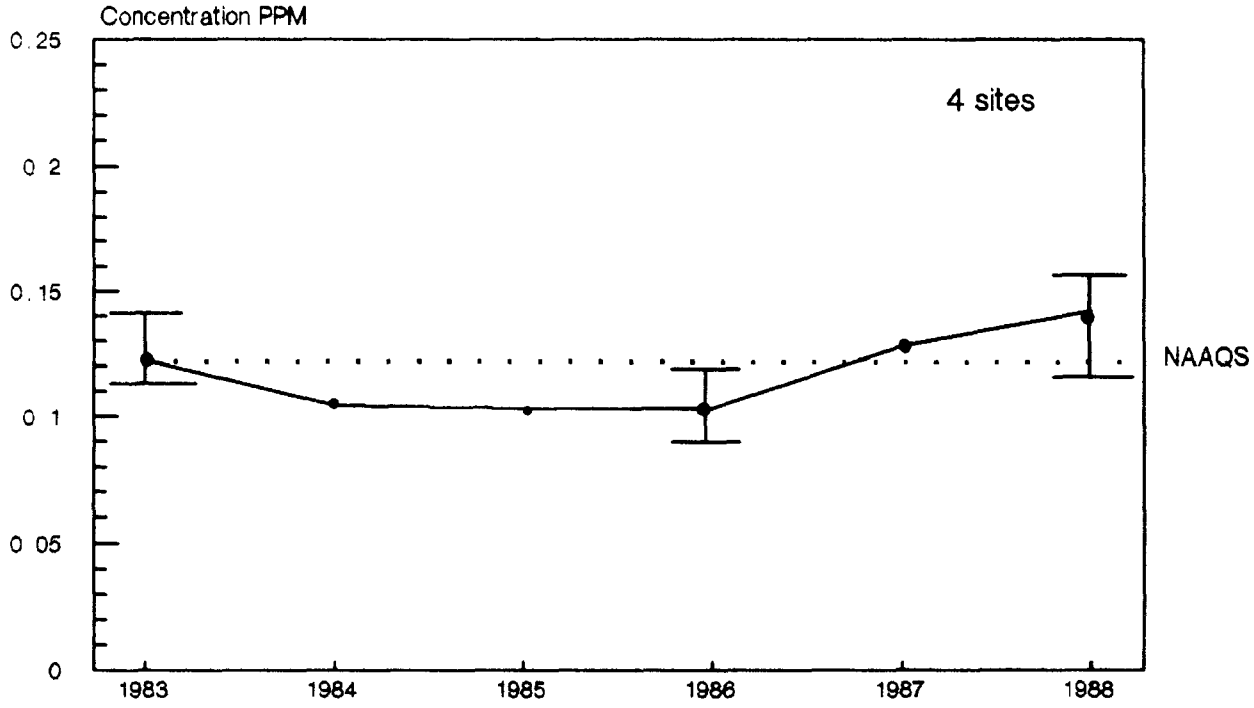


Figure 3-13 Trend in the composite mean and range for the annual second daily maximum 1-hour ozone concentration, Allegheny County, 1983-1988

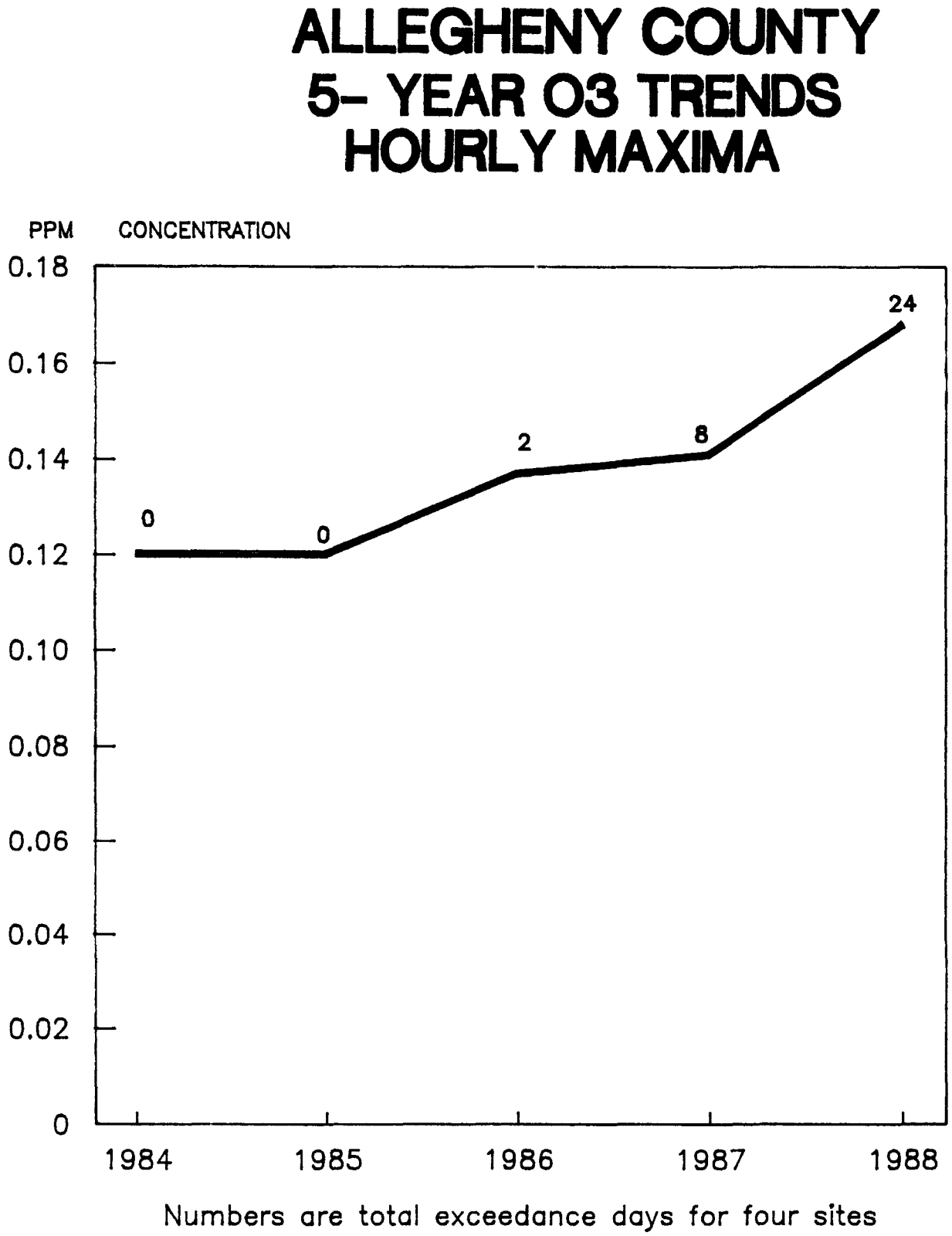


Figure 3–12 Allegheny County 5–Year Ozone Trends, Hourly Maximum, 1984–1988.

3.3.6 CITY OF PHILADELPHIA

Photochemical Oxidants are principally composed of ozone and is a seasonal pollutant prevalent in the warm weather months. Violations of the ozone NAAQS occur throughout the Philadelphia area with the highest ozone levels detected within the counties in Pennsylvania and New Jersey that are adjacent to Philadelphia. Within Philadelphia, the three (3) ozone monitoring stations are located in the areas where the levels are the highest and show worst case exposure.

Average air quality trends for ozone in Philadelphia are characterized by three (3) sites for the period 1983-1988.

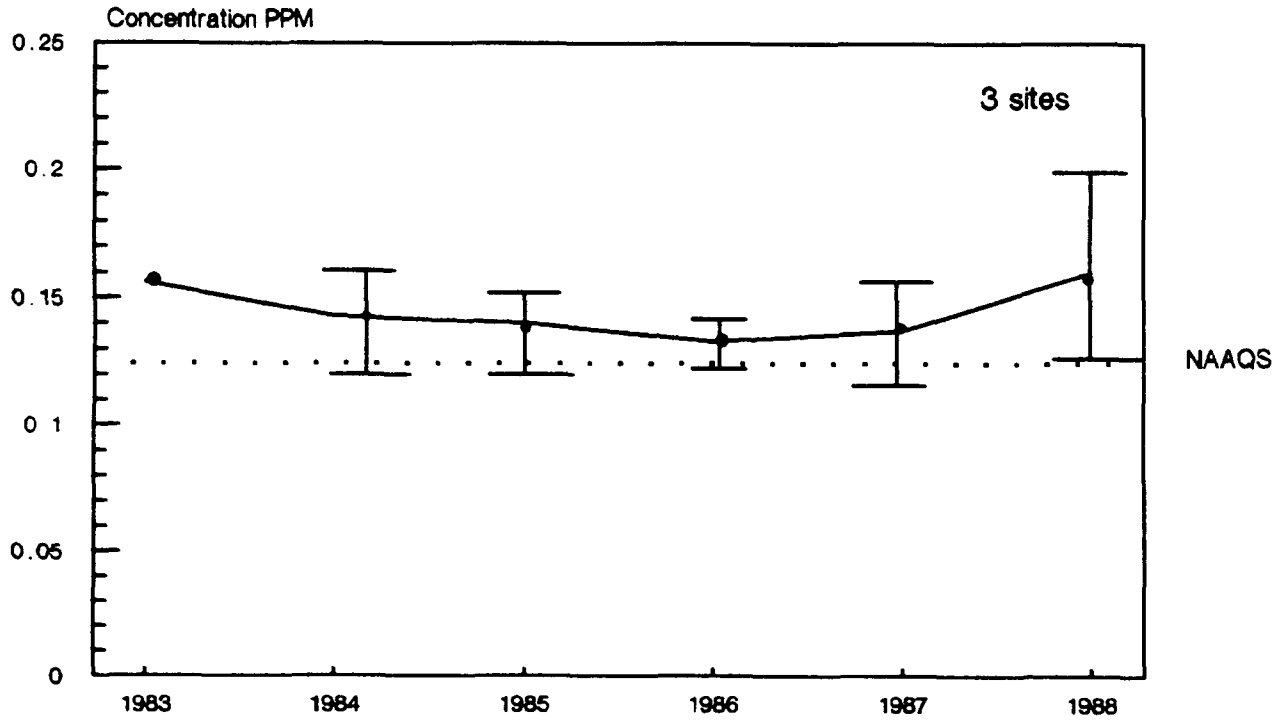


Figure 3-14 Trend in the composite mean and range for the annual second daily maximum 1-hour ozone concentration, City of Philadelphia, 1983-1988.

3.3.7 COMMONWEALTH OF VIRGINIA

As was the case in 1987, the hot and unusually dry summer of 1988 contributed to the unprecedented number of ozone exceedances throughout the Commonwealth. The Richmond area remained a non-attainment area due to multiple exceedances at all of the area monitoring sites in the summer of 1988. For Northern Virginia, ozone exceedances occurred at all of the seven monitoring sites. All but one of the monitoring sites showed that area continued to be non-attainment. In the Tidewater area, the Suffolk ozone monitoring site that was established in 1987 showed two exceedances in 1987 and four in 1988.

There are two monitoring sites in the Shenandoah National Park that measure sulfur dioxide and three sites that measure ozone. Each of the ozone monitors, for the first time, measured exceedances of the ambient air quality standards in 1988.

Average air quality trends for ozone in Virginia are characterized by eighteen (18) sites for the period 1983-1988.

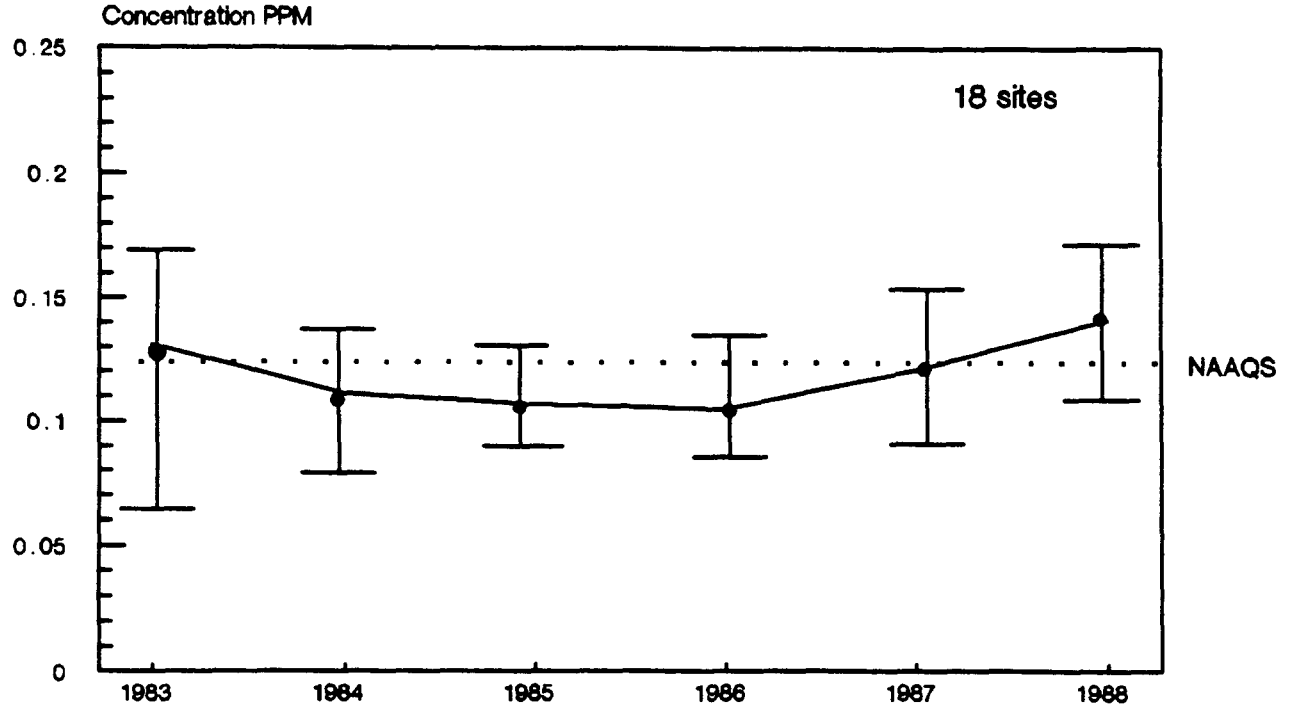


Figure 3-15 Trend in the composite mean and range for the annual second daily maximum 1-hour ozone concentration, Commonwealth of Virginia, 1983-1988.

3.3.8 STATE OF WEST VIRGINIA

Ozone levels as measured at four (4) sites in West Virginia has shown a steady increase since 1984. Non-attainment counties in the State are depicted in the Ozone Profile.

The measurements from the four (4) ozone sites in West Virginia show that West Virginia experiences the same year to year variation of the elevated ozone exposure as do other states in Region III even though West Virginia is not in the highly populated Northeast corridor. This similarity of ozone exposure demonstrates the widespread nature of the ozone problem.

Average air quality trends for ozone in West Virginia are characterized by four (4) sites for the period 1983-1988.

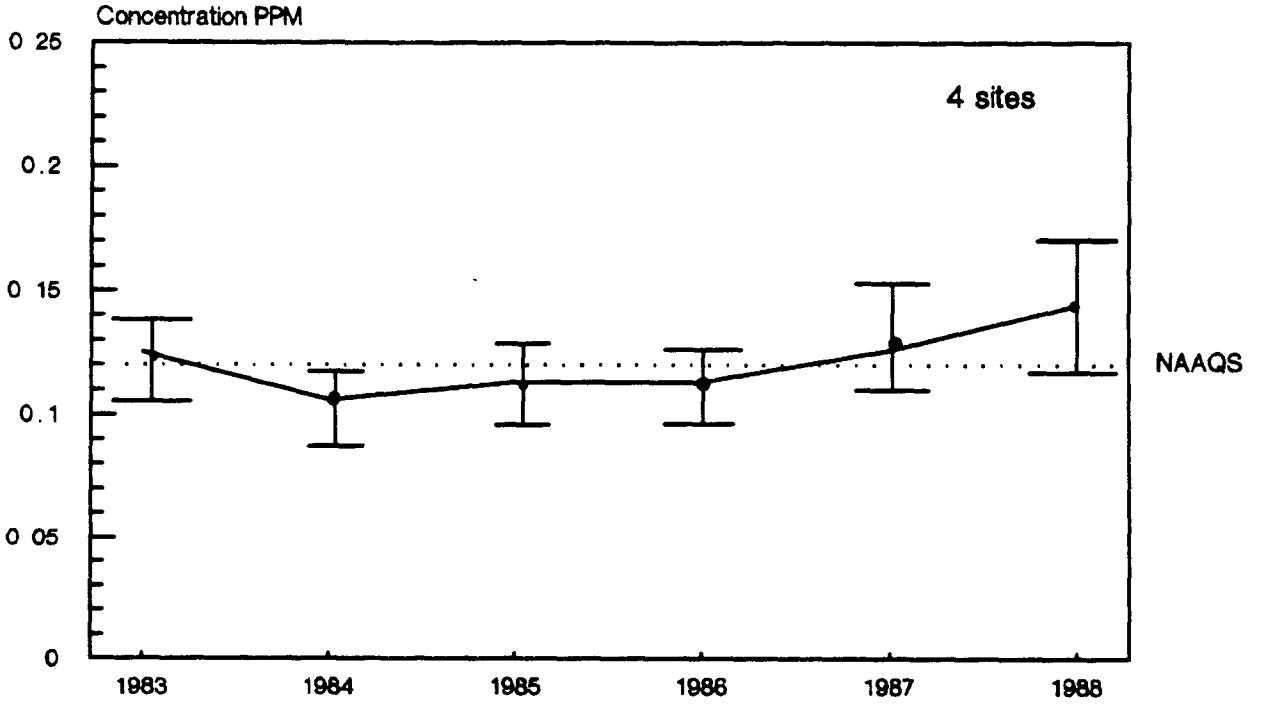


Figure 3-16 Trend in the composite mean and range for the annual second daily maximum 1-hour ozone concentration, State of West Virginia, 1983-1988.

3.4 EMISSION TRENDS

- The principal sources of VOC emissions are transportation (automobiles) and industrial processes.
- Nationally, VOC emissions decreased approximately 17 percent between 1978 and 1987.
- Greatest improvement occurred in the transportation category.
- In Region III, a 17 percent decrease in VOC emissions is estimated to have occurred between 1983-1988.

3.5 COMMENTS

- The severity of the ozone problem varies from year to year and is dependent on the frequency and strength of the stationary high pressure centers that occur during the warmer months. The highest ozone concentrations are likely to occur in June and July. August is about half as likely to have unhealthy high ozone days. Occasionally, unhealthy high ozone days occur in May and September, but in these few instances the problem is usually less severe than during the summer months.
- The seasonal trend in ozone exceedances is presented in Figure 3-17. This chart depicts the percentage of observed exceedances of the NAAQS by month, by state for the period 1983-1988.
- The total number of exceedances of the ozone NAAQS in Region III states are depicted in Figures 3-18. The severity of the 1983 and 1988 ozone season and variability by state is apparent.

SEASONAL TRENDS IN OZONE EXCEEDANCES IN REGION III STATES

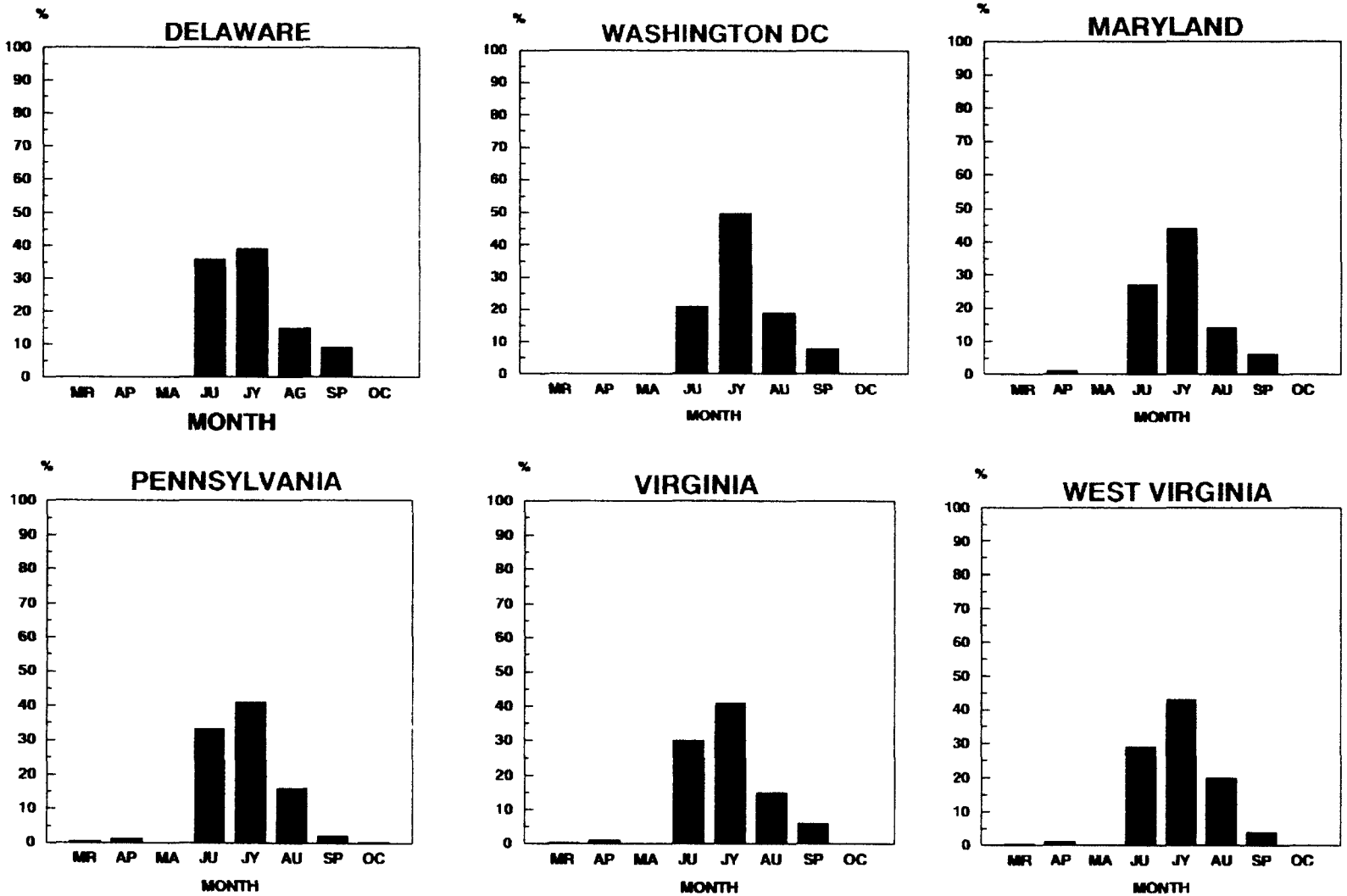


Figure 3-17

3.6 WORTH NOTING

- Ozone trends in the 1980's show that the 1980, 1983 and 1988 values were higher than other years. The magnitude of these increases and the alternate year decreases are likely attributable to variations in meteorological conditions conducive to ozone formation.

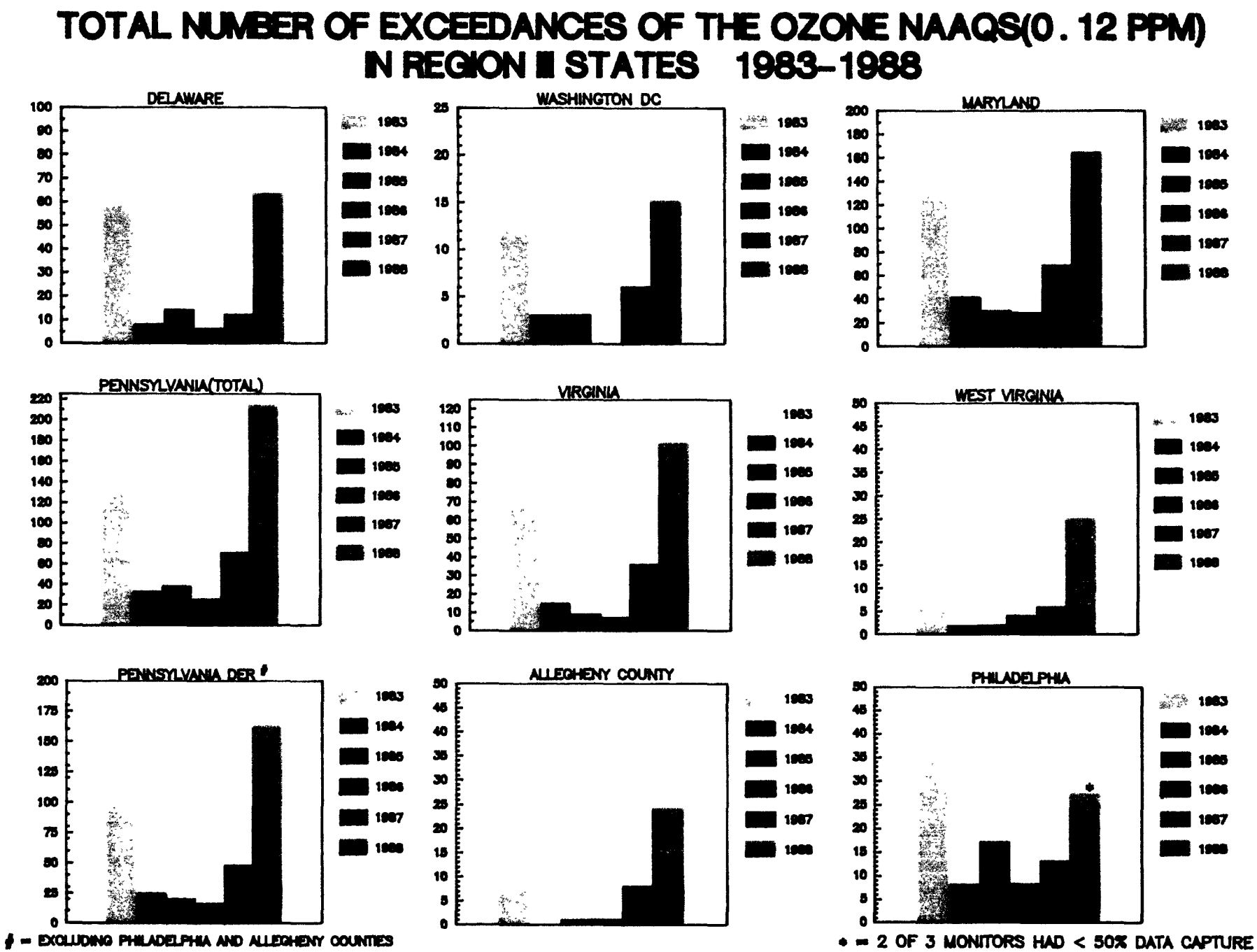


Figure 3-18. Total number of exceedances of the ozone NAAQS in Region III states, 1983 - 1988

4.0 TRENDS IN CARBON MONOXIDE

This section will describe and characterize the air quality status and trends for the pollutant carbon monoxide (CO).

Following a discussion on characteristics and sources of the pollutant, health effects and national air quality status, regional trends for CO will be discussed on a state-by-state basis. Methods of presentation include:

- Graphs to depict CO trends for the composite mean and range for the second highest eight (8) hour average for specific sites within each state.
- Selected use of state graphs to depict CO trends by site (Maryland) and by air basins (Pennsylvania).
- Use of three dimensional graphs to show the highest CO concentrations by city and/or area for 1988 in the Commonwealth of Pennsylvania.
- CO attainment/non-attainment status maps for Region III.

4.1 CHARACTERISTICS AND SOURCES OF THE POLLUTANT

Carbon monoxide (CO) is a tasteless, colorless, odorless and poisonous gas produced by incomplete fuel combustion. The primary anthropogenic source of atmospheric carbon monoxide is the automobile, especially when engines burn fuel inefficiently when starting up in the morning, idling or moving slowly in congested traffic. Over two thirds of CO emissions are from motor vehicle exhaust. Other sources are incinerators, wood stoves and some industrial processes.

4.2 EFFECTS

When inhaled, carbon monoxide enters the bloodstream and reduces the amount of oxygen delivered to all tissues of the body. Such oxygen depletion impairs the functioning even of healthy individuals and can be life threatening to those with heart disease. The amount of oxygen reduction depends on the amount of air inhaled, carbon monoxide concentrations and length of exposure.

Even at relatively low concentrations, carbon monoxide can effect mental functioning, breathing, alertness and other physical and mental functions. Individuals who smoke, those living in high altitudes and persons suffering from anemia, emphysema and other lung diseases are the most susceptible to the effects of carbon monoxide.

4.3 AIR QUALITY TRENDS

The general trend has been for ambient CO concentrations to decrease even though the number of automobiles and miles travelled has increased.

The implementation of the Federal Motor Vehicle Control Program (FMVCP) has successfully contributed to the reduction of CO emissions since the early 1970's. Even though total vehicle miles increased, total CO emissions from highway vehicles decreased during the period 1970 through 1985. Overall from 1970 to 1985 without the FMVCP, vehicle emissions would have increased nearly 48%. In comparison, actual emissions are estimated to have decreased 44%. Also, inspection and maintenance (I/M) programs have been established in problem areas to ensure automobile emissions are within National limits and control equipment is functioning properly.

- Nationally, ambient CO levels measured at 198 trend sites, decreased 32 percent between 1978 and 1987; ambient CO levels decreased 6 percent between 1986 and 1987.

- In Region III, between 1983 and 1988, ambient CO levels decreased approximately 18 percent while nationally a 14 percent decrease was observed.

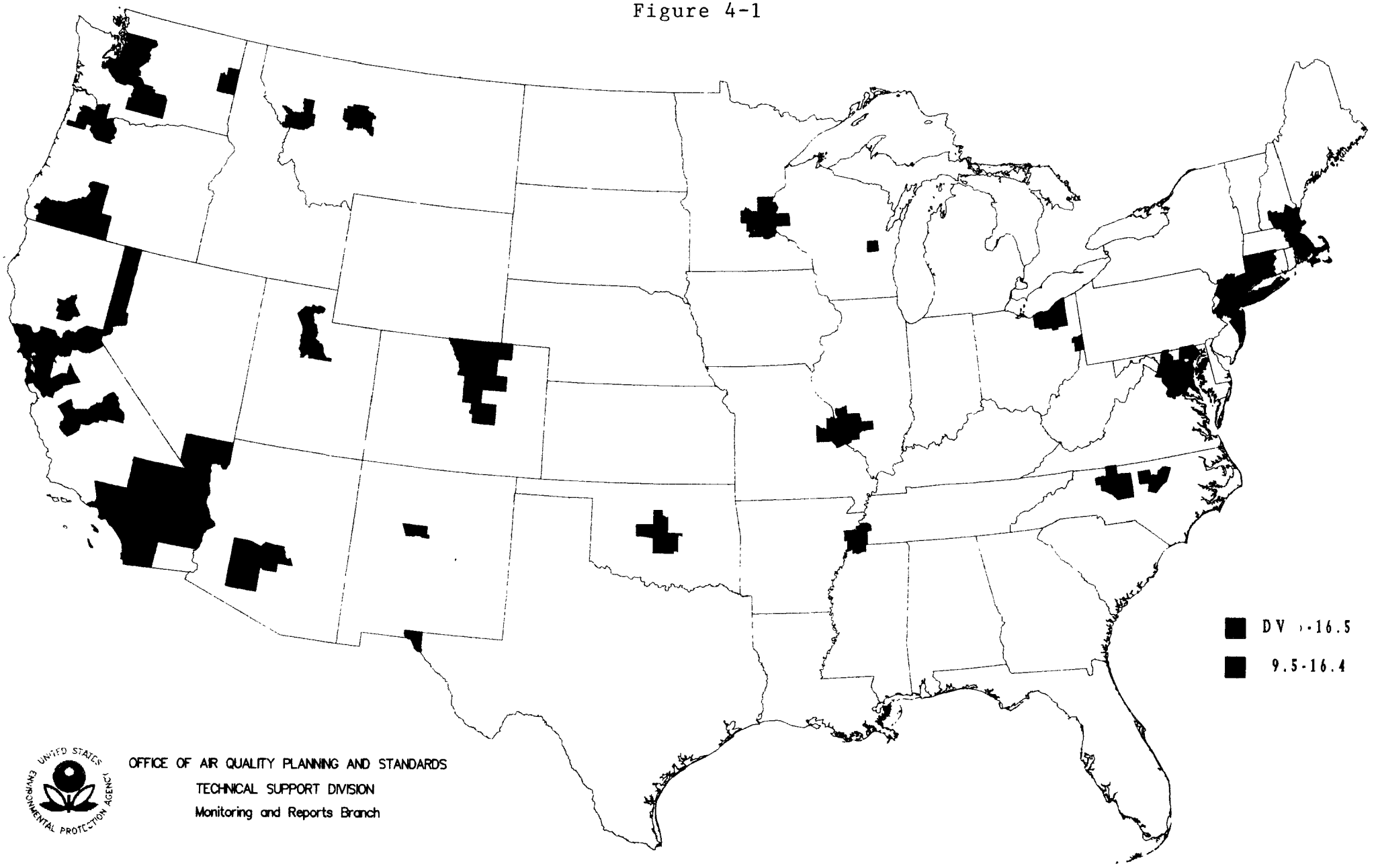
Areas exceeding the CO NAAQS in the United States based on 1987-1988 air quality data are depicted in Figure 4-1.

One of the five (5) serious areas (design value $\geq$ 16.5 ppm) in the United States, is located in Region III: Steubenville-Weirton, OH-WV. Two (2) of the thirty-nine (39) moderate areas (design value 9.5 - 16.4 ppm) in the United States are located in Region III: Baltimore, MD and Washington, DC-MD-VA.

AREAS EXCEEDING THE CARBON MONOXIDE NAAQS

BASED ON 1987-88 DATA

Figure 4-1



4.3.1 STATE OF DELAWARE

The State of Delaware is currently in attainment with the NAAQS for carbon monoxide. Carbon monoxide levels increased from 1983 to 1985 and then decreased in 1986 and 1987. A slight increase was observed in 1988.

Average air quality trends for carbon monoxide are characterized by two (2) sites for the period 1983-1988.

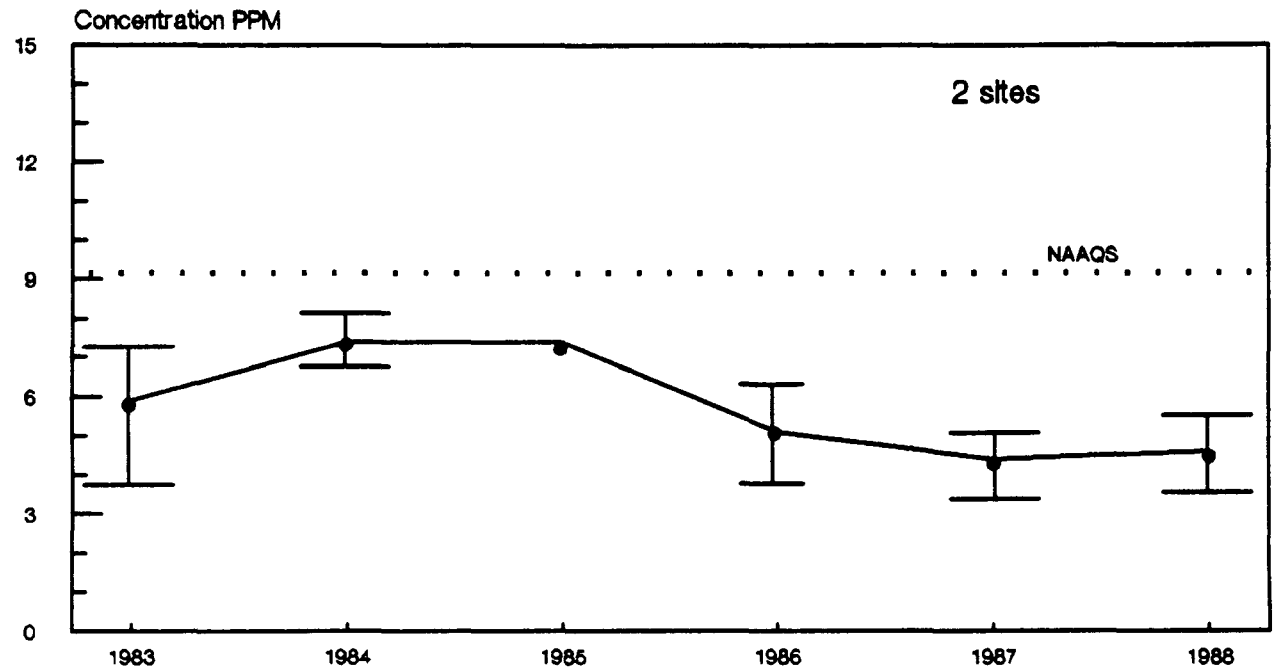


Figure 4-2 Trend in the composite mean and range for the second highest nonoverlapping 8-hour average carbon monoxide concentration, State of Delaware, 1983-1988.

4.3.2 DISTRICT OF COLUMBIA

The District of Columbia is currently in non-attainment for carbon monoxide. From 1983 to 1985, carbon monoxide levels decreased by 25% (as determined by the average second highest maximums). However, a steady upward trend has been observed since 1985 with levels in 1988 exceeding the NAAQS. The number of violations of the eight (8) hour standard decreased from 10 in 1983 to 2 in 1987. In 1988, the number of violations increased to twenty-three (23). Nearly 15 of these violations occurred during a four day period in November, 1988 when CO levels were elevated for the full event (24 hours per day) at between 8-20 ppm. EPA and the District are currently investigating the validity of this data.

Average air quality trends for carbon monoxide are characterized by two (2) sites for the period 1983-1988.

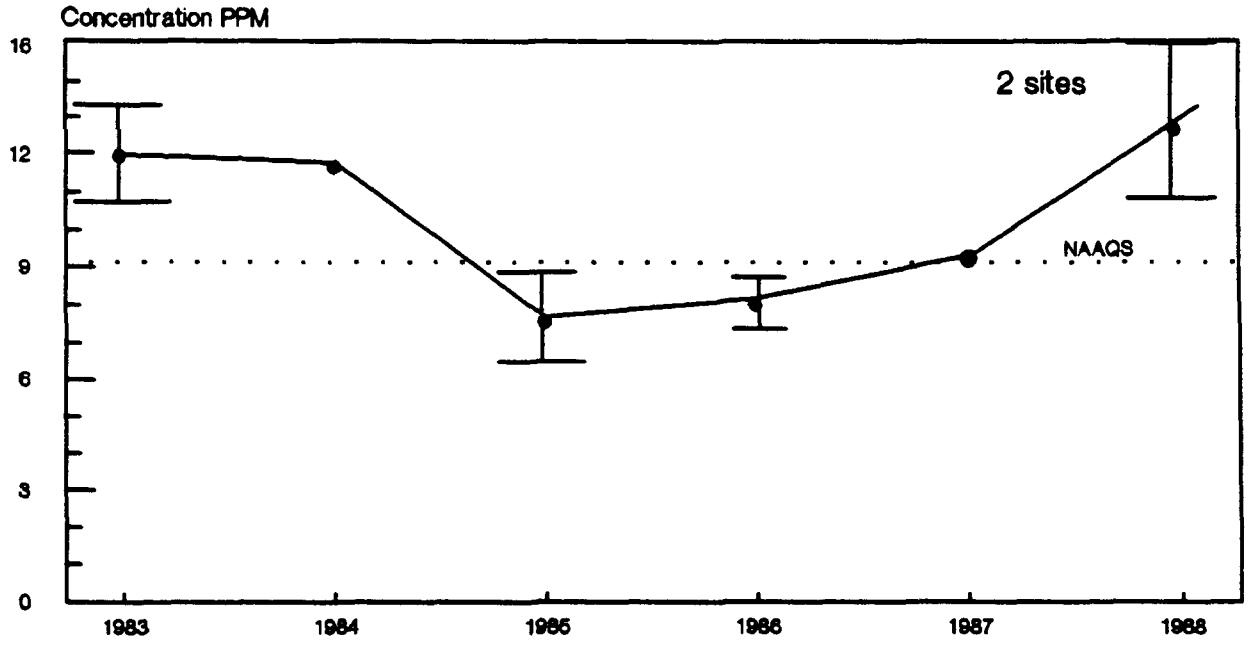


Figure 4-3 Trend in the composite mean and range for the second highest nonoverlapping 8-hour average carbon monoxide concentration, District of Columbia, 1983-1988.

4.3.3 STATE OF MARYLAND

The present Maryland CO monitoring network consists of four (4) monitors in the Baltimore metropolitan area, two (2) in the Washington metropolitan area and one (1) in Cumberland (Western Maryland).

The carbon monoxide levels have steadily decreased since 1984. The potential for CO violations is confined to two areas of high traffic density and topographical features which prevent adequate dispersion: downtown Baltimore and Bladensburg (Washington metro). Downtown Baltimore has decreased from 19 violations of the standard in 1984 to two (2) in 1988; Bladensburg has decreased from nine (9) violations in 1984 to one (1) in 1988. (See Figure 4-5.)

Average air quality trends for carbon monoxide are characterized by seven (7) sites for the period 1983-1988.

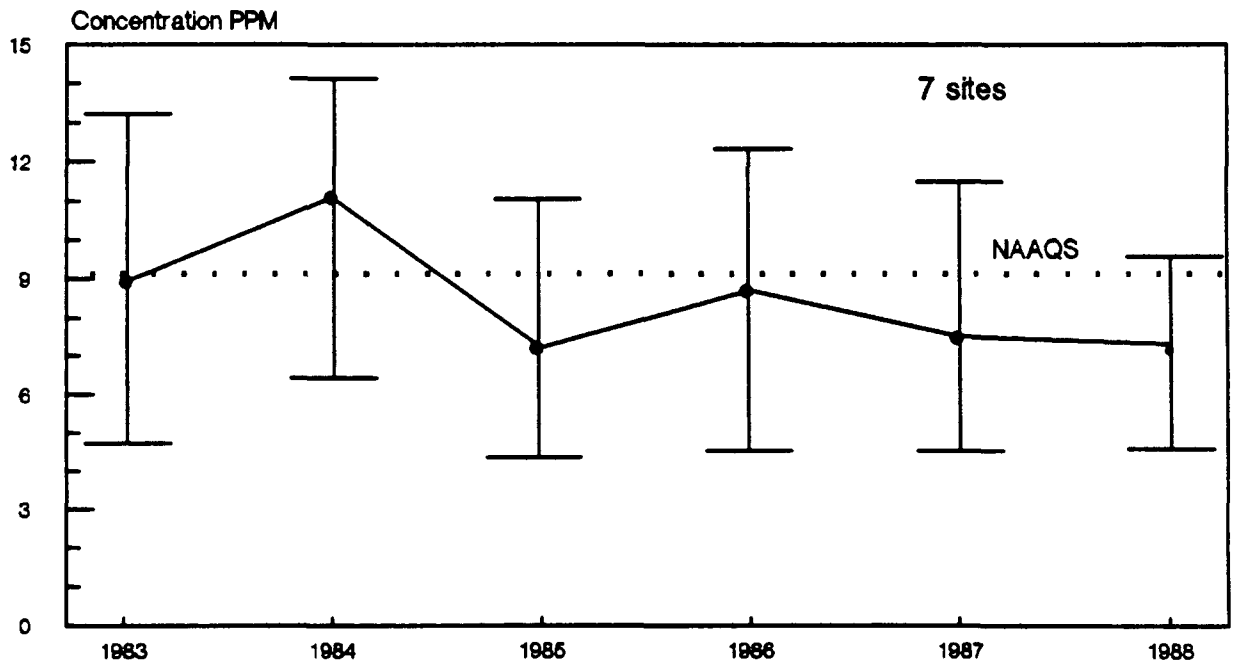
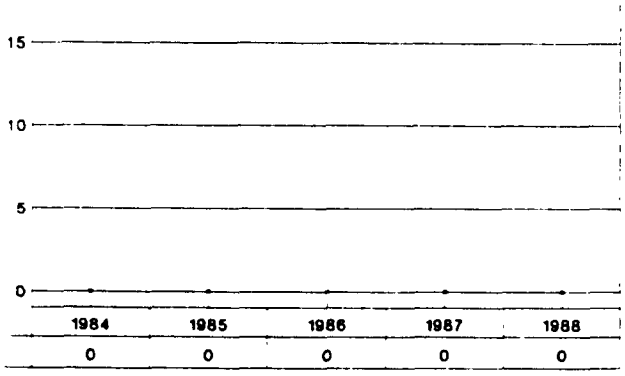


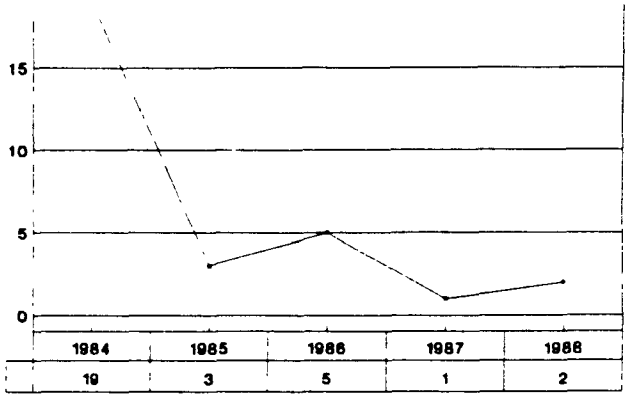
Figure 4-4 Trend in the composite mean and range for the second highest nonoverlapping 8-hour average carbon monoxide concentration, State of Maryland, 1983-1988.

