AIR QUALITY MANAGEMENT PROGRAM
SEQUOIA AND KINGS CANYON NATIONAL PARKS

1990
ANNUAL REPORT

Prepared by
Diane M. Ewell
Air Quality Specialist

Resources Management Division
Sequoia and Kings Canyon National Parks
Three Rivers, California 93271

April 10, 1991

Table of Contents

I. Introduction

A new Federal Clean Air Act was signed in 1990 by President Bush after more than a decade of Congressional debate. The act has 11 titles and is nearly 800 pages long (the original act was less than 50). It includes provisions on air toxics, acid rain, stratospheric ozone depletion and visibility. It now treats violations with felony-level sanctions. The visibility provisions may result in progress towards the haze problem but interstate commissions must be formed (requires at least two governors to establish). The act does specifically call for establishment of a Grand Canyon commission (California will be represented) within two years of enactment. New deadlines for attainment of pollutant standards are specified in the act, but the past track record for meeting deadlines has been poor. The good news is that the California Clean Air Act (passed in 1988) is as or more stringent and if effectively implemented, will achieve the most air quality improvements for California.

Notable activities of the 1990 Sequoia and Kings Canyon National Parks (SEKI) air quality program were the following:

Air Quality Workshop for California National Parks was held in San Francisco.

Progress was made on establishing a joint Sierra National Park Service, Forest Service and Bureau of Land Management working group to address air quality issues, form joint policies and provide a communication network.

The California Air Resources Board and Sequoia Natural History Association (SNHA) agreed to fund production of the SEKI air quality brochure.

The visibility camera funded by SNHA was set up at Milk Ranch in July.

Instruments were set up in various locations in SEKI as part of San Joaquin Valley Air Quality Study (SJVAQS), and Atmospheric Utility Signatures, Predictions, and Experiments (AUSPEX).

The new air quality wayside exhibit for Eleven Range Overlook was installed in April.

The first issues of the Resources Management and Research Divisions' "Sierra Crestline" newsletter were distributed in June, July and November.

We participated in a 20th anniversary Earth Day Exhibition in Visalia.

A portable solar powered ozone monitor operated for the summer at Junction Meadow, Kern Canyon.

Event precipitation sampling began in Giant Forest as part of a new California Air Resources Board study.

Mid-canopy branches of three 165' tall giant sequoia trees were fumigated with different levels of ozone to study ozone effects in a jointly-funded project by the Forest Service and National Park Service.

Peak ozone levels for Ash Mountain, Lower Kaweah and Grant Grove were reported in SEKI's morning reports beginning in July.

II. Air Quality Monitoring

A. Ozone Monitoring

Currently, SEKI has four stations where ozone concentrations are monitored year round. These are Ash Mountain (1800'), Lookout Point (4000'), Lower Kaweah (6300') and Grant Grove (6600'). The Lookout Point site has solar panels and batteries that supply the equipment with 24V DC power. The other sites are operated on normal 110V AC power. In addition, a solar powered portable ozone monitoring system (on loan from the Air Quality Division) was set up at Junction Meadow (8600') this summer. As a side benefit, on the weekly station trips to Grant Grove, we are able to transport Grant Grove inner-park and SNHA mail and return with Ash Mountain mail.

The Air Quality Division (AQD) has begun to rank data capture rates by percent among the 37 NPS network stations. Grant Grove, Lower Kaweah and Ash Mountain have had the 2nd, 3rd and 4th best cumulative data capture rates of the network stations for 1990.

Summary tables listing significant events for the four monitoring stations can be found in Appendix A. Equipment inventories for each station are listed in Appendix B.

The stations have run continuously and, except for Lookout Point, have had very little down time. We continue to poll the stations (except Lookout Point) every day by phone. This has allowed us to discover problems much sooner than previously and store the data to computer files. In the future, the Lookout Point station will have a phone line and modem as well.

At the end of the year (immediately following a site visit by Air Resource Specialists), Ash Mountain had some problems with dirty optic cells in the calibrator and condensation in the analyzer's outside sample line. As a result, several days of ozone data will be invalidated.

The Lookout Point station was down from 11/16/89-04/28/90 and 10/03-25/90 for instrument repairs on the TECO. After 11/30/90, the TECO began having problems again. It was operative again by 02/15/91. The station was greatly improved this year by Gary Ward (SEKI Radio Shop), who rewired the system. The battery banks are no longer charged in parallel which may have been causing voltage differences between the two banks. The strip chart recorder now runs on 24V rather than a 12V tap from one of the battery banks (also contributing to voltage differences). The relay box for controlling the shelter and TECO fan as well as turning the system on/off was removed because it was causing grounding problems (fabricated by Environmental Monitoring Systems, Inc.). A new relay system still needs to be installed. Paul Atkinson finished construction of an insulated box which Tom Pittenger began. The box is allowing the TECO to run warm in the cold months of winter.

The Portable Light-Weight Ozone Monitoring System (PLOMS) has been on loan to SEKI since 1988. It was flown out to Junction Meadow (8600') on 6/20/90. Paul Atkinson, the Tyndal Ranger, took care of the PLOMS until it was flown out on 09/20/90. The week before sending the PLOMS to Junction Meadow, Owen Houston of Environics had modified the digital/analog output from 0.1V=1ppm to 1V=1ppm to improve the signal strength from the analyzer to the data logger. The span setting (for elevation) was estimated for Junction Meadow. To confirm this setting, the PLOMS was taken to the top of the Palm Springs Aerial Tram (8500') and calibrated using a Dasibi PC. The span setting was 154 instead of 146, so the data collected at Junction Meadow will have to be slightly corrected (the actual ozone concentrations will be slightly higher as a result of the correction). The data are currently being analyzed and will be presented in a poster session at the Annual Air and Waste Management Association meeting in June, 1991.

B. Other Pollutant Monitoring

The carbon monoxide (CO) monitor was operated 08/01-30/90 in the Cedar Grove residence area by the fire monitoring team during the Avalanche prescribed natural fire (see appendix C). The monitor was set up because of smoke complaints from the fire.

The California Air Resources Board (CARB) dry deposition sampler and meteorological tower at Lower Kaweah were installed May, 1988. Every 6th day, two 12-hour samples (6:00 am - 6:00 pm, 6:00 pm - 6:00 am) of particulate matter less than 10 (PM-10) and less than 2.5 micron (PM-2.5) diameter are collected onto filter packs. The filters are analyzed for elemental, sulfur dioxide, ammonia, nitric acid and nitrogen dioxide concentrations, and gravimetric mass. Flow checks and blank runs are conducted on a monthly basis. Meteorological sensors zero and span values are checked weekly.

The pump filters were replaced and the sample intakes cleaned in March in preparation for an audit conducted by Desert Research Institute in April. On 4/7/90, the wind direction sensor failed and was replaced on 4/27/90. On 12/21, the teflon sample lines shattered due to weathering. They were replaced on 1/8/91.

The SNHA-purchased camera was set up at Milk Ranch on July 27. We could not obtain a databack (imprints date and time on the slides) that worked with the camera (Contax 167MT). The camera was exchanged for a Cannon EOS650 with a databack that worked. The camera at Lower Kaweah ozone monitoring station has been operating continuously. Paul Atkinson has compiled slide sets that show visibility ranging from very good to very poor visibility. The slide sets will be used for slide programs and will be sent to ARS for visual range analysis.

NOAA has agreed to loan the parks a nephelometer that will be colocated with an AISI tape sampler (on loan from CARB) to monitor visibility. These instruments represent the CARB's "Method V" for visibility monitoring. They will be located at the Ash Mountain ozone monitoring station and be integrated into the present data logging system.

The field program of the "San Joaquin Valley Air Quality Study" (SJVAQS) and "Atmospheric Utility Signatures, Predictions and Experiments" (AUSPEX) studies was conducted this summer. Combined funding totalled $16 million with more than 65 entities contributing. Results from the study will be used to model effectiveness of emission control measures. The model won't be on-line for several years. Staff from the AQD and SEKI attended planning meetings prior to the field program.

In the parks, three tracer samplers were located at Ash Mountain and Lower Kaweah ozone monitoring stations, and at the Cedar Grove Heliport. In addition, there were gas and particle samplers at Lower Kaweah. The study focused around "forecasted episodes" when ozone concentrations were predicted to be high. Interestingly, when ozone was highest in the valley, they were not particularly high at the park monitoring stations (except for 9/27-29). Target ozone levels for the "episodes" were near .150 ppm. The last episode was intentionally lower so that the model can be tested at lower concentrations. Below are the daily maxima (ppm) for each episode from the Lower Kaweah station. For July, the highest hourly average was .110 ppm, and August .111 ppm. The 8/3-6/90 episode is considered the best of all the intensives and will play a major role in model development.

7/13-14	.079, .077
7/20-21	.085, .081
7/27-29	.099, .110, .107
8/3-6*	.099, .085, .073, .083
8/22-24	.088, .089, .072

research study on "Atmospheric Transport of the Cotton Defoliant, DEF, in the Central Valley" was conducted from November, 1990, to March, 1991, by Jack Zabik, a graduate student from UC Davis. Paul Atkinson and myself collected the water and air samples, and meteorological data for the project. It was a pilot study to determine if concentrations were high enough to pursue a larger study.

C. Quality Assurance

Multipoint calibrations (MP) are conducted by the site operator quarterly (or as needed) on the ozone analyzers at all the stations and biweekly at Lookout Point using a Dasibi 1003-PC calibrator. More frequent calibrations at Lookout Point compensate for the lack of automated daily and weekly checks which are conducted at the other stations. The calibrator generates known concentrations of ozone as well as air containing no ozone that are simultaneously sampled by the calibrator and analyzer. The calibrator and analyzer ozone concentration values are compared and an overall percent difference (%) is calculated. In general, anything more than a $\pm$five percent difference indicates possible problems with the instrumentation. If the percent difference is greater than $\pm$five percent, appropriate steps are taken until five percent or less is obtained.

The NPS Air Quality Network supervisors contracted by Air Quality Division are responsible for calibration and maintenance (Cal/Maint) of all NPS air quality monitoring stations. They conduct Cal/Maint visits to park units every six months or as needed. Air Resource Specialists (ARS) are the NPS Air Quality Network supervisors (previously EMSI).

Audits are conducted annually by AeroVironment, Inc., (AV) and CARB on the ozone analyzers. Audits are needed for independent verification of system performance. Percent differences are calculated the same as described above for MPs. The EPA and CARB use 15 percent as a general guideline for determining whether a system is performing adequately. If audit results are outside the 15 percent guideline, the data are not automatically invalidated. Other factors are investigated to determine data validity and final determinations are made by AQD.

The table on the next page shows the date, operator and overall percent difference by station for all MPs, Cal/Maint visits and audits in 1990.

ASH MOUNTAIN
02/15 ARS Cal/Maint (-2.5%)
05/02 AV Audit (-2.6%).
05/23 SEKI MP (3.6%)
07/25 SEKI MP (0.9%).
09/12 CARB Audit (-6.1%)
11/28 ARS Cal/Maint (-0.7%).

GRANT GROVE
01/08 SEKI MP (-5.9%)
02/14 ARS Cal/Maint (-1.7%)
05/03 AV Audit (-1.0%)
05/17 SEKI MP (-2.1%)
07/26 SEKI MP (-4.4%).
09/13 CARB Audit (-0.7%)
11/29 ARS Cal/maint. (0.9%)

LOOKOUT POINT
04/30 SEKI MP (5.1%)
05/04 AV Audit (6.7%)
05/16 SEKI MP (8.0%)
06/06 SEKI MP (2.3%)
06/22 SEKI MP (3.9%)
07/06 SEKI MP (3.3%)
07/18 SEKI MP (4.1%)
08/01 SEKI MP (5.4%)
08/15 SEKI MP (0.9%)
08/31 SEKI MP (3.3%)
09/12 CARB Audit (0.7%)
10/31 SEKI MP (-3.7%)
11/14 SEKI MP (2.6%)
11/30 ARS Cal/maint (-2.0%)
12/14 SEKI MP (-6.2%).

LOWER KAWEAH
02/13 ARS Cal/Maint (-1.3%)
05/02 AV Audit (-4.6%)
05/15 SEKI MP (3.7%)
07/24 SEKI MP (-3.5%)
08/21 SEKI MP (-1.7%)
09/13 CARB Audit (-5.3%)
11/30 ARS Cal/Maint (-3.8%)

Desearch Reasearch Institute (DRI) conducted an audit on the dry deposition sampler at Lower Kaweah on 4/19. All instruments were working fine except the wind direction sensor (which was down from 4/7-27). The meteorological instruments were also checked by ARS on 2/13 and by AV on 5/2 and were reportedly working well.

D. Air Quality Monitoring Data

1. Ozone Data

AeroVironment operates the Data Processing Center (DPC) in Lakewood, Colorado, under contract with the AQD. Ozone data are preliminary from March, 1989 to present. Until the data are validated (determination of data accuracy), the data are subject to changes.

A memo was drafted for Western Region to send to AQD requesting the DPC to send ozone data collected at California National Parks to the California Air Resources Board. The memo requested that data from Sequoia and Kings Canyon and Yosemite National Parks, and Pinnacles National Monument be a high priority since the data were needed for the SJVAQS (see section IIA). To date, the ozone and meteorological data for July-September, 1990, have been sent in SAROAD (EPA database) format to CARB. To enter the data routinely into the state database will require minor changes to the SAROAD format. Tom Pomales of CARB recently visited ARS and the DPC to review the data collection/validation procedures. He will write a report to the management indicating that the data quality is acceptable. At that time, all concerns will have been addressed and the data will begin to be transferred to CARB and appear in their quarterly and annual summary reports.

On the next page are summary ozone tables for Ash Mountain, Grant Grove and Lower Kaweah for May-November, 1990 (period when ozone concentrations are highest).

The rows are as follows (data derived from hourly averages):

Hi Avg ppm	= high 24-hour average (ozone, ppm)
Lo Avg ppm	= low 24-hour average (ozone, ppm)
Avg ppm	= 24-hour average (ozone, ppm)
Min	= minimum (ozone, ppm)
Max	= maximum (ozone, ppm)
# Days/# Hours	= number of days/number of hours the state standard (0.10 ppm) was exceeded
# Days	= number of days sampled

Ozone concentrations exceeding 0.08 ppm were recorded during May-October at all stations. Ash Mountain and Lower Kaweah ozone concentrations exceeded 0.08 ppm in April as well. At 0.08 ppm or greater, injury to sensitive plant species has been observed. Ozone concentrations exceeding the state health standard were recorded during June-October at all stations and in April and May at the Ash Mountain station. The federal health standard for ozone was not exceeded. To exceed the state health standard for ozone, the hourly average concentration must be greater than 0.094 ppm. To exceed the federal health standard for ozone, the hourly average concentration must be greater than 0.124 ppm.

