United States
Environmental Protection
Agency

Office of Air Quality and Standards
Air Quality Strategies and Standards Division
Research Triangle Park, NC

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United States
Environmental Protection
Agency

National Air Quality and Emissions Trends Report

2003 SPECIAL STUDIES EDITION

$$CPA = \frac{\sum xy - \frac{\sum x \sum y}{n}}{\frac{\sum (x-y)^2 + \sqrt{\left[\sum x^2 - \frac{(\sum x)^2}{n}\right]\left[\sum y^2 - \frac{(\sum y)^2}{n}\right]}}{n}}$$

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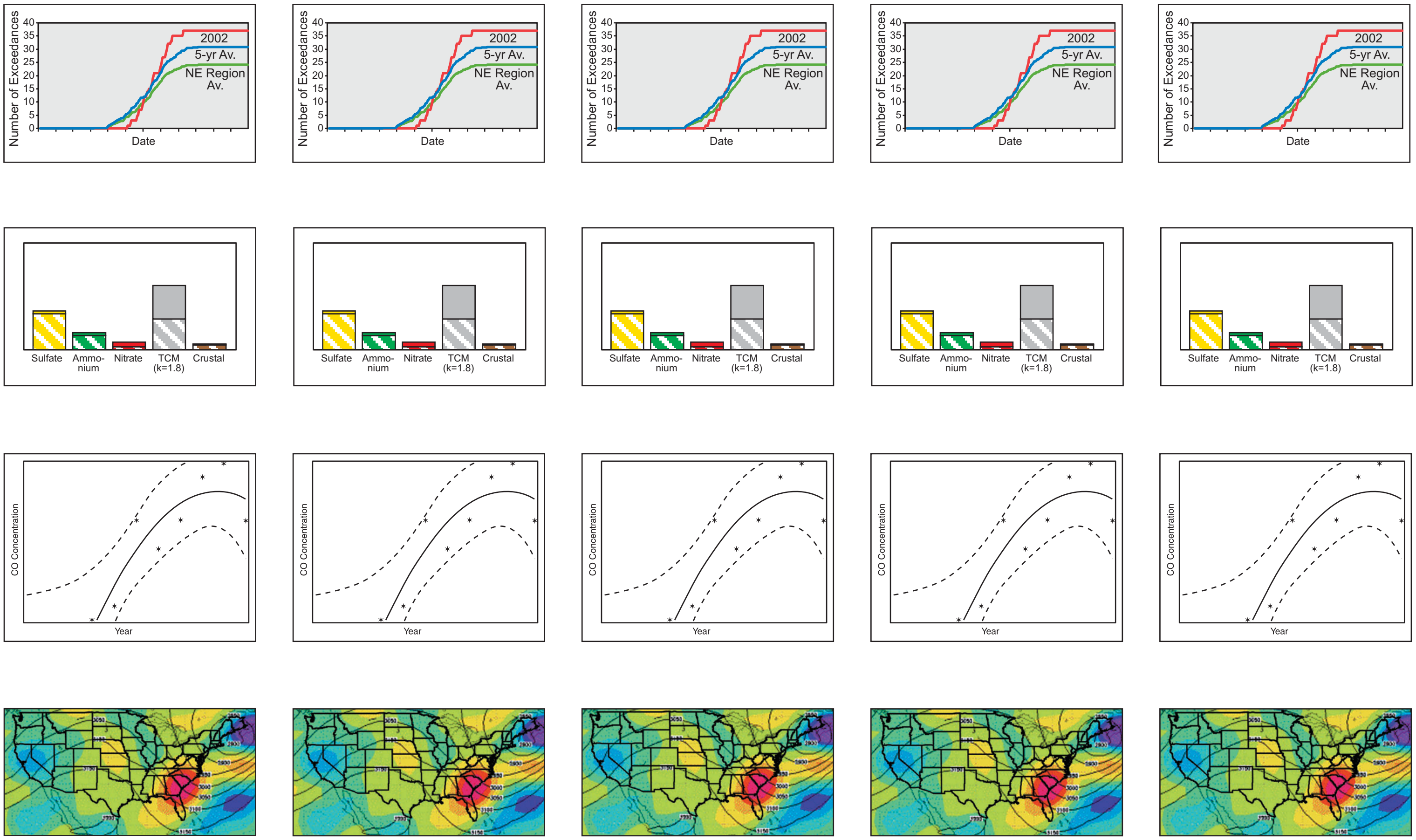

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U.S. Environmental Protection Agency
Office of Air Quality Planning and Standards
Emissions Monitoring and Analysis Division
Air Quality Trends Analysis Group
Research Triangle Park, North Carolina 27711

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About the Cover

Cover graphics reflect the range of topics addressed in the series of exploratory analyses studies included in this 2003 Special Studies Edition of the National Air Quality and Emissions Trends Report. Subjects addressed in these studies include new air quality reporting techniques, chemical speciation of $PM_{2.5}$, national spatial variation, ozone exceedances, trends in CO concentrations, and transport of Asian dust.

Disclaimer

This report has been reviewed and approved for publication by the U.S. Environmental Protection Agency's Office of Air Quality Planning and Standards. Mention of trade names or commercial products is not intended to constitute endorsement or recommendation for use.

Acknowledgments

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Preface

This is the 28th report on air pollution trends in the United States issued by the U.S. 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.

The report can be accessed via the Internet at **http://www.epa.gov/airtrends/**. AQTAG solicits comments on this report and welcomes suggestions regarding techniques, interpretations, conclusions, or methods of presentation. Comments can be submitted via the website or mailed to:

Attn: Trends Team
AQTAG (C304-01)
U.S. EPA
Research Triangle Park, NC 27711

Readers can access data from the Aerometric Information Retrieval System (AIRS) at **http://www.epa.gov/air/data/index/html** and real time air pollution data at **http://www.epa.gov/airnow/**.

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Acronyms

AIRS	Aerometric Information Retrieval System
AQI	Air Quality Index
AQS	Air Quality System
AQTAG	Air Quality Trends Analysis Group
CAA	Clean Air Act
CAAA	Clean Air Act Amendments
CASTNet	Clean Air Status and Trends Network
CEMs	continuous emissions monitors
CFC	chlorofluorocarbons
CFR	Code of Federal Regulations
CMSA	consolidated metropolitan statistical area
CO	carbon monoxide
CPA	coefficient of perfect agreement
EGR	emission gas recycle
EPA	Environmental Protection Agency
GLM	General Linear Model
HAPs	hazardous air pollutants
I/M	inspection and maintenance
IMPROVE	Interagency Monitoring of Protected Environments
MACT	maximum achievable control technology
MSA	metropolitan statistical area
MDL	minimum detectable level
NAAQS	National Ambient Air Quality Standards
NADP/NTN	National Atmospheric Deposition Program/National Trends Network
NAMS	National Air Monitoring Stations
NEI	National Emissions Inventory
NO_2	nitrogen dioxide
NO_x	nitrogen oxides
NPS	National Park Service
NTI	National Toxics Inventory
O_2	oxygen
O_3	ozone
PAMS	Photochemical Assessment Monitoring Stations
PAN	peroxyacetyl nitrate
Pb	lead
PM	particulate matter
PM_{10}	particulate matter of 10 micrometers in diameter or less
$PM_{2.5}$	particulate matter of 2.5 micrometers in diameter or less
PMSA	primary metropolitan statistical area
POC	pollutant occurrence code
ppm	parts per million
PSI	Pollutant Standards Index
RVP	Reid Vapor Pressure
SLAMS	State and Local Air Monitoring Stations
SO_2	sulfur dioxide
SO_x	sulfur oxides
STN	Speciation Trends Network
TNMOC	total non-methane organic compound
TSP	total suspended particulate
VMT	vehicle miles traveled
VOCs	volatile organic compounds
$\mu g/m^3$	micrograms per cubic meter

CHAPTER 1

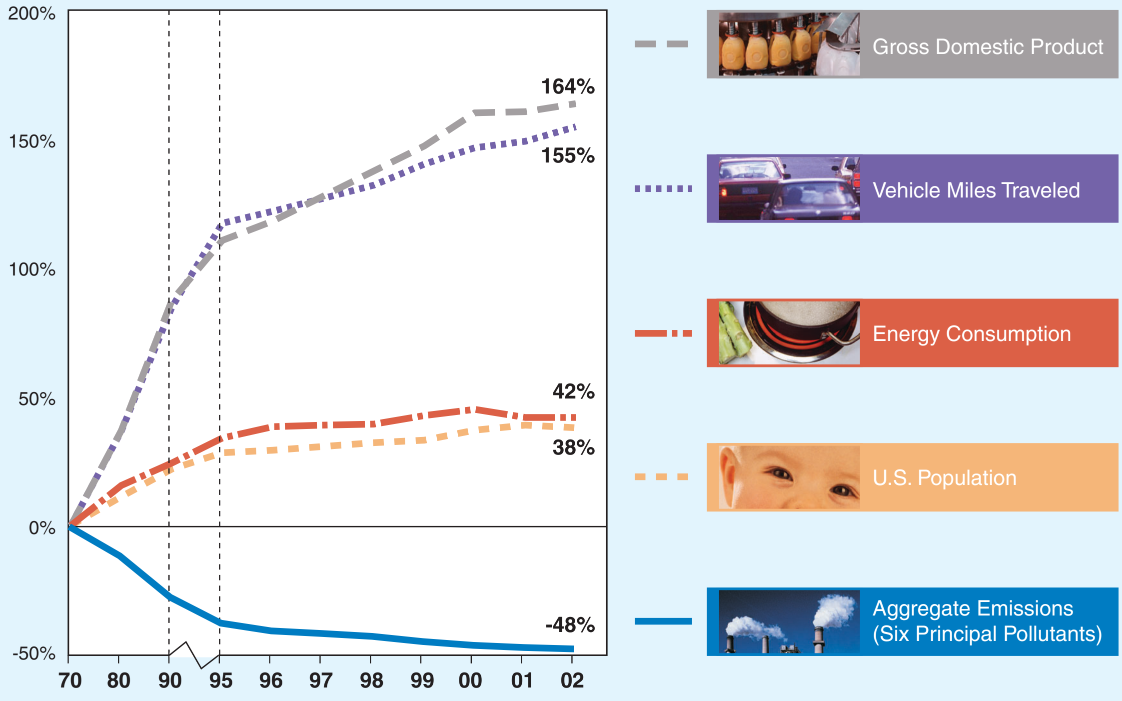
Executive Summary

http://www.epa.gov/oar/airtrends

This 28th *National Air Quality and Emission Trends Report* documents air pollution trends in the United States, focusing on the 20-year period from 1983 to 2002 or 1982 to 2001 if that is the most recent data available. This document highlights the U.S. Environmental Protection Agency's (EPA's) most recent thorough assessment of the nation's air quality, and, for the first time, brings special attention to a series of special studies of policy-relevant air quality issues (see Chapter 6 and the Special Studies section).

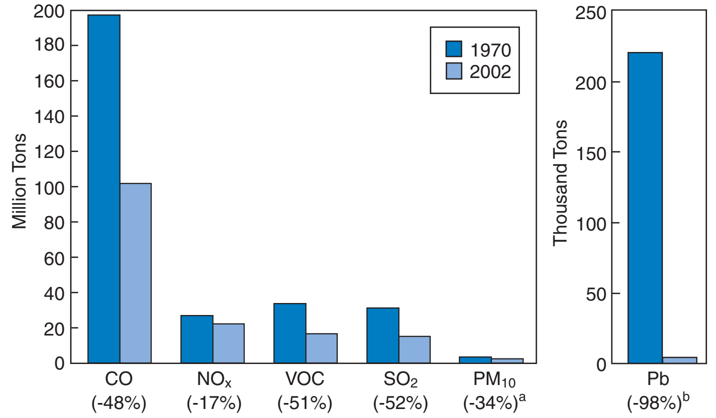
In the future, the detailed information traditionally contained in this report will be provided on the Web at **http://www.epa.gov/airtrends** to facilitate timely updates. A summary of that information will be published each summer as it has for the past several years in EPA's *Latest Findings on National Air Quality: Status and Trends*. This *National Air Quality and Emissions Trends Report* will no longer appear annually in hard copy. Expect future reports to focus on special studies as this report does.

Comparison of Growth Areas and Emissions



Between 1970 and 2002, gross domestic product increased 164 percent, vehicle miles traveled increased 155 percent, energy consumption increased 42 percent, and U.S. population increased 38 percent. At the same time, total emissions of the six principal air pollutants decreased 48 percent.

Comparison of 1970 and 2002 Emissions



Highlights

- National air quality levels measured at thousands of monitoring stations across the country have shown improvements over the past 20 years for all six principal pollutants.
- Since 1970, aggregate emissions of the six principal pollutants have been cut 48 percent. During that same time, U.S. gross domestic product increased 164 percent, energy consumption increased 42 percent, and vehicle miles traveled increased 155 percent.
- Despite this progress, about 160 million tons of pollution are emitted into the air each year in the United States. Approximately 146 million people live in counties where monitored air in 2002 was unhealthy at times because of high levels of at least one of the six principal air pollutants.
- The vast majority of areas that experienced unhealthy air did so because of one or both of two pollutants—ozone and particulate matter (PM). Important efforts to control these pollutants include implementing more protective National Ambient Air Quality Standards (NAAQS) for ozone and PM and issuing rules to reduce emissions from onroad transportation and stationary combustion sources. These rules will bring reductions in emissions over the next several years.
- Additional reductions will be needed to provide clean air in the future. For example, the Clear Skies legislation currently being considered in Congress would, if enacted, mandate reductions of particle- and ozone-forming compounds from power generators by 70 percent from current levels through a nationwide cap and trade program. This will also reduce acid rain and improve visibility. Also, in May 2003, EPA proposed nonroad diesel engine regulations that would help improve PM and ozone air quality. By 2030, this program would reduce annual emissions of PM by 95 percent, nitrogen oxides (NO_x) by 90 percent, and sulfur levels by 99 percent from these engines.
- Of the six tracked pollutants, progress has been slowest for ground-level ozone. Over the past 20 years, almost all geographic areas experienced some progress in lowering ozone concentrations. The Northeast and Pacific Southwest exhibited the greatest improvement. In particular, substantial progress seen in Los Angeles has continued through 2002. However, the national average ozone (8-hour) levels have been fairly constant in other metropolitan areas. An analysis to adjust 8-hour ozone levels in metropolitan areas to account for the influence of meteorological conditions shows the 10-year trend to be relatively unchanged. At the same time, for many national parks, the 8-hour ozone levels have increased somewhat.
- Ground-level ozone is not emitted directly into the air, but is formed in the atmosphere by the reaction of volatile organic compounds (VOCs) and NO_x in the presence of heat and sunlight. Emissions of VOCs have decreased about 40 percent over the past 20 years. However, regional-scale NO_x reductions over the same period are only 15 percent. More NO_x reductions will be necessary before more substantial ozone air quality improvements are realized. Some of these additional reductions will result from existing and recently enacted NO_x emission reduction programs and also, potentially, from the Clear Skies legislation, if enacted.
- The improvement in overall emissions since 1970 included in this year's findings reflect more accurate estimates of VOC, NO_x, PM, and carbon monoxide (CO) releases from highway vehicles and nonroad engines. Previous years' findings underreported emissions for cars and trucks in the 1970s and 1980s. This year's findings incorporate improvements in

EPA's mobile source emission models, which are based on actual emissions measurements from thousands of motor vehicles and have been peer-reviewed. The new mobile model better represents average U.S. driving habits, such as more rapid accelerations and faster highway speeds.

- Sulfates formed primarily from sulfur dioxide (SO_2) emissions from coal-fired power plants are a major component of fine particles (known as $PM_{2.5}$) in the eastern United States. SO_2 emissions decreased approximately 33 percent from 1983 to 2002. Nationally, average SO_2 ambient concentrations have been cut approximately 54 percent over the same period. Reductions in SO_2 concentrations and emissions since 1990 are primarily due to controls implemented under EPA's Acid Rain Program. Sulfate reductions since 1999 are partly responsible for some improvement in ambient fine particle concentrations, particularly in the southeastern United States.
- In many locations, EPA now has 4 years of air quality monitoring data for $PM_{2.5}$. Areas across the Southeast, Mid-Atlantic, Midwest regions, and California have air quality that is unhealthy due to particle pollution. Region-wide emissions from power plants and motor vehicles are among the largest contributors to the high $PM_{2.5}$ concentrations.
- Since 1990, many actions have been taken that will significantly reduce air toxics across the country. Specifically, regulations for facilities such as chemical plants, dry cleaners, coke ovens, and incinerators will reduce emissions of toxic air pollution by 1.5 million tons from 1990 levels. In addition, recent actions to address emissions of toxic air pollutants from motor vehicles as well as stringent standards for heavy-duty trucks, buses, and diesel fuel will eliminate 95 percent of emissions of diesel particulate matter.
- Measurements have shown that atmospheric concentrations of methyl chloroform are falling, indicating that emissions have been greatly reduced. Concentrations of other ozone-depleting substances in the upper layers of the atmosphere, like chlorofluorocarbons (CFCs), are also beginning to decrease.

Air Pollution

The Concern

Exposure to air pollution is associated with numerous effects on human health, including respiratory problems, hospitalization for heart or lung diseases, and even premature death. Children are at greater risk because they are generally more active outdoors and their lungs are still developing. The elderly and people with heart or lung diseases are also more sensitive to some types of air pollution.

Air pollution can also significantly affect ecosystems. For example, ground-level ozone has been associated with reductions of agricultural and commercial forest yields, and airborne releases of NO_x are one of the largest sources of nitrogen pollution in certain waterbodies, such as the Chesapeake Bay.

The Causes

Air pollution comes from many different sources. These include large stationary sources such as factories, power plants, and smelters; smaller sources such as dry cleaners and degreasing operations; mobile sources such as cars, buses, planes, trucks, and trains; and natural sources such as windblown dust and wildfires.

Under the Clean Air Act

EPA establishes air quality standards to protect public health, including the health of "sensitive" populations such as children, older adults, and people with asthma. EPA also sets limits to protect public welfare. This includes protecting ecosystems, including plants and animals, from harm, as well as protecting against decreased visibility and damage to crops, vegetation, and buildings.

EPA has set national air quality standards for six principal air pollutants (also called the criteria pollutants): nitrogen dioxide (NO_2), ozone (O_3), sulfur dioxide, particulate matter, carbon monoxide, and lead (Pb). Four of these pollutants (CO, Pb, NO_2, and SO_2) are emitted directly from a variety of sources. Ozone is not directly emitted, but is formed when NO_x and VOCs react in the presence of sunlight. PM can be directly emitted, or it can be formed when emissions of nitrogen oxides, sulfur oxides, ammonia, organic compounds, and other gases react in the atmosphere.

Each year EPA looks at the levels of these pollutants in the air and the amounts of emissions from various sources to see how both have changed over time and to summarize the current status of air quality.

Reporting Air Quality and Emissions Trends

Each year, air quality trends are created using measurements from monitors located across the country. The following table shows that the air quality based on concentrations

	Percent Change in Air Quality 1983-2002	 1993-2002
NO_2	-21	-11
O_3 1-h	-22	-2[a]
8-h	-14	+4[a]
SO_2	-54	-39
PM_{10}	—	-13
$PM_{2.5}$	—	-8[b]
CO	-65	-42
Pb	-94	-57

	Percent Change in Emissions 1983-2002	 1993-2002
NO_x	-15	-12
VOC	-40	-25
SO_2	-33	-31
PM_{10}[c]	-34[d]	-22
$PM_{2.5}$[c]	—	-17
CO	-41	-21
Pb[e]	-93	-5

—Trend data not available.

[a] Not statistically significant.

[b] Based on percentage change from 1999.

[c] Includes only directly emitted particles.

[d] Based on percentage change from 1985. Emission estimates prior to 1985 are uncertain.

[e] Lead emissions are included in the toxic air pollutant emissions inventory and are presented for 1982-2001.

Negative numbers indicate improvements in air quality or reductions in emissions. Positive numbers show where emissions have increased.

of the principal pollutants has improved nationally over the past 20 years (1983–2002).

EPA estimates nationwide emissions of ambient air pollutants and the pollutants they are formed from (their precursors). These estimates are based on actual monitored readings or engineering calculations of the amounts and types of pollutants emitted by vehicles, factories, and other sources. Emission estimates are based on many factors, including levels of industrial activity, technological developments, fuel consumption, vehicle miles traveled, and other activities that cause air pollution.

Methods for estimating emissions continue to improve. Today's estimates are different from last year's estimates. One reason is because this year EPA used updated, peer-reviewed models that estimate VOC, NO_x, CO, and PM emissions from highway vehicles and nonroad engines and and better represent real-world conditions, such as more rapid accelerations and faster highway speeds. The emissions estimates generated by the new highway vehicle model are derived from actual tailpipe measurements from thousands of vehicles. Another change in the reporting of emissions trends is that emissions from wildfires and prescribed burnings are not considered in the estimates of emission change. This is due to the large variability in the year-to-year levels of these emissions and the relatively small impact these distant emissions have on most monitoring locations. Because of the high degree of uncertainty in predicting emissions for these fires, their emissions have not been projected for 2002 for PM, CO, and VOCs. These emissions will be estimated when 2002 acres-burned data become available. However, fire emissions are included in the emission graphics through 2001. As a result of these reporting changes, some emissions trends have changed significantly. For example, rather than describing no change in the 20-year emission trend for CO, EPA now estimates a 41 percent decrease in CO emissions from 1983 to 2002. This estimated change in emissions is supported by the trend in CO air quality.

Emissions of air pollutants continue to play an important role in a number of air quality issues. About 160 million tons of pollution are emitted into the atmosphere each year in the United States. These emissions mostly contribute to the formation of ozone and particles, the deposition of acids, and visibility impairment.

Despite great progress in air quality improvement, approximately 146 million people nationwide lived in counties with pollution levels above the NAAQS in 2002. Out of the 230 nonattainment areas identified during the 1990 Clean Air Act Amendments designation process, 124 areas remain. In these nonattainment areas, however, the severity of air pollution episodes has decreased.

The Clean Air Act

The Clean Air Act provides the principal framework for national, state, tribal, and local efforts to protect air quality. Improvements in air quality are the result of effective implementation of clean air laws and regulations, as well as efficient industrial technologies. Under the Clean Air Act, EPA has a number of responsibilities, including

- Conducting periodic reviews of the NAAQS for the six principal pollutants that are considered harmful to public health and the environment.
- Ensuring that these air quality standards are met (in cooperation with the state, tribal, and local governments) through national standards and strategies to control air pollutant emissions from vehicles, factories, and other sources.
- Reducing emissions of SO_2 and NO_x that cause acid rain.
- Reducing air pollutants such as PM, SO_x, and NO_x, which can reduce visibility across large regional areas, including many of the nation's most treasured parks and wilderness areas.

- Ensuring that sources of toxic air pollutants that may cause cancer and other adverse human health and environmental effects are well controlled and that the risks to public health and the environment are substantially reduced.
- Limiting the use of chemicals that damage the stratospheric ozone layer in order to prevent increased levels of harmful ultraviolet radiation.

Criteria Pollutants — Metropolitan Area Trends

Out of 263 metropolitan statistical areas, 34 have significant upward trends. Of these, only those trends involving 8-hour ozone had values over the level of the air quality standard.

Of the five criteria pollutants used to calculate the Air Quality Index (AQI), only four (CO, O_3, PM_{10}, and SO_2) generally contribute to the AQI value. Nitrogen dioxide is rarely the highest pollutant measured. Although five criteria pollutants can contribute to the AQI, the index is usually driven mostly by ozone.

Criteria Pollutants — Official Nonattainment Areas

As of September 2002, there were a total of 124 classified nonattainment areas on the condensed nonattainment list (see Table A-19). The areas on the condensed list are displayed alphabetically by state. There were, as of September 2002, approximately 126 million people living in classified areas designated as nonattainment for at least one of the criteria pollutants.

Air Toxics

EPA has developed a National-Scale Air Toxics Assessment, which is a nationwide analysis of air toxics. The assessment uses computer modeling of the 1996 National Emissions Inventory (NEI) air toxics data as the basis for developing health risk estimates for 33 toxic air pollutants (a subset of the Clean Air Act's list of 188 air toxics plus diesel PM). The highest ranking 20 percent of the counties in terms of risk (622 counties) contain almost three-fourths of the U.S. population. Three air toxics (chromium, benzene, and formaldehyde) appear to pose the greatest nationwide carcinogenic risk. One air toxic, acrolein, is estimated to pose the highest potential nationwide for significant chronic adverse effects other than cancer.

Special Studies

For the first time, a series of policy-relevant studies and exploratory analyses are summarized in this report (see Chapter 6). These studies address analysis of PM concentrations, carbon monoxide trends, the number of days above AQI levels of 100 for the ozone NAAQS, the spatial variation of air pollutants, and a proposed new reporting technique for air quality data. The full reports are also included in this Special Studies edition.

CHAPTER 2

Criteria Pollutants — National Trends

http://www.epa.gov/oar/airtrends

This chapter presents national and regional trends for each of the six criteria pollutants for which the U.S. Environmental Protection Agency (EPA) has established National Ambient Air Quality Standards (NAAQS): carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), ozone (O_3), particulate matter (PM), and sulfur dioxide (SO_2). Table 2-1 lists the NAAQS for each pollutant in terms of the level and averaging time of the standard used to evaluate compliance.

There are two types of standards: primary and secondary. Primary standards protect against adverse human health effects, whereas secondary standards protect against welfare effects such as damage to crops, ecosystems, vegetation, and buildings, as well as decreased visibility. There are primary standards for all of the criteria pollutants. Some pollutants (PM and SO_2) have primary standards for both long-term (annual average) and short-term (24 hours or less) averaging times. Short-term standards most directly protect people from adverse health effects associated with peak short-term exposures to air pollution, whereas long-term standards can protect people from adverse health effects associated with short- and long-term exposures to air pollution.

Table 2-1. NAAQS in Effect as of December 2002

	Primary Standard (Health-Related)		Secondary Standard (Welfare-Related)	
Pollutant	**Type of Average**	**Standard Level Concentration**[a]	**Type of Average**	**Standard Level Concentration**[a]
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	
	4th Maximum Daily[d] 8-hour Average	0.08 ppm (157 µg/m^3)	Same as Primary Standard	
PM_{10}	Annual Arithmetic Mean	50 µg/m^3	Same as Primary Standard	
	24-hour[e]	150 µg/m^3	Same as Primary Standard	
$PM_{2.5}$	Annual Arithmetic Mean[f]	15 µg/m^3	Same as Primary Standard	
	24-hour[g]	65 µg/m^3	Same as Primary Standard	
SO_2	Annual Arithmetic Mean	0.03 ppm (80 µg/m^3)	3-hour[b]	0.50 ppm (1,300 µg/m^3)
	24-hour[b]	0.14 ppm (365 µg/m^3)		

[a] Parenthetical value is an approximately equivalent concentration. (See *40 CFR* Part 50.)

[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 1, as determined according to Appendix H of the Ozone NAAQS.

[d] Three-year average of the annual 4th highest daily maximum 8-hour average concentration.

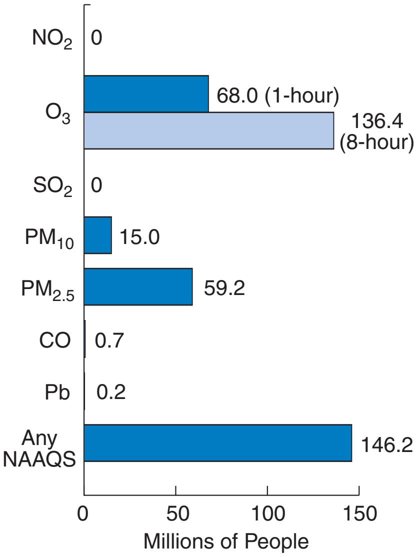
[e] The short-term (24-hour) standard of 150 µg/m^3 is not to be exceeded more than once per year on average over 3 years.

[f] Spatially averaged over designated monitors.

[g] The form is the 98th percentile.

Secondary standards have been established for each criteria pollutant except CO. Secondary standards are identical to the primary standards, with the exception of the one for SO_2. As Figure 2-1 shows, approximately 146 million people in the United States reside in counties that did not meet the primary standard for at least one of the criteria pollutants for the single year 2002.

Figure 2-1. Number of people living in counties with air quality concentrations above the level of NAAQS in 2002.



The trends information presented in this chapter is based on two types of data: ambient concentrations and emissions estimates. Ambient concentrations are measurements of pollutant concentrations in the ambient air from monitoring sites across the country. This year's report contains trends data accumulated between 1983 and 2002 on the criteria pollutants at thousands of monitoring stations located throughout the United States. For some pollutants, 2002 data are provided; for other pollutants (e.g., lead), 2001 data are reported. In each case, the most recent, complete data are used, with the relevant years clearly noted. The trends presented here are derived from the composite average of these direct measurements. The averaging times and air quality statistics used in the trends calculations relate directly to the NAAQS.

The second type of data presented in this chapter are national emissions estimates. These are based largely on engineering calculations of the amounts and kinds of pollutants emitted by automobiles, factories, and other sources over a given period. In addition, some emissions estimates are based on measurements from continuous emissions monitors (CEMs) that have been installed at major electric utilities to measure actual emissions. The emissions data summarized in this chapter and in Appendix A were obtained from the National Emission Inventory data located at **http://www.epa.gov/ttn/chief**.

Methods for estimating emissions continue to evolve. For example, the emissions data presented here reflect the use of new models for estimating volatile organic compounds (VOCs), nitrogen oxides (NO_x), and CO emissions from highway vehicles and nonroad engines. Also, emissions from wildfires and prescribed burning have not been projected for 2002 for PM, CO, and VOCs, due to the high degree of uncertainty in predicting emissions for these fires. For a complete description of the methodology changes for calculating emissions, see Appendix B.

Changes in ambient concentrations do not always match changes in national emissions estimates, for several reasons. 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, whereas total emissions in rural areas may 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 O_3 are caused by VOC emissions as well as NO_x emissions.

Third, the amount of some pollutants measured at monitoring locations depends on what chemical reactions, if any, occur in the atmosphere during the time it takes the pollutant to travel from its source to the monitoring station.

Fourth, meteorological conditions often control the formation and buildup of pollutants in the ambient air. For example, peak ozone concentrations typically occur during hot, dry, stagnant summertime conditions. CO is predominantly a cold weather problem. Also, the amount of rainfall can affect particulate matter levels.

Fifth, emissions estimates have uncertainties and may not reflect actual emissions. In some cases, estimation methods are not consistent across all years presented in this report.

For a more detailed discussion of the methodology used to compute the trend statistics in this chapter, please refer to Appendix B.

Carbon Monoxide

Air Quality Concentrations		
1983–02	65%	decrease
1993–02	42%	decrease

Emissions		
1983–02	41%	decrease
1993–02	21%	decrease

Worth Noting

- Nationally, carbon monoxide (CO) levels for 2002 are the lowest recorded in the past 20 years and improvement is consistent across all regions of the country.
- All of the original 42 areas designated nonattainment for the 8-hour CO NAAQS in 1991 met the CO NAAQS in 2001–2002.
- However, three additional areas failed to meet the CO NAAQS in 2001–2002.

Nature and Sources

Carbon monoxide is a colorless and odorless gas, formed when carbon in fuel is not burned completely. It is a component of motor vehicle exhaust, which contributes about 60 percent of all CO emissions nationwide. Nonroad vehicles account for the remaining CO emissions from transportation sources. High concentrations of CO generally occur in areas with heavy traffic congestion. In cities, as much as 95 percent of all CO emissions may come from automobile exhaust. Other sources of CO emissions include industrial processes, nontransportation fuel combustion, and natural sources such as wildfires. Peak CO concentrations typically occur during the colder months of the year when CO automotive emissions are greater and nighttime inversion conditions (where air pollutants are trapped near the ground beneath a layer of warm air) are more frequent.

Health Effects

CO enters the bloodstream through the lungs and reduces oxygen delivery to the body's organs and tissues. The health threat from levels of CO sometimes found in the ambient air is most serious for those who suffer from cardiovascular disease such as angina pectoris. At much higher levels of exposure not commonly found in ambient air, CO can be poisonous, and even healthy individuals may be affected. Visual impairment, reduced work capacity, reduced manual dexterity, poor learning ability, and difficulty in performing complex tasks are all associated with exposure to elevated CO levels.

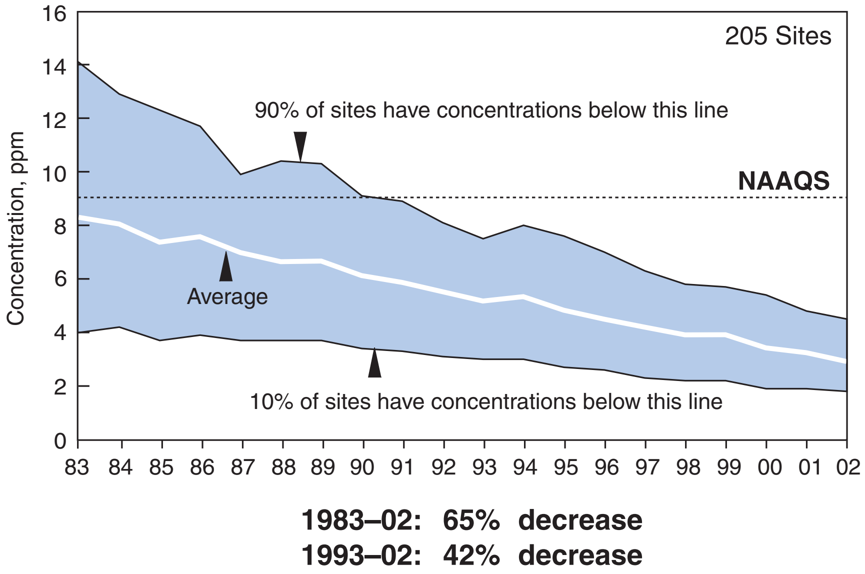
Primary Standards

There are two primary NAAQS for ambient CO: a 1-hour average of 35 ppm and an 8-hour average of 9 ppm. These concentrations are not to be exceeded more than once per year. There currently are no secondary standards for CO.

National Air Quality Trends

Nationally, CO concentrations have consistently declined over the past 20 years. Figure 2-2 reveals a 65 percent improvement in composite average ambient CO concentrations from 1983 to 2002 and a 42 percent reduction over the past 10 years.[1] Following an upturn in 1994, the nation experienced year-to-year reductions in peak 8-hour CO concentrations through the remainder of the decade. In fact, the 2002 CO levels were the lowest recorded during the past 20 years. Exceedances of the 8-hour CO NAAQS (which are simply a count of the number of times the level of the standard is exceeded) have declined. In fact, all of the original 42 areas designated nonattainment for the 8-hour CO NAAQS in 1991 met the CO NAAQS in 2001–2002. However, three additional areas failed to meet the CO NAAQS in 2001–2002. This improvement occurred despite a 23 percent increase in vehicle miles traveled in the United States during the past 10 years.

Figure 2-2. CO air quality, 1983–2002, based on annual second maximum 8-hour average.



1983–02: 65% decrease
1993–02: 42% decrease

Long-term reductions in ambient CO concentrations have been measured across all monitoring environments—rural, suburban, and urban sites. Figure 2-3 shows that, on average, urban monitoring sites record higher CO concentrations than do suburban sites, with the lowest levels found at four rural sites. During the past 20 years, the 8-hour CO concentrations decreased 44 percent at 4 rural monitoring sites, 60 percent at 89 suburban sites, and 63 percent at 116 urban sites.

Regional Air Quality Trends

The map in Figure 2-4 shows regional trends in ambient CO concentrations during the past 20 years, 1982 to 2001. All 10 EPA Regions recorded 20-year improvements in CO levels as measured by the regional composite mean concentrations. Significant 20-year concentration reductions of 50 percent or more were evidenced across the nation.

National Emissions Trends

Figure 2-5 shows that the transportation category, composed of onroad and nonroad sources, accounted for 82 percent of the nation's total CO

Figure 2-3. Trend in second maximum nonoverlapping 8-hour average CO concentrations by type of location, 1982–2001.

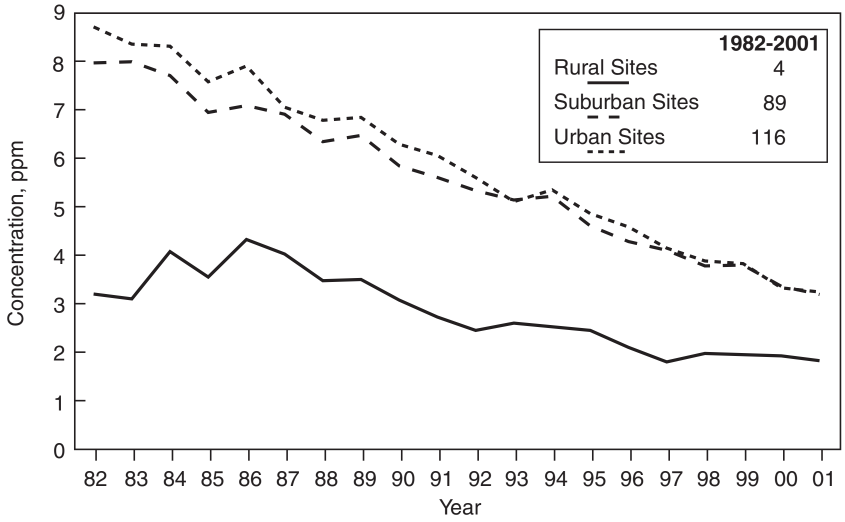
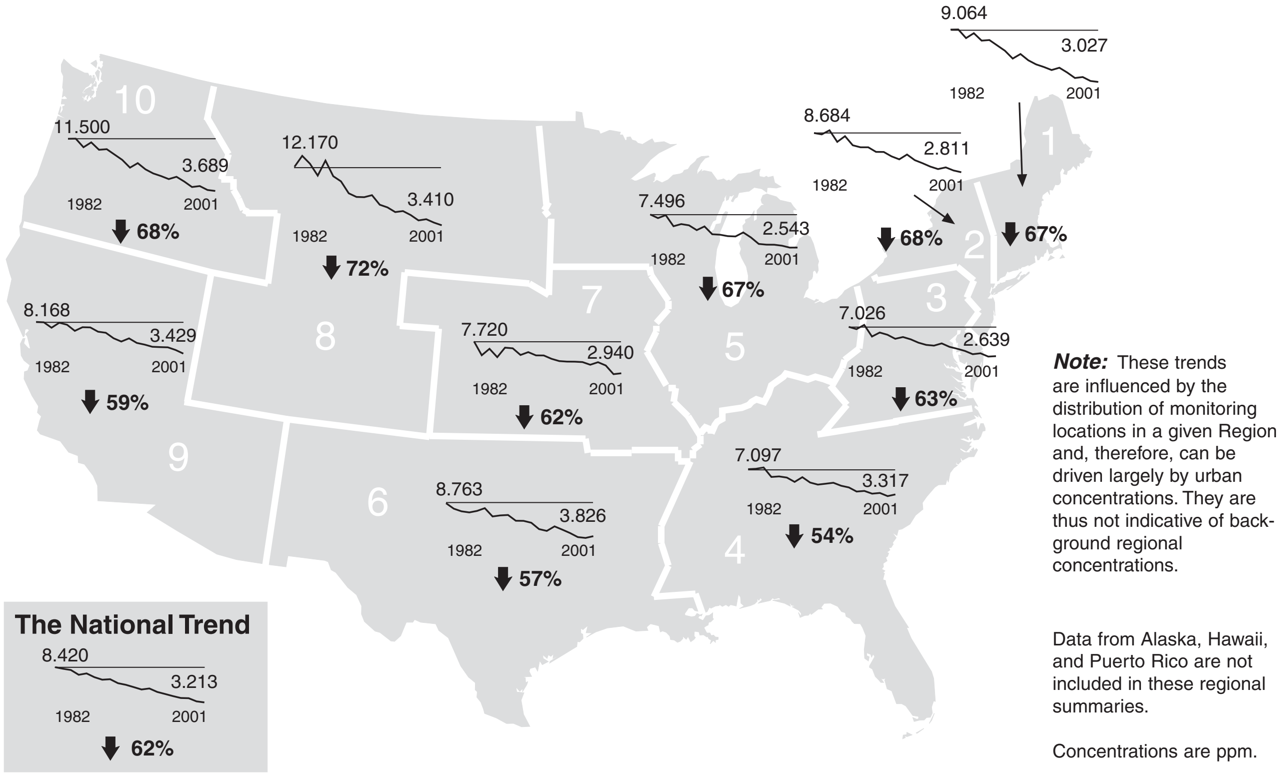


Figure 2-4. Trend in CO second maximum nonoverlapping 8-hour concentrations by EPA Region, 1982–2001.



Note: These trends are influenced by the distribution of monitoring locations in a given Region and, therefore, can be driven largely by urban concentrations. They are thus not indicative of background regional concentrations.

Data from Alaska, Hawaii, and Puerto Rico are not included in these regional summaries.

Concentrations are ppm.

emissions in 2002. Figure 2-6 presents the broad geographic distributions of 2001 CO emissions based on the tonnage per square mile for each county. This visualization clearly shows that the eastern third of the country and the West Coast emitted more CO (on a density basis) than did the western two-thirds of the continental United States. As a result of automotive emissions control programs, CO emission have decreased 41 percent the past 20 years (1983 to 2002) and 21 percent in the past 10 years (1993 to 2002) despite a 155 percent increase in VMT since 1970 (see Figure 2-7). However, emissions from all transportation sources have decreased only 10 percent over the same period, primarily due to an increase in offroad emissions that has offset the gains realized in reductions of onroad vehicle emissions.

Figure 2-5. CO emissions by source category, 2002.

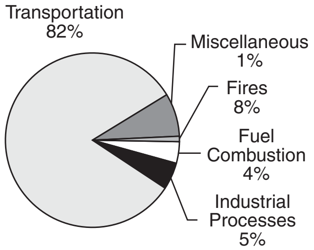


Figure 2-6. Density map of 2001 CO emissions, by county.

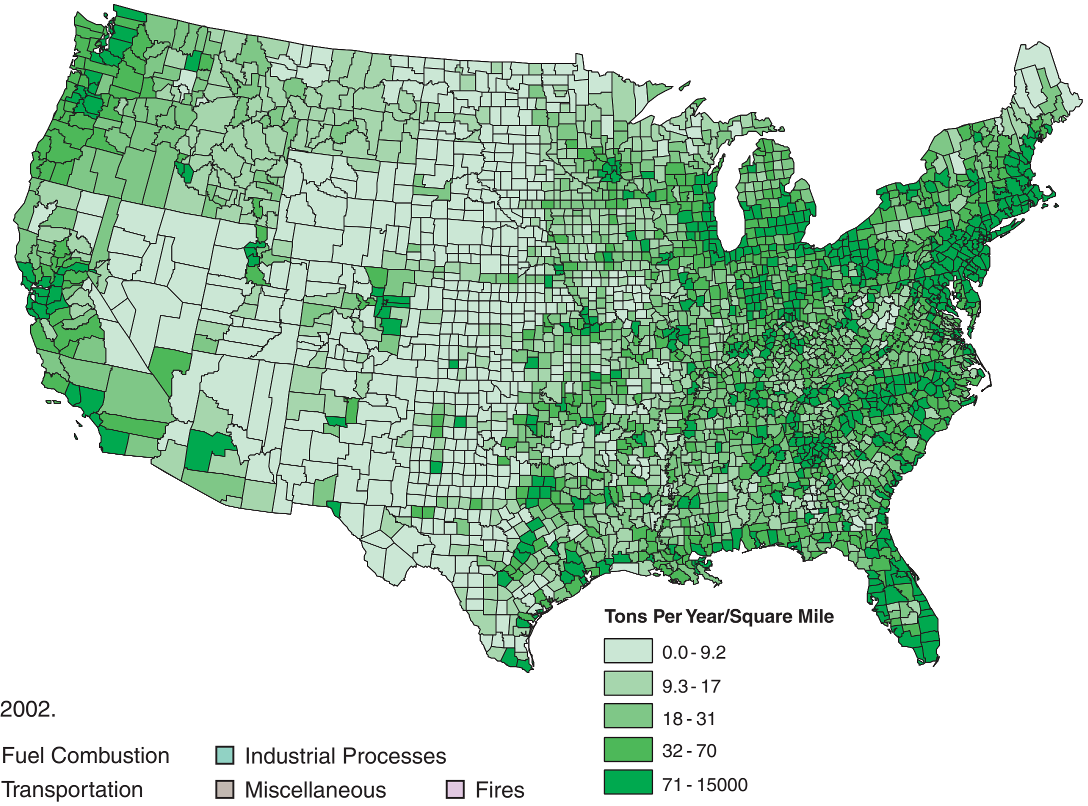
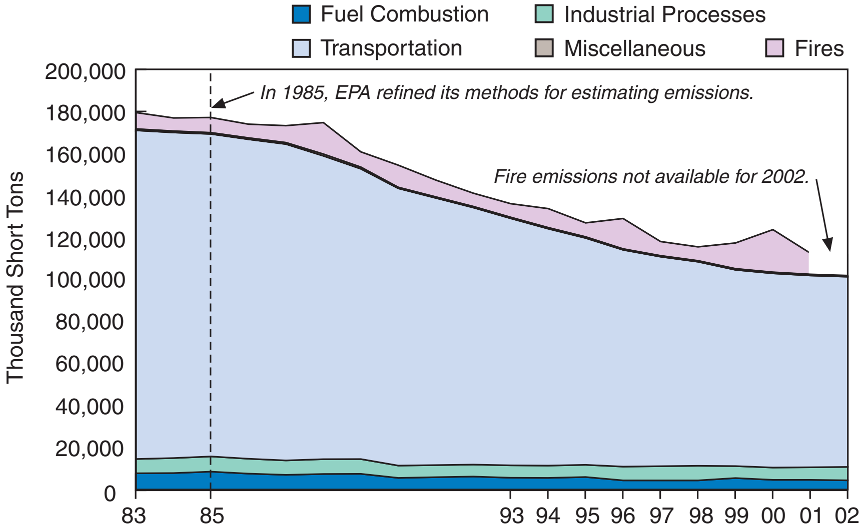


Figure 2-7. CO emissions, 1983–2002.



1983–02: 41% decrease[a]
1993–02: 21% decrease

Note: Emission estimation methods and data sources have evolved over time, resulting in some inconsistency in estimates in different years. In the methods used for this report, the significant changes have occurred between 1984 and 1986 and between 1995 and 1996, although not all source types were affected. More explanation is provided in Appendix B.

[a] Emissions trends data are not available for 1983; thus, the 20-year trend was interpolated based on emissions data for 1980 and 1985.

Table 2-2 lists some of the major milestones in the control of emissions from automobiles, starting with the Clean Air Act (the Act) of 1970. At the national level, these measures, which have led to reductions in emissions of CO as well as other pollutants, include establishing national standards for tailpipe emissions, new vehicle technologies, and clean fuels programs. State and local emissions reduction measures include inspection and maintenance (I/M) programs and transportation management programs.

In the area of clean fuels, the 1990 Clean Air Act Amendments (1990 Amendments) require oxygenated gasoline programs in several regions of the country during the winter months. Under the program regulations, a minimum oxygen content (2.7 percent by weight) is required in gasoline to ensure more complete fuel combustion.[2,3] Of the 36 CO nonattainment areas that initially implemented the program in 1992, 15 areas participated in the program during 2000.[4]

2001 Air Quality Status

The map in Figure 2-8 shows the variations in CO concentrations across the country in 2001. The air quality indicator is the largest annual second maximum 8-hour CO concentration measured at any site 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 in Figure 2-8 correspond to the colors of the concentration ranges displayed in the map legend. The only areas not meeting the 8-hour CO NAAQS in 2001–2002 are Birmingham, AL, Calexico, CA, and Weirton, WV.

Table 2-2. Milestones in motor vehicle emission control.

1970	New Clean Air Act sets auto emissions standards.
1971	Charcoal canisters appear to meet evaporative standards.
1973	Emission gas recycle (EGR) valves appear to meet NO_x standards.
1974	Fuel economy standards are set.
1975	The first catalytic converters appear for hydrocarbon, CO. Unleaded gas appears for use in catalyst-equipped cars.
1981	Three-way catalysts with onboard computers and O_2 sensors appear.
1983	Inspection and maintenance programs (I/M) programs are established in 64 cities.
1989	Fuel volatility limits are set for Reid Vapor Pressure (RVP).
1990	The 1990 Amendments set new tailpipe standards.
1992	Oxyfuel introduced in cities with high CO levels.
1993	Limits set on sulfur content of diesel fuel.
1994	Phase-in begins of new vehicle standards and technologies.
1995	Onboard diagnostic systems in 1996 model-year cars.
1995	Phase I Federal Reformulated Gasoline sales begin in worst ozone nonattainment areas.
1998	Sales of 1999 model-year California emissions-equipped vehicles begin in the Northeast.

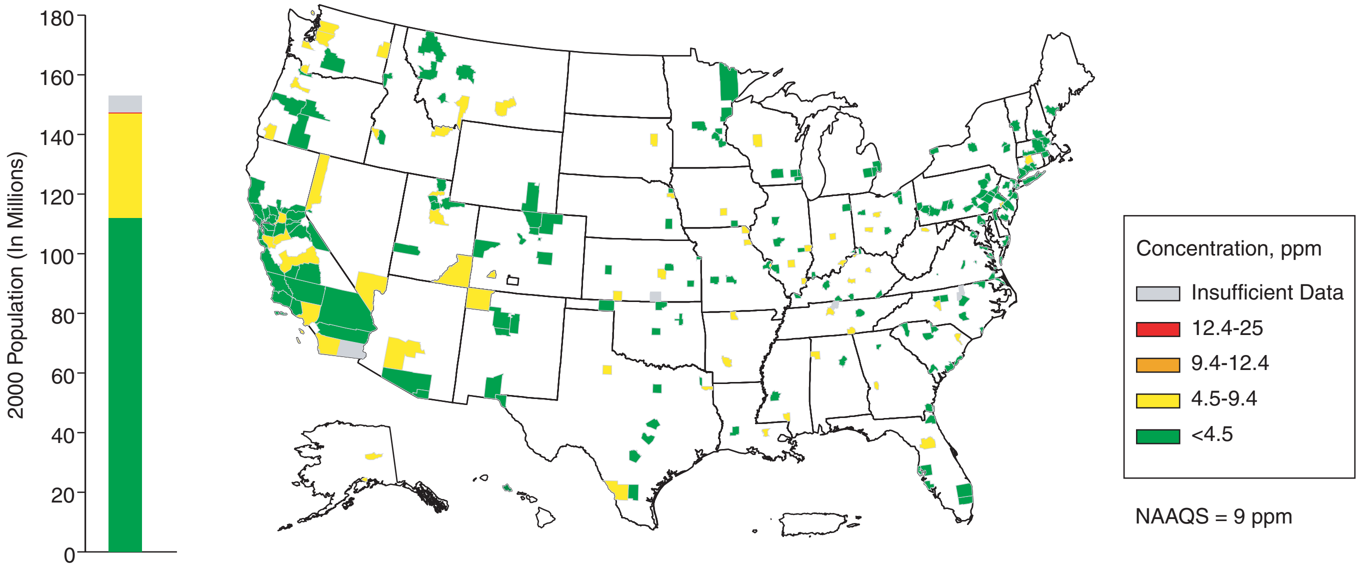


Figure 2-8. Highest second maximum nonoverlapping 8-hour average CO concentration by county, 2001.

Lead

Air Quality Concentrations

1983–02	94%	decrease
1993–02	57%	decrease

Emissions

1982–02	93%	decrease
1993–02	5%	decrease

Worth Noting

- The lead (Pb) monitoring strategy now focuses on emissions from point sources since large reductions in long-term Pb emissions from transportation sources have occurred due to phase-out of leaded gasoline.

Nature and Sources

In the past, automotive sources were the major contributor of lead emissions to the atmosphere. As a result of EPA's regulatory efforts to reduce the content of lead in gasoline, however, the contribution of air emissions of lead from the transportation sector, and particularly the automotive sector, has greatly declined over the past two decades. Today, industrial processes, primarily metals processing, are the major source of lead emissions to the atmosphere. The highest air concentrations of lead are usually found in the vicinity of smelters and battery manufacturers.

Health and Environmental Effects

Exposure to lead occurs through ingestion of lead in food, water, soil, or dust and through inhalation. It accumulates in the blood, bones, and soft tissues. Lead can also adversely affect the kidneys, liver, nervous system, and other organs. Excessive exposure to lead 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 human body. Additionally, even low levels of Pb exposure may cause central nervous system damage in fetuses and children. Recent studies show that neurobehavioral changes may result from Pb exposure during the child's first years of life and that lead may be a factor in high blood pressure and subsequent heart disease.

Airborne lead can also have adverse impacts on the environment. Wild and domestic grazing animals may ingest lead that has deposited on plant or soil surfaces or that has been absorbed by plants through leaves or roots. Animals, however, do not appear to be more susceptible or more sensitive to adverse effects from lead than are humans. Therefore, the secondary standard for lead is identical to the primary standard.

At relatively low concentrations (2–10 µg/m^3), lead can inhibit plant growth and result in a shift to more tolerant plant species growing near roadsides and stationary source emissions. Although the majority of soil lead becomes bound so that it is insoluble, immobile, and biologically unavailable, elevated soil Pb concentrations have been observed to cause shifts in the microbial community (fungi and bacteria), reduced numbers of invertebrates, and reduced decomposition and nitrification rates and has altered other soil parameters. Because lead remains in the soil, soil concentrations continue to build over time, even when deposition rates are low. Thus, another concern is that acid precipitation may be increasing the mobility and bioavailability of soil lead in some places.

Lead enters water systems mainly through urban runoff, sewage effluents, and industrial waste streams. Most of this lead is rapidly complexed and bound in the sediment. However, water Pb concentrations can reach levels that are associated with increased mortality and impaired reproduction in aquatic invertebrates and blood and neurological changes in fish. Because of these effects, there continue to be implications for the long-term impact of lead on ecosystem function and stability. (See also Chapter 5 in this report as well as the December 1990 Office of Air Quality Planning and Standards Staff Paper [EPA-450/2-89-022].)

Primary and Secondary Standards

The primary as well as secondary NAAQS for lead is a quarterly average concentration not to exceed 1.5 µg/m^3.

National Air Quality Trends

The statistic used to track ambient lead air quality is the maximum quarterly mean concentration for each year. From 1982 to 2001, a total of 39 ambient Pb monitors met the trends data completeness criteria, and a total of 96 ambient Pb monitors met the trends data completeness criteria for the 10-year period from 1992 to 2001. Point-source-oriented monitoring data were omitted from all ambient trends analysis presented in this section to avoid masking the underlying urban trends.

Figure 2-9 indicates that between 1993 and 2002, maximum quarterly average Pb concentrations decreased 57 percent at population-oriented monitors. Between 1999 and 2002, national average Pb concentrations (approaching the minimum detectable level) remained unchanged.

The effect of the conversion to unleaded gasoline usage in vehicles on ambient Pb concentrations is most evident when viewed over a longer period, such as that illustrated in Figure 2-9. Between 1983 and 2002, ambient monitor data indicate that concentrations of lead declined 94 percent. This large decline tracks well with overall Pb emissions, which also declined approximately 93 percent between 1983 and 2002.

Figure 2-10 examines urban, rural, and suburban 20-year trends separately. The overall downward trend in Pb concentrations can be noted for all locations from 1982 to 2001.

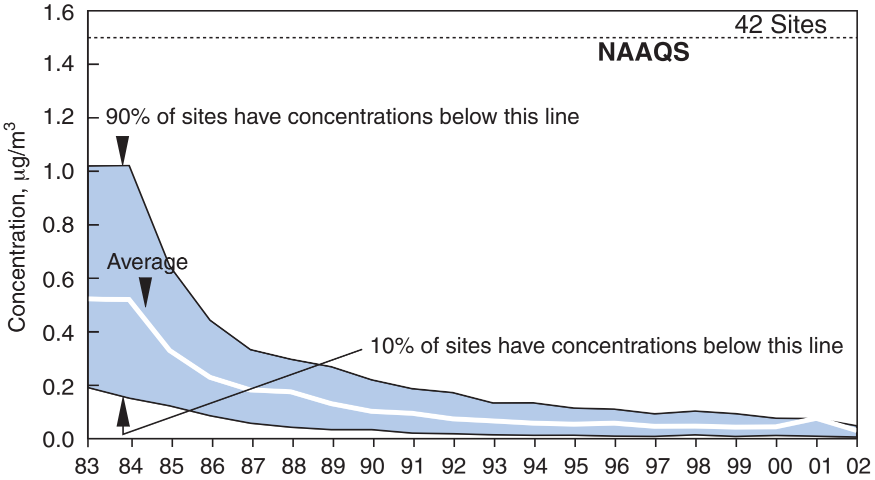
National Emission Trends

For stationary sources, Pb emissions for past trends reports have been estimated for fuel combustion and industrial sources based on current data for national activity, but with emission factor and control efficiency estimates that have not been updated with any new information in many years. When gasoline contained lead, mobile sources were by far the largest contributor to Pb emissions, and approximations for stationary sources did not introduce much uncertainty into the understanding of the total emissions trend. Now, most lead is emitted by industrial facilities, particularly by primary and secondary metals processing plants. Moreover, many of these facilities have been the focus of control and compliance efforts in recent years. There are also some issues of possible double counting and inventory gaps.

For example, about 10 percent of Pb emissions estimated in previous reports were from miscellaneous fuel combustion, the only element of which is the combustion of used motor oil containing lead picked up from gasoline. This estimate should be viewed with caution, as the reduction factor of 90 percent used for this source category to reflect the end of leaded gasoline for highway use seems inconsistent with a much greater reduction factor used for exhaust emissions from vehicles. Also, the emission estimates for the sources that burn this fuel (e.g., cement kilns) may double count some of the Pb emissions. Conversely, the estimate of zero Pb emissions from nonroad gasoline engines is inconsistent with the assumption for highway vehicles that cross-contamination with leaded aviation gasoline causes unleaded fuel to still have small amounts of Pb content on average. Aviation gasoline is not regulated for Pb content and can use significant amounts of lead to comply with octane requirements.

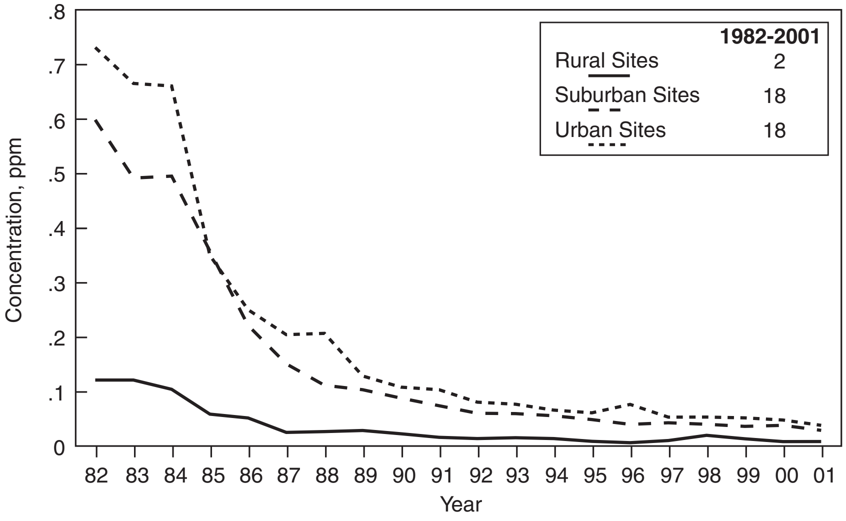
EPA believes that the uncertainties in the past top-down approach for

Figure 2-9. Pb air quality, 1983–2002, based on annual maximum quarterly average.



1983–02: 94% decrease
1993–02: 57% decrease

Figure 2-10. Maximum quarterly mean Pb concentration trends by location (excluding sites designated as point-source oriented), 1982–2001.



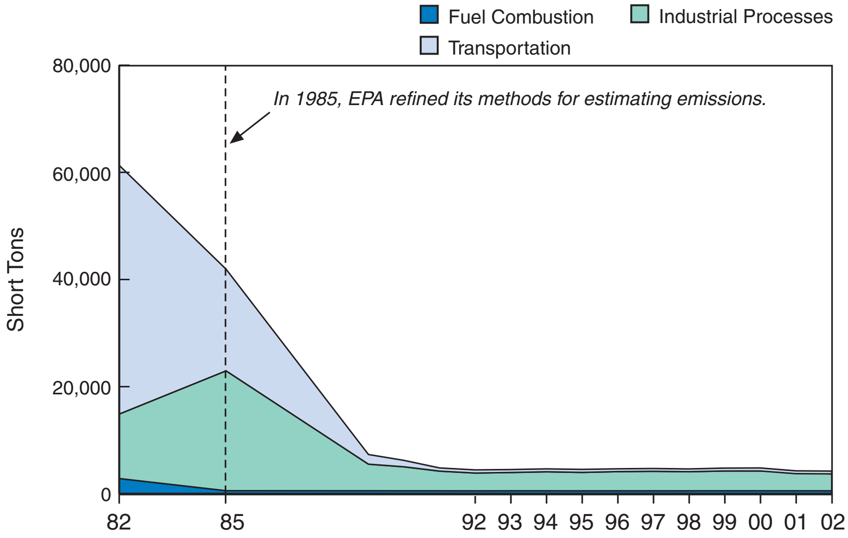
fuel combustion and industrial sources are greater than the actual year-to-year variation in emissions. Consequently, we have not repeated it for this report. The Pb emission estimates for these sources presented here are the same as in the *1999 National Air Quality and Emissions Trends Report*, with the previous estimates for 2000 repeated for 2001. Lead emissions for transportation sources have been adjusted for activity changes.

The preferred approach for estimating Pb emissions is to make facility-specific estimates for the source types with significant emissions, reflecting the best information on fuel and ore Pb content, control equipment, and throughput. Ideally, emission tests would be conducted. For the single year of 1996, EPA collected as many such estimates as possible from state/local air agencies, the Toxics Release Inventory, and from EPA studies in preparation for the promulgation of emission standards. A comparison of these estimates to the earlier top-down estimates suggests that Pb emissions from coal-fired utilities may have been higher in 1996 than stated in this report, depending on whether a few states have correctly estimated such emissions. Emissions of lead from other industrial sources in 1996 were somewhat lower than reported in this document for that year.

Regardless of these uncertainties, the long-term trend in Pb emissions is very clear. Because of the phase-out of leaded gasoline, Pb emissions (and concentrations) decreased sharply during the 1980s and early 1990s. There was an approximate decrease in Pb emissions of 93 percent from 1982 to 1991. Figure 2-11 indicates that total Pb emissions have stayed about the same from 1991 on. The large ambient and emission reductions in lead going from 1982 to 1991 can be largely attributed to the phasing out of leaded gasoline for automobiles. Relative to levels in the 1970s, Pb emissions in the past 10 years have been essentially constant.

Figure 2-12 shows that industrial processes were the major source of Pb emissions in 2001, accounting for 78 percent of the total. The transportation sector (which includes both onroad and nonroad sources) now accounts for only 12 percent of the total 2001 Pb emissions, with most of that coming from aircraft.

Figure 2-11. Pb emissions, 1982–2002.



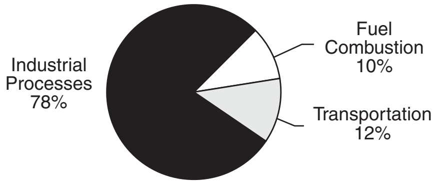
In 1985, EPA refined its methods for estimating emissions.

1982–02: 93% decrease[a]
1993–02: 5% decrease

Note: Emission estimation methods and data sources have evolved over time, resulting in some inconsistency in estimates in different years. In the methods used for this report, the significant changes have occurred between 1984 and 1986, and between 1995 and 1996, although not all source types were affected. More explanation is provided in Appendix B.

[a] Emissions trends data are not available for 1982; thus, the 20-year trend was interpolated based on emissions data for 1980 and 1985.

Figure 2-12. Pb emissions by source category, 2001.



Regional Trends

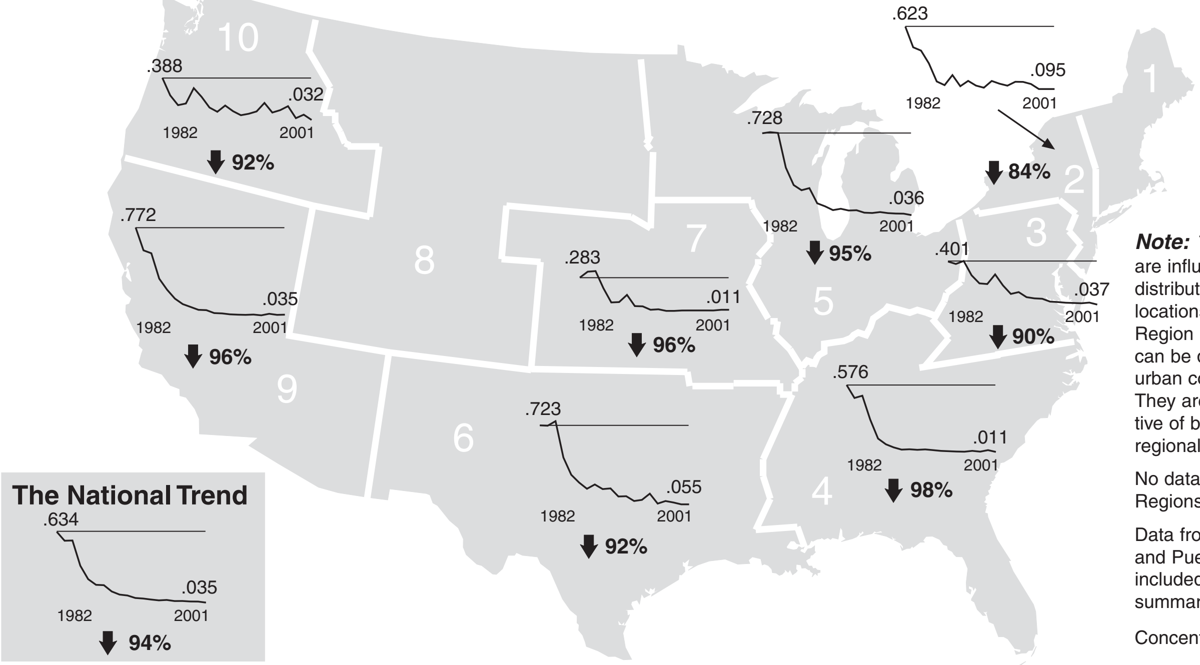
Figure 2-13 segregates the ambient trend analysis by EPA Region. Although most Regions showed large concentration reductions between 1982 and 2001, there were some intermittent upturns, including a rather large upturn in the Region 1 trends plot. Most of these "bumps" in the trends graphs can be attributed to the inherent variability and noise associated with data reported near minimum detectable levels.

2001/2002 Air Quality Status

The large reductions in long-term Pb emissions from transportation sources have changed the nature of the ambient Pb problem in the United States. Because industrial processes are now responsible for all violations of the Pb standard, the Pb monitoring strategy currently focuses on emissions from these point sources.

The map in Figure 2-14 shows the highest quarterly mean Pb concentration by county in 2001. One area, with a total population of 201,219, containing some of the point sources identified in Figure 2-14 did not meet the Pb NAAQS in 2001.

Figure 2-13. Trend in Pb maximum quarterly mean concentration by EPA Region, 1982–2001.



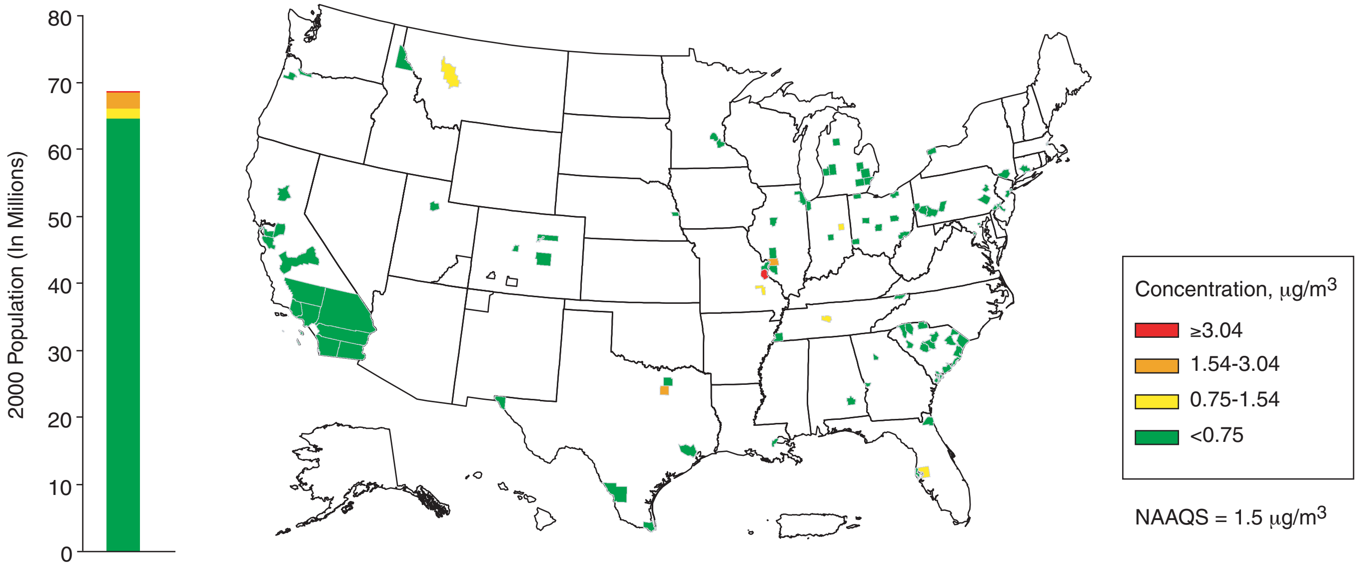
Note: These trends are influenced by the distribution of monitoring locations in a given Region and, therefore, can be driven largely by urban concentrations. They are thus not indicative of background regional concentrations.

No data were available for Regions 1 and 8.

Data from Alaska, Hawaii, and Puerto Rico are not included in these regional summaries.

Concentrations are µg/m^3.

Figure 2-14. Highest Pb maximum quarterly mean by county, 2001.



Nitrogen Dioxide

Air Quality Concentrations		
1983–02	21%	decrease
1993–02	11%	decrease

Emissions		
1983–02	15%	decrease
1993–02	12%	decrease

Worth Noting

- Over the past 20 years, nitrogen dioxide (NO_2) concentrations across the country have decreased significantly.
- All areas of the country that once violated the national air quality standard for NO_2 now meet that standard.

Nature and Sources

Nitrogen dioxide is a reddish-brown, highly reactive gas that is formed in the ambient air through the oxidation of nitric oxide (NO). Nitrogen oxides (NO_x), the term used to describe the sum of NO, NO_2, and other oxides of nitrogen, play a major role in the formation of ozone in the atmosphere through a complex series of reactions with VOCs. A variety of NO_x compounds and their transformation products occur both naturally and as a result of human activities. Anthropogenic (i.e., man-made) emissions of NO_x account for a large majority of all nitrogen inputs to the environment. The major sources of anthropogenic NO_x emissions are high-temperature combustion processes, such as those occurring in automobiles and power plants. Most NO_x from combustion sources (about 95 percent) are emitted as NO; the remainder are largely NO_2. Because NO is readily converted to NO_2 in the environment, the emissions estimates reported here assume nitrogen oxides are in the NO_2 form. Natural sources of NO_x are lightning, biological and abiological processes in soil, and stratospheric intrusion. Ammonia and other nitrogen compounds produced naturally are important in the cycling of nitrogen through the ecosystem. Home heaters and gas stoves also produce substantial amounts of NO_2 in indoor settings.

Health and Environmental Effects

Nitrogen dioxide is the most widespread and commonly found nitrogen oxide and is a matter of public health concern. The most troubling health effects associated with short-term exposures (i.e., less than 3 hours) to NO_2 at or near the ambient NO_2 concentrations seen in the United States include cough and increased changes in airway responsiveness and pulmonary function in individuals with preexisting respiratory illnesses, as well as increases in respiratory illnesses in children 5 to 12 years old.[5,6] Evidence suggests that long-term exposures to NO_2 may lead to increased susceptibility to respiratory infection and may cause structural alterations in the lungs.

Atmospheric transformation of NO_x can lead to the formation of ozone and nitrogen-bearing particles (e.g., nitrates and nitric acid). As discussed in the ozone and particulate matter sections of this chapter, exposure to both PM and O_3 is associated with adverse health effects.

Nitrogen oxides contribute to a wide range of effects on public welfare and the environment, including global warming and stratospheric ozone depletion. Deposition of nitrogen can lead to fertilization, eutrophication, or acidification of terrestrial, wetland, and aquatic (e.g., fresh water bodies, estuaries, and coastal water) systems. These effects can alter competition between existing species, leading to changes in the number and type of species (composition) within a community. For example, eutrophic conditions in aquatic systems can produce explosive algae growth leading to a depletion of oxygen in the water and/or an increase in levels of toxins harmful to fish and other aquatic life.

Primary and Secondary Standards

The level for both the primary and secondary NAAQS for NO_2 is 0.053 ppm annual arithmetic average (mean), not to be exceeded. In this report, the annual arithmetic average (mean) concentration is the metric used to evaluate and track ambient NO_2 air quality trends.

National Air Quality Trends

Since 1983, monitored levels of NO_2 have decreased 21 percent.[7] These downward trends in national NO_2 levels are reflected in all regions of the country. Nationally, average NO_2 concentrations are well below the NAAQS and are currently at the lowest levels recorded in the past 20 years. All areas of the country that once violated the NAAQS for NO_2 now meet that standard. Over the past 20 years, national emissions of NO_x have declined by almost 15 percent. Annual mean NO_2 concentrations declined in the early 1980s, were relatively unchanged during the mid-to-late 1980s, and resumed their decline in the 1990s. Figure 2-15 shows that the national composite annual mean NO_2 concentration in 2002 is 11 percent lower than that recorded in 1993. Except for 1994 and 1999, NO_2 concentrations have decreased, or remained unchanged, each year since 1989.

Figure 2-16 reveals how the trends in annual mean NO_2 concentrations vary among rural, suburban, and urban locations. The highest annual mean NO_2 concentrations are typically found in urban areas, with significantly lower annual mean concentrations recorded at rural sites.

Interestingly, as the nation has experienced these significant decreases in NO_2 concentrations, NO_x emissions are increasing, as described in more detail later in this section of the chapter. One possible explanation involves the location of the majority of the nation's NO_2 monitors. Most NO_2 monitoring sites are mobile-source-oriented sites in urban areas, and the 20-year decline in ambient NO_2 levels closely tracks the 19 percent reduction in emissions from gasoline-powered vehicles over the same time period.

Regional Air Quality Trends

The map in Figure 2-17 provides regional trends in NO_2 concentrations during the past 20 years, 1982 to 2001 (except Region 10, which does not have any NO_2 trend sites). The trends seen in the suburban and urban sites track the declining trend in NO_x emissions, as compared with the trend in rural sites. The trends statistic is the regional composite mean of the NO_2 annual mean concentrations across all sites with at least 8 years of ambient measurements. The largest reductions in NO_2 concentrations occurred in the south coast of California and parts of the Northeast and Mid-Atlantic states. Slightly smaller reductions in mean NO_2 concentrations were recorded in New England, the Southeast, and the Southwest. Interestingly, NO_2 concentrations were unchanged in the Midwest states and have actually increased in the North Central states.

Figure 2-15. NO_2 air quality, 1982–2001, based on annual arithmetic average.

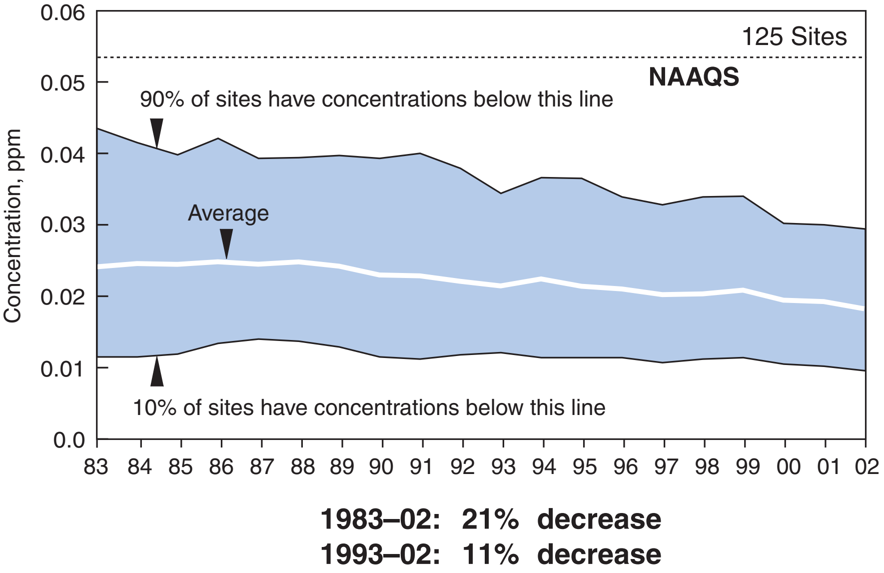


Figure 2-16. Trend in annual mean NO_2 concentrations by type of location, 1982–2001.

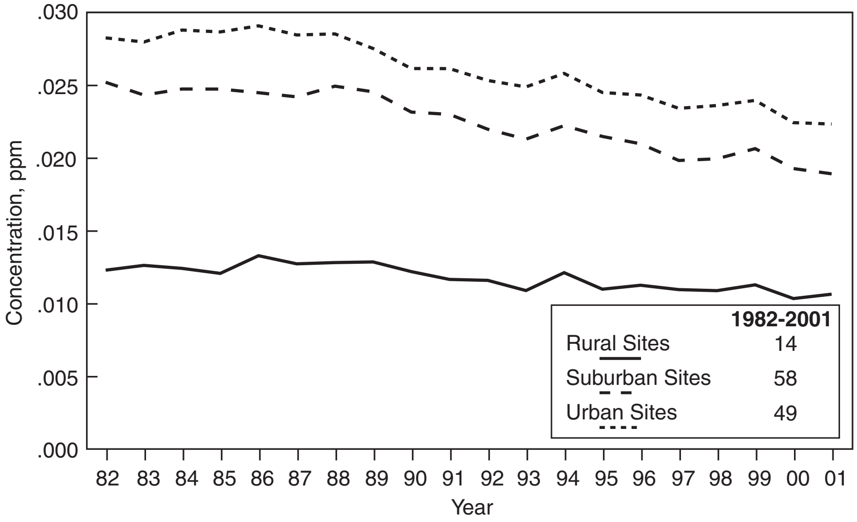
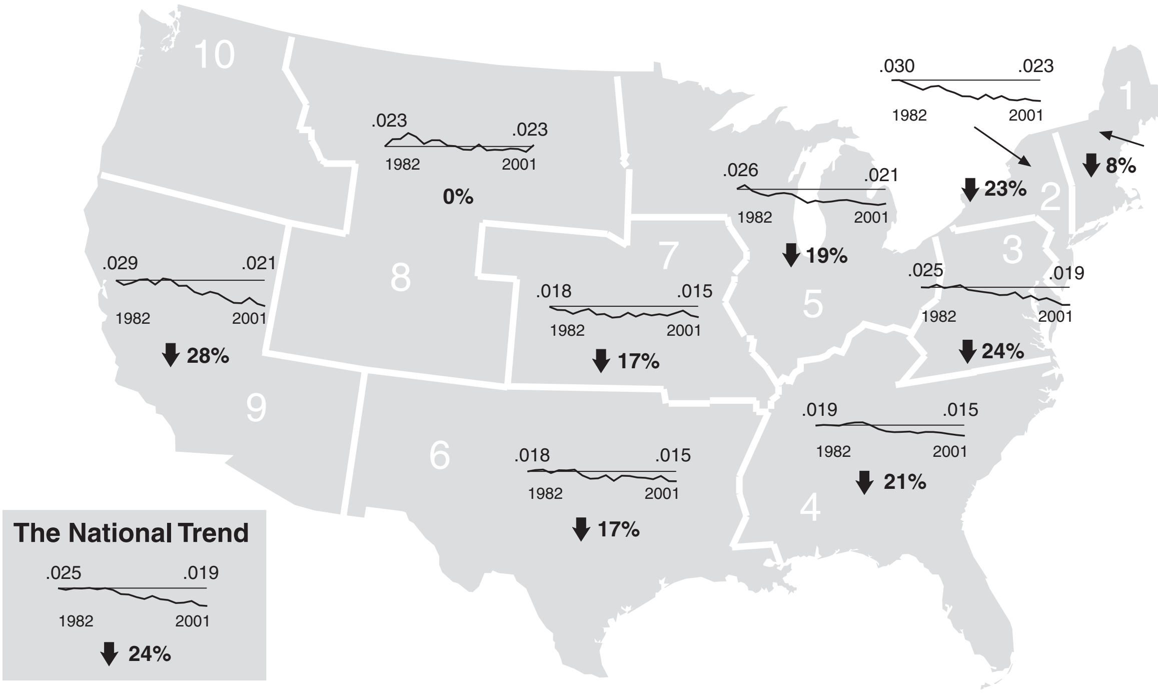


Figure 2-17. Trend in NO_2 maximum quarterly mean concentration by EPA Region, 1982–2001.



Note: These trends are influenced by the distribution of monitoring locations in a given Region and, therefore, can be driven largely by urban concentrations. They are thus not indicative of background regional concentrations.

Data from Alaska, Hawaii, and Puerto Rico are not included in these regional summaries.

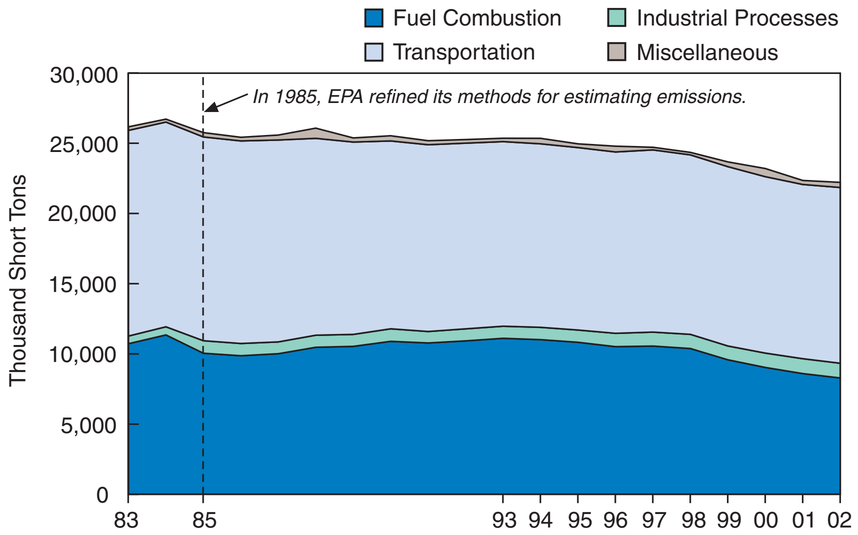
Concentrations are ppm.

This increase coincides with increases in NO_x emissions from transportation (both onroad and nonroad) as well as power plants in selected states with NO_2 monitors in these areas.

National Emissions Trends

The reduction in emissions for NO_x shown in Figure 2-18 differs from the increase in NO_x emissions reported in previous editions of this report. These emission trends reflect new and improved emission estimates for highway vehicles and nonroad engines. While NO_x emissions are declining overall, emissions from some sources such as nonroad engines have actually increased since 1983. These increases are of concern given the significant role NO_x emissions play in the formation of ground-level ozone (smog) as well as other environmental problems like acid rain and nitrogen loadings to

Figure 2-18. NO_x emissions, 1983–2002.



1983–02: 15% decrease[a]
1993–02: 12% decrease

Note: Emission estimation methods and data sources have evolved over time, resulting in some inconsistency in estimates in different years. In the methods used for this report, the significant changes have occurred between 1984 and 1986, and between 1995 and 1996, although not all source types were affected. More explanation is provided in Appendix B.

[a] Emissions trends data are not available for 1983; thus, the 20-year trend was interpolated based on emissions data for 1980 and 1985.

waterbodies described above. In response, EPA has proposed regulations that will significantly control NO_x emissions from nonroad diesel engines.

Figure 2-19 indicates that the two primary sources of NO_x emissions are transportation and stationary source fuel combustion. Together, these two sources make up 93 percent of 2002 total NO_x emissions. Emissions from transportation sources have decreased 15 percent over the past 20 years and decreased 5 percent during the past 10 years. For both light-duty gasoline vehicles and light-duty gasoline trucks, NO_x emissions peaked in 1994 and then began a steady decrease through 2000. This decrease can be attributed primarily to the implementation of the Tier 1 emission standards that lowered NO_x emissions from new cars and light-duty trucks. In contrast, NO_x emissions from heavy-duty vehicles, both gasoline and diesel, decreased significantly over the 10-year period (17 percent decrease for gasoline and 12 percent increase for diesel). A portion of this increase is due to the increase in VMT for these categories for heavy-duty gasoline vehicles and diesel trucks. In addition, emissions from heavy-duty diesel vehicles increased over this period due to the identification of "excess emissions" in many diesel vehicles. These excess emissions peaked in 1998, and emissions of heavy-duty diesel vehicles are now declining. New emission standards will lead to further reductions in emissions from heavy duty vehicles in the future. Further, emissions from nonroad vehicles, particularly those fueled with diesel, have steadily increased over the last 10 years. EPA is developing new standards to reduce these emissions.

Reductions in NO_x emissions from fuel combustion, particularly those from electric power generator units in the past 2 years, have partially offset the impact of increases in the transportation sector. Emissions from these generator units in 2001 were 5 percent lower than they were in 2000. The Acid Deposition Control provisions of the Act (Title IV) required EPA to establish NO_x annual emission limits for coal-fired electric utility units in two phases, resulting in NO_x reductions of approximately 400,000 tons per year during Phase I (1996–1999) and 2 million tons per year in Phase II (year 2000 and subsequent years).[8]

Figure 2-20 shows the geographic distribution of 2001 NO_x emissions based on the tonnage per square mile for each county. This map illustrates that the eastern half of the country and the West Coast emit more NO_x (on a density basis) than does the western half of the continental United States.

2001 Air Quality Status

All monitoring locations across the nation met the NO_2 NAAQS in 2001. This is reflected in Figure 2-21, which displays the highest annual mean NO_2 concentration measured in each county.

Figure 2-19. NO_x emissions by source category, 2002.

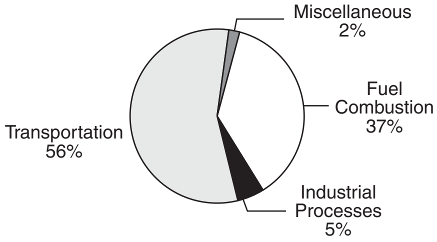


Figure 2-20. Density map of 2001 NO_2 emissions, by county.

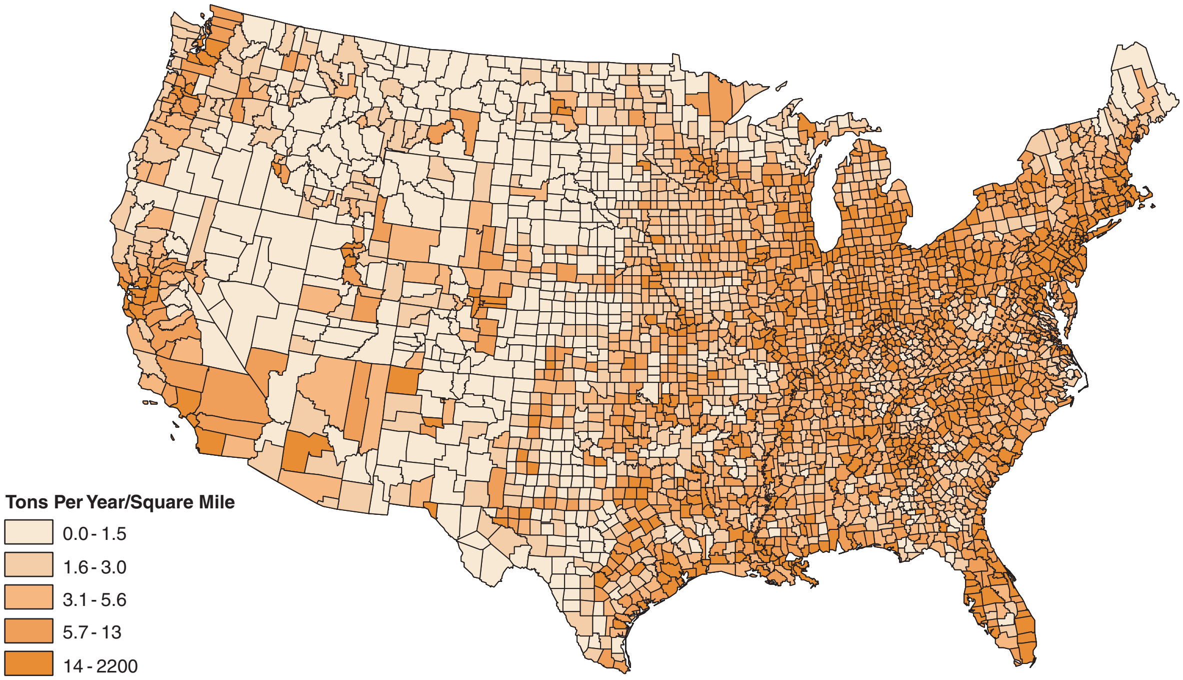
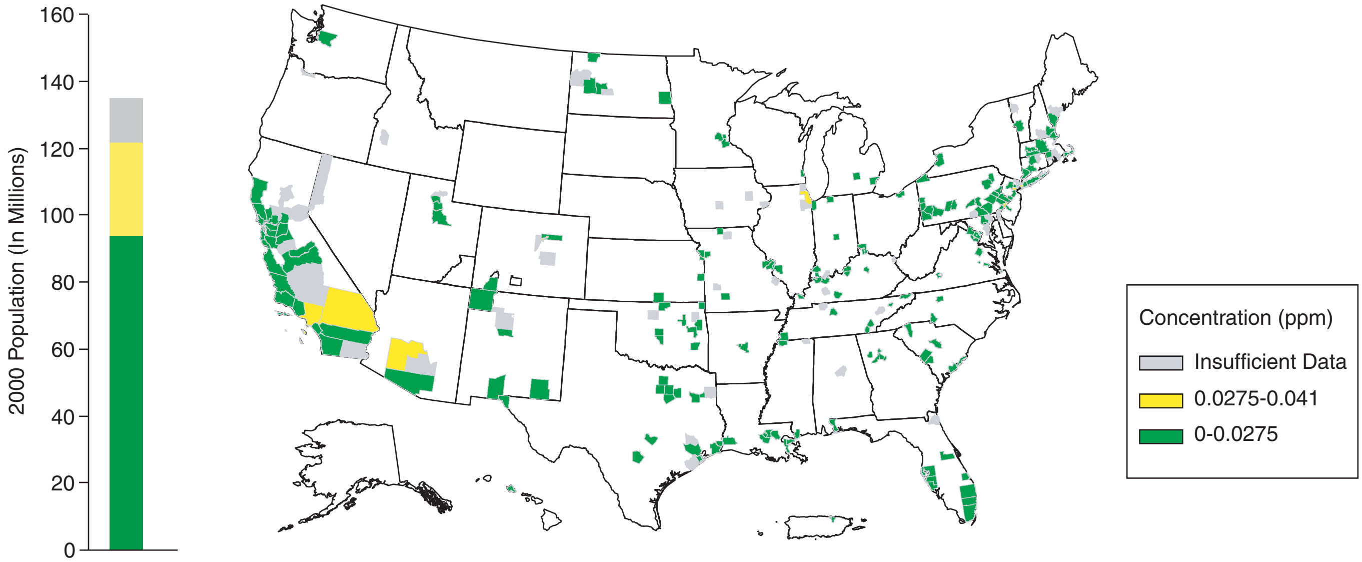


Figure 2-21. Highest NO_2 maximum quarterly mean by county, 2001.



Ozone

Air Quality Concentrations		
1983–02	22% decrease (1-hr)	
	14% decrease (8-hr)	
1993–02	2% decrease (1-hr)	
	4% increase (8-hr)	

Emissions (Anthropogenic VOCs)	
1983–02	40% decrease
1993–02	25% decrease

Worth Noting

- Over the past 20 years, ozone (O_3) levels (1-hour and 8-hour) have improved considerably nationwide.
- However, over the past 10 years, ozone levels (1-hour and 8-hour) have been relatively flat.

Nature and Sources

Ground-level O_3 remains a pervasive pollution problem in the United States. Ozone is readily formed in the atmosphere by the reaction of VOCs and NO_x in the presence of heat and sunlight, which are most abundant in the summer. VOCs are emitted from a variety of sources, including motor vehicles, chemical plants, refineries, factories, consumer and commercial products, other industries, and natural (biogenic) sources. Nitrogen oxides (a precursor to ozone) are emitted from motor vehicles, power plants, and other sources of combustion, as well as natural sources including lightning and biological processes in soil. Changing weather patterns contribute to yearly differences in O_3 concentrations. Ozone and the precursor pollutants that cause O_3 also can be transported into an area from pollution sources located hundreds of miles upwind.

Health and Environmental Effects

Ozone occurs naturally in the stratosphere and provides a protective layer high above the Earth. However, at ground level, it is the prime ingredient of smog. Short-term (1- to 3-hour) and prolonged (6- to 8-hour) exposures to ambient O_3 concentrations have been linked to a number of health effects of concern. For example, increased hospital admissions and emergency room visits for respiratory causes have been associated with ambient O_3 exposures.

Exposures to O_3 result in lung inflammation, aggravate preexisting respiratory diseases such as asthma, and may make people more susceptible to respiratory infection. Other health effects attributed to short-term and prolonged exposures to O_3, generally while individuals are engaged in moderate or heavy exertion, include significant decreases in lung function and increased respiratory symptoms such as chest pain and cough. Children active outdoors during the summer when O_3 levels are at their highest are most at risk of experiencing such effects. Other at-risk groups include adults who are active outdoors, such as outdoor workers, and individuals with preexisting respiratory disorders such as asthma and chronic obstructive lung disease. Within each of these groups are individuals who are unusually sensitive to O_3. In addition, repeated long-term exposure to O_3 presents the possibility of irreversible changes in the lungs, which could lead to premature aging of the lungs and/or chronic respiratory illnesses.

Ozone also affects sensitive vegetation and ecosystems. Specifically, O_3 can lead to reductions in agricultural and commercial forest yields, reduced survivability of sensitive tree seedlings, and increased plant susceptibility to disease, pests, and other environmental stresses such as harsh weather. In long-lived species, these effects may become evident only after several years or even decades. As these species are out-competed by others, long-term effects on forest ecosystems and habitat quality for wildlife and endangered species become evident. Furthermore, O_3 injury to the foliage of trees and other plants can decrease the aesthetic value of ornamental species as well as the natural beauty of our national parks and recreation areas.

Primary and Secondary 1-hour Ozone Standards

In 1979, EPA established 1-hour primary and secondary standards for O_3. The level of the 1-hour primary and secondary O_3 NAAQS is 0.12 ppm daily maximum 1-hour concentration that is not to be exceeded more than once per year on average.

Primary and Secondary 8-hour Ozone Standards

On July 18, 1997, EPA strengthened the O_3 NAAQS based on the latest scientific information showing adverse effects from exposures allowed by the then-existing standards. The standard was set in terms of an 8-hour averaging time.[9]

Refer to **http://www.epa.gov/airlinks** for up-to-date information concerning actions surrounding the revised standards.

Air Quality Trends

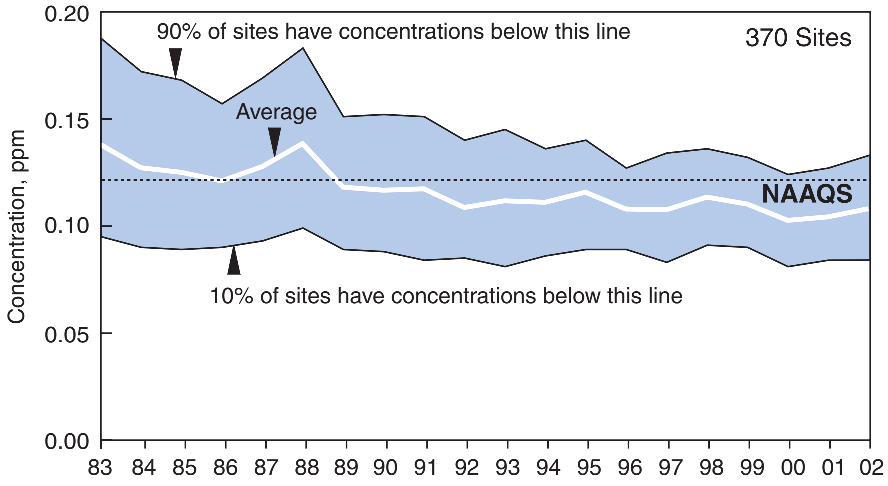
Because the 1-hour and 8-hour NAAQS have different averaging times and forms, two different statistics are used in this report to track ambient O_3 air quality trends. For the 1-hour O_3 NAAQS, this report uses the composite mean of the annual second-highest daily maximum 1-hour O_3 concentration as the statistic to evaluate trends. For the 8-hour O_3 NAAQS, this report relies on the annual fourth-highest 8-hour daily maximum O_3 concentration as the statistic of interest to assess trends.

National Air Quality Trends

Figure 2-22 clearly shows that, over the past 20 years, peak 1-hour O_3 concentrations have declined considerably at monitoring sites across the country. From 1983 to 2002, national 1-hour O_3 levels improved 22 percent, with 1983, 1988, and 1995 representing peak years for this pollutant. Figure 2-22 shows that 370 sites met the data completeness criteria over the past 20 years (1983–2002). It is important to interpret such long-term, quantitative ambient O_3 trends carefully given changes in network design, siting criteria, spatial coverage, and monitoring instrument calibration procedures during the past two decades. More recently, national 1-hour O_3 levels have continued to improve, but the progress has been less rapid, as evidenced by the 2 percent decrease from 1993 to 2002.

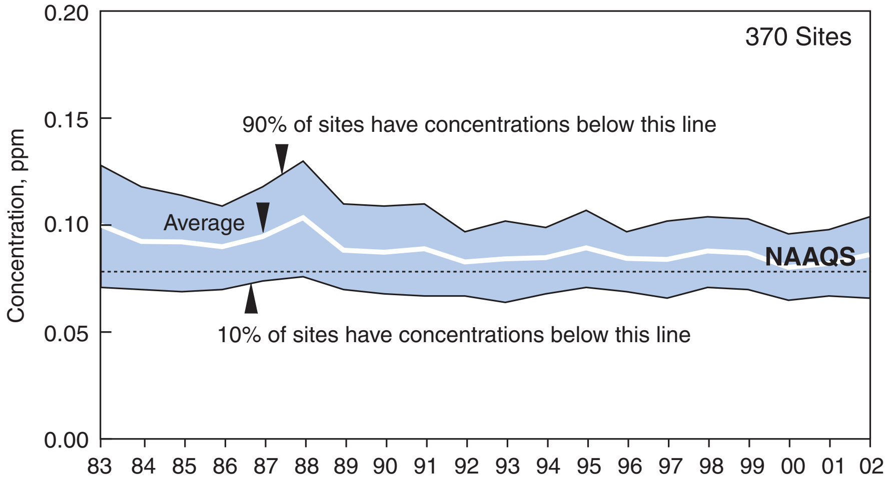
Figure 2-23 shows the national trend in 8-hour O_3 concentrations across the same sites used to estimate the national 1-hour O_3 trends. Nationally, 8-hour levels have decreased 14 percent over the last 20 years. However, just as is true for the 1-hour levels, the progress in 8-hour O_3 levels over the last 10 years has slowed and actually shows a 4 percent increase in national levels between 1993 and 2002. Standard statistical tests applied to the 10-year trends for both 1-hour and 8-hour ozone shows that these trends are not statistically significant. Ozone

Figure 2-22. O_3 air quality, 1983–2002, based on annual second maximum 1-hour average.



1983–02: 22% decrease
1993–02: 2% decrease

Figure 2-23. O_3 air quality, 1983–2002, based on annual fourth maximum 8-hour average.



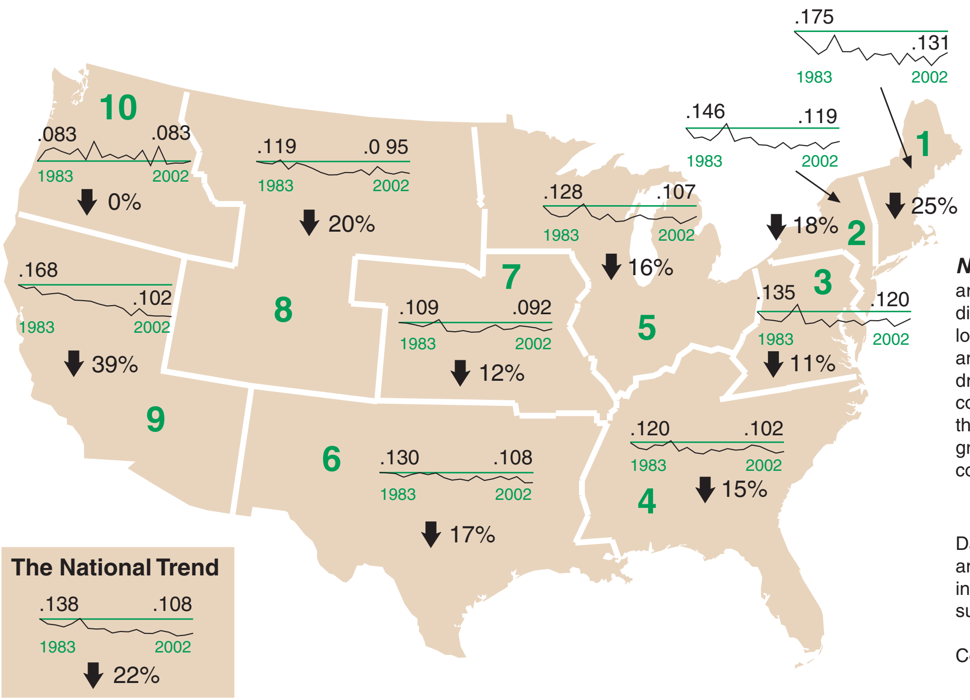
1983–02: 14% decrease
1993–02: 4% increase

concentrations varied over this 10-year period from year to year but did not change overall.The trend in the 8-hour O_3 statistic is similar to the trend in the 1-hour values, although the concentration range is smaller.

Regional Air Quality Trends

The map in Figure 2-24 examines trends in 1-hour O_3 concentrations during the past 20 years by geographic region of the country. The 1-hour O_3 levels in all areas of the country have generally followed the pattern of declining trends since 1982 similar to that of the national observations. However, the magnitude of improvement has not been consistent across all regions.

Figure 2-24. Trend in 1-hour O_3 levels, 1983–2002, averaged across EPA Regions, based on annual second highest daily maximum.

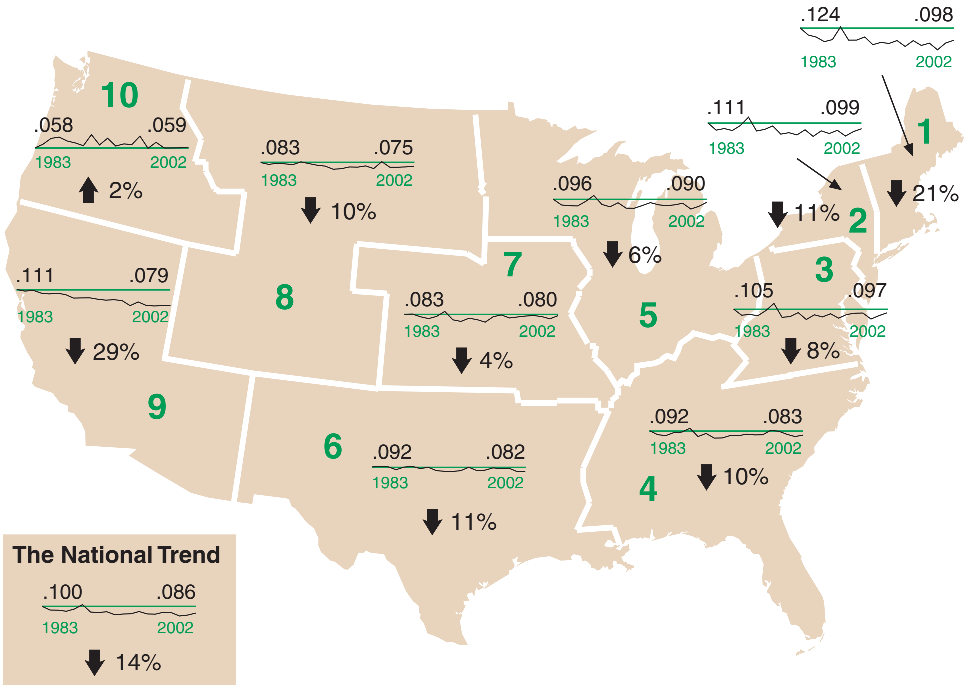


Note: These trends are influenced by the distribution of monitoring locations in a given Region and, therefore, can be driven largely by urban concentrations. They are thus not indicative of background regional concentrations.

Data from Alaska, Hawaii, and Puerto Rico are not included in these regional summaries.

Concentrations are ppm.

Figure 2-25. Trend in 8-hour O_3 levels, 1983–2002, averaged across EPA Regions, based on annual fourth maximum 8-hour average.



Note: These trends are influenced by the distribution of monitoring locations in a given Region and, therefore, can be driven largely by urban concentrations. They are thus not indicative of background regional concentrations.

Data from Alaska, Hawaii, and Puerto Rico are not included in these regional summaries.

Concentrations are ppm.

Similarly, Figure 2-25 portrays 8-hour O_3 trends by geographic region of the country. Again, most areas of the country show 20-year air quality improvements (with respect to 8-hour O_3) consistent with the national trend, with the most significant improvements occurring in the Northeast and Pacific Southwest. The Pacific Northwest region showed a slight increase in the 8-hour ozone for the period 1983–2002.

In Figure 2-26, the national 1-hour O_3 trend is disaggregated to show the 20-year change in ambient O_3 concentrations among rural, suburban, and urban monitoring sites. The highest ambient O_3 concentrations are typically found at suburban sites, consistent with the downwind transport of emissions from the urban center. During the past 20 years, O_3 concentrations decreased by approximately 23 percent at suburban sites, and 26 percent at urban sites. At rural sites, 1-hour O_3 levels for 2002 are approximately 16 percent lower than they were in 1983 and, for the sixth consecutive year, are greater than the level observed for urban sites.

Urban Area Air Quality Trends

It is important to note that year-to-year changes in ambient ozone trends are influenced by meteorological conditions, population growth, and changes in emission levels of ozone precursors (i.e., VOCs and NO_x) resulting from ongoing control measures. For example, to further evaluate the 10-year 8-hour ozone trends, EPA applied a model to the annual rate of change in ozone based on measurements in 53 metropolitan areas (Figure 2-27). This model adjusted the ozone data in these areas to account for the influence of local meteorological conditions, including surface temperature and windspeed. Figure 2-27 shows the aggregated trend in 8-hour ozone for these 53 areas adjusted for meteorological conditions for the 10-year period 1993-2002. The figure also shows the aggregated trend for these areas unadjusted for meteorology and the national average in 8-hour ozone. From this figure, the meteorologically adjusted trend for this 10-year period can be seen as relatively flat.

EPA's analysis of ambient ozone concentration data indicates that ozone concentrations are on the increase in some urban areas. These increases are evident based on both 1-hour and 8-hour trends, as shown

Figure 2-26. Trend in annual second-highest daily maximum 1-hour O_3 concentrations by location, 1983–2002.

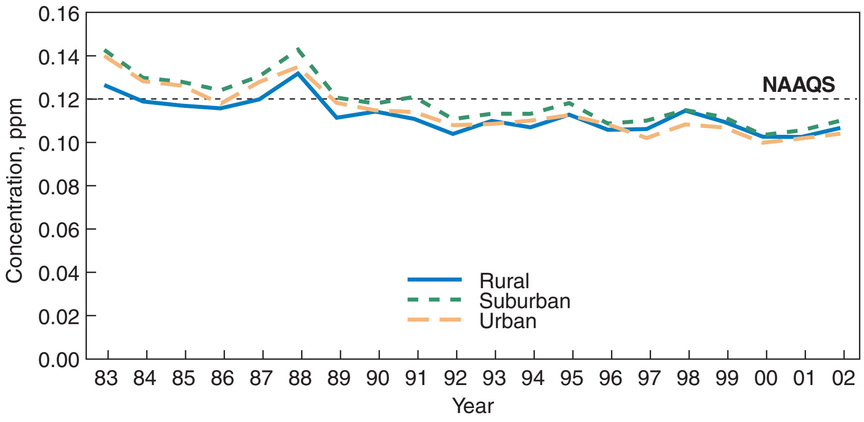
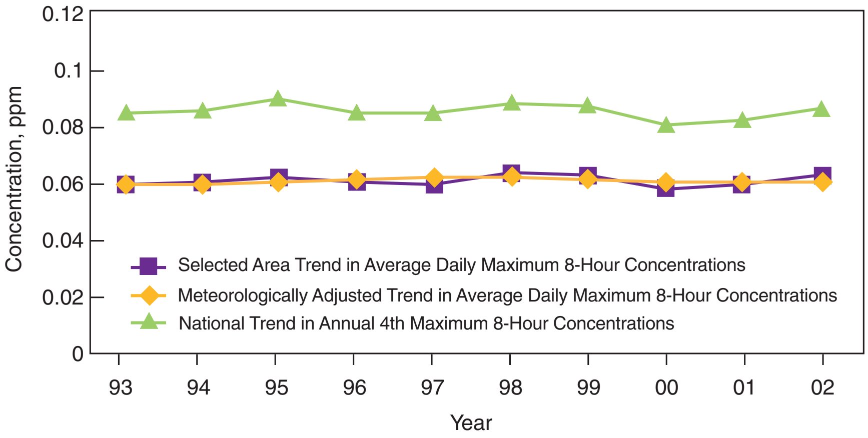
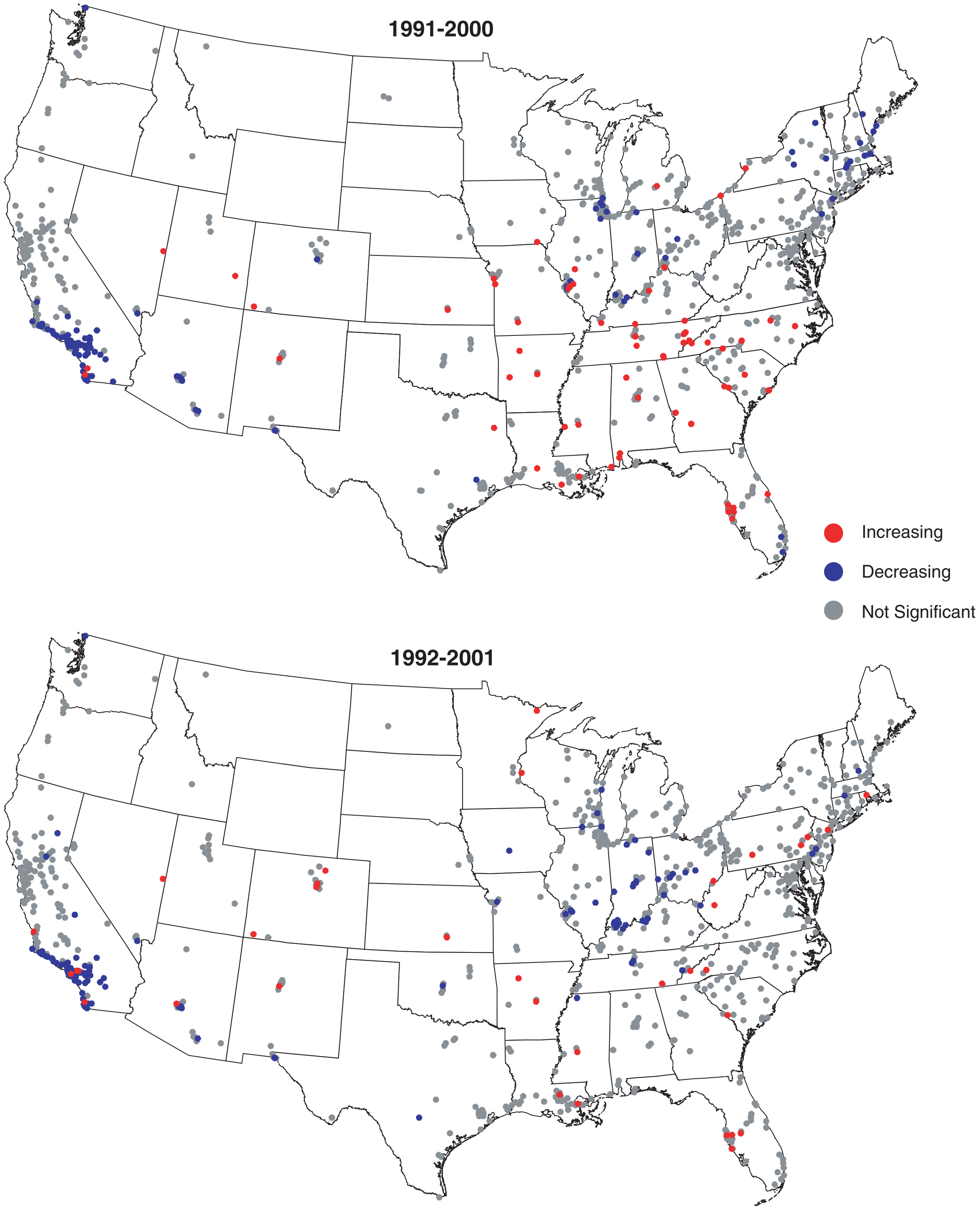


Figure 2-27. Comparison of actual and meteorologically adjusted 8-hour O_3 trends, 1993–2002.



in Figures 2-28 and 2-29. Ozone concentrations are on the increase in several cities in the southeastern and midwestern United States, while urban areas on the West Coast and in New England generally show decreasing trends. Figures 2-28 and 2-29 show a comparison of ozone trends over two consecutive 10-year time frames. The 1-hour trends show an increasing number of cities with upward ozone trends in the western

Figure 2-28. 1-Hour O_3 trends for 1991–2000 and 1992–2001.

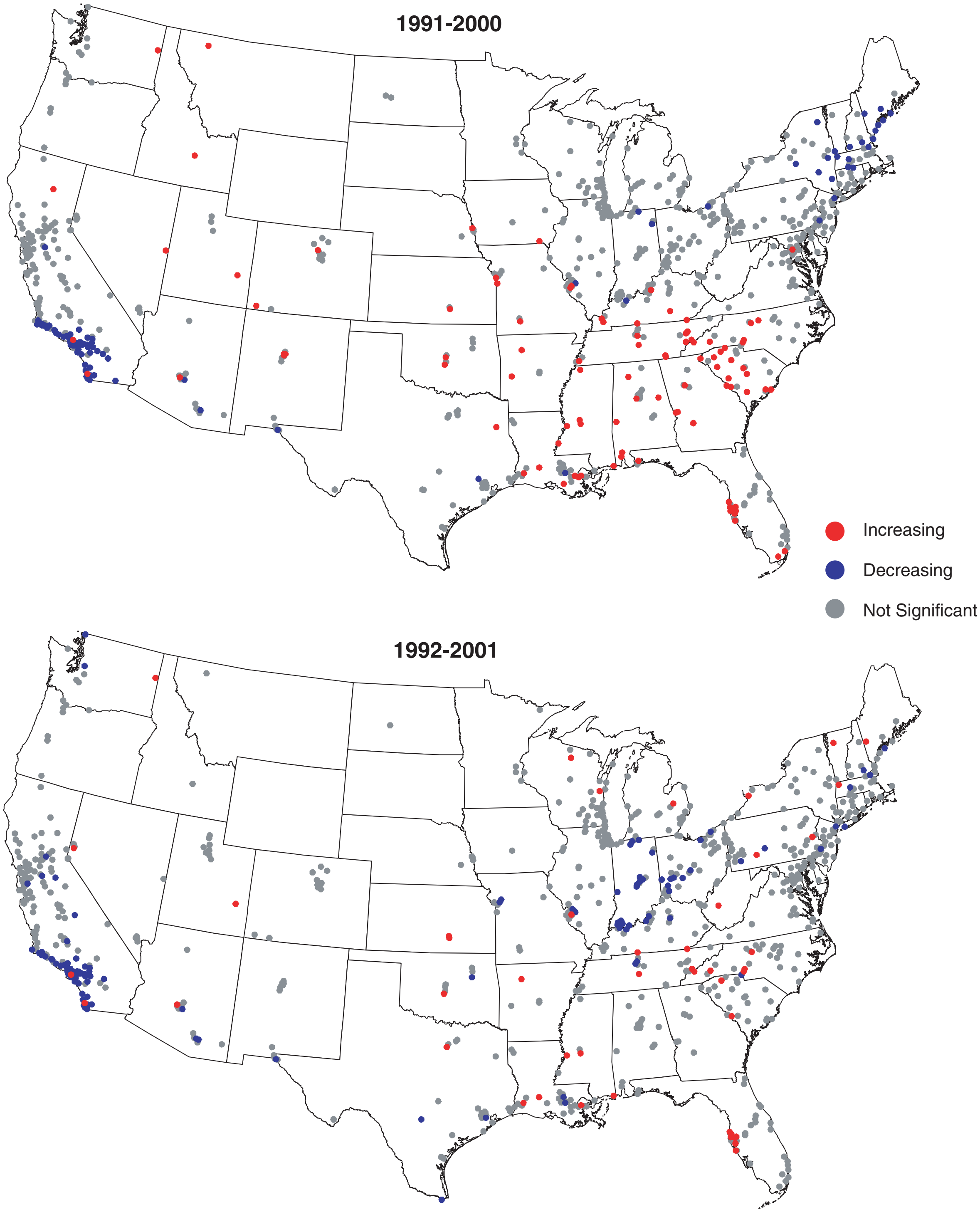


and mid-Atlantic urban areas and a decreasing number of cities with upward ozone trends in the Southeast. The 8-hour ozone trends also show a decrease in the number of cities with upward ozone trends in the Southeast, but an increasing number of cities with upward trends in New England and around the Great Lakes.

Trends at PAMS Sites

Photochemical Assessment Monitoring Program Stations (PAMS) are operated by states in areas that were originally classified as extreme,

Figure 2-29. 8-Hour O_3 trends for 1991–2000 and 1992–2001.



severe, or serious nonattainment for ozone. Ozone, ozone precursor, and surface and upper air meteorological conditions are monitored at PAMS sites during the summer months when meteorological conditions are most conducive to ozone formation. Some PAMS sites have been in operation since 1994 and there are now sufficient data available to examine long-term air quality trends. Trends in total nonmethane organic compounds (TNMOC), NO_x, and selected VOC species at PAMS locations are tabulated in Table 2-3; median percent changes are illustrated in Figure 2-30. These trends are for concentrations averaged over the hours from 6 to 9 a.m. when ozone precursor concentrations are typically at their maximum and best represent the influence of fresh, local emissions. VOC species were selected for inclusion in this analysis based primarily on relative abundance and status as a hazardous air pollutant under the Clean Air Act. Trends in other VOC species monitored under the PAMS program can generally be expected to be similar to those shown here.

All species except isoprene and NO_x exhibited substantial median percentage declines over the 1995 to 2001 trend period. Isoprene is largely emitted by biogenic sources (trees and other vegetation) and would therefore not be expected to show a significant trend. For TNMOC and TNMOC species other than isoprene, concentrations decreased at all or nearly all sites, although the decline was not statistically significant in every case. NO_x concentrations increased at roughly one third of all sites, but none of these increases were found to be statistically significant. Trends at PAMS Type 2 sites, which are generally located within areas of maximum

Table 2-3. Trends in TNMOC, NO_x, and Selected VOC Species

	All Site Types					Type 2 Sites					Median % Change	
	Total	All Sites[a]		Stat. Significant[b]		Total	All Sites[a]		Stat. Significant[b]		All Sites	Type 2 Sites
		Up	Down	Up	Down		Up	Down	Up	Down		
TNMOC	28	4	23	0	14	14	2	12	0	7	-32	-36
NO_x	63	16	33	0	7	25	6	16	0	2	-8	-9
Ethylene	21	1	15	0	7	12	0	10	0	4	-42	-40
Propylene	17	0	14	0	5	10	0	9	0	3	-40	-39
Isopentane	22	0	18	0	8	11	0	10	0	4	-30	-36
Isoprene	22	8	5	0	0	12	3	4	0	0	0	0
Benzene	22	0	18	0	12	12	0	12	0	9	-35	-43
Toluene	22	2	19	0	7	12	0	11	0	4	-29	-38
m/p-Xylene	22	0	20	0	9	12	0	12	0	6	-31	-33
o-Xylene	20	0	16	0	8	12	0	11	0	6	-36	-36
1,2,4-Trimethylbenzene	20	4	12	0	4	11	0	9	0	4	-38	-57

TNMOC = Total nonmethane organic compound.

[a] Indicates sign of trend regardless of statistical significance.

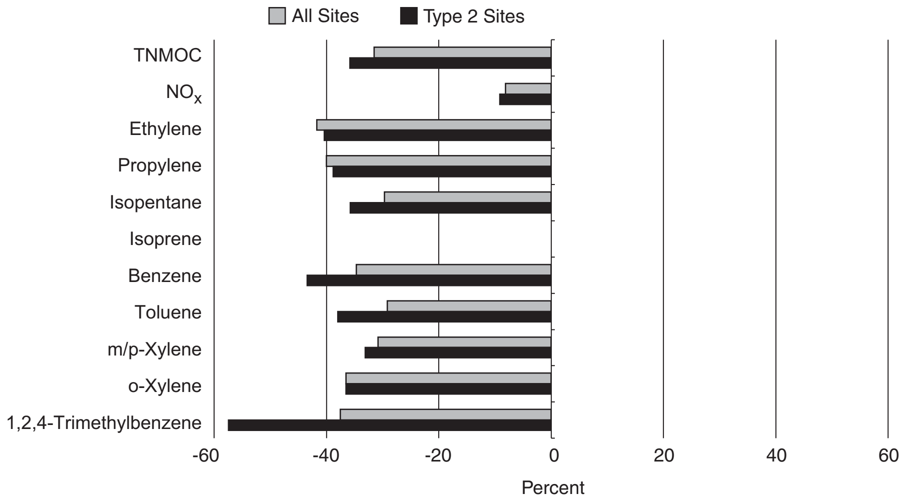
[b] Indicates sign of trend at sites where trend is statistically significant at the 95% confidence level.

Notes:

1 The number of sites listed in the up and down columns indicates the number of PAMS locations at which the 1995–2001 trend in 6–9 a.m. average concentration is in the indicated direction. The number of sites in the total column may not equal the total of the up and down columns–either because the nonparametric trend estimate for some sites is identically zero or the trend at many sites is not statistically significant.

2 Theil's two-sided nonparametric significance test for the slope was used to assess statistical significance at the 95% confidence level consistent with the methodology used in previous National Air Quality and Emissions Trends reports. Note that these results are not adjusted for multiple comparisons.

Figure 2-30. Median percent change for the period 1995–2001 at PAMS monitors for selected species.



precursor emissions, are similar to trends over all site types although the Type 2 sites exhibited somewhat greater declines in isopentane, benzene, toluene, and 1,2,4-trimethylbenzene.

Methodology

All data were obtained from EPA's Air Quality System (AQS) database. Trends are based on data from sites meeting certain data completeness criteria for the 1995–2001 period. Data completeness requirements are the same as those used in previous National Air Quality and Emissions Trends reports.[10] Annual averages computed from 1-hour samples of TNMOC or NO_x were considered valid if data were available for 50 percent or more of all possible observations. Sites selected for trends analysis must have valid annual summary statistics available for 5 or more years. Missing annual summary statistics were filled in via linear interpolation from surrounding years. If a missing value happened to fall at the beginning or end year of the period being investigated, the value was set equal to the nearest available valid year of data. Theil's nonparametric trend-slope estimates and two-sided significance test results for the slope were used to assess statistical significance consistent with the methodology used in previous National Air Quality and Emissions Trends reports. Note that these results are not adjusted for multiple comparisons.

Ozone and Ozone Precursor Trends in Chicago and Atlanta

Despite much progress in the years since passage of the 1990 Clean Air Act Amendments, some metropolitan areas are still classified as nonattainment with respect to the NAAQS for 1-hour ozone. Two notable examples are Chicago and Atlanta. Atlanta is currently classified as a "serious" ozone nonattainment area; Chicago is currently classified as "severe." In this section we take a closer look at recent trends in ozone and ozone precursors in these two major metropolitan areas.

Composite ozone trends for 1-hour and 8-hour annual ozone design values in Chicago and Atlanta are depicted in Figure 2-31.[11] Trends in 1-hour design values are shown for the period 1991 to 2001; 8-hour design values are shown for the period 1996 to 2001 because 1996 is the first year for which EPA began reporting 8-hour design values. Design values vary from year to year, largely in response to changes in meteorological conditions that make it difficult to identify any long-term trend in either city.

Composite trends in summer weekday morning ozone precursor concentrations in Chicago and Atlanta are illustrated in Figure 2-32. Trends are shown for concentrations on weekday mornings (6–9 a.m.), the period when precursor concentrations are typically at their maximum and are most directly influenced by fresh emissions from local sources. To maintain consistency between nonattainment areas and to retain sites in the analysis from Chicago that would otherwise not meet the data completeness criteria for a time period extending back to 1991, NO_x summary statistics were calculated for the period 1995 to 2001 only. TNMOC data are only available starting in 1995 for both nonattainment areas. An examination of Figure 2 -34 indicates that TNMOC concentrations declined in both cities during this period, while NO_x concentrations increased slightly.

Air quality trend statistics for both cities are summarized in Table 2-4. Although none of the trends were found to be statistically significant, the results are generally consistent with a slight decrease in ozone accompanied by a more noticeable decrease in morning TNMOC and a slight increase in morning NO_x.

Figure 2-31. Annual 1-hour and 8-hour composite O_3 design values in the Atlanta and Chicago-Gary lake county nonattainment areas.

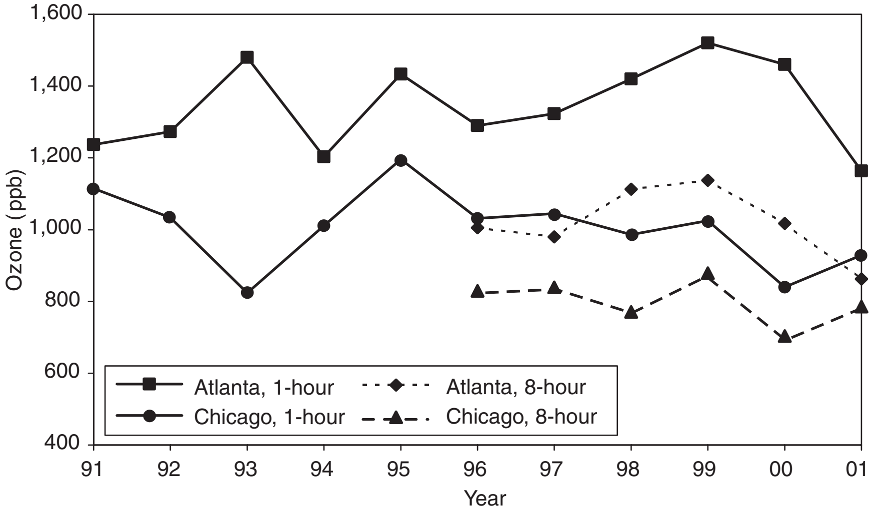


Figure 2-32. June-August weekday morning average NO_x and TNMOC at PAMS Type 2 trend sites (June 1–September 1, 6:00–9:00 a.m.).

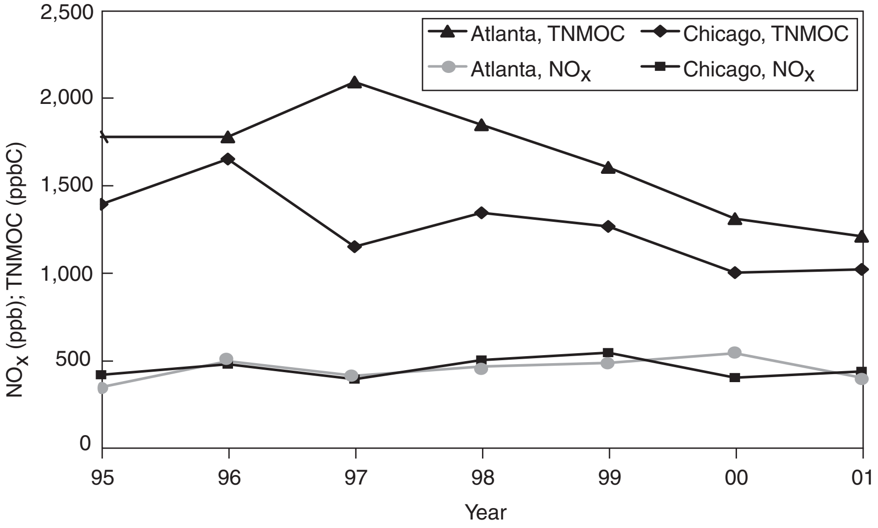


Table 2-4. Summary of 1991–2001 Trends in Ozone Design Values and 1995–2001 Trends in Summer Weekday Morning Ozone Precursor Trends in Atlanta and Chicago

City	Pollutant	Composite Trend (ppb/year)	No. of Sites with Trend Increasing	No. of Sites with Trend Decreasing
Atlanta	O_3 (1-hour)	1.4	2	1
	O_3 (8-hour)	-2.5	1	3
	TNMOC	-11.4	0	1
	NO_x	2.1	2	0
Chicago	O_3 (1-hour)	-1.2	1	7
	O_3 (8-hour)	-1.3	2	9
	TNMOC	-7.8	0	2
	NO_x	0.3	1	1

TNMOC = Total nonmethane organic compound

Methodology

All data were obtained from EPA's AirData Web site (for 1991–2000 data) and AQS database (for 2001 data). Trends are based on data from sites meeting certain data completeness criteria for the 1991–2001 period. Data completeness requirements are the same as those used in previous National Air Quality and Emissions Trends reports.[10] Annual summary statistics for a year of 1-hour or 8-hour ozone data were considered valid if data were available for at least 75 percent of all possible observations. Annual averages computed from round-the-clock 1-hour samples of TNMOC or NO_x were considered valid if data were available for 50 percent or more of all possible observations. For monitors with less frequent TNMOC sampling schedules (1 day in 6, etc.), the annual mean was considered valid if at least 75 percent of scheduled samples were available. Sites selected for trends analysis must have valid annual summary statistics available for 8 or more years for 1991–2001 trends; 5 or more years for 1995–2001 trends. Missing annual summary statistics were filled in via linear interpolation from surrounding years. If a missing value happened to fall at the beginning or end year of the period being investigated, the value was set equal to the nearest available valid year of data.

Composite trends were calculated for each pollutant in both nonattainment areas by averaging the annual summary statistic over all sites in a region. Theil's nonparametric trend-slope estimates and two-sided significance test results for the slope were used to assess statistical significance consistent with the methodology used in previous National Air Quality and Emissions Trends reports. Note that these results are not adjusted for multiple comparisons. Additional methodological details are reported by Coulter-Burke and Stoeckenius.[12]

Rural Area Air Quality Trends

Figure 2-33 presents the trend in 8-hour O_3 concentrations for 34 rural sites from the Clean Air Status and Trends Network (CASTNet) for the most recent 10-year period, 1990–2001.[13] The 8-hour O_3 concentrations at these eastern sites, which were the highest during the hot and dry summers of 1991 and 1998, have decreased 8 percent over the last 10 years. This trend in 8-hour O_3 levels at 34 selected sites is mirrored at other rural sites nationwide. Across the nation, rural 8-hour O_3

levels improved 9 percent from 1981 to 2000, but improved by only 2 percent over the last 10 years.[14]

Figure 2-34 further examines patterns in rural O_3 levels by presenting the 10-year trends in the 8-hour O_3 concentrations at 11 selected National Park Service (NPS) sites.[15] These sites are located in Class I areas, a special subset of rural environments (all National Parks and wilderness areas exceeding 5,000 acres) accorded a higher degree of protection under the Clean Air Act provisions for the prevention of significant deterioration. There are more than 33 NPS sites nationally; however, this analysis focuses on the specific sites with sufficient data to evaluate 10-year trends. Over the last 10 years, 8-hour O_3 concentrations in 33 of our National Parks increased nearly 4 percent. Four monitoring sites in 11 of these parks experienced statistically significant upward trends in 8-hour O_3 levels–Great Smoky Mountains (TN), Mammoth Cave (KY), Yellowstone (WY), and Craters of the Moon (ID). For the remaining 22 parks, 8-hour O_3 levels at 18 increased only slightly between 1992 and 2001, five showed decreasing levels, and three were unchanged.

Figure 2-33. Trends in fourth highest daily 8-hour O_3 concentrations for 34 rural sites from CASTNet, 1990–2001.

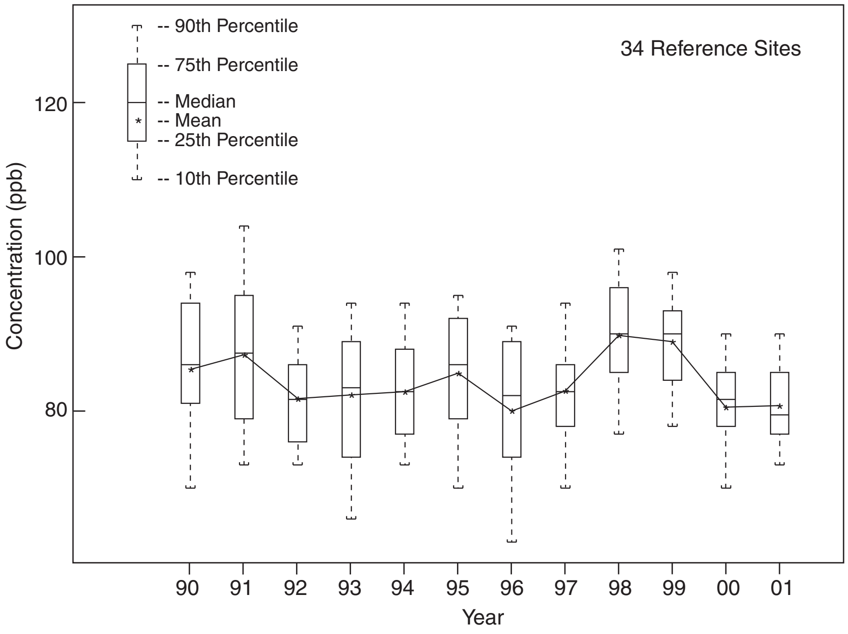
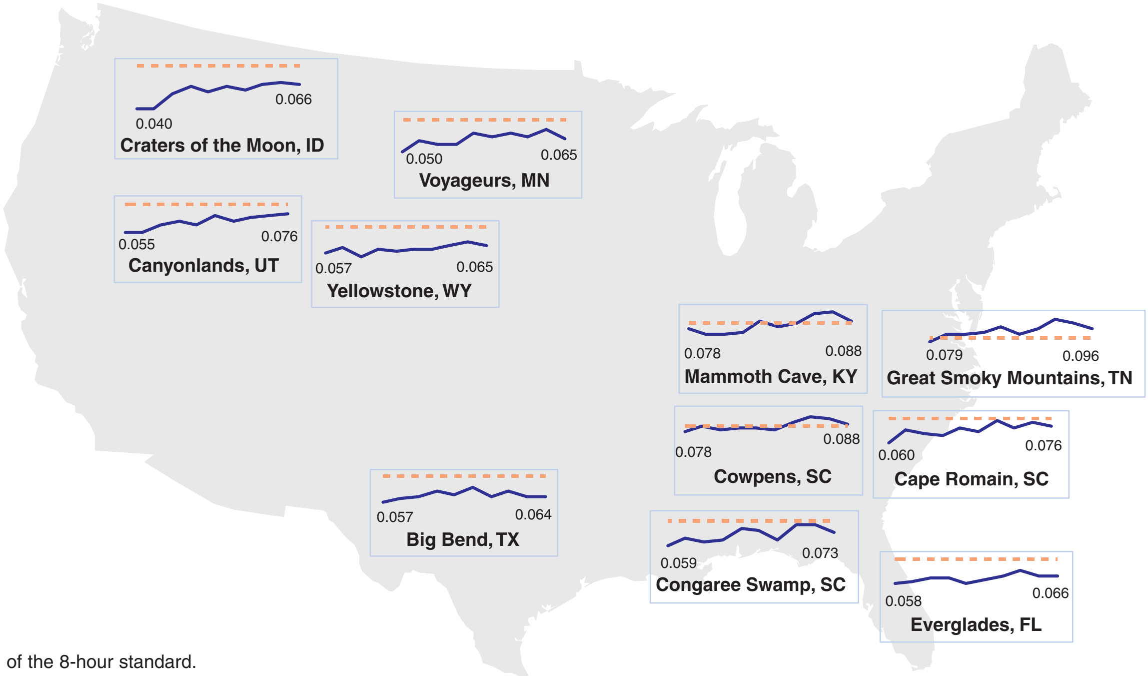


Figure 2-34. Trend in annual fourth highest daily maximum 8-hour O_3 concentrations in National Parks, 1992–2001.



---- Level of the 8-hour standard.
Concentrations are ppm.

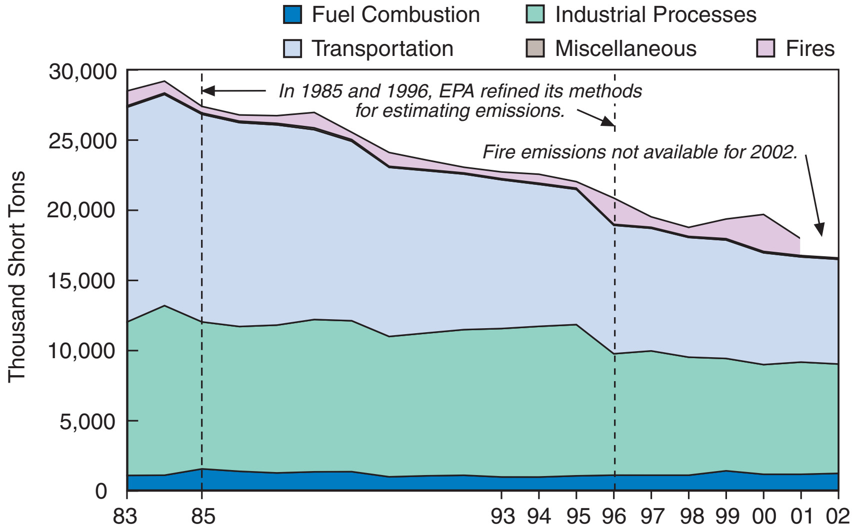
National Emissions Trends

Figure 2-35 shows that national total VOC emissions (which contribute to O_3 formation) from anthropogenic (man-made, excluding wildfires and prescribed burnings) sources decreased 40 percent between 1983 and 2002, and 25 percent over the past 10 years. National total NO_x emissions (the other major precursor to O_3 formation) decreased approximately 15 percent and 12 percent, respectively, over the same two periods.

Nationally, the two major sources of VOC emissions are industrial processes (47 percent) and transportation sources (45 percent), as shown in Figure 2-36. Solvent use makes up 63 percent of the industrial processes emission category and 29 percent of total VOC emissions. Industrial process VOC emissions have decreased 26 percent since 1993, in part due to the implementation of maximum achievable control technology (MACT) controls that affect specific chemical and solvent industries. The VOC emissions totals by source category and year are presented in Table A-5 in Appendix A. Recent control measures to reduce transportation sector emissions include regulations to lower fuel volatility and to reduce NO_x and VOC emissions from tailpipes.[10] The effectiveness of these control measures is reflected in a decrease in VOC emissions from highway vehicles. VOC emissions from highway vehicles have declined 39 percent since 1993, whereas highway vehicle NO_x emissions have decreased 10 percent over the same period.

In addition to anthropogenic sources of VOC and NO_x, there are natural or biogenic sources of these compounds as well. Table 2-5 shows the different predominant plant species responsible for VOC emissions in different parts of the country for two major biogenic species of concern, isoprene and monoterpenes. Although it is not possible to control the level of these natural emissions,

Figure 2-35. VOC emissions, 1983–2002.

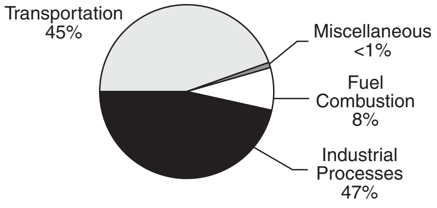


1983–02: 40% decrease[a]
1993–02: 25% decrease

Note: Emission estimation methods and data sources have evolved over time, resulting in some inconsistency in estimates in different years. In the methods used for this report, the significant changes have occurred between 1984 and 1986 and between 1995 and 1996, although not all source types were affected. More explanation is provided in Appendix B.

[a] Emissions trends data are not available for 1983; thus, the 20-year trend was interpolated based on emissions data for 1980 and 1985.

Figure 2-36. Anthropogenic VOC emissions by source category, 2002.[a]



[a] Sums do not equal 100 due to rounding.

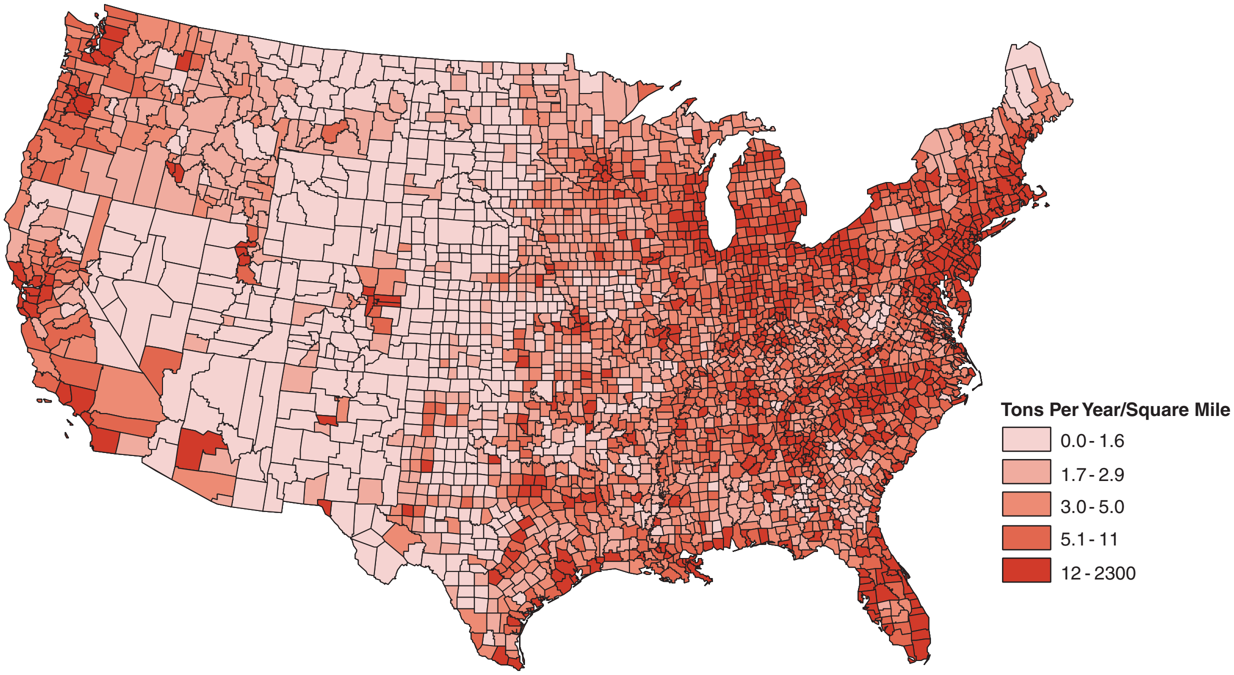
Table 2-5. Biogenic Sources of VOC Emissions by Region

Region	VOC	Source
Southwestern United States	Isoprene	Oak (mostly), citrus, eucalyptus
	Monoterpenes	Pine, citrus, eucalyptus
Northeastern	Isoprene	Oak (mostly), spruce
United States	Monoterpenes	Maple, hickory, pine, spruce, fir, cottonwood

their presence is an important factor to consider when developing O_3 control strategies. Biogenic NO_x emissions are associated with lightning and biological processes in soil. On a regional basis, biogenic VOC emissions can be greater than anthropogenic VOC emissions. Biogenic NO_x emissions, however, make up less than 10 percent of total NO_x emissions.[17]

Figure 2-37 shows the geographic distribution of 2001 anthropogenic VOC emissions based on the tonnage per square mile for each county. This map illustrates that the eastern half of the country and the West Coast emit more VOC (on a density basis) than does the western half of the continental United States.

Figure 2-37. Density map of 2001 anthropogenic VOC emissions, by county.



Particulate Matter

PM_{10} Air Quality Concentrations		
1993–02	13%	decrease

PM_{10} Direct Emissions		
1993–02	22%	decrease

$PM_{2.5}$ Air Quality Concentrations		
1999–02	8%	decrease

$PM_{2.5}$ Direct Emissions		
1993–02	17%	decrease

Worth Noting

$PM_{2.5}$

- Annual average $PM_{2.5}$ concentrations decreased 8 percent nationally from 1999 to 2002. The Southeast was responsible for most of that reduction, where the monitored levels of $PM_{2.5}$ decreased 18 percent from 1999 to 2002. Lower 2002 annual average concentrations in the Southeast are due, in part, to decreases in sulfates, which largely result from power plant emissions of SO_2.

Nature and Sources

Particulate matter is the general term used for a mixture of solid particles and liquid droplets found in the air. Some particles are large enough to be seen as dust or dirt. Others are so small they can be detected only with an electron microscope. $PM_{2.5}$ describes the "fine" particles that are less than or equal to 2.5 µm in diameter. "Coarse fraction" particles are greater than 2.5 µm, but less than or equal to 10 µm in diameter. PM_{10} refers to all particles less than or equal to 10 µm in diameter. A particle 10 µm in diameter is about one-seventh the diameter of a human hair. PM can be emitted directly or form in the atmosphere. "Primary" particles, such as dust from roads or elemental carbon (soot) from wood combustion, are emitted directly into the atmosphere. "Secondary" particles are formed in the atmosphere from primary gaseous emissions. Examples include sulfates, formed from SO_2 emissions from power plants and industrial facilities, and nitrates, formed from NO_x emissions from power plants, automobiles, and other types of combustion sources. The chemical composition of particles depends on location, time of year, and weather. Generally, coarse PM is composed largely of primary particles and fine PM contains many more secondary particles.

