

**Annual Data Summary
CHIRICAHUA NATIONAL MONUMENT
2002**

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



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At Chiricahua National Monument, the ARD specifically recognizes Ruth Olsen and Carrie Dennett 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 PROGRAM (GPMP)

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.

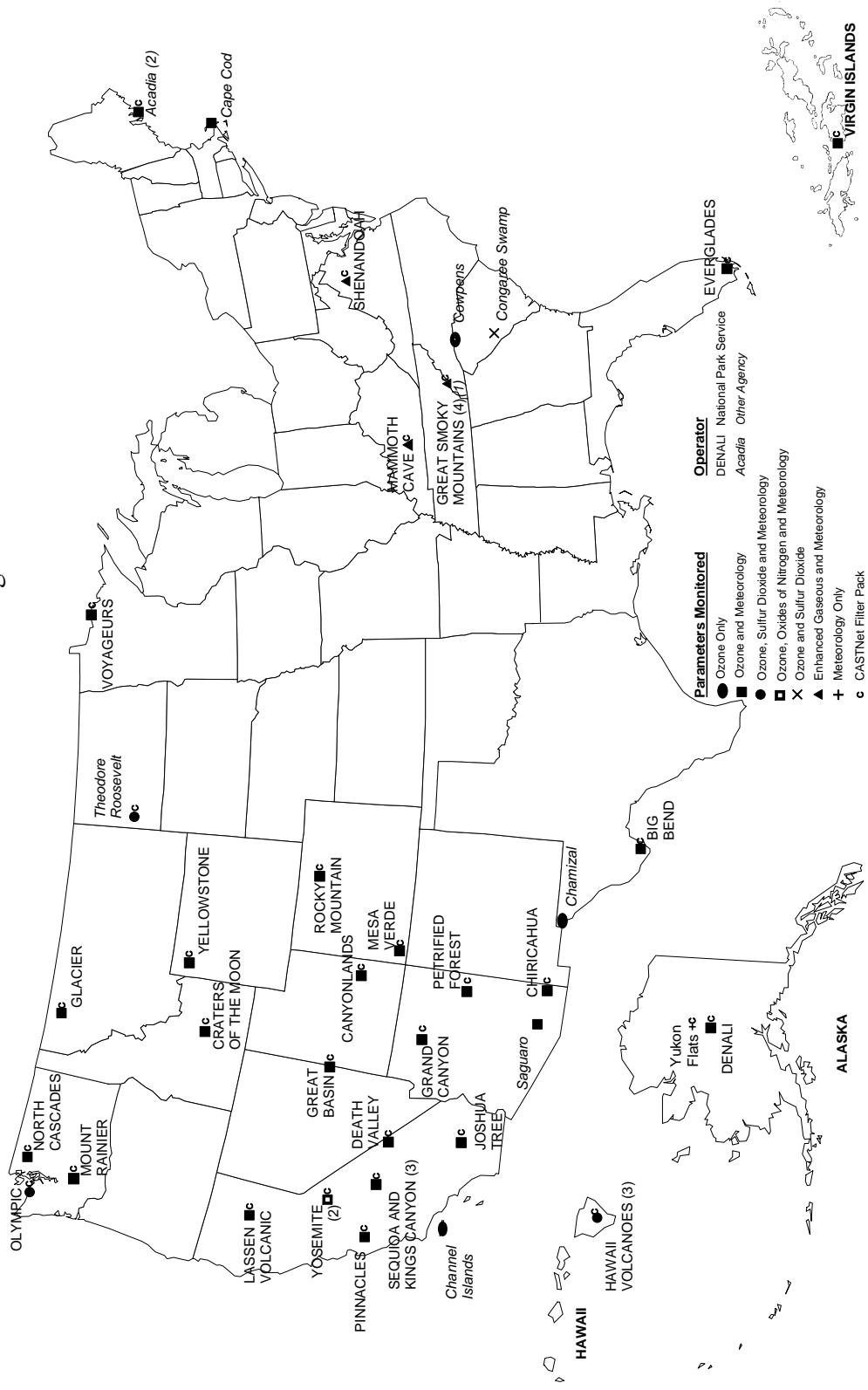
Other monitoring objectives call for the collection of data to support the National Park Service's required involvement in both the development of state air quality control plans, and the evaluation of permit applications for new or expanding air pollution sources wishing to locate near park units. The 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 Program site locations and measured parameters collected in this reporting year are shown on the map on the following page. During this reporting period, 47 monitoring sites in 37 units of the National Park System had some combination of ozone, sulfur dioxide, nitrogen, meteorological, and Clean Air Status and Trends Network (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 digital copy of all data collected during the year and data summary products are available; see Section 3.0 for information on obtaining these data. Individual reports are generated for each site where monitoring was conducted in the national park network.

NATIONAL PARK SERVICE
GASEOUS POLLUTANT MONITORING NETWORK

2002 Monitoring Sites

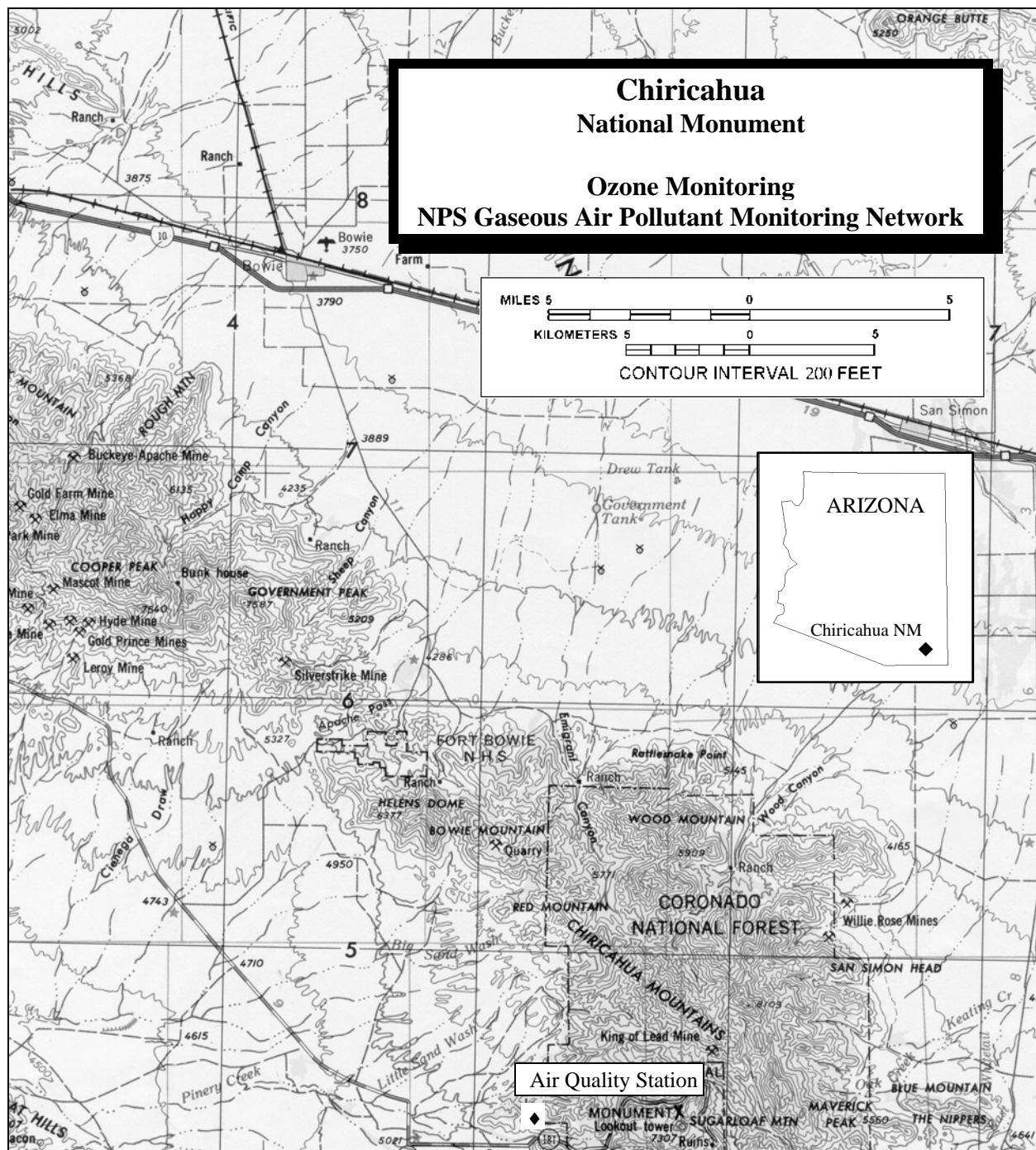


1.2 CHIRICAHUA NATIONAL MONUMENT

Chiricahua National Monument, a Class I area, is located near Cochise Head in the Sonoran Desert portion of the Basin and Range province of Southeast Arizona. Its location and site specifications are presented on the following page.

Chiricahua National Monument was proclaimed by Congress on April 18, 1924.

The monument, nearly 12,000 acres in size, is a variation of rock formations that were created millions of years ago by volcanic activity aided by erosion. The wilderness portion of the monument comprises 9,440 acres.



SITE IDENTIFICATION		MAP INFORMATION
Site Abbreviation: CHIR		Mean Elevation: 1570 m
INSTRUMENTATION		
O ₃ Analyzer	Temperature	Longitude: 109° 23' 21"W
Calibrator	Solar Radiation	Latitude: 32° 00' 33"N
Wind Speed	Precipitation	UTM Zone: 12
Wind Direction	Delta Temperature	Easting: 652145 m
Relative Humidity	Wetness	Northing: 3542401 m
	Filter Pack	Map Reference: Silver City Rev. 1970 NI 12-12 1:250,000

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
Chiricahua National Park

Final Validation

01/01/2002 - 12/31/2002

Parameter	Interval	Par Code	Data Recovery			Valid Data	
			No. Possible	No. Collected	% Collected	No. Valid	% Valid
Ozone Analyzer	hourly	O3	8760	7999	91.3	7550	86.2
Scalar Wind Speed	hourly	SWS	8760	8728	99.6	8728	99.6
Vector Wind Speed	hourly	VWS	8760	8728	99.6	8728	99.6
Vector Wind Direction	hourly	VWD	8760	8728	99.6	8728	99.6
Standard Deviation for Wind Direction	hourly	SDWD	8760	8728	99.6	8728	99.6
Ambient Temperature (aspirated)	hourly	TMP	8760	8740	99.8	8523	97.3
Delta Temperature	hourly	DTP	8760	8740	99.8	8519	97.2
Relative Humidity	hourly	RH	8760	8744	99.8	8744	99.8
Precipitation	hourly	RNF	8760	8686	99.2	8686	99.2
Wetness Sensor	hourly	WET	8760	8691	99.2	8690	99.2
Solar Radiation	hourly	SOL	8760	8742	99.8	8742	99.8
Filter Pack Flow Rate	hourly	FLOW	8760	8750	99.9	8750	99.9

Notes: 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.

Performance Goals:

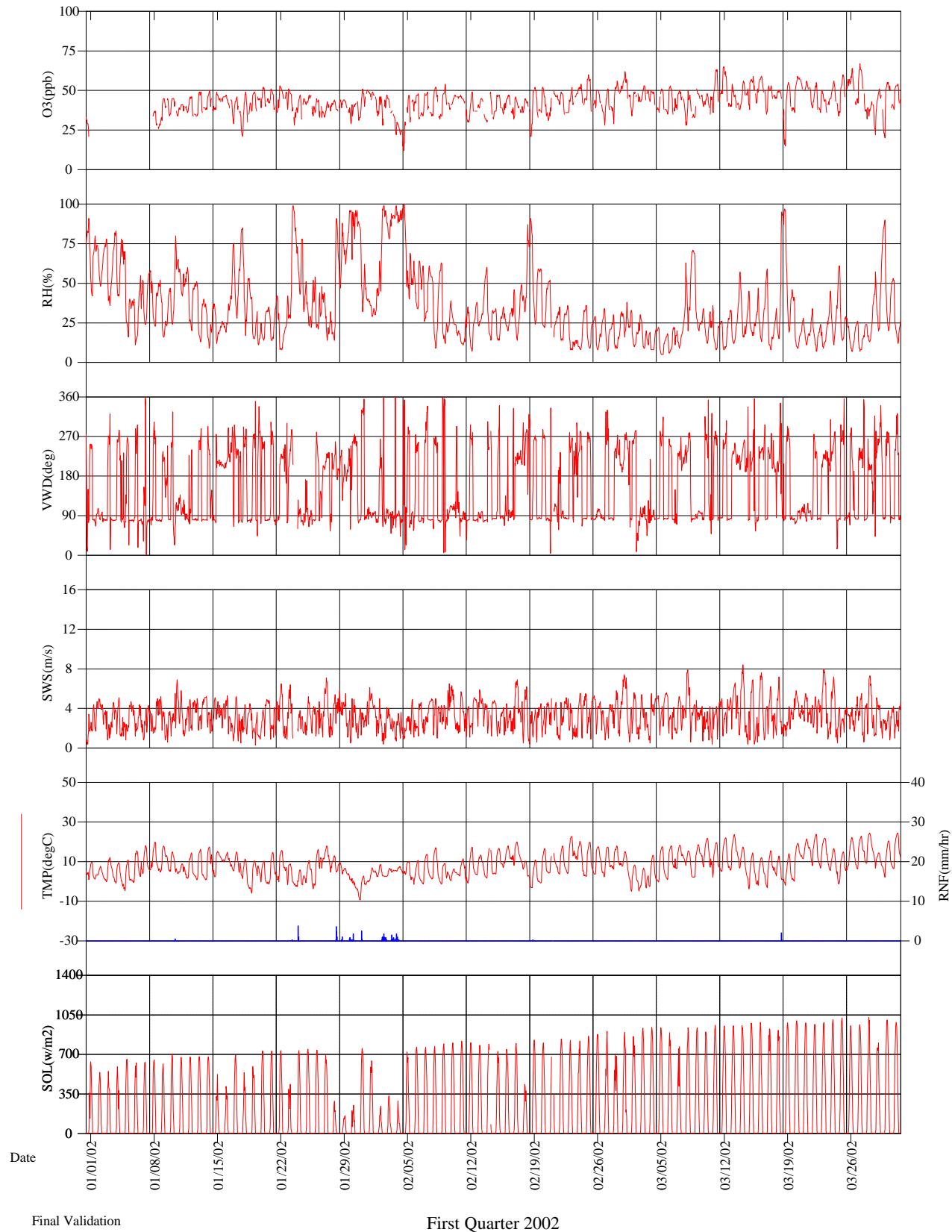
Quarterly Criteria:

100% of sites, >= 85% valid data capture
 90% of sites, >= 90% valid data capture
 80% of sites, >= 95% valid data capture

Monthly Criteria:

100% of sites, >= 60% valid data capture
 90% of sites, >= 75% valid data capture
 80% of sites, >= 85% valid data capture

