

ANNUAL DATA SUMMARY
AIR QUALITY IN TUCSON, ARIZONA
1986 - 1987



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TABLE OF CONTENTS

PAGE

LIST OF ABBREVIATIONS/ACRONYMS.....	v
SUMMARY.....	1
COMMON AIR POLLUTANTS.....	2
PM-10 and Total Suspended Particulates - TSP.....	2
Carbon Monoxide - CO.....	3
Ozone - O ₃	4
Nitrogen Dioxide - NO ₂	4
Sulfur Dioxide - SO ₂	4
Sulfates - SO ₄	4
Non-Methane Hydrocarbons - NMHC.....	5
Lead - Pb.....	5
Visibility.....	5
Units of Measurement for Air Pollutants.....	6
National Ambient Air Quality Standards.....	6
POLLEN AND MOULD.....	7
Tucson Pollen and Mould Calendar.....	8
Active Pollen and Mould Monitoring Sites.....	9
Tucson Metropolitan Map of Monitoring Sites.....	10
POLLUTANT STANDARDS INDEX - PSI.....	11
Figure 1 - PSI Values - 1986 Monthly Averages.....	13
Figure 2 - PSI Values - 1987 Monthly Averages.....	13
Figure 3 - PSI 1986 - 1987 Percentage of Good/Moderate Days.....	14
VARIATION IN AIR QUALITY: SEASONAL, HOURLY, GEOGRAPHICAL.....	15
1. Seasonal Variation of Air Pollution in Tucson, Arizona.....	15
Figure 4 - Formation of Atmospheric Temperature Inversions.....	15
Figure 5 - 1986 Monthly Average CO Concentration.....	16
Figure 6 - 1987 Monthly Average CO Concentration.....	16
Figure 7 - Highest 1987 CO 8-Hour Average (by month).....	17
Figure 8 - 1986 Average Monthly TSP Concentration.....	18
Figure 9 - 1987 Monthly Average TSP Concentration.....	18
Figure 10 - 1986 - 1987 Monthly Average Ozone Concentration Pomona Site.....	19

TABLE OF CONTENTS

	PAGE
2. Hourly Variation of Air Pollution.....	20
Figure 11 - 22nd/Alvernon CO Hourly Average Concentration.....	21
Figure 12 - Pomona Ozone Hourly Average Concentration.....	21
3. Geographical Distribution of Air Pollution.....	22
Figure 13 - 1-Hr. Maximum Ozone Concentration in ppm 1987.....	23
Figure 14 - Particulates Annual Geometric Means $\mu\text{g}/\text{m}^3$ 1986/87.....	24
PM-10.....	25
Figure 15 - PM-10 24-Hr. Average Concentration Orange Grove Site.....	26
Figure 16 - 1985 PM-10 Concentration $150 \mu\text{g}/\text{m}^3$ 24-Hr. NAAQS.....	27
Figure 17 - 1986 PM-10 Concentration $150 \mu\text{g}/\text{m}^3$ 24 Hr. NAAQS.....	27
Figure 18 - 1987 PM-10 Concentration $150 \mu\text{g}/\text{m}^3$ 24 Hr. NAAQS.....	27
RESPIRABLE PARTICULATES.....	28
Figure 19 - Respirable Particulates in the Human Respiratory System.....	28
1986 - 1987 DATA SUMMARIES.....	29
Total Suspended Particulates (TSP).....	30
Carbon Monoxide.....	31
Ozone.....	31
Nitrogen Dioxide.....	32
Sulfur Dioxide.....	32
Water Soluble Sulfates.....	33
Lead.....	33
AIR QUALITY HISTORICAL DATA.....	34
Figure 20 - Annual Average Visibility - Downtown Site.....	35
Total Suspended Particulates (TSP) 1976 - 1987.....	36
Total Suspended Particulates 1966 - 1975.....	37
Carbon Monoxide.....	38
Ozone.....	39
Nitrogen Dioxide.....	40
Non-Methane Hydrocarbons.....	40
Sulfur Dioxide.....	41
Water Soluble Sulfates.....	42
Lead.....	42

TABLE OF CONTENTS

	PAGE
AQCD ACTIVE MONITORING SITES (Pollutants).....	43
AQCE ACTIVE MONITORING SITES (Pollutants).....	44
AQCD ACTIVE MONITORING SITES (Pollutants).....	45
AQCD ACTIVE MONITORING SITES (Pollutants).....	46
AQCD MONITORING LOCATIONS Metropolitan Tucson.....	47

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150 West Congress Street
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LIST OF ABBREVIATIONS/ACRONYMS

CO	- Carbon Monoxide, a criteria air pollutant.
EPA	- Environmental Protection Agency, a Federal agency.
IP	- Inhalable Particulates.
mg/m ³	- Milligrams per cubic meter. A metric unit of concentration. 1 milligram = 10 ⁻³ grams.
NAAQS	- National Ambient Air Quality Standards, levels of pollutant concentration designed to protect human health and welfare. Currently established for six (6) criteria air pollutants.
NMHC	- Non-Methane Hydrocarbons, a former criteria air pollutant.
NO ₂	- Nitrogen Dioxide, a criteria air pollutant.
O ₃	- Ozone, a toxic triatomic form of oxygen. One of the criteria air pollutants.
Pb	- Chemical symbol for Lead, a metal. One of the criteria air pollutants.
PCAQCD	- Pima County (Arizona) Air Quality Control District.
PM-10	- Particulate matter with an aerodynamic diameter of ten microns or less. One of the criteria air pollutants.
ppm	- Parts per million, a unit of concentration, also most commonly used to express gaseous concentrations.
PSI	- Pollutant Standards Index, an index signifying air pollutant concentrations and associated health effects.
SO ₂	- Sulfur Dioxide. One of the criteria air pollutants.
SO ₄	- Water Soluble Sulfates, a class of non-criteria, particulate air pollutants.
TSP	- Total Suspended Particulates. Formerly one of the criteria air pollutants.
ug/m ³	- Micrograms per cubic meter, a metric unit used to express concentration. 1 microgram = 10 ⁻⁶ grams.

S U M M A R Y

The 1968-1987 Data Summary discusses air pollution levels in and around the Tucson area. Tucson shares its air with urban and suburban growth, industries and significant vehicular use. As the city of Tucson grows so does its environmental problems relating to air. The Data Summary will list historical data of pollutants in the area and address the 1986-1987 levels of federally regulated criteria pollutants in relation to the federal health and welfare standards.

In July of 1987 EPA instituted major changes in the regulations of airborne particulate matter. Until this time such particulate matter was reported in terms of TSP (total suspended particulate matter). In July promulgation of the new PM-10 regulations went into effect and TSP regulations were no longer effective. PM-10 denotes particulate matter with an aerodynamic diameter of ten microns or less. Although the District still operates several TSP sites for data collection the county now has eight PM-10 monitors located throughout the area. Three years of PM-10 data will need to be collected and analyzed before it will be known if Tucson meets or exceeds the new PM-10 regulations.

Carbon monoxide levels did not exceed Federal health standards in Tucson for the years of 1986-1987. Automobiles are the number one source of carbon monoxide in the Tucson area. Even with increased vehicular traffic, levels have dropped considerably since the county began monitoring this pollutant in 1973. Most of this can be attributed to the progress made by the automobile manufacturers in meeting emissions-performance standards and the State's vehicle emissions-control program. The last exceedance of the 8-hour health standard occurred in December of 1985.

The first and only exceedance of the current one hour ozone standard occurred at the Pomona site in 1982 while other monitoring sites recorded values at the standard. Maximum ozone levels at all monitoring sites in 1986-87 were below health standards but remained consistent with preceding years averages. (A violation of ozone requires four or more exceedances over a three-year period.)

Measured lead levels dropped considerably in 1986-1987. This is probably due to the implementation of the EPA Federal law which cut the lead content of regular gasoline by 90 percent on January 1, 1986. The highest quarterly average recorded in 1987 at the Prince Road site was 0.10 ug/m^3 as compared to 0.58 ug/m^3 in 1985.

The other common pollutants measured in Pima County, (nitrogen dioxide, sulfur dioxide, and sulfates) remained well below their respective health and/or welfare standards.

Long term projections for levels of pollutants such as ozone and carbon monoxide remain uncertain due to the potential impacts of continued growth.

This booklet will give detailed information about the concentrations of common air pollutants in relation to different areas around and within Tucson. A section is provided showing the location of different monitoring stations and what pollutants are monitored. A section explaining the different types of pollens and moulds, their concentrations in different areas in the city, and the projection of trends for the next six years has been added due to the increased interest of the public. Requests for more extensive information should be made to the Technical Operations Supervisor of the Pima County Air Quality Control District.

COMMON AIR POLLUTANTS

The Pima County Air Quality Control District measures levels of pollutants for which National Ambient Air Quality Standards (NAAQS) have been set. A detailed data summary for 1986-1987, long term historical data, and precise site locations are presented in pages 29 - 47. Narrative descriptions of common air pollutants, units of measurement used for air pollutants, and the Pollutant Standards Index are provided to inform and explain to the reader what exactly is being monitored and the possible health effects these pollutants have on individuals and the general public.

PM-10 AND TOTAL SUSPENDED PARTICULATES - TSP

On July 1, 1987 the EPA promulgated national ambient air quality standards (NAAQS) for particulate matter with an aerometric diameter of a nominal ten microns or less (PM-10). This was to replace the Total Suspended Particulate (TSP) standards which included any particles small or light enough to remain suspended in the air. The new health standards are set around particles (ten microns or less) that can be inhaled and deposited in the respiratory system. The size of the particle determines how deeply it will penetrate into the lungs. The health hazard of particulates may be physical, from the clogging of the lung sacs by the particles, or chemical, from reactions of the body to very small substances that can pass through the lung membranes into the blood and onto other body organs. Primary sources of particulate matter in Tucson are traffic on unpaved roads, on unpaved shoulders, and on paved streets; earthmoving, mining, and agriculture; and a natural desert background, comprising about one-third of the typical urban levels.

Eight PM-10 monitors have been operating in the field since the promulgation of the new PM-10 standards. TSP monitors have been replaced at five of the monitoring sites; although the District continues to monitor TSP at several locations throughout the county. As funding becomes available more of the TSP monitors will be replaced with the PM-10 monitors. At present Pima County has enough monitors to meet EPA requirements; and four more will be deployed in the field sometime in 1988. PM-10 data collected since 1985 at the Orange Grove site will be discussed in detail in the section "PM-10" in this booklet.

Total suspended particulates continued to exceed the old TSP health standards in 1986-1987. Currently the average of the entire TSP network exceeds the old health standard by about 10 percent. Although there was only one exceedance of the old primary 24-hour standard in 1986-1987 five out of the eight monitoring stations exceeded the secondary standard. Four of the monitoring stations exceeded the Annual Geometric Mean for both years.

Carbon Monoxide - CO

Carbon monoxide is a colorless, odorless, poisonous gas produced by the incomplete combustion of fuels. Over ninety percent of the CO released into the atmosphere in the Tucson area is from gasoline and diesel engines, e.g., automobiles and trucks. Carbon monoxide normally disperses rapidly. Its danger comes from localized concentrations such as traffic-filled intersections. Atmospheric conditions are a prevalent factor in carbon monoxide concentrations and dispersion processes.

The fundamental health effect from CO lies in its ability to replace oxygen in the red blood cells, reducing the amount of oxygen that can reach body cells. Symptoms of high CO concentrations may include dizziness, slowed reaction times, and headaches.

Even with increased vehicular traffic in the Tucson area carbon monoxide levels have continued to decline. There were no exceedances of the health standard in 1986 or 1987. One exceedance of the 8-hour standard was recorded in 1985 at the 22nd/Alvernon site as compared to three exceedances in 1984.

From November 17, 1986 to March 20, 1987 Pima County Air Quality Control District conducted a "hotspot" monitoring study for carbon monoxide at the intersection of 22nd Street and Alvernon Way. The purpose of this study was to collect data representative of local conditions during peak traffic hours at a typical busy intersection. The site is a good representative of high volume traffic intersections in Tucson, typically handling traffic in excess of 80,000 vehicles per day. The collected data were to be used for computer dispersion modeling for predicting CO concentrations near roadways. Input parameters required for such models include ambient CO concentrations, meteorology, site geometry and traffic flow patterns. CO concentrations measured in the study could be used to evaluate the accuracy of the computer models. Accurate modeling programs could be used to predict CO levels at other locations throughout the city.

The permanent air quality monitoring station is located on the northwest corner of 22nd/Alvernon. Besides a carbon monoxide analyzer, meteorological equipment giving data on wind speed, wind direction, temperature, and relative humidity is housed at the trailer. Bag samplers (samplers containing 8 individual plastic bags which fill up with hourly samples of ambient air) were placed on the southwest and southeast corners of the intersection. From December 1986 to March 1987 these were placed in pairs so comparisons of the samplers could be obtained for quality assurance. No exceedances of the Federal Health Standards were observed throughout the study.

Ozone - O₃

Ozone is the principal constituent of photochemical smog. The primary health effect associated with this hazardous form of oxygen is irritation of the mucous membranes in the nose and throat causing coughing, choking, and impaired lung function. Ozone also aggravates chronic respiratory diseases like asthma and bronchitis. Peroxyacyl nitrates and other photochemical oxidants that accompany ozone are powerful eye irritants.

Formed by the reaction of nitrogen oxides and hydrocarbons in the presence of sunlight, ozone levels are usually highest at mid-day in summer. As the precursors to ozone are released in morning rush hour traffic the atmosphere is starting to heat up. By midmorning ozone levels are starting to rise and continue to rise till mid-day or early afternoon. Afternoon rush hour traffic does not contribute as much to the formation of ozone due to the cooling process in the evening and the less intensity of the sun. In the night ozone levels drop to very low values then start rising again in midmorning. Of Tucson's urban ozone levels, about one-quarter is formed from vehicular and industrial emissions, while three-quarters is present as a natural background. The Federal Health Standards for ozone was not exceeded in 1986-1987.

Nitrogen Dioxide - NO₂

Nitrogen dioxide is a poisonous and highly reactive gas produced by high-temperature combustion processes and formed photochemically from nitric oxide. Although high levels of NO₂ irritate the respiratory system, its principal harm in Tucson comes from the ozone that it helps to form by reacting with atmospheric oxygen. 1986-1987 NO₂ levels remained well within the health standard.

Sulfur Dioxide - SO₂

The major source of SO₂ in Arizona is copper smelting. Tucson itself has no important sources of SO₂. Many types of respiratory disease, such as coughs and colds, asthma and bronchitis, are associated with sulfur dioxide pollution. 1986-1987 levels of SO₂ continued to be extremely low and well below all primary and secondary standards.

Sulfates - SO₄

Formed by the atmospheric conversion of SO₂, sulfates contribute to acid rain and decrease visibility. No health standard has been set for sulfates. 1986-1987 average levels fail to show any significant trend development as compared to 1984-1985 levels.

Non-Methane Hydrocarbons - NMHC

Formed by the incomplete combustion of fuel and by evaporation of solvents and fuels, reactive hydrocarbons combine with nitrogen oxides to form smog. The 6 a.m. to 9 a.m. concentration of reactive hydrocarbons, all hydrocarbons except methane, is a supposed crude predictor of the smog level formed later in the day. Although some individual hydrocarbons are poisonous, most are not. The air quality standard for hydrocarbons was rescinded by EPA in February 1983, and there is currently no health or welfare standard.

