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Office of Air Quality
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Research Triangle Park NC 27711

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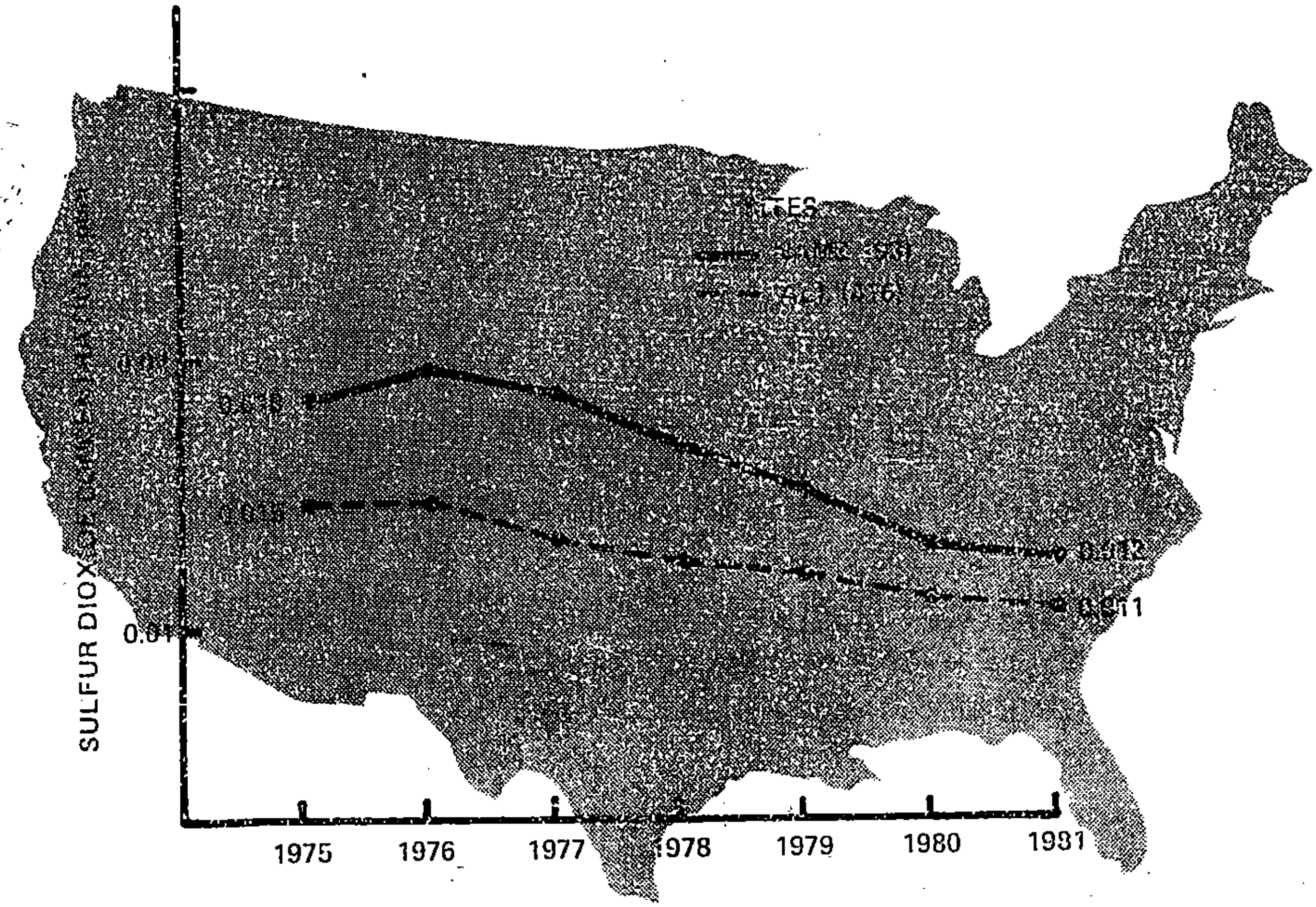

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NATIONAL AIR QUALITY AND EMISSION TRENDS REPORT, 1981

U. S. Environmental Protection Agency
Office of Air, Noise, and Radiation
Office of Air Quality Planning and Standards
Research Triangle Park, North Carolina 27711

March 1983

DISCLAIMER

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PREFACE

This is the ninth annual report of air pollution trends issued by the Monitoring and Data Analysis Division of the U. S. Environmental Protection Agency. The report is directed toward both the technical air pollution audience and the interested general public. The Division solicits comments on this report and welcomes suggestions on our trend techniques, interpretations, conclusions, and methods of presentation. Please forward any response to William F. Hunt, Jr., (MD-14) U. S. Environmental Protection Agency, Monitoring and Data Anlaysis Division, Research Triangle Park, N. C. 27711.

The Monitoring and Data Analysis Division would like to acknowledge William F. Hunt, Jr. for the overall management, coordination, and direction given in assembling this report. Special mention should also be given to Helen Hinton for typing the report and Joyce Baptista, Systems Applications, Incorporated for the preparation of graphics.

The following people are recognized for their contributions to each of the sections of the report as principal authors:

Section 1 - William F. Hunt, Jr., and Robert E. Neligan
Section 2 - William F. Hunt, Jr.
Section 3 - Thomas C. Curran, Robert B. Faoro, and Neil H. Frank
Section 4 - Robert B. Faoro and Edward Mask

Also deserving special thanks are Edward Mask for assembling the air quality data base and Chuck Mann for the emission trend analyses.

CONTENTS

FIGURES

Figures		Page
3-17	National Trend in the Composite Average of the Estimated Number of Exceedances of the 8-hour Carbon Monoxide NAAQS at Both NAMS and All Sites, 1975-1981.	31
3-18	Comparison of Short-term Trends in the 90th Percentile of 8-hour Average Carbon Monoxide Concentrations at 163 Sites, 1980 and 1981.	33
3-19	Comparison of Short-term Trends in Second Highest Nonoverlapping 8-hour Average Carbon Monoxide Concentrations at 163 Sites, 1980 and 1981.	33
3-20	Regional Comparison of the 1975-78 and 1979-81 Composite Average of the Second-Highest Nonoverlapping 8-hour Carbon Monoxide Concentration.	33
3-21	National Trend in the Composite Average of Nitrogen Dioxide Concentration at Both NAMS and All Sites, 1975-1981.	35
3-22	National Trend in Emissions of Nitrogen Oxides, 1975-1981.	35
3-23	Comparison of Short-term Trends in Annual Mean Nitrogen Dioxide Concentrations at 201 Sites, 1980 and 1981.	37
3-24	Regional Comparison of the 1975-78 and 1979-81 Composite Average of Nitrogen Dioxide Concentrations.	37
3-25	National Trend in the Composite Average of the Second-Highest Daily Maximum 1-hour Ozone Concentration at Both NAMS and All Sites, 1975-1981.	39
3-26	National Trend in Emissions of Volatile Organic Compounds, 1975-1981.	39
3-27	National Trend in the Composite Average of the Estimated Number of Daily Exceedances of the Ozone NAAQS in the Third Quarter (July-September) at Both NAMS and All Sites, 1975-1981.	41
3-28	Comparison of Short-term Trends in Annual Second-Highest Daily Maximum 1-hour Ozone Concentrations at 159 Sites, 1980 and 1981.	41
3-29	Regional Comparison of the 1975-78 and 1979-81 Composite Average of the Second-Highest Daily 1-hour Ozone Concentration.	41

Figures		Page

NATIONAL AIR QUALITY AND EMISSION TRENDS REPORT

1981

EXECUTIVE SUMMARY

NATIONAL AIR QUALITY AND EMISSION TRENDS REPORT, 1981

1. EXECUTIVE SUMMARY

1.1 GENERAL OVERVIEW

National long-term (1975 through 1981) improvements can be seen for sulfur dioxide (SO_2), carbon monoxide (CO), and lead (Pb). Similar improvements have been documented in earlier air quality trends reports,[1-8] issued by the U. S. Environmental Protection Agency (EPA). Short-term improvements (1980 versus 1981) have also been observed for total suspended particulate (TSP), ozone (O_3) and nitrogen dioxide (NO_2). The more recent improvements in TSP, SO_2, O_3 and NO_2 may be due in part to the reduced industrial activity in 1981.

In the ambient air quality trend analyses which follow, the National Air Monitoring Sites (NAMS) are compared with all the air monitoring sites meeting trends criteria. The NAMS provide accurate and timely data to EPA from a stream-lined, high quality, more cost-effective, national air monitoring network. They are located in areas with high pollutant concentrations, high population exposure, or a combination of both. Because the NAMS are located in the more heavily polluted areas, the pollutant-specific trend lines for the NAMS are higher than the trend lines for all the trend sites taken together. In general, the rates of improvement observed at the NAMS are very similar to the rates of improvement observed at all the trend sites.

1.2 MAJOR FINDINGS

Total Suspended Particulate (TSP) - The composite annual average of TSP levels measured at 1972 sites decreased 3 percent during the 1975 to 1981 time period (Figure 1-1). The TSP trend was relatively stable during the 1975 to 1980 time period and then fell between 1980 and 1981. The median rate of decrease among the 1289 sites with data in 1980 and 1981 was 6 percent. Most of the decrease, between 1980 and 1981, occurred in the Northeastern, North Central, Rocky Mountain and Northwestern States. The largest decrease in TSP levels was observed in the Northwestern States (Region X) which fell 13 percent between 1980 and 1981. Particulate emissions, on the other hand, exhibited a decrease of approximately 20 percent during the 1975 through 1981 time period with a decrease of approximately 2 percent between 1980 and 1981 (Figure 1-2). It is not entirely clear why this apparent inconsistency exists between trends in TSP ambient levels and emissions. A possible explanation may be attributed to high background levels of naturally occurring particulate emissions, as well as uninventoried area source emissions, such as reintrained dust, which contribute to ambient concentrations but are not included in the emission inventory. This explanation, however, does not satisfactorily explain the drop in ambient levels between 1980 and 1981, which could be due to reduced industrial activity, changes in the weather or a combination of both.

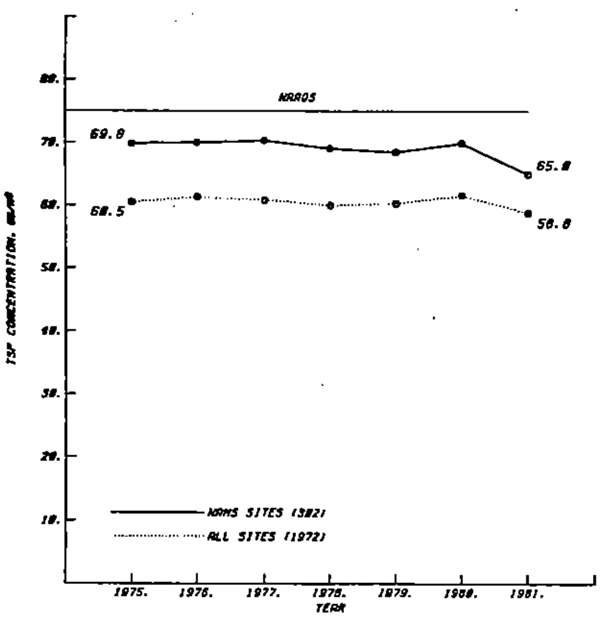


FIGURE 1-1. NATIONAL TRENDS IN THE COMPOSITE AVERAGE OF THE GEOMETRIC MEAN TOTAL SUSPENDED PARTICULATE AT BOTH NAMS AND ALL SITES, 1975-1981.

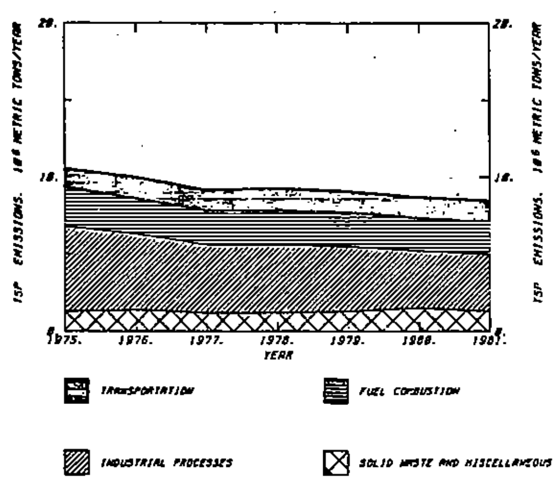


FIGURE 1-2. NATIONAL TREND IN PARTICULATE EMISSIONS, 1975-1981.

<u>Sulfur Dioxide (SO_2)</u> - Annual average SO_2 levels measured at 416 sites with continuous SO_2 monitors decreased 27 percent from 1975 to 1981 (Figure 1-3). A similar decrease of 31 percent was observed in the trend in the composite average of the second maximum 24-hour average (Figure 1-4). An even greater improvement was observed in the estimated number of exceedances of the 24-hour standard, which decreased 84 percent (Figure 1-5). Correspondingly, there was a 12 percent drop in sulfur oxide emissions (Figure 1-6). The difference between emissions and air quality trends arises because large electric utility plants were shifted from urban areas in the early 1970's. Most of the SO_2 monitors are in urban areas, with fewer monitors in rural locations. The SO_2 ambient air quality improvement continued between 1980 and 1981 with a median rate of improvement of 8 percent for the annual mean and 4 percent for the second maximum 24-hour averages.

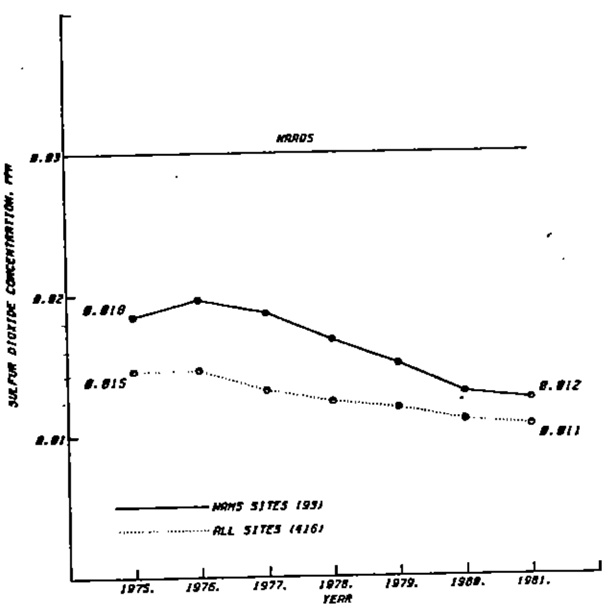


FIGURE 1-3. NATIONAL TREND IN THE ANNUAL AVERAGE SULFUR DIOXIDE CONCENTRATION AT BOTH NAMS AND ALL SITES, 1975-1981.

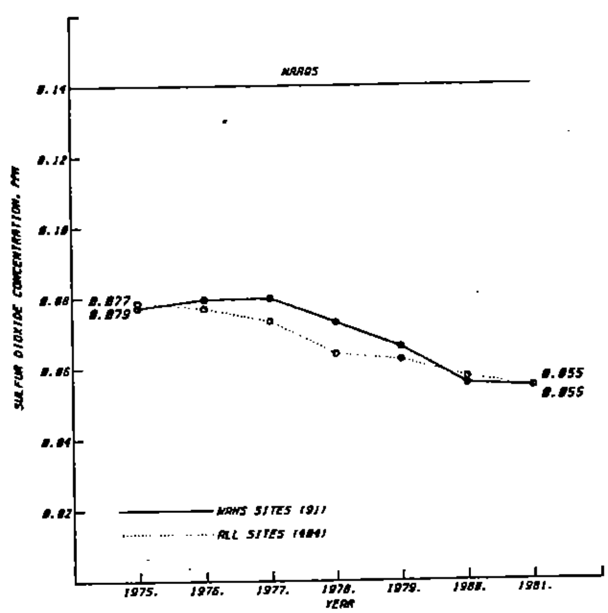


FIGURE 1-4. NATIONAL TREND IN THE COMPOSITE AVERAGE OF THE SECOND-HIGHEST 24-HOUR SULFUR DIOXIDE CONCENTRATION AT BOTH NAMS AND ALL SITES, 1975-1981.

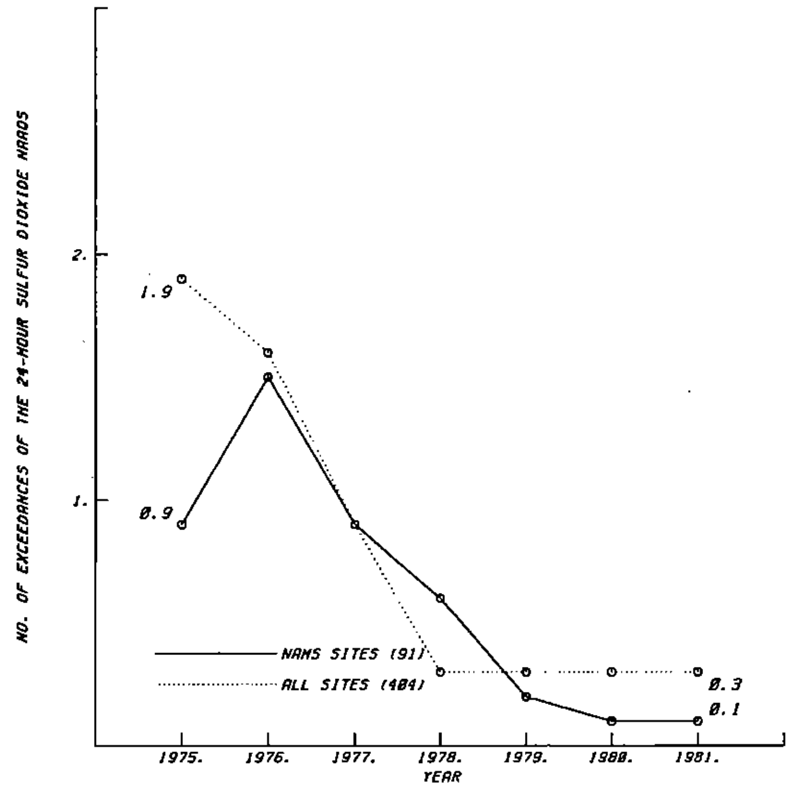


FIGURE 1-5. NATIONAL TREND IN THE COMPOSITE AVERAGE OF THE ESTIMATED NUMBER OF EXCEEDANCES OF THE 24-HOUR SULFUR DIOXIDE NAAQS AT BOTH NAMS AND ALL SITES. 1975-1981.

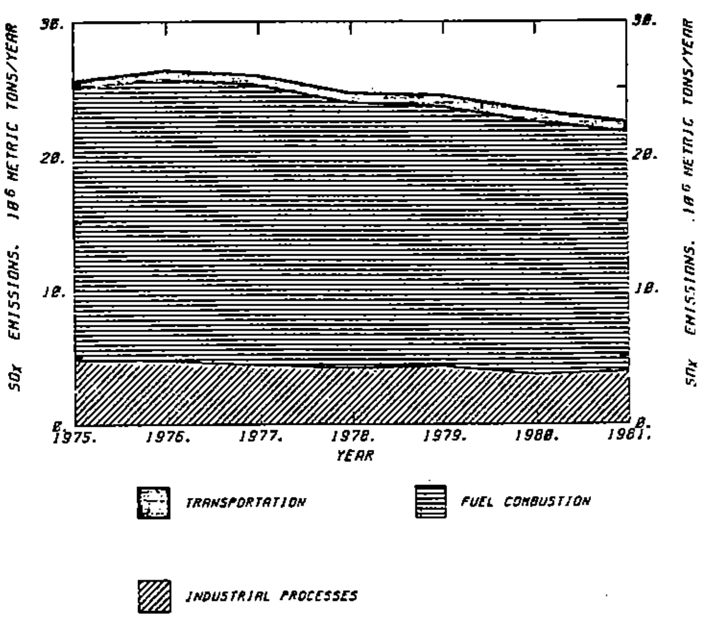


FIGURE 1-6. NATIONAL TREND IN EMISSIONS OF SULFUR OXIDES. 1975-1981.

Carbon Monoxide (CO) - Nationally, the second highest non-overlapping 8-hour average CO levels at 224 sites decreased at a rate of approximately 5 percent per year, with an overall reduction of 26 percent between 1975 and 1981 (Figure 1-7). An even greater improvement was observed in the estimated number of exceedances, which decreased 84 percent (Figure 1-8). The improvements generally reflect CO levels at traffic-saturated monitoring sites in the center city, which have experienced little or no change in the number of vehicles in their vicinity. Consequently, the improvement in CO levels reflects the reduction in emissions from new cars resulting from federal standards for vehicle emissions. CO emissions decreased 10 percent during the same period (Figure 1-9). Between 1980 and 1981, the NAMS showed a slight increase in the second maximum 8-hour average and the national composite of 224 sites showed little change (Figure 1-7). In contrast, both the NAMS and the national composite of 224 sites show consistent improvements between 1980 and 1981 in the 90th percentile of 8-hour averages and in the estimated number of exceedances. Unlike the annual second maximum 8-hour averages, both the 90th percentiles and the estimated number of exceedances are more stable indicators of trend and less likely to be influenced by unusual meteorological events, than the second maximum 8-hour average. The reason for inconsistency in the short-term, 1980 versus 1981, trend between the second maximum 8-hour average and the 90th percentile and the estimated number of exceedances is unclear.

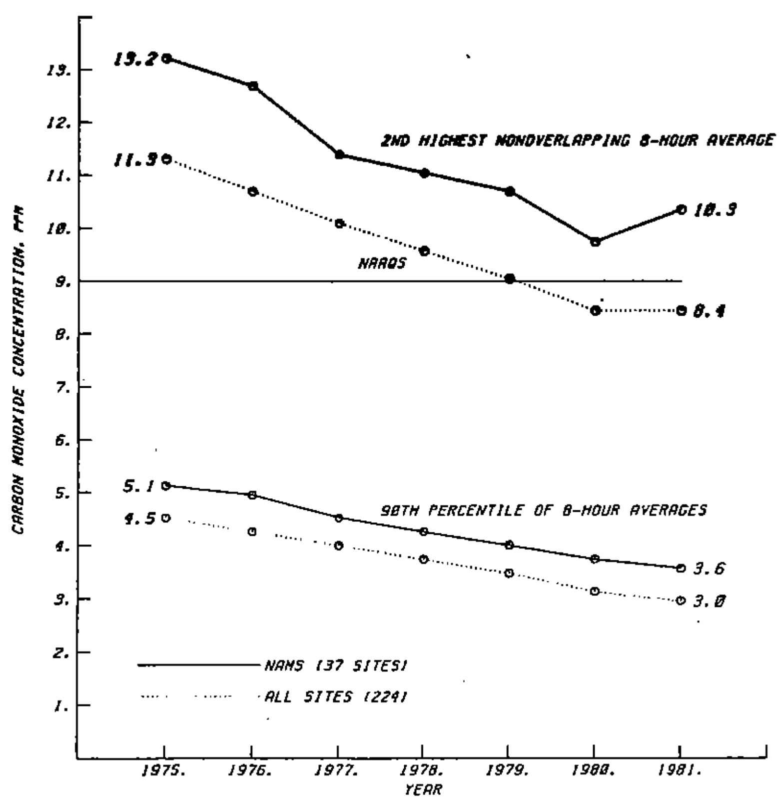


FIGURE 1-7. NATIONAL TREND IN CARBON MONOXIDE LEVELS, COMPARING NAMS WITH ALL SITES AND THE SECOND HIGHEST NONOVERLAPPING 8-HOUR AVERAGE WITH THE 90TH PERCENTILE OF 8-HOUR AVERAGES, 1975-1981.

