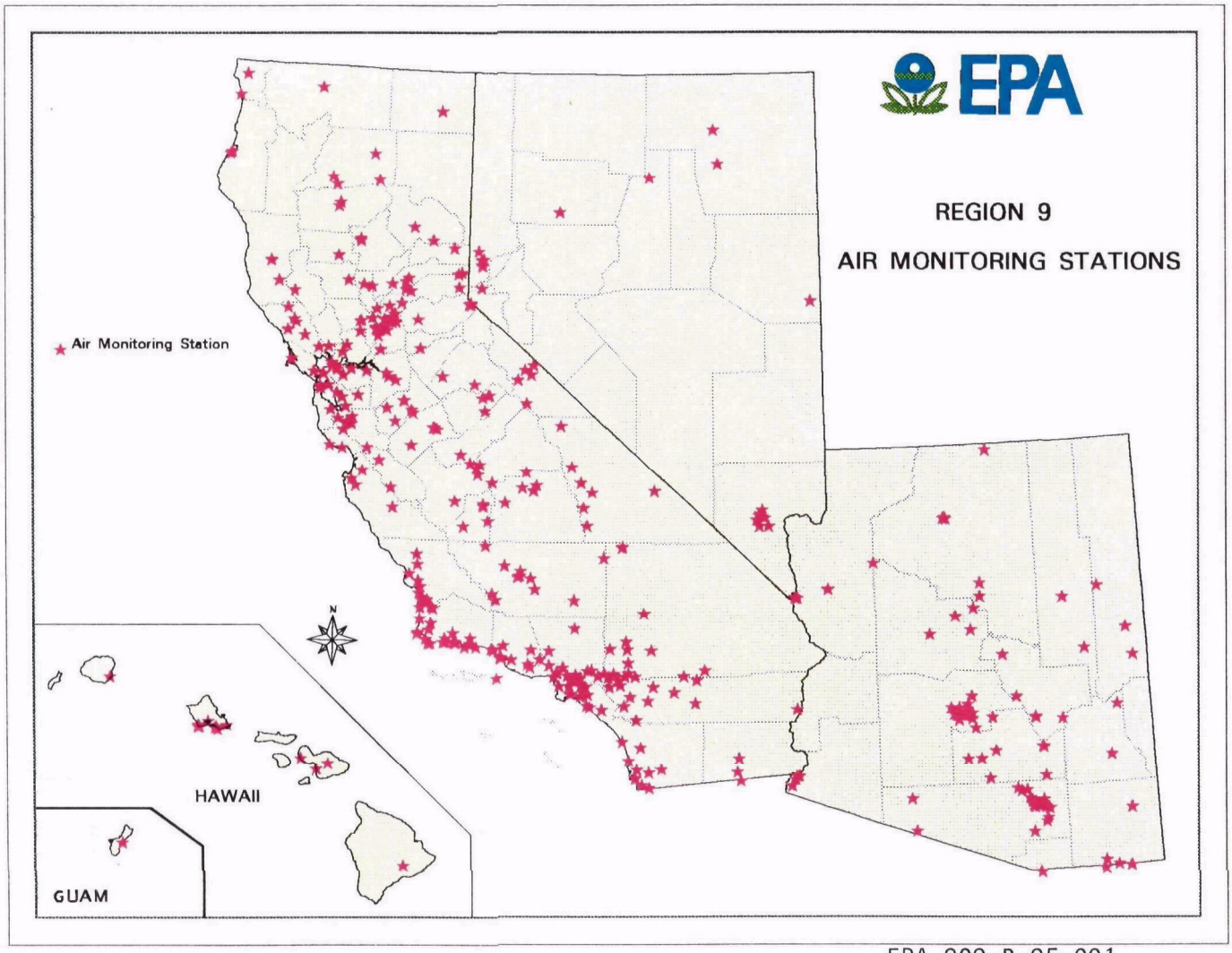
BREATHING EASIER:
A REPORT ON AIR QUALITY
IN CALIFORNIA, ARIZONA, NEVADA & HAWAII

May 1995

U.S. ENVIRONMENTAL PROTECTION AGENCY, REGION 9



EPA 909-R-95-001
MAY 1995

BREATHING EASIER:

A REPORT ON AIR QUALITY
IN CALIFORNIA, ARIZONA, NEVADA & HAWAII

May 1995

Prepared By:

U.S. Environmental Protection Agency
Region 9
Air and Toxics Division

75 Hawthorne Street (A-2-4)
San Francisco, CA 94105

Table of Contents

EXECUTIVE SUMMARY ES-1
INTRODUCTION i
OZONE 1-1
PARTICULATE MATTER 2-1
CARBON MONOXIDE 3-1
NITROGEN DIOXIDE 4-1
SULFUR DIOXIDE 5-1
LEAD 6-1

EXECUTIVE SUMMARY

WE'RE BREATHING EASIER:

A DECADE OF PROGRESS TOWARD CLEANER AIR IN THE WESTERN STATES

There has been a substantial improvement in air quality in U.S. EPA's western region -- California, Arizona, Nevada, and Hawaii -- over the last ten years. Despite an increase in auto travel of almost 50% over the past decade, air pollutant levels have decreased overall by about one-third. Both the number of days on which air pollution has exceeded federal air quality standards, and the air pollutant concentration levels have decreased for the six major air pollutants targeted for reduction under the federal Clean Air Act.

Of the six pollutants, the greatest reductions have been recorded for lead (93%), followed by sulfur dioxide (34%), and carbon monoxide (29%). The tremendous reduction in lead levels has resulted mostly from the phase-out of lead in gasoline. Particulate matter, nitrogen dioxide, and smog-forming ground-level ozone present the most serious remaining challenges. However, all six pollutants are being steadily reduced.

Long-Term (1984-93) Air Quality Trends

Ten-year trends show that air quality has improved for ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), and lead (Pb). Although particulate matter (PM_{10}) has only been monitored for six years, levels have decreased during that period.

Changes in air pollutant levels between 1984 and 1993 (the most recent year for which complete data are available) for all long-term monitoring sites in California, Arizona, Nevada, and Hawaii are as follows:

- Lead (Pb): 93% decrease
- Sulfur Dioxide (SO_2): 34% decrease
- Carbon Monoxide (CO): 29% decrease
- Particulate Matter (PM_{10}): 25% decrease
- Ozone (O_3): 18% decrease
- Nitrogen Dioxide (NO_2): 13% decrease

Most Improved Areas

Many of the geographic areas that failed to meet federal air quality standards when the Clean Air Act Amendments were passed in 1990 have improved enough to meet the standards based on data from more recent years (1991, 1992, and 1993). Areas in this "most improved" category, for each of the six pollutants, are:

- Ground-level Ozone (O_3): San Francisco Bay Area and Monterey Bay, California; and Reno, Nevada.

- Particulate Matter (PM_{10}): Sacramento, California; Ajo, Rillito, Payson, Hayden, and Miami, Arizona.

- Carbon Monoxide (CO): San Francisco Bay Area, San Diego, Sacramento, Fresno, Stockton, Modesto, Chico, Lake Tahoe, and Reno.

- Sulfur Dioxide (SO_2): In earlier years, violations had occurred near nonferrous metal (copper) smelters in Arizona, but none have been recorded recently. The only recent violations were from naturally-occurring volcanic emissions at Hawaii Volcanoes National Park.

- Nitrogen Dioxide (NO_2): The only violation of the standard was in the South Coast Air Basin (Los Angeles Area) in 1991. That area met the standard in 1992 and 1993.

- Lead (Pb): All areas met the federal standard.

WHERE PROBLEMS REMAIN

- Ground-level ozone (O_3) violations were recorded in most of Southern California, the San Joaquin Valley, the Sacramento Area, and Phoenix.

- Particulate matter (PM_{10}) violations were recorded in the South Coast Air Basin, Southeast Desert, Great Basin Valley, San Joaquin Valley, Reno, Las Vegas, Phoenix and some rural areas in Arizona.

- Carbon monoxide (CO) violations occurred in the South Coast Air Basin, Phoenix, and Las Vegas.

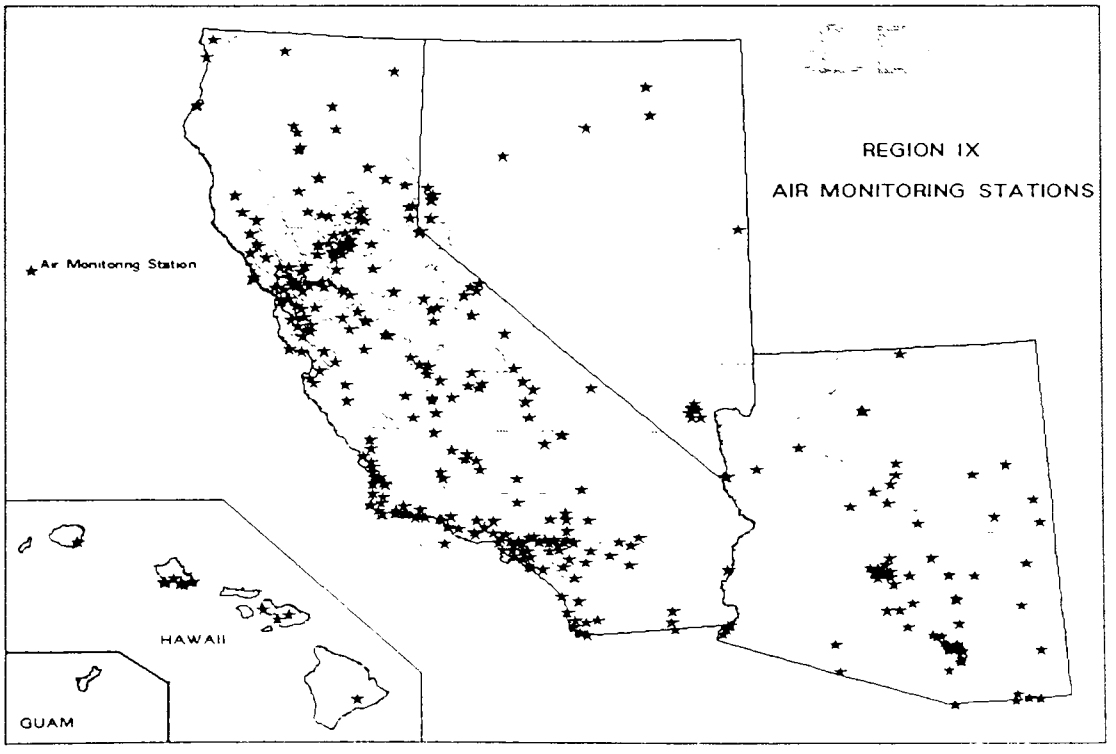


Figure ESa - Air Monitoring Stations, 1991-1993.

INTRODUCTION

This report presents the last ten years' air quality information for areas within EPA Region 9, consisting of Arizona, California, Hawaii, Nevada, and the Pacific Islands. Current air quality (through 1993) and ten-year trends are presented for the six air pollutants for which National Ambient Air Quality Standards (NAAQS) have been developed. These air pollutants are carbon monoxide (CO), ozone (O_3), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), lead (Pb), and particulate matter with aerodynamic size of 10 microns or less (PM_{10}). The Federal standards are presented in Table 1. State air quality standards may differ from the NAAQS.

The air quality data for this report were collected from several hundred monitoring sites throughout Region 9 by local, state, and Federal agencies and private organizations. Most of the data are stored on EPA's Aerometric Information Retrieval Systems (AIRS) data base. The data, analysis methods, and emissions estimates used in this report are taken from EPA's annual "National Air Quality and Emissions Trends Report", but are tailored specifically to EPA Region 9. The reader may refer to that document for technical details and for air quality information about areas outside of Region 9.

