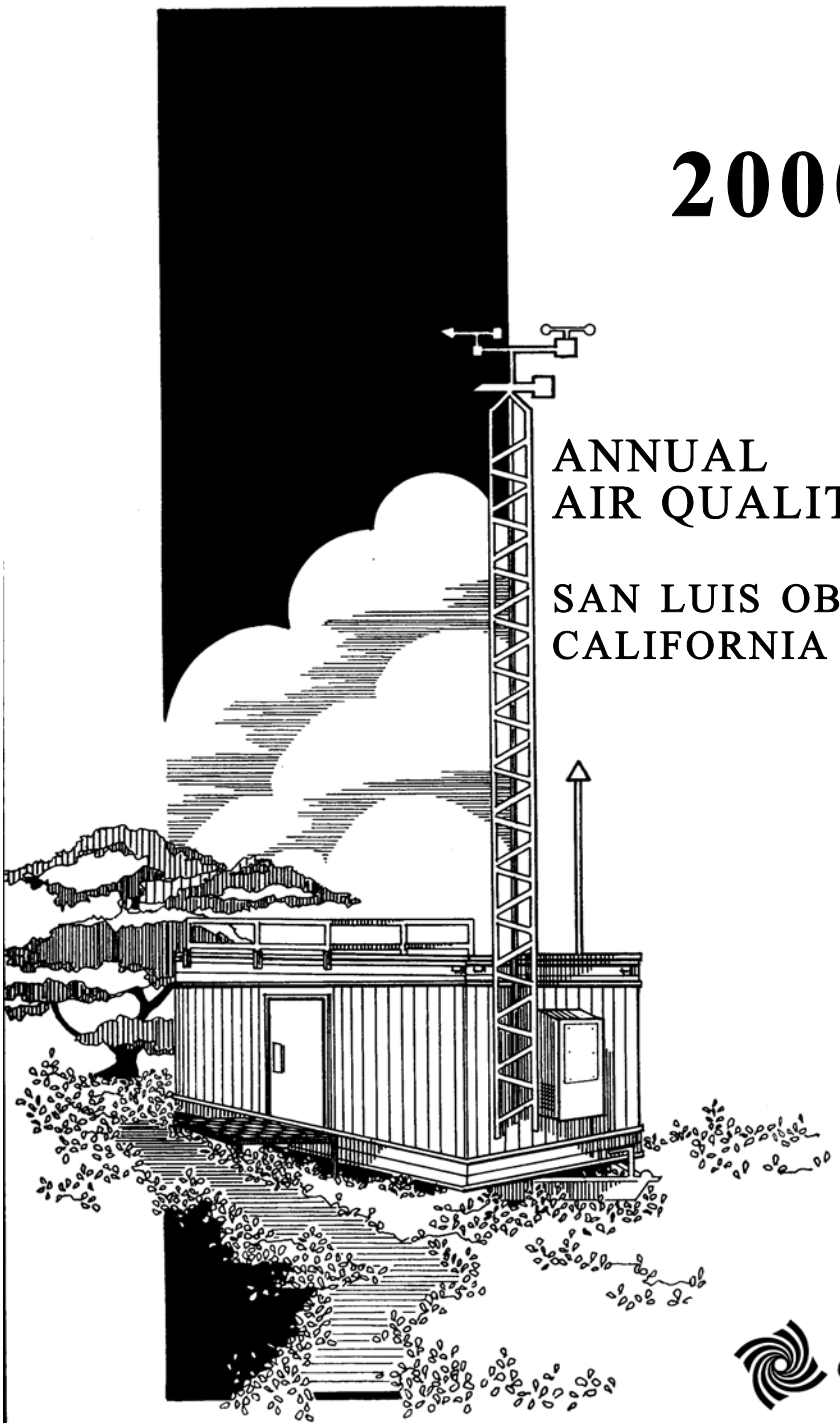
2000



ANNUAL AIR QUALITY REPORT

SAN LUIS OBISPO COUNTY CALIFORNIA

AIR POLLUTION CONTROL DISTRICT
COUNTY OF SAN LUIS OBISPO

AIR POLLUTION CONTROL DISTRICT
COUNTY OF SAN LUIS OBISPO

3433 Roberto Court
San Luis Obispo, California 93401

Phone: (805) 781-5912
Fax: (805) 781-1002
Burn Advisory (toll free): (800) 834-2876
Email: cleanair@sloapcd.dst.ca.us
World Wide Web Homepage: www.sloapcd.dst.ca.us

2000 Annual Air Quality Report
prepared by Jay Courtney
Technical Services Division

Published January 2002

The air quality database for San Luis Obispo County is a public record and is available from the APCD office in various forms, including comprehensive records of all hourly or other sample values acquired anywhere in the county. Data summaries are published in the APCD quarterly newsletter Clear Vision, and in this Annual Air Quality Report. Ozone summary data appear weekly in the Saturday edition of the San Luis Obispo County Telegram Tribune, a local newspaper. Each month data from all countywide monitoring is added to separate archives maintained by the federal Environmental Protection Agency (EPA) and by the ARB. Summary data from San Luis Obispo County can be found in EPA and ARB publications and on the District's website at:

www.sloapcd.dst.ca.us.

2000 Air Quality Summary

Most populated areas of San Luis Obispo County enjoyed good air quality this year. In 2000 the state and federal ozone standards were not exceeded at any of the permanent ambient air monitoring stations. State and federal ozone standards were exceeded at three special study sites associated with the Central California Ozone Study (CCOS) described on page 5. Countywide, exceedances of the state PM_{10} standard of 50 ug/m^3 occurred on 15 out of 60 different sample days in 2000. Both the Paso Robles and Atascadero monitoring stations recorded two state PM_{10} exceedances this year while the Ralcoa Way station on the Nipomo Mesa recorded fifteen exceedance days with a maximum value of 110.5 ug/m^3. There were no exceedances of the national air quality standard for PM_{10} in the county in 2000.

In San Luis Obispo County, ozone and PM_{10} are the pollutants of main concern, since exceedances of state health-based standards for those are experienced here in most years. For this reason our county is designated as a non-attainment area for both the state ozone and PM_{10} standards.

Air Quality Monitoring

San Luis Obispo County air quality was measured in 2000 by a network of ten permanent monitoring stations and two temporary stations run only during the summer ozone season for the CCOS study. Station locations are depicted on the map on page 2. The APCD operated stations at Nipomo Regional Park, Grover Beach, Morro Bay, and Atascadero and research stations at Red Hills and on the summit of Black Mountain. The APCD also operated stations at Piedras Blancas and Camp Roberts for the summer months only. The State Air Resources Board (ARB) operated stations at San Luis Obispo and Paso Robles. Two stations on the Nipomo Mesa were operated by a private contractor for a petroleum refining and production company.

