United States
Environmental Protection
Agency

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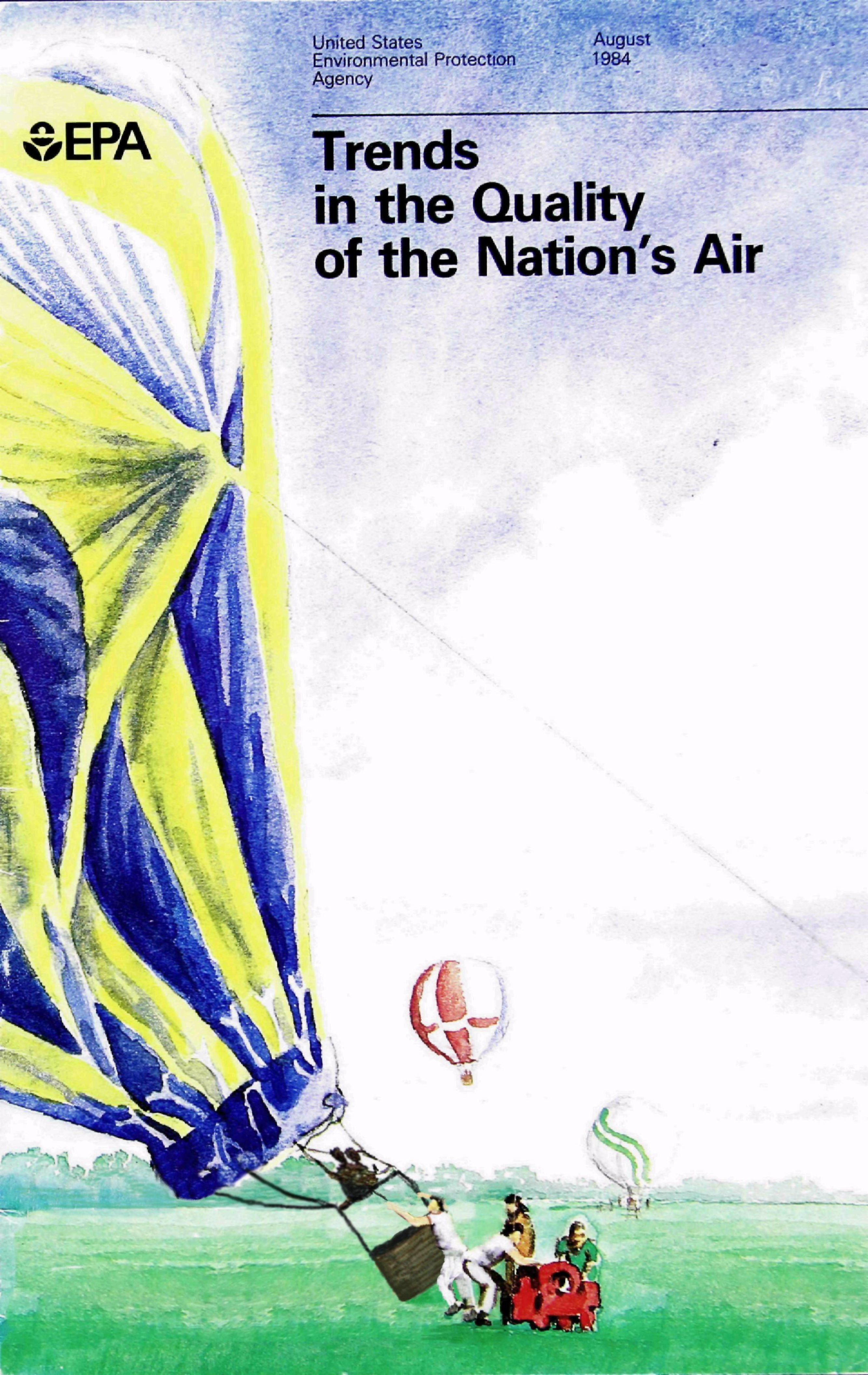
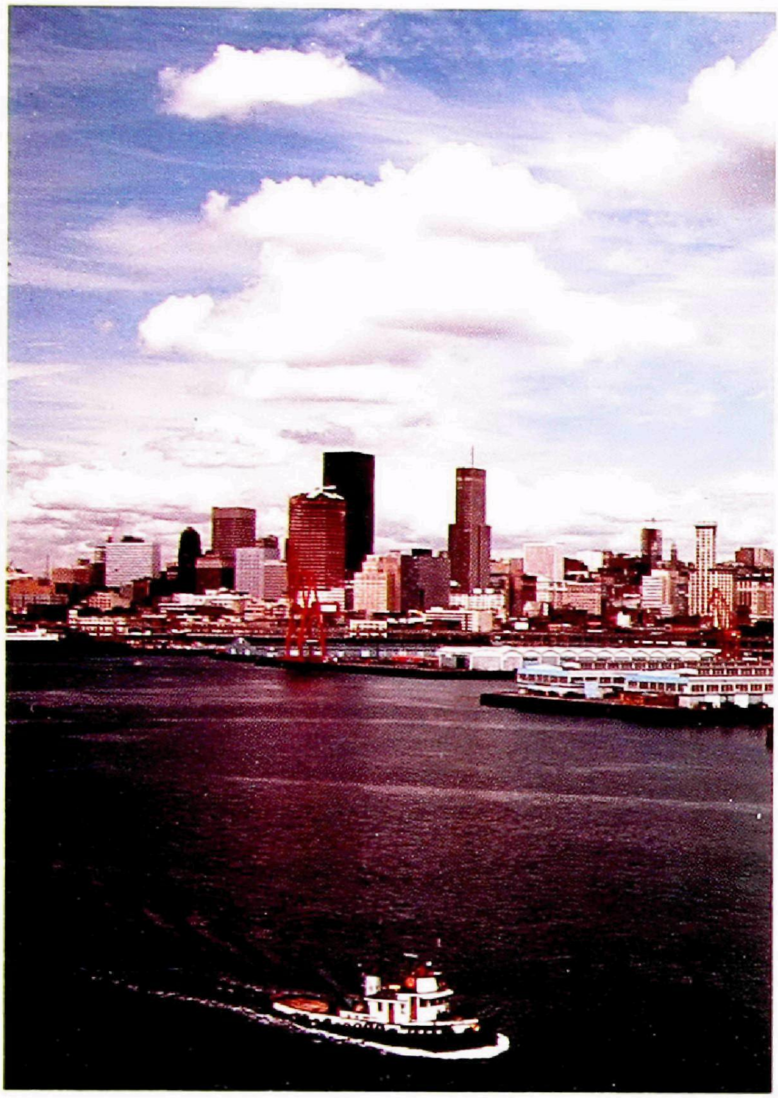
EPA

Trends in the Quality of the Nation's Air





Background

Since the mid-1950's, the nation has maintained a steady commitment to protecting public health from the adverse effects of air pollution. This commitment became a federal mandate with enactment of the 1970 Clean Air Act, and through subsequent amendments to that Act in 1977.

The Act includes several specific requirements and deadlines for federal and state governments, and for industry to reduce air pollution. It also provides for public participation and intergovernmental consultation. These have fostered cooperative efforts to solve the technical and political problems involved in cleaning the nation's air.

Most states have developed a wide range of regulatory, enforcement, and administrative programs to reduce emissions of air pollution. These include controls on pollution from factories, industries, and utilities, and motor vehicle emission inspection and maintenance programs.

