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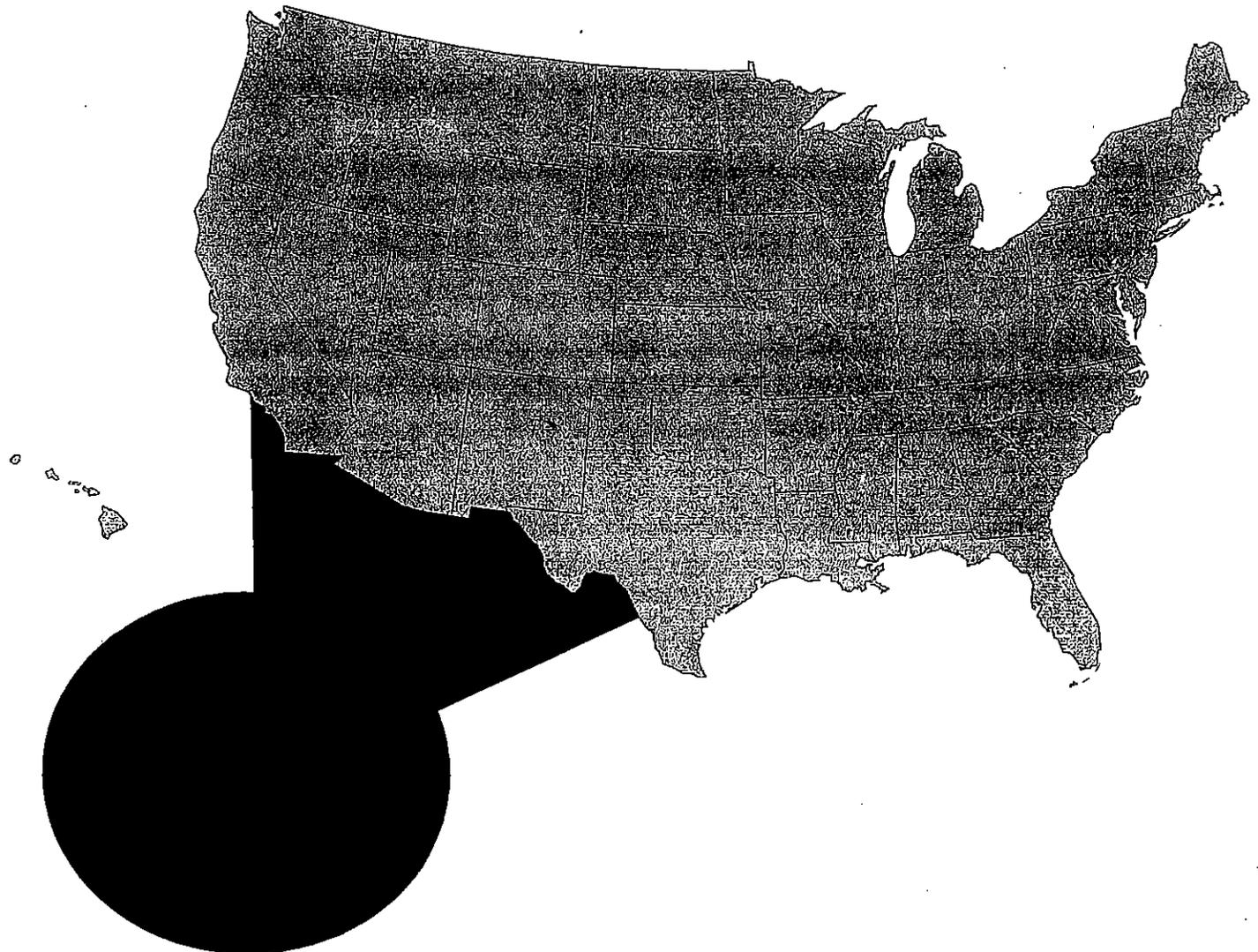
Office of Air Quality
Planning and Standards
Research Triangle Park NC 27711

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National Air Quality and Emissions Trends Report, 1994



National Air Quality and Emissions Trends Report, 1994

**U.S. Environmental Protection Agency
Office of Air Quality Planning and Standards
Emissions Monitoring and Analysis Division
Air Quality Trends Analysis Group
Research Triangle Park, North Carolina 27711**

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95

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Preface

This is the twenty-second annual report on air pollution trends in the United States issued by the Environmental Protection Agency. The report is prepared by the Air Quality Trends Analysis Group (AQTAG) in Research Triangle Park, North Carolina and is directed toward both the technical air pollution audience and other interested parties and individuals. AQTAG solicits comments on this report and welcomes suggestions regarding techniques, interpretations, conclusions, or methods of presentation. Please forward any response to the Trends Team, (MD-14) U.S. Environmental Protection Agency, Air Quality Trends Analysis Group, Research Triangle Park, North Carolina, 27711.

Readers of previous reports should note the following changes:

- An expanded appendix including:
 - All statistical data tables.
 - A discussion of methodology.
- Graphics displaying the 10 and 20 year air quality trends in urban, suburban, and rural locales.
- Additional air quality trends statistical summaries.
- Additional categories in the pollutant emissions tables.

For additional air quality data, readers can access the Aerometric Information Retrieval System's (AIRS) executive software from the AIRS bulletin board on the Office of Air Quality Planning and Standards' (OAQPS) Technology Transfer Network (TTN). Electronic copies of trends graphics and Lotus 1-2-3 spreadsheets can be obtained from the Ambient Monitoring Technology Information Center (AMTIC) bulletin board system of the TTN. To gain access by modem, dial (919) 541-5742. Internet users can access EPA's homepage at: (<http://www.epa.gov/docs/oar/oarhome.html>), or the TTN at the following telnet address: ([ttnbbs.rtpnc.epa.gov](telnet://ttnbbs.rtpnc.epa.gov)). For help in accessing the OAQPS's TTN, dial (919) 541-5384.

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Chapter 1

Executive Summary

The following is the 22nd annual report documenting air pollution trends in the United States. This report primarily focuses on pollutants for which the United States Environmental Protection Agency (EPA) has established National Ambient Air Quality Standards (NAAQS). The Clean Air Act (CAA) provides for two types of standards. Primary standards set limits to protect the public health, including sensitive populations such as asthmatics, children and the elderly. Secondary standards set limits to protect the public welfare, including animals, crops, vegetation, and buildings. There are six *criteria* pollutants with primary standards: carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO₂), ozone (O₃), particulate matter whose aerodynamic size is less than or equal to 10 microns (PM-10), and sulfur dioxide (SO₂).

Each year, EPA analyzes air quality data for the most recent 10-year period. Specific monitoring sites are included in this trend analysis only if they have complete data for a minimum of eight out of the 10 years. In 1987, the standard for Total Suspended Particulates (TSP) was replaced with the PM-10 standard. Therefore, PM-10 trend analyses are based on data collected at monitoring sites that have complete data for six out of the seven years between 1988 and 1994. This report contains data accumulated on criteria pollutants between 1985 and 1994 from more than 4,000 monitoring stations around the country.

It is important to note that discussions of ozone refer to ground level, or tropospheric ozone, as opposed to stratospheric ozone. In the stratosphere, miles above the earth, ozone acts as a screen from the sun's ultraviolet rays. Ozone at ground level (in the air we breathe) is a health concern as well as an environmental concern. It is the primary ingredient of what is commonly known as smog. However, ozone is not emitted directly into the air; rather it is created

when sunlight reacts with oxides of nitrogen and volatile organic compounds (VOCs) in the ambient air.

EPA tracks ambient air quality trends for criteria pollutants based on direct measurements of pollutant concentrations in the air at selected sites throughout the country. Additionally, EPA tracks air emission trends based on estimates of total tonnage of criteria pollutants released into the air annually. Emission trends are estimated using the best available engineering calculations. These calculations express the level of industrial activity, changes in technology, fuel consumption, VMT, and other air polluting activities. Emission trends reflect emissions from natural sources, changes in air pollution regulations, and the installation of emission controls.

A 10-year period is convenient for considering ambient pollution trends because of the changes that occurred in monitoring networks during the early 1980s, as well as the changes that routinely occur in the geographic distribution of monitors. Although it is difficult to provide ambient trends going back more than 10 years, it is important not to overlook some of the earlier control efforts in the air pollution field. While ambient monitoring trends and emission trends can be viewed as independent assessments of the underlying pollutant trends, emission estimates can also be used to provide information on longer time periods. Figure 1-1 provides a convenient summary of emission changes for all six NAAQS pollutants between 1970 and 1994. Emissions for all criteria pollutants except nitrogen oxides decreased between 1970 and 1994, the greatest success story being a 98-percent decrease in Pb emissions.

These reductions occurred during a period of significant population and economic growth. Since 1970, total U.S. population increased 27 percent, vehicle miles traveled (VMT) increased 111 percent, and the gross domestic product increased 90 percent as noted in Figures 1-2 through 1-4.

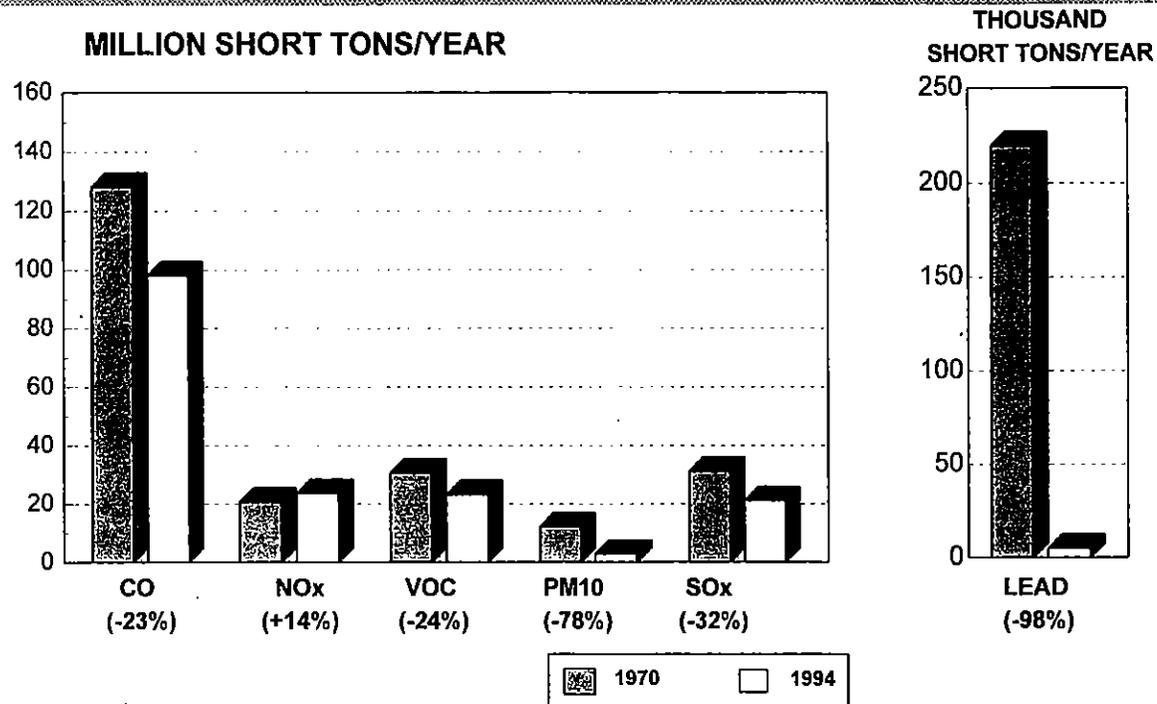
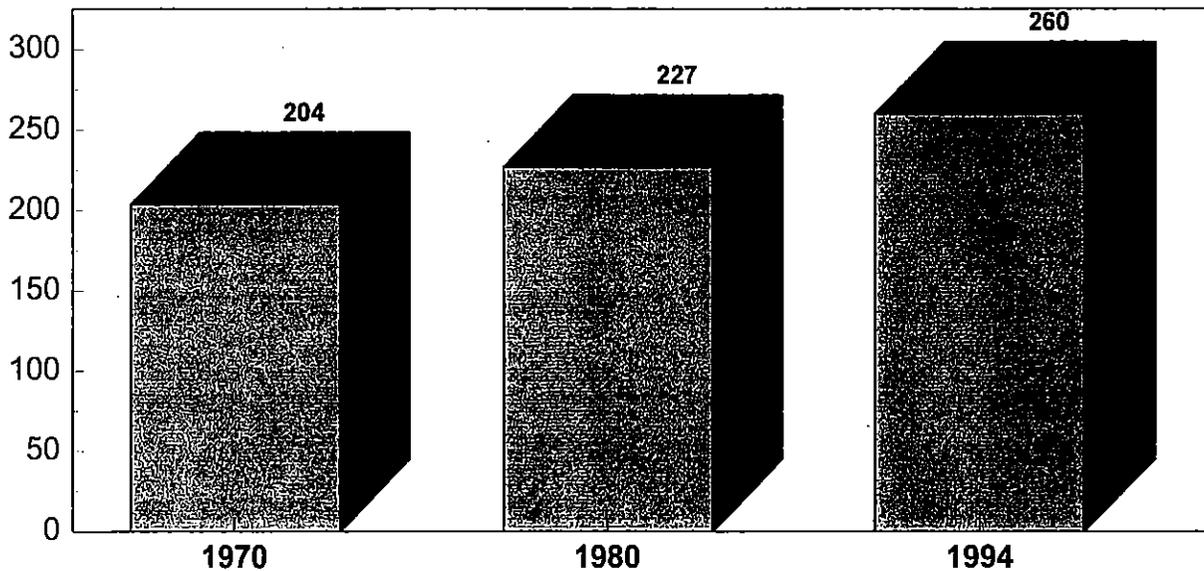


Figure 1-1: Summary of emissions changes for all six NAAQS pollutants between 1970 and 1994.

27% increase, 1970 to 1994

MILLIONS OF PEOPLE



Sources: U.S. Bureau of the Census

Figure 1-2: Total U.S. population, 1970-1994.

Between 1985 and 1994, ambient air quality measurements at selected monitoring sites revealed the following data:

- **Carbon monoxide** concentrations decreased 28 percent.
- **Lead** concentrations decreased 86 percent.
- **Nitrogen dioxide** concentrations decreased 9 percent.
- **Ozone** concentrations decreased 12 percent.
- **Particulate matter** concentrations decreased 20 percent (between 1988 and 1994).
- **Sulfur dioxide** concentrations decreased 25 percent.

These air quality improvements are a direct result of effective implementation of clean air laws and regulations. Despite the increase in U.S. population, total VMT, and gross domestic product since 1970, there is strong evidence of a general trend of air quality improvement.

Between 1985 and 1994, emission estimates revealed the following data:

- **Carbon monoxide** emissions decreased 15 percent.
- **Lead** emissions decreased 75 percent.
- Emissions of **nitrogen oxides** increased 3 percent.
- Emissions of **volatile organic compounds** (largely responsible for ozone formation) decreased 10 percent.
- **Particulate matter** emissions (between 1988 and 1994) decreased 12 percent.
- **Sulfur dioxide** emissions decreased 9 percent.

Emissions are affected by the nation's economic activity, meteorological conditions, and regulatory controls. The slight increase observed in NO_x emissions is attributed to increased production and processing by industry and greater fuel combustion by electric utilities.

While progress has been made, it is important not to lose sight of the magnitude of the air pollution problem that still remains. Figure 1-5 summarizes the number of people living in counties with air quality levels above the NAAQS. About 62 million people in the United States reside in counties that did not meet a minimum of one air quality standard based on 1994

monitoring data. The ground level O₃ standard is the most commonly violated standard, based on both population and number of areas not meeting standards. In 1994, 50 million people lived in counties that exceeded the O₃ standard. However, 1994 is the third consecutive year that every monitoring site in the country met the NO₂ standard. With respect to SO₂, it is important to note that while most monitoring sites are currently meeting ambient standards, SO₂ problems in the United States are associated with point sources and are typically identified by modeling rather than by routine ambient monitoring. The population estimates in Figure 1-5 are based only upon a single year of data, 1994, and only consider counties with monitoring data for that pollutant. For example, the number of people living in nonattainment areas as of September 1995 was approximately 134 million (based on the formal designations of nonattainment areas) as opposed to 62 million (based on those counties with air quality data that exceeded any NAAQS in 1994). There are two reasons for this difference in population estimates. First, formal designations generally encompass entire metropolitan areas rather than just the county with the monitor. Second, formal designations are based on multiple years of data (rather than the most recent calendar year) to account for a broader range of meteorological conditions.

Although this report emphasizes those six pollutants for which NAAQS exist, there are other air pollutants of concern. Air toxics are chemicals known or suspected of causing cancer or other serious health effects (e.g., reproductive effects). According to EPA's Toxic Release Inventory (TRI), estimated emissions of hazardous air pollutants (189 compounds identified for regulatory attention by the CAAA) declined 33 percent between 1989 and 1993, with an 8-percent decrease reported between 1992 and 1993. Control programs designed to address criteria pollutant reductions also reduce air toxic releases to some degree (by reducing emissions of particulates, VOCs, and NO_x). However, Title III of the CAA (section 112 of the CAAA) provides specific new tools to directly address releases of hazardous air pollutants. EPA is also implementing programs to reduce emissions of pollutants contributing to O₃ depletion in the stratosphere and acidic deposition (i.e., acid rain).

111% increase, 1970 to 1994

BILLIONS OF MILES

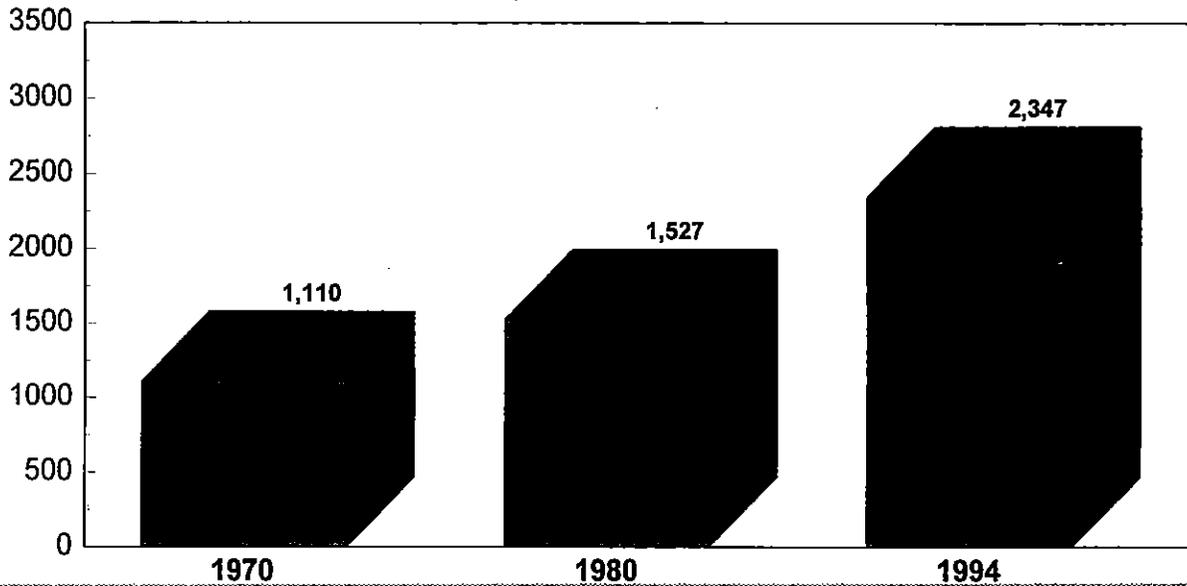


Figure 1-3: Total U.S. vehicle miles traveled, 1970-1994.

90% increase, 1970 to 1994

BILLIONS OF DOLLARS

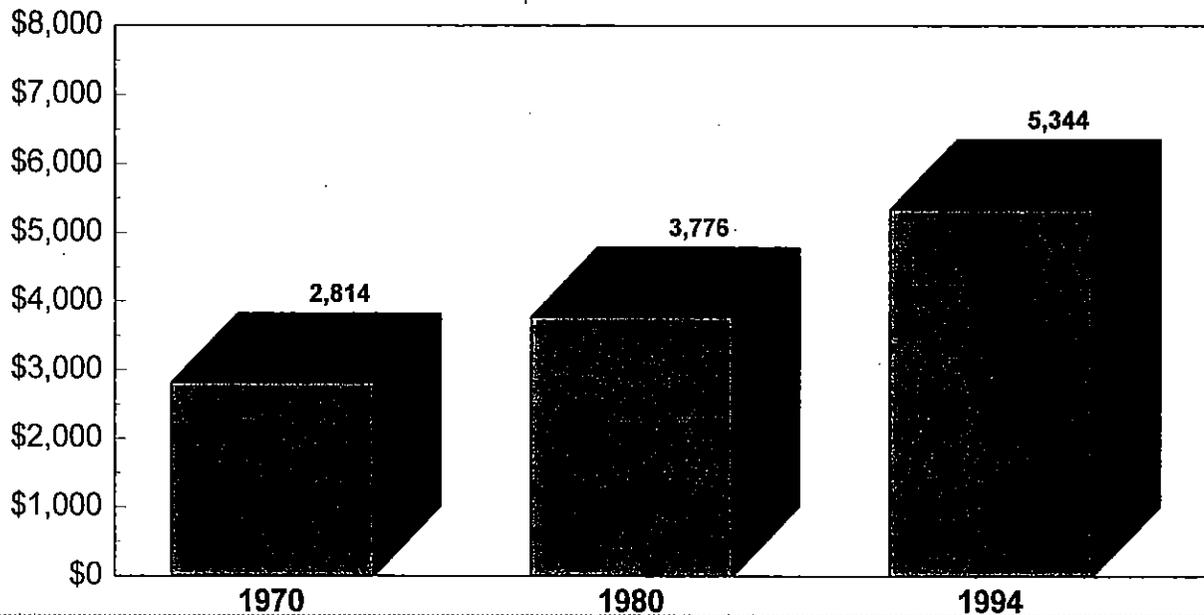


Figure 1-4: Total U.S. Gross Domestic Product, 1970-1994.

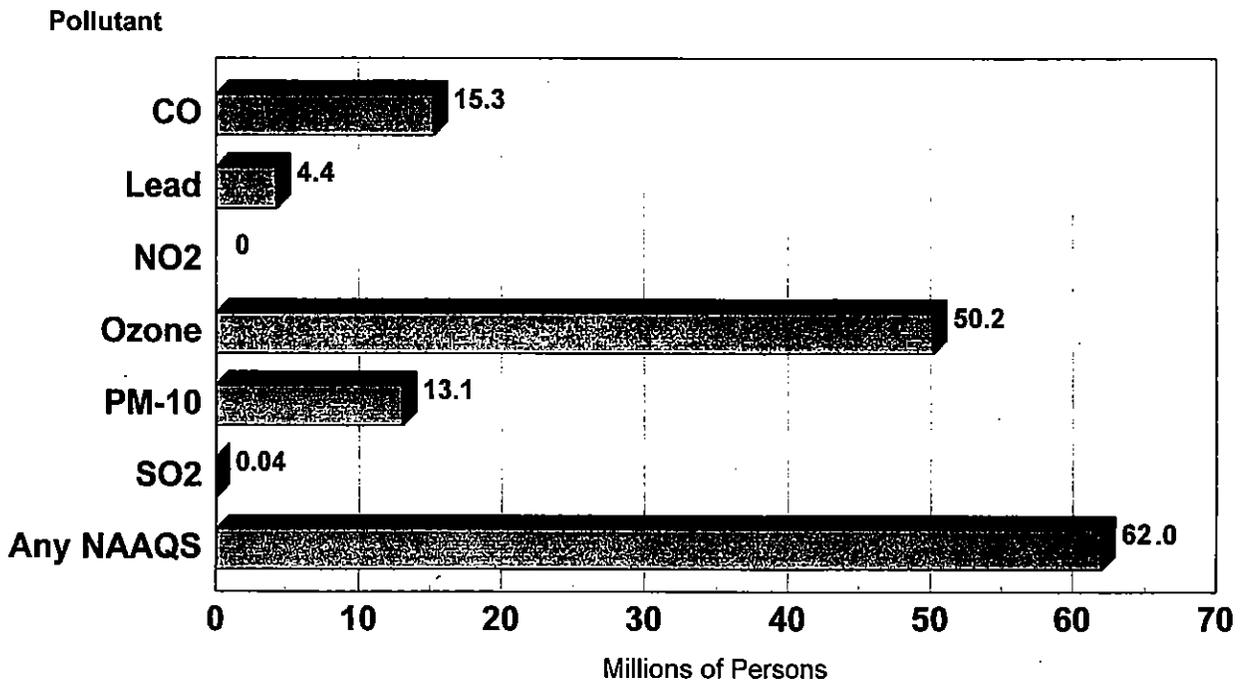


Figure 1-5: Number of people living in counties with air quality levels above the NAAQS in 1994.



Chapter 2

Air Quality Trends

EPA has established National Ambient Air Quality Standards (NAAQS) for six *criteria* pollutants to protect public health and welfare. These six pollutants are carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO₂), ozone (O₃), particulate matter whose aerodynamic size is less than or equal to 10 microns (PM-10), and sulfur dioxide (SO₂). Table 2-1 lists the NAAQS for each pollutant in terms of the level of the standard, the associated averaging time, and the form of the statistic used to evaluate compliance. There are primary standards for all of the criteria pollutants. Some pollutants (PM-10 and SO₂) have primary standards for both long-term (annual average) and short-term (24-hours or less) averaging times. Short-term standards are established to protect the population from any adverse health effects associated with acute exposure to air pollution, while long-term standards are established to protect the population from any adverse health effects associated with chronic exposure to air pollution. The secondary standard for most pollutants is the same as the primary standard, except for SO₂.

Most air quality trends information is based on data from three related indicators:

- Measurements of pollutant concentrations in the ambient air.
- Estimates of total national pollutant emissions.
- The number of times that air quality standards are violated.

National trends in air quality are derived from routine measurements recorded over time at monitoring sites located primarily in urban and suburban areas, and to a lesser extent in selected rural areas. These monitoring stations are operated by state, tribal, and local government agencies as well as some federal agencies. The national air quality trends calculated for this report were derived from the composite average of direct measurements of air

concentrations obtained from monitoring sites (see Table A-10 of Appendix A). The averaging times and air quality statistics used in these trends calculations relate directly to ambient air quality standards.

Another indicator of air quality trends is the estimated total of nationwide emissions. This estimate is based on engineering calculations of the amounts and kinds of pollutants emitted by automobiles, factories, and other sources over a given period.¹

Although air pollutant concentrations can only be reduced over time by decreasing or eliminating pollutant emissions, changes in pollutant concentrations do not always track changes in pollutant emissions resulting from human activities. There are four primary reasons for the differences observed between trends in concentrations and trends in emission estimates. First, because most monitors are positioned in urban, population-oriented locales, air quality trends are more likely to track changes in urban emissions rather than changes in total national emissions. Urban emissions are generally dominated by mobile sources, while rural areas are more likely to be dominated by large stationary sources such as power plants and smelters. Second, emissions for some pollutants are calculated or measured in a different form than the primary air pollutant. For example, concentrations of NO₂ are caused by emissions of oxides of nitrogen which include nitric oxide and NO₂. Also, concentrations of O₃ are caused by emissions of volatile organic compounds (VOCs) and oxides of nitrogen. Third, the amount of each pollutant measured at monitoring locations depends on what chemical reactions occur in the atmosphere during the time it takes the pollutant to travel from its source to the monitoring station. Fourth, meteorological conditions can be conducive to the formation and buildup of pollutants in the ambient air. For example, peak O₃ concentrations typically occur during hot, dry, stagnant summertime conditions (i.e., high temperature and strong solar insolation). In

contrast, CO is predominately a cold weather problem with peak CO concentrations occurring during the winter months. The temporal variation in particulate levels may also be attributed to fluctuations in meteorological conditions, especially precipitation. Rainfall has the effect of reducing re-entrainment of particles and washing particles out of the air. Also, drier conditions are associated with an increase in the frequency of forest fires.

This chapter describes air quality and emissions trends for each of the six criteria pollutants. Interested readers will find a discussion of the trends

methodology in Appendix B, and an expanded section containing data tables in Appendix A.

Table 2-1: NAAQS in effect in 1994.

| Pollutant | Primary (Health Related) | | Secondary (Welfare Related) | |
|-----------------|----------------------------------------------|----------------------------------------------|--------------------------------|--------------------------------------|
| | Type of Average | Standard Level Concentration ^a | Type of Average | Standard Level Concentration |
| CO | 8-hour ^b | 9 ppm (10 mg/m ³) | No Secondary Standard | |
| | 1-hour ^b | 35 ppm (40 mg/m ³) | No Secondary Standard | |
| Pb | Maximum Quarterly Average | 1.5 µg/m ³ | Same as Primary Standard | |
| NO ₂ | Annual Arithmetic Mean | 0.053 ppm (100 µg/m ³) | Same as Primary Standard | |
| O ₃ | Maximum Daily 1-hour Average ^c | 0.12 ppm (235 µg/m ³) | Same as Primary Standard | |
| PM-10 | Annual Arithmetic Mean ^d | 50 µg/m ³ | Same as Primary Standard | |
| | 24-hour ^d | 150 µg/m ³ | Same as Primary Standard | |
| SO ₂ | Annual Arithmetic Mean | 80 µg/m ³ (0.03 ppm) | 3-hour ^b | 1300 µg/m ³ (0.50 ppm) |
| | 24-hour ^b | 365 µg/m ³ 0.14 ppm | | |

^a Parenthetical value is an approximately equivalent concentration.

^b Not to be exceeded more than once per year.

^c The standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is equal to or less than one, as determined according to Appendix H of the Ozone NAAQS.

^d Particulate standards use PM-10 as the indicator pollutant. The annual standard is attained when the expected annual arithmetic mean concentration is less than or equal to 50 µg/m³; the 24-hour standard is attained when the expected number of days per calendar year above 150 µg/m³ is equal to or less than one, as determined according to Appendix K of the PM NAAQS.

Carbon Monoxide (CO)

Nature and Sources

CO is a colorless, odorless, poisonous gas formed when carbon in fuels is not burned completely. It is a by-product of motor vehicle exhaust, which contributes more than three-fourths of all CO emissions nationwide. In cities, automobile exhaust can cause as much as 95 percent of all CO emissions. These emissions can result in high concentrations of CO particularly in local areas with heavy traffic congestion. Peak CO concentrations typically occur during the colder months of the year when CO automotive "cold start" emissions are greater and nighttime inversion conditions are more frequent. Other sources of CO emissions include industrial processes, non-transportation fuel combustion, and natural sources such as wildfires. Despite an overall downward trend in concentrations and emissions of CO, some metropolitan areas still fail to meet the CO NAAQS.

Health Effects

CO enters the bloodstream and reduces oxygen delivery to the body's organs and tissues. The health threat from CO is most serious for those who suffer from cardiovascular disease. At higher levels of exposure, healthy individuals are also affected. Exposure to elevated CO levels is associated with visual impairment, reduced work capacity, reduced manual dexterity, poor learning ability, and difficulty in performing complex tasks. There are two primary NAAQS for ambient CO, a 1-hour average of 35 ppm and an 8-hour average of 9 ppm. These standards cannot be exceeded more than once per year.

Trends

Long-term improvements continued between 1985 and 1994. Figure 2-1 indicates that national average CO levels decreased 28 percent during the past 10 years as measured by the composite average of the annual second highest 8-hour concentration. National total CO emissions decreased 15 percent since 1985 as illustrated in Figure 2-2. The ambient trends plotting points and emissions totals by source category are listed in Tables A-1 and A-2 of Appendix A.

Because the urban CO monitoring network is primarily mobile-source oriented, CO air quality improvements track the estimated 21 percent reduction in highway vehicle emissions. This air quality improvement occurred across all monitoring environments (see Figure 2-3) despite a 32-percent increase in miles traveled in the United States since 1985.

Between 1993 and 1994, national average CO concentrations increased two percent, while total CO emissions increased four percent. This one year increase in the national average concentration has a distinct regional component which is likely associated with the year to year differences in meteorological conditions. Ambient concentrations increased in the northeastern and north central regions of the country coinciding the much colder than normal winters in those regions. Except for southern California, the remainder of the country continued the downward trend in ambient CO levels. The map in Figure 2-4 shows the variations in CO concentrations across the country in 1994. The air quality indicator is the highest annual second maximum 8-hour concentration measured in each county. The bar chart to the left of the map displays the number of people living in counties within each concentration range. The colors on the map and bar chart correspond to the colors for the concentration ranges displayed in the map legend. Ten counties (with a total population of approximately 15 million) had second maximum 8-hour concentrations greater than 9 ppm in 1994.

The composite average of the estimated number of exceedances of the CO NAAQS declined 92 percent between 1985 and 1994. The large difference between the rate of change in concentrations and the percentage change in exceedances is due to the nature of the exceedance statistic (which is simply a count of a pass/fail indicator). As noted above, the trend in the annual second maximum 8-hour concentration tracks the trend in highway vehicle emissions.

Figure 2-5 shows that transportation sources now account for 78 percent of the nation's total CO emissions. The observed increase in CO emissions between 1993 and 1994 is attributed to two sources: transportation emissions (up two percent) and wildfire emissions (up 159 percent) exacerbated by

1985-94: 28% decrease
1993-94: 2% increase

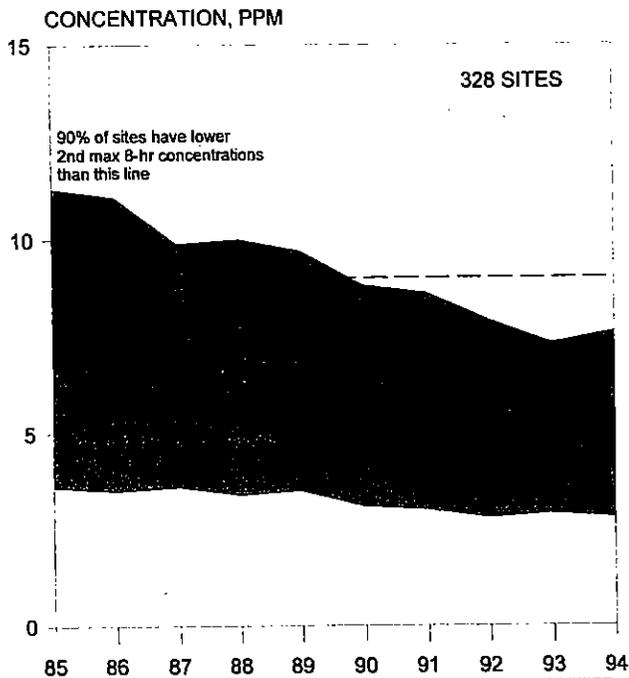


Figure 2-1: Trend in second maximum non-overlapping 8-hour average CO concentrations, 1985-1994.

the dry conditions in the West and Northwest regions.

Ten-year trends in ambient concentrations are the focus of this report since changes over time in monitoring methods and site locations limit the number of sites having the continuous data record needed for a long-term trends assessment. Although it is difficult to provide a quantitative assessment, qualitative long-term comparisons can be made. Figure 2-6 illustrates the improvement in ambient CO air quality during the past 20 years. The apparent discontinuity between the endpoint of the 1975-1984 trend line and the first year of the 1985-1994 trend line results from differences in the mix of trend sites for the two periods (141 vs. 328 sites). The plotting points for the 20-year trend charts are listed in Table A-9 of Appendix A.

1985-94: 15% decrease
1993-94: 4% increase

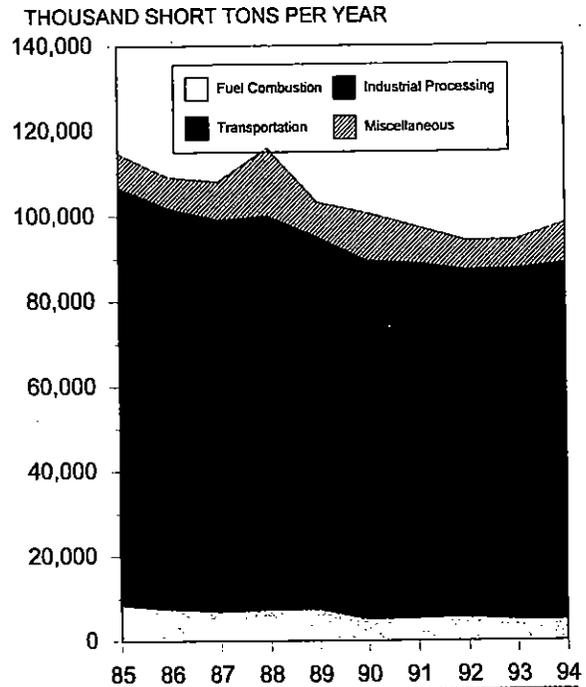


Figure 2-2: National total CO emissions trend, 1985-1994.

Concentration, ppm

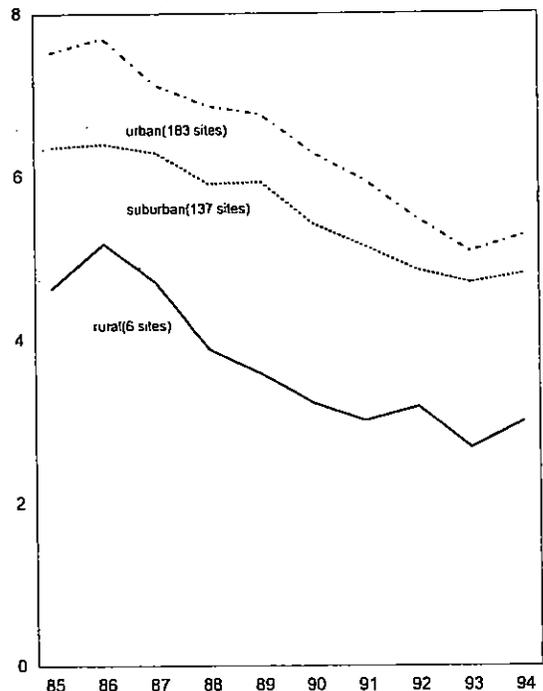


Figure 2-3: CO second maximum 8-hour concentration trends by location, 1985-1994.

Carbon Monoxide Air Quality Concentrations, 1994
Highest Second Max 8-Hour Average

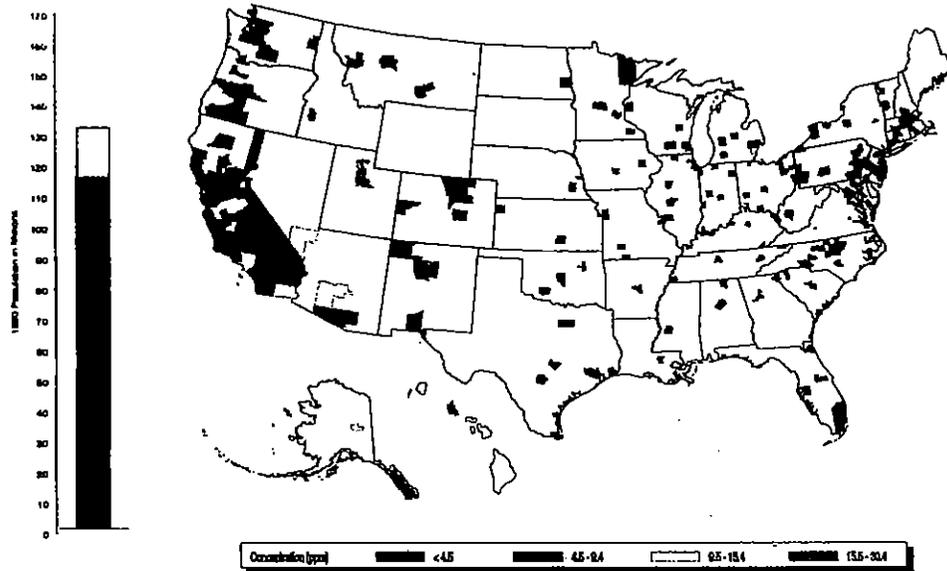


Figure 2-4: Highest CO second maximum 8-hour concentration by county, 1994.

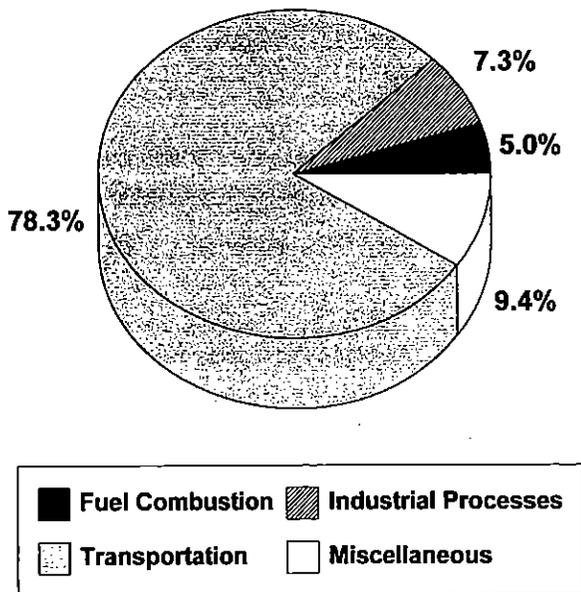


Figure 2-5: CO emissions by source category, 1994.

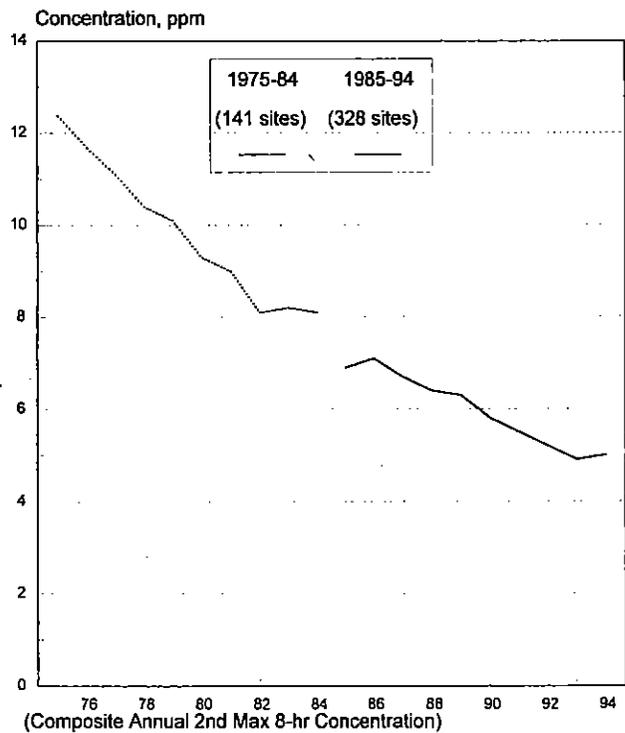


Figure 2-6: Long-term ambient CO trend, 1975-1994.

Lead (Pb)

Nature and Sources

In the past, automotive sources were the major contributor of Pb emissions to the atmosphere. As a result of EPA's regulatory efforts to reduce the content of Pb in gasoline, the contribution from the transportation sector has declined. Today, smelters, battery plants, followed by highway vehicles are the major sources of Pb emissions to the atmosphere. The highest concentrations of Pb are found in the vicinity of nonferrous smelters and other stationary sources of Pb emissions.

Health Effects

Exposure to Pb mainly occurs through the inhalation of air and the ingestion of Pb in food, water, soil, or dust. Pb accumulates in the body in blood, bone, and soft tissue. Because it is not readily excreted, Pb can also affect the kidneys, liver, nervous system, and other organs. Excessive exposure to Pb may cause neurological impairments such as seizures, mental retardation, and/or behavioral disorders. Even at low doses, Pb exposure is associated with changes in fundamental enzymatic, energy transfer, and homeostatic mechanisms in the body. Fetuses and children are especially susceptible to low doses of Pb, often suffering central nervous system damage. Recent studies show that Pb may be a factor in high blood pressure and subsequent heart disease in middle-aged white males. The primary NAAQS for Pb is a quarterly average concentration not to exceed 1.5 $\mu\text{g}/\text{m}^3$.

Trends

Figure 2-7 indicates that between 1985 and 1994, quarterly average Pb concentrations in urban areas throughout the country decreased 86 percent, while Figure 2-8 shows that total Pb emissions decreased 75 percent. These reductions are a direct result of the use of unleaded gasoline in automobiles. During the last 10 years, Pb emissions from highway vehicles decreased 91 percent. Figure 2-9 reveals that the air quality trends at urban and suburban locations are similar, which is not surprising since highway vehicles are the major emission source at these locations. The large reduction in Pb emissions from transportation sources has changed the nature of the ambient Pb problem in the United States. The map in Figure 2-10

shows the 1994 peak quarterly concentrations measured in the vicinity of major Pb sources. Despite the reduction of lead from transportation sources, there are still violations of the Pb standard around some Pb point sources. The Pb monitoring strategy now focuses on these point sources of Pb emissions. For example, various enforcement and regulatory actions are being actively pursued by EPA and the States for those sources shown on the map recording violations of the Pb NAAQS. The map in Figure 2-11 shows how the highest quarterly mean Pb concentration varied by county in 1994. Ten counties, with a total population of 4.4 million and containing the point sources from Figure 2-10, did not meet the Pb NAAQS in 1994.

Between 1993 and 1994, Pb emissions remained unchanged, while national average Pb concentrations (approaching the minimum detectable level) decreased 20 percent. Figure 2-12 shows that the two major categories of Pb emissions are industrial processes (58 percent) and emissions from transportation sources (32 percent). A listing of Pb emissions by major source category is provided in Table A-3 of Appendix A. The long-term Pb success story is that ambient Pb concentrations have been reduced by more than 97 percent since 1975, as illustrated in Figure 2-13.