The information presented here is organized by pollutant and is intended to show general air quality and trends for some areas in Region 9 and for the Region as a whole. In most cases, air quality information is not presented for individual monitors.

POLLUTANT	PRIMARY (HEALTH RELATED)		SECONDARY (WELFARE RELATED)	
	Type of Average	Standard Level Concentration	Type of Average	Standard Level Concentration
O3	Max. Daily 1-hour Avg	0.12 ppm (235 µg/m3)	Same as Primary Standard	
PM-10	Annual Mean	50 µg/m3	Same as Primary Standard	
	24-hour	150 µg/m3	Same as Primary Standard	
CO	8-hour	9 ppm (10 mg/m3)	No Secondary Standard	
	1-hour	35 ppm (40 mg/m3)	No Secondary Standard	
NO2	Annual Mean	0.053 ppm (100 µg/m3)	Same as Primary Standard	
SO2	Annual Mean	80 µg/m3 (0.03 ppm)	3-hour	1300 µg/m3 (0.50 ppm)
	24-hour	366 µg/m3 (0.14 ppm)		
Pb	Max Quarterly Average	1.5 µg/m3	Same as Primary Standard	

ppm = parts per million; ppb = parts per billion;
mg/m3 = milligrams per cubic meter; µg/m3 = micrograms per cubic meter

Table 1

OZONE

BACKGROUND and HEALTH EFFECTS

Ground-level ozone (O_3) is the major component of smog. While ozone in the upper atmosphere benefits life by shielding the earth from the sun's harmful ultraviolet radiation, high concentrations of ozone at ground level are a major health and environmental concern. Ozone is not emitted directly into the air, but is formed through complex chemical reactions between precursor emissions of volatile organic compounds (VOC) and nitrogen oxides (NO_x) in the presence of sunlight. These reactions are stimulated by sunlight and temperature so that peak ozone levels typically occur during the warmer times of the year. Both VOC and NO_x are emitted by motor vehicles and industrial sources.

The reactivity of ozone causes health problems because it damages lung tissue, reduces lung function, and sensitizes the lungs to other irritants. Scientific evidence indicates that ambient levels of ozone not only affect people with impaired respiratory systems, such as asthmatics, but healthy adults and children as well. Exposure to ozone for several hours at relatively low concentrations has been found to reduce lung function significantly in normal, healthy people during exercise. This decrease in lung function generally is accompanied by symptoms including chest pain, coughing, sneezing, and pulmonary congestion. Ozone also damages agricultural crops and forests.

The national health standard for O_3 is defined in terms of the daily highest (1-hour average) concentration. Ambient O_3 concentrations should not exceed 120 ppb more than one day per year, based on a three-year average.

RECENT OZONE AIR QUALITY IN REGION 9

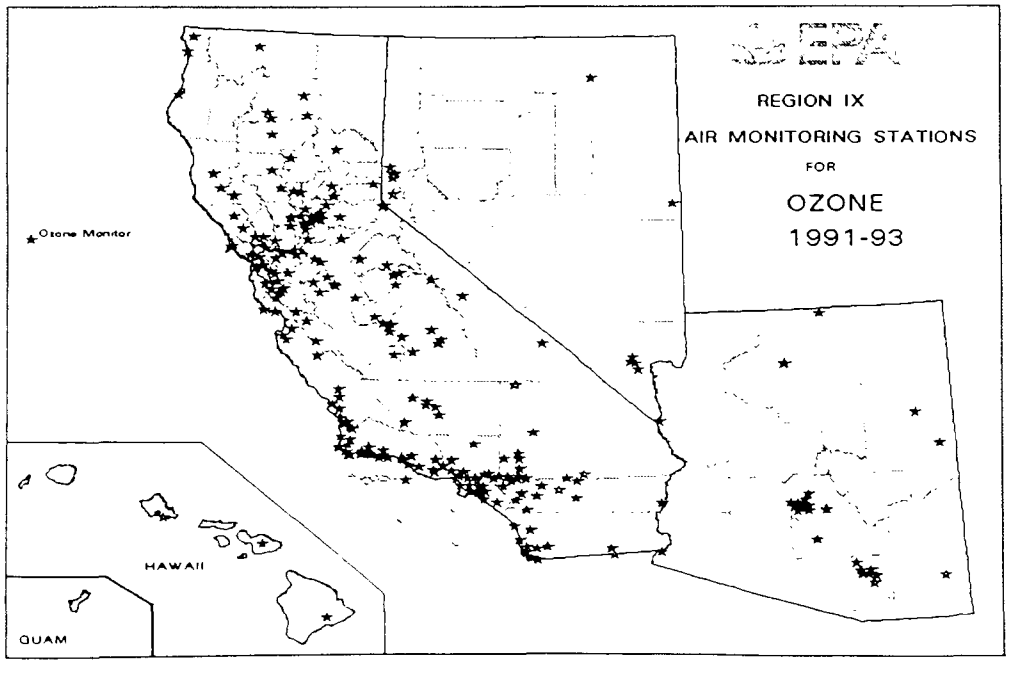


Figure 1a

For the three-year period 1991-93, O_3 was monitored at 252 sites in Region 9. Figure 1a shows the geographic distribution of O_3 monitors throughout the Region. In general, more monitors are located in or near urban areas than in rural areas.

The 81 monitoring stations

where ozone pollution exceeded the NAAQS during 1991-93 are shown on the map in Figure 1b as the vertical "spikes". The height of each spike is proportional to the number of days per year that the NAAQS was exceeded. The most serious O_3 problem in the Region (and in the nation) is in the South Coast Air Basin (Los Angeles area). Other areas that violated the O_3 NAAQS include San Diego and Ventura counties, the California Southeast Desert, San Joaquin Valley, Sacramento, and Phoenix.

LONG-TERM OZONE TRENDS: 1984-93

With respect to ozone, air quality has improved over the last ten years in most areas of Region 9. For the Region as a whole, there were 124 long-term monitors that operated for the ten-year period. These monitors, as a group, showed an 18% decrease in O_3 concentrations between 1984 and 1993 (based on the second highest daily 1-hour maximum concentration). This compares to a 12% decrease at 532 sites nationwide.

Figure 1c shows the number of days that the O_3 Stage 1 ("smog alert") level of 200 ppb was reached in the six most serious O_3 pollution areas of Region 9. Ozone air quality measured by this air quality indicator has improved gradually over the last ten years. The South Coast had 97 Stage 1 days in 1984 compared to 23 in 1993. Likewise, the Southeast Desert has improved from a high of 18 Stage 1 days in 1986 to one day in 1993. Stage 1 days have not occurred at all in the other four areas in several years.

Figure 1d shows the number of days in which ozone levels exceeded the O_3 standard of 120 ppb for each of the last 10 years in various areas of the Region. Note that the number of days is a "basin-wide" composite from all O_3 monitors in an air basin. It represents the number of days during the year that the O_3 standard was exceeded at one or more monitors.

The largest reduction in ozone pollution has been in the California South Coast Air Basin. The standard was exceeded in the Basin on 179 days at its worst in 1984. In 1993, it was exceeded on only 124 days. The second-largest improvement occurred in the California Southeast Desert area, where the number of exceedances decreased from 123 days in 1988 to 76 days in 1993.

The trend toward fewer days above the O_3 NAAQS and Stage 1 smog alert level has been accompanied by a trend in lower O_3 concentrations. Peak O_3 concentrations in each area of Region 9 that had several long-term monitors showed improving air quality. The percent decreases in peak O_3 concentration between 1984 and 1993 were as follows:

% Decrease In Peak Concentration	Area
27%	South Coast
20%	San Francisco Bay Area
20%	Ventura County
19%	Southeast Desert
18%	Sacramento - Metro
16%	San Diego County
13%	San Joaquin Valley
10%	Santa Barbara Co.
6%	Phoenix

The South Coast Air Basin had the largest decrease in peak O_3 concentrations. There were 25 long-term O_3 monitors in the South Coast and the average (second highest daily 1-hour) concentration at those sites decreased from 260 ppb in 1984 to 180 ppb in 1993.

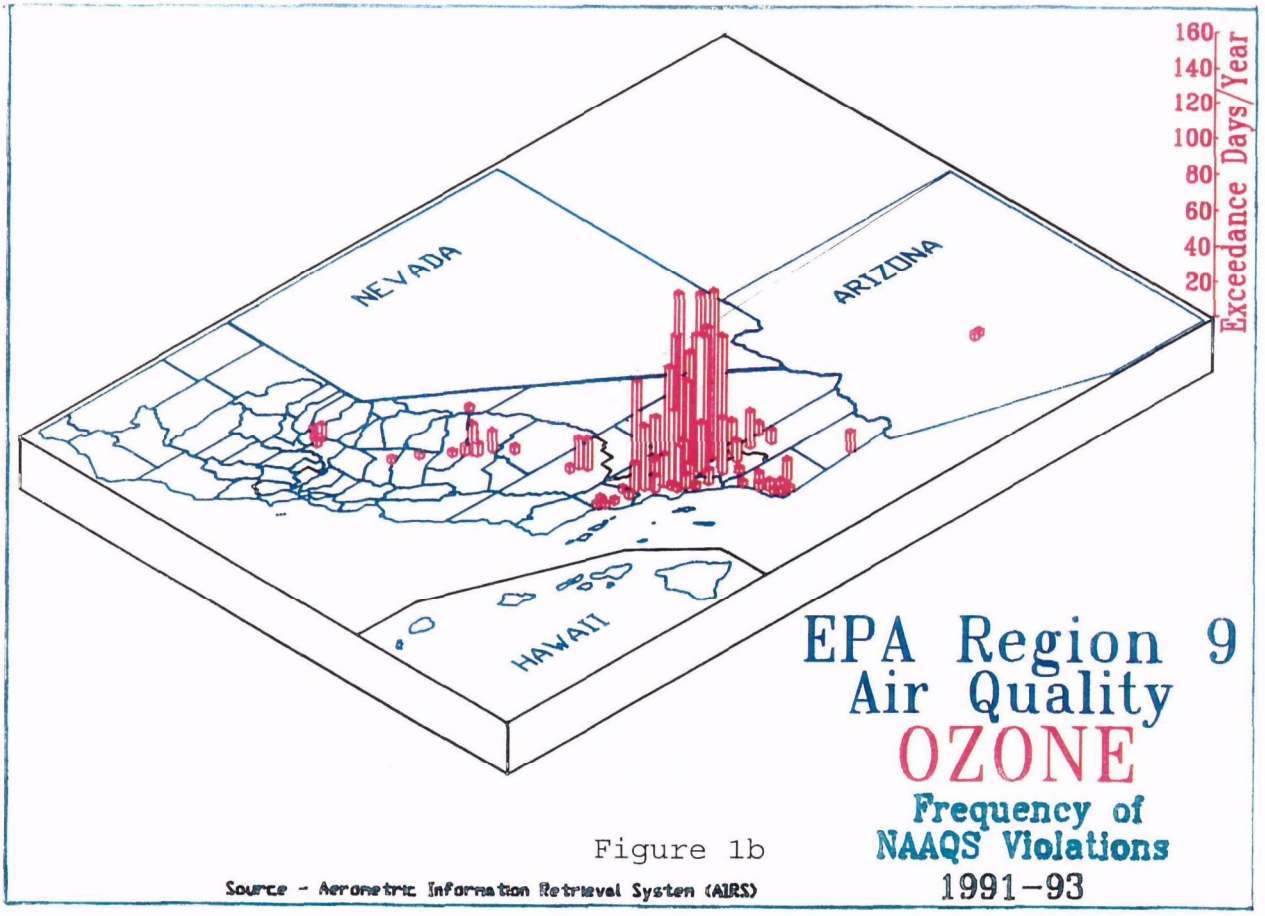


Figure 1b

Air Quality Trends 1984-93

OZONE Stage 1 Days

Number of days O_3 Stage 1 (200 ppb) reached.