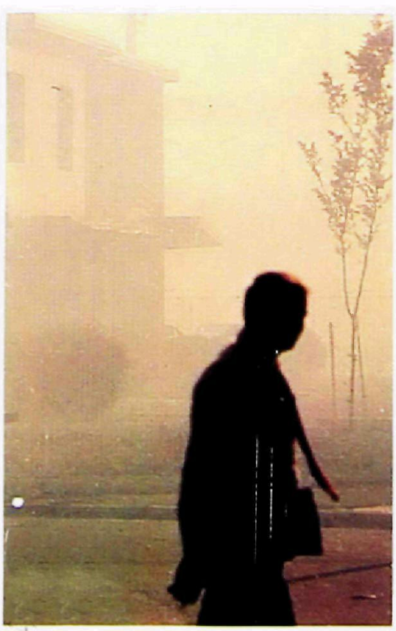
The state programs have been augmented by federal regulations and control measures for reducing emissions from new motor vehicles and certain industrial sources. EPA is specifically responsible for coordinating and approving most state air pollution plans and programs. The Agency also provides substantial technical assistance to states ranging from information on new air pollution control technology to studies of the health effects of air pollution.

The development of new and improved air pollution control technology is especially noteworthy. In recent years, this has involved state governments and industry in efforts to establish a variety of innovative pollution control measures that have reduced the cost of complying with federal requirements while achieving commensurate reductions of emissions.

The overall goal of these programs is to ensure that national ambient air quality standards (NAAQS) are achieved and maintained for several major air pollutants. A program has also been developed to protect very clean air in pristine and wilderness areas.

Several major air pollution problems remain to be fully solved during the coming years. One of the more complex of these is the phenomenon of acid rain.

Acid rain is the term used to describe a chain of complex processes that starts with air pollutant emissions from utilities, industry, and motor vehicles as well as natural sources. When these emissions interact with sunlight and vapor in the air, they are changed into acidic compounds that may be transported long distances to other areas and subsequently deposited with rain, snow, or dust.



A great deal of public concern has been focused on the harmful effects that acid rain may be having on fish and other wildlife, lakes, forests, crops, and on manmade objects such as buildings and statues. While certain aspects of the acid rain phenomenon are generally accepted by the scientific community, many other causes and effects are uncertain. Some of these include the geographic range of damage from acid rain, the rate at which acidification takes place, and the combination of pollutants that are involved in the formation of acid rain. For example, most attention has been focused on the contribution of sulfur emissions to acid deposition, but other pollutants (including oxides of nitrogen) are also contributors.

Another major air quality issue involves the transport of ozone and its precursors. This chiefly involves a process whereby emissions of volatile organic compounds are transported over long distances from the sources of emissions. This phenomenon has complicated the development of control strategies for some areas of the country and has also compounded the difficulties of achieving air quality standards for ozone, one of the major pollutants. This has been a particularly difficult problem in some large urban areas and regions of the country.

Finally, there is the issue of hazardous air pollutants which pose potentially serious but primarily localized health problems. EPA is focusing research and technical studies to determine the health effects and the most feasible control programs for these pollutants.

Despite these problems, the overall trends in the quality of the nation's air are encouraging. In many areas, the air quality standards for protecting public health were achieved for all major air pollutants by the end of 1982. In some other areas, where higher levels have existed for one or more pollutants, achievement of standards appears likely by the statutory deadlines.

The latest publication that documents recent progress in reducing air pollution is entitled, *National Air Quality and Emissions Trends Report, 1982.*

Highlights of that detailed report are presented in this booklet.

Summary

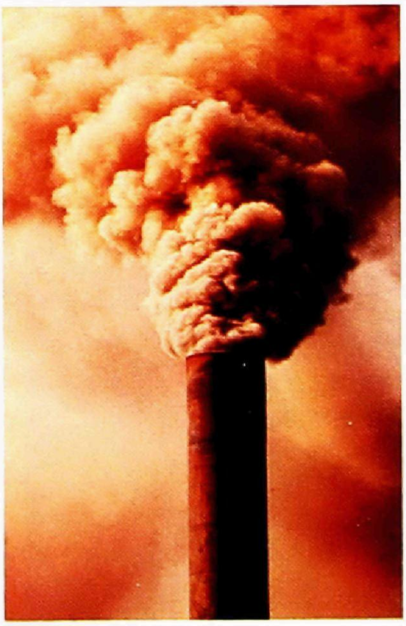
Approximately 5,000 air monitors across the country measure and record air pollution levels. This report covers data accumulated from these stations between 1975 and 1982 for six principal pollutants.

The six are: lead, carbon monoxide, ozone, nitrogen dioxide, sulfur dioxide, and particulates. All six are known or suspected causes of illness or disease, and they sometimes occur in concentrations that are above the health standards set by EPA.

In most respects, the air quality data are encouraging. Pollution levels for five of the six pollutants were lower in 1982 than in 1975.

For example:

- Levels of **lead** recorded at 46 urban sites decreased a dramatic 64 percent between 1975 and 1982.
- **Carbon monoxide** levels recorded mainly at traffic saturated areas in center city locations fell 31 percent in the same time period.
- **Ozone** (smog) decreased 18 percent from recordings taken at almost 200 sites. The reasons for the reduction appears to be due to a combination of decreasing emissions from volatile organic compounds, which are the precursor of ozone, and a change which occurred in the calibration procedures at the monitoring sites between 1978 and 1979. To eliminate the influence of the calibration change, trends for ozone were examined for the 1979-1982 time period. Ozone levels improved by 9 percent during this latest 4-year interval, a period which was not influenced by the calibration change.
- **Nitrogen dioxide** levels were the same in 1982 as they were in 1975, but the levels generally declined between 1979 and 1982 after increasing slightly between 1975 and 1978.
- **Sulfur dioxide** in urban areas decreased 33 percent from 1975 to 1982.
- The level of **particulates** in the air decreased 15 percent between 1978 and 1982.
- How Air Quality is Determined



How Air Quality Is Determined

Most of our information about pollution levels is determined from data based on three related measurements: (1) Trends recorded from the measurements of ambient air quality; (2) Trends derived from estimates of total national pollution emissions; and (3) Trends in the number of times an air quality standard is violated.

National Trends in Pollutant Concentrations

Measurements for ambient air quality trends tell us the amounts and kinds of pollutants that are concentrated in the air we breathe at a given time and place. Pollutant concentrations are measured routinely by monitoring stations operated by State and local agencies. National trends (1975-1982) in ambient pollution concentrations are averaged over available monitoring sites for each of the six major pollutants. These trends appear in the set of Graph A's on subsequent pages of this booklet.

National Trends in Estimated Total Emissions

National trends in total emissions are the combined estimates of the amounts and kinds of pollution that are generated by automobiles, factories, and other sources based on the best available engineering calculations. Emissions estimates tell us how many millions of metric tons of any pollutant were released into the air over the nation as a whole. Graph B under each pollutant shows the estimated total national emissions for each year between 1975 and 1982.

National Violation Trends

While national air quality and emissions trends show the overall progress in reducing various pollutants, the results will have more significance by considering the impact at the various monitoring sites.