1985-94: 86% decrease
1993-94: 20% decrease

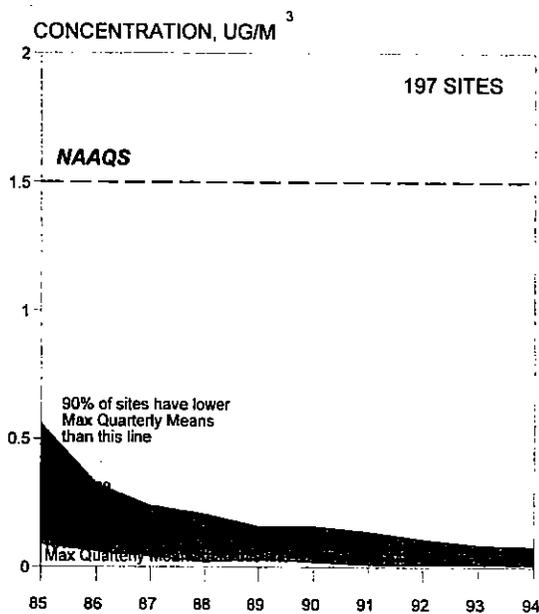


Figure 2-7: Trend in maximum quarterly average Pb concentrations, 1985-1994.

1985-94: 75% decrease
1993-94: no change

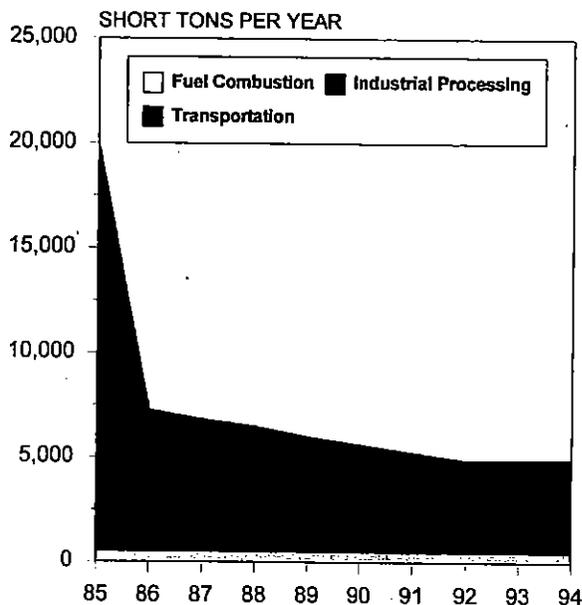


Figure 2-8: National total Pb emissions trend, 1985-1994.

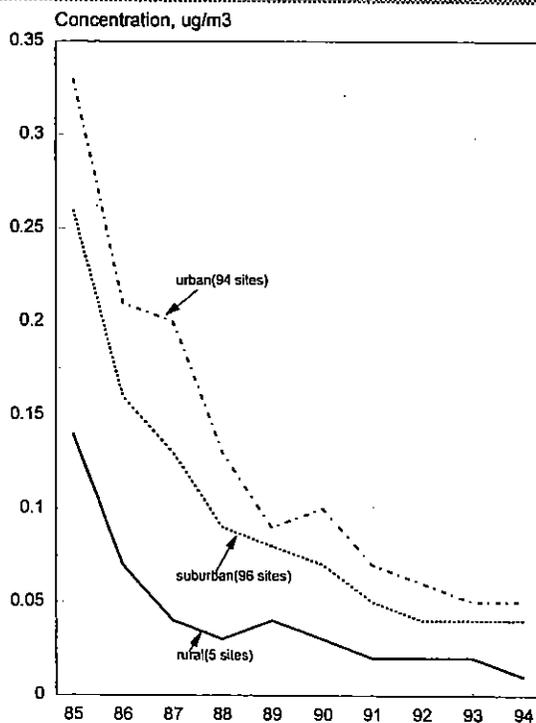


Figure 2-9: Pb maximum quarterly mean concentration trends by location, 1985-1994.

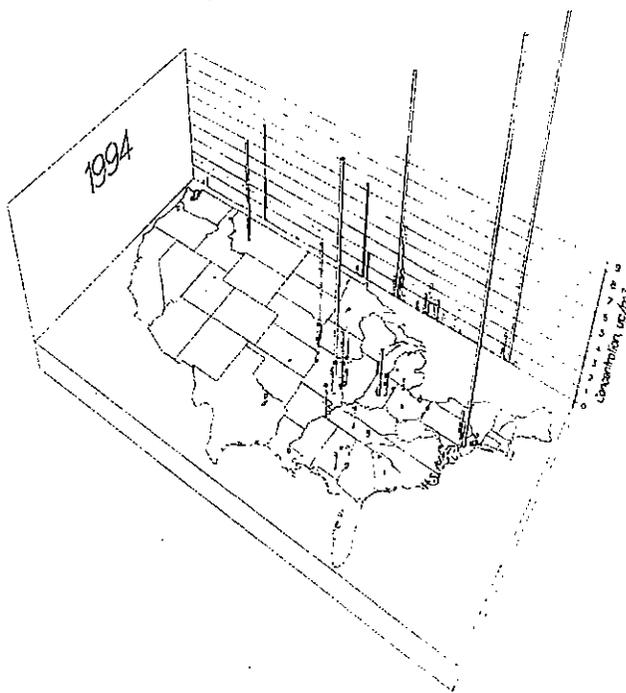


Figure 2-10: Maximum quarterly Pb concentrations in the vicinity of Pb point sources.

Lead Air Quality Concentrations, 1994 Highest Quarterly Average

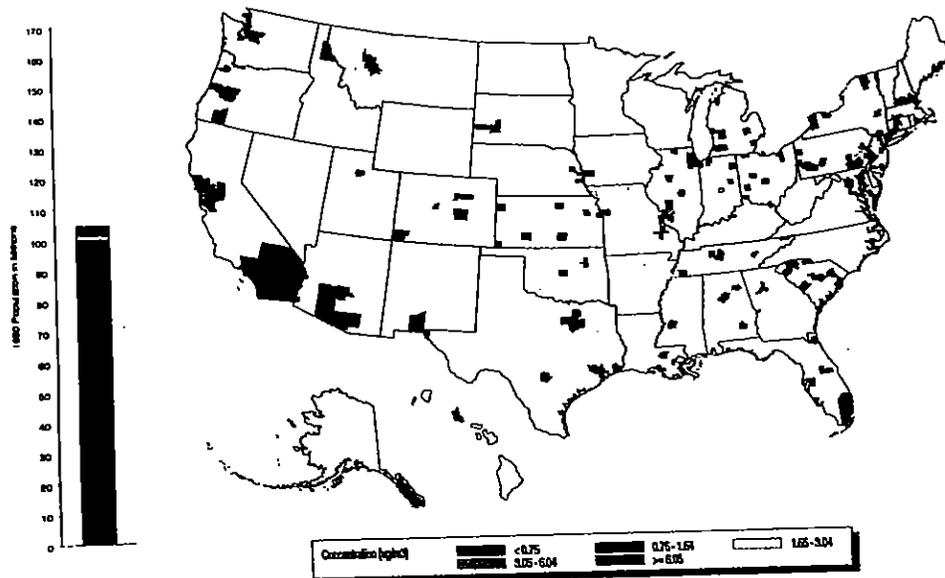


Figure 2-11: Highest Pb maximum quarterly mean concentration by county, 1994.

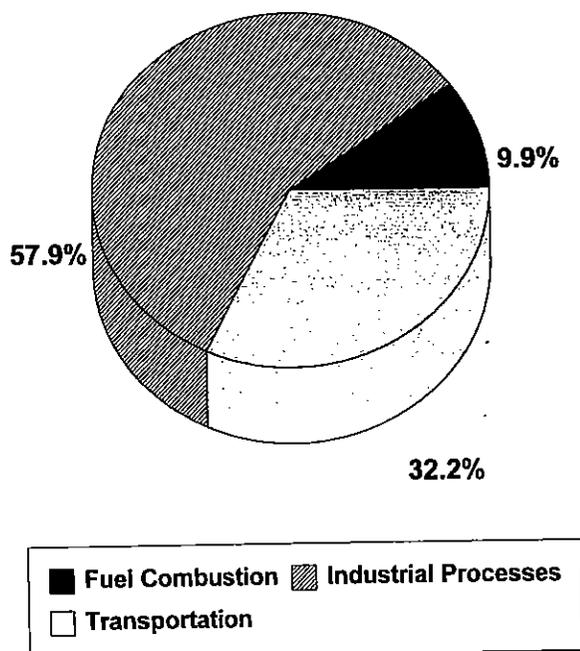


Figure 2-12: Pb emissions by source category.

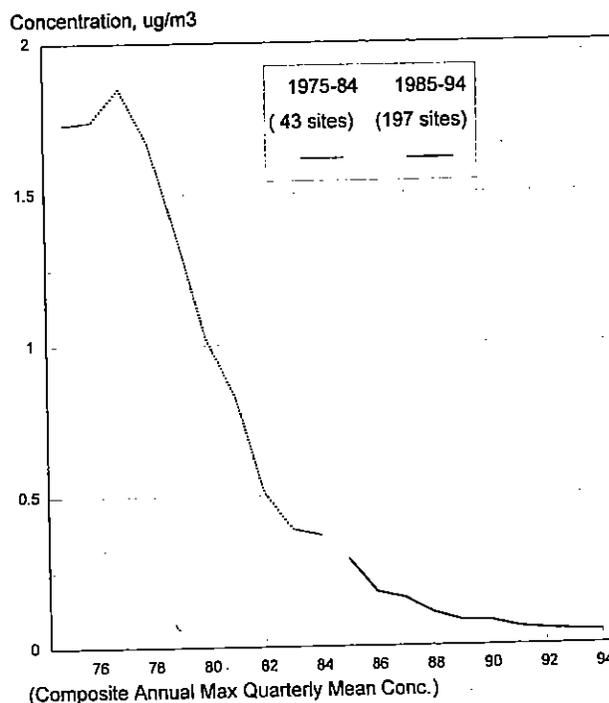


Figure 2-13: Long-term ambient Pb trend, 1975-1994.

Nitrogen Dioxide (NO₂)

Nature and Sources

Nitrogen dioxide belongs to a family of poisonous, highly reactive gases called oxides of nitrogen (NO_x). These gases form when fuel is burned at high temperatures, and come principally from motor vehicle exhaust and stationary sources such as electric utilities and industrial boilers. A suffocating, brownish gas, nitrogen dioxide is a strong oxidizing agent that reacts with water to form corrosive nitric acid. It also plays a major role in the atmospheric reactions that produce O₃.

Health and Other Effects

Nitrogen dioxide can irritate the lungs and lower resistance to respiratory infections such as influenza. The effects of short-term exposure are still unclear, but continued or frequent exposure to concentrations higher than those normally found in the ambient air may cause increased incidence of acute respiratory disease in children. The ambient NO₂ primary NAAQS is an annual mean concentration not to exceed 0.053 ppm. Oxides of nitrogen are an important precursor to both O₃ and acidic precipitation (acid rain) and may affect both terrestrial and aquatic ecosystems. The regional transport and deposition of atmospheric NO_x is a potentially significant contributor to such environmental effects as the growth of algae and subsequent unhealthy or toxic conditions for fish in the Chesapeake Bay and other estuaries. In some parts of the western United States, oxides of nitrogen have a significant impact on particulate matter concentrations.

Trends

Nationally, annual mean NO₂ concentrations remained relatively constant throughout the 1980s, followed by decreasing concentrations in the 1990s. The 1994 composite average of the NO₂ annual mean concentrations is nine percent lower than the 1985 level, but five percent higher than the 1993 level, as illustrated in Figure 2-14.

The trend in national total emissions of NO_x is shown in Figure 2-15. Since 1985, national total NO_x emissions increased 3 percent, while highway vehicle NO_x emissions declined seven percent and fuel combustion emissions increased 8 percent. The two primary sources of the NO_x emissions in 1994 were

fuel combustion (50 percent) and transportation (45 percent) as shown in Figure 2-16. Table A-4 in Appendix A provides a listing of NO_x emissions by major source category. The increase in NO_x emissions between 1993 and 1994 is attributed to increased emissions from off-highway vehicles and wildfires.

Although the highest ambient NO₂ levels are typically observed in urban areas, Figure 2-17 shows that the ambient NO₂ air quality trends are similar across monitoring locations. Even with an increase in annual mean NO₂ concentrations, 1994 is the third consecutive year that all monitoring locations across the nation, including Los Angeles, met the federal NO₂ air quality standard (see Figure 2-18). Twenty-year trends in ambient NO₂ concentrations are not shown because the sites meeting the 1975-1984 completeness criteria (a total of 40 sites) are not representative of the mix of 205 sites in the current trends data base. The lack of data resulted in a large discontinuity between the levels of the two trend lines.

1985-94: 9% decrease
1993-94: 5% increase

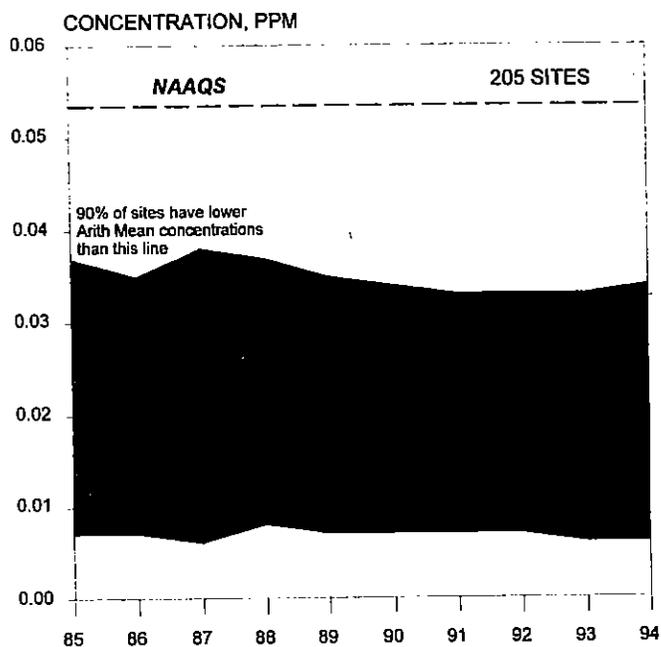


Figure 2-14: Trend in annual mean NO₂ concentrations, 1985-1994.

1985-94: 3% increase
1993-94: 1% increase

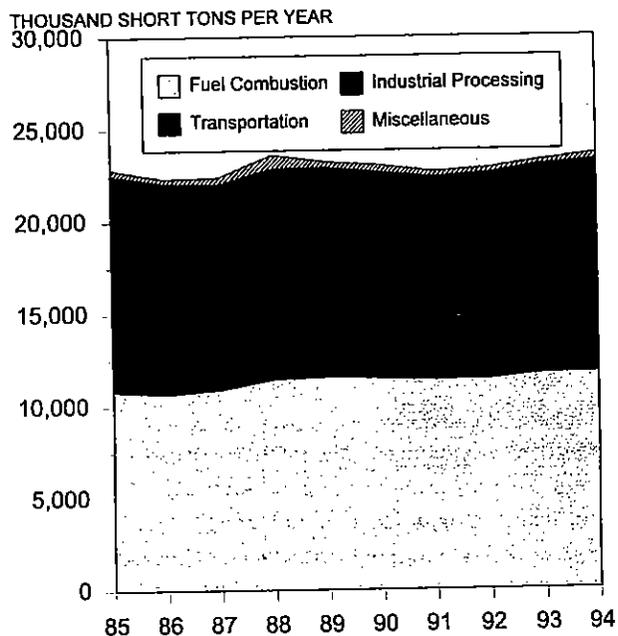


Figure 2-15: National total NO_x emissions trend, 1985-1994.

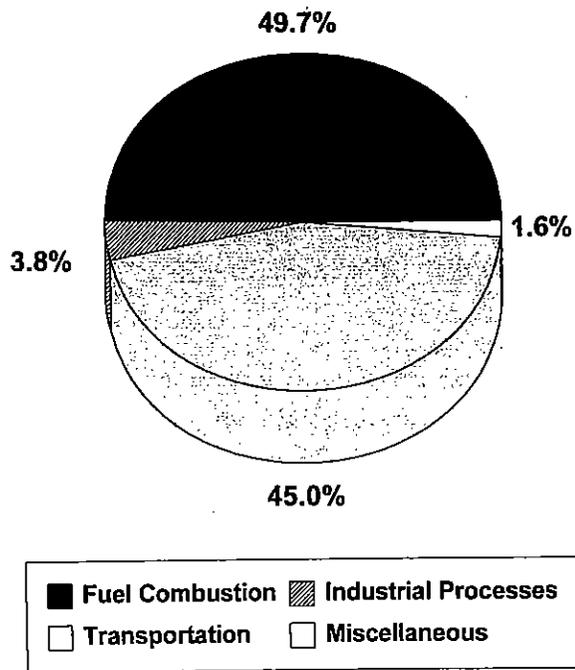


Figure 2-16: NO_x emissions by source category, 1994.

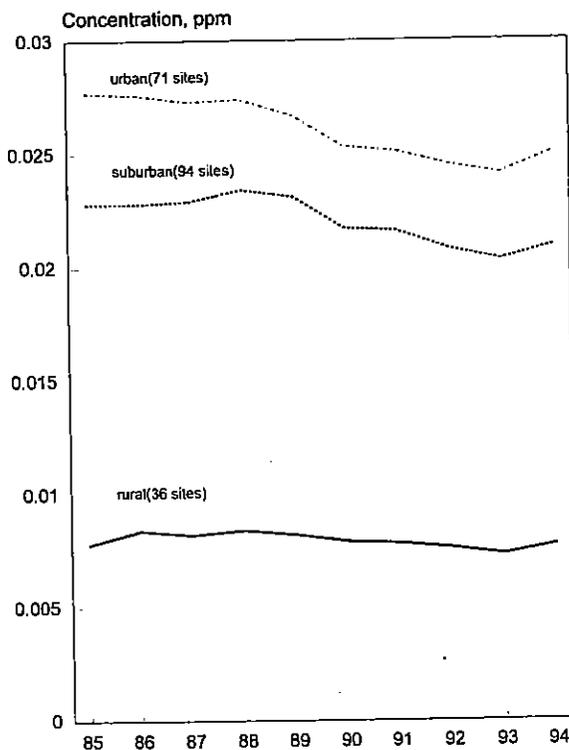


Figure 2-17: NO₂ annual mean concentration trends by location, 1985-1994.

Nitrogen Dioxide Air Quality Concentrations, 1994
Highest Arithmetic Mean

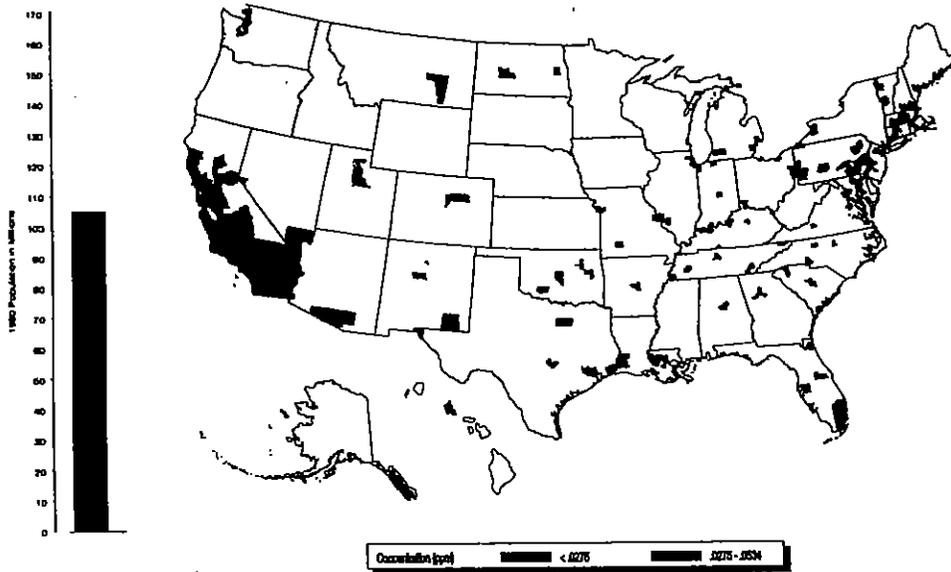


Figure 2-18: Highest NO₂ annual mean concentration by county, 1994.

Ozone (O₃)

Nature and Sources

Ground-level O₃ is the most complex, difficult to control, and pervasive of the six criteria pollutants. Unlike other pollutants, O₃ is not emitted directly into the air by specific sources. A poisonous form of pure oxygen, it is created when sunlight reacts with oxides of nitrogen and VOCs in the air. There are thousands of sources of these gases. Some of the more common sources are gasoline vapors, chemical solvents, combustion products of various fuels, and consumer products. These products can frequently be found in large industrial facilities, gas stations, and small businesses such as bakeries and dry cleaners. Often these "precursor" gases are emitted in one area, but the actual chemical reactions, stimulated by sunlight and temperature, take place in another. Combined emissions from motor vehicles and stationary sources can be carried hundreds of miles from their origins, forming high O₃ concentrations over very large regions. Approximately 50 million people lived in counties with air quality levels above the primary O₃ NAAQS in 1994. The highest levels of O₃ were recorded in Los Angeles. High levels also persist along the Texas Gulf Coast and much of the Northeast.

Health and Other Effects

While O₃ in the upper atmosphere is beneficial in that it shields the earth from harmful ultraviolet rays, ground-level O₃ causes health problems because it damages lung tissue, reduces lung function, and sensitizes the lungs to other irritants. Scientific evidence indicates that ambient levels of O₃ not only affect people with impaired respiratory systems (such as asthmatics) but healthy adults and children as well. Exposure to O₃ for six to seven hours, even at relatively low concentrations, has been found to significantly reduce lung function and induce respiratory inflammation in normal, healthy people during periods of moderate exercise. This decrease in lung function is often accompanied by such symptoms as chest pain, coughing, nausea, and pulmonary congestion. Recent studies provide evidence of an association between elevated ambient O₃ levels and increases in hospital admissions for respiratory problems in several U.S. cities. Though less well established in humans, animal studies have

demonstrated that repeated exposure to O₃ for months to years can produce permanent structural damage in the lungs and accelerate the rate of lung function decline and the aging of the lungs. Ambient O₃ also is responsible for several billion dollars of agricultural crop yield loss in the United States each year. It also causes noticeable leaf damage in many crops and species of trees. Forest and ecosystem studies indicate that damage is resulting from current ambient O₃ levels. The ambient standard for O₃ is 0.12 ppm daily maximum 1-hour concentration not to be exceeded more than once per year averaged over three calendar years.

Trends

Ground level O₃ (the primary constituent of smog) has been a pervasive pollution problem throughout the United States. Ambient O₃ trends are influenced by year-to-year changes in meteorological conditions as well as emission reductions from ongoing control measures. Although meteorological conditions in 1994 were conducive to O₃ formation, especially in the Southeast, Figure 2-19 reveals that the 1994 composite national average daily maximum 1-hour O₃ concentration is 12 percent lower than the 1985 composite mean level. The national 1994 composite mean is the second lowest national average of this 10-year trends period. The lowest level was recorded in 1992 and the highest in 1988. The composite mean of the number of exceedances of the O₃ NAAQS declined 56 percent since 1985. Figure 2-20 shows that the trends in composite mean second daily maximum 1-hour concentrations are similar across monitoring environments, while the highest levels are typically found at suburban sites. During the past 10 years, urban sites recorded the largest air quality improvement (a 14 percent decline in O₃ concentrations), followed by suburban sites (-12 percent) then rural sites (-nine percent). The map in Figure 2-21 presents the highest second daily maximum 1-hour concentration by county in 1994. The accompanying bar chart to the left of the map reveals that in 1994 approximately 50 million people lived in counties where the second daily maximum 1-hour concentration was above the level of the O₃ NAAQS.

As noted in a study by the National Academy of Science, and in previous Trends Reports, O₃ trends are affected by changing meteorological conditions that are conducive to O₃ formation.^{2,3} EPA has developed a statistical model that factors out meteorological effects and helps reduce the degree of uncertainty in the resulting trend estimates.⁴ Results from application of the model in 44 major urban areas indicate that meteorologically adjusted O₃ trends are improving at a median rate of 1.2 percent per year since 1984. Quantitative long-term ambient O₃ trends assessments are difficult due to historical changes in network design, siting criteria, spatial coverage and monitoring instrument calibration procedures. Figure 2-22 contrasts the 1975–1984 composite trend line based on 149 sites with the current 1985–1994 composite trend line based on 549 sites. Although the overall trend is downward, short-term upturns corresponding to peak O₃ conducive years are evident. The shaded area in the late 1970s indicates the period corresponding to the old calibration procedure where concentration levels are less certain.

Recent control measures include regulations to lower fuel volatility as well as NO_x and VOC emissions from tailpipes.⁵ Figure 2-23 shows that emissions of VOCs (which contribute to O₃ formation) decreased 10 percent between 1985 and 1994. Nationally, the two major sources of VOC emissions are industrial processes (56 percent) and transportation sources (37 percent) as shown in Figure 2-24 or in Table A-5 of Appendix A. NO_x emissions (the other major precursor to O₃ formation) increased three percent between 1985 and 1994.

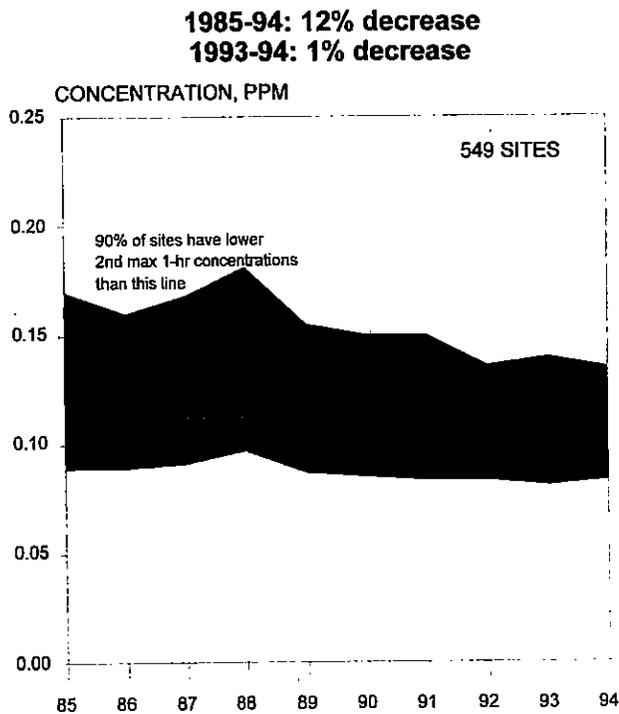


Figure 2-19: Trend in annual second daily maximum 1-hour O₃ concentrations, 1985–1994.

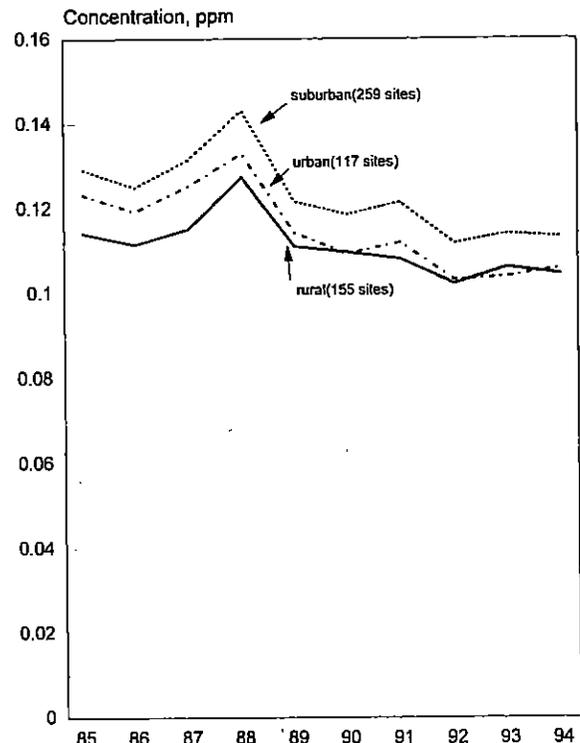


Figure 2-20: O₃ second daily maximum 1-hour concentration trends by location, 1985–1994.

Ozone Air Quality Concentrations, 1994
Highest Second Daily 1-Hour Max

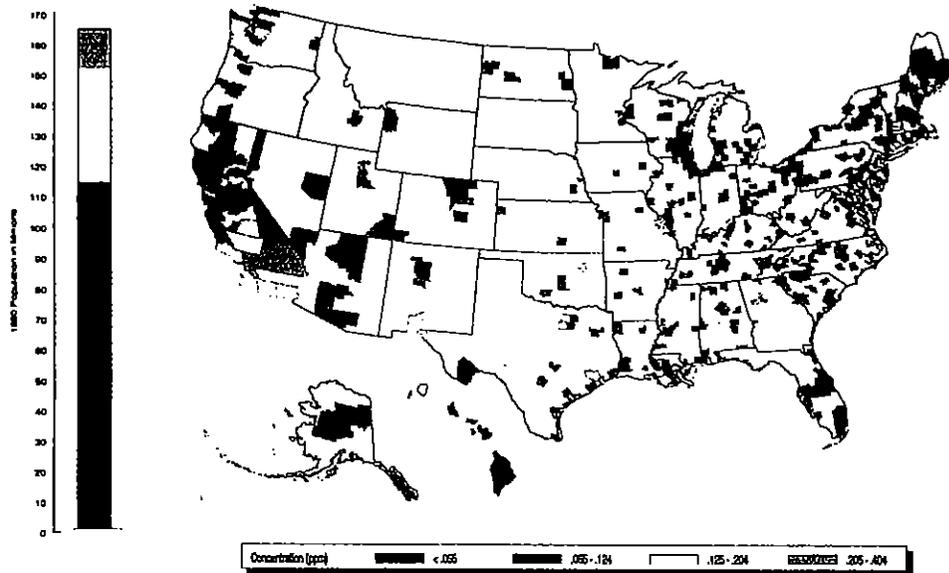


Figure 2-21: Highest O₃ second daily maximum 1-hour concentration by county, 1994.

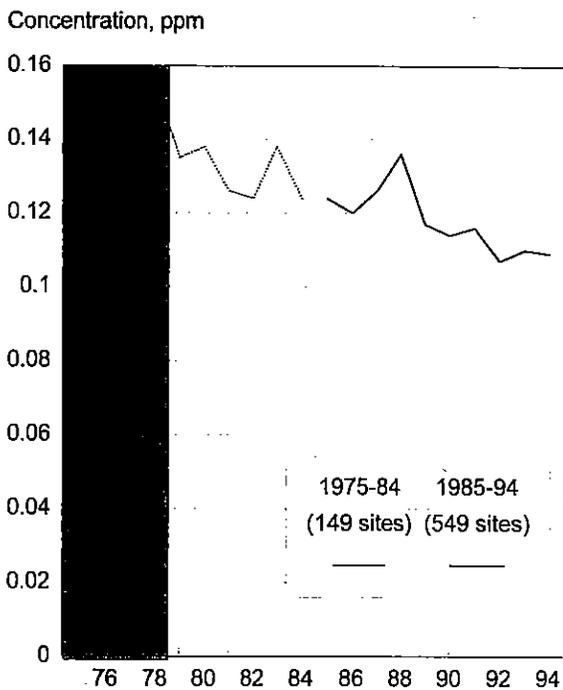


Figure 2-22: Long-term ambient O₃ trend, 1975-1994.

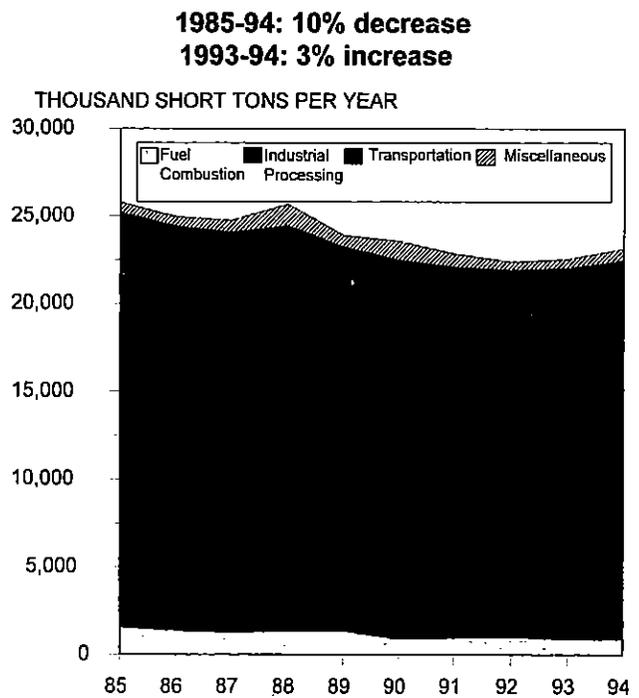


Figure 2-23: National total VOC emissions trend, 1985-1994.

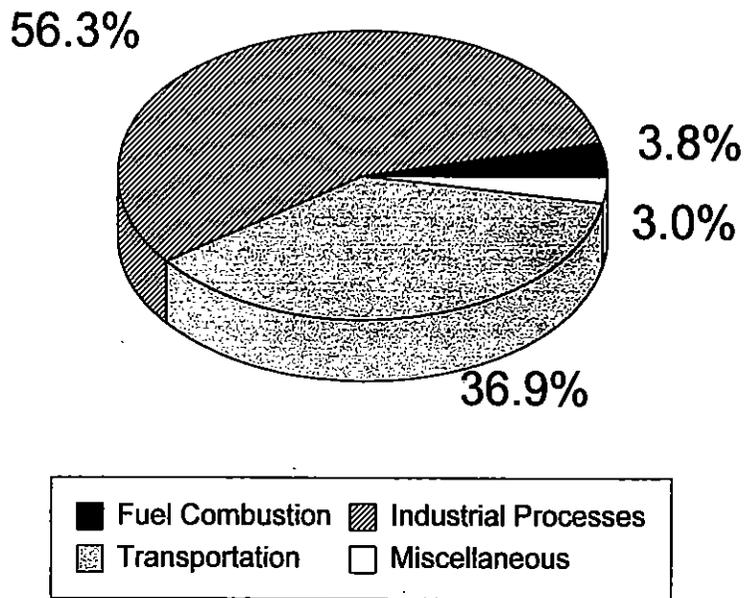


Figure 2-24: VOC emissions by source category, 1994.

Particulate Matter (PM-10)

Nature and Sources

Particulate matter is the general term for solid or liquid particles found in the atmosphere. Some particles are large or dark enough to be seen as soot or smoke. Others are so small they can only be identified with an electron microscope. Because particles originate from a variety of mobile and stationary sources, their chemical and physical compositions vary widely depending on location and time of year. In 1987, EPA replaced the earlier Total Suspended Particulate (TSP) standard with a PM-10 standard.⁶ The new standard focuses on smaller particles that are likely to be responsible for adverse health effects because of their ability to reach the lower regions of the respiratory tract. PM-10 includes only those particles that have a mass less than or equal to a standard particle with a diameter of 10 micrometers (0.0004 inches).

Health and Other Effects

Based on studies of human populations exposed to ambient particle pollution (sometimes in the presence of SO₂) and laboratory studies of both animals and humans, areas of concern for human health have been identified as: negative effects on breathing and respiratory systems, aggravation of existing respiratory and cardiovascular disease, alterations in the body's defense systems against foreign materials, damage to lung tissue, carcinogenesis, and premature death. The elderly, children, and people with chronic obstructive pulmonary or cardiovascular disease, influenza, or asthma are especially sensitive to the effects of PM-10. In addition, PM-10 serves as a carrier for a variety of toxic metals and compounds, and is a major cause of reduced visibility in many parts of the United States.

There are both short-term and long-term PM-10 NAAQS. The long-term standard specifies an expected annual arithmetic mean not to exceed 50 $\mu\text{g}/\text{m}^3$, while the short-term 24-hour standard of 150 $\mu\text{g}/\text{m}^3$, is not to be exceeded more than once per year.

Trends

Ambient monitoring networks were revised in 1987 to measure PM-10 (replacing the earlier TSP standard instruments). Between 1988 and 1994, the national composite average of annual mean PM-10 concen-

trations decreased 20 percent, while estimated PM-10 emissions from traditionally inventoried sources decreased 12 percent as shown in Figure 2-25 and Figure 2-26. Urban and suburban sites have similar trends and comparable average concentration levels (see Figure 2-27). The trends at rural sites are consistent with these urban and suburban patterns, although the composite mean level is significantly lower. Between 1993 and 1994, mean PM-10 concentrations remained unchanged, while PM-10 emissions increased one percent.

PM-10 emissions from traditionally inventoried sources decreased 17 percent since 1985. Figure 2-28 shows that the three major categories, fuel combustion, industrial processes, and transportation contribute almost equally to the total. Emissions from residential wood combustion decreased 50 percent in the past 10 years. Table A-6 of Appendix A lists PM-10 emission estimates from these sources for 1985-1994. On a national basis, fugitive sources (e.g., emissions from agricultural tilling, construction, and unpaved roads) contribute about 85 percent to total PM-10 emissions as compared to the 15-percent contribution from sources historically included in emission inventories (See Figure 2-29). Miscellaneous and natural source PM-10 emissions estimates are provided in Table A-7 of Appendix A.

Figure 2-30 displays the highest second maximum 24-hour PM-10 concentration by county in 1994. Though not shown here, when both the annual and 24-hour standards are considered, there were 13 million people living in 19 counties with PM-10 concentrations above the PM-10 NAAQS in 1994.

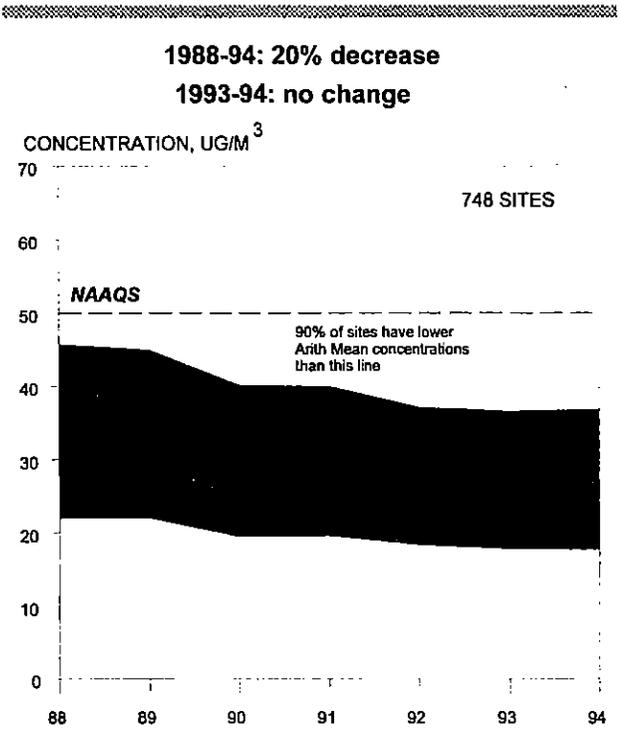


Figure 2-25: Trend in annual mean PM-10 concentrations, 1985-1994.

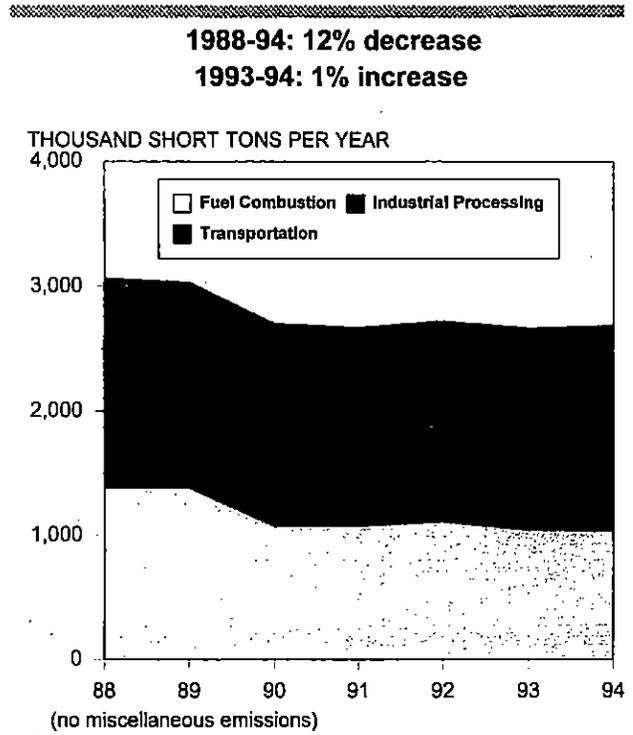


Figure 2-26: National total PM-10 emissions trend, 1985-1994 (traditionally inventoried sources only).

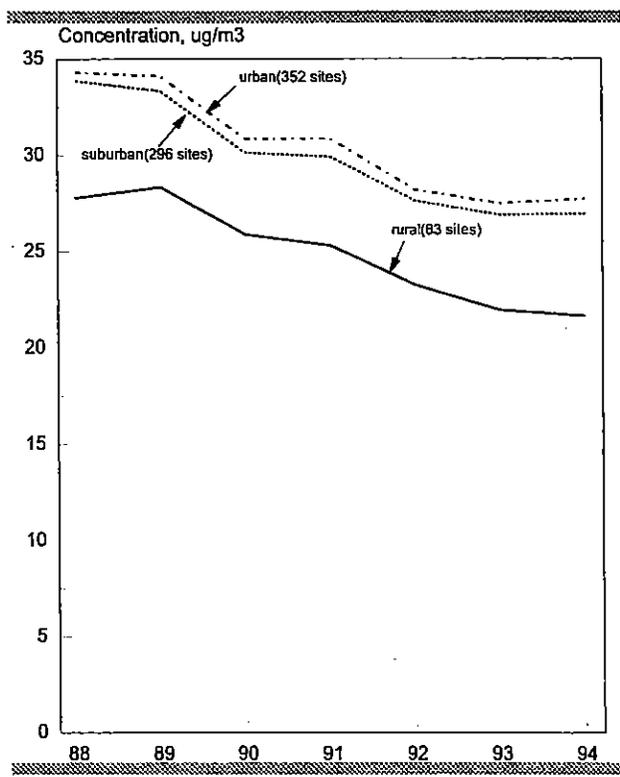


Figure 2-27: PM-10 annual mean concentration trends by location, 1985-1994.

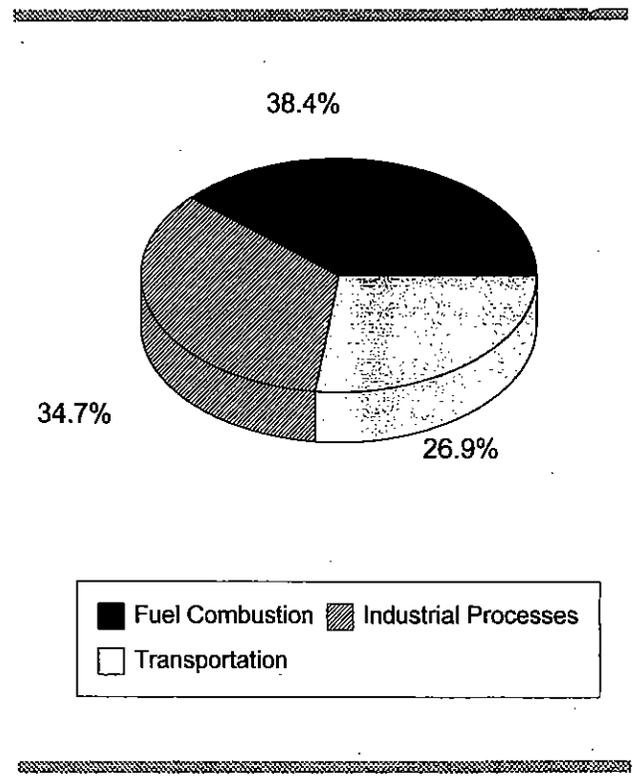


Figure 2-28: PM-10 emissions from traditionally inventoried source categories, 1994.

85.4%

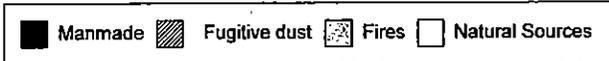
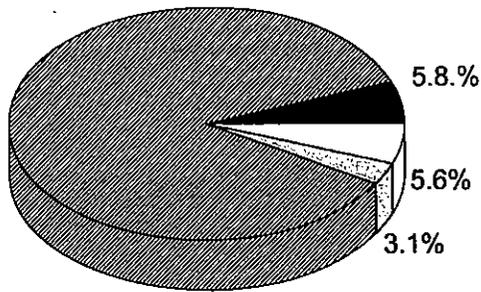


Figure 2-29: PM-10 total emissions by source category, 1994.

PM-10 Air Quality Concentrations, 1994 Highest Second Max 24-Hour Average

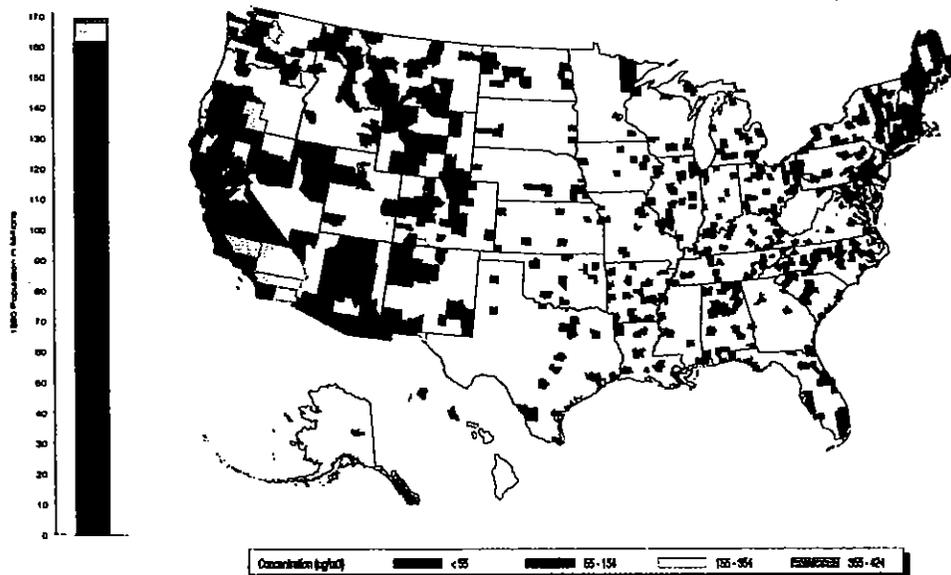


Figure 2-30: Highest second maximum 24-hour PM-10 concentration by county, 1994.