STATE OF MARYLAND
CARBON MONOXIDE
Exceedances
1984____1988

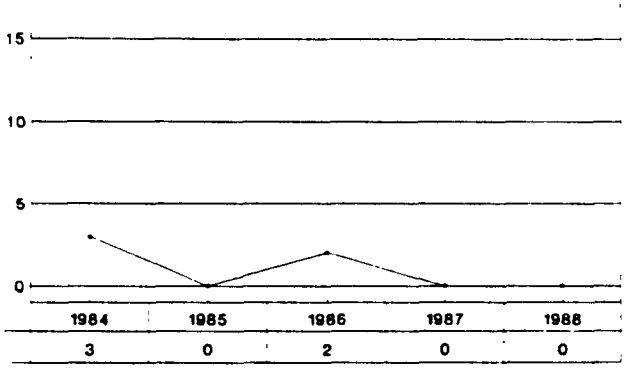
Figure 4-5.



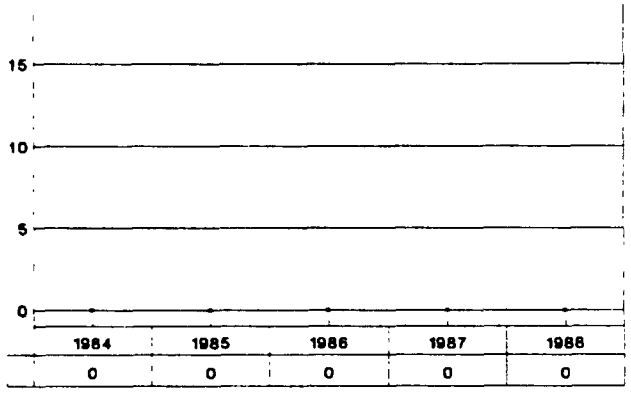
CUMBERLAND



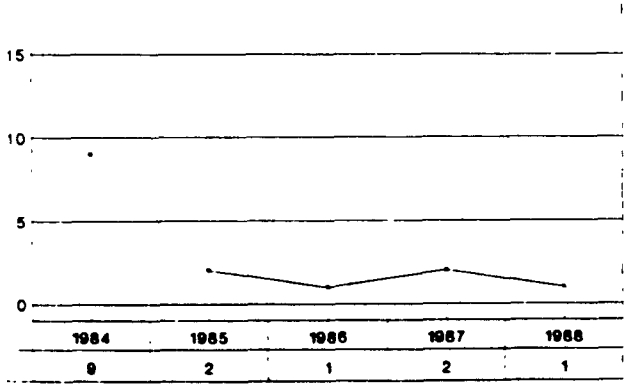
CBD 1



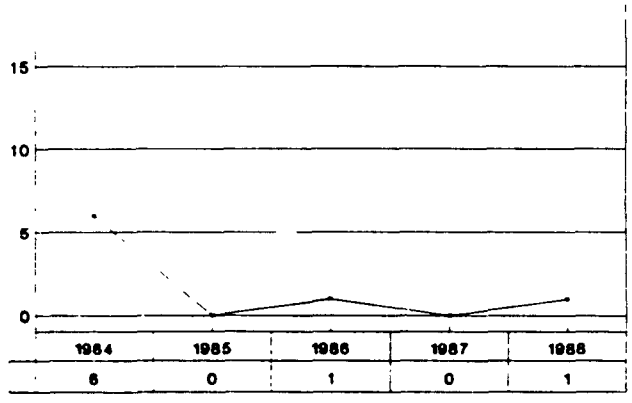
GUILFORD



ROCKVILLE



BLADENSBURG



OLD TOWN

4.3.4 COMMONWEALTH OF PENNSYLVANIA

Since the major source of carbon monoxide is vehicular emissions, this pollutant is only a problem in high traffic density areas of Pennsylvania or in areas near a stationary source of the pollutant. The ten year trend from 1979 to 1988, of the second maximum 8-hour nonoverlapping running averages is shown in Figure 4-7. Carbon monoxide levels have remained fairly constant over the last 5 years, since the addition of downtown high traffic density (CBD) sites to the network. The dashed lines represent the 8-hour air quality standard for carbon monoxide.

There were no exceedances of the 1-hour air quality standard in 1988. The downtown Allentown site had a single exceedance of the 8-hour air quality standard in 1988. Carbon monoxide second maximum 8-hour concentrations for selected areas of the Commonwealth in 1988 are depicted in Figure 4-8.

Average air quality trends for carbon monoxide are characterized by sixteen (16) sites for the period 1983-1988.

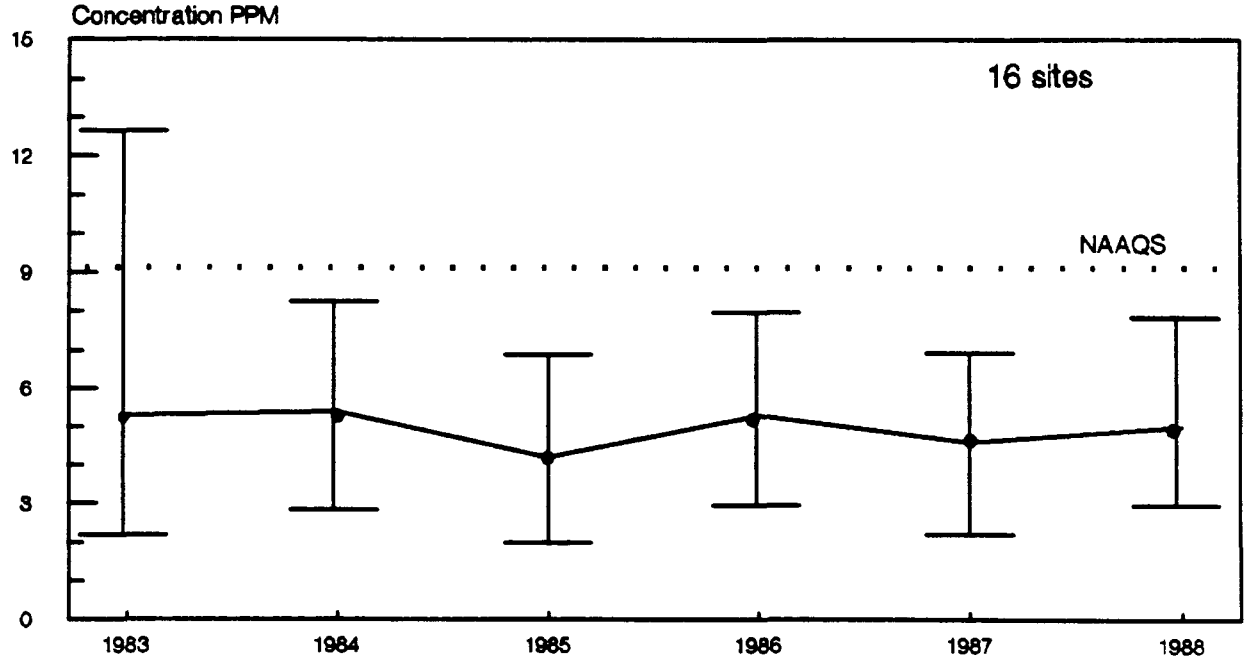


Figure 4-6 Trend in the composite mean and range for the second highest nonoverlapping 8-hour average carbon monoxide concentration, Commonwealth of Pennsylvania, 1983-1988.

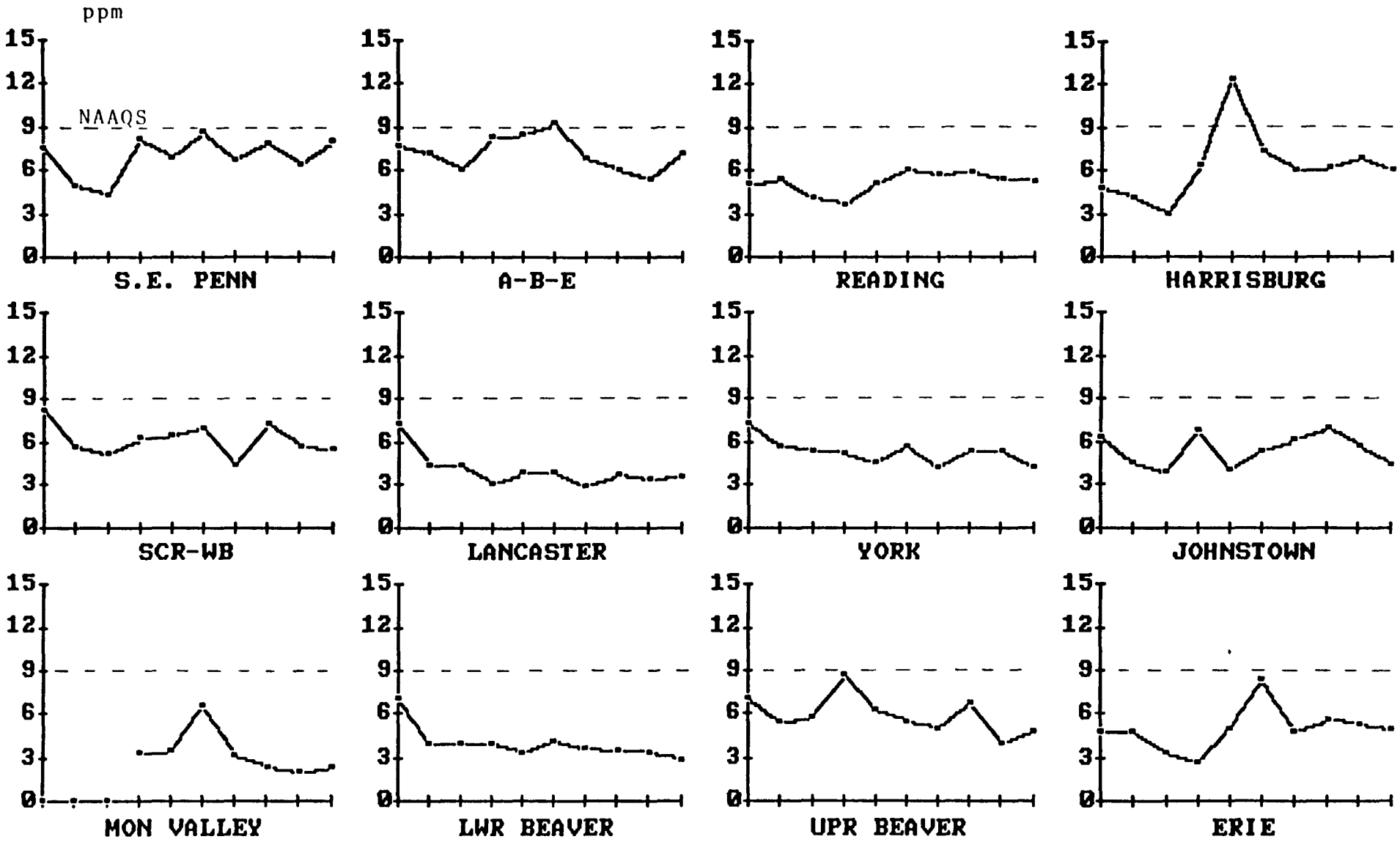


Figure 4-7. Carbon monoxide trends in the Commonwealth of Pennsylvania, second maximum 8-hour running mean, 1979-1988.

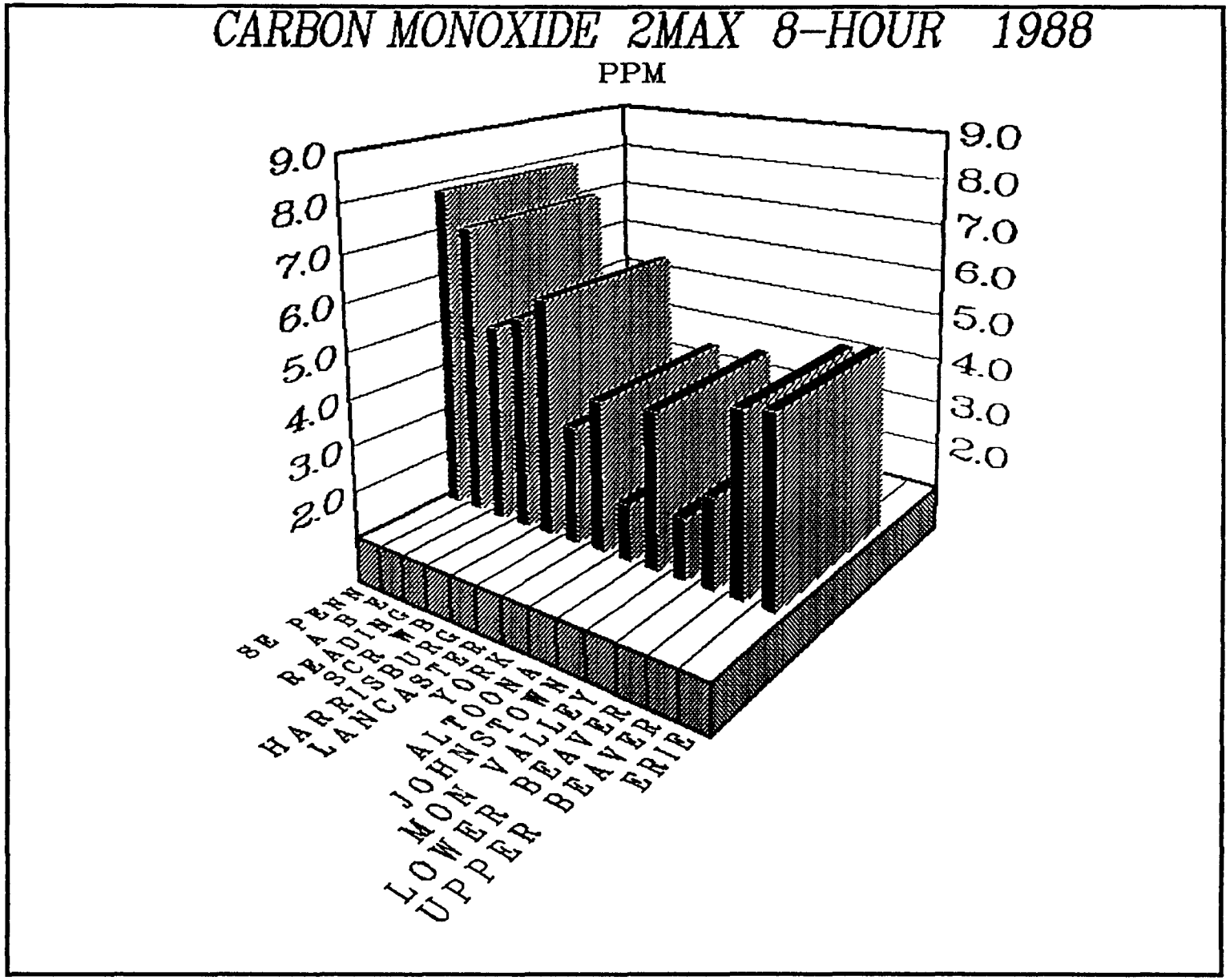


Figure 4-8. Carbon monoxide second maximum 8-hour concentration, Commonwealth of Pennsylvania,1988.

ALLEGHENY COUNTY
5-YEAR CO TRENDS

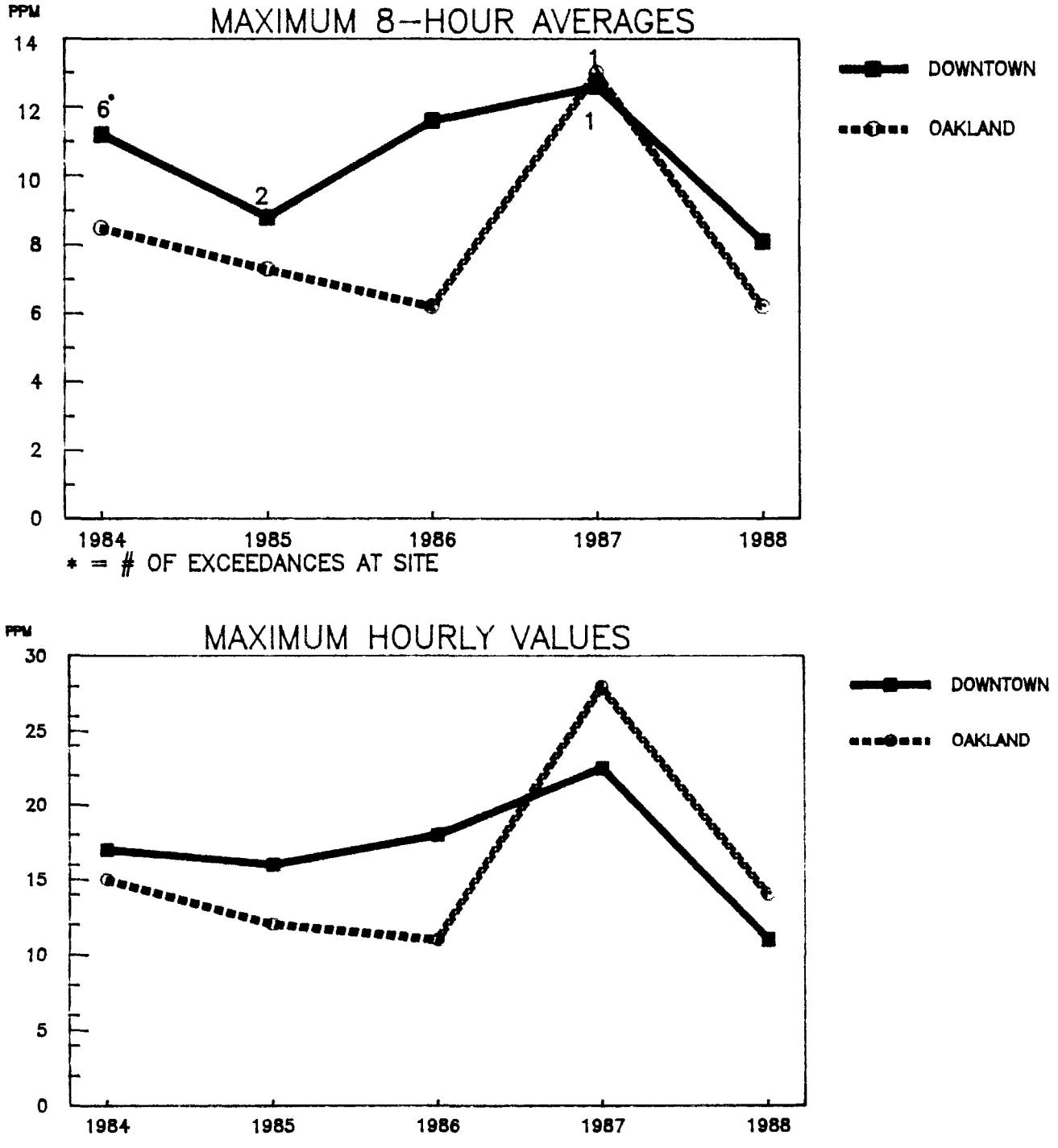


FIGURE 4-9 ALLEGHENY COUNTY 5-YEAR CARBON MONOXIDE TRENDS, 1984-88.

4.3.5 ALLEGHENY COUNTY

There were no exceedances of the 8-hour (9 ppm) nor 1-hour (35 ppm) standards in 1988. Oakland had the highest 8-hour average (8.6 ppm), while Downtown had the largest hourly value (28.8 ppm). In 1987 Oakland, Downtown, and the Point had one 8-hour exceedance each (thus no violations). No site has had an hourly exceedance since 1980.

Five-year trends show that although the highest 8-hour and hourly values occurred in 1987 the most 8-hour exceedances (six) occurred in 1984; 1985 was the only year, other than 1988, in which there were no exceedances. The five-year trend of maximum hourly values follows the same pattern as that of the 8-hour maxima. (See Figure 4-9.)

Average air quality trends for carbon monoxide are characterized by four (4) sites for the period 1983-1988.

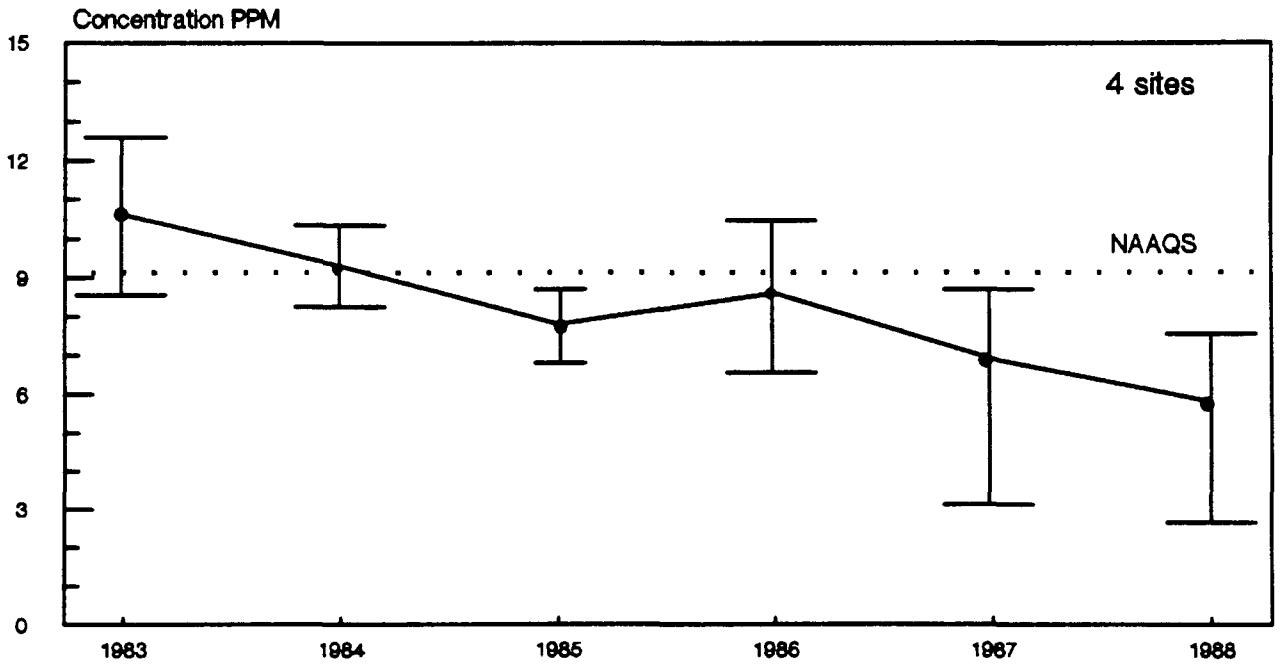


Figure 4-10 Trend in the composite mean and range for the second highest nonoverlapping 8-hour average carbon monoxide concentration, Allegheny County, 1983-1988.

4.3.6 CITY OF PHILADELPHIA

A general downward trend in carbon monoxide (CO) has occurred in recent years and reflects the impact of Federal new vehicle emission controls. In the past air quality standards were exceeded in center city and other high traffic areas.

Average air quality trends for carbon monoxide are characterized by six (6) sites for the period 1983-1988.

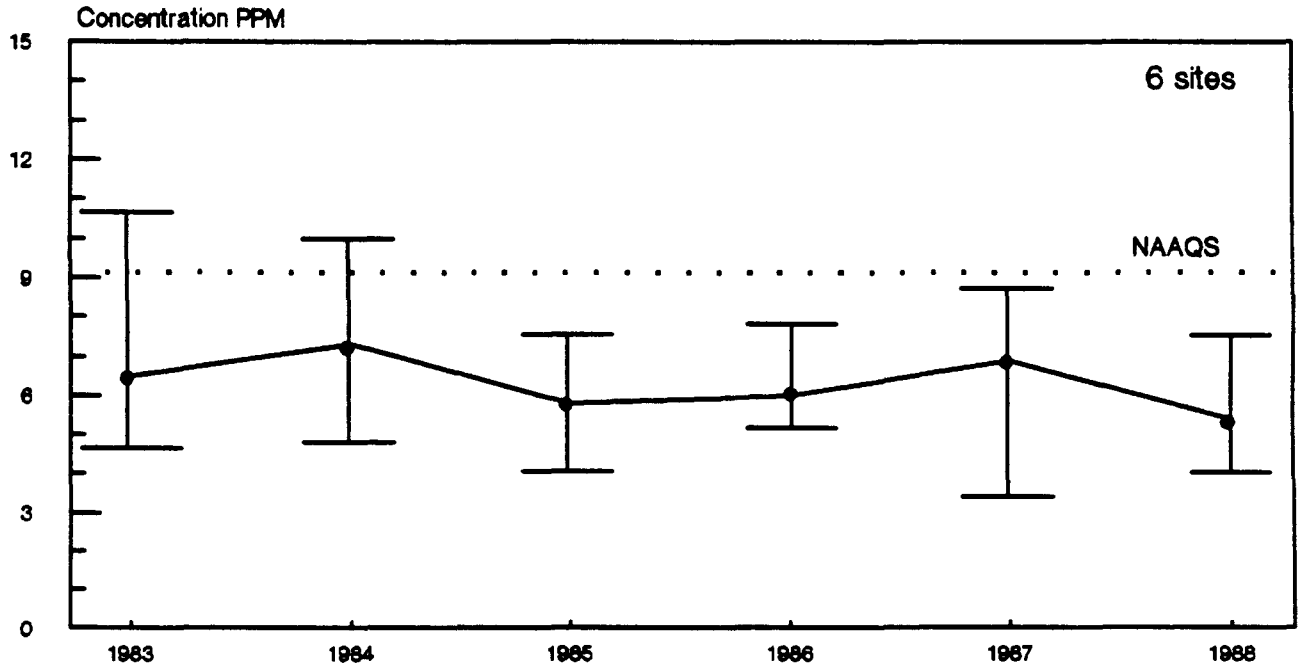


Figure 4-11 Trend in the composite mean and range for the second highest nonoverlapping 8-hour average carbon monoxide concentration, City of Philadelphia, 1983-1988.

4.3.7 COMMONWEALTH OF VIRGINIA

For carbon monoxide (CO), the primary 1-hour ambient air quality standards were not violated in 1988. All areas in the Commonwealth are in compliance with the standards, except for Arlington and the City of Alexandria. Northern Virginia is part of an interstate air quality region which includes Washington, D.C. and the metropolitan areas of Maryland. As of January 1, 1989, the Commonwealth has implemented an enhanced inspection and maintenance (I/M) program for automobiles in the Northern Virginia area designed to further reduce CO ambient air concentrations.

Average air quality trends for carbon monoxide are characterized by twelve (12) sites for the period 1983-1988.

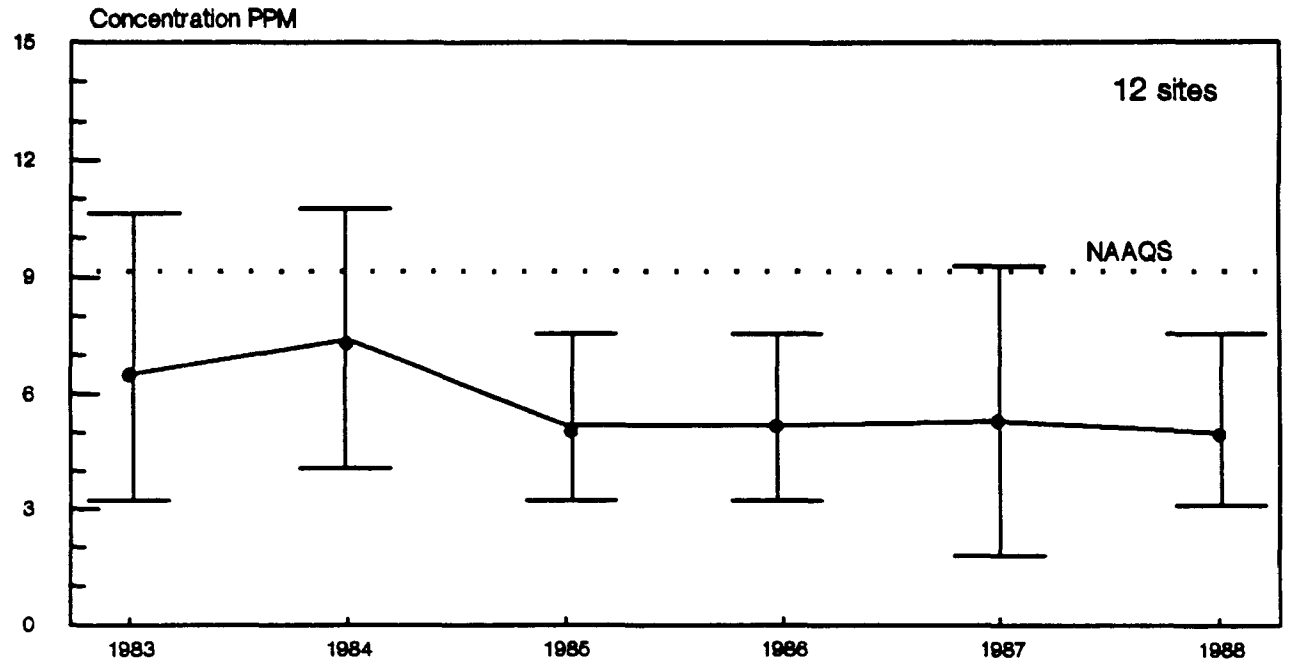


Figure 4-12 Trend in the composite mean and range for the second highest nonoverlapping 8-hour average carbon monoxide concentration, Commonwealth of Virginia, 1983-1988.

4.3.8 STATE OF WEST VIRGINIA

Carbon monoxide levels have been decreasing since 1984 at three (3) sites in the state. The trend levels are well below the national standard.

Average air quality trends for carbon monoxide are characterized by three (3) sites for the period 1983-1988.

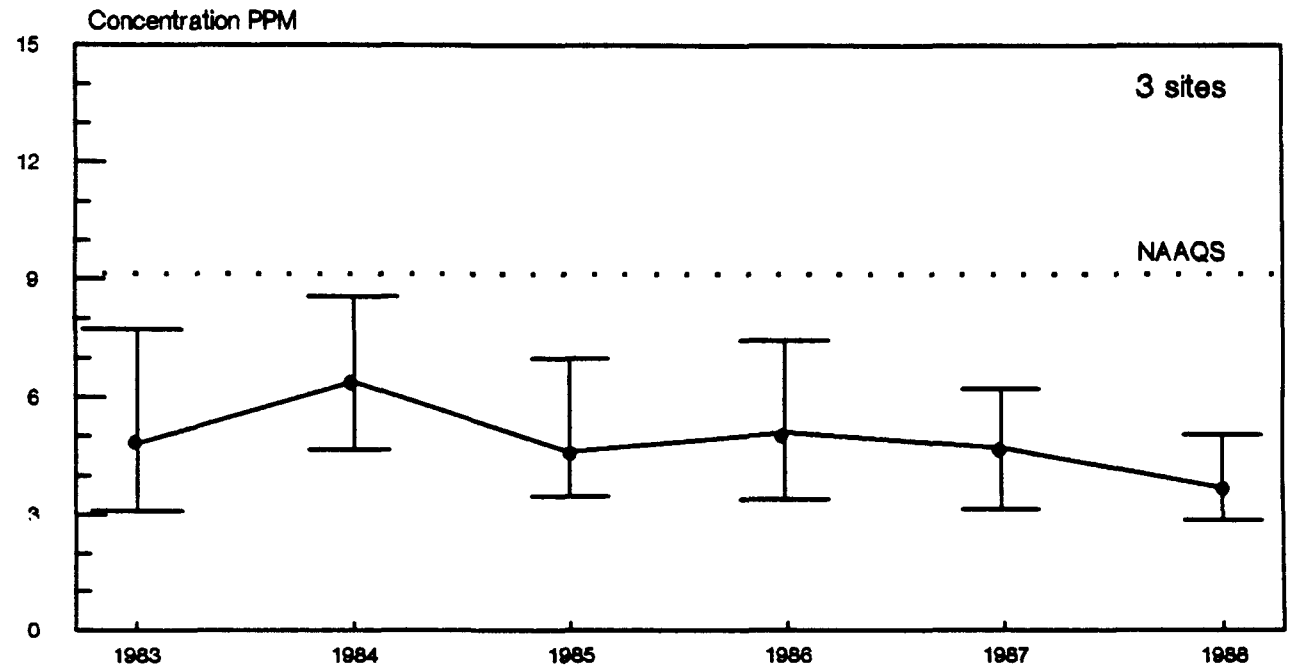


Figure 4-13 Trend in the composite mean and range for the second highest nonoverlapping 8-hour average carbon monoxide concentration, State of West Virginia, 1983-1988.

4.4 EMISSION TRENDS

- Nationally, total CO emissions are estimated to have declined 25 percent between 1978 and 1987. The principle source of CO emissions is transportation related.

- Between 1986 and 1987, CO emissions increased slightly (less than 1 percent) due to forest fires.

- In Region III, CO emissions are estimated to have declined an average of 19 percent between 1983 and 1988. During this same period, national CO emissions decreased 16 percent.

4.5 COMMENTS

- Most CO monitors are typically located to identify potential problems and are often placed in traffic saturated areas that may not experience significant increases in vehicle miles of travel (VMT).

- As a result CO levels generally improved at a faster rate than total CO emissions, reflecting greater improvement in the congested center city than in the suburbs.

- Standard violations usually are detected during October through January.

- Carbon monoxide attainment/non-attainment status in Region III is depicted in Figure 4-14.

- Portions of Allegheny County are officially designated in 40 C.F.R. Part 81 (Section 81.339) as a non-attainment area for carbon monoxide (CO). However, the most recent air quality data indicates that no violations of the NAAQS for CO have been recorded since March 1986. As of November 1, 1989, EPA is reviewing a request from Allegheny County to formally redesignate the entire county as an attainment area for CO.

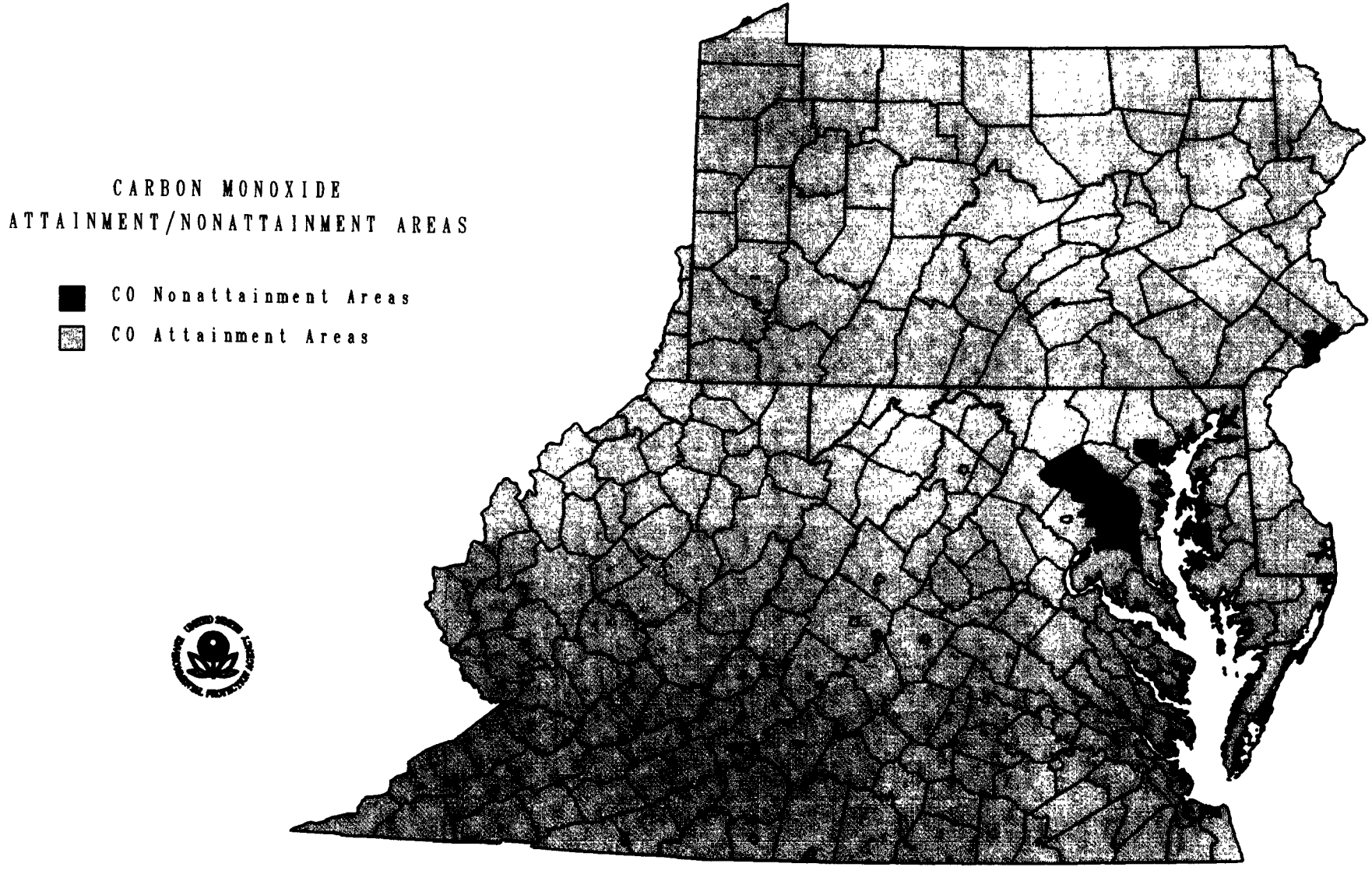
4.6 WORTH NOTING

- The improvement in ambient CO levels and in estimated CO emissions has occurred despite a 24% increase in vehicle miles traveled during the past 10 years. National estimates are that CO emission from highway vehicles have decreased 38% because controls have offset growth.

- During the 1970's all the major metropolitan areas in Region III had monitoring stations that frequently detected levels above the 8-hour standard. Since that time, improved automotive controls and inspection and maintenance programs have resulted in a substantial reduction in carbon monoxide emissions. This is reflected in the measurements that show almost the entire Region attaining the carbon monoxide standard.

CARBON MONOXIDE ATTAINMENT/NONATTAINMENT STATUS IN REGION III

Figure 4-14.



5.0 TRENDS IN NITROGEN DIOXIDE

This section will describe and characterize the air quality status and trends for the pollutant nitrogen dioxide (NO_2).

Following a discussion on characteristics and sources of the pollutant, health effects and national air quality status, regional trends for NO_2 will be discussed on a state-by-state basis. Methods of presentation include:

- Graphs to depict NO_2 trends for the composite mean and range for the annual arithmetic average for specific sites within each state.
- Three dimensional display of average annual mean NO_2 concentration for Pennsylvania in 1988.
- Annual trends for specific sites in the State of Maryland.

5.1 CHARACTERISTICS AND SOURCES OF THE POLLUTANT

Nitrogen dioxide is a highly toxic, reddish-brown gas that is a emitted primarily from the combustion of fuels by stationary and mobile sources. Nitrogen dioxide levels correlate significantly with ambient temperatures although not as high a statistical significance as do ozone and sulfur dioxide. Nitrogen dioxide is formed when combustion temperatures are extremely high: Nitric oxide (NO) is formed through the direct combustion of nitrogen and oxygen from the air in the intense heat of any combustion process. Nitrogen dioxide in the atmosphere is then able, in the presence of sunlight, to combine with additional oxygen to form nitrogen dioxide. Nitrogen dioxide plays a major role in the formation of photochemical oxidants.

5.2 EFFECTS

Nitrogen oxides have been clearly established as exerting detrimental effects on human health and welfare. When inhaled, nitrogen dioxide can irritate the lungs, cause bronchitis and pneumonia and lower resistance to respiratory infections. Short-term exposures can cause chest discomfort, coughing and eye irritation.

5.3 AIR QUALITY TRENDS

Nitrogen dioxide does not present a significant air quality problem at this time for most areas of the country.

- Nationally, the annual average NO_2 levels, measured at 84 trend sites, declined 12% between 1978 and 1987 with no change recorded between 1986 and 1987.

- In Region III, a 1% decrease in annual average NO_2 levels were measured between 1983 and 1988 at 46 trend sites.

- The regional and national trend in NO_2 emissions and air quality measurements has changed little from 1983 to the present.

5.3.1 STATE OF DELAWARE

The State of Delaware is currently in attainment with the NAAQS for nitrogen dioxide with levels well below the national standard.

Average air quality trends for NO_2 are characterized by two (2) sites for the period 1983-1988.

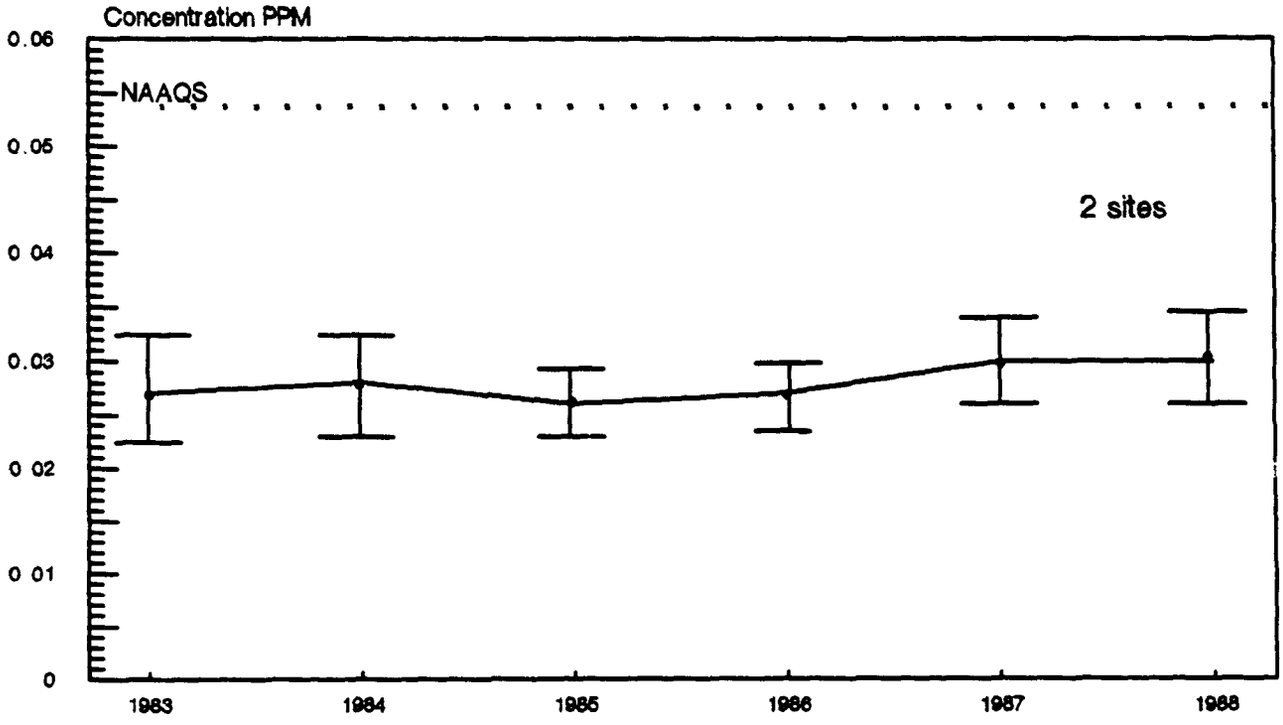


Figure 5-1 Trend in the composite mean and range for the annual arithmetic average nitrogen dioxide concentration, State of Delaware, 1983-1988.

5.3.2 DISTRICT OF COLUMBIA

The District of Columbia is in compliance with the NAAQS for nitrogen dioxide. Average nitrogen dioxide levels have exhibited a slow rise since 1983, with the exception of 1987, to the point where 1988 levels are approximately 16% greater than those in 1983. Levels in downtown Washington are presently 66% of the annual standard.

Average air quality trends for NO_2 are characterized by two (2) sites for the period 1983-1988.

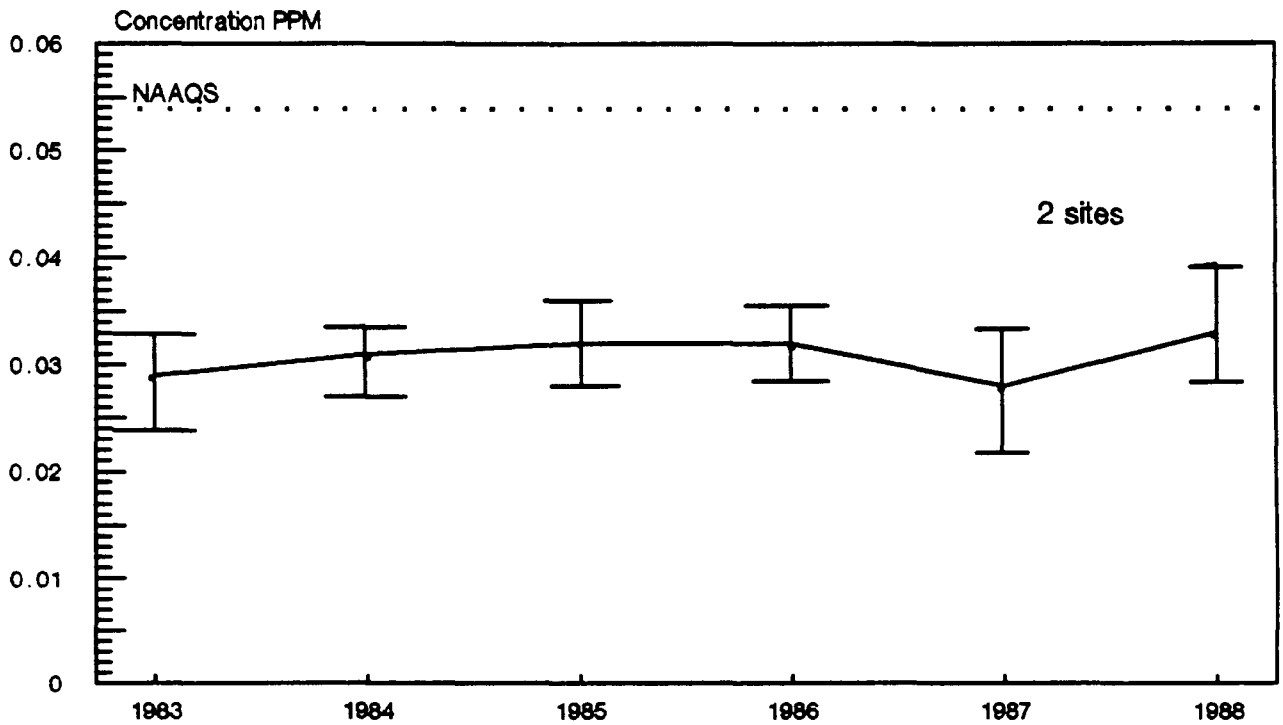


Figure 5-2 Trend in the composite mean and range for the annual arithmetic average nitrogen dioxide concentration, District of Columbia, 1983-1988.