ASH MOUNTAIN

	May	June	July	Aug	Sept	Oct	Nov
Hi Avg ppm	.069	.079	.090	.086	.087	.074	.049
Lo Avg ppm	.021	.032	.057	.040	.037	.037	.015
Avg ppm	.049	.060	.070	.063	.063	.056	.032
Min ppm	.008	.015	.032	.023	.017	.019	.007
Max ppm	.096	.106	.120	.119	.119	.105	.068
#days/							
#hours	1/1	9/20	10/42	8/32	6/26	1/2	0/0
#days	31	30	28	30	30	31	30
GRANT GROVE							
Hi Avg ppm	.069	.079	.090	.086	.084	.064	.050
Lo Avg ppm	.028	.032	.047	.038	.034	.034	.028
Avg ppm	.049	.056	.067	.061	.058	.051	.038
Min ppm	.014	.017	.029	.024	.019	.019	.019
Max ppm	.090	.105	.121	.118	.119	.091	.062
#days/							
#hours	0/0	4/10	11/37	8/28	5/18	0/0	0/0
#days	31	30	30	31	30	31	30
LOWER KAWEAH							
Hi Avg ppm	.072	.081	.085	.086	.087	.073	.045
Lo Avg ppm	.029	.031	.042	.035	.032	.031	.019
Avg ppm	.051	.061	.064	.058	.057	.051	.034
Min ppm	.014	.012	.016	.011	.012	.008	.006
Max ppm	.094	.112	.110	.111	.121	.099	.066
#days/							
#hours	0/0	12/26	7/19	5/15	3/12	2/2	0/0
#days	31	30	31	31	30	31	30

The table below summarizes the ozone data for June-October, 1990 (the "ozone season"). Ash Mountain had 36 days (124 hours total) when the state standard was exceeded (this includes 1 hour/1 day each for April and May) as compared to a 9-year average of 47 days (224 hours). Lower Kaweah had 29 days (74 hours total) as compared to a 9-year average of 21 days (70 hours). The summer averages for Ash Mountain, Grant Grove and Lower Kaweah for June through October were 0.062, 0.059 and 0.058 ppm, respectively.

	ASH MOUNTAIN	GRANT GROVE	LOWER KAWEAH
Hi Avg ppm	.074	.090	.087
Lo Avg ppm	.032	.032	.029
Avg ppm	.062	.059	.058
Min ppm	.008	.017	.011
Max ppm	.120	.121	.121
#days/#hours	36/124	28/93	29/74
#days	149	152	153

The table on the next page shows the number of days/number of hours the state, and federal ozone health standards were exceeded at Ash Mountain and Lower Kaweah for 1982-90. The years which had some missing data are marked with an asterisk (these years could be underestimates of exceedences). The 1982-83 data for

Lower Kaweah were actually collected at nearby Lodgepole. The data indicate that despite state and county efforts to reduce pollution, ozone concentrations have not decreased. What the data do show, however, is the large variation from year to year.

	# DAYS/ # HOURS			
Year	Ash Mountain		Lower Kaweah	
	State	Federal	State	Federal
1982	67/467	10/25	7/23*	1/2*
1983	29/103	0/0	8/23*	0/0*
1984	25/104*	1/2*	16/64	0/0
1985	64/313	4/4	34/160*	1/1*
1986	38/296	1/2	20/94*	1/1*
1987	80/292	2/5	17/37	0/0
1988	60/237	0/0	34/88	0/0
1989	26/80	0/0	25/61	0/0
1990	36/124	0/0	29/74	0/0
AVG	47/224	2/4	21/70	0/0

The table below compares Visalia ozone data to park data for May-October, 1989. The table shows hourly average (ppm), number of days/number of hours of state health standard exceedences and the maxima (ppm). While the averages were higher at park stations, # days/# hours and maxima were highest at the Visalia station. The higher average in the parks is due to its remote location. Ozone is formed through a chemical reaction driven by sunlight. The ozone equation reverses at night (ozone is destroyed) if there are continuing sources of nitrogen oxides. In cities, where there is constant nitrogen oxide-emitting traffic, ozone is destroyed at night to levels close to zero ppm. In the parks, ozone concentrations stay relatively high. The result is a higher 24-hour average than in urban areas. This is significant because when trees begin to photosynthesize at first morning light, ozone levels are still high. On the positive side, trees reduce their activity during hot, dry afternoons when ozone cocentrations are highest. It is thought that sensitive trees (more injured) are more active than tolerant trees in the afternoon and therefor receive higher ozone doses.

ASH MOUNTAIN	MAY	JUNE	JULY	AUG	SEPT	OCT
average	.045	.058	.072	.067	.056	.045
days/hours	0/0	5/9	9/27	2/2	2/3	2/5
maximum	.089	.114	.116	.101	.102	.102
LOWER KAWEAH						
average	.041	.053	.068	.065	.051	.041
days/hours	0/0	1/2	11/19	1/2	1/2	0/0
maximum	.086	.108	.112	.100	.101	.090
VISALIA						
average	.039	.049	.059	.052	.037	.026
days/hours	0/0	9/32	24/108	17/83	11/36	4/9
maximum	.090	.120	.160	.150	.110	.110

2. Carbon Monoxide Data

Appendix C contains the carbon monoxide report by Kris Wiese, Fire Monitor. Unfortunately, the worst smoke days occurred prior to setting the monitor up. No state or federal CO health standards were exceeded during the monitoring period from 8/1-30.

3. Dry Deposition Data

A draft report "Measurement of Dry Deposition Parameters for the California Acid Deposition Monitoring Program" by Desert Research Institute (Watson et al. 1990) was submitted to CARB upon completion of the contract. The network was taken over by CARB this year. The network is comprised of seven urban sites (Azusa, Bakersfield, Fremont, Bay Area, Long Beach, Los Angeles, Sacramento, Santa Barbara) and three rural sites (Gasquet, Yosemite, Sequoia). Appendix D includes excerpts from the report relevant to SEKI.

The report states that average and maximum concentrations of most species were much lower at the rural sites compared to the urban. NO_2 was not found at Sequoia or Yosemite. Of the three rural sites, sulfate, nitrate and nitric acid averages were highest at Sequoia.

Since the data are averaged over the 4th quarter 1988 through 3rd quarter 1989, it is not possible to determine if the state 24-hour PM-10 health standard was exceeded (50 ug/m^3). The PM-10 daytime average (16.00 ug/m^3) and nighttime average (19.56 ug/m^3) for the four quarters indicate that the annual geometric mean health standard of 30 ug/m^3 was probably not exceeded.

III. Biological Effects Studies

A. In-House Studies

A pilot study was conducted in 1987 by Linda Mazzu to determine the effect of ozone injury on ponderosa pine needle specific leaf weight. Specific leaf weight is a ratio of leaf weight to leaf area and indicates photosynthetic capacity. Dry measurements had been completed for only 12 of the 30 trees. Tim Hostiuck, a Student Conservation Association (SCA) volunteer for Lodgepole Interpretation, was able to finish the dry measurements during quiet times at the Lodgepole Visitor Center front desk. The data were needed to determine appropriate methodology for conducting a larger study.

The 57 permanent pine plots (10-15 trees each) for monitoring visible ozone injury on yellow pine were re-evaluated during the summer, 1989. The plots were originally established by Tom Warner during the summers of 1980-82. A subset of 28 plots (more severly injured plots) were reread in 1984-85. A paper comparing

the two evaluation periods was published in the Effects of Air Pollution on Western Forests Air and Waste Management Association symposium (Duriscoe and Stolte, 1989). They found a 30 percent increase in the number of trees showing visible ozone injury between the two time periods with the average injury score decreasing from 2.9 to 2.4 (scale of 0 to 4 with 0 indicating no whorls free of injury and 4 indicating 4 or more whorls free of visible ozone injury).

Twenty-seven of the plots (more severly injured plots) can be compared for all evaluation periods (1980-82, 1984-85 and 1989). Plot number 38 was burned in the 1988 Buckeye wildfire and therefor cannot be included in the 1989 data. The table below shows the average score for all plots. While there was a decrease in the score (more injury) between 1980-82 and 1984-85, 1989 showed a similar score compared to 1980-82. Lodgepole and Giant Forest precipitation records indicate that the winters of 1983-84 and 1984-85 had close to average precipitation (46" and 42" compared to a 50-year average of 47") while the winter of 1988-89 was the third year of below average precipitation (32"). Stomates in pine needles are the primary entry way for gases including ozone. When a tree is actively photosynthesizing, stomates are open. If there is a lack of ground moisture, stomates are closed to conserve water. During the wetter summers of 1984-85, the trees may have had increased exposure to ozone because they were more active; trees may have been less active during the dryer 1989 summer and therefor may have had less exposure to ozone. The percent of trees injured, however, did not show as much of a return to 1980-82 levels. Over time, a tree's tolerance may decline to the point where the tree begins to show visible injury.

	1980-82	1984-85	1989
average score	2.84	2.40	2.90
% trees injured	47[1]	79[1]	70
% plots injured	96	100	100
no. trees	270	270	266
no. plots	27	27	27

[1] includes plot 38 (no. trees = 280)

The table on the next page shows data from 53 plots which can be compared for the 1980-82 and 1989 evaluation periods. This sample is more representative of the yellow pine population as a whole. There was very little difference in the numbers indicating that the severity and incidence of visible ozone injury had changed very little between the two evaluations. This data can be compared to a yellow pine survey conducted in 1986 by Dan Duriscoe. The average ozone injury score was 3.35 (98 points) and 39 percent of the trees sampled (1470 trees) had visible injury. The results are strikingly similar considering the different methodologies and time period.

	1980-82	1989
average score	3.25	3.25
% trees injured	36[1]	39
% plots injured	75	83
no. trees	530	526
no. plots	53	53

[1] includes plot 38 (no. trees = 540)

Fourteen plots evaluated in 1989 are compared with 15 plots evaluated in 1985 in the table below. The needles were rated based on percent of surface area with visible ozone injury (rather than the 0-4 rating scale). There was a decline in the average percent injury and incidence remained approximately the same from 1985 to 1989. This is in agreement with the 27 plot data above.

	1985[1]	1989
average percent	6.5	4.0
% trees injured	87	80
% plots injured	100	100
no. trees	225	209
no. plots	15	14

[1] includes plot 38

B. Contracted Studies

The only contracted study for FY90 at SEKI was a continuing study on the affects of ozone on giant sequoia. Nancy Grulke and Paul Miller of U.S. Forest Service, Pacific Southwest Experiment and Range Station, conducted a study on large, 165 foot tall giant sequoia trees ("large saplings"). The project was co-funded by AQD. They worked from a platform on top of 100 foot scaffolding. Branches of three large saplings were fumigated with filtered, and 100, 200 and 300 percent ambient ozone. Results have not yet been reported and the study will not be repeated in 1991 as previously thought. Once the data are fully analyzed, a decision will be made as to the direction of future studies.

IV. Interpretation

The park was invited to participate in an Earthday Awareness Exhibition on 4/21 at Sequoia Mall, Visalia (1990 was the 20th anniversary of Earthday). The exhibition was hosted by the Tulare Air Pollution Control District. Tom Pittenger designed and constructed an exhibit on the SEKI air quality program. In addition, an already existing poster on the Research Division's acid deposition program was displayed.

The "Sierra Crestline" is Resources Management and Research Divisions' new newsletter. One of the main purposes of the newsletter is to present up-to-date information on management and research projects, especially for the Interpretation Division. Three issues were produced in 1990, with Tom Pittenger being the

editor.

Tom Pittenger and myself assisted with the annual seasonal interpretation training. The training took place at Sunset Rock and Lower Kaweah as requested by Doug Wilson. The outside setting was well received and the training will probably continue to be held outdoors.

The parks considered being part of a pilot ozone advisory program proposed by AQD. The purpose of the program is to advise visitors of ozone levels in the parks using the federal index system (good, moderate, unhealthful, etc). Due to uncertainties on the part of Squad members of the ramifications of the advisory, SEKI did not partake. Shenendoah NP and Pinnacles NM were the only two park units that started the program. We did, however, begin to anounce the daily maximum hourly average in the morning report so that employees were more aware.

CARB and SNHA agreed to fund production of the air quality brochure that Tom Pittenger authored. The first review of the typesetting was in December and production should be completed by May, 1991. A one-page handout was drafted by George SanMiguel and Mark Boehler, and finalized early 1991 for printing. The AQD funded this project in FY90 for $500. The final bill was $575 to produce 5500 copies.

This year was phenomenal for public outreach in large part due to the giant sequoia study but also as a result of increased environmental awareness. Newscasts included worldwide ABC, local and statewide CBS and ABC, and several other local channels. Newspapers around the country and state featured articles including New York Times, LA Times, Christian Science Monitor, Tulare Advance Register, Fresno Bee, San Jose Mercury news, Sacramento Bee, Visalia-Times Delta, Valley Voice, and local Hanford and Sequoia Sentinels. Articles appeared in magazines such as NPCA, California Parks and Recreation, and Sunset Magazine. There was even an interview with KUZZ radio. The air quality issue is covered in the new Lodgepole and Grant Grove Visitor Center slide shows (produced for the parks' Centennial). The program will also be covered in the new National Park Handbook for the parks. We now have several slide sets that can be loaned out at request which has been very useful.

V. Meetings, Trainings, Etc.

On the next two pages is a list of dates of conferences, workshops, meetings, training, etc, that were attended in 1990. Only a few will be discussed in detail here. Trip reports were completed for several of the meetings listed. Apendix E contains two letters, one submitted to the City of Hanford for the preparation of a draft EIR on a coal-fired cogeneration plant and one submitted to Fresno County regarding the draft EIRs for two

coal-fired cogeration plants. Since the Fresno hearing (5/17/90), Fresno County Supervisors officially banned coal burning. As a result, the two proposed GWF coal-fired cogeneration plants will not receive approval.

In 1989, a senate bill (SB3) was authored by State Senator McCorquodale proposing a San Joaquin Valley Unified Air Pollution Control District (SJVUAPCD). In late 1989, rather than wait for the legislation, the eight San Joaquin Valley counties formed a Joint Powers Agreement (JPA) establishing a unified air basin authority whereby they would hire an executive officer and secretary to coordinate planning and regulation within the valley and hold meetings on a regular basis (this replaced the existing Basin Control Council). Gov. Deukmejian vetoed SB3 because he felt the new JPA was adequately addressing the need for basin coordination. Not being satisfied with the JPA, Senator McCorquodale resubmitted the bill in 1990. The eight counties in early 1991 officially formed a SJVUAPCD with one Air Pollution Control Officer (APCO). They have also allowed three city representatives on the district. The eight county APCD offices will remain in place but will only be responsible for permitting and enforcement. The SJVUAPCD will be responsible for planning and rule making. A San Joaquin Valley attainment plan will be workshoped some time in May, 1991. It is uncertain whether the bill will be signed by the new governor, Pete Wilson. The bill "zone" rather than county offices.

In late 1990, prior to the Sierra interagency line officers meeting, I met with Trent Procter and Judy Rocchio of the U.S. Forest Service, and Tom Ritter, Superintendent, to discuss the proposal of an interagency air quality group for the Sierra. The proposal was presented by Ritter and Jim Crates (Sequoia National Forest Supervisor) at the interagency meeting. The line officers approved of the concept. The group will include the National Park Service, Forest Service and Bureau of Land Management. The air quality group will facilitate information sharing and coordinated PSD permit review, strengthen public hearing statements and air pollution monitoring data bases, and participate in the regulatory process by serving on committees and attending workshops and hearings. Coordinating these activities agency wide is important given the limited budget and resources available, and will provide for an integrated FLM response. The group selected the name "Federal Clean Air Partnership" (FCAP).

Trent Procter from Sequoia National Forest (Region 5 Air Resource Specialist) was able to obtain access to the Data General (DG) Forest Service communications network for the SEKI air quality program. The network is the largest of its kind, linking every Forest Service employee across the nation. It has greatly facilitated our communications on air quality issues and now with FCAP, will greatly enhance our abilities to keep up-to-date on

air quality issues. Perhaps the NPS will soon have a network of its own. CC Mail is currently being looked at for this purpose and is being used by a few parks.