While it would be impractical to list findings from thousands of sites across the nation, a reasonable alternative exists in the National Violations Trends (NVT) which is used in this booklet. The NVT shows the average number of days that standards for two of the pollutants (ozone and sulfur dioxide) are violated at all monitoring sites during the course of a year. In the case of carbon monoxide, the number of non-overlapping 8-hour violations of the standard are examined. There could be as many as three 8-hour carbon monoxide violations in a single day, although that is unlikely.

The NVT is denoted as a set of Graph C's throughout this booklet. It serves as a complementary statistic to the set of Graph A's that show the national ambient air quality trends for the three pollutants.

Two final points should be observed. The first is that three of the principal emissions have names different from the pollutants they help to form in the air. Emissions of sulfur oxides help to form sulfur dioxide pollution, while nitrogen oxides emissions contribute to nitrogen dioxide pollution. In addition, emissions of volatile organic compounds and oxides of nitrogen are the principal sources for ozone pollution. Lead, carbon monoxide, and particulates have the same name for emissions and the pollutants they form in the air.

The second point is that the reductions of pollutant concentration in the air (as a national average) are often quite different from those of the estimated emissions which contribute to that pollutant in the ambient environment.

For example:

(1) Average ambient concentration of sulfur dioxide declined over 33 percent from 1975 to 1982, although estimated total emissions of sulfur oxides declined only 17 percent. The monitoring stations recording sulfur dioxide pollution are principally located in urban areas where low sulfur fuel is used to maintain air quality standards. High sulfur fuel is more common in rural areas with fewer monitoring stations, so the emissions figures account for these sources.

(2) Ambient carbon monoxide concentrations dropped 31 percent between 1975 and 1982, while total estimated emissions from highway vehicles decreased only 17 percent. Both figures reflect improvements as a result of federal emissions standards on newer motor vehicles. Carbon monoxide levels are generally monitored in center city areas where motor vehicle activity was more or less constant between 1975 and 1982. The estimated emissions figures takes into account a 20 percent increase in vehicle miles travelled nationally. So, while very significant progress was made in reducing motor vehicle emissions, the improvements were partially offset by increases in motor vehicle travel.

(3) Particulate pollution is another area where apparent discrepancies exist. Dust and soot from natural dust, road debris, construction, and other activities contribute to ambient concentrations of particulates. However, these are not included in the total emissions inventory. Consequently, between 1975 and 1982 ambient concentration of particulates declined less than total particulate emissions.

The reader will be better able to grasp the variations as well as the interrelated significance of air pollution terminology and measurement if these points are kept in mind.

Lead

Sources and Nature of the Pollutant

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

Health Effects

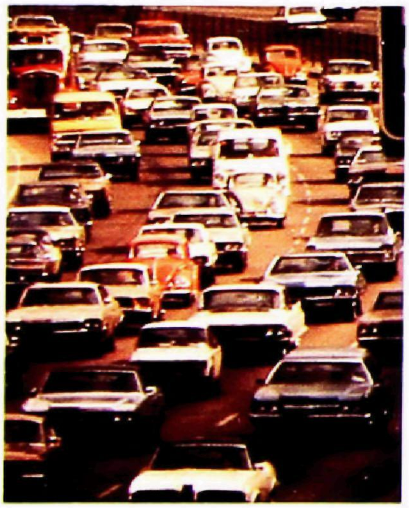
Lead is physically harmful when ingested or inhaled. It accumulates in the body in the blood, in bone, and in soft tissue. Because it is not readily excreted, lead also affects the kidneys, nervous system, and all blood-forming organs. People who ingest excessive amounts of lead may show neurological impairment such as seizures, mental retardation, and/or behavioral disorders. Infants and children are particularly susceptible to lead damage to the central nervous system.

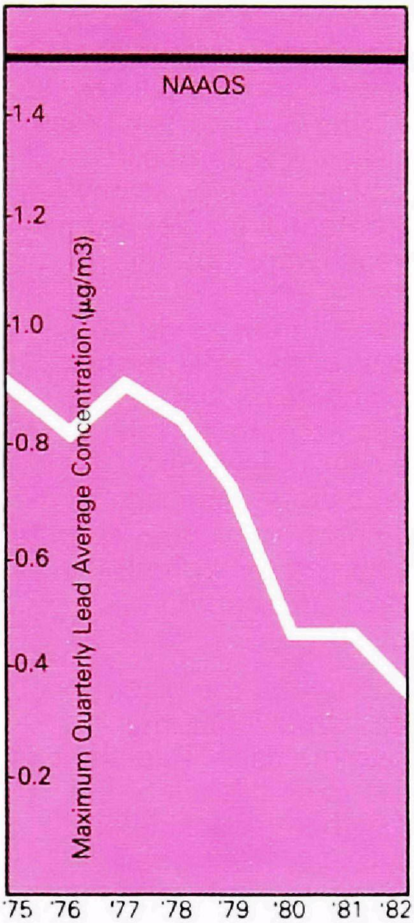
Trends in Lead Levels

There was a 64 percent decrease in the average ambient concentrations of lead, measured at 46 sites between 1975 and 1982. In order to increase the number of sites and their geographical representation, lead trends at 214 sites in 21 states were studied for the period 1979 to 1982. The results showed a decline of 43 percent at these sites during the four year period.

Complementing the figures for reduced ambient lead levels are consumption figures on leaded gasoline from the U. S. Department of Energy and a private corporation. These show an overall percentage decrease of 69 percent for consumption of leaded gasoline between 1975 and 1982.

Further bolstering the conclusion that very dramatic reductions in lead pollution have occurred is a recent study on lead levels in blood in the civilian popoulation by the National Center for Health Statistics. This study measured the degree of exposure the noninstitutionalized population of the country was subjected to between 1976 and 1980. It showed a 37 percent decrease in the mean blood lead levels from the first 6 months of 1976 to the last 6 months of 1980.



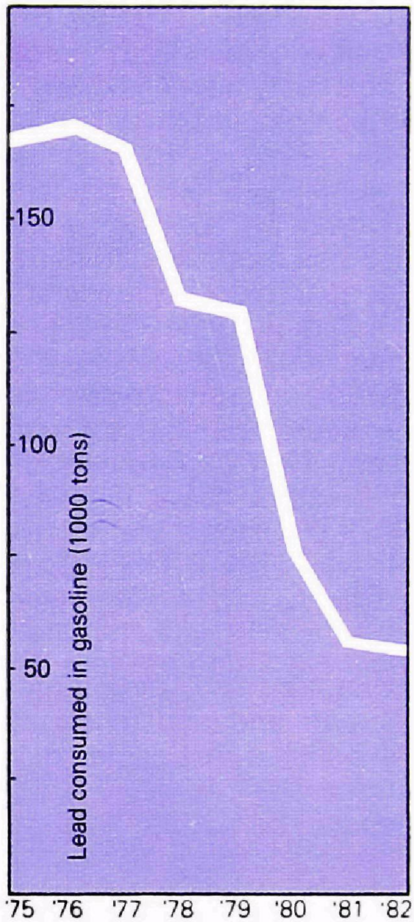


The National Trend in Lead Concentrations, 1975-1982

(Graph A)

This graph shows the national average change in ambient lead concentrations between 1975 and 1982 as measured at 46 sites. The recorded reductions, amounting to 64 percent, were generally steady during the 8-year time frame.

