GARFIELD COUNTY
QUARTERLY MONITORING REPORT

FOURTH QUARTER
OCTOBER 1 THROUGH DECEMBER 31, 2011

Prepared for:

Garfield County Public Health Department
195 West 14th Street
Rifle, CO 81650

Prepared by:

Air Resource Specialists, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, CO 80525
Phone: 970-484-7941
www.air-resource.com

March 30, 2012

TABLE OF CONTENTS

Section		Page
1.0	**INTRODUCTION**	**1-1**
1.1	Background	1-1
2.0	**DATA COLLECTION STATISTICS**	**2-1**
3.0	**METEOROLOGICAL SUMMARIES**	**3-1**
4.0	**CRITERIA POLLUTANT SUMMARIES**	**4-1**
4.1	Ozone	4-3
4.2	Particulate Matter (PM_{10} and $PM_{2.5}$)	4-7
5.0	**SNMOC AND CARBONYL SUMMARIES**	**5-1**
5.1	SNMOC	5-1
5.2	Carbonyls	5-5

APPENDIX A Garfield County Stackplots, October 1, 2011 - December 31, 2011 A-1

APPENDIX B Garfield County SNMOC Concentrations, October 1, 2011 - December 31, 2011 B-1

APPENDIX C Garfield County Carbonyl Concentrations, October 1, 2011 - December 31, 2011 C-1

LIST OF FIGURES

Figure		Page
1-1	Map of Garfield County Monitoring Sites	1-2
3-1	Quarterly Wind Rose for the Parachute Monitoring Site	3-2
3-2	Quarterly Wind Rose for the Rifle Monitoring Site	3-3
3-3	Quarterly Wind Rose for the Bell-Melton Monitoring Site	3-4
3-4	Quarterly Wind Rose for the Battlement Mesa Monitoring Site	3-5
4-1	Daily Maximum 8-Hour Averages of Ozone Monitored at the Rifle Site	4-3
4-2	Quarterly Ozone Pollutant Rose for the Rifle Monitoring Site	4-5
4-3	Quarterly Ozone Diurnal Plot for the Rifle Monitoring Site	4-6
4-4	Quarterly PM_{10} Pollutant Rose for the Rifle Monitoring Site	4-8
4-5	Quarterly $PM_{2.5}$ Pollutant Rose for the Rifle Monitoring Site	4-9

LIST OF FIGURES (continued)

Figure		Page
4-6	Quarterly PM_{10} Diurnal Plot for the Rifle Monitoring Site	4-10
4-7	Quarterly $PM_{2.5}$ Diurnal Plot for the Rifle Monitoring Site	4-11
5-1	24-Hour SNMOC Measurements by Category in Units of ppbV	5-3
5-2	24-Hour SNMOC Measurements by Category in Units of ppbC	5-4
5-3	24-Hour Major Carbonyl Compound Concentrations in Units of ppbV	5-6

LIST OF TABLES

Table		Page
1-1	Garfield County Parameters Monitored by Site	1-3
2-1	Data Collection Statistics for Parachute Site	2-1
2-2	Data Collection Statistics for Rifle Site	2-2
2-3	Data Collection Statistics for Bell-Melton Site	2-3
2-4	Data Collection Statistics for Battlement Mesa Site	2-4
4-1	Rifle Site, Standards Summary	4-2
4-2	Parachute Site, Standards Summary	4-2
4-3	Rifle Site, Ten Highest Daily Maximum 8-Hour Ozone Averages	4-4

1.0 INTRODUCTION

This air quality data summary report has been prepared by Air Resource Specialists, Inc. (ARS) for the Garfield County Public Health Department (GCPHD). This report summarizes data collected from October 1, 2011 through December 31, 2011 at the Garfield County monitoring sites, including metrological characteristics, criteria pollutant levels, and levels of volatile organic compounds (VOCs). Any questions regarding the contents of this report should be addressed to:

Cassie Archuleta

Air Resource Specialists, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, Colorado 80525
Telephone: 970-484-7941
Fax: 970-484-3423
carchuleta@air-resource.com

1.1 BACKGROUND

Oil and gas exploration and production within the Piceance Basin in Colorado, and elsewhere in the Rocky Mountain region, has undergone rapid growth over the last decade. In response to this growth, concerns have grown regarding air quality impacts of oil and gas development in Garfield County. The Garfield County Public Health Department (GCPHD) is committed to protecting the health and welfare of its citizens. In 2005, the GCPHD enhanced air quality monitoring efforts to evaluate levels of particulate matter $\leq$ 10 microns (PM_{10}) and VOCs in the area. In 2008, the monitoring network was modified to encompass speciated non-methane organic compounds (SNMOCs) and carbonyl compounds. Also, the regulatory monitoring network expanded from PM_{10} to include particulate matter $\leq$ 2.5 microns ($PM_{2.5}$) and ozone (O_3). These changes were designed to serve a wide range of purposes, including monitoring of criteria pollutant levels, ozone formation potential, toxics assessments, and source attribution.

The 2011 monitoring network in Garfield County consists of four (4) monitoring locations. Characteristics of the monitoring locations are described below.

- Parachute (PACO): Parachute is a small urban center of approximately 1,300 people within very close proximity to oil and development and production activities. The town is located along Interstate 70 and is the transportation hub for heavily traveled roads which service the surrounding canyons.
- Rifle (RICO): Rifle is a rapidly growing urban center on the Interstate 70 corridor with estimated population of about 9,200 people. Rifle is in close proximity to oil and gas development activities, and is also central to industrial support for the oil and gas industry.
- Bell-Melton (BRCO): The Bell-Melton site is a rural homestead approximately four miles south of the town of Silt, in close proximity to moderate oil and gas development and heavy natural gas production.

- Battlement Mesa (BMCO): Battlement Mesa is a rural community located about 1.5 miles southeast of Parachute. The town takes its name from Battlement Mesa, a basalt-topped mesa that sits to the south of the town. This site began operation in September 2010 as substantial natural gas development and production activities began increasing in the immediate area.

Figure 1-1 is a map of the monitoring sites in Garfield County and Table 1-1 lists the parameters monitored. The Garfield County Public Health Department (GCPHD) monitors pollutants and meteorology at these stations with technical support from several agencies. Filter based PM_{10} monitors in Rifle and Parachute are operated by the GCPHD, with filter analysis supported by the Colorado Department of Public Health and Environment (CDPHE). SNMOC and carbonyl compounds are sampled at all sites and analyzed by the Eastern Research Group, Inc. (ERG). The GCPHD monitors meteorology at the Bell-Melton sites and Battlement Mesa sites. Air Resource Specialists, Inc. (ARS) supports monitoring, data collection and data validation for continuous PM_{10} and $PM_{2.5}$, O_3, and meteorology at the Rifle site, and meteorology at the Parachute site. GCPHD also operates a digital Web camera at the Rifle site. Camera images are collected every 15-minutes and displayed on the Garfield County Air Quality Monitoring Web site (http://www.garfieldcountyaq.net), along with associated data.

Figure 1-1. Map of Garfield County Monitoring Sites.

Table 1-1

Garfield County
Parameters Monitored by Site

Component	Method	Sampling Frequency	Reporting Agency
Rifle, Colorado			
SNMOC	TO-12	24-hour (1/6 day)	ERG
Carbonyls	TO-11A	24-hour (1/12 day)	ERG
PM_{10}	FRM	24-hour (1/3 day)	CDPHE
PM_{10}	TEOM	Hourly	ARS
$PM_{2.5}$	TEOM	Hourly	ARS
Ozone	42C	Hourly	ARS
Meteorology	Various	Hourly	ARS
Visibility Web Camera	Digital	15-min	ARS
Parachute, Colorado			
SNMOC	TO-12	24-hour (1/6 day)	ERG
Carbonyls	TO-11A	24-hour (1/12 day)	ERG
PM_{10}	FRM	24-hour (1/3 day)	CDPHE
Meteorology	Various	Hourly	ARS
Bell-Melton, Colorado			
SNMOC	TO-12	24-hour (1/6 day)	ERG
Carbonyls	TO-11A	24-hour (1/12 day)	ERG
Meteorology	Various	Hourly	GCPHD
Battlement Mesa, Colorado			
SNMOC	TO-12	24-hour (1/6 day)	ERG
Carbonyls	TO-11A	24-hour (1/12 day)	ERG
Meteorology	Various	Hourly	GCPHD

2.0 DATA COLLECTION STATISTICS

Tables 2-1 through 2-4 list the data collection statistics by site for the quarter. Continuous gas, particulate and meteorological data are reported as hourly averages, SNMOC samples are reported as 24-hour averages every sixth day, and carbonyl averages are reported as 24-hour averages every twelfth day.