Lead - Pb

About 90 percent of airborne lead is emitted from vehicles burning leaded fuel. Lead is a poison when ingested or inhaled. It accumulates in the body, in bone and soft tissue, and affects the blood forming organs, the kidneys, and the nervous system. Although lead levels have been below the health standard in the Tucson area they dropped even lower in 1986-1987. This could be contributed to the Federal law that went into effect in January 1986 that cut the amount of lead allowed in leaded fuel by approximately 90 percent. This, combined with less lead burning vehicles on the roadways has dropped the lead levels in Tucson's ambient air to very low levels.

Visibility

During 1986 the integrating nephelometer (an instrument used to measure visibility at the downtown site) quit operating and could not be repaired. Due to the age of the instrument, parts were hard to find and qualified personnel to work on the instrument were no longer available.

Pima County is in the process of replacing the instrument with a new integrating nephelometer and retaining a consulting firm to put together a working program for measuring visibility in the Tucson area. Hopefully this will give valuable insight into the haze or brown cloud that is visible in the winter in the Tucson area. Historical visibility data from 1978 through 1985 are presented in this booklet. 1984 and 1985 average visibility remained constant at an average of 35 miles.

UNITS OF MEASUREMENTS FOR AIR POLLUTANTS

Presented throughout this report are the following units of measurement for air pollutants and Federal standards:

ppm - parts per million
ppb - parts per billion
 $\mu\text{g}/\text{m}^3$ - micrograms per cubic meter of air
 mg/m^3 - milligrams per cubic meter of air

NATIONAL AMBIENT AIR QUALITY STANDARDS

<u>Pollutants</u>	<u>Averaging Time</u>	<u>Primary Standards</u>	<u>Secondary Standards</u>
CO	8 hours 1 hour	9 ppm 35 ppm	
Lead	Quarter	$1.5 \mu\text{g}/\text{m}^3$	$1.5 \mu\text{g}/\text{m}^3$
NO ₂	Annual	0.053 ppm	0.053 ppm
Ozone	1 hour	0.12 ppm	0.12 ppm
PM-10	24 hour Annual	$150 \mu\text{g}/\text{m}^3$ $50 \mu\text{g}/\text{m}^3$	$150 \mu\text{g}/\text{m}^3$ $50 \mu\text{g}/\text{m}^3$
SO ₂	Annual 24 hour 3 hour	0.03 ppm 0.14 ppm	0.5 ppm
* TSP	Annual 24 hour	$75 \mu\text{g}/\text{m}^3$ $260 \mu\text{g}/\text{m}^3$	$60 \mu\text{g}/\text{m}^3$ $150 \mu\text{g}/\text{m}^3$

* Replaced by PM-10 standards on July 1, 1987.

POLLEN AND MOULD

The Office of Pollen and Mould operates as a division of the Air Quality offices of Pima County Health Department. The office officially started collecting data in July of 1984. At present six High Tech Volumetric monitors are located across the city. These are a new design that were installed in 1987 to replace an older model monitor which was used to establish the 40-year database for the area. During the fall and spring pollen season, ten of the older models are relocated in the field as a measure for the effectiveness of the Pollen-Control Ordinance.

The pollen-control ordinance went into effect in January of 1985. The ordinance was designed to regulate and reduce large amounts of allergenic, wind-borne pollens which are noxious and contribute to human disease: Common Bermuda grass, mulberry trees, and olive trees. The ordinance allows for the enforcement of cutting of Bermuda grass and prohibits the sale and planting of mulberry and olive trees in the County.

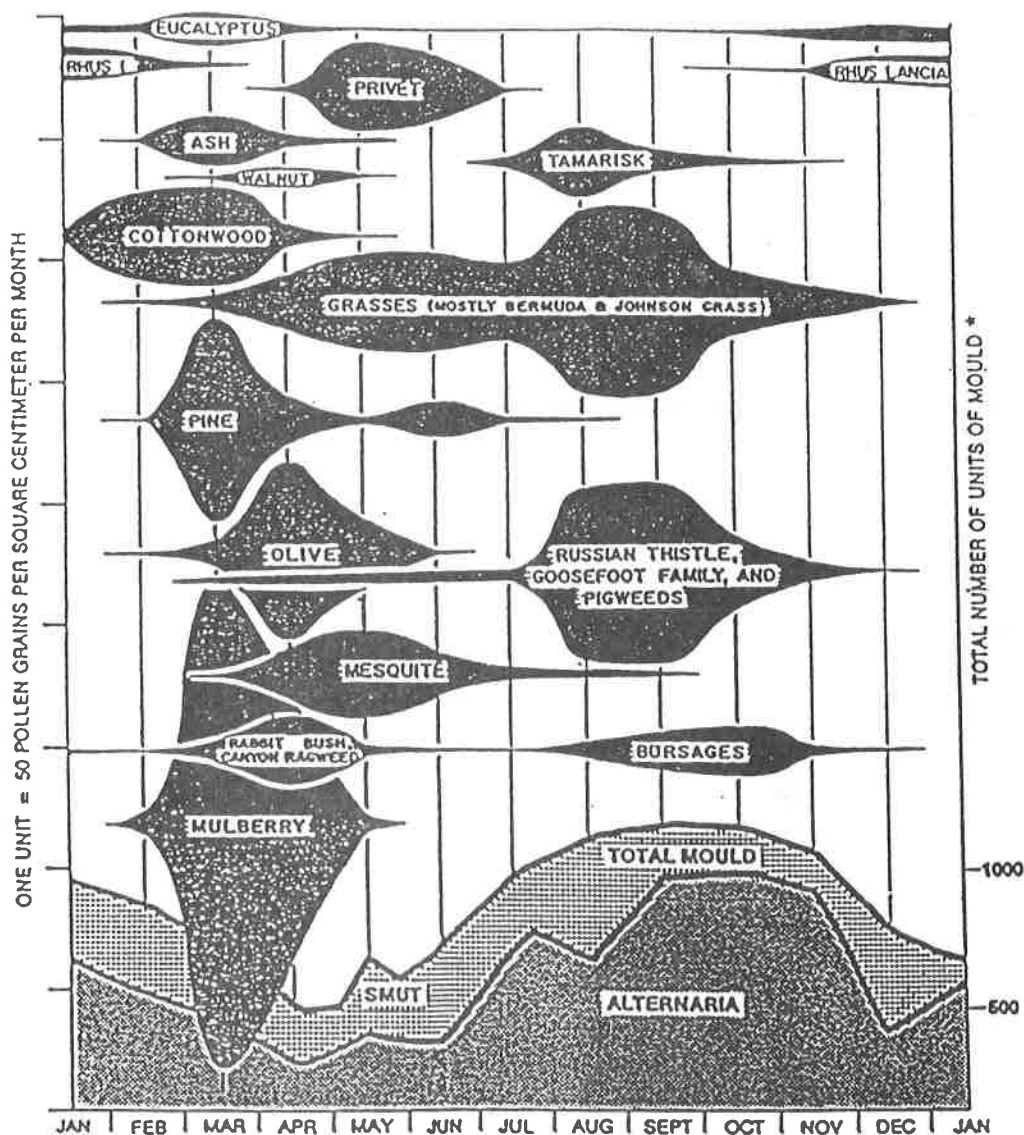
Dr. Mark Sneller operates the office of Pollens and Moulds. The 1987 Bermuda Grass Report showed there was a general decrease in the amount of fall pollens and total pollens since 1983. This includes Bermuda grass-like pollens and moulds, also Alternaria. Since 1985, Bermuda grass-like pollens have decreased 51 percent. Although much of this can be attributed to climatic factors, (variation in rainfall and late of early seasonal changes), increased awareness by the public and enforcement of the pollen-control ordinance has also helped to decrease the levels.

Excluding Bermuda grass-like pollens, since 1985 the decrease in fall pollens has been 39 percent. This includes Russian Thistle, Carelessweed, Ragweed, and other weeds and wild grasses. Dr. Sneller attributes this to climatological changes in the valley that are part of an eleven year cyclical sunspot-rainfall pattern which reached a peak in 1982 and 1983. In 1987 Tucson was in the lower part of this cycle. This trend is expected to reverse in 1989 and will be marked by an increase in rainfall year by year with a corresponding increase in all categories of pollen and mould. Within six years this cycle is expected to reverse itself.

The office of Pollen and Moulds has a daily recording of current Aero-Allergen information. This can be reached by calling 791-3560. Requests for more extensive information can be made to Dr. Mark Sneller at the same number.

TUCSON POLLEN and MOULD CALENDAR

Compliments of
PIMA COUNTY HEALTH DEPARTMENT
Pollen and Mold Division
150 West Congress Street
Tucson, Arizona 85701-1317
(602) 791-3560
4/87



* Total mould consists of numerous allergenic fungi, including Alternaria, Cladosporium, smut, assorted Basidiomycetes, Ascomycetes, Fungi Imperfecti, as well as mycelia sterilia and unidentifiable species.

The above data are based on mean monthly pollen and mould counts measured over a 20-yr. period at Tucson Clinic, 116 North Tucson Blvd., Tucson, Arizona. Data collection commissioned by Tucson Clinic, P.C.; pollen analyzed by H.D. Hayes; data analyzed by A.M. Solomon and H.D. Hayes; mould data analyzed by M. Sneller.

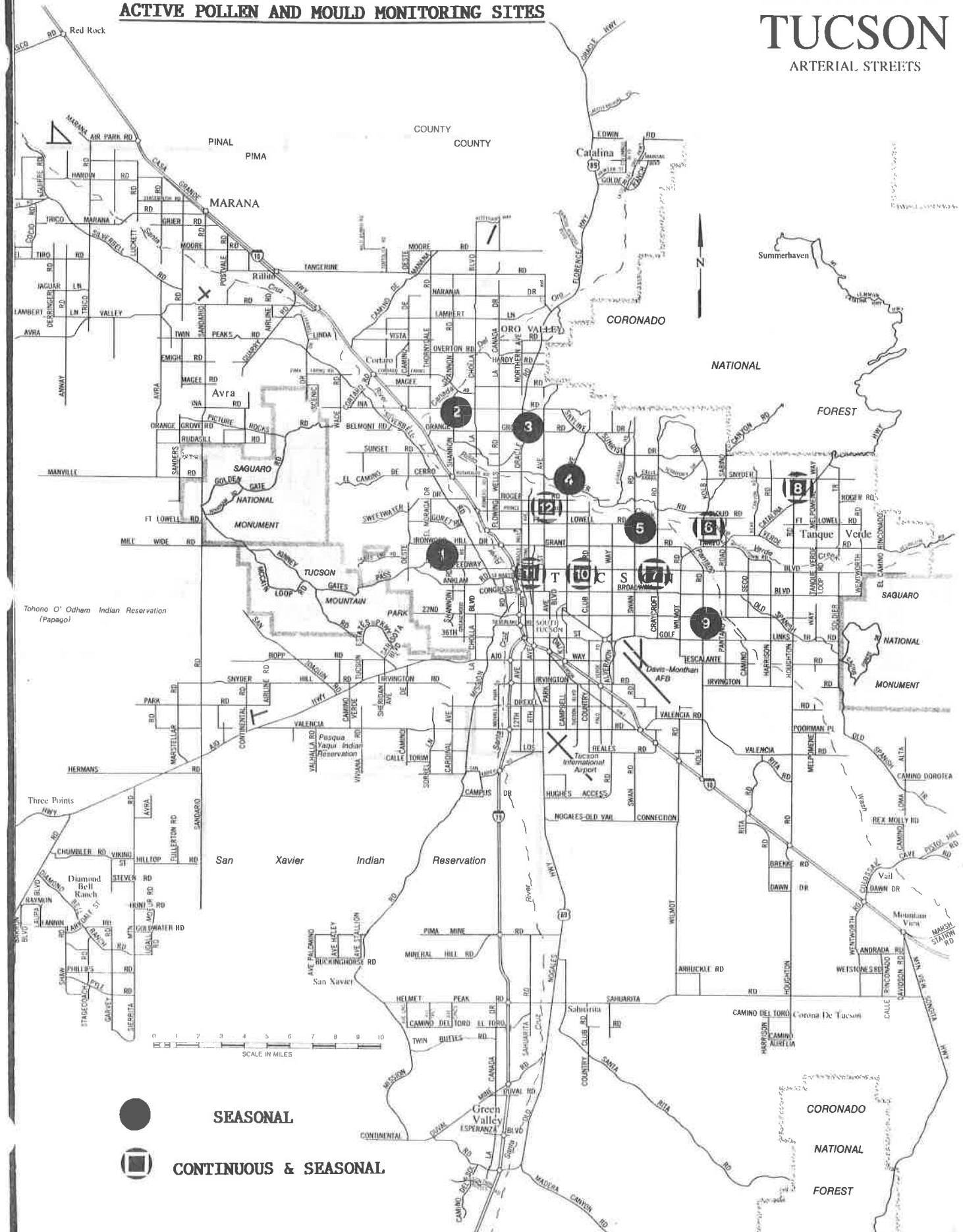
ACTIVE POLLEN AND MOULD MONITORING SITES

Sampling occurs on a twenty-four hour basis at the continuous sites. Samplers run one minute out of every ten, sampling forty-seven liters of air per minute. Samples are picked up every twenty-four hours and analyzed in the laboratory at the Health and Welfare Building at 150 W. Congress. The readings of all six continuous samplers are averaged together to obtain the mould and pollen readings for any particular day.

Seasonal monitors run in the spring (mid February through mid May) to catch the tree pollen season, and in late summer-fall (July through October) to monitor the fall Bermuda grass season. The data base for the county is based on using these old style monitors. By adding information to the base it can be determined if the Pollen Ordinance has had any effect.

<u>Map No.</u>	<u>Site location</u>	<u>Frequency of Operation</u>
1	Old Pima College West	Seasonally
2	Shannon and Orange Grove	Seasonally
3	Oracle and Rudasill	Seasonally
4	Roger Road and Campbell Ave.	Seasonally
5	Grant Road and Swan Ave.	Seasonally
6	Tanque Verde and Sabino Canyon Road	Seasonally Continuous
7	Fifth Street and Craycroft Road	Seasonally Continuous
8	Prince Road and Catalina Highway	Seasonally Continuous
9	Kolb Road and Golf Links Road	Seasonally
10	Broadway Blvd. and Tucson Blvd.	Seasonally Continuous
11	Downtown Art Museum on Alameda Street	Seasonally Continuous
12	First Ave. and Ft. Lowell Road	Seasonally Continuous

**METROPOLITAN
TUCSON**
ARTERIAL STREETS



PSI

POLLUTANT STANDARD INDEX

The Pollutant Standard Index (PSI) is the EPA measure by which daily air pollution levels are reported to the public. The one-hour high of ozone, the eight- consecutive-hour average high for carbon monoxide, and the twenty-four hour average of particulate matter, ten microns or less, are the averages used in calculating the air quality index for any given day. These averages are translated into a numerical category (index value) with corresponding qualitative descriptors. The descriptors include good, moderate, unhealthy, very unhealthy, and hazardous. These are used to enable the public to easily understand the current air quality conditions.

The PSI for Tucson is calculated every day except weekends and holidays by Pima County Air Quality Control District. The site used for collection of data is located in downtown Tucson at 150 West Congress Street. Ozone, carbon monoxide, and PM-10 are monitored daily on a continuous basis to generate the necessary data to calculate the PSI.