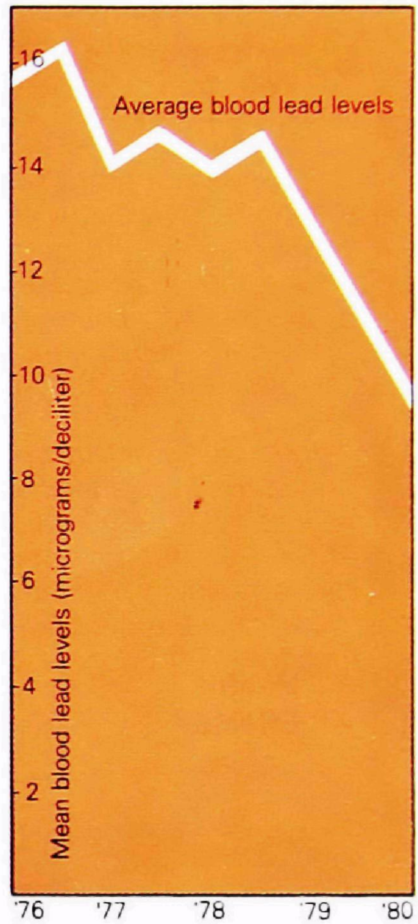
The improvements are almost totally due to a sharp decrease in the consumption of leaded gasoline caused by the continued replacement of older vehicles with new ones that require unleaded gasoline.



The National Trend in Consumption of Leaded Gasoline, 1975-1982

(Graph B)

The significant decline in consumption of leaded gasoline is depicted in this graph. The consumption drop of 69 percent is particularly noteworthy, since there was an increase of approximately 20 percent in the number of vehicle miles travelled nationally during the same period. The consumption drop would have been even greater if some motorists had not tampered with their automobiles by using leaded gasoline in newer vehicles designed to burn unleaded fuel.



Blood Lead Levels 1976-1980

(Graph C)

The National Center for Health Statistics in 1981 examined the exposure of the U. S. civilian population to lead between 1976 -1980. Graph C shows that a 37 percent reduction in lead levels in blood occurred. This 37 percent reduction in blood lead levels does complement a 48 percent decrease in ambient lead levels and a 56 percent decrease in the consumption of leaded gasoline during the same 5-year period.

It can reasonably be concluded that further reductions in lead pollution will occur as more and more older vehicles that consume leaded gasoline are phased out during the coming years. Reductions in ambient lead concentrations will be reduced at an even greater rate, if people use the proper gasoline in their automobiles. Leaded gasoline should not be used in newer automobiles with catalytic control devices.

Carbon Monoxide

Sources and Nature of the Pollutant

Over two thirds of the carbon monoxide released into the air comes from motor vehicle exhaust. It is a colorless, odorless, and poisonous gas produced by incomplete burning of carbon in fuels. In certain areas, transportation sources, especially the automobile, are responsible for 95 percent of these emissions. Any city with heavy traffic may have a potential problem from carbon monoxide, and it can reach very high concentrations in such areas.

Carbon monoxide is also emitted from some industrial processes, 6.5 percent of the total estimated emissions. Solid waste, fuel combustion and miscellaneous emission sources account for the remaining 21.1 percent of the total emissions.

In some areas, high levels of carbon monoxide from motor vehicles are isolated to only a few street corners. In other cities, the problem is spread throughout the center-city and along major commuter corridors.

Health Effects

When inhaled, carbon monoxide enters the blood stream and binds chemically to hemoglobin, the substance that carries oxygen to the cells. This reduces the amount of oxygen delivered to all tissues of the body. The adverse impacts of carbon monoxide on hemoglobin are determined by the amount of air breathed, the concentration of the pollutant, and the length of exposure.

Cigarette smoke also contains carbon monoxide. Therefore, cigarette smokers have a portion of their hemoglobin inactivated by this source as well as by external air pollution.

Carbon monoxide weakens the contractions of the heart, reducing the amount of blood pumped to various parts of the body. It results in a reduction of oxygen available to the muscles and various organs. It diminishes the functioning of even healthy individuals and can be life threatening to those with heart disease.

Individuals with anemia, emphysema, and other lung diseases, as well as cigarette smokers and those living at high altitudes, are likely to be more susceptible to the effects of carbon monoxide. Even at relatively low concentrations, carbon monoxide can affect mental function, visual acuity, and alertness.

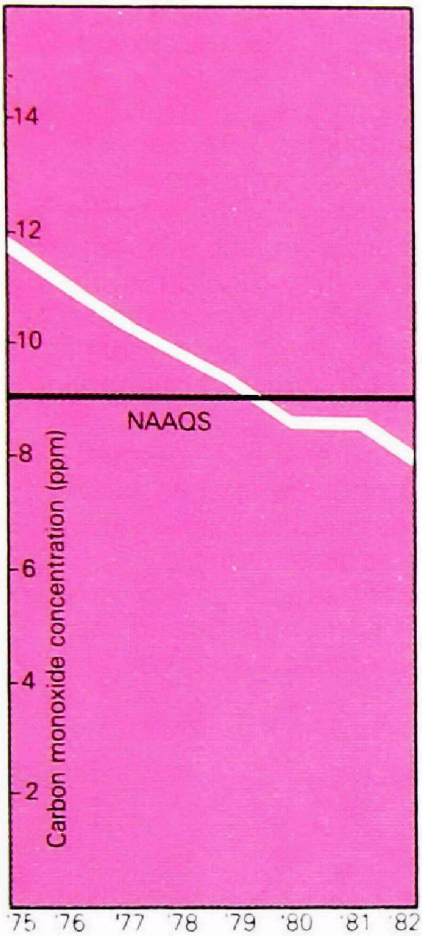
Carbon Monoxide Trends

Ambient carbon monoxide concentrations, as measured at 196 urban sites, have steadily decreased. From 1975 to 1982, carbon monoxide levels dropped at a rate of 5 percent per year with an overall reduction of about 31 percent. Improvements were recorded in all regions of the country and at 88 percent of the monitoring sites.

Estimates of nationwide carbon monoxide emissions from all sources show an 11 percent decrease since

1975. Highway vehicle emissions, which are the dominant contributors to ambient levels, decreased 17 percent between 1975 and 1982. The smaller reductions in estimated emissions than air quality is largely due to a 20 percent increase in total vehicle miles travelled since 1975. Since carbon monoxide monitors are generally located in areas where traffic saturation has been a chronic problem, the amount of traffic and vehicle miles of travel they record is rather constant from year to year. As a result, the carbon monoxide concentrations at these locations generally improve at a faster rate than the estimated nationwide reduction in emissions.

It can be concluded from this that the 31 percent reduction in ambient carbon monoxide concentration reflects the reductions in emissions from new cars brought about by federal standards on vehicle emissions. The fact that the estimated highway vehicle emissions only declined by 17 percent is due to the fact that motor vehicle travel increased by 20 pecent during the same time period.