1. Conferences, Workshops and Symposia

1/10	AWMA monthly dinner meeting, Trent Proctor gives presentation on USFS air resource management program, Bakersfield
2/27-3/1	Resources Management Plan scoping session, Ash Mountain
3/5-7	Air Quality Workshop for California National Parks, San Francisco
3/20-22	AWMA Tropospheric Ozone and the Environment Conference, Los Angeles
4/22	Earth Day Exhibition poster presentation at Sequoia Mall in Visalia.
5/2-4	USFS Screening Workshop at Lake Tahoe
5/7-8	San Joaquin Valley Air Quality Study conference in Fresno
6/13	AWMA monthly dinner meeting, Biogenics
7/26	USFS workshop on fugitive dust regulations in San Francisco
10/5-7	2nd Century Conference in Giant Forest
10/17	AWMA monthly dinner meeting, San Joaquin Valley Air Quality Study
10/23	USFS workshop on fugitive dust regulations in San Francisco
11/15	AWMA Annual Technician Conference in Bakersfield

2. Training

1/23-25	Lichen Taxonomy Course, Charis Bratt, Santa Barbara Natural History Museum
1/31	Intermediate dBase III+ training, Ash Mountain (3 hours)
3/12-16	Tom Pittenger attends Air Quality Monitoring Course at Grand Canyon
3/27-29	Supervisor's Workshop, Ash Mountain (18 hours)
5/31	Public Information training, Ash Mountain (3.5 hours)
10/17	Data General Training at Sequoia National Forest (3 hours)

3. Division Meetings (Ash Mountain)

1/23	Division meeting
2/23	Division meeting
3/23	Division meeting
4/23	Division meeting
6/1	Division meeting

4. County and State Public Hearings and Meetings

2/28	Fugitive Dust Regulations public hearing, Visalia
4/6	San Joaquin Valley Air Quality Study policy committee meeting, Sacramento.
5/17	Fresno County Supervisors' consider proposal to ban coal burning (gave short presentation on SEKI air quality)
6/29	San Joaquin Valley Air Quality Study policy committee meeting in Fresno (accompanied by Bill Tweed)

5. Miscellaneous

1/29	EEO meeting, Lodgepole (2.5 hours)
2/4-12	AQD, Lakewood Colorado, writing summary of SEKI biological effects studies with Ken Stolte
4/17	Presentation on SEKI air quality program to Sequoia Lions Club in Visalia
4/23	Lindsay centennial tree planting ceremony
5/16-18	Joan McGlaughlin from Yosemite visits Parks
5/22	Two hour training to resource trainee class on how to identify visible ozone injury on pines.
6/15	Four hour training to new Interpretation seasonals
7/12	Conference call with AQD and other parks on O_3 advisory
7/18	Met with Ken Stolte, Tom Nichols and Anne Esperanza on research priorities (Ash Mountain)
7/20	Presentation to NAS group doing NPS science review
8/24	Press event at scaffolding research project in Giant Forest
8/27-30	Pine plot training for USFS and NPS employees at Giant Forest
9/23	Centennial celebration, Moro Rock
11/26	Presented slide show at Sierra Club meeting in Visalia

VI. Personnel

Tom Pittenger was primary site operator 4/24/89-7/27/91. I conducted site operations until his position was filled with Todd Anderson on 12/3/91. The position is now permanent, less than full-time, GS-5/6/7. Paul Atkinson was hired on intermittently mid-October primarily to run the event precipitation sampling. Lynne Mager volunteered from 11/5-12/13/91 to develop a slide/tape program on the SEKI air quality program for high school level students.

LIST OF ABBREVIATIONS

AC	-Alternating Current
AM	-Ash Mountain
AQD	-Air Quality Division
APCD	-Air Pollution Control District
ARS	-Air Resource Specialists (NPS Network Supervisors)
AV	-AeroVironment (NPS auditors)
AUSPEX	-Atmospheric Utilities, Signatures and Prediction Experiment
AWMA	-Air and Waste Management Association
Cal/Maint	-Calibration and Maintenance
CARB	-California Air Resources Board
CO	-carbon monoxide
DC	-Direct Current
Deg C	-degrees Celsius
DPC	-NPS Data Processing Center
EMSI	-Environmental Monitoring Services, Inc. (NPS Network Supervisors)
EPA	-Environmental Protection Agency
FCAP	-Federal Clean Air Partnership
FY89	-fiscal year 1989 (10/1/88-9/30/89)
GIS	-Geographic Information System
GSI	-General Services, Inc. (SEKI's Concessionaire)
LK	-Lower Kaweah
MP	-multipoint calibration
NOAA	-National Oceanic and Atmospheric Administration
NPS	-National Park Service
PLOMS	-Portable Lightweight Ozone Monitoring System
PM-10	-Particulate Matter less than 10 micron diameter
pphm	-parts per hundred million
ppm	-parts per million
ROPIS	-Responce of Plants to Integrated Stresses
SAROAD	-
SJVAQS	-San Joaquin Valley Air Quality Study
SEKI	-Sequoia and Kings Canyon National Parks
SNHA	-Sequoia Natural History Association
TECO	-Thermo Electron Corporation
UCD	-University of California, Davis
UCLA	-University of California, Los Angeles
USFS	-United States Forest Service
YOSE	-Yosemite National Park

Air Quality Acronyms

AB	- Assembly Bill
APCB	- Air Pollution Control Board
APCD	- Air Pollution Control District
APCO	- Air Pollution Control Officer
AQAP	- Air Quality Attainment Plan
AQE	- Air Quality Engineer
AQMD	- Air Quality Management District
AQS	- Air Quality Specialist
ATC	- Authority to Construct
AUSPEX	- Atmospheric Utility Signatures, Predictions and Experiments Study
AVR	- Average Vehicle Ridership
BACM	- Best Available Control Method
BACT	- Best Available Control Technology
BAR	- Bureau of Automotive Repair
BARCT	- Best Available Retrofit Control Technology
CAAQS	- California Ambient Air Quality Standard
CAPCOA	- California Air Pollution Control Officers' Association
CARB	- California Air Resources Board
CCAA	- California Clean Air Act
CCAQPTF	- City/County Air Quality Planners Task Force
CEC	- California Energy Commission
CEM	- Continuous Emission Monitor
CEQA	- California Environmental Quality Act
CES	- Compliance Evaluation Section
CFR	- Code of Federal Regulations
CH&SC	- California Health and Safety Code
CIPA	- Calif. Independent Petroleum Assoc.
CNG	- Compressed Natural Gas
CO	- Carbon Monoxide
CTG	- Control Technology Guideline
CTS	- Compliance Technical Services
DEL	- Daily Emission Limit
DOC	- Determination of Compliance
EES	- Engineering Evaluation Section
EGR	- Exhaust Gas Recirculation
EI	- Emission Inventory
EIR	- Environmental Impact Report
EITAC	- Emissions Inventory Technical Advisory Committee
EPA	- Environmental Protection Agency
ERC	- Emissions Reduction Credit
ETS	- Engineering Technical Services
EV	- Electric Vehicle
FCAA	- Federal Clean Air Act
FGR	- Flue Gas Recirculation
GVC	- Gasoline Vapor Recovery
HC	- Hydrocarbons
HRA	- Health Risk Assessment
I&M	- Vehicle Inspection & Maintenance
IOPA	- Independent Oil Producers Association
ISR	- Indirect Source Review
JPA	- Joint Powers Agreement
KAN	- Kern Air News
KCAPCD	- Kern County Air Pollution Control District
KernCOG	- Kern Council of Governments
LAER	- Lowest Achievable Emission Rate
LEV	- Low Emission Vehicle
LNG	- Liquified Natural Gas
LPG	- Liquified Petroleum Gas
MOU	- Memorandum of Understanding
M85	- 85% Methanol + 15% Gasoline Fuel
NAAQS	- National Ambient Air Quality Standard
NAMS	- National Air Monitoring Stations
NAP	- Non-Attainment Area Plan
NESHAPS	- National Emission Standards for Hazardous Air Pollutants
NMHC	- Non-Methane Hydrocarbons
NOx	- Oxides of Nitrogen
NOV	- Notice of Violation
NSPS	- New Source Performance Standards
NSR	- New Source Review
O3	- Ozone
OVA	- Organic Vapor Analyzer
PCA	- Project Clean Air
PM	- Particulate Matter
PM-10	- PM of 10 microns in aerometric diameter or less
PROC	- Photochemically Reactive Organic Compounds
PSD	- Prevention of Significant Deterioration
PSI	- Pollutant Standards Index
PSIA	- Pounds Per Square Inch Absolute
PTO	- Permit to Operate
PADS	- Planning and Development Services
RACM	- Reasonably Available Control Method
RACT	- Reasonably Available Control Technology
RFP	- Reasonable Further Progress
RMA	- Resource Management Agency
ROG	- Reactive Organic Gases
RVP	- Reid Vapor Pressure
SARMAP	- SJVAQS/AUSPEX Regional Model Adaptation Project
SB	- Senate Bill
SCAQMD	- South Coast Air Quality Management District
SCM	- Suggested Control Measure
SCR	- Selective Catalytic Reduction
SEDAB	- Southeast Desert Air Basin
SIP	- State Implementation Plan
SJV	- San Joaquin Valley
SJVAB	- San Joaquin Valley Air Basin
SJVAQS	- San Joaquin Valley Air Quality Study
SJVUABA	- San Joaquin Valley Unified Air Basin Authority
SLAMS	- State & Local Air Monitoring Stations
SLC	- Specific Limiting Condition
SOx	- Oxides of Sulfur
SO4	- Sulfates
SSSA	- Small Source Siting Allowance
TAC	- Technical Advisory Committee
TARG	- Transportation/Air Quality Review Group
TEIP	- Toxic Emissions Inventory Plan
TEIR	- Toxic Emissions Inventory Report
TEOR	- Thermally Enhanced Oil Recovery
TCM	- Transportation Control Measure
TLEV	- Transitional Low Emission Vehicle
TOG	- Total Organic Gases
TREU	- Temporary Replacement Emissions Unit
UABA	- Unified Air Basin Authority
ULEV	- Ultra Low Emission Vehicle
VOC	- Volatile Organic Compounds

APPENDIX A
Summary Tables for the Air Quality Monitoring Stations

Note: After T. Pittenger attended the Air Quality Monitoring Course in March, the following changes were made in the protocols for all stations: 1) Data Quality Assessment Reporting Form entry for section 45-47 was changed to ozone level 1 (previously ozone level 1 - ozone level 0); 2) filter conditioning with span gas after sample inlet filter replacement; and 3) multipoint calibration procedures were modified significantly (see new forms). Other major station changes were as follows. Silica gel canisters were installed in sequence with the zero air canisters for the Dasibi PCs at all stations except Lookout Point. New lightning protection panels were also installed. Grant Grove received a new strip chart recorder and Ash Mountain received a new SUMX program. All stations now have electric clocks which are set to WWV time. Ladder covers and gate padlocks were installed to prevent ladder access at all stations except Lookout Point (Lookout Point station is fenced in). Lookout Point station had major wiring reconfiguration by the Radio Shop and is still in the process of being modified. As part of the AUSPEX study, tracer samplers were located at Ash Mountain and Lower Kaweah stations (one was also located at the heliport in Cedar Grove). In addition, Lower Kaweah had gas and particle samplers.

ASH MOUNTAIN

01/03	Regprogrammed precision check to run on 1/4, did not run as usual because of year change.
01/04	Reset theoretical CAL level 1 from -.010 to .000 and level 5 from .390 to .400 (to match other sites).
01/10	Manual ozone adjust on Dasibi PC changed from 15 to 16, adjusted sample frequency potentiometer on J8 board on Dasibi PC.
01/11	Adjusted UV lamp on Dasibi PC, calibration of MAST using Dasibi PC.
01/18	Set span on MAST according to Dasibi PC span gas (changed from 110 to 115), left column 2 (CAL) down by mistake.
01/22	Reentered password (lost for unknown reasons from SUMX memory), column 2 upped.
01/26	Station leveled by maintenance.
02/15	Cal/Maint Visit by Robert Lehrman of ARS (-2.5%), Lehrman discovered the station is not grounded, submitted work order to maintenance.
02/16	Robert Lehrman (ARS) conducted zero, span and precision checks.
02/21	Discovered year set on 1989 from 2/17-20, reset year to 1990.
02/23	MP calibration of PLOMS using Dasibi PC, reentered password (lost for unknown reasons from SUMX memory), Dasibi PC ozone pump flow rate reduced from 5.0 to 4.5

	lpm.
02/27	Monitor Labs UV lamp adjusted, Dasibi PC ozone pump flow rate increased from 4.5 to 5.0 lpm.
03/16	Dasibi PC ozone pump flow adjusted from 5.0 to 5.5.
03/28	Ran span/zero events to condition new filter (new procedure).
03/29	Keyboard jammed, turned SUMX off/on to regain control
04/02	Check on PLOMS.
04/13	Check on PLOMS.
04/18	Keyboard jammed, data for 04/17 partially lost (flagged with "F" but no power failure).
04/20	Check on PLOMS.
04/25	The ground wire that was found disconnected by Robert Lehrman (ARS) was repaired by Frank Bleggi (SEKI).
04/30	Lookout Point Dasibi PC was checked with Ash Mountain Dasibi PC, reference voltage low (resolved 5/16), check on PLOMS, one of Dasibi PC ports left disconnected by mistake.
05/01	Zero check high because of yesterday's mistake, corrected today.
05/02	AV audit by Chris Lanane (-2.6%).
05/09	More checks on Lookout Point Dasibi PC, Ash Mountain Dasibi PC left on manual by mistake.
05/10	Reset Dasibi PC back to auto.
05/11	MP calibration on PLOMS.
05/15	PLOMS removed from station for modifications.
05/16	Low reference voltage due to Dasibi PC incorrectly plugged in, manual ozone setting from 16 to 15.
05/18	PLOMS returns to station.
05/22	MP calibration on PLOMS.
05/23	Manual ozone setting changed from 15 to 16, quarterly MP calibration (SLIC -4.15%, MP 3.6%).
05/29	Data misflagged.
06/05	Data misflagged, PLOMS removed from station.
06/11	Passwords lost, reentered by AQD.
06/12	Third-level password reentered.
06/16	PLOMS returned to station.
06/19	PLOMS removed for summer.
07/09	Air conditioner turned off by mistake and station temperature >30 deg C.
07/10	Air conditioner turned back on.
07/25	Quarterly MP calibration (SLIC -3.6%, MP 0.9%).
08/15	Monitor Labs UV lamp adjusted for higher lamp value.
08/22	Automatic span/zero events to condition new sample inlet filter remained on all day until the next mornings scheduled events.
09/12	Audit by Fred Burriell and Gabriel Ruit of CARB (-6.1%) using CARB Dasibi 1008-PC audit instrument.
09/26	Monitor Labs UV lamp adjusted for higher lamp value.
11/28	Cal/Maint visit by Mitch Walker of ARS (-0.7%). New lightning protection panel (LPP) and SUMX program installed.

11/29 M. Walker ran span check because morning span unusual, reinitialized and reset events, removed electrometer board to take to Grant Grove, reinstalled in evening.

11/30 J. Faust increased Dasibi PC ozone pump flow rate from 5.5 to 5.9

12/05 High zero values in Dasibi PC, Dasibi PC leak checks OK.

12/06 Man. O_3 adj. lowered from 16 to 15.

12/19 Dasibi photometer UV lamp replaced.

12/21 Dasibi photometer UV lamp replaced again.

12/22 Inserted Mast sample line into tee.

12/26 Dasibi PC optic cells cleaned (unremoveable stains observed in one cell), Dasibi PC leak test OK, span and zero rescheduled for noon because of condensation in sample line from freezing night temps.

12/28 Replace electrometer board and optic cell in Dasibi with one from Lookout Point.

12/31 Span and zero reset for 0400 PST, the MAST sample line was removed from the tee because it was drawing in too much sample during the zero and span checks at noon.

GRANT GROVE

01/03 Reprogrammed precision check to run on 1/4, did not run as usual due to new year.

01/04 10 power outages totalling ~2 hours on 1/1, adjusted ML UV lamp, replaced Dasibi PC scrubber, leak tested (not OK?), cleaned optic cell, replaced ML scrubber, leak tested (OK), replaced ML UV lamp.

01/08 Quarerly MP (SLIC 1.8%, MP -5.9%), leak tested Dasibi PC (not OK?).