Fine and coarse particles typically exhibit different behavior in the atmosphere. Coarse particles can settle rapidly from the atmosphere within hours, and their spatial impact is typically limited because they tend to fall out of the air in the downwind area near their emission point. Larger coarse particles are not readily transported across urban or broader areas because they are generally too large to follow air streams and they tend to be removed easily by impaction on surfaces. Smaller-sized coarse particles can have longer lives and longer travel distances, especially in extreme circumstances, such as dust storms.

Global meteorological conditions play a role in transporting dust periodically from Africa and Asia to North America. A special study, summarized in Chapter 6 and provided in full in the Special Studies section of this report, examines how a particularly large event in Asia in April 2001 affected PM concentrations in the United States.

Health and Environmental Effects

Scientific studies show a link between inhalable PM (alone, or combined with other pollutants in the air), which includes both fine and coarse particles, and a series of significant health effects. Both coarse and fine particles can accumulate in the respiratory system and are associated with numerous adverse health effects. Exposure to coarse particles is primarily associated with the aggravation of respiratory conditions such as asthma. Exposure to fine particles is most closely associated with decreased lung function, increased hospital admissions and emergency room visits, increased respiratory symptoms and disease, and premature death. Sensitive groups that appear to be at greatest risk to such PM effects include the elderly, individuals with cardiopulmonary disease such as asthma or congestive heart disease, and children.

Particulate matter also can cause adverse impacts to the environment. Fine particles are the major cause of reduced visibility in parts of the United States, including many of our National Parks. Other environmental impacts occur when particles deposit onto soils, plants, water, or materials. For example, particles containing nitrogen and sulfur that deposit onto land or waterbodies may change the nutrient balance and acidity of those environments so that species composition and buffering capacity change. Particles that are deposited directly onto the leaves of plants can, depending on their chemical composition, corrode leaf surfaces or interfere with plant metabolism. Finally, PM causes soiling and erosion damage to materials, including culturally important objects such as carved monuments and statues.

Primary and Secondary PM Standards

The NAAQS for PM_{10} were established in 1987. The primary (health-based) and secondary (public welfare-based) standards for PM_{10} include both short- and long-term NAAQS. The short-term (24-hour) standard of 150 µg/m^3 is not to be exceeded more than once per year, on average, over 3 years. The long-term standard specifies an expected annual arithmetic mean not to exceed 50 µg/m^3 averaged over 3 years.

The NAAQS for $PM_{2.5}$ were established in 1997. The primary and secondary standards for $PM_{2.5}$ are set at 15 µg/m^3 and 65 µg/m^3, respectively, for the annual and 24-hour NAAQS.[18] Compliance with the annual standard is determined by the average of three consecutive annual average values (e.g., for 1999, 2000, and 2001). Compliance with the 24-hour standard is determined by the 3-year average of annual 98th percentile concentrations.

National 10-Year PM_{10} Air Quality Trends

Because 1988 represents the first complete year of PM_{10} data for most monitored locations, a 20-year trend is not available. However, as Figure 2-38 illustrates, the most recent 10-year period (1993 to 2002) shows that the national average of annual mean PM_{10} concentrations at 804 monitoring sites decreased 13 percent. The downward trend is apparent through 1998. However, between 1998 and 1999, the national average increased 1 percent. This slight increase was largely influenced by higher concentrations in the West, particularly in California. PM_{10} concentrations in California were higher than normal from September to December 1999, a period that coincided with major wildfires and particularly dry conditions.

When the sites are grouped as rural, suburban, and urban, as in Figure 2-39, the individual trends are similar to the national trend. The highest values are generally found at the urban sites, followed closely by the values at suburban sites. The annual mean is much lower at the rural sites, which are generally located away from local sources of PM_{10}.

Several factors have played a role in reducing PM_{10} concentrations. Where appropriate, states required emissions from industrial sources

Figure 2-38. PM_{10} air quality, 1993–2002, based on seasonally weighted annual average.

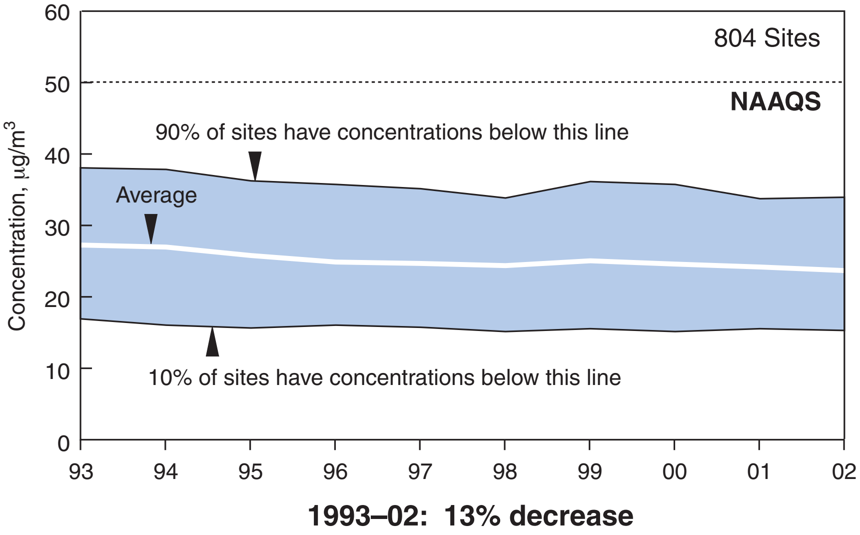
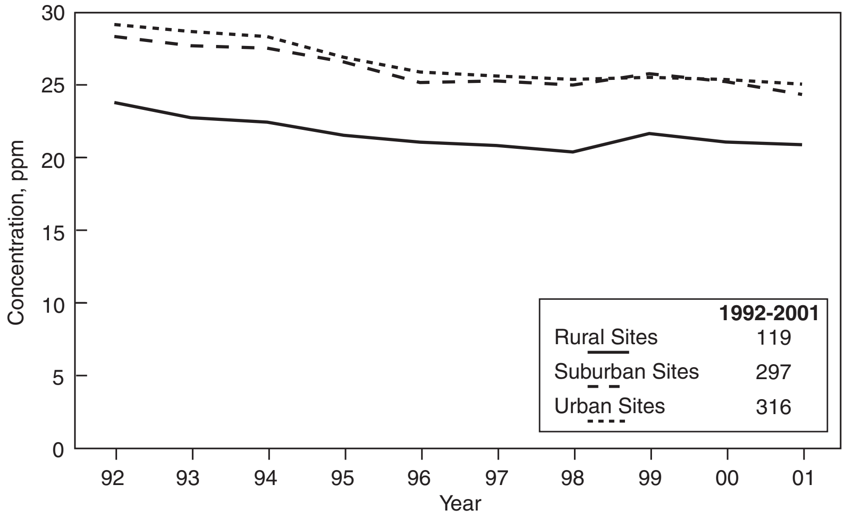


Figure 2-39. PM_{10} annual mean concentration trends by location, 1992–2001.



and construction activities to be reduced to meet the PM_{10} standards. Measures were also adopted to reduce street dust emissions, including the winter-time use of clean anti-skid materials such as washed sand, better control of the amount of material used, and removal of the material from the street as soon as the ice and snow melt. Additionally, cleaner burning fuels such as natural gas and fuel oil have replaced wood and coal as fuels for residential heating, industrial furnaces, and electric utility and industrial boilers.

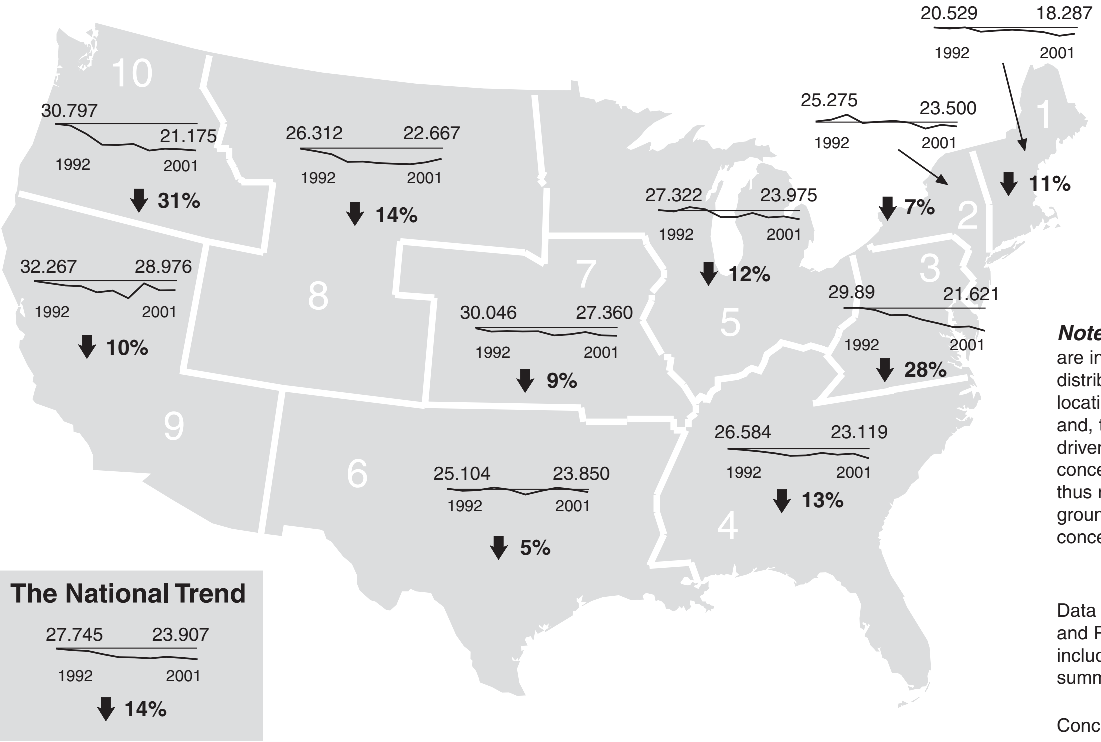
PM_{10} Regional Air Quality Trends

Figure 2-40 is a map of regional trends for the PM_{10} annual mean from 1992 to 2001. All 10 EPA Regions show decreasing trends over the 10-year period, with declines ranging from 5 to 31 percent. The largest 10-year decreases occurred in the Northwest. This is significant because PM_{10} concentrations generally have been higher in the western regions.

In the western States, programs such as those with residential wood stoves and agricultural practices have helped reduce emissions of PM_{10}.

In the eastern United States, the Clean Air Act's Acid Rain Program has contributed to the decrease in PM_{10} emissions. The program has reduced SO_2 and NO_x emissions, both of which are precursors of particulate matter in the atmosphere (see the SO_2 section in this chapter for more information on the Acid Rain Program).

Figure 2-40. Trend in PM_{10} annual mean concentration by EPA Region, 1992–2001.



Note: These trends are influenced by the distribution of monitoring locations in a given Region and, therefore, can be driven largely by urban concentrations. They are thus not indicative of background regional concentrations.

Data from Alaska, Hawaii, and Puerto Rico are not included in these regional summaries.

Concentrations are μg/m^3.

PM_{10} 2001 Air Quality Status

The map in Figure 2-41 displays the highest second maximum 24-hour PM_{10} concentration in each county for 2001. The highest of these was recorded in Inyo County, California, caused by wind-blown dust from a dry lake bed.[19] The bar chart that accompanies the national map shows the number of people living in counties within each concentration range. The colors on the map and bar chart correspond to the colors of the concentration ranges displayed in the map legend. In 2001, approximately 8 million people lived in 13 counties where the highest second maximum 24-hour PM_{10} concentration was above the level of the 24-hour PM_{10} NAAQS. When both the annual and 24-hour PM_{10} standards are considered, there were 11 million people living in 17 counties with PM_{10} concentrations above the NAAQS levels in 2001. See Chapter 4 for information concerning officially designated PM_{10} nonattainment areas.

The Franklin Smelter facility, responsible for historically high recorded PM_{10} concentrations in Philadelphia, shut down in August 1997 and was dismantled in late 1999,[20] resulting in 24-hour concentrations below the level of the standard at the nearby monitoring site.

National PM_{10} Emissions Trends

Direct PM_{10} emissions are generally examined in two separate groups. First, there are the emissions from the more traditionally inventoried sources, which decreased 22 percent nationally between 1993 and 2002 (see Figure 2-42). These sources include fuel combustion, industrial processes, and transportation. Of these, the fuel combustion category saw the largest decrease over the 10-year period (27 percent).

The second group of direct PM_{10} emissions is a combination of miscellaneous and natural sources, including agriculture and forestry, wildfires and managed burning, and fugitive dust from paved and unpaved roads. Although fugitive dust emissions are large and can adversely affect air quality, they do not transport to more distant areas readily as do emissions from other source types. It should be noted that fugitive dust emissions from geogenic wind erosion have been removed from the emissions inventory for all years, because the annual emission estimates based on past methods for this category are not believed to be representative. As Figure 2-43 shows, these miscellaneous and natural sources actually account for a large percentage of the total direct PM_{10}

Figure 2-41. Highest second maximum 24-hour PM_{10} concentration by county, 2001.

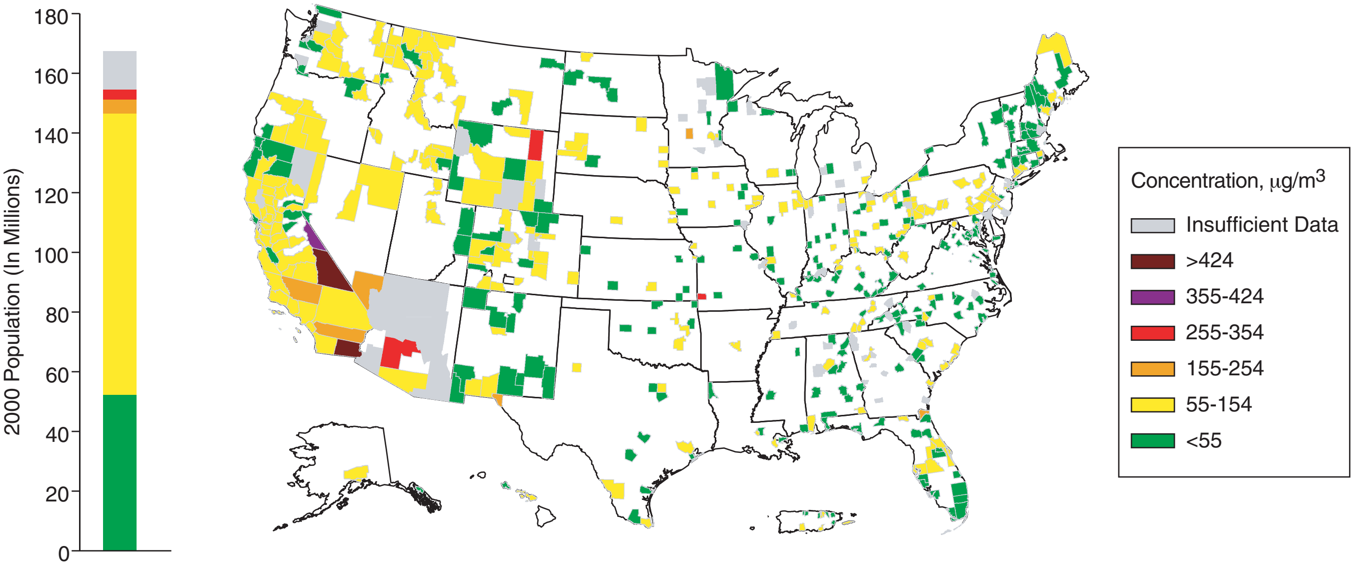
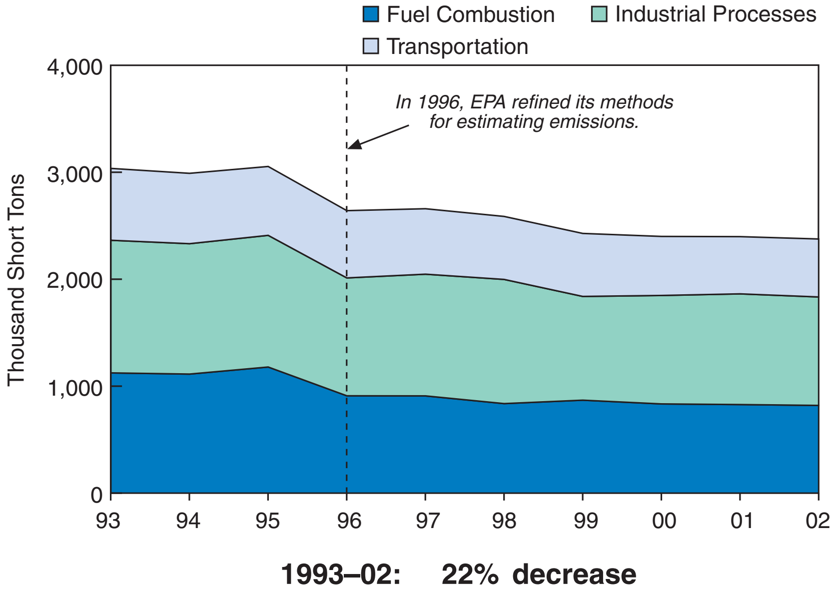
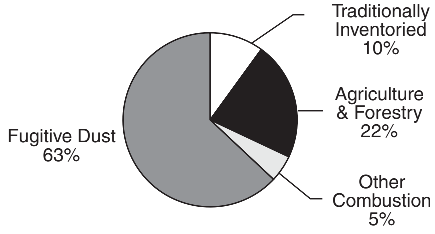


Figure 2-42. National direct PM_{10} emissions, 1993–2002 (traditionally inventoried sources only).



Note: Emission estimation methods and data sources have evolved over time, resulting in some inconsistency in estimates in different years. In the methods used for this report, the significant changes have occurred between 1984 and 1986, and between 1995 and 1996, although not all source types were affected. More explanation is provided in Appendix B.

Figure 2-43. National direct PM_{10} emissions by source category, 2002.



emissions nationwide, although they can be difficult to quantify compared to the traditionally inventoried sources. The trend of emissions in the miscellaneous/natural group may be more uncertain from one year to the next or over several years because of this difficulty and because these emissions tend to fluctuate a great deal from year to year.

Table A-6 lists PM_{10} emissions estimates for the traditionally inventoried and miscellaneous and natural sources.

Figure 2-44 shows the emission density for PM_{10} in each U.S. county. The PM_{10} emission density closely follows patterns in population density and thus is the highest in the eastern half of the United States, in large metropolitan areas, areas with a high concentration of agriculture (e.g., the San Joaquin Valley in California), and along the Pacific Coast. One exception is that open biomass burning is an important source category that is more prevalent in forested areas and in some agricultural areas. Also, fugitive dust is an important component in arid and agricultural areas.

Trends in $PM_{2.5}$ Levels and Direct Emissions

Figure 2-45 shows that direct $PM_{2.5}$ emissions from man-made sources decreased 17 percent nationally between 1993 and 2002. This chart tracks only directly emitted particles and does not account for secondary particles formed when emissions of NO_x, SO_2, ammonia, and other gases react in the atmosphere. The principal types of secondary particles are sulfates and nitrates, which are formed when SO_2 and NO_x react with ammonia.

Figures 2-46 and 2-47 show how sulfates and nitrates, along with other components, contribute to $PM_{2.5}$ concentrations. Figure 2-48 represents the most recent year of data available from the Interagency Monitoring of Protected Visual Environments (IMPROVE) network, which was established in 1987 to track trends in pollutants, such as $PM_{2.5}$, that contribute to visibility impairment. Because the monitoring sites are located in rural areas

Figure 2-44. Direct PM_{10} emissions density by county, 2001.

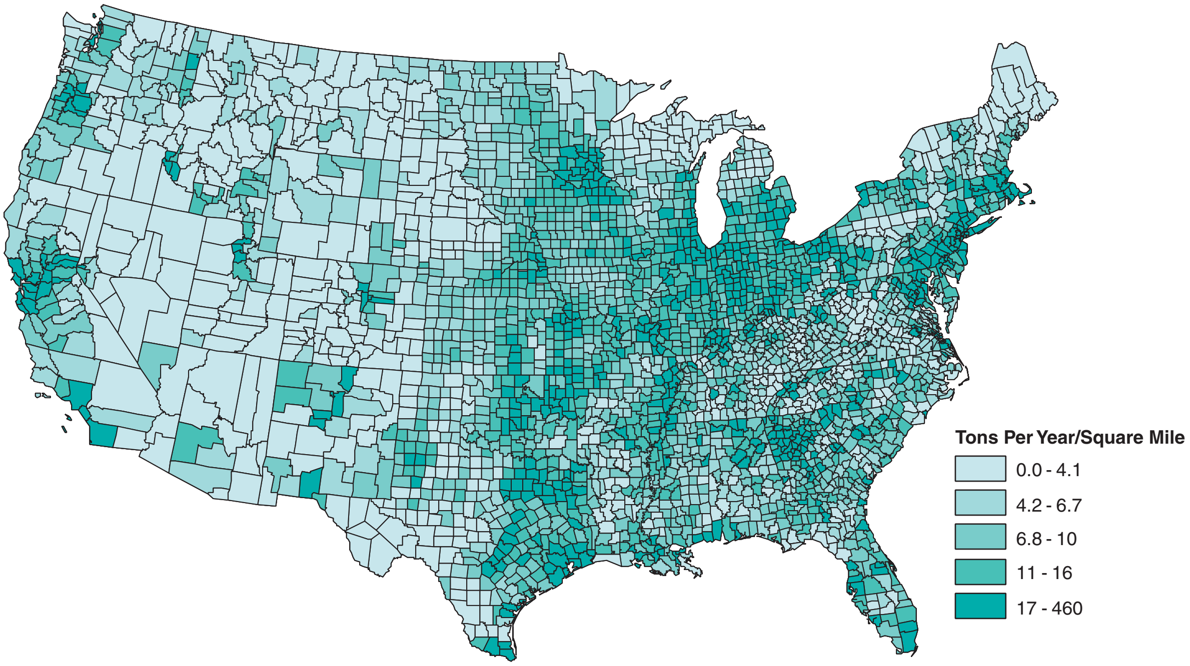
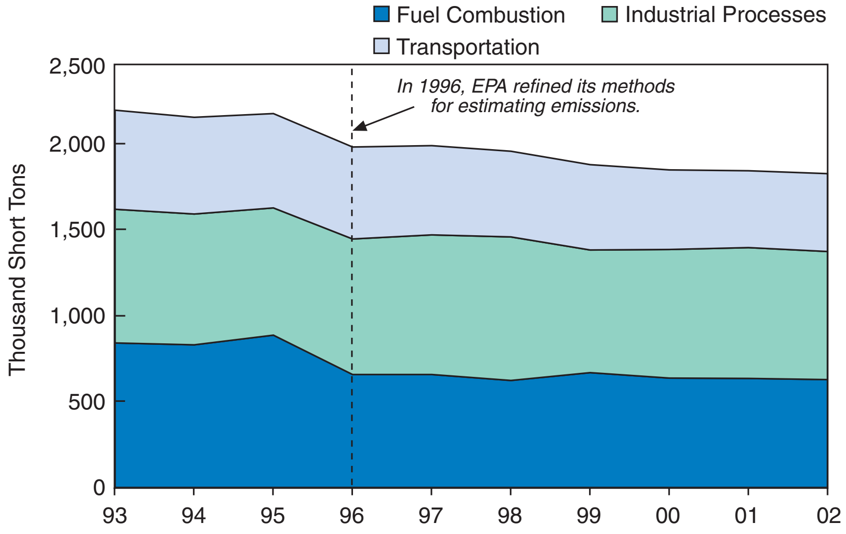


Figure 2-45. National direct $PM_{2.5}$ emissions, 1993–2002 (traditionally inventoried sources only).



1993–02: 17% decrease

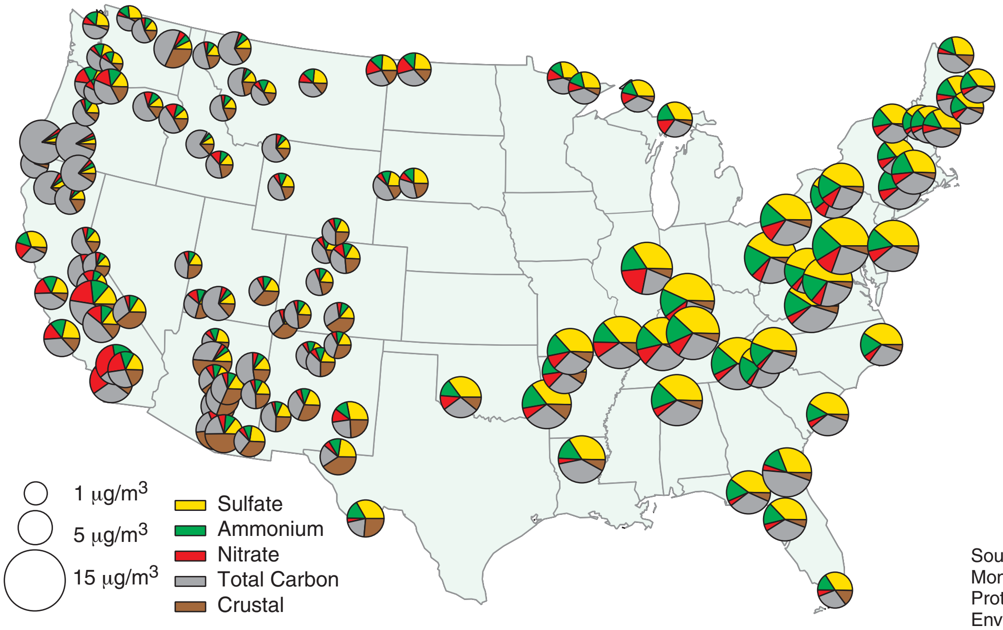
Note: Emission estimation methods and data sources have evolved over time, resulting in some inconsistency in estimates in different years. In the methods used for this report, the significant changes have occurred between 1984 and 1986 and between 1995 and 1996, although not all source types were affected. More explanation is provided in Appendix B.

throughout the country, the network is a good source for assessing regional differences in $PM_{2.5}$. Figure 2-47 represents the most recent year of data from EPA's urban speciation network, which was established in 1999. All of these sites are located in urban areas.

The IMPROVE data show that $PM_{2.5}$ levels in rural areas are highest in the eastern United States and southern California, as shown by the larger circles. Sulfates and associated ammonium dominate the East, with carbon as the next most prevalent component. Sulfate concentrations in the East largely result from SO_2 emissions from coal-fired power plants. In California and other areas of the West, carbon and nitrates make up most of the $PM_{2.5}$ measured.

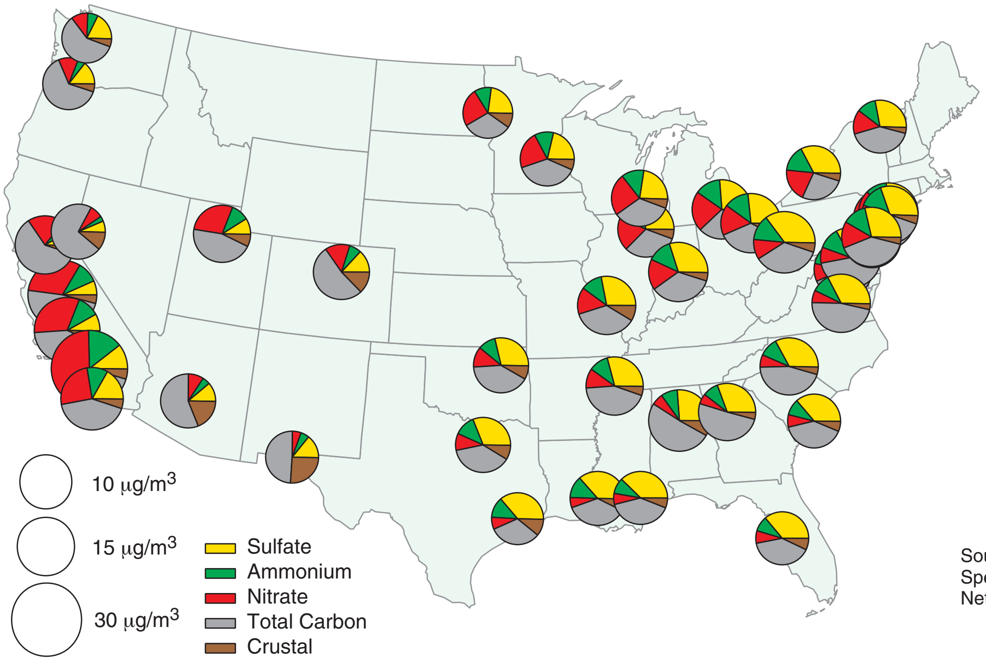
The urban speciation data show that sites in urban areas, as shown in the circles in the map in Figure 2-47, generally have higher annual

Figure 2-46. Annual average $PM_{2.5}$ concentrations (µg/m^3) and particle type in rural areas, 2002.



Source: Interagency Monitoring of Protected Visual Environments Network, 2002.

Figure 2-47. Annual average $PM_{2.5}$ concentrations (µg/m^3) and particle type in urban areas, 2002.



Source: EPA Speciation Network, 2002.

Note: Direct comparisons of the information in Figures 2-46 and 2-47 should take into consideration the fact that one is an urban network and the other is a rural network and that there are differences in instruments and measurement methods.

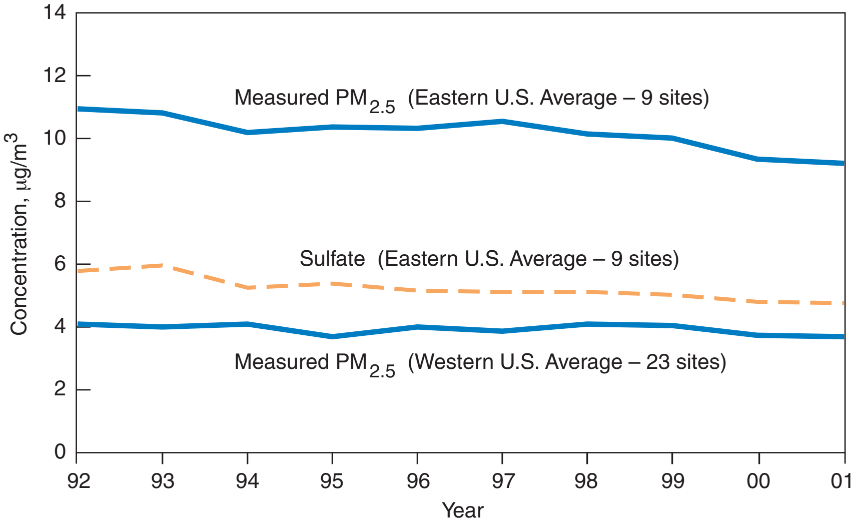
average PM$_{2.5}$ concentrations than nearby rural areas. Urban sites in the East include a large percentage of carbon and sulfates (and ammonium). Urban sites in the Midwest and far West (and especially in California) include a large percentage of carbon and nitrates.

Trends in rural PM$_{2.5}$ concentrations can be examined with data from the IMPROVE network, as shown in Figure 2-48. In the East, where sulfates contribute most to rural PM$_{2.5}$, the annual average PM$_{2.5}$ concentrations decreased 16 percent from 1992 to 2001. This decrease was largely due to a decline in sulfate concentrations, which decreased 17 percent. The other major components remained relatively unchanged over the same period. Average PM$_{2.5}$ concentrations in the West were less than one-half of the average for the eastern sites during this period.

In 1999, EPA and its state, tribal, and local air pollution control partners deployed a monitoring network to begin measuring PM$_{2.5}$ concentrations nationwide. Figure 2-49 shows annual average PM$_{2.5}$ concentrations by county. This map also indicates that PM$_{2.5}$ concentrations vary regionally. Based on the monitoring data, parts of California and much of the eastern United States have annual average PM$_{2.5}$ concentrations above the level of the annual PM$_{2.5}$ standard, as indicated by the orange and red on the map. With few exceptions, the rest of the country generally has annual average concentrations below the level of the annual PM$_{2.5}$ health standard.

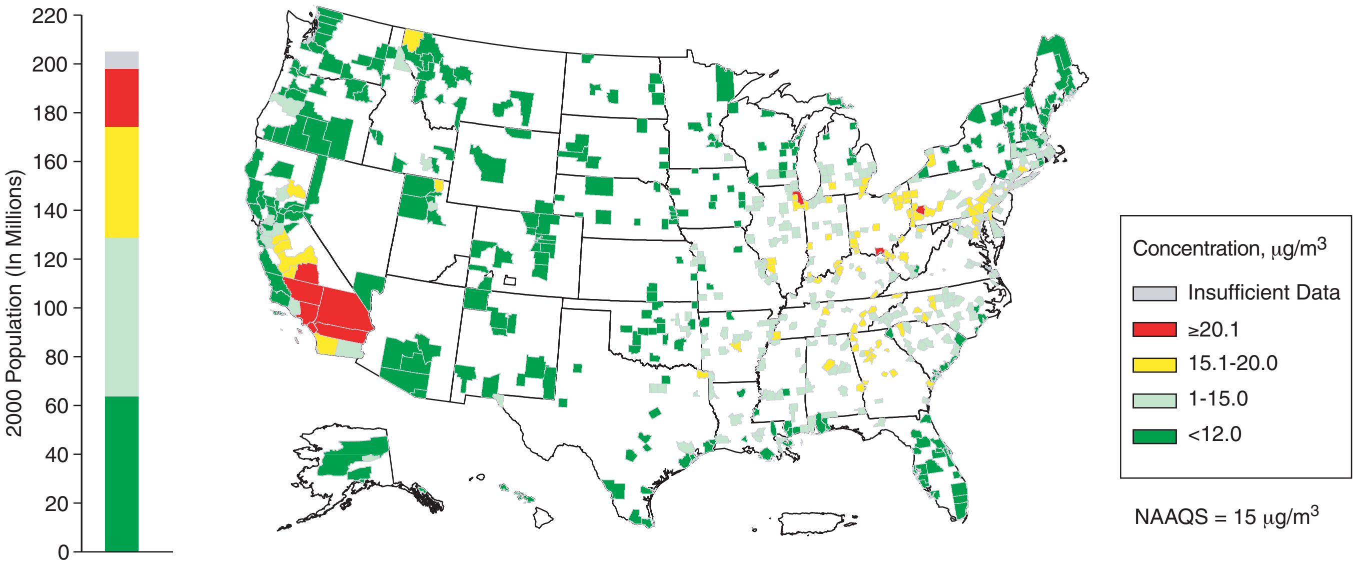
Now that there are several years of monitoring data available, EPA has begun to examine trends at the national level, as shown in Figure 2-50. Annual average PM$_{2.5}$ concentrations decreased 8 percent nationally from 1999 to 2002. The Southeast was responsible for most

Figure 2-48. Annual average PM$_{2.5}$ concentrations in rural areas.



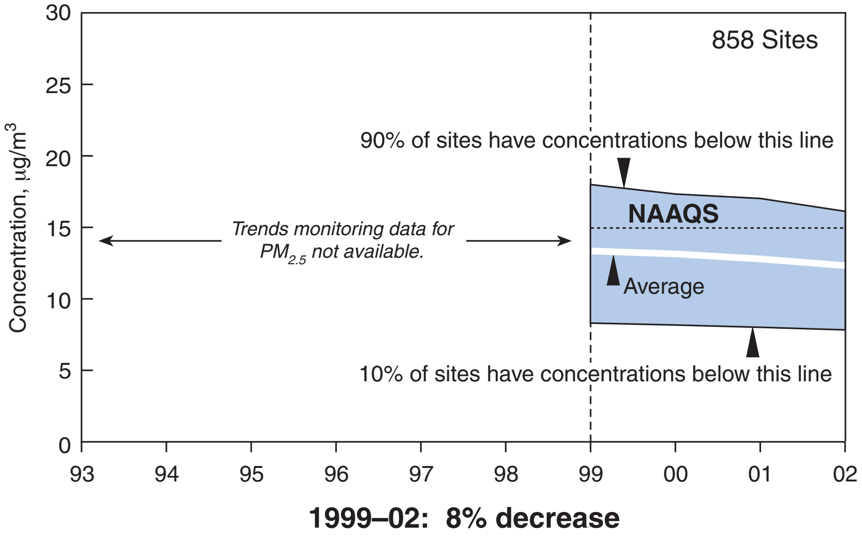
Source: Interagency Monitoring of Protected Visual Environments Network, 1999.

Figure 2-49. Annual average PM$_{2.5}$ concentrations by county, 2001.



of that reduction, where the monitored levels of $PM_{2.5}$ decreased 18 percent from 1999 to 2002. Lower 2002 annual average concentrations in the Southeast are due, in part, to decreases in sulfates, which largely result from power plant emissions of SO_2.

Figure 2-50. Annual average $PM_{2.5}$ concentrations (µg/m^3), 2002 (based on seasonally weighted annual average).



Sulfur Dioxide

Air Quality Concentrations		
1983–02	54%	decrease
1993–02	39%	decrease
Emissions		
1983–02	33%	decrease
1993–02	31%	decrease

Worth Noting

- Steady 20-year improvement has reduced sulfur dioxide (SO_2) ambient concentrations by one-half and emissions by more than one-third.
- Phase II of the Acid Rain Program was implemented in 2000 and has resulted in new reductions.

Nature and Sources

Sulfur dioxide (SO_2) belongs to the family of sulfur oxide (SO_x) gases. These gases are formed when fuel containing sulfur (mainly coal and oil) is burned and during metal smelting and other industrial processes. The highest monitored concentrations of SO_2 have been recorded in the vicinity of large industrial facilities.

Health and Environmental Effects

High concentrations of SO_2 can result in temporary breathing impairment for asthmatic children and adults who are active outdoors. Short-term exposures of asthmatic individuals to elevated SO_2 levels while at moderate exertion may result in reduced lung function that may be accompanied by symptoms such as wheezing, chest tightness, or shortness of breath. Other effects that have been associated with longer-term exposures to high concentrations of SO_2, in conjunction with high levels of PM, include respiratory illness, alterations in the lungs' defenses, and aggravation of existing cardiovascular disease. The subgroups of the population that may be affected under these conditions include individuals with cardiovascular disease or chronic lung disease, as well as children and the elderly.

Additionally, there are a variety of environmental concerns associated with high concentrations of SO_2. Because SO_2, along with NO_x, is a major precursor to acidic deposition (acid rain), it contributes to the acidification of soils, lakes, and streams and the associated adverse impacts on ecosystems. Sulfur dioxide exposure to vegetation can increase foliar injury, decrease plant growth and yield, and decrease the number and variety of plant species in a given community. Sulfur dioxide also is a major precursor to $PM_{2.5}$ (aerosols), which is of significant concern to human health (as discussed in the particulate matter section of this chapter), as well as a main pollutant that impairs visibility. Finally, SO_2 can accelerate the corrosion of natural and man-made materials (e.g., concrete and limestone) that are used in buildings and monuments, as well as paper, iron-containing metals, zinc, and other protective coatings.

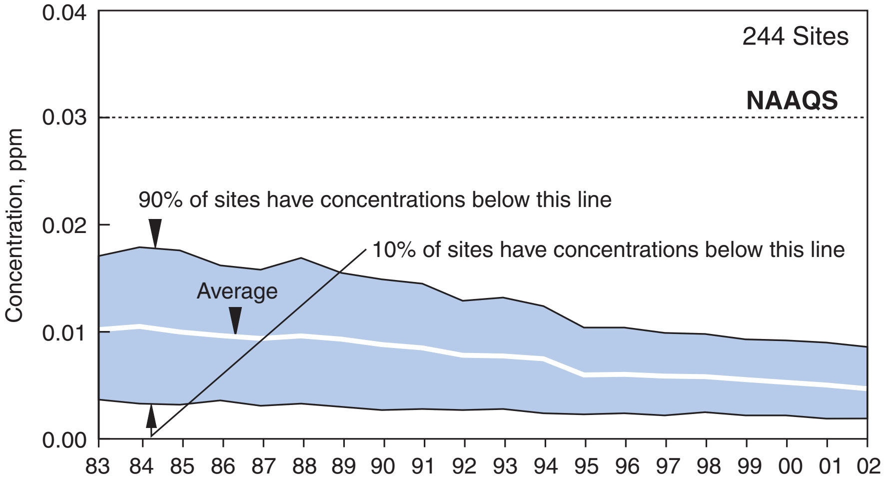
Primary and Secondary Standards

There are both short- and long-term primary NAAQS for SO_2. The short-term (24-hour) standard of 0.14 ppm (365 µg/m^3) is not to be exceeded more than once per year. The long-term standard specifies an annual arithmetic mean not to exceed 0.030 ppm (80 µg/m^3). The secondary NAAQS (3-hour) of 0.50 ppm (1,300 µg/m^3) is not to be exceeded more than once per year. The standards for SO_2 have undergone periodic review, but the science has not warranted a change since they were established in 1972.

National 10-Year Air Quality Trends

The national composite average of SO_2 annual mean concentrations decreased 39 percent between 1993 and 2002 as shown in Figure 2-51, with the largest single-year reduction (16 percent) occurring between 1994 and 1995.[21] The composite trend has since leveled off, declining only

Figure 2-51. SO_2 air quality, 1983–2002, based on annual arithmetic average.



1983–02: 54% decrease
1993–02: 39% decrease

4.5 percent from 2001 to 2002. This same general trend is seen in Figure 2-52, which plots the ambient concentrations grouped by rural, suburban, and urban sites. It shows that the mean concentrations at the urban and suburban sites have been consistently higher than those at the rural sites. However, the 1994 to 1995 reduction in the concentrations at nonrural sites has narrowed the gap between the trends. The greater reduction seen in the nonrural sites reflects the fact that the proportion of nonrural sites is greater in the eastern United States, which is where most of the 1994 to 1995 emissions reductions at electric utilities occurred.[22] The national composite second maximum 24-hour SO_2 annual mean concentrations decreased 35 percent between 1992 and 2001 with the largest single year reduction (25 percent) also occurring between 1994 and 1995.

National Emissions Trends

As shown in Figure 2-53, national SO_2 emissions decreased 31 percent between 1993 and 2002, with an even more impressive 33 percent decrease in the past 20 years (1983 to 2002). The dramatic reduction in 1995 was caused by implementation of the Acid Rain Program; subsequent year-to-year variations are driven in part by the yearly changes in emissions from the electric utility industry, which accounts for most of the fuel combustion category in Figure 2-54. In particular, coal-burning power plants have consistently been the largest contributor to SO_2 emissions, as documented in Table A-9 in Appendix A.

Figure 2-55 shows the emissions density for SO_2 in each U.S. county. SO_2 emissions density is highest in the eastern United States, in large metropolitan areas, and in areas with coal-burning power plants.

Figure 2-52. Annual mean SO_2 concentration by trend location, 1982–2001.

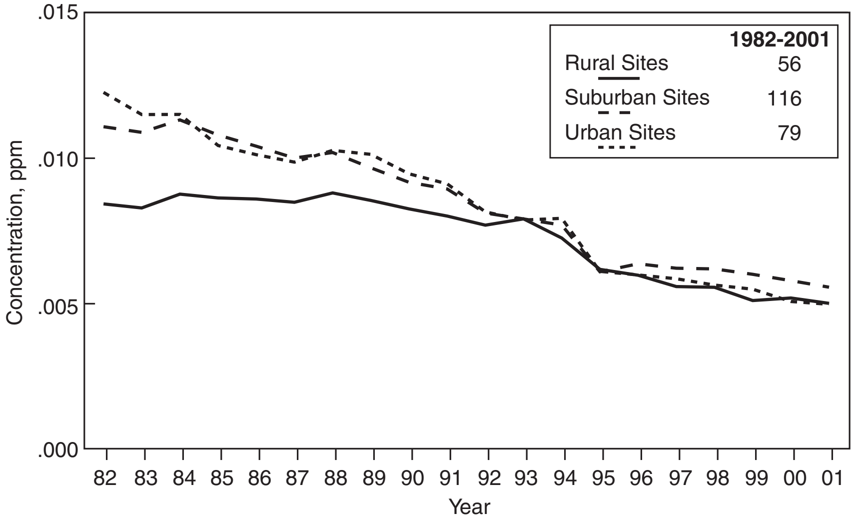
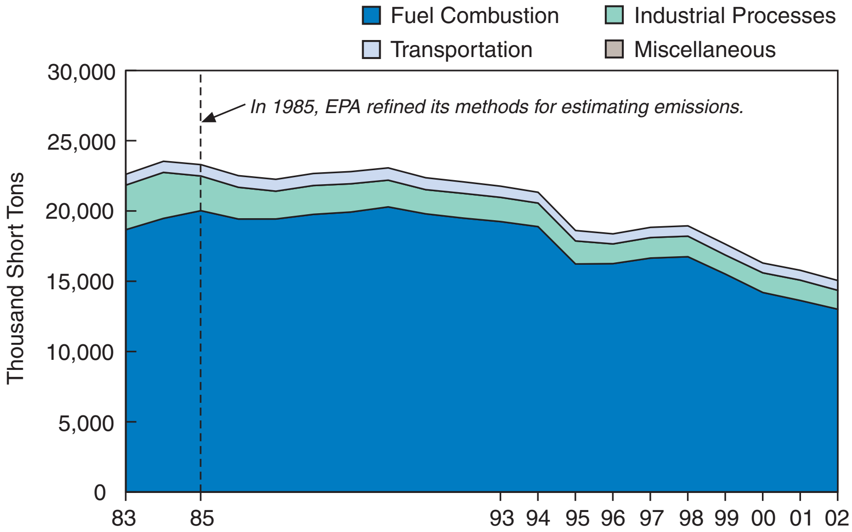


Figure 2-53. SO_2 emissions, 1983–2002.

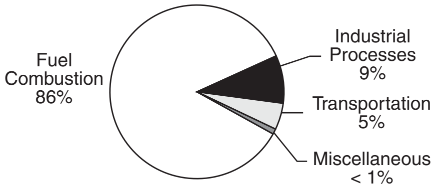


1983–02: 33% decrease[a]
1993–02: 31% decrease

Note: Emission estimation methods and data sources have evolved over time, resulting in some inconsistency in estimates in different years. In the methods used for this report, the significant changes have occurred between 1984 and 1986 and between 1995 and 1996, although not all source types were affected. More explanation is provided in Appendix B.

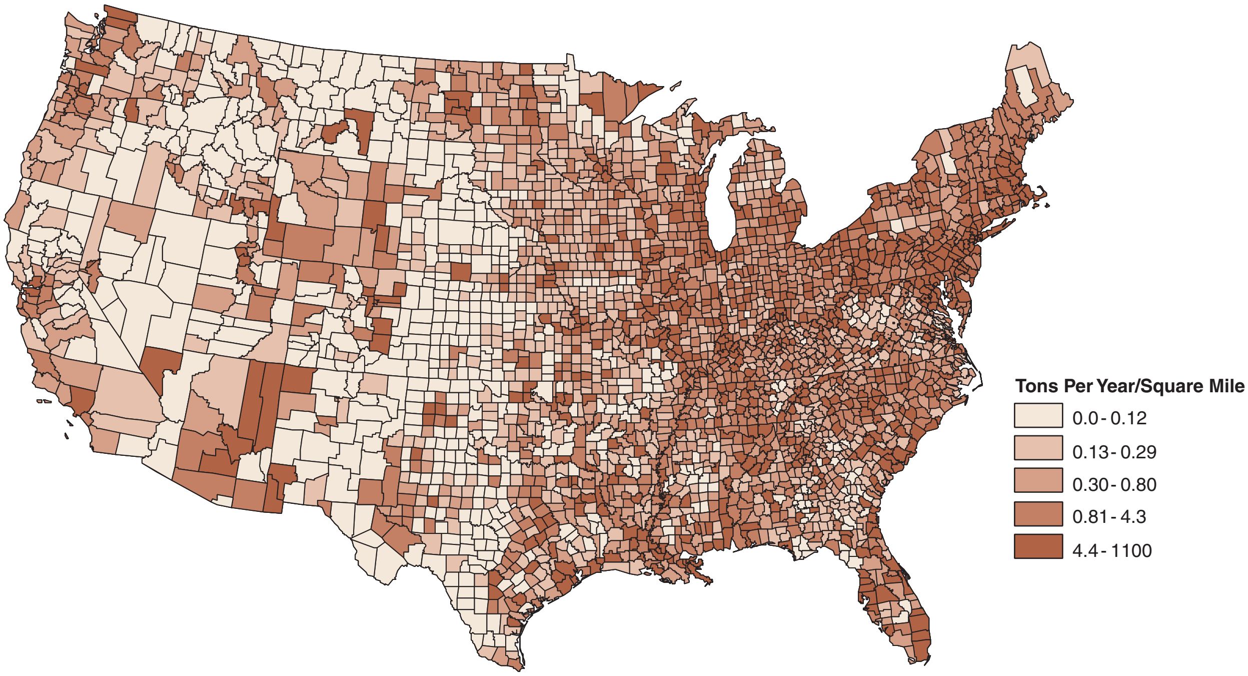
[a] Emissions trends data are not available for 1983; thus, the 20-year trend was interpolated based on emissions data for 1980 and 1985.

Figure 2-54. SO_2 emissions by source category, 2002.[a]



[a] Sums do not equal 100 due to rounding.

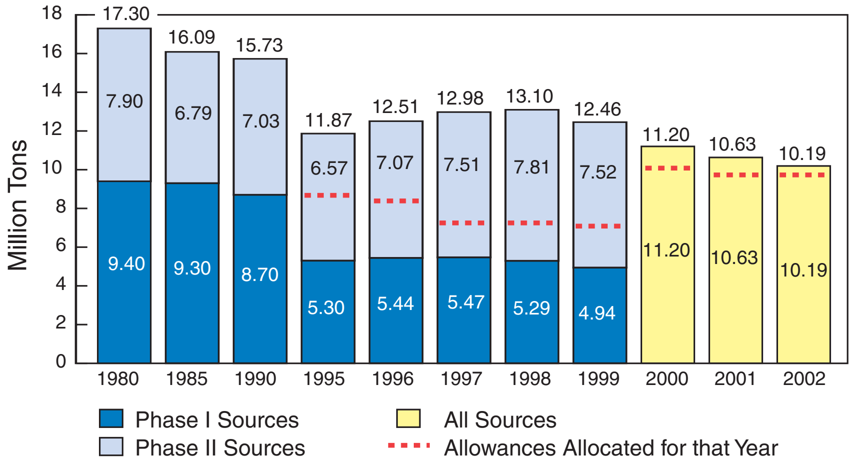
Figure 2-55. Direct SO_2 emissions density by county, 2001.



The Acid Rain Program

The substantial national reductions in SO_2 emissions and ambient SO_2 and sulfate concentrations from 1994 to 1995 were due mainly to Phase I implementation of the Acid Rain Program. Established by EPA under Title IV of the 1990 Amendments, the Acid Rain Program's principal goal is to achieve significant reductions in SO_2 and NO_x emissions from electric utilities. Phase I compliance for SO_2 began in 1995 and significantly reduced emissions from the participating utilities.[23] Phase II began in 2000 and sets restrictions on Phase I plants as well as smaller coal-, gas-, and oil-fired plants. Approximately 3,000 units are now affected by the Acid Rain Program. Figure 2-56 shows the reduction in SO_2 emissions for all sources.

Figure 2-56. National SO_2 emissions trend for all Title IV affected units.



Between 1996 and 1998, total SO_2 emissions from electric utilities had increased slightly, compared to their levels in 1995. Since 2000, however, total SO_2 emissions have decreased, falling slightly below 1995 levels. Most Phase I plants overcomplied in Phase I (1995 to 2000), banking their SO_2 allowances for use in Phase II, resulting in significant early reductions. However, some Phase I units did increase their emissions during these years. Because Phase I units account for only 18 percent of the total 1996 to 1998 increase, the majority of the increase is attributed to those units not yet participating in the Acid Rain Program until Phase II. By 2010, the Acid Rain Program will reduce annual SO_2 emissions by half from 1980 levels. The program sets a permanent cap at 8.95 million tons per year on the total amount of SO_2 that may be emitted from power plants nationwide. For more information on the Acid Rain Program, visit **http://www.epa.gov/airmarkets**.

National 20-Year Air Quality Trends

The progress in reducing ambient SO_2 concentrations during the past 20 years is shown in Figure 2-57. The national 2001 composite average SO_2 annual mean concentration is 50 percent lower than it was in 1982. In addition to the previously mentioned effects of the Acid Rain Program, these steady reductions over time were 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.

Regional Air Quality Trends

The map of regional trends in Figure 2-58 shows that ambient SO_2 concentrations are generally higher in the eastern United States. The effects of Phase I of the Acid Rain Program are seen most vividly in the northeast. In particular, concentrations fell 20 to 25 percent between 1994 and 1995 in EPA Regions 1, 2, 3, and 5. These broad regional trends are not surprising because most of the units affected by Phase I of the Acid Rain Program also are located in the East. This figure also shows that ambient concentrations have increased slightly between 1995 and 1997 in Regions 3 and 4 where many of the electric utility units not yet affected by the Acid Rain Program are located.

2001 Air Quality Status

The most recent year of ambient data shows that all counties did meet the primary SO_2 short-term standard, as shown by Figure 2-59.

Figure 2-57. Long-term ambient SO_2 trend, 1982-2001.

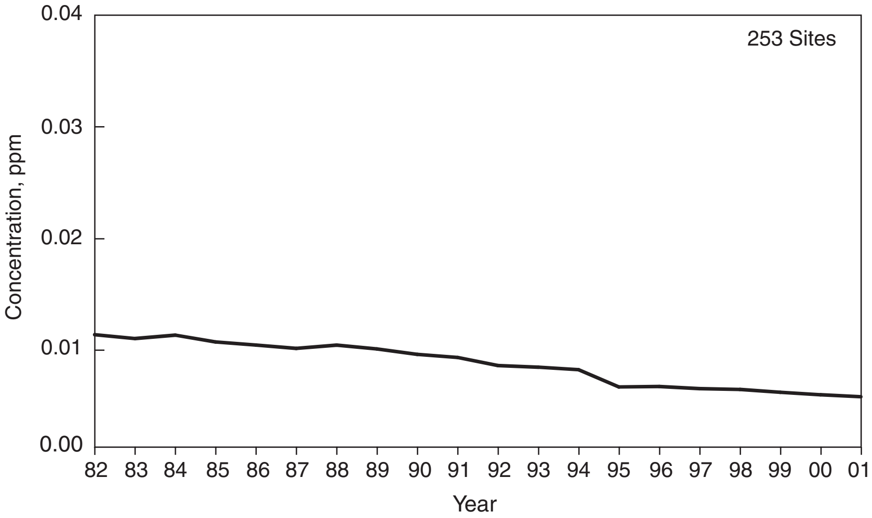
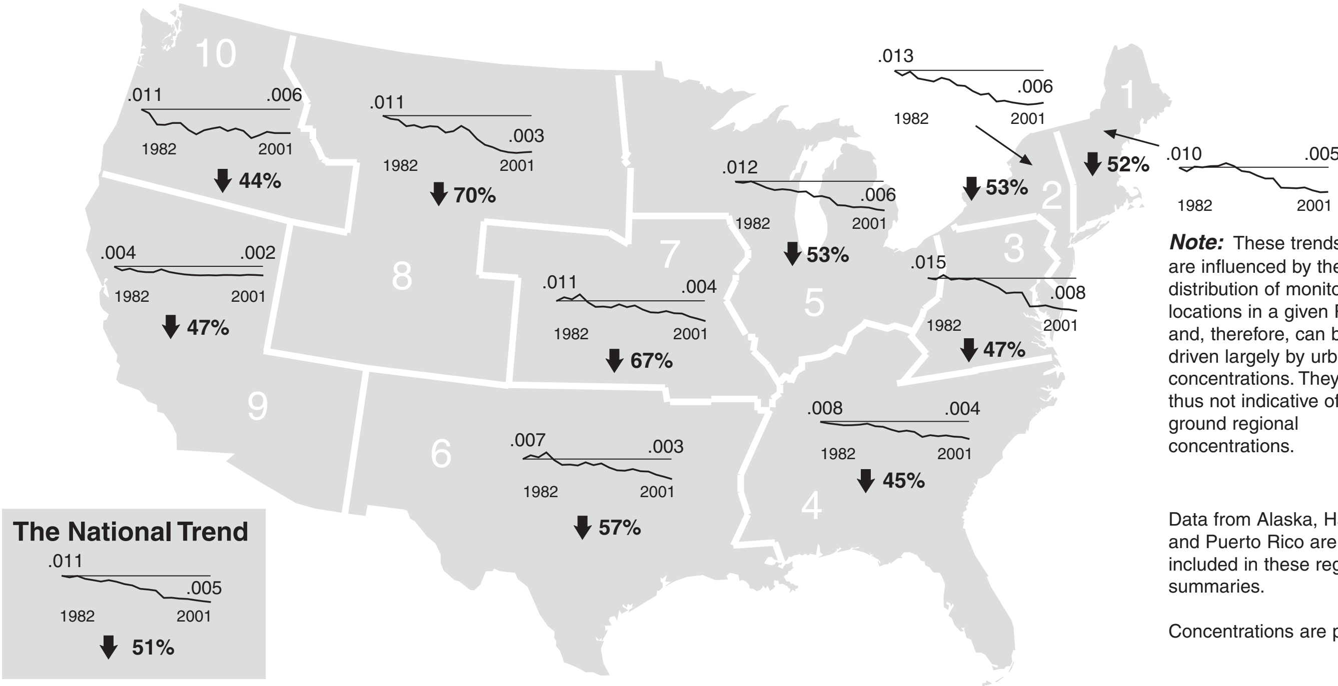


Figure 2-58. Trend in SO_2 annual arithmetic mean concentration by EPA Region, 1982–2001.

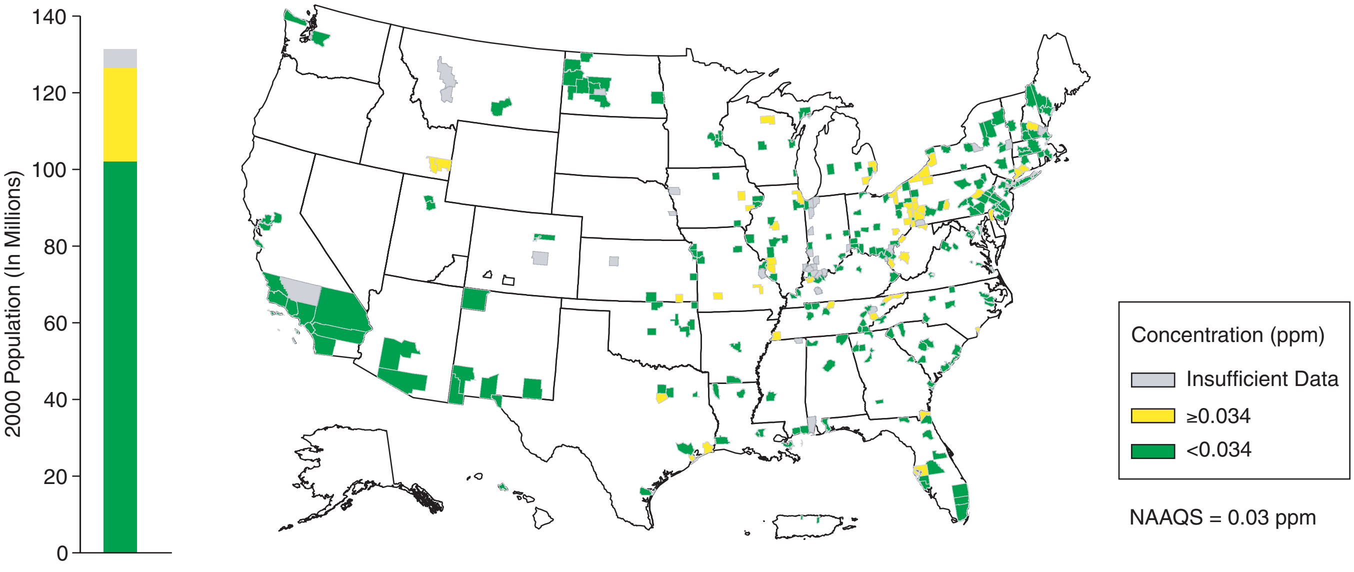


Note: These trends are influenced by the distribution of monitoring locations in a given Region and, therefore, can be driven largely by urban concentrations. They are thus not indicative of background regional concentrations.

Data from Alaska, Hawaii, and Puerto Rico are not included in these regional summaries.

Concentrations are ppm.

Figure 2-59. Highest SO_2 annual mean concentration by county, 2001.



NAAQS = 0.03 ppm

References

1. Note that due to the annual loss and replacement of ambient monitoring sites (e.g., redevelopment, new leases), too few sites possess a monitoring record sufficient to construct a representative 20-year trend for the nation. Therefore, this report assesses long-term trends by piecing together two separate 10-year trends databases.

2. *Oxygenated Gasoline Implementation Guidelines*, EPA, Office of Mobile Sources, Washington, DC, July 27, 1992.

3. *Guidelines for Oxygenated Gasoline Credit Programs and Guidelines on Establishment of Control Periods Under Section 211(m) of the Clean Air Act as Amended*, 57 FR 47853 (October 20, 1992).

4. Table of winter oxygenated fuels programs by state, EPA, Office of Transportation and Air Quality, Washington, DC, December 8, 1999. **http://www.epa.gov/otaq/regs/fuels/oxy-area.pdf**

5. National Ambient Air Quality Standards for Nitrogen Dioxide: Final Decision, *Federal Register*, 61 FR 196, Washington, DC, October 8, 1996.

6. *Review of the National Ambient Air Quality Standards for Nitrogen Oxides: Assessment of Scientific and Technical Information*, EPA-452/R-95-005, U.S. Environmental Protection Agency, Research Triangle Park, NC, September 1995.

7. Atmospheric concentrations of NO_2 are determined by indirect photomultiplier measurement of the luminescence produced by a critical reaction of NO with ozone. The measurement of NO_2 is based first on the conversion of NO_2 to NO, and then subsequent detection of NO using this well-characterized chemiluminescence technique. This conversion is not specific for NO_2, hence chemiluminescence analyzers are subject to interferences produced by response to other nitrogen-containing compounds (e.g., peroxyacetyl nitrate [PAN]) that can be converted to NO. The chemiluminescence technique has been reported to overestimate NO_2 due to these interferences. This is not an issue for compliance because there are no violations of the NO_2 NAAQS. In addition, the interferences are believed to be relatively small in urban areas. The national and regional air quality trends depicted are based primarily on data from monitoring sites in urban locations and are expected to be reasonable representations of urban NO_2 trends. That is not the case in rural and remote areas, however, where air mass aging could foster greater relative levels of PAN and nitric acid and interfere significantly with the interpretation of NO_2 monitoring data.

8. *1998 Compliance Report*, U.S. Environmental Protection Agency, Acid Rain Program, Washington, DC, August 1999.

9. National Ambient Air Quality Standards for Ozone; Final Rule, *Federal Register*, 62 FR 38856, Washington, DC, July 18, 1997.

10. United States Environmental Protection Agency. Office of Air Quality Planning and Standards. 2000. "National Air Quality and Emissions Trends Reports, 1998." Appedix B.

11. The 1-hour annual ozone design value is defined at an individual monitoring location as the second highest daily maximum 1-hour average concentration; the 8-hour annual design value is definedas the fourth highest daily maximum 8-hour average concentration.

12. Coulter-Burke, S. and T. Stoeckenius, 2002. *Analysis of Ambient Air Quality Trends in the Chicago and Atlanta Ozone Nonattainment Areas.* ENVIRON International Corp., September.

13. CASTNet is considered the nation's primary source for atmospheric data to estimate dry acidic deposition and to provide data on rural ozone levels. Used in conjunction with other national monitoring networks, CASTNet helps to determine the effectiveness of national emission control programs. Established in 1987, CASTNet now comprises 79 monitoring stations across the United States. The longest data records are primarily at eastern sites. The majority of the monitoring stations are operated by EPA's Office of Air and Radiation; however, 27 stations are operated by the National Park Service (NPS) in cooperation with EPA. The CASTNet data complement the larger O_3 data sets gathered by the State and Local Air Monitoring Stations (SLAMS) and National Air Monitoring Stations (NAMS) networks with additional rural coverage.

14. Similarly, although registering declines in 8-hour ozone levels of 16 and 12 percent, respectively, over the last 20 years, urban and suburban site progress slowed between 1991 and 2000 (to 8.5 and 8 percent improvement).

15. This analysis utilizes a nonparametric regression procedure to assess statistical significance, a description of which is provided in Chapter 3: Criteria Pollutants – Metropolitan Area Trends.

16. "Volatility Regulations for Gasoline and Alcohol Blends Sold in Calendar Years 1989 and Beyond," *Federal Register*, 54 FR 11868,

Washington, DC, March 22,1989.

17. *Reformulated Gasoline: A Major Step Toward Cleaner Air*, EPA-420-B-94-004, U.S. Environmental Protection Agency, Office of Air and Radiation, Washington, DC, September 1994.

18. National Ambient Air Quality Standards for Particulate Matter: Final Rule, *Federal Register*, 62 FR 38652, Washington, DC, July 18, 1997. **http://www.epa.gov/ttn/oarpg/t1/fr_notices/pmnaaqs.pdf**.

19. Personal communication with EPA Region 9.

20. Personal communication with EPA Region 3.

21. *Revised Requirements for Designation of Reference and Equivalent Methods for PM2.5 and Ambient Air Quality Surveillance for Particulate Matter: Final Rule*, *Federal Register 62* July 18, 1997.

22. IMPROVE, Cooperative Center for Research in the Atmosphere, Colorado State University, Ft. Collins, CO, May 2000.

23. *1997 Compliance Report: Acid Rain Program*, EPA-430-R-98-012, U.S. Environmental Protection Agency, Office of Air and Radiation, Washington, DC, August 1998.

CHAPTER 3

Criteria Pollutants — Metropolitan Area Trends

http://www.epa.gov/oar/airtrends/metro.html

Worth Noting

- Out of 296 metropolitan statistical areas, 36 have significant upward trends.
- Of these, only trends involving ozone had values over the level of air quality standards.

This chapter presents status and trends in criteria pollutants for metropolitan statistical areas (MSAs) in the United States. The MSA status and trends give a local picture of air pollution and can reveal regional patterns of trends. Such information can allow individuals to gauge the air pollution situation where they live. Not all areas in the country are in MSAs, and not all MSAs are included here. A complete list of MSAs and their boundaries can be found in the Statistical Abstract of the United States.[1] The status and trends of MSAs are based on four tables found in Appendix A (A-15 through A-18). Table A-15 gives the 2000 peak statistics for all MSAs, providing the status of that year. It also shows 10-year trends for the 263 MSAs having data that meet the trends requirements explained in Appendix B. Table A-16 lists these MSAs and reports criteria pollutant trends as "upward," "downward," or "not significant." These categories are based on a statistical test, known as the Theil test, described later in this chapter.

Another way to assess trends in MSAs is to examine Air Quality Index (AQI) values.[2,3,4] The AQI is used to present daily information to the public on one or more criteria pollutants in an easily understood format and in a timely manner. Tables A-17 and A-18 list the number of days with AQI values greater than 100 for the nation's 94 largest metropolitan areas (population greater than 500,000). Table A-17 lists AQI values based on all pollutants, and Table A-18 lists AQI values based on ozone alone. The tables listing Pollutant Standards Index (PSI) data from previous reports may not agree with the tables in this report because of the new way to calculate the AQI. These changes are presented in more detail later in this chapter.

A new technique for displaying air quality information is also described. This technique presents visual clues as to the status of different MSAs.

Not every MSA appears in these tables. Some do not appear because the population is so small or the air quality is so good that AQI reporting is not currently required. Ambient monitoring for a particular pollutant may not be conducted if there is no problem, thus some MSAs have no ongoing air quality monitoring for one or more of the criteria pollutants. In addition, there are also MSAs with too little monitoring data for trends analysis purposes (see Appendix B).

Status: 2001

The air quality status for MSAs is provided in Table A-15, which lists peak statistics for all criteria pollutants measured in an MSA. As discussed above, not all criteria pollutants are measured in all MSAs, hence the "ND" (no data) listings in Table A-15. Examining Table A-15 shows that 140 areas had peak concentrations exceeding standard levels for at least one criteria pollutant. The number of these areas increased by 4 the count from 2000 (136 areas). These 140 areas are home to 56 percent of the U.S. population. Similarly, there were 60 areas (with 36 percent of the population) that had peak statistics that exceeded two or more standards. Six areas—Bakersfield, CA, Riverside–San Bernardino, CA, Fresno, CA, Birmingham, AL, St. Louis, MO, and Visalia–Tulare–Porterville, CA (with 3 percent of the U.S. population)—had peak statistics from three pollutants that exceeded the respective standards. There was one area that violated four or more standards (St. Louis, MO).

Trends Analysis

Table A-16 displays air quality trends for MSAs. The data in this table are average statistics of pollutant concentrations from the subset of ambient monitoring sites that meet the trends criteria explained in Appendix B. A total of 246 MSAs have at least one monitoring site that meets these criteria. As stated previously, not all pollutants are measured in every MSA. From 1992 to 2001, statistics based on the standards were calculated for each site and pollutant with available data. Spatial averages were obtained for each of the 246 MSAs by averaging these statistics across all sites in an MSA. This process resulted in one value per MSA per year for each pollutant. Although there are seasonal patterns of high values for some pollutants in some locations, the averages for every MSA and year provide a consistent indicator with which to assess trends.

Because air pollution levels are affected by variations in meteorology, emissions, and day-to-day activities of populations in MSAs, trends in air pollution levels are not always well defined. To assess upward or downward trends, we applied a statistical significance test to these data. An advantage of using the statistical test is the ability to test whether or not the upward or downward trend is real (significant) or just a chance product of year-to-year variation (not significant). Because the underlying pollutant distributions do not meet the usual assumptions required for common significance tests, the test was based on a nonparametric method commonly referred to as the Theil test.[5,6,7,8] By using linear regression to estimate the trend from changes during the entire 10-year period, we can detect an upward or downward trend even when the concentration level of the first year equals the concentration level of the last year.

Table 3-1. Summary of MSA Trend Analyses by Pollutant, 1990–1999

	Trend Statistic	Total # MSAs	# MSAs Up	# MSAs Down	# MSAs with No Significant Trend
CO	Second max. 8-hour	134	0	104	30
Pb	Max. quarterly mean	35	1	12	22
NO_2	Arithmetic mean	97	3	37	57
O_3	Fourth max. 8-hour	202	17	10	175
O_3	Second daily max. 1-hour	202	12	15	175
PM_{10}	Ninetieth percentile	164	4	41	119
PM_{10}	Weighted annual mean	164	7	60	97
SO_2	Arithmetic mean	139	4	70	65
SO_2	Second max. 24-hour	139	2	62	75

Table 3-1 summarizes the trend analysis performed on the 246 MSAs. It shows that there were no upward trends in carbon monoxide (CO). PM_{10} and sulfur dioxide had upward trends in 7 MSAs over the past decade, NO_2 had upward trends in 3 MSAs, while SO_2 had upward trends in 4 MSAs. Lead had an upward trend in 1 MSA. Further examination of Table A-16 shows that, of the 246 MSAs, (1) 180 had downward trends in at least one of the criteria pollutants, (2) 36 had upward trends (of these 36, 25 also had downward trends in other pollutants, leaving 9 MSAs with exclusively upward trends), and (3) only 2 MSAs had no significant trends. A closer look at the 36 MSAs with upward trends reveals that 13 were exceeding the level of the 8-hour ozone standard, and 3 were above the 1-hour standard. For all other pollutants with upward trends in any MSA, the levels observed were well below standard levels. Taken as a whole, these results still demonstrate significant improvements in urban air quality over the past decade for the nation; however, the number of MSAs with upward trends is increasing when compared to numbers in previous reports.

The Air Quality Index

The AQI provides information on pollutant concentrations for ground-level ozone, particulate matter, carbon monoxide, sulfur dioxide, and nitrogen dioxide. Formerly known as the PSI, this nationally uniform air quality index is used by state and local agencies for reporting daily air quality to the public. In 1999, EPA updated the AQI to reflect the latest science on air pollution health effects and to make it more appropriate for use in contemporary news media, thereby enhancing the public's understanding of air pollution across the nation. Currently, the AQI may be found in national media such as *USA Today* and on the Weather Channel, as well as in local newspapers and broadcasts across the country. It also serves as a basis for community-based programs that encourage the public to take action to reduce air pollution on days when levels are projected to be of concern. An Internet Web site, AIRNOW **(http://www.epa.gov/airnow)**, which presents "real time" air quality data and forecasts of summertime smog levels for most states, uses the AQI to communicate information about air quality. The index has been adopted by many other countries (e.g., Mexico, Singapore, and Taiwan) and is used around the world to provide the public with information on air pollutants.

AQI values for each of the pollutants are derived from concentrations of that pollutant. The index is "normalized" across each pollutant so that, generally, an index value of 100 is set at the level of the short-term, health-based standard for that pollutant. An index value of 500 is set at the significant harm level, which represents imminent and substantial endangerment to public health.[9] The higher the index value, the greater the level of air pollution and health risk.

To make the AQI as easy to understand as possible, EPA has divided the AQI scale into six general categories that correspond to a different level of health concern:

- **Good** (0–50): Air quality is considered satisfactory, and air pollution poses little or no risk.
- **Moderate** (51–100): Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number of individuals. For example, people who are unusually sensitive to ozone may experience respiratory symptoms.
- **Unhealthy for Sensitive Groups** (101–150): Certain groups of people may be particularly sensitive to the harmful effects of certain air pollutants. This means they are likely to be affected at lower levels than is the general public. For example, people with respiratory disease are at greater risk from exposure to ozone, while people with respiratory disease or heart disease are at greater risk from particulate matter. When the AQI is in this range, members of sensitive groups may experience health effects, but the general public is not likely to be affected.
- **Unhealthy** (151–200): Everyone may begin to experience health effects. Members of sensitive groups may experience more serious health effects.
- **Very Unhealthy** (201–300): Air quality in this range triggers a health alert, meaning everyone may experience more serious health effects.
- **Hazardous** (over 300): Air quality in this range triggers health warnings of emergency conditions. The entire population is more likely to be affected.

Because different groups of people are sensitive to different pollutants, there are pollutant-specific health effects and cautionary statements for each category in the AQI.

An AQI report will contain an index value, category name, and the pollutant of concern and is often featured on local television or radio news programs and in newspapers, especially when values are high. For national consistency and ease of understanding, if the AQI is reported using color, there are specific, required colors associated with each category. Examples of the use of color in AQI reporting include the color bars that appear in many newspapers and the color contours of the ozone map. The six AQI categories, their respective health effects descriptors, colors, index ranges, and corresponding concentration ranges are shown in Table 3-2. EPA has also developed an AQI logo (Figure 3-1) to increase the awareness of the AQI in media reports and also to indicate that the AQI is uniform throughout the country.

The AQI integrates information on pollutant concentrations across an entire monitoring network into a single number that represents the worst daily air quality experienced in an urban area. For each of the pollutants, concentrations are converted into index values between 0 and 500. The level of the pollutant with the highest index value is reported as the AQI level for that day. There is a new AQI requirement to report any pollutant with an index value above 100. In addition, when the AQI is above 100, a pollutant-specific statement indicating what specific groups are most at risk must be reported. For example, when the index value is above 100 for ozone, the AQI report will state "children and people with asthma are most at risk." The AQI must be reported in all MSAs with air quality problems and populations greater than 350,000 according to the 2000 census. Previously, urbanized areas with populations greater than 200,000 were required to report the index.

Table 3-2. AQI Categories, Colors, and Ranges

Category	AQI	O_3 (ppm) 8-hour	O_3 (ppm) 1-hour	$PM_{2.5}$ (µg/m^3)	PM_{10} (µg/m^3)	CO (ppm)	SO_2 (ppm)	NO_2 (ppm)
Good	0–50	0.000–0.064	(b)	0.0–15.4	0–54	0.0–4.4	0.000–0.034	(c)
Moderate	51–100	0.065–0.084	(b)	15.5–40.4	55–154	4.5–9.4	0.035–0.144	(c)
Unhealthy for Sensitive Groups	101–150	0.085–0.104	0.125–0.164	40.5–65.4	155–254	9.5–12.4	0.145–0.224	(c)
Unhealthy	151–200	0.105–0.124	0.165–0.204	65.5–150.4	255–354	12.5–15.4	0.225–0.304	(c)
Very unhealthy	201–300	0.125–0.374	0.205–0.404	150.5–250.4	355–424	15.5–30.4	0.305–0.604	0.65–1.24
Hazardous	301–400	(a)	0.405–0.504	250.5–350.4	425–504	30.5–40.4	0.605–0.804	1.25–1.64
	401–500	(a)	0.505–0.604	350.5–500.4	505–604	40.5–50.4	0.805–1.004	1.65–2.04

[a] No health effects information for these levels—use 1-hour concentrations.
[b] 1-hour concentrations provided for areas where the AQI is based on 1-hour values might be more cautionary.
[c] NO_2 has no short-term standard but does have a short-term "alert" level.

Figure 3-1. Air quality index logo.

Summary of AQI Analyses

Of the five criteria pollutants used to calculate the AQI, only four (CO, O_3, PM_{10}, and SO_2) generally contribute to the AQI value. In recent years, nitrogen dioxide has never been the highest pollutant measured because it does not have a short-term standard and can be included only when the index reaches a value of 200 or greater. Ten-year AQI trends are based on daily maximum pollutant concentrations from the subset of ambient monitoring sites that meet the trends requirements in Appendix B.

Because an AQI value greater than 100 indicates that at least one criteria pollutant has reached levels at which people in sensitive groups are likely to suffer health effects, the number of days with AQI values greater than 100 provides an indicator of air quality in urban areas. Figure 3-2 shows the trend in the number of days with AQI values greater than 100 summed across the nation's largest metropolitan areas. This number is expressed as a percentage of the days in the first year (1992). Because of their magnitude, AQI totals for Los Angeles, CA, Riverside, CA, Bakersfield, CA, Ventura, CA, Orange County, CA, and San Diego, CA, are shown separately as California. Plotting these values as a percentage of 1992 values allows trends of different magnitudes to be compared on the same graph. The long-term air quality improvement in California urban areas is evident in this figure. Between 1992 and 2001, the total number of days with AQI values greater than 100 decreased more than 50 percent. The variability in the remaining major cities across the United States makes it difficult to interpret the change over the same period (labeled as "rest" in Figure 3-2), though it does appear to be rising. Other areas that had serious, severe, or extreme ozone problems (labeled as "pams" in Figure 3-2) show almost no change.

Although five criteria pollutants can contribute to the AQI, the index is driven mostly by ozone. AQI estimates depend on the number of pollutants monitored as well as the number of monitoring sites where data are collected. The more pollutants measured and the more sites that are available in an area, the better the estimate of the AQI for a given day. Historically, ozone accounts for the majority of days, with AQI values above 100. Soon, $PM_{2.5}$ will also be monitored and reported on a regular basis, which will reduce the percentage of days that ozone is the greatest AQI pollutant. Table A-18 shows the number of days with AQI values greater than 100 that are attributed to ozone alone. Comparing Tables A-17 and A-18, the number of days with an AQI above 100 are increasingly due to ozone. In fact, the percentage of days with an AQI above 100 due to ozone have increased from 94 percent in 1992 to 98 percent in 2001 (Figure 3-3). This increase reveals that ozone increasingly accounts for those days above the 100 level and, therefore, reflects the success in achieving lower CO and PM_{10} concentrations. However, the typical 1-in-6 day sampling schedule for most PM_{10} sites limits the number of days that PM_{10} can factor into the AQI determination, which may, in some places, account for the predominance of ozone. In the future, $PM_{2.5}$ may challenge ozone as the dominant pollutant.

A New Display Technique

As more and more information about air pollution and its effect on our health is being presented to the public through various media channels, a need has arisen to provide the general public with a simple, visual method for assessing the degree of air pollution in their communities. To meet this need, EPA is exploring a new technique for displaying air quality information that is designed to allow the general public to quickly and easily review the degree of air pollution in the 319 MSAs across the United States. This technique would

Figure 3-2. Number of days with AQI values >100, as a percentage of 1990 value.

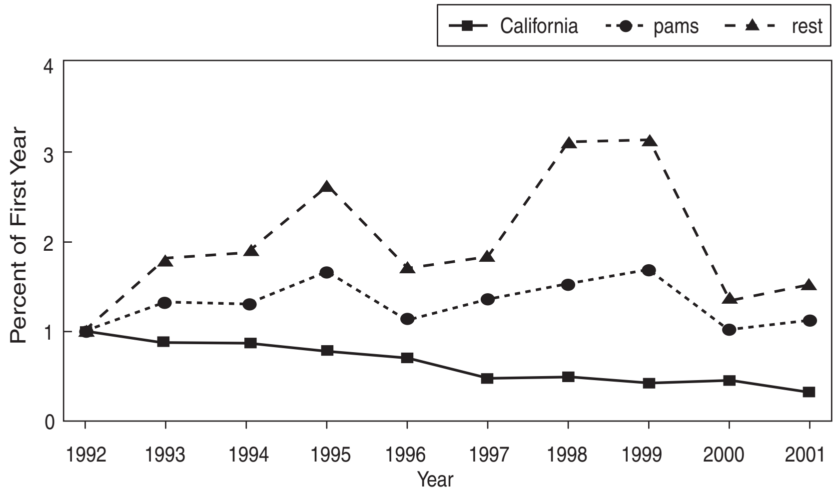
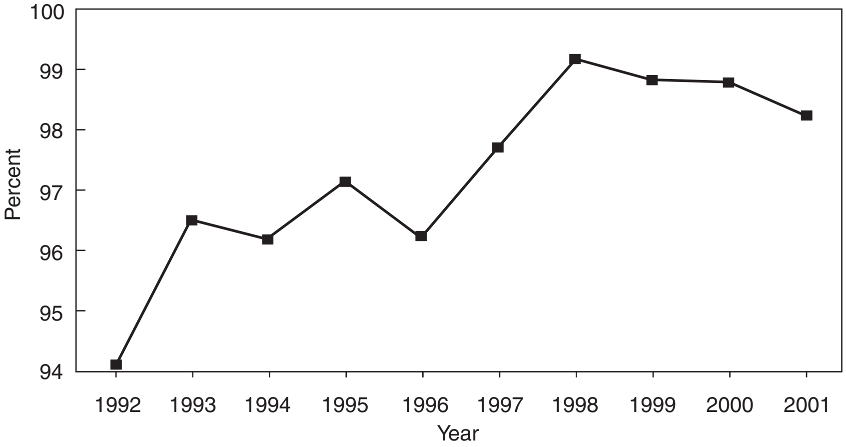


Figure 3-3. Percentage of days over 100 due to ozone.

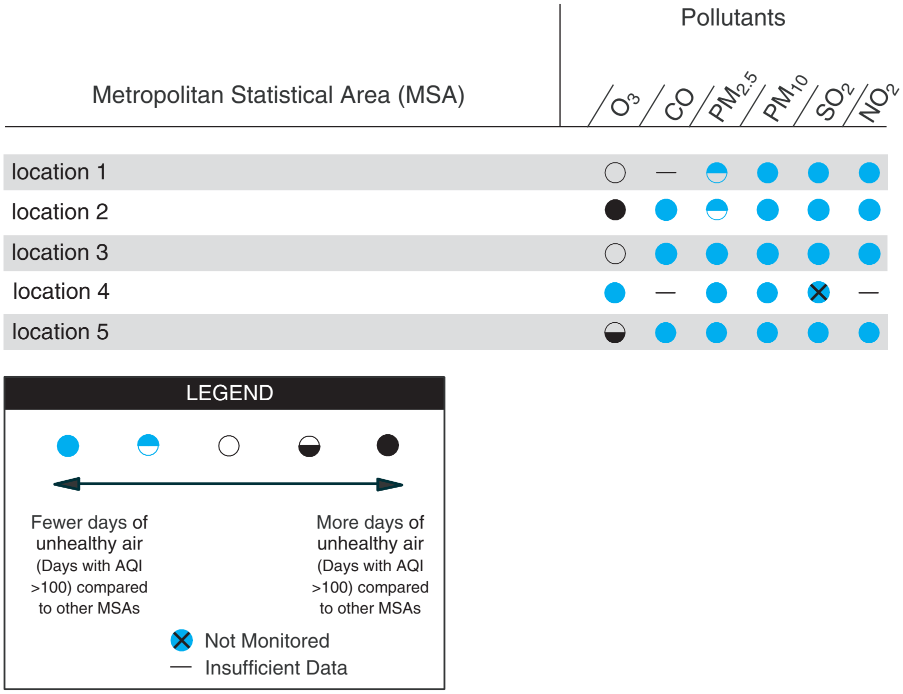


use color-coded circles to show levels of each criteria pollutant in each MSA relative to its levels in the other MSAs. A solid blue 🔵 indicates fewer days of unhealthy air (meaning that MSA had fewer AQI days over 100 for, say, ozone than most of the other MSAs had for ozone). On the other end of the spectrum, a black ● indicates more days of unhealthy air.

Figure 3-4 presents an example of how this new display technique might appear. The legend in Figure 3-4 explains how the color-coded symbols could be used to quickly and easily provide information about air quality and air pollutants. The new display technique would not provide new or additional air quality data, nor would it be used as a rating system or show trends in air quality over time. Rather, its purpose would be to provide a simplified, visual tool for interpreting air quality information in selected MSAs for a specific year for each of the selected pollutants. EPA is continuing to assess the feasibility of the new technique and to explore additional capabilities that might be added, such as a Web-based application that would allow users to sort and query information to generate customized reports about health-related air quality issues, as well as components relating to multiyear displays and visibility.

Additional information on this new display technique is presented in a discussion paper in the Special Studies section of this report.

Figure 3-4. Sample from the new display technique.



Metropolitan Statistical Area (MSA)	Pollutants					
	O_3	CO	$PM_{2.5}$	PM_{10}	SO_2	NO_2
location 1	○	—	◓	🔵	🔵	🔵
location 2	●	🔵	◓	🔵	🔵	🔵
location 3	○	🔵	🔵	🔵	🔵	🔵
location 4	🔵	—	🔵	🔵	⊗	—
location 5	◒	🔵	🔵	🔵	🔵	🔵

LEGEND

🔵 ◓ ○ ◒ ●

Fewer days of unhealthy air (Days with AQI >100) compared to other MSAs

More days of unhealthy air (Days with AQI >100) compared to other MSAs

⊗ Not Monitored

— Insufficient Data

References and Notes

1. *Statistical Abstracts of the United States, 2000,* U.S. Department of Commerce, U.S. Bureau of the Census.

2. *Air Quality Index, A Guide to Air Quality and Your Health,* EPA-454/R-00-005, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, June 2000.

3. *Code of Federal Regulations,* 40 CFR Part 58, Appendix G.

4. *Guideline for Reporting of Daily Air Quality—Air Quality Index (AQI),* EPA-454/R-99-010, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, July 1999.

5. *Note*: Although the results are summarized in the report for comparison purposes, the intent of publishing Tables A-16 through A-18 is to present information on a localized basis, to be used on a localized basis (i.e., one MSA at a time). Therefore, no attempt was made to adjust the Type I error to a table-wide basis. All the tests for trends were conducted at the 5 percent significance level. No inference has been made from the tables as a whole.

6. T. Fitz-Simons and D. Mintz, *Assessing Environmental Trends with Nonparametric Regression in the SAS Data Step*, American Statistical Association 1995 Winter Conference, Raleigh, NC, January, 1995.

7. Freas, W.P. and E.A. Sieurin, *A Nonparametric Calibration Procedure for Multi-Source Urban Air Pollution Dispersion Models*, presented at the Fifth Conference on Probability and Statistics in Atmospheric Sciences, American Meteorological Society, Las Vegas, NV, November 1977.

8. M. Hollander and D.A. Wolfe, *Nonparametric Statistical Methods*, John Wiley and Sons, Inc., New York, NY, 1973.

9. Based on the short-term standards, federal episode criteria, and significant harm levels, the AQI is computed for PM (particulate matter), SO_2, CO, O_3, and NO_2. Lead is the only criteria pollutant not included in the index because it does not have a short-term standard, federal episode criteria, or significant harm level.

CHAPTER 4

Criteria Pollutants — Nonattainment Areas

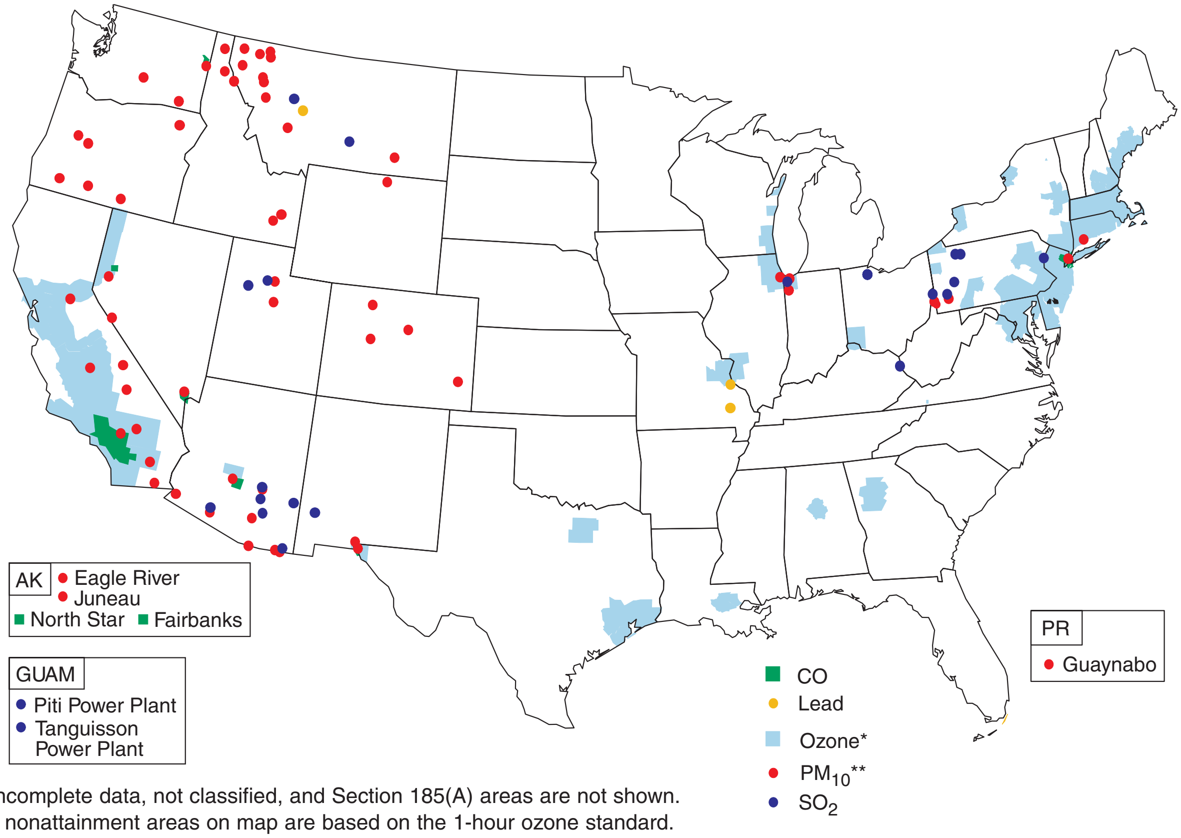
http://www.epa.gov/oar/airtrends/non.html

Worth Noting

- As of September 2002, there were 124 classified nonattainment areas on the condensed nonattainment list.

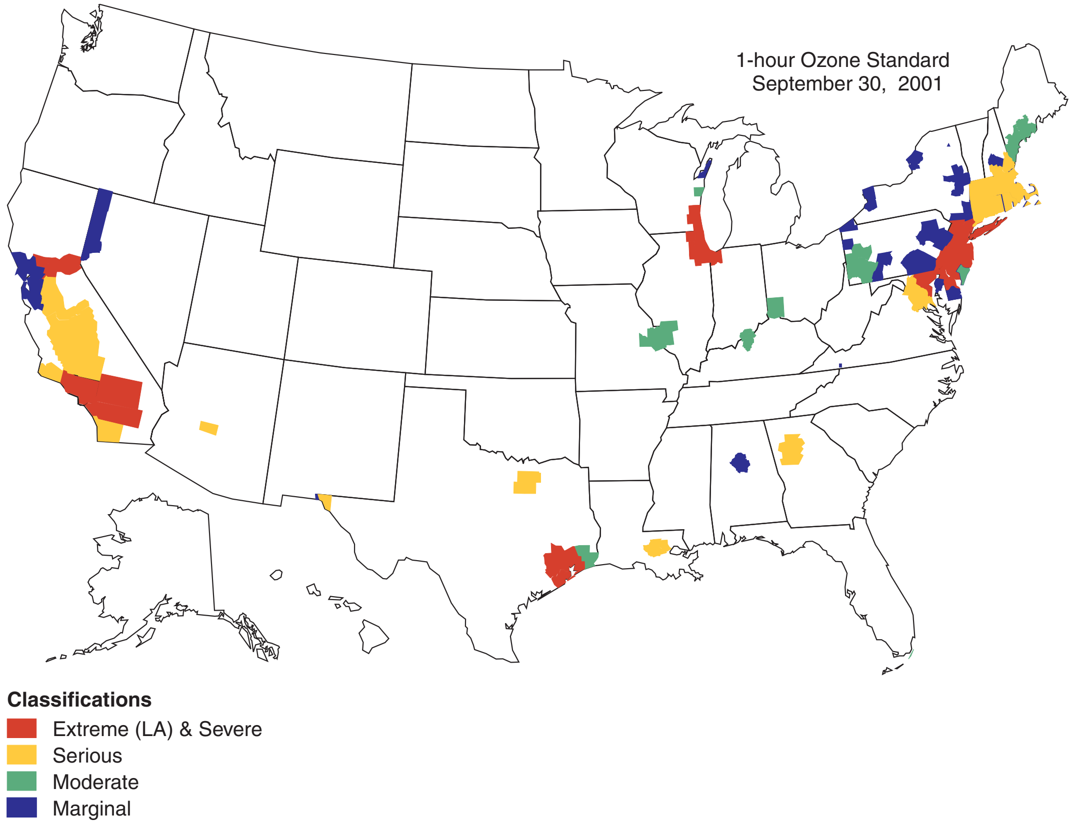
This chapter provides general information on geographical regions known as nonattainment areas. When an area does not meet the air quality standard for one of the criteria pollutants, the area may be subject to the formal rule-making process that designates the area as nonattainment. The 1990 Clean Air Act Amendments (CAAA) further classify ozone, carbon monoxide, and some particulate matter nonattainment areas based on the magnitude of an area's problem. Nonattainment classifications may be used to specify what air pollution reduction measures an area must

Figure 4-1. Location of nonattainment areas for criteria pollutants, September 2002.



Note: Incomplete data, not classified, and Section 185(A) areas are not shown.
*Ozone nonattainment areas on map are based on the 1-hour ozone standard.
**PM_{10} nonattainment areas on map are based on the existing PM_{10} standards.

Figure 4-2. Classified ozone nonattainment areas.



Note: San Francisco is classified Other/Sec 185(A) and nonattainment areas with incomplete data are not included.

adopt and when the area must reach attainment. The technical details underlying these classifications are discussed in the *Code of Federal Regulations*, Part 81 (40 CFR 81), see **http://www.epa.gov/docs/epacfr40/chapt-I.info/subch-C.htm**.

Figure 4-1 shows the location of the classified nonattainment areas for each criteria pollutant as of September 2002. Figure 4-2 identifies the 1-hour ozone nonattainment areas classified by degree of severity. A summary of classified nonattainment areas can be found in Table A-19 in Appendix A. An area is on the condensed list if the area is designated nonattainment for one or more of the criteria pollutants. Note that Section 185(A) nonattainment classified areas (formerly known as "transitional areas") and incomplete data nonattainment areas are excluded from the counts in Table A-19. Another source of information for areas designated as nonattainment, including Section 185(A) and incomplete areas, is the *Green Book*. The current *Green Book* is located at **http://www.epa.gov/oar/oaqps/greenbk**.

As of September 2002, there were 124 classified nonattainment areas on the condensed nonattainment list. The areas on the condensed list are displayed alphabetically by state. There were, as of September 2002, approximately 126 million people living in classified areas designated as nonattainment for at least one of the criteria pollutants. Areas redesignated to attainment between September 2001 and September 2002 are listed in Table 4-1 by pollutant.

Table 4-1. Areas Redesignated to Attainment from September 2001 to September 2002

Pollutant	Area	State	Classification	Redesignation Effective Date
CO	Denver-Boulder	CO	Serious	01/14/2002
CO	Lowell	MA	Not Classified	04/22/2002
CO	Springfield	MA	Not Classified	04/22/2002
CO	Waltham	MA	Not Classified	04/22/2002
CO	Worcester	MA	Not Classified	04/22/2002
CO	Billings	MT	Not Classified	04/22/2002
CO	Great Falls	MT	Not Classified	07/08/2002
CO	New York–N. New Jersey–Long Island*	NY	Moderate > 12.7ppm	05/20/2002
CO	Klamath Falls	OR	Moderate ≤ 12.7ppm	11/19/2001
CO	Medford	OR	Moderate ≤ 12.7ppm	09/23/2002
Ozone	Louisville	IN	Moderate	11/23/2001
Ozone	Cincinnati-Hamilton	KY	Moderate	08/30/2002
Ozone	Louisville	KY	Moderate	11/23/2001
Ozone	Pittsburgh-Beaver Valley	PA	Moderate	11/19/2001
PM_{10}	Mohave County (part); Bullhead City	AZ	Moderate	08/26/2002
PM_{10}	Pinal and Gila counties; Payson	AZ	Moderate	08/26/2002
PM_{10}	Ramsey County; (part)	MN	Moderate	09/24/2002
SO_2	Central Steptoe Valley	NV	Primary	06/11/2002
SO_2	AQCR 238: Marathon County: Rothschild Sub-city area, Rib Mountain, Weston	WI	Primary, Secondary	07/29/2002

Includes areas classified as nonattainment by the CAAA of 1990.

*The final approval of the NJ portion of the New York–N. New Jersey–Long Island CO area was published on 08/30/2002, and the effective redesignation date was 10/22/2002.

CHAPTER 5

Air Toxics

http://www.epa.gov/oar/airtrends/toxic_mid.html

Nature and Sources of the Problem

Toxic air pollutants, or air toxics, are those pollutants that cause or may cause cancer or other serious health effects, such as reproductive effects or birth defects. Air toxics may also cause adverse environmental and ecological effects. Examples of toxic air pollutants include benzene, found in gasoline; perchloroethylene, emitted from some dry cleaning facilities; and methylene chloride, used as a solvent by a number of industries. Most air toxics originate from man-made sources, including mobile sources (e.g., cars, trucks, construction equipment) and stationary sources (e.g., factories, refineries, power plants), as well as indoor sources (e.g., some building materials and cleaning solvents). Some air toxics are also released from natural sources such as volcanic eruptions and forest fires. The Clean Air Act identifies 188 air toxics from industrial sources. EPA has identified 20 of these pollutants that are associated with mobile sources and one additional mobile source air toxic designated "diesel particulate matter and diesel exhaust organic gases."

Health and Environmental Effects

People exposed to toxic air pollutants at sufficient concentrations may experience various health effects, including cancer, damage to the immune system, as well as neurological, reproductive (e.g., reduced fertility), developmental, respiratory, and other health problems. In addition to exposure from breathing air toxics, risks also are associated with the deposition of toxic pollutants onto soils or surface waters, where they are taken up by plants and ingested by animals and eventually magnified up through the food chain. Like humans, animals may experience health problems due to air toxics exposure.

Trends in Toxic Air Pollutants

EPA and states do not maintain an extensive nationwide monitoring network for air toxics as they do for many of the other pollutants discussed in this report. While EPA, states, tribes, and local air regulatory agencies collect monitoring data for a number of toxic air pollutants, both the chemicals monitored and the geographic coverage of the monitors vary from state to state. EPA is working with these regulatory partners to build upon the existing monitoring sites to create a national monitoring network for a number of toxic air pollutants. The goal is to ensure that those compounds that pose the greatest risk are measured. The available monitoring data help air pollution control agencies track trends in toxic air pollutants in various locations around the country. EPA began a pilot city monitoring project in 2001 and is scheduled to include at least 12 months of sampling in four urban areas and six small city/rural areas (see Figure 5-1). This program is intended to help answer several important national network design questions (e.g., sampling and analysis precision, sources of variability, and minimal detection levels). In addition, an initial 11-city trends network is being established that will help develop national trends for several pollutants of concern. For the latest information on national air toxics monitoring, see **www.epa.gov/ttn/amtic/airtxfil.html**.

EPA also compiles an air toxics inventory as part of the National Emissions Inventory (NEI, formerly the National Toxics Inventory) to estimate and track national emissions trends for the 188 toxic air pollutants regulated under the Clean Air Act. In the NEI, EPA divides emissions into four types of sectors: (1) major (large industrial) sources; (2) area and other sources, which include smaller industrial sources like small dry cleaners and gasoline stations, as well as natural sources like wildfires; (3) onroad mobile sources, including highway vehicles; and (4) nonroad mobile sources like aircraft, locomotives, and construction equipment.

As shown in Figure 5-2, based on 1996 estimates, the most recent year of available data, the emissions of toxic air pollutants are relatively equally divided among the four types of sources. However, this distribution varies from city to city. Based on the data in the NEI (Figure 5-3), estimates of nationwide air toxics emissions have dropped approximately 24 percent between baseline (1990–1993) and 1996. Thirty-three of these air toxics, which pose the greatest threat to public health in urban areas, have similarly dropped 31 percent. Although changes in how EPA compiled the national inventory over time may account for some differences, EPA and state regulations, as well as voluntary reductions by industry, have clearly achieved large reductions in overall air toxic emissions. Trends for individual air toxics vary from pollutant to pollutant. Benzene, which is the most widely monitored toxic air pollutant, is emitted from cars, trucks, oil refineries, and chemical processes. Figure 5-4 shows measurements of benzene taken from 95 urban monitoring sites around the country. These urban areas generally have higher levels of benzene than other areas of the country. Measurements taken at these sites show, on average, a 47 percent drop in benzene levels from 1994 to 2000. During this period, EPA phased in new (so-called "tier 1") car emission standards; required many cities to begin using cleaner-burning gasoline; and set standards that required significant reductions in benzene and other pollutants emitted from oil refineries and chemical processes. EPA estimates that, nationwide, benzene emissions from all sources dropped 20 percent from 1990 to 1996.

Figure 5-1. Map of 10 cities in monitoring pilot project.

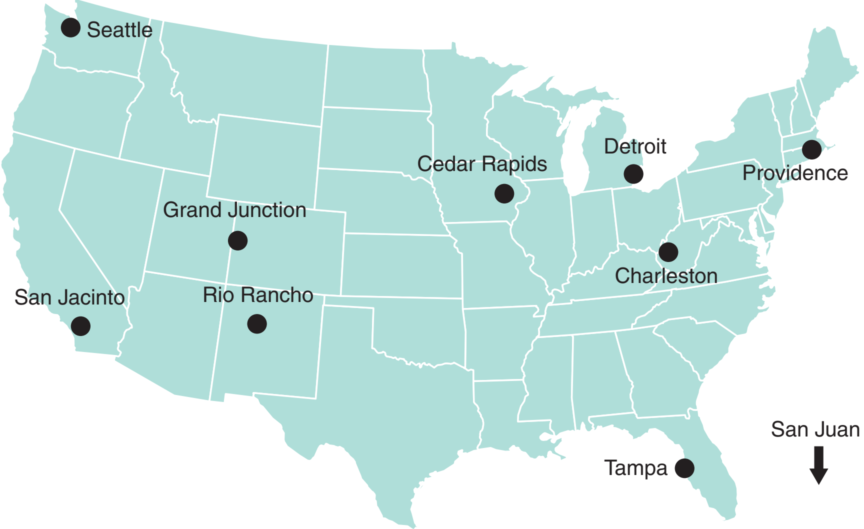


Figure 5-2. National air toxics emissions, 1996.

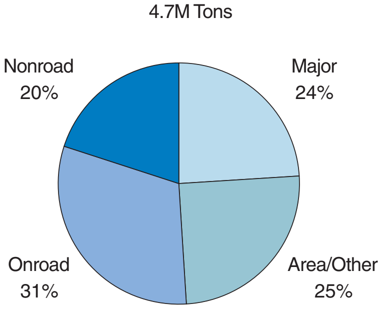


Figure 5-3. National air toxics emissions.

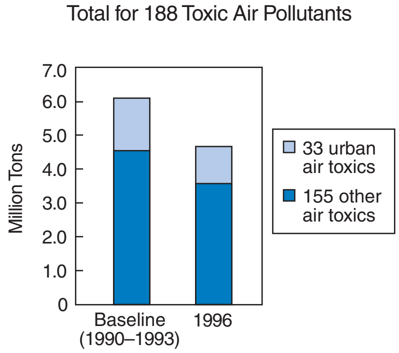
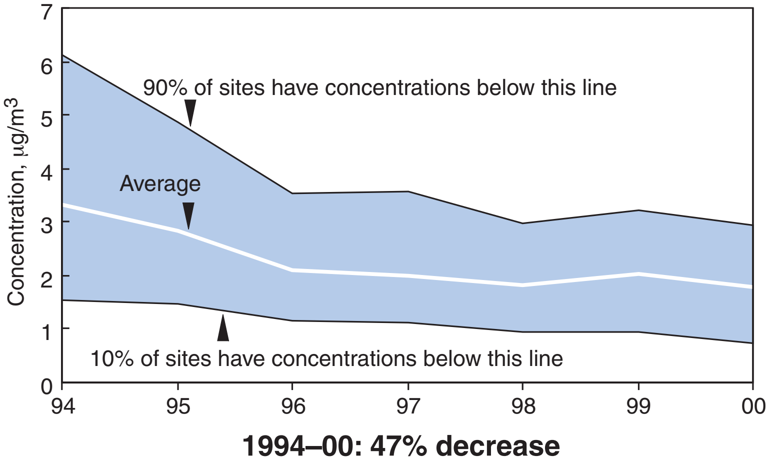


Figure 5-4. Ambient benzene, annual average urban concentrations, nationwide, 1994–2000.



CHAPTER 6

Special Studies Summary

http://www.epa.gov/oar/aqtrnd03/chapter6.pdf

Summary of Exploratory Analyses

This chapter summarizes several recent papers describing analyses conducted on various policy-relevant topics. Two of the papers analyze aspects of particulate matter. The first covers an event in which particulate matter was transported from Asia and its effect on parts of the United States. The second discusses speciated $PM_{2.5}$ in urban and rural areas. Trends in CO in localized areas are analyzed in a third article, providing a better understanding of oxyfuel programs. Current-year ozone levels are compared to historical trends in a fourth paper. New tools are discussed in two additional papers. One tool is the coefficient of perfect agreement, or CPA, which is derived to assist in characterizing the spatial variation of pollutants. The final paper discusses a new reporting and display tool that could be used to present air quality information in an innovative way. The papers are presented in their entirety in the Special Studies section at the end of this report.

Impact of April 2001 Asian Dust Event on PM Concentrations in the United States

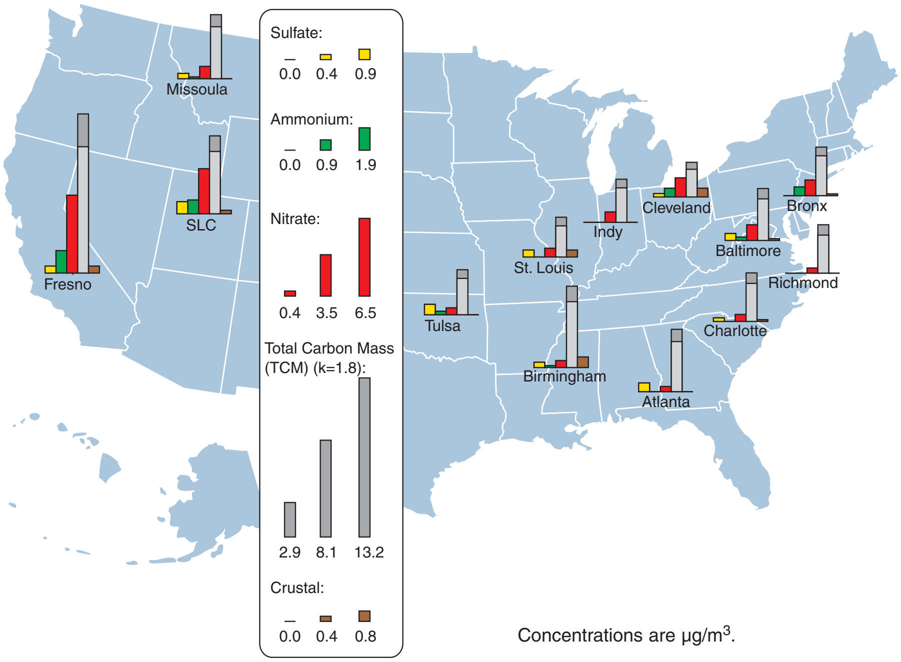
Jim Szykman, David Mintz, Jack Creilson, Michelle Wayland

On April 6, 2001, the combination of strong surface winds and an intense area of low pressure over the Gobi Desert produced a large dust cloud that was lofted into the free troposphere and transported east. The dust cloud, captured and tracked by satellite imagery, made its way across the Pacific Ocean and reached the United States on April 12 and 13. Examination of ridges and troughs, rising or sinking air, and trajectories showing origins and paths of air masses were all used to understand how and when the dust cloud affected measurements of PM in the United States.

The position of the dust cloud and vertical movement of air was found to determine which regions experienced elevated “soil” PM concentrations. U.S. regions from Utah to Maine were impacted. Specific regions impacted were the West (on April 16th), the Southeast (on April 19th), and the Mid-Atlantic/Northeast (on April 22nd).

Quantities of soil-related particles attributable to the dust storm were calculated using historical trends to develop a baseline of typical April soil concentrations in particulate

Figure 6-1. Urban $PM_{2.5}$ increments.



Concentrations are µg/m^3.

matter. Table 6-1 shows the quantities attributable to the dust storm by region. This dust event is the first time that East Coast soil particulate matter peaks have been associated with dust transport from Asia. Peak concentrations were composed of fine fraction (detected as $PM_{2.5}$) in some locations and coarse fraction (detected as PM_{10}) at other locations. Composition of the dust-storm-related particles was examined using percentages of potassium, calcium, and silicon as indicators of whether the detected dust was Asian in origin. These chemical speciation data showed that the Asian dust contributed, on average, 3.1 to 7.4 $\mu g/m^3$ to the total $PM_{2.5}$ mass concentrations during the period studied.

Table 6-1. Estimated $PM_{2.5}$ Concentrations Attributable to Asian Dust Cloud

Date	Number of Sites	Site Locations	Median Typical April Soil Concentration ($\mu g/m^3$)	Median Asian Dust Contribution ($\mu g/m^3$)	Maximum Asian Dust Contribution ($\mu g/m^3$)
4/16/01	43	West	0.7	7.4	21.2
4/19/01	19	Midwest and Southeast	0.5	3.6	12.9
4/22/01	16	Mid-Atlantic and Northeast	0.4	3.1	7.4

Potential health impacts of the dust were also examined. On the dates on which the dust cloud was crossing the United States, there were nine areas with an EPA Air Quality Index (AQI) value above 100 for PM_{10} or $PM_{2.5}$, indicating that the air quality posed a health risk to sensitive populations such as children and the elderly. Unfortunately, there are no speciation data in these areas for estimating Asian dust contributions. Further review and, in some cases, additional data would be needed to determine whether the Asian dust event contributed to these levels.

Chemical Speciation of $PM_{2.5}$ in Rural and Urban Areas

Venkatesh Rao, Neil Frank, Alan Rush, and Fred Dimmick

Existing ambient air quality monitoring data from the predominantly urban Speciation Trends Network (STN) and the predominantly rural Interagency Monitoring of Protected Visual Environment (IMPROVE) network were analyzed to identify first-order approximations of local and regional contributions to urban $PM_{2.5}$ concentrations from March 2001 to February 2002. Urban sites were paired with matched rural sites to calculate the "urban increment" of $PM_{2.5}$ mass and increment of individual species. Data from the two monitoring networks were selected and adjusted to create comparable datasets. This work addressed the problem that often half or more of $PM_{2.5}$ is composed of secondarily formed species, thus hiding their point of origin.

Figure 6-1 shows the urban increments by components. On average, the urban excess for the site combinations investigated was found to be 8 $\mu g/m^3$. Carbonaceous mass was found to be the major contributor to urban excess at all sites studied. Such an amount of $PM_{2.5}$ implies that programs are likely needed to address urban sources of $PM_{2.5}$.

Carbonaceous mass appears to be attributed to local emissions, with mobile sources as a possible major contributor. Nitrates are prevalent in the urban excess estimates of the North and West, but not in the East. However, more work is needed to assess the compatibility of nitrate measurements and monitoring methods between networks. Some locations show a sizeable urban excess of crustal materials, some of which may be attributed to industrial sources.

Trends in Monitored Concentrations of Carbon Monoxide

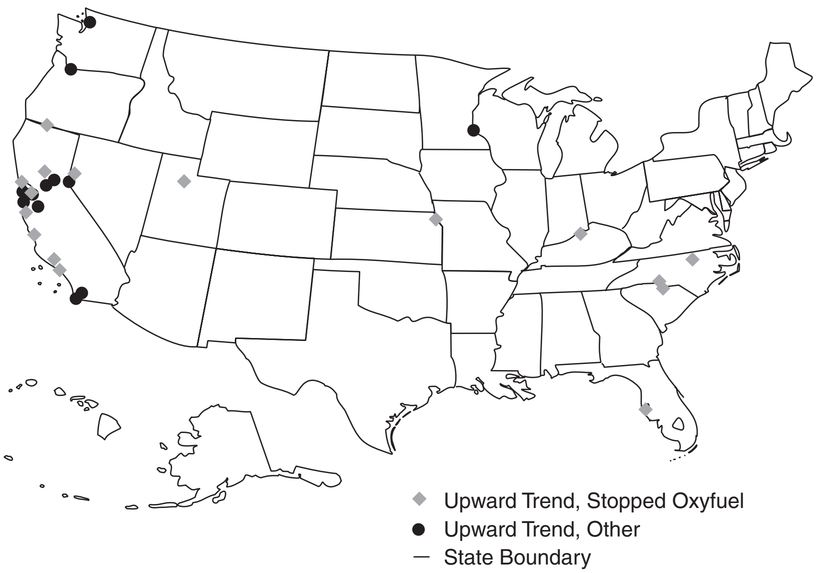
Jo Ellen Brandmeyer, Peter Frechtel, Margaret Z. Byron, Joe Elkins, James Hemby, Venkatesh Rao

In 1999, numerous metropolitan areas instituted oxygenated gasoline (oxyfuel) programs during winter months to reduce CO emissions from motor vehicles. Some have since discontinued these requirements. This paper demonstrates a screening method for determining CO trends at specific monitoring stations. By contrast, we often examine trends for regions based on metropolitan statistical areas (MSAs). By eliminating averaging across MSAs, this study identified trends in more localized areas. Uncovering localized trends is important when one part of an MSA experiences rapid population growth accompanied by a rapid growth in vehicular emissions.

This study used data from EPA's Air Quality System (AQS), which contains air quality data from the air quality monitoring stations. Stations with at least 8 years of relevant data during the period 1990 through 2000 were screened for either an upward linear trend or upward inflection. The second maximum nonoverlapping 8-hour average of CO for each monitor over the 11-year period was used.

Because no single test will necessarily detect trends at all relevant sites, three separate statistical tests were applied to data from each station: Theil test, first-order linear regression, and quadratic (second-order) linear regression. The three tests were used together to discern patterns in the data. Of the 433 sites analyzed, 34 showed a statistically significant overall upward trend or statistically significant upward curvature. Figure 6-2 shows locations of these sites and whether they have discontinued their oxyfuel programs. Of the sites listing dates ending the oxyfuel program, all either are located in a federal reformulated gasoline area or have an oxyfuel requirement in their contingency plan.

Figure 6-2. Monitoring stations showing upward CO trends.



This analysis method can be used to screen for sites with increasing CO concentrations. The identified sites should then be examined further to determine the magnitude of the concentrations as compared to the existing standard. Because both vehicle miles traveled and the vehicle mix in fleets are changing with time, the authors recommend repeating this analysis annually to determine sites that warrant further analysis.

Cumulative Ozone Exceedances—A Measure of Current Year Ozone Levels Compared to Historical Trends

Dennis Doll, Terence Fitz-Simons

Policy makers at the state and federal level are often asked how the current year's ozone season compares to previous years. In order to address that question, the authors used data measured in the Air Quality System network of monitoring stations maintained by EPA's Office of Air Quality Planning and Standards. We addressed data from the network of monitors assigned to cities for which the air quality index (AQI) is forecasted during the ozone season (i.e., April-October), known as the "USA Today list of cities." Data from 2002 (the most recent year) were compared to a 5-year historical average in these cities and the regions in which they are located. Based on this comparison, policy makers can qualitatively assess the severity of the most recent year's ozone measurements with historical year measurements.

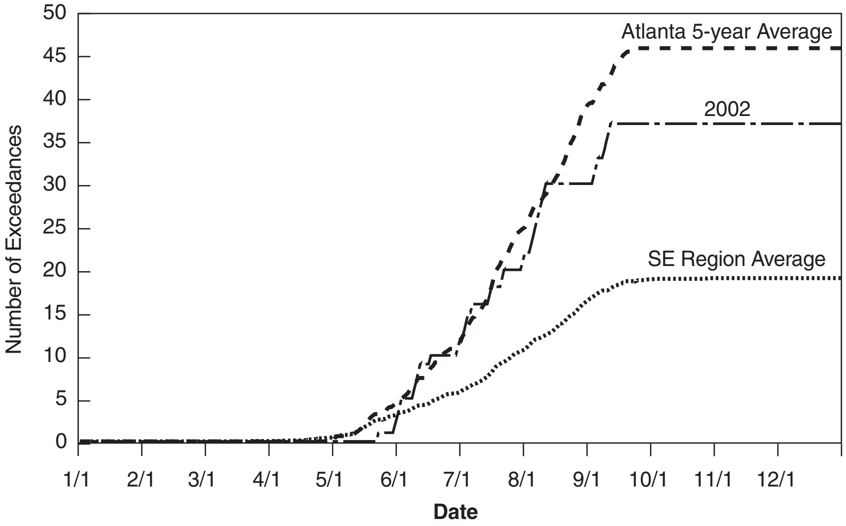
To construct the measurements, the authors used AQS data to analyze the number of days ozone measurements exceeded the 8-hour NAAQS for ozone (>0.085 ppm). This indicates that air quality falls into the category "Unhealthy for Sensitive Groups." For the given set of monitors assigned to a city, if one or more monitors measured an 8-hour ozone level >0.085 ppm, the researchers recorded an exceedance for the day. This procedure was repeated for each day of the year for the set of monitors assigned to each city. In this way researchers counted the number of days exceedances were measured in a given city in 2002. For the historical 5-year period 1997 to 2001, the average number of the cumulative count of days was obtained over the 5-year period for each set of monitors assigned to each city to yield a 5-year trend.

We then divided the subject cities into geographic regions and examined a 5-year cumulative regional average as well as city-based averages. This measure helps illustrate differences among and within regions.

Analysis of the southeast region showed that, in 2002, ozone trends in Atlanta and Charlotte were similar to 5-year southeast regional trends, while in Memphis, Nashville, and New Orleans, the number of exceedances was lower than the 5-year regional trends. Figure 6-3 shows the comparison of Atlanta and regional trends. In contrast, for most of the cities analyzed in this study in the northeast region, the 2002 data revealed a lower trend than the 5-year average through approximately early July, then a higher trend than the 5-year average from mid-July into mid-September.

Cities analyzed in the midwest region analysis showed seasonal variation for 2002 compared with the 5-year average. For Chicago, Cleveland, Cincinnati, Columbus, Pittsburgh, Indianapolis, Detroit, and St. Louis, the 2002 data trends were lower than the 5-year average through approximately mid- to late June, then were progressively higher than the 5-year average from late June onward. Midwest cities outside the core midwest region (e.g., Kansas City and Minneapolis) showed 2002 data trends similar to or lower than the 5-year average data.

Figure 6-3. Cumulative exceedances—5-year average (97–01) (Atlanta) compared to 2002 data and southeast region average.



Characterization of National Spatial Variation

Terence Fitz-Simons

Spatial variability is an important quality of air pollutants for many areas of policy within EPA. Monitoring regulations depend heavily on knowledge of spatial variability. Control strategies, “action day” programs, and public information programs also rely on this knowledge. This paper explores a new way to examine spatial variability on a national scale that addresses the limitations of existing spatial variability methods.

Traditional Spatial Methods and Their Limitations

Often spatial variability is examined by creating a map showing ranges of pollutant levels by county. Such a map shows which counties have higher pollutant values, but does not allow easy visualization of how close adjoining counties are to others. Some analysts enhance spatial maps with an estimated surface of pollutant levels using a spatial interpolation technique known as kriging. Kriging removes the blank areas on a map, making it somewhat easier to see how pollutants vary over space; however, because the surface itself is smoothed by the process, kriging actually hides some of the spatial variation.

Kriging relies on variograms, which represent the statistical variance of the difference between two data points on a map as it relates to the distance between the two points on the map. The variogram, in turn, relies on the variance, which is a measure of the spread of a distribution or data representing measurement differences between two locations paired by time. The authors use a scatterplot of particulate matter ($PM_{2.5}$) data to examine how effectively such kriged maps represent the actual relationship between locations paired by time. The scatterplot shown in Figure 6-4 makes clear that there is no simple relationship between the variance of the difference and distance. This brings into question the assumption used in kriging that the variance of the difference over distance can be described by a line.

The authors next investigated correlation over distance, using $PM_{2.5}$ to calculate the correlation of daily $PM_{2.5}$ values between two sites. Latitude and longitude were used to calculate the distance between two sites, producing a correlation and a distance for each pair of sites. Based on that information, scatterplots were generated that further question the simplicity of the variogram used in kriging.

Coefficient of Perfect Agreement Method

The coefficient of perfect agreement (CPA) method addresses the problems raised in the examination of kriging. CPA provides a measure of agreement with many of the characteristics of the correlation coefficient, thus allowing examination of the agreement between pollutant values over distance.

The classical correlation coefficient is a measure of how well paired values track each other. The value 0 (zero) means they do not track each other at all, while a value of 1 means they track each other perfectly. The correlation coefficient is defined as:

$$r = \frac{\sum xy - \frac{\sum x \sum y}{n}}{\frac{\sqrt{\left(\sum x^2 - \frac{\left(\sum x\right)^2}{n}\right)\left(\sum y^2 - \frac{\left(\sum y\right)^2}{n}\right)}}{n}}$$

The authors discuss several issues involved in constructing a CPA, including sample size, and managing units conversion so that the resulting CPA is unitless. Within those restrictions, the authors apply the CPA to construct a new scatterplot of $PM_{2.5}$. Figure 6-5 shows that the denser part of the distribution dips quickly and falls off gradually. This is a different trend than that found in the earlier scatterplot (shown in Figure 6-4) based on variance of difference vs. distance.

This scatterplot gives a national picture of the spatial variation of $PM_{2.5}$. The mean CPA starts off at around 0.6 and falls off rapidly out to about 150 km, then falls off gradually to about 0.2 at 500 km. Quantitatively, interpretation of this coefficient is difficult, but it is useful in comparisons with other pollutants. To compare pollutants, the authors display the scatterplot as a box and whisker plot. Pollutants can then be compared by joining the means by a line for several pollutants.

Such comparisons between pollutants could be used to guide policy. For example, daily values of $PM_{2.5}$, daily values of PM_{10}, hourly values of CO (carbon monoxide), and hourly values of ozone were used to produce Figure 6-6. The plot of $PM_{2.5}$ has a mean CPA that is above ozone for most of the distances out to at least 450 km. This might suggest

Figure 6-4. Variance of the difference vs. distance.

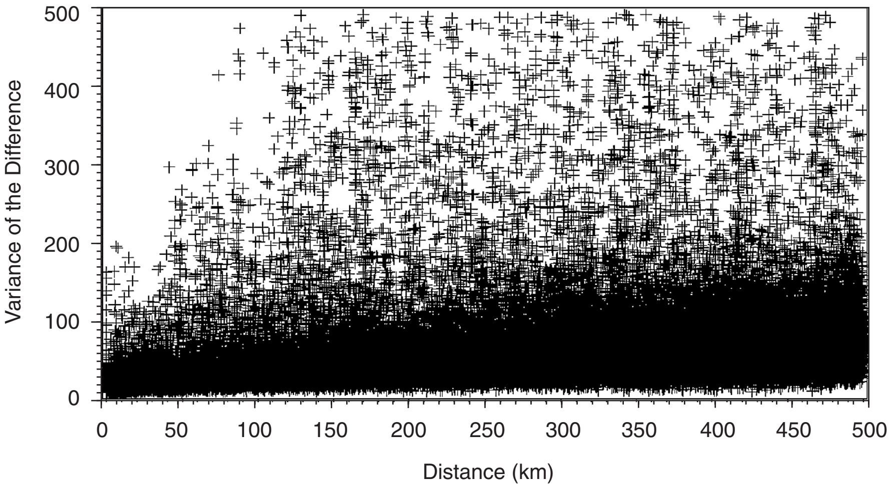


Figure 6-5. CPA vs. distance (km).

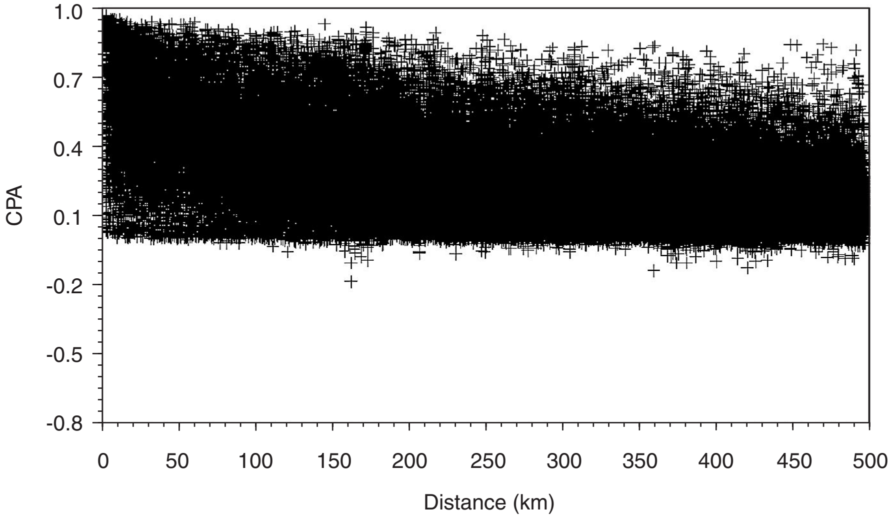
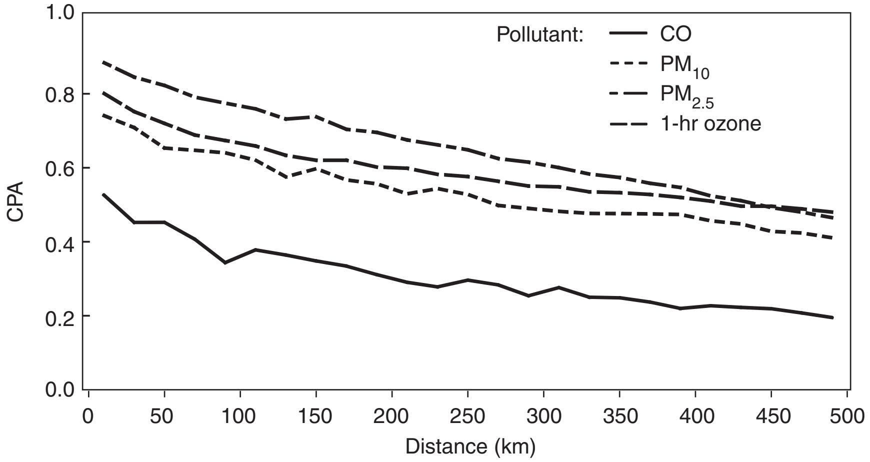


Figure 6-6. Comparison of mean CPA vs. distance (km).



that, if a regional control strategy is being pursued for the ozone problem in the United States, a regional strategy also makes sense for $PM_{2.5}$.

Development of a New Reporting Technology for Air Quality

Prepared by RTI International for the Office of Air Quality Planning and Standards

This display technique would provide the general public with a new tool to review air quality in MSAs around the United States. The primary function of the display would be to present location- and pollutant-specific air quality data in a graphical format that allows for easy interpretation of air quality data for MSAs. The display would not provide new or additional air quality data; rather, it would present existing data in a new format. The graphical display of data would improve the public's access to air quality information and enhance their ability to use this information in a meaningful way. Potential capabilities that may be added include a Web-based application that would allow users to sort and query information to generate customized reports, as well as visibility and multiyear components.

EPA recognizes that there are limitations to this new display technique and is continuing to assess the usefulness of such a reporting method as well as additional capabilities that might be added. Developing a simple metric for displaying air quality data on an urban basis across the nation is a difficult and challenging endeavor. However, EPA feels that this information is useful and informative to the public, especially to those who have potential health concerns related to poor air quality. A graphical display that is easily understood is essential to communicating this information, and EPA will continue to refine the display to ensure that it meets this objective based on comments and input from the air quality community and potential users.

APPENDIX A

Data Tables

http://www.epa.gov/oar/aqtrnd03/appenda.pdf

Table A-1a. National Air Quality Trends Statistics for Criteria Pollutants, 1981–1990

Statistic	# of Sites	Units	Percentile	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Carbon Monoxide													
2nd Max. 8-hr.	321	ppm	95th	15.2	15.3	15.3	13.8	12.7	12.2	11.6	11.3	10.9	10.2
2nd Max. 8-hr.	321	ppm	90th	12.9	12.8	12.4	11.9	11.0	11.0	9.7	9.9	9.6	8.8
2nd Max. 8-hr.	321	ppm	75th	10.6	10.0	9.8	9.9	8.9	8.9	8.3	7.8	7.8	7.2
2nd Max. 8-hr.	321	ppm	50th	7.7	7.4	7.3	7.3	6.3	6.7	6.3	6.0	6.0	5.5
2nd Max. 8-hr.	321	ppm	25th	5.6	5.5	5.2	5.2	4.9	5.0	4.7	4.5	4.5	4.3
2nd Max. 8-hr.	321	ppm	10th	4.2	4.3	4.0	4.2	3.8	3.9	3.7	3.5	3.6	3.3
2nd Max. 8-hr.	321	ppm	5th	3.7	3.6	3.4	3.5	3.4	3.3	3.3	3.1	2.9	2.9
2nd Max. 8-hr.	321	ppm	Arith. Mean	8.4	8.1	7.9	7.8	7.1	7.2	6.7	6.4	6.4	5.9
Lead													
Max. Qtr. AM	228	ppm	95th	1.39	1.31	1.04	1.03	0.70	0.41	0.31	0.29	0.23	0.17
Max. Qtr. AM	228	ppm	90th	1.02	0.96	0.77	0.72	0.56	0.30	0.21	0.20	0.15	0.13
Max. Qtr. AM	228	ppm	75th	0.61	0.69	0.55	0.50	0.32	0.19	0.13	0.11	0.10	0.08
Max. Qtr. AM	228	ppm	50th	0.41	0.43	0.37	0.33	0.21	0.12	0.09	0.07	0.06	0.05
Max. Qtr. AM	228	ppm	25th	0.28	0.28	0.24	0.23	0.14	0.08	0.06	0.04	0.04	0.03
Max. Qtr. AM	228	ppm	10th	0.20	0.18	0.16	0.15	0.10	0.06	0.04	0.02	0.03	0.02
Max. Qtr. AM	228	ppm	5th	0.15	0.14	0.13	0.12	0.07	0.05	0.03	0.02	0.02	0.01
Max. Qtr. AM	228	ppm	Arith. Mean	0.58	0.58	0.47	0.45	0.28	0.18	0.13	0.12	0.10	0.08
Nitrogen Dioxide													
Arith. Mean	169	ppm	95th	0.051	0.050	0.046	0.046	0.048	0.050	0.043	0.048	0.045	0.042
Arith. Mean	169	ppm	90th	0.041	0.039	0.038	0.040	0.039	0.036	0.038	0.038	0.038	0.035
Arith. Mean	169	ppm	75th	0.028	0.029	0.028	0.029	0.029	0.029	0.028	0.029	0.029	0.028
Arith. Mean	169	ppm	50th	0.021	0.021	0.022	0.023	0.022	0.022	0.022	0.023	0.022	0.020
Arith. Mean	169	ppm	25th	0.016	0.016	0.016	0.016	0.017	0.016	0.017	0.017	0.016	0.015
Arith. Mean	169	ppm	10th	0.009	0.009	0.008	0.009	0.009	0.009	0.010	0.009	0.009	0.009
Arith. Mean	169	ppm	5th	0.006	0.004	0.004	0.004	0.005	0.004	0.004	0.003	0.004	0.004
Arith. Mean	169	ppm	Arith. Mean	0.024	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.022
Ozone													
2nd Max. 1-hr.	471	ppm	95th	0.220	0.210	0.224	0.204	0.190	0.170	0.183	0.203	0.180	0.170
2nd Max. 1-hr.	471	ppm	90th	0.167	0.161	0.186	0.165	0.160	0.150	0.164	0.181	0.147	0.146
2nd Max. 1-hr.	471	ppm	75th	0.140	0.136	0.150	0.139	0.133	0.130	0.140	0.155	0.124	0.122
2nd Max. 1-hr.	471	ppm	50th	0.116	0.115	0.130	0.114	0.112	0.112	0.118	0.130	0.108	0.109
2nd Max. 1-hr.	471	ppm	25th	0.100	0.100	0.110	0.100	0.098	0.099	0.104	0.110	0.098	0.096
2nd Max. 1-hr.	471	ppm	10th	0.090	0.087	0.095	0.090	0.088	0.086	0.090	0.097	0.086	0.084
2nd Max. 1-hr.	471	ppm	5th	0.080	0.080	0.086	0.081	0.078	0.080	0.087	0.088	0.080	0.077
2nd Max. 1-hr.	471	ppm	Arith. Mean	0.126	0.125	0.137	0.125	0.123	0.118	0.125	0.136	0.116	0.114
4th Max. 8-hr.	468	ppm	95th	0.133	0.131	0.145	0.132	0.134	0.123	0.128	0.141	0.122	0.116
4th Max. 8-hr.	468	ppm	90th	0.116	0.115	0.126	0.113	0.113	0.107	0.116	0.129	0.106	0.106
4th Max. 8-hr.	468	ppm	75th	0.101	0.098	0.110	0.100	0.097	0.095	0.102	0.116	0.093	0.094
4th Max. 8-hr.	468	ppm	50th	0.088	0.088	0.097	0.088	0.087	0.085	0.091	0.102	0.084	0.083
4th Max. 8-hr.	468	ppm	25th	0.077	0.076	0.083	0.077	0.078	0.076	0.080	0.087	0.076	0.075
4th Max. 8-hr.	468	ppm	10th	0.065	0.065	0.070	0.067	0.068	0.068	0.071	0.076	0.068	0.066
4th Max. 8-hr.	468	ppm	5th	0.057	0.058	0.064	0.061	0.062	0.061	0.067	0.067	0.063	0.059
4th Max. 8-hr.	468	ppm	Arith. Mean	0.091	0.090	0.099	0.091	0.091	0.088	0.093	0.102	0.087	0.085

Table A-1a. National Air Quality Trends Statistics for Criteria Pollutants, 1981–1990 (continued)

Statistic	# of Sites	Units	Percentile	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
***PM**$_{10}$*													
Annual Avg.	—	μg/m3	95th	—	—	—	—	—	—	—	—	—	—
Annual Avg.	—	μg/m3	90th	—	—	—	—	—	—	—	—	—	—
Annual Avg.	—	μg/m3	75th	—	—	—	—	—	—	—	—	—	—
Annual Avg.	—	μg/m3	50th	—	—	—	—	—	—	—	—	—	—
Annual Avg.	—	μg/m3	25th	—	—	—	—	—	—	—	—	—	—
Annual Avg.	—	μg/m3	10th	—	—	—	—	—	—	—	—	—	—
Annual Avg.	—	μg/m3	5th	—	—	—	—	—	—	—	—	—	—
Annual Avg.	—	μg/m3	Arith. Mean	—	—	—	—	—	—	—	—	—	—
Sulfur Dioxide													
Arith. Mean	456	ppm	95th	0.0223	0.0199	0.0184	0.0193	0.0186	0.0180	0.0169	0.0182	0.0176	0.0160
Arith. Mean	456	ppm	90th	0.0186	0.0165	0.0152	0.0164	0.0160	0.0147	0.0142	0.0150	0.0148	0.0137
Arith. Mean	456	ppm	75th	0.0134	0.0123	0.0121	0.0126	0.0117	0.0118	0.0114	0.0113	0.0114	0.0103
Arith. Mean	456	ppm	50th	0.0091	0.0087	0.0086	0.0089	0.0087	0.0083	0.0082	0.0082	0.0080	0.0074
Arith. Mean	456	ppm	25th	0.0061	0.0058	0.0058	0.0055	0.0053	0.0052	0.0051	0.0050	0.0047	0.0045
Arith. Mean	456	ppm	10th	0.0028	0.0030	0.0028	0.0028	0.0026	0.0024	0.0024	0.0025	0.0023	0.0022
Arith. Mean	456	ppm	5th	0.0018	0.0015	0.0016	0.0017	0.0018	0.0016	0.0016	0.0019	0.0017	0.0016
Arith. Mean	456	ppm	Arith. Mean	0.0102	0.0095	0.0093	0.0095	0.0090	0.0088	0.0086	0.0087	0.0085	0.0079
2nd Max. 24-hr.	—	ppm	95th	—	—	—	—	—	—	—	—	—	—
2nd Max. 24-hr.	—	ppm	90th	—	—	—	—	—	—	—	—	—	—
2nd Max. 24-hr.	—	ppm	75th	—	—	—	—	—	—	—	—	—	—
2nd Max. 24-hr.	—	ppm	50th	—	—	—	—	—	—	—	—	—	—
2nd Max. 24-hr.	—	ppm	25th	—	—	—	—	—	—	—	—	—	—
2nd Max. 24-hr.	—	ppm	10th	—	—	—	—	—	—	—	—	—	—
2nd Max. 24-hr.	—	ppm	5th	—	—	—	—	—	—	—	—	—	—
2nd Max. 24-hr.	—	ppm	Arith. Mean	—	—	—	—	—	—	—	—	—	—

Table A-1b. National Air Quality Trends Statistics for Criteria Pollutants, 1991–2000

Statistic	# of Sites	Units	Percentile	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Carbon Monoxide													
2nd Max. 8-hr.	327	ppm	95th	9.8	8.9	8.5	8.3	7.9	7.7	6.9	7.0	6.5	6.1
2nd Max. 8-hr.	327	ppm	90th	8.9	8.0	7.4	7.7	7.0	6.7	6.2	5.8	5.6	5.1
2nd Max. 8-hr.	327	ppm	75th	7.1	6.6	6.2	6.3	5.7	5.2	5.0	4.7	4.5	4.1
2nd Max. 8-hr.	327	ppm	50th	5.3	5.0	4.8	5.0	4.4	4.0	3.8	3.6	3.6	3.2
2nd Max. 8-hr.	327	ppm	25th	4.0	3.8	3.6	3.9	3.3	3.0	2.9	2.8	2.6	2.4
2nd Max. 8-hr.	327	ppm	10th	2.8	2.8	2.8	2.7	2.5	2.3	2.1	2.1	1.9	1.8
2nd Max. 8-hr.	327	ppm	5th	2.1	2.2	2.1	2.1	2.2	1.9	1.7	1.8	1.6	1.4
2nd Max. 8-hr.	327	ppm	Arith. Mean	5.6	5.3	5.0	5.1	4.6	4.3	4.1	3.9	3.7	3.4
Lead													
Max. Qtr. AM	130	ppm	95th	0.38	0.23	0.18	0.16	0.18	0.15	0.12	0.14	0.10	0.11
Max. Qtr. AM	130	ppm	90th	0.19	0.15	0.12	0.12	0.10	0.10	0.09	0.10	0.09	0.09
Max. Qtr. AM	130	ppm	75th	0.08	0.07	0.07	0.06	0.05	0.05	0.05	0.05	0.05	0.05
Max. Qtr. AM	130	ppm	50th	0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.03	0.02	0.02
Max. Qtr. AM	130	ppm	25th	0.03	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01
Max. Qtr. AM	130	ppm	10th	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Max. Qtr. AM	130	ppm	5th	0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.01	0.01	0.01
Max. Qtr. AM	130	ppm	Arith. Mean	0.08	0.07	0.06	0.05	0.05	0.05	0.04	0.04	0.04	0.04
Nitrogen Dioxide													
Arith. Mean	234	ppm	95th	0.043	0.038	0.037	0.040	0.039	0.037	0.034	0.035	0.035	0.033
Arith. Mean	234	ppm	90th	0.032	0.032	0.031	0.032	0.031	0.031	0.029	0.030	0.029	0.028
Arith. Mean	234	ppm	75th	0.025	0.024	0.024	0.024	0.023	0.023	0.022	0.023	0.023	0.021
Arith. Mean	234	ppm	50th	0.018	0.018	0.018	0.019	0.018	0.018	0.017	0.017	0.017	0.017
Arith. Mean	234	ppm	25th	0.012	0.013	0.013	0.013	0.012	0.012	0.012	0.012	0.013	0.012
Arith. Mean	234	ppm	10th	0.008	0.008	0.008	0.008	0.007	0.007	0.008	0.007	0.008	0.008
Arith. Mean	234	ppm	5th	0.005	0.005	0.005	0.005	0.005	0.005	0.004	0.005	0.005	0.005
Arith. Mean	234	ppm	Arith. Mean	0.019	0.019	0.019	0.020	0.019	0.019	0.018	0.018	0.018	0.017
Ozone													
2nd Max. 1-hr.	738	ppm	95th	0.161	0.152	0.150	0.146	0.149	0.140	0.140	0.147	0.138	0.134
2nd Max. 1-hr.	738	ppm	90th	0.145	0.130	0.135	0.128	0.138	0.125	0.129	0.132	0.130	0.124
2nd Max. 1-hr.	738	ppm	75th	0.121	0.112	0.120	0.116	0.122	0.114	0.115	0.119	0.117	0.111
2nd Max. 1-hr.	738	ppm	50th	0.106	0.100	0.104	0.104	0.110	0.103	0.103	0.109	0.107	0.098
2nd Max. 1-hr.	738	ppm	25th	0.093	0.090	0.091	0.092	0.097	0.093	0.091	0.097	0.096	0.088
2nd Max. 1-hr.	738	ppm	10th	0.081	0.081	0.080	0.082	0.085	0.083	0.080	0.086	0.085	0.079
2nd Max. 1-hr.	738	ppm	5th	0.075	0.075	0.074	0.077	0.078	0.079	0.074	0.076	0.076	0.073
2nd Max. 1-hr.	738	ppm	Arith. Mean	0.111	0.105	0.107	0.106	0.112	0.105	0.104	0.110	0.107	0.100
4th Max. 8-hr.	741	ppm	95th	0.115	0.106	0.108	0.105	0.111	0.102	0.105	0.109	0.105	0.100
4th Max. 8-hr.	741	ppm	90th	0.107	0.096	0.100	0.097	0.106	0.097	0.099	0.102	0.101	0.095
4th Max. 8-hr.	741	ppm	75th	0.095	0.087	0.090	0.090	0.095	0.090	0.091	0.095	0.094	0.087
4th Max. 8-hr.	741	ppm	50th	0.084	0.079	0.081	0.082	0.088	0.082	0.082	0.087	0.087	0.080
4th Max. 8-hr.	741	ppm	25th	0.073	0.072	0.073	0.074	0.077	0.075	0.074	0.078	0.077	0.072
4th Max. 8-hr.	741	ppm	10th	0.063	0.065	0.063	0.067	0.068	0.068	0.065	0.069	0.068	0.064
4th Max. 8-hr.	741	ppm	5th	0.057	0.059	0.058	0.061	0.062	0.062	0.059	0.062	0.061	0.057
4th Max. 8-hr.	741	ppm	Arith. Mean	0.085	0.081	0.082	0.083	0.087	0.083	0.082	0.086	0.086	0.079

Table A-1b. National Air Quality Trends Statistics for Criteria Pollutants, 1991–2000 (continued)

Statistic	# of Sites	Units	Percentile	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
PM_{10}													
Annual Avg.	886	µg/m3	95th	46.4	41.8	41.5	40.0	38.9	37.9	38.1	35.8	39.7	39.0
Annual Avg.	886	µg/m3	90th	40.1	36.7	36.6	36.4	34.9	33.6	33.0	31.9	33.2	32.9
Annual Avg.	886	µg/m3	75th	33.8	31.3	30.5	30.7	29.1	27.7	27.2	27.5	27.6	27.5
Annual Avg.	886	µg/m3	50th	28.2	26.1	25.9	25.6	24.1	23.1	23.1	23.4	23.2	23.1
Annual Avg.	886	µg/m3	25th	23.6	22.2	21.1	21.1	19.9	19.4	19.5	19.7	19.1	19.1
Annual Avg.	886	µg/m3	10th	18.5	18.0	17.4	16.9	15.9	16.1	16.1	15.3	15.4	15.2
Annual Avg.	886	µg/m3	5th	16.1	15.2	14.3	14.1	13.3	13.8	13.4	13.4	13.5	12.7
Annual Avg.	886	µg/m3	Arith. Mean	29.4	27.3	26.6	26.4	25.1	24.2	24.1	23.8	24.1	23.8
Sulfur Dioxide													
Arith. Mean	457	ppm	95th	0.0167	0.0167	0.0159	0.0151	0.0118	0.0113	0.0111	0.0107	0.0105	0.0106
Arith. Mean	457	ppm	90th	0.0145	0.0130	0.0130	0.0125	0.0104	0.0100	0.0094	0.0096	0.0091	0.0090
Arith. Mean	457	ppm	75th	0.0101	0.0096	0.0095	0.0094	0.0077	0.0075	0.0073	0.0074	0.0070	0.0065
Arith. Mean	457	ppm	50th	0.0076	0.0070	0.0068	0.0067	0.0051	0.0054	0.0052	0.0050	0.0049	0.0048
Arith. Mean	457	ppm	25th	0.0046	0.0044	0.0041	0.0039	0.0033	0.0033	0.0032	0.0033	0.0032	0.0030
Arith. Mean	457	ppm	10th	0.0023	0.0023	0.0023	0.0022	0.0019	0.0019	0.0019	0.0020	0.0020	0.0019
Arith. Mean	457	ppm	5th	0.0017	0.0015	0.0016	0.0016	0.0014	0.0015	0.0014	0.0014	0.0015	0.0015
Arith. Mean	457	ppm	Arith. Mean	0.0081	0.0076	0.0074	0.0072	0.0057	0.0057	0.0056	0.0055	0.0053	0.0051
2nd Max. 24-hr.	457	ppm	95th	0.0800	0.0800	0.0730	0.0760	0.0590	0.0610	0.0530	0.0540	0.0530	0.0470
2nd Max. 24-hr.	457	ppm	90th	0.0640	0.0630	0.0600	0.0640	0.0490	0.0480	0.0470	0.0450	0.0430	0.0410
2nd Max. 24-hr.	457	ppm	75th	0.0440	0.0450	0.0420	0.0460	0.0340	0.0330	0.0330	0.0320	0.0290	0.0300
2nd Max. 24-hr.	457	ppm	50th	0.0320	0.0310	0.0290	0.0330	0.0230	0.0230	0.0230	0.0220	0.0210	0.0210
2nd Max. 24-hr.	457	ppm	25th	0.0210	0.0200	0.0190	0.0200	0.0160	0.0150	0.0150	0.0150	0.0140	0.0140
2nd Max. 24-hr.	457	ppm	10th	0.0110	0.0110	0.0110	0.0100	0.0080	0.0090	0.0080	0.0080	0.0080	0.0080
2nd Max. 24-hr.	457	ppm	5th	0.0080	0.0070	0.0070	0.0060	0.0060	0.0060	0.0050	0.0050	0.0060	0.0060
2nd Max. 24-hr.	457	ppm	Arith. Mean	0.0364	0.0353	0.0340	0.0358	0.0267	0.0267	0.0257	0.0247	0.0238	0.0233

Table A-2. National Carbon Monoxide Emissions Estimates, 1980, 1985, 1989–2000 (thousand short tons)

Source Category	1980	1985	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Fuel Combustion	7,302	8,485	7,443	5,510	5,856	6,155	5,586	5,519	5,934	4,349	4,336	4,337	4,348	4,590
FUEL COMB. ELEC. UTIL.	322	291	321	363	349	350	363	370	372	409	423	450	424	445
Coal	188	207	233	234	234	236	246	247	250	251	257	242	229	234
Oil	48	18	26	20	19	15	16	15	10	12	14	19	19	18
Gas	85	56	51	51	51	51	49	53	55	79	84	97	96	105
Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	8	9	33	19	26
Internal Combustion	NA	10	11	57	45	47	51	55	58	58	60	60	61	62
FUEL COMB. INDUSTRIAL	750	670	672	879	920	955	1,043	1,041	1,056	1,191	1,163	1,151	1,175	1,221
Coal	58	86	87	105	101	102	101	100	98	110	109	106	109	110
Oil	35	47	46	74	60	64	66	66	71	54	52	51	52	55
Gas	418	257	271	226	284	300	322	337	345	340	339	336	340	361
Other	239	167	173	279	267	264	286	287	297	349	333	334	341	355
Internal Combustion	NA	113	96	195	208	227	268	251	245	337	330	324	334	340
FUEL COMB. OTHER	6,230	7,525	6,450	4,269	4,587	4,849	4,181	4,108	4,506	2,749	2,750	2,736	2,749	2,924
Commercial/Institutional Coal	13	14	15	14	14	15	15	15	15	14	14	15	15	15
Commercial/Institutional Oil	21	18	17	18	17	18	18	18	19	19	20	16	16	16
Commercial/Institutional Gas	26	42	49	44	44	51	53	54	54	64	65	63	68	69
Misc. Fuel Comb. (Except Residential)	NA	57	55	149	141	141	143	147	145	46	48	49	50	51
Residential Wood	5,992	7,232	6,161	3,781	4,090	4,332	3,679	3,607	3,999	2,351	2,351	2,351	2,351	2,526
fireplaces	5,992	7,232	6,161	3,781	4,090	4,332	3,679	3,607	3,999	1,043	1,043	1,043	1,043	1,118
woodstoves	NA	NA	NA	NA	NA	NA	NA	NA	NA	1,308	1,308	1,308	1,308	1,408
other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Residential Other	178	162	153	262	281	292	274	268	273	255	252	242	249	246
Industrial Processes	9,250	7,215	7,013	5,852	5,740	5,683	5,898	5,839	5,790	7,187	7,348	7,362	7,343	7,521
CHEMICAL & ALLIED PRODUCT MFG	2,151	1,845	1,925	1,183	1,127	1,112	1,093	1,171	1,223	1,053	1,071	1,081	1,081	1,112
Organic Chemical Mfg	543	251	285	149	128	131	132	130	127	90	91	92	93	96
ethylene dichloride	17	0	0	0	0	0	0	0	0	0	0	0	0	0
maleic anhydride	103	16	16	3	3	4	4	4	4	0	0	0	0	0
cyclohexanol	37	5	6	0	0	0	0	1	1	0	0	0	0	0
other	386	230	264	146	125	127	128	125	123	89	90	92	92	95
Inorganic Chemical Mfg	191	89	95	133	129	130	131	135	134	120	121	123	125	128
pigments; TiO2 chloride process: reactor	34	77	84	119	119	119	119	119	119	117	118	120	122	125
other	157	12	12	14	11	12	13	16	15	3	3	3	3	3
Polymer & Resin Mfg	NA	19	18	3	6	5	5	5	5	5	5	5	5	5
Agricultural Chemical Mfg	NA	16	17	44	19	19	18	17	17	12	13	13	13	13
Paint, Varnish, Lacquer, Enamel Mfg	NA	NA	NA	0	0	0	0	0	0	0	0	0	0	0
Pharmaceutical Mfg	NA	0	0	0	0	0	0	0	0	0	0	0	1	1
Other Chemical Mfg	1,417	1,471	1,510	854	844	827	805	885	939	826	841	847	845	869
carbon black mfg	1,417	1,078	1,112	798	756	736	715	793	845	796	811	818	815	839
carbon black furnace: fugitives	NA	155	180	17	54	57	60	63	65	4	4	4	4	4
other	NA	238	219	39	35	34	30	30	29	26	26	26	26	26
METALS PROCESSING	2,246	2,223	2,132	2,640	2,571	2,496	2,536	2,475	2,380	1,604	1,709	1,702	1,673	1,735
Nonferrous Metals Processing	842	694	677	436	438	432	423	421	424	459	475	465	451	461
aluminum anode baking	421	41	41	41	47	41	41	41	41	22	23	23	23	23
prebake aluminum cell	421	257	254	260	260	260	260	260	260	277	288	281	271	278
other	NA	396	382	135	131	131	122	120	123	160	164	160	157	160

Table A-2. National Carbon Monoxide Emissions Estimates, 1980, 1985, 1989–2000 (thousand short tons) (cont.)

