

Annual Data Summary

**CRATERS OF THE MOON
NATIONAL MONUMENT**

1997

**National Park Service
Gaseous Air Pollutant Monitoring Network**



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RESEARCH AND MONITORING BRANCH**

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At Craters of the Moon National Monument, the ARD specifically recognizes Natalene Cummings and John Apel for performing the technical and administrative skills required to help produce the data presented within this report.

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1.0 INTRODUCTION

1.1 THE NATIONAL PARK SERVICE GASEOUS POLLUTANT MONITORING NETWORK

Gaseous air pollutants, including ozone and sulfur dioxide, are of concern to the National Park Service (NPS). Pollutants like these can affect park unit biological resources as well as the health of park unit residents and visitors. The NPS established a gaseous pollutant monitoring program for several pollutants linked to effects on NPS resources. This program was designed to meet certain resource management objectives.

The primary objective of this monitoring program is to establish the status and trends of park unit air quality conditions and to determine if a park unit is exceeding the National Ambient Air Quality Standards established by the U.S. Environmental Protection Agency (EPA) to protect public health and welfare. In addition, such monitoring is designed to detect changes or trends in pollution levels over time. A monitoring station may also be established if there is documented biological injury due to air pollution in a park unit. Information on ambient air pollution levels is an important part of research on effects of air pollutants on NPS resources, and can help confirm suspected causes of observed effects.

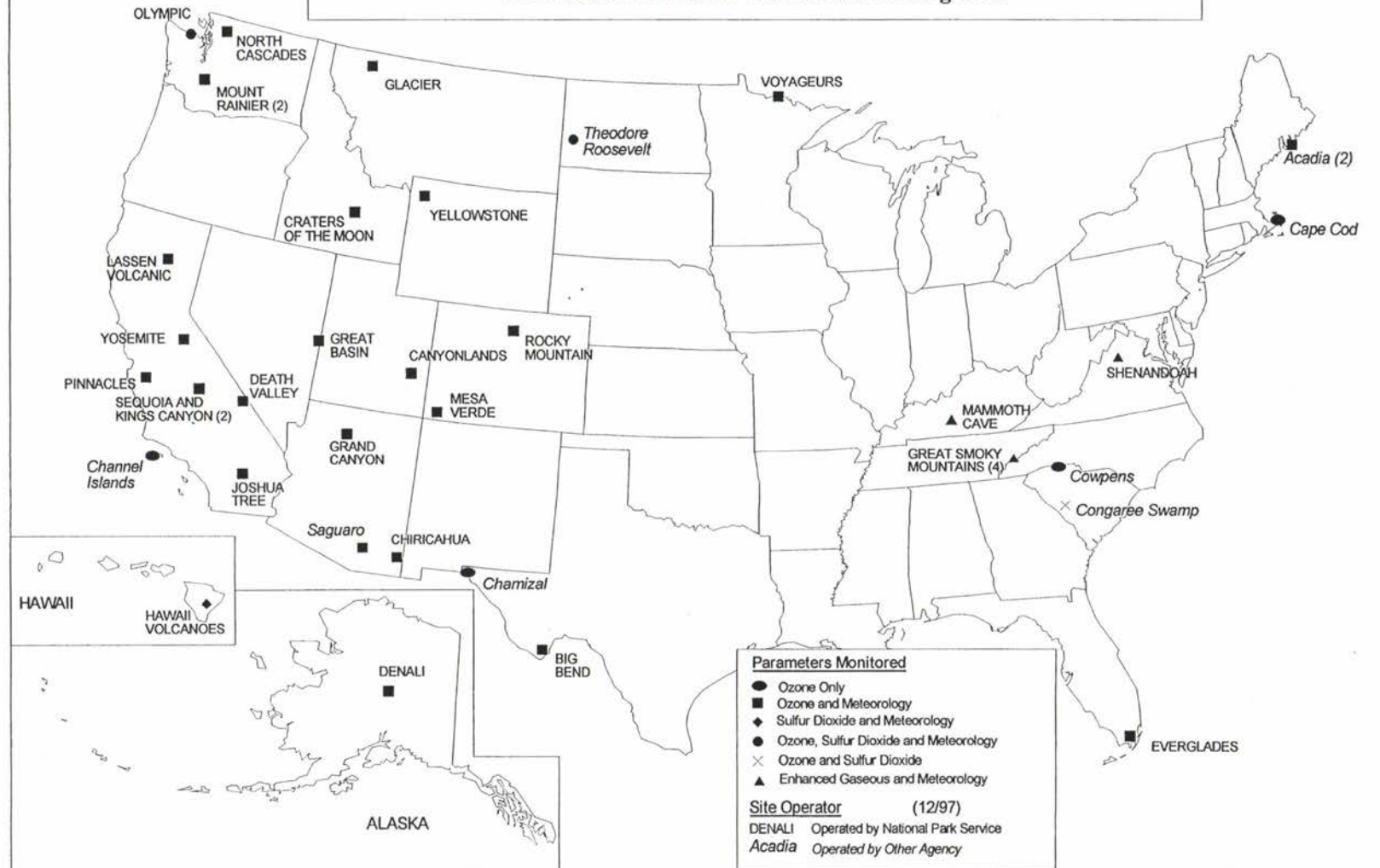
Other monitoring objectives call for the collection of data to support the National Park Service's required involvement in both the development of state air quality control plans, and the evaluation of permit applications for new or expanding air pollution sources wishing to locate near park units. The Clean Air Act gives federal land managers and superintendents an affirmative responsibility to protect air quality related values in Class I areas and to assess whether new sources will have an adverse impact on park unit resources and values. Information on air quality levels in NPS units can also be used to evaluate the performance of atmospheric models that simulate how pollutants are transported into park units and predict impacts on the park unit caused by air pollution sources.

The National Park Service Gaseous Pollutant Monitoring Network site locations and measured parameters collected in this reporting year are shown on the map on the following page. During this reporting period, 41 monitoring sites in 34 units of the National Park System had some combination of ozone, sulfur dioxide, meteorological, and CASTNet dry deposition monitoring. Monitoring methods and quality assurance procedures used in the national park network meet the applicable 40 CFR Part 58 EPA requirements. This allows for the direct comparison of NPS collected data with that collected by the EPA, and state and local air pollution control agencies. Data collected by this network are incorporated in the EPA Aerometric Information Retrieval System (AIRS) database which is a national database of all air quality data collected throughout the country. These data are also stored in the NPS Air Resources Division's Information Management Center (IMC) that allows for easy access and analysis of data.

This report includes a variety of data summaries for data collected at an individual monitoring site at a national park unit during this reporting period. These summaries highlight the average range and frequency of the data collected during the year. A PC-compatible diskette containing a digital copy of all data collected during the year and data summary products included in this report is available. Individual reports are generated for each site where monitoring was conducted in the national park network.

NATIONAL PARK SERVICE GASEOUS POLLUTANT MONITORING NETWORK

1997 Ozone and Sulfur Dioxide Monitoring Sites



1.2 CRATERS OF THE MOON NATIONAL MONUMENT

Craters of the Moon National Monument, a Class I area, is located in southern Idaho about 60 miles northwest of Pocatello. Its location and site specifications are presented on the following page.

Craters of the Moon National Monument was established by presidential proclamation in 1924. It occupies approximately 54,000 acres in the eastern Snake River Plain, which crosses southern Idaho as a broad arc of low topographic relief, contrasting with the mountainous terrain of the rest of the state.

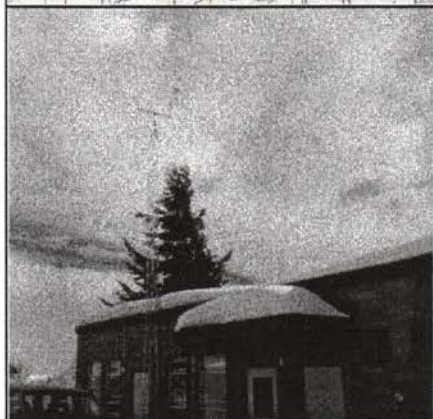
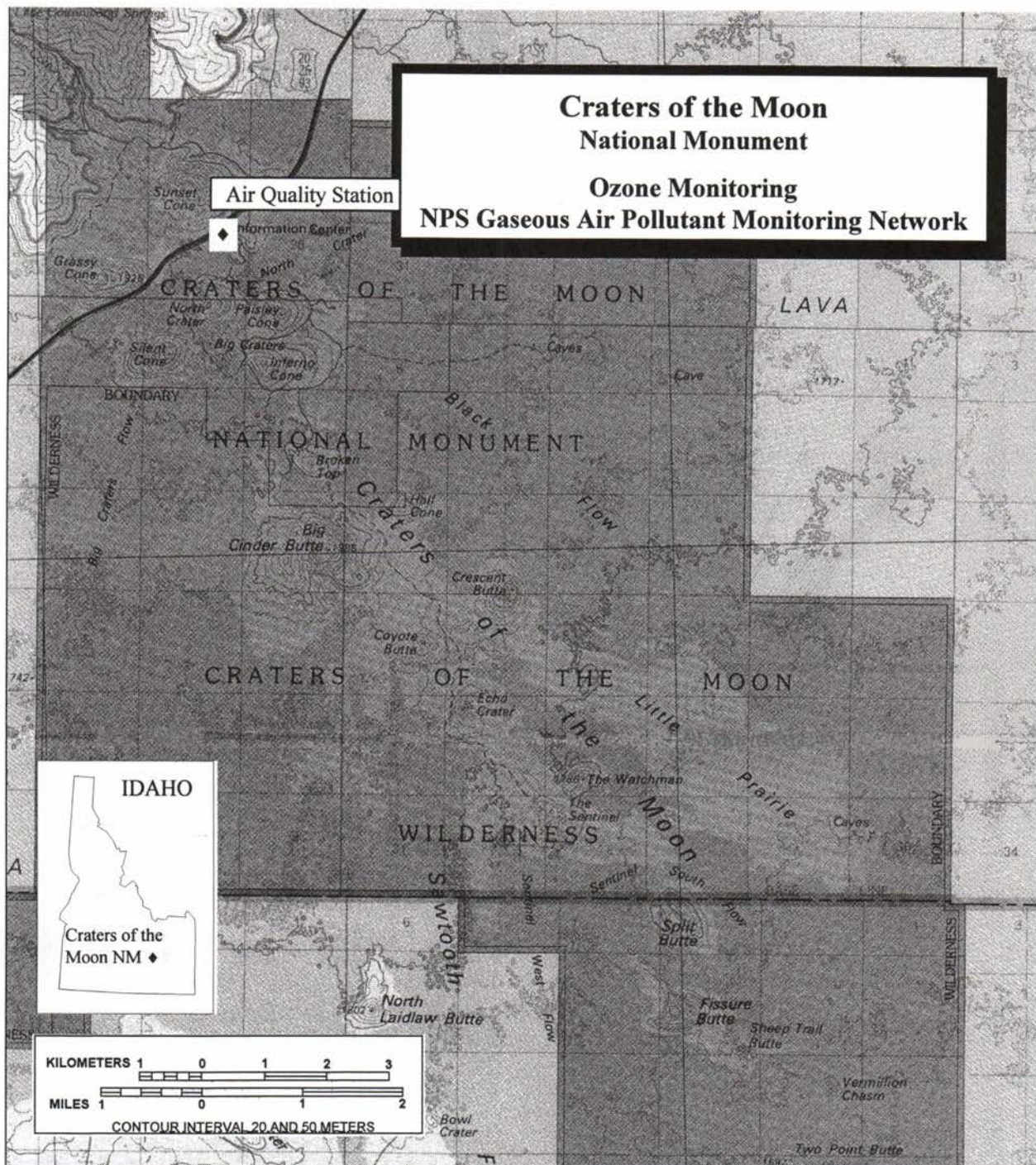
The significance of the monument is the relatively young age of the lava flows and the diversity of volcanic features in a small geographic area. The monument contains part of one of the four rift sets that make up the Great Rift, a volcanic rift zone that extends for 60 miles from the Pioneer Mountains south nearly to the Snake River. Visitors to the monument can see some of the most spectacular and diverse features along the Great Rift, including vast basaltic lava flows and associated volcanic products from eruptions that occurred between 15,000 and 2,100 years ago. Features include two types of lava flow, cinder cones, rafted blocks, fissure cracks, vents, spatter cones, lava tubes, and tree molds.

The monument's fauna and particularly its flora reflect the influence of the geologic setting. Plant succession is well illustrated among the different aged lava flows. Limber pine grows at a lower altitude in the monument than throughout the rest of its range. Three subspecies of small mammals were first described from this area and are found only in the vicinity of lava flows of the Great Rift.

The northern end of the monument includes a small portion of the foothills of the Pioneer Mountains. The north unit (4,125 acres) is a different environment from the volcanic area to the south: it is a sagebrush-grassland shrub steppe with stands of Douglas-fir and quaking aspen. Riparian areas surround the small watercourses that arise from springs in the foothills.

Approximately 81 percent of the monument (43,243 acres) was designated wilderness on October 23, 1970. This wilderness area was designated a Class I area in the Clean Air Act, as amended in 1977. The rest of the monument is designated as a class II area, however, the entire monument is managed as a class I area.

Visibility and scenery are notable air quality related values at Craters of the Moon.