Sulfur Dioxide (SO₂)

Nature and Sources

Sulfur dioxide belongs to the family of sulfur oxide gases (SO_x). These gases are formed when fuel containing sulfur (mainly coal and oil) is burned, and during metal smelting and other industrial processes. Most sulfur dioxide monitoring stations are located in urban areas. The highest monitored concentrations of sulfur dioxide are recorded in the vicinity of large industrial facilities.

Health and Other Effects

The major health concerns associated with exposure to high concentrations of sulfur dioxide include effects on breathing, respiratory illness, alterations in the lungs' defenses, and aggravation of existing cardiovascular disease. Major subgroups of the population that are most sensitive to sulfur dioxide include asthmatics and individuals with cardiovascular disease or chronic lung disease (such as bronchitis or emphysema) as well as children and the elderly. There are two primary NAAQS for SO₂ that address these health concerns: an annual mean concentration of 80 µg/m³ (0.03 ppm) not to be exceeded, and a 24-hour daily concentration of 365 µg/m³ (0.14 ppm) not to be exceeded more than once per year.

SO₂ also can produce damage to the foliage of trees and agricultural crops. Together, sulfur dioxide and oxides of nitrogen are the major precursors to acidic deposition (acid rain), which is associated with the acidification of lakes and streams, accelerated corrosion of buildings and monuments, and reduced visibility. The secondary SO₂ NAAQS, which protects against such damage, is a 3-hour average concentration of 1300 µg/m³ (0.50 ppm) not to be exceeded more than once per year.

Trends

The map in Figure 2-31 displays the highest second maximum 24-hour SO₂ concentration by county in 1994. Only one county, containing a major SO₂ point source, failed to meet the ambient SO₂ NAAQS in 1994. The national composite average of SO₂ annual mean concentrations decreased 25 percent between 1985 and 1994 (see Figure 2-32), while SO₂

emissions decreased nine percent (see Figure 2-33). Between 1993 and 1994, national SO₂ mean concentrations decreased four percent, and SO₂ emissions decreased two percent. Table A-8 of Appendix A lists national total SO₂ emission estimates by source category between 1985 and 1994.

The difference between concentrations and emissions trends is mainly a result of the location of the ambient monitoring network. Historically, networks are positioned in population-oriented locales. However, fuel combustion sources, which comprise 88 percent of total national SO₂ emissions (Figure 2-34), tend to be located in less populated areas. Figure 2-35 reveals that composite annual mean concentrations at sites in urban and suburban locations decreased 28 percent, while ambient levels decreased 14 percent at rural sites. The progress in reducing ambient SO₂ concentrations during the past 20 years is portrayed in Figure 2-36. This reduction can be accomplished by installing flue-gas control equipment at coal-fired generating plants, reducing emissions from industrial processing facilities such as smelters and sulfuric acid manufacturing plants, reducing the average sulfur content of fuels burned, and using cleaner fuels in residential and commercial burners.

Sulfur Dioxide Air Quality Concentrations, 1994
Highest Second Max 24-Hour Average

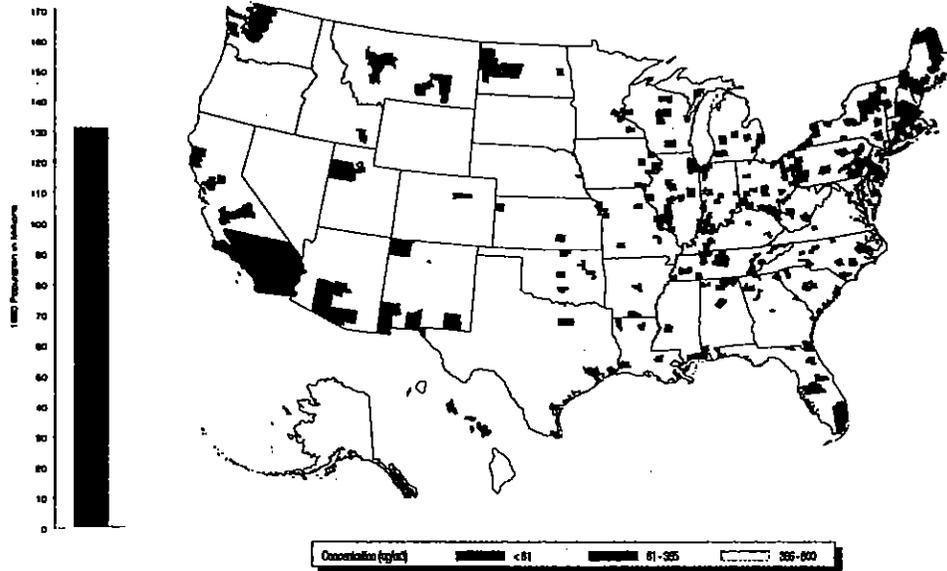


Figure 2-31: Highest second maximum 24-hour SO₂ concentration by county, 1994.

1985-94: 25% decrease
1993-94: 4% decrease

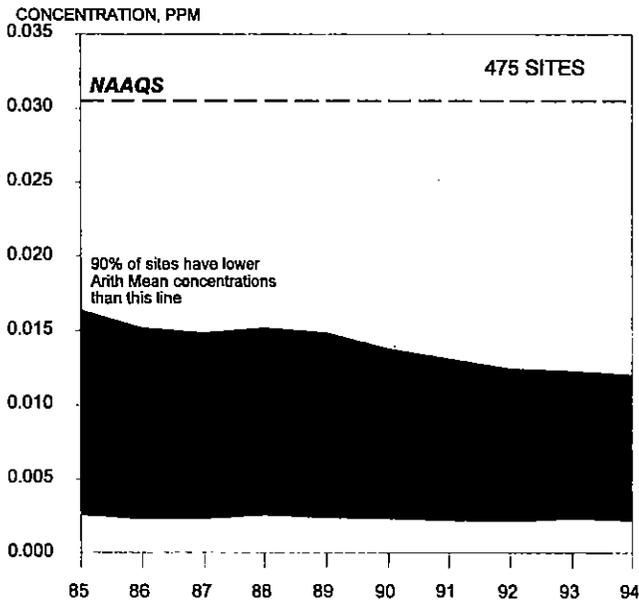


Figure 2-32: Trend in annual mean SO₂ concentrations, 1985-1994.

1985-94: 9% decrease
1993-94: 2% decrease

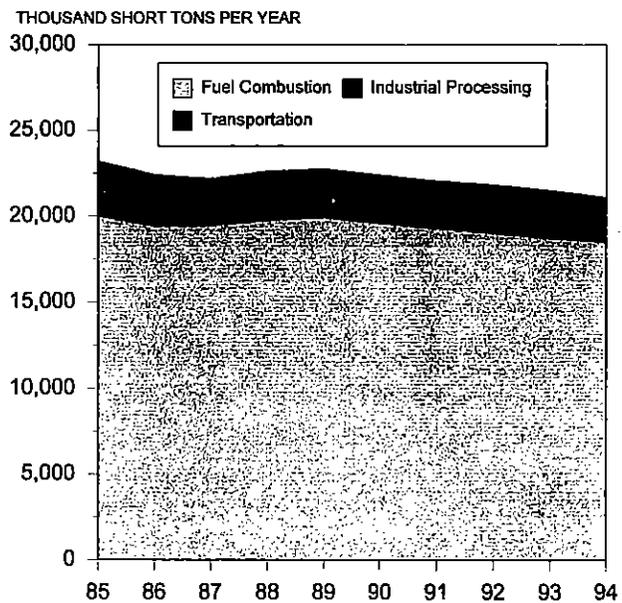


Figure 2-33: National total SO₂ emissions trend, 1985-1994.

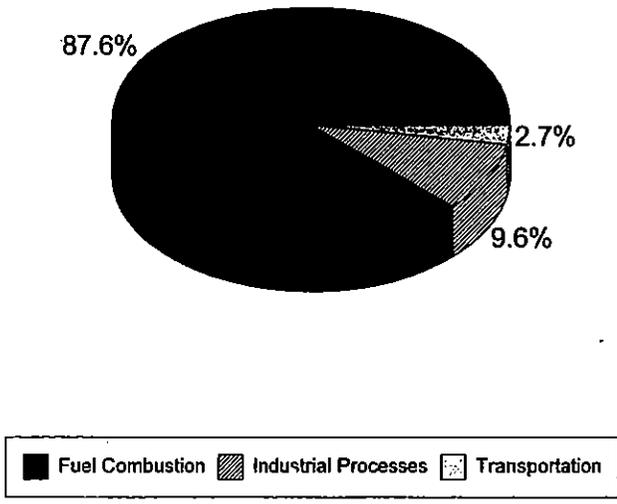


Figure 2-34: SO₂ total emissions by source category, 1994.

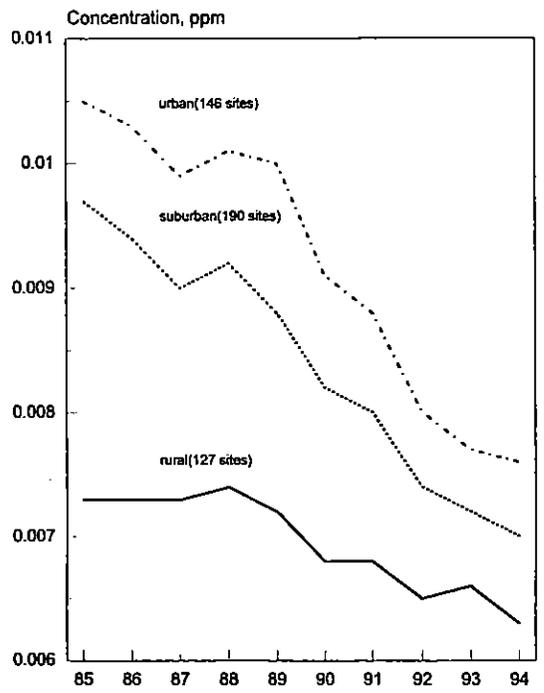


Figure 2-35: SO₂ annual mean concentration trends by location, 1985-1994.

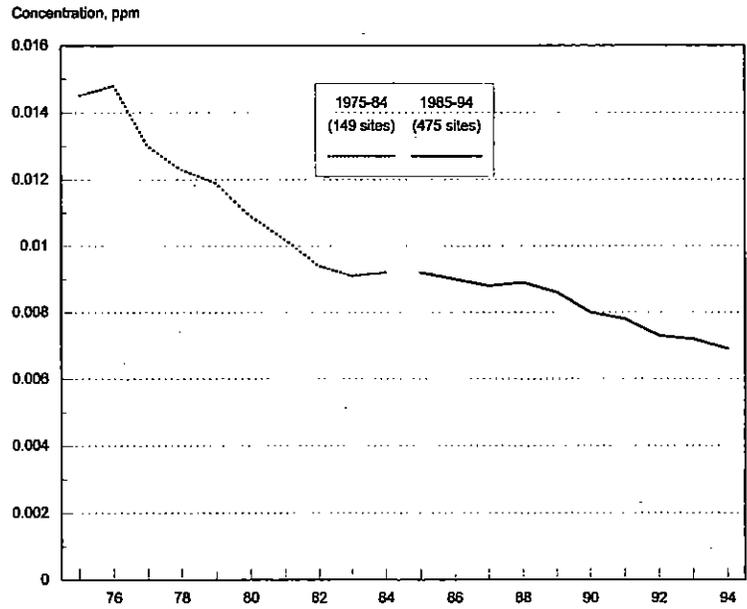


Figure 2-36: Long-term ambient SO₂ trend, 1985-1994.

Visibility

Nature and Sources of the Problem

Visibility impairment, which is most simply described as the haze which obscures the clarity, color, texture, and form of what we see, is actually a complex problem that relates to several of the pollutants discussed in this chapter. Visibility impairment is a result of aerosols or gas mixtures and suspended particles in the atmosphere. These gases and particles cause light to be scattered or absorbed, thereby reducing visibility.

Sulfates are the largest single contributor to light extinction, or visibility reduction, in many parts of the United States as shown in Figure 2-37. The pie charts are scaled to indicate the relative difference in the amount of light extinction by region. In the Appalachian Mountains, sulfates account for 68 percent of visibility reduction. Organic carbon, the next largest contributor, causes 16 percent of visibility reduction. In most areas of the West and Alaska, sulfates and organics contribute equally to light extinction. In southern California, nitrate is the greatest contributor to light extinction. Light absorbing carbon is generally the smallest contributor to visibility reduction at all monitoring sites.

Monitoring Technologies

In 1980, the National Park Service in cooperation with EPA, established the Interagency Monitoring of Protected Visual Environments (IMPROVE) network, a long-term visibility monitoring program, at remote locations throughout the United States.⁷ Since then, several other Federal and regional organizations have joined the effort. The IMPROVE network is devoted to fully characterizing visibility.

Visibility impairment can also be studied by analyzing the data collected since 1960 at 280 monitoring stations located at airports across the country. At these stations, measurements of visual range (the maximum distance at which an observer can discern the outline of an object) were recorded. Long-term records of visual range help reveal trends in visibility. There are two large contiguous haze regions in the United States, one over the eastern states and another over the Rocky Mountains and the Sierra-Cascade ranges. Figure 2-38 reveals that this general pattern has been preserved over the 30-year period beginning in 1960, with intermittent changes in regional trends. In the 1980s, haze reduction north of the Ohio River and east of the Mississippi River continued, while haze regions over the southeastern United States and the Pacific states remained virtually unchanged.⁸

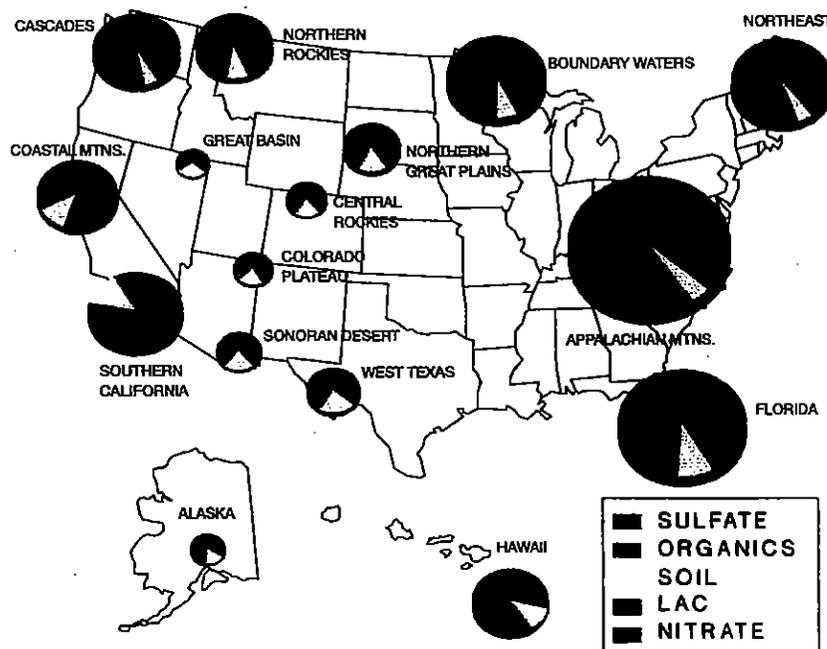


Figure 2-37: Annual average light extinction.

Programs to Improve Visibility

In April of 1994, EPA announced that it would begin work on a Regional Haze Program to address visibility impairment in Class I areas (national parks and wilderness areas). This program will introduce technical approaches to monitoring and modeling regional haze as well as define the policy for achieving "reasonable progress" toward the national goal of eliminating visibility impairment in these areas. The program will be developed in coordination with efforts of the Grand Canyon Visibility Transport Commission. This commission is in the process of

developing recommendations for EPA regarding protection of the Class I areas on the Colorado Plateau in the southwestern United States. In addition to the Regional Haze Program, better controls for sources of criteria pollutants such as NO_x could also lead to improvements in visibility.

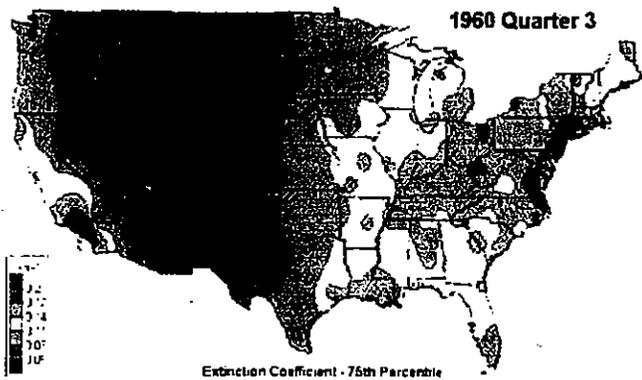


Figure 2-41: (a) Trend in 75th percentile light extinction, 1960.

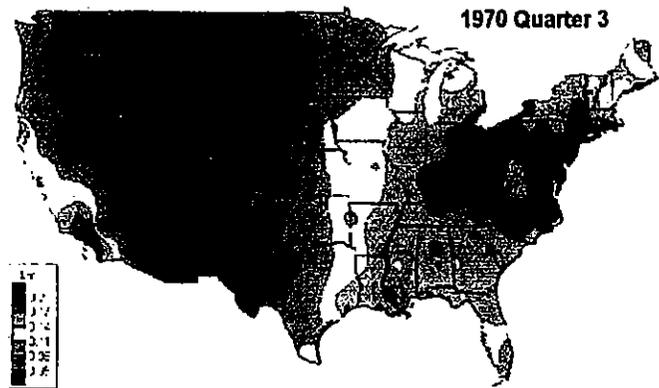


Figure 2-37: (b) Trend in 75th percentile light extinction, 1970.

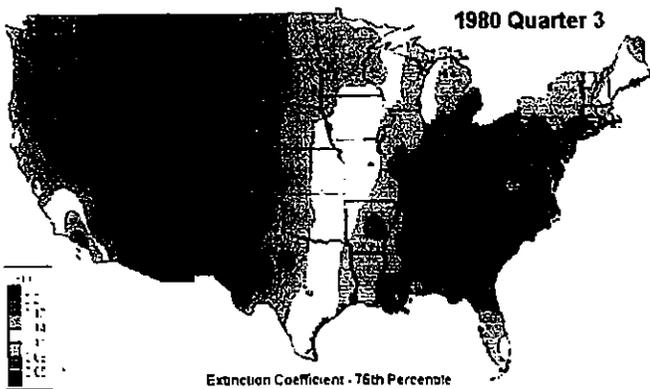


Figure 2-37: (c) Trend in 75th percentile light extinction, 1980.

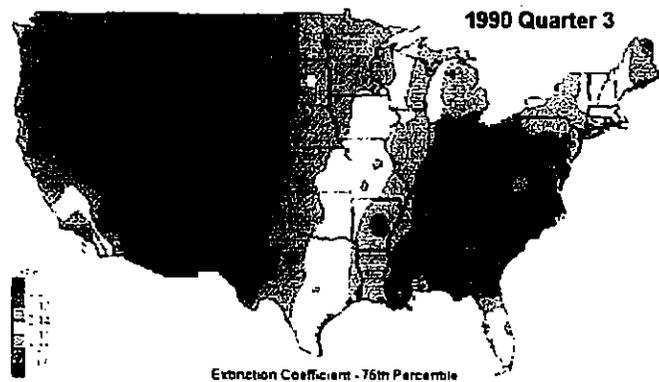


Figure 2-37: (d) Trend in 75th percentile light extinction, 1990.

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Chapter 3

PAMS: Enhanced Ozone and Precursor Monitoring

Of the six criteria pollutants, ozone (O_3) is the most pervasive. The most prevalent photochemical oxidant and an important contributor to “smog”, O_3 is unique among the NAAQS pollutants in that it is not emitted directly into the air, but instead results from complex chemical reactions in the atmosphere between volatile organic compounds (VOCs) and nitrogen oxides (NO_x) in the presence of sunlight. Further, there are thousands of sources of VOCs and NO_x located across the country. To track and control O_3 , EPA must develop an understanding of not only the pollutant, but the chemicals, reactions, and conditions that contribute to its formation as well.

Section 182(c)(1) of the 1990 Clean Air Act

Amendments (CAAA) called for improved monitoring of O_3 and its precursors, VOC and NO_x , in order to obtain more comprehensive and representative data on O_3 . Responding to this requirement, EPA promulgated regulations to initiate the PAMS (Photochemical Assessment Monitoring Stations) program in February 1993. The PAMS program requires the establishment of an enhanced monitoring network in all O_3 nonattainment areas classified as serious, severe or extreme. The 22 affected O_3 areas, shown in Figure 3-1, cover 113 thousand square miles and have a total population of 79 million people.

Each PAMS network will consist of as many as five monitoring stations, depending on the area's population.

PHOTOCHEMICAL ASSESSMENT MONITORING STATIONS (PAMS) PROGRAM

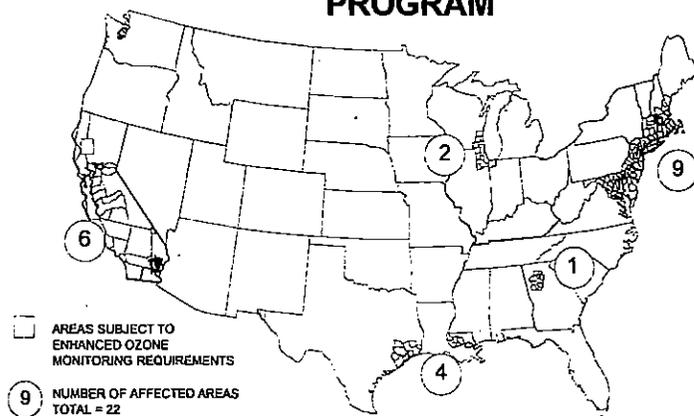


Figure 3-1: Photochemical Assessment Monitoring Stations (PAMS) Program

These stations will be carefully located based on meteorology and other conditions at the site. Generally, each PAMS network will consist of four different monitoring sites (Types 1, 2, 3, and 4) designed to fulfill unique data collection objectives. The Type 1 site is located upwind of the metropolitan area to measure O₃ and precursors being transported into the area. The Type 2 site is referred to as the maximum precursor emissions impact site¹. As the name implies, it is designed to collect data on the type and magnitude of O₃ precursor emissions emanating from the metropolitan area. The Type 2 sites are typically located downwind of the central business district, and operate according to a more intensive monitoring schedule than other PAMS stations. The Type 2 sites are capable of measuring a greater array of precursors and are also suited for the evaluation of urban air toxics. The Type 3 stations are intended to measure maximum O₃ concentrations and are sited downwind of the urban area and the Type 2 sites. The Type 4 PAMS site is located downwind of the nonattainment area to assess O₃ and precursor O₃ levels exiting the area and potentially contributing to the O₃ problem in other areas.

Over its initial three years, the PAMS program has exhibited steady and successful growth. Currently, there are 57 PAMS surface air quality and meteorology monitoring stations established and operating across the nation. This represents at least one monitoring station in each of the 20 areas involved in the PAMS program². Despite the ambitious schedule and "cutting edge" nature of the monitoring technologies employed, data from nearly all sites operating in 1993 and half those running in 1994 have been reported to the Aerometric Information Retrieval System (AIRS). AIRS is EPA's national repository for air pollution data.

The data collected at the PAMS sites include measurements of O₃, NO_x, a target list of VOCs including several carbonyls (see Table 3-1) as well as surface and upper air meteorology. Most PAMS sites measure 56 target hydrocarbons on an hourly basis during the O₃ season. Included in the monitored VOC species are nine compounds classified as hazardous air pollutants (HAPs). The Type 2 sites also collect data on carbonyl compounds (aldehydes and ketones) every three hours during the O₃ monitoring period. All stations measure O₃, NO_x, and surface meteorological parameters on an hourly basis.

The PAMS networks produce a wealth of information invaluable to the development and evaluation of O₃ control strategies and programs. In

addition to providing a long term perspective on changes in atmospheric concentrations of O₃ and its precursors, the PAMS program will help to improve emission inventories, serve as input to photochemical grid models, provide information to evaluate population exposure, and provide routine measurements of selected HAPs. Most importantly, PAMS will deliver a more complete understanding of the complex problem of O₃ so that we may move toward the best solution to reduce O₃ concentrations.

Currently, comprehensive analyses of the current PAMS data are underway and an interpretation of the results of such assessments is beyond the scope of this report. However, significant attention and effort has been recently directed to the analysis and interpretation of the PAMS data. For example, preliminary assessments of data from a Type 2 site in the Southeast and one in the Mid Atlantic area yielded interesting insights (albeit extremely exploratory) into relationships between selected VOC species and O₃ levels. Statistical models of hydrocarbon concentrations and surface meteorological conditions explained a significant portion of the variability in downwind O₃ (see Figure 3.2). Surprisingly, the hydrocarbons (although selected based on their correlation with the O₃ values unique to the individual PAMS areas) were similar despite the expected differences in the VOC sources in the two locations. While there is considerable additional work to be performed to reproduce, strengthen and verify this approach, the analyses are exciting, as they are a glimpse into the potential advances that innovative PAMS data analysis may offer. In addition, the Ambient Monitoring and Assessment Committee of the Northeast states for Coordinated Air Use Management (NESCAUM) and the Lake Michigan Air Directors Consortium (LADCO) recently released draft reports of their preliminary examination of the PAMS data in their geographic areas.

Although exploratory in nature and based on a limited sample of PAMS data (focuses on data collected at six northeastern sites during two three-day episodes in July, 1994), the NESCAUM report demonstrates the variety of applications of PAMS data analysis and reflects the value of the program to Federal and State ozone control efforts³. Selected analytic results and interpretations from this report are summarized below. Note that all results and interpretations are based on analysis of data for the ozone episodes occurring on July 6-8, 1994 and July 20-22, 1994.

The most active ozone-forming VOCs in the NESCAUM region were formaldehyde, isoprene, acetaldehyde, m/p-xylene and toluene. Together, these 5 compounds accounted for more than 75% of the ozone formation potential during the studied episodes.

Table 3-2 contrasts these results for the most active ozone-forming VOCs with those of a previous study in the Northeast and an evaluation in California. An earlier study, limited to the six a.m. to nine a.m. time period in five Northeastern cities⁴, found six of the same seven compounds leading the VOC abundance list. Another, more extensive study of speciated VOCs⁵ in the Los Angeles area, found the same seven anthropogenic compounds to be most abundant and, with the exception of propane, in virtually the same rank of occurrence.

Of the targeted biogenic VOC compounds, only isoprene (emitted predominantly by deciduous vegetation) is currently quantifiable by most PAMS sites in the Northeast. Isoprene levels during the 2 episodes examined here were higher than anticipated (up to 25 - 35 ppbc) at several Northeastern sites. These levels are similar to concentrations reported during similar high temperature periods in the Southeast, and are considerably higher than current model estimates.

Short term exposures to high levels of ozone are frequently characterized by relatively low levels of benzene, relatively high levels of formaldehyde and particulate matter.

As shown in Figure 3-3, the only day that PM-10 sampling was performed during the studied episode periods (i.e., July 7, 1994) was characterized by high regional PM-10 concentrations, exhibiting a similar spatial pattern to the high, afternoon ozone values on that day (note: PM-10 data from PA and more southerly states were not available at time of extraction).

PAMS data have sufficient detail to quantify effects of air mass aging, as more reactive VOC species are photochemically destroyed during daytime transport from urban centers to downwind sites.

Figure 3-4 displays the estimated benzene-to-toluene (B/T) and xylene-to-toluene (X/T) ratios for urban areas based on 1990 Atlanta source profiles and source mix. Figure 3-5 shows the measured hourly B/T and X/T ratios from the urban (type 2) PAMS site in East Hartford, CT during the July, 1994 episode periods. The scatter plot in Figure 3.5 reveals that toluene levels at the East Hartford site were highly correlated with both benzene and xylene - in a manner consistent with a

“common source” (i.e., fresh motor vehicle-related emissions) and as expected for an urban area.

Figure 3-6 shows the hypothetical effect of aging on Atlanta B/T and X/T ratios - benzene, toluene and m/p-xylene will be less well correlated than in urban centers. Figure 3-7 shows the measured B/T and X/T ratios for the rural type 3 PAMS site in Stafford, CT (about 20 miles downwind of East Hartford) during the July 1994 episodes. The scatter plot in Figure 3-7 shows that the B/T ratio at the downwind, rural Stafford site has increased and the X/T ratio has decreased in comparison to the urban East Hartford site. This is consistent with the predicted effect of air mass aging, as the more reactive species are differentially removed during transport. The points plotted in Figure 3-7 also exhibit greater scatter (B/T and X/T correlations are poorer) than Figure 3-5. While common (motor vehicle-related) sources are still anticipated to be a predominant cause of benzene, toluene, and xylene at the Stafford site, the species inter-correlations are diminished during transport, as the degree of aging depends on variable factors such as wind speed direction, solar radiation, OH, NO_x, etc.

The July 20-22/94 episode provides clear evidence of the transport of both ozone and ozone precursors (reactive VOCs and NO_x) along the coast of Maine from sources to the Southwest. In this case, the transport of ozone itself appears to be more important than the transport of precursors.

Routine ozone measurements alone can often provide strong empirical evidence of transport. For example, Figure 3-8 displays peak hourly concentrations and hour of occurrence at sites along the north Atlantic coast on 7/21/94. Concentrations in excess of the 80 ppb Maine State Standard were recorded at all of these coastal sites, four of which also recorded exceedances of the federal standard. With persistent southwesterly winds, the hour of maximum concentration occurs progressively later in the day as one moves to the northeast, ranging from 12 noon at Lynn, MA to as late as nine p.m. at Jonesport, ME. The ozone levels from these North Atlantic Coastal sites are also displayed as 8-hour running averages in Figure 3-9, and provide a clear impression of ozone transport along the coast.

More detailed, independent reports on the results and interpretation of the analysis of PAMS data and compilations of summary statistics for the previous year's data are planned for future publication and annual updates.

Table 3-1: PAMS target list of VOCs.

| | | |
|--------------------|------------------------|------------------------|
| Acetylene | Cyclopentene | n-Heptane |
| Ethylene | 4-Methyl-1-Pentene | Methylcyclohexane |
| Ethane | Cyclopentane | 2,3,4-Trimethylpentane |
| Propylene | 2,3-Dimethylbutane | Toluene |
| Propane | 2-Methylpentane | 2-Methylheptane |
| Isobutane | 3-Methylpentane | 3-Methylheptane |
| 1-Butene | 2-Methyl-1-Pentene | n-Octane |
| n-Butane | n-Hexane | Ethylbenzene |
| trans-2-Butene | trans-2-Hexene | p-Xylene |
| cis-2-Butene | cis-2-Hexene | Styrene |
| 3-Methyl-1-Butene | Methylcyclopentane | o-Xylene |
| Isopentane | 2,4-Dimethylpentane | n-Nonane |
| 1-Pentene | Benzene | Isopropylbenzene |
| Isoprene | Cyclohexane | n-Propylbenzene |
| trans-2-Pentene | 2-Methylhexane | β-Pinene |
| cis-2-Pentene | 2,3-Dimethylpentane | 1,3,5-Trimethylbenzene |
| 2-Methyl-2-Butene | 3-Methylhexane | 1,2,4-Trimethylbenzene |
| 2,2-Dimethylbutane | 2,2,4-Trimethylpentane | β-Pinene |
| | Total NMOC | |
| Acetaldehyde | Acetone | Formaldehyde |

PREDICTED OZONE LEVELS VERSUS OBSERVED OZONE LEVELS
 Southeast Site, 1993 Data
 (MET and VOC data)

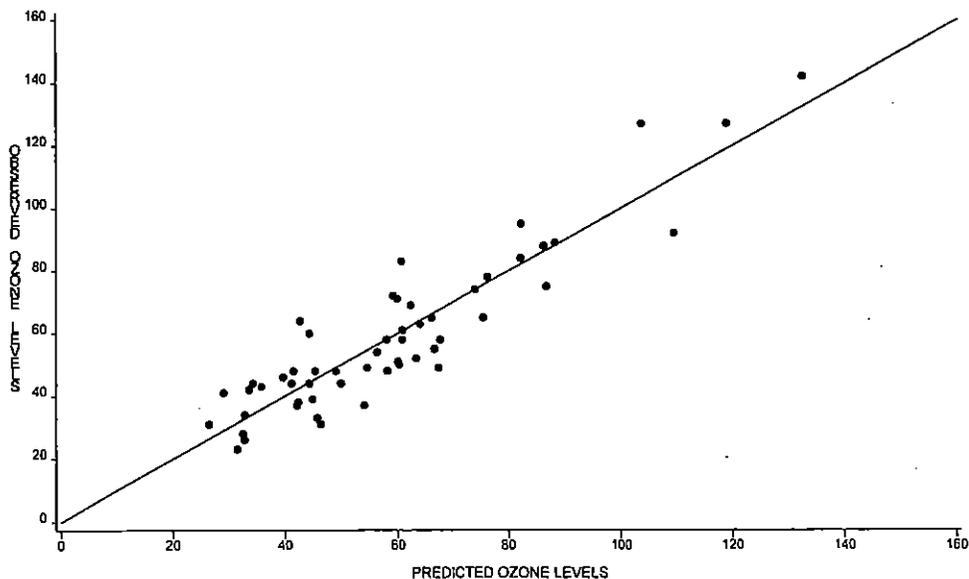


Figure 3-2: Predicted vs. observed ozone levels; Southeast site, 1993 data. (MET and VOC data)

Table 3-2: Most abundant anthropogenic VOCs in selected measurement campaigns.

| | Northeast '94 | 5 City '84 | Los Angeles '87 |
|----|----------------------|-------------------|------------------------|
| 1. | Isopentane | Isopentane | Propane |
| 2. | Toluene | n-Butane | Isopentane |
| 3. | Propane | Toluene | Toluene |
| 4. | Ethane | n-Pentane | n-Butane |
| 5. | n-Butane | m/p-Xylene | Ethane |
| 6. | m/p-Xylene | Propane | m/p-Xylene |
| 7. | n-Pentane | Isobutane | n-Pentane |

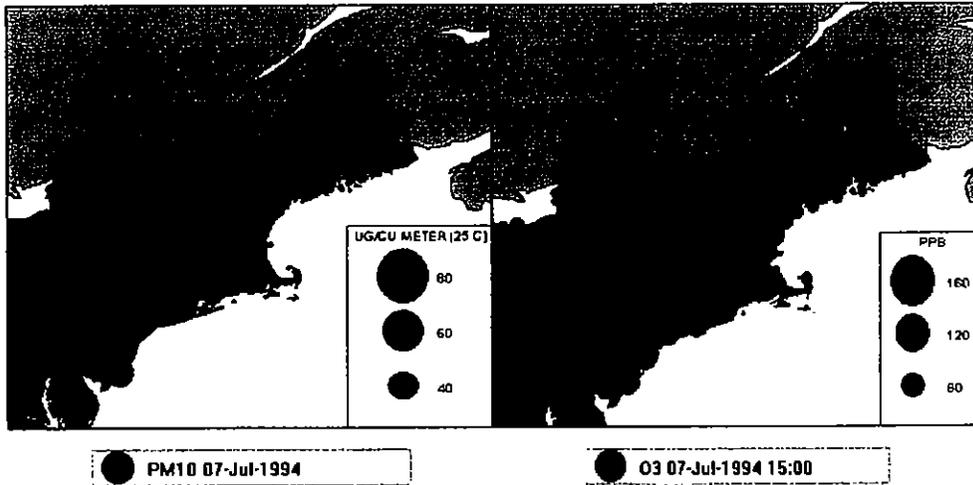


Figure 3-3: Comparison of daily PM-10 and three o'clock p.m ozone concentrations on July 7, 1994.

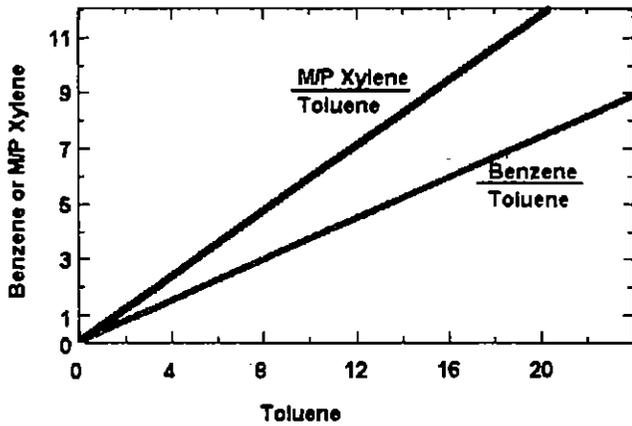


Figure 3-4: Estimated urban B/T and X/T ratios from Atlanta source profiles (from Henry et al., 1994).

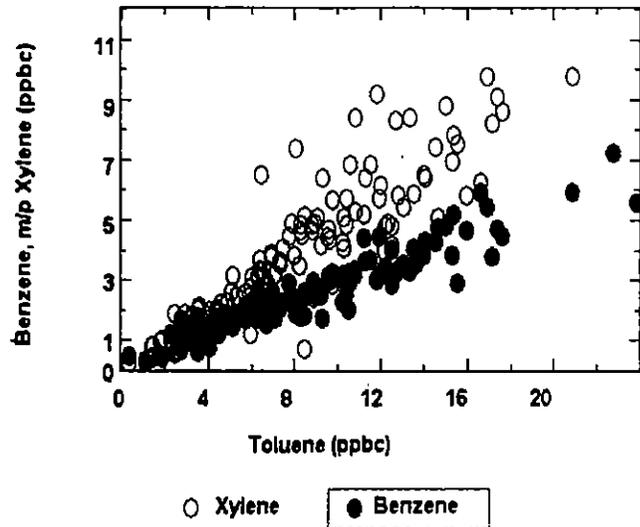


Figure 3-5: Measured urban B/T and X/T ratios from East Hartford, CT PAMS site during July 1994 episodes.

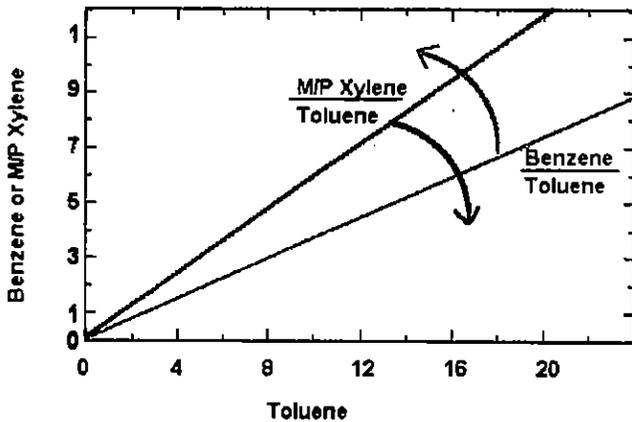


Figure 3-6: Predicted changes in B/T and X/T ratios at rural sites (resulting from air mass aging).

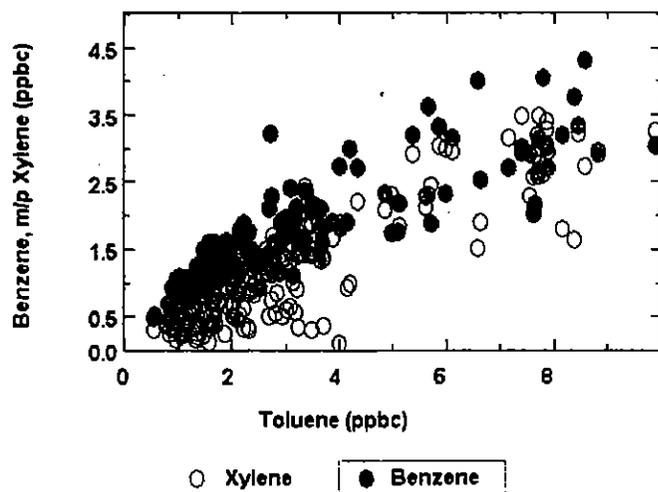


Figure 3-7: Measured rural B/T and X/T ratios from Stafford, CT PAMS sites during July 1994 episodes.

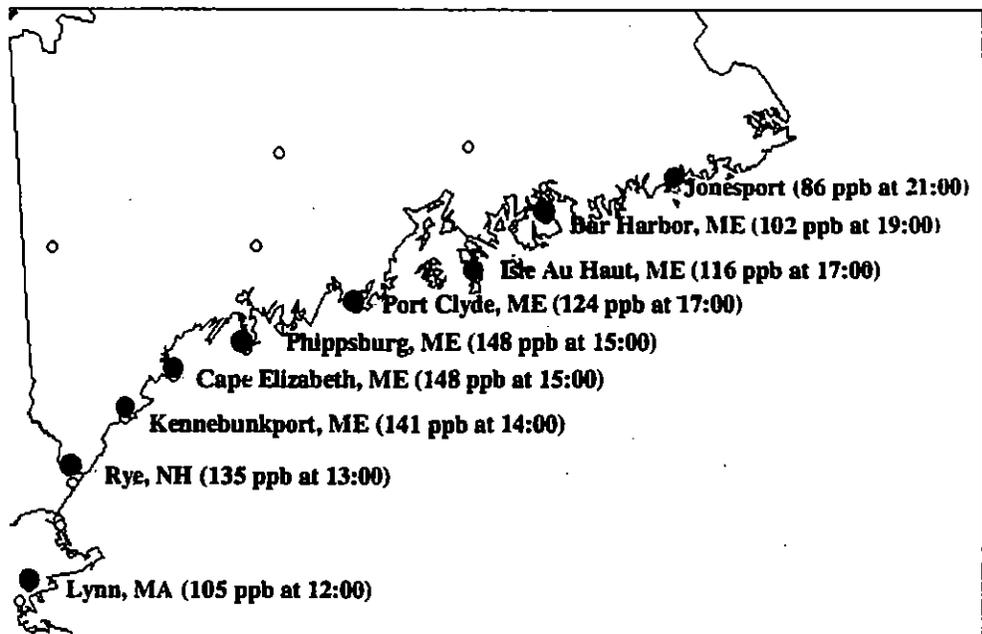


Figure 3-8: Maximum ozone concentrations and hour of occurrence on July 21, 1994.

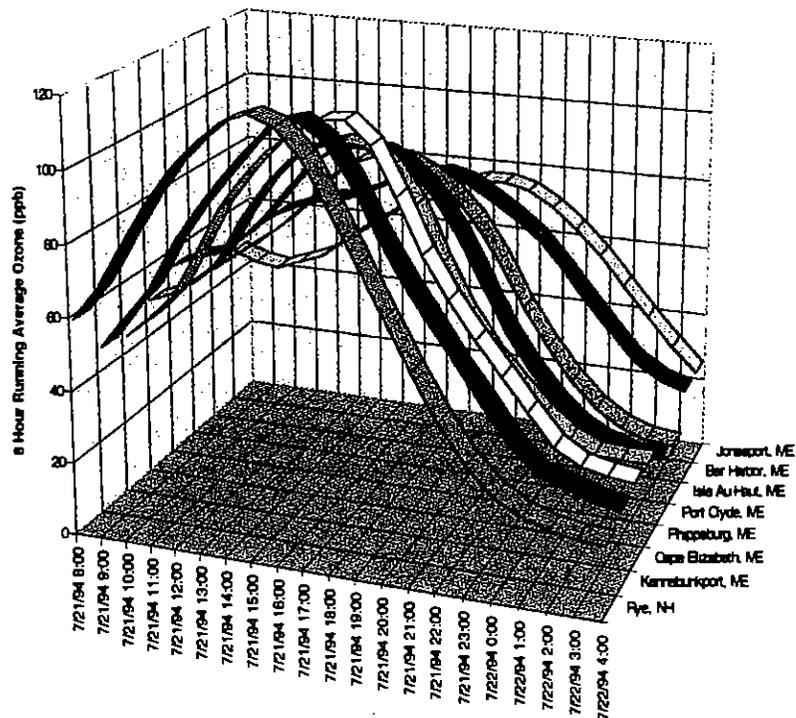


Figure 3-9: 8-hour moving average ozone concentrations on July 21, 1994.

Endnotes

1. A second Type 2 site may be required in some PAMS areas and would be positioned to capture the precursor emissions in the second-most predominant morning wind direction. This additional Type 2 site constitutes the fifth PAMS site in the network.
2. Although there are 20 areas classified as serious, severe, or extreme for ozone, the flexibility of the PAMS program allowed areas (in close proximity to one another) in two regions to consolidate their monitoring operations. Therefore, only 20 PAMS networks exist.
3. The Ambient Monitoring and Assessment Committee, NESCAUM (Northeast States for Coordinated Air Use Management). 1995. Preview of 1994 Ozone Precursor Concentrations in the Northeastern United States. R. Poirot, ed. Boston, MA. The complete report is available from the NESCAUM office (617-367-8540) or via the Internet from the CAPITA anonymous FTP server (capita.wustl.edu).
4. Wixtrom, R.N. and S.L. Brown. 1992. In: *J. Exposure Analysis and Environmental Epidemiology*, Edo Pellizzari, ed. 2: 51 (averages recalculated here for 5 NE cities only.)
5. Lurmann, F.W. and H.H. Main. 1992. Analysis of Ambient VOC Data Collected in the Southern California Air Quality Study. Report to California Air Resources Board. Sonoma Technologies, Inc. Santa Rosa, CA.