Air quality monitoring is rigorously controlled by federal and state quality assurance and control procedures to ensure data validity. Gaseous pollutant levels are measured continuously and averaged each hour, 24 hours a day. Particulate pollutants are generally sampled by filter techniques for averaging periods of three to 24 hours. PM_{10} (inhalable particulate matter 10 microns or less in size) and $PM_{2.5}$ (inhalable particulate matter 2.5 microns or less in size) are sampled for 24 hours every sixth day on the same schedule nationwide. In addition, PM_{10} is sampled continuously at the Atascadero monitoring station using a TEOM (*tapered element oscillating microbalance*) sampler.

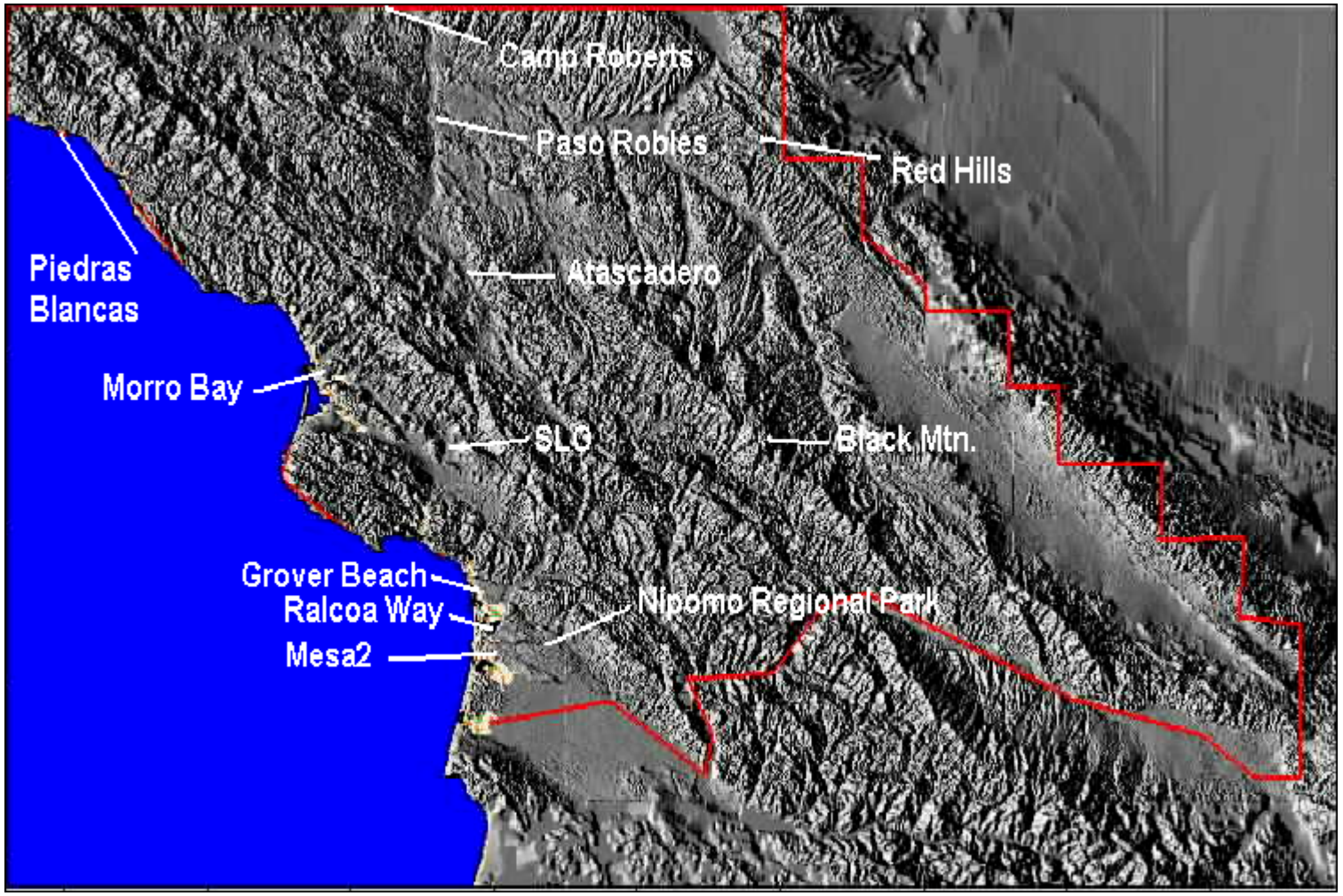


Figure 1: Ambient Air Monitoring Stations in San Luis Obispo County in 2000

Table 1: Ambient Air Quality Parameters Monitored in San Luis Obispo County (2000)

	O_3	NO	NO_2	NOx	SO_2	CO	PM_{10}	$PM_{2.5}$	TEOM	WS	WD	ATM
APCD Stations												
Atascadero	X	X	X	X			X	X	X	X	X	X
Morro Bay	X						X			X	X	
Nipomo Regional Park	X	X	X	X	X		X			X	X	
Grover Beach	X	X	X	X	X					X	X	
*Black Mountain	X									X	X	
*Red Hills	X	X	X	X						X	X	X
**Camp Roberts	X									X	X	X
**Piedras Blancas	X	X	X	X						X	X	
ARB Stations												
San Luis Obispo	X	X	X	X		X	X	X		X	X	X
Paso Robles	X						X			X	X	X
Contractor Operated Stations												
Nipomo, Guadalupe Rd.					X		X			X	X	X
Nipomo, Ralcoa Way					X		X			X	X	

Acronyms:

O_3	Ozone	SO_2	Sulfur Dioxide	PM_{10}	Particulates < 10 microns (samples every sixth day)	WS	Wind Speed
NO	Nitric Oxide	CO	Carbon Monoxide			WD	Wind Direction
NO_2	Nitrogen Dioxide	TEOM	Particulates <10 microns (monitored continuously)	$PM_{2.5}$	Particulates < 2.5 microns (samples every sixth day)	ATM	Ambient Temp
Nox	Oxides of Nitrogen						

* Research station

** Special station for the CCOS study

Table 2: Ambient Air Quality Standards

Pollutant		Averaging Time	California Standard	National Standard
Ozone		1 Hour	0.09 ppm	0.12 ppm
		8 Hour		0.08 ppm (not yet implemented)
Carbon Monoxide		8 Hour	9.0 ppm	9 ppm
		1 Hour	20 ppm	35 ppm
Nitrogen Dioxide		Annual Average		0.053 ppm
		1 Hour	0.25 ppm	
Sulfur Dioxide		Annual Average		80 $\mu g/m^3$ (primary)
		24 Hour	0.04 ppm	0.14 ppm (primary)
		3 Hour		0.5 ppm (secondary)
		1 Hour	0.25 ppm	
Suspended Particulate Matter	**PM_{10}**	Annual Geometric Mean	30 $\mu g/m^3$	
		24 Hour	50 $\mu g/m^3$	150 $\mu g/m^3$
		Annual Arithmetic Mean		50 $\mu g/m^3$
	$PM_{2.5}$	Annual Arithmetic Mean		15 $\mu g/m^3$ (proposed)
		24 Hour		65 $\mu g/m^3$ (proposed)
Hydrogen Sulfide		1 Hour	0.03 ppm	
Visibility		1 Observation	In sufficient amount to reduce the prevailing visibility to less than ten miles when the relative humidity is less than 70%.	