SITE IDENTIFICATION		MAP INFORMATION	
Site Abbreviation: CRMO		Mean Elevation: 1815 m	
AIRS ID NO.: 16-023-0101		Longitude: 113° 33' 44"W	
		Latitude: 43° 27' 38"N	
		UTM Zone: 12	
		Easting: 292714 m	
		Northing: 4814934 m	
		Map Reference: Craters of the Moon	
		N4300-W11300	
		1:100,000	
INSTRUMENTATION			
O ₃ Analyzer	Dew Point		
Calibrator	Temperature		
Wind Speed	Solar Radiation		
Wind Direction	Precipitation		

2.0 DATA SUMMARY

2.1 OVERVIEW

Based on the site specifications during this annual reporting period, data summaries and statistics are provided in this section.

Data Collection Statistics
Craters of the Moon National Monument

Final Data

01/01/97 - 12/31/97

Parameter	Par Code	Data Recovery			Valid Data	
		No. Possible	No. Collected	% Collected	No. Valid	% Valid
Ozone Analyzer	O3	7423	6693	90.2	6605	89.0
Scalar Wind Speed	SWS	7423	6994	94.2	6888	92.8
Vector Wind Speed	VWS	7423	6994	94.2	6888	92.8
Vector Wind Direction	VWD	7423	6994	94.2	6888	92.8
Ambient Temperature (aspirated)	TMP	7423	6993	94.2	6879	92.7
Dew Point	DPT	7423	6993	94.2		
Solar Radiation	SOL	7423	6994	94.2	6888	92.8

Notes: All statistics are for hourly averages.

The number collected does not include normal maintenance or events beyond the control of the network.

The percent valid is calculated against the number possible.

Automatic zeros and spans are performed daily on most ambient gas analyzers, therefore, no ambient data can be collected during this time. As a result, the maximum percent valid for ambient gas data typically can not be greater than 95.8.

NPS Performance Goals:

Quarterly Criteria:

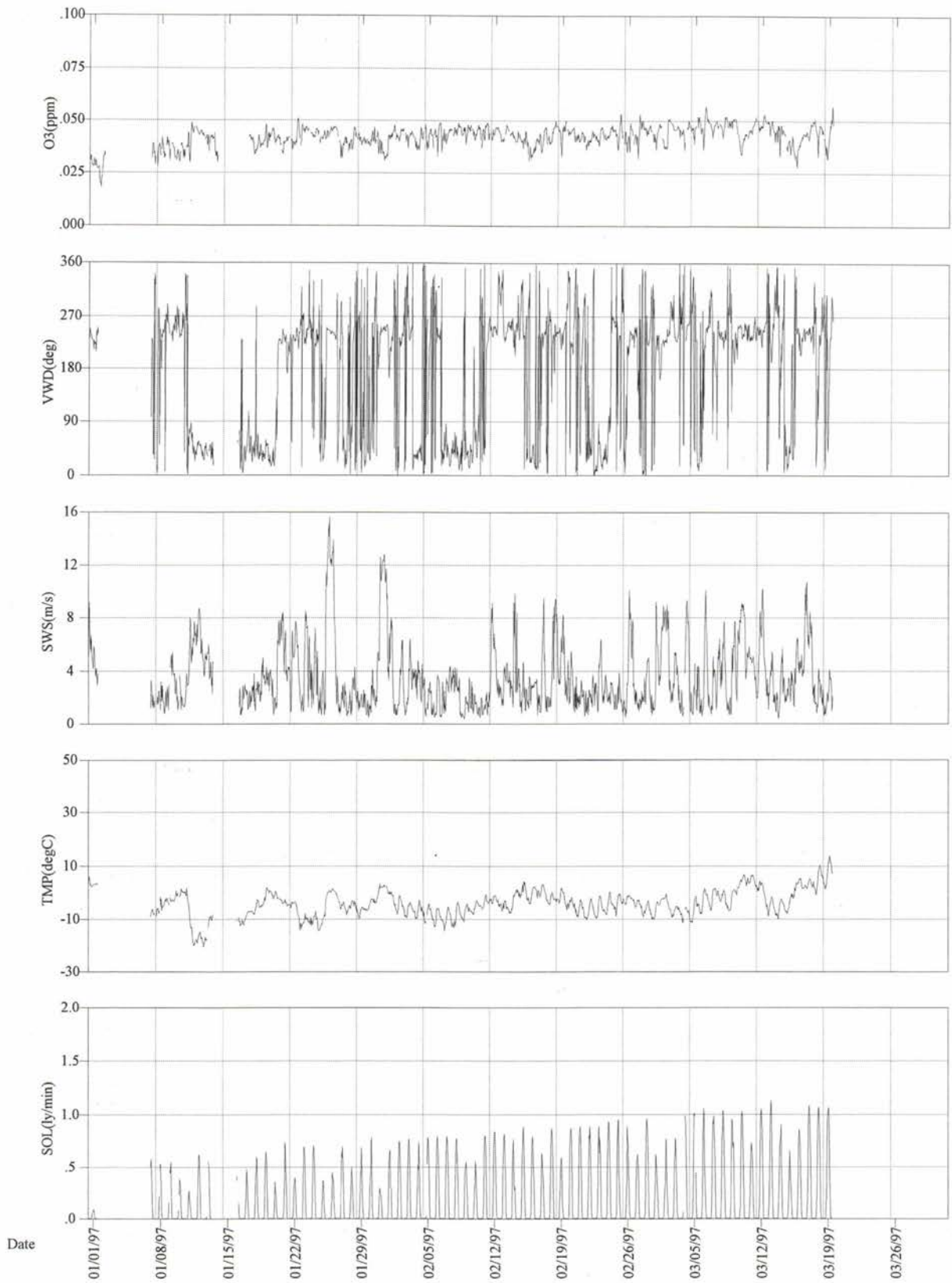
100% of sites, $\geq$ 85% valid data capture
90% of sites, $\geq$ 90% valid data capture
80% of sites, $\geq$ 95% valid data capture

Monthly Criteria:

100% of sites, $\geq$ 60% valid data capture
90% of sites, $\geq$ 75% valid data capture
80% of sites, $\geq$ 85% valid data capture

* The validity of dew point and relative humidity data is currently under investigation.