Table 2-1

Data Collection Statistics for Parachute Site
10/1/2010 – 12/31/10

Parameter	Interval	Data Recovery			Valid Data		Comments
		No. Possible	No. Collected	% Collected	No. Valid	% Valid	
Relative Humidity	hourly	2208	2208	100.0	2208	100.0	
Precipitation	hourly	2208	2208	100.0	2208	100.0	
Standard Deviation for Wind Direction	Hourly	2208	2208	100.0	2208	100.0	
Scalar Wind Direction	hourly	2208	2208	100.0	2208	100.0	
Scalar Wind Speed	hourly	2208	2208	100.0	2208	100.0	
Ambient Temperature	hourly	2208	2208	100.0	2208	100.0	
PM_{10}	1/3 day	28	28	100%	28	100%	
SNMOCs	1/6 day	15	15	100%	15	100%	
Carbonyls	1/12 day	7	6	85.7%	6	82.7%	

Table 2-2

Data Collection Statistics for Rifle Sites
10/1/2010 – 12/31/10

Parameter	Interval	Data Recovery			Valid Data		Comments
		No. Possible	No. Collected	% Collected	No. Valid	% Valid	
Ozone	hourly	2208	2198	99.5%	2198	99.5%	
$PM_{2.5}$	hourly	2208	1040	47.1%	1029	46.6%	TEOM mass transducer failed
PM_{10}	hourly	2208	1040	47.1%	1029	46.6%	TEOM mass transducer failed
Relative Humidity	hourly	2208	2201	99.7%	2201	99.7%	
Precipitation	hourly	2208	2200	99.6%	2200	99.6%	
Standard Deviation for Wind Direction	Hourly	2208	2201	99.7%	2201	99.7%	
Scalar Wind Direction	hourly	2208	2201	99.7%	2201	99.7%	
Scalar Wind Speed	hourly	2208	2201	99.7%	2201	99.7%	
Vector Wind Direction	Hourly	2208	2201	99.7%	2201	99.7%	
Vector Wind Speed	Hourly	2208	2201	99.7%	2201	99.7%	
Ambient Temperature	hourly	2208	2201	99.7%	2201	99.7%	
PM_{10}	1/3 day	28	28	100%	28	100%	
SNMOCs	1/6 day	15	14	93.3%	14	93.3%	
Carbonyls	1/12 day	7	3	42.9%	3	42.9%	

Table 2-3

Data Collection Statistics for Bell-Melton Site
10/1/2010 – 12/31/10

Parameter	Interval	Data Recovery			Valid Data		Comments
		No. Possible	No. Collected	% Collected	No. Valid	% Valid	
Barometric Pressure	hourly	2208	1069	48%	1069	48%	
Relative Humidity	hourly	2208	1069	48%	1069	48%	
Scalar Wind Direction	hourly	2208	1069	48%	1069	48%	
Scalar Wind Speed	hourly	2208	1069	48%	1069	48%	
Ambient Temperature	hourly	2208	1069	48%	1069	48%	
SNMOCs	1/6 day	15	15	100%	15	100%	
Carbonyls	1/12 day	7	5	71%	5	71%	

Table 2-4

Data Collection Statistics for Battlement Mesa Site
10/1/2010 – 12/31/10

Parameter	Interval	Data Recovery			Valid Data		Comments
		No. Possible	No. Collected	% Collected	No. Valid	% Valid	
Barometric Pressure	hourly	2208	2208	100%	2208	100%	
Relative Humidity	hourly	2208	2208	100%	2208	100%	
Standard Deviation for Wind Direction	hourly	2208	2208	100%	2208	100%	
Scalar Wind Direction	hourly	2208	2208	100%	2208	100%	
Scalar Wind Speed	hourly	2208	2208	100%	2208	100%	
Ambient Temperature	hourly	2208	2208	100%	2208	100%	
SNMOCs	1/6 day	15	13	87%	13	87%	
Carbonyls	1/12 day	7	5	71%	5	71%	

3.0 METEOROLOGICAL SUMMARIES

Meteorological data collected along with air quality parameters are used to better understand the local conditions and transport of air pollutants. Meteorological data collected at these sites includes wind speed, wind direction, temperature, relative humidity, and precipitation. Time series plots for all parameters collected between October 1, 2011 and December 31, 2011 are presented in Appendix A.

Figures 3-1 through 3-3 present quarterly wind roses for all monitoring sites. A wind rose shows the frequency of wind direction and uses different shading to represent wind speeds.

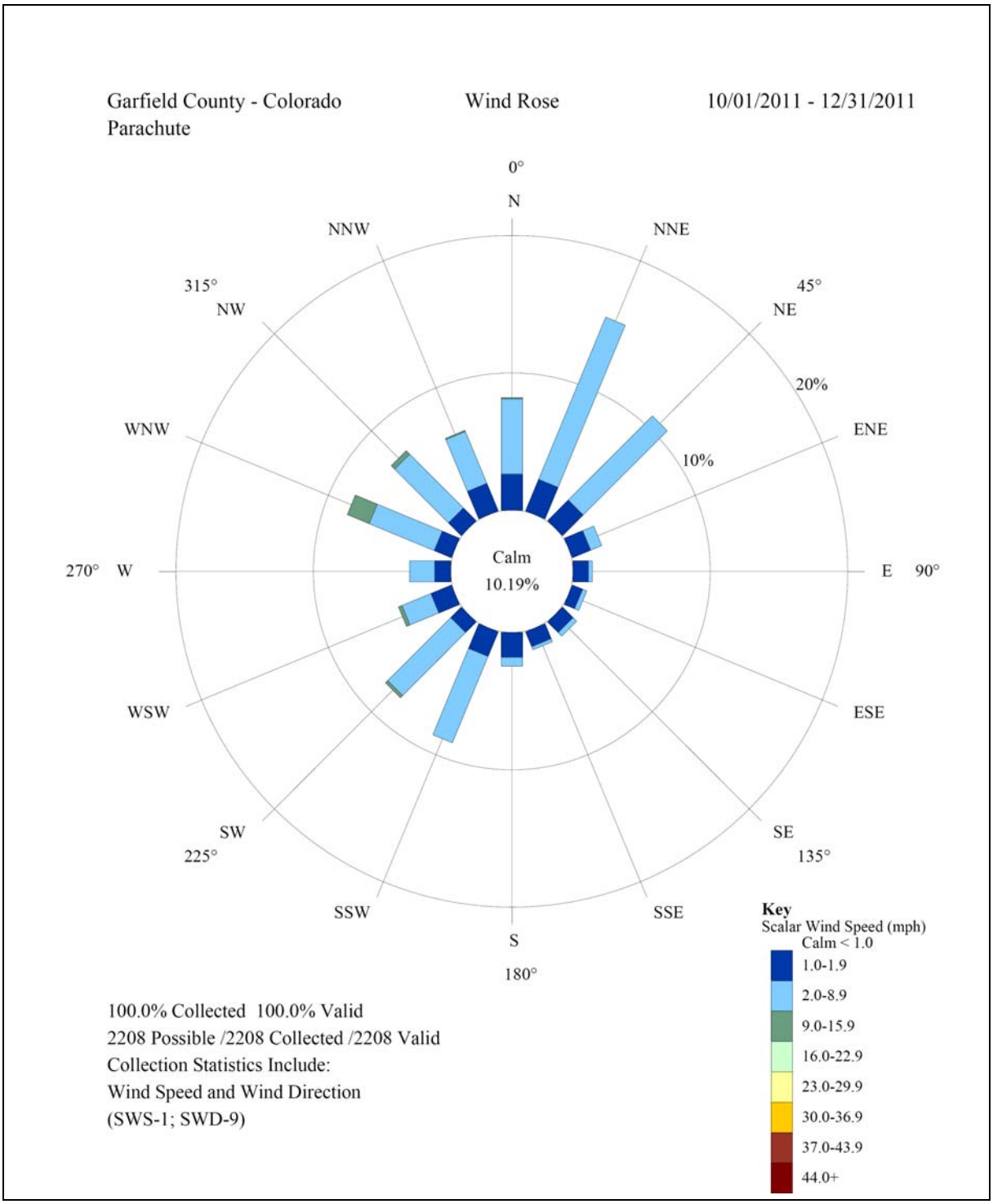


Figure 3-1. Quarterly Wind Rose for the Parachute Monitoring Site.