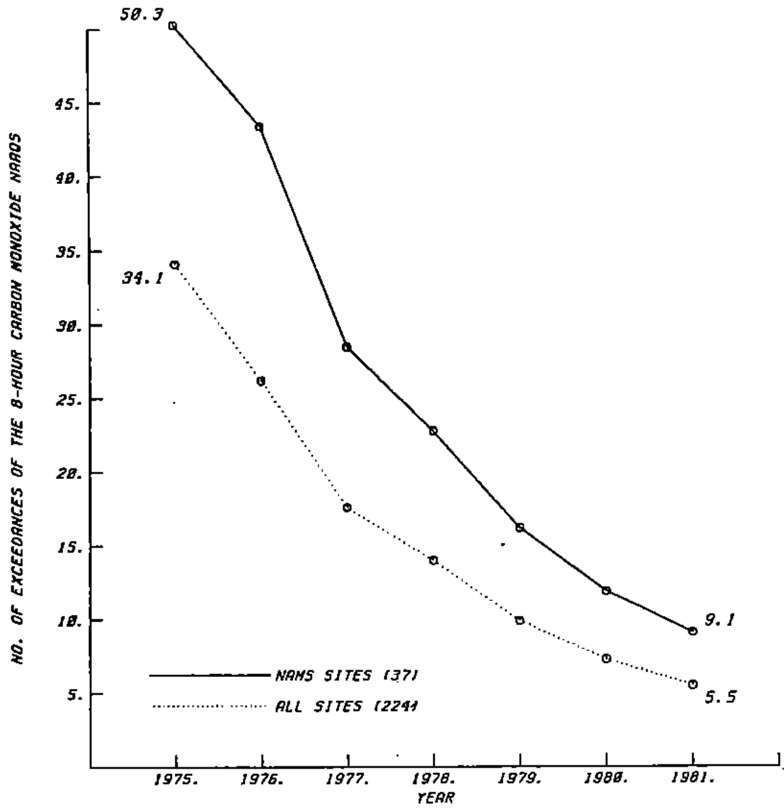


FIGURE 1-8. NATIONAL TREND IN THE COMPOSITE AVERAGE OF THE ESTIMATED NUMBER OF EXCEEDANCES OF THE 8-HOUR CARBON MONOXIDE NAAQS AT BOTH NAMS AND ALL SITES, 1975-1981.

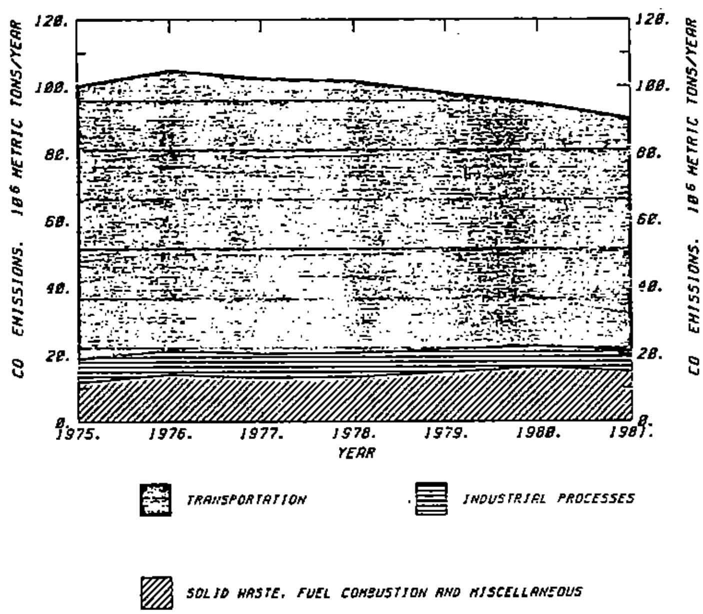


FIGURE 1-9. NATIONAL TREND IN EMISSIONS OF CARBON MONOXIDE, 1975-1981.

Nitrogen Dioxide (NO_2) - Annual average NO_2 levels measured at 445 sites increased from 1975 to 1979 and then began declining. The air quality trend is very similar to the trend in nitrogen oxides emissions. The net long-term change between 1975 and 1981 is an increase of 5 percent in NO_2 levels (Figure 1-10) and a 5 percent increase in emission levels (Figure 1-11). A decrease was observed betweeen 1980 and 1981 in both the air quality, as measured at 201 sites, and emissions levels of 8 and 2 percent, respectively. The NAMS trend line is based on only 13 NAMS which met the historical data completeness criteria. The NAMS report a slight increase between 1980 and 1981 in contrast to the decrease reported at the 445 sites. It is difficult to conclude very much from this discrepancy, since the sample of NAMS is so small.

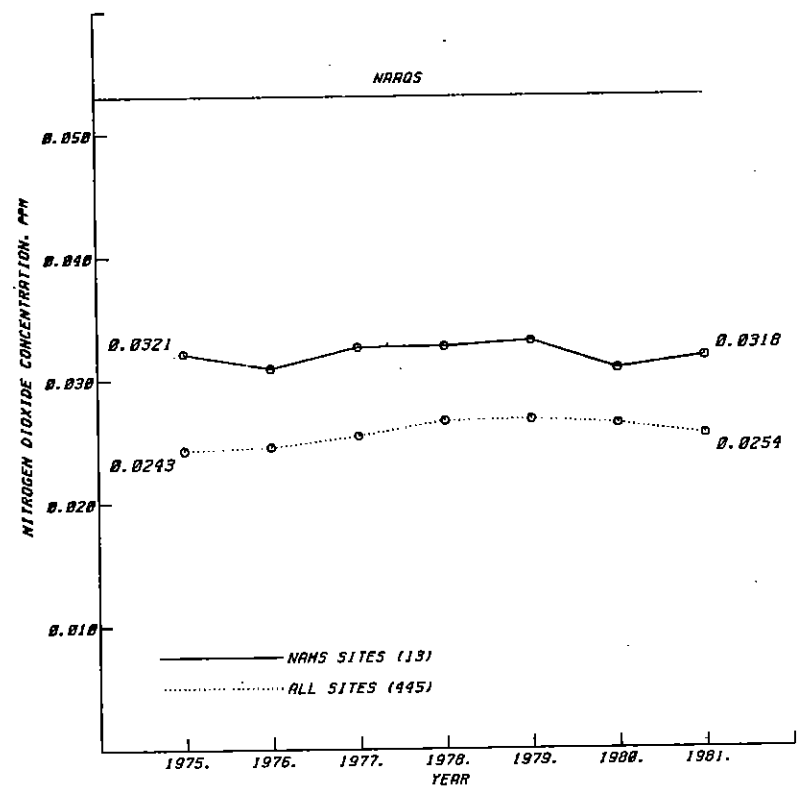


FIGURE 1-10. NATIONAL TREND IN THE COMPOSITE AVERAGE OF NITROGEN DIOXIDE CONCENTRATION AT BOTH NAMS AND ALL SITES. 1975-1981.

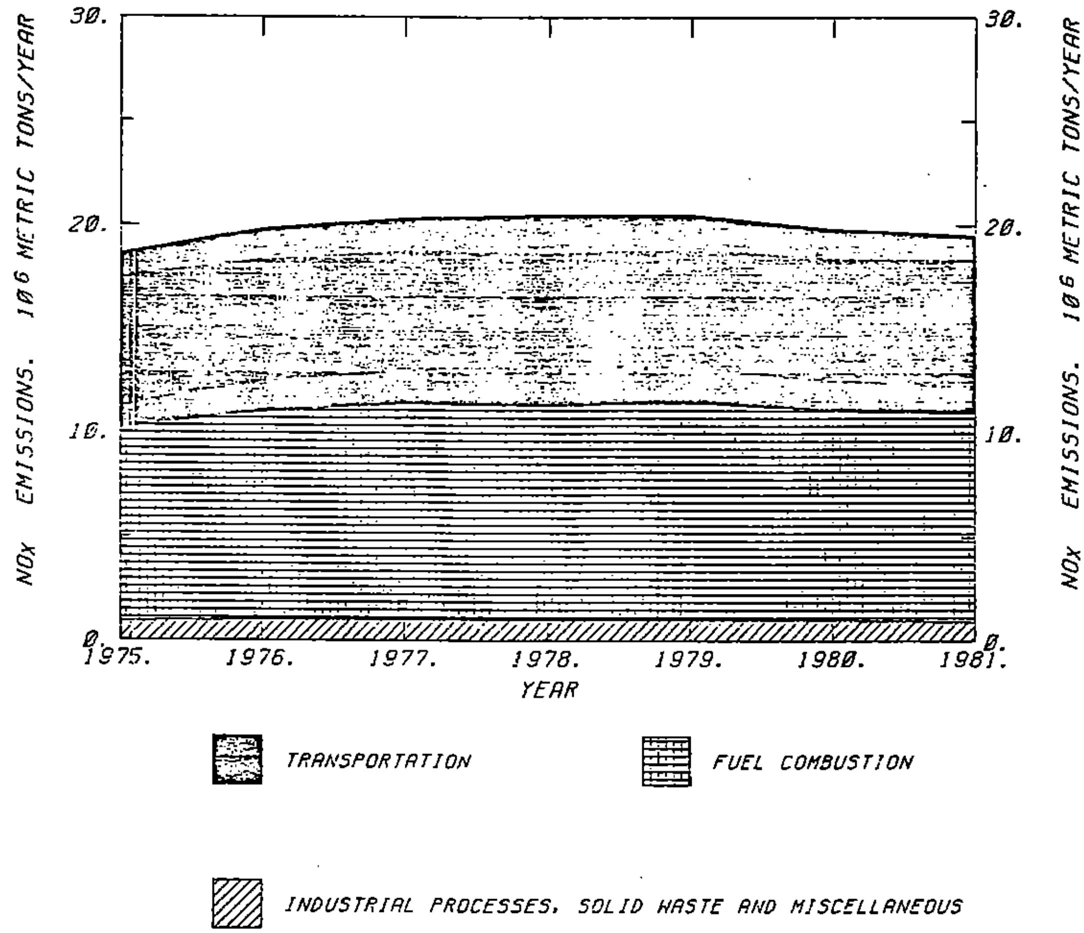


FIGURE 1-11. NATIONAL TREND IN EMISSIONS OF NITROGEN OXIDES, 1975-1981.

Ozone (O_3) - Nationally, the composite average of the second-highest daily maximum 1-hour O_3 values recorded at 209 sites decreased 14 percent between 1975 and 1981 (Figure 1-12). An even greater improvement was observed in the estimated number of exceedances in the ozone season (July - September), which decreased 42 percent (Figure 1-13). Volatile organic compound (VOC) emissions decreased 9 percent during the same time period (Figure 1-14). The greater improvement observed in ozone levels appears to be a combination of reductions in VOC emissions and the change in the calibration procedure which took place between 1978 and 1979. Between 1980 and 1981, the majority of the 159 monitoring sites with data in both years decreased with a median rate of improvement of 8 percent. This is consistent with the 7 percent drop in VOC emissions during this period.

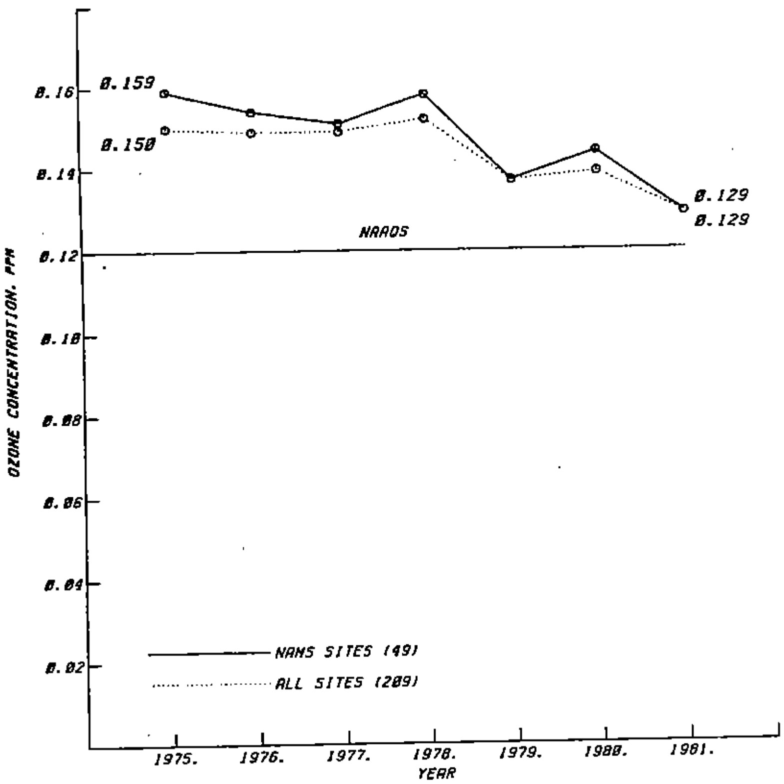


FIGURE 1-12. NATIONAL TREND IN THE COMPOSITE AVERAGE OF THE SECOND-HIGHEST DAILY MAXIMUM 1-HOUR OZONE CONCENTRATION AT BOTH NAMS AND ALL SITES. 1975-1981.

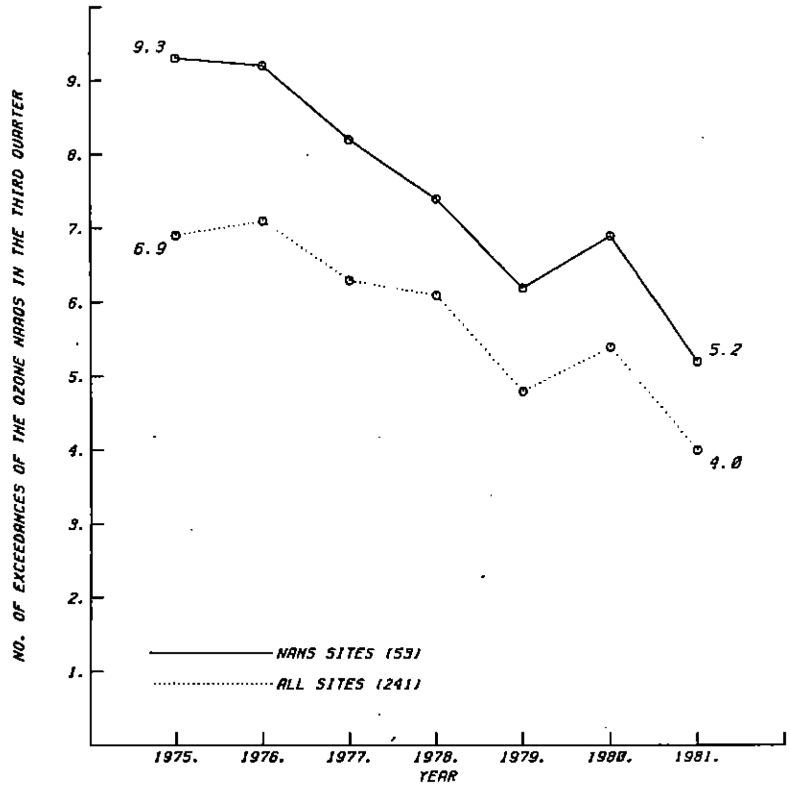


FIGURE 1-13. NATIONAL TREND IN THE COMPOSITE AVERAGE OF THE ESTIMATED NUMBER OF DAILY EXCEEDANCES OF THE OZONE NAAQS IN THE THIRD QUARTER (JULY-SEPTEMBER) AT BOTH NAMS AND ALL SITES, 1975-1981.

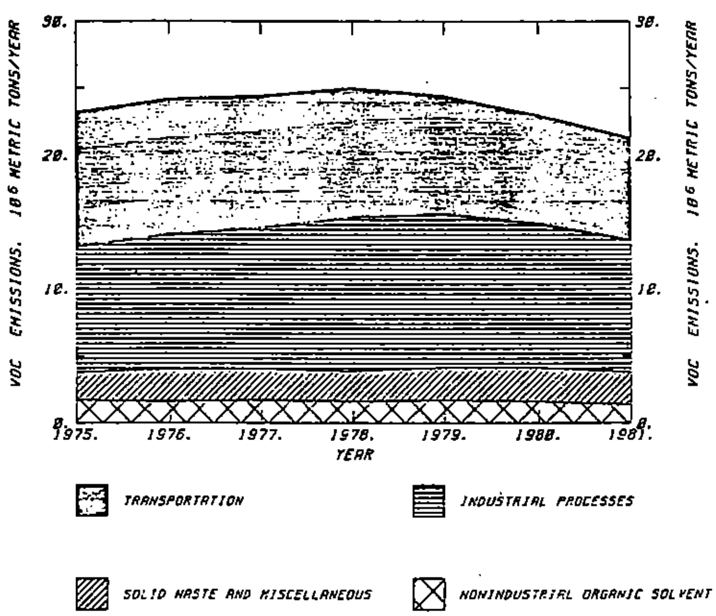
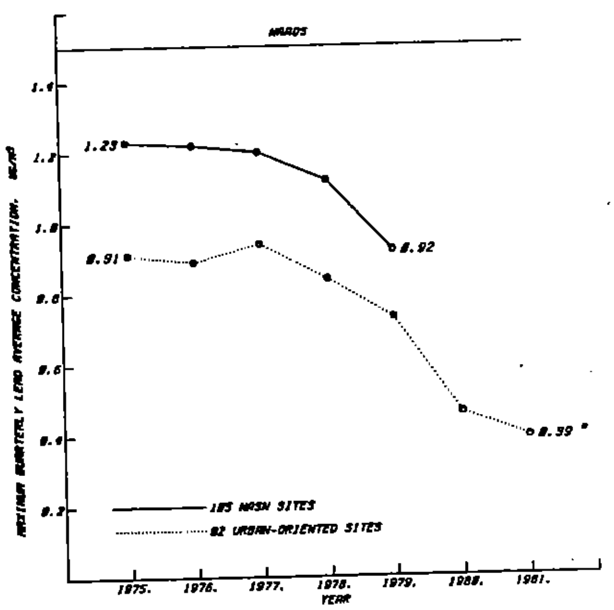


FIGURE 1-14. NATIONAL TREND IN EMISSIONS OF VOLATILE ORGANIC COMPOUNDS, 1975-1981.

Lead (Pb) - The composite maximum quarterly average of ambient lead levels, recorded at 92 sites, decreased 57 percent between 1975 and 1981 (Figure 1-15). The trend at the 92 sites is also contrasted with the trend at 105 National Air Sampling Network (NASN) sites for the common time period 1975 to 1979. The NASN sites were established in the 1960's to monitor ambient air quality levels of TSP and the associated trace metals, including lead. They were largely discontinued in 1980 because they did not meet the siting requirements in the Pb monitoring regulations. For the common 1975-1979 time period, the two trend lines show comparable overall improvement with the NASN sites decreasing 25 percent and the 92 sites decreasing 20 percent. The sample of 92 sites is heavily weighted by monitors in the States of Texas, Maryland and Pennsylvania. Individual trends in each of these States show decreases. The lead consumed in gasoline dropped 67 percent, primarily because the use of unleaded gasoline is required in catalyst equipped cars (Figure 1-16). Between 1980 and 1981, the maximum quarterly average lead levels decreased 18 percent among the 113 sites with data in both years. The decrease in lead consumption over the same time period is 29 percent.



* The 1981 composite average of the maximum quarterly average is based on a partial sample of 42 sites with lead data for both 1980 and 1981.

FIGURE 1-15. NATIONAL TREND IN MAXIMUM QUARTERLY AVERAGE LEAD LEVELS, 1975-1981.

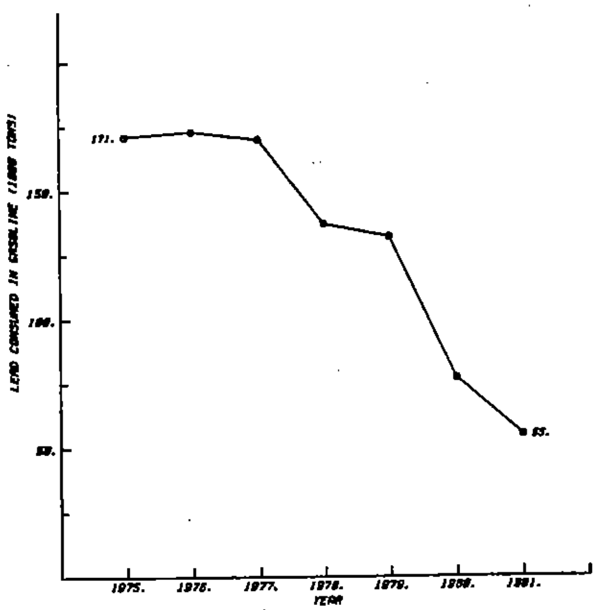


FIGURE 1-16. LEAD CONSUMED IN GASOLINE -- 1975-1981.

(SALES TO THE MILITARY EXCLUDED)

1.3 CONCLUSIONS

For the first time, short-term improvements between 1980 and 1981 have been observed for all major pollutants with decreases ranging from 3 percent for NO_2 to 18 percent for lead. The more recent improvements in TSP, SO_2, O_3 and NO_2 may be due in part to the reduced industrial activity in 1981.

The long-term improvement (1975-81) in CO, O_3 and SO_2, as measured by the trend in the appropriate standard-related peak statistics, is more dramatically illustrated by the reduction in the estimated number of days exceeding the standards. While CO, O_3 and SO_2 peak air quality levels drop 25, 14 and 31 percent, respectively, their associated estimated number of exceedances decreased 84, 42 and 84 percent, respectively. This underscores the success of the air pollution control program in greatly reducing the number of days to which the general public had been exposed to levels above the air quality standards.

1.4 REFERENCES

1. The National Air Monitoring Program: Air Quality and Emissions Trends - Annual Report, Volumes 1 and 2. U. S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, N.C. Publication No. EPA-450/1-73-001a and b. July 1973.

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9. Federal Register, Vol. 44, May 10, 1979, pp 27558-27604.

2. INTRODUCTION

This report focuses on both long and short-term trends in each of the major pollutants as well as Regional and, where appropriate, specific Statewide air quality trends. Air quality trends are presented for both the National Air Monitoring Sites (NAMS) and other site categories. The NAMS were established through monitoring regulations promulgated in May 1979[1] to provide accurate and timely data to the U. S. Environmental Protection Agency (EPA) from a national air monitoring network. The NAMS are located in areas with high pollutant concentrations, high population exposure, or a combination of both. These stations meet uniform criteria for siting, quality assurance, equivalent analytical methodology, sampling intervals, and instrument selection to assure consistent data reporting among the States. Other sites operated by the State and local air pollution control agencies, such as the State and Local Air Monitoring Sites (SLAMS) and Special Purpose Monitors (SPM), in general, also meet the same rigid criteria, except that in addition to being located in the area of highest concentration and high population exposure, they are located in other areas as well.

In addition to ambient air quality, trends are also presented for annual nationwide emissions. These emissions are estimated using the best available engineering calculations; the ambient levels presented are averages of direct measurements. The emission trends are taken from the EPA publication, National Air Pollutant Emission Estimates, 1970-1981[2] and the reader is referred to this publication for more detailed information.

Air quality progress is measured by comparing the ambient air pollution levels with the appropriate primary and secondary NAAQS for each of the pollutants (Table 2-1). Primary standards protect the public health; secondary standards protect the public welfare as measured by effects of pollution on vegetation, materials, and visibility. The standards are further categorized for long or short-term exposure. Long-term standards specify an annual or quarterly mean that may not be exceeded; short-term standards specify upper limit values for 1-, 3-, 8-, or 24-hour averages. With the exception of the pollutant ozone, the short-term standards are not to be exceeded more than once per year. The ozone standard requires that the expected number of days per calendar year with daily maximum hourly concentrations exceeding 0.12 parts per million (ppm) be less than or equal to one.

This report introduces a new section, Air Quality Levels in Standard Metropolitan Statistical Areas (SMSA's). It's purpose is to provide interested members of the air pollution control community, the private sector and the general public with greatly simplified air pollution information. Air quality statistics are presented for each of the pollutants for all SMSA's with populations exceeding 500,000 for the years 1979, 1980 and 1981.

TABLE 2-1. National Ambient Air Quality Standards (NAAQS)

POLLUTANT	PRIMARY (HEALTH RELATED)		SECONDARY (WELFARE RELATED)	
	AVERAGING TIME	CONCENTRATION	AVERAGING TIME	CONCENTRATION
TSP	Annual Geometric Mean	75 ug/m^3	Annual Geometric Mean	60 ug/m^3*
	24-hour	260 ug/m^3	24-hour	150 ug/m^3
SO_2	Annual Arithmetic Mean	(0.03 ppm) 80 ug/m^3	3-hour	1300 ug/m^3 (0.50 ppm)
	24-hour	(0.14 ppm) 365 ug/m^3		
CO	8-hour	(9 ppm) 10 mg/m^3	Same as Primary	
	1-hour	(35 ppm) 40 mg/m^3	Same as Primary	
NO_2	Annual Arithmetic Mean	(0.053 ppm) 100 ug/m^3	Same as Primary	
O_3	Maximum Daily 1-hour Average	(235 ug/m^3) 0.12 ppm	Same as Primary	
Pb	Maximum Quarterly Average	1.5 ug/m^3	Same as Primary	

*This annual geometric mean is a guide to be used in assessing implementation plans to achieve the 24-hour standard of 150 ug/m^3.