Craters of the Moon National Monument

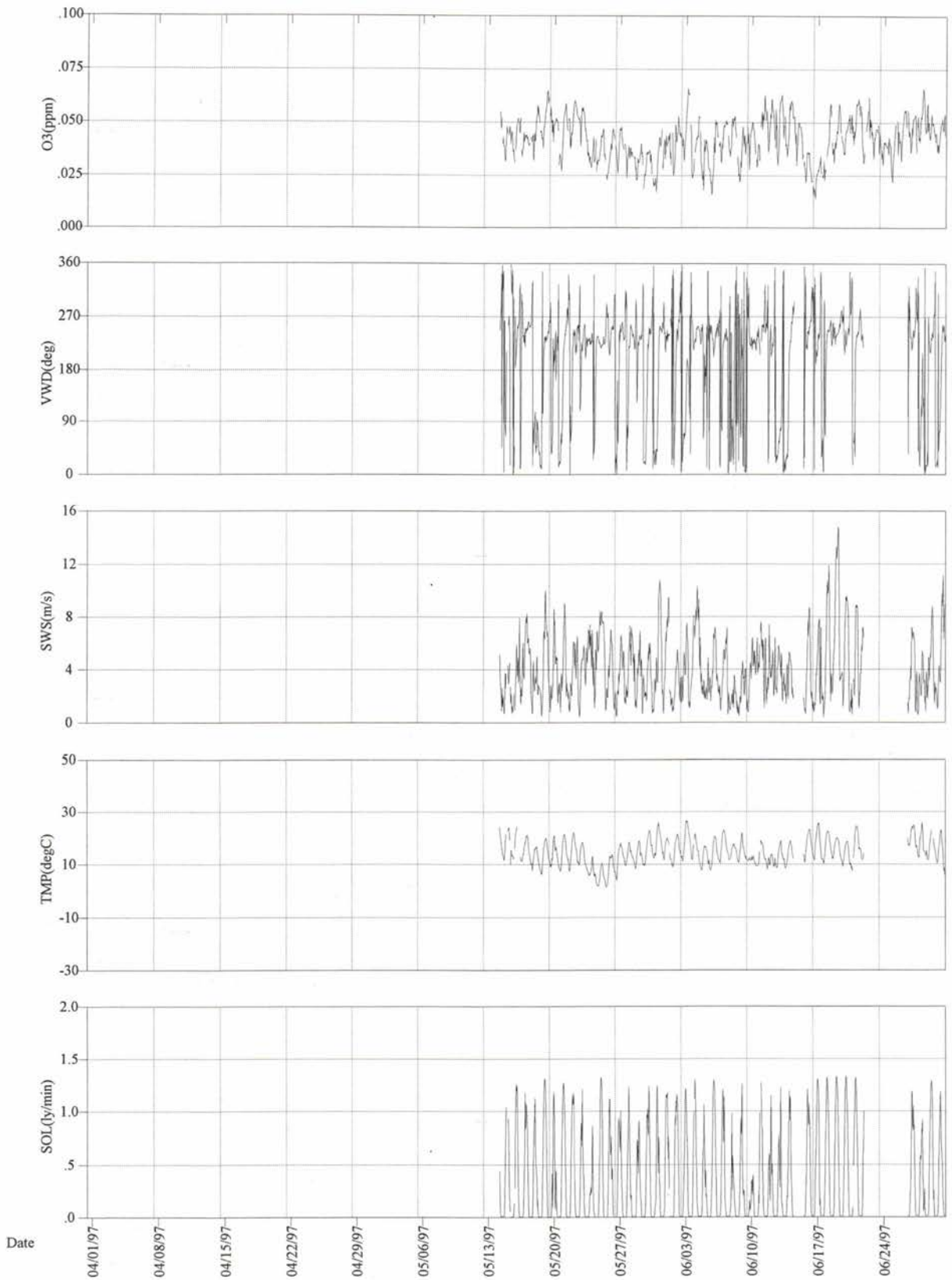


Final Validation

First Quarter 1997

crmo97.stk - crmo97.dat 10-13-1998

Craters of the Moon National Monument

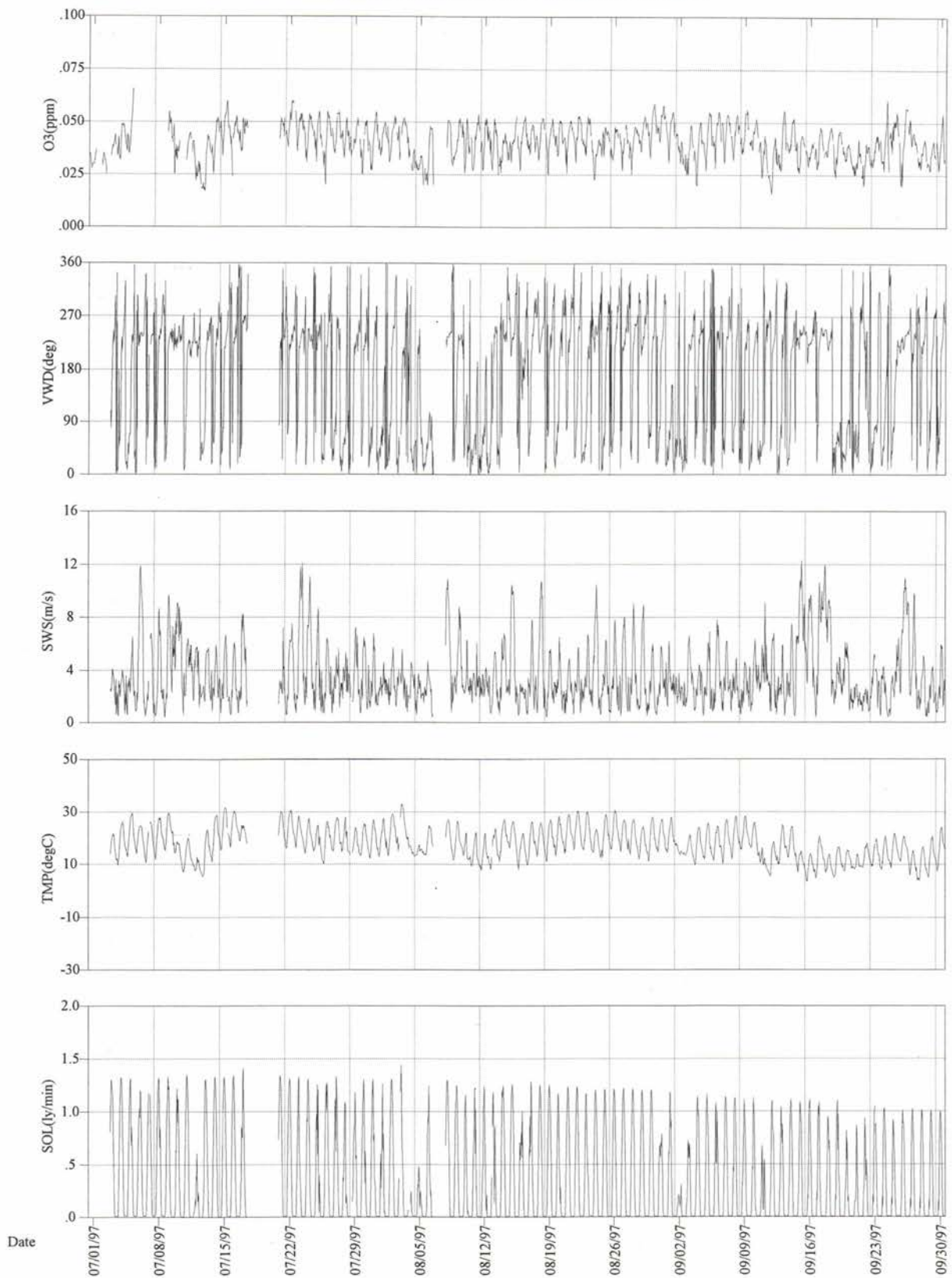


Final Validation

Second Quarter 1997

crmo97.stk - crmo97.dat 10-13-1998

Craters of the Moon National Monument

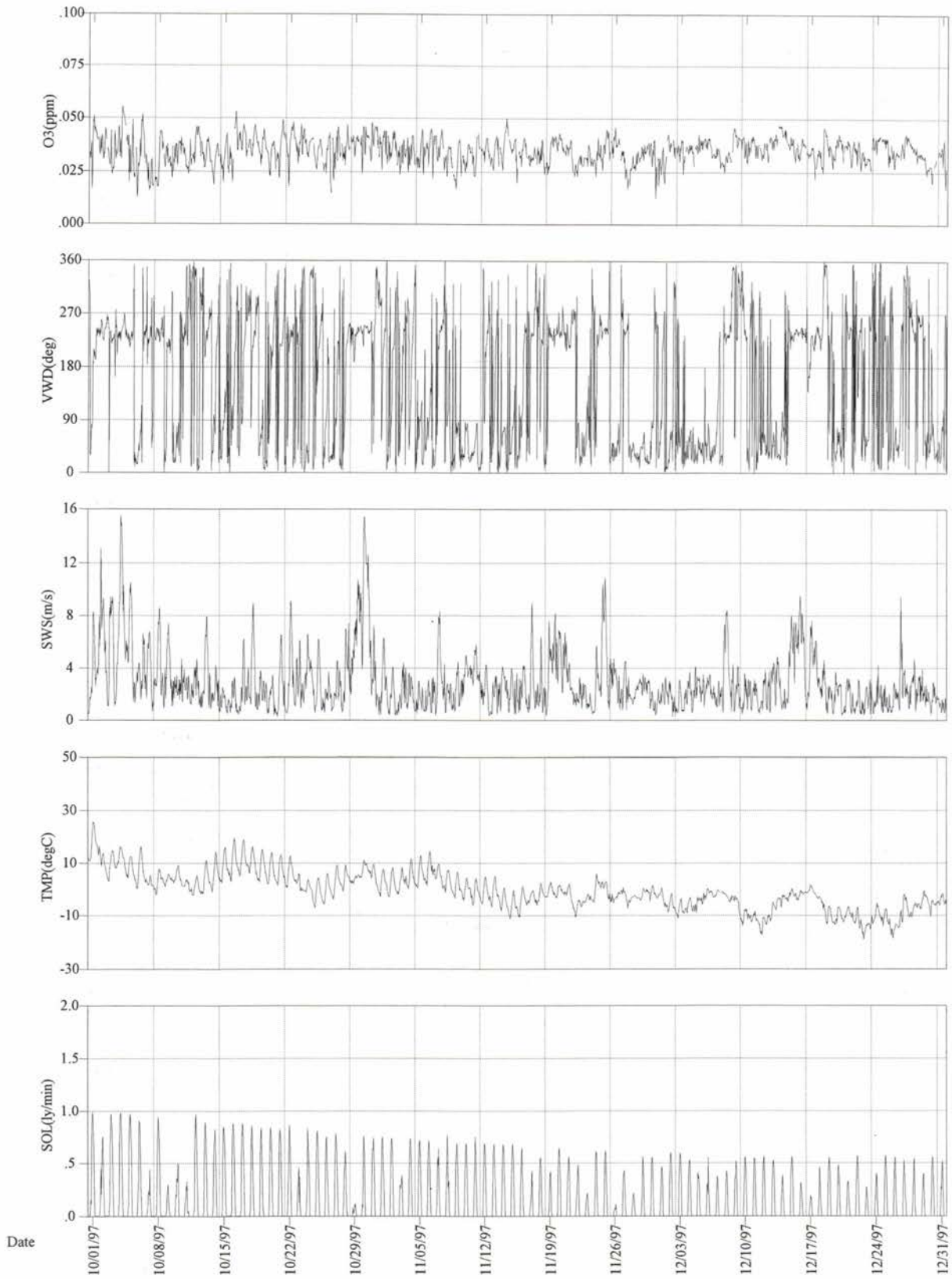


Final Validation

Third Quarter 1997

crmo97.stk - crmo97.dat 10-13-1998

Craters of the Moon National Monument



Final Validation

Fourth Quarter 1997

crmo97.stk - crmo97.dat 10-13-1998

2.2 OZONE DATA SUMMARY

Ozone Quick Look Annual Summary Statistics
Craters of the Moon National Monument

01/01/97 - 12/31/97

STATISTIC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MAY- SEP	ANNUAL
DAILY 1-HR MAXIMUM	51	53	57		65	66	66	59	61	55	50	47	66	66
NO. OF DAYS	(25)	(28)	(19)		(18)	(30)	(25)	(30)	(30)	(31)	(30)	(31)	(133)	(297)
AVERAGE DAILY MAXIMUM	44	48	50		50	54	51	50	49	45	41	41	51	47
NO. OF DAYS	(25)	(28)	(19)		(18)	(30)	(25)	(30)	(30)	(31)	(30)	(31)	(133)	(297)
MAXIMUM DAILY MEAN	45	46	49		52	52	51	50	47	43	39	44	52	52
NO. OF DAYS	(21)	(28)	(19)		(17)	(30)	(18)	(29)	(30)	(31)	(30)	(31)	(124)	(284)
AVERAGE DAILY MEAN	40	43	45		41	43	42	41	39	35	34	36	41	40
NO. OF DAYS	(21)	(28)	(19)		(17)	(30)	(18)	(29)	(30)	(31)	(30)	(31)	(124)	(284)
MAX PEAK:MIN RATIO	1.633	1.656	1.781		2.765	3.188	2.750	2.400	2.850	4.000	3.077	2.353	3.188	4.000
NO. OF DAYS	(21)	(28)	(19)		(17)	(30)	(18)	(29)	(30)	(31)	(30)	(31)	(124)	(284)
AVERAGE PEAK:MIN RATIO	1.287	1.289	1.346		1.810	1.904	1.846	1.747	1.804	1.965	1.700	1.469	1.822	1.662
NO. OF DAYS	(21)	(28)	(19)		(17)	(30)	(18)	(29)	(30)	(31)	(30)	(31)	(124)	(284)
MAX 9AM-4PM AVERAGE	47	48	53		55	60	54	54	51	49	43	43	60	60
NO. OF DAYS	(24)	(28)	(18)		(17)	(29)	(25)	(30)	(30)	(31)	(30)	(31)	(131)	(293)
MONTHLY 9AM-4PM AVERAGE	40	44	46		45	47	45	45	43	38	37	36	45	42
NO. OF DAYS	(24)	(28)	(18)		(17)	(29)	(25)	(30)	(30)	(31)	(30)	(31)	(131)	(293)
MAX 7AM-7PM AVERAGE	46	47	50		55	57	54	52	50	46	42	43	57	57
NO. OF DAYS	(22)	(28)	(19)		(17)	(29)	(25)	(30)	(30)	(31)	(30)	(31)	(131)	(292)
MONTHLY 7AM-7PM AVERAGE	40	44	46		43	46	44	44	42	37	35	35	44	41
NO. OF DAYS	(22)	(28)	(19)		(17)	(29)	(25)	(30)	(30)	(31)	(30)	(31)	(131)	(292)
MONTHLY MEAN	40	43	45		41	43	42	41	39	35	34	35	41	40
NO. OF HOURS	(518)	(638)	(429)		(392)	(678)	(503)	(671)	(683)	(707)	(684)	(702)	(2927)	(6605)
SUM0 EXPOSURE INDEX	20467	27548	19328		16007	28883	21088	27828	26678	25030	23244	24918	120484	261019
NO. OF HOURS	(518)	(638)	(429)		(392)	(678)	(503)	(671)	(683)	(707)	(684)	(702)	(2927)	(6605)
SUM60 EXPOSURE INDEX	-	-	-		435	1615	368	-	61	-	-	-	2479	2479
NO. OF HOURS	(0)	(0)	(0)		(7)	(26)	(6)	(0)	(1)	(0)	(0)	(0)	(40)	(40)
SUM80 EXPOSURE INDEX	-	-	-		-	-	-	-	-	-	-	-	-	-
NO. OF HOURS	(0)	(0)	(0)		(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
W126 EXPOSURE INDEX	826	1529	1441		1289	2772	1618	1808	1491	803	519	618	8978	14714
NO. OF HOURS	(518)	(638)	(429)		(392)	(678)	(503)	(671)	(683)	(707)	(684)	(702)	(2927)	(6605)

Concentrations in parts per billion (ppb)
Exposures in parts per billion-hours (ppb-hr)

Frequency Distribution Ozone Analyzer Craters of the Moon National Monument Monitoring Season: 04/01/97 - 10/31/97 ¹															
Averaging Period	% Obs. ³	# Obs. ²	Min. Obs. ⁴	10	30	50	Percentile ⁵				Max. Obs.	2nd Max.	Arith. Mean	Geo. Mean	Geo. Stdv.
1-Hour	75	3634	0.033	0.040	0.046	0.051	0.053	0.059	0.060	0.066	0.066	0.066	0.0496	0.0491	1.15
Concentrations in parts per million (ppm)															

¹ Records for this report are selected in accordance with the AIRS Geo-Common file criteria. These criteria are based on the state-specific Monitoring Season defined in AIRS.

² The number of observations (# Obs.) includes all valid observations recorded within the Monitoring Season.

³ The percent of valid observations (% Obs.) is the percentage of valid days to the number of possible monitoring days during the Monitoring Season. A valid day is defined as a day with 9 or more valid observations between 9:00 a.m. and 9:00 p.m..

⁴ The minimum observation value (Min. Obs.) is the minimum daily maximum recorded during the Monitoring Season.

⁵ The percentiles and other statistics are derived from the daily maximums.

Ozone Standards Report and
Daily Maximum 1-Hour Concentrations (ppm)
Craters of the Moon National Monument

01/01/97 - 12/31/97

Day	Jan-97	Feb-97	Mar-97	Apr-97	May-97	Jun-97	Jul-97	Aug-97	Sep-97	Oct-97	Nov-97	Dec-97
1	.033 W	.048 S	.049 S	T	T	.045 S	.037 T	.050 F	.055 M	.051 W	.044 S	.040 M
2	T	.046 S	.051 S	W	F	.053 M	.035 W	.053 S	.045 T	.045 T	.044 S	.043 T
3	F	.045 M	.049 M	T	S	.066 T	.044 T	.052 S	.049 W	.044 F	.040 M	.040 W
4	S	.047 T	.050 T	F	S	.053 W	.049 F	.047 M	.050 T	.055 S	.042 T	.038 T
5	S	.048 W	.052 W	S	M	.044 T	S	.034 T	.055 F	.049 S	.045 W	.043 F
6	M	.049 T	.057 T	S	T	.051 F	S	.048 W	.055 S	.052 M	.045 T	.041 S
7	.039 T	.046 F	.050 F	M	W	.051 S	M	T	.054 S	.033 T	.045 F	.037 S
8	.042 W	.049 S	.052 S	T	T	.053 S	T	.051 F	.054 M	.044 W	.037 S	.035 M
9	.042 T	.048 S	.051 S	W	F	.048 M	.055 W	.052 S	.056 T	.038 T	.040 S	.046 T
10	.039 F	.048 M	.044 M	T	S	.050 T	T	.052 S	.052 W	.041 F	.038 M	.042 W
11	.049 S	.049 T	.052 T	F	S	.063 W	.045 F	.054 M	.044 T	.040 S	.043 T	.042 T
12	.047 S	.047 W	.053 W	S	M	.061 T	.041 S	.052 T	.043 F	.046 S	.041 W	.041 F
13	.044 M	.048 T	.050 T	S	T	.063 F	.044 S	.052 W	.056 S	.041 M	.042 T	.046 S
14	T	.045 F	.048 F	M	W	.060 S	.052 M	.045 T	.052 S	.038 T	.050 F	.047 S
15	W	.045 S	.043 S	T	.048 T	.050 S	.060 T	.053 F	.044 M	.043 W	.041 S	.042 M
16	T	.042 S	.044 S	W	.052 F	.036 M	.053 W	.053 S	.041 T	.053 T	.041 S	.041 T
17	F	.047 M	.051 M	T	.045 S	.034 T	.052 T	.049 S	.048 W	.047 F	.037 M	.037 W
18	.043 S	.050 T	.048 T	F	.058 S	.059 W	F	.052 M	.048 T	.047 S	.040 T	.046 T
19	.048 S	.050 W	.057 W	S	.065 M	.059 T	S	.052 T	.046 F	.045 S	.042 W	.044 F
20	.046 M	.047 T	T	S	.057 T	.054 F	S	.051 W	.040 S	.039 M	.043 T	.043 S
21	.042 T	.045 F	F	M	.059 W	.061 S	.052 M	.051 T	.042 S	.049 T	.040 F	.040 S
22	.051 W	.045 S	S	T	.060 T	S	.060 T	.053 F	.040 M	.048 W	.033 S	.040 M
23	.048 T	.047 S	S	W	.057 F	.051 M	.055 W	.053 S	.044 T	.047 T	.038 S	.036 T
24	.046 F	.048 M	M	T	.043 S	.045 T	.054 T	.042 S	.061 W	.041 F	.041 M	.042 W
25	.045 S	.053 T	T	F	.047 S	.051 W	.055 F	.048 M	.055 T	.040 S	.045 T	.041 T
26	.047 S	.049 W	W	S	.047 M	.056 T	.055 S	.048 T	.057 F	.043 S	.046 W	.037 F
27	.042 M	.053 T	T	S	.048 T	.054 F	.055 S	.049 W	.052 S	.046 M	.035 T	.043 S
28	.047 T	.048 F	F	M	.039 W	.066 S	.052 M	.048 T	.042 S	.047 T	.035 F	.039 S
29	.044 W		S	T	.040 T	.059 S	.052 T	.053 F	.041 M	.042 W	.038 S	.034 M
30	.047 T		S	W	.037 F	.054 M	.051 W	.059 S	.054 T	.046 T	.040 S	.033 T
31	.045 F		M		.047 S		.055 T	.058 S		.048 F		.040 W
Valid Days	22	28	19	0	17	29	23	30	30	31	30	31
Maximum	.051	.053	.057	.000	.065	.066	.060	.059	.061	.055	.050	.047
Violations	0	0	0	0	0	0	0	0	0	0	0	0