Source Category	1980	1985	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Ferrous Metals Processing	1,404	1,523	1,449	2,163	2,108	2,038	2,089	2,029	1,930	1,101	1,189	1,193	1,181	1,233
basic oxygen furnace	80	694	662	594	731	767	768	677	561	268	296	301	301	316
carbon steel electric arc furnace	280	19	18	45	54	49	58	61	65	60	65	66	66	69
coke oven charging	43	9	9	14	16	17	7	7	8	4	4	4	4	4
gray iron cupola	340	302	280	124	118	114	121	128	120	111	115	111	106	108
iron ore sinter plant windbox	600	304	293	211	211	211	211	211	211	46	50	50	50	52
other	61	194	187	1,174	979	880	924	945	966	612	659	661	654	683
Metals Processing NEC	NA	6	6	40	25	26	25	25	25	44	46	44	41	41
PETROLEUM & RELATED INDUSTRIES	1,723	462	436	333	345	371	371	338	348	354	367	366	366	369
Oil & Gas Production	NA	11	8	38	18	21	22	35	34	27	27	27	27	28
Petroleum Refineries & Related Industries	1,723	449	427	291	324	345	344	299	309	319	332	331	332	333
fluid catalytic cracking units	1,680	403	390	284	315	333	328	286	299	308	320	319	320	321
other	44	46	37	7	9	13	17	13	10	11	12	12	12	12
Asphalt Manufacturing	NA	2	2	3	4	5	5	5	5	8	8	8	7	7
OTHER INDUSTRIAL PROCESSES	830	694	716	537	548	544	594	600	624	561	582	590	599	620
Agriculture, Food, & Kindred Products	NA	0	0	3	3	3	3	2	6	4	4	4	4	4
Textiles, Leather, & Apparel Products	NA	0	0	0	0	0	0	0	0	0	0	0	0	0
Wood, Pulp & Paper, & Publishing Prod.	798	627	655	473	461	449	453	461	484	356	370	378	388	401
sulfate pulping: rec. furnace/evaporator	NA	475	497	370	360	348	350	355	370	274	285	291	299	309
sulfate (kraft) pulping: lime kiln	798	140	146	87	81	75	78	76	82	50	52	53	55	57
other	NA	12	13	16	21	25	24	30	32	32	33	34	34	36
Rubber & Miscellaneous Plastic Products	NA	0	0	0	0	0	0	0	0	0	0	0	0	0
Mineral Products	32	43	43	54	77	85	131	131	127	180	186	186	185	192
Machinery Products	NA	0	0	0	0	0	0	0	0	1	1	1	1	1
Electronic Equipment	NA	18	12	2	2	2	2	2	2	0	0	0	0	0
Transportation Equipment	NA	0	0	0	0	0	0	0	0	0	0	0	0	0
Miscellaneous Industrial Processes	NA	6	5	5	5	6	4	4	4	19	19	20	20	20
SOLVENT UTILIZATION	NA	2	2	5	5	5	5	5	6	1	2	2	2	2
Degreasing	NA	1	1	0	0	0	0	0	0	0	0	0	0	0
Graphic Arts	NA	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry Cleaning	NA	NA	NA	0	0	0	0	1	1	0	0	0	0	0
Surface Coating	NA	0	1	0	1	1	1	1	1	1	1	1	1	1
Other Industrial	NA	0	0	4	4	4	4	4	4	0	0	0	0	0
Nonindustrial	NA	NA	NA	0	0	0	0	0	0	0	0	0	0	0
Solvent Utilization NEC	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0	0	0	0
STORAGE & TRANSPORT	NA	49	55	76	28	17	51	24	25	70	71	72	72	74
Bulk Terminals & Plants	NA	0	0	0	2	0	4	4	4	0	0	0	0	0
Petroleum & Petroleum Product Storage	NA	0	0	0	12	0	32	4	4	0	0	0	0	0
Petroleum & Petroleum Product Transport	NA	0	0	0	0	0	0	0	0	0	0	0	0	0
Service Stations: Stage I	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0	0	0	0
Service Stations: Stage II	NA	NA	NA	NA	NA	NA	NA	0	0	0	0	0	0	0
Organic Chemical Storage	NA	42	49	74	13	13	13	13	13	68	69	70	70	72
Organic Chemical Transport	NA	NA	NA	0	0	0	0	0	0	0	0	0	0	0
Inorganic Chemical Storage	NA	0	0	0	0	0	0	0	0	0	0	0	0	0
Bulk Materials Storage	NA	6	5	1	1	3	2	3	3	1	1	1	1	1

Table A-2. National Carbon Monoxide Emissions Estimates, 1980, 1985, 1989–2000 (thousand short tons) (cont.)

Source Category	1980	1985	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
WASTE DISPOSAL & RECYCLING	2,300	1,941	1,747	1,079	1,116	1,138	1,248	1,225	1,185	3,544	3,546	3,549	3,550	3,609
Incineration	1,246	958	876	372	392	404	497	467	432	72	74	77	76	78
conical wood burner	228	17	19	6	7	6	6	6	6	2	2	2	2	2
municipal incinerator	13	34	35	16	17	15	14	14	15	7	7	8	8	8
industrial	NA	9	9	9	10	10	87	48	10	9	10	10	10	10
commmercial/institutional	60	32	39	19	20	21	21	21	21	22	23	24	24	25
residential	945	865	773	294	312	324	340	347	351	0	0	0	0	0
other	NA	2	2	27	26	28	29	30	29	32	32	33	33	33
Open Burning	1,054	982	870	706	722	731	749	755	750	3,466	3,466	3,466	3,467	3,524
industrial	1,007	20	21	14	14	15	15	15	15	0	0	0	0	0
commmercial/institutional	47	4	5	46	48	50	52	54	52	0	0	0	0	0
residential	NA	958	845	509	516	523	529	533	536	425	425	425	425	436
land clearing debris	NA	NA	NA	NA	NA	NA	NA	NA	NA	2,998	2,998	2,998	2,998	3,044
other	NA	NA	NA	137	144	144	153	153	147	43	43	43	43	44
POTW	NA	NA	NA	0	0	0	0	0	0	0	0	0	0	0
Industrial Waste Water	NA	NA	NA	0	0	0	0	0	0	0	0	0	0	0
TSDF	NA	NA	NA	0	0	0	0	0	0	0	0	0	0	0
Landfills	NA	0	0	1	1	2	2	2	2	6	6	6	6	6
Other	NA	0	0	0	0	0	1	1	1	0	0	0	0	0
Transportation	92,538	93,386	83,829	76,635	81,583	80,235	81,224	82,699	75,035	82,631	81,353	80,288	77,821	76,426
ON-ROAD VEHICLES	78,049	77,387	66,050	58,444	62,999	61,236	61,833	62,903	54,811	54,388	53,315	52,360	49,740	48,469
Light-Duty Gas Vehicles & Motorcycles	53,561	49,451	42,234	34,996	35,680	33,761	33,185	33,317	29,787	29,163	28,639	28,420	26,685	26,718
light-duty gas vehicles	53,342	49,273	42,047	34,806	35,503	33,582	32,995	33,122	29,601	28,974	28,449	28,225	26,502	26,519
motorcycles	219	178	187	190	177	179	190	195	187	189	191	195	183	199
Light-Duty Gas Trucks	16,137	18,960	15,940	17,118	20,622	21,536	22,795	22,614	19,434	16,873	16,949	16,948	16,532	15,837
light-duty gas trucks 1	10,395	11,834	9,034	9,672	11,606	12,065	12,647	12,428	11,029	11,221	11,296	11,315	11,111	10,732
light-duty gas trucks 2	5,742	7,126	6,906	7,446	9,016	9,471	10,148	10,186	8,405	5,652	5,652	5,634	5,421	5,105
Heavy-Duty Gas Vehicles	7,189	7,716	6,506	5,029	5,369	4,586	4,483	5,523	4,103	6,260	5,549	4,782	4,264	3,680
Diesels	1,161	1,261	1,369	1,301	1,327	1,353	1,370	1,449	1,487	2,093	2,178	2,210	2,260	2,234
heavy-duty diesel vehicles	1,139	1,235	1,336	1,233	1,292	1,317	1,333	1,411	1,447	2,074	2,162	2,197	2,249	2,223
light-duty diesel trucks	4	4	6	46	8	9	10	10	10	7	6	5	4	4
light-duty diesel vehicles	19	22	28	22	27	27	28	29	29	12	10	8	7	6
NON-ROAD ENGINES AND VEHICLES	14,489	15,999	17,779	18,191	18,585	18,999	19,391	19,796	20,224	28,243	28,038	27,928	28,081	27,957
Non-Road Gasoline	12,760	13,659	15,021	15,394	15,738	16,081	16,424	16,765	17,112	25,432	25,210	25,098	25,087	24,980
recreational	299	312	321	355	361	366	371	374	382	4,796	4,796	4,796	4,796	4,792
construction	527	603	603	603	602	602	602	602	602	723	688	674	671	668
industrial	709	807	740	723	707	690	674	657	640	864	823	793	826	796
lawn & garden	6,764	7,166	8,023	8,237	8,451	8,665	8,880	9,094	9,308	11,330	11,243	11,073	11,148	11,057
farm	338	372	407	416	424	433	442	450	459	340	343	346	359	360
light commercial	2,095	2,263	2,754	2,877	3,000	3,123	3,246	3,369	3,491	3,992	4,061	4,138	4,062	4,051
logging	28	31	47	50	54	58	62	66	69	1,160	1,012	1,016	1,067	1,105
airport service	9	10	10	10	10	9	9	9	9	9	9	9	9	9
railway maintenance	NA	5	6	6	6	6	6	6	7	7	7	7	7	6
recreational marine vessels	1,990	2,090	2,112	2,117	2,122	2,128	2,133	2,138	2,144	2,211	2,228	2,244	2,144	2,137

Table A-2. National Carbon Monoxide Emissions Estimates, 1980, 1985, 1989–2000 (thousand short tons) (cont.)

Source Category	1980	1985	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Non-Road Diesel	829	900	1,062	1,098	1,134	1,169	1,204	1,238	1,269	1,386	1,377	1,352	1,300	1,242
recreational	2	3	3	3	3	3	3	3	3	5	5	5	5	4
construction	479	534	637	662	688	714	739	763	785	878	869	846	802	754
industrial	83	105	121	124	127	130	134	138	142	149	151	151	151	151
lawn & garden	13	14	26	29	32	34	37	39	42	47	50	53	53	49
farm	174	142	163	166	168	170	172	174	175	165	163	161	157	153
light commercial	28	34	44	46	48	49	51	52	54	62	64	67	72	77
logging	49	61	58	58	58	57	57	56	55	63	58	52	46	40
airport service	1	2	3	4	4	5	5	5	6	7	7	8	8	8
railway maintenance	NA	1	2	2	2	2	2	3	3	3	3	3	3	3
recreational marine vessels	NA	3	4	4	4	4	4	4	5	7	7	7	4	4
Aircraft	743	831	955	904	888	901	905	915	942	360	360	360	360	365
Marine Vessels	62	73	98	129	136	132	126	127	127	138	139	140	140	141
coal	4	5	7	4	4	4	4	5	4	NA	NA	NA	NA	NA
diesel	57	67	90	80	83	79	75	76	77	131	131	131	131	133
residual oil	1	1	2	11	11	12	12	12	10	8	8	8	8	8
gasoline	NA	NA	NA	2	2	2	2	2	2	NA	NA	NA	NA	NA
other	NA	NA	NA	31	36	35	33	33	34	0	0	0	0	0
Railroads	96	106	121	121	120	125	120	114	114	117	121	120	119	119
Non-Road Other	*NA*	430	522	545	568	591	614	637	660	810	831	858	1,075	1,110
liquified petroleum gas	NA	288	376	398	420	442	464	486	508	704	724	749	950	983
compressed natural gas	NA	142	146	147	148	149	150	151	152	106	108	109	125	127
MISCELLANEOUS	8,344	7,927	8,153	11,122	8,618	6,934	7,082	9,656	7,298	10,472	12,474	9,303	12,886	20,806
Agriculture & Forestry	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0	0	0	0
Other Combustion	8,344	7,927	8,153	11,122	8,618	6,934	7,082	9,656	7,298	10,472	12,474	9,303	12,885	20,806
structural fires	217	242	242	78	80	81	82	83	84	18	18	18	18	18
agricultural fires	501	396	571	415	413	421	415	441	465	454	464	471	479	489
slash/prescribed burning	2,226	4,332	4,332	4,668	4,666	4,729	4,966	4,990	5,252	5,402	5,769	6,152	3,967	2,397
forest wildfires	5,396	2,957	3,009	5,928	3,430	1,674	1,586	4,114	1,469	4,574	6,200	2,638	8,398	17,878
other	4	NA	NA	32	28	30	34	28	28	22	23	23	24	24
Health Services	NA	NA	NA	0	NA	NA	NA	NA	NA	0	0	0	0	0
Cooling Towers	NA	NA	NA	NA	0	0	NA	0	0	0	0	0	0	0
Fugitive Dust	NA	NA	NA	0	0	0	0	0	0	0	0	0	0	0
TOTAL ALL SOURCES	117,434	117,013	106,439	99,119	101,797	99,007	99,791	103,713	94,058	104,639	105,511	101,290	102,398	109,343

Note: Some columns may not sum to totals due to rounding.

Table A-3. National Lead Emissions Estimates, 1980, 1985, 1989–2000 (short tons)

Source Category	1980	1985	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Fuel Combustion	4,299	515	505	500	495	491	497	496	490	492	493	494	501	501
FUEL COMB. ELEC. UTIL.	129	64	67	64	61	59	62	62	57	61	64	69	72	72
Coal	95	51	46	46	46	47	50	50	50	53	54	55	56	56
bituminous	57	31	28	28	28	28	30	30	30	32	33	33	34	34
subbituminous	28	15	14	14	14	14	15	15	15	16	16	16	17	17
anthracite & lignite	9	5	4	4	4	4	5	5	5	5	5	5	5	5
Oil	34	13	21	18	15	12	12	12	7	8	10	14	16	16
residual	34	13	21	18	15	12	12	12	7	8	10	14	16	16
distillate	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FUEL COMB. INDUSTRIAL	60	30	18	18	18	18	19	19	18	16	16	15	17	17
Coal	45	22	14	14	15	14	14	14	14	13	14	13	13	13
bituminous	31	15	10	10	10	10	10	10	10	9	9	9	9	9
subbituminous	10	5	3	3	3	3	3	3	3	3	3	3	3	3
anthracite & lignite	4	2	1	1	1	1	1	1	1	1	1	1	1	1
Oil	14	8	4	3	3	4	5	5	4	3	2	2	3	3
residual	14	7	3	3	2	3	4	4	3	2	2	1	3	3
distillate	1	1	1	1	1	1	1	1	1	1	1	1	1	1
FUEL COMB. OTHER	4,111	421	420	418	416	414	416	415	415	415	413	410	412	412
Commercial/Institutional Coal	12	6	4	4	3	4	4	3	4	5	5	4	4	4
bituminous	6	4	3	3	2	2	2	2	2	3	3	2	2	2
subbituminous	2	1	1	1	1	1	1	1	1	1	1	1	1	1
anthracite, lignite	4	1	1	0	0	0	1	0	1	1	1	1	1	1
Commercial/Institutional Oil	10	4	4	4	4	4	4	4	3	3	2	2	3	3
residual	9	3	3	3	3	3	3	3	2	2	2	1	3	3
distillate	1	1	1	1	1	1	1	1	1	1	1	1	1	1
other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0	0	0
Misc. Fuel Comb. (Except Residential)	4,080	400	400	400	400	400	400	400	400	400	400	400	400	400
Residential Other	9	11	12	10	9	7	8	8	8	7	6	5	5	5
Industrial Processes	5,148	3,402	3,161	3,278	3,081	2,736	2,872	3,007	2,875	3,061	3,121	3,045	3,162	3,162
CHEMICAL & ALLIED PRODUCT MFG	104	118	136	136	132	93	92	96	163	167	188	194	218	218
Inorganic Chemical Mfg	104	118	136	136	132	93	92	96	163	167	188	194	218	218
lead oxide and pigments	104	118	136	136	132	93	92	96	163	167	188	194	218	218
METALS PROCESSING	3,026	2,097	2,088	2,170	1,974	1,774	1,900	2,027	2,049	2,055	2,081	1,991	2,078	2,078
Nonferrous Metals Processing	1,826	1,376	1,337	1,409	1,258	1,112	1,210	1,287	1,337	1,333	1,342	1,259	1,329	1,329
primary lead production	1,075	874	715	728	623	550	637	633	674	588	619	608	623	623
primary copper production	20	19	19	19	19	20	21	22	21	22	24	25	25	25
primary zinc production	24	16	9	9	11	11	13	12	12	13	13	12	12	12
secondary lead production	481	288	433	449	414	336	341	405	432	514	484	413	465	465
secondary copper production	116	70	37	75	65	73	70	76	79	76	82	78	81	81
lead battery manufacture	50	65	74	78	77	77	81	94	102	103	107	110	117	117
lead cable coating	37	43	50	50	48	44	47	44	16	16	14	13	4	4
other	24	3	1	1	1	1	1	1	1	1	1	1	1	1

Table A-3. National Lead Emissions Estimates, 1980, 1985, 1989–2000 (short tons) (continued)

Source Category	**1980**	**1985**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
Ferrous Metals Processing	911	577	582	576	517	461	496	540	528	529	538	536	555	555
coke manufacturing	6	3	4	4	3	3	2	0	0	0	0	0	0	0
ferroalloy production	13	7	20	18	14	14	12	13	8	8	8	7	6	6
iron production	38	21	19	18	16	17	18	18	19	18	18	18	18	18
steel production	481	209	138	138	145	139	145	160	159	160	165	168	173	173
gray iron production	373	336	401	397	339	288	319	349	342	343	348	343	357	357
Metals Processing NEC	289	144	170	185	199	202	194	200	184	193	201	196	195	195
metal mining	207	141	169	184	198	201	193	199	183	192	200	195	194	194
other	82	3	1	1	1	1	1	1	1	1	1	1	1	1
OTHER INDUSTRIAL PROCESSES	808	316	173	169	167	56	55	54	59	51	54	54	53	53
Mineral Products	93	43	23	26	24	26	27	28	29	29	30	30	31	31
cement manufacturing	93	43	23	26	24	26	27	28	29	29	30	30	31	31
Miscellaneous Industrial Processes	715	273	150	143	143	30	28	26	30	22	25	23	22	22
WASTE DISPOSAL & RECYCLING	1,210	871	765	804	808	812	825	830	604	788	798	806	813	813
Incineration	1,210	871	765	804	808	812	825	830	604	788	798	806	813	813
municipal waste	161	79	45	67	70	68	69	68	70	76	76	76	77	77
other	1,049	792	720	738	738	744	756	762	534	712	722	729	736	736
Transportation	64,706	18,973	1,802	1,197	592	584	547	544	564	525	523	518	536	565
ON-ROAD VEHICLES	60,501	18,052	982	421	18	18	19	19	19	19	20	21	22	20
Light-Duty Gas Vehicles & Motorcycles	47,184	13,637	733	314	13	14	14	14	14	12	13	14	14	14
Light-Duty Gas Trucks	11,671	4,061	232	100	4	4	5	5	5	7	7	7	7	5
Heavy-Duty Gas Vehicles	1,646	354	16	7	0	0	0	0	0	0	0	1	1	1
NON-ROAD ENGINES AND VEHICLES	4,205	921	820	776	574	565	529	525	544	505	503	497	515	545
Non-Road Gasoline	3,320	229	166	158	0	0	0	0	0	0	0	0	0	0
Aircraft	885	692	655	619	574	565	528	525	544	505	503	497	515	545
TOTAL ALL SOURCES	74,153	22,890	5,468	4,975	4,169	3,810	3,916	4,047	3,929	4,077	4,137	4,057	4,199	4,228

Note: Some columns may not sum to totals due to rounding.

Table A-4. National Nitrogen Oxides Emissions Estimates, 1980, 1985, 1989–2000 (thousand short tons)

Source Category	1980	1985	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Fuel Combustion	11,320	10,048	10,537	10,895	10,779	10,928	11,111	11,015	10,827	10,502	10,563	10,389	9,964	9,649
FUEL COMB. ELEC. UTIL.	7,024	6,127	6,593	6,663	6,519	6,504	6,651	6,565	6,384	6,141	6,279	6,231	5,672	5,266
Coal	6,123	5,240	5,676	5,642	5,559	5,579	5,744	5,636	5,579	5,574	5,644	5,436	4,929	4,573
bituminous	3,439	4,378	4,595	4,532	4,435	4,456	4,403	4,207	3,830	3,776	3,828	3,635	3,176	2,910
subbituminous	1,694	668	837	857	874	868	1,087	1,167	1,475	1,570	1,591	1,575	1,551	1,462
anthracite & lignite	542	194	245	254	250	255	255	262	273	229	225	226	201	201
other	447	NA	NA	NA	NA	NA	NA	NA	NA	0	0	0	0	0
Oil	901	193	285	221	212	170	180	163	96	118	145	223	188	154
residual	39	178	268	207	198	158	166	149	94	116	142	220	184	149
distillate	862	15	17	14	14	13	14	14	2	2	2	3	3	4
other	NA	NA	NA	0	NA	NA	NA	NA	NA	0	0	0	0	0
Gas	NA	646	582	565	580	579	551	591	562	285	319	381	370	353
natural	NA	646	582	565	580	579	551	591	562	273	306	363	368	351
process	NA	NA	NA	NA	NA	NA	NA	NA	NA	12	13	19	2	1
Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	6	7	27	19	18
Internal Combustion	NA	48	49	235	168	175	176	175	148	158	165	164	166	170
FUEL COMB. INDUSTRIAL	3,555	3,209	3,209	3,035	2,979	3,071	3,151	3,147	3,144	3,157	3,102	3,051	3,130	3,222
Coal	444	608	615	585	570	574	589	602	597	543	537	524	539	543
bituminous	306	430	446	399	387	405	413	420	412	369	364	357	367	370
subbituminous	94	14	14	18	20	21	28	38	46	46	46	44	46	46
anthracite & lignite	44	33	30	26	26	26	26	27	26	19	19	18	18	18
other	NA	131	124	141	137	122	122	117	112	109	108	105	108	109
Oil	286	309	294	265	237	244	245	241	247	225	216	209	214	228
residual	179	191	176	180	146	154	153	149	156	141	130	126	129	139
distillate	63	89	88	71	73	73	75	76	73	73	74	72	73	75
other	44	29	29	14	18	17	17	17	17	11	12	11	11	13
Gas	2,619	1,520	1,625	1,182	1,250	1,301	1,330	1,333	1,324	1,205	1,189	1,175	1,200	1,253
natural	2,469	1,282	1,405	967	1,025	1,068	1,095	1,103	1,102	993	970	958	984	1,010
process	5	227	209	211	222	230	233	228	220	210	216	215	214	240
other	145	11	10	3	3	3	2	2	2	3	3	3	3	3
Other	205	118	120	131	129	126	124	124	123	120	115	115	118	123
wood/bark waste	138	89	92	89	82	82	83	83	84	83	79	80	83	86
liquid waste	NA	12	12	8	11	10	11	11	11	9	8	8	8	9
other	67	17	16	34	36	34	30	30	28	29	28	27	27	28
Internal Combustion	NA	655	556	874	793	825	863	846	854	1,064	1,045	1,028	1,059	1,076
FUEL COMB. OTHER	741	712	736	1,196	1,281	1,353	1,308	1,303	1,298	1,204	1,182	1,107	1,162	1,161
Commercial/Institutional Coal	25	37	38	40	36	38	40	40	38	34	35	37	37	37
Commercial/Institutional Oil	155	106	106	97	88	93	93	95	103	96	97	80	79	80
Commercial/Institutional Gas	131	145	159	200	210	225	232	237	231	247	252	243	265	269
Misc. Fuel Comb. (Except Residential)	NA	11	11	34	32	28	31	31	30	27	28	29	28	29
Residential Wood	74	88	75	46	50	53	45	44	49	30	30	30	30	33
Residential Other	356	326	347	780	865	916	867	857	847	770	740	688	723	713
distillate oil	85	75	78	209	211	210	210	210	210	193	188	172	175	169
natural gas	238	248	267	449	469	489	513	516	519	470	437	400	433	431
other	33	3	3	121	185	218	144	131	118	108	114	117	116	114
Industrial Processes	666	891	852	892	816	857	861	878	873	888	923	933	933	967

Table A-4. National Nitrogen Oxides Emissions Estimates, 1980, 1985, 1989–2000 (thousand short tons) (continued)

Source Category	1980	1985	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
CHEMICAL & ALLIED PRODUCT MFG	213	262	273	168	165	163	155	160	158	125	127	129	131	134
Organic Chemical Mfg	54	37	42	18	22	22	19	20	20	21	21	21	21	22
Inorganic Chemical Mfg	159	22	18	12	12	10	5	6	7	6	6	6	6	6
Polymer & Resin Mfg	NA	22	23	6	6	6	5	5	4	3	3	3	3	3
Agricultural Chemical Mfg	NA	143	152	80	77	76	74	76	74	50	51	52	53	55
Paint, Varnish, Lacquer, Enamel Mfg	NA	0	0	0	0	0	0	0	0	0	0	0	0	0
Pharmaceutical Mfg	NA	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Chemical Mfg	NA	38	39	52	48	50	51	54	54	45	46	47	47	48
METALS PROCESSING	65	87	83	97	76	81	83	91	98	83	88	88	88	91
Nonferrous Metals Processing	NA	16	15	14	15	13	12	12	12	11	12	12	12	12
Ferrous Metals Processing	65	58	54	78	56	62	67	75	83	66	71	71	70	73
Metals Processing NEC	NA	13	14	6	5	6	4	4	4	6	6	6	6	7
PETROLEUM & RELATED INDUSTRIES	72	124	97	153	121	148	123	117	110	139	143	143	143	146
Oil & Gas Production	NA	69	47	104	65	68	70	63	58	86	88	88	88	90
Petroleum Refineries & Related Industries	72	55	49	47	52	76	49	49	48	47	48	48	48	49
Asphalt Manufacturing	NA	1	1	3	4	4	5	5	5	7	7	7	7	7
OTHER INDUSTRIAL PROCESSES	205	327	311	378	352	361	370	389	399	438	460	467	465	487
Agriculture, Food, & Kindred Products	NA	5	5	3	3	3	4	3	6	5	5	5	5	5
Textiles, Leather, & Apparel Products	NA	0	0	0	0	0	0	0	0	1	1	1	1	1
Wood, Pulp & Paper, & Publishing Prods	24	73	77	91	88	86	86	89	89	86	89	91	92	96
Rubber & Miscellaneous Plastic Prods	NA	0	0	0	0	0	0	0	0	0	0	0	0	0
Mineral Products	181	239	220	270	249	259	267	281	287	331	350	355	351	369
cement mfg	98	137	124	151	131	139	143	150	153	200	212	214	208	220
glass mfg	60	48	45	59	59	61	64	66	67	69	74	76	77	81
other	23	54	51	61	59	60	60	64	66	62	64	65	65	67
Machinery Products	NA	2	2	3	2	2	3	6	7	2	3	3	3	3
Electronic Equipment	NA	NA	NA	0	0	0	0	0	0	0	0	0	0	0
Transportation Equipment	NA	0	0	0	0	0	0	0	0	0	0	0	0	0
Miscellaneous Industrial Processes	NA	8	7	10	10	10	9	9	10	12	12	12	12	12
SOLVENT UTILIZATION	NA	2	3	1	2	3	3	3	3	2	3	3	3	3
Degreasing	NA	0	0	0	0	0	0	0	0	0	0	0	0	0
Graphic Arts	NA	0	0	0	1	1	1	1	1	1	1	1	1	1
Dry Cleaning	NA	NA	NA	0	0	0	0	0	0	0	0	0	0	0
Surface Coating	NA	2	2	1	2	2	2	2	2	2	2	2	2	2
Other Industrial	NA	0	0	0	0	0	0	0	0	0	0	0	0	0
Nonindustrial	NA	NA	NA	0	0	0	0	0	0	0	0	0	0	0
Solvent Utilization NEC	NA	NA	NA	NA	NA	NA	NA	0	0	0	0	0	0	0
STORAGE & TRANSPORT	NA	2	2	3	6	5	5	5	6	15	16	16	16	17
Bulk Terminals & Plants	NA	NA	NA	0	1	1	1	1	1	2	2	2	2	2
Petroleum & Petroleum Product Storage	NA	1	1	2	2	0	0	0	0	7	8	8	8	8
Petroleum & Petroleum Product Transport	NA	0	0	0	0	0	0	0	0	0	0	0	0	0
Service Stations: Stage I	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0	0	0	0
Service Stations: Stage II	NA	NA	NA	NA	NA	NA	NA	0	0	0	0	0	0	0
Organic Chemical Storage	NA	1	1	0	2	3	3	3	4	4	4	4	4	4
Organic Chemical Transport	NA	NA	NA	0	0	0	0	0	0	0	0	0	0	0
Inorganic Chemical Storage	NA	0	0	0	0	0	0	0	0	0	0	0	0	0
Bulk Materials Storage	NA	0	1	0	0	0	0	0	1	2	2	2	2	2

Table A-4. National Nitrogen Oxides Emissions Estimates, 1980, 1985, 1989–2000 (thousand short tons) (continued)

Source Category	1980	1985	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
WASTE DISPOSAL & RECYCLING	111	87	84	91	95	96	123	114	99	86	86	87	87	89
Incineration	37	27	31	49	51	51	74	65	53	53	53	54	54	55
Open Burning	74	59	52	42	43	43	44	44	44	30	30	30	30	31
POTW	NA	NA	NA	0	0	0	0	0	0	0	0	0	0	0
Industrial Waste Water	NA	NA	NA	0	0	0	0	0	0	0	0	0	0	0
TSDF	NA	NA	NA	0	0	0	0	0	0	0	0	0	0	0
Landfills	NA	0	0	0	0	1	1	1	1	2	2	2	2	2
Other	NA	0	0	0	1	1	4	3	1	1	1	1	1	1
Transportation	12,150	11,948	12,210	12,014	12,457	12,692	12,902	13,191	13,085	14,260	14,470	14,371	13,731	13,251
ON-ROAD VEHICLES	8,621	8,089	7,682	7,210	7,557	7,759	7,960	8,176	7,956	8,793	8,924	8,816	8,612	8,150
Light-Duty Gas Vehicles & Motorcycles	4,421	3,806	3,494	3,013	3,069	3,098	3,117	3,173	3,043	3,006	2,996	2,933	2,825	2,790
light-duty gas vehicles	4,416	3,797	3,483	3,002	3,058	3,086	3,105	3,161	3,031	2,994	2,983	2,920	2,813	2,777
motorcycles	5	9	11	11	11	12	12	13	12	12	12	12	12	13
Light-Duty Gas Trucks	1,408	1,530	1,386	1,552	1,839	2,004	2,131	2,160	1,991	1,709	1,742	1,703	1,676	1,608
light-duty gas trucks 1	864	926	803	901	1,074	1,171	1,242	1,251	1,183	1,166	1,185	1,157	1,141	1,099
light-duty gas trucks 2	544	603	584	651	766	833	888	909	809	543	557	546	535	509
Heavy-Duty Gas Vehicles	300	330	343	306	321	309	316	351	330	518	505	467	455	439
Diesels	2,493	2,423	2,458	2,340	2,328	2,347	2,397	2,492	2,591	3,560	3,680	3,713	3,655	3,312
heavy-duty diesel vehicles	2,463	2,389	2,416	2,248	2,284	2,302	2,351	2,446	2,544	3,538	3,662	3,698	3,644	3,300
light-duty diesel trucks	5	6	7	63	11	11	12	12	13	8	7	6	5	4
light-duty diesel vehicles	25	28	35	28	33	33	33	34	34	14	11	9	7	7
NON-ROAD ENGINES AND VEHICLES	3,529	3,859	4,528	4,804	4,900	4,934	4,942	5,015	5,128	5,467	5,546	5,555	5,558	5,558
Non-Road Gasoline	101	108	114	120	121	123	124	126	127	164	181	197	203	212
recreational	1	1	1	6	6	6	6	6	6	29	29	29	29	30
construction	4	4	4	4	4	4	4	4	4	4	5	6	6	6
industrial	13	14	13	12	12	12	11	11	11	14	14	14	15	14
lawn & garden	29	31	35	36	37	38	39	40	41	51	61	71	79	84
farm	5	5	5	6	6	6	6	6	6	4	4	4	4	4
light commercial	11	12	14	15	16	16	17	18	18	22	27	31	32	34
logging	0	0	0	0	0	0	0	0	0	3	4	5	5	5
airport service	0	0	0	0	0	0	0	0	0	0	0	0	0	0
railway maintenance	NA	0	0	0	0	0	0	0	0	0	0	0	0	0
recreational marine vessels	38	40	41	41	41	41	41	41	41	37	37	37	33	34
Non-Road Diesel	2,125	2,155	2,472	2,513	2,552	2,595	2,640	2,687	2,739	2,746	2,760	2,751	2,707	2,660
recreational	2	2	3	3	3	3	3	3	3	5	5	5	5	5
construction	843	943	1,083	1,102	1,120	1,138	1,156	1,174	1,198	1,267	1,273	1,267	1,247	1,222
industrial	193	244	270	268	265	265	268	270	274	240	242	241	237	234
lawn & garden	19	22	40	45	50	54	59	64	69	70	76	81	84	83
farm	926	755	877	898	917	936	953	970	987	935	934	926	910	894
light commercial	44	54	72	77	82	87	91	96	101	109	114	119	123	126
logging	94	118	101	94	88	82	79	77	75	79	73	67	61	56
airport service	2	3	6	7	7	8	8	9	9	10	10	10	10	10
railway maintenance	NA	2	3	3	4	4	4	4	4	4	4	4	7	7
recreational marine vessels	NA	13	16	17	17	18	19	19	20	28	29	30	23	24

Table A-4. National Nitrogen Oxides Emissions Estimates, 1980, 1985, 1989–2000 (thousand short tons) (continued)

Source Category	1980	1985	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Aircraft	106	119	138	158	155	156	156	161	165	81	81	81	81	84
Marine Vessels	467	557	747	943	995	961	917	929	936	1,083	1,084	1,084	1,083	1,090
coal	0	0	0	0	0	0	0	0	0	NA	NA	NA	NA	NA
diesel	396	469	628	630	649	621	593	604	615	996	996	996	996	1,006
residual oil	71	87	118	114	115	116	114	115	105	87	87	87	87	84
gasoline	NA	NA	NA	10	10	9	9	9	10	NA	NA	NA	NA	NA
other	NA	NA	NA	190	221	214	201	201	206	0	0	0	0	0
Railroads	731	808	923	929	929	946	945	947	990	1,183	1,222	1,215	1,242	1,230
Non-Road Other	*NA*	112	135	141	147	153	159	165	171	210	218	227	271	281
liquified petroleum gas	NA	75	98	103	109	115	120	126	132	183	190	199	240	249
compressed natural gas	NA	37	38	38	38	39	39	39	39	27	28	28	31	32
MISCELLANEOUS	248	310	293	369	286	255	241	390	267	415	401	318	343	576
Agriculture and Forestry	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0	0	0	0
agricultural livestock	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0	0	0	0
Other Combustion	248	310	293	368	285	253	240	388	265	415	401	318	343	576
Health Services	NA	NA	NA	NA	NA	0	0	0	0	0	0	0	0	0
Cooling Towers	NA	NA	NA	NA	NA	0	NA	0	0	0	0	0	0	0
Fugitive Dust	NA	NA	NA	1	1	1	1	1	1	0	0	0	0	0
TOTAL ALL SOURCES	24,384	23,198	23,893	24,170	24,338	24,732	25,116	25,474	25,051	26,065	26,357	26,011	25,439	24,899

Note: Some columns may not sum to totals due to rounding.

Table A-5. National Volatile Organic Compounds Emissions Estimates, 1980, 1985, 1989–2000 (thousand short tons)

Source Category	1980	1985	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Fuel Combustion	1,050	1,570	1,372	1,005	1,075	1,114	993	989	1,073	1,125	1,122	1,122	1,136	1,206
FUEL COMB. ELEC. UTIL.	45	32	37	47	44	44	45	45	44	50	52	56	62	64
Coal	31	24	27	27	27	27	29	29	29	28	29	29	29	30
Oil	9	5	7	6	5	4	4	4	3	3	4	5	5	4
Gas	5	2	2	2	2	2	2	2	2	8	8	10	10	11
Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0	1	7	8
Internal Combustion	NA	1	1	12	10	10	10	10	10	10	11	11	11	11
FUEL COMB. INDUSTRIAL	157	134	134	182	196	187	186	196	206	179	175	174	179	185
Coal	3	7	7	7	6	7	6	8	6	7	7	7	7	7
Oil	3	17	16	12	11	12	12	12	12	9	8	8	8	9
Gas	62	57	61	58	60	52	51	63	73	59	59	59	60	63
Other	89	35	36	51	51	49	51	50	50	35	34	34	35	37
Internal Combustion	NA	18	15	54	68	66	66	64	65	69	68	67	69	70
FUEL COMB. OTHER	848	1,403	1,200	776	835	884	762	748	823	896	895	892	895	957
Commercial/Institutional Coal	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Commercial/Institutional Oil	3	4	4	3	3	3	3	3	3	3	3	3	3	3
Commercial/Institutional Gas	7	6	7	8	8	10	11	11	11	14	14	13	15	15
Misc. Fuel Comb. (Except Residential)	NA	4	4	8	8	8	9	9	8	9	9	9	10	10
Residential Wood	809	1,372	1,169	718	776	822	698	684	759	833	833	833	833	895
fireplaces	809	1,372	1,169	718	776	822	698	684	759	541	541	541	541	580
woodstoves	NA	NA	NA	NA	NA	NA	NA	NA	NA	292	292	292	292	315
other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Residential Other	28	16	15	38	39	40	40	40	41	36	35	33	34	34
Industrial Processes	12,861	10,474	10,755	10,000	10,178	10,380	10,578	10,738	10,780	8,682	8,900	8,442	8,003	8,033
CHEMICAL & ALLIED PRODUCT MFG	1,595	881	980	634	710	715	701	691	660	387	388	394	396	407
Organic Chemical Mfg	884	349	387	192	216	211	215	217	210	131	133	136	139	143
ethylene oxide mfg	10	2	2	0	1	1	1	1	1	0	0	0	0	0
phenol mfg	NA	0	0	4	4	4	4	4	2	2	2	2	2	2
terephthalic acid mfg	60	24	27	20	23	17	19	21	17	11	11	11	11	12
ethylene mfg	111	28	33	9	11	10	10	9	10	5	5	5	5	5
charcoal mfg	40	37	45	33	33	33	33	34	33	30	31	31	32	33
socmi reactor	118	43	49	26	30	30	32	33	33	27	28	28	29	30
socmi distillation	NA	7	7	8	9	8	8	8	8	4	4	4	4	4
socmi air oxidation processes	NA	0	1	2	2	2	2	2	2	1	1	1	1	1
socmi fugitives	254	179	193	61	67	69	70	70	70	40	41	42	42	43
other	291	27	30	29	38	37	36	35	34	12	12	12	13	13
Inorganic Chemical Mfg	93	3	3	2	3	3	2	2	3	3	3	3	3	3
Polymer & Resin Mfg	384	343	389	242	268	283	269	257	222	128	124	126	124	128
polypropylene mfg	1	12	13	2	2	2	2	2	2	2	2	2	2	2
polyethylene mfg	22	51	57	39	44	45	46	46	35	16	17	17	17	17
polystyrene resins	15	6	7	4	5	5	5	5	5	5	3	3	3	3
Polymer & Resin Mfg (continued)														
synthetic fiber	199	217	250	144	161	173	157	143	142	78	80	82	83	86
styrene/butadiene rubber	70	45	50	15	15	16	17	18	16	11	7	7	7	7
other	77	12	13	37	41	42	42	43	22	16	16	16	13	13
Agricultural Chemical Mfg	NA	11	12	6	7	8	7	6	5	8	8	8	8	8

Table A-5. National Volatile Organic Compounds Emissions Estimates, 1980, 1985, 1989–2000 (thousand short tons) (continued)

Source Category	1980	1985	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Paint, Varnish, Lacquer, Enamel Mfg	65	8	8	14	16	17	18	17	18	7	8	8	8	8
paint & varnish mfg	65	8	8	13	15	16	16	16	16	6	6	6	6	6
other	NA	0	0	1	1	1	1	1	2	2	2	2	2	2
Pharmaceutical Mfg	77	43	48	20	21	24	23	24	38	7	7	7	*8*	*8*
Other Chemical Mfg	92	125	132	158	179	169	166	168	164	104	105	106	107	109
carbon black mfg	92	26	26	9	17	16	16	21	24	27	28	28	28	29
printing ink mfg	NA	2	3	1	1	1	1	2	2	1	1	1	1	1
fugitives unclassified	NA	12	12	23	23	21	20	27	30	13	13	13	13	13
carbon black furnace: fugitives	NA	4	5	0	1	1	1	1	1	0	0	0	0	0
other	NA	81	87	125	136	129	127	117	107	63	64	64	65	66
METALS PROCESSING	273	76	74	122	123	124	124	126	125	73	78	78	76	79
Nonferrous Metals Processing	NA	18	19	18	19	17	18	20	21	19	20	20	20	21
Ferrous Metals Processing	273	57	54	98	99	100	98	97	96	44	47	47	46	48
coke oven door & topside leaks	152	12	12	19	22	27	27	26	26	5	6	6	6	6
coke oven by-product plants	NA	3	3	7	9	9	9	9	9	5	5	5	5	5
other	121	41	39	71	68	63	62	62	61	35	37	36	35	37
Metals Processing NEC	NA	1	1	7	6	8	8	8	8	10	11	11	*10*	*11*
PETROLEUM & RELATED INDUSTRIES	1,440	703	639	612	640	632	649	647	642	477	487	485	424	433
Oil & Gas Production	379	107	68	301	301	297	310	305	299	271	274	272	271	279
Petroleum Refineries & Related Industries	1,045	592	568	308	337	332	336	339	339	201	208	208	149	150
vaccuum distillation	32	15	13	7	7	7	7	7	6	3	3	3	3	3
fluid catalytic cracking units	21	34	31	15	17	16	15	16	16	16	16	16	16	16
process unit turnarounds	NA	15	13	11	11	11	11	10	12	2	2	2	2	2
petroleum refinery fugitives	NA	76	65	99	105	103	109	109	111	84	87	86	27	27
other	992	454	446	177	196	195	194	198	194	97	101	101	101	101
Asphalt Manufacturing	16	3	3	3	3	3	3	3	4	5	5	5	4	4
OTHER INDUSTRIAL PROCESSES	237	390	403	401	391	414	442	438	450	422	438	443	463	480
Agriculture, Food, & Kindred Products	191	169	175	138	130	127	146	145	147	104	108	109	110	114
vegetable oil mfg	81	46	49	16	18	19	19	16	16	1	1	1	1	1
whiskey fermentation: aging	64	24	23	24	16	12	24	24	25	15	16	16	16	17
bakeries	46	51	51	43	44	44	46	46	47	41	42	42	43	44
other	NA	49	52	55	52	51	58	58	60	47	49	50	50	52
Textiles, Leather, & Apparel Products	NA	10	10	20	18	19	19	19	19	10	10	10	10	10
Wood, Pulp & Paper, & Publishing Products	NA	42	44	96	92	101	112	105	122	154	160	164	167	173
Rubber & Miscellaneous Plastic Products	44	41	46	58	59	64	62	61	60	49	51	52	52	54
rubber tire mfg	44	10	11	5	5	5	5	6	6	6	6	6	6	6
green tire spray	NA	5	6	3	4	3	3	3	3	2	2	2	2	2
other	NA	26	29	50	50	55	53	52	51	41	43	44	44	46
Mineral Products	2	15	14	18	17	27	28	30	31	31	32	32	32	33
Machinery Products	NA	4	4	7	8	10	8	11	11	11	12	12	12	12
Electronic Equipment	NA	0	0	2	2	3	3	3	2	1	1	1	13	13
Transportation Equipment	NA	1	0	2	2	2	3	3	2	3	4	4	4	4
Construction	NA	NA	NA	0	0	0	0	0	0	0	0	0	0	0
Miscellaneous Industrial Processes	NA	108	109	59	62	62	62	62	57	58	60	60	64	66

Table A-5. National Volatile Organic Compounds Emissions Estimates, 1980, 1985, 1989–2000 (thousand short tons) (continued)

Source Category	1980	1985	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
SOLVENT UTILIZATION	6,584	5,699	5,964	5,750	5,782	5,901	6,016	6,162	6,183	5,474	5,621	5,149	4,828	4,827
Degreasing	513	756	757	744	718	737	753	775	789	602	624	372	371	382
open top	NA	28	29	18	25	26	26	27	24	8	8	4	4	4
conveyorized	NA	5	4	5	6	6	6	6	5	4	5	2	2	2
cold cleaning	NA	31	35	30	23	24	24	22	23	22	23	10	11	11
other	513	691	689	691	664	680	697	719	737	567	588	356	354	365
Graphic Arts	373	317	363	274	301	308	322	333	339	287	293	300	295	304
letterpress	NA	2	2	4	8	8	8	8	8	6	6	6	6	6
flexographic	NA	18	20	20	24	26	26	25	24	19	19	20	16	16
lithographic	NA	4	4	14	17	18	21	22	20	12	12	13	13	13
gravure	NA	131	150	75	82	81	87	93	91	50	51	52	45	46
other	373	162	187	162	171	175	180	185	196	200	205	210	214	222
Dry Cleaning	320	169	212	215	218	224	225	228	230	154	163	166	168	169
perchloroethylene	NA	85	107	110	112	115	116	117	118	58	61	63	63	64
petroleum solvent	NA	84	105	104	106	109	110	111	112	89	94	96	97	98
other	320	0	0	0	0	0	0	0	1	7	8	8	8	8
Surface Coating	3,685	2,549	2,635	2,523	2,521	2,577	2,632	2,716	2,681	2,373	2,456	2,193	2,138	2,087
industrial adhesives	55	381	375	390	374	386	400	419	410	351	366	147	148	154
fabrics	186	34	35	14	14	16	16	15	15	10	10	10	11	11
paper	626	106	114	75	64	61	59	59	52	48	49	50	51	53
large appliances	36	22	18	21	20	20	21	22	21	23	24	23	22	23
magnet wire	5	0	0	1	1	1	1	1	1	2	2	2	2	2
autos & light trucks	165	85	87	92	90	93	92	96	96	94	100	102	105	109
metal cans	73	97	95	94	91	93	96	98	102	99	106	109	113	117
metal coil	21	50	50	45	49	47	49	48	47	45	47	48	49	51
wood furniture	231	132	140	158	154	159	171	185	179	175	185	127	130	143
metal furniture	52	41	44	48	47	49	52	56	53	52	54	56	58	59
flatwood products	82	4	4	9	10	10	11	12	13	16	17	17	18	19
plastic parts	25	11	11	27	22	23	22	22	18	15	16	16	16	17
large ships	20	15	15	15	14	15	15	15	13	17	18	18	19	16
aircraft	2	27	34	7	7	7	7	7	6	11	11	12	5	6
misc. metal parts	NA	14	14	59	87	90	92	93	92	38	40	40	41	41
steel drums	NA	NA	NA	3	3	3	3	4	4	4	4	4	4	4
architectural	477	473	500	495	500	505	510	515	522	480	485	487	483	406
traffic markings	NA	100	106	105	106	107	108	109	111	93	94	94	93	77
maintenance coatings	106	79	80	79	76	78	81	85	84	80	83	84	85	71
railroad	9	4	3	3	3	3	3	4	4	3	3	3	4	4
auto refinishing	186	111	132	130	132	137	140	144	142	161	163	163	104	102
machinery	62	37	28	28	26	26	27	27	25	25	25	22	20	19
electronic & other electrical	NA	79	79	78	75	77	80	85	85	78	82	82	82	87
general	52	146	154	121	127	129	133	140	138	100	105	106	107	113
miscellaneous	799	104	103	32	37	42	39	38	35	30	31	32	33	35
thinning solvents	NA	90	96	96	97	100	94	96	99	51	53	54	54	56
other	415	306	317	297	295	302	310	321	314	273	280	282	282	293

Table A-5. National Volatile Organic Compounds Emissions Estimates, 1980, 1985, 1989–2000 (thousand short tons) (continued)

Source Category	1980	1985	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Other Industrial	690	125	131	94	98	102	102	99	96	106	110	111	113	118
miscellaneous	44	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
rubber & plastics mfg	327	25	29	28	28	28	29	31	31	38	40	40	40	42
other	319	100	102	66	71	74	73	68	64	68	70	71	72	76
Nonindustrial	1,002	1,783	1,867	1,900	1,925	1,952	1,982	2,011	2,048	1,949	1,973	2,004	1,743	1,765
cutback asphalt	323	191	199	199	202	207	214	221	227	135	140	144	147	150
other asphalt	NA	NA	NA	NA	NA	NA	NA	NA	NA	43	44	45	46	48
pesticide application	241	212	260	258	264	272	280	289	299	388	393	408	412	421
adhesives	NA	345	353	361	365	368	372	375	380	301	304	307	250	252
consumer solvents	NA	1,035	1,056	1,083	1,095	1,105	1,116	1,126	1,142	1,076	1,085	1,095	883	890
other	437	NA	NA	NA	NA	NA	NA	NA	NA	6	6	6	5	5
Solvent Utilization NEC	*NA*	*NA*	*NA*	0	NA	NA	0	0	0	3	3	3	2	2
STORAGE & TRANSPORT	1,975	1,747	1,753	1,495	1,532	1,583	1,600	1,629	1,652	1,289	1,327	1,327	1,245	1,225
Bulk Terminals & Plants	517	606	651	359	369	384	395	403	406	208	215	214	206	208
fixed roof	12	14	15	9	11	12	13	16	16	6	6	6	6	7
floating roof	39	46	50	26	29	30	34	29	19	11	11	11	12	12
variable vapor space	1	1	1	2	2	1	1	1	0	0	0	0	0	0
efr with seals	NA	NA	NA	2	3	3	4	4	3	2	2	2	2	2
ifr with seals	NA	NA	NA	2	2	3	5	3	3	3	3	3	3	3
underground tanks	0	0	0	1	2	2	2	2	2	2	2	2	2	2
area source: gasoline	440	512	553	282	281	292	292	305	322	163	167	167	157	157
other	26	32	33	36	40	42	44	43	41	21	22	22	24	25
Petroleum & Petroleum Product Storage	306	223	210	157	195	204	205	194	191	181	187	187	108	109
fixed roof gasoline	43	26	23	13	17	17	16	16	16	14	14	14	1	1
fixed roof crude	148	26	21	21	25	26	28	24	21	25	26	25	10	11
floating roof gasoline	45	27	24	15	25	24	24	22	22	16	16	16	11	11
floating roof crude	36	5	5	2	7	7	8	6	6	5	6	6	2	2
efr / seal gasoline	3	2	2	7	11	13	14	14	15	9	9	9	9	9
efr / seal crude	2	0	0	3	3	3	3	3	2	3	3	4	3	3
ifr / seal gasoline	1	1	1	1	2	2	2	2	2	3	3	3	3	3
ifr / seal crude	2	0	0	0	0	0	0	0	0	1	1	1	1	1
variable vapor space gasoline	3	1	2	1	2	5	6	3	0	0	0	0	0	0
area source: crude	NA	NA	NA	0	0	0	0	0	0	0	0	0	0	0
other	23	133	132	92	102	106	103	103	106	104	108	108	68	69
Petroleum & Petroleum Product Transport	61	126	125	151	146	149	142	139	134	115	119	119	121	97
gasoline loading: normal / splash	0	3	3	3	2	2	2	3	2	3	3	3	3	3
gasoline loading: balanced / submerged	2	21	22	15	17	15	13	11	10	7	7	7	7	7
gasoline loading: normal / submerged	3	41	42	26	25	26	24	25	23	13	14	13	14	14
gasoline loading: clean / submerged	0	2	2	0	0	0	0	0	0	0	0	0	1	1
marine vessel loading: gasoline & crude	50	24	22	31	30	30	29	28	29	31	32	33	34	12
other	6	35	35	76	73	75	73	72	70	61	62	62	63	60
Service Stations: Stage I	461	207	223	300	295	303	309	322	334	310	318	318	320	321
Service Stations: Stage II	583	485	441	433	430	442	449	467	484	399	410	410	412	414
Service Stations: Breathing & Emptying	NA	49	52	52	51	52	53	55	57	43	45	45	45	45
Organic Chemical Storage	46	34	36	30	35	38	39	39	37	26	26	27	25	26
Organic Chemical Transport	NA	17	15	10	8	8	7	7	7	5	5	5	5	3
Inorganic Chemical Storage	NA	0	0	0	1	1	1	1	1	1	1	1	1	1
Inorganic Chemical Transport	NA	0	0	0	0	0	0	0	0	0	0	0	0	0
Bulk Materials Storage	NA	0	0	2	2	2	1	1	1	1	1	1	1	1
Bulk Materials Transport	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0	0	0	0

Table A-5. National Volatile Organic Compounds Emissions Estimates, 1980, 1985, 1989–2000 (thousand short tons) (continued)

Source Category	1980	1985	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
WASTE DISPOSAL & RECYCLING	758	979	941	986	999	1,010	1,046	1,046	1,067	560	561	566	571	582
Incineration	366	64	59	48	50	51	76	65	54	24	24	25	26	26
Open Burning	372	309	274	196	200	203	207	208	208	364	364	364	364	371
industrial	NA	6	6	4	4	4	5	5	5	0	0	0	0	0
commmercial/institutional	NA	1	2	9	9	10	10	10	10	0	0	0	0	0
residential	NA	302	266	165	167	169	171	172	173	150	150	150	150	154
land clearing debris	NA	NA	NA	NA	NA	NA	NA	NA	NA	206	206	206	206	209
other	372	NA	NA	19	20	20	21	21	20	8	8	8	8	8
POTW	NA	10	11	49	47	48	50	52	51	48	48	49	50	51
Industrial Waste Water	NA	1	2	14	18	19	19	19	16	19	20	20	21	21
TSDF	NA	594	595	589	591	589	588	587	628	41	41	42	42	43
Landfills	NA	0	0	64	66	69	74	80	75	35	35	36	36	37
Other	20	0	0	26	28	31	33	35	36	29	29	30	32	33
Transportation	11,291	11,818	9,744	8,988	9,240	8,882	8,973	9,235	8,515	9,336	9,082	8,972	8,754	8,396
ON-ROAD VEHICLES	8,979	9,376	7,192	6,443	6,660	6,289	6,348	6,563	5,816	5,541	5,438	5,439	5,332	5,035
Light-Duty Gas Vehicles & Motorcycles	5,907	5,864	4,462	3,692	3,608	3,288	3,232	3,332	3,029	2,911	2,878	2,935	2,907	2,798
light-duty gas vehicles	5,843	5,810	4,412	3,635	3,571	3,256	3,198	3,295	2,991	2,875	2,842	2,895	2,865	2,756
motorcycles	64	54	50	56	36	33	34	37	38	36	36	39	42	42
Light-Duty Gas Trucks	2,059	2,425	1,867	2,016	2,318	2,347	2,471	2,488	2,135	1,786	1,789	1,788	1,759	1,655
light-duty gas trucks 1	1,229	1,437	1,018	1,103	1,245	1,255	1,313	1,307	1,172	1,157	1,164	1,171	1,166	1,108
light-duty gas trucks 2	830	988	849	912	1,073	1,092	1,157	1,181	963	629	624	617	593	546
Heavy-Duty Gas Vehicles	611	716	517	405	416	335	327	414	325	488	439	400	375	323
Diesels	402	370	346	331	318	318	318	330	326	356	332	316	290	260
heavy-duty diesel vehicles	392	360	332	298	303	302	302	313	309	348	325	311	286	256
light-duty diesel trucks	2	2	3	24	4	5	5	5	5	4	3	3	2	2
light-duty diesel vehicles	8	8	11	9	11	11	11	12	12	5	4	3	3	2
NON-ROAD ENGINES AND VEHICLES	2,312	2,442	2,552	2,545	2,581	2,594	2,624	2,672	2,699	3,834	3,684	3,573	3,461	3,404
Non-Road Gasoline	1,787	1,886	1,907	1,889	1,920	1,925	1,957	1,991	2,021	3,303	3,156	3,056	2,973	2,942
recreational	151	156	160	128	130	132	133	135	138	604	604	604	604	605
construction	39	45	44	44	44	44	44	44	44	68	59	54	51	50
industrial	33	37	33	33	32	31	30	29	28	42	34	32	29	28
lawn & garden	583	616	682	700	718	734	752	771	789	1,047	971	888	852	830
farm	17	19	20	20	21	21	21	22	22	17	17	16	15	14
light commercial	127	137	164	171	179	185	192	200	207	233	204	182	163	155
logging	5	5	8	9	9	10	11	11	12	372	344	351	369	382
airport service	1	1	1	1	1	1	1	1	1	0	0	0	0	0
railway maintenance	NA	0	0	0	0	0	0	0	0	0	0	0	0	0
recreational marine vessels	830	869	793	784	787	768	772	778	779	917	924	929	890	878
Non-Road Diesel	327	332	384	390	397	403	408	414	420	412	406	395	369	342
recreational	1	1	1	1	1	1	1	1	1	1	1	1	1	1
construction	135	151	176	181	185	190	194	199	204	207	205	198	185	169
industrial	28	36	40	40	41	41	42	42	43	41	41	41	39	37
lawn & garden	4	5	9	10	11	12	13	14	14	15	16	17	18	15
farm	138	113	127	126	126	125	124	123	121	107	104	101	95	89
light commercial	8	10	13	13	14	14	15	16	16	18	19	20	20	21
logging	11	14	14	14	15	15	15	14	14	15	13	10	8	6
airport service	0	1	1	1	1	2	2	2	2	2	2	2	2	2
railway maintenance	NA	1	1	1	1	1	1	1	1	1	1	1	2	2
recreational marine vessels	NA	2	3	3	3	3	3	3	3	4	4	5	1	1

Table A-5. National Volatile Organic Compounds Emissions Estimates, 1980, 1985, 1989–2000 (thousand short tons) (continued)

Source Category	1980	1985	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Aircraft	146	165	190	180	177	179	176	176	178	32	32	32	32	29
Marine Vessels	19	22	30	32	34	33	32	43	32	39	39	40	39	39
coal	0	1	1	0	0	0	0	1	0	NA	NA	NA	NA	NA
diesel	17	20	27	21	22	21	20	27	20	31	31	31	31	32
residual oil	1	1	2	3	3	3	3	4	3	8	8	8	8	7
gasoline	NA	NA	NA	1	1	1	1	1	1	NA	NA	NA	NA	NA
other	NA	NA	NA	7	8	8	8	11	8	0	0	0	0	0
Railroads	33	37	42	52	52	54	52	49	49	48	50	50	48	48
Non-Road Other	*NA*	0	0	0	0	0	0	0	0	0	0	0	0	0
liquified petroleum gas	NA	0	0	0	0	0	0	0	0	0	0	0	0	0
compressed natural gas	NA	0	0	0	0	0	0	0	0	0	0	0	0	0
MISCELLANEOUS	1,134	566	642	1,059	756	486	556	720	551	742	1,181	702	1,506	2,710
Agriculture & Forestry	NA	NA	NA	5	6	6	6	6	7	7	7	7	8	8
Other Combustion	1,134	565	641	1,049	743	474	544	707	537	729	1,168	688	1,493	2,696
structural fires	40	44	44	14	14	15	15	15	15	3	3	3	3	3
agricultural fires	70	55	79	48	48	49	48	51	54	51	52	52	53	54
slash/prescribed burning	285	182	182	234	239	243	266	259	293	277	293	311	281	183
forest wildfires	739	283	335	749	439	164	212	379	171	395	817	319	1,152	2,452
other	1	NA	NA	3	3	3	3	3	3	3	3	3	3	3
Catastrophic/Accidental Releases	NA	NA	NA	4	4	4	4	4	4	4	5	5	5	5
Health Services	NA	0	1	1	0	1	1	1	1	0	1	1	1	1
Cooling Towers	NA	NA	NA	0	2	2	1	2	2	1	1	1	1	1
Fugitive Dust	NA	NA	NA	0	0	0	0	0	0	0	0	0	0	0
TOTAL ALL SOURCES	26,336	24,428	22,513	21,053	21,249	20,862	21,099	21,683	20,918	19,924	20,325	19,278	19,439	20,384

Note: Some columns may not sum to totals due to rounding.

Table A-6. National PM_{10} Emissions Estimates, 1980, 1985, 1989–2000 (thousand short tons)

Source Category	1980	1985	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Fuel Combustion	2,445	1,536	1,382	1,196	1,147	1,183	1,124	1,113	1,179	978	980	912	950	997
FUEL COMB. ELEC. UTIL.	879	280	271	295	257	257	279	273	268	289	294	229	259	270
Coal	796	268	255	265	232	234	253	246	244	264	268	197	231	242
bituminous	483	217	193	188	169	167	185	181	174	195	196	134	125	129
subbituminous	238	35	39	37	39	43	46	44	48	51	51	47	57	57
anthracite & lignite	75	16	22	41	23	23	22	21	21	19	21	17	49	56
other	NA	0	0	NA	NA	NA	NA	NA	NA	0	0	0	0	0
Oil	76	8	12	9	10	7	9	8	5	6	7	5	3	3
residual	74	8	11	9	10	7	9	8	5	6	7	5	3	3
distillate	2	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas	7	1	1	1	1	0	1	1	1	1	1	1	0	0
Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	1	1	7	6	6
Internal Combustion	NA	3	3	20	15	16	17	17	18	17	18	18	19	19
FUEL COMB. INDUSTRIAL	679	247	243	270	233	243	257	270	302	239	233	230	235	244
Coal	18	71	70	84	72	74	71	70	70	73	73	71	74	74
bituminous	12	48	49	59	48	53	51	49	49	43	43	42	44	44
subbituminous	4	1	1	5	3	3	3	5	5	5	5	5	5	5
anthracite & lignite	2	7	6	2	1	1	1	1	1	1	1	1	1	1
other	NA	15	14	19	19	17	16	16	15	24	23	23	23	24
Oil	67	52	48	52	44	45	45	44	49	46	43	42	43	46
residual	63	43	39	44	36	37	38	37	42	38	35	34	35	38
distillate	4	5	5	6	6	6	6	6	6	7	7	7	7	7
other	0	4	4	2	2	1	1	1	1	1	1	1	1	1
Gas	23	47	44	41	34	40	43	43	45	42	42	42	42	45
natural	20	24	24	30	24	26	29	30	30	28	27	27	28	29
process	3	22	20	11	10	13	13	14	15	14	15	15	14	16
other	NA	1	1	0	0	0	0	0	0	0	0	0	0	0
Other	571	75	78	87	72	74	86	74	73	61	58	59	59	62
wood/bark waste	566	67	71	80	67	67	71	68	68	54	51	52	53	55
liquid waste	NA	1	1	1	1	1	1	1	1	1	1	1	1	1
other	5	6	6	6	5	6	14	6	5	7	6	6	6	6
Internal Combustion	NA	3	3	6	10	11	12	38	64	17	17	16	17	17
FUEL COMB. OTHER	887	1,009	869	631	657	683	588	570	610	450	453	453	456	483
Commercial/Institutional Coal	8	13	13	15	14	15	15	15	16	16	16	17	17	17
Commercial/Institutional Oil	30	12	13	13	11	12	11	12	12	12	12	10	9	10
Commercial/Institutional Gas	4	4	5	5	6	6	6	7	6	8	8	7	8	8
Misc. Fuel Comb. (Except Residential)	NA	3	3	79	73	73	72	73	73	72	76	79	81	84
Residential Wood	818	959	817	501	535	558	464	446	484	319	319	319	319	342
fireplaces	818	959	817	501	535	558	464	446	484	144	144	144	144	154
woodstoves	NA	NA	NA	NA	NA	NA	NA	NA	NA	175	175	175	175	188
other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Residential Other	27	18	18	18	18	18	18	18	18	23	22	21	22	21

Table A-6. National PM_{10} Emissions Estimates, 1980, 1985, 1989–2000 (thousand short tons) (continued)

Source Category	1980	1985	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Industrial Processes	3,026	1,339	1,276	1,306	1,264	1,269	1,240	1,219	1,231	1,180	1,203	1,207	1,209	1,242
CHEMICAL & ALLIED PRODUCT MFG	148	58	63	77	68	71	66	76	67	63	64	65	65	67
Organic Chemical Mfg	19	19	22	26	28	28	28	29	29	29	29	30	30	31
Inorganic Chemical Mfg	25	7	8	19	4	5	5	5	5	4	4	4	4	4
Polymer & Resin Mfg	NA	4	5	5	4	5	4	4	4	3	3	3	3	3
Agricultural Chemical Mfg	61	9	10	11	11	11	11	10	10	8	9	9	9	9
Paint, Varnish, Lacquer, Enamel Mfg	NA	0	0	1	1	1	1	1	1	1	1	1	1	1
Pharmaceutical Mfg	NA	0	0	1	0	0	0	0	0	0	0	0	0	0
Other Chemical Mfg	42	18	18	14	20	20	18	27	18	19	19	19	19	19
METALS PROCESSING	622	220	211	214	251	250	181	184	212	144	151	150	148	152
Nonferrous Metals Processing	130	46	45	50	46	47	40	39	41	34	35	35	35	35
copper	32	3	3	14	14	15	12	11	12	6	6	6	6	6
lead	18	4	3	3	2	2	2	2	3	2	2	2	2	2
zinc	3	3	3	6	6	6	1	2	2	2	2	2	2	2
other	77	36	36	27	23	23	25	25	25	24	25	25	25	25
Ferrous Metals Processing	322	164	156	155	123	115	121	125	149	91	96	95	93	96
primary	271	136	129	128	99	92	97	100	123	64	68	68	67	70
secondary	51	26	26	25	24	23	24	25	26	27	28	27	26	26
other	NA	2	2	2	0	0	0	0	0	0	0	0	0	0
Metals Processing NEC	170	10	10	9	82	88	20	20	22	19	20	20	21	21
PETROLEUM & RELATED INDUSTRIES	138	63	58	55	43	43	38	38	40	29	30	30	29	30
Oil & Gas Production	NA	0	0	2	2	2	2	2	2	1	1	1	1	1
Petroleum Refineries & Related Industries	41	28	24	20	20	21	20	19	20	17	17	17	17	17
fluid catalytic cracking units	41	24	21	17	17	18	17	16	18	12	12	12	12	12
other	NA	4	3	3	3	3	3	3	3	5	5	5	5	5
Asphalt Manufacturing	97	35	34	33	21	20	17	17	18	12	12	11	11	11
OTHER INDUSTRIAL PROCESSES	1,846	611	591	583	520	506	501	495	511	325	336	338	343	355
Agriculture, Food, & Kindred Products	402	68	72	73	80	69	73	73	80	59	61	59	61	63
country elevators	258	7	9	9	10	10	10	9	9	5	5	5	5	6
terminal elevators	86	6	6	6	7	8	8	7	7	2	2	2	2	2
feed mills	3	6	7	7	4	5	5	5	5	3	3	3	3	4
soybean mills	22	13	14	14	15	11	12	12	12	7	7	7	7	8
wheat mills	1	3	3	3	4	4	4	4	4	2	2	2	2	2
other grain mills	6	7	8	8	6	5	6	6	7	5	5	5	5	6
other	26	25	25	25	34	26	28	30	37	36	37	34	36	37
Textiles, Leather, & Apparel Products	NA	0	0	0	0	0	0	0	0	1	1	1	1	1
Wood, Pulp & Paper, & Publishing Products	183	101	106	105	81	79	78	76	81	75	77	79	80	84
sulfate (kraft) pulping	142	71	74	73	53	50	49	50	53	38	40	40	41	43
other	41	30	33	32	27	29	29	26	28	37	38	39	39	41
Rubber & Miscellaneous Plastic Products	NA	3	4	4	4	4	3	3	3	4	4	4	4	4
Mineral Products	1,261	401	374	367	320	318	316	313	317	160	166	167	168	174
cement mfg	417	213	193	190	147	145	140	139	140	23	24	25	24	26
surface mining	127	20	15	15	14	15	17	17	17	16	17	17	17	17
stone quarrying/processing	421	52	54	54	59	60	60	58	58	23	24	24	24	24
other	296	116	111	108	99	98	99	100	102	97	101	102	103	107
Machinery Products	NA	8	9	9	8	9	7	7	7	5	5	5	5	6
Electronic Equipment	NA	0	0	0	0	0	0	0	0	1	1	1	1	1
Transportation Equipment	NA	2	2	2	2	2	0	0	0	0	0	0	0	0
Construction	NA	NA	NA	0	0	0	0	0	0	0	0	0	0	0
Miscellaneous Industrial Processes	NA	28	23	23	25	24	22	22	23	21	21	21	22	22

Table A-6. National PM_{10} Emissions Estimates, 1980, 1985, 1989–2000 (thousand short tons) (continued)

Source Category	**1980**	**1985**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
SOLVENT UTILIZATION	NA	2	2	4	5	5	6	6	6	6	6	6	6	7
Degreasing	NA	0	0	0	0	0	0	0	0	0	0	0	0	0
Graphic Arts	NA	0	0	0	0	0	0	0	0	1	1	1	1	1
Dry Cleaning	NA	0	0	0	0	0	0	0	0	0	0	0	0	0
Surface Coating	NA	2	2	3	4	4	5	5	5	4	5	5	5	5
Other Industrial	NA	0	0	1	1	1	1	1	1	0	0	0	0	0
Nonindustrial	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0	0	0	0
Solvent Utilization NEC	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0	0	0	0
STORAGE & TRANSPORT	NA	107	101	102	101	117	114	106	109	81	83	84	85	87
Bulk Terminals & Plants	NA	0	0	0	0	0	0	0	0	0	0	0	0	0
Petroleum & Petroleum Product Storage	NA	0	0	0	1	1	1	0	0	1	1	1	1	1
Petroleum & Petroleum Product Transport	NA	0	0	0	0	0	0	0	0	0	0	0	0	0
Service Stations: Stage II	NA	NA	NA	NA	NA	NA	NA	0	0	0	0	0	0	0
Organic Chemical Storage	NA	1	1	1	1	1	1	1	1	1	1	1	1	1
Organic Chemical Transport	NA	0	0	0	0	0	0	0	0	0	0	0	0	0
Inorganic Chemical Storage	NA	0	0	1	1	1	1	1	1	0	0	1	1	1
Inorganic Chemical Transport	NA	NA	NA	0	0	0	0	0	0	0	0	0	0	0
Bulk Materials Storage	NA	105	99	100	99	115	111	104	107	78	80	81	82	84
storage	NA	33	31	31	27	30	32	31	30	26	26	27	27	28
transfer	NA	72	67	69	71	85	79	73	76	51	53	54	54	56
combined	NA	1	1	1	0	0	0	0	0	0	0	0	0	0
other	NA	NA	NA	NA	0	0	NA	0	0	0	0	0	0	0
Bulk Materials Transport	NA	0	0	1	0	0	0	0	0	0	0	0	0	0
WASTE DISPOSAL & RECYCLING	273	278	251	271	276	278	334	313	287	532	533	534	533	544
Incineration	75	52	50	65	66	65	119	96	69	26	27	28	28	29
residential	42	39	35	39	41	43	44	45	45	0	0	0	0	0
other	32	13	15	26	25	23	74	52	25	26	27	28	28	29
Open Burning	198	225	200	206	209	211	214	216	217	502	502	502	502	511
residential	*198*	*221*	*195*	*195*	*197*	*199*	*202*	*203*	*204*	*190*	*190*	*190*	*190*	*195*
land clearing debris	NA	NA	NA	NA	NA	NA	NA	NA	NA	302	302	302	302	306
other	NA	4	5	11	12	12	13	13	13	10	10	10	10	10
POTW	NA	NA	NA	0	0	0	0	0	0	0	0	0	0	0
Industrial Waste Water	NA	0	0	NA	0	0	0	0	0	0	0	0	0	0
TSDF	NA	NA	NA	0	0	0	0	0	0	0	0	0	0	0
Landfills	NA	0	0	0	0	1	1	1	0	3	3	3	3	3
Other	NA	0	0	0	0	0	0	1	1	1	1	1	1	1
Transportation	795	786	844	838	842	839	810	804	756	809	791	769	741	708
ON-ROAD VEHICLES	397	363	367	349	353	349	327	324	300	345	331	312	296	273
Light-Duty Gas Vehicles & Motorcycles	120	77	65	57	56	55	55	55	55	56	57	58	59	59
light-duty gas vehicles	119	77	64	57	55	54	55	54	55	56	56	58	58	58
motorcycles	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Light-Duty Gas Trucks	55	43	34	37	44	47	46	46	41	35	36	36	36	36
light-duty gas trucks 1	25	19	16	18	21	22	22	22	23	23	24	24	25	25
light-duty gas trucks 2	29	24	19	19	23	25	24	24	19	12	12	12	11	11
Heavy-Duty Gas Vehicles	15	14	11	10	10	9	10	10	9	14	13	12	11	11
Diesels	208	229	257	245	243	238	215	213	194	239	225	206	190	168
heavy-duty diesel vehicles	194	219	247	225	233	228	206	204	185	235	221	203	188	166
light-duty diesel trucks	2	1	2	13	2	3	2	2	2	2	1	1	1	1
light-duty diesel vehicles	12	8	9	7	8	8	7	7	7	3	2	2	1	1

Table A-6. National PM_{10} Emissions Estimates, 1980, 1985, 1989–2000 (thousand short tons) (continued)

Source Category	1980	1985	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
NON-ROAD ENGINES AND VEHICLES	398	424	477	489	489	490	483	480	456	464	460	457	445	435
Non-Road Gasoline	42	44	46	47	47	48	48	48	49	89	90	91	92	93
recreational	3	3	3	3	3	3	3	3	3	6	6	6	6	6
construction	1	1	1	1	1	1	1	1	1	2	2	2	2	2
industrial	0	0	0	0	0	0	0	0	0	0	0	0	0	0
lawn & garden	9	9	10	11	11	11	12	12	12	21	21	20	20	21
farm	0	0	0	0	0	0	0	0	0	0	0	0	0	0
light commercial	1	1	2	2	2	2	2	2	2	2	2	2	2	2
logging	0	0	0	0	0	0	0	0	0	19	20	22	23	23
airport service	0	0	0	0	0	0	0	0	0	0	0	0	0	0
railway maintenance	NA	0	0	0	0	0	0	0	0	0	0	0	0	0
recreational marine vessels	28	29	30	30	30	30	30	30	30	38	38	39	39	39
Non-Road Diesel	263	272	302	301	299	297	296	296	296	273	268	263	251	241
recreational	0	1	1	1	1	1	1	1	1	1	1	1	1	1
construction	123	134	149	149	148	147	147	146	146	142	139	135	128	121
industrial	27	35	38	38	37	37	38	38	38	33	33	33	33	33
lawn & garden	4	4	8	8	9	10	11	11	12	11	11	12	12	12
farm	85	70	78	78	77	76	75	74	73	62	59	57	54	52
light commercial	7	9	11	12	12	12	13	13	14	13	14	14	15	15
logging	16	19	15	13	11	10	9	9	8	8	7	7	6	5
airport service	0	0	1	1	1	1	1	1	1	1	1	1	1	1
railway maintenance	NA	0	1	1	1	1	1	1	1	1	1	1	1	1
recreational marine vessels	NA	1	1	1	1	1	1	2	2	2	2	2	1	1
Aircraft	33	37	43	44	44	45	43	41	40	5	5	5	5	5
Marine Vessels	23	28	38	44	46	45	43	44	43	66	65	66	66	65
coal	2	2	3	3	3	3	3	3	3	NA	NA	NA	NA	NA
diesel	15	17	23	27	28	27	26	26	26	42	42	42	42	42
residual oil	7	9	12	14	14	14	14	14	13	24	24	24	24	23
gasoline	NA	NA	NA	1	1	1	1	1	1	NA	NA	NA	NA	NA
Railroads	37	41	47	53	53	54	52	50	27	29	30	30	30	30
Non-Road Other	*NA*	1	1	1	1	1	1	1	1	2	2	2	1	1
liquified petroleum gas	NA	1	1	1	1	1	1	1	1	1	1	1	1	1
compressed natural gas	NA	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL ALL SOURCES	6,267	3,662	3,502	3,340	3,253	3,292	3,174	3,136	3,165	2,967	2,974	2,888	2,900	2,947

Note: Some columns may not sum to totals due to rounding.

Table A-7. Miscellaneous and Natural PM_{10} Emissions Estimates, 1980, 1985, 1989–2000 (thousand short tons)

Source Category	1980	1985	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
NATURAL SOURCES	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Geogenic	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wind Erosion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MISCELLANEOUS	852	37,736	37,461	24,540	24,233	23,958	24,328	25,619	22,765	20,283	21,124	20,836	21,138	21,926
Agriculture & Forestry	NA	7,108	7,320	5,292	5,234	5,017	4,575	4,845	4,902	4,911	4,952	4,951	4,998	5,045
agricultural crops	NA	6,833	6,923	4,745	4,684	4,464	4,016	4,281	4,334	4,330	4,373	4,366	4,408	4,449
agricultural livestock	NA	275	396	547	550	553	558	564	569	581	579	585	590	596
Other Combustion	852	894	912	1,181	924	770	800	1,053	849	1,136	1,283	987	1,332	2,018
structural fires	23	59	59	22	22	23	23	23	24	3	3	3	3	3
agricultural fires	NA	59	85	88	88	89	86	92	97	99	101	103	104	106
slash/prescribed burning	315	468	468	470	481	487	539	514	583	532	579	620	444	248
forest wildfires	514	308	300	601	332	171	152	424	145	502	599	261	780	1,660
other	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cooling Towers	NA	NA	NA	0	0	0	0	0	1	3	3	3	3	3
Fugitive Dust	NA	29,734	29,229	18,068	18,075	18,170	18,953	19,722	17,012	14,233	14,886	14,895	14,805	14,860
unpaved roads	NA	11,644	11,798	11,234	11,206	10,918	11,430	11,370	10,362	9,071	9,461	9,327	9,158	9,154
paved roads	NA	5,080	5,769	2,248	2,399	2,423	2,462	2,538	2,409	2,400	2,595	2,663	2,769	2,741
construction	NA	12,670	11,269	4,249	4,092	4,460	4,651	5,245	3,654	2,117	2,117	2,117	2,117	2,187
other	NA	339	392	336	377	369	409	569	586	645	713	788	760	777
TOTAL ALL SOURCES	852	37,736	37,461	24,540	24,233	23,958	24,328	25,619	22,765	20,283	21,124	20,836	21,138	21,926

Table A-8. National $PM_{2.5}$ Emissions Estimates, 1990–2000 (thousand short tons)

SOURCE CATEGORY	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Fuel Combustion	909	893	927	852	841	898	735	737	705	719	756
FUEL COMB. ELEC. UTIL.	121	105	106	112	108	107	157	161	130	137	141
Coal	97	85	87	90	86	86	133	135	103	113	116
bituminous	59	53	53	57	54	52	88	89	62	57	59
subbituminous	14	16	18	18	17	20	32	31	30	35	35
anthracite & lignite	23	16	16	15	15	15	13	15	11	20	22
Oil	5	5	4	5	5	3	5	6	4	3	2
Gas	NA	NA	NA	NA	NA	NA	1	1	1	0	0
Other	NA	NA	NA	NA	NA	NA	0	0	3	3	4
Internal Combustion	20	15	16	17	17	18	17	18	18	19	19
FUEL COMB. INDUSTRIAL	177	151	159	172	183	203	153	149	147	150	157
Coal	29	23	25	24	25	25	23	23	23	24	24
bituminous	23	18	20	20	19	19	18	18	18	18	18
subbituminous	2	1	1	2	3	3	3	3	3	3	3
anthracite & lignite	1	1	0	0	0	1	0	0	0	0	0
other	3	3	3	3	2	2	2	2	2	2	2
Oil	31	26	26	27	26	28	26	24	24	24	26
residual	26	22	22	23	22	24	22	20	19	20	22
distillate	4	3	3	4	4	4	4	4	4	4	4
other	1	1	1	1	1	1	0	1	0	0	1
Gas	39	34	39	41	42	44	39	39	38	39	41
natural	29	23	26	28	29	29	25	25	25	25	26
process	11	10	13	13	14	15	13	14	14	14	15
other	0	0	0	0	0	0	0	0	0	0	0
Other	73	58	59	69	60	59	50	48	48	48	51
wood/bark waste	68	55	54	58	55	55	44	42	42	43	45
liquid waste	1	0	0	1	0	0	0	0	0	0	0
other	4	3	4	10	4	3	6	5	5	5	5
Internal Combustion	5	10	10	11	29	48	15	15	15	15	16
FUEL COMB. OTHER	611	638	662	568	550	589	425	427	428	432	458
Commercial/Institutional Coal	6	6	6	6	6	6	7	7	7	7	7
Commercial/Institutional Oil	5	5	5	5	5	5	5	5	4	4	4
Commercial/Institutional Gas	5	5	6	6	6	6	7	7	7	7	7
Misc. Fuel Comb. (Except Residential)	78	73	72	72	72	73	72	75	78	81	83
Residential Wood	501	535	558	464	446	484	319	319	319	319	342
fireplaces	501	535	558	464	446	484	144	144	144	144	154
woodstoves	NA	NA	NA	NA	NA	NA	175	175	175	175	188
Residential Other	15	15	15	15	15	15	15	14	13	14	14
Industrial Processes	794	812	819	788	771	749	874	886	891	893	915
CHEMICAL & ALLIED PRODUCT MFG	47	43	45	41	49	42	39	39	40	40	41
Organic Chemical Mfg	10	10	11	10	11	11	12	12	12	12	13
Inorganic Chemical Mfg	12	3	4	4	4	3	3	3	3	3	3
Polymer & Resin Mfg	4	3	4	3	3	3	2	2	2	2	2
Agricultural Chemical Mfg	8	8	8	8	8	8	5	6	6	6	6
Paint, Varnish, Lacquer, Enamel Mfg	0	0	0	0	0	0	0	0	0	0	0
Pharmaceutical Mfg	0	0	0	0	0	0	0	0	0	0	0
Other Chemical Mfg	13	17	17	15	23	16	16	16	17	17	17

Table A-8. National $PM_{2.5}$ Emissions Estimates, 1990–2000 (thousand short tons) (continued)

SOURCE CATEGORY	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
METALS PROCESSING	157	197	198	125	125	134	100	105	105	104	107
Non-Ferrous Metals Processing	31	29	29	25	25	25	22	23	23	23	23
copper	9	9	9	8	8	8	4	5	4	4	5
lead	2	2	2	2	2	2	2	2	2	2	2
zinc	5	5	5	1	1	1	1	1	1	1	2
other	14	13	13	14	14	14	15	15	15	15	15
Ferrous Metals Processing	121	89	83	86	86	92	65	69	68	66	68
primary	103	72	66	68	68	74	47	50	50	50	52
secondary	17	16	16	17	18	19	18	18	18	17	17
other	1	0	0	0	0	0	0	0	0	0	0
Metals Processing NEC	5	80	85	14	14	16	13	14	14	15	15
PETROLEUM & RELATED INDUSTRIES	27	24	24	22	22	22	17	17	17	17	17
Oil & Gas Production	2	2	2	2	2	2	1	1	1	1	1
Petroleum Refineries & Related Industries	13	14	14	13	13	13	12	12	12	12	12
fluid catalytic cracking units	11	12	12	11	11	11	7	8	8	8	8
other	2	2	2	2	2	2	4	4	4	4	4
Asphalt Manufacturing	12	9	8	7	7	8	4	4	4	4	4
OTHER INDUSTRIAL PROCESSES	284	264	259	260	256	256	180	186	189	191	198
Agriculture, Food, & Kindred Products	39	46	40	44	43	40	20	21	21	22	22
country elevators	6	6	7	6	6	6	1	1	1	1	1
terminal elevators	3	3	4	5	4	4	0	0	0	0	0
feed mills	2	2	2	2	2	2	1	1	1	1	1
soybean mills	5	4	4	5	5	5	3	3	3	3	3
wheat mills	1	1	1	1	1	1	1	1	1	1	1
other grain mills	4	3	3	3	3	3	2	3	3	3	3
other	17	26	19	21	22	20	14	14	14	14	15
Textiles, Leather, & Apparel Products	0	0	0	0	0	0	0	1	0	0	1
Wood, Pulp & Paper, & Publishing Products	77	61	59	59	57	60	52	53	55	56	58
sulfate (kraft) pulping	57	40	38	38	38	40	31	32	32	33	34
other	21	21	21	21	19	20	21	22	22	23	24
Rubber & Miscellaneous Plastic Products	3	3	3	3	3	3	2	2	2	2	2
Mineral Products	144	134	135	136	133	134	88	92	93	93	97
cement mfg	54	40	39	38	38	38	11	11	11	11	12
surface mining	6	6	7	7	7	6	7	7	7	7	8
stone quarrying/processing	24	28	28	28	26	26	9	9	9	9	9
other	61	60	61	62	63	63	61	64	65	66	68
Machinery Products	3	3	3	3	3	3	2	2	2	2	2
Electronic Equipment	0	0	0	0	0	0	1	1	1	1	1
Transportation Equipment	1	1	1	0	0	0	0	0	0	0	0
Construction	0	0	0	0	0	0	0	0	0	0	0
Miscellaneous Industrial Processes	16	16	17	15	16	16	14	14	15	15	15

Table A-8. National $PM_{2.5}$ Emissions Estimates, 1990–2000 (thousand short tons) (continued)

SOURCE CATEGORY	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
SOLVENT UTILIZATION	4	4	5	6	6	5	5	5	5	6	6
Degreasing	0	0	0	0	0	0	0	0	0	0	0
Graphic Arts	0	0	0	0	0	0	1	1	1	1	1
Dry Cleaning	0	0	0	0	0	0	0	0	0	0	0
Surface Coating	3	3	4	4	4	4	4	4	4	4	4
Other Industrial	1	1	1	1	1	1	0	0	0	0	0
Nonindustrial	NA	NA	NA	NA	NA	NA	0	0	0	0	0
Solvent Utilization NEC	NA	NA	NA	NA	NA	NA	0	0	0	0	0
STORAGE & TRANSPORT	42	42	50	46	43	42	30	31	31	31	32
Bulk Terminals & Plants	0	0	0	0	0	0	0	0	0	0	0
Petroleum & Petroleum Product Storage	0	1	1	1	0	0	0	0	0	0	0
Petroleum & Petroleum Product Transport	0	0	0	0	0	0	0	0	0	0	0
Service Stations: Stage II	0	0	0	0	0	0	0	0	0	0	0
Organic Chemical Storage	0	0	0	0	0	0	1	1	1	1	1
Organic Chemical Transport	0	0	0	0	0	0	0	0	0	0	0
Inorganic Chemical Storage	0	0	0	0	0	0	0	0	0	0	0
Inorganic Chemical Transport	0	0	0	0	0	0	0	0	0	0	0
Bulk Materials Storage	41	41	48	44	41	41	28	29	29	30	31
storage	13	11	12	13	13	12	11	11	11	11	12
transfer	28	29	36	31	28	29	17	18	18	18	19
combined	0	0	0	0	0	0	0	0	0	0	0
other	NA	0	0	NA	0	0	0	0	0	0	0
Bulk Materials Transport	0	0	0	0	0	0	0	0	0	0	0
WASTE DISPOSAL & RECYCLING	234	238	239	288	271	247	503	503	504	504	514
Incineration	46	47	46	93	73	50	15	15	16	16	16
residential	27	28	30	31	31	31	0	0	0	0	0
other	19	18	16	62	42	19	15	15	16	16	16
Open Burning	187	190	192	195	196	197	486	486	486	486	495
residential	177	179	181	183	184	185	174	174	174	174	178
land clearing debris	NA	NA	NA	NA	NA	NA	302	302	302	302	306
other	10	11	11	11	12	11	10	10	10	10	10
POTW	0	0	0	0	0	0	0	0	0	0	0
Industrial Waste Water	0	0	0	0	0	0	0	0	0	0	0
TSDF	0	0	0	0	0	0	0	0	0	0	0
Landfills	0	0	1	1	1	0	2	2	2	2	2
Other	0	0	0	0	1	0	0	0	0	0	0
Transportation	719	720	717	688	682	640	702	686	666	638	608
ON-ROAD VEHICLES	286	288	284	261	258	237	276	263	246	230	209
Light-Duty Gas Vehicles & Motorcycles	34	33	32	32	32	32	32	33	34	34	33
ldgv	34	33	32	32	32	32	32	33	33	34	33
motorcycles	0	0	0	0	0	0	0	0	0	0	0
Light-Duty Gas Trucks	24	28	30	30	29	26	22	22	22	22	22
ldgt1	12	13	14	14	14	14	14	15	15	15	15
ldgt2	13	15	16	16	15	12	8	8	7	7	7

Table A-8. National $PM_{2.5}$ Emissions Estimates, 1990–2000 (thousand short tons) (continued)

SOURCE CATEGORY	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Heavy-Duty Gas Vehicles	6	6	6	7	7	6	9	9	8	8	7
Diesels	221	220	216	192	190	173	212	199	181	166	147
hddv	204	211	207	184	182	165	208	196	179	165	145
lddt	12	2	2	2	2	2	1	1	1	1	1
lddv	6	7	7	6	6	6	2	2	1	1	1
NON-ROAD ENGINES AND VEHICLES	432	432	433	427	424	403	426	423	420	408	399
Non-Road Gasoline	43	43	43	44	44	45	81	82	83	84	85
recreational	2	3	3	3	3	3	5	5	5	5	5
construction	1	1	1	1	1	1	2	2	2	2	2
industrial	0	0	0	0	0	0	0	0	0	0	0
lawn & garden	10	10	10	11	11	11	19	19	19	19	19
farm	0	0	0	0	0	0	0	0	0	0	0
light commercial	1	2	2	2	2	2	2	2	2	2	2
logging	0	0	0	0	0	0	17	19	20	21	22
airport service	0	0	0	0	0	0	0	0	0	0	0
railway maintenance	0	0	0	0	0	0	0	0	0	0	0
recreational marine vessels	27	27	27	28	28	28	35	35	36	36	35
Non-Road Diesel	277	275	273	273	272	272	251	247	242	231	222
recreational	1	1	1	1	1	1	1	1	1	1	1
construction	137	136	136	135	134	134	130	128	124	118	111
industrial	35	34	34	35	35	35	30	30	30	30	30
lawn & garden	8	8	9	10	11	11	10	10	11	11	11
farm	71	71	70	69	68	67	57	55	53	50	48
light commercial	11	11	11	12	12	13	12	13	13	13	14
logging	12	10	9	8	8	8	8	7	6	5	5
airport service	1	1	1	1	1	1	1	1	1	1	1
railway maintenance	1	1	1	1	1	1	1	1	1	0	0
recreational marine vessels	1	1	1	1	1	1	2	2	2	1	1
Aircraft	31	31	32	30	29	28	4	4	4	4	4
Marine Vessels	32	34	33	31	32	31	61	60	61	61	60
coal	1	1	1	1	1	1	NA	NA	NA	NA	NA
diesel	25	26	25	24	24	24	38	38	38	38	39
residual oil	6	6	6	6	6	6	22	22	22	22	21
gasoline	0	0	0	0	0	0	NA	NA	NA	NA	NA
Railroads	49	48	50	48	46	25	27	28	28	27	27
Non-Road Other	1	1	1	1	1	1	2	2	2	1	1
liquified petroleum gas	1	1	1	1	1	1	1	1	1	1	1
compressed natural gas	0	0	0	0	0	0	0	0	0	0	0
NATURAL SOURCES	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Geogenic	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wind Erosion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MISCELLANEOUS	5,234	5,003	4,854	4,926	5,359	4,726	4,411	4,735	4,479	4,829	5,466
Agriculture & Forestry	1,031	1,019	976	887	941	952	953	961	961	970	979
agricultural crops	949	937	893	803	856	867	866	875	873	882	890
agricultural livestock	82	83	83	84	85	85	87	87	88	89	89

Table A-8. National $PM_{2.5}$ Emissions Estimates, 1990–2000 (thousand short tons) (continued)

SOURCE CATEGORY	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Other Combustion	1,037	807	666	693	912	735	931	1,123	855	1,200	1,817
structural fires	20	20	21	21	21	22	3	3	3	3	3
agricultural fires	80	80	81	78	83	89	89	91	93	94	96
slash/prescribed burning	399	408	413	457	436	494	453	491	526	400	223
forest wildfires	538	299	151	137	372	130	386	538	233	702	1,494
other	0	0	0	0	0	0	0	0	0	0	0
Cooling Towers	0	0	0	0	0	1	2	2	3	3	3
Fugitive Dust	3,166	3,177	3,212	3,346	3,506	3,037	2,525	2,649	2,660	2,657	2,667
unpaved roads	1,687	1,684	1,642	1,718	1,709	1,559	1366	1427	1406	1,381	1,380
paved roads	562	600	606	616	634	585	600	649	666	693	686
construction	850	818	892	930	1,049	777	423	423	423	423	437
other	67	75	73	81	113	117	136	150	165	159	163
TOTAL ALL SOURCES	7,655	7,429	7,318	7,254	7,653	7,013	6,722	7,044	6,741	7,079	7,745

Note: Some columns may not sum to totals due to rounding.

Table A-9. National Sulfur Dioxide Emissions Estimates, 1980, 1985, 1989–2000 (thousand short tons)

Source Category	1980	1985	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Fuel Combustion	21,391	20,021	19,924	20,290	19,796	19,493	19,245	18,887	16,230	16,232	16,649	16,746	16,027	14,876
FUEL COMB. ELEC. UTIL.	17,469	16,272	16,215	15,909	15,784	15,416	15,189	14,889	12,080	12,730	13,195	13,416	12,653	11,389
Coal	16,073	15,630	15,404	15,220	15,087	14,824	14,527	14,313	11,603	12,206	12,615	12,470	11,826	10,723
bituminous	*NA*	*14,029*	*13,579*	*13,371*	*13,215*	*12,914*	*12,212*	*11,841*	*8,609*	*8,998*	*9,517*	*9,357*	*8,596*	*7,866*
subbituminous	NA	1,292	1,422	1,415	1,381	1,455	1,796	1,988	2,345	2,632	2,490	2,486	2,609	2,367
anthracite & lignite	*NA*	*309*	*404*	*434*	*491*	*455*	*519*	*484*	*649*	*576*	*608*	*627*	*621*	*489*
Oil	1,395	612	779	639	652	546	612	522	413	460	514	762	639	511
residual	*NA*	*604*	*765*	*629*	*642*	*537*	*601*	*512*	*408*	*454*	*509*	*756*	*631*	*502*
distillate	NA	8	14	10	10	9	10	10	5	6	5	6	7	8
Gas	1	1	1	1	1	1	1	1	9	7	6	6	7	9
Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	4	4	121	123	88
Internal Combustion	NA	30	30	49	45	46	49	53	55	53	56	57	58	59
FUEL COMB. INDUSTRIAL	2,951	3,169	3,086	3,550	3,256	3,292	3,284	3,218	3,357	2,863	2,805	2,742	2,788	2,894
Coal	1,527	1,818	1,840	1,914	1,805	1,783	1,763	1,740	1,728	1,321	1,306	1,274	1,305	1,320
bituminous	1,058	1,347	1,384	1,050	949	1,005	991	988	1,003	885	877	858	878	889
subbituminous	326	28	29	50	53	60	67	77	81	63	63	61	64	64
anthracite & lignite	144	90	79	67	68	67	68	68	68	61	60	57	57	58
other	NA	353	348	746	735	650	636	606	576	312	306	298	306	309
Oil	1,065	862	812	927	779	801	809	777	912	807	764	738	754	806
residual	851	671	625	687	550	591	597	564	701	626	578	559	571	618
distillate	85	111	107	198	190	191	193	193	191	158	161	156	159	161
other	129	80	80	42	39	20	20	20	20	23	25	23	24	27
Gas	299	397	346	543	516	552	555	542	548	575	582	578	575	609
Other	60	86	82	158	142	140	140	141	147	140	134	133	135	140
Internal Combustion	NA	7	6	9	14	16	17	19	23	20	19	19	20	20
FUEL COMB. OTHER	971	579	624	831	755	784	772	780	793	639	649	588	586	593
Commercial/Institutional Coal	110	158	169	212	184	190	193	192	200	179	184	196	196	200
Commercial/Institutional Oil	637	239	274	425	376	396	381	391	397	308	314	250	245	252
Commercial/Institutional Gas	1	2	2	7	7	7	8	8	8	10	10	10	11	11
Misc. Fuel Comb. (Except Residential)	NA	1	1	6	6	6	6	6	5	6	6	6	6	6
Residential Wood	13	13	11	7	7	8	6	6	7	5	5	5	5	5
Residential Other	211	167	167	175	176	177	178	177	176	131	130	121	123	119
distillate oil	*157*	*128*	*132*	*137*	*141*	*144*	*145*	*145*	*144*	*108*	*106*	*97*	*98*	*95*
bituminous/subbituminous coal	*43*	*29*	*27*	*30*	*26*	*26*	*25*	*25*	*24*	*17*	*18*	*18*	*18*	*18*
other	*11*	*10*	*8*	*9*	*8*	*8*	*8*	*8*	*8*	*6*	*6*	*6*	*6*	*6*
Industrial Processes	3,807	2,467	2,010	1,900	1,720	1,758	1,723	1,675	1,638	1,408	1,458	1,463	1,457	1,498
CHEMICAL & ALLIED PRODUCT MFG	280	456	440	297	280	278	269	275	286	255	259	261	262	268
Organic Chemical Mfg	NA	16	17	10	9	9	9	8	8	4	4	4	4	5
Inorganic Chemical Mfg	271	354	334	214	208	203	191	194	199	173	176	178	179	183
sulfur compounds	271	346	326	211	205	199	187	189	195	171	174	176	177	181
other	NA	8	8	2	3	4	4	4	4	2	2	2	2	2
Polymer & Resin Mfg	NA	7	7	1	1	1	1	1	0	1	1	1	1	1
Agricultural Chemical Mfg	NA	4	4	5	4	4	4	4	5	1	1	1	1	1
Paint, Varnish, Lacquer, Enamel Mfg	NA	NA	NA	NA	NA	NA	0	0	0	0	0	0	0	0
Pharmaceutical Mfg	NA	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Chemical Mfg	10	76	77	67	57	60	64	68	74	76	76	77	76	78

Table A-9. National Sulfur Dioxide Emissions Estimates, 1980, 1985, 1989–2000 (thousand short tons) (continued)

Source Category	1980	1985	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
METALS PROCESSING	1,842	1,042	695	726	612	615	603	562	530	390	407	405	400	411
Nonferrous Metals Processing	1,279	853	513	517	435	438	431	391	361	267	276	274	271	278
copper	1,080	655	327	323	234	247	250	206	177	93	99	98	97	100
lead	34	121	113	129	135	131	122	128	126	112	113	114	114	116
aluminum	95	62	60	60	61	55	53	51	53	57	59	57	55	56
other	71	14	13	4	5	5	6	6	6	5	5	5	5	5
Ferrous Metals Processing	562	172	165	186	159	158	153	153	151	107	114	114	112	116
Metals Processing NEC	NA	18	17	22	18	18	19	19	18	17	17	17	16	17
PETROLEUM & RELATED INDUSTRIES	734	505	429	430	378	416	383	379	369	335	344	342	341	346
Oil & Gas Production	157	204	156	122	98	93	98	95	89	90	90	90	90	92
natural gas	157	202	155	120	96	92	96	93	88	89	90	89	89	92
other	NA	2	1	2	2	2	2	2	1	1	1	1	1	1
Petroleum Refineries & Related Industries	577	300	272	304	274	315	278	276	271	238	246	245	244	246
fluid catalytic cracking units	330	212	195	183	182	185	183	188	188	157	163	162	162	163
other	247	88	77	121	92	130	95	88	83	81	83	83	82	83
Asphalt Manufacturing	NA	1	1	4	7	7	7	8	9	8	8	8	7	7
OTHER INDUSTRIAL PROCESSES	918	425	405	399	396	396	392	398	403	390	409	415	414	432
Agriculture, Food, & Kindred Products	NA	3	3	3	3	3	3	3	3	4	4	4	5	5
Textiles, Leather, & Apparel Products	NA	0	0	0	0	0	0	0	0	0	0	0	0	0
Wood, Pulp & Paper, & Publishing Prods	223	131	136	116	123	119	113	109	114	101	105	107	109	113
Rubber & Miscellaneous Plastic Prods	NA	1	1	0	0	0	0	0	0	1	1	1	1	1
Mineral Products	694	286	261	275	267	270	272	282	282	270	285	288	284	299
cement mfg	630	192	172	181	165	168	170	167	171	171	181	183	179	189
other	64	95	89	94	102	102	102	114	111	99	103	105	105	109
Machinery Products	NA	0	0	0	0	1	0	1	1	0	0	0	0	0
Electronic Equipment	NA	0	0	0	0	0	0	0	0	0	0	0	0	0
Transportation Equipment	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Miscellaneous Industrial Processes	NA	3	3	5	3	3	3	3	4	13	13	14	14	14
SOLVENT UTILIZATION	NA	1	1	0	0	1	1	1	1	1	1	1	1	1
Degreasing	NA	0	0	0	0	0	0	0	0	0	0	0	0	0
Graphic Arts	NA	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry Cleaning	NA	NA	NA	NA	NA	0	NA	0	0	0	0	0	0	0
Surface Coating	NA	1	1	0	0	0	0	0	0	0	0	0	0	0
Other Industrial	NA	0	0	0	0	0	0	0	0	1	1	1	1	1
STORAGE & TRANSPORT	NA	4	5	7	10	9	5	2	2	5	5	5	5	5
Bulk Terminals & Plants	NA	NA	NA	0	1	1	0	0	0	1	1	1	1	1
Petroleum & Petroleum Product Storage	NA	0	0	5	7	0	0	0	0	0	0	0	0	0
Petroleum & Petroleum Product Transport	NA	1	1	0	0	0	0	0	0	1	1	2	2	2
Service Stations: Stage II	NA	NA	NA	NA	NA	NA	NA	0	0	0	0	0	0	0
Organic Chemical Storage	NA	1	1	0	0	0	0	0	0	0	0	0	0	0
Organic Chemical Transport	NA	NA	NA	0	0	0	0	0	0	0	0	0	0	0
Inorganic Chemical Storage	NA	0	0	0	0	0	0	0	0	0	0	0	0	0
Inorganic Chemical Transport	NA	0	0	0	0	0	0	0	0	0	0	0	0	0
Bulk Materials Storage	NA	1	2	1	1	7	4	1	1	2	2	2	2	2

Table A-9. National Sulfur Dioxide Emissions Estimates, 1980, 1985, 1989–2000 (thousand short tons)

Source Category	1980	1985	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
WASTE DISPOSAL & RECYCLING	33	34	36	43	44	44	71	59	47	32	33	34	34	35
Incineration	21	25	28	32	32	32	51	42	35	26	27	28	28	29
industrial	NA	10	10	5	4	5	25	17	8	6	6	7	7	7
other	21	15	18	26	28	27	26	26	27	20	21	21	21	22
Open Burning	12	9	8	11	11	11	11	11	11	5	5	5	5	5
industrial	NA	0	0	0	0	0	0	0	0	0	0	0	0	0
land clearing debris	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
other	12	8	7	10	10	11	11	11	11	5	5	5	5	5
POTW	NA	NA	NA	0	0	0	0	0	0	0	0	0	0	0
Industrial Waste Water	NA	NA	NA	0	0	0	0	0	0	0	0	0	0	0
TSDF	NA	NA	NA	0	0	0	0	0	0	0	0	0	0	0
Landfills	NA	0	0	0	0	0	0	0	0	1	1	1	1	1
industrial	NA	0	0	0	0	0	0	0	0	0	0	0	0	0
other	NA	0	0	0	0	0	0	0	0	0	0	0	0	0
Other	NA	0	0	0	1	1	8	6	0	0	0	0	0	0
Transportation	697	1,159	1,349	1,476	1,517	1,553	1,497	1,297	1,311	1,791	1,816	1,837	1,853	1,805
ON-ROAD VEHICLES	521	522	570	560	573	586	526	307	311	343	353	358	366	314
Light-Duty Gas Vehicles & Motorcycles	159	146	145	129	126	125	124	125	126	128	131	134	136	108
light-duty gas vehicles	158	145	145	128	126	125	124	124	126	128	130	134	136	107
motorcycles	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Light-Duty Gas Trucks	50	55	58	69	81	87	90	92	93	85	89	90	94	75
light-duty gas trucks 1	33	36	38	45	52	56	58	59	60	62	65	66	69	55
light-duty gas trucks 2	16	19	21	24	29	31	32	32	32	22	23	24	24	20
Heavy-Duty Gas Vehicles	10	11	11	10	10	10	11	12	11	18	18	17	17	13
Diesels	303	311	356	352	356	364	300	79	82	112	117	117	119	118
NON-ROAD ENGINES AND VEHICLES	175	637	779	916	944	968	972	990	999	1,448	1,463	1,479	1,487	1,491
Non-Road Gasoline	NA	20	22	22	22	22	23	23	23	35	35	35	35	35
Non-Road Diesel	NA	407	488	509	529	549	570	590	610	459	474	490	497	516
Aircraft	6	6	7	11	11	11	11	11	11	8	8	8	8	8
Marine Vessels	117	143	193	251	259	258	249	252	239	887	887	887	887	872
Railroads	53	59	67	122	120	125	117	113	113	56	56	56	56	56
Non-Road Other	NA	1	2	2	2	2	2	2	2	3	3	3	4	4
MISCELLANEOUS	11	11	11	12	11	10	10	15	10	16	15	12	12	21
Agriculture & Forestry	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0	0	0	0
Other Combustion	11	11	11	12	11	9	9	15	10	16	15	12	12	21
Fugitive Dust	NA	NA	NA	0	0	0	1	0	0	0	0	0	0	0
TOTAL ALL SOURCES	25,905	23,658	23,293	23,679	23,044	22,813	22,474	21,875	19,189	19,447	19,939	20,059	19,349	18,201

Note: Some columns may not sum to totals due to rounding.

Table A-10. National Ammonia Emissions Estimates, 1990–2000 (thousand short tons)

Source Category	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Fuel Combustion	25	25	25	26	26	26	47	47	47	49	50
FUEL COMB. ELEC. UTIL.	0	0	0	0	0	0	6	6	8	8	8
Coal	NA	NA	NA	NA	NA	NA	0	0	0	0	0
Oil	NA	NA	NA	NA	NA	NA	2	2	3	3	3
Gas	NA	NA	NA	NA	NA	NA	4	4	4	5	5
Other	NA	NA	NA	NA	NA	NA	0	0	0	0	0
Internal Combustion	0	0	0	0	0	0	0	0	0	0	0
FUEL COMB. INDUSTRIAL	17	17	17	18	18	18	34	34	33	34	35
Coal	0	0	0	0	0	0	0	0	0	0	0
Oil	4	4	4	4	4	4	4	4	4	4	4
Gas	13	13	13	14	14	13	25	25	25	25	27
Other	0	0	0	0	0	0	0	0	0	0	0
Internal Combustion	0	0	0	0	0	0	5	5	5	5	5
FUEL COMB. OTHER	8	8	8	8	8	8	7	7	6	7	7
Commercial/Institutional Coal	0	0	0	0	0	0	0	0	0	0	0
Commercial/Institutional Oil	2	2	2	2	2	2	2	2	2	2	2
Commercial/Institutional Gas	1	1	1	1	1	1	1	1	1	1	1
Misc. Fuel Comb. (Except Residential)	NA	NA	NA	NA	NA	NA	0	0	0	0	0
Residential Other	5	5	5	5	5	5	5	5	4	4	4
Industrial Processes	351	355	359	364	364	365	271	277	284	289	296
CHEMICAL & ALLIED PRODUCT MFG	183	183	183	183	183	183	123	125	130	133	137
Organic Chemical Mfg	NA	NA	NA	NA	NA	NA	0	0	0	0	0
Inorganic Chemical Mfg	NA	NA	NA	NA	NA	NA	0	0	0	0	0
Polymer & Resin Mfg	NA	NA	NA	NA	NA	NA	0	0	0	0	0
Agricultural Chemicals	183	183	183	183	183	183	109	111	115	118	121
ammonium nitrate/urea mfg.	***111***	***111***	***111***	***111***	***111***	***111***	***41***	***42***	***43***	***44***	***46***
other	**71**	**71**	**71**	**71**	**71**	**71**	**68**	**70**	**72**	**73**	**76**
Other Chemical Mfg	NA	NA	NA	NA	NA	NA	13	14	14	15	15
METALS PROCESSING	6	6	6	6	6	6	4	5	5	5	5
Non-Ferrous Metals Processing	0	0	0	0	0	0	0	0	0	0	0
Ferrous Metals Processing	6	6	6	6	6	6	4	5	5	5	5
Metals Processing NEC	0	0	0	0	0	0	0	0	0	0	0
PETROLEUM & RELATED INDUSTRIES	43	43	43	43	43	43	16	17	17	17	17
Oil & Gas Production	0	0	0	0	0	0	0	0	0	0	0
Petroleum Refineries & Related Industries	*43*	*43*	*43*	*43*	*43*	*43*	*16*	*17*	*17*	*17*	*17*
catalytic cracking	43	43	43	43	43	43	16	17	17	17	17
other	0	0	0	0	0	0	0	0	0	0	0
OTHER INDUSTRIAL PROCESSES	38	38	39	39	40	40	43	45	45	45	47
Agriculture, Food, & Kindred Products	2	2	3	3	2	2	4	4	4	4	4
Textiles, Leather, & Apparel Products	NA	NA	NA	NA	NA	NA	0	0	0	0	0
Wood, Pulp & Paper, & Publishing Products	NA	NA	NA	NA	NA	NA	1	1	1	1	1
Rubber & Miscellaneous Plastic Products	NA	NA	NA	NA	NA	NA	0	0	0	0	0
Mineral Products	0	0	0	0	0	0	0	0	0	0	0
Machinery Products	NA	NA	NA	NA	NA	NA	0	0	0	0	0
Electronic Equipment	NA	NA	NA	NA	NA	NA	0	0	0	0	0
Miscellaneous Industrial Processes	35	35	36	37	38	38	39	40	40	40	42

Table A-10. National Ammonia Emissions Estimates, 1990–2000 (thousand short tons) (continued)

Source Category	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
SOLVENT UTILIZATION	NA	NA	NA	NA	NA	NA	***0***	***0***	***0***	***0***	***0***
Degreasing	NA	NA	NA	NA	NA	NA	0	0	0	0	0
Graphic Arts	NA	NA	NA	NA	NA	NA	0	0	0	0	0
Dry Cleaning	NA	NA	NA	NA	NA	NA	0	0	0	0	0
Surface Coating	NA	NA	NA	NA	NA	NA	0	0	0	0	0
Other Industrial	NA	NA	NA	NA	NA	NA	0	0	0	0	0
STORAGE & TRANSPORT	0	0	0	0	0	0	1	1	1	1	1
Bulk Terminals & Plants	NA	NA	NA	NA	NA	NA	0	0	0	0	0
Petroleum & Petroleum Product Storage	NA	NA	NA	NA	NA	NA	1	1	1	1	1
Petroleum & Petroleum Product Transport	NA	NA	NA	NA	NA	NA	0	0	0	0	0
Organic Chemical Storage	NA	NA	NA	NA	NA	NA	0	0	0	0	0
Inorganic Chemical Storage	NA	NA	NA	NA	NA	NA	0	0	0	0	0
Bulk Materials Storage	0	0	0	0	0	0	0	0	0	0	0
WASTE DISPOSAL & RECYCLING	82	86	89	93	93	93	84	84	86	88	89
Incineration	NA	NA	NA	NA	NA	NA	0	0	0	0	0
Open Burning	NA	NA	NA	NA	NA	NA	0	0	0	0	0
POTW	82	86	89	93	93	93	84	84	86	87	89
wastewater treatment	82	86	89	93	93	93	84	84	86	87	89
other	NA	NA	NA	NA	NA	NA	0	0	0	0	0
Industrial Waste Water	NA	NA	NA	NA	NA	NA	0	0	0	0	0
TSDF	NA	NA	NA	NA	NA	NA	0	0	0	0	0
Landfills	NA	NA	NA	NA	NA	NA	0	0	0	0	0
Other	NA	NA	NA	NA	NA	NA	0	0	0	0	0
Transportation	194	205	214	224	239	258	238	267	262	265	268
ON-ROAD VEHICLES	188	198	208	218	233	252	229	258	252	261	264
Light-Duty Gas Vehicles & Motorcycles	149	151	155	159	168	180	157	168	169	173	174
Light-Duty Gas Trucks	38	46	52	58	63	70	63	80	72	78	80
Heavy-Duty Gas Vehicles	0	0	1	1	1	1	4	4	4	4	4
Diesels	0	0	0	0	0	0	6	6	6	6	6
NON-ROAD ENGINES AND VEHICLES	6	7	7	7	7	7	9	9	10	4	4
Non-Road Gasoline	1	1	1	1	1	1	1	1	1	1	1
Non-Road Diesel	2	3	3	3	3	3	3	3	3	3	3
Aircraft	NA	NA	NA	NA	NA	NA	3	3	4	NA	NA
Marine Vessels	1	1	1	1	1	1	1	1	1	NA	NA
Railroads	2	2	2	2	2	2	1	1	1	NA	NA
NATURAL SOURCES	0	0	0	0	0	0	0	0	0	0	0
Biogenic	0	0	0	0	0	0	0	0	0	0	0
MISCELLANEOUS	3,757	3,799	3,841	3,897	3,953	4,009	4,138	4,196	4,293	4,311	4,349
Agriculture & Forestry	3,757	3,799	3,841	3,897	3,953	4,009	4,138	4,196	4,293	4,311	4,349
agricultural crops	420	446	473	499	525	551	649	678	739	724	724
agricultural livestock	3,337	3,353	3,368	3,398	3,428	3,458	3,489	3,518	3,554	3,587	3,625
Fugitive Dust	0	0	0	0	0	0	0	0	0	0	0
TOTAL ALL SOURCES	4,327	4,383	4,440	4,512	4,583	4,658	4,694	4,787	4,886	4,914	4,963

Note: Some columns may not sum to totals due to rounding.

Table A-11. National Long-Term Air Quality Trends, 1981–2000

Year	CO 2nd Max. 8-hr ppm	Pb Max. Qtr. µg/m³	NO_2 Arith. Mean ppm	Ozone 2nd Max. 1-hr ppm	PM_{10} Wtd. Arith. Mean µg/m³	SO_2 Arith. Mean ppm
1981–-90	***321 sites***	***228 sites***	***169 sites***	***471 sites***		***456 sites***
1981	8.4	0.58	0.024	0.126	—	0.0102
1982	8.1	0.58	0.023	0.125	—	0.0095
1983	7.9	0.47	0.023	0.137	—	0.0093
1984	7.8	0.45	0.023	0.125	—	0.0095
1985	7.1	0.28	0.023	0.123	—	0.0090
1986	7.2	0.18	0.023	0.118	—	0.0088
1987	6.7	0.13	0.023	0.125	—	0.0086
1988	6.4	0.12	0.023	0.136	—	0.0087
1989	6.4	0.10	0.023	0.116	—	0.0085
1990	5.9	0.08	0.022	0.114	—	0.0079
1991–00	***327 sites***	***130 sites***	***234 sites***	***738 sites***	***886 sites***	***457 sites***
1991	5.6	0.08	0.019	0.111	29.4	0.0081
1992	5.3	0.07	0.019	0.105	27.3	0.0076
1993	5.0	0.06	0.019	0.107	26.6	0.0074
1994	5.1	0.05	0.020	0.106	26.4	0.0072
1995	4.6	0.05	0.019	0.112	25.1	0.0057
1996	4.3	0.05	0.019	0.105	24.2	0.0057
1997	4.1	0.04	0.018	0.104	24.1	0.0056
1998	3.9	0.04	0.018	0.110	23.8	0.0055
1999	3.7	0.04	0.018	0.107	24.1	0.0053
2000	3.4	0.04	0.017	0.100	23.8	0.0051

Table A-12. National Air Quality Trends by Monitoring Location, 1981–2000

Statistic	# of Sites	Units	Location	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Carbon Monoxide													
2nd Max. 8-hr.	4	ppm	Rural	4.7	4.9	3.8	3.3	4.1	3.8	4.5	3.8	3.5	3.2
2nd Max. 8-hr.	136	ppm	Suburban	8.0	7.8	7.5	7.5	7.3	6.6	6.6	6.4	6.1	6.1
2nd Max. 8-hr.	178	ppm	Urban	9.1	8.8	8.6	8.3	8.2	7.5	7.6	7.0	6.8	6.6
Lead													
Max. Qtr.	10	µg/m^3	Rural	1.12	0.98	0.94	1.03	0.37	0.48	0.29	0.25	0.24	0.17
Max. Qtr.	107	µg/m^3	Suburban	0.57	0.52	0.45	0.43	0.30	0.19	0.14	0.12	0.10	0.09
Max. Qtr.	106	µg/m^3	Urban	0.54	0.60	0.44	0.41	0.26	0.15	0.11	0.09	0.08	0.06
Nitrogen Dioxide													
Arith. Mean	22	ppm	Rural	0.009	0.008	0.008	0.008	0.008	0.009	0.009	0.008	0.008	0.008
Arith. Mean	81	ppm	Suburban	0.025	0.024	0.024	0.024	0.024	0.024	0.024	0.024	0.024	0.023
Arith. Mean	64	ppm	Urban	0.028	0.027	0.027	0.028	0.028	0.028	0.028	0.028	0.027	0.026
Ozone													
2nd Max. 1-hr.	127	ppm	Rural	0.117	0.114	0.126	0.117	0.115	0.112	0.117	0.129	0.110	0.111
2nd Max. 1-hr.	229	ppm	Suburban	0.131	0.130	0.142	0.128	0.127	0.122	0.129	0.141	0.119	0.116
2nd Max. 1-hr.	105	ppm	Urban	0.128	0.126	0.140	0.127	0.123	0.119	0.126	0.134	0.116	0.112
4th Max. 8-hr.	127	ppm	Rural	0.089	0.087	0.096	0.089	0.089	0.087	0.091	0.102	0.086	0.087
4th Max. 8-hr.	227	ppm	Suburban	0.093	0.093	0.102	0.092	0.093	0.090	0.095	0.105	0.088	0.086
4th Max. 8-hr.	104	ppm	Urban	0.090	0.086	0.098	0.091	0.090	0.086	0.091	0.098	0.086	0.082
PM_{10}													
Wtd. Arith. Mean	—	µg/m^3	Rural	—	—	—	—	—	—	—	—	—	—
Wtd. Arith. Mean	—	µg/m^3	Suburban	—	—	—	—	—	—	—	—	—	—
Wtd. Arith. Mean	—	µg/m^3	Urban	—	—	—	—	—	—	—	—	—	—
Sulfur Dioxide													
Arith. Mean	120	ppm	Rural	0.0083	0.0076	0.0075	0.0079	0.0076	0.0075	0.0075	0.0075	0.0073	0.0070
Arith. Mean	187	ppm	Suburban	0.0102	0.0096	0.0094	0.0098	0.0094	0.0090	0.0086	0.0088	0.0084	0.0079
Arith. Mean	142	ppm	Urban	0.0118	0.0111	0.0106	0.0106	0.0098	0.0098	0.0095	0.0098	0.0096	0.0088

* PM_{10} trend data is not available for this 10-year period.

Table A-12. National Air Quality Trends by Monitoring Location, 1991–2000

Statistic	# of Sites	Units	Location	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Carbon Monoxide													
2nd Max. 8-hr.	13	ppm	Rural	2.3	2.3	2.0	2.2	2.2	1.9	1.7	1.7	1.6	1.6
2nd Max. 8-hr.	153	ppm	Suburban	5.4	5.1	4.9	5.1	4.4	4.1	4.0	3.8	3.7	3.4
2nd Max. 8-hr.	217	ppm	Urban	6.0	5.6	5.2	5.4	4.9	4.6	4.3	4.0	3.9	3.5
Lead													
Max. Qtr.	4	$\mu g/m^3$	Rural	0.03	0.03	0.04	0.04	0.11	0.03	0.02	0.04	0.03	0.04
Max. Qtr.	58	$\mu g/m^3$	Suburban	0.07	0.06	0.05	0.05	0.05	0.04	0.04	0.04	0.04	0.04
Max. Qtr.	63	$\mu g/m^3$	Urban	0.09	0.07	0.07	0.06	0.05	0.05	0.05	0.04	0.04	0.04
Nitrogen Dioxide													
Arith. Mean	39	ppm	Rural	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.008	0.009	0.008
Arith. Mean	105	ppm	Suburban	0.020	0.020	0.019	0.020	0.020	0.019	0.018	0.018	0.019	0.018
Arith. Mean	87	ppm	Urban	0.023	0.023	0.023	0.024	0.023	0.022	0.022	0.022	0.022	0.021
Ozone													
2nd Max. 1-hr.	259	ppm	Rural	0.105	0.101	0.103	0.102	0.107	0.102	0.101	0.108	0.105	0.099
2nd Max. 1-hr.	332	ppm	Suburban	0.116	0.108	0.111	0.110	0.115	0.107	0.108	0.113	0.110	0.103
2nd Max. 1-hr.	127	ppm	Urban	0.110	0.106	0.105	0.106	0.110	0.106	0.102	0.105	0.104	0.097
4th Max. 8-hr.	263	ppm	Rural	0.082	0.080	0.081	0.081	0.085	0.082	0.082	0.086	0.086	0.080
4th Max. 8-hr.	332	ppm	Suburban	0.088	0.082	0.084	0.085	0.090	0.084	0.084	0.089	0.087	0.081
4th Max. 8-hr.	126	ppm	Urban	0.082	0.079	0.079	0.080	0.084	0.081	0.079	0.082	0.081	0.075
PM$_{10}$													
Wtd. Arith. Mean	140	$\mu g/m^3$	Rural	24.3	22.8	22.0	21.9	20.3	20.3	20.1	19.7	20.4	20.3
Wtd. Arith. Mean	353	$\mu g/m^3$	Suburban	30.0	28.0	27.2	27.1	26.0	24.8	24.8	24.5	24.9	24.4
Wtd. Arith. Mean	373	$\mu g/m^3$	Urban	30.9	28.5	27.8	27.6	26.1	25.4	25.1	24.9	24.9	24.7
Sulfur Dioxide													
Arith. Mean	119	ppm	Rural	0.0068	0.0065	0.0067	0.0063	0.0053	0.0050	0.0048	0.0047	0.0045	0.0044
Arith. Mean	197	ppm	Suburban	0.0087	0.0081	0.0079	0.0076	0.0059	0.0060	0.0059	0.0059	0.0058	0.0056
Arith. Mean	131	ppm	Urban	0.0087	0.0079	0.0076	0.0076	0.0060	0.0058	0.0057	0.0056	0.0055	0.0052

Table A-13. National Air Quality Trends Statistics by EPA Region, 1981–1990

	Statistic	# of Sites	Units	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Region 1													
CO	2nd Max. 8-hr.	11	ppm	9.1	9.6	9.2	8.9	7.0	7.5	6.7	5.7	5.8	6.1
Pb	Max. Qtr.	15	$\mu g/m^3$	0.51	0.56	0.44	0.38	0.32	0.12	0.08	0.06	0.05	0.04
NO_2	Arith. Mean	4	ppm	0.030	0.028	0.026	0.032	0.031	0.029	0.030	0.030	0.028	0.027
O_3	2nd Max. 1-hr.	23	ppm	0.142	0.150	0.166	0.153	0.140	0.123	0.132	0.161	0.129	0.124
O_3	4th Max. 8-hr.	23	ppm	0.101	0.109	0.119	0.105	0.102	0.090	0.095	0.120	0.094	0.093
PM_{10}*	Wtd. Arith. Mean	—	$\mu g/m^3$	—	—	—	—	—	—	—	—	—	—
SO_2	Arith. Mean	49	ppm	0.0096	0.0095	0.0089	0.0097	0.0093	0.0100	0.0098	0.0100	0.0093	0.0084
Region 2													
CO	2nd Max. 8-hr.	22	ppm	9.4	8.5	7.8	8.3	6.7	7.4	6.4	6.2	6.1	5.6
Pb	Max. Qtr.	12	$\mu g/m^3$	0.73	0.73	0.65	0.67	0.50	0.16	0.11	0.08	0.05	0.05
NO_2	Arith. Mean	10	ppm	0.031	0.032	0.033	0.032	0.031	0.030	0.031	0.031	0.030	0.029
O_3	2nd Max. 1-hr.	28	ppm	0.134	0.136	0.153	0.131	0.131	0.123	0.141	0.160	0.118	0.126
O_3	4th Max. 8-hr.	28	ppm	0.100	0.098	0.112	0.096	0.099	0.095	0.106	0.121	0.092	0.096
PM_{10}*	Wtd. Arith. Mean	—	$\mu g/m^3$	—	—	—	—	—	—	—	—	—	—
SO_2	Arith. Mean	37	ppm	0.0142	0.0132	0.0124	0.0130	0.0115	0.0112	0.0107	0.0115	0.0109	0.0097
Region 3													
CO	2nd Max. 8-hr.	41	ppm	7.0	7.0	6.8	7.6	5.7	6.3	5.9	5.5	5.3	5.2
Pb	Max. Qtr.	30	$\mu g/m^3$	0.40	0.44	0.34	0.35	0.22	0.15	0.12	0.14	0.10	0.07
NO_2	Arith. Mean	36	ppm	0.023	0.023	0.024	0.025	0.024	0.024	0.025	0.024	0.023	0.023
O_3	2nd Max. 1-hr.	64	ppm	0.122	0.124	0.138	0.119	0.118	0.113	0.128	0.150	0.111	0.112
O_3	4th Max. 8-hr.	64	ppm	0.092	0.095	0.107	0.092	0.093	0.089	0.100	0.116	0.088	0.089
PM_{10}*	Wtd. Arith. Mean	—	$\mu g/m^3$	—	—	—	—	—	—	—	—	—	—
SO_2	Arith. Mean	62	ppm	0.0141	0.0134	0.0133	0.0141	0.0131	0.0136	0.0132	0.0138	0.0136	0.0124
Region 4													
CO	2nd Max. 8-hr.	49	ppm	7.8	7.3	7.4	7.7	6.2	6.2	5.9	5.6	6.0	5.3
Pb	Max. Qtr.	38	$\mu g/m^3$	0.60	0.70	0.61	0.58	0.28	0.22	0.15	0.13	0.12	0.09
NO_2	Arith. Mean	10	ppm	0.019	0.019	0.019	0.019	0.019	0.019	0.019	0.019	0.019	0.017
O_3	2nd Max. 1-hr.	70	ppm	0.108	0.106	0.120	0.108	0.105	0.114	0.113	0.124	0.103	0.110
O_3	4th Max. 8-hr.	70	ppm	0.084	0.081	0.092	0.084	0.082	0.087	0.089	0.097	0.080	0.086
PM_{10}*	Wtd. Arith. Mean	—	$\mu g/m^3$	—	—	—	—	—	—	—	—	—	—
SO_2	Arith. Mean	59	ppm	0.0088	0.0078	0.0073	0.0072	0.0071	0.0072	0.0074	0.0077	0.0071	0.0068
Region 5													
CO	2nd Max. 8-hr.	40	ppm	7.8	7.1	7.1	7.5	5.8	6.0	6.2	5.4	5.6	5.0
Pb	Max. Qtr.	44	$\mu g/m^3$	0.47	0.57	0.38	0.33	0.21	0.13	0.10	0.10	0.08	0.08
NO_2	Arith. Mean	17	ppm	0.021	0.021	0.022	0.022	0.021	0.021	0.022	0.021	0.022	0.019
O_3	2nd Max. 1-hr.	97	ppm	0.116	0.113	0.129	0.110	0.106	0.108	0.119	0.131	0.107	0.100
O_3	4th Max. 8-hr.	97	ppm	0.087	0.086	0.097	0.083	0.082	0.082	0.090	0.104	0.085	0.079
PM_{10}*	Wtd. Arith. Mean	—	$\mu g/m^3$	—	—	—	—	—	—	—	—	—	—
SO_2	Arith. Mean	124	ppm	0.0113	0.0106	0.0105	0.0107	0.0102	0.0096	0.0093	0.0092	0.0092	0.0089

* PM_{10} trend data is not available for this 10-year period.

Table A-13. National Air Quality Trends Statistics by EPA Region, 1981–1990 (continued)

	Statistic	# of Sites	Units	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Region 6													
CO	2nd Max. 8-hr.	25	ppm	7.9	7.8	7.3	7.2	7.3	7.1	7.4	6.4	6.3	6.3
Pb	Max. Qtr.	22	µg/m^3	0.71	0.62	0.58	0.55	0.35	0.19	0.16	0.13	0.12	0.09
NO_2	Arith. Mean	14	ppm	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.016	0.015
O_3	2nd Max. 1-hr.	41	ppm	0.129	0.124	0.124	0.124	0.121	0.115	0.119	0.123	0.120	0.122
O_3	4th Max. 8-hr.	41	ppm	0.091	0.087	0.089	0.090	0.090	0.084	0.088	0.091	0.085	0.088
PM_{10}*	Wtd. Arith. Mean	—	µg/m^3	—	—	—	—	—	—	—	—	—	—
SO_2	Arith. Mean	32	ppm	0.0076	0.0072	0.0079	0.0070	0.0074	0.0065	0.0062	0.0059	0.0058	0.0055
Region 7													
CO	2nd Max. 8-hr.	15	ppm	7.0	6.9	5.6	6.4	5.2	6.3	6.0	5.3	5.5	5.3
Pb	Max. Qtr.	19	µg/m^3	0.21	0.17	0.17	0.17	0.13	0.09	0.05	0.04	0.04	0.02
NO_2	Arith. Mean	9	ppm	0.015	0.017	0.016	0.016	0.015	0.016	0.017	0.016	0.015	0.014
O_3	2nd Max. 1-hr.	24	ppm	0.104	0.100	0.116	0.113	0.104	0.103	0.110	0.114	0.095	0.092
O_3	4th Max. 8-hr.	24	ppm	0.068	0.069	0.088	0.085	0.075	0.074	0.079	0.088	0.074	0.070
PM_{10}*	Wtd. Arith. Mean	—	µg/m^3	—	—	—	—	—	—	—	—	—	—
SO_2	Arith. Mean	19	ppm	0.0087	0.0093	0.0092	0.0088	0.0081	0.0079	0.0074	0.0072	0.0074	0.0068
Region 8													
CO	2nd Max. 8-hr.	16	ppm	10.9	10.6	11.9	10.8	9.7	10.9	9.3	8.7	7.4	6.8
Pb	Max. Qtr.	6	µg/m^3	1.18	1.23	1.13	1.31	0.98	0.79	0.68	0.65	0.51	0.46
NO_2	Arith. Mean	15	ppm	0.624	0.586	0.449	0.416	0.246	0.189	0.135	0.104	0.091	0.079
O_3	2nd Max. 1-hr.	13	ppm	0.101	0.103	0.110	0.104	0.102	0.109	0.097	0.104	0.103	0.096
O_3	4th Max. 8-hr.	13	ppm	0.073	0.074	0.078	0.075	0.076	0.076	0.075	0.078	0.077	0.073
PM_{10}*	Wtd. Arith. Mean	—	µg/m^3	—	—	—	—	—	—	—	—	—	—
SO_2	Arith. Mean	20	ppm	0.0064	0.0060	0.0055	0.0048	0.0050	0.0045	0.0043	0.0040	0.0043	0.0041
Region 9													
CO	2nd Max. 8-hr.	77	ppm	8.1	8.0	7.9	7.0	7.8	7.5	6.5	7.1	7.0	6.6
Pb	Max. Qtr.	36	µg/m^3	0.62	0.59	0.45	0.42	0.25	0.19	0.13	0.10	0.09	0.08
NO_2	Arith. Mean	54	ppm	0.030	0.028	0.027	0.027	0.028	0.028	0.027	0.029	0.029	0.027
O_3	2nd Max. 1-hr.	105	ppm	0.153	0.149	0.161	0.152	0.156	0.138	0.141	0.144	0.138	0.130
O_3	4th Max. 8-hr.	105	ppm	0.101	0.097	0.106	0.103	0.105	0.097	0.098	0.100	0.096	0.089
PM_{10}*	Wtd. Arith. Mean	—	µg/m^3	—	—	—	—	—	—	—	—	—	—
SO_2	Arith. Mean	48	ppm	0.0056	0.0043	0.0039	0.0044	0.0041	0.0035	0.0031	0.0033	0.0032	0.0030
Region 10													
CO	2nd Max. 8-hr.	25	ppm	11.6	11.5	11.2	10.3	10.5	9.4	9.3	9.1	8.4	7.7
Pb	Max. Qtr.	6	µg/m^3	1.69	0.65	0.54	0.53	0.42	0.23	0.15	0.10	0.07	0.07
NO_2	Arith. Mean	—	ppm	—	—	—	—	—	—	—	—	—	—
O_3	2nd Max. 1-hr.	6	ppm	0.121	0.108	0.093	0.098	0.105	0.107	0.098	0.110	0.089	0.114
O_3	4th Max. 8-hr.	6	ppm	0.084	0.075	0.063	0.066	0.074	0.078	0.073	0.072	0.064	0.082
PM_{10}*	Wtd. Arith. Mean	—	µg/m^3	—	—	—	—	—	—	—	—	—	—
SO_2	Arith. Mean	5	ppm	0.0101	0.0096	0.0088	0.0096	0.0091	0.0100	0.0097	0.0071	0.0067	0.0070

* PM_{10} trend data is not available for this 10-year period.