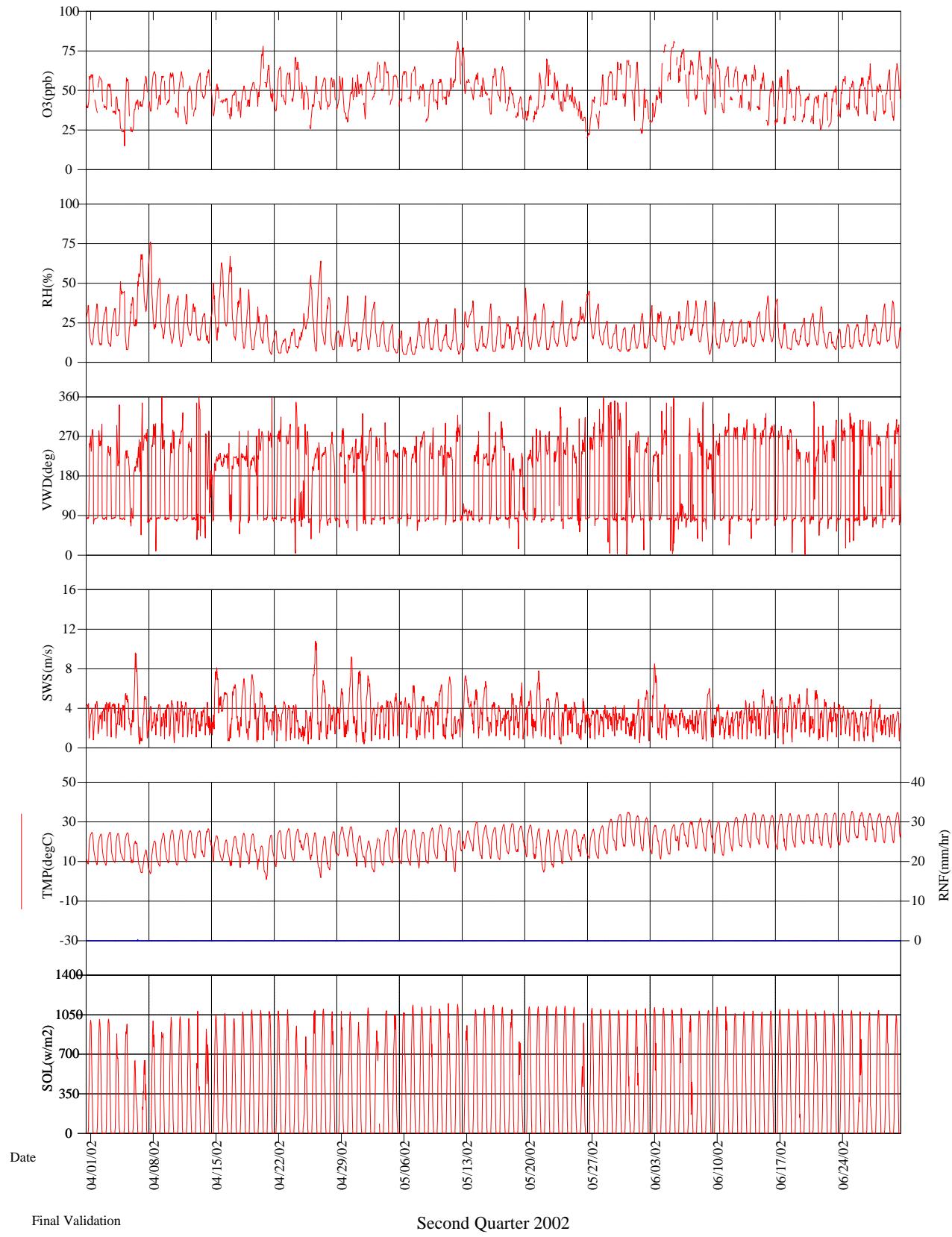
Chiricahua National Monument



Final Validation

First Quarter 2002

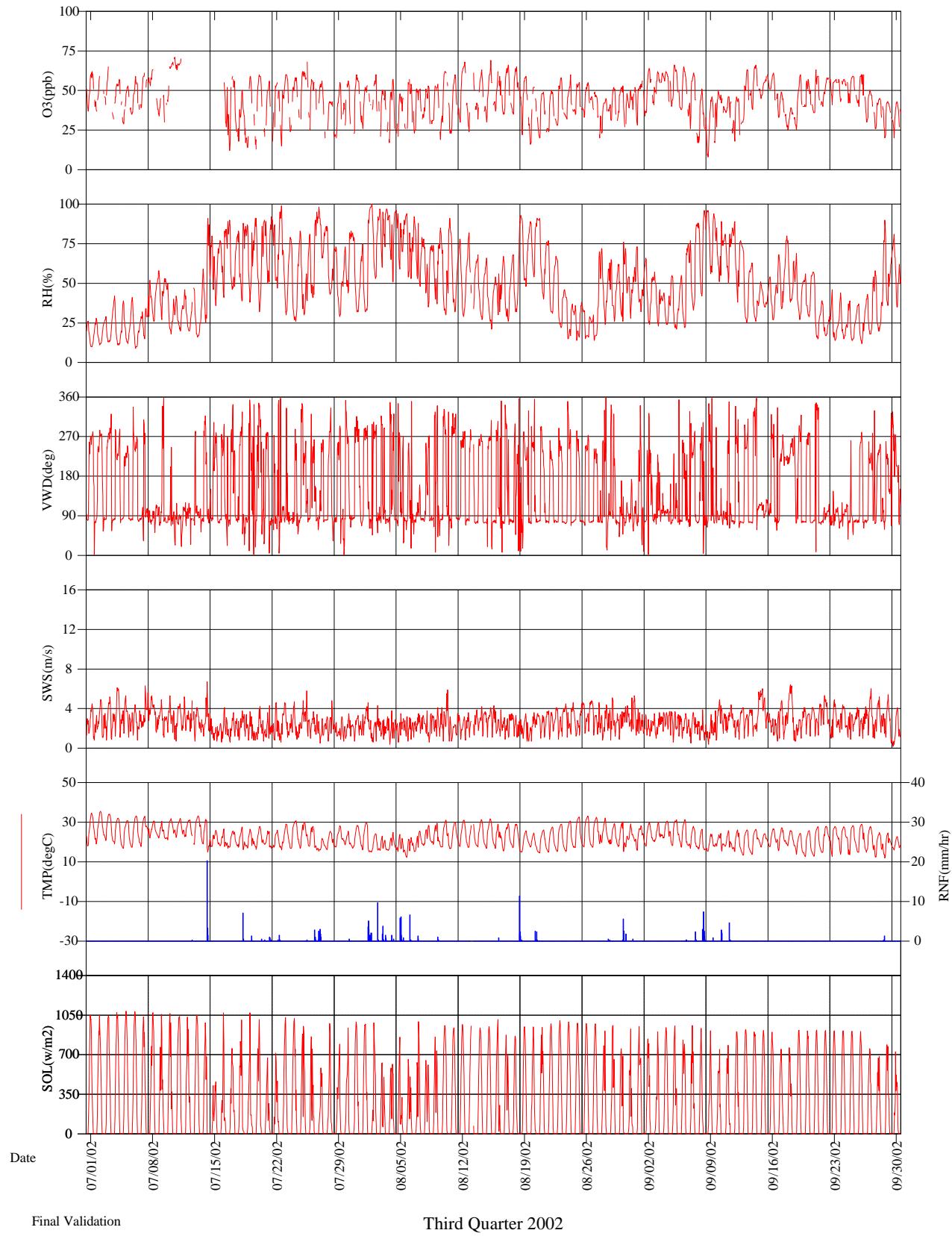
Chiricahua National Monument



Final Validation

Second Quarter 2002

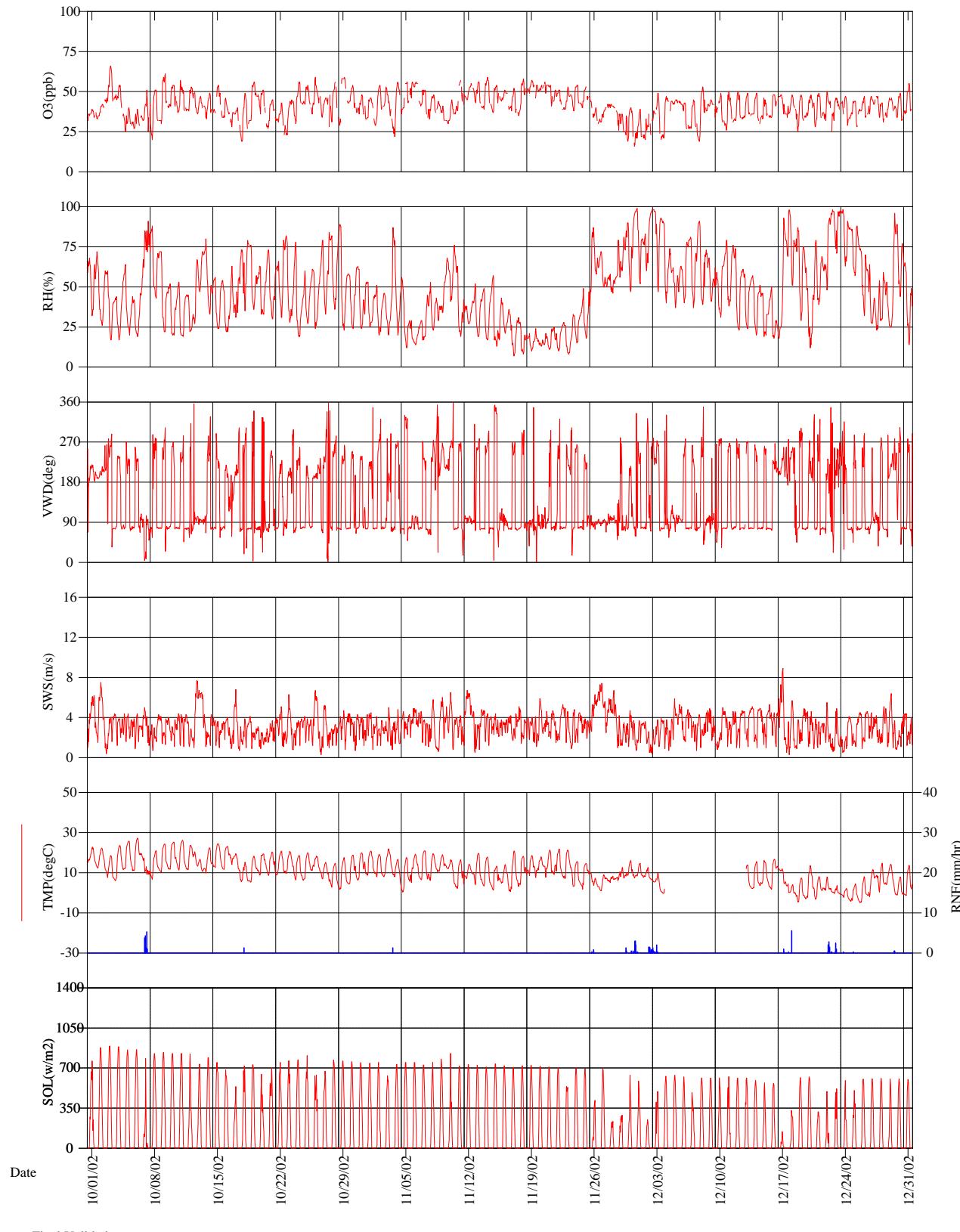
Chiricahua National Monument



Final Validation

Third Quarter 2002

Chiricahua National Monument



2.2 OZONE DATA SUMMARY

Ozone Quick Look Annual Summary Statistics
Chiricahua National Park

01/01/2002 - 12/31/2002

STATISTIC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MAY-SEP	ANNUAL
DAILY 1-HR MAXIMUM	53	60	67	78	81	81	71	69	66	59	55	81	81	81
NO. OF DAYS	(25)	(28)	(31)	(30)	(31)	(30)	(27)	(31)	(30)	(31)	(30)	(31)	(149)	(355)
AVERAGE DAILY MAXIMUM	46	49	55	58	60	62	58	56	56	51	47	58	54	54
NO. OF DAYS	(25)	(28)	(31)	(30)	(31)	(30)	(27)	(31)	(30)	(31)	(30)	(31)	(149)	(355)
MAXIMUM/DAILY MEAN	46	49	55	58	67	70	58	51	58	52	53	43	70	70
NO. OF DAYS	(23)	(27)	(31)	(30)	(31)	(30)	(19)	(27)	(30)	(31)	(30)	(31)	(137)	(340)
AVERAGE DAILY MEAN	41	41	46	47	49	44	44	43	45	41	44	39	47	44
NO. OF DAYS	(23)	(27)	(31)	(30)	(31)	(30)	(19)	(27)	(30)	(31)	(30)	(31)	(137)	(340)
MAX PEAK:MIN RATIO	2,333	3,917	3,667	3,867	2,308	2,615	4,917	3,353	5,750	2,579	2,545	2,789	5,750	5,750
NO. OF DAYS	(23)	(27)	(31)	(30)	(31)	(30)	(19)	(27)	(30)	(31)	(30)	(31)	(137)	(340)
AVERAGE PEAK:MIN RATIO	1,432	1,629	1,614	1,737	1,652	1,829	2,715	2,184	1,963	1,658	1,482	1,670	2,011	1,771
NO. OF DAYS	(23)	(27)	(31)	(30)	(31)	(30)	(19)	(27)	(30)	(31)	(30)	(31)	(137)	(340)
MAX 9AM-4PM AVERAGE	51	57	63	67	77	78	67	62	64	61	56	51	78	78
NO. OF DAYS	(24)	(26)	(31)	(30)	(31)	(30)	(23)	(31)	(30)	(31)	(30)	(31)	(145)	(348)
MONTHLY 9AM-4PM AVERAGE	44	46	52	54	54	57	54	52	52	47	48	44	54	51
NO. OF DAYS	(24)	(26)	(31)	(30)	(31)	(30)	(23)	(31)	(30)	(31)	(30)	(31)	(145)	(348)
MAX 7AM-7PM AVERAGE	49	52	60	65	74	77	67	60	60	58	55	47	77	77
NO. OF DAYS	(24)	(26)	(31)	(30)	(31)	(30)	(22)	(30)	(30)	(31)	(30)	(31)	(143)	(346)
MONTHLY 7AM-7PM AVERAGE	42	44	50	52	54	56	52	49	50	45	46	41	52	48
NO. OF DAYS	(24)	(26)	(31)	(30)	(31)	(30)	(22)	(30)	(30)	(31)	(30)	(31)	(143)	(346)
MONTHLY MEAN	41	41	46	47	49	49	45	43	45	41	44	39	47	44
NO. OF HOURS	(527)	(600)	(676)	(651)	(669)	(643)	(488)	(638)	(658)	(675)	(650)	(675)	(3096)	(7550)
SUM0 EXPOSURE INDEX	21,453	24,769	31,401	30,735	32,982	31,533	22,200	27,532	29,809	27,904	28,560	26,076	14,4056	33,4954
NO. OF HOURS	(527)	(600)	(676)	(651)	(669)	(643)	(488)	(638)	(658)	(675)	(650)	(675)	(3096)	(7550)
SUM60 EXPOSURE INDEX	-	60	1,689	3,885	7,526	8,808	3,588	2,876	3,541	4,45	-	-	26,339	32,418
NO. OF HOURS	(0)	(1)	(27)	(61)	(116)	(132)	(56)	(46)	(57)	(7)	(0)	(0)	(407)	(503)
SUM80 EXPOSURE INDEX	-	-	-	-	161	321	-	-	-	-	-	-	482	482
NO. OF HOURS	(0)	(0)	(0)	(0)	(2)	(4)	(0)	(0)	(0)	(0)	(0)	(0)	(6)	(6)
W126 EXPOSURE INDEX	1047	1,487	3,601	4,518	6,228	6,908	3,686	3,139	4,123	2,085	2,492	1,144	24,084	40,459
NO. OF HOURS	(527)	(600)	(676)	(651)	(669)	(643)	(488)	(638)	(658)	(675)	(650)	(675)	(3096)	(7550)

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

Final Validation

* Statistics defined in the Quick Look subsection of the Glossary

Frequency Distribution

Chiricahua National Park

Monitoring Season: 01/01/02 - 12/31/02¹

Averaging Period	% Obs. ³	# Obs. ²	Min.	Percentile ⁵					Max.	2nd Max.	Arith. Mean	Geo. Mean	Geo. Stdv.		
				10	30	50	70	90							
1-Hour	94	7550	0.034	0.045	0.049	0.054	0.058	0.065	0.068	0.077	0.081	0.081	0.0542	0.0536	1.16
Concentrations in parts per million (ppm)															

¹Records 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.