6605 Total Samples

75.4 % Possible

290 Valid daily maxima

0 Daily-maxima exceeding the standard of .12 ppm (starred[*])

3 Missing days assumed to be less than the standard

0 Daily maxima exceed the alert level of .200 ppm

Concentrations in parts per million (ppm)

Final Validation

10/9/98

Craters of the Moon NM

1997 Attainment Status With U.S. Environmental Protection Agency (EPA) PRIMARY Ozone National Ambient Air Quality Standard

Ozone Season: April Through October

The primary National Ambient Air Quality Standard for ozone is designed to protect human health. The level of the primary ozone standard promulgated by the EPA on July 18, 1997 is 0.08 parts per million (ppm) [80 parts per billion, (ppb)], daily maximum 8-hour average. The primary ozone standard is met at an ambient monitoring site when the 3-year average of the annual fourth-highest daily maximum 8-hour average ozone concentration is less than or equal to 0.08 ppm. This standard is not met when the 3-year average is greater than 0.08 ppm. Using the EPA's rounding convention, a computed 3-year average ozone concentration of 0.085 ppm (85 ppb) is the smallest value that is greater than the level of the 0.08 ppm standard.

The primary standard requires 90 percent data completeness, on average, during the 3-year period, with no single year within the period having less than 75 percent data completeness. This data completeness requirement would have to be satisfied in order to determine that the standard has been met at a monitoring site. However, calendar years with less than 75 percent data completeness are included in the computation if the annual fourth-highest daily maximum 8-hour concentration is greater than the level of the standard. A site could be found not to have met the standard with less than complete data. The percent data completeness is the percent of valid ozone monitoring days. A day is valid if valid 8-hour averages are available for at least 75 percent of possible hours in the day (i.e., at least 18 of the 24 averages). An 8-hour average is considered valid if at least 75 percent (or 6) of the hourly averages for the 8-hour period are available.

The table below lists the 3-year average fourth-highest daily maximum 8-hour ozone concentration based on data collected in 1997 and the two previous years. This is the number to compare to the level of the new primary standard. The 3-year average data completeness percent and the 1997 highest five daily maximum 8-hour averages are also tabulated. A * in the Data Comp % Met? column indicates EPA data completeness requirement was not met for the three-year period.

Year	3-Year Avg 4th High Daily Max 8-hr Ozone (ppb)	3-Year Avg Data Comp %	Data Comp % Met?	Annual 1st High Daily Max 8-hr Ozone (ppb)	Annual 2nd High Daily Max 8-hr Ozone (ppb)	Annual 3rd High Daily Max 8-hr Ozone (ppb)	Annual 4th High Daily Max 8-hr Ozone (ppb)	Annual 5th High Daily Max 8-hr Ozone (ppb)
1997	60	83	*	64	62	61	60	60

Ozone
Ten Highest Daily 1-Hour Average Maximum Concentrations
Craters of the Moon National Monument

Final Data
01/01/97 - 12/31/97

Rank	Date	Hour	Concentration (ppm)
1	06/03/97	16	0.066*
2	06/28/97	14	0.066*
3	07/05/97	16	0.066*
4	05/19/97	18	0.065*
5	06/11/97	20	0.063
6	06/13/97	15	0.063*
7	06/22/97	20	0.062
8	06/12/97	13	0.061
9	06/21/97	18	0.061
10	09/24/97	17	0.061

* Other high value(s) were also recorded during one or more hours in the day.

Note: The primary and secondary ambient air standard for ozone is 0.12 ppm averaged over a one hour period not to be exceeded more than once per year. (A value greater than .12 ppm, 124 ppb, or 235 $\mu\text{g}/\text{m}^3$ exceeds the standard.) (40 CFR 50.9 with reference to Appendix D and H.)

Episodes with 1-Hour Ozone Concentrations
 ≥ 100 ppb and > 124 ppb
 Craters of the Moon National Monument

Final Data
 01/01/97 - 12/31/97

Date	Beginning Hour	No. Hours		Max (ppb)
		≥ 100 ppb	>124 ppb	
No values exceeded 100 ppb during this period				
Total		0	0	

Note: The primary and secondary national ambient air standard for ozone that applied in 1996 is 0.12 ppm over a one hour period not to be exceeded more than once per year. (A value greater than .12 ppm, 124 ppb, or 235 $\mu\text{g}/\text{m}^3$ exceeds the standard.) (40 CFR 50.9 with reference to Appendix D and H.)

Episodes with 8-Hour Average Ozone Concentrations > 84 ppb
Craters of the Moon National Monument

Final Data
01/01/97 - 12/31/97

Date	Start and End Time of Daily Maximum 8-Hour Average > 84 ppb (hr)	Daily Maximum 8-Hour Average (ppb)	Number of 8-Hour Averages > 84 ppb During the Day
No values exceeded 84 ppb during this period			
0	Days with 8-hour average concentrations > 84 ppb		

Note: This table presents episodes of high ozone based on running 8-hour averages. In 1997, the EPA published new primary and secondary national ambient air quality standards for ozone based on 8-hour average ozone concentrations. Attainment of the new primary standard is reached if the annual fourth highest daily maximum 8-hour ozone concentration, averaged over three years, does not exceed 0.08 ppm (84 ppb or 157 ug/m³). (40 CFR 50.10.)

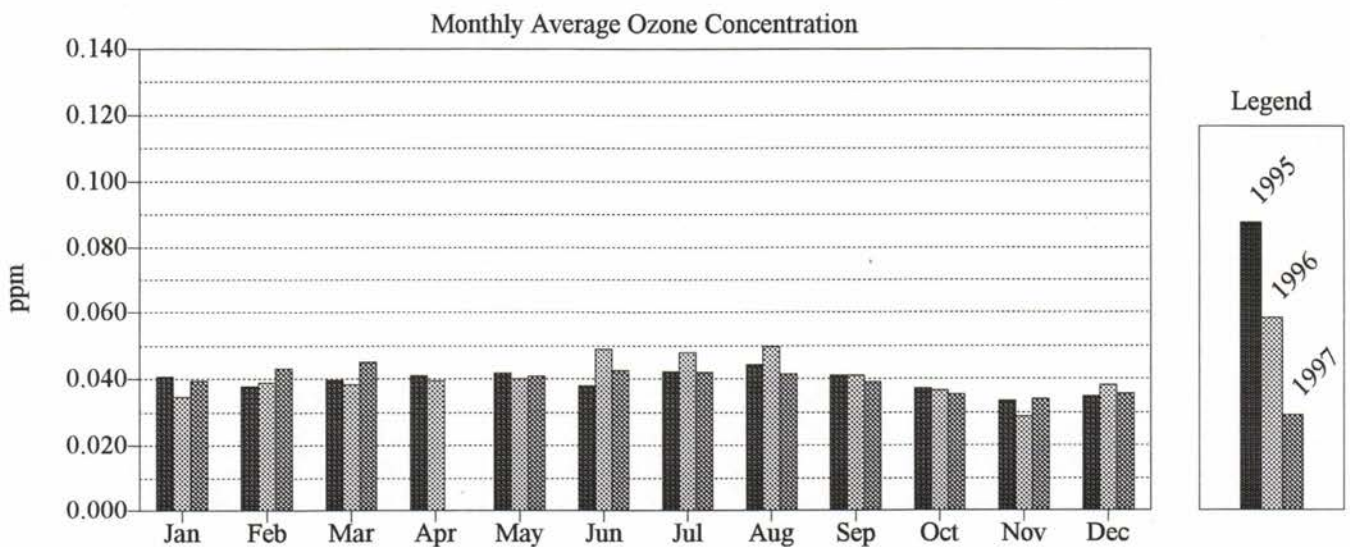
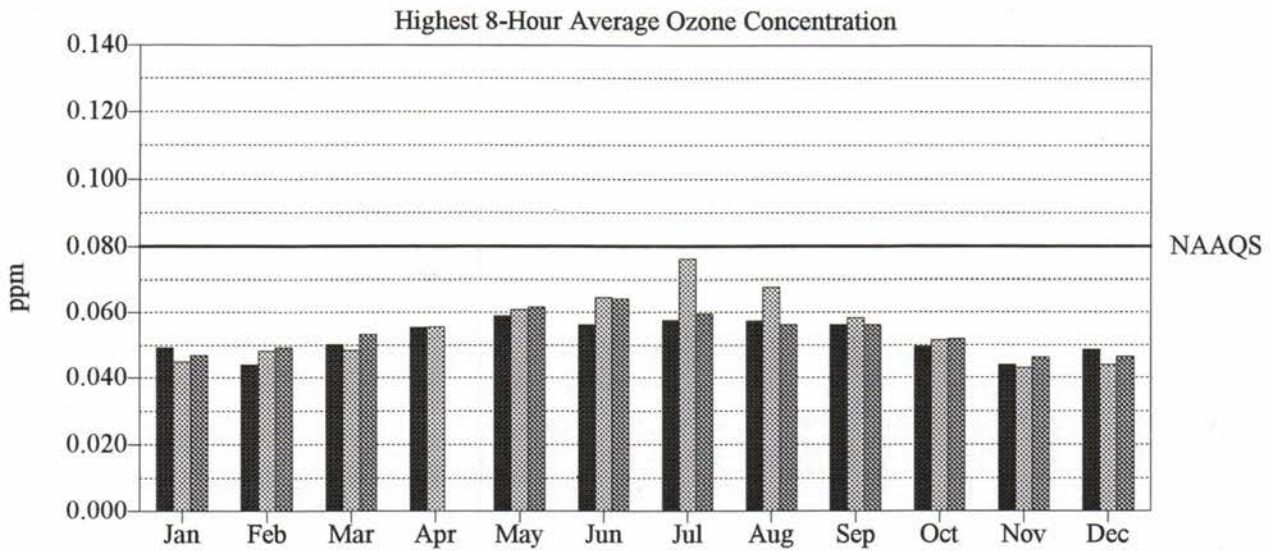
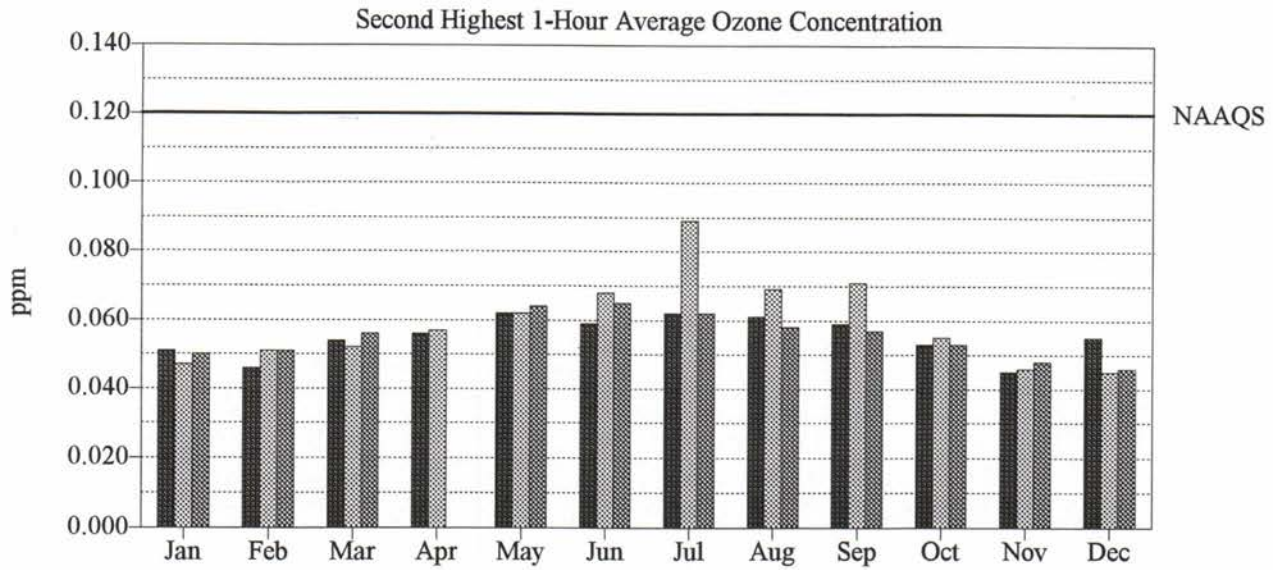
Ozone Rank Listings of Second Highest 1-Hour Average Concentrations, 4th Highest 8-Hour Average Concentrations, and Annual SUM60 Exposure Index for All NPS Monitoring Sites