Chapter 4

Air Toxics

Emission Trends

Extent of the Problem

In 1993, emissions of hazardous air pollutants (HAPs) nationally totaled 1.2 billion pounds, as reported in EPA's Toxic Release Inventory (TRI). This total represents a decrease of approximately 600 million pounds (or 33 percent) from 1989 levels, and of 110 million pounds (or eight percent) from 1992 levels as illustrated in Figure 4-1. In comparison, between 1989 and 1993, total TRI air releases and total TRI releases (to all media) declined 35 percent. Between 1992 and 1993, total TRI air releases decreased nine percent and total TRI releases (to all media) decreased six percent.^{1,2,3}

Figure 4-2 utilizes a grid map to present total HAP emissions for 1993 by geographic area. In 1993, seven states reported total HAP emissions of less than one million pounds (Idaho joined the six states: New Mexico, North Dakota, Wyoming, Hawaii, Nevada, and Vermont

from 1992). In 1993, four states reported HAP releases greater than 65 million pounds down from five states in 1992 and 11 in 1989.

Changes in the TRI estimates of HAP emissions by state from 1989 to 1993 and 1992 to 1993 are depicted in Figures 4-3 and 4-4. The total HAP emissions of 37 states have declined more than 25 percent from 1989 levels. While only one state reported net increases in HAP emissions for the five-year period, seven states estimate one-year increases in HAP releases since 1992.

Figure 4-5 compares annual TRI emission estimates from 1989 to 1993 for the top 10 HAPs (based on 1989 levels). These estimates show a downward trend in emissions for all 10 pollutants since 1989. However, emissions of five of the 10 HAPs increased since 1992 [i.e., xylene (mixed isomers), chlorine, carbon disulfide, hydrochloric acid, and trichloroethylene]. Similarly, Figure 4-6 presents yearly HAP emissions for the top 10 industrial categories based on 1989 releases. All industrial categories show decreased emissions since

1989-93: 33% decrease

1992-93: 8% decrease

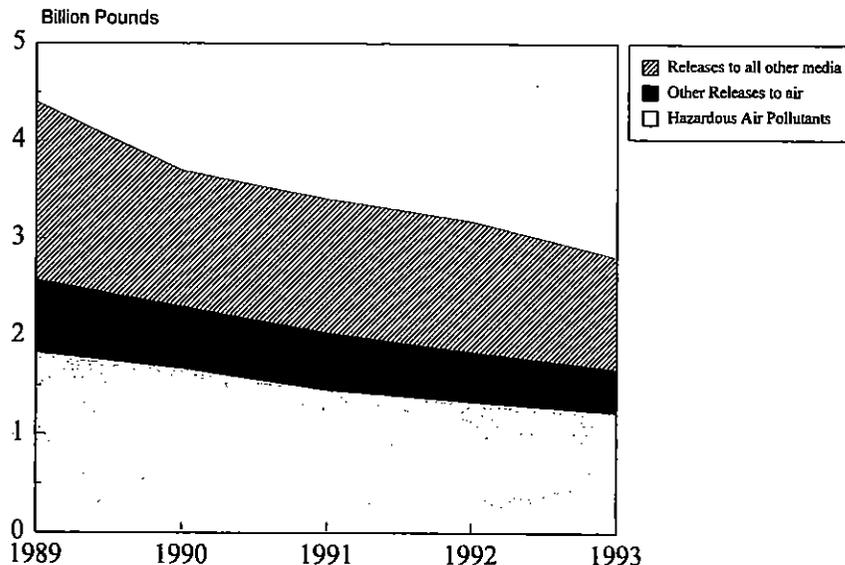


Figure 4-1: Trends in HAP Emissions (1989-1993).

Source: Toxic Release Inventory

Total Air Releases of Hazardous Air Pollutants for 1993

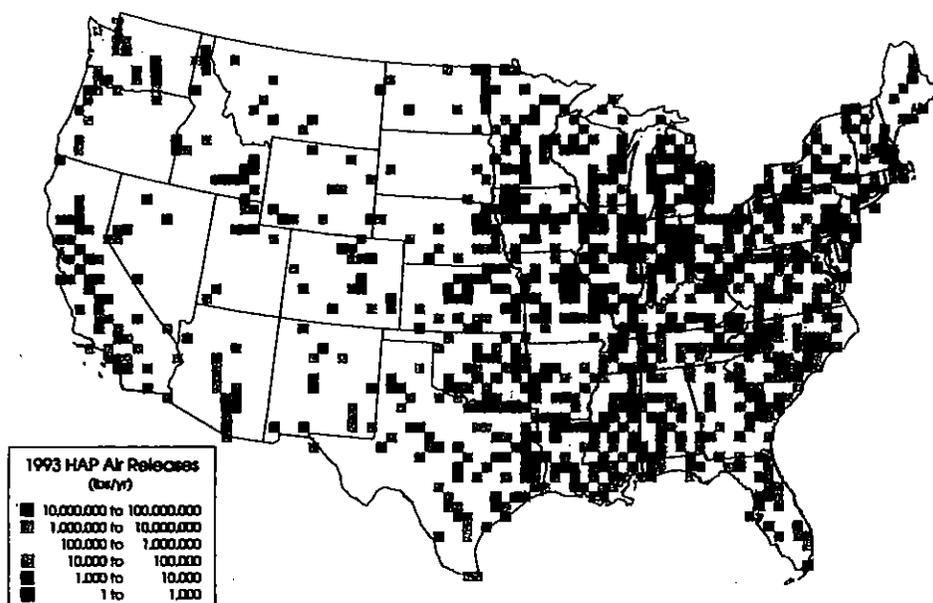


Figure 4-2: Total HAPs emissions for 1993.

1989 except for the paper products classification. Between 1992 and 1993, emissions from the transportation equipment, and furniture and fixture industries increased, while the other eight categories decreased. The chemical products industry has consistently reported greater aggregate HAP emissions to the TRI than any other source category.

Background and Further Details

Problem Definition

Hazardous air pollutants, also commonly referred to as "air toxics," are pollutants that cause, or might cause, severe health effects or ecosystem damage. Examples of air toxics include dioxin, benzene, arsenic, beryllium, mercury, and vinyl chloride. The Clean Air Act Amendments (CAAA) list 189 pollutants as hazardous air pollutants (HAPs) and specifically targets them for regulation in Title III, section 112 (b)(1).⁴ Air toxics are emitted from all types of sources including stationary sources, area sources, and mobile sources. Control of air toxic pollutants differs in focus from controlling the six principle National Ambient Air Quality Standards (NAAQS) pollutants. For the six NAAQS pollutants,

control strategies are used in geographic areas where the national air quality standards have been violated. In contrast, EPA has focused on identifying all air toxics emission sources and developing nationwide technology-based performance standards for these sources. The objective is to ensure that sources of air toxic pollution are as well controlled as technology will allow, regardless of geographic location.

The air toxics and the NAAQS programs complement each other. Many air toxics are emitted in the form of particulates or as organic compounds. Control efforts to meet the NAAQS for ozone (O₃) and PM-10 will also reduce air toxic emissions. Further, as air pollution control strategies for automobiles become more stringent, air toxic emissions that can result from vehicles are also reduced. Emission requirements under the air toxics program can also significantly reduce emissions of the six NAAQS pollutants. For example, EPA's final air toxics rule for organic chemical manufacturing is expected to reduce emissions of Volatile Organic Compounds (VOCs), which form O₃ or ground-level smog, by nearly 1 million tons annually. Many of these emission reductions are expected to benefit geographic areas in meeting the national air quality standards for ozone.

Percent Change In Hazardous Air Pollutant (HAP) Air Releases
from 1989 to 1993

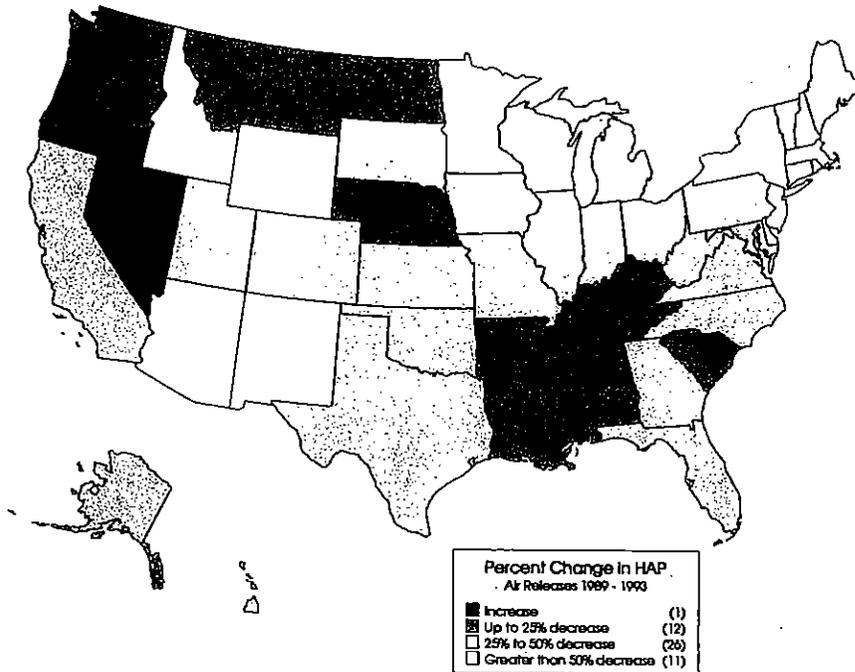


Figure 4-3: Changes in TRI estimates of HAP emissions by state, 1989–1993.

Percent Change In Hazardous Air Pollutant (HAP) Air Releases
from 1992 to 1993

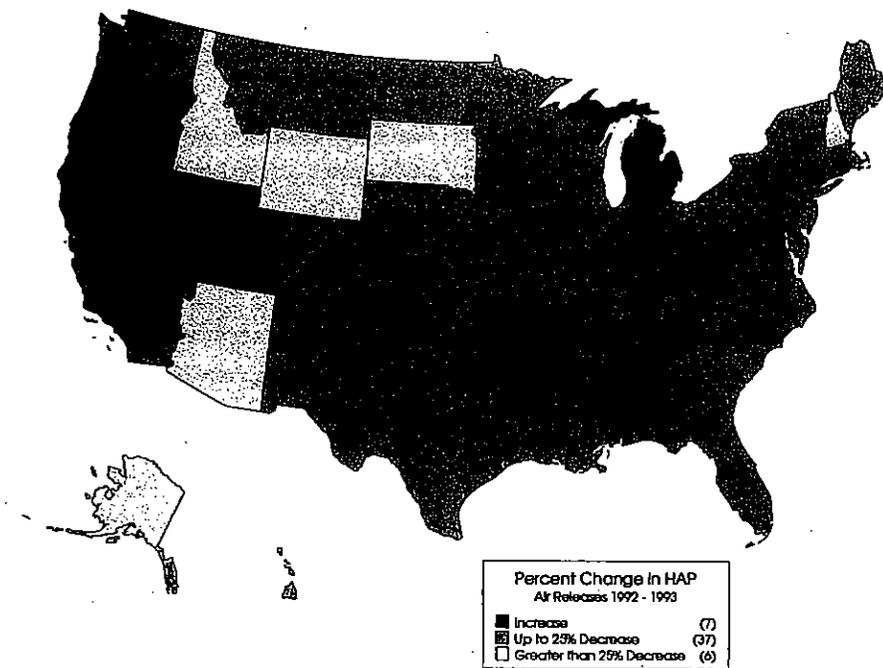


Figure 4-4: Changes in TRI estimates of HAP emissions by state, 1992–1993.

**Top 10 Hazardous Air Pollutants
(1989 Base Year)**

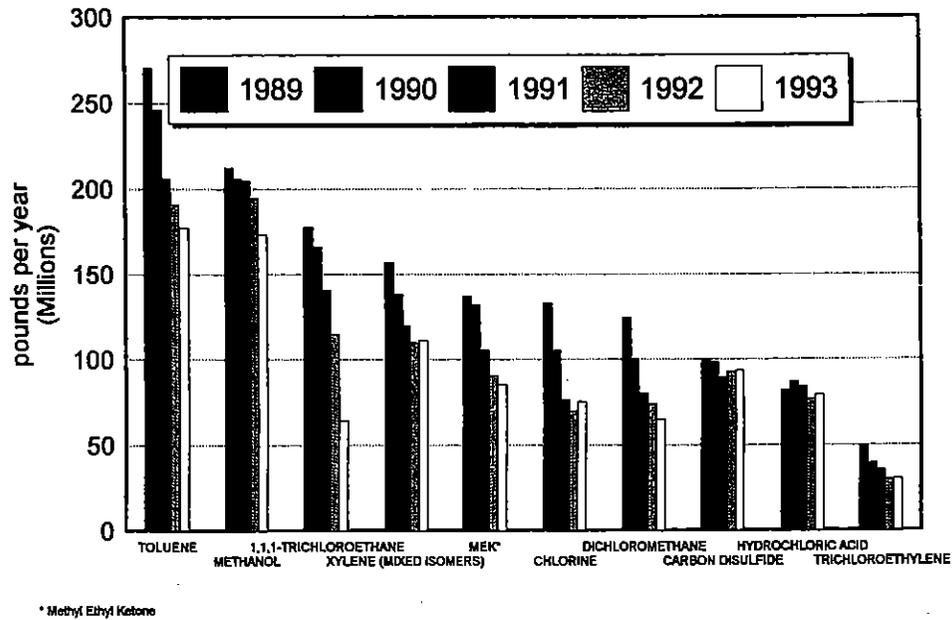


Figure 4-5: Comparison of annual TRI emission estimates for the top 10 HAPs from 1989-1993.

**Top 10 Industrial Categories
(1989 Base Year)**

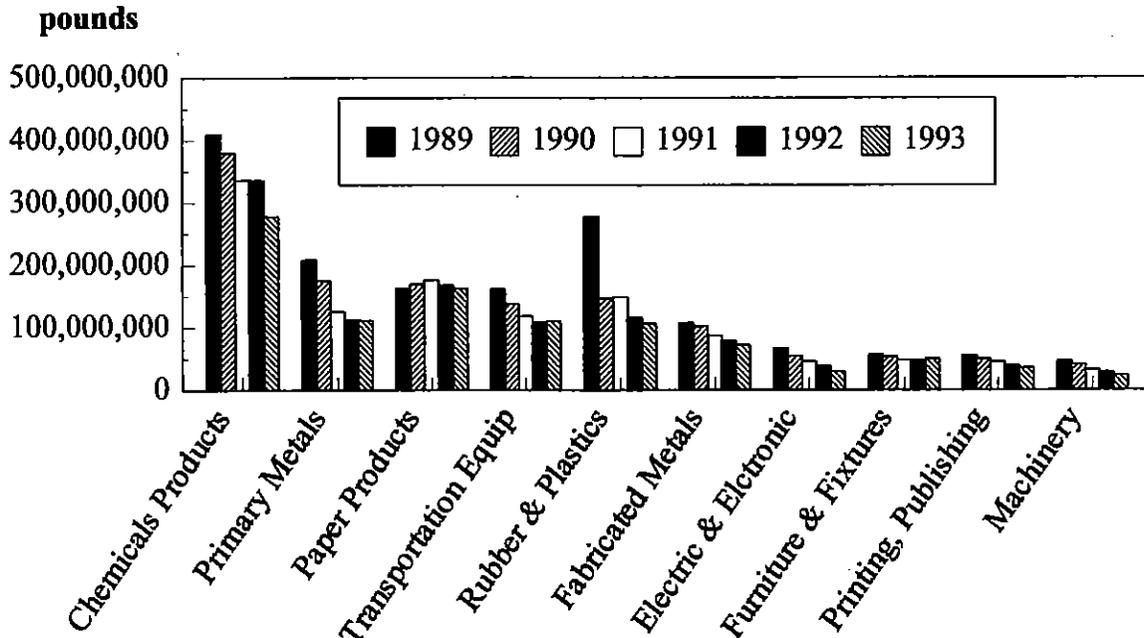


Figure 4-6: Comparison of annual HAP emissions for the top 10 industrial categories from 1989-1993.

The air toxics program is especially important in reducing air emissions at or near isolated industrial locations, and in controlling pollutants that are toxic even when emitted in small amounts. Additionally, EPA has developed mechanisms to prevent sudden, catastrophic releases like the Bhopal, India chemical plant explosion in 1985. Companies handling or using toxic chemicals are required by EPA to develop programs to prevent accidental releases, and to contain any releases in the event an accident should occur.

Health and Other Effects

At sufficient concentrations and exposure durations, human health effects from air toxics can include cancer, poisoning, and immediate illness. Other less measurable effects include immunological, neurological, reproductive, developmental, and respiratory effects. Hazardous air pollutants may also be deposited onto soil or into water bodies, thereby affecting ecological systems and eventually human health.

In addition to inhalation exposure from HAPs, indirect exposures occur particularly through the ingestion of food. Some of these HAPs (like mercury) can bio-accumulate in body tissues and magnify up the food web with each level accumulating the toxics and passing the burden along to the next level. Top consumers in the food web, usually consumers of large fish, may accumulate chemical concentrations many millions of times greater than the concentrations present in the water. As a result, fish consumption advisories have been issued in hundreds of water bodies nationwide, including the Great Lakes. Adverse effects range from immune system disease and reproductive problems in wildlife to subtle developmental and neurological impacts on children and fetuses.

Ecological effects attributable to bio-accumulating HAPs can be subtle or delayed in the onset. Effects such as immune function impairment, reproductive problems, and neurological changes—all of which can affect population survival—can occur.

Data Sources and Limitations

Ambient concentration data for individual air toxic pollutants is limited (both spatially and temporally) in comparison to the long-term nationwide monitoring for the six NAAQS pollutants. Therefore, this chapter focuses on emission trends and relies on EPA's Toxic Release Inventory (TRI) as the primary source of comprehensive information on emissions of air toxics. Authorized by the Emergency Planning and Community

Right to Know Act (EPCRA) of 1986, the TRI requires facilities with 10 or more employees meeting thresholds for manufacturing, processing or otherwise using listed chemicals (including air toxics) to submit annual reports to EPA on their releases. Data for the TRI has been collected since 1987 and it is the only air toxics inventory which is regularly updated. Consequently, the data from the TRI are used in this report to provide an indication of trends in toxic emissions.

While TRI is the only database available for assessing air toxic emission trends, there are significant limitations in the inventory's portrayal of overall HAP emissions. First, facilities with Standard Industrial Classification (SIC) codes outside the range of 20 to 39 (the manufacturing SIC range) are not required to report. Therefore, HAP emissions from facilities such as mining operations, electric utilities, and oil and gas production operations are not represented in the TRI. In addition, emissions from small manufacturing facilities (those with fewer than 10 employees) as well as mobile, commercial, residential, and consumer sources are not included in TRI. However, comprehensive, single-year national inventories for specific pollutants (prepared by EPA to support special studies called for by the CAAA) have demonstrated that for some toxic air pollutants, emissions from these excluded source categories can be much more significant than those from the manufacturing sector.⁵ Furthermore, TRI data are self-reported by the emitting facilities, and facilities are not required to perform actual monitoring or testing to develop their TRI estimates. As a result, the accuracy of the reported data can vary from facility to facility and year to year. Finally, the original TRI list only required reporting for 173 of the 189 HAPs identified in the CAAA.

Efforts are underway to enhance the TRI database by expanding both the type of facilities that must report their releases and the list of chemicals that must be reported. Two of the 16 compounds omitted from the original TRI list (acetophenone and ethylidene dichloride) will be added in the 1994 reporting year. Also, nine additional HAPs have been proposed for addition to the TRI. However, there are no plans to add the remaining five HAPs to the TRI because they are either produced in quantities too low to meet the reporting thresholds or emitted by sources which currently are not required to report to the TRI. In summary, 173 of the 189 HAPs (those included in the TRI data base) are included in the analyses within this chapter. All references to HAPs emissions in the following section are to the sum of these compounds as reported in the TRI.

Air Toxics Regulation and Implementation Status

The downward trend in emissions of air toxics described in Section 4.1 is expected to continue. The 1990 CAAA greatly expanded the number of industries affected by national air toxic emission controls, and the emission reductions from these controls are just beginning to be realized for some industries. Large industrial complexes (major sources) such as chemical plants, oil refineries, aerospace manufacturers, and steel mills are some of the industries being controlled for toxic air pollution. Where warranted, smaller sources (area sources) of toxic air pollution such as dry cleaning operations, solvent cleaning, and chrome plating are also affected. Within the next 10 years, the air toxics program is projected to reduce emissions of toxic air pollutants by well over one million tons per year.

Emission Reductions Through Air Toxics Regulation

The regulation of air toxics emissions through the process outlined in Section 112 of the 1990 CAAA, referred to as maximum achievable control technology (MACT) regulations, is beginning to achieve significant emission reductions of HAPs as well as criteria pollutants. As Figure 4.7 shows, MACT standards have been promulgated for twenty-seven source categories as of October, 1995. Sources are required to comply with these standards within three years of the effective date of the regulation, with some exceptions. In addition to the reduction of 880,000 tons per year in HAP emissions from these source categories, EPA also estimates that the MACT standards will result in reductions in the combined emissions of PM-10 (a criteria pollutant) and volatile organic compounds (ozone precursors) of about 1,890,000 tons per year as shown in Figure 4-8.

The five MACT standards in Figure 4.9, which are collectively responsible for the majority of the HAP emission decreases, individually produce reductions ranging from 38,000 to 510,000 tons per year. The ten MACT standards in Figure 4.10 reduce emissions of hazardous air pollutants which have very significant health impacts such as dioxin, chromium, lead, mercury, cadmium, arsenic, coke oven emissions, 1,3-butadiene, and benzene.

The specific pollutants whose emissions are reduced by the MACT program are detailed in Table 4.1 and further in the Table A.16 in Appendix A. In Table 4.1,

HAPs controlled by each standard are designated by an "x". Some of these HAPs are of particular interest to the special studies discussed in the next section.

Special Studies

As required by the 1990 CAAA, EPA is also conducting special studies to assess the magnitude and effects of air toxics focusing on specific sources, receptors and pollutants. Summaries of examples of such examinations are presented below.

The Great Waters Study

The CAA, Section 112(m)(5), requires a report to Congress every two years assessing the extent of atmospheric deposition of HAPs and other pollutants to the Great Lakes, the Chesapeake Bay, Lake Champlain and coastal waters. The need for new regulations to protect these water bodies will also be included in this report.⁴ The pollutants of concern include nitrogen compounds, mercury, pesticides, and other HAPs. There are extensive research studies underway throughout this program to provide new understanding of the complicated issue of atmospheric deposition of air pollution to water bodies. New scientific findings will be incorporated into each biennial report and appropriate regulatory recommendations will be made based on those findings. The CAA provides the authority to introduce new regulations or influence those under development in order to prevent adverse effects as well as environmental effects resulting from exposure to these pollutants.

Utility Air Toxics Study

As mandated by Section 112(n)(1)(A) of the 1990 CAAA, the EPA is studying HAP emissions from fossil fuel fired (coal, oil and gas) electric utilities. EPA is also studying the adverse health effects associated with those emissions.⁴ A draft Utility Air Toxics Study Report published in June 1995 identified 67 HAPs in the emissions database. Based on a screening assessment, 13 HAPs were determined as priority for risk analysis. From coal-fired utilities, five HAPs (mercury, arsenic, chromium, hydrogen chloride, and hydrogen fluoride) appear to be of greatest concern. From oil-fired plants, three HAPs (arsenic, chromium, nickel) are at the top of the list. The report predicts that in the next two decades, there will be roughly a 30-percent increase in HAP emissions from coal-fired utilities and roughly a 50-percent decline in HAP emissions from oil-fired utilities. These projections are primarily based on anticipated

energy demands and changes in fuel usage, but also consider other factors such as expected controls. EPA plans to complete the Utility Air Toxics Study in late 1995.

The Mercury Study

The Mercury Study Report to Congress is a comprehensive study of mercury emissions from anthropogenic sources in the United States. The report assesses the effect on health and ecological systems from mercury emissions and analyzes technologies to control mercury emissions as well as the costs of such controls. The study is mandated by section 112 (n)(1)(B) of the 1990 CAAA.⁴

For industrial or manufacturing sources that use mercury in products or processes, the overall consumption of mercury is generally declining. Industrial consumption of mercury has declined by about one-third between 1988 (1508 Mg) and 1993 (558 Mg). Much of this decline is attributed to the elimination of mercury as a paint additive and the reduction of mercury in batteries. Manufacturing decreases are important because emissions of mercury are more likely to occur when products containing mercury are broken or discarded. Based on trends in mercury use and emissions, EPA predicts that manufacturing use of mercury will continue to decline. Secondary production of mercury will continue to increase as more recycling

facilities recover mercury from discarded products and wastes. A significant decrease will occur in mercury emissions from municipal waste combustors and medical waste incinerators if the regulations proposed by EPA for these source categories are fully implemented. Based on predictions in energy demands and fuel usage, mercury emissions from utility boilers are expected to increase. The Mercury Study Report to Congress is due to be submitted to Congress in December 1995.

The Specific Pollutants Strategy

The CAA, Section 112(c)(6), requires EPA to identify the sources of 90 percent of air emissions of alkylated lead compounds, polycyclic organic matter, hexachlorobenzene, mercury, polychlorinated biphenyls, 2,3,7,8-tetrachlorodibenzofurans and 2,3,7,8-tetrachlorodibenzo-p-dioxin.⁴ The Agency is required to develop a strategy to promulgate standards for these sources by the year 2000.

The Urban Area Source Program

The CAA, Section 112(k), requires EPA to develop a strategy that will subject the sources of HAPs emissions in urban areas to standard controls and thereby reduce cancer risk from those HAPs by 75 percent.⁴ Research to determine which HAPs and sources will be included in the strategy is currently under way.

Table 4-1: Major pollutants controlled by standards promulgated (1990-1995).

| NAAT or Section 112 Standard | Dioxin, Furans | Chromium | Metals (Pb, Hg, Cd, As) | Coke Oven Emissions | POM | TCE | | Benzene Toluene Xylenes | Ethyl-Benzene | Epichlorohydrin | 1,2-Butadiene | Ethylene Oxide | MEK MIBK |
|------------------------------------------------------------|--------------------------|----------|-------------------------------|------------------------|-----|------------------------------|------------------------------------|-------------------------------|---------------|-----------------|---------------|----------------|-------------|
| | | | | | | Perchloroethylene 111-TCA | Carbon Tetrachloride Chloroform | | | | | | |
| Perchloroethylene Dry Cleaning | | | | | | | Methylene Chloride | | | | | | |
| Coke Ovens | | | | x | | | | | | | | | |
| Industrial Cooling Towers | | x | | | | | | | | | | | |
| Commercial Sterilization | | | | | | | | | | | | x | |
| Chromium Electroplating | | x | | | | | | | | | | | |
| Magnetic Tape Manufacturing | | | | | | | | x | | | | | x |
| Stage I Gasoline Distribution | | | | | | | | x | | | | | |
| Solvent Cleaning | | | | | | | x | | | | | | |
| Polymers & Resins II | | | | | | | | | | x | | | |
| Secondary Lead Smelters | | | x | | | | | | | | | | |
| Petroleum Refineries | | | | | | | | x | | | x | | |
| Aerospace Manufacturing | | x | | | | | x | | | | | | x |
| Marine Tank Vessel Loading | | | | | | | | x | | | | | |
| Municipal Waste Combustors I & II | x | | x | | | | | | | | | | |
| Synthetic Organic Chemical Manufacturing Industry (HON) | Many HAPs are controlled | | | | | | | | | | | | |

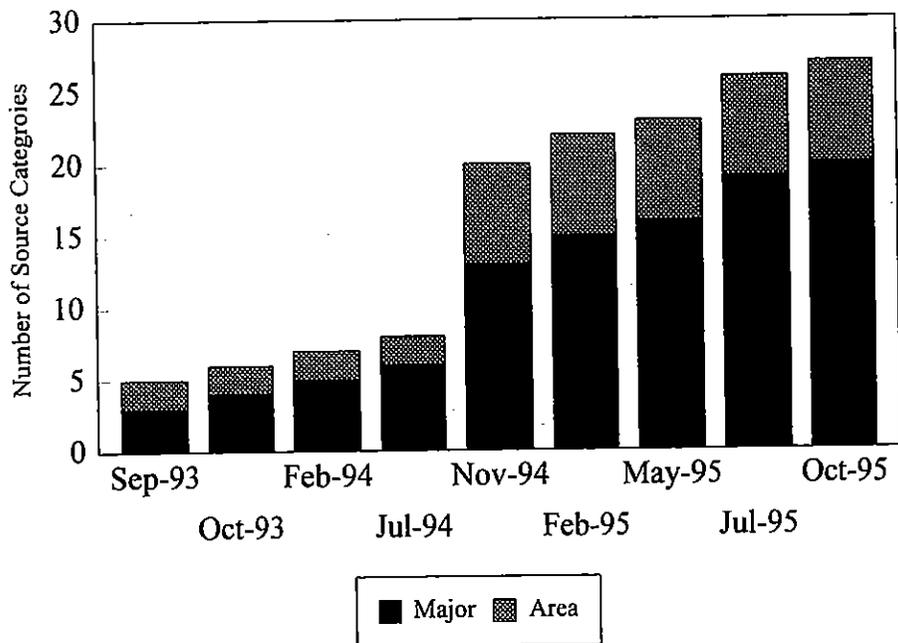


Figure 4-7: Cumulative number of source categories with MACT standards promulgated (1990-1995).

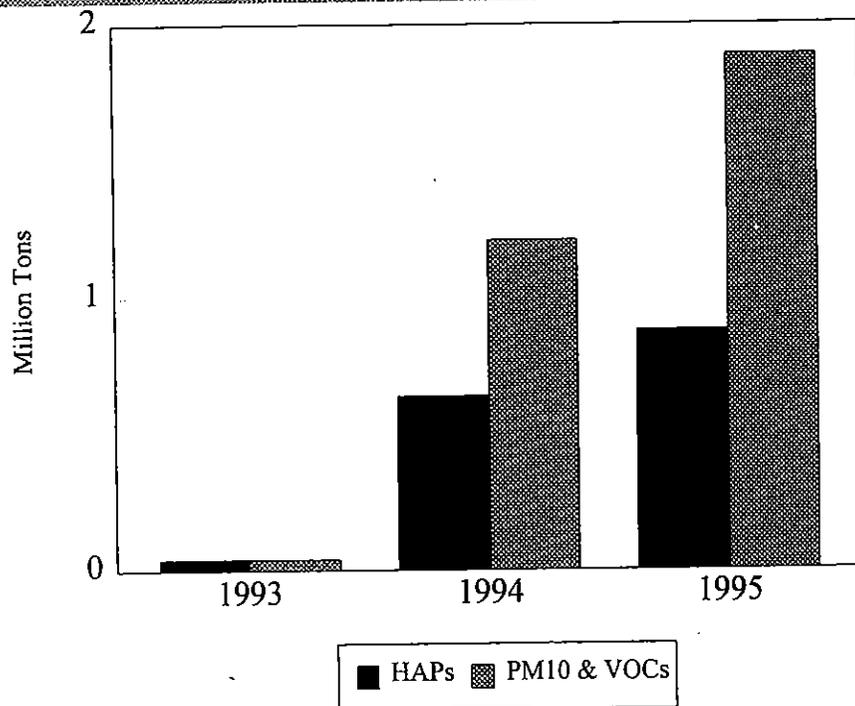


Figure 4-8: Cumulative emission reductions from promulgated MACT standards (1990-1995).

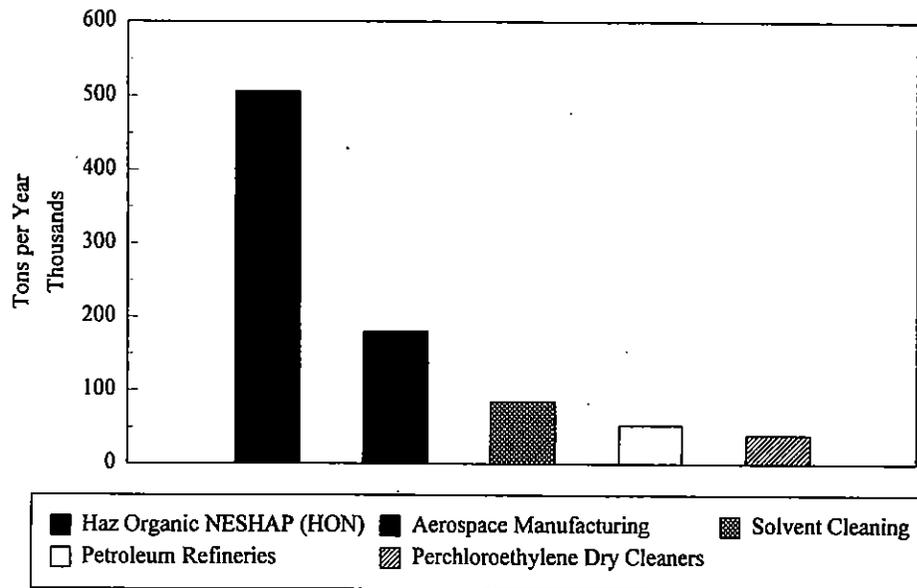


Figure 4-9: Emission reductions (greater than 5000 tons/year) from promulgated MACT standards (1990-1995).

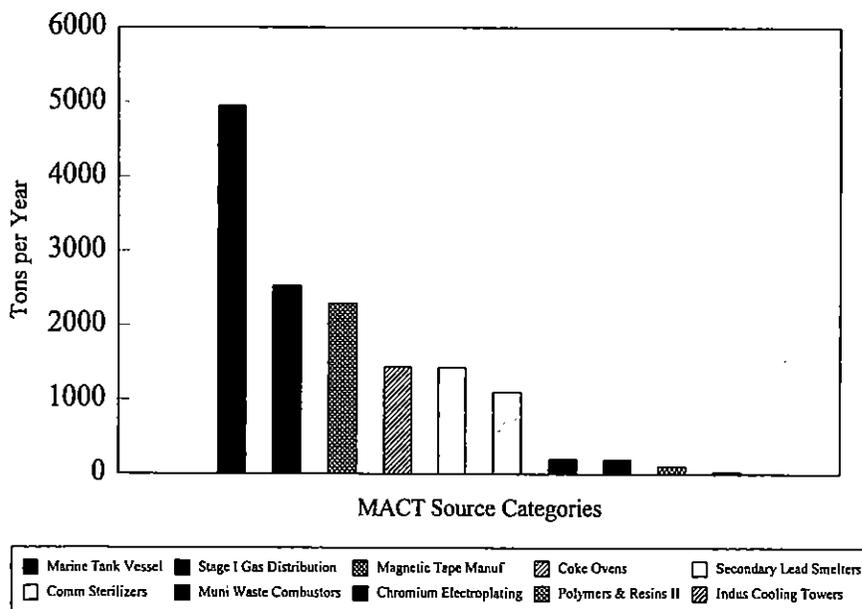


Figure 4-10: Emission reductions (less than 5000 tons/year) from promulgated MACT standards (1990-1995).

References

1. As used in this report, estimates of air releases or emissions of "hazardous air pollutants" or "HAPs" refer to the 173 (of the 189) air toxics defined by the Clean Air Act that are included in the TRI. The term "TRI air releases" refers to reported emissions of both HAP and non-HAP compounds to air. Finally, the term "total TRI releases" represents all emissions of any pollutants (HAPs and non-HAPs) to any media (e.g., air, water).
2. *1993 Toxics Release Inventory*, EPA-745-R-95-010, U.S. Environmental Protection Agency, Office of Pollution Prevention and Toxics, Washington, D.C. 20460, March 1995.
3. *1992 Toxics Release Inventory*, EPA-745-R-94-001, U.S. Environmental Protection Agency, Office of Pollution Prevention and Toxics, Washington, D.C. 20460, April 1994.
4. *Clean Air Act Amendments of 1990*, U.S. Code of Federal Regulations, vol. 42 sec. 7412(b)(2), 1990
5. *National Air Pollutant Emission Trends, 1900-1994*, EPA-454-R-95-011, U.S. Environmental Protection Agency, Office of Air Quality Standards and Planning, Research Triangle Park, N.C. 27711

Chapter 5

Nonattainment Areas

This chapter provides general information on geographical regions known as nonattainment areas. When an area does not meet the National Ambient Air Quality Standards (NAAQS) for one of the criteria pollutants, it may be designated as nonattainment. The Clean Air Act Amendments (CAAA) of 1990 further classify nonattainment areas for ozone (O₃), carbon monoxide (CO), and particulate matter (PM-10) based on the magnitude of an area's problem. Nonattainment classifications may be used to specify which air pollution reduction measures an area must adopt, and when the area must reach attainment. The technical details underlying these classifications are discussed in part 51 of the *Code of Federal Regulations*. To move into attainment status, a nonattainment area must meet the NAAQS and fulfill all CAAA requirements. Table 5-1 shows the total number of nonattainment areas for each pollutant and provides comparable statistics for each year since the CAAA designations were implemented. Note that transitional and incomplete areas are excluded from these counts. Over the past year, the total number of nonattainment areas dropped by 13, with O₃ having the greatest net reduction of 14 areas. The number of nonattainment areas for CO and lead (Pb) declined by two, sulfur dioxide (SO₂) declined by four, and PM-10 declined by one, while the nitrogen dioxide (NO₂) count remained at one. It is important to note that there are several areas that have

begun the redesignation process, but are still included in these counts since their redesignations have not yet been finalized. As of September 1995, there were 4 CO, 1-Pb, 2 PM-10, and 29 O₃ nonattainment areas with pending redesignation requests.

Figure 5-1 shows the location of the nonattainment areas for each criteria pollutant. Figure 5-2 further identifies the O₃ nonattainment areas by degree of severity. A "simplified" summary of nonattainment areas can be found in Table A-11 in Appendix A. The simplified list was created by combining geographic areas that are in nonattainment for more than one criteria pollutant. As of September 1995, there were a total of 185 nonattainment areas on the simplified nonattainment list. Roughly one-fourth of these areas maintain nonattainment status for more than one criteria pollutant. The areas on the simplified list are shown alphabetically by state. A more detailed listing is contained in the *Code of Federal Regulations*, Part 81 (40 CFR 81). In Table A-11, the population totals corresponding to each nonattainment area are based on 1990 Census figures. For nonattainment areas defined as partial counties, only population totals for the applicable portion were used if available; otherwise, the entire county population totals are shown. When a larger nonattainment area encompassed a smaller one, double-counting the population was avoided by only counting the population of the larger area. When two

Table 5-1: Nonattainment area counts for NAAQS pollutants.

| <i>Pollutant</i> | <i>CAAA 1990</i> | <i>Number as of:</i> | | | |
|---------------------------|---------------------|----------------------|-------------------|-------------------|-------------------|
| | <i>Designations</i> | <i>Aug. 1992</i> | <i>Sept. 1993</i> | <i>Sept. 1994</i> | <i>Sept. 1995</i> |
| <i>Carbon Monoxide</i> | 42 | 38 | 41 | 38 | 36 |
| <i>Lead</i> | 12 | 12 | 13 | 13 | 11 |
| <i>Nitrogen Dioxide</i> | 1 | 1 | 1 | 1 | 1 |
| <i>Ozone</i> | 98 | 97 | 94 | 91 | 77 |
| <i>Particulate Matter</i> | 70 | 70 | 70 | 83 | 82 |
| <i>Sulfur Dioxide</i> | 51 | 50 | 46 | 47 | 43 |

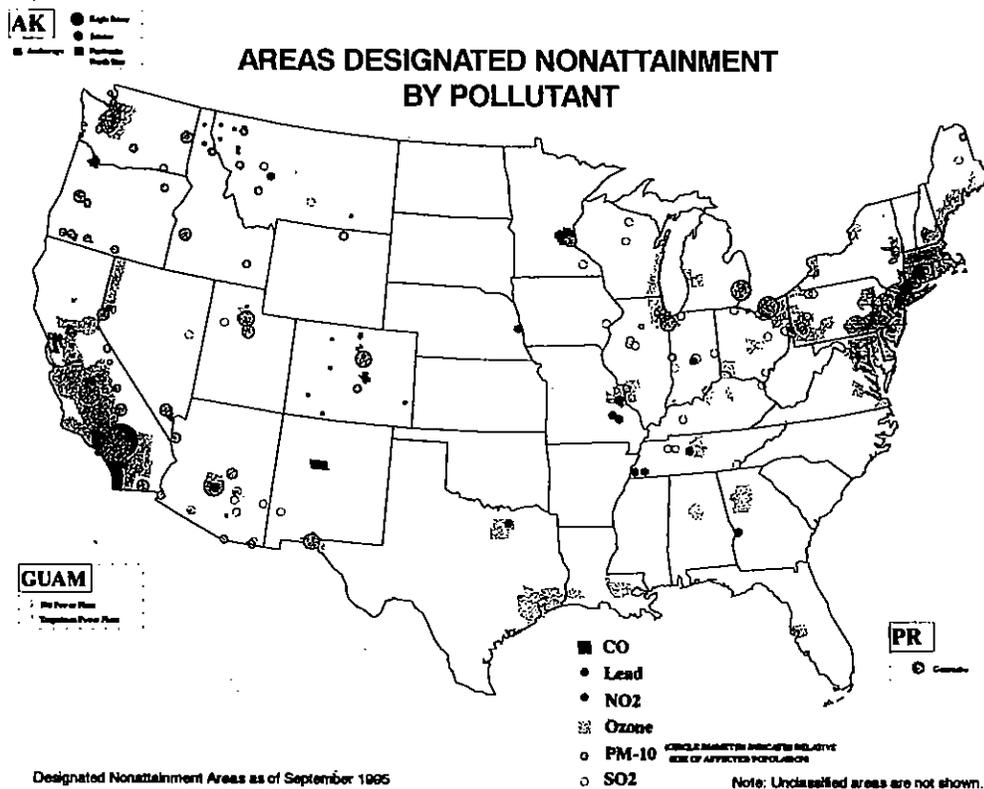


Figure 5-1: Location of nonattainment areas for criteria pollutants.

nonattainment areas only partially overlapped, the areas were counted as two distinct nonattainment areas and the populations were added accordingly. There are approximately 134 million people living in areas currently designated as nonattainment.

Boundaries of nonattainment areas generally coincide with those of Metropolitan Statistical Areas (MSAs). MSAs are defined as areas comprising a large population center with adjacent communities that have a high degree of economic and social integration with the urban center. MSA boundaries are appointed by the U.S. Office of Management and Budget. MSAs contain a central county and any adjacent counties with at least 50 percent of their population in the urbanized area. Although MSAs compose only 19 percent of the

land area in the United States, they account for almost 80 percent of the total population. Table A-12 in Appendix A presents a summary of the highest air quality levels measured in each MSA during 1994. The 330 MSAs are listed alphabetically along with the 1990 population estimate. Concentrations above the level of the respective NAAQS are shown in *bold italic* type. Readers are cautioned that this summary is not adequate in itself to numerically rank MSAs according to their air quality. The monitoring data represent the quality of the air in the vicinity of the monitoring site, but may not necessarily represent urban-wide air quality.

Classified Ozone Nonattainment Areas

As of July 21, 1995

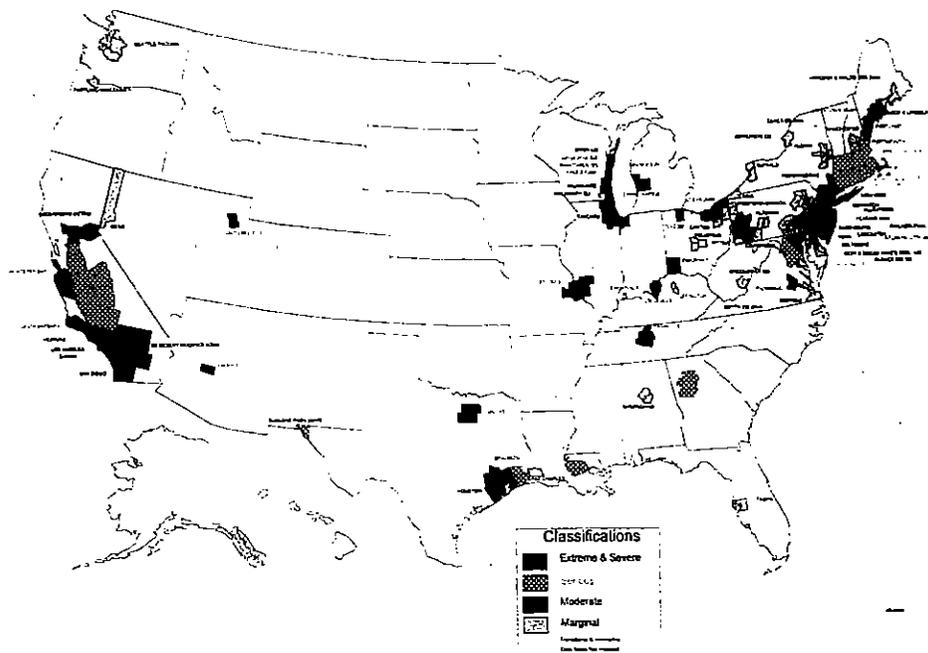


Figure 5-2: O₃ nonattainment areas by degree of severity.

Chapter 6

Selected Metropolitan Area Trends

While most of this report discusses air quality trends on a national scale, there is a great interest in local air quality trends. The Pollutant Standards Index (PSI) is used as an overall assessment of air quality for any given day. PSI values are reported in all metropolitan areas of the United States with populations exceeding 200,000. Table A-13 in Appendix A lists the number of PSI days greater than 100 for all criteria pollutants [except lead (Pb)] in Metropolitan Statistical Areas (MSAs). Table A-14, also in Appendix A, lists the number of PSI days greater than 100 for ozone (O₃) only. Summary statistics of PSI trends are listed in Table A-15 of Appendix A. Ten-year PSI trends are based on daily maximum pollutant concentrations from the subset of ambient monitoring sites that have complete data for a minimum of eight out of the 10 years.