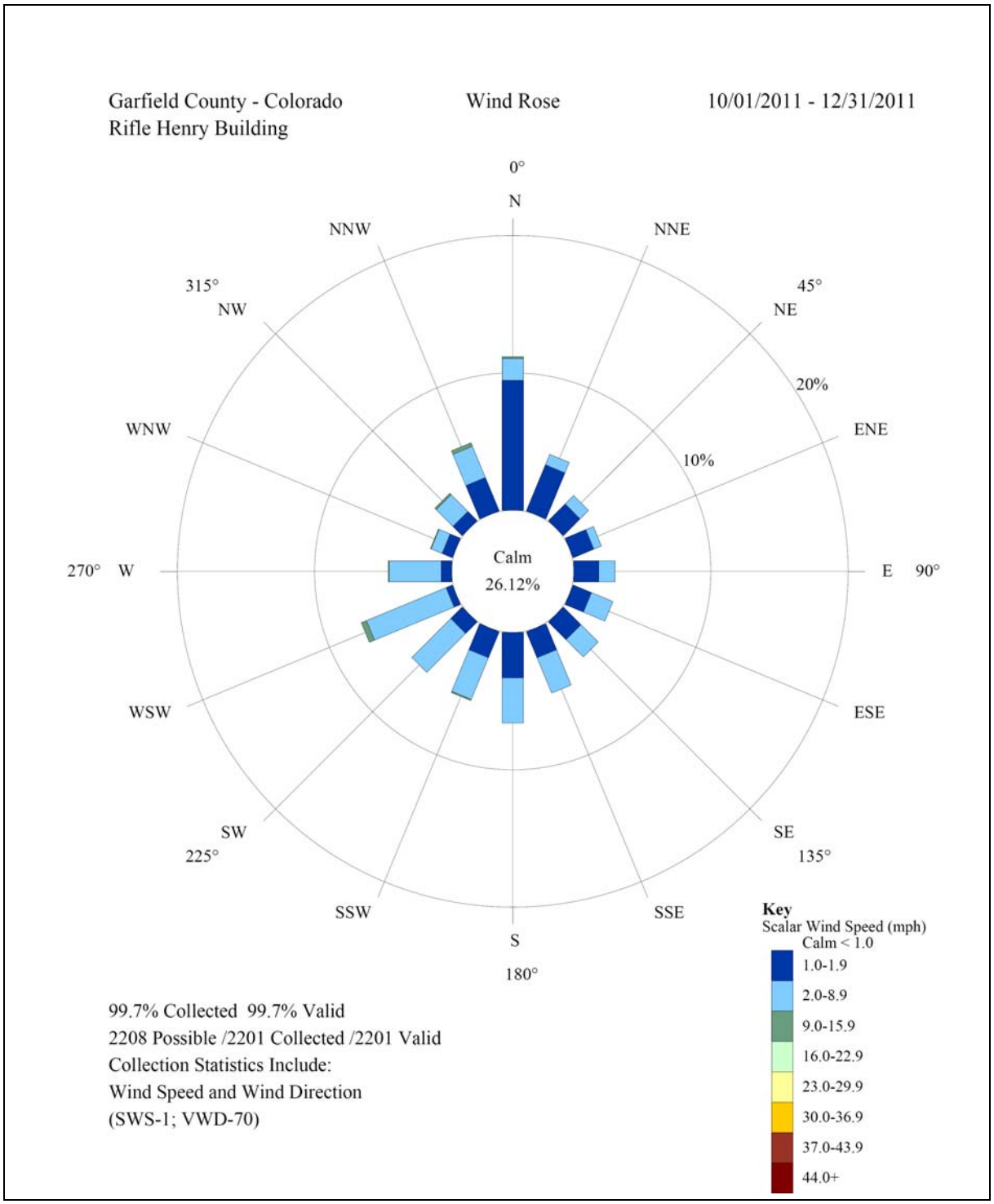


Figure 3-2. Quarterly Wind Rose for the Rifle Monitoring Site.

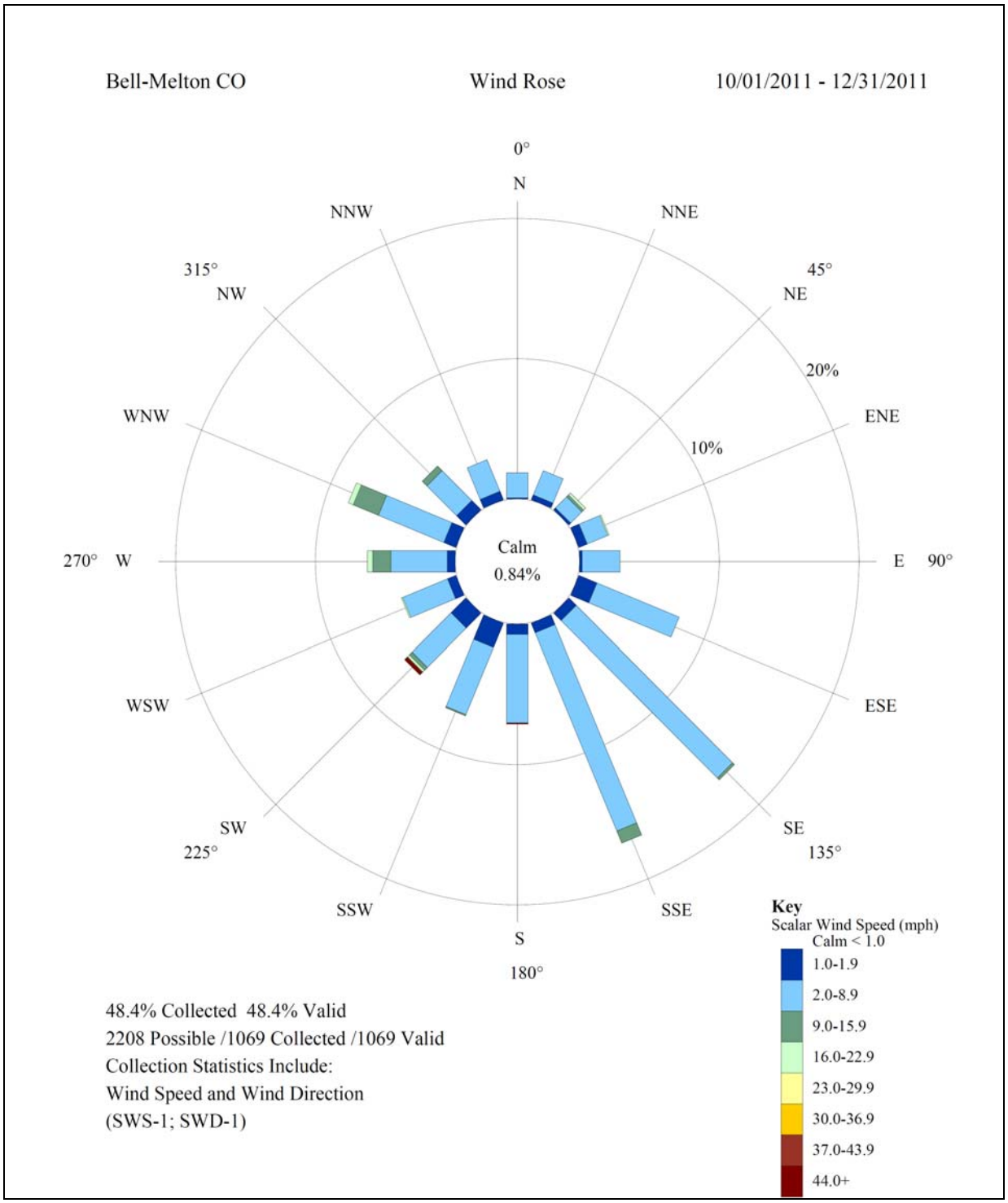


Figure 3-3. Quarterly Wind Rose for the Bell-Melton Monitoring Site.