01/01/97 - 12/31/97

Second Highest 1-Hour Average Concentration		
Site	Rank	Concentration (ppb)
JOTR-YV	1	142
CHAM-XX	2	119
CACO-XX	3	117
GRSM-LR	4	116
SEKI-LP	5	115
ACAD-CM	6	114
GRSM-CM	7	111
SEKI-LK	8	111
GRSM-CD	9	110
MACA-HM	10	109
PINN-ES	11	108
YOSE-TD	12	107
ACAD-ST	13	105
COWP-XX	14	104
SHEN-BM	15	101
GRSM-CC	16	99
SAGU-PC	17	97
MACA-OC	18	96
COSW-XX	19	88
EVER-BC	20	86
ROMO-LP	21	85
DEVA-PV	22	83
GRBA-MY	23	82
VOYA-SB	24	81
CHIS-XX	25	80
LAVO-ML	26	80
THRO-NO	27	80
GRCA-AS	28	77
MORA-PP	29	76
CANY-IS	30	73
CHIR-ES	31	71
BIBE-KB	32	68
MEVE-MY	33	68
YELL-WT	34	67
CRMO-VC	35	65
GLAC-WG	36	57
OLYM-VC	37	56
DENA-HQ	38	55
MORA-TW	39	50
NOCA-MM	40	47

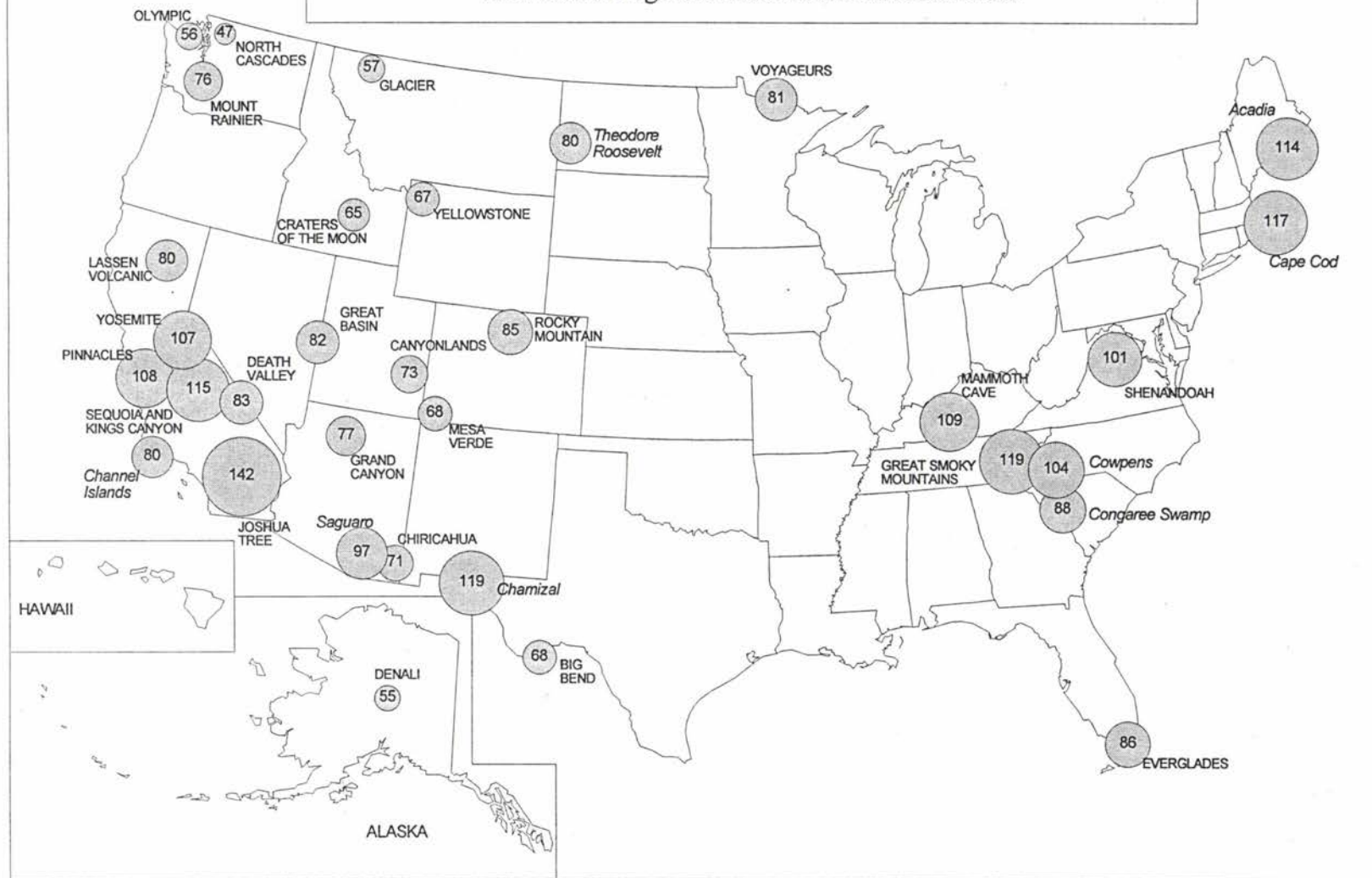
4th Highest 8-hour Average Concentration		
Site	Rank	Concentration (ppb)
JOTR-YV	1	118
SEKI-LP	2	101
CACO-XX	3	100
GRSM-LR	4	99
SEKI-LK	5	98
GRSM-CM	6	95
COWP-XX	7	91
GRSM-CD	8	90
SHEN-BM	9	89
ACAD-CM	10	86
MACA-HM	11	82
YOSE-TD	12	82
SAGU-PC	13	80
ACAD-ST	14	78
GRSM-CC	15	78
MACA-OC	16	78
DEVA-PV	17	77
PINN-ES	18	77
GRBA-MY	19	74
GRCA-AS	20	73
THRO-NO	21	72
CHAM-XX	22	71
VOYA-SB	23	71
ROMO-LP	24	70
CANY-IS	25	68
LAVO-ML	26	68
EVER-BC	27	67
CHIR-ES	28	65
COSW-XX	29	65
BIBE-KB	30	64
CHIS-XX	31	64
MEVE-MY	32	62
MORA-PP	33	62
YELL-WT	34	62
CRMO-VC	35	60
GLAC-WG	36	53
DENA-HQ	37	52
OLYM-VC	38	46
MORA-TW	39	40
NOCA-MM	40	39

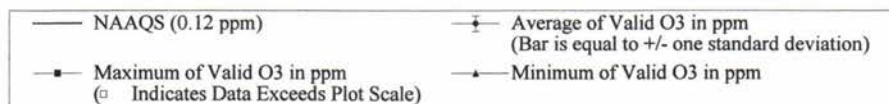
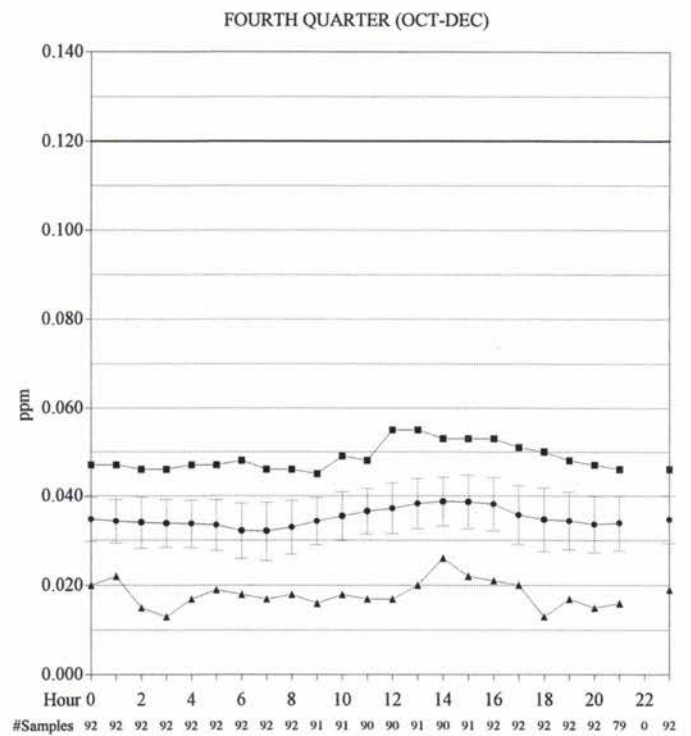
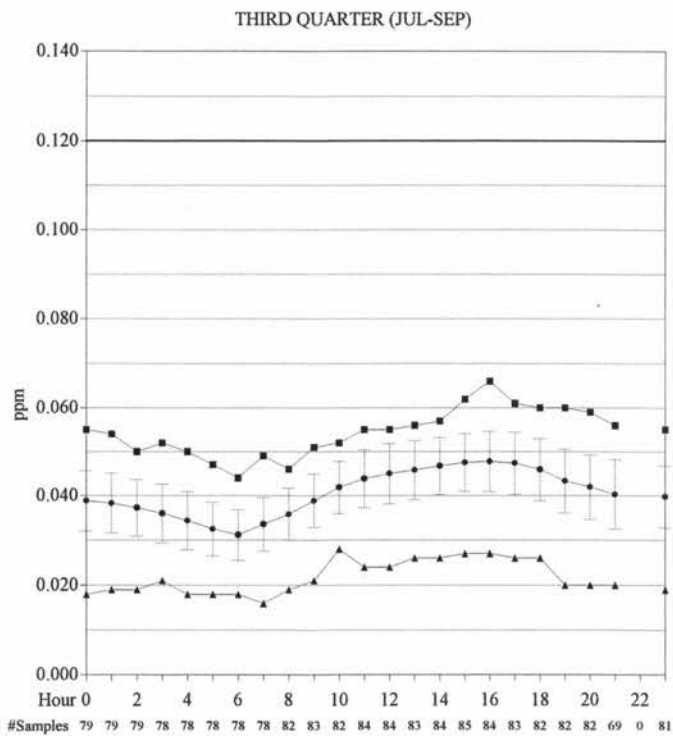
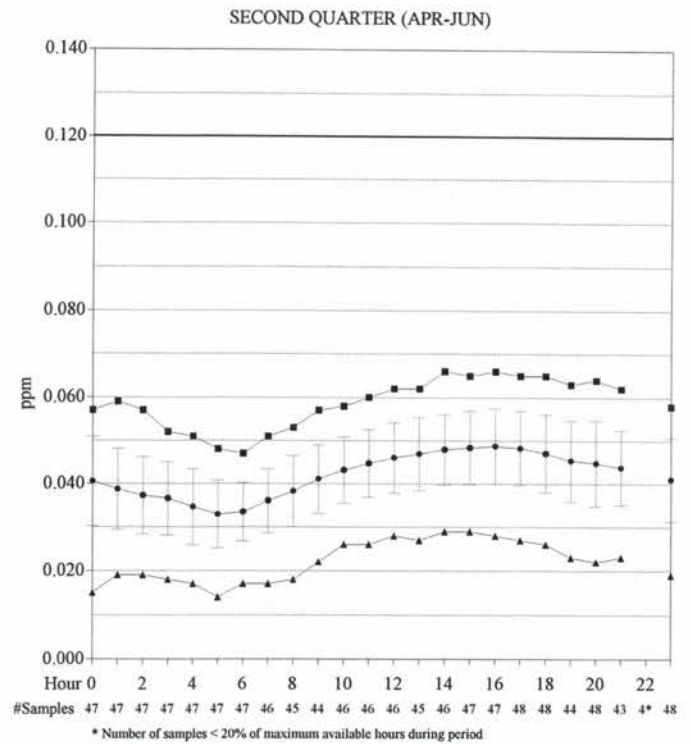
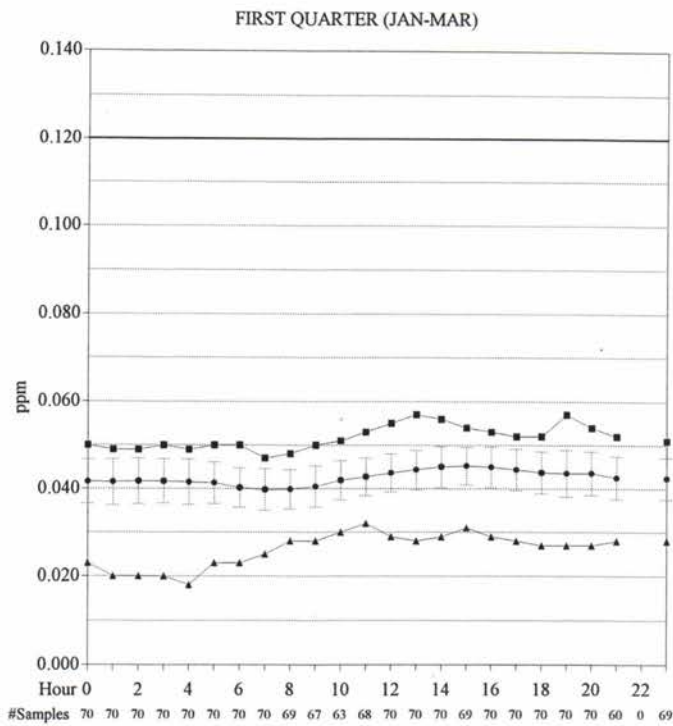
Annual Sum60 Exposure Index			
Site	Rank	Sum60	Count
JOTR-YV	1	178426	2394
GRSM-CM	2	148193	2096
SEKI-LP	3	140618	1875
GRSM-LR	4	127438	1769
GRSM-CD	5	123326	1786
SEKI-LK	6	105677	1441
SHEN-BM	7	87871	1282
COWP-XX	8	70269	973
YOSE-TD	9	52168	767
DEVA-PV	10	50321	762
CACO-XX	11	48101	638
SAGU-PC	12	47868	715
GRCA-AS	13	42617	670
GRSM-CC	14	41867	615
PINN-ES	15	36598	543
ACAD-CM	16	31617	445
GRBA-MY	17	29588	456
ROMO-LP	18	25982	397
CANY-IS	19	25322	401
MACA-HM	20	20894	294
MACA-OC	21	18996	283
CHIR-ES	22	17380	276
CHAM-XX	23	17137	244
VOYA-SB	24	12331	185
LAVO-ML	25	12231	188
THRO-NO	26	11738	178
ACAD-ST	27	10470	147
COSW-XX	28	10043	148
CHIS-XX	29	9740	151
MEVE-MY	30	6346	101
BIBE-KB	31	5644	90
MORA-PP	32	3794	59
EVER-BC	33	3618	53
YELL-WT	34	3323	53
CRMO-VC	35	2479	40
DENA-HQ	36	0	0
GLAC-WG	37	0	0
MORA-TW	38	0	0
NOCA-MM	39	0	0
OLYM-VC	40	0	0