The ozone analyzer, CO analyzer, and the PM-10 air sampler used for PSI data collection are all EPA approved equipment. Sample lines located outside the air quality lab are connected to the CO and O₃ analyzers supplying a continuous stream of outdoor ambient air. The air samples are converted into continuous readings of the concentrations of CO and O₃ by the respective analyzers. The two gaseous analyzers feed this information to a computer which is used as a data logging system. Every fifteen seconds the concentrations of the pollutants are recorded on the data logger. The fifteen second readings are averaged every five minutes for one five minute average. These five minute averages are averaged every hour by the data logger for the one hour pollutant concentrations. These are all recorded on a data disk by the computer and used later for the calculation of the PSI.

The PM-10 high volume sampler is located downtown on the roof of the Tucson Community Center. At three p.m. during the weekdays, the quartz fiber filter containing the particulate catch for a twenty-four hour period is removed and a new filter is installed. The high volume sampler acts as a large vacuum cleaner pulling air at a calibrated rate through the filter where the size specific suspended particulates are deposited. The used filter is then taken to the air quality lab where it is weighed. All filters are weighed previously before being used so the weight of the filter can be subtracted from the weight of the used filter to give the total weight of the suspended particulates. The cubic feet per minute (CFM) of air passing through the high volume is calculated by reading a dixon chart which records the air flow on a circular graph. The samplers are calibrated to maintain a constant air flow between 40-45 CFM. By using these two numbers, the weight of the suspended particulates and the air volume passing through the sampler, and the use of a mathematical formula, the micrograms per meter cubed of airborne particulates in the air for the twenty-four hour period is obtained.

At 3:45 p.m. the data disk is removed from the data logger of the ozone and carbon monoxide analyzers in the air quality lab. The disk is then inserted in another computer where a printout of the hourly data from the analyzers is generated.

The data on the printout is then examined to find the maximum one hour average during the preceeding twenty-four hours, in the case of ozone, and the eight consecutive hour average high for CO. These numbers and the particulate ug/m³ are then used with the PSI index sheet to find the corresponding index number and descriptor. The PSI is then recorded on a monthly log sheet and is ready for public distribution.

The table below describes the general health effects and precautionary actions that should be taken in the event of a high PSI. Although levels in Tucson rarely reach the unhealthful point, occasional high values (100) are reported.

INDEX VALUE	PSI DESCRIPTOR	GENERAL HEALTH EFFECTS	CAUTIONARY STATEMENT
401 to 500	Hazardous	Premature death of ill persons; healthy people will experience adverse symptoms that affect their normal activity.	All persons should remain indoors, keeping windows and doors closed. All persons should minimize physical exertion and traffic.
301	Hazardous	Premature onset of certain diseases in addition to significant aggravation of symptoms and decreased exercise tolerance in healthy persons.	Elderly and persons with existing diseases should stay indoors and avoid physical exertion. General population should avoid outdoor activity.
201 to 300	Very Unhealthful	Significant aggravation of symptoms and decreased exercise tolerance in persons with heart or lung disease with widespread symptoms in the healthy population.	Elderly and persons with existing heart or lung disease should stay indoors and reduce physical exertion and outdoor activity.
101 to 200	Unhealthful	Mild aggravation of symptoms in susceptible persons, with irritation symptoms in the healthy population.	Persons with existing heart or respiratory ailments should reduce physical exertion and outdoor activity.
51 to 100	Moderate		
0 to 50	Good		

FIGURE 1

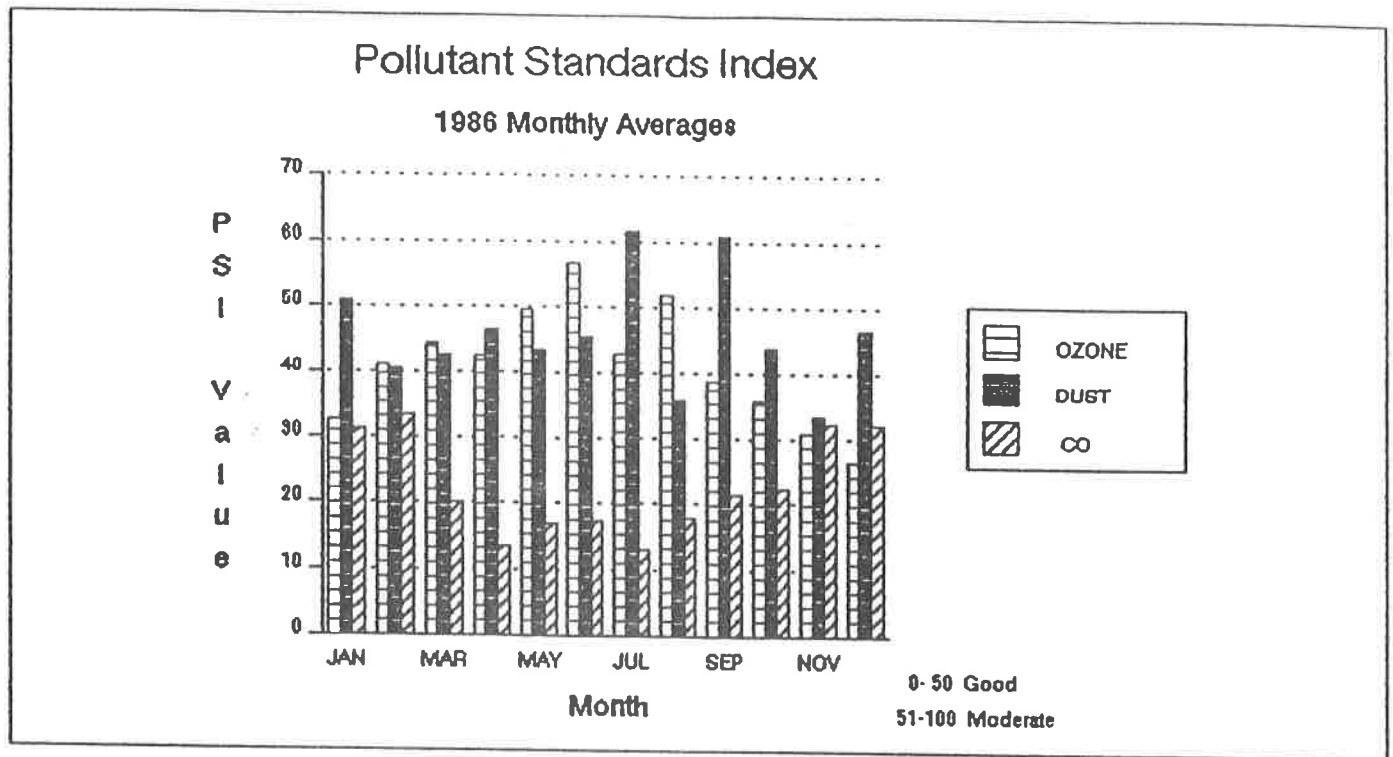
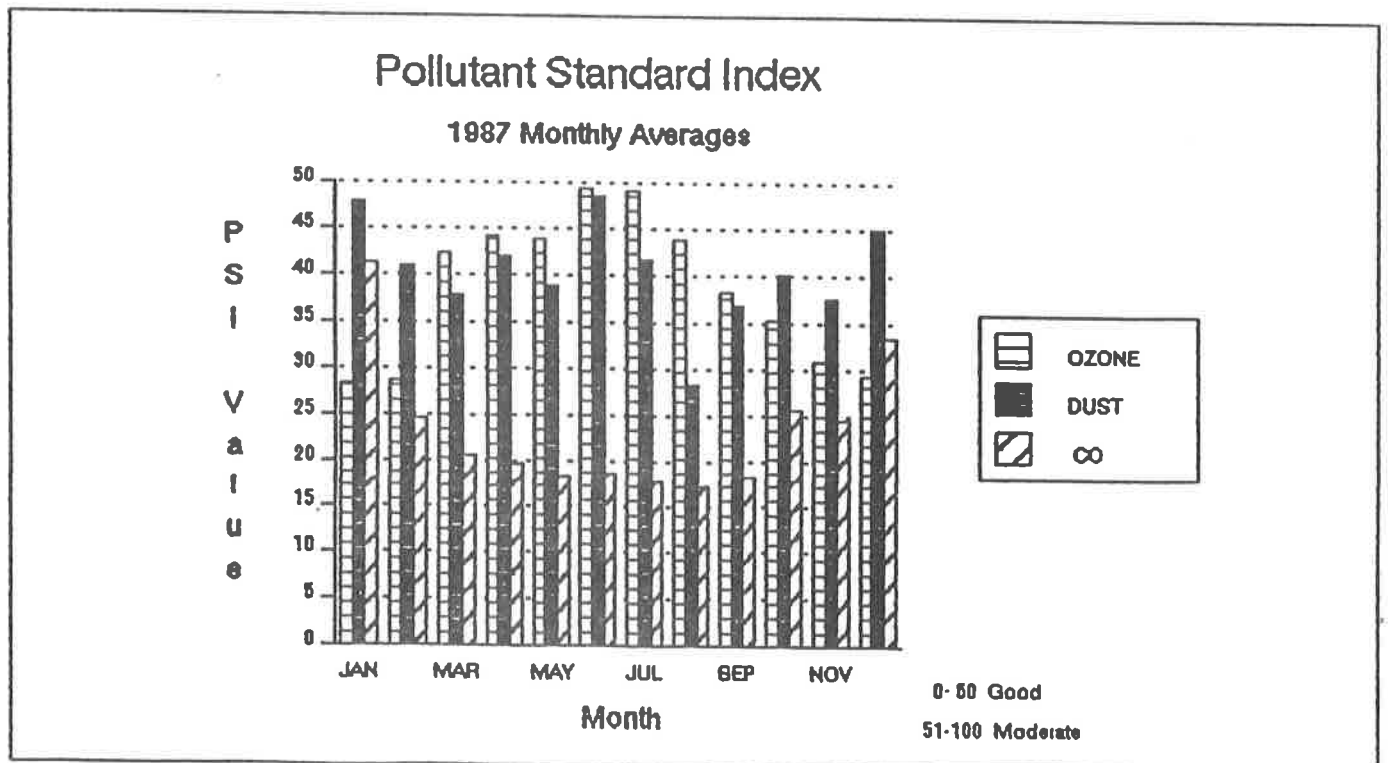


FIGURE 2



Pollutant Standard Index – 1986 & 1987

Percentage of Good/Moderate Days

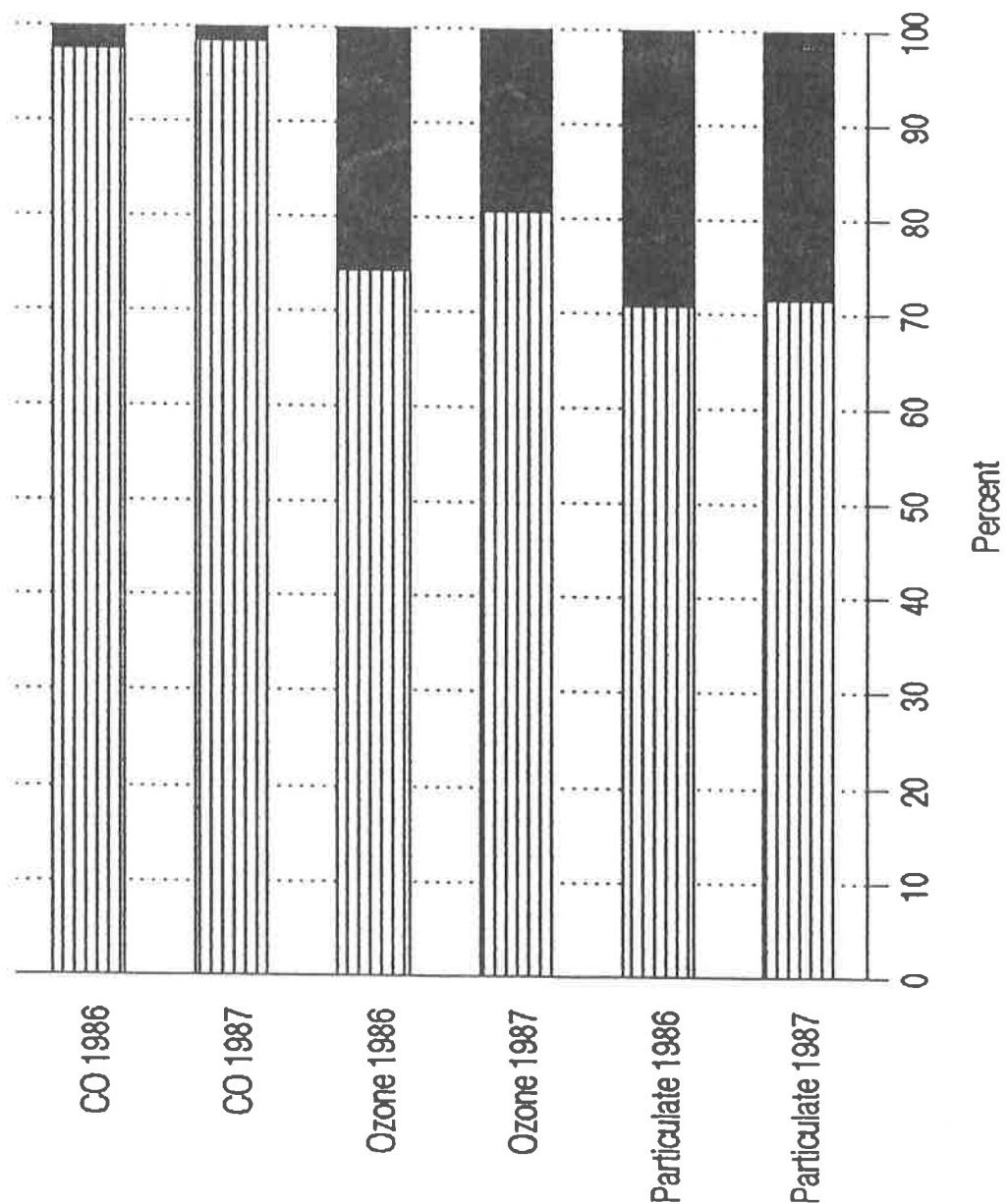


FIGURE 3

VARIATION IN AIR QUALITY: SEASONAL, HOURLY, GEOGRAPHICAL

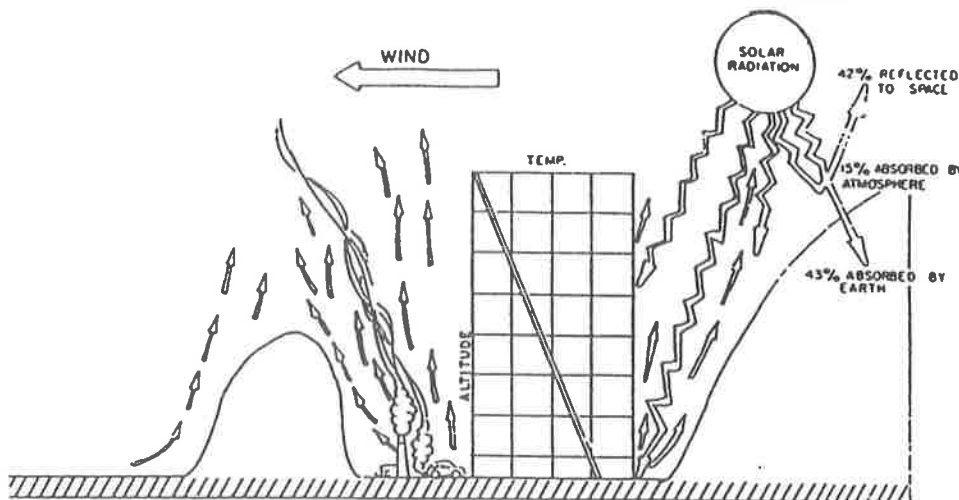
1. Seasonal Variations of Air Pollution in Tucson, Arizona

Concentrations of air pollutants vary with the season; for all pollutants except ozone, the higher levels occur in winter when the air is most calm and stagnant. Under these conditions, especially during winter evenings and early mornings, pollutants become trapped by inversion formation. Accumulations of air pollutants are sometimes visible in Tucson's lower atmosphere on winter mornings. As the surface temperature increases between sunrise and noon, the air gradually becomes more turbulent, the surface winds increase, and the pollutants are slowly dispersed into the atmosphere. The common air pollutants affected by this phenomenon are total suspended particulates, carbon monoxide, nitrogen oxides, and hydrocarbons. On the other hand, because sunlight drives the chemical reactions forming ozone, the highest ozone levels usually, but not always, occur in summer.