In recent years we have experienced both our worst and our cleanest ozone seasons. The factors that lead to ozone formation are very complex and include: climate, topography, emissions of precursor pollutants, and pollutant transport. Air quality monitoring has shown that ozone levels can be very different from year to year. The reasons for this are not yet fully understood and are the subject of ongoing research.

***A standard exceedance** occurs when a measured value meets exceedance criteria prescribed by state or federal agencies and does not necessarily constitute a violation.*

***A standard violation** may occur following a single or cumulative series of standard exceedances. Criteria constituting a violation are unique for each pollutant and may result in changes to an area's attainment status.*

Central California Ozone Study

During the summer of 2000 the Air Pollution Control District (APCD) participated in an air quality research effort called the Central California Ozone Study (CCOS). The study was guided by a policy committee comprised of staff from the California Air Resources Board (ARB), the California Energy Commission (CEC), local air pollution control agencies, and industry. The study is a multi-year effort to examine ozone formation and transport in central and northern California. The field study portion, which occurred in the summer of 2000, will provide emissions, meteorology and air quality data for use in photochemical models and other analyses to be performed over the next several years. The study area extended from Redding in the north to the Mojave desert in the south, and from the Pacific Ocean to the Sierra Nevada mountains.

As a partner in the study the APCD installed and operated three new ambient air monitoring stations at Piedras Blancas, Camp Roberts, and Red Hills (mostly using donated equipment). These new stations continuously monitored ambient ozone concentrations as well as wind speed, direction, and air temperature. They were located at the northern, western and eastern county boundaries to augment our existing network of stations, and to shed light on the mechanisms and effects of pollutant transport in and out of the county. In addition to surface-level measurements of pollutants and meteorology, APCD staff also launched and tracked weather balloons from the Paso Robles airport to better understand air flow and other characteristics of upper level air.

Along with other important information obtained in the study, was the discovery of a layer of very polluted air that frequently resides over the interior northeast portion of the county during the summer ozone season. This layer is of variable thickness and seems to extend above about 2000 feet in elevation. In this layer ozone concentrations can significantly exceed those found at ground level. The polluted air is apparently normally kept from reaching the ground surface by the presence of a persistent surface layer of relatively clean marine air from the Pacific Ocean. The conditions under which polluted air over the interior of the county might be mixed down to ground level where it can affect people, and details about the origin and transport of the pollutants are still under investigation.

Numerous cities, companies, and government institutions donated funds or other resources in support of the APCD's involvement with the CCOS study. Supporters within the county included the cities of Atascadero, Morro Bay, Paso Robles, Pismo Beach, and San Luis Obispo. County businesses supporting CCOS included Duke Energy, Lime Mountain Company, TOSCO Santa Maria Refinery, TOSCO Pipeline Division, and Union Asphalt. We would like to extend our sincere thanks to all that contributed to this important research effort.

Ambient Air Quality Data Summaries

Ozone

While ground level ozone is harmful to plants and animals and is considered a pollutant, upper level (stratospheric) ozone occurs naturally and protects the earth from harmful ultra-violet energy from the sun.

Although ozone occurs naturally at low concentrations near the earth's surface, much higher and unhealthful levels are created when airborne mixtures of hydrocarbons and oxides of nitrogen are driven by sunlight to react, forming ozone pollution. The emissions of these ozone precursor pollutants come from many human activities, but primarily from industry and the wide use of motor vehicles. As a pollutant, ozone is a strong oxidant gas, which attacks plant and animal tissues. It causes impaired breathing and reduced lung capacity, especially among children, athletes, and persons with respiratory disorders. It also causes significant crop and forest damage. Ozone is a pollutant of particular concern in California where geography, climate and high population densities contribute to frequent violations of health-based air quality standards.

Particulate Matter

Fine particulate matter, in addition to being a health hazard, can greatly reduce visibility. Recent research suggests that fine particulate may be much more detrimental to human health than previously thought.

The two classes of particulate matter are PM_{10} (coarse particulate matter less than 10 microns in aerodynamic diameter), and $PM_{2.5}$ (fine particulate matter 2.5 microns or less in aerodynamic diameter). Both consist of many different types of particles that vary in their chemical activity and toxicity. $PM_{2.5}$ tends to be a greater health risk since it cannot be removed from the lungs once it is deeply inhaled. Sources of particulate pollution include: mineral extraction and production; combustion products from industry and motor vehicles; demolition and construction; agricultural operations; fire; paved and unpaved roads; condensation of gaseous pollutants into liquid or solid particles; and natural sources such as wind-blown dust.

NO_2, SO_2, CO

NO_2 and SO_2 create aerosols, which may fall as acid rain causing damage to crops, forests, and lakes.

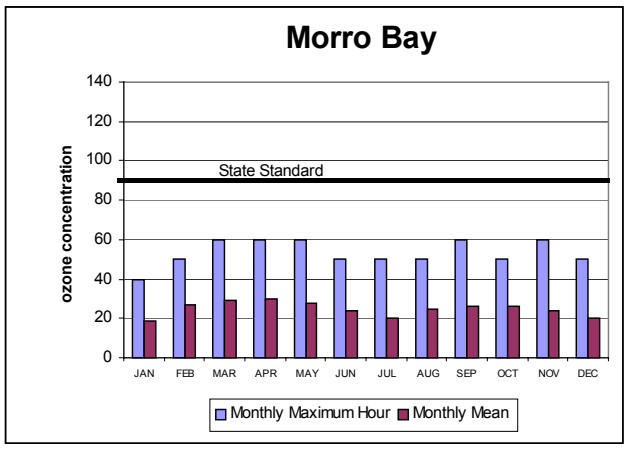
CO is a colorless, odorless gas that can lower the bloods ability to carry oxygen.

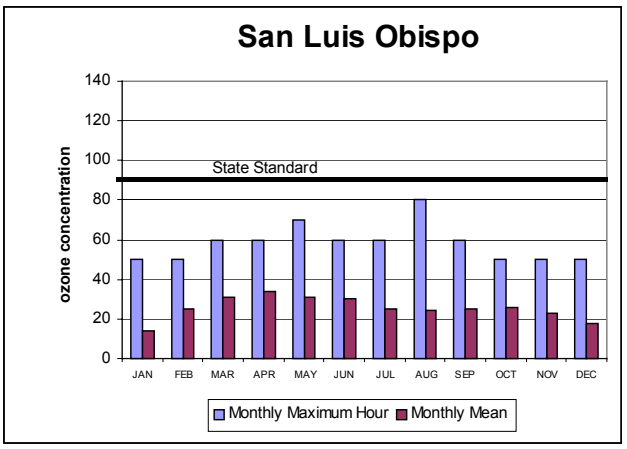
Nitrogen dioxide (NO_2) is the brownish-colored component of smog. NO_2 irritates the eyes, nose and throat, and can damage lung tissues. Sulfur dioxide (SO_2) is a colorless gas with health effects similar to NO_2. SO_2 and NO_2 are generated by fossil fuel combustion in mobile sources (such as vehicles, ships and aircraft), and at stationary sources (such as industry, homes and businesses). SO_2 may also be emitted by petroleum production and refining operations. The state and national standards for NO_2 have never been exceeded in this county. The state standard for SO_2 was exceeded 34 times on the Nipomo Mesa after monitoring began there in 1984. As a result, San Luis Obispo County was formerly listed as non-attainment for the state SO_2 standard by the ARB. Equipment and processes at the facilities responsible for the emissions have changed in recent years, and the state SO_2 standard has not been exceeded since 1993. Exceedances of the federal SO_2 standard have never been measured here.