5.3.3 STATE OF MARYLAND

The present Maryland NO_2 monitoring network consists of three sites in the Baltimore metropolitan area. During the summer months, an additional site is operated at a non-methane organic compound monitoring site in order to evaluate the relationship of NO_x, non-methane organic compounds, and the formation of ozone. From 1984 to 1985, NO2 levels increased 5 - 16%; since 1985, the NO_2 levels have remained constant. Levels in downtown Baltimore are presently 64% of the standard. Trend graphs for the three Maryland NO_2 sites are presented in Figure 5-4.

Average air quality trends for NO_2 are characterized by three (3) sites for the period 1983-1988.

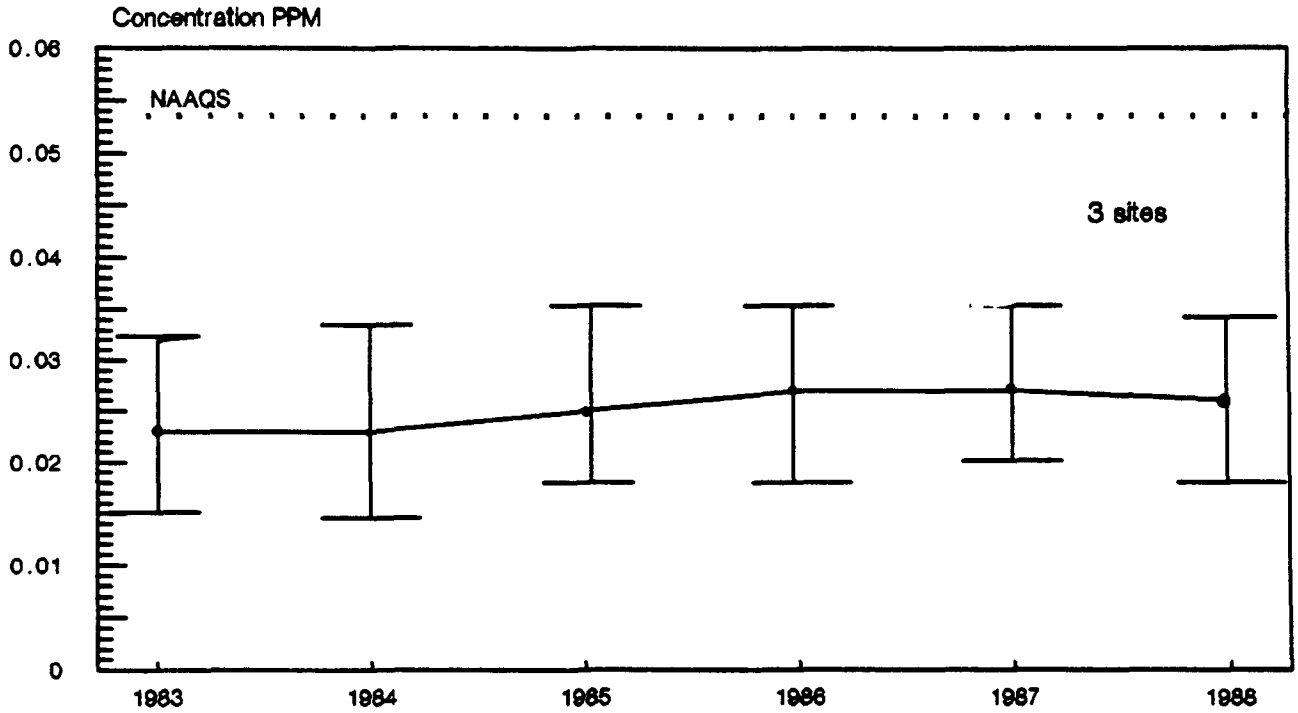
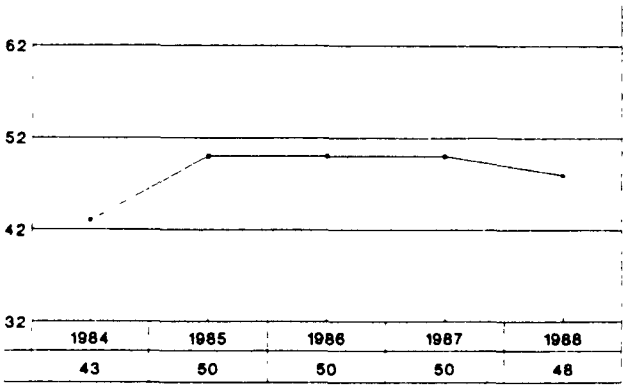


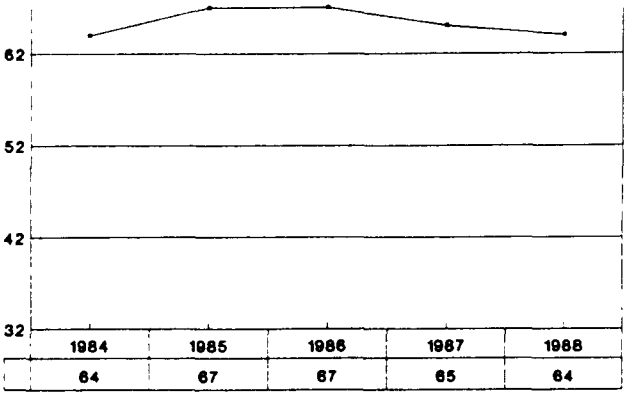
Figure 5-3 Trend in the composite mean and range for the annual arithmetic average nitrogen dioxide concentration, State of Maryland, 1983-1988.

STATE OF MARYLAND
NITROGEN DIOXIDE
MICROGRAMS PER CUBIC METER
1984____1988

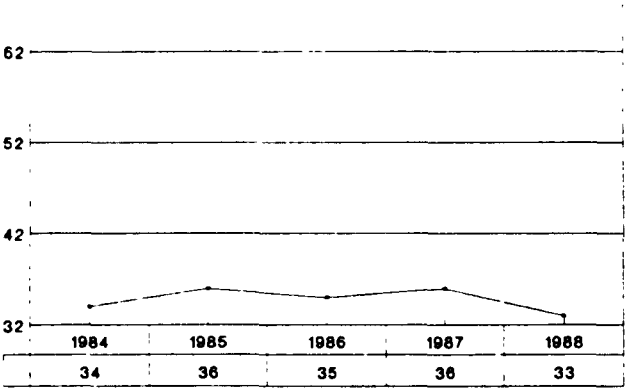
Figure 5-4



ESSEX



OLD TOWN



FORT MEADE

5.3.4 COMMONWEALTH OF PENNSYLVANIA

Nitrogen dioxide levels have remained relatively constant over the last 10 years in the Commonwealth and no site exceeded the annual primary standard in 1988. Nitrogen dioxide levels correlate significantly with ambient temperatures although not as high a statistical significance as do ozone and sulfur dioxide.

Nitrogen dioxide trends, 1979-1988, specific to each air basin and annual means for 1988 are presented in Figures 5-6 and 5-7, respectively.

Average air quality trends for NO_2 are characterized by fifteen (15) sites for the period 1983-1988.

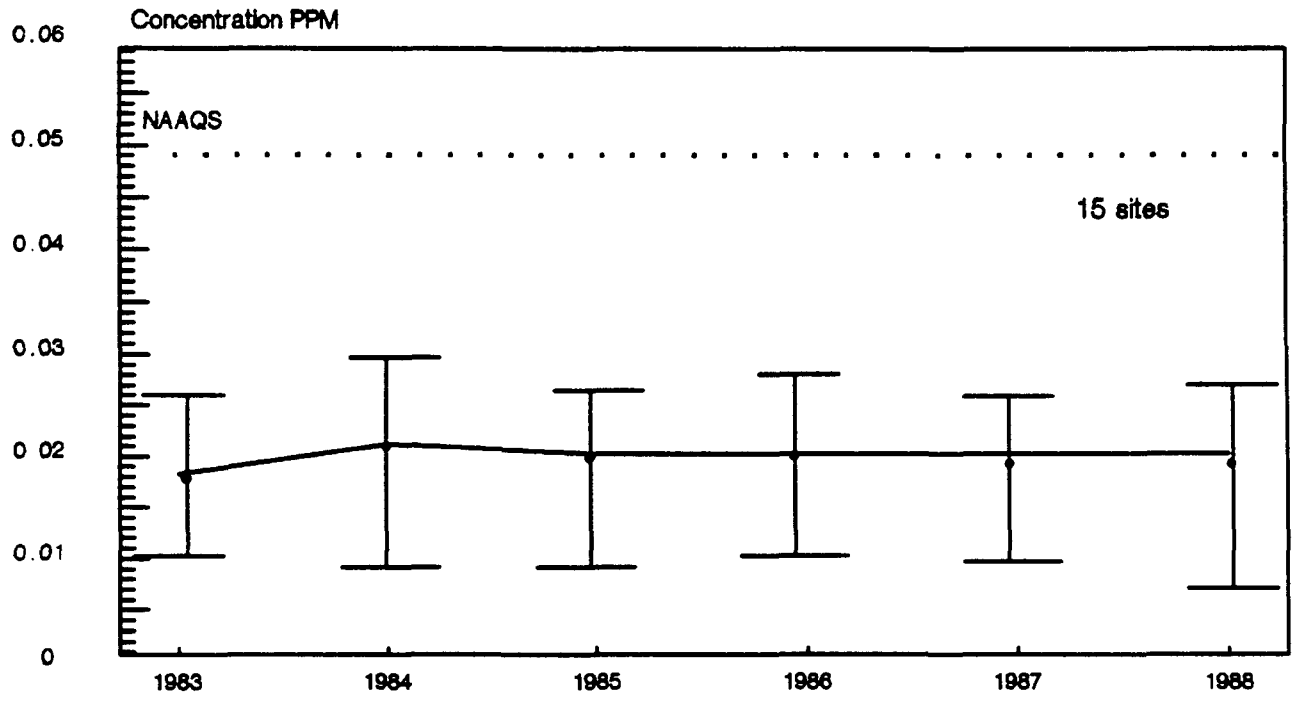


Figure 5-5 Trend in the composite mean and range for the annual arithmetic average nitrogen dioxide concentration, Commonwealth of Pennsylvania, 1983-1988.

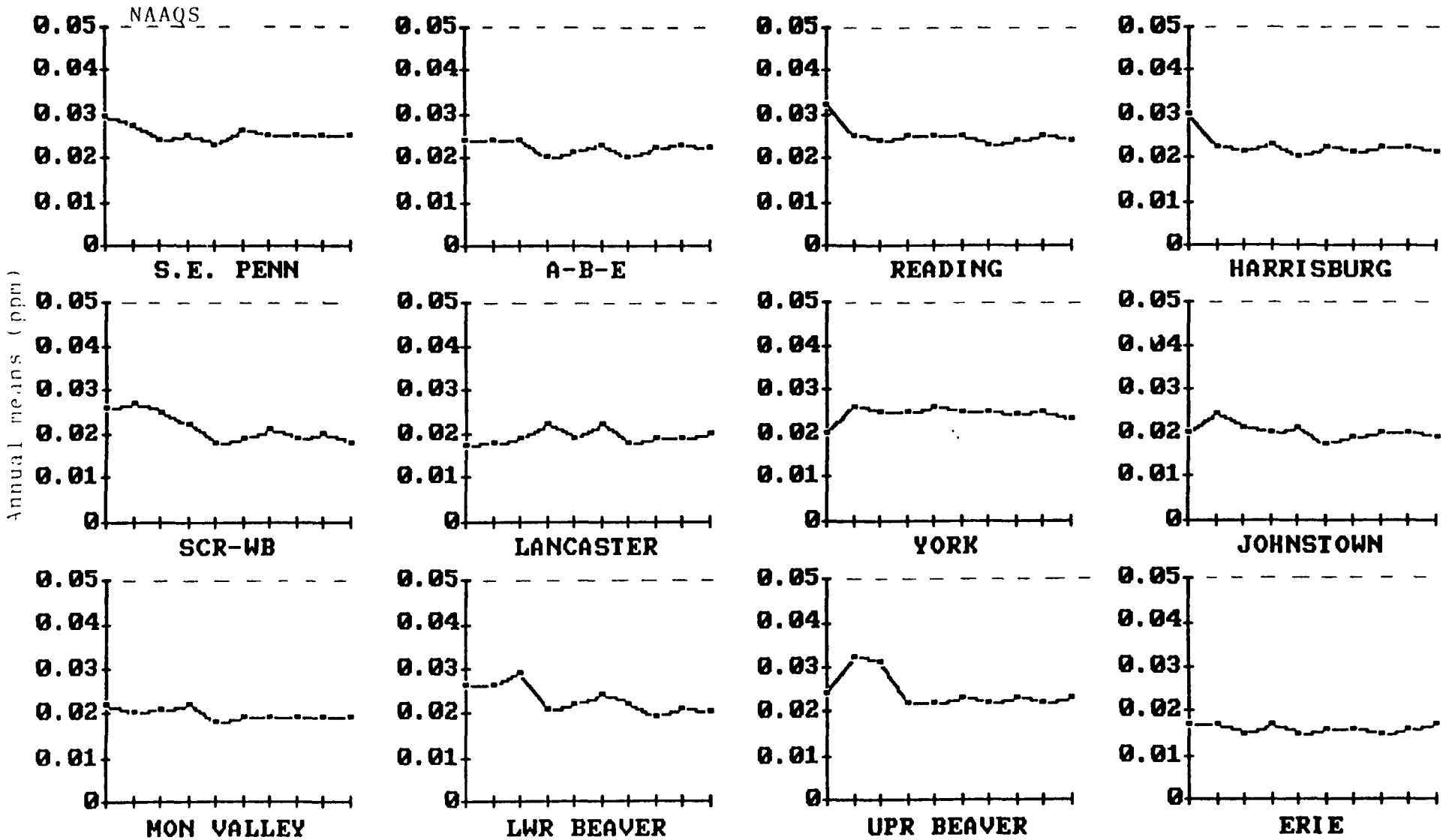


Figure 5-6. Nitrogen dioxide trends in the Commonwealth of Pennsylvania, by air basins,1979-1988.

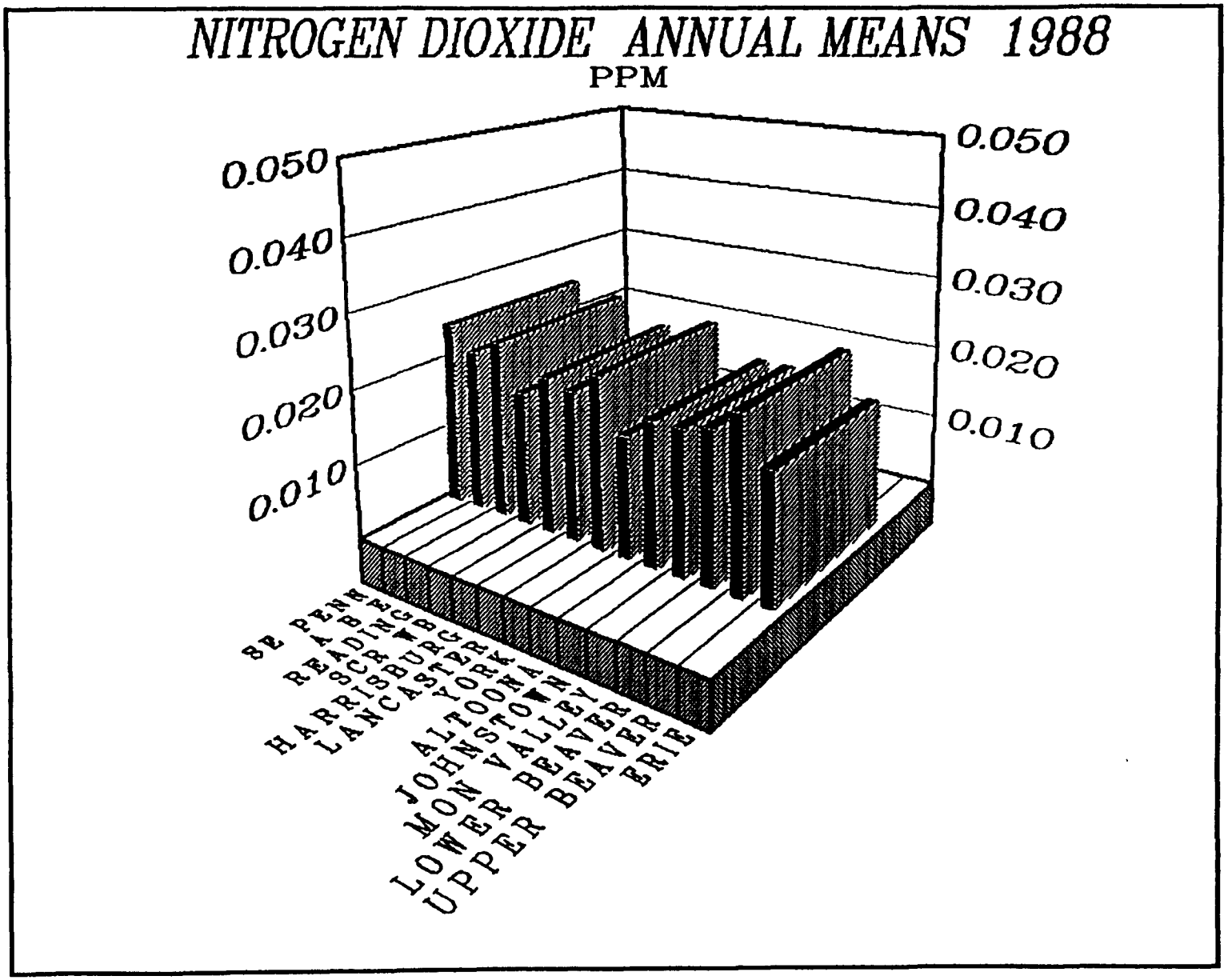


Figure 5-7 . Nitrogen dioxide annual means for areas in the Commonwealth of Pennsylvania,1988.

5.3.5 ALLEGHENY COUNTY

During 1988 all three (3) county sites were well within attainment of the annual NO_2 standard of 0.05 ppm. The two (2) Pittsburgh sites have been attainment since monitoring began in 1980. Consistently, Downtown levels have been slightly higher than Lawrenceville's. Monroeville in 1988 was the low site.

Average air quality trends for NO2 are characterized by three (3) sites for the period 1983-1988.

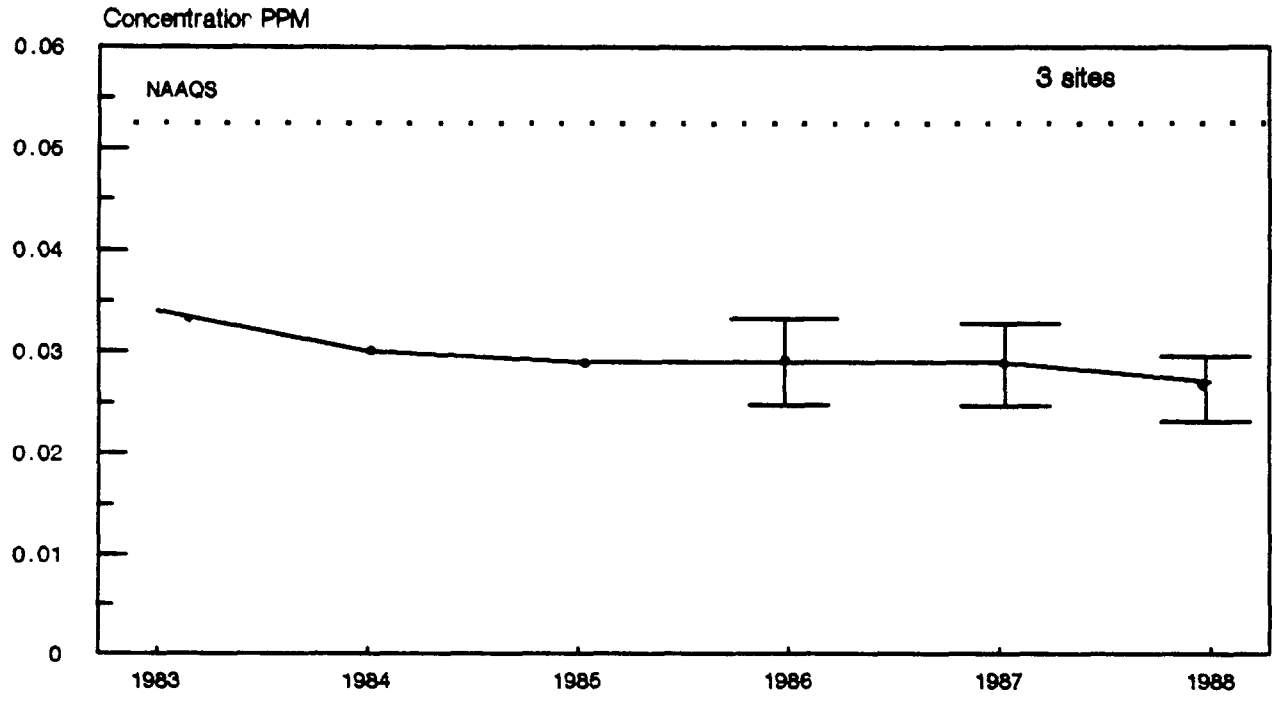


Figure 5-8 Trend in the composite mean and range for the annual arithmetic average nitrogen dioxide concentration, Allegheny County, 1983-1988.

5.3.6 CITY OF PHILADELPHIA

Nitrogen dioxide has exhibited somewhat erratic behavior over the past several years. Currently, only limited control requirements for nitrogen oxides exist and are applied only to new or modified stationary sources. The single, largest emission source category (motor vehicles) has not yet been subjected to extensive nitrogen oxides control. Nitrogen dioxide air quality standards are being attained throughout Philadelphia.

Average air quality trends for NO_2 are characterized by three (3) sites for the period 1983-1988.

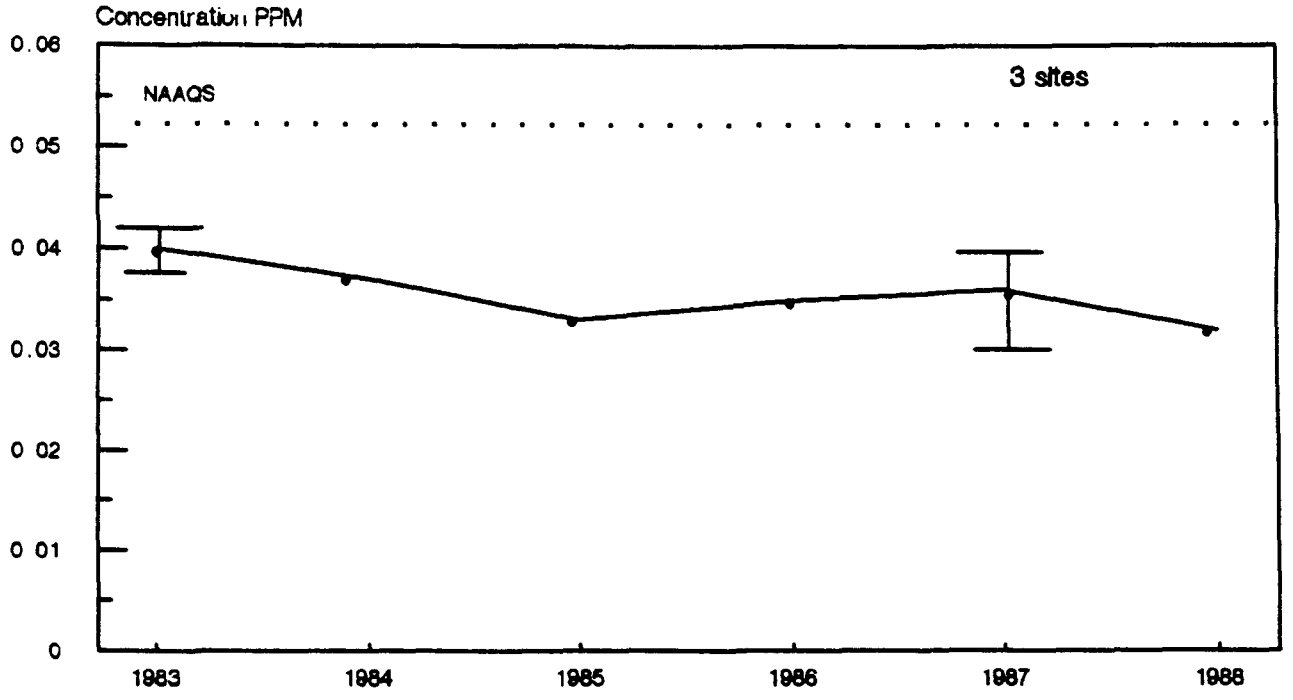


Figure 5-9 Trend in the composite mean and range for the annual arithmetic average nitrogen dioxide concentration, City of Philadelphia, 1983-1988.

5.3.7 COMMONWEALTH OF VIRGINIA

The Commonwealth of Virginia is in compliance with the NAAQS in all areas of the state for nitrogen dioxide. The state network is comprised of nine (9) NO_2 monitors which for the past (7) years has shown a trend well below the national standards.

Average air quality trends for NO_2 are characterized by nine (9) sites for the period 1983-1988.

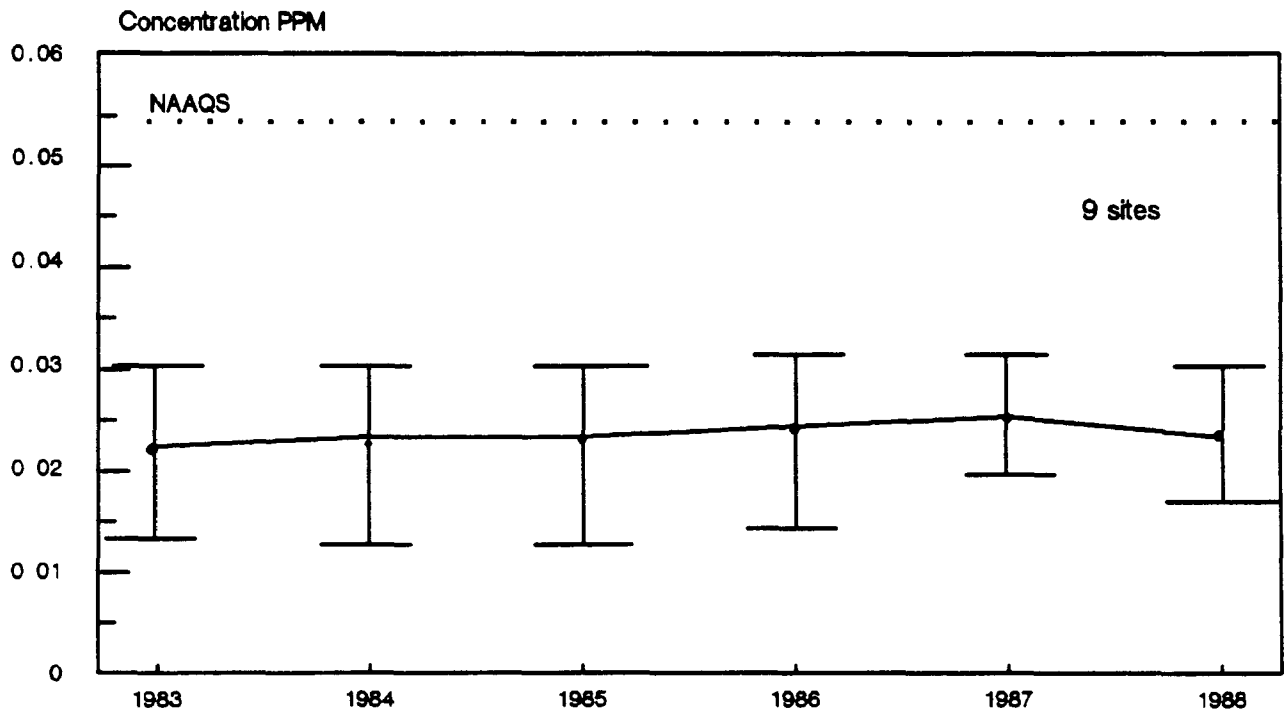


Figure 5-10 Trend in the composite mean and range for the annual arithmetic average nitrogen dioxide concentration, Commpnwealth of Virginia, 1983-1988.

5.3.8 STATE OF WEST VIRGINIA

Nitrogen dioxide levels have remained relatively constant over the last five (5) years as measured at four (4) sites in the state. Levels are well below the national standard.

Average air quality trends for NO_2 are characterized by four (4) sites for the period 1983-1988.

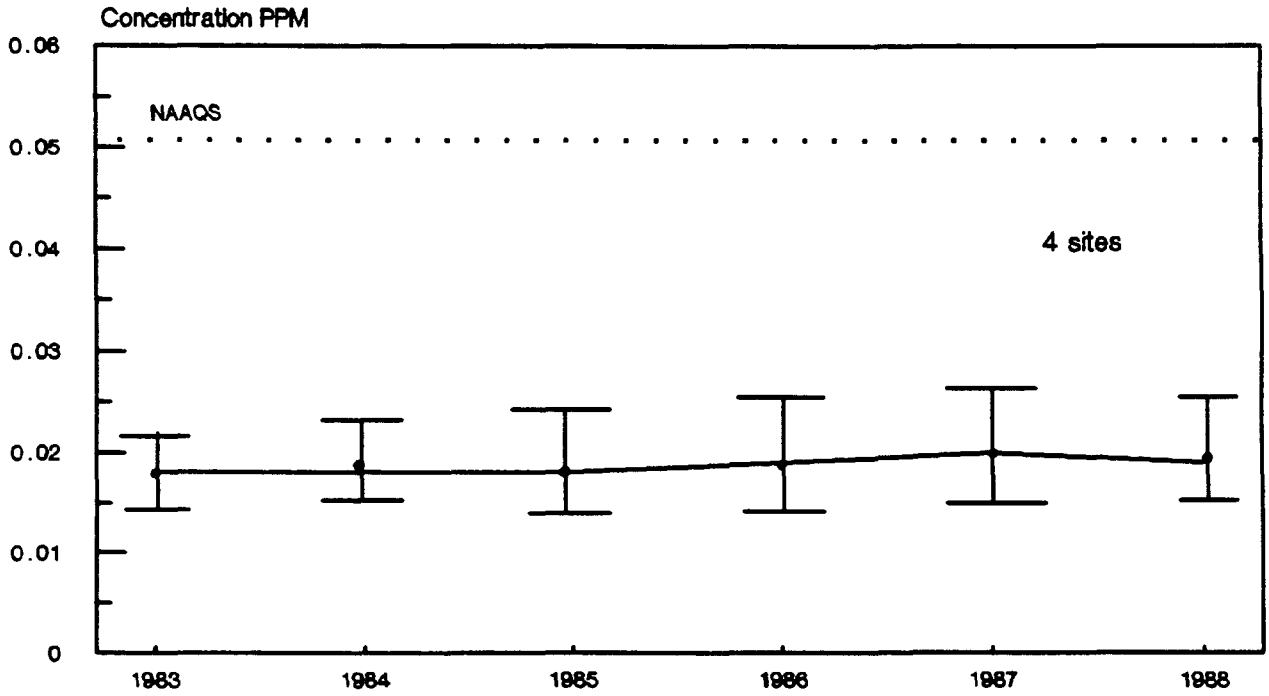


Figure 5-11 Trend in the composite mean and range for the annual arithmetic average nitrogen dioxide concentration, State of West Virginia, 1983-1988.

5.4 EMISSION TRENDS

- The principal sources of NO_x emissions are fuel combustion and transportation.
- Nationally, total NO_x emissions decreased 8% between 1978 and 1987.
- In Region III, NO_x emissions are estimated to have decreased about 1% between 1983 and 1988, while nationally during this period a slight increase was observed.

5.5 COMMENTS

- Nitrogen dioxide does not present a significant air quality problem for most areas of the country.
- There are currently no areas in Region III violating the NO_2 NAAQS.

5.6 WORTH NOTING

- Los Angeles, CA is the only area in the country currently exceeding the NO_2 NAAQS of 0.053 ppm.

6.0 TRENDS IN SULFUR DIOXIDE

This section will describe and characterize the air quality status and trends for the pollutant sulfur dioxide (SO_2).

Following a discussion on characteristics and sources of the pollutant, health effects and national air quality status, regional trends for SO_2 will be discussed on a state by state basis. Methods of presentation include:

- Graphs to depict SO_2 trends for the composite mean and range for the annual arithmetic average for specific sites within each state.
- Three dimensional graph depicting the 1988 annual mean sulfur dioxide concentration for selected areas in Pennsylvania.
- Regional SO_2 Profile Map

6.1 CHARACTERISTICS AND SOURCES OF THE POLLUTANT

Several areas of the United States still exceed ambient air quality standards for sulfur dioxide. Serious health and environmental problems are associated with excessive levels of SO_2 in the ambient air. Sulfur dioxide, a poisonous gas which irritates the eyes, nose and throat results from combustion processes, refining of petroleum, nonferrous smelters and the manufacture of sulfuric acid. Sulfur dioxide can be transported long distances since it bonds to dust particles, smoke and aerosols. Once in the atmosphere, some sulfur dioxide can be oxidized to SO_3 (sulfur trioxide). With water vapor, SO_3 is converted to sulfuric acid mist. These compounds ultimately will fall back to earth as acid rain.

Up until the 1950's the major source of sulfur dioxide pollution was through the burning of wood and fuel. Today, two-thirds of all national sulfur dioxide emissions come from electric power plants (coal-fired accounts for 95% of all power plant emissions).

6.2 EFFECTS

Concentrated sulfur dioxide is a yellowish gas with a rather distinctive odor, but at normal levels in the atmosphere most people cannot detect its presence. Even at low levels in the atmosphere, however, sulfur dioxide interferes with the normal breathing functions, causes aggravation of respiratory diseases including coughs and colds, asthma, bronchitis and emphysema. High levels of sulfur dioxide can obstruct breathing and studies have found increased death rates among people with existing heart and lung disease.

Sulfur dioxide causes chlorosis in plant leaves and in moist air forms acids that damage structural materials. Effects are magnified by high particulate levels.

6.3 AIR QUALITY TRENDS

There are three NAAQS for SO_2: an annual arithmetic mean of 0.03 ppm, a 24-hour level of 0.14 ppm and a 3-hour level of 0.50 ppm. The first two are primary (health related) standard, while the 3-hour NAAQS is a secondary (welfare-related) standard. The annual mean standard is not to be exceeded, while the short-term standards are not to be exceeded more than once per year per site.

- Nationally, annual average SO_2 levels, measured at 347 trend sites, declined 35 percent from 1978 to 1987, while SO_x emissions decreased 17 percent.

- SO_2 NAAQS: annual arithmetic mean of 0.03 ppm

  - The higher concentrations are generally found in the heavily populated Midwest and Northeast.

  - All of the metropolitan areas have ambient air quality concentrations lower than the annual standard of 0.03 parts per million.

  - Despite the major improvement in SO_2 air quality nationally, nearly 1.6 million people live in areas with measured violations of the standards.

- SO_2 NAAQS: 24 hour average of 0.14 ppm not to be exceeded more than once per year

  - Pittsburgh is the only (major urban) area violating the 24-hour SO_2 standard.

- In Region 3 between 1983 and 1988, ambient SO_2 levels remained relatively constant (less than a one percent change).

6.3.1 STATE OF DELAWARE

The State of Delaware is in attainment with the NAAQS for sulfur dioxide with recorded levels well below the standard.

Average air quality trends for sulfur dioxide are characterized by eight (8) sites for the period 1983-1988.

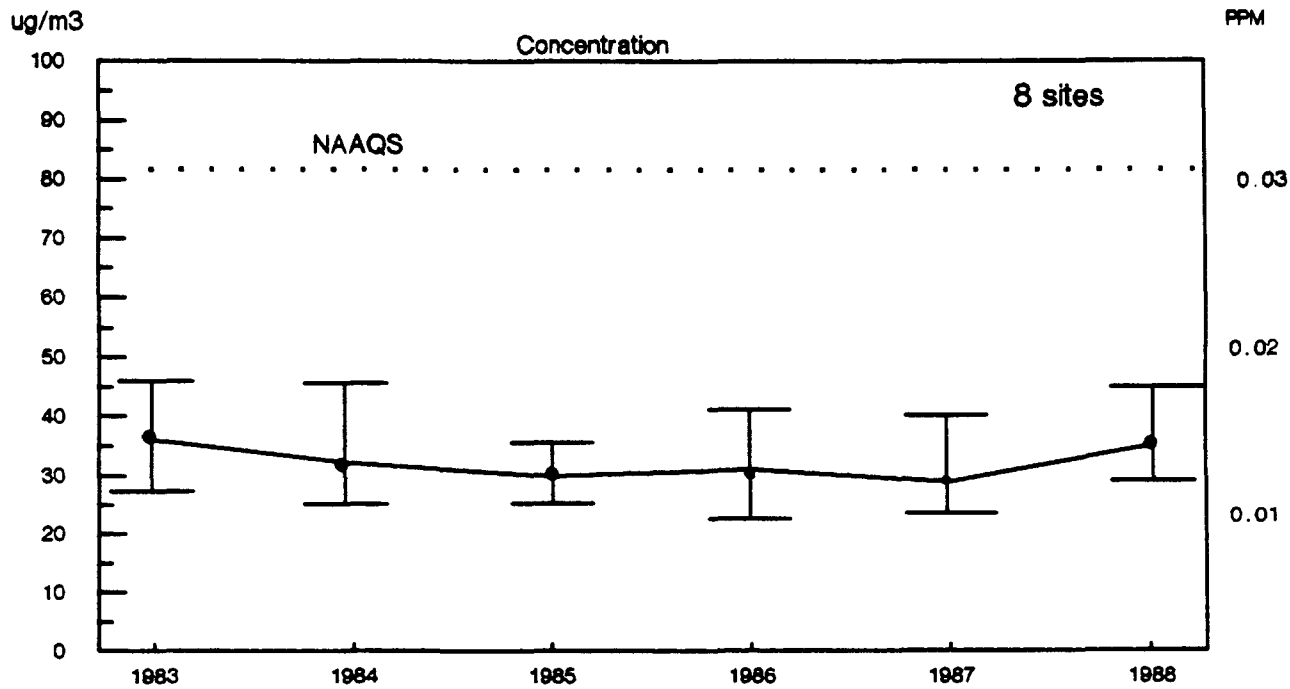


Figure 6-1 Trend in the composite mean and range for the annual arithmetic average sulfur dioxide concentration, State of Delaware, 1983-1988.

6.3.2 DISTRICT OF COLUMBIA

The District of Columbia is in compliance with the NAAQS for sulfur dioxide with measurements recorded which are well below the national standard. Average sulfur dioxide levels have been variable from 1983-1987. The net effect has been a slight increase (approximately 3%) in ambient levels. Current levels are about 40% of the annual standard.

Average air quality trends for sulfur dioxide are characterized by two (2) sites for the period 1983-1988.

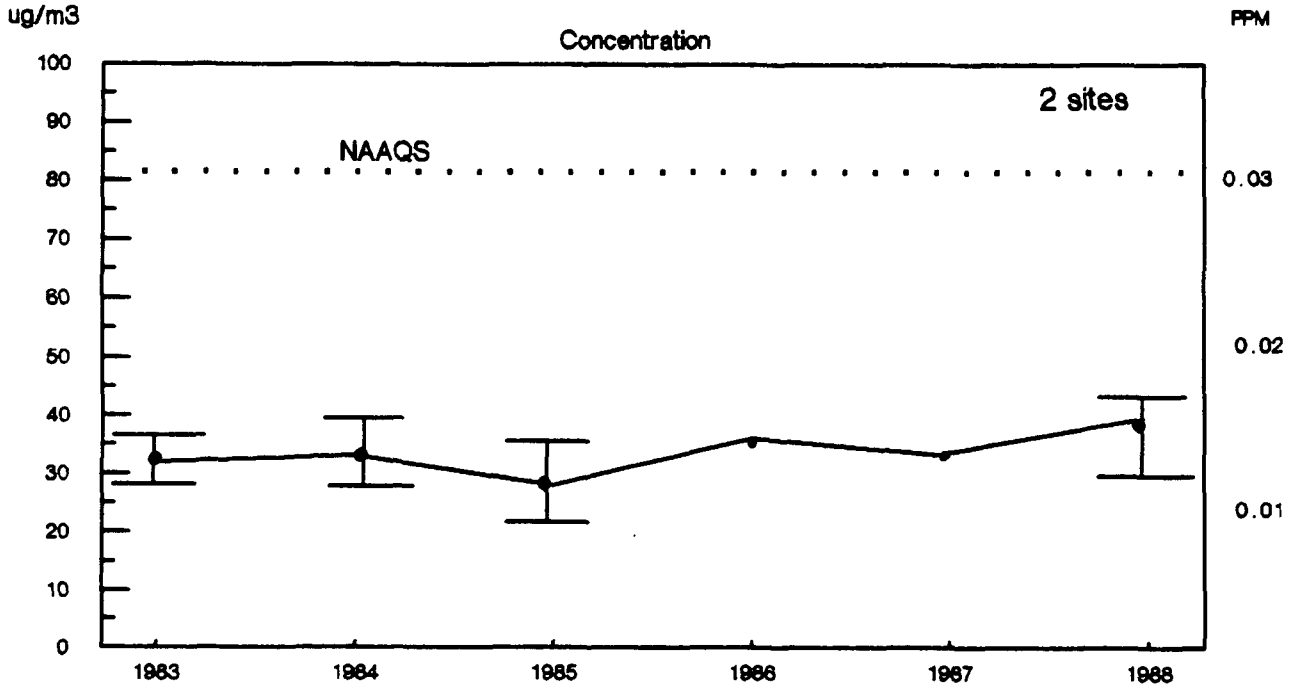


Figure 6-2 Trend in the composite mean and range for the annual arithmetic average sulfur dioxide concentration, District of Colmbia, 1983-1988.

6.3.3 STATE OF MARYLAND

The present Maryland SO_2 monitoring network consists of four monitors in the Baltimore metropolitan area and one in Cumberland (Western Maryland). Levels have remained at 30-40% of ambient standards since 1984 and are expected to continue at these levels for the next several years. Site-specific trends for the annual arithmetic average of sulfur dioxide concentration for the period 1984-1988 are shown in Figure 6-4.

Average air quality trends for sulfur dioxide are characterized by six (6) sites for the period 1983-1988.

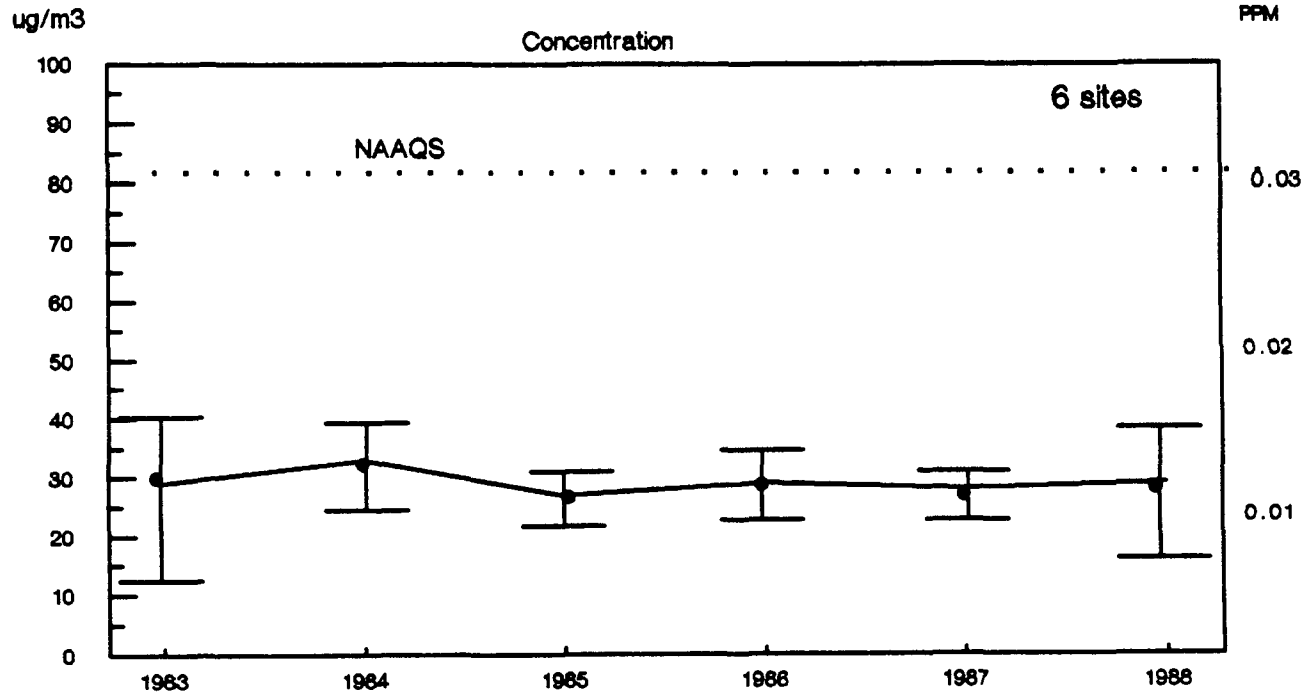
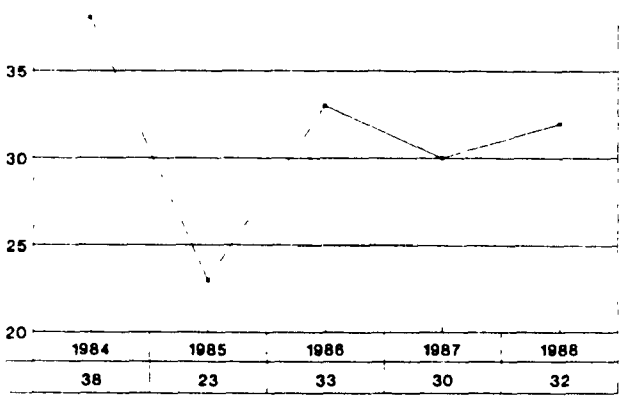


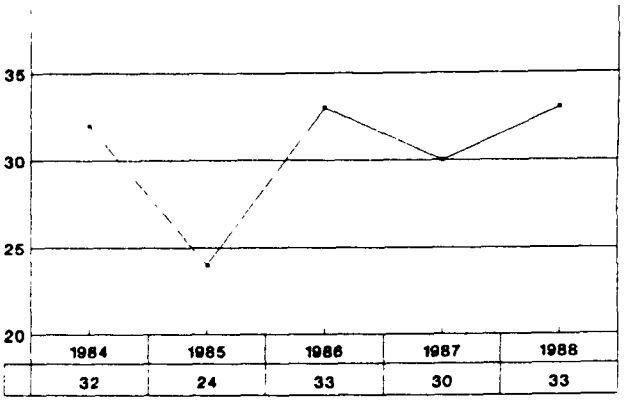
Figure 6-3 Trend in the composite mean and range for the annual arithmetic average sulfur dioxide concentration, State of Maryland, 1983-1988.