2.1 DATA BASE

The ambient air quality data used in this report were obtained from EPA's National Aerometric Data Bank (NADB). Air quality data are submitted to the NADB by both State and local governments, as well as federal agencies. At the present time there are over 200 million air pollution measurements on the NADB, the vast majority of which represent the more heavily populated urban areas of the Nation.

In this report, a special effort has been made to expand the size of the available air quality trends data base. This has been accomplished by merging data at sites which have experienced changes in the agency operating the site, the instrument used, or a change in the project code, such as a change from residential to commercial. A discussion of the impact of the merging of the air quality data is presented in each of the individual pollutant discussions.

While a representative national air quality trends data base exists for TSP, SO_2, CO, NO_2, and O_3, this is not the case for Pb. The data base for lead is heavily weighted by concentrations of monitoring sites in a relatively small number of States. This is addressed in the lead trends section of the report (Section 3.6).

In order for a monitoring site to have been included in this analysis, the site had to contain at least 5 out of the 7 years of data in the period 1975 to 1981. Each year with data had to satisfy an annual data completeness criteria. To begin with, the air quality data are divided into two major groupings -- 24-hour measurements and continuous 1-hour measurements. The 24-hour measurements are obtained from monitoring instruments that produce one measurement per 24-hour period and are operated on a systematic sampling schedule of once every 6 days or 61 samples per year. Such instruments are used to measure TSP, SO_2, NO_2, and Pb. For these measurement methods, the NADB defines a valid quarter's record as one consisting of at least five sample measurements representively distributed among the months of that quarter. Distributions of measurements that show no samples in 2 months of a quarter or that show no samples in 1 month and only one sample in another month are judged unacceptable for calculating a representative estimate of the mean. A valid annual mean for TSP, SO_2 and NO_2, measured with this type of sampler, requires four valid quarters to satisfy the NADB criteria. For the pollutant lead, the data used has to satisfy the criteria for a valid quarter in at least 3 of the 4 possible quarters in a year.

The 1-hour data are obtained from monitoring instruments that operate continuously, producing a measurement every hour for a possible total of 8760 hourly measurements in a year. For continuous hourly data, a valid annual mean for SO_2 and NO_2 requires at least 4380 hourly observations. In the case of the peak statistics - the second maximum 24-hour SO_2 average, the second maximum nonoverlapping 8-hour CO average and the second daily maximum 1-hour O_3 average - the same annual data completeness criteria of 4380 hours was required. This criteria was also used to calculate the estimated number of exceedances of the 24-hour average SO_2 and the 8-hour average CO standards.

Finally, because of the seasonal nature of ozone, the estimated number of exceedances of the O_3 NAAQS was calculated for the third quarter of the year. In order for a site to be included it had to have at least 50 percent of the third quarter hourly data or 1104 values.

For all the pollutants, the site must satisfy the annual completeness criteria, specified above, in at least 5 out of 7 years to be included in the air quality trends data base.

2.2 TREND STATISTICS

The air quality analyses presented in this report comply with the recommendations of the Intra-Agency Task Force on Air Quality Indicators.[2] This task force was established in January 1980 to recommend standardized air quality indicators and statistical methodologies for presenting air quality status and trends. The Task Force report was published in February 1981. The air quality statistics used in these pollutant-specific trend analyses relate directly to the appropriate NAAQS's. In addition to the standard related statistics, other statistics are used, when appropriate, to further clarify observed air quality trends. Particular attention is given to the estimated number of exceedances of the short-term NAAQS's. The estimated number of exceedances is the measured number of exceedances adjusted to account for incomplete sampling.

The emission data are reported as teragrams (one million metric tons) emitted to the atmosphere per year.[3] These are estimates of the amount and kinds of pollution being generated by automobiles, factories, and other sources, based upon the best available engineering calculations for a given time period.

2.3 REFERENCES

1. Federal Register, Vol. 44, May 10, 1979, pp 27558-27604.

2. U. S. Environmental Protection Agency Intra-Agency Task Force Report on Air Quality Indicators. U. S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, N. C. Publication No. EPA-450/81-015. February 1981.

3. National Air Pollutant Emission Estimates, 1970-1981. U. S. Environmental Protection Agency. Office of Air Quality Planning and Standards, Research Triangle Park, N.C. Publication No. EPA-450/4-82-012. September 1982.

3. NATIONAL AND REGIONAL TRENDS IN CRITERIA POLLUTANTS

This chapter focuses on both long- and short-term trends in each of the six major pollutants. Comparisons are made between all the trend sites and the subset of NAMS. Trends are examined for both the Nation and the ten EPA Regions (Figure 3-1). Where appropriate, trend analyses are also presented for selected States.

The air quality trends data base has been expanded for SO_2, CO, NO_2 and O_3 by merging data at sites which have experienced changes in the agency operating the site, the instrument used, or the designation of the project code, such as residential to commercial. The air quality trends data base was not expanded for TSP, because the TSP trends data base is very large, consisting of almost 2000 monitoring sites. On the other hand, the lead trends data base was not expanded, because many of the historic National Air Sampling Network (NASN) sites, were eliminated in 1980, as they had been primarily used to measure TSP and did not meet the Pb siting criteria. The impact of merging the air quality data is discussed in each of the individual pollutant discussions.

The air quality trends information is presented using standard trend lines, bar graphs and Box plots.[1] The ambient levels are averages of direct measurements. The Box plots are used to compare the short-term change in ambient pollution levels between 1980 and 1981. They have the advantage of displaying, simultaneously, several features of the data. Figure 3-2 illustrates the use of this technique in presenting the composite average, the median, and selected percentiles corresponding to the lower and higher concentration levels. The bargraphs are used for the Regional comparisons. The composite average of the appropriate air quality statistic of the 1975-78 time period is compared with the composite average of the 1979-81 time period. The approach is simple and it allows the reader at a glance to compare the long term trend in all ten EPA Regions.

In addition to ambient air quality, trends are also presented for annual nationwide emissions. These emissions data are estimated using the best available engineering calculations.

3.1 TRENDS IN TOTAL SUSPENDED PARTICULATE

TSP is a measure of suspended particles in the ambient air ranging up to 25-45 micrometers in diameter. These particles originate from a variety of stationary and mobile sources. TSP is measured using a "hi-volume" sampler which simply measures the total ambient particle concentration. It does not provide information regarding particle size, nor can it differentiate the relative contributions of wind blown fugitive dust from those of industrial sources.

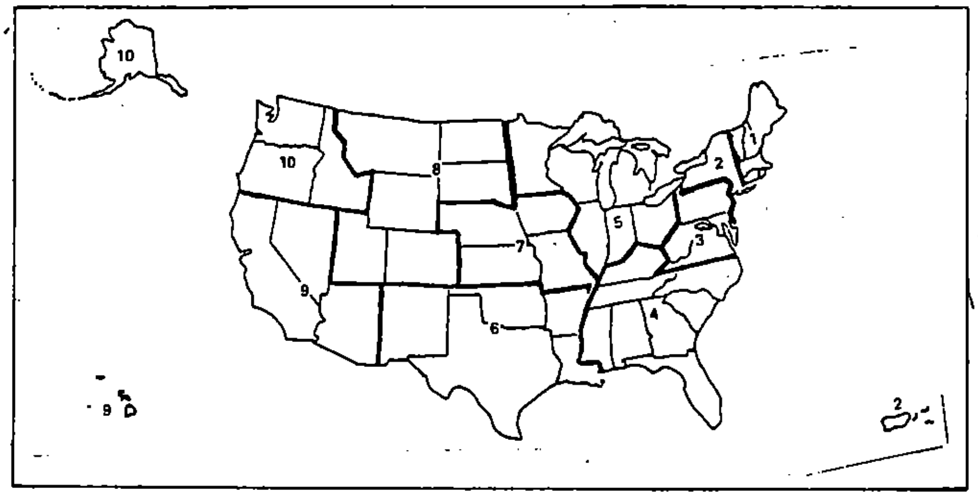


FIGURE 3-1. TEN REGIONAL OFFICES OF THE U. S. ENVIRONMENTAL PROTECTION AGENCY

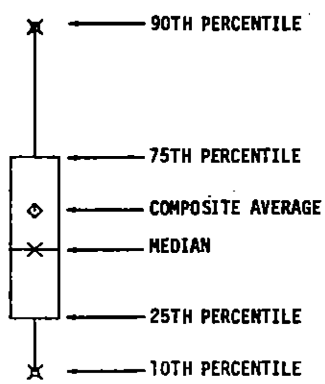


Figure 3-2. Sample illustration of plotting conventions for box plots.

3.1.1 Long-term TSP Trends, 1975-81

The 7-year trend in average TSP levels, 1975-1981, is shown in Figure 3-3 for almost 2000 sites geographically distributed throughout the Nation and for the subset of 302 National Air Monitoring Stations (NAMS) which are located in the large urban areas. The TSP levels are expressed in terms of the composite average annual geometric mean.

The curves shown in Figure 3-3 indicate a very slight decrease in composite levels from 1975-1981. The NAMS sites show higher composite levels than the sites for the Nation in general and appear to show a slightly larger decrease as well. The composite annual average of TSP levels measured at 1972 sites decreased 3 percent during the 1975 to 1981 time period, while the NAMS decreased 7 percent. With the use of a statistical technique (non-parametric regression) applied at each individual site, the trends have been further quantified in terms of the annual rate of change. This is a more precise description of the long-term trend than a simple reading of the composite curves. Among all TSP sites, almost equal numbers of sites exhibited increasing and decreasing rates of change. This resulted in a zero median rate of change over the 7 year period. At the NAMS sites, however, the median rate of change was -1 percent per year. These results appear consistent with the curves presented in Figure 3-3.

Although the ambient TSP data show little or no change, nationwide TSP emissions trends show an overall decrease of approximately 20 percent during this period (Figure 3-4). The apparent inconsistency between ambient particulate levels and the estimated change in particulate emissions is attributed to the unaccounted-for high background levels of naturally occurring particulate emissions, as well as uninventoried area source emissions such as reentrained dust. Recent chemical-element balance studies have shown that reentrained road dust emissions can contribute as much as 50 percent of the annual TSP loading in a given area, and up to 80 percent on a worst-day basis.[2-4] In addition, some particulate matter consists of sulfates and nitrates, which results from atmospheric conversion of emissions of gaseous sulfur oxides and nitrogen oxides.

The 20 percent reduction in particulate emissions occurred primarily because of the reductions in industrial emissions. This is attributed to a combination of installation of control equipment for industrial processes, and reduced industrial productivity. Other areas of TSP emission reductions include reduced coal burning by non-utility users, installation of control equipment by electric utilities that burn coal, and a decrease in the burning of solid waste.[5]

3.1.2 Short-term Trends, 1980-81

The composite geometric mean TSP was lowest in 1981 for the monitoring stations nationally as well as for the urbanized NAMS sites

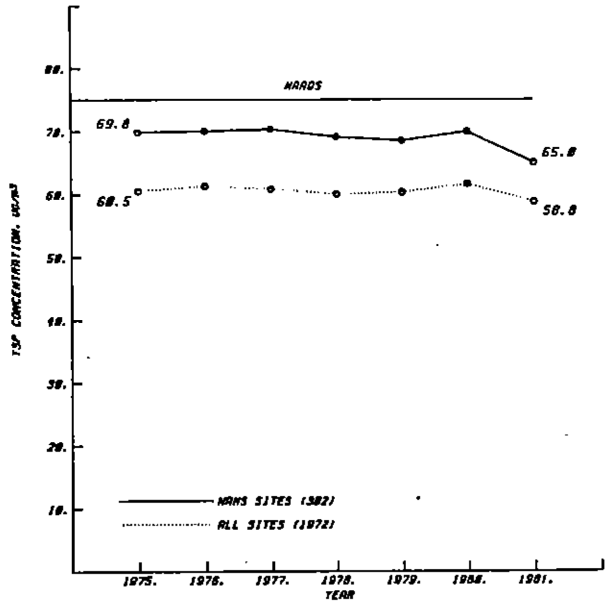


FIGURE 3-3. NATIONAL TRENDS IN THE COMPOSITE AVERAGE OF THE GEOMETRIC MEAN TOTAL SUSPENDED PARTICULATE AT BOTH NAMS AND ALL SITES. 1975-1981.

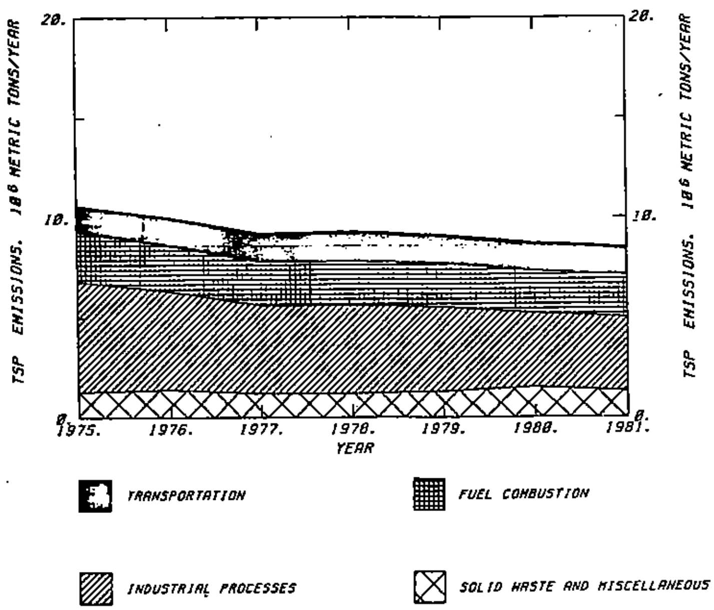


FIGURE 3-4. NATIONAL TREND IN PARTICULATE EMISSIONS. 1975-1981.

(Figure 3-3). Figure 3-5 focuses on the distribution of those sites recording geometric means in both 1980 and 1981. Roughly three quarters of all sites showed decreases between these years. Nationally, the median rate of decrease from 1980 to 1981 was 6 percent at 1289 sites and 8 percent at 248 NAMS sites reporting data in both years.

Possible reasons for these decreases were explored. One likely factor is reduced TSP emissions. While a significant 1-year improvement in pollutant control levels would not be expected, industrial production levels for many sectors in 1981 were significantly lower than in the previous few years.[5] This downturn in industrial production may have contributed to a decreased level of emissions which would have contributed to improved air quality. The impact of reduced productivity is evident in some area specific trends. One illustration of this relationship is derived from a recent air quality study for the Beaver Valley Air Basin in Pennsylvania which is located north-northwest of Pittsburgh.[6] Quarterly composite TSP concentrations show remarkable similarity to raw steel production in the neighboring Pittsburgh area from 1972-1980 (Figure 3-6). The trend in steel production continued through 1981.

Another possible factor for the 1980-1981 trend is meteorology. Previous studies have shown precipitation to be an important factor in TSP trends.[7-8] A preliminary investigation of the influence of precipitation to the change in TSP did not show a strong consistent association between these two quantities.[9] Nevertheless, increases in precipitation did occur in seven out of ten EPA Regions. These seven Regions include five of the EPA Regions mentioned later with notable decreases in TSP levels between 1980 and 1981. Only Region III showed a notable decrease in TSP with a corresponding decrease in precipitation. Based on these comparisons, it appears that the impact of precipitation can not be entirely discounted. The combined effects of reduced productivity and increased precipitation probably account for part of the decrease in TSP levels between 1980 and 1981.

3.1.3 Regional Trends

Figure 3-7 shows a comparison of the 7-year change in TSP levels by EPA Regions in terms of the average 1975-1978 levels versus the 1979-1981 levels. Major differences did not exist in these Regional trends. Some Regions showed a small decrease while others showed a modest increase. The largest increase (7 percent) occurred in Region VIII, and can be attributed to the impact of Mt. St. Helens during 1980.

The short-term 1980-1981 decrease reported earlier shows some Regional differences. Although all Regions decreased, average decreases larger than 10 percent were reported in Regions I, VII, VIII and X. Two of these Regions - I and VII and two additional Regions - III and V reported their lowest 7-year levels during 1981.

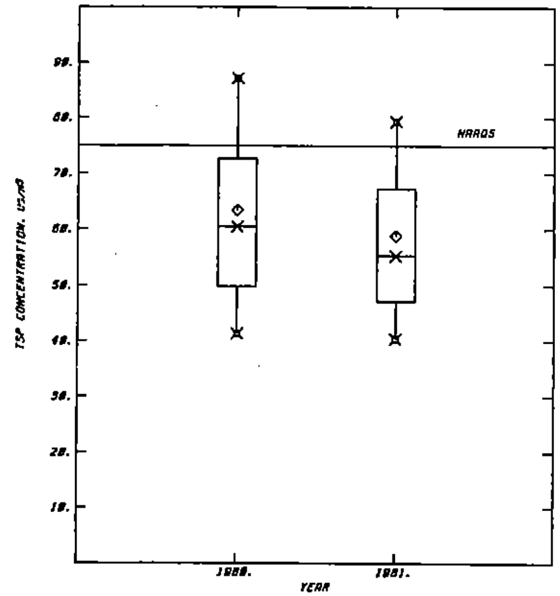
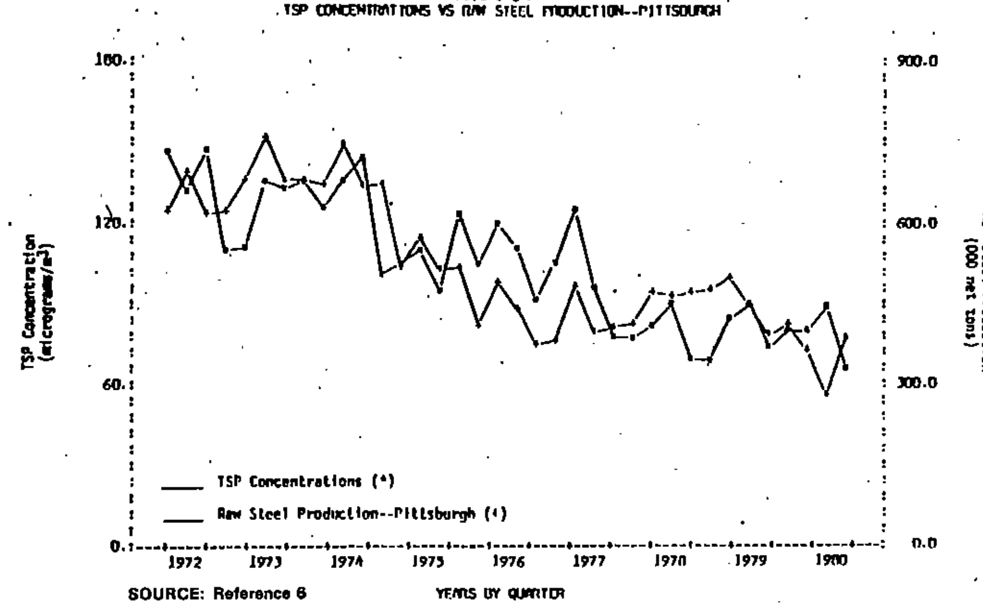


FIGURE 3-5. COMPARISON OF SHORT-TERM TRENDS IN ANNUAL GEOMETRIC MEAN TOTAL SUSPENDED PARTICULATE CONCENTRATIONS AT 1289 SITES. 1980 AND 1981.

FIGURE 3-6
TSP CONCENTRATIONS VS RAW STEEL PRODUCTION--PITTSBURGH



SOURCE: Reference 6

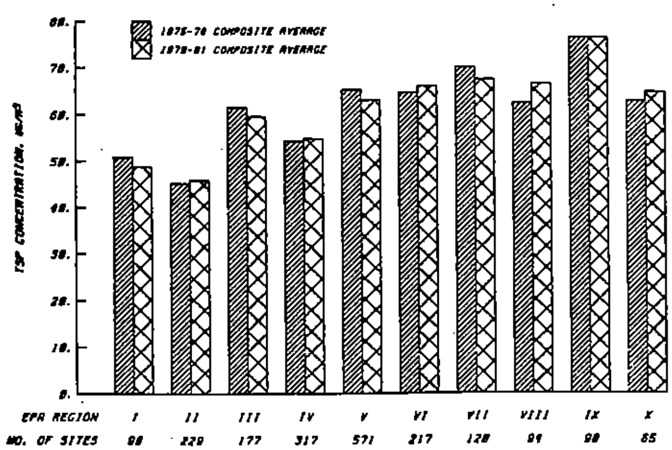


FIGURE 3-7. REGIONAL COMPARISON OF THE 1975-78 AND 1979-81 COMPOSITE AVERAGE OF THE GEOMETRIC MEAN TOTAL SUSPENDED PARTICULATE.

3.2 TRENDS IN SULFUR DIOXIDE

Ambient sulfur dioxide (SO_2) results primarily from stationary source combustion and from nonferrous smelters. SO_2 is measured using either a continuous monitoring instrument, which can collect as many as 8760 hourly values a year, or a 24-hour bubbler, which collects one measurement per 24-hour period and is operated on a sampling schedule of once every 6 days. Prior to 1978, most SO_2 monitors were 24-hour bubblers. In 1978, the EPA required that all SO_2 bubblers be modified with a temperature control device to rectify a sampling problem (when the temperature rose too high, the SO_2 sample collected tended to be underestimated).[10] After 1978, many SO_2 bubblers were retired. Therefore, the bubbler data was not used in the trend analysis, because the instrument modification would complicate the interpretation of the trends analysis. Further, given the bubbler sampling frequency of once every 6 days, the SO_2 peak statistics would be underestimated and not comparable to those obtained from the continuous instruments.

The trends in ambient concentrations are derived from continuous monitoring instruments which can collect as many as 8760 hourly values per year. The SO_2 measurements reported in this section are summarized into a variety of summary statistics which relate to the SO_2 NAAQS. The statistics on which ambient trends will be reported are the annual arithmetic mean concentration, the second highest annual 24-hour average (measured midnight to midnight), and the expected annual number of 24-hour exceedances of 0.14 ppm (24-hour NAAQS).

3.2.1 <u>Long-term Trends, 1975-81</u>

The long-term trend in ambient SO_2, 1975-1981, is graphically presented in Figures 3-8 to 3-10. In each figure, the trend at the NAMS is contrasted with the trend at all sites. For each of the statistics presented, a steady downward trend is evident. Nationally, the annual mean SO_2 examined at 416 sites decreased at a median rate of approximately 4 percent per year; this resulted in an overall change of about 27 percent (Figure 3-8). The subset of 78 NAMS recorded higher average concentrations but declined at a higher rate of 8 percent per year.

The annual second highest 24-hour values displayed a similar decline. Nationally, among 404 stations with adequate trend data, the average rate of change was 5 percent per year with an overall decline of 31 percent (Figure 3-9). The 76 NAMS exhibited a similar rate of improvement for an overall change of 30 percent. In 1980 and 1981, the composite average of the second highest 24-hour averages were almost identical for the NAMS and the national composite of 404 sites. While the NAMS are higher than

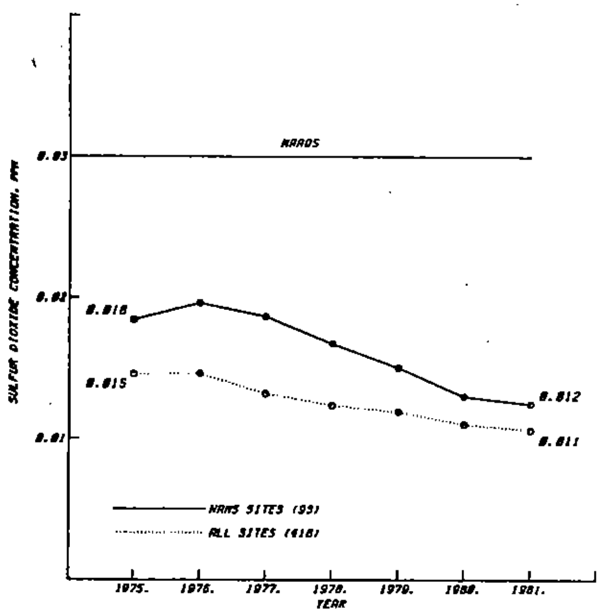


FIGURE 3-8. NATIONAL TREND IN THE ANNUAL AVERAGE SULFUR DIOXIDE CONCENTRATION AT BOTH NAMS AND ALL SITES. 1975-1981.