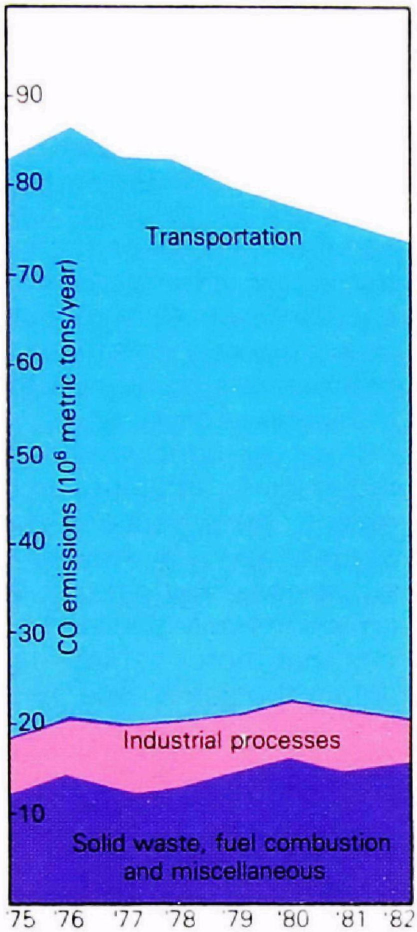


The National Trend in Carbon Monoxide Concentrations, 1975-1982

(Graph A)

This graph shows the year-by-year changes in annual average carbon monoxide concentration between I975 and I982. The results were recorded at monitoring stations at I96 urban sites.

It can be seen that carbon monoxide levels improved at a rate of 5 percent per year with an overall reduction of about 3l percent. The improvement reflects reduced levels at traffic-saturated monitoring sites, chiefly in center-city areas. Since motor vehicle activity has remained relatively constant in these urban downtown areas, the lower ambient levels reflect almost totally the reductions in emissions from new cars brought about by federal emissions standards.

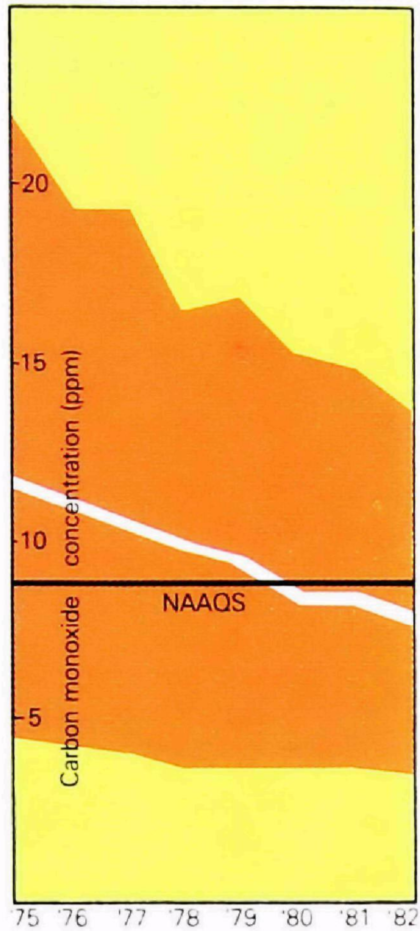


National Trend in Emissions of Carbon Monoxide, 1975-1982

(Graph B)

Total carbon monoxide emissions were 11 percent lower in 1982 than in 1975. Highway vehicle emissions, which are the main source of the pollutant, decreased a full 17 percent. A 20 percent increase in total vehicle miles travelled during the period partially offsets the decrease in emissions per car achieved by federal emissions standards.

There was almost no change in estimated emissions of carbon monoxide from sources other than motor vehicles. Emissions from industrial processes were down slightly, but there was a small increase in emissions from solid waste, fuel combustion, and miscellaneous sources.



National Violation Trends for Carbon Monoxide 1975-1982

(Graph C)

The average number of times the 8-hour carbon monoxide standard was violated decreased 87 percent, as measured at 196 monitoring sites. The average number of times the standard was violated fell from 34 to under 5 between 1975 and 1982. Although the average number of days that standards were violated was less than 5 in 1982, some areas are exceeding standards at a far higher number of times than the average. So while significant progress continues to be made in reducing carbon monoxide concentrations, additional work is needed to bring all affected areas into compliance.

Particulates

Sources and Nature of the Pollutant

Total suspended particulate matter is the general term for particles found in the atmosphere. They form as solid particles or liquid droplets small enough to remain suspended in air. Some particles are large enough to be visible as soot or smoke. Others are so small that they can be detected only with an electron microscope. Some particles may be formed in the air as a result of various chemical and physical processes, so the chemical composition of particulates varies widely depending upon location and time of year.

Health Effects

When airborne particles are inhaled, they may irritate the respiratory system, or damage the clearance mechanism of the lungs, thereby contributing to acute respiratory illnesses in much the same way as gaseous pollutants do. Prolonged inhalation of certain components of airborne particles may increase the number of cases and the severity of chronic respiratory diseases. Certain particulates, including sulfates, nitrates, and metals, are being studied to determine what contribution they may be making (if any) to the adverse health effects that have been observed from elevated particulate levels.

Particulate Trends

Annual average concentrations of total suspended particulate (largely soot and dust) decreased 15 percent between 1975 and 1982. This corresponds to a 27 percent decrease in estimated particulate emissions for the same period.

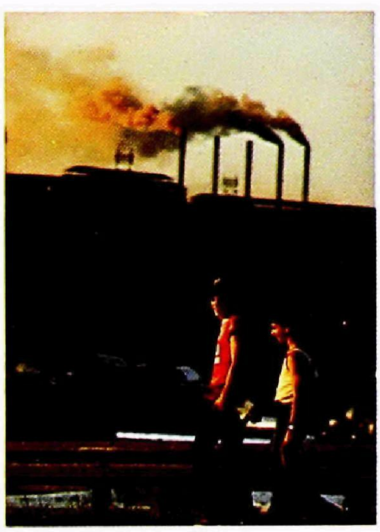
It's important to note why there is an apparent discrepancy between reductions in the ambient concentration of particulates and the decline in estimated emissions nationwide. Particulate air quality levels do not improve in direct proportion to estimated emissions reductions, because particulate levels are influenced by factors such as natural dust, street dust, construction work, and other activities that generate soot and dust. These are not included in the estimate of total particulate emissions.

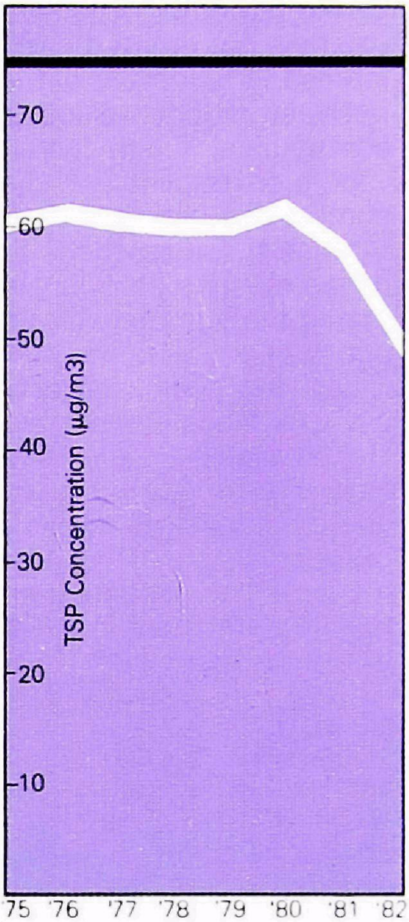
In addition, technical problems related to the filters used throughout the nation at total suspended particulate monitoring sites probably led to the recording of higher air quality values in some of the years than actually existed. In particular, the filters used in 1979, 1980, and 1981 were found to record higher concentrations than the filters used in 1978 and 1982. Therefore, although the air quality values for the years 1979-1981 are probably biased high, the decreasing trend between 1978 and 1982 is valid.