Figure 4 illustrates the formation of atmospheric temperature inversions. Figure 5 and 6 illustrate average monthly concentration of CO while Figure 7 shows the highest 8-hour average CO concentrations by month for 1987. Figures 8 and 9 show the monthly TSP concentrations for 1986/87 for Corona de Tucson (background station) and Golf Links/ Harrison. Figure 10 illustrates average monthly ozone concentrations for 1986/87 at the Pomona site.

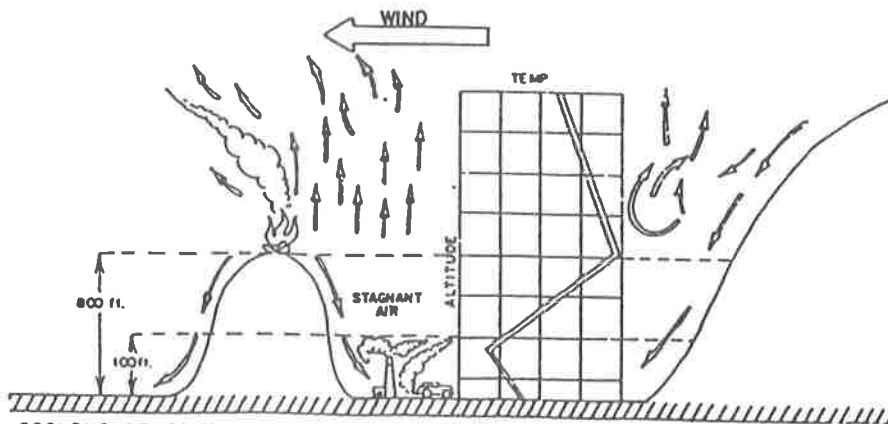
FIGURE 4

FORMATION OF ATMOSPHERIC TEMPERATURE INVERSIONS



NORMAL HEATING OF EARTH'S SURFACE DURING DAYTIME

(Normal heating, normal temperatures, and ventilated pollutants)



COOLING OF EARTH'S SURFACE AT NIGHT WITH TEMPERATURE INVERSION

(Cooling with inverted temperature and trapped pollutants)

FIGURE 5

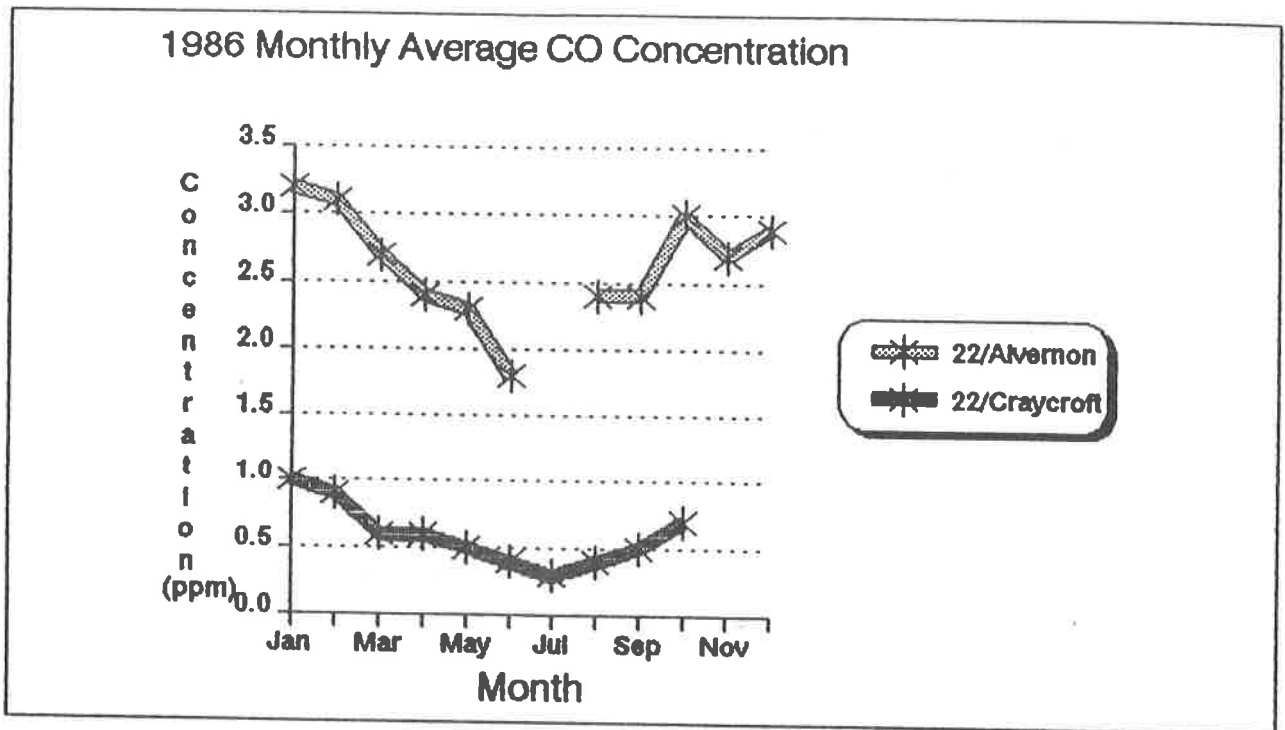
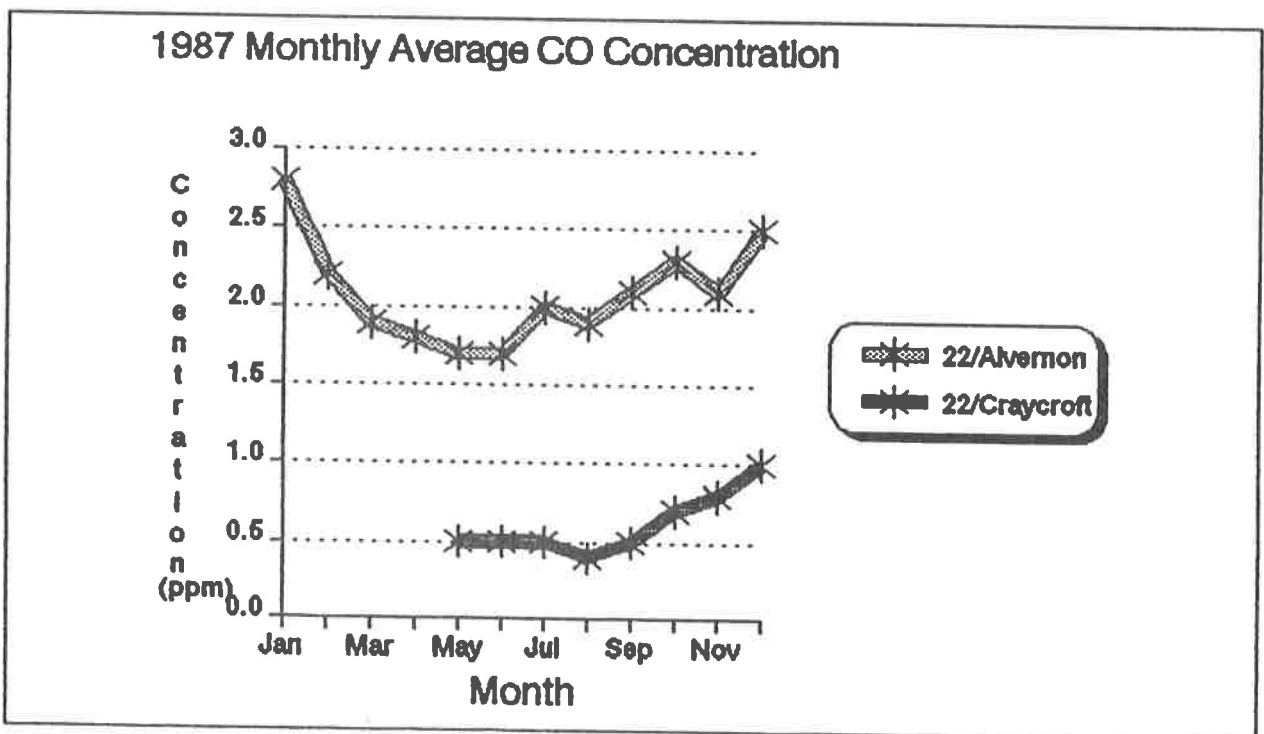


FIGURE 6



Highest 1987 CO 8 - Hour Average (by Month)