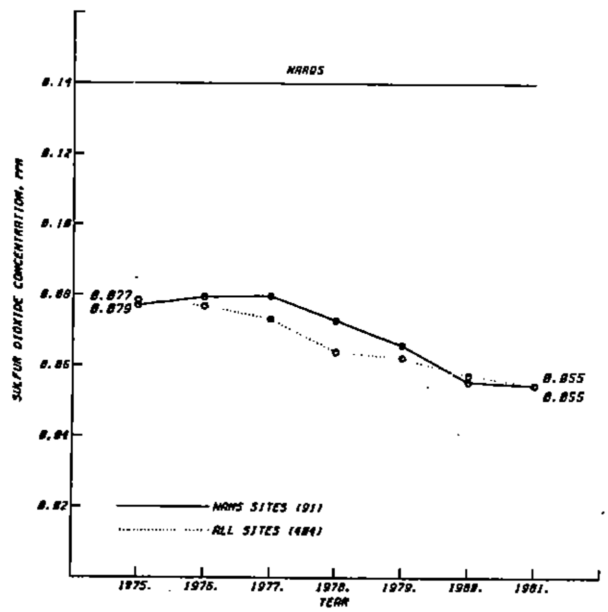


FIGURE 3-9. NATIONAL TREND IN THE COMPOSITE AVERAGE OF THE SECOND-HIGHEST 24-HOUR SULFUR DIOXIDE CONCENTRATION AT BOTH NAMS AND ALL SITES. 1975-1981.

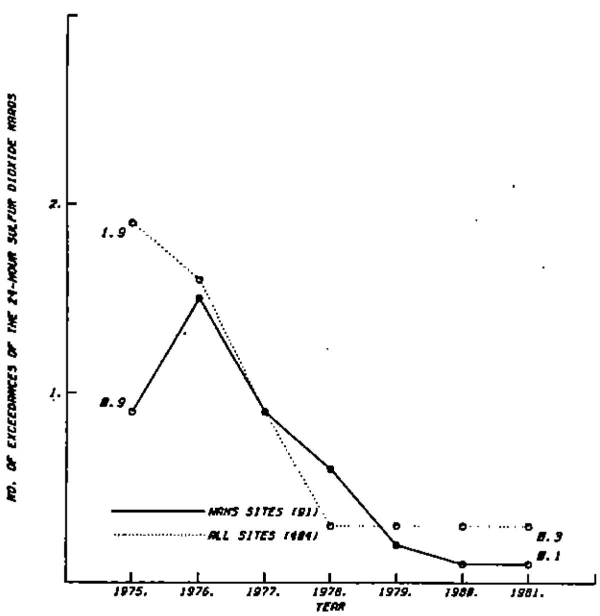


FIGURE 3-10. NATIONAL TREND IN THE COMPOSITE AVERAGE OF THE ESTIMATED NUMBER OF EXCEEDANCES OF THE 24-HOUR SULFUR DIOXIDE NAAQS AT BOTH NAMS AND ALL SITES. 1975-1981.

other population oriented sites, the national composite includes not only population-oriented sites, but high concentration sites at smelter locations, as well. The estimated number of exceedances also showed declines for the NAMS as well as the composite of all sites (Figure 3-10). The vast majority of SO_2 sites do not show any exceedances of the 24-hour NAAQS. Most of the exceedances as well as the bulk of the improvements occurred at source oriented sites including a few smelters in particular.

SO_2 emissions (Figure 3-11) are dominated by electric utilities and the trend generally tracks the pattern of ambient data. Emissions increased from 1975 to 1976 due to improved economic conditions but decreased since then reflecting the installation of flue gas desulfurization controls at coal-fired electric generating stations and a reduction in the average sulfur content of fuels consumed. Emissions from other stationary source fuel combustion sectors also declined, mainly due to decreased combustion of coal by these consumers. Sulfur oxide emissions from industrial processes are also significant. Emissions from industrial processes have declined, primarily as the result of controls implemented to reduce emissions from nonferrous smelters and sulfuric acid manufacturing plants.[5]

Nationally, SO_2 emissions decreased 12 percent from 1975 to 1981. The difference between emission trends and air quality trends arises because the use of high sulfur fuels was shifted from power plants in urban areas, where most of our monitors are, to power plants in rural areas which have fewer monitors.

3.2.2 Short-term Trends, 1980-81

Two hundred ninety five sites had both annual means and annual second maximum 24-hour averages in 1980 and 1981. The distributions of the 295 sites, illustrated in the Box plots for annual means (Figure 3-12) and for the second maximum 24-hour averages (Figure 3-13), show a decline in all the percentile levels (10th, 25th, 50th, 75th and 90th) between 1980 and 1981. The median rate of improvement was 8 percent for the annual means and 4 percent for the second maximum 24-hour averages.

3.2.3 Regional Trends

The annual mean SO_2 levels decreased in eight EPA Regions from 1975-1981 (Figure 3-14). Only two Regions, VI and VIII, had a majority of sites increasing over this time period. In Region VI, these sites were primarily special purpose monitors located in areas with low SO_2 concentrations. In Region VIII, the increases all occurred at a non-ferrous smelter in Montana. The long-term change in the second high 24-hour values also showed similar patterns.

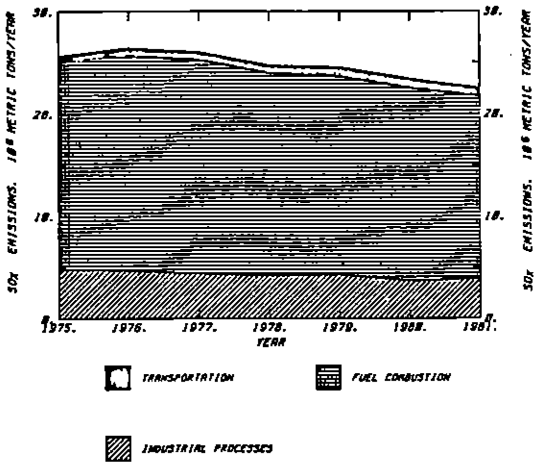


FIGURE 3-11. NATIONAL TREND IN EMISSIONS OF SULFUR OXIDES. 1975-1981.

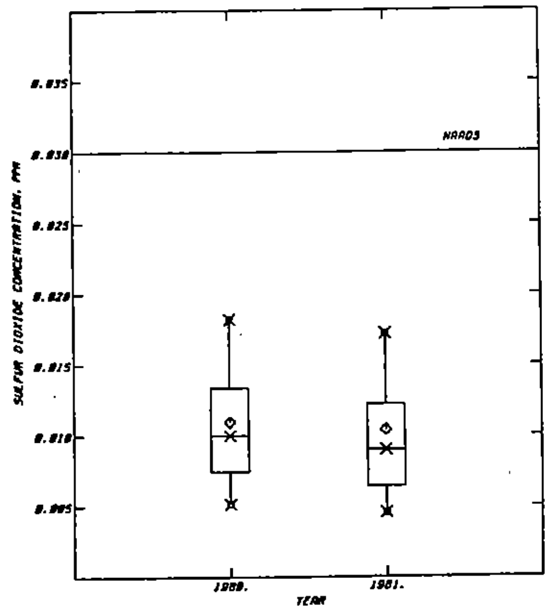


FIGURE 3-12. COMPARISON OF SHORT-TERM TRENDS IN ANNUAL MEAN SULFUR DIOXIDE CONCENTRATIONS AT 295 SITES. 1980 AND 1981.

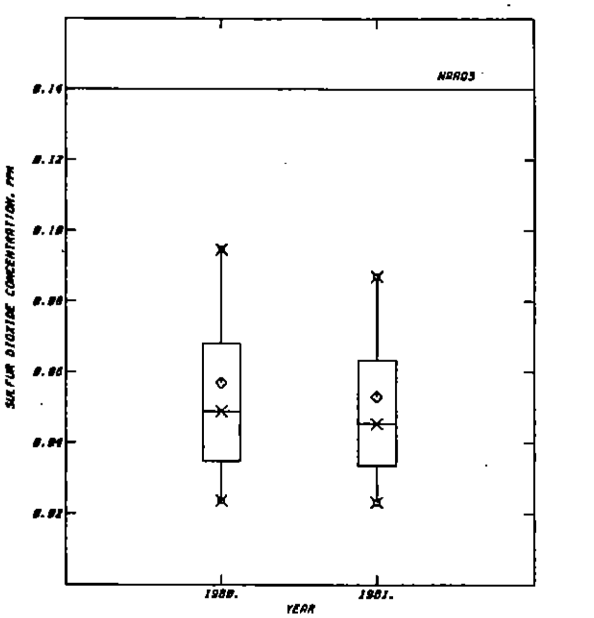


FIGURE 3-13. COMPARISON OF SHORT-TERM TRENDS IN SECOND HIGHEST 24-HOUR AVERAGE SULFUR DIOXIDE CONCENTRATIONS AT 295 SITES. 1980 AND 1981.

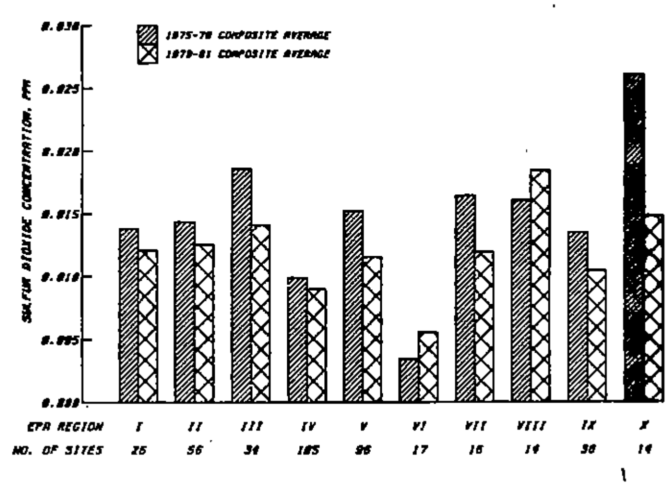


FIGURE 3-14. REGIONAL COMPARISON OF THE 1975-78 AND 1979-81 COMPOSITE AVERAGE OF THE ANNUAL AVERAGE SULFUR DIOXIDE CONCENTRATIONS.

3.3 TRENDS IN CARBON MONOXIDE

There are both 1-hour and 8-hour National Ambient Air Quality Standards (NAAQS) for carbon monoxide (CO). The 1-hour standard specifies a level of 35 ppm not to be exceeded more than once per year while the 8-hour standard specifies a level of 9 ppm not to be exceeded more than once per year. Because the 8-hour standard is generally more restrictive, this section focuses primarily on the 8-hour data.

The 8-hour CO trends data base for these analyses consisted of all sites that had at least 50 percent complete data for at least 5 of the 7 years during the 1975-81 time period. This resulted in a data base of 224 sites. In this selection process, data from sites at the same location were merged even though the agency or project code or monitoring method may have changed over time. However, only monitoring methods that are equivalent to the Federal Reference Method were considered. Although approximately 25 percent of the trend sites reflect merged data, there is no significant difference in the trends between the merged and unmerged sites.

3.3.1 Long-term Carbon Monoxide Trends: 1975-81

The 1975-81 trend for 8-hour CO is shown in Figure 3-15 for the 224 sites and the subset of 37 NAMS. Both the second highest non-overlapping 8-hour average and the 90th percentile are shown and illustrate the net improvement in ambient CO levels during the 1975-81 time period. The national composite decreased 26 percent for the second maximum, or approximately 5 percent per year, and 35 percent for the 90th percentile, or approximately 7 percent per year. During the 1975-81 time period, 80 percent of the sites in the Nation recorded long-term improvement. This is further demonstrated in terms of the composite average of the number of times per year that the 8-hour CO standard was exceeded (Figure 3-16). This statistic shows an even greater improvement than the second maxima or 90th percentiles, decreasing 84 percent at the 224 sites with a similar decrease at the NAMS over the 1975 through 1981 time period.

Between 1980 and 1981, the 37 NAMS show a slight increase in the second highest nonoverlapping 8-hour average, but continue to show a consistent improvement in both the 90th percentiles of 8-hour averages (Figure 3-15) and in the estimated number of annual exceedances (Figure 3-16.) Both the 90th percentile of 8-hour averages and the estimated number of annual exceedances are more stable statistical indicators for air quality trends, than the second highest nonoverlapping 8-hour average, which is more likely to be influenced by unusual meteorological events. Since there are only 37 NAMS, the short-term trend (1980-81) is examined in greater detail in Section 3.3.2 by analyzing 163 sites with data in both 1980 and 1981.

Between 1975 and 1981 national carbon monoxide emissions decreased 10 percent as shown in Figure 3-17.[5] These emission trend estimates show a slight rise between 1975 and 1976 but then a consistent decrease year after year through 1981. Highway vehicle emissions, which are the dominant component affecting ambient trends, are estimated to have decreased 16 percent between 1975 and 1981 but this actually reflects

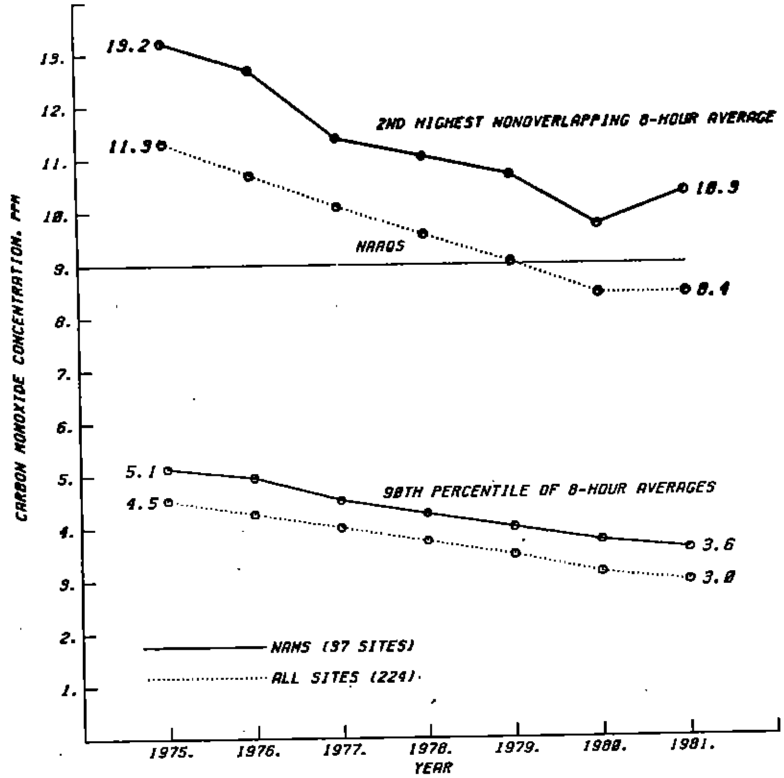


FIGURE 3-15. NATIONAL TREND IN CARBON MONOXIDE LEVELS, COMPARING NAMS WITH ALL SITES AND THE SECOND HIGHEST NONOVERLAPPING 8-HOUR AVERAGE WITH THE 90TH PERCENTILE OF 8-HOUR AVERAGES, 1975-1981.

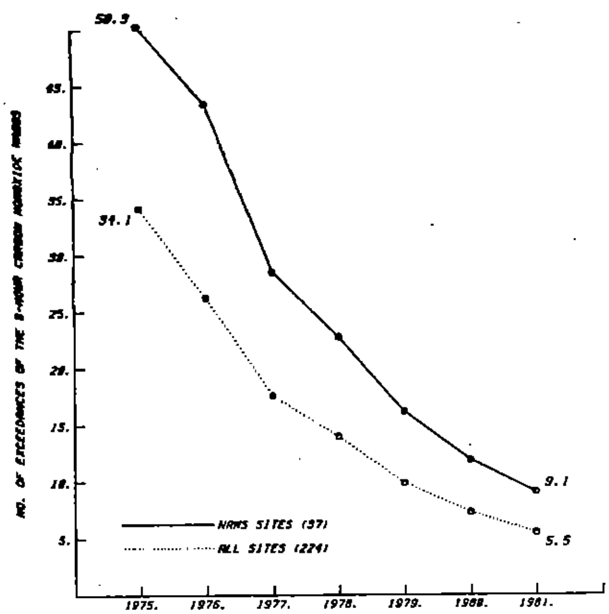


FIGURE 3-16. NATIONAL TREND IN THE COMPOSITE AVERAGE OF THE ESTIMATED NUMBER OF EXCEEDANCES OF THE 8-HOUR CARBON MONOXIDE NAAQS AT BOTH NAMS AND ALL SITES, 1975-1981.

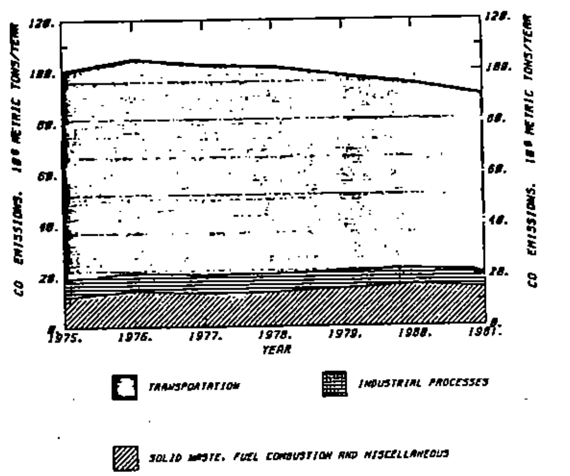


FIGURE 3-17. NATIONAL TREND IN EMISSIONS OF CARBON MONOXIDE, 1975-1981.

a relatively stable pattern between 1975 and 1978 followed by a 15 percent drop between 1978 and 1981.

In attempting to compare ambient CO trends and emission trends, it is important to recognize that the trends in estimated CO emissions for highway vehicles involve two main components: emissions per vehicle miles of travel and the number of vehicle miles of travel. The Federal Motor Vehicle Control Program has been successful since the early 1970's in reducing CO emissions per vehicle miles of travel, but the net effect on national CO emissions was dampened by an increase of 16 percent in vehicle miles of travel between 1975 and 1978. However, from 1978 to 1981 it is estimated that the vehicle miles of travel decreased by 1 percent so that the impact of the emissions controls is more apparent as evidenced by the 15 percent decrease in emissions between 1978 and 1981.[5] The extent to which ambient trends agree with the nationwide emission trends depends upon whether the local traffic patterns around these trend sites are consistent with the trends in national averages for vehicle miles of travel. Because CO monitors are typically located to identify potential problems, they are likely to be placed in traffic saturated areas that do not experience increases in vehicle miles of travel. Therefore the rate of CO air quality improvement would be faster than the CO emission trend, because the CO air quality trend is less likely to be influenced by increases in traffic.

3.3.2 Short-term Carbon Monoxide Trend: 1980-81

The change in the CO levels is shown for both the 90th percentile of 8-hour averages (Figure 3-18) and the second highest nonoverlapping 8-hour average (Figure 3-19) for the 163 sites with both 1980 and 1981 data. While the 90th percentile shows continued improvement with a median improvement of 7 percent between 1980 and 1981, the change in the second maximum is somewhat mixed. Although the median rate of improvement for the second maximum was 3 percent between 1980 and 1981, the national composite average showed little change. If only the sites with second maximum values above the level of the 8-hour CO standard (9 ppm) are considered, the median rate of improvement between 1980 and 1981 was 7 percent so that the higher sites continued to show improvement for the second maximum value between 1980 and 1981. The sites with lower concentrations, as represented by the 25th percentile on the Box plots in Figures 3-18 and 3-19, show improvement in the 90th percentile of CO values (Figure 3-18), but not in the second maxima (Figure 3-19). Once again, the 90th percentile is the more stable trend statistic, while the second maximum 8-hour average is more likely to be influenced by unusual meteorological events. The reason for this inconsistency is not clear.

3.3.3 Regional Carbon Monoxide Trends

Figure 3-20 displays the 1975-78 and 1979-81 composite averages of the second highest 8-hour carbon monoxide concentrations by Region and provides a convenient display of long-term trends during this time period. Every Region showed long-term improvement with the majority of sites in each Region reporting progress.

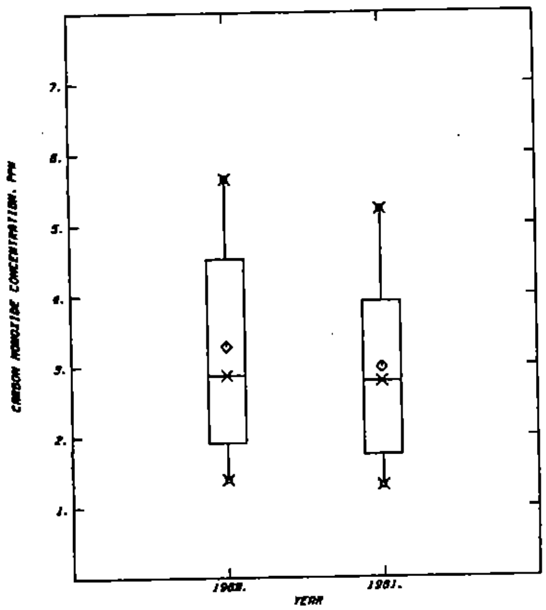


FIGURE 3-18. COMPARISON OF SHORT-TERM TRENDS IN THE 90TH PERCENTILE OF 8-HOUR AVERAGE CARBON MONOXIDE CONCENTRATIONS AT 163 SITES. 1980 AND 1981.

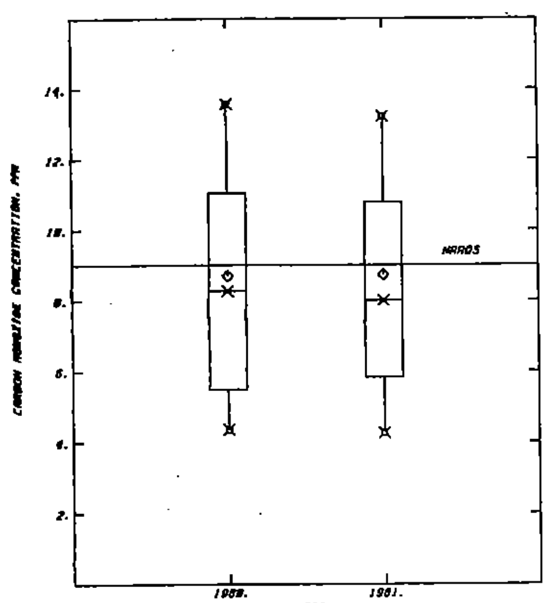


FIGURE 3-19. COMPARISON OF SHORT-TERM TRENDS IN SECOND HIGHEST NONOVERLAPPING 8-HOUR AVERAGE CARBON MONOXIDE CONCENTRATIONS AT 169 SITES. 1980 AND 1981.

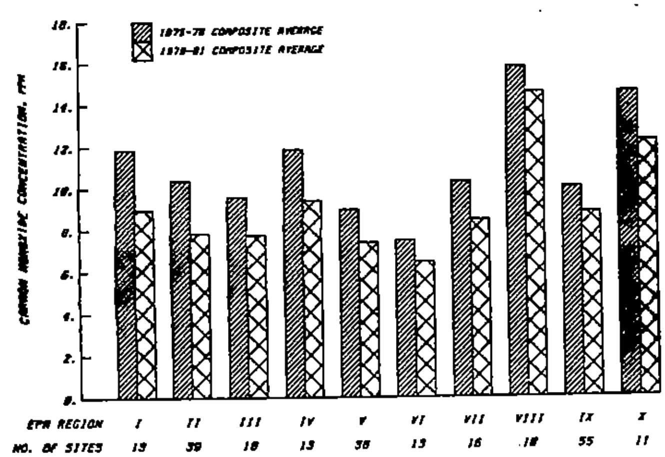


FIGURE 3-20. REGIONAL COMPARISON OF THE 1975-78 AND 1979-81 COMPOSITE AVERAGE OF THE SECOND-HIGHEST NON-OVERLAPPING 8-HOUR CARBON MONOXIDE CONCENTRATION.

3.4 TRENDS IN NITROGEN DIOXIDE

NO_2 is measured using either a continuous monitoring instrument, which can collect as many as 8760 hourly values a year, or a 24-hour bubbler, which collects one measurement per 24-hour period. Both monitors are used to compare annual average concentrations with the annual NO_2 standard of 100 ug/m^3.

In order to expand the size of the available trends data base, data was merged at sites which experienced changes in the agency operating the site, the instrument used, or the designation of the project code, such as residential or commerical. The merging was accomplished by treating the bubbler and continuous hourly data separately. If a monitor at a given site was changed from a 24-hour bubbler to a continuous hourly monitor or vice versa, the data would not be merged. If, on the other hand, a monitor at a given site changed from one type of bubbler to another type of bubbler or one type of continuous instrument to another type of continuous instrument the data would be merged.