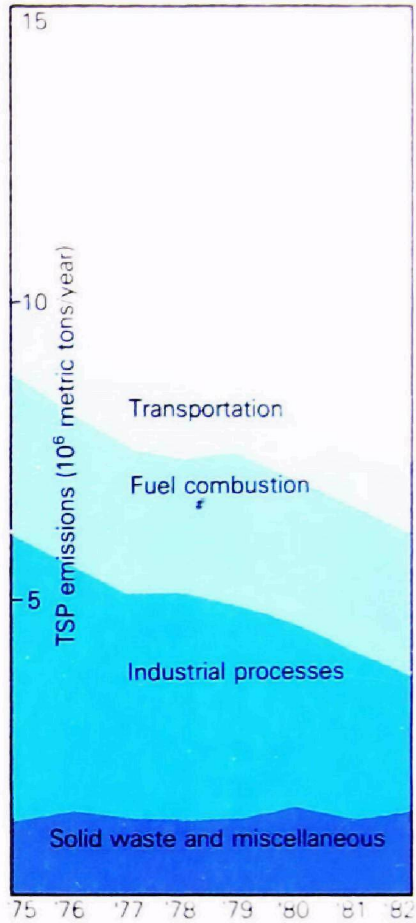
The air quality improvement between 1978 and 1982 is due not only to reductions in particulate emissions, but also to more favorable meteorology in 1982. An analysis of meteorological conditions for 1982 indicated that lower TSP concentrations may have been caused in part by abnormally high precipitation.

Particulate emissions declined between 1975 and 1982 primarily because of reductions in industrial emissions nationwide. This was attributed both to the installation of control equipment for industrial processes and to reduced industrial productivity. Also contributing to lower emissions were reduced coal burning by non-utility users, the installation of pollution control equipment by electric utilities that burn coal, and a decrease in the burning of solid wastes.

All regions of the country showed lower average particulate concentration in 1982 than in 1975. The areas with the largest decreases included parts of the Northeast, the Great Lakes area, and Pacific Coast states.







National Trend in Average Particulate Concentrations 1975-1982

(Graph A)

This graph shows year-by-year changes in average ambient particulate concentrations between 1975 and 1982 based on measurements taken at 1768 monitoring stations throughout the country. These showed a decline of 15 percent in the 8-year period.

The major reductions were due to the placing of emission controls on particulate sources such as fuel combustion, solid waste disposal operations, and industrial processes. Meteorological conditions may also have accounted for some of the reductions that were recorded.

National Trend in Particulate Emissions 1975-1982

(Graph B)

The 27 percent reduction in particulate emissions from 1975 to 1982 is rooted in reductions of industrial emissions from the installation of control processes, and from reduced industrial productivity. Declining coal consumption by non- utility users, the installation of control equipment by electric utilities that burn coal and a decrease in the burning of solid wastes, all caused further reductions.

Ozone

Sources and Nature of the Pollutant

Unlike the other pollutants described in this report, ozone is not emitted directly by specific sources. Instead, it is formed in the air by chemical reactions between nitrogen oxides and volatile organic compounds. These come from sources such as: (1) vapors of gasoline; (2) chemical solvents; and (3) combustion products of various fuels.

Since these reactions are stimulated by sunlight, ozone reaches peak levels in most parts of the country during the summer. This type of pollution first gained public attention in the 1940's as Los Angeles "smog." It has long been a major air pollution problem in that city as well as in most major metropolitan areas of the United States. These areas have abundant sunlight and high emissions from motor vehicle traffic — a major source of volatile organic compounds and nitrogen oxides.

Ozone has become increasingly important in most major urban areas in subsequent years as motor vehicle traffic has increased.

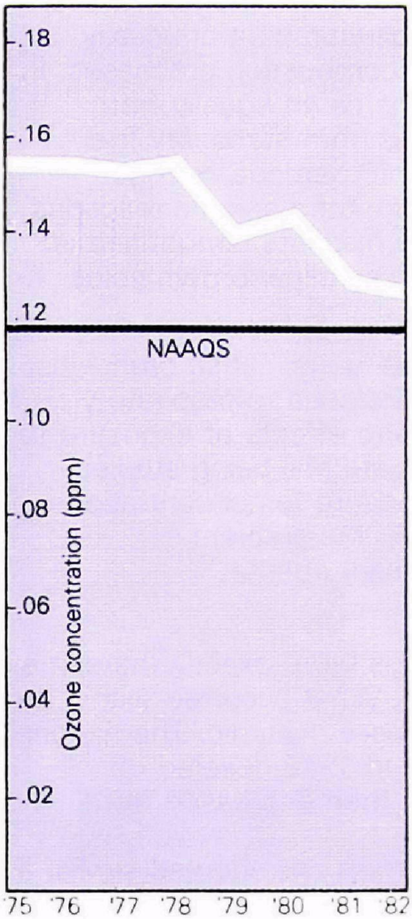
Health Effects

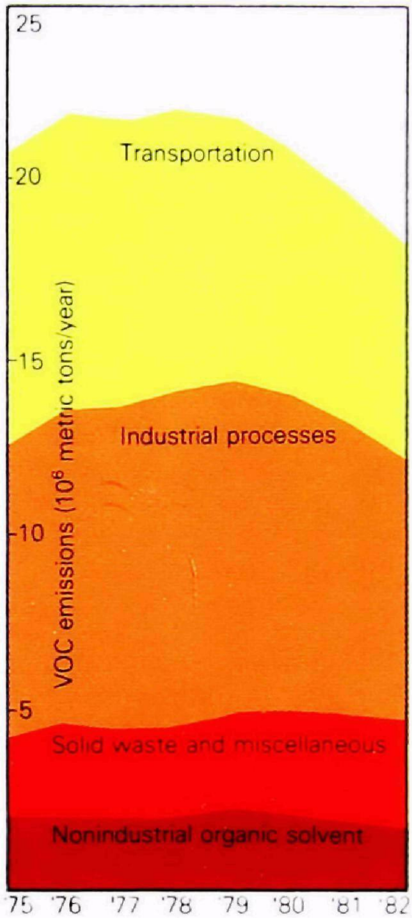
Ozone, the main constituent of photochemical oxidants, and peroxyacyl nitrates are associated with a number of health effects in humans. Peroxyacyl nitrates and other chemicals, such as aldehydes, cause the eye irritation that is characteristic of photochemical pollution.

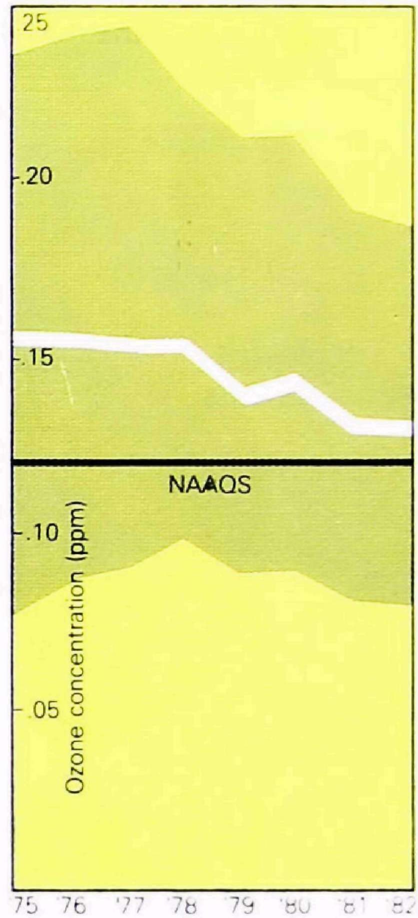
Ozone severely irritates the mucous membranes of the nose and throat. It impairs normal functioning of the lungs and reduces the ability to perform physical exercise. Its effects are more severe in individuals with chronic lung disease. The length of exposure, frequency of exposure, and ozone concentration are significant factors in determining the effects. Individuals with asthma or diseases of the heart and circulatory system experience symptoms at lower ozone concentrations. It also appears that ozone in combination with sulfur dioxide has a greater effect on respiratory function than either pollutant alone.