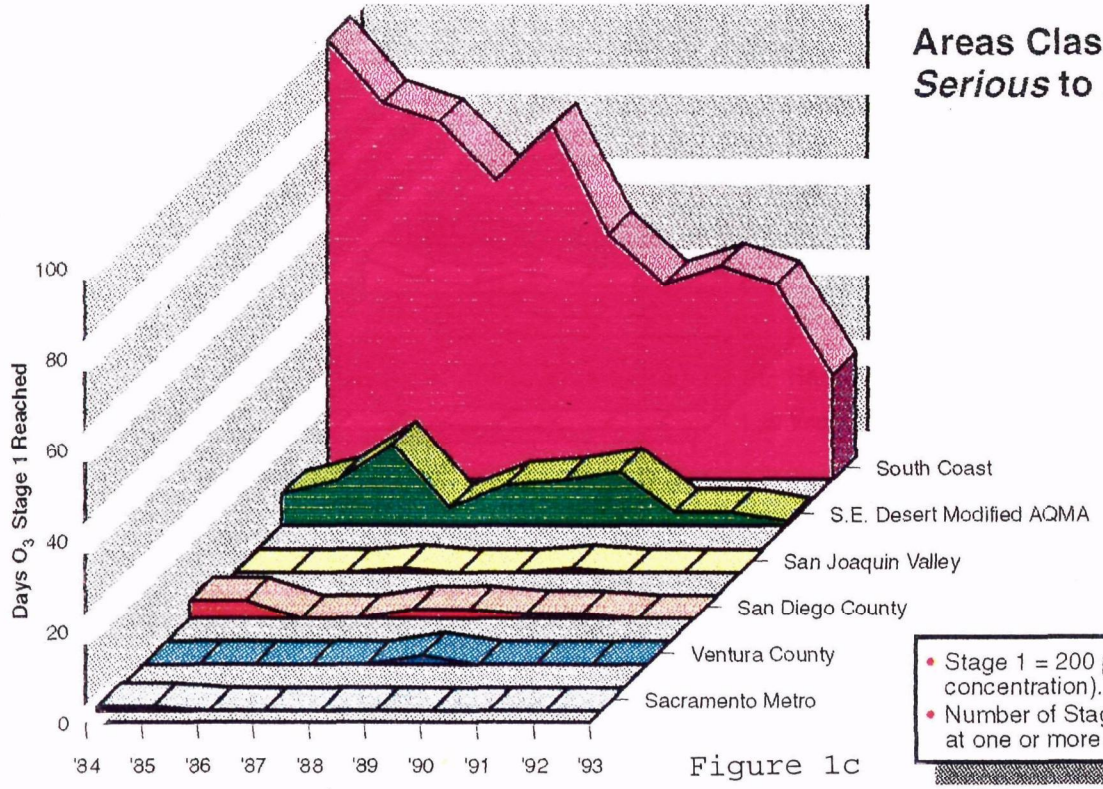
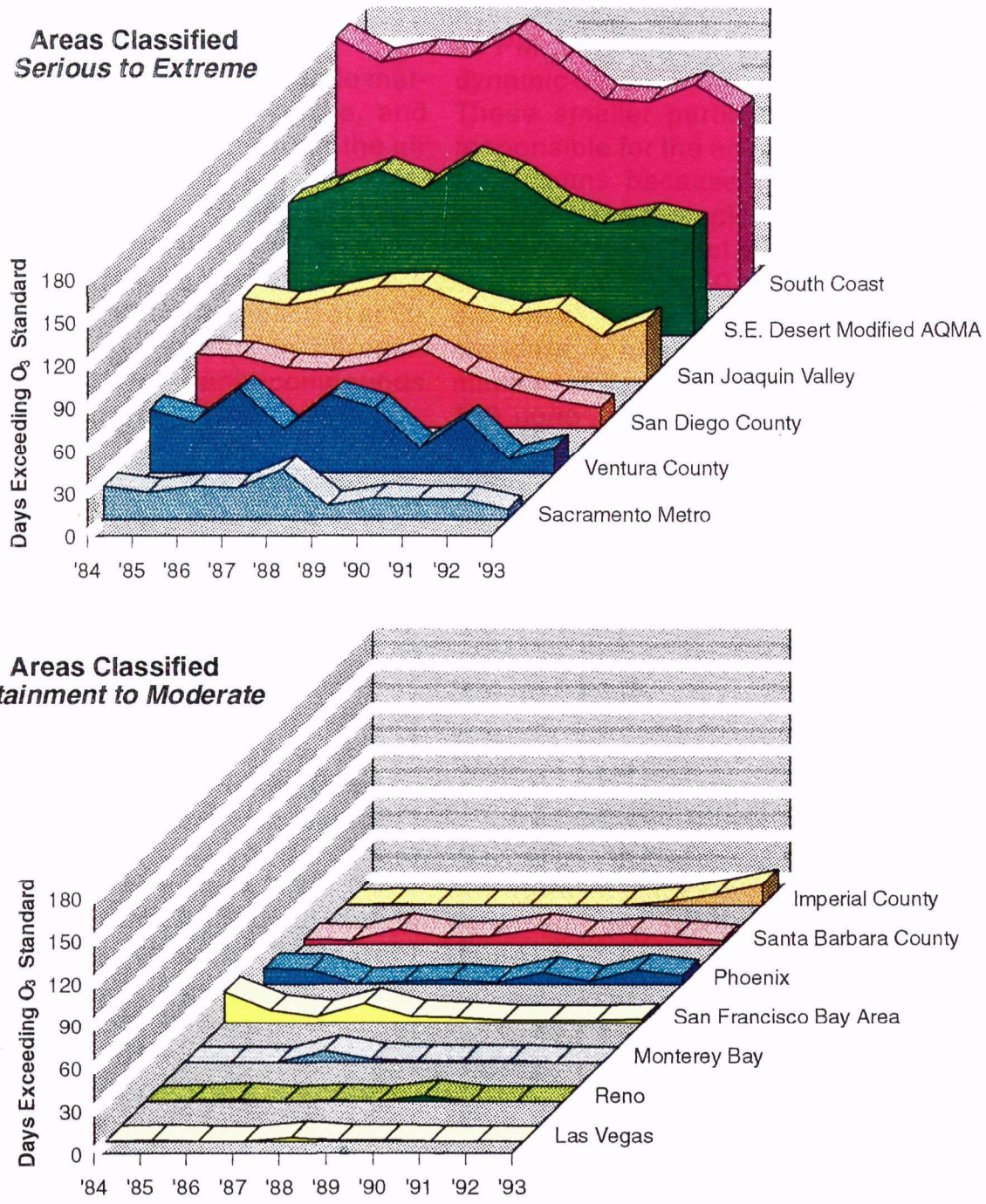


Figure 1c

OZONE Exceedances

Number of days exceeding the O_3 NAAQS.



- Number of days exceeding the NAAQS at one or more locations.
- NAAQS = 120 ppb (1-hour concentration).
- NAAQS = National Ambient Air Quality Standard.

1-23-95

Figure 1d

PARTICULATE MATTER

BACKGROUND and HEALTH EFFECTS

Air pollutants called "particulate matter" include dust, dirt, soot, smoke, and liquid droplets directly emitted into the air by sources such as factories, power plants, transportation sources, construction activity, fires, and windblown dust. Particulates are also formed in the atmosphere by condensation or transformation of emitted gases such as sulfur dioxide, nitrogen oxides, and volatile organic compounds into tiny droplets.

Based on studies of human populations exposed to high concentrations of particles (often in the presence of sulfur dioxide) and on laboratory studies of animals and humans, the major concerns for human health include effects on breathing and respiratory symptoms, aggravation of existing respiratory and cardiovascular disease, alterations in the body's defense systems against foreign materials, damage to lung tissue, carcinogenesis and premature death. The major subgroups of the populations that appear likely to be most sensitive to the effects of particulate matter include individuals with chronic obstructive pulmonary cardiovascular disease, individuals with influenza, asthmatics, the elderly, and children. Particulate matter may injure crops, trees and shrubs, and may cause damage to metal surfaces, fabrics, etc. Fine particulates also impair visibility by scattering light and reducing the visual range in urban, rural, and wilderness areas. The haze caused by fine particles can diminish crop yields by reducing sunlight.

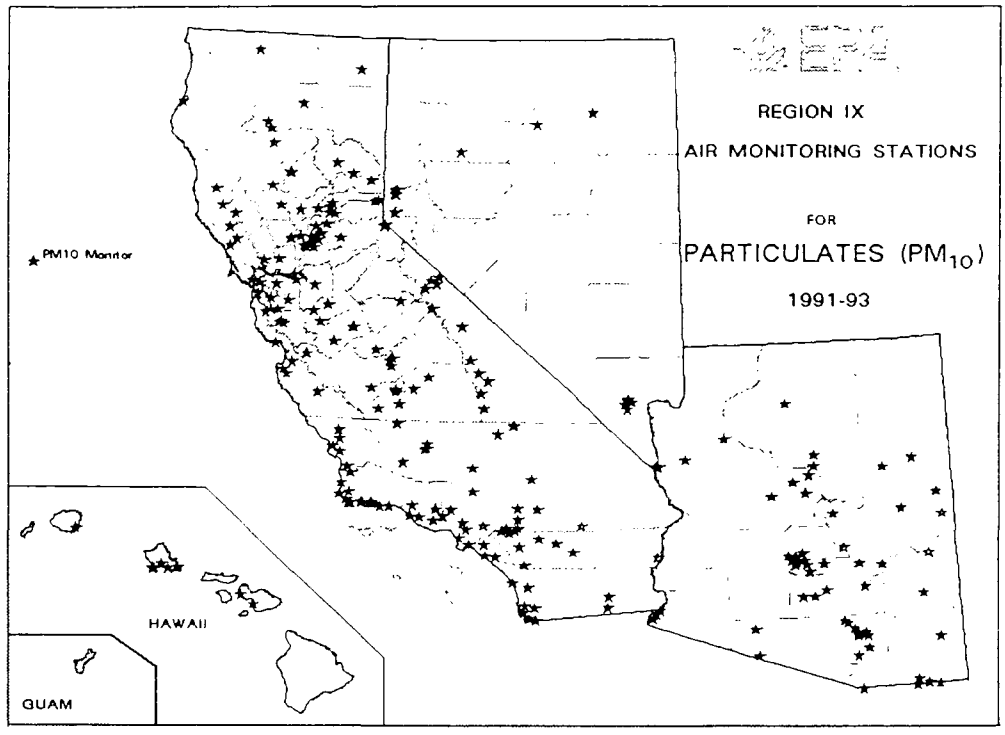
The current NAAQS for particulate matter was established in 1987. The particulate size measurement used, known as PM_{10}, includes particles with an aerodynamic diameter of less than 10 microns. These smaller particles are most likely responsible for the adverse health effects on humans because particles so small can reach the thoracic or lower regions of the respiratory tract. The PM_{10} annual mean standard is 50 micrograms per cubic meter of air ($\mu g/m^3$). The 24-hour standard is attained when the expected number of days per calendar year above 150 $\mu g/m^3$ is no more than one. EPA is currently reviewing recent health effects studies on fine particulates, and may revise the PM_{10} NAAQS to focus on particles smaller than ten microns. In addition, EPA is considering standards for visibility impairment and regional haze, which may be part of the revised PM NAAQS or separate standards.