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

³The 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..

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

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

Ozone Standards Report and
Daily Maximum 1-Hour Concentrations (ppm)
Chiricahua National Park

01/01/2002 - 12/31/2002

Day	Jan-02	Feb-02	Mar-02	Apr-02	May-02	Jun-02	Jul-02	Aug-02	Sep-02	Oct-02	Nov-02	Dec-02
1	T	.050	F	.062	M	.060	W	.068	S	.062	M	.053
2	W	.046	S	.049	S	.059	T	.062	T	.051	S	.064
3	T	.047	S	.053	S	.054	W	.068	F	.049	M	.050
4	F	.034	M	.050	M	.046	T	.068	S	.057	T	.062
5	S	.047	T	.051	T	.058	F	.060	S	.081	W	.053
6	S	.048	W	.053	W	.044	S	.062	M	.076	T	.059
7	M	.049	T	.050	T	.059	S	.065	T	.069	F	.061
8	.037	T	.052	F	.050	F	.062	M	.054	W	.075	S
9	.045	W	.054	S	.051	S	.059	T	.057	T	.071	S
10	.045	T	.047	S	.048	S	.061	W	.057	F	.070	M
11	.041	F	.047	M	.063	M	.062	T	.058	S	.065	T
12	.046	S	.049	T	.065	T	.053	F	.081	S	.065	W
13	.049	S	.045	W	.054	W	.061	S	.077	M	.060	T
14	.050	M	.050	T	.056	T	.063	S	.061	T	.066	F
15	.049	T	.047	F	.059	F	.054	M	.058	W	.061	S
16	.047	W	.047	S	.059	S	.045	T	.064	T	.056	S
17	.046	T	.046	S	.053	S	.050	W	.065	F	.059	W
18	.049	F	.045	M	.050	M	.053	T	.052	S	.063	T
19	.049	S	.052	T	.055	T	.055	F	.046	S	.053	W
20	.052	S	.052	W	.059	W	.078	S	.047	M	.048	T
21	.051	M	.051	T	.056	T	.066	S	.061	T	.047	F
22	.053	T	.049	F	.055	F	.065	M	.070	W	.049	S
23	.051	W	.052	S	.050	S	.061	T	.061	T	.053	W
24	.047	T	.054	S	.056	S	.071	W	.054	F	.059	M
25	.047	F	.060	M	.060	M	.055	T	.052	S	.056	T
26	.045	S	.050	T	.064	T	.059	F	.043	S	.058	W
27	.043	S	.051	W	.067	W	.058	S	.046	M	.067	T
28	.044	M	.056	T	.043	T	.058	S	.060	T	.054	F
29	.044	T	.051	F	.059	M	.062	W	.063	S	.055	M
30	.043	W	.055	S	.058	T	.068	T	.067	S	.056	T
31	.051	T	.054	S	.069	F	.069	F	.081	.081	.070	.069
Valid Days	24	26	31	30	31	29	21	30	30	31	30	30
Maximum	.053	.060	.067	.078	.081	.081	.081	.070	.069	.066	.066	.053
Violations	0	0	0	0	0	0	0	0	0	0	0	0

7528 Total Samples
86.2 % Possible
343 Valid daily maxima

Final Validation

0 Daily-maxima exceeding the standard of .12 ppm (starred[*])
4 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)

4/22/03

Chiricahua National Park

2002 Attainment Status With U.S. Environmental Protection Agency (EPA) PRIMARY Ozone National Ambient Air Quality Standard

Ozone Season: January through December

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 during the reported year 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 reported year highest five daily maximum 8-hour averages are also tabulated. A 'No' 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 Complete	Data Complete %	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)
2002	69	92%		Yes	77	74	72	69	68

Ozone Analyzer
10 Highest Daily 1-Hour Average Maximum Concentrations
Chiricahua National Park

Final Validation
 01/01/2002 - 12/31/2002

Value	Date	Hour	Concentration (ppb)
Ozone Analyzer			
1	05/12/2002	12	81
2	06/05/2002	16	81
3	06/04/2002	16	79*
4	04/20/2002	18	78
5	05/13/2002	3	77
6	06/06/2002	16	76*
7	06/08/2002	13	75
8	04/24/2002	9	71
9	06/09/2002	17	71
10	07/11/2002	0	71

* This value was also recorded during one or more hours later in the day.

Episodes with 1-Hour Ozone Concentrations
≥ 100 ppb and > 124 ppb
Chiricahua National Park

01/01/2002 - 12/31/2002
FINAL VALIDATION

Site	Date	Beginning Hour	No. Hours		Max (ppb)
			≥ 100 ppb	>124 ppb	
No values greater than or equal 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 ug/m³ exceeds the standard.) (40 CFR 50.9 with reference to Appendix D and H.)

Episodes with 8-Hour Average Ozone Concentrations > 84 ppb

Chiricahua National Park

01/01/2002 - 12/31/2002

FINAL VALIDATION

Site	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).

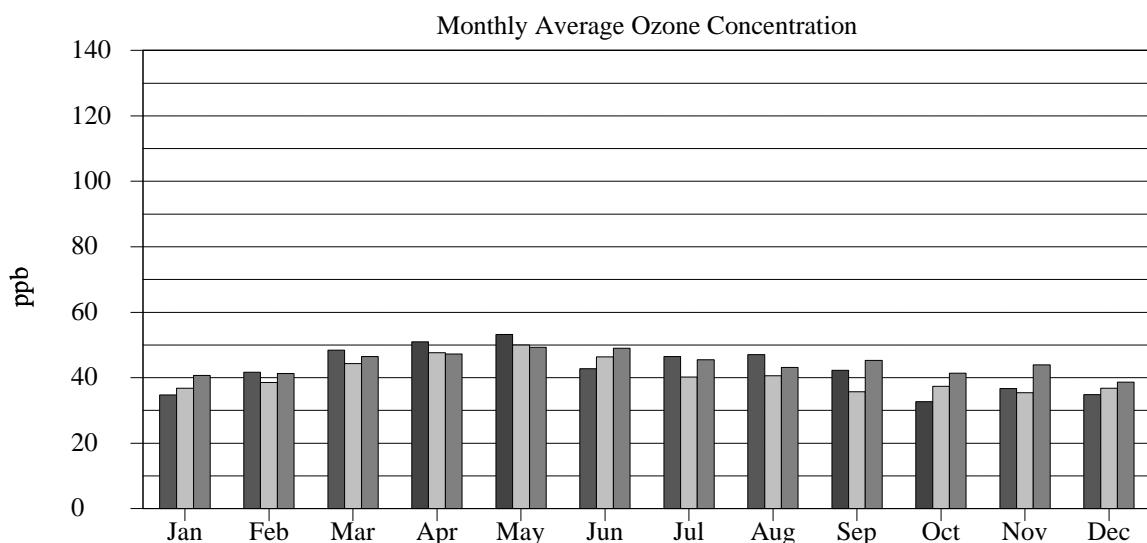
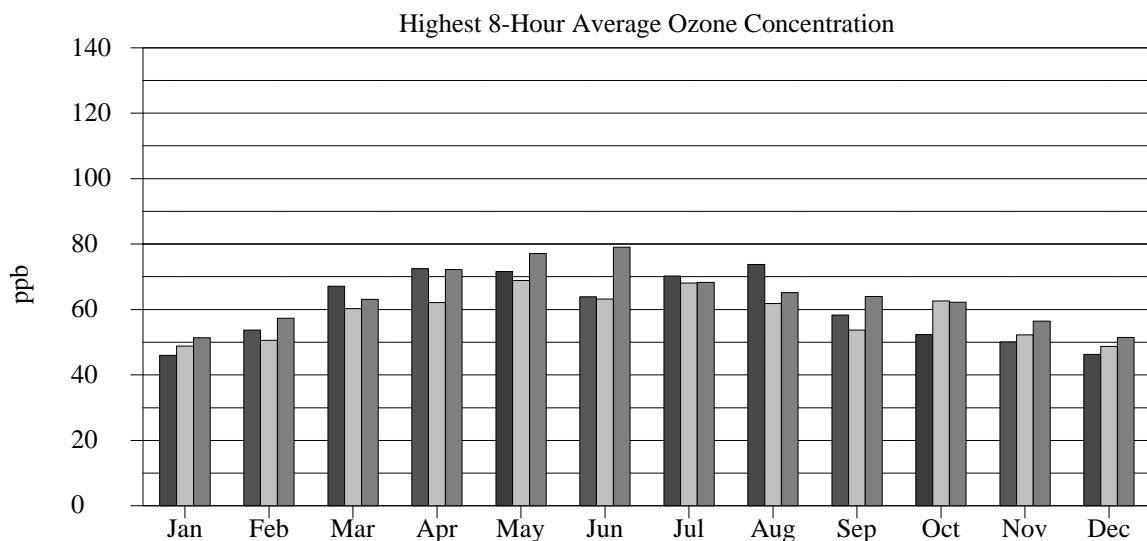
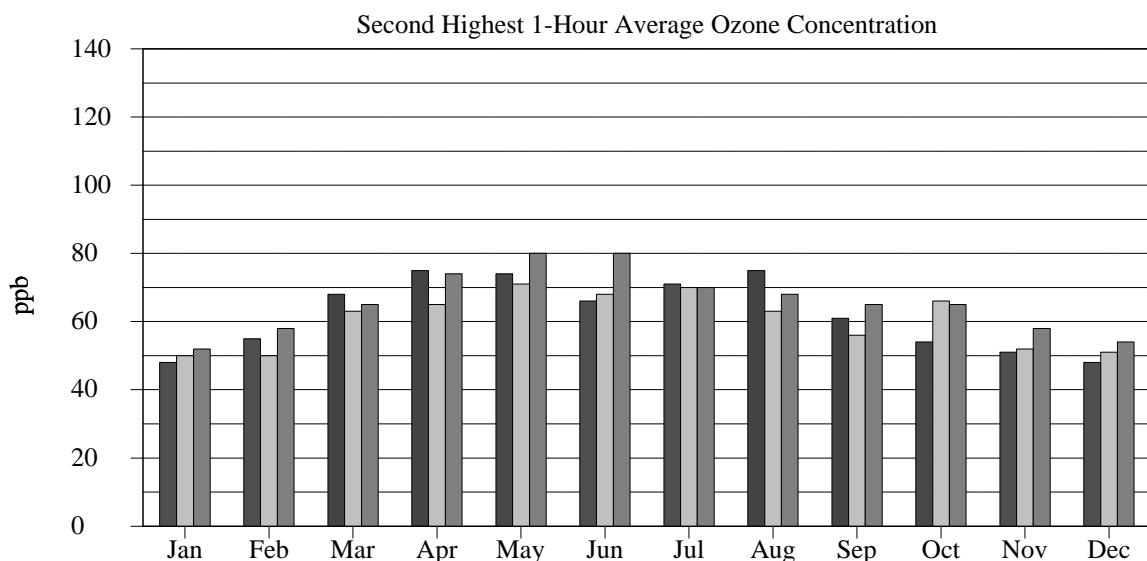
**Ozone Rank Listings of Second Highest 1-Hour Average Concentrations, 4th Highest
8-Hour Average Concentrations, and Annual SUM60 Exposure Index for All NPS Monitoring Sites**

01/01/2002 - 12/31/2002

Second Highest 1-Hour Average Concentration		
Site	Rank	Concentration (ppb)
ACAD-CM	1	127
CHAM-XX	2	127
JOTR-YV	3	127
SEKI-LK	4	126
SEKI-AS	5	124
SEKI-LP	6	124
GRSM-LR	7	122
CACO-XX	8	118
COWP-XX	9	118
ACAD-MH	10	117
GRSM-CM	11	117
GRSM-CD	12	115
COSW-BL	13	111
MACA-HM	14	110
PINN-ES	15	110
GRSM-CC	16	108
ROMO-LP	17	106
GRSM-PK	18	105
YOSE-TD	19	105
SHEN-BM	20	103
DEVA-PV	21	97
SAGU-PC	22	90
GRBA-MY	23	89
GRCA-AS	24	85
LAVO-ML	25	84
CHIR-ES	26	80
YOSE-MR	27	80
MEVE-MY	28	79
CHIS-XX	29	78
CANY-IS	30	77
CRMO-VC	31	75
YELL-WT	32	73
THRO-VC	33	71
MORA-TW	34	70
NOCA-MM	35	70
VOYA-SB	36	70
PEFO-HB	37	69
BIBE-KB	38	68
EVER-BC	39	68
DENA-HQ	40	65
GLAC-WG	41	59
VIIS-LP	42	57
HAVO-TH	43	50
OLYM-VC	44	44

4th Highest 8-hour Average Concentration		
Site	Rank	Concentration (ppb)
SEKI-LP	1	109
SEKI-LK	2	108
JOTR-YV	3	107
SEKI-AS	4	107
GRSM-CM	5	103
GRSM-LR	6	102
GRSM-CD	7	101
ACAD-CM	8	100
GRSM-PK	9	94
CACO-XX	10	93
COWP-XX	11	93
YOSE-TD	12	93
ACAD-MH	13	89
CHAM-XX	14	89
ROMO-LP	15	87
PINN-ES	16	86
SHEN-BM	17	86
MACA-HM	18	85
DEVA-PV	19	83
COSW-BL	20	82
GRSM-CC	21	82
GRCA-AS	22	79
SAGU-PC	23	77
LAVO-ML	24	75
GRBA-MY	25	74
CANY-IS	26	72
YOSE-MR	27	72
MEVE-MY	28	70
CHIR-ES	29	69
CRMO-VC	30	69
CHIS-XX	31	66
YELL-WT	32	66
VOYA-SB	33	65
BIBE-KB	34	62
THRO-VC	35	62
EVER-BC	36	57
DENA-HQ	37	55
PEFO-HB	38	55
GLAC-WG	39	52
MORA-TW	40	52
VIIS-LP	41	48
NOCA-MM	42	46
HAVO-TH	43	42
OLYM-VC	44	39

Annual Sum60 Exposure Index		
Site	Rank	Sum60 Count
SEKI-LK	1	204306 2639
SEKI-AS	2	196849 2529
SEKI-LP	3	193795 2491
JOTR-YV	4	175177 2398
GRSM-CM	5	169849 2320
YOSE-TD	6	164764 2298
GRSM-LR	7	131936 1794
GRSM-CD	8	130649 1793
GRSM-PK	9	118538 1656
DEVA-PV	10	106174 1586
GRCA-AS	11	104360 1584
ROMO-LP	12	95145 1403
SHEN-BM	13	88006 1273
CANY-IS	14	68738 1068
COWP-XX	15	66858 924
PINN-ES	16	54322 767
MEVE-MY	17	49400 771
GRSM-CC	18	42779 611
CACO-XX	19	39974 546
MACA-HM	20	39775 571
ACAD-CM	21	39360 529
SAGU-PC	22	35867 540
COSW-BL	23	34655 491
CHAM-XX	24	34216 482
CRMO-VC	25	34186 537
CHIR-ES	26	32418 503
GRBA-MY	27	30461 466
YELL-WT	28	29522 470
ACAD-MH	29	26476 362
LAVO-ML	30	26432 394
YOSE-MR	31	22272 334
VOYA-SB	32	7405 116
BIBE-KB	33	7215 116
CHIS-XX	34	6974 106
THRO-VC	35	4004 63
DENA-HQ	36	996 16
PEFO-HB	37	951 15
EVER-BC	38	833 13
MORA-TW	39	453 7
NOCA-MM	40	267 4
GLAC-WG	41	124 2
HAVO-TH	42	0 0
OLYM-VC	43	0 0
VIIS-LP	44	0 0