The Pollutant Standards Index

The Pollutant Standards Index (PSI) is computed for particulate matter whose aerodynamic size is equal to or less than 10 microns (PM-10), sulfur dioxide (SO₂), carbon monoxide (CO), ozone (O₃) and nitrogen dioxide (NO₂), and is based on their short-term National Ambient Air Quality Standards (NAAQS), Federal Episode Criteria, and Significant Harm Levels. Pb is the only major pollutant not included in the index because it does not have a short-term NAAQS, a Federal Episode Criteria, or a Significant Harm Level. The five PSI color categories and their respective health effect descriptors are listed in Table 6-1. The PSI is primarily used to report the daily air quality of a large urban area to the general public. It is reported simply as a number or a word, and is featured on local TV or radio news programs and in newspapers. Usually the index is presented in a pictorial form as shown in Figure 6-1.

The PSI integrates information from five major pollutants across an entire monitoring network into a single number that represents the worst daily air quality experienced in an urban area. Criteria pollutant concentrations (except Pb) are converted into a number between zero and 500. The index is calculated by first

computing a separate sub-index for each pollutant with data for the day, and then determining the highest PSI of any pollutant. The pollutant with the highest index is reported as the PSI for that day. Therefore, the PSI does not take into account the possible adverse effects associated with combinations of pollutants (i.e., synergism).^{1,2}

A PSI value of 100 corresponds to the standard established under the Clean Air Act (CAA), and a PSI greater than 100 indicates that at least one criteria pollutant exceeded air quality standards on a given day; therefore, air quality would be in the unhealthy range on that day. PSI values activate public health warnings. For example, a PSI of 200 initiates a First Stage Alert at which time sensitive populations (the elderly, and persons with impaired respiratory illnesses) are advised to remain indoors and reduce physical activity. A PSI of 300 initiates a Second Stage Alert at which time the general public is advised to avoid outdoor activity.

The PSI was designed to protect the public from acute health effects (24 hours or less) as opposed to chronic health effects (months or years) experienced as a result of poor air quality. PSI values do not directly account for the amount of damage air pollutants can cause to public welfare, namely animals, vegetation, and materials such as building surfaces and statues. However, increased PSI levels generally reflect increased damage to the environment.

PSI estimates depend on the number of pollutants monitored as well as the number of monitoring sites where data is collected. The more pollutants and sites that are available in an area, the better the estimate of the maximum PSI for a given day. Ozone accounts for the majority of days with a PSI above 100, but is collected only at a small number of sites in each area. However, since O₃ concentrations are relatively uniform over large areas, O₃ data can be used to estimate maximum pollutant concentrations. The typical one-in-six day sampling schedule for most PM-10 sites limits the number of days that PM-10 can factor into the PSI determination. This limitation can result in an underestimation of the PSI.

Summary of PSI Analyses

Of the five criteria pollutants used to calculate PSI, CO, O₃, PM-10, and SO₂ generally contribute to the PSI. NO₂ is rarely the highest pollutant measured because it does not have a short term NAAQS and can only be included when concentrations exceed one of the Federal Episode Criteria or Significant Harm Levels.

Figure 6-2 shows the trend in the number of PSI days greater than 100 summed across the nation's 90 largest metropolitan areas (those cities with total 1990 population greater than 500,000). Because of their magnitude, PSI totals for Los Angeles, CA and Riverside, CA are shown separately. The long-term air quality improvement is evident in this figure. Between 1985 and 1994, the total number of PSI days greater than 100 decreased 35 percent in Los Angeles, 27 percent in Riverside, and 72 percent in the remaining major cities across the United States.

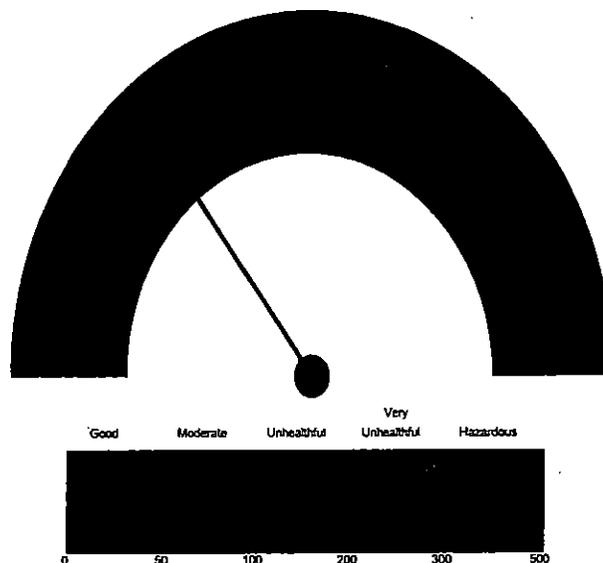


Figure 6-1: Pollutant Standards Index

Table 6-1: Pollutant Standards Index values with pollutant concentration, health descriptors, and PSI colors.

| INDEX VALUE | AIR QUALITY LEVEL | POLLUTANT LEVELS | | | | | HEALTH EFFECT DESCRIPTOR | PSI COLORS |
|-------------|-------------------|----------------------------------------------------|---------------------------------------------------|-----------------------|-----------------------------------|------------------------------------|--------------------------|------------|
| | | PM ₁₀ (24-hour) ug/m ³ | SO ₂ (24-hour) ug/m ³ | CO (8-hour) ppm | O ₃ (1-hour) ppm | NO ₂ (1-hour) ppm | | |
| 500 | SIGNIFICANT HARM | 600 | 2620 | 50 | 0.6 | 2.0 | | |
| 400 | EMERGENCY | 500 | 2100 | 40 | 0.5 | 1.6 | HAZARDOUS | RED |
| 300 | WARNING | 420 | 1600 | 30 | 0.4 | 1.2 | VERY UNHEALTHFUL | ORANGE |
| 200 | ALERT | 350 | 800 | 15 | 0.2 | 0.6 | UNHEALTHFUL | YELLOW |
| 100 | NAAQS | 150 | 365 | 9 | 0.12 | a | MODERATE | GREEN |
| 50 | 50% OF NAAQS | 50 | 80 ^b | 4.5 | 0.06 | a | GOOD | BLUE |
| 0 | | 0 | 0 | 0 | 0 | a | | |

^a No index values reported at concentration levels below those specified by "Alert Level" criteria.
^b Annual primary NAAQS.

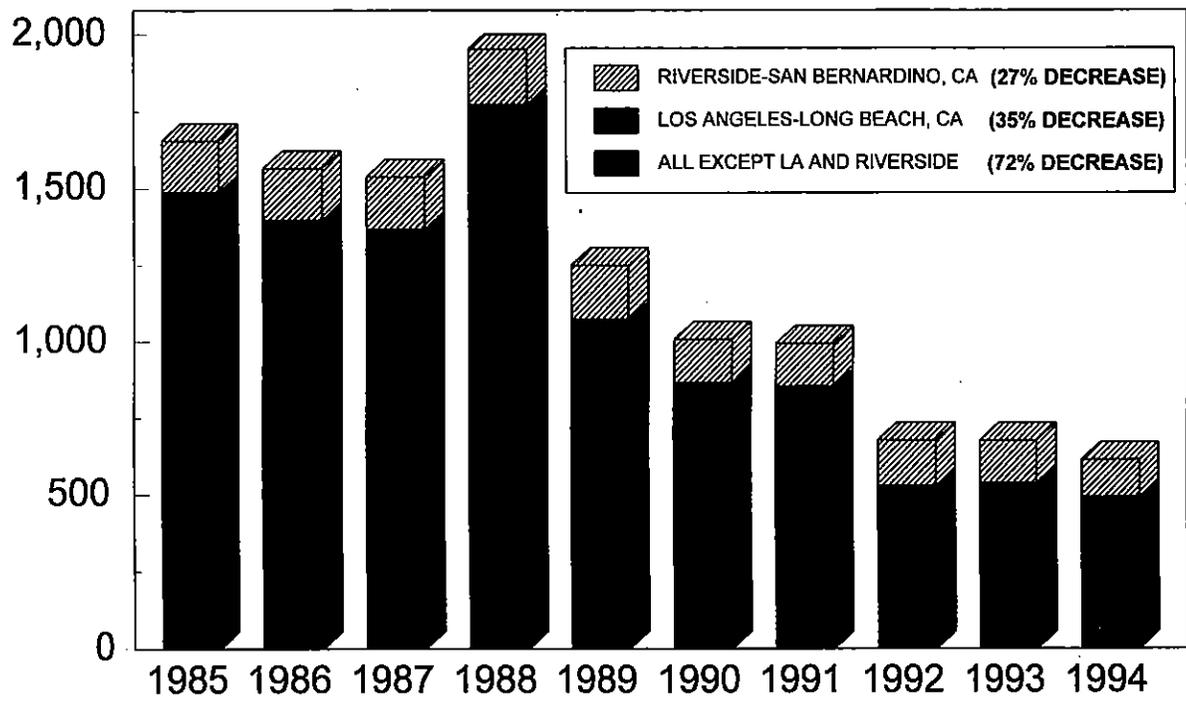


Figure 6-2: Total number of PSI days greater than 100 in the 90 largest cities.

References

1. *Measuring Air Quality, The Pollutant Standards Index*, EPA-451/K-94-001, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, February 1994.
2. *Code of Federal Regulations*, 40 CFR Part 58, Appendix G.

Chapter 7

International Air Pollution Perspective

This chapter discusses air pollution emissions and ambient concentrations for selected cities and countries around the world. Because air quality standards and goals often differ among countries, common statistics have been selected for purposes of comparison. However, it is important to note that *trends observed within a specific country are more accurate than comparisons of trends made between countries.*

Emissions

Estimates of global and national pollutant emissions vary widely. Discrepancies in definitions, estimation methodology, and model inputs cause this variability, though misreporting may also be a factor. In 1985, the European Council of Ministers began a program called CORINE (Coordination d'Information Environnementale) to gather, coordinate, and ensure the consistency of information on the state of the environment in Europe.¹ One of CORINE's component projects was CORINAIR, an air emission inventory. This inventory was first conducted for the year 1985 for the 12 European Union (EU-12) countries namely, Belgium, Denmark, France, former West Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, and the United Kingdom. In 1990, coverage was expanded to include additional European nations. A standardized approach has enhanced the usefulness of emission data for international comparisons albeit for a limited number of countries and years. Data from CORINAIR are used in this section wherever possible. U.S. data are taken from *National Air Pollutant Emission Trends, 1990-1994*; Canadian data are generally from Environment Canada (1985 and 1990); and additional emissions estimates are culled primarily from reports of the Organization for Economic

Cooperation and Development (OECD) (1993). U.S. data are taken from *National Air Pollutant Emission Trends, 1990-1994*; Canadian data are generally from Environment Canada (1985 and 1990); and additional emissions estimates are culled primarily from reports of the Organization for Economic

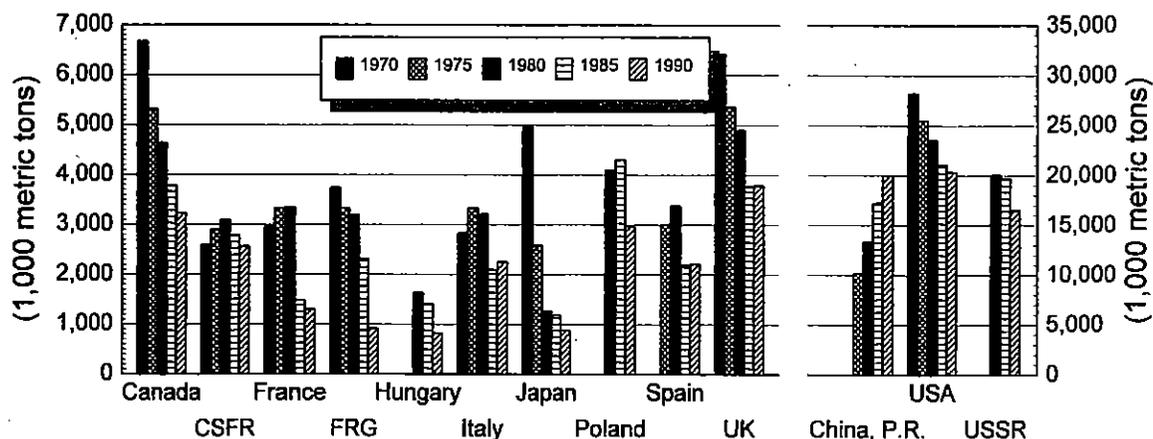


Figure 7-1: Emissions of sulfur dioxide from anthropogenic sources in selected countries, 1970 to 1990. Source: CORINAIR, Environment Canada, OECD (1993), USEPA (1995). [Japan: 1985 data refer to 1986]

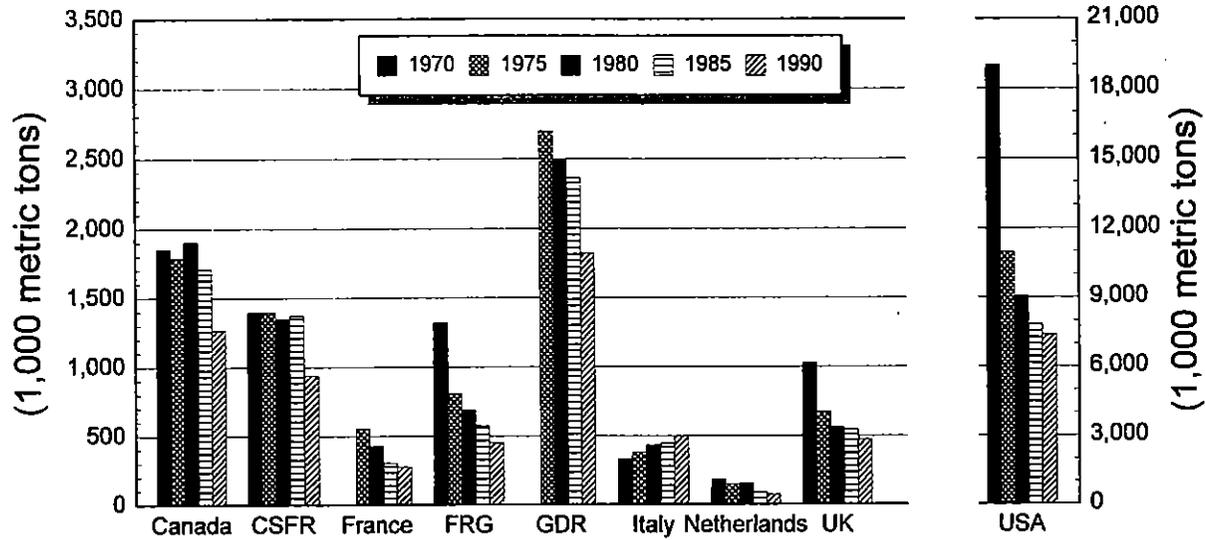


Figure 7-2: Particulate matter emissions from anthropogenic sources in selected countries, 1970 to 1990.
 Source: CORINAIR, Environment Canada, OECD (1993), USEPA (1995)

Cooperation and Development (OECD) and the United Nation Environment Program (UNEP).

Worldwide anthropogenic emissions of sulfur oxides (SO_x , reported as SO_2) were reported by OECD to be approximately 99 million metric tons per year in the early 1990s.² Emissions data for selected countries between 1970 and 1990 are shown in Figure 7-1. These countries account for over three-fourths of the 1990 emissions estimate. Mexico also has significant emissions of SO_x (based on their 1985 estimate of 6.5 million metric tons), but insufficient statistics are available to chart any trend.³ Between 1970 and 1990, SO_x emissions decreased in most of the countries shown in Figure 7-1. The People's Republic of China is a notable exception; their sulfur dioxide emissions increased 98 percent between 1975 and 1990, from 10.1 to 20.0 million metric tons. (Note: 1970 data are not available.)⁴ The United States reduced SO_x emissions by almost eight million tons between 1970 and 1990, the largest reduction of the countries charted. Another environmental data source estimated 1985 global anthropogenic emissions of sulfur oxides to be approximately 160 million tons.⁵ The difference between the 1985 and 1990 global SO_x emission estimates (61 million metric tons or 38 percent) likely exaggerates actual global SO_x emission reductions during this period. The countries represented in Figure

7-1 collectively recorded a decrease of almost seven percent between 1985 and 1990. This percent decrease is probably a better representation of global SO_x emission reductions during this time frame.

In 1990, global emissions of suspended particulate matter were approximately 57 million metric tons.⁶ Fossil fuel combustion was the greatest contributor to this total. Despite increased coal combustion in many industrialized countries, particulate emissions have decreased. This is a direct result of cleaner burning techniques.⁷ Except for Italy, particulate emissions in the countries listed in Figure 7-2 decreased between 1970 and 1990. The United States, the Netherlands, former West Germany, and the United Kingdom all realized reductions of more than 50 percent.

Global anthropogenic emissions of nitrogen oxides (NO_x , reported as NO_2) were approximately 68 million metric tons in 1990.² Table 7-1 provides 1985 and 1990 NO_x emission data for the EU-12 countries plus Canada and the United States. These countries account for nearly two-thirds of the nitrogen oxides emitted into the atmosphere as a result of human activities. Although aggregate NO_x emissions for the EU-12 countries increased 26.5 percent during this period, NO_x emissions in the United States and Canada remained relatively constant, increasing only 0.8 and 0.5 percent, respectively.

Table 7-1: Emissions of nitrogen oxides from anthropogenic sources in selected countries, 1985 and 1990 (1,000 metric tons).

| Country | 1985 | 1990 | % Change 1985-1990 |
|--------------------|---------------|---------------|--------------------|
| Belgium | 349 | 378 | 8.3 |
| Denmark | 300 | 301 | 0.3 |
| France | 1,769 | 1,753 | -0.9 |
| FRG | 2,994 | 2,673 | -10.7 |
| Greece | 340 | 599 | 76.2 |
| Ireland | 93 | 128 | 37.6 |
| Italy | 1,735 | 2,263 | 30.4 |
| Luxembourg | 25 | 25 | 0.0 |
| Netherlands | 519 | 635 | 22.4 |
| Portugal | 106 | 243 | 129.2 |
| Spain | 927 | 1,386 | 49.5 |
| UK | 2,342 | 4,159 | 77.6 |
| EU-12 Total | 11,499 | 14,543 | 26.5 |
| Canada | 2,222 | 2,233 | 0.5 |
| USA | 20,734 | 20,895 | 0.8 |

Source: CORINAIR, Environment Canada, USEPA (1995)

In addition to tracking emissions of criteria pollutants, an increasing number of national and international environmental organizations also track emissions of greenhouse gases. Water vapor, carbon dioxide, methane, nitrous oxide, ozone, and chlorofluorocarbons (CFCs) are the most commonly referenced greenhouse gases. These gases allow sunlight to pass through the atmosphere, but trap and absorb the energy radiated from the earth's surface (as does a greenhouse). Rising concentrations of greenhouse gases increase global temperatures and can adversely affect sea levels and flora. Carbon dioxide (CO₂), methane (CH₄), and CFCs have the greatest global warming potential.⁸ Human activities are largely responsible for the recent atmospheric build-up of these gases. Five of the largest contributors to the global emission total for each of these gases are shown in Figure 7-3. In 1992, the United States signed and ratified the Framework Convention on Climate Change. This agreement seeks to develop methodology for estimating sources and sinks of greenhouse gases, as well as consistent measures of greenhouse gases emissions. In 1970, global CO₂ emissions (from energy use and industrial processes) were approximately 15.6 billion metric tons. In 1991, global CO₂ emissions had increased to approximately 22.0 billion metric tons. The Middle East experienced the largest gain during this period, more than quadrupling their emissions.³

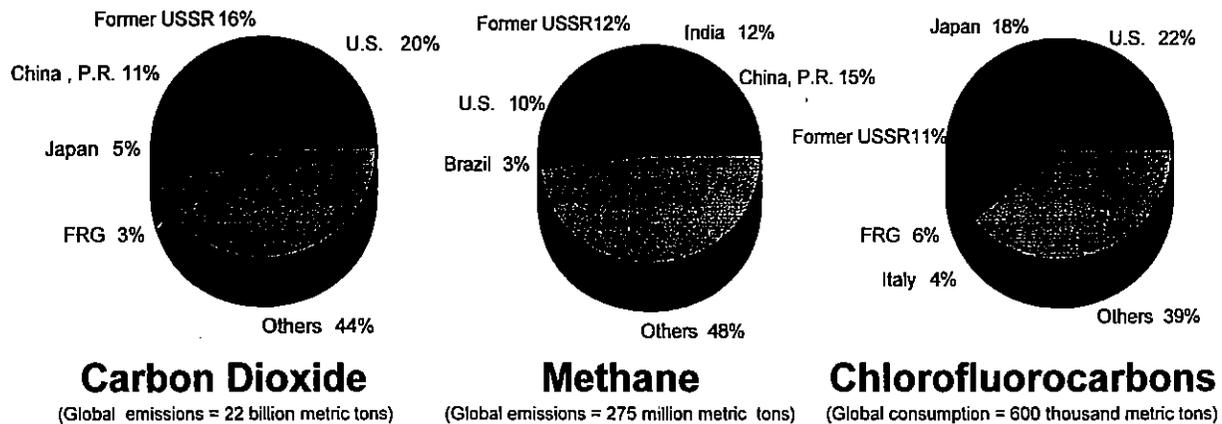


Figure 7-3: Global anthropogenic emissions of greenhouse gases, 1990 Source: OECD (1993), USEPA (1994)

Worldwide CFC consumption was about 600 thousand tons in 1990.⁸ Because CFCs deplete stratospheric ozone, the United States and other countries have drastically curtailed their production over the past decade. The United States' consumption of CFCs decreased almost two-thirds between 1986 and 1990.⁴ Although the most common CFC substitutes (perfluorinated carbons and partially halogenated compounds) are not harmful to the stratospheric ozone layer, they are extremely powerful greenhouse gases.³ Global anthropogenic emissions of methane were about 275 million tons in 1990.⁸ Landfills are the largest source of human-induced methane in the United States.³

Ambient Air

Most countries regulate ambient concentrations of pollutants to protect their citizens and the environment. The averaging times, number of exceedances, and units for these regulations vary between countries. The World Health Organization (WHO) has developed recommended international guidelines for the six criteria pollutants (see Table 7-2). In conjunction with UNEP, WHO also established the ongoing Global Environment Monitoring System (GEMS). GEMS is an urban air pollution monitoring and assessment program involving over 850 monitors in 46 countries worldwide. The GEMS program intends to strengthen urban air pollution monitoring and assessment capabilities, improve the validity and comparability of data, and provide global appraisals on concentrations and trends of urban air pollutants. Sulfur dioxide and particulate matter account for almost 75 percent of the GEMS monitoring network.⁹ This portion of the network (excluding the United States) is highlighted in Figure 7-4 along with 1990 concentration data from the GEMS/AIR program for selected cities around the world. With almost 200 GEMS/AIR designated monitors, the United States' portion of the GEMS/AIR network is the most extensive of all participating nations.

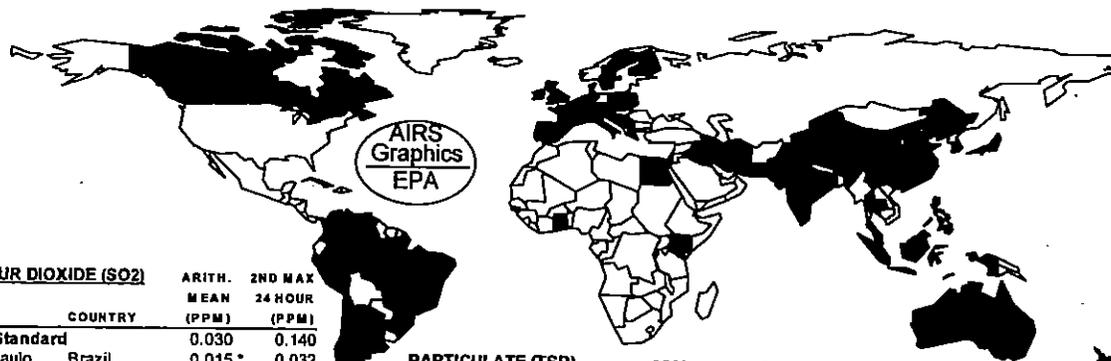
By the year 2000, almost half of the earth's population are expected to be living in cities. The urban air quality of 20 of the world's largest cities was recently evaluated by UNEP/WHO. The study concluded that air pollution is widespread in all 20 urban areas. Each city exceeded WHO guidelines for at least one criteria pollutant, 14 cities exceeded at least two WHO guidelines, and seven cities exceeded three or

Table 7-2: WHO health guidelines.

| | |
|----------------------------|---------------------------|
| Carbon Monoxide: | |
| <i>8-hour average</i> | 10 µg/m ³ |
| <i>1-hour average</i> | 30 µg/m ³ |
| Lead: | |
| <i>Annual average</i> | 0.5–1.0 µg/m ³ |
| Nitrogen: | |
| <i>24-hour average</i> | 150 µg/m ³ |
| <i>1-hour average</i> | 400 µg/m ³ |
| Ozone: | |
| <i>1-hour average</i> | 100–200 µg/m ³ |
| <i>8-hour average</i> | 100–120 µg/m ³ |
| Particulate Matter: | |
| <i>SPM annual avg.*</i> | 60–90 µg/m ³ |
| <i>SPM 24-hour avg.*</i> | 150–230 µg/m ³ |
| <i>PM-10 24-hour avg.*</i> | 70 µg/m ³ |
| Sulfur dioxide: | |
| <i>Annual average*</i> | 40–60 µg/m ³ |
| <i>24-hour average*</i> | 100–150 µg/m ³ |
| <i>1-hour average</i> | 350 µg/m ³ |
| <i>10-minute average</i> | 500 µg/m ³ |

* Guideline values for combined exposure to SO₂ and SPM.

more. Mexico City exceeded WHO guidelines for all six pollutants. Their sulfur dioxide, carbon monoxide, particulate matter, and ozone pollution levels were classified as serious problems, while their lead and nitrogen dioxide pollution levels were classified as moderate problems. Particulate matter was the predominant air pollution problem afflicting the 20 megacities. New York was one of only three cities that normally met the particulate matter WHO guideline. Sulfur dioxide and ozone were the next most prevalent forms of air pollution.¹⁰ Of the six criteria pollutants, ozone tends to be the least monitored. A chart comparing the maximum pollutant level of O₃ at various world cities in 1991 is shown in Figure 7-5.



| SULFUR DIOXIDE (SO ₂) | | ARITH. MEAN (PPM) | 2ND MAX 24 HOUR (PPM) |
|-----------------------------------|-------------|-------------------|-----------------------|
| CITY | COUNTRY | | |
| U.S. Standard | | 0.030 | 0.140 |
| Sao Paulo | Brazil | 0.015 * | 0.032 |
| Montreal | Canada | 0.008 * | 0.045 |
| Toronto | Canada | 0.007 * | 0.040 |
| Vancouver | Canada | 0.006 * | 0.018 |
| Beijing | China, P.R. | 0.047 | 0.201 |
| Shanghai | China, P.R. | 0.042 | 0.123 |
| Cairo | Egypt | 0.014 | 0.063 |
| Hessen | Germany | 0.007 * | 0.032 |
| Tehran | Iran | 0.059 * | 0.091 |
| Osaka | Japan | 0.047 * | 0.099 |
| Tokyo | Japan | 0.049 * | 0.099 |
| Auckland | New Zealand | 0.001 | 0.004 |
| Christchurch | New Zealand | 0.002 | 0.008 |
| Jarczew | Poland | 0.010 | 0.052 |
| Wroclaw | Poland | 0.027 | 0.070 |
| Lisbon | Portugal | 0.016 | 0.035 |
| Madrid | Spain | 0.012 | 0.025 |
| Caracas | Venezuela | 0.009 | 0.012 |
| Zagreb | Yugoslavia | 0.025 | 0.076 |

| PARTICULATE (TSP) | | GEOM. MEAN (PPM) | 2ND MAX 24 HOUR (PPM) |
|-----------------------|-------------|------------------|-----------------------|
| CITY | COUNTRY | | |
| Earlier U.S. Standard | | 75 | 260 |
| Sao Paulo | Brazil | 24 | 90 |
| Hamilton | Canada | 64 | 201 |
| Montreal | Canada | 45 | 110 |
| Toronto | Canada | 64 | 201 |
| Vancouver | Canada | 37 | 77 |
| Beijing | China, P.R. | 390 | 1322 |
| Shanghai | China, P.R. | 263 | 753 |
| Hessen | Germany | 32 | 74 |
| Hong Kong | Hong Kong | 86 | 249 |
| Osaka | Japan | 47 | 154 |
| Tokyo | Japan | 55 | 258 |
| Christchurch | New Zealand | 11 | 559 |
| Lahore | Pakistan | 386 | 685 |
| Zagreb | Yugoslavia | 118 | 308 |

Nations with the Most Monitors (1990)

| SO ₂ | | TSP | |
|-----------------|-------|-----------|-------|
| Nation | Count | Nation | Count |
| Canada | 40 | Canada | 43 |
| India | 28 | Argentina | 22 |
| China | 21 | China | 20 |
| Argentina | 16 | Japan | 18 |
| UK | 12 | Columbia | 15 |

* Indicates data did not meet ARS summary criteria

Figure 7-4: GEMS: 1990 sulfur dioxide and particulate matter monitors — location and sample data. [Monitors are located in shaded countries (317 SO₂ monitors in 44 nations; 300 particulate matter monitors in 41 nations). Note that South Korea, Austria, Germany, and the Netherlands only monitored SO₂; Luxembourg only monitored particulate matter.] Source: AIRS, USEPA

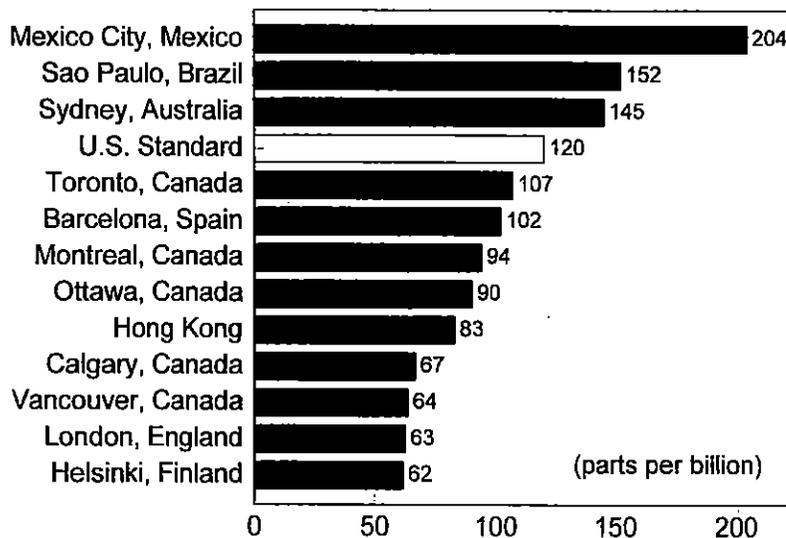


Figure 7-5: Maximum daily average ozone levels at selected world cities, 1991.

Source: Environment Canada, USEPA, UNEP (1992). [Note: Mexico City & Sao Paulo data are approximate.]

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Appendix A: Data Tables

Table A-1. Trend Statistics Used in the 1994 Trends Report - Summary Statistics

| STATISTIC | UNITS | # of SITES | PERCENTILE | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 |
|-------------------------|-------|------------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| CARBON MONOXIDE | | | | | | | | | | | | | |
| 2nd Max. 8hr. | PPM | 328 | 95th | 12.8 | 12.4 | 11.9 | 11.3 | 11.0 | 10.5 | 9.7 | 8.6 | 8.1 | 8.3 |
| " | " | " | 90th | 11.3 | 11.1 | 9.9 | 10.0 | 9.7 | 8.8 | 8.6 | 7.9 | 7.3 | 7.6 |
| " | " | " | 75th | 8.5 | 8.9 | 8.3 | 7.7 | 7.8 | 7.1 | 6.9 | 6.4 | 5.8 | 6.1 |
| " | " | " | 50th | 6.3 | 6.5 | 6.3 | 6.1 | 6.0 | 5.5 | 5.2 | 4.9 | 4.7 | 4.9 |
| " | " | " | 25th | 4.8 | 4.9 | 4.7 | 4.4 | 4.4 | 4.3 | 3.8 | 3.7 | 3.6 | 3.8 |
| " | " | " | 10th | 3.6 | 3.5 | 3.6 | 3.4 | 3.5 | 3.1 | 3.0 | 2.8 | 2.9 | 2.8 |
| " | " | " | 5th | 3.0 | 2.9 | 3.0 | 3.0 | 2.8 | 2.6 | 2.5 | 2.5 | 2.3 | 2.3 |
| " | " | " | Arith. Mean | 6.9 | 7.1 | 6.7 | 6.4 | 6.3 | 5.9 | 5.5 | 5.2 | 4.9 | 5.0 |
| LEAD | | | | | | | | | | | | | |
| Max. Qtr | UG/M3 | 197 | 95th | 0.71 | 0.43 | 0.41 | 0.30 | 0.23 | 0.26 | 0.19 | 0.15 | 0.14 | 0.14 |
| " | " | " | 90th | 0.56 | 0.33 | 0.24 | 0.21 | 0.16 | 0.16 | 0.14 | 0.11 | 0.09 | 0.08 |
| " | " | " | 75th | 0.37 | 0.21 | 0.15 | 0.11 | 0.10 | 0.08 | 0.06 | 0.05 | 0.05 | 0.05 |
| " | " | " | 50th | 0.22 | 0.14 | 0.09 | 0.07 | 0.06 | 0.05 | 0.04 | 0.03 | 0.03 | 0.03 |
| " | " | " | 25th | 0.14 | 0.09 | 0.06 | 0.04 | 0.04 | 0.03 | 0.02 | 0.02 | 0.02 | 0.02 |
| " | " | " | 10th | 0.09 | 0.06 | 0.04 | 0.02 | 0.03 | 0.02 | 0.01 | 0.01 | 0.01 | 0.01 |
| " | " | " | 5th | 0.07 | 0.05 | 0.03 | 0.02 | 0.02 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| " | " | " | Arith. Mean | 0.29 | 0.18 | 0.16 | 0.11 | 0.08 | 0.08 | 0.06 | 0.05 | 0.05 | 0.04 |
| NITROGEN DIOXIDE | | | | | | | | | | | | | |
| Arith. Mean | PPM | 205 | 95th | 0.043 | 0.045 | 0.043 | 0.046 | 0.043 | 0.041 | 0.041 | 0.039 | 0.037 | 0.040 |
| " | " | " | 90th | 0.037 | 0.035 | 0.038 | 0.037 | 0.035 | 0.034 | 0.033 | 0.033 | 0.033 | 0.034 |
| " | " | " | 75th | 0.028 | 0.027 | 0.028 | 0.028 | 0.028 | 0.026 | 0.027 | 0.025 | 0.025 | 0.026 |
| " | " | " | 50th | 0.021 | 0.021 | 0.021 | 0.022 | 0.021 | 0.020 | 0.020 | 0.019 | 0.019 | 0.020 |
| " | " | " | 25th | 0.014 | 0.014 | 0.015 | 0.014 | 0.014 | 0.013 | 0.012 | 0.013 | 0.013 | 0.013 |
| " | " | " | 10th | 0.007 | 0.007 | 0.006 | 0.008 | 0.007 | 0.007 | 0.007 | 0.007 | 0.006 | 0.006 |
| " | " | " | 5th | 0.004 | 0.004 | 0.004 | 0.004 | 0.003 | 0.004 | 0.003 | 0.004 | 0.004 | 0.004 |
| " | " | " | Arith. Mean | 0.022 | 0.022 | 0.022 | 0.022 | 0.022 | 0.020 | 0.020 | 0.020 | 0.019 | 0.020 |
| OZONE | | | | | | | | | | | | | |
| 2nd Max. 1hr. | PPM | 549 | 95th | 0.210 | 0.180 | 0.183 | 0.210 | 0.190 | 0.180 | 0.176 | 0.160 | 0.160 | 0.156 |
| " | " | " | 90th | 0.170 | 0.160 | 0.168 | 0.181 | 0.155 | 0.150 | 0.150 | 0.136 | 0.140 | 0.135 |
| " | " | " | 75th | 0.134 | 0.130 | 0.140 | 0.154 | 0.126 | 0.122 | 0.127 | 0.114 | 0.120 | 0.118 |
| " | " | " | 50th | 0.113 | 0.113 | 0.118 | 0.130 | 0.109 | 0.108 | 0.110 | 0.100 | 0.105 | 0.105 |
| " | " | " | 25th | 0.099 | 0.099 | 0.105 | 0.111 | 0.097 | 0.096 | 0.097 | 0.091 | 0.092 | 0.094 |
| " | " | " | 10th | 0.089 | 0.089 | 0.091 | 0.097 | 0.087 | 0.085 | 0.083 | 0.083 | 0.081 | 0.083 |
| " | " | " | 5th | 0.080 | 0.080 | 0.087 | 0.088 | 0.080 | 0.077 | 0.078 | 0.078 | 0.077 | 0.077 |
| " | " | " | Arith. Mean | 0.124 | 0.120 | 0.126 | 0.136 | 0.117 | 0.114 | 0.116 | 0.107 | 0.110 | 0.109 |

Table A-1. Trend Statistics Used in the 1994 Trends Report - Summary Statistics

| STATISTIC | UNITS | # of SITES | PERCENTILE | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 |
|-----------------------|-------|------------|-------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| PM10 | | | | | | | | | | | | | |
| Wtd. Arith. Mean | UG/M3 | 748 | 95th | | | | 53.5 | 56.2 | 47.0 | 46.5 | 42.6 | 41.7 | 40.0 |
| " | " | " | 90th | | | | 45.8 | 45.0 | 40.2 | 40.1 | 37.2 | 38.6 | 36.9 |
| " | " | " | 75th | | | | 38.2 | 37.2 | 34.6 | 33.8 | 31.4 | 30.5 | 31.0 |
| " | " | " | 50th | | | | 31.6 | 30.9 | 28.4 | 28.5 | 26.1 | 25.8 | 25.8 |
| " | " | " | 25th | | | | 26.7 | 26.5 | 23.9 | 24.2 | 22.2 | 21.4 | 21.5 |
| " | " | " | 10th | | | | 22.0 | 22.0 | 19.5 | 19.6 | 18.3 | 17.8 | 17.7 |
| " | " | " | 5th | | | | 18.2 | 18.5 | 16.6 | 16.3 | 15.0 | 14.8 | 14.3 |
| " | " | " | Arith. Mean | | | | 33.4 | 33.2 | 29.9 | 29.8 | 27.3 | 26.5 | 26.6 |
| SULFUR DIOXIDE | | | | | | | | | | | | | |
| Arith. Mean | PPM | 475 | 95th | 0.0198 | 0.0177 | 0.0169 | 0.0182 | 0.0176 | 0.0161 | 0.0154 | 0.0142 | 0.0145 | 0.0137 |
| " | " | " | 90th | 0.0164 | 0.0152 | 0.0149 | 0.0152 | 0.0149 | 0.0138 | 0.0131 | 0.0125 | 0.0123 | 0.0120 |
| " | " | " | 75th | 0.0121 | 0.0122 | 0.0116 | 0.0116 | 0.0114 | 0.0105 | 0.0100 | 0.0096 | 0.0092 | 0.0091 |
| " | " | " | 50th | 0.0087 | 0.0084 | 0.0082 | 0.0084 | 0.0081 | 0.0076 | 0.0075 | 0.0068 | 0.0067 | 0.0065 |
| " | " | " | 25th | 0.0054 | 0.0054 | 0.0053 | 0.0055 | 0.0051 | 0.0046 | 0.0047 | 0.0044 | 0.0042 | 0.0041 |
| " | " | " | 10th | 0.0026 | 0.0023 | 0.0023 | 0.0026 | 0.0024 | 0.0023 | 0.0022 | 0.0021 | 0.0023 | 0.0022 |
| " | " | " | 5th | 0.0016 | 0.0016 | 0.0015 | 0.0018 | 0.0017 | 0.0016 | 0.0017 | 0.0016 | 0.0016 | 0.0016 |
| " | " | " | Arith. Mean | 0.0092 | 0.0090 | 0.0088 | 0.0089 | 0.0086 | 0.0080 | 0.0078 | 0.0073 | 0.0072 | 0.0069 |
| 2nd Max. 8hr. | PPM | 475 | 95th | 0.0962 | 0.1000 | 0.0855 | 0.0840 | 0.0866 | 0.0748 | 0.0683 | 0.0691 | 0.0657 | 0.0683 |
| " | " | " | 90th | 0.0748 | 0.0767 | 0.0702 | 0.0714 | 0.0729 | 0.0626 | 0.0573 | 0.0561 | 0.0553 | 0.0557 |
| " | " | " | 75th | 0.0557 | 0.0585 | 0.0515 | 0.0550 | 0.0515 | 0.0477 | 0.0443 | 0.0431 | 0.0408 | 0.0431 |
| " | " | " | 50th | 0.0405 | 0.0397 | 0.0382 | 0.0401 | 0.0386 | 0.0332 | 0.0321 | 0.0305 | 0.0279 | 0.0305 |
| " | " | " | 25th | 0.0252 | 0.0260 | 0.0248 | 0.0260 | 0.0244 | 0.0210 | 0.0210 | 0.0191 | 0.0183 | 0.0191 |
| " | " | " | 10th | 0.0122 | 0.0115 | 0.0103 | 0.0134 | 0.0126 | 0.0103 | 0.0099 | 0.0107 | 0.0099 | 0.0092 |
| " | " | " | 5th | 0.0080 | 0.0076 | 0.0065 | 0.0088 | 0.0084 | 0.0073 | 0.0076 | 0.0073 | 0.0061 | 0.0061 |
| " | " | " | Arith. Mean | 0.0438 | 0.0440 | 0.0406 | 0.0430 | 0.0408 | 0.0367 | 0.0340 | 0.0330 | 0.0314 | 0.0327 |

Table A-2. National Carbon Monoxide Emission Estimates, 1985-1994 (thousand short tons)

| Source Category | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 |
|--------------------------------|----------------|----------------|----------------|----------------|----------------|----------------|---------------|---------------|---------------|---------------|
| Fuel Combustion | 8,486 | 7,548 | 6,960 | 7,372 | 7,441 | 5,064 | 5,356 | 5,601 | 4,954 | 4,884 |
| Electric utilities | 292 | 291 | 300 | 313 | 319 | 314 | 315 | 313 | 323 | 325 |
| Steam generated fossil-fuel | NA | NA | NA | NA | NA | NA | 303 | 302 | 311 | 313 |
| Other (ic and gl) | NA | NA | NA | NA | NA | NA | 12 | 11 | 12 | 12 |
| Industrial | 670 | 650 | 649 | 669 | 672 | 677 | 667 | 672 | 670 | 671 |
| Other fuel combustion | 7,525 | 6,607 | 6,011 | 6,390 | 6,450 | 4,072 | 4,373 | 4,616 | 3,961 | 3,888 |
| Residential wood | 7,232 | 6,316 | 5,719 | 6,086 | 6,161 | 3,781 | 4,090 | 4,332 | 3,679 | 3,607 |
| Other | 293 | 291 | 292 | 303 | 288 | 291 | 283 | 283 | 283 | 281 |
| Industrial Processes & Related | 5,274 | 5,151 | 5,001 | 5,227 | 5,266 | 5,228 | 5,114 | 5,193 | 5,277 | 5,414 |
| Chemical & allied product mfg | 1,845 | 1,853 | 1,798 | 1,917 | 1,925 | 1,940 | 1,944 | 1,964 | 1,998 | 2,048 |
| Metals processing | 2,223 | 2,079 | 1,984 | 2,101 | 2,132 | 2,080 | 1,992 | 2,044 | 2,091 | 2,166 |
| Petroleum & related industries | 462 | 451 | 455 | 441 | 436 | 435 | 412 | 410 | 398 | 390 |
| Other industrial processes | 694 | 715 | 713 | 711 | 716 | 717 | 710 | 719 | 732 | 751 |
| Solvent utilization | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Storage & transport | 49 | 51 | 50 | 56 | 55 | 55 | 54 | 55 | 56 | 58 |
| Waste disposal & recycling | 1,941 | 1,916 | 1,850 | 1,806 | 1,747 | 1,686 | 1,701 | 1,717 | 1,732 | 1,746 |
| Transportation | 91,094 | 87,330 | 85,381 | 85,581 | 80,568 | 77,500 | 76,675 | 74,759 | 75,471 | 76,727 |
| Highway vehicles | 77,387 | 73,347 | 71,250 | 71,081 | 66,050 | 62,858 | 62,074 | 59,859 | 60,202 | 61,070 |
| Off-highway | 13,706 | 13,984 | 14,131 | 14,500 | 14,518 | 14,642 | 14,601 | 14,900 | 15,269 | 15,657 |
| Natural Sources | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Miscellaneous | 7,895 | 7,254 | 8,820 | 15,863 | 8,121 | 11,173 | 8,530 | 6,774 | 6,700 | 9,245 |
| Wildfires | 2,957 | 2,271 | 3,795 | 10,709 | 3,009 | 6,079 | 3,439 | 1,674 | 1,586 | 4,115 |
| Prescribed burning | 4,300 | 4,300 | 4,300 | 4,300 | 4,300 | 4,300 | 4,300 | 4,300 | 4,300 | 4,300 |
| Other | 638 | 683 | 725 | 854 | 813 | 794 | 791 | 800 | 814 | 831 |
| Total | 114,690 | 109,199 | 108,012 | 116,849 | 103,144 | 100,660 | 97,376 | 94,043 | 94,133 | 98,017 |