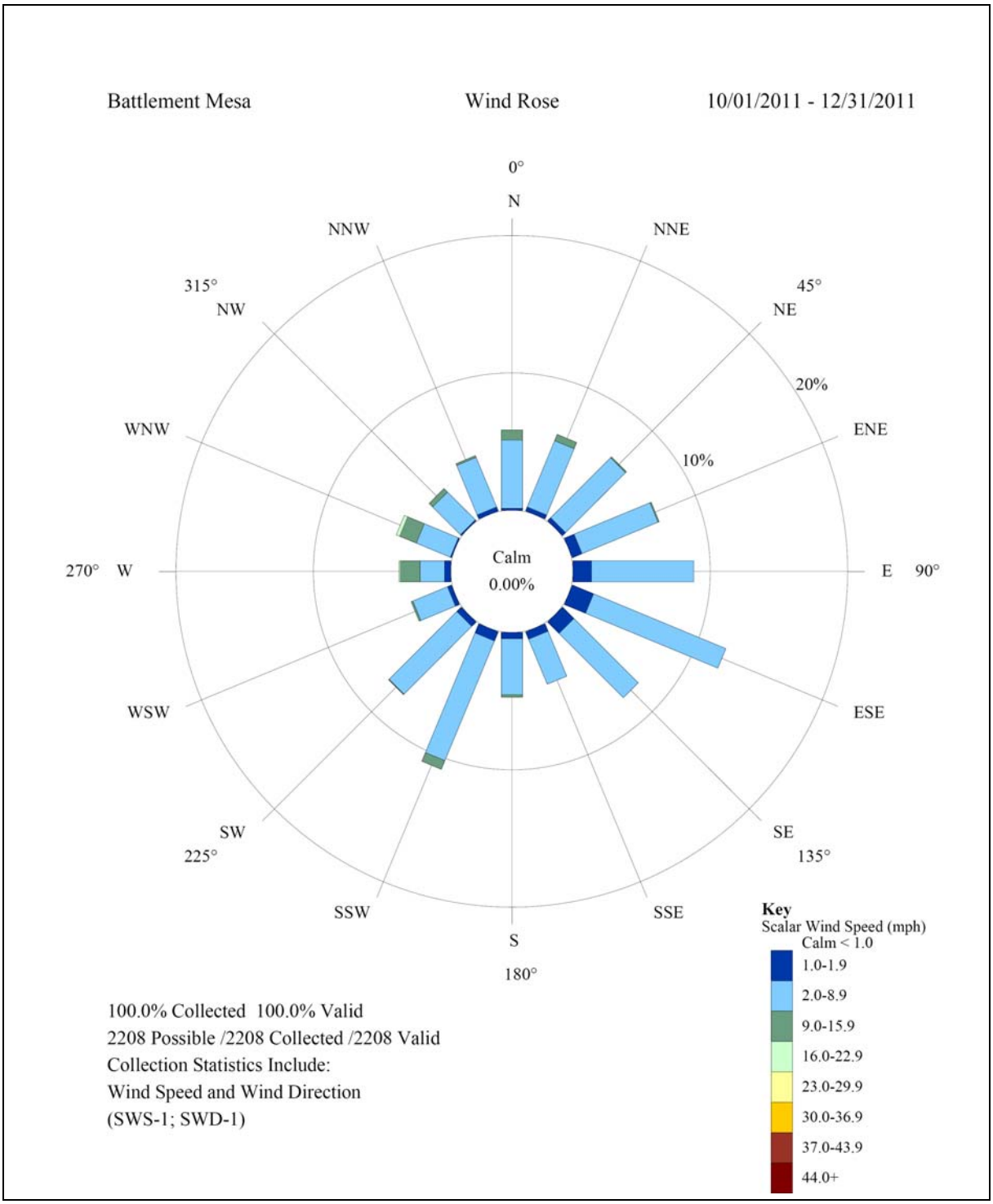


Figure 3-4. Quarterly Wind Rose for the Battlement Mesa Monitoring Site.

4.0 CRITERIA POLLUTANT SUMMARIES

The Clean Air Act requires the Environmental Protection Agency (EPA) to set two (2) types of National Ambient Air Quality Standards (NAAQS) for ground-level O_3, particle pollution ($PM_{2.5}$ and PM_{10}), lead, nitrogen dioxide (NO_2), carbon monoxide (CO), and sulfur dioxide (SO_2). The types of standards are as follows:

- Primary Standards: These standards are designed to protect public health with an adequate margin of safety, including the health of sensitive populations such as asthmatics, children, and the elderly.

- Secondary Standards: These standards are designed to protect public welfare from adverse effects, including visibility impairment and effects on the environment (e.g., vegetation, soils, water, and wildlife).

PM_{10} is monitored using filter-based Federal Reference Method (FRM) samplers at the Parachute and Rifle sites. Continuous $PM_{2.5}$ and PM_{10} are also monitored at the Rifle site. The level of the national primary and secondary ambient air quality standards for PM_{10} is a 24-hour average concentration of 150 micrograms per cubic meter ($\mu g/m^3$). A violation of the standard occurs when the number of days with a 24-hour average concentration above 150 $\mu g/m^3$ over a three (3) year period is equal to or less than one. The standards for $PM_{2.5}$ are an annual arithmetic mean of 15 $\mu g/m^3$, and a 24-hour average of 35 $\mu g/m^3$. A violation of the $PM_{2.5}$ standard occurs when the three (3) year average of the weighted annual mean exceeds that annual standard, or the three (3) year average of the 98th percentile 24-hour average value exceeds the 24-hour standard.

Continuous O_3 is monitored at the Rifle site. The NAAQS for O_3 is currently 0.075 ppm (75 ppb) over an 8-hour period. An exceedance of the standard occurs when an 8-hour average O_3 concentration is greater than or equal to 76 ppb. A violation of the standard occurs when the three (3) year average of the fourth highest daily maximum 8-hour average ozone concentration equals or exceeds 76 ppb.

Values measured for O_3, $PM_{2.5}$, and PM_{10} measured year-to-date in 2011 at the Rifle site are presented with corresponding NAAQS in Table 4-1. PM_{10} measured at the Parachute site is presented in Table 4-2. At present, air quality measurements in Garfield County do not violate air quality standards for these criteria pollutants.