RECENT PM_{10} AIR QUALITY IN REGION 9

For the three-year period 1991-93, PM_{10} was monitored at 258 sites in Region 9. Figure 2a shows the geographic distribution of PM_{10} monitors throughout the Region.

The 51 PM_{10} sites that violated the NAAQS during 1991-93 are shown on the map in Figure 2b. The "spikes" represent monitors with PM_{10} levels in violation of the annual standard, and the height of each spike shows the annual mean concentration for the site. The triangles on the map show monitors that attained the annual standard but exceeded the 24-hour standard. The more serious PM_{10} problem areas in Region 9 are in the South Coast Air Basin (Los Angeles area), San Joaquin Valley, California's Southeast

Figure 2a



Desert and Great Basin Valley, Reno, Las Vegas, Phoenix, and several areas near the Mexican border.

LONG-TERM PM_{10} TRENDS: 1988-93

PM_{10} is the newest NAAQS pollutant to be measured, with data going back only to 1988 in most areas. Overall, PM_{10} annual mean concentrations have decreased by 25% in Region 9, based on 142 monitoring sites operating from 1988 through 1993. This compares to a 20% decrease at 799 sites nationwide.

Figure 2c shows the 6-year PM_{10} changes for 22 areas in Region 9 from 1988 through 1993. For most of the areas, the number of exceedances of the 24-hour standard has decreased over time. For example, the number of exceedances in the San Joaquin Valley decreased from 13 days in 1990 to 4 days in 1993. Likewise, Paul Spur, a town in Arizona, improved from 11 days above the standard in 1989 to none in 1992 and 1993.

Figure 2d shows the trend in PM_{10} concentrations since 1988. For most areas, the annual mean concentration has decreased. The ten areas with the largest percentage reduction in their annual mean concentration are:

% Decrease in Concentration	Area
69%	Rillito, AZ
62%	Payson, AZ
57%	Paul Spur, AZ
50%	Hayden, AZ
46%	Ajo, AZ
45%	Douglas, AZ
44%	San Bernardino Co. (Desert) CA
41%	Owens Valley, CA
39%	Nogales, AZ
38%	Yuma, AZ

California's South Coast Air Basin has the largest long-term PM_{10} monitoring network, with 13 sites, and has shown an overall 32% reduction in annual mean concentrations between 1988 and 1993.

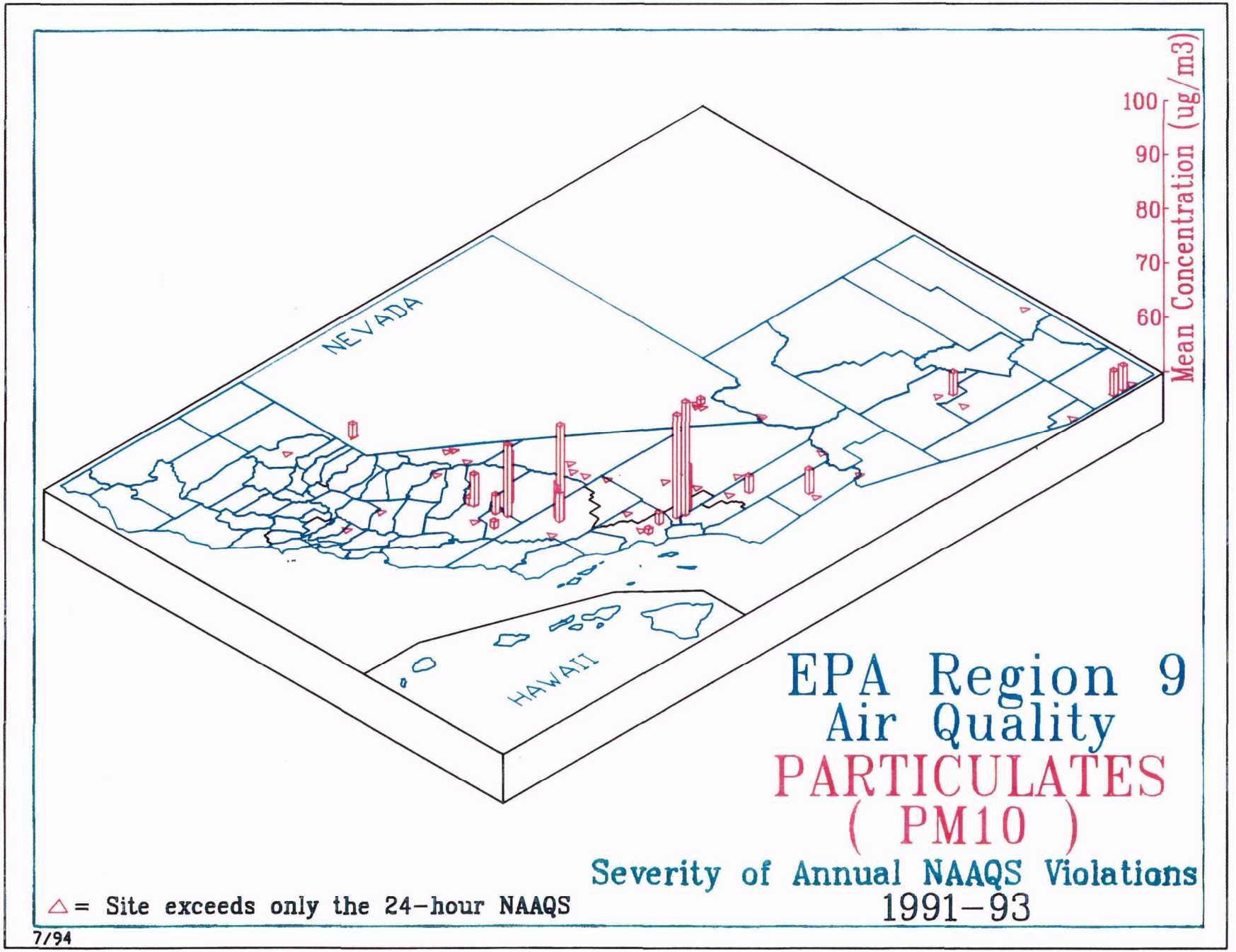

NEVADA
HAWAII
100
90
80
70
60
Mean Concentration (ug/m3)
EPA Region 9
Air Quality
PARTICULATES
(PM10)
Severity of Annual NAAQS Violations
1991–93
△ = Site exceeds only the 24-hour NAAQS
7/94

Figure 2b

PARTICULATE MATTER (PM_{10}) Exceedances

Number of days exceeding the 24-hour PM_{10} NAAQS.

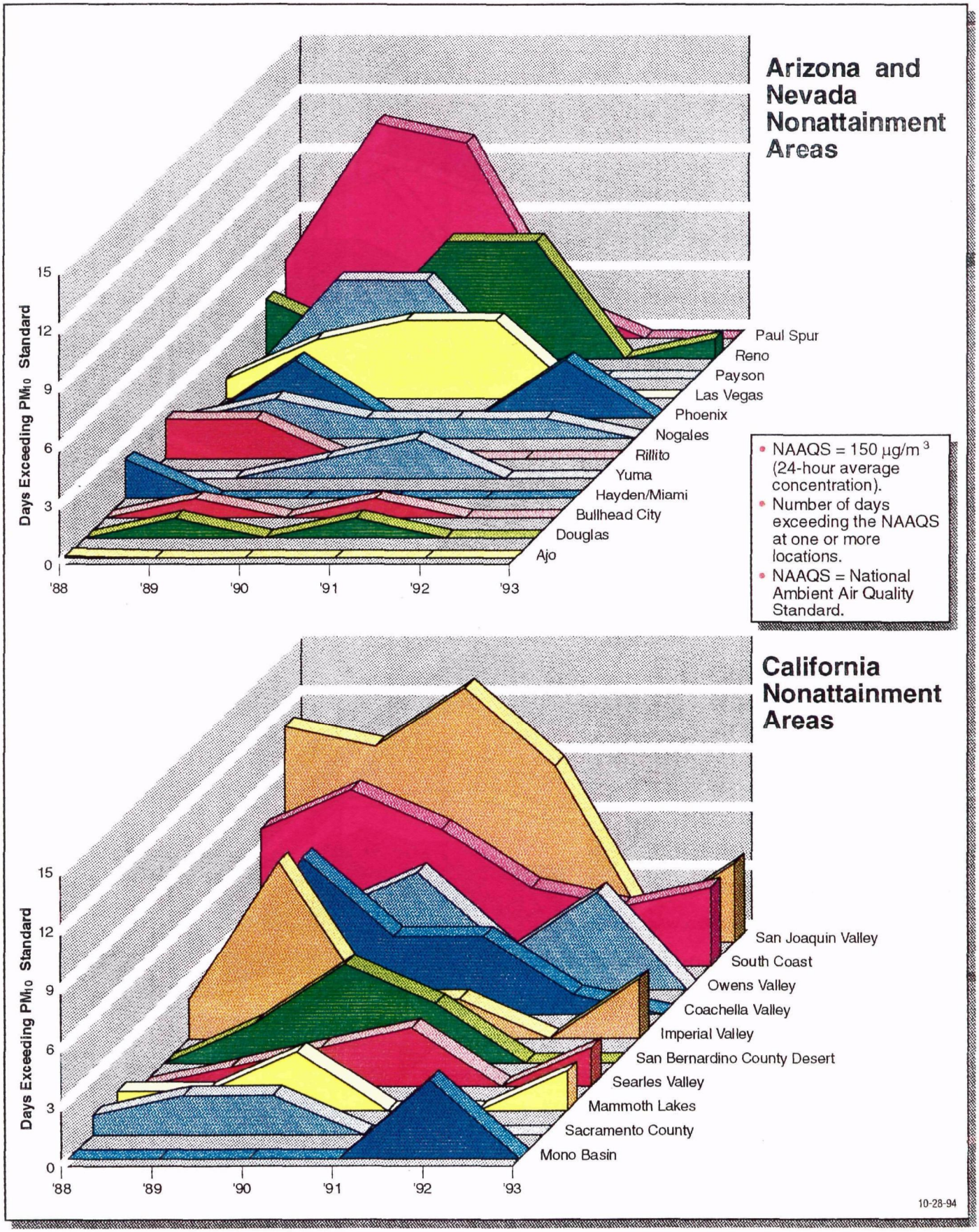


Figure 2c

PARTICULATE MATTER (PM_{10}) Concentrations

Composite annual mean concentrations.