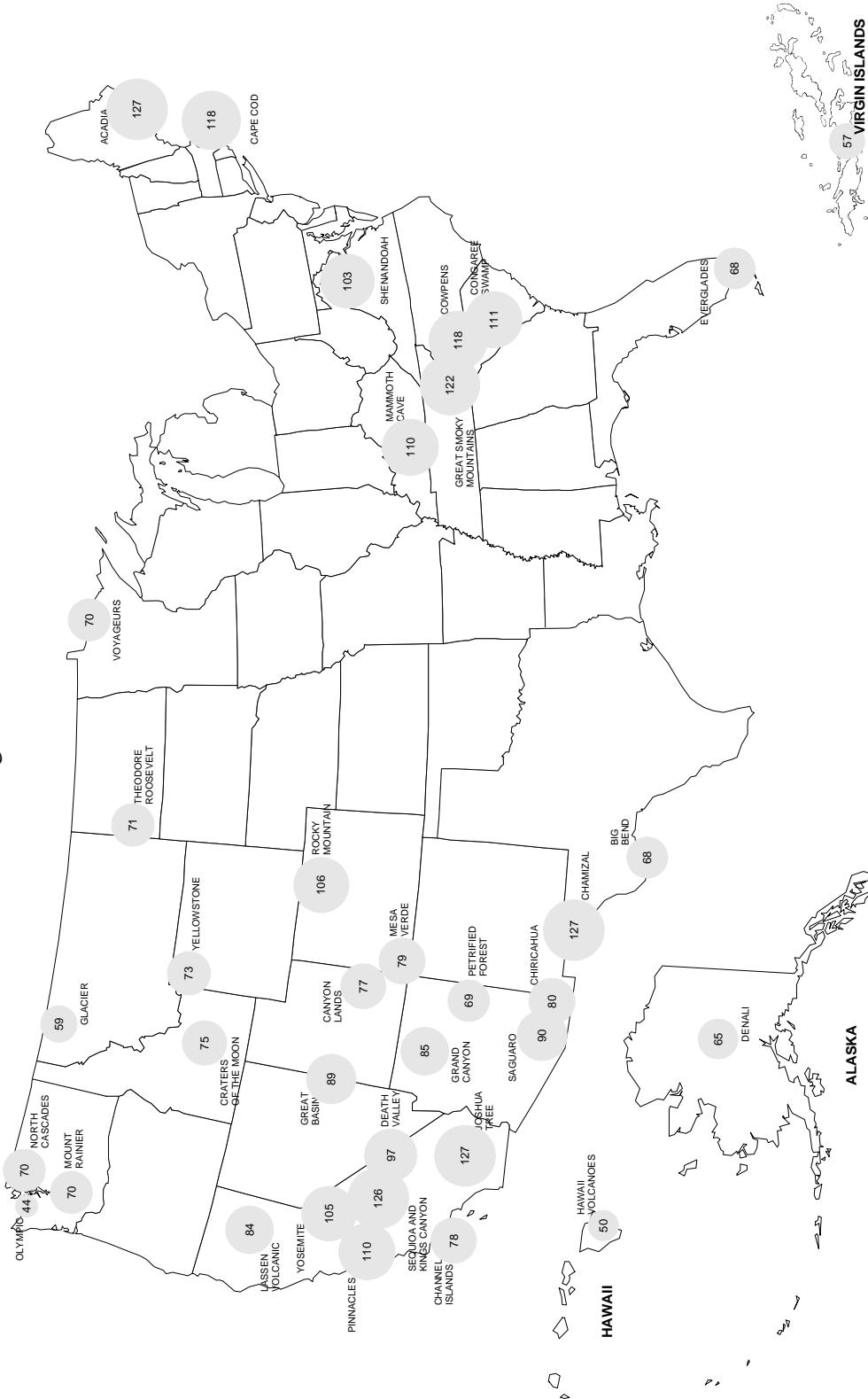


Legend

2000
2001
2002

NATIONAL PARK SERVICE
GASEOUS POLLUTANT MONITORING NETWORK

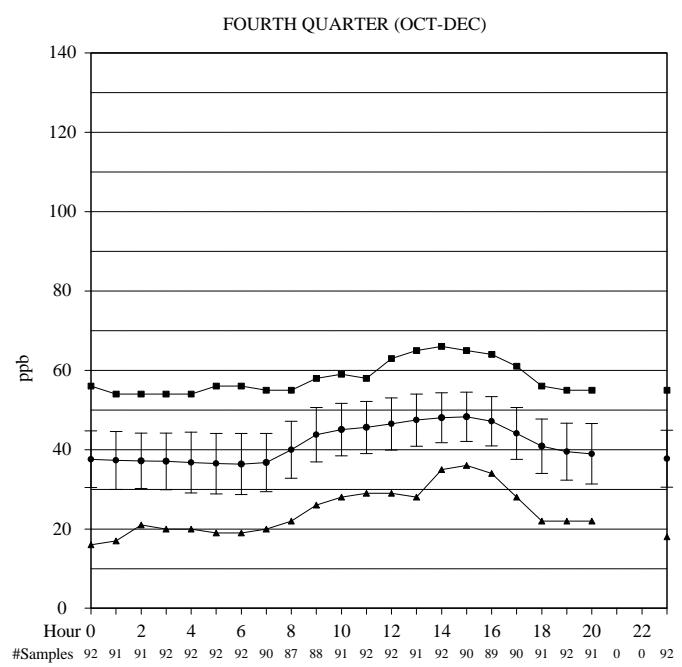
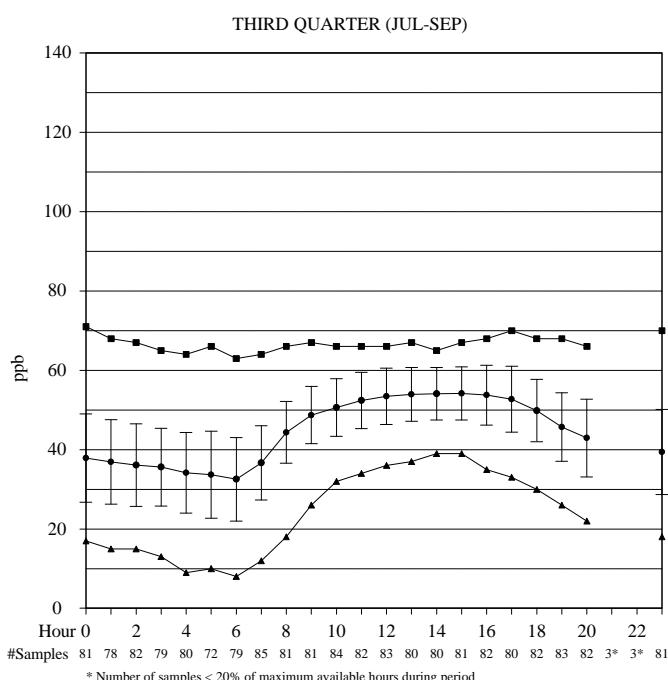
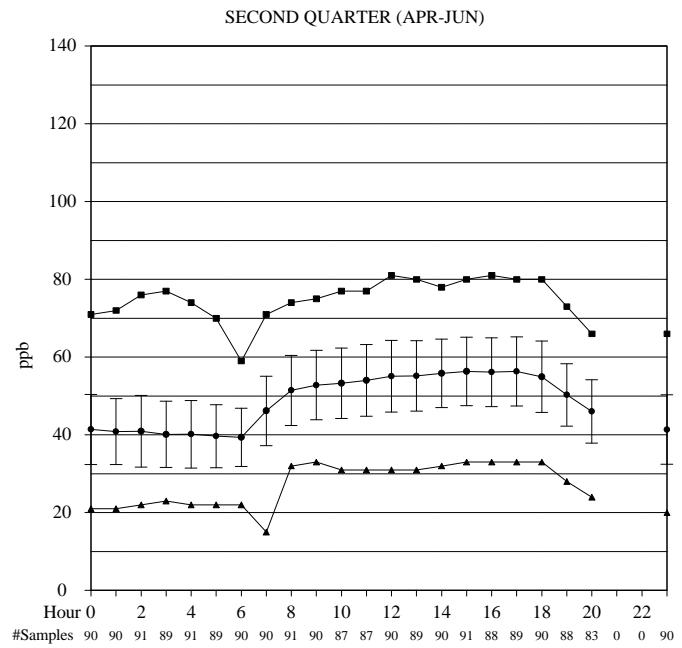
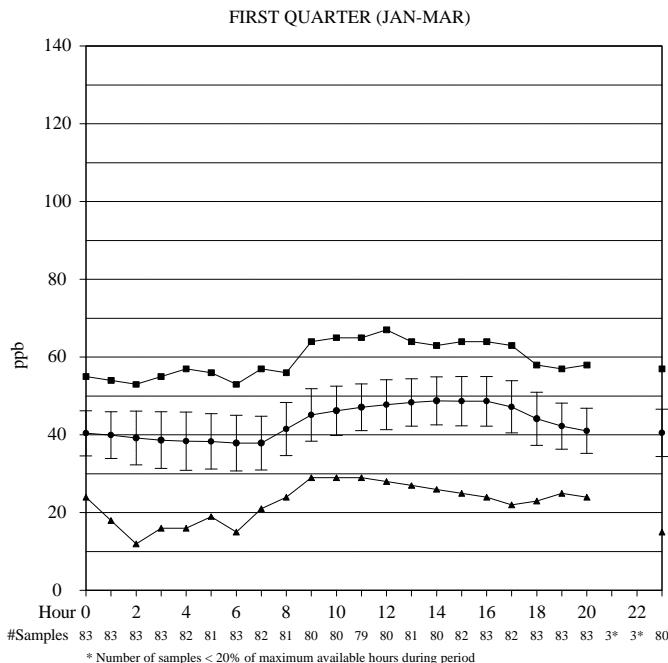
2002 Second Highest 1-Hour Ozone Concentrations



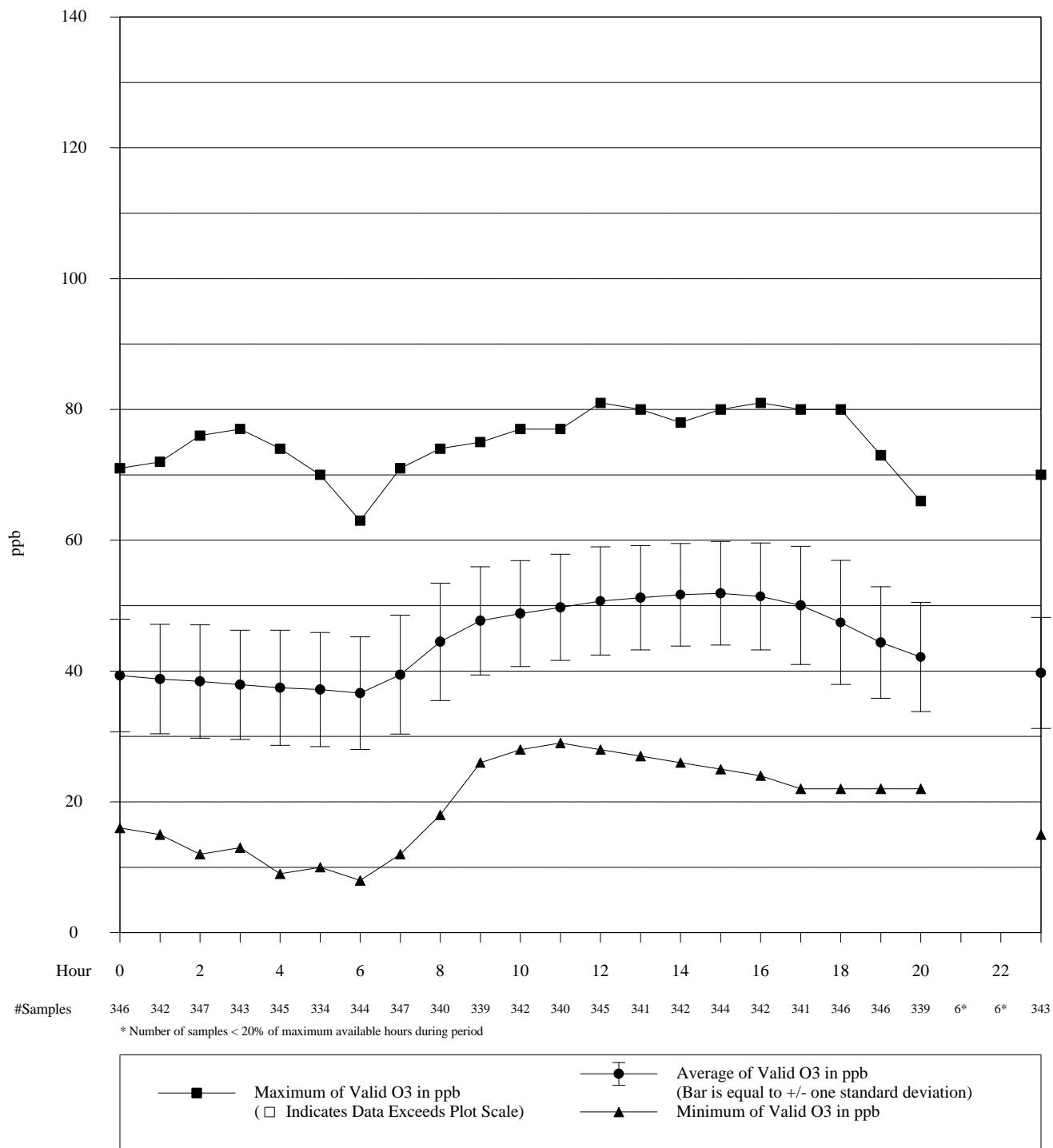
Chiricahua National Park
Entrance Station

Quarterly Diurnal
Ozone Plots

2002



—■— Maximum of Valid O ₃ in ppb	—±— Average of Valid O ₃ in ppb (Bar is equal to ± one standard deviation)
□ Indicates Data Exceeds Plot Scale	—▲— Minimum of Valid O ₃ in ppb

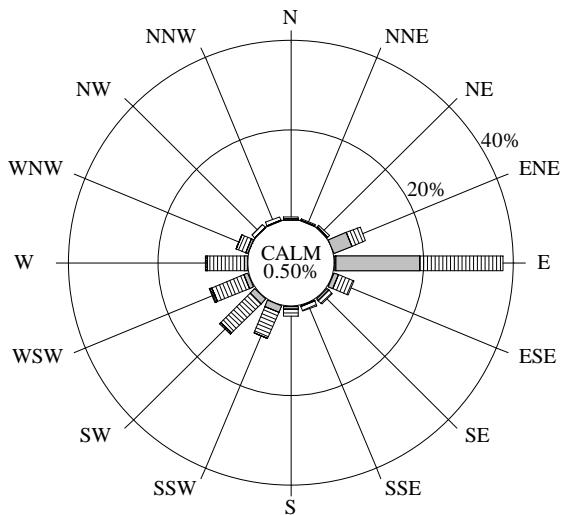


Chiricahua National Park

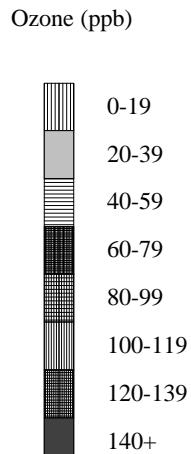
Quarterly Ozone
Pollutant Rose

2002

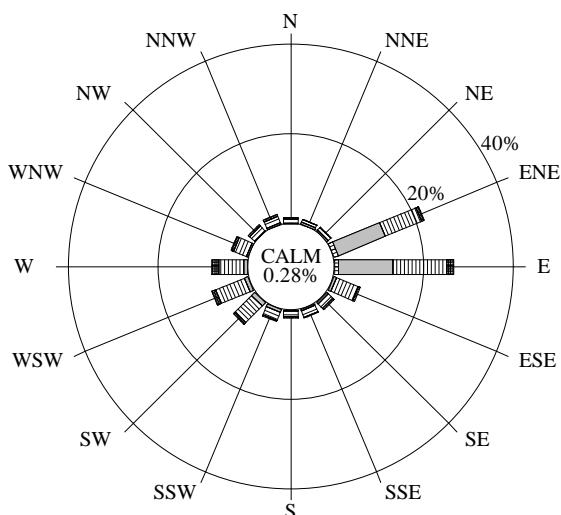
FIRST QUARTER (JAN-MAR)