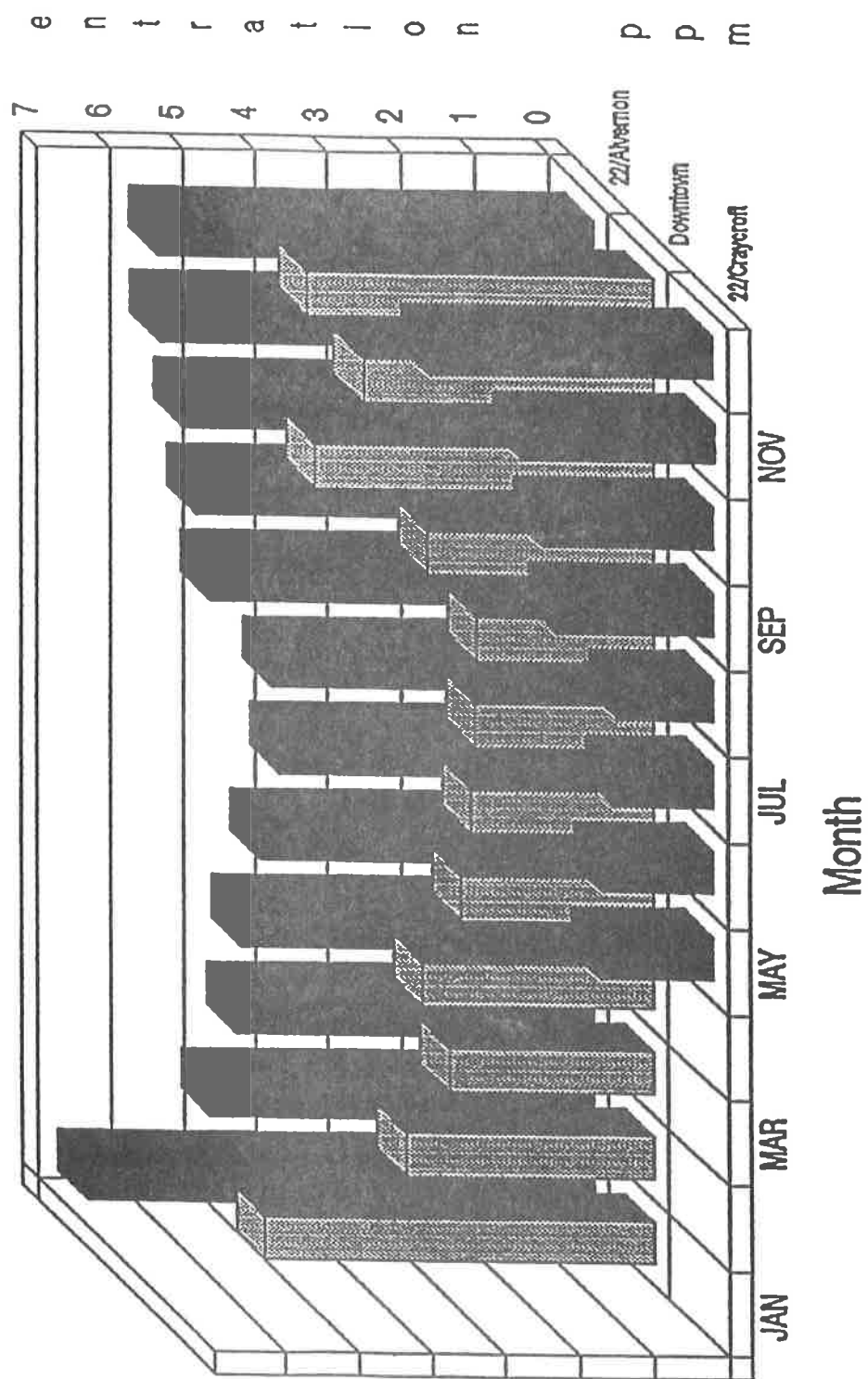


FIGURE 7

FIGURE 8

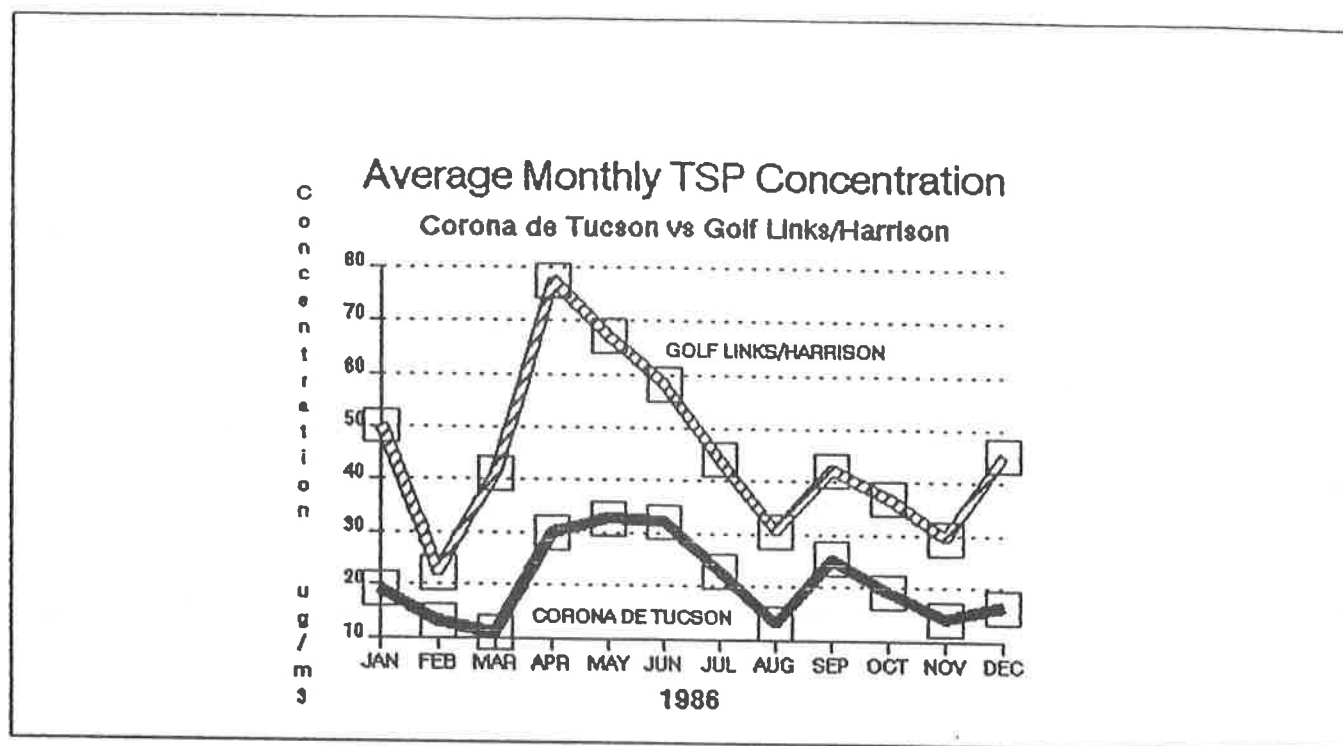


FIGURE 9

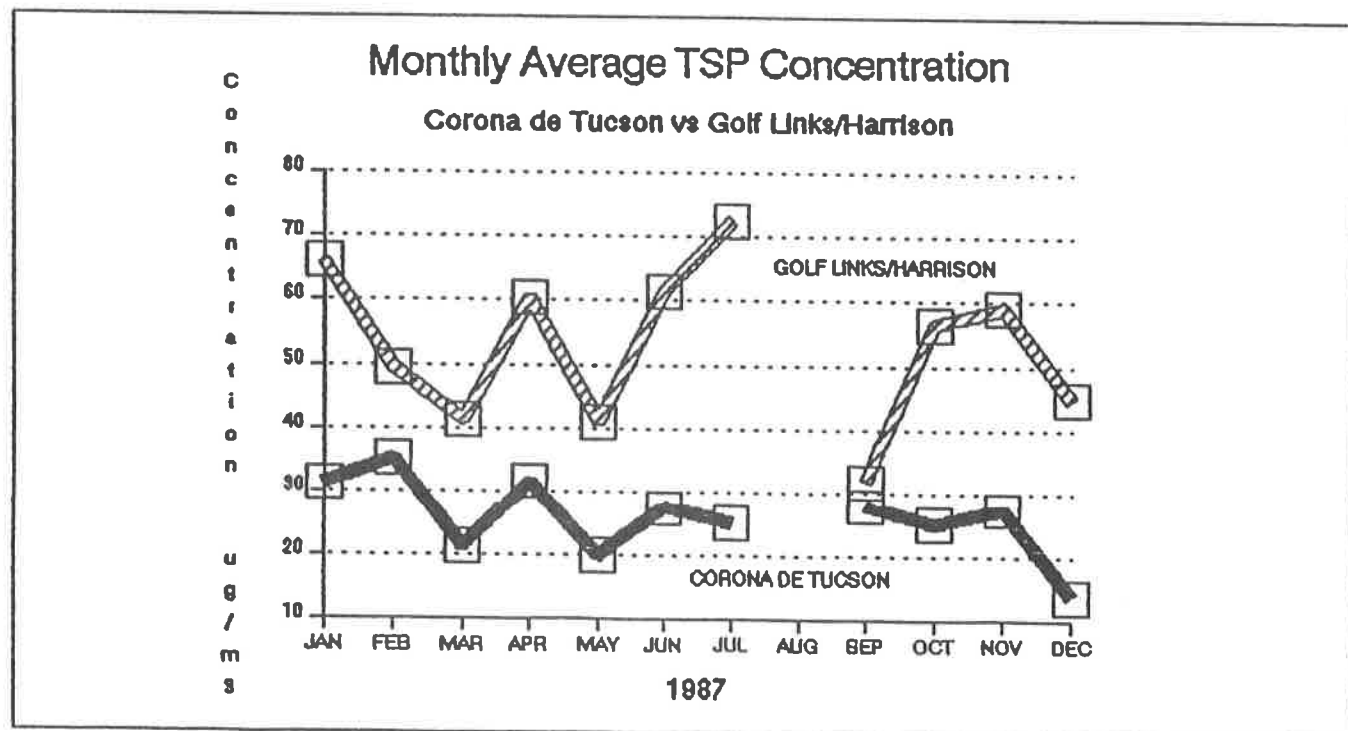
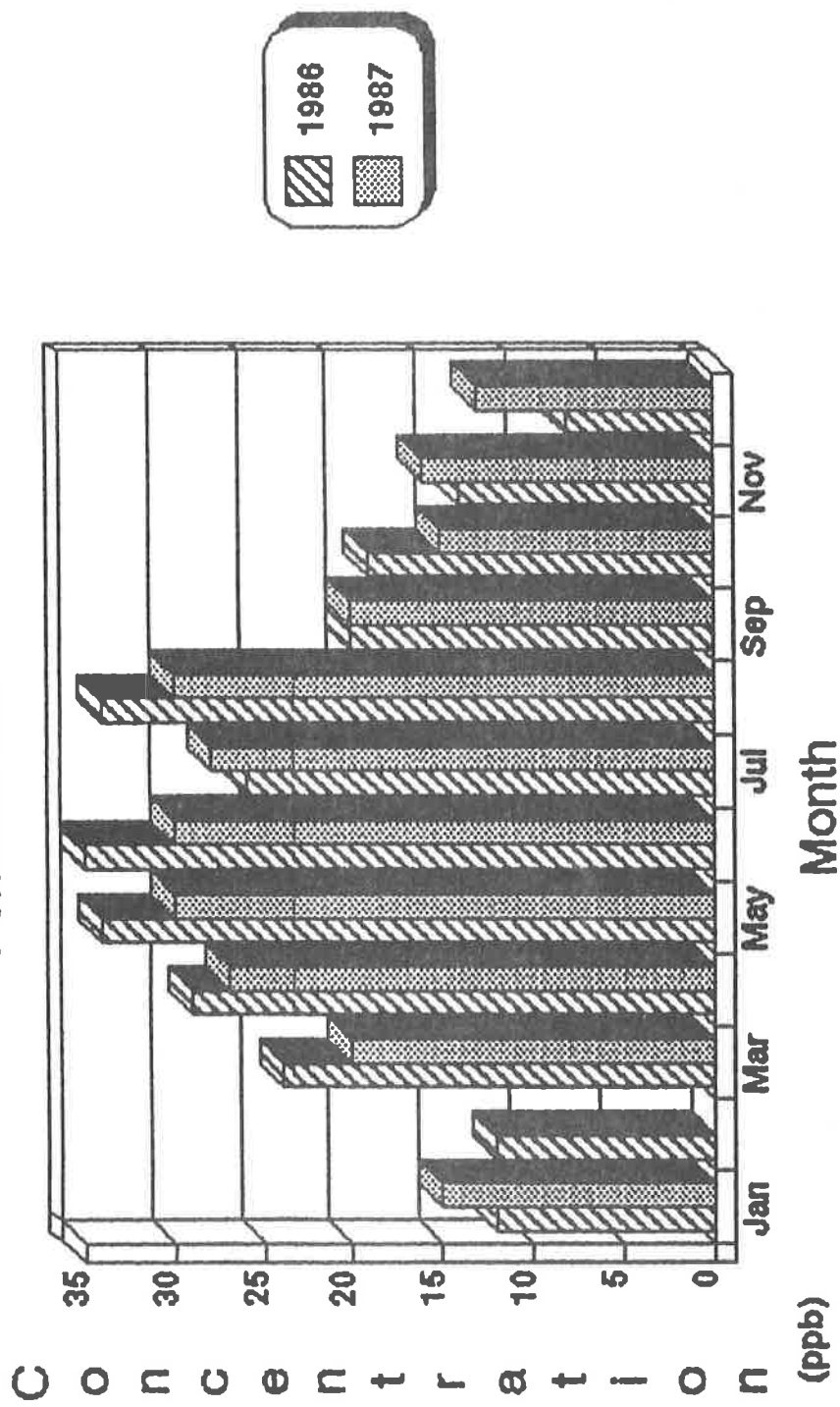


FIGURE 10

Monthly Average Ozone Concentration

Pomona Site



2. Hourly Variation of Air Pollution

Air pollution concentrations vary with time because traffic densities, windspeed, and the dispersive capacity of the atmosphere all change throughout the day. Those pollutants emitted by vehicles - carbon monoxide and nitrogen oxides - peak during the morning hour, level off during the afternoon, climb again during the evening rush hour, and reach their low during the early morning when traffic is lightest. Ozone, formed photochemically from nitrogen oxides and hydrocarbons, peaks later in the morning and early afternoon than the oxides of nitrogen. Ozone usually falls to near zero at night because it reacts with other pollutants and cannot be produced in absence of sunlight.

Particulate matter, mostly generated by vehicular traffic on paved and unpaved roads, is highest shortly after the morning rush hour. Levels decrease as the air becomes more turbulent in the afternoon, and during the early morning hours. Figures 11 illustrates the variations of carbon monoxide hourly averages for December 1986 and 1987 from the 22nd/Alvernon site. Figure 12 illustrate the hourly variations of ozone for July 1985, 1986, 1987 from the Pomona site.

FIGURE 11

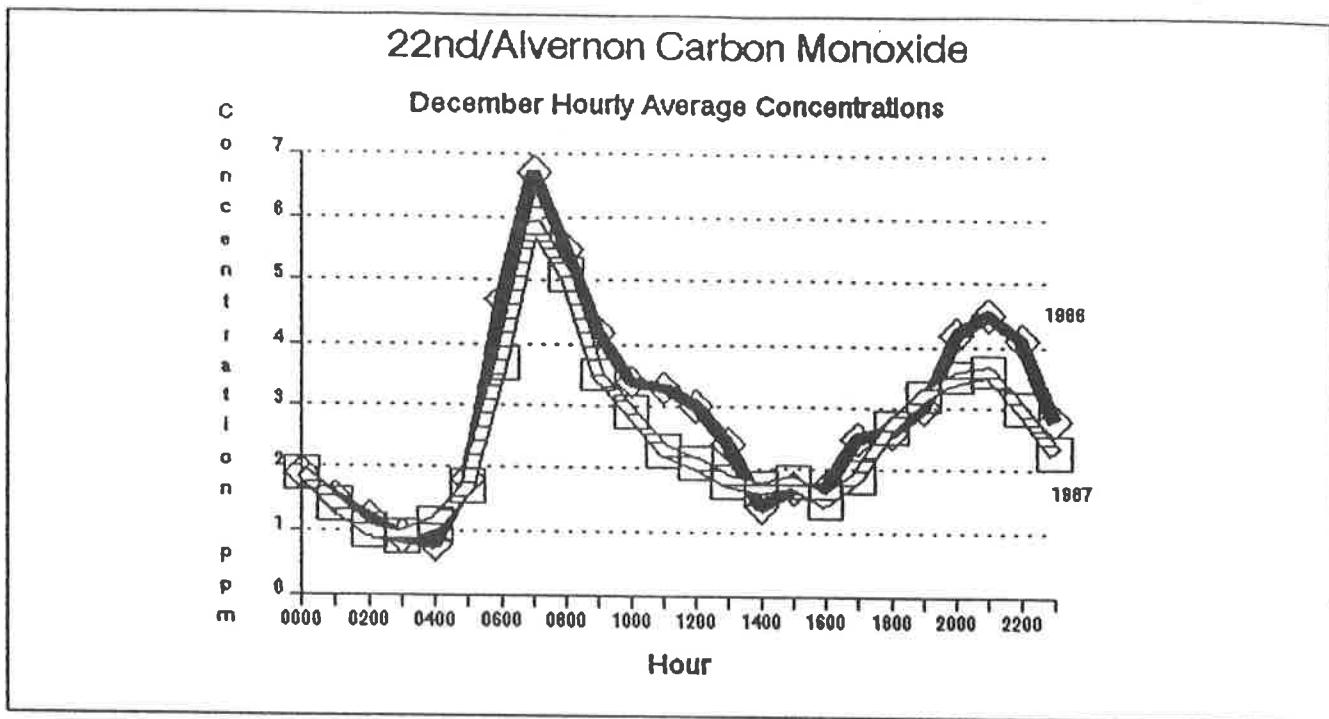
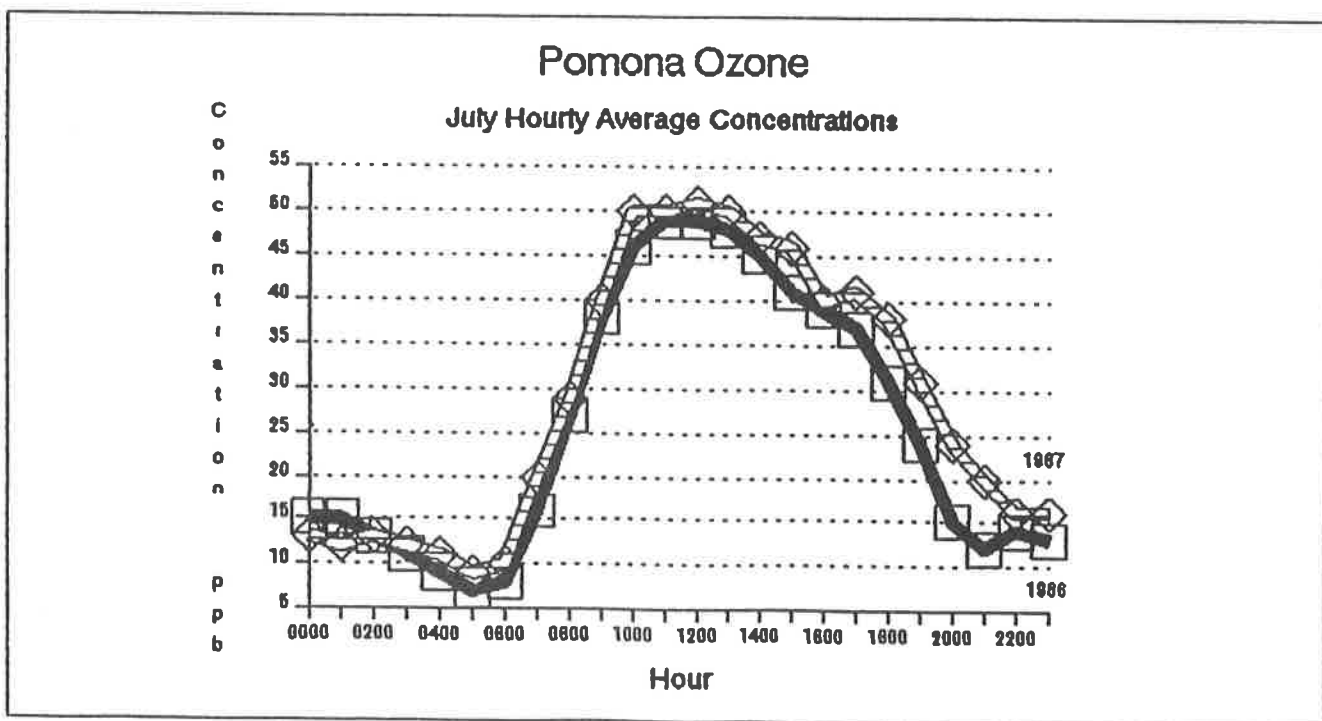


FIGURE 12



3. Geographical Distribution of Air Pollution

Concentrations of the three major pollutants vary from place to place within the Tucson airshed. Carbon monoxide levels are highest in the immediate vicinity of major intersections and congested major streets. In off-street neighborhoods, however, carbon monoxide values are lower. Ozone is normally highest northwest of downtown, although maximum values have been measured at both the Downtown and 22nd/Craycroft sites. Particulates are highest near unpaved roads, and heavily travelled paved roads. Because of prevailing southeasterly winds, the north-central to northwest region of the airshed has higher particulate levels than the south and southeastern areas.