Table A-13. National Air Quality Trends Statistics by EPA Region, 1991–2000

	Statistic	# of Sites	Units	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Region 1													
CO	2nd Max. 8-hr.	18	ppm	5.5	5.6	4.8	5.9	5.3	4.8	4.1	3.7	3.7	3.2
Pb	Max. Qtr.	1	μg/m^3	0.69	0.19	0.02	0.02	0.04	0.03	0.03	0.02	0.01	0.02
NO_2	Arith. Mean	15	ppm	0.022	0.020	0.021	0.022	0.019	0.020	0.019	0.020	0.019	0.018
O_3	2nd Max. 1-hr.	41	ppm	0.118	0.127	0.110	0.119	0.114	0.116	0.102	0.116	0.106	0.113
O_3	4th Max. 8-hr.	41	ppm	0.096	0.086	0.088	0.086	0.090	0.081	0.090	0.084	0.087	0.075
PM_{10}	Wtd. Arith. Mean	62	μg/m^3	23.2	20.5	20.2	20.6	18.7	19.3	19.5	19.3	18.9	17.9
SO_2	Arith. Mean	40	ppm	0.0077	0.0072	0.0069	0.0068	0.0053	0.0051	0.0052	0.0052	0.0048	0.0045
Region 2													
CO	2nd Max. 8-hr.	28	ppm	6.0	5.4	4.9	5.7	5.0	4.3	3.9	3.5	3.7	3.3
Pb	Max. Qtr.	4	μg/m^3	0.05	0.05	0.07	0.07	0.06	0.06	0.06	0.06	0.05	0.05
NO_2	Arith. Mean	11	ppm	0.029	0.028	0.028	0.029	0.027	0.028	0.027	0.027	0.027	0.027
O_3	2nd Max. 1-hr.	37	ppm	0.121	0.109	0.109	0.104	0.115	0.102	0.111	0.107	0.114	0.102
O_3	4th Max. 8-hr.	37	ppm	0.098	0.085	0.088	0.084	0.094	0.081	0.091	0.087	0.093	0.081
PM_{10}	Wtd. Arith. Mean	65	μg/m^3	26.4	23.8	23.8	24.3	21.6	22.5	23.0	22.1	21.8	22.1
SO_2	Arith. Mean	42	ppm	0.0088	0.0081	0.0075	0.0077	0.0059	0.0060	0.0055	0.0054	0.0053	0.0054
Region 3													
CO	2nd Max. 8-hr.	39	ppm	4.9	4.6	4.6	5.2	4.2	3.8	3.6	3.4	3.2	3.0
Pb	Max. Qtr.	16	μg/m^3	0.09	0.06	0.06	0.06	0.04	0.04	0.04	0.04	0.04	0.04
NO_2	Arith. Mean	35	ppm	0.021	0.021	0.021	0.022	0.020	0.021	0.020	0.020	0.019	0.018
O_3	2nd Max. 1-hr.	79	ppm	0.117	0.103	0.116	0.111	0.117	0.105	0.116	0.115	0.120	0.104
O_3	4th Max. 8-hr.	79	ppm	0.095	0.083	0.093	0.088	0.094	0.084	0.093	0.095	0.095	0.084
PM_{10}	Wtd. Arith. Mean	55	μg/m^3	32.6	29.5	29.2	29.2	27.1	26.9	25.8	24.6	23.6	23.8
SO_2	Arith. Mean	79	ppm	0.0126	0.0117	0.0117	0.0117	0.0085	0.0086	0.0090	0.0086	0.0083	0.0082
Region 4													
CO	2nd Max. 8-hr.	62	ppm	4.8	4.8	4.9	4.6	4.3	3.7	4.0	3.6	3.7	3.2
Pb	Max. Qtr.	21	μg/m^3	0.04	0.04	0.03	0.03	0.03	0.02	0.02	0.02	0.03	0.04
NO_2	Arith. Mean	32	ppm	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014
O_3	2nd Max. 1-hr.	144	ppm	0.097	0.096	0.104	0.100	0.104	0.101	0.102	0.112	0.109	0.103
O_3	4th Max. 8-hr.	144	ppm	0.075	0.077	0.082	0.081	0.083	0.081	0.082	0.090	0.089	0.084
PM_{10}	Wtd. Arith. Mean	159	μg/m^3	28.0	26.4	25.9	25.2	24.8	23.8	23.9	24.7	24.0	24.0
SO_2	Arith. Mean	80	ppm	0.0057	0.0054	0.0055	0.0051	0.0043	0.0044	0.0045	0.0046	0.0045	0.0044
Region 5													
CO	2nd Max. 8-hr.	45	ppm	4.6	4.4	4.3	5.0	4.0	3.4	3.3	3.3	3.0	2.8
Pb	Max. Qtr.	36	μg/m^3	0.10	0.09	0.09	0.09	0.07	0.06	0.06	0.06	0.05	0.05
NO_2	Arith. Mean	12	ppm	0.021	0.022	0.022	0.023	0.023	0.023	0.022	0.023	0.022	0.022
O_3	2nd Max. 1-hr.	142	ppm	0.109	0.098	0.097	0.104	0.111	0.103	0.102	0.106	0.105	0.094
O_3	4th Max. 8-hr.	142	ppm	0.087	0.078	0.077	0.083	0.090	0.085	0.083	0.085	0.088	0.077
PM_{10}	Wtd. Arith. Mean	154	μg/m^3	29.5	27.7	26.6	28.3	27.5	24.8	24.9	26.5	25.2	25.5
SO_2	Arith. Mean	102	ppm	0.0092	0.0081	0.0082	0.0078	0.0062	0.0062	0.0060	0.0060	0.0059	0.0056

Table A-13. National Air Quality Trends Statistics by EPA Region, 1991–2000 (continued)

	Statistic	# of Sites	Units	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Region 6													
CO	2nd Max. 8-hr.	31	ppm	5.6	5.5	5.5	4.6	4.5	4.9	4.4	4.0	3.6	3.4
Pb	Max. Qtr.	11	μg/m^3	0.15	0.11	0.10	0.08	0.12	0.12	0.06	0.08	0.06	0.06
NO_2	Arith. Mean	28	ppm	0.013	0.014	0.014	0.015	0.015	0.015	0.014	0.014	0.014	0.013
O_3	2nd Max. 1-hr.	76	ppm	0.112	0.109	0.110	0.109	0.120	0.109	0.113	0.115	0.111	0.116
O_3	4th Max. 8-hr.	76	ppm	0.079	0.078	0.080	0.082	0.089	0.082	0.083	0.086	0.086	0.086
PM_{10}	Wtd. Arith. Mean	50	μg/m^3	25.5	25.2	24.4	24.7	25.9	24.9	23.1	24.0	26.1	25.1
SO_2	Arith. Mean	27	ppm	0.0062	0.0064	0.0054	0.0048	0.0046	0.0048	0.0044	0.0042	0.0037	0.0034
Region 7													
CO	2nd Max. 8-hr.	20	ppm	5.2	4.6	4.4	4.3	4.1	4.2	3.8	4.4	3.5	2.9
Pb	Max. Qtr.	4	μg/m^3	0.04	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
NO_2	Arith. Mean	11	ppm	0.015	0.016	0.015	0.016	0.016	0.016	0.015	0.016	0.017	0.016
O_3	2nd Max. 1-hr.	28	ppm	0.092	0.090	0.086	0.098	0.102	0.094	0.094	0.099	0.100	0.097
O_3	4th Max. 8-hr.	28	ppm	0.075	0.074	0.066	0.078	0.081	0.076	0.076	0.078	0.080	0.077
PM_{10}	Wtd. Arith. Mean	46	μg/m^3	29.2	28.6	27.5	28.0	27.5	28.2	26.2	26.4	26.2	25.2
SO_2	Arith. Mean	25	ppm	0.0073	0.0067	0.0065	0.0068	0.0054	0.0052	0.0047	0.0045	0.0047	0.0042
Region 8													
CO	2nd Max. 8-hr.	20	ppm	6.9	7.0	5.9	5.5	5.0	5.0	4.7	4.0	4.0	3.5
Pb	Max. Qtr.	8	μg/m^3	0.06	0.06	0.06	0.04	0.04	0.03	0.03	0.04	0.04	0.04
NO_2	Arith. Mean	12	ppm	0.013	0.013	0.014	0.015	0.014	0.014	0.013	0.014	0.013	0.013
O_3	2nd Max. 1-hr.	18	ppm	0.089	0.087	0.084	0.087	0.087	0.090	0.084	0.096	0.089	0.087
O_3	4th Max. 8-hr.	18	ppm	0.067	0.066	0.065	0.068	0.067	0.070	0.067	0.076	0.070	0.069
PM_{10}	Wtd. Arith. Mean	99	μg/m^3	26.6	25.3	24.3	23.6	20.8	20.9	20.2	20.1	19.8	20.6
SO_2	Arith. Mean	24	ppm	0.0074	0.0082	0.0080	0.0070	0.0060	0.0048	0.0037	0.0035	0.0034	0.0034
Region 9													
CO	2nd Max. 8-hr.	97	ppm	5.9	5.1	4.7	5.1	4.4	4.3	4.0	4.0	3.9	3.5
Pb	Max. Qtr.	24	μg/m^3	0.05	0.04	0.04	0.03	0.03	0.02	0.03	0.02	0.03	0.03
NO_2	Arith. Mean	78	ppm	0.023	0.022	0.021	0.022	0.021	0.020	0.019	0.019	0.020	0.019
O_3	2nd Max. 1-hr.	157	ppm	0.125	0.123	0.119	0.116	0.119	0.114	0.102	0.114	0.102	0.100
O_3	4th Max. 8-hr.	157	ppm	0.090	0.090	0.088	0.087	0.088	0.087	0.078	0.085	0.079	0.077
PM_{10}	Wtd. Arith. Mean	127	μg/m^3	36.7	32.2	31.2	30.4	29.9	28.0	28.5	25.9	30.4	28.4
SO_2	Arith. Mean	30	ppm	0.0021	0.0021	0.0018	0.0019	0.0019	0.0019	0.0019	0.0019	0.0020	0.0021
Region 10													
CO	2nd Max. 8-hr.	27	ppm	8.4	7.7	7.1	6.8	6.6	6.5	6.1	5.4	5.6	4.9
Pb	Max. Qtr.	5	μg/m^3	0.06	0.04	0.05	0.05	0.05	0.04	0.05	0.06	0.04	0.04
NO_2	Arith. Mean	—	ppm	—	—	—	—	—	—	—	—	—	—
O_3	2nd Max. 1-hr.	16	ppm	0.086	0.087	0.080	0.087	0.085	0.095	0.074	0.094	0.073	0.074
O_3	4th Max. 8-hr.	16	ppm	0.062	0.067	0.058	0.063	0.063	0.074	0.057	0.067	0.059	0.057
PM_{10}	Wtd. Arith. Mean	69	μg/m^3	32.0	30.5	30.0	26.6	23.0	22.9	23.2	20.5	21.0	20.8
SO_2	Arith. Mean	8	ppm	0.0063	0.0068	0.0065	0.0061	0.0053	0.0049	0.0048	0.0048	0.0051	0.0051

Table A-14. Maximum Air Quality Concentrations by County, 2000

State	County	CO 2000 Population	Pb 8-hr (ppm)	NO_2 QMax ($\mu g/m^3$)	O_3 AM (ppm)	O_3 1-hr (ppm)	PM_{10} 8-hr (ppm)	PM_{10} Wtd AM ($\mu g/m^3$)	$PM_{2.5}$ 24-hr ($\mu g/m^3$)	$PM_{2.5}$ Wtd AM ($\mu g/m^3$)	SO_2 24-hr ($\mu g/m^3$)	SO_2 AM (ppm)	24-hr (ppm)
AL	Baldwin County	140,415	ND	ND	ND	0.12	**0.10**	ND	ND	IN	IN	ND	ND
AL	Clay County	14,254	ND	ND	ND	0.09	0.08	ND	ND	IN	IN	ND	ND
AL	Colbert County	54,984	ND	ND	ND	ND	ND	ND	IN	IN	IN	0.003	0.017
AL	DeKalb County	64,452	ND	ND	ND	ND	ND	23	44	IN	IN	ND	ND
AL	Elmore County	65,874	ND	ND	ND	0.10	0.08	ND	ND	ND	ND	ND	ND
AL	Escambia County	38,440	ND	ND	ND	ND	ND	26	60	IN	IN	ND	ND
AL	Etowah County	103,459	ND	ND	ND	ND	ND	26	64	IN	IN	ND	ND
AL	Franklin County	31,223	ND	ND	ND	ND	ND	ND	IN	ND	ND	ND	ND
AL	Houston County	88,787	ND	ND	ND	ND	ND	24	70	IN	IN	ND	ND
AL	Jackson County	53,926	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.005	0.041
AL	Jefferson County	662,047	5	ND	ND	0.12	**0.09**	IN	125	**22.3**	53	IN	0.057
AL	Lawrence County	34,803	ND	ND	ND	0.10	0.08	ND	ND	ND	ND	0.002	0.005
AL	Madison County	276,700	2	ND	ND	0.11	**0.09**	24	80	IN	IN	ND	ND
AL	Marengo County	22,539	ND	ND	ND	ND	ND	23	46	ND	ND	ND	ND
AL	Mobile County	399,843	ND	ND	ND	0.12	**0.09**	24	150	IN	IN	0.002	0.008
AL	Montgomery County	223,510	ND	ND	ND	0.11	**0.09**	25	61	IN	IN	ND	ND
AL	Morgan County	111,064	ND	ND	ND	0.11	**0.09**	23	53	IN	IN	ND	ND
AL	Pike County	29,605	ND	0.57	ND	ND	ND	24	48	ND	ND	ND	ND
AL	Russell County	49,756	ND	ND	ND	ND	ND	26	52	IN	IN	ND	ND
AL	Shelby County	143,293	ND	ND	0.011	**0.13**	**0.10**	27	60	IN	IN	ND	ND
AL	Sumter County	14,798	ND	ND	ND	0.09	0.08	ND	ND	IN	IN	ND	ND
AL	Talladega County	80,321	ND	ND	ND	ND	ND	26	68	IN	IN	ND	ND
AL	Tuscaloosa County	164,875	ND	ND	ND	ND	ND	IN	68	IN	IN	ND	ND
AL	Walker County	70,713	ND	ND	ND	ND	ND	IN	IN	IN	IN	ND	ND
AK	Anchorage Municipality	260,283	6	ND	ND	ND	ND	IN	108	6.1	20	ND	ND
AK	Fairbanks North Star Borough	82,840	9	ND	ND	ND	ND	IN	IN	12.2	42	ND	ND
AK	Juneau City and Borough	30,711	ND	ND	ND	ND	ND	IN	27	IN	IN	ND	ND
AK	Ketchikan Gateway Borough	14,070	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
AK	Matanuska-Susitna Borough	59,322	ND	ND	ND	ND	ND	IN	58	IN	IN	ND	ND
AK	Yukon-Koyukuk Census Area	6,551	ND	ND	ND	0.05	0.04	ND	ND	IN	IN	ND	ND
AZ	Cochise County	117,755	ND	ND	ND	0.08	0.07	38	90	IN	IN	ND	ND
AZ	Coconino County	116,320	ND	ND	ND	0.08	0.07	16	33	IN	IN	ND	ND
AZ	Gila County	51,335	ND	ND	ND	ND	ND	25	65	IN	IN	ND	ND
AZ	Graham County	33,489	ND	ND	ND	ND	ND	IN	IN	ND	ND	ND	ND
AZ	Maricopa County	3,072,149	7	ND	0.036	0.11	**0.09**	**70**	**232**	IN	IN	0.003	0.016
AZ	Mohave County	155,032	ND	ND	ND	ND	ND	15	29	ND	ND	ND	ND
AZ	Navajo County	97,470	ND	ND	ND	ND	ND	IN	34	ND	ND	ND	ND
AZ	Pima County	843,746	5	ND	0.017	0.09	0.08	39	123	IN	IN	0.002	0.007
AZ	Santa Cruz County	38,381	ND	ND	ND	ND	ND	49	120	IN	IN	ND	ND
AZ	Yavapai County	167,517	ND	ND	ND	0.09	0.08	16	34	ND	ND	ND	ND
AZ	Yuma County	160,026	ND	ND	ND	0.08	0.06	IN	IN	ND	ND	ND	ND
AR	Arkansas County	20,749	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
AR	Ashley County	24,209	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
AR	Craighead County	82,148	ND	ND	ND	ND	ND	ND	ND	**15.2**	IN	ND	ND
AR	Crittenden County	50,866	ND	ND	ND	0.11	**0.09**	ND	ND	**15.7**	IN	ND	ND
AR	Faulkner County	86,014	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
AR	Garland County	88,068	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
AR	Jefferson County	84,278	ND	ND	ND	ND	ND	ND	ND	15.0	27	ND	ND
AR	Marion County	16,140	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
AR	Miller County	40,443	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
AR	Mississippi County	51,979	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
AR	Montgomery County	9,245	ND	ND	ND	0.08	0.07	ND	ND	ND	ND	ND	ND
AR	Newton County	8,608	ND	ND	ND	0.08	0.08	ND	ND	ND	ND	ND	ND
AR	Ouachita County	28,790	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AR	Phillips County	26,445	ND	ND	ND	ND	ND	ND	ND	14.7	30	ND	ND
AR	Polk County	20,229	ND	ND	ND	ND	ND	ND	ND	12.3	26	ND	ND
AR	Pope County	54,469	ND	ND	ND	ND	ND	ND	ND	14.4	29	ND	ND

Table A-14. Maximum Air Quality Concentrations by County, 2000 (continued)

State	County	CO 2000 Population	Pb 8-hr (ppm)	NO_2 QMax (µg/m³)	O_3 AM (ppm)	O_3 1-hr (ppm)	PM_{10} 8-hr (ppm)	PM_{10} Wtd AM (µg/m³)	$PM_{2.5}$ 24-hr (µg/m³)	$PM_{2.5}$ Wtd AM (µg/m³)	SO_2 24-hr (µg/m³)	SO_2 AM (ppm)	24-hr (ppm)
AR	Pulaski County	361,474	3	ND	0.010	0.11	**0.09**	25	48	**15.7**	34	0.002	0.007
AR	Sebastian County	115,071	ND	ND	ND	ND	ND	ND	ND	13.5	27	ND	ND
AR	Union County	45,629	ND	ND	ND	ND	ND	ND	ND	IN	IN	0.005	0.030
AR	Washington County	157,715	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
AR	White County	67,165	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
CA	Alameda County	1,443,741	3	0.00	0.020	**0.13**	0.08	22	63	11.2	50	ND	ND
CA	Amador County	35,100	1	ND	ND	0.12	**0.09**	ND	ND	ND	ND	ND	ND
CA	Butte County	203,171	4	0.00	0.012	0.10	**0.09**	27	77	**16.3**	**70**	ND	ND
CA	Calaveras County	40,554	1	ND	ND	0.12	**0.10**	18	33	9.0	30	ND	ND
CA	Colusa County	18,804	ND	ND	ND	0.09	0.07	25	88	8.0	26	ND	ND
CA	Contra Costa County	948,816	3	0.00	0.016	0.10	0.08	20	50	10.9	46	0.003	0.021
CA	Del Norte County	27,507	ND	ND	ND	ND	ND	IN	36	ND	ND	ND	ND
CA	El Dorado County	156,299	2	ND	0.011	**0.13**	**0.10**	20	50	7.8	22	ND	ND
CA	Fresno County	799,407	6	0.00	0.020	**0.15**	**0.11**	41	122	**25.4**	**89**	ND	ND
CA	Glenn County	26,453	ND	ND	ND	0.09	0.07	22	75	ND	ND	ND	ND
CA	Humboldt County	126,518	ND	ND	ND	ND	ND	21	46	9.2	22	ND	ND
CA	Imperial County	142,361	**10**	0.02	IN	**0.16**	**0.09**	**212**	**545**	**16.8**	IN	IN	0.007
CA	Inyo County	17,945	ND	ND	ND	0.09	0.08	**140**	**6230**	IN	**67**	ND	ND
CA	Kern County	661,645	5	0.00	0.023	**0.14**	**0.11**	46	136	**21.7**	100	ND	ND
CA	Kings County	129,461	ND	ND	0.014	0.12	**0.11**	50	129	**16.2**	IN	ND	ND
CA	Lake County	58,309	ND	ND	ND	0.08	0.06	11	21	IN	IN	ND	ND
CA	Lassen County	33,828	ND	ND	ND	ND	ND	IN	IN	ND	ND	ND	ND
CA	Los Angeles County	9,519,338	**10**	0.06	0.044	**0.17**	**0.11**	46	93	**23.9**	**83**	0.003	0.010
CA	Madera County	123,109	ND	ND	0.013	0.10	**0.09**	ND	ND	ND	ND	ND	ND
CA	Marin County	247,289	2	ND	0.016	0.07	0.05	20	39	ND	ND	ND	ND
CA	Mariposa County	17,130	ND	ND	ND	0.11	**0.09**	25	56	ND	ND	ND	ND
CA	Mendocino County	86,265	2	ND	0.011	0.07	0.05	23	47	IN	IN	ND	ND
CA	Merced County	210,554	ND	ND	0.012	0.12	**0.10**	35	89	**17.3**	47	ND	ND
CA	Modoc County	9,449	ND	ND	ND	ND	ND	23	59	8.3	37	ND	ND
CA	Mono County	12,853	IN	ND	ND	ND	ND	13	**1642**	IN	IN	ND	ND
CA	Monterey County	401,762	1	ND	0.007	0.08	0.06	30	70	8.0	22	ND	ND
CA	Napa County	124,279	3	ND	0.012	0.08	0.06	16	43	ND	ND	ND	ND
CA	Nevada County	92,033	ND	ND	ND	0.12	**0.10**	17	49	IN	IN	ND	ND
CA	Orange County	2,846,289	6	ND	0.029	0.12	0.08	40	119	**20.4**	37	0.002	0.005
CA	Placer County	248,399	2	0.00	0.017	0.12	**0.10**	24	50	12.2	43	ND	ND
CA	Plumas County	20,824	ND	ND	ND	0.08	0.07	20	61	IN	IN	ND	ND
CA	Riverside County	1,545,387	4	0.05	0.022	**0.15**	**0.11**	**59**	**190**	**28.4**	**81**	0.002	0.026
CA	Sacramento County	1,223,499	6	ND	0.019	**0.13**	**0.10**	27	82	12.3	**81**	IN	0.015
CA	San Benito County	53,234	ND	ND	ND	0.10	0.08	16	31	ND	ND	ND	ND
CA	San Bernardino County	1,709,434	4	0.05	0.038	**0.17**	**0.12**	**53**	108	**26.0**	**70**	0.003	0.010
CA	San Diego County	2,813,833	5	0.02	0.024	0.12	**0.10**	31	86	**15.9**	IN	0.004	0.011
CA	San Francisco County	776,733	3	0.00	0.020	0.06	0.04	24	53	IN	IN	0.002	0.007
CA	San Joaquin County	563,598	4	0.00	0.020	0.11	0.08	32	79	**17.3**	IN	ND	ND
CA	San Luis Obispo County	246,681	2	ND	0.012	0.08	0.07	21	102	10.5	41	0.005	0.028
CA	San Mateo County	707,161	4	ND	0.018	0.08	0.05	21	50	10.9	43	ND	ND
CA	Santa Barbara County	399,347	3	0.00	0.018	0.10	0.08	26	62	9.7	19	0.002	0.003
CA	Santa Clara County	1,682,585	7	0.00	0.025	0.10	0.07	27	68	13.5	57	ND	ND
CA	Santa Cruz County	255,602	1	ND	0.005	0.09	0.06	26	50	7.9	18	0.001	0.003
CA	Shasta County	163,256	ND	ND	ND	0.11	0.08	24	47	IN	IN	ND	ND
CA	Sierra County	3,555	ND	ND	ND	ND	ND	IN	IN	ND	ND	ND	ND
CA	Siskiyou County	44,301	ND	ND	ND	0.10	0.06	IN	33	ND	ND	ND	ND
CA	Solano County	394,542	5	ND	0.013	0.10	0.07	18	46	11.6	60	0.002	0.005
CA	Sonoma County	458,614	3	ND	0.013	0.08	0.06	18	40	10.3	40	ND	ND
CA	Stanislaus County	446,997	4	0.00	0.018	0.11	**0.09**	35	100	**18.9**	**71**	ND	ND
CA	Sutter County	78,930	4	ND	0.013	0.10	0.08	28	66	11.5	38	ND	ND
CA	Tehama County	56,039	ND	ND	ND	0.10	0.08	IN	43	ND	ND	ND	ND
CA	Trinity County	13,022	ND	ND	ND	ND	ND	19	48	ND	ND	ND	ND

Table A-14. Maximum Air Quality Concentrations by County, 2000 (continued)

State	County	CO 2000 Population	Pb 8-hr (ppm)	NO_2 QMax (μg/m^3)	O_3 AM (ppm)	O_3 1-hr (ppm)	PM_{10} 8-hr (ppm)	PM_{10} Wtd AM (μg/m^3)	$PM_{2.5}$ 24-hr (μg/m^3)	$PM_{2.5}$ Wtd AM (μg/m^3)	SO_2 24-hr (μg/m^3)	SO_2 AM (ppm)	24-hr (ppm)
CA	Tulare County	368,021	3	ND	0.018	0.12	**0.11**	**53**	127	**23.7**	**103**	ND	ND
CA	Tuolumne County	54,501	2	ND	ND	0.11	**0.10**	ND	ND	ND	ND	ND	ND
CA	Ventura County	753,197	3	0.00	0.020	0.12	**0.10**	31	80	IN	IN	0.002	0.007
CA	Yolo County	168,660	1	ND	0.011	0.10	0.08	26	66	10.3	38	ND	ND
CO	Adams County	363,857	3	0.15	0.016	0.08	0.06	43	134	11.6	41	0.003	0.009
CO	Alamosa County	14,966	ND	ND	ND	ND	ND	IN	88	ND	ND	ND	ND
CO	Arapahoe County	487,967	ND	ND	ND	0.10	0.08	ND	ND	8.7	22	ND	ND
CO	Archuleta County	9,898	ND	ND	ND	ND	ND	28	87	IN	IN	ND	ND
CO	Boulder County	291,288	4	ND	ND	0.09	0.07	23	74	9.5	25	ND	ND
CO	Delta County	27,834	ND	ND	ND	ND	ND	24	62	IN	IN	ND	ND
CO	Denver County	554,636	5	0.02	IN	0.10	0.07	29	80	10.8	30	IN	0.017
CO	Douglas County	175,766	ND	ND	ND	0.10	0.08	15	31	IN	IN	ND	ND
CO	Eagle County	41,659	ND	ND	ND	ND	ND	IN	23	ND	ND	ND	ND
CO	Elbert County	19,872	ND	ND	ND	ND	ND	ND	ND	4.1	12	ND	ND
CO	El Paso County	516,929	4	0.01	0.035	0.09	0.07	25	87	7.5	16	0.004	0.014
CO	Fremont County	46,145	ND	ND	ND	ND	ND	17	36	ND	ND	ND	ND
CO	Garfield County	43,791	ND	ND	ND	ND	ND	23	53	ND	ND	ND	ND
CO	Gunnison County	13,956	ND	ND	ND	ND	ND	28	88	IN	IN	ND	ND
CO	Jefferson County	527,056	4	ND	0.011	0.11	0.08	16	32	ND	ND	ND	ND
CO	Lake County	7,812	ND	0.03	ND	ND	ND	ND	ND	ND	ND	ND	ND
CO	La Plata County	43,941	ND	ND	ND	ND	ND	36	121	IN	IN	ND	ND
CO	Larimer County	251,494	4	ND	ND	0.10	0.08	IN	66	8.3	20	ND	ND
CO	Mesa County	116,255	4	ND	ND	ND	ND	20	53	7.4	26	ND	ND
CO	Montezuma County	23,830	ND	ND	ND	0.09	0.07	ND	ND	ND	ND	ND	ND
CO	Montrose County	33,432	ND	ND	ND	ND	ND	IN	87	ND	ND	ND	ND
CO	Pitkin County	14,872	ND	ND	ND	ND	ND	22	71	ND	ND	ND	ND
CO	Prowers County	14,483	ND	ND	ND	ND	ND	22	136	ND	ND	ND	ND
CO	Pueblo County	141,472	ND	ND	ND	ND	ND	24	64	7.9	22	ND	ND
CO	Routt County	19,690	ND	ND	ND	ND	ND	25	96	IN	IN	ND	ND
CO	San Miguel County	6,594	ND	ND	ND	ND	ND	IN	62	IN	IN	ND	ND
CO	Summit County	23,548	ND	ND	ND	ND	ND	22	71	ND	ND	ND	ND
CO	Teller County	20,555	ND	ND	ND	ND	ND	27	113	ND	ND	ND	ND
CO	Weld County	180,936	4	ND	ND	0.09	0.07	21	58	8.9	28	ND	ND
CT	Fairfield County	882,567	3	ND	0.018	0.12	**0.09**	31	67	IN	IN	0.006	0.026
CT	Hartford County	857,183	7	ND	0.017	0.10	0.08	18	39	IN	IN	0.004	0.021
CT	Litchfield County	182,193	ND	ND	ND	0.11	**0.09**	15	31	ND	ND	ND	ND
CT	Middlesex County	155,071	ND	ND	ND	0.12	**0.09**	ND	ND	ND	ND	ND	ND
CT	New Haven County	824,008	3	0.02	0.025	**0.14**	**0.09**	32	86	**16.2**	40	0.006	0.031
CT	New London County	259,088	ND	ND	ND	**0.14**	0.08	16	40	IN	IN	ND	ND
CT	Tolland County	136,364	ND	ND	IN	0.10	0.08	ND	ND	ND	ND	ND	ND
DE	Kent County	126,697	ND	ND	ND	**0.13**	**0.09**	ND	ND	12.9	23	ND	ND
DE	New Castle County	500,265	3	ND	IN	0.12	**0.10**	26	46	**16.8**	29	0.007	0.047
DE	Sussex County	156,638	ND	ND	ND	0.11	**0.10**	ND	ND	14.6	28	ND	ND
DC	District of Columbia	572,059	5	0.00	0.023	0.12	**0.09**	ND	ND	**18.9**	50	0.008	0.023
FL	Alachua County	217,955	ND	ND	ND	0.10	0.08	20	36	11.9	27	ND	ND
FL	Baker County	22,259	ND	ND	ND	0.09	0.08	ND	ND	ND	ND	ND	ND
FL	Bay County	148,217	ND	ND	ND	0.12	**0.09**	25	46	ND	ND	ND	ND
FL	Brevard County	476,230	ND	ND	ND	0.09	0.08	IN	34	IN	IN	ND	ND
FL	Broward County	1,623,018	4	0.05	0.010	0.09	0.07	19	31	9.6	36	0.003	0.026
FL	Citrus County	118,085	ND	ND	ND	ND	ND	ND	ND	10.5	31	ND	ND
FL	Collier County	251,377	ND	ND	ND	ND	ND	IN	IN	ND	ND	ND	ND
FL	Duval County	778,879	4	0.03	0.015	0.11	0.08	26	46	IN	IN	0.003	0.055
FL	Escambia County	294,410	ND	ND	0.010	0.12	**0.10**	22	38	13.9	32	0.005	0.032
FL	Hamilton County	13,327	ND	ND	ND	ND	ND	24	46	ND	ND	0.004	0.013
FL	Hillsborough County	998,948	3	**2.01**	0.011	0.11	0.08	33	73	13.5	33	0.006	0.025
FL	Holmes County	18,564	ND	ND	ND	0.10	0.08	ND	ND	ND	ND	ND	ND
FL	Lake County	210,528	ND	ND	ND	IN	IN	20	53	ND	ND	ND	ND

Table A-14. Maximum Air Quality Concentrations by County, 2000 (continued)

State	County	CO 2000 Population	Pb 8-hr (ppm)	NO_2 QMax (µg/m³)	O_3 AM (ppm)	O_3 1-hr (ppm)	PM_{10} 8-hr (ppm)	PM_{10} Wtd AM (µg/m³)	$PM_{2.5}$ 24-hr (µg/m³)	$PM_{2.5}$ Wtd AM (µg/m³)	SO_2 24-hr (µg/m³)	SO_2 AM (ppm)	24-hr (ppm)
FL	Lee County	440,888	ND	ND	ND	0.09	0.08	19	43	9.6	25	ND	ND
FL	Leon County	239,452	ND	ND	ND	0.09	0.08	18	46	IN	IN	ND	ND
FL	Manatee County	264,002	ND	ND	0.009	0.11	**0.09**	23	40	IN	IN	0.002	0.014
FL	Marion County	258,916	ND	ND	ND	0.09	0.08	ND	ND	11.0	24	ND	ND
FL	Monroe County	79,589	ND	ND	ND	ND	ND	18	36	ND	ND	ND	ND
FL	Nassau County	57,663	ND	ND	ND	ND	ND	IN	65	ND	ND	0.007	0.053
FL	Orange County	896,344	3	ND	0.012	0.11	0.08	26	50	12.1	31	0.003	0.009
FL	Osceola County	172,493	ND	ND	ND	0.10	0.08	ND	ND	ND	ND	ND	ND
FL	Palm Beach County	1,131,184	3	ND	0.016	0.09	0.08	IN	38	9.4	27	0.002	0.008
FL	Pasco County	344,765	ND	ND	ND	0.09	0.08	ND	ND	ND	ND	ND	ND
FL	Pinellas County	921,482	2	0.01	0.013	0.10	0.08	26	45	12.4	43	0.005	0.031
FL	Polk County	483,924	ND	ND	ND	0.10	0.08	23	121	12.2	28	0.005	0.018
FL	Putnam County	70,423	ND	ND	ND	ND	ND	27	49	ND	ND	0.003	0.014
FL	St. Lucie County	192,695	ND	ND	0.010	0.08	0.07	18	35	10.1	23	ND	ND
FL	Santa Rosa County	117,743	ND	ND	ND	0.11	**0.10**	ND	ND	ND	ND	ND	ND
FL	Sarasota County	325,957	4	ND	0.004	0.11	**0.09**	26	48	11.0	30	0.002	0.019
FL	Seminole County	365,196	ND	ND	ND	0.10	0.08	IN	32	11.0	27	ND	ND
FL	Volusia County	443,343	ND	ND	ND	0.09	0.08	21	53	10.5	26	ND	ND
GA	Baldwin County	44,700	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.003	0.016
GA	Bartow County	76,019	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.003	0.016
GA	Bibb County	153,887	ND	ND	ND	**0.13**	**0.10**	IN	48	**18.6**	37	0.003	0.015
GA	Chatham County	232,048	ND	ND	ND	0.10	0.08	26	66	**15.1**	IN	0.003	0.024
GA	Chattooga County	25,470	ND	ND	ND	ND	ND	IN	IN	ND	ND	ND	ND
GA	Cherokee County	141,903	ND	ND	ND	0.08	0.07	ND	ND	ND	ND	ND	ND
GA	Clarke County	101,489	ND	ND	ND	ND	ND	ND	ND	**19.0**	IN	ND	ND
GA	Clayton County	236,517	ND	ND	ND	ND	ND	ND	ND	**19.2**	IN	ND	ND
GA	Cobb County	607,751	ND	ND	ND	0.12	**0.11**	ND	ND	**18.7**	50	ND	ND
GA	Coweta County	89,215	ND	ND	ND	0.11	**0.10**	ND	ND	ND	ND	ND	ND
GA	Dawson County	15,999	ND	ND	ND	0.10	0.08	ND	ND	ND	ND	ND	ND
GA	DeKalb County	665,865	3	0.04	0.018	**0.15**	**0.11**	IN	64	**18.9**	IN	ND	ND
GA	Dougherty County	96,065	ND	ND	ND	ND	ND	IN	IN	**17.4**	IN	ND	ND
GA	Douglas County	92,174	ND	ND	ND	0.12	**0.10**	28	56	ND	ND	ND	ND
GA	Fannin County	19,798	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.003	0.018
GA	Fayette County	91,263	ND	ND	ND	**0.15**	**0.10**	ND	ND	ND	ND	ND	ND
GA	Floyd County	90,565	ND	ND	ND	ND	ND	24	50	**18.4**	IN	0.003	0.013
GA	Fulton County	816,006	3	ND	0.023	**0.16**	**0.11**	36	85	**21.4**	IN	0.005	0.019
GA	Glynn County	67,568	ND	ND	ND	0.09	0.07	IN	41	IN	IN	ND	ND
GA	Gwinnett County	588,448	ND	ND	ND	**0.13**	**0.10**	ND	ND	**19.4**	IN	ND	ND
GA	Hall County	139,277	ND	ND	ND	ND	ND	ND	ND	**18.3**	IN	ND	ND
GA	Henry County	119,341	ND	ND	ND	**0.16**	**0.11**	ND	ND	ND	ND	ND	ND
GA	Houston County	110,765	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
GA	Lowndes County	92,115	ND	ND	ND	ND	ND	ND	ND	**15.6**	IN	ND	ND
GA	Murray County	36,506	ND	ND	ND	0.11	**0.09**	ND	ND	ND	ND	ND	ND
GA	Muscogee County	186,291	ND	0.11	ND	0.11	**0.09**	IN	59	**19.2**	**71**	ND	ND
GA	Paulding County	81,678	ND	ND	0.005	0.10	**0.09**	ND	ND	**16.9**	46	ND	ND
GA	Richmond County	199,775	ND	ND	ND	0.12	**0.09**	IN	48	**17.5**	IN	ND	ND
GA	Rockdale County	70,111	ND	ND	0.008	**0.13**	**0.10**	ND	ND	ND	ND	ND	ND
GA	Spalding County	58,417	ND	ND	ND	ND	ND	26	56	ND	ND	ND	ND
GA	Sumter County	33,200	ND	ND	ND	0.11	**0.09**	ND	ND	ND	ND	ND	ND
GA	Walker County	61,053	ND	ND	ND	ND	ND	IN	IN	IN	IN	ND	ND
GA	Washington County	21,176	ND	ND	ND	ND	ND	IN	54	IN	IN	ND	ND
GA	Wilkinson County	10,220	ND	ND	ND	ND	ND	ND	ND	**17.6**	IN	ND	ND
HI	Hawaii County	148,677	ND	ND	ND	0.05	0.04	ND	ND	ND	ND	ND	ND
HI	Honolulu County	876,156	2	ND	0.005	0.05	0.04	16	52	4.9	10	0.002	0.007
HI	Kauai County	58,463	ND	ND	ND	ND	ND	IN	IN	ND	ND	ND	ND
HI	Maui County	128,094	ND	ND	ND	ND	ND	24	76	IN	IN	ND	ND

Table A-14. Maximum Air Quality Concentrations by County, 2000 (continued)

State	County	CO 2000 Population	Pb 8-hr (ppm)	NO_2 QMax ($\mu g/m^3$)	O_3 AM (ppm)	O_3 1-hr (ppm)	PM_{10} 8-hr (ppm)	PM_{10} Wtd AM ($\mu g/m^3$)	$PM_{2.5}$ 24-hr ($\mu g/m^3$)	$PM_{2.5}$ Wtd AM ($\mu g/m^3$)	SO_2 24-hr ($\mu g/m^3$)	SO_2 AM (ppm)	24-hr (ppm)
ID	Ada County	300,904	3	ND	IN	ND	ND	34	88	9.2	38	ND	ND
ID	Bannock County	75,565	ND	ND	ND	ND	ND	31	94	10.5	57	0.008	0.036
ID	Benewah County	9,171	ND	ND	ND	ND	ND	IN	63	ND	ND	ND	ND
ID	Bingham County	41,735	ND	ND	ND	ND	ND	IN	IN	ND	ND	ND	ND
ID	Bonner County	36,835	ND	ND	ND	ND	ND	22	56	9.8	37	ND	ND
ID	Bonneville County	82,522	ND	ND	ND	ND	ND	21	54	IN	IN	ND	ND
ID	Boundary County	9,871	ND	ND	ND	ND	ND	IN	42	ND	ND	ND	ND
ID	Butte County	2,899	ND	ND	ND	0.07	0.07	ND	ND	ND	ND	ND	ND
ID	Canyon County	131,441	5	ND	ND	ND	ND	30	82	9.7	38	ND	ND
ID	Caribou County	7,304	ND	ND	ND	ND	ND	IN	IN	ND	ND	0.004	0.034
ID	Kootenai County	108,685	ND	ND	ND	ND	ND	21	70	9.9	33	ND	ND
ID	Lemhi County	7,806	ND	ND	ND	ND	ND	44	**255**	ND	ND	ND	ND
ID	Lewis County	3,747	ND	ND	ND	ND	ND	31	58	ND	ND	ND	ND
ID	Minidoka County	20,174	ND	ND	ND	ND	ND	25	58	ND	ND	ND	ND
ID	Nez Perce County	37,410	3	ND	ND	ND	ND	23	53	10.1	30	ND	ND
ID	Power County	7,538	ND	ND	ND	ND	ND	IN	**221**	ND	ND	ND	ND
ID	Shoshone County	13,771	ND	0.08	ND	ND	ND	21	64	12.2	30	ND	ND
ID	Twin Falls County	64,284	ND	ND	ND	ND	ND	25	47	3.2	19	ND	ND
IL	Adams County	68,277	ND	ND	ND	0.08	0.07	ND	ND	13.1	30	0.004	0.025
IL	Champaign County	179,669	ND	ND	ND	0.08	0.07	ND	ND	14.8	28	0.002	0.016
IL	Cook County	5,376,741	4	0.15	0.032	0.10	0.08	35	123	**20.2**	43	0.012	0.075
IL	DuPage County	904,161	ND	ND	ND	0.08	0.06	ND	ND	**15.3**	34	0.003	0.018
IL	Effingham County	34,264	ND	ND	ND	0.09	0.07	ND	ND	ND	ND	ND	ND
IL	Hamilton County	8,621	ND	ND	ND	0.10	0.08	ND	ND	ND	ND	ND	ND
IL	Jackson County	59,612	ND	ND	ND	ND	ND	23	55	ND	ND	ND	ND
IL	Jersey County	21,668	ND	ND	ND	0.10	0.08	ND	ND	ND	ND	ND	ND
IL	Kane County	404,119	ND	ND	ND	0.08	0.07	IN	IN	IN	IN	ND	ND
IL	Lake County	644,356	ND	ND	IN	0.09	0.07	ND	ND	12.2	31	ND	ND
IL	La Salle County	111,509	ND	ND	ND	ND	ND	26	135	**15.2**	35	ND	ND
IL	McHenry County	260,077	ND	ND	ND	0.09	0.08	ND	ND	14.7	35	ND	ND
IL	McLean County	150,433	ND	ND	ND	ND	ND	ND	ND	14.9	33	ND	ND
IL	Macon County	114,706	ND	ND	ND	0.09	0.08	ND	ND	15.0	31	0.005	0.025
IL	Macoupin County	49,019	ND	0.01	ND	0.10	0.08	23	40	IN	IN	0.003	0.012
IL	Madison County	258,941	2	**1.76**	ND	0.11	0.08	45	116	**20.6**	37	0.008	0.041
IL	Peoria County	183,433	3	0.02	ND	0.08	0.07	24	54	14.8	32	0.006	0.036
IL	Randolph County	33,893	ND	ND	ND	0.09	0.08	ND	ND	**15.2**	33	0.003	0.017
IL	Rock Island County	149,374	ND	ND	ND	0.07	0.06	ND	ND	13.6	28	0.003	0.012
IL	St. Clair County	256,082	ND	0.07	0.018	0.11	0.08	32	62	**17.4**	36	0.007	0.030
IL	Sangamon County	188,951	2	ND	ND	0.10	0.08	26	54	13.4	32	0.005	0.035
IL	Tazewell County	128,485	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.005	0.063
IL	Wabash County	12,937	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.006	0.035
IL	Will County	502,266	1	ND	0.009	0.09	0.08	IN	59	**16.0**	31	0.005	0.023
IL	Winnebago County	278,418	3	ND	ND	0.08	0.07	ND	ND	15.0	36	ND	ND
IN	Allen County	331,849	4	ND	ND	0.10	**0.09**	IN	43	**15.7**	47	ND	ND
IN	Bartholomew County	71,435	ND	ND	ND	ND	ND	IN	70	ND	ND	ND	ND
IN	Boone County	46,107	ND	ND	ND	0.10	0.08	ND	ND	ND	ND	ND	ND
IN	Clark County	96,472	ND	ND	ND	0.10	**0.09**	28	65	**18.6**	IN	ND	ND
IN	Daviess County	29,820	ND	ND	ND	ND	ND	23	60	ND	ND	0.006	0.015
IN	Dearborn County	46,109	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.009	0.053
IN	DeKalb County	40,285	ND	ND	ND	ND	ND	24	60	ND	ND	ND	ND
IN	Delaware County	118,769	ND	0.58	ND	ND	ND	ND	ND	**16.1**	49	ND	ND
IN	Dubois County	39,674	ND	ND	ND	ND	ND	26	62	**17.1**	48	ND	ND
IN	Elkhart County	182,791	ND	ND	ND	0.08	0.06	ND	ND	**15.7**	IN	ND	ND
IN	Floyd County	70,823	ND	ND	ND	0.09	0.08	ND	ND	**16.0**	IN	0.015	0.037
IN	Fountain County	17,954	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.007	0.031
IN	Gibson County	32,500	ND	ND	0.010	0.08	0.07	ND	ND	ND	ND	0.006	0.070

Table A-14. Maximum Air Quality Concentrations by County, 2000 (continued)

State	County	CO 2000 Population	Pb 8-hr (ppm)	NO_2 QMax ($\mu g/m^3$)	O_3 AM (ppm)	O_3 1-hr (ppm)	PM_{10} 8-hr (ppm)	PM_{10} Wtd AM ($\mu g/m^3$)	$PM_{2.5}$ 24-hr ($\mu g/m^3$)	$PM_{2.5}$ Wtd AM ($\mu g/m^3$)	SO_2 24-hr ($\mu g/m^3$)	SO_2 AM (ppm)	24-hr (ppm)
IN	Greene County	33,157	ND	ND	ND	0.10	**0.09**	ND	ND	ND	ND	ND	ND
IN	Hamilton County	182,740	ND	ND	ND	0.10	**0.09**	ND	ND	ND	ND	ND	ND
IN	Hancock County	55,391	ND	ND	ND	0.10	**0.09**	ND	ND	ND	ND	ND	ND
IN	Hendricks County	104,093	2	ND	IN	0.10	**0.09**	IN	67	ND	ND	IN	0.108
IN	Henry County	48,508	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
IN	Howard County	84,964	ND	ND	ND	ND	ND	ND	ND	**15.6**	35	ND	ND
IN	Huntington County	38,075	ND	ND	ND	0.09	**0.09**	ND	ND	ND	ND	ND	ND
IN	Jackson County	41,335	ND	ND	ND	0.10	0.08	ND	ND	ND	ND	ND	ND
IN	Jasper County	30,043	ND	ND	ND	ND	ND	18	34	ND	ND	0.003	0.014
IN	Jefferson County	31,705	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.007	0.027
IN	Johnson County	115,209	ND	ND	ND	0.10	0.08	ND	ND	ND	ND	ND	ND
IN	Knox County	39,256	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
IN	Lake County	484,564	3	0.11	0.020	0.10	**0.09**	31	123	**17.1**	38	0.006	0.046
IN	LaPorte County	110,106	ND	ND	ND	0.10	0.08	ND	ND	IN	IN	0.004	0.016
IN	Madison County	133,358	ND	ND	ND	0.09	0.08	21	40	**16.9**	IN	ND	ND
IN	Marion County	860,454	4	0.12	0.017	0.10	0.08	27	55	**17.8**	36	0.007	0.025
IN	Morgan County	66,689	ND	ND	ND	0.10	**0.09**	ND	ND	ND	ND	ND	ND
IN	Perry County	18,899	ND	ND	ND	0.10	**0.09**	30	75	ND	ND	0.007	0.030
IN	Pike County	12,837	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.008	0.029
IN	Porter County	146,798	ND	ND	ND	0.10	**0.09**	18	54	13.4	30	0.006	0.027
IN	Posey County	27,061	ND	ND	ND	0.10	**0.09**	ND	ND	ND	ND	ND	ND
IN	Putnam County	36,019	ND	ND	ND	ND	ND	25	57	ND	ND	ND	ND
IN	St. Joseph County	265,559	ND	ND	0.016	0.10	0.08	19	35	13.7	36	ND	ND
IN	Shelby County	43,445	ND	ND	ND	0.10	**0.09**	ND	ND	ND	ND	ND	ND
IN	Spencer County	20,391	ND	ND	0.007	ND	ND	25	51	IN	IN	0.008	0.028
IN	Sullivan County	21,751	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.008	0.040
IN	Tippecanoe County	148,955	ND	ND	ND	ND	ND	ND	ND	**15.6**	35	ND	ND
IN	Vanderburgh County	171,922	3	ND	0.014	0.09	0.08	28	68	**16.1**	39	0.004	0.020
IN	Vigo County	105,848	ND	ND	ND	0.09	0.08	25	54	**15.7**	37	0.012	0.055
IN	Warrick County	52,383	ND	ND	ND	0.09	0.08	ND	ND	ND	ND	0.015	0.084
IN	Wayne County	71,097	ND	ND	ND	ND	ND	24	47	ND	ND	0.006	0.031
IA	Black Hawk County	128,012	ND	ND	ND	ND	ND	31	71	11.6	29	ND	ND
IA	Bremer County	23,325	ND	ND	ND	0.09	0.08	ND	ND	ND	ND	ND	ND
IA	Cerro Gordo County	46,447	ND	ND	ND	ND	ND	35	138	10.6	28	0.003	0.053
IA	Clinton County	50,149	ND	ND	ND	0.09	0.08	24	70	12.0	29	0.005	0.028
IA	Delaware County	18,404	ND	ND	ND	ND	ND	IN	46	ND	ND	ND	ND
IA	Emmet County	11,027	ND	ND	ND	ND	ND	17	39	IN	IN	ND	ND
IA	Harrison County	15,666	ND	ND	ND	0.09	0.08	ND	ND	ND	ND	ND	ND
IA	Johnson County	111,006	ND	ND	ND	ND	ND	ND	ND	10.9	28	ND	ND
IA	Lee County	38,052	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.002	0.011
IA	Linn County	191,701	2	ND	0.005	0.08	0.08	IN	60	10.7	29	0.003	0.037
IA	Muscatine County	41,722	ND	ND	ND	ND	ND	25	119	IN	IN	0.009	0.084
IA	Palo Alto County	10,147	ND	ND	ND	0.08	0.07	IN	IN	ND	ND	ND	ND
IA	Polk County	374,601	5	ND	ND	0.07	0.06	31	134	10.8	28	ND	ND
IA	Pottawattamie County	87,704	ND	ND	ND	ND	ND	23	39	9.9	27	ND	ND
IA	Scott County	158,668	ND	ND	IN	0.09	0.08	41	141	12.7	30	0.003	0.014
IA	Story County	79,981	ND	ND	ND	0.08	0.07	ND	ND	9.8	27	ND	ND
IA	Van Buren County	7,809	ND	ND	ND	0.08	0.07	ND	ND	9.7	27	0.001	0.005
IA	Warren County	40,671	ND	ND	ND	0.08	0.07	ND	ND	ND	ND	ND	ND
IA	Woodbury County	103,877	ND	ND	ND	ND	ND	25	76	9.5	31	ND	ND
KS	Ford County	32,458	ND	ND	ND	ND	ND	22	49	ND	ND	ND	ND
KS	Johnson County	451,086	ND	ND	ND	ND	ND	ND	ND	11.2	26	ND	ND
KS	Linn County	9,570	2	ND	0.004	0.11	0.08	ND	ND	11.3	29	0.001	0.004
KS	Montgomery County	36,252	ND	ND	ND	ND	ND	24	75	ND	ND	0.006	0.044
KS	Neosho County	16,997	ND	ND	ND	ND	ND	26	63	ND	ND	ND	ND
KS	Sedgwick County	452,869	6	ND	ND	0.09	0.08	26	87	12.7	29	ND	ND

Table A-14. Maximum Air Quality Concentrations by County, 2000 (continued)

State	County	2000 Population	CO 8-hr (ppm)	Pb QMax (μg/m³)	NO_2 AM (ppm)	O_3 1-hr (ppm)	O_3 8-hr (ppm)	PM_{10} Wtd AM (μg/m³)	PM_{10} 24-hr (μg/m³)	$PM_{2.5}$ Wtd AM (μg/m³)	$PM_{2.5}$ 24-hr (μg/m³)	SO_2 AM (ppm)	SO_2 24-hr (ppm)
KS	Shawnee County	169,871	ND	ND	ND	ND	ND	20	49	10.8	23	ND	ND
KS	Sherman County	6,760	ND	ND	ND	ND	ND	25	60	ND	ND	ND	ND
KS	Sumner County	25,946	2	ND	IN	0.09	0.08	ND	ND	10.6	23	0.001	0.002
KS	Trego County	3,319	ND	ND	ND	0.09	0.08	ND	ND	ND	ND	ND	ND
KS	Wyandotte County	157,882	5	ND	0.017	0.11	**0.09**	37	64	13.3	32	0.002	0.012
KY	Bell County	30,060	3	ND	ND	0.11	**0.09**	IN	54	IN	IN	ND	ND
KY	Boone County	85,991	ND	ND	ND	0.11	0.08	ND	ND	ND	ND	ND	ND
KY	Boyd County	49,752	1	ND	0.015	0.09	0.08	32	80	IN	IN	0.007	0.020
KY	Bullitt County	61,236	ND	ND	0.013	0.10	0.08	IN	68	IN	IN	ND	ND
KY	Campbell County	88,616	ND	ND	0.015	0.11	**0.09**	IN	IN	IN	IN	0.007	0.040
KY	Carter County	26,889	ND	ND	ND	0.09	0.08	ND	ND	IN	IN	ND	ND
KY	Christian County	72,265	ND	ND	ND	0.10	0.08	ND	ND	IN	IN	ND	ND
KY	Daviess County	91,545	1	ND	0.011	0.08	0.07	20	64	IN	IN	0.005	0.018
KY	Edmonson County	11,644	ND	ND	ND	0.10	**0.09**	ND	ND	ND	ND	ND	ND
KY	Fayette County	260,512	2	ND	0.013	0.09	0.08	21	49	IN	IN	0.005	0.020
KY	Franklin County	47,687	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
KY	Graves County	37,028	ND	ND	ND	0.10	0.08	ND	ND	ND	ND	ND	ND
KY	Greenup County	36,891	ND	ND	ND	0.09	0.08	ND	ND	ND	ND	0.007	0.024
KY	Hancock County	8,392	ND	ND	ND	0.09	0.08	ND	ND	ND	ND	0.005	0.018
KY	Hardin County	94,174	ND	ND	ND	0.09	0.08	IN	IN	IN	IN	ND	ND
KY	Harlan County	33,202	ND	ND	ND	ND	ND	24	48	ND	ND	ND	ND
KY	Henderson County	44,829	2	ND	0.016	0.09	0.08	IN	48	IN	IN	0.006	0.034
KY	Jefferson County	693,604	4	ND	0.013	0.11	**0.09**	31	84	**17.9**	IN	0.008	0.036
KY	Jessamine County	39,041	ND	ND	ND	0.08	0.08	ND	ND	ND	ND	ND	ND
KY	Kenton County	151,464	2	ND	0.018	0.11	**0.09**	19	50	IN	IN	ND	ND
KY	Livingston County	9,804	ND	ND	ND	0.10	0.08	IN	IN	ND	ND	0.005	0.017
KY	McCracken County	65,514	3	ND	0.010	0.10	0.08	21	74	IN	IN	0.002	0.014
KY	McLean County	9,938	ND	ND	ND	0.09	0.08	ND	ND	ND	ND	ND	ND
KY	Madison County	70,872	ND	ND	ND	ND	ND	IN	43	IN	IN	ND	ND
KY	Marshall County	30,125	ND	ND	ND	ND	ND	IN	IN	ND	ND	ND	ND
KY	Oldham County	46,178	ND	ND	ND	0.11	**0.09**	ND	ND	ND	ND	ND	ND
KY	Perry County	29,390	ND	ND	ND	0.09	0.07	IN	IN	IN	IN	ND	ND
KY	Pike County	68,736	ND	ND	ND	0.09	0.08	IN	43	IN	IN	ND	ND
KY	Pulaski County	56,217	ND	ND	ND	0.10	**0.09**	25	50	ND	ND	ND	ND
KY	Scott County	33,061	ND	ND	ND	0.08	0.07	ND	ND	ND	ND	ND	ND
KY	Simpson County	16,405	ND	ND	ND	0.10	**0.09**	ND	ND	ND	ND	ND	ND
KY	Trigg County	12,597	ND	ND	ND	0.09	0.08	ND	ND	ND	ND	ND	ND
KY	Warren County	92,522	ND	ND	0.010	0.10	**0.09**	19	47	IN	IN	ND	ND
KY	Whitley County	35,865	ND	ND	ND	ND	ND	25	57	ND	ND	ND	ND
LA	Ascension Parish	76,627	ND	ND	ND	**0.13**	**0.10**	ND	ND	ND	ND	ND	ND
LA	Beauregard Parish	32,986	ND	ND	IN	**0.13**	0.08	ND	ND	ND	ND	ND	ND
LA	Bossier Parish	98,310	ND	ND	ND	**0.13**	**0.09**	ND	ND	ND	ND	0.002	0.006
LA	Caddo Parish	252,161	ND	ND	ND	0.11	**0.09**	24	51	13.8	31	ND	ND
LA	Calcasieu Parish	183,577	ND	ND	0.005	**0.13**	**0.09**	ND	ND	13.1	34	0.004	0.013
LA	Concordia Parish	20,247	ND	ND	ND	ND	ND	ND	ND	12.3	27	ND	ND
LA	East Baton Rouge Parish	412,852	4	ND	0.017	**0.14**	**0.10**	IN	53	15.0	35	0.004	0.015
LA	Grant Parish	18,698	ND	ND	ND	0.10	0.08	ND	ND	ND	ND	ND	ND
LA	Iberville Parish	33,320	ND	ND	0.010	**0.13**	**0.10**	ND	ND	IN	IN	ND	ND
LA	Jefferson Parish	455,466	ND	ND	0.011	0.12	**0.10**	ND	ND	13.5	35	ND	ND
LA	Lafayette Parish	190,503	ND	ND	ND	0.12	**0.09**	ND	ND	13.0	33	ND	ND
LA	Lafourche Parish	89,974	ND	ND	ND	0.12	**0.09**	ND	ND	ND	ND	ND	ND
LA	Livingston Parish	91,814	ND	ND	0.005	**0.13**	**0.10**	ND	ND	ND	ND	ND	ND
LA	Orleans Parish	484,674	4	ND	0.019	0.11	0.08	IN	44	14.1	37	ND	ND
LA	Ouachita Parish	147,250	ND	ND	ND	0.10	0.08	ND	ND	13.3	27	0.002	0.003
LA	Pointe Coupee Parish	22,763	ND	ND	IN	0.11	0.08	ND	ND	ND	ND	ND	ND
LA	Rapides Parish	126,337	ND	ND	ND	ND	ND	ND	ND	13.3	30	ND	ND
LA	St. Bernard Parish	67,229	ND	ND	ND	0.11	**0.09**	ND	ND	13.1	35	0.005	0.020

Table A-14. Maximum Air Quality Concentrations by County, 2000 (continued)

State	County	CO 2000 Population	Pb 8-hr (ppm)	NO_2 QMax ($\mu g/m^3$)	O_3 AM (ppm)	O_3 1-hr (ppm)	PM_{10} 8-hr (ppm)	PM_{10} Wtd AM ($\mu g/m^3$)	$PM_{2.5}$ 24-hr ($\mu g/m^3$)	$PM_{2.5}$ Wtd AM ($\mu g/m^3$)	SO_2 24-hr ($\mu g/m^3$)	SO_2 AM (ppm)	24-hr (ppm)
LA	St. Charles Parish	48,072	ND	ND	ND	0.12	**0.09**	IN	57	ND	ND	ND	ND
LA	St. James Parish	21,216	ND	ND	IN	0.12	**0.09**	ND	ND	ND	ND	ND	ND
LA	St. John the Baptist Parish	43,044	ND	0.12	ND	0.12	**0.09**	ND	ND	ND	ND	ND	ND
LA	St. Mary Parish	53,500	ND	ND	ND	0.12	**0.09**	ND	ND	ND	ND	ND	ND
LA	Tangipahoa Parish	100,588	ND	ND	ND	ND	ND	ND	ND	14.0	35	ND	ND
LA	Terrebonne Parish	104,503	ND	ND	ND	ND	ND	ND	ND	12.4	29	ND	ND
LA	West Baton Rouge Parish	21,601	ND	ND	0.017	0.12	**0.09**	IN	68	14.2	36	0.006	0.031
ME	Androscoggin County	103,793	ND	ND	ND	ND	ND	IN	36	9.6	26	0.004	0.018
ME	Aroostook County	73,938	ND	ND	ND	ND	ND	24	87	10.4	24	ND	ND
ME	Cumberland County	265,612	ND	ND	ND	0.08	0.07	27	74	11.0	35	0.005	0.018
ME	Franklin County	29,467	ND	ND	ND	ND	ND	IN	29	ND	ND	ND	ND
ME	Hancock County	51,791	ND	ND	IN	0.10	0.08	ND	ND	5.6	14	ND	ND
ME	Kennebec County	117,114	ND	ND	ND	0.08	0.06	IN	IN	9.6	31	ND	ND
ME	Knox County	39,618	ND	ND	ND	0.09	0.07	IN	32	IN	IN	ND	ND
ME	Oxford County	54,755	ND	ND	ND	0.06	0.05	IN	31	IN	IN	0.003	0.013
ME	Penobscot County	144,919	ND	ND	ND	IN	IN	17	37	9.0	24	ND	ND
ME	Piscataquis County	17,235	ND	ND	ND	0.07	0.06	ND	ND	ND	ND	ND	ND
ME	Sagadahoc County	35,214	ND	ND	ND	0.09	0.08	ND	ND	ND	ND	ND	ND
ME	York County	186,742	ND	ND	0.010	0.09	0.07	ND	ND	9.4	24	ND	ND
MD	Anne Arundel County	489,656	ND	ND	IN	0.12	**0.10**	25	48	**16.1**	IN	0.006	0.024
MD	Baltimore County	754,292	ND	ND	0.017	0.11	0.08	15	33	IN	IN	ND	ND
MD	Calvert County	74,563	ND	ND	ND	0.11	**0.09**	ND	ND	ND	ND	ND	ND
MD	Carroll County	150,897	ND	ND	ND	0.11	**0.09**	ND	ND	ND	ND	ND	ND
MD	Cecil County	85,951	ND	ND	ND	**0.13**	**0.11**	IN	27	14.1	25	ND	ND
MD	Charles County	120,546	ND	ND	ND	0.11	**0.09**	ND	ND	ND	ND	ND	ND
MD	Frederick County	195,277	ND	ND	ND	0.11	**0.09**	ND	ND	ND	ND	ND	ND
MD	Harford County	218,590	ND	ND	IN	0.11	**0.09**	ND	ND	**15.5**	IN	ND	ND
MD	Kent County	19,197	ND	ND	ND	**0.13**	**0.11**	ND	ND	ND	ND	ND	ND
MD	Montgomery County	873,341	ND	ND	ND	0.09	0.08	ND	ND	14.3	25	ND	ND
MD	Prince George's County	801,515	ND	ND	ND	**0.13**	**0.09**	24	56	**17.1**	IN	ND	ND
MD	Washington County	131,923	ND	ND	ND	0.10	0.08	ND	ND	**15.6**	29	ND	ND
MD	Wicomico County	84,644	ND	ND	ND	ND	ND	13	29	ND	ND	ND	ND
MD	Baltimore city	651,154	3	0.01	0.024	ND	ND	29	75	**19.7**	IN	ND	ND
MA	Barnstable County	222,230	ND	ND	IN	0.11	0.08	ND	ND	ND	ND	ND	ND
MA	Berkshire County	134,953	ND	ND	ND	IN	IN	ND	ND	IN	IN	ND	ND
MA	Bristol County	534,678	ND	ND	0.007	0.10	0.08	ND	ND	11.7	29	0.005	0.042
MA	Essex County	723,419	ND	ND	0.011	0.09	0.07	ND	ND	IN	IN	0.004	0.020
MA	Hampden County	456,228	4	ND	0.026	0.10	0.08	28	57	**15.9**	37	0.005	0.023
MA	Hampshire County	152,251	ND	ND	0.006	0.10	0.08	11	25	IN	IN	0.002	0.015
MA	Middlesex County	1,465,396	3	ND	ND	0.09	0.08	ND	ND	IN	IN	IN	0.034
MA	Norfolk County	650,308	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
MA	Plymouth County	472,822	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
MA	Suffolk County	689,807	2	0.02	0.029	0.09	0.07	29	59	**15.8**	IN	0.006	0.035
MA	Worcester County	750,963	3	ND	0.018	0.10	0.08	19	54	12.1	33	0.006	0.019
MI	Allegan County	105,665	ND	ND	ND	0.12	0.08	ND	ND	11.7	32	ND	ND
MI	Alpena County	31,314	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
MI	Bay County	110,157	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
MI	Benzie County	15,998	ND	ND	ND	0.09	0.08	ND	ND	ND	ND	ND	ND
MI	Berrien County	162,453	ND	ND	ND	0.11	0.08	ND	ND	12.1	30	ND	ND
MI	Calhoun County	137,985	ND	ND	ND	ND	ND	IN	IN	ND	ND	ND	ND
MI	Cass County	51,104	ND	ND	ND	0.10	0.08	ND	ND	ND	ND	ND	ND
MI	Clinton County	64,753	ND	ND	ND	0.09	0.07	ND	ND	ND	ND	ND	ND
MI	Delta County	38,520	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.002	0.010
MI	Genesee County	436,141	ND	0.01	ND	0.09	0.07	19	36	12.9	32	0.004	0.015
MI	Grand Traverse County	77,654	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
MI	Huron County	36,079	ND	ND	ND	0.09	0.07	ND	ND	ND	ND	ND	ND

Table A-14. Maximum Air Quality Concentrations by County, 2000 (continued)

State	County	CO 2000 Population	Pb 8-hr (ppm)	NO_2 QMax ($\mu g/m^3$)	O_3 AM (ppm)	O_3 1-hr (ppm)	PM_{10} 8-hr (ppm)	PM_{10} Wtd AM ($\mu g/m^3$)	$PM_{2.5}$ 24-hr ($\mu g/m^3$)	$PM_{2.5}$ Wtd AM ($\mu g/m^3$)	SO_2 24-hr ($\mu g/m^3$)	SO_2 AM (ppm)	24-hr (ppm)
MI	Ingham County	279,320	ND	ND	IN	0.09	0.08	ND	ND	13.6	38	ND	ND
MI	Kalamazoo County	238,603	ND	ND	ND	0.09	0.07	ND	ND	**15.1**	37	ND	ND
MI	Kent County	574,335	3	0.00	ND	0.11	0.07	21	49	13.8	35	0.002	0.010
MI	Lenawee County	98,890	ND	ND	ND	0.09	0.08	ND	ND	ND	ND	ND	ND
MI	Macomb County	788,149	1	ND	ND	0.09	0.08	ND	ND	13.4	33	0.003	0.014
MI	Mason County	28,274	ND	ND	ND	0.12	0.08	ND	ND	ND	ND	ND	ND
MI	Missaukee County	14,478	ND	0.00	0.004	0.08	0.07	ND	ND	ND	ND	ND	ND
MI	Monroe County	145,945	ND	ND	ND	ND	ND	ND	ND	**15.2**	37	ND	ND
MI	Muskegon County	170,200	ND	ND	ND	0.12	0.08	ND	ND	11.9	35	ND	ND
MI	Oakland County	1,194,156	3	ND	ND	0.09	0.08	ND	ND	**15.4**	IN	ND	ND
MI	Ottawa County	238,314	ND	ND	ND	0.11	0.08	IN	40	13.2	34	ND	ND
MI	Saginaw County	210,039	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
MI	St. Clair County	164,235	ND	ND	ND	0.10	0.08	ND	ND	IN	IN	0.006	0.039
MI	Washtenaw County	322,895	ND	0.00	ND	0.09	0.08	ND	ND	IN	IN	ND	ND
MI	Wayne County	2,061,162	5	0.04	0.024	0.10	0.08	43	113	**20.1**	45	0.008	0.043
MN	Anoka County	298,084	2	ND	ND	0.09	0.07	ND	ND	ND	ND	ND	ND
MN	Crow Wing County	55,099	ND	ND	ND	ND	ND	IN	IN	IN	IN	ND	ND
MN	Dakota County	355,904	2	0.40	0.012	0.08	0.07	IN	IN	IN	IN	0.003	0.016
MN	Douglas County	32,821	ND	ND	ND	ND	ND	IN	IN	IN	IN	ND	ND
MN	Freeborn County	32,584	ND	ND	ND	ND	ND	IN	IN	IN	IN	ND	ND
MN	Hennepin County	1,116,200	3	0.01	0.022	ND	ND	31	103	IN	IN	0.003	0.023
MN	Itasca County	43,992	ND	ND	ND	ND	ND	IN	IN	IN	IN	ND	ND
MN	Kandiyohi County	41,203	ND	ND	ND	ND	ND	IN	IN	IN	IN	ND	ND
MN	Koochiching County	14,355	ND	ND	ND	ND	ND	ND	ND	ND	ND	IN	0.001
MN	Lake County	11,058	ND	ND	ND	0.07	0.06	IN	IN	IN	IN	ND	ND
MN	McLeod County	34,898	ND	ND	ND	ND	ND	IN	IN	IN	IN	ND	ND
MN	Mille Lacs County	22,330	ND	ND	ND	0.07	0.07	12	26	IN	IN	ND	ND
MN	Nicollet County	29,771	ND	ND	ND	ND	ND	IN	IN	IN	IN	ND	ND
MN	Olmsted County	124,277	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
MN	Otter Tail County	57,159	ND	ND	ND	ND	ND	IN	IN	IN	IN	ND	ND
MN	Pine County	26,530	2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MN	Ramsey County	511,035	5	ND	0.017	ND	ND	36	74	IN	IN	0.002	0.009
MN	St. Louis County	200,528	2	ND	ND	0.07	0.07	29	69	IN	IN	ND	ND
MN	Scott County	89,498	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
MN	Stearns County	133,166	3	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
MN	Washington County	201,130	ND	ND	ND	0.09	0.07	21	42	IN	IN	0.002	0.011
MN	Wright County	89,986	ND	ND	ND	ND	ND	IN	IN	IN	IN	ND	ND
MS	Adams County	34,340	ND	ND	ND	0.10	**0.09**	ND	ND	IN	IN	ND	ND
MS	Bolivar County	40,633	ND	ND	ND	0.09	0.08	ND	ND	IN	IN	ND	ND
MS	DeSoto County	107,199	ND	ND	0.010	0.12	**0.09**	ND	ND	IN	IN	ND	ND
MS	Forrest County	72,604	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
MS	Hancock County	42,967	ND	ND	0.005	**0.14**	**0.09**	ND	ND	IN	IN	ND	ND
MS	Harrison County	189,601	ND	ND	ND	0.12	**0.09**	ND	ND	IN	IN	0.003	0.033
MS	Hinds County	250,800	3	ND	ND	0.10	0.08	24	64	**15.6**	35	0.002	0.006
MS	Jackson County	131,420	ND	ND	ND	0.11	**0.09**	16	35	IN	IN	0.002	0.010
MS	Jones County	64,958	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
MS	Lauderdale County	78,161	ND	ND	ND	0.10	0.08	ND	ND	IN	IN	ND	ND
MS	Lee County	75,755	ND	ND	ND	0.10	0.08	17	34	IN	IN	ND	ND
MS	Lowndes County	61,586	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
MS	Madison County	74,674	ND	ND	ND	0.09	0.08	ND	ND	ND	ND	ND	ND
MS	Pearl River County	48,621	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
MS	Rankin County	115,327	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
MS	Scott County	28,423	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
MS	Warren County	49,644	ND	ND	ND	0.10	0.08	ND	ND	IN	IN	ND	ND
MO	Buchanan County	85,998	ND	ND	ND	ND	ND	31	80	11.8	27	IN	0.021
MO	Cass County	82,092	ND	ND	ND	0.12	0.08	ND	ND	10.9	25	ND	ND

Table A-14. Maximum Air Quality Concentrations by County, 2000 (continued)

State	County	CO 2000 Population	Pb 8-hr (ppm)	NO_2 QMax (μg/m³)	O_3 AM (ppm)	O_3 1-hr (ppm)	PM_{10} 8-hr (ppm)	PM_{10} Wtd AM (μg/m³)	$PM_{2.5}$ 24-hr (μg/m³)	$PM_{2.5}$ Wtd AM (μg/m³)	SO_2 24-hr (μg/m³)	SO_2 AM (ppm)	24-hr (ppm)
MO	Cedar County	13,733	ND	ND	IN	0.11	0.09	ND	ND	IN	IN	ND	ND
MO	Clay County	184,006	4	ND	0.014	0.12	**0.09**	ND	ND	13.1	29	0.002	0.007
MO	Greene County	240,391	3	ND	0.012	0.09	0.08	18	35	12.3	27	0.005	0.077
MO	Holt County	5,351	ND	0.00	ND	ND	ND	ND	ND	ND	ND	ND	ND
MO	Howell County	37,238	ND	ND	ND	ND	ND	ND	ND	13.4	28	ND	ND
MO	Iron County	10,697	ND	1.00	ND	ND	ND	ND	ND	ND	ND	0.008	0.099
MO	Jackson County	654,880	5	0.01	ND	ND	ND	29	56	13.4	30	0.004	0.039
MO	Jasper County	104,686	ND	ND	ND	ND	ND	IN	126	13.2	26	ND	ND
MO	Jefferson County	198,099	ND	**6.86**	ND	0.10	0.08	ND	ND	IN	IN	0.005	0.042
MO	Lincoln County	38,944	ND	ND	ND	ND	ND	17	51	ND	ND	ND	ND
MO	Mercer County	3,757	ND	ND	0.004	ND	ND	ND	ND	ND	ND	ND	ND
MO	Monroe County	9,311	ND	ND	ND	0.09	0.08	12	37	10.9	30	0.003	0.013
MO	Platte County	73,781	ND	ND	0.009	0.12	**0.09**	ND	ND	ND	ND	0.002	0.008
MO	St. Charles County	283,883	ND	ND	0.009	0.12	**0.09**	ND	ND	14.9	34	0.004	0.017
MO	Ste. Genevieve County	17,842	ND	ND	IN	0.12	**0.09**	ND	ND	**15.1**	33	ND	ND
MO	St. Louis County	1,016,315	3	0.01	0.021	0.12	**0.09**	19	50	14.8	33	0.005	0.026
MO	St. Louis city	348,189	4	ND	0.026	0.11	**0.09**	39	92	**16.4**	43	0.007	0.043
MT	Big Horn County	12,671	ND	ND	ND	ND	ND	IN	106*	ND	ND	ND	ND
MT	Cascade County	80,357	4	ND	ND	ND	ND	ND	ND	IN	IN	IN	0.008
MT	Flathead County	74,471	4	ND	ND	IN	IN	24	98	IN	IN	ND	ND
MT	Gallatin County	67,831	5	ND	ND	ND	ND	IN	65	IN	IN	ND	ND
MT	Glacier County	13,247	ND	ND	ND	ND	ND	20	101	ND	ND	ND	ND
MT	Jefferson County	10,049	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.005	0.035
MT	Lake County	26,507	ND	ND	ND	ND	ND	21	86	12.1	33	ND	ND
MT	Lewis and Clark County	55,716	ND	0.98	ND	ND	ND	20	58	IN	IN	0.006	0.028
MT	Lincoln County	18,837	ND	ND	ND	ND	ND	26	69	**17.1**	IN	ND	ND
MT	Missoula County	95,802	3	ND	ND	ND	ND	18	58	IN	IN	ND	ND
MT	Park County	15,694	ND	ND	ND	ND	ND	IN	17*	ND	ND	ND	ND
MT	Ravalli County	36,070	ND	ND	ND	ND	ND	19	60	IN	IN	ND	ND
MT	Roosevelt County	10,620	ND	ND	ND	ND	ND	IN	IN	ND	ND	ND	ND
MT	Rosebud County	9,383	ND	ND	IN	ND	ND	29	124	IN	IN	IN	0.002
MT	Sanders County	10,227	ND	ND	ND	ND	ND	IN	41	6.9	18	ND	ND
MT	Silver Bow County	34,606	5	ND	ND	ND	ND	20	66	IN	IN	ND	ND
MT	Yellowstone County	129,352	5	ND	ND	ND	ND	18	43	8.1	25	0.006	0.026
NE	Cass County	24,334	ND	ND	ND	ND	ND	IN	118	IN	IN	ND	ND
NE	Cedar County	9,615	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
NE	Cherry County	6,148	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
NE	Dawson County	24,365	ND	ND	ND	ND	ND	IN	125	ND	ND	ND	ND
NE	Deuel County	2,098	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
NE	Douglas County	463,585	3	0.08	ND	0.08	0.07	48	124	11.5	28	0.001	0.016
NE	Hall County	53,534	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
NE	Lancaster County	250,291	3	ND	ND	0.07	0.06	ND	ND	IN	IN	ND	ND
NE	Lincoln County	34,632	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
NE	Sarpy County	122,595	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
NE	Scotts Bluff County	36,951	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
NE	Washington County	18,780	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
NV	Clark County	1,375,765	7	ND	ND	0.09	0.08	48	188	10.8	32	ND	ND
NV	Douglas County	41,259	4	ND	ND	0.09	0.07	9	19	IN	IN	ND	ND
NV	Elko County	45,291	ND	ND	ND	ND	ND	IN	91	ND	ND	ND	ND
NV	Lander County	5,794	ND	ND	ND	ND	ND	22	91	ND	ND	ND	ND
NV	Washoe County	339,486	5	ND	0.008	0.09	0.07	42	96	9.0	31	ND	ND
NV	White Pine County	9,181	ND	ND	ND	0.08	0.08	ND	ND	ND	ND	ND	ND
NV	Carson City	52,457	4	ND	ND	0.08	0.07	ND	ND	ND	ND	ND	ND
NH	Carroll County	43,666	ND	ND	ND	0.07	0.06	ND	ND	ND	ND	ND	ND
NH	Cheshire County	73,825	ND	ND	ND	0.08	0.06	19	41	IN	IN	0.006	0.022
NH	Coos County	33,111	ND	ND	ND	IN	IN	28	72	ND	ND	0.005	0.030

Table A-14. Maximum Air Quality Concentrations by County, 2000 (continued)

State	County	CO 2000 Population	Pb 8-hr (ppm)	NO$_2$ QMax (µg/m^3)	O$_3$ AM (ppm)	O$_3$ 1-hr (ppm)	PM$_{10}$ 8-hr (ppm)	PM$_{10}$ Wtd AM (µg/m^3)	PM$_{2.5}$ 24-hr (µg/m^3)	PM$_{2.5}$ Wtd AM (µg/m^3)	SO$_2$ 24-hr (µg/m^3)	SO$_2$ AM (ppm)	24-hr (ppm)
NH	Grafton County	81,743	ND	ND	ND	0.08	0.06	ND	ND	ND	ND	ND	ND
NH	Hillsborough County	380,841	4	ND	0.011	0.09	0.07	15	39	IN	IN	0.005	0.022
NH	Merrimack County	136,225	ND	ND	ND	0.08	0.07	IN	26	ND	ND	0.005	0.044
NH	Rockingham County	277,359	ND	ND	0.006	0.08	0.07	IN	33	IN	IN	0.003	0.013
NH	Strafford County	112,233	ND	ND	ND	0.08	0.07	13	29	ND	ND	ND	ND
NH	Sullivan County	40,458	ND	ND	ND	0.08	0.07	IN	24	ND	ND	0.004	0.015
NJ	Atlantic County	252,552	ND	ND	ND	0.11	**0.09**	23	42	ND	ND	0.003	0.013
NJ	Bergen County	884,118	3	ND	ND	0.10	0.08	37	86	14.6	36	0.005	0.020
NJ	Burlington County	423,394	4	ND	ND	ND	ND	ND	ND	ND	ND	0.004	0.016
NJ	Camden County	508,932	4	0.01	0.021	**0.13**	**0.10**	29	76	**15.5**	IN	0.006	0.020
NJ	Cumberland County	146,438	ND	ND	ND	0.12	**0.09**	ND	ND	ND	ND	0.004	0.017
NJ	Essex County	793,633	ND	ND	0.029	ND	ND	ND	ND	**15.6**	IN	ND	ND
NJ	Gloucester County	254,673	ND	ND	ND	0.12	**0.10**	ND	ND	**15.1**	34	0.005	0.021
NJ	Hudson County	608,975	5	ND	0.026	0.10	0.08	IN	63	**17.5**	**69**	0.008	0.025
NJ	Hunterdon County	121,989	ND	ND	ND	0.11	**0.09**	ND	ND	ND	ND	ND	ND
NJ	Mercer County	350,761	ND	ND	0.016	0.11	**0.10**	26	55	14.7	43	ND	ND
NJ	Middlesex County	750,162	3	0.15	0.019	0.11	**0.09**	ND	ND	IN	IN	0.005	0.018
NJ	Monmouth County	615,301	3	ND	ND	**0.13**	**0.10**	ND	ND	ND	ND	ND	ND
NJ	Morris County	470,212	3	ND	0.011	0.11	**0.09**	ND	ND	12.9	30	0.004	0.021
NJ	Ocean County	510,916	ND	ND	ND	**0.14**	**0.11**	ND	ND	IN	IN	ND	ND
NJ	Passaic County	489,049	ND	ND	ND	0.10	0.08	ND	ND	IN	IN	ND	ND
NJ	Union County	522,541	5	ND	0.041	ND	ND	35	108	**18.7**	47	0.009	0.025
NJ	Warren County	102,437	ND	ND	ND	ND	ND	ND	ND	13.9	38	ND	ND
NM	Bernalillo County	556,678	4	ND	0.017	0.09	0.08	25	122	7.9	19	ND	ND
NM	Chaves County	61,382	ND	ND	ND	ND	ND	20	41	6.8	15	ND	ND
NM	Dona Ana County	174,682	4	ND	0.012	0.12	0.08	42	96	10.5	31	0.001	0.003
NM	Eddy County	51,658	ND	ND	0.006	0.08	0.07	ND	ND	ND	ND	0.001	0.007
NM	Grant County	31,002	ND	ND	ND	ND	ND	20	43	5.5	11	0.004	0.024
NM	Hidalgo County	5,932	ND	ND	ND	ND	ND	IN	38	ND	ND	0.001	0.002
NM	Lea County	55,511	ND	ND	ND	ND	ND	21	40	6.8	14	ND	ND
NM	Luna County	25,016	ND	ND	ND	ND	ND	IN	35	ND	ND	ND	ND
NM	Otero County	62,298	ND	ND	ND	ND	ND	20	57	ND	ND	ND	ND
NM	Sandoval County	89,908	1	ND	0.010	0.09	0.08	17	36	6.3	10	ND	ND
NM	San Juan County	113,801	2	ND	0.011	0.09	0.08	16	27	6.1	13	0.008	0.032
NM	Santa Fe County	129,292	2	ND	ND	ND	ND	11	28	5.2	10	ND	ND
NM	Taos County	29,979	ND	ND	ND	ND	ND	10	36	ND	ND	ND	ND
NM	Valencia County	66,152	ND	ND	ND	0.08	0.07	ND	ND	ND	ND	ND	ND
NY	Albany County	294,565	1	ND	ND	0.08	0.07	ND	ND	12.3	30	0.004	0.020
NY	Bronx County	1,332,650	4	ND	0.032	0.10	0.07	23	57	**16.6**	44	0.011	0.042
NY	Broome County	200,536	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
NY	Chautauqua County	139,750	ND	ND	ND	0.11	**0.09**	14	32	IN	IN	0.008	0.065
NY	Chemung County	91,070	ND	ND	ND	0.09	0.07	ND	ND	ND	ND	0.003	0.012
NY	Columbia County	63,094	ND	ND	ND	ND	ND	IN	29	ND	ND	ND	ND
NY	Dutchess County	280,150	ND	ND	ND	0.11	0.08	ND	ND	11.3	33	ND	ND
NY	Erie County	950,265	2	ND	0.022	0.11	**0.09**	ND	ND	**16.1**	33	0.010	0.051
NY	Essex County	38,851	ND	ND	ND	0.09	0.08	IN	21	5.5	18	0.002	0.006
NY	Hamilton County	5,379	ND	ND	ND	0.09	0.07	ND	ND	ND	ND	0.002	0.008
NY	Herkimer County	64,427	ND	ND	ND	0.08	0.07	9	23	ND	ND	0.001	0.007
NY	Jefferson County	111,738	ND	ND	ND	0.08	0.07	ND	ND	ND	ND	ND	ND
NY	Kings County	2,465,326	4	ND	ND	ND	ND	IN	IN	**16.2**	44	IN	0.000
NY	Madison County	69,441	ND	ND	ND	0.08	0.07	ND	ND	ND	ND	0.002	0.012
NY	Monroe County	735,343	3	ND	ND	0.08	0.07	ND	ND	11.8	28	0.006	0.021
NY	Nassau County	1,334,544	3	ND	0.024	ND	ND	17	38	12.2	36	0.006	0.025
NY	New York County	1,537,195	4	ND	0.038	0.07	0.06	22	49	**18.4**	48	0.013	0.046
NY	Niagara County	219,846	2	0.02	ND	0.10	0.08	IN	31	IN	IN	0.005	0.017
NY	Oneida County	235,469	ND	ND	ND	0.08	0.07	ND	ND	11.8	34	ND	ND

Table A-14. Maximum Air Quality Concentrations by County, 2000 (continued)

State	County	CO 2000 Population	Pb 8-hr (ppm)	NO_2 QMax (µg/m³)	O_3 AM (ppm)	O_3 1-hr (ppm)	PM_{10} 8-hr (ppm)	PM_{10} Wtd AM (µg/m³)	$PM_{2.5}$ 24-hr (µg/m³)	$PM_{2.5}$ Wtd AM (µg/m³)	SO_2 24-hr (µg/m³)	SO_2 AM (ppm)	24-hr (ppm)
NY	Onondaga County	458,336	2	ND	ND	0.08	0.07	ND	ND	IN	IN	0.003	0.022
NY	Orange County	341,367	ND	0.18	ND	0.10	0.08	ND	ND	IN	IN	ND	ND
NY	Putnam County	95,745	ND	ND	ND	0.10	0.08	ND	ND	ND	ND	0.003	0.015
NY	Queens County	2,229,379	3	ND	0.030	0.11	0.08	ND	ND	14.1	43	0.007	0.025
NY	Rensselaer County	152,538	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.002	0.010
NY	Richmond County	443,728	ND	0.02	ND	0.12	**0.09**	IN	46	14.3	42	IN	0.028
NY	St. Lawrence County	111,931	ND	ND	ND	ND	ND	ND	ND	7.3	22	ND	ND
NY	Saratoga County	200,635	ND	ND	ND	0.09	0.07	ND	ND	ND	ND	ND	ND
NY	Schenectady County	146,555	3	ND	ND	0.08	0.06	ND	ND	10.8	26	0.004	0.016
NY	Steuben County	98,726	ND	ND	ND	ND	ND	ND	ND	9.1	31	ND	ND
NY	Suffolk County	1,419,369	3	ND	0.017	**0.13**	**0.09**	ND	ND	IN	IN	0.007	0.023
NY	Ulster County	177,749	ND	ND	ND	0.09	0.08	10	29	ND	ND	0.002	0.009
NY	Wayne County	93,765	ND	ND	ND	0.09	0.07	ND	ND	ND	ND	ND	ND
NY	Westchester County	923,459	ND	ND	ND	0.11	0.08	ND	ND	IN	IN	ND	ND
NC	Alamance County	130,800	ND	ND	ND	ND	ND	ND	ND	**15.4**	IN	ND	ND
NC	Alexander County	33,603	ND	ND	ND	0.11	**0.09**	ND	ND	ND	ND	ND	ND
NC	Avery County	17,167	ND	ND	ND	0.09	0.08	ND	ND	ND	ND	ND	ND
NC	Beaufort County	44,958	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.004	0.020
NC	Buncombe County	206,330	ND	ND	ND	0.11	**0.09**	18	38	**15.1**	IN	ND	ND
NC	Cabarrus County	131,063	ND	ND	ND	ND	ND	21	40	**16.5**	IN	ND	ND
NC	Caldwell County	77,415	ND	ND	ND	0.10	**0.09**	ND	ND	ND	ND	ND	ND
NC	Camden County	6,885	ND	ND	ND	0.08	0.07	ND	ND	ND	ND	ND	ND
NC	Caswell County	23,501	ND	ND	ND	0.12	**0.09**	ND	ND	14.9	46	ND	ND
NC	Catawba County	141,685	ND	ND	ND	ND	ND	22	42	**17.4**	38	ND	ND
NC	Chatham County	49,329	ND	ND	ND	0.10	0.08	ND	ND	13.3	32	ND	ND
NC	Cumberland County	302,963	4	ND	ND	0.11	**0.09**	IN	52	**16.2**	**67**	ND	ND
NC	Davidson County	147,246	ND	ND	ND	ND	ND	21	41	**17.8**	38	ND	ND
NC	Davie County	34,835	ND	ND	ND	0.11	**0.10**	ND	ND	ND	ND	0.004	0.018
NC	Duplin County	49,063	ND	ND	ND	0.10	0.08	ND	ND	13.1	32	ND	ND
NC	Durham County	223,314	1	ND	ND	0.12	**0.09**	23	43	**15.8**	40	ND	ND
NC	Edgecombe County	55,606	ND	ND	ND	0.11	**0.09**	20	41	14.7	35	ND	ND
NC	Forsyth County	306,067	4	ND	0.018	0.11	**0.09**	22	51	**16.5**	35	0.005	0.019
NC	Franklin County	47,260	ND	ND	ND	0.11	**0.09**	ND	ND	ND	ND	ND	ND
NC	Gaston County	190,365	ND	ND	ND	ND	ND	21	37	**16.0**	37	ND	ND
NC	Granville County	48,498	1	ND	ND	0.11	**0.09**	ND	ND	ND	ND	ND	ND
NC	Guilford County	421,048	3	ND	ND	0.12	**0.09**	24	44	**16.8**	37	ND	ND
NC	Harnett County	91,025	ND	ND	ND	ND	ND	28	52	ND	ND	ND	ND
NC	Haywood County	54,033	ND	ND	ND	0.10	**0.09**	26	47	14.8	33	ND	ND
NC	Henderson County	89,173	ND	ND	ND	ND	ND	23	44	ND	ND	ND	ND
NC	Jackson County	33,121	ND	ND	ND	0.10	**0.09**	ND	ND	IN	IN	ND	ND
NC	Johnston County	121,965	ND	ND	ND	0.12	0.08	ND	ND	ND	ND	ND	ND
NC	Lenoir County	59,648	ND	ND	ND	0.10	0.08	ND	ND	12.7	32	ND	ND
NC	Lincoln County	63,780	ND	ND	ND	0.11	**0.09**	ND	ND	ND	ND	0.004	0.018
NC	McDowell County	42,151	ND	ND	ND	ND	ND	22	45	**16.4**	39	ND	ND
NC	Martin County	25,593	ND	ND	ND	0.10	0.08	ND	ND	ND	ND	ND	ND
NC	Mecklenburg County	695,454	5	ND	0.018	**0.14**	**0.10**	31	62	**17.2**	34	0.004	0.017
NC	Mitchell County	15,687	ND	ND	ND	ND	ND	27	50	**16.3**	37	ND	ND
NC	Montgomery County	26,822	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
NC	New Hanover County	160,307	4	ND	ND	0.10	0.08	17	36	12.5	32	0.006	0.030
NC	Northampton County	22,086	ND	ND	ND	0.10	0.08	ND	ND	ND	ND	0.004	0.012
NC	Onslow County	150,355	ND	ND	ND	ND	ND	17	32	12.3	34	ND	ND
NC	Orange County	118,227	IN	ND	ND	ND	ND	ND	ND	14.4	30	ND	ND
NC	Pasquotank County	34,897	ND	ND	ND	ND	ND	17	34	IN	IN	ND	ND
NC	Person County	35,623	ND	ND	ND	0.10	0.08	ND	ND	ND	ND	ND	ND
NC	Pitt County	133,798	ND	ND	ND	0.11	0.08	19	36	13.9	41	0.003	0.007
NC	Robeson County	123,339	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND

Table A-14. Maximum Air Quality Concentrations by County, 2000 (continued)

State	County	CO 2000 Population	Pb 8-hr (ppm)	NO_2 QMax (µg/m^3)	O_3 AM (ppm)	O_3 1-hr (ppm)	PM_{10} 8-hr (ppm)	PM_{10} Wtd AM (µg/m^3)	$PM_{2.5}$ 24-hr (µg/m^3)	$PM_{2.5}$ Wtd AM (µg/m^3)	SO_2 24-hr (µg/m^3)	SO_2 AM (ppm)	24-hr (ppm)
NC	Rockingham County	91,928	ND	ND	ND	0.10	0.08	ND	ND	ND	ND	ND	ND
NC	Rowan County	130,340	1	ND	ND	0.12	**0.10**	ND	ND	ND	ND	ND	ND
NC	Swain County	12,968	ND	ND	ND	0.08	0.07	19	33	14.1	38	ND	ND
NC	Union County	123,677	ND	ND	ND	0.10	**0.09**	ND	ND	ND	ND	ND	ND
NC	Wake County	627,846	5	ND	ND	0.12	**0.09**	23	51	**16.5**	52	ND	ND
NC	Wayne County	113,329	ND	ND	ND	ND	ND	21	40	**15.8**	40	ND	ND
NC	Yancey County	17,774	ND	ND	ND	0.11	**0.09**	ND	ND	ND	ND	ND	ND
ND	Billings County	888	ND	ND	ND	0.07	0.06	ND	ND	IN	IN	0.001	0.004
ND	Burke County	2,242	ND	ND	0.003	ND	ND	IN	49	5.9	12	0.002	0.011
ND	Burleigh County	69,416	ND	ND	ND	ND	ND	ND	ND	6.6	14	ND	ND
ND	Cass County	123,138	ND	ND	0.007	0.07	0.06	17	39	8.2	29	0.001	0.003
ND	Dunn County	3,600	ND	ND	0.003	IN	IN	ND	ND	ND	ND	0.001	0.008
ND	Grand Forks County	66,109	ND	ND	ND	ND	ND	ND	ND	8.2	25	ND	ND
ND	McKenzie County	5,737	ND	ND	ND	ND	ND	6	17	ND	ND	0.002	0.011
ND	McLean County	9,311	ND	ND	ND	ND	ND	8	20	ND	ND	0.002	0.007
ND	Mercer County	8,644	ND	ND	0.004	0.06	0.05	ND	ND	6.2	12	0.003	0.016
ND	Morton County	25,303	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.006	0.053
ND	Oliver County	2,065	ND	ND	0.003	0.06	0.06	ND	ND	ND	ND	0.002	0.011
ND	Stark County	22,636	ND	ND	ND	ND	ND	ND	ND	5.4	10	ND	ND
ND	Steele County	2,258	ND	ND	0.003	0.07	0.06	ND	ND	6.8	21	0.001	0.002
ND	Williams County	19,761	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.003	0.020
OH	Adams County	27,330	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.007	0.029
OH	Allen County	108,473	ND	ND	ND	0.10	**0.09**	IN	42	ND	ND	0.003	0.015
OH	Ashtabula County	102,728	ND	ND	ND	0.11	0.08	ND	ND	ND	ND	0.005	0.021
OH	Athens County	62,223	ND	ND	ND	ND	ND	IN	39	IN	IN	ND	ND
OH	Belmont County	70,226	ND	ND	ND	ND	ND	28	62	ND	ND	0.010	0.043
OH	Butler County	332,807	ND	0.01	ND	0.10	0.08	32	69	**17.0**	38	0.006	0.023
OH	Clark County	144,742	ND	ND	ND	0.11	**0.09**	ND	ND	IN	IN	0.004	0.018
OH	Clermont County	177,977	ND	ND	ND	0.11	**0.09**	ND	ND	ND	ND	0.005	0.029
OH	Clinton County	40,543	ND	ND	ND	0.11	**0.10**	ND	ND	ND	ND	ND	ND
OH	Columbiana County	112,075	ND	ND	ND	ND	ND	IN	128	ND	ND	IN	0.037
OH	Cuyahoga County	1,393,978	8	0.20	0.023	0.10	0.08	43	122	**19.8**	46	0.007	0.035
OH	Delaware County	109,989	ND	ND	ND	0.10	0.08	ND	ND	ND	ND	ND	ND
OH	Franklin County	1,068,978	3	0.03	ND	0.11	0.08	34	73	**18.5**	IN	0.004	0.019
OH	Fulton County	42,084	ND	0.33	ND	ND	ND	ND	ND	ND	ND	ND	ND
OH	Geauga County	90,895	ND	ND	ND	0.11	**0.09**	ND	ND	ND	ND	ND	ND
OH	Greene County	147,886	ND	ND	ND	0.11	0.08	21	46	ND	ND	ND	ND
OH	Hamilton County	845,303	2	ND	0.022	0.11	**0.09**	32	70	**19.7**	44	0.007	0.031
OH	Hancock County	71,295	ND	ND	ND	ND	ND	IN	41	ND	ND	ND	ND
OH	Jefferson County	73,894	5	ND	ND	0.10	0.08	31	70	**19.1**	47	0.010	0.045
OH	Knox County	54,500	ND	ND	ND	0.10	**0.09**	ND	ND	ND	ND	ND	ND
OH	Lake County	227,511	1	ND	ND	0.11	0.08	21	46	13.8	40	0.009	0.040
OH	Lawrence County	62,319	ND	ND	ND	0.09	0.08	23	41	**17.0**	IN	0.005	0.025
OH	Licking County	145,491	ND	ND	ND	0.11	**0.09**	IN	IN	ND	ND	ND	ND
OH	Logan County	46,005	ND	0.24	ND	ND	ND	ND	ND	ND	ND	ND	ND
OH	Lorain County	284,664	ND	ND	ND	IN	IN	29	52	**15.1**	IN	0.003	0.021
OH	Lucas County	455,054	ND	ND	ND	0.10	0.08	23	60	IN	IN	0.005	0.017
OH	Madison County	40,213	ND	ND	ND	0.12	**0.09**	ND	ND	ND	ND	ND	ND
OH	Mahoning County	257,555	ND	ND	ND	0.10	0.08	27	55	**15.9**	35	0.007	0.024
OH	Medina County	151,095	ND	ND	ND	0.10	0.08	ND	ND	ND	ND	ND	ND
OH	Meigs County	23,072	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.006	0.034
OH	Miami County	98,868	ND	ND	ND	0.10	0.08	ND	ND	ND	ND	ND	ND
OH	Monroe County	15,180	ND	ND	ND	ND	ND	25	48	ND	ND	ND	ND
OH	Montgomery County	559,062	3	ND	ND	0.09	0.08	32	64	**18.0**	43	0.004	0.016
OH	Morgan County	14,897	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.006	0.040
OH	Ottawa County	40,985	ND	ND	ND	ND	ND	24	43	ND	ND	ND	ND

Table A-14. Maximum Air Quality Concentrations by County, 2000 (continued)

State	County	CO 2000 Population	Pb 8-hr (ppm)	NO_2 QMax (µg/m³)	O_3 AM (ppm)	O_3 1-hr (ppm)	PM_{10} 8-hr (ppm)	PM_{10} Wtd AM (µg/m³)	$PM_{2.5}$ 24-hr (µg/m³)	$PM_{2.5}$ Wtd AM (µg/m³)	SO_2 24-hr (µg/m³)	SO_2 AM (ppm)	24-hr (ppm)
OH	Portage County	152,061	ND	ND	ND	0.11	**0.09**	ND	ND	**15.6**	36	ND	ND
OH	Preble County	42,337	ND	ND	ND	0.09	0.07	ND	ND	IN	IN	ND	ND
OH	Richland County	128,852	ND	ND	ND	ND	ND	IN	53	ND	ND	ND	ND
OH	Sandusky County	61,792	ND	ND	ND	ND	ND	25	46	ND	ND	ND	ND
OH	Scioto County	79,195	ND	ND	ND	ND	ND	29	59	**15.6**	IN	0.007	0.024
OH	Seneca County	58,683	ND	ND	ND	ND	ND	22	100	ND	ND	ND	ND
OH	Stark County	378,098	3	ND	ND	0.10	**0.09**	24	49	**18.6**	40	0.008	0.028
OH	Summit County	542,899	3	ND	ND	0.11	0.08	22	53	**16.8**	36	0.009	0.044
OH	Trumbull County	225,116	ND	ND	ND	0.09	0.08	24	50	**15.5**	IN	ND	ND
OH	Tuscarawas County	90,914	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.006	0.031
OH	Warren County	158,383	ND	ND	ND	0.11	**0.09**	ND	ND	ND	ND	ND	ND
OH	Washington County	63,251	ND	ND	ND	0.10	0.08	IN	75	ND	ND	ND	ND
OH	Wood County	121,065	ND	ND	ND	0.09	0.08	ND	ND	ND	ND	ND	ND
OH	Wyandot County	22,908	ND	ND	ND	ND	ND	29	63	ND	ND	ND	ND
OK	Caddo County	30,150	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
OK	Canadian County	87,697	ND	ND	ND	ND	ND	ND	ND	10.8	26	ND	ND
OK	Carter County	45,621	ND	ND	ND	ND	ND	ND	ND	10.2	24	ND	ND
OK	Cherokee County	42,521	1	ND	0.008	0.10	**0.09**	ND	ND	IN	IN	0.001	0.004
OK	Cleveland County	208,016	2	ND	0.011	0.09	0.08	ND	ND	ND	ND	ND	ND
OK	Comanche County	114,996	1	ND	ND	0.09	**0.09**	ND	ND	9.1	19	ND	ND
OK	Custer County	26,142	ND	ND	ND	ND	ND	23	50	9.7	30	ND	ND
OK	Garfield County	57,813	ND	ND	0.007	ND	ND	ND	ND	10.3	25	ND	ND
OK	Jefferson County	6,818	ND	ND	ND	0.10	**0.09**	ND	ND	ND	ND	ND	ND
OK	Kay County	48,080	1	ND	0.007	0.10	0.08	IN	48	10.3	23	0.005	0.020
OK	Latimer County	10,692	ND	ND	IN	0.08	0.06	ND	ND	ND	ND	ND	ND
OK	Lincoln County	32,080	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
OK	Love County	8,831	ND	ND	ND	0.12	**0.10**	ND	ND	ND	ND	ND	ND
OK	McClain County	27,740	ND	ND	ND	0.10	0.08	ND	ND	ND	ND	ND	ND
OK	Marshall County	13,184	ND	ND	ND	0.10	**0.09**	ND	ND	ND	ND	ND	ND
OK	Ma County	38,369	ND	ND	0.007	ND	ND	ND	ND	11.1	30	ND	ND
OK	Muskogee County	69,451	ND	ND	0.008	ND	ND	IN	99	IN	IN	0.003	0.019
OK	Oklahoma County	660,448	4	ND	0.013	0.10	**0.09**	26	62	11.5	29	0.003	0.007
OK	Ottawa County	33,194	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
OK	Pawnee County	16,612	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
OK	Payne County	68,190	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
OK	Pittsburg County	43,953	ND	ND	ND	ND	ND	IN	43	IN	IN	ND	ND
OK	Pottawatomie County	65,521	ND	ND	ND	ND	ND	ND	ND	10.8	24	ND	ND
OK	Seminole County	24,894	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
OK	Tulsa County	563,299	4	ND	0.015	0.12	**0.09**	25	58	12.1	30	0.006	0.027
OR	Benton County	78,153	ND	ND	ND	ND	ND	ND	ND	8.1	30	ND	ND
OR	Clackamas County	338,391	ND	ND	ND	0.08	0.07	IN	IN	ND	ND	ND	ND
OR	Columbia County	43,560	ND	ND	ND	0.08	0.05	ND	ND	7.0	18	ND	ND
OR	Deschutes County	115,367	4	ND	ND	ND	ND	IN	109	7.3	27	ND	ND
OR	Harney County	7,609	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
OR	Jackson County	181,269	5	ND	ND	0.08	0.07	IN	68	11.4	49	ND	ND
OR	Josephine County	75,726	ND	ND	ND	ND	ND	IN	40	8.9	33	ND	ND
OR	Klamath County	63,775	IN	ND	ND	ND	ND	IN	93	9.6	48	ND	ND
OR	Lake County	7,422	ND	ND	ND	ND	ND	IN	78	7.0	46	ND	ND
OR	Lane County	322,959	4	ND	ND	IN	IN	IN	69	IN	IN	ND	ND
OR	Linn County	103,069	ND	ND	ND	ND	ND	ND	ND	9.1	42	ND	ND
OR	Marion County	284,834	IN	ND	ND	0.07	0.06	ND	ND	8.9	31	ND	ND
OR	Multnomah County	660,486	4	ND	0.012	ND	ND	IN	45	9.6	31	ND	ND
OR	Umatilla County	70,548	ND	ND	ND	ND	ND	IN	45	8.9	37	ND	ND
OR	Union County	24,530	ND	ND	ND	ND	ND	IN	71	IN	IN	ND	ND
OR	Wasco County	23,791	ND	ND	ND	ND	ND	ND	ND	9.7	30	ND	ND
OR	Washington County	445,342	ND	ND	ND	ND	ND	ND	ND	9.9	34	ND	ND

Table A-14. Maximum Air Quality Concentrations by County, 2000 (continued)

State	County	2000 Population	CO 8-hr (ppm)	Pb QMax ($\mu g/m^3$)	NO_2 AM (ppm)	O_3 1-hr (ppm)	O_3 8-hr (ppm)	PM_{10} Wtd AM ($\mu g/m^3$)	PM_{10} 24-hr ($\mu g/m^3$)	$PM_{2.5}$ Wtd AM ($\mu g/m^3$)	$PM_{2.5}$ 24-hr ($\mu g/m^3$)	SO_2 AM (ppm)	SO_2 24-hr (ppm)
OR	Yamhill County	84,992	ND	0.11	ND	ND	ND	ND	ND	ND	ND	ND	ND
PA	Adams County	91,292	1	ND	0.004	ND	ND	ND	ND	IN	IN	ND	ND
PA	Allegheny County	1,281,666	3	0.03	0.025	0.11	**0.09**	39	124	**20.0**	**84**	0.011	0.054
PA	Armstrong County	72,392	ND	ND	ND	0.10	0.08	ND	ND	ND	ND	ND	ND
PA	Beaver County	181,412	1	0.07	0.017	0.10	0.08	IN	52	**16.3**	IN	0.013	0.086
PA	Berks County	373,638	2	0.33	0.020	0.11	0.08	IN	45	**16.9**	34	0.008	0.028
PA	Blair County	129,144	1	ND	0.014	0.10	0.08	IN	51	ND	ND	0.006	0.045
PA	Bucks County	597,635	4	ND	0.017	0.12	**0.10**	IN	39	IN	IN	0.007	0.027
PA	Cambria County	152,598	2	0.05	0.015	0.10	**0.09**	IN	51	**15.9**	IN	0.007	0.026
PA	Carbon County	58,802	ND	0.11	ND	ND	ND	ND	ND	ND	ND	ND	ND
PA	Centre County	135,758	ND	ND	ND	0.11	0.08	ND	ND	IN	IN	ND	ND
PA	Chester County	433,501	ND	ND	ND	IN	IN	ND	ND	ND	ND	ND	ND
PA	Clearfield County	83,382	ND	ND	ND	0.11	0.08	ND	ND	ND	ND	ND	ND
PA	Cumberland County	213,674	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
PA	Dauphin County	251,798	2	ND	0.017	0.11	**0.09**	IN	53	**15.8**	IN	0.005	0.024
PA	Delaware County	550,864	ND	0.05	0.019	0.12	**0.09**	IN	45	**16.0**	30	0.010	0.026
PA	Erie County	280,843	6	ND	0.012	0.10	0.08	IN	41	IN	IN	0.008	0.041
PA	Franklin County	129,313	ND	ND	ND	0.10	**0.09**	ND	ND	ND	ND	ND	ND
PA	Greene County	40,672	0	ND	ND	0.11	**0.09**	ND	ND	ND	ND	0.007	0.022
PA	Lackawanna County	213,295	2	ND	0.015	0.09	0.08	IN	40	11.7	31	0.004	0.021
PA	Lancaster County	470,658	2	ND	0.014	0.11	**0.09**	IN	56	**18.4**	IN	0.005	0.024
PA	Lawrence County	94,643	2	ND	0.019	0.09	0.07	IN	62	ND	ND	0.008	0.031
PA	Lehigh County	312,090	3	ND	0.013	0.11	**0.09**	IN	79	14.5	37	0.007	0.027
PA	Luzerne County	319,250	2	ND	0.014	0.09	0.08	IN	46	12.7	33	0.006	0.026
PA	Lycoming County	120,044	ND	ND	ND	0.09	0.07	IN	IN	ND	ND	0.005	0.019
PA	Mercer County	120,293	ND	ND	ND	0.10	0.08	ND	ND	IN	IN	0.007	0.024
PA	Montgomery County	750,097	2	ND	0.018	**0.13**	**0.10**	IN	41	IN	IN	0.005	0.022
PA	Northampton County	267,066	2	ND	0.017	0.11	**0.09**	IN	85	IN	IN	0.008	0.023
PA	Perry County	43,602	ND	ND	0.007	0.10	0.07	ND	ND	12.2	23	0.003	0.015
PA	Philadelphia County	1,517,550	4	0.05	0.028	0.11	**0.09**	IN	IN	IN	IN	0.006	0.027
PA	Schuylkill County	150,336	1	ND	ND	ND	ND	ND	ND	ND	ND	0.006	0.025
PA	Tioga County	41,373	ND	ND	ND	0.10	0.08	ND	ND	ND	ND	ND	ND
PA	Warren County	43,863	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.013	0.092
PA	Washington County	202,897	1	ND	0.015	0.11	0.08	IN	78	**15.4**	30	0.009	0.031
PA	Westmoreland County	369,993	2	0.04	0.017	0.10	0.08	IN	45	**16.0**	IN	0.010	0.029
PA	York County	381,751	2	ND	0.018	0.11	**0.09**	IN	53	**16.6**	31	0.006	0.020
RI	Kent County	167,090	ND	ND	IN	0.12	**0.09**	12	26	8.8	26	ND	ND
RI	Providence County	621,602	4	ND	0.020	0.12	0.08	29	91	14.9	36	0.007	0.026
RI	Washington County	123,546	ND	ND	ND	0.12	**0.09**	ND	ND	8.8	21	ND	ND
SC	Abbeville County	26,167	ND	ND	ND	0.10	**0.09**	ND	ND	ND	ND	ND	ND
SC	Aiken County	142,552	ND	0.01	0.005	0.11	**0.09**	21	34	ND	ND	ND	ND
SC	Anderson County	165,740	ND	ND	ND	0.10	0.08	ND	ND	ND	ND	ND	ND
SC	Barnwell County	23,478	ND	ND	0.004	0.11	**0.09**	21	42	ND	ND	0.002	0.007
SC	Beaufort County	120,937	ND	0.00	ND	ND	ND	ND	ND	12.6	23	ND	ND
SC	Berkeley County	142,651	ND	ND	ND	0.09	0.08	ND	ND	ND	ND	ND	ND
SC	Charleston County	309,969	3	0.02	0.011	0.11	0.08	23	52	14.8	31	0.003	0.013
SC	Cherokee County	52,537	ND	ND	ND	0.12	**0.09**	ND	ND	ND	ND	ND	ND
SC	Chester County	34,068	ND	ND	ND	0.09	0.08	ND	ND	ND	ND	ND	ND
SC	Chesterfield County	42,768	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
SC	Colleton County	38,264	ND	ND	ND	0.10	0.08	ND	ND	IN	IN	ND	ND
SC	Darlington County	67,394	ND	ND	ND	0.11	**0.09**	ND	ND	ND	ND	ND	ND
SC	Dillon County	30,722	ND	0.00	ND	ND	ND	ND	ND	ND	ND	ND	ND
SC	Edgefield County	24,595	ND	ND	ND	0.09	0.08	ND	ND	14.8	27	ND	ND
SC	Fairfield County	23,454	ND	ND	ND	ND	ND	23	40	ND	ND	ND	ND
SC	Florence County	125,761	ND	0.01	ND	ND	ND	ND	ND	14.4	25	ND	ND
SC	Georgetown County	55,797	ND	0.02	ND	ND	ND	33	72	**15.6**	28	IN	0.010

Table A-14. Maximum Air Quality Concentrations by County, 2000 (continued)

State	County	CO 2000 Population	Pb 8-hr (ppm)	NO_2 QMax (µg/m³)	O_3 AM (ppm)	O_3 1-hr (ppm)	PM_{10} 8-hr (ppm)	PM_{10} Wtd AM (µg/m³)	$PM_{2.5}$ 24-hr (µg/m³)	$PM_{2.5}$ Wtd AM (µg/m³)	SO_2 24-hr (µg/m³)	SO_2 AM (ppm)	24-hr (ppm)
SC	Greenville County	379,616	4	0.02	0.016	IN	IN	IN	54	**16.5**	32	0.003	0.011
SC	Greenwood County	66,271	ND	0.02	ND	ND	ND	ND	ND	**15.3**	27	ND	ND
SC	Hampton County	21,386	ND	0.00	ND	ND	ND	ND	ND	ND	ND	ND	ND
SC	Horry County	196,629	ND	0.01	ND	ND	ND	ND	ND	IN	IN	ND	ND
SC	Laurens County	69,567	ND	0.01	ND	ND	ND	ND	ND	ND	ND	ND	ND
SC	Lexington County	216,014	ND	0.02	ND	ND	ND	46	132	**16.3**	26	0.003	0.014
SC	Oconee County	66,215	ND	ND	ND	0.10	0.08	ND	ND	IN	IN	0.002	0.009
SC	Pickens County	110,757	ND	ND	ND	0.10	0.08	ND	ND	ND	ND	ND	ND
SC	Richland County	320,677	4	0.07	0.014	0.12	**0.10**	26	109	**16.3**	28	0.003	0.010
SC	Spartanburg County	253,791	ND	0.01	ND	0.11	**0.09**	24	44	**15.4**	31	ND	ND
SC	Sumter County	104,646	ND	0.01	ND	ND	ND	ND	ND	ND	ND	ND	ND
SC	Union County	29,881	ND	ND	ND	0.09	0.08	ND	ND	ND	ND	ND	ND
SC	Williamsburg County	37,217	ND	ND	ND	0.09	0.08	ND	ND	ND	ND	ND	ND
SC	York County	164,614	ND	0.04	ND	0.09	0.08	28	46	IN	IN	ND	ND
SD	Brookings County	28,220	ND	ND	ND	ND	ND	23	71	IN	IN	ND	ND
SD	Brown County	35,460	ND	ND	ND	ND	ND	19	50	IN	IN	ND	ND
SD	Jackson County	2,930	ND	ND	ND	ND	ND	12	35	IN	IN	ND	ND
SD	Minnehaha County	148,281	ND	ND	ND	IN	IN	20	53	IN	IN	ND	ND
SD	Pennington County	88,565	ND	ND	ND	IN	IN	38	139	IN	IN	ND	ND
TN	Anderson County	71,330	ND	ND	ND	0.11	**0.09**	ND	ND	ND	ND	0.004	0.018
TN	Blount County	105,823	ND	ND	IN	0.11	**0.10**	ND	ND	IN	IN	0.010	0.060
TN	Bradley County	87,965	ND	ND	0.014	ND	ND	33	105	ND	ND	0.008	0.026
TN	Davidson County	569,891	6	ND	0.019	0.11	0.08	34	65	IN	IN	0.004	0.017
TN	Dickson County	43,156	ND	ND	IN	IN	IN	ND	ND	ND	ND	IN	0.012
TN	Dyer County	37,279	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
TN	Greene County	62,909	ND	ND	ND	ND	ND	IN	66	ND	ND	ND	ND
TN	Hamilton County	307,896	ND	ND	ND	0.12	**0.10**	30	67	IN	IN	ND	ND
TN	Hawkins County	53,563	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.007	0.043
TN	Haywood County	19,797	ND	ND	ND	0.12	**0.09**	ND	ND	ND	ND	ND	ND
TN	Humphreys County	17,929	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.004	0.025
TN	Jefferson County	44,294	ND	ND	ND	0.12	**0.10**	ND	ND	ND	ND	ND	ND
TN	Knox County	382,032	3	0.00	0.013	**0.13**	**0.10**	30	73	IN	IN	0.002	0.012
TN	Lawrence County	39,926	ND	ND	ND	0.09	0.08	ND	ND	IN	IN	ND	ND
TN	McMinn County	49,015	ND	ND	0.015	ND	ND	40	96	IN	IN	0.006	0.022
TN	Madison County	91,837	ND	ND	ND	ND	ND	23	44	IN	IN	ND	ND
TN	Maury County	69,498	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
TN	Meigs County	11,086	ND	ND	ND	0.11	**0.10**	ND	ND	ND	ND	ND	ND
TN	Montgomery County	134,768	ND	ND	IN	0.11	**0.09**	23	51	IN	IN	0.006	0.018
TN	Polk County	16,050	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.009	0.023
TN	Putnam County	62,315	ND	ND	ND	0.10	**0.09**	ND	ND	IN	IN	ND	ND
TN	Roane County	51,910	ND	ND	0.008	0.12	**0.09**	27	77	IN	IN	0.003	0.018
TN	Rutherford County	182,023	ND	ND	ND	0.10	**0.09**	ND	ND	ND	ND	ND	ND
TN	Sevier County	71,170	ND	ND	ND	0.12	**0.10**	ND	ND	ND	ND	ND	ND
TN	Shelby County	897,472	4	0.59	0.025	0.12	**0.09**	28	71	IN	IN	0.006	0.038
TN	Stewart County	12,370	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.002	0.010
TN	Sullivan County	153,048	2	0.20	0.015	**0.13**	**0.10**	ND	ND	IN	IN	0.011	0.043
TN	Sumner County	130,449	ND	ND	ND	0.12	**0.09**	ND	ND	IN	IN	0.004	0.040
TN	Union County	17,808	ND	ND	ND	ND	ND	34	125	ND	ND	ND	ND
TN	Williamson County	126,638	ND	1.50	ND	0.12	**0.09**	ND	ND	ND	ND	ND	ND
TN	Wilson County	88,809	ND	ND	ND	0.10	**0.09**	ND	ND	ND	ND	ND	ND
TX	Bexar County	1,392,931	3	ND	0.018	0.10	0.08	IN	IN	IN	IN	ND	ND
TX	Bowie County	89,306	ND	ND	ND	ND	ND	ND	ND	14.7	31	ND	ND
TX	Brazoria County	241,767	ND	ND	ND	**0.14**	0.08	ND	ND	IN	IN	ND	ND
TX	Brewster County	8,866	ND	ND	ND	0.07	0.06	ND	ND	ND	ND	IN	0.002
TX	Caldwell County	32,194	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
TX	Cameron County	335,227	2	0.01	ND	0.08	0.06	25	58	IN	IN	0.001	0.002

Table A-14. Maximum Air Quality Concentrations by County, 2000 (continued)

State	County	CO 2000 Population	Pb 8-hr (ppm)	NO_2 QMax (µg/m³)	O_3 AM (ppm)	O_3 1-hr (ppm)	PM_{10} 8-hr (ppm)	PM_{10} Wtd AM (µg/m³)	$PM_{2.5}$ 24-hr (µg/m³)	$PM_{2.5}$ Wtd AM (µg/m³)	SO_2 24-hr (µg/m³)	SO_2 AM (ppm)	24-hr (ppm)
TX	Collin County	491,675	ND	0.54	ND	0.12	**0.10**	ND	ND	11.6	26	ND	ND
TX	Dallas County	2,218,899	2	0.13	0.014	**0.13**	**0.10**	29	55	13.2	32	0.002	0.005
TX	Denton County	432,976	ND	ND	0.009	0.12	**0.10**	ND	ND	ND	ND	ND	ND
TX	Ector County	121,123	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
TX	Ellis County	111,360	ND	ND	0.009	0.12	**0.10**	28	58	ND	ND	0.006	0.047
TX	El Paso County	679,622	9	0.10	0.029	0.12	0.08	46	124	9.8	23	0.002	0.006
TX	Galveston County	250,158	ND	ND	0.005	**0.14**	**0.09**	27	53	IN	IN	0.004	0.037
TX	Gregg County	111,379	ND	ND	0.006	**0.13**	**0.10**	ND	ND	13.4	29	0.002	0.011
TX	Harris County	3,400,578	4	0.01	0.021	**0.19**	**0.12**	46	102	IN	IN	0.006	0.031
TX	Hidalgo County	569,463	ND	ND	ND	0.09	0.08	IN	53	11.0	23	ND	ND
TX	Hood County	41,100	ND	ND	ND	0.10	0.08	ND	ND	ND	ND	ND	ND
TX	Jefferson County	252,051	ND	ND	0.008	**0.16**	**0.10**	ND	ND	IN	**122**	0.006	0.046
TX	Johnson County	126,811	ND	ND	ND	0.11	0.08	ND	ND	ND	ND	ND	ND
TX	Kaufman County	71,313	ND	ND	0.007	IN	IN	ND	ND	ND	ND	0.002	0.005
TX	Lubbock County	242,628	ND	ND	ND	ND	ND	IN	38	7.4	19	ND	ND
TX	McLennan County	213,517	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
TX	Marion County	10,941	ND	ND	0.005	0.12	**0.10**	ND	ND	12.3	29	ND	ND
TX	Montgomery County	293,768	ND	ND	0.006	**0.14**	**0.10**	ND	ND	IN	IN	ND	ND
TX	Nueces County	313,645	ND	ND	ND	0.10	0.08	36	71	IN	IN	0.003	0.017
TX	Orange County	84,966	ND	ND	0.008	0.12	**0.09**	ND	ND	IN	IN	ND	ND
TX	Parker County	88,495	ND	ND	ND	IN	IN	ND	ND	ND	ND	ND	ND
TX	Potter County	113,546	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
TX	Rockwall County	43,080	ND	ND	ND	0.12	**0.09**	ND	ND	ND	ND	ND	ND
TX	Smith County	174,706	ND	ND	0.006	0.10	**0.09**	ND	ND	ND	ND	ND	ND
TX	Tarrant County	1,446,219	2	ND	0.015	0.12	**0.10**	23	42	12.7	29	ND	ND
TX	Travis County	812,280	1	ND	0.005	0.11	**0.09**	23	50	12.1	27	ND	ND
TX	Victoria County	84,088	ND	ND	ND	0.09	0.08	ND	ND	ND	ND	ND	ND
TX	Webb County	193,117	6	0.04	ND	0.09	0.07	31	56	12.1	23	ND	ND
UT	Box Elder County	42,745	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
UT	Cache County	91,391	3	ND	ND	0.08	0.07	25	79	IN	IN	ND	ND
UT	Davis County	238,994	3	ND	0.019	0.10	0.08	ND	ND	9.0	40	0.002	0.013
UT	Grand County	8,485	ND	ND	ND	ND	ND	20	44	ND	ND	ND	ND
UT	Salt Lake County	898,387	5	0.07	0.026	0.10	0.08	46	117	14.2	57	0.004	0.013
UT	San Juan County	14,413	ND	ND	ND	IN	IN	ND	ND	ND	ND	ND	ND
UT	Tooele County	40,735	ND	ND	ND	ND	ND	ND	ND	7.1	30	ND	ND
UT	Utah County	368,536	6	ND	0.024	0.10	0.08	32	89	10.1	34	ND	ND
UT	Weber County	196,533	6	ND	IN	0.09	0.07	IN	IN	7.6	25	ND	ND
VT	Bennington County	36,994	ND	ND	ND	0.09	0.07	15	28	9.5	20	ND	ND
VT	Chittenden County	146,571	2	ND	IN	0.08	0.07	12	28	8.3	17	IN	0.007
VT	Rutland County	63,400	3	ND	0.011	ND	ND	18	42	11.1	24	0.005	0.033
VT	Washington County	58,039	ND	ND	ND	ND	ND	17	43	10.1	20	ND	ND
VA	Arlington County	189,453	3	ND	0.023	0.11	0.08	ND	ND	14.6	28	ND	ND
VA	Caroline County	22,121	ND	ND	IN	0.10	0.08	ND	ND	ND	ND	ND	ND
VA	Carroll County	29,245	ND	ND	ND	ND	ND	20	52	ND	ND	ND	ND
VA	Charles City County	6,926	ND	ND	0.011	0.09	0.08	ND	ND	IN	IN	0.006	0.017
VA	Chesterfield County	259,903	ND	ND	ND	0.10	0.08	ND	ND	**15.1**	29	ND	ND
VA	Culpeper County	34,262	ND	ND	ND	ND	ND	18	39	ND	ND	ND	ND
VA	Fairfax County	969,749	4	ND	0.021	0.11	**0.09**	20	45	14.0	34	0.011	0.030
VA	Fauquier County	55,139	ND	ND	ND	0.09	0.08	ND	ND	ND	ND	ND	ND
VA	Frederick County	59,209	ND	ND	ND	0.09	0.08	ND	ND	ND	ND	ND	ND
VA	Henrico County	262,300	ND	ND	ND	0.11	0.08	ND	ND	14.6	30	ND	ND
VA	King William County	13,146	ND	ND	ND	ND	ND	18	40	ND	ND	ND	ND
VA	Loudoun County	169,599	ND	ND	0.013	0.09	0.08	ND	ND	13.5	28	ND	ND
VA	Madison County	12,520	ND	ND	ND	0.09	0.08	ND	ND	ND	ND	0.003	0.011
VA	Northumberland County	12,259	ND	ND	ND	ND	ND	18	38	ND	ND	ND	ND
VA	Page County	23,177	ND	ND	ND	0.09	0.08	ND	ND	13.2	25	ND	ND

Table A-14. Maximum Air Quality Concentrations by County, 2000 (continued)

State	County	CO 2000 Population	Pb 8-hr (ppm)	NO_2 QMax (µg/m^3)	O_3 AM (ppm)	O_3 1-hr (ppm)	PM_{10} 8-hr (ppm)	PM_{10} Wtd AM (µg/m^3)	$PM_{2.5}$ 24-hr (µg/m^3)	$PM_{2.5}$ Wtd AM (µg/m^3)	SO_2 24-hr (µg/m^3)	SO_2 AM (ppm)	24-hr (ppm)
VA	Prince William County	280,813	ND	ND	0.009	0.09	0.08	IN	47	ND	ND	ND	ND
VA	Roanoke County	85,778	ND	ND	0.011	0.10	0.08	ND	ND	ND	ND	0.003	0.014
VA	Rockbridge County	20,808	ND	ND	ND	0.09	0.08	ND	ND	ND	ND	ND	ND
VA	Rockingham County	67,725	ND	ND	ND	ND	ND	26	59	ND	ND	0.003	0.008
VA	Stafford County	92,446	ND	ND	ND	0.10	0.08	ND	ND	ND	ND	ND	ND
VA	Warren County	31,584	ND	ND	ND	ND	ND	20	43	ND	ND	ND	ND
VA	Wise County	40,123	ND	ND	ND	ND	ND	IN	IN	ND	ND	ND	ND
VA	Wythe County	27,599	ND	ND	ND	0.09	0.08	ND	ND	ND	ND	ND	ND
VA	Alexandria city	128,283	3	ND	0.023	0.10	0.08	ND	ND	ND	ND	0.006	0.020
VA	Bristol city	17,367	ND	ND	ND	ND	ND	ND	ND	**16.4**	29	ND	ND
VA	Charlottesville city	45,049	ND	ND	ND	ND	ND	23	70	ND	ND	ND	ND
VA	Chesapeake city	199,184	ND	ND	ND	ND	ND	IN	40	IN	IN	ND	ND
VA	Fredericksburg city	19,279	ND	ND	ND	ND	ND	18	36	ND	ND	ND	ND
VA	Hampton city	146,437	2	ND	ND	0.09	0.08	20	41	IN	IN	0.005	0.017
VA	Lynchburg city	65,269	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
VA	Newport News city	180,150	ND	ND	ND	ND	ND	ND	ND	13.0	24	ND	ND
VA	Norfolk city	234,403	4	ND	0.016	ND	ND	22	39	13.6	26	0.007	0.023
VA	Richmond city	197,790	3	ND	0.017	ND	ND	IN	42	IN	IN	0.005	0.015
VA	Roanoke city	94,911	3	ND	ND	ND	ND	32	66	**15.9**	31	ND	ND
VA	Salem city	24,747	ND	ND	ND	ND	ND	ND	ND	**15.5**	33	ND	ND
VA	Suffolk city	63,677	ND	ND	ND	0.10	0.08	ND	ND	ND	ND	ND	ND
VA	Virginia Beach city	425,257	ND	ND	ND	ND	ND	ND	ND	13.0	25	ND	ND
VA	Winchester city	23,585	ND	ND	ND	ND	ND	20	43	ND	ND	ND	ND
WA	Adams County	16,428	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
WA	Asotin County	20,551	ND	ND	ND	ND	ND	27	59	ND	ND	ND	ND
WA	Benton County	142,475	ND	ND	ND	ND	ND	IN	140	IN	IN	ND	ND
WA	Chelan County	66,616	ND	ND	ND	ND	ND	20	49	ND	ND	ND	ND
WA	Clallam County	64,525	ND	ND	ND	0.06	0.05	ND	ND	10.8	26	0.002	0.005
WA	Clark County	345,238	6	ND	ND	0.07	0.06	16	41	10.8	40	ND	ND
WA	Cowlitz County	92,948	ND	ND	ND	ND	ND	21	49	ND	ND	ND	ND
WA	Jefferson County	25,953	ND	ND	ND	ND	ND	ND	ND	9.1	25	ND	ND
WA	King County	1,737,034	6	ND	0.021	0.10	0.07	23	66	12.7	36	0.003	0.011
WA	Kittitas County	33,362	ND	ND	ND	ND	ND	IN	104	ND	ND	ND	ND
WA	Klickitat County	19,161	ND	ND	ND	0.07	0.07	ND	ND	ND	ND	ND	ND
WA	Lewis County	68,600	ND	ND	ND	IN	IN	ND	ND	IN	IN	ND	ND
WA	Pierce County	700,820	6	ND	ND	0.08	0.06	28	58	13.0	49	ND	ND
WA	Skagit County	102,979	ND	ND	ND	0.06	0.05	ND	ND	8.2	18	ND	ND
WA	Snohomish County	606,024	6	ND	ND	ND	ND	IN	47	12.6	43	ND	ND
WA	Spokane County	417,939	6	ND	ND	0.08	0.07	28	87	11.0	38	ND	ND
WA	Stevens County	40,066	ND	ND	ND	ND	ND	30	137	ND	ND	ND	ND
WA	Thurston County	207,355	5	ND	ND	0.08	0.06	15	36	10.3	41	ND	ND
WA	Walla Walla County	55,180	ND	ND	ND	ND	ND	29	108	ND	ND	ND	ND
WA	Whatcom County	166,814	ND	ND	ND	0.06	0.05	15	29	8.4	21	ND	ND
WA	Whitman County	40,740	ND	ND	ND	ND	ND	ND	ND	6.8	19	ND	ND
WA	Yakima County	222,581	3	ND	ND	ND	ND	27	58	IN	IN	ND	ND
WV	Berkeley County	75,905	ND	ND	ND	ND	ND	24	68	**16.1**	46	ND	ND
WV	Brooke County	25,447	ND	ND	ND	ND	ND	26	54	**16.6**	35	0.013	0.060
WV	Cabell County	96,784	ND	ND	ND	0.09	0.08	24	60	**17.6**	40	0.006	0.028
WV	Greenbrier County	34,453	ND	ND	ND	0.09	0.08	ND	ND	ND	ND	ND	ND
WV	Hancock County	32,667	8	ND	ND	0.09	0.07	31	95	**16.5**	45	0.014	0.069
WV	Harrison County	68,652	ND	ND	ND	ND	ND	20	43	14.9	31	ND	ND
WV	Kanawha County	200,073	ND	ND	ND	0.09	**0.09**	27	50	**18.1**	37	0.012	0.046
WV	Marion County	56,598	ND	ND	ND	ND	ND	23	54	**15.9**	IN	ND	ND
WV	Marshall County	35,519	ND	ND	ND	ND	ND	IN	43	**16.3**	33	0.013	0.044
WV	Mercer County	62,980	ND	ND	ND	ND	ND	22	48	13.5	33	ND	ND
WV	Monongalia County	81,866	ND	ND	ND	0.10	0.08	23	47	15.0	33	0.010	0.040

Table A-14. Maximum Air Quality Concentrations by County, 2000 (continued)

State	County	CO 2000 Population	Pb 8-hr (ppm)	NO_2 QMax (μg/m³)	O_3 AM (ppm)	O_3 1-hr (ppm)	PM_{10} 8-hr (ppm)	PM_{10} Wtd AM (μg/m³)	$PM_{2.5}$ 24-hr (μg/m³)	$PM_{2.5}$ Wtd AM (μg/m³)	SO_2 24-hr (μg/m³)	SO_2 AM (ppm)	24-hr (ppm)
WV	Ohio County	47,427	2	ND	ND	0.09	0.07	23	43	**15.5**	35	0.009	0.041
WV	Raleigh County	79,220	ND	ND	ND	ND	ND	19	43	13.8	32	ND	ND
WV	Summers County	12,999	ND	ND	ND	ND	ND	16	41	10.4	30	ND	ND
WV	Wayne County	42,903	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.012	0.046
WV	Wood County	87,986	ND	ND	ND	0.11	**0.09**	21	42	**17.5**	36	0.011	0.036
WI	Brown County	226,778	ND	ND	ND	0.09	0.07	ND	ND	11.3	32	0.004	0.016
WI	Columbia County	52,468	ND	ND	ND	0.09	0.07	ND	ND	ND	ND	ND	ND
WI	Dane County	426,526	2	ND	ND	0.09	0.07	22	57	13.2	34	ND	ND
WI	Dodge County	85,897	ND	ND	ND	0.09	0.07	ND	ND	11.7	28	ND	ND
WI	Door County	27,961	ND	ND	ND	0.10	0.08	ND	ND	7.2	26	ND	ND
WI	Douglas County	43,287	ND	ND	ND	ND	ND	19	35	8.2	24	ND	ND
WI	Florence County	5,088	ND	ND	ND	0.08	0.07	ND	ND	ND	ND	ND	ND
WI	Fond du Lac County	97,296	ND	ND	ND	0.08	0.07	ND	ND	ND	ND	ND	ND
WI	Grant County	49,597	ND	ND	ND	ND	ND	ND	ND	12.3	27	ND	ND
WI	Green County	33,647	ND	ND	ND	IN	IN	ND	ND	ND	ND	ND	ND
WI	Jefferson County	74,021	ND	ND	ND	IN	IN	ND	ND	12.1	33	ND	ND
WI	Kenosha County	149,577	ND	ND	ND	0.10	**0.09**	ND	ND	11.4	27	ND	ND
WI	Kewaunee County	20,187	ND	ND	ND	0.10	0.08	ND	ND	ND	ND	ND	ND
WI	Manitowoc County	82,887	ND	ND	ND	0.09	0.08	ND	ND	10.1	30	ND	ND
WI	Marathon County	125,834	ND	ND	ND	0.08	0.07	IN	IN	ND	ND	ND	ND
WI	Milwaukee County	940,164	2	ND	0.021	0.10	0.08	20	59	14.2	35	0.004	0.026
WI	Oneida County	36,776	ND	ND	ND	0.07	0.07	ND	ND	ND	ND	0.006	0.075
WI	Outagamie County	160,971	ND	ND	ND	0.08	0.07	ND	ND	11.5	32	ND	ND
WI	Ozaukee County	82,317	ND	ND	IN	0.10	**0.09**	ND	ND	11.5	27	ND	ND
WI	Racine County	188,831	2	ND	ND	0.10	0.08	ND	ND	ND	ND	ND	ND
WI	Rock County	152,307	ND	ND	ND	0.10	0.08	ND	ND	13.3	29	ND	ND
WI	St. Croix County	63,155	ND	ND	ND	0.09	0.07	ND	ND	IN	IN	ND	ND
WI	Sauk County	55,225	ND	ND	ND	0.08	0.07	ND	ND	ND	ND	ND	ND
WI	Sheboygan County	112,646	ND	ND	ND	0.11	**0.09**	ND	ND	ND	ND	ND	ND
WI	Vernon County	28,056	ND	ND	ND	0.08	0.07	ND	ND	ND	ND	ND	ND
WI	Vilas County	21,033	ND	ND	ND	0.07	0.07	7	20	5.4	17	ND	ND
WI	Walworth County	93,759	ND	ND	ND	0.09	0.08	ND	ND	ND	ND	ND	ND
WI	Washington County	117,493	ND	ND	ND	0.09	0.08	ND	ND	ND	ND	ND	ND
WI	Waukesha County	360,767	2	ND	ND	0.09	0.08	21	45	13.4	31	ND	ND
WI	Winnebago County	156,763	ND	ND	ND	0.09	0.07	ND	ND	11.4	32	ND	ND
WI	Wood County	75,555	ND	ND	ND	ND	ND	ND	ND	10.9	35	IN	0.019
WY	Albany County	32,014	ND	ND	ND	ND	ND	IN	64	ND	ND	ND	ND
WY	Campbell County	33,698	ND	ND	ND	ND	ND	47	143	ND	ND	ND	ND
WY	Converse County	12,052	ND	ND	ND	ND	ND	26	62	ND	ND	ND	ND
WY	Fremont County	35,804	ND	ND	ND	ND	ND	22	53	IN	IN	ND	ND
WY	Laramie County	81,607	ND	ND	ND	ND	ND	16	30	5.6	13	ND	ND
WY	Natrona County	66,533	ND	ND	ND	ND	ND	17	38	ND	ND	ND	ND
WY	Park County	25,786	ND	ND	ND	ND	ND	20	62	ND	ND	ND	ND
WY	Sheridan County	26,560	ND	ND	ND	ND	ND	IN	67	11.6	36	ND	ND
WY	Sweetwater County	37,613	ND	ND	ND	ND	ND	26	124	ND	ND	ND	ND
WY	Teton County	18,251	ND	ND	ND	0.07	0.07	IN	IN	ND	ND	ND	ND
PR	Barceloneta Municipio	22,322	ND	ND	ND	ND	ND	IN	74	ND	ND	IN	0.016
PR	Bayamon Municipio	224,044	ND	ND	ND	ND	ND	25	77	7.3	18	0.004	0.058
PR	Carolina Municipio	186,076	ND	ND	ND	ND	ND	IN	74	ND	ND	ND	ND
PR	Catano Municipio	30,071	ND	ND	0.018	0.10	0.05	30	89	ND	ND	0.006	0.027
PR	Fajardo Municipio	40,712	ND	ND	ND	ND	ND	IN	84	IN	IN	ND	ND
PR	Guayama Municipio	44,301	ND	ND	ND	ND	ND	26	77	IN	IN	ND	ND
PR	Guayanilla Municipio	23,072	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
PR	Guaynabo Municipio	100,053	ND	ND	ND	ND	ND	37	102	IN	IN	ND	ND
PR	Humacao Municipio	59,035	ND	ND	ND	ND	ND	IN	IN	IN	IN	ND	ND
PR	Lares Municipio	34,415	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
PR	Manati Municipio	45,409	ND	ND	ND	ND	ND	IN	73	ND	ND	ND	ND

Table A-14. Maximum Air Quality Concentrations by County, 2000 (continued)

State	County	CO 2000 Population	Pb 8-hr (ppm)	NO_2 QMax ($\mu g/m^3$)	O_3 AM (ppm)	O_3 1-hr (ppm)	PM_{10} 8-hr (ppm)	PM_{10} Wtd AM ($\mu g/m^3$)	$PM_{2.5}$ 24-hr ($\mu g/m^3$)	$PM_{2.5}$ Wtd AM ($\mu g/m^3$)	SO_2 24-hr ($\mu g/m^3$)	SO_2 AM (ppm)	24-hr (ppm)
PR	Mayaguez Municipio	98,434	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
PR	Ponce Municipio	186,475	ND	ND	ND	ND	ND	40	77	IN	IN	ND	ND
PR	Rio Grande Municipio	52,362	ND	ND	ND	ND	ND	IN	71	ND	ND	ND	ND
PR	San Juan Municipio	434,374	6	0.02	IN	ND	ND	IN	60	ND	ND	ND	ND
PR	Vieques Municipio	9,106	ND	ND	ND	ND	ND	IN	IN	ND	ND	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 μg/m3)*
NO_2 – Highest arithmetic mean concentration *(Applicable NAAQS is 0.053 ppm)*
O_3 (1-hr) – Highest second daily maximum 1-hour concentration *(Applicable NAAQS is 0.12 ppm)*
O_3 (8-hr) – Highest fourth daily maximum 8-hour concentration *(Applicable NAAQS is 0.08 ppm)*
PM_{10} – Highest weighted annual mean concentration *(Applicable NAAQS is 50 μg/m3)*
– Highest second maximum 24-hour concentration *(Applicable NAAQS is 150 μg/m3)*
SO_2 – 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
$\mu g/m^3$ – Units are micrograms per cubic meter
PPM – Units are parts per million

Data from exceptional events not included.

(*) – These PM_{10} statistics were converted from local temperature and pressure to standard temperature and pressure to ensure all PM_{10} data in this table reflect standard conditions.

Note: The reader is 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 air in the vicinity of the monitoring site but may not necessarily represent urban-wide air quality.