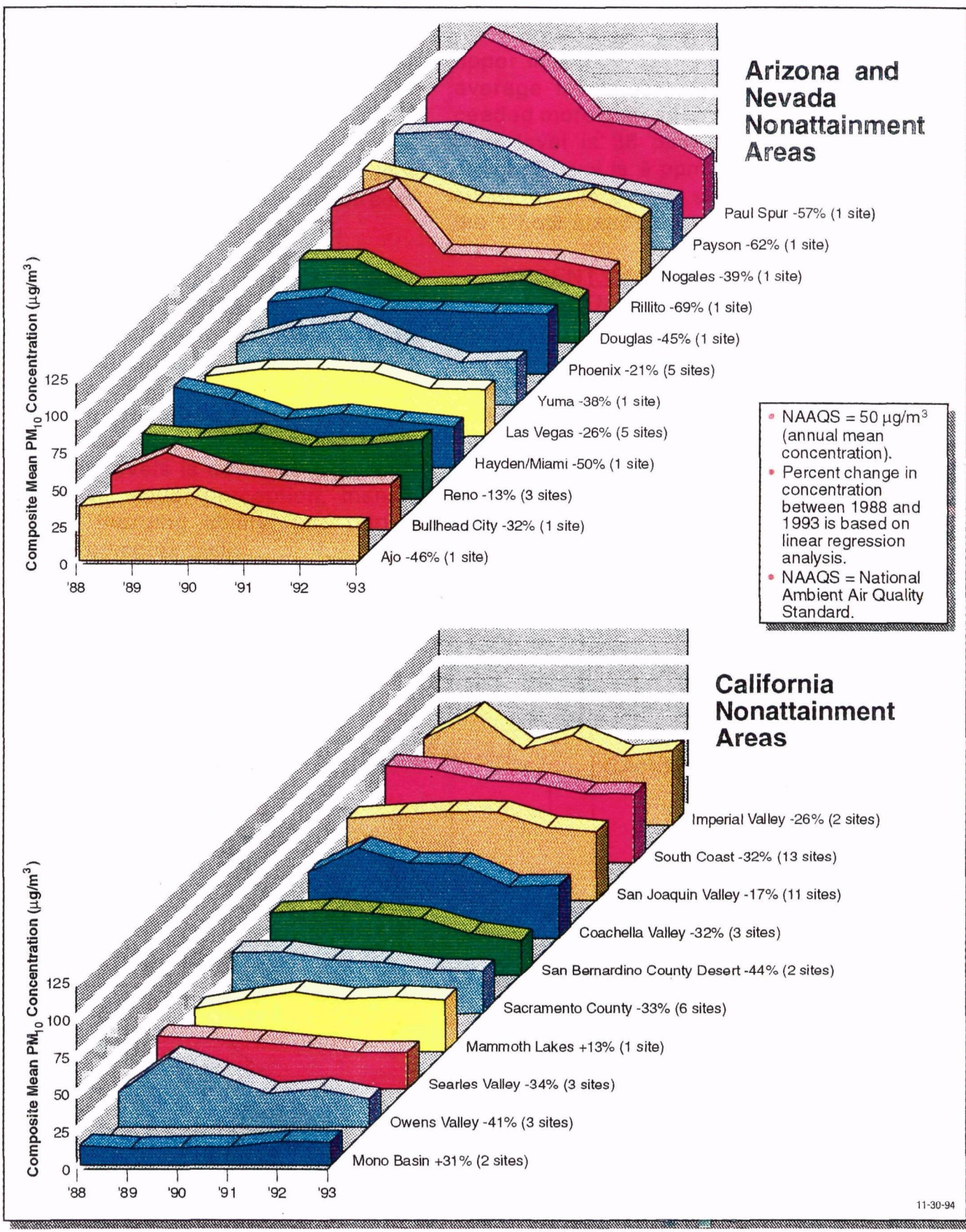


Figure 2d

CARBON MONOXIDE

BACKGROUND and HEALTH EFFECTS

Carbon monoxide (CO) is a colorless, odorless, and poisonous gas produced by incomplete combustion of carbon in fuels. Two-thirds of the nationwide CO emissions are from transportation sources, with the largest contribution coming from highway motor vehicles.

Carbon monoxide enters the bloodstream and reduces the delivery of oxygen to the body's organs and tissues. The health threat is most serious for those who suffer from cardiovascular disease, particularly those with angina or peripheral vascular disease. Exposure to elevated CO levels is associated with impairment of visual perception, manual dexterity, learning ability, and performance of complex tasks.

The NAAQS for ambient CO specify upper limits for both 1-hour and 8-hour average levels that are not to be exceeded more than once per year. The 1-hour level is 35 ppm, and the 8-hour average level is 9 ppm. This report focuses on the 8-hour standard because the 1-hour standard is rarely exceeded.

RECENT CARBON MONOXIDE AIR QUALITY IN REGION 9

For the two-year period 1992-93, CO was monitored at 139 sites in Region 9. Figure 3a shows the geographic distributions of CO monitors throughout the Region. In general, more monitors are located in or near urban areas than in rural areas.

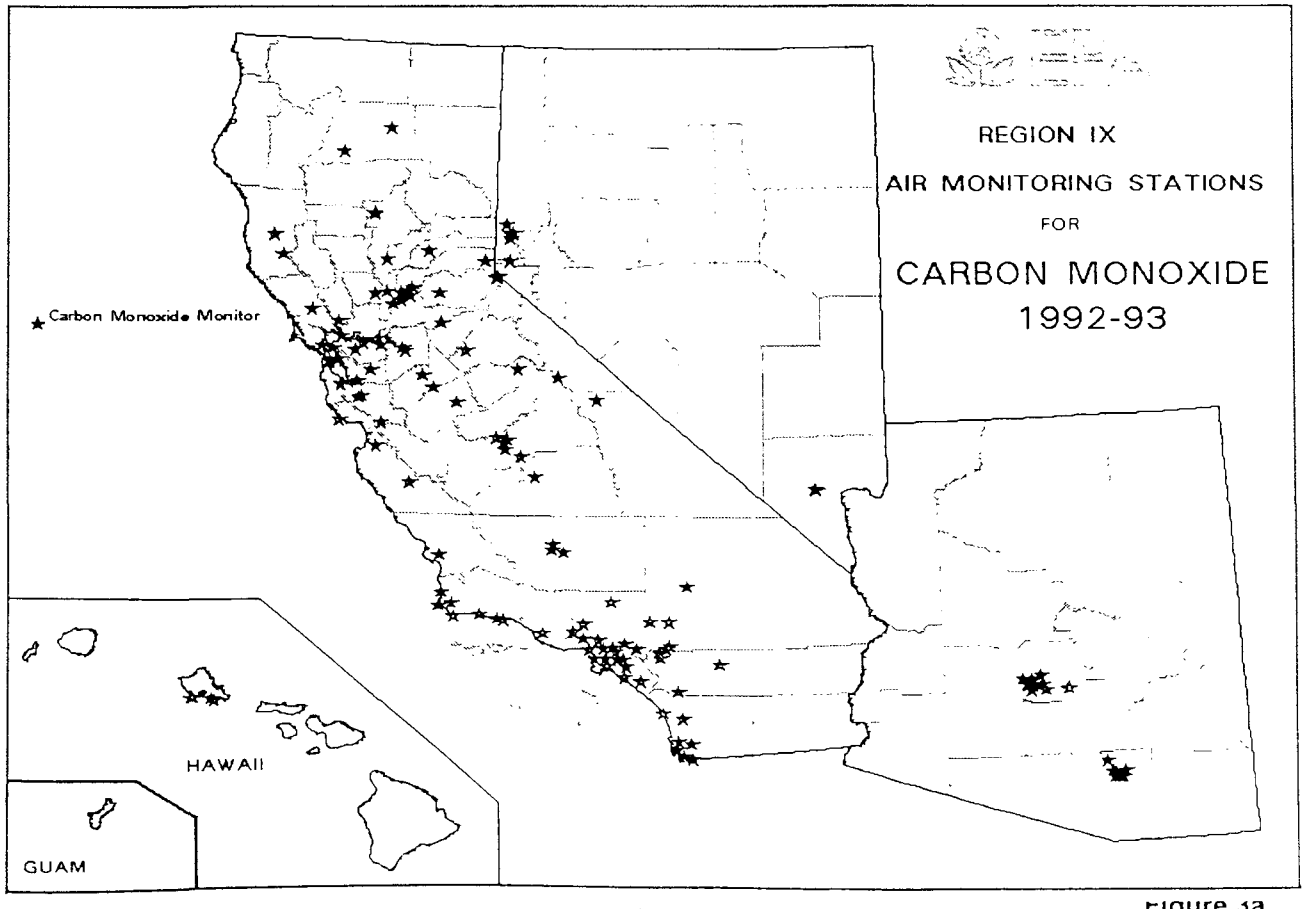


Figure 3a

The five CO monitoring sites that violated the NAAQS during 1992-93 are shown on the map in Figure 3b. The vertical "spikes" represent CO monitors in violation, and the height of each spike shows the number of violations. The three areas with violations were the South Coast Air Basin (Los Angeles area), Phoenix, and Las Vegas. Three other areas (Sacramento, Bakersfield, and South Lake Tahoe) occassionally exceeded the NAAQS but not often enough to cause a violation.

LONG-TERM CO TRENDS: 1984-93

Carbon monoxide air quality has greatly improved over the last ten years in all areas of Region 9. Overall, CO concentrations (second high 8-hour average) have decreased by 29% in the Region based on 81 sites operating from 1984 through 1993. This compares to a 37% decrease at 314 sites nationwide. Much of the CO air quality improvement can be attributed to newer, cleaner-burning vehicles and fuels, and state smog check programs.

Figure 3c shows the number of days with CO pollution above the standard for each of the last 10 years for 14 areas of the Region. Note that the number of days is a composite from all CO monitors in an air basin. It represents the number of days during the year that the CO standard was exceeded at one or more monitors.

Several areas have shown remarkable reductions in CO exceedances during the last ten years. The CO exceedances in Phoenix decreased from 99 days in 1984 to one day in 1993. The South Coast decreased from 76 days to 29. Las Vegas decreased from 54 days to five. Lake Tahoe decreased from 42 days to none.

Peak CO concentrations (8-hour average) have also decreased substantially during the last ten years in seven areas that have several long-term monitors. The percent decreases in CO concentrations between 1984 and 1993 were as follows:

% Decrease in Peak Concentration	Area
50%	Lake Tahoe
43%	Phoenix
37%	Tucson
27%	San Francisco Bay Area
26%	South Coast Air Basin
20%	San Diego County
16%	Sacramento