Ozone Trends

Measurements of ozone concentrations nationwide showed an 18 percent decrease between 1975 and 1982. The reduction is due to a combination of decreasing emissions from volatile organic compounds and a change which occurred in the calibration procedures at the monitoring sites between 1978 and 1979.







National Trend in Oxone Concentrations 1975-1982
(Graph A)
This graph compares the year-by-year changes in ozone concentration at 193 sites between 1975 and 1982. There was an average decrease of 18 percent in ozone concentrations at all sites during the 8-year period. The pattern, however, shows fairly consistent levels from 1975 through 1978, followed by a rather sharp drop between 1978 and 1979 due principally to a change in the calibration procedure, and more modest decreases after 1979.

National Trend in Emissions of Volatile Organic Compounds 1975-1982
(Graph B)
Volatile organic compound emissions decreased 13 percent in the 8-year time period of this report. The most significant feature is the decline from transportation sources despite a 20 percent national increase in vehicle miles travelled.

While emissions from industrial processes were about the same in 1982 as they were in 1975, there was a decline beginning in 1979 following modest increases between 1975 and 1978.

One conclusion is abundantly clear from these data. Federal standards limiting vehicle emissions have been the major factor accounting for the decline in volatile organic compounds emissions.

National Violation Trends for Ozone, 1975-1982
(Graph C)
Reduced ozone emissions and ozone levels nationally caused a sharp reduction in the average number of days that standards were violated at the 193 monitoring sites. Thee was an average decline of about 50 percent from slightly under 14 days in 1975 to about 7 days in 1982.

Nitrogen Dioxide

Sources and Nature of the Pollutant

Nitrogen dioxide is one of a family of nitrogen oxides. The oxides important to air pollution control usually come from high temperature combustion processes. In 1982, nitrogen oxide emissions came equally from transportation, 48 percent, and from stationary fuel combustion sources, another 48 percent. Nitrogen dioxide plays a major role in the atmospheric reactions which produce photochemical oxidants (smog) and is primarily responsible for smog's yellow-brown color.

Health Effects

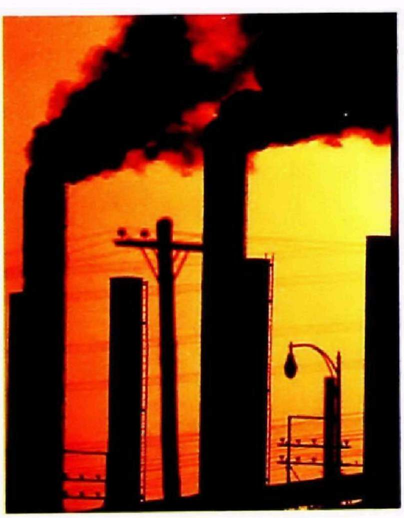
Nitrogen oxides can irritate the lungs, cause bronchitis and pneumonia, and lower resistance to respiratory infections such as influenza. The effects of exposure to the pollutant for short periods are still being studied, but continued or frequent exposure to concentrations higher than have been found in the ambient atmosphere can cause pulmonary edema.

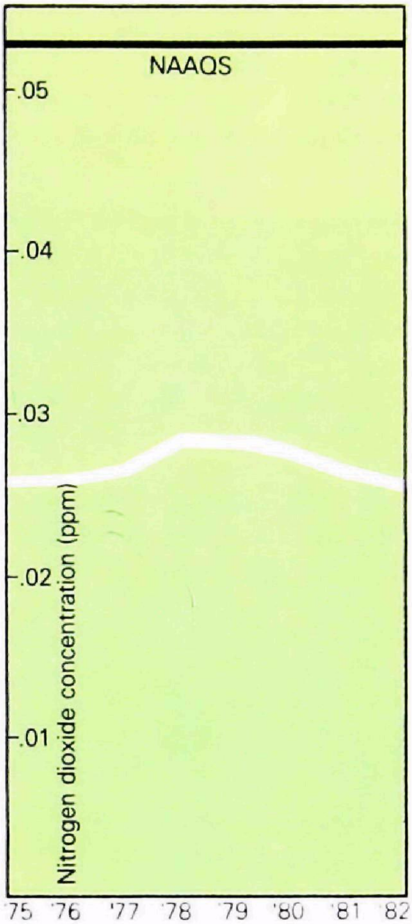
Nitrogen Dioxide Trends

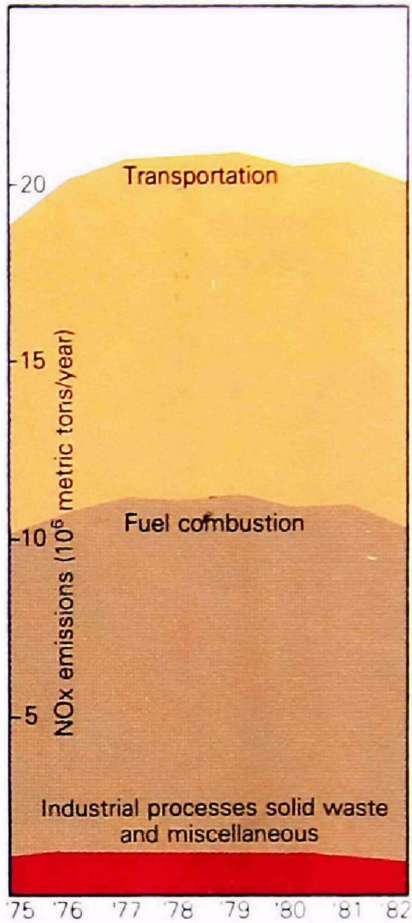
Nitrogen dioxide concentrations were exactly the same in 1982 as they were in 1975. What occurred within the time period, however, is far more dynamic. The national average increased from 1975 to 1978, leveled off between 1978 and 1979, and then decreased from 1979 to 1982.

Estimated nitrogen oxide emissions showed similar if somewhat more modest variation during the same time period. It is interesting to note that the relative trends in nitrogen oxide emissions from transportation, industrial processes, solid waste, and miscellaneous sources closely paralleled one another over the 8-year period.

While there was a slight increase in emissions from transportation sources, it is negligible and actually somewhat encouraging in view of the 20 percent increase that occurred in vehicle miles travelled nationally.







National Trend in Average Nitrogen Dioxide Concentrations 1975-1982

(Graph A)

The year-by-year changes in average nitrogen dioxide concentrations based on measurements obtained from 276 sites show the increase, levelling off, and decline between 1975 and 1982. In terms of air quality, the average concentrations recorded in 1982 were exactly the same as those in 1975.

The trends in nitrogen dioxide levels correspond closely to emissions trends from transportation and stationary sources which are shown on the next graph.