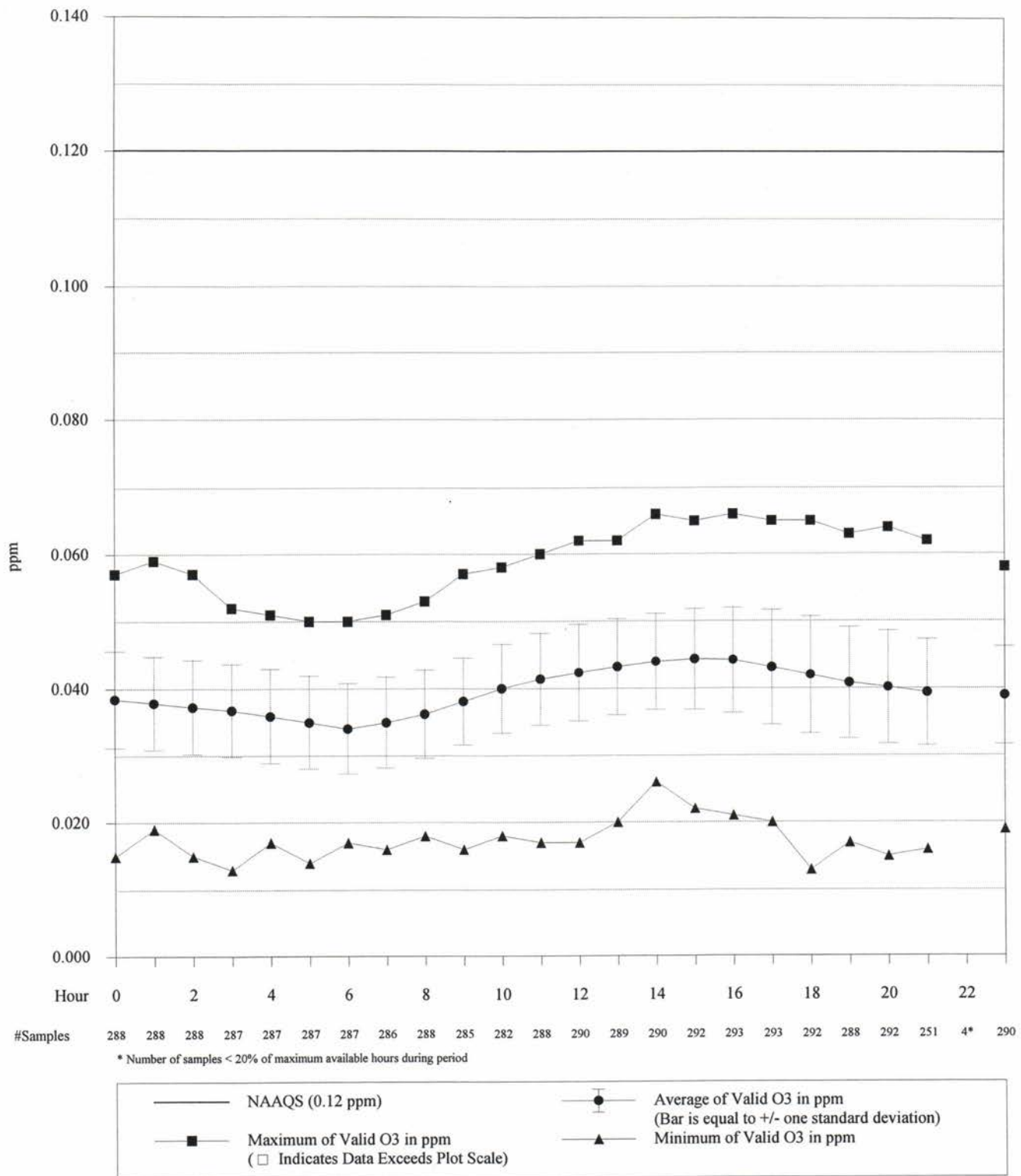


NATIONAL PARK SERVICE GASEOUS POLLUTANT MONITORING NETWORK

1997 Second Highest 1-Hour Ozone Concentrations





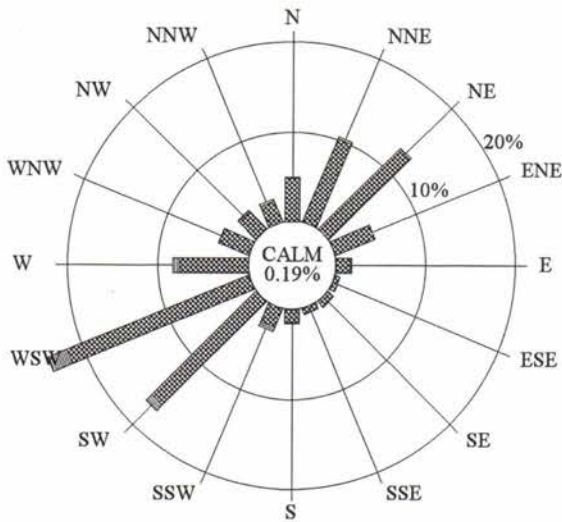


Craters of the
Moon National Monument

Quarterly Ozone
Pollutant Rose

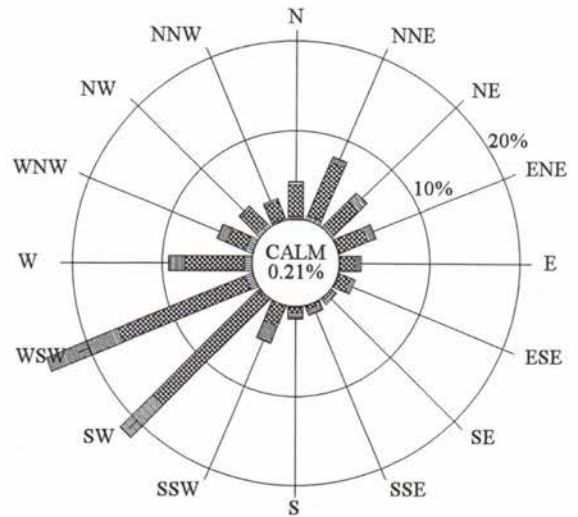
1997

FIRST QUARTER (JAN-MAR)



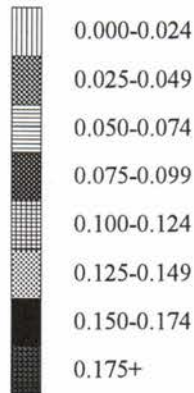
83.3% Collected 83.3% Valid
1872 Possible / 1559 Collected / 1559 Valid

SECOND QUARTER (APR-JUN)

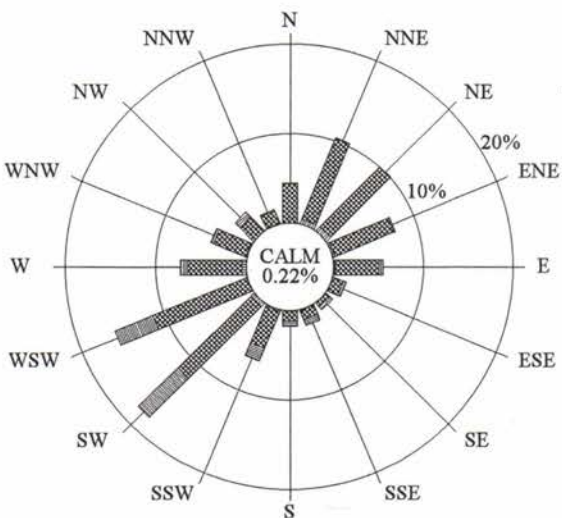


91.6% Collected 82.7% Valid
1135 Possible / 1040 Collected / 939 Valid

Ozone (ppm)

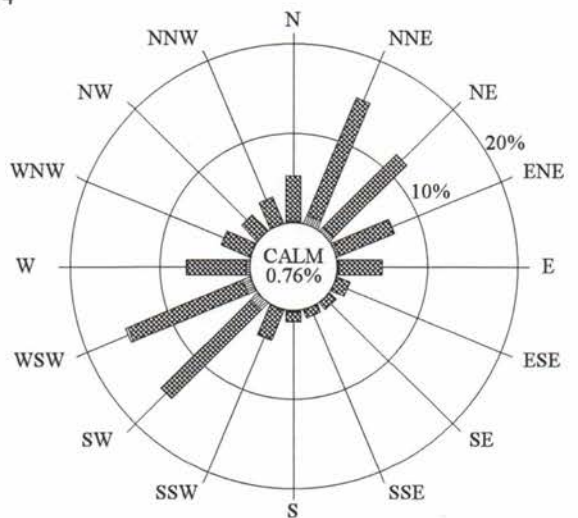


THIRD QUARTER (JUL-SEP)

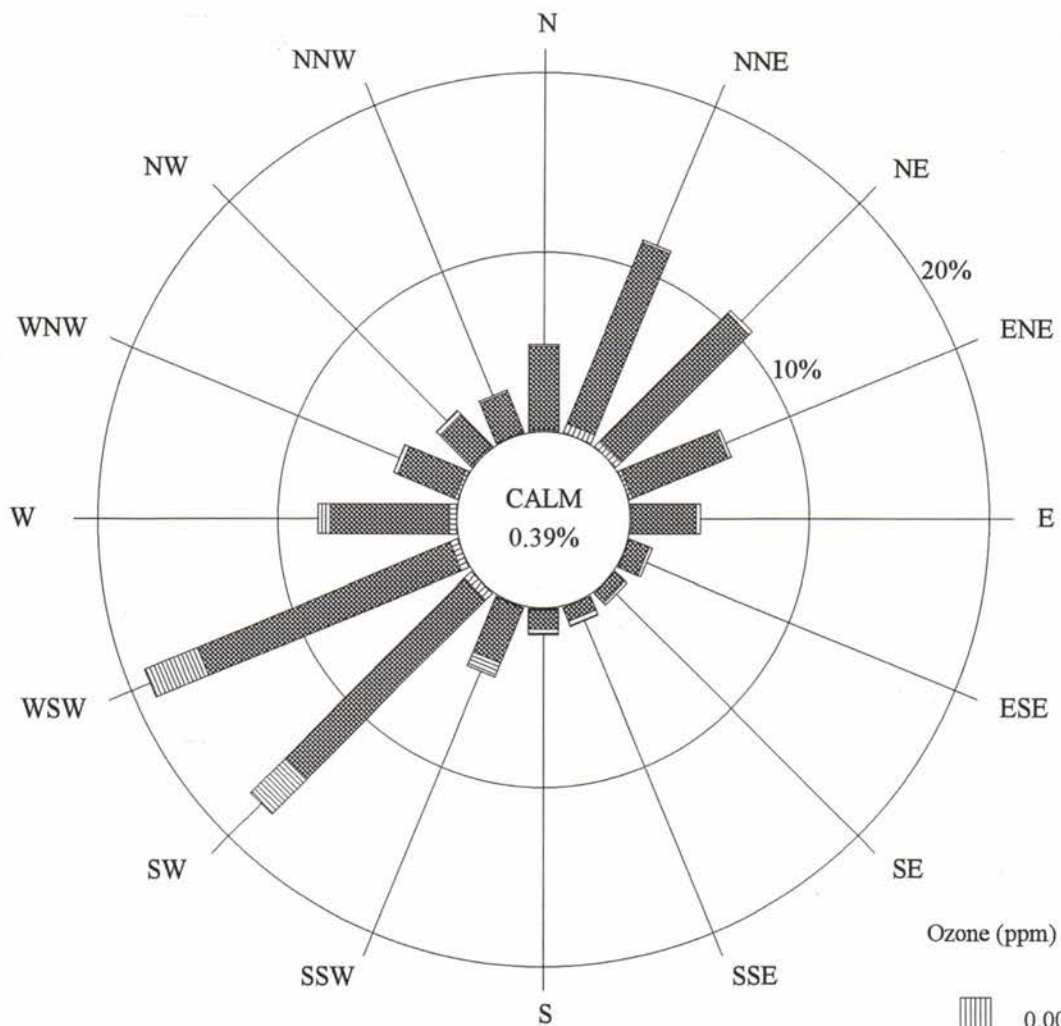


86.5% Collected 82.7% Valid
2208 Possible / 1910 Collected / 1825 Valid

FOURTH QUARTER (OCT-DEC)



94.8% Collected 94.8% Valid
2208 Possible / 2093 Collected / 2093 Valid



88.9% Collected 86.4% Valid
7423 Possible /6602 Collected /6416 Valid

Ozone Precision Check Summary

Craters of the Moon National Monument

Precision checks are required by the Environmental Protection Agency (EPA) of all monitoring instruments collecting data which are to be submitted to the EPA Aerometric Information Retrieval System (AIRS). A precision check is performed by challenging the pollutant analyzer with a known concentration of gas (between 0.08 and 0.10 ppm for ozone and sulfur dioxide) from the pollutant transfer standard. This precision check must be performed at least every 14 days of monitoring operation. The percent difference between the analyzer and the transfer standard is then calculated. According to NPS Standard Operating Procedures, the pollutant analyzer must respond within 10% of the transfer standard.² The table below gives the number of precision checks performed during each quarter, the average of all the individual precision check percent differences for the quarter, and the upper and lower 95% probability limits for precision checks. The probability limits represent the interval having a 95% chance of containing the true average percent difference. The quarterly average percent difference and probability limits should ideally be within +/- 10%.