01/18 Short power outages on 1/13,15,16, adjusted ML UV lamp, reinitialized rampack.

01/26 Strip chart ran out on 1/25 2200 PST, Dasibi PC manual ozone adjust changed from 23 to 22, shelter heater adjusted, adjusted ML UV lamp

02/01 Adjusted heater, adjusted ML UV lamp

02/08 Installed new rampack

02/13 Installed new ML UV lamp (old one needing adjustment weekly) so ready for tomorrow's Cal/Maint Visit, strip chart trace sporadic 1620-2220 PST.

02/14 Cal/Maint Visit by Robert Lehrman of ARS (pre:-3.7%, post:-1.7%), strip chart trace sporadic 0145, 0845, 2345 PST, ML span changed from 298 to 293, Dasibi PC span changed from 661 to 686.

02/15 Robert Lehrman (ARS) installs new LPP to try to solve phone problem but problem still exists (phone routed around LPP to function properly), Dasibi PC manual ozone adjust changed from 23 to 22.

02/22 Short power outages on 2/18,16, shelter heater adjusted, strip chart recorder removed and taken to park radio shop for adjustment.

03/01 Strip chart recorder returned to station, changed Dasibi PC manual ozone adjust from 22 to 23, adjusted

shelter heater.

03/09 Strip chart ran out 3/8 2200 PST, adjusted ML UV lamp.

03/15 Adjusted ML UV lamp, cleaned optic cell, adjusted preamp span potentiometer, leak tested (OK).

03/16 Adjusted ML preamp span potentiometer.

03/23 Conducted ML lamp peak adjustment procedure to stabilize UV lamp voltage, checked preamp offset.

03/29 Changed Dasibi PC manual ozone adjust from 23 to 22 and ozone pump flow from 5.0 to 4.5 lpm, ran span/zero events to condition new filter (new procedure), adjusted ML UV lamp, unusual strip chart trace 3/28 1638-1646 PST.

04/05 Adjusted ozonator pump from 4.5 to 4.0 lpm.

04/25 Reprogrammed event 4 but used wrong code.

04/26 Changed lines to summer configuration.

05/03 AV audit by Chris Lanane (-1.0%), station temperature probe off by +1.6 deg C.

05/17 Quarterly MP calibration (SLIC -4.4%, MP -2.1%), Dasibi PC unstable.

05/22 Unable to call station.

05/24 Modem reset manually.

05/28 Reprogrammed event 4.

05/31 Replaced charcoal in zero air canister.

06/07 Installed new QA module and Soltec strip chart recorder.

06/15 Changed manual ozone setting from 22 to 23, changed ozonator flow from 4.0 to 5.2 lpm.

06/16 Reference voltage low.

06/21 Reference voltage fixed itself during station check, calibration for new strip chart recorder.

06/22 2 1/2 hour power failure beginning 0237 PST.

07/05 Adjust ML UV lamp.

07/07 8 second power failure at 0817 PST.

07/12 Ladder cover installed for safety.

07/15 8 second power failure at 1727 PST.

07/26 Quarterly MP (SLIC -2.5%, MP -4.4%).

08/03 Could not poll station, modem manually reset.

08/04 Chart paper ran out at midnight.

08/09 Could not poll station, modem manually reset.

08/17 Power outage for 8 seconds at 1727 PST.

08/30 AC increased from 9 to 9.5, ML lamp adjusted.

08/31 Power outage for 8 seconds at 2204 PST.

09/13 Audit by Fred Burriell and Gabriel Ruit of CARB (-0.7%) using CARB Dasibi 1008-PC audit instrument.

09/24 Could not enter password for polling. Modem manually reset and okay.

09/23 Power outage for 4 seconds at 1014 PST.

09/27 Adjusted ML lamp, power outage at 1524 for 8 seconds.

10/04 Adjusted ML lamp.

10/17 Power outage for 8 seconds at 1524 PST.

10/24 Adjusted ML lamp, strip chart trace is zero from 1230 to 2315 PST for unknown reason.

11/01 Dasibi optic cells and mirrors cleaned, lamp replaced.

11/09 Dasibi sample frequency changed using potentiometer.

11/16 Strip chart recorder on zero for 13 minutes for unknown reason, sampling line placed in winter configuration.
11/20 Control and sample frequencies adjusted using potentiometers.
11/29 Adjusted ML lamp, cal/maint. by Mitch Walker of ARS (0.9%), Daisibi PC UV lamp replaced, power outage for 10 minutes to replace LPP (phone now connected through LPP, see 2/15), new chart equation.
12/13 Charcoal changed in Dasibi zero air supply.
12/20 Dasibi PC left on control freq. by mistake.
12/21 Reset Dasibi PC to operate.
12/27 ML sample flow adjusted from 0.37 to 0.60.

LOOKOUT POINT

01/06 Reprogrammed CR21X to record ambient temperature.
02/02 Ambient temperature probe moved from east side to west side of building.
03/16 Load current and solar charge sensors connected directly to CR21X and CR21X reprogrammed.
04/28 TECO returned to station, it had been in for repairs since 11/16/89 (Owen Houston of Environics repaired D/A board, installed head kit for pump, and tested new scrubber), biweekly MP not possible because Dasibi PC 4124 ozonator lamp not functioning (recently repaired by ARS).
04/30 Changed TECO span 479 to 523, biweekly MP calibration (no SLIC, MP 5.1%) using Dasibi PC 4234 from Ash Mountain station.
05/04 AV audit by Chris Lanane (6.7%), discrepancy between TECO display and analog output.
05/16 Biweekly MP calibration using Dasibi PC 4234 from Ash Mountain station (SLIC -4.4%, MP 8.0%).
05/23 Dasibi PC 4124 repaired by radio shop, tested against ML at Ash Mountain station.
05/30 Reprogrammed load current and solar charge channels, biweekly MP calibration unsuccessful-Dasibi PC 4124 variable, changed TECO span from 523 to 503.
06/04 Troubleshooting voltage problem, added channel for ozone standard deviation.
06/05 Changed ozone program from single to differential ended, ran zero/span/precision.
06/06 Biweekly MP calibration (SLIC -1.4%, MP 2.3%), switched storage locations for ozone standard deviation and concentration.
06/13 Installed new voltage regulator for strip chart recorder and burned it up, replaced wires to original positions, moved 12v tap from one battery bank to the other, removed strip chart recorder from station for repairs.
06/20 "Repaired" strip chart recorder returned to station but still does not work, removed.
06/22 Biweekly MP calibration (SLIC 0.3%, MP 3.9%), removed ozone-offset channel.

06/26 Tested grounds with each other, all had a positive 30-90 mv reading indicating differences in ground references between the instrumentation.

06/28 Gary Ward from the radio shop visits station, tightened loose connection on battery bank which was causing unequal charging, added grounding wire from the blue box to CR21X, new regulator for strip chart recorder burned up, Gary will try again.

07/06 Changed TECO span 503-488, biweekly MP calibration (SLIC -2.7%, MP 3.3%).

07/18 Biweekly MP calibration (SLIC 1.9%, MP 4.1%), strip chart jammed in the evening.

08/01 Biweekly MP calibration (SLIC -3.2%, MP 5.4%).

08/15 Biweekly MP calibration (SLIC -0.5, MP 0.9%).

08/20 Station exterior oiled by maintenance.

08/31 Biweekly MP calibration (SLIC -4.4%, MP 3.3%).

09/12 Audit by Fred Burriell and Gabriel Ruit of CARB (0.7%) using CARB Dasibi 1008-PC audit instrument.

09/19 Zero and span potentiometers adjusted.

09/26 Gary Ward from radio shop installed new switch for charging battery banks, blue box removed.

10/03 Strip chart pen off scale, problems with TECO so removed from site.

10/25 TECO returned after working on the solenoids and cleaning the optics.

10/26 Zero/span/precision check, cleaned windows, adjusted UV lamp, zero and span pots.

10/31 Biweekly MP calibration (SLIC -1.3%, MP -3.7%).

11/09 Voltage divider installed for solar voltage sensor.

11/14 The TECO sample line had been left open to shelter air since 10/31, biweekly MP calibration (SLIC 3.9%, MP 2.6%).

11/30 Cal/maint. by Mitch Walker and John Faust of ARS (-2.0%).

12/10 Insulated box installed.

12/14 Biweekly MP calibration (SLIC 0.1%, MP -6.2%).

12/27 Possible solenoid leak.

LOWER KAWEAH

01/02 Reprogrammed precision check to run on 1/4, did not run as usual due to new year.

01/09 Dasibi PC optics cell cleaned, adjusted potentiometer on J8 board, adjusted UV lamp.

01/10 Power outage from 1/10 1735 PST to 1/11 0441 PST, missing met. data for this time period, shelter heater adjusted.

01/16 Adjusted potentiometer on J8 board, adjusted shelter heater.

01/19 Tested ML scrubber (OK), replaced Dasibi PC scrubber, leak tested both (OK).

02/06 ML scrubber tested, leak tested ML and Dasibi PC (OK).

02/13 Cal/Maint Visit by Robert Lehrman of ARS (-1.3%).

02/15 Robert Lehrman (ARS) checked meteorological sensors.

03/06	Adjusted ML UV lamp.
03/07-08	Missing meteorological data.
03/09	Reinitialized rampack.
03/27	Ran span/zero events to condition new filter (new procedure).
04/07	Wind direction sensor goes bad.
04/17	Cleaned optics on Dasibi PC, adjusted sample frequency pot.
04/19	DRI audit of meteorological equipment and particle samplers, readjusted Dasibi PC sample frequency.
04/24	Changed lines to summer configuration, SLIC (-5.8%).
04/25	Reprogrammed event 4 but used incorrect code.
04/27	Cleaned sample lines with alcohol, SLIC (-7.5%), installed new wind direction sensor.
05/02	AV audit by Chris Lanane (-4.6%).
05/04	Manually reset modem.
05/08	High zero values last few days, replaced scrubber in Dasibi PC, attached different charcoal canister.
05/15	Replaced dryerite, quarterly MP calibration (SLIC -5.8%, MP 3.7%).
05/22	Adjusted wetness sensor pot.
05/28	Reprogrammed event 4 (had been removed on 1/3 by mistake and then reprogrammed wrong on 4/25).
06/05	B. Zarnowski (CARB) visits site.
06/12	Used Dasibi PC to calibrate Grulke's instruments, cleaned optics tube in station Dasibi PC.
06/16	MP on PLOMS, Dasibi PC left on manual by mistake.
06/18	Dasibi PC reset to auto.
06/21	TRS 80 jammed by Grulke's assistant, NOAA 16' trailer located between shed and road, Tracer Technology's tracer sampler on west side of building, and DRI particle/gas sampler at base of rock (AUSPEX study).
06/30	Troubleshooting zero/span values, problem resolved on 07/03 by ARS.
07/24	Quarterly MP calibration (SLIC -6.5%, MP -3.5%).
08/06	Teflon tubing replaced, SLIC (6.1%).
08/09	Phone line dead due to lightning.
08/13	Phone line fixed by phone company.
08/21	MP because teflon tubing replaced (SLIC -1.4%, MP -1.7%).
08/23	Full scale value for ozone changed from .500 to .495.
09/13	Audit by Fred Burriell and Gabriel Ruit of CARB (-5.3%) using CARB Dasibi 1008-PC audit instrument.
09/21	Power outage for 3 seconds at 1748 PST.
09/22	Power outages for 3 seconds at 0530 and 0533 PST.
09/25	All AUSPEX study instruments and trailer removed from site.
09/29	Could not poll station, manually reset modem.
10/16	Cleaned Dasibi optic tubes.
11/05	Power outage for 3 seconds at 0558 PST.
11/06	Rampack had to be reinitialized.
11/11	Power outage for 3 seconds at 0312 PST.
11/13	Adjusted ML UV lamp, adjusted Dasibi PC lamp and detector, winter configuration of sample lines.

11/30	Cal/maint Visit by Mitch Walker of ARS (-3.8%), new LPP installed, ML malfunction for several hours after audit, power outage at 1841 PST for 15 minutes.
12/07	Power outage for 4 seconds at 0059 PST.
12/11	Charcoal changed in Dasibi zero air supply, wetness sensor potentiometer changed.
12/18	Wetness sensor potentiometer readjusted.
12/21	Snow shaken off the meteorological tower which invalidated the wind speed and direction measurements.

APPENDIX B
STATION INVENTORIES

ASH MOUNTAIN OFFICE MONITORING INVENTORY

March, 1991

DASIBI:

- Ozonator lamps (2)
- Photometer lamps (2)
- 5 LPM pump
- 1 LPM pump
- 2 LPM rotameter, adjustable
- Mirror set and gaskets

MONITOR LABS:

- Photometer lamps (2)
- Temporary scrubbers (3)

PARTS:

- Chart pens
- Printer paper
- Printer ribbon (DMP-106)
- Teflon sample filters, 2 inch
- Teflon 1/4" tubing (20 feet)
- Activated charcoal
- Silica gel
- Funnel
- Latex gloves, medium (2 boxes)
- Latex gloves, small (1 box)
- Small Kimwipes (3 boxes)

ASH MOUNTAIN OZONE MONITORING SHELTER INVENTORY

February, 1991

Parts:

- Strip chart pens
- Strip chart paper
- Printer paper
- Printer ribbon (DMP-106)
- Teflon sample filters (2 inch)
- Miscellaneous screws, bolts, nuts

Supplies:

- Pens
- Notepad
- White out
- Rubber bands
- Scotch tape
- Teflon tape
- Electrical tape
- Giant cotton swabs
- Kimwipes
- Plastic garbage bags
- Step stool
- Trash can
- Door rug
- Broom

Tools:

- Jewelers screwdriver set (6 straight)
- Large interchangeable screwdriver set
- Small straight screwdriver
- Small phillips screwdriver
- Small allen wrench
- Vacuum cleaner
- Scissors

Manuals:

- NPS Air Monitoring Network
- Dasibi 1003-PC
- SumX SX-445 Data Acquisition System
- Tandy 102 computer
- Tandy DMP-106 printer
- Anderson-Jacobson modem AJ 1212-ST
- Telenetics error controller
- DRI lightning protection panel
- Quality assurance monitor
- Friedrich air conditioner
- Casio calculator information
- New logbook with carbon paper

ASH MOUNTAIN OZONE MONITORING EQUIPMENT INVENTORY

February, 1991

ITEM DESCRIPTION	MODEL	SERIAL #	PROPERTY #
Alan building	8'x 8'	8611661808	
Monitor Labs ozone analyzer	8810	557	01618 (WASO)
Dasibi O3 transfer standard	1003-PC	4234	23476 (SEKI)
Sumx data acquisition system	444	009	
Tandy computer	102	706001129	
Chessell strip chart recorder	300D	8607-723	01144 (WASO)
Anderson-Jacobsen modem	AJ 1212-ST	5735	
Telenetics error controller	ECS	2-000202	01563 (WASO)
Tandy dot matrix printer	DMP-106	7H54002	
Bendix CO monitor	8501-5CA	301275-21	03815 (CARB)
Bristol strip chart recorder	64A-1PH590-51	72A-13969	04710 (CARB)
Victor gas valve, double gauge			
Friedrich air conditioner	SP07G10	84LS10301	
Inmac printer stand	Microfold		
Pemall fire extinguisher	HU-6-T	D 723,226	
Casio FX-115 calculator	Super FX		
Mercury thermometer	8124-70	3434	
Radio Shack telephone	43-509		
Clock (battery powered)			

GRANT GROVE OZONE MONITORING SHELTER INVENTORY

February, 1991

Parts:

- Monitor Labs UV lamp
- Dasibi ozone generator lamp
- Monitor labs ozone scrubber (temporary use only)
- Dasibi ozone scrubber (temporary use only)
- Strip chart pens
- Strip chart paper
- Printer paper
- Printer ribbon (DMP-106)
- Teflon sample filters (2 inch)