Table 4-1

Rifle Site
Standards Summary
January 1, 2011 – December 31, 2011

Parameter	NAAQS		Measured	
	Averaging Time	Standard	Measured Value	Date(s)
Ozone (O_3)	Rolling 8-hour	0.075 ppm/ 75 ppb	Highest Daily Max.: 68 ppb	6/10, 6/19
			4th Highest Daily Max.: 66 ppb	5/30, 6/14
Particulate Matter ≤2.5µm* ($PM_{2.5}$)	Annual	15 µg/m^3	Arithmetic Mean: 8.2 µg/m^3	1/1-12/31
	24-hour	35 µg/m^3	Highest Daily Max.: 31.8 µg/m^3	1/11
			2nd Highest Daily Max.: 17.5 µg/m^3	1/14
Particulate Matter ≤10µm (PM_{10})**	24-hour	150 µg/m^3	Highest Daily Max.: 54 µg/m^3	3/19
			2nd Highest Daily Max.: 53 µg/m^3	4/9

*Calculated using continuous TEOM measurements
**Calculated using 1/3 day filter-based measurements

Table 4-2

Parachute Site
Standards Summary
January 1, 2011 – December 31, 2011

Parameter	NAAQS		Measured	
	Averaging Time	Standard	Measured Value	Date(s)
Particulate Matter ≤10µm (PM_{10})	24-hour	150 µg/m^3	Highest Daily Max.: 96 µg/m^3	3/22
			2nd Highest Daily Max.: 73 µg/m^3	4/9

4.1 OZONE

Ozone is measured at the Rifle site. Figure 4-1 presents daily maximum 8-hour averages of ozone measured year-to-date in 2011 along with the NAAQS. Table 4-3 presents the highest daily maximum 8-hour O_3 measurements in 2011.

Figure 4-2 presents a quarterly O_3 pollutant rose for the Rifle site. The highest ozone values were associated with winds between the south and west. Figure 4-3 presents the quarterly diurnal cycle of measured hourly O_3 at the Rifle station. The cycle shows lowest concentrations in the early morning hours and maximum concentrations in the late afternoon. This pattern results from daytime photochemical production from oxides of nitrogen (NO_X, NO + NO_2) and VOC precursors, and ozone loss by dry deposition and reaction with NO at night.

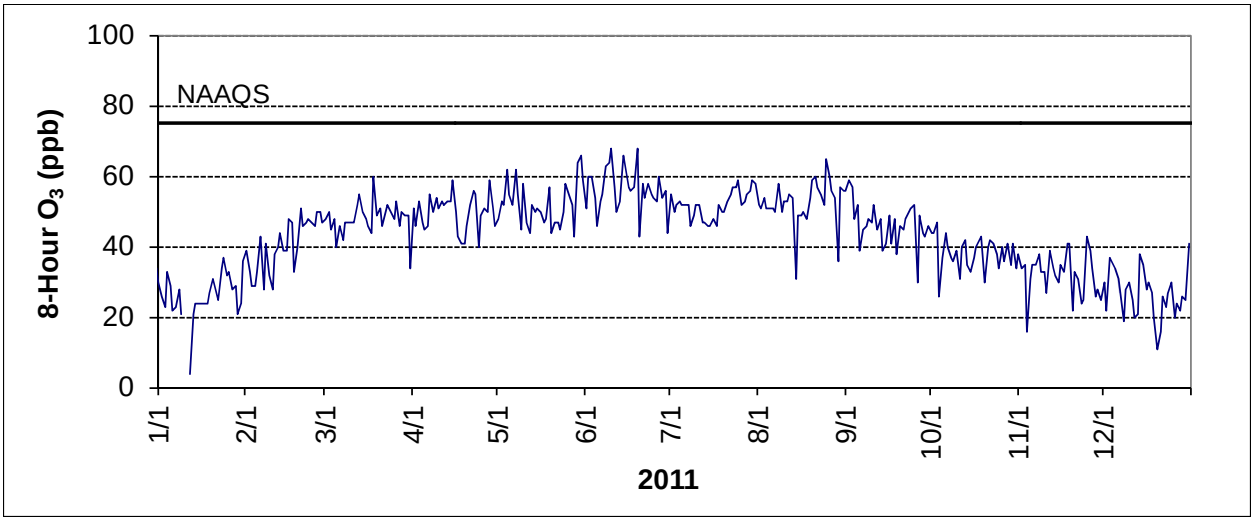


Figure 4-1. Daily Maximum 8-Hour Averages of Ozone Monitored at the Rifle Site.

Table 4-3

Rifle Site
Ten Highest Daily Maximum 8-Hour Ozone Averages
January 1, 2011 – December 31, 2011

Level	Date	Daily Maximum 8-Hour Ozone (ppb)
1	06/10/2011	68
2	06/19/2011	68
3	05/30/2011	66
4*	06/14/2011	**66**
5	08/25/2011	65
6	05/29/2011	64
7	06/09/2011	64
8	06/08/2011	63
9	05/04/2011	62
10	05/07/2011	62

* The 3-year average of the 4th highest daily maximum is used to determine attainment status.

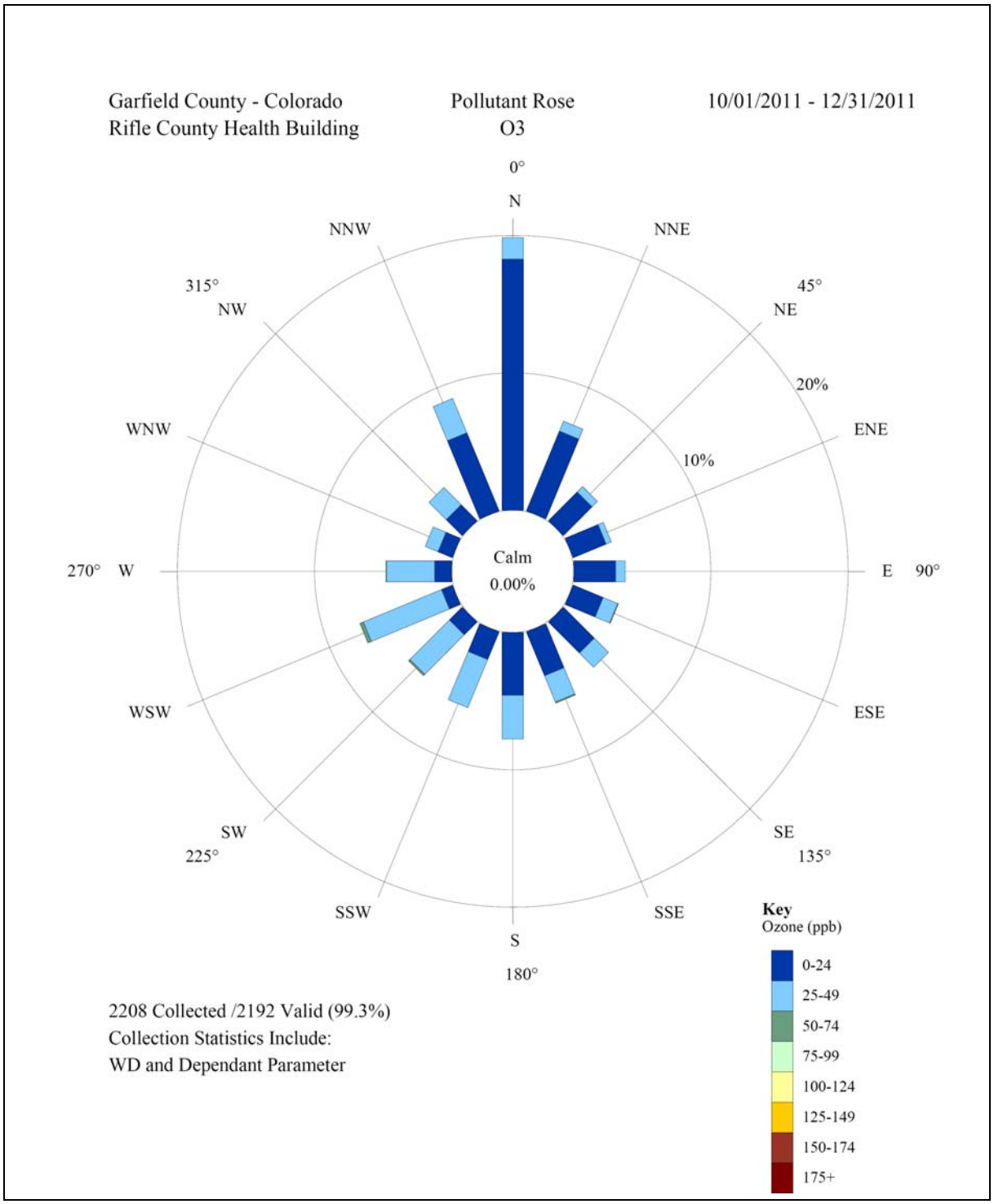


Figure 4-2. Quarterly Ozone Pollutant Rose for the Rifle Monitoring Site.