91.2% Collected 82.9% Valid
2160 Possible / 1969 Collected / 1791 Valid
(includes WS and WD)



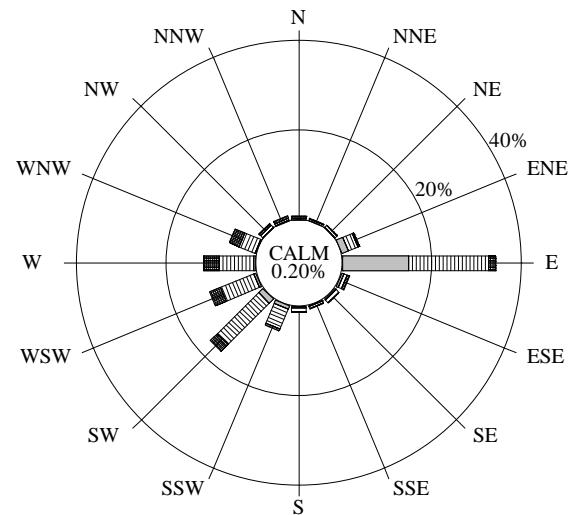
THIRD QUARTER (JUL-SEP)



90.9% Collected 80.8% Valid
2208 Possible / 2008 Collected / 1784 Valid
(includes WS and WD)

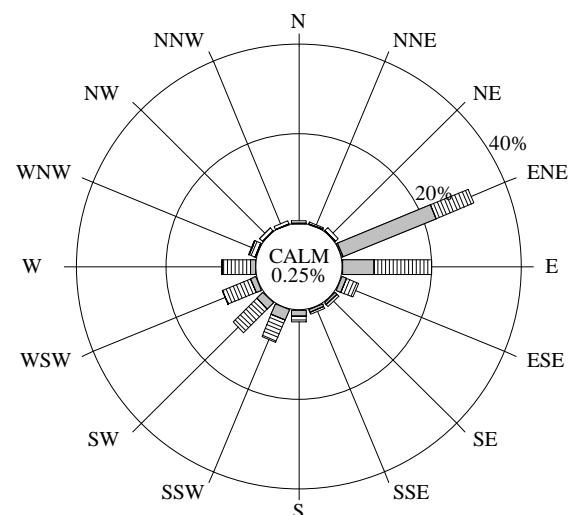
Final Validation

SECOND QUARTER (APR-JUN)



91.4% Collected 89.9% Valid
2184 Possible / 1997 Collected / 1963 Valid
(includes WS and WD)

FOURTH QUARTER (OCT-DEC)



91.1% Collected 90.5% Valid
2208 Possible / 2011 Collected / 1998 Valid
(includes WS and WD)

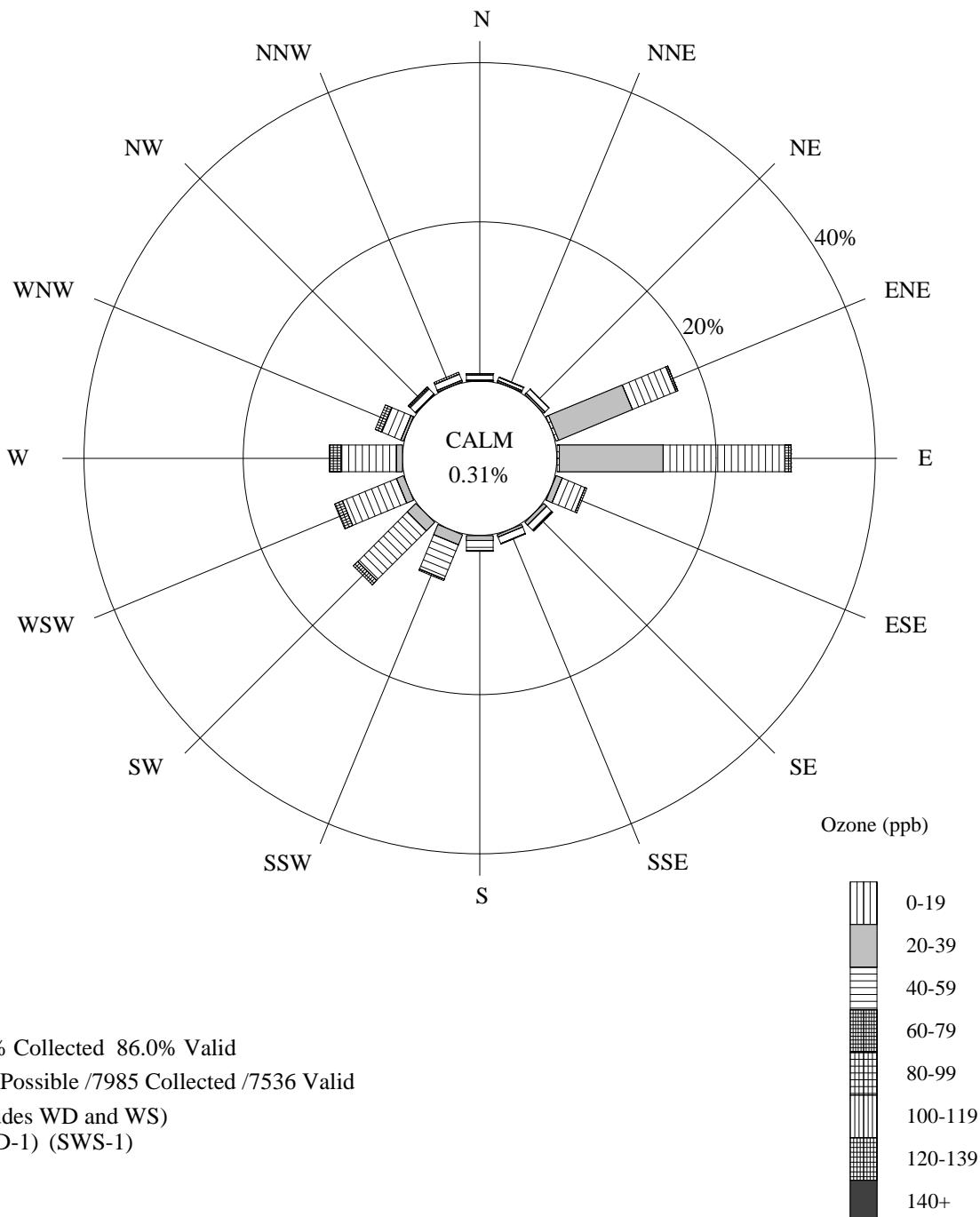
2-20

04-18-2003

Chiricahua National
Monument

Annual Ozone
Pollutant Rose

2002



Ozone Analyzer Precision Check Summary
Chiricahua 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 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.¹ According to NPS Standard Operating Procedures, the pollutant analyzer must respond within 10% of the transfer standard. The table below gives the number of precision checks performed during each quarter, the average² of all the individual precision check percent differences for the quarter, and the upper and lower 95% probability limits³ 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 Validation 01/01/2002 - 12/31/2002				
Calendar Quarter	Number of Precision Checks	Average Percent Difference ^{1 2}	Lower 95% Probability Limit ³	Upper 95% Probability Limit ³
1	80	1.38	0.38	2.38
2	84	1.26	-0.55	3.06
3	78	0.66	-2.50	3.83
4	92	2.35	1.15	3.55

¹ Percent Difference= $\frac{\text{analyzer} - \text{transfer std}}{\text{transfer std}}$ X 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

Chiricahua National Park

Final Validation

01/01/2002 - 12/31/2002

Parameter	Value	Units	Number	Std Dev
SCALAR WIND SPEED				
Average	3.1	m/s	8728	1.4
Maximum	10.8	m/s		
Percent calm = 0.28				
AMBIENT TEMPERATURE				
Average	15.6	degC	8523	8.8
Maximum	35.6	degC		
Minimum	-9.3	degC		
RELATIVE HUMIDITY				
Average	38	percent	8744	23
Maximum	100	percent		
Minimum	5	percent		
PRECIPITATION (Rainfall or Snow melt)				
Average non-zero rate	1.4	mm/hr	210	2.1
Maximum non-zero rate	20.3	mm/hr		
Minimum non-zero rate	.3	mm/hr		
Accumulated during period	304.3	mm		
SOLAR RADIATION				
Average Daily Total	18,548,720	joules/m ² day	360	6,866,842
Maximum Daily Total	30,105,600	joules/m ² day		
Minimum Daily Total	1,712,000	joules/m ² 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.

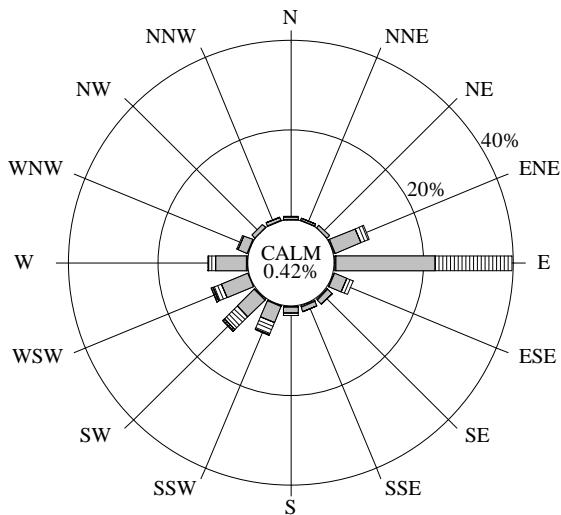
NA indicates instrument not available.

Chiricahua National Park

Quarterly Wind Rose

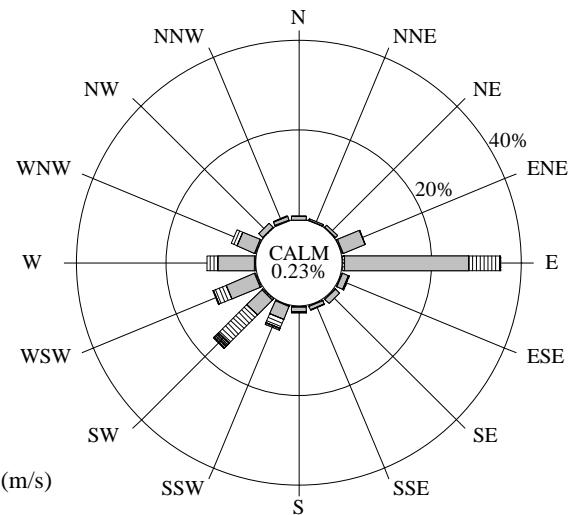
2002

FIRST QUARTER (JAN-MAR)



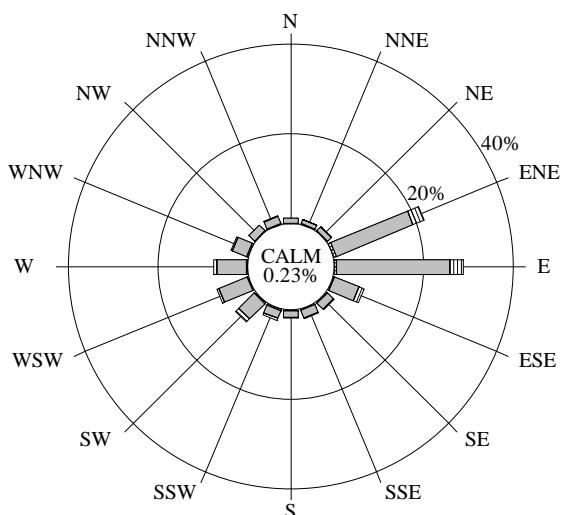
99.1% Collected 99.1% Valid
2160 Possible /2140 Collected /2140 Valid
(includes WS and WD)

SECOND QUARTER (APR-JUN)



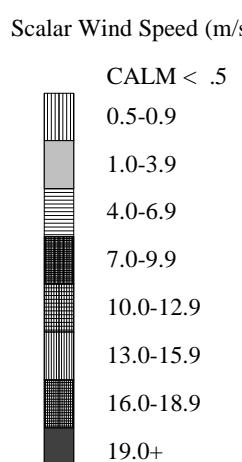
99.9% Collected 99.9% Valid
2184 Possible /2182 Collected /2182 Valid
(includes WS and WD)

THIRD QUARTER (JUL-SEP)

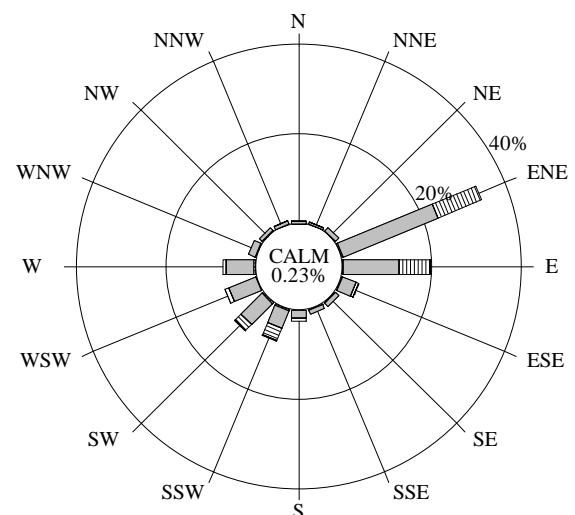


99.6% Collected 99.6% Valid
2208 Possible /2200 Collected /2200 Valid
(includes WS and WD)

Final Validation



FOURTH QUARTER (OCT-DEC)