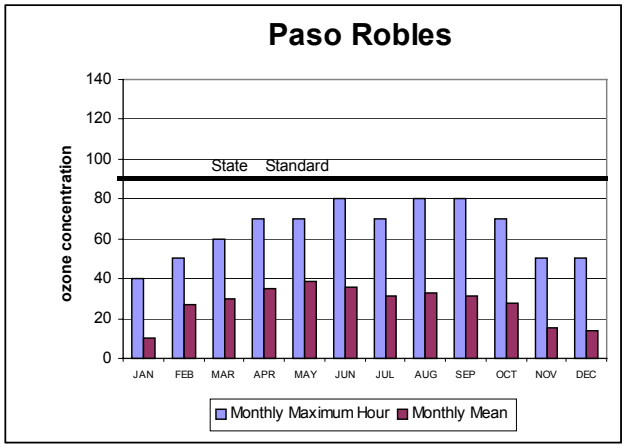
Carbon monoxide (CO) can cause headaches and fatigue and results from fuel combustion of all types. Motor vehicles are by far the chief contributor of CO in outdoor air. State CO standards have not been exceeded in San Luis Obispo since 1975. CO is measured at only one location in the county and the measured concentrations have been low in recent years.

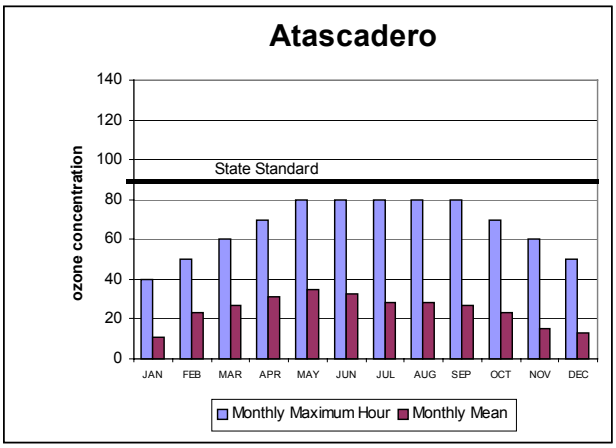
2000 Ozone

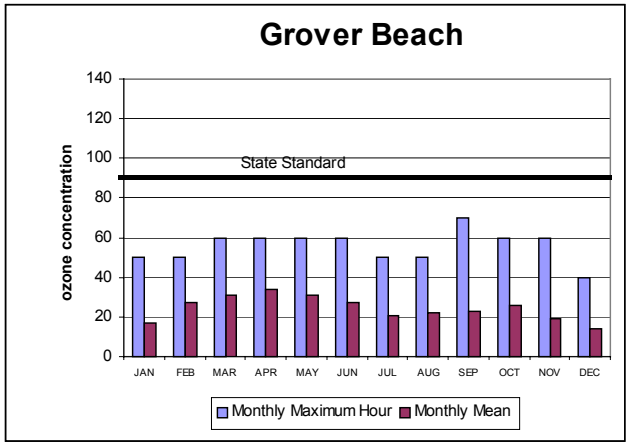
The following graphs depict 2000 monthly ozone concentrations at six locations. There are two data bars presented for each month. The monthly maximum hour bar shows the highest hourly average concentration during the month in parts per billion (ppb). The monthly mean bar is a monthly average concentration and depicts an overall average ozone intensity (in ppb) for the month.