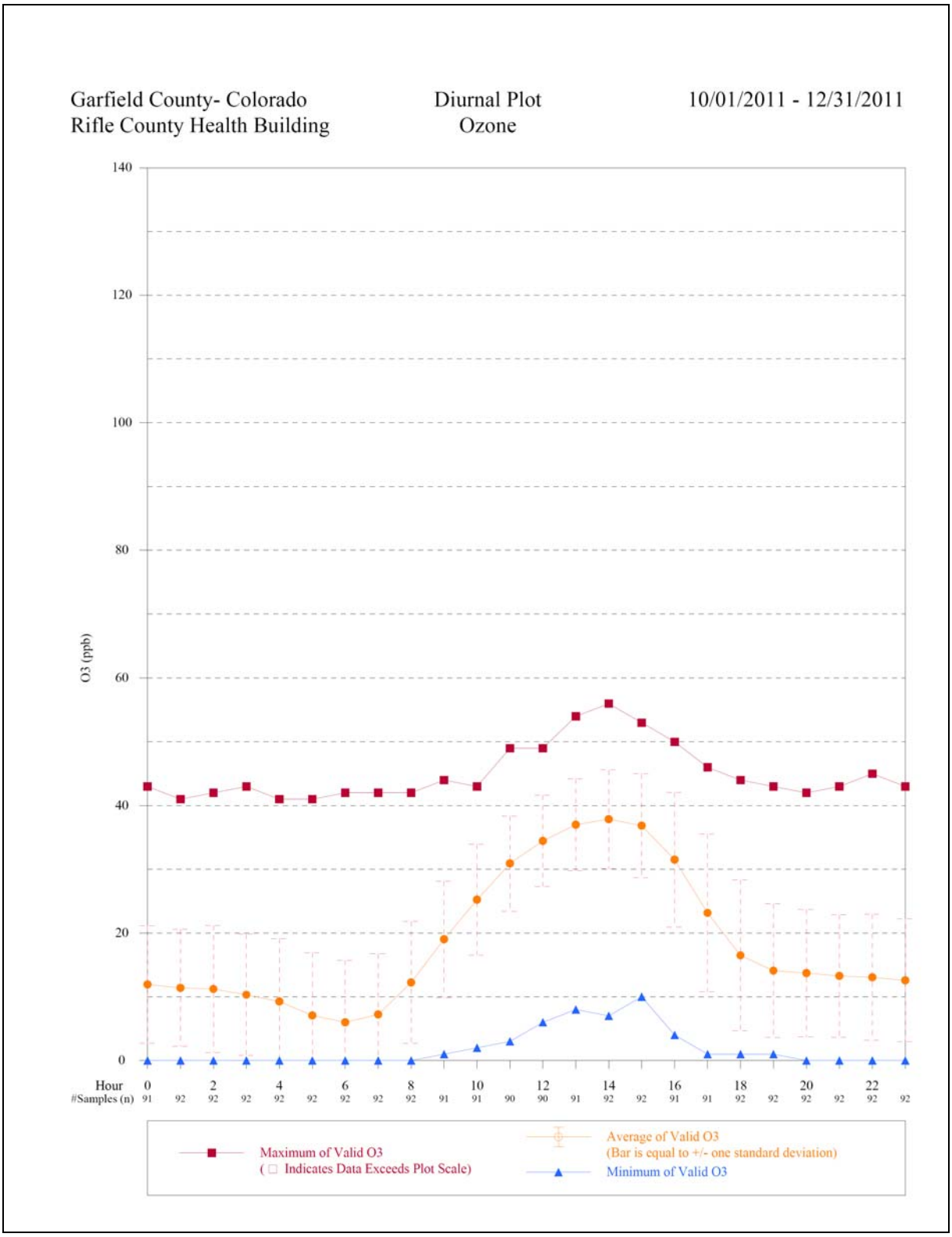


Figure 4-3. Quarterly Ozone Diurnal Plot for Rifle Monitoring Site.

4.2 PARTICULATE MATTER (PM_{10} AND $PM_{2.5}$)

Filter based 24-hour PM_{10} samples are collected every third day at the Parachute and Rifle sites, and continuous hourly PM_{10} and $PM_{2.5}$ concentrations are collected at the Rifle site.

Figures 4-4 and 4-5 present quarterly PM_{10} and $PM_{2.5}$ pollutant roses constructed from the continuous hourly data measured at the Rifle site. Highest particulate concentrations were measured when winds were out of the south-southwest. Figures 4-6 and 4-7 present quarterly diurnal plots for continuous PM_{10} and $PM_{2.5}$.

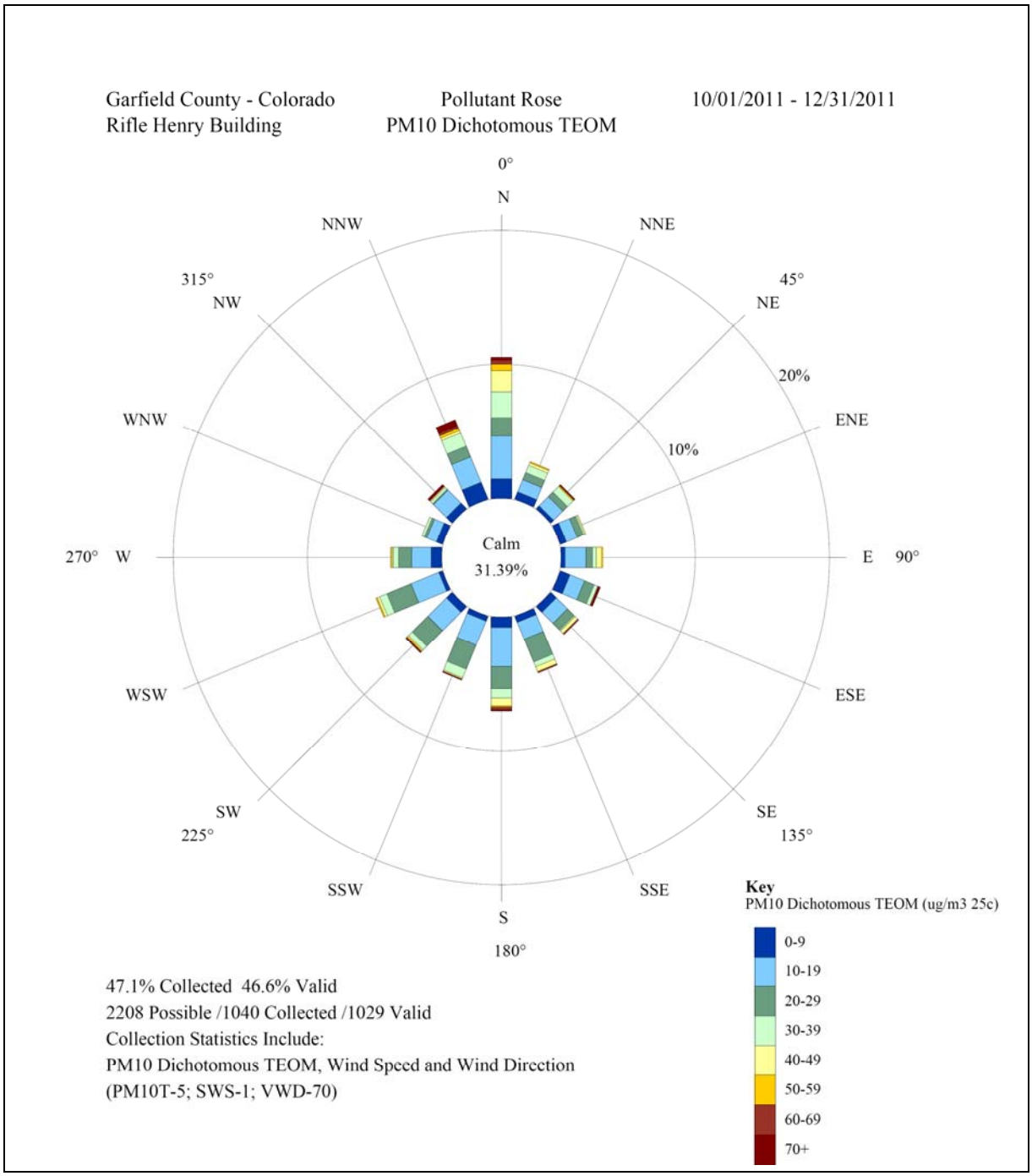


Figure 4-4. Quarterly PM_{10} Pollutant Rose for the Rifle Monitoring Site.