Supplies:

- Pens
- Notepad
- White out
- Rubber bands
- Scotch tape
- Teflon tape
- Electrical tape
- Giant cotton swabs
- Kimwipes
- Plastic garbage bags
- Step stool
- Trash can
- Door rug
- Broom

Tools:

- Jewelers screwdriver set (6 straight)
- Large interchangeable screwdriver set
- Small straight screwdriver
- Small phillips screwdriver
- Small allen wrench
- Scissors

Manuals:

- NPS Air Monitoring Network
- Dasibi 1003-PC Ozone Monitor
- SumX SX-445 Data Acquisition System
- Tandy 102 computer
- Tandy DMP-106 printer
- Anderson-Jacobson modem AJ 1212-ST
- Telenetics error controller
- DRI lightning protection panel
- Quality Assurance Monitor
- Friedrich air conditioner
- Casio calculator information
- New logbook with carbon paper

GRANT GROVE OZONE MONITORING EQUIPMENT INVENTORY

February, 1991

ITEM DESCRIPTION	MODEL	SERIAL #	PROPERTY #
Alan building	6'x 6'	89 1029 1606	02267 (WASO)
Dasibi O3 transfer standard	1003-PC	5161	02260 (WASO)
Monitor Labs ozone analyzer	8810	525	01439 (WASO)
Chessell strip chart recorder	300D	9002-1035	02386 (WASO)
Sumx data acquisition system	445	24	
Telenetics modem	12S/24S	353854-2	02251 (WASO)
Tandy portable computer	102	706001126	
Tandy dot matrix printer	DMP-105	5S22960-032	
Inmac printer stand	Microfold		
Drierite cylinders (2)			
Charcoal canisters (2)			
Friedrich air conditioner	SP06G10	85ES09001	
Casio calculator	FX-115N		
Lighting Protection Panel			
ITT telephone			
Clock (battery powered)			

LOWER KAWEAH OZONE MONITORING SHELTER INVENTORY

February, 1991

Parts:

- Monitor Labs UV lamp
- Desert Research Institute particulate samplers:
  - O-rings
  - Large cover gaskets (4)
  - Carbon vanes (8)
  - Capsule filter - 3um (2)
  - Pump filters (5)
- Hygrothermograph C-cell batteries (2)
- Camera MS-76 button batteries (2)
- Motordrive AA batteries (4)
- Lens cloth and paper
- Color control chart
- Rain gauge charts
- Strip chart pens
- Strip chart paper
- Printer paper
- Printer ribbon (DMP-106)
- Teflon sample filters (2 inch)
- Squeeze bottle - distilled water
- Miscellaneous screws, bolts, nuts

Supplies:

- Pens
- Notepad
- White out
- Rubber bands
- Clip boards (2)
- Scotch tape
- Teflon tape
- Electrical tape
- Giant cotton swabs
- Kimwipes
- Plastic garbage bags

Tools:

- Jewelers screwdriver set (6 straight)
- Large interchangeable screwdriver set
- Small straight screwdrivers (2)
- Small phillips screwdriver
- Small allen wrench
- Scissors
- Met. tower climbing belt
- Trash can
- Step stool
- Broom
- Rug

LOWER KAWEAH OZONE MONITORING SHELTER INVENTORY

February, 1991

Manuals:

- NPS Air Monitoring Network
- Dasibi 1003-PC
- Monitor Labs 8810
- SumX SX-445 Data Acquisition System
- Tandy 102 computer
- Tandy DMP-106 printer
- Met One 120 Translator and Instruments
- DRI particulate sampler log and operating procedures
- Olympus OM-2S camera
- Olympus Recordata back 4
- Olympus winder 2
- Operating procedures for visibility camera
- Extech timer instructions
- Telenetics Express Data modem
- DRI lightning protection panel
- Quality assurance monitor
- Friedrich air conditioner
- Casio calculator information
- New logbook with carbon paper

LOWER KAWEAH OZONE MONITORING EQUIPMENT INVENTORY

February, 1991

ITEM DESCRIPTION	MODEL	SERIAL #	PROPERTY #
Alan building	6' X 6'	8611671608	
Friedrich air conditioner	SP06G10	84LS05977	
Pemall fire extinquisher	HU-6-T	D-724,509	
Dasibi O3 transfer standard	1003-PC	4456	01134 (WASO)
Monitor Labs ozone analyzer	8810	555	01616 (WASO)
Sumx data acquisition system	444	339	
Tandy TRS-80 computer	100	304013280	
Tandy printer	DMP 105	5S22934-039	
Inmac printer stand	Microfold		
Telenetics modem	12S/24S	353732-2	01984 (WASO)
Chessell strip chart recorder	300-D	8703-672	01402 (WASO)
Lightning protection panel			
DRI particulate sampler	2.5 & 10 micron		(CARB)
Dwyer flow gauge 100 SCFH	RMC-102	S728	ARB106
Dwyer flow gauge 4 LPM	VFB-65	S729	ARB046
Dwyer flow gauge 400 SCFH	RMC-104	S735	ARB406
Met One translator	120-7	E1042	
Meteorological tower with instruments			
Hygrothermograph			
Sling phsycrometer			
Olympus 35mm camera	OM-2S	1120594	23769 (SEKI)
Zuiko auto-T lens	135 mm	409900	23765 (SEKI)
Olympus databack	Recordata back4		
Olympus film winder	Winder 2	703748	
Extech three channel timer	Compu 2003	4452/4D87	
Casio calculator	FX-115N		
Mercury thermometer	8124-70	3434	
ITT telephone			
Clock (battery powered)			

LOOKOUT POINT OZONE MONITORING SHELTER INVENTORY

February, 1991

Parts:

- UV lamp for TECO
- Fuses - 2, 3 and 5 amp
- Rectifiers - 6 amps, 50 PIV (3)
- Campbell data transfer cables (2)
- Strip chart paper
- Strip chart pens
- Teflon sample filters (2 inch)

Supplies:

- Pens
- Notepad
- Whiteout
- Rubber bands
- Clipboard
- Masking tape
- Scotch tape
- Electrical tape
- Teflon tape
- Kimwipes
- Large swabs
- Plastic trash sacks
- Weekly station checklists
- Multipoint calibration worksheets

Tools:

- Jeweler's screwdriver set
- Large interchangeable screwdriver set
- Small straight screwdriver
- Small phillips screwdriver
- Extension cords (50 feet)(2)
- Snapit 8-outlet surge protector
- Hydrometer
- Portable fluorescent light
- Broom

Manuals:

- TECO Model 49/49PS Instruction Manual
- Casio calculator information

LOOKOUT POINT OZONE MONITORING EQUIPMENT INVENTORY

February, 1991

ITEM DESCRIPTION	MODEL	SERIAL #	PROPERTY #
Thermoelectron O3 analyzer		49	AOM 12421-129-S
Dasibi ozone transfer standard		1003-PC	4124
Campbell Scientific datalogger		CR21X	52700163 7 (WASO)
Esterline Angus strip chart recorder	MS401BB	S-22234-1A	
Amer. Aerospace current sensor		913A-50C	3864
Amer. Aerospace current sensor		913A-10C	3863
McGraw Edison batteries (40)		Americad CED250	
Motorola solar panels (14)	MSP-43A-40		
Casio calculator	FX-115N		
Clock (battery powered)			
Nalgene 3 gallon jug (DI water)			
Step stool			
Trash can			

APPENDIX C
ANNUAL CARBON MONOXIDE REPORT

AVALANCHE FIRE CARBON MONOXIDE REPORT FOR AUGUST 1990

Kris Wiese
Fire Weather Behavior Specialist

September 20,1990

INTRODUCTION

Carbon Monoxide (CO) is a by-product of forest fires that might possibly accumulate into unacceptable concentrations in areas near a fire. Smoke from the Avalanche prescribed natural fire in Kings Canyon National Park was settling into the Cedar Grove area at night. This report analyzes data collected by a CO monitor set up in Cedar Grove while the Avalanche fire was burning.

MATERIALS AND METHODS

A Bendix model 8501-5CA infrared gas analyzer was set up in Cedar grove on 1 August. The analyzer was calibrated again on 2 and 9 August, using a standardized zero (0.0 CO in N) and span (40.5 ppm CO) gas. The analyzer recorded CO concentrations continuously from 2 until 30 August, and this data was averaged for each hour from 2 until 10 August. Averaged hourly CO concentration values were used as input for analysis by 'Statgraphics' packaged computer software. This software generated graphs and the analysis of variance tests used to check for correlations between the variables examined in this report.

Fire maps for the Avalanche fire were examined using a dot overlay to calculate the acreage consumed each day. Park records of visitor camp site use for tents, recreational vehicles, and both combined were also examined. The effects of burned acreage

per day and camp sites used per day were then compared with CO production to see if any correlation was evident.

RESULTS

The computer analysis for all variables showed that the hour of the day was the only variable that related significantly to the CO concentrations recorded in Cedar Grove from 2 until 10 August. Camp site use and acres consumed on each day did not correlate with CO readings recorded.

Graphical results for the hourly concentration data is shown with a Box and Whisker plot included in this report. (On the box and whisker plot, the line within the box represents the mean CO reading for that hour, and the box is the 95% confidence interval calculated for the mean. The whiskers connect the maximum and minimum values for each hour, and the small boxes represent outlier values that are greater than 1.5 times the box length away from the box.)

The hourly data is also shown in a continuous plot, and the maximum hourly average, 1.7 ppm was recorded at 8:00 pm on 6 August.

DISCUSSION

The hourly levels of CO recorded never approached the

State maximum allowable standards of 20.0 ppm for one hour or 9.0 ppm for eight consecutive hours. If the State standards were ever approached in the future, the results in this report would seem to indicate that prohibiting campfires in nearby campgrounds would have little effect on CO levels. This may not be true, since I used daily totals for both CO average levels and occupied camp sites to examine correlation of these variables. A more reliable measure would record CO only during the time of actual burning of camp fires and related this to the number of camp-fires, not campsites.

The correlation between hour and CO levels is expected in light of the visual data collected on the fire. Smoke from the Avalanche fire would begin to settle into Cedar Grove between 8:00 and 10:00 pm, and continue to collect there until 8:00 to 9:00 am. At that time, the wind would shift and began to blow the smoke away from Cedar Grove. By 10:00 am the CO readings would be zero or were approaching zero.

An interesting phenomenon that was not analyzed were the spikes of CO that occurred on most mornings between 6:00 and 8:00 am. These were probably due to someone starting their car in the morning and driving to work.

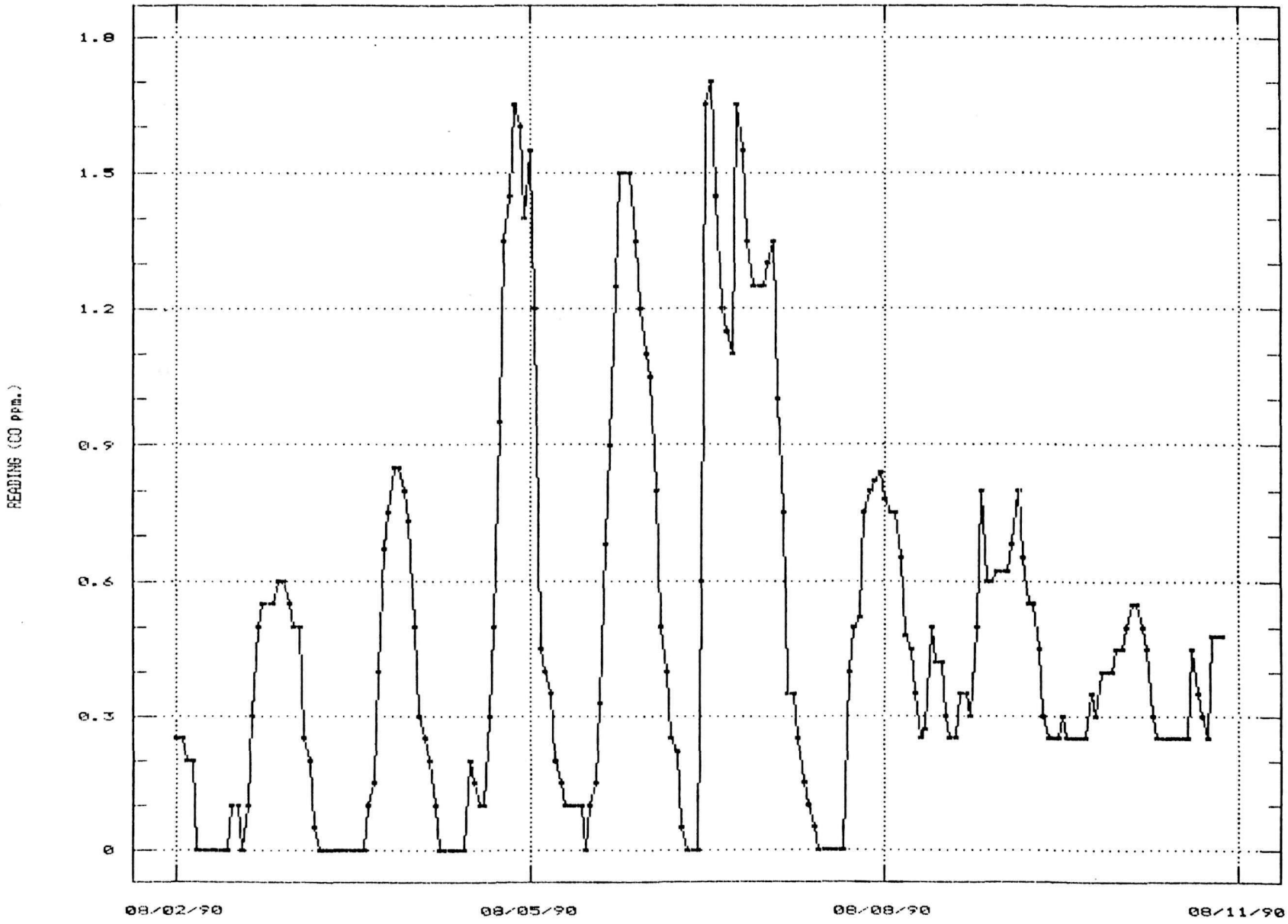
I was surprised not to find any correlation between acres consumed and CO levels recorded. On a larger fire, if the CO monitor was located in the wind during the day, the hourly readings would probably be higher and the diel pattern would probably be reversed.