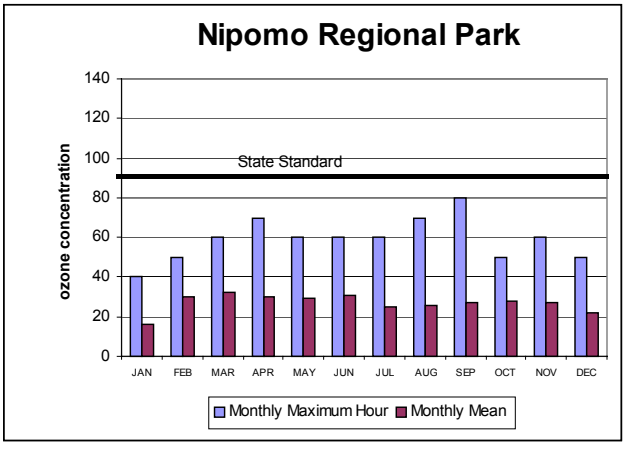










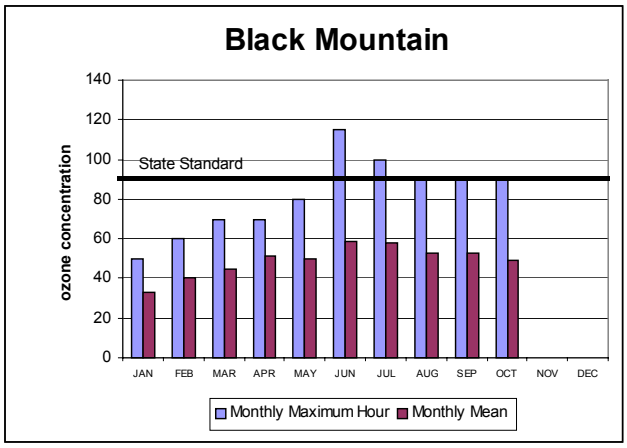


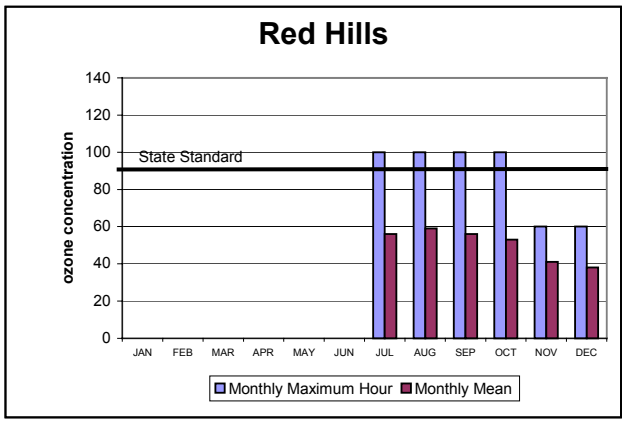
2000 Ozone at CCOS Special Study Sites

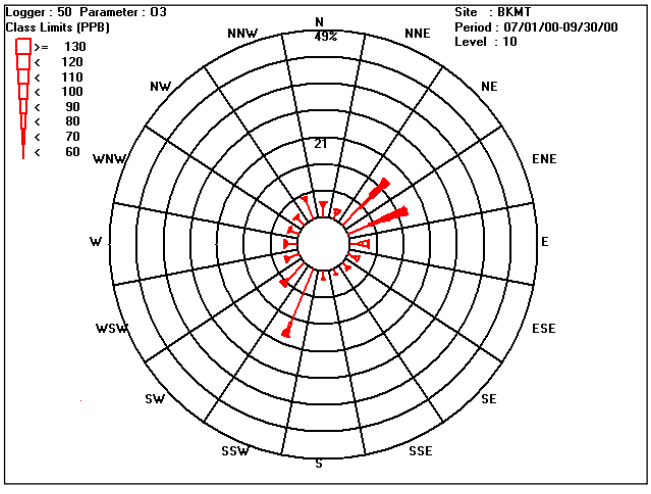
The following graphs depict 2000 monthly ozone concentrations at three of the special temporary monitoring stations in place for the CCOS study (see page 5). There are two data bars presented for each month. The monthly maximum hour bar shows the highest hourly average concentration during the month in parts per billion (ppb). The monthly mean bar is a monthly average concentration and depicts an overall average ozone intensity for the month (in ppb).

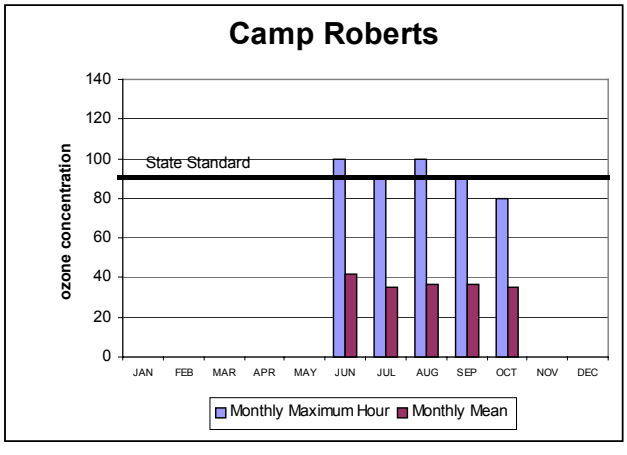
These three monitoring stations were located in relatively unpopulated areas on mountaintops and near the interior borders of our county. They were sited to give us more information about possible transport of polluted air into our county from other areas, as well as providing us with a profile of ozone concentration in the air column from ground level to about 4000 foot elevation. This information is invaluable to APCD staff and ARB researchers in understanding pollutant transport within California.

In general, ozone levels were higher at all three sites than in populated areas where we regularly monitor for ozone. The wind rose for ozone at Black Mountain shows how the highest ozone concentrations are present when the wind is out of the northeast.



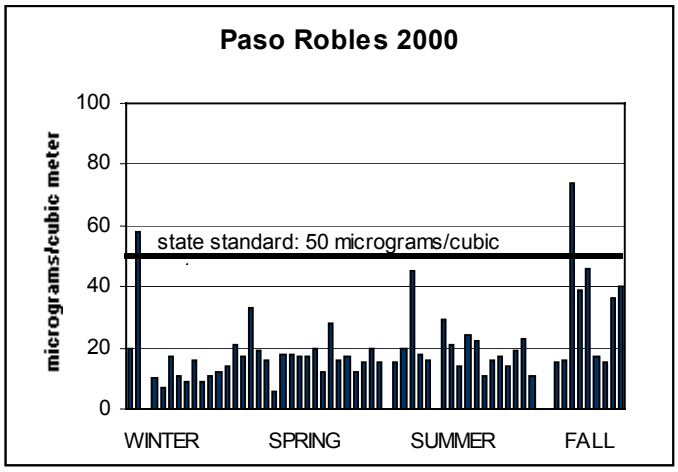


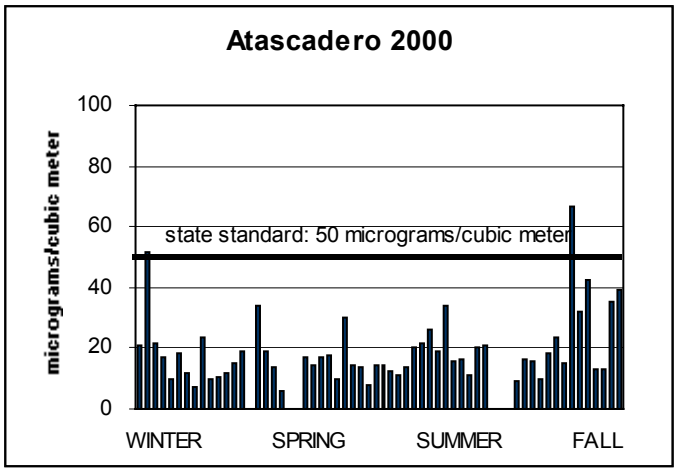


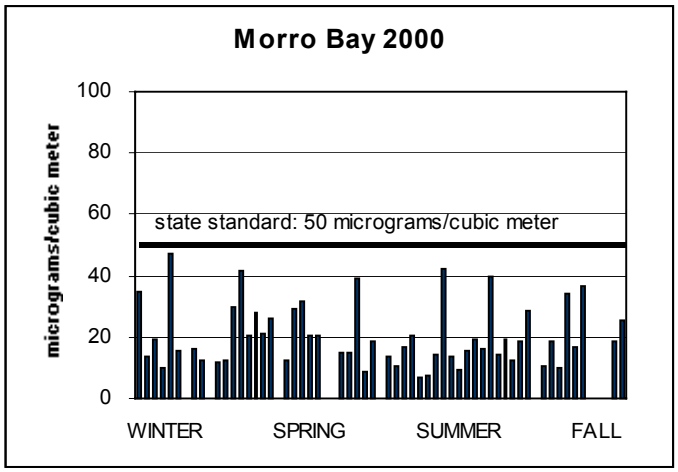


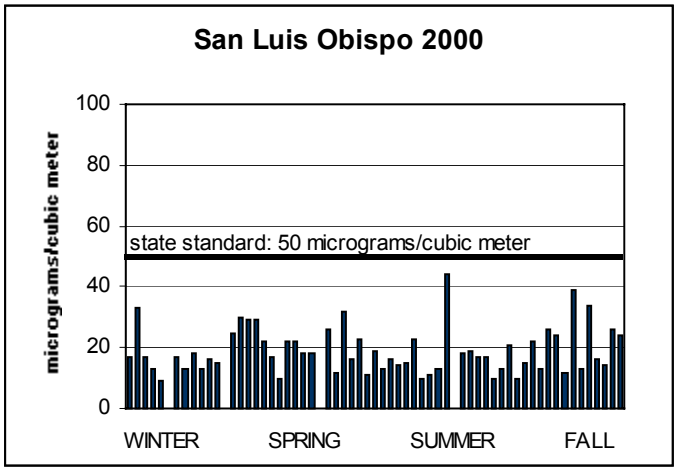
Particulate Matter, 10 microns or less (PM_{10})