Final Data 01/01/97 - 12/31/97				
Calendar Quarter	Number of Precision Checks	Average Percent Difference ^{1,2}	Lower 95% Probability Limit ³	Upper 95% Probability Limit ³
1	9	0.62	-3.37	4.62
2	5	-0.23	-3.50	3.03
3	12	2.44	-2.47	7.34
4	12	-0.19	-5.82	5.44

¹ Percent Difference = $\frac{\text{analyzer} - \text{transfer std}}{\text{transfer std}} \times 100$.

² Average Percent Difference is the mean of all individual precision check percent differences during the quarter.

³ Upper/Lower 95% Probability Limits = (Average Percent Difference) +/- (1.96)(Standard Deviation of precision check percent differences in the quarter.)

2.3 METEOROLOGICAL DATA SUMMARY

Summary of Selected Meteorological Data
Craters of the Moon National Monument

Final Data
01/01/97 - 12/31/97

Parameter	Value	Units	Number	Std Dev
SCALAR WIND SPEED				
Average	3.4	m/s	6888	2.4
Maximum	15.6	m/s		
Percent calm = 0.41				
AMBIENT TEMPERATURE				
Average	6.3	degC	6879	11.2
Maximum	33.0	degC		
Minimum	-20.6	degC		
RELATIVE HUMIDITY				
Average	NA			
Maximum				
Minimum				
PRECIPITATION (Rainfall or Snow melt)				
Average non-zero rate	NA			
Maximum non-zero rate				
Minimum non-zero rate				
Accumulated during period				
SOLAR RADIATION				
Average Daily Total	337.798	ly/day	365	175.846
Maximum Daily Total	729.060	ly/day		
Minimum Daily Total	29.100	ly/day		

Note: Calms are included in the average scalar wind speed and are defined as winds less than 0.5 m/s (1.0 mph).

Solar radiation terms are based on the calculation of the total amount of solar energy incident on a unit area during each day. The maximum and minimum daily totals are selected from the list of daily totals. The totals for all days are then added and divided by the number of days to yield the average daily total. Only days with 24 valid values are included in these statistics.

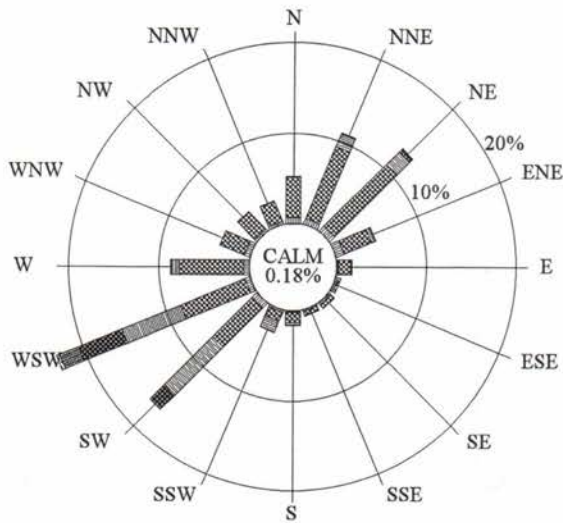
NA indicates instrument not available.

Craters of the Moon National Monument

Quarterly Wind Rose

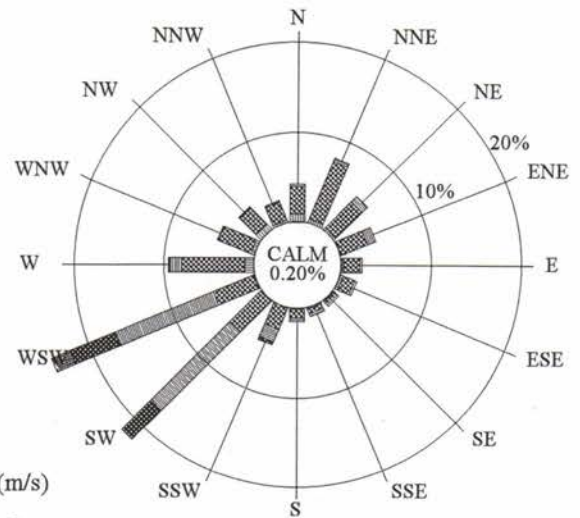
1997

FIRST QUARTER (JAN-MAR)



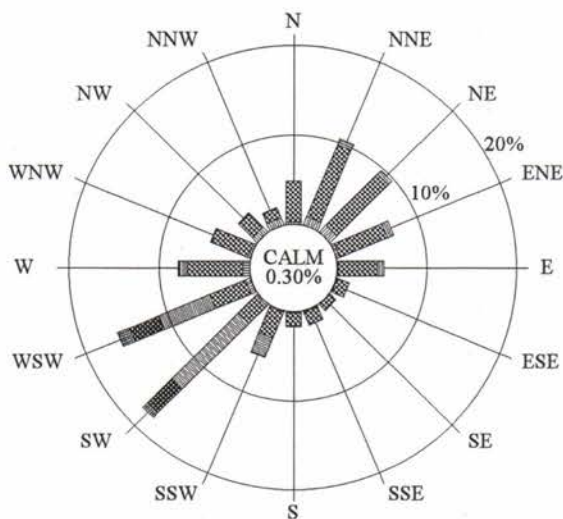
88.9% Collected 88.9% Valid
1872 Possible /1664 Collected /1664 Valid

SECOND QUARTER (APR-JUN)



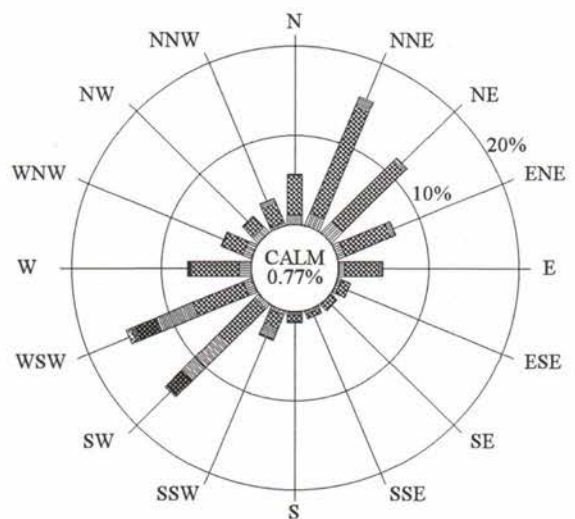
96.7% Collected 87.3% Valid
1135 Possible /1097 Collected /991 Valid

THIRD QUARTER (JUL-SEP)

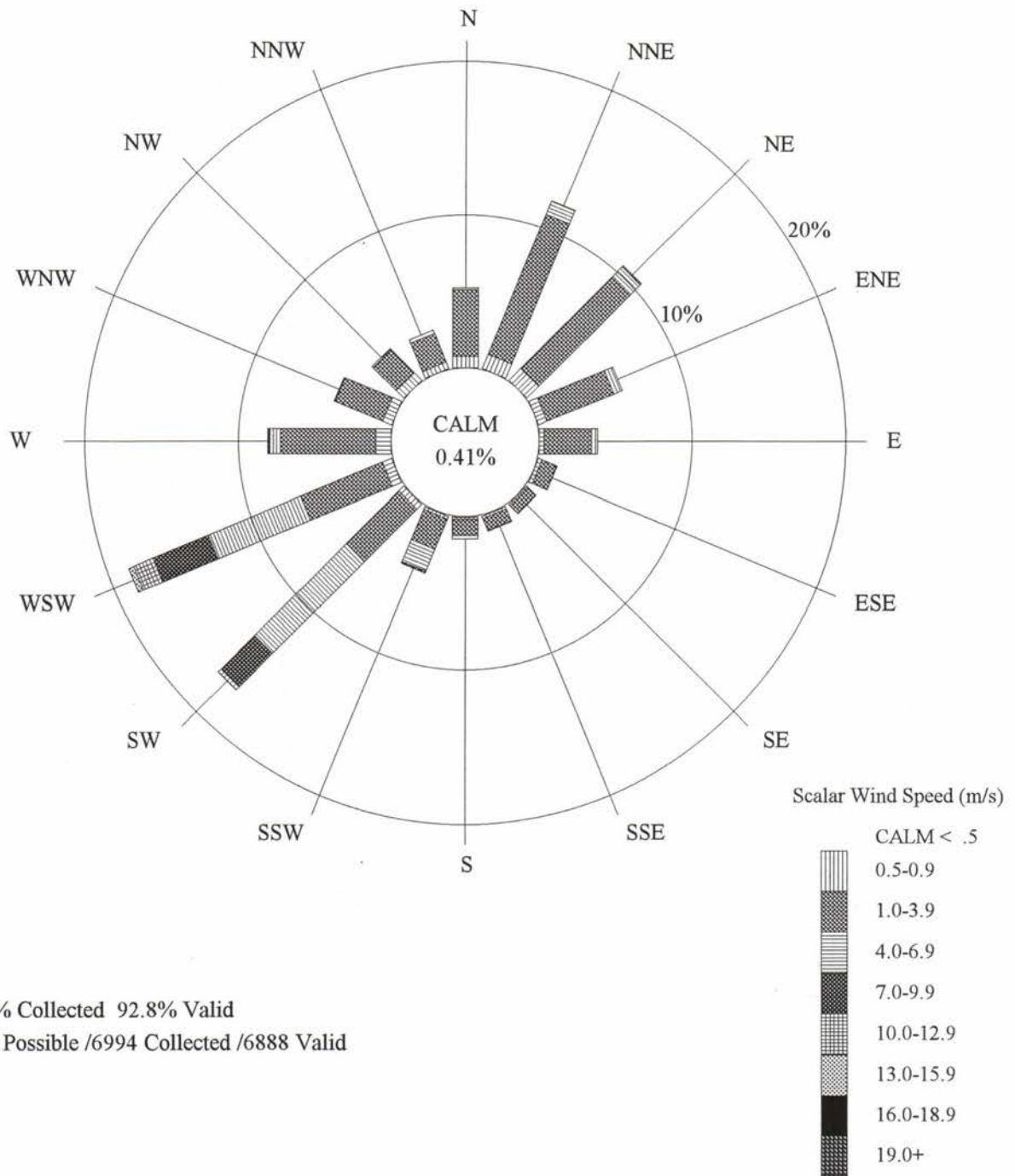


91.7% Collected 91.7% Valid
2208 Possible /2025 Collected /2025 Valid

FOURTH QUARTER (OCT-DEC)



100.0% Collected 100.0% Valid
2208 Possible /2208 Collected /2208 Valid



94.2% Collected 92.8% Valid
7423 Possible /6994 Collected /6888 Valid

3.0 NATIONAL PARK SERVICE AIR RESOURCES DIVISION DATA SOURCES

3.1 GUIDE TO ATTACHED DATA DISKS

Data disks containing ASCII files of the validated hourly data, as shown in the following table are available. Please return the enclosed postcard or contact the address below. These data may be imported into other programs to perform additional data processing and analysis. The data format of each file is included within each file. The second table describes the validation codes used in the data tables to indicate why data are missing or invalid. Wind and pollutant frequency distribution tables in ASCII format are also included on the diskette if available for this site.

Data users should acknowledge the National Park Service Air Resources Division whenever using these data or any portion of this report.