After the merging took place the trends sites that were selected had to satisfy an annual data completeness criteria in at least 5 out of 7 years in the 1975 to 1981 time period. For sites with 24-hour bubblers the annual data completeness criteria used for the annual mean was the NADB validity criteria, as defined in Section 2.1. The annual data completeness criteria for sites with continuous instruments required the site to collect at least 50 percent of the possible hourly data or 4380 measurements. The impact of merging the data was to increase the size of the NO_2 trends data base from 306 to 445 sites or 45 percent. The 445 sites consisted of 111 sites with continuous monitors, of which 62 contained merged data, and 334 bubblers, of which 77 contained merged data. The rates of change were computed at each of the sites, using nonparametric regression.[11] Treating the continuous and bubbler data separately, the rates of change at the sites with merged data were compared with the rates of change at the sites with unmerged data using the analysis of variance (ANOVA).[12] Based on the ANOVA no significant difference was found between the merged and unmerged bubbler data nor between the merged and unmerged continuous data.

3.4.1 Long-term NO_2 Trends: 1975-81

Nationally, annual average NO_2 levels, measured at the 445 sites, increased 5 percent (Figure 3-21). Correspondingly, oxides of nitrogen emissions increased 5 percent (Figure 3-22). Both the NO_2 air quality and nitrogen oxide emission trend lines are very similar. Both trend lines show an increase from 1975 to about 1978, a leveling off from 1978 to 1979 and a decrease from 1979 to 1981. The two major emission source categories - transportation and stationary source fuel combustion - both show the same general pattern. Emissions from transportation

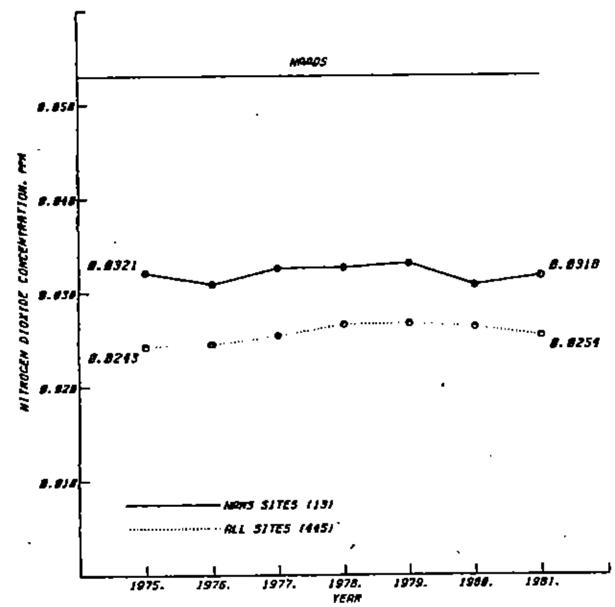


FIGURE 3-21. NATIONAL TREND IN THE COMPOSITE AVERAGE OF NITROGEN DIOXIDE CONCENTRATION AT BOTH NAMS AND ALL SITES. 1975-1981.

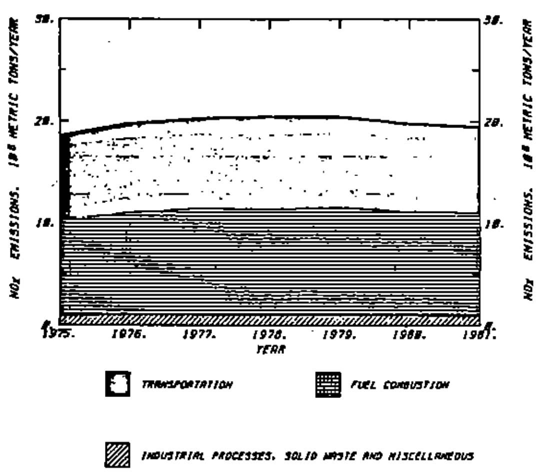


FIGURE 3-22. NATIONAL TREND IN EMISSIONS OF NITROGEN OXIDES. 1975-1981.

sources increased through 1978 as the result of increased motor vehicle travel. Since then, emissions have declined slightly as the result of Federal motor vehicle controls and the lack of significant growth in vehicle miles travelled. The drop in stationary fuel combustion between 1979 and 1980 occurred primarily in the industrial source category and is due to a combination of reduced industrial activity and conservation measures.

Of the 445 sites, only 13 were NAMS. This is to be expected, because NO_2 does not represent a significant air quality problem in many areas. The NAMS are only located in those urban areas with populations greater than 1,000,000. Many of the NAMS are new sites located in the areas of maximum concentration (urban scale), downwind of the area of peak nitrogen oxides emissions, or in that part of the urban area where the emission density of nitrogen oxides is the highest.

The 13 NAMS are located in nine standard metropolitan statistical areas in seven States. As would be expected the composite averages of the NAMS are consistently higher than those of the 445 sites, since the NAMS are located in the areas of highest concentration. The NAMS report an overall decrease of 2 percent between 1975 and 1981 in contrast to the 5 percent increase reported at the 445 sites. It is difficult to conclude very much from this discrepancy, since the sample of NAMS is so small.

3.4.2 Short-term NO_2 trend: 1980-81

Two hundred and one sites had annual means in both 1980 and 1981. The distribution of the 201 sites illustrated in the Box plot (Figure 3-23) shows a decline in all the percentile levels (10th, 25th, 50th, 75th and 90th) between 1980 and 1981. The composite mean of the 201 sites decreased 8 percent between 1980 and 1981. This compares with a 2 percent decrease in emissions.

3.4.3 Regional Trends

The Regional trends display the composite average of all the sites in each Region over two time periods 1975-78 versus 1979-81 (Figure 3-24). The Regional trends are mixed, with five Regions (I, IV, V, VI and VIII) showing increases and the remaining Regions showing decreases. It should be noted that there is only one site meeting the historical trends criteria in Region X and, as such, the trend represents the site and not the Region.

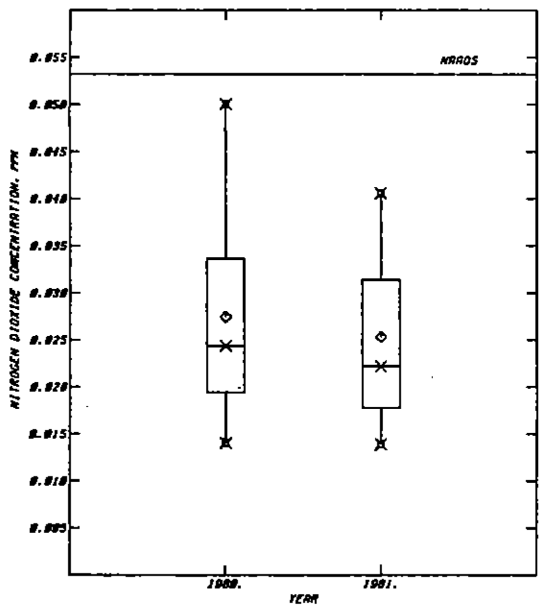


FIGURE 3-23. COMPARISON OF SHORT-TERM TRENDS IN ANNUAL MEAN NITROGEN DIOXIDE CONCENTRATIONS AT 201 SITES, 1980 AND 1981.

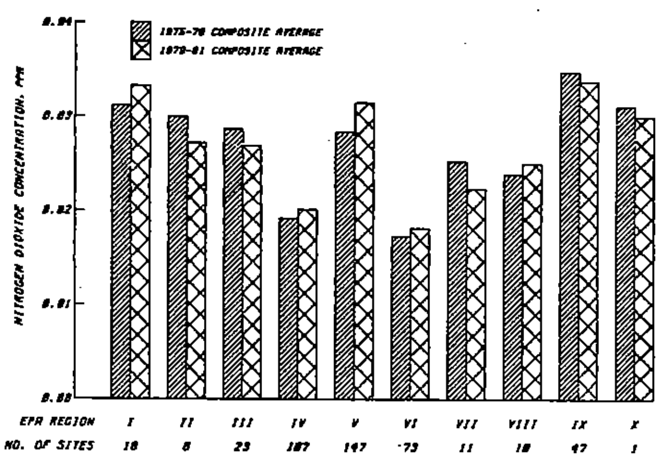


FIGURE 3-24. REGIONAL COMPARISON OF THE 1975-78 AND 1979-81 COMPOSITE AVERAGE OF NITROGEN DIOXIDE CONCENTRATIONS.

3.5 TRENDS IN OZONE

Ozone is strongly seasonal with higher ambient concentrations typically occurring during the warmer times of the year. The National Ambient Air Quality Standard for ozone applies to the maximum hourly value for the day and the level of the standard is 0.12 ppm. Because of the seasonal nature of ambient ozone levels, trends for the 1975-81 time period were examined both in terms of an annual statistic, the second highest daily maximum, and a statistic focusing only upon the third quarter (July-September), the estimated number of exceedances.

The data base for the annual trends analysis consisted of all sites that recorded at least 50 percent of the hourly values for 5 or more of the 7 years in the 1975-81 period. For the third quarter analysis, the 50 percent completeness criterion was applied only to the third quarter rather than the entire year. There were 209 sites that qualified as trend sites on an annual basis and 241 sites that qualified for the third quarter analysis. This increase in the number of sites meeting the trends criteria for the third quarter is primarily due to additional sites in the New England and Great Lakes regions. This is reasonable because many of the sites in the colder climates operate on a monitoring schedule that is not year-round but is restricted to the ozone season. Therefore, such sites would not have 50 percent complete data for the entire year but would be 50 percent complete for the third quarter. For both data sets, data were merged from sites at the same location even though the agency or project code may have changed or the monitoring method changed, although any method used would have to be an equivalent method. While approximately 20 percent of the sites involved merged data, there was no significant difference in the trends between the sites with merged data and those that did not have merged data.

3.5.1 Long-term Ozone Trends: 1975-81

The overall trend for the annual second high day is shown in Figure 3-25 for the 209 annual trend sites. Although the graph indicates an overall decrease of 14 percent between 1975 and 1981, the pattern is fairly stable initially from 1975 to 1978 followed by a drop between 1978 and 1979 and a slight rise in 1980 and then a further decrease between 1980 and 1981. This same pattern is also apparent for the subset of 49 NAMS sites. Because volatile organic compounds (VOC), along with nitrogen oxides, are involved in the atmospheric chemical and physical processes that result in the formation of ozone, the VOC emission trends during this same time period are displayed in Figure 3-26.[5] Total VOC emissions decreased 8 percent between 1975 and 1981 but it is worth noting that emissions increased from 1975 to 1978 and then consistently decreased through 1981 (Figure 3-26). In comparing the ambient trends and emission trends it is important to note that the apparent improvement in ambient ozone levels in the late 1970's may be partly attributable to the change in calibration procedure

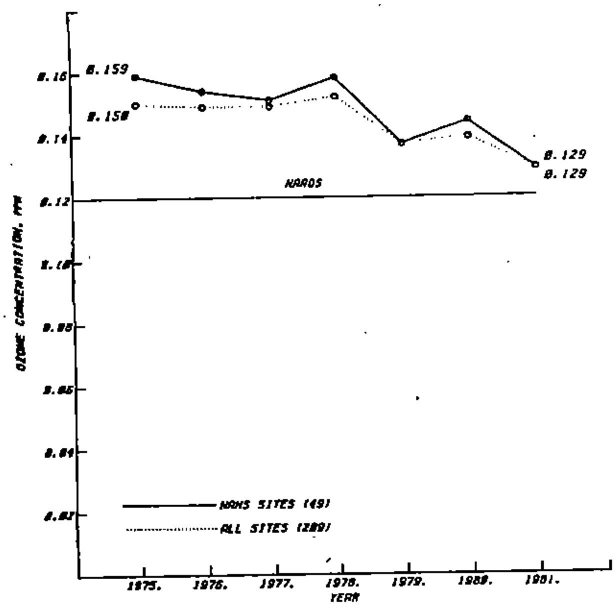


FIGURE 3-25. NATIONAL TREND IN THE COMPOSITE AVERAGE OF THE SECOND-HIGHEST DAILY MAXIMUM 1-HOUR OZONE CONCENTRATION AT BOTH NAMS AND ALL SITES, 1975-1981.

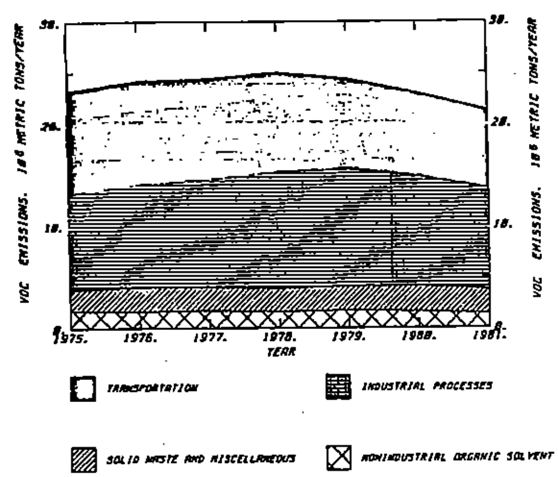


FIGURE 3-26. NATIONAL TREND IN EMISSIONS OF VOLATILE ORGANIC COMPOUNDS. 1975-1981.

recommended by EPA in June 1978.[13] Quantifying the exact impact of this calibration change is difficult, but some caution is warranted in interpreting the results prior to 1979.[14]

Figure 3-27 displays the 1975-81 trend in estimated exceedances for third quarter ozone data and shows an overall decrease for the entire time period with an increase in 1980 that is more than offset by the drop between 1980 and 1981. Again, the interpretation of the overall trend is complicated by the effect of the change in calibration procedure in the late 1970's.

3.5.2 Short-term Ozone Trend: 1980-81

There were 159 trend sites that satisfied the annual completeness criterion in both 1980 and 1981. The Box plot in Figure 3-28 indicates the decrease between 1980 and 1981 in annual second maximum levels. The majority of sites had decreases and the median rate of improvement between 1980 and 1981 was 8 percent. This is consistent with the 7 percent drop in VOC emissions during this same period.

This improvement between 1980 and 1981 was primarily due to decreasing levels at those sites that had second high values above the level of the ozone standard in 1980. There were 91 of the 159 trend sites with more than one day above .12 ppm in 1980 and the median rate of improvement at these sites was 13 percent between 1980 and 1981. This greater improvement at the higher sites was widespread and not limited to any particular geographical region.

3.5.3 Regional Ozone Trends

Figure 3-29 contrasts the composite average of the second highest daily 1-hour ozone concentration for the 1975-78 and 1979-81 time periods by EPA Region. Although this graph is consistent with the general improvement discussed in the previous section there are a few points worth noting. For example, the graph is presented in terms of the annual trends data base and Region I is represented by only three sites, because of seasonal monitoring for ozone in the New England area. If the third quarter data base were used, the number of trend sites in this Region would have increased to 17 and the results would still show net improvement. The results shown in this figure are also of interest with respect to the earlier discussion on the possible effect of the calibration change on the apparent long-term improvement. Although Region IX showed improvement between 1980 and 1981, it is the only Region that does not show long-term improvement. This Region was not significantly affected by the calibration change, because California, which dominates the Region, changed calibration procedures in 1975. Further, the long-term improvement results should be tempered by an awareness that a calibration change did occur in the late 1970's in the other nine Regions and that the recent trends are of more interest.

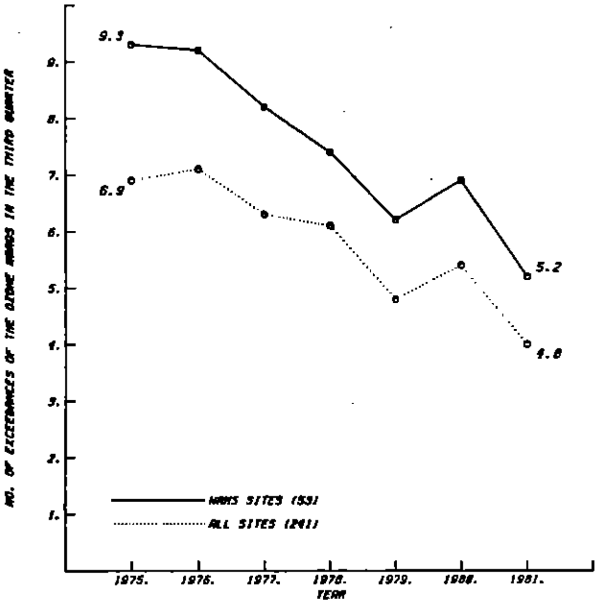


FIGURE 3-27. NATIONAL TREND IN THE COMPOSITE AVERAGE OF THE ESTIMATED NUMBER OF DAILY EXCEEDANCES OF THE OZONE NAAQS IN THE THIRD QUARTER (JULY-SEPTEMBER) AT BOTH NAMS AND ALL SITES, 1975-1981.

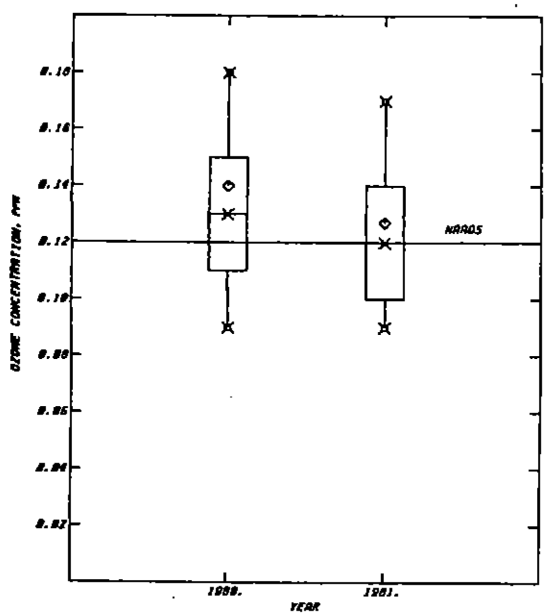


FIGURE 3-28. COMPARISON OF SHORT-TERM TRENDS IN ANNUAL SECOND HIGHEST DAILY MAXIMUM 1-HOUR OZONE CONCENTRATIONS AT 159 SITES, 1980 AND 1981.

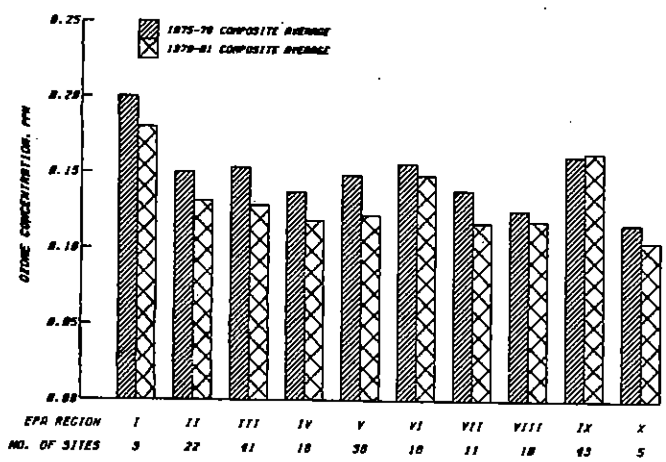


FIGURE 3-29. REGIONAL COMPARISON OF THE 1975-78 AND 1979-81 COMPOSITE AVERAGE OF THE SECOND-HIGHEST DAILY 1-HOUR OZONE CONCENTRATION.

3.6 TRENDS IN LEAD

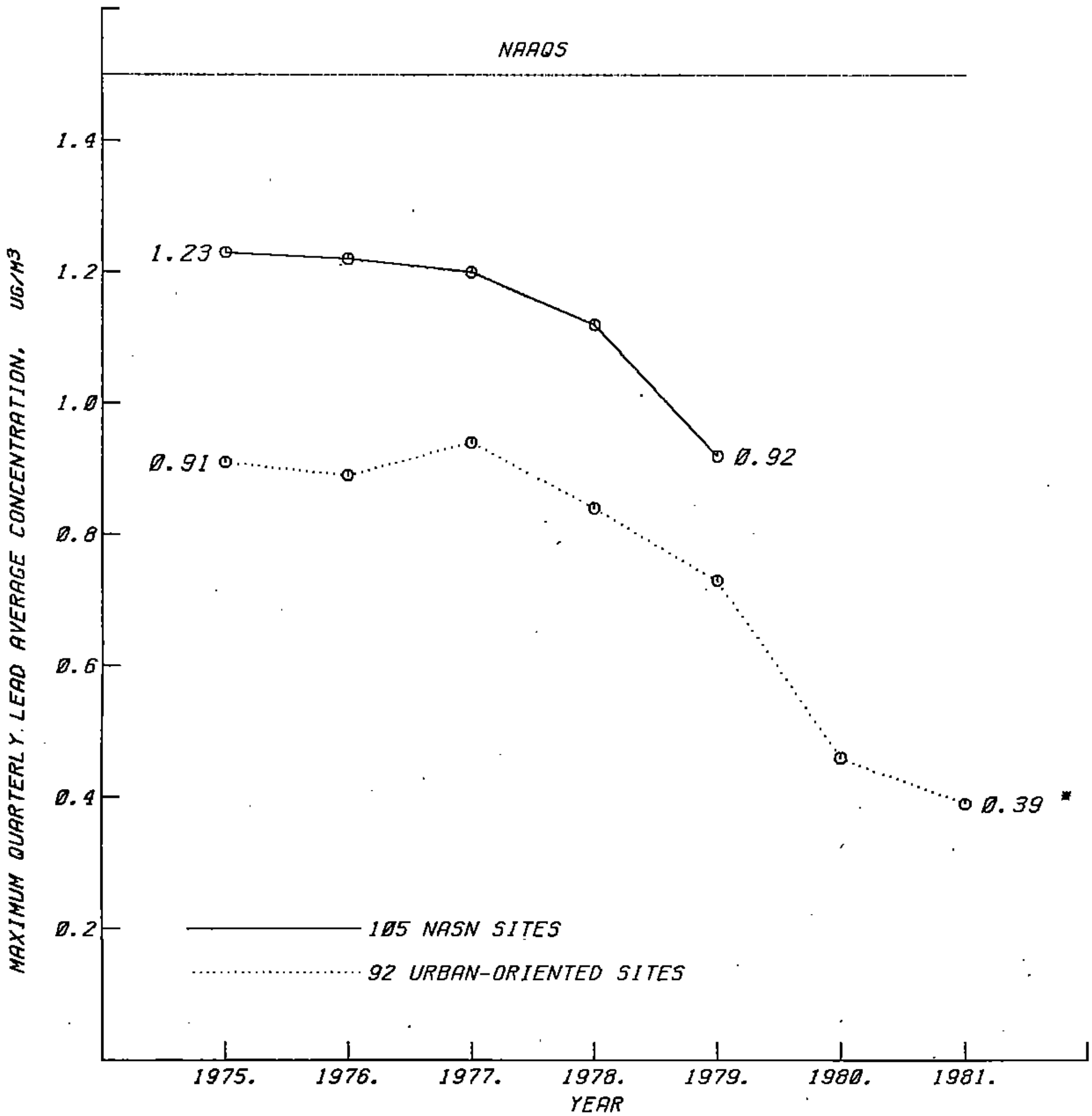
Lead gasoline additives, non-ferrous smelters, and battery plants are the most significant contributors to atmospheric lead emissons. Transportation sources alone contribute about 80 percent of the annual emissions.

Prior to promulgation of the lead standard in October 1978,[15] two air pollution control programs were implemented by EPA that have resulted in lower ambient lead levels. First, regulations, were issued in the early 1970's which required the lead content of all gasoline to be gradually reduced over a period of many years. Second, as part of EPA's overall automotive emission control program, unleaded gasoline was introduced in 1975 for use in automobiles equipped with catalytic control devices which reduced emissions of carbon monoxide, hydrocarbons and nitrogen oxides. The overall effect of these two control programs has been a major reduction in both the amount of lead in gasoline and in ambient levels.

3.6.1 Long-term Lead Trends, 1975-81

Previous trend analyses of ambient Pb data[16,17] were based almost exclusively on National Air Surveillance Network (NASN) sites. These sites were established in the 1960's to monitor ambient air quality levels of TSP and associated trace metals, including lead. The sites were predominantly located in the central business districts of larger American cities. In October 1980, new ambient Pb monitoring regulations were promulgated.[18] The siting criteria in the regulations resulted in the elimination of many of the old historic TSP monitoring sites as suitable sites for the measurement of ambient Pb concentrations.