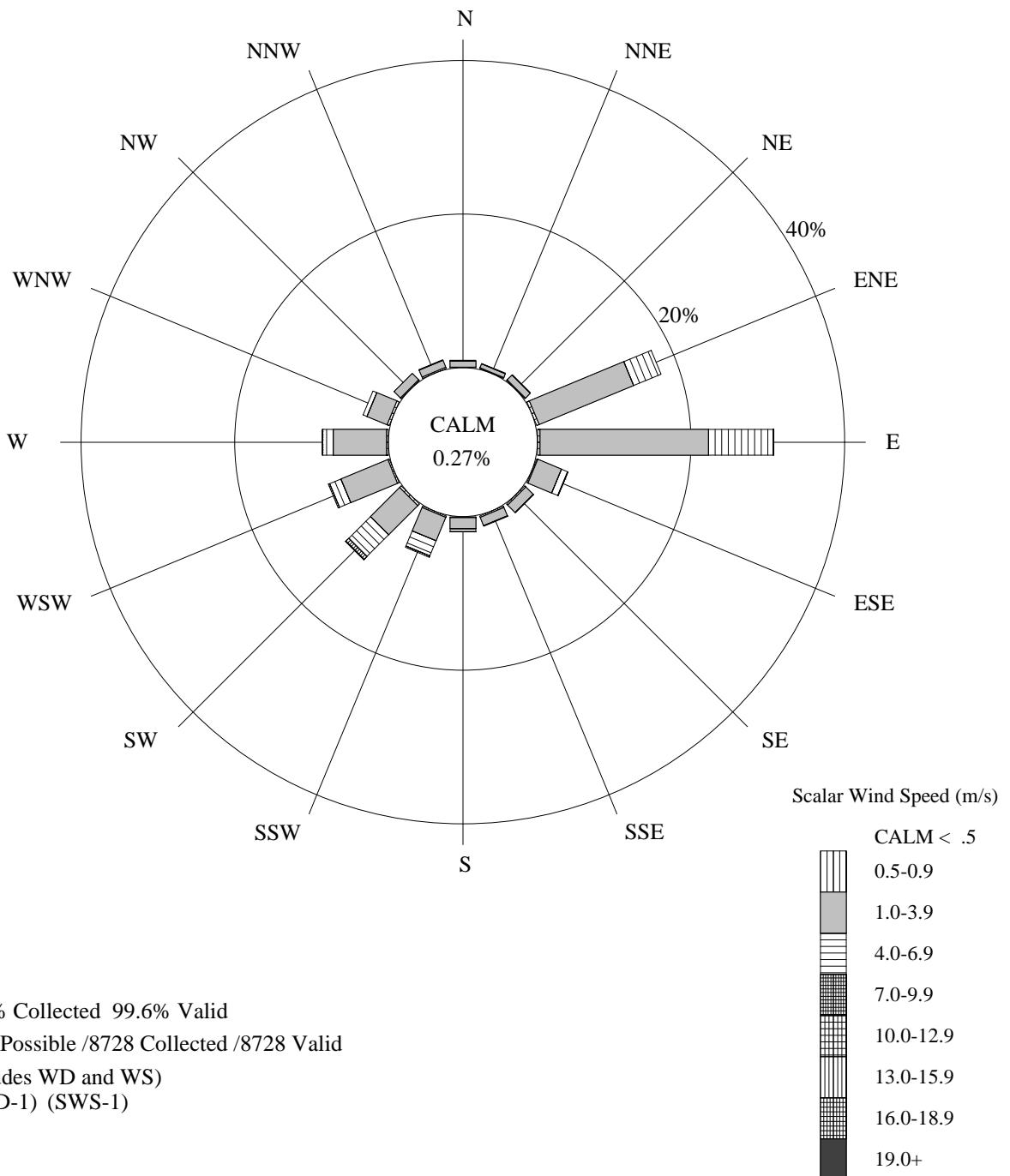


99.9% Collected 99.9% Valid
2208 Possible /2206 Collected /2206 Valid
(includes WS and WD)

Chiricahua National
Monument

Annual Wind Rose

2002



2.4 DRY DEPOSITION DATA SUMMARY

Clean Air Status and Trends Network (CASTNet) Dry Deposition Monitoring

In 1995, the National Park Service (NPS) and the Environmental Protection Agency (EPA) entered a partnership to jointly measure dry deposition in park units, mostly in the West. A portion of the 2000, 2001, and 2002 data collected from this partnership is presented in this section. These data are presented using local conditions. Data presented in reports prior to 2002 are based on standard conditions.

Atmospheric deposition of acidic species takes two pathways: wet deposition and dry deposition. Wet deposition is the result of precipitation events (rain, snow, or fog) that remove particles and gases from the atmosphere. Dry deposition is less event driven, but still involves the transfer of particles and gases from the atmosphere to surfaces and plants. Wet deposition has been well documented for many years. In the national parks, the National Acidic Deposition Program (NADP) measures and reports wet deposition (see the web site at <http://nadp.sws.uiuc.edu> for further information). Dry deposition is much harder to measure and a smaller network of monitoring stations is involved. The method used to measure dry deposition is sometimes called the "inferential method" because air quality concentration data are combined with meteorological measurements and land use functions to compute deposition velocities. The CASTNet program provides long-term estimates of total acidic deposition by adding dry deposition values to wet deposition values.

This annual summary report presents the air quality concentration portion of the dry deposition inferential method, which is the only currently available data set. These data were compiled from the analyses of filters collected by CASTNet deposition filter pack systems in the parks. The filter pack analyses yielded weekly average concentrations of particulate sulfate (SO_4^{2-}), particulate nitrate (NO_3^-), particulate ammonium (NH_4^+), sulfur dioxide (SO_2), and nitric acid (HNO_3). In some cases, the positive ions Na^+ , K^+ , Ca^{2+} , and Mg^{2+} were also measured from the filter samples. These concentration data for the individual ionic species are presented as annual bar charts and summarized by quarter and by year in this report. Concentration data can be used to compare sites and to indicate the amount of acidic species available for deposition. As with the continuous analyzer data, the filter pack concentration data are included on a computer diskette that accompanies this report.

Estimated dry deposition values derived from EPA modeling will be reported at a later time to complete the inferential analyses. When available, these modeling results will be posted on the NPS Air Resources Division Internet web site at <http://www.aqd.nps.gov/ard1> or on the EPA CASTNet site. Initial CASTNet results have shown that dry deposition can be a significant portion of total acidic deposition.

CASTNet Dry Deposition Monitoring
 Quarterly and Annual Average Concentrations
 Chiricahua National Monument
 1/1/02 - 12/31/02

Quarter	No. Valid Samples	p-NO ₃ (ug/m ³)	HNO ₃ (ug/m ³)	Total NO ₃ (ug/m ³)	NH ₄ (ug/m ³)	p-SO ₄ (ug/m ³)	SO ₂ (ug/m ³)	SO ₄ /SO ₂ Ratio
1	13	0.289	0.346	0.630	0.189	0.518	0.511	1.015
2	13	0.439	0.620	1.049	0.368	1.016	0.612	1.661
3	13	0.399	1.046	1.428	0.518	1.524	0.432	3.524
4	14	0.313	0.457	0.763	0.288	0.813	0.602	1.352
Annual Average		0.359	0.614	0.963	0.340	0.965	0.540	1.786
Standard Deviation		0.170	0.338	0.387	0.157	0.474	0.154	

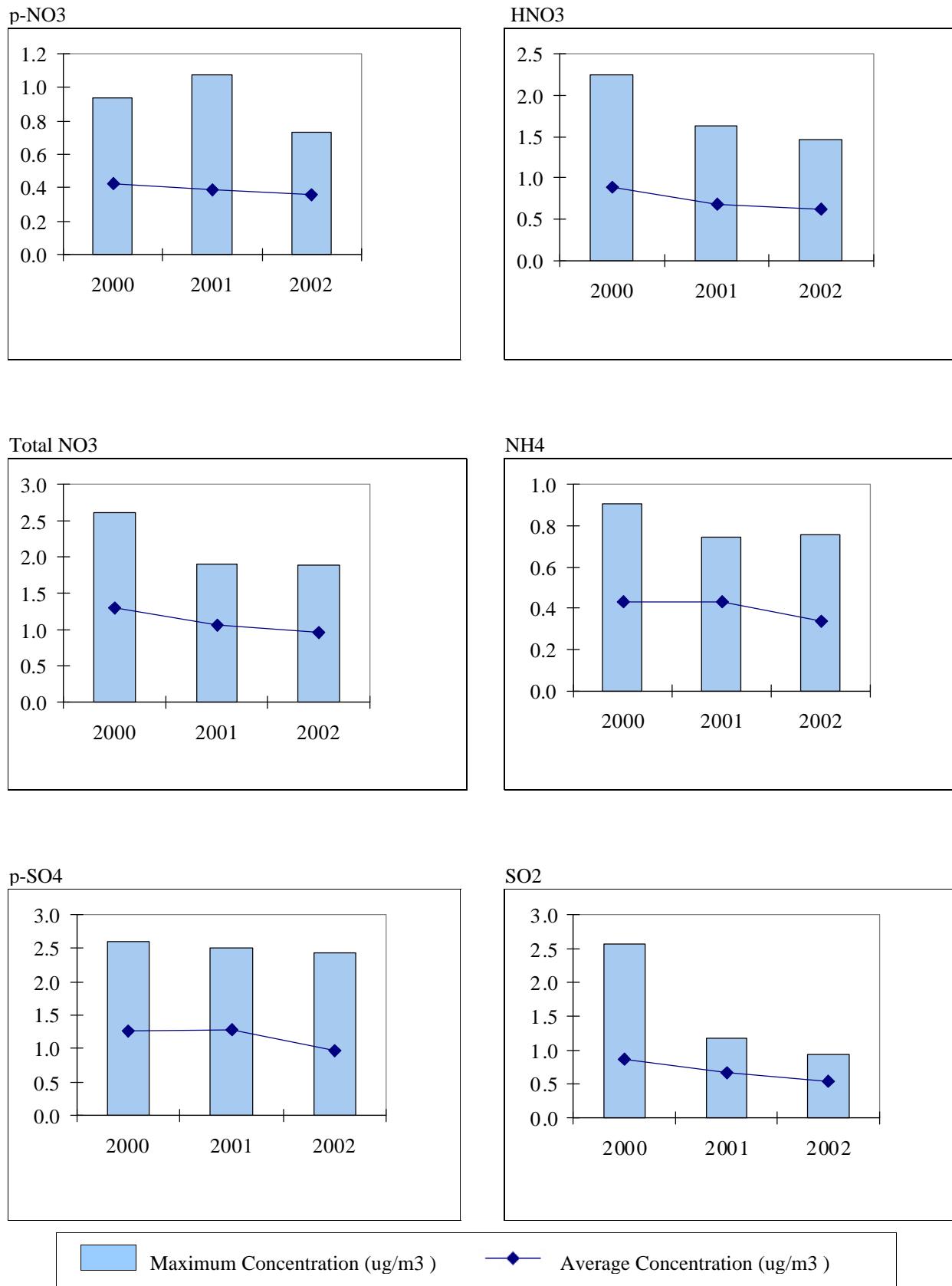
Data Recovery Table			
Total No. Filters	No. Invalidated	Data Capture	No. Valid Hours
53	0	100.0%	8916.0

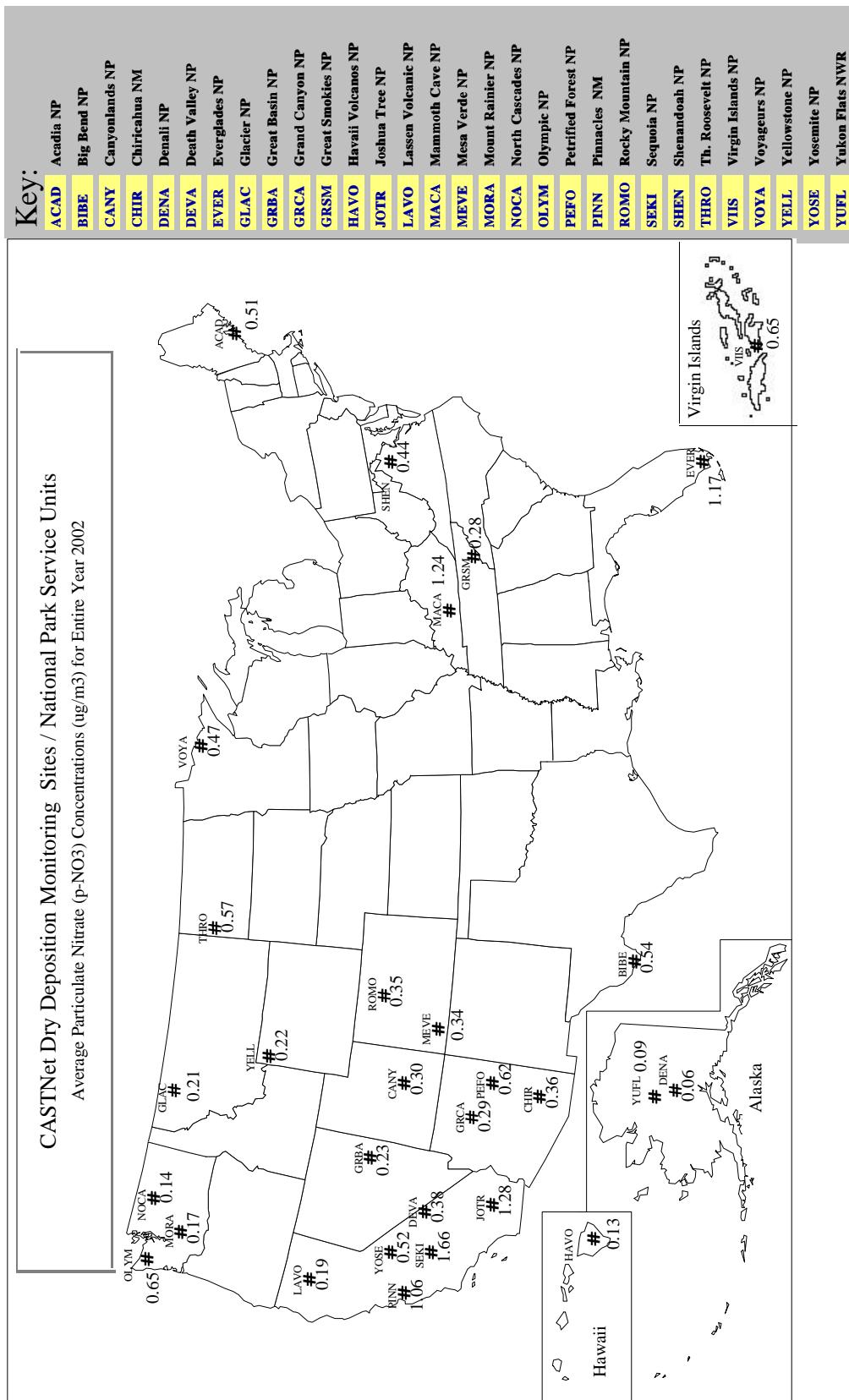
CASTNet Dry Deposition Monitoring Weekly Concentrations Report
Chiricahua National Monument