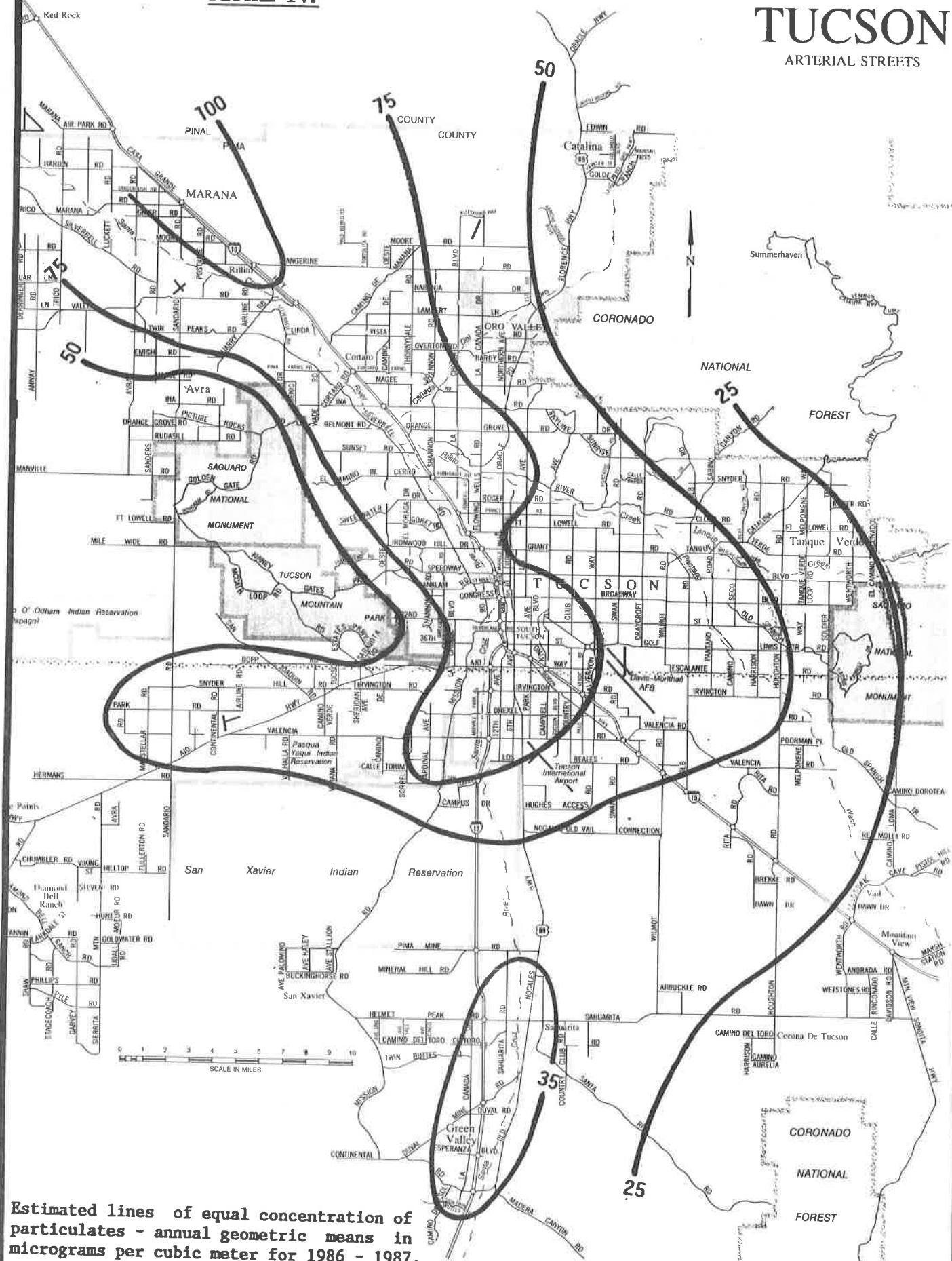
In general, particulates decrease with increasing elevation: the low-lying areas, especially in the northwest, have higher particulate levels. Figures 13 and 14 depicts the geographical distribution of particulates.

Ozone levels are not necessarily the highest in areas where the largest volumes of traffic exist. As the pollutants are released from car exhaust during rush hour traffic they may travel by wind or simple dispersion away from the concentrated areas before reacting with sunlight to form ozone.

FIGURE 14:

METROPOLITAN TUCSON

ARTERIAL STREETS



Estimated lines of equal concentration of particulates - annual geometric means in micrograms per cubic meter for 1986 - 1987.

PM-10

When the Federal Clean Air Act was established two of its governing abilities were the establishment and revision of national ambient air quality standards (NAAQS). EPA reviews criteria every five years to determine if pollutant NAAQS require review. It is the EPA's responsibility to identify pollutants which may reasonably be anticipated to endanger public health or welfare and issue air quality criteria for them. These criteria must reflect the latest scientific information available in indicating the kind and extent of all identifiable effects on health or welfare that may be expected from the presence of a pollutant in the ambient air. Since 1979 EPA has been working to complete additional research needed to revise the existing criteria documents for particulate matter. In July 1987 these new standards went into effect, specifying new standards for particulate matter and redefining particulate matter as those particles with an aerodynamic diameter of ten microns or less. These size particles are considered to be inhalable and pose the largest health risks to the public.

Health risks posed by inhaled particulates are influenced both by the penetration and deposition of particles in the various regions of the respiratory tract, and by the biological responses to these deposited materials. The larger particles are deposited in the head region while somewhat smaller particles reach the throat and bronchial area. Still smaller particles can reach the deepest portion of the lungs, the alveolar region.

EPA has adopted a policy by which it is dividing all areas of the country into three categories for particulates. Areas with a strong likelihood of violating the PM-10 NAAQS and requiring substantial adjustments to their State Implementation Plan (SIP) are categorized as Group I. Areas in this group have a probability of not attaining the PM-10 standard of at least 95 percent. Group II are areas where attainment of the standards is possible and existing SIP's probably need less adjustment. Areas with a probability of between 20 and 95 percent of violating the primary standard fit into this group. Group III are areas with a strong likelihood of attaining the PM-10 NAAQS and therefore needing only adjustments to the applicable prevention of significant deterioration/new source review and monitoring provisions in their State Implementation Plans. Areas with a probability of less than 20 percent of violation are in this group.

All three group areas have been designated in Pima County. Tucson and Ajo have been designated as Group II areas while the Rillito Planning area has been designated as Group I. The rest of the county fall into Group III; an area that will most probably meet or falls below the new PM-10 standards.

PM-10 monitoring begin in February, 1985 at the Orange Grove site on an every other day schedule. Orange Grove was chosen for initial PM-10 monitoring based on historical TSP data collected at the site. Orange Grove has had consistently higher TSP readings than the rest of the TSP network and was expected to record any exceedances of the PM-10 proposed regulations. One exceedance of the proposed 24-hour standard (150 ug/m^3) standard was observed in July of 1985.

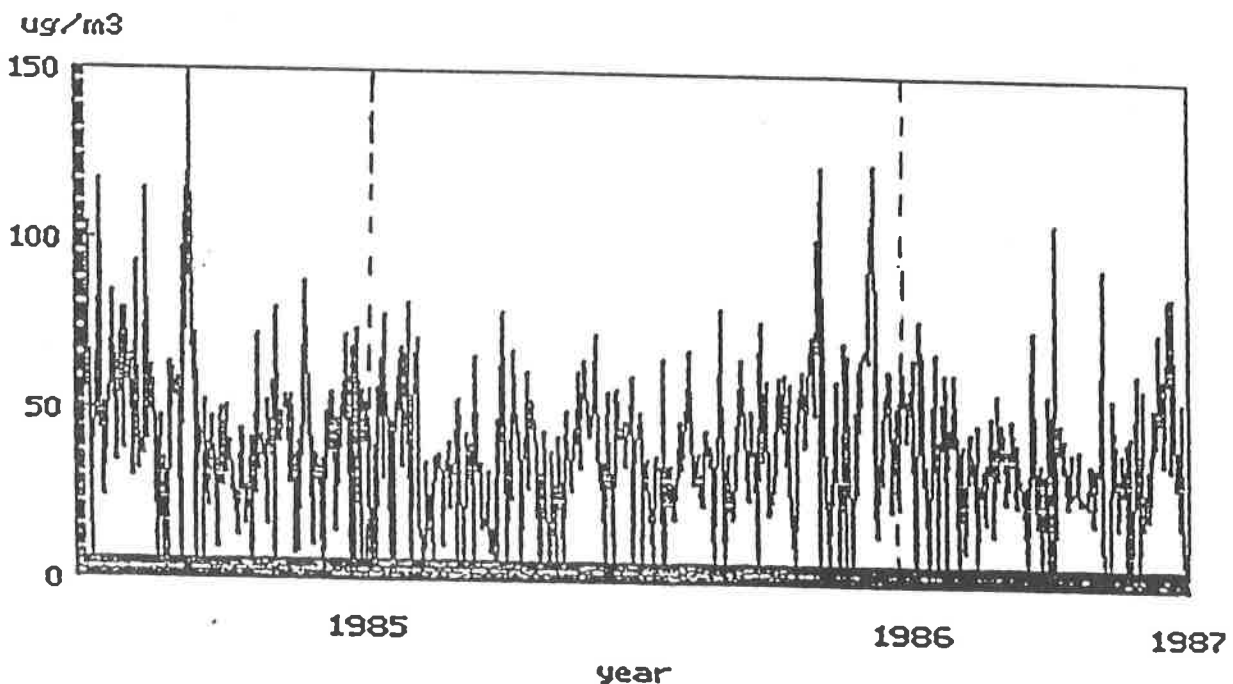
Because of the exceedance, sampling began on an every day basis in November of 1985 and continued through the entire year of 1986. Since no exceedances were recorded in 1986 the every other day schedule was resumed in 1987. No exceedances were recorded in 1987. Figure 15 illustrates collective data from 1985 through 1987 while Figures 16 through 18 show individual years.

As of August 1987 eight PM-10 monitors are operating throughout the county. A minimum of three years of data will have to be collected before it is known whether Tucson is in compliance or exceeds the new PM-10 standards.

FIGURE 15:

Orange Grove Site - 1985, 1986, 1987

PM-10 - 24-Hour Average Concentrations



PM-10 NAAQS 24-Hour Average 150 $\mu\text{g}/\text{m}^3$.
Exceedance value rounded to the nearest 10.
Maximum 24-Hr. value 190 $\mu\text{g}/\text{m}^3$ on 7/6/85.

FIGURE 16

Orange Grove Road Site - 1985 - PM-10 Concentrations - 150 ug/m^3 is 24-Hour NAAQS

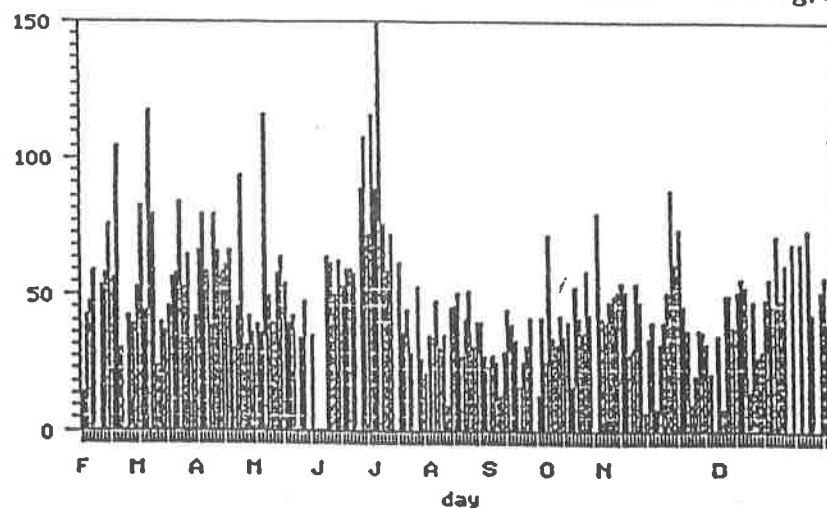


FIGURE 17

Orange Grove Road Site - 1986 - PM-10 Concentrations - 150 ug/m^3 is 24-Hour NAAQS

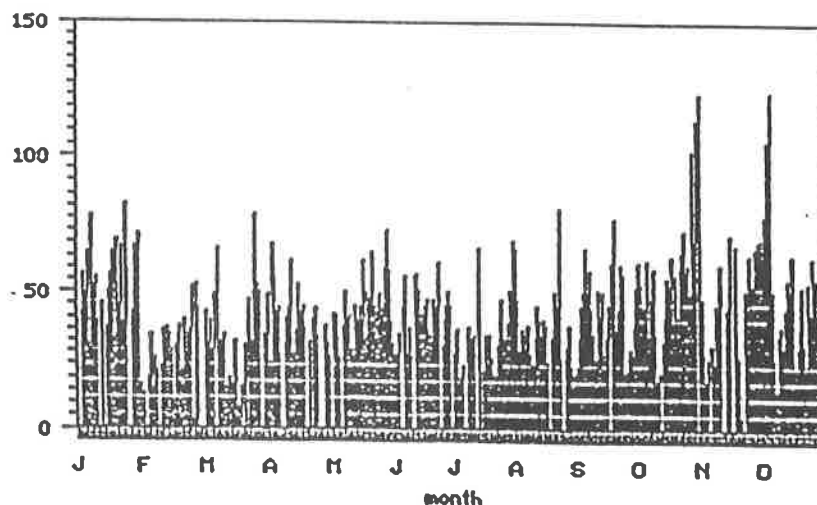


FIGURE 18

Orange Grove Road Site - 1987 - PM-10 Concentrations - 150 ug/m^3 is 24-Hour NAAQS