STATE OF MARYLAND
SULFUR DIOXIDE
MICROGRAMS PER CUBIC METER
1984____1988

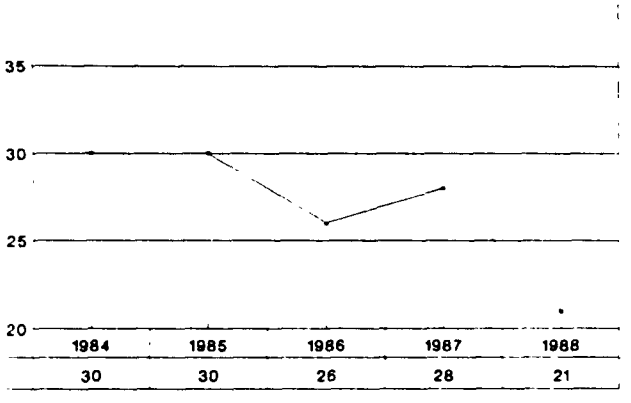
Figure 6-4



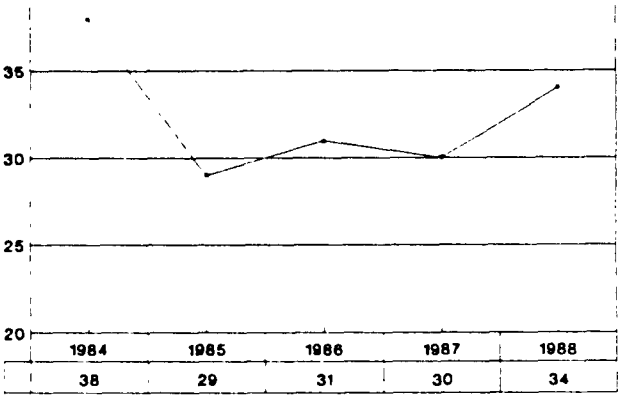
CUMBERLAND



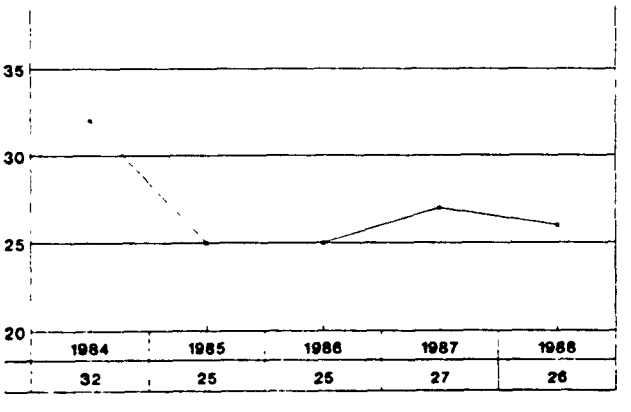
DUNDALK



SUN ST.



GUILFORD



RIVIERA BEACH

6.3.4 COMMONWEALTH OF PENNSYLVANIA

Sulfur dioxide levels for the years 1979 to 1988 are represented by annual means, have shown little variation over the past 10 years and continue to be well below the air quality standard. Figure 6-6 shows the ten year trend (1979 to 1988) of the 12 air basin averages. The dashed lines represent the annual air quality standard of 0.030 parts per million (ppm). Although all areas for the last 5 years have shown little improvement of sulfur dioxide levels, all sites in the Commonwealth met the annual and 3-hour air quality standards. Two sites in the lower Beaver Valley air basin which are along the Ohio border had one exceedance of the 24-hour standard.

Annual means for 1988 for selected areas in Pennsylvania are shown in the three dimensional graph in Figure 6-7.

Average air quality trends for sulfur dioxide are characterized by twenty-five (25) sites for the period of 1983-1988.

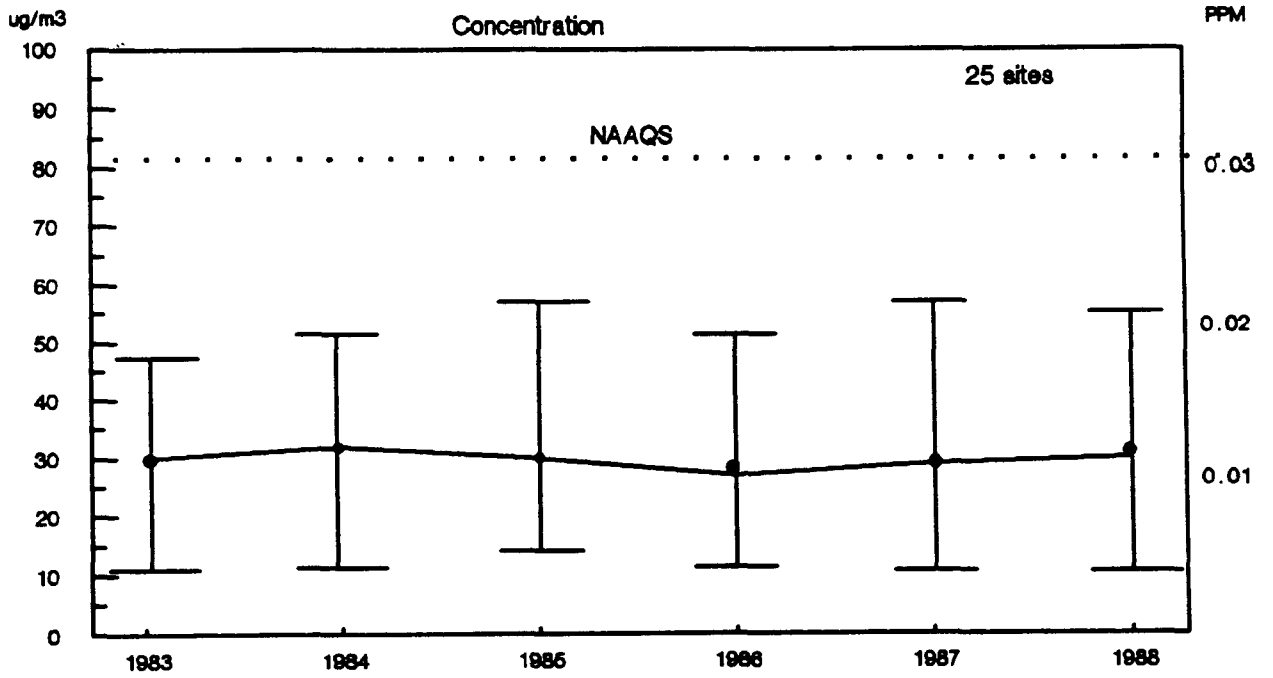


Figure 6-5 Trend in the composite mean and range for the annual arithmetic average sulfur dioxide concentration, Commonwealth of Pennsylvania, 1983-1988.

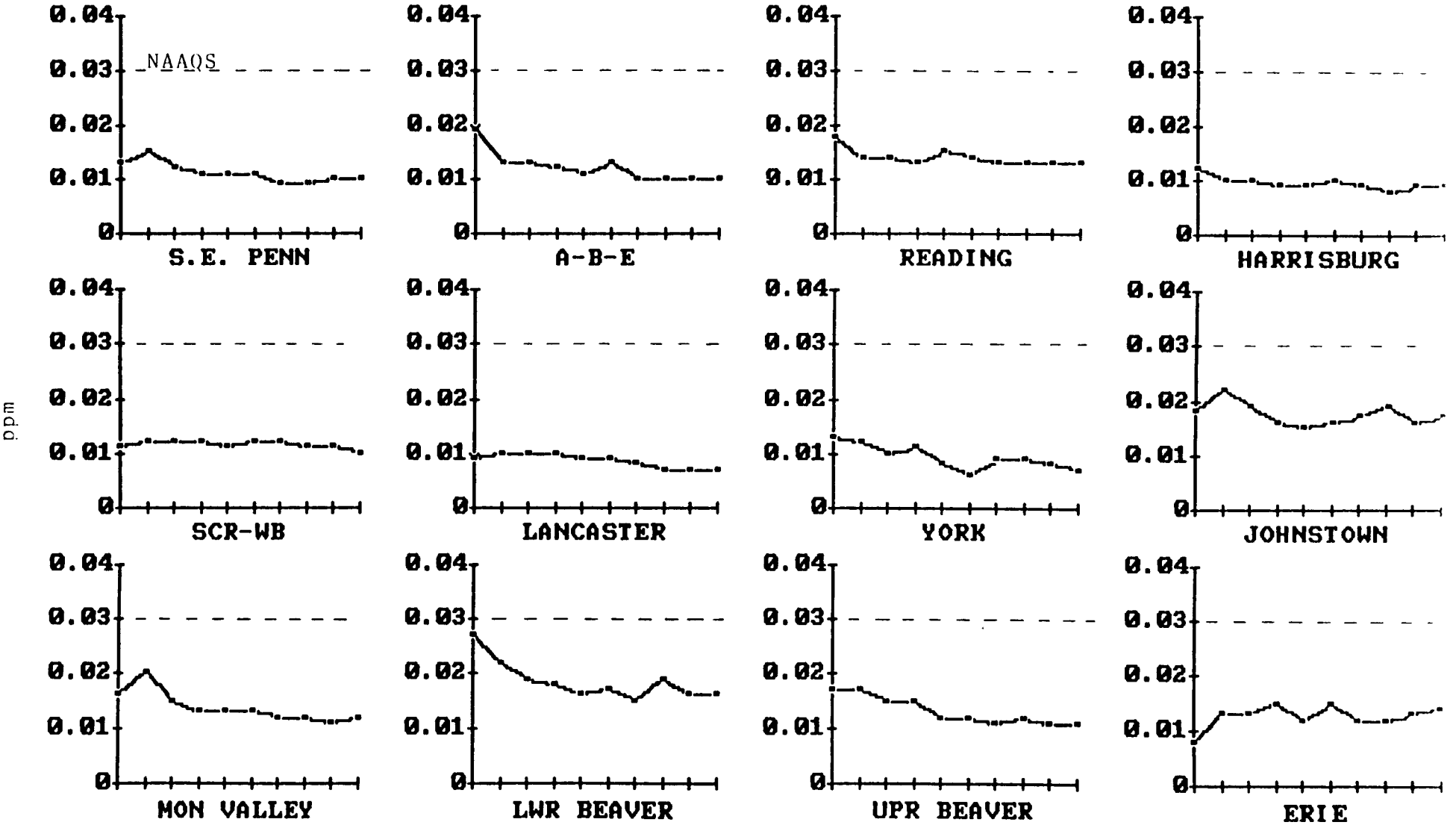


Figure 6-6. Trend in the annual arithmetic average sulfur dioxide concentration, annual means (ppm), Commonwealth of Pennsylvania, 1979-1988.

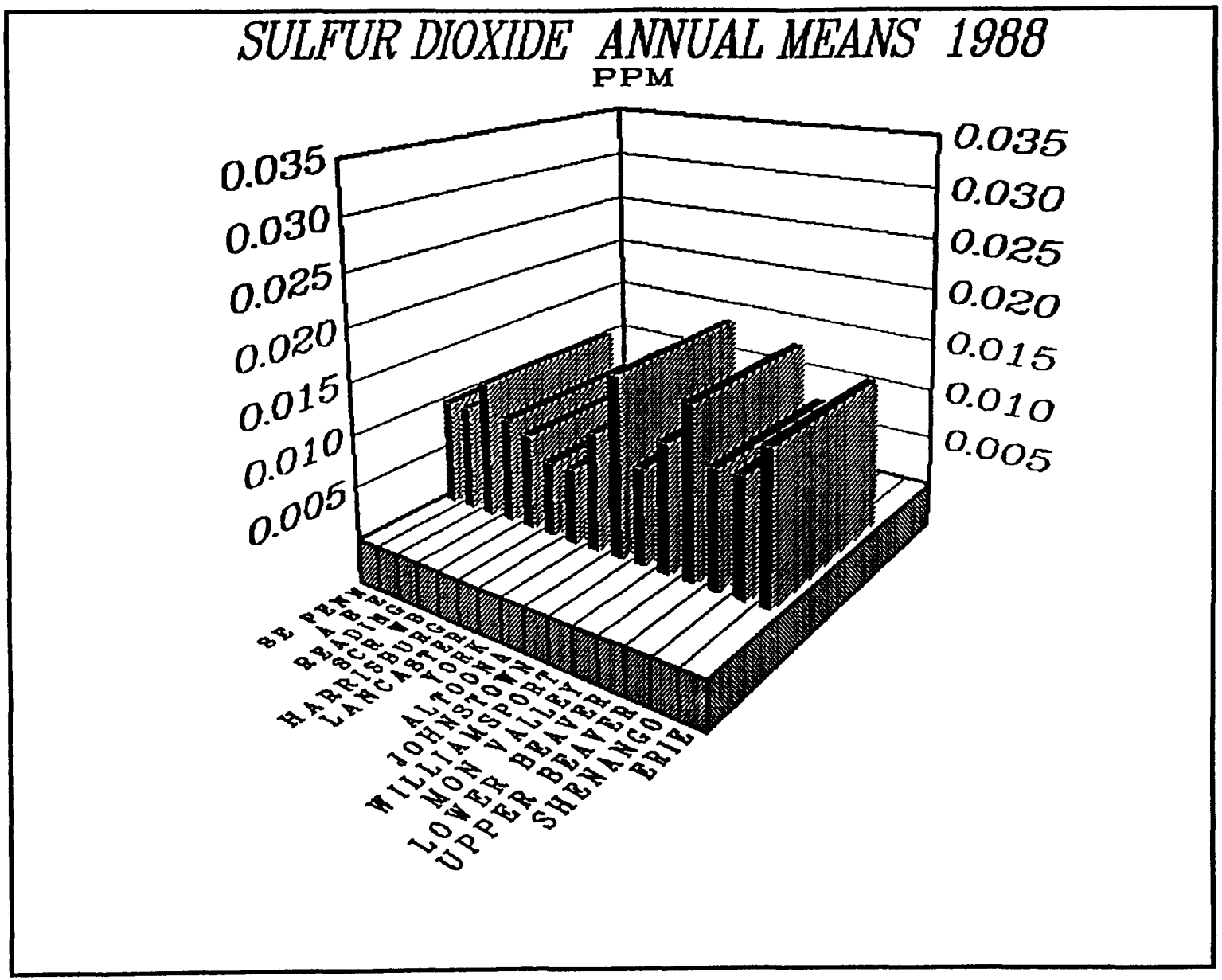


Figure 6-7. Sulfur dioxide annual means for areas in the Commonwealth of Pennsylvania, 1988.

6.3.5 ALLEGHENY COUNTY

In 1988, all ten sites were in attainment of the 0.03 ppm annual standard for the fourth straight year. Glassport at 0.027 ppm had the highest annual average. Glassport, along with Avalon, had the largest increase from 1987 (12%). For the network, five sites had an increase, two had a decrease and three were unchanged. The overall 1988 average was 0.019 compared to 0.018 for 1987. In 1988, Glassport had six and Liberty had one exceedance of the daily standard of 0.14 ppm.

The annual average trend line is nearly horizontal for the period of 1983-1988. The five-year network daily maximum trend indicates that 1988 was the only year to have more total exceedances than the previous year. (See Figure 6-8.)

The highest concentration of SO_2 in a large urban area was found at a site in Pittsburgh, PA in 1988. This area is impacted by major SO_2 sources.

Average air quality trends for sulfur dioxide are characterized by ten (10) sites for the period of 1983-1988.

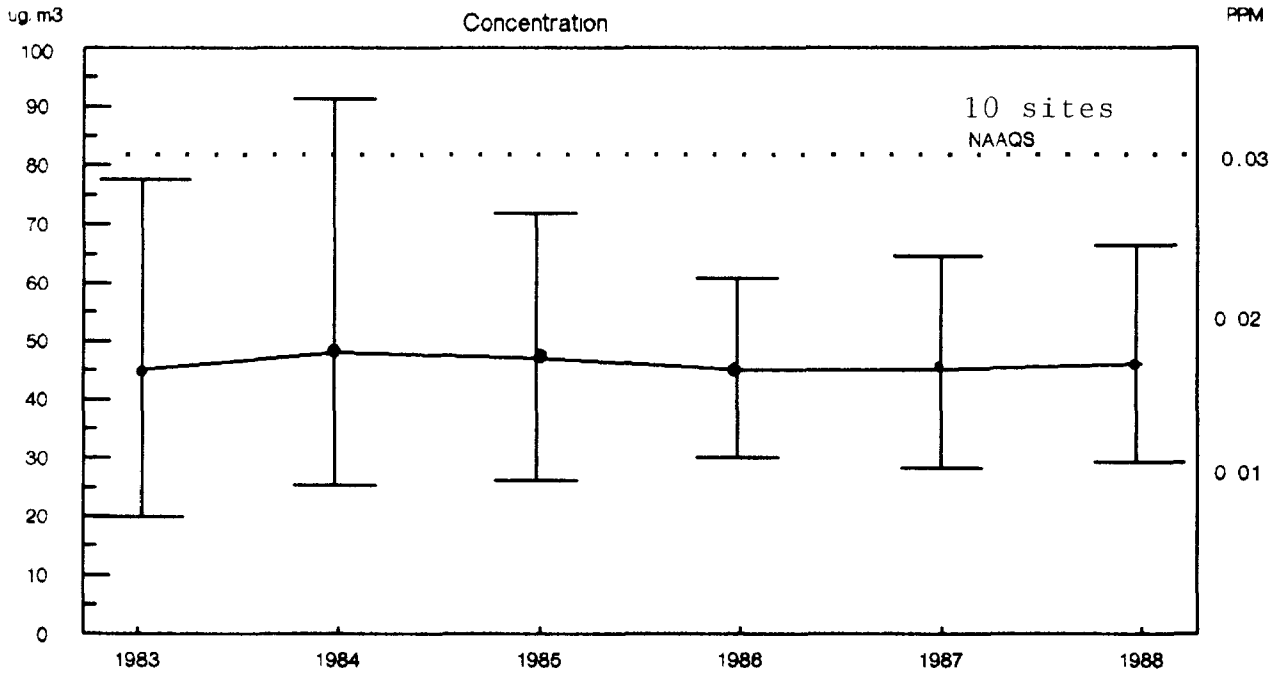


Figure 6-9 Trend in the composite mean and range for the annual arithmetic average sulfur dioxide concentration, Allegheny County, 1983-1988

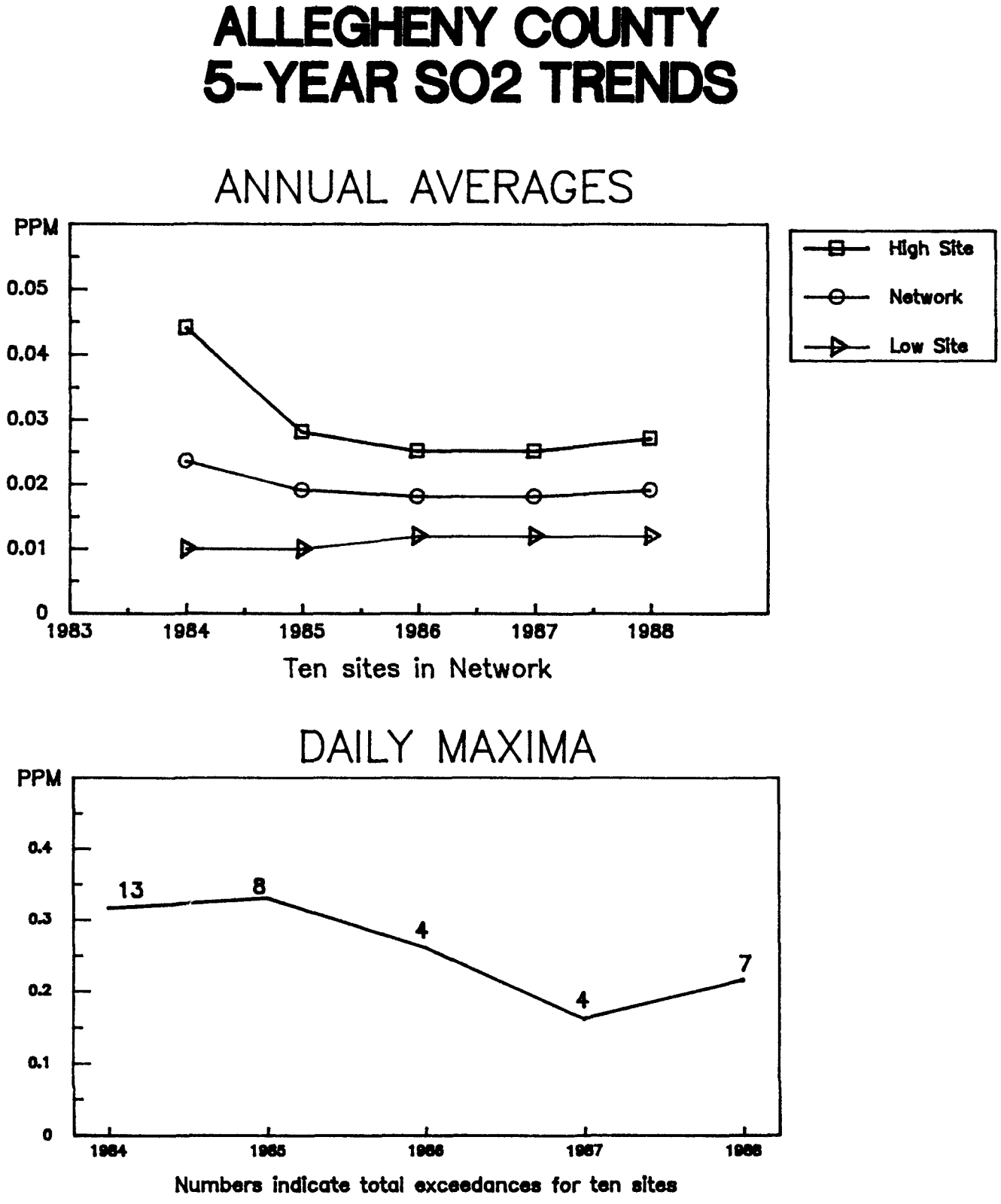


Figure 6–8 ALLEGHENY COUNTY 5–YEAR SO2 TRENDS

6.3.6 CITY OF PHILADELPHIA

Sulfur Dioxide has shown a marked decrease since 1968, principally as a result of sulfur-in-fuel regulation and more recently from reduced fuel burning for electric power generation, fuel conversion, energy conservation and improvements at petroleum refining facilities. Sulfur dioxide air quality standards are currently being attained throughout Philadelphia.

Average air quality trends for sulfur dioxide are characterized seven (7) by sites for the period of 1983-1988.

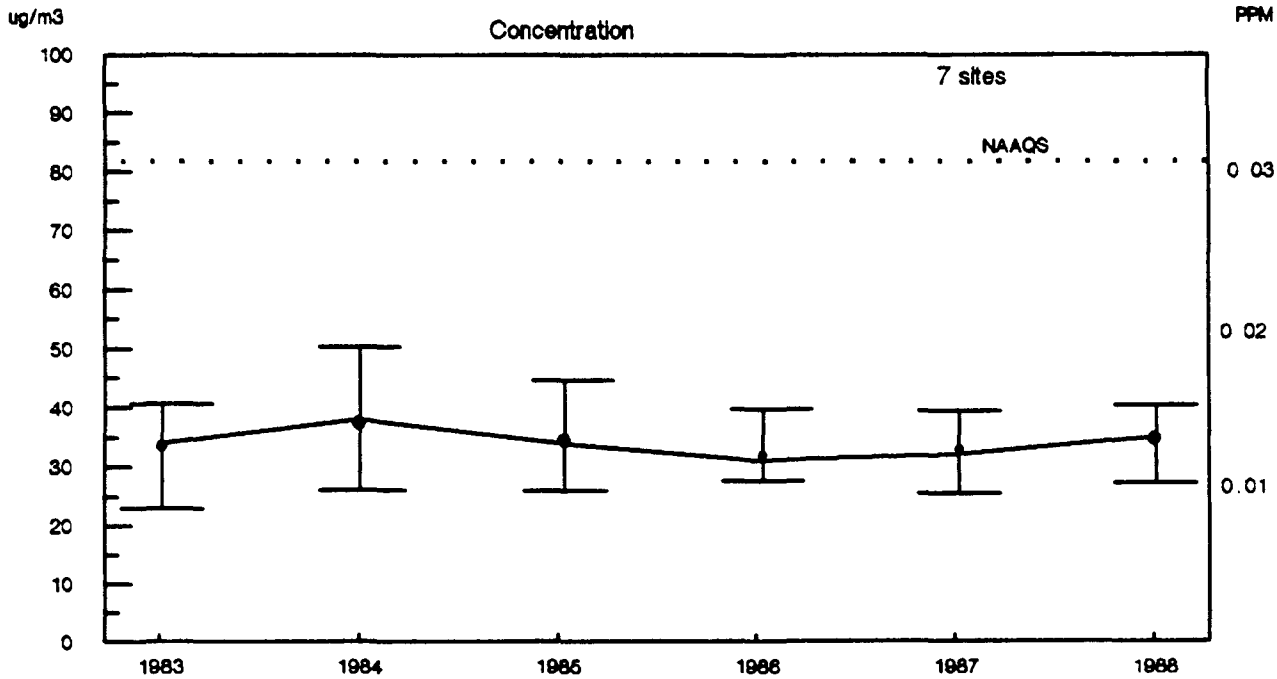


Figure 6-10 Trend in the composite mean and range for the annual arithmetic average sulfur dioxide concentration, City of Philadelphia, 1983-1988.

6.3.7 COMMONWEALTH OF VIRGINIA

The Commonwealth of Virginia is in compliance with the NAAQS in all areas of the state for sulfur dioxide. The state network is comprised of ten (10) sulfur dioxide monitors which for the past seven (7) years has shown a trend well below the national standard.

Average air quality trends for sulfur dioxide are characterized by ten (10) sites for the period of 1983-1988.

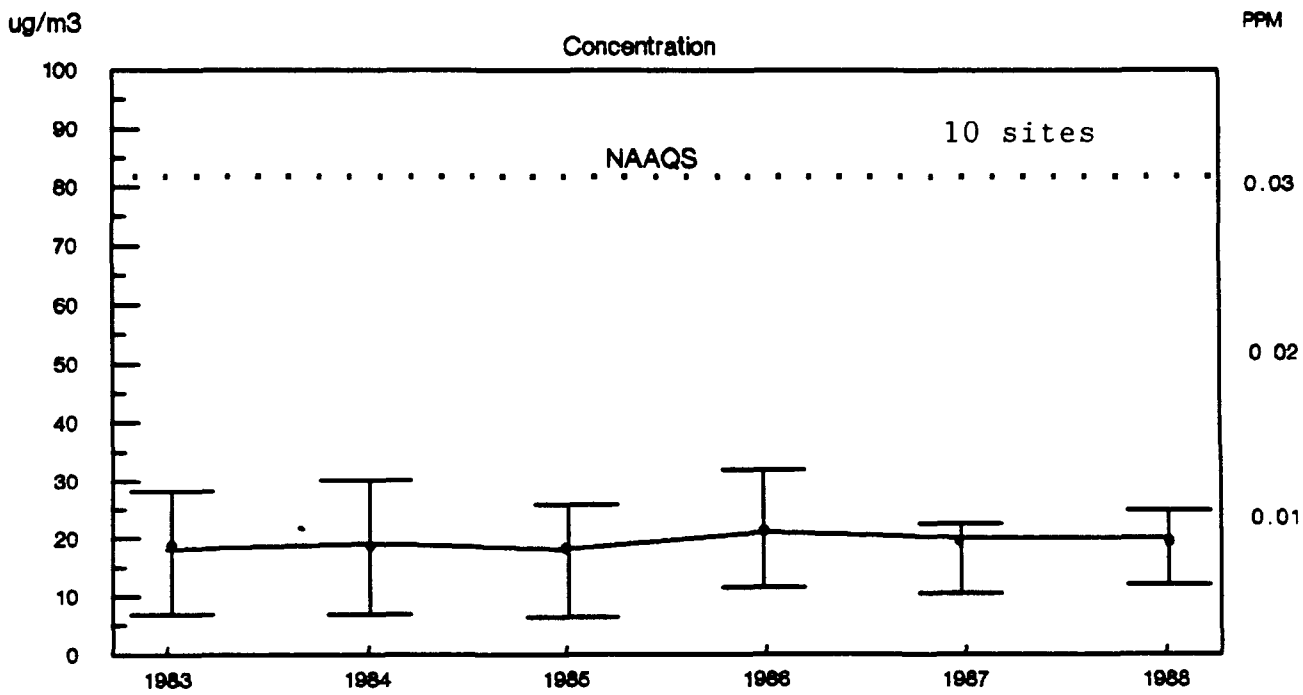


Figure 6-11 Trend in the composite mean and range for the annual arithmetic average sulfur dioxide concentration, Commonwealth of Virginia, 1983-1988.

6.3.8 STATE OF WEST VIRGINIA

During 1983 through 1988 the annual average sulfur dioxide concentration in West Virginia was around 62% of the standard. This average annual concentration is the highest for any state in Region III. Six of the 12 stations are located in the Wheeling Panhandle, northern part of the state, where there are a number of coal fired electric utility stations, two large steel plants, and other heavy industry. Sulfur dioxide levels observed at the other 6 stations that are spread across the state are typical of other moderate to highly populated areas in Region III.

The exceedance of the annual standard shown for each year in Figure 6-12 is for one station in the Wheeling Panhandle at Weirton, WV. The sulfur dioxide emissions causing these exceedances are from a nearby steel plant with substantial impact also from coal fired power plants in the area.

Average air quality trends for sulfur dioxide are characterized by twelve (12) sites for the period 1983-1988.

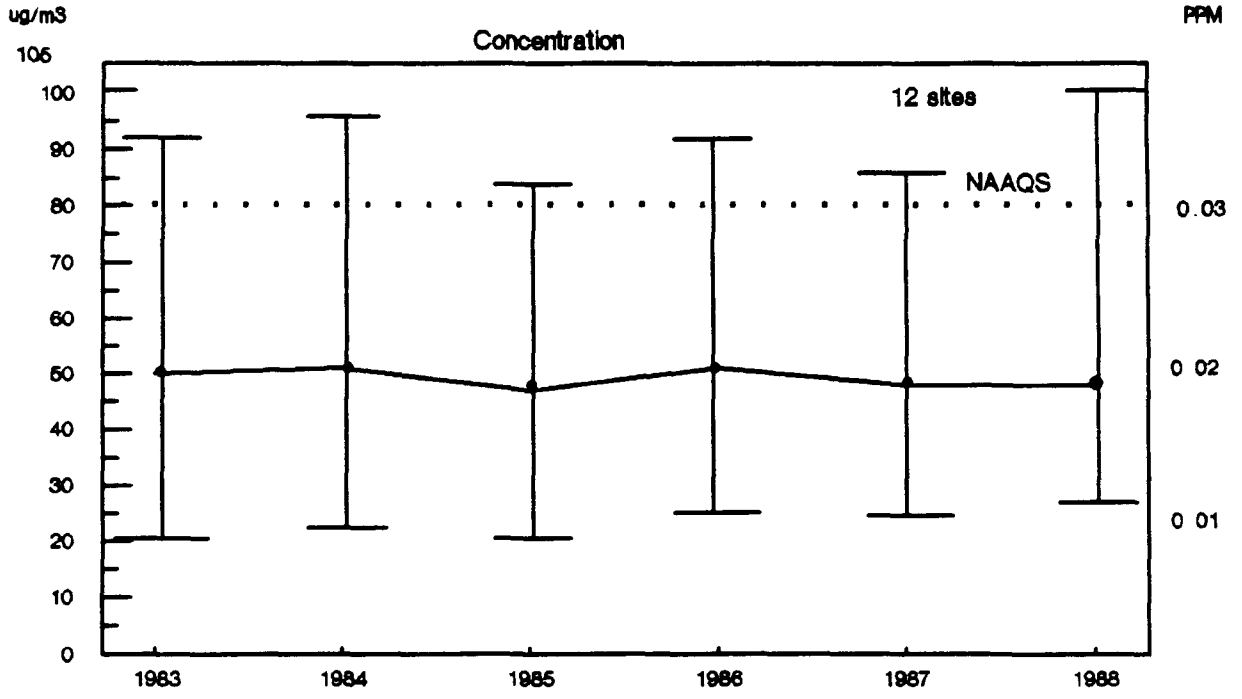


Figure 6-12 Trend in the composite mean and range for the annual arithmetic average sulfur dioxide concentration, State of West Virginia, 1983-1988.

6.4 EMISSION TRENDS

. Nationally, total sulfur oxides (SO_x) emissions are estimated to have decreased 17 percent between 1978 and 1987.

. Two thirds of all national SO_2 emissions are generated be electric utilities. Improvements are due to:

  - Installation of flue gas desulfurization controls at coal-fired stations.

  - Reduction in the average sulfur content of fuels.

  - Decreased coal use by other consumers.

. Improvement in industrial processes are due to

  - Results of controls to reduce emissions from non-ferrous smelters and sulfuric acid manufacturing plants.

. In Region III, estimated SO_2 emissions decreased less than 1 percent between 1983 and 1988.

6.5 COMMENTS

. Nationally, the vast majority of SO_2 monitoring sites do not show any exceedance of the 24 hour NAAQS.

. Nationally and regionally, ambient SO_2 levels and SO_X emissions declined at different rates. The difference between emissions and air quality can be attributed to several factors:

  - SO_2 monitors are mostly urban population-oriented and do not reflect many major emitters which tend to be located in more rural areas.

  - Residential and commercial areas, where most of the monitors are located, have shown SO_2 emissions improvements comparable to SO_2 air quality improvement.

  - Energy conservation measure.

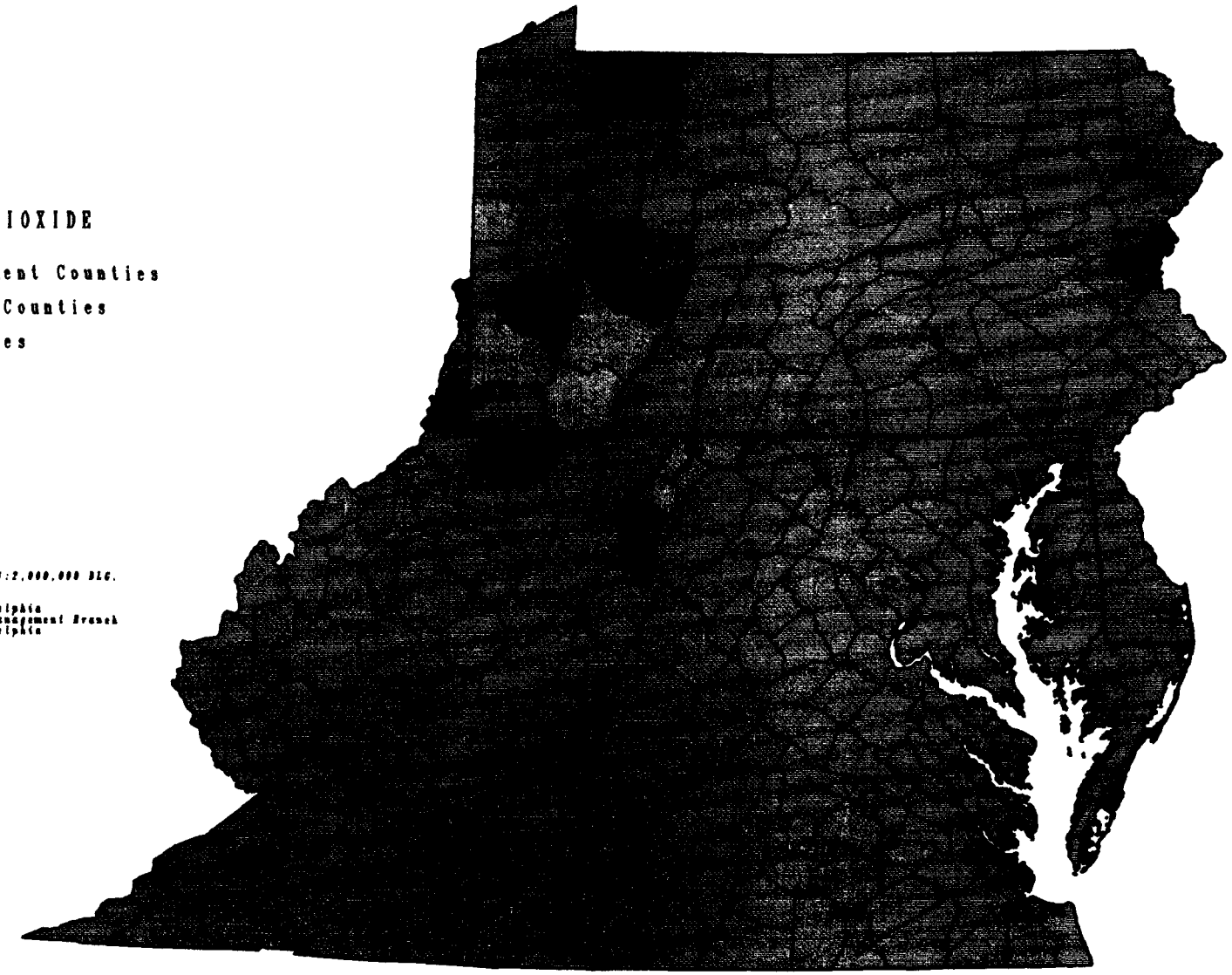
  - Use of cleaner fuels.

. Sulfur dioxide attainment/non-attainment status is depicted in the Region III Sulfur Dioxide Profile Map in Figure 6-13.

. Allegheny County (Pittsburgh, PA) is the only major urban area violating the 24 hour SO_2 standard in the country.

EPA REGION III
SULFUR DIOXIDE PROFILE

Figure 6-13



6.6 WORTH NOTING

Ambient SO_2 is well in conformance with the current ambient standards in most of U.S. urban areas. Current concerns about ambient SO_2 focus on major emitters which tend to be located in more rural areas. This is the major reason for the disparity between air quality and emission trends for sulfur dioxide. The residential and commercial areas, where most monitors are located, have shown sulfur oxide emission decrease comparable to SO_2 air quality improvement.

Within Region III, coal fired electrical power generation is the major source of sulfur dioxide emissions followed by emissions from the steel industry. The sites that have measured exceedances of the National Ambient Air Quality Standards are primarily impacted by emissions from these two categories of sources.

7.0 PARTICULATE MATTER

This section will describe and characterize the air quality status and trends for particulate matter.

Following a discussion on characteristics and sources of the pollutant, health effects and national air quality status, regional trends for particulate will be discussed on a state by state basis. Methods of presentation include:

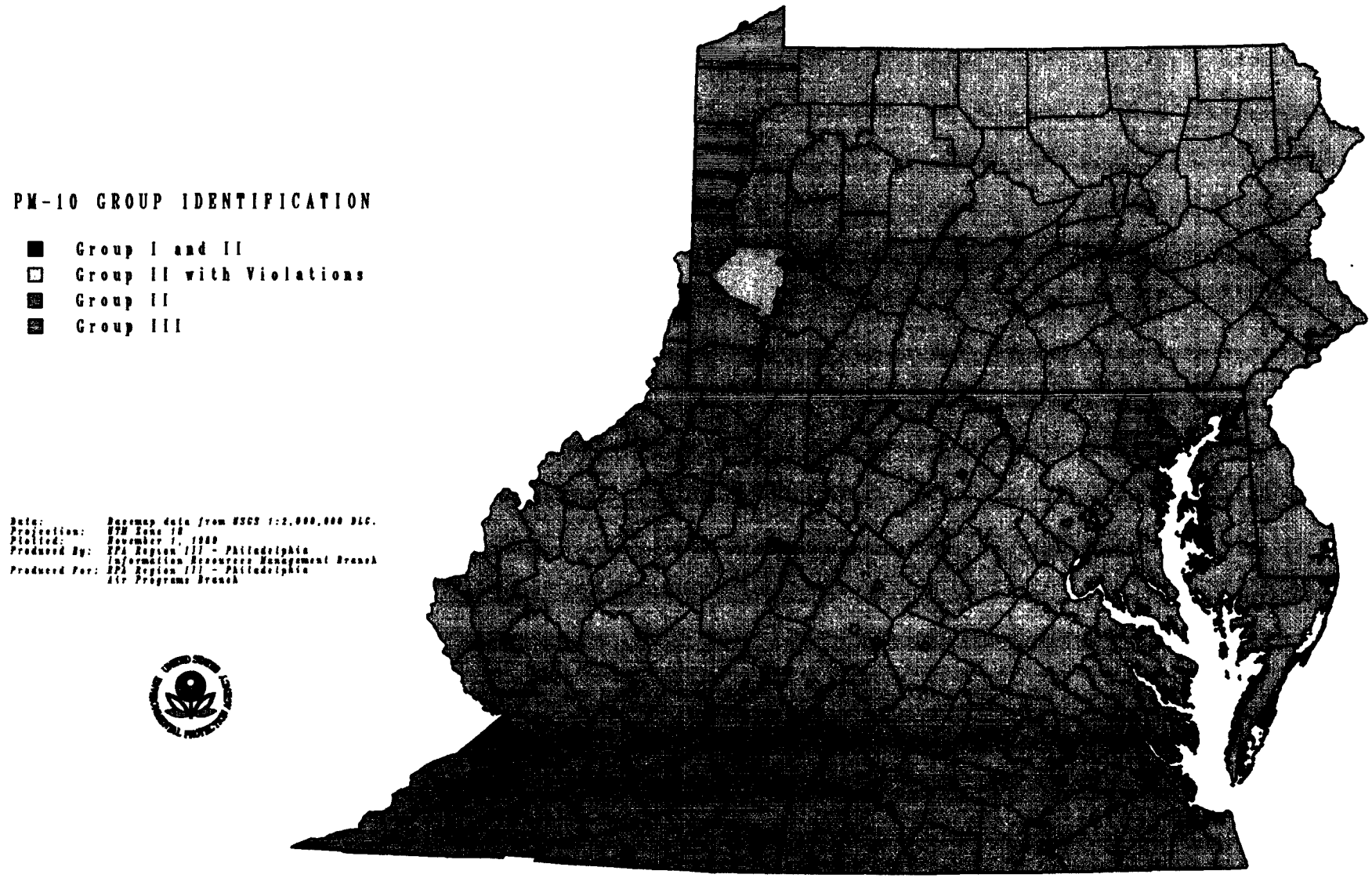
- Graphs to depict particulate trends for the composite mean and range for the annual geometric mean
- Graphs to depict PM10 trends for the composite mean and range for the highest 24 hour value
- Graphs to depict TSP and PM10 trends by site (Maryland) and by air basin (Pennsylvania).
- Three dimensional chart to show TSP and PM10 annual means for cities and areas in Pennsylvania
- Computer generated regional isopleth for a graphic display of particulate concentrations in Region 3

7.1 CHARACTERISTICS AND SOURCES OF THE POLLUTANT

Particulate matter is the general term for solid or non-volatile liquid particles found in the atmosphere. Particulates vary in size, may remain suspended in the air for periods ranging from seconds to months, and have both short and long-term health and environmental effects. Major sources of particulates include steel mills, power plants, factories, cotton gins, cement plants, smelters, cars and diesel engines. Other sources are fires, windblown dust, construction work, demolition, wood-burning stoves and fireplaces. Limiting emissions from industrial facilities through the installation of pollution controls, such as electrically charged plates and filters, improved paving, better street cleaning, limits on agricultural and forest burning practices, and bans on backyard burning in urban areas are some ways that particulate concentrations are reduced.

EPA REGION III
PM-10 GROUP IDENTIFICATION

Figure 7-1



7.2 EFFECTS

Inhaled particulates can aggravate or cause a variety of chronic respiratory ailments and can also carry other pollutants into the lungs. Other effects range from irritating the eyes and throat to reducing resistance to infection. Fine particulates about the size of cigarette smoke can cause permanent damage when deeply inhaled. Some particles, such as those from diesel engines are suspected of causing cancer; windblown dust can carry a variety of toxics substances such as polychlorinated biphenyls (PCBs), pesticides, lead and cadmium. Particulates also corrode building materials, damage vegetation and reduce visibility.