Table A-15. Maximum Air Quality Concentrations by Metropolitan Statistical Area, 2000

Metropolitan Statistical Area Population	CO 2000 (ppm)	Pb 8-hr (μg/m^3)	NO$_2$ QMax (ppm)	O$_3$ AM (ppm)	O$_3$ 1-hr (ppm)	PM$_{10}$ 8-hr (μg/m^3)	PM$_{10}$ Wtd AM (μg/m^3)	PM$_{2.5}$ 24-hr (μg/m^3)	PM$_{2.5}$ Wtd AM (μg/m^3)	SO$_2$ 24-hr (ppm)	SO$_2$ AM (ppm)	24-hr
Akron, OH PMSA	694,960	3	ND	ND	0.11	**0.09**	22	53	**16.8**	36	0.009	0.044
Albany, GA MSA	120,822	ND	ND	ND	ND	ND	IN	IN	**17.4**	IN	ND	ND
Albany—Schenectady—Troy, NY MSA	875,583	3	ND	ND	0.09	0.07	ND	ND	12.3	30	0.004	0.020
Albuquerque, NM MSA	712,738	4	ND	0.017	0.09	0.08	25	122	7.9	19	ND	ND
Alexandria, LA MSA	126,337	ND	ND	ND	ND	ND	ND	ND	13.3	30	ND	ND
Allentown—Bethlehem—Easton, PA MSA	637,958	3	0.11	0.017	0.11	**0.09**	IN	85	14.5	37	0.008	0.027
Altoona, PA MSA	129,144	1	ND	0.014	0.10	0.08	IN	51	ND	ND	0.006	0.045
Amarillo, TX MSA	217,858	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
Anchorage, AK MSA	260,283	6	ND	ND	ND	ND	IN	108	6.1	20	ND	ND
Ann Arbor, MI PMSA	578,736	ND	0.00	ND	0.09	0.08	ND	ND	IN	IN	ND	ND
Appleton—Oshkosh—Neenah, WI	358,365	ND	ND	ND	0.09	0.07	ND	ND	11.5	32	ND	ND
Asheville, NC MSA	225,965	ND	ND	ND	0.11	**0.09**	18	38	**15.1**	IN	ND	ND
Athens, GA MSA	153,444	ND	ND	ND	ND	ND	ND	ND	**19.0**	IN	ND	ND
Atlanta, GA MSA	4,112,198	3	0.04	0.023	**0.16**	**0.11**	36	85	**21.4**	50	0.005	0.019
Atlantic—Cape May, NJ PMSA	354,878	ND	ND	ND	0.11	**0.09**	23	42	ND	ND	0.003	0.013
Augusta—Aiken, GA—SC MSA	477,441	ND	0.01	0.005	0.12	**0.09**	21	48	**17.5**	27	ND	ND
Austin—San Marcos, TX MSA	1,249,763	1	ND	0.005	0.11	**0.09**	23	50	12.1	27	ND	ND
Bakersfield, CA MSA	661,645	5	0.00	0.023	**0.14**	**0.11**	46	136	**21.7**	**100**	ND	ND
Baltimore, MD PMSA	2,552,994	3	0.01	0.024	0.12	**0.10**	29	75	**19.7**	IN	0.006	0.024
Bangor, ME MSA	90,864	ND	ND	ND	IN	IN	17	37	9.0	24	ND	ND
Baton Rouge, LA MSA	602,894	4	ND	0.017	**0.14**	**0.10**	IN	68	15.0	36	0.006	0.031
Beaumont—Port Arthur, TX MSA	385,090	ND	ND	0.008	**0.16**	**0.10**	ND	ND	IN	**122**	0.006	0.046
Bellingham, WA MSA	166,814	ND	ND	ND	0.06	0.05	15	29	8.4	21	ND	ND
Benton Harbor, MI MSA	162,453	ND	ND	ND	0.11	0.08	ND	ND	12.1	30	ND	ND
Bergen—Passaic, NJ PMSA	1,373,167	3	ND	ND	0.10	0.08	37	86	14.6	36	0.005	0.020
Billings, MT MSA	129,352	5	ND	ND	ND	ND	18	43	8.1	25	0.006	0.026
Biloxi—Gulfport—Pascagoula, MS MSA	363,988	ND	ND	0.005	**0.14**	**0.09**	16	35	IN	IN	0.003	0.033
Binghamton, NY MSA	252,320	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
Birmingham, AL MSA	921,106	5	ND	0.011	**0.13**	**0.10**	27	125	**22.3**	53	IN	IN
Bismarck, ND MSA	94,719	ND	ND	ND	ND	ND	ND	ND	6.6	14	0.006	0.053
Bloomington—Normal, IL MSA	150,433	ND	ND	ND	ND	ND	ND	ND	14.9	33	ND	ND
Boise City, ID MSA	432,345	5	ND	IN	ND	ND	34	88	9.7	38	ND	ND
Boston, MA—NH PMSA	3,406,829	2	0.02	0.029	0.09	0.08	29	59	**15.8**	IN	0.006	0.030
Boulder—Longmont, CO PMSA	291,288	4	ND	ND	0.09	0.07	23	74	9.5	25	ND	ND
Brazoria, TX PMSA	241,767	ND	ND	ND	**0.14**	0.08	ND	ND	IN	IN	ND	ND
Bridgeport, CT PMSA	459,479	2	ND	0.018	0.12	**0.09**	20	51	IN	IN	0.006	0.024
Brockton, MA PMSA	255,459	ND	ND	0.007	0.09	0.07	ND	ND	IN	IN	ND	ND
Brownsville—Harlingen—San Benito, T	335,227	2	0.01	ND	0.08	0.06	25	58	IN	IN	0.001	0.002
Buffalo—Niagara Falls, NY MSA	1,170,111	2	0.02	0.022	0.11	**0.09**	IN	31	**16.1**	33	0.010	0.051
Burlington, VT MSA	169,391	2	ND	IN	ND	ND	12	28	8.3	17	IN	IN
Canton—Massillon, OH MSA	406,934	3	ND	ND	0.10	**0.09**	24	49	**18.6**	40	0.008	0.028
Casper, WY MSA	66,533	ND	ND	ND	ND	ND	17	38	ND	ND	ND	ND
Cedar Rapids, IA MSA	191,701	2	ND	0.005	0.08	0.08	IN	60	10.7	29	0.003	0.037
Champaign—Urbana, IL MSA	179,669	ND	ND	ND	0.08	0.07	ND	ND	14.8	28	0.002	0.016
Charleston—North Charleston, SC MSA	549,033	3	0.02	0.011	0.11	0.08	23	52	14.8	31	0.003	0.013
Charleston, WV MSA	251,662	ND	ND	ND	0.09	**0.09**	27	50	**18.1**	37	0.012	0.046
Charlotte—Gastonia—Rock Hill, NC—S	1,499,293	5	0.04	0.018	**0.14**	**0.10**	31	62	**17.2**	37	0.004	0.018
Charlottesville, VA MSA	159,576	ND	ND	ND	ND	ND	23	70	ND	ND	ND	ND
Chattanooga, TN—GA MSA	465,161	ND	ND	ND	0.12	**0.10**	30	67	IN	IN	ND	ND
Cheyenne, WY MSA	81,607	ND	ND	ND	ND	ND	16	30	5.6	13	ND	ND
Chicago, IL PMSA	8,272,768	4	0.15	0.032	0.10	0.08	35	123	**20.2**	43	0.012	0.075
Chico—Paradise, CA MSA	203,171	4	0.00	0.012	0.10	**0.09**	27	77	**16.3**	**70**	ND	ND
Cincinnati, OH—KY—IN PMSA	1,646,395	2	ND	0.022	0.11	**0.09**	32	70	**19.7**	44	0.009	0.053
Clarksville—Hopkinsville, TN—KY MSA	207,033	ND	ND	IN	0.11	**0.09**	23	51	IN	IN	0.006	0.018
Cleveland—Lorain—Elyria, OH PMSA	2,250,871	8	0.20[a]	0.023	0.11	**0.09**	43	122	**19.8**	46	0.009	0.040

Table A-15. Maximum Air Quality Concentrations by Metropolitan Statistical Area, 2000 (continued)

Metropolitan Statistical Area Population	CO 2000 (ppm)	Pb 8-hr ($\mu g/m^3$)	NO_2 QMax (ppm)	O_3 AM (ppm)	O_3 1-hr (ppm)	PM_{10} 8-hr ($\mu g/m^3$)	PM_{10} Wtd AM ($\mu g/m^3$)	$PM_{2.5}$ 24-hr ($\mu g/m^3$)	$PM_{2.5}$ Wtd AM ($\mu g/m^3$)	SO_2 24-hr (ppm)	SO_2 AM (ppm)	24-hr
Colorado Springs, CO MSA	516,929	4	0.01	0.035	0.09	0.07	25	87	7.5	16	0.004	0.014
Columbia, SC MSA	536,691	4	0.07	0.014	0.12	0.10	46	132	16.3	28	0.003	0.014
Columbus, GA—AL MSA	274,624	ND	0.11b	ND	0.11	0.09	26	59	19.2	71	ND	ND
Columbus, OH MSA	1,540,157	3	0.03c	ND	0.12	0.09	34	73	18.5	IN	0.004	0.019
Corpus Christi, TX MSA	380,783	ND	ND	ND	0.10	0.08	36	71	IN	IN	0.003	0.017
Dallas, TX PMSA	3,519,176	2	0.54d	0.014	0.13	0.10	29	58	13.2	32	0.006	0.047
Danbury, CT PMSA	217,980	ND	ND	ND	0.12	0.09	ND	ND	IN	IN	0.003	0.017
Davenport—Moline—Rock Island, IA—I	359,062	ND	ND	IN	0.09	0.08	41	141	13.6	30	0.003	0.014
Dayton—Springfield, OH MSA	950,558	3	ND	ND	0.11	0.09	32	64	18.0	43	0.004	0.018
Daytona Beach, FL MSA	493,175	ND	ND	ND	0.09	0.08	21	53	10.5	26	ND	ND
Decatur, AL MSA	145,867	ND	ND	ND	0.11	0.09	23	53	IN	IN	0.002	0.005
Decatur, IL MSA	114,706	ND	ND	ND	0.09	0.08	ND	ND	15.0	31	0.005	0.025
Denver, CO PMSA	2,109,282	5	0.15	0.016	0.11	0.08	43	134	11.6	41	0.003	0.009
Des Moines, IA MSA	456,022	5	ND	ND	0.08	0.07	31	134	10.8	28	ND	ND
Detroit, MI PMSA	4,441,551	5	0.04	0.024	0.10	0.08	43	113	20.1	45	0.008	0.043
Dothan, AL MSA	137,916	ND	ND	ND	ND	ND	24	70	IN	IN	ND	ND
Dover, DE MSA	126,697	ND	ND	ND	0.13	0.09	ND	ND	12.9	23	ND	ND
Duluth—Superior, MN—WI MSA	243,815	2	ND	ND	0.07	0.07	29	69	8.2	24	ND	ND
Dutchess County, NY PMSA	280,150	ND	ND	ND	0.11	0.08	ND	ND	11.3	33	ND	ND
El Paso, TX MSA	679,622	9	0.10	0.029	0.12	0.08	46	124	9.8	23	0.002	0.006
Elkhart—Goshen, IN MSA	182,791	ND	ND	ND	0.08	0.06	ND	ND	15.7	IN	ND	ND
Elmira, NY MSA	91,070	ND	ND	ND	0.09	0.07	ND	ND	ND	ND	0.003	0.012
Enid, OK MSA	57,813	ND	ND	0.007	ND	ND	ND	ND	10.3	25	ND	ND
Erie, PA MSA	280,843	6	ND	0.012	0.10	0.08	IN	41	IN	IN	0.008	0.041
Eugene—Springfield, OR MSA	322,959	4	ND	ND	IN	IN	IN	69	IN	IN	ND	ND
Evansville—Henderson, IN—KY MSA	296,195	3	ND	0.016	0.10	0.09	28	68	16.1	39	0.015	0.084
Fargo—Moorhead, ND—MN MSA	174,367	N^D	ND	0.007	0.07	0.06	17	39	8.2	29	0.001	0.003
Fayetteville, NC MSA	302,963	4	ND	ND	0.11	0.09	IN	52	16.2	67	ND	ND
Fayetteville—Springdale—Rogers, AR	311,121	ND	ND	ND	ND	ND	ND	N^D	IN	IN	ND	ND
Fitchburg—Leominster, MA PMSA	142,284	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
Flagstaff, AZ—UT MSA	122,366	ND	ND	ND	0.08	0.07	16	33	IN	IN	ND	ND
Flint, MI PMSA	436,141	ND	0.01	ND	0.09	0.07	19	36	12.9	32	0.004	0.015
Florence, AL MSA	142,950	ND	ND	ND	ND	ND	ND	ND	IN	IN	0.003	0.017
Florence, SC MSA	125,761	ND	0.01	ND	ND	ND	ND	ND	14.4	25	ND	ND
Fort Collins—Loveland, CO MSA	251,494	4	ND	ND	0.10	0.08	IN	66	8·3	20	ND	ND
Fort Lauderdale, FL PMSA	1,623,018	4	0.05	0.010	0.09	0.07	19	31	9.6	36	0.003	0.026
Fort Myers—Cape Coral, FL MSA	440,888	ND	ND	ND	0.09	0.08	19	43	9.6	25	ND	ND
Fort Pierce—Port St. Lucie, FL MSA	319,426	ND	ND	0.010	0.08	0.07	18	35	10.1	23	N^D	ND
Fort Smith, AR—OK MSA	207,290	ND	ND	ND	ND	ND	ND	ND	13.5	27	ND	ND
Fort Wayne, IN MSA	502,141	4	ND	ND	0.10	0.09	24	60	15.7	47	ND	ND
Fort Worth—Arlington, TX PMSA	1,702,625	2	ND	0.015	0.12	0.10	23	42	12.7	29	ND	ND
Fresno, CA MSA	922,516	6	0.00	0.020	0.15	0.11	41	122	25.4	89	ND	ND
Gadsden, AL MSA	103,459	ND	ND	ND	ND	ND	26	64	IN	IN	ND	ND
Gainesville, FL MSA	217,955	ND	ND	ND	0.10	0.08	20	36	11.9	27	ND	ND
Galveston—Texas City, TX PMSA	250,158	ND	ND	0.005	0.14	0.09	27	53	IN	IN	0.004	0.037
Gary, IN PMSA	631,362	3	0.11	0.020	0.10	0.09	31	123	17.1	38	0.006	0.046
Goldsboro, NC MSA	113,329	ND	ND	ND	ND	ND	21	40	15·8	40	ND	ND
Grand Forks, ND—MN MSA	97,478	ND	ND	ND	ND	ND	ND	ND	8.2	25	ND	ND
Grand Junction, CO MSA	116,255	4	ND	ND	ND	ND	20	53	7.4	26	ND	ND
Grand Rapids—Muskegon—Holland, MI M	1,088,514	3	0.00	ND	0.12	0.08	21	49	13.8	35	0.002	0.010
Great Falls, MT MSA	80,357	4	ND	ND	ND	ND	ND	ND	IN	IN	IN	IN
Greeley, CO PMSA	180,936	4	ND	ND	0.09	0.07	21	58	8.9	28	ND	ND
Green Bay, WI MSA	226,778	ND	ND	ND	0.09	0.07	ND	ND	11.3	32	0.004	0.016
Greensboro—Winston-Salem—High Point	1,251,509	4	ND	0.018	0.12	0.10	24	51	17.^{8}	38	0.005	0.019

Table A-15. Maximum Air Quality Concentrations by Metropolitan Statistical Area, 2000 (continued)

Metropolitan Statistical Area Population	CO 2000 (ppm)	Pb 8-hr (µg/m³)	NO_2 QMax (ppm)	O_3 AM (ppm)	O_3 1-hr (ppm)	PM_{10} 8-hr (µg/m³)	PM_{10} Wtd AM (µg/m³)	$PM_{2.5}$ 24-hr (µg/m³)	$PM_{2.5}$ Wtd AM (µg/m³)	SO_2 24-hr (ppm)	SO_2 AM (ppm)	24-hr
Greenville, NC MSA	133,798	ND	ND	ND	0.11	0.08	19	36	13.9	41	0.003	0.007
Greenville—Spartanburg—Anderson, SC	962,441	4	0.02	0.016	0.12	0.09	24	54	16.5	32	0.003	0.011
Hagerstown, MD PMSA	131,923	ND	ND	ND	0.10	0.08	ND	ND	15.6	29	ND	ND
Hamilton—Middletown, OH PMSA	332,807	ND	0.01	ND	0.10	0.08	32	**69**	17.0	38	0.006	0.023
Harrisburg—Lebanon—Carlisle, PA MSA	629,401	2	ND	0.017	0.11	0.09	**IN**	53	15.8	23	0.005	0.024
Hartford, CT MSA	1,183,110	7	ND	0.017	0.12	0.09	18	39	IN	IN	0.004	0.021
Hattiesburg, MS MSA	111,674	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
Hickory—Morganton—Lenoir, NC MSA	341,851	ND	ND	ND	0.11	0.09	**22**	**42**	17.4	38	**ND**	ND
Honolulu, HI MSA	876,156	2	ND	0.005	0.05	0.04	16	52	4.9	10	**0.002**	**0.007**
Houma, LA MSA	194,477	ND	ND	ND	0.12	0.09	ND	ND	12.4	29	ND	ND
Houston, TX PMSA	4,177,646	4	0.01	0.021	0.19	0.12	46	102	IN	IN	0.006	0.031
Huntington—Ashland, WV—KY—OH MSA	315,538	1	ND	0.015	0.09	0.08	32	80	17.6	40	0.012	0.046
Huntsville, AL MSA	342,376	2	ND	ND	0.11	0.09	24	80	IN	IN	ND	ND
Indianapolis, IN MSA	1,607,486	4	0.12e	0.017	0.10	0.09	27	67	17.8	36	0.007	0.025
Iowa City, IA MSA	111,006	ND	ND	ND	ND	ND	ND	ND	10.9	28	ND	ND
Jackson, MS MSA	440,801	3	ND	ND	0.10	0.08	24	64	15.6	35	0.002	0.006
Jackson, TN MSA	107,377	ND	ND	ND	ND	ND	23	44	IN	IN	ND	ND
Jacksonville, FL MSA	1,100,491	4	0.03	0.015	0.11	0.08	26	65	IN	IN	0.007	0.055
Jacksonville, NC MSA	150,355	ND	ND	ND	ND	ND	17	32	12.3	34	ND	ND
Jamestown, NY MSA	139,750	ND	ND	ND	0.11	0.09	14	32	IN	IN	0.008	0.065
Janesville—Beloit, WI MSA	152,307	ND	ND	ND	0.10	0.08	ND	ND	13.3	29	ND	ND
Jersey City, NJ PMSA	608,975	5	ND	0.026	0.10	0.08	IN	63	17.5	69	0.008	0.025
Johnson City—Kingsport—Bristol, TN-	480,091	2	0.20	0.015	0.13	0.10	ND	ND	16.4	29	0.011	0.043
Johnstown, PA MSA	232,^{6}21	2	0.05	0.015	0.10	0.09	**IN**	51	15.9	IN	0.007	0.026
Jonesboro, AR MSA	82,148	ND	ND	ND	ND	ND	ND	ND	15.2	IN	ND	ND
Joplin, MO MSA	157,322	ND	ND	ND	ND	ND	IN	126	13.2	26	ND	ND
Kalamazoo—Battle Creek, MI MSA	452,851	ND	ND	ND	0.09	0.07	IN	IN	15.1	37	ND	ND
Kansas City, MO—KS MSA	1,776,062	5	0.01	0.017	0.12	0.09	**37**	64	13.4	32	0.004	0.039
Kenosha, WI PMSA	149,577	ND	ND	ND	0.10	0.09	ND	ND	**11.4**	**27**	**ND**	**ND**
Knoxville, TN MSA	687,249	3	0.00	0.013	0.13	0.10	34	125	IN	IN	0.010	0.060
Kokomo, IN MSA	101,541	ND	ND	ND	ND	ND	ND	ND	15.6	35	ND	ND
Lafayette, LA MSA	385,647	ND	ND	ND	0.12	0.09	ND	ND	13.0	33	ND	ND
Lafayette, IN MSA	182,821	ND	ND	ND	ND	ND	ND	ND	15.6	35	ND	ND
Lake Charles, LA MSA	183,577	ND	ND	0.005	0.13	0.09	ND	ND	13.1	34	0.004	**0.013**
Lakeland—Winter Haven, FL MSA	483,924	ND	ND	ND	0.10	0.08	23	121	**12.2**	**28**	0.005	0.018
Lancaster, PA MSA	470,658	2	ND	0.014	0.11	0.09	IN	56	18.4	IN	0.005	0.024
Lansing—East Lansing, MI MSA	447,728	ND	ND	IN	0.09	0.08	ND	ND	13.6	38	ND	ND
Laredo, TX MSA	193,117	6	0.04	ND	0.09	0.07	31	56	12.1	23	ND	ND
Las Cruces, NM MSA	174,682	^{4}	ND	0.012	0.12	0.08	42	96	10.5	31	0.001	0.003
Las Vegas, NV—AZ MSA	1,563,282	7	ND	ND	0.09	0.08	48	188	10.8	32	ND	ND
Lawrence, MA—NH PMSA	396,230	ND	ND	ND	0.07	0.06	ND	ND	IN	IN	0.004	0.020
Lawton, OK MSA	114,996	1	ND	ND	0.09	0.09	ND	ND	9.1	19	ND	ND
Lewiston—Auburn, ME MSA	90,830	ND	ND	ND	ND	ND	IN	36	9.6	26	0.004	0.018
Lexington, KY MSA	479,198	2	ND	0.013	0.09	0.08	21	49	IN	**IN**	0.005	**0.020**
Lima, OH MSA	155,084	ND	ND	ND	0.10	0.09	IN	42	ND	ND	0.003	0.015
Lincoln, NE MSA	250,291	3	ND	ND	0.07	0.06	ND	ND	IN	IN	ND	ND
Little Rock—North Little Rock, AR MS	583,845	3	ND	0.010	0.11	0.09	25	48	15.7	34	0.002	0.007
Longview—Marshall, TX MSA	208,780	ND	ND	0.006	0.13	0.10	ND	ND	13.4	29	0.002	0.011
Los Angeles—Long Beach, CA PMSA	9,519,338	10	0.06	0.044	0.17	0.11	46	93	23.9	83	0.003	0.010
Louisville, KY—IN MSA	1,025,598	4	ND	0.013	0.11	0.09	31	84	18.6	IN	0.015	0.037
Lowell, MA—NH PMSA	301,686	3	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
Lubbock, TX MSA	242,628	ND	ND	ND	ND	ND	IN	38	7.4	19	ND	ND
Lynchburg, VA MSA	214,911	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
Macon, GA MSA	322,549	ND	ND	ND	0.13	0.10	IN	48	18.6	37	**0.003**	0.015
Madison, WI MSA	426,526	2	ND	ND	0.09	0.07	22	57	13.2	34	ND	ND

Table A-15. Maximum Air Quality Concentrations by Metropolitan Statistical Area, 2000 (continued)

Metropolitan Statistical Area Population	CO 2000 (ppm)	Pb 8-hr ($\mu g/m^3$)	NO$_2$ QMax (ppm)	O$_3$ AM (ppm)	O$_3$ 1-hr (ppm)	PM$_{10}$ 8-hr ($\mu g/m^3$)	PM$_{10}$ Wtd AM ($\mu g/m^3$)	PM$_{2.5}$ 24-hr ($\mu g/m^3$)	PM$_{2.5}$ Wtd AM ($\mu g/m^3$)	SO$_2$ 24-hr (ppm)	SO$_2$ AM (ppm)	24-hr
Manchester, NH PMSA	198,378	ND	ND	0.011	0.09	0.06	IN	39	IN	IN	0.005	0.022
Mansfield, OH MSA	175,818	ND	ND	ND	ND	ND	IN	53	ND	ND	ND	ND
Mayaguez, PR MSA	253,347	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
McAllen—Edinburg—Mission, TX MSA	569,463	ND	ND	ND	0.09	0.08	IN	53	11.0	23	ND	ND
Medford—Ashland, OR MSA	181,269	5	ND	ND	0.08	0.07	IN	68	11.4	49	ND	ND
Melbourne—Titusville—Palm Bay, FL M	476,230	ND	ND	ND	0.09	0.08	IN	34	IN	IN	ND	ND
Memphis, TN—AR—MS MSA	1,135,614	4	0.59f	0.025	0.12	0.09	28	71	15.7	IN	0.006	0.038
Merced, CA MSA	210,554	ND	ND	0.012	0.12	0.10	35	89	17.3	47	ND	ND
Miami, FL PMSA	2,253,362	3	ND	0.016	0.09	0.08	26	51	11.3	24	0.002	0.003
Middlesex—Somerset—Hunterdon, NJ PM	1,169,641	3	0.15g	0.019	0.11	0.09	ND	ND	IN	IN	0.005	0.018
Milwaukee—Waukesha, WI PMSA	1,500,741	2	ND	0.021	0.10	0.09	21	59	14.2	35	0.004	0.026
Minneapolis—St. Paul, MN—WI MSA	2,968,806	5	0.40h	0.022	0.09	0.07	36	103	IN	IN	0.003	0.023
Mobile, AL MSA	540,258	ND	ND	ND	0.12	0.10	24	150	IN	IN	0.002	0.008
Modesto, CA MSA	446,997	4	0.00	0.018	0.11	0.09	35	100	18.9	71	ND	ND
Monmouth—Ocean, NJ PMSA	1,126,217	3	ND	ND	0.14	0.11	ND	ND	IN	IN	ND	ND
Monroe, LA MSA	147,250	ND	ND	ND	0.10	0.08	ND	ND	13.3	27	0.002	0.003
Montgomery, AL MSA	333,055	ND	ND	ND	0.11	0.09	25	61	IN	IN	ND	ND
Muncie, IN MSA	118,769	ND	0.58i	ND	ND	ND	ND	ND	16.1	49	ND	ND
Myrtle Beach, SC MSA	196,629	ND	0.01	ND	ND	ND	ND	ND	IN	IN	ND	ND
Naples, FL MSA	251,377	ND	ND	ND	ND	ND	IN	IN	ND	ND	ND	ND
Nashua, NH PMSA	190,949	4	ND	ND	0.09	0.07	15	33	ND	ND	0.004	0.020
Nashville, TN MSA	1,231,311	6	1.50j	0.019	0.12	0.09	34	65	IN	IN	0.004	0.040
Nassau—Suffolk, NY PMSA	2,753,913	3	ND	0.024	0.13	0.09	17	38	12.2	36	0.007	0.025
New Bedford, MA PMSA	175,198	ND	ND	ND	0.10	0.08	ND	ND	IN	IN	ND	ND
New Haven—Meriden, CT PMSA	542,149	3	ND	0.025	0.14	0.09	32	86	16.2	40	0.006	0.031
New London—Norwich, CT—RI MSA	293,566	ND	ND	ND	0.14	0.08	16	40	IN	IN	ND	ND
New Orleans, LA MSA	1,337,726	4	0.12	0.019	0.12	0.10	IN	57	14.1	37	0.005	0.020
New York, NY PMSA	9,314,235	4	0.02	0.038	0.12	0.09	23	57	18.4	48	0.013	0.046
Newark, NJ PMSA	2,032,989	5	ND	0.041	0.11	0.09	35	108	18.7	47	0.009	0.025
Newburgh, NY—PA PMSA	387,669	ND	0.18k	ND	0.10	0.08	ND	ND	IN	IN	ND	ND
Norfolk—Virginia Beach—Newport News	1,569,541	4	ND	0.016	0.10	0.08	22	41	13.6	26	0.007	0.023
Oakland, CA PMSA	2,392,557	3	0.00	0.020	0.13	0.08	22	63	11.2	50	0.003	0.021
Ocala, FL MSA	258,916	ND	ND	ND	0.09	0.08	ND	ND	11.0	24	ND	ND
Odessa—Midland, TX MSA	237,132	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
Oklahoma City, OK MSA	1,083,346	4	ND	0.013	0.10	0.09	26	62	11.5	29	0.003	0.007
Olympia, WA PMSA	207,355	5	ND	ND	0.08	0.06	15	36	10.3	41	ND	ND
Omaha, NE—IA MSA	716,998	3	0.08l	ND	0.08	0.07	48	124	11.5	28	0.001	0.016
Orange County, CA PMSA	2,846,289	6	ND	0.029	0.12	0.08	40	119	20.4	37	0.002	0.005
Orlando, FL MSA	1,644,561	3	ND	0.012	0.11	0.08	26	53	12.1	31	0.003	0.009
Owensboro, KY MSA	91,545	1	ND	0.011	0.08	0.07	20	64	IN	IN	0.005	0.018
Panama City, FL MSA	148,217	ND	ND	ND	0.12	0.09	25	46	ND	ND	ND	ND
Parkersburg—Marietta, WV—OH MSA	151,237	ND	ND	ND	0.11	0.09	21	75	17.5	36	0.011	0.036
Pensacola, FL MSA	412,153	ND	ND	0.010	0.12	0.10	22	38	13.9	32	0.005	0.032
Peoria—Pekin, IL MSA	347,387	3	0.02	ND	0.08	0.07	24	54	14.8	32	0.006	0.063
Philadelphia, PA—NJ PMSA	5,100,931	4	0.05	0.028	0.13	0.10	29	76	16.0	34	0.010	0.027
Phoenix—Mesa, AZ MSA	3,251,876	7	ND	0.036	0.11	0.09	70	232	IN	IN	0.003	0.016
Pine Bluff, AR MSA	84,278	ND	ND	ND	ND	ND	ND	ND	15.0	27	ND	ND
Pittsburgh, PA MSA	2,358,695	3	0.07	0.025	0.11	0.09	39	124	20.0	84	0.013	0.086
Pittsfield, MA MSA	84,699	ND	ND	ND	IN	IN	ND	ND	IN	IN	ND	ND
Pocatello, ID MSA	75,565	ND	ND	ND	ND	ND	31	94	10.5	57	0.008	0.036
Ponce, PR MSA	361,094	ND	ND	ND	ND	ND	40	77	IN	IN	ND	ND
Portland, ME MSA	243,537	ND	ND	ND	0.08	0.07	27	74	11.0	35	0.005	0.018
Portland—Vancouver, OR—WA PMSA	1,918,009	6	0.11	0.012	0.08	0.07	16	45	10.8	40	ND	ND
Portsmouth—Rochester, NH—ME PMSA	240,698	ND	ND	0.010	0.09	0.07	13	33	IN	IN	0.003	0.013
Providence—Fall River—Warwick, RI—	1,188,613	4	ND	0.020	0.12	0.09	29	91	14.9	36	0.007	0.042

Table A-15. Maximum Air Quality Concentrations by Metropolitan Statistical Area, 2000 (continued)

Metropolitan Statistical Area Population	**CO 2000 (ppm)**	**Pb 8-hr (µg/m^3)**	**NO$_2$ QMax (ppm)**	**O$_3$ AM (ppm)**	**O$_3$ 1-hr (ppm)**	**PM$_{10}$ 8-hr (µg/m^3)**	**PM$_{10}$ Wtd AM (µg/m^3)**	**PM$_{2.5}$ 24-hr (µg/m^3)**	**PM$_{2.5}$ Wtd AM (µg/m^3)**	**SO$_2$ 24-hr (ppm)**	**SO$_2$ AM (ppm)**	**24-hr**
Provo—Orem, UT MSA	368,536	6	ND	0.024	0.10	0.08	32	89	10.1	34	ND	ND
Pueblo, CO MSA	141,472	ND	ND	ND	ND	ND	24	64	7.9	22	ND	ND
Racine, WI PMSA	188,831	2	ND	ND	0.10	0.08	ND	ND	ND	ND	ND	ND
Raleigh—Durham—Chapel Hill, NC MSA	1,187,941	5	ND	ND	0.12	0.09	23	51	16.5	52	ND	ND
Rapid City, SD MSA	88,565	ND	ND	ND	IN	IN	38	139	IN	IN	ND	ND
Reading, PA MSA	373,638	2	0.33m	0.020	0.11	0.08	IN	45	16.9	34	0.008	0.028
Redding, CA MSA	163,256	ND	ND	ND	0.11	0.08	24	47	IN	IN	ND	ND
Reno, NV MSA	339,486	5	ND	0.008	0.09	0.07	42	96	9.0	31	ND	ND
Richland—Kennewick—Pasco, WA MSA	191,822	ND	ND	ND	ND	ND	IN	140	IN	IN	ND	ND
Richmond—Petersburg, VA MSA	996,512	3	ND	0.017	0.11	0.08	IN	42	15.1	30	0.006	0.017
Riverside—San Bernardino, CA PMSA	3,254,821	4	0.05	0.038	0.17	0.12	59	190	28.4	81	0.003	0.026
Roanoke, VA MSA	235,932	3	ND	0.011	0.10	0.08	32	66	15.9	33	0.003	0.014
Rochester, MN MSA	124,277	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
Rochester, NY MSA	1,098,201	3	ND	ND	0.09	0.07	ND	ND	11.8	28	0.006	0.021
Rockford, IL MSA	371,236	3	ND	ND	0.08	0.07	ND	ND	15.0	36	ND	ND
Rocky Mount, NC MSA	143,026	ND	ND	ND	0.11	0.09	20	41	14.7	35	ND	ND
Sacramento, CA PMSA	1,628,197	6	0.00	0.019	0.13	0.10	27	82	12.3	81	IN	IN
Saginaw—Bay City—Midland, MI MSA	403,070	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
St. Cloud, MN MSA	167,392	3	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
St. Joseph, MO MSA	102,490	ND	ND	ND	ND	ND	31	80	11.8	27	IN	IN
St. Louis, MO—IL MSA	2,603,607	4	6.86n	0.026	0.12	0.09	45	116	20.6	43	0.008	0.043
Salem, OR PMSA	347,214	IN	ND	ND	0.07	0.06	ND	ND	8.9	31	ND	ND
Salinas, CA MSA	401,762	1	ND	0.007	0.08	0.06	30	70	8.0	22	ND	ND
Salt Lake City—Ogden, UT MSA	1,333,914	6	0.07	0.026	0.10	0.08	46	117	14.2	57	0.004	0.013
San Antonio, TX MSA	1,592,383	3	ND	0.018	0.10	0.08	IN	IN	IN	IN	ND	ND
San Diego, CA MSA	2,813,833	5	0.02	0.024	0.12	0.10	31	86	15.9	IN	0.004	0.011
San Francisco, CA PMSA	1,731,183	4	0.00	0.020	0.08	0.05	24	53	10.9	43	0.002	0.007
San Jose, CA PMSA	1,682,585	7	0.00	0.025	0.10	0.07	27	68	13.5	57	ND	ND
San Juan—Bayamon, PR PMSA	1,967,627	6	0.02	0.018	0.10	0.05	37	102	7.3	18	0.006	0.058
San Luis Obispo—Atascadero—Paso Rob	246,681	2	ND	0.012	0.08	0.07	21	102	10.5	41	0.005	0.028
Santa Barbara—Santa Maria—Lompoc, C	399,347	3	0.00	0.018	0.10	0.08	26	62	9.7	19	0.002	0.003
Santa Cruz—Watsonville, CA PMSA	255,602	1	ND	0.005	0.09	0.06	26	50	7.9	18	0.001	0.003
Santa Fe, NM MSA	147,635	2	ND	ND	ND	ND	11	28	5.2	10	ND	ND
Santa Rosa, CA PMSA	458,614	3	ND	0.013	0.08	0.06	18	40	10.3	40	ND	ND
Sarasota—Bradenton, FL MSA	589,959	4	ND	0.009	0.11	0.09	26	48	11.0	30	0.002	0.019
Savannah, GA MSA	293,000	ND	ND	ND	0.10	0.08	26	66	15.1	IN	0.003	0.024
Scranton—Wilkes-Barre—Hazleton, PA	624,776	2	ND	0.015	0.09	0.08	IN	46	12.7	33	0.006	0.026
Seattle—Bellevue—Everett, WA PMSA	2,414,616	6	ND	0.021	0.10	0.07	23	66	12.7	43	0.003	0.011
Sharon, PA MSA	120,293	ND	ND	ND	0.10	0.08	ND	ND	IN	IN	0.007	0.024
Sheboygan, WI MSA	112,646	ND	ND	ND	0.11	0.09	ND	ND	ND	ND	ND	ND
Shreveport—Bossier City, LA MSA	392,302	ND	ND	ND	0.13	0.09	24	51	13.8	31	0.002	0.006
Sioux City, IA—NE MSA	124,130	ND	ND	ND	ND	ND	25	76	9.5	31	ND	ND
Sioux Falls, SD MSA	172,412	ND	ND	ND	IN	IN	20	53	IN	IN	ND	ND
South Bend, IN MSA	265,559	ND	ND	0.016	0.10	0.08	19	35	13.7	36	ND	ND
Spokane, WA MSA	417,939	6	ND	ND	0.08	0.07	28	87	11.0	38	ND	ND
Springfield, IL MSA	201,437	2	ND	ND	0.10	0.08	26	54	13.4	32	0.005	0.035
Springfield, MO MSA	325,721	3	ND	0.012	0.09	0.08	18	35	12.3	27	0.005	0.077
Springfield, MA MSA	591,932	4	ND	0.026	0.10	0.08	28	57	15.9	37	0.005	0.023
Stamford—Norwalk, CT PMSA	353,556	3	ND	ND	0.12	0.08	31	67	IN	IN	0.005	0.026
State College, PA MSA	135,758	ND	ND	ND	0.11	0.08	ND	ND	IN	IN	ND	ND
Steubenville—Weirton, OH—WV MSA	132,008	8	ND	ND	0.10	0.08	31	95	19.1	47	0.014	0.069
Stockton—Lodi, CA MSA	563,598	4	0.00	0.020	0.11	0.08	32	79	17.3	IN	ND	ND
Sumter, SC MSA	104,646	ND	0.01	ND	ND	ND	ND	ND	ND	ND	ND	ND
Syracuse, NY MSA	732,117	2	ND	ND	0.08	0.07	ND	ND	IN	IN	0.003	0.022

Table A-15. Maximum Air Quality Concentrations by Metropolitan Statistical Area, 2000 (continued)

Metropolitan Statistical Area Population	CO 2000 (ppm)	Pb 8-hr (µg/m^3)	NO_2 QMax (ppm)	O_3 AM (ppm)	O_3 1-hr (ppm)	PM_{10} 8-hr (µg/m^3)	PM_{10} Wtd AM (µg/m^3)	$PM_{2.5}$ 24-hr (µg/m^3)	$PM_{2.5}$ Wtd AM (µg/m^3)	SO_2 24-hr (ppm)	SO_2 AM (ppm)	24-hr
Tacoma, WA PMSA	700,820	6	ND	ND	0.08	0.06	28	58	13.0	49	ND	ND
Tallahassee, FL MSA	284,539	ND	ND	ND	0.09	0.08	18	46	IN	IN	ND	ND
Tampa—St. Petersburg—Clearwater, FL	2,395,997	3	2.01o	0.013	0.11	0.08	33	73	13.5	43	0.006	0.031
Terre Haute, IN MSA	149,192	ND	ND	ND	0.09	0.08	25	54	15.7	37	0.012	0.055
Texarkana, TX—Texarkana, AR MSA	129,749	ND	ND	ND	ND	ND	ND	ND	14.7	31	ND	ND
Toledo, OH MSA	618,203	ND	0.33	ND	0.10	0.08	23	60	IN	IN	0.005	0.017
Topeka, KS MSA	169,871	ND	ND	ND	ND	ND	20	49	10.8	23	ND	ND
Trenton, NJ PMSA	350,761	ND	ND	0.016	0.11	0.10	26	55	14.7	43	ND	ND
Tucson, AZ MSA	843,746	5	ND	0.017	0.09	0.08	39	123	IN	IN	0.002	0.007
Tulsa, OK MSA	803,235	4	ND	0.015	0.12	0.09	25	58	12.1	30	0.006	0.027
Tuscaloosa, AL MSA	164,875	ND	ND	ND	ND	ND	IN	68	IN	IN	ND	ND
Tyler, TX MSA	174,706	ND	ND	0.006	0.10	0.09	ND	ND	ND	ND	ND	ND
Utica—Rome, NY MSA	299,896	ND	ND	ND	0.08	0.07	9	23	11.8	34	0.001	0.007
Vallejo—Fairfield—Napa, CA PMSA	518,821	5	ND	0.013	0.10	0.07	18	46	11.6	60	0.002	0.005
Ventura, CA PMSA	753,197	3	0.00	0.020	0.12	0.10	31	80	IN	IN	0.002	0.007
Victoria, TX MSA	84,088	ND	ND	ND	0.09	0.08	ND	ND	ND	ND	ND	ND
Vineland—Millville—Bridgeton, NJ PM	146,438	ND	ND	ND	0.12	0.09	ND	ND	ND	ND	0.004	0.017
Visalia—Tulare—Porterville, CA MSA	368,021	3	ND	0.018	0.12	0.11	53	127	23.7	103	ND	ND
Waco, TX MSA	213,517	ND	ND	ND	ND	ND	ND	ND	IN	IN	ND	ND
Washington, DC—MD—VA—WV PMSA	4,923,153	5	0.00	0.023	0.13	0.09	24	68	18.9	50	0.011	0.030
Waterbury, CT PMSA	228,984	ND	0.02	ND	ND	ND	21	41	IN	IN	0.004	0.017
Waterloo—Cedar Falls, IA MSA	128,012	ND	ND	ND	ND	ND	31	71	11.6	29	ND	ND
Wausau, WI MSA	125,834	ND	ND	ND	0.08	0.07	IN	IN	ND	ND	ND	ND
West Palm Beach—Boca Raton, FL MSA	1,131,184	3	ND	0.016	0.09	0.08	IN	38	9.4	27	0.002	0.008
Wheeling, WV—OH MSA	153,172	2	ND	ND	0.09	0.07	28	62	16.3	35	0.013	0.044
Wichita, KS MSA	545,220	6	ND	ND	0.09	0.08	26	87	12.7	29	ND	ND
Williamsport, PA MSA	120,044	ND	ND	ND	0.09	0.07	IN	IN	ND	ND	0.005	0.019
Wilmington—Newark, DE—MD PMSA	586,216	3	ND	IN	0.13	0.11	26	46	16.8	29	0.007	0.047
Wilmington, NC MSA	233,450	4	ND	ND	0.10	0.08	17	36	12.5	32	0.006	0.030
Worcester, MA—CT PMSA	511,389	3	ND	0.018	0.10	0.08	19	54	12.1	33	0.006	0.019
Yakima, WA MSA	222,581	3	ND	ND	ND	ND	27	58	IN	IN	ND	ND
Yolo, CA PMSA	168,660	1	ND	0.011	0.10	0.08	26	66	10.3	38	ND	ND
York, PA MSA	381,751	2	ND	0.018	0.11	0.09	IN	53	16.6	31	0.006	0.020
Youngstown—Warren, OH MSA	594,746	ND	ND	ND	0.10	0.08	27	128	15.9	35	0.007	0.024
Yuba City, CA MSA	139,149	4	ND	0.013	0.10	0.08	28	66	11.5	38	ND	ND
Yuma, AZ MSA	160,026	ND	ND	ND	0.08	0.06	IN	IN	ND	ND	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 µg/m^3)*
NO_2 – Highest arithmetic mean concentration *(Applicable NAAQS is 0.053 ppm)*
O_3 (1-hr) – Highest second daily maximum 1-hour concentration *(Applicable NAAQS is 0.12 ppm)*
O_3 (8-hr) – Highest fourth daily maximum 8-hour concentration *(Applicable NAAQS is 0.08 ppm)*
PM_{10} – Highest weighted annual mean concentration *(Applicable NAAQS is 50 µg/m^3)*
– Highest second maximum 24-hour concentration *(Applicable NAAQS is 150 µg/m^3)*
SO_2 – 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
µg/m^3 – Units are micrograms per cubic meter
PPM – Units are parts per million

Table A-16. Metropolitan Statistical Area Air Quality Trends, 1993–2002

Metropolitan Statistical Area		Trend	#Trend Sites	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
AKRON, OH													
CO	2nd max (daily-non-overlapping 8-h)	down	1	3.1	5.3	3.3	3.4	3.2	2.6	2.5	2.4	2.7	1.8
SO_2	2nd daily max	ns	1	0.056	0.042	0.046	0.042	0.072	0.044	0.065	0.044	0.044	0.06
	Annual mean	ns	1	0.015	0.012	0.009	0.01	0.012	0.01	0.011	0.009	0.01	0.01
Ozone	2nd highest daily max	ns	2	0.108	0.1	0.117	0.105	0.103	0.112	0.115	0.106	0.113	0.12
	4th highest daily max 8-h average	ns	2	0.093	0.086	0.092	0.091	0.087	0.097	0.097	0.085	0.096	0.1
$PM_{2.5}$*	98th percentile	NA	2	ND	ND	ND	ND	ND	ND	41.45	37.15	44.1	41.9
	Weighted annual mean	NA	2	ND	ND	ND	ND	ND	ND	17.215	16.435	16.75	16.745
ALBANY, GA													
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	ND	37.7	36.1	30.5
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	ND	16.61	14.64	13.82
ALBANY-SCHENECTADY-TROY, NY													
CO	2nd max (daily-non-overlapping 8-h)	down	1	3.8	5.2	4.3	3.7	4.5	4.4	4.2	2.9	2.4	3.4
SO_2	2nd daily max	down	1	0.028	0.037	0.023	0.025	0.02	0.016	0.016	0.02	0.024	0.019
	Annual mean	ns	1	0.006	0.007	0.003	0.004	0.003	0.004	0.003	0.004	0.005	0.004
Ozone	2nd highest daily max	ns	2	0.102	0.103	0.101	0.095	0.094	0.096	0.106	0.08	0.104	0.113
	4th highest daily max 8-h average	ns	2	0.083	0.078	0.08	0.077	0.077	0.075	0.082	0.066	0.086	0.088
$PM_{2.5}$*	98th percentile	NA	2	ND	ND	ND	ND	ND	ND	ND	25.3	32.1	33.65
	Weighted annual mean	NA	2	ND	ND	ND	ND	ND	ND	ND	10.54	10.685	10.91
ALBUQUERQUE, NM													
CO	2nd max (daily-non-overlapping 8-h)	down	2	6.2	5	4.35	4.3	4.05	3.85	4.05	3.45	3.25	2.8
NO_2	Annual mean	ns	1	0.024	0.023	0.018	0.022	0.019	0.016	0.016	0.017	0.017	0.019
Ozone	2nd highest daily max	ns	2	0.086	0.078	0.082	0.089	0.088	0.089	0.091	0.088	0.085	0.087
	4th highest daily max 8-h average	up	2	0.065	0.063	0.061	0.071	0.071	0.07	0.071	0.07	0.07	0.075
PM_{10}*	90th percentile	down	2	43	36	36.5	30.5	30.5	28.5	28.5	29.5	27.5	39.5
	Weighted annual mean	down	2	26.85	22.6	22.4	20.5	19.7	19.2	19.3	18.65	18.7	24.55
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	22.1	17.5	19.7	18.5
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	6.54	6.39	6.39	6.31
ALEXANDRIA, LA													
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	30.7	30.1	29.4	24.7
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	14.29	13.35	12.15	10.55
ALLENTOWN-BETHLEHEM-EASTON, PA													
Lead	Maximum quarterly value	ns	1	0.181	0.131	0.074	0.083	0.093	0.12	0.071	0.111	0.071	0.088
CO	2nd max (daily-non-overlapping 8-h)	down	1	3.5	4.7	4.8	3.2	2.7	2.9	3.2	2.6	3.3	2.3
SO_2	2nd daily max	down	1	0.034	0.053	0.028	0.035	0.03	0.03	0.03	0.027	0.028	0.028
	Annual mean	ns	1	0.007	0.008	0.006	0.006	0.008	0.008	0.006	0.007	0.007	0.008
NO_2	Annual mean	down	1	0.02	0.021	0.018	0.018	0.016	0.016	0.015	0.013	0.017	0.014
Ozone	2nd highest daily max	up	1	0.104	0.105	0.109	0.114	0.116	0.106	0.125	0.112	0.126	0.114
	4th highest daily max 8-h average	ns	1	0.082	0.084	0.091	0.094	0.101	0.095	0.105	0.091	0.094	0.094
$PM_{2.5}$*	98th percentile	NA	2	ND	ND	ND	ND	ND	ND	31.4	37.75	42.85	39.9
	Weighted annual mean	NA	2	ND	ND	ND	ND	ND	ND	12.37	13.975	15.215	13.62
ALTOONA, PA													
CO	2nd max (daily-non-overlapping 8-h)	down	1	2	2.4	1.7	1.9	1.5	1.2	1.6	1	1.1	0.7
SO_2	2nd daily max	ns	1	0.052	0.058	0.037	0.033	0.046	0.032	0.03	0.045	0.042	0.032
	Annual mean	ns	1	0.009	0.01	0.008	0.008	0.01	0.008	0.007	0.006	0.009	0.007
NO_2	Annual mean	ns	1	0.015	0.015	0.013	0.013	0.014	0.013	0.013	0.014	0.014	0.013
Ozone	2nd highest daily max	ns	1	0.1	0.106	0.112	0.101	0.114	0.114	0.111	0.104	0.107	0.102
	4th highest daily max 8-h average	ns	1	0.086	0.092	0.091	0.083	0.096	0.098	0.091	0.08	0.083	0.089
ANCHORAGE, AK													
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	ND	20.2	16.3	18.2
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	ND	6.05	6.17	6.92
ANN ARBOR, MI													
Ozone	2nd highest daily max	ns	1	0.09	0.094	0.11	0.104	0.089	0.097	0.09	0.094	0.103	0.1
	4th highest daily max 8-h average	ns	1	0.074	0.084	0.089	0.085	0.076	0.086	0.083	0.082	0.086	0.089
$PM_{2.5}$*	98th percentile	NA	2	ND	ND	ND	ND	ND	ND	ND	31.7	39.1	31.1
	Weighted annual mean	NA	2	ND	ND	ND	ND	ND	ND	ND	13.73	13.995	14.215
ASHEVILLE, NC													
Ozone	2nd highest daily max	up	1	0.079	0.084	0.085	0.084	0.09	0.114	0.099	0.107	0.091	0.106
	4th highest daily max 8-h average	up	1	0.066	0.069	0.076	0.074	0.075	0.09	0.084	0.09	0.076	0.09
PM_{10}*	90th percentile	ns	1	43	30	28	29	38	36	36	33	26	28
	Weighted annual mean	down	1	22.3	19	18.4	18.8	20.7	20.1	20.5	18.3	17.5	7.6
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	31.6	30.5	29.4	30.5
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	15.61	14.195	12.78	13.77

Table A-16. Metropolitan Statistical Area Air Quality Trends, 1993–2002 (continued)

Metropolitan Statistical Area			Trend	#Trend Sites	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
ATHENS, GA														
	PM$_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	48.2	39.7	50.9	27.8
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	19.84	18.48	17.53	14.96
ATLANTA, GA														
	Lead	Maximum quarterly value	ns	1	0.02	0.02	0.027	0.02	0.017	0.013	0.053	0.04	0.05	0.037
	CO	2nd max (daily-non-overlapping 8-h)	down	1	4.9	5.3	4.5	3.7	4.3	4.1	4.1	3.2	4.1	3.6
	SO$_2$	2nd daily max	down	2	0.026	0.026	0.019	0.021	0.023	0.018	0.019	0.019	0.015	0.018
		Annual mean	down	2	0.006	0.005	0.004	0.004	0.004	0.004	0.004	0.004	0.003	0.003
	NO$_2$	Annual mean	ns	1	0.025	0.023	0.019	0.027	0.025	0.024	0.024	0.023	0.023	0.019
	Ozone	2nd highest daily max	ns	1	0.158	0.125	0.145	0.137	0.133	0.157	0.156	0.158	0.114	0.123
		4th highest daily max 8-h average	ns	1	0.122	0.089	0.118	0.11	0.104	0.126	0.124	0.113	0.084	0.1
	PM$_{10}$*	90th percentile	ns	1	57	53	56	48	61	53	56	52	85	45
		Weighted annual mean	ns	1	35.1	32.2	33.3	31.2	32.2	31.1	34.9	36	37.6	26.4
	PM$_{2.5}$*	98th percentile	NA	3	ND	ND	ND	ND	ND	ND	46.05	51	37.867	33.167
		Weighted annual mean	NA	3	ND	ND	ND	ND	ND	ND	22.035	19.987	17.79	15.93
ATLANTIC-CAPE MAY, NJ														
	SO$_2$	2nd daily max	down	1	0.014	0.019	0.011	0.014	0.011	0.01	0.009	0.013	0.01	0.009
		Annual mean	down	1	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
	Ozone	2nd highest daily max	ns	1	0.115	0.099	0.116	0.108	0.131	0.118	0.118	0.108	0.105	0.107
		4th highest daily max 8-h average	ns	1	0.093	0.083	0.1	0.095	0.106	0.091	0.095	0.085	0.095	0.093
AUGUSTA-AIKEN, GA-SC														
	Lead	Maximum quarterly value	down	1	0.012	0.011	0.006	0.004	0.009	0.02	0.003	0.006	0.004	0.002
	NO$_2$	Annual mean	ns	1	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.004	0.004
	Ozone	2nd highest daily max	ns	3	0.1	0.093	0.1	0.098	0.104	0.116	0.106	0.106	0.096	0.107
		4th highest daily max 8-h average	ns	3	0.084	0.08	0.079	0.083	0.083	0.096	0.087	0.087	0.08	0.092
	PM$_{10}$*	90th percentile	ns	1	35	35	29	29	31	38	35	30	27	28
		Weighted annual mean	ns	1	22.1	21.3	18.7	18.7	21.4	22.4	21.1	20.5	16.7	17.2
	PM$_{2.5}$*	98th percentile	NA	2	ND	ND	ND	ND	ND	ND	42.3	34.9	28.45	28.4
		Weighted annual mean	NA	2	ND	ND	ND	ND	ND	ND	19.89	16.005	13.78	13.295
AUSTIN-SAN MARCOS, TX														
	Ozone	2nd highest daily max	ns	1	0.091	0.102	0.105	0.098	0.089	0.115	0.102	0.107	0.091	0.103
		4th highest daily max 8-h average	ns	1	0.08	0.085	0.089	0.08	0.075	0.088	0.087	0.088	0.078	0.091
	PM$_{2.5}$*	98th percentile	NA	2	ND	ND	ND	ND	ND	ND	ND	24.5	20.85	27.35
		Weighted annual mean	NA	2	ND	ND	ND	ND	ND	ND	ND	10.925	9.625	10.565
BAKERSFIELD, CA														
	Lead	Maximum quarterly value	down	1	0.013	0.013	0.013	0.012	0.011	0.015	0.01	0.011	0.008	0.008
	CO	2nd max (daily-non-overlapping 8-h)	ns	1	3.6	3.6	3.6	3.6	2.7	2.8	5	5.2	3.2	2.5
	NO$_2$	Annual mean	down	2	0.02	0.02	0.018	0.019	0.016	0.016	0.018	0.016	0.012	0.017
	Ozone	2nd highest daily max	ns	2	0.136	0.133	0.133	0.144	0.122	0.132	0.122	0.128	0.124	0.133
		4th highest daily max 8-h average	ns	2	0.103	0.104	0.106	0.117	0.098	0.11	0.103	0.105	0.102	0.11
	PM$_{10}$*	90th percentile	ns	1	103	103	103	87	69	103	109	87	111	87
		Weighted annual mean	ns	1	58.2	58.2	58.2	53.6	46.5	47	59.3	53.6	59.8	59.1
	PM$_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	95.3	93.9	95.9	80.4
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	26.36	22.63	21.83	24.08
BALTIMORE, MD														
	CO	2nd max (daily-non-overlapping 8-h)	down	1	4.9	5.7	4.2	3.9	4.8	3.3	4.6	3.4	3.3	3
	SO$_2$	2nd daily max	ns	1	0.024	0.029	0.022	0.028	0.025	0.021	0.02	0.024	0.026	0.021
		Annual mean	down	1	0.007	0.008	0.006	0.008	0.007	0.007	0.006	0.006	0.006	0.006
	NO$_2$	Annual mean	down	1	0.033	0.032	0.026	0.027	0.026	0.026	0.024	0.024	0.023	0.025
	Ozone	2nd highest daily max	ns	3	0.135	0.121	0.135	0.112	0.134	0.12	0.135	0.111	0.122	0.138
		4th highest daily max 8-h average	ns	3	0.106	0.09	0.104	0.086	0.1	0.098	0.107	0.089	0.094	0.105
	PM$_{10}$*	90th percentile	down	4	49.5	48	46	40.75	43.75	45	39.5	44	41.75	35.75
		Weighted annual mean	down	4	29.375	29.225	27.475	25.9	27.058	26.542	24.975	26.225	24.95	20.825
	PM$_{2.5}$*	98th percentile	NA	5	ND	ND	ND	ND	ND	ND	ND	37.24	40.3	39.08
		Weighted annual mean	NA	5	ND	ND	ND	ND	ND	ND	ND	16.58	16.052	14.966
BANGOR, ME														
	PM$_{10}$*	90th percentile	ns	1	34	35	32	27	33	34	24	31	32	33
		Weighted annual mean	down	1	22.2	21.9	20	18.8	21.1	17.5	16.7	17.3	17.1	16.6
	PM$_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	25.7	22.8	31.1	27
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	8.98	9.08	10.09	10.44

Table A-16. Metropolitan Statistical Area Air Quality Trends, 1993–2002 (continued)

Metropolitan Statistical Area		Trend	#Trend Sites	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
BATON ROUGE, LA													
CO	2nd max (daily-non-overlapping 8-h)	ns	1	9	4.6	3.4	4.7	5.4	3.9	4.5	3.6	4.8	3.7
SO$_2$	2nd daily max	ns	2	0.023	0.021	0.026	0.022	0.023	0.027	0.022	0.023	0.021	0.027
	Annual mean	ns	2	0.006	0.006	0.005	0.006	0.006	0.006	0.005	0.005	0.005	0.006
NO$_2$	Annual mean	ns	2	0.015	0.017	0.017	0.018	0.017	0.017	0.017	0.017	0.017	0.017
Ozone	2nd highest daily max	ns	3	0.117	0.121	0.12	0.118	0.122	0.123	0.117	0.127	0.106	0.112
	4th highest daily max 8-h average	ns	3	0.084	0.084	0.091	0.089	0.09	0.087	0.087	0.093	0.08	0.078
PM$_{10}$*	90th percentile	up	1	29	40	40	40	45	48.5	52	52	55	37
	Weighted annual mean	up	1	18.2	26.8	25.9	26.4	27	30.35	33.7	31.8	32.6	26.4
PM$_{2.5}$*	98th percentile	NA	2	ND	ND	ND	ND	ND	ND	32.05	35.55	30.2	23.8
	Weighted annual mean	NA	2	ND	ND	ND	ND	ND	ND	15.005	14.42	13.39	12.19
BEAUMONT-PORT ARTHUR, TX													
SO$_2$	2nd daily max	ns	1	0.059	0.05	0.031	0.044	0.038	0.028	0.023	0.046	0.039	0.03
	Annual mean	down	1	0.008	0.007	0.006	0.006	0.006	0.004	0.003	0.005	0.005	0.004
NO$_2$	Annual mean	down	2	0.009	0.01	0.01	0.01	0.01	0.008	0.01	0.008	0.009	0.008
Ozone	2nd highest daily max	ns	1	0.11	0.118	0.12	0.119	0.156	0.11	0.092	0.124	0.093	0.111
	4th highest daily max 8-h average	ns	1	0.085	0.082	0.088	0.08	0.09	0.073	0.064	0.087	0.073	0.085
BELLINGHAM, WA													
Ozone	2nd highest daily max	down	1	0.08	0.082	0.079	0.078	0.07	0.07	0.062	0.063	0.061	0.067
	4th highest daily max 8-h average	down	1	0.058	0.059	0.054	0.062	0.052	0.056	0.05	0.052	0.05	0.053
PM$_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	24.5	20.7	18.3	23.3
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	8.08	8.38	7.17	7.8
BENTON HARBOR, MI													
Ozone	2nd highest daily max	ns	1	0.093	0.116	0.115	0.125	0.118	0.136	0.107	0.107	0.117	0.118
	4th highest daily max 8-h average	ns	1	0.079	0.086	0.098	0.098	0.099	0.093	0.096	0.077	0.088	0.098
PM$_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	35.4	29.7	32.3	30.6
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	12.27	12.11	13.16	12.53
BERGEN-PASSAIC, NJ													
CO	2nd max (daily-non-overlapping 8-h)	down	1	4.5	5.3	5	3.6	3.65	3.7	3.8	3.4	2.6	2.6
SO$_2$	2nd daily max	ns	1	0.023	0.028	0.023	0.018	0.018	0.018	0.02	0.02	0.018	0.018
	Annual mean	down	1	0.007	0.006	0.005	0.005	0.004	0.004	0.005	0.005	0.005	0.004
PM$_{10}$*	90th percentile	ns	1	59	71	53	58	58.5	59	53	61	63	49
	Weighted annual mean	ns	1	36.5	40.9	34.6	37.4	38.25	39.1	34.3	36.5	36.3	28.8
PM$_{2.5}$*	98th percentile	NA	2	ND	ND	ND	ND	ND	ND	39.65	35.9	34.775	33.95
	Weighted annual mean	NA	2	ND	ND	ND	ND	ND	ND	12.985	14.155	13.918	12.94
BILLINGS, MT													
SO$_2$	2nd daily max	down	2	0.099	0.073	0.066	0.048	0.033	0.024	0.02	0.02	0.025	0.024
	Annual mean	down	2	0.023	0.017	0.013	0.008	0.006	0.006	0.005	0.005	0.006	0.006
PM$_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	16.6	24.7	23.4	14.2
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	7.98	8.07	7.55	6.56
BILOXI-GULFPORT-PASCAGOULA, MS													
SO$_2$	2nd daily max	ns	2	0.026	0.018	0.018	0.03	0.021	0.019	0.02	0.022	0.011	0.021
	Annual mean	down	2	0.005	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.002	0.002
Ozone	2nd highest daily max	ns	2	0.094	0.105	0.104	0.103	0.103	0.113	0.107	0.121	0.097	0.09
	4th highest daily max 8-h average	ns	2	0.076	0.085	0.085	0.079	0.087	0.093	0.09	0.09	0.083	0.075
PM$_{10}$*	90th percentile	ns	1	31	32	26	28	40	36	28	29	26	24
	Weighted annual mean	down	1	20.4	20.9	18.7	17.7	21.4	20.3	14.7	16.2	17.7	15.2
PM$_{2.5}$*	98th percentile	NA	2	ND	ND	ND	ND	ND	ND	32.65	29.65	24.15	21.2
	Weighted annual mean	NA	2	ND	ND	ND	ND	ND	ND	14.93	12.825	11.215	10.24
BINGHAMTON, NY													
PM$_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	ND	25.3	29.6	38.7
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	ND	11.6	11.1	11.51
BIRMINGHAM, AL													
CO	2nd max (daily-non-overlapping 8-h)	down	1	7.1	6.9	6.4	4.9	5.9	4.4	4.4	3.7	6.3	3.7
SO$_2$	2nd daily max	ns	1	0.05	0.037	0.016	0.015	0.018	0.032	0.057	0.057	0.019	0.015
	Annual mean	ns	1	0.009	0.007	0.006	0.004	0.006	0.007	0.009	0.01	0.004	0.004
Ozone	2nd highest daily max	ns	2	0.118	0.103	0.124	0.122	0.113	0.132	0.121	0.119	0.107	0.11
	4th highest daily max 8-h average	ns	2	0.091	0.081	0.1	0.094	0.085	0.104	0.096	0.093	0.084	0.087
PM$_{2.5}$*	98th percentile	NA	2	ND	ND	ND	ND	ND	ND	52.7	45.5	36.25	35.9
	Weighted annual mean	NA	2	ND	ND	ND	ND	ND	ND	23.41	19.51	16.275	14.895
BISMARCK, ND													
PM$_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	23	14.3	17.1	15.5
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	7.61	6.62	6.68	6.38

Table A-16. Metropolitan Statistical Area Air Quality Trends, 1993–2002 (continued)

Metropolitan Statistical Area		Trend	#Trend Sites	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
BLOOMINGTON-NORMAL, IL													
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	ND	32.5	32.4	25.7
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	ND	14.86	14.79	12.85
BOISE CITY, ID													
CO	2nd max (daily-non-overlapping 8-h)	down	1	6.4	5.4	6.4	5	6.2	3.9	4.6	3.1	3.2	3.1
PM_{10}*	90th percentile	ns	1	62	57	47	40	40	30	47	41	34	49
	Weighted annual mean	down	1	32.9	31.5	24.8	23.7	24.1	17.7	23.7	23	22.9	25.7
$PM_{2.5}$*	98th percentile	NA	2	ND	ND	ND	ND	ND	ND	31.35	36.3	44.7	32.65
	Weighted annual mean	NA	2	ND	ND	ND	ND	ND	ND	9.045	9.24	10.37	9.69
BOSTON, MA-NH													
CO	2nd max (daily-non-overlapping 8-h)	down	2	3.6	4.3	3.55	3.25	3.3	2.9	3.9	2.35	2.45	1.6
SO_2	2nd daily max	down	3	0.035	0.035	0.025	0.023	0.032	0.028	0.024	0.025	0.019	0.018
	Annual mean	down	3	0.01	0.009	0.007	0.007	0.008	0.008	0.007	0.005	0.005	0.005
NO_2	Annual mean	down	4	0.026	0.027	0.024	0.024	0.024	0.024	0.023	0.02	0.021	0.02
Ozone	2nd highest daily max	ns	1	0.102	0.121	0.119	0.105	0.105	0.113	0.115	0.085	0.122	0.145
	4th highest daily max 8-h average	ns	1	0.078	0.09	0.094	0.083	0.091	0.1	0.088	0.07	0.1	0.1
PM_{10}*	90th percentile	ns	1	44	45	41	33	37	42	43	36	40	41
	Weighted annual mean	ns	1	30.2	28.2	26.2	24.4	24.7	26.4	29.6	24.5	26.8	24.6
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	33	27.2	31.5	29.3
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	11.31	11.35	12.13	10.06
BOULDER-LONGMONT, CO													
CO	2nd max (daily-non-overlapping 8-h)	down	1	6.4	6.2	4.7	5.5	5.4	4.7	3.7	3.1	3.5	3.2
Ozone	2nd highest daily max	ns	1	0.092	0.092	0.09	0.087	0.092	0.111	0.099	0.09	0.088	0.094
	4th highest daily max 8-h average	ns	1	0.072	0.072	0.074	0.075	0.072	0.089	0.075	0.072	0.071	0.078
PM_{10}*	90th percentile	ns	1	35	35	35	30	31	36	35	32	36	37
	Weighted annual mean	up	1	19.5	19.5	19.5	19.6	20.9	24.1	22.5	22.4	24.2	23.4
$PM_{2.5}$*	98th percentile	NA	2	ND	ND	ND	ND	ND	ND	21.4	20.1	22.85	22.95
	Weighted annual mean	NA	2	ND	ND	ND	ND	ND	ND	7.53	8.82	9.145	8.635
BRAZORIA, TX													
Ozone	2nd highest daily max	ns	1	0.132	0.112	0.148	0.11	0.137	0.111	0.161	0.136	0.113	0.136
	4th highest daily max 8-h average	ns	1	0.092	0.085	0.113	0.079	0.085	0.09	0.112	0.079	0.084	0.095
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	ND	25.3	24.9	22.7
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	ND	10.48	10.21	9.47
BRIDGEPORT, CT													
CO	2nd max (daily-non-overlapping 8-h)	down	1	3.7	5.8	4.9	3	4	2.8	3.2	2.4	2.7	2.5
SO_2	2nd daily max	ns	1	0.035	0.049	0.028	0.023	0.031	0.024	0.023	0.024	0.029	0.029
	Annual mean	down	1	0.01	0.01	0.007	0.006	0.007	0.007	0.006	0.006	0.007	0.005
Ozone	2nd highest daily max	ns	1	0.165	0.174	0.14	0.123	0.135	0.134	0.14	0.122	0.144	0.145
	4th highest daily max 8-h average	ns	1	0.111	0.093	0.115	0.096	0.103	0.097	0.096	0.09	0.102	0.103
PM_{10}*	90th percentile	ns	1	43	46	37	32	34	33	30	37	36	34
	Weighted annual mean	down	1	20.8	25.7	21.8	20.6	21.4	20.8	19.4	20.4	19.3	17.4
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	31.1	41.5	40.1	32.9
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	13.06	13.89	13.73	12.7
BROCKTON, MA													
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	26	28.95	31.9	35.9
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	11.08	11.63	12.18	11.64
BROWNSVILLE-HARLINGEN-SAN BENITO, TX M													
CO	2nd max (daily-non-overlapping 8-h)	down	1	3.8	3.8	2.6	2.2	3.2	3.2	2.6	1.6	1.5	1.9
Ozone	2nd highest daily max	ns	1	0.034	0.085	0.084	0.077	0.08	0.081	0.075	0.08	0.074	0.077
	4th highest daily max 8-h average	down	1	0.072	0.072	0.069	0.065	0.065	0.069	0.066	0.064	0.063	0.065
PM_{10}*	90th percentile	ns	1	45	36	35	28	36	45	32	47	31	33
	Weighted annual mean	ns	1	22.4	22.5	21.4	18.9	20.6	24.6	21.5	25.4	19.3	20
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	ND	18.3	18	22.7
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	ND	9.59	9.75	9.79
BUFFALO-NIAGARA FALLS, NY													
CO	2nd max (daily-non-overlapping 8-h)	down	1	4.4	4.2	3.1	3.7	3.3	3.1	2.2	2	1.9	1.8
SO_2	2nd daily max	ns	2	0.04	0.043	0.039	0.033	0.057	0.034	0.037	0.038	0.037	0.046
	Annual mean	ns	2	0.01	0.011	0.008	0.008	0.009	0.008	0.008	0.008	0.008	0.008
NO_2	Annual mean	ns	2	0.017	0.019	0.019	0.019	0.018	0.018	0.019	0.018	0.018	0.017
Ozone	2nd highest daily max	up	1	0.088	0.088	0.099	0.091	0.088	0.111	0.102	0.105	0.116	0.116
	4th highest daily max 8-h average	up	1	0.072	0.079	0.082	0.074	0.073	0.094	0.09	0.085	0.102	0.105
$PM_{2.5}$*	98th percentile	NA	3	ND	ND	ND	ND	ND	ND	ND	30.033	39.767	38.333
	Weighted annual mean	NA	3	ND	ND	ND	ND	ND	ND	ND	13.45	13.29	12.363

Table A-16. Metropolitan Statistical Area Air Quality Trends, 1993–2002 (continued)

Metropolitan Statistical Area		Trend	#Trend Sites	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
BURLINGTON, VT													
PM$_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	ND	22.7	29.9	38
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	ND	8.32	9.74	9.89
CANTON-MASSILLON, OH													
CO	2nd max (daily-non-overlapping 8-h)	ns	1	3.2	5.2	3	2.5	2.5	3.5	2.3	2.6	2.6	2.8
SO$_2$	2nd daily max	down	1	0.046	0.052	0.033	0.032	0.025	0.029	0.028	0.028	0.025	0.021
	Annual mean	ns	1	0.01	0.009	0.006	0.006	0.007	0.007	0.007	0.008	0.007	0.007
Ozone	2nd highest daily max	ns	2	0.104	0.098	0.111	0.096	0.096	0.114	0.105	0.099	0.105	0.108
	4th highest daily max 8-h average	ns	2	0.09	0.084	0.093	0.085	0.083	0.096	0.09	0.084	0.089	0.096
PM$_{10}$*	90th percentile	ns	3	41	47.667	48.667	35.667	41.333	43.333	35.333	37.667	33	39
	Weighted annual mean	down	3	24.633	27.233	27.567	23.967	24.067	24.433	23.133	23	21.733	21.367
PM$_{2.5}$*	98th percentile	NA	2	ND	ND	ND	ND	ND	ND	41.7	38.8	44.6	40.4
	Weighted annual mean	NA	2	ND	ND	ND	ND	ND	ND	17.735	17.785	17.225	16.515
CASPER, WY													
PM$_{10}$*	90th percentile	ns	1	27	34	32	33	29	31	29	30	31	30
	Weighted annual mean	ns	1	17.7	17.3	19.4	19.1	15.7	17.2	19.7	17	18.7	17.1
CEDAR RAPIDS, IA													
CO	2nd max (daily-non-overlapping 8-h)	down	1	3.2	4.2	2.6	7.8	2.4	2.5	2	1.8	1.9	1.4
SO$_2$	2nd daily max	ns	2	0.017	0.016	0.013	0.011	0.012	0.01	0.016	0.008	0.015	0.018
	Annual mean	ns	2	0.003	0.003	0.003	0.002	0.003	0.003	0.003	0.002	0.002	0.002
PM$_{10}$*	90th percentile	up	1	32	33	34	33	41	42	34	47	39	35
	Weighted annual mean	up	1	20.7	21.5	21.4	20.9	25.7	26.4	23.3	31.6	26.7	24
PM$_{2.5}$*	98th percentile	NA	2	ND	ND	ND	ND	ND	ND	32.15	27.95	33.9	26.1
	Weighted annual mean	NA	2	ND	ND	ND	ND	ND	ND	11.7	10.78	11.635	11.045
CHAMPAIGN-URBANA, IL													
SO$_2$	2nd daily max	ns	1	0.015	0.024	0.011	0.013	0.018	0.019	0.01	0.016	0.016	0.016
	Annual mean	down	1	0.004	0.004	0.003	0.003	0.004	0.003	0.002	0.002	0.002	0.002
Ozone	2nd highest daily max	ns	1	0.074	0.094	0.095	0.094	0.088	0.105	0.108	0.084	0.08	0.091
	4th highest daily max 8-h average	ns	1	0.066	0.083	0.084	0.085	0.076	0.083	0.094	0.073	0.073	0.082
PM$_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	ND	27.8	29.3	23.4
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	ND	14.82	12.59	12.2
CHARLESTON-NORTH CHARLESTON, SC													
Lead	Maximum quarterly value	ns	2	0.012	0.015	0.01	0.016	0.011	0.021	0.01	0.02	0.008	0.005
CO	2nd max (daily-non-overlapping 8-h)	down	1	5.8	4	6.4	4.7	3.9	2.9	4	2.7	3	2.8
SO$_2$	2nd daily max	down	1	0.025	0.038	0.02	0.021	0.022	0.013	0.011	0.013	0.011	0.01
	Annual mean	down	1	0.004	0.004	0.003	0.003	0.003	0.003	0.002	0.003	0.003	0.003
NO$_2$	Annual mean	ns	1	0.012	0.011	0.011	0.01	0.011	0.01	0.01	0.011	0.011	0.01
Ozone	2nd highest daily max	ns	1	0.109	0.097	0.087	0.099	0.09	0.106	0.099	0.093	0.085	0.095
	4th highest daily max 8-h average	ns	1	0.076	0.074	0.066	0.076	0.072	0.083	0.081	0.08	0.071	0.074
PM$_{10}$*	90th percentile	ns	2	40.5	38.5	30.5	32.5	31	40	31.5	35.5	32	26.5
	Weighted annual mean	down	2	25.65	24.9	20.7	21.65	21	22.8	20.8	22.6	20.45	17.8
PM$_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	ND	30.3	25.8	27.2
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	ND	13.44	11.97	11.64
CHARLESTON, WV													
PM$_{10}$*	90th percentile	ns	1	52	49	40	41	32	35	37	44	41	36
	Weighted annual mean	ns	1	29.2	28.1	26	24	21.1	21.4	21.9	26.5	24.8	23.4
PM$_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	38.7	37	44.5	38.6
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	17.89	18.2	18.1	17.2
CHARLOTTE-GASTONIA-ROCK HILL, NC-SC M													
	Maximum quarterly value	ns	1	0.016	0.032	0.013	0.01	0.007	0.021	0.018	0.042	0.008	0.006
CO	2nd max (daily-non-overlapping 8-h)	down	1	5.8	5.8	4.7	4.4	6	5	4.3	4.7	4.3	3.2
Ozone	2nd highest daily max	ns	2	0.126	0.114	0.114	0.127	0.115	0.13	0.126	0.123	0.118	0.125
	4th highest daily max 8-h average	ns	2	0.098	0.089	0.094	0.099	0.098	0.107	0.104	0.094	0.093	0.101
PM$_{10}$*	90th percentile	ns	3	41.333	43.667	41.667	44	43.667	49.667	43.667	47.333	38.667	41
	Weighted annual mean	ns	3	28.467	29.1	27.767	30.4	28.433	29.767	27.8	29.267	25.9	24.933
PM$_{2.5}$*	98th percentile	NA	2	ND	ND	ND	ND	ND	ND	37.5	32.95	31.85	31
	Weighted annual mean	NA	2	ND	ND	ND	ND	ND	ND	17.58	16.54	15.16	14.28
CHARLOTTESVILLE, VA													
PM$_{10}$*	90th percentile	ns	1	40	33	41	35	36	33	32	43	32	30
	Weighted annual mean	down	1	23.7	21.5	22.5	21.3	20.9	22.7	19.9	22.9	17.8	19.4

Table A-16. Metropolitan Statistical Area Air Quality Trends, 1993–2002 (continued)

Metropolitan Statistical Area		Trend	#Trend Sites	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
CHATTANOOGA, TN-GA													
Ozone	2nd highest daily max	ns	2	0.104	0.114	0.108	0.113	0.107	0.129	0.117	0.119	0.106	0.111
	4th highest daily max 8-h average	ns	2	0.088	0.088	0.09	0.088	0.088	0.1	0.096	0.097	0.085	0.097
PM_{10}*	90th percentile	down	1	49	50	51	49	43	43	42	45	42	33
	Weighted annual mean	down	1	32.1	33.9	32.1	32.5	26.4	27	26.9	28.9	26.9	21.8
CHEYENNE, WY													
PM_{10}*	90th percentile	ns	1	24	28	26	25	20	22	23	24	26	29
	Weighted annual mean	ns	1	15.5	17.8	14.6	15.1	12.9	13.9	14.9	15.7	15.7	16.4
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	12.4	13.2	12.2	13.8
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	5.57	5.58	5.03	4.66
CHICAGO, IL													
	Maximum quarterly value	down	2	0.076	0.077	0.061	0.059	0.059	0.063	0.042	0.085	0.038	0.037
CO	2nd max (daily-non-overlapping 8-h)	down	2	5.45	5.8	4.1	4.05	4.15	4.6	3.9	3.2	2.9	2.85
SO_2	2nd daily max	ns	3	0.044	0.042	0.032	0.028	0.033	0.039	0.036	0.043	0.023	0.022
	Annual mean	ns	3	0.007	0.007	0.006	0.006	0.007	0.007	0.007	0.007	0.005	0.005
NO_2	Annual mean	ns	1	0.031	0.032	0.032	0.031	0.034	0.032	0.032	0.032	0.032	0.032
Ozone	2nd highest daily max	ns	3	0.085	0.098	0.114	0.102	0.105	0.096	0.104	0.083	0.093	0.104
	4th highest daily max 8-h average	ns	3	0.068	0.076	0.085	0.077	0.082	0.078	0.089	0.067	0.073	0.082
PM_{10}*	90th percentile	ns	1	67	67	67	61	59	59	66	68	72	69
	Weighted annual mean	ns	1	37.4	37.4	37.4	35.8	33.9	35.2	36.1	35.1	38	36.1
$PM_{2.5}$*	98th percentile	NA	2	ND	ND	ND	ND	ND	ND	54.1	40.65	45.95	40.35
	Weighted annual mean	NA	2	ND	ND	ND	ND	ND	ND	21.85	19.265	20.12	17.11
CHICO-PARADISE, CA													
	Maximum quarterly value	ns	1	0.01	0.008	0.005	0.005	0.006	0.006	0.004	0.005	0.005	0.005
CO	2nd max (daily-non-overlapping 8-h)	ns	1	3.9	4.1	3.5	3.4	3.5	3.8	4	3.5	3.8	3.4
NO_2	Annual mean	down	1	0.016	0.015	0.014	0.013	0.013	0.013	0.015	0.012	0.012	0.012
Ozone	2nd highest daily max	ns	1	0.09	0.097	0.091	0.096	0.074	0.103	0.11	0.091	0.094	0.092
	4th highest daily max 8-h average	ns	1	0.076	0.082	0.076	0.074	0.066	0.078	0.087	0.078	0.08	0.081
PM_{10}*	90th percentile	ns	1	60	55	52	40	40	37	50	56	47	49
	Weighted annual mean	ns	1	27.2	33.3	26.3	25	25.9	22.3	28.6	27.4	29.2	28.1
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	ND	70	56	53
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	ND	16.26	13.01	15.13
CINCINNATI, OH-KY-IN													
CO	2nd max (daily-non-overlapping 8-h)	down	1	4.8	4.1	3.1	2.7	2.4	2.5	2.5	2.4	2.2	2.6
SO_2	2nd daily max	ns	1	0.037	0.051	0.025	0.045	0.045	0.036	0.03	0.053	0.042	0.043
	Annual mean	ns	1	0.011	0.009	0.007	0.011	0.01	0.01	0.008	0.009	0.011	0.01
Ozone	2nd highest daily max	ns	1	0.104	0.118	0.114	0.112	0.11	0.121	0.105	0.11	0.106	0.115
	4th highest daily max 8-h average	ns	1	0.08	0.099	0.098	0.088	0.084	0.091	0.091	0.087	0.082	0.096
PM_{10}*	90th percentile	down	2	54.5	47.5	53	41	44	43.75	42	43	40.5	37.5
	Weighted annual mean	down	2	28.75	28.25	29.9	25.6	25.65	25.675	24.7	25	23.3	21.95
$PM_{2.5}$*	98th percentile	NA	4	ND	ND	ND	ND	ND	ND	35.433	37.2	40.3	40.375
	Weighted annual mean	NA	4	ND	ND	ND	ND	ND	ND	17	16.83	15.695	15.763
CLARKSVILLE-HOPKINSVILLE, TN-KY													
SO_2	2nd daily max	down	1	0.058	0.037	0.019	0.023	0.026	0.02	0.016	0.018	0.017	0.017
	Annual mean	ns	1	0.01	0.007	0.006	0.006	0.005	0.006	0.005	0.006	0.005	0.007
Ozone	2nd highest daily max	ns	1	0.103	0.103	0.102	0.1	0.099	0.111	0.115	0.099	0.096	0.1
	4th highest daily max 8-h average	ns	1	0.082	0.092	0.086	0.079	0.082	0.086	0.092	0.081	0.082	0.093
PM_{10}*	90th percentile	down	1	40	40	40	41	35	39	36	40	31	30
	Weighted annual mean	down	1	25.8	25.8	25.8	24.9	21.4	23.1	22.9	23.3	20.4	19.3
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	30.1	38.3	27.2	29.3
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	15.12	15.45	13.51	13.09
CLEVELAND-LORAIN-ELYRIA, OH													
	Maximum quarterly value	down	1	0.11	0.06	0.053	0.037	0.05	0.043	0.03	0.023	0.03	0.027
CO	2nd max (daily-non-overlapping 8-h)	down	1	4.6	7.7	8.2	4.9	4.5	3.9	3.9	3.2	3.5	2.2
SO_2	2nd daily max	down	2	0.053	0.047	0.039	0.037	0.044	0.046	0.044	0.031	0.029	0.029
	Annual mean	down	2	0.014	0.012	0.01	0.01	0.01	0.01	0.01	0.008	0.008	0.008
NO_2	Annual mean	down	1	0.028	0.028	0.027	0.026	0.028	0.027	0.025	0.023	0.024	0.022
Ozone	2nd highest daily max	ns	1	0.107	0.093	0.108	0.103	0.096	0.12	0.118	0.101	0.108	0.108
	4th highest daily max 8-h average	ns	1	0.084	0.074	0.088	0.089	0.084	0.098	0.092	0.081	0.086	0.088
PM_{10}*	90th percentile	down	3	81	76.667	78	65	67.667	66.667	67.333	69	65	55.333
	Weighted annual mean	down	3	38.867	46.933	45.667	40.433	40.1	42.5	41.4	40.4	38.7	33.033
$PM_{2.5}$*	98th percentile	NA	3	ND	ND	ND	ND	ND	ND	43.967	44.267	44.4	41.467
	Weighted annual mean	NA	3	ND	ND	ND	ND	ND	ND	19.16	19.573	18.33	17.287

Table A-16. Metropolitan Statistical Area Air Quality Trends, 1993–2002 (continued)

Metropolitan Statistical Area		Trend	#Trend Sites	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
COLORADO SPRINGS, CO													
	Maximum quarterly value	ns	1	0.013	0.014	0.01	0.004	0.004	0.012	0.009	0.011	0.009	0.006
CO	2nd max (daily-non-overlapping 8-h)	down	1	5.7	4.9	5.5	5	4.9	3.8	4.2	3	2.8	5.2
SO_2	2nd daily max	down	1	0.011	0.01	0.01	0.008	0.007	0.007	0.008	0.006	0.006	0.006
	Annual mean	down	1	0.003	0.004	0.003	0.002	0.002	0.002	0.002	0.002	0.002	0.002
NO_2	Annual mean	ns	1	0.008	0.008	0.008	0.007	0.008	0.007	0.007	0.009	0.008	0.008
PM_{10}*	90th percentile	ns	3	40	36	35	31.333	28.333	30.667	27	30.333	32	34.333
	Weighted annual mean	ns	3	23.067	21.5	19.7	19.333	18.7	18.833	18.233	18.6	20.2	21.533
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	ND	14.6	15.5	19.6
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	ND	7.58	7.72	7.77
COLUMBIA, SC													
SO_2	2nd daily max	ns	2	0.013	0.013	0.011	0.015	0.015	0.016	0.013	0.012	0.014	0.014
	Annual mean	ns	2	0.003	0.002	0.002	0.003	0.003	0.003	0.003	0.003	0.003	0.003
NO_2	Annual mean	ns	1	0.013	0.011	0.013	0.013	0.011	0.014	0.014	0.014	0.014	0.012
Ozone	2nd highest daily max	ns	1	0.112	0.103	0.104	0.088	0.108	0.116	0.117	0.113	0.104	0.101
	4th highest daily max 8-h average	ns	1	0.089	0.082	0.079	0.074	0.086	0.098	0.094	0.096	0.082	0.084
PM_{10}*	90th percentile	ns	2	73.5	71	72	69	75.5	89.5	83.5	70.5	65.5	60.5
	Weighted annual mean	ns	2	41	40.65	40.6	38.75	42.75	48.6	47.55	40.6	39.75	34.6
$PM_{2.5}$*	98th percentile	NA	2	ND	ND	ND	ND	ND	ND	36.6	29.5	25	28.1
	Weighted annual mean	NA	2	ND	ND	ND	ND	ND	ND	15.9	15.795	13.58	12.99
COLUMBUS, GA-AL													
Ozone	2nd highest daily max	ns	1	0.097	0.097	0.113	0.095	0.094	0.108	0.107	0.105	0.088	0.095
	4th highest daily max 8-h average	ns	1	0.075	0.075	0.089	0.08	0.08	0.091	0.089	0.087	0.073	0.079
PM_{10}*	90th percentile	ns	1	37	44	46	33	39	45	40	44	39	33
	Weighted annual mean	ns	1	25.4	26.5	28.2	22.2	26.4	30.1	26.5	25.6	22.4	22.6
$PM_{2.5}$*	98th percentile	NA	2	ND	ND	ND	ND	ND	ND	44.1	46.5	40.1	33.1
	Weighted annual mean	NA	2	ND	ND	ND	ND	ND	ND	19.885	18.975	15.695	14.45
COLUMBUS, OH													
CO	2nd max (daily-non-overlapping 8-h)	down	1	5.3	4.1	4.9	2.7	2.9	3.7	2.5	2.8	2.6	2.5
SO_2	2nd daily max	ns	1	0.032	0.04	0.016	0.015	0.021	0.018	0.015	0.019	0.017	0.017
	Annual mean	ns	1	0.007	0.006	0.003	0.004	0.005	0.005	0.004	0.004	0.004	0.004
Ozone	2nd highest daily max	ns	1	0.101	0.102	0.106	0.106	0.095	0.113	0.111	0.105	0.097	0.112
	4th highest daily max 8-h average	ns	1	0.083	0.088	0.088	0.087	0.083	0.094	0.095	0.079	0.08	0.095
PM_{10}*	90th percentile	ns	1	50	46	53	39	63	70	62	54	52	44
	Weighted annual mean	ns	1	27.1	26.7	30.6	24.8	30.9	34.2	32.6	34.1	30.5	29.2
$PM_{2.5}$*	98th percentile	NA	3	ND	ND	ND	ND	ND	ND	38.633	39.167	40.433	39.567
	Weighted annual mean	NA	3	ND	ND	ND	ND	ND	ND	17.603	17.597	17.083	16.003
CORPUS CHRISTI, TX													
Ozone	2nd highest daily max	ns	1	0.11	0.103	0.109	0.099	0.094	0.102	0.103	0.099	0.092	0.104
	4th highest daily max 8-h average	ns	1	0.08	0.079	0.089	0.083	0.077	0.082	0.084	0.083	0.077	0.084
PM_{10}*	90th percentile	ns	1	57	48	47	37	50	57	62	54	41	48
	Weighted annual mean	ns	1	30.6	31.3	31.1	25.1	30.5	34.5	34.9	35.7	27.2	32.9
CORVALLIS, OR													
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	31.6	30.1	27.5	27.3
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	7.05	7.88	7.26	7.64
DALLAS, TX													
CO	2nd max (daily-non-overlapping 8-h)	down	1	4.4	4.4	4.4	5.3	4.6	4.4	3.2	2.2	2.4	2.1
SO_2	2nd daily max	ns	2	0.012	0.012	0.012	0.012	0.013	0.007	0.01	0.01	0.01	0.01
	Annual mean	down	2	0.003	0.003	0.003	0.002	0.002	0.002	0.002	0.002	0.002	0.001
NO_2	Annual mean	down	1	0.02	0.02	0.02	0.02	0.018	0.02	0.021	0.019	0.019	0.018
PM_{10}*	90th percentile	ns	2	42.5	44	45	42	39.5	45.5	42.5	41.5	41.5	45.5
	Weighted annual mean	ns	2	25.1	25.6	26.65	25.7	24.8	27.7	26.7	27.05	27.2	26.1
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	ND	33	31.3	37.6
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	ND	13.45	13.91	13.57
DANBURY, CT													
SO_2	2nd daily max	ns	1	0.024	0.037	0.02	0.02	0.024	0.02	0.024	0.017	0.022	0.023
	Annual mean	down	1	0.006	0.006	0.004	0.005	0.005	0.004	0.004	0.004	0.004	0.004
Ozone	2nd highest daily max	ns	1	0.14	0.125	0.134	0.11	0.138	0.115	0.151	0.124	0.133	0.141
	4th highest daily max 8-h average	ns	1	0.096	0.093	0.093	0.081	0.105	0.092	0.106	0.09	0.096	0.109
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	ND	32.9	35.2	30.7
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	ND	12.73	13.2	12.59

Table A-16. Metropolitan Statistical Area Air Quality Trends, 1993–2002 (continued)

Metropolitan Statistical Area		Trend	#Trend Sites	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
DAVENPORT-MOLINE-ROCK ISLAND, IA-IL M													
SO_2	2nd daily max	down	1	0.022	0.034	0.02	0.014	0.02	0.018	0.014	0.014	0.01	0.013
	Annual mean	down	1	0.005	0.006	0.006	0.004	0.005	0.004	0.004	0.003	0.002	0.002
PM_{10}*	90th percentile	down	1	79	92	108	89	90	68	80	70	63	70
	Weighted annual mean	down	1	46.5	59.9	66.8	50	49.3	37.9	43.5	40.2	36.2	42
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	29.7	30.3	33	29.5
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	13.14	12.75	13.21	12.25
DAYTON-SPRINGFIELD, OH													
CO	2nd max (daily-non-overlapping 8-h)	down	1	4	4.4	3.7	3	4	3.4	2.8	3.1	2.6	1.8
SO_2	2nd daily max	ns	1	0.028	0.034	0.017	0.031	0.022	0.016	0.017	0.018	0.017	0.023
	Annual mean	ns	1	0.006	0.007	0.004	0.005	0.005	0.004	0.004	0.004	0.004	0.005
Ozone	2nd highest daily max	ns	3	0.109	0.114	0.116	0.113	0.107	0.117	0.116	0.1	0.097	0.11
	4th highest daily max 8-h average	ns	3	0.087	0.091	0.091	0.097	0.089	0.096	0.093	0.086	0.083	0.096
PM_{10}*	90th percentile	ns	1	50	44	48	38	40	45	45	44	42	37
	Weighted annual mean	ns	1	24.9	25.5	27.3	22.7	24.5	24.5	23.6	26.7	25.2	23.8
DAYTONA BEACH, FL													
Ozone	2nd highest daily max	ns	2	0.094	0.084	0.083	0.079	0.086	0.094	0.087	0.087	0.085	0.085
	4th highest daily max 8-h average	ns	2	0.074	0.072	0.068	0.066	0.072	0.079	0.075	0.075	0.072	0.068
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	25.2	26	21.7	21.6
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	11.36	10.48	10	8.75
DECATUR, IL													
SO_2	2nd daily max	ns	1	0.025	0.03	0.024	0.022	0.021	0.02	0.027	0.025	0.025	0.021
	Annual mean	down	1	0.006	0.007	0.005	0.005	0.006	0.005	0.006	0.005	0.005	0.004
Ozone	2nd highest daily max	ns	1	0.077	0.095	0.097	0.1	0.087	0.094	0.102	0.092	0.078	0.094
	4th highest daily max 8-h average	ns	1	0.065	0.079	0.08	0.094	0.077	0.078	0.087	0.077	0.071	0.085
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	ND	30.9	34.7	33.9
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	ND	15.04	14.27	14.1
DENVER, CO													
	Maximum quarterly value	ns	1	0.108	0.067	0.054	0.05	0.03	0.106	0.078	0.149	0.103	0.114
CO	2nd max (daily-non-overlapping 8-h)	down	1	10.4	8.2	9.5	7.3	5.5	4.7	5	5.4	4.1	3.7
SO_2	2nd daily max	ns	1	0.035	0.034	0.019	0.024	0.026	0.023	0.024	0.025	0.026	0.023
	Annual mean	down	1	0.009	0.007	0.005	0.006	0.006	0.004	0.005	0.005	0.005	0.005
NO_2	Annual mean	up	1	0.034	0.035	0.035	0.033	0.034	0.035	0.036	0.036	0.037	0.035
Ozone	2nd highest daily max	ns	2	0.103	0.098	0.098	0.103	0.095	0.115	0.099	0.101	0.102	0.105
	4th highest daily max 8-h average	ns	2	0.079	0.076	0.077	0.081	0.076	0.087	0.079	0.081	0.08	0.086
PM_{10}*	90th percentile	ns	1	23	20	19	22	18	23	20	24	24	24
	Weighted annual mean	ns	1	14.3	12.7	9.7	11.6	9.4	12.6	11.8	13.1	13.1	13.1
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	ND	27.9	37.2	24.5
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	ND	10.78	11.81	10.1
DES MOINES, IA													
CO	2nd max (daily-non-overlapping 8-h)	down	1	5.4	4.9	5.7	3.6	3	4.1	3.5	2.7	2.3	2.7
Ozone	2nd highest daily max	ns	1	0.08	0.073	0.081	0.082	0.075	0.065	0.069	0.071	0.067	0.071
	4th highest daily max 8-h average	ns	1	0.04	0.052	0.071	0.064	0.063	0.056	0.059	0.061	0.06	0.059
PM_{10}*	90th percentile	ns	2	52	57.5	53	56	65	55.5	50.75	48	57	40.5
	Weighted annual mean	ns	2	31.7	32.8	30.1	32.8	34	30.3	28.15	28.4	33.2	24.3
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	28.3	32.3	29.9	31.9
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	11.39	10.56	10.61	10.55
DETROIT, MI													
	Maximum Quarterly Value	ns	2	0.038	0.047	0.047	0.034	0.063	0.043	0.056	0.03	0.031	0.031
CO	2nd max (daily-non-overlapping 8-h)	down	2	4.15	5.8	5	3.55	3.15	3.15	3.85	3.9	2.5	3
SO_2	2nd daily max	up	2	0.031	0.038	0.039	0.032	0.037	0.036	0.044	0.038	0.04	0.042
	Annual mean	ns	2	0.008	0.008	0.007	0.007	0.007	0.008	0.009	0.007	0.007	0.007
NO_2	Annual mean	ns	1	0.022	0.025	0.022	0.02	0.026	0.023	0.024	0.024	0.023	0.021
Ozone	2nd highest daily max	ns	2	0.102	0.128	0.114	0.099	0.115	0.115	0.112	0.091	0.112	0.11
	4th highest daily max 8-h average	ns	2	0.076	0.095	0.081	0.085	0.085	0.092	0.09	0.076	0.091	0.094
PM_{10}*	90th percentile	down	3	63.667	71.667	65.667	53	55.667	63.667	61.667	59	57	52.333
	Weighted annual mean	ns	3	37.567	43.5	38.7	33.6	33.2	33.833	35.733	35.333	34.867	30.733
$PM_{2.5}$*	98th percentile	NA	5	ND	ND	ND	ND	ND	ND	31.9	40.34	42.64	40.36
	Weighted annual mean	NA	5	ND	ND	ND	ND	ND	ND	12.72	16.54	16.924	16.428
DOTHAN, AL													
PM_{10}*	90th percentile	down	1	52	47	46	36	45	41	43	48	37	31
	Weighted annual mean	ns	1	26.4	27.8	28.1	22.3	24.9	27.3	28.8	24.4	22.5	21
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	39.7	34.6	26.6	26.7
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	19.58	15.42	14	13.03

Table A-16. Metropolitan Statistical Area Air Quality Trends, 1993–2002 (continued)

Metropolitan Statistical Area			Trend	#Trend Sites	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
DOVER, DE														
	Ozone	2nd highest daily max	down	1	0.137	0.137	0.137	0.11	0.124	0.131	0.12	0.126	0.117	0.112
		4th highest daily max 8-h average	ns	1	0.097	0.097	0.097	0.088	0.099	0.102	0.097	0.093	0.091	0.094
	$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	28.5	34.4	34.4	37.1
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	12.47	13.2	13.05	12.38
DULUTH-SUPERIOR, MN-WI														
	CO	2nd max (daily-non-overlapping 8-h)	down	1	4.1	4.3	4.5	4.5	3.2	3.7	2.9	2.1	2.5	2.1
	PM_{10}*	90th percentile	ns	2	36	33.5	35	31	32.5	31	37	44	34.5	36.5
		Weighted annual mean	ns	2	21.4	20.65	20.5	20.05	19.85	21.3	21.75	23.9	22.25	21.05
	$PM_{2.5}$*	98th percentile	NA	2	ND	ND	ND	ND	ND	ND	25.3	25.2	23.45	23.25
		Weighted annual mean	NA	2	ND	ND	ND	ND	ND	ND	8.64	8.385	8.48	7.855
DUTCHESS COUNTY, NY														
	Ozone	2nd highest daily max	ns	1	0.139	0.117	0.115	0.109	0.111	0.108	0.12	0.105	0.109	0.152
		4th highest daily max 8-h average	ns	1	0.099	0.087	0.093	0.089	0.089	0.089	0.093	0.079	0.091	0.111
	$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	ND	30.8	27.6	31.2
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	ND	11.55	11.17	10.74
EL PASO, TX														
		Maximum quarterly value	down	1	0.229	0.14	0.192	0.153	0.108	0.144	0.145	0.099	0.099	0.099
	CO	2nd max (daily-non-overlapping 8-h)	down	1	10.6	7.6	7.5	9.1	7.2	8.3	5.7	7.3	5.8	4.8
	Ozone	2nd highest daily max	ns	1	0.098	0.115	0.126	0.123	0.114	0.122	0.108	0.114	0.116	0.127
		4th highest daily max 8-h average	ns	1	0.059	0.075	0.084	0.078	0.071	0.088	0.071	0.08	0.075	0.089
	$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	20.7	23	23.8	29.5
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	9.24	9.18	9.34	10.61
ELKHART-GOSHEN, IN														
	$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	ND	38.6	37.5	35.2
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	ND	15.67	15.7	14.98
ELMIRA, NY														
	SO_2	2nd daily max	ns	1	0.019	0.023	0.014	0.016	0.015	0.011	0.015	0.012	0.015	0.013
		Annual mean	ns	1	0.005	0.004	0.004	0.004	0.003	0.003	0.003	0.003	0.004	0.004
	Ozone	2nd highest daily max	up	1	0.09	0.084	0.088	0.088	0.081	0.094	0.092	0.089	0.094	0.098
		4th highest daily max 8-h average	ns	1	0.08	0.074	0.076	0.072	0.073	0.082	0.082	0.073	0.082	0.089
ENID, OK														
	$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	ND	24.8	28.7	27.8
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	ND	10.24	10.73	9.7
ERIE, PA														
	SO_2	2nd daily max	down	1	0.072	0.076	0.05	0.066	0.035	0.068	0.043	0.041	0.043	0.037
		Annual mean	ns	1	0.011	0.01	0.009	0.011	0.009	0.01	0.01	0.008	0.01	0.011
	NO_2	Annual mean	down	1	0.014	0.015	0.015	0.015	0.015	0.014	0.015	0.012	0.012	0.012
	Ozone	2nd highest daily max	ns	1	0.107	0.101	0.105	0.1	0.103	0.122	0.112	0.095	0.104	0.114
		4th highest daily max 8-h average	ns	1	0.081	0.09	0.088	0.083	0.087	0.098	0.096	0.078	0.089	0.098
	$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	ND	28.2	37.5	42.9
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	ND	13.99	13.83	13.21
EUGENE-SPRINGFIELD, OR														
	CO	2nd max (daily-nonoverlapping 8-h)	down	1	5.9	6.4	5.7	5.7	5.2	4.6	5	4.3	4.1	4.2
	Ozone	2nd highest daily max	ns	1	0.072	0.082	0.077	0.111	0.073	0.089	0.068	0.056	0.077	0.08
		4th highest daily max 8-h average	ns	1	0.054	0.068	0.06	0.084	0.056	0.073	0.056	0.047	0.061	0.067
	PM_{10}*	90th percentile	down	2	72	53	49	37	41.5	36	36.5	36.5	40	36.5
		Weighted annual mean	down	2	27.9	23.65	21.5	18.6	20.1	17	17.9	18.4	18.35	19.4
	$PM_{2.5}$*	98th percentile	NA	2	ND	ND	ND	ND	ND	ND	46.65	45.75	46.9	50.8
		Weighted annual mean	NA	2	ND	ND	ND	ND	ND	ND	10.65	11.28	11.605	11.88
EVANSVILLE-HENDERSON, IN-KY														
	CO	2nd max (daily-nonoverlapping 8-h)	down	2	4.35	4.05	3.2	3.05	3.65	3.05	2.95	2.3	2.4	2.3
	SO_2	2nd daily max	ns	3	0.06	0.055	0.051	0.064	0.062	0.057	0.074	0.062	0.05	0.051
		Annual mean	ns	3	0.014	0.012	0.01	0.01	0.01	0.012	0.012	0.011	0.01	0.01
	NO_2	Annual mean	ns	1	0.017	0.018	0.017	0.017	0.016	0.018	0.016	0.016	0.016	0.016
	Ozone	2nd highest daily max	ns	1	0.094	0.096	0.108	0.092	0.086	0.103	0.109	0.092	0.09	0.09
		4th highest daily max 8-h average	ns	1	0.071	0.079	0.089	0.081	0.075	0.078	0.081	0.078	0.072	0.072
	PM_{10}*	90th percentile	down	3	50	51	51.333	39.333	43	44.333	43.333	41.333	39.667	38.333
		Weighted annual mean	down	3	29.733	31.333	29.833	24.833	25.667	27.367	25.167	24.5	24.733	24.267
	$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	ND	37.3	36.4	46.7
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	ND	16.08	15.57	15.36

Table A-16. Metropolitan Statistical Area Air Quality Trends, 1993–2002 (continued)

Metropolitan Statistical Area			Trend	#Trend Sites	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
FARGO-MOORHEAD, ND-MN														
	$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	26.7	26.4	23.9	21
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	9.39	7.71	8.43	7.35
FAYETTEVILLE, NC														
	Ozone	2nd highest daily max	ns	1	0.115	0.098	0.1	0.099	0.098	0.112	0.12	0.101	0.108	0.113
		4th highest daily max 8-h average	ns	1	0.093	0.084	0.081	0.086	0.085	0.093	0.1	0.086	0.08	0.094
	PM_{10}*	90th percentile	ns	1	41	40	35	39	41	41	39	39	39	39
		Weighted annual mean	ns	1	27.3	25.1	23.3	25.3	24.8	26.5	24.4	28	28	28
	$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	33.5	33	27	30.6
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	16.19	15.86	14.28	13.64
FAYETTEVILLE-SPRINGDALE-ROGERS, AR														
	$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	ND	31.4	25	25.8
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	ND	12.5	11.56	10.76
FITCHBURG-LEOMINSTER, MA														
	$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	34.5	21.1	23.35	25.6
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	9.39	9.79	9.595	9.4
FLAGSTAFF, AZ-UT														
	Ozone	2nd highest daily max	ns	1	0.07	0.081	0.075	0.082	0.076	0.076	0.086	0.082	0.074	0.085
		4th highest daily max 8-h average	ns	1	0.066	0.073	0.069	0.073	0.072	0.072	0.076	0.071	0.07	0.079
FLINT, MI														
		Maximum quarterly value	ns	1	0.016	0.011	0.014	0.012	0.011	0.015	0.014	0.011	0.012	0.015
	SO_2	2nd daily max	down	1	0.017	0.017	0.016	0.012	0.012	0.014	0.011	0.015	0.014	0.006
		Annual mean	down	1	0.005	0.004	0.003	0.002	0.002	0.002	0.003	0.004	0.002	0.002
	Ozone	2nd highest daily max	ns	1	0.106	0.09	0.097	0.113	0.094	0.104	0.108	0.086	0.108	0.102
		4th highest daily max 8-h average	ns	1	0.068	0.077	0.082	0.089	0.081	0.089	0.089	0.072	0.091	0.088
	PM_{10}*	90th percentile	ns	1	40	36	37	31	33	37	33	32	42	32
		Weighted annual mean	down	1	23.9	20.1	21.1	20.2	20.2	20.6	19	18.6	20	17.4
	$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	32.8	32.2	38	30.8
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	12.02	12.95	13.12	12.54
FLORENCE, AL														
	SO_2	2nd daily max	down	1	0.022	0.022	0.018	0.019	0.02	0.019	0.017	0.017	0.016	0.013
		Annual mean	down	1	0.004	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.002
	$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	35.6	32.4	28.7	33.5
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	17.32	15.62	12.82	12.81
FLORENCE, SC														
	$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	31.7	31.3	24.3	30.5
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	14.37	14.4	13.11	12.11
FORT COLLINS-LOVELAND, CO														
	CO	2nd max (daily-nonoverlapping 8-h)	down	1	6.6	6	5.2	5.1	5.2	4.1	5.1	3.8	3	2.9
	Ozone	2nd highest daily max	ns	2	0.091	0.095	0.089	0.092	0.088	0.092	0.085	0.093	0.086	0.097
		4th highest daily max 8-h average	ns	2	0.068	0.072	0.072	0.069	0.07	0.076	0.069	0.074	0.069	0.08
	$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	ND	19.7	24.7	18
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	ND	8.3	8.63	7.73
FORT LAUDERDALE, FL														
	CO	2nd max (daily-nonoverlapping 8-h)	down	2	4.45	4.65	5.15	3.65	3.7	2.8	4.05	3.2	3.55	3.2
	SO_2	2nd daily max	ns	1	0.011	0.013	0.008	0.008	0.011	0.017	0.015	0.026	0.016	0.011
		Annual mean	ns	1	0.002	0.002	0.002	0.002	0.002	0.003	0.003	0.003	0.002	0.002
	NO_2	Annual mean	ns	1	0.01	0.009	0.011	0.01	0.01	0.01	0.011	0.01	0.009	0.008
	Ozone	2nd highest daily max	ns	2	0.102	0.097	0.097	0.102	0.091	0.1	0.102	0.091	0.1	0.091
		4th highest daily max 8-h average	ns	2	0.081	0.071	0.066	0.066	0.071	0.077	0.073	0.073	0.074	0.063
	PM_{10}*	90th percentile	ns	3	28.667	23.333	23.667	27.667	25.333	30.333	23	24	29.333	22
		Weighted annual mean	ns	3	18.967	17.2	16.767	17.967	17.733	19.967	17.3	17.1	18.033	15.5
	$PM_{2.5}$*	98th percentile	NA	2	ND	ND	ND	ND	ND	ND	25.2	24.55	21.6	18.25
		Weighted annual mean	NA	2	ND	ND	ND	ND	ND	ND	9.23	9.41	8.485	7.915
FORT MYERS-CAPE CORAL, FL														
	$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	21.2	24.5	21.9	16.4
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	10.12	9.55	9.21	7.81
FORT PIERCE-PORT ST. LUCIE, FL														
	$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	18.7	23.4	21	16.9
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	9.63	10.06	8.99	8.01
FORT SMITH, AR-OK														
	$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	ND	27.3	29.5	26.2
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	ND	13.54	13.74	11.75

Table A-16. Metropolitan Statistical Area Air Quality Trends, 1993–2002 (continued)

Metropolitan Statistical Area		Trend	#Trend Sites	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
FORT WAYNE, IN													
CO	2nd max (daily-nonoverlapping 8-h)	ns	1	4.7	4.7	4.7	2.7	6.3	3	3.3	3.9	2.6	3.3
Ozone	2nd highest daily max	ns	2	0.093	0.113	0.109	0.1	0.095	0.103	0.1	0.093	0.091	0.11
	4th highest daily max 8-h average	ns	2	0.081	0.094	0.094	0.091	0.087	0.089	0.089	0.086	0.078	0.095
PM_{10}*	90th percentile	ns	1	36	43	44	28	28	39	31	32	33	34
	Weighted annual mean	ns	1	22.9	23.5	23.9	17.2	19.6	23.7	17	20.2	18	17.9
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	35.5	33.6	32	32.1
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	13.33	15.65	14.16	14.88
FORT WORTH-ARLINGTON, TX													
CO	2nd max (daily-nonoverlapping 8-h)	down	1	3.5	2.7	3.3	2.8	2.8	2.5	2.6	2.1	2	2.1
NO_2	Annual mean	ns	1	0.013	0.017	0.017	0.015	0.016	0.013	0.017	0.012	0.012	0.013
Ozone	2nd highest daily max	ns	2	0.113	0.133	0.141	0.129	0.123	0.126	0.145	0.118	0.125	0.13
	4th highest daily max 8-h average	ns	2	0.093	0.101	0.104	0.094	0.092	0.099	0.102	0.094	0.098	0.101
$PM_{2.5}$*	98th percentile	NA	2	ND	ND	ND	ND	ND	ND	22.7	27.8	26.75	34.7
	Weighted annual mean	NA	2	ND	ND	ND	ND	ND	ND	12.58	12.36	12.18	12.275
FRESNO, CA													
	Maximum quarterly value	down	1	0.025	0.02	0.015	0.008	0.011	0.013	0.008	0.01	0.01	0.009
CO	2nd max (daily-nonoverlapping 8-h)	down	4	4.175	4.925	4.225	4.15	3.5	3.5	3.4	3.35	3.1	2.8
NO_2	Annual mean	down	4	0.021	0.02	0.02	0.019	0.018	0.018	0.021	0.018	0.018	0.018
Ozone	2nd highest daily max	ns	4	0.14	0.127	0.134	0.14	0.126	0.155	0.129	0.134	0.134	0.142
	4th highest daily max 8-h average	ns	4	0.107	0.098	0.102	0.107	0.101	0.118	0.102	0.105	0.106	0.111
PM_{10}*	90th percentile	ns	3	91.667	66	83.333	63.333	81	62	96.333	76	78.333	76.333
	Weighted annual mean	ns	3	46.9	42.567	44.567	37.333	42.767	34.833	48.1	41.933	46.733	44.633
$PM_{2.5}$*	98th percentile	NA	2	ND	ND	ND	ND	ND	ND	89.6	85.75	74.75	64.1
	Weighted annual mean	NA	2	ND	ND	ND	ND	ND	ND	23.73	20.115	19.1	18.905
GAINESVILLE, FL													
PM_{10}*	90th percentile	ns	1	30	33	27	23	32	29	29	31	29	29
	Weighted annual mean	ns	1	19.5	18.5	17.5	17.1	20.7	19.9	19	19.9	19.7	19.7
$PM_{2.5}$*	98th percentile	NA	2	ND	ND	ND	ND	ND	ND	25.9	26.5	23.25	24.55
	Weighted annual mean	NA	2	ND	ND	ND	ND	ND	ND	11.28	11.505	10.215	9.88
GALVESTON-TEXAS CITY, TX													
SO_2	2nd daily max	down	1	0.056	0.052	0.089	0.067	0.053	0.039	0.04	0.037	0.045	0.025
	Annual mean	ns	1	0.005	0.006	0.006	0.014	0.006	0.004	0.007	0.004	0.005	0.004
Ozone	2nd highest daily max	ns	1	0.176	0.125	0.198	0.107	0.175	0.146	0.172	0.127	0.113	0.109
	4th highest daily max 8-h average	ns	1	0.114	0.088	0.14	0.08	0.097	0.095	0.108	0.09	0.076	0.083
GARY, IN													
	Maximum quarterly value	ns	1	0.044	0.052	0.044	0.064	0.043	0.04	0.077	0.108	0.017	0.032
CO	2nd max (daily-nonoverlapping 8-h)	down	1	5	4.6	3.7	2.8	3.8	3.2	3.1	3.2	3.2	2.6
SO_2	2nd daily max	down	1	0.044	0.055	0.039	0.031	0.032	0.055	0.028	0.025	0.03	0.013
	Annual mean	down	1	0.008	0.008	0.008	0.007	0.008	0.009	0.007	0.006	0.006	0.004
Ozone	2nd highest daily max	ns	2	0.1	0.11	0.118	0.112	0.113	0.109	0.11	0.094	0.106	0.122
	4th highest daily max 8-h average	ns	2	0.083	0.088	0.097	0.094	0.093	0.085	0.095	0.081	0.087	0.098
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	43.8	43.6	50.2	39.5
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	15.87	17.38	18.11	16.43
GOLDSBORO, NC													
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	40.6	34.4	29.2	28.8
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	15.42	15.77	14.65	13.18
GRAND FORKS, ND-MN													
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	26.3	24.6	22.5	22.5
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	10.23	8.18	8.28	8.28
GRAND JUNCTION, CO													
CO	2nd max (daily-nonoverlapping 8-h)	down	1	6.1	6	5.4	5.8	5.4	5.3	4.7	4.1	3.7	3.6
PM_{10}*	90th percentile	ns	1	31	32	31	30	28	29	31	37	35	39
	Weighted annual mean	ns	1	21.5	21.4	21.7	20.6	19.6	19.8	20	23.6	23.6	26.5
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	18.3	18.4	20.7	18.2
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	6.93	7.21	7.86	8.1

Table A-16. Metropolitan Statistical Area Air Quality Trends, 1993–2002 (continued)

Metropolitan Statistical Area		Trend	#Trend Sites	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
GRAND RAPIDS-MUSKEGON-HOLLAND, MI													
CO	2nd max (daily-nonoverlapping 8-h)	ns	1	3.2	4	4.6	3.3	2.4	2.9	3.5	2.6	3.1	2.8
SO_2	2nd daily max	down	1	0.012	0.013	0.011	0.011	0.008	0.008	0.006	0.01	0.007	0.007
	Annual mean	down	1	0.003	0.003	0.002	0.002	0.002	0.002	0.001	0.002	0.002	0.002
Ozone	2nd highest daily max	ns	4	0.103	0.113	0.129	0.122	0.107	0.109	0.111	0.112	0.112	0.116
	4th highest daily max 8-h average	ns	4	0.083	0.088	0.101	0.09	0.086	0.088	0.093	0.076	0.089	0.095
PM_{10}*	90th percentile	down	2	39	46	40	35.5	32	38.5	36	31	36.5	34
	Weighted annual mean	down	2	21.85	26.9	20.95	20.25	18.65	21.25	18.9	18.65	20.4	18.45
$PM_{2.5}$*	98th percentile	NA	3	ND	ND	ND	ND	ND	ND	36.733	33.567	37	36.2
	Weighted annual mean	NA	3	ND	ND	ND	ND	ND	ND	12.977	12.917	13.693	13.113
GREAT FALLS, MT													
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	ND	23	17.3	17.6
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	ND	6.13	5.39	5.25
GREELEY, CO													
CO	2nd max (daily-nonoverlapping 8-h)	down	1	5.8	5.2	5.3	7	4.8	4.4	3.4	3.8	3.7	3.7
Ozone	2nd highest daily max	ns	1	0.087	0.087	0.093	0.097	0.095	0.102	0.092	0.093	0.105	0.064
	4th highest daily max 8-h average	ns	1	0.063	0.071	0.072	0.07	0.069	0.075	0.069	0.069	0.074	0.057
PM_{10}*	90th percentile	ns	1	40	37	34	30	30	30	29	34	33	34
	Weighted annual mean	ns	1	22.6	23.1	19.9	17.7	17.8	16.4	17.5	20.5	20.8	21
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	ND	20.4	35.7	25.9
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	ND	8.93	10.61	9.22
GREEN BAY, WI													
SO_2	2nd daily max	ns	1	0.018	0.015	0.017	0.011	0.017	0.011	0.011	0.016	0.013	0.013
	Annual mean	down	1	0.003	0.003	0.004	0.003	0.003	0.003	0.003	0.004	0.003	0.002
Ozone	2nd highest daily max	ns	1	0.085	0.085	0.112	0.105	0.091	0.098	0.097	0.09	0.107	0.094
	4th highest daily max 8-h average	ns	1	0.069	0.069	0.083	0.091	0.073	0.077	0.085	0.071	0.088	0.084
$PM_{2.5}$*	98th percentile	NA	2	ND	ND	ND	ND	ND	ND	33.4	32.1	33.85	28.45
	Weighted annual mean	NA	2	ND	ND	ND	ND	ND	ND	10.81	10.96	11.35	10.75
GREENSBORO-WINSTON-SALEM-HIGH POINT, NC													
SO_2	2nd daily max	ns	1	0.022	0.021	0.025	0.026	0.023	0.023	0.02	0.019	0.016	0.024
	Annual mean	down	1	0.006	0.007	0.007	0.007	0.007	0.006	0.005	0.005	0.005	0.005
NO_2	Annual mean	down	1	0.017	0.017	0.016	0.016	0.017	0.017	0.016	0.016	0.016	0.014
Ozone	2nd highest daily max	ns	2	0.112	0.104	0.114	0.106	0.11	0.117	0.112	0.11	0.109	0.124
	4th highest daily max 8-h average	up	2	0.089	0.084	0.09	0.082	0.089	0.099	0.098	0.09	0.09	0.102
PM_{10}*	90th percentile	ns	2	40.5	35.5	37.5	37.5	38	41	38.5	36.5	36.5	34.5
	Weighted annual mean	down	2	24.8	23.95	25.25	24.65	24.2	25.2	23.9	22.3	22.7	21.95
$PM_{2.5}$*	98th percentile	NA	3	ND	ND	ND	ND	ND	ND	36.8	35.633	35.267	32.533
	Weighted annual mean	NA	3	ND	ND	ND	ND	ND	ND	16.897	17.04	15.667	14.88
GREENVILLE, NC													
Ozone	2nd highest daily max	ns	1	0.108	0.086	0.098	0.097	0.122	0.109	0.109	0.109	0.091	0.106
	4th highest daily max 8-h average	ns	1	0.091	0.074	0.082	0.086	0.097	0.089	0.093	0.082	0.077	0.091
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	ND	30.5	27.8	30.6
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	ND	13.92	12.52	12.28
GREENVILLE-SPARTANBURG-ANDERSON, SC MS													
	Maximum quarterly value	ns	1	0.02	0.018	0.012	0.011	0.01	0.011	0.012	0.021	0.01	0.01
CO	2nd max (daily-nonoverlapping 8-h)	down	1	5.4	5.5	5.3	4.6	5.6	4.3	4.8	3.7	3.4	3.3
SO_2	2nd daily max	ns	1	0.012	0.016	0.007	0.012	0.014	0.015	0.009	0.011	0.013	0.014
	Annual mean	up	1	0.003	0.003	0.001	0.002	0.003	0.003	0.003	0.003	0.003	0.003
NO_2	Annual mean	down	1	0.018	0.018	0.017	0.016	0.017	0.017	0.017	0.016	0.015	0.016
Ozone	2nd highest daily max	ns	2	0.116	0.101	0.1170.103		0.1030.118	0.12	0.107	0.104	0.112	
	4th highest daily max 8-h average	up	2	0.085	0.085	0.09	0.086	0.087	0.099	0.1	0.087	0.089	0.093
PM_{10}*	90th percentile	down	2	41	42.5	45.5	46.5	38.5	39.5	40.5	38.5	35.5	35
	Weighted annual mean	down	2	25.95	26.4	30.6	31.3	23.5	25	25.5	23.95	22.15	21.15
HAGERSTOWN, MD													
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	ND	39.9	41.6	42.7
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	ND	15.55	14.17	14.9

Table A-16. Metropolitan Statistical Area Air Quality Trends, 1993–2002 (continued)

Metropolitan Statistical Area			Trend	#Trend Sites	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
HAMILTON-MIDDLETOWN, OH														
	SO_2	2nd daily max	ns	1	0.042	0.046	0.02	0.026	0.035	0.022	0.021	0.023	0.027	0.034
		Annual mean	ns	1	0.008	0.008	0.005	0.006	0.006	0.006	0.007	0.006	0.006	0.006
	Ozone	2nd highest daily max	ns	1	0.121	0.103	0.121	0.107	0.104	0.109	0.117	0.095	0.107	0.115
		4th highest daily max 8-h average	ns	1	0.086	0.087	0.089	0.092	0.088	0.089	0.096	0.082	0.083	0.1
	PM_{10}*	90th percentile	down	3	62.667	54	57.333	43	55	53.667	48	51	46	39.333
		Weighted annual mean	down	3	31.567	30.667	33.433	29.133	30.933	30.733	28.1	29.867	26.567	24.233
	$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	37	38.1	41.7	40.7
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	18.82	16.96	16.43	16.83
HARRISBURG-LEBANON-CARLISLE, PA														
	SO_2	2nd daily max	down	1	0.025	0.04	0.02	0.022	0.022	0.021	0.021	0.024	0.015	0.013
		Annual mean	down	1	0.006	0.007	0.005	0.006	0.007	0.006	0.005	0.005	0.005	0.005
	NO_2	Annual mean	down	1	0.015	0.022	0.02	0.021	0.019	0.019	0.018	0.017	0.018	0.016
	Ozone	2nd highest daily max	ns	1	0.118	0.118	0.099	0.096	0.112	0.116	0.114	0.101	0.099	0.126
		4th highest daily max 8-h average	ns	1	0.095	0.091	0.084	0.078	0.084	0.097	0.095	0.079	0.086	0.098
	PM_{10}*	90th percentile	down	1	45	40	37	38	37	35	34	33	39	35
		Weighted annual mean	down	1	27.5	23.6	21.7	23.4	22.2	20.4	20.3	20.2	21.9	19.6
	$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	39.7	45.8	47.7	42.7
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	14.39	15.69	16.5	14.5
HARTFORD, CT														
	CO	2nd max (daily-nonoverlapping 8-h)	down	1	7.2	7.9	7	6.45	5.9	7.1	5.5	7.3	4.5	5.1
	SO_2	2nd daily max	down	1	0.023	0.031	0.023	0.022	0.025	0.019	0.019	0.021	0.023	0.018
		Annual mean	down	1	0.006	0.007	0.005	0.006	0.005	0.005	0.004	0.004	0.005	0.004
	NO_2	Annual mean	ns	1	0.018	0.02	0.017	0.016	0.018	0.02	0.018	0.017	0.02	0.017
	Ozone	2nd highest daily max	ns	3	0.146	0.133	0.134	0.098	0.143	0.12	0.138	0.106	0.137	0.14
		4th highest daily max 8-h average	ns	3	0.1	0.099	0.097	0.082	0.099	0.09	0.097	0.082	0.099	0.104
	PM_{10}*	90th percentile	ns	1	22	25	19	23	27	22	23	22	20	20
		Weighted annual mean	down	1	12.9	14.3	12.1	12.4	13.8	13.7	11.9	11.3	10.8	10.5
	$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	29.5	32.3	32.8	31.5
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	10.79	10.67	12.27	11.28
HATTIESBURG, MS														
	$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	ND	29.6	30	31.5
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	ND	14.93	13.56	12.78
HICKORY-MORGANTON-LENOIR, NC														
	Ozone	2nd highest daily max	up	1	0.092	0.092	0.093	0.094	0.099	0.133	0.106	0.107	0.099	0.111
		4th highest daily max 8-h average	up	1	0.075	0.075	0.077	0.078	0.08	0.096	0.082	0.091	0.088	0.095
	PM_{10}*	90th percentile	ns	1	44	39	36	37	37	37	43	33	33	37
		Weighted annual mean	down	1	26.4	26.3	23.2	24.1	23.7	23.1	25	22	21	22
	$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	34	34.2	32	33.5
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	17.43	17.35	15.98	15.16
HONOLULU, HI														
	CO	2nd max (daily-nonoverlapping 8-h)	down	2	2	1.8	1.85	1.9	1.7	1.45	1.25	1.3	1.15	1
	SO_2	2nd daily max	down	2	0.011	0.007	0.004	0.008	0.004	0.008	0.003	0.005	0.004	0.003
		Annual mean	ns	2	0.002	0.001	0.001	0.002	0.002	0.002	0.001	0.001	0.001	0.001
	NO_2	Annual mean	ns	1	0.004	0.004	0.003	0.003	0.003	0.003	0.003	0.004	0.004	0.004
	Ozone	2nd highest daily max	ns	1	0.055	0.055	0.056	0.047	0.053	0.056	0.054	0.048	0.051	0.053
		4th highest daily max 8-h average	down	1	0.049	0.052	0.051	0.041	0.047	0.049	0.048	0.044	0.042	0.043
	PM_{10}*	90th percentile	ns	2	24.5	22.5	21	23	21.5	23	18.5	23	24	24
		Weighted annual mean	down	2	17.7	16.25	16.1	17.05	16.1	16	13.95	15.6	16.05	15.8
HOUMA, LA														
	$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	ND	28.7	26.2	17.8
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	ND	12.38	10.89	9.33
HOUSTON, TX														
	CO	2nd max (daily-nonoverlapping 8-h)	down	2	4.75	4.15	3.8	4.85	3.45	3.45	3.35	3.2	3.35	2.8
	SO_2	2nd daily max	down	2	0.023	0.02	0.02	0.024	0.018	0.019	0.016	0.021	0.017	0.016
		Annual mean	down	2	0.005	0.005	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.003
	NO_2	Annual mean	ns	2	0.016	0.017	0.019	0.019	0.018	0.016	0.018	0.016	0.017	0.015
	Ozone	2nd highest daily max	ns	2	0.166	0.154	0.173	0.154	0.203	0.185	0.144	0.161	0.139	0.137
		4th highest daily max 8-h average	ns	2	0.09	0.099	0.114	0.113	0.113	0.119	0.102	0.106	0.097	0.096
	PM_{10}*	90th percentile	ns	2	56	62	59.5	46.5	59.5	75	57.5	57	48	47
		Weighted annual mean	ns	2	34.6	37.6	33.85	30.5	34.65	40.25	35.6	35.4	30.65	28.5
	$PM_{2.5}$*	98th percentile	NA	2	ND	ND	ND	ND	ND	ND	ND	25.6	32.2	31.35
		Weighted annual mean	NA	2	ND	ND	ND	ND	ND	ND	ND	12.745	12.4	12.925

Table A-16. Metropolitan Statistical Area Air Quality Trends, 1993–2002 (continued)

Metropolitan Statistical Area			Trend	#Trend Sites	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
HUNTINGTON-ASHLAND, WV-KY-OH														
	SO_2	2nd daily max	down	3	0.05	0.048	0.04	0.031	0.034	0.031	0.029	0.038	0.028	0.028
		Annual mean	down	3	0.012	0.01	0.01	0.01	0.009	0.009	0.009	0.01	0.008	0.008
	Ozone	2nd highest daily max	ns	1	0.119	0.12	0.122	0.113	0.124	0.136	0.115	0.092	0.11	0.123
		4th highest daily max 8-h average	ns	1	0.099	0.097	0.092	0.086	0.086	0.105	0.096	0.081	0.087	0.097
	PM_{10}*	90th percentile	down	1	61	65	64	52	62	53	68	50	50	47
		Weighted annual mean	ns	1	33.1	39	38.4	37	39	35.2	39.1	32.7	30	27.9
	$PM_{2.5}$*	98th percentile	NA	2	ND	ND	ND	ND	ND	ND	35.25	36.8	41.15	42.55
		Weighted annual mean	NA	2	ND	ND	ND	ND	ND	ND	16.175	16.63	16.385	16.135
HUNTSVILLE, AL														
	CO	2nd max (daily-nonoverlapping 8-h)	down	1	4	3.5	3.6	3	3.1	3.3	4.3	2.3	2.3	2.3
	Ozone	2nd highest daily max	ns	1	0.112	0.107	0.102	0.096	0.096	0.118	0.106	0.111	0.088	0.098
		4th highest daily max 8-h average	ns	1	0.087	0.075	0.08	0.081	0.086	0.092	0.093	0.088	0.08	0.078
	PM_{10}*	90th percentile	ns	3	38.667	34.333	34.333	32.667	37	36.667	36.667	37.333	35.333	29.667
		Weighted annual mean	ns	3	23.267	23.233	22.1	20.7	20.867	22.633	23.4	24	21.033	18.9
	$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	30.9	41.5	29.7	34.1
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	15.61	16.28	14.6	13.8
INDIANAPOLIS, IN														
	CO	2nd max (daily-nonoverlapping 8-h)	down	2	4	3.45	3.85	2.75	3.15	2.65	2.4	3.3	2.35	3.3
	SO_2	2nd daily max	ns	3	0.04	0.041	0.022	0.027	0.025	0.022	0.021	0.023	0.022	0.023
		Annual mean	down	3	0.009	0.008	0.006	0.006	0.006	0.005	0.006	0.006	0.005	0.005
	NO_2	Annual mean	ns	1	0.018	0.019	0.02	0.018	0.015	0.019	0.018	0.017	0.017	0.018
	Ozone	2nd highest daily max	ns	2	0.094	0.107	0.108	0.118	0.101	0.105	0.106	0.097	0.092	0.126
		4th highest daily max 8-h average	ns	2	0.079	0.09	0.091	0.093	0.086	0.09	0.095	0.08	0.08	0.103
	PM_{10}*	90th percentile	down	2	54	57.5	49.5	34	40.5	43.5	37	38.5	32.5	27.5
		Weighted annual mean	down	2	31.4	32	29.6	22	24.05	25.45	21	22.3	20.7	18.1
	$PM_{2.5}$*	98th percentile	NA	2	ND	ND	ND	ND	ND	ND	39.2	38.725	41.8	40.75
		Weighted annual mean	NA	2	ND	ND	ND	ND	ND	ND	17.32	17.618	17.855	17.56
IOWA CITY, IA														
	$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	32.4	28.4	34.5	25.6
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	12.32	10.93	11.67	11.38
JACKSON, MS														
	CO	2nd max (daily-nonoverlapping 8-h)	down	1	6.2	5.1	4.4	4.8	3.8	3.7	5	3.2	4.2	3
	SO_2	2nd daily max	ns	1	0.01	0.008	0.007	0.008	0.007	0.008	0.007	0.006	0.006	0.008
		Annual mean	ns	1	0.003	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
	Ozone	2nd highest daily max	ns	2	0.089	0.086	0.09	0.093	0.095	0.105	0.103	0.096	0.091	0.09
		4th highest daily max 8-h average	ns	2	0.073	0.073	0.076	0.078	0.077	0.084	0.083	0.08	0.076	0.074
	PM_{10}*	90th percentile	ns	1	42	35	39	35	44	48	38	36	33	33
		Weighted annual mean	ns	1	22.8	22.1	21.9	21.8	25.6	28	24.9	23.5	20.6	20.6
	$PM_{2.5}$*	98th percentile	NA	3	ND	ND	ND	ND	ND	ND	33.65	35.633	29.2	29.433
		Weighted annual mean	NA	3	ND	ND	ND	ND	ND	ND	16.195	15.233	13.45	12.233
JACKSON, TN														
	$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	37.5	30.4	27.4	32.2
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	16.22	14.99	13.56	12.23
JACKSONVILLE, FL														
		Maximum quarterly value	ns	1	0.022	0.017	0.027	0.023	0.015	0.017	0.017	0.029	0.017	0.008
	CO	2nd max (daily-nonoverlapping 8-h)	down	1	4.8	3.4	3.7	3.1	2.8	2.8	3.9	2.6	2.7	2.9
	SO_2	2nd daily max	ns	2	0.032	0.041	0.033	0.024	0.025	0.03	0.028	0.032	0.027	0.032
		Annual mean	ns	2	0.004	0.004	0.004	0.004	0.003	0.004	0.004	0.005	0.004	0.004
	NO_2	Annual mean	ns	1	0.015	0.014	0.016	0.015	0.014	0.015	0.016	0.015	0.013	0.015
	Ozone	2nd highest daily max	ns	1	0.103	0.087	0.1	0.086	0.085	0.1	0.103	0.09	0.092	0.087
		4th highest daily max 8-h average	ns	1	0.08	0.069	0.068	0.073	0.073	0.08	0.08	0.071	0.072	0.066
	$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	ND	30.1	26.2	22.3
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	ND	12.1	10.94	9.29
JACKSONVILLE, NC														
	$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	35.7	27.7	26	23.8
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	12.7	12.28	11.45	10.88

Table A-16. Metropolitan Statistical Area Air Quality Trends, 1993–2002 (continued)

Metropolitan Statistical Area			Trend	#Trend Sites	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
JAMESTOWN, NY														
	SO_2	2nd daily max	down	1	0.032	0.033	0.023	0.027	0.019	0.019	0.022	0.023	0.02	0.016
		Annual mean	down	1	0.007	0.006	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.004
	Ozone	2nd highest daily max	ns	1	0.104	0.094	0.104	0.097	0.101	0.112	0.101	0.101	0.097	0.109
		4th highest daily max 8-h average	ns	1	0.081	0.08	0.089	0.081	0.085	0.095	0.087	0.083	0.085	0.094
	PM_{10}*	90th percentile	ns	1	26	32	32	28	32	35	32	29	25	21
		Weighted annual mean	down	1	15.4	14.4	15.7	15.1	15.4	16.9	14.1	13.7	11.7	12.4
	$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	ND	30.6	34.2	37.8
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	ND	11.38	11.06	11.25
JANESVILLE-BELOIT, WI														
	Ozone	2nd highest daily max	down	1	0.108	0.108	0.103	0.103	0.097	0.1	0.105	0.098	0.093	0.098
		4th highest daily max 8-h average	ns	1	0.077	0.077	0.087	0.085	0.085	0.084	0.093	0.083	0.084	0.087
JERSEY CITY, NJ														
	CO	2nd max (daily-nonoverlapping 8-h)	down	1	5.6	5.9	6.2	4.9	4.3	4.1	3.9	3.8	3	2.8
	SO_2	2nd daily max	down	2	0.03	0.036	0.026	0.027	0.025	0.022	0.024	0.024	0.027	0.022
		Annual mean	down	2	0.009	0.009	0.007	0.008	0.008	0.007	0.007	0.007	0.008	0.006
	NO_2	Annual mean	ns	1	0.027	0.026	0.026	0.027	0.026	0.027	0.026	0.026	0.026	0.023
	Ozone	2nd highest daily max	ns	1	0.131	0.118	0.125	0.12	0.119	0.118	0.139	0.103	0.132	0.109
		4th highest daily max 8-h average	ns	1	0.103	0.095	0.104	0.087	0.105	0.089	0.106	0.082	0.091	0.09
	PM_{10}*	90th percentile	ns	1	54	62	48	51	50	42	43	50	53	50
		Weighted annual mean	down	1	34.3	38.8	30.8	32.8	30.6	26.9	27.8	30.6	29.3	28.3
	$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	46	39.5	34.1	34.3
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	16.13	16.83	14.1	14.35
JOHNSON CITY-KINGSPORT-BRISTOL, TN-VA														
	CO	2nd max (daily-nonoverlapping 8-h)	down	1	6.5	3.4	3.1	3	3.5	3.4	2.8	2.2	2.1	1.9
	SO_2	2nd daily max	ns	1	0.045	0.05	0.038	0.05	0.042	0.039	0.038	0.043	0.037	0.044
		Annual mean	ns	1	0.01	0.011	0.01	0.012	0.011	0.011	0.01	0.011	0.01	0.008
	NO_2	Annual mean	down	1	0.017	0.017	0.018	0.018	0.018	0.017	0.016	0.015	0.015	0.014
	Ozone	2nd highest daily max	ns	1	0.125	0.103	0.114	0.099	0.111	0.115	0.106	0.109	0.11	0.109
		4th highest daily max 8-h average	ns	1	0.088	0.083	0.091	0.082	0.082	0.096	0.086	0.092	0.085	0.093
	$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	ND	42.2	37.1	34
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	ND	17.17	15.4	14.3
JOHNSTOWN, PA														
	CO	2nd max (daily-nonoverlapping 8-h)	down	1	4.2	4.1	3.5	4.8	2.7	3.1	2.8	2	2.1	2.6
	SO_2	2nd daily max	down	1	0.049	0.08	0.042	0.034	0.03	0.027	0.025	0.026	0.031	0.025
		Annual mean	down	1	0.015	0.014	0.012	0.011	0.009	0.008	0.009	0.007	0.008	0.007
	NO_2	Annual mean	down	1	0.017	0.018	0.015	0.018	0.016	0.015	0.015	0.015	0.014	0.012
	Ozone	2nd highest daily max	up	1	0.099	0.094	0.101	0.098	0.104	0.124	0.107	0.104	0.106	0.106
		4th highest daily max 8-h average	ns	1	0.083	0.083	0.09	0.083	0.092	0.098	0.09	0.086	0.09	0.088
	$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	31	34.1	40.1	46.6
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	14.78	15.34	15.85	16.09
JONESBORO, AR														
	$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	ND	27.9	28.6	31.5
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	ND	14.64	12.69	11.16
JOPLIN, MO														
	$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	26.7	29.5	28.7	31.5
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	13.11	13.49	14.48	13.9
KALAMAZOO-BATTLE CREEK, MI														
	PM_{10}*	90th percentile	ns	1	40	44	50	33	38	47	44	49	49	49
		Weighted annual mean	ns	1	24	25.9	26	22	22.6	26.7	22.5	26.3	26.3	26.3
	$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	38	35.5	40	32.3
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	14.89	15.1	15.63	14.78
KANSAS CITY, MO-KS														
	SO_2	2nd daily max	ns	1	0.025	0.033	0.023	0.033	0.021	0.01	0.009	0.039	0.009	0.015
		Annual mean	ns	1	0.002	0.002	0.002	0.003	0.003	0.002	0.002	0.004	0.002	0.002
	NO_2	Annual mean	ns	1	0.009	0.008	0.009	0.009	0.009	0.009	0.009	0.009	0.008	0.008
	Ozone	2nd highest daily max	ns	1	0.114	0.112	0.131	0.114	0.121	0.133	0.111	0.115	0.106	0.105
		4th highest daily max 8-h average	ns	1	0.082	0.09	0.099	0.087	0.098	0.095	0.082	0.091	0.079	0.087
	PM_{10}*	90th percentile	ns	1	43	47	41	58	38	47	41	47	47	53
		Weighted annual mean	ns	1	30.7	33.8	19.1	32.6	26.2	29.7	27.8	29.1	31.6	36.2
	$PM_{2.5}$*	98th percentile	NA	3	ND	ND	ND	ND	ND	ND	28.1	27.333	29.567	29.867
		Weighted annual mean	NA	3	ND	ND	ND	ND	ND	ND	12.68	12.647	13.333	13.213

Table A-16. Metropolitan Statistical Area Air Quality Trends, 1993–2002 (continued)

Metropolitan Statistical Area			Trend	#Trend Sites	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
KENOSHA, WI														
	Ozone	2nd highest daily max	ns	2	0.114	0.119	0.119	0.13	0.111	0.121	0.121	0.097	0.12	0.14
		4th highest daily max 8-h average	ns	2	0.085	0.088	0.103	0.084	0.087	0.09	0.097	0.084	0.098	0.113
	PM$_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	34.2	27.2	33	31.7
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	12.35	11.38	12.7	11.57
KNOXVILLE, TN														
	CO	2nd max (daily-nonoverlapping 8-h)	down	1	4.6	4.3	4.1	3.3	4.8	3.9	3.8	3.1	3	3
	SO$_2$	2nd daily max	ns	1	0.063	0.057	0.053	0.058	0.048	0.038	0.056	0.06	0.089	0.07
		Annual mean	ns	1	0.009	0.01	0.01	0.009	0.008	0.007	0.009	0.01	0.01	0.011
	Ozone	2nd highest daily max	ns	2	0.11	0.109	0.117	0.102	0.111	0.114	0.123	0.11	0.101	0.117
		4th highest daily max 8-h average	ns	2	0.088	0.09	0.098	0.086	0.091	0.099	0.1	0.095	0.086	0.101
	PM$_{10}$*	90th percentile	down	1	64	58	55	54	56	47	43	46	44	36
		Weighted annual mean	down	1	39.6	38.1	37.1	35.3	33.1	29.9	30.1	28.9	26.3	23.2
	PM$_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	42.8	45.7	36.8	34.3
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	22.72	20.08	17.45	16.48
KOKOMO, IN														
	PM$_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	ND	34.3	38.1	29.7
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	ND	15.59	15.01	14.72
Lafayette, LA														
	Ozone	2nd highest daily max	ns	1	0.101	0.101	0.109	0.098	0.105	0.1	0.094	0.123	0.09	0.095
		4th highest daily max 8-h average	ns	1	0.083	0.083	0.09	0.084	0.078	0.084	0.081	0.092	0.077	0.074
	PM$_{2.5}$*	98th percentile	NA	2	ND	ND	ND	ND	ND	ND	26.9	32	29.75	22.6
		Weighted annual mean	NA	2	ND	ND	ND	ND	ND	ND	12.85	13.07	11.445	10.05
LAKE CHARLES, LA														
	SO$_2$	2nd daily max	ns	1	0.019	0.017	0.018	0.018	0.012	0.012	0.015	0.013	0.012	0.017
		Annual mean	ns	1	0.006	0.004	0.005	0.003	0.003	0.003	0.004	0.004	0.003	0.004
	NO$_2$	Annual mean	ns	1	0.004	0.006	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.004
	Ozone	2nd highest daily max	ns	3	0.11	0.094	0.103	0.096	0.119	0.119	0.103	0.117	0.097	0.089
		4th highest daily max 8-h average	ns	3	0.081	0.074	0.078	0.074	0.084	0.085	0.079	0.085	0.078	0.072
	PM$_{2.5}$*	98th percentile	NA	2	ND	ND	ND	ND	ND	ND	35.4	33.75	30.55	30.35
		Weighted annual mean	NA	2	ND	ND	ND	ND	ND	ND	12.99	12.795	11.235	10.005
LAKELAND-WINTER HAVEN, FL														
	SO$_2$	2nd daily max	ns	2	0.019	0.016	0.013	0.019	0.016	0.022	0.016	0.017	0.014	0.01
		Annual mean	ns	2	0.004	0.004	0.004	0.005	0.005	0.006	0.005	0.005	0.004	0.004
	Ozone	2nd highest daily max	ns	2	0.103	0.088	0.089	0.089	0.101	0.104	0.097	0.101	0.108	0.09
		4th highest daily max 8-h average	ns	2	0.082	0.072	0.073	0.07	0.078	0.087	0.078	0.078	0.084	0.072
	PM$_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	23.4	28.1	25.9	24.4
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	11.03	12.21	11.14	10.09
LANCASTER, PA														
	CO	2nd max (daily-non-overlapping 8-h)	ns	1	3	3.8	2.4	2.6	3.3	1.9	2.1	1.9	2.2	2.2
	SO$_2$	2nd daily max	ns	1	0.026	0.03	0.018	0.021	0.023	0.02	0.021	0.024	0.018	0.014
		Annual mean	down	1	0.007	0.006	0.006	0.005	0.007	0.006	0.005	0.005	0.004	0.005
	NO$_2$	Annual mean	down	1	0.015	0.019	0.016	0.017	0.016	0.015	0.015	0.014	0.014	0.013
	Ozone	2nd highest daily max	ns	1	0.118	0.111	0.124	0.101	0.133	0.119	0.127	0.107	0.127	0.115
		4th highest daily max 8-h average	ns	1	0.095	0.093	0.102	0.085	0.102	0.101	0.102	0.09	0.097	0.096
	PM$_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	38.2	47.4	42.1	40.2
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	15.64	18.22	17.11	16.15
LANSING-EAST LANSING, MI														
	Ozone	2nd highest daily max	ns	2	0.096	0.093	0.096	0.087	0.087	0.1	0.1	0.091	0.105	0.096
		4th highest daily max 8-h average	ns	2	0.079	0.079	0.082	0.077	0.077	0.08	0.088	0.076	0.085	0.087
	PM$_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	34.6	37.2	37.2	32.8
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	12.6	13.07	14.04	13.52
LAREDO, TX														
	PM$_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	ND	23.2	26.4	25.5
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	ND	12.1	10.29	10.06
LAS CRUCES, NM														
	CO	2nd max (daily-non-overlapping 8-h)	down	1	8.7	5	4.4	4.3	4.8	4.2	3.8	3.7	3.3	3
	SO$_2$	2nd daily max	down	2	0.055	0.023	0.021	0.03	0.014	0.012	0.005	0.003	0.004	0.003
		Annual mean	down	2	0.006	0.004	0.004	0.004	0.003	0.003	0.001	0.001	0.001	0.001
	Ozone	2nd highest daily max	down	3	0.107	0.104	0.105	0.104	0.09	0.1	0.092	0.1	0.087	0.089
		4th highest daily max 8-h average	ns	3	0.073	0.074	0.074	0.075	0.067	0.072	0.074	0.073	0.068	0.072
	PM$_{10}$*	90th percentile	up	1	51	62	65	60	56	58	80	73	74	80
		Weighted annual mean	ns	1	31.3	36	38.4	37.2	31.6	32.3	44.6	41.6	37.3	39.5
	PM$_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	26.8	30.5	30.3	38.7
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	11.2	10.54	10.91	12.22

Table A-16. Metropolitan Statistical Area Air Quality Trends, 1993–2002 (continued)

Metropolitan Statistical Area			Trend	#Trend Sites	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
LAS VEGAS, NV-AZ														
	Ozone	2nd highest daily max	ns	1	0.099	0.099	0.086	0.096	0.09	0.103	0.09	0.086	0.092	0.096
		4th highest daily max 8-h average	ns	1	0.082	0.077	0.074	0.082	0.075	0.084	0.074	0.074	0.07	0.078
	PM_{10}*	90th percentile	down	2	81.5	77.5	82.5	83	76	69.75	70	63	65.5	68
		Weighted annual mean	ns	2	43.4	45.55	45.2	51.7	47.5	41.95	40.8	38.4	40.4	45.7
	$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	32.6	31.6	33.3	28.8
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	11.71	10.53	10.62	11.68
LAWRENCE, MA-NH														
	SO_2	2nd daily max	down	1	0.027	0.032	0.033	0.023	0.027	0.031	0.021	0.02	0.021	0.015
		Annual mean	down	1	0.007	0.007	0.007	0.005	0.006	0.008	0.005	0.004	0.004	0.004
	Ozone	2nd highest daily max	ns	1	0.1	0.101	0.081	0.092	0.097	0.096	0.09	0.072	0.081	0.124
		4th highest daily max 8-h average	ns	1	0.076	0.082	0.069	0.079	0.078	0.076	0.068	0.06	0.062	0.088
LAWTON, OK														
	CO	2nd max (daily-non-overlapping 8-h)	ns	1	2.6	1.9	3.1	2.667	2.233	1.8	1.7	1.4	2.2	2.1
	$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	ND	19.2	26.2	25.2
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	ND	9.08	9.91	9.35
LEWISTON-AUBURN, ME														
	SO_2	2nd daily max	down	1	0.025	0.025	0.02	0.018	0.017	0.019	0.016	0.018	0.015	0.016
		Annual mean	down	1	0.007	0.006	0.004	0.004	0.004	0.004	0.004	0.003	0.004	0.004
	PM_{10}*	90th percentile	ns	1	50	35	37	31	35	31	31	28	37	37
		Weighted annual mean	ns	1	24.3	20.2	19.8	20	20.6	18.2	18.6	17.5	20.7	18.8
	$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	35.7	25.8	32.5	30.3
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	9.99	9.6	11.31	10.45
LEXINGTON, KY														
	SO_2	2nd daily max	ns	1	0.026	0.037	0.016	0.02	0.016	0.023	0.02	0.02	0.029	0.016
		Annual mean	down	1	0.007	0.008	0.006	0.006	0.006	0.006	0.008	0.005	0.005	0.004
	NO_2	Annual mean	down	1	0.017	0.016	0.017	0.014	0.014	0.011	0.013	0.013	0.013	0.012
	Ozone	2nd highest daily max	ns	2	0.102	0.102	0.103	0.089	0.098	0.104	0.108	0.085	0.088	0.095
		4th highest daily max 8-h average	ns	2	0.081	0.086	0.088	0.081	0.081	0.089	0.087	0.077	0.077	0.083
	PM_{10}*	90th percentile	down	2	42	46	39.5	37.5	37	40	40	37.5	35	36.5
		Weighted annual mean	down	2	23.85	27.6	22.8	23.1	21.85	23	22.55	22.95	22.2	21.45
	$PM_{2.5}$*	98th percentile	NA	2	ND	ND	ND	ND	ND	ND	35.2	37.45	34.2	41.3
		Weighted annual mean	NA	2	ND	ND	ND	ND	ND	ND	15.475	16.59	15.955	15.32
LIMA, OH														
	SO_2	2nd daily max	down	1	0.023	0.036	0.015	0.015	0.016	0.017	0.013	0.015	0.013	0.01
		Annual mean	ns	1	0.005	0.005	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
	Ozone	2nd highest daily max	ns	1	0.099	0.102	0.106	0.11	0.091	0.102	0.107	0.1	0.096	0.109
		4th highest daily max 8-h average	ns	1	0.09	0.089	0.092	0.092	0.083	0.089	0.093	0.085	0.081	0.098
	PM_{10}*	90th percentile	down	1	40	42	38	38	43	37	26	36	29	36
		Weighted annual mean	down	1	27.9	30.6	27.2	24.9	24	24.3	16.6	24.6	20.8	24.4
LINCOLN, NE														
	CO	2nd max (daily-non-overlapping 8-h)	ns	1	5.1	5.3	6.2	4.7	6.9	6	5.7	2.9	4	3.7
	Ozone	2nd highest daily max	ns	1	0.057	0.075	0.07	0.06	0.061	0.068	0.062	0.072	0.061	0.063
		4th highest daily max 8-h average	ns	1	0.049	0.062	0.06	0.054	0.054	0.058	0.053	0.057	0.051	0.054
	$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	25.2	25.1	23.4	26
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	10.57	10.25	10.08	9.55
LITTLE ROCK-NORTH LITTLE ROCK, AR														
	SO_2	2nd daily max	down	1	0.017	0.009	0.008	0.009	0.006	0.006	0.005	0.007	0.005	0.005
		Annual mean	down	1	0.006	0.003	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
	NO_2	Annual mean	ns	1	0.009	0.011	0.011	0.011	0.01	0.011	0.011	0.01	0.01	0.01
	Ozone	2nd highest daily max	ns	2	0.096	0.09	0.106	0.096	0.099	0.096	0.103	0.113	0.102	0.101
		4th highest daily max 8-h average	up	2	0.076	0.076	0.086	0.078	0.077	0.078	0.083	0.09	0.079	0.085
	$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	ND	33.5	32	31.9
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	ND	15.47	14.72	13.24
LONGVIEW-MARSHALL, TX														
	Ozone	2nd highest daily max	ns	1	0.114	0.104	0.145	0.106	0.124	0.129	0.134	0.131	0.111	0.11
		4th highest daily max 8-h average	ns	1	0.093	0.081	0.102	0.082	0.091	0.104	0.105	0.099	0.082	0.084
	$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	ND	28.8	28	39.2
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	ND	13.41	12.18	12.36

Table A-16. Metropolitan Statistical Area Air Quality Trends, 1993–2002 (continued)

Metropolitan Statistical Area		Trend	#Trend Sites	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
LOS ANGELES-LONG BEACH, CA													
	Maximum quarterly value	ns	2	0.088	0.072	0.058	0.053	0.067	0.045	0.094	0.059	0.08	0.036
CO	2nd max (daily-non-overlapping 8-h)	down	4	8.725	10.75	9.525	9.25	8.55	7.575	7.475	6.5	5.025	5.125
SO$_2$	2nd daily max	ns	2	0.008	0.006	0.005	0.006	0.006	0.007	0.006	0.006	0.006	0.007
	Annual mean	ns	2	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
NO$_2$	Annual mean	down	3	0.039	0.046	0.045	0.043	0.039	0.039	0.041	0.039	0.037	0.035
Ozone	2nd highest daily max	down	4	0.15	0.165	0.14	0.126	0.112	0.138	0.101	0.118	0.104	0.103
	4th highest daily max 8-h average	down	4	0.098	0.101	0.089	0.085	0.081	0.088	0.07	0.08	0.074	0.073
PM$_{10}$*	90th percentile	ns	2	74.5	62.5	73.5	71	70	62.5	75	64.5	67	58
	Weighted annual mean	ns	2	44	41.1	45.15	43.35	45.55	38.3	50	42.7	43.1	41.75
PM$_{2.5}$*	98th percentile	NA	4	ND	ND	ND	ND	ND	ND	53.775	66.475	65.025	55.225
	Weighted annual mean	NA	4	ND	ND	ND	ND	ND	ND	23.955	23.211	24.325	23.355
LOUISVILLE, KY-IN													
CO	2nd max (daily-non-overlapping 8-h)	ns	1	4.5	4.6	3.6	3.4	3.8	3.8	3.3	3.8	3.9	4.8
SO$_2$	2nd daily max	down	2	0.038	0.038	0.036	0.033	0.029	0.027	0.027	0.033	0.031	0.024
	Annual mean	down	2	0.011	0.011	0.01	0.008	0.006	0.005	0.009	0.007	0.005	0.005
NO$_2$	Annual mean	ns	1	0.026	0.026	0.022	0.02	0.02	0.023	0.022	0.022	0.023	0.02
Ozone	2nd highest daily max	ns	2	0.123	0.124	0.124	0.109	0.126	0.136	0.114	0.097	0.101	0.12
	4th highest daily max 8-h average	ns	2	0.096	0.099	0.097	0.087	0.091	0.102	0.092	0.081	0.081	0.099
PM$_{10}$*	90th percentile	ns	2	54.5	45.5	49	49	49.5	43	44.5	57.5	48.75	42
	Weighted annual mean	ns	2	29.65	30.5	29	28.25	30.45	26.35	26.35	31.1	28.7	25.9
PM$_{2.5}$*	98th percentile	NA	3	ND	ND	ND	ND	ND	ND	39.267	37.9	41.383	44.233
	Weighted annual mean	NA	3	ND	ND	ND	ND	ND	ND	16.443	16.673	16.908	16.41
LOWELL, MA-NH													
CO	2nd max (daily-non-overlapping 8-h)	down	1	5.1	6.5	7.8	4.5	3.6	3.4	4.2	3.2	2.7	2.4
LUBBOCK, TX													
PM$_{10}$*	90th percentile	ns	1	30	33	34	34	27	37	26	32	29	29
	Weighted annual mean	ns	1	19.9	23	20.8	21.7	16.7	20.5	18.1	19	19.7	19.7
PM$_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	ND	18.5	17.2	21.3
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	ND	7.42	7.66	7.55
MACON, GA													
PM$_{2.5}$*	98th percentile	NA	2	ND	ND	ND	ND	ND	ND	49.2	36.45	31	31.75
	Weighted annual mean	NA	2	ND	ND	ND	ND	ND	ND	18.21	17.505	14.935	14.635
MADISON, WI													
Ozone	2nd highest daily max	ns	1	0.079	0.082	0.1	0.094	0.088	0.089	0.098	0.087	0.088	0.09
	4th highest daily max 8-h average	ns	1	0.066	0.071	0.08	0.079	0.079	0.076	0.085	0.071	0.078	0.08
PM$_{10}$*	90th percentile	ns	1	37	33	43	30	34	43	38	34	32	31
	Weighted annual mean	ns	1	21	22.4	22.8	19.6	20.3	26.6	20.8	22	22	19
PM$_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	33.4	34.2	36.6	32.7
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	13.43	12.75	13.31	12.31
MANSFIELD, OH													
PM$_{10}$*	90th percentile	down	1	44	49	42	40	40	41	39	37	37	37
	Weighted annual mean	down	1	27.7	29.2	24.7	24.3	23.3	23.8	22.6	23.7	23.7	23.7
MAYAGUEZ, PR													
PM$_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	18.8	16.4	15.7	16.7
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	8.79	7.91	8.08	7.8
MCALLEN-EDINBURG-MISSION, TX													
PM$_{2.5}$*	98th percentile	NA	2	ND	ND	ND	ND	ND	ND	ND	22.4	21.45	28.55
	Weighted annual mean	NA	2	ND	ND	ND	ND	ND	ND	ND	10.835	10.52	10.48
MEDFORD-ASHLAND, OR													
Ozone	2nd highest daily max	ns	1	0.081	0.087	0.091	0.101	0.074	0.117	0.077	0.079	0.081	0.099
	4th highest daily max 8-h average	ns	1	0.066	0.068	0.071	0.075	0.063	0.085	0.065	0.067	0.064	0.078
PM$_{10}$*	90th percentile	down	3	50.667	45.667	37.333	37	36.333	33	42	38.333	34.667	36.667
	Weighted annual mean	down	3	28.767	27.6	22.067	21.167	22.2	21	24.1	20.933	19.8	21.033
PM$_{2.5}$*	98th percentile	NA	3	ND	ND	ND	ND	ND	ND	33.95	34.6	26.1	33.6
	Weighted annual mean	NA	3	ND	ND	ND	ND	ND	ND	9.08	9.447	8.673	10.37