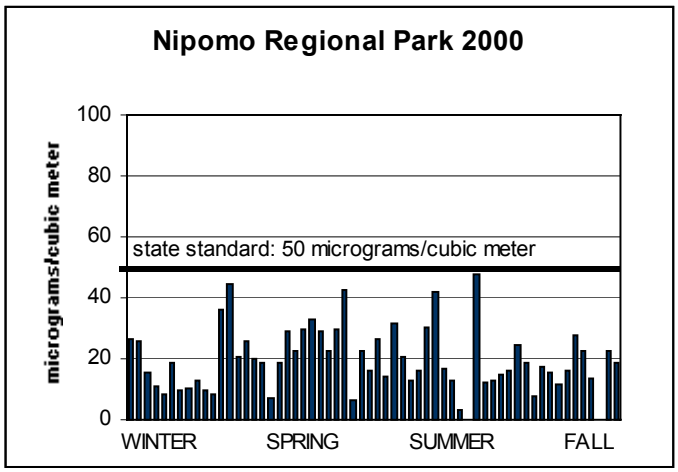
The graphs on this and the next page present PM_{10} data from seven locations and a graph of PM_{10} trends over the past eight years. In 2000, exceedances of the state standard of 50 micrograms per cubic meter were recorded at four air monitoring stations in the county. No exceedance of the national standard of 150 micrograms per cubic meter was measured.

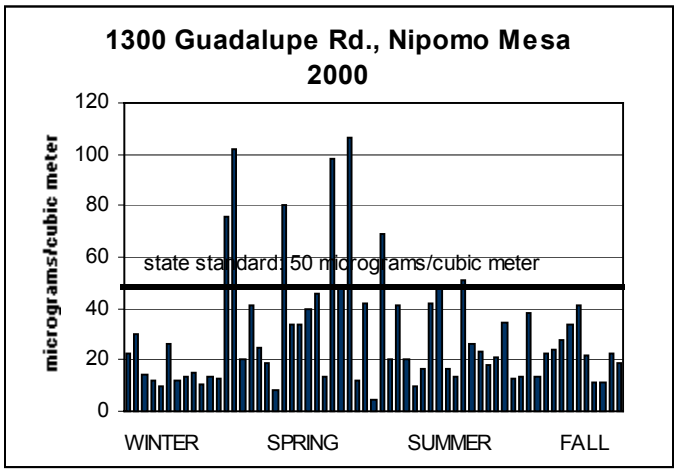




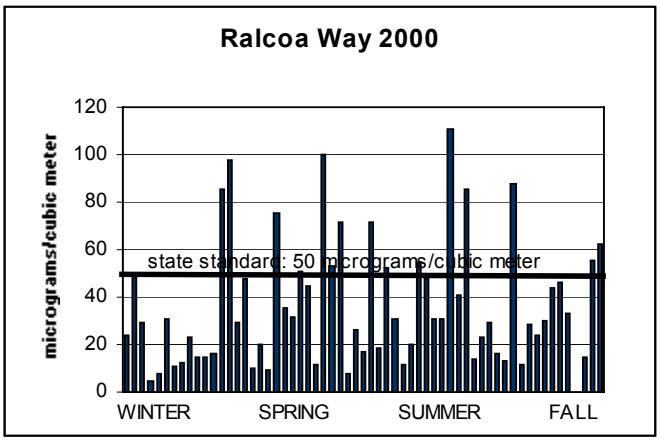








Particulate Matter, 10 microns or less (PM_{10}) continued.



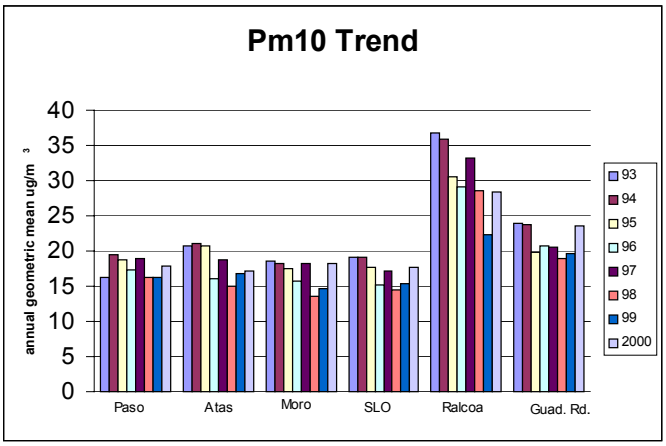


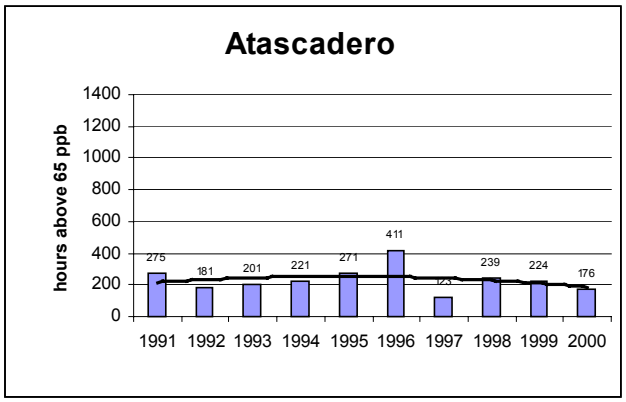
Table 4: First, Second and Third Highest Hourly Averages for 2000

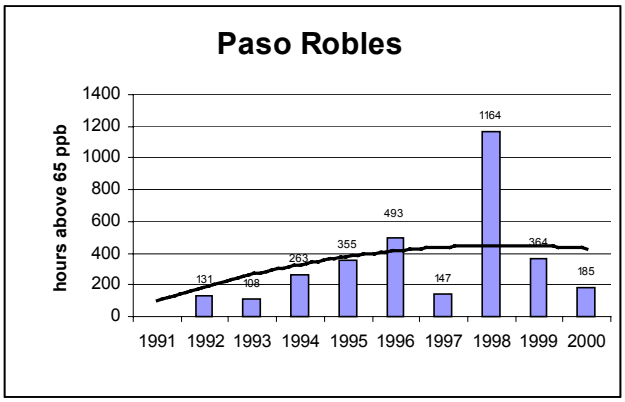
sampling date and hour appears with each data value in the format of month/day : hour.