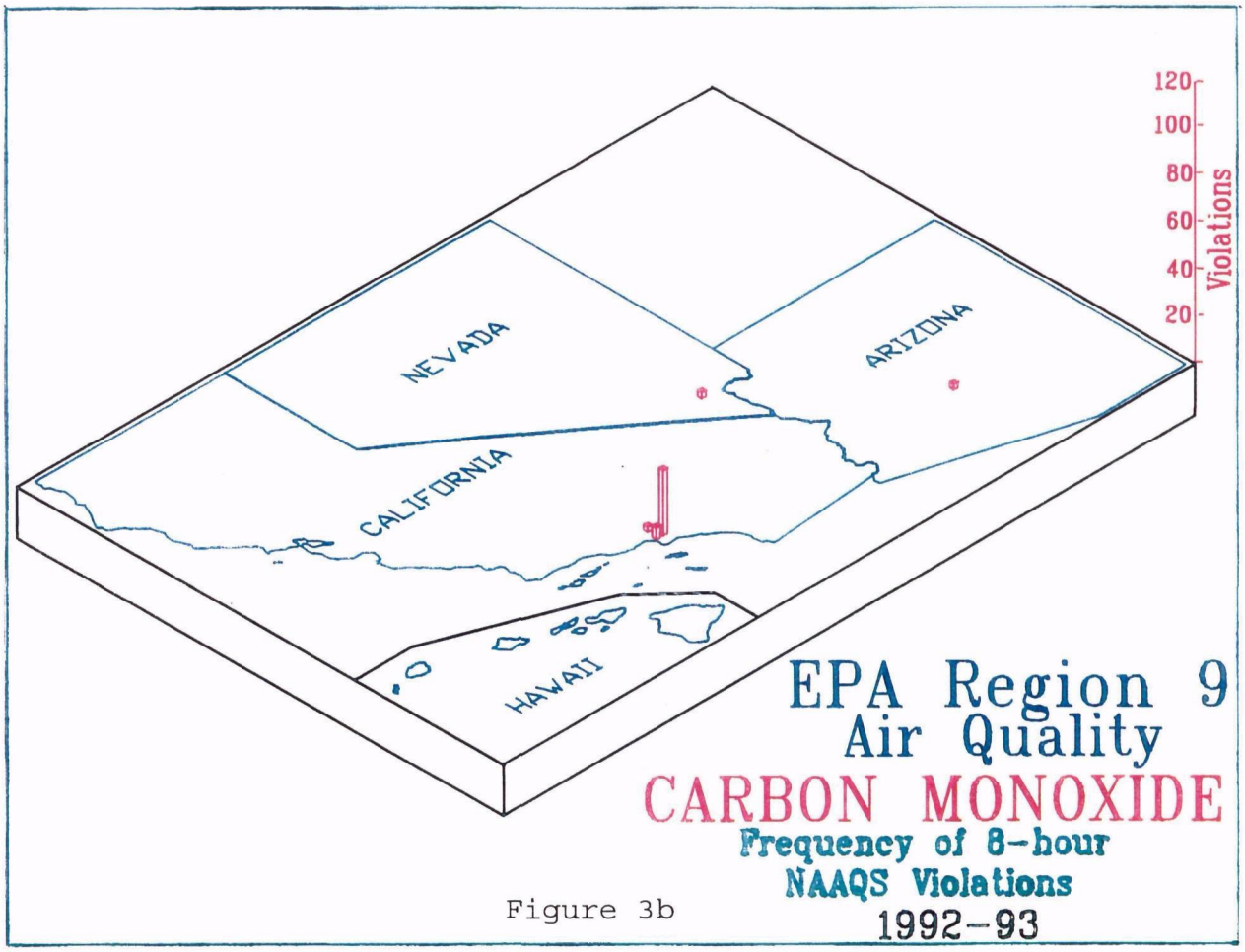


Figure 3b

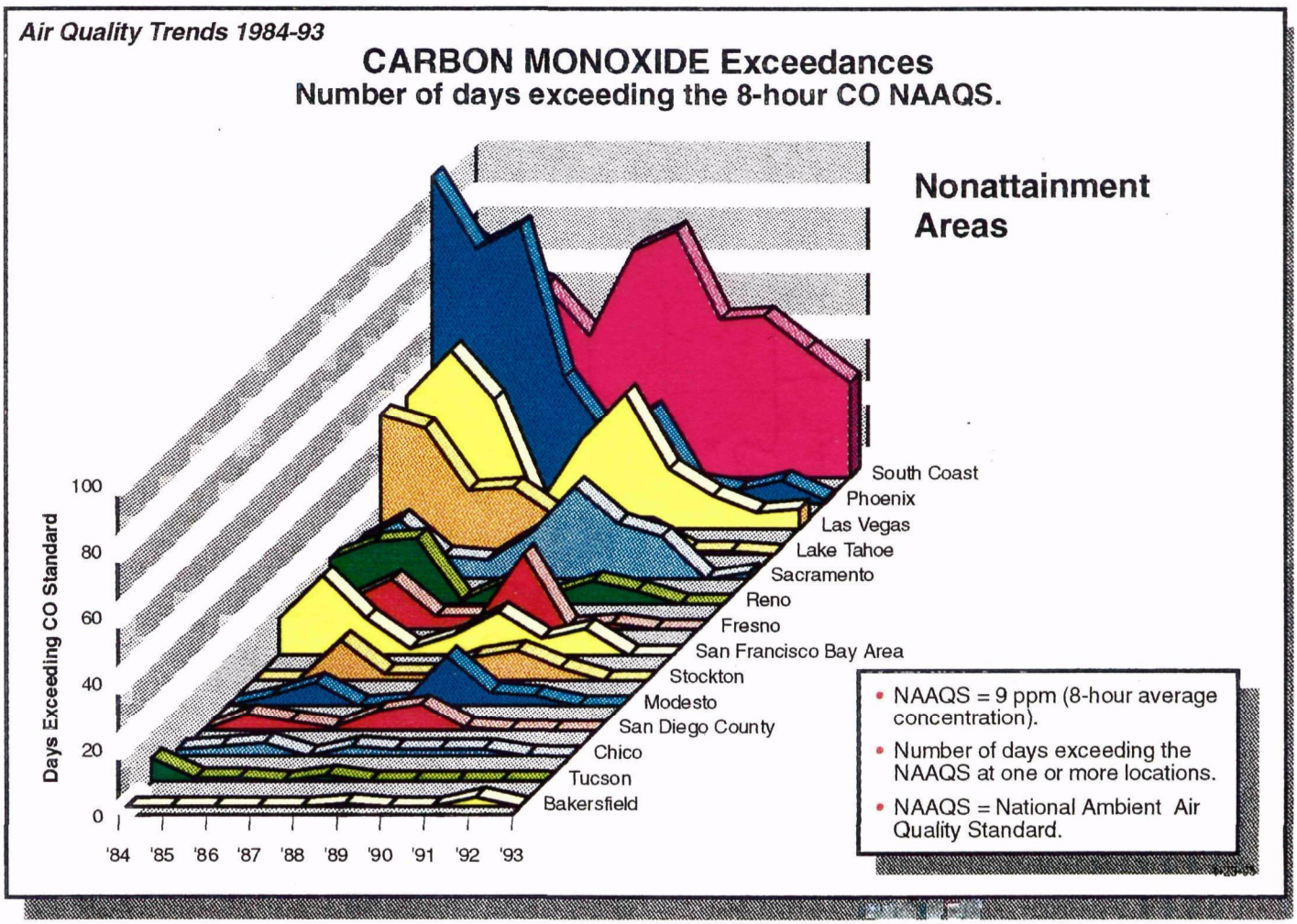


Figure 3c

NITROGEN DIOXIDE

BACKGROUND and HEALTH EFFECTS

Nitrogen dioxide (NO_2) is a brownish, highly reactive gas which is present in urban atmospheres. NO_2 is formed in the atmosphere from emissions of oxides of nitrogen (NO_x). NO_x plays a major role, together with volatile organic compounds, in the atmospheric reactions that produce ozone. NO_x forms when fuel is burned at high temperatures. The two major NO_x emission categories are transportation sources (primarily motor vehicles) and stationary fuel combustion sources, such as electric utilities and industrial boilers.

The NAAQS is based on nitrogen dioxide (NO_2) because it is known to be highly toxic to humans. Nitrogen dioxide can irritate the lungs, cause bronchitis and pneumonia, and lower resistance to respiratory infections. Nitrogen oxides are an important precursor to both ozone and acidic precipitation, which harm both terrestrial and aquatic ecosystems. The NAAQS for NO_2 is 53 ppb annual mean concentration.

RECENT NO_2 AIR QUALITY IN REGION 9

For the two-year period 1992-93, NO_2 was monitored at 135 sites in Region 9. Figure 4a shows the geographic distribution of NO_2 monitors throughout the Region. In general, more monitors are located in or near urban areas than in rural

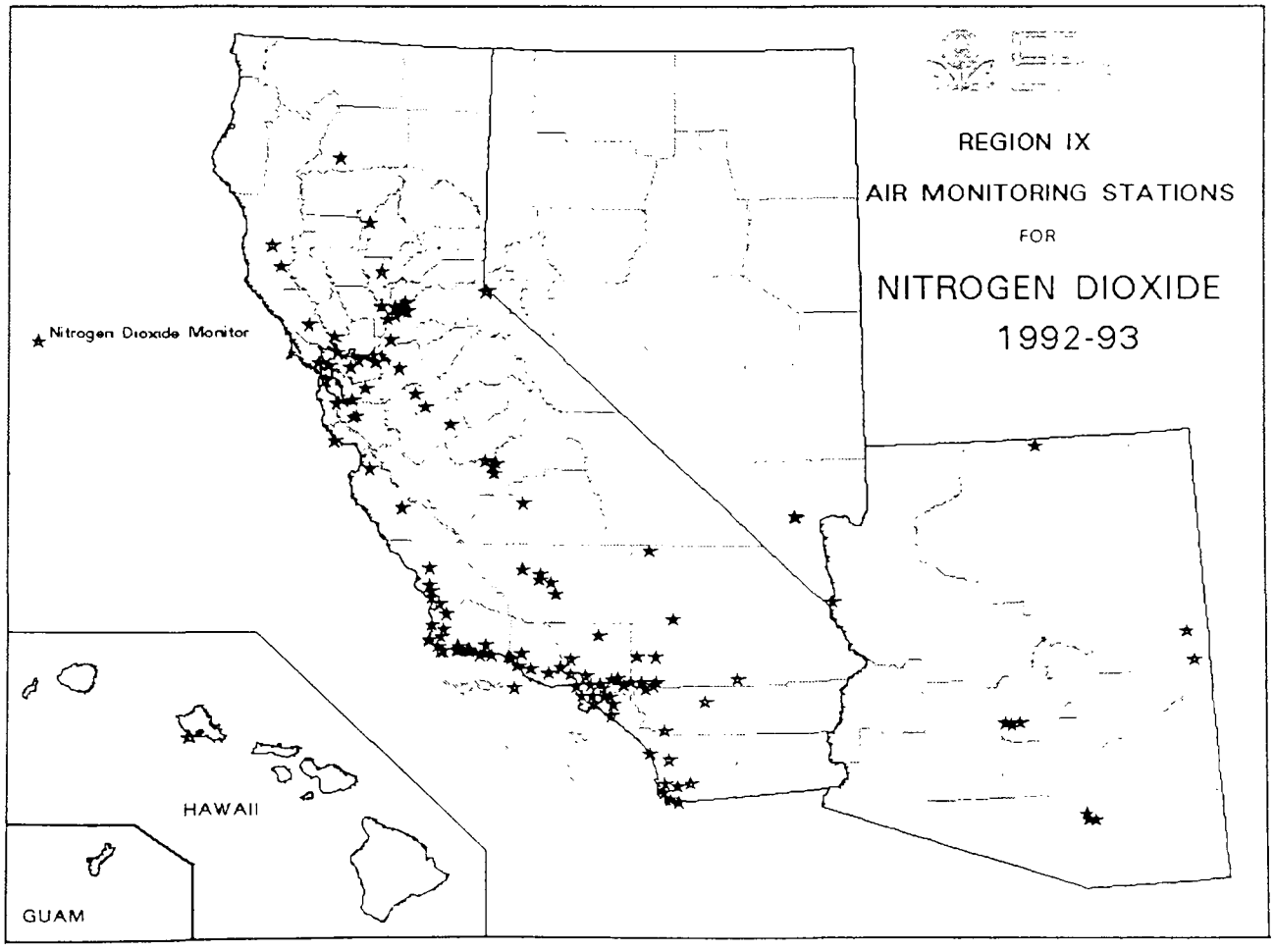


Figure 4a

areas.

There were no sites that violated the NO_2 NAAQS in 1992 or 1993. In fact, there were no violations anywhere in the United States during this period. The most recent violation occurred in the South Coast Air Basin (Los Angeles area) in 1991.

LONG-TERM NO_2 TRENDS: 1984-93

Air quality with respect to nitrogen dioxide has improved over the last ten years in Region 9. For the Region as a whole, there were 69 long-term monitors that operated for the 10-year period. These monitors, as a group, showed a 13% decrease in their annual mean NO_2 concentrations between 1984 and 1993. This compares with a 12% decrease at 201 sites nationwide.

Figure 4b shows the change in annual mean concentration for six sites since 1984. These sites represent the higher NO_2 concentrations found in the South Coast, San Diego, San Joaquin Valley, Bay Area, and Sacramento areas. Note that all areas were well below the standard except for the South Coast Air Basin. However, the South Coast was below the NO_2 standard for the last two years. Based on a composite of 17 long-term sites in the South Coast, their annual mean NO_2 concentration decreased by 17% between 1984 and 1993.