NA = Not Available

Table A-3. National Lead Emission Estimates, 1985-1994 (short tons)

| Source Category | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 |
|--------------------------------|---------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Fuel Combustion | 515 | 516 | 510 | 511 | 505 | 500 | 495 | 491 | 491 | 493 |
| Electric utilities | 64 | 69 | 64 | 66 | 67 | 64 | 61 | 59 | 61 | 63 |
| Industrial | 30 | 25 | 22 | 19 | 18 | 18 | 18 | 18 | 15 | 15 |
| Other fuel combustion | 421 | 422 | 425 | 426 | 420 | 418 | 416 | 414 | 415 | 415 |
| Industrial Processes & Related | 3,402 | 2,972 | 3,004 | 3,090 | 3,161 | 3,278 | 3,081 | 2,771 | 2,866 | 2,868 |
| Chemical & allied product mfg | 118 | 108 | 123 | 136 | 136 | 136 | 132 | 93 | 96 | 93 |
| Metals processing | 2,097 | 1,820 | 1,835 | 1,965 | 2,088 | 2,169 | 1,975 | 1,775 | 1,887 | 1,873 |
| Petroleum & related industries | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Other industrial processes | 316 | 199 | 202 | 172 | 173 | 169 | 167 | 56 | 54 | 55 |
| Solvent utilization | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage & transport | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Waste disposal & recycling | 871 | 844 | 844 | 817 | 765 | 804 | 807 | 847 | 829 | 847 |
| Transportation | 16,207 | 3,808 | 3,343 | 2,911 | 2,368 | 1,888 | 1,704 | 1,637 | 1,580 | 1,596 |
| Highway vehicles | 15,978 | 3,589 | 3,121 | 2,700 | 2,161 | 1,690 | 1,519 | 1,444 | 1,401 | 1,403 |
| Off-highway | 229 | 219 | 222 | 211 | 207 | 197 | 186 | 193 | 179 | 193 |
| Natural Sources | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Miscellaneous | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | 20,124 | 7,296 | 6,857 | 6,513 | 6,034 | 5,666 | 5,279 | 4,899 | 4,938 | 4,956 |

Table A-4. National Nitrogen Oxides Emission Estimates, 1985-1994 (thousand short tons)

| Source Category | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 |
|-------------------------------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| Fuel Combustion | 10,836 | 10,668 | 10,897 | 11,457 | 11,552 | 11,483 | 11,382 | 11,421 | 11,696 | 11,728 |
| Electric utilities | 6,916 | 6,909 | 7,128 | 7,530 | 7,607 | 7,516 | 7,488 | 7,475 | 7,773 | 7,795 |
| Steam generated fossil-fuel | NA | NA | NA | NA | NA | NA | 7,432 | 7,422 | 7,717 | 7,740 |
| Other [c and g] | NA | NA | NA | NA | NA | NA | 56 | 52 | 56 | 55 |
| Industrial | 3,209 | 3,065 | 3,063 | 3,187 | 3,209 | 3,256 | 3,175 | 3,216 | 3,197 | 3,206 |
| Other fuel combustion | 712 | 694 | 706 | 740 | 736 | 712 | 719 | 730 | 726 | 727 |
| Residential wood | 88 | 77 | 69 | 74 | 75 | 46 | 50 | 53 | 45 | 44 |
| Other | 624 | 618 | 636 | 666 | 661 | 666 | 670 | 678 | 681 | 683 |
| Industrial Processes & Related | 891 | 873 | 840 | 860 | 851 | 850 | 838 | 852 | 866 | 888 |
| Chemical & allied product mfg | 262 | 264 | 255 | 274 | 272 | 276 | 278 | 284 | 286 | 291 |
| Metals processing | 87 | 80 | 75 | 82 | 83 | 81 | 78 | 80 | 81 | 84 |
| Petroleum & related industries | 124 | 109 | 101 | 100 | 97 | 100 | 97 | 96 | 95 | 95 |
| Other industrial processes | 327 | 328 | 320 | 315 | 311 | 306 | 297 | 305 | 315 | 328 |
| Solvent utilization | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 |
| Storage & transport | 2 | 3 | 3 | 3 |
| Waste disposal & recycling | 87 | 87 | 85 | 85 | 84 | 82 | 83 | 83 | 84 | 85 |
| Transportation | 10,823 | 10,550 | 10,315 | 10,575 | 10,526 | 10,331 | 10,170 | 10,325 | 10,485 | 10,624 |
| Highway vehicles | 8,089 | 7,773 | 7,651 | 7,661 | 7,682 | 7,488 | 7,373 | 7,440 | 7,510 | 7,530 |
| Off-highway | 2,734 | 2,777 | 2,664 | 2,914 | 2,844 | 2,843 | 2,796 | 2,885 | 2,985 | 3,095 |
| Natural Sources | 0 |
| Miscellaneous | 309 | 257 | 351 | 726 | 292 | 373 | 283 | 249 | 219 | 374 |
| Wildfires | 142 | 89 | 182 | 554 | 121 | 203 | 112 | 78 | 47 | 203 |
| Prescribed burning | 153 |
| Other | 14 | 15 | 16 | 19 | 18 | 17 | 17 | 18 | 18 | 18 |
| Total | 22,860 | 22,348 | 22,403 | 23,618 | 23,222 | 23,038 | 22,672 | 22,847 | 23,276 | 23,616 |

NA = Not Available

Table A-5. National Volatile Organic Compound Emission Estimates, 1985-1994 (thousand short tons)

| Source Category | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 |
|--------------------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| Fuel Combustion | 1,570 | 1,396 | 1,282 | 1,361 | 1,371 | 919 | 977 | 1,022 | 899 | 886 |
| Electric utilities | 32 | 34 | 34 | 37 | 37 | 36 | 36 | 35 | 36 | 36 |
| Steam generated | NA | NA | NA | NA | NA | NA | 35 | 34 | 35 | 35 |
| Other (ic and gt) | NA | NA | NA | NA | NA | NA | 1 | 1 | 1 | 1 |
| Industrial | 134 | 133 | 131 | 136 | 134 | 135 | 135 | 135 | 134 | 135 |
| Other fuel combustion | 1,403 | 1,230 | 1,117 | 1,188 | 1,200 | 749 | 807 | 853 | 729 | 715 |
| Residential wood | 1,373 | 1,199 | 1,085 | 1,155 | 1,169 | 718 | 776 | 822 | 698 | 684 |
| Other | 31 | 31 | 32 | 33 | 31 | 31 | 30 | 31 | 30 | 30 |
| Industrial Processes & Related | 12,282 | 12,138 | 12,329 | 12,737 | 12,629 | 12,638 | 12,537 | 12,702 | 12,851 | 13,054 |
| Chemical & allied product mfg | 1,358 | 1,412 | 1,410 | 1,513 | 1,506 | 1,526 | 1,533 | 1,546 | 1,557 | 1,577 |
| Metals processing | 76 | 73 | 70 | 74 | 74 | 72 | 69 | 72 | 74 | 77 |
| Petroleum & related industries | 703 | 666 | 655 | 645 | 639 | 643 | 634 | 638 | 631 | 630 |
| Other industrial processes | 390 | 395 | 394 | 408 | 403 | 401 | 398 | 403 | 406 | 411 |
| Solvent utilization | 5,699 | 5,626 | 5,743 | 5,945 | 5,964 | 5,975 | 5,918 | 6,031 | 6,156 | 6,313 |
| Storage & transport | 1,747 | 1,673 | 1,801 | 1,842 | 1,753 | 1,759 | 1,720 | 1,745 | 1,757 | 1,773 |
| Waste disposal & recycling | 2,310 | 2,293 | 2,256 | 2,310 | 2,290 | 2,262 | 2,265 | 2,268 | 2,271 | 2,273 |
| Transportation | 11,384 | 10,912 | 10,515 | 10,396 | 9,295 | 8,974 | 8,621 | 8,231 | 8,309 | 8,549 |
| Highway vehicles | 9,376 | 8,874 | 8,477 | 8,290 | 7,192 | 6,854 | 6,499 | 6,072 | 6,103 | 6,295 |
| Off-highway | 2,008 | 2,039 | 2,038 | 2,106 | 2,103 | 2,120 | 2,122 | 2,159 | 2,206 | 2,255 |
| Natural Sources | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Miscellaneous | 562 | 544 | 652 | 1,227 | 639 | 1,069 | 741 | 466 | 516 | 685 |
| Wildfires | 283 | 259 | 361 | 918 | 335 | 768 | 440 | 164 | 212 | 379 |
| Prescribed burning | 179 | 179 | 179 | 179 | 179 | 179 | 179 | 179 | 179 | 179 |
| Other | 100 | 106 | 112 | 130 | 124 | 122 | 121 | 123 | 125 | 127 |
| Total | 26,799 | 24,991 | 24,777 | 25,720 | 23,934 | 23,600 | 22,876 | 22,422 | 22,675 | 23,174 |

NA = Not Available

Table A-6. National Particulate Matter (PM-10) Emission Estimates, 1985-1994 (thousand short tons)

| Source Category | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 |
|--------------------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Fuel Combustion | 1,538 | 1,419 | 1,333 | 1,383 | 1,383 | 1,075 | 1,076 | 1,109 | 1,041 | 1,033 |
| Electric utilities | 284 | 288 | 284 | 279 | 273 | 282 | 248 | 247 | 268 | 266 |
| Steam generated fossil-fuel | 280 | 284 | 280 | 275 | 269 | 278 | 244 | 243 | 264 | 262 |
| Other [ic and gl] | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| Industrial | 245 | 243 | 238 | 242 | 241 | 240 | 234 | 236 | 234 | 237 |
| Other | 1,009 | 888 | 811 | 862 | 869 | 553 | 593 | 626 | 539 | 529 |
| Residential wood | 959 | 837 | 758 | 807 | 817 | 501 | 542 | 574 | 488 | 478 |
| Other | 50 | 51 | 53 | 55 | 52 | 51 | 51 | 51 | 51 | 51 |
| Industrial Processes & Related | 952 | 945 | 921 | 929 | 913 | 900 | 881 | 894 | 910 | 932 |
| Chemical & allied product mfg | 57 | 58 | 57 | 61 | 62 | 62 | 62 | 63 | 63 | 64 |
| Metals processing | 142 | 132 | 126 | 136 | 137 | 136 | 130 | 133 | 136 | 141 |
| Petroleum & related industries | 32 | 31 | 30 | 29 | 28 | 28 | 27 | 27 | 27 | 26 |
| Other industrial processes | 382 | 390 | 384 | 385 | 377 | 374 | 362 | 368 | 377 | 390 |
| Solvent utilization | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Storage & transport | 59 | 58 | 56 | 56 | 56 | 57 | 55 | 56 | 57 | 59 |
| Waste disposal & recycling | 278 | 274 | 265 | 259 | 251 | 242 | 244 | 246 | 248 | 250 |
| Transportation | 731 | 729 | 710 | 756 | 739 | 729 | 717 | 722 | 716 | 722 |
| Highway vehicles | 363 | 356 | 360 | 369 | 367 | 357 | 349 | 343 | 321 | 311 |
| Off-highway | 368 | 372 | 350 | 387 | 372 | 372 | 367 | 379 | 395 | 411 |
| Total | 3,220 | 3,092 | 2,964 | 3,067 | 3,036 | 2,704 | 2,674 | 2,725 | 2,666 | 2,688 |

Table A-7. Miscellaneous & Natural Source PM-10 Emission Estimates, 1985-1994 (thousand short tons)

| Source Category | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 |
|--------------------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| Miscellaneous | 37,909 | 37,166 | 37,518 | 39,616 | 37,504 | 37,232 | 36,188 | 36,371 | 38,636 | 40,766 |
| Fugitive dust | 36,742 | 36,065 | 36,203 | 37,539 | 36,199 | 35,655 | 34,870 | 35,207 | 37,480 | 39,325 |
| Unpaved roads | 11,830 | 11,773 | 11,184 | 12,563 | 11,849 | 12,311 | 11,911 | 11,527 | 13,215 | 13,497 |
| Paved roads | 5,071 | 5,257 | 5,526 | 5,893 | 5,767 | 5,967 | 5,967 | 5,942 | 6,077 | 6,343 |
| Construction | 12,670 | 11,825 | 12,121 | 11,662 | 11,269 | 10,044 | 9,672 | 10,543 | 10,993 | 12,397 |
| Mining & quarrying | 337 | 312 | 375 | 344 | 391 | 350 | 367 | 357 | 358 | 372 |
| Agricultural tilling | 6,833 | 6,899 | 6,996 | 7,077 | 6,923 | 6,983 | 6,952 | 6,838 | 6,837 | 6,716 |
| Other Combustion | 1,167 | 1,101 | 1,315 | 2,077 | 1,305 | 1,578 | 1,319 | 1,164 | 1,157 | 1,442 |
| Wildfires | 308 | 226 | 389 | 1,086 | 300 | 590 | 333 | 171 | 152 | 424 |
| Prescribed burning | 447 | 447 | 447 | 447 | 447 | 447 | 447 | 447 | 447 | 447 |
| Other | 412 | 427 | 479 | 544 | 558 | 541 | 538 | 546 | 557 | 571 |
| Natural Sources (Wind Erosion) | 4,047 | 10,324 | 1,577 | 18,110 | 12,101 | 4,362 | 10,095 | 4,626 | 1,978 | 2,593 |
| Total | 41,956 | 47,490 | 39,095 | 57,727 | 49,605 | 41,594 | 46,284 | 40,997 | 40,614 | 43,360 |

Table A-8. National Sulfur Oxides Emission Estimates, 1985-1994 (thousand short tons)

| Source Category | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 |
|-------------------------------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| Fuel Combustion | 20,021 | 19,428 | 19,445 | 19,761 | 19,927 | 19,598 | 19,295 | 19,019 | 18,732 | 18,497 |
| Electric utilities | 16,273 | 15,701 | 15,715 | 15,990 | 16,218 | 15,898 | 15,788 | 15,418 | 15,191 | 14,869 |
| Steam generated | NA | NA | NA | NA | NA | NA | 15,754 | 15,386 | 15,159 | 14,836 |
| Other (ic and gf) | NA | NA | NA | NA | NA | NA | 35 | 32 | 32 | 34 |
| Industrial | 3,169 | 3,116 | 3,068 | 3,111 | 3,086 | 3,106 | 2,915 | 3,002 | 2,942 | 3,029 |
| Other fuel combustion | 579 | 611 | 662 | 660 | 624 | 595 | 592 | 599 | 599 | 599 |
| Residential wood | 13 | 11 | 10 | 11 | 11 | 7 | 7 | 8 | 6 | 6 |
| Other | 566 | 600 | 652 | 650 | 613 | 588 | 585 | 592 | 593 | 592 |
| Industrial Processes & Related | 2,467 | 2,256 | 1,976 | 2,052 | 2,010 | 1,985 | 1,928 | 1,957 | 1,982 | 2,029 |
| Chemical & allied product mfg | 456 | 432 | 425 | 449 | 440 | 440 | 440 | 447 | 450 | 457 |
| Metals processing | 1,042 | 888 | 648 | 707 | 695 | 663 | 633 | 650 | 667 | 692 |
| Petroleum & related industries | 505 | 469 | 445 | 443 | 429 | 440 | 422 | 417 | 409 | 406 |
| Other industrial processes | 425 | 427 | 418 | 411 | 405 | 401 | 391 | 401 | 413 | 431 |
| Solvent utilization | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Storage & transport | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| Waste disposal & recycling | 34 | 35 | 35 | 36 | 36 | 36 | 36 | 37 | 37 | 37 |
| Transportation | 730 | 748 | 771 | 806 | 837 | 836 | 836 | 851 | 795 | 579 |
| Highway vehicles | 522 | 527 | 538 | 553 | 570 | 571 | 570 | 578 | 517 | 295 |
| Off-highway | 208 | 221 | 233 | 253 | 267 | 265 | 266 | 273 | 278 | 283 |
| Natural Sources | 0 |
| Miscellaneous | 11 | 9 | 13 | 27 | 10 | 14 | 10 | 9 | 8 | 14 |
| Widfires | 6 | 3 | 7 | 22 | 5 | 8 | 4 | 3 | 2 | 8 |
| Prescribed burning | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| Total | 23,230 | 22,442 | 22,204 | 22,647 | 22,785 | 22,433 | 22,068 | 21,836 | 21,517 | 21,118 |

NA = Not Available

Table A-9. Long-term Air Quality Trends: Plotting Points, 1975- 1994

| Year | CO 2nd Max. 8hr. PPM | NO2 Arith. Mean PPM | OZONE 2nd Max. 1hr. PPM | PB Max. Qtr UG/M3 | PM-10 Wtd. Arith. Mean UG/M3 | SO2 Arith. Mean PPM |
|---------|----------------------------|---------------------------|-------------------------------|-------------------------|------------------------------------|---------------------------|
| 1975-84 | (141 sites) | (40 sites) | (149 sites) | (43 sites) | TSP(1610 sites) | (149 sites) |
| 1975 | 12.4 | 0.0300 | 0.152 | 1.730 | 72.3 | 0.0145 |
| 1976 | 11.7 | 0.0290 | 0.151 | 1.740 | 73.7 | 0.0148 |
| 1977 | 11.1 | 0.0290 | 0.150 | 1.850 | 73.1 | 0.0130 |
| 1978 | 10.4 | 0.0300 | 0.154 | 1.670 | 71.8 | 0.0123 |
| 1979 | 10.1 | 0.0290 | 0.135 | 1.360 | 71.8 | 0.0119 |
| 1980 | 9.3 | 0.0270 | 0.138 | 1.020 | 72.5 | 0.0109 |
| 1981 | 9.0 | 0.0260 | 0.126 | 0.830 | 66.7 | 0.0102 |
| 1982 | 8.1 | 0.0240 | 0.124 | 0.510 | 56.4 | 0.0094 |
| 1983 | 8.2 | 0.0240 | 0.138 | 0.390 | 56.7 | 0.0091 |
| 1984 | 8.1 | 0.0250 | 0.124 | 0.370 | 57.3 | 0.0092 |
| 1985-94 | (328 sites) | (205 sites) | (549 sites) | (197 sites) | PM-10(748 sites) | (475 sites) |
| 1985 | 6.9 | 0.0217 | 0.124 | 0.290 | | 0.0092 |
| 1986 | 7.1 | 0.0218 | 0.120 | 0.180 | | 0.0090 |
| 1987 | 6.7 | 0.0217 | 0.126 | 0.160 | | 0.0088 |
| 1988 | 6.4 | 0.0220 | 0.136 | 0.110 | 33.4 | 0.0089 |
| 1989 | 6.3 | 0.0216 | 0.117 | 0.082 | 33.2 | 0.0086 |
| 1990 | 5.8 | 0.0204 | 0.114 | 0.081 | 29.9 | 0.0080 |
| 1991 | 5.5 | 0.0203 | 0.116 | 0.059 | 29.8 | 0.0078 |
| 1992 | 5.2 | 0.0197 | 0.107 | 0.051 | 27.3 | 0.0073 |
| 1993 | 4.9 | 0.0192 | 0.110 | 0.046 | 26.5 | 0.0072 |
| 1994 | 5.0 | 0.0200 | 0.109 | 0.044 | 26.6 | 0.0069 |

Table A-10. Air Quality Trend Statistics By Monitoring Location

| STATISTIC | UNITS | # of | | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 |
|-------------------------|-------|-------|----------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| | | SITES | LOCATION | | | | | | | | | | |
| CARBON MONOXIDE | | | | | | | | | | | | | |
| 2nd Max. 8hr. | PPM | 6 | RURAL | 4.6 | 5.2 | 4.7 | 3.9 | 3.6 | 3.2 | 3.0 | 3.2 | 2.7 | 3.0 |
| " | " | 137 | SUBURBAN | 6.4 | 6.4 | 6.3 | 5.9 | 5.9 | 5.4 | 5.1 | 4.8 | 4.7 | 4.8 |
| " | " | 183 | URBAN | 7.5 | 7.7 | 7.1 | 6.9 | 6.8 | 6.3 | 6.0 | 5.5 | 5.1 | 5.3 |
| LEAD | | | | | | | | | | | | | |
| Max. Qtr | UG/M3 | 5 | RURAL | 0.14 | 0.07 | 0.04 | 0.03 | 0.04 | 0.03 | 0.02 | 0.02 | 0.02 | 0.01 |
| " | " | 96 | SUBURBAN | 0.26 | 0.16 | 0.13 | 0.09 | 0.08 | 0.07 | 0.05 | 0.04 | 0.04 | 0.04 |
| " | " | 94 | URBAN | 0.33 | 0.21 | 0.2 | 0.13 | 0.09 | 0.1 | 0.07 | 0.06 | 0.05 | 0.05 |
| NITROGEN DIOXIDE | | | | | | | | | | | | | |
| Arith. Mean | PPM | 36 | RURAL | 0.008 | 0.008 | 0.008 | 0.008 | 0.008 | 0.008 | 0.008 | 0.008 | 0.007 | 0.008 |
| " | " | 94 | SUBURBAN | 0.023 | 0.023 | 0.023 | 0.023 | 0.023 | 0.022 | 0.022 | 0.021 | 0.020 | 0.021 |
| " | " | 71 | URBAN | 0.028 | 0.028 | 0.027 | 0.027 | 0.027 | 0.025 | 0.025 | 0.025 | 0.024 | 0.025 |
| OZONE | | | | | | | | | | | | | |
| 2nd Max. 1hr. | PPM | 155 | RURAL | 0.114 | 0.112 | 0.115 | 0.127 | 0.111 | 0.110 | 0.108 | 0.102 | 0.106 | 0.104 |
| " | " | 259 | SUBURBAN | 0.129 | 0.125 | 0.132 | 0.143 | 0.122 | 0.119 | 0.121 | 0.112 | 0.114 | 0.113 |
| " | " | 117 | URBAN | 0.123 | 0.119 | 0.125 | 0.133 | 0.114 | 0.109 | 0.112 | 0.103 | 0.104 | 0.106 |
| PM10 | | | | | | | | | | | | | |
| Wtd. Arith. Mean | UG/M3 | 83 | RURAL | | | | 27.8 | 28.35 | 25.88 | 25.3 | 23.26 | 21.92 | 21.6 |
| " | " | 296 | SUBURBAN | | | | 33.87 | 33.34 | 30.13 | 29.92 | 27.63 | 26.88 | 26.93 |
| " | " | 352 | URBAN | | | | 34.31 | 34.11 | 30.85 | 30.86 | 28.21 | 27.48 | 27.71 |
| SULFUR DIOXIDE | | | | | | | | | | | | | |
| Arith. Mean | PPM | 127 | RURAL | 0.0073 | 0.0073 | 0.0073 | 0.0074 | 0.0072 | 0.0068 | 0.0068 | 0.0065 | 0.0066 | 0.0063 |
| " | " | 190 | SUBURBAN | 0.0097 | 0.0094 | 0.0090 | 0.0092 | 0.0088 | 0.0082 | 0.0080 | 0.0074 | 0.0072 | 0.0070 |
| " | " | 146 | URBAN | 0.0105 | 0.0103 | 0.0099 | 0.0101 | 0.0100 | 0.0091 | 0.0088 | 0.0080 | 0.0077 | 0.0076 |

TABLE A-11. SIMPLIFIED NONATTAINMENT AREAS LIST(a)

| STATE | AREA NAME(b) | POLLUTANT(c) | | | | | | POPULATION(d) (1000s) |
|-------|--------------|-----------------------------------|----|-------|-------|----|-------|--------------------------|
| | | O3 | CO | SO2 | PM10 | Pb | NO2 | |
| 1 | AK | Anchorage | | 1 | | 1 | | 130 |
| 2 | AK | Fairbanks | | 1 | | | | 41 |
| 3 | AK | Juneau | | | | 1 | | 12 |
| 4 | AL | Birmingham | 1 | | | | | 751 |
| 5 | AZ | Ajo | | | 1 | 1 | | 6 |
| 6 | AZ | Bullhead City | | | | 1 | | 5 |
| 7 | AZ | Douglas | | | 1 | 1 | | 13 |
| 8 | AZ | Miami-Hayden | | | 2 | 1 | | 3 |
| 9 | AZ | Morenci | | | 1 | | | 8 |
| 10 | AZ | Nogales | | | | 1 | | 19 |
| 11 | AZ | Paul Spur | | | | 1 | | 1 |
| 12 | AZ | Payson | | | | 1 | | 5 |
| 13 | AZ | Phoenix | 1 | 1 | | 1 | | 2092 |
| 14 | AZ | Rillito | | | | 1 | | 1 |
| 15 | AZ | San Manuel | | | 1 | | | 5 |
| 16 | AZ | Yuma | | | | 1 | | 55 |
| 17 | CA | Chico | | 1 | | | | 72 |
| 18 | CA | Coachella Valley | | | | 1 | | 183 |
| 19 | CA | Imperial Valley | | | | 1 | | 92 |
| 20 | CA | Lake Tahoe South Shore | | 1 | | | | 30 |
| 21 | CA | Los Angeles-South Coast Air Basin | 1 | 1 | | 2 | 1 | 13513 |
| 22 | CA | Mammoth Lakes (in Mono Co.) | | | | 1 | | 10 (Pop Mono Co.) |
| 23 | CA | Mono Basin (in Mono Co.) | | | | 1 | | (See Mono Co. above) |
| 24 | CA | Monterey Bay | 1 | | | | | 622 |
| 25 | CA | Owens Valley | | | | 1 | | 18 |
| 26 | CA | Sacramento Metro | 1 | 1 | | 1 | | 1639 |
| 27 | CA | San Diego | 1 | 1 | | | | 2498 |
| 28 | CA | San Francisco-Oakland-San Jose | | 1 (e) | | | | 3830 |
| 29 | CA | San Joaquin Valley | 1 | 3 | | 1 | | 2742 |
| 30 | CA | Santa Barbara-Santa Maria-Lompoc | 1 | | | | | 370 |
| 31 | CA | Searles Valley | | | | 1 | | 31 |
| 32 | CA | Southeast Desert Modified AQMA | 1 | | | | | 384 |
| 33 | CA | Ventura Co. | 1 | | | | | 669 |
| 34 | CO | Aspen | | | | 1 | | 5 |
| 35 | CO | Canon City | | | | 1 | | 13 |
| 36 | CO | Colorado Springs | | 1 | | | | 353 |
| 37 | CO | Denver-Boulder | | 1 | | 1 | | 1836 |
| 38 | CO | Fort Collins | | 1 | | | | 106 |
| 39 | CO | Lamar | | | | 1 | | 8 |
| 40 | CO | Longmont | | 1 | | | | 52 |
| 41 | CO | Pagosa Springs | | | | 1 | | 1 |
| 42 | CO | Steamboat Springs | | | | 1 | | 7 |
| 43 | CO | Telluride | | | | 1 | | 1 |
| 44 | CT | Greater Connecticut | 1 | 1 | | 1 | | 2470 |
| 45 | DC-MD-VA | Washington | 1 | 1 | | | | 3924 |
| 46 | DE | Sussex Co. | 1 | | | | | 113 |
| 47 | FL | Tampa-St. Petersburg-Clearwater | 1 | | | | | 1686 |
| 48 | GA | Atlanta | 1 | | | | | 2653 |
| 49 | GA | Muscogee Co. | | | | | 1 | 179 |
| 50 | GU | Piti Power Plant | | | 1 | | | 145 |
| 51 | GU | Tanguisson Power Plant | | | 1 | | | (See Guam above) |
| 52 | IA | Muscatine Co. | | | 1 | | | 40 |
| 53 | ID | Boise | | | | 1 | | 205 |
| 54 | ID | Bonner Co.(Sandpoint) | | | | 1 | | 27 |
| 55 | ID | Pinehurst | | | | 1 | | 2 |
| 56 | ID | Pocatello | | | | 1 | | 61 |
| 57 | ID | Shoshone | | | | 1 | | 1 |
| 58 | IL | Oglesby | | | | 1 | | 4 |
| 59 | IL-IN | Chicago-Gary-Lake County | 1 | | 1 | 3 | | 7886 |
| 60 | IN | Evansville | 1 | | | | | 165 |
| 61 | IN | Marion Co. | | | 1 | | 1 (f) | 80 |
| 62 | IN | Laporte Co. | | | 1 | | | 107 |
| 63 | IN | Vermilion Co. | | | | 1 | | 17 |
| 64 | IN | Vigo Co. | | | 1 | | | 106 |
| 65 | IN | Wayne Co. | | | 1 | | | 72 |
| 66 | KY | Boyd Co. | | | 1 (g) | | | 51 |
| 67 | KY | Lexington-Fayette | 1 | | | | | 249 |
| 68 | KY | Muhlenberg Co. | | | 1 | | | 31 |
| 69 | KY-IN | Louisville | 1 | | | | | 834 |
| 70 | LA | Baton Rouge | 1 | | | | | 582 |

TABLE A-11.

SIMPLIFIED NONATTAINMENT AREAS LIST(a) (cont.)

| STATE | AREA NAME(b) | POLLUTANT(c) | | | | | | POPULATION(d) (1000s) |
|-------|--------------|------------------------------------|-------|-----|------|-------|-------|--------------------------|
| | | O3 | CO | SO2 | PM10 | Pb | NO2 | |
| 71 | LA | Lake Charles | 1 | . | . | . | . | 168 |
| 72 | MA | Springfield (W. Mass) | 1 | . | . | . | . | 812 |
| 73 | MA-NH | Boston-Lawrence-Worcester | 1 | 1 | . | . | . | 5500 |
| 74 | MD | Baltimore | 1 | 1 | . | . | . | 2348 |
| 75 | MD | Kent and Queen Anne Cos. | 1 | . | . | . | . | 52 |
| 76 | ME | Hancock and Waldo Cos. | 1 | . | . | . | . | 80 |
| 77 | ME | Knox and Lincoln Cos. | 1 | . | . | . | . | 67 |
| 78 | ME | Lewiston-Auburn | 1 | . | . | . | . | 221 |
| 79 | ME | Millinocket | . | . | 1 | . | . | 8 |
| 80 | ME | Portland | 1 | . | . | . | . | 441 |
| 81 | ME | Presque Isle | . | . | . | 1 | . | 11 |
| 82 | MI | Detroit | . | . | . | 1 | . | 1028 |
| 83 | MI | Grands Rapids | 1 | . | . | . | . | 688 |
| 84 | MI | Muskegon | 1 | . | . | . | . | 159 |
| 85 | MN | Minneapolis-St. Paul | . | 1 | . | 1 | . | 2310 |
| 86 | MN | Olmsted Co. | . | . | 1 | . | . | 71 |
| 87 | MO | Dent | . | . | . | . | 1 | 1 |
| 88 | MO | Liberty-Arcadia | . | . | . | . | 1 | 6 |
| 89 | MO-L | St. Louis | 1 | . | . | 1 (h) | 1 (i) | 2390 |
| 90 | MT | Butte | . | . | . | 1 | . | 34 |
| 91 | MT | Columbia Falls | . | . | . | 1 | . | 3 |
| 92 | MT | Kalispell | . | . | . | 1 | . | 12 |
| 93 | MT | Lame Deer | . | . | . | 1 | . | 1 |
| 94 | MT | Lewis & Clark | . | . | 1 | . | 1 (j) | 2 |
| 95 | MT | Libby | . | . | . | 1 | . | 3 |
| 96 | MT | Missoula | . | 1 | . | 1 | . | 43 |
| 97 | MT | Polson | . | . | . | 1 | . | 3 |
| 98 | MT | Ronan | . | . | . | 1 | . | 2 |
| 99 | MT | Thompson Falls | . | . | . | 1 | . | 1 |
| 100 | MT | Whitefish | . | . | . | 1 | . | 4 |
| 101 | MT | Yellowstone | . | . | 1 | . | . | 5 |
| 102 | NE | Douglas | . | . | . | . | 1 | <1 |
| 103 | NH | Manchester | 1 | . | . | . | . | 222 |
| 104 | NH | Portsmouth-Dover-Rochester | 1 | . | . | . | . | 183 |
| 105 | NJ | Atlantic City | 1 | . | . | . | . | 319 |
| 106 | NM | Albuquerque | . | 1 | . | . | . | 481 |
| 107 | NM | Anthony | . | . | . | 1 | . | 2 |
| 108 | NM | Grant Co. | . | . | 1 | . | . | 28 |
| 109 | NM | Sunland Park | 1 (k) | . | . | . | . | 8 |
| 110 | NV | Central Steptoe Valley | . | . | 1 | . | . | 9 |
| 111 | NV | Las Vegas | . | 1 | . | 1 | . | 741 |
| 112 | NV | Reno | 1 | 1 | . | 1 | . | 255 |
| 113 | NY | Albany-Schenectady-Troy | 1 | . | . | . | . | 874 |
| 114 | NY | Buffalo-Niagara Falls | 1 | . | . | . | . | 1189 |
| 115 | NY | Essex Co. (White Mtn.) | 1 | . | . | . | . | <1 |
| 116 | NY | Jefferson Co. | 1 | . | . | . | . | 111 |
| 117 | NY | Poughkeepsie | 1 | . | . | . | . | 552 |
| 118 | NY-NJ-CT | New York-N. New Jersey-Long Island | 1 | 1 | . | 1 | . | 17654 |
| 119 | OH | Canton | 1 | . | . | . | . | 368 |
| 120 | OH | Cleveland-Akron-Lorain | 1 | . | 2 | 1 | . | 2859 |
| 121 | OH | Columbus | 1 | . | . | . | . | 1157 |
| 122 | OH | Coshocton Co. | . | . | 1 | . | . | 35 |
| 123 | OH | Gallia Co. | . | . | 1 | . | . | 31 |
| 124 | OH | Jefferson Co. | . | . | 1 | 1 | . | 80 |
| 125 | OH | Lake Co. | . | . | 1 | . | . | 215 |
| 126 | OH | Lucas Co. | . | . | 1 | . | . | 462 |
| 127 | OH-KY | Cincinnati-Hamilton | 1 | . | . | . | . | 1705 |
| 128 | OH-PA | Youngstown-Warren-Sharon | 1 | . | . | . | . | 614 |
| 129 | OR | Grants Pass | . | 1 | . | 1 | . | 25 |
| 130 | OR | Klamath Falls | . | 1 | . | 1 | . | 37 |
| 131 | OR | Lakeview | . | . | . | 1 | . | 4 |
| 132 | OR | LaGrande | . | . | . | 1 | . | 12 |
| 133 | OR | Medford | . | 1 | . | 1 | . | 116 |
| 134 | OR | Oakridge | . | . | . | 1 | . | 3 |
| 135 | OR | Springfield-Eugene | . | . | . | 1 | . | 190 |
| 136 | OR-WA | Portland-Vancouver AQMA | 1 | 1 | . | . | . | 1107 |
| 137 | PA | Altoona | 1 | . | . | . | . | 131 |
| 138 | PA | Cortewango Twp. (in Warren Co, PA) | . | . | 1 | . | . | 45 (Pop Warren Co, PA) |
| 139 | PA | Erie | 1 | . | . | . | . | 276 |
| 140 | PA | Harrisburg-Lebanon-Cartisle | 1 | . | . | . | . | 588 |

TABLE A-11. SIMPLIFIED NONATTAINMENT AREAS LIST(a) (cont.)

| STATE | AREA NAME(b) | POLLUTANT(c) | | | | | | POPULATION(d) (1000s) |
|-------|--------------|------------------------------------|----|-----|------|----|-------|---------------------------|
| | | O3 | CO | SO2 | PM10 | Pb | NO2 | |
| 141 | PA | Johnstown | 1 | . | . | . | . | 241 |
| 142 | PA | Lancaster | 1 | . | . | . | . | 423 |
| 143 | PA | Pittsburgh-Beaver Valley | 1 | . | 2 | 1 | . | 2468 |
| 144 | PA | Reading | 1 | . | . | . | . | 337 |
| 145 | PA | Scranton-Wilkes-Barre | 1 | . | . | . | . | 734 |
| 146 | PA | Warren-Pleas.-Glade (in Warren Co) | . | . | 1 | . | . | (See Warren Co, PA above) |
| 147 | PA | York | 1 | . | . | . | . | 418 |
| 148 | PA-DE-NJ-MD | Philadelphia-Wilmington-Trenton | 1 | 1 | . | . | . | 6010 |
| 149 | PA-NJ | Allentown-Bethlehem-Easton | 1 | . | 1 | . | . | 687 |
| 150 | PR | Guaynabo Co. | . | . | . | 1 | . | 85 |
| 151 | RI | Providence (all of RI) | 1 | . | . | . | . | 1003 |
| 152 | TN | Benton Co. | . | . | 1 | . | . | 15 |
| 153 | TN | Fayette Co. | . | . | . | . | 1 | 26 |
| 154 | TN | Humphreys Co. | . | . | 1 | . | . | 16 |
| 155 | TN | Shelby Co. | . | . | . | . | 1 (l) | 826 |
| 156 | TN | Nashville | 1 | . | . | . | 1 (m) | 881 |
| 157 | TN | Polk Co. | . | . | 1 | . | . | 14 |
| 158 | TX | Beaumont-Port Arthur | 1 | . | . | . | . | 361 |
| 159 | TX | Dallas-Fort Worth | 1 | . | . | . | 1 (n) | 3561 |
| 160 | TX | El Paso | 1 | 1 | . | 1 | . | 592 |
| 161 | TX | Houston-Galveston-Brazoria | 1 | . | . | . | . | 3731 |
| 162 | UT | Ogden | . | 1 | . | . | . | 63 |
| 163 | UT | Salt Lake City | 1 | . | 1 | 1 | . | 914 |
| 164 | UT | Tooele Co. | . | . | 1 | . | . | 27 |
| 165 | UT | Utah Co. | . | 1 | . | 1 | . | 264 |
| 166 | VA | Norfolk-Virg. Beach-Newport News | 1 | . | . | . | . | 1366 |
| 167 | VA | Richmond | 1 | . | . | . | . | 738 |
| 168 | VA | Smyth Co. (White Top Mtn.) | 1 | . | . | . | . | <1 |
| 169 | WA | Olympia-Tumwater-Lacey | . | . | . | 1 | . | 64 |
| 170 | WA | Seattle-Tacoma | 1 | 1 | . | 3 | . | 2559 |
| 171 | WA | Spokane | . | 1 | . | 1 | . | 279 |
| 172 | WA | Walla Walla | . | . | . | 1 | . | 2 |
| 173 | WA | Yakima | . | . | . | 1 | . | 93 |
| 174 | WI | Door Co. | 1 | . | . | . | . | 26 |
| 175 | WI | Kewaunee Co. | 1 | . | . | . | . | 19 |
| 176 | WI | Manitowish Co. | 1 | . | . | . | . | 80 |
| 177 | WI | Marathon Co. | . | . | 1 | . | . | 115 |
| 178 | WI | Milwaukee-Racine | 1 | . | . | . | . | 1735 |
| 179 | WI | Oneida Co. | . | . | 1 | . | . | 32 |
| 180 | WI | Sheboygan | 1 | . | . | . | . | 104 |
| 181 | WI | Walworth Co. | 1 | . | . | . | . | 75 |
| 182 | WV | Follansbee | . | . | . | 1 | . | 3 |
| 183 | WV | New Manchester Gr. (in Hancock Co) | . | . | 1 | . | . | 35 (Pop Hancock Co.) |
| 184 | WV | Wier.-Butler-Clay (in Hancock Co) | . | . | 1 | 1 | . | (See Hancock Co. above) |
| 185 | WY | Sheridan | . | . | . | 1 | . | 14 |
| | | | 77 | 36 | 43 | 82 | 11 | 133,920 |

Notes:

- (a) This is a simplified listing of Classified Nonattainment areas. Unclassified and transitional nonattainment areas are not included. In certain cases, footnotes are used to clarify the areas involved. For example, the lead nonattainment area listed within the Dallas-Fort Worth ozone nonattainment area is in Frisco, Texas, which is not in Dallas county, but is within the designated boundaries of the ozone nonattainment area. Readers interested in more detailed information should use the official Federal Register citation (40 CFR 81).
- (b) Names of nonattainment areas are listed alphabetically within each state. The largest city determines which state is listed first in the case of multiple-city nonattainment areas. When a larger nonattainment area, such as ozone, contains 1 or more smaller nonattainment areas, such as PM-10 or lead, the common name for the larger nonattainment area is used.
- (c) The number of nonattainment areas for each of the criteria pollutants is listed.

(d) Population figures were obtained from 1990 census data. For nonattainment areas defined as only partial counties, population figures for just the nonattainment area were used when these were available. Otherwise, whole county population figures were used. When a larger nonattainment area encompasses a smaller one, double-counting the population is avoided by only counting the population of the larger nonattainment area. Note that several smaller nonattainment areas may be inside one larger nonattainment area, as is the case in Figure 1, which is considered one nonattainment area. Caution must be used in these cases, as population figures will not be representative of small nonattainment areas for one pollutant inside larger nonattainment areas for another pollutant. Occasionally, two nonattainment areas may only partially overlap, as in Figure 2. For the purpose of this table, these are considered two distinct nonattainment areas.

(e) Carbon monoxide nonattainment area includes San Francisco county, and parts of Alameda, Contra Costa, Marin, Napa, San Mateo, Santa Clara, Solano, Sonoma counties.

(f) Lead nonattainment area is a portion of Franklin township, Marion county, Indiana.

(g) Sulfur dioxide nonattainment area is a portion of Boyd county.

(h) PM-10 nonattainment area is Granite City, Illinois, in Madison county.

(i) Lead nonattainment area is Herculaneum, Missouri in Jefferson county.

(j) Lead nonattainment area is a portion of Lewis and Clark county, Montana.

(k) Ozone nonattainment area is a portion of Dona Ana county, New Mexico.

(l) Lead nonattainment area is a portion of Shelby county, Tennessee.

(m) Lead nonattainment area is a portion of Williamson county, Tennessee.

(n) Lead nonattainment area is Frisco, Texas, in Collin county.

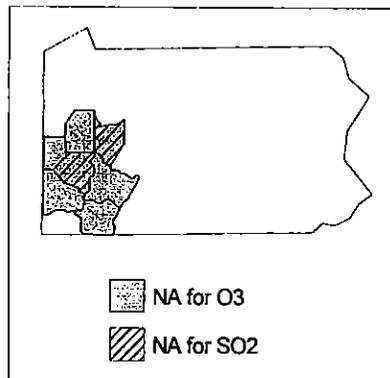


Figure 1: (Multiple NA areas within a larger NA area) 2 SO₂ NA areas inside the Pittsburgh-Beaver Valley ozone NA. Counted as 1 NA area.

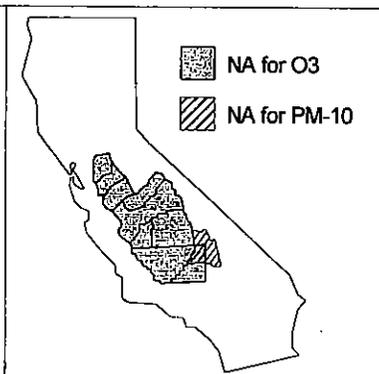


Figure 2: (Overlapping NA areas) Searles Valley PM-10 NA partially overlaps the San Joaquin Valley ozone NA. Counted as 2 NA areas.