In displaying the long-term Pb trend, two separate trend lines are presented. The NASN trend line, covering the period 1975-79, represents 105 urban, primarily NASN, sites located in 37 States (Figure 3-30).[17] The NASN trend line covers only the 1975-79 period, because most of the sites were discontinued after 1980. The second trend line is based on 92 urban-oriented sites that contained at least 5 out of the last 7 years of data (Figure 3-30). Of these sites more than half (69) were located in only three States - Texas with 41, Maryland with 15, and Pennsylvania with 13. Only 11 States had one or more sites represented in this sample. This sample of 92 sites is not as representative of the Nation, as a whole, as the 105 NASN sites which are located in more States. When the trend line for the 92 sites is compared, however, with the trend line represented by the NASN sites, considerable similarity in the direction of the trend and the rate of improvement can be seen. For the common period, 1975-1979, the NASN sites show a 25 percent decrease, while the 92 sites show a 20 percent decrease. The amount of lead consumed in gasoline over this same period decreased 22 percent. Clearly then, both sets of sites reflect improvements brought about the Federal program to control lead content of gasoline. As such, the 92 sites appear to be a good indicator of the impact of the Federal program.



* The 1981 composite average of the maximum quarterly average is based on a partial sample of 42 sites with lead data for both 1980 and 1981.

FIGURE 3-30. NATIONAL TREND IN MAXIMUM QUARTERLY AVERAGE LEAD LEVELS. 1975-1981.

The 92 sites are the only sites available to examine progress over the period 1975-1981 which meet the historical trends data completeness criteria of having at least 5 out of 7 years of data. The composite maximum quarterly average of ambient lead levels at these sites decreased 57 percent between 1975 and 1981 (Figure 3-30). The lead consumed in gasoline dropped 67 percent, during the same period (Figure 3-31).[19,20] Lead consumed in gasoline in 1975 was estimated to be about 170,000 tons while in 1981 the estimate decreased to 55,000 tons. The drop in consumption has been particularly significant since 1979.

3.6.2 Short-term Pb Trend, 1980-1981

The data base was increased to 113 sites for the short-term 1980-1981 comparison. Of the 113 sites, more than half (65) were located in four States - Arizona with 29, Pennsylvania with 15, Indiana with 14 and Illinois with 12. The number of States with trend sites increased from 11 to 16. The composite average of the maximum quarterly average of the 113 sites was 0.55 ug/m^3 in 1980 and 0.45 ug/m^3 in 1981 for a decrease of 18 percent. The decrease in lead consumption in gasoline over the same period was 29 percent.

3.6.3 Statewide Pb Trends, 1975-1981

Improvements can be seen in each of the ambient lead level trends in Maryland, Pennsylvania and Texas (Figure 3-32). Over the 1975-1981 time period, lead levels decreased 73 percent in Maryland, 55 percent in Pennsylvania and 23 percent in Texas. The Texas lead levels are lower for two major reasons. First, many of the sites are located in smaller cities and towns and, secondly, in the larger cities such as Dallas and Houston the sites are not located in areas where maximum lead concentration would be expected. None of the sites are located in the microscale environment. The reduction in lead consumed in gasoline was 67 percent over the same period.

3.6.4 Comparison of Ambient Lead Levels to Mean Blood Levels, 1976-1980

Recently, the National Center for Health Statistics (NCHS) measured the degree of exposure of the U.S. civilian noninstitutionalized population to lead over the time period, 1976-1980.[21] Their analysis shows a 37 percent decrease in the mean blood lead levels from 15.8 mg/dl during the first 6 months of the survey to 10.0 mg/dl during the last 6 months (Figure 3-33). Although ambient air is not the only path by which lead can enter the body, the 37 percent improvement compares with a 48 percent decrease in ambient lead levels and a 56 percent decrease in lead consumed in gasoline. Clearly, the improvement was due in part to the reductions in ambient lead levels brought about by the Federal programs to reduce the lead content of gasoline and to introduce unleaded gasoline.

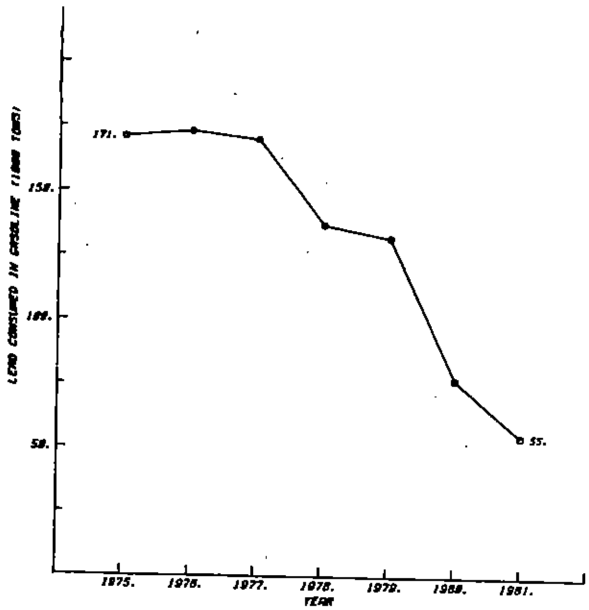


FIGURE 3-31. LEAD CONSUMED IN GASOLINE -- 1975-1981.

(SALES TO THE MILITARY EXCLUDED)

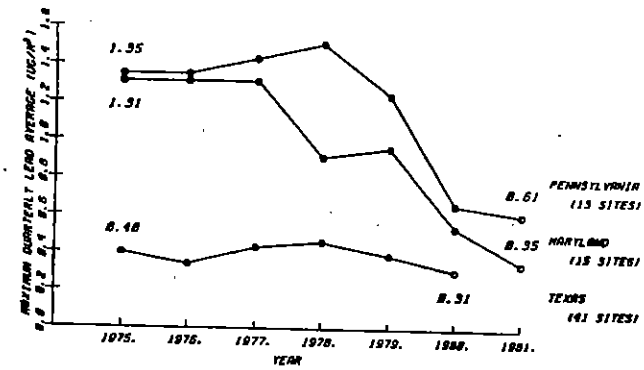
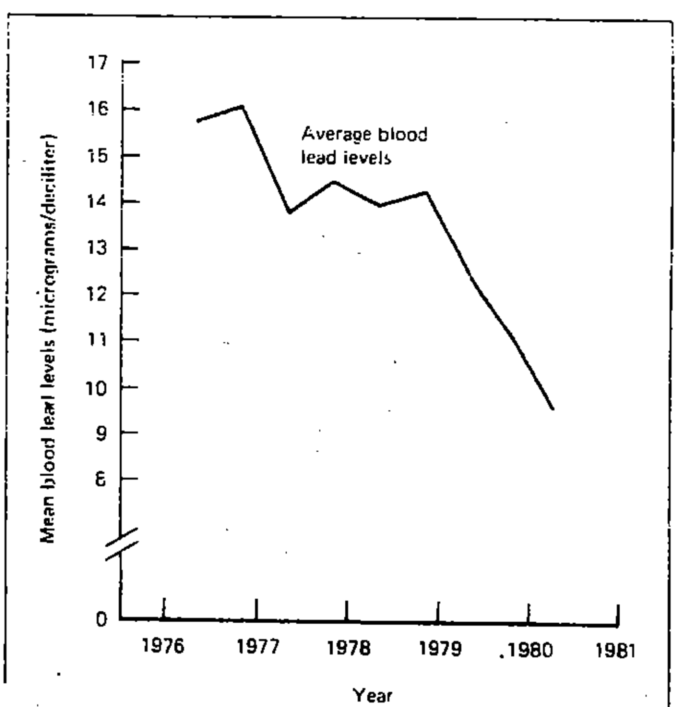


FIGURE 3-32. COMPARISON OF TRENDS IN THE MAXIMUM QUARTERLY LEAD AVERAGE IN MARYLAND, PENNSYLVANIA AND TEXAS. 1975-1981



SOURCE: Reference 21
Mean blood levels of U. S. population
Feb. 1976 - Feb. 1980

FIGURE 3-33

3.7 REFERENCES

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4. AIR QUALITY LEVELS IN STANDARD METROPOLITAN STATISTICAL AREAS

The Tables in this section summarize air quality by Standard Metropolitan Statistical Area (SMSA) for SMSA's with populations greater than 500,000. The air quality statistics relate to pollutant-specific NAAQS. The purpose of these summaries is to provide the reader with information on how air quality varies among SMSA's and from year-to-year. The higher air quality levels measured in the SMSA are summarized for the years 1979, 1980 and 1981.

The reader should be cautioned that these summaries are not sufficient in themselves to adequately rank or compare the SMSA's according to their air quality. To properly rank the air pollution severity in different SMSA(s), data on population characteristics, daily population mobility, transportation patterns, industrial composition, emission inventories, meteorological factors and, most important, the spatial representativeness of the monitoring sites would also be needed.

The same annual data completeness criteria used in the air quality trends data base was used here for the calculation of annual means. (See Section 2.1). With respect to the summary statistics for air quality levels with averaging times less than or equal to 24-hours, measured with continuous monitoring instruments, a footnote will be placed next to the level if the volume of annual data is less than 4380 hours for CO, NO_2, and SO_2 or less than 90 days of data during the warm months for O_3. For the 24-hour intermittent monitoring measurements for TSP, SO_2 and NO_2, collected once every 6 days, a footnote will be placed next to the measurement if it does not satisfy either the NADB annual validity criteria or have at least 30 days of intermittent measurements collected during the course of the year.

4.1 SUMMARY STATISTICS

In the following SMSA summaries, the air quality levels reported are the highest levels measured within the SMSA(s). The pollutant-specific statistics reported are summarized in Table 4-1, along with their associated primary NAAQS concentrations. In the case of Pb, the quarterly average is either based on as many as 15 24-hour measurements or one or more chemical composite measurements. Most of the maximum quarterly Pb averages are based on multiple 24-hour measurements. If the maximum quarterly average is based on a chemical composite, it is footnoted accordingly.

Table 4-1. Air Quality Summary Statistics and Their Associated National Ambient Air Quality Standards (NAAQS)

POLLUTANT	STATISTICS	PRIMARY NAAQS CONCENTRATION
Total Suspended Particulate	annual geometric mean	75 ug/m^3
Sulfur Dioxide	annual arithmetic mean	0.03 ppm
	second highest 24-hour average	0.14 ppm
Carbon Monoxide	second highest nonoverlapping 8-hour average	9 ppm
Nitrogen Dioxide	annual arithmetic mean	0.053 ppm
Ozone	second highest daily maximum 1-hour average	0.12 ppm
Lead	maximum quarterly average	1.5 ug/m^3

ug/m^3 = micrograms per cubic meter

ppm = parts per million

4.2 AIR QUALITY SMSA COMPARISONS

In each of the following SMSA air quality summaries, the SMSA's are grouped according to population starting with the largest SMSA - New York, NY-NJ and continuing to the smallest SMSA with a population in excess of 500,000, Long Branch - Asbury Park, NJ. The population groupings and the number of SMSA's contained within each are as follows: 16 SMSA's have populations in excess of 2 million, 23 SMSA's have populations between 1 and 2 million and 41 SMSA's have populations between 0.5 and 1 million. The population statistics are based on the 1980 census.

The air quality summary statistics are summarized in the following tables:

Table 4-2. Annual Geometric Mean Suspended Particulate Concentration by SMSA, 1979-81.

Table 4-3. Annual Arithmetic Mean Sulfur Dioxide Concentration by SMSA, 1979-81.

Table 4-4. Second Maximum 24-hour Average Sulfur Dioxide Concentration by SMSA, 1979-81.

Table 4-5. Second Maximum Nonoverlapping 8-hour Average Carbon Monoxide Concentration by SMSA, 1979-81.

Table 4-6. Annual Arithmetic Mean Nitrogen Dioxide Concentration by SMSA, 1979-81.

Table 4-7. Second Daily Maximum 1-hour Average Ozone Concentration by SMSA, 1979-81.

Table 4-8. Maximum Quarterly Average Lead Concentration by SMSA, 1979-81.

The air quality summaries follow:

TABLE 4-2

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 02/10/83 SUSPENDED PARTICULATE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 1

STANDARD METROPOLITAN STATISTICAL AREA	SUSPENDED PARTICULATE CONCENTRATION (UG/M3) ANNUAL GEOMETRIC MEAN 1979	1980	1981
POPULATION: > 2 MILLION			
NEW YORK, NY-NJ	77	68	68 *
LOS ANGELES-LONG BEACH, CA	104	123	121
CHICAGO, IL	126	118	111
PHILADELPHIA, PA-NJ	109	75	82
DETROIT, MI	162	138	116
SAN FRANCISCO-OAKLAND, CA	70	66	56
WASHINGTON, DC-MD-VA	71	67	65
DALLAS-FORT WORTH, TX	76	77 *	77
HOUSTON, TX	147	159	151
BOSTON, MA	67	74	62
NASSAU-SUFFOLK, NY	54	59	56
ST. LOUIS, MO-IL	215	167	190
PITTSBURGH, PA	161	115	100
BALTIMORE,MD	98	90	90
MINNEAPOLIS-ST. PAUL, MN-WI	118	114 *	100
ATLANTA, GA	69	65	79

* THE ANNUAL AVERAGE IS BASED ON AT LEAST 30 DAYS OF 24-HOUR DATA (50 % OF EPA RECOMMENDED SAMPLING DAYS), BUT DOES NOT MEET THE NADB VALIDITY CRITERIA

TABLE 4-2

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 02/10/83 SUSPENDED PARTICULATE CONCENTRATION BY SMSA POPULATION RANGE

STANDARD METROPOLITAN STATISTICAL AREA	SUSPENDED PARTICULATE CONCENTRATION (UG/M3) ANNUAL GEOMETRIC MEAN 1979	1980	1981
POPULATION: > 2 MILLION (CONT)			
TOTAL SMSA'S > 2 MILLION : 16			

* THE ANNUAL AVERAGE IS BASED ON AT LEAST 30 DAYS OF 24-HOUR DATA (50 % OF EPA RECOMMENDED SAMPLING DAYS), BUT DOES NOT MEET THE NADB VALIDITY CRITERIA

TABLE 4-2

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 02/10/83 SUSPENDED PARTICULATE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 3

STANDARD METROPOLITAN STATISTICAL AREA	SUSPENDED PARTICULATE CONCENTRATION (UG/M3) ANNUAL GEOMETRIC MEAN 1979	1980	1981
POPULATION: 1 - 2 MILLION			
NEWARK, NJ	104 *	84	95 *
ANAHEIM-SANTA ANA-GARDEN GROVE, CA	93	100	104
CLEVELAND, OH	155	148	129
SAN DIEGO, CA	85	95	95
MIAMI, FL	78	84	97
DENVER-BOULDER, CO	194	199	183
SEATTLE-EVERETT, WA	106	84	87
TAMPA-ST. PETERSBURG, FL	85	89	82
RIVERSIDE-SAN BERNARDINO-ONTARIO, CA	152	197 *	157
PHOENIX, AZ	172	177	178
CINCINNATI, OH-KY-IN	124	110	84
MILWAUKEE, WI	105	102	73
KANSAS CITY, MO-KS	105	113	96
SAN JOSE, CA	66	76	64
BUFFALO, NY	111	109	97
PORTLAND, OR-WA	189	159 *	114

* THE ANNUAL AVERAGE IS BASED ON AT LEAST 30 DAYS OF 24-HOUR DATA (50 % OF EPA RECOMMENDED SAMPLING DAYS), BUT DOES NOT MEET THE NADB VALIDITY CRITERIA

TABLE 4-2

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 02/10/83 SUSPENDED PARTICULATE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 4

STANDARD METROPOLITAN STATISTICAL AREA	SUSPENDED PARTICULATE CONCENTRATION (UG/M3) ANNUAL GEOMETRIC MEAN 1979	1980	1981
POPULATION: 1 - 2 MILLION (CONT)			
NEW ORLEANS, LA	62	72 *	82
INDIANAPOLIS, IN	90 *	82	80
COLUMBUS, OH	77 *	78	74
SAN JUAN, PR	107	96	94
SAN ANTONIO, TX	100	90	73
FORT LAUDERDALE-HOLLYWOOD, FL	63	66	69
SACRAMENTO, CA	79	74	68

TOTAL SMSA'S 1 - 2 MILLION : 23

* THE ANNUAL AVERAGE IS BASED ON AT LEAST 30 DAYS OF 24-HOUR DATA (50 % OF EPA RECOMMENDED SAMPLING DAYS), BUT DOES NOT MEET THE NADB VALIDITY CRITERIA

TABLE 4-2

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 02/10/83 SUSPENDED PARTICULATE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 5

STANDARD METROPOLITAN STATISTICAL AREA	SUSPENDED PARTICULATE CONCENTRATION (UG/M3) ANNUAL GEOMETRIC MEAN 1979	1980	1981
POPULATION: .5 - 1 MILLION			
ROCHESTER, NY	52	63	73
SALT LAKE CITY-OGDEN, UT	97 *	77	67
PROVIDENCE-WARWICK-PAWTUCKET, RI-MA	82	78	57
MEMPHIS, TN-AR-MS	77	84	74
LOUISVILLE, KY-IN	102	100	92
NASHVILLE-DAVIDSON, TN	82	80 *	74 *
BIRMINGHAM, AL	113	114	111
OKLAHOMA CITY, OK	83	85	96 *
DAYTON, OH	78	92	77
GREENSBORO-WINSTON-SALEM-HIGH POINT, NC	66	90	61
NORFOLK-VIRGINIA BEACH-PORTSMOUTH, VA-NC	68	78	64 *
ALBANY-SCHENECTADY-TROY, NY	77	65	59
TOLEDO, OH-MI	85	81	72
HONOLULU, HI	65 *	53	51
JACKSONVILLE, FL	62	68	79
HARTFORD, CT	63 *	55	47

* THE ANNUAL AVERAGE IS BASED ON AT LEAST 30 DAYS OF 24-HOUR DATA (50 % OF EPA RECOMMENDED SAMPLING DAYS), BUT DOES NOT MEET THE NADB VALIDITY CRITERIA

TABLE 4-2

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 02/10/83 SUSPENDED PARTICULATE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 6

STANDARD METROPOLITAN STATISTICAL AREA	SUSPENDED PARTICULATE CONCENTRATION (UG/M3) ANNUAL GEOMETRIC MEAN 1979	1980	1981
POPULATION: .5 - 1 MILLION (CONT)			
ORLANDO, FL	51	55	67 *
TULSA, OK	78	130	99
AKRON, OH	87	81	67
GARY-HAMMOND-EAST CHICAGO, IN	159 *	250 *	121 *
SYRACUSE, NY	63	67	76
NORTHEAST PENNSYLVANIA	66	80	61
CHARLOTTE-GASTONIA, NC	68	70	67
ALLENTOWN-BETHLEHEM-EASTON, PA-NJ	88	97	84
RICHMOND, VA	69 *	70	50 *
GRAND RAPIDS, MI	63	57	58
NEW BRUNSWICK-PERTH AMBOY-SAYREVILLE, NJ	77	76	69
WEST PALM BEACH-BOCA RATON, FL	54	57	59
OMAHA, NE-IA	118	106	91
GREENVILLE-SPARTANBURG, SC	64	64 *	63
JERSEY CITY, NJ	88	100	86
AUSTIN, TX	62	50	78 *

* THE ANNUAL AVERAGE IS BASED ON AT LEAST 30 DAYS OF 24-HOUR DATA (50 % OF EPA RECOMMENDED SAMPLING DAYS), BUT DOES NOT MEET THE NADB VALIDITY CRITERIA

TABLE 4-2

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 02/10/83 SUSPENDED PARTICULATE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 7

STANDARD METROPOLITAN STATISTICAL AREA	SUSPENDED PARTICULATE CONCENTRATION (UG/M3) ANNUAL GEOMETRIC MEAN 1979	1980	1981
POPULATION: .5 - 1 MILLION (CONT)			
YOUNGSTOWN-WARREN, OH	148	110	96
TUCSON, AZ	132	117	112
RALEIGH-DURHAM, NC	60	63	53
SPRINGFIELD-CHICOPEE-HOLYOKE, MA-CT	61	65	73
OXNARD-SIMI VALLEY-VENTURA, CA	96	93 *	90
WILMINGTON, DE-NJ-MD	56	69	65
FLINT, MI	89	80	60
FRESNO, CA	118	114	109
LONG BRANCH-ASBURY PARK, NJ	54 *	58	62 *

TOTAL SMSA'S .5 - 1 MILLION : 41

* THE ANNUAL AVERAGE IS BASED ON AT LEAST 30 DAYS OF 24-HOUR DATA (50 % OF EPA RECOMMENDED SAMPLING DAYS), BUT DOES NOT MEET THE NADB VALIDITY CRITERIA

TABLE 4-3

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 02/10/83 SULFUR DIOXIDE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 1

STANDARD METROPOLITAN STATISTICAL AREA	SULFUR DIOXIDE CONCENTRATION (PPM) ANNUAL ARITHMETIC AVERAGE 1979	1980	1981
POPULATION: > 2 MILLION			
NEW YORK, NY-NJ	.031	.029	.025
LOS ANGELES-LONG BEACH, CA	.012	.012	.011
CHICAGO, IL	.037	.016	.015
PHILADELPHIA, PA-NJ	.028	.020	.022
DETROIT, MI	.018	.017	.017
SAN FRANCISCO-OAKLAND, CA	.003	.004	.005
WASHINGTON, DC-MD-VA	.020	.017	.017
DALLAS-FORT WORTH, TX	.003	.003	.003
HOUSTON, TX	.002	.009	.005
BOSTON, MA	.020	.021	.019
NASSAU-SUFFOLK, NY	.009	.011	.011
ST. LOUIS, MO-IL	.022	.023	.022
PITTSBURGH, PA	.042	.042	.045
BALTIMORE,MD	.019	.013	.015
MINNEAPOLIS-ST. PAUL, MN-WI	.017	.013	.011
ATLANTA, GA	.013	.011	.009

* THE ANNUAL AVERAGE IS BASED ON AT LEAST 30 DAYS OF 24-HOUR DATA (50 % OF EPA RECOMMENDED SAMPLING DAYS), BUT DOES NOT MEET THE NADB VALIDITY CRITERIA
B = REPRESENTS AN AVERAGE BASED ON 24-HR BUBBLER MEASUREMENTS

TABLE 4Q3

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 02/10/83 SULFUR DIOXIDE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 2

STANDARD METROPOLITAN STATISTICAL AREA	SULFUR DIOXIDE CONCENTRATION (PPM) ANNUAL ARITHMETIC AVERAGE 1979	1980	1981
POPULATION: > 2 MILLION (CONT)			
TOTAL SMSA'S > 2 MILLION : 16			

* THE ANNUAL AVERAGE IS BASED ON AT LEAST 30 DAYS OF 24-HOUR DATA (50 % OF EPA RECOMMENDED SAMPLING DAYS), BUT DOES NOT MEET THE NADB VALIDITY CRITERIA
B = REPRESENTS AN AVERAGE BASED ON 24-HR BUBBLER MEASUREMENTS

TABLE 4-3

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 02/10/83 SULFUR DIOXIDE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 3

STANDARD METROPOLITAN STATISTICAL AREA	SULFUR DIOXIDE CONCENTRATION (PPM) ANNUAL ARITHMETIC AVERAGE 1979	1980	1981
POPULATION: 1 - 2 MILLION			
NEWARK, NJ	.018	.018	.021
ANAHEIM-SANTA ANA-GARDEN GROVE, CA	.008	.010	.007
CLEVELAND, OH	.026	.018	.019
SAN DIEGO, CA	.007	.008	.007
MIAMI, FL	ND	.003	.003
DENVER-BOULDER, CO	.017	.013	.013
SEATTLE-EVERETT, WA	.013	.008	.015
TAMPA-ST. PETERSBURG, FL	.010	.008	.010
RIVERSIDE-SAN BERNARDINO-ONTARIO, CA	.011	.006	.007
PHOENIX, AZ	ND	.006	.006
CINCINNATI, OH-KY-IN	.020 B	.019 B*	.014
MILWAUKEE, WI	.017	.012	.009
KANSAS CITY, MO-KS	.030	.017	.019
SAN JOSE, CA	ND	ND	ND
BUFFALO, NY	.032	.029	.026
PORTLAND, OR-WA	.013	.012	.012

* THE ANNUAL AVERAGE IS BASED ON AT LEAST 30 DAYS OF 24-HOUR DATA (50 % OF EPA RECOMMENDED SAMPLING DAYS), BUT DOES NOT MEET THE NADB VALIDITY CRITERIA
B = REPRESENTS AN AVERAGE BASED ON 24-HR BUBBLER MEASUREMENTS