Table A-16. Metropolitan Statistical Area Air Quality Trends, 1993–2002 (continued)

Metropolitan Statistical Area		Trend	#Trend Sites	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
MEMPHIS, TN-AR-MS													
CO	2nd max (daily-non-overlapping 8-h)	down	1	8.5	7.8	6.2	5	4.2	5.1	4.6	4.4	4.1	3.5
NO_2	Annual mean	ns	1	0.026	0.027	0.027	0.024	0.028	0.029	0.025	0.025	0.025	0.022
Ozone	2nd highest daily max	ns	1	0.102	0.109	0.14	0.114	0.122	0.1	0.13	0.112	0.121	0.126
	4th highest daily max 8-h average	ns	1	0.077	0.084	0.099	0.096	0.091	0.085	0.095	0.091	0.092	0.1
PM_{10}*	90th percentile	down	2	49.5	45.5	47	39.5	45.5	41.5	42	37.5	36	30.5
	Weighted annual mean	down	2	29.55	28.05	28.7	26.15	27.55	25.8	26.1	26.2	23.9	19.4
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	34.9	36	31.9	36.3
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	15.85	16.3	14.53	13.78
MERCED, CA													
NO_2	Annual mean	ns	1	0.015	0.013	0.012	0.012	0.013	0.011	0.012	0.012	0.012	0.012
Ozone	2nd highest daily max	ns	1	0.12	0.119	0.13	0.124	0.09	0.14	0.125	0.12	0.113	0.137
	4th highest daily max 8-h average	ns	1	0.096	0.097	0.107	0.102	0.074	0.112	0.105	0.103	0.096	0.105
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	ND	68.4	70.1	55.1
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	ND	17.28	16.75	18.74
MIAMI, FL													
CO	2nd max (daily-non-overlapping 8-h)	down	1	5.5	4.9	5.1	4.6	4.1	3.4	3.9	3.4	4.2	3
SO_2	2nd daily max	ns	1	0.004	0.004	0.004	0.005	0.004	0.004	0.003	0.003	0.004	0.004
	Annual mean	ns	1	0.001	0.001	0.002	0.002	0.001	0.001	0.001	0.002	0.002	0.002
NO_2	Annual mean	ns	2	0.012	0.01	0.011	0.011	0.012	0.011	0.012	0.011	0.011	0.01
Ozone	2nd highest daily max	ns	2	0.105	0.092	0.098	0.092	0.101	0.103	0.107	0.088	0.098	0.089
	4th highest daily max 8-h average	ns	2	0.081	0.072	0.072	0.069	0.073	0.083	0.077	0.074	0.067	0.063
PM_{10}*	90th percentile	ns	3	39	33.667	35.667	41.667	32	35.667	32.667	33.667	38	33.333
	Weighted annual mean	down	3	27.533	25.067	26.067	26.767	23.467	26	23.067	23.967	24.133	21.4
$PM_{2.5}$*	98th percentile	NA	2	ND	ND	ND	ND	ND	ND	21.75	22.65	19.45	19.6
	Weighted annual mean	NA	2	ND	ND	ND	ND	ND	ND	10.33	10.075	8.97	8.27
MIDDLESEX-SOMERSET-HUNTERDON, NJ PMS													
CO	2nd max (daily-non-overlapping 8-h)	down	1	3.7	4.3	5.4	3.3	3.8	3	3.2	3.2	3.3	2.6
SO_2	2nd daily max	ns	1	0.018	0.028	0.018	0.024	0.019	0.018	0.016	0.018	0.024	0.016
	Annual mean	ns	1	0.005	0.005	0.004	0.005	0.005	0.005	0.005	0.005	0.005	0.005
NO_2	Annual mean	ns	1	0.019	0.019	0.019	0.02	0.018	0.019	0.019	0.019	0.018	0.016
Ozone	2nd highest daily max	ns	2	0.088	0.085	0.133	0.117	0.13	0.118	0.144	0.111	0.132	0.121
	4th highest daily max 8-h average	ns	2	0.069	0.065	0.106	0.092	0.105	0.098	0.11	0.093	0.103	0.101
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	31.4	34.5	34.1	26
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	11.49	13.14	13.23	11.13
MILWAUKEE-WAUKESHA, WI													
CO	2nd max (daily-non-overlapping 8-h)	down	1	2.9	3	2.4	1.9	1.8	1.9	1.9	1.5	1.5	1.5
SO_2	2nd daily max	ns	1	0.018	0.032	0.025	0.028	0.028	0.022	0.024	0.026	0.018	0.018
	Annual mean	ns	1	0.003	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.003	0.003
NO_2	Annual mean	down	1	0.017	0.017	0.017	0.017	0.016	0.016	0.016	0.016	0.016	0.016
Ozone	2nd highest daily max	ns	2	0.103	0.133	0.123	0.112	0.118	0.118	0.116	0.096	0.113	0.118
	4th highest daily max 8-h average	ns	2	0.082	0.087	0.103	0.086	0.083	0.084	0.091	0.08	0.093	0.091
PM_{10}*	90th percentile	ns	2	44	37.5	51	34.5	33.5	37.5	36	32.5	33.5	38.5
	Weighted annual mean	ns	2	23.95	24.25	25.65	23.35	22.1	24.65	22.3	20.55	22.05	22.5
$PM_{2.5}$*	98th percentile	NA	3	ND	ND	ND	ND	ND	ND	37.733	31.233	37.3	35.033
	Weighted annual mean	NA	3	ND	ND	ND	ND	ND	ND	14.427	13.253	13.67	12.873
MINNEAPOLIS-ST. PAUL, MN-WI													
CO	2nd max (daily-non-overlapping 8-h)	down	3	3.933	4.833	3.867	3.067	3.233	4	3.033	3.067	3	2.633
SO_2	2nd daily max	ns	2	0.021	0.025	0.018	0.019	0.024	0.019	0.022	0.02	0.015	0.015
	Annual mean	down	2	0.003	0.004	0.003	0.003	0.004	0.003	0.003	0.003	0.003	0.002
NO_2	Annual mean	down	1	0.019	0.019	0.019	0.015	0.014	0.013	0.014	0.012	0.012	0.01
Ozone	2nd highest daily max	ns	2	0.074	0.081	0.101	0.092	0.088	0.092	0.085	0.088	0.097	0.088
	4th highest daily max 8-h average	ns	2	0.058	0.069	0.077	0.071	0.076	0.071	0.074	0.068	0.075	0.074
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	ND	42.7	34.7	24.3
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	ND	13.12	13.02	11.33
MISSOULA, MT													
PM_{10}*	90th percentile	down	1	76	63	45	45	40	37	29	30	34	31
	Weighted annual mean	down	1	45	33	24.2	24	21.3	20.2	17.7	18.3	19.9	16.4
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	29.3	33.8	43.7	24.8
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	9.83	12.41	10.43	8.47

Table A-16. Metropolitan Statistical Area Air Quality Trends, 1993–2002 (continued)

Metropolitan Statistical Area			Trend	#Trend Sites	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
MOBILE, AL														
	Ozone	2nd highest daily max	ns	1	0.098	0.085	0.108	0.104	0.117	0.114	0.118	0.115	0.095	0.094
		4th highest daily max 8-h average	ns	1	0.074	0.072	0.079	0.081	0.081	0.098	0.085	0.089	0.076	0.075
	$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	36.1	39.7	26.7	22.8
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	16.81	15.27	12.35	10.57
MODESTO, CA														
	CO	2nd max (daily-non-overlapping 8-h)	ns	2	4.65	5.1	4.2	4.3	3.7	4.3	4.85	4.25	3.95	3.2
	NO_2	Annual mean	down	2	0.02	0.02	0.019	0.019	0.019	0.019	0.02	0.017	0.018	0.017
	Ozone	2nd highest daily max	ns	2	0.12	0.112	0.125	0.124	0.11	0.14	0.109	0.108	0.11	0.115
		4th highest daily max 8-h average	ns	2	0.093	0.09	0.099	0.096	0.086	0.103	0.089	0.089	0.093	0.095
	PM_{10}*	90th percentile	ns	2	52.5	52.5	69.5	48	51.5	54.5	71	53	54.5	53.5
		Weighted annual mean	ns	2	34.45	34.45	33.7	28.6	31.55	28.15	38.55	30	32.4	31
	$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	100	71	69	69
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	24.88	18.92	15.58	18.67
MONMOUTH-OCEAN, NJ														
	CO	2nd max (daily-non-overlapping 8-h)	down	1	6.4	5	3.6	4.6	3.2	2.9	3.4	3.2	3.8	1.9
	Ozone	2nd highest daily max	ns	1	0.123	0.119	0.149	0.118	0.15	0.135	0.135	0.136	0.13	0.146
		4th highest daily max 8-h average	ns	1	0.103	0.099	0.117	0.095	0.113	0.104	0.105	0.114	0.108	0.125
	$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	36.8	36.6	32.55	28.5
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	10.37	11.52	11.165	10.81
MONROE, LA														
	$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	28.2	27.2	27.2	32.9
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	13.93	13.33	11.85	10.77
MONTGOMERY, AL														
	Ozone	2nd highest daily max	ns	2	0.116	0.098	0.097	0.097	0.085	0.119	0.103	0.105	0.093	0.099
		4th highest daily max 8-h average	ns	2	0.086	0.078	0.082	0.072	0.069	0.092	0.085	0.085	0.077	0.081
	PM_{10}*	90th percentile	ns	2	37	38	42	36	39.5	40	40	42.5	40	33
		Weighted annual mean	ns	2	24.35	25.45	25	21.85	23.4	27.25	24.65	25.25	22.1	21.2
	$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	44.5	42.2	29	28.4
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	18.94	17.2	14.4	14.56
MUNCIE, IN														
	$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	ND	34.8	35.7	30
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	ND	16.24	14.49	14.51
MYRTLE BEACH, SC														
		Maximum quarterly value	ns	1	0.006	0.006	0.004	0.004	0.003	0.009	0.01	0.005	0.008	0.002
NASHUA, NH														
	CO	2nd max (daily-non-overlapping 8-h)	down	1	5.8	8	7.6	7.8	5.3	5.3	5.3	4.1	4	3.7
	SO_2	2nd daily max	down	2	0.019	0.023	0.019	0.019	0.02	0.016	0.015	0.016	0.014	0.013
		Annual mean	down	2	0.005	0.006	0.004	0.004	0.005	0.004	0.004	0.003	0.004	0.003
	Ozone	2nd highest daily max	ns	1	0.125	0.105	0.111	0.098	0.115	0.1	0.1	0.089	0.108	0.12
		4th highest daily max 8-h average	ns	1	0.086	0.083	0.088	0.081	0.094	0.084	0.089	0.07	0.091	0.094
	PM_{10}*	90th percentile	ns	2	28.5	32.5	26	28.5	30	29	28	25	32.5	30.5
		Weighted annual mean	ns	2	16.55	14.8	13.85	16.9	18.25	16.65	16.5	15.05	16.85	15.5
	$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	50.9	20.8	28.2	28.2
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	13.5	10.29	10.83	10.83
NASHVILLE, TN														
	CO	2nd max (daily-non-overlapping 8-h)	down	1	7.3	7.1	7.3	5	6.3	5.6	5.4	5.6	5.8	5.1
	SO_2	2nd daily max	down	2	0.063	0.041	0.025	0.049	0.059	0.035	0.029	0.029	0.026	0.015
		Annual mean	down	2	0.01	0.007	0.005	0.006	0.006	0.005	0.004	0.004	0.004	0.003
	NO_2	Annual mean	ns	1	0.012	0.02	0.014	0.012	0.013	0.011	0.019	0.019	0.018	0.016
	Ozone	2nd highest daily max	ns	2	0.098	0.093	0.095	0.096	0.113	0.105	0.116	0.096	0.086	0.098
		4th highest daily max 8-h average	ns	2	0.074	0.076	0.078	0.078	0.092	0.088	0.092	0.079	0.073	0.082
	PM_{10}*	90th percentile	ns	2	41.5	45.5	44	39	40.5	43	40.5	44.5	39.5	41
		Weighted annual mean	down	2	27.25	26.1	27.2	25.55	24.45	25.4	24.2	26.95	24.15	22.4
	$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	43	36.9	34.7	33.3
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	18.83	16.97	15.23	14.3
NASSAU-SUFFOLK, NY														
	NO_2	Annual mean	down	1	0.026	0.028	0.025	0.026	0.025	0.022	0.025	0.024	0.024	0.022
	Ozone	2nd highest daily max	ns	1	0.134	0.126	0.146	0.12	0.137	0.143	0.126	0.112	0.126	0.141
		4th highest daily max 8-h average	ns	1	0.097	0.092	0.11	0.091	0.106	0.096	0.091	0.086	0.084	0.108
	PM_{10}*	90th percentile	ns	1	30	41	37	29	35	29	25	29	26	31
		Weighted annual mean	down	1	19.4	23.9	20.1	18	21.3	18.1	15.9	17	17.4	17.5
	$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	ND	32.1	31.3	31.9
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	ND	12.22	12.86	11.35

Table A-16. Metropolitan Statistical Area Air Quality Trends, 1993–2002 (continued)

Metropolitan Statistical Area		Trend	#Trend Sites	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
NEW BEDFORD, MA													
Ozone	2nd highest daily max	ns	1	0.088	0.096	0.138	0.118	0.123	0.101	0.125	0.101	0.136	0.113
	4th highest daily max 8-h average	ns	1	0.073	0.077	0.107	0.092	0.092	0.083	0.098	0.082	0.101	0.087
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	30	34.65	39.3	23.1
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	12.12	12.395	12.67	10.25
NEW HAVEN-MERIDEN, CT													
CO	2nd max (daily-non-overlapping 8-h)	down	1	3.7	3.7	3.7	2.9	3.9	2.7	3.1	2.6	2.5	2.3
SO_2	2nd daily max	ns	1	0.044	0.056	0.038	0.031	0.032	0.031	0.027	0.031	0.037	0.032
	Annual mean	ns	1	0.009	0.01	0.008	0.008	0.006	0.006	0.007	0.006	0.007	0.007
NO_2	Annual mean	ns	1	0.027	0.03	0.025	0.026	0.024	0.027	0.026	0.025	0.027	0.025
Ozone	2nd highest daily max	ns	1	0.147	0.148	0.165	0.12	0.145	0.13	0.143	0.136	0.146	0.146
	4th highest daily max 8-h average	ns	1	0.105	0.093	0.117	0.095	0.109	0.097	0.104	0.087	0.1	0.11
PM_{10}*	90th percentile	ns	2	48	61.5	48.5	40	38.5	35.5	38	38.5	43.5	39
	Weighted annual mean	down	2	28.05	34	26.7	24.35	24.95	23.95	23.5	24.15	24.85	22.2
$PM_{2.5}$*	98th percentile	NA	3	ND	ND	ND	ND	ND	ND	36.05	37.133	37.4	34.067
	Weighted annual mean	NA	3	ND	ND	ND	ND	ND	ND	15.525	13.94	14.377	13.403
NEW LONDON-NORWICH, CT-RI													
Ozone	2nd highest daily max	ns	1	0.126	0.118	0.14	0.121	0.15	0.116	0.127	0.135	0.11	0.134
	4th highest daily max 8-h average	ns	1	0.099	0.093	0.101	0.095	0.104	0.083	0.096	0.084	0.09	0.095
PM_{10}*	90th percentile	down	1	32	40	31	31	30	29	25	26	32	28
	Weighted annual mean	down	1	18.8	22.7	17.6	19.4	18.9	18	16.5	16.2	17.1	14.6
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	ND	27.6	34.4	25.7
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	ND	11.05	12.74	11.13
NEW ORLEANS, LA													
	Maximum quarterly value	ns	1	0.074	0.121	0.411	0.093	0.055	0.115	0.078	0.115	0.103	0.125
CO	2nd max (daily-non-overlapping 8-h)	ns	1	5.2	4.3	3.1	4	3.2	3	3.1	4	3.6	3.6
SO_2	2nd daily max	ns	1	0.025	0.027	0.022	0.035	0.017	0.026	0.023	0.02	0.026	0.016
	Annual mean	down	1	0.006	0.008	0.007	0.006	0.005	0.004	0.005	0.005	0.005	0.004
NO_2	Annual mean	ns	1	0.019	0.02	0.021	0.018	0.018	0.02	0.022	0.019	0.02	0.017
Ozone	2nd highest daily max	ns	3	0.108	0.11	0.11	0.106	0.098	0.11	0.108	0.115	0.098	0.102
	4th highest daily max 8-h average	ns	3	0.079	0.084	0.086	0.084	0.078	0.083	0.087	0.089	0.078	0.073
PM_{10}*	90th percentile	ns	1	42	42	35	33	39	43	47	44	49	37
	Weighted annual mean	ns	1	26.7	26.7	24.6	23.1	25.8	26.45	27.1	26.2	29.6	23.3
$PM_{2.5}$*	98th percentile	NA	2	ND	ND	ND	ND	ND	ND	36	33.45	29	22.2
	Weighted annual mean	NA	2	ND	ND	ND	ND	ND	ND	15.04	14.02	13.135	11.13
NEW YORK, NY													
	Maximum quarterly value	ns	1	0.031	0.031	0.024	0.024	0.022	0.021	0.022	0.023	0.024	0.024
CO	2nd max (daily-non-overlapping 8-h)	down	3	4.7	4.967	5.633	4.467	3.667	3.767	4.167	3.533	2.833	2.667
SO_2	2nd daily max	down	1	0.052	0.064	0.047	0.047	0.04	0.038	0.045	0.046	0.038	0.036
	Annual mean	down	1	0.018	0.017	0.015	0.015	0.012	0.012	0.013	0.013	0.013	0.012
NO_2	Annual mean	down	2	0.037	0.038	0.036	0.037	0.035	0.035	0.035	0.034	0.034	0.033
Ozone	2nd highest daily max	ns	2	0.116	0.121	0.123	0.12	0.14	0.104	0.142	0.106	0.111	0.125
	4th highest daily max 8-h average	ns	2	0.094	0.099	0.1	0.089	0.109	0.078	0.104	0.083	0.087	0.098
PM_{10}*	90th percentile	down	1	35	34	30	31	30	29	35	31	28	27
	Weighted annual mean	down	1	19.7	20.7	19.1	20	19.6	17.5	16.2	18.8	15.9	18.3
$PM_{2.5}$*	98th percentile	NA	4	ND	ND	ND	ND	ND	ND	ND	38.525	36.425	34.075
	Weighted annual mean	NA	4	ND	ND	ND	ND	ND	ND	ND	15.108	15.135	13.783
NEWARK, NJ													
CO	2nd max (daily-non-overlapping 8-h)	down	1	6	11.3	7.7	6	5.1	5.1	6.6	4.7	4.8	4.4
SO_2	2nd daily max	down	2	0.025	0.033	0.026	0.027	0.025	0.021	0.022	0.023	0.023	0.02
	Annual mean	ns	2	0.007	0.007	0.005	0.006	0.006	0.006	0.006	0.006	0.006	0.006
NO_2	Annual mean	ns	2	0.024	0.027	0.025	0.026	0.026	0.027	0.026	0.026	0.026	0.025
Ozone	2nd highest daily max	ns	1	0.121	0.119	0.125	0.114	0.111	0.119	0.119	0.11	0.121	0.142
	4th highest daily max 8-h average	ns	1	0.104	0.094	0.11	0.093	0.097	0.097	0.102	0.09	0.101	0.105
PM_{10}*	90th percentile	ns	1	59	62	48	52	51	49	55	54	50	51
	Weighted annual mean	ns	1	33.7	36.7	28.9	35.6	32	31.2	32.7	35.3	32.4	29.8
$PM_{2.5}$*	98th percentile	NA	2	ND	ND	ND	ND	ND	ND	35.25	37.2	36.6	36.7
	Weighted annual mean	NA	2	ND	ND	ND	ND	ND	ND	13.365	14.03	13.78	12.58
NEWBURGH, NY-PA													
Ozone	2nd highest daily max	ns	1	0.115	0.115	0.115	0.12	0.102	0.104	0.119	0.096	0.108	0.099
	4th highest daily max 8-h average	down	1	0.095	0.095	0.095	0.091	0.088	0.088	0.094	0.078	0.09	0.085
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	ND	29.8	27.8	30.5
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	ND	11.87	11.58	11.04

Table A-16. Metropolitan Statistical Area Air Quality Trends, 1993–2002 (continued)

Metropolitan Statistical Area		Trend	#Trend Sites	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
NORFOLK-VIRGINIA BEACH-NEWPORT NEWS, V													
CO	2nd max (daily-non-overlapping 8-h)	down	2	5.55	6.3	4.7	5.05	3.7	5.55	4.25	3.65	3.85	3.6
SO_2	2nd daily max	ns	1	0.027	0.025	0.028	0.025	0.023	0.021	0.022	0.023	0.023	0.031
	Annual mean	ns	1	0.007	0.008	0.007	0.007	0.007	0.006	0.007	0.007	0.006	0.006
NO_2	Annual mean	ns	1	0.021	0.019	0.018	0.018	0.019	0.019	0.017	0.016	0.018	0.018
Ozone	2nd highest daily max	ns	1	0.123	0.101	0.099	0.097	0.113	0.104	0.135	0.094	0.1	0.128
	4th highest daily max 8-h average	ns	1	0.095	0.085	0.082	0.083	0.097	0.09	0.097	0.081	0.085	0.102
$PM_{2.5}$*	98th percentile	NA	2	ND	ND	ND	ND	ND	ND	35.4	29.75	30.4	28.05
	Weighted annual mean	NA	2	ND	ND	ND	ND	ND	ND	13.33	13.585	13.515	12.155
OAKLAND, CA													
	Maximum quarterly value	down	1	0.015	0.012	0.009	0.009	0.005	0.006	0.007	0.012	0.005	0.005
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	ND	38.3	54.4	50.5
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	ND	11.21	11.93	13.83
OCALA, FL													
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	21.3	23.9	22.8	24.8
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	11.4	10.95	10.37	9.82
OKLAHOMA CITY, OK													
CO	2nd max (daily-non-overlapping 8-h)	down	1	6.2	5.3	4.8	5.2	5.4	4.1	4.3	4.2	4	3
NO_2	Annual mean	ns	1	0.013	0.015	0.014	0.014	0.015	0.015	0.014	0.013	0.013	0.014
Ozone	2nd highest daily max	down	1	0.103	0.1	0.103	0.102	0.103	0.109	0.097	0.091	0.093	0.091
	4th highest daily max 8-h average	ns	1	0.077	0.079	0.085	0.081	0.084	0.089	0.084	0.08	0.078	0.08
PM_{10}*	90th percentile	ns	1	39	35	42	49	42	42.667	43.333	44	38	38
	Weighted annual mean	ns	1	23.9	23.3	22.8	27.4	23.8	24.4	25	25.6	22.9	22.5
$PM_{2.5}$*	98th percentile	NA	2	ND	ND	ND	ND	ND	ND	ND	25.9	26	29.5
	Weighted annual mean	NA	2	ND	ND	ND	ND	ND	ND	ND	10.66	10.895	10.445
OLYMPIA, WA													
PM_{10}*	90th percentile	down	1	49	30	35	30	36	22	26	31	26	25
	Weighted annual mean	down	1	23.8	17.7	16.8	15.4	16	14.1	14.4	15.4	15.4	13.9
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	29.4	41.2	36.4	30.1
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	9.21	10.33	9.64	9.04
OMAHA, NE-IA													
CO	2nd max (daily-non-overlapping 8-h)	ns	1	7.3	4.2	7.5	6.9	5.4	7.7	8.8	3	3.8	3.9
Ozone	2nd highest daily max	ns	1	0.058	0.078	0.088	0.074	0.074	0.075	0.088	0.077	0.07	0.08
	4th highest daily max 8-h average	ns	1	0.048	0.065	0.075	0.063	0.063	0.065	0.068	0.063	0.056	0.07
PM_{10}*	90th percentile	ns	2	50	55	49	53	59.5	69.5	83.5	60	57	59
	Weighted annual mean	up	2	31.95	35.05	30.1	36.2	35.4	36.15	44.55	39.3	36.7	36.85
$PM_{2.5}$*	98th percentile	NA	2	ND	ND	ND	ND	ND	ND	ND	25.8	23.75	27.1
	Weighted annual mean	NA	2	ND	ND	ND	ND	ND	ND	ND	10.775	10.52	10.615
ORANGE COUNTY, CA													
CO	2nd max (daily-non-overlapping 8-h)	down	2	6.65	7.95	6.3	6.35	5.2	5.7	5.675	5.45	4.1	4.15
SO_2	2nd daily max	ns	1	0.006	0.005	0.005	0.004	0.006	0.005	0.005	0.005	0.004	0.009
	Annual mean	ns	1	0.002	0.002	0.003	0.001	0.001	0.002	0.002	0.002	0.002	0.002
NO_2	Annual mean	down	2	0.03	0.032	0.031	0.027	0.026	0.026	0.027	0.025	0.022	0.021
Ozone	2nd highest daily max	down	2	0.14	0.131	0.117	0.105	0.097	0.126	0.108	0.1	0.094	0.092
	4th highest daily max 8-h average	down	2	0.084	0.085	0.078	0.075	0.071	0.08	0.073	0.071	0.068	0.068
PM_{10}*	90th percentile	ns	1	63	54	74	57	58	53	89	59	55	49
	Weighted annual mean	ns	1	38.3	37.5	43.5	35.2	38.8	35.8	44.3	39.5	36	33.5
$PM_{2.5}$*	98th percentile	NA	2	ND	ND	ND	ND	ND	ND	ND	51.4	52.05	46.95
	Weighted annual mean	NA	2	ND	ND	ND	ND	ND	ND	ND	17.53	18.91	17.055
ORLANDO, FL													
CO	2nd max (daily-non-overlapping 8-h)	down	2	3.8	3.6	3.3	3.25	3.55	2.95	2.75	2.5	2.05	2.5
SO_2	2nd daily max	ns	1	0.011	0.012	0.006	0.008	0.006	0.007	0.007	0.009	0.008	0.005
	Annual mean	ns	1	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.003	0.002	0.001
NO_2	Annual mean	ns	1	0.012	0.011	0.01	0.013	0.013	0.011	0.012	0.012	0.012	0.011
Ozone	2nd highest daily max	ns	2	0.097	0.101	0.099	0.1	0.103	0.109	0.101	0.104	0.094	0.101
	4th highest daily max 8-h average	ns	2	0.081	0.082	0.075	0.077	0.079	0.089	0.082	0.08	0.078	0.075
PM_{10}*	90th percentile	ns	3	32.333	30	30.333	34.333	30	34.667	33.333	33.333	30	27.667
	Weighted annual mean	ns	3	22.333	21.6	20.5	22.267	21.8	23.9	23.2	22.8	22.8	18.967
$PM_{2.5}$*	98th percentile	NA	2	ND	ND	ND	ND	ND	ND	24.6	29.7	27	21.85
	Weighted annual mean	NA	2	ND	ND	ND	ND	ND	ND	11.275	11.94	10.795	9.605

Table A-16. Metropolitan Statistical Area Air Quality Trends, 1993–2002 (continued)

Metropolitan Statistical Area		Trend	#Trend Sites	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
OWENSBORO, KY													
SO_2	2nd daily max	down	1	0.05	0.035	0.028	0.02	0.027	0.023	0.024	0.017	0.019	0.02
	Annual mean	down	1	0.009	0.009	0.007	0.007	0.007	0.007	0.006	0.005	0.004	0.004
NO_2	Annual mean	down	1	0.012	0.012	0.013	0.011	0.012	0.013	0.011	0.011	0.01	0.01
Ozone	2nd highest daily max	ns	1	0.106	0.107	0.109	0.107	0.108	0.11	0.102	0.082	0.086	0.109
	4th highest daily max 8-h average	ns	1	0.081	0.092	0.088	0.086	0.087	0.086	0.09	0.074	0.073	0.086
PM_{10}*	90th percentile	down	1	43	42	42	40	39	40	38	32	34	33
	Weighted annual mean	down	1	24.9	25.6	24.9	23.4	22.8	23.1	22	20	20.6	19.9
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	33.1	32.3	31.5	29.5
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	15.22	15.2	15.18	14.64
PANAMA CITY, FL													
PM_{10}*	90th percentile	ns	1	46	34	37	31	38	41	35	37	31	31
	Weighted annual mean	ns	1	29.3	22.6	23.4	21.9	25.1	25.4	25.2	24.8	22.4	20.8
PARKERSBURG-MARIETTA, WV-OH													
SO_2	2nd daily max	ns	1	0.065	0.084	0.041	0.046	0.052	0.089	0.058	0.036	0.035	0.038
	Annual mean	ns	1	0.014	0.017	0.01	0.01	0.01	0.013	0.013	0.011	0.009	0.01
Ozone	2nd highest daily max	ns	2	0.114	0.113	0.117	0.107	0.106	0.113	0.121	0.104	0.106	0.114
	4th highest daily max 8-h average	ns	2	0.092	0.095	0.097	0.088	0.085	0.093	0.096	0.085	0.085	0.095
PM_{10}*	90th percentile	ns	1	51	51	40	34	39	44	36	39	37	37
	Weighted annual mean	down	1	29.2	27.3	25.3	22.7	23.1	23.1	20.5	21.4	22.1	23.5
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	42.8	38	42.1	37
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	17.27	17.68	17.4	15.76
PENSACOLA, FL													
SO_2	2nd daily max	ns	2	0.047	0.045	0.023	0.024	0.031	0.023	0.024	0.027	0.025	0.021
	Annual mean	down	2	0.006	0.005	0.003	0.004	0.004	0.004	0.004	0.004	0.003	0.003
Ozone	2nd highest daily max	ns	2	0.102	0.108	0.117	0.098	0.11	0.121	0.102	0.113	0.093	0.09
	4th highest daily max 8-h average	ns	2	0.08	0.085	0.083	0.079	0.085	0.095	0.084	0.09	0.079	0.073
PM_{10}*	90th percentile	ns	2	39	34.5	31.5	31	41.5	37	38	32.5	30	27.5
	Weighted annual mean	down	2	25.8	23	21.7	20	23.7	21.9	23.25	21.8	20.9	17.7
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	29.8	31.8	22.2	22.4
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	14.82	13.93	11.39	10.95
PEORIA-PEKIN, IL													
	Maximum quarterly value	down	1	0.032	0.019	0.026	0.024	0.019	0.017	0.017	0.018	0.019	0.013
CO	2nd max (daily-non-overlapping 8-h)	down	1	7.3	5.7	5.6	4.6	4.7	5.8	4.6	3.4	3.5	3.1
SO_2	2nd daily max	ns	2	0.039	0.05	0.084	0.045	0.042	0.041	0.036	0.05	0.054	0.043
	Annual mean	down	2	0.007	0.007	0.007	0.007	0.007	0.007	0.006	0.006	0.006	0.005
Ozone	2nd highest daily max	ns	2	0.079	0.089	0.094	0.089	0.086	0.085	0.098	0.083	0.081	0.098
	4th highest daily max 8-h average	ns	2	0.064	0.076	0.082	0.081	0.072	0.076	0.082	0.072	0.074	0.083
PM_{10}*	90th percentile	ns	1	35	39	38	31	41	42	40	43	36	36
	Weighted annual mean	ns	1	19.6	20.6	20.1	20.6	26.2	25.5	23.1	24.3	22.3	21.2
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	38	32.2	36.4	33.6
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	16.04	14.85	13.94	13.88
PHILADELPHIA, PA-NJ													
	Maximum quarterly value	down	2	0.076	0.06	0.058	0.05	0.045	0.037	0.039	0.049	0.031	0.03
CO	2nd max (daily-non-overlapping 8-h)	down	5	5.4	6.16	4.36	4.72	4	3.6	3.86	3.58	3.34	2.36
SO_2	2nd daily max	down	4	0.029	0.04	0.028	0.026	0.026	0.022	0.022	0.024	0.025	0.023
	Annual mean	down	4	0.008	0.009	0.007	0.007	0.007	0.007	0.006	0.007	0.006	0.006
NO_2	Annual mean	down	4	0.024	0.027	0.024	0.025	0.023	0.023	0.022	0.022	0.022	0.021
Ozone	2nd highest daily max	ns	5	0.121	0.115	0.131	0.12	0.117	0.115	0.126	0.113	0.116	0.126
	4th highest daily max 8-h average	ns	5	0.096	0.088	0.106	0.091	0.095	0.093	0.099	0.09	0.094	0.104
PM_{10}*	90th percentile	down	2	48	59	48.5	49	49	42	37.5	42	42	38.5
	Weighted annual mean	down	2	28.25	32.75	29.25	29.9	28.25	24.5	20.35	23.825	24.1	23.25
$PM_{2.5}$*	98th percentile	NA	4	ND	ND	ND	ND	ND	ND	34.8	36.975	37.975	36.025
	Weighted annual mean	NA	4	ND	ND	ND	ND	ND	ND	13.353	14.895	15.244	14.148
PHOENIX-MESA, AZ													
CO	2nd max (daily-non-overlapping 8-h)	down	2	6.5	7.25	6.1	5.95	5.2	6.35	5.5	5.15	4.55	4.1
SO_2	2nd daily max	ns	1	0.008	0.008	0.008	0.017	0.009	0.011	0.012	0.012	0.009	0.01
	Annual mean	ns	1	0.002	0.002	0.002	0.003	0.004	0.004	0.003	0.003	0.003	0.003
NO_2	Annual mean	ns	1	0.029	0.029	0.029	0.029	0.028	0.028	0.031	0.029	0.026	0.029
Ozone	2nd highest daily max	ns	2	0.116	0.108	0.123	0.111	0.105	0.113	0.109	0.103	0.098	0.11
	4th highest daily max 8-h average	ns	2	0.081	0.077	0.088	0.088	0.085	0.088	0.088	0.084	0.081	0.085
PM_{10}*	90th percentile	ns	2	56	62	64.5	64	67	59.5	74	70	54	62.5
	Weighted annual mean	ns	2	38.55	38.85	39.9	39.9	43.75	34.15	42.95	44.9	36.1	45.15

Table A-16. Metropolitan Statistical Area Air Quality Trends, 1993–2002 (continued)

Metropolitan Statistical Area		Trend	#Trend Sites	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
PITTSBURGH, PA													
	Maximum quarterly value	ns	1	0.134	0.171	0.115	0.058	0.075	0.061	0.081	0.07	0.057	0.111
CO	2nd max (daily-non-overlapping 8-h)	down	1	5.4	7	5.9	4.3	3.8	3.8	3.9	3.2	3.4	2.7
SO_2	2nd daily max	down	2	0.077	0.087	0.073	0.053	0.068	0.073	0.065	0.064	0.063	0.057
	Annual mean	down	2	0.016	0.016	0.013	0.013	0.013	0.013	0.013	0.011	0.012	0.013
NO_2	Annual mean	down	1	0.024	0.027	0.023	0.024	0.022	0.026	0.024	0.022	0.021	0.02
Ozone	2nd highest daily max	ns	3	0.116	0.114	0.124	0.107	0.114	0.114	0.128	0.098	0.105	0.117
	4th highest daily max 8-h average	ns	3	0.094	0.097	0.104	0.09	0.094	0.095	0.096	0.082	0.089	0.103
PM_{10}*	90th percentile	down	2	79	82	71	68	67.5	70	61.5	65.5	67	63
	Weighted annual mean	down	2	38.45	43.3	37.1	35.55	34.3	35.75	32.2	34.05	35.85	31.6
$PM_{2.5}$*	98th percentile	NA	2	ND	ND	ND	ND	ND	ND	49.3	49.15	52.8	50.65
	Weighted annual mean	NA	2	ND	ND	ND	ND	ND	ND	18.8	18.275	19.815	17.815
PITTSFIELD, MA													
Ozone	2nd highest daily max	ns	1	0.112	0.085	0.086	0.108	0.087	0.078	0.092	0.088	0.112	0.103
	4th highest daily max 8-h average	ns	1	0.083	0.074	0.072	0.081	0.078	0.069	0.075	0.072	0.092	0.086
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	47.7	28.8	33.8	31.5
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	12.78	11.8	13.35	11.44
POCATELLO, ID													
SO_2	2nd daily max	ns	1	0.037	0.037	0.037	0.03	0.034	0.034	0.046	0.036	0.037	0.027
	Annual mean	ns	1	0.007	0.007	0.007	0.006	0.005	0.006	0.007	0.008	0.007	0.005
PM_{10}*	90th percentile	ns	1	56	50	40	46	39	37	48	45	48	45
	Weighted annual mean	ns	1	39.4	30.5	23.2	24.4	22.9	22.4	25.3	24.9	26	25.4
$PM_{2.5}$*	98th percentile	NA	2	ND	ND	ND	ND	ND	ND	72.25	51.1	36.2	36.85
	Weighted annual mean	NA	2	ND	ND	ND	ND	ND	ND	9.64	10.46	9.32	8.66
PONCE, PR													
$PM_{2.5}$*	98th percentile	NA	2	ND	ND	ND	ND	ND	ND	17.35	17.95	14.25	13.1
	Weighted annual mean	NA	2	ND	ND	ND	ND	ND	ND	8.19	7.27	7.24	7.23
PORTLAND, ME													
Ozone	2nd highest daily max	ns	1	0.112	0.122	0.116	0.1	0.13	0.12	0.105	0.077	0.116	0.122
	4th highest daily max 8-h average	ns	1	0.089	0.088	0.096	0.083	0.103	0.089	0.076	0.067	0.097	0.096
PM_{10}*	90th percentile	ns	1	51	46	69	43	51	46	33	46	46	53
	Weighted annual mean	down	1	29	26.5	34.3	27.1	29.3	26.7	21.4	23.7	25.6	24.6
$PM_{2.5}$*	98th percentile	NA	2	ND	ND	ND	ND	ND	ND	34.2	27.1	30.5	28.3
	Weighted annual mean	NA	2	ND	ND	ND	ND	ND	ND	10.01	9.565	10.28	9.58
PORTLAND-VANCOUVER, OR-WA													
CO	2nd max (daily-non-overlapping 8-h)	down	1	6.8	7.8	6.3	6.4	6	5.5	6.7	6.2	4.7	5.7
Ozone	2nd highest daily max	ns	1	0.082	0.106	0.092	0.124	0.079	0.136	0.094	0.082	0.093	0.099
	4th highest daily max 8-h average	ns	1	0.062	0.078	0.073	0.099	0.062	0.081	0.072	0.065	0.069	0.063
PM_{10}*	90th percentile	down	3	47.667	41.333	35	33	34.333	31.667	31.333	31.667	26.333	27.667
	Weighted annual mean	down	3	26.867	25.2	21.433	21.267	22.667	20.533	19.3	18.667	17.1	17.1
$PM_{2.5}$*	98th percentile	NA	4	ND	ND	ND	ND	ND	ND	30.55	32.325	27.325	34.525
	Weighted annual mean	NA	4	ND	ND	ND	ND	ND	ND	9.115	10.028	8.998	9.323
PORTSMOUTH-ROCHESTER, NH-ME													
SO_2	2nd daily max	down	1	0.019	0.022	0.017	0.015	0.018	0.016	0.019	0.013	0.013	0.013
	Annual mean	down	1	0.006	0.006	0.004	0.004	0.004	0.004	0.004	0.003	0.003	0.003
NO_2	Annual mean	down	1	0.014	0.013	0.012	0.013	0.013	0.012	0.01	0.011	0.011	0.011
Ozone	2nd highest daily max	ns	2	0.117	0.118	0.122	0.097	0.121	0.11	0.107	0.087	0.102	0.106
	4th highest daily max 8-h average	ns	2	0.085	0.087	0.087	0.079	0.091	0.087	0.087	0.069	0.079	0.081
PM_{10}*	90th percentile	down	1	31	29	27	30	29	27	30	26	26	26
	Weighted annual mean	down	1	19	15.3	15.3	17.8	17.9	16.4	16.2	14.5	14.5	14.5
PROVIDENCE-FALL RIVER-WARWICK, RI-MA													
CO	2nd max (daily-non-overlapping 8-h)	down	1	5.4	6.7	7	4.4	5.6	4.7	3.9	3.5	3.8	2.7
SO_2	2nd daily max	ns	3	0.034	0.035	0.024	0.03	0.031	0.025	0.024	0.031	0.028	0.022
	Annual mean	down	3	0.008	0.008	0.006	0.007	0.007	0.006	0.006	0.006	0.006	0.005
NO_2	Annual mean	ns	1	0.022	0.022	0.022	0.025	0.025	0.025	0.024	0.02	0.02	0.018
Ozone	2nd highest daily max	ns	1	0.12	0.12	0.131	0.112	0.108	0.098	0.108	0.115	0.128	0.124
	4th highest daily max 8-h average	ns	1	0.089	0.089	0.096	0.083	0.084	0.077	0.08	0.08	0.102	0.092
PM_{10}*	90th percentile	down	1	46	46	36	40	35	32	35	31	38	30
	Weighted annual mean	down	1	28.6	28.6	21.5	24.5	24.1	22.5	23.1	21.3	21.7	18.3
$PM_{2.5}$*	98th percentile	NA	3	ND	ND	ND	ND	ND	ND	36	28.867	33.267	29.067
	Weighted annual mean	NA	3	ND	ND	ND	ND	ND	ND	11.75	10.99	12.383	10.837

Table A-16. Metropolitan Statistical Area Air Quality Trends, 1993–2002 (continued)

Metropolitan Statistical Area		Trend	#Trend Sites	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
PROVO-OREM, UT													
NO_2	Annual mean	ns	1	0.026	0.024	0.023	0.024	0.023	0.024	0.024	0.024	0.024	0.025
Ozone	2nd highest daily max	ns	1	0.084	0.084	0.083	0.097	0.08	0.102	0.096	0.085	0.086	0.096
	4th highest daily max 8-h average	ns	1	0.068	0.069	0.068	0.078	0.07	0.083	0.073	0.071	0.067	0.077
PM_{10}*	90th percentile	ns	2	71.5	55	48.5	56.5	49.5	44	51.5	52	53	48.5
	Weighted annual mean	ns	2	37.5	34.25	28.8	33.7	30	26.25	29.6	29.1	31.4	30.15
$PM_{2.5}$*	98th percentile	NA	2	ND	ND	ND	ND	ND	ND	31.15	33.75	55.15	41.4
	Weighted annual mean	NA	2	ND	ND	ND	ND	ND	ND	9.355	9.925	11.685	11.26
PUEBLO, CO													
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	ND	19.9	19.4	16.9
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	ND	7.81	8.52	7.76
RACINE, WI													
CO	2nd max (daily-non-overlapping 8-h)	down	1	4.1	4.3	4.3	3	3.1	3	2.7	2.3	2.1	2
Ozone	2nd highest daily max	ns	1	0.103	0.114	0.113	0.129	0.117	0.124	0.114	0.096	0.115	0.141
	4th highest daily max 8-h average	ns	1	0.08	0.088	0.096	0.083	0.098	0.084	0.093	0.078	0.092	0.111
RALEIGH-DURHAM-CHAPEL HILL, NC													
Ozone	2nd highest daily max	ns	4	0.103	0.101	0.102	0.095	0.106	0.115	0.122	0.11	0.103	0.116
	4th highest daily max 8-h average	ns	4	0.085	0.081	0.084	0.08	0.09	0.095	0.097	0.086	0.085	0.1
PM_{10}*	90th percentile	ns	2	39	31	33.5	39	39.5	40	36.5	35.5	37	34.5
	Weighted annual mean	ns	2	24.75	21.8	23.3	25.1	24.6	24.4	22.15	23.05	23.15	21.55
$PM_{2.5}$*	98th percentile	NA	4	ND	ND	ND	ND	ND	ND	35.375	31.125	30.85	30.025
	Weighted annual mean	NA	4	ND	ND	ND	ND	ND	ND	15.258	14.843	13.958	13.12
RAPID CITY, SD													
$PM_{2.5}$*	98th percentile	NA	3	ND	ND	ND	ND	ND	ND	25	23.133	19.533	22.6
	Weighted annual mean	NA	3	ND	ND	ND	ND	ND	ND	9.09	7.833	7.917	7.37
READING, PA													
SO_2	2nd daily max	down	1	0.027	0.037	0.032	0.037	0.028	0.022	0.027	0.028	0.025	0.019
	Annual mean	down	1	0.009	0.01	0.009	0.009	0.008	0.009	0.008	0.008	0.007	0.007
NO_2	Annual mean	down	1	0.021	0.023	0.021	0.022	0.021	0.021	0.021	0.02	0.02	0.019
Ozone	2nd highest daily max	ns	2	0.108	0.104	0.112	0.105	0.115	0.105	0.126	0.103	0.122	0.11
	4th highest daily max 8-h average	ns	2	0.088	0.084	0.093	0.086	0.092	0.091	0.101	0.08	0.095	0.093
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	35.7	37.5	43	48.5
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	13.51	16.87	16.49	16.66
REDDING, CA													
PM_{10}*	90th percentile	ns	1	47	47	47	39	37	46	40	37	41	42
	Weighted annual mean	ns	1	29.9	29.9	25.2	24.1	22.2	23.4	28.5	23.6	23.6	25.4
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	55	42	29	38
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	11.53	10.355	9.18	10.68
RENO, NV													
CO	2nd max (daily-non-overlapping 8-h)	down	3	6.067	7.633	5.533	6.467	6.533	6.033	7	4.633	4.5	4.3
Ozone	2nd highest daily max	ns	2	0.087	0.088	0.083	0.096	0.084	0.093	0.094	0.083	0.087	0.095
	4th highest daily max 8-h average	ns	2	0.063	0.07	0.069	0.074	0.068	0.075	0.075	0.067	0.07	0.076
PM_{10}*	90th percentile	ns	3	81.333	74	58	61	67	64.333	62	64.333	64.667	56
	Weighted annual mean	down	3	45.767	41.767	36.567	34.167	37.133	35.467	40.233	33.4	34.367	35.1
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	32.8	31.4	36.4	25.9
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	9.93	8.92	9.82	9.12
RICHLAND-KENNEWICK-PASCO, WA													
PM_{10}*	90th percentile	up	1	27	27	34	38	33	30	42	40	38	42
	Weighted annual mean	up	1	15.1	15.1	17.8	20.3	19.4	19.9	20.8	24	22	22.8
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	ND	31.2	18.2	22.5
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	ND	8.4	6.76	6.39
RICHMOND-PETERSBURG, VA													
CO	2nd max (daily-non-overlapping 8-h)	down	1	3	2.7	2.3	2.5	2.5	1.7	1.9	2	2.3	2
SO_2	2nd daily max	down	1	0.032	0.024	0.023	0.022	0.017	0.019	0.017	0.017	0.019	0.021
	Annual mean	down	1	0.007	0.006	0.005	0.006	0.006	0.006	0.005	0.006	0.005	0.005
NO_2	Annual mean	ns	1	0.01	0.012	0.011	0.01	0.012	0.012	0.011	0.011	0.012	0.012
Ozone	2nd highest daily max	ns	1	0.132	0.101	0.106	0.104	0.123	0.116	0.133	0.094	0.119	0.137
	4th highest daily max 8-h average	ns	1	0.1	0.082	0.088	0.084	0.1	0.092	0.097	0.076	0.089	0.105
PM_{10}*	90th percentile	down	1	45	36	43	44	39	39	28	38	35	29
	Weighted annual mean	down	1	24.2	22.1	24.3	23.8	22.7	23.4	18.6	22.2	20.4	18.1
$PM_{2.5}$*	98th percentile	NA	4	ND	ND	ND	ND	ND	ND	35.467	32.875	33.1	30.35
	Weighted annual mean	NA	4	ND	ND	ND	ND	ND	ND	14.117	14.515	13.74	13.093

Table A-16. Metropolitan Statistical Area Air Quality Trends, 1993–2002 (continued)

Metropolitan Statistical Area			Trend	#Trend Sites	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
RIVERSIDE-SAN BERNARDINO, CA														
		Maximum quarterly value	ns	1	0.036	0.026	0.033	0.031	0.045	0.046	0.038	0.032	0.029	0.027
	CO	2nd max (daily-non-overlapping 8-h)	down	2	5.55	5.8	5.5	4.8	4.95	4.4	4	4	3.45	3.25
	NO_2	Annual mean	down	2	0.036	0.036	0.038	0.033	0.03	0.029	0.032	0.03	0.031	0.03
	Ozone	2nd highest daily max	down	3	0.223	0.218	0.216	0.195	0.163	0.205	0.143	0.16	0.158	0.148
		4th highest daily max 8-h average	down	3	0.162	0.153	0.151	0.138	0.118	0.152	0.112	0.115	0.121	0.115
	PM_{10}*	90th percentile	down	2	81.5	71.5	77	67	68.5	66	73	64.5	71.5	66
		Weighted annual mean	ns	2	51.35	45.8	44.45	43.3	43.35	41.65	49.55	41.6	46.2	44.3
	$PM_{2.5}$*	98th percentile	NA	3	ND	ND	ND	ND	ND	ND	70.15	55.633	53.7	53.333
		Weighted annual mean	NA	3	ND	ND	ND	ND	ND	ND	28.875	21.85	23.547	22.79
ROANOKE, VA														
	CO	2nd max (daily-non-overlapping 8-h)	down	1	4.5	5.7	5.2	5.9	4.3	3.9	3.7	3.1	3.4	3
	SO_2	2nd daily max	ns	1	0.018	0.011	0.01	0.014	0.013	0.009	0.01	0.014	0.009	0.009
		Annual mean	down	1	0.004	0.004	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
	NO_2	Annual mean	ns	1	0.015	0.013	0.013	0.013	0.013	0.014	0.012	0.011	0.014	0.013
	Ozone	2nd highest daily max	ns	1	0.103	0.102	0.093	0.084	0.102	0.126	0.105	0.095	0.101	0.107
		4th highest daily max 8-h average	ns	1	0.084	0.084	0.079	0.073	0.084	0.099	0.089	0.081	0.089	0.091
	PM_{10}*	90th percentile	down	1	63	63	64	71	64	54	54	57	42	47
		Weighted annual mean	down	1	40	40	40.3	37.9	34.6	33.3	34.7	31.5	26.6	28.2
	$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	31.8	35.5	34.2	36
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	13.82	15.52	15.1	15.09
ROCHESTER, NY														
	CO	2nd max (daily-non-overlapping 8-h)	down	2	3.15	4.5	3.15	3.7	1.9	2.7	2.5	2.2	1.75	2.1
	SO_2	2nd daily max	down	2	0.041	0.043	0.038	0.033	0.038	0.053	0.03	0.021	0.025	0.016
		Annual mean	down	2	0.01	0.011	0.01	0.009	0.009	0.009	0.006	0.006	0.007	0.005
	Ozone	2nd highest daily max	ns	1	0.092	0.099	0.103	0.083	0.097	0.088	0.096	0.08	0.099	0.114
		4th highest daily max 8-h average	ns	1	0.074	0.079	0.09	0.068	0.085	0.077	0.088	0.073	0.084	0.098
	$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	ND	28.4	37.5	31.9
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	ND	11.76	11.66	11.22
ROCKFORD, IL														
	CO	2nd max (daily-non-overlapping 8-h)	down	1	4	4	4.5	3.2	3.7	3.6	3.8	2.9	2.9	2.4
	Ozone	2nd highest daily max	ns	1	0.079	0.101	0.104	0.089	0.08	0.085	0.093	0.084	0.086	0.091
		4th highest daily max 8-h average	ns	1	0.062	0.079	0.084	0.077	0.071	0.073	0.082	0.069	0.078	0.079
ROCKY MOUNT, NC														
	Ozone	2nd highest daily max	ns	1	0.11	0.104	0.097	0.091	0.106	0.107	0.104	0.106	0.099	0.109
		4th highest daily max 8-h average	ns	1	0.092	0.088	0.084	0.08	0.089	0.09	0.092	0.085	0.085	0.095
SACRAMENTO, CA														
		Maximum quarterly value	down	1	0.01	0.007	0.005	0.006	0.005	0.046	0.005	0.005	0.005	0.005
	CO	2nd max (daily-non-overlapping 8-h)	down	3	6.5	6.633	5	5	4.8	4.933	4.9	3.767	4.167	3.3
	SO_2	2nd daily max	up	2	0.004	0.005	0.005	0.004	0.005	0.01	0.008	0.01	0.01	0.007
		Annual mean	up	2	0.001	0.001	0.002	0.002	0.002	0.002	0.003	0.003	0.002	0.002
	NO_2	Annual mean	ns	3	0.018	0.016	0.017	0.017	0.015	0.016	0.017	0.016	0.016	0.016
	Ozone	2nd highest daily max	ns	3	0.117	0.105	0.131	0.12	0.095	0.14	0.113	0.113	0.113	0.117
		4th highest daily max 8-h average	ns	3	0.085	0.086	0.093	0.093	0.078	0.093	0.088	0.086	0.087	0.094
	PM_{10}*	90th percentile	ns	3	57.667	44.333	53.333	39.667	37	45	54.333	43	46.667	43
		Weighted annual mean	ns	3	30.6	28.367	26.7	24.2	23.033	23.833	29.333	24.733	27.167	26.767
	$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	67	49	53	63
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	16.58	12.37	11.63	14.33
ST. CLOUD, MN														
	CO	2nd max (daily-non-overlapping 8-h)	down	1	5	6.4	4.4	4	4	3.8	3.3	2.7	2.6	2.9
ST. JOSEPH, MO														
	$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	28.2	26.8	29	30.9
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	12.48	11.89	12.9	13
ST. LOUIS, MO-IL														
	CO	2nd max (daily-non-overlapping 8-h)	ns	1	3.6	3.8	3.2	3.9	3.7	4	2.3	2.2	2.6	6.9
	SO_2	2nd daily max	ns	3	0.048	0.051	0.047	0.059	0.042	0.042	0.042	0.038	0.043	0.045
		Annual mean	down	3	0.011	0.012	0.01	0.011	0.009	0.009	0.009	0.007	0.006	0.006
	NO_2	Annual mean	ns	1	0.024	0.028	0.026	0.025	0.025	0.026	0.027	0.026	0.025	0.023
	Ozone	2nd highest daily max	ns	3	0.118	0.126	0.124	0.111	0.106	0.115	0.126	0.108	0.103	0.118
		4th highest daily max 8-h average	ns	3	0.085	0.095	0.095	0.089	0.083	0.091	0.1	0.083	0.086	0.097
	$PM_{2.5}$*	98th percentile	NA	2	ND	ND	ND	ND	ND	ND	35.85	33.3	33.55	44.7
		Weighted annual mean	NA	2	ND	ND	ND	ND	ND	ND	16.165	16.295	15.895	16.38

Table A-16. Metropolitan Statistical Area Air Quality Trends, 1993–2002 (continued)

Metropolitan Statistical Area			Trend	#Trend Sites	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
SALEM, OR														
	Ozone	2nd highest daily max	ns	1	0.1	0.1	0.1	0.117	0.081	0.112	0.082	0.074	0.081	0.096
		4th highest daily max 8-h average	ns	1	0.064	0.064	0.064	0.092	0.061	0.077	0.065	0.059	0.057	0.063
	$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	26.3	28.7	32.7	34.8
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	7.51	8.94	8.15	8.15
SALINAS, CA														
	Ozone	2nd highest daily max	down	1	0.09	0.09	0.08	0.089	0.078	0.073	0.074	0.084	0.078	0.077
		4th highest daily max 8-h average	ns	1	0.077	0.068	0.064	0.07	0.061	0.057	0.063	0.063	0.063	0.066
	PM_{10}*	90th percentile	ns	1	25	24	23	23	21	17	26	19	23	23
		Weighted annual mean	ns	1	15.7	15.3	13.4	14.2	14.3	12.2	15.4	12.7	14.6	14.4
SALT LAKE CITY-OGDEN, UT														
		Maximum quarterly value	ns	1	0.096	0.054	0.066	0.032	0.105	0.094	0.082	0.068	0.042	0.055
	CO	2nd max (daily-non-overlapping 8-h)	down	2	5.95	5.7	5	6.55	5.95	5.3	5.1	4.55	3.95	3.4
	SO_2	2nd daily max	down	1	0.052	0.014	0.012	0.021	0.011	0.01	0.01	0.013	0.013	0.01
		Annual mean	down	1	0.009	0.005	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
	NO_2	Annual mean	ns	2	0.022	0.021	0.021	0.023	0.022	0.021	0.023	0.022	0.022	0.021
	Ozone	2nd highest daily max	ns	2	0.104	0.109	0.115	0.114	0.102	0.122	0.107	0.096	0.105	0.107
		4th highest daily max 8-h average	ns	2	0.079	0.081	0.083	0.085	0.077	0.094	0.08	0.075	0.079	0.085
	PM_{10}*	90th percentile	ns	2	80	66	65	79	63	56	69	66	64	66.5
		Weighted annual mean	ns	2	43.9	38.65	36.75	41.35	36.65	32.9	36.95	37.65	37.95	36.65
	$PM_{2.5}$*	98th percentile	NA	4	ND	ND	ND	ND	ND	ND	42.925	50.125	61.55	56.725
		Weighted annual mean	NA	4	ND	ND	ND	ND	ND	ND	10.315	11.575	12.438	13.295
SAN ANTONIO, TX														
	CO	2nd max (daily-non-overlapping 8-h)	down	1	5.3	3.3	4.3	4.5	4.4	4.6	4.2	2.7	2.7	2.6
	Ozone	2nd highest daily max	ns	1	0.111	0.101	0.121	0.11	0.103	0.107	0.109	0.094	0.089	0.126
		4th highest daily max 8-h average	ns	1	0.084	0.083	0.095	0.082	0.084	0.089	0.091	0.077	0.078	0.104
	$PM_{2.5}$*	98th percentile	NA	2	ND	ND	ND	ND	ND	ND	ND	22	17.7	26.15
		Weighted annual mean	NA	2	ND	ND	ND	ND	ND	ND	ND	9.365	8.2	9.005
SAN DIEGO, CA														
		Maximum quarterly value	ns	2	0.032	0.017	0.026	0.023	0.024	0.018	0.028	0.035	0.045	0.024
	CO	2nd max (daily-non-overlapping 8-h)	down	5	5.14	5.42	4.74	4.96	4.26	4.02	4.28	4.18	4.22	3.32
	SO_2	2nd daily max	ns	3	0.009	0.013	0.012	0.015	0.012	0.011	0.012	0.01	0.01	0.009
		Annual mean	ns	3	0.002	0.003	0.003	0.004	0.003	0.003	0.003	0.003	0.003	0.004
	NO_2	Annual mean	ns	5	0.019	0.02	0.021	0.019	0.019	0.019	0.021	0.019	0.018	0.019
	Ozone	2nd highest daily max	down	5	0.122	0.111	0.119	0.106	0.115	0.106	0.098	0.097	0.099	0.096
		4th highest daily max 8-h average	down	5	0.089	0.084	0.084	0.084	0.082	0.082	0.072	0.074	0.074	0.074
	PM_{10}*	90th percentile	ns	3	57.667	60.667	70.667	49.667	54.667	49.667	61	54	62	59
		Weighted annual mean	ns	3	37.1	39.9	37.967	32.067	35.5	30.733	38.267	36.733	36.933	38.933
	$PM_{2.5}$*	98th percentile	NA	3	ND	ND	ND	ND	ND	ND	40.067	43.133	37.267	36.967
		Weighted annual mean	NA	3	ND	ND	ND	ND	ND	ND	16.91	14.85	16.523	15.157
SAN FRANCISCO, CA														
		Maximum quarterly value	down	1	0.026	0.016	0.027	0.014	0.02	0.013	0.012	0.011	0.01	0.014
	CO	2nd max (daily-non-overlapping 8-h)	down	3	4.3	3.967	3.2	3.5	3.167	3.5	3.333	2.767	2.867	2.233
	SO_2	2nd daily max	ns	1	0.01	0.005	0.005	0.007	0.006	0.006	0.006	0.007	0.007	0.005
		Annual mean	ns	1	0.002	0.001	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
	NO_2	Annual mean	down	3	0.022	0.021	0.019	0.02	0.018	0.018	0.019	0.018	0.018	0.018
	Ozone	2nd highest daily max	ns	3	0.083	0.072	0.094	0.082	0.074	0.063	0.082	0.067	0.074	0.069
		4th highest daily max 8-h average	ns	3	0.048	0.049	0.061	0.055	0.048	0.045	0.052	0.045	0.05	0.049
	PM_{10}*	90th percentile	ns	3	40.333	42.667	35	35	32.333	34.333	43.667	36.333	40.333	35.667
		Weighted annual mean	down	3	25.967	25.267	21.733	21.867	23.1	21.4	24.333	21.633	23	21.2
	$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	53.4	36.9	46.1	36.3
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	12.13	10.9	11.31	12.6
SAN JOSE, CA														
		Maximum quarterly value	down	1	0.03	0.019	0.018	0.013	0.012	0.016	0.012	0.014	0.011	0.011
	CO	2nd max (daily-non-overlapping 8-h)	ns	1	6.7	7.5	5.8	5.8	5.6	6.3	6.2	6.9	5	5
	NO_2	Annual mean	down	1	0.027	0.028	0.027	0.025	0.025	0.025	0.026	0.025	0.024	0.024
	Ozone	2nd highest daily max	ns	2	0.1	0.102	0.12	0.109	0.087	0.121	0.107	0.092	0.106	0.09
		4th highest daily max 8-h average	down	2	0.074	0.073	0.084	0.08	0.064	0.078	0.071	0.06	0.07	0.064
	PM_{10}*	90th percentile	ns	1	48	57	48	36	36	41	47	52	46	46
		Weighted annual mean	ns	1	27.6	30.4	25.3	24.5	25.4	25.1	28.7	26.8	28.9	28.9
San Juan-Bayamon, PR														
	$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	16.8	18.1	14.9	11.4
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	7.51	7.26	6.83	6.43

Table A-16. Metropolitan Statistical Area Air Quality Trends, 1993–2002 (continued)

Metropolitan Statistical Area		Trend	#Trend Sites	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
SAN LUIS OBISPO-ATASCADERO-PASO ROBLES													
CO	2nd max (daily-non-overlapping 8-h)	down	1	3.1	3.1	2.4	2.3	2.3	2	2.9	2.2	1.7	1.6
SO_2	2nd daily max	ns	1	0.028	0.028	0.028	0.029	0.026	0.03	0.027	0.028	0.028	0.021
	Annual mean	down	1	0.006	0.006	0.006	0.006	0.005	0.005	0.005	0.005	0.005	0.004
NO_2	Annual mean	down	2	0.014	0.014	0.012	0.012	0.012	0.012	0.013	0.012	0.011	0.01
Ozone	2nd highest daily max	ns	3	0.088	0.087	0.091	0.1	0.079	0.093	0.085	0.078	0.085	0.083
	4th highest daily max 8-h average	ns	3	0.067	0.07	0.071	0.079	0.066	0.076	0.069	0.065	0.068	0.07
PM_{10}*	90th percentile	ns	2	45.5	37	39	31.5	29	28	34	36.5	30.5	30.5
	Weighted annual mean	down	2	23.2	21.15	22.25	19.4	20.75	17.35	20.75	19.95	19.65	19.8
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	26.9	41	50.7	25.7
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	9.32	10.31	10.12	9.23
SANTA BARBARA-SANTA MARIA-LOMPOC, CA M													
CO	2nd max (daily-non-overlapping 8-h)	down	3	1.867	1.933	1.333	1.267	1.267	1.267	1.267	1.2	1.333	1.1
SO_2	2nd daily max	down	4	0.004	0.004	0.003	0.003	0.002	0.002	0.002	0.002	0.002	0.002
	Annual mean	ns	4	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
NO_2	Annual mean	down	5	0.007	0.007	0.007	0.007	0.007	0.006	0.007	0.007	0.006	0.006
Ozone	2nd highest daily max	down	5	0.103	0.101	0.118	0.114	0.089	0.093	0.083	0.088	0.085	0.082
	4th highest daily max 8-h average	down	5	0.079	0.077	0.081	0.084	0.073	0.07	0.068	0.069	0.07	0.067
PM_{10}*	90th percentile	ns	3	35.333	33	28.667	29.667	31.333	29.667	29.667	33.333	28.667	29
	Weighted annual mean	ns	3	21.1	20.733	18.4	17.267	20.067	17.633	18.9	20.433	18.067	17.933
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	ND	19.3	23.4	19.4
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	ND	9.77	10.4	9.52
SANTA CRUZ-WATSONVILLE, CA													
CO	2nd max (daily-non-overlapping 8-h)	ns	1	1	1.2	0.8	0.7	0.7	0.8	0.7	0.7	0.9	0.8
SO_2	2nd daily max	ns	1	0.006	0.006	0.008	0.003	0.002	0.003	0.002	0.003	0.006	0.007
	Annual mean	ns	1	0.002	0.002	0.001	0.002	0.001	0.001	0.001	0.001	0.001	0.001
NO_2	Annual mean	down	1	0.006	0.006	0.005	0.005	0.004	0.004	0.005	0.005	0.005	0.005
Ozone	2nd highest daily max	ns	2	0.075	0.074	0.073	0.086	0.071	0.074	0.078	0.074	0.075	0.074
	4th highest daily max 8-h average	ns	2	0.06	0.056	0.058	0.062	0.057	0.059	0.064	0.057	0.059	0.058
PM_{10}*	90th percentile	ns	1	49	49	65	61	65	47	53	41	50	45
	Weighted annual mean	ns	1	31.1	31.1	36.4	32.8	36.9	28.5	30.9	26.2	28.7	26.8
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	21.9	17.9	23.1	22
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	9.2	7.93	9.13	8.6
SANTA FE, NM													
CO	2nd max (daily-non-overlapping 8-h)	down	1	3.4	2.7	2.3	2.2	2.1	2	1.7	1.7	2.1	1.5
PM_{10}*	90th percentile	ns	2	21.5	21	17.5	20	19	20	18.5	19.5	17	21
	Weighted annual mean	ns	2	14.4	13.25	12.25	13.45	13	13.6	12.95	12.05	12.15	13.75
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	11	9.5	10.1	13.9
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	4.89	4.9	4.73	4.94
SANTA ROSA, CA													
CO	2nd max (daily-non-overlapping 8-h)	down	1	3.8	3.2	2.4	3	3.1	3	3.3	2.7	2.3	2
NO_2	Annual mean	down	1	0.016	0.015	0.015	0.014	0.013	0.015	0.014	0.013	0.013	0.013
Ozone	2nd highest daily max	ns	2	0.085	0.085	0.089	0.08	0.089	0.084	0.096	0.07	0.083	0.075
	4th highest daily max 8-h average	ns	2	0.061	0.06	0.065	0.062	0.064	0.063	0.073	0.056	0.059	0.058
PM_{10}*	90th percentile	ns	3	33	28.667	25.333	26	23.667	24.667	32.333	27	28.333	24.667
	Weighted annual mean	ns	3	19.133	18.1	15.033	15.633	15.567	14.7	18.567	14.8	16.833	15.867
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	44.5	36.8	41.4	42.4
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	12.11	10.31	10.8	10.54
SARASOTA-BRADENTON, FL													
CO	2nd max (daily-non-overlapping 8-h)	down	1	6.5	5.3	5.9	5.1	5.3	5.6	4.95	4.3	3.4	3.4
SO_2	2nd daily max	ns	1	0.012	0.012	0.012	0.015	0.012	0.014	0.011	0.019	0.013	0.013
	Annual mean	ns	1	0.003	0.003	0.002	0.002	0.002	0.003	0.002	0.002	0.002	0.002
Ozone	2nd highest daily max	ns	2	0.102	0.095	0.097	0.094	0.104	0.12	0.111	0.106	0.109	0.088
	4th highest daily max 8-h average	ns	2	0.078	0.079	0.076	0.075	0.08	0.089	0.084	0.084	0.084	0.072
PM_{10}*	90th percentile	ns	2	37	34.5	30.5	27	32	33	34	33	30.5	29
	Weighted annual mean	ns	2	25.25	21.5	19.75	19.05	21.1	21.25	21.55	22.2	21.6	18.2
$PM_{2.5}$*	98th percentile	NA	2	ND	ND	ND	ND	ND	ND	30.75	26.9	28.6	21.7
	Weighted annual mean	NA	2	ND	ND	ND	ND	ND	ND	11.095	10.64	10.205	8.885

Table A-16. Metropolitan Statistical Area Air Quality Trends, 1993–2002 (continued)

Metropolitan Statistical Area		Trend	#Trend Sites	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
SAVANNAH, GA													
SO_2	2nd daily max	ns	1	0.023	0.023	0.023	0.03	0.024	0.027	0.018	0.024	0.02	0.022
	Annual mean	down	1	0.006	0.006	0.006	0.005	0.004	0.003	0.003	0.003	0.003	0.003
Ozone	2nd highest daily max	ns	1	0.089	0.089	0.089	0.085	0.08	0.097	0.107	0.102	0.085	0.083
	4th highest daily max 8-h average	ns	1	0.073	0.073	0.073	0.072	0.071	0.075	0.083	0.079	0.067	0.065
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	ND	32.1	30.5	27.3
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	ND	15.38	14.71	13.09
SCRANTON-WILKES-BARRE-HAZLETON, PA													
CO	2nd max (daily-non-overlapping 8-h)	down	2	2.9	3.55	2.8	3.8	3.05	2.5	2.15	2.15	2.05	2.1
SO_2	2nd daily max	ns	2	0.026	0.035	0.036	0.028	0.029	0.024	0.022	0.024	0.029	0.024
	Annual mean	ns	2	0.007	0.007	0.005	0.006	0.007	0.005	0.006	0.005	0.006	0.006
NO_2	Annual mean	down	2	0.018	0.018	0.016	0.018	0.016	0.015	0.015	0.014	0.015	0.014
Ozone	2nd highest daily max	ns	3	0.111	0.103	0.107	0.109	0.104	0.105	0.111	0.086	0.099	0.121
	4th highest daily max 8-h average	ns	3	0.091	0.086	0.09	0.083	0.089	0.088	0.094	0.074	0.087	0.092
PM_{10}*	90th percentile	down	1	35	35	42	36	35	35	32.5	30	33	34
	Weighted annual mean	ns	1	16	16	23.3	21	20.3	20	18.6	17.2	19.5	18.4
$PM_{2.5}$*	98th percentile	NA	2	ND	ND	ND	ND	ND	ND	31.25	32.2	37.05	35.45
	Weighted annual mean	NA	2	ND	ND	ND	ND	ND	ND	11.77	12.16	13.22	12.22
SEATTLE-BELLEVUE-EVERETT, WA													
CO	2nd max (daily-non-overlapping 8-h)	down	1	6.7	7	6.1	6.8	6.5	5.5	5.9	5.2	6.5	5
NO_2	Annual mean	ns	1	0.019	0.019	0.019	0.02	0.019	0.02	0.019	0.02	0.02	0.019
Ozone	2nd highest daily max	ns	1	0.097	0.106	0.087	0.098	0.072	0.111	0.067	0.08	0.069	0.071
	4th highest daily max 8-h average	down	1	0.06	0.06	0.062	0.073	0.058	0.063	0.054	0.056	0.051	0.054
PM_{10}*	90th percentile	down	2	61.5	42.5	46	36	43.5	34.5	33.5	41	30.5	28.5
	Weighted annual mean	down	2	30.7	24.35	25.4	22.75	24.85	19.7	20.6	23.5	19.55	19.1
$PM_{2.5}$*	98th percentile	NA	4	ND	ND	ND	ND	ND	ND	27.5	29.65	26.9	28.225
	Weighted annual mean	NA	4	ND	ND	ND	ND	ND	ND	9.233	10.023	9.208	9.15
SHARON, PA													
SO_2	2nd daily max	ns	1	0.029	0.047	0.032	0.029	0.032	0.029	0.039	0.024	0.033	0.024
	Annual mean	down	1	0.008	0.008	0.008	0.007	0.007	0.007	0.007	0.007	0.007	0.006
Ozone	2nd highest daily max	ns	1	0.105	0.111	0.113	0.103	0.111	0.121	0.108	0.098	0.113	0.118
	4th highest daily max 8-h average	ns	1	0.083	0.09	0.095	0.09	0.092	0.106	0.091	0.081	0.094	0.103
SHREVEPORT-BOSSIER CITY, LA													
SO_2	2nd daily max	ns	1	0.011	0.008	0.004	0.004	0.007	0.01	0.006	0.006	0.004	0.005
	Annual mean	ns	1	0.004	0.002	0.001	0.002	0.002	0.003	0.002	0.002	0.002	0.002
Ozone	2nd highest daily max	ns	1	0.122	0.094	0.092	0.096	0.103	0.111	0.108	0.129	0.105	0.091
	4th highest daily max 8-h average	ns	1	0.092	0.08	0.078	0.078	0.083	0.088	0.094	0.093	0.084	0.076
PM_{10}*	90th percentile	down	1	45	41	41	31	37	37	37	37	34	35
	Weighted annual mean	down	1	25.3	25.5	24.1	22.1	23.3	22.85	22.4	23.9	21.7	21.3
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	30.9	30.7	28.1	31.8
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	14.16	13.77	13.15	12.37
SIOUX CITY, IA-NE													
PM_{10}*	90th percentile	ns	1	40	42	55	72	53	45	48	43	51	46
	Weighted annual mean	ns	1	22.2	22.9	26	32.1	27.9	27.9	28	25.4	28.6	27.1
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	24.9	31.4	24.5	24.7
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	9.92	9.54	10.55	9.63
SIOUX FALLS, SD													
PM_{10}*	90th percentile	ns	1	27	42	40	32	39	36	37	33	42	31
	Weighted annual mean	ns	1	18.2	23.5	23.1	22.2	22.6	22.2	22.1	19.8	24.3	20.8
$PM_{2.5}$*	98th percentile	NA	2	ND	ND	ND	ND	ND	ND	32.6	28.35	21.15	22.3
	Weighted annual mean	NA	2	ND	ND	ND	ND	ND	ND	12.21	9.305	10.08	9.09
SOUTH BEND, IN													
Ozone	2nd highest daily max	ns	2	0.087	0.096	0.112	0.107	0.114	0.115	0.103	0.093	0.107	0.123
	4th highest daily max 8-h average	ns	2	0.076	0.084	0.091	0.089	0.091	0.092	0.089	0.08	0.086	0.102
PM_{10}*	90th percentile	ns	1	36	43	45	35	30	44	39	30	29	30
	Weighted annual mean	down	1	23.4	28.6	22.9	20.2	17	23.9	23.2	19.4	17.2	16.7
$PM_{2.5}$*	98th percentile	NA	2	ND	ND	ND	ND	ND	ND	ND	33.3	37.2	32.05
	Weighted annual mean	NA	2	ND	ND	ND	ND	ND	ND	ND	13.885	14.635	14.165

Table A-16. Metropolitan Statistical Area Air Quality Trends, 1993–2002 (continued)

Metropolitan Statistical Area		Trend	#Trend Sites	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
SPOKANE, WA													
CO	2nd max (daily-non-overlapping 8-h)	down	1	9.8	8.1	8.4	9	6.3	5.6	5.7	5.6	5.2	4.9
Ozone	2nd highest daily max	ns	1	0.069	0.085	0.08	0.079	0.083	0.082	0.073	0.082	0.084	0.086
	4th highest daily max 8-h average	up	1	0.06	0.068	0.065	0.067	0.068	0.07	0.065	0.068	0.071	0.071
PM_{10}*	90th percentile	down	2	71	65	55.5	52	48	50	47	47.5	45.5	52
	Weighted annual mean	down	2	39.25	36.1	29.6	30.95	28.05	28.3	26.35	27.8	27.7	29.55
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	30	35.5	28.4	37.9
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	10.26	10.95	10.12	10.2
SPRINGFIELD, IL													
CO	2nd max (daily-non-overlapping 8-h)	down	1	3.9	3.1	3.2	3	2.1	1.9	2.4	1.7	2.8	1.5
SO_2	2nd daily max	ns	1	0.04	0.05	0.062	0.061	0.043	0.061	0.059	0.035	0.028	0.017
	Annual mean	ns	1	0.006	0.006	0.006	0.006	0.006	0.007	0.006	0.005	0.004	0.004
Ozone	2nd highest daily max	ns	1	0.106	0.101	0.1	0.098	0.085	0.093	0.099	0.1	0.095	0.095
	4th highest daily max 8-h average	ns	1	0.081	0.081	0.08	0.079	0.071	0.078	0.075	0.079	0.073	0.08
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	38.8	32.2	33.3	31.5
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	15.88	13.36	13.25	13.55
SPRINGFIELD, MO													
CO	2nd max (daily-non-overlapping 8-h)	down	1	5.3	5.9	4.1	3.3	4.6	4	3.1	2.6	2.9	3.3
SO_2	2nd daily max	down	2	0.04	0.067	0.021	0.044	0.022	0.021	0.021	0.02	0.024	0.018
	Annual mean	ns	2	0.006	0.008	0.003	0.005	0.002	0.004	0.004	0.004	0.004	0.003
NO_2	Annual mean	ns	1	0.011	0.013	0.012	0.011	0.011	0.012	0.013	0.012	0.013	0.011
Ozone	2nd highest daily max	ns	2	0.075	0.093	0.098	0.086	0.08	0.09	0.094	0.088	0.089	0.087
	4th highest daily max 8-h average	ns	2	0.069	0.072	0.079	0.074	0.066	0.071	0.078	0.076	0.072	0.076
PM_{10}*	90th percentile	ns	1	30	28	28	26	24	29	28	30	30	29
	Weighted annual mean	ns	1	17.5	17.6	17.3	17.9	15.4	17.5	17.5	18.4	19.8	17.9
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	30.4	26.7	28.5	27.8
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	12.22	12.26	12.23	12.66
SPRINGFIELD, MA													
CO	2nd max (daily-non-overlapping 8-h)	down	2	6.1	7.5	7.9	7.1	5.1	4.1	4.8	3.8	2.95	3.45
SO_2	2nd daily max	ns	1	0.026	0.041	0.031	0.027	0.02	0.019	0.019	0.023	0.022	0.025
	Annual mean	ns	1	0.007	0.008	0.006	0.006	0.005	0.004	0.004	0.005	0.006	0.005
NO_2	Annual mean	ns	2	0.02	0.023	0.019	0.02	0.017	0.016	0.017	0.019	0.019	0.019
Ozone	2nd highest daily max	ns	2	0.132	0.125	0.128	0.105	0.12	0.105	0.105	0.098	0.113	0.137
	4th highest daily max 8-h average	ns	2	0.097	0.092	0.093	0.082	0.092	0.087	0.085	0.075	0.086	0.103
PM_{10}*	90th percentile	ns	2	47.5	44	38.5	41	38	42.5	43.5	40.5	45	40.5
	Weighted annual mean	ns	2	24.75	27.25	22.65	25	25.15	23.35	26.6	24.4	25.75	23.8
$PM_{2.5}$*	98th percentile	NA	2	ND	ND	ND	ND	ND	ND	41.1	33.05	37.6	42.9
	Weighted annual mean	NA	2	ND	ND	ND	ND	ND	ND	14.66	11.985	12.485	12.2
STAMFORD-NORWALK, CT													
CO	2nd max (daily-non-overlapping 8-h)	down	1	5.2	6.2	5.4	4.1	5.1	3.8	3.8	3	3.1	3.2
SO_2	2nd daily max	ns	1	0.032	0.057	0.032	0.026	0.03	0.025	0.026	0.026	0.035	0.035
	Annual mean	down	1	0.008	0.01	0.011	0.005	0.006	0.006	0.006	0.005	0.006	0.005
Ozone	2nd highest daily max	ns	1	0.145	0.155	0.136	0.121	0.142	0.113	0.143	0.123	0.13	0.15
	4th highest daily max 8-h average	ns	1	0.101	0.107	0.102	0.093	0.101	0.089	0.107	0.084	0.098	0.103
PM_{10}*	90th percentile	ns	1	44	58	56	50	48	42	44	45	48	51
	Weighted annual mean	down	1	29.7	36.4	32.1	32.3	31.3	28.1	28.7	30.5	28.3	27.8
$PM_{2.5}$*	98th percentile	NA	2	ND	ND	ND	ND	ND	ND	ND	34.85	35.95	33.8
	Weighted annual mean	NA	2	ND	ND	ND	ND	ND	ND	ND	12.975	12.54	12.115
STEUBENVILLE-WEIRTON, OH-WV													
CO	2nd max (daily-non-overlapping 8-h)	ns	2	7.55	8.9	5.95	4.85	6.1	8.95	3.45	6.4	6.25	9.2
SO_2	2nd daily max	down	4	0.12	0.125	0.063	0.056	0.054	0.045	0.056	0.047	0.043	0.046
	Annual mean	ns	4	0.024	0.021	0.011	0.011	0.013	0.012	0.013	0.012	0.012	0.011
Ozone	2nd highest daily max	ns	1	0.093	0.096	0.108	0.099	0.097	0.099	0.108	0.088	0.093	0.113
	4th highest daily max 8-h average	ns	1	0.081	0.082	0.091	0.082	0.083	0.088	0.091	0.072	0.083	0.1
PM_{10}*	90th percentile	down	2	75.5	77.5	66.5	69	59	65	54	55	55	63
	Weighted annual mean	down	2	39.95	40.75	37.9	36.6	31.9	33.1	29.5	30.15	30.85	30.65
$PM_{2.5}$*	98th percentile	NA	2	ND	ND	ND	ND	ND	ND	42.75	46.4	45.85	49.65
	Weighted annual mean	NA	2	ND	ND	ND	ND	ND	ND	18.145	18.39	17.79	17.4

Table A-16. Metropolitan Statistical Area Air Quality Trends, 1993–2002 (continued)

Metropolitan Statistical Area			Trend	#Trend Sites	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
STOCKTON-LODI, CA														
		Maximum quarterly value	down	1	0.024	0.015	0.019	0.023	0.014	0.013	0.009	0.012	0.008	0.01
	CO	2nd max (daily-non-overlapping 8-h)	down	1	5.1	6.4	4.4	5.3	3.4	5.3	4.5	3.7	3.6	3.2
	NO$_2$	Annual mean	down	1	0.024	0.024	0.022	0.023	0.022	0.023	0.024	0.021	0.019	0.021
	Ozone	2nd highest daily max	ns	2	0.11	0.12	0.125	0.101	0.094	0.108	0.12	0.103	0.102	0.099
		4th highest daily max 8-h average	down	2	0.083	0.086	0.087	0.079	0.073	0.085	0.083	0.078	0.078	0.077
	PM$_{10}$*	90th percentile	ns	1	84	63	49	40	47	53	69	60	55	56
		Weighted annual mean	ns	1	39.1	36.9	31.4	27.4	29.7	29.1	36.4	31.5	35.8	34.9
	PM$_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	79	55	58	50
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	19.56	15.62	13.85	16.68
SYRACUSE, NY														
	CO	2nd max (daily-non-overlapping 8-h)	down	1	5.6	6.5	3.3	3.9	4	3	3.1	2.4	2.2	2.1
	SO$_2$	2nd daily max	down	2	0.018	0.02	0.016	0.014	0.017	0.01	0.014	0.017	0.011	0.012
		Annual mean	down	2	0.003	0.003	0.003	0.003	0.002	0.002	0.002	0.003	0.003	0.003
	Ozone	2nd highest daily max	ns	2	0.097	0.095	0.1	0.085	0.096	0.093	0.092	0.083	0.096	0.1
		4th highest daily max 8-h average	ns	2	0.083	0.077	0.086	0.073	0.078	0.082	0.084	0.074	0.084	0.088
	PM$_{2.5}$*	98th percentile	NA	2	ND	ND	ND	ND	ND	ND	ND	28.65	35.3	38.8
		Weighted annual mean	NA	2	ND	ND	ND	ND	ND	ND	ND	11.545	11.07	11.205
TACOMA, WA														
	CO	2nd max (daily-non-overlapping 8-h)	ns	1	6	6	6.3	6.3	6.8	5.8	6.6	5.5	5	4.5
	PM$_{10}$*	90th percentile	ns	1	52	41	43	43	50	35	44	48	38	36
		Weighted annual mean	ns	1	28.4	23.1	26	23.1	27.4	21.1	23.1	28.4	20.5	20.8
	PM$_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	ND	49	41.5	42.9
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	ND	13	11.39	10.56
TALLAHASSEE, FL														
	PM$_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	31.3	29.5	31.4	28.4
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	13.92	13.64	12.51	12.92
TAMPA-ST. PETERSBURG-CLEARWATER, FL MS														
	CO	2nd max (daily-non-overlapping 8-h)	ns	1	3.9	3.5	5	3.9	3.7	4.1	3.3	3.1	3	3.8
	SO$_2$	2nd daily max	down	2	0.032	0.043	0.032	0.025	0.034	0.027	0.028	0.024	0.026	0.022
		Annual mean	down	2	0.007	0.007	0.006	0.005	0.006	0.006	0.006	0.005	0.005	0.005
	NO$_2$	Annual mean	ns	1	0.01	0.01	0.011	0.01	0.01	0.011	0.01	0.011	0.011	0.011
	Ozone	2nd highest daily max	ns	3	0.091	0.097	0.107	0.111	0.109	0.122	0.111	0.106	0.113	0.091
		4th highest daily max 8-h average	ns	3	0.072	0.076	0.08	0.081	0.084	0.089	0.085	0.082	0.083	0.07
	PM$_{10}$*	90th percentile	ns	2	39	40.5	46	49	48.5	45.5	50.5	44.5	44	37
		Weighted annual mean	ns	2	28.35	27.8	28.3	29.85	30.95	29.35	30	29.6	27.6	24.75
	PM$_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	24.6	30.6	27.9	22.3
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	12.92	12.39	11.7	10.75
TERRE HAUTE, IN														
	SO$_2$	2nd daily max	ns	1	0.035	0.033	0.035	0.039	0.025	0.032	0.024	0.055	0.058	0.027
		Annual mean	ns	1	0.011	0.012	0.01	0.012	0.006	0.01	0.007	0.012	0.01	0.007
	Ozone	2nd highest daily max	ns	1	0.088	0.106	0.099	0.112	0.096	0.099	0.093	0.088	0.096	0.096
		4th highest daily max 8-h average	ns	1	0.074	0.094	0.085	0.098	0.083	0.084	0.082	0.075	0.082	0.082
	PM$_{10}$*	90th percentile	ns	2	48.5	42.5	53	39	40.5	43	45	44	39.5	36
		Weighted annual mean	down	2	28.15	27.7	29.5	24.95	24.8	26.1	24.75	24.35	21.85	21.15
	PM$_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	ND	34.2	38.4	40.2
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	ND	15.72	15.18	14.55
TEXARKANA, TX-TEXARKANA, AR														
	PM$_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	ND	31	29.6	35.7
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	ND	14.68	15.09	13.21
TOLEDO, OH														
		Maximum quarterly value	down	1	0.63	0.7	0.43	0.437	0.417	0.35	0.263	0.33	0.273	0.13
	SO$_2$	2nd daily max	ns	1	0.025	0.056	0.024	0.014	0.021	0.021	0.052	0.017	0.02	0.026
		Annual mean	ns	1	0.006	0.007	0.004	0.003	0.003	0.004	0.009	0.005	0.006	0.007
	Ozone	2nd highest daily max	ns	2	0.117	0.115	0.108	0.111	0.105	0.106	0.119	0.094	0.109	0.114
		4th highest daily max 8-h average	ns	2	0.089	0.09	0.09	0.092	0.085	0.086	0.085	0.08	0.092	0.095
	PM$_{2.5}$*	98th percentile	NA	2	ND	ND	ND	ND	ND	ND	41	38.575	35.85	38.15
		Weighted annual mean	NA	2	ND	ND	ND	ND	ND	ND	15.56	15.388	14.745	15.115
TOPEKA, KS														
	PM$_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	26.1	23.5	22.8	29.1
		Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	12.32	10.73	10.71	11.14

Table A-16. Metropolitan Statistical Area Air Quality Trends, 1993–2002 (continued)

Metropolitan Statistical Area		Trend	#Trend Sites	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
TRENTON, NJ													
NO$_2$	Annual mean	ns	1	0.016	0.016	0.016	0.017	0.017	0.015	0.017	0.016	0.017	0.016
Ozone	2nd highest daily max	ns	1	0.135	0.14	0.132	0.121	0.126	0.113	0.149	0.113	0.134	0.133
	4th highest daily max 8-h average	ns	1	0.102	0.103	0.107	0.09	0.106	0.095	0.113	0.099	0.104	0.109
PM$_{10}$*	90th percentile	ns	1	46	52	38	40	40	35	36	41	41	35
	Weighted annual mean	down	1	26.6	29.1	23.9	26.7	27	23.9	20.6	25.6	23.3	21.1
PM$_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	28.3	31.5	31.85	32.2
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	11.14	12.06	11.765	11.47
TUCSON, AZ													
CO	2nd max (daily-non-overlapping 8 h)	down	2	4.55	4.35	4.25	3.95	3.5	3.15	2.9	3.55	2.3	2.2
SO$_2$	2nd daily max	ns	1	0.005	0.004	0.004	0.004	0.004	0.004	0.005	0.007	0.003	0.004
	Annual mean	ns	1	0.002	0.002	0.002	0.001	0.002	0.002	0.002	0.002	0.001	0.001
NO$_2$	Annual mean	down	1	0.018	0.019	0.019	0.018	0.018	0.017	0.018	0.017	0.015	0.017
Ozone	2nd highest daily max	down	2	0.097	0.098	0.103	0.091	0.093	0.094	0.09	0.084	0.08	0.089
	4th highest daily max 8-h average	down	2	0.079	0.078	0.082	0.077	0.078	0.075	0.07	0.075	0.068	0.076
PM$_{10}$*	90th percentile	ns	2	45	36.5	56.5	45	48.5	55.5	65.5	61	48	52
	Weighted annual mean	ns	2	28.05	25.7	34.4	32.85	33.45	37.35	44.55	37.95	31.65	36.25
PM$_{2.5}$*	98th percentile	NA	2	ND	ND	ND	ND	ND	ND	21.75	11.95	17.75	20.85
	Weighted annual mean	NA	2	ND	ND	ND	ND	ND	ND	9.22	7.3	7.205	6.49
TULSA, OK													
CO	2nd max (daily-non-overlapping 8-h)	ns	1	4.5	4.7	4.5	6.8	6.3	4.7	3.5	3.7	4.1	3
SO$_2$	2nd daily max	ns	1	0.026	0.025	0.034	0.042	0.028	0.034	0.051	0.027	0.028	0.032
	Annual mean	ns	1	0.006	0.004	0.008	0.008	0.008	0.01	0.008	0.006	0.008	0.006
Ozone	2nd highest daily max	ns	1	0.117	0.112	0.121	0.115	0.114	0.11	0.114	0.122	0.107	0.108
	4th highest daily max 8-h average	ns	1	0.077	0.091	0.096	0.088	0.081	0.092	0.091	0.088	0.084	0.083
PM$_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	ND	28	29.5	29.5
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	ND	12.53	12.96	12.26
TUSCALOOSA, AL													
PM$_{10}$*	90th percentile	up	1	43	41	48	41	44	44	51	59	59	59
	Weighted annual mean	up	1	26	25.9	27.4	26.2	25.2	28.3	28.1	28.7	28.7	28.7
UTICA-ROME, NY													
SO$_2$	2nd daily max	ns	1	0.012	0.012	0.008	0.009	0.007	0.005	0.007	0.007	0.007	0.008
	Annual mean	down	1	0.002	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.002	0.001
Ozone	2nd highest daily max	ns	2	0.085	0.085	0.092	0.075	0.085	0.089	0.087	0.081	0.095	0.098
	4th highest daily max 8-h average	up	2	0.067	0.072	0.077	0.063	0.073	0.074	0.076	0.067	0.08	0.083
PM$_{10}$*	90th percentile	ns	1	24	23	19	24	21	24	24	15	19	23
	Weighted annual mean	ns	1	11.7	11.6	11.2	12.3	11.3	12.5	12	8.7	9.4	11.3
PM$_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	ND	26.9	34.6	38.4
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	ND	11.8	11.69	12.06
VALLEJO-FAIRFIELD-NAPA, CA													
CO	2nd max (daily-non-overlapping 8-h)	down	2	5.55	5.2	4.2	4.15	4.4	4.2	4.15	3.75	3.35	3
SO$_2$	2nd daily max	down	1	0.007	0.007	0.005	0.006	0.005	0.005	0.006	0.005	0.004	0.004
	Annual mean	ns	1	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.001	0.002
NO$_2$	Annual mean	down	2	0.015	0.015	0.015	0.014	0.013	0.013	0.014	0.013	0.013	0.013
Ozone	2nd highest daily max	ns	2	0.1	0.095	0.106	0.1	0.08	0.104	0.102	0.073	0.081	0.086
	4th highest daily max 8-h average	ns	2	0.07	0.066	0.076	0.071	0.054	0.064	0.075	0.056	0.062	0.065
PM$_{10}$*	90th percentile	ns	3	33	31.667	30.333	29	26.667	31.333	34.333	28.667	32	33.667
	Weighted annual mean	ns	3	21.3	20.867	19	17.933	17.433	17.133	19.2	16.533	21.267	20.967
PM$_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	ND	44	56	54
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	ND	11.57	12.48	13.61
VENTURA, CA													
	Maximum quarterly value	ns	1	0.01	0.01	0.01	0.008	0.008	0.006	0.013	0.011	0.009	0.007
CO	2nd max (daily-non-overlapping 8-h)	down	2	2.45	2.75	3.15	2.35	2.35	2.25	1.9	2.05	2	1.6
SO$_2$	2nd daily max	ns	1	0.004	0.004	0.003	0.003	0.011	0.011	0.005	0.007	0.009	0.004
	Annual mean	ns	1	0.001	0.001	0.001	0.001	0.003	0.003	0.002	0.002	0.004	0.001
NO$_2$	Annual mean	down	2	0.018	0.02	0.02	0.019	0.017	0.016	0.018	0.017	0.015	0.013
Ozone	2nd highest daily max	down	2	0.13	0.136	0.137	0.131	0.114	0.119	0.108	0.1	0.102	0.1
	4th highest daily max 8-h average	down	2	0.098	0.101	0.104	0.103	0.09	0.093	0.084	0.084	0.084	0.078
PM$_{10}$*	90th percentile	ns	2	45.5	47	49.5	42	45	40	46	41.5	47	45
	Weighted annual mean	ns	2	28.2	29.85	27.15	26.45	29.8	22.8	28.8	27.75	29.8	28.4
PM$_{2.5}$*	98th percentile	NA	2	ND	ND	ND	ND	ND	ND	32.6	37.1	36.2	31.55
	Weighted annual mean	NA	2	ND	ND	ND	ND	ND	ND	12.975	13.94	14	13.76

Table A-16. Metropolitan Statistical Area Air Quality Trends, 1993–2002 (continued)

Metropolitan Statistical Area		Trend	#Trend Sites	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
VICTORIA, TX													
Ozone	2nd highest daily max	ns	1	0.098	0.094	0.104	0.087	0.092	0.093	0.102	0.094	0.085	0.096
	4th highest daily max 8-h average	ns	1	0.081	0.075	0.087	0.071	0.078	0.073	0.086	0.079	0.073	0.078
VINELAND-MILLVILLE-BRIDGETON, NJ PMS													
SO_2	2nd daily max	ns	1	0.019	0.032	0.016	0.016	0.018	0.012	0.012	0.017	0.021	0.016
	Annual mean	down	1	0.006	0.005	0.004	0.005	0.004	0.004	0.003	0.004	0.004	0.004
Ozone	2nd highest daily max	ns	1	0.121	0.102	0.126	0.105	0.115	0.117	0.117	0.117	0.129	0.12
	4th highest daily max 8-h average	ns	1	0.103	0.086	0.091	0.086	0.104	0.098	0.096	0.094	0.101	0.101
VISALIA-TULARE-PORTERVILLE, CA													
CO	2nd max (daily-non-overlapping 8-h)	down	1	3.5	4	4.2	3.9	3.5	3.6	3.9	3.3	3.2	2.8
NO_2	Annual mean	ns	1	0.023	0.023	0.023	0.018	0.019	0.017	0.021	0.018	0.018	0.019
Ozone	2nd highest daily max	down	2	0.138	0.137	0.118	0.131	0.114	0.13	0.116	0.111	0.117	0.124
	4th highest daily max 8-h average	ns	2	0.107	0.108	0.1	0.104	0.096	0.102	0.099	0.095	0.098	0.105
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	114	103	96	70
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	27.6	23.92	22.49	23.22
WASHINGTON, DC-MD-VA-WV													
CO	2nd max (daily-non-overlapping 8-h)	down	2	5.6	5.3	4.95	4.1	4.4	3.45	4.7	3.85	3.6	3.55
SO_2	2nd daily max	ns	2	0.023	0.03	0.021	0.036	0.023	0.021	0.022	0.022	0.024	0.02
	Annual mean	down	2	0.008	0.009	0.008	0.007	0.007	0.007	0.007	0.007	0.006	0.007
NO_2	Annual mean	ns	4	0.027	0.027	0.023	0.024	0.023	0.024	0.023	0.022	0.024	0.024
Ozone	2nd highest daily max	ns	3	0.127	0.127	0.12	0.109	0.127	0.113	0.126	0.11	0.121	0.144
	4th highest daily max 8-h average	ns	3	0.099	0.09	0.097	0.083	0.093	0.097	0.099	0.081	0.096	0.107
$PM_{2.5}$*	98th percentile	NA	4	ND	ND	ND	ND	ND	ND	37.4	39.725	42.25	41.425
	Weighted annual mean	NA	4	ND	ND	ND	ND	ND	ND	15.145	15.523	15.905	15.628
WATERBURY, CT													
	Maximum quarterly value	ns	1	0.02	0.017	0.037	0.033	0.025	0.017	0.01	0.017	0.013	0.017
SO_2	2nd daily max	ns	1	0.021	0.03	0.019	0.022	0.02	0.021	0.02	0.017	0.018	0.02
	Annual mean	down	1	0.006	0.007	0.005	0.005	0.005	0.006	0.005	0.004	0.004	0.004
PM_{10}*	90th percentile	down	1	43	41	37	45	36	32	32	30	35	34
	Weighted annual mean	down	1	22.6	25.1	23.6	25.4	23.3	21.6	19.2	19.9	19.8	19.1
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	38.4	34.4	35.4	32.6
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	13.22	13.56	13.97	13.13
WATERLOO-CEDAR FALLS, IA													
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	30.3	28.7	30.2	24.1
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	12.05	11.37	11.8	10.95
WAUSAU, WI													
Ozone	2nd highest daily max	ns	1	0.081	0.077	0.088	0.079	0.08	0.098	0.095	0.081	0.078	0.08
	4th highest daily max 8-h average	ns	1	0.066	0.064	0.075	0.07	0.068	0.077	0.084	0.073	0.072	0.073
WEST PALM BEACH-BOCA RATON, FL													
CO	2nd max (daily-non-overlapping 8-h)	down	1	3.1	2.8	2.8	2.5	3.5	2.5	2.8	2.7	2.2	2.3
SO_2	2nd daily max	down	1	0.028	0.016	0.019	0.014	0.013	0.004	0.013	0.008	0.003	0.002
	Annual mean	down	1	0.004	0.003	0.002	0.002	0.002	0.001	0.002	0.002	0.001	0.001
NO_2	Annual mean	up	1	0.013	0.012	0.012	0.013	0.013	0.013	0.014	0.016	0.017	0.017
PM_{10}*	90th percentile	ns	1	30	30	30	42	34	34	30	30	30	24
	Weighted annual mean	ns	1	18.6	18.6	18.6	22.6	20.4	25.7	19	19.4	19.7	15.4
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	ND	26.9	18	16.1
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	ND	9.37	7.69	7.04
WHEELING, WV-OH													
CO	2nd max (daily-non-overlapping 8-h)	down	1	4.1	4.6	5	3.5	3.1	3.5	3	2.3	1.9	1.6
SO_2	2nd daily max	down	2	0.064	0.067	0.061	0.059	0.048	0.051	0.047	0.043	0.04	0.036
	Annual mean	down	2	0.018	0.016	0.013	0.012	0.012	0.013	0.012	0.011	0.01	0.011
Ozone	2nd highest daily max	ns	1	0.11	0.095	0.104	0.105	0.11	0.104	0.1	0.093	0.104	0.111
	4th highest daily max 8-h average	ns	1	0.077	0.078	0.089	0.087	0.082	0.087	0.088	0.071	0.088	0.097
PM_{10}*	90th percentile	down	1	49	46	45	38	40	45	43	39	41	39
	Weighted annual mean	down	1	27.5	27	27.7	27	23.2	24.8	25.1	23.2	24	23.3
$PM_{2.5}$*	98th percentile	NA	2	ND	ND	ND	ND	ND	ND	36.15	34.45	37.75	40.3
	Weighted annual mean	NA	2	ND	ND	ND	ND	ND	ND	16.51	15.88	15.8	15.32

Table A-16. Metropolitan Statistical Area Air Quality Trends, 1993–2002 (continued)

Metropolitan Statistical Area		Trend	#Trend Sites	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
WICHITA, KS													
CO	2nd max (daily-non-overlapping 8-h)	down	1	5.6	6.5	5.4	6.1	5.3	5.3	4.5	3.7	4.1	3.7
Ozone	2nd highest daily max	ns	1	0.08	0.08	0.09	0.095	0.092	0.1	0.095	0.093	0.096	0.092
	4th highest daily max 8-h average	up	1	0.059	0.067	0.069	0.074	0.079	0.083	0.079	0.08	0.084	0.079
PM_{10}*	90th percentile	down	1	54	42	50	43	39	46	38	38	36	37
	Weighted annual mean	down	1	32.6	24.6	26	25.8	21.8	25.2	23.2	21.7	22.2	21.6
$PM_{2.5}$*	98th percentile	NA	2	ND	ND	ND	ND	ND	ND	25.75	25.85	25	27.9
	Weighted annual mean	NA	2	ND	ND	ND	ND	ND	ND	12.205	11.695	11.18	10.76
WILMINGTON-NEWARK, DE-MD													
CO	2nd max (daily-non-overlapping 8-h)	ns	1	1.7	1.7	1.5	1.6	1.1	1.3	1.4	1.6	1.6	1.2
SO_2	2nd daily max	down	1	0.06	0.056	0.098	0.067	0.057	0.044	0.049	0.047	0.043	0.054
	Annual mean	down	1	0.012	0.011	0.013	0.011	0.01	0.008	0.008	0.006	0.006	0.006
Ozone	2nd highest daily max	ns	2	0.118	0.108	0.136	0.108	0.124	0.118	0.128	0.115	0.112	0.132
	4th highest daily max 8-h average	ns	2	0.086	0.082	0.105	0.085	0.093	0.093	0.1	0.09	0.092	0.101
$PM_{2.5}$*	98th percentile	NA	3	ND	ND	ND	ND	ND	ND	35.35	39.1	41.133	36.633
	Weighted annual mean	NA	3	ND	ND	ND	ND	ND	ND	15.135	15.783	16.29	14.297
WILMINGTON, NC													
SO_2	2nd daily max	ns	1	0.063	0.063	0.063	0.036	0.028	0.026	0.027	0.03	0.039	0.04
	Annual mean	down	1	0.009	0.009	0.009	0.007	0.007	0.007	0.007	0.006	0.006	0.007
Ozone	2nd highest daily max	down	1	0.104	0.104	0.097	0.09	0.102	0.102	0.081	0.097	0.089	0.091
	4th highest daily max 8-h average	ns	1	0.081	0.081	0.079	0.076	0.083	0.086	0.067	0.08	0.078	0.08
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	37.4	28	25.4	22.9
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	12.81	12.48	11.49	10.36
WORCESTER, MA-CT													
CO	2nd max (daily-non-overlapping 8-h)	down	1	6.1	5.9	4.2	5.3	3.4	3.5	3.3	2.6	2.6	2.9
SO_2	2nd daily max	down	1	0.025	0.024	0.023	0.021	0.021	0.017	0.013	0.019	0.022	0.018
	Annual mean	ns	1	0.007	0.008	0.006	0.005	0.004	0.005	0.004	0.006	0.005	0.005
NO_2	Annual mean	down	1	0.028	0.025	0.021	0.019	0.019	0.019	0.02	0.018	0.02	0.017
Ozone	2nd highest daily max	ns	1	0.155	0.125	0.118	0.091	0.106	0.124	0.113	0.098	0.118	0.127
	4th highest daily max 8-h average	ns	1	0.092	0.097	0.096	0.074	0.092	0.097	0.093	0.076	0.088	0.091
PM_{10}*	90th percentile	down	1	37	35	32	29	34	27	34	31	30	30
	Weighted annual mean	down	1	20.3	20.3	20.1	19.1	20.3	18.2	20.8	19	17.7	15.3
$PM_{2.5}$*	98th percentile	NA	2	ND	ND	ND	ND	ND	ND	35.5	29.55	34.75	37.5
	Weighted annual mean	NA	2	ND	ND	ND	ND	ND	ND	13.34	11.955	13.01	11.23
YOLO, CA													
Ozone	2nd highest daily max	ns	1	0.09	0.097	0.108	0.113	0.092	0.109	0.115	0.101	0.099	0.104
	4th highest daily max 8-h average	ns	1	0.076	0.076	0.083	0.087	0.068	0.087	0.088	0.08	0.075	0.076
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	56	38	35	31
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	16.29	10.25	10.39	10.72
YORK, PA													
CO	2nd max (daily-non-overlapping 8-h)	down	1	3.3	3.9	2.7	2.8	3.4	2.4	2.4	1.8	2.2	2.2
SO_2	2nd daily max	down	1	0.032	0.041	0.02	0.022	0.026	0.023	0.019	0.02	0.019	0.014
	Annual mean	ns	1	0.008	0.009	0.006	0.007	0.009	0.008	0.007	0.006	0.006	0.005
NO_2	Annual mean	down	1	0.022	0.024	0.021	0.021	0.019	0.019	0.019	0.018	0.02	0.017
Ozone	2nd highest daily max	ns	1	0.112	0.115	0.097	0.098	0.109	0.112	0.121	0.112	0.104	0.124
	4th highest daily max 8-h average	ns	1	0.09	0.082	0.086	0.081	0.094	0.095	0.094	0.09	0.087	0.101
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	34.9	41.1	41.3	47.3
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	15.4	16.55	16.62	17.09
YOUNGSTOWN-WARREN, OH													
PM_{10}*	90th percentile	down	1	48	46	53	37	41	45	40	40	33	39
	Weighted annual mean	down	1	25.9	29.3	32.5	26.2	24.8	26.5	24.7	25.5	22.7	22.1
$PM_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	38.6	34.6	44.8	38.3
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	16.94	15.97	16.36	14.75

Table A-16. Metropolitan Statistical Area Air Quality Trends, 1993–2002 (continued)

Metropolitan Statistical Area		Trend	#Trend Sites	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
YUBA CITY, CA													
CO	2nd max (daily-non-overlapping 8-h)	down	1	5	5.6	4.1	4.1	3.9	3.9	4.2	3.6	3.4	3.2
NO$_2$	Annual mean	ns	1	0.018	0.016	0.014	0.013	0.014	0.013	0.014	0.013	0.014	0.015
Ozone	2nd highest daily max	ns	1	0.09	0.107	0.102	0.108	0.09	0.102	0.103	0.097	0.099	0.101
	4th highest daily max 8-h average	ns	1	0.078	0.089	0.085	0.085	0.072	0.088	0.083	0.079	0.081	0.08
PM$_{10}$*	90th percentile	ns	1	59	51	68	50	48	44	68	40	52	49
	Weighted annual mean	ns	1	30.4	34.1	32.2	29.2	28.6	23.1	38.4	27.9	29	30.4
PM$_{2.5}$*	98th percentile	NA	1	ND	ND	ND	ND	ND	ND	53	37	54	35
	Weighted annual mean	NA	1	ND	ND	ND	ND	ND	ND	15.85	11.46	11.79	12.64
YUMA, AZ													
PM$_{10}$*	90th percentile	up	1	50	51	67	52	62	75	59	68	84.5	101
	Weighted annual mean	up	1	31.8	31.1	35.1	37.1	36.6	40.1	35.2	42.3	45.1	47.9

CO = Highest second maximum non-overlapping 8-hour concentration *(Applicable NAAQS is 9 ppm)*
Pb = Highest quarterly maximum concentration *(Applicable NAAQS is 1.5 μg/m^3)*
NO$_2$ = Highest arithmetic mean concentration *(Applicable NAAQS is 0.053 ppm)*
PM$_{10}$ = Highest second maximum 24-hour concentration *(Applicable NAAQS is 150 μg/m^3)*
SO$_2$ = Highest second maximum 24-hour concentration *(Applicable NAAQS is 0.14 ppm)*
ppm = Units are parts per million
μg/m^3 = Units are micrograms per cubic meter

*PM$_{2.5}$ does not have enough years to assess trends.

Table A-17. Number of Days with AQI Values Greater Than 100 at Trend Sites, 1993–2002, and All Sites in 2002

Metropolitan Statistical Area	# of Trend Sites	1993	1994	1995	1996	1997	1998	1999	2000*	2001*	2002*	Total # of Sites 2002	2002 Count*
Akron, OH	7	10	8	12	11	6	14	20	4	12	22	9	24
Albany–Schenectady–Troy, NY	6	5	6	3	4	3	3	6	1	11	8	12	18
Albuquerque, NM	23	0	1	0	0	0	0	1	0	1	4	31	4
Allentown–Bethlehem–Easton, PA	4	3	3	7	6	12	18	19	5	9	18	12	27
Atlanta, GA	21	36	15	36	28	33	52	67	34	18	24	37	37
Austin–San Marcos, TX	1	2	4	10	0	0	5	8	6	0	5	8	5
Bakersfield, CA	27	97	105	107	110	58	78	144	132	125	152	29	153
Baltimore, MD	20	48	40	36	28	30	51	40	19	32	42	33	44
Baton Rouge, LA	18	13	10	22	12	16	21	26	33	5	6	22	7
Bergen–Passaic, NJ	5	0	0	0	0	0	1	0	0	0	0	9	21
Birmingham, AL	18	10	6	32	15	8	23	51	49	35	16	30	23
Boston, MA–NH	21	2	6	7	4	7	8	10	1	12	16	35	26
Buffalo–Niagara Falls, NY	8	1	4	6	3	1	13	8	5	13	21	15	22
Charleston–North Charleston, SC	12	2	2	1	3	3	3	5	4	0	1	13	3
Charlotte–Gastonia–Rock Hill, NC–SC	15	29	15	18	21	29	50	42	28	27	37	26	40
Chicago, IL	51	4	13	24	7	10	12	19	2	22	21	70	26
Cincinnati, OH–KY–IN	16	5	16	19	10	11	13	16	14	14	30	33	32
Cleveland–Lorain–Elyria, OH	42	17	25	27	19	13	22	40	22	32	31	48	33
Columbus, OH	9	8	12	18	19	13	21	26	10	13	21	15	30
Dallas, TX	21	12	24	29	10	27	33	25	22	16	15	40	22
Dayton–Springfield, OH	12	11	14	11	18	10	19	21	14	7	28	15	30
Denver, CO	32	6	3	5	2	0	9	5	3	8	8	29	8
Detroit, MI	33	5	11	14	13	11	17	20	15	27	26	35	28
El Paso, TX	19	7	6	3	6	2	6	5	4	9	13	40	18
Fort Lauderdale, FL	16	4	1	1	1	0	1	3	2	3	3	21	3
Fort Worth–Arlington, TX	5	9	31	28	14	14	17	19	16	17	23	19	33
Fresno, CA	19	59	55	61	70	75	67	133	131	138	152	25	156
Gary, IN	19	0	6	18	12	12	9	16	10	19	20	30	24
Grand Rapids–Muskegon–Holland, MI	9	3	14	18	9	10	19	22	6	17	21	14	24
Greensboro–Winston Salem–High Point, NC	15	22	7	13	7	14	26	24	14	14	24	22	32
Greenville–Spartanburg–Anderson, SC	9	8	5	7	7	9	28	19	11	13	28	11	29
Harrisburg–Lebanon–Carlisle, PA	9	15	12	13	3	9	22	19	16	22	21	11	24
Hartford, CN	9	14	18	14	5	16	10	18	7	16	21	13	23
Honolulu, HI	19	0	0	0	0	0	0	2	2	2	2	26	2
Houston, TX	29	27	41	66	28	47	38	52	42	29	23	60	30
Indianapolis, IN	25	9	22	21	16	12	19	24	5	10	25	34	26
Jacksonville, FL	12	0	0	0	0	0	3	2	0	0	1	17	1
Jersey City, NJ	7	19	12	16	5	9	7	20	4	7	8	9	8
Kansas City, MO–KS	18	4	10	21	7	16	14	3	11	4	7	34	12
Knoxville, TN	16	25	16	26	21	37	54	66	41	23	45	21	45
Las Vegas, NV–AZ	15	3	3	3	14	4	5	8	2	1	6	56	14
Little Rock–North Little Rock, AR	6	2	2	7	1	1	3	5	16	4	9	14	11
Los Angeles–Long Beach, CA	56	134	139	113	94	60	56	56	87	88	80	69	108
Louisville, KY–IN	35	23	28	26	17	18	29	47	18	19	29	36	29
Memphis, TN–AR–MS	15	15	10	21	19	17	27	35	24	13	16	20	17
Miami, FL	16	6	1	2	1	3	8	7	2	1	1	16	1
Middlesex–Somerset–Hunterdon, NJ	5	13	9	20	15	19	22	26	11	21	29	7	30
Milwaukee–Waukesha, WI	20	4	12	14	5	5	12	19	5	15	12	28	12
Minneapolis–St. Paul, MN–WI	27	0	2	5	0	0	1	1	2	2	1	49	2
Monmouth–Ocean, NJ	3	24	13	20	17	21	31	27	11	21	31	4	32
Nashville, TN	18	19	21	26	23	20	30	36	19	7	16	21	21
Nassau–Suffolk, NY	7	17	15	10	8	12	11	18	5	3	13	13	19
New Haven–Meriden, CT	8	12	13	14	8	19	9	19	9	15	25	11	29
New Orleans, LA	12	6	8	20	8	7	7	18	17	5	2	19	2

Table A-17. Number of Days with AQI Values Greater Than 100 at Trend Sites, 1993–2002, and All Sites in 2002 (continued)

Metropolitan Statistical Area	# of Trend Sites	1993	1994	1995	1996	1997	1998	1999	2000*	2001*	2002*	Total # of Sites 2002	2002 Count*
New York, NY	19	11	16	21	14	23	18	25	19	19	31	44	34
Newark, NJ	11	13	12	20	11	13	22	24	10	16	30	23	30
Norfolk–Virginia Beach–Newport News,VA–NC	10	19	6	6	4	17	15	17	5	7	15	17	15
Oakland, CA	30	4	3	12	11	0	12	17	12	9	19	45	21
Oklahoma City, OK	9	2	5	13	2	4	7	4	6	2	2	19	4
Omaha, NE–IA	11	1	1	1	1	0	5	5	1	1	0	20	0
Orange County, CA	15	25	15	9	9	3	6	14	31	31	19	16	21
Orlando, FL	14	4	3	1	1	5	14	4	3	6	1	16	1
Philadelphia, PA–NJ	44	62	37	38	38	38	37	32	22	29	33	60	39
Phoenix–Mesa, AZ	25	14	10	22	15	12	14	10	10	8	8	68	22
Pittsburgh, PA	57	14	22	27	12	21	39	40	29	52	53	66	55
Portland–Vancouver, OR–WA	13	0	2	2	6	0	3	4	5	4	6	21	6
Providence–Fall River–Warwick, RI–MA	9	0	5	7	2	3	2	3	3	10	9	20	15
Raleigh–Durham–Chapel Hill, NC	11	17	15	12	14	22	40	29	13	8	29	19	30
Richmond–Petersburg, VA	8	22	9	14	5	19	22	21	6	15	22	16	25
Riverside–San Bernardino, CA	47	168	150	125	118	107	96	123	145	155	145	68	147
Rochester, NY	6	0	1	6	0	6	4	9	1	5	13	8	13
Sacramento, CA	39	20	37	41	44	17	29	69	45	49	69	52	77
St. Louis, MO–IL	55	9	33	38	23	15	24	31	18	17	34	68	36
Salt Lake City–Ogden, UT	24	5	17	5	14	2	19	8	15	15	18	37	36
San Antonio, TX	2	3	3	17	2	3	6	9	0	0	17	12	17
San Diego, CA	36	59	46	48	31	14	33	33	31	31	20	36	20
San Francisco, CA	16	0	0	2	0	0	0	10	4	12	17	16	17
San Jose, CA	11	4	2	14	8	0	8	23	24	14	11	13	13
SanJuan–Bayamon, PR	17	0	0	0	1	1	0	2	0	0	0	31	0
Scranton–Wilkes Barre–Hazleton, PA	14	10	7	12	4	11	7	12	3	12	23	12	23
Seattle–Bellevue–Everett, WA	13	0	3	2	6	1	3	6	7	3	6	30	7
Springfield, MA	16	13	12	9	5	10	7	15	3	13	12	19	17
Syracuse, NY	5	4	1	5	0	2	3	4	1	4	9	9	10
Tacoma, WA	8	0	2	0	1	0	4	4	5	4	0	9	7
Tampa–St. Petersburg–Clearwater, FL	36	1	3	2	3	4	11	10	8	4	0	47	0
Toledo, OH	3	7	8	9	11	4	5	4	2	9	13	10	18
Tucson, AZ	23	1	0	3	0	1	0	7	0	0	3	27	3
Tulsa, OK	11	4	12	21	14	7	9	14	10	6	5	17	6
Ventura, CA	21	43	63	66	62	45	29	24	31	25	11	25	16
Washington, DC–MD–VA–WV	46	52	22	32	18	30	47	39	11	22	34	65	39
West Palm Beach–Boca Raton, FL	8	3	0	0	0	0	2	1	0	1	0	10	0
Wilmington–Newark, DE–MD	8	29	24	27	13	22	28	21	18	19	21	18	23
Youngstown–Warren, OH	9	9	5	11	8	10	20	16	5	22	18	15	25

*Includes $PM_{2.5}$.

Table A-18. Number of Days with Air Quality Index Values Greater Than 100 at Trend Sites, 1993–2002, and All Sites in 2002, Ozone Only

Metropolitan Statistical Area	# of Trend Sites	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	Total # of Sites 2002	2002 Count
AKRON, OH	2	10	8	12	11	6	14	20	4	12	22	2	22
ALBANY-SCHENECTADY-TROY, NY	3	5	6	3	4	3	3	6	1	11	8	4	16
ALBUQUERQUE, NM	8	0	1	0	0	0	0	1	0	1	0	11	0
ALLENTOWN-BETHLEHEM-EASTON, PA	1	3	3	7	6	12	18	19	5	9	18	3	21
ATLANTA, GA	5	36	15	36	28	33	52	61	27	10	24	12	37
AUSTIN-SAN MARCOS, TX	1	2	4	10	0	0	5	8	6	0	5	2	5
BAKERSFIELD, CA	8	97	105	106	110	58	76	93	82	85	91	8	91
BALTIMORE, MD	7	48	40	36	28	30	51	40	16	26	39	8	39
BATON ROUGE, LA	7	12	10	22	12	16	21	26	30	5	6	7	6
BERGEN-PASSAIC, NJ	.	0	0	0	0	0	0	0	0	0	0	2	20
BIRMINGHAM, AL	6	10	6	32	15	8	23	30	21	11	13	10	15
BOSTON, MA-NH	2	2	6	7	4	7	8	8	1	12	13	6	19
BUFFALO-NIAGARA FALLS, NY	2	1	4	6	3	1	13	8	5	13	21	2	21
CHARLESTON-NORTH CHARLESTON, SC	3	2	2	1	3	3	3	5	4	0	1	3	1
CHARLOTTE-GASTONIA-ROCK HILL, NC-SC	6	29	15	18	21	29	50	42	24	26	36	8	38
CHICAGO, IL	22	3	8	24	7	10	12	14	1	16	20	21	21
CINCINNATI, OH-KY-IN	4	5	16	19	10	11	13	11	4	6	26	8	29
CLEVELAND-LORAIN-ELYRIA, OH	8	16	23	24	18	13	21	20	4	17	29	9	31
COLUMBUS, OH	4	8	12	18	19	13	21	22	6	7	19	7	28
DALLAS, TX	3	12	24	29	10	27	33	25	22	16	15	10	22
DAYTON-SPRINGFIELD, OH	4	11	14	11	18	10	19	19	6	4	28	5	28
DENVER, CO	8	3	2	3	2	0	9	3	2	2	7	8	7
DETROIT, MI	7	5	11	12	12	11	17	14	3	16	21	7	21
EL PASO, TX	2	3	2	3	1	0	6	0	3	1	4	6	6
FORT LAUDERDALE, FL	2	4	1	1	1	0	1	1	1	2	1	3	1
FORT WORTH-ARLINGTON, TX	2	9	31	28	14	14	17	19	16	17	23	8	33
FRESNO, CA	5	59	55	61	70	75	67	81	78	92	91	9	95
GARY, IN	3	0	6	18	12	11	9	10	5	10	20	6	23
GRAND RAPIDS-MUSKEGON-HOLLAND, MI	4	3	14	18	9	10	19	21	3	11	20	5	20
GREENSBORO-WINSTON SALEM-HIGH POINT, NC	4	22	7	13	7	14	26	24	12	12	24	7	30
GREENVILLE-SPARTANBURG-ANDERSON, SC	4	8	5	7	7	9	28	19	11	13	28	4	28
HARRISBURG-LEBANON-CARLISLE, PA	3	15	12	13	3	9	22	17	5	17	17	3	17
HARTFORD, CN	3	14	18	13	5	16	10	18	7	16	21	3	21
HONOLULU, HI	1	0	0	0	0	0	0	0	0	0	0	1	0
HOUSTON, TX	9	27	41	66	28	47	38	51	41	28	22	17	29
INDIANAPOLIS, IN	7	9	22	21	16	12	19	24	4	8	23	12	24

Table A-18. Number of Days with Air Quality Index Values Greater Than 100 at Trend Sites, 1993–2002, and All Sites in 2002, Ozone Only (continued)

Metropolitan Statistical Area	# of Trend Sites	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	Total # of Sites 2002	2002 Count
JACKSONVILLE, FL	1	0	0	0	0	0	3	2	0	0	0	3	0
JERSEY CITY, NJ	1	19	12	16	5	9	7	17	3	6	6	1	6
KANSAS CITY, MO-KS	4	3	10	21	6	16	14	3	10	4	7	6	12
KNOXVILLE, TN	7	25	16	26	21	37	54	62	36	17	45	7	45
LAS VEGAS, NV-AZ	4	3	3	0	4	0	3	0	0	1	2	15	6
LITTLE ROCK-NORTH LITTLE ROCK, AR	2	2	2	7	1	1	2	5	16	4	9	3	9
LOS ANGELES-LONG BEACH, CA	14	112	117	97	74	45	46	19	45	37	35	16	68
LOUISVILLE, KY-IN	7	22	28	26	17	18	29	44	10	10	26	7	26
MEMPHIS, TN-AR-MS	4	13	10	21	18	17	27	35	24	13	16	4	16
MIAMI, FL	4	6	1	2	1	3	8	5	0	1	0	4	0
MIDDLESEX-SOMERSET-HUNTERDON, NJ	2	13	9	20	15	19	22	26	11	21	29	2	29
MILWAUKEE-WAUKESHA, WI	9	4	12	14	5	5	12	17	4	12	12	9	12
MINNEAPOLIS-ST. PAUL, MN-WI	4	0	0	3	0	0	1	0	0	2	1	6	2
MONMOUTH-OCEAN, NJ	2	24	13	20	17	21	31	27	11	21	31	2	31
NASHVILLE, TN	6	18	21	26	22	20	30	33	16	7	16	7	21
NASSAU-SUFFOLK, NY	2	17	15	10	8	12	11	18	5	3	13	3	18
NEW HAVEN-MERIDEN, CT	1	12	13	14	8	19	9	16	6	11	20	2	24
NEW ORLEANS, LA	6	6	8	20	8	7	7	18	17	5	2	6	2
NEW YORK, NY	5	11	16	20	14	23	18	25	11	16	30	7	30
NEWARK, NJ	1	13	11	20	11	13	22	21	6	13	27	2	27
NORFOLK-VIRGINIA BEACH-NEWPORT NEWS, VA-NC	3	19	6	6	4	17	15	16	5	6	15	3	15
OAKLAND, CA	8	4	3	12	11	0	12	8	3	3	5	11	6
OKLAHOMA CITY, OK	3	2	5	13	2	4	7	4	6	2	2	6	3
OMAHA, NE-IA	3	0	0	0	0	0	0	2	0	0	0	3	0
ORANGE COUNTY, CA	4	25	15	8	9	3	6	1	4	2	0	4	1
ORLANDO, FL	4	4	3	1	1	5	14	4	3	3	1	5	1
PHILADELPHIA, PA-NJ	10	51	25	30	22	32	37	32	17	27	33	12	37
PHOENIX-MESA, AZ	7	14	7	19	15	10	14	10	9	6	6	21	14
PITTSBURGH, PA	11	13	20	25	12	20	39	23	4	19	28	12	32
PORTLAND-VANCOUVER, OR-WA	3	0	1	2	6	0	3	0	0	0	1	4	1
PROVIDENCE-FALL RIVER-WARWICK, RI-MA	1	0	5	7	2	3	2	2	2	10	9	2	14
RALEIGH-DURHAM-CHAPEL HILL, NC	7	17	15	12	14	22	40	29	12	8	29	8	29
RICHMOND-PETERSBURG, VA	3	22	9	14	5	19	22	21	5	12	21	4	25
RIVERSIDE-SAN BERNARDINO, CA	15	167	149	119	115	104	95	96	98	92	96	18	97
ROCHESTER, NY	2	0	1	6	0	6	4	9	1	5	13	2	13

Table A-18. Number of Days with Air Quality Index Values Greater Than 100 at Trend Sites, 1993–2002, and All Sites in 2002, Ozone Only (continued)

Metropolitan Statistical Area	# of Trend Sites	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	Total # of Sites 2002	2002 Count
SACRAMENTO, CA	10	20	37	41	44	17	29	39	29	34	39	15	47
ST. LOUIS, MO-IL	15	9	31	38	23	14	24	29	16	14	32	17	32
SALT LAKE CITY-OGDEN, UT	6	2	9	5	12	2	19	4	7	4	7	8	9
SAN ANTONIO, TX	1	3	3	17	2	3	6	9	0	0	17	3	17
SAN DIEGO, CA	9	58	46	48	31	14	33	16	14	17	13	9	13
SAN FRANCISCO, CA	3	0	0	2	0	0	0	0	0	0	0	3	0
SAN JOSE, CA	5	4	2	14	8	0	8	3	1	3	6	6	6
SANJUAN-BAYAMON, PR	.	0	0	0	0	0	0	0	0	0	0	1	0
SCRANTON-WILKES BARRE-HAZLETON, PA	4	10	7	12	4	11	7	12	1	10	16	4	16
SEATTLE-BELLEVUE-EVERETT, WA	2	0	3	0	6	1	3	1	1	0	0	4	0
SPRINGFIELD, MA	4	13	12	9	4	10	7	10	2	13	12	4	12
SYRACUSE, NY	2	4	1	5	0	2	3	4	1	4	9	3	9
TACOMA, WA	2	0	2	0	1	0	4	0	0	0	0	4	0
TAMPA-ST. PETERSBURG-CLEARWATER, FL	7	1	3	2	3	4	11	9	6	4	0	10	0
TOLEDO, OH	2	7	8	9	11	4	5	4	2	9	13	5	16
TUCSON, AZ	5	1	0	3	0	1	0	1	0	0	1	6	1
TULSA, OK	3	4	12	21	14	7	9	14	10	4	5	5	6
VENTURA, CA	6	43	63	66	62	44	29	22	27	19	10	7	15
WASHINGTON, DC-MD-VA-WV	16	52	22	32	18	30	47	39	11	22	34	20	38
WEST PALM BEACH-BOCA RATON, FL	1	3	0	0	0	0	2	1	0	1	0	2	0
WILMINGTON-NEWARK, DE-MD	4	29	24	27	13	22	28	21	18	19	21	5	21
YOUNGSTOWN-WARREN, OH	2	9	5	11	8	10	20	12	2	12	16	3	24

Table A-19. Condensed Nonattainment Areas List[a]

			1-h Pollutant[c]						1-h Population[d] (1000s)					
	State	Area Name[b]	O_3	CO	SO_2	PM_{10}	Pb	NO_2	O3	CO	SO_2	PM_{10}	Pb	All
1	AK	Anchorage	.	1	.	1	.	.	.	255	.	195	.	255
2	AK	Fairbanks	.	1	.	.	.	.	.	39	.	.	.	39
3	AK	Juneau	.	.	.	1	.	.	.	.	.	13	.	13
4	AL	Birmingham	1	.	.	.	.	.	805	.	.	.	.	805
5	AZ	Ajo	.	.	1	1	.	.	.	.	7	7	.	7
6	AZ	Douglas	.	.	1	1	.	.	.	.	15	15	.	15
7	AZ	Miami-Hayden	.	.	2	1	.	.	.	.	4	4	.	4
8	AZ	Morenci	.	.	1	.	.	.	.	.	8	.	.	8
9	AZ	Nogales	.	.	.	1	.	.	.	.	.	24	.	24
10	AZ	Paul Spur	.	.	.	1	.	.	.	.	.	1	.	1
11	AZ	Phoenix	1	1	.	1	.	.	3028	3028	.	3111	.	3111
12	AZ	Rillito	.	.	.	1	.	.	.	.	.	0	.	0
13	AZ	San Manuel	.	.	1	.	.	.	.	.	7	.	.	7
14	AZ	Yuma	.	.	.	1	.	.	.	.	.	82	.	82
15	CA	Imperial Valley	.	.	.	1	.	.	.	.	.	119	.	119
16	CA	Los Angeles-South Coast	1	1	.	1	.	.	14550	14550	.	14550	.	14550
17	CA	Mono Basin (in Mono Co.)	.	.	.	1	.	.	.	.	.	0	.	0
18	CA	Owens Valley	.	.	.	1	.	.	.	.	.	7	.	7
19	CA	Sacramento Metro	1	.	.	1	.	.	1978	.	.	1223	.	1978
20	CA	San Diego	1	.	.	.	.	.	2813	.	.	.	.	2813
21	CA	San Francisco-Oakland-San Jose	1	.	.	.	.	.	6541	.	.	.	.	6541
22	CA	San Joaquin Valley	2	.	.	1	.	.	3302	.	.	3080	.	3302
23	CA	Santa Barbara-Santa Maria-Lompoc	1	.	.	.	.	.	399	.	.	.	.	399
24	CA	Searles Valley	.	.	.	3	.	.	.	.	.	22	.	22
25	CA	Southeast Desert Modified AQMA	1	.	.	2	.	.	1024	.	.	424	.	1024
26	CA	Ventura Co.	1	.	.	.	.	.	753	.	.	.	.	753
27	CO	Aspen	.	.	.	1	.	.	.	.	.	5	.	5
28	CO	Denver-Boulder	.	.	.	1	.	.	.	.	.	2389	.	2389
29	CO	Fort Collins	.	1	.	.	.	.	.	143	.		.	143
30	CO	Lamar	.	.	.	1	.	.	.	.	.	8	.	8
31	CO	Steamboat Springs	.	.	.	1	.	.	.	.	.	9	.	9
32	CT	Greater Connecticut	1	.	.	1	.	.	2532	.	.	123	.	2532
33	DC-MD-VA	Washington	1	.	.	.	.	.	4544	.	.	.	.	4544
34	DE	Sussex County	1	.	.	.	.	.	156	.	.	.	.	156
35	GA	Atlanta	1	.	.	.	.	.	3698	.	.	.	.	3698
36	GU	Piti Power Plant	.	.	1	.	.	.	.	.	1	.	.	1
37	GU	Tanguisson Power Plant	.	.	1	.	.	.	.	.	1	.	.	1
38	ID	Boise	.	1	.	.	.	.	.	197	.	.	.	197
39	ID	Bonner Co.(Sandpoint)	.	.	.	1	.	.	.	.	.	36	.	36
40	ID	Pocatello Area	.	.	.	2	.	.	.	.	.	66	.	66
41	ID	Shoshone Co.	.	.	.	2	.	.	.	.	.	12	.	12
42	IL-IN	Chicago-Gary-Lake County	1	.	1	3	.	.	8757	.	484	322	.	8757
43	LA	Baton Rouge	1	.	.	.	.	.	636	.	.	.	.	636
44	MA	Bostton-Lawerence	1	.	.	.	.	.	5883	.	.	.	.	5883
45	MA	Springfield (W. Mass)	1	.	.	.	.	.	814	.	.	.	.	814
46	MD	Baltimore	1	.	.	.	.	.	2512	.	.	.	.	2512
47	MD	Kent and Queen Anne Cos.	1	.	.	.	.	.	59	.	.	.	.	59
48	ME	Knox/Lincoln County	1	.	.	.	.	.	73	.	.	.	.	73
49	ME	Lewiston-Auburn	1	.	.	.	.	.	220	.	.	.	.	220
50	ME	Portland	1	.	.	.	.	.	487	.	.	.	.	487
51	MO	Liberty-Arcadia	.	.	.	.	1	.	.	.	.	.	6	6
52	MO-IL	St. Louis	1	.	.	.	1[e]	.	2482	.	.	.	2	2482
53	MT	Billings/Laural	.	.	1	.	.	.	.	6	.	.	.	6
54	MT	Butte	.	.	.	1	.	.	.	.	.	34	.	34
55	MT	Columbia Falls	.	.	.	.	.	1	.	.	.	3	.	3
56	MT	East Helena	.	.	1	.	1	.	.	.	2	.	2	2
57	MT	Kalispell	.	.	.	1	.	.	.	.	.	15	.	15
58	MT	Lame Deer	.	.	.	.	1	.	.	.	.	0	.	0
59	MT	Libby	.	.	.	1	.	.	.	.	.	3	.	3
60	MT	Missoula	.	1	.	1	.	.	.	52	.	52	.	52
61	MT	Polson	.	.	.	1	.	.	.	.	.	3	.	3
62	MT	Ronan	.	.	.	1	.	.	.	.	.	2	.	2
63	MT	Thompson Falls	.	.	.	1	.	.	.	.	.	1	.	1
64	MT	Whitefish	.	.	.	1	.	.	.	.	.	5	.	5
65	NH	Manchester	1	.	.	.	.	.	364	.	.	.	.	364
66	NH	Portsmouth-Bover-Rocherster	1	.	.	.	.	.	192	.	.	.	.	192
67	NJ	Atlantic City	1	.	.	.	.	.	354	.	.	.	.	354
68	NM	Anthony	.	.	.	1	.	.		.	.	2	.	2

Table A-19. Condensed Nonattainment Areas List[a] (continued)

			1-h Pollutant[c]						**1-h Population[d] (1000s)**					
State		**Area Name[b]**	**O_3**	**CO**	**SO_2**	**PM_{10}**	**Pb**	**NO_2**	**O3**	**CO**	**SO_2**	**PM_{10}**	**Pb**	**All**
69	NM	Grant Co.	.	.	1	.	.	.	.	.	31	.	.	31
70	NM	Sunland Park	1[f]	.	.	.	.	.	10	.	.	.	.	10
71	NV	Lake Tahoe Nevada	.	1	.	.	.	.	.	29	.	.	.	29
72	NV	Las Vegas	.	1	.	1	.	.	.	478	.	1375	.	1375
73	NV	Reno	1	1	.	1	.	.	339	178	.	339	.	339
74	NY	Abany-Schenectedy	1	.	.	.	.	.	892	.	.	.	.	892
75	NY	Buffalo-Niagara Falls	1	.	.	.	.	.	1170	.	.	.	.	1170
76	NY	“Essex Cy, Whiteface”	1	.	.	.	.	.	0	.	.	.	.	0
77	NY	Jefferson County	1	.	.	.	.	.	111	.	.	.	.	111
78	NY	Poughkeepsie	1	.	.	.	.	.	600	.	.	.	.	600
79	NY-NJ-CT	New York-N. New Jersey-Long Island	1	.	.	1	.	.	19171	.	.	1537	.	19171
80	OH	Cleveland-Akron-Lorain	.	.	1	.	.	.	.	.	1095	.	.	1095
81	OH	Lucas Co. (Toledo)	.	.	1	.	.	.	.	.	455	.	.	455
82	OH-KY	Cinncinnati-Hamilton	1	.	.	.	.	.	1514	.	.	.	.	1514
83	OH-PA	Youngstown-Warren	1	.	.	.	.	.	120	.	.	.	.	120
84	OR	Grants Pass	.	.	.	1	.		.	.	.	20	.	20
85	OR	Klamath Falls	.	.	.	1	.	.	.	.	.	19	.	19
86	OR	LaGrande	.	.	.	1	.	.	.	.	.	12	.	12
87	OR	Lakeview	.	.	.	1	.	.	.	.	.	3	.	3
88	OR	Medford	.	.	.	1	.	.	.	.	.	78	.	78
89	OR	Oakridge	.	.	.	1	.	.	.	.	.	3	.	3
90	OR	Springfield-Eugene	.	.	.	1	.	.	.	.	.	179	.	179
91	OR	Salem	.	1	.	.	.	.	.	135	.	.	.	135
92	PA	Altoona	1	.	.	.	.	.	129	.	.	.	.	129
93	PA	Erie	1	.	.	.	.	.	280	.	.	.	.	280
94	PA	Harrisburg-Lebanon	1	.	.	.	.	.	629	.	.	.	.	629
95	PA	Johnstown	1	.	.	.	.	.	232	.	.	.	.	232
96	PA	Lancaster	1	.	.	.	.	.	470	.	.	.	.	470
97	PA .	Pittsburgh-Beaver Valley	.	1	2	1	.	.		335	410	21	.	410
98	PA	Scranton-Wilkes_Barre	1	.	.	.	.	.	763	.		.	.	763
99	PA	Warren Co	.	.	2	.	.	.	.	.	20	.	.	20
100	PA	York	1	.	.	.	.	.	473	.	.	.	.	473
101	PA-DE-NJ-MD	Philadelphia-Wilmington-Trenton	1	.	.	.	.	.	6311	.	.	.	.	6311
102	PA-NJ	Allentown-Bethlehem	1	.	1	.	.	.	740	.	102	.	.	740
103	PR	Guaynabo Co.	.	.	.	1	.	.	.	.	.	92	.	92
104	RI	Providence (all of RI)	1	.	.	.	.	.	1048	.	.	.	.	1048
105	TX	Beaumont-Port Arthur	1	.	.	.	.	.	385	.	.	.	.	385
106	TX	Dallas-Fort Worth	1	.	.	.	.	.	4589	.	.	.	.	4589
107	TX	El Paso	1	1	.	1	.	.	679	62	.	563	.	679
108	TX	Houston-Galveston-Brazoria	1	.	.	.	.	.	4669	.	.	.	.	4669
109	UT	Ogden	.	.	.	1	.	.	.	.	.	77	.	77
110	UT	Salt Lake City	.	.	1	1	.	.	.	.	898	898	.	898
111	UT	Tooele Co.	.	.	1	.	.	.	.	.	40	.	.	40
112	UT	Utah Co. (Provo)	.	1	.	1	.	.	.	118	.	368	.	368
113	VA	“Smyth Cy, White Top”	1	.	.	.	.	.	.	0	.	.	.	0
114	WA	Spokane	.	1	.	1	.	.	.	322	.	204	.	322
115	WA	Wallula	.	.	.	1	.	.	.	.	.	0	.	0
116	WA	Yakima	.	1	.	1	.	.	.	.	.	63	.	63
117	WI	Door County	1	.	.	.	.	.	27	.	.	.	.	27
118	WI	Manitowoc Co.	1	.	.	.	.	.	82	.	.	.	.	82
119	WI	Milwaukee-Racine	1	.	.	.	.	.	1839	.	.	.	.	1839
120	WV	Follansbee	.	.	.	1	.	.	.	.	.	2	.	2
121	WV	New Manchester Gr. (in Hancock Co)	.	.	1	.	.	.	.	.	9	.	.	9
122	WV	Wier.-Butler-Clay (in Hancock Co)	.	.	1	1	.	.	.	.	16	15	.	16
123	WV-KY	Huntington-Ashland	.	.	1	.	.	.	.	.	49	.	.	49
124	WY	Sheridan	.	.	.	1	.	.	.	.	.	15	.	15
			56	16	24	67	3	0	116228	19921	3660	31850	10	125730

Table A-19. Condensed Nonattainment Areas List[a] (continued)

Notes:

[a] This is a simplified listing of Classified Nonattainment areas. Unclassified and Section 185(A) nonattainment areas are not included. In certain cases, footnotes are used to clarify the areas involved. For example, the lead Readers interested in more detailed information should use the official Federal Register Citation (40CFR81).

[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 one or more smaller nonattainment areas, such as PM_{10} or lead, the common name for the larger nonattainment area is used. Note that several smaller nonattainment areas may be inside one larger nonattainment area, as illustrated in Figure 1. For the purpose of this table, these are considered one nonattainment area and are listed on one line. Occasionally, two nonattainment areas may only partially overlap, as illustrated in Figure 2. These are counted as two distinct nonattainment areas and are listed on separate lines.

[c] The number of nonattainment areas for each of the criteria pollutants is listed.

[d] Population figures were obtained from 2000 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 in the “All” column is avoided by only counting the population of the larger nonattainment area.

[e] Lead nonattainment area is Herculaneum, Missouri, in Jefferson County.

[f] Ozone nonattainment area is a portion of Dona Ana County, New Mexico.

Figure A-1. (Multiple NA areas within a larger NA area) Two SO_2 areas inside the Pittsburgh–Beaver Valley ozone NA. Counted as one NA area.

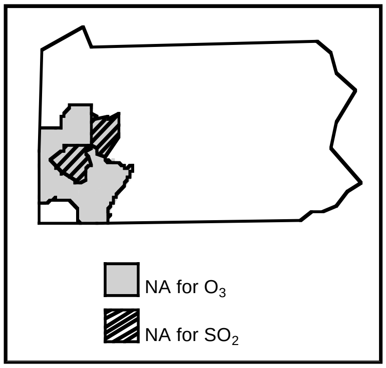


Figure A-2. (Overlapping NA areas) Searles Valley PM_{10} NA partially overlaps the San Joaquin Valley ozone NA. Counted as two NA areas.