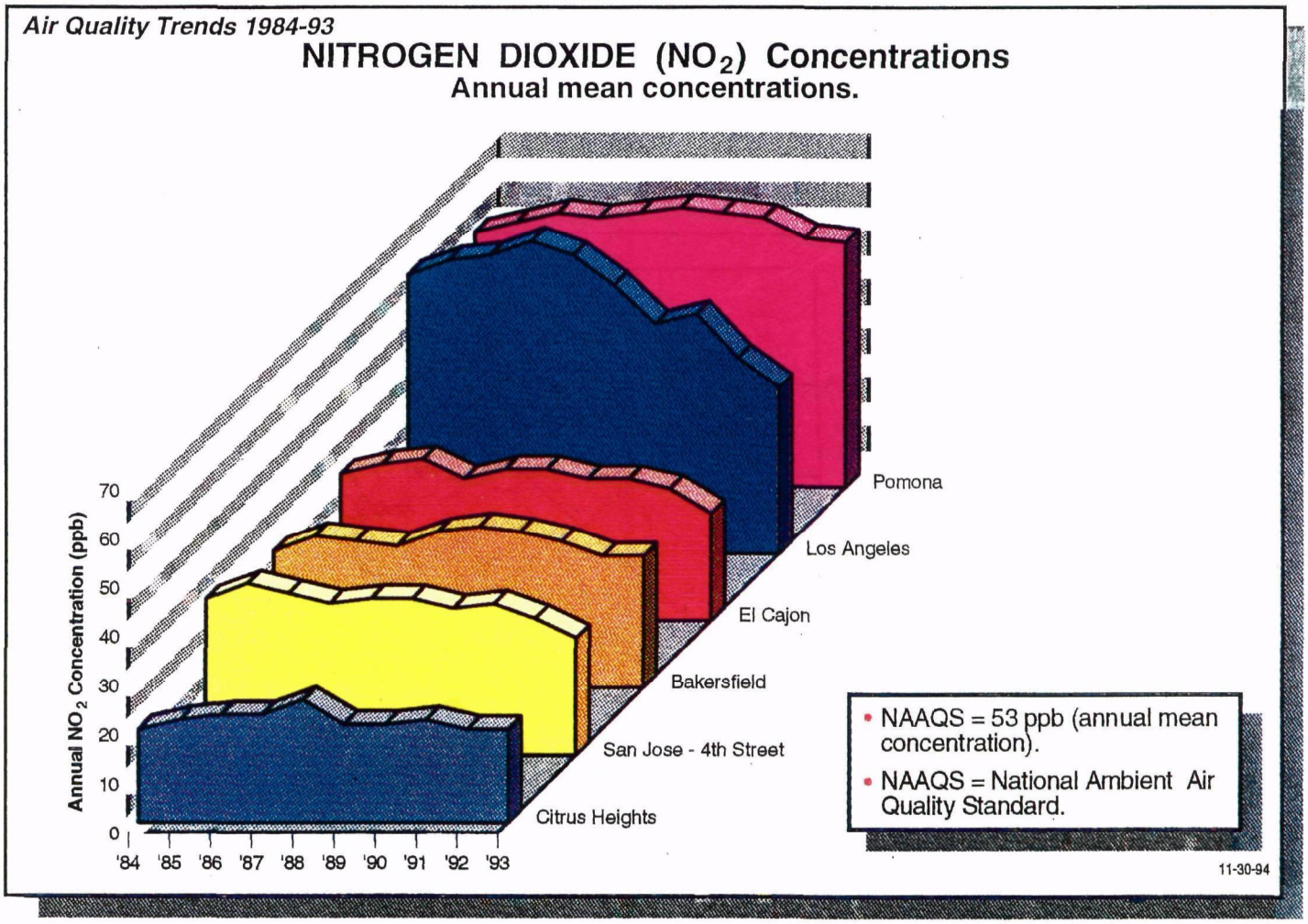


Figure 4b

SULFUR DIOXIDE

BACKGROUND and HEALTH EFFECTS

Ambient sulfur dioxide (SO_2) results largely from stationary sources that burn coal and oil, refineries, pulp and paper mills, and from nonferrous metal smelters.

High concentrations of SO_2 affect breathing and may aggravate existing respiratory and cardiovascular disease. Sensitive populations include asthmatics, individuals with bronchitis or emphysema, children, and the elderly. SO_2 also produces leaf damage to trees and agricultural crops.

Sulfur dioxide and other oxides of sulfur combine with oxygen to form sulfates and with water vapor to form aerosols of sulfurous and sulfuric acid. These acid mists can irritate the respiratory systems of humans and animals and injure plants. Particulate sulfates also reduce visibility.

There are three NAAQS for SO_2: an annual arithmetic mean of 80 micrograms per cubic meter of air ($\mu g/m^3$), a 24-hour level of 365 $\mu g/m^3$ and a 3-hour level of 1300 $\mu g/m^3$. The first two standards are primary (health-related) standards, while the 3-hour NAAQS is a secondary (welfare-related) standard. For an air basin to be classified as having attained the SO_2 standard, the annual mean standard is not to be exceeded, while the short-term standards are not to be exceeded more than once per year.

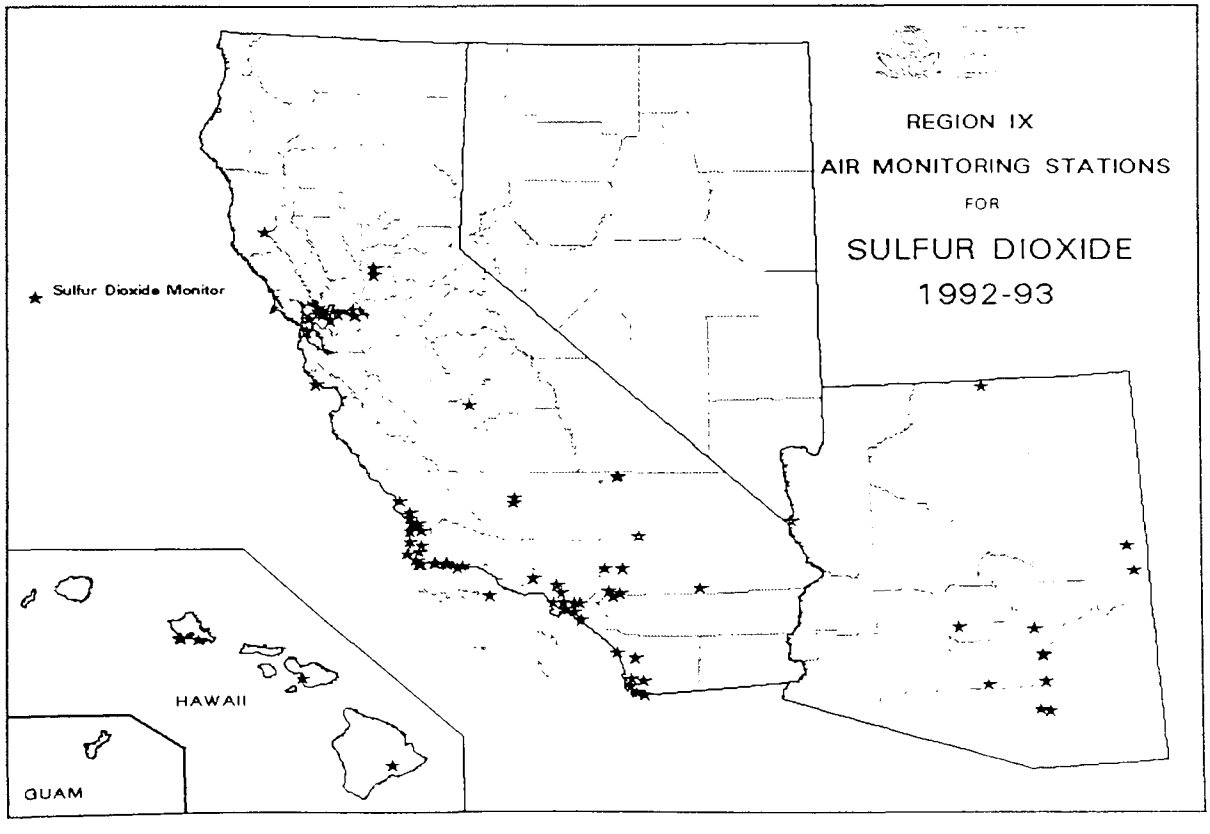


Figure 5a

RECENT SO_2 AIR QUALITY IN REGION 9

For the two-year period 1992-93, SO_2 was monitored at 88 sites in Region 9. Figure 5a shows the geographic distribution of SO_2 monitors throughout the Region. The only site in Region 9 which violated the NAAQS during this period was one monitor at Hawaii Volcanoes National Park, which exceeded both the 24-hour and 3-hour standards. The exceedances were due to natural SO_2 emissions from volcanoes. The annual standard was not violated at any monitoring site.

LONG-TERM SO_2 TRENDS: 1984-93

There have been no exceedances of the annual SO_2 standard in Region 9 since 1984, and the trend in SO_2 concentrations has been downward for the last ten years. For the Region as a whole, there were 37 long-term monitors during that period. These monitors, as a group, showed a 34% decrease in annual SO_2 concentrations between 1984 and 1993. This compares to a 26% decrease at 474 sites nationwide.

Until the mid-1980's, the SO_2 NAAQS was exceeded at sites near nonferrous metal smelters in Arizona. See Figure 5b for the 10-year trends for both the 24-hour and 3-hour standards. During the last ten years, several smelters have ceased operations. The currently operating smelters near the towns of Hayden, Miami, and San Manuel have substantially reduced their SO_2 emissions, and consequently the number of NAAQS violations has declined. For example, the Miami area went from eleven exceedances of the 24-hour standard in 1984 to none in recent years. Likewise, for the 3-hour standard, Miami went from 30 exceedances in 1984 to none in recent years.

SULFUR DIOXIDE Exceedances

Number of exceedances of the SO_2 NAAQS.