In the future, it would be interesting to have two CO

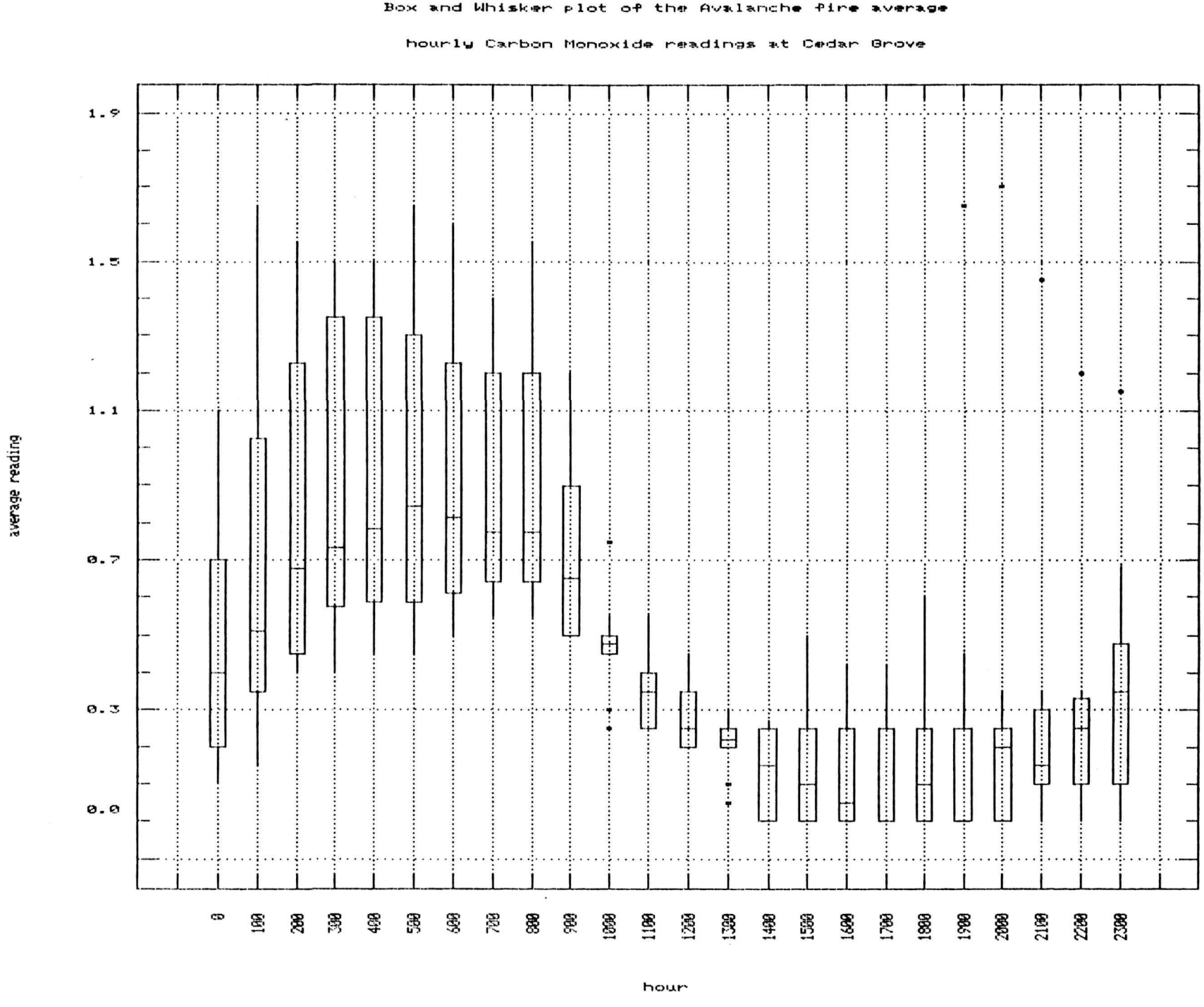
monitors set up so that one would always be in the smoke despite the day and night wind shifts.

AVALANCHE FIRE CARBON MONOXIDE LEVELS

CEDAR GROVE



HOURLY AVERAGES BEGINNING AT 1000 ON 8/2/90


Box and Whisker plot of the Avalanche fire average
hourly Carbon Monoxide readings at Cedar Grove
average reading
1.9
1.5
1.1
0.7
0.3
0.0
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
2100
2200
2300
hour

One-Way Analysis of Variance

Data: READING

Level codes: HOUR

Labels:

Range test: Scheffe Confidence level: 95

Analysis of variance

Source of variation	Sum of Squares	d.f.	Mean square	F-ratio	Sig. level
Between groups	18.946551	23	.8237631	7.130	.0000
Within groups	21.027550	182	.1155360		
Total (corrected)	39.974101	205			

1 missing value(s) have been excluded.

APPENDIX D
DRY DEPOSITION REPORT

DRY DEPOSITION MEASUREMENTS FOR THE CALIFORNIA ACID DEPOSITION MONITORING PROGRAM

Draft Report
DRI Document No. 8068.1D1

Submitted to

California Air Resources Board
1800 15th Street (15th & R)
Sacramento, California 95814
Attn: Dr. Lowell Ashbaugh
Dr. John Holmes

Contract Number: A6-076-32

Prepared by

John G. Watson	Co-Principal Investigator
Judith C. Chow	Co-Principal Investigator
Richard T. Egami	Field Operations Manager
John L. Bowen	Quality Assurance Officer
Clifton A. Frazier	Field Operations Supervisor
Alan W. Gertler	Project Administrator
Douglas H. Lowenthal	Data Specialist

Desert Research Institute
P.O. Box 60220
Reno, Nevada 89506

and

Kochy F. Fung — Technical Advisor

Atmosphere Assessment Associates
21354 Nordhoff Street, Suite 113
Chatsworth, CA 91311

July 31, 1990

ABSTRACT

The concentration/deposition velocity method of estimating dry deposition fluxes will be applied to assess deposition fluxes of acidic gases and particles at 10 sites throughout the State of California. Seven of these sampling sites represent urban areas (South Coast Air Basin, San Francisco Bay Area, Bakersfield, Santa Barbara, and Sacramento) and three represent forested areas (Sequoia, Yosemite, and Redwood National Parks). Several of these sampling sites are collocated with sites which are part of other air quality compliance and forest response monitoring networks.

Hourly average values for ozone, wind speed, wind direction, atmospheric stability, temperature, dew point, time of wetness, and solar radiation are obtained from continuous monitors. Daytime and nighttime measurements are taken every sixth day for sulfur dioxide, ammonia, nitrogen dioxide, and nitric acid gases on absorbing substrates. Mass, sulfate, nitrate, chloride, ammonium, sodium, magnesium, potassium, and calcium ion measurements are made on filter samples of particles in the $PM_{2.5}$ and PM_{10} size ranges. The substrate-based measurements are taken following the EPA and ARB regulatory sampling schedules for suspended particulate matter. Weekly average wet deposition samples are taken at or near the dry deposition sampling sites.

The first year of the routine monitoring program included installation of the network, training of technicians, acquisition and validation of data, and transfer of the sampling and analysis technology to Air Resources Board (ARB) operating divisions. The majority of the California Acid Deposition Monitoring Program came under the ARB's operation on February 1, 1990.

Table 7-2 (continued)

Statistical Summary of Gas/Particle Ambient Concentrations for
Samples Taken from the Fourth Quarter of 1988 Through the Third Quarter of 1989

Site Name: **Yosemite (Measurement Period: October 6, 1988 through September 25, 1989)**

Concentrations in $\mu g/m^3$

		Daytime (0600-1800 PST)						Nighttime (1801-0600 PST)					
Species	Size	Average	±	Std. Dev.	Min	Max	Number of Samples	Average	±	Std. Dev.	Min	Max	Number of Samples
Particle Mass	$PM_{2.5}$	6.08	±	7.19	0.00	40.07	51	6.97	±	13.79	0.00	90.29	51
Particle Mass	PM_{10}	10.32	±	8.54	0.00	35.77	45	10.46	±	15.60	0.00	99.31	45
Sodium (Na^+)	$PM_{2.5}$	0.059	±	0.079	0.00	0.24	52	0.059	±	0.086	0.00	0.42	52
Sodium (Na^+)	PM_{10}	0.12	±	0.12	0.00	0.51	46	0.12	±	0.19	0.00	0.95	46
Magnesium (Mg^{++})	$PM_{2.5}$	0.012	±	0.015	0.00	0.098	52	0.011	±	0.011	0.00	0.059	52
Magnesium (Mg^{++})	PM_{10}	0.025	±	0.022	0.00	0.084	46	0.024	±	0.023	0.00	0.12	46
Potassium (K^+)	$PM_{2.5}$	0.049	±	0.052	0.00	0.18	51	0.053	±	0.063	0.00	0.28	51
Potassium (K^+)	PM_{10}	0.057	±	0.063	0.00	0.24	43	0.088	±	0.224	0.00	1.44	43
Calcium (Ca^{++})	$PM_{2.5}$	0.042	±	0.057	0.00	0.38	52	0.041	±	0.046	0.00	0.25	52
Calcium (Ca^{++})	PM_{10}	0.089	±	0.084	0.00	0.37	46	0.078	±	0.067	0.00	0.22	46
Ammonium (NH_4^+)	$PM_{2.5}$	0.21	±	0.18	0.00	0.66	50	0.28	±	0.22	0.00	0.76	51
Ammonium (NH_4^+)	PM_{10}	0.48	±	1.12	0.00	7.50	43	0.37	±	0.30	0.037	1.59	44
Chloride (Cl^-)	$PM_{2.5}$	0.16	±	0.41	0.00	1.77	51	0.07	±	0.20	0.00	1.34	50
Chloride (Cl^-)	PM_{10}	0.13	±	0.38	0.00	1.53	43	0.057	±	0.131	0.00	0.79	41
Sulfate ($SO_4^=$)	$PM_{2.5}$	0.69	±	0.59	0.00	2.12	50	0.87	±	0.96	0.00	6.12	51
Sulfate ($SO_4^=$)	PM_{10}	0.72	±	0.57	0.00	2.41	41	0.82	±	0.62	0.025	2.35	42
Sulfur Dioxide (SO_2)	Gas	0.42	±	0.59	0.00	2.76	41	0.32	±	0.34	0.00	1.08	41
Nitrogen Dioxide (NO_2)	Gas	0.00	±	0.00	0.00	0.00	42	0.017		0.110	0.00	0.71	41
Ammonia (NH_3)	Gas	1.54	±	2.26	0.09	13.96	46	0.67	±	0.80	0.037	4.70	46
Nitrate (NO_3^-)	PM_{10}	0.25	±	0.24	0.00	1.11	41	0.28	±	0.36	0.00	1.90	42
Nitrate (NO_3^-)	$PM_{2.5}$	0.17	±	0.15	0.00	0.67	50	0.20	±	0.30	0.00	1.51	51
Nitrate (NO_3^-)	Undenuded $PM_{2.5}$	0.76	±	0.71	0.00	2.56	51	0.36	±	0.31	0.00	1.23	51
Nitrate (NO_3^-)	Denuded $PM_{2.5}$	0.58	±	1.18	0.00	8.41	50	0.44	±	0.37	0.00	1.62	50
Nitric Acid (HNO_3)	Gas	0.58	±	0.66	0.00	2.42	49	0.18	±	0.28	0.00	1.16	50

Table 7-2 (continued)

Statistical Summary of Gas/Particle Ambient Concentrations for
Samples Taken from the Fourth Quarter of 1988 Through the Third Quarter of 1989

Site Name: Sequoia (Measurement Period: October 6, 1988 thorugh September 25, 1989)

Concentrations in $\mu g/m^3$

		Daytime (0600-1800 PST)						Nighttime (1801-0600 PST)					
Species	Size	Average	±	Std. Dev.	Min	Max	Number of Samples	Average	±	Std. Dev.	Min	Max	Number of Samples
Particle Mass	$PM_{2.5}$	9.21	±	9.17	0.00	47.29	50	14.59	±	29.37	0.00	157.18	49
Particle Mass	PM_{10}	16.00	±	14.45	0.00	72.25	52	19.56	±	33.28	0.00	176.60	51
Sodium (Na^+)	$PM_{2.5}$	0.072	±	0.12	0.00	0.65	51	0.052	±	0.072	0.00	0.26	51
Sodium (Na^+)	PM_{10}	0.16	±	0.18	0.00	0.86	52	0.10	±	0.13	0.00	0.52	52
Magnesium (Mg^{++})	$PM_{2.5}$	0.012	±	0.012	0.00	0.048	51	0.01	±	0.01	0.00	0.033	51
Magnesium (Mg^{++})	PM_{10}	0.032	±	0.028	0.00	0.098	52	0.025	±	0.025	0.00	0.12	52
Potassium (K^+)	$PM_{2.5}$	0.077	±	0.079	0.00	0.33	51	0.12	±	0.17	0.00	0.91	51
Potassium (K^+)	PM_{10}	0.15	±	0.34	0.00	2.39	51	0.15	±	0.22	0.00	0.99	51
Calcium (Ca^{++})	$PM_{2.5}$	0.048	±	0.049	0.00	0.21	51	0.057	±	0.11	0.00	0.75	51
Calcium (Ca^{++})	PM_{10}	0.14	±	0.14	0.00	0.72	52	0.12	±	0.20	0.00	1.34	52
Ammonium (NH_4^+)	$PM_{2.5}$	0.52	±	0.55	0.00	2.33	50	0.40	±	0.36	0.00	1.41	47
Ammonium (NH_4^+)	PM_{10}	0.60	±	0.59	0.00	2.80	49	0.43	±	0.34	0.00	1.32	46
Chloride (Cl^-)	$PM_{2.5}$	0.14	±	0.45	0.00	2.59	48	0.097	±	0.28	0.00	1.84	45
Chloride (Cl^-)	PM_{10}	0.054	±	0.077	0.00	0.46	50	0.074	±	0.190	0.00	1.22	47
Sulfate ($SO_4^=$)	$PM_{2.5}$	1.15	±	1.01	0.00	4.27	50	1.03	±	0.79	0.00	3.24	46
Sulfate ($SO_4^=$)	PM_{10}	1.24	±	0.90	0.069	3.50	49	1.01	±	0.77	0.00	2.77	46
Sulfur Dioxide (SO_2)	Gas	0.74	±	0.82	0.00	2.58	49	0.47	±	0.59	0.00	2.55	49
Nitrogen Dioxide (NO_2)	Gas	0.007	±	0.051	0.00	0.36	51	0.21	±	0.70	0.00	3.87	50
Ammonia (NH_3)	Gas	1.66	±	1.86	0.00	8.31	54	1.18	±	2.46	0.00	15.69	53
Nitrate (NO_3^-)	PM_{10}	0.54	±	0.92	0.00	6.00	49	0.44	±	0.51	0.00	2.12	46
Nitrate (NO_3^-)	$PM_{2.5}$	0.47	±	0.92	0.00	4.98	50	0.39	±	0.74	0.00	4.47	46
Nitrate (NO_3^-)	Undenuded $PM_{2.5}$	0.93	±	0.86	0.00	3.28	51	0.36	±	0.35	0.00	1.27	51
Nitrate (NO_3^-)	Denuded $PM_{2.5}$	1.24	±	1.64	0.088	8.22	50	0.87	±	1.56	0.00	10.63	49
Nitric Acid (HNO_3)	Gas	0.47	±	0.61	0.00	2.04	47	0.14	±	0.27	0.00	1.35	42

7.3.3 Differences Among Sampling Sites

The largest differences in the averages are observed among the different sampling sites. Average and maximum concentrations of most species at Gasquet, Yosemite, and Sequoia are much lower than those found at the urban sites. NO_2 was not found at Yosemite or Sequoia, while Gasquet averaged 2 to 4 $\mu g/m^3$ of NO_2. This is consistent with the location of Gasquet near a major state highway, while the Yosemite and Sequoia sites are quite a distance from heavily travelled roadways. Sulfate, nitrate, and nitric acid averages are highest at Sequoia, which is known to experience a greater amount of pollutant transport from the San Joaquin Valley than does Yosemite. The Gasquet concentrations for these species are several times less than those found at the Sierra Nevada sites.