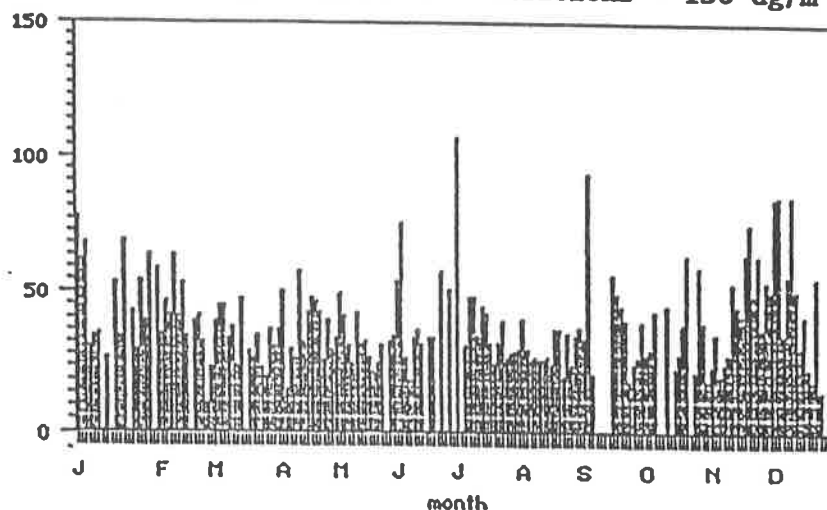
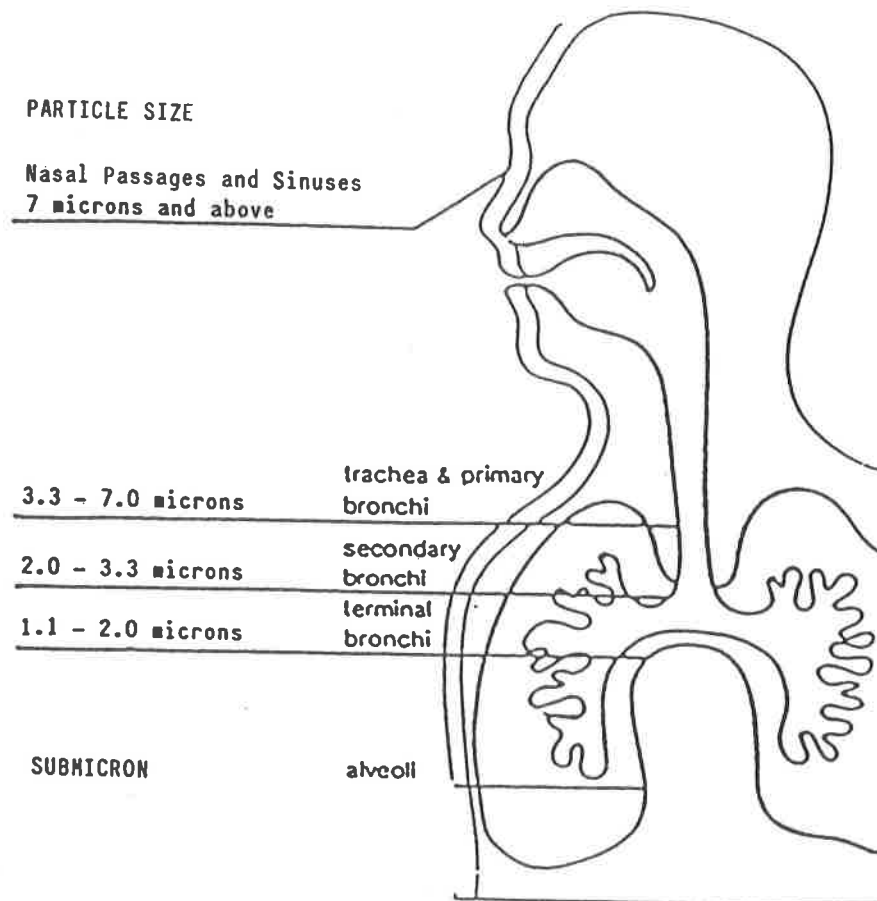


Figure 19:

Deposition for each stage or size range of respirable particulates in the human respiratory system.



1986-87 DATA SUMMARIES

TOTAL SUSPENDED PARTICULATES (TSP)

Site Name	Map No.	Yr.	Annual Geometric Mean	24-Hour Averages		No. of Exceedances 24-Hour Standards		No. of Samples
				Max.	2nd High	Primary	Secondary	
Univ. of Arizona	15	86	82	236	201	0	4	50
		87	66	252	188	0	3	54
So. Tucson	5	86	95	250	232	0	5	60
		87	83	348	244	1	5	54
Prince Road	6	86	93	259	224	0	6	58
		87	87	253	205	0	3	48
Corona de Tucson	8	86	20	49	48	0	0	51
		87	25	53	49	0	0	47
Grn. Valley	9	86	39	142	96	0	0	52
		87	39	150	120	0	0	57
Orange Grove	12	86	86	253	249	0	4	58
		87	80	222	199	0	2	58
Golf Links/Harrison	14	86	42	140	95	0	0	59
		87	52	155	149	0	1	51
Broadway/Swan	19	86	62	120	109	0	0	51
		87	66	142	128	0	0	28

Note: Hughes/Nogales site discontinued in 1986

STATE AND FEDERAL STANDARDS
PRIMARY AND SECONDRY

Annual Geometric Mean

Primary
75 ug/m³

Secondary
60 ug/m³

24-Hour Average

Primary
260 ug/m³

Secondary
150 ug/m³

CARBON MONOXIDE
Measurements in ppm

<u>Site</u>	<u>Map No.</u>	<u>Yr</u>	<u>Annual Arithmetic Mean</u>	<u>1-Hr. Avg.</u>		<u>8-Hr. Avg.</u>		<u>No. of Exceedances</u>		<u>Percent Data Recovery</u>
				<u>Max</u>	<u>2nd Hi</u>	<u>Max</u>	<u>2nd Hi</u>	<u>1-Hr. Std.</u>	<u>8-Hr. Std.</u>	
Downtown	1	86	1.4	13.8	13.0	9.2	7.8	0	0	89
		87	1.3	10.3	9.1	5.3	4.7	0	0	94
22nd/ Craycroft	2	86	0.6	7.9	7.7	3.8	2.9	0	0	66
		87	0.7	9.0	8.2	3.8	3.8	0	0	47
22nd/ Alvernon	3	86	2.6	18.2	16.3	9.3	8.5	0	0	79
		87	2.1	15.2	15.0	6.9	6.9	0	0	98

Averages were recorded in $\mu\text{g}/\text{m}^3$ before 1985 now all values are recorded in ppm.

STATE AND FEDERAL STANDARDS
PRIMARY AND SECONDARY

1-Hr. Average
35 ppm

8-Hr. Average
9 ppm

OZONE
Measurements in ppm

<u>Site</u>	<u>Map No.</u>	<u>Yr.</u>	<u>1 -Hr. Highest Value</u>	<u>Average 2nd-High Value</u>	<u>Annual Arithmetic Mean</u>	<u>No. of Exceedances</u>	<u>Percent Data Recovery</u>
Downtown	1	86	0.091	0.090	0.021	0	91
		87	0.089	0.083	0.021	0	95
22nd/ Craycroft	2	86	0.078	0.078	0.020	0	48
		87	0.092	0.091	0.030	0	84
Pomona	17	86	0.084	0.082	0.021	0	87
		87	0.119	0.087	0.022	0	85
Saguaro NM (E)*	18	86	0.103	0.095	0.039	0	91
		87	-	-	-	-	-

* In 1987 the National Parks Service began reporting quarterly data directly to EPA - 1987 Data is unavailable at this time.

STATE AND FEDERAL STANDARDS
PRIMARY

1-Hr. Average
.12 ppm

NITROGEN DIOXIDE

Measurements in ppm

<u>Site</u>	<u>Map No.</u>	<u>Yr.</u>	<u>1-Hr. Average</u>		<u>Annual Arithmetic Mean</u>	<u>No. of Exceedances</u>	<u>Percent Data Recovery</u>
			<u>Highest Value</u>	<u>2nd-Highest Value</u>			
Downtown*	1	86	0.083	0.083	0.023	0	61
22nd/ Craycroft	2	86	0.160	0.148	0.019	0	52
		87	0.194	0.190	0.019	0	76

STATE AND FEDERAL STANDARDS
PRIMARY AND SECONDARY

ANNUAL AVERAGE
.053 ppm

* Downtown site discontinued in 1987.

SULFUR DIOXIDE

Measurements in ppm

<u>Site</u>	<u>Map No.</u>	<u>Yr.</u>	<u>3-Hr. Average</u>		<u>24-Hr. Average</u>	<u>Arith. Mean</u>	<u>Annual Data Recovery</u>
			<u>Maximum</u>	<u>Maximum</u>			
22nd/ Craycroft	2	86	0.031		0.016	0.004	70
		87	0.061		0.013	0.003	69
Saguaro NM (E)*	18	87	-		-	-	-

STATE AND FEDERAL STANDARDS
PRIMARY AND SECONDARY

Primary
Annual Average 24-Hr. Average
.03 ppm .14 ppm

Secondary
3-Hr. Average
.50 ppm

* Tanque Verde Loop site was discontinued in 1985 and an SO₂ was monitor installed at Saguaro Monument-East at the end of 1986. 1987 data for SME is unavailable at this time.

WATER SOLUBLE SULFATES

NO STATE OR FEDERAL STANDARDS

ug/m³

<u>Site</u>	<u>Map No.</u>	<u>Yr.</u>	<u>Annual Average</u>	<u>High Value</u>	<u>2nd High Value</u>	<u>No. of Samples</u>
South Tucson	5	86	5.1	10.0	9.1	24
		87	4.2	6.6	5.8	23
Prince Road	6	86	7.4	46.0	13.6	23
		87	5.1	9.6	6.8	20
Coróna de Tucson	8	86	4.1	11.7	8.8	23
		87	3.4	6.6	6.5	23
Green Valley	9	86	4.7	11.1	9.5	20
		87	4.3	7.0	6.1	23
Orange Grove	12	86	5.2	11.4	9.5	24
		87	4.3	7.1	7.0	23

No State or Federal standards have been set for water soluble sulfates

LEAD

STATE AND FEDERAL STANDARDS
PRIMARY AND SECONDARY

CALENDAR QUARTER AVERAGE
1.5 ug/m³

<u>Site</u>	<u>Map No.</u>	<u>Yr.</u>	<u>Quarterly Average</u>				<u>No. of Samples</u>			
			<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>
Prince Road	6	86	0.25	0.14	0.14	0.27	15	14	15	14
		87	0.06	0.07	0.06	0.10	13	12	11	13
Broadway/ Swan	19	86	0.16	0.11	0.09	0.15	12	10	15	14
		87	0.03	0.04	0.02	0.05	14	13	11	10

AIR QUALITY HISTORICAL DATA

Annual Average Visibility: Downtown Site (Derived from Integrating Nephelometer)

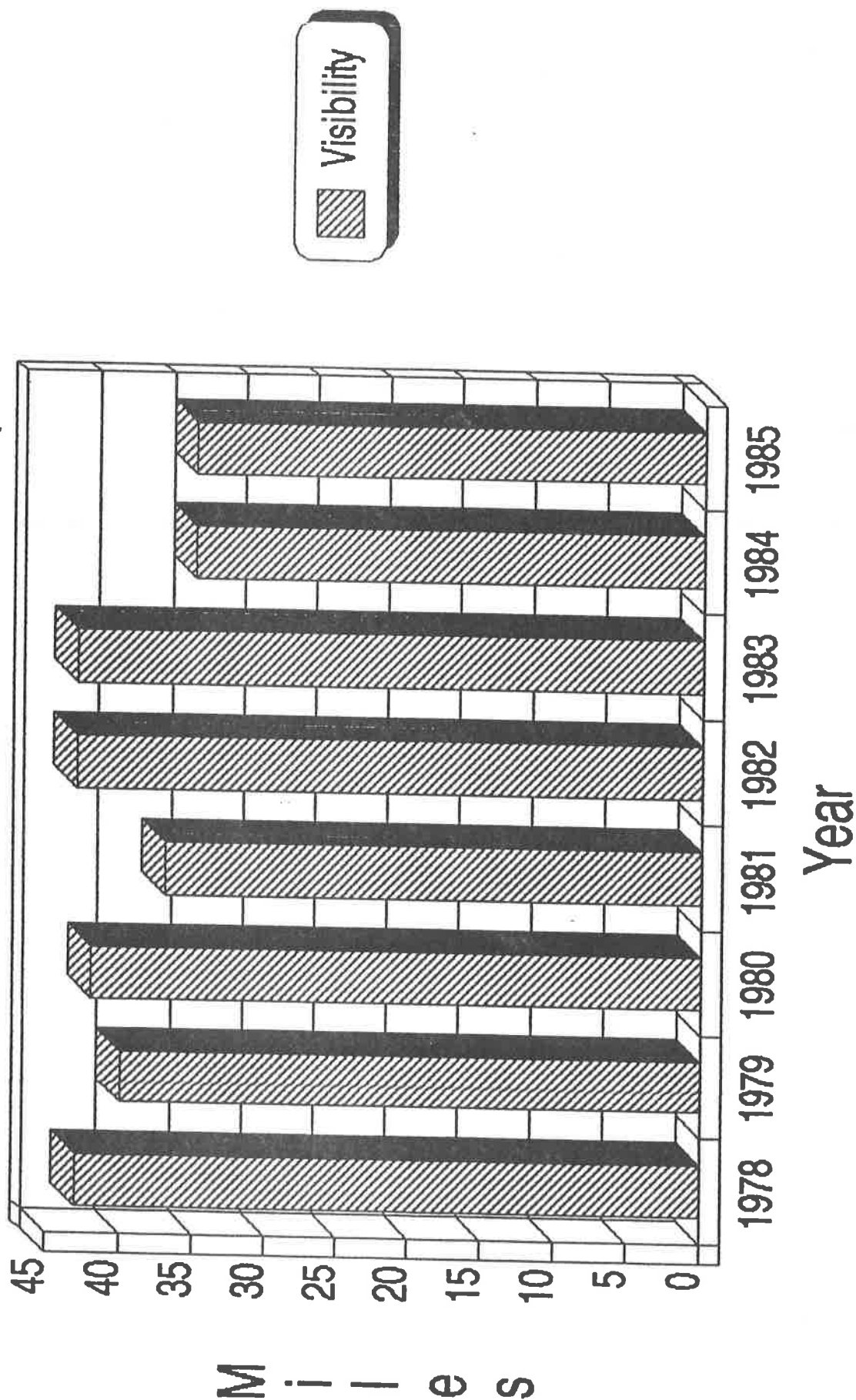


FIGURE 20

TOTAL SUSPENDED PARTICULATES (TSP)
Annual Geometric Means in ug/m³

	<u>'87</u>	<u>'86</u>	<u>'85</u>	<u>'84</u>	<u>'83</u>	<u>'82</u>	<u>'81</u>	<u>'80</u>	<u>'79</u>	<u>'78</u>	<u>'77</u>	<u>'76</u>
Univ. of AZ	66	82	77	70	54	59	76	75	89	61	71	73
So. Tucson	83	95	99	91	79	89	112	97	101	117	119	118
Downtown*	-	-	-	63	52	64	67	61	69	56	68	71
Prince Road	87	93	102	91	77	93	101	117	129	110	122	94
Magnetic Observatory*	-	-	-	54	45	53	62	59	61	56	67	59
Corona de Tucson	25	20	20	25	18	22	35	22	28	20	24	28
Green Valley	39	39	37	39	27	33	46	39	54	45	55	54
Border Patrol*	-	-	-	69	48	52	58	61	69	66	72	76
Orange Grove	80	86	87	92	78	86	107	108	109	84	85	85
Hughes/Nogales	-	-	52	48	34	44	54	54	54	43	50	51
Alvernon/ Ft. Lowell	-	-	76	73	70	89	98	101	120	126	155	168
Golf Links/ Harrison	52	42	47	55	48	58	67	59	65	55	63	57
Broadway/Swan	66	62	76	65	59	-	-	-	-	-	-	-
Rillito ¹	-	-	84	-	-	107	112	114	132	100	143	112
Pima College*	-	-	-	-	-	36	47	43	47	42	50	-
Davis Monthan*	-	-	-	-	-	-	68	67	69	69	76	72
Florence/Magee*	-	-	-	-	-	-	-	-	60	50	72	54
Pantano Fire*	-	-	-	-	-	-	-	-	-	-	93	93
Tanque Verde/ Wrightstown*	-	-	-	-	-	-	-	-	-	-	-	-
Romero/Roger*	-	-	-	-	-	-	-	-	-	-	-	-
Old Downtown*	-	-	-	-	-	-	-	-	-	-	-	-

¹ ADHS Monitor TSP discontinued in 1986 for use of PM-10 monitor.
* Sites discontinued