Table A-12. 1994 Metropolitan Statistical Area Air Quality Factbook Peak Statistics for Criteria Pollutants

| METROPOLITAN STATISTICAL AREA | 1990 POPULATION | CO | PB | NO2 | OZONE | PM10 | PM10 | SO2 | SO2 |
|--------------------------------------|--------------------|---------------|---------------|-------------|------------------|-----------------|------------------|-------------|----------------|
| | | 8-HR (PPM) | QMAX (UGM) | AM (PPM) | 2ND MAX (PPM) | WTD AM (UGM) | 2ND MAX (UGM) | AM (PPM) | 24-HR (PPM) |
| ABILENE, TX | 119,655 | ND | ND | ND | ND | ND | ND | ND | ND |
| AGUADILLA, PR | 156,000 | ND | ND | ND | ND | ND | ND | ND | ND |
| AKRON, OH | 436,905 | 7 | 0.06 | ND | 0.10 | 28 | 80 | 0.012 | 0.042 |
| ALBANY-SCHENECTADY-TROY, NY | 874,304 | 5 | 0.04 | IN | 0.12 | 25 | 67 | 0.007 | 0.037 |
| ALBANY, GA | 112,561 | ND | ND | ND | ND | ND | ND | ND | ND |
| ALBUQUERQUE, NM | 480,577 | 8 | ND | 0.023 | 0.10 | 37 | 84 | ND | ND |
| ALEXANDRIA, LA | 131,556 | ND | ND | ND | ND | 23 | 49 | ND | ND |
| ALLENTOWN-BETHLEHEM-EASTON, PA | 686,688 | 8 | 0.13 | 0.023 | 0.12 | IN | 70 | 0.010 | 0.053 |
| ALTOONA, PA | 130,542 | 2 | ND | 0.015 | 0.11 | 26 | 74 | 0.010 | 0.058 |
| AMARILLO, TX | 187,547 | ND | ND | ND | ND | 18 | 32 | ND | ND |
| ANCHORAGE, AK | 226,338 | 11 | ND | ND | ND | IN | 145 | ND | ND |
| ANN ARBOR, MI | 282,937 | ND | ND | ND | 0.09 | IN | 42 | ND | ND |
| ANNISTON, AL | 116,034 | ND | ND | ND | ND | IN | 44 | ND | ND |
| APPLETON-OSHKOSH-NEENAH, WI | 315,121 | 2 | ND | ND | 0.08 | ND | ND | ND | ND |
| ARECIBO, PR | 140,608 | ND | ND | ND | ND | ND | ND | ND | ND |
| ASHEVILLE, NC | 174,821 | ND | ND | ND | 0.08 | 25 | 58 | ND | ND |
| ATHENS, GA | 156,267 | ND | ND | ND | ND | ND | ND | ND | ND |
| ATLANTA, GA | 2,833,511 | 5 | 0.03 | 0.023 | 0.13 | 32 | 71 | 0.005 | 0.029 |
| ATLANTIC-CAPE MAY, NJ | 319,416 | 5 | 0.04 | ND | 0.10 | 33 | 56 | 0.003 | 0.019 |
| AUGUSTA-AIKEN, GA-SC | 396,809 | ND | 0.01 | ND | 0.10 | 21 | 45 | 0.003 | 0.014 |
| AURORA-ELGIN, IL | 356,884 | ND | ND | ND | ND | ND | ND | ND | ND |
| AUSTIN-SAN MARCOS, TX | 781,572 | 6 | ND | 0.018 | 0.10 | 20 | 47 | ND | ND |
| BAKERSFIELD, CA | 543,477 | 6 | ND | 0.020 | 0.17 | 40 | 184 | 0.003 | 0.007 |
| BALTIMORE, MD | 2,382,172 | 7 | 0.04 | 0.032 | 0.15 | 33 | 75 | 0.009 | 0.031 |
| BANGOR, ME | 88,745 | ND | ND | ND | 0.08 | 22 | 59 | ND | ND |
| BARNSTABLE-YARMOUTH, MA | 94,132 | ND | ND | ND | ND | ND | ND | ND | ND |
| BATON ROUGE, LA | 628,264 | 5 | 0.10 | 0.018 | 0.14 | 27 | 55 | 0.008 | 0.025 |
| BEAUMONT-PORT ARTHUR, TX | 361,226 | 2 | 0.04 | 0.012 | 0.12 | IN | 45 | 0.007 | 0.050 |
| BELLINGHAM, WA | 127,780 | ND | ND | ND | 0.08 | IN | 51 | 0.007 | 0.019 |
| BENTON HARBOR, MI | 161,378 | ND | ND | ND | 0.12 | ND | ND | ND | ND |
| BERGEN-PASSAIC, NJ | 1,278,440 | 7 | 0.08 | 0.031 | 0.11 | 41 | 101 | 0.008 | 0.045 |
| BILLINGS, MT | 113,419 | 6 | ND | ND | ND | IN | 62 | 0.019 | 0.095 |
| BILOXI-GULFPORT-PASCAGOULA, MS | 197,125 | ND | ND | ND | 0.12 | 21 | 40 | 0.003 | 0.021 |
| BINGHAMTON, NY | 264,497 | ND | ND | ND | ND | IN | 44 | ND | ND |
| BIRMINGHAM, AL | 907,810 | 7 | 0.11 (a) | 0.013 | 0.11 | 34 | 104 | 0.007 | 0.037 |
| BISMARCK, ND | 83,831 | ND | ND | ND | ND | 18 | 40 | ND | ND |
| BLOOMINGTON-NORMAL, IL | 129,180 | ND | ND | ND | ND | ND | ND | ND | ND |
| BLOOMINGTON, IN | 108,978 | ND | ND | ND | ND | ND | ND | ND | ND |
| BOISE CITY, ID | 205,775 | 5 | ND | ND | ND | 39 | 110 | ND | ND |
| BOSTON, MA-NH | 2,870,669 | 6 | 0.01 | 0.035 | 0.12 | 29 | 58 | 0.011 | 0.041 |
| BOULDER-LONGMONT, CO | 225,339 | 6 | ND | ND | 0.09 | 21 | 58 | ND | ND |
| BRAZORIA, TX | 391,707 | ND | ND | ND | 0.11 | ND | ND | ND | ND |
| BREMERTON, WA | 189,731 | ND | ND | ND | ND | 20 | 41 | ND | ND |
| BRIDGEPORT, CT | 443,722 | 6 | 0.02 | 0.026 | 0.17 | 30 | 62 | 0.010 | 0.052 |
| BROCKTON, MA | 189,478 | ND | ND | ND | 0.12 | ND | ND | ND | ND |
| BROWNSVILLE-HARLINGEN-SAN BENITO, TX | 260,120 | 4 | ND | ND | 0.09 | 26 | 53 | 0.001 | 0.004 |
| BRYAN-COLLEGE STATION, TX | 121,862 | ND | ND | ND | ND | ND | ND | ND | ND |
| BUFFALO-NIAGARA FALLS, NY | 1,189,288 | 4 | 0.05 | 0.021 | 0.10 | 21 | 48 | 0.012 | 0.056 |
| BURLINGTON, VT | 131,439 | 5 | ND | 0.017 | ND | 21 | 47 | 0.003 | 0.013 |
| CAGUAS, PR | 173,961 | ND | ND | ND | ND | ND | ND | ND | ND |

See definitions and footnotes at end of table

Table A-12. 1994 Metropolitan Statistical Area Air Quality Factbook Peak Statistics for Criteria Pollutants

| METROPOLITAN STATISTICAL AREA | 1990 POPULATION | CO | PB | NO ₂ | OZONE | PM ₁₀ | PM ₁₀ | SO ₂ | SO ₂ |
|-------------------------------------|--------------------|---------------|---------------|-----------------|------------------|------------------|------------------|-----------------|-----------------|
| | | 8-HR (PPM) | QMAX (UGM) | AM (PPM) | 2ND MAX (PPM) | WTD AM (UGM) | 2ND MAX (UGM) | AM (PPM) | 24-HR (PPM) |
| CANTON-MASSILLON, OH | 394,106 | 5 | ND | ND | 0.10 | 32 | 61 | 0.009 | 0.052 |
| CASPER, WY | 61,226 | ND | ND | ND | ND | IN | 46 | ND | ND |
| CEDAR RAPIDS, IA | 168,767 | 4 | ND | ND | 0.07 | 24 | 47 | 0.005 | 0.048 |
| CHAMPAIGN-URBANA, IL | 173,025 | ND | ND | ND | 0.09 | 25 | 50 | 0.004 | 0.024 |
| CHARLESTON-NORTH CHARLESTON, SC | 506,875 | 4 | 0.02 | 0.011 | 0.10 | 26 | 84 | 0.004 | 0.038 |
| CHARLESTON, WV | 250,454 | 4 | ND | IN | 0.10 | ND | ND | 0.011 | 0.038 |
| CHARLOTTE-GASTONIA-ROCK HILL, NC-SC | 1,162,093 | 6 | 0.03 | 0.016 | 0.12 | 30 | 56 | 0.004 | 0.017 |
| CHARLOTTESVILLE, VA | 131,107 | ND | ND | ND | ND | 22 | 40 | ND | ND |
| CHATTANOOGA, TN-GA | 433,210 | ND | ND | ND | 0.12 | 34 | 66 | ND | ND |
| CHEYENNE, WY | 73,142 | ND | ND | ND | ND | IN | 35 | ND | ND |
| CHICAGO, IL | 6,069,974 | 8 | 0.65 (b) | 0.034 | 0.12 | 44 | 140 | 0.009 | 0.060 |
| CHICO-PARADISE, CA | 182,120 | 5 | ND | 0.015 | 0.10 | 33 | 81 | ND | ND |
| CINCINNATI, OH-KY-IN | 1,452,645 | 5 | 0.04 | 0.027 | 0.13 | 32 | 90 | 0.010 | 0.052 |
| CLARKSVILLE-HOPKINSVILLE, TN-KY | 169,439 | ND | ND | IN | ND | 22 | 44 | 0.007 | 0.037 |
| CLEVELAND-LORAIN-ELYRIA, OH | 2,202,069 | 8 | 1.29 (c) | 0.028 | 0.13 | 60 | 143 | 0.014 | 0.081 |
| COLORADO SPRINGS, CO | 397,014 | 5 | 0.02 | ND | 0.07 | 29 | 90 | ND | ND |
| COLUMBIA, MO | 112,379 | ND | ND | ND | ND | ND | ND | ND | ND |
| COLUMBIA, SC | 453,331 | 5 | 0.02 | 0.011 | 0.10 | 42 | 116 | 0.003 | 0.015 |
| COLUMBUS, GA-AL | 243,072 | ND | 1.43 (d) | ND | 0.11 | 27 | 49 | ND | ND |
| COLUMBUS, OH | 1,377,419 | 5 | 0.11 | IN | 0.11 | 29 | 78 | 0.006 | 0.041 |
| CORPUS CHRISTI, TX | 349,894 | ND | ND | ND | 0.11 | 31 | 57 | 0.002 | 0.013 |
| CUMBERLAND, MD-WV | 101,643 | ND | ND | ND | ND | ND | ND | 0.010 | 0.037 |
| DALLAS, TX | 2,553,362 | 5 | 0.58 (e) | 0.016 | 0.14 | 29 | 59 | IN | 0.018 |
| DANBURY, CT | 187,867 | ND | ND | ND | 0.13 | IN | 48 | 0.006 | 0.037 |
| DANVILLE, VA | 108,711 | ND | ND | ND | ND | ND | ND | ND | ND |
| DAVENPORT-MOLINE-ROCK ISLAND, IA-IL | 350,861 | ND | 0.02 | ND | 0.09 | 60 | 147 | 0.004 | 0.034 |
| DAYTONA BEACH, FL | 370,712 | ND | ND | ND | 0.09 | 26 | 63 | ND | ND |
| DAYTON-SPRINGFIELD, OH | 951,270 | 4 | 0.04 | ND | 0.12 | 27 | 61 | 0.007 | 0.034 |
| DECATUR, AL | 131,556 | ND | ND | ND | 0.09 | IN | 45 | IN | 0.021 |
| DECATUR, IL | 117,206 | ND | 0.05 | ND | 0.10 | 29 | 66 | 0.007 | 0.030 |
| DENVER, CO | 1,622,980 | 8 | 0.07 | 0.035 | 0.11 | 36 | 107 | 0.007 | 0.034 |
| DES MOINES, IA | 392,928 | 5 | ND | ND | 0.07 | IN | 92 | ND | ND |
| DETROIT, MI | 4,382,299 | 10 | 0.07 | 0.025 | 0.14 | 49 | 129 | 0.010 | 0.045 |
| DOTHAN, AL | 130,964 | ND | ND | ND | ND | 28 | 63 | ND | ND |
| DOVER, DE | 110,993 | ND | ND | ND | 0.10 | ND | ND | ND | ND |
| DUBUQUE, IA | 86,403 | ND | ND | ND | ND | ND | ND | IN | 0.023 |
| DULUTH-SUPERIOR, MN-WI | 239,971 | 4 | ND | ND | ND | 21 | 46 | ND | ND |
| DUTCHESS COUNTY, NY | 640,220 | ND | ND | ND | 0.12 | ND | ND | ND | ND |
| EAU CLAIRE, WI | 137,543 | ND | ND | ND | ND | ND | ND | ND | ND |
| EL PASO, TX | 591,610 | 8 | 0.14 | 0.034 | 0.14 | 39 | 169 | 0.008 | 0.031 |
| ELKHART-GOSHEN, IN | 156,198 | ND | ND | ND | 0.10 | ND | ND | ND | ND |
| ELMIRA, NY | 95,195 | ND | ND | ND | 0.08 | 19 | 41 | 0.004 | 0.023 |
| ENID, OK | 56,735 | ND | ND | ND | ND | ND | ND | ND | ND |
| ERIE, PA | 275,572 | 4 | ND | 0.015 | 0.10 | IN | 54 | 0.010 | 0.076 |
| EUGENE-SPRINGFIELD, OR | 282,912 | 6 | 0.02 | ND | 0.09 | 24 | 143 | ND | ND |
| EVANSVILLE-HENDERSON, IN-KY | 278,980 | 5 | ND | 0.018 | 0.14 | 33 | 102 | 0.017 | 0.061 |
| FARGO-MOORHEAD, ND-MN | 153,296 | 3 | ND | ND | 0.05 | 18 | 39 | ND | ND |
| FAYETTEVILLE-SPRINGDALE-ROGERS, AR | 113,409 | ND | ND | ND | ND | IN | 49 | ND | ND |
| FAYETTEVILLE, NC | 274,566 | 6 | ND | ND | 0.10 | IN | 44 | IN | 0.011 |
| FITCHBURG-LEOMINSTER, MA | 102,797 | ND | ND | ND | ND | ND | ND | ND | ND |

See definitions and footnotes at end of table

Table A-12. 1994 Metropolitan Statistical Area Air Quality Factbook Peak Statistics for Criteria Pollutants

| METROPOLITAN STATISTICAL AREA | 1990 POPULATION | CO | PB | NO2 | OZONE | PM10 | PM10 | SO2 | SO2 |
|---------------------------------------|--------------------|---------------|---------------|-------------|------------------|-----------------|------------------|-------------|----------------|
| | | 8-HR (PPM) | QMAX (UGM) | AM (PPM) | 2ND MAX (PPM) | WTD AM (UGM) | 2ND MAX (UGM) | AM (PPM) | 24-HR (PPM) |
| FLINT, MI | 430,459 | ND | 0.01 | ND | 0.09 | 20 | 42 | 0.004 | 0.017 |
| FLORENCE, AL | 131,327 | ND | ND | ND | 0.10 | IN | 39 | 0.003 | 0.022 |
| FLORENCE, SC | 114,344 | ND | 0.01 | ND | ND | ND | ND | ND | ND |
| FORT COLLINS-LOVELAND, CO | 186,136 | 6 | ND | ND | 0.10 | IN | 45 | ND | ND |
| FORT LAUDERDALE, FL | 1,255,488 | 6 | 0.03 | 0.009 | 0.10 | 18 | 56 | 0.002 | 0.013 |
| FORT MYERS-CAPE CORAL, FL | 335,113 | ND | ND | ND | 0.09 | IN | 22 | ND | ND |
| FORT PIERCE-PORT ST. LUCIE, FL | 251,071 | ND | ND | ND | ND | ND | ND | ND | ND |
| FORT SMITH, AR-OK | 175,911 | ND | ND | ND | ND | 24 | 44 | ND | ND |
| FORT WALTON BEACH, FL | 143,776 | ND | ND | ND | ND | IN | 31 | ND | ND |
| FORT WAYNE, IN | 363,811 | 5 | 0.05 | ND | 0.11 | 24 | 60 | ND | ND |
| FORT WORTH-ARLINGTON, TX | 1,332,053 | 4 | 0.03 | 0.017 | 0.15 | 21 | 41 | 0.002 | 0.006 |
| FRESNO, CA | 667,490 | 9 | ND | 0.023 | 0.14 | 50 | 124 | 0.004 | 0.010 |
| GADSDEN, AL | 99,840 | ND | 0.06 | ND | ND | 31 | 57 | ND | ND |
| GAINESVILLE, FL | 204,111 | ND | ND | ND | ND | 21 | 41 | ND | ND |
| GALVESTON-TEXAS CITY, TX | 217,399 | ND | 0.02 | ND | 0.13 | 23 | 57 | 0.006 | 0.052 |
| GARY, IN | 604,526 | 7 | 0.16 | 0.025 | 0.12 | 32 | 69 | 0.008 | 0.055 |
| GLENS FALLS, NY | 118,539 | ND | ND | ND | ND | 20 | 53 | 0.004 | 0.027 |
| GOLDSBORO, NC | 78,143 | ND | ND | ND | ND | 21 | 39 | ND | ND |
| GRAND FORKS, ND-MN | 70,683 | ND | ND | ND | ND | 16 | 56 | ND | ND |
| GRAND RAPIDS-MUSKEGON-HOLLAND, MI | 688,399 | 4 | 0.02 | ND | 0.12 | IN | 77 | 0.003 | 0.013 |
| GREAT FALLS, MT | 77,691 | 5 | ND | ND | ND | 21 | 48 | IN | 0.020 |
| GREELEY, CO | 131,821 | 5 | ND | ND | 0.09 | IN | 68 | ND | ND |
| GREEN BAY, WI | 194,594 | ND | ND | ND | 0.09 | ND | ND | 0.003 | 0.015 |
| GREENSBORO-WINSTON-SALEM-HIGH POINT | 942,091 | 6 | ND | 0.017 | 0.11 | 28 | 61 | 0.007 | 0.021 |
| GREENVILLE, NC | 88,741 | ND | ND | ND | 0.09 | 19 | 37 | 0.003 | 0.010 |
| GREENVILLE-SPARTANBURG-ANDERSON, SC | 640,861 | 6 | 0.02 | 0.018 | 0.10 | 29 | 65 | 0.002 | 0.016 |
| HAGERSTOWN, MD | 121,393 | ND | ND | ND | ND | IN | 66 | ND | ND |
| HAMILTON-MIDDLETOWN, OH | 291,479 | ND | ND | ND | 0.12 | 34 | 76 | 0.008 | 0.045 |
| HARRISBURG-LEBANON-CARLISLE, PA | 567,986 | ND | 0.04 | 0.022 | 0.12 | IN | 77 | 0.007 | 0.040 |
| HARTFORD, CT | 767,641 | 8 | 0.02 | 0.020 | 0.14 | 26 | 67 | 0.007 | 0.033 |
| HICKORY-MORGANTON, NC | 221,700 | ND | ND | ND | 0.10 | 26 | 46 | 0.004 | 0.011 |
| HONOLULU, HI | 836,231 | 5 | 0.00 | 0.004 | 0.06 | 17 | 76 | 0.002 | 0.009 |
| HOUMA, LA | 182,842 | ND | ND | ND | 0.10 | ND | ND | ND | ND |
| HOUSTON, TX | 3,301,937 | 6 | 0.01 | 0.028 | 0.17 | 47 | 104 | 0.005 | 0.035 |
| HUNTINGTON-ASHLAND, WV-KY-OH | 312,529 | 5 | 0.04 | 0.017 | 0.13 | 32 | 109 | 0.013 | 0.057 |
| HUNTSVILLE, AL | 238,912 | 4 | ND | ND | 0.11 | 21 | 54 | IN | 0.011 |
| INDIANAPOLIS, IN | 1,249,822 | 4 | 3.10 (1) | 0.019 | 0.12 | 37 | 83 | 0.009 | 0.045 |
| IOWA CITY, IA | 98,119 | ND | ND | ND | ND | ND | ND | ND | ND |
| JACKSON, MI | 149,756 | ND | ND | ND | ND | ND | ND | ND | ND |
| JACKSON, MS | 395,396 | 5 | 0.00 | ND | 0.09 | 23 | 112 | 0.002 | 0.008 |
| JACKSONVILLE, FL | 906,727 | 5 | 0.02 | 0.014 | 0.11 | 27 | 51 | 0.006 | 0.064 |
| JACKSONVILLE, NC | 149,838 | ND | ND | ND | ND | IN | 37 | ND | ND |
| JACKSON, TN | 77,982 | ND | ND | 0.016 | 0.11 | 22 | 49 | 0.005 | 0.027 |
| JAMESTOWN, NY | 141,895 | ND | ND | ND | 0.09 | 18 | 39 | 0.010 | 0.072 |
| JANESVILLE-BELOIT, WI | 139,510 | ND | ND | ND | 0.11 | ND | ND | ND | ND |
| JERSEY CITY, NJ | 553,099 | 11 | 0.04 | 0.026 | 0.12 | 39 | 106 | 0.011 | 0.042 |
| JOHNSON CITY-KINGSPORT-BRISTOL, TN-VA | 436,047 | 3 | 0.05 | 0.017 | 0.10 | 30 | 60 | 0.011 | 0.050 |
| JOHNSTOWN, PA | 241,247 | 4 | 0.05 | 0.018 | 0.09 | 29 | 69 | 0.014 | 0.080 |
| JOPLIN, MO | 134,910 | ND | ND | ND | ND | ND | ND | ND | ND |
| KALAMAZOO-BATTLE CREEK, MI | 223,411 | 2 | 0.02 | 0.016 | 0.09 | 26 | 57 | 0.004 | 0.028 |

See definitions and footnotes at end of table

Table A-12. 1994 Metropolitan Statistical Area Air Quality Factbook Peak Statistics for Criteria Pollutants

| METROPOLITAN STATISTICAL AREA | 1990 POPULATION | CO | PB | NO2 | OZONE | PM10 | PM10 | SO2 | SO2 |
|-----------------------------------|--------------------|---------------|---------------|-------------|------------------|-----------------|------------------|-------------|----------------|
| | | 8-HR (PPM) | QMAX (UGM) | AM (PPM) | 2ND MAX (PPM) | WTD AM (UGM) | 2ND MAX (UGM) | AM (PPM) | 24-HR (PPM) |
| KANKAKEE, IL | 516,418 | ND | ND | ND | ND | ND | ND | ND | ND |
| KANSAS CITY, MO-KS | 1,566,280 | 5 | 0.03 | 0.011 | 0.11 | 40 | 98 | 0.006 | 0.034 |
| KENOSHA, WI | 128,181 | ND | ND | ND | 0.12 | ND | ND | ND | ND |
| KILLEEN-TEMPLE, TX | 255,301 | ND | ND | ND | ND | 15 | 35 | ND | ND |
| KNOXVILLE, TN | 604,816 | 4 | ND | ND | 0.11 | 38 | 69 | 0.009 | 0.057 |
| KOKOMO, IN | 96,225 | ND | ND | ND | ND | ND | ND | ND | ND |
| LA CROSSE, WI-MN | 97,904 | ND | ND | ND | ND | ND | ND | ND | ND |
| LAFAYETTE, IN | 130,598 | ND | ND | ND | ND | ND | ND | ND | ND |
| LAFAYETTE, LA | 208,740 | ND | ND | ND | 0.10 | 21 | 42 | ND | ND |
| LAKE CHARLES, LA | 168,134 | ND | ND | 0.006 | 0.11 | 23 | 46 | 0.004 | 0.017 |
| LAKELAND-WINTER HAVEN, FL | 405,382 | ND | ND | ND | 0.09 | ND | ND | 0.004 | 0.016 |
| LANCASTER, PA | 422,822 | 4 | 0.04 | 0.019 | 0.11 | IN | 117 | 0.006 | 0.030 |
| LANSING-EAST LANSING, MI | 432,674 | ND | ND | ND | 0.09 | ND | ND | ND | ND |
| LAREDO, TX | 133,239 | ND | ND | ND | ND | IN | 73 | ND | ND |
| LAS CRUCES, NM | 135,510 | 5 | 0.06 | ND | 0.14 | 40 | 125 | 0.007 | 0.040 |
| LAS VEGAS, NV-AZ | 741,459 | 11 | ND | 0.027 | 0.10 | 47 | 114 | ND | ND |
| LAWRENCE, KS | 81,798 | ND | ND | ND | ND | ND | ND | ND | ND |
| LAWRENCE, MA-NH | 393,516 | ND | 0.00 | ND | 0.11 | IN | 35 | 0.007 | 0.032 |
| LAWTON, OK | 111,486 | 3 | ND | 0.008 | 0.09 | IN | 51 | ND | ND |
| LEWISTON-AUBURN, ME | 88,141 | ND | ND | ND | ND | 20 | 46 | 0.006 | 0.026 |
| LEXINGTON, KY | 348,428 | 4 | ND | 0.016 | 0.11 | 29 | 60 | 0.008 | 0.037 |
| LIMA, OH | 154,340 | ND | ND | ND | 0.10 | 29 | 46 | 0.004 | 0.037 |
| LINCOLN, NE | 213,641 | 5 | ND | ND | 0.08 | 28 | 49 | ND | ND |
| LITTLE ROCK-NORTH LITTLE ROCK, AR | 513,117 | 4 | ND | 0.011 | 0.10 | 30 | 62 | 0.003 | 0.009 |
| LONGVIEW-MARSHALL, TX | 162,431 | ND | ND | ND | 0.10 | ND | ND | ND | ND |
| LOS ANGELES-LONG BEACH, CA | 8,863,164 | 15 | 0.08 | 0.050 | 0.24 | 47 | 112 | 0.004 | 0.010 |
| LOUISVILLE, KY-IN | 952,662 | 8 | 0.03 | 0.026 | 0.13 | 35 | 75 | 0.013 | 0.050 |
| LOWELL, MA-NH | 273,067 | 7 | ND | ND | ND | ND | ND | ND | ND |
| LUBBOCK, TX | 222,636 | ND | ND | ND | ND | 23 | 153 | ND | ND |
| LYNCHBURG, VA | 142,199 | ND | ND | ND | ND | 23 | 40 | ND | ND |
| MACON, GA | 281,103 | ND | ND | ND | ND | ND | ND | 0.002 | 0.013 |
| MADISON, WI | 367,085 | 5 | ND | ND | 0.08 | 22 | 50 | 0.004 | 0.026 |
| MANCHESTER, NH | 147,809 | ND | ND | ND | ND | ND | ND | ND | ND |
| MANSFIELD, OH | 126,137 | ND | ND | ND | ND | 29 | 58 | ND | ND |
| MAYAGUEZ, PR | 133,497 | ND | ND | ND | ND | ND | ND | ND | ND |
| MCALLEN-EDINBURG-MISSION, TX | 383,545 | ND | ND | ND | ND | ND | ND | ND | ND |
| MEDFORD-ASHLAND, OR | 146,389 | 7 | 0.02 | ND | 0.09 | 39 | 94 | ND | ND |
| MELBOURNE-TITUSVILLE-PALM BAY, FL | 398,978 | ND | ND | ND | 0.09 | 17 | 34 | ND | ND |
| MEMPHIS, TN-AR-MS | 981,747 | 8 | 2.20 (a) | 0.027 | 0.11 | 29 | 76 | 0.005 | 0.025 |
| MERCED, CA | 178,403 | ND | ND | 0.013 | 0.12 | 39 | 109 | ND | ND |
| MIAMI, FL | 3,192,582 | 5 | 0.01 | 0.014 | 0.11 | 25 | 74 | 0.001 | 0.004 |
| MIDDLESEX-SOMERSET-HUNTERDON, NJ | 1,019,835 | 4 | 0.12 | ND | 0.14 | 27 | 57 | 0.005 | 0.028 |
| MILWAUKEE-WAUKESHA, WI | 1,432,149 | 7 | 0.03 | 0.025 | 0.13 | 33 | 87 | 0.004 | 0.032 |
| MINNEAPOLIS-ST. PAUL, MN-WI | 2,464,124 | 6 | ND | IN | 0.08 | IN | 155 | 0.002 | 0.036 |
| MOBILE, AL | 476,923 | ND | ND | ND | 0.09 | 31 | 76 | 0.011 | 0.052 |
| MODESTO, CA | 370,522 | 6 | ND | 0.023 | 0.12 | 41 | 103 | ND | ND |
| MONMOUTH-OCEAN, NJ | 986,327 | 5 | ND | ND | 0.12 | ND | ND | ND | ND |
| MONROE, LA | 142,191 | ND | ND | ND | 0.10 | 34 | 99 | 0.004 | 0.009 |
| MONTGOMERY, AL | 292,517 | ND | ND | ND | 0.10 | 26 | 72 | ND | ND |
| MUNCIE, IN | 119,659 | ND | 1.33 | ND | ND | ND | ND | ND | ND |

See definitions and footnotes at end of table

Table A-12. 1994 Metropolitan Statistical Area Air Quality Factbook Peak Statistics for Criteria Pollutants

| METROPOLITAN STATISTICAL AREA | 1990 POPULATION | CO | PB | NO2 | OZONE | PM10 | PM10 | SO2 | SO2 |
|--------------------------------------|--------------------|---------------|---------------|-------------|------------------|-----------------|------------------|-------------|----------------|
| | | 8-HR (PPM) | QMAX (UGM) | AM (PPM) | 2ND MAX (PPM) | WTD AM (UGM) | 2ND MAX (UGM) | AM (PPM) | 24-HR (PPM) |
| MYRTLE BEACH, SC | 144,053 | ND | ND | ND | ND | ND | ND | ND | ND |
| NAPLES, FL | 152,099 | ND | ND | ND | ND | ND | ND | ND | ND |
| NASHUA, NH | 180,557 | 9 | 0.01 | 0.015 | 0.11 | 15 | 40 | 0.007 | 0.037 |
| NASHVILLE, TN | 985,026 | 7 | 1.38 (h) | 0.020 | 0.12 | 36 | 71 | 0.007 | 0.071 |
| NASSAU-SUFFOLK, NY | 2,609,212 | 5 | ND | 0.028 | 0.13 | 24 | 65 | 0.008 | 0.039 |
| NEW BEDFORD, MA | 175,841 | ND | ND | ND | 0.10 | 19 | 49 | ND | ND |
| NEW HAVEN-MERIDEN, CT | 638,220 | 8 | 0.17 | 0.030 | 0.15 | 28 | 106 | 0.010 | 0.056 |
| NEW LONDON-NORWICH, CT-RI | 266,819 | ND | ND | ND | 0.12 | 23 | 53 | 0.005 | 0.029 |
| NEW ORLEANS, LA | 1,238,816 | 5 | 0.12 | 0.020 | 0.12 | 31 | 71 | 0.008 | 0.027 |
| NEW YORK, NY | 8,548,846 | 7 | 0.11 | 0.046 | 0.13 | 53 | 130 | 0.018 | 0.071 |
| NEWARK, NJ | 1,824,321 | 11 | 0.30 | 0.042 | 0.13 | 43 | 107 | 0.009 | 0.035 |
| NEWBURGH, NY-PA | 307,647 | ND | 0.11 | ND | ND | ND | ND | ND | ND |
| NORFOLK-VIRGINIA BEACH-NEWPORT NEWS | 1,396,107 | 7 | 0.02 | 0.019 | 0.10 | 22 | 44 | 0.008 | 0.025 |
| OAKLAND, CA | 2,082,914 | 4 | 0.02 | 0.022 | 0.13 | 22 | 78 | 0.002 | 0.009 |
| OCALA, FL | 194,833 | ND | ND | ND | ND | ND | ND | ND | ND |
| ODESSA-MIDLAND, TX | 118,934 | ND | ND | ND | ND | ND | ND | ND | ND |
| OKLAHOMA CITY, OK | 958,839 | 7 | 0.01 | 0.015 | 0.10 | 23 | 55 | 0.004 | 0.007 |
| OLYMPIA, WA | 161,238 | 4 | ND | ND | ND | IN | 63 | ND | ND |
| OMAHA, NE-IA | 618,262 | 4 | 6.47 (h) | ND | 0.08 | 32 | 114 | 0.003 | 0.018 |
| ORANGE COUNTY, CA | 2,410,556 | 8 | 0.04 | 0.042 | 0.21 | 40 | 104 | 0.002 | 0.006 |
| ORLANDO, FL | 1,072,748 | 5 | 0.00 | 0.011 | 0.11 | 26 | 40 | 0.002 | 0.012 |
| OWENSBORO, KY | 87,189 | 4 | ND | 0.012 | 0.11 | 26 | 93 | 0.009 | 0.035 |
| PANAMA CITY, FL | 126,994 | ND | ND | ND | ND | 23 | 39 | ND | ND |
| PARKERSBURG-MARIETTA, WV-OH | 149,169 | ND | ND | ND | 0.11 | ND | ND | 0.017 | 0.084 |
| PENSACOLA, FL | 344,406 | ND | ND | ND | 0.11 | IN | 33 | 0.006 | 0.051 |
| PEORIA-PEKIN, IL | 339,172 | 6 | 0.02 | ND | 0.09 | 26 | 62 | 0.008 | 0.063 |
| PHILADELPHIA, PA-NJ | 4,856,881 | 8 | 22.10 (h) | 0.037 | 0.13 | 111 | 371 | 0.013 | 0.057 |
| PHOENIX-MESA, AZ | 2,122,101 | 10 | 0.04 | IN | 0.12 | 50 | 114 | IN | 0.003 |
| PINE BLUFF, AR | 85,487 | ND | ND | ND | ND | IN | 56 | ND | ND |
| PITTSBURGH, PA | 2,058,705 | 7 | 0.07 | 0.031 | 0.12 | 41 | 157 | 0.022 | 0.111 (h) |
| PITTSFIELD, MA | 79,250 | ND | ND | ND | 0.09 | ND | ND | ND | ND |
| PONCE, PR | 253,285 | ND | ND | ND | ND | 27 | 64 | ND | ND |
| PORTLAND-VANCOUVER, OR-WA | 1,239,842 | 8 | 0.27 | IN | 0.11 | 32 | 70 | 0.005 | 0.013 |
| PORTLAND, ME | 215,281 | ND | ND | 0.002 | 0.12 | 27 | 69 | 0.008 | 0.043 |
| PORTSMOUTH-ROCHESTER, NH-ME | 223,578 | ND | 0.02 | 0.013 | 0.12 | 15 | 37 | 0.006 | 0.022 |
| PROVIDENCE-FALL RIVER-WARWICK, RI-MA | 1,141,510 | 7 | ND | 0.022 | 0.12 | 37 | 70 | 0.009 | 0.045 |
| PROVO-OREM, UT | 263,590 | 9 | ND | 0.024 | 0.09 | 33 | 122 | ND | ND |
| PUEBLO, CO | 123,051 | ND | ND | ND | ND | IN | 54 | ND | ND |
| PUNTA GORDA, FL | 110,975 | ND | ND | ND | ND | ND | ND | ND | ND |
| RACINE, WI | 175,034 | 4 | ND | ND | 0.11 | ND | ND | ND | ND |
| RALEIGH-DURHAM-CHAPEL HILL, NC | 735,480 | 7 | ND | 0.009 | 0.11 | 22 | 38 | ND | ND |
| RAPID CITY, SD | 81,343 | ND | 0.00 | ND | ND | 45 | 144 | ND | ND |
| READING, PA | 336,523 | 5 | 1.84 (h) | 0.023 | 0.11 | 29 | 80 | 0.012 | 0.044 |
| REDDING, CA | 147,036 | 2 | ND | ND | 0.11 | 24 | 54 | ND | ND |
| RENO, NV | 254,667 | 9 | ND | ND | 0.09 | 40 | 140 | ND | ND |
| RICHLAND-KENNEWICK-PASCO, WA | 150,033 | ND | ND | ND | ND | IN | 103 | ND | ND |
| RICHMOND-PETERSBURG, VA | 865,640 | 4 | ND | 0.024 | 0.12 | 22 | 40 | 0.006 | 0.024 |
| RIVERSIDE-SAN BERNARDINO, CA | 2,588,793 | 6 | 0.04 | 0.041 | 0.23 | 66 | 184 | 0.002 | 0.012 |
| ROANOKE, VA | 224,477 | 6 | ND | 0.013 | 0.10 | 40 | 83 | 0.004 | 0.011 |
| ROCHESTER, MN | 106,470 | 5 | ND | ND | ND | IN | 43 | IN | 0.010 |

See definitions and footnotes at end of table

Table A-12. 1994 Metropolitan Statistical Area Air Quality Factbook Peak Statistics for Criteria Pollutants

| METROPOLITAN STATISTICAL AREA | 1990 POPULATION | CO | | NO2 | OZONE | PM10 | | SO2 | SO2 |
|---------------------------------------|--------------------|---------------|---------------|-------------|------------------|-----------------|------------------|-------------|----------------|
| | | 8-HR (PPM) | QMAX (UGM) | AM (PPM) | 2ND MAX (PPM) | WTD AM (UGM) | 2ND MAX (UGM) | AM (PPM) | 24-HR (PPM) |
| ROCHESTER, NY | 1,002,410 | 5 | 0.04 | ND | 0.10 | 22 | 45 | 0.013 | 0.052 |
| ROCKFORD, IL | 283,719 | 4 | 0.04 | ND | 0.10 | 19 | 44 | ND | ND |
| ROCKY MOUNT, NC | 133,235 | ND | ND | ND | ND | 21 | 41 | ND | ND |
| SACRAMENTO, CA | 1,481,102 | 8 | 0.02 | 0.022 | 0.14 | 28 | 101 | 0.001 | 0.007 |
| SAGINAW-BAY CITY-MIDLAND, MI | 399,320 | ND | ND | ND | ND | 22 | 45 | ND | ND |
| ST. CLOUD, MN | 190,921 | 5 | ND | ND | ND | ND | ND | ND | ND |
| ST. JOSEPH, MO | 83,083 | ND | ND | ND | ND | 34 | 77 | IN | 0.062 |
| ST. LOUIS, MO-IL | 2,444,099 | 6 | 5.11 (m) | 0.028 | 0.15 | 45 | 122 | 0.014 | 0.089 |
| SALEM, OR | 278,024 | 8 | ND | ND | ND | ND | ND | ND | ND |
| SALINAS, CA | 355,660 | 2 | ND | 0.012 | 0.09 | 20 | 33 | ND | ND |
| SALT LAKE CITY-OGDEN, UT | 1,072,227 | 8 | 0.05 | 0.029 | 0.11 | 38 | 140 | 0.011 | 0.039 |
| SAN ANGELO, TX | 98,485 | ND | ND | ND | ND | ND | ND | ND | ND |
| SAN ANTONIO, TX | 1,302,099 | 4 | 0.03 | ND | 0.11 | 25 | 53 | ND | ND |
| SAN DIEGO, CA | 2,498,016 | 7 | 0.02 | 0.024 | 0.14 | 51 | 121 | 0.003 | 0.015 |
| SAN FRANCISCO, CA | 1,603,678 | 5 | 0.02 | 0.022 | 0.08 | IN | 72 | 0.001 | 0.005 |
| SAN JOSE, CA | 1,497,577 | 7 | 0.02 | 0.028 | 0.11 | 26 | 89 | ND | ND |
| SAN JUAN-BAYAMON, PR | 1,086,376 | 5 | ND | ND | ND | 34 | 82 | 0.013 | 0.077 |
| SAN LUIS OBISPO-ATASCADERO-PASO ROBLE | 217,162 | 3 | ND | 0.014 | 0.10 | 22 | 45 | ND | ND |
| SANTA BARBARA-SANTA MARIA-LOMPOC, CA | 369,608 | 6 | ND | 0.022 | 0.13 | 33 | 56 | 0.002 | 0.005 |
| SANTA CRUZ-WATSONVILLE, CA | 229,734 | 1 | ND | 0.006 | 0.09 | 31 | 61 | 0.002 | 0.006 |
| SANTA FE, NM | 117,043 | 3 | ND | 0.003 | 0.07 | 15 | 29 | 0.002 | 0.008 |
| SANTA ROSA, CA | 388,222 | 3 | 0.01 | 0.015 | 0.09 | IN | 51 | ND | ND |
| SARASOTA-BRADENTON, FL | 277,776 | 5 | ND | ND | 0.10 | 26 | 81 | 0.003 | 0.017 |
| SAVANNAH, GA | 242,622 | ND | ND | ND | ND | ND | ND | 0.003 | 0.015 |
| SCRANTON-WILKES-BARRE-HAZLETON, PA | 734,175 | 4 | ND | 0.020 | 0.11 | 26 | 63 | 0.007 | 0.036 |
| SEATTLE-BELLEVUE-EVERETT, WA | 1,972,961 | 7 | 0.61 | ND | 0.13 | 28 | 83 | 0.007 | 0.026 |
| SHARON, PA | 121,003 | ND | 0.05 | ND | 0.11 | 30 | 68 | 0.008 | 0.047 |
| SHEBOYGAN, WI | 103,877 | ND | ND | ND | 0.11 | ND | ND | ND | ND |
| SHERMAN-DENISON, TX | 95,021 | ND | ND | ND | ND | ND | ND | ND | ND |
| SHREVEPORT-BOSSIER CITY, LA | 334,341 | ND | ND | ND | 0.09 | 26 | 51 | 0.002 | 0.008 |
| SIOUX CITY, IA-NE | 115,018 | ND | ND | ND | ND | 23 | 69 | ND | ND |
| SIOUX FALLS, SD | 123,809 | ND | ND | ND | ND | 24 | 45 | ND | ND |
| SOUTH BEND, IN | 247,052 | 4 | ND | 0.011 | 0.11 | 19 | 71 | ND | ND |
| SPOKANE, WA | 361,364 | 9 | ND | ND | 0.09 | 34 | 115 | ND | ND |
| SPRINGFIELD, IL | 189,550 | 3 | ND | ND | 0.10 | 22 | 53 | 0.006 | 0.050 |
| SPRINGFIELD, MA | 529,519 | 8 | 0.01 | 0.029 | 0.13 | 24 | 68 | 0.008 | 0.070 |
| SPRINGFIELD, MO | 239,971 | 6 | ND | 0.013 | 0.10 | 18 | 39 | 0.010 | 0.103 |
| STAMFORD-NORWALK, CT | 127,378 | 6 | ND | ND | 0.16 | 36 | 76 | 0.010 | 0.057 |
| STATE COLLEGE, PA | 123,786 | ND | ND | ND | ND | ND | ND | ND | ND |
| STEUBENVILLE-WEIRTON, OH-WV | 142,523 | 17 | ND | 0.020 | 0.11 | 39 | 187 (k) | 0.035 | 0.200 (k) |
| STOCKTON-LODI, CA | 480,628 | 8 | 0.00 | 0.024 | 0.12 | 37 | 93 | ND | ND |
| SUMTER, SC | 102,637 | ND | 0.02 | ND | ND | ND | ND | ND | ND |
| SYRACUSE, NY | 659,864 | 7 | ND | ND | 0.11 | 25 | 64 | 0.004 | 0.022 |
| TACOMA, WA | 586,203 | 6 | ND | ND | 0.11 | 27 | 76 | 0.007 | 0.024 |
| TALLAHASSEE, FL | 233,598 | ND | ND | ND | ND | ND | ND | ND | ND |
| TAMPA-ST. PETERSBURG-CLEARWATER, FL | 2,067,959 | 4 | 0.89 (n) | 0.010 | 0.10 | 30 | 69 | 0.007 | 0.095 |
| TERRE HAUTE, IN | 130,812 | 3 | ND | ND | 0.11 | 28 | 57 | 0.012 | 0.044 |
| TEXARKANA, TX-TEXARKANA, AR | 120,132 | ND | ND | ND | ND | 23 | 52 | ND | ND |
| TOLEDO, OH | 614,128 | 4 | 0.70 (o) | ND | 0.12 | 26 | 66 | 0.007 | 0.056 |
| TOPEKA, KS | 160,976 | ND | 0.01 | ND | ND | IN | 49 | ND | ND |

See definitions and footnotes at end of table

Table A-12. 1994 Metropolitan Statistical Area Air Quality Factbook Peak Statistics for Criteria Pollutants

| METROPOLITAN STATISTICAL AREA | 1990 POPULATION | CO | PB | NO2 | OZONE | PM10 | PM10 | SO2 | SO2 |
|----------------------------------|--------------------|---------------|---------------|-------------|------------------|-----------------|------------------|-------------|----------------|
| | | 8-HR (PPM) | QMAX (UGM) | AM (PPM) | 2ND MAX (PPM) | WTD AM (UGM) | 2ND MAX (UGM) | AM (PPM) | 24-HR (PPM) |
| TRENTON, NJ | 325,824 | ND | ND | ND | 0.14 | 29 | 64 | ND | ND |
| TULSA, OK | 708,954 | 5 | 0.10 | 0.017 | 0.13 | 28 | 53 | 0.005 | 0.036 |
| TUSCALOOSA, AL | 150,522 | ND | ND | ND | ND | 26 | 48 | ND | ND |
| TUSCON, AZ | 666,880 | 6 | 0.05 | 0.021 | 0.10 | 31 | 63 | 0.002 | 0.004 |
| TYLER, TX | 151,309 | ND | ND | ND | 0.10 | 18 | 40 | ND | ND |
| UTICA-ROME, NY | 316,633 | ND | ND | ND | 0.09 | 21 | 49 | 0.002 | 0.011 |
| VALLEJO-FAIRFIELD-NAPA, CA | 451,186 | 6 | 0.01 | 0.016 | 0.10 | 21 | 57 | 0.002 | 0.007 |
| VENTURA, CA | 669,016 | 4 | ND | 0.024 | 0.16 | 31 | 67 | 0.001 | 0.004 |
| VICTORIA, TX | 74,361 | ND | ND | ND | 0.09 | ND | ND | ND | ND |
| VINELAND-MILLVILLE-BRIDGETON, NJ | 138,053 | ND | ND | ND | 0.10 | ND | ND | 0.005 | 0.032 |
| VISALIA-TULARE-PORTERVILLE, CA | 311,921 | 4 | ND | 0.023 | 0.15 | 48 | 93 | ND | ND |
| WACO, TX | 189,731 | ND | ND | ND | ND | ND | ND | ND | ND |
| WASHINGTON, DC-MD-VA-WV | 3,000,504 | 6 | 0.04 | 0.030 | 0.13 | 29 | 64 | 0.011 | 0.038 |
| WATERBURY, CT | 221,629 | ND | 0.02 | ND | ND | 27 | 58 | 0.006 | 0.030 |
| WATERLOO-CEDAR FALLS, IA | 146,611 | ND | ND | ND | ND | 29 | 59 | ND | ND |
| WAUSAU, WI | 115,400 | ND | ND | ND | 0.08 | ND | ND | 0.004 | 0.024 |
| WEST PALM BEACH-BOCA RATON, FL | 863,518 | 3 | 0.00 | 0.012 | 0.09 | 20 | 56 | 0.002 | 0.016 |
| WHEELING, WV-OH | 159,301 | 5 | ND | ND | 0.10 | 31 | 69 | 0.019 | 0.087 |
| WICHITA FALLS, TX | 122,378 | ND | ND | ND | ND | IN | 73 | ND | ND |
| WICHITA, KS | 485,270 | 7 | 0.01 | ND | 0.09 | 32 | 100 | 0.004 | 0.005 |
| WILLIAMSPORT, PA | 118,710 | ND | ND | ND | 0.08 | 27 | 61 | 0.006 | 0.042 |
| WILMINGTON-NEWARK, DE-MD | 578,587 | 4 | ND | 0.019 | 0.13 | 38 | 82 | 0.014 | 0.056 |
| WILMINGTON, NC | 120,284 | ND | ND | ND | 0.10 | IN | 30 | ND | ND |
| WORCESTER, MA-CT | 320,006 | 6 | ND | 0.025 | 0.13 | 20 | 44 | 0.008 | 0.024 |
| YAKIMA, WA | 188,823 | 8 | ND | ND | ND | 31 | 86 | ND | ND |
| YOLYO, CA | 381,288 | 5 | ND | ND | 0.10 | 30 | 71 | ND | ND |
| YORK, PA | 417,848 | 4 | 0.04 | 0.024 | 0.12 | 31 | 80 | 0.009 | 0.041 |
| YOUNGSTOWN-WARREN, OH | 492,619 | 3 | ND | 0.017 | 0.10 | 39 | 110 | 0.013 | 0.084 |
| YUBA CITY, CA | 122,643 | 6 | ND | 0.016 | 0.11 | 34 | 81 | ND | ND |
| YUMA, AZ | 106,895 | ND | ND | ND | ND | 34 | 54 | ND | ND |

CO = Highest second maximum non-overlapping 8-hour concentration (Applicable NAAQS is 9 ppm)
 PB = Highest quarterly maximum concentration (Applicable NAAQS is 1.5 ug/m3)
 NO2 = Highest arithmetic mean concentration (Applicable NAAQS is 0.053 ppm)
 O3 = Highest second daily maximum 1-hour concentration (Applicable NAAQS is 0.12 ppm)
 PM10 = Highest weighted annual mean concentration (Applicable NAAQS is 50 ug/m3)
 Data from exceptional events not included
 SO2 = Highest second maximum 24-hour concentration (Applicable NAAQS is 150 ug/m3)
 = Highest annual mean concentration (Applicable NAAQS is 0.03 ppm)
 = Highest second maximum 24-hour concentration (Applicable NAAQS is 0.14 ppm)
 ND = Indicates data not available
 IN = Indicates insufficient data to calculate summary statistic

WTD = Weighted
 AM = annual mean
 UGM = Units are micrograms per cubic meter
 PPM = Units are parts per million

- (a) - Impact from an industrial source in Leeds, AL. Highest population oriented site in Birmingham, AL is 0.11 ug/m3.
- (b) - Impact from an industrial source in Chicago, IL. Highest population oriented site in Chicago, IL is 0.10 ug/m3.
- (c) - Impact from an industrial source in Cleveland, OH. This facility has been shutdown. Highest site in Cleveland, OH is 0.12 ug/m3.
- (d) - Impact from an industrial source in Columbus, GA. Highest population oriented site in Columbus, GA is 0.16 ug/m3.
- (e) - Impact from an industrial source in Collin Co., TX. Highest population oriented site in Dallas, TX is 0.08 ug/m3.
- (f) - Impact from an industrial source in Indianapolis, IN. Highest population oriented site in Indianapolis, IN is 0.2 ug/m3.
- (g) - Impact from an industrial source in Memphis, TN. Highest population oriented site in Memphis, TN is 0.10 ug/m3.
- (h) - Impact from an industrial source in Williamston Co., TN. Highest population oriented site in Nashville, TN is 0.09 ug/m3.
- (i) - Impact from an industrial source in Omaha, NE. Highest population oriented site in Omaha, NE is 0.67 ug/m3.
- (j) - Impact from an industrial source in Philadelphia, PA. Highest population oriented site in Philadelphia, PA is 0.49 ug/m3.
- (k) - Impact from an industrial source.
- (l) - Impact from an industrial source in Reading, PA.
- (m) - Impact from an industrial source in Herculaneum, MO. Highest population oriented site in St. Louis is 0.06 ug/m3.
- (n) - Impact from an industrial source in Tampa, FL.
- (o) - Impact from an industrial source in Toledo, OH.