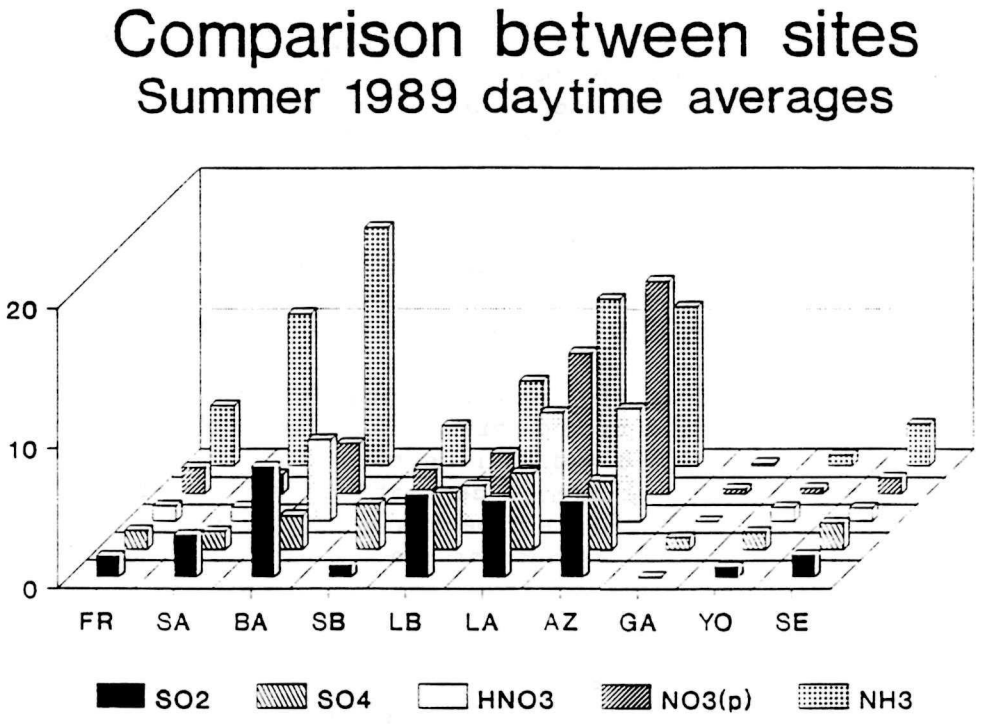
The coastal sites of Fremont, Santa Barbara, and Long Beach show sodium concentrations which are two to three times higher than sodium measured at inland sites such as Bakersfield and Sacramento. Particulate nitrate and nitric acid are at their highest average concentrations at Bakersfield, Los Angeles, and Azusa. The geologically related species of magnesium, potassium, and calcium are similar among most sites, except for the fine particle potassium which was noted above as possibly originating from vegetative burning.

A better picture of inter-site similarities and differences is given by Figures 7-5 and 7-6. Figure 7-5 shows the summertime averages of reactive species for the daytime and nighttime samples, while Figure 7-6 shows similar results for wintertime averages.

These figures show that SO_2 is highest at Bakersfield during the summer, with Long Beach and Azusa exhibiting the highest levels during winter. The daytime and nighttime distributions of SO_2 are fairly constant across the South Coast Air Basin during summertime, but a west to east gradient develops during wintertime and at night when the onshore transport patterns are not as dominant as they are during the summertime. These observations are consistent with known emissions in these areas. Bakersfield is affected by oil-extraction activities which burn heavy crude oil containing large amounts of sulfur. The Long Beach site is near oil refineries, oil- or gas-burning power plants, and ship traffic.

The sulfate concentrations roughly follow the SO_2 concentrations, but the differences among sites are not as great as those for SO_2. The South Coast Air Basin sites have the highest sulfate levels during summertime, both day and night, while Bakersfield has the highest sulfate during the wintertime. Summertime sulfate at Santa Barbara is of the same magnitude as that measured at Bakersfield, and it is larger than the sulfate found at Sacramento and Fremont. This difference may be caused by off-shore oil exploration and ship traffic located several miles off the Pacific Coast. The higher sulfate during daytime with respect to nighttime might correspond to the onshore winds which would transport pollutants emitted over the ocean to the sampling site.

Nitric acid concentrations are significant only during the summer on daytime samples, and only at urban sites (Bakersfield, Long Beach, Los Angeles, and Azusa).



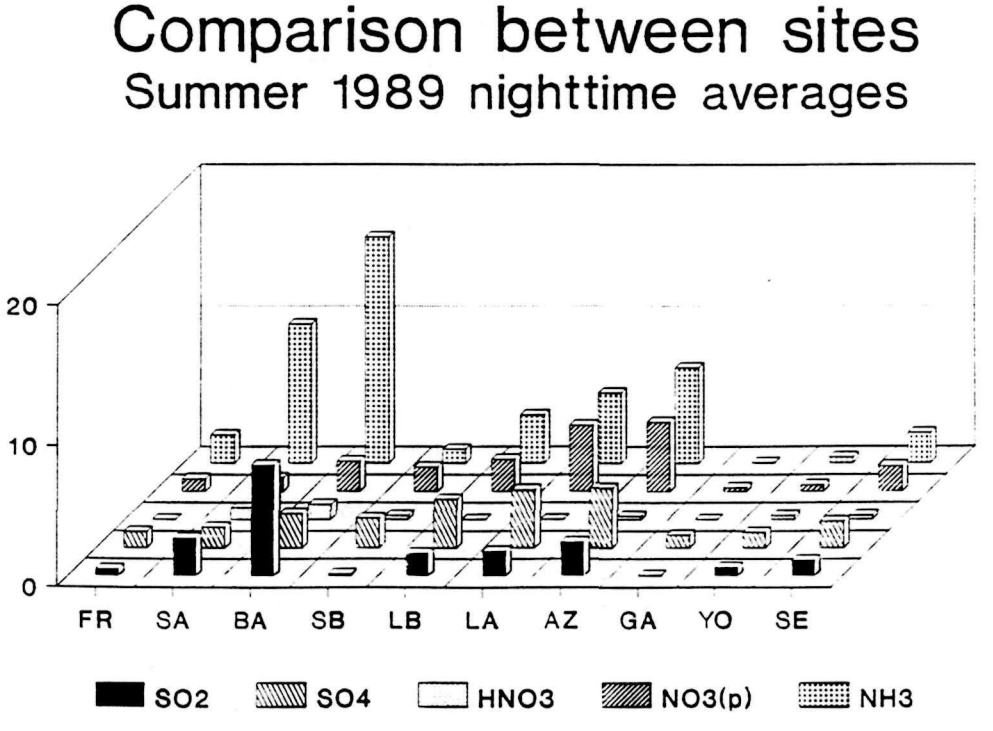
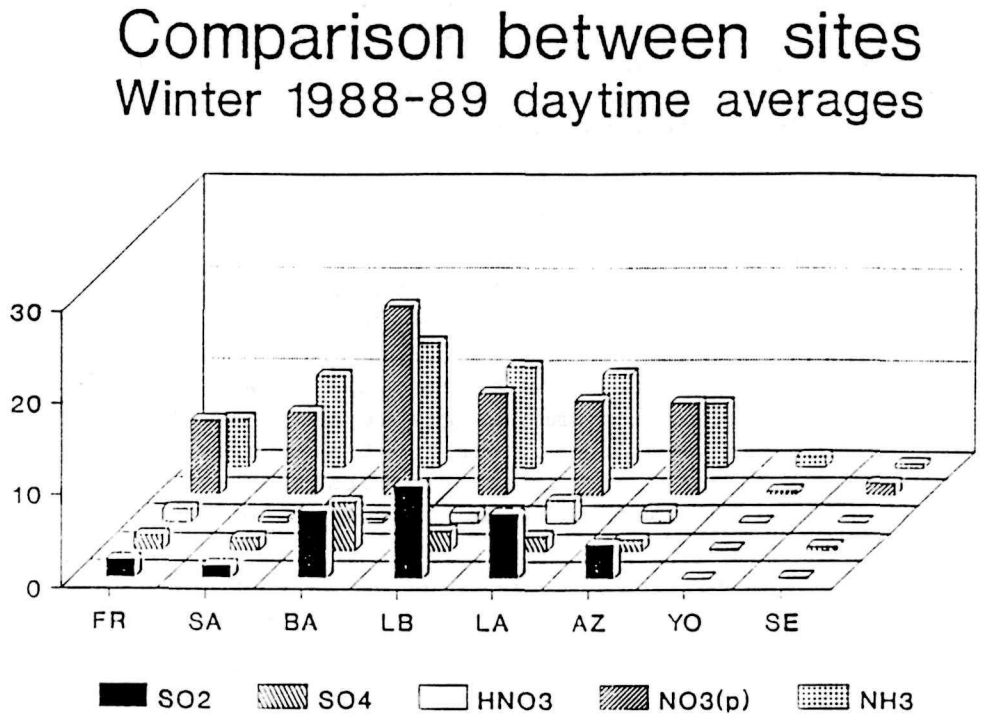


Figure 7-5: Comparison of June, July, and August Average Concentrations at Different Sampling Locations.



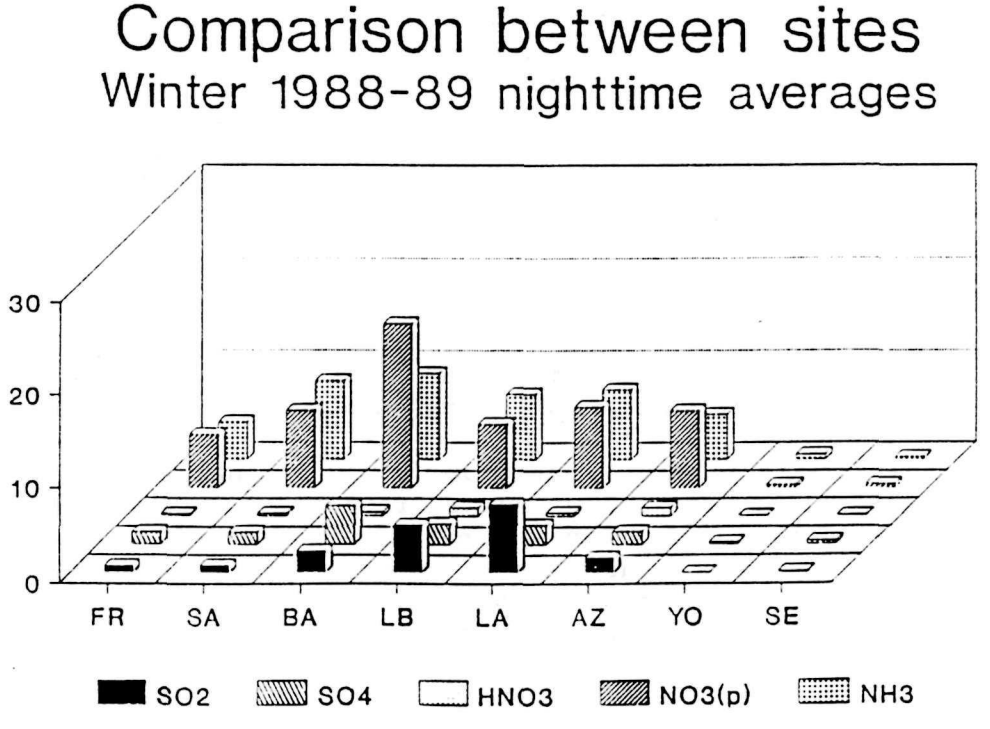


Figure 7-6: Comparison of December, January, and February Average Concentrations at Different Sampling Locations. (Sufficient data were not available from Santa Barbara and Gasquet for this period.)

Particulate nitrate is highest at Azusa during the summer daylight hours, and shows a steady increase in concentration across the South Coast Air Basin (from Long Beach to Los Angeles to Azusa). At night, the average summertime nitrate in the South Coast Air Basin drops to about half the daytime values, and the west-east gradient becomes less pronounced. Average summertime nitrate levels at the other urban sites are less than half those found in the South Coast Air Basin, with Bakersfield having slightly higher average nitrate than Fremont, Sacramento, and Santa Barbara.

The particulate nitrate distribution is markedly different in the wintertime, when nitrate levels are more than twice their summer averages at Fremont, Sacramento, and Bakersfield. Bakersfield has the largest particulate nitrate concentration during winter, and the west to east gradient in the South Coast Air Basin disappears. The cooler temperatures during wintertime favor particulate ammonium nitrate over gaseous nitric acid, and Figures 7-5 and 7-6 show that there is sufficient ammonia gas present to allow neutralization of the nitric acid. The high wintertime nitrate at Bakersfield may also be enhanced by aqueous-phase reactions of nitric acid in persistent tule fogs, which are common occurrences in the San Joaquin Valley during winter months.

Figures 7-5 and 7-6 show that there is always excess ammonia at the urban sampling sites, with especially high levels at Sacramento and Bakersfield during the summer. These high ammonia concentrations are consistent with expectations of substantial emissions from agricultural operations in the San Joaquin and Sacramento Valleys.

7.4 Correlations

Table 7-3 shows time series correlation coefficients among the measured variables for three selected sites: Sacramento, Sequoia, and Azusa. These coefficients show which concentrations change in the same way over time. Coefficients which exceed 0.75 show a fairly strong covariation, coefficients between 0.5 and 0.75 show a moderate covariation, and coefficients which are less than 0.50 are not considered to be physically significant (though they may be statistically significant). High correlation coefficients are observed when pairs of variables originate from the same source, are equally affected by transport and dispersion, or undergo related chemical transformations.

In most cases, the $PM_{2.5}$ and PM_{10} measurements of the same species are moderately to highly correlated. This is reasonable because, as noted above, $PM_{2.5}$ is a major fraction of PM_{10} for many species.

At Sacramento and Azusa, ammonium is very strongly correlated with nitrate, which is consistent with particulate nitrate being in the form of nitric acid. Nitrate correlations with sodium are not significant. This correlation would be higher if significant quantities of nitrate were present as sodium nitrate. Sulfate is moderately correlated with ammonium, consistent with its presumed compounds of ammonium sulfate and ammonium bisulfate.

Table 7-3

Correlation Coefficients Among Gas/Particle Concentrations
at Sequoia, Sacramento, and Azusa

Site Name: Sequoia

	Variables																						
	FMass	TMass	FNa^+	TNa^+	FMg^{++}	TMg^{++}	FK^+	TK^+	FCa^{++}	TCa^{++}	FNH_4^+	TNH_4^+	FCl^-	TCl^-	$FSO_4^=$	$TSO_4^=$	$SO_2(g)$	$NO_2(g)$	$NH_3(g)$	TNO_3^-	FNO_3^-	$NO_3^-BU^b$	PNO_3^{-c}	$HNO_3(g)$
FMass	1.00																						
TMass	0.96	1.00																					
FNa^+	0.26	0.30	1.00																				
TNa^+	0.13	0.24	0.51	1.00																			
FMg^{++}	0.29	0.40	0.68	0.65	1.00																		
TMg^{++}	0.18	0.31	0.42	0.82	0.64	1.00																	
FK^+	0.46	0.55	0.33	0.29	0.41	0.32	1.00																
TK^+	0.15	0.19	0.12	0.19	0.18	0.42	0.37	1.00															
FCa^{++}	0.11	0.15	0.23	0.28	0.33	0.22	0.30	0.14	1.00														
TCa^{++}	0.27	0.41	0.33	0.42	0.52	0.67	0.43	0.40	0.31	1.00													
FNH_4^+	0.22	0.26	0.20	0.14	0.20	0.18	0.23	0.03	0.06	0.05	1.00												
TNH_4^+	0.18	0.26	0.20	0.45	0.30	0.48	0.26	0.11	0.17	0.22	0.80	1.00											
FCl^-	0.01	0.00	0.16	-0.10	-0.07	-0.08	-0.02	0.08	0.20	-0.05	0.02	-0.04	1.00										
TCl^-	0.03	0.03	0.11	0.41	0.42	0.28	-0.01	0.02	0.08	0.11	-0.06	0.03	0.07	1.00									
$FSO_4^=$	0.33	0.38	0.32	0.29	0.44	0.38	0.23	0.14	-0.04	0.23	0.72	0.59	-0.11	0.05	1.00								
$TSO_4^=$	0.31	0.40	0.41	0.50	0.56	0.63	0.42	0.23	0.18	0.38	0.66	0.74	0.04	0.12	0.78	1.00							
$SO_2(g)$	0.24	0.36	0.46	0.38	0.51	0.49	0.33	0.21	0.03	0.43	0.33	0.35	0.09	-0.02	0.40	0.44	1.00						
$NO_2(g)$	0.68	0.67	0.02	-0.04	0.09	0.03	0.56	0.24	0.07	0.19	0.08	0.02	0.01	0.02	0.13	0.16	-0.00	1.00					
$NH_3(g)$	0.40	0.51	0.25	0.22	0.33	0.29	0.54	0.25	0.08	0.31	0.29	0.36	0.04	0.06	0.32	0.53	0.46	0.45	1.00				
TNO_3^-	0.26	0.35	0.27	0.67	0.39	0.62	0.35	0.21	0.24	0.29	0.36	0.63	-0.07	0.27	0.25	0.48	0.32	0.09	0.23	1.00			
FNO_3^-	0.29	0.29	-0.01	0.03	-0.01	-0.00	0.36	0.17	0.07	-0.03	0.49	0.54	-0.01	-0.01	0.12	0.15	0.01	0.42	0.34	0.48	1.00		
$NO_3^-BU^b$	0.12	0.22	0.39	0.23	0.41	0.31	0.22	0.07	0.02	0.25	0.47	0.42	0.10	0.12	0.52	0.57	0.47	0.02	0.52	0.19	0.04	1.00	
PNO_3^{-c}	0.17	0.21	0.23	0.20	0.18	0.17	0.18	0.02	0.18	0.17	0.49	0.53	-0.00	0.06	0.23	0.26	0.08	0.03	0.13	0.43	0.64	0.19	1.00
$HNO_3(g)$	0.13	0.18	0.20	0.05	0.20	0.12	0.10	0.06	-0.06	0.12	0.23	0.12	0.04	0.05	0.34	0.34	0.32	0.04	0.36	-0.00	-0.03	0.82	-0.11	1.00

United States Department of the Interior

NATIONAL PARK SERVICE

SEQUOIA AND KINGS CANYON NATIONAL PARKS
THREE RIVERS, CALIFORNIA 93271

Sequoia National Park
Centennial
1890-1990
California's First National Park

IN REPLY REFER TO:
N3615 (WR-RN)(WASO-AQD)

July 25, 1990

Mr. Jerry K. Boren
Development Services Manager
County of Fresno
Public Works and Development Services Department
2220 Tulare Street, Sixth Floor
Fresno, California 93721

Dear Mr. Boren:

We appreciate the opportunity to review the draft Environmental Impact Reports (EIRs) for the Vie-Del No. 1 and No. 2 cogeneration projects proposed by GWF Power Systems Company, Inc. (GWF). Our comments on the proposed projects are discussed below.