7.3 AIR QUALITY TRENDS

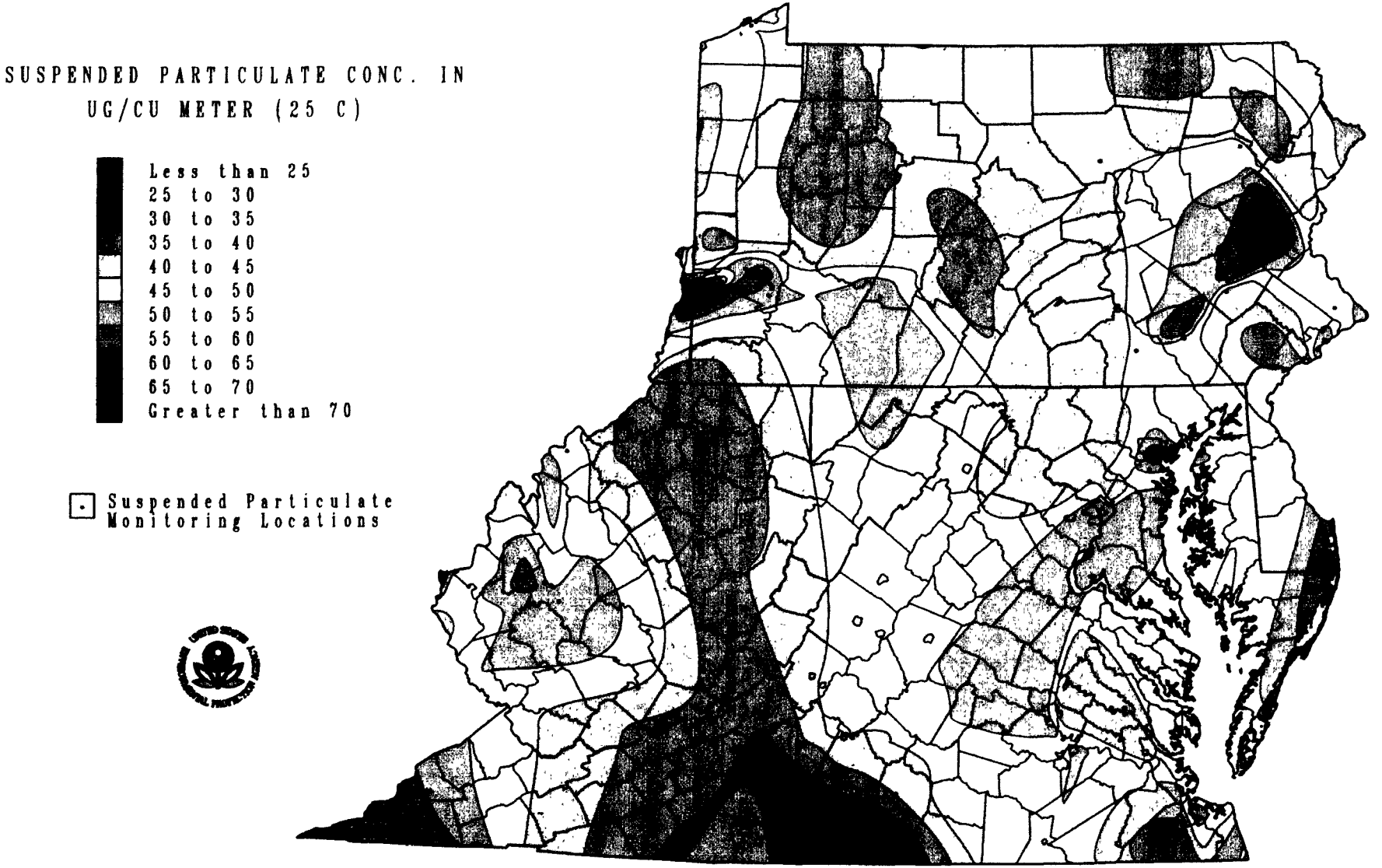
The presentation of particulate matter data in this report is complicated by the change in the particulate standard. In 1971, EPA issued a National Ambient Air Quality Standard for total suspended particulates covering all kinds and sizes. In July 1987, EPA published new standards based on particulate matter smaller than ten microns in size (PM 10). These smaller inhaled particulates present the most serious health threat because they tend to become lodged in the lungs and remain in the body for a long time. As the standards have been revised, PM-10 monitoring networks are being deployed. Because of the limited amount of PM-10 data available, both PM-10 and TSP data are used to evaluate trends in this report.

In order to present the current regional status, a PM-10 group Identification Map is presented in Figure 7-1. As a way of focusing resources on those areas which exhibited major problems, EPA developed three Groups. Preliminary groupings were established based on TSP monitoring data. The preliminary groupings were updated with more recent size-specific data and finally adjusted to take into account local, unusual situations. These data were then used with a statistical process to calculate an initial probability that an area would violate the PM-10 standards.

SUSPENDED PARTICULATE CONCENTRATIONS IN REGION III

1988 GEOMETRIC MEAN

Figure 7-2



Some specific observations relating to national and regional particulate trends are as follows:

- Nationally, annual average TSP levels, measured at 1726 trend sites, declined 21 percent between 1978 and 1987.

- Between 1986 and 1987, ambient particulate levels increased in all Regions except the Mid-Atlantic States (Region III) and the Southern States (Region IV).

- The two Regions which experienced declines in particulate levels between 1986 and 1987 had higher than normal precipitation.

- The highest concentrations are generally found in the west and industrial Midwest.

- In arid areas of the country, the natural background is very close and may exceed the NAAQS. Also, in areas where wood is the principal fuel for space heating, particulate emissions may cause exceedances of the NAAQS.

- In Region III, between 1983-1988, ambient particulate levels remained relatively constant (less than a 1 percent change) measured at 220 sites.

A computer generated regional isopleth of suspended particulate concentrations (geometric means) for 1988 is shown in Figure 7-2. This display presents at a glance the variation in TSP concentration within Region III.

7.3.1 STATE OF DELAWARE

Suspended particulate levels have remained relatively constant over the past five years with levels well below the former NAAQS for particulate matter.

Average air quality trends for the TSP are characterized by nine (9) sites for the period of 1983-1988.

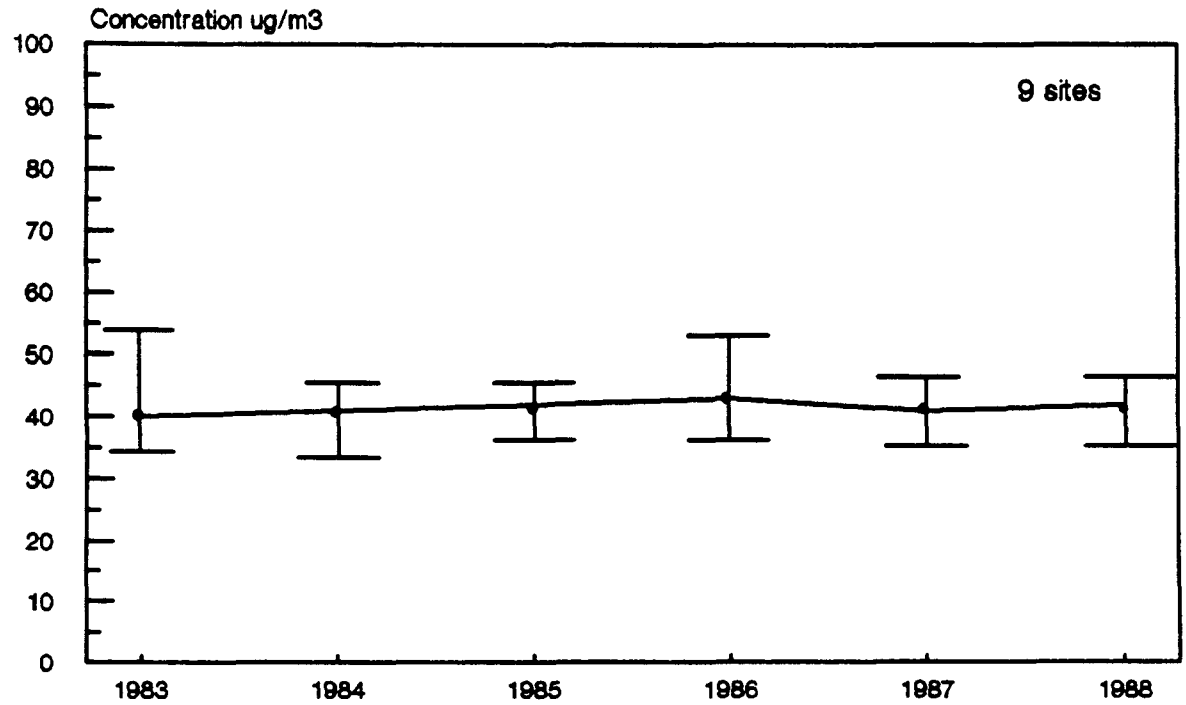


Figure 7-3 Trend in the composite average and range of the annual geometric mean total suspended particulate concentration, State of Delaware, 1983-1988.

Monitoring for PM-10 began in 1985 at three (3) sites. To date levels have been well below the NAAQS for this pollutant.

Average trends for PM-10 are characterized by three (3) sites for the period 1985 to 1988.

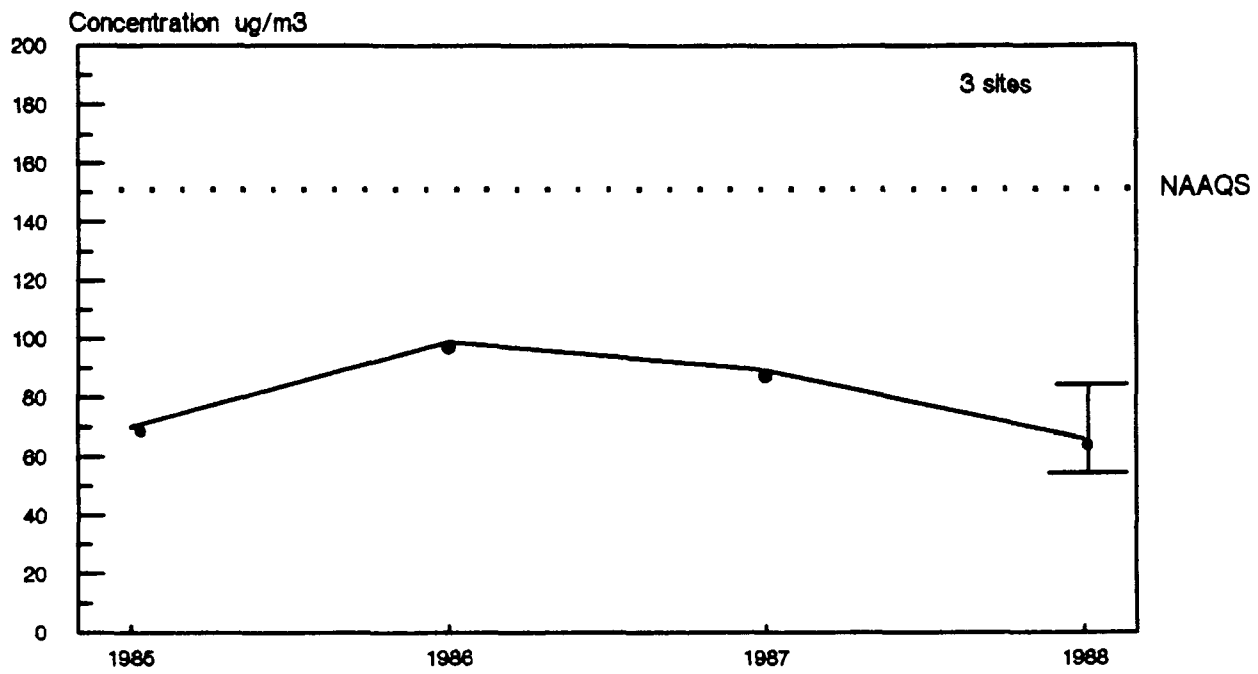


Figure 7-4 Trend in the composite mean and range for the maximum 24-hour PM-10 concentration, State of Delaware, 1983-1988.

7.3.2 DISTRICT OF COLUMBIA

Average TSP levels have fluctuated from approximately 49 to 53 ug/m3 during 1983-1988, with the 1983 and 1988 levels approximately equivalent at 50 ug/m3 or 67% of the old standard. These fluctuations can probably be attributed to periods of increased construction activity over this period and are reflected in the variability of the range of the annual geometric averages presented in the trends graph.

Average TSP trends for the District are characterized by six (6) sites for the period 1983-1988.

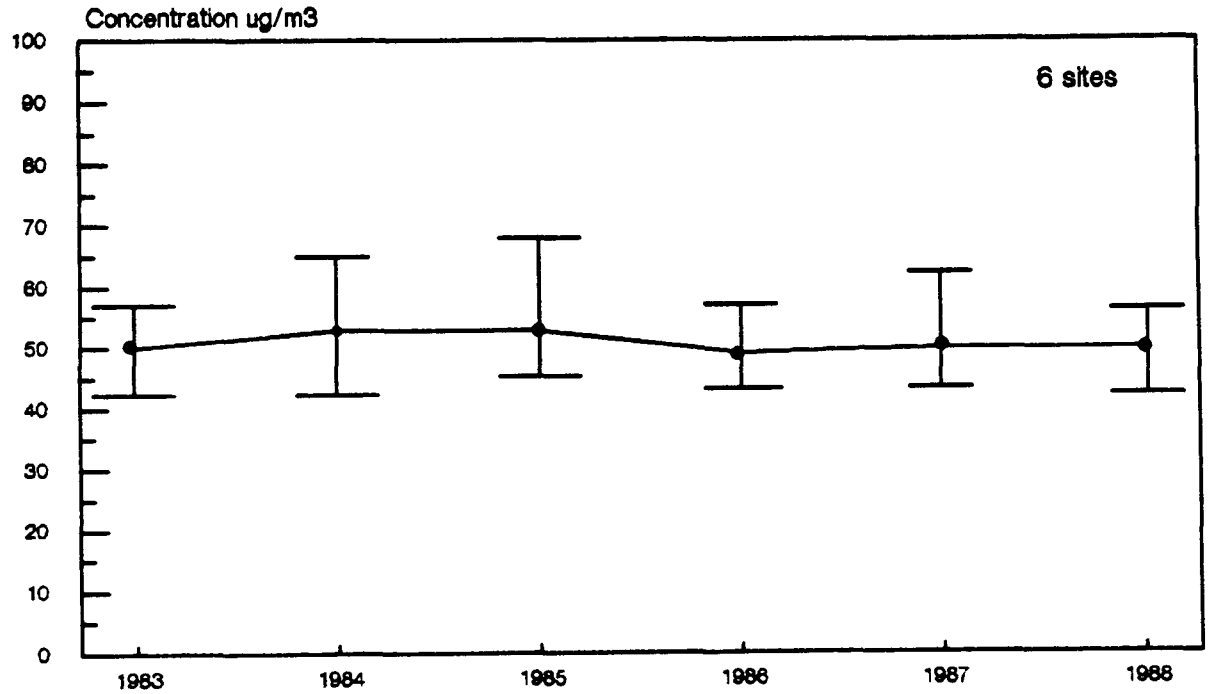


Figure 7-5 Trend in the composite average and range of the annual geometric mean total suspended particulate concentration, District of Columbia, 1983-1988.

There is no particulate trend evident in PM-10 measurements in the District with current levels approximately 60% of the twenty-four hour standard and 80% of the annual standard.

Average PM-10 trends for the District are characterized by two (2) sites for the period 1983-1988.

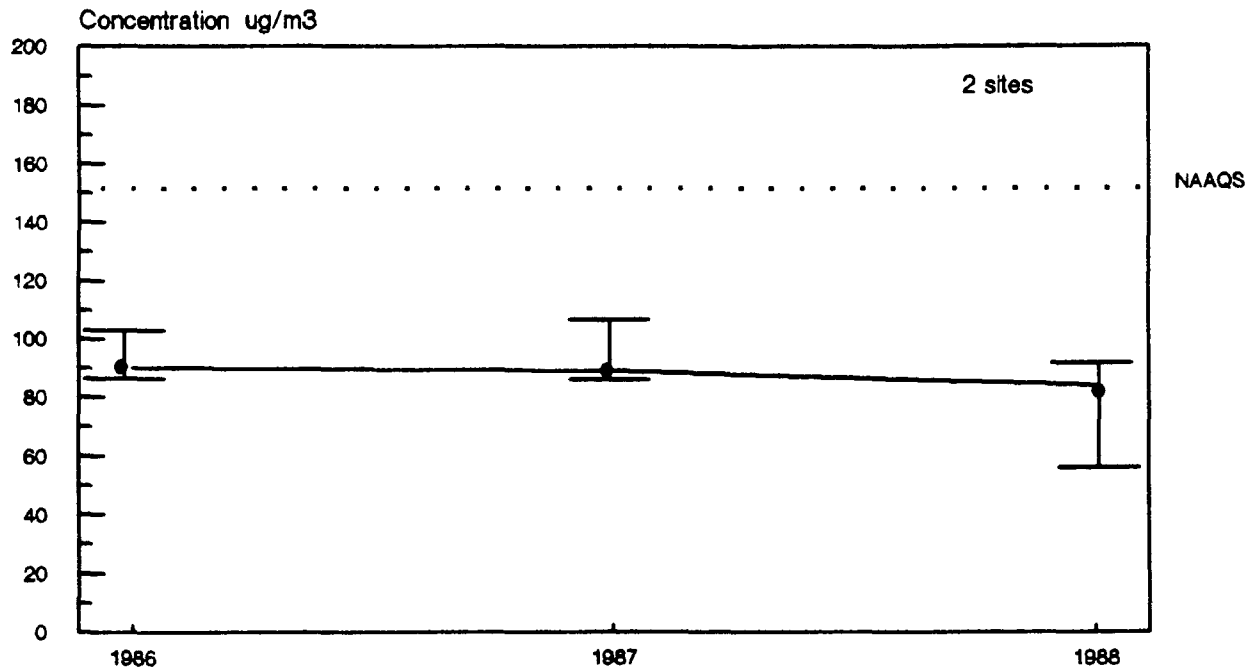


Figure 7-6 Trend in the composite mean and range for the maximum 24-hour PM-10 concentration, District of Columbia, 1983-1988.

7.3.3 STATE OF MARYLAND

Due to the extremely hot and dry summer, TSP levels increased in some areas by as much as 32%; however, most areas showed elevated levels only during the hot summer months. Total suspended particulate trends are depicted in Figure 7-8 for six (6) specific areas in the State of Maryland.

Average TSP trends for the state are characterized by 28 sites for the period 1983-1988.

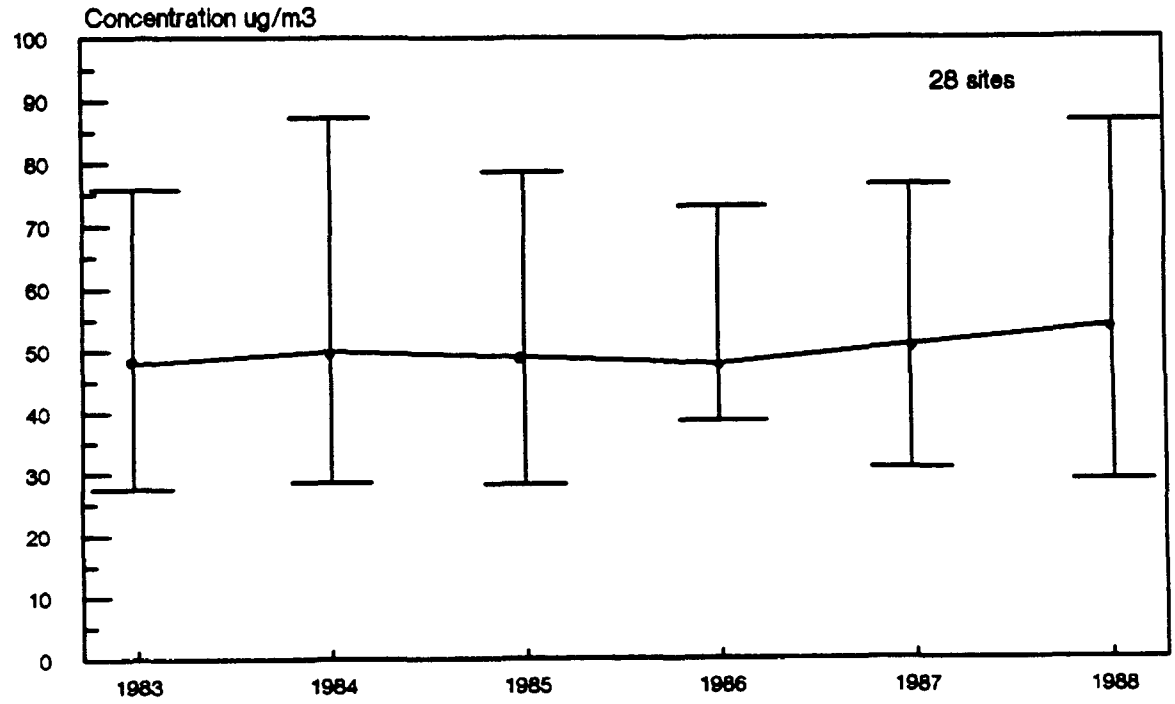
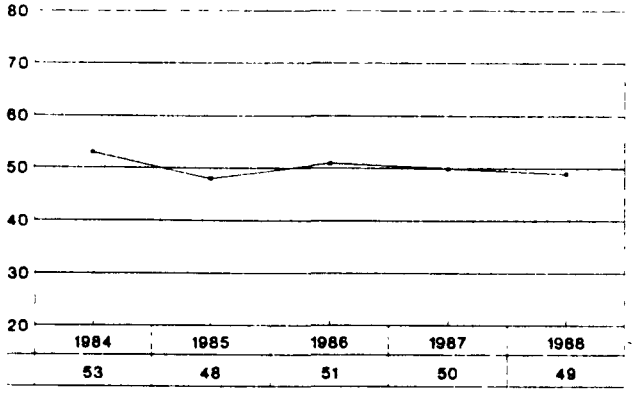


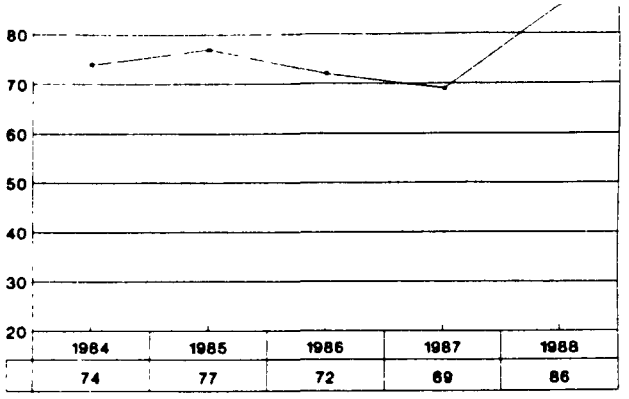
Figure 7-7 Trend in the composite average and range of the annual geometric mean total suspended particulate concentration, State of Maryland, 1983-1988.

STATE OF MARYLAND
TOTAL SUSPENDED PARTICULATE, TSP
MICROGRAMS PER CUBIC METER
1984___1988

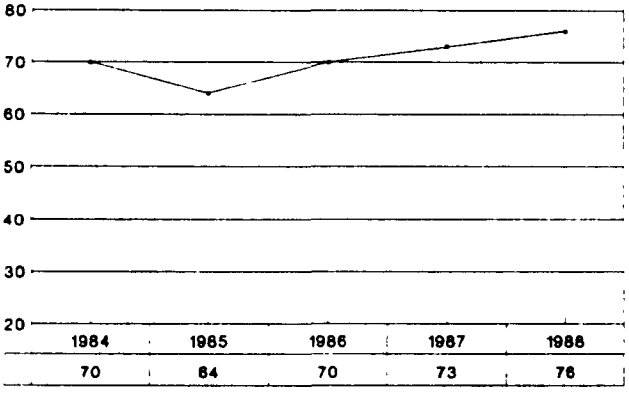
Figure 7-8



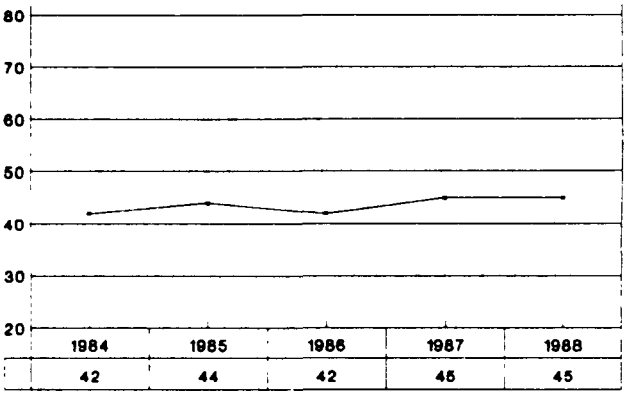
CUMBERLAND



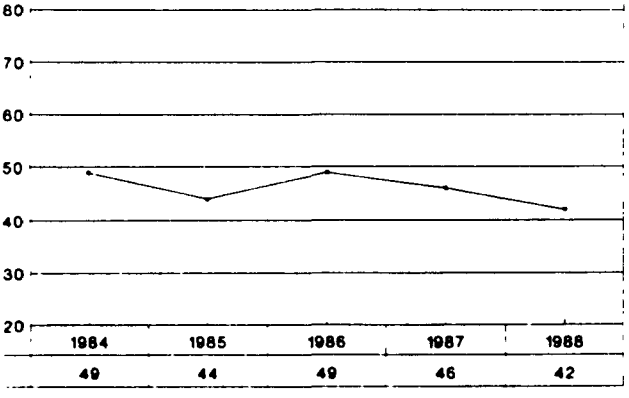
FAIRFIELD



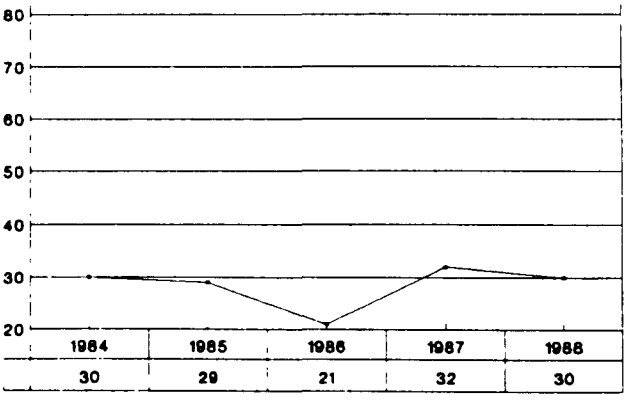
FREDERICK



MARYVALE



SALISBURY



SOLOMONS

Monitoring for PM-10 began in 1984 with two sites in Baltimore (Canton Rec and Fairfield). In 1985, the Westport site was added, and in 1987, the Frederick site was started. In mid 1988, the Canton Rec site was replaced with a new site at the Kane Bag Company, approximately 100 yards east of the former Canton Rec site. The Baltimore area monitoring data shows compliance with the annual and 24-hour standards. Although TSP levels increased in 1988, PM-10 levels decreased at all sites between 3-17% PM-10 trends for four (4) sites in the State of Maryland are depicted in Figure 7-10.

Average PM-10 trends for the state are characterized by four (4) sites for the period of 1983-1988.

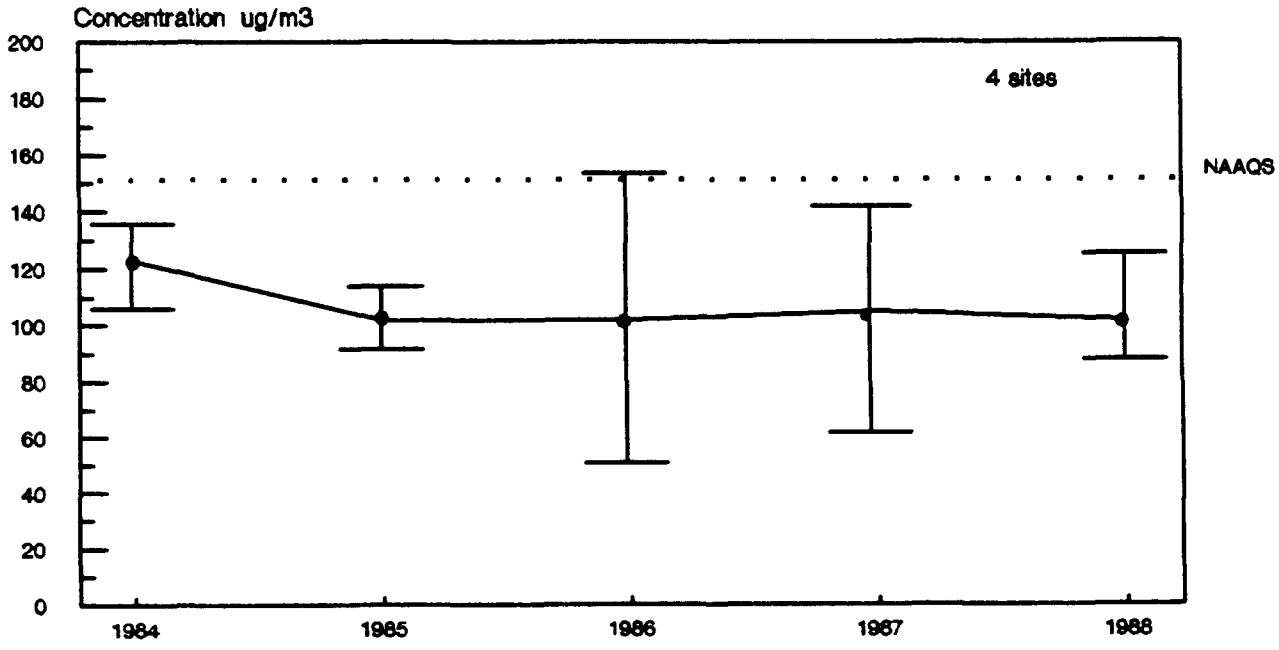
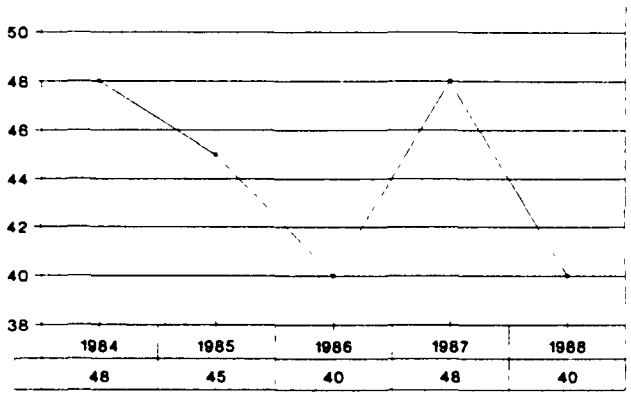


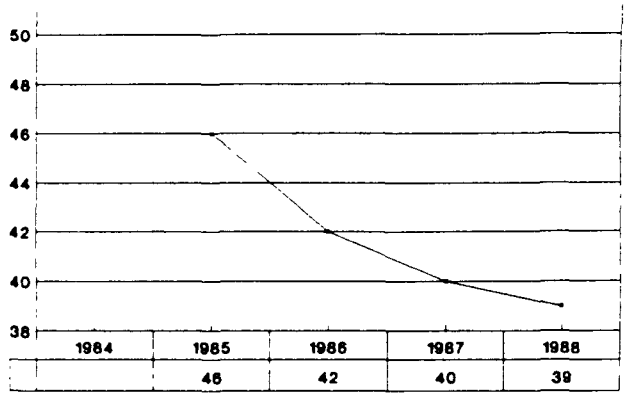
Figure 7-9 Trend in the composite mean and range for the maximum 24-hour PM-10 concentration, State of Maryland, 1983-1988.

STATE OF MARYLAND
PARTICULATE MATTER, PM-10
MICROGRAMS PER CUBIC METER
1984___1988

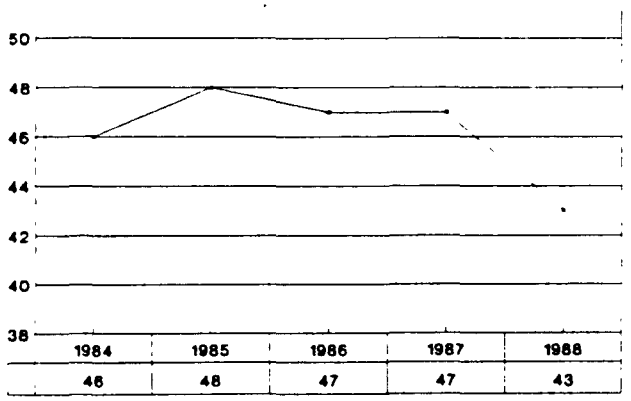
Figure 7-10



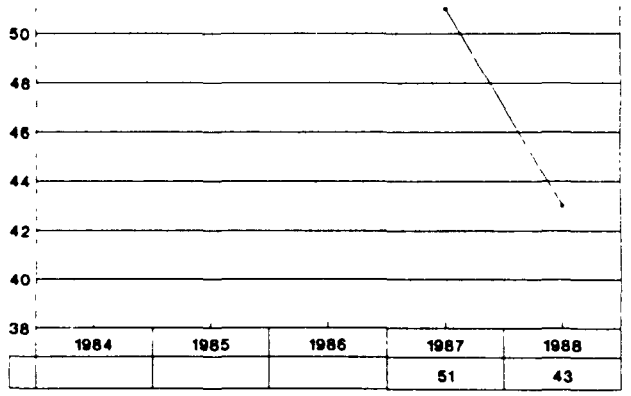
CANTON REC/KANE BAG



WESTPORT



FAIRFIELD



FREDERICK

7.3.4 COMMONWEALTH OF PENNSYLVANIA

Total suspended particulate matter (TSP) is represented by annual means for the years 1979 to 1988. This pollutant has improved considerably from levels in 1979-80 although there was a minor increase in levels in 1988 as compared to 1987. This was due in part to the drought conditions experienced by the Commonwealth causing excessive dust from fields to be blown into the atmosphere.

Air quality trends for TSP annual geometric means are depicted in Figure 7-12 and 7-13 for selected areas in the Commonwealth.

Average TSP trends for the Commonwealth are characterized by 55 sites for the period 1983-1988.

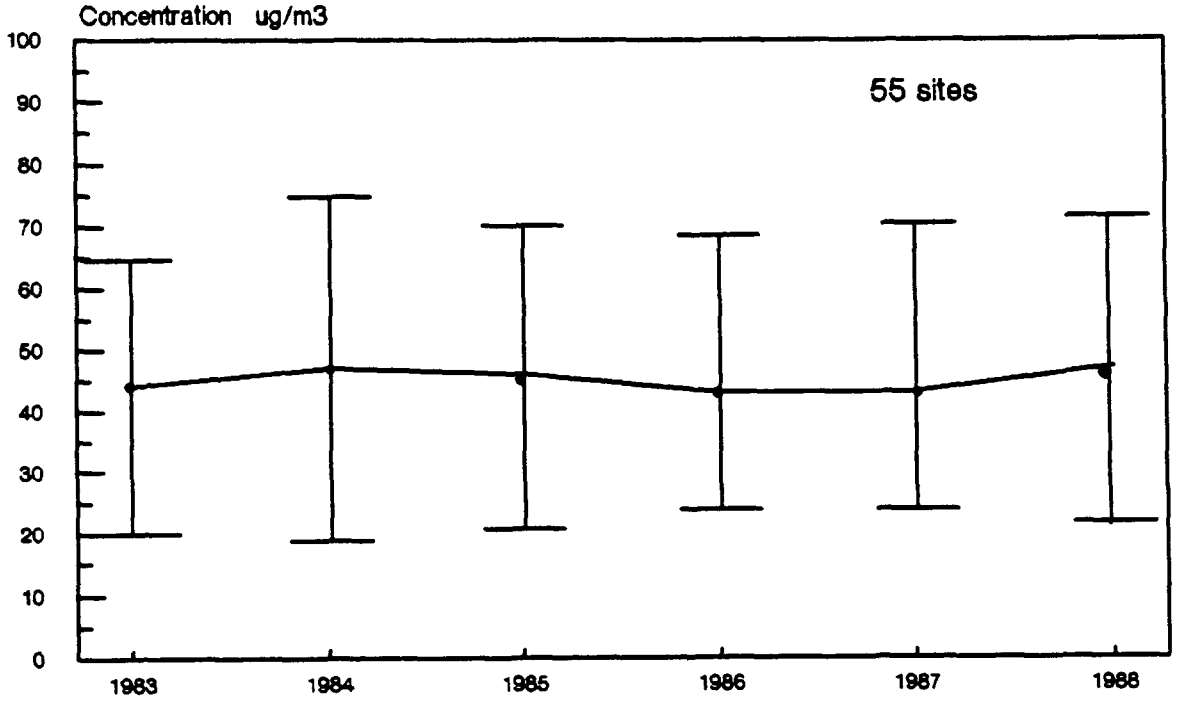


Figure 7-11 Trend in the composite average and range of the annual geometric mean total suspended particulate concentration, Commonwealth of Pennsylvania, 1983-1988.

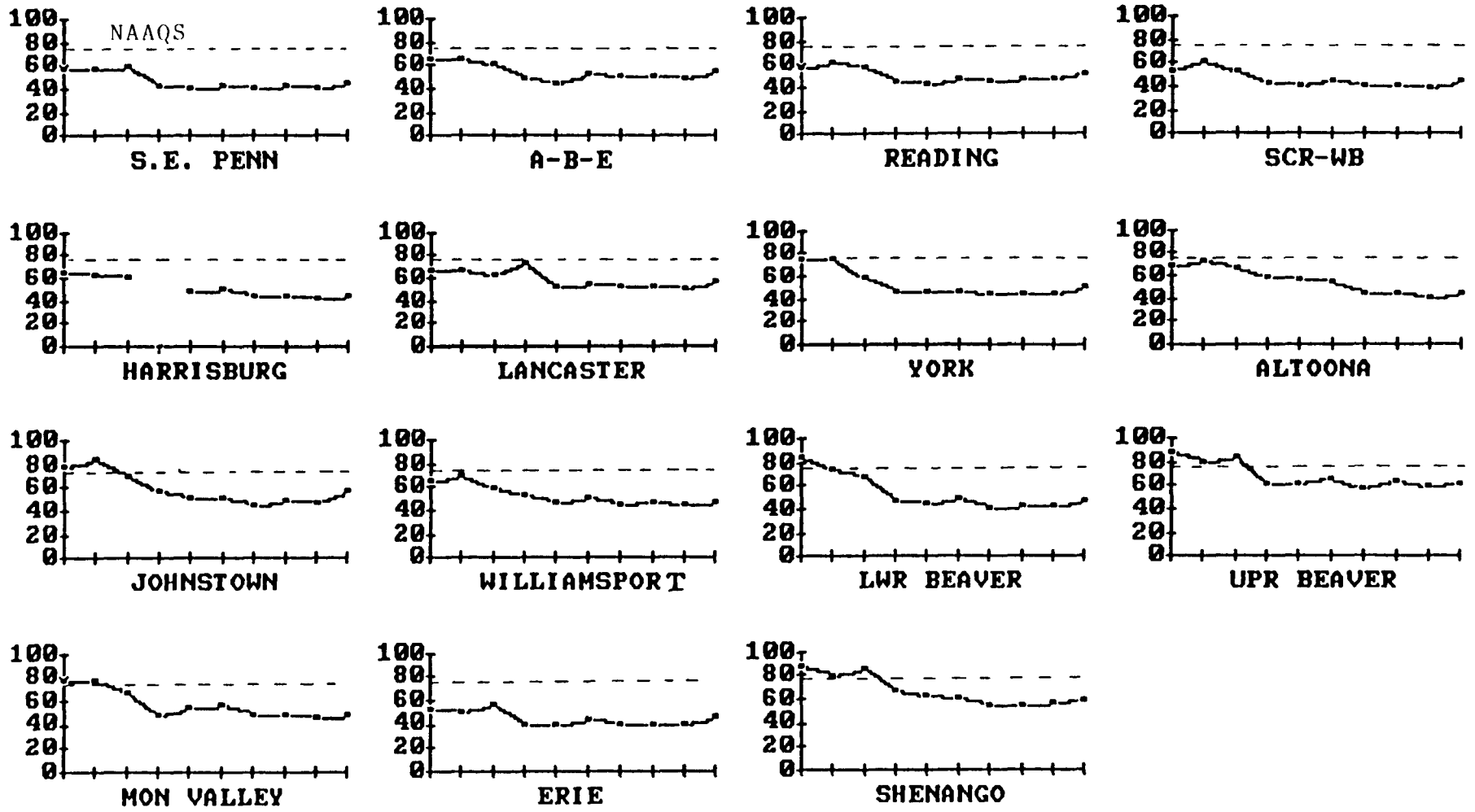


Figure 7-12. Trend in the annual geometric mean total suspended particulate concentration, Commonwealth of Pennsylvania, 1979-1988.

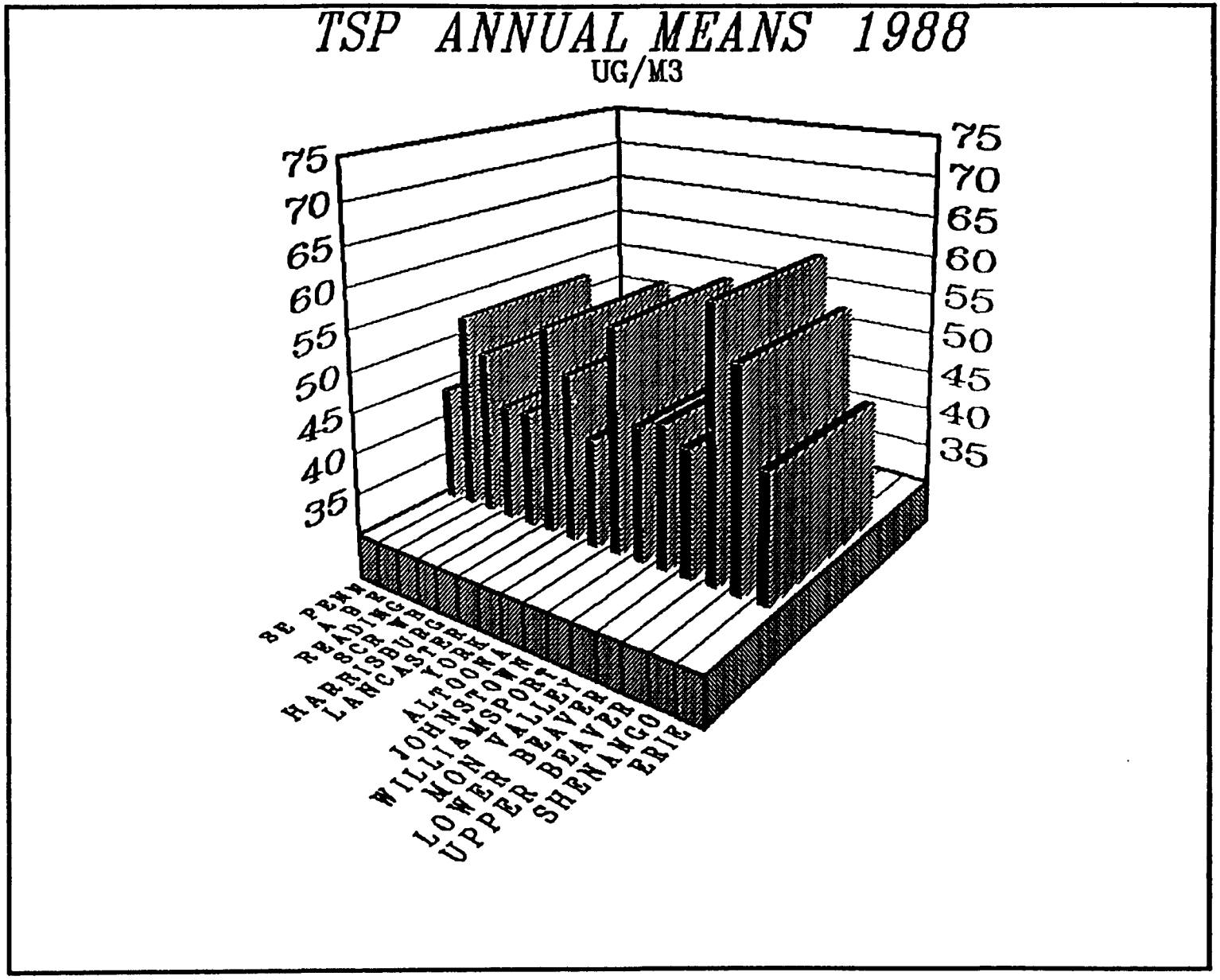


Figure 7-13. Total suspended particulate concentration, annual mean, Commonwealth of Pennsylvania,1988.

PM-10 monitoring began in 8 areas of the Commonwealth in 1985. PM-10 is represented by the annual means for the years 1985 to 1988. (See Figures 7-15 and 7-16). The first three years of monitoring showed a decrease, but 1988 showed a minor increase which can be explained, as in the case of TSP, by the lack of rainfall causing increasing blowing dust. The apparent high value in the Harrisburg area for 1985 was from a site that only operated for a short time and is not representative of levels for the area. All sites have shown no real improvement in levels since 1985. There are no sites in the Commonwealth that are currently in violation of any PM-10 air quality standard.

Average PM-10 trends are characterized by eleven (11) sites for the period 1983-1988.