Table A-13 Number of PSI Days Greater Than 100 at Trend Sites, 1985-94, and All Sites in 1994

| METROPOLITAN STATISTICAL AREA | # trend sites | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | Total # sites | PSI >100 1994 |
|-------------------------------------|---------------|------|------|------|------|------|------|------|------|------|------|---------------|---------------|
| ALBANY-SCHENECTADY-TROY, NY | 4 | 2 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 1 | 14 | 1 |
| ALLENTOWN-BETHLEHEM-EASTON, PA | 9 | 4 | 3 | 5 | 16 | 0 | 0 | 3 | 0 | 0 | 1 | 11 | 1 |
| ATLANTA, GA | 7 | 9 | 18 | 27 | 21 | 3 | 17 | 6 | 5 | 17 | 4 | 13 | 4 |
| AUSTIN-SAN MARCOS, TX | 4 | 3 | 0 | 0 | 2 | 1 | 0 | 1 | 0 | 0 | 1 | 5 | 1 |
| BAKERSFIELD, CA | 7 | 57 | 54 | 70 | 85 | 56 | 48 | 48 | 16 | 49 | 45 | 27 | 50 |
| BALTIMORE, MD | 15 | 25 | 23 | 28 | 43 | 9 | 12 | 20 | 5 | 14 | 17 | 28 | 18 |
| BATON ROUGE, LA | 6 | 10 | 6 | 10 | 10 | 9 | 18 | 6 | 2 | 3 | 2 | 13 | 4 |
| BERGEN-PASSAIC, NJ | 8 | 8 | 5 | 14 | 19 | 4 | 4 | 3 | 0 | 0 | 0 | 9 | 0 |
| BIRMINGHAM, AL | 17 | 3 | 7 | 11 | 16 | 3 | 5 | 0 | 2 | 5 | 0 | 17 | 0 |
| BOSTON, MA-NH | 24 | 3 | 2 | 5 | 15 | 4 | 1 | 3 | 1 | 3 | 1 | 29 | 2 |
| BUFFALO-NIAGARA FALLS, NY | 20 | 2 | 1 | 4 | 19 | 1 | 2 | 0 | 0 | 0 | 0 | 22 | 0 |
| CHARLESTON-NORTH CHARLESTON, SC | 7 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 0 |
| CHARLOTTE-GASTONIA-ROCK HILL, NC-SC | 7 | 6 | 12 | 10 | 21 | 3 | 5 | 2 | 0 | 4 | 0 | 26 | 1 |
| CHICAGO, IL | 40 | 9 | 9 | 17 | 22 | 4 | 3 | 8 | 7 | 1 | 8 | 58 | 8 |
| CINCINNATI, OH-KY-IN | 19 | 5 | 7 | 11 | 24 | 3 | 6 | 7 | 0 | 1 | 5 | 24 | 5 |
| CLEVELAND-LORAIN-ELYRIA, OH | 25 | 1 | 2 | 7 | 21 | 6 | 2 | 7 | 1 | 2 | 4 | 40 | 7 |
| COLUMBUS, OH | 9 | 0 | 1 | 1 | 4 | 0 | 1 | 3 | 1 | 0 | 0 | 13 | 1 |
| DALLAS, TX | 9 | 27 | 9 | 13 | 14 | 7 | 8 | 1 | 3 | 5 | 1 | 23 | 7 |
| DAYTON-SPRINGFIELD, OH | 11 | 0 | 2 | 3 | 17 | 3 | 1 | 1 | 0 | 3 | 2 | 12 | 2 |
| DENVER, CO | 20 | 38 | 49 | 37 | 19 | 11 | 9 | 7 | 7 | 3 | 2 | 35 | 2 |
| DETROIT, MI | 25 | 2 | 5 | 9 | 17 | 10 | 3 | 8 | 0 | 2 | 8 | 35 | 8 |
| EL PASO, TX | 16 | 32 | 43 | 32 | 16 | 33 | 27 | 10 | 13 | 6 | 10 | 19 | 10 |
| FORT LAUDERDALE, FL | 5 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 20 | 0 |
| FORT WORTH-ARLINGTON, TX | 8 | 12 | 10 | 4 | 11 | 8 | 5 | 9 | 2 | 1 | 8 | 8 | 8 |
| FRESNO, CA | 5 | 37 | 37 | 49 | 29 | 45 | 22 | 32 | 27 | 27 | 11 | 16 | 19 |
| GARY, IN | 17 | 10 | 8 | 8 | 13 | 1 | 3 | 3 | 2 | 0 | 1 | 26 | 2 |
| GRAND RAPIDS-MUSKEGON-HOLLAND, MI | 6 | 2 | 2 | 5 | 10 | 3 | 2 | 2 | 0 | 1 | 1 | 10 | 3 |
| GREENSBORO-WINSTON-SALEM-HIGH POINT | 7 | 0 | 3 | 1 | 12 | 0 | 1 | 0 | 0 | 2 | 0 | 25 | 1 |
| GREENVILLE-SPARTANBURG-ANDERSON, SC | 1 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 1 | 0 | 8 | 0 |
| HARRISBURG-LEBANON-CARLISLE, PA | 8 | 2 | 0 | 5 | 13 | 0 | 2 | 0 | 0 | 1 | 2 | 7 | 2 |
| HARTFORD, CT | 14 | 17 | 7 | 20 | 27 | 11 | 7 | 14 | 9 | 9 | 10 | 17 | 10 |
| HONOLULU, HI | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 | 0 |
| HOUSTON, TX | 28 | 64 | 55 | 67 | 61 | 42 | 61 | 42 | 31 | 26 | 29 | 30 | 32 |
| INDIANAPOLIS, IN | 24 | 2 | 0 | 3 | 9 | 2 | 1 | 0 | 1 | 0 | 2 | 33 | 2 |
| JACKSONVILLE, FL | 13 | 2 | 0 | 2 | 2 | 0 | 1 | 0 | 0 | 1 | 0 | 19 | 0 |
| JERSEY CITY, NJ | 8 | 26 | 8 | 12 | 18 | 2 | 7 | 8 | 1 | 5 | 1 | 9 | 7 |
| KANSAS CITY, MO-KS | 19 | 3 | 4 | 6 | 4 | 2 | 2 | 1 | 1 | 2 | 0 | 25 | 0 |
| KNOXVILLE, TN | 10 | 0 | 0 | 0 | 8 | 0 | 5 | 0 | 0 | 2 | 0 | 17 | 1 |
| LAS VEGAS, NV-AZ | 8 | 56 | 40 | 7 | 30 | 46 | 21 | 15 | 5 | 8 | 12 | 11 | 12 |
| LITTLE ROCK-NORTH LITTLE ROCK, AR | 6 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 8 | 0 |
| LOS ANGELES-LONG BEACH, CA | 37 | 208 | 226 | 201 | 239 | 226 | 178 | 182 | 185 | 146 | 136 | 41 | 136 |
| LOUISVILLE, KY-IN | 15 | 4 | 9 | 2 | 20 | 3 | 4 | 4 | 0 | 6 | 4 | 27 | 5 |
| MEMPHIS, TN-AR-MO | 10 | 15 | 13 | 10 | 8 | 4 | 6 | 1 | 1 | 4 | 0 | 16 | 2 |
| MIAMI, FL | 7 | 5 | 4 | 4 | 5 | 4 | 1 | 2 | 0 | 0 | 0 | 12 | 0 |
| MIDDLESEX-SOMERSET-HUNTERDON, NJ | 5 | 17 | 7 | 10 | 24 | 8 | 12 | 8 | 3 | 1 | 5 | 7 | 5 |
| MILWAUKEE-WAUKESHA, WI | 17 | 5 | 10 | 13 | 19 | 8 | 2 | 10 | 0 | 0 | 4 | 22 | 5 |
| MINNEAPOLIS-ST. PAUL, MN-WI | 14 | 22 | 13 | 7 | 1 | 5 | 1 | 0 | 1 | 0 | 3 | 25 | 3 |
| MONMOUTH-OCEAN, NJ | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 |
| NASHVILLE, TN | 11 | 3 | 9 | 4 | 17 | 4 | 8 | 1 | 1 | 3 | 3 | 27 | 3 |
| NASSAU-SUFFOLK, NY | 4 | 4 | 9 | 15 | 10 | 6 | 7 | 13 | 2 | 4 | 3 | 7 | 3 |

Table A-13 Number of PSI Days Greater Than 100 at Trend Sites, 1985-94, and All Sites in 1994

| METROPOLITAN STATISTICAL AREA | # trend sites | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | Total # sites | PSI >100 1994 |
|--------------------------------------|---------------|------|------|------|------|------|------|------|------|------|------|---------------|---------------|
| NEW HAVEN-MERIDEN, CT | 12 | 11 | 7 | 17 | 16 | 7 | 10 | 22 | 3 | 11 | 8 | 13 | 8 |
| NEW ORLEANS, LA | 8 | 1 | 3 | 5 | 2 | 1 | 0 | 0 | 1 | 2 | 2 | 14 | 2 |
| NEW YORK, NY | 24 | 65 | 58 | 44 | 46 | 18 | 18 | 22 | 4 | 6 | 8 | 34 | 9 |
| NEWARK, NJ | 13 | 24 | 20 | 24 | 33 | 5 | 8 | 11 | 5 | 2 | 6 | 17 | 6 |
| NORFOLK-VIRGINIA BEACH-NEWPORT NEWS | 8 | 1 | 1 | 5 | 8 | 0 | 0 | 1 | 2 | 4 | 2 | 14 | 2 |
| OAKLAND, CA | 22 | 12 | 8 | 14 | 10 | 3 | 5 | 6 | 2 | 3 | 3 | 29 | 3 |
| OKLAHOMA CITY, OK | 11 | 6 | 4 | 6 | 0 | 2 | 2 | 0 | 0 | 0 | 2 | 14 | 2 |
| OMAHA, NE-IA | 9 | 3 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 13 | 1 |
| ORANGE COUNTY, CA | 10 | 78 | 66 | 58 | 65 | 66 | 47 | 42 | 43 | 25 | 14 | 12 | 14 |
| ORLANDO, FL | 5 | 0 | 1 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 16 | 0 |
| PHILADELPHIA, PA-NJ | 36 | 31 | 23 | 36 | 35 | 20 | 14 | 25 | 3 | 22 | 6 | 52 | 18 |
| PHOENIX-MESA, AZ | 22 | 88 | 88 | 42 | 26 | 30 | 9 | 4 | 9 | 7 | 7 | 28 | 9 |
| PITTSBURGH, PA | 31 | 9 | 8 | 13 | 25 | 9 | 11 | 4 | 2 | 5 | 2 | 50 | 8 |
| PORTLAND-VANCOUVER, OR-WA | 11 | 3 | 6 | 11 | 8 | 6 | 8 | 9 | 2 | 0 | 2 | 17 | 4 |
| PROVIDENCE-FALL RIVER-WARWICK, RI-MA | 13 | 12 | 7 | 10 | 9 | 2 | 7 | 11 | 2 | 1 | 2 | 21 | 3 |
| RALEIGH-DURHAM-CHAPEL HILL, NC | 3 | 0 | 0 | 2 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 18 | 1 |
| RICHMOND-PETERSBURG, VA | 9 | 5 | 1 | 8 | 18 | 1 | 1 | 1 | 2 | 4 | 1 | 11 | 1 |
| RIVERSIDE-SAN BERNARDINO, CA | 34 | 168 | 170 | 171 | 180 | 177 | 143 | 141 | 150 | 139 | 122 | 58 | 124 |
| ROCHESTER, NY | 8 | 0 | 1 | 1 | 5 | 0 | 1 | 0 | 0 | 0 | 0 | 9 | 0 |
| SACRAMENTO, CA | 18 | 75 | 69 | 52 | 76 | 60 | 43 | 44 | 21 | 10 | 11 | 39 | 13 |
| ST. LOUIS, MO-IL | 46 | 10 | 13 | 17 | 18 | 13 | 8 | 6 | 3 | 5 | 11 | 61 | 13 |
| SALT LAKE CITY-OGDEN, UT | 19 | 21 | 36 | 8 | 11 | 17 | 6 | 19 | 10 | 3 | 10 | 31 | 11 |
| SAN ANTONIO, TX | 7 | 3 | 2 | 2 | 2 | 0 | 1 | 0 | 0 | 0 | 1 | 7 | 1 |
| SAN DIEGO, CA | 21 | 88 | 70 | 61 | 84 | 90 | 60 | 39 | 37 | 17 | 16 | 27 | 16 |
| SAN FRANCISCO, CA | 11 | 5 | 4 | 1 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 11 | 0 |
| SAN JOSE, CA | 8 | 34 | 17 | 18 | 16 | 21 | 11 | 11 | 2 | 2 | 0 | 14 | 1 |
| SAN JUAN-BAYAMON, PR | 6 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 19 | 0 |
| SCRANTON-WILKES-BARRE-HAZLETON, PA | 11 | 1 | 0 | 1 | 12 | 1 | 0 | 2 | 0 | 0 | 0 | 11 | 0 |
| SEATTLE-BELLEVUE-EVERETT, WA | 13 | 25 | 13 | 14 | 20 | 8 | 5 | 2 | 1 | 0 | 0 | 21 | 4 |
| SPRINGFIELD, MA | 15 | 12 | 5 | 3 | 19 | 5 | 4 | 5 | 4 | 7 | 3 | 17 | 3 |
| SYRACUSE, NY | 4 | 19 | 9 | 4 | 2 | 2 | 1 | 2 | 0 | 0 | 0 | 9 | 0 |
| TACOMA, WA | 8 | 12 | 4 | 9 | 9 | 4 | 3 | 1 | 1 | 0 | 1 | 9 | 1 |
| TAMPA-ST. PETERSBURG-CLEARWATER, FL | 20 | 6 | 5 | 5 | 1 | 1 | 3 | 0 | 1 | 0 | 0 | 33 | 0 |
| TOLEDO, OH | 6 | 0 | 2 | 2 | 6 | 1 | 0 | 1 | 0 | 3 | 1 | 8 | 2 |
| TUSCON, AZ | 16 | 3 | 2 | 4 | 6 | 2 | 0 | 0 | 0 | 0 | 0 | 29 | 0 |
| TULSA, OK | 10 | 5 | 4 | 2 | 2 | 2 | 3 | 2 | 1 | 1 | 2 | 13 | 2 |
| VENTURA, CA | 14 | 31 | 84 | 54 | 83 | 59 | 36 | 49 | 25 | 16 | 24 | 16 | 24 |
| WASHINGTON, DC-MD-VA-WV | 32 | 17 | 12 | 26 | 37 | 8 | 5 | 17 | 2 | 13 | 7 | 55 | 8 |
| WEST PALM BEACH-BOCA RATON, FL | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 0 |
| WILMINGTON-NEWARK, DE-MD | 8 | 10 | 9 | 16 | 31 | 7 | 5 | 6 | 2 | 3 | 1 | 12 | 7 |

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| METROPOLITAN STATISTICAL AREA | # trend sites | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | Total # sites | PSI >100 1994 |
|-------------------------------------|---------------|------|------|------|------|------|------|------|------|------|------|---------------|---------------|
| ALBANY-SCHENECTADY-TROY, NY | 2 | 2 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 1 |
| ALLENTOWN-BETHLEHEM-EASTON, PA | 3 | 4 | 3 | 5 | 15 | 0 | 0 | 3 | 0 | 0 | 0 | 3 | 0 |
| ATLANTA, GA | 3 | 9 | 18 | 27 | 21 | 3 | 17 | 6 | 5 | 17 | 4 | 4 | 4 |
| AUSTIN-SAN MARCOS, TX | 2 | 3 | 0 | 0 | 2 | 1 | 0 | 1 | 0 | 0 | 1 | 2 | 1 |
| BAKERSFIELD, CA | 3 | 55 | 51 | 69 | 80 | 50 | 41 | 41 | 15 | 49 | 43 | 9 | 48 |
| BALTIMORE, MD | 6 | 15 | 18 | 26 | 40 | 8 | 11 | 20 | 5 | 14 | 16 | 8 | 17 |
| BATON ROUGE, LA | 3 | 10 | 6 | 10 | 10 | 9 | 18 | 6 | 2 | 3 | 2 | 7 | 4 |
| BERGEN-PASSAIC, NJ | 1 | 8 | 2 | 13 | 18 | 2 | 3 | 3 | 0 | 0 | 0 | 1 | 0 |
| BIRMINGHAM, AL | 5 | 3 | 5 | 7 | 15 | 1 | 5 | 0 | 2 | 5 | 0 | 6 | 0 |
| BOSTON, MA-NH | 3 | 3 | 2 | 4 | 15 | 4 | 1 | 3 | 1 | 3 | 1 | 6 | 2 |
| BUFFALO-NIAGARA FALLS, NY | 2 | 2 | 0 | 4 | 18 | 1 | 1 | 0 | 0 | 0 | 0 | 2 | 0 |
| CHARLESTON-NORTH CHARLESTON, SC | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 |
| CHARLOTTE-GASTONIA-ROCK HILL, NC-SC | 3 | 1 | 10 | 10 | 21 | 2 | 3 | 2 | 0 | 4 | 0 | 6 | 1 |
| CHICAGO, IL | 15 | 9 | 6 | 16 | 21 | 3 | 0 | 7 | 3 | 0 | 2 | 22 | 2 |
| CINCINNATI, OH-KY-IN | 7 | 3 | 7 | 11 | 24 | 3 | 6 | 7 | 0 | 1 | 5 | 8 | 5 |
| CLEVELAND-LORAIN-ELYRIA, OH | 7 | 1 | 2 | 7 | 21 | 3 | 2 | 7 | 1 | 1 | 2 | 8 | 3 |
| COLUMBUS, OH | 2 | 0 | 1 | 1 | 4 | 0 | 1 | 3 | 0 | 0 | 0 | 4 | 1 |
| DALLAS, TX | 3 | 26 | 9 | 13 | 14 | 7 | 8 | 1 | 3 | 5 | 1 | 6 | 7 |
| DAYTON-SPRINGFIELD, OH | 3 | 0 | 2 | 2 | 17 | 3 | 1 | 1 | 0 | 3 | 2 | 4 | 2 |
| DENVER, CO | 5 | 1 | 3 | 5 | 4 | 0 | 2 | 0 | 0 | 0 | 0 | 9 | 0 |
| DETROIT, MI | 7 | 1 | 3 | 6 | 16 | 10 | 3 | 8 | 0 | 2 | 6 | 8 | 6 |
| EL PASO, TX | 3 | 18 | 19 | 17 | 6 | 13 | 9 | 7 | 7 | 4 | 6 | 4 | 6 |
| FORT LAUDERDALE, FL | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 3 | 0 |
| FORT WORTH-ARLINGTON, TX | 2 | 12 | 10 | 4 | 11 | 8 | 5 | 9 | 2 | 1 | 8 | 2 | 8 |
| FRESNO, CA | 3 | 37 | 37 | 49 | 28 | 45 | 22 | 32 | 27 | 27 | 11 | 6 | 19 |
| GARY, IN | 4 | 2 | 5 | 6 | 13 | 0 | 3 | 3 | 2 | 0 | 1 | 4 | 1 |
| GRAND RAPIDS-MUSKEGON-HOLLAND, MI | 2 | 2 | 2 | 5 | 10 | 3 | 2 | 2 | 0 | 1 | 1 | 5 | 3 |
| GREENSBORO-WINSTON-SALEM-HIGH POINT | 2 | 0 | 3 | 1 | 12 | 0 | 1 | 0 | 0 | 2 | 0 | 6 | 1 |
| GREENVILLE-SPARTANBURG-ANDERSON, SC | 1 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 1 | 0 | 4 | 0 |
| HARRISBURG-LEBANON-CARLISLE, PA | 3 | 2 | 0 | 5 | 13 | 0 | 2 | 0 | 0 | 1 | 2 | 3 | 2 |
| HARTFORD, CT | 3 | 11 | 2 | 10 | 24 | 9 | 7 | 12 | 8 | 9 | 10 | 3 | 10 |
| HONOLULU, HI | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| HOUSTON, TX | 11 | 64 | 53 | 66 | 61 | 42 | 61 | 42 | 31 | 26 | 29 | 11 | 32 |
| INDIANAPOLIS, IN | 5 | 2 | 0 | 3 | 9 | 2 | 1 | 0 | 0 | 0 | 2 | 7 | 2 |
| JACKSONVILLE, FL | 2 | 2 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 3 | 0 |
| JERSEY CITY, NJ | 1 | 15 | 4 | 12 | 18 | 2 | 7 | 8 | 1 | 5 | 1 | 1 | 1 |
| KANSAS CITY, MO-KS | 5 | 3 | 3 | 5 | 4 | 1 | 2 | 1 | 1 | 1 | 0 | 6 | 0 |
| KNOXVILLE, TN | 2 | 0 | 0 | 0 | 8 | 0 | 5 | 0 | 0 | 2 | 0 | 7 | 1 |
| LAS VEGAS, NV-AZ | 2 | 1 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 4 | 0 |
| LITTLE ROCK-NORTH LITTLE ROCK, AR | 2 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 2 | 0 |
| LOS ANGELES-LONG BEACH, CA | 14 | 168 | 174 | 160 | 178 | 154 | 132 | 134 | 143 | 116 | 107 | 15 | 107 |
| LOUISVILLE, KY-IN | 4 | 4 | 9 | 2 | 20 | 1 | 4 | 4 | 0 | 6 | 4 | 6 | 4 |
| MEMPHIS, TN-AR-MS | 3 | 8 | 6 | 5 | 8 | 2 | 4 | 0 | 0 | 1 | 0 | 4 | 1 |
| MIAMI, FL | 3 | 3 | 4 | 4 | 5 | 3 | 1 | 2 | 0 | 0 | 0 | 4 | 0 |
| MIDDLESEX-SOMERSET-HUNTERDON, NJ | 2 | 17 | 7 | 10 | 24 | 8 | 12 | 8 | 3 | 1 | 5 | 2 | 5 |
| MILWAUKEE-WAUKESHA, WI | 6 | 5 | 10 | 13 | 19 | 8 | 2 | 10 | 0 | 0 | 4 | 9 | 5 |
| MINNEAPOLIS-ST. PAUL, MN-WI | 3 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 |
| MONMOUTH-OCEAN, NJ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 |
| NASHVILLE, TN | 3 | 3 | 3 | 3 | 17 | 2 | 7 | 1 | 1 | 2 | 3 | 8 | 3 |
| NASSAU-SUFFOLK, NY | 1 | 4 | 8 | 11 | 8 | 6 | 7 | 13 | 2 | 4 | 3 | 2 | 3 |

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| METROPOLITAN STATISTICAL AREA | # trend sites | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | Total # sites | PSI >100 1994 |
|--------------------------------------|---------------|------|------|------|------|------|------|------|------|------|------|---------------|---------------|
| NEW HAVEN-MERIDEN, CT | 2 | 11 | 7 | 17 | 16 | 7 | 8 | 20 | 3 | 7 | 6 | 2 | 6 |
| NEW ORLEANS, LA | 4 | 1 | 2 | 5 | 2 | 1 | 0 | 0 | 1 | 2 | 2 | 6 | 2 |
| NEW YORK, NY | 5 | 20 | 8 | 16 | 32 | 12 | 13 | 19 | 3 | 6 | 8 | 7 | 9 |
| NEWARK, NJ | 3 | 10 | 12 | 23 | 30 | 4 | 7 | 8 | 5 | 2 | 4 | 3 | 4 |
| NORFOLK-VIRGINIA BEACH-NEWPORT NEWS | 2 | 1 | 1 | 3 | 7 | 0 | 0 | 1 | 2 | 4 | 2 | 3 | 2 |
| OAKLAND, CA | 7 | 12 | 8 | 14 | 10 | 3 | 5 | 5 | 2 | 3 | 3 | 9 | 3 |
| OKLAHOMA CITY, OK | 3 | 1 | 0 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 4 | 0 |
| OMAHA, NE-IA | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 |
| ORANGE COUNTY, CA | 4 | 70 | 63 | 54 | 55 | 48 | 44 | 42 | 41 | 25 | 14 | 4 | 14 |
| ORLANDO, FL | 2 | 0 | 1 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 4 | 0 |
| PHILADELPHIA, PA-NJ | 9 | 31 | 21 | 35 | 35 | 18 | 14 | 25 | 3 | 22 | 5 | 11 | 5 |
| PHOENIX-MESA, AZ | 8 | 9 | 0 | 2 | 3 | 0 | 3 | 0 | 4 | 5 | 2 | 9 | 4 |
| PITTSBURGH, PA | 6 | 2 | 1 | 5 | 16 | 2 | 0 | 2 | 0 | 3 | 2 | 9 | 4 |
| PORTLAND-VANCOUVER, OR-WA | 3 | 2 | 4 | 2 | 2 | 0 | 4 | 1 | 2 | 0 | 0 | 4 | 1 |
| PROVIDENCE-FALL RIVER-WARWICK, RI-MA | 2 | 9 | 6 | 10 | 8 | 2 | 7 | 11 | 2 | 1 | 2 | 3 | 3 |
| RALEIGH-DURHAM-CHAPEL HILL, NC | 1 | 0 | 0 | 2 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 1 |
| RICHMOND-PETERSBURG, VA | 3 | 5 | 1 | 7 | 18 | 1 | 1 | 1 | 2 | 4 | 1 | 4 | 1 |
| RIVERSIDE-SAN BERNARDINO, CA | 15 | 157 | 165 | 168 | 179 | 168 | 136 | 138 | 148 | 138 | 121 | 21 | 123 |
| ROCHESTER, NY | 2 | 0 | 1 | 1 | 5 | 0 | 1 | 0 | 0 | 0 | 0 | 2 | 0 |
| SACRAMENTO, CA | 7 | 25 | 31 | 30 | 52 | 20 | 18 | 29 | 20 | 8 | 11 | 13 | 13 |
| ST. LOUIS, MO-IL | 14 | 10 | 11 | 14 | 18 | 7 | 8 | 6 | 3 | 5 | 10 | 17 | 11 |
| SALT LAKE CITY-OGDEN, UT | 4 | 14 | 9 | 2 | 8 | 7 | 2 | 1 | 0 | 0 | 1 | 8 | 1 |
| SAN ANTONIO, TX | 2 | 3 | 1 | 2 | 2 | 0 | 1 | 0 | 0 | 0 | 1 | 2 | 1 |
| SAN DIEGO, CA | 7 | 85 | 67 | 60 | 80 | 81 | 60 | 39 | 37 | 17 | 16 | 9 | 16 |
| SAN FRANCISCO, CA | 3 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 |
| SAN JOSE, CA | 4 | 10 | 9 | 18 | 11 | 6 | 2 | 3 | 2 | 2 | 0 | 7 | 1 |
| SAN JUAN-BAYAMON, PR | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SCRANTON-WILKES-BARRE-HAZLETON, PA | 4 | 1 | 0 | 1 | 12 | 1 | 0 | 2 | 0 | 0 | 0 | 4 | 0 |
| SEATTLE-BELLEVUE-EVERETT, WA | 1 | 1 | 1 | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 3 | 2 |
| SPRINGFIELD, MA | 3 | 12 | 3 | 2 | 19 | 5 | 4 | 5 | 3 | 7 | 3 | 4 | 3 |
| SYRACUSE, NY | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| TACOMA, WA | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 1 | 1 | 1 |
| TAMPA-ST. PETERSBURG-CLEARWATER, FL | 5 | 6 | 5 | 5 | 0 | 1 | 3 | 0 | 1 | 0 | 0 | 7 | 0 |
| TOLEDO, OH | 2 | 0 | 2 | 2 | 6 | 1 | 0 | 1 | 0 | 3 | 1 | 4 | 2 |
| TUSCON, AZ | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 0 |
| TULSA, OK | 3 | 5 | 4 | 1 | 2 | 2 | 3 | 2 | 0 | 1 | 2 | 3 | 2 |
| VENTURA, CA | 6 | 31 | 83 | 54 | 83 | 59 | 36 | 49 | 25 | 16 | 24 | 7 | 24 |
| WASHINGTON, DC-MD-VA-WV | 13 | 14 | 10 | 21 | 35 | 5 | 5 | 16 | 2 | 13 | 7 | 18 | 8 |
| WEST PALM BEACH-BOCA RATON, FL | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| WILMINGTON-NEWARK, DE-MD | 2 | 10 | 9 | 16 | 31 | 7 | 5 | 6 | 2 | 3 | 1 | 4 | 7 |

Table A-15. Total Number of PSI Days Greater Than 100 at Trend Sites, 1985-94, and All Sites in 1994

| METROPOLITAN STATISTICAL AREA | # trend sites | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | Total # sites | PSI >100 1994 |
|-------------------------------|---------------|------|------|------|------|------|------|------|------|------|------|---------------|---------------|
| ALL POLLUTANTS | | | | | | | | | | | | | |
| ALL TREND SITES | 1204 | 1656 | 1567 | 1538 | 1954 | 1250 | 1008 | 994 | 678 | 676 | 613 | 1833 | 704 |
| LOS ANGELES-LONG BEACH, CA | 37 | 208 | 226 | 201 | 239 | 226 | 178 | 182 | 185 | 146 | 136 | 41 | 136 |
| RIVERSIDE-SAN BERNARDINO, CA | 33 | 168 | 170 | 171 | 180 | 177 | 143 | 141 | 150 | 139 | 122 | 56 | 124 |
| ALL EXCEPT LA AND RIVERSIDE | 1134 | 1280 | 1171 | 1166 | 1535 | 847 | 687 | 671 | 343 | 391 | 355 | 1736 | 444 |
| OZONE ONLY | | | | | | | | | | | | | |
| ALL TREND SITES | 352 | 1108 | 1057 | 1226 | 1675 | 889 | 818 | 839 | 578 | 615 | 530 | 502 | 589 |
| LOS ANGELES-LONG BEACH, CA | 14 | 168 | 174 | 160 | 178 | 154 | 132 | 134 | 143 | 116 | 107 | 15 | 107 |
| RIVERSIDE-SAN BERNARDINO, CA | 15 | 157 | 165 | 168 | 179 | 168 | 136 | 138 | 148 | 138 | 121 | 21 | 123 |
| ALL EXCEPT LA AND RIVERSIDE | 323 | 783 | 718 | 898 | 1318 | 567 | 550 | 567 | 287 | 361 | 302 | 466 | 359 |

Table A-16. Emission Reductions for Regulations Promulgated in 1990-95

| SOURCE CATEGORY | Dates | | No. of Facil. | Emiss. Reduc., Mg/Yr | HAPs Controlled Pollutants |
|---------------------------------------|----------------|----------------------------------|-------------------|---------------------------------------|---------------------------------------------------------------------------------------------------------------|
| | Promul. | Compliance | | | |
| Chromium Electroplating Coke Ovens | 11/94 10/93 | 11/97 | 5,000 75 Batt. | 173 1,305 if MACT 1,500 if LAER | Chromium Coke Oven Emissions |
| Commercial Sterilizers Degreasers | 11/94 11/94 | 12/97 12/97 | 75 25,000 | 1,000 77,000 | Ethylene Oxide Methylene Chloride, TCE, Perchloroethylene, 111-TCA, Carbon Tetrachloride, Chloroform |
| Industrial Cooling Towers | 7/94 | 1/95 | | 25 | Chromium |
| Magnetic Tape | 11/94 | 11/96 11/97 | 14 | 2,080 | MEK, MIBK, Toluene, Xylene, Ethylbenzene |
| Stage I Gasoline Marketing | 11/94 | 12/95-12/97 | 260 | 2,300 | Hexane, Toluene, Benzene, Others |
| Perchloroethylene Dry Cleaning | 9/93 | 9/96 | 30,000 | 35,600 | Perchloroethylene |
| Hazardous Organic NESHAP (HON) | 2/94 | 4/97 | 370 | 460,000 | Many CAAA Section 112 HAPs |
| Aerospace Industry | 9/95 | 9/98 | 3,000 | 164,100 | Chromium, Toluene, MEK, TCE, 111-TCA MIBK, Many others |
| Marine Tank Vessels | 9/95 | 9/98 9/99 | 28 | 4,500 | Benzene, Hexane, Xylene |
| Petroleum Refineries | 8/95 | 8/98 | 190 | 48,000 | Benzene, Toluene, Xylene, Ethylbenzene |
| Municipal Waste Combustors I & II | 9/94, 10/95 | New-at Startup Exist- 3-5 yrs | 200 | 181 | Dioxin, Lead, Cadmium, Mercury |
| Polymers & Resins II | 2/95 | 3/98 | 19 | 97 | Epichlorohydrin |
| Secondary Lead Smelters | 5-93 | 6/98 | 23 | 1,300 | Lead & Arsenic Compounds, 1,3-butadiene |

Appendix B: Methodology

Air Quality Data Base

The ambient air quality data presented in this report are obtained from EPA's Aerometric Information Retrieval System (AIRS). These are direct measurements of pollutant concentrations at monitoring stations operated by state and local governments throughout the nation. The monitoring stations are generally located in the larger urban areas. EPA and other federal agencies operate some air quality monitoring sites on a temporary basis as a part of air pollution research studies. The national monitoring network conforms to uniform criteria for monitor siting, instrumentation, and quality assurance.²

In 1994, more than 4,600 monitoring sites reported air quality data for one or more of the six NAAQS pollutants to AIRS. Air quality monitoring sites are selected as national trends sites if they have complete data for at least eight of the 10 years between 1985 and 1994. The annual data completeness criteria are appropriate to each pollutant and measurement methodology. Table B-1 displays the number of sites meeting the 10-year trend completeness criteria. For the PM-10 standard which was established in 1987, the trend analyses are based on sites with data in five of six years present during the 1988-94 period. Because of the annual turnover of monitoring sites, the use of a moving 10-year window maximizes the number of sites available for trends, and yields a data base that is more consistent with the current monitoring network.

The air quality data are divided into two major groupings: daily (or 24-hour) measurements and continuous 1-hour measurements. The daily measurements are obtained from monitoring instruments that produce one measurement per 24-hour period and typically operate on a systematic sampling schedule of once every six days, or 61 samples per year. Such instruments are used to measure PM-10 and Pb. More frequent sampling of PM-10 (every other day, or every day) is also common. Only PM-10 weighted annual arithmetic means that meet the AIRS annual summary criteria are selected as valid means for trends purposes.³ Only Pb sites with at least six

samples per quarter in three of the four calendar quarters qualify as trends sites. Monthly composite Pb data are used if at least two monthly samples are available for at least three of the four calendar quarters.

Monitoring instruments that operate continuously produce a measurement every hour for a possible total of 8,760 hourly measurements in a year. For hourly data, only annual averages based on at least 4,380 hourly observations are considered as trends statistics. The SO₂ standard-related daily statistics require 183, or more, daily values to be included in the analysis. Ozone sites meet the annual trends data completeness requirement if they have at least 50 percent of the daily data available for the ozone season, which varies by state, but typically runs from May through September.⁴

Air Quality Trend Statistics

The air quality statistics presented in this report relate to the pollutant-specific NAAQS and comply with the recommendations of the Intra-Agency Task Force on Air Quality Indicators.⁵ A composite average of each of the trend statistics is used in the graphical presentations throughout this report. All sites were weighted equally in calculating the composite average trend statistic. Missing annual summary statistics for the second through ninth years for a site are estimated by linear interpolation from the surrounding years. Missing end points are replaced with the nearest valid year of data. The resulting data sets are statistically balanced, allowing simple statistical procedures and graphics to be easily applied. This procedure also is conservative since end-point rates of change are dampened by the interpolated estimates.

Emission Estimates Methodology

Trends are presented for annual nationwide emissions of CO, Pb, nitrogen oxides (NO_x), volatile organic compounds (VOCs), PM-10, and sulfur dioxide (SO₂). These are estimates of the amount and kinds of pollution being emitted by automobiles, factories and other sources, based upon best available engineering calculations.

The estimates of emissions in this report differ from those reported in previous reports due to improvements in emission estimation methodologies. Readers should also note that the 1990 to 1994 emission estimates are based on some preliminary data and are subject to revision in future reports. Additional emission estimates and a more detailed description of the estimation methodology is contained in a companion report, *National Air Pollutant Emission Trends, 1900-1994*.⁵

Table B-1: Number of monitoring sites

| Pollutant | Number of Sites Reporting in 1994 | Number of Trend Sites, 1985-94 |
|-----------------|-----------------------------------|--------------------------------|
| CO | 544 | 328 |
| Pb | 424 | 197 |
| NO _x | 383 | 205 |
| O ₃ | 941 | 549 |
| PM-10 | 1673 | 748* |
| SO ₂ | 703 | 475 |
| Total | 4668 | 2502 |

*Number of trend sites for 1988-1994.

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| 7. AUTHOR(S) W. Freas, T. Fitz-Simons, J. Hemby, D. Mintz, M. Schmidt, H. Tanajian, C. Sansevero, R. Thompson, S. Nizich, | 9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Environmental Protection Agency Office of Air and Radiation Office of Air Quality Planning and Standards Research Triangle Park, NC 27711 | |
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15. SUPPLEMENTARY NOTES

16. ABSTRACT

This report presents national and regional trends in air quality from 1985 through 1994 for particulate matter, sulfur dioxide, carbon monoxide, nitrogen dioxide, ozone and lead. Air quality trends are also presented for 90 metropolitan areas. Both national and regional trends in each of these pollutants are examined. National air quality trends are also presented for both the National Air Monitoring Sites (NAMS) and other site categories. In addition to ambient air quality, trends are also presented for annual nationwide emissions. These emissions are estimated using the best available engineering calculations; the ambient levels presented are averages of direct measurements. International comparisons of air quality and emissions are contained in this report. The topics of air toxics and visibility are also addressed.

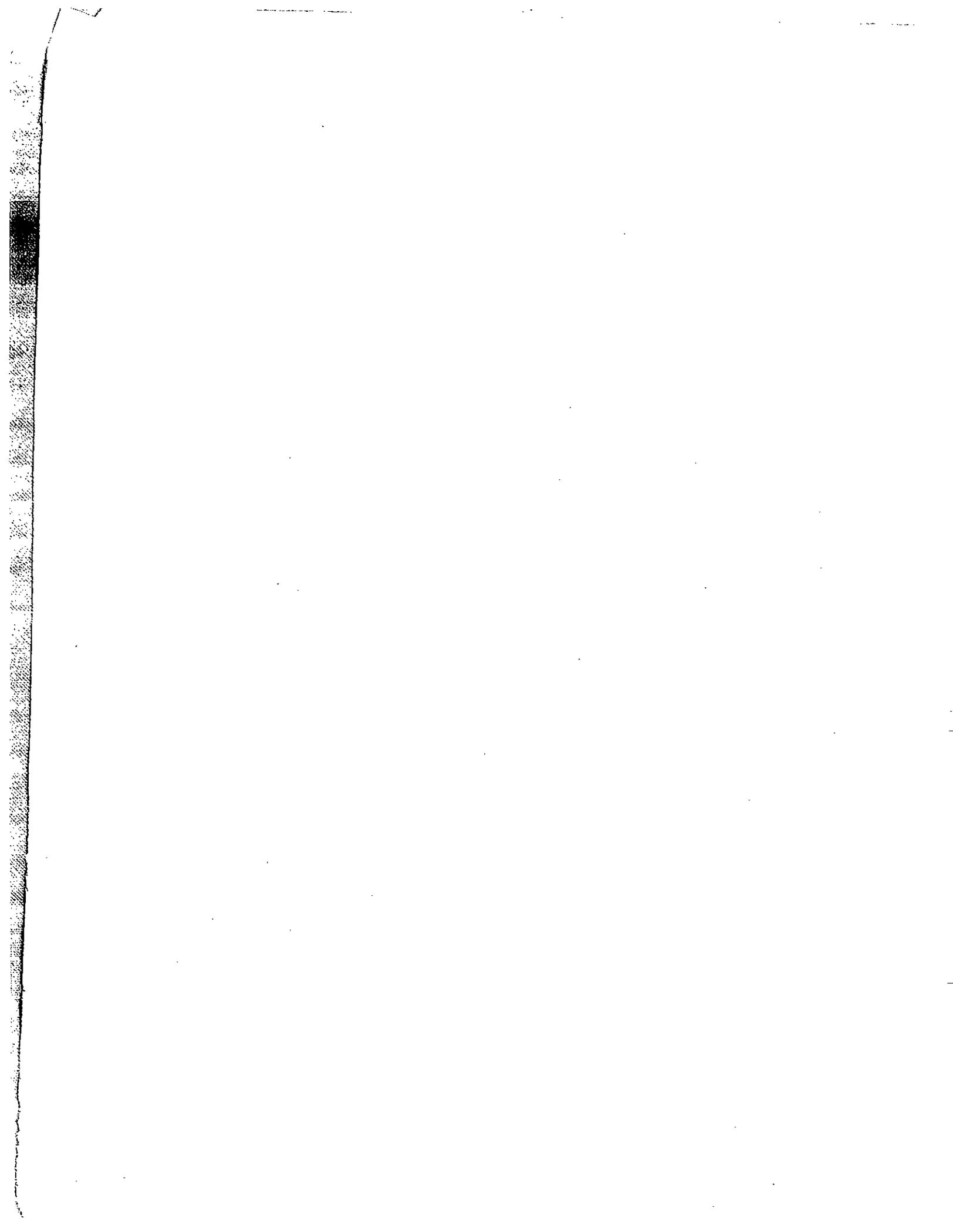
This report also includes a section call Selected Metropolitan Area Trends. Its purpose is to provide interested members of the air pollution control community, the private sector and the general public with greatly simplified air pollution information for the single year 1994. Air quality statistics are presented for each of the pollutants for all Metropolitan Statistical Areas with data in 1994.

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|------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| Lead Air Pollution Trends Emission Trends Carbon Monoxide Nitrogen Dioxide Ozone Sulfur Dioxide Total Suspended Particulates | Visibility Particulate Matter Air Pollution Air Quality Standards National Air Monitoring Stations (NAMS) Air Toxics Pollutant Standards Index | |
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| Air Pollution Trends | Particulate Matter | | |
| Emission Trends | Air Pollution | | |
| Carbon Monoxide | Air Quality Standards | | |
| Nitrogen Dioxide | National Air Monitoring Stations (NAMS) | | |
| Ozone | Air Toxics | | |
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