National Trend in Emissions of Nitrogen Oxides 1975-1982

(Graph B)

Modest increases and subsequently small reductions in estimated nitrogen oxide emissions were recorded from both transportation and stationary sources over the period. These collectively contribute about 95 percent of the emissions of this pollutant. Since vehicle miles travelled increased 20 percent, it is clear that reductions occurred when measured in terms of emissions per vehicle mile travelled. During the same period, industrial process emissions rose very slightly while solid waste, industrial processes, and miscellaneous emissions decreased.

Sulfur Dioxide

Sources and Nature of the Pollutant

Sulfur dioxide is one of a number of sulfur- containing compounds found in the atmosphere. It enters the air primarily from the burning of coal and oil, and from various other industrial processes.

Health Effects

Studies of serious air pollution episodes have found an increase in death rates among people with existing heart and lung disease when high concentrations of sulfur dioxide are present in combination with high concentrations of total suspended particulate matter (see next section). A noticeable increase in acute and chronic respiratory diseases can also occur at lower levels.

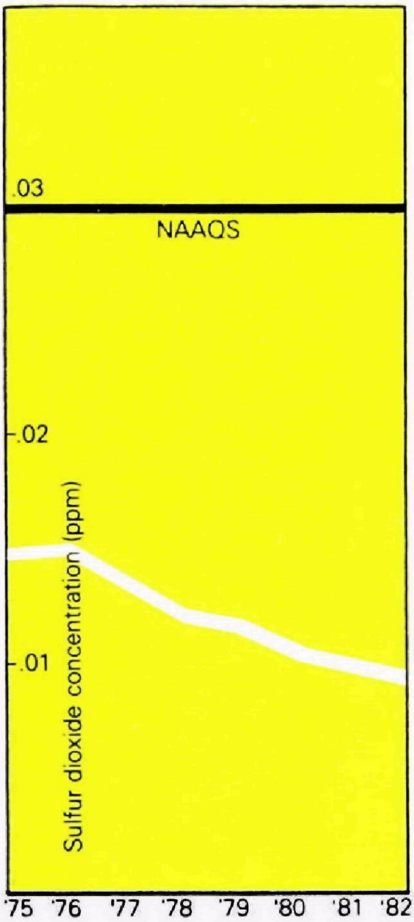
Sulfur dioxide reacts in the atmosphere to form other compound such as sulfuric acid, sulfates, and sulfites. These may be even more irritating to the respiratory system than sulfur dioxide itself. Not enough is known about these pollutants at present to permit EPA to take any specific regulatory steps other than controlling sulfur dioxide, which generally lowers the concentrations of other sulfur compounds.

Sulfur Dioxide Trends

Concentration of sulfur dioxide in the air decreased by 33 percent between 1975 and 1982. Declines occurred in all regions except for parts of the southwestern United States.

Sulfur oxides are emitted mainly by electric utilities that burn coal or oil. Emissions decreases were mainly due to the installation of controls at coal- fired electric generating stations and by reductions in the average sulfur content of fuels consumed. Emissions from other sources also declined from decreased combustion of coal and from emissions controls on nonferrous smelters and sulfuric acid manufacturing plants.

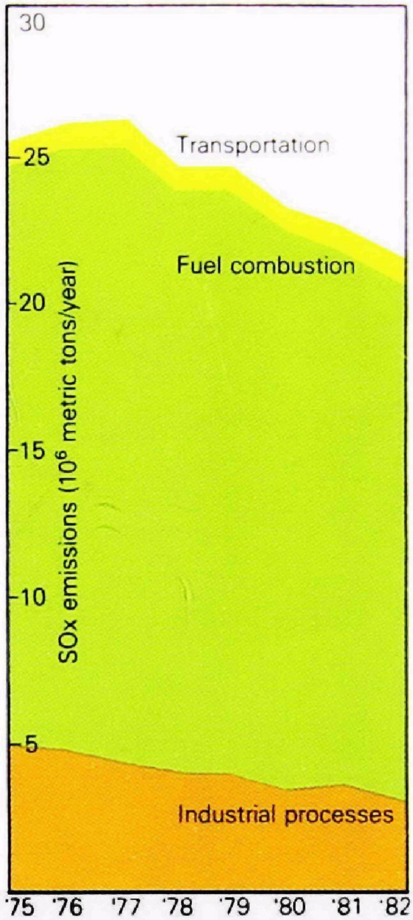
Nationally, the sulfur dioxide problem has diminished to the point that air quality standards appear to have been achieved at almost all sites. In an effort to curb imports of oil from foreign countries, programs are underway for converting power plants from oil to coal. These changes could increase future levels of sulfur dioxide, although the effects should be mitigated by the installation of emissions controls and by fuel conservation measures.



National Trend in Sulfur Dioxide Concentrations, 1975-1982

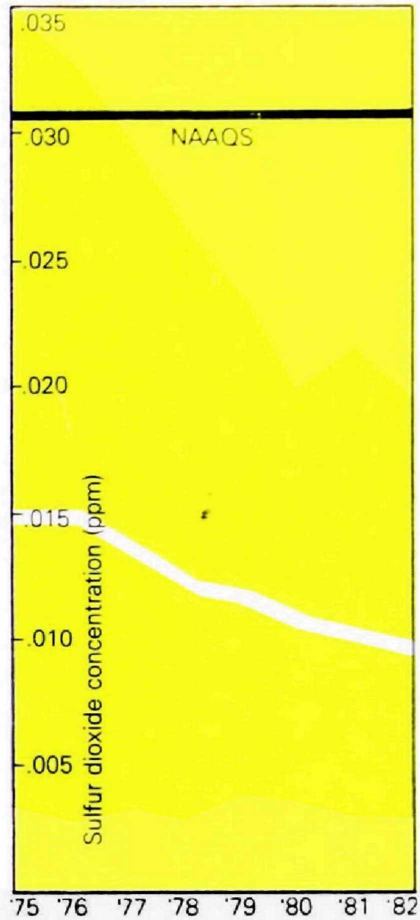
(Graph A)
Nationally, annual average sulfur dioxide concentrations, measured at 351 sites, declined about 33 percent between 1975 and 1982.

The improvement in air quality during this period was due mainly to: (1) a reduction in the average sulfur content of fuels consumed: (2) the installation of flue gas control equipment at coal-fired electric generating stations; (3) reduced emissions from industrial processing facilities such as smelters and sulfuric acid manufacturing plants; and (4) the use of cleaner fuels in the residential and commercial areas.



National Trend in Emissions of Sulfur Oxides, 1975-1982

(Graph B)
Sulfur oxide emissions declined 17 percent from 1975 to 1982. The difference between trends in estimated emissions and trends in ambient concentration arises because the use of high sulfur fuels has shifted from power plants in urban areas, where most of sulfur dioxide monitors are located, to power plants in rural areas with fewer monitoring stations. Further, the residential and commercial areas, where the monitors are located, have shown sulfur oxide emissions decreases comparable to improvements in sulfur dioxide air quality. These decreases in sulfur oxide emissions are due to a combination of energy conservation measures and the use of low sulfur fuels in these areas.



National Violation Trends for Sulfur Dioxide 1975-1982

(Graph C)
The estimated average number of days that sulfur dioxide standards were violated also declined at the 351 monitoring sites between 1975 to 0.17 of a day in 1982. This is about a 93 percent decrease.