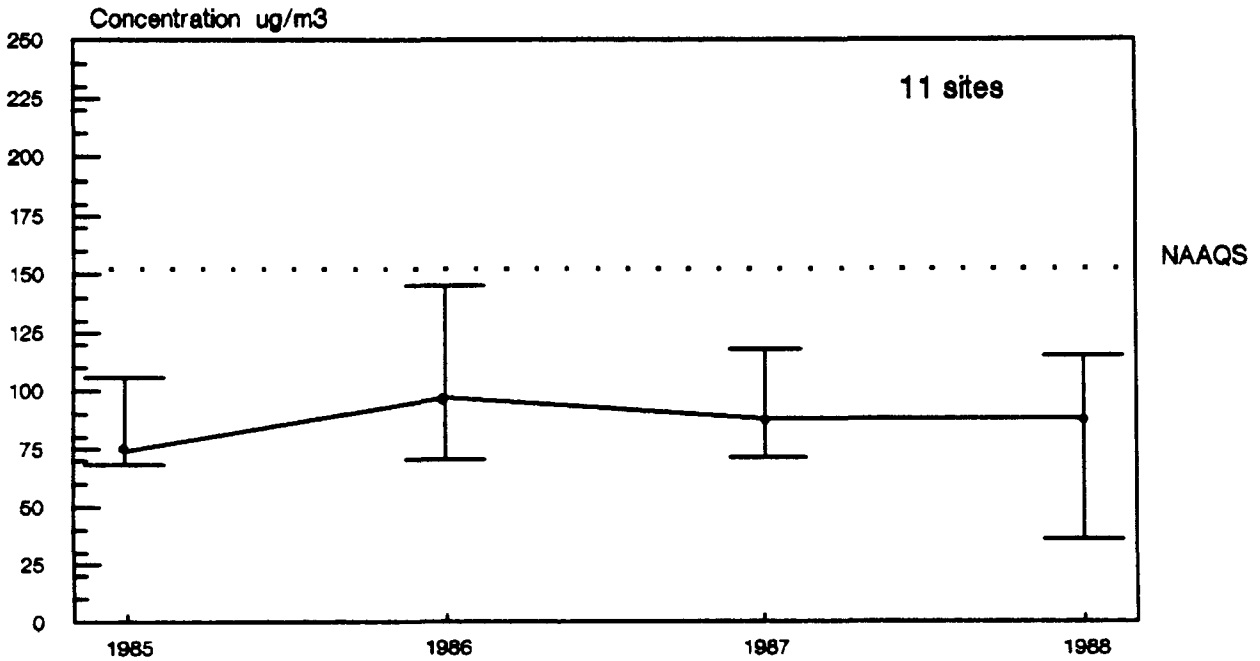


Figure 7-14 Trend in the composite mean and range for the maximum 24-hour PM-10 concentration, Commonwealth of Pennsylvania, 1983-1988.

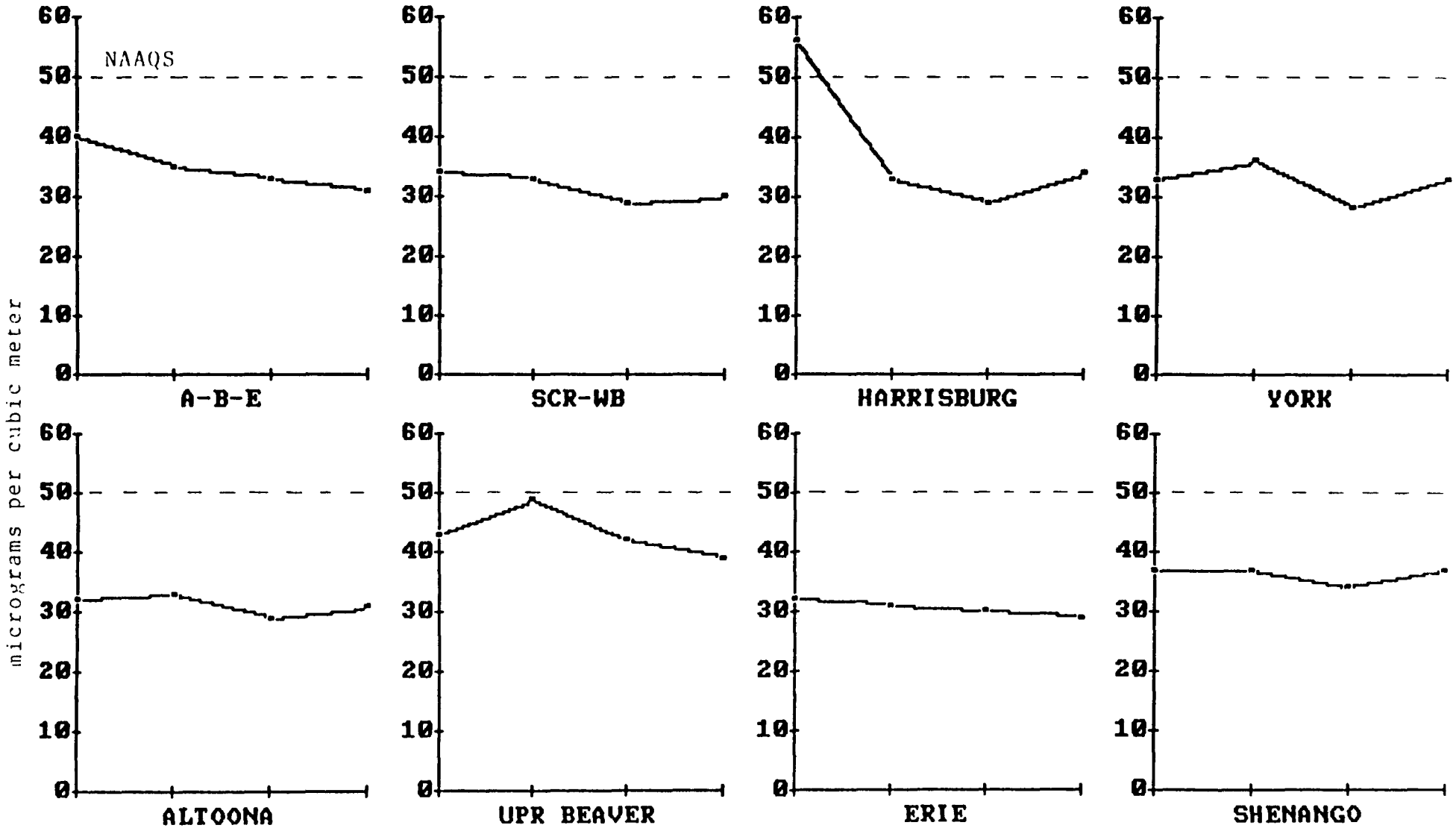


Figure 7-15. Trend in the annual mean PM10 concentration, Commonwealth of Pennsylvania, 1985-1988.

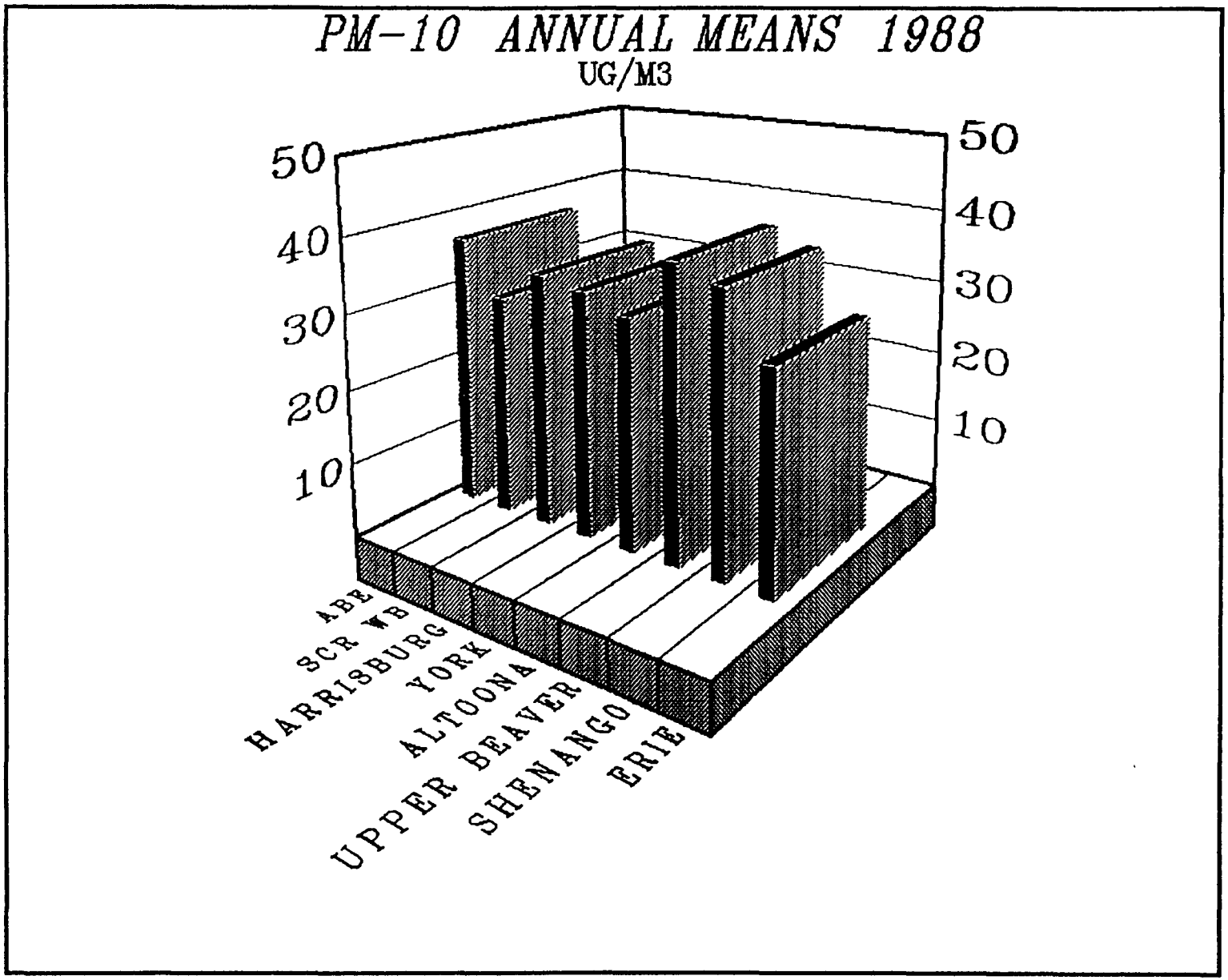


Figure 7-16. PM10 annual means for areas in the Commonwealth of Pennsylvania, 1988.

ALLEGHENY COUNTY 5-YEAR TSP TRENDS

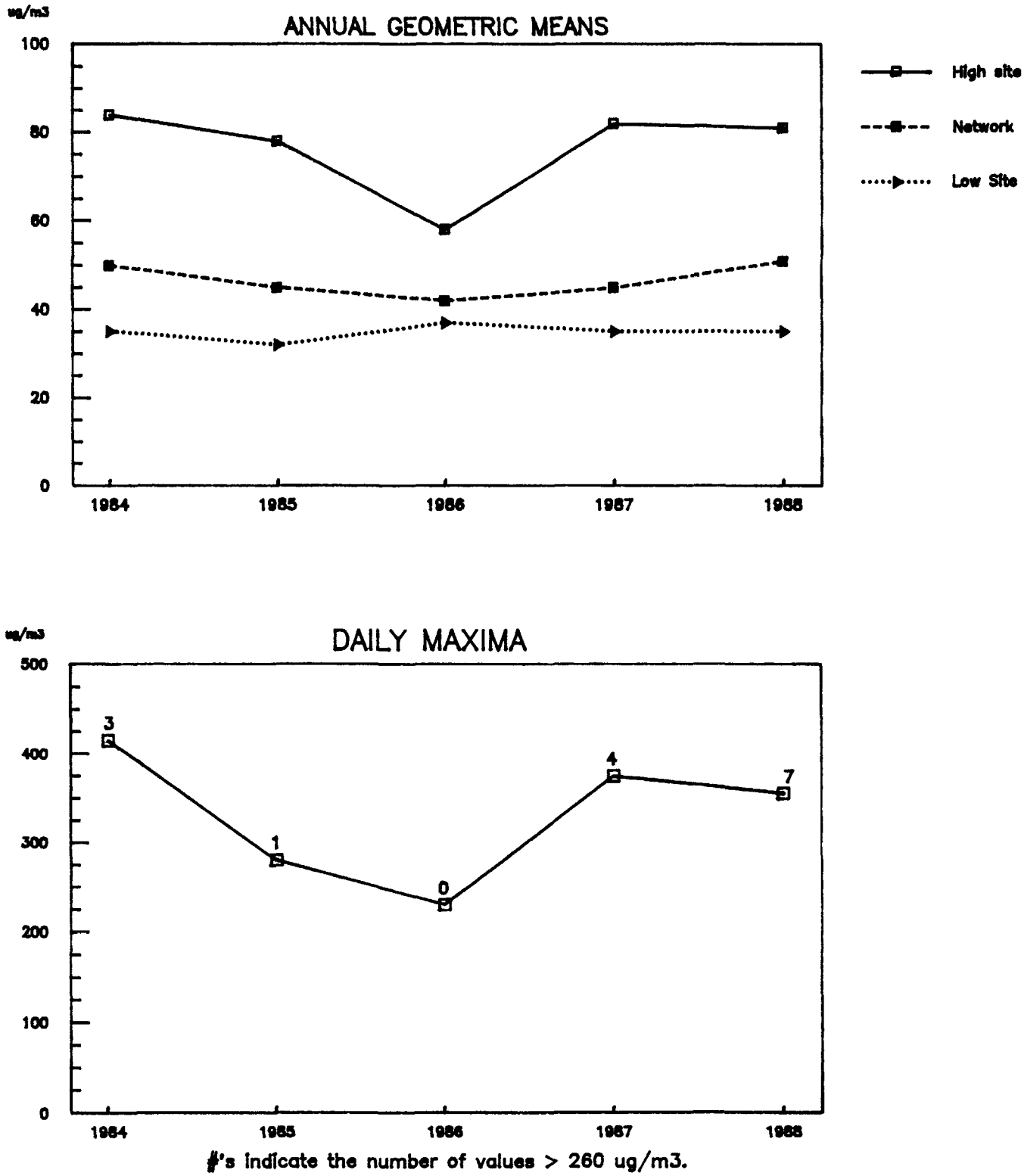


Figure 7-17 ALLEGHENY COUNTY 5-YEAR TSP TRENDS, 1984-1988.

7.3.5 ALLEGHENY COUNTY

Only one TSP site (Braddock at 81 ug/m^3) had a geometric mean above the former NAAQS for TSP in 1988. The overall network average in 1988 for eighteen (18) sites was approximately 60 ug/m^3. Fourteen (14) of the sites showed increases while four (4) remained unchanged. Sites in the Monongahela Valley, which are impacted by USX steel plants, had much higher levels than those in Pittsburgh and other Allegheny County sites.

The five year trend shows little change except for a marked dip for the high rate (Braddock) in 1986. An eight month strike of USX began in August of that year.

The TSP daily maximum trend varies considerably from year to year. The number of daily values above the former standard has increased since 1986 (see Figure 7-17).

Average TSP trends are characterized by 18 sites for the period of 1983-1988.

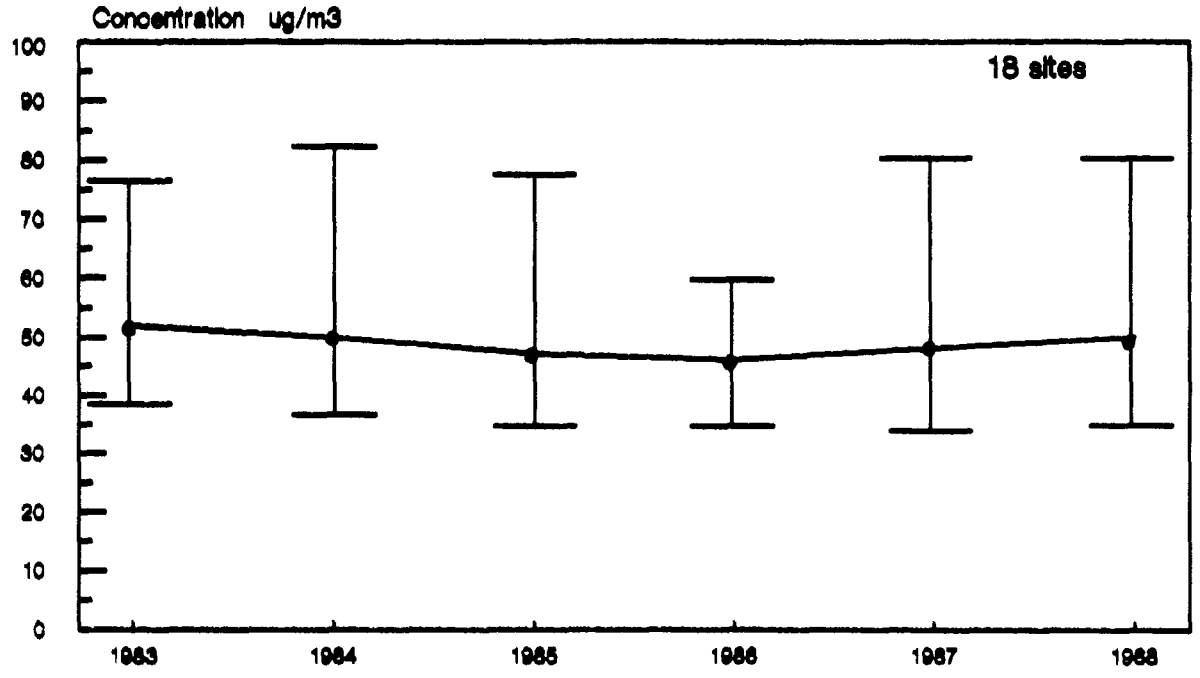


Figure 7-18 Trend in the composite average and range of the annual geometric mean total suspended particulate concentration, Allegheny County, 1983-1988.

ALLEGHENY COUNTY
4-YEAR PM10 TRENDS

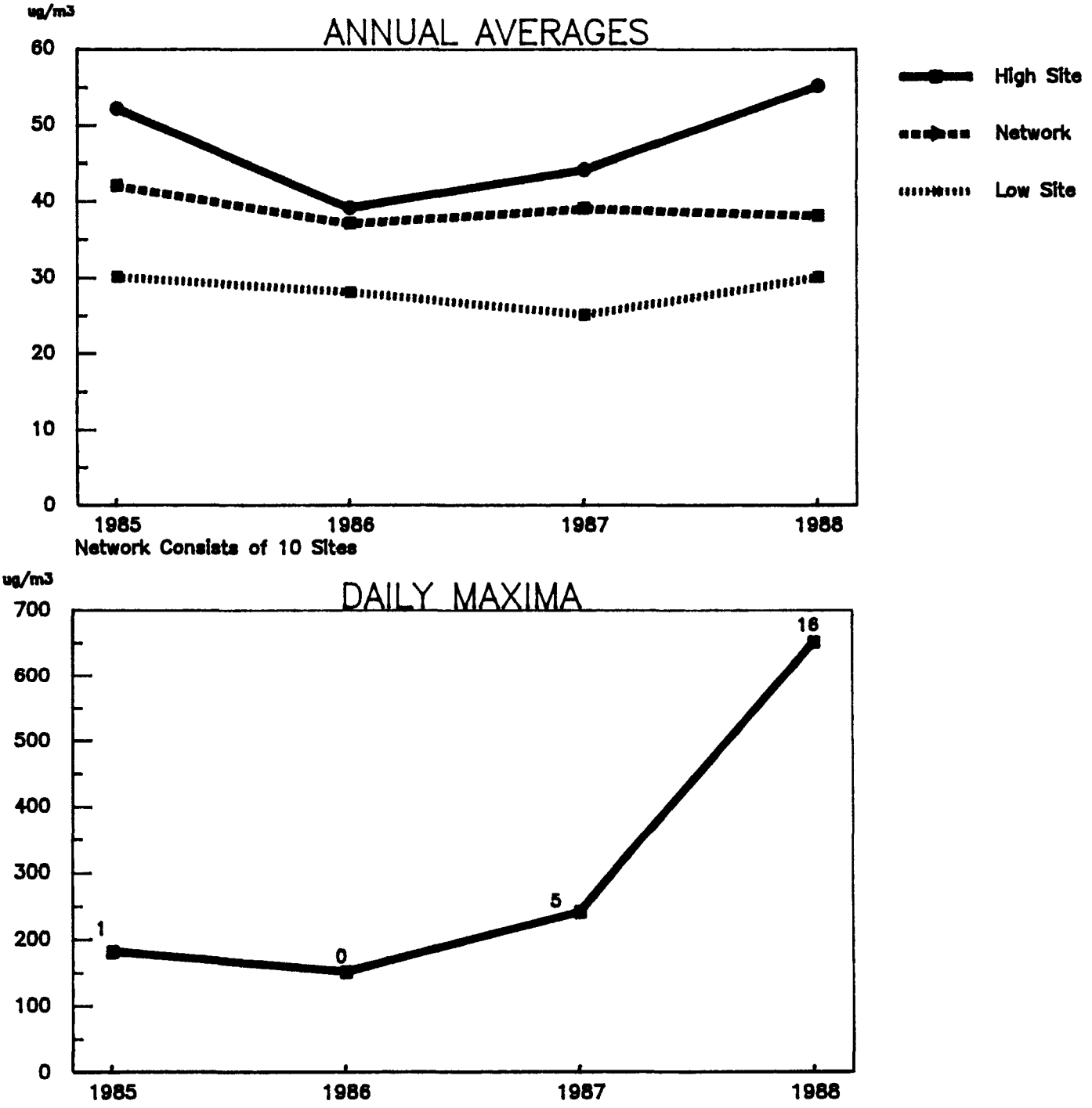


Figure 7–19. Allegheny County 4–Year PM–10 Trends, 1985–1988.

PM-10 monitoring began in 1985, with most of the monitors initiated around mid-year. In 1988 all sites were in attainment with the 50 ug/m^3 annual standard. Attainment is based on the average of the past three annual averages. Liberty Boro at 45 ug/m^3, had the highest 3-year average. Liberty's 1988 average, however, was 53 ug/m^3, which was the second time since monitoring began that an annual average exceeded 50 ug/m^3 (Braddock averaged 51 ug/m^3 in 1985).

Liberty also had the greatest increase from 1987 (18%). Six other sites had an increase, the largest of which was 15% at Duquesne. Three sites showed a decrease. Avalon's 12% was the largest. Liberty incurred 16 exceedances of the 150 ug/m^3 daily standard in 1988. No other site had any. The largest value at a site other than Liberty was 132 ug/m^3 at Braddock and North Braddock.

Liberty's maximum exeedance of 632 ug/m^3 occurred on the day of coke oven venting at the Clairton Coke Works. In comparison, the second largest exceedance was 255 ug/m^3.

In 1987, Liberty had one exceedance. Four other sites had one exceedance each, all on November 8th. This was during nearby West Virginia forest fires, and these were the only monitors operating on that day.

In early November 1987, a series of forest fires occurred in West Virginia and in five other Southern states. The worst fires were located in southern West Virginia along the Kentucky border where nearly 150,000 acres were ravaged by the fires. Due to southwesterly winds, smoke from these fires blanketed Southwestern Pennsylvania including Allegheny County. On November 8, all four Allegheny PM-10 monitors exceeded the 150 ug/m^3 standard. PM-10 concentrations at the four sites ranged from 164 to 231 ug/m^3. On November 9, a change of wind direction and light rain cleared southwestern Pennsylvania of the smoke and haze. PM-10 levels dropped to 54 ug/m^3 at the Braddock station on November 9 (was 231 ug/m^3 on November 8). All four stations recorded PM-10 concentrations from 10-11 ug/m^3 on November 11.

At the present time, Allegheny County has petitioned EPA to have these four exceedances of the standard flagged in the data base in accordance with the "Guidelines of the Identification and Use of Air Quality Data Affected by Exceptional Events."

Four-year average trends are fairly flat except for the high site, which has relatively large increases since 1986. Daily maxima and exceedances also show sharp increases since 1986, when there were no exceedances (Figure 7-19). The steep rise in daily maximum from 1987 to 1988 was due to the exceptionally large exceedance of March 11 at Liberty.

Average PM-10 trends for Allegheny County are characterized by thirteen (13) sites for the period 1983-1988.

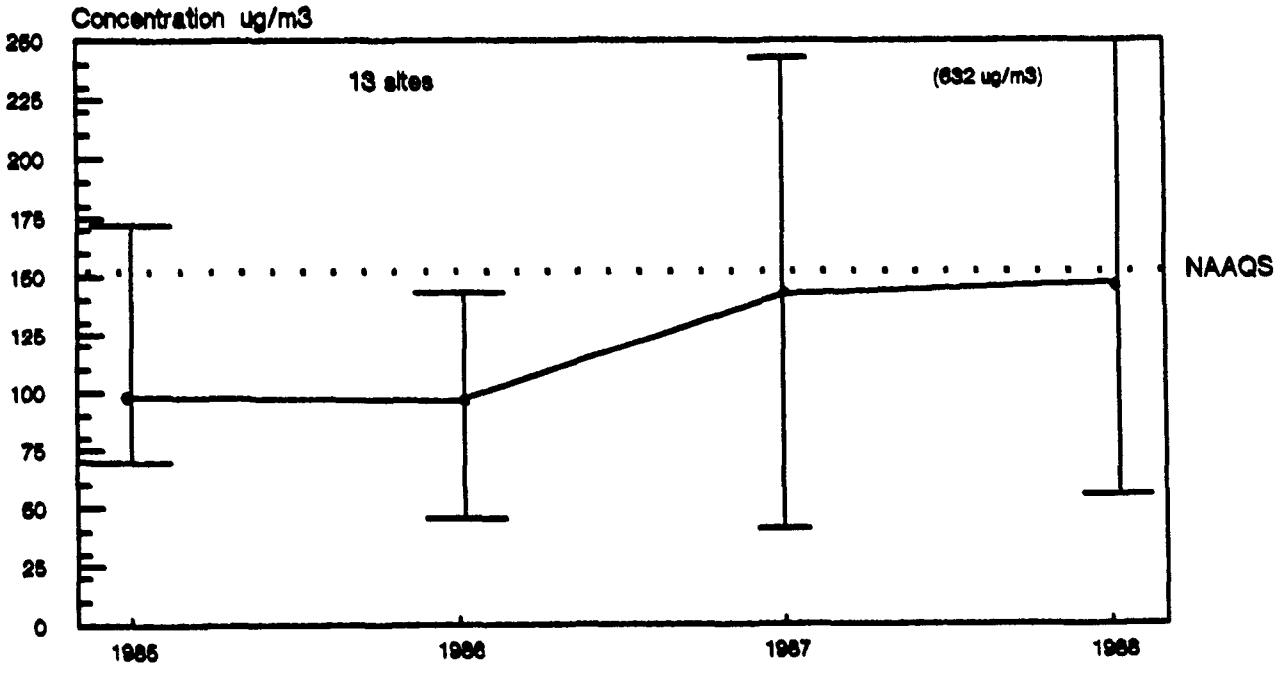


Figure 7-20 Trend in the composite mean and range for the maximum 24-hour PM-10 concentration, Allegheny County, 1983-1988.

7.3.6 CITY OF PHILADELPHIA

Total suspended particulate levels show a long term downward trend since 1965 when the annual geometric mean was nearly 125 ug/m^3. Since 1983 TSP levels have been in the 50-55 ug/m^3 range. The long term reduction reflects both emission regulations and the decrease use of coal as fuel.

Average air quality trends for TSP are characterized by fourteen (14) sites for the period 1983-1988.

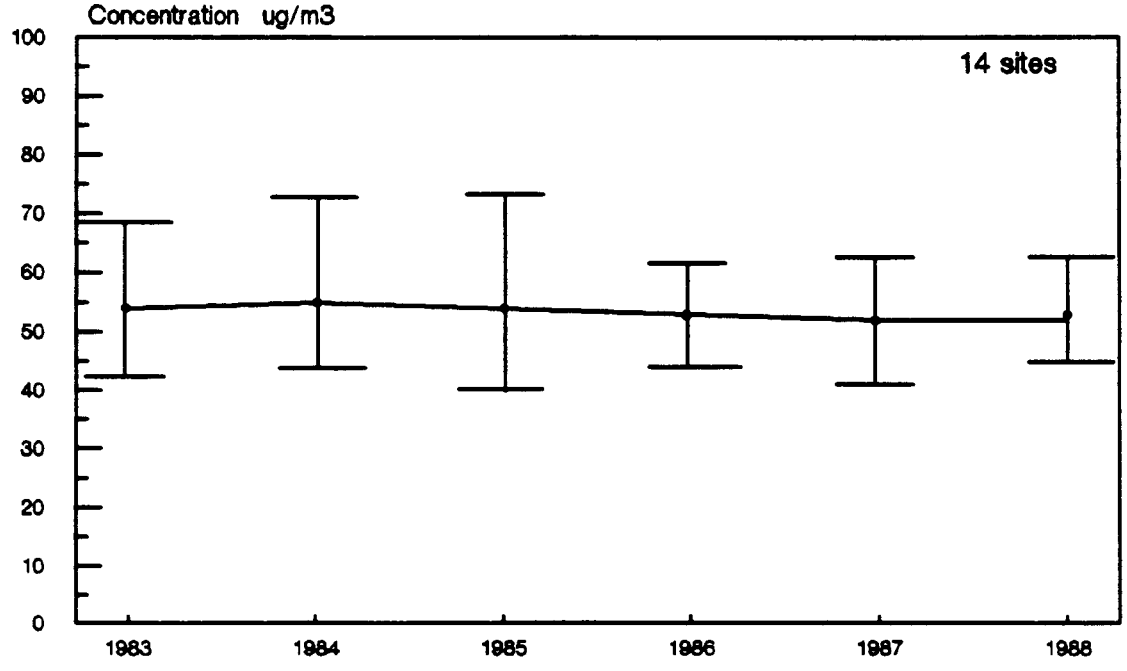


Figure 7-21 Trend in the composite average and range of the annual geometric mean total suspended particulate concentration, City of Philadelphia, 1983-1988.

Monitoring for PM-10 began in 1985 with 4 sites located throughout the city. The composite mean and range for the highest 24 hour value (ug/m^3) has shown a downward trend since the start of monitoring with no violation of the NAAQS.

Average trends for PM-10 are characterized by four (4) sites for the period 1983-1988.

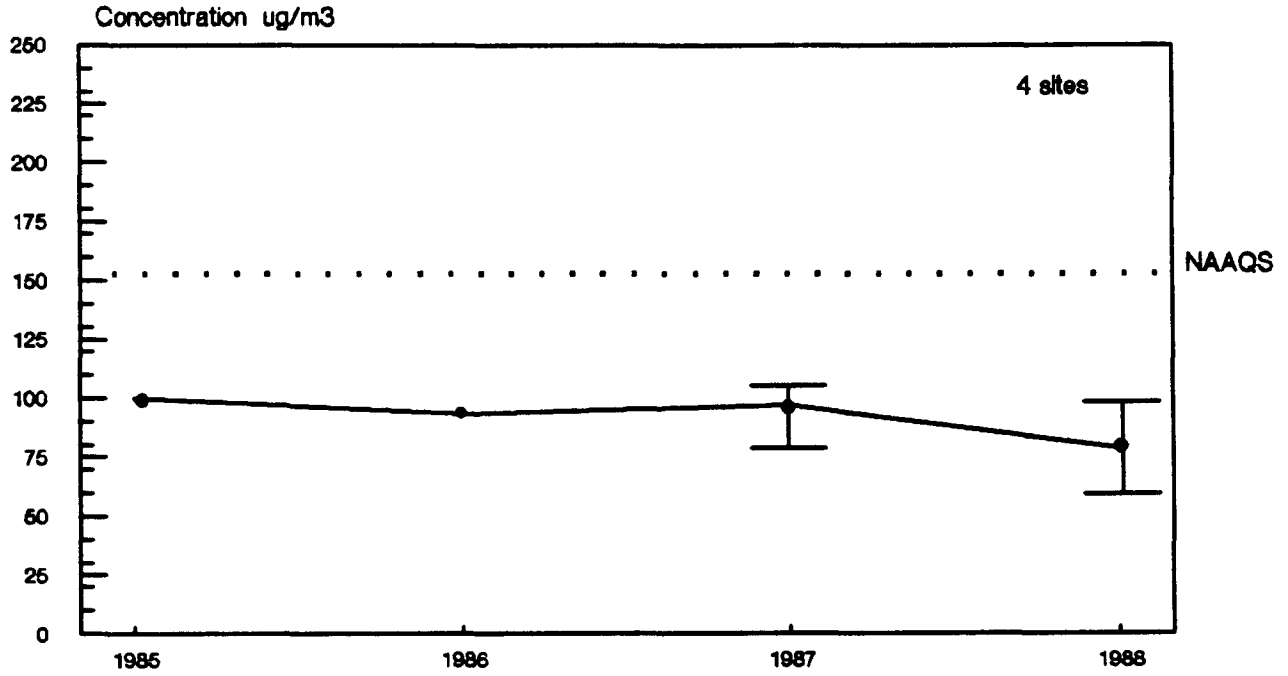


Figure 7-22 Trend in the composite mean and range for the maximum 24-hour PM-10 concentration, City of Philadelphia, 1983-1988.

7.3.7 COMMONWEALTH OF VIRGINIA

The state ambient air quality standard for TSP was exceeded at two sites, Ironto, Montgomery County, and Kimballton, Giles County in 1988. Both sites are influenced by fugitive dust.

Average air quality trends for TSP are characterized by 62 sites for the period 1983-1988.

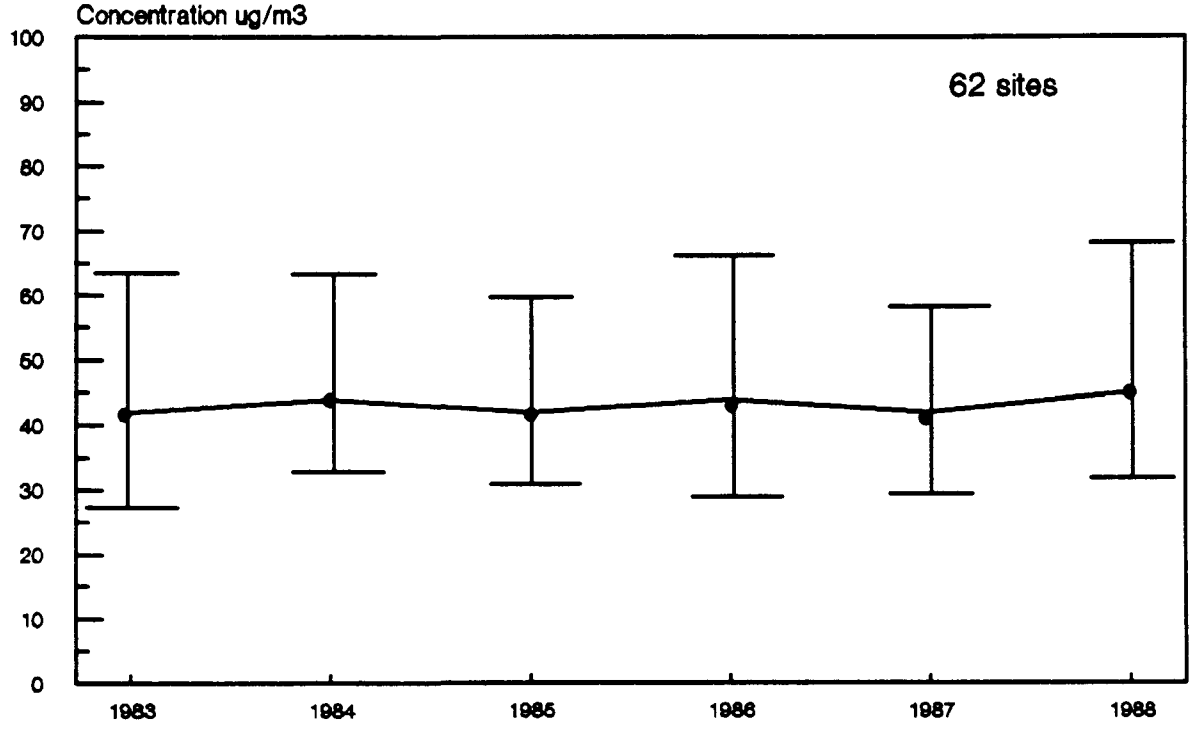


Figure 7-23 Trend in the composite average and range of the annual geometric mean total suspended particulate concentration, Commonwealth of Virginia, 1983-1988.

PM-10 monitoring began in the Commonwealth in 1985. All PM-10 monitoring sites in the Commonwealth are in compliance with the NAAQS.

Average PM-10 trends are characterized by thirteen (13) sites for the period 1983-1988.

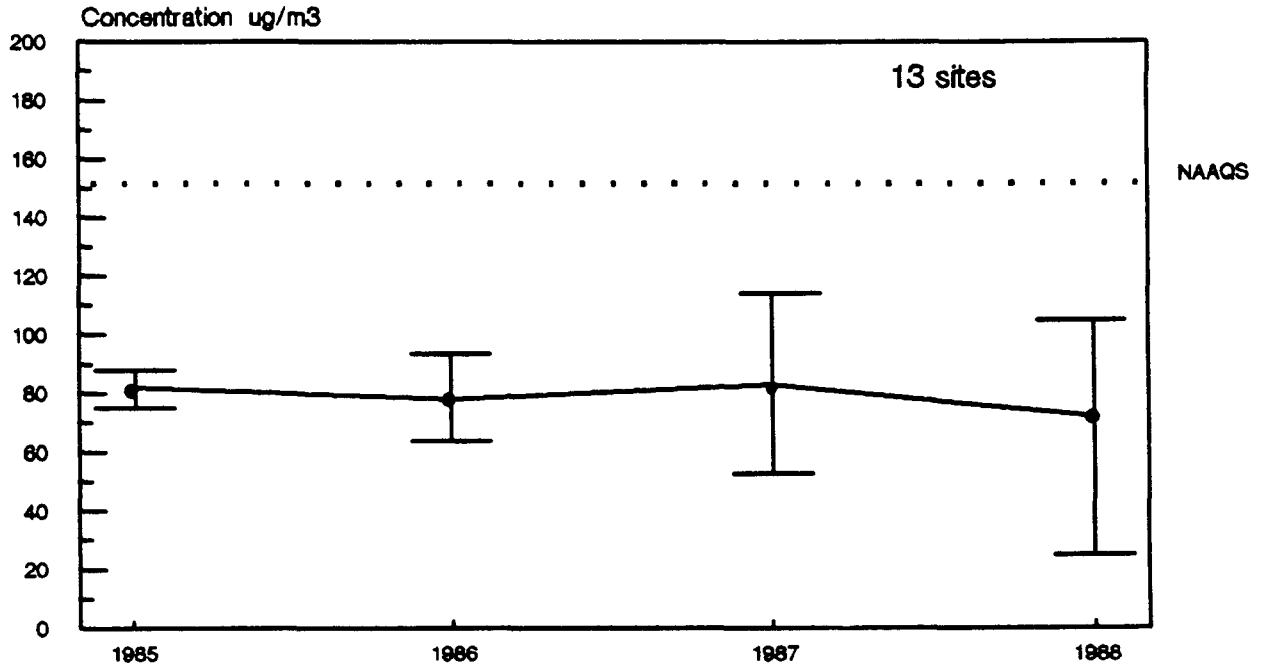


Figure 7-24 Trend in the composite mean and range for the maximum 24-hour PM-10 concentration, Commonwealth of Virginia, 1983-1988.

7.3.8 STATE OF WEST VIRGINIA

Total suspended particulate has declined somewhat during the period 1983-1988 with all sites below the national standard.

As shown in Figure 7-27, there have been only small changes in the annual levels of total suspended particulate in the State of West Virginia. The variations in annual levels of TSP are primarily the result of annual variations in rainfall. Industrial emissions of particulate have decreased only slightly in West Virginia during 1983-88.

A comparison of total suspended particulate matter annual geometric means and maximum observed values for 1988 and 1965 (1967 in some cases) depict the particulate reduction throughout the state (see Figures 7-25 and 7-26).

Average total suspended particulate trends for the period 1983-1988 are characterized by 28 sites.

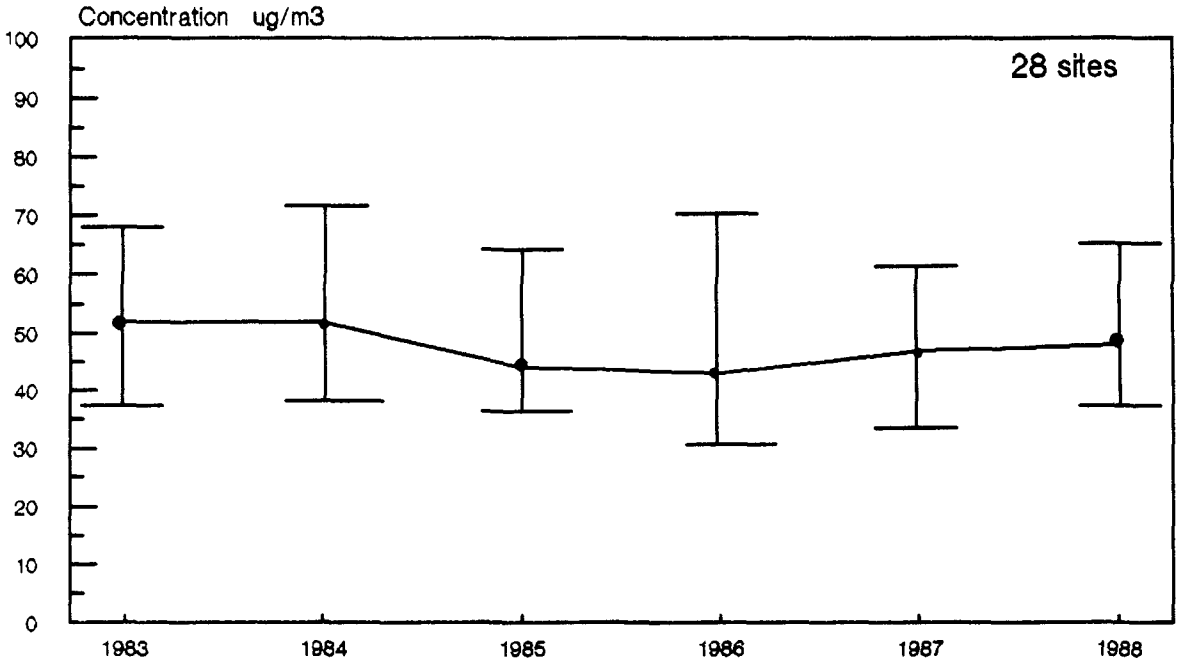


Figure 7-27 Trend in the composite average and range of the annual geometric mean total suspended particulate concentration, State of West Virginia, 1983-1988.

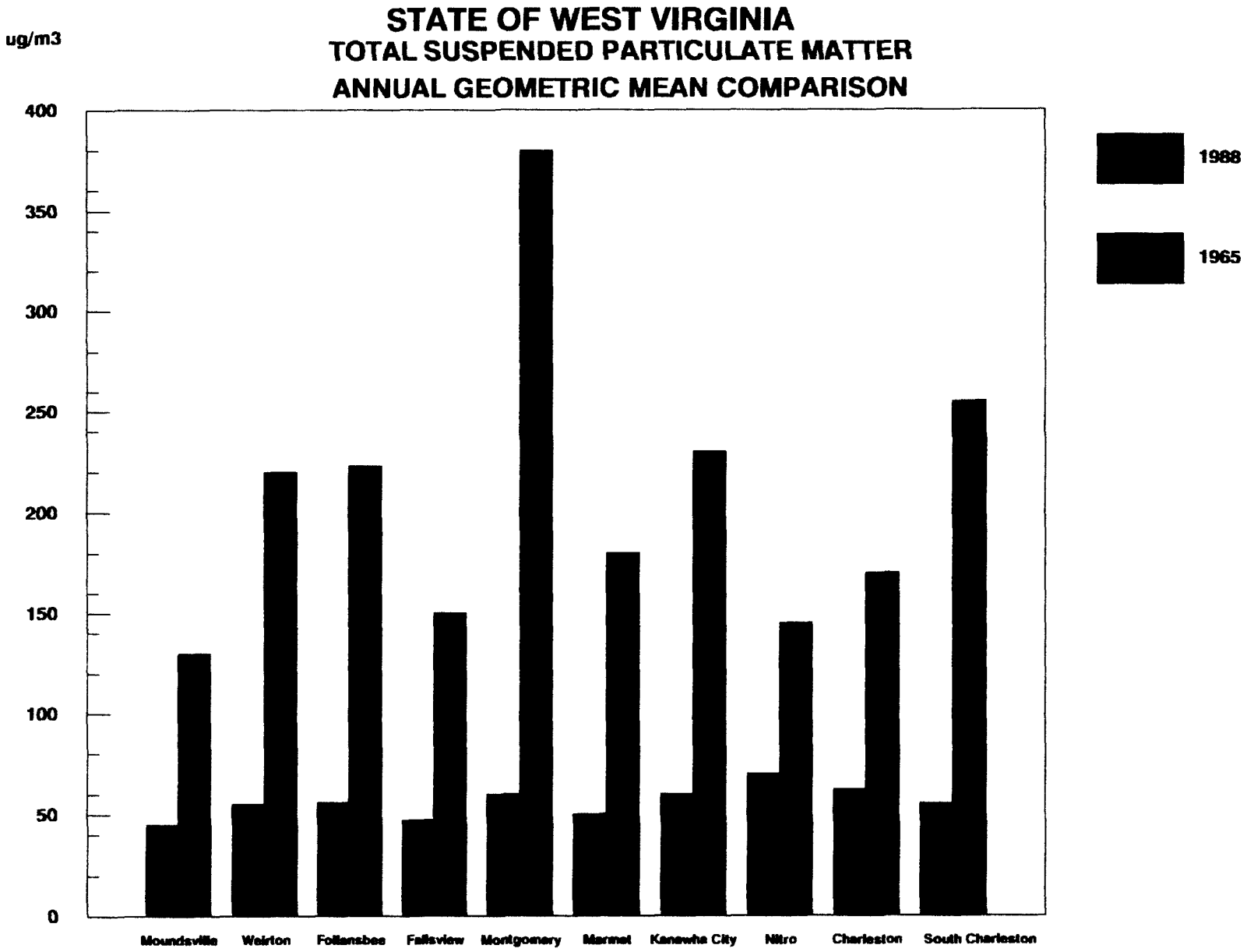

STATE OF WEST VIRGINIA
TOTAL SUSPENDED PARTICULATE MATTER
ANNUAL GEOMETRIC MEAN COMPARISON
ug/m3
400
350
300
250
200
150
100
50
0
1988
1965
Moundsville
Weirton
Follansbee
Fallsview
Montgomery
Marmet
Kanawha City
Nitro
Charleston
South Charleston

Figure 7-25.