The proposed projects would be located approximately 60 km west of Sequoia and Kings Canyon National Parks, a Class I air quality area administered by the National Park Service. As you may recall, at the August 25, 1988, public hearing regarding the original EIRs for the proposed Vie-Del projects, the NPS presented testimony regarding existing air pollution effects at Sequoia and Kings Canyon National Parks. Specifically, ambient air quality monitors located at the Parks have recorded exceedances of the National and State ambient air quality standards for ozone. In addition, extensive research studies conducted at Sequoia and Kings Canyon National Parks have shown that several tree species in the Parks are being adversely affected by ozone. Jeffrey and ponderosa pines have shown visible foliar injury, reduced whorl retention, reduced needle initiation and biomass, and increased susceptibility to mortality. Also, reduced tree ring growth has been documented on Jeffrey pines. Enclosed is a copy of the August 25, 1988 testimony. The concerns raised, at that time, are still valid today, and we ask that you include this testimony as part of the official record for the revised EIRs.

Given the existing ozone impacts discussed above, one of the main objectives of our testimony was to request that GWF be required to offset the ozone precursor emissions associated with the proposed projects. We are pleased to see that GWF plans to obtain 2.1 to 1 emission reductions at an existing Fresno County facility to offset the proposed increases in sulfur dioxide, nitrogen oxide, and particulate matter emissions. However, we believe that the proposed reactive organic compound (ROC) emissions could exacerbate the existing ozone effects occurring at the Parks and should be offset as well. We understand that after 1991, all increases in ROC emissions in the County (regardless of size) would need to be offset. Because it is unlikely that the proposed Vie-Del projects will be operating before 1991, our request for ROC offsets is consistent with this requirement. We also believe that the County should ensure (1) that the proposed emission offsets are reductions in actual emissions, as opposed to simple allowable emissions, (2) that the offsets are enforceable, and (3) that the offsets are obtained before commercial operation of the Vie-Del projects begins.

We hope the above comments are helpful in your review of the Vie-Del projects. If you have any questions regarding our comments, please contact me or Diane Ewell, of my staff, at (209) 565-3341.

Sincerely,

J. Thomas Ritter
Superintendent

Enclosure

cc:
Air Quality Coordinator - Jay Goldsmith (WR-RN) w/c encl.
Air Quality Division - John Bunyak (WASO) w/c encl.
Environmental Specialist w/c encl.
Biological Technician (Air Quality) w/c encl.

DMEwell:vmb

Testimony for GWF Power Project - Fresno County
Statement of the National Park Service Regarding

Final Environmental Impact Report for GWF Power System Co., Inc.

August 25, 1988

I am Tom Nichols, the Environmental Specialist for Sequoia and Kings Canyon National Parks. I thank the members of the Fresno County Planning Commission for this opportunity to comment.

Sequoia and Kings Canyon National Parks, as most of you know, occupy a major portion of the mountain areas east of Fresno. Kings Canyon National Park is in Fresno and Tulare Counties. Sequoia National Park is in Tulare County. Both are subject to air pollution rising from the San Joaquin Valley.

We would like to:

1) request that the National Park Service be notified of future Prevention of Significant Deterioration (PSD) permit applications,

2) inform representatives of the Fresno County Planning Commission of the air pollution damage occurring in Sequoia National Park and

3) request that GWF Power Systems Company, Inc., provide offsets for the ozone precursors to be generated from the project.

To put these requests in perspective, we would like to provide some background information.

In a 1980 Report to Congress, the National Park Service identified air quality degradation as one of the major threats to our national parks. The National Park Service has been monitoring ozone in Sequoia and Kings Canyon National Parks since 1982. During this time, the National Park Service has recorded exceedances of the National Ambient Air Quality Standard for ozone (0.12 parts per million) as well as the State Standard for ozone (0.10 parts per million). For example, during August of 1986, a particularly bad month, at our Ash Mountain Headquarters Site, the State Standard was exceeded 28 out of 31 days. At a site located near Giant Forest, above the 6,000 feet altitude level, during the same month, the State Standards were exceeded 20 out of 24 days sampled.

The highest value ever recorded in the two Parks was 0.15 parts per million. Summaries of the National Park Service ozone data for Sequoia National Park can be provided upon request to the National Park Service Air Quality Division. Preliminary results of modeling analyses suggest that ozone and its precursors from

within the San Joaquin Valley do contribute to higher ozone levels in Sequoia and Kings Canyon National Parks during upslope wind conditions.

The high levels of ozone measured at Sequoia and Kings Canyon National Parks have resulted in research studies to document the effects that air pollution may have on the structure and functioning of the ecosystems. In addition, the California Air Resources Board has in recent years established an extensive monitoring effort in Sequoia National Park to identify the affects of acidic deposition on foothill, mid-elevation and subalpine ecosystems.

Several tree species are being adversely affected by ozone in Sequoia and Kings Canyon National Parks. Studies on Jeffrey and ponderosa pines have shown visible foliar injury, reduced whorl retention, reduced needle initiation and biomass, and increased susceptibility to mortality. In addition, reduced tree ring growth has been documented on Jeffrey pines. In 1986, an extensive cruise survey of ponderosa and Jeffrey pine throughout Sequoia and Kings Canyon National Parks (1470 trees in 98 sample points) revealed that 39 percent of the trees had foliar ozone injury. Some west side areas showed as much as 78 percent foliar ozone injury. It should be noted that the area showing the most foliar ozone injury was Grant Grove directly east of Fresno.

We have evidence from field and fumigation studies that current ozone concentrations in these Parks can produce foliar injury on giant sequoia seedlings and that future increases in ozone concentrations could affect giant sequoia seedling root and shoot growth. To determine if ozone may be affecting older giant sequoia life stages, fumigation studies were initiated in 1988 on rooted cuttings of sequoia saplings. The ozone injury on pines will probably result in loss of sensitive genotypes in the pine ecosystem and may cause serious consequences to the sequoia ecosystems as ozone sensitive pines are replaced by more ozone tolerant species.

Under the Prevention of Significant Deterioration (PSD) provisions of the Clean Air Act, the Vie-Del Number two plant is considered a major stationary source on the basis of the quantity of emissions. As such, it is subject to the permitting requirements of applicable PSD regulations. These regulations provide national parks with special protection against the impacts of air pollution. The parks with special protection have been designated as Class I areas under the Federal Clean Air Act. Sequoia and Kings Canyon National Parks are two of these congressionally-designated Class I areas.

The PSD provisions require that the permit granting authority give the federal land manager early notification of any industrial source subject to PSD whose emissions would have the potential to affect the air quality or air quality related values of a Class I area. Once notified, the federal land manager

assesses the project's potential impacts on the resources of the area and determines whether or not the emissions from the proposed source would have an adverse impact on the air quality related values of any nearby class I areas.

In general, the permit granting authority must notify the federal land manager, or the federal official in charge of the management of resources, of proposed projects subject to PSD that are within 100 kilometers of a Class I area. Major portions of Sequoia and Kings Canyon National Parks are within 100 kilometers of the proposed power plant sites.

Unfortunately, Fresno County failed to notify the National Park Service of the project during either the PSD application process, or during the Draft Environmental Impact Report public comment period. We understand that the project represents one of Fresno County's first PSD permit applications, and that the county was unaware of the notification requirements. In the future, however, we would like to be notified as soon as possible, preferably during early consultation before applications are filed. If that is not possible, we would like to be notified during the PSD application completeness determination.

While the size of the source is below that which requires offsets, we would like to request that offsets for ozone precursors be required. While the project is a relatively small source and will use best available control technology, the affected area exceeds the ambient air quality standards for ozone and PM-10, and the project will contribute to the cumulative impact of these pollutants.

Summary:

Our monitoring data show exceedances of the State and National Ambient Air Quality Standards for ozone. In addition, our modeling analyses show that ozone and its precursors originating from the San Joaquin Valley contribute to ozone in Sequoia National Park during upslope wind conditions.

We do not know what the long term consequences of increased ozone will be on the ecosystem of Sequoia and Kings Canyon National Parks. We are currently conducting experiments to increase our ability to predict the consequences. However, the giant sequoias are a resource that cannot be replaced in our lifetimes or perhaps ever. Ozone damage is found in the Parks and is having an impact on park resources including Jeffrey and ponderosa pine, black oak, and giant sequoia seedlings.

We urge the Fresno Planning Commission to reduce ozone precursors in Fresno County. While the Vie-Del cogeneration project is relatively small and would use best available control technology, we recommend offsets be required for ozone precursors - nitrogen oxides and reactive organic compounds. Ultimately, we would like

ozone levels reduced at Sequoia and Kings Canyon National Parks.

We would also like to reiterate that the National Park Service should be informed at the earliest possible time of any projects requiring a PSD permit application. This will allow us to work with the County and the applicant to ensure that project development also protects the nation's natural resources.

Thank you for this opportunity to comment on the Vie-Del number two cogeneration plant, and to express the concerns of the National Park Service.

United States Department of the Interior
National Park Service

Denver Air Quality Division
P.O. Box 25287
Lakewood CO 80225
(303) 969-2070

Sequoia and Kings Canyon
National Parks
Three Rivers CA 93271
(209) 565-3341
Attn:Public Information Officer
MR. William Tweed

United States Department of the Interior

NATIONAL PARK SERVICE

SEQUOIA AND KINGS CANYON NATIONAL PARKS

THREE RIVERS, CALIFORNIA 93271-9700

Sequoia National Park Centennial 1890-1990

California's First National Park

IN REPLY REFER TO:

N3615

December 18, 1990

Mr. Jim Beath
Hanford Community Development Director
City of Hanford
218 North Douty Street
Hanford, California 93230

Dear Mr. Beath:

We appreciate the opportunity to become involved with the preparation of the draft environmental impact report for the G.W.F. coal-fired cogeneration plant in Hanford. The geography and meteorology of the San Joaquin Valley Air Basin are such that Sequoia and Kings Canyon National Parks are recipients of the air pollution from the San Joaquin Valley. Although the Parks are 80 kilometers and more distant from the Hanford plant, increases in basin emissions would be transported to the Parks.

The National Park Service is mandated by its Organic Act of 1916 to conserve the Parks' scenic, natural and historic resources unimpaired and to ensure visitor enjoyment. The Federal Clean Air Act gives the Federal land manager the affirmative responsibility to protect air quality related values and sets as a national goal "... the prevention of any future, and the remedying of any existing impairment of visibility in mandatory Class I Federal areas which impairment results from manmade air pollution."

Should the Hanford cogeneration plant be considered a major stationary source on the basis of the quantity of emissions, it will be subject to permitting requirements of applicable Prevention of Significant Deterioration (PSD) provisions of the Federal Clean Air Act. These regulations require special protection for some National Parks from impacts of air pollution. Parks with special protection have been designated as Class I areas under the Federal Clean Air Act. Sequoia and Kings Canyon National Parks represent 740,000 acres of Class I area. Surrounding lands include U.S. Forest Service Wilderness areas that are also designated as Class I.

The differences in meteorology, geography, population and vegetation result in different pollution problems in the Sierra compared to the San Joaquin Valley. Because of this, we feel it is important to submit information from monitoring and research studies conducted in Sequoia and Kings Canyon National Parks for the preparation of the draft environmental impact report (see enclosures).

Briefly, ambient air quality monitors located at the Parks have recorded exceedances of the National and State ambient air quality health and welfare standards for ozone. In addition, extensive research studies conducted at

Sequoia and Kings Canyon National Parks have shown that several tree species in the Parks are being adversely affected by ozone. Two out of every five ponderosa and Jeffrey pines exhibit needle injury caused by ozone. Sequoia seedlings suffer needle injury at current levels of ozone and reduced growth when exposed to higher levels.

The scenic vistas, once awe-inspiring, are now impaired by regional haze. Only a few days during the year are the San Joaquin Valley and coastal mountains (over 50 miles away) visible.

A 10 year monitoring program has documented the occurrence of acidic deposition. Highly acidic rain and snowmelt have been found to cause changes in chemical composition of lakes and streams in the Parks. Experiments in the Parks have indicated that aquatic organism populations can be affected when exposed to pH levels similar to those measured during snowmelt and late summer storms.

Given the existing ozone impacts discussed above, we request that G.W.F. be required to offset the ozone precursor emissions associated with the proposed project. We understand that after 1991, offsets will be required of new sources for any net emission increases of any non-attainment air contaminant for which there is a national ambient air quality standard or any precursor of such contaminant. For the San Joaquin Valley these include PM-10 and ozone precursors. In addition, while the valley is in attainment for sulfur dioxide, we recommend sulfur dioxide emissions be offset due to the potential for serious impacts from acidic deposition in the Parks. The offsets should be reductions in actual emissions (as opposed to simple allowable emissions), enforceable, and obtained before commercial operation of the project.

Again, thank you for this opportunity and please keep us updated on the progress of this project. Please direct any questions and correspondence to myself or Diane Ewell at (209) 565-3341.

Sincerely,

151

J. Thomas Ritter
Superintendent

Enclosures:

(1) Three articles from the Effects of Air Pollution on Western Forests, Annual Air and Waste Management Association Symposium, Anaheim, California, June 1989
(2) One article by Peterson et al., 1987
(3) Park prototype air quality brochure (soon to be published)
(4) Graphs showing ozone monitoring data
(5) Ozone Monitoring, Past and Present (unpublished)

cc:
John Bunyak (WASO-AIR); Jay Goldsmith (WR-RN); Superintendent (YOSE); Forest Supervisor (Sequoia National Forest)

DMEwell:dme/vmb