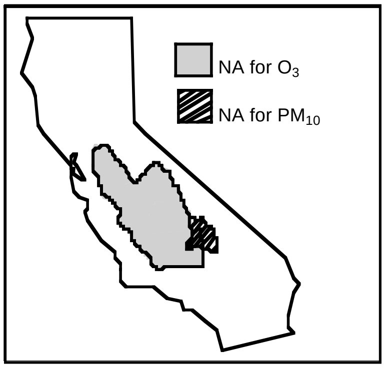


Table A-20. Trend in 8-hr ozone concentrations (ppm) exceedances at National Park and National Monument sites, 1991–2000

National Park	Trend	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Acadia NP	NS	0.095	0.080	0.080	0.075	0.092	0.073	0.077	0.088	0.092	0.070
		7	1	3	0	5	2	1	4	5	0
Big Bend NP	NS	0.057	0.061	0.063	0.069	0.065	0.073	0.063	0.070	0.064	0.064
		0	0	0	0	0	0	0	0	0	0
Brigantine	NS	0.111	0.094	0.093	0.083	0.100	0.095	0.106	0.091	0.095	0.085
		34	8	13	2	10	13	18	22	13	4
Canyonlands NP	UP	nd	0.055	0.063	0.068	0.063	0.074	0.067	0.071	0.073	0.076
		nd	0	0	0	0	0	0	0	0	0
Cape Cod NS	NS	0.111	0.096	0.088	0.088	0.105	0.096	0.100	0.084	0.101	0.083
		16	6	4	4	9	8	17	2	12	3
Cape Romain	UP	0.060	0.072	0.069	0.067	0.075	0.071	0.082	0.076	0.080	0.076
		0	0	0	0	1	1	3	0	2	2
Chamizal	NS	nd	0.072	0.059	0.075	0.084	0.078	0.071	0.088	0.071	0.080
		nd	2	0	2	3	1	0	6	0	2
Chiricahua NM	NS	0.071	0.065	0.068	0.071	0.069	0.072	0.065	0.067	0.072	0.071
		0	0	0	0	0	0	0	0	0	0
Congaree Swamp	UP	0.059	0.067	0.063	0.064	0.076	0.074	0.065	0.081	0.080	0.073
		0	0	0	0	1	0	0	0	0	0
Cowpens NB	UP	0.078	0.086	0.082	0.083	0.084	0.080	0.091	0.096	0.094	0.088
		1	4	3	2	3	2	5	15	9	4
Craters of the Moon	UP	nd	0.040	0.056	0.063	0.057	0.064	0.060	0.065	0.068	0.066
		nd	0	0	0	0	0	0	0	0	0
Denali NP	NS	0.049	0.050	0.048	0.049	0.053	0.053	0.051	0.054	0.054	0.038
		0	0	0	0	0	0	0	0	0	0
Everglades NP	UP	0.060	0.061	0.064	0.064	0.058	0.063	0.066	0.072	0.067	0.066
		0	0	0	0	0	0	0	0	2	0
Glacier NP	NS	0.051	0.051	0.044	0.055	nd	0.057	0.040	0.053	0.048	0.050
		0	0	0	0	nd	0	0	0	0	0
Grand Canyon NP	NS	0.073	0.074	0.066	0.073	0.069	0.073	0.072	0.072	0.076	0.071
		0	0	0	0	0	0	0	0	0	0
Great Smoky Mtn	UP	0.079	0.088	0.088	0.093	0.099	0.088	0.098	0.110	0.106	0.096
		2	5	4	10	13	8	19	35	37	12
Great Smoky Mtn	UP	0.082	0.075	0.089	0.088	0.093	0.092	0.095	0.106	0.101	0.096
		1	3	7	6	12	12	20	34	36	18
Great Smoky Mtn	UP	nd	nd	0.074	0.076	0.089	0.087	0.089	0.106	0.101	0.100
		nd	nd	0	3	9	7	6	33	29	21
Lassen Volcanic	NS	0.066	0.069	0.064	0.078	0.074	0.073	0.067	0.078	0.084	0.074
		0	0	0	1	0	1	0	1	2	0
Mammoth Cave NP	UP	0.078	0.073	0.072	0.075	0.088	0.082	0.078	0.092	0.098	0.088
		0	0	0	1	6	2	4	12	19	4
Mount Rainier	NS	nd	nd	0.055	0.067	0.065	0.065	0.040	0.051	0.064	0.057
		nd	nd	0	2	0	0	0	0	0	0
Olympic NP	NS	0.041	0.046	0.042	0.041	0.044	0.046	0.045	0.041	0.043	0.047
		0	0	0	0	0	0	0	0	0	0
Pinnacles NM	NS	0.084	0.084	0.060	0.078	0.083	0.094	0.076	0.088	0.082	0.078
		3	3	2	0	3	9	1	5	1	0
Rocky Mountain	NS	0.076	0.071	0.071	0.076	0.076	0.072	0.070	0.080	0.074	0.078
		0	0	1	0	0	0	0	1	1	2
Saguaro NM	NS	0.073	0.074	0.082	0.080	0.083	0.076	0.079	0.077	0.069	0.074
		0	1	1	0	2	0	0	0	1	0
Sequoia/Kings C	NS	0.097	0.102	0.106	0.106	0.095	0.105	0.097	0.094	0.097	0.090
		34	50	48	58	18	50	26	27	39	8
Shenandoah NP	NS	0.083	0.077	0.083	0.083	0.087	0.081	0.089	0.107	0.093	0.080
		3	1	2	2	7	1	6	22	15	1
Theodore Roosevelt	NS	0.060	0.057	0.055	0.057	0.058	0.059	0.071	0.056	0.058	0.059
		0	0	0	0	0	0	0	0	0	0
Voyageurs NP	UP	0.050	0.054	0.058	0.062	0.064	0.067	0.071	0.067	0.074	0.065
		0	0	0	0	0	0	0	0	0	0
Yellowstone	UP	0.057	0.063	0.053	0.061	0.060	0.061	0.061	0.066	0.069	0.065
		0	0	0	0	0	0	0	0	0	0
Yosemite NP	UP	0.098	0.091	0.063	0.094	0.091	0.090	0.081	0.094	0.085	0.087
		31	7	0	12	11	10	3	9	4	6

Notes:

1. The trends statistic is the annual fourth highest daily maximum 8-hour ozone concentration (ppm). The number of exceedances of the level of the 8-hour ozone NAAQS is shown below the concentration value.
2. “nd” indicates no data available for that year.
3. “inc” indicates less than 90 days of monitoring data available for that year.
4. “NS” indicates no statistically significant trend (at the 0.05 level).
5. “UP” indicates a statistically significant upward trend in ozone concentrations.

Table A-21. Onroad and Nonroad Emissions of 21 Mobile Source Air Toxics, 1996

	Onroad		Nonroad		Mobile Sources	
Compound	Tons	Percent of Total National Emissions	Tons	Percent of Total National Emissions	Tons	Percent of Total National Emissions
1,3-Butadiene*	23,500	42%	9,900	18%	33,400	60%
Acetaldehyde*	28,700	29%	40,800	41%	69,500	70%
Acrolein*	5,000	16%	7,400	23%	12,400	39%
Arsenic Compounds*	0.25	0.06%	2.01	0.51%	2.26	0.57%
Benzene*	168,200	48%	98,700	28%	266,900	76%
Chromium Compounds*	14	1.2%	35	3%	49	4.2%
Dioxins/Furans* [1]	NA	NA	NA	NA	NA	NA
Ethylbenzene	80,800	47%	62,200	37%	143,000	84%
Formaldehyde*	83,000	24%	86,400	25%	169,400	49%
Lead Compounds*	19	0.8%	546	21.8%	565	22.6%
Manganese Compounds*	5.8	0.2%	35.5	1.3%	41.3	1.5%
Mercury Compounds*	0.2	0.1%	6.6	4.1%	6.8	4.2%
MTBE	65,100	47%	53,900	39%	119,000	86%
n-Hexane	63,300	26%	43,600	18%	106,600	44%
Naphthalene[2]	NA	NA	NA	NA	NA	NA
Nickel Compounds*	10.7	0.9%	92.8	7.6%	103.5	8.5%
POM (as sum of 7 PAH)*	42.0	4%	19.3	2%	61.3	6%
Styrene	16,300	33%	3,500	7%	19,800	40%
Toluene	549,900	51%	252,200	23%	802,100	74%
Xylene	311,000	43%	258,400	36%	569,400	79%
Diesel Particulate Matter	182,000	34%	341,000	65%	523,000	99%

*On the urban HAPs list for the Integrated Urban Air Toxics Strategy

[1] Dioxin/Furans emission estimates are still under review
[2] Naphthalene emission estimates are currently included in POM. This will be corrected in the 1999 NTI.

Methodology

http://www.epa.gov/oar/aqtrnd03/appendb.pdf

AQS Methodology

The ambient air quality data presented in Chapters 2 and 3 of this report are based on data retrieved from the Air Quality System (AQS) on July 2003. These are direct measurements of pollutant concentrations at monitoring stations operated by tribes and state and local governments throughout the nation. The monitoring stations are generally located in larger urban areas. EPA and other federal agencies also 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.[1,2]

Emission estimation methods used for historical years prior to 1985 are considered "top-down approaches," e.g., pollutant emissions were estimated by using national average emission characterization techniques (for NO_x, VOC, CO, Pb, and PM_{10}). Emission estimates for the years 1985 to present represent an evolution in methods for significant categories, resulting in a "bottom-up approach" including data submitted directly by state/local agencies (for all criteria pollutants, $PM_{2.5}$, and NH_3).

In 2002, thousands of monitoring sites reported air quality data for one or more of the six National Ambient Air Quality Standards (NAAQS) pollutants to AQS, as shown in Table B-1. The sites consist of National Air Monitoring Stations (NAMS), State and Local Air Monitoring Stations (SLAMS), and other special-purpose monitors. NAMS were established to ensure a long-term national network for urban area-oriented ambient monitoring and to provide a systematic, consistent database for air quality comparisons and trends analysis. SLAMS allow state or local governments to develop networks tailored for their immediate monitoring needs.

Table B-1. Number of Ambient Monitors with Valid Annual Summary Statistics

Pollutant	No. of Sites with Valid Annual Summary Statistics in 2002	No. of Trend Sites 1992–2002
CO	331	387
Pb	77	96
NO_2	217	250
O_3	718	785
PM_{10}	629	770
SO_2	361	449

Air quality monitoring sites are selected as national trends sites if they have complete data for at least 8 of the 10 years. The annual data completeness criteria are specific to each pollutant and measurement methodology. Table B-1 displays the number of sites meeting the 10-year trend completeness criteria. 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 database that is consistent with the current monitoring network.

The air quality data are divided into two major groupings: daily (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 6 days, or 61 samples per year. Such instruments are used to measure PM_{10} and lead. More frequent sampling of PM_{10} (every other day or every day) also is common. Only PM_{10}-weighted (for each quarter to account for seasonality) annual arithmetic means that meet the AQS annual summary criteria are selected as valid means for trends purposes.[3] Only lead sites with at least six samples per quarter in three of the four calendar quarters qualify as trends sites. Monthly composite lead 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 SO_2 standard-related daily statistics require at least 183 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 trend statistic 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 is conservative since endpoint rates of change are dampened by the interpolated estimates.

Emissions Estimate Methodology

Trends are presented for annual nationwide emissions of CO, lead, NO_x, VOC, PM_{10}, SO_2, and NH_3. These trends are estimates of the amount and kinds of pollution being emitted by automobiles, factories, and other sources based on best available engineering calculations. Methodologies for estimating emissions are constantly evolving and resources do not always allow for them to be recalculated for all years. Thus, some apparent changes in the emission trends are actually caused by a methods change rather than an actual change in emissions. Comparison of the estimates for a given year in this report to the same year in previous reports is not appropriate.

The emission estimates presented in this report reflect several major changes in methodologies. For stationary sources, state-derived emission estimates were included primarily for nonutility point and area sources beginning in 1996. Also, 1985–1994 source NO_x emission rates derived from test data from EPA's Acid Rain Division were used.

For mobile sources, the MOBILE6 model and 2002 draft of the NONROAD model were run for several base years and interpolated between modeled years, making mobile source trends and emission methodology consistent across the entire period of years shown. This change in mobile source estimation methods makes for significant changes in the trends, in particular raising estimated emission levels for earlier years over previous reports. New methods have also been developed for estimating emissions from locomotives, aircraft, and commercial marine vessels. Improved methods for these three categories are based on year-specific activity data and are superior to the previous estimates that were projected from year to year. However, they leave a few data gaps. For instance, the emission estimates erroneously show no PM emissions for commercial aircraft due to problems in confirming a valid emission factor.

In addition to the changes in methodology affecting most source categories and pollutants, other changes were made to the emissions for specific pollutants, source categories, and/or individual sources. Activity data and correction parameters for agricultural crops and paved roads were included. A change in methodology occurred starting in 1996 for calculating PM_{10} emissions from unpaved roads and in 1999 for calculating emissions from construction. This has led to lower PM_{10} emissions than would have been predicted using the previous methods. The development of new emission estimation methodologies has added emissions for open burning of residential yard waste and land-clearing debris burning. Starting in 1999, these estimates contributed to a significant increase in industrial category emissions for CO, PM_{10}, and $PM_{2.5}$ between 1998 and 1999. Rule effectiveness from pre-1990 chemical and allied product emissions was removed. Alaska and Hawaii nonutility point and area source emissions from several sources were added. Also, this report incorporates data from continuous emissions monitors (CEMs) collected between 1994 and 1999 for NO_x and SO_2 emissions at major electric utilities.

Another change is the addition of PM condensible emissions. Previous reports included only the filterable portion of PM for stationary sources. Onroad and nonroad mobile source estimates included condensibles due to the test methodology on which the estimates are based. In this latest report, we have tried to address this by augmenting our estimates to include the condensible portion for point source and selected area source emissions. This primarily affects combustion sources.

All of these changes are part of a broad effort to update and improve emission estimates. Additional emission estimates and a more detailed description of the estimation methodology are available from EPA's Emission Factor and Inventory Group (go to **www.epa.gov/ttn/chief** and click on "Emission Inventories," then click on "National Emissions Inventory Data," then click on the documentation and data for the latest year available).

IMPROVE Methodology

Data collected from the Interagency Monitoring of Protected Visual Environments (IMPROVE) network is summarized in Chapter 2 ($PM_{2.5}$ section) of this report. The completeness criteria and averaging method used to summarize the IMPROVE data are slightly different from those used for the criteria pollutants. (Data handling guidance is currently being developed for the IMPROVE network. Future summaries will be based on this guidance.) The source data sets were obtained from Dr. James Sisler of Colorado State University.

The annual average statistics in these files were used to assess trends in this report. The IMPROVE data are not reported in terms of a calendar year. The IMPROVE year runs from March to February of the following year. It follows that the four seasons are: March to May (spring), June to August (summer), September to November (autumn), and December to the following February (winter). The network samplers monitor on Wednesdays and Saturdays throughout the year, yielding 104 samples per year and 26 samples per season. To be included in this analysis, sites were required to have data for at least 50 percent of the scheduled samples (13 days) for every calendar quarter.

IMPROVE monitoring sites are selected as trends sites if they have complete data for at least 8 of the 10 years between 1990 and 1999 (or 6 of 8 years for those who began monitoring in 1992). A year is valid only if there are at least 13 samples (50 percent complete) per season for both measured and reconstructed $PM_{2.5}$.

Figure B-1. Class I Areas in the IMPROVE Network meeting data completeness criteria.

The same linear interpolation applied to the criteria pollutants is applied here. The IMPROVE sites meeting the data completeness criteria are shown in Figure B-1.

For consistency, the same sites are used in both the $PM_{2.5}$ section. The exceptions are Washington, DC, and South Lake Tahoe, which are not included in the visibility trends analysis because they are urban sites.

Air Toxics Methodology

Database

The 1990–1999 ambient air quality data presented in Chapter 5 of this report are based on air toxics data retrieved from AIRS in July 2000, data retrieved from the IMPROVE network in June 2000, and data voluntarily submitted to EPA by state and local monitoring agencies and received by June 30, 2000. For more details about the database, see Rosenbaum et al., 1999.[6] All statistical summaries are based on annual average concentrations. Measurements for hazardous air pollutants (HAPs) are frequently reported as nondetectable concentrations. To calculate annual average concentrations, one-half of the actual or plausible detection limit is used to substitute values for nondetects (or if the reported value is zero). The plausible detection limit, used for cases where the minimum detectable limit (MDL) is missing, is the lowest of the measured concentrations and MDLs for the given monitor and HAP.

Separate summaries are presented for sites in a metropolitan statistical area (MSA)/PMSA (primary MSA), excluding the (primarily rural) sites from the IMPROVE network, and for other sites. Areas (one or more counties) are assigned to either an MSA or a CMSA (consolidated MSA) consisting of two or more PMSAs or are just assigned to a county. Each non-IMPROVE site in an MSA or CMSA was assigned either to its MSA or PMSA. Some analyses allocated MSA/PMSAs to states. If the MSA/PMSA crosses state boundaries, the state containing the largest portion of that MSA/PMSA was used.

Completeness

All calculations are based on the average of calculated or measured 24-hour values. For each HAP, a series of completeness rules are applied sequentially starting with using the raw hourly data to determine daily completeness. Multiple records for the same HAP, monitoring site, day, and time period are averaged together. A day is complete if the total number of hours monitored for that day is 18 or more (i.e., 75 percent of 24 hours). For example, 18 hourly averages, three 6-hour averages, or three 8-hour averages will satisfy the daily completeness criteria. Once daily completeness is satisfied, quarterly completeness is determined. Calendar quarters are

- (Late winter) January–March
- (Early summer) April–June
- (Late summer) July–September
- (Early winter) October–December.

A calendar quarter is complete if it has 75 percent or more complete days out of the expected number of daily samples for that quarter and if there are at least five complete days in the quarter. To determine the expected number of daily samples, the most frequently occurring sampling interval (days from one sample to the next sample) was used; in cases of ties, the minimum sampling interval was applied. A calendar year is complete if both the summer and winter 6-month seasons have at least one complete quarter, that is, if (1) quarter 1 or 4 or both quarters 1 and 4 are complete, and (2) quarter 2 or 3 or both quarters 2 and 3 are complete.

In some cases, collocated samples for the same HAP and location were collected. For AQS data, collocated monitors are identified by having the same 9-digit AQS ID number but a different pollutant occurrence code (POC) number. The higher POC numbers are generally used for quality assurance monitoring data that are not as complete as the primary sampling data. Therefore, if multiple AIRS monitors at the same location meet the above completeness requirements, then only the data from the monitor with the lowest POC number were used for these analyses. For data not reported to AIRS, collocated monitors can have very different monitor identifiers. If multiple monitors at the same latitude and longitude location for a given sampling program and HAP meet the completeness requirements, then only the data from the monitor with the highest monitoring frequency were used for these analyses. In case of tied highest monitoring frequencies, the monitor with the most daily average records (from complete quarters in the trend period) was used.

National Analyses

Based on the available years of monitoring data across the nation, the national analyses were restricted to the 6-year period 1994 to 1999. A site was included for a particular HAP if, and only if, there were four or more complete years for that period.

California Analyses

A similar, but longer term trend analysis was performed on metropolitan sites located only in California using 1990 to 1999 data. A site was included for a given HAP if there was at least one period of 5 years or longer so that at least 75 percent of those years are complete and the period ends in 1997 or later. Only the data from the most recent of the longest such periods were used.

Trend Analysis

Annual averages for years with four complete quarters were computed by averaging the four quarterly averages. If a year had one or more missing or incomplete quarters, then those missing or incomplete quarterly averages were filled in (if possible) using the General Linear Model (GLM) fill-in methodology described below, and the annual average was computed by first averaging the quarterly averages (actual or filled-in) for a season and then averaging across the two seasons.[7] Filled-in quarterly averages were used for incomplete quarters even if there were some data for that quarter. Data from incomplete quarters were not used in the analyses. The filled-in quarterly average can be negative sometimes, and occasionally this leads to a negative annual average. To deal with this case, negative or zero filled-in quarterly averages were used to compute the annual average (this avoids biasing the results), but any resulting negative annual averages were reset to zero. In the summary analyses, averages across multiple sites were computed as trimmed means rather than simple arithmetic means in order to reduce the influence of the most extreme monitor averages on the trend line. If there were nine sites or less, then no trimming was performed, so the trimmed mean is the arithmetic mean of all the site averages. If there were between 10 and 40 sites, inclusive, the trimmed mean is the arithmetic mean of all the site averages except for the highest and lowest averages. If there were 41 sites or more, the trimmed mean is the arithmetic mean of all the site averages except for the highest 2.5 percent and the lowest 2.5 percent of the averages. The reported numbers of sites and percentiles are based on all sites meeting the completeness criteria, that is, including the sites that were excluded for the trimmed mean calculation.

The overall slope (trend) was estimated nonparametrically as the median of the ratios of the difference in the annual average to the difference in calendar year, for all pairs of calendar years. The significance level of the trend was computed using the associated nonparametric Theil test, based on the number of pairs of years where the annual averages increased. The *p*-values are calculated for a two-sided test for whether or not the annual averages have a trend (which may be increasing or decreasing). The trend is reported as “Significant Up Trend” or “Significant Down Trend” if the corresponding one-sided test is significant at the 5 percent significance level; otherwise the result is reported as “Non-significant Up Trend,” “No Trend,” or “Non-significant Down Trend.”

For the tables summarizing the annual average trends by monitor, the GLM fill-in method was not used. Instead, those monitor annual averages were computed by averaging all complete daily averages for each complete quarter, then averaging the complete quarterly averages for each season, and then averaging over the two seasons. All other analyses used the filled-in quarterly averages as described above.

GLM Fill-in Methodology

The GLM fill-in methodology and software used to fill in missing quarterly averages were based on the report by Cohen and Pollack (1990),[8] which can be consulted for more details. The method was modified to apply to the sequence of quarterly averages (24 values for the 6-year 1994–1999 period) instead of five annual means. The method was also modified to use a fitted statistical model with six year effects and four quarterly adjustments, instead of having 24 independent year/quarter effects. In other words, the fitted model assumes that the seasonal (quarterly) variation is the same for every site and year. Initially, each site is allocated to a region, which for these analyses was the MSA/PMSA for sites within an MSA or PMSA or was the county. Suppose that for each of the four quarters there is at least one site in the region with complete data for that quarter in at least 1 year. Suppose also that for each of the 6 years there is at least one site in the region with complete data for at least one quarter in that year. If these two conditions apply, then the missing quarterly averages for all sites in that region are computed by fitting a GLM so that the expected value for a given site and quarter q is the sum of the site average, a yearly adjustment term, and a quarterly adjustment term. The yearly adjustment term is the fixed effect of the y’th year, $1 \le y \le 6$, assumed to be the same value for all sites in the region. The quarterly adjustment term is the fixed effect of the q’th quarter, $1 \le q \le 4$, assumed to be the same value for all sites in the region and all years. If a region does not meet these two conditions, then the region is expanded to become a larger, augmented region with some site data for every quarter and some site data for every year, and the GLM approach is applied to the augmented region. Candidates for the augmented region are selected by finding the nearest site(s) in the same state that have complete data for the missing quarter(s) and year(s). The selected augmented region is the region giving the lowest mean square error for the GLM.

Although the GLM methodology filled in most missing quarters, there were some states, HAPs, and years that had no complete quarters for any site in the state. In those cases, the missing quarters were not filled in by the GLM approach (which restricts the augmented regions to sites in the same state). For the national analyses of distributions across sites in different states, the missing site-years were then filled in using the same EPA extrapolation and interpolation method used elsewhere in this report: If the site annual average for 1994 was missing, it was filled in with the 1995 annual average; if the 1995 annual average was also missing, then the 1994 and 1995 annual averages were filled in with the 1996 annual average. If the site annual average for 1999 was missing, it was filled in with the 1998 annual average; if the 1998 annual average was also missing, then the 1999 and 1998 annual averages were filled in with the 1997 annual average. Otherwise, any missing annual averages were filled in using simple linear interpolation from the two surrounding annual averages.

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3. Aerometric Information Retrieval System (AIRS), Volume 2, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, October, 1993.

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6. Rosenbaum, A. S., Stiefer, M. P., and Iwamiya, R. K. November, 1999. *Air Toxics Data Archive and AIRS Combined Dataset: Contents Summary Report*. SYSAPP-99/26d. Systems Applications International, San Rafael, CA.

7. In all cases analyzed, four non-missing quarterly means were available after applying the GLM method, so that the resulting annual mean is the arithmetic mean of the four quarterly averages.

8. Cohen, J.P. and A. K. Pollack. 1990. *General Linear Models Approach to Estimating National Air Quality Trends Assuming Different Regional Trends*. SYSAPP-90/102. Systems Applications International, San Rafael, CA.

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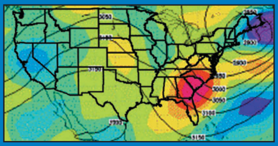

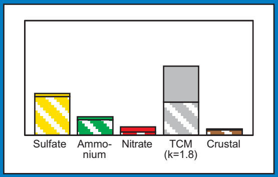

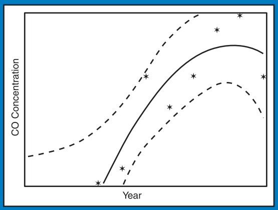

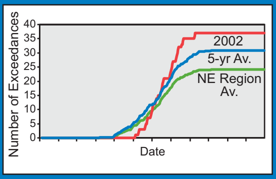

$$CPA = \frac{\sum xy - \frac{\sum x \sum y}{n}}{\frac{\sum (x-y)^2 + \sqrt{\left[\sum x^2 - \frac{(\sum x)^2}{n}\right]\left[\sum y^2 - \frac{(\sum y)^2}{n}\right]}}{n}}$$

Impact of April 2001 Asian Dust Event on Particulate Matter Concentrations in the United States

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Abstract

In April 2001, a large dust storm formed over the Gobi desert in northern China. Satellite remote sensing data and analyses of meteorological conditions were used in this study to follow the dust cloud from China, over the Pacific Ocean, and then coast to coast across the United States over a period of several weeks. Chemical speciation data were used to estimate the $PM_{2.5}$ mass increment associated with the Asian dust, and peak concentrations were plotted to show the progression of elevated concentrations across the contiguous United States. Meteorological analyses, including air parcel trajectories, were used to link the dust cloud overhead to the concentrations below. Also, the contribution of Asian dust to the total mass concentrations measured at the monitors was examined with respect to the U.S. Environmental Protection Agency's (EPA's) health standards and Air Quality Index (AQI) for particulate matter. The findings suggest that this transport event contributed to higher PM concentrations in several areas across the United States, with "average" estimated contributions ranging from 3.1 to 7.4 mg/m^3. Because the event occurred in the springtime when daily concentrations of other PM components are generally low, there were relatively few areas with "unhealthy" AQI days. Nevertheless, this event possibly contributed to "unhealthy" AQI days in three areas. In addition, it raised the 3-year average related to the long-term $PM_{2.5}$ health standard by an estimated 0.1 mg/m^3 in the affected regions. For most sites, this is insignificant, but there are implications for sites with 3-year averages just above the level of the standard.

Introduction

In early April 2001, an unusually large dust storm developed over the Gobi desert in northern China (Figure 1). The generation of dust storms and their impact on islands in the North Pacific have been the focus of research dating back to the late 1960s.[2] However, the focus on the impacts of Asian dust storms did not turn to the western United States until 1998.[3,4] In recent years, the satellite remote sensing data from such instruments as TOMS (Total Ozone Mapping Spectrometer), SeaWIFS (Sea-viewing Wide Field-

Figure 1. Map of Mongolia and northern China, highlighting the Gobi Desert region.[1]

of-view Sensor), MODIS (Moderate Resolution Imaging Spectroradiometer), and AVHRR (Advanced Very High Resolution Radiometer) have added a new dimension to studying such episodic events. These satellite sensors now allow the movement of the dust plume to be captured. In the case of the April 2001 dust storm, the satellites provide an eye-catching image of the dust cloud arriving at the doorstep of the western United States and beyond. But what does such an event, and the compelling satellite images resulting from the event, mean with respect to air quality in the United States and in particular to the levels of health concern for particulate matter?

The purpose of this paper is to provide a meaningful analysis of the impact of the April 2001 Asian dust storm on ground-level particulate matter concentrations within the contiguous United States. In this paper, we explore the formation of the dust storm over the Gobi Desert, the transport of the dust from its origin to the east coast of the United States, the mechanism for transport of dust to the boundary layer, and the ground-level impacts of the dust storm.

Following the Asian Dust Cloud

Formation over the Gobi Desert

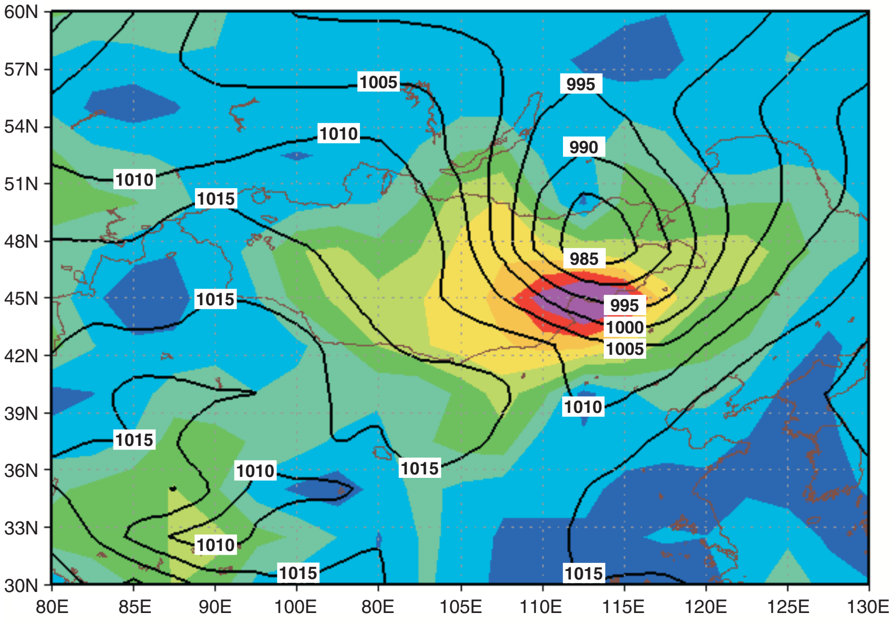
Wind-blown dust in eastern Asia is a locally well-known springtime occurrence. The dust storms tend to originate in the arid deserts of Mongolia and China, particularly the Gobi Desert, and spread eastward with the prevailing winds. The dust cloud itself forms when the friction from high surface winds, with speeds typically in excess of 5 m/s,[5] lifts loose dust particles up into the boundary layer and lofts them into the free troposphere where they can be transported eastward.[3]

An analysis of surface meteorological data for April 6 from the National Center for Environmental Prediction/National Center for Atmospheric Research (NCEP/NCAR) Reanalysis Project[6] indicates that a strong Siberian low-pressure area (985 mb) was located in northeastern Mongolia (Figure 2). This feature, coupled with relatively higher pressure to the south, produced strong surface winds in excess of 24 m/s in eastern and southern Mongolia. The windspeeds shown are well above the threshold for particle suspension of 5 to 6 m/s[5] and are located over the Gobi Desert region.

The deep low-pressure area evident in Figure 2 continued to propagate eastward on April 7 with the center of maximum winds mirroring the track of the cyclone (low-pressure area). Averaged over a 24-hour period, the maximum surface winds were greater than 20 m/s. The sustained windspeed combined with the upward vertical velocities associated with the low-pressure system were sufficient to elevate the dust above the boundary layer for transport. An analysis of the circulations at 700 and 500 mb showed that the flow was essentially zonal (along the latitude) and toward the east-northeast. The zonal flow allowed the dust cloud a relatively direct pathway to the Pacific Ocean.

Satellites also confirm the formation of the dust cloud. Figure 3 is a composite AVHRR image from the National Oceanographic and Atmospheric Administration (NOAA)-16 satellite centered over Mongolia and northern China on April 6. This image clearly shows the wind-driven dust over southeastern Mongolia becoming entrained in the low-pressure system to the north. The low-pressure area is indicated in the image by the cyclonic cloud formation. The location of the blowing

Figure 2. April 6, 2001, surface windspeeds (color-shaded regions in m/s) overlaid with sea level pressure contours (mb) over the Mongolia and northern China region.



dust, highlighted by the red arrows, correlates well with the center of maximum surface winds shown in Figure 2.

Transport across the Pacific Ocean

Once the dust cloud reached the Pacific Ocean on April 8, it was carried by the northern midlatitude westerly winds (30°–60°N) that are typical during the springtime. Figure 4, created using data from both TOMS and SeaWiFS,[7] shows the daily progression of the dust cloud.[8] The TOMS aerosol index (AI) has been used in the past to show the daily spatial distribution of dust clouds.[9]

As shown in Figure 4, the dust cloud remained fairly compact, with no large sections peeling off northward and no evidence that longitudinal stretching occurred. It is difficult to determine the actual height at which the cloud was transported. Its rapid movement across the Pacific Ocean (5-day average speeds in excess of 20 m/s at 500 mb) and the lack of strong removal processes suggest that the cloud was in the free troposphere and traveling with the strong trans-Pacific westerly flow. The transport speed and zonal flow pattern during this period were verified by an analysis of the circulation at 500 mb.

Transport across the United States

As Figure 4 shows, the dust cloud first passed over the west coast of North America on April 12 and 13, initially impacting Canada and then the United States. An analysis of meteorological data (Figure 5d–f) shows that the transport of the dust cloud in the free troposphere on April 12 and 13 was from the northwest around the top of a high-pressure ridge that was off the coast of the United States. The pattern then became zonal, which lasted until April 15, when a large high-pressure ridge developed over the Rocky Mountains. The strong ridge moved slowly eastward, carrying the dust cloud with it. Once the ridge moved into the Southeast, it became stalled, allowing the dome of high pressure to increase in size and strengthen, thus trapping the dust cloud within it. The ridge over the Southeast lasted from April 19 to 23, causing southwesterly flow into the Northeast. This flow transported the dust cloud from the Southeast into the mid-Atlantic and Northeast regions on April 22 and 23.

Figure 3. NOAA-16 AVHRR image of the dust storm over Mongolia for April 6, 2001 (Image courtesy of NOAA).

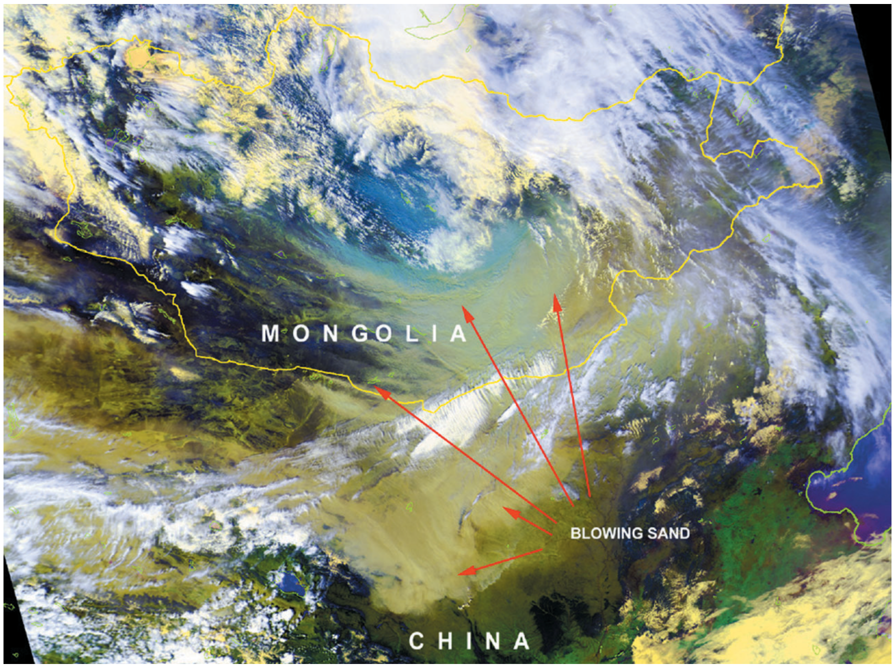
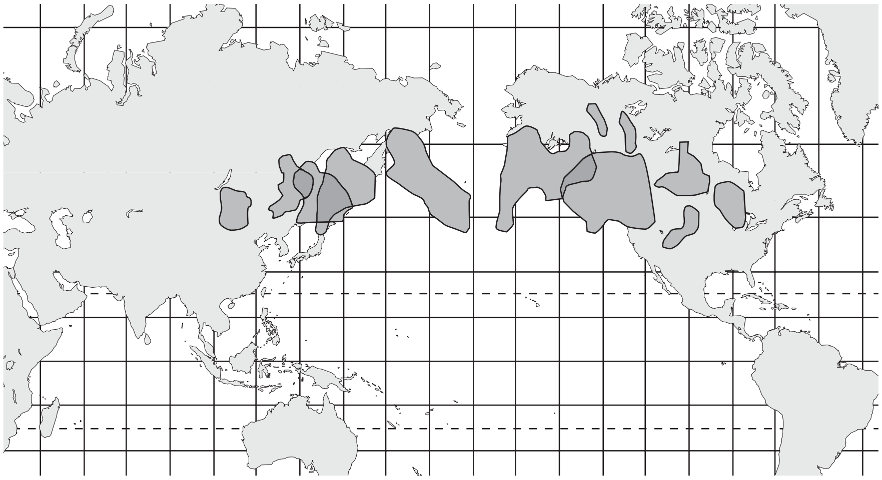


Figure 4. Path of the dust cloud from Asia to the United States, April 6 through April 14, 2001.



A review of TOMS AI and SeaWIFS to assess the temporal and spatial movement of the Asian dust as it crossed over the United States indicates that there were several days that the TOMS AI showed a dust cloud covering much of the United States. An analysis of meteorological conditions in conjunction with the measurements taken at PM monitors indicates that large-scale transport from the free troposphere to the boundary layer did not always occur. In some instances, it appears that the Asian dust was transported over the entire United States with relatively little effect on PM concentrations below (Figure 5).

However, as the dust cloud passed over the United States, monitors in some locations did measure elevated concentrations (>5 $\mu g/m^3$) of the soil component of $PM_{2.5}$ at some time during the month of April 2001, as discussed later in this paper. A closer look at the meteorology, including the location and movement of ridges and troughs from west to east, the rising or sinking of large-scale areas of air (negative and positive omega [ω], respectively) at 700 mb,[10] and the calculation of trajectories using the HYbrid Single-Particle Lagrangian Integrated Trajectories (HYSPLIT) program,[11–13] helps to explain the timing and location of the elevated particulate concentrations with respect to the cloud of Asian dust. Three dates are described here, corresponding to three areas of the country that were affected by the dust cloud: the West, the Southeast, and the Mid-Atlantic/Northeast.

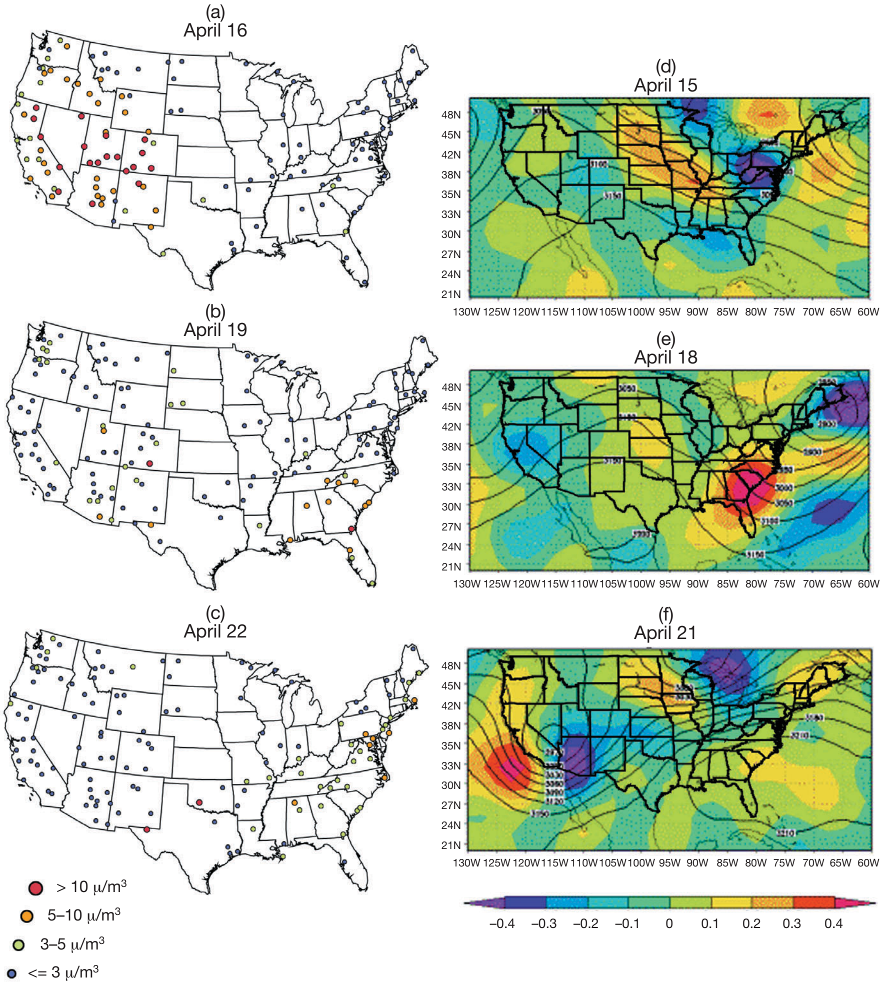
April 16, the West

As shown in Figure 5 (a and d), the peak concentrations seen over the West on this day can be attributed to the synoptic-scale ridging that was in place on April 15. The development of this ridge, coupled with the elevated terrain of the West, caused descending air. This large-scale sinking of air typically occurs under domes of high pressure. Also influencing the concentrations in the West is the likelihood that the dust cloud would have its greatest impact in this region because its first opportunity for measurable deposition was here. The high concentrations in the boundary layer were supported by numerous reports of decreased visibility at many of the national parks (Figure 6) and major cities located in that region, as well as with laser radar (LIDAR) measurements taken in Boulder, CO, on April 15.[14]

April 19, the Southeast

The peak concentrations seen in the Southeast on April 19 (Figure 5b) can be attributed to large-scale dynamic forcing that is associated with episodes of strong sinking motion (positive ω). Figure 5e shows the 700-mb height and omega patterns over the Southeast for April 18. A large area of sinking air is shown in red over this region, suggesting that for the Southeast there is a 1-day lag

Figure 5 (a–c). Peak $PM_{2.5}$ estimated soil mass from IMPROVE and STN monitoring networks.
(d–f) NCEP/NCAR reanalysis data for ω (color-shaded regions in pascal/s), overlaid with 700-mb heights.



between the day of peak positive ω (sinking motion) and the peak concentrations measured at the monitors on April 19. The length of the lag appears to depend on the meteorology but may also be exaggerated by the once-every-3-day monitoring schedule, as well as the fact that 24-hour PM concentrations are determined by averaging hourly measurements from midnight to midnight.

Results of a 3-day backward ensemble trajectory (Figure 7) provide insight into the origin of the air mass coming into the Southeast on April 19. The backward ensemble trajectory starts from four separate monitoring locations: Okefenokee, FL, Cape Romain, SC, Great Smoky Mountains, TN, and Gulfport, MS.

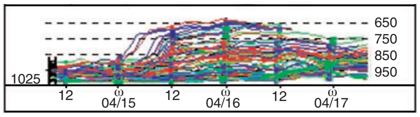
The results for the four ensemble trajectories show consistent flow fields with little divergence from the general origin of the air mass, which is the Midwest. The trajectory results were not surprising when compared to the NCEP/NCAR reanalysis data over the same time period. The NCEP/NCAR reanalysis data for the 700-mb heights (Figure 5e) show a northerly flow from the Midwest into the Southeast. A comparison of the vertical motion of the trajectories with ω (Figure 5e) shows good agreement with a large area of sinking air in the Southeast on April 18. When compared with the April 17 TOMS AI and SeaWIFS (Figure 8), this information suggests that the large dust cloud passing over the Great Lakes region is the likely source of the elevated levels of particulate matter.

April 22, Mid-Atlantic/Northeast

The peak concentrations seen in the mid-Atlantic and Northeast on April 22 (Figure 5c) can be attributed to a combination of ridging over the Southeast and a pattern of generally subsiding air over the region. The

Figure 6. Haze over Glen Canyon National Recreation Area (UT, AZ) on April 16, 2001.[4]

Figure 7. Three-day backward ensemble trajectories originating from Okefenokee, FL (30.74 N 82.13 W), Cape Romain, SC (32.94 N 79.66 W), Great Smoky Mountains, TN (35.63 N 83.94 W), and Gulfport, MS (30.39 N 89.05 W) and ending at 15 UTC (11:00 a.m. EDT) on April 19, 2001.



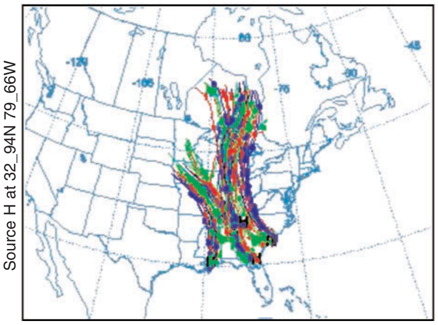
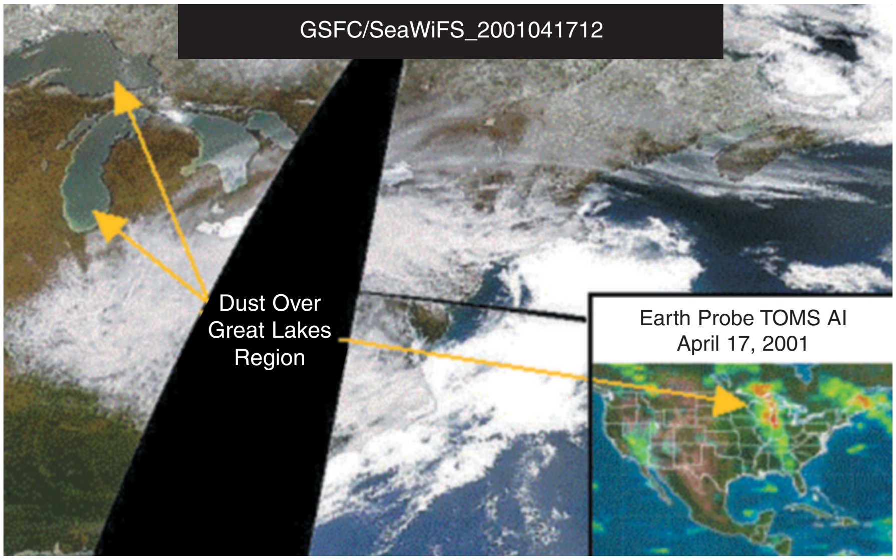


Figure 8. The SeaWiFS image taken on April 17, 2001, shows dust over the Great Lakes region. The eclipsed area in the image is a result of areas not covered during the SeaWiFS overpass on this day. The inset shows that TOMS Aerosol Index for April 17 also captures the dust cloud over the Great Lakes region, extending down into the southeastern United States.



NASA/Goddard Space Flight Center, The SeaWiFs Project, and ORBIMAGE Science Visualization Studio.

ridging over the Southeast seen on April 21 (Figure 5f) is associated with a developing dome of high pressure that generated southwesterly flow toward the Northeast around the periphery of the high. This return flow would have transported any boundary layer pollution (i.e., dust) located over the region into the mid-Atlantic and northeast regions. This synoptic feature, coupled with any sinking air that forced down the remains of the dust cloud, is a likely cause of the increased particulate concentrations seen in the mid-Atlantic/Northeast. A series of backward trajectories from several mid-Atlantic and northeastern monitoring sites with elevated particulate matter concentrations on April 22 indicate that air originated from the southeastern United States 2 days prior to April 22. This result is consistent with the results of the 700-mb analysis.

Assessing the Impact of the Asian Dust Cloud

Characteristics of Particulate Matter

Monitoring data from the $PM_{2.5}$ chemical Speciation Trends Network (STN)[15] and the Interagency Monitoring and Protected Visual Environment (IMPROVE) aerosol monitoring network[16] were used to examine the elemental soil components. In addition, mass measurements from the national PM_{10} and $PM_{2.5}$ Federal Reference Method (FRM) networks were used to assess the health impact of the April 2001 dust event across the United States.

The STN and IMPROVE network use similar sampling and analytical methods to generate similar aerosol composition data. The soil component of $PM_{2.5}$ can be determined from the measurements made by these networks using the following formula:

$$PM_{2.5}\text{ dust} = 2.2[Al] + 2.49[Si] + 1.63[Ca] + 2.42[Fe] + 1.94[Ti].^{17}$$

In the United States, dust (also called crustal material or soil) in the ambient air typically originates from wind-blown dust, road surface materials, construction activity, and certain agricultural activities.[18] Dust particles are typically less than 10 µm in diameter. Those particles nominally less than 2.5 µm in diameter are typically measured as part of the fine ($PM_{2.5}$) mass. Those between 2.5 and 10 µm are typically measured as part of the coarse (PM_{10}–$PM_{2.5}$) mass. Because monitors do not have a perfectly sharp size separator at the 2.5-µm cutpoint, some of the particles greater than 2.5 µm can be captured as $PM_{2.5}$ mass, and some of the particles measuring less than 2.5 µm can be captured as coarse mass.[19] The degree to which this occurs varies, depending on the monitoring device and particle separator. During the April 1998 Asian dust event, the mass mean diameter of the dust was observed to be 2 to 3 µm, overlapping the 2.5-µm cutpoint.[3]

Soil concentrations make up only a small fraction of $PM_{2.5}$ in the East and most areas of the West. Other components such as sulfates, nitrates, and carbon make up the majority of the $PM_{2.5}$ mass. Concentrations of these components are influenced by meteorology and emission sources and, therefore, vary by season and region of the country.

Because very few speciation data are available for the coarse mass, and there is a growing network of $PM_{2.5}$ speciation data, the analyses in this paper focus on $PM_{2.5}$ soil components. Results relevant to EPA's particulate matter health standards are shown in terms of $PM_{2.5}$ and PM_{10} mass.

Examining Historical Trends

Although 24-hour $PM_{2.5}$ soil concentrations are typically low (<3 µg/m^3),[20] unusual events such as dust storms can cause short-term peaks. Local dust storms in the desert Southwest are relatively common. However, long-term transport of dust from Asia to North America is not, although there is evidence suggesting that Asian dust storms have become more intense in the past decade. Recent studies have linked the increased intensity to climate change, drought conditions, and land use practices in China.

The dust transported from Asia in April 2001 caused the soil component of $PM_{2.5}$ to rise dramatically at certain locations in the United States, with some monitoring sites seeing record-high levels. The $PM_{2.5}$ soil concentration at Canyonlands National Park in southeast Utah (Figure 9), for example, measured 16.6 µg/m^3, twice as high as any previous measurement on record. However, other sites have measured higher levels in previous years. Sula, MT (Figure 10), for example, recorded a higher concentration during the April 1998 Asian dust event.[3] At sites in the Southeast, such as Okefenokee National Wildlife Refuge in Georgia (Figure 11), the peaks in previous years are consistent with seasonal Sahara dust transport.

April 2001 is the first time that East Coast soil peaks have been associated with dust transport from Asia. The site at Brigantine National Wildlife Refuge in New Jersey (Figure 12), for example, had a peak soil concentration of 7.8 µg/m^3 on

Figure 9. Historical $PM_{2.5}$ soil concentrations at Canyonlands National Park.

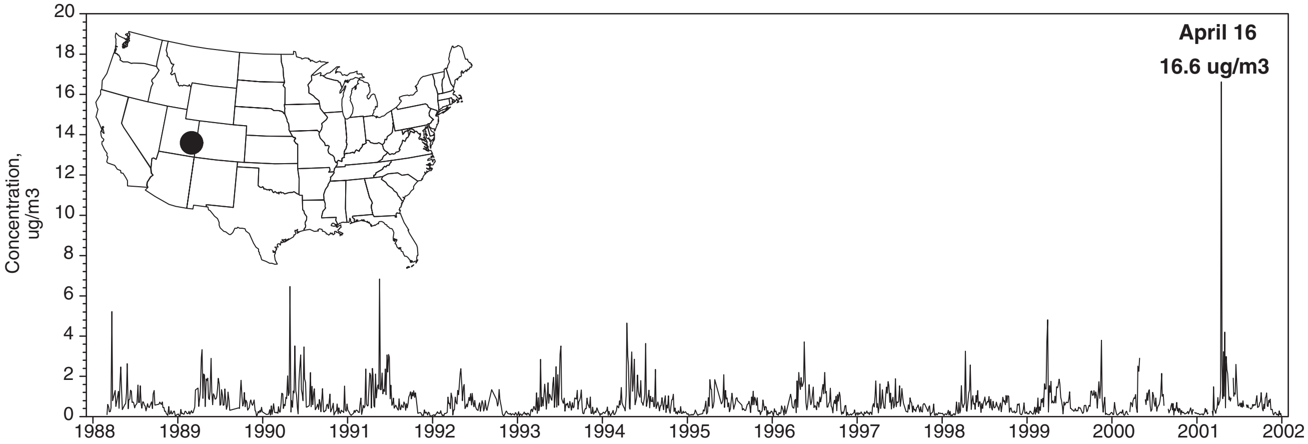


Figure 10. Historical $PM_{2.5}$ soil concentrations at Sula Wilderness Area.

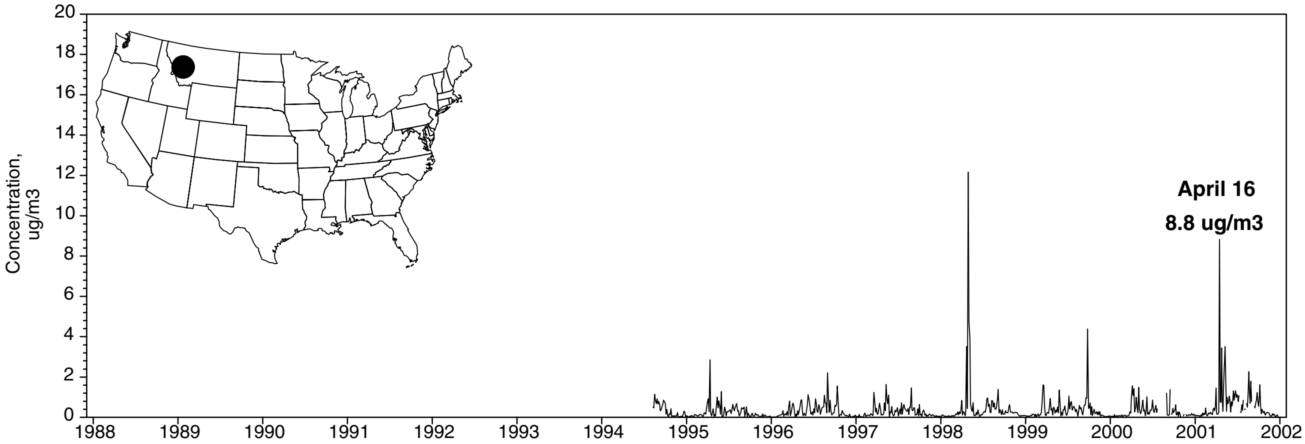


Figure 11. Historical $PM_{2.5}$ soil concentrations at Okefenokee National Wildlife Refuge.

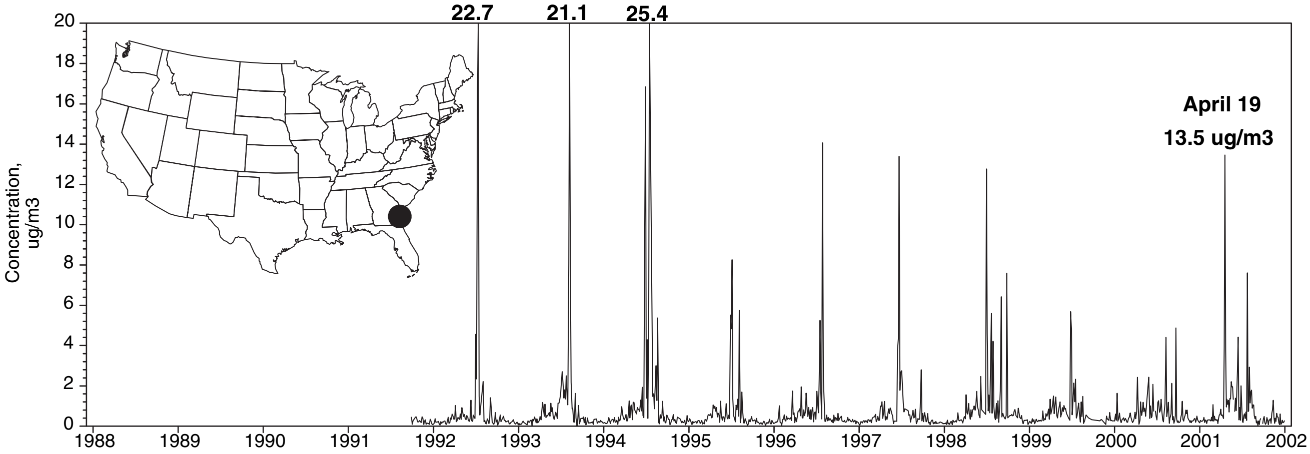
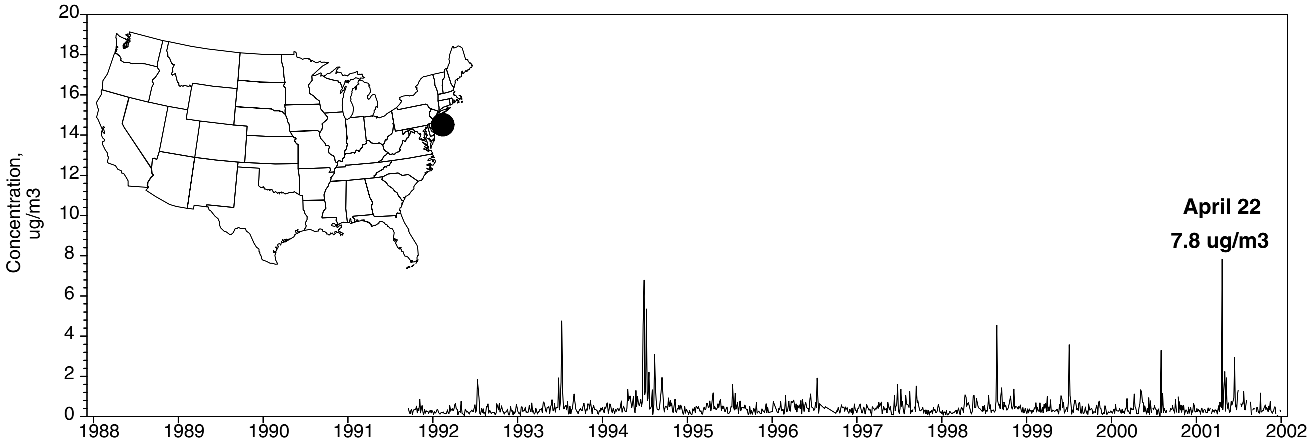


Figure 12. Historical $PM_{2.5}$ soil concentrations at Brigantine National Wildlife Refuge.



April 22. Other sites along the East Coast, from Florida to Maine, had modest increases in soil concentrations from mid to late April.

Estimating Asian Dust Contribution to PM2.5 Mass

A logical next step in assessing the impact of this dust event on $PM_{2.5}$ mass concentrations was to estimate the soil increment associated with Asian dust on days with peak soil concentrations. The IMPROVE network provided enough historical data to develop a baseline of "typical" April soil concentrations. The typical April soil concentration was represented by the median of all April observations from years other than 2001. An estimate of Asian dust contribution was obtained by subtracting the typical April soil contribution from the peak soil concentration on a site-by-site basis. In this way, an estimate of Asian dust contribution was obtained for every IMPROVE site having adequate data. A graphical illustration of this procedure is provided in Figure 13.

Table 1 groups the sites by date of peak soil concentration. Because it is less resistant to extreme values, the median among sites is used to represent typical values for each date. As might be expected from the dust cloud location shown earlier in this paper, most sites in the West had peak concentrations on April 16. The median Asian dust contribution was 7.4 µg/m^3, ten times as much as the median of the typical April soil concentrations (0.7 µg/m^3). The highest Asian dust contribution on this date (21.2 µg/m^3) occurred at a site in Death Valley, CA. The $PM_{2.5}$ and PM_{10} mass values at this site were 30.7 µg/m^3 and 59.9 µg/m^3, respectively.

On April 19, sites in the Midwest and Southeast experienced peak soil concentrations. The Asian dust contribution on this date was 3.6 µg/m^3, compared to 0.5 µg/m^3 for typical April days. The site with the highest contribution (12.9 µg/m^3) was the Okefenokee National Wildlife Refuge in southeastern Georgia. The $PM_{2.5}$ and PM_{10} mass values at this site were 22.2 µg/m^3 and 50.7 µg/m^3, respectively.

On April 22, sites in the mid-Atlantic and Northeast experienced peak soil concentrations. The Asian dust contribution was 3.1 µg/m^3, compared to typical April soil concentrations (0.4 µg/m^3). The site at Brigantine National Wildlife Refuge had the highest Asian dust contribution (7.4 µg/m^3). The $PM_{2.5}$ and PM_{10} mass values at this site were 24.4 µg/m^3 and 50.6 µg/m^3, respectively.

The dates of the peaks in soil concentrations correspond directly to the meteorological and satellite information presented in earlier sections. The median Asian dust contribution ranges from 3.1 to 7.4 µg/m^3 during the April 16–22 period, with double-digit contributions in some locations.

Examining Soil Composition on Peak Days

There is some uncertainty associated with the composition of transported dust, mainly because of the lack of speciation data, especially for the coarse fraction. However, some insights can be gained by examining the $PM_{2.5}$ speciation data measured during the April 2001 Asian dust event.

We examined various elemental concentrations and ratios in search of potential indicators of Asian dust. Specifically, we compared the primary elemental soil components on the April 2001 peak days with typical April days (represented by the median of April data from other years). We then identified a subset of 20 sites with peak soil concentrations

Figure 13. PM$_{2.5}$ soil concentrations, April 2001 vs. typical April days, at Brigantine National Wildlife Refuge.

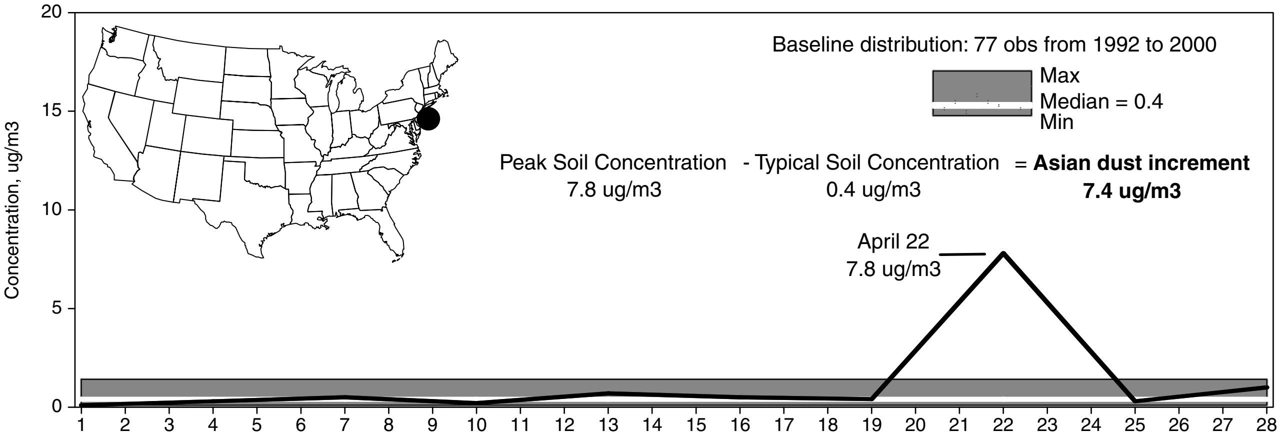


Table 1. Summary of Asian Dust Contribution by Date

Date	Number of Sites	Site Locations	Median Typical April Soil Concentration (μg/m^3)	Median Asian Dust Contribution (μg/m^3)	Maximum Asian Dust Contribution (μg/m^3)
4/16/01	43	West (AZ, CA, CO, ID, MT, NM, NV, OR, UT, WA, WY)	0.7	7.4	21.2
4/19/01	19	Midwest and Southeast (FL, GA, MI, MN, NC, ND, SC, SD)	0.5	3.6	12.9
4/22/01	16	Mid-Atlantic and Northeast (DC, KY, ME, NJ, VA, VT, WV)	0.4	3.1	7.4

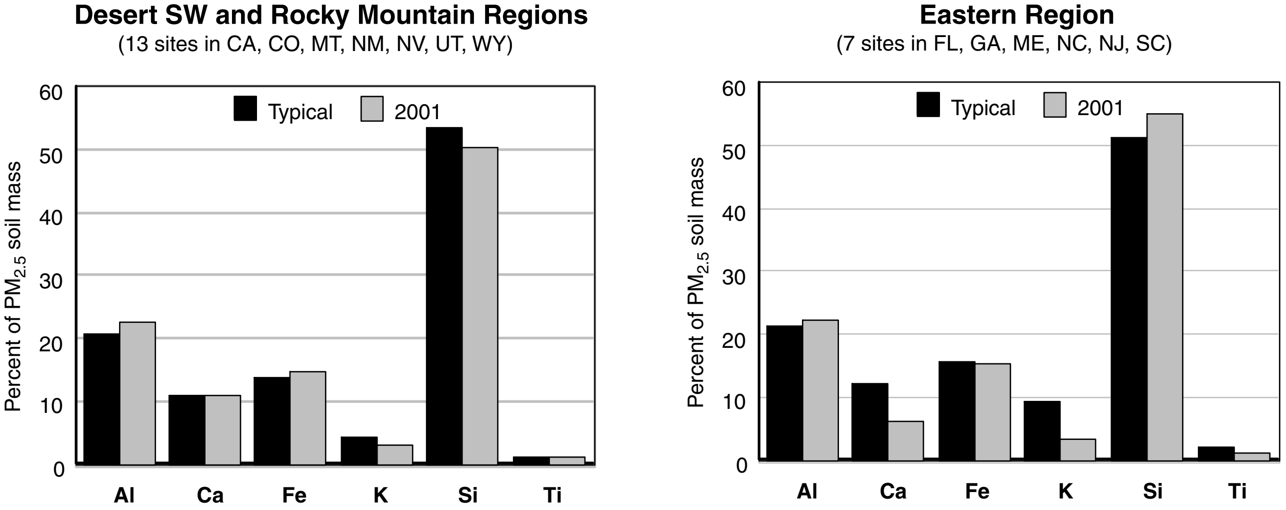
corresponding to the position of the dust cloud. The most distinctive contrast among the indicators was potassium (K) as a percent of total PM$_{2.5}$ soil mass. The percent of potassium (%K) was 3 to 4 on the peak days. In eastern areas where %K is typically much larger, this appears to be a good indicator that the soil composition is atypical. However, in the desert Southwest and Rocky Mountain regions, where the %K is typically 4, the ratio is of little help. Figure 14 is an aggregation of the data at sites in these regions.

In addition to %K, the percent of calcium (%Ca) and the percent of silicon (%Si) between 2001 peak days and typical days are significantly different in the eastern sites. Because the peak day %Ca and %Si are different in the western locations vs. the eastern locations, it is too early to speculate whether they could be potential indicators of Asian dust. It is certainly possible that the dust size and composition differ after several days and several thousand miles of transport. More speciation data, especially in the coarse range, could help explain differences in composition of transported dust.

Assessing Potential Health Impact

As the satellite and meteorological information suggests, only certain regions (coinciding with the position of the dust cloud and the vertical movement of air) experienced elevated soil concentrations and, consequently, higher PM$_{10}$ and PM$_{2.5}$ concentrations. Sometimes the increase was reflected evenly in the coarse and fine fractions, but in most cases the coarse fraction showed a larger increase than the fine. Two examples of the effect of this Asian dust event on PM$_{10}$ and PM$_{2.5}$ mass are shown in Figures 15 and 16. The peak at the Salt Lake City site occurred on April 16. In this example, most of the increase is reflected in the coarse fraction. On April 22, several days later, concentrations peaked at the Acadia National Park site in Maine. Unlike the Salt Lake City example, more of the increase here is reflected in the fine fraction.

Figure 14. Summary of $PM_{2.5}$ soil composition on April 2001 peak days vs. typical April days, by region.



In the preceding examples, the resulting PM mass concentrations show an increase, but the peaks are not above a significant level of health concern for the general population. EPA has designed an index, the Air Quality Index, to communicate information about daily air quality and associated health concerns. According to the AQI, cautions for sensitive populations (people with heart or lung disease, older adults, and children) are associated with daily $PM_{2.5}$ and PM_{10} concentrations greater than 40.4 µg/m^3 and 154 µg/m^3, respectively. These concentrations correspond to an AQI value of 100. The cautionary statement associated with PM concentrations at this level of concern says that "people with heart or lung disease, older adults, and children should limit prolonged or heavy exertion." There are additional health concerns associated with higher concentration ranges.[22]

There were nine areas (cities or counties) corresponding to the general location and movement of the dust cloud that had at least 1 day with an AQI value above 100 for $PM_{2.5}$ or PM_{10}. Four of these areas had no days above 100 during the entire spring season in the surrounding years (1999, 2000, and 2002). Unfortunately, there are no speciation data in these areas for estimating Asian dust contribution. However, based on estimates computed previously for nearby IMPROVE sites, three of the nine areas might have actually been below 100 were it not for Asian dust contribution. Still, further review and, in some cases, additional data might be needed to determine exact contributions from Asian dust versus dust from other sources.

Because this transport event occurred in April, a temperate part of the year, meteorological conditions were not conducive to the formation of sulfates, nitrates, or organic carbon (major components of $PM_{2.5}$ mass). If higher levels of any of these components were combined with the increased dust concentrations, there might have been more AQI values above 100.

With respect to EPA's long-term health standard for $PM_{2.5}$, the 1- or 2-day increases from this dust event had relatively little effect. For example, when the "Median Asian Dust Contribution" (3.1 to 7.4 µg/m^3, depending on region) from Table 1 is excluded from the 3-year averages for 1999 through 2001, the averages are 0.1 µg/m^3 lower. This small shift could be important for any sites bordering the level of the standard of 15.0 µg/m^3. For this particular 3-year period, there were three counties with averages of 15.1 µg/m^3, just above the standard. Further review would be required to determine whether or not the sites in these counties were affected by the Asian dust and to what extent.

Conclusions

On April 6, 2001, the combination of strong surface winds and an intense area of low pressure over the Gobi Desert produced a large dust cloud that was lofted into the free troposphere and transported eastward. The dust cloud, captured and tracked by satellite imagery, made its way across the Pacific Ocean and ultimately reached the United States on April 12 and 13. Once the cloud was over the United States, sinking air associated with large areas of subsidence and strong downward vertical motion appeared to coincide

Figure 15. Daily PM_{10}, $PM_{2.5}$, and soil ($PM_{2.5}$) concentrations at Salt Lake City, UT.

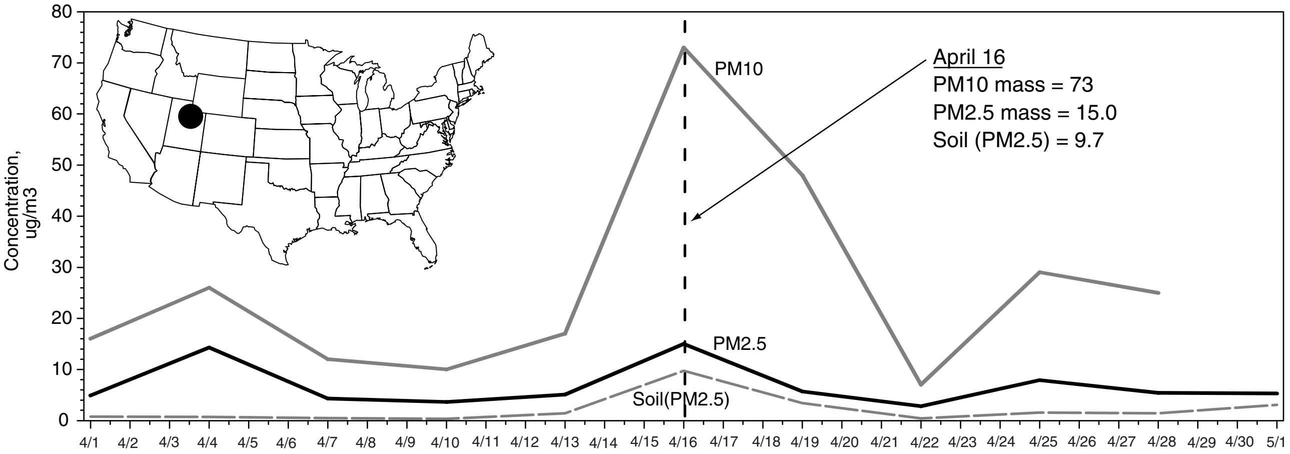
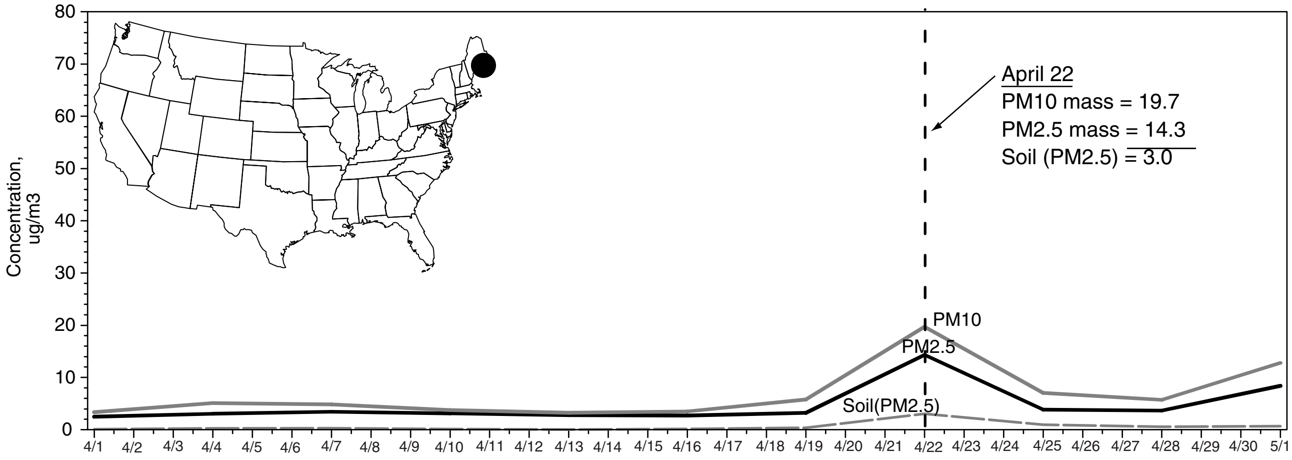


Figure 16. Daily PM_{10}, $PM_{2.5}$, and soil ($PM_{2.5}$) concentrations at Acadia National Park, ME.



with increased soil concentrations in certain areas of the country. In some instances, there appeared to be a lagged relationship (days with increased concentrations lagging days of strong downward vertical motion). This lag could be exaggerated by the once-every-3-day monitoring schedule as well as 24-hour averaging technique employed at the monitoring sites.

Although the TOMS imagery showed days with a dust cloud over much of the United States, an analysis of meteorological conditions in conjunction with IMPROVE and STN monitors indicated that large-scale transport to the boundary layer (which would result in increased particulate matter concentrations) did not occur everywhere. Ridges and troughs, rising or sinking air, and trajectories showing the origins and paths of air masses were all examined to gain an increased understanding of how and when the Asian dust cloud affected the monitors below.

In the areas identified by the satellite and meteorological information, chemical speciation data showed that Asian dust contributed “on average” 3.1 to 7.4 µg/m^3 to the total $PM_{2.5}$ mass concentrations during the April 16–22 period. There were nine areas (cities or counties) corresponding to the general location and movement of the dust cloud that had at least 1 day with an AQI value above 100 for $PM_{2.5}$ or PM_{10}. Values for three of the nine areas might have actually been below 100 were it not for Asian dust contribution. Still, further review and, in some cases, additional data might be needed to determine exact contributions from Asian dust versus dust from other sources.

Because the event occurred in the

springtime when daily concentrations of other PM components are generally low, there were relatively few areas with AQI days above 100. If higher levels of any of these components were combined with the increased dust concentrations, there might have been more AQI values above 100.

With respect to EPA's long-term health standard for $PM_{2.5}$, this dust event raised the 3-year average by an estimated 0.1 $\mu g/m^3$ in the affected regions. For most sites, this is insignificant, but there are implications for sites with 3-year averages just above the level of the standard.

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Chemical Speciation of $PM_{2.5}$ in Urban and Rural Areas

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Abstract

Data from the Interagency Monitoring of PROtected Visual Environment (IMPROVE) and the Speciation Trends Network (STN) are used to analyze the chemical composition of $PM_{2.5}$ and to explore issues associated with interpretation of their measurements. The data from the largely rural IMPROVE network and urban STN are used to examine spatial patterns and to develop estimates of the local urban excess over the regional background concentrations. This work will give some insights into which of the chemical constituents are driving urban excess of $PM_{2.5}$ mass in different regions of the United States.

Introduction

With the promulgation of the new Particulate Matter National Ambient Air Quality Standards ($PM_{2.5}$ NAAQS), all future designated nonattainment areas and surrounding regions may need to reduce emission of fine particles and their precursors to permit those areas to attain the NAAQS. Efficient air quality management requires knowing which sources contribute to the problem and how much. Determining $PM_{2.5}$ source contributions is complicated due to the fact that often half or more of the $PM_{2.5}$ mass is composed of secondarily formed species,[1] hiding their point of origin. In addition, $PM_{2.5}$ has a lifetime on the order of several days,[2] enabling sources up to 1,500 miles away to affect a source region.

This work examines a simple subset of the source apportionment problem by providing evidence for local and regional source contributions and first-order approximations of their respective contributions to the following major urban areas: Fresno, CA, Missoula, MT, Salt Lake City, UT, Tulsa, OK, St. Louis, MO, Birmingham, AL, Indianapolis, IN, Atlanta, GA, Cleveland, OH, Charlotte, NC, Richmond, VA, Baltimore, MD, and New York, NY. This is accomplished by computing urban excess concentrations—by comparing annual concentrations of $PM_{2.5}$ mass and its most abundant chemical species at the urban monitors with nearby rural monitors. In the process of arriving at the urban excess numbers, several graphics are used to show the chemical species that make up $PM_{2.5}$ mass across the United States.

Data Sources

Ambient monitoring data from the $PM_{2.5}$ chemical Speciation Trends Network (STN) and the Interagency Monitoring of PROtected Visual Environmental (IMPROVE) aerosol monitoring network were the main sources of data used to assess the urban and rural $PM_{2.5}$ species concentrations across the United States.

The $PM_{2.5}$ STN was established by regulation[3] and is a companion network to the mass-based Federal Reference Method (FRM) network implemented in support of the $PM_{2.5}$ NAAQS. EPA established the STN network to provide nationally consistent speciated $PM_{2.5}$ data for the assessment of trends at representative sites in urban areas across the country. As part of a routine monitoring program, the STN quantifies mass concentrations and $PM_{2.5}$ constituents, including numerous trace elements, ions (sulfate, nitrate, sodium, potassium, ammonium), elemental carbon, and organic carbon. The STN began operation in late 1999, and there are currently a total of 54 STN sites.

In 1987 the IMPROVE aerosol monitoring network was established among federal and state agencies to provide information for determining the types of pollutants and sources primarily responsible for visibility impairment within federally designated Class I areas.[4] Ambient aerosol mass concentrations have been measured under the IMPROVE program to characterize the visibility conditions in these Class I areas since 1988. Over the past few years, the IMPROVE network has expanded from its original 20 monitoring sites to 110 sites in 2002. In addition, there are currently over 50 supplemental sites in regionally representative rural areas that deploy the exact same aerosol monitoring protocol. As with the STN, the IMPROVE network also quantifies mass concentrations and $PM_{2.5}$ constituents.

Both the STN and IMPROVE programs employ a 1-in-3-day sampling protocol.

Data Work-Up

The time period chosen for this analysis is the 1-year period from March 2001 to February 2002. Any references to an annual average will refer to these 12 months. Out of the possible 54 STN sites, 35 had "complete" annual data. Similarly, 98 IMPROVE sites had "complete" annual data for this time period. Complete data, for the purposes of this analysis, refers to 50% or more of the "relevant" species observations being present for the four quarters that make up the 12 months from March 2001 to February 2002. To be consistent with previous EPA characterizations[5] of the composition of ambient $PM_{2.5}$, the following "relevant" chemical species that make up $PM_{2.5}$ mass are considered in this analysis. The relevant species for the STN are nitrate, sulfate, organic carbon, elemental carbon, ammonium, and the trace elements that go into the "crustal" calculation: aluminum, silicon, calcium, iron, and titanium. Similarly, for IMPROVE, the relevant species are nitrate, sulfate, organic carbon, elemental carbon, and the same five trace elements that go into the "crustal" calculation. Because both networks employ a 1-in-3-day sampling protocol, the 50% completeness criterion amounts to there being 15 or more observations per quarter. No further requirement was imposed for matching days among sites or between networks. Quarters for the 12 months analyzed are defined in Table 1.

Figures 1 and 2 show the 35 STN and 98 IMPROVE locations that had complete data, as defined by the completeness criterion defined above, for the time period analyzed.

Table 1. Quarter Definitions

Quarter	Months Used in Analysis
1	January 2002, February 2002, March 2001
2	April 2001, May 2001, June 2001
3	July 2001, August 2001, September 2001
4	October 2001, November 2001, December 2001

Figure 1. 35 STN locations.

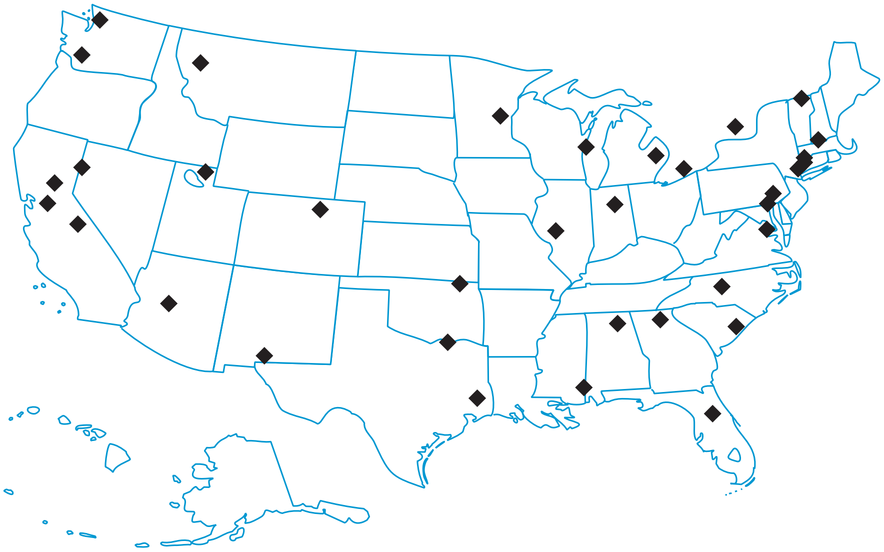
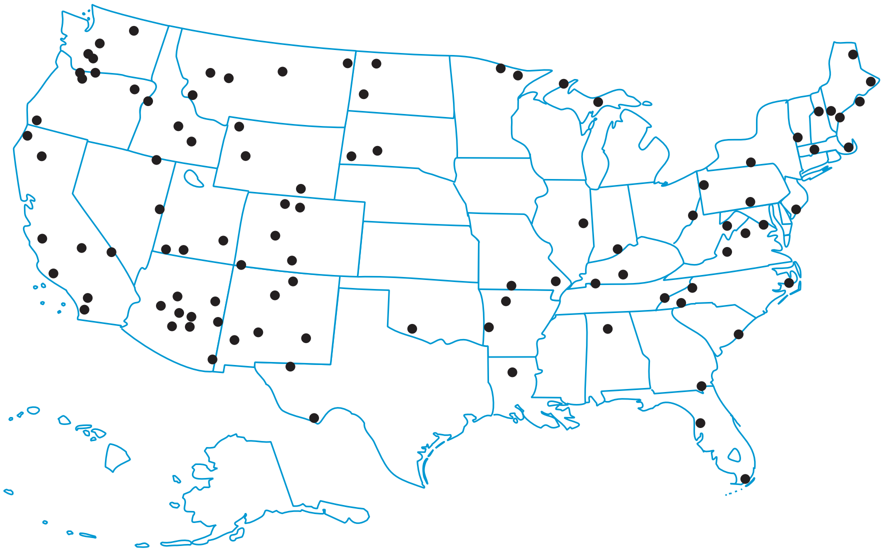


Figure 2. 98 IMPROVE locations.



Data Handling Protocols

Even though the STN and IMPROVE networks use similar sampling and analytical methods, there are differences in the species they measure and the operational protocols they employ. To put aerosol composition data derived from both these networks on an as-similar-as-possible basis, the following data handling protocols were employed:

- **Ammonium**: Although directly measured ammonium as performed by STN is important in characterizing the composition of $PM_{2.5}$, network-wide IMPROVE measurements are currently lacking in this area. Ammonium concentrations are thus estimated for IMPROVE (and for comparison purposes, for STN as well) from sulfate (SO_4) and nitrate measurements, assuming (1) all sulfates are ammonium sulfate (NH_4SO_4), and (2) all nitrates are ammonium nitrate. For now, the inter-network measure based on assumed ammonium sulfate and assumed ammonium nitrate compounds is more comparable and will therefore be used to define urban excess. These "estimated" ammonium concentrations are the values shown on all graphics that compare rural and urban ammonium concentrations.
- **Sulfate**: The IMPROVE program estimates sulfate concentrations as three times the sulfur concentration, whereas with the STN program, sulfate concentrations are used as measured. In this analysis, the sulfate ion measurement is used from both networks to represent sulfates.
- **Carbon**: Carbon is monitored somewhat differently by the IMPROVE and STN programs. The variances in their analytical and sampling procedures effectively result in two different operational definitions of organic and elemental carbon.[5,6] For this reason, organic (OC) and elemental carbon (EC) are not analyzed separately. Instead, total carbonaceous mass (TCM) is estimated as: TCM = k * OC + EC for both programs. Here k is the factor for converting measured organic carbon to organic carbon mass (to account for hydrogen, oxygen, etc.). Historically, EPA and IMPROVE programs have used k=1.4 to convert from carbon to carbon mass. Most recent findings by Turpin et al.[7] suggest that a higher factor to convert carbon to carbon mass may be needed in both urban and rural areas. In this work, both k=1.4 and k=1.8 are used to represent TCM. In some cases, TCM (k=1.8) is used to show total carbonaceous mass, whereas in other cases, comparisons are made between use of k=1.8 and k=1.4.[7]

The OC measurements reported by STN are blank-corrected data using network-wide estimates.[5] This is consistent with the approach used by the IMPROVE program.[6] The OC values reported by the IMPROVE program are automatically blank-corrected using an appropriate blank correction factor.[6] Table 2 lists the OC blank correction factors used for each of the speciation samplers that are in the STN network (also shown for comparison purposes is the IMPROVE blank correction factor). It should be noted that only organic carbon concentrations for the STN are blank-corrected (none of the other STN chemical constituents nor the total gravimetric mass is blank-corrected in this analysis).

Urban $PM_{2.5}$ Excess

Local and regional contributions to the urban centers were estimated by computing the differences between the concentrations of the annual average urban and nearby rural monitoring data. These estimates are thus a first approximation of local and regional contributions of $PM_{2.5}$ mass and its chemical constituents to the urban areas investigated. Although strong regional similarity exists for each of the chemical species on a large spatial scale, there are still local gradients that exist in the rural concentration domain. See, for example, Figures 3

Table 2. Organic Carbon (OC) Blank Correction Factors

Speciation Sampler	24-h Sample Volume, m^3	OC Blank Correction Factor ($\mu g/m^3$)
MetOne SASS	9.6	1.40
Anderson RASS	10.4	1.28
R&P 2300	14.4	0.93
URG MASS	16.7	0.56
IMPROVE	32.8	0.4

Soil: The soil component of $PM_{2.5}$ ("crustal" material) was computed using the following formula, which is the same as that employed by the IMPROVE program[8]:

$$PM_{2.5}\ \text{Fine Soil} = \text{“Crustal”} = 2.2[Al] + 2.49\ [Si] + 1.63\ [Ca] + 2.42\ [Fe] + 1.94[Ti].$$

through 5, which show spatially averaged concentrations of carbonaceous mass, sulfates, and nitrate for the March 2001–February 2002 time period (together with the annual mean concentrations at each IMPROVE monitoring location). Thus, the location of a rural site (for eventual pairing to an urban site to determine urban increments) may influence the amount of urban excess seen for the specific chemical constituents of $PM_{2.5}$. One way to remove this effect and standardize the choice of rural background concentrations is to use spatial interpolation to determine average concentrations for any particular urban location. Although doing this for all sites is beyond the scope of this paper, spatial averaging for rural concentrations was applied, albeit in a simple manner, at two urban locations. At the St. Louis, MO, urban site, three nearby IMPROVE sites were used to determine an inverse-distance-weighted annually averaged rural concentration for each of the species. Similarly at the Atlanta, GA, urban site, two nearby IMPROVE sites were used to determine an average annual rural concentration for each of the species. See the discussion in the next section and Table 3 for more information on the choice of pairing of specific urban/rural sites. In general, this approach assumes that the $PM_{2.5}$ at the rural sites is generally representative of the upwind regional concentrations and is not significantly influenced by nearby emissions and that the regional sources (including upwind urban areas) have the same impact on the rural monitors and the particular urban monitors.

Figure 3. Spatial averaging of rural sulfate concentrations.

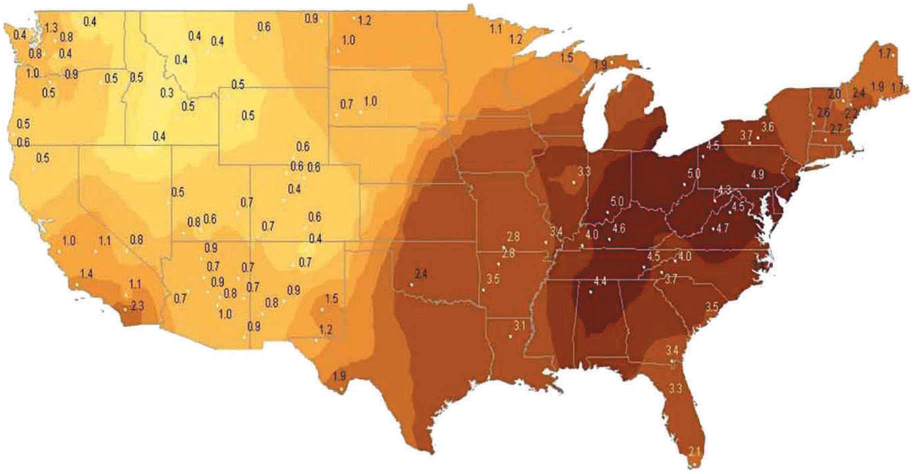


Figure 4. Spatial averaging of rural nitrate concentrations.

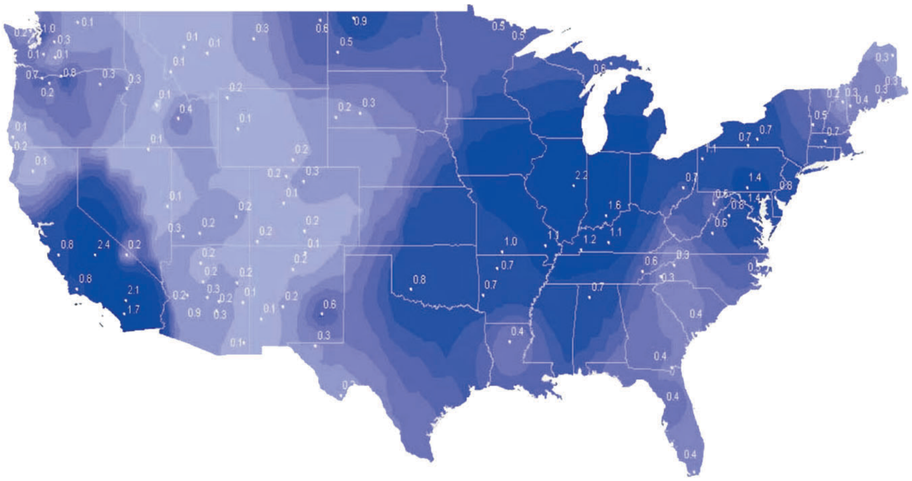
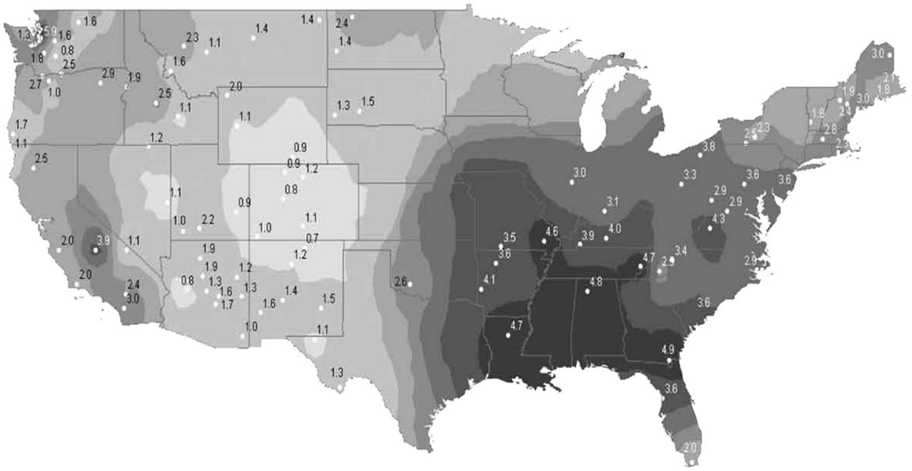


Figure 5. Spatial averaging of rural TCM (k=1,8) concentrations.



Choice of Urban and Rural Sites

Figure 6 summarizes the urban and rural locations chosen for this analysis. There are five urban sites (Bronx, NY, Baltimore, MD, Richmond, VA, Charlotte, NC, and Atlanta, GA) in the Northeast and Mid-Atlantic States, five urban sites stretching from north to south in the mid portion of the United States (Cleveland, OH, Indianapolis, IN, St. Louis, MO, Tulsa, OK, and Birmingham, AL), and three urban sites in the West (Fresno, CA, Salt Lake City, UT, and Missoula, MT). These were chosen due to their data being complete for the year in question as well as their ease in matching up with nearby IMPROVE rural (discussed further below) sites for the urban excess study. Except for Tulsa, they were also selected to represent states with reported $PM_{2.5}$ mass concentrations greater than 15 µg/m^3, which is the level of the annual $PM_{2.5}$ NAAQS. IMPROVE sites with complete data were chosen for assumed representativeness of upwind background concentrations. In the case of matching the urban Atlanta and St. Louis sites to nearby rural sites, a single available rural site with complete data was not judged to be sufficiently representative of the requisite requirement, and therefore a multiple site approach (as explained above) was employed.

Table 3 summarizes all the STN and IMPROVE sites for their elevation and separation distances. For the analyses of urban excess, all

Figure 6. Thirteen urban/rural site paintings.

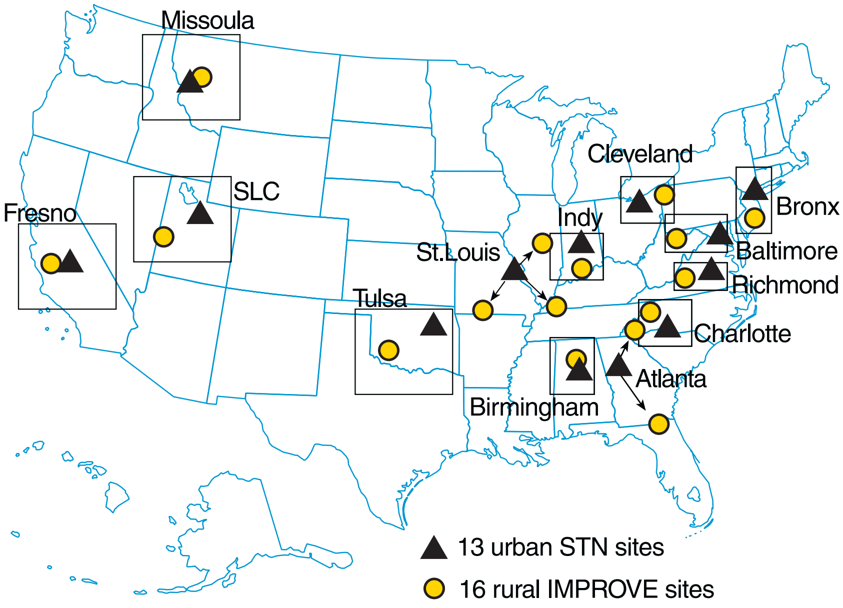


Table 3. STN and IMPROVE Site Particulars

Urban Location/Site	Elevation (m)	Rural Location/Site	Elevation (m)	Distance Apart (km)
Fresno, CA	96	Pinnacles National Monument, CA	317	28
Missoula, MT	975	Monture, MT	1,293	72
Salt Lake City, UT	1,306	Great Basin National Park, NV	2,068	277
Tulsa, OK	198	Wichita Mountains, OK	487	298
St. Louis, MO	0	Cadiz, KY	188	296
		Hercules-Glades, MO	423	322
		Bondville, IL	211	220
Birmingham, AL	174	Sipsy Wilderness, AL	279	100
Indianapolis, IN	235	Livonia, IN	298	142
Atlanta, GA	308	Okefenokee National Wildlife Refuge, GA	49	324
		Shining Rock Wilderness, NC	1,621	236
Cleveland, OH	206	M.K. Goddard, PA	383	129
Charlotte, NC	232	Linville Gorge, NC	986	132
Richmond, VA	59	James River Face, VA	300	179
Baltimore, MD	5	Dolly Sods/Otter Creek Wilderness, WV	1,158	256
Bronx, NY	0	Brigantine National Wildlife Refuge, NJ	9	165

urban/rural pairings were elevation-adjusted to account for the effect of 24-h average sample volume density on aerosol concentration. Both IMPROVE- and STN-reported data represent local conditions. This elevation adjustment was done in two steps: (1) all the concentrations from the IMPROVE sites were adjusted to sea-level conditions, and (2) all these sea-level-adjusted concentrations were adjusted once again to the elevation corresponding to the matched urban site. Except for the St. Louis and Atlanta STN monitors and their pairing with rural IMPROVE monitors, all other STN sites were matched one-on-one with the rural monitors listed in Table 3. In the case of St. Louis, the three IMPROVE monitors shown in Table 3 as matched sites were inverse-distance weighted, and the urban Atlanta site was compared to the averaged concentration(s) derived from the two IMPROVE sites shown in Table 3.

Elevation Effects on $PM_{2.5}$ Concentrations

As mentioned previously, all the IMPROVE data were adjusted for elevation (based on temperature and barometric pressure correction factors) twice: once to adjust to sea level and then again, as necessary, to adjust to the elevation of the matched urban site. Basically, this elevation adjustment is a small technical correction to make the "urban excess" calculation more meaningful. Other than at the Dolly Sods/Baltimore rural/urban pairing of sites, however, the urban/rural elevation differences were small, and these adjustments are very minor as can be seen in Figures 7 through 11, which show the effects of elevation adjustments for all the chemical species of interest at the 13 urban/rural paired combinations.

Figure 7. Effect of evaluation on rural sulfate concentrations.

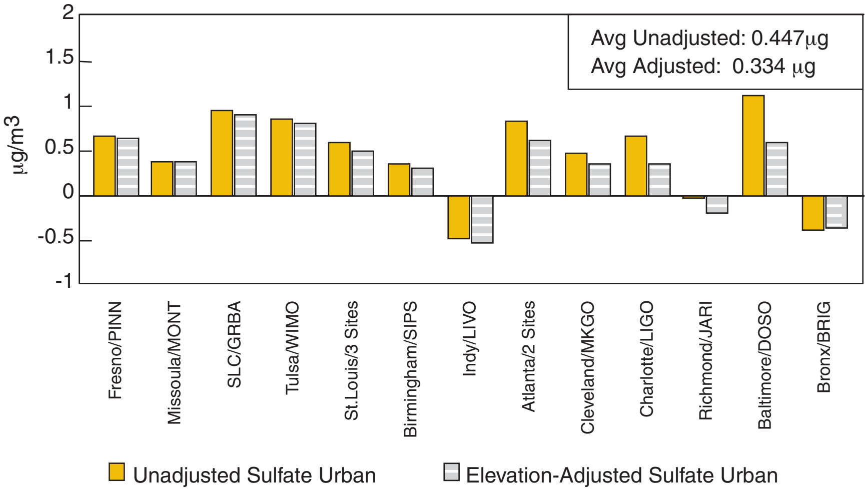


Figure 8. Effect of evaluation on rural ammonium concentration.

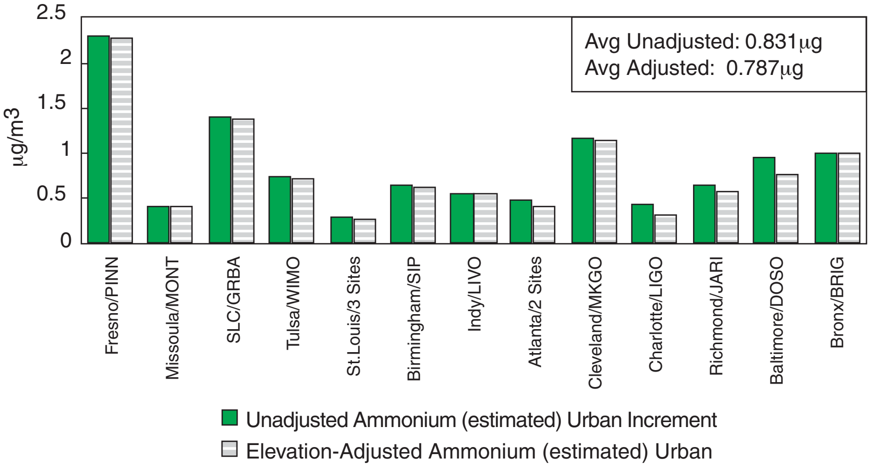
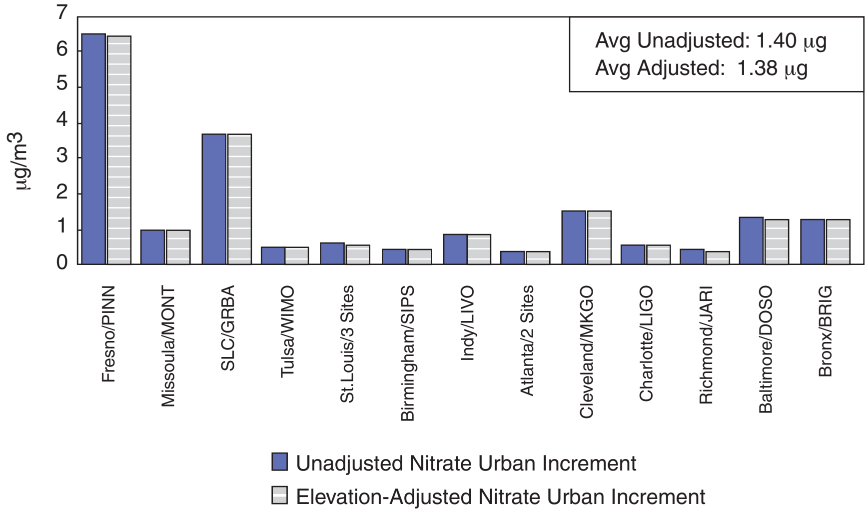


Figure 9. Effect of evaluation on rural nitrate concentration.



Urban Increments of $PM_{2.5}$ Mass and the Chemical Species

Urban sites were paired with matched rural sites as listed in Table 3, and the annual average concentrations were calculated for both the urban sites and the companion rural site(s). All rural values reflect elevation-adjusted values. These averaged rural concentrations were subtracted from the appropriate urban concentrations to arrive at the urban increments of mass and increments of the individual chemical species.

Shown first in Figure 12 is the comparison of urban concentrations to estimated regional background for total measured gravimetric mass. The difference is the “urban increment.” The height of each bar represents the annually averaged urban gravimetric mass. Overlaying the nearby rural gravimetric mass on top of the urban mass levels shows how much of the total mass can be attributed to rural vs. urban sources. It can be seen that Fresno, Cleveland, and Birmingham are the urban sites in this analysis with the largest urban $PM_{2.5}$ mass during the time period investigated. The largest urban increment in $PM_{2.5}$ mass is seen to be at the Fresno, CA, site, with an average excess of about 18 $\mu g/m^3$. The smallest urban increment for mass is seen to be at the St. Louis site, which shows an average urban excess of about 5 $\mu g/m^3$ total $PM_{2.5}$ mass. Although this result suggests that there are more local sources influencing urban $PM_{2.5}$ mass at the Fresno, CA, location than at the St. Louis, MO, location, the selected rural sites in the eastern United States may be more reflective of background concentrations. The Fresno site may be influenced by other $PM_{2.5}$ sources throughout the

Figure 10. Effect of elevation on rural TCM (k=1.8) concentrations.

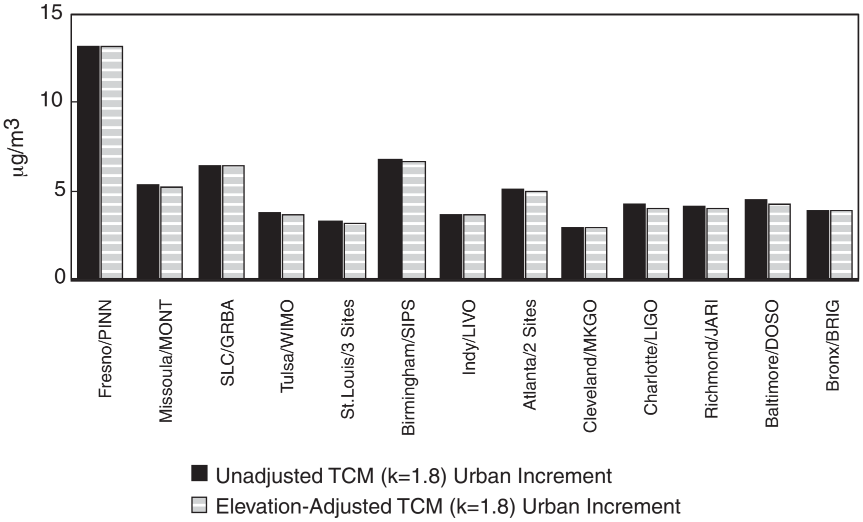


Figure 11. Effect of elevation on rural crustal concentrations.

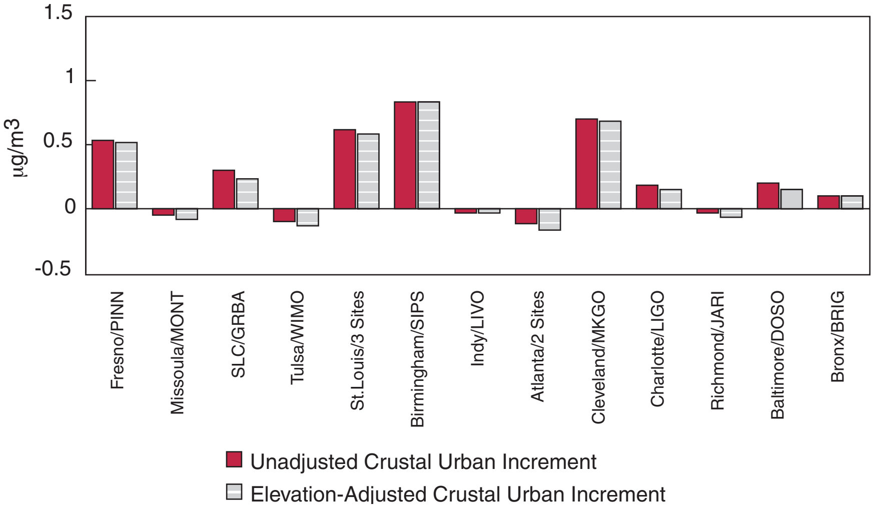
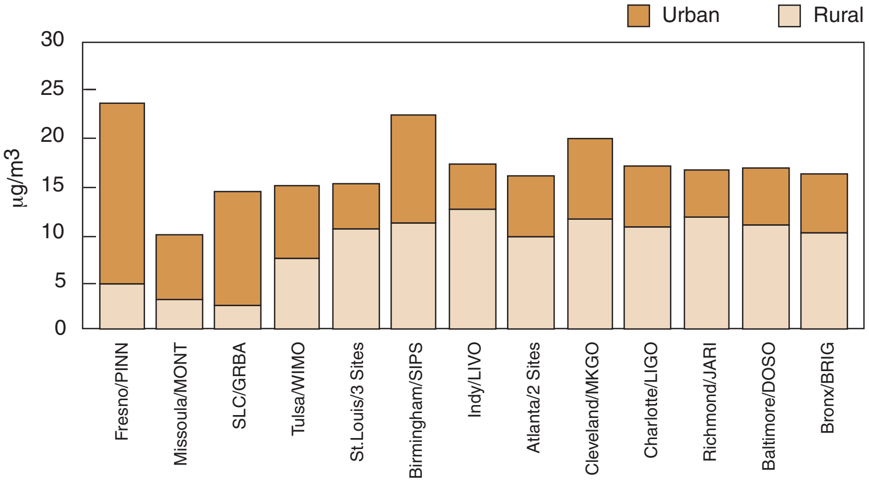


Figure 12. Urban excess for total $PM_{2.5}$ gravimetric mass.



San Joaquin Valley. In general, the total excess mass ranges from 4 to16 µg/m^3, with the West generally showing more mass urban excess than the East. On average, the urban excess in $PM_{2.5}$ mass for the investigated 13 site combinations is seen to be about 8 µg/m^3.

Figures 13 through 16 show a comparison of urban concentrations with estimated regional background for four example sites (urban sites: Fresno, CA, St. Louis, MO, New York, NY, and Charlotte, NC—see Table 3 for the matched rural sites for these urban locations) out of the total 13 urban/rural pairings investigated. The height of each bar represents the average urban concentration by species. Overlaying the nearby rural concentrations by chemical component on the urban chemical component concentrations, the example stacked bar charts (Figures 13-16) show that the estimated regional background represents varying proportions of the total urban concentrations by component and location. Specifically, TCM and nitrates dominate Fresno particulate aerosol, whereas carbon and sulfates are the highest among the example eastern sites. In terms of urban excess, all four of these examples show TCM and nitrate concentrations to be the major components. Urban increments of TCM are seen to range from 13 µg/m^3 at the Fresno, CA, location to about 3 to 4 µg/m^3 at the other three locations. Similarly, nitrate urban excess is seen to be 6.5 µg/m^3 at the Fresno, CA, location and is in the 0.5 to 1.3 µg/m^3 range at the other sites studied. As stated earlier, the Fresno values are probably reflective of contributions from the San Joaquin Valley.

Another interesting way to look at urban excess at the 13 selected urban/rural pairs is by examining

Figure 13. Urban excess at Fresno, CA.

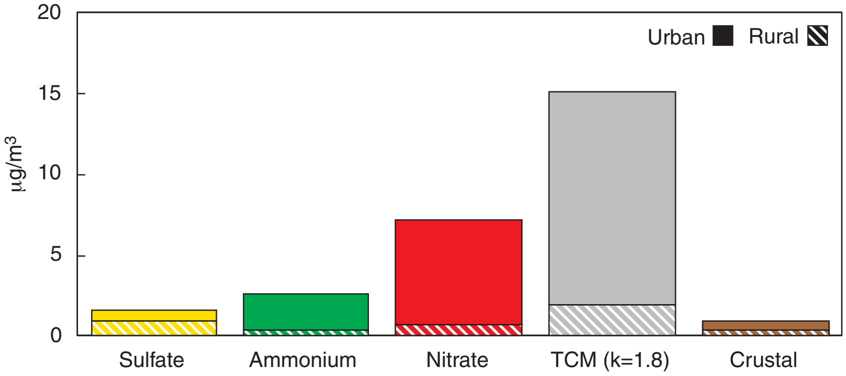


Figure 14. Urban excess at Charlotte, NC.

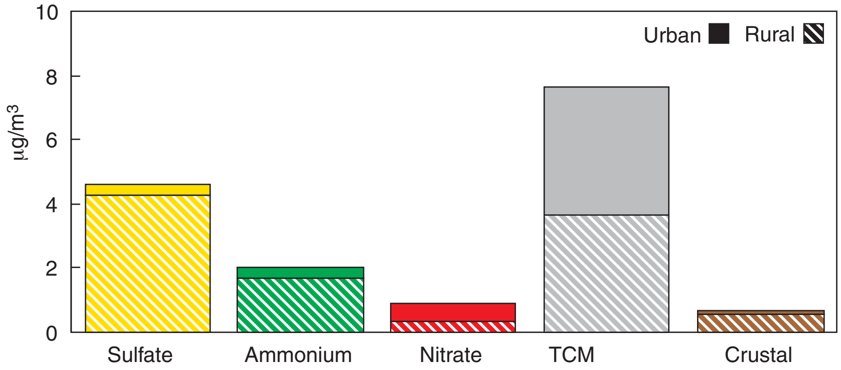


Figure 15. Urban excess at St. Louis, MO.

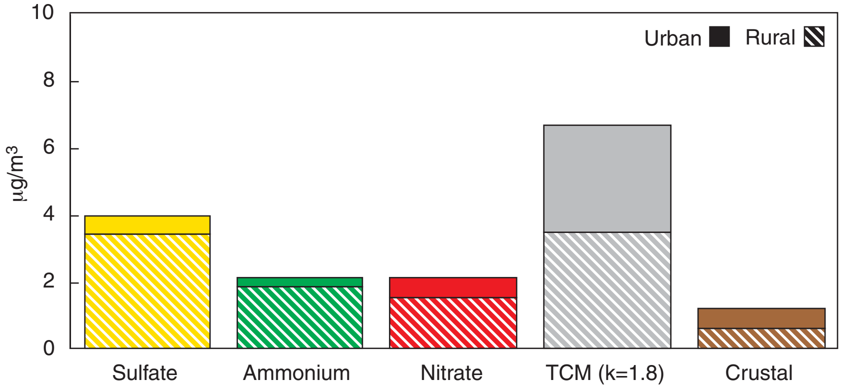
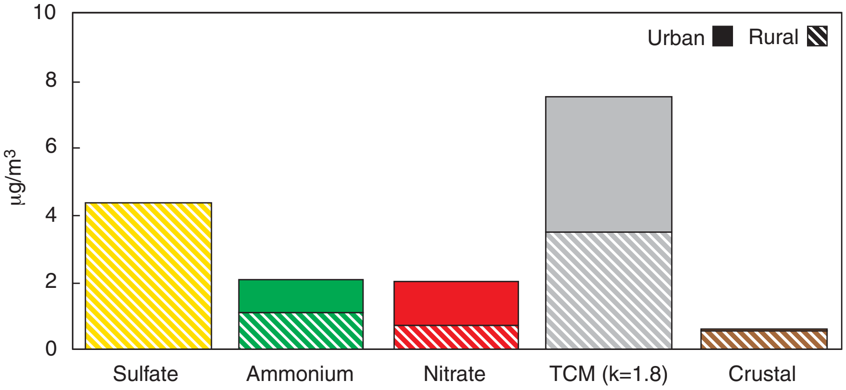


Figure 16. Urban excess at New York City, NY.

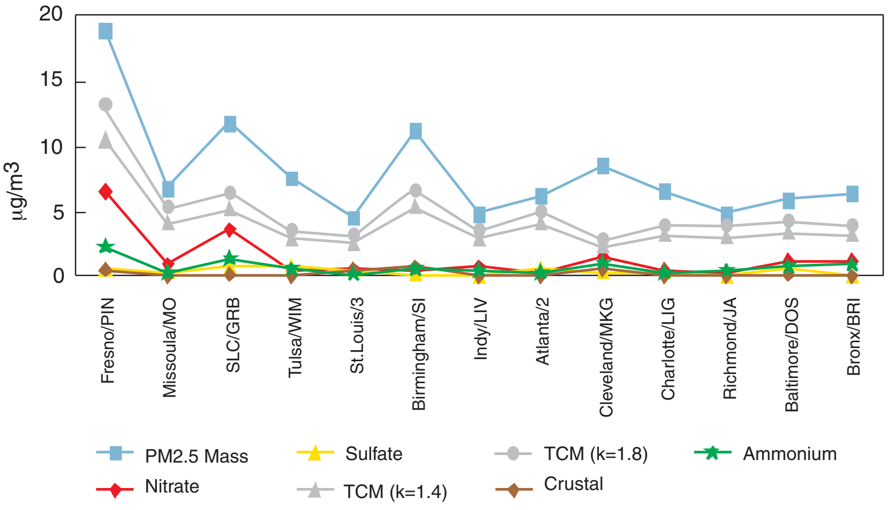


the urban increment of gravimetric mass as it compares to the urban increments of each of the chemical species that drive that mass. This is shown in Figure 17. The top line in Figure 17 depicts the total $PM_{2.5}$ mass urban excess for these 13 urban/rural site combination pairs. The urban mass is derived from the STN speciation samplers. The urban sites are arranged to reflect a west-to-east trend as you go from left to right on the graph. At all locations, total carbonaceous mass is seen to be the major contributor to $PM_{2.5}$ mass, and, at the western sites, nitrates also play a role in determining the total $PM_{2.5}$ mass increments for the time period investigated. The average excess urban mass seen in the eastern sites is 5 to 8 µg/m^3 with carbon contributing between 3 and 5 µg/m^3 to the mass increment. The exception to this average is the Birmingham, AL, urban site. This site is paired with the Sipsy Wilderness rural site (~100 km away) to estimate urban excess. Birmingham shows a mass increment of about 12 µg/m^3, with carbon contributing about 5.0 to 6.5 µg/m^3 to the total mass increment. Birmingham probably has local (urban) emissions sources that are contributing to the $PM_{2.5}$ mass. To understand why the mass is so much higher in the urban Birmingham area compared with the other eastern sites studied, more work is needed to investigate how these sources differ from emissions sources in the other eastern locations.

National Map of Urban Excess

The estimated urban excess concentrations are displayed in the national map shown in Figure 18 for the selected 13 urban/rural combinations. Table 4 presents these same findings through summary statistics.

Figure 17. Comparison of mass urban increment to chemical species.



Those urban excess numbers that were less than zero were set equal to zero in Table 4 (the "minimum" values for sulfate and crustal concentrations in the "East" and "Overall" columns). However, the actual numbers, both positive and negative, were used to compute average concentrations (of urban excess concentrations).

The significant points and important caveats are as follows:

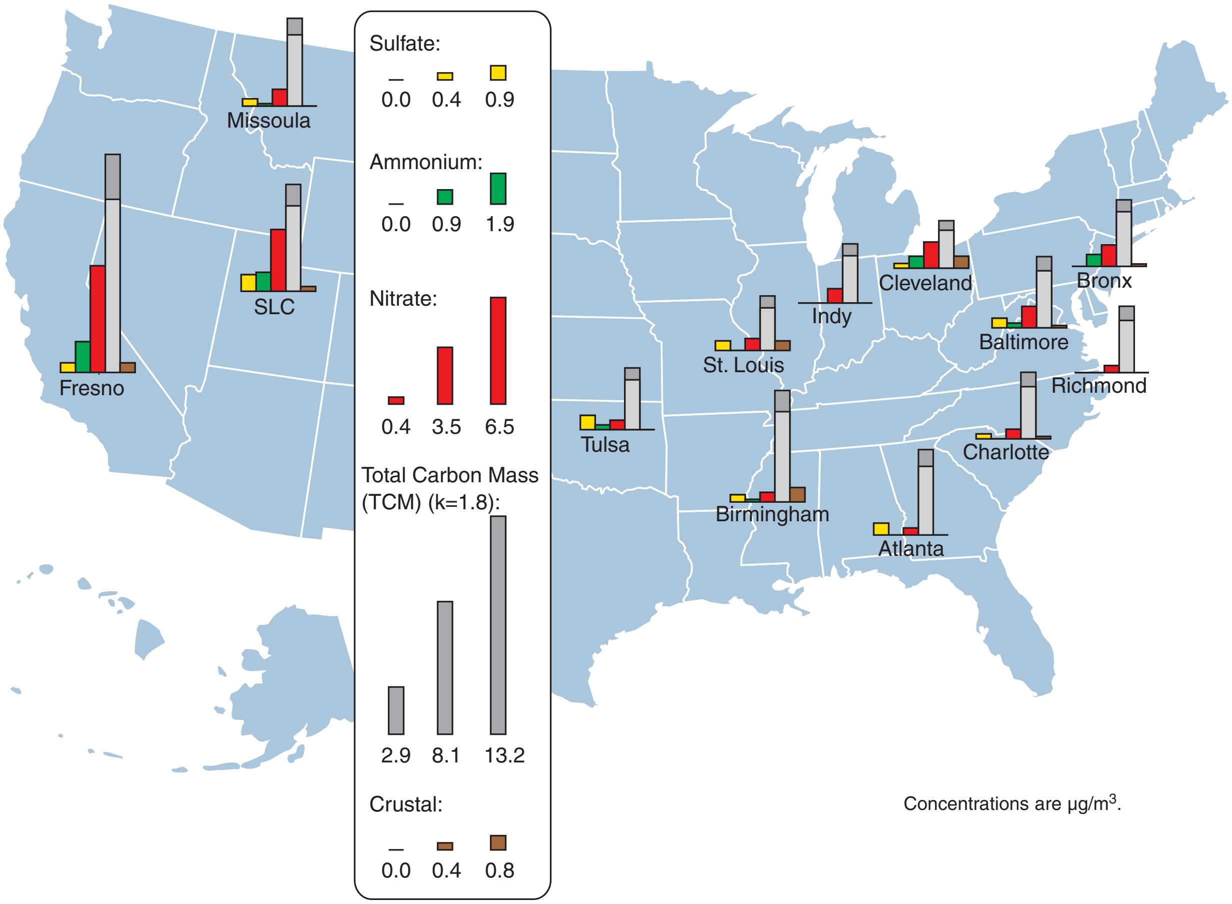
- The estimate for urban excess sulfate is invariably very small in the eastern United States, which is consistent with the notion that most sulfates are transported from regional sources of SO_2. This small estimated urban excess in the East (0.0-0.5 µg/m^3) is attributed at least in part to sulfur emissions associated with fuel combustion from stationary and mobile sources.
- Nitrates are seen to be in excess in the more northern and western locations, showing a larger local contribution than sulfates or any other species except carbon. This is assumed to reflect local nitrogen sources (e.g., mobile), nitric acid from NO_x/VOC reactions, and preferential winter-time nitrate formation compared to sulfates. However, more work is needed to assess the comparability of nitrate measurements and monitoring methods between networks. To that end, a major study is planned next year by the IMPROVE program. This was initiated, in part, because there is concern that the IMPROVE protocol may produce relatively lower concentrations of nitrates, so some of the reported difference may be measurement related.
- Carbonaceous mass is shown to have a substantial urban excess (2.9 to 13.2 µg/m^3 when k=1.8). It is clearly the largest among all reported chemical components in this "urban excess" analysis. It appears to be attributed to local emissions, with mobile sources as a possible major contributor.
- Some locations also show a sizeable urban excess of "crustal material." The estimation procedure used in the IMPROVE protocol includes the measurement of iron and other trace elements.

Therefore, this difference also reflects oxidized particulate metals, some of which may be attributed to road dust or industrial sources in urban areas.

Conclusions

In this work, the local and regional source contributions of $PM_{2.5}$ to urban areas were investigated at 13 urban locations in the United States. This was accomplished by matching urban sites to nearby rural sites and then comparing the appropriate concentrations of chemical constituents and mass. Although

Figure 18. National map depicting urban excess by component for 13 example areas.



Concentrations are µg/m^3.

Table 4. Minimum, Maximum, and Average Urban Excess in µg/m^3 for 13 STN/IMPROVE Combinations

	West (3 sites)			East (10 sites)			Overall (13 sites)		
Chemical Species	**Min**	**Max**	**Average**	**Min**	**Max**	**Average**	**Min**	**Max**	**Average**
Sulfate	0.4	0.9	0.6	0	0.8	0.3	0	0.9	0.3
Estimated Ammonium	0.4	2.3	1.4	0.3	1.1	0.6	0.3	2.3	0.8
Nitrate	1.0	6.5	3.7	0.4	1.5	0.8	0.4	6.5	1.5
Total Carbonaceous Mass (k=1.4)	4.2	10.5	6.6	2.4	5.4	3.3	2.4	10.5	4.1
Total Carbonaceous Mass (k=1.8)	5.3	13.2	8.3	2.9	6.7	4.2	2.9	13.2	5.1
“Crustal”	-0.1	0.5	0.2	0	0.8	0.2	0	0.8	0.2

there is uncertainty in the measured mass and in other measurement protocols, it is clear that carbonaceous mass is prevalent everywhere (average of 5.1 µg/m^3 with k=1.8) and is the major component of urban excess at all the sites studied. In the western sites, the TCM (based on k=1.4) urban excess varies from 4.5 to 10.5 µg/m^3, whereas in the eastern sites, TCM urban excess is in the range of 2 to 5.4 µg/m^3. TCM, based on k=1.8, varies from a range of 5.3 to 13.2 µg/m^3 in the West and to a range of 2.9 to 6.7 µg/m^3 in the East. Similarly, nitrates are prevalent in the urban excess estimates for the North and West (2 to 6 µg/m^3). Consistent with the theory that most sulfates are transported from regional sources of SO_2, the urban excess of this chemical component is invariably very small in the eastern United States. These results may be viewed as a first step in differentiating between regional and local sources that contribute to $PM_{2.5}$ mass. More work is needed in the areas of estimating regional background associated with specific urban areas using spatial analysis, identifying specific emission sources with the estimated urban excesses using source apportionment techniques, more refined data analysis that includes meteorological variables, and examination of the data on finer time resolution to get to the next and more refined level of urban excess concentrations. These will be the subjects of future papers in this area.

Disclaimer

The views and opinions expressed in this paper are solely those of the authors and do not necessarily reflect those of the U.S. Environmental Protection Agency.

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Trends in Monitored Concentrations of Carbon Monoxide

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Abstract

Carbon monoxide (CO) is one of the criteria pollutants regulated under the Clean Air Act. Numerous metropolitan areas instituted oxygenated gasoline (oxyfuel) programs during winter months to reduce CO emissions from motor vehicles, but some have since discontinued these requirements. This paper demonstrates a screening method for determining monitoring stations of potential interest. Monitoring stations with at least 8 years of relevant data during the period from 1990 through 2000 were screened for either an upward linear trend or upward inflection. Statistical tests assessed the trend in the annual second maximum nonoverlapping 8-hour average of CO for each monitor over the 11-year period. Of the 433 sites analyzed, 34 showed a statistically significant overall upward trend or statistically significant upward curvature. This analysis method can be used to screen for sites with increasing CO concentrations. The identified sites should then be examined further to determine the magnitude of the concentrations as compared to the existing standard. Because some areas have changed their fuel requirements within the last few years of the analysis, we recommend repeating this test annually.

Introduction

Carbon monoxide (CO) is a colorless, odorless, and poisonous gas produced by incomplete burning of carbon in fuels. Approximately 75% of nationwide CO emissions are from transportation sources. The largest emissions contribution comes from highway motor vehicles. Thus, the focus of CO controls as well as CO monitoring has been on traffic-oriented sites in urban areas where the main source of CO is motor vehicle exhaust. Other CO sources include wood-burning stoves, incinerators, and other heavy industrial sources.

The National Ambient Air Quality Standard (NAAQS) for carbon monoxide is 9 ppm for an 8-h average not to be exceeded more than once per year. The EPA motor vehicle program has achieved considerable success in reducing CO emissions. EPA standards in the early 1970s prompted automakers to improve basic engine design. By 1975, most new cars were equipped with catalytic convertors designed to convert CO to carbon dioxide. In the 1980s, automakers introduced more sophisticated converters plus on-board computers and oxygen sensors to help optimize the efficiency of the catalytic converter.

CO emissions from automobiles increase dramatically in cold weather because cars need more fuel to start at cold temperatures, and some emission control devices operate less efficiently when they are cold. Until 1994, vehicles were tested for CO emissions only at 75°F. But, recognizing the effect of cold weather, the 1990 Clean Air Act (the Act) calls for 1994 and later cars and light trucks to meet a carbon monoxide standard at 20°F as well.

The Act also stipulates expanded requirements for inspection and maintenance programs. These routine emission system checks should help identify malfunctioning vehicles that emit excessive levels of CO and other pollutants (the so-called “high emitters”). The inspections will be complemented by requirements for onboard warning devices to alert drivers when their emission control systems are not working properly.

Yet another strategy to reduce CO emissions from vehicles is to add oxygen-containing compounds to gasoline. This has the effect of “leaning-out” the air-to-fuel ratio, thereby promoting more complete fuel combustion. The most common oxygen additives are ethers and alcohols. Several western and northern U.S. cities have employed wintertime oxygenated gasolines for many years. The Act expands this concept and requires that oxygenated gasolines be used during the winter months in certain metropolitan areas with high CO levels.

With these control programs and technology improvements, today's passenger cars and light-duty trucks are capable of emitting 90% to 95% less CO over their lifetimes than their uncontrolled counterparts of the 1960s. As a result, ambient CO levels have dropped, despite large increases in the number of vehicles on the road and the number of miles they travel. However, in recent months, with continued heavy increase in vehicle travel, there have been indications that CO levels are climbing again in certain parts of the country. The objective of this work is to examine those areas of the country where mobile-source activity is heavy (in CO nonattainment and problem areas) and/or where CO air quality has been a persistent problem and determine whether CO levels are increasing.

Experimental Methods

CO concentration data were extracted for 858 monitoring sites from EPA's Aerometric Information Retrieval System (AIRS) on March 14, 2002. To meet the completeness requirement for this analysis, at least 8 years of data must have been available for the years 1990 to 2000, inclusive. Statistical analyses were performed for the 433 sites that met this requirement.

The Metropolitan Statistical Area (MSA) code was also downloaded for each site. The codes were linked to the most recent list of areas that employ or have discontinued oxyfuel requirements.[1] This information was used to group the sites (oxyfuel ended vs. no change in oxyfuel requirements) and to interpret the results of the analyses.

The effects of meteorology on ambient CO concentrations were not examined in this study. For example, certain meteorological parameters (e.g., mixing height and windspeed) need to be considered when comparing emissions to ambient concentration measurements.[3,4] However, the Glen et al. study[3] concluded that seasonal fluctuations in CO concentrations are explained by the variations in these meteorological parameters, whereas the long-term trend is primarily due to the trend in emissions. Although the current analysis did not account for interannual meteorological changes, the same overall downward trend was identified.

The analysis used the second maximum nonoverlapping 8-h average CO concentration (SECMX) for each year. This statistic was selected for analysis because it coincides with the 8-h NAAQS for CO. Missing values (i.e., years without a SECMX value for a monitor) were not filled in; that is, linear interpolation or some other method was not employed to fill in missing data. The data for each site were then analyzed independently of all other sites; that is, no spatial averaging was performed to obtain annual average values for each MSA.

Although the SECMX values form the basis of the annual CO trends published by EPA's Air Quality Trends Analysis Group in the Trends Report,[2] the methodology employed in this study differed in three basic ways:

- The Trends Report fills in missing data, whereas this study used only the data that were available from AIRS.
- The Trends Report aggregates data and analyzes results for each MSA, whereas this study performed the data analysis separately for each monitor.
- The analysis for the Trends Report used only the nonparametric Theil test, whereas this study also used two linear regression models.

The three analyses that were performed for each site were the Theil test, first-order linear regression, and quadratic (second-order) linear regression. Each of these analyses included a statistical hypothesis test that computes a p-value for each monitor. If the p-value is less than a critical value n between 0 and 1, then the test has a result that is "significant at $\alpha = n$." A smaller value for α indicates a greater likelihood that the data truly possess the detected trend.

Every test was two-sided, meaning that the α-level used to detect an increasing or a decreasing trend was $\alpha/2$. Therefore, if a monitor exhibited an increasing trend, then the p-value for the test would have to be less than $\alpha/2$ for the increasing trend to be significant. For example, if a monitor exhibited an upward trend that was significant at $\alpha = 0.01$, then the probability of seeing as extreme an upward trend as this monitor under the null hypothesis of no trend is less than 0.005 (0.5%).

The Theil test and both regression models are discussed below.

Theil Test

The Theil test[5] is a nonparametric statistical test that can be used instead of regression-based methods for discerning a monotonic trend. It examines whether the concentration from year to year tends to increase or decrease consistently, making it a test of monotonicity. This test is not concerned with the magnitude of the year-to-year differences. The null hypothesis is that there is no monotonic trend in the data.

The first step in the test is to examine all possible $[n(n-1)/2]$ pairs of data points from a given monitor, where n = 8, 9, 10, or 11. Next, a count is taken of all the pairs that show an increasing or decreasing trend. The null hypothesis will be rejected and the test results will indicate a significant monotonic increasing (or decreasing) trend if this count of the data point pairs is greater than (or less than) a certain critical value. A large positive value indicates a positive trend, and a large negative value indicates a negative trend.

The Theil test was applied for two reasons. First, it is appropriate when the errors from a linear regression are not normally, or close to normally, distributed. The data here may not meet the normality assumption. Second, this test was recommended to EPA for determining whether an area has a significant trend.[6] Therefore, this test is used in EPA's annual Trends Reports.

Choice of Urban and Rural Sites

Unlike the Theil test, linear regression is a parametric test. All linear regression models incorporate three basic assumptions: (1) the data are normally distributed, (2) the variance is constant at each time, and (3) no autocorrelation exists between time periods.

A first-order linear regression was performed using PROC REG in SAS.[7] The linear regression model used SECMX as the dependent variable. To make the results less dependent on the magnitude of the year, a transformation was performed on the value of the year by subtracting 1989 (i.e., 1 less than the minimum year in the dataset):

$$YR' = YEAR - 1989 \tag{1}$$

YR' was the only independent variable in the regression model.

PROC REG includes a hypothesis test for a nonzero slope. The *p*-value from this hypothesis test is presented in the results tables.

Quadratic Regression

A second linear regression was also performed using PROC REG. This test was a quadratic (second-order) linear regression that used both (YR′) and $(YR')^2$ as independent variables. The *p*-value from the test for a nonzero coefficient on the squared term is presented in the results tables. A significant *p*-value for this test indicates significant curvature in the regression line. That is, an upward trend suggests that the slope has increased from the early years to the recent years.

Interpretation of Statistical Results

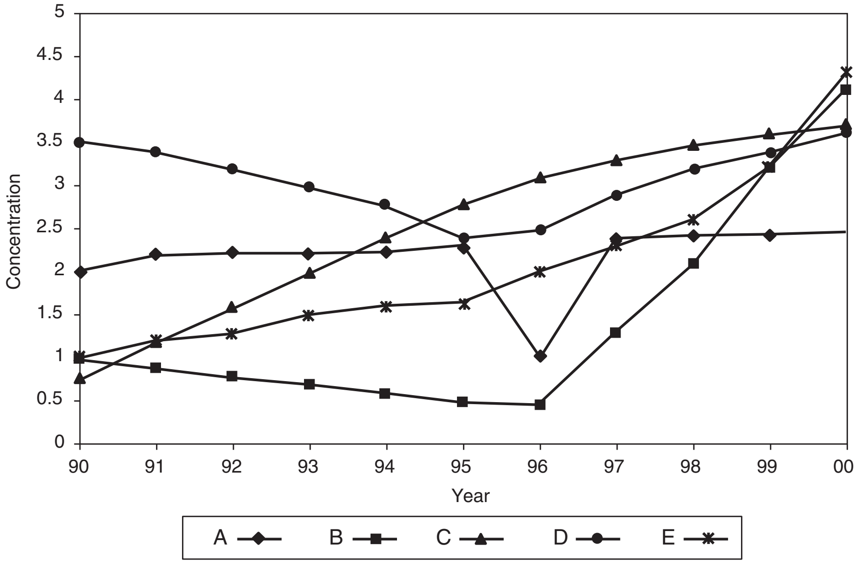
These three statistical tests are complementary in that each examines the data differently. The Theil test looks for a monotonic trend, first-order linear regression applies normality theory for a linear trend, and quadratic regression applies normality theory for a nonlinear trend. All three spotlight sites that may be of interest to policy makers, but no single test will detect all interesting sites. They can be used together, however, to discern patterns in the data. Consider the following five trends, as illustrated in Figure 1.

Trend A

This site has a consistent, upward trend that is not dramatic. However, 1996 was a very "clean" year at the site, with a SECMX value lower than the rest of the years.

The Theil test undoubtedly will detect a significant upward trend at site A. The first-order regression model may not find a significant trend at site A for two reasons. First, the anomalous point in 1996 inflates the variance. Second, the slope estimate will not be much greater than zero because the increasing trend is only slight. The quadratic regression model may or may not be significant for this site.

Figure 1. Examples of trends A through E.



Site A may be of interest to policy makers. For example, upon examination of associated data such as temperature, they may find a meteorological reason that 1996 was such a clean year (e.g., warm winter) and decide that the true pattern is a consistent increase in CO concentration.

Trend B

From 1990 to 1996, the concentrations at site B decreased slightly. The concentrations then increased dramatically from 1997 to 2000.

At site B the Theil test may not detect a trend because of a lack of a consistent pattern in the early years. It also will not be influenced by the explosive pattern in the recent years. However, the first-order regression model will certainly detect an increasing trend. The high concentrations in the later years will increase the slope of the regression line. If the increase is more dramatic in the very recent years, the quadratic regression model may also detect a significant upward inflection.

Site B also would likely be of interest to policy makers, because the most recent years show a dramatic increase in concentration.

Trend C

The concentrations at site C increased dramatically from 1990 to 1995. The rate of increase then slowed from 1996 to 2000, although the concentrations continued to increase.

At site C, both the Theil test and the first-order regression model will detect an increasing trend. However, the quadratic regression model might detect a downward curvature.

This may be a site where population growth is explosive, but the state or local government has taken drastic steps to reduce emissions per capita. This pattern is likely to interest policy makers because the site is showing improvement via slower concentration growth, although the concentration at the site is still increasing.

Trend D

The concentrations at site D decreased from 1990 to 1995 but increased from 1996 to 2000. The concentrations in 1990 and 2000 were similar to each other.

At site D, both the Theil test and the first-order regression model likely will fail to detect a trend. The Theil test will have about the same number of increasing and decreasing pairs. The slope of the first-order linear regression line likely will be nearly zero. The quadratic regression model, however, will detect a significant upward curvature.

This site may be of interest to policy makers because the pattern suggests that the concentrations will continue to increase. This pattern may be prevalent where the oxyfuels program was discontinued.

Trend E

The concentrations at site E increased from 1990 to 1995. The increase became more pronounced from 1996 to 2000.

At site E, all three tests will produce significant results. This site exhibits a consistent increase in concentrations, and it merits special vigilance.

Results and Discussion

This study analyzed data for the 433 sites that met the completeness test. One or more statistical tests revealed significance at 79% of the sites at the $\alpha = 0.10$ level. This result was expected due to the effects of fleet turnover.

Of greater interest to this study, however, was that a statistically significant upward trend or curvature was revealed at 34 sites. Table 1 lists the results of the three statistical models for all sites where at least one model revealed a significant upward trend or positive quadratic component. Seven pieces of information are included for each site: (1) MSA containing the site, (2) ending date for the oxyfuel program (if applicable), (3) monitor ID in AIRS, (4) number of years of data used in the analysis, (5) results of the Theil test, (6) results of a hypothesis test that the slope of the line from the first-order linear regression model is nonzero, and (7) results of a hypothesis test that the coefficient associated with the squared term is nonzero for the quadratic regression model. Of the sites listing dates ending the oxyfuel program, all either are located in a federal reformulated gasoline area or have an oxyfuel requirement in their contingency plan.

Figure 2 shows the locations of the monitoring sites with at least one statistical model showing a statistically significant upward trend or positive quadratic component. Only those sites located within the coterminous United States are included in this map.

A plot of the SECMX vs. year was generated for each of the 433 sites in this analysis. For each plot the concentration values are shown as stars. The solid line represents the quadratic regression line, and the dashed lines represent the 95% confidence bands around the regression line. That is, there is a 95% probability that the true trend lies within the area bounded by the dashed lines and only a 5% probability that the true trend lies outside this area. Examples of patterns found in these plots are included as Figures 3 through 7.

Table 1. Carbon Monoxide Monitoring Sites Where at Least One Statistical Test Shows Increasing Concentration

MSA	Ending Date Oxyfuel Requirement	Monitor ID	Years of Data	Theil Test	1st Order Regression Model	2nd Order Regression Model
—	—	370770001421011	8	NS	UP10	NS
—	—	410350006421011	11	DOWN01	DOWN01	UP01
Charlotte, NC	—	371190038421011	11	DOWN01	DOWN01	UP05
Charlotte, NC	—	371191009421011	8	UP05	UP05	NS
Kansas City, MO	—	290470009421011	10	DOWN05	DOWN05	UP10
Los Angeles, CA	—	060371201421011	11	DOWN01	DOWN01	UP10
Los Angeles, CA	—	060379002421011	11	DOWN01	DOWN01	UP05
Louisville, KY	—	211110046421011	11	DOWN05	DOWN01	UP05
Minneapolis–St. Paul, MN	—	271230865421011	8	DOWN05	DOWN05	UP05
Modesto, CA	6/1/1998*	060990005421011	11	DOWN05	DOWN05	UP01
Oakland, CA	—	060010003421011	10	DOWN05	DOWN01	UP10
Oakland, CA	—	060130002421011	11	DOWN01	DOWN01	UP05
Oakland, CA	—	060133001421011	11	DOWN01	DOWN01	UP05
Vancouver, WA	10/21/1996*	530110010421011	11	DOWN01	DOWN01	UP01
Provo, UT	—	490490002421011	11	DOWN01	DOWN01	UP05
Reno, NV	—	320311005421011	11	DOWN01	DOWN01	UP05
Sacramento, CA	6/1/1998*†	060170010421011	9	DOWN05	DOWN01	UP01
Sacramento, CA	6/1/1998*†	060170011421011	8	DOWN01	DOWN01	UP10
Sacramento, CA	6/1/1998*†	060670006421011	11	DOWN01	DOWN01	UP10
Sacramento, CA	6/1/1998 *†	060670007421011	11	DOWN01	DOWN01	UP01
San Diego, CA	6/1/1998*†	060730003421011	10	DOWN01	DOWN01	UP05
San Diego, CA	6/1/1998*†	060731007421011	11	DOWN01	DOWN01	UP01
San Francisco, CA	6/1/1998*	060811001421011	11	DOWN01	DOWN01	UP10
San Jose, CA	—	060850004421011	11	DOWN05	DOWN01	UP01
San Jose, CA	—	060850004421012	11	DOWN05	DOWN01	UP01
San Juan, PR	—	721270002421011	11	DOWN05	DOWN05	UP10
San Luis Obispo, CA	—	060792002421011	11	DOWN01	DOWN01	UP10
Santa Rosa, CA	—	060970003421011	11	DOWN05	DOWN05	UP10
Seattle, WA	10/11/1996*	530610012421011	11	DOWN01	DOWN01	UP05
Stockton, CA	6/1/1998*	060770008421011	11	DOWN05	DOWN05	UP05
Stockton, CA	6/1/1998*	060771002421011	11	DOWN05	DOWN01	UP05
Tampa, FL	—	120571045421011	8	DOWN05	DOWN01	UP10
Vallejo, CA	—	060950004421011	11	DOWN01	DOWN01	UP05
Yuba City, CA	—	061010003421011	10	DOWN01	DOWN01	UP05

*Oxyfuel program retained as contingency measure.
†Federal reformulated gasoline program area.

The following notation was used for the statistical results:

DOWN01 = downward trend, significant at α level 0.01
DOWN05 = downward trend, significant at α level 0.05
DOWN10 = downward trend, significant at α level 0.10
NS = no significant trend
UP01 = upward trend, significant at α level 0.01
UP05 = upward trend, significant at α level 0.05
UP10 = upward trend, significant at α level 0.10

Figure 3 illustrates a site that was screened out by this analysis; none of the three tests revealed an upward trend. The statistical results were DOWN01, DOWN01, and NS for the Theil test, first-order linear regression, and quadratic regression, respectively.

The Theil test revealed a statistically significant upward trend at only one site. Its data and quadratic regression results are shown in Figure 4. The first-order linear regression model also revealed an upward trend at this site. Both these tests were significant at the $\alpha = 0.05$ level. The second-order linear regression found no significant trend at this site. This pattern is similar to Trend C, described above.

Figure 4 also demonstrates how this analysis method should be used to screen monitoring sites. Although two statistical tests revealed an upward trend, this site is not of immediate concern because the concentrations are far below the NAAQS value of 9 ppm. If this site is located in an area of high population growth, then it should be reevaluated in the future.

Figures 5 through 7 illustrate patterns that are similar to Trend D, described above. The site in Figure 5 apparently experienced minimum CO concentrations during the period 1995 to 1997. The concentrations increased after that period. For this site, the Theil test revealed a downward pattern at the $\alpha = 0.05$ level, and the first-order linear regression model revealed a downward pattern at the $\alpha = 0.01$ level. However, the quadratic regression model revealed an upward pattern at the $\alpha = 0.01$ level. Also, the lower bound of the 95% confidence limit is increasing, and concentrations are not low like those shown in Figure 4.

Figure 2. Locations of monitoring sites in the coterminous United States with at least one statistical model showing a significant upward trend. Circles represent sites that have stopped an oxygenated gasoline requirement. Diamonds represent other sites.

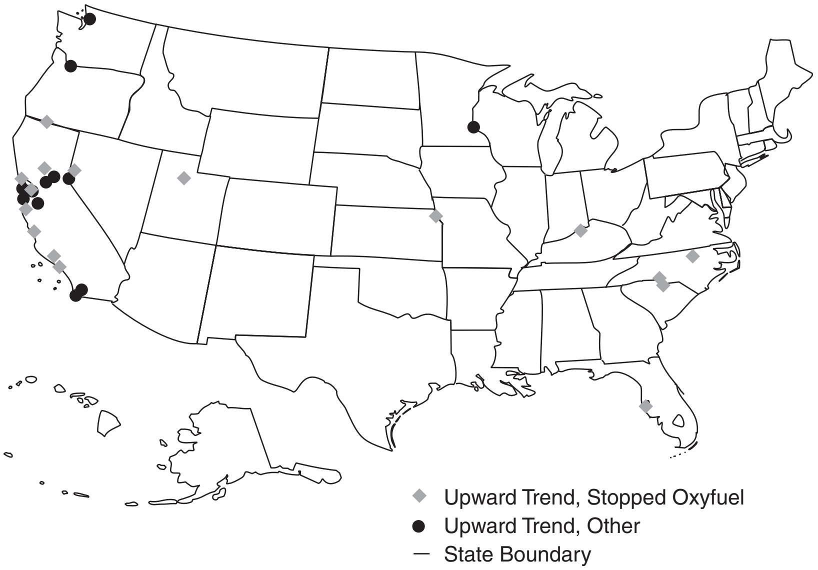


Figure 3. Example of a site screened out by the combined statistical models.

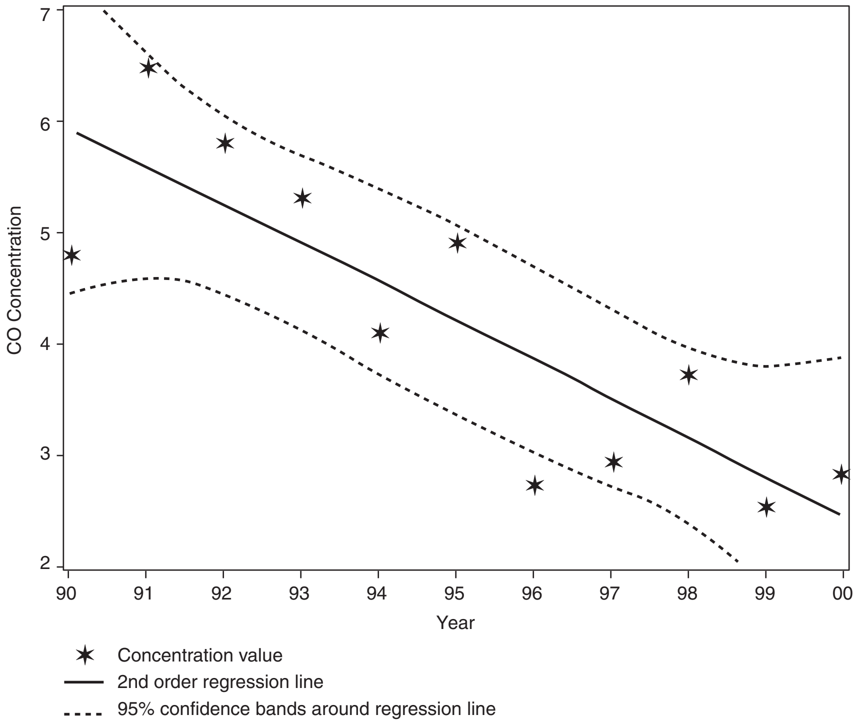


Figure 4. Example of a site with increasing trend. This site did not have data for the years 1990 through 1992.