TABLE 4-3

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 02/10/83 SULFUR DIOXIDE CONCENTRATION BY SMSA POPULATION RANGE

STANDARD METROPOLITAN STATISTICAL AREA	SULFUR DIOXIDE CONCENTRATION (PPM) ANNUAL ARITHMETIC AVERAGE 1979	1980	1981
POPULATION: 1 - 2 MILLION (CONT)			
NEW ORLEANS, LA	ND	ND	ND
INDIANAPOLIS, IN	.030	.017	.027
COLUMBUS, OH	.010	.009	.015
SAN JUAN, PR	.002 B	.007	ND
SAN ANTONIO, TX	ND	.002	.002
FORT LAUDERDALE-HOLLYWOOD, FL	.001 B*	.003 B*	.002 B
SACRAMENTO, CA	.005	.002	.004

TOTAL SMSA'S 1 - 2 MILLION : 23

* THE ANNUAL AVERAGE IS BASED ON AT LEAST 30 DAYS OF 24-HOUR DATA (50 % OF EPA RECOMMENDED SAMPLING DAYS), BUT DOES NOT MEET THE NADB VALIDITY CRITERIA
B = REPRESENTS AN AVERAGE BASED ON 24-HR BUBBLER MEASUREMENTS

TABLE 4-3

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 02/10/83 SULFUR DIOXIDE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 5

STANDARD METROPOLITAN STATISTICAL AREA	SULFUR DIOXIDE CONCENTRATION (PPM) ANNUAL ARITHMETIC AVERAGE 1979	1980	1981
POPULATION: .5 - 1 MILLION			
ROCHESTER, NY	.018	.026	.022
SALT LAKE CITY-OGDEN, UT	.031	.031	.035
PROVIDENCE-WARWICK-PAWTUCKET, RI-MA	.019	.016	.015
MEMPHIS, TN-AR-MS	.012	.019	.018
LOUISVILLE, KY-IN	.030	.026	.019
NASHVILLE-DAVIDSON, TN	.008	.012	.011
BIRMINGHAM, AL	ND	ND	.007
OKLAHOMA CITY, OK	.001	.001	.003
DAYTON, OH	.012 B	.009	.008 B
GREENSBORO-WINSTON-SALEM-HIGH POINT, NC	.004 B	.006 B	.004 B
NORFOLK-VIRGINIA BEACH-PORTSMOUTH, VA-NC	.012	.012	.013
ALBANY-SCHENECTADY-TROY, NY	.013	.013	.013
TOLEDO, OH-MI	.019	.013	.014
HONOLULU, HI	.001 B	.007 B	.007 B*
JACKSONVILLE, FL	.015 B	.009	.020 B*
HARTFORD, CT	.014	.015	.011

* THE ANNUAL AVERAGE IS BASED ON AT LEAST 30 DAYS OF 24-HOUR DATA (50 % OF EPA RECOMMENDED SAMPLING DAYS), BUT DOES NOT MEET THE NADB VALIDITY CRITERIA
B = REPRESENTS AN AVERAGE BASED ON 24-HR BUBBLER MEASUREMENTS

TABLE 4-3

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 02/10/83 SULFUR DIOXIDE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 6

STANDARD METROPOLITAN STATISTICAL AREA	SULFUR DIOXIDE CONCENTRATION (PPM) ANNUAL ARITHMETIC AVERAGE 1979	1980	1981
POPULATION: .5 - 1 MILLION (CONT)			
ORLANDO, FL	.002 B	.002 B	.006
TULSA, OK	.006	.008	.008
AKRON, OH	.023	.022	.021
GARY-HAMMOND-EAST CHICAGO, IN	.034	.022	.017
SYRACUSE, NY	.014	.013	.010
NORTHEAST PENNSYLVANIA	.012	.012	.012
CHARLOTTE-GASTONIA, NC	.009	.011	.011
ALLENTOWN-BETHLEHEM-EASTON, PA-NJ	.017	.015	.016
RICHMOND, VA	.012	ND	ND
GRAND RAPIDS, MI	.007	ND	.008
NEW BRUNSWICK-PERTH AMBOY-SAYREVILLE, NJ	.016	.015	.018
WEST PALM BEACH-BOCA RATON, FL	ND	.002 B*	.003
OMAHA, NE-IA	.009 B	.010	.004 B
GREENVILLE-SPARTANBURG, SC	.004 B*	ND	.003
JERSEY CITY, NJ	.020	.016	.018
AUSTIN, TX	ND	.001	.001

* THE ANNUAL AVERAGE IS BASED ON AT LEAST 30 DAYS OF 24-HOUR DATA (50 % OF EPA RECOMMENDED SAMPLING DAYS), BUT DOES NOT MEET THE NADB VALIDITY CRITERIA
B = REPRESENTS AN AVERAGE BASED ON 24-HR BUBBLER MEASUREMENTS

TABLE 4-3

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 02/10/83 SULFUR DIOXIDE CONCENTRATION BY SMSA POPULATION RANGE

STANDARD METROPOLITAN STATISTICAL AREA	SULFUR DIOXIDE CONCENTRATION (PPM) ANNUAL ARITHMETIC AVERAGE 1979	1980	1981
POPULATION: .5 - 1 MILLION (CONT)			
YOUNGSTOWN-WARREN, OH	.017	.017 B*	.015 B
TUCSON, AZ	.003	.002	.004
RALEIGH-DURHAM, NC	.007	.003 B	.003 B
SPRINGFIELD-CHICOPEE-HOLYOKE, MA-CT	.013	.013	.011
OXNARD-SIMI VALLEY-VENTURA, CA	.004	.003	ND
WILMINGTON, DE-NJ-MD	.014	.012	.010
FLINT, MI	.007	.005	.014
FRESNO, CA	.004	.003	.003
LONG BRANCH-ASBURY PARK, NJ	.010	.008	.008

TOTAL SMSA'S .5 - 1 MILLION : 41

* THE ANNUAL AVERAGE IS BASED ON AT LEAST 30 DAYS OF 24-HOUR DATA (50 % OF EPA RECOMMENDED SAMPLING DAYS), BUT DOES NOT MEET THE NADB VALIDITY CRITERIA

B = REPRESENTS AN AVERAGE BASED ON 24-HR BUBBLER MEASUREMENTS

TABLE 4-4

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 02/10/83 SULFUR DIOXIDE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 1

STANDARD METROPOLITAN STATISTICAL AREA	SULFUR DIOXIDE CONCENTRATION (PPM) ** 24-HR B/A 2ND MAXIMUM N/O VALUE 1979	1980	1981
POPULATION: > 2 MILLION			
NEW YORK, NY-NJ	.102	.105	.097
LOS ANGELES-LONG BEACH, CA	.043 *	.046 *	.036
CHICAGO, IL	.115 *	.050	.061
PHILADELPHIA, PA-NJ	.111	.080	.081
DETROIT, MI	.098	.068	.102
SAN FRANCISCO-OAKLAND, CA	.020	.035	.018
WASHINGTON, DC-MD-VA	.110	.053 *	.047
DALLAS-FORT WORTH, TX	.037	.020	.029
HOUSTON, TX	.042 *	.040	.047 *
BOSTON, MA	.056	.063	.066
NASSAU-SUFFOLK, NY	.044	.053	.054
ST. LOUIS, MO-IL	.242	.129 *	.114
PITTSBURGH, PA	.131	.138 *	.192
BALTIMORE,MD	.068	.043 *	.058 *
MINNEAPOLIS-ST. PAUL, MN-WI	.069	.097 *	.113 *
ATLANTA, GA	.048	.038	.034

* LESS THAN 183 BLOCK AVERAGE VALUES
** = MIDNIGHT TO MIDNIGHT AVERAGE
ND = NO DATA

TABLE 4-4

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 02/10/83 SULFUR DIOXIDE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 2

STANDARD METROPOLITAN STATISTICAL AREA	SULFUR DIOXIDE CONCENTRATION (PPM) 24-HR B/A 2ND MAXIMUM N/O VALUE 1979	1980	1981

POPULATION: > 2 MILLION (CONT)

TOTAL SMSA'S > 2 MILLION : 16

* LESS THAN 183 BLOCK AVERAGE VALUES

TABLE 4-4

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 02/10/83 SULFUR DIOXIDE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 3

STANDARD METROPOLITAN STATISTICAL AREA	SULFUR DIOXIDE CONCENTRATION (PPM) 24-HR B/A 2ND MAXIMUM N/O VALUE 1979	1980	1981
POPULATION: 1 - 2 MILLION			
NEWARK, NJ	.065	.056	.114
ANAHEIM-SANTA ANA-GARDEN GROVE, CA	.034	.031	.019
CLEVELAND, OH	.140	.125	.081 *
SAN DIEGO, CA	.032 *	.035	.023
MIAMI, FL	ND	.007	.009
DENVER-BOULDER, CO	.079	.057	.043
SEATTLE-EVERETT, WA	.019 *	.034	.066
TAMPA-ST. PETERSBURG, FL	.127	.048	.042
RIVERSIDE-SAN BERNARDINO-ONTARIO, CA	.034	.026	.027
PHOENIX, AZ	ND	.015 *	.037
CINCINNATI, OH-KY-IN	.084	.105	.106
MILWAUKEE, WI	.094 *	.093	.066
KANSAS CITY, MO-KS	.247	.137	.208
SAN JOSE, CA	ND	ND	ND
BUFFALO, NY	.119	.124	.277
PORTLAND, OR-WA	.068	.051	.051

* LESS THAN 183 BLOCK AVERAGE VALUES

TABLE 4-4

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 02/10/83 SULFUR DIOXIDE CONCENTRATION BY SMSA POPULATION RANGE

STANDARD METROPOLITAN STATISTICAL AREA	SULFUR DIOXIDE CONCENTRATION (PPM) 24-HR B/A 2ND MAXIMUM N/O VALUE 1979	1980	1981
POPULATION: 1 - 2 MILLION (CONT)			
NEW ORLEANS, LA	ND	ND	ND
INDIANAPOLIS, IN	.115	.075	.073 *
COLUMBUS, OH	.076 *	.041 *	.068
SAN JUAN, PR	.029 *	.037	.038 *
SAN ANTONIO, TX	.005 *	.008	.008
FORT LAUDERDALE-HOLLYWOOD, FL	ND	ND	ND
SACRAMENTO, CA	.021	.015 *	.011

TOTAL SMSA'S 1 - 2 MILLION : 23

* LESS THAN 183 BLOCK AVERAGE VALUES

TABLE 4-4

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 02/10/83 SULFUR DIOXIDE CONCENTRATION BY SMSA POPULATION RANGE

STANDARD METROPOLITAN STATISTICAL AREA	SULFUR DIOXIDE CONCENTRATION (PPM) 24-HR B/A 2ND MAXIMUM N/O VALUE 1979	1980	1981
POPULATION: .5 - 1 MILLION			
ROCHESTER, NY	.067	.111	.090
SALT LAKE CITY-OGDEN, UT	.125	.139	.160
PROVIDENCE-WARWICK-PAWTUCKET, RI-MA	.052	.065	.071
MEMPHIS, TN-AR-MS	.062	.108	.157
LOUISVILLE, KY-IN	.185 *	.108	.130
NASHVILLE-DAVIDSON, TN	.063	.078	.072
BIRMINGHAM, AL	.013 *	ND	.024
OKLAHOMA CITY, OK	.003	.006 *	.009
DAYTON, OH	.021 *	.040	.035
GREENSBORO-WINSTON-SALEM-HIGH POINT, NC	ND	ND	ND
NORFOLK-VIRGINIA BEACH-PORTSMOUTH, VA-NC	.039 *	.049 *	.047
ALBANY-SCHENECTADY-TROY, NY	.058 *	.065 *	.066 *
TOLEDO, OH-MI	.134	.086	.061
HONOLULU, HI	ND	ND	ND
JACKSONVILLE, FL	.078	.058	.122
HARTFORD, CT	.056	.065	.074

* LESS THAN 183 BLOCK AVERAGE VALUES

TABLE 4-4

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 02/10/83 SULFUR DIOXIDE CONCENTRATION BY SMSA POPULATION RANGE

STANDARD METROPOLITAN STATISTICAL AREA	SULFUR DIOXIDE CONCENTRATION (PPM) 24-HR B/A 2ND MAXIMUM N/O VALUE 1979	1980	1981
POPULATION: .5 - 1 MILLION (CONT)			
ORLANDO, FL	.003 *	.014 *	.025
TULSA, OK	.042 *	.043	.071
AKRON, OH	.092	.104	.117
GARY-HAMMOND-EAST CHICAGO, IN	.216	.121	.100
SYRACUSE, NY	.059	.418	.034
NORTHEAST PENNSYLVANIA	.049	.072	.066
CHARLOTTE-GASTONIA, NC	.031 *	.032	.042
ALLENTOWN-BETHLEHEM-EASTON, PA-NJ	.125 *	.054	.074
RICHMOND, VA	.054	.038 *	.049 *
GRAND RAPIDS, MI	.047	.018 *	.032
NEW BRUNSWICK-PERTH AMBOY-SAYREVILLE, NJ	.062	.087	.085
WEST PALM BEACH-BOCA RATON, FL	.011 *	.011 *	.018
OMAHA, NE-IA	.015 *	.037	ND
GREENVILLE-SPARTANBURG, SC	.002 *	.007 *	.016
JERSEY CITY, NJ	.079 *	.054	.078
AUSTIN, TX	.012 *	.007	.003

* LESS THAN 183 BLOCK AVERAGE VALUES

TABLE 4-4

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 02/10/83 SULFUR DIOXIDE CONCENTRATION BY SMSA POPULATION RANGE

STANDARD METROPOLITAN STATISTICAL AREA	SULFUR DIOXIDE CONCENTRATION (PPM) 24-HR B/A 2ND MAXIMUM N/O VALUE 1979	1980	1981
POPULATION: .5 - 1 MILLION (CONT)			
YOUNGSTOWN-WARREN, OH	.058	.060	.058
TUCSON, AZ	.018	.014	.024
RALEIGH-DURHAM, NC	.023 *	.014 *	ND
SPRINGFIELD-CHICOPEE-HOLYOKE, MA-CT	.086 *	.050	.055
OXNARD-SIMI VALLEY-VENTURA, CA	.020	.014	ND
WILMINGTON, DE-NJ-MD	.081	.050	.058
FLINT, MI	.030	.024	.037
FRESNO, CA	.016	.038	.012
LONG BRANCH-ASBURY PARK, NJ	.043 *	.041	.050

TOTAL SMSA'S .5 - 1 MILLION : 41

* LESS THAN 183 BLOCK AVERAGE VALUES

TABLE 4-5

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 02/10/83 CARBON MONOXIDE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 1

STANDARD METROPOLITAN STATISTICAL AREA	CARBON MONOXIDE CONCENTRATION (PPM) ** *** 8-HR R/A 2ND MAXIMUM N/O VALUE 1979	1980	1981
POPULATION: > 2 MILLION			
NEW YORK, NY-NJ	17	15	17
LOS ANGELES-LONG BEACH, CA	21	25	21
CHICAGO, IL	15	14	10
PHILADELPHIA, PA-NJ	13	9	10
DETROIT, MI	12 *	8	12
SAN FRANCISCO-OAKLAND, CA	9	7 *	7
WASHINGTON, DC-MD-VA	19	13 *	13
DALLAS-FORT WORTH, TX	3 *	5	7
HOUSTON, TX	9 *	8	7
BOSTON, MA	14	11 *	10
NASSAU-SUFFOLK, NY	12	10	11
ST. LOUIS, MO-IL	13	14	11
PITTSBURGH, PA	18	11	11
BALTIMORE,MD	13	11 *	13
MINNEAPOLIS-ST. PAUL, MN-WI	14	12	13 *
ATLANTA, GA	10	16	10

* LESS THAN 4380 HOURLY VALUES OF DATA
** = MIDNIGHT TO MIDNIGHT AVERAGE
*** = NON-OVERLAPPING
ND = NO DATA

TABLE 4-5

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 02/10/83 CARBON MONOXIDE CONCENTRATION BY SMSA POPULATION RANGE

STANDARD METROPOLITAN STATISTICAL AREA	CARBON MONOXIDE CONCENTRATION (PPM) 8-HR R/A 2ND MAXIMUM N/O VALUE		
	1979	1980	1981

POPULATION: > 2 MILLION (CONT)

TOTAL SMSA'S > 2 MILLION : 16

* LESS THAN 4380 HOURLY VALUES OF DATA

TABLE 4-5

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 02/10/83 CARBON MONOXIDE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 3

STANDARD METROPOLITAN STATISTICAL AREA	CARBON MONOXIDE CONCENTRATION (PPM) 8-HR R/A 2ND MAXIMUM N/O VALUE 1979	1980	1981
POPULATION: 1 - 2 MILLION			
NEWARK, NJ	17	15	13
ANAHEIM-SANTA ANA-GARDEN GROVE, CA	13	18	12
CLEVELAND, OH	11	11	10
SAN DIEGO, CA	10 *	9	9
MIAMI, FL	15 *	15 *	15
DENVER-BOULDER, CO	25	21	28
SEATTLE-EVERETT, WA	15	12	14
TAMPA-ST. PETERSBURG, FL	8 *	10	8
RIVERSIDE-SAN BERNARDINO-ONTARIO, CA	10	8	9
PHOENIX, AZ	15 *	19 *	19
CINCINNATI, OH-KY-IN	10	6	10
MILWAUKEE, WI	13	8	9
KANSAS CITY, MO-KS	10 *	9	15
SAN JOSE, CA	14	16	11
BUFFALO, NY	6	5	6
PORTLAND, OR-WA	17	13	12

* LESS THAN 4380 HOURLY VALUES OF DATA

TABLE 4-5

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 02/10/83 CARBON MONOXIDE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 4

STANDARD METROPOLITAN STATISTICAL AREA	CARBON MONOXIDE CONCENTRATION (PPM) 8-HR R/A 2ND MAXIMUM N/O VALUE 1979	1980	1981
POPULATION: 1 - 2 MILLION (CONT)			
NEW ORLEANS, LA	ND	ND	7
INDIANAPOLIS, IN	12	11	15
COLUMBUS, OH	21	12	10
SAN JUAN, PR	ND	ND	13 *
SAN ANTONIO, TX	3 *	8	8 *
FORT LAUDERDALE-HOLLYWOOD, FL	10 *	10	10
SACRAMENTO, CA	7	13 *	12

TOTAL SMSA'S 1 - 2 MILLION : 23

* LESS THAN 4380 HOURLY VALUES OF DATA

TABLE 4-5

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 02/10/83 CARBON MONOXIDE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 5

STANDARD METROPOLITAN STATISTICAL AREA	CARBON MONOXIDE CONCENTRATION (PPM) 8-HR R/A 2ND MAXIMUM N/O VALUE 1979	1980	1981
POPULATION: .5 - 1 MILLION			
ROCHESTER, NY	9	5	9
SALT LAKE CITY-OGDEN, UT	16	15	11 *
PROVIDENCE-WARWICK-PAWTUCKET, RI-MA	11	12	10
MEMPHIS, TN-AR-MS	12 *	11	14
LOUISVILLE, KY-IN	13	13	13
NASHVILLE-DAVIDSON, TN	12	11 *	12
BIRMINGHAM, AL	10	9 *	8 *
OKLAHOMA CITY, OK	9	5 *	8
DAYTON, OH	8 *	7	8
GREENSBORO-WINSTON-SALEM-HIGH POINT, NC	ND	6	7
NORFOLK-VIRGINIA BEACH-PORTSMOUTH, VA-NC	6	7	6
ALBANY-SCHENECTADY-TROY, NY	7	6	7
TOLEDO, OH-MI	5	6	7
HONOLULU, HI	4 *	1	6
JACKSONVILLE, FL	7 *	9	9
HARTFORD, CT	10	9	8

* LESS THAN 4380 HOURLY VALUES OF DATA

TABLE 4-5

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 02/10/83 CARBON MONOXIDE CONCENTRATION BY SMSA POPULATION RANGE

STANDARD METROPOLITAN STATISTICAL AREA	CARBON MONOXIDE CONCENTRATION (PPM) 8-HR R/A 2ND MAXIMUM N/O VALUE 1979	1980	1981
POPULATION: .5 - 1 MILLION (CONT)			
ORLANDO, FL	8 *	7 *	8 *
TULSA, OK	10	10 *	10 *
AKRON, OH	8 *	8	11 *
GARY-HAMMOND-EAST CHICAGO, IN	8	4 *	10
SYRACUSE, NY	4	5	4
NORTHEAST PENNSYLVANIA	ND	ND	ND
CHARLOTTE-GASTONIA, NC	13	17	12
ALLENTOWN-BETHLEHEM-EASTON, PA-NJ	7	6	5 *
RICHMOND, VA	10	12	9
GRAND RAPIDS, MI	5	3 *	6
NEW BRUNSWICK-PERTH AMBOY-SAYREVILLE, NJ	9	9	7
WEST PALM BEACH-BOCA RATON, FL	4 *	5	5
OMAHA, NE-IA	15	6	9
GREENVILLE-SPARTANBURG, SC	ND	9 *	ND
JERSEY CITY, NJ	13	11	10
AUSTIN, TX	4	3 *	ND

* LESS THAN 4380 HOURLY VALUES OF DATA

TABLE 4-5

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 02/10/83 CARBON MONOXIDE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 7

STANDARD METROPOLITAN STATISTICAL AREA	CARBON MONOXIDE CONCENTRATION (PPM) 8-HR R/A 2ND MAXIMUM N/O VALUE 1979	1980	1981
POPULATION: .5 - 1 MILLION (CONT)			
YOUNGSTOWN-WARREN, OH	10	6	7
TUCSON, AZ	10	11	10
RALEIGH-DURHAM, NC	19	14	12
SPRINGFIELD-CHICOPEE-HOLYOKE, MA-CT	9	9	7 *
OXNARD-SIMI VALLEY-VENTURA, CA	7	6	ND
WILMINGTON, DE-NJ-MD	8	7	11
FLINT, MI	ND	ND	1 *
FRESNO, CA	16	15	12
LONG BRANCH-ASBURY PARK, NJ	11	9	10

TOTAL SMSA'S .5 - 1 MILLION : 41

* LESS THAN 4380 HOURLY VALUES OF DATA

TABLE 4-6

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 02/23/83 NITROGEN DIOXIDE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 1

STANDARD METROPOLITAN STATISTICAL AREA	NITROGEN DIOXIDE CONCENTRATION (PPM) ANNUAL ARITHMETIC AVERAGE 1979	1980	1981
POPULATION: > 2 MILLION			
NEW YORK, NY-NJ	.044	.031	.034
LOS ANGELES-LONG BEACH, CA	.078	.071	.071
CHICAGO, IL	.078 B	.060 B	.050 B
PHILADELPHIA, PA-NJ	.049	.046	.046
DETROIT, MI	.048	.036	.038
SAN FRANCISCO-OAKLAND, CA	.031	.029	.027
WASHINGTON, DC-MD-VA	.035	.025 B	.034
DALLAS-FORT WORTH, TX	.036 B	.051 B	.017
HOUSTON, TX	.055 B	.043 B	.025
BOSTON, MA	.046	.050	.041
NASSAU-SUFFOLK, NY	.028	.030	.028
ST. LOUIS, MO-IL	.028	.035	.026
PITTSBURGH, PA	.027	.027	.034
BALTIMORE,MD	.039 B*	.039	.030
MINNEAPOLIS-ST. PAUL, MN-WI	.037 B	.036 B	.028 B*
ATLANTA, GA	ND	.031 B	ND

* THE ANNUAL AVERAGE IS BASED ON AT LEAST 30 DAYS OF 24-HOUR DATA (50 % OF EPA RECOMMENDED SAMPLING DAYS), BUT DOES NOT MEET THE NADB VALIDITY CRITERIA

ND = NO DATA

TABLE 4-6

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 02/23/83 NITROGEN DIOXIDE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 2

STANDARD METROPOLITAN STATISTICAL AREA	NITROGEN DIOXIDE CONCENTRATION (PPM) ANNUAL ARITHMETIC AVERAGE		
	1979	1980	1981
POPULATION: > 2 MILLION (CONT)			
TOTAL SMSA'S > 2 MILLION : 16			

* THE ANNUAL AVERAGE IS BASED ON AT LEAST 30 DAYS OF 24-HOUR DATA (50 % OF EPA RECOMMENDED SAMPLING DAYS), BUT DOES NOT MEET THE NADB VALIDITY CRITERIA
ND = NO DATA