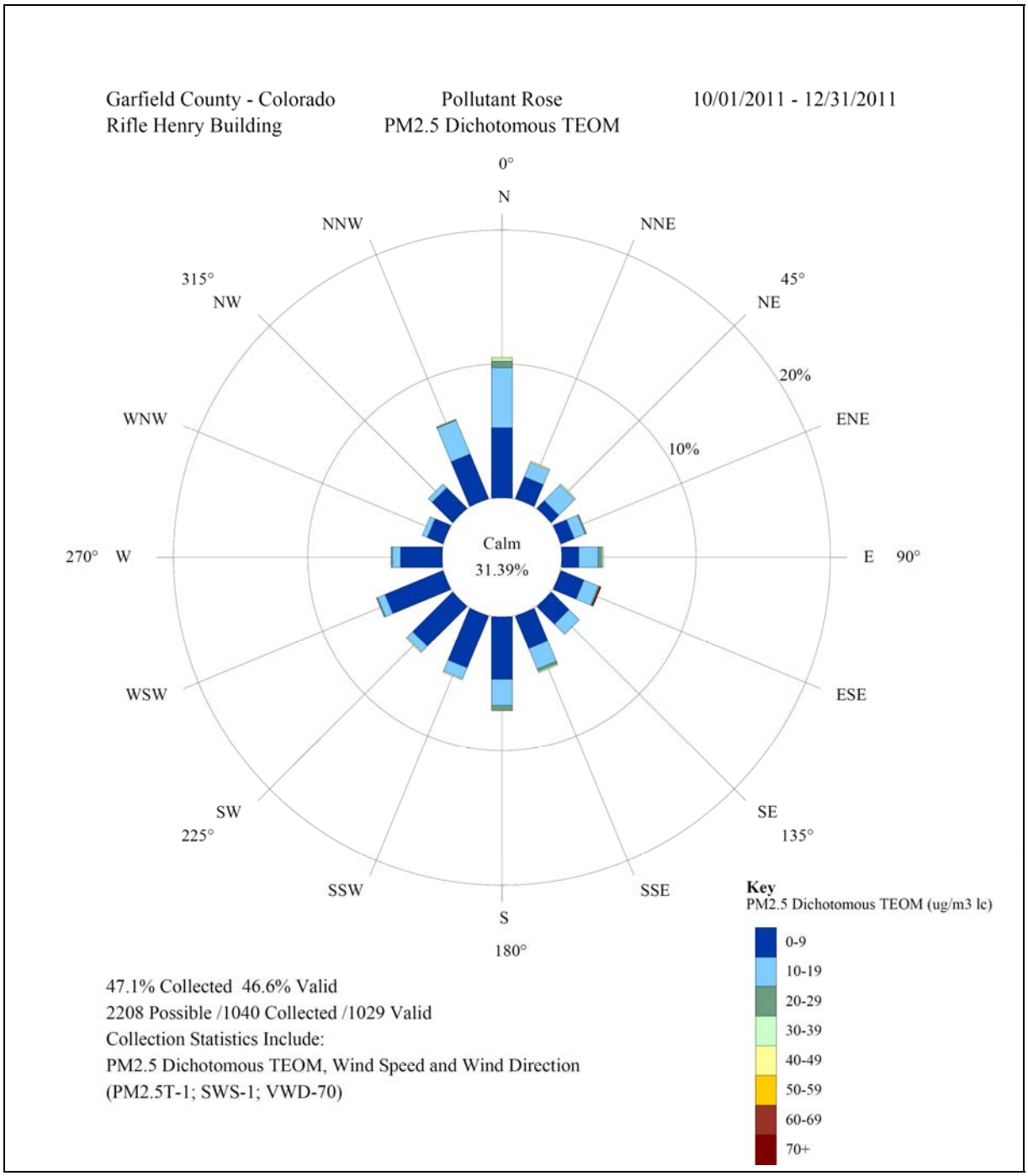


Figure 4-5. Quarterly $PM_{2.5}$ Pollutant Rose for the Rifle Monitoring Site.

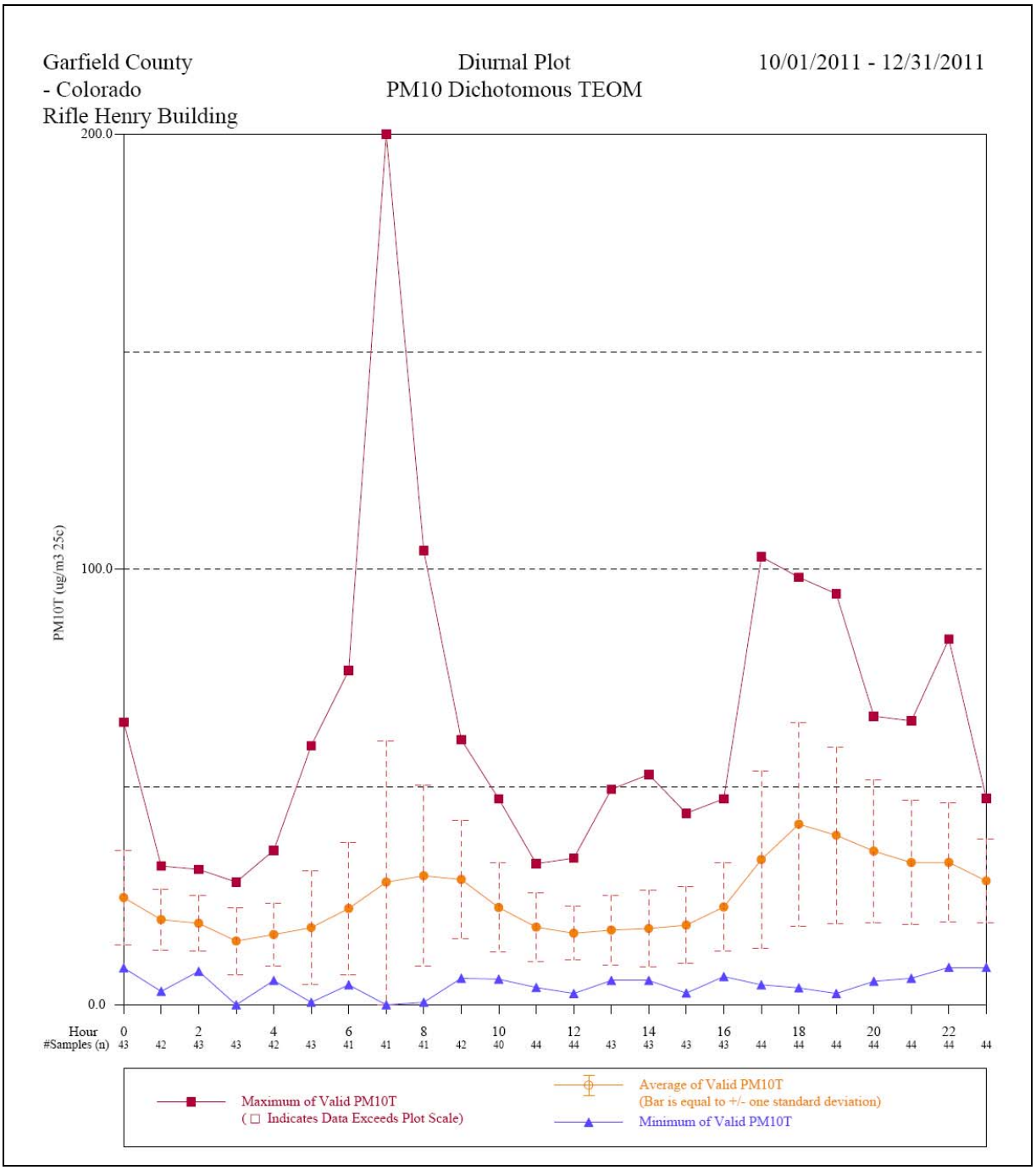


Figure 4-6. Quarterly PM_{10} Diurnal Plot for the Rifle Monitoring Site.