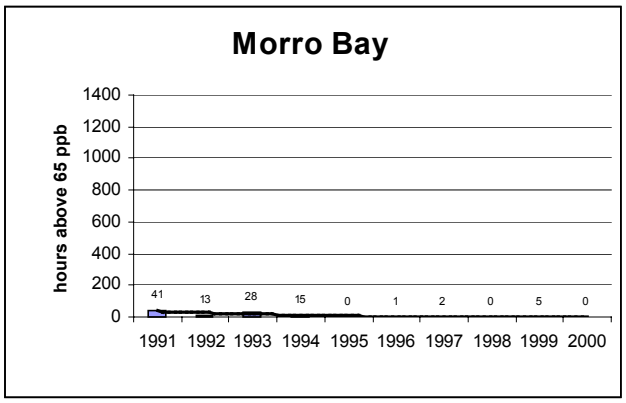
Station	O_3 (ppm)			SO_2 (ppm)			NO_2 (ppm)			CO (ppm)		
	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
Paso Robles	**.083** 8/1:11	**.082** 8/16:11	**.082** 8/17:11									
Atascadero	**.084** 6/14:10	**.082** 8/1:11	**.082** 9/13:11				**.059** 9/12:18	**.056** 9/12:19	**.054** 4/1:19			
Morro Bay	**.063** 4/2:15	**.061** 4/1:16	**.060** 3/31:16									
San Luis Obispo	**.075** 8/1:17	**.069** 5/21:17	**.064** 4/1:16				**.051** n/a	**.050** n/a	n/a	**3.9** 12/6:17	**3.4** 11/20:08	**3.3** 12/27:08
Grover Beach	**.068** 9/13:14	**.063** 4/1:16	**.063** 4/12:12	**.022** 5/28:18	**.021** 3/21:20	**.017** 7/31:00	**.050** 12/18:11	**.044** 11/03:18	**.044** 12/05:14			
Nipomo Regional Park	**.078** 9/13:13	**.067** 8/1:12	**.066** 4/01:16	**.140** 12/28:16	**.083** 11/20:09	**.051** 4/02:09	**.043** 11/19:18	**.040** 11/3:19	**.039** 12/26:19			
Nipomo, 1300 Guadalupe Road				**.150** 5/26:17	**.124** 3/10:13	**.121** 12/18:13						
Nipomo, Ralcoa Way				**.159** 5/19:15	**.130** 5/31:18	**.112** 5/30:08						

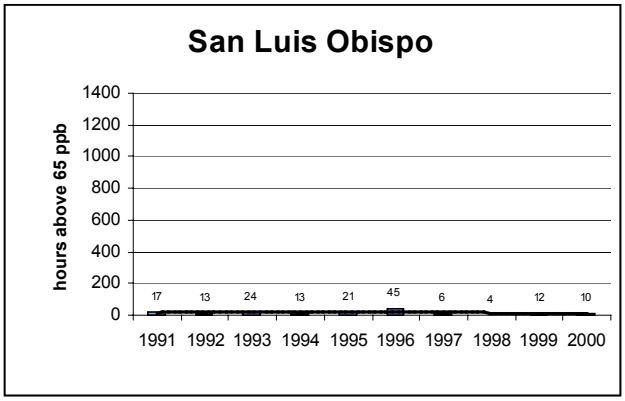
COUNTYWIDE OZONE TRENDS - 1991-2000

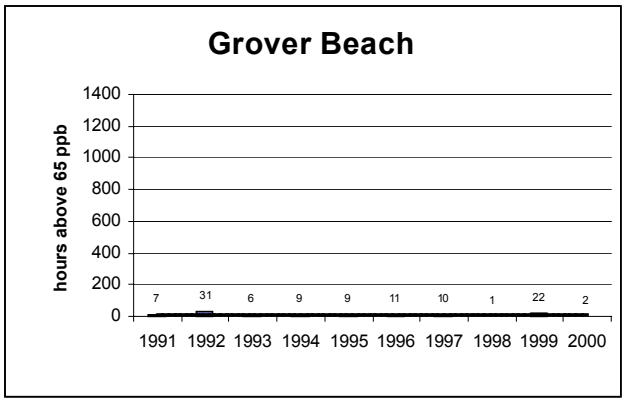
The following graphs depict ozone trends at six locations within the county for the past ten years (nine years at Paso Robles and eight at Nipomo). Each data bar represents the total number of hours in a given year in which the ozone concentrations exceeded 65 parts per billion. This concentration level is a useful indicator for trend purposes even though there are no health standards for single-hour exposures to 65 parts per billion of ozone. The location of the Paso Robles monitoring station was changed in 1991. Consequently, data from Paso Robles is incomplete for 1991. No data was collected for Nipomo in 1997 and 1998 during which time the station was relocated. Monitoring resumed at Nipomo in November 1998.