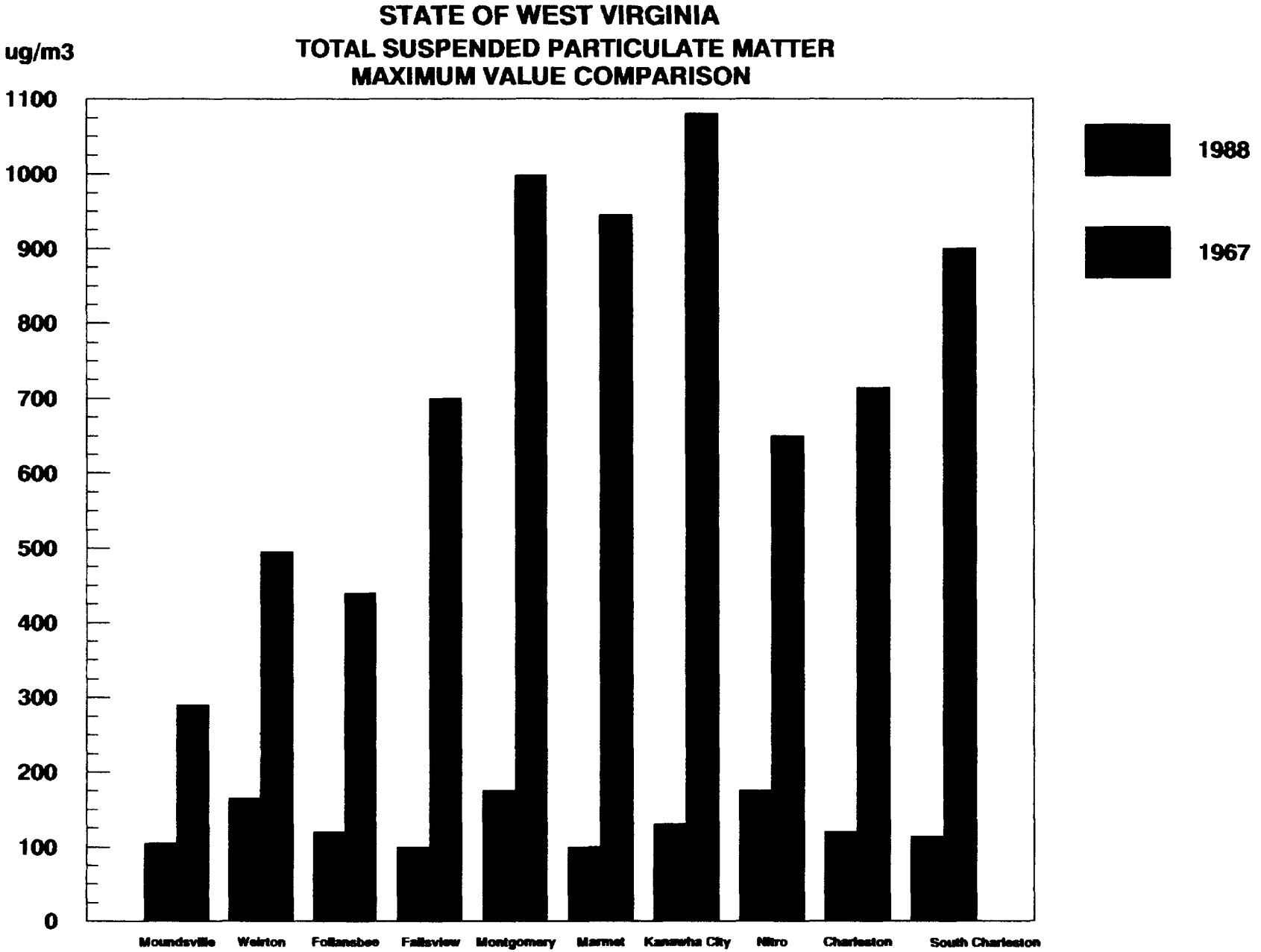

STATE OF WEST VIRGINIA
TOTAL SUSPENDED PARTICULATE MATTER
MAXIMUM VALUE COMPARISON
ug/m3
1100
1000
900
800
700
600
500
400
300
200
100
0
1988
1967
Moundsville
Weirton
Follansbee
Fallsview
Montgomery
Marmet
Kanawha City
Nitro
Charleston
South Charleston

Figure 7-26.

The four (4) PM10 monitoring sites were placed in operation in 1984 at the TSP stations that detected the highest particulate levels within the State. Three (3) of the sites are in the Wheeling Panhandle where heavy industry is located.

Figure 7-28, which shows the PM10 levels at the four monitoring sites, represents worst case exposure to particulate primarily in areas near large industrial sources in the Wheeling Panhandle. The highest levels were detected at the monitoring station in Weirton, WV.

Average PM10 trends for the period 1983-1988 are characterized by four(4) sites.

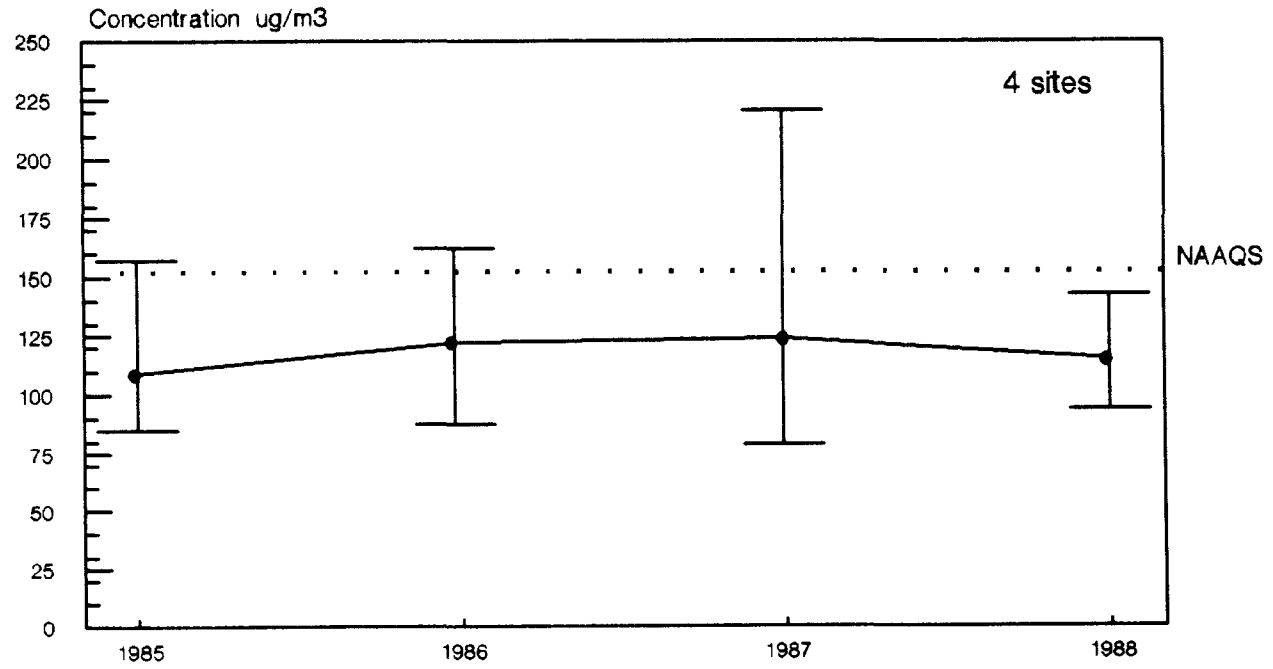


Figure 7-28 Trend in the composite mean and range for the maximum 24-hour PM-10 concentration, State of West Virginia, 1983-1988.

7.4 EMISSION TRENDS

. Nationwide TSP emission trends show a 23 percent decrease from 1978 to 1987 which matches the TSP air quality improvement for this period. Emission decreases occurred primarily because of reductions in industrial sources, installation of control equipment and reduced activity in some industries, i.e. iron and steel.

7.5 COMMENTS

Recent trends throughout the country have been very flat, with slight changes such as the 1984-85 decrease and the 1986-87 increase likely due to changes in meteorological conditions such as precipitation. The increase in particulate emissions from 1986 to 1987 results from increased forest fire activity in 1987.

7.6 WORTH NOTING

On July 1, 1987, EPA promulgated new standards for particulate matter using a new indicator, PM-10, rather than TSP. PM-10 focuses on those particles with aerodynamic diameters smaller than 10 micrometers, which are likely to be responsible for adverse health effects because of their ability to reach the thoracic or lower regions of the respiratory tract. PM-10 networks are now being deployed but do not as yet have sufficient historical data for long term trends analysis.

8.0 TRENDS IN LEAD

This section will describe and characterize the air quality status and trends for lead.

Following a discussion on characteristic and sources of the pollutant, health effects and national air quality status, regional trends for lead will be discussed on a state by state basis. Methods of presentation include:

- Graphs to depict lead trends for the composite mean and range for the highest average quarterly arithmetic mean

- Graphs that show trends for lead by site (Maryland) and by air basin (Pennsylvania)

8.1 CHARACTERISTICS AND SOURCES OF THE POLLUTANT

The primary sources of lead in the air are from stationary sources and vehicles burning leaded fuel. Stationary sources which emit lead into the air include primary and secondary lead smelters, primary copper smelters, lead gasoline additive plants, lead-acid storage battery manufacturing plants and lead-acid battery reclamation plants.

In response to growing evidence that lead in the ambient air caused anemia and other blood disorders, EPA set an ambient standard for lead. The phase down of lead in gasoline, the introduction of unleaded gasoline in 1975 for use in automobiles equipped with catalytic control devices, automobile emission control programs and reductions in emissions from stationary sources are all responsible for the reduction in airborne lead levels.

8.2 EFFECTS

Lead is a highly toxic metal when ingested or inhaled and accumulates in the body in blood, bone and soft tissues. Since it is not readily excreted, lead also affects the kidneys, nervous system and blood-forming organs. Exposure to excessive amounts may cause neurological impairments such as seizures and mental retardation. Infants and children are particularly susceptible to the effects of high lead levels.

8.3 AIR QUALITY TRENDS

Two air pollution control programs implemented by EPA before promulgation of the lead standard in October 1978 have resulted in lower ambient lead levels. First, regulations issued in the early 1970's required gradual reduction of the lead content of all gasoline over a period of many years. Second, unleaded gasoline was introduced in 1975 for automobiles equipped with catalytic control devices. These devices reduce emissions of carbon monoxide, volatile organics and nitrogen oxides. In 1987 unleaded gasoline sales accounted for 76 percent of the total gasoline market. Additionally, lead emissions from stationary sources have been substantially reduced by control programs oriented toward attainment of the particulate and lead ambient standards. The overall effect of these three control programs has been a major reduction in the amount of lead in the ambient air.

- Nationally, ambient lead levels, measured at 97 trend sites, declined 88 percent between 1978 and 1987, which is a direct reflection of the estimated 94 percent reduction in lead emissions.

8.3.1 STATE OF DELAWARE

The State of Delaware is in attainment with the NAAQS for lead with levels well below the national standard.

Average air quality trends for lead are characterized by two (2) sites for the period 1983-1988.

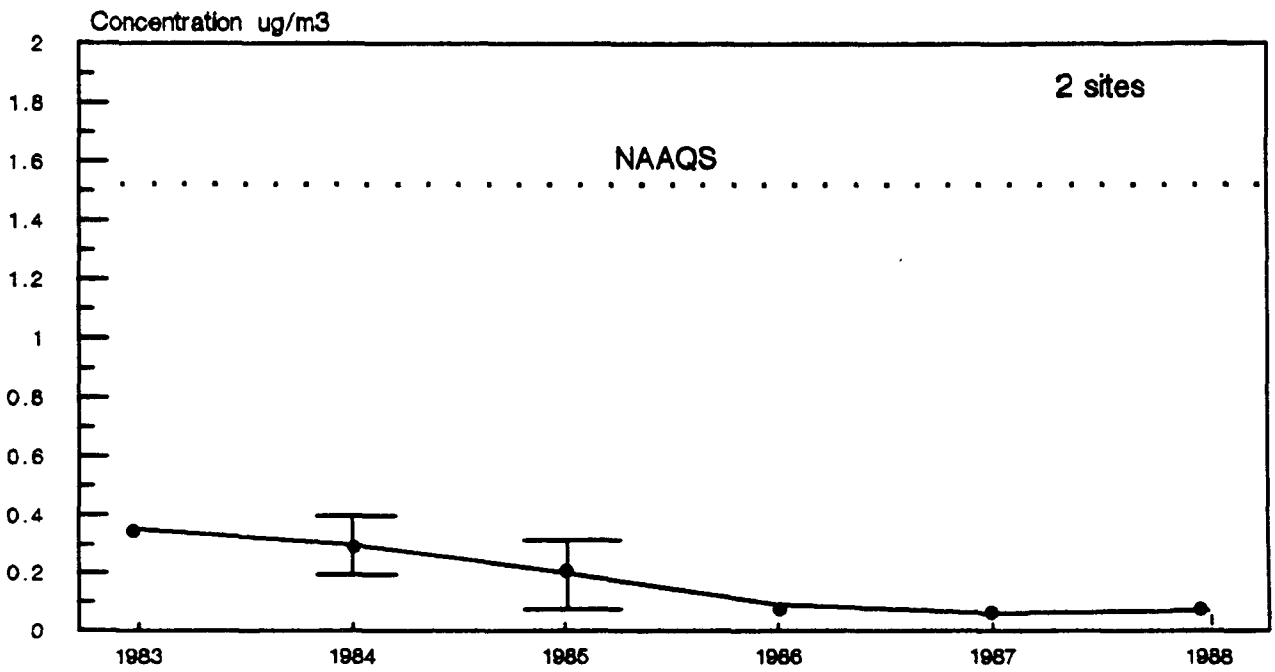


Figure 8-1 Trend in the composite mean and range for the maximum quarterly arithmetic mean lead concentration, State of Delaware, 1983-1988.

8.3.2 DISTRICT OF COLUMBIA

The District of Columbia is in compliance with the NAAQS for lead with levels well below the national standard.

Average air quality trends for lead are characterized by two (2) sites for the period 1983-1988.

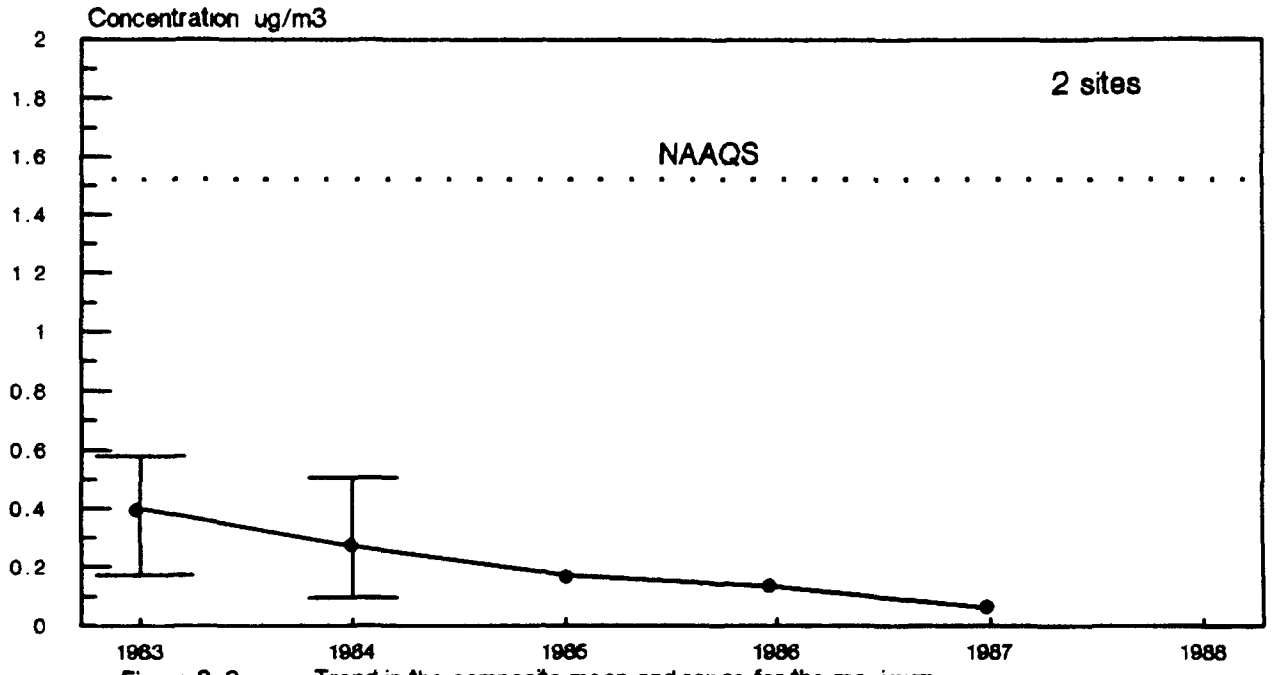


Figure 8-2 Trend in the composite mean and range for the maximum quarterly arithmetic mean lead concentration, District of Columbia, 1983-1988.

8.3.3 STATE OF MARYLAND

The present Maryland monitoring network consists of five sites in the Baltimore metropolitan area and one in the Washington area. Lead levels in Maryland have been steadily decreasing, paralleling the reduced usage of leaded gasoline. Present levels are 2 - 6% of the ambient standard.

Specific lead trends for six (6) sites are shown in Figure 8-4.

Average air quality trends for lead are characterized by six (6) sites for the period 1983-1988.

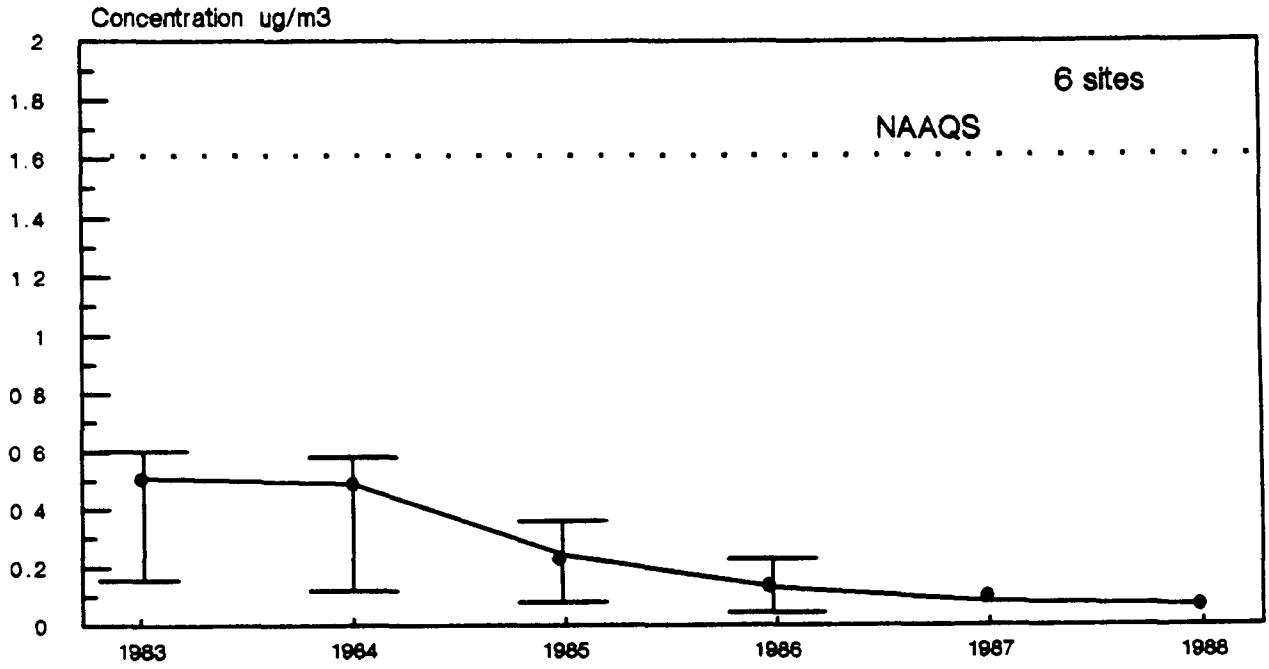
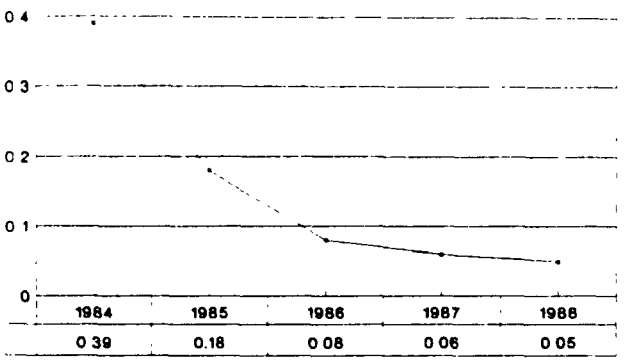


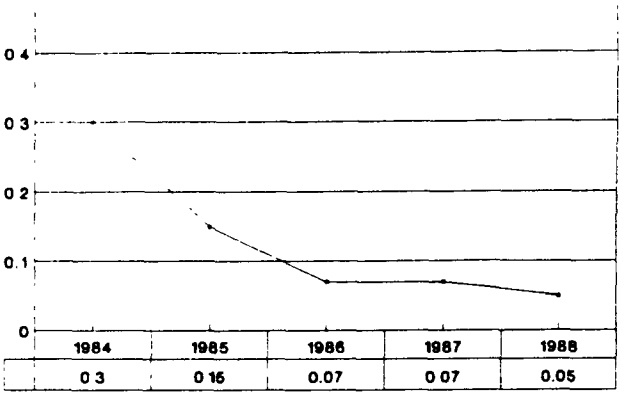
Figure 8-3 Trend in the composite mean and range for the maximum quarterly arithmetic mean lead concentration, State of Maryland, 1983-1988.

STATE OF MARYLAND
LEAD
MICROGRAMS PER CUBIC METER
1984____1988

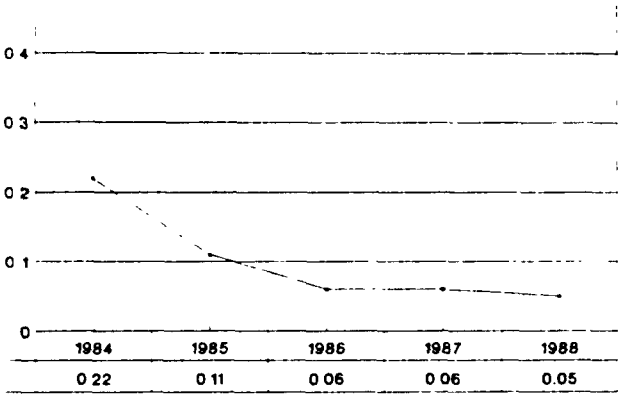
Figure 8-4



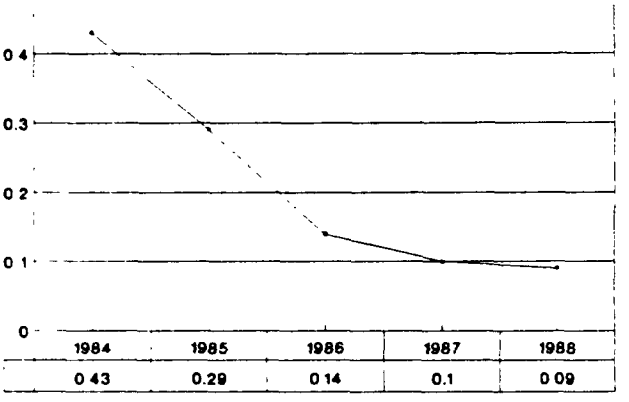
I-95



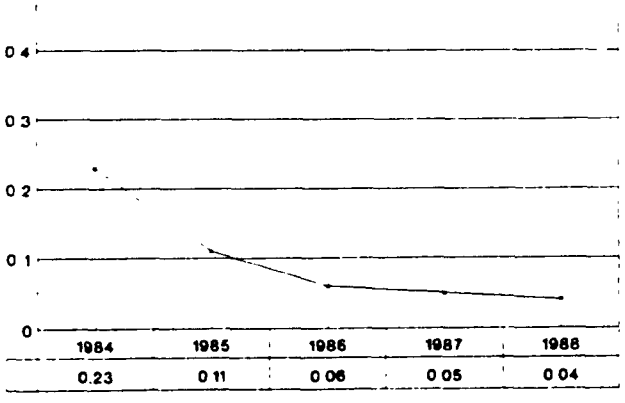
ALLEGANY PEPSI



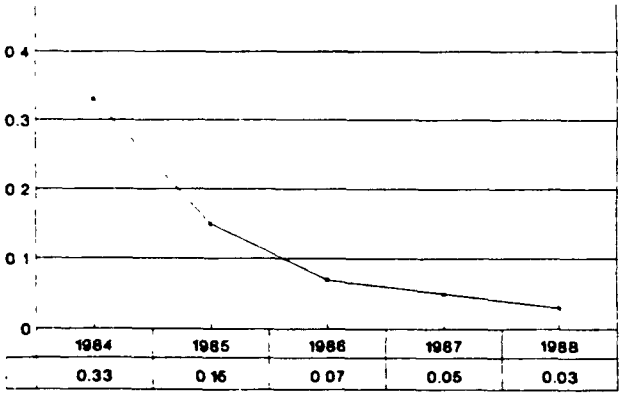
GUILFORD AVE



SOUTH EAST POLICE STATION



SOUTH WEST POLICE STATION



CHEVERLY

8.3.4 COMMONWEALTH OF PENNSYLVANIA

Lead trends are shown in Figure 8-6 for the years 1979 to 1988. The dashed lines represent the quarterly mean standard of 1.5. ug/m^3 on these graphs. Lead levels have shown little improvement over the last 2 years after the initial dramatic improvements due to the use of lead-free gasoline. The particulate lead standard was not exceeded at any monitoring site in 1988. The Laureldale site in Berks County continues to show a dramatic improvement since 1984, with levels dropping 63 percent as a result of increased industrial controls. The Palmerton site in Carbon County is experiencing a significant increase in lead levels since 1985 due to an industrial source in the area.

Average air quality trends for lead are characterized by four (4) sites for the period of 1983-1988.

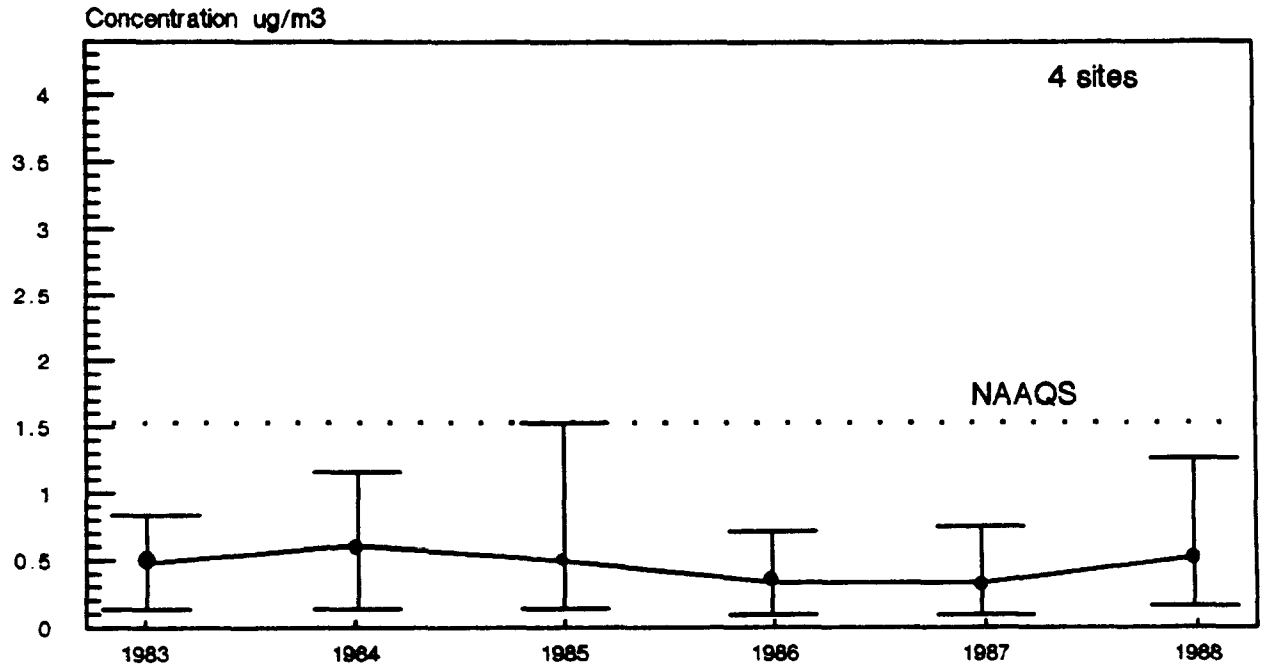


Figure 8-5 Trend in the composite mean and range for the maximum quarterly arithmetic mean lead concentration, Commonwealth of Pennsylvania, 1983-1988.

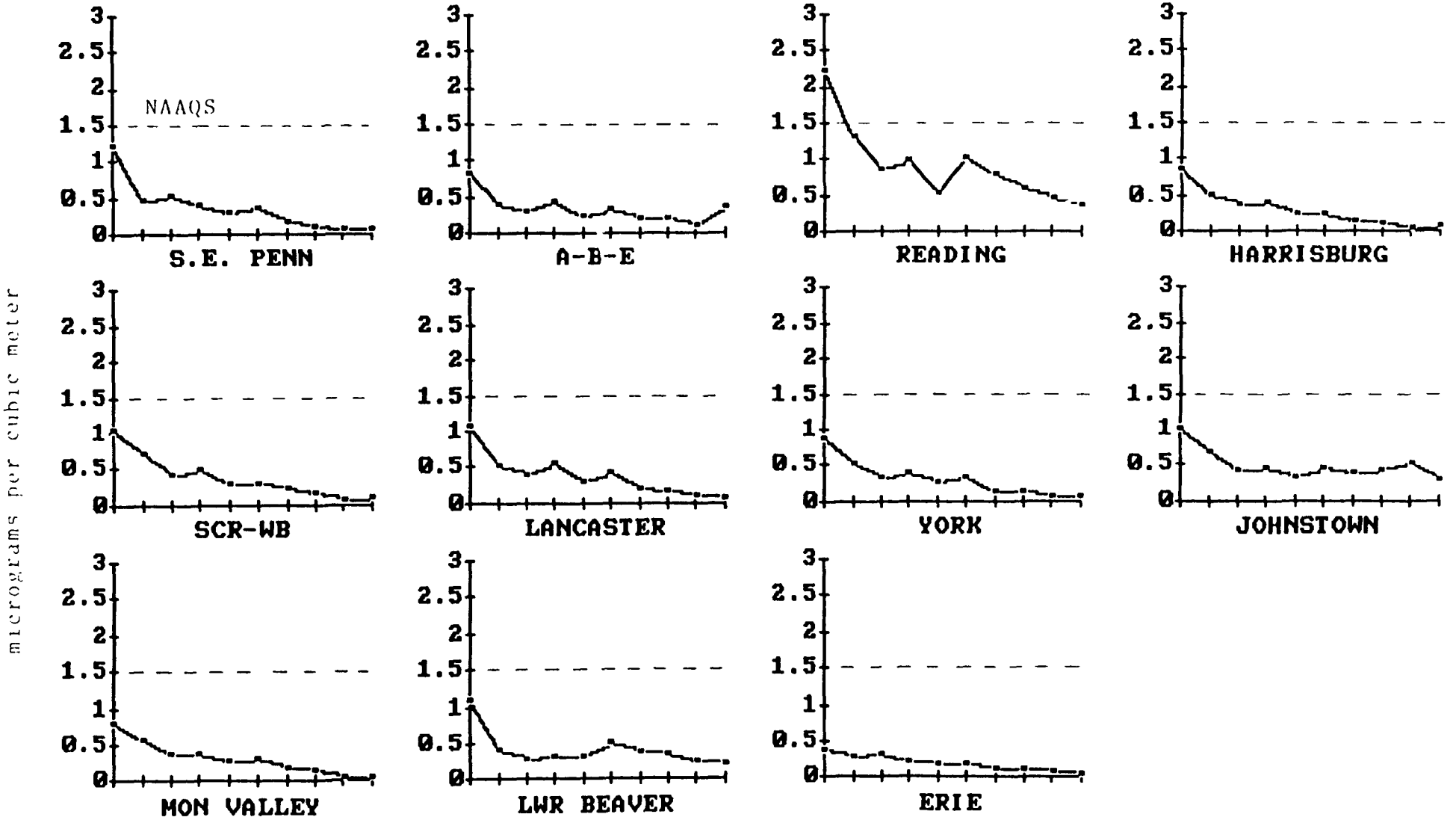


Figure 8-6 Trend in the maximum quarterly mean lead concentration, Commonwealth of Pennsylvania, 1979-1988.

8.3.5 ALLEGHENY COUNTY

All quarterly lead averages for the past five years are below the 1.5 micro gram per cubic meter (ug/m^3) standard. The highest quarterly average in 1988 was 0.20 ug/m^3 at Braddock. The highest daily value in 1988 was 0.85 ug/m^3 also at Braddock.

Average air quality trends for lead are characterized by three (3) sites for the period 1983-1988.

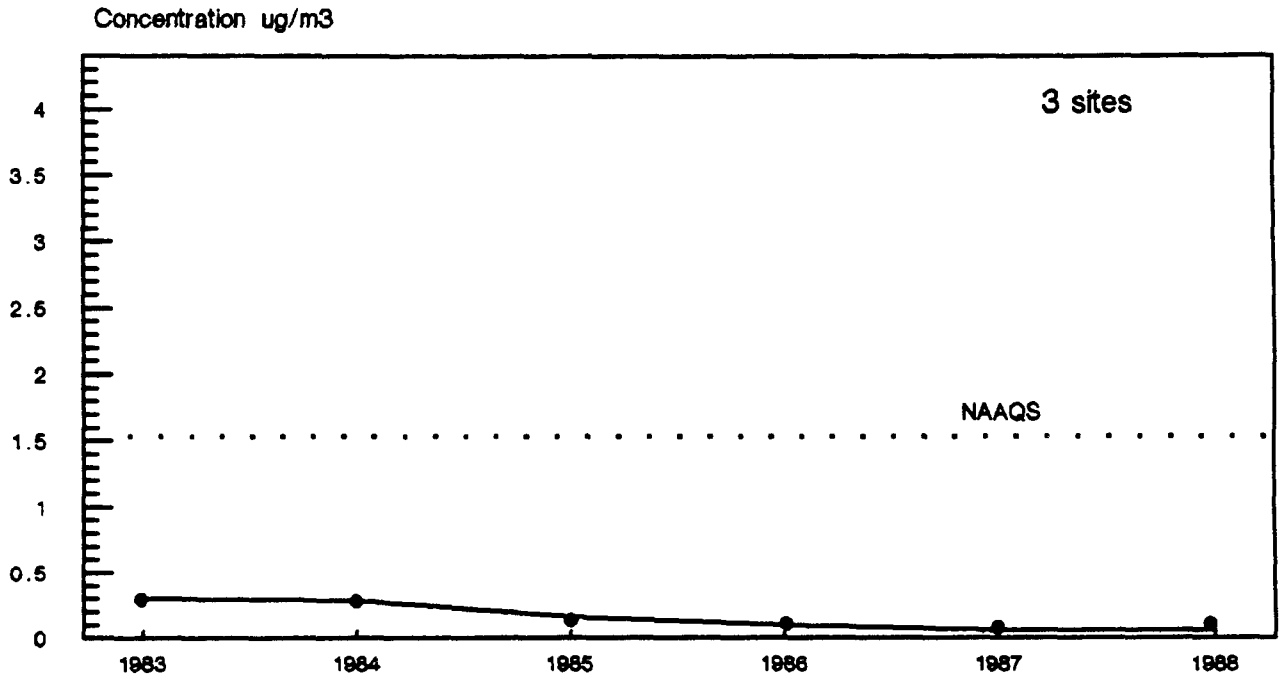


Figure 8-7 Trend in the composite mean and range for the maximum quarterly arithmetic mean lead concentration, Allegheny County, 1983-1988.

8.3.6 CITY OF PHILADELPHIA

Lead shows a continuous downward trend at most sites to well below the ambient standard. This is mainly due to the reduction of lead in gasoline. The AFS monitoring site has shown recent ambient levels above the standard. This site is located near a major stationary source of lead which is currently under a compliance agreement to reduce lead emissions from its operations. The NET site also showed an exceedance of the standard in 1986.

Average air quality trends for lead are characterized by five (5) sites for the period 1983-1988.

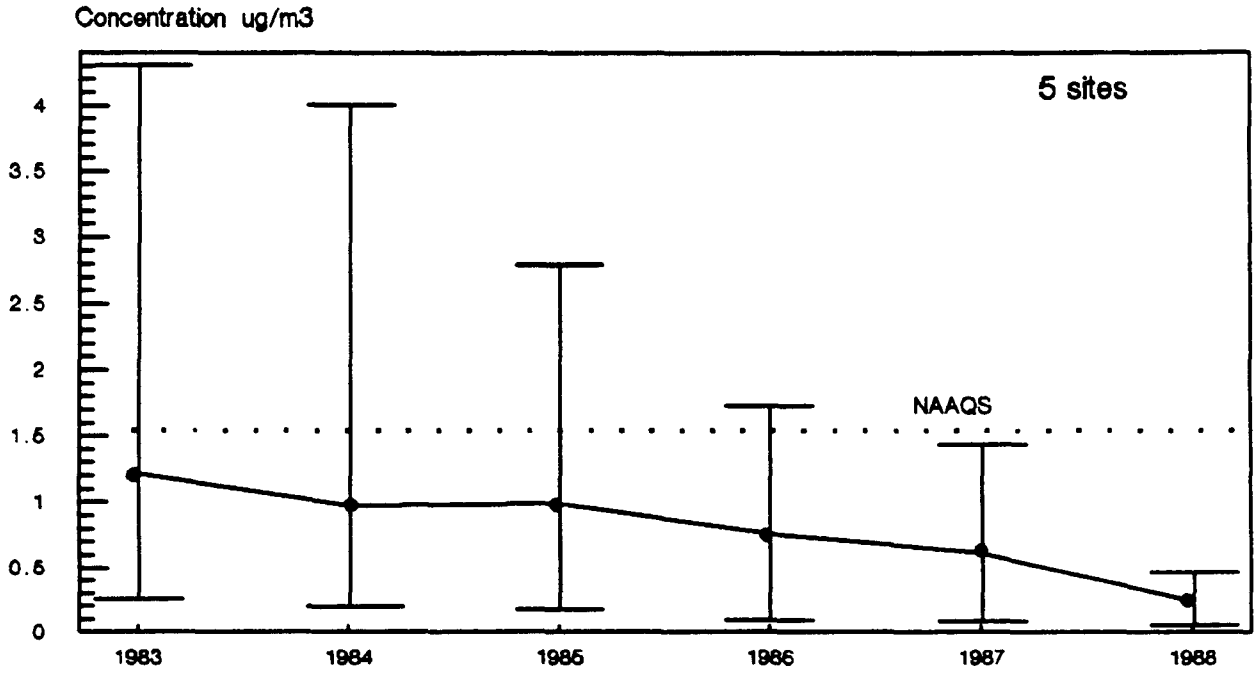


Figure 8-8 Trend in the composite mean and range for the maximum quarterly arithmetic mean lead concentration, City of Philadelphia, 1983-1988.

8.3.7 COMMONWEALTH OF VIRGINIA

The Commonwealth of Virginia is in compliance with the NAAQS for lead in all areas of the state. The State network of lead stations has shown a trend well below national standards for the past seven years.

Average air quality trends for lead are characterized by five (5) sites for the period 1983-1988.

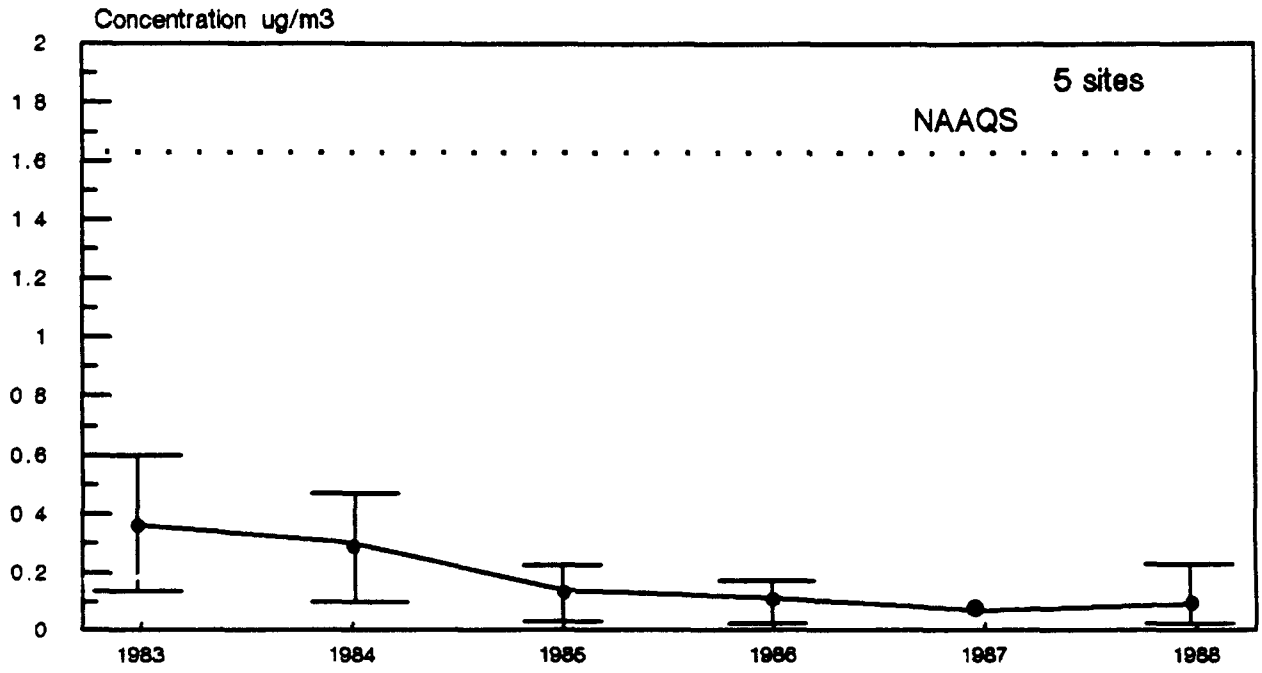


Figure 8-9 Trend in the composite mean and range for the maximum quarterly arithmetic mean lead concentration, Commonwealth of Virginia, 1983-1988.

8.3.8 STATE OF WEST VIRGINIA

Lead levels have been steadily decreasing in West Virginia since 1983. Lead trends are well below the national standard as monitored at eleven sites in the state.

Average lead trends are characterized by eleven (11) sites for the period 1983-1988.

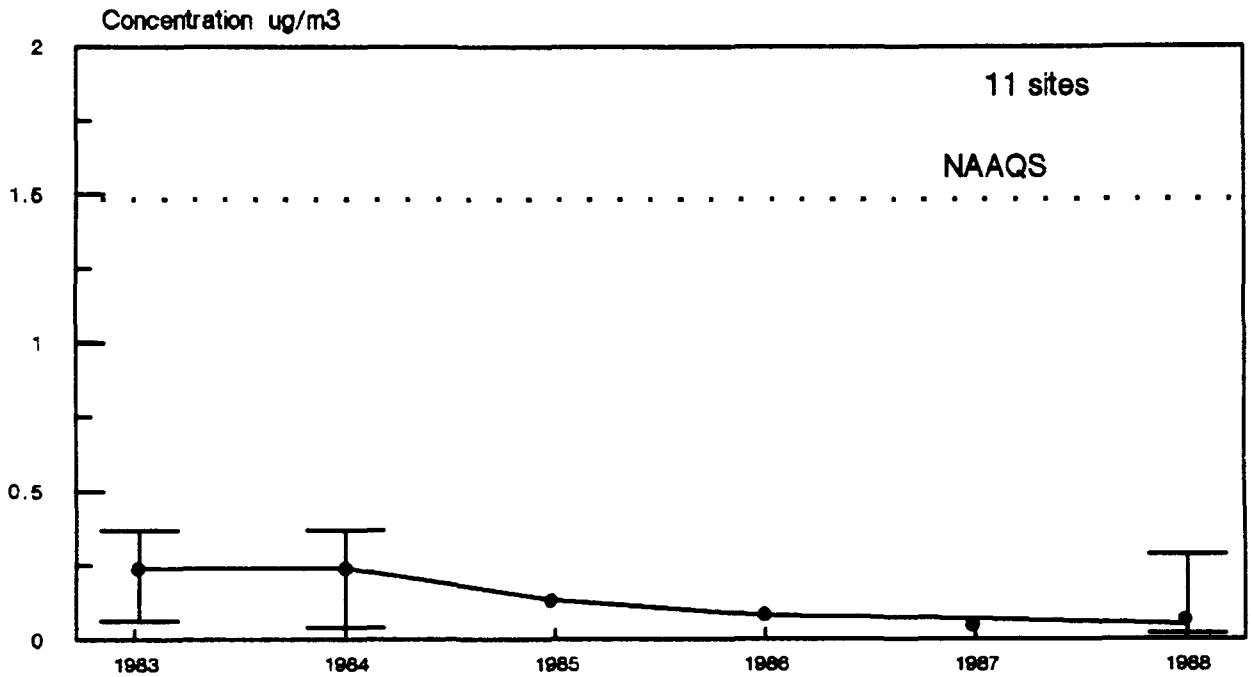


Figure 8-10 Trend in the composite mean and range for the maximum quarterly arithmetic mean lead concentration, State of West Virginia, 1983-1988.

8.4 EMISSION TRENDS

. Nationally, lead emissions declined 94 percent between 1978 and 1987.