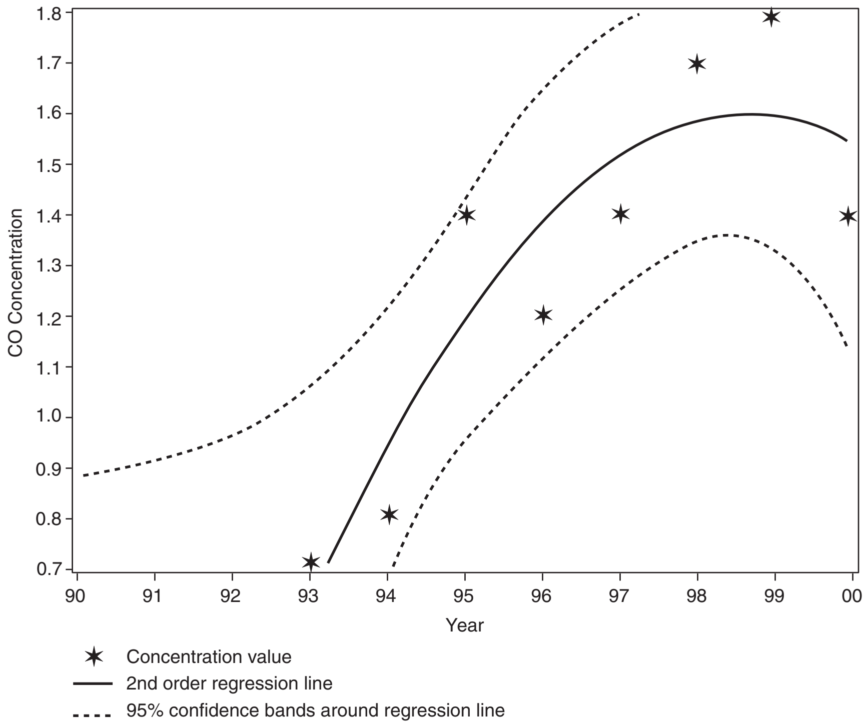
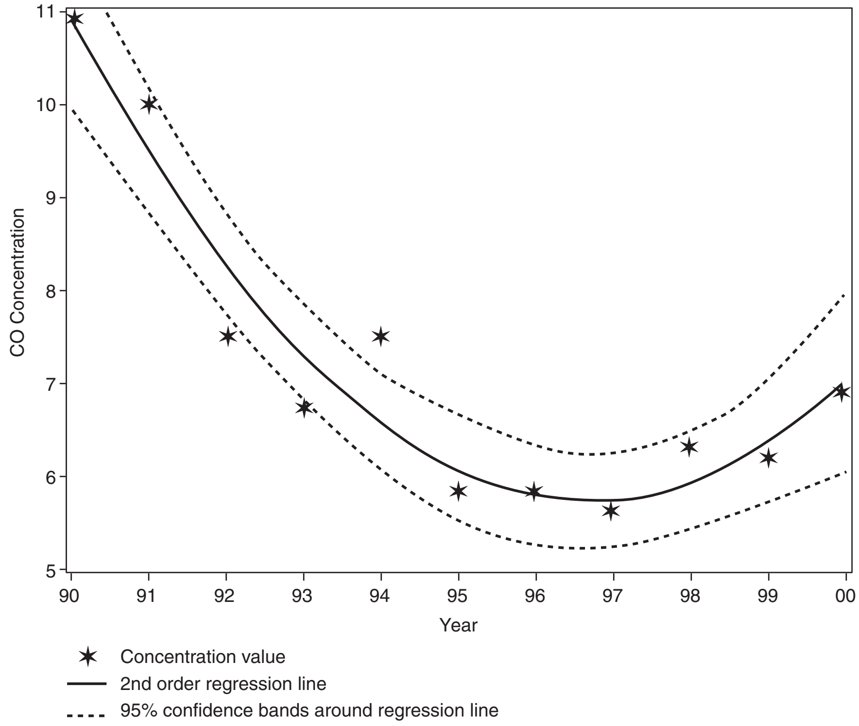


Figure 5. Example of a site with increasing trend in recent years.



The site in Figure 6 discontinued its oxyfuel requirements as of October 21, 1996; the vertical line at Year = 1996 indicates the year that this requirement ended. However, the data do not include whether the second highest concentration for 1996 occurred during or after the oxyfuel program. For this site, both the Theil test and the first-order linear regression model revealed a downward pattern at the $\alpha = 0.01$ level. However, the second-order linear regression model revealed an upward pattern at the $\alpha = 0.01$ level. The pattern of the 95% confidence limits of the second-order linear regression line indicates a high probability of nearly stable to rapidly increasing concentration.

The site in Figure 7 discontinued its oxyfuel requirements as of June 1, 1998, more recently than the site in Figure 6. Because of the increased scatter of the data around the regression line, the 95% confidence region is larger and the patterns not as statistically significant as those for the site in Figure 6. For this site, both the Theil test and the first-order linear regression model revealed a downward pattern at the $\alpha = 0.05$ level, whereas the quadratic regression model revealed an upward pattern at the $\alpha = 0.05$ level.

This study demonstrates the utility of using more than one statistical test to determine patterns in ambient concentration data. The Theil test is a nonparametric, monotonic test that measures numbers of pairs of data that increase vs. decrease. First-order linear regression examines the significance of the slope of the least-squares line through all the available data. Quadratic regression examines the significance of the coefficient of the second-order term in the least-squares regression. Although interpolation cannot be used to extrapolate beyond the range of the data, the significance of the second-order term provides a measure of the curvature (i.e., change in the trend) of the regression line. This additional information is useful in locating sites with recent increasing concentrations, even when the overall trend is downward or not significant.

Unlike the Trends Report,[2] which examines trends for regions based on MSA, this study looked for trends associated with individual monitors. Trends in more localized areas, therefore, could be discovered because areal averaging was not performed. Uncovering localized trends is important when one part of an MSA experiences rapid population growth with the associated rapid growth in vehicular emissions.

Conclusions

This analysis revealed relatively few sites with statistically significant upward trends or inflection in CO concentrations during the period 1990 to 2000. By combining regression models with the Theil test, 34 of 433 sites were identified for further analysis. Because this study demonstrated that the simpler Theil test performed nearly as well as the first-order linear regression in identifying upward linear trends, we do not recommend performing first-order linear regression on these relatively short data sets in the future. However, this study showed that the quadratic regression model successfully identifies sites where the concentration has increased in recent years, thereby identifying potential problem areas earlier than the Theil test. Because this method is to be used to identify sites of potential interest, we further recommend using $\alpha = 0.10$ and a one-sided

Figure 6. Example of a site with increasing trend in recent years. The vertical line indicates the year that the oxygenated gasoline requirement ended.

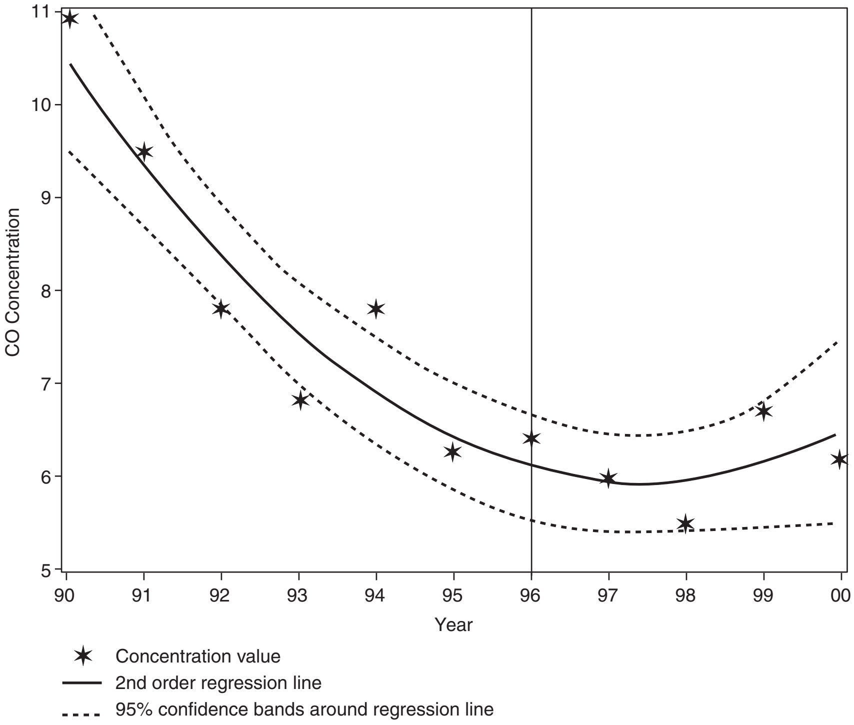
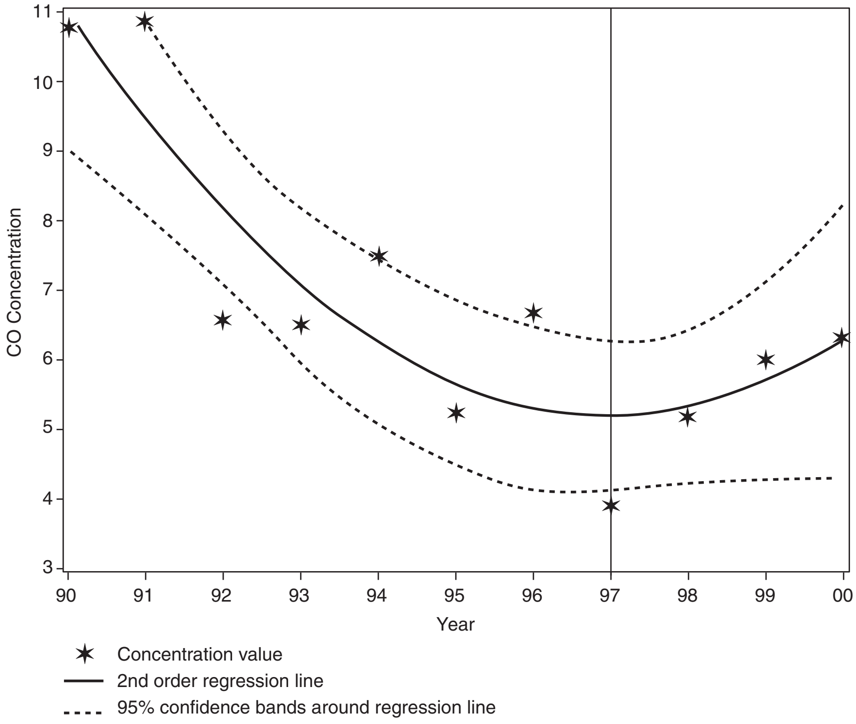


Figure 7. Example of a site with increasing trend that discontinued oxygenated gasoline requirements more recently. The trends for this site are not as significant as those shown in Figure 5.



hypothesis test to reduce the number of false negative results.

This method was designed to be an automated screening method for potential problem areas. Because both vehicle-miles traveled and the vehicle mix in fleets are changing with time, we recommend repeating this analysis annually to determine sites that warrant further analysis.

Acknowledgments

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Cumulative Ozone Exceedances—A Measure of Current Year Ozone Levels Compared to Historical Trends

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Introduction

The U.S. Environmental Protection Agency (EPA) maintains a historical record of air pollutant data in the EPA Air Quality System (AQS), which is overseen by the Office of Air Quality Planning and Standards. This database provides quality-assured pollutant measurement data from a network of monitoring stations in metropolitan areas and regions throughout the United States. The AQS usually contains the most recent 10-year period of monitored data. Pollutant measurement data are entered into the AQS by state and local agencies maintaining the network of monitoring stations. These data are entered on a continuous basis throughout the year but are usually complete within about 3 months after the end of the calendar year.

Ozone is one of the principal pollutants measured at a network of monitoring stations throughout the United States. The historical ozone database maintained in the AQS provides a unique opportunity to conduct analyses to investigate and characterize the ozone levels in these metropolitan areas and regions. Comparisons of historical data with the most recent year of data in the AQS can provide an indication of the current magnitude of ozone pollutant levels in metropolitan areas and regions throughout the United States compared to historical levels and can show whether ozone levels are worse, better, or about the same in the most recent year compared to recent historical trends.

Origin of Data

The ozone monitoring "season" occurs in the period from April through October in most major metropolitan areas throughout the United States. Frequently states, EPA Regional Offices, and EPA Headquarter Offices are asked how this year's ozone season compared to that of previous years. These queries occur particularly when there may have been several ozone "episodes" during the year or if there were periods of especially high ozone measurements prompting air quality alerts that may have been widely reported in the media.

One potentially useful way to compare ozone seasons is to depict the seasonal trend in ozone by counting the number of days in which ozone exceedances are measured in selected metropolitan areas and/or regions. The measure of ozone exceedances that is most widely reported in the media is the EPA Air Quality Index (AQI). The AQI contains categories of ozone levels based on health effects and includes (1) Moderate, (2) Unhealthy for Sensitive Groups, (3) Unhealthy, (4) Very Unhealthy, and (5) Hazardous.

The Unhealthy for Sensitive Groups category is based on the 8-hour National Ambient Air Quality Standards (NAAQS) for ozone (≥0.085 ppm). Other categories (Unhealthy, Very Unhealthy, and Hazardous) are based on ozone levels of increasing severity. By tracking the number of days ozone measurements exceed the NAAQS (e.g., Unhealthy for Sensitive Groups) during the ozone season as reported in the AQS, a comparison can be made of the most recent year's ozone measurements with previous or historical year measurements. Based on this comparison, a qualitative assessment of the "severity" of the most recent year's ozone measurements with historical year measurements can be made.

In this analysis, we use ozone data measured from the network of monitors assigned to the *USA Today* newspaper cities, for which the AQI is forecasted during the ozone season. Monitoring data from additional cities could be used as well, but we chose the *USA Today* cities as an illustration of the type of comparisons that can be done and because it the most widely reported measure of ozone levels in the media.

EPA maintains a list of monitors that are assigned to these *USA Today* cities (see Table 1).[1] Using these same monitors, the historical ozone data can be obtained for each of the *USA Today* cities from previous years' data reported in the AQS. In this analysis, we use the 2002 data reported in the AQS as the most recent year data and the previous

Table 1. Monitoring Sites for *USA Today* Cities

City	AIRS_ID	Site
Atlanta	130570001	130570001
Atlanta	130670003	130670003
Atlanta	130770002	130770002
Atlanta	130890002	130890002
Atlanta	130893001	130893001
Atlanta	130970002	130970002
Atlanta	130970004	130970004
Atlanta	131130001	131130001
Atlanta	131210034	131210034
Atlanta	131210053	131210053
Atlanta	131210055	131210055
Atlanta	131215001	131215001
Atlanta	131215002	131215002
Atlanta	131350002	131350002
Atlanta	131510002	131510002
Atlanta	132230001	132230001
Atlanta	132230002	132230002
Atlanta	132230003	132230003
Atlanta	132470001	132470001
Atlanta	132558001	132558001
Baltimore	240030001	240030001
Baltimore	240030014	240030014
Baltimore	240030019	240030019
Baltimore	240031003	240031003
Baltimore	240032002	240032002
Baltimore	240050003	240050003
Baltimore	240050010	240050010
Baltimore	240051007	240051007
Baltimore	240053001	240053001
Baltimore	240054002	240054002
Baltimore	240056001	240056001
Baltimore	240130001	240130001
Baltimore	240250080	240250080
Baltimore	240251001	240251001
Baltimore	240259001	240259001
Baltimore	240270005	240270005
Baltimore	245100004	245100004
Baltimore	245100011	245100011
Baltimore	245100018	245100018
Baltimore	245100019	245100019
Baltimore	245100036	245100036
Baltimore	245100040	245100040
Baltimore	245100050	245100050
Charlotte	371790003	371790003
Charlotte	450910002	450910002
Charlotte	450910004	450910004
Baltimore	245100051	245100051
Baltimore	245100053	245100053
Boston	250091002	250091002
Boston	250091201	250091201
Boston	250092006	250092006
Boston	250093001	250093001
Boston	250093102	250093102
Boston	250094001	250094001
Boston	250094003	250094003
Boston	250094004	250094004
Boston	250170004	250170004
Boston	250171001	250171001
Boston	250171002	250171002
Boston	250171005	250171005
Boston	250171102	250171102
Boston	250173003	250173003
Boston	250176001	250176001
Boston	250211001	250211001
Boston	250212002	250212002
Boston	250213003	250213003
Boston	250232001	250232001
Boston	250250002	250250002
Boston	250250015	250250015
Boston	250250021	250250021
Boston	250250041	250250041
Boston	250250042	250250042
Boston	250250081	250250081
Boston	250251003	250251003
Charlotte	371090004	371090004
Charlotte	371090099	371090099
Charlotte	371190011	371190011
Charlotte	371190018	371190018
Charlotte	371190019	371190019
Charlotte	371190026	371190026
Charlotte	371190028	371190028
Charlotte	371190030	371190030
Charlotte	371190033	371190033
Charlotte	371190034	371190034
Charlotte	371190041	371190041
Charlotte	371191005	371191005
Charlotte	371191009	371191009
Charlotte	371590021	371590021
Charlotte	371590022	371590022
Chicago	170314006	170314006
Chicago	170314007	170314007
Chicago	170314201	170314201

Table 1. Monitoring Sites for *USA Today* Cities (continued)

City	AIRS_ID	Site
Charlotte	450910006	450910006
Charlotte	450911004	450911004
Chicago	170310001	170310001
Chicago	170310002	170310002
Chicago	170310003	170310003
Chicago	170310004	170310004
Chicago	170310006	170310006
Chicago	170310007	170310007
Chicago	170310009	170310009
Chicago	170310025	170310025
Chicago	170310026	170310026
Chicago	170310027	170310027
Chicago	170310032	170310032
Chicago	170310033	170310033
Chicago	170310034	170310034
Chicago	170310036	170310036
Chicago	170310037	170310037
Chicago	170310038	170310038
Chicago	170310039	170310039
Chicago	170310040	170310040
Chicago	170310042	170310042
Chicago	170310044	170310044
Chicago	170310045	170310045
Chicago	170310050	170310050
Chicago	170310053	170310053
Chicago	170310062	170310062
Chicago	170310063	170310063
Chicago	170310064	170310064
Chicago	170310072	170310072
Chicago	170310075	170310075
Chicago	170311002	170311002
Chicago	170311003	170311003
Chicago	170311501	170311501
Chicago	170311601	170311601
Chicago	170312002	170312002
Chicago	170312301	170312301
Chicago	170313001	170313001
Chicago	170313005	170313005
Chicago	170314002	170314002
Chicago	170314003	170314003
Cincinnati	390610003	390610003
Cincinnati	390610006	390610006
Cincinnati	390610010	390610010
Cincinnati	390610019	390610019
Cincinnati	390610020	390610020
Cincinnati	390610034	390610034
Chicago	170315001	170315001
Chicago	170315002	170315002
Chicago	170316002	170316002
Chicago	170317002	170317002
Chicago	170318001	170318001
Chicago	170318003	170318003
Chicago	170370002	170370002
Chicago	170430003	170430003
Chicago	170431002	170431002
Chicago	170436001	170436001
Chicago	170438002	170438002
Chicago	170890003	170890003
Chicago	170890005	170890005
Chicago	170890006	170890006
Chicago	170970001	170970001
Chicago	170970006	170970006
Chicago	170970007	170970007
Chicago	170970008	170970008
Chicago	170970009	170970009
Chicago	170971002	170971002
Chicago	170971003	170971003
Chicago	170971007	170971007
Chicago	170973001	170973001
Chicago	171110001	171110001
Chicago	171111001	171111001
Chicago	171970005	171970005
Chicago	171971007	171971007
Chicago	171971008	171971008
Chicago	171971011	171971011
Cincinnati	180290003	180290003
Cincinnati	210150003	210150003
Cincinnati	210151002	210151002
Cincinnati	210370003	210370003
Cincinnati	210371001	210371001
Cincinnati	210374001	210374001
Cincinnati	211170007	211170007
Cincinnati	211910002	211910002
Cincinnati	390250002	390250002
Cincinnati	390250020	390250020
Cincinnati	390250022	390250022
Columbus	390970006	390970006
Columbus	390970007	390970007
Columbus	391298001	391298001
Dallas-Fort Worth	480850004	480850004
Dallas-Fort Worth	480850005	480850005
Dallas-Fort Worth	480850010	480850010

Table 1. Monitoring Sites for *USA Today* Cities (continued)

City	AIRS_ID	Site
Cincinnati	390610035	390610035
Cincinnati	390610037	390610037
Cincinnati	390610040	390610040
Cincinnati	390616002	390616002
Cincinnati	391650006	391650006
Cincinnati	391651002	391651002
Cleveland	390071001	390071001
Cleveland	390350002	390350002
Cleveland	390350033	390350033
Cleveland	390350034	390350034
Cleveland	390350035	390350035
Cleveland	390350064	390350064
Cleveland	390350081	390350081
Cleveland	390352001	390352001
Cleveland	390353003	390353003
Cleveland	390354003	390354003
Cleveland	390355002	390355002
Cleveland	390550004	390550004
Cleveland	390850001	390850001
Cleveland	390850003	390850003
Cleveland	390853002	390853002
Cleveland	390930013	390930013
Cleveland	390930017	390930017
Cleveland	390931002	390931002
Cleveland	390931003	390931003
Cleveland	391030002	391030002
Cleveland	391030003	391030003
Cleveland	391032001	391032001
Columbus	390410002	390410002
Columbus	390490004	390490004
Columbus	390490009	390490009
Columbus	390490015	390490015
Columbus	390490028	390490028
Columbus	390490029	390490029
Columbus	390490037	390490037
Columbus	390490081	390490081
Columbus	390890005	390890005
Denver	80590004	080590004
Denver	80590005	080590005
Denver	80590006	080590006
Denver	80590011	080590011
Denver	80590600	080590600
Denver	80590601	080590601
Detroit	260990009	260990009
Detroit	260991003	260991003
Detroit	261150037	261150037
Dallas-Fort Worth	480850085	480850085
Dallas-Fort Worth	481130039	481130039
Dallas-Fort Worth	481130044	481130044
Dallas-Fort Worth	481130045	481130045
Dallas-Fort Worth	481130047	481130047
Dallas-Fort Worth	481130052	481130052
Dallas-Fort Worth	481130055	481130055
Dallas-Fort Worth	481130069	481130069
Dallas-Fort Worth	481130075	481130075
Dallas-Fort Worth	481130086	481130086
Dallas-Fort Worth	481130087	481130087
Dallas-Fort Worth	481131047	481131047
Dallas-Fort Worth	481133003	481133003
Dallas-Fort Worth	481210002	481210002
Dallas-Fort Worth	481210033	481210033
Dallas-Fort Worth	481210034	481210034
Dallas-Fort Worth	481210054	481210054
Dallas-Fort Worth	481390015	481390015
Dallas-Fort Worth	481390082	481390082
Dallas-Fort Worth	482570001	482570001
Dallas-Fort Worth	482570005	482570005
Dallas-Fort Worth	483970001	483970001
Dallas-Fort Worth	483970081	483970081
Denver	80010600	080010600
Denver	80013001	080013001
Denver	80017015	080017015
Denver	80050002	080050002
Denver	80050003	080050003
Denver	80051002	080051002
Denver	80310002	080310002
Denver	80310009	080310009
Denver	80310010	080310010
Denver	80310011	080310011
Denver	80310014	080310014
Denver	80350002	080350002
Denver	80350603	080350603
Denver	80590002	080590002
Houston	482010047	482010047
Houston	482010051	482010051
Houston	482010055	482010055
Houston	482010059	482010059
Houston	482010062	482010062
Houston	482010066	482010066
Houston	482010070	482010070
Houston	482010075	482010075
Houston	482010099	482010099

Table 1. Monitoring Sites for *USA Today* Cities (continued)

City	AIRS_ID	Site
Detroit	261150745	261150745
Detroit	261250001	261250001
Detroit	261250902	261250902
Detroit	261251002	261251002
Detroit	261470003	261470003
Detroit	261470005	261470005
Detroit	261470030	261470030
Detroit	261630001	261630001
Detroit	261630009	261630009
Detroit	261630014	261630014
Detroit	261630016	261630016
Detroit	261630018	261630018
Detroit	261630019	261630019
Detroit	261630020	261630020
Detroit	261630025	261630025
Detroit	261630062	261630062
Detroit	261632002	261632002
Detroit	261632003	261632003
Honolulu	150031001	150031001
Honolulu	150031004	150031004
Houston	480710900	480710900
Houston	480710901	480710901
Houston	480710902	480710902
Houston	480710903	480710903
Houston	481570004	481570004
Houston	482010007	482010007
Houston	482010024	482010024
Houston	482010026	482010026
Houston	482010027	482010027
Houston	482010028	482010028
Houston	482010029	482010029
Houston	482010038	482010038
Houston	482010039	482010039
Houston	482010046	482010046
Indianapolis	180970050	180970050
Indianapolis	180970057	180970057
Indianapolis	180970070	180970070
Indianapolis	180970073	180970073
Indianapolis	180970082	180970082
Indianapolis	180970901	180970901
Indianapolis	180970902	180970902
Indianapolis	180970903	180970903
Indianapolis	180970904	180970904
Indianapolis	180970905	180970905
Indianapolis	180970906	180970906
Indianapolis	180972001	180972001
Houston	482011003	482011003
Houston	482011034	482011034
Houston	482011035	482011035
Houston	482011036	482011036
Houston	482011037	482011037
Houston	482011039	482011039
Houston	482011050	482011050
Houston	482017001	482017001
Houston	482910089	482910089
Houston	483390078	483390078
Houston	483390088	483390088
Houston	483390089	483390089
Houston	484730001	484730001
Indianapolis	180110001	180110001
Indianapolis	180570004	180570004
Indianapolis	180571001	180571001
Indianapolis	180590001	180590001
Indianapolis	180590002	180590002
Indianapolis	180590003	180590003
Indianapolis	180590004	180590004
Indianapolis	180591001	180591001
Indianapolis	180630004	180630004
Indianapolis	180810001	180810001
Indianapolis	180810002	180810002
Indianapolis	180950009	180950009
Indianapolis	180950010	180950010
Indianapolis	180970004	180970004
Indianapolis	180970021	180970021
Indianapolis	180970025	180970025
Indianapolis	180970030	180970030
Indianapolis	180970031	180970031
Indianapolis	180970033	180970033
Indianapolis	180970037	180970037
Indianapolis	180970042	180970042
Las Vegas	320030043	320030043
Las Vegas	320030071	320030071
Las Vegas	320030072	320030072
Las Vegas	320030073	320030073
Las Vegas	320030538	320030538
Las Vegas	320030601	320030601
Las Vegas	320031001	320031001
Las Vegas	320031005	320031005
Las Vegas	320031007	320031007
Las Vegas	320031019	320031019
Los Angeles	60370001	060370001
Los Angeles	60370002	060370002

Table 1. Monitoring Sites for *USA Today* Cities (continued)

City	AIRS_ID	Site
Indianapolis	181090001	181090001
Indianapolis	181090003	181090003
Indianapolis	181090004	181090004
Indianapolis	181090005	181090005
Indianapolis	181450001	181450001
Kansas City	200910005	200910005
Kansas City	201030002	201030002
Kansas City	201210001	201210001
Kansas City	202090001	202090001
Kansas City	202090011	202090011
Kansas City	202090017	202090017
Kansas City	202090021	202090021
Kansas City	290370002	290370002
Kansas City	290370003	290370003
Kansas City	290470003	290470003
Kansas City	290470004	290470004
Kansas City	290470005	290470005
Kansas City	290470018	290470018
Kansas City	290470025	290470025
Kansas City	290472004	290472004
Kansas City	290950022	290950022
Kansas City	290950036	290950036
Kansas City	291650003	291650003
Kansas City	291650023	291650023
Las Vegas	320030005	320030005
Las Vegas	320030007	320030007
Las Vegas	320030009	320030009
Las Vegas	320030016	320030016
Las Vegas	320030020	320030020
Las Vegas	320030021	320030021
Las Vegas	320030022	320030022
Los Angeles	60376012	060376012
Los Angeles	60377001	060377001
Los Angeles	60378001	060378001
Los Angeles	60379002	060379002
Los Angeles	60379006	060379006
Los Angeles	60379033	060379033
Memphis	50350005	050350005
Memphis	280330002	280330002
Memphis	470470103	470470103
Memphis	471570012	471570012
Memphis	471570021	471570021
Memphis	471570024	471570024
Memphis	471570032	471570032
Memphis	471571004	471571004
Miami	120250008	120250008
Los Angeles	60370004	060370004
Los Angeles	60370016	060370016
Los Angeles	60370018	060370018
Los Angeles	60370019	060370019
Los Angeles	60370030	060370030
Los Angeles	60370031	060370031
Los Angeles	60370113	060370113
Los Angeles	60370206	060370206
Los Angeles	60371002	060371002
Los Angeles	60371004	060371004
Los Angeles	60371102	060371102
Los Angeles	60371103	060371103
Los Angeles	60371104	060371104
Los Angeles	60371105	060371105
Los Angeles	60371106	060371106
Los Angeles	60371201	060371201
Los Angeles	60371301	060371301
Los Angeles	60371401	060371401
Los Angeles	60371601	060371601
Los Angeles	60371701	060371701
Los Angeles	60371902	060371902
Los Angeles	60372002	060372002
Los Angeles	60372005	060372005
Los Angeles	60372101	060372101
Los Angeles	60372301	060372301
Los Angeles	60372401	060372401
Los Angeles	60374001	060374001
Los Angeles	60374002	060374002
Los Angeles	60374101	060374101
Los Angeles	60375001	060375001
Los Angeles	60376002	060376002
Minneapolis-St. Paul	271636015	271636015
Minneapolis-St. Paul	271710009	271710009
Minneapolis-St. Paul	551090001	551090001
Minneapolis-St. Paul	551091002	551091002
Nashville	470370011	470370011
Nashville	470370012	470370012
Nashville	470370026	470370026
Nashville	470430007	470430007
Nashville	470430009	470430009
Nashville	471490101	471490101
Nashville	471650007	471650007
Nashville	471650101	471650101
Nashville	471870103	471870103
Nashville	471870105	471870105
Nashville	471870106	471870106

Table 1. Monitoring Sites for *USA Today* Cities (continued)

City	AIRS_ID	Site
Miami	120250021	120250021
Miami	120250023	120250023
Miami	120250026	120250026
Miami	120250027	120250027
Miami	120250029	120250029
Miami	120250030	120250030
Miami	120251006	120251006
Miami	120251008	120251008
Miami	120251009	120251009
Miami	120254002	120254002
Minneapolis-St. Paul	270030002	270030002
Minneapolis-St. Paul	270031001	270031001
Minneapolis-St. Paul	270031002	270031002
Minneapolis-St. Paul	270032002	270032002
Minneapolis-St. Paul	270370006	270370006
Minneapolis-St. Paul	270371007	270371007
Minneapolis-St. Paul	270376018	270376018
Minneapolis-St. Paul	270530022	270530022
Minneapolis-St. Paul	270530027	270530027
Minneapolis-St. Paul	270530047	270530047
Minneapolis-St. Paul	271230001	271230001
Minneapolis-St. Paul	271230003	271230003
Minneapolis-St. Paul	271230030	271230030
Minneapolis-St. Paul	271230031	271230031
Minneapolis-St. Paul	271410001	271410001
Minneapolis-St. Paul	271410002	271410002
Minneapolis-St. Paul	271410008	271410008
Minneapolis-St. Paul	271630027	271630027
New York	360610010	360610010
New York	360610050	360610050
New York	360610056	360610056
New York	360610061	360610061
New York	360610063	360610063
New York	360790005	360790005
New York	360810004	360810004
New York	360810070	360810070
New York	360810097	360810097
New York	360810098	360810098
New York	360810124	360810124
New York	360850067	360850067
New York	361191002	361191002
New York	361192004	361192004
New York	361195003	361195003
Orlando	120690002	120690002
Orlando	120950008	120950008
Orlando	120952002	120952002
Nashville	471890103	471890103
New Orleans	220510003	220510003
New Orleans	220511001	220511001
New Orleans	220512001	220512001
New Orleans	220710005	220710005
New Orleans	220710011	220710011
New Orleans	220710012	220710012
New Orleans	220710082	220710082
New Orleans	220710083	220710083
New Orleans	220711001	220711001
New Orleans	220870002	220870002
New Orleans	220890001	220890001
New Orleans	220890003	220890003
New Orleans	220890100	220890100
New Orleans	220930001	220930001
New Orleans	220930002	220930002
New Orleans	220950002	220950002
New York	360050003	360050003
New York	360050006	360050006
New York	360050073	360050073
New York	360050080	360050080
New York	360050083	360050083
New York	360050110	360050110
New York	360470007	360470007
New York	360470011	360470011
New York	360470018	360470018
New York	360470076	360470076
New York	360610005	360610005
Philadelphia	421010023	421010023
Philadelphia	421010024	421010024
Philadelphia	421010025	421010025
Philadelphia	421010026	421010026
Philadelphia	421010027	421010027
Philadelphia	421010029	421010029
Philadelphia	421010136	421010136
Phoenix	40130009	040130009
Phoenix	40130013	040130013
Phoenix	40130014	040130014
Phoenix	40130015	040130015
Phoenix	40130016	040130016
Phoenix	40130018	040130018
Phoenix	40130019	040130019
Phoenix	40131003	040131003
Phoenix	40131004	040131004
Phoenix	40131006	040131006
Phoenix	40131010	040131010

Table 1. Monitoring Sites for *USA Today* Cities (continued)

City	AIRS_ID	Site
Orlando	120972002	120972002
Orlando	121171002	121171002
Philadelphia	340050007	340050007
Philadelphia	340053001	340053001
Philadelphia	340070003	340070003
Philadelphia	340071001	340071001
Philadelphia	340150002	340150002
Philadelphia	340333001	340333001
Philadelphia	420170012	420170012
Philadelphia	420290050	420290050
Philadelphia	420290070	420290070
Philadelphia	420290100	420290100
Philadelphia	420450002	420450002
Philadelphia	420450102	420450102
Philadelphia	420450103	420450103
Philadelphia	420910013	420910013
Philadelphia	420910069	420910069
Philadelphia	420910101	420910101
Philadelphia	421010002	421010002
Philadelphia	421010004	421010004
Philadelphia	421010014	421010014
Philadelphia	421010019	421010019
Philadelphia	421010020	421010020
Philadelphia	421010021	421010021
Philadelphia	421010022	421010022
Phoenix	40139997	040139997
Phoenix	40139998	040139998
Phoenix	40218001	040218001
Pittsburgh	420030008	420030008
Pittsburgh	420030010	420030010
Pittsburgh	420030067	420030067
Pittsburgh	420030080	420030080
Pittsburgh	420030081	420030081
Pittsburgh	420030088	420030088
Pittsburgh	420031001	420031001
Pittsburgh	420031005	420031005
Pittsburgh	420070002	420070002
Pittsburgh	420070003	420070003
Pittsburgh	420070004	420070004
Pittsburgh	420070005	420070005
Pittsburgh	420070014	420070014
Pittsburgh	420070501	420070501
Pittsburgh	420190501	420190501
Pittsburgh	421250005	421250005
Pittsburgh	421250200	421250200
Pittsburgh	421250501	421250501
Phoenix	40132001	040132001
Phoenix	40132004	040132004
Phoenix	40132005	040132005
Phoenix	40133002	040133002
Phoenix	40133003	040133003
Phoenix	40133004	040133004
Phoenix	40133006	040133006
Phoenix	40133009	040133009
Phoenix	40133010	040133010
Phoenix	40134003	040134003
Phoenix	40134004	040134004
Phoenix	40134005	040134005
Phoenix	40134006	040134006
Phoenix	40134007	040134007
Phoenix	40139508	040139508
Phoenix	40139604	040139604
Phoenix	40139701	040139701
Phoenix	40139702	040139702
Phoenix	40139704	040139704
Phoenix	40139706	040139706
Phoenix	40139707	040139707
Phoenix	40139805	040139805
Phoenix	40139993	040139993
Phoenix	40139994	040139994
Phoenix	40139995	040139995
Sacramento	60171002	060171002
Sacramento	60172002	060172002
Sacramento	60610002	060610002
Sacramento	60610004	060610004
Sacramento	60610006	060610006
Sacramento	60610810	060610810
Sacramento	60611003	060611003
Sacramento	60613001	060613001
Sacramento	60670001	060670001
Sacramento	60670002	060670002
Sacramento	60670003	060670003
Sacramento	60670005	060670005
Sacramento	60670006	060670006
Sacramento	60670010	060670010
Sacramento	60670011	060670011
Sacramento	60670012	060670012
Sacramento	60670013	060670013
Sacramento	60671001	060671001
Sacramento	60675001	060675001
Sacramento	60675002	060675002
Sacramento	60675003	060675003

Table 1. Monitoring Sites for *USA Today* Cities (continued)

City	AIRS_ID	Site
Pittsburgh	421255001	421255001
Pittsburgh	421290006	421290006
Pittsburgh	421290008	421290008
Pittsburgh	421290101	421290101
Portland	410050004	410050004
Portland	410051006	410051006
Portland	410052001	410052001
Portland	410052002	410052002
Portland	410053001	410053001
Portland	410054001	410054001
Portland	410090004	410090004
Portland	410511002	410511002
Portland	530110007	530110007
Portland	530110009	530110009
Portland	530110011	530110011
Portland	530111001	530111001
Sacramento	60170006	060170006
Sacramento	60170009	060170009
Sacramento	60170010	060170010
Sacramento	60170011	060170011
Sacramento	60170012	060170012
Sacramento	60170020	060170020
San Diego	60730003	060730003
San Diego	60730005	060730005
San Diego	60730006	060730006
San Diego	60731001	060731001
San Diego	60731002	060731002
San Diego	60731003	060731003
San Diego	60731004	060731004
San Diego	60731005	060731005
San Diego	60731006	060731006
San Diego	60731007	060731007
San Diego	60731008	060731008
San Diego	60731009	060731009
San Diego	60732007	060732007
San Diego	60734001	060734001
San Diego	60737001	060737001
San Francisco	60410001	060410001
San Francisco	60410002	060410002
San Francisco	60750003	060750003
San Francisco	60750004	060750004
San Francisco	60750005	060750005
San Francisco	60810002	060810002
San Francisco	60811001	060811001
Seattle	530330010	530330010
Seattle	530330017	530330017
Salt Lake City	490110001	490110001
Salt Lake City	490110002	490110002
Salt Lake City	490350002	490350002
Salt Lake City	490350003	490350003
Salt Lake City	490350004	490350004
Salt Lake City	490350009	490350009
Salt Lake City	490351001	490351001
Salt Lake City	490351002	490351002
Salt Lake City	490351005	490351005
Salt Lake City	490352004	490352004
Salt Lake City	490353001	490353001
Salt Lake City	490353003	490353003
Salt Lake City	490353006	490353006
Salt Lake City	490353007	490353007
Salt Lake City	490570001	490570001
Salt Lake City	490570003	490570003
Salt Lake City	490570007	490570007
Salt Lake City	490571001	490571001
Salt Lake City	490571002	490571002
Salt Lake City	490571003	490571003
San Diego	60730001	060730001
San Diego	60730002	060730002
St. Louis	171192005	171192005
St. Louis	171192006	171192006
St. Louis	171192007	171192007
St. Louis	171192008	171192008
St. Louis	171193007	171193007
St. Louis	171198001	171198001
St. Louis	171331001	171331001
St. Louis	171332001	171332001
St. Louis	171630008	171630008
St. Louis	171630009	171630009
St. Louis	171630010	171630010
St. Louis	171631001	171631001
St. Louis	171631006	171631006
St. Louis	171631007	171631007
St. Louis	171631008	171631008
St. Louis	171631009	171631009
St. Louis	290990012	290990012
St. Louis	291830002	291830002
St. Louis	291830005	291830005
St. Louis	291830008	291830008
St. Louis	291831002	291831002
St. Louis	291831004	291831004
St. Louis	291890001	291890001
St. Louis	291890002	291890002

Table 1. Monitoring Sites for *USA Today* Cities (continued)

City	AIRS_ID	Site
Seattle	530330018	530330018
Seattle	530330023	530330023
Seattle	530330058	530330058
Seattle	530330059	530330059
Seattle	530330080	530330080
Seattle	530330088	530330088
Seattle	530332001	530332001
Seattle	530337001	530337001
Seattle	530337002	530337002
Seattle	530610007	530610007
Seattle	530612001	530612001
St. Louis	170830001	170830001
St. Louis	170831001	170831001
St. Louis	171190005	171190005
St. Louis	171190006	171190006
St. Louis	171190008	171190008
St. Louis	171190012	171190012
St. Louis	171191004	171191004
St. Louis	171191009	171191009
St. Louis	295100066	295100066
St. Louis	295100067	295100067
St. Louis	295100068	295100068
St. Louis	295100069	295100069
St. Louis	295100070	295100070
St. Louis	295100071	295100071
St. Louis	295100072	295100072
St. Louis	295100080	295100080
St. Louis	295100086	295100086
Tampa	120570025	120570025
Tampa	120570074	120570074
Tampa	120570081	120570081
Tampa	120570110	120570110
Tampa	120571021	120571021
Tampa	120571022	120571022
Tampa	120571035	120571035
Tampa	120571042	120571042
Tampa	120571052	120571052
Tampa	120571055	120571055
Tampa	120571065	120571065
Tampa	120571068	120571068
Tampa	120574004	120574004
Tampa	121010005	121010005
Tampa	121012001	121012001
Tampa	121030003	121030003
Tampa	121030004	121030004
Tampa	121030012	121030012

City	AIRS_ID	Site
St. Louis	291890004	291890004
St. Louis	291890006	291890006
St. Louis	291890007	291890007
St. Louis	291890008	291890008
St. Louis	291890009	291890009
St. Louis	291890010	291890010
St. Louis	291892002	291892002
St. Louis	291893001	291893001
St. Louis	291894001	291894001
St. Louis	291895001	291895001
St. Louis	291897001	291897001
St. Louis	291897002	291897002
St. Louis	291897003	291897003
St. Louis	295100002	295100002
St. Louis	295100007	295100007
St. Louis	295100061	295100061
St. Louis	295100062	295100062
St. Louis	295100063	295100063
St. Louis	295100064	295100064
Washington	110010043	110010043
Washington	110011000	110011000
Washington	240090010	240090010
Washington	240170010	240170010
Washington	240210034	240210034
Washington	240210037	240210037
Washington	240310005	240310005
Washington	240310006	240310006
Washington	240311001	240311001
Washington	240311004	240311004
Washington	240313001	240313001
Washington	240330002	240330002
Washington	240330003	240330003
Washington	240330004	240330004
Washington	240338001	240338001
Washington	240338002	240338002
Washington	510130008	510130008
Washington	510130020	510130020
Washington	510590005	510590005
Washington	510590014	510590014
Washington	510590018	510590018
Washington	510590030	510590030
Washington	510591004	510591004
Washington	510595001	510595001
Washington	510610002	510610002
Washington	511071005	511071005
Washington	511530008	511530008

Table 1. Monitoring Sites for *USA Today* Cities (continued)

City	AIRS_ID	Site
Tampa	121030018	121030018
Tampa	121030020	121030020
Tampa	121030021	121030021
Tampa	121030023	121030023
Tampa	121033001	121033001
Tampa	121035002	121035002
Tampa	121037001	121037001
Washington	110010003	110010003
Washington	110010008	110010008
Washington	110010011	110010011
Washington	110010013	110010013
Washington	110010014	110010014
Washington	110010017	110010017
Washington	110010018	110010018
Washington	110010025	110010025
Washington	110010041	110010041
Washington	511530009	511530009
Washington	511790001	511790001
Washington	511870002	511870002
Washington	515100009	515100009
Washington	516000005	516000005
Washington	516300003	516300003
Washington	540030003	540030003

5 years (1997 through 2001) of data from the AQS for developing the historical data.

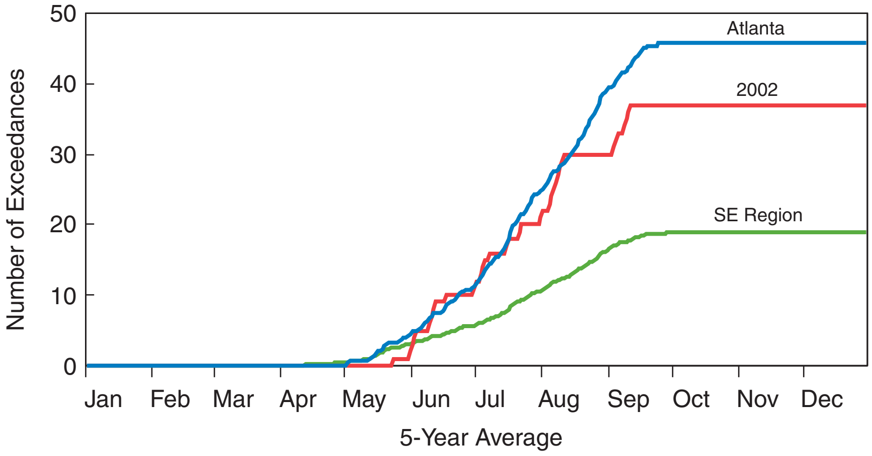
Procedures

Using the data described above, we observed the following procedure for determining an ozone exceedance day for a particular *USA Today* city. For each day of the year, if one of the monitors assigned to a particular city measured an 8-hour ozone level ≥0.085 ppm, that one measurement resulted in one exceedance day for the city. Even if more than one of the city's assigned monitors recorded an 8-hour ozone level ≥0.085 ppm on a given day, the exceedance count for that day and city remained one. The number of days exceedances are measured are then accumulated over the year to obtain a count of days (or cumulative count) of exceedance measurements.

For 2002, the cumulative count of days was obtained from the AQS database described above for each city. For the historical 5-year period (i.e., 1997 through 2001), the average number of the cumulative count of days was obtained over the 5-year period for each set of monitors assigned to each city to yield a 5-year trend. We decided to use an average value as a comparison instead of a year-to-year comparison because the year-to-year cumulative count of days will vary, making comparisons with the most recent year less meaningful.

Using these data, we generated graphs showing the 5-year average cumulative count of days with the 2002 cumulative count of days for selected cities. Figure 1 provides the graph for Atlanta, which shows that the cumulative count of days in 2002 for the Atlanta area closely matches the 5-year average trend in the cumulative count of days through approximately the middle of August. After the middle of August, the 2002 count of days was less than the 5-year average, and, by the end of the ozone season, the cumulative count of days for 2002 was 37 compared to the 5-year average trend of 46.

Figure 1. Cumulative exceedances—5-year average (97–01) (Atlanta) compared to 2002 data and SE region average.



We also added a regional aspect for comparison to the individual city data. We grouped the *USA Today* cities into geographic regions and then calculated a 5-year regional average cumulative count of days based on the individual city data within the region. This regional average was also depicted on the individual city graphics to offer a comparison of the city data to regional data.

As shown in Table 2, the *USA Today* cities were grouped into southeast, northeast, midwest, and southwest regions. Dallas, Houston, and Los Angeles were treated as individual cities because of their unique geographic locations and—especially in the case of Los Angeles—unique emission density characteristics compared to other *USA Today* cities. The combination of cities included in the regional average cumulative count of days was somewhat subjective for this illustration, and other combinations could be done for different comparative purposes.

Table 2. Regional Groupings of *USA Today* Cities

Southeast U.S. Cities	Atlanta Charlotte Memphis Nashville	New Orleans Miami Orlando Tampa
Northeast U.S. Cities	Boston New York Philadelphia	Baltimore Washington, D.C.
Midwest U.S. Cities	Chicago Cleveland Cincinnati Columbus Detroit	Indianapolis Kansas City Minneapolis Pittsburgh St. Louis
Southwest U.S. Cities	Las Vegas Phoenix	Sacramento San Diego
Individual U.S. Cities	Dallas Houston	Los Angeles

Discussion of Graphical Depictions of Cumulative Count of Days

The following sections discuss the graphical depictions of the cumulative count of days for 30 of the 36 *USA Today* cities used in this analysis. The *USA Today* cities of Portland (OR), Seattle, Denver, Honolulu, Salt Lake City, and San Francisco were not included because ozone exceedances are typically minimal in these locations.

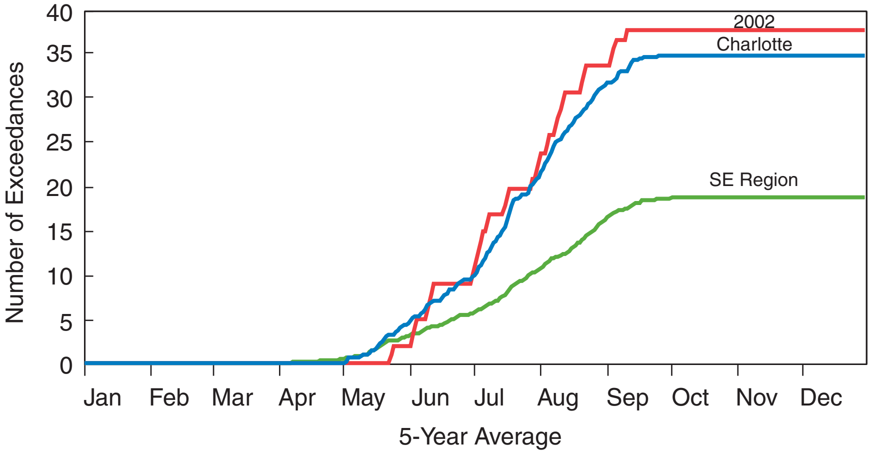
Southeast U.S. Region

We have included the following cities in the Southeast (SE) U.S. Region: Atlanta, Charlotte, Memphis, Nashville, New Orleans, Miami, Orlando, and Tampa. The graph for each SE city depicts the city 5-year average cumulative count of days, the combined 5-year average for all SE Region cities, and the 2002 cumulative count of days for the city.

The Atlanta graph (see Figure 1) shows that the 2002 count of days was tracking the Atlanta 5-year average rather closely through approximately the middle of August then trended less than the 5-year average for the remainder of the year. An ozone episode of several days is depicted on the graph in early August, when the count of days increased from 22 days to 30 days. For comparative purposes, the Atlanta data are higher than those for the combined SE Region average; that is, the Atlanta 5-year average cumulative count of days is about 46 days per year, whereas the SE Region average is approximately 18 days per year.

For Charlotte (Figure 2), the 2002 count of days trended slightly less than the 5-year average through early June but then trended slightly greater than the 5-year average from early July onward. Ozone episodes are noted in early July and early August. Also, the Charlotte data are comparatively higher than those for

Figure 2. Cumulative exceedances—5-year average (97–01) (Charlotte) compared to 2002 data and SE region average.



the combined SE Region average. The Charlotte data show that the city's 5-year average cumulative count of days is about 35 days per year, whereas the combined SE Region average is about 18 days per year.

The graph for Memphis (Figure 3) shows that the 2002 data were trending less than the Memphis 5-year average count of days throughout the year. As a result, the total cumulative count of days for 2002 was 16, whereas the 5-year average total is approximately 23 days. Again, an ozone episode is noted in early August for Memphis, similar to those noted in Atlanta and Charlotte.

As with the graph for Memphis, the graph for Nashville (Figure 4) also shows the 2002 data trending slightly less than the 5-year average throughout the year. The total count of days for 2002 was 21 days, whereas the 5-year average count of days is approximately 25 days. Notable ozone episodes are shown in early August and early September.

The graph for New Orleans (Figure 5) shows the count of days for 2002 trended less than the 5-year average throughout the year. The 2002 total was 2 days, whereas the 5-year is 8 days.

Figure 3. Cumulative exceedances—5-year average (97–01) (Memphis) compared to 2002 data and SE region average.

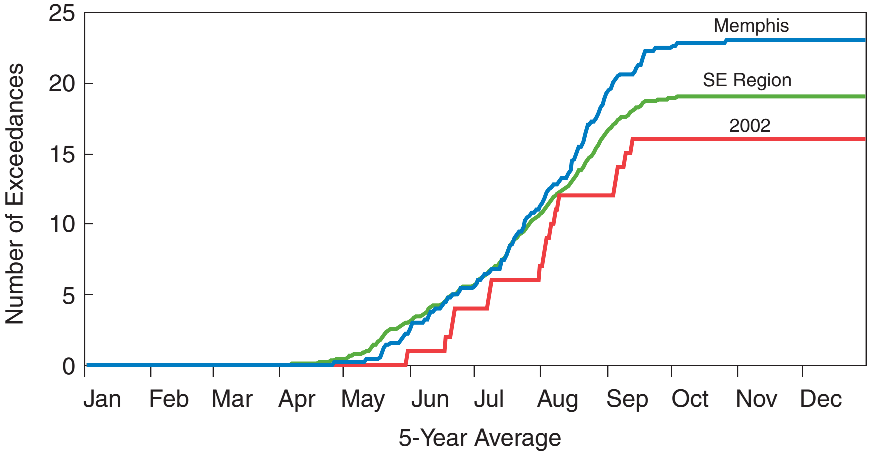


Figure 4. Cumulative exceedances—5-year average (97–01) (Nashville) compared to 2002 data and SE region average.

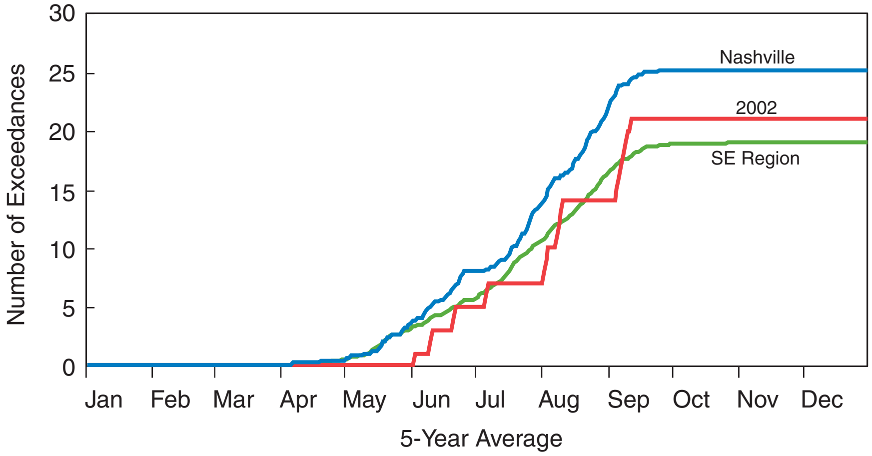


Figure 5. Cumulative exceedances—5-year average (97–01) (New Orleans) compared to 2002 data and SE region average.

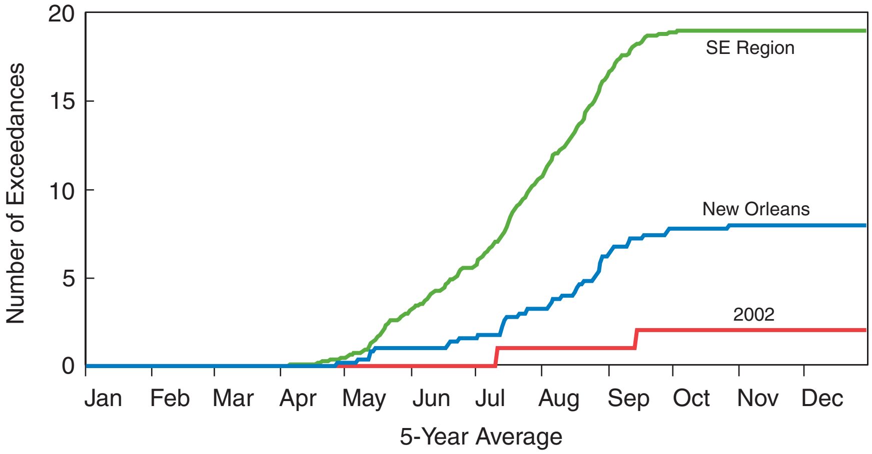


Figure 6. Cumulative exceedances—5-year average (97–01) (Miami) compared to 2002 data and SE region average.

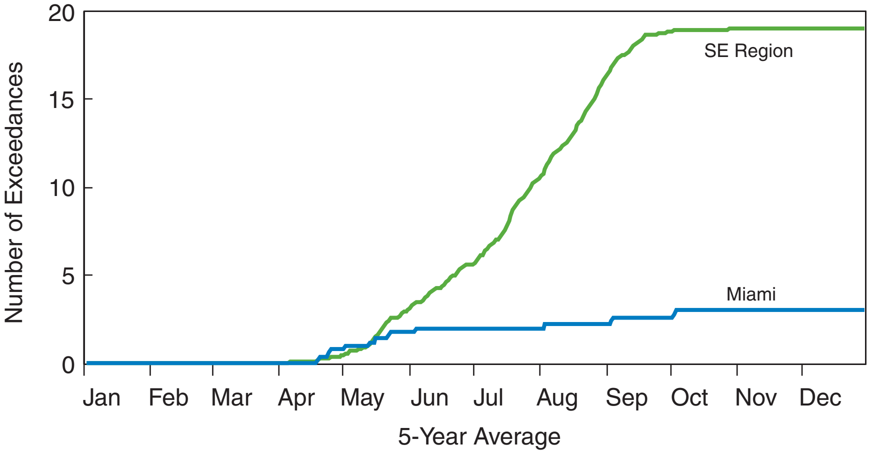


Figure 7. Cumulative exceedances—5-year average (97–01) (Orlando) compared to 2002 data and SE region average.

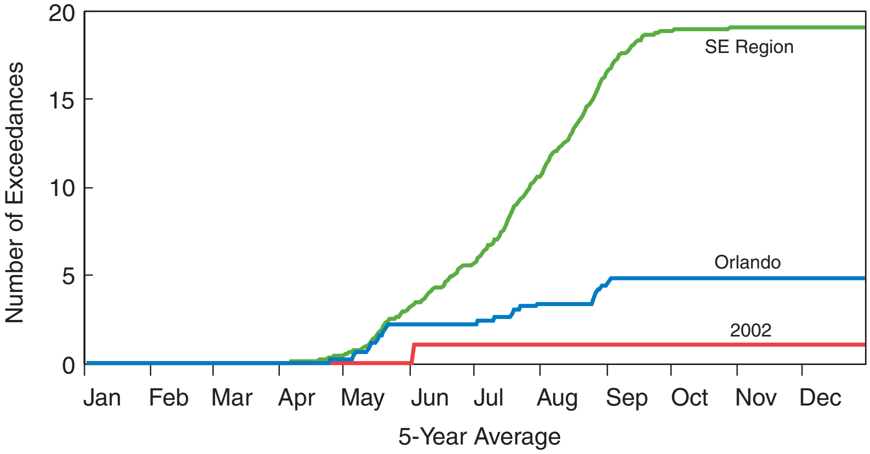
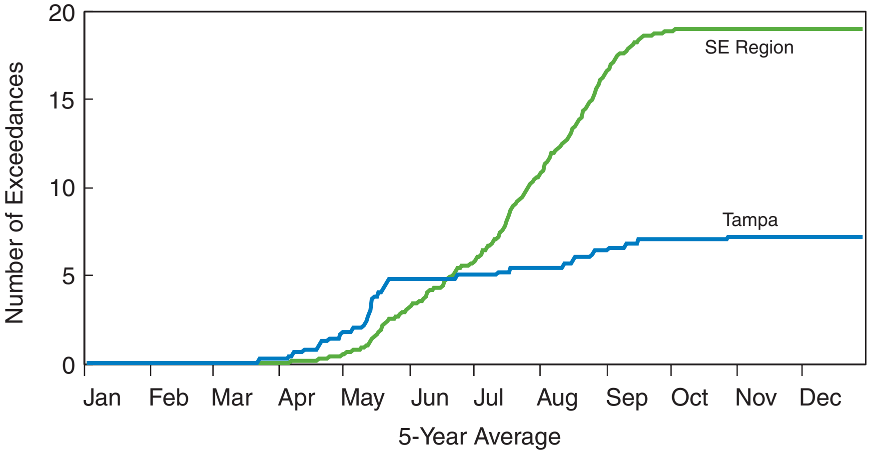


Figure 8. Cumulative exceedances—5-year average (97–01) (Tampa) compared to 2002 data and SE region average.



Miami (Figure 6), Orlando (Figure 7), and Tampa (Figure 8) all show 2002 cumulative counts of days throughout the year less than the 5-year average. Miami and Tampa show no exceedances counted for 2002. In comparison, Miami averaged 5 days for the 5-year period, and Tampa averaged 7 days.

Northeast U.S. Region

The following cities were included for the Northeast (NE) U.S. Region: Boston, New York, Philadelphia, Baltimore, and Washington, DC. The graph for each NE city depicts the city 5-year average count of days, the combined 5-year average count of days for all NE cities, and the city's 2002 count of days.

The graphical depiction for the Boston area (Figure 9) shows that the 2002 data trended greater than the 5-year average from approximately late June onward. A notable ozone episode of high ozone with several days of measured exceedances occurred during early to mid-August. The total count of days in the Boston area for 2002 was 18, whereas the 5-year average count of days is approximately 8 days.

Figure 9. Cumulative exceedances—5-year average (97–01) (Boston) compared to 2002 data and NE region average.

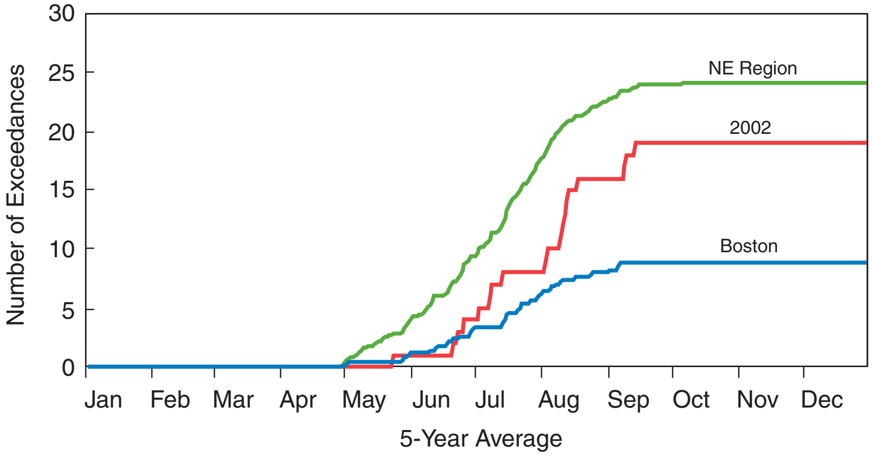


Figure 10. Cumulative exceedances—5-year average (97–01) (New York) compared to 2002 data and NE region average.

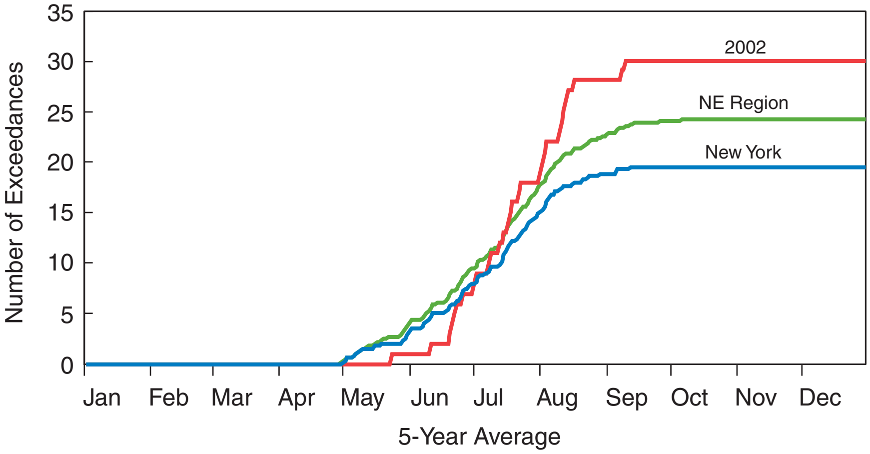
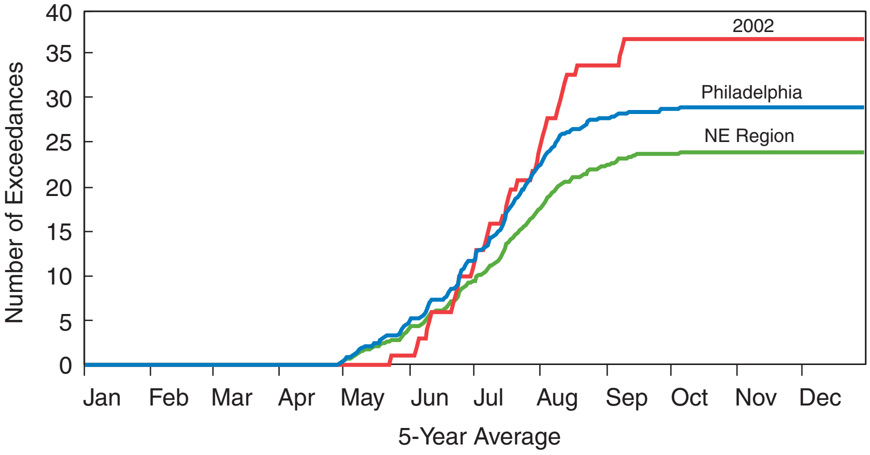


Figure 11. Cumulative exceedances—5-year average (97–01) (Philadelphia) compared to 2002 data and NE region average.



The graph for the New York area (Figure 10) shows a trend similar to the one in Boston, with the 2002 data trending greater than the 5-year average from approximately the beginning of July onward. The New York data also show an ozone episode in early to mid-August. The total count of days for 2002 was 30, compared to the 5-year average of 19 days.

For Philadelphia (Figure 11), the graph shows the 2002 data trending similar to the 5-year data until the beginning of August. After that, the 2002 data trend greater, with a 2002 total count of days of 37, whereas the 5-year average is approximately 29 days. As with Boston and New York, the ozone episode is evident in early to mid-August.

The graph for Baltimore (Figure 12) shows a pattern nearly identical to that of Philadelphia. The 2002 total count of days was 39, whereas the 5-year average is approximately 33 days.

The Washington, DC, graph (Figure 13) shows a pattern similar to that of Philadelphia and Baltimore, with the 2002 data showing a greater trend than the 5-year average from approximately the beginning of August onward. The total 2002 count of days for Washington was 37, as compared to the 5-year average of 31 days.

Midwest U.S. Region

The following cities were included in the Midwest U.S. Region: Chicago, Cleveland, Cincinnati, Columbus, Detroit, Indianapolis, Kansas City, Minneapolis, Pittsburgh, and St. Louis.

The graph for Chicago (Figure 14) shows a similar trend for 2002 count of days compared to the 5-year average trend through approximately the middle of June. Thereafter, the 2002 data show a notably greater trend than the 5-year average. A notable ozone episode of several days is evident in the middle of July. Other episodes are shown in early August and early September. The total count of days for 2002 in the Chicago area was 20, as compared to the 5-year average of approximately 9.

Figure 12. Cumulative exceedances—5-year average (97–01) (Baltimore) compared to 2002 data and NE region average.

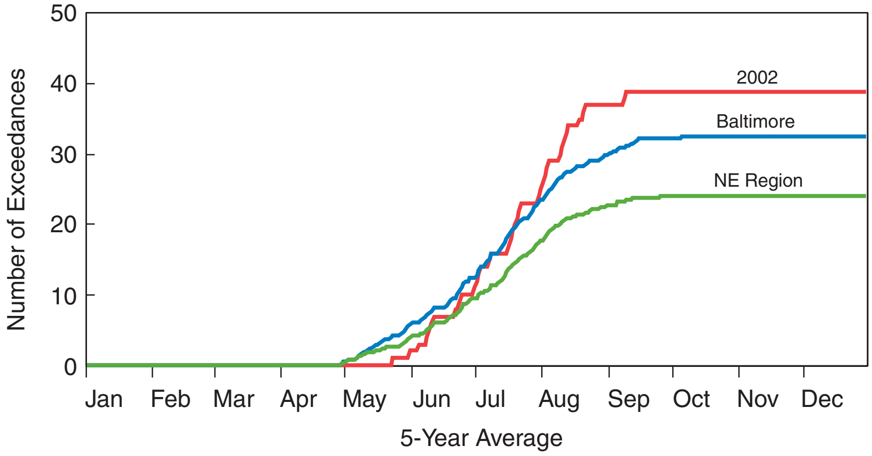


Figure 13. Cumulative exceedances—5-year average (97–01) (Washington, DC) compared to 2002 data and NE region average.

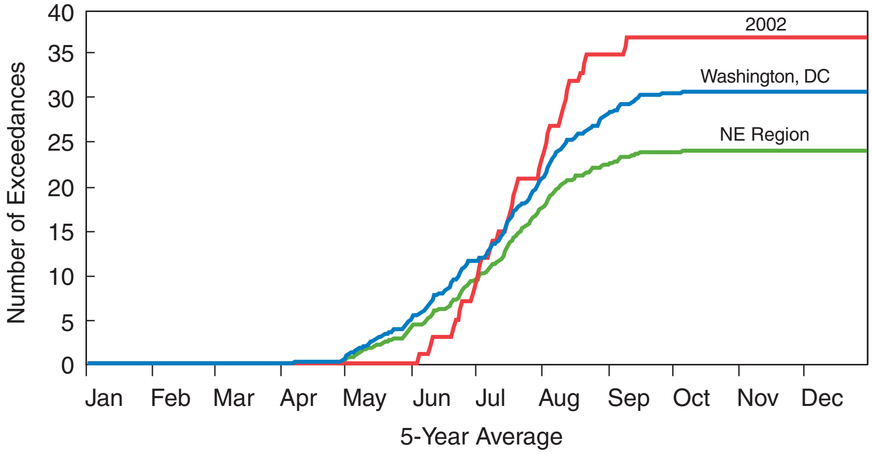
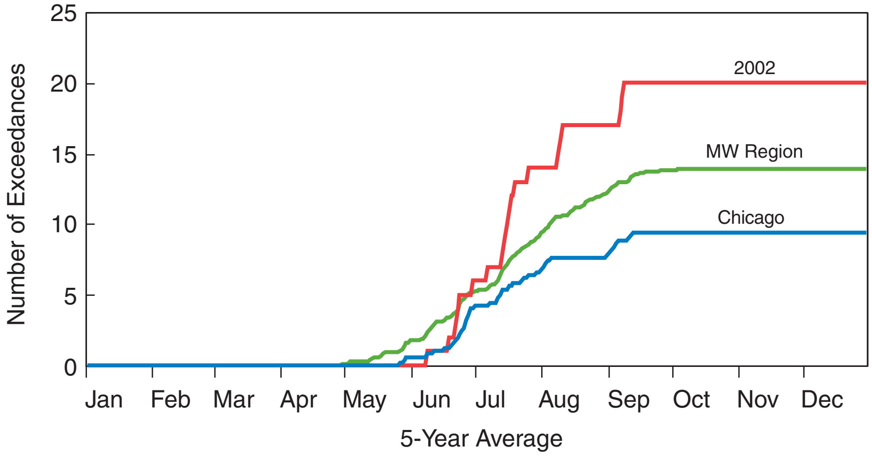


Figure 14. Cumulative exceedances—5-year average (97–01) (Chicago) compared to 2002 data and MW region average.



The graph for Cleveland (Figure 15) shows a pattern similar to the one for Chicago. There is a similar trend in the 2002 data and 5-year average data through the end of June, then a notably greater trend in the count of days from the middle of June onward. The total 2002 count of days was 31 compared to the 5-year average of approximately 18 days.

Cincinnati (Figure 16), Columbus (Figure 17), Detroit (Figure 18), Indianapolis (Figure 19), Pittsburgh (Figure 20), and St. Louis (Figure 21) all show a similar pattern, with the 2002 data trending less than the 5-year average until the middle or end of June, then trending notably greater than the 5-year average onward. All show ozone episodes around the beginning of August and in early September. Another episode common to all cities is seen in the middle of June. For Cincinnati, the 2002 total count of days was 28, compared to a 5-year average of approximately 17 days. For Columbus, the 2002 total was 27 days, compared to a 5-year average of approximately 16 days.

Figure 15. Cumulative exceedances—5-year average (97–01) (Cleveland) compared to 2002 data and MW region average.

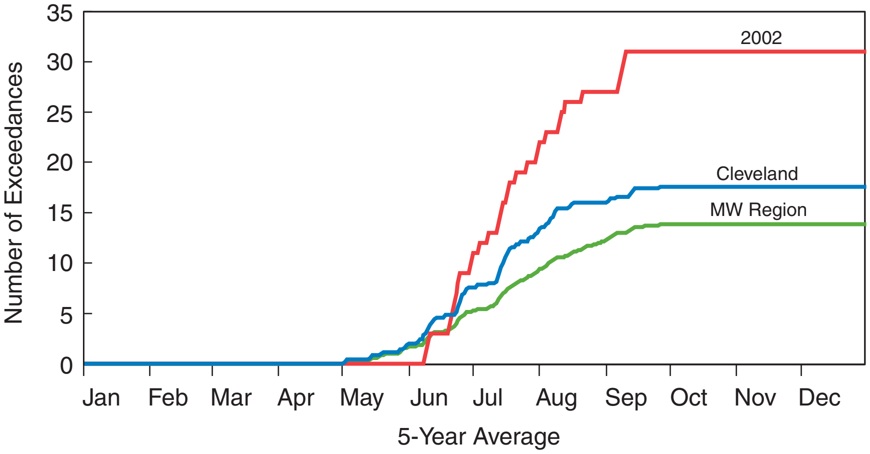


Figure 16. Cumulative exceedances—5-year average (97–01) (Cincinnati) compared to 2002 data and MW region average.

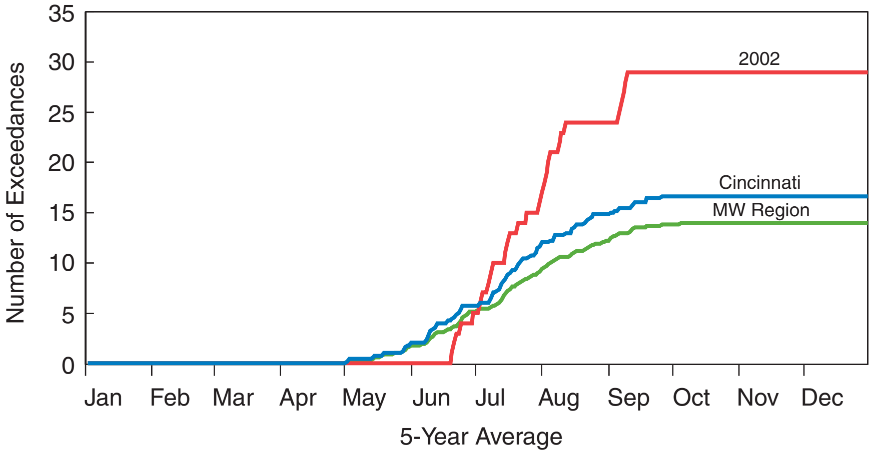
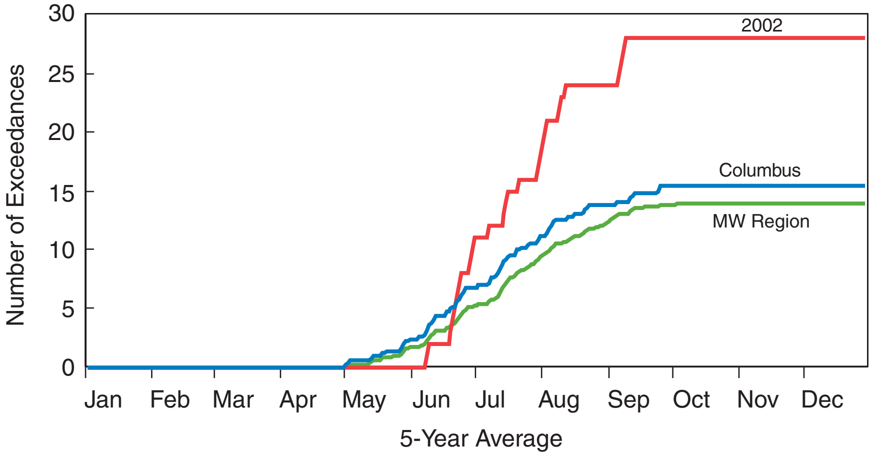


Figure 17. Cumulative exceedances—5-year average (97–01) (Columbus) compared to 2002 data and MW region average.



For Detroit, the 2002 total was 22 days, compared to approximately 12 days for the 5-year average. For Indianapolis, the 2002 total was 24 days, compared to approximately 15 days for the 5-year average.

For Pittsburgh, the 2002 total was 33 days, compared to a 5-year average of approximately 23 days.

Figure 18. Cumulative exceedances—5-year average (97–01) (Detroit) compared to 2002 data and MW region average.

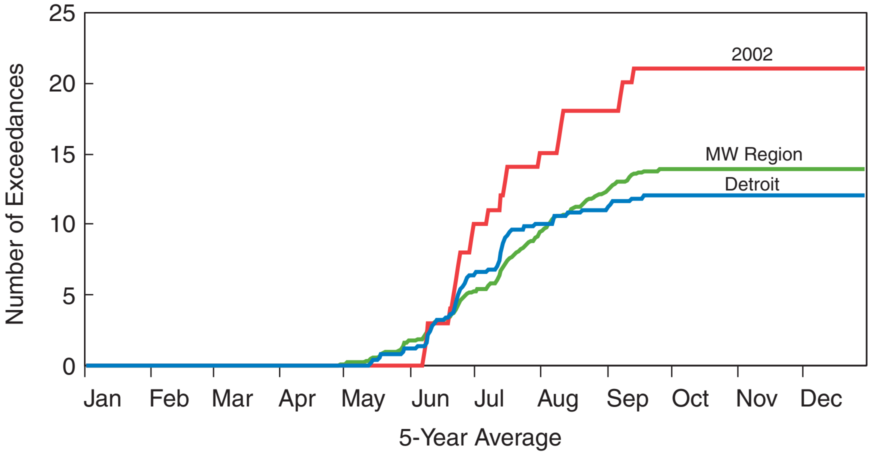


Figure 19. Cumulative exceedances—5-year average (97–01) (Indianapolis) compared to 2002 data and MW region average.

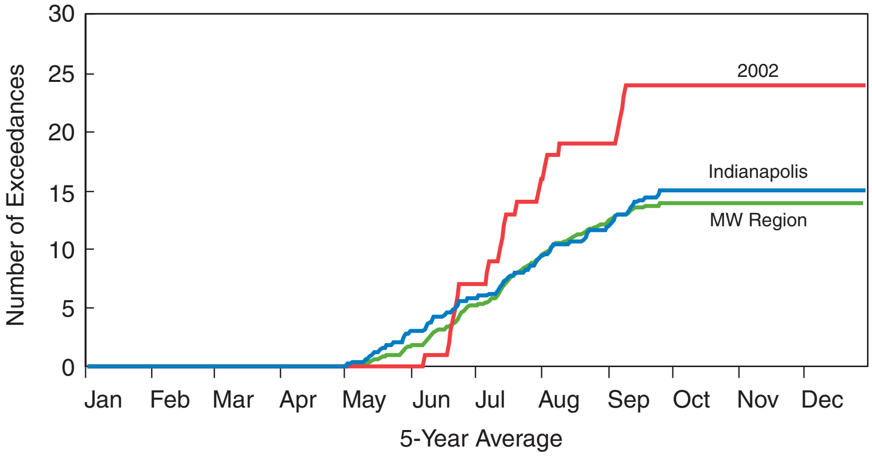
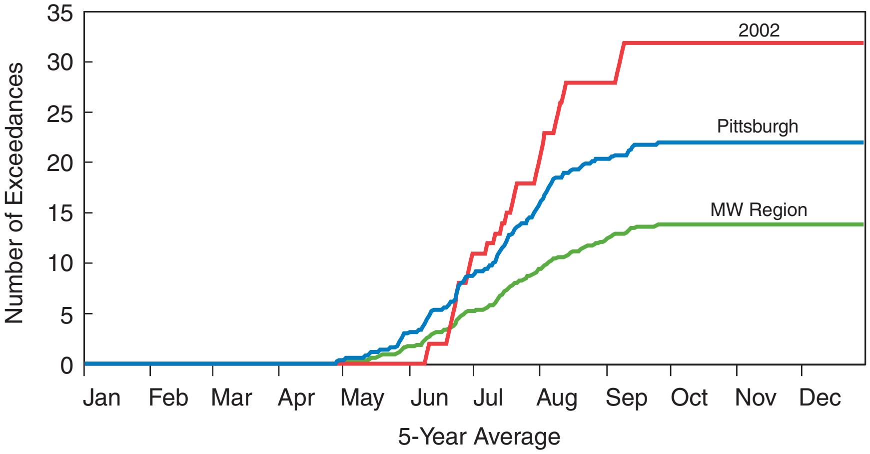


Figure 20. Cumulative exceedances—5-year average (97–01) (Pittsburgh) compared to 2002 data and MW region average.



For St. Louis, the 2002 total was 32 days, compared to a 5-year average of approximately 19 days.

The graph for Kansas City (Figure 22) showed no exceedances until early July. Ozone exceedances trended similar to the 5-year average for July and into August, then trended less than the 5-year average onward. The 2002 cumulative count of days was 7, whereas the 5-year average for Kansas City is approximately 11 days.

Minneapolis (Figure 23) historically has few exceedance days, averaging about 1 day over the 5-year period. The 2002 data show there were 2 exceedance days.

Figure 21. Cumulative exceedances—5-year average (97–01) (St. Louis) compared to 2002 data and MW region average.

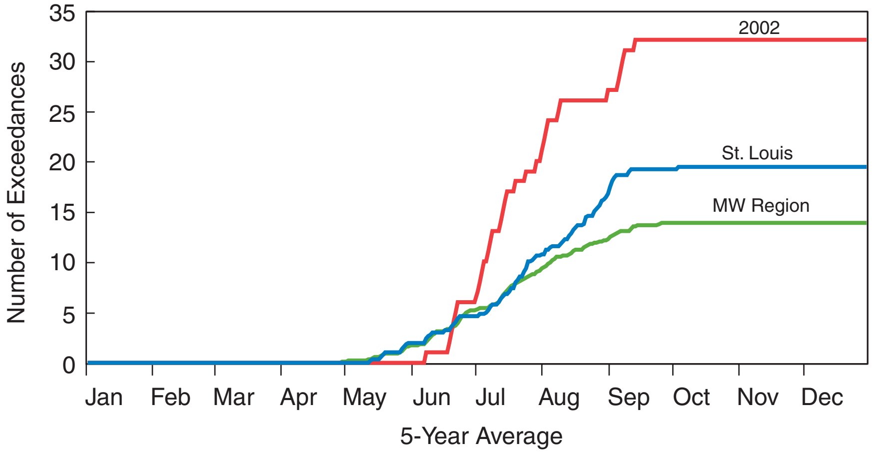


Figure 22. Cumulative exceedances—5-year average (97–01) (Kansas City) compared to 2002 data and MW region average.

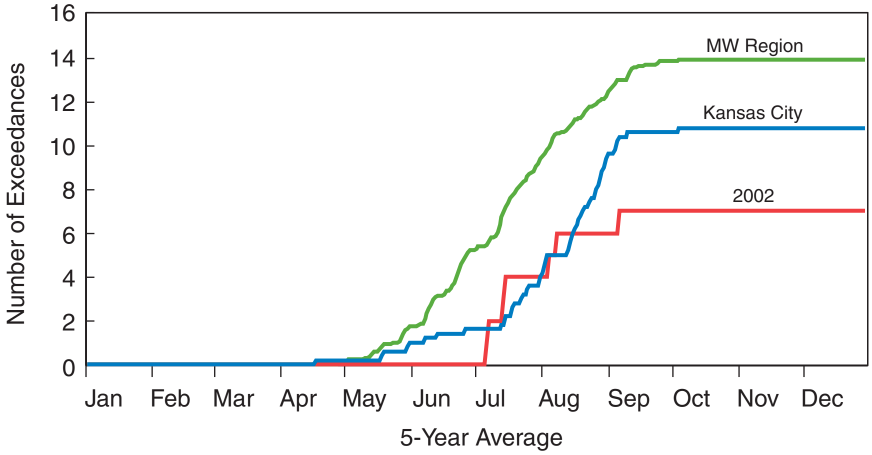
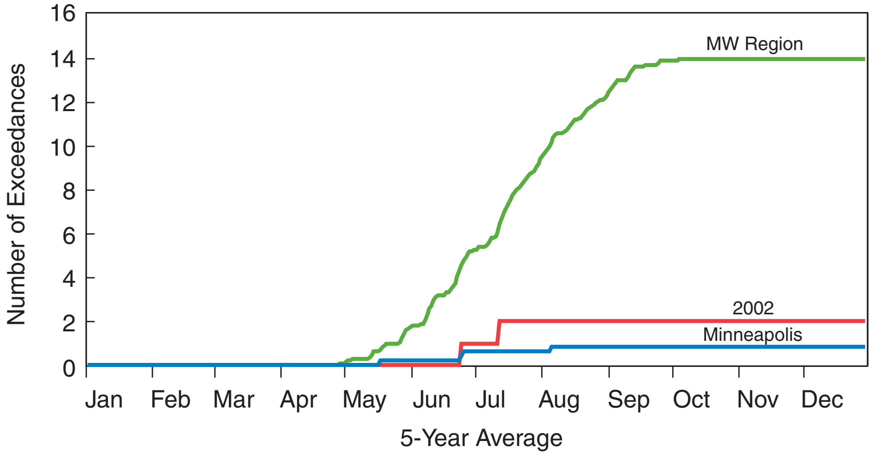


Figure 23. Cumulative exceedances—5-year average (97–01) (Minneapolis) compared to 2002 data and MW region average.



Southwest U.S. Region

The following cities were included in the Southwest (SW) U.S. Region: Las Vegas, Phoenix, Sacramento, and San Diego. Los Angeles was viewed separately for the SW Region. Also, any comparisons of the SW Region to individual cities may be less meaningful than comparisons in other regions because of the larger distances and more unique geographic and emission characteristics among the SW region cities.

For Las Vegas (Figure 24), the trend in the cumulative count of days for 2002 was similar to the 5-year average trend. The total number of days for 2002 was 6, whereas the 5-year average count of days is 3.

The 2002 cumulative count of days for San Diego (Figure 25) trended persistently less than the 5-year average throughout the year. The total count of days for 2002 was 13, as compared to the 5-year average of approximately 20 days.

The graph for Sacramento (Figure 26) showed a similar trend for 2002 as compared to the 5-year average through the beginning of July. Thereafter, the 2002 count of days trended greater than the 5-year average from early July onward. The total 2002 cumulative count of days was 45 days, whereas the 5-year average is approximately 35 days.

Figure 24. Cumulative exceedances—5-year average (97–01) (Las Vegas) compared to 2002 data and SW region average.

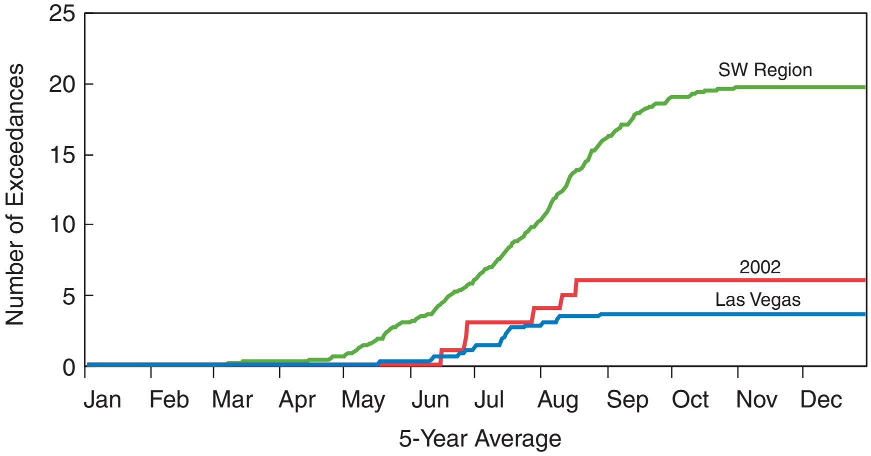


Figure 25. Cumulative exceedances—5-year average (97–01) (San Diego) compared to 2002 data and SW region average.

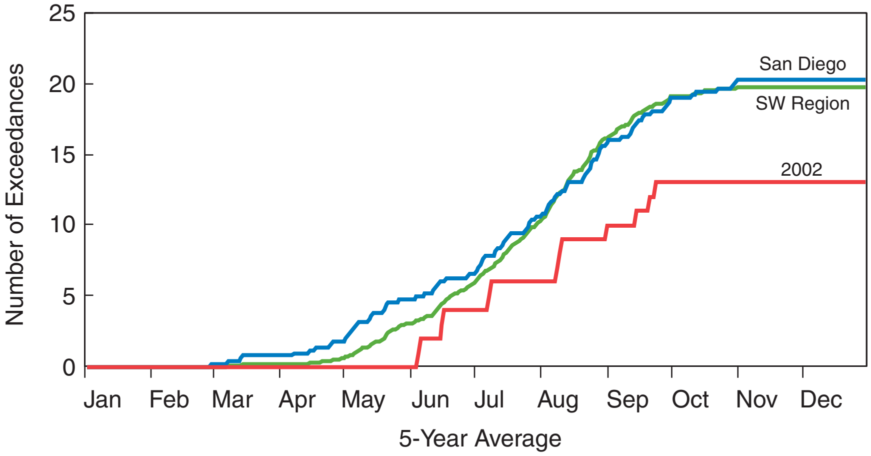
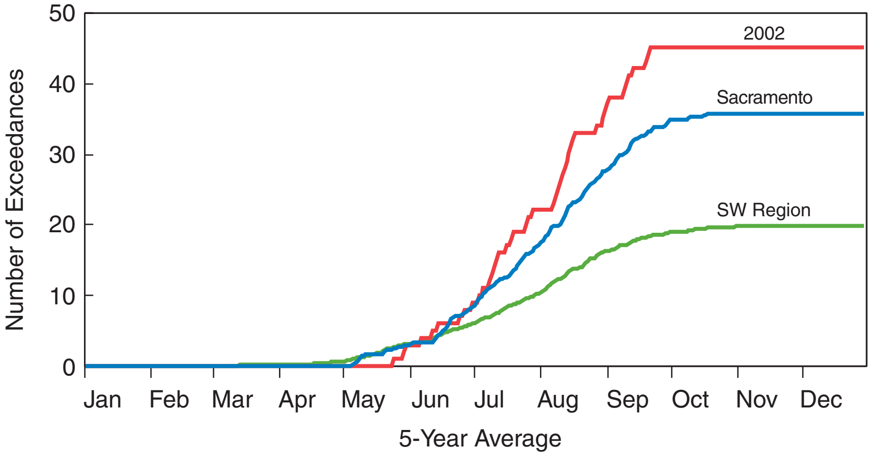


Figure 26. Cumulative exceedances—5-year average (97–01) (Sacramento) compared to 2002 data and SW region average.



The data for Phoenix (Figure 27) showed distinct ozone episodes in early June and early July. The resulting pattern for 2002 trended less than the 5-year average through early June but greater than the 5-year average for early July onward. After late July there were no additional exceedances reported in the AQS for the Phoenix area. For 2002, the total cumulative count of days was 14, whereas the 5-year average count of days is approximately 19.

Other Areas

Dallas, Houston, and Los Angeles were treated separately in this analysis due to their unique geographic locations and emission densities as compared to nearby locations.

For Dallas (Figure 28), the 2002 data trended close to the 5-year average data through early August then trended somewhat less than the 5-year average from early August onward. The 2002 count of days was 20 days, whereas the 5-year average count of days is approximately 33 days.

The 2002 data for Houston (Figure 29) was similar to that for Dallas in that it also trended lower than the 5-year average, especially after early August. For 2002, the total cumulative count of days was 22, whereas the 5-year average is approximately 36 days.

Figure 27. Cumulative exceedances—5-year average (97–01) (Phoenix) compared to 2002 data and SW region average.

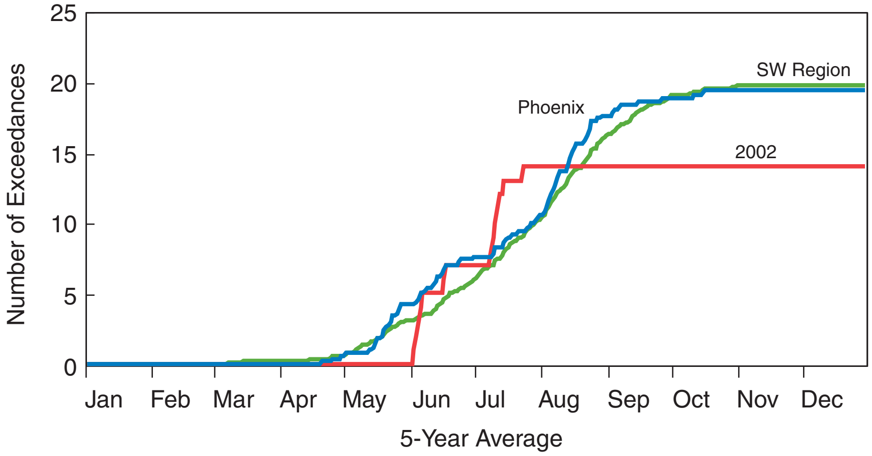


Figure 28. Cumulative exceedances—5-year average (97–01) (Dallas) compared to 2002 data.

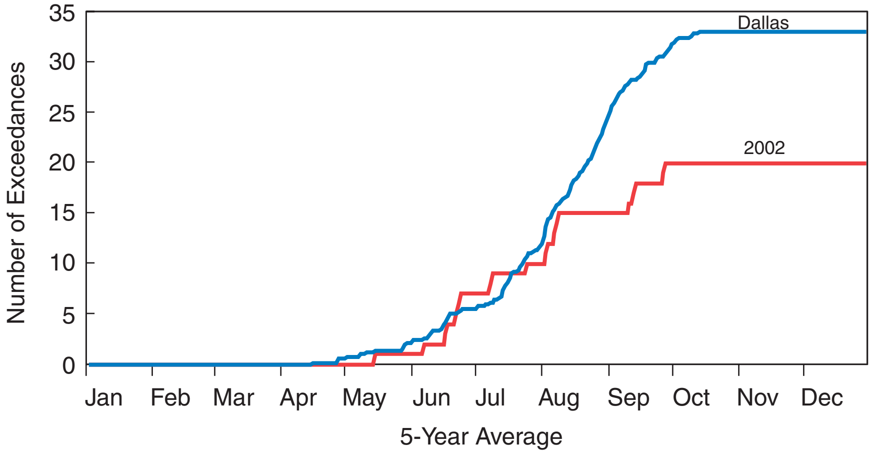
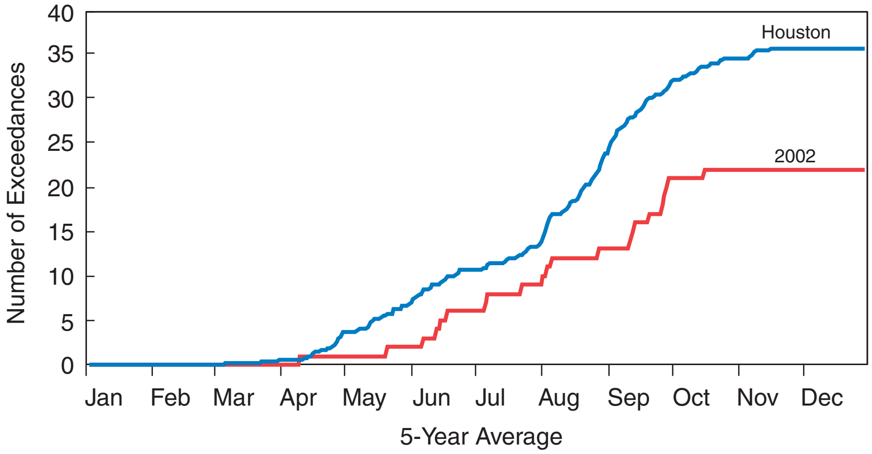
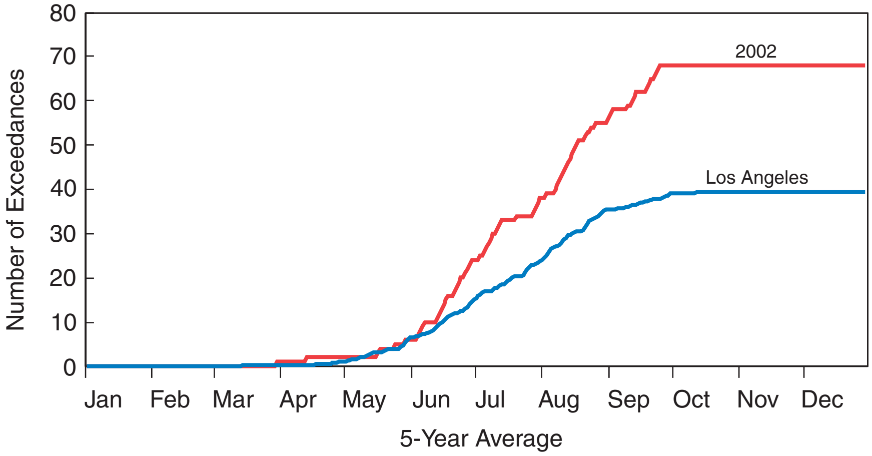


Figure 29. Cumulative exceedances—5-year average (97–01) (Houston) compared to 2002 data.



For Los Angeles (Figure 30), the 2002 data showed a similar trend to the 5-year average data through the beginning of June, then trended progressively greater than the 5-year average from early June onward. A notable episode occurred in early to mid-August. For 2002, the total count of days was 68, whereas the 5-year average is approximately 40 days.

Figure 30. Cumulative exceedances—5-year average (97–01) (Los Angeles) compared to 2002 data.



Summary

This analysis provided a comparative illustration of accumulated ozone exceedance days among *USA Today* cities throughout the United States. These comparisons were illustrated for distinct geographic regions due to the regional nature of ground-level ozone formation and transport.

The illustrations show distinctive differences among regions and also within regions when 2002 data are compared to historical 5-year average trends. For example, in the SE region, the 2002 accumulated count of days trended in a similar pattern to the 5-year average trend for some cities (e.g., Atlanta, Charlotte), whereas the 2002 data trended lower than the 5-year average for some other cities (e.g., Memphis, Nashville, New Orleans). In contrast, for most of the cities analyzed in this study in the NE region, the 2002 data trended lower than the 5-year average through approximately early July, then trended higher than the 5-year average from mid-July into mid-September.

The MW Region comparison presented different results than did the comparisons for the SE and NE regions. For example, for all cities in the core area of the MW region (Chicago, Cleveland, Cincinnati, Columbus, Pittsburgh, Indianapolis, Detroit, and St. Louis), the 2002 data trended less than the 5-year average through approximately mid- to late June, then trended progressively higher than the 5-year average from late June onward. Other cities outside the core MW Region (e.g., Kansas City, Minneapolis) showed 2002 data trending similar to or less than the 5-year average data.

Reference

1. John E. White. Information Transfer Group, Information Transfer and Program Integration Division, Office of Air Quality Planning and Standards, Research Triangle Park, NC. Personal communication, September, 2002.

Characterization of National Spatial Variation

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Abstract

Spatial variability is an important quality of air pollutants for many areas of policy within the U.S. Environmental Protection Agency (EPA). Obviously, monitoring regulations depend heavily on knowledge of spatial variability. In addition, control strategies depend on this knowledge, which helps determine whether a local or regional program would be more effective. Action day programs and public information programs also benefit from this knowledge.

Traditionally, spatial variation has been depicted by isopleth maps, concentration maps, and box plots of various sites. Does this really give us useful knowledge about spatial variation? This paper explores a new way to examine spatial variability on a national scale and also presents an extension of this method in an attempt to characterize spatial variability in a useful way. The new methodology is presented along with its application using $PM_{2.5}$ and ozone data.

Introduction

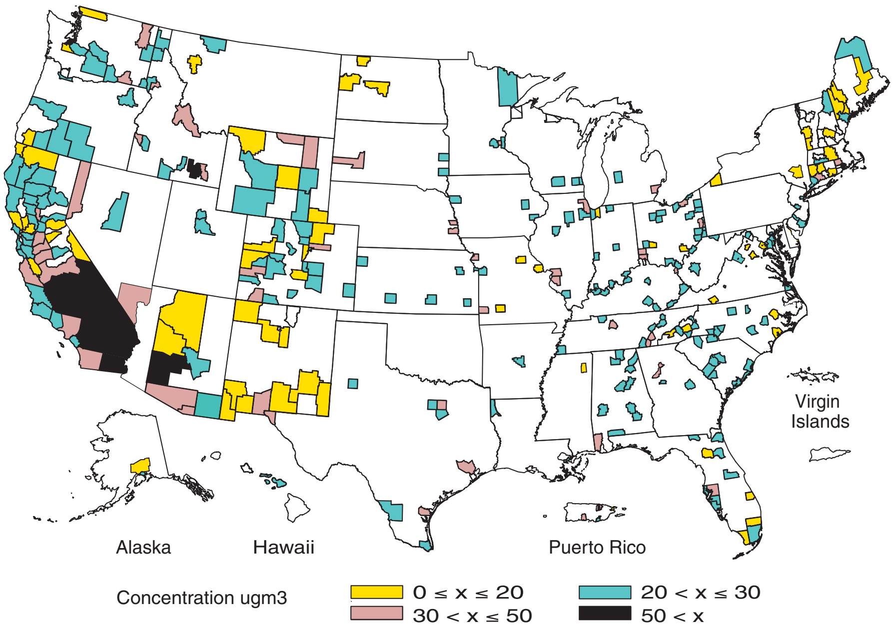
Spatial variability is a very important quality of air pollutants for many areas of EPA policy. Obviously, monitoring regulations and network design depend heavily on knowledge of spatial variability, as do implementation strategies and policies. Control strategies also depend heavily on this knowledge, which helps state and local agencies decide whether a local or regional program may be more effective. Action day programs and public information programs also depend on this information to facilitate decisions regarding how large of an area should be included in various alerts or information publications. Traditionally, spatial variation has been depicted by isopleth maps, concentration maps, and box plots of various sites. Each of these methods gives a crude idea of spatial variability. This paper explores a new way to visualize large-scale spatial variability and also presents an extension of this method in an attempt to characterize spatial variability in a useful way. The new methodology is presented along with its application using data from several pollutants nationwide.

Characterizing Spatial Variation

One of the first questions arising from almost any investigation of an air pollutant is, “What is the spatial and temporal variability or variation?” Very often, the spatial part of the question is answered with a map showing ranges of pollutant levels by county. These maps show where pollutant levels are higher and lower and, in general, where information is available or where monitoring sites are located (see Figure 1).

After the work of producing the map is done, the question is usually considered answered. However, this is a crude view of spatial variability. Looking at such a map, counties with

Figure 1. PM_{10} annual averages (county maximum).



higher values are easily spotted but it is hard to visualize how close adjoining counties are to others. Some analysts go a step farther and show a map of an estimated surface of pollutant levels. The latest and most popular way to do this is called kriging.[1] Kriging is a spatial interpolation technique developed for the mining industry in South Africa to predict ore reserves. With an interpolated surface, all the blank areas on the map are gone, and it is somewhat easier to see how pollutants may vary over space. Figure 2 provides an example of a kriged surface. Because the surface itself is smoothed by the process, kriging actually hides some of the spatial variation, which may or may not be a good result depending on the purpose of the analysis.

At the heart of kriging is a concept called a variogram, which is a representation of the statistical variance of the difference between two data points on a map as it relates to the distance between the two points on the map. Much like the mean, which is a measure of the center of a distribution of data, the variance is a measure of the spread of a distribution of data. In this case, the data are a series of measurements representing differences between two locations paired by time. Thus if d_i is the difference between two readings at two monitors at a given time i, then $d_i = x_{1i} - x_{2i}$. If x_1 and x_2 are both random variables from two locations, then the variance of the difference is $V(x_1 - x_2)$, or V(d). In fact, the variance of the difference is $V(d) = V(x_1) + V(x_2) - 2COV(x_1, x_2)$. This is the sum of the variances of the two random variables minus twice the covariance (a measure of how much the two random variables vary together). Basically, this says that the more the two random variables change together (they go up or down together but they do not necessarily change the same amount), the smaller the variance of the difference will be because the values at two different sites would be expected to vary together more if they are close together and vary more independently if they are far apart. This leads to the concept of the variogram, which, in this case, is the relationship between the variance of the differences and the distance between two sites (Figure 3). The dotted line in Figure 3 shows how the variance changes with the distance. At a distance of zero (0), there is still variation left that does not go away even if the sites are at the same location. This is called the nugget. Similarly, there is a point, called the sill, at which the variance levels out. The area between 0 and the sill is called the range. The range can be thought of as the region where there is a correlation between two sites. The region after the sill can be thought of as the distances at which sites appear to be independent of each other.

Figure 2. Example of a kriged surface.

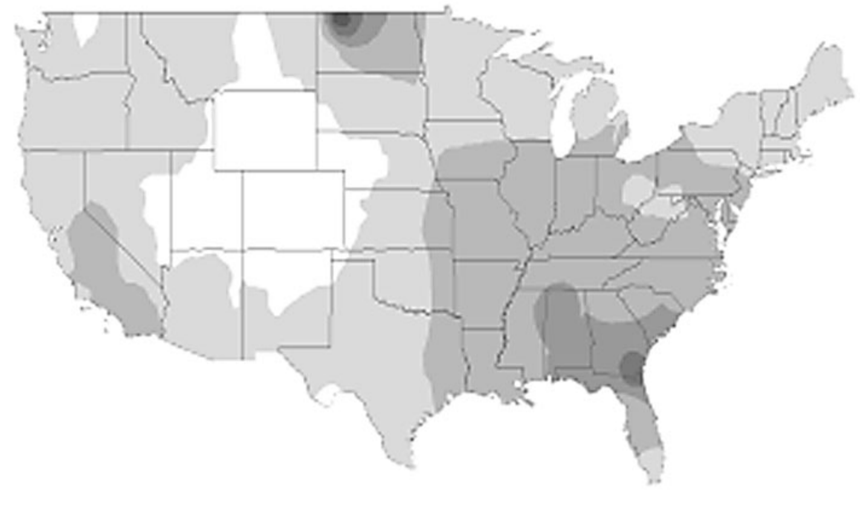


Figure 3. Schematic of a variogram.

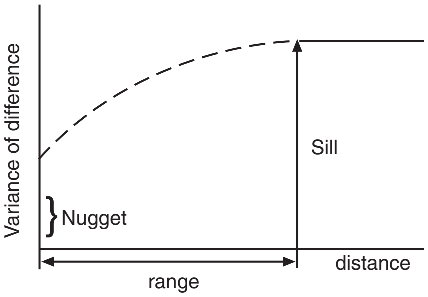


Figure 4 shows how $PM_{2.5}$ data can be used to plot the variance of the difference against distance. The difference in daily $PM_{2.5}$ values was calculated for various sites across the country. The variance of the differences was calculated, and the latitude and longitude of each site were used to calculate the distance between two sites. Each pair of sites then had a variance of the difference and a distance, which were plotted for all possible pairs of sites across the country.

Looking at the scatterplot, it is clear that there is no simple relationship between the variance of the difference and distance. A very dense cluster of points seems to center over 25 at 0 distance and then slowly increases as the distance increases. However, from a casual examination of the plot, enough points fall outside the dense cloud (in fact, many were cut off to actually see any trend at all by setting the maximum variance displayed to 500) to bring into question the assumption used in kriging, as shown in Figure 3, that the variance of the difference over distance can be described by a line.

The point of defining all these terms is to show that the variance of the differences between two measurements taken at the same time but at different locations is generally increasing because the covariance is decreasing over the distance. Because the correlation is covariance normalized by the variances, we can characterize the spatial dependence of data from two locations through the correlation. Because the variance of the difference generally increased, the covariance and, therefore, the correlation should decrease over distance. This raises the question, how does the correlation vary over distance? To answer this question, $PM_{2.5}$ data were used to calculate the correlation of daily $PM_{2.5}$ values between two sites, and the latitude and longitude were used to calculate the distance between two sites. Thus for each pair of sites, we have correlation and a distance. Looking at all the possible pairs of sites, scatterplots may be generated, such as the one in Figure 5. The values of the correlations are restricted to all values between -1 and 1, but the variance of the distance must be positive. These restrictions help provide a much more coherent picture. There is, again, a dense cloud that trends downward as the distance increases. Also, there are many points not in the dense cloud that fall beneath the trend. Again, these points are numerous enough to question the simplicity of the variogram used in kriging.

To simplify what is seen in this scatter plot, the data could be summarized by box plots of the data over 20-km intervals. This would result in Figure 6, which shows a much less confusing picture. The whiskers represent the maxima and minima of the intervals. The box represents the 75th and 25th percentiles, the plus sign (+) represents the mean, and the single line in the box represents the median or 50th percentile. Now a trend is much more apparent in the correlation than in the scatterplot. However, this display shows only how well the data "track" or follow a pattern. It does not show how well the data from different sites actually agree. In other words, the data from one site might track the data from another site very well but still have very different concentrations on average than data from the other site. Here we present a solution to this problem, a coefficient of perfect agreement, or CPA.

Figure 4. Variance of the difference vs. distance.

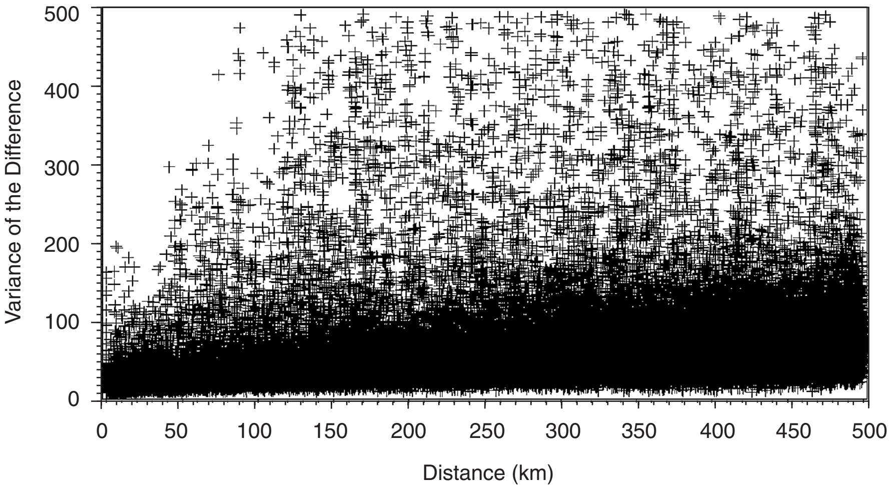


Figure 5. Correlation (r) vs. distance for $PM_{2.5}$.

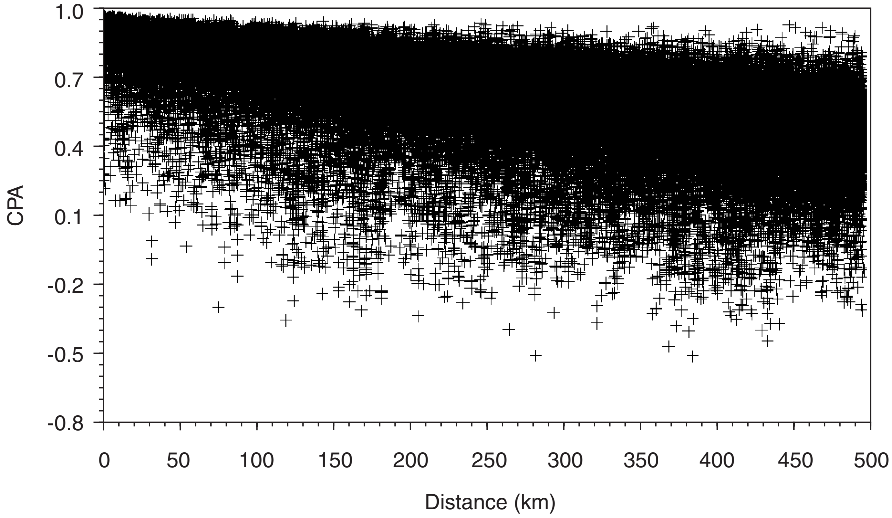
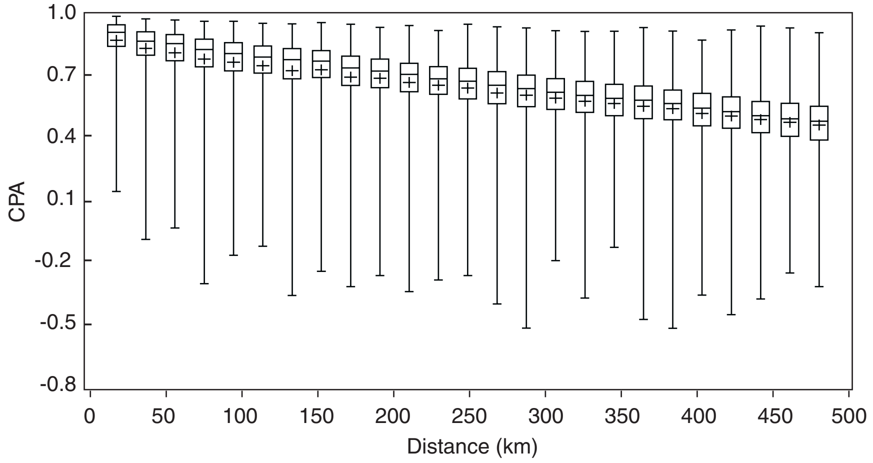


Figure 6. Box plot of correlation vs. distance.



The Coefficient of Perfect Agreement

The goal of formulating a CPA is to give a measure of agreement with many of the characteristics of the correlation coefficient.

The classical correlation coefficient is a measure of how well paired values track each other. The value 0 (zero) means they do not track each other at all, whereas a value of 1 means they track each other perfectly (all the points in a scatterplot would be on a straight line). A value of -1 also means perfect tracking, but the scatterplot line would have a downward or negative slope. The correlation coefficient is defined as shown in Equation A.

As stated earlier, the correlation coefficient has a nice feature in that, when the data from two sites agree in a perfectly linear fashion, then r is 1 (or -1). However, if the data agreed perfectly, the only line that mattered would be a line with a slope of 1 and an intercept of 0 (the line y = x). Therefore, the first characteristic we desire in a CPA is that the CPA = 1 when all points in a scatterplot fall on the line y = x, and the CPA = 0 if there is no systematic agreement. One way to create this would be to include a term in the denominator of the correlation coefficient as shown in Equation B.

If there were no agreement, this term would become large and the CPA would become small (or close to 0). If there were perfect agreement, the term would be 0, and, because all the points would fall on a straight line, the rest of the equation (the correlation coefficient) would be 1, allowing the CPA to be 1. However, if the two data streams fell on a straight line that did not have a slope of 1 and an intercept of 0, then the

Equation A

$$r = \frac{\sum xy - \frac{\sum x \sum y}{n}}{\frac{\sqrt{\left(\sum x^2 - \frac{\left(\sum x\right)^2}{n}\right)\left(\sum y^2 - \frac{\left(\sum y\right)^2}{n}\right)}}{n}}$$

Equation B

$$CPA = \frac{\sum xy - \frac{\sum x \sum y}{n}}{\frac{\sum (x-y)^2 + \sqrt{\left(\sum x^2 - \frac{\left(\sum x\right)^2}{n}\right)\left(\sum y^2 - \frac{\left(\sum y\right)^2}{n}\right)}}{n}}$$

Equation C

$$CPA = \frac{\sum xy - \frac{\sum x \sum y}{n}}{\frac{\frac{\sum (x-y)^2}{n} + \sqrt{\left(\sum x^2 - \frac{\left(\sum x\right)^2}{n}\right)\left(\sum y^2 - \frac{\left(\sum y\right)^2}{n}\right)}}{n}}$$

Equation D

$$CPA = \frac{\sum xy - \frac{\sum x \sum y}{n}}{\frac{\left(\sum (x-y)^2\right)n}{\sqrt{\left(\sum x^2 - \frac{\left(\sum x\right)^2}{n}\right)\left(\sum y^2 - \frac{\left(\sum y\right)^2}{n}\right)}} + \sqrt{\left(\sum x^2 - \frac{\left(\sum x\right)^2}{n}\right)\left(\sum y^2 - \frac{\left(\sum y\right)^2}{n}\right)}}$$

CPA would certainly not be 1 but less than 1 because y would not equal x everywhere. This seems to have all the characteristics desired in a CPA.

However, note that the $\sum(x-y)^2$ term will get larger and larger as the number of data points gets larger and larger, making the CPA get smaller and smaller. Unless there were a situation of perfect agreement, then such a CPA could be made to be arbitrarily small by taking larger and larger numbers of data points to compute the CPA. A further refinement would then be defined as shown in Equation C.

This solves the sample size problem, but there is one problem left. The correlation coefficient is a unitless or unit invariant quantity. This CPA is not, but it should be. Units have been reintroduced into the formula. Because a units conversion could result in a different CPA value, this is not a desirable trait for a coefficient. The added term is divided by the same divisor used to normalize the covariance to get the correlation resulting in Equation D.

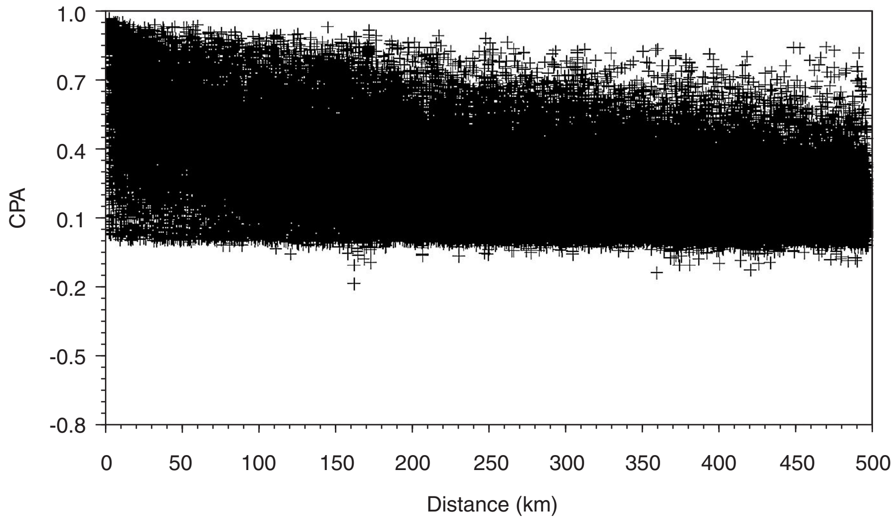
Now the CPA is unitless.

Monte Carlo studies of the CPA were performed by generating values from a straight line. In linear regression, $Y = a + bX + e$, where e has a normal distribution with a mean of 0 and a variance of σ^2. This last term is also called the variation about the line. Five hundred sets of values were generated with different slopes, intercepts, and variations about the line. Slopes ranged from 0 to 5, intercepts ranged from -10 to 10, and the variance about the line, σ^2, ranged from 0 to 100. In this case, whenever σ^2 is 0, then r is 1 (a perfect linear relationship). However, the CPA is equal to 1 only if a is 0, b is 1, and σ^2 is 0. The studies found the CPA to be relatively sensitive to the lack of perfect agreement when there was only a perfect linear relationship (when r is 1 and the CPA should be less than 1).

Application

Using the CPA instead of r, a new scatterplot can be constructed (Figure 7). Now the denser part of the distribution of points has a different trend. The trend dips quickly and then falls off gradually. If, as before, the data are displayed as box and whisker plots, the more pronounced trend in Figure 8 is revealed. This gives a national picture of the spatial variation of $PM_{2.5}$. The mean CPA starts off at around 0.6 and falls off rapidly out to about 150 km, then falls off gradually from there to about 0.2 at 500 km. The maximum and minimum of the coefficient (the whiskers on the box and whiskers plot) still vary almost across all possible values of the coefficient (perfect agreement, or 1, to no agreement at all, or 0) at any distance. Quantitatively, interpretation of this coefficient is difficult at best. Where it might be of most use is in comparisons with other pollutants.

Figure 7. CPA vs distance (km).



Comparison of Pollutants

Pollutants can be compared by following the previous steps used to produce Figure 8. The means in Figure 8 (the pluses [+]) can be joined by a line for several pollutants. This is where the usefulness of a CPA can be demonstrated. A comparison between pollutants could be made to help guide policy. For example, daily values of $PM_{2.5}$, daily values of PM_{10}, hourly values of CO (carbon monoxide), and hourly values of ozone were used to produce Figure 9. As can be seen from the plot, $PM_{2.5}$ has a mean CPA that is above ozone for most of the distances out to 500 km (at least until 450 km). This might suggest that if a regional control strategy is being pursued for the ozone problem in the United States, a regional strategy also makes sense for $PM_{2.5}$.

Figure 8. Coefficient of perfect agreement vs distance (km).

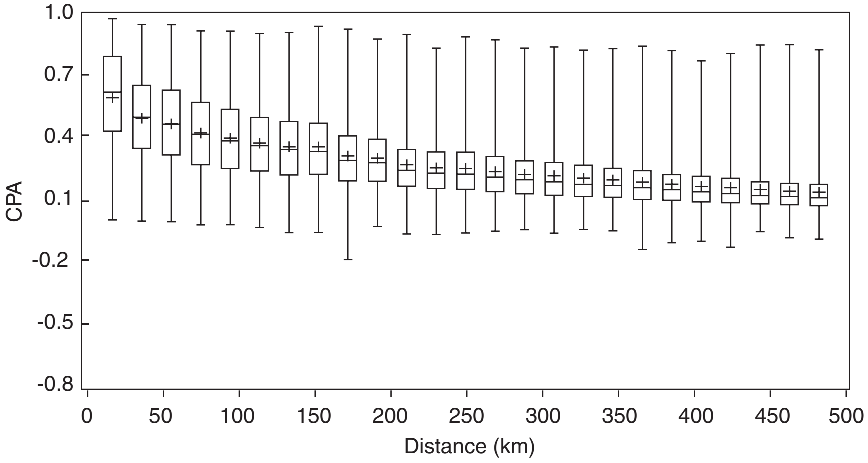
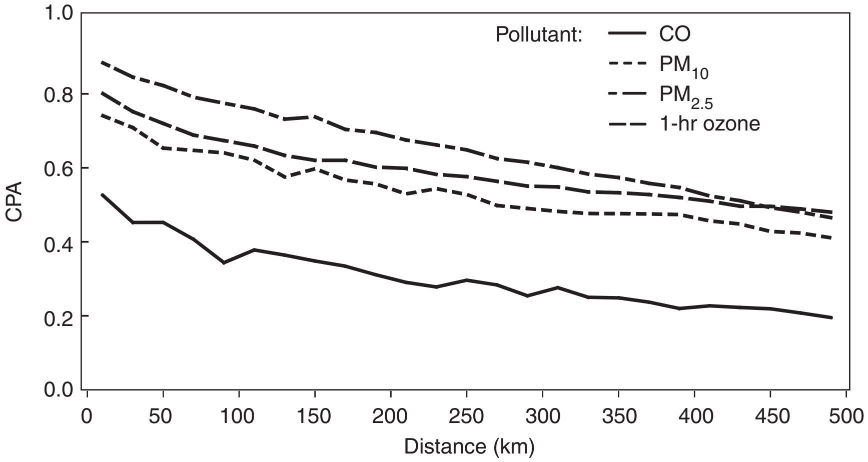


Figure 9. Comparison of mean CPA vs distance (km).



Conclusions

A CPA can be formulated that can be of some use in assessing spatial variation on a national scale. The statistical properties of the CPA used here are not known, and the CPA cannot be used to quantify this variability. However, it can be a useful comparative tool to visualize differences in national scale spatial variation among pollutants.

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1. Matheron, G. Principles of Geostatistics. *Economic Geology*. **1963**, 58, 1246–1266.

Development of a New Reporting Technique for Air Quality

Prepared by
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Reporting Air Quality Information

The U.S. Environmental Protection Agency (EPA) has long taken the lead in reporting air quality information to the general public. EPA routinely presents status and trends for the outdoor concentrations of different kinds of air pollutants in documents that provide clear and informative text, graphics, and data tables for general and technical audiences. These documents include the *National Air Quality and Emissions Trends Report* (the Trends Report) and a related booklet, *Latest Findings on National Air Quality: Status and Trends*. In addition, EPA maintains the Air Trends Web site (**http://www.epa.gov/airtrends/index.html**), which presents current and past air trends information and data, highlights of EPA's air pollution programs, and detailed information about air quality in the United States.

Air quality information is often complex and not always easily interpreted by the general public. As more and more information about air pollution and its effect on our health is being presented to the public through common channels such as television and radio news programs, daily newspapers, and Web postings, a need has arisen to provide the general public with a simple, visual method for assessing the degree of air pollution in their communities. As one approach to meeting this need, EPA is exploring a method of displaying air quality information that is designed to allow the general public to quickly and easily review the degree of air pollution in locations across the United States. Although this simplified display offers obvious benefits to users, there are limitations to this reporting technique as well. This paper describes the new reporting technique in detail and discusses its advantages and disadvantages.

A New Reporting Tool

EPA is evaluating the use of a new tool for displaying air quality information using data from EPA's Air Quality Index (AQI), which monitors air quality in selected city groupings known as metropolitan statistical areas (MSAs). Information for 319 MSAs would be included in the display. MSAs are defined by the Office of Management and Budget and generally include one or more entire counties, except in New England where cities and towns are the basic geographic units. MSAs have been selected as the reporting unit because they are the basis for AQI reports and for listings of attainment and nonattainment status for National Ambient Air Quality Standards (NAAQS).

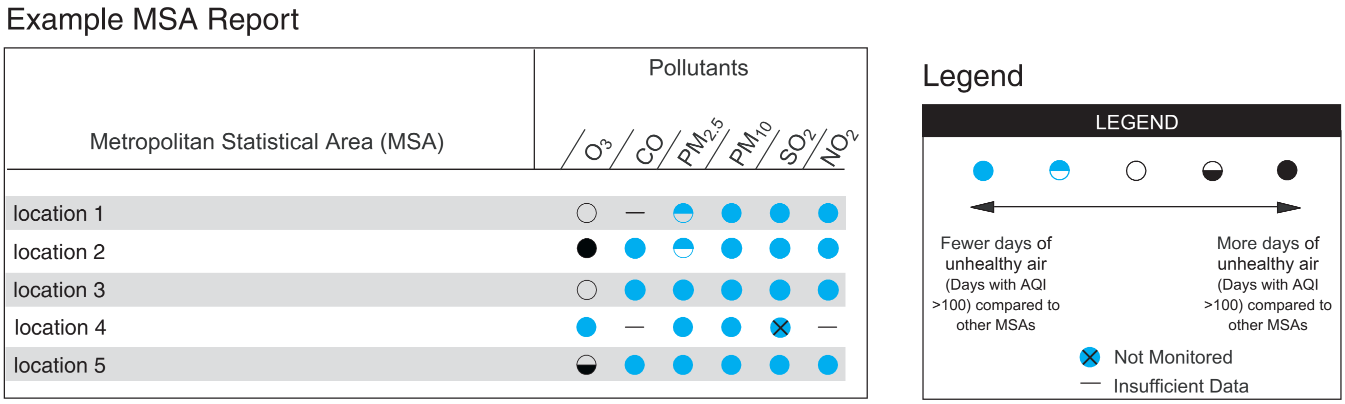
The new display technique would present air quality information by MSA for the following pollutants:

- Carbon monoxide (CO)
- Nitrogen dioxide (NO_2)
- Ozone (O_3)
- Particulate matter (PM_{10} and $PM_{2.5}$)
- Sulfur dioxide (SO_2).

Information would be displayed using color-coded circles to indicate air quality for each of these pollutants in the selected MSAs. Users would be able to view the air quality status for different locations and pollutants by scrolling up and down an alphabetical list of MSAs.

The purpose of this new reporting technique would be to provide a simplified, visual tool for interpreting air quality information in selected MSAs for a specific year for each of the selected pollutants. It would not be used as a rating system, nor would it show trends in air quality over time. Future versions of this method could allow users to sort the information based on the relative rankings for each pollutant of interest and generate a report based on their relative degree of suitability for someone with asthma, angina, or other health conditions.

Figure 1. Interpreting the symbols in the new display technique



Cutpoint Table for 2001

Pollutant	🔵	◓	○	◒	●
Ozone	1 or fewer days with AQI above 100	2 or 3 days with AQI above 100	4-12 days with AQI above 100	13-25 days with AQI above 100	more than 25 days with AQI above 100
Carbon monoxide	0 days with AQI above 100	1 days with AQI above 100	2 days with AQI above 100	3 days with AQI above 100	more than 3 days with AQI above 100
$PM_{2.5}$	1 or fewer days with AQI above 100	2 or 3 days with AQI above 100	4-12 days with AQI above 100	13-28 days with AQI above 100	more than 28 days with AQI above 100
PM_{10}	1 day with AQI above 100	2 days with AQI above 100	3-11 days with AQI above 100	12-36 days with AQI above 100	more than 36 days with AQI above 100
Sulfur dioxide	0 days with AQI above 100	1 day with AQI above 100	2 days with AQI above 100	3 days with AQI above 100	more than 3 days with AQI above 100
Nitrogen dioxide	0 days with AQI above 100	1 day with AQI above 100	2 days with AQI above 100	3 days with AQI above 100	more than 3 days with AQI above 100

Developing the Tool

Selecting Pollutants

The pollutants to be included in this display are CO, NO_2, O_3, particulate matter (PM_{10} and $PM_{2.5}$), and SO_2. These pollutants are five of the six "criteria" pollutants for which EPA has set National Ambient Air Quality Standards (NAAQS) as required by the Clean Air Act. The NAAQS for each pollutant indicate an outdoor (or ambient) concentration not to be exceeded on average over a 3-year period; concentrations below the NAAQS are preferable and would be expected to cause fewer adverse health effects. EPA tracks air quality based on measurements of pollutant concentrations in outdoor air at monitoring sites across the country and then compiles and processes these data to generate the Air Quality Index or AQI.

Designing the Display

Figure 1 shows one potential display method for a sample of several MSAs. In this sample, a solid black circle indicates poorer air quality than most MSAs and a solid blue circle indicates better air quality than most MSAs, with indications for three degrees of quality in between (half blue circle, empty circle, and half black circle). Again, this display would be pollutant-specific and limited to a specific year. It would not suggest air quality trends for these locations over time.

The colored circle symbols would be derived in different ways for different pollutants. For pollutants with a lot of data available, EPA would use percentiles to set ranges for the symbols. For those pollutants with few data, EPA would set the ranges to facilitate presentation.

Figure 1 presents the basis for the suggested symbols for each of the pollutants. The following section describes the methodology for assigning the symbols to data ranges in more detail.

Looking at sample MSAs in Figure 1, we can determine that location 3, for example, has fewer days of unhealthy air than most of the MSAs monitored for CO, particulate matter, SO_2, and NO_2 (indicated by the solid blue circles). For ozone, location 3 has about the median number of days of unhealthy air; in other words, roughly equal numbers of MSAs have more days and fewer days of unhealthy air than location 3 for ozone. Thus, location 3 would appear to be a relatively good location for someone with asthma, since particulate matter, sulfur dioxide, and ozone are pollutants of concern for people with asthma.

Where the "Not monitored" symbol (⊗) appears, no monitoring is performed for that pollutant in that particular MSA, and the MSA is presumed to have healthy air for that pollutant. The "Insufficient data" symbol (—) means that the area is monitored but not enough data were available to be included.

Methodology

The new reporting method would be developed from outdoor air quality data collected at monitoring stations operated by state, tribal, and local government agencies as well as some federal agencies, including EPA. The monitoring data are used to calculate the AQI, which reports daily air quality for a given location. The AQI values, in turn, would be the basis for this reporting tool. To generate the new display, three steps would be required, as described in the following sections: analyze outdoor air quality monitoring data, calculate the AQI, and assign the symbols shown in Figure 1 for each pollutant individually.

Analyze Outdoor Air Quality Data

As currently conceived, the display would be generated based on measurements of pollutant concentrations in the outdoor air at monitoring stations across the country. The air quality data consist of daily (24-hour) measurements for PM_{10} and $PM_{2.5}$ and continuous (1-hour) measurements for CO, NO_2, O_3, and SO_2.[1] The daily measurements for particulate matter are taken from monitoring instruments that produce one 24-hour measurement and typically operate on a systematic sampling schedule of once every 6 days, or 61 samples per year. In other words, these instruments generate one 24-hour sample every 6 days. EPA has determined that these 61 daily samples adequately represent outdoor air quality throughout the year. Monitoring instruments for CO, NO_2, O_3, and SO_2 operate continuously and produce a measurement every hour for a possible total of 8,760 hourly measurements in a year.

Calculate Air Quality Index

EPA compiles and processes outdoor air quality data to generate the AQI. The AQI is an index for reporting daily air quality for a given location and is a key tool in EPA's efforts to make air quality data accessible and useful to the general public. It indicates how clean or how polluted the outside air is. Based on monitoring data, the AQI gives a daily score of 1 to 500 for each pollutant monitored in each MSA. An AQI of 100 means the outdoor air concentration is generally no higher than the respective NAAQS. For example, an AQI of 50 means good air quality, whereas an AQI of 300 means poor air quality.

The AQI for particulate matter is a special case, in that day counts are derived slightly differently. AQI levels for particulate matter are best estimated from daily particulate matter monitors, and, therefore, the nation's air programs are installing more continuous particulate matter monitors. However, when using EPA's Federal Reference Method (FRM) data, the nondaily sampling schedules for particulate matter (e.g., one sample per 3 days) can affect the observed day counts. Therefore, EPA is evaluating methods for adjusting the counts for particulate matter days with an AQI over 100. The easiest method to adjust particulate matter counts, and that currently being used, is based on a simple ratio of the number of days in a quarter to the number of days with at least one sample in an MSA. The ratio is multiplied times the actual number of days in the quarter with the AQI above 100 for particulate matter to get an adjusted quarterly count, which can then be used to calculate an annual number. For example, if there are 90 days in a quarter and 15 sampling days in that quarter, the ratio of 90:15, or 6, is used to adjust the count of days with an AQI over 100 for particulate matter. Thus, if there are 2 days with sample values resulting in an AQI greater than 100, the count is adjusted to 12 days with an AQI greater than 100.

EPA maintains a Web site that fully explains the derivation of the AQI and its interpretation and use at **http://www.epa.gov/airnow/aqibroch/aqi.html#1**. This Web site includes information linking particular health effects such as asthma and angina to the different principal pollutants. Users can determine which of the pollutants are particularly problematic for different health conditions. For example, asthma is related to concentrations of O_3, PM_{10}, $PM_{2.5}$, and SO_2, and angina is exacerbated by elevated concentrations of CO.

Assign Pollutant-Specific Symbols

To generate the new display, EPA would compile the AQI values for all MSAs (for a given time period, say calendar year 2001) and assign the symbols for each pollutant separately, as shown in Figure 1. For each pollutant, EPA would first count the number of days for each MSA when the AQI was above 100. The data for the MSAs would then be listed in order from the fewest days with AQI above 100 to the most days with AQI above 100. The data display technique is designed to indicate the MSA's relative rank by percentile. An MSA's percentile rank tells what portion of the sampled MSAs is above it (fewer days of unhealthy air) and what portion is below (more days of unhealthy air). For example, if an MSA is at the 90th percentile, 10% of the MSAs have fewer days of unhealthy air and 90% have more days of unhealthy air.

This approach works when there is sufficient variability, or range, in the data. In the 2001 data for O_3, PM_{10}, and $PM_{2.5}$, the range is relatively wide from the MSA with the fewest days with the AQI above 100 to the MSA with the most days, and the percentile method would be used for these pollutants. However, the 2001 data for CO, NO_2, and SO_2 do not vary enough among MSAs for percentiles to be derived. For these pollutants, the 2001 data show three or four MSAs having 1 day with the AQI greater than 100 and the remaining MSAs having no days with the AQI above 100. Therefore, the symbols would simply be assigned to 0, 1, 2, 3, 4, and greater than 4 days. While two different methods are used to set the boundaries, or "cutpoints," for the symbols, MSAs can be interpreted in the same manner for all pollutants.

The cutpoint table in Figure 1 presents the cutpoints, or ranges of day counts, indicated by each symbol for each pollutant. For pollutants with sufficient data variability to use the percentile method (i.e., O_3, PM_{10}, and $PM_{2.5}$), the top 5% would be considered to have the best air quality for that particular pollutant. Thus, MSAs within the top 5% would be given a blue circle. For example, as shown in Figure 1, location 4 has a blue circle for O_3, which means that location 4 is in the 5% of MSAs reporting the lowest number of days with the AQI above 100 for O_3. The remaining 95% of the MSAs sampled have more unhealthy days than location 4 with respect to O_3 levels (i.e., they had more days with the AQI for O_3 greater than 100). If there were 300 MSAs for which O_3 was sampled, location 4 would be one of 15 MSAs assigned a blue circle for O_3. Note that the blue circle does not indicate the actual number of days when the AQI was greater than 100; it simply tells whether location 4 experienced fewer or more unhealthy days than other sampled MSAs.

The remaining symbols for O_3, PM_{10}, and $PM_{2.5}$ would be assigned similarly, based on percentiles, as shown in the cutpoint table in Figure 1. A half blue circle would be assigned to MSAs above the 5th percentile and below the 25th percentile. An MSA with this symbol would have had more unhealthy days than those with a full blue circle (the top 5%), but fewer unhealthy days than the remaining 75% of the MSAs sampled. Likewise, the white circle would be assigned to MSAs from the 25th to 75th percentiles; they experience more unhealthy days than the MSAs with the full or half blue circles, but they have fewer unhealthy days than the remaining 25% of the MSAs sampled. The half black and full black circles would be assigned to the MSAs with more unhealthy days. The half black circle indicates that the MSA has more unhealthy days than 95% of the MSAs sampled and that only 5% of the MSAs have as many or more unhealthy days. The full black circle would be assigned to the MSAs with the most unhealthy days.

Assumptions and Limitations

The new reporting technique that EPA is evaluating includes several assumptions and limitations, as described below. These issues indicate areas where discussion and further development may be appropriate.

- The new display technique is based on the AQI, which, in turn, is based on short-term (daily) concentrations. However, for NO_2, PM, and SO_2, long-term standards also apply. Some MSAs may have no problem complying with short-term standards (thus being assigned a blue circle) while failing to meet the annual standard. An additional component that incorporates annual concentration data into the display technique may be desirable.
- At this time, the new display technique is designed to address CO, NO_2, O_3, particulate matter (PM_{10} and $PM_{2.5}$), and SO_2; it does not

address any hazardous air pollutants (HAPs). Addition of a component addressing HAPs could be considered. Benzene may provide a reasonable test case for reporting on HAPs, because it commonly occurs in ambient air and is monitored in the most locations.

- EPA acknowledges that the general public is not always familiar with MSAs. For example, users living in small towns may not realize they are part of an MSA named for a nearby larger town. Furthermore, not all areas in the country are in MSAs, and not all MSAs would be included in this display. Those MSAs with small populations, those with air quality that is so good that AQI reporting is not currently required, and those with too little monitoring data would not be included.
- Information would be presented for those air quality data that meet EPA's data quality requirements.[2] However, all pollutants are not monitored in all MSAs, and some MSAs are not monitored at all. For example, certain MSAs with small populations and those where the air quality is not considered a problem would not have data in the display. Thus, the "Not monitored" symbol can mean that there is no perceived air quality problem for that pollutant in that MSA, and the "Insufficient data" symbol means that there is not enough data available to be included. The latter case does not necessarily mean that there is no cause for concern.
- Different MSAs have different numbers of monitors. This display technique would not account for the fact that MSAs with more monitors will tend to have more days with AQIs above 100. The display technique might be modified to normalize the day counts based on number of monitors.
- Air quality may vary across a single MSA. In assigning a single symbol for each pollutant in each MSA, the display would not reflect this potential variation.
- The methods used to set the cutpoints for the data display are designed to give an intuitive visual display of air quality in MSAs. The new method would be based on percentiles to provide consistency in setting cutpoints from one year to the next; however, there are other approaches that might also work to meet the objectives.
- The color-coded symbols suggested for the new display technique would indicate an MSA's air quality relative to the air quality in the other MSAs reported. As such, the symbols would not be an indication of a particular level of health protection. Because the symbols would indicate relative air quality, a black circle, for example, could be assigned for few days or for many days of unhealthy air, depending on the number of unhealthy days for most MSAs. For example, a black circle would be assigned for 20 days of unhealthy air if most MSAs had fewer than 20 unhealthy days, or for 120 days of unhealthy air if most MSAs had up to 120 unhealthy days. It will be important to ensure that users are aware of the relative nature of the information.
- The color-coded symbols would be based on counts of days with the AQI exceeding 100, but, as currently conceived, there is no indication of the degree of exceedance. For example, a day with an AQI of 103 counts the same as a day with an AQI of 350. To reflect increased concern for days with higher AQI values, alternatives such as weighting days with an AQI above, say 200, could be considered.
- The display would present air quality for the current year. The percentile-based symbols would indicate an MSA's status relative to the other sampled MSAs. The percentiles reflect a given year's data; therefore, the number of unhealthy days implied by each symbol would change with each subsequent year's data. In its initial format, the display would not indicate trends in air quality or whether air quality in a particular MSA is improving or declining. Furthermore, users should be made aware that a single year's report may or may not indicate an MSA's general air quality or whether it is a "good" place to live, since any given year can reflect anomalies in air quality trends.
- The display would not provide any indication or distinction of source contribution.

Potential Uses for the New Display Technique

The new display technique is a work in progress. The preceding section described the report's current iteration, but EPA is exploring additional capabilities and features to enhance the technique. For example, EPA is determining how to add this display to the Air Trends Web site to allow users to sort and query the list to focus on particular health effects. Capabilities currently being discussed for this new technique are described in the following sections.

Particular Health Effect Perspective

Allowing users to evaluate air quality with respect to particular health concerns is perhaps the most significant capability that is being considered for the new display technique. The AQI Web site (**http://www.epa.gov/airnow/aqibroch/aqi.html#1**) provides information linking health concerns and sensitive populations to particular pollutants and outdoor concentrations. For example, the AQI is used as the basis for advisories to people with asthma; these individuals are advised to limit outdoor exertion when AQI values for O_3, PM_{10}, $PM_{2.5}$, or SO_2 are over 100. Similarly, people with angina are cautioned when the AQI for CO is over 100. EPA is looking into ways in which the MSA report could allow users to sort the data based on specific health-based concerns for any of these pollutants and generate a report focusing on health concerns for someone with asthma, angina, or other health conditions.

Visibility and Regional Haze

Degradation in visibility is related to several criteria pollutants and is an important environmental issue for the public, particularly in National Parks and wilderness areas (Class I areas). For example, the annual Trends Report presents useful information on the impacts of air pollution on visibility. Without the effects of pollution, a natural visual range in the United States is approximately 75 to 150 km (45 to 90 miles) in the East and 200 to 300 km (120 to 180 miles) in the West. However, data collected by EPA show that, in 1999, mean visual range in the East was only 24 km (14.4 miles) for the worst days and only 84 km (50.4 miles) for the best days. In the West, the mean visual range for 1999 was 80 km (48 miles). EPA is considering methods for including similar graphical information of this type of data in the display.

Multiyear Reports

EPA is considering adding a multiyear dimension to the display. In addition to presenting the annual reports described above, EPA would also provide graphically similar reports that would reflect a 5- or 10-year average for the number of days that the AQI was above 100 for each pollutant in each MSA. Using these averaged day counts, percentiles would be derived and symbols assigned as described above for the annual data. Users could see the report for a 5-year average as well as for any individual year for the past 5 years. Reports for individual years could be compared to the average as well as to each other.

Summary and Conclusions

This display technique would provide the general public with a new tool to review air quality in MSAs around the United States. The primary function of the display would be to present location- and pollutant-specific air quality data in a graphical format that allows for easy interpretation of air quality data for MSAs. The display would not provide new or additional air quality data; rather, it would present existing data in a new format. The graphical display of data would improve the public's access to air quality information and enhance their ability to use this information in a meaningful way. Potential capabilities that may be added include a Web-based application that would allow users to sort and query information to generate customized reports, as well as visibility and multiyear components.

EPA recognizes that there are limitations to this new display technique and is continuing to assess the usefulness of such a reporting method as well as additional capabilities that might be added. Developing a simple metric for displaying air quality data on an urban basis across the nation is a difficult and challenging endeavor. However, EPA feels that this information is useful and informative to the public, especially to those who have potential health concerns related to poor air quality. A graphical display that is easily understood is essential to communicating this information, and EPA will continue to refine the display to ensure that it meets this objective based on comments and input from the air quality community and potential users.

References

1. Although continuous PM monitors are being installed and some continuous monitoring data are available, these data would not be included in this display. Only Federal Reference Method (FRM) data would be incorporated into the data display as currently conceived, and the PM continuous monitoring data are not based on EPA's FRM.

2. For more information on EPA's data quality requirements, see Appendix B–Metropolitan Area Trends of the Trends Report at **http://www.epa.gov/airtrends/metro.html**.

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15. SUPPLEMENTARY NOTES

16. ABSTRACT

THIS REPORT PRESENTS NATIONAL TRENDS IN AIR QUALITY FOR OZONE, PARTICULATE MATTER, NITROGEN DIOXIDE, CARBON MONOXIDE, LEAD AND SULFUR DIOXIDE FOR 10 AND 20 YEAR PERIODS. IN ADDITION TO AIR QUALITY TRENDS FROM DATA COLLECTED AT MONITORING STATIONS ACROSS THE COUNTRY, TRENDS IN NATIONWIDE EMISSIONS ARE ALSO PRESENTED. THIS REPORT ALSO INCLUDES A SPECIAL STUDIES SECTION INCLUDING REPORTS ON CHEMICAL SPECIATION INCLUDING THE URBAN INCREMENT, IMPACT OF THE ASIAN DUST STORM, CUMULATIVE OZONE EXCEEDANCES, CHARACTERIZATION OF NATIONAL SPATIAL VARIATION, AND A NEW REPORTING TECHNIQUE.

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