TOTAL SUSPENDED PARTICULATES (con't)
Annual Geometric Means in ug/m³

	<u>'75</u>	<u>'74</u>	<u>'73</u>	<u>'72</u>	<u>'71</u>	<u>'70</u>	<u>'69</u>	<u>'68</u>	<u>'67</u>	<u>'66</u>
Univ. of AZ	71	69	67	98	881	961	781	701	891	801
So. Tucson	96	106	116	95	140	143	136	115	145	-
Downtown*	67	77	77	88	109	88	98	-	-	-
Prince Road	74	81	109	110	101	-	-	-	-	-
Magnetic Observatory*	60	47	46	53	-	-	-	-	-	-
Corona de Tucson	27	24	25	26	-	-	-	-	-	-
Green Valley	53	53	50	43	59	-	-	-	-	-
Border Patrol*	79	60	73	-	-	-	-	-	-	-
Orange Grove	87	76	-	-	-	-	-	-	-	-
Hughes/Nogales	54	54	-	-	-	-	-	-	-	-
Alvernon/ Ft. Lowell	174	-	-	-	-	-	-	-	-	-
Golf Links/ Harrison	62	59	-	-	-	-	-	-	-	-
Broadway/Swan	-	-	-	-	-	-	-	-	-	-
Rillito ¹	-	-	-	-	-	-	-	-	-	-
Pima College*	-	-	-	-	-	-	-	-	-	-
Davis Monthan*	73	80	88	-	-	-	-	-	-	-
Florence/Magee*	66	64	44	-	-	-	-	-	-	-
Pantano Fire*	84	89	101	-	-	-	-	-	-	-
Tanque Verde/ Wrightstown*	-	-	-	130	115	86	91	72	114	-
Romero/Roger*	-	-	-	-	247	164	156	-	232	-
Old Downtown*	-	-	-	-	-	-	-	91	102	106

¹ ADHS Monitor

CARBON MONOXIDE

STATE AND FEDERAL STANDARDS PRIMARY AND SECONDARY

MAXIMUM 1-HR. AVERAGE
35 ppm

MAXIMUM 8-HR. AVERAGE
9.0 ppm

DOWNTOWN	Maximum		No. 8-Hr. Std.	% Data Recovery	22ND/CRAYCROFT ¹		Maximum 1-Hr. Avg. 8-Hr. Avg.	No. 8-Hr. Std.	% Data Recovery
	1-Hr. Avg.	8-Hr. Avg.			1-Hr. Avg.	8-Hr. Avg.			
1973	27.5	9.3	0	30	1973	20.0	9.4	0	36
1974	21.0	9.6	1	96	1974	20.5	11.0	1	69
1975	23.0	8.2	0	99	1975	16.5	8.0	0	67
1976	17.0	10.2	1	90	1976	14.0	7.6	0	87
1977	21.0	9.9	1	99	1977	21.0	9.7	0	92
1978	14.1	7.2	0	95	1978	15.9	7.4	0	93
1979	10.0	6.1	0	84	1979	11.0	6.8	0	74
1980	14.0	6.5	0	42	1980	16.5	7.0	0	98
1981	15.5	9.3	0	93	1981	11.2	6.5	0	88
1982	15.5	9.1	0	95	1982	12.0	6.9	0	88
1983	18.5	9.6	1	92	1983	16.5	6.6	0	95
1984	11.0	5.8	0	95	1984	11.9	8.6	0	74
1985	12.0	7.1	0	98	1985	12.2	5.4	0	78
1986	13.8	9.2	0	89	1986	7.9	3.8	0	66
1987	10.3	5.3	0	94	1987	9.0	3.8	0	47

22ND/ALVERNON

	Maximum		No. 8-Hr. Std.	% Data Recovery
	1-Hr. Avg.	8-Hr. Avg.		
1973	-	-	-	-
1974	-	-	-	-
1975	25.5	15.4	24	71
1976	27.0	14.6	36	98
1977	24.0	11.2	10	64
1978	22.9	12.7	16	80
1979	25.1	11.0	4	93
1980	24.8	12.2	4	98
1981	21.0	11.6	2	97
1982	27.0	11.0	4	90
1983	25.0	11.8	10	98
1984	21.0	10.4	3	95
1985	19.2	10.0	1	97
1986	18.2	9.3	0	79
1987	15.2	6.9	0	98

¹ Site moved on 1/3/80 from point 79 meters (m) south of and 212 m west; to 260 m south and 280 m west of 22nd and Craycroft streets respectively.

* All values before 1985 were recorded in ug/m³. All historical data has been converted to ppm.

OZONE

STATE AND FEDERAL STANDARDS
PRIMARY AND SECONDARY

1-HR. AVERAGE
.12 ppm

<u>DOWNTOWN</u>					<u>22ND/CRAYCROFT¹</u>				
		<u>1-Hr. Average</u>		<u>Percent Data Recovery</u>			<u>1-Hr. Average</u>		<u>Percent Data Recovery</u>
<u>Year</u>	<u>Ann. Avg.</u>	<u>Max.</u>	<u>2nd High</u>		<u>Year</u>	<u>Ann. Avg.</u>	<u>Max.</u>	<u>2nd High</u>	
1972	0.008*	0.100	0.080	--	1973	0.032*	0.180	0.150	50
1973	0.016*	0.120	0.110	58	1974	0.025	0.230	0.150	88
1974	0.014	0.120	0.110	84	1975	0.025	0.130	0.130	77
1975	0.018	0.110	0.100	94	1976	0.022	0.090	0.090	80
1976	0.020	0.110	0.110	99	1977	0.022	0.100	0.100	81
1977	0.018	0.100	0.090	98	1978	0.024	0.107	0.105	86
1978	0.018	0.103	0.100	92	1979	0.027	0.103	0.103	82
1979	0.022	0.109	0.102	91	1980	0.034	0.110	0.102	90
1980	0.021	0.122	0.112	99	1981	0.027	0.124	0.120	93
1981	0.022	0.088	0.088	98	1982	0.025	0.121	0.120	85
1982	0.027	0.123	0.107	95	1983	0.024	0.105	0.101	84
1983	0.023	0.109	0.097	98	1984	0.026	0.111	0.108	93
1984	0.020	0.103	0.102	95	1985	0.027	0.106	0.105	85
1985	0.020	0.097	0.094	96	1986	0.020	0.078	0.078	48
1986	0.021	0.091	0.090	91	1987	0.030	0.092	0.091	84
1987	0.021	0.089	0.083	95					

<u>ARTHUR PACK</u>					<u>POMONA</u>				
		<u>1 Hr. Average</u>		<u>Percent Data Recovery</u>			<u>1Hr. Average</u>		<u>Percent Data Recovery</u>
<u>Year</u>	<u>Ann. Avg.</u>	<u>Max.</u>	<u>2nd High</u>		<u>Year</u>	<u>Ann. Avg.</u>	<u>Max.</u>	<u>2nd High</u>	
1979	0.033*	0.104	0.097	55	1980	0.025*	0.108	0.106	74
1980	0.033	0.092	0.088	79	1981	0.028	0.095	0.095	89
1981	0.035	0.095	0.090	89	1982	0.029	0.130	0.124	89
1982	0.033	0.117	0.104	76	1983	0.025	0.121	0.108	80
1983	0.027*	0.090	0.088	51	1984	0.026	0.113	0.101	88
1984	0.027*	0.069	0.067	18	1985	0.025	0.110	0.103	92
1985	SITE DISCONTINUED				1986	0.021	0.084	0.082	87
					1987	0.022	0.119	0.087	85

SAGUARO NATIONAL MONUMENT - EAST 1-Hr. Average

<u>Year</u>	<u>Annual Avg.</u>	<u>Max.</u>	<u>2nd High</u>	<u>% Data Recovery</u>
1982	0.032*	0.100	0.091	55
1983	0.038	0.111	0.107	92
1984	0.038	0.108	0.104	92
1985	0.038	0.105	0.104	85
1986	0.030	0.103	0.095	91
1987				

* Annual average based on a limited number of samples. 1973-75 data from 22nd/Craycroft site are total oxidants.

NITROGEN DIOXIDE
Measurements in ug/m³

STATE AND FEDERAL STANDARDS
PRIMARY AND SECONDARY

ANNUAL AVERAGE
.053 ppm

<u>22ND/CRAYCROFT</u>					<u>DOWNTOWN</u>			
<u>Year</u>	<u>Annual Average</u>	<u>Max. 1-Hr.</u>	<u>Max. 24-Hr.</u>	<u>Percent Data Recovery</u>	<u>Annual Average</u>	<u>Max. 1-Hr.</u>	<u>Max. 24-Hr.</u>	<u>Percent Data Recovery</u>
1973	.044*	.150	.081	15	-	-	-	-
1974	.032	.120	.069	81	-	-	-	-
1975	.028	.120	.060	88	.032	.250	.084	55
1976	.027	.130	.056	89	.027	.240	.073	99
1977	.026	.120	.050	95	.032	.150	.057	95
1978	.022	.090	.049	78	.031	.230	.074	97
1979	.015	.070	.038	56	.025*	.140	.052	65
1980	.023	.170	.062	71	.036*	.220	.128	84
1981	.029	.240	.060	82	.037	.210	.076	95
1982	.021	.140	.058	82	.036	.270	.111	83
1983	.020	.120	.042	90	.032	.240	.111	33
1984	.019	.130	.071	86	.026	.120	.048	52
1985	.016	.100	.035	94	.024	.110	.044	48
1986	.019	.160	.050	52	.023	.083	.054	61
1987	.019	.194	.060	76	***			

NON-METHANE HYDROCARBONS

STATE AND FEDERAL STANDARD
PRIMARY AND SECONDARY

3-HR. AVERAGE (6-9 A.M.)**
160 ug/m³

<u>Year</u>	<u>Annual Average</u>	<u>Max. 3-Hr.</u>	<u>Downtown 2nd-High 3-Hr.</u>	<u>Exceedances of Standards</u>	<u>Percent Data Recovery</u>
1975	149	828	806	136	82
1976	113	806	532	96	78
1977	86	435	436	51	74
1978	115*	604	414	89	67
1979	136*	534	519	116	64
1980	73*	399	364	37	74
1981	136*	676	589	76	43
1982	140*	523	469	28	17
1983**	-	-	-	-	-

* Annual average based on limited number of samples.

** Non-methane hydrocarbons monitoring discontinued in February 1983, when Federal Standard was rescinded.

SULFUR DIOXIDE
Measurements in ug/m³

<u>STATE AND FEDERAL STANDARDS</u> <u>PRIMARY AND SECONDARY</u>					<u>Primary</u> <u>Annual Average</u> .03 ppm	<u>Primary</u> <u>24-Hr. Average</u> .14 ppm	<u>Secondary</u> <u>3-Hr. Average</u> .50 ppm	
<u>DOWNTOWN¹</u>					<u>22ND/CRAYCROFT¹</u>			
<u>Year</u>	<u>Annual</u> <u>Average</u>	<u>Max.</u> <u>3-Hr.</u>	<u>Max.</u> <u>24-Hr.</u>	<u>Percent</u> <u>Data</u> <u>Recovery</u>	<u>Annual</u> <u>Average</u>	<u>Max.</u> <u>3-Hr.</u>	<u>Max.</u> <u>24-Hr.</u>	<u>Percent</u> <u>Data</u> <u>Recovery</u>
1973	-	-	-	-	.001*	.063	.020	48
1974	.004*	.035	.016	28	.002	.127	.020	7
1975	.003	.097	.036	85	.001	.060	.019	88
1976	.003	.070	.021	91	.002	.053	.015	90
1977	.003	.053	.022	83	.002	.057	.020	81
1978	.002	.060	.016	77	.001	.053	.014	93
1979	.002	.044	.012	81	.002	.080	.020	97
1980	.001	.040	.010	82	.001	.030	.013	81
1981	.002*	.050	.013	29	.003	.083	.024	92
1982	-	-	-	-	.002*	.060	.019	50
1983	-	-	-	-	.001	.070	.016	95
1984	-	-	-	-	.003	.060	.028	85
1985	-	-	-	-	.005	.090	.025	97
1986	-	-	-	-	.004	.031	.016	70
1987	-	-	-	-	.003	.061	.013	69

TANQUE VERDE LOOP¹
(1985 Site Discontinued)

<u>Year</u>	<u>Annual</u> <u>Average</u>	<u>Max. 3-Hr</u> <u>Average</u>	<u>Max. 24-Hr</u> <u>Average</u>	<u>Percent</u> <u>Data</u> <u>Recovery</u>
1975	.004*	.050	.015	21
1976	.002	.100	.042	80
1977	.001	.120	.026	95
1978	.001*	.070	.014	73
1979	.001	.037	.011	86
1980	.002*	.060	.021	51
1981	.002	.133	.027	86
1982	.002*	.073	.015	45
1983	.003	.040	.028	69
1984	.001	.023	.008	61
1985	.001	.020	.008	25

- ¹ Total sulfur reported as Sulfur Dioxide equivalent.
* Annual average based on limited number of samples.

WATER SOLUBLE SULFATES

NO STATE OR FEDERAL STANDARDS

Annual Average ug/m³

<u>Site</u>	<u>Map No.</u>	<u>'87</u>	<u>'86</u>	<u>'85</u>	<u>'84</u>	<u>'83</u>	<u>'82</u>	<u>'81</u>	<u>'80</u>	<u>'79</u>	<u>'78</u>	<u>'77</u>	<u>'76</u>
Downtown*	1	-	-	-	4.9	4.9	3.5	4.7	4.1	4.3	5.1	5.1	4.5
So. Tucson	6	4.2	5.1	5.2	5.0	5.3	3.4	5.5	4.3	4.4	5.4	5.6	4.6
Prince Road	7	5.1	7.4	5.2	4.9	5.3	3.8	4.7	4.6	4.3	5.7	5.4	-
Corona de Tucson	9	3.4	4.1	3.2	4.3	3.4	2.1	-	-	-	-	-	-
Davis Monthan*	10	-	-	-	-	-	-	5.4	4.6	4.1	5.6	5.1	4.6
Grn Valley	11	4.3	4.7	4.3	5.3	3.5	2.4	4.3	3.4	3.8	4.2	4.0	3.8
Orange Grove	14	4.3	5.2	4.5	4.4	5.0	3.8	5.6	4.3	5.3	5.6	5.1	4.8
Alvernon/ Ft. Lowell*	15	-	-	4.5	4.3	5.0	3.4	4.6	4.7	3.9	5.7	5.4	4.8

* Davis Monthan Site discontinued in 1982

* Downtown Site discontinued in 1985

* Alvernon/Ft. Lowell site discontinued in 1986

LEAD

STATE AND FEDERAL STANDARDS PRIMARY AND SECONDARY

CALENDAR QUARTER AVERAGE 1.5 ug/m³

High Quarterly Average in ug/m³

<u>Site</u>	<u>Map No.</u>	<u>'87</u>	<u>'86</u>	<u>'85</u>	<u>'84</u>	<u>'83</u>	<u>'82</u>	<u>'81</u>	<u>'80</u>	<u>'79</u>	<u>'78</u>	<u>'77</u>
Prince Road	7	.10	.27	.58	.59	.65	.58	.52	.82	1.14	1.17	1.61
Magnetic Observ.*	8	-	-	-	-	.24	.21	.22	.23	.40	.42	-
Broadway/ Swan	25	.04	.16	.50	.37	.50	-	-	-	-	-	-

* Magnetic Observatory discontinued in 1984