. Reductions are due primarily to:

- Regulations issued in the early 1970's which resulted in reducing the Pb content of gasoline.

- Unleaded gasoline introduced in 1975 for use in automobiles equipped with catalytic control devices

- Most recently, the Pb content of the leaded gasoline pool was reduced from an average of 1.0 grams/gallon to 0.5 grams/gallon on July 1, 1985 and still further to 0.1 grams/gallon on January 1, 1986.

8.5 COMMENTS

As reflected in the data, Pennsylvania had at least one site that detected levels above the lead standard which was an auto battery salvage plant. Philadelphia had problems with emissions from a lead chemical plant which is now controlled and continues to have problems with lead emissions from a secondary (scrap) copper smelter where controls are to be in place during 1990.

8.6 WORTH NOTING

Ambient lead concentrations in urban areas throughout the country continue to decline because of both the increased usage of unleaded gasoline and the reduction of the lead content in leaded gasoline.

Prior to 1978 when leaded gasoline was used by most automobiles, the ambient lead levels in high traffic areas in major metropolitan areas customarily ranged from 20 percent below to 20 percent above the lead standard. In 1988, ambient lead levels near roadways are generally less than 10 percent of the standard.

9.0 OTHER MAJOR AIR QUALITY ISSUES

Historically, EPA has been concerned primarily with air pollutants such as ozone, sulfur dioxide, nitrogen oxides, carbon monoxide, lead and particulate matter. Following World War II technological advances have introduced thousands of new chemicals to the market which have the potential for release to the atmosphere during processing. Many of these chemicals are toxic to humans, causing cancer or other short and long-term effects.

In addition to air toxics, other major areas of concern are acid deposition, indoor air pollution, and global air quality problems. A brief discussion of these issues is presented in the following section of this report.

9.1 TOXICS AIR POLLUTANTS

In late 1984, the tragic chemical poisoning of thousands of people in Bhopal, India aroused public concern and stimulated congressional scrutiny over the potentially adverse health effects posed by exposure to toxic air pollutants. A large pool of sources emit toxic chemicals into our environment: a variety of industrial and manufacturing processes, chemical plants, refineries, sewage treatment plants, incinerators, motor vehicles, hazardous waste handling and disposal facilities, smelters, metal refineries, and combustion sources. Emissions from these sources can include such substances as lead, arsenic, chromium, cadmium, mercury, beryllium, and many toxic volatile organic compounds (VOC) such as vinyl chloride, benzene, and dioxins.

Most of the information on direct human health effects of airborne toxics come from studies of industrial workers where exposure is generally much higher than in the ambient air. Relatively little is known about the health effects of chronic exposure to most airborne toxics at low levels found in ambient air. Toxic air pollutants include large numbers of carcinogens and noncarcinogens for which no national or state ambient air quality standards have been established. The air toxics problem overlaps with particulate (PM) and VOC problems. The vast majority of toxic substances belong to the general categories of PM and VOC's. In general, the major contributors to annual cancer incidence tend to be small point and area sources and road vehicles (especially in urban areas).

The Clean Air Act requires the promulgation of National Emission Standards for Hazardous Air Pollutants (NESHAP) to control their emission levels which at very low amounts are dangerous. EPA has issued NESHAPs for seven hazardous air pollutants: asbestos, beryllium, mercury, vinyl chloride,

benzene, inorganic arsenic, and radionuclides. EPA is working on controls for other carcinogenic pollutants from several source categories. Because of the toxic, hazardous, or carcinogenic nature of these air contaminants, EPA has given NESHAPs implementation and enforcement one of the highest air program priorities. In addition to assessing risk and control options of these and many additional chemicals, the Agency is working with state and local governments to solve air toxic problems. Currently the Region has 97 active air pollution sources regulated under NESHAPs.

EPA Region III has worked with the regional states and local agencies to address the serious and expanding air toxics issue. Studies were conducted in Philadelphia, PA, Baltimore, MD and the Kanawha Valley, WV on the causes, impacts, and alternative solutions to toxic problems present in all media. Philadelphia was among the first cities in the country to adopt regulations for toxic air pollutants. Maryland and Virginia are currently implementing adopted regulations covering a wider range of pollutants. Maryland's regulations provide for a state-of-the-art health risk assessment for each pollutant. In addition, Delaware and West Virginia have proposed regulations which are presently undergoing public reviews. Allegheny County has also developed a regulation undergoing internal review.

EPA Region III is currently providing support to regional air agencies on identification of potentially high risk sources of air toxics through monitoring, analysis, and management of data, particularly from urban areas.

Air toxics control is one of EPA's highest priorities and the agency plans to move aggressively to assist state and local governments in their quest to develop their own program by such activity as:

- continue promulgation and enforcement of NESHAPs and mobile source regulations
- increase compliance with existing emission standards
- establish federal programs to identify and regulate air toxics from stationary and mobile sources
- enhancement of state and local programs by providing financial and technical support
- expand and improve air toxics monitoring programs: consistent sampling, measurement techniques, data reliability, etc.
- integrated approach to controlling cross-media toxic problems

KANAWHA VALLEY STUDY

In late 1984 the tragic chemical poisoning of thousands of people in Bhopal, India propelled the Kanawha Valley of West Virginia into the national limelight because of the heavy concentration of chemical manufacturing facilities located there. Public concern and congressional scrutiny intensified over the potentially adverse health effects posed by both high short-term, and low continuous exposure to a variety of toxic pollutants known to be present.

Part of Region III's response to this concern was to undertake a screening study of the health risks (primarily cancer) associated with long-term exposure of local residents to several unregulated chemicals present in Kanawha Valley. In cooperation with West Virginia, EPA examined exposures through air, drinking water, fish consumption, and ground water pathways with air receiving the most attention. The study was the first in the Valley to look not only at the levels of pollutants present, but to link these levels with possible community health risks using improved methods of risk assessment.

The results showed that in several cases the potential risks were sufficiently high to suggest action to be taken to reduce their levels. Study results have been used by area industries and the West Virginia Air Pollution Control Commission to target reduction in the amount of chemicals emitted into the air.

This study has served as a model for addressing other environmental issues requiring an integrated approach to problem solving and has provided Region III with an opportunity to communicate with the public about risk assessment concepts and results.

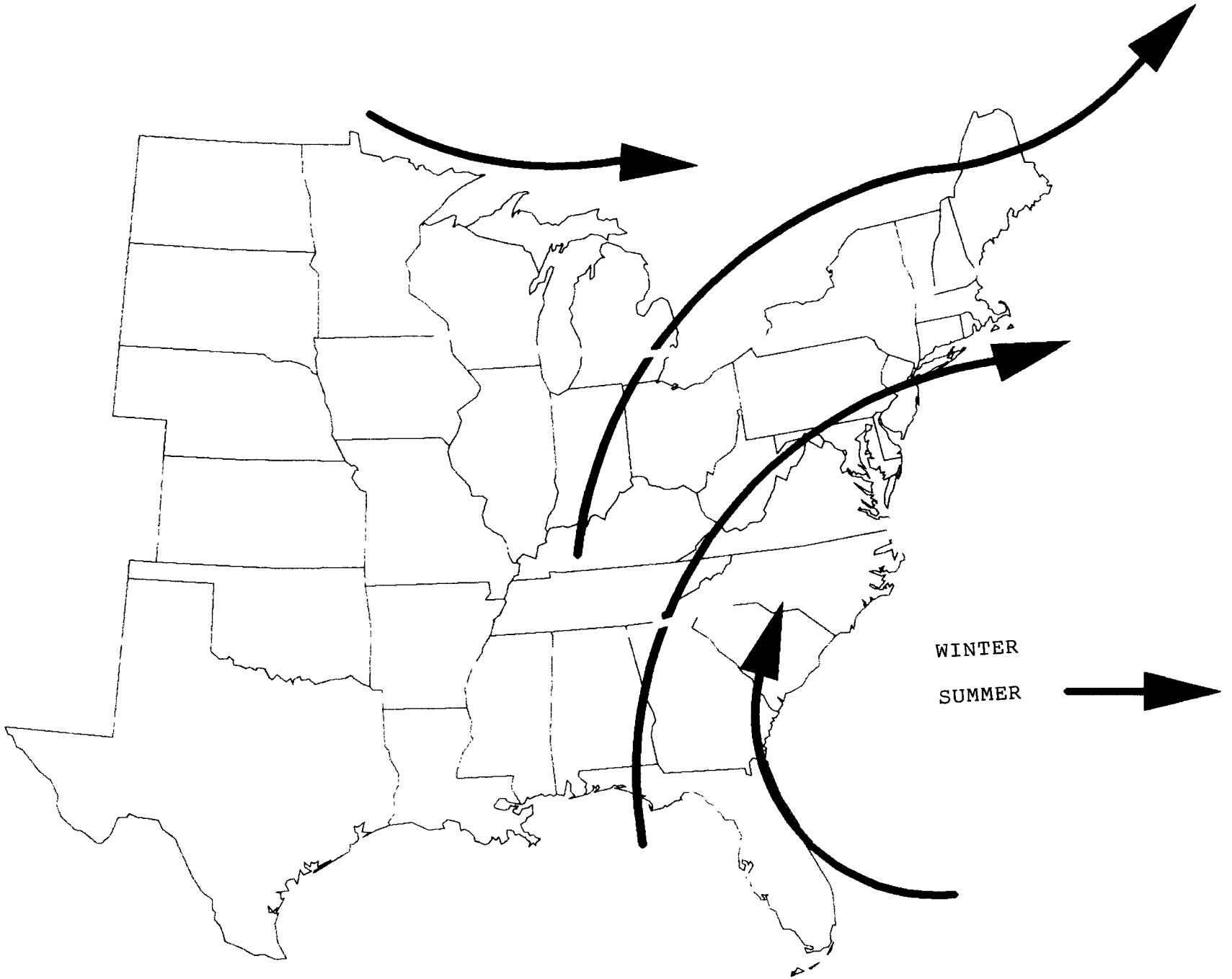


Figure 9-1. Wind patterns relevant to Acid Precipitation

9.2 ACID DEPOSITION

Acid deposition, a problem as complex as any that EPA has had to resolve, has no easy solution. Its fundamental nature is both scientific and political. Acid deposition refers to a chain of complex processes that begins with emissions of sulfur and nitrogen oxides primarily from coal burning power plants, motor vehicles, petroleum refining and other industrial processes. These compounds react with sunlight, water vapor and each other in the atmosphere to form acidic pollutants that fall to earth as acid rain. These compounds can also fall as dry deposition when they join airborne particles and may come to earth hundreds of miles from the source of contamination. Some efforts to improve local air quality by increasing stack heights have only aggravated the problem by pouring the noxious fumes high into the prevailing winds.

Acid precipitation thus evolves through four consecutive stages: sulfur and nitrogen emissions, long-range atmospheric transport, the chemical transformation of oxides into acid and finally, fallout of acidic pollutants to earth through rain, snow and dry deposition. Wind patterns relevant to acid precipitation in Region III are depicted in Figure 9-1.

Sulfur dioxide emissions are primarily concentrated along the Ohio River Valley in Indiana, Ohio, Pennsylvania, Illinois and West Virginia. These five states along with Missouri and Tennessee produce nearly 45% of all SO_2 in the United States. NOx emissions are more evenly distributed but again states along the Ohio River are especially high producers. Four out of five of the highest SO_2 producers (Ohio, Indiana, Pennsylvania, and Illinois) are also among the top ten NO_x producers. Thus, the Ohio River Valley and the states immediately adjacent to it lead the U.S. in emissions of both major components of acid rain.

Data collected by several different monitoring networks show that areas of the U.S. receiving the most acid rainfall are downwind and northeast of those states with the highest SO_2 and NO_x emissions. The location of acid rain monitoring stations in Region III are shown in Figure 9-2. A visual display of SO_x and NO_x emission locations are shown in Figure 9-4.

Acid deposition may harm fish and other wildlife, lakes, forests, crops and manmade materials and objects such as buildings and statues. Effects are generally classified into four (4) areas: aquatic, terrestrial, materials and human health. Acid rain can cause certain effects in each category, however, the extent of these effects and the risks these effects may pose to public health and welfare are unclear.

ACID RAIN STATIONS IN REGION III

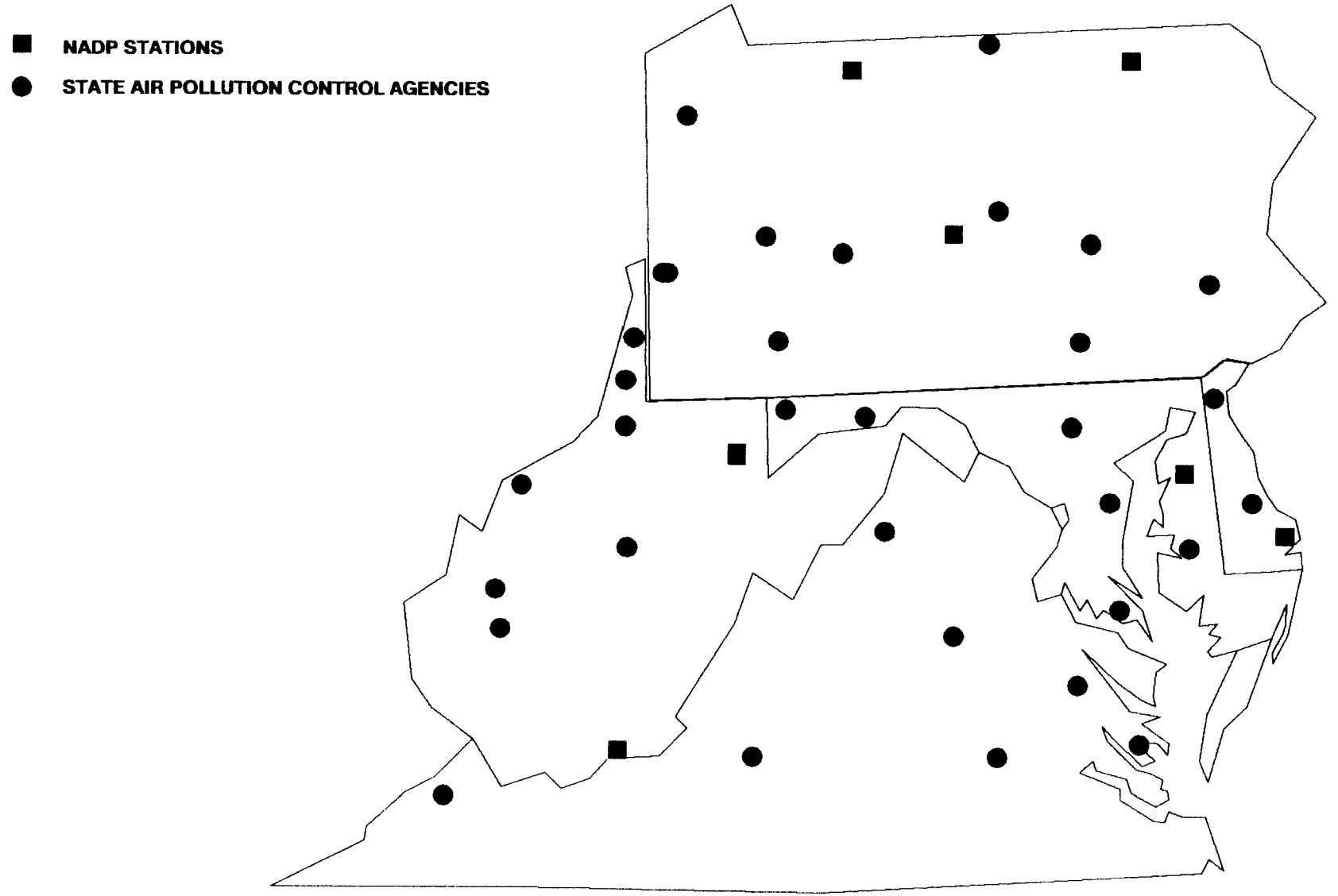


Figure 9-2.

AQUATIC: Adverse effects of acid rain are most clearly seen in aquatic ecosystems. Effects include damage to reproductive cycles of animals and fish, alterations of metabolism, release of toxic metals. Figure 9-5 depicts areas in North America containing lakes sensitive to acid precipitation.

TERRESTRIAL: Less is known about acid rain's effects on forest and crops than about effects on aquatic systems. The most extreme damage is the unexplained death of whole sections of once thriving forests; acid rain can leach nutrients from soil and foliage; it inhibits photosynthesis and can kill essential microorganisms.

MATERIALS EFFECTS: Damage to man-made materials can include degradation of building materials (limestone, marble, carbonate-based paints, galvanized steel) it can weaken and erode materials.

HUMAN HEALTH: So far no conclusive scientific evidence exists to show any human health problems resulting from direct contact with acid rain. Inhaling acidic particles may pose some risk, for example, but is not confirmed.

While certain aspects of the acid rain process are generally accepted by the scientific community, others are uncertain. Unanswered questions include the geographic range of damage from acid rain, the origin of the pollutants involved in its formation, and the rate at which acidification takes place. New information indicates that significant adverse effects to forests and materials now occur when acid rain and other pollutants such as ozone exist together in high concentration. Figure 9-3 displays at a glance the pH of wet deposition recorded in 1987. The isolines identify the annual average acidity of precipitation throughout the United States.

In Region III, the Commonwealth of Pennsylvania a has long history of concern with acidic streams. Pennsylvania is frequently cited as the state receiving the most acidic precipitation of any state. Several statewide surveys conducted by the U.S. Fish and Wildlife Service, Pennsylvania State University, the Pennsylvania Fish Commission and the U.S. EPA indicate:

Figure 9-3 pH of Wet Deposition in 1987. (Precipitation-weighted Annual Average) Based on NADP/NTN Data. Isolines omitted in West due to sparceness of data points.

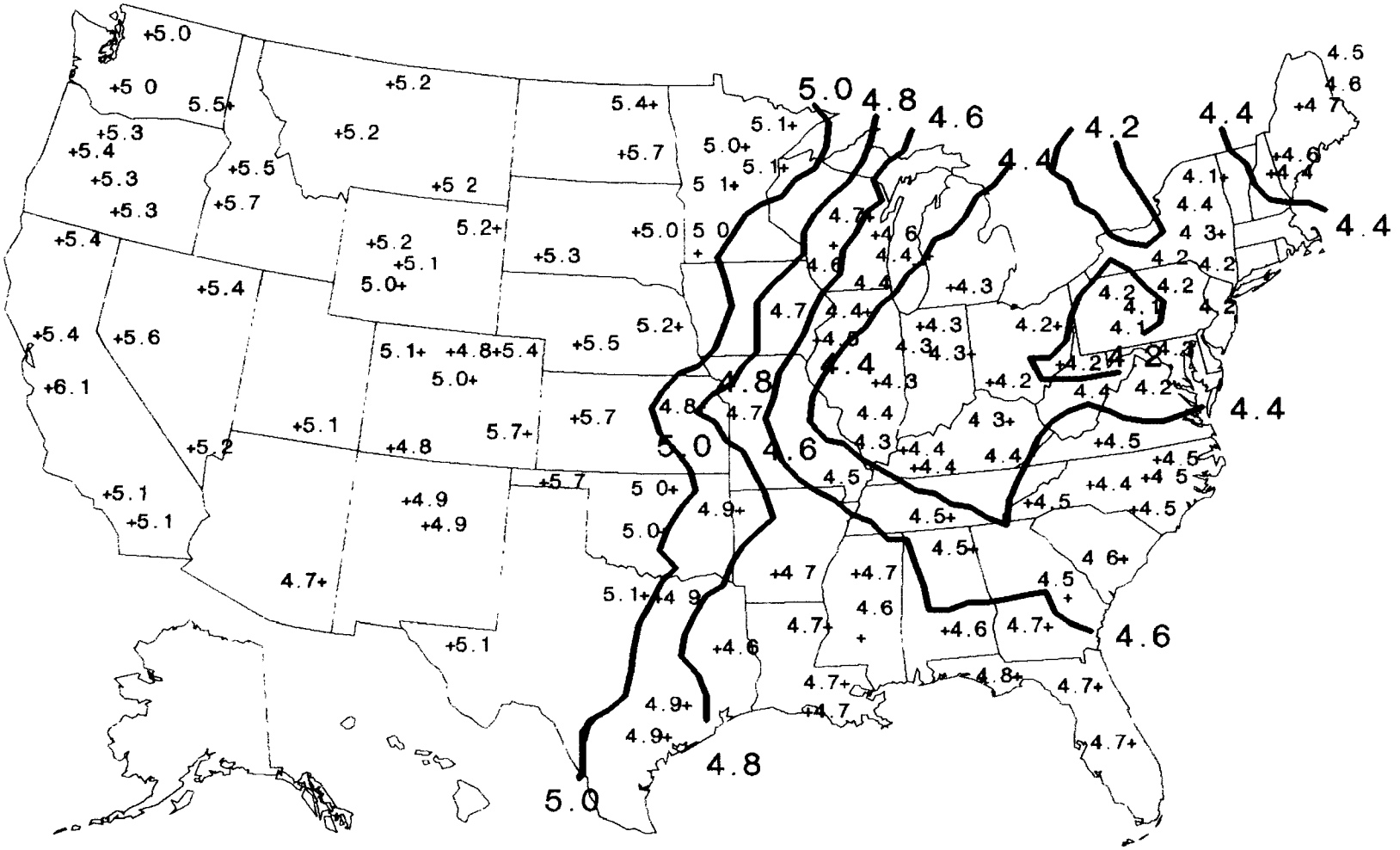


Figure 9-4 Locations of major emissions of NOx and SOx .

- Approximately 6,000 miles of streams in Pennsylvania are vulnerable to acidification.

- Since 1969, 12 streams and one lake have been removed from the Pennsylvania Fish Commission's stocking list.

- 10 of 61 watersheds in the southwestern part of the state are fishless.

- Projected annual economic and resource losses in coldwater fisheries alone in Pennsylvania would reach 50 million and 125 million dollars.

In addition to Pennsylvania, the nearby states of West Virginia, Virginia and Maryland have also reported instances of lost stream fish populations.

This past July, the President announced a proposal to deal with acid rain problems. As part of the Administration's Clean Air Act Amendments, the proposal contains provisions to achieve significant reductions in sulfur dioxide and nitrogen oxides by the year 2000. The bill would also establish a system of marketable permits to allow acid rain reductions to be achieved in the least costly manner. Currently, the President's bill is under debate by Congress, with the expectation of final Congressional action by the end of 1990.

Figure 9-5 Areas in North America containing lakes sensitive to acid precipitation.

9.3 INDOOR AIR POLLUTION

Exposure to environmental pollutants all pose varying degrees of risk. In the last few years, scientific evidence has indicated that the air within our homes and other buildings can be more polluted than the outdoor air, especially where buildings are tightly constructed to conserve energy. Those most susceptible to the risk of indoor air pollution (the young, the elderly, and chronically ill) spend nearly 90% of their time indoors.

9.3.1 SOURCES

- Oil, gas, kerosene, coal combustion sources
- Building materials and furnishing: asbestos containing insulation, carpeting, furniture
- Products for cleaning and maintenance
- Central heating and cooling systems
- Tobacco smoke, space heaters, wood preservation

9.3.2 HEALTH EFFECTS

- Immediate effects which show up after a simple exposure: irritation of eye, nose, throat, headaches, dizziness, fatigue, nausea, irritability, lethargy
- Long term effects may show up years after exposure; emphysema, respiratory diseases, heart disease, and cancer

9.3.3 POLLUTANTS

- Asbestos
- Airborne pathogens - viruses, bacteria, fungi
- Radioactive gases - radon
- Inorganic compounds: mercury, lead
- Organic compounds: formaldehyde, chloroform, perchloroethylene

RADON

Radon is a naturally occurring radioactive gas which poses a health threat in a significant number of homes across the country. The Office of the U.S. Surgeon General recently issued a health advisory stating that indoor radon is second only to cigarette smoking as a leading cause of cancer. Due to the geology of Region III, radon is found here more often and in higher levels than in most of the United States. For this reason, Region III has aggressively pursued risk communication efforts to inform the public about testing and mitigation measures. Region III efforts have led to the development of comprehensive profiles detailing the extent of the radon problem in each of the Region III states (see Figure 9-6). Analysis has included compilation of measured house data, evaluations of uranium deposits, water data, and geology. The results from these analyses are then used to help develop and direct state programs. Region III states have been active in developing effective radon programs with limited resources.

The study of radon in schools began in Fairfax, Virginia in 1988; Maryland, Virginia and Pennsylvania are active members in the House Evaluation Program. By the end of 1990, Pennsylvania will have finished participation in a second national survey in which testing is made available to homeowners on a voluntary basis. West Virginia is currently negotiating conditions for participation in the survey.

The Region III map (Figure 9-6) shows the voluntary radon test results by county. Since radon test results can vary greatly from house to house, the only way to know what the radon level is in your home is to have it tested. An informed homeowner will not only have a screening test conducted, but understands that if an elevated level of radon is found in the dwelling, corrective action should not be taken until a more detailed evaluation is completed. The follow-up testing will not only determine whether the radon poses an unacceptable health risk, but will also aid in determining which corrective actions are necessary. Radon can usually be fixed at a cost of $200 to $1,500.

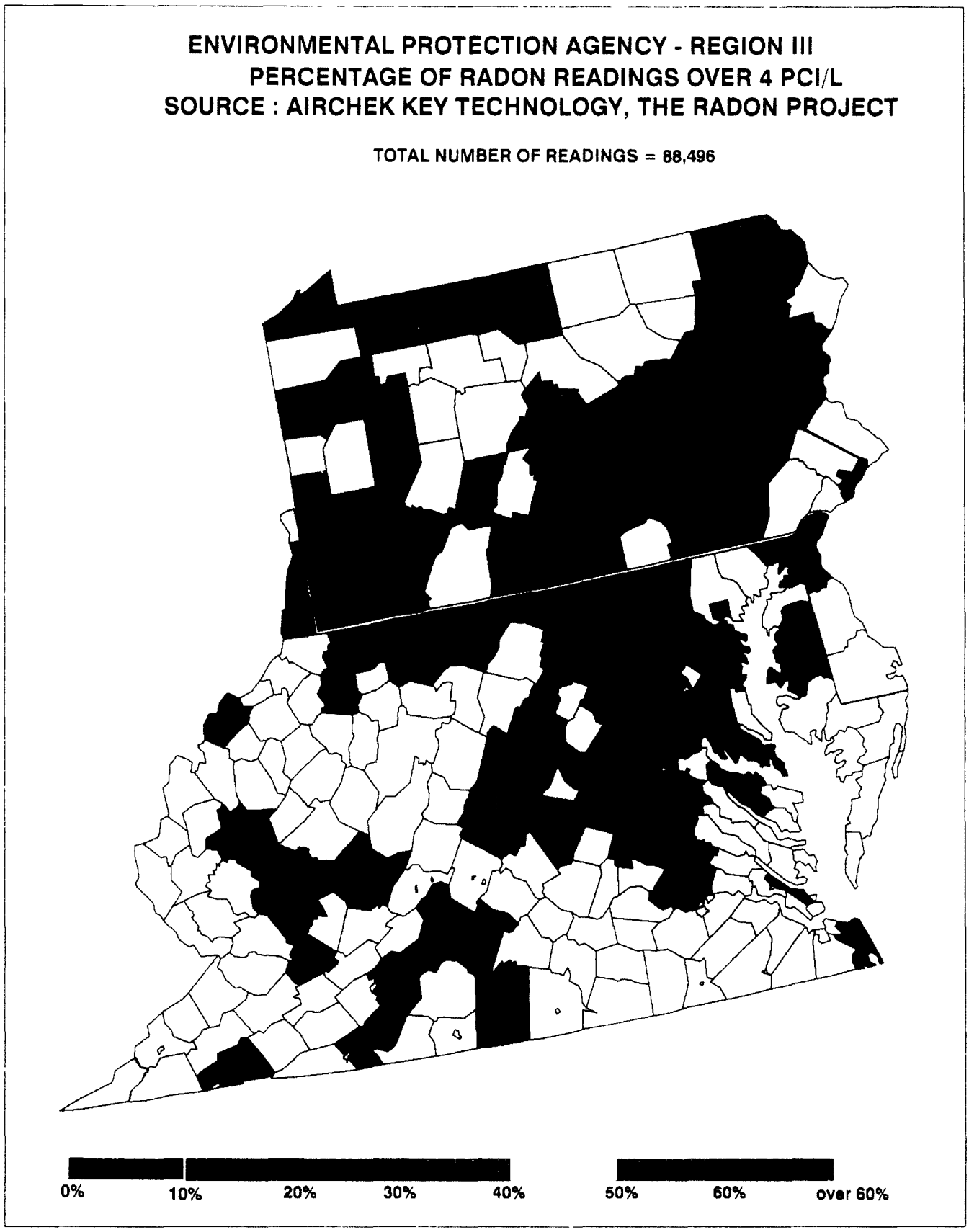

ENVIRONMENTAL PROTECTION AGENCY - REGION III
PERCENTAGE OF RADON READINGS OVER 4 PCI/L
SOURCE : AIRCHEK KEY TECHNOLOGY, THE RADON PROJECT
TOTAL NUMBER OF READINGS = 88,496
0%
10%
20%
30%
40%
50%
60%
over 60%

Figure 9-4.

ASBESTOS

Because health studies of asbestos workers showed they had a high risk of contracting asbestosis (scarring of the lung tissues) from inhaling asbestos fibers, EPA listed asbestos as a hazardous air pollutant under Section 112 of the Clean Air Act. Asbestos exposure can lead to asbestosis, lung cancer, and mesothelioma (rare chest and abdominal cancer). EPA subsequently promulgated regulations to control asbestos emissions to the air during renovations and demolitions of buildings. For the past few years, EPA has considered the implementation and enforcement of the asbestos regulations as one of the Agency's highest priorities.

The asbestos removal industry, and hence EPA's program, has grown exponentially. With this program growth, EPA and the states have continued to inspect more and more asbestos removal operations and enforce against noncomplying contractors.

Due to the hazards associated with asbestos, safety during removal and inspection activities are inherent in EPA's enforcement philosophy. Unsafe removal of asbestos material can create a much higher risk to the public than leaving the asbestos in place. EPA inspectors must also take special safety precautions when obtaining asbestos samples during inspections.

Since 1984, Region III has issued 252 Notices of Deficiencies, issued 26 Administrative Orders and filed 16 civil and 3 criminal lawsuits against asbestos abatement contractors. Through these inspections, enforcement efforts, and initiatives to identify non-notifiers, EPA Region III has been a national leader in ensuring compliance with the asbestos NESHAP Standard.

9.4 GLOBAL AIR QUALITY PROBLEMS

Finally, there are growing concerns about two global phenomena that could seriously affect the health and welfare of future generations. These are the depletion of the stratospheric ozone layer, and global climate change brought about by the ever-increasing concentrations of air pollutants in the earth's atmosphere.

9.4.1 DEPLETION OF STRATOSPHERIC OZONE LAYER

Ozone is considered a harmful pollutant when manmade emissions cause high concentrations of the compound to occur near the surface of the earth. Ozone, however, also occurs naturally in the stratosphere, about 30 miles above the earth's surface. This ozone layer screens out harmful ultra-violet (UV) radiation from the sun. A class of chemical compounds, called chlorofluorocarbons (CFCs), that were developed in the 1930s and widely used in industry, rise up to the stratosphere and deplete the ozone layer, allowing increased UV to reach the earth's surface. CFCs are very stable and can last for up to 150 years. These gases rise slowly to about 25 miles where chlorine is freed from the CFC. One atom of chlorine then destroys about 100,000 molecules of ozone. Such depletion, with subsequent increases in ultraviolet radiation would most likely lead to severe and widespread health problems, ranging from increased cases of skin cancer and eye cataracts to suppression of immune system functioning. Ozone depletion may also accelerate the formation of ground-level pollutants and damage agriculture, plants, and fragile aquatic ecosystems.

Unfortunately, manmade ozone at the earth's surface cannot rise up and replace the depleted stratospheric ozone, due to the short lifetime of ozone molecules. EPA has therefore acted to protect the ozone layer by reducing CFC emissions, even as we struggle to reduce ground-level ozone.

In 1978, EPA banned the use in this country of CFCs in nonessential aerosol propellants, at that time the largest source of CFC emissions. Emissions of CFCs from other sources, however, such as refrigerants, air conditioners, and various solvents, have continued to increase. Worldwide CFC emissions have increased, in part because many countries still use CFCs in aerosol sprays and spray products. In 1988, EPA acted to require a 50% reduction in domestic production of CFCs, in compliance with the 1987 Montreal Protocol. The Protocol has been signed and verified by 38 countries worldwide.

9.4.2 GLOBAL WARMING

Increased industrial activity has produced ever greater concentrations of carbon dioxide, CFCs, methane, nitrous oxides, and other trace gases in the Earth's atmosphere. In a phenomenon known as the "greenhouse effect," these gases trap heat in the atmosphere, causing world temperatures to rise. Most scientist believe that by the time visible manifestations of these problems appear, it may well be too late to reverse them. Measures to avoid them may include international controls, massive reforestation programs, and greatly increased use non-fossil fuel energy sources.

EPA's report, The Potential Effects of Global Climate Change on the United States, attempts to predict the environmental and health effects of global warming in the United States. EPA expects carbon dioxide levels to double by the year 2030 and that global temperatures will soon equal or exceed the temperature of more than 100,000 years ago.

The report states, "The mean growth rate of CO_2 for the period 1850-1958, was about 4 ppm/decade. The growth in recent decades is about 15 ppm/decade. The near quadrupling...is mainly attributed to combustion of fossil fuel and deforestation."

In addition to pollutants from industrial activity and mobile sources, tropical deforestation is a major contributor. The burning of one acre of primary forest, a part of slash-and-burn agriculture systems of many nations (i.e., Brazil), results in about 400,000 pounds of carbon dioxide emissions.

The growth of trace gases is also up, and it is known that these gases influence the chemistry of the stratosphere and troposphere in many ways. Methane levels are increasing at 1% per year; ozone, at 0.5%-to-1% per year; nitrous oxide, at 0.2%-to-0.3% per year; carbon monoxide, at 1%-to-2% per year; and chloroflourocarbons, depending on the compound, at 1%-to-7% per year.

The EPA report, which predicts that a global temperature rise of 1.5^{o} C to 4.5^{o} C, has the following implications for the United States:

- Forest declines may begin in 30 to 80 years;
- Most coastal wetlands will be lost as sea levels rise;

- Continental and shore-nesting birds will suffer as nesting places are lost;

- Algal blooms will harm fish inhabiting shallow waters;

- Water quality in drier parts of the U.S. will decline if there is less rainfall and runoff to dilute pollutants;

- Crop acreage in Appalachia, the Southeast and the southern Great Plains may decrease by 5% to 25%;

- Natural emissions of hydrocarbons will increase;

- Increases in the persistence and level of air pollution episodes associated with climate change will have adverse health effects.

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APPENDIX A

FURTHER INFORMATION

If you would like further air quality information and reports, a list of EPA and state agency names, addresses and telephone numbers is provided for your information:

U.S. Environmental Protection Agency
Region III
841 Chestnut Building
Philadelphia, PA 19107

Edwin B. Erickson
Regional Administrator

Stanley L. Laskowski
Deputy Regional Administrator

Greene A. Jones, Director
Environmental Services Division
215-597-4532

Thomas J. Maslany, Director
Air Management Division
215-597-9390

STATE OF DELAWARE

Department of Natural Resources

Mr. Phillip Retallic, Director
Air and Waste Management Division
Department of Natural Resources
and Environmental Control
89 Kings Highway
P.O. Box 1401
Dover, DE 19901

301-736-4791

Mr. Joseph Kliment, Director
Technical Services Section
Delaware Department of Natural Resources
and Environmental Control
715 Grantham Lane
New Castle, DE 19720
302-323-4565

DISTRICT OF COLUMBIA

Department of Consumer and Regulatory Affairs

Mr. A. Padmanabha, Chief
Environmental Control Division
D.C. Department of Consumer and
Regulatory Affairs
614 H Street, N.W.
Washington, D.C. 20001

202-767-7370

Dr. Joseph K. Nwude, Chief
Air Quality Control Division
D.C. Department of Consumer and
Regulatory Affairs
614 H Street, N.W.
Washington, D.C. 20032

202-767-7370

STATE OF MARYLAND

Air Management Administration

Mr. George P. Ferreri, Director
Air Management Administration
Office of Environmental Programs
2500 Broening Highway
Baltimore, MD 21224

301-631-3255

Mr. Robert O'Melia, Chief
Division of Air Monitoring
Maryland Department of the Environment
2500 Broening Highway
Baltimore, MD 21224

301-631-3285

COMMONWEALTH OF PENNSYLVANIA

Department of Environmental Resources

Mr. James Hambright
Director, Bureau of Air Quality Control
Pennsylvania Department of Environmental Resources
P.O. Box 2063
Third and Locust Streets
Harrisburg, PA 17120

717-787-9702

Mr. Ben Brodovicz, Chief
Technical Services Division
Pennsylvania Department
of Environmental Resources
P.O. Box 2063
Third & Locust Streets
Harrisburg, PA 17120

717-787-6547

CITY OF PHILADELPHIA

Air Management Services

Mr. William Reilly
Assistant Health Commissioner
Department of Public Health
Air Management Services
500 South Broad Street
Philadelphia, PA 19146

215-875-5623

Mr. Clem Lazenka, Chief
Technical Services Group
Philadelphia Air Management Services
1501 East Lycoming Street
Philadelphia, PA 19124
215-228-5177

ALLEGHENY COUNTY

Bureau of Air Pollution Control

Mr. Ronald Chleboski
Deputy Director
Allegheny County Health Department
Bureau of Air Pollution Control
301 39th Street
Pittsburgh, PA 15201

412-578-8101

Mr. Harilal Patel, Chief
Air Quality Monitoring Division
Allegheny County health Department
301 39th Street
Pittsburgh, PA 15201

412-578-8113

COMMONWEALTH OF VIRGINIA

Department of Air Pollution Control

Mr. Wallace Davis
Executive Director
VA Department of Air Pollution Control
P.O. Box 10089
Richmond, VA 23240

804-786-6035

Mr. William Parks, Director
Air Monitoring Division
VA Department of Air Pollution Control
5324 Distributor Drive
Richmond, VA 23225

804-786-1019

STATE OF WEST VIRGINIA

Air Pollution Control Commission

Mr. G. Dale Farley, Director
WV Air Pollution Control Commission
1558 Washington Street, East
Charleston, WV 25311

304-348-4022/3286

Mr. Ron Engle, Chief
Air Monitoring and Quality Assurance
WV Air Pollution Control Commission
1558 Washington, Street, East
Charleston, WV 25311

304-348-4022

APPENDIX B

MAJOR AIR POLLUTANT SOURCES AND CONCERNS

Pollutants	Sources	Concerns
Carbon Monoxide (CO)	Motor-vehicle exhaust some industrial processes; produced by incomplete combustion of carbon.	Reacts in bloodstream to deprive heart and brain of oxygen; impairs ability of blood to carry oxygen; cardiovascular, nervous and pulmonary system affected; can cause angina; high concentrations are lethal; moderate concentration significantly reduce brain functions.
Sulfur Dioxide (SO_2)	Heat and Power generation facilities, combustion processes that use oil or coal containing sulfur; sulfuric acid plants; petroleum refining, smelting of sulfur containing ore.	Respiratory tract problems, eye irritation; permanent harm to lung tissue; combines with water to form acid aerosols and sulfuric acid mist which falls to earth as acid rain; causes plant and structural damage.
Suspended Particulate Matter (PM10)	Motor-vehicle exhaust, industrial processes, incinerators, heat and power generation, steel mills, smelters, demolition, wood-burning stoves, fugitive dust, pollen.	Eye and throat irritation; bronchitis; lung damage; impairs visibility; soils materials and causes corrosion; acts as a carrier of toxics adsorbed or absorbed by it.

Pollutants	Sources	Concerns
Nitrogen Oxides (NO, NO_2)	Motor-vehicle exhaust, heat and power generation, nitric acid, explosives, fertilizer plants, combustion of fuels.	Respiratory illness, lung damage, impairment of dark adaption, increased airway resistance and may enhance susceptibility to respiratory infection; can cause edema (in concentrations of 10 ppm for 8 hours); concentrations of 20-30 ppm for 8 hours can produce fatal lung damage; reacts with hydrocarbons and sunlight to form photochemical oxidants.
Lead (Pb)	Motor-vehicle exhaust; lead smelters; battery plants.	Retardation and brain damage, especially in children; liver disease; interferes with blood-forming system, nervous system and renal system; can affect the normal functions of the reproduction and cardiovascular system; most lead is contained in TSP.
Ozone (O_3)	Formed in atmosphere by the reaction of nitrogen oxides, hydrocarbons and sunlight.	Respiratory tract problems such as difficult breathing and reduced lung function; asthma, eye irritation, nasal congestion, reduced resistance to infection and possible premature aging of lung tissue; Ozone injures vegetation, has adverse effects on materials; Ozone exhibits a strong diurnal (daily) and seasonal (April to October) character.

Pollutants	Sources	Concerns
Nonmethane Hydrocarbons (includes ethane, ethylene, propane, butanes, pentances, acetylene)	Motor-vehicle emissions, solvent evaporation, industrial processes, solid waste disposal, fuel combustion.	Respiratory tract problems, reduced lung function, eye irritation; reacts with nitrogen oxides and sunlight to form photochemical oxidants.
Carbon Dioxide (CO_2)	All combustion sources, burning of fossil fuels.	Possibly injurious to health at concentrations greater than 5,000 ppm over 2-8 hours; atmospheric levels have been increasing since early 1950's; this trends may contribute to warming of earth; CO_2 in atmosphere remained stable for centuries (at about 260 ppm); present level is 336 ppm.
Asbestos	A naturally occurring mineral substance used in a multitude of products (brake linings, floor tile, sealants, cement pipe, paper and textiles, insulation); of concern is exposure to airborne asbestos from breakage, crushing, sanding, etc. of asbestos materials. Asbestos mining, manufacturing, demolition, renovation are of concern.	A variety of lung diseases, including lung cancer, asbestosis, mesothelioma, other cancers (esophagus, larynx, stomach, colon, kidney). Asbestos is a known human carcinogen for which no level of exposure is known to be without risk. Asbestos induced lung cancer has a 20 year latency period.

Pollutants	Sources	Concerns
Beryllium	Extraction plants, ceramic plants, foundries, incinerators, propellant plants, machine shop (facilities that cut, grind, mill, etch, etc.)	Primarily a lung disease, although also affects liver, spleen, kidneys and lymph glands. A designated hazardous air pollutant for which a National Emission Standard for Hazardous Air Pollutants (NESHAP) has been established which limit emissions from sources to the atmosphere.
Mercury	Ore processors, incinerators, sources which recover mercury, wastewater treatment plant sludge, incineration and drying plants.	Several areas of the brain as well as kidneys and bowels are affected. A designated hazardous air pollutant for which a NESHAP has been established.
Vinyl Chloride	Vinyl chloride is a colorless gas used in the manufacture of polyvinyl chloride which is an ingredient in plastics. Sources which produce vinyl chloride, ethylene dichloride, polyvinyl chloride.	Vinyl chloride has been shown to cause liver cancer. and there is evidence linking it to lung cancer, nervous disorders, and other illnesses. A designated hazardous air pollutant for which NESHAP has been established.
Arsenic	Glass manufacturing plants, primary cooper smelters, arsenic production plants.	Accumulates in the lung and can cause cancer. A designated hazardous air pollutant for which a NESHAP has been established.
Radio-nuclide	Uranium mines, DOE facilities, phosphorous plants.	Causes cancer. A designated hazardous air pollutant for which a NESHAP has been established.

Pollutants	Sources	Concerns
Benzene	Fugitive emissions from equipment leaks at chemical plants.	Causes leukemia. A designated hazardous air pollutant for which a NESHAP has been established.
Coke Oven Emissions	Production of Coke	Causes of respiratory cancer.

APPENDIX C

References to the Pollutant Standard Index (PSI) are made in this report. The PSI is derived from a linear function that transforms ambient concentrations of five health related pollutants (O_3, CO, NO_2, SO_2, PM-10) onto a scale of 0 through 500. Reference is in the Federal Register, 40 C.F.R. Part 58, Appendix E.

PSI	Air Quality
0 - 50	Good
51 - 100	Moderate
101 - 200	Unhealthy
201 - 300	Very unhealthy
> 300	Hazardous

Areas in Region III were the PSI is routinely reported are:

STATE	AREA
Delaware	Wilmington
District of Columbia	Metro DC area
Maryland	Baltimore
	Metro DC area
Pennsylvania	Allegheny County
	A-B-E Air Basin
	Erie Air Basin
	Harrisburg Air Basin
	Johnstown Air Basin
	Lancaster Air Basin
	Lower Beaver Valley Air Basin
	Monongahela Valley Air Basin
	Reading Air Basin
	Scranton - W-B Air Basin
	SE PA Air Basin
	Upper Beaver Valley Air Basin
	York Air Basin
Virginia	Richmond
	Norfolk - Hampton
	Roanoke
	Metro DC area
West Virginia	Charleston
	Wheeling

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16. ABSTRACT

This report presents regional trends in air quality from 1983 through 1988 for ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, particulates and lead. National pollution trends are briefly highlighted and compared to regional trends for each of these pollutants. In addition to ambient air quality, trends are also discussed for annual nationwide emissions which are estimated using best available information. The ambient levels presented are direct measurements. The report concludes with a brief discussion of some other major areas of concern : air toxics, acid deposition, indoor air pollution, depletion of stratospheric ozone layer and global warming.

The purpose of this report is to provide interested members of the air pollution control community, the private sector and the general public with useful air pollution information.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Air Pollution Trends Ozone Carbon Monoxide Nitrogen Dioxide Sulfur Dioxide Particulates Lead Air Quality Standards National Air Monitoring Stations(NAMS) State and Local Air Monitoring Stations(SLAMS) Health and Welfare Effects		

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