3.2 OTHER SOURCES FOR RETRIEVING NATIONAL PARK SERVICE GASEOUS POLLUTANT DATA

The data contained in this report may also be obtained from the following sources:

- National Park Service AIRWeb (<http://www.aqd.nps.gov/natnet/ard>) - available after last quarter 1997
- EPA AIRS database
- Data requests directed to:

NPS Air Resources Division
Information Management Center
c/o Air Resource Specialists, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, Colorado 80525
Telephone: (970) 484-7941
Fax: (970) 484-3423
E-Mail: AIR-IMC@AIR-RESOURCE.COM

Data Disk Contents Summary	
File Name (s)	Description
Hourly	
ssssyy.DAT	All Validated Air Quality Data
ssssyymm.ppp	Monthly Data Summary Tables
ssssAN95.Rpp	Annual Wind and Pollutant Frequency Distribution
ssssQ195.Rpp	Quarter 1 Wind and Pollutant Frequency Distribution
ssssQ295.Rpp	Quarter 2 Wind and Pollutant Frequency Distribution
ssssQ395.Rpp	Quarter 3 Wind and Pollutant Frequency Distribution
ssssQ495.Rpp	Quarter 4 Wind and Pollutant Frequency Distribution
Where: ssss = site code yy = year mm = month ppp = air quality data parameter code AN = Annual Qn = Quarter 1-4 R = Wind Frequency distribution table	
CASTNet Weekly Species Summary Data	
File Name (s)	Description
CASTNet	
ssssCNyr.ASC	Weekly averages
Where: ssss = site code CN = CASTNet yr = year asc = ascii file	

NPS IMC and AIRS Invalid Data Codes			
NPS IMC VAL CODE	REASON	AIRS CODE	AIRS REASON
TO	Sample time out of limits	9973	Sample time out of limits
IW	Instrument warmup	9978	Voided by operator
OE	Operator error	9978	
BM	Begin monitoring	9979	Miscellaneous void
TL	Station temp low	9979	
OS	Off scale	9979	
EM	End monitoring	9979	
LI	Local interference	9979	
TH	Station temp high	9979	
IM	Instrument malfunction	9980	Machine malfunction
IN	Interference	9981	Bad weather
RF	Recording system failure	9983	Collection error
NA	No data	9987	Monitoring waived
PF	Power failure	9988	Power Failure
PC	Precision check	9990	Precision Check
ZS	Instrument zero/span check	9991	QC Control Points (Zero/Span)
SA	System audit	9992	QC Audit
PA	Performance audit	9992	
MT	Maintenance	9993	Maintenance/Routine Repairs
OR	Out for repair	9993	
CA	Calibration	9995	Multipoint calibration
SC	Station check	9998	Precision/zero/span

4.0 GLOSSARY

4.1 DEFINITIONS AND COMPUTATIONAL PROCEDURES FOR NATIONAL PARK SERVICE QUICK LOOK ANNUAL SUMMARY STATISTICS REPORT

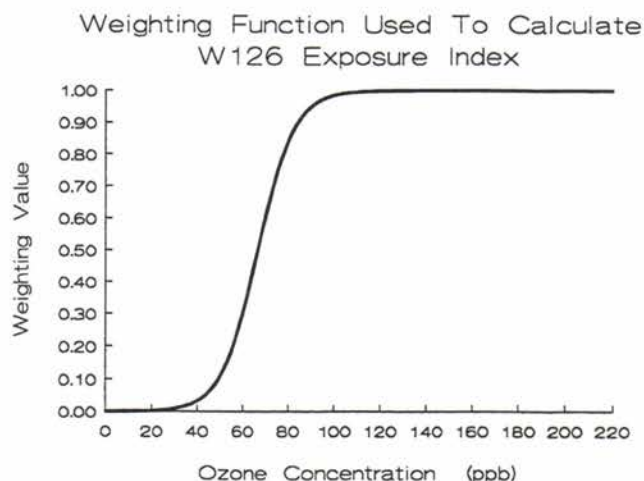
The National Park Service Quick Look Annual Summary Statistics Table (Page 2-8) provides ozone summary statistics for various indices computed on a monthly basis for an entire year. Growing season (generically defined to be May 1 - September 30) and annual statistics are also presented under the "MAY-SEP" and "ANNUAL" columns, respectively. All concentrations are expressed in the units of parts per billion (PPB) and exposures in parts per billion-hours (PPB-HR). The definitions for each of the statistics appearing on the Quick Look Annual Summary Table are given below.

- (1) **Daily 1-Hr Maximum.** The maximum 1-hour average concentration recorded during each month, the growing season or the year regardless of the number of valid hourly observations recorded during a given day. The number in parentheses below this statistic, (N), indicates the number of days in the month, growing season, or year with valid data.
- (2) **Average Daily Maximum.** The average of all Daily 1-Hr Maxima during the month regardless of the number of Daily 1-Hr Maxima recorded during the month. For the "MAY-SEP" column the average of all the Daily Maxima recorded during the growing season is given. For the "ANNUAL" column the average of all the Daily Maxima is given. N is as in (1) above.
- (3) **Maximum Daily Mean.** The maximum of the valid daily means computed for each month, the growing season ("MAY-SEP" column), and the year ("ANNUAL" column). A valid daily mean is one for which 75% of the observations are available for each day, i.e., 18 hours. N is the number of days during each month, growing season, and year with at least 18 observations.
- (4) **Average Daily Mean.** The average of all valid daily means for the month, the growing season ("MAY-SEP" column), and the year ("ANNUAL" column). N is as in (3) above.
- (5) **Max Peak:Min Ratio.** The ratio of the Daily 1-Hr Maximum to the Daily 1-Hr Minimum. A ratio is computed only if a valid Daily Mean is computed and if the Daily 1-Hr Minimum is not equal to zero. N is the number of days with a valid Peak:Min ratio.
- (6) **Average Peak:Min Ratio.** The average of all Peak:Min ratios for the month, growing season, or year. N is as in (5) above.
- (7) **Max 9AM-4PM Average.** The maximum of all valid 9AM-4PM Averages computed for the month, growing season, or year. A valid 9AM-4PM Average is one which has 75% of the observations available during that time period (i.e., 6 hours. N is the number of days with valid averages.)

- (8) **Monthly 9AM-4PM Average.** The average of all valid 9AM-4PM Averages for the month, growing season, or year. N is as in (7) above.
- (9) **Max 7AM-7PM Average.** The maximum of all valid 7AM-7PM Averages computed for the month, growing season, or year. A valid 7AM-7PM Average is one which has 75% of the observations available during that time period, i.e., 9 hours. N is the number of days with valid averages.
- (10) **Monthly 7AM-7PM Average.** The average of all valid 7AM-7PM averages for the month, growing season, or year. N is as in (9) above.
- (11) **Monthly Mean.** The average of all 1-Hr ozone concentrations recorded during the month, growing season, or year. A mean is computed regardless of the number of hours with valid data. N is the number of hours with valid observations.
- (12) **SUM0 Exposure Index.** The monthly sum of all hourly ozone concentrations. Units are PPB-HR. The "MAY-SEP" column sums across the months of May through September to give the cumulative exposure for the growing season. The "ANNUAL" column sums across every month to give the cumulative exposure for the year. N is the number of hours with valid observations and is the same N as in (11) above.
- (13) **SUM60 Exposure Index.** The monthly sum of all hourly ozone concentrations equaling or exceeding 60 PPB. Units are PPB-HR. The "MAY-SEP" column sums across the months of May through September to give the cumulative exposure for the growing season. The "ANNUAL" column sums across every month to give the cumulative exposure for the year. N is the number of hours equaling or exceeding 60 PPB during the month, growing season, or year.
- (14) **SUM80 Exposure Index.** The monthly sum of all hourly ozone concentrations equaling or exceeding 80 PPB. Units are PPB-HR. The "MAY-SEP" column sums across the months of May through September to give the cumulative exposure for the growing season. The "ANNUAL" column sums across every month to give the cumulative exposure for the year. N is the number of hours equaling or exceeding 80 PPB during the month, growing season, or year.
- (15) **W126 Exposure Index.** The monthly sum of all hourly ozone concentrations where each concentration is weighted by a function that gives greater emphasis to the higher hourly concentrations while still including the lower ones. This weighting function provides a weighting value that is unique for each hourly ozone concentration. The weighting function, as described by Lefohn, Laurence, and Kohut¹ is:

$$w_i = \frac{1}{1 + 4403 \exp(-.126c_i)}$$

where



w_i = weighting value for hourly concentration i ,
and
 c_i = hourly concentration i in PPB.

The graph of weighting value versus ozone concentration, in the figure to the left, illustrates the greater weights given to higher hourly ozone concentrations.

Each hour's weighting value is multiplied by its corresponding hourly concentration. This product is summed over all the valid hours in each month to calculate the monthly W126 exposure.

Thus, the monthly W126 exposure is:

$$W126 = \sum_{i=1}^n w_i c_i$$

where

W126 = monthly W126 exposure index,
 w_i = weighting value for hourly concentration i ,
 c_i = hourly concentration i in PPB, and
 n = number of hours in the month with valid ozone concentrations.

The "MAY-SEP" column sums across the months of May through September to give the cumulative exposure for the growing season. The "ANNUAL" column sums across every month to give the cumulative exposure for the year. The exposure units are PPB-HR.

Because each hour contributes to this exposure index, N is the number of hours with valid observations and is the same N as in (11) and (12) above.

The U.S. Environmental Protection Agency usually considers air quality statistics, such as a mean, to be "valid" (i.e., representative of the parameter being estimated for the time interval in question) only if 75% or more of the total possible observations have been measured during that time interval. Therefore, one should exercise caution when comparing these statistics between months and sites, particularly those that are not averages (e.g., maxima and exposures) whenever the number of valid observations is less than 75% of the total possible.

References

1. Lefohn, A.S., J. A. Laurence, and R. J. Kohut. 1988. A Comparison of Indices That Describe the Relationship Between Exposure to Ozone and Reduction in the Yield of Agricultural Crops. *Atmospheric Environment* 22, 1229-1240.

4.2 AIR QUALITY GLOSSARY

Acid Deposition: Air pollution produced when acid chemicals are incorporated into rain, snow, fog, or mist.

Aerometric Information Retrieval System (AIRS): A computer-based database of U.S. air pollution information administered by the EPA Office of Air Quality Planning and Standards (U.S. Environmental Protection Agency).

AIRWeb: Air Resources Web, an air quality information retrieval system for U.S. parks and wildlife refuges developed by the Air Resources Division of the National Park Service and the Air Quality Branch of the Fish and Wildlife Service.

Air Pollutant: An unwanted chemical or other material found in the air.

Air Pollution: Degradation of air quality resulting from unwanted chemicals or other materials occurring in the air.

Air Quality: The properties and degree of purity of air to which people and natural and heritage resources are exposed (in the context of national parks).

Air Pollution Control Permitting Process: Process by which facilities are permitted to emit specified types and quantities of air pollutants.

Air Quality Related Values (AQRVs): Values including visibility, flora, fauna, cultural and historical resources, odor, soil, water, and virtually all resources that are dependent upon and affected by air quality. "These values include visibility and those scenic, cultural, biological, and recreation resources of an area that are affected by air quality." (43 Fed. Reg. 15016)

Ambient Air: Air that is accessible to the public.

Class I: Areas of the country set aside under the Clean Air Act to receive the most stringent degree of air quality protection.

Class II: Areas of the country protected under the Clean Air Act but identified for somewhat less stringent protection from air pollution damage than Class I, except in specified cases.

Clean Air Act: Originally passed in 1963, our current national air pollution control program is based on the 1970 version of the law. Substantial revisions were made by the 1990 Clean Air Act Amendments.

Continuous Sampling Device: An air analyzer that measures air quality components continuously.

Criteria: Information on health and/or environmental effects of pollution (in the context of criteria air pollutants).

Criteria Air Pollutant: A group of very common air pollutants regulated by EPA on the basis of criteria and for which a National Ambient Air Quality Standard is established (SO₂, NO₂, PM₁₀, Pb, CO, O₃).

Emissions: Release of pollutants into the air from a source.

Environmental Protection Agency (EPA): The federal agency responsible for regulating air quality.

Monitoring: Measurement of air pollution.

National Ambient Air Quality Standards (NAAQS): Permissible levels of criteria air pollutant established to protect public health and welfare.

Ozone (O₃): A criteria air pollutant that is a strong oxidizing agent, reactive with many other compounds and surfaces, and a health hazard in high concentrations. Ozone is formed by nitrogen oxides and organic compounds reacting in sunlight.

Source: Any place or object from which air pollutants are released. Sources that are fixed in space are stationary sources; sources that move are mobile sources.

Sulfur Dioxide (SO₂): A criteria air pollutant that is a gas produced by burning coal and some industrial processes.

* Recent updates to this glossary may be found on the NPSARD AIRWeb - <http://www.aqd.nps.gov/natnet/ard/glossary.htm>.

4.3 GLOSSARY OF AIR QUALITY UNITS

Units Conversion Table			
Parameter Type	Multiply	By	To Obtain
Pollutant	ppm	1000	ppb
	ppm	1960	$\mu\text{g}/\text{m}^3$ Ozone (at 25°C)
	ppm	2615	$\mu\text{g}/\text{m}^3$ Sulfur Dioxide (at 25°C)
	ppb	0.001	ppm
	ppb	1.960	$\mu\text{g}/\text{m}^3$ Ozone (at 25°C)
	ppb	2.615	$\mu\text{g}/\text{m}^3$ Sulfur Dioxide (at 25°C)
	$\mu\text{g}/\text{m}^3$ Ozone (25°C)	0.0005102	ppm
	$\mu\text{g}/\text{m}^3$ Ozone (25°C)	0.5102	ppb
	$\mu\text{g}/\text{m}^3$ Sulfur Dioxide (25°C)	0.0003824	ppm
	$\mu\text{g}/\text{m}^3$ Sulfur Dioxide (25°C)	0.3824	ppb
Wind Speed	m/s	2.05	mph
	mph	0.489	m/s
Solar Radiation	ly/min	697	w/m^2
	w/m^2	0.00143	ly/min
Precipitation	mm/hr	0.0394	in/hr
	in/hr	25.4	mm/hr
Temperature	°C + 17.78	1.8	°F
	°F - 32	5/9	°C
Where: ppm = parts per million ppb = parts per billion $\mu\text{g}/\text{m}^3$ = micrograms per cubic meter (at 25°C) m/s = meters per second mph = miles per hour ly/min = langley's per minute w/m^2 = watts per square meter mm/hr = millimeters per hour in/hr = inches per hour °C = degrees centigrade °F = degrees fahrenheit			