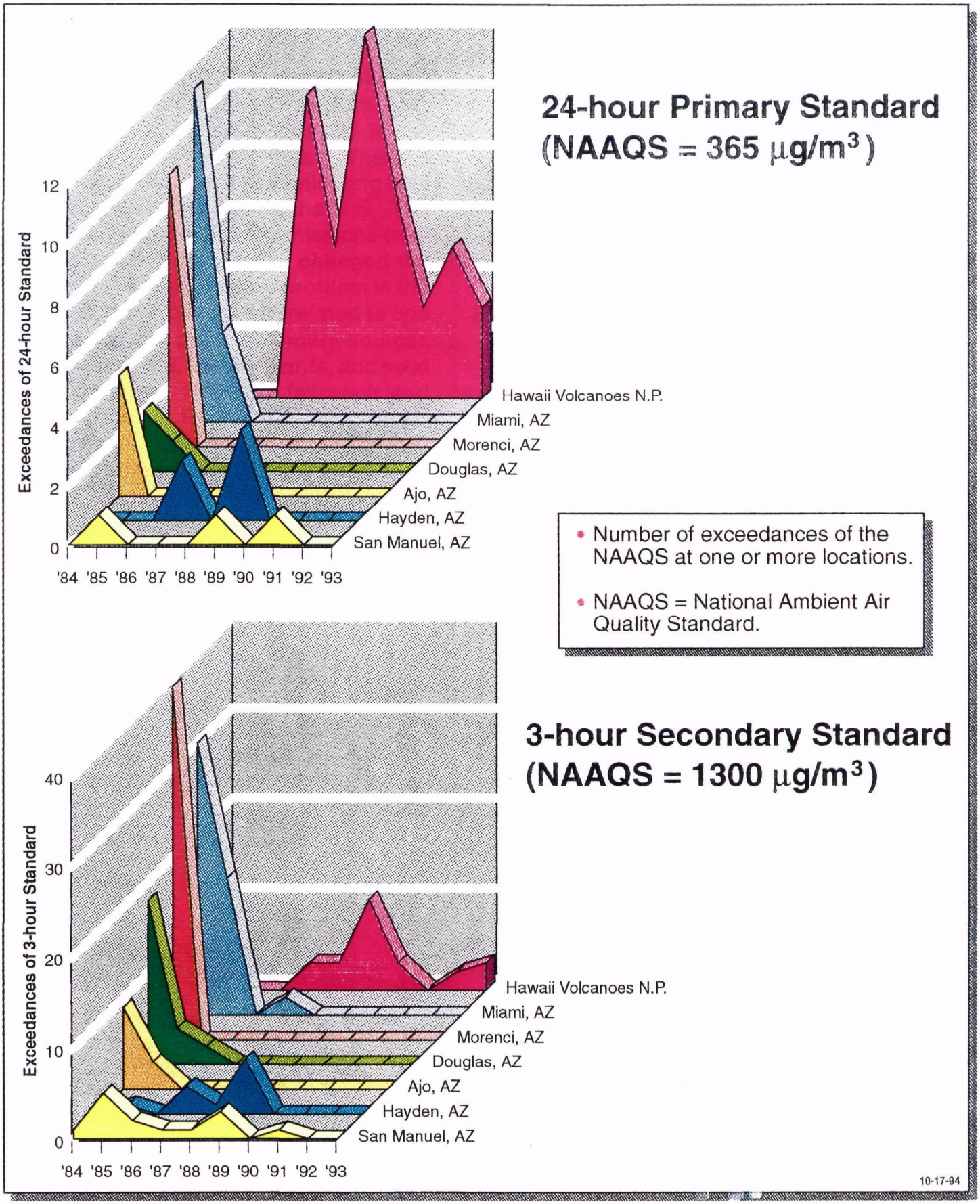


Figure 5b

LEAD

BACKGROUND and HEALTH EFFECTS

Since the mid-1970's, lead (Pb) emissions have been reduced over 90% - the most dramatic success thus far in the nation's struggle for cleaner air. This has been mainly the result of eliminating lead from most gasoline sold in the U.S. The virtual elimination of lead emissions from transportation sources has changed the nature of the ambient lead problem in the United States from vehicle-related to one associated with point stationary sources such as smelters, battery plants, and solid waste disposal. There are few such lead point sources in Region 9.

Exposure to lead can occur through multiple pathways, including inhalation of air and ingestion of lead in food, water, soil, or dust. Excessive lead exposure can cause seizures, mental retardation and/or behavioral disorders. Fetuses, infants, and children are especially susceptible to low doses of lead, resulting in central nervous system damage. The NAAQS for Pb is 1.5 micrograms per cubic meter of air ($\mu g/m^3$) average concentration over a three-month period.

RECENT Pb AIR QUALITY IN REGION 9

For the two-year period 1992-93, Pb was monitored at 54 sites in Region 9. Figure 6a shows the geographic distribution of the Pb monitors throughout the Region.

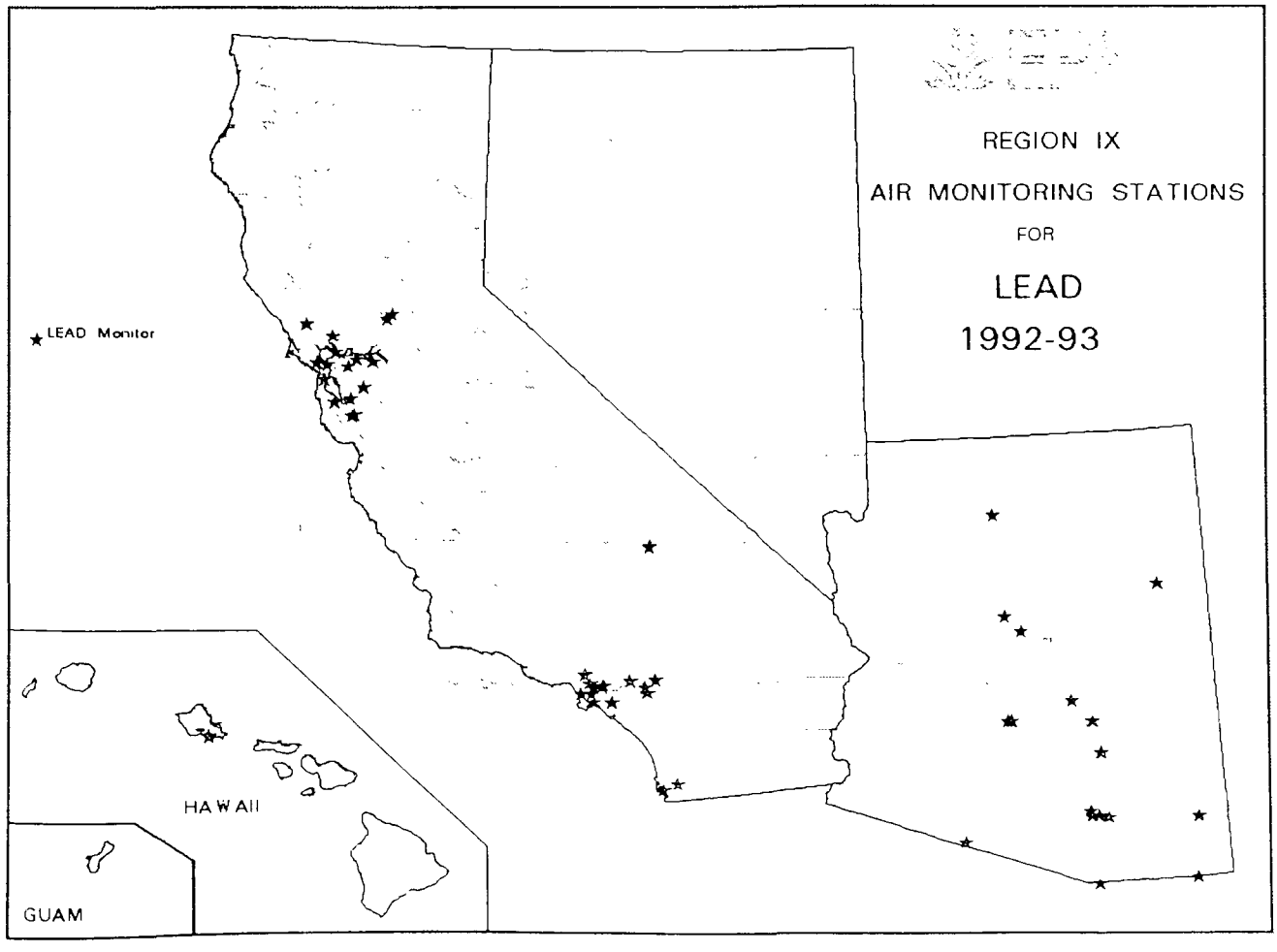


Figure 6a

There were no violations of the Pb NAAQS at any sites during 1992-93. Lead concentrations are now typically 10% of the Federal standard or less. The only Pb violation in the last ten years was measured at a special purpose monitor in 1991. The monitor is sited near a lead smelter in Commerce, located in the South Coast Air Basin. Anti-pollution measures were subsequently put into place at this source, and Pb emissions have been greatly reduced.

LONG-TERM Pb TRENDS: 1984-93

Lead concentrations have been continually declining over the past ten years throughout Region 9. The highest concentrations today are only a small fraction of the Federal standard. For the Region as a whole, there were 30 long-term monitors that operated for the ten-year period. These monitors, as a group, showed an astounding 93% decrease in maximum quarterly mean Pb concentrations between 1984 and 1993. This compares to an equally notable 89% decrease at 204 sites nationwide.

Figure 6b shows the 10-year change in Pb concentrations for the South Coast Air Basin (Los Angeles area) and the San Francisco Bay Area.

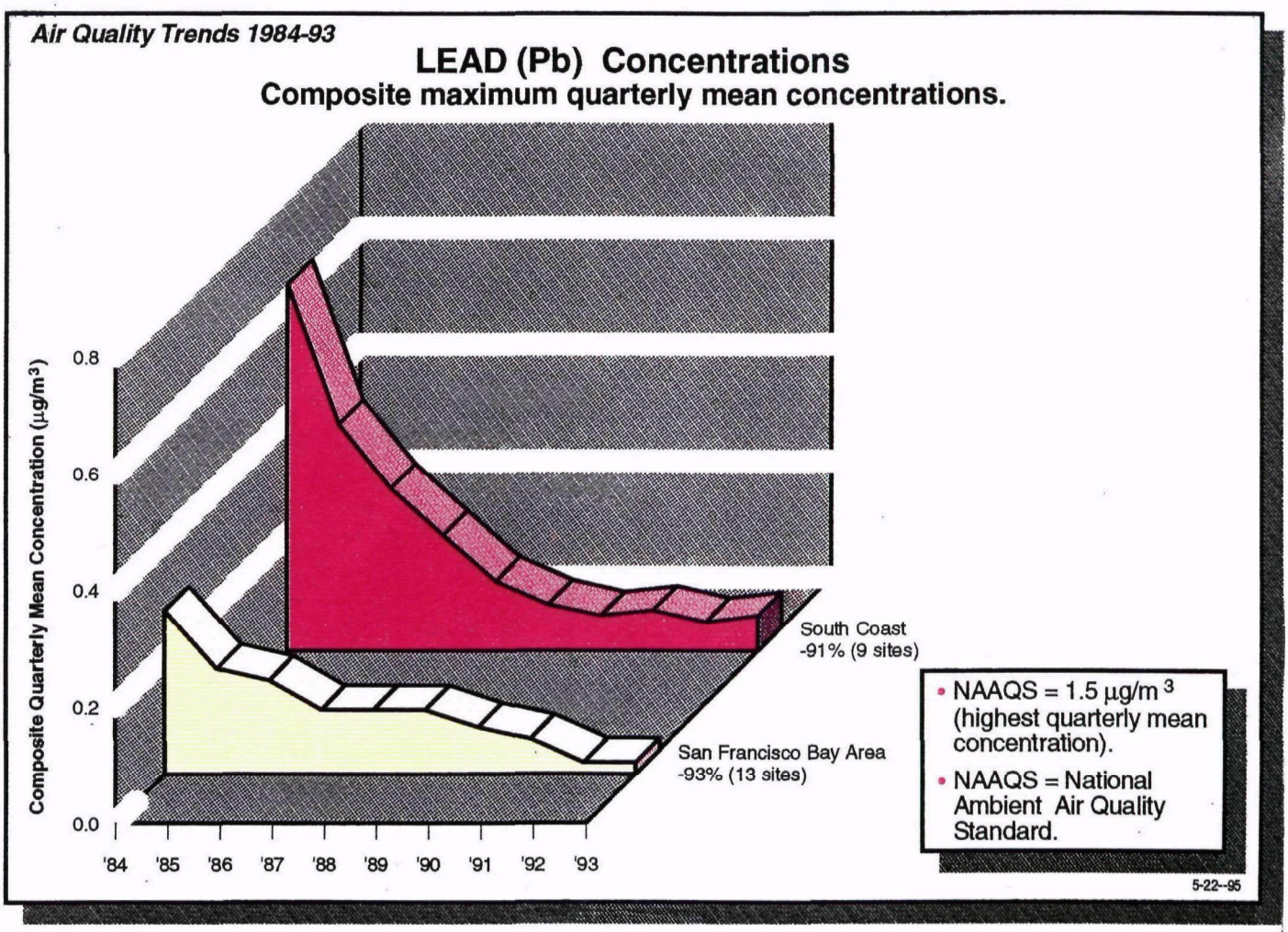


Figure 6b