1/1/02 - 12/31/02

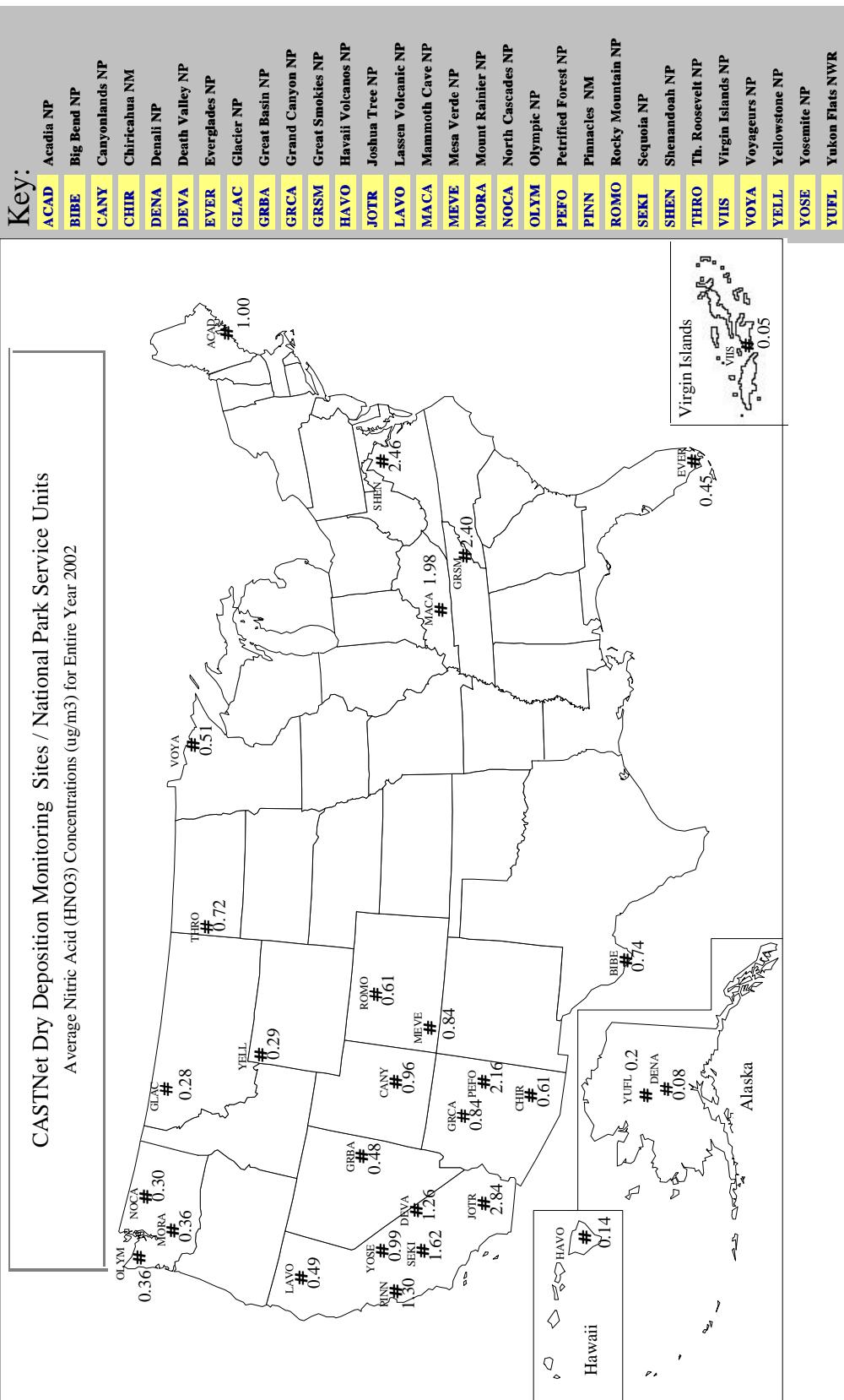
On Date	Off Date	p-NO ₃ (ug/m ³)	HNO ₃ (ug/m ³)	Total NO ₃ (ug/m ³)	NH ₄ (ug/m ³)	p-SO ₄ (ug/m ³)	SO ₂ (ug/m ³)	SO ₄ /SO ₂ Ratio
12/24/01	01/01/02	0.237	0.315	0.547	0.132	0.311	0.581	0.535
01/01/02	01/08/02	0.185	0.558	0.734	0.242	0.633	0.488	1.296
01/08/02	01/15/02	0.148	0.304	0.447	0.151	0.407	0.573	0.710
01/15/02	01/22/02	0.659	0.258	0.912	0.203	0.594	0.676	0.878
01/22/02	01/29/02	0.397	0.166	0.561	0.213	0.719	0.599	1.199
01/29/02	02/05/02	0.108	0.399	0.500	0.121	0.303	0.412	0.735
02/05/02	02/12/02	0.139	0.428	0.560	0.152	0.388	0.270	1.434
02/12/02	02/19/02	0.243	0.338	0.576	0.218	0.576	0.691	0.833
02/19/02	02/26/02	0.145	0.394	0.533	0.126	0.406	0.357	1.139
02/26/02	03/05/02	0.366	0.330	0.691	0.283	0.667	0.555	1.201
03/05/02	03/12/02	0.186	0.423	0.603	0.150	0.385	0.373	1.031
03/12/02	03/19/02	0.618	0.330	0.943	0.218	0.758	0.530	1.430
03/19/02	03/26/02	0.324	0.260	0.580	0.245	0.591	0.530	1.116
03/26/02	04/02/02	0.438	0.446	0.878	0.285	0.756	0.729	1.036
04/02/02	04/09/02	0.658	0.460	1.111	0.396	1.105	0.478	2.311
04/09/02	04/16/02	0.483	0.629	1.103	0.468	1.312	0.526	2.494
04/16/02	04/23/02	0.428	0.303	0.726	0.226	0.618	0.418	1.480
04/23/02	04/30/02	0.347	0.642	0.979	0.350	0.960	0.458	2.095
04/30/02	05/07/02	0.382	0.375	0.751	0.295	0.727	0.557	1.305
05/07/02	05/14/02	0.599	0.387	0.980	0.344	0.962	0.665	1.447
05/14/02	05/21/02	0.363	0.402	0.758	0.331	0.869	0.742	1.171
05/21/02	05/28/02	0.364	0.485	0.842	0.337	0.855	0.814	1.050
05/28/02	06/04/02	0.311	1.037	1.331	0.428	1.172	0.862	1.360
06/04/02	06/11/02	0.441	0.918	1.344	0.455	1.257	0.493	2.548
06/11/02	06/18/02	0.508	1.223	1.712	0.454	1.345	0.627	2.143
06/18/02	06/25/02	0.382	0.753	1.123	0.419	1.274	0.583	2.187
06/25/02	07/02/02	0.535	1.240	1.755	0.565	1.587	0.817	1.943
07/02/02	07/09/02	0.729	1.031	1.744	0.561	1.583	0.486	3.260
07/09/02	07/16/02	0.561	1.347	1.887	0.759	2.091	0.396	5.280
07/16/02	07/23/02	0.269	1.464	1.710	0.389	1.143	0.280	4.079
07/23/02	07/30/02	0.371	1.286	1.637	0.412	1.205	0.502	2.399
07/30/02	08/06/02	0.441	0.925	1.352	0.417	1.309	0.310	4.220
08/06/02	08/13/02	0.416	0.991	1.391	0.607	1.784	0.308	5.792
08/13/02	08/20/02	0.481	1.209	1.670	0.509	1.672	0.615	2.719
08/20/02	08/27/02	0.225	0.798	1.011	0.420	1.187	0.439	2.703
08/27/02	09/03/02	0.236	0.823	1.046	0.520	1.600	0.324	4.944
09/03/02	09/10/02	0.157	0.970	1.112	0.760	2.429	0.387	6.275
09/10/02	09/17/02	0.173	0.913	1.072	0.467	1.296	0.233	5.564
09/17/02	09/24/02	0.595	0.595	1.181	0.341	0.922	0.525	1.756
09/24/02	10/01/02	0.249	0.559	0.799	0.491	1.266	0.483	2.621
10/01/02	10/08/02	0.395	0.310	0.700	0.312	0.942	0.666	1.413
10/08/02	10/15/02	0.383	0.558	0.932	0.460	1.170	0.527	2.221
10/15/02	10/22/02	0.689	0.350	1.033	0.416	1.243	0.710	1.750
10/22/02	10/29/02	0.436	0.219	0.651	0.389	1.091	0.581	1.877
10/29/02	11/05/02	0.397	0.476	0.865	0.315	0.844	0.935	0.903
11/05/02	11/12/02	0.157	0.411	0.561	0.165	0.445	0.531	0.836
11/12/02	11/19/02	0.104	0.588	0.683	0.193	0.456	0.624	0.732
11/19/02	11/26/02	0.162	0.607	0.760	0.190	0.530	0.699	0.758
11/26/02	12/03/02	0.540	0.509	1.041	0.414	1.315	0.517	2.542
12/03/02	12/10/02	0.080	0.809	0.876	0.270	0.676	0.591	1.144
12/10/02	12/17/02	0.187	0.552	0.730	0.154	0.518	0.639	0.811
12/17/02	12/24/02	0.398	0.133	0.529	0.091	0.371	0.455	0.815
12/24/02	12/31/02	0.206	0.314	0.515	0.175	0.522	0.464	1.123

Chiricahua National Monument
CASTNet Dry Deposition Monitoring
Three Year Comparison of Maximum and Average Concentrations

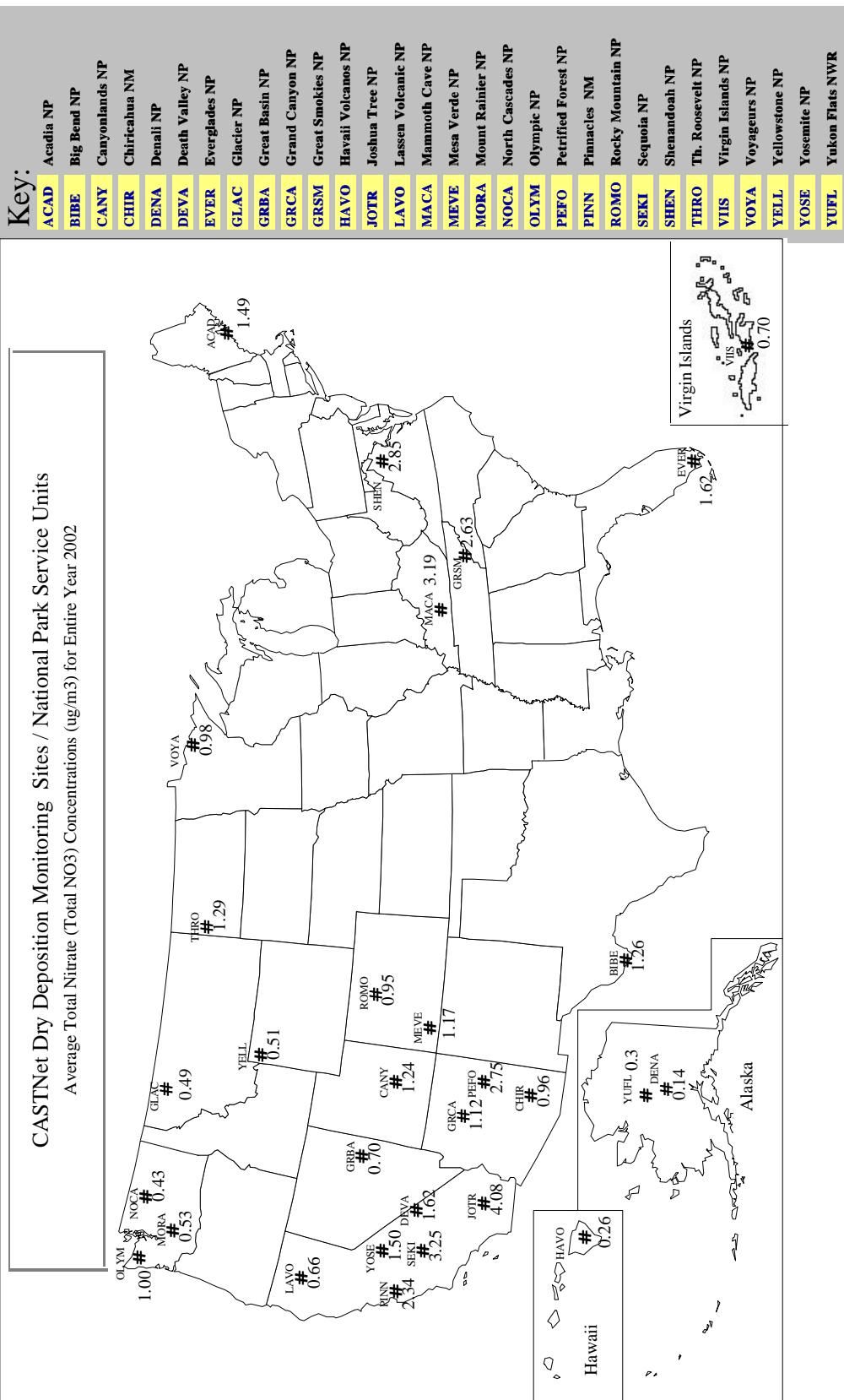




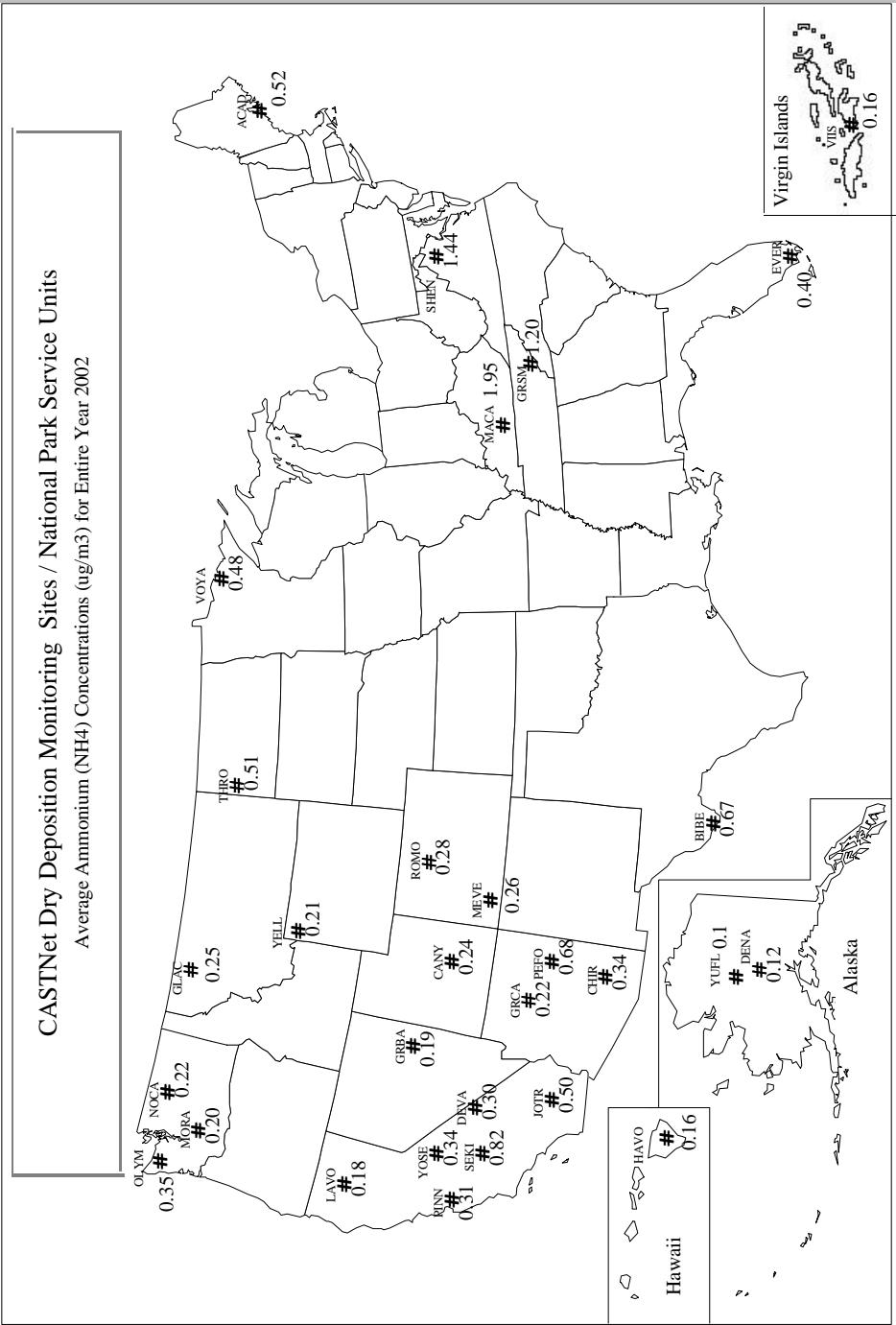
CASTNet Dry Deposition Monitoring Sites / National Park Service Units
 Average Nitric Acid (HNO₃) Concentrations (ug/m³) for Entire Year 2002



CASTNet Dry Deposition Monitoring Sites / National Park Service Units
 Average Total Nitrate (Total NO₃) Concentrations ($\mu\text{g}/\text{m}^3$) for Entire Year 2002