TABLE 4-6

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 02/23/83 NITROGEN DIOXIDE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 3

STANDARD METROPOLITAN STATISTICAL AREA	NITROGEN DIOXIDE CONCENTRATION (PPM) ANNUAL ARITHMETIC AVERAGE 1979	1980	1981
POPULATION: 1 - 2 MILLION			
NEWARK, NJ	.043	.040	.034
ANAHEIM-SANTA ANA-GARDEN GROVE, CA	.060	.055	.061
CLEVELAND, OH	.050 B	.048 B	.039 B
SAN DIEGO, CA	.049	.036	.043
MIAMI, FL	.003 B*	.006 B	.018
DENVER-BOULDER, CO	.051	.050	.047
SEATTLE-EVERETT, WA	ND	.020	.022
TAMPA-ST. PETERSBURG, FL	.032 B	.033 B	.030 B
RIVERSIDE-SAN BERNARDINO-ONTARIO, CA	.066	.050	.049
PHOENIX, AZ	ND	.009	.011
CINCINNATI, OH-KY-IN	.053 B	.050 B	.031
MILWAUKEE, WI	.048 B	ND	.026
KANSAS CITY, MO-KS	.006	ND	.014
SAN JOSE, CA	.041	.036	.033
BUFFALO, NY	.028	.023	.026
PORTLAND, OR-WA	.034	.028	ND

* THE ANNUAL AVERAGE IS BASED ON AT LEAST 30 DAYS OF 24-HOUR DATA (50 % OF EPA RECOMMENDED SAMPLING DAYS), BUT DOES NOT MEET THE NADB VALIDITY CRITERIA

ND = NO DATA

TABLE 4-6

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 02/23/83 NITROGEN DIOXIDE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 4

STANDARD METROPOLITAN STATISTICAL AREA	NITROGEN DIOXIDE CONCENTRATION (PPM) ANNUAL ARITHMETIC AVERAGE 1979	1980	1981
POPULATION: 1 - 2 MILLION (CONT)			
NEW ORLEANS, LA	.029 B	.029 B	.030 B
INDIANAPOLIS, IN	.055 B	.036	.030
COLUMBUS, OH	.034 B	.032 B	.023
SAN JUAN, PR	.020 B	ND	ND
SAN ANTONIO, TX	.028 B	.030 B	.026 B*
FORT LAUDERDALE-HOLLYWOOD, FL	.022 B	.027 B	.027 B*
SACRAMENTO, CA	.032	.028	.021

TOTAL SMSA'S 1 - 2 MILLION : 23

* THE ANNUAL AVERAGE IS BASED ON AT LEAST 30 DAYS OF 24-HOUR DATA (50 % OF EPA RECOMMENDED SAMPLING DAYS), BUT DOES NOT MEET THE NADB VALIDITY CRITERIA
ND = NO DATA

TABLE 4-6

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICF OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 02/23/83 NITROGEN DIOXIDE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 5

STANDARD METROPOLITAN STATISTICAL AREA	NITROGEN DIOXIDE CONCENTRATION (PPM) ANNUAL ARITHMETIC AVERAGE 1979	1980	1981
POPULATION: .5 - 1 MILLION			
ROCHESTER, NY	.030	ND	ND
SALT LAKE CITY-OGDEN, UT	.031	.033	.028
PROVIDENCE-WARWICK-PAWTUCKET, RI-MA	.037	.036	ND
MEMPHIS, TN-AR-MS	.034 B*	.034 B*	ND
LOUISVILLE, KY-IN	.040 B	.041 B	.035
NASHVILLE-DAVIDSON, TN	.039 B	.047 B*	.049 B
BIRMINGHAM, AL	ND	ND	ND
OKLAHOMA CITY, OK	.019 B*	.019	.023
DAYTON, OH	.036	.029 B	.028 B
GREENSBORO-WINSTON-SALEM-HIGH POINT, NC	.030 B	.025 B	.022 B
NORFOLK-VIRGINIA BEACH-PORTSMOUTH, VA-NC	ND	.018	.015
ALBANY-SCHENECTADY-TROY, NY	.016	ND	ND
TOLEDO, OH-MI	.030 B	.032 B	.031 B*
HONOLULU, HI	ND	ND	ND
JACKSONVILLE, FL	ND	ND	.017
HARTFORD, CT	.041 B	.042 B	.019

* THE ANNUAL AVERAGE IS BASED ON AT LEAST 30 DAYS OF 24-HOUR DATA (50 % OF EPA RECOMMENDED SAMPLING DAYS), BUT DOES NOT MEET THE NADB VALIDITY CRITERIA
ND = NO DATA

TABLE 4-6

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 02/23/83 NITROGEN DIOXIDE CONCENTRATION BY SMSA POPULATION RANGE

STANDARD METROPOLITAN STATISTICAL AREA	NITROGEN DIOXIDE CONCENTRATION (PPM) ANNUAL ARITHMETIC AVERAGE 1979	1980	1981
POPULATION: .5 - 1 MILLION (CONT)			
ORLANDO, FL	.013 B	.022 B	.018 B*
TULSA, OK	.059 B	.021	.010
AKRON, OH	.029 B	.029 B	.024 B*
GARY-HAMMOND-EAST CHICAGO, IN	.036 B	ND	ND
SYRACUSE, NY	.031	.021	ND
NORTHEAST PENNSYLVANIA	.035	.032	.029
CHARLOTTE-GASTONIA, NC	.033 B	.031 B	.026 B
ALLENTOWN-BETHLEHEM-EASTON, PA-NJ	.028	.025	.026
RICHMOND, VA	.029 B*	.031	ND
GRAND RAPIDS, MI	.021	ND	ND
NEW BRUNSWICK-PERTH AMBOY-SAYREVILLE, NJ	ND	.025	ND
WEST PALM BEACH-BOCA RATON, FL	.010	.014	.015 B*
OMAHA, NE-IA	.036 B	.027 B*	.020 B
GREENVILLE-SPARTANBURG, SC	.028 B	ND	.029 B*
JERSEY CITY, NJ	.034	.030	.028
AUSTIN, TX	.030 B*	.021 B	ND

* THE ANNUAL AVERAGE IS BASED ON AT LEAST 30 DAYS OF 24-HOUR DATA (50 % OF EPA RECOMMENDED SAMPLING DAYS), BUT DOES NOT MEET THE NADB VALIDITY CRITERIA
ND = NO DATA

TABLE 4-6

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 02/23/83 NITROGEN DIOXIDE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 7

STANDARD METROPOLITAN STATISTICAL AREA	NITROGEN DIOXIDE CONCENTRATION (PPM) ANNUAL ARITHMETIC AVERAGE 1979	1980	1981
POPULATION: .5 - 1 MILLION (CONT)			
YOUNGSTOWN-WARREN, OH	.050	.041	.035
TUCSON, AZ	.016	.023	.029
RALEIGH-DURHAM, NC	.019 B	.022 B	.019 B
SPRINGFIELD-CHICOPEE-HOLYOKE, MA-CT	.042	ND	ND
OXNARD-SIMI VALLEY-VENTURA, CA	.030	.026	ND
WILMINGTON, DE-NJ-MD	.029	.034	ND
FLINT, MI	ND	ND	ND
FRESNO, CA	.036	.034	.026
LONG BRANCH-ASBURY PARK, NJ	ND	ND	ND

TOTAL SMSA'S .5 - 1 MILLION : 41

* THE ANNUAL AVERAGE IS BASED ON AT LEAST 30 DAYS OF 24-HOUR DATA (50 % OF EPA RECOMMENDED SAMPLING DAYS), BUT DOES NOT MEET THE NADB VALIDITY CRITERIA
ND = NO DATA

TABLE 4-7

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 02/10/83 OZONE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 1

STANDARD METROPOLITAN STATISTICAL AREA	OZONE CONCENTRATION (PPM) 1-HR 2ND HIGH DAILY MAX 1979		1980		1981	
POPULATION: > 2 MILLION						
NEW YORK, NY-NJ	.19		.18	*	.18	*
LOS ANGELES-LONG BEACH, CA	.44		.44	*	.35	
CHICAGO, IL	.22	*	.15		.14	
PHILADELPHIA, PA-NJ	.18	*	.24	*	.17	
DETROIT, MI	.12	*	.15	*	.15	
SAN FRANCISCO-OAKLAND, CA	.14		.18		.14	
WASHINGTON, DC-MD-VA	.18	*	.19		.15	
DALLAS-FORT WORTH, TX	.17		.18		.15	
HOUSTON, TX	.24		.30		.23	*
BOSTON, MA	.22	*	.15	*	.13	*
NASSAU-SUFFOLK, NY	.18		.17		.14	
ST. LOUIS, MO-IL	.16	*	.18		.15	
PITTSBURGH, PA	.17	*	.17	*	.16	
BALTIMORE,MD	.14	*	.18	*	.17	*
MINNEAPOLIS-ST. PAUL, MN-WI	.10	*	.13		.10	*
ATLANTA, GA	.16		.15		.14	

* LESS THAN 90 DAYS OF DATA

TABLE 4-7

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 02/10/83 OZONE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 2

STANDARD METROPOLITAN STATISTICAL AREA	OZONE CONCENTRATION (PPM) 1-HR 2ND HIGH DAILY MAX 1979	1980	1981
POPULATION: > 2 MILLION (CONT)			
TOTAL SMSA'S > 2 MILLION : 16			

* LESS THAN 90 DAYS OF DATA

TABLE 4-7

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 02/10/83 OZONE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 3

STANDARD METROPOLITAN STATISTICAL AREA	OZONE CONCENTRATION (PPM) 1-HR 2ND HIGH DAILY MAX 1979	1980	1981
POPULATION: 1 - 2 MILLION			
NEWARK, NJ	.15	.15 *	.14
ANAHEIM-SANTA ANA-GARDEN GROVE, CA	.35	.29	.31
CLEVELAND, OH	.14 *	.12	.12 *
SAN DIEGO, CA	.36	.22	.24
MIAMI, FL	.05 *	.15	.14
DENVER-BOULDER, CO	.16	.13	.13
SEATTLE-EVERETT, WA	.13	.09 *	.12 *
TAMPA-ST. PETERSBURG, FL	.11	.13	.11
RIVERSIDE-SAN BERNARDINO-ONTARIO, CA	.42	.38	.34
PHOENIX, AZ	.12 *	.15	.16
CINCINNATI, OH-KY-IN	.13	.16 *	.13
MILWAUKEE, WI	.17	.14 *	.17 *
KANSAS CITY, MO-KS	.12 *	.16	.12 *
SAN JOSE, CA	.17	.19 *	.14
BUFFALO, NY	.11 *	.14 *	.12 *
PORTLAND, OR-WA	.11	.10	.15

* LESS THAN 90 DAYS OF DATA

TABLE 4-7

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 02/10/83 OZONE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 4

STANDARD METROPOLITAN STATISTICAL AREA	OZONE CONCENTRATION (PPM) 1-HR 2ND HIGH DAILY MAX 1979	1980	1981
POPULATION: 1 - 2 MILLION (CONT)			
NEW ORLEANS, LA	.12	.12	.11 *
INDIANAPOLIS, IN	.12	.14	.13
COLUMBUS, OH	.10	.12	.11
SAN JUAN, PR	ND	ND	.07 *
SAN ANTONIO, TX	.11	.12	.12
FORT LAUDERDALE-HOLLYWOOD, FL	.10 *	.12 *	.11 *
SACRAMENTO, CA	.16 *	.17	.17

TOTAL SMSA'S 1 - 2 MILLION : 23

* LESS THAN 90 DAYS OF DATA

TABLE 4-7

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 02/10/83 OZONE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 5

STANDARD METROPOLITAN STATISTICAL AREA	OZONE CONCENTRATION (PPM) 1-HR 2ND HIGH DAILY MAX 1979	1980	1981
POPULATION: .5 - 1 MILLION			
ROCHESTER, NY	.12	.12	.12
SALT LAKE CITY-OGDEN, UT	.15	.17	.15
PROVIDENCE-WARWICK-PAWTUCKET, RI-MA	.17	.21	.15
MEMPHIS, TN-AR-MS	.11 *	.13	.12 *
LOUISVILLE, KY-IN	.16 *	.19 *	.14
NASHVILLE-DAVIDSON, TN	.09 *	.13	.13
BIRMINGHAM, AL	ND	.16 *	.16
OKLAHOMA CITY, OK	.11 *	.12	.11
DAYTON, OH	.14 *	.13	.12
GREENSBORO-WINSTON-SALEM-HIGH POINT, NC	.10 *	.12 *	.11 *
NORFOLK-VIRGINIA BEACH-PORTSMOUTH, VA-NC	.10	.12	.11
ALBANY-SCHENECTADY-TROY, NY	.13	.13	.13
TOLEDO, OH-MI	.15	.14	.13
HONOLULU, HI	.04 *	.04	.04
JACKSONVILLE, FL	.13	.12	.10
HARTFORD, CT	.20	.24	.15 *

* LESS THAN 90 DAYS OF DATA

TABLE 4-7

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 02/10/83 OZONE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 6

STANDARD METROPOLITAN STATISTICAL AREA	OZONE CONCENTRATION (PPM) 1-HR 2ND HIGH DAILY MAX 1979		1980		1981	
POPULATION: .5 - 1 MILLION (CONT)						
ORLANDO, FL	.10	*	.09	*	.10	
TULSA, OK	.13		.15		.15	
AKRON, OH	.15		.11	*	.27	
GARY-HAMMOND-EAST CHICAGO, IN	.13	*	.15	*	.14	
SYRACUSE, NY	.13	*	.11		.11	
NORTHEAST PENNSYLVANIA	.11		.15		.10	
CHARLOTTE-GASTONIA, NC	.12	*	.14		.12	
ALLENTOWN-BETHLEHEM-EASTON, PA-NJ	.17	*	.15		.12	
RICHMOND, VA	.13	*	.13	*	.11	*
GRAND RAPIDS, MI	.11		.11	*	.11	
NEW BRUNSWICK-PERTH AMBOY-SAYREVILLE, NJ	.10	*	.19		.13	
WEST PALM BEACH-BOCA RATON, FL	.08	*	.09		.09	
OMAHA, NE-IA	.10	*	.14		.08	*
GREENVILLE-SPARTANBURG, SC	.11	*	.11		.11	*
JERSEY CITY, NJ	.15	*	.16	*	.14	
AUSTIN, TX	.12	*	.13		.12	

* LESS THAN 90 DAYS OF DATA

TABLE 4-7

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 02/10/83 OZONE CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 7

STANDARD METROPOLITAN STATISTICAL AREA	OZONE CONCENTRATION (PPM) 1-HR 2ND HIGH DAILY MAX 1979	1980	1981
POPULATION: .5 - 1 MILLION (CONT)			
YOUNGSTOWN-WARREN, OH	.13	.12	.13
TUCSON, AZ	.10	.10 *	.12
RALEIGH-DURHAM, NC	.10 *	.13 *	.12 *
SPRINGFIELD-CHICOPEE-HOLYOKE, MA-CT	.16 *	.15 *	.16 *
OXNARD-SIMI VALLEY-VENTURA, CA	.19	.18	.20
WILMINGTON, DE-NJ-MD	.16 *	.17 *	.12 *
FLINT, MI	.11	.11 *	.11
FRESNO, CA	.18	.19 *	.17
LONG BRANCH-ASBURY PARK, NJ	.14 *	.16 *	ND

TOTAL SMSA'S .5 - 1 MILLION : 41

* LESS THAN 90 DAYS OF DATA

TABLE 4-8

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 02/10/83 LEAD CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 1

STANDARD METROPOLITAN STATISTICAL AREA	LEAD CONCENTRATION (UG/M3) MAXIMUM QUARTERLY AVERAGE 1979	1980	1981
POPULATION: > 2 MILLION			
NEW YORK, NY-NJ	1.08	.47	ND
LOS ANGELES-LONG BEACH, CA	1.51	2.56	1.58
CHICAGO, IL	1.15 M	1.95 M	.89
PHILADELPHIA, PA-NJ	2.71 *	1.26 *	1.30 *
DETROIT, MI	ND	ND	ND
SAN FRANCISCO-OAKLAND, CA	.42	.73	.41
WASHINGTON, DC-MD-VA	1.90	.69 M	.48 M
DALLAS-FORT WORTH, TX	1.59	.67	.86
HOUSTON, TX	1.39	.64	.75
BOSTON, MA	1.01	.57	ND
NASSAU-SUFFOLK, NY	ND	ND	ND
ST. LOUIS, MO-IL	3.17 M*	2.97 M*	7.27 M *
PITTSBURGH, PA	.82	.44	.41
BALTIMORE,MD	148 M	1.11	.61 M
MINNEAPOLIS-ST. PAUL, MN-WI	2.87 *	3.04 *	3.11 *
ATLANTA, GA	ND	.51	.39

M = REPRESENTS MONTHLY COMPOSITE DATA
Q = REPRESENTS QUARTERLY COMPOSITE DATA
ND = NO DATA
* = This level reflects the impact of industrial sources

TABLE 4-8

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 02/10/83 LEAD CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 2

STANDARD METROPOLITAN STATISTICAL AREA	LEAD CONCENTRATION (UG/M3) MAXIMUM QUARTERLY AVERAGE 1979	1980	1981
POPULATION: > 2 MILLION (CONT)			
TOTAL SMSA'S > 2 MILLION : 16			

M = REPRESENTS MONTHLY COMPOSITE DATA
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ND = NO DATA

TABLE 4-8

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 02/10/83 LEAD CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 3

STANDARD METROPOLITAN STATISTICAL AREA	LEAD CONCENTRATION (UG/M3) MAXIMUM QUARTERLY AVERAGE 1979	1980	1981
POPULATION: 1 - 2 MILLION			
NEWARK, NJ	1.17	.53	ND
ANAHEIM-SANTA ANA-GARDEN GROVE, CA	1.11	1.52	.97
CLEVELAND, OH	.38	.34	ND
SAN DIEGO, CA	.91	1.50	.90
MIAMI, FL	1.46	1.10	.88
DENVER-BOULDER, CO	3.47 M	1.53 M	1.03 M
SEATTLE-EVERETT, WA	1.36 *	.86 *	.52 *
TAMPA-ST. PETERSBURG, FL	1.60 *	1.09 *	.68 *
RIVERSIDE-SAN BERNARDINO-ONTARIO, CA	.91	1.46	1.00
PHOENIX, AZ	2.59	1.49	1.39
CINCINNATI, OH-KY-IN	1.16 M	.85	.37 M
MILWAUKEE, WI	.72	.49	.31
KANSAS CITY, MO-KS	.82	.38	.19
SAN JOSE, CA	.92	.94	.61
BUFFALO, NY	.47	.41	.38
PORTLAND, OR-WA	.60	.41	.29

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TABLE 4-8

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 02/10/83 LEAD CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 4

STANDARD METROPOLITAN STATISTICAL AREA	LEAD CONCENTRATION (UG/M3) MAXIMUM QUARTERLY AVERAGE 1979	1980	1981
POPULATION: 1 - 2 MILLION (CONT)			
NEW ORLEANS, LA	.70	.35	.25
INDIANAPOLIS, IN	1.16	.63	.42
COLUMBUS, OH	.43	.35	.34
SAN JUAN, PR	3.59	1.06	1.02
SAN ANTONIO, TX	1.23	.79	.76
FORT LAUDERDALE-HOLLYWOOD, FL	.33	.36	.23
SACRAMENTO, CA	.69	.60	.62

TOTAL SMSA'S 1 - 2 MILLION : 23

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TABLE 4-8

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 02/10/83 LEAD CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 5

STANDARD METROPOLITAN STATISTICAL AREA	LEAD CONCENTRATION (UG/M3) MAXIMUM QUARTERLY AVERAGE 1979	1980	1981
POPULATION: .5 - 1 MILLION			
ROCHESTER, NY	.49	.39	.29
SALT LAKE CITY-OGDEN, UT	ND	ND	ND
PROVIDENCE-WARWICK-PAWTUCKET, RI-MA	1.92 *	1.16*	.51
MEMPHIS, TN-AR-MS	.57	.50	.54
LOUISVILLE, KY-IN	1.55 M	2.52 M	.75 M
NASHVILLE-DAVIDSON, TN	1.05	.74	.54
BIRMINGHAM, AL	.80	ND	2.30 *
OKLAHOMA CITY, OK	ND	.32	.37
DAYTON, OH	ND	.43	.34
GREENSBORO-WINSTON-SALEM-HIGH POINT, NC	.80	.50	.30
NORFOLK-VIRGINIA BEACH-PORTSMOUTH, VA-NC	.62	.56	.21
ALBANY-SCHENECTADY-TROY, NY	.56	.25	.19
TOLEDO, OH-MI	.42	.18	.19
HONOLULU, HI	.42	.41	.25
JACKSONVILLE, FL	.72	.15	1.42
HARTFORD, CT	ND	ND	.48

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TABLE 4-8

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 02/10/83 LEAD CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 6

STANDARD METROPOLITAN STATISTICAL AREA	LEAD MAXIMUM QUARTERLY AVERAGE 1979	CONCENTRATION (UG/M3) 1980	1981
POPULATION: .5 - 1 MILLION (CONT)			
ORLANDO, FL	ND	ND	.34
TULSA, OK	ND	ND	ND
AKRON, OH	.46	.29	.15
GARY-HAMMOND-EAST CHICAGO, IN	2.19*	1.04 *	1.09 *
SYRACUSE, NY	.66	.43	ND
NORTHEAST PENNSYLVANIA	1.13	1.06	.45
CHARLOTTE-GASTONIA, NC	.70	ND	ND
ALLENTOWN-BETHLEHEM-EASTON, PA-NJ	.84	.65	.34
RICHMOND, VA	ND	ND	ND
GRAND RAPIDS, MI	ND	ND	ND
NEW BRUNSWICK-PERTH AMBOY-SAYREVILLE, NJ	1.08	ND	ND
WEST PALM BEACH-BOCA RATON, FL	ND	ND	.51
OMAHA, NE-IA	1.08	.81	.97
GREENVILLE-SPARTANBURG, SC	1.38	.70	.55
JERSEY CITY, NJ	.69	.61	ND
AUSTIN, TX	.77	.48	.67

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RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

REPORT DATE 02/10/83 LEAD CONCENTRATION BY SMSA POPULATION RANGE PAGE NO: 7

STANDARD METROPOLITAN STATISTICAL AREA	LEAD CONCENTRATION (UG/M3) MAXIMUM QUARTERLY AVERAGE 1979	1980	1981
POPULATION: .5 - 1 MILLION (CONT)			
YOUNGSTOWN-WARREN, OH	.45	.37	.07
TUCSON, AZ	1.18	.82	.52
RALEIGH-DURHAM, NC	.81	.71	.33
SPRINGFIELD-CHICOPEE-HOLYOKE, MA-CT	1.68	1.04	ND
OXNARD-SIMI VALLEY-VENTURA, CA	ND	.53	.67
WILMINGTON, DE-NJ-MD	1.21	.76	.40
FLINT, MI	ND	.15	.17
FRESNO, CA	.75	1.47	1.13
LONG BRANCH-ASBURY PARK, NJ	ND	ND	ND

TOTAL SMSA'S .5 - 1 MILLION : 41

M = REPRESENTS MONTHLY COMPOSITE DATA
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TECHNICAL REPORT DATA

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16. ABSTRACT

This report presents national and regional trends in air quality from 1975 through 1981 for total suspended particulate, sulfur dioxide, carbon monoxide, nitrogen dioxide, ozone and lead. Both long and short-term trends in each of the major pollutants are examined and, where appropriate, specific Statewide air quality trends. Air quality trends are also presented for both the National Air Monitoring Sites (NAMS) and other site categories.

In addition to ambient air quality, trends are also presented for annual nationwide emissions. These emissions are estimated using the best available engineering calculations; the ambient levels presented are averages of direct measurement.

This report introduces a new section, Air Quality Levels in Standard Metropolitan Statistical Areas (SMSA's). Its purpose is to provide interested members of the air pollution control community, the private sector and the general public with greatly simplified air pollution information. Air quality statistics are presented for each of the pollutants for all SMSA's with populations exceeding 500,000 for the years 1979, 1980 and 1981.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Air Pollution Trends Emission Trends Carbon Monoxide Nitrogen Dioxide Oxidants Sulfur Dioxide Total Suspended Particulates Air Pollution Standard Metropolitan Statistical Area (SMSA) Air Quality Statistics National Air Monitoring Stations (NAMS)		

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