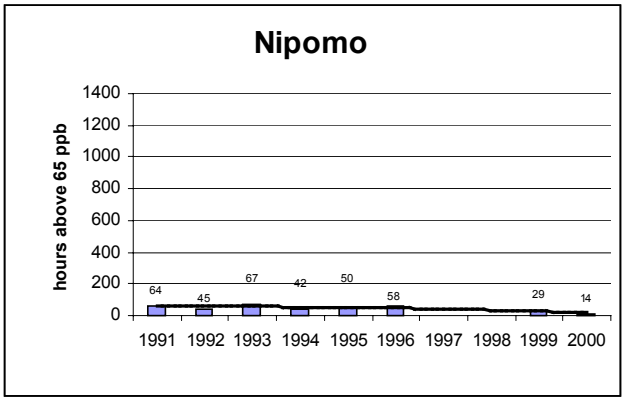






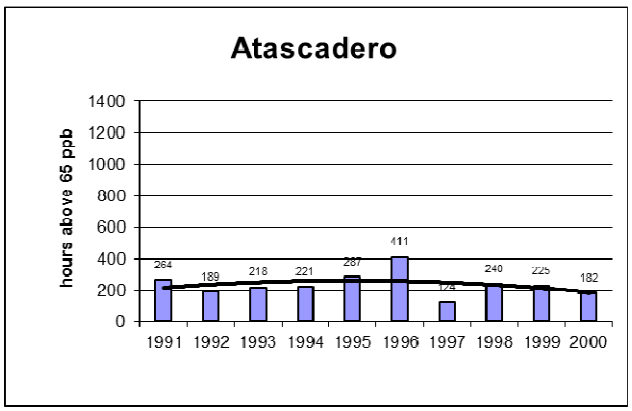


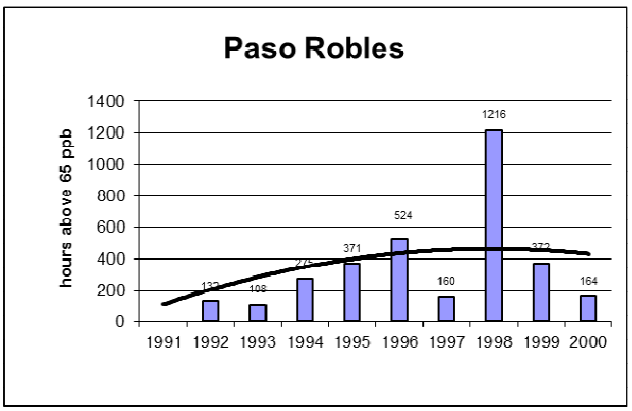


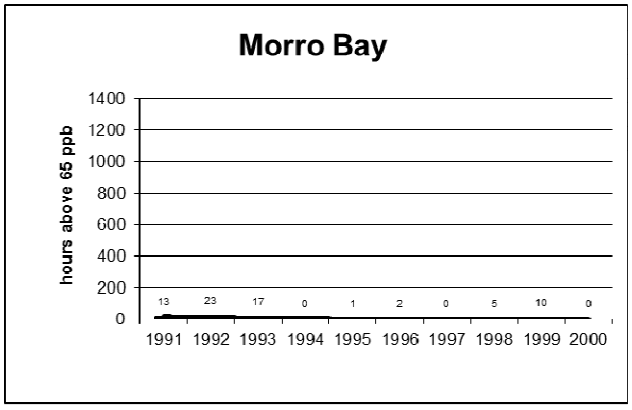


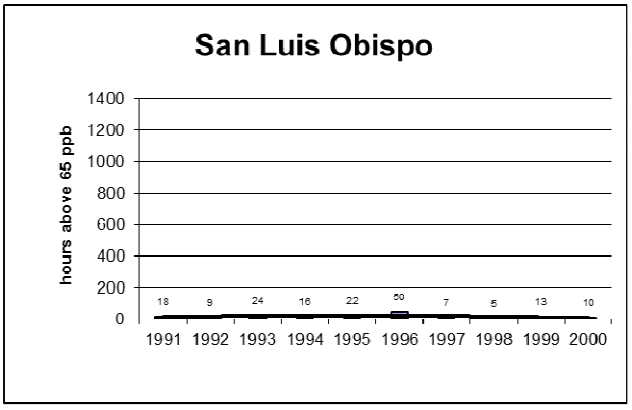
Errata

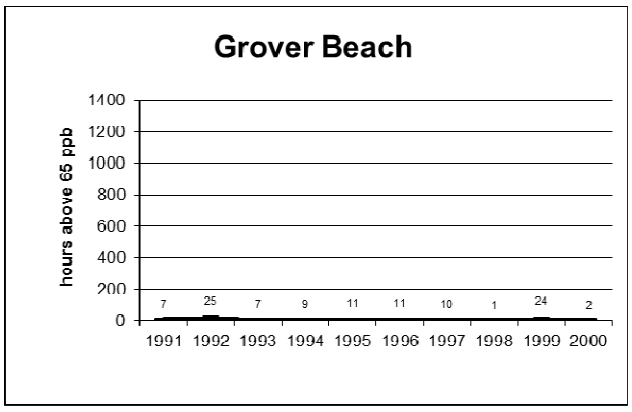
Subsequent to the original publication of this report, some minor errors were discovered in the ozone and PM_{10} trends charts on pages 10 and 11. Corrected charts appear below; see the 2008-2009 Annual Air Quality Report for detailed discussion of the errors in the original figures.

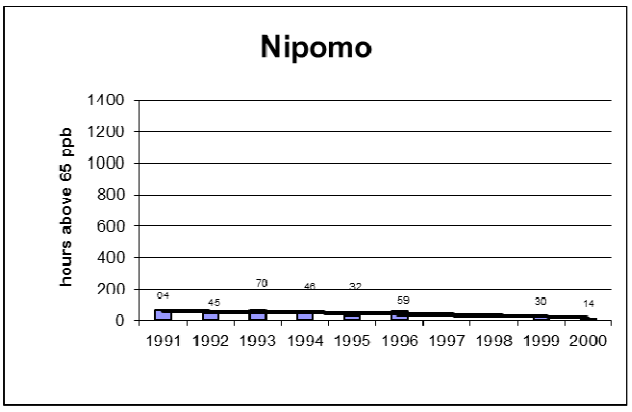


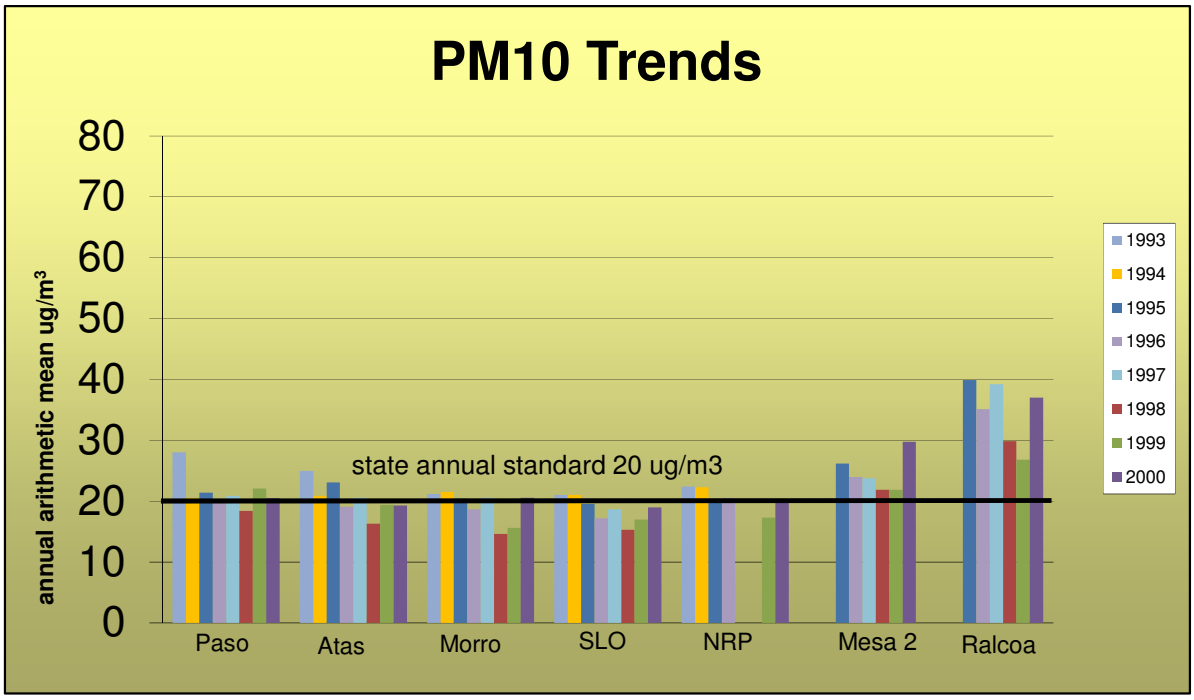











PM10 Trends
annual arithmetic mean ug/m3
80
70
60
50
40
30
20
10
0
state annual standard 20 ug/m3
Paso
Atas
Morro
SLO
NRP
Mesa 2
Ralcoa
1993
1994
1995
1996
1997
1998
1999
2000