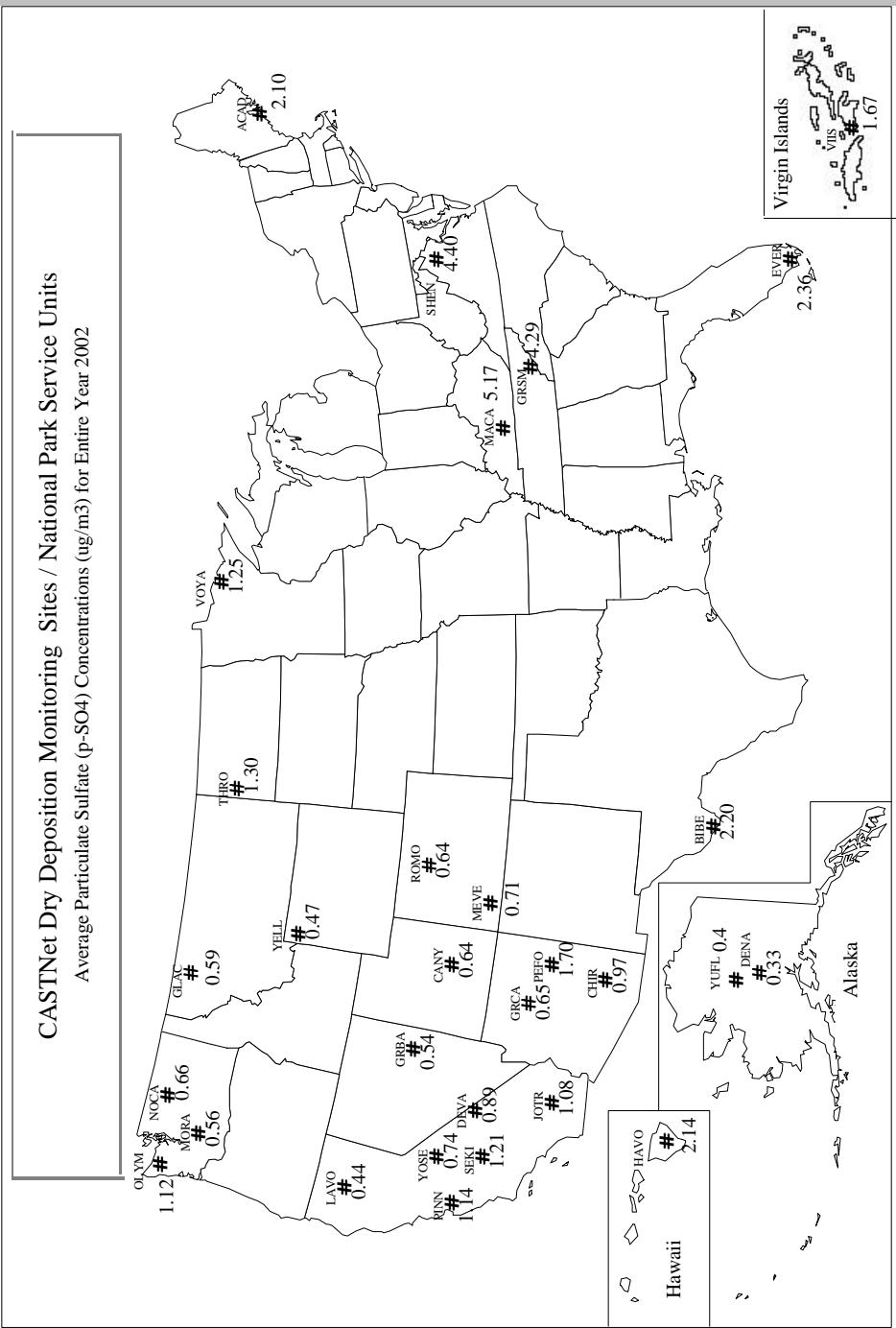
CASTnet Dry Deposition Monitoring Sites / National Park Service Units
 Average Ammonium (NH_4) Concentrations ($\mu\text{g}/\text{m}^3$) for Entire Year 2002



Key:

ACAD	Acadia NP
BIBE	Big Bend NP
CANY	Canyonlands NP
CHIR	Chiricahua NM
DENA	Denali NP
DEVA	Death Valley NP
EVER	Everglades NP
GLAC	Glacier NP
GRBA	Great Basin NP
GRCA	Grand Canyon NP
GRSM	Great Smokies NP
HAVO	Hawaii Volcanos NP
JOTR	Joshua Tree NP
LAVO	Lassen Volcanic NP
MACA	Mammoth Cave NP
MEVE	Mesa Verde NP
MORA	Mount Rainier NP
NOCA	North Cascades NP
OLYM	Olympic NP
PEFO	Petrified Forest NP
PINN	Pinnacles NM
ROMO	Rocky Mountain NP
SEKI	Sequoia NP
SHEN	Shenandoah NP
THRO	Th. Roosevelt NP
VIRIS	Virgin Islands NP
VOYA	Voyagers NP
YELL	Yellowstone NP
YOSE	Yosemite NP
YUFL	Yukon Flats NWR

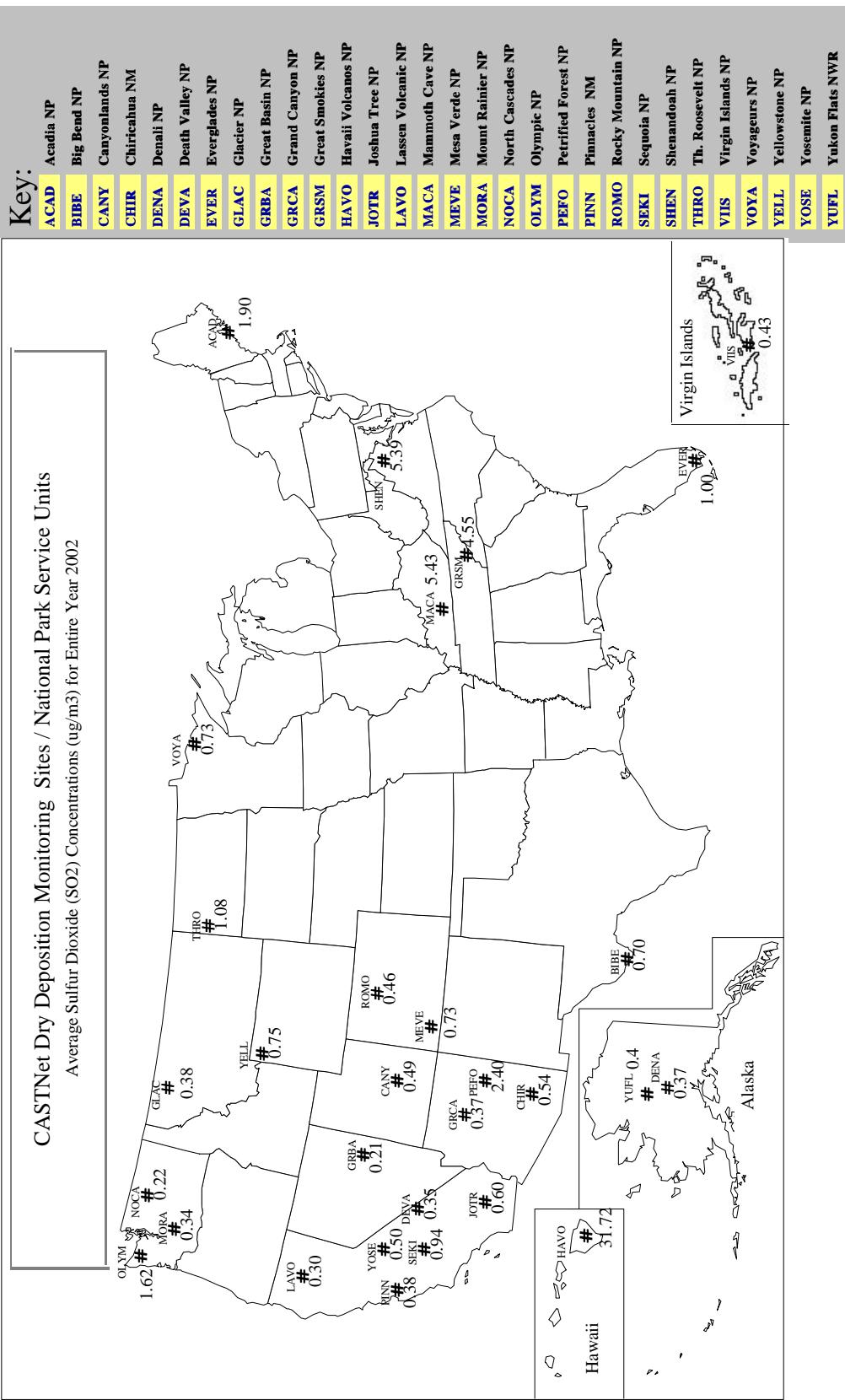
CASTNet Dry Deposition Monitoring Sites / National Park Service Units
 Average Particulate Sulfate (p-SO₄) Concentrations (ug/m³) for Entire Year 2002



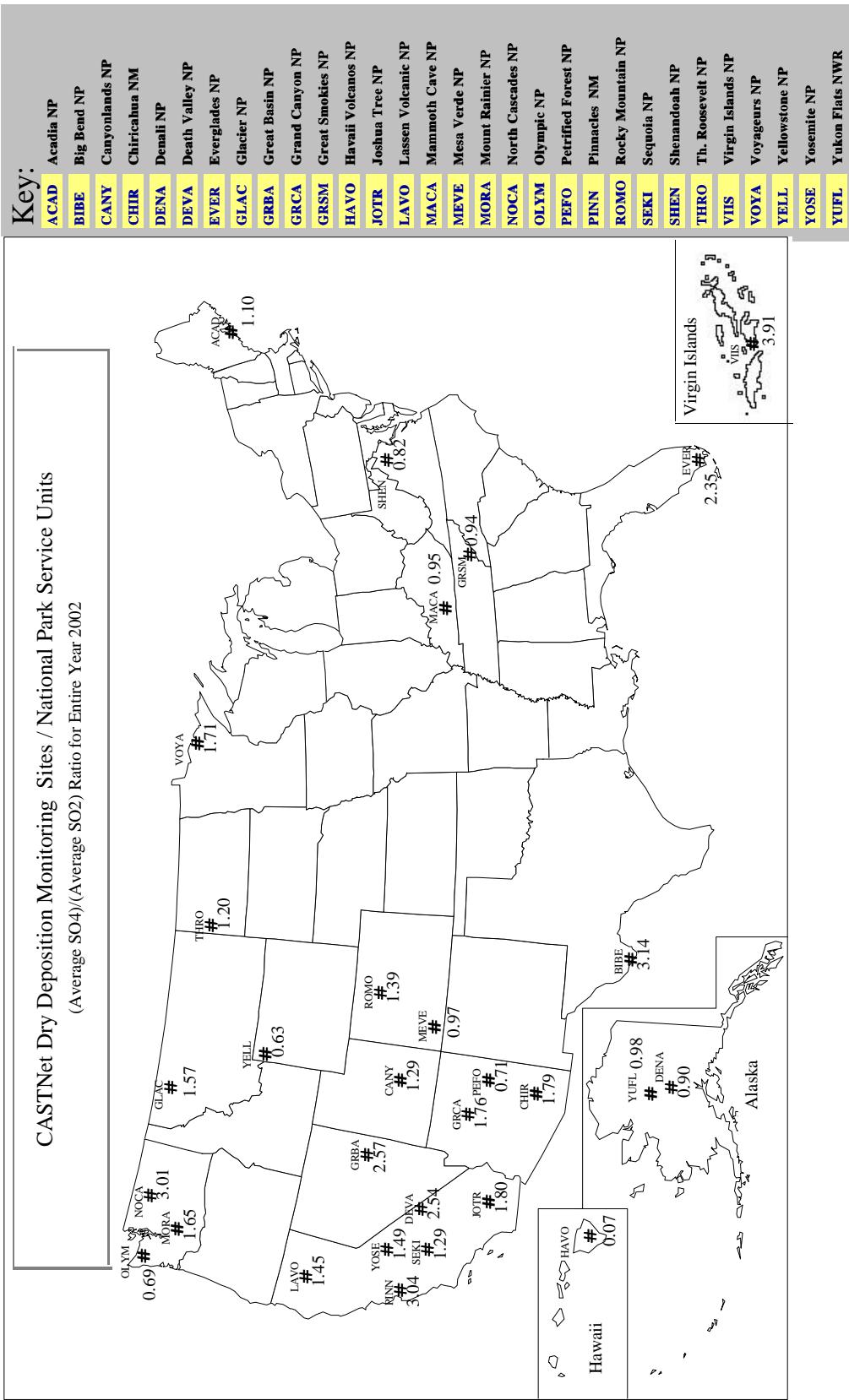
Key:

ACAD	Acadia NP
BIBE	Big Bend NP
CANY	Canyonlands NP
CHIR	Chiricahua NM
DENA	Denali NP
DEVA	Death Valley NP
EVER	Everglades NP
GLAC	Glacier NP
GRBA	Great Basin NP
GRCA	Grand Canyon NP
GRSM	Great Smokies NP
HAVO	Hawaii Volcanos NP
JOTR	Joshua Tree NP
LAVO	Lassen Volcanic NP
MACA	Mammoth Cave NP
MEVE	Mesa Verde NP
MORA	Mount Rainier NP
NOCA	North Cascades NP
OLYM	Olympic NP
PEFO	Petrified Forest NP
PINN	Pinnacles NM
ROMO	Rocky Mountain NP
SEKI	Sequoia NP
SHEN	Shenandoah NP
THRO	Th. Roosevelt NP
VIRIS	Virgin Islands NP
VOYA	Voyagers NP
YELL	Yellowstone NP
YOSE	Yosemite NP
YUFL	Yukon Flats NWR

CASTNet Dry Deposition Monitoring Sites / National Park Service Units
 Average Sulfur Dioxide (SO₂) Concentrations ($\mu\text{g}/\text{m}^3$) for Entire Year 2002



CASTNet Dry Deposition Monitoring Sites / National Park Service Units
 (Average SO₄)/(Average SO₂) Ratio for Entire Year 2002



3.0 NATIONAL PARK SERVICE AIR RESOURCES DIVISION DATA SOURCES

Meteorological and hourly gaseous data contained in this report may be obtained from the following sources:

- National Park Service AIRWeb (<http://www.aqd.nps.gov/natnet/ard>)
- 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

CASTNet concentration data may be obtained from the following Web site:

<http://www.epa.gov/castnet/data.html>

4.0 GLOSSARY

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

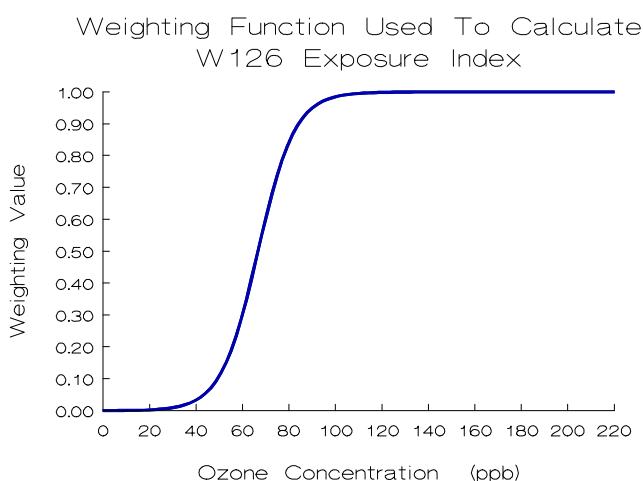
The National Park Service Quick Look Annual Summary Statistics Table (Page 2-8) provides ozone summary statistics for various indices computed on a monthly basis for an entire year. Growing season (generically defined to be May 1 - September 30) and annual statistics are also presented under the "MAY-SEP" 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 (SO_2 , NO_2 , PM_{10} , Pb, CO, O_3).

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 (O_3): 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 (SO_2): 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	$^\circ\text{C} + 17.78$	1.8	$^\circ\text{F}$
	$^\circ\text{F} - 32$	5/9	$^\circ\text{C}$

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
- mps = miles per hour
- ly/min = langleyes per minute
- w/m^2 = watts per square meter
- mm/hr = millimeters per hour
- in/hr = inches per hour
- $^\circ\text{C}$ = degrees centigrade
- $^\circ\text{F}$ = degrees fahrenheit