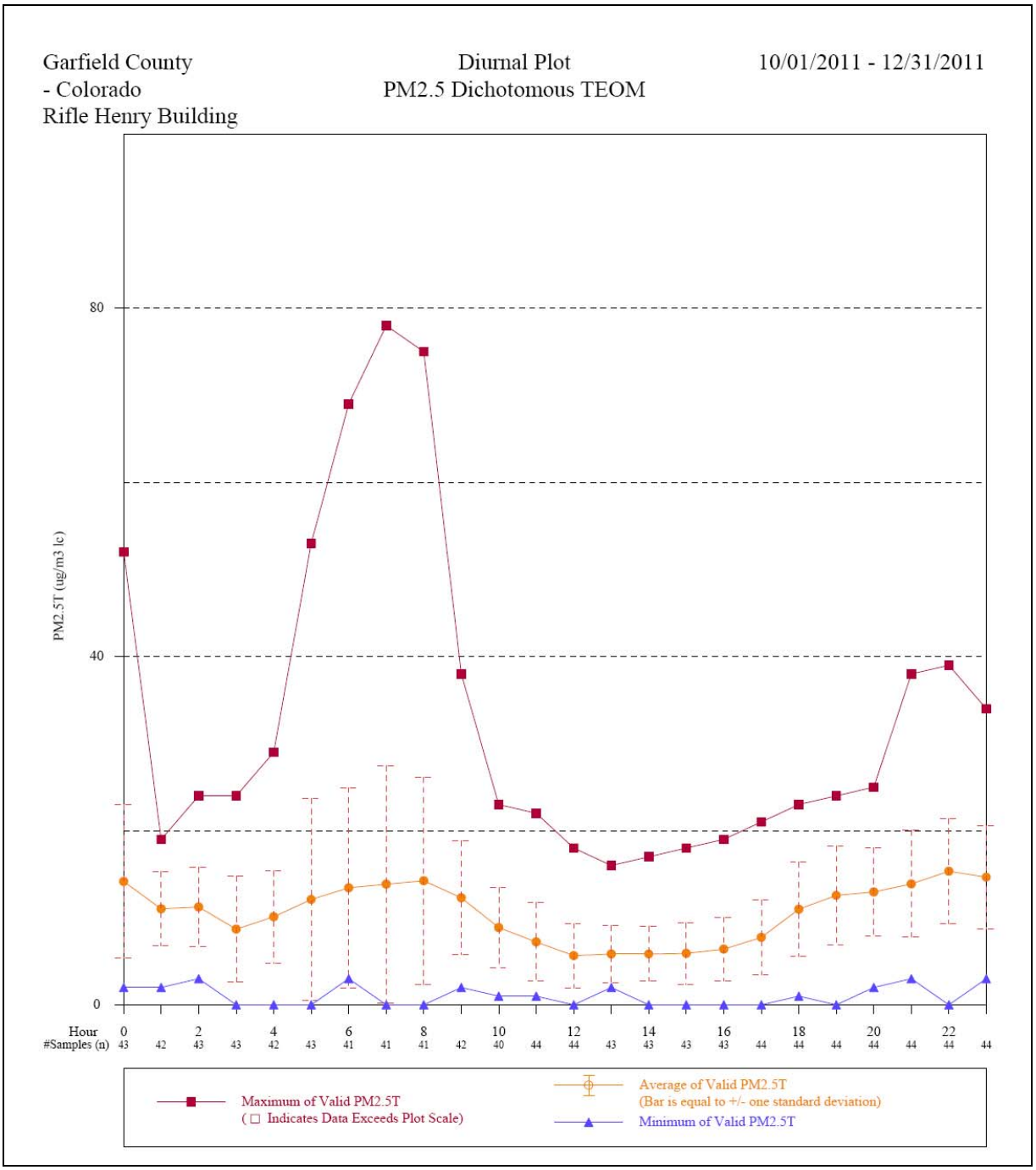


Figure 4-7. Quarterly $PM_{2.5}$ Diurnal Plot for Rifle Monitoring Site.

5.0 SNMOC AND CARBONYL SUMMARIES

Speciated Non-Methane Organic Compounds (SNMOCs) and carbonyl compounds are monitored each site in Garfield County. SNMOCs and carbonyl compounds are subsets of VOCs. VOCs are generally carbon- and hydrogen-based chemicals that exist in the gas phase or can evaporate from liquids. VOCs can react in the atmosphere to form ozone and fine particulate matter. Hazardous air pollutants (HAPs) are a subset of VOC compounds, and include compounds that are known or believed to cause human health effects at low doses. Levels of HAPs will be analyzed in a separate annual risk assessment report prepared by the CDPHE. Summaries of SNMOC and carbonyl monitoring are presented in this section.

5.1 SNMOC

SNMOC compounds were collected and analyzed according to EPA Compendium Method TO-12, with 24-hour samples collected at all four sites on a 1-in-6 day schedule. This method includes analyses for 81 different compounds. Appendix B lists minimum, maximum, and average concentrations of all detected SNMOC compounds by site.

SNMOC compounds can be grouped into classifications with similar characteristics. For these summaries, measured SNMOC compounds were grouped into the following categories:

- Light Alkanes: Alkanes are the simplest hydrocarbons, consisting of only carbon and hydrogen with single bonds. Light alkanes, which here include alkanes with up to five carbon atoms (ethane, propane, iso/n-butane and iso/n-pentane) are the primary components of natural gas.

- Heavy Alkanes: The hydrocarbons in crude oil are mostly heavy alkanes, which here include alkanes with more than five carbon atoms (C5). Crude oil products include gasoline, a refined mix of predominantly C6 to C10 hydrocarbons, and diesel, which is a refined mix ranging from approximately C10 to C15.

- Alkenes: Alkenes are more complex than alkanes, with at least one carbon to carbon double bond. These compounds are not generally found in crude oil. Alkenes are much more reactive than alkanes, and will deplete quickly in the atmosphere. Alkenes are produced in refineries when larger alkane molecules are dissociated (or cracked) into smaller compounds. Some alkene compounds, including terpenes such as isoprene and a- and b-pinene, are naturally emitted from vegetation.

- Aromatics: Aromatic compounds are the most abundant compounds emitted from gas-fired engines. These compounds include the BTEX parameters (benzene, toluene, ethylbenzene and m/p-xylenes), which are commonly associated with motor vehicles and condensate.

Figure 5-1 presents categories of measured SNMOCs in units of ppbV (parts per billion by volume) measured in 2011 at each site. In general, compounds measured were dominated by light alkanes.

Figure 5-2 presents the year to date daily measurements by category in units of ppbC, where ppbC is results in ppbV multiplied by the number of carbons in each compound. Carbon content in a molecule is related to the compound reactivity, which contributes to ozone formation potential. Heavier alkanes and aromatics are more significant sources of carbon, especially at the more urban Parachute and Rifle sites. The unknown category indicates the part of the total carbon measurements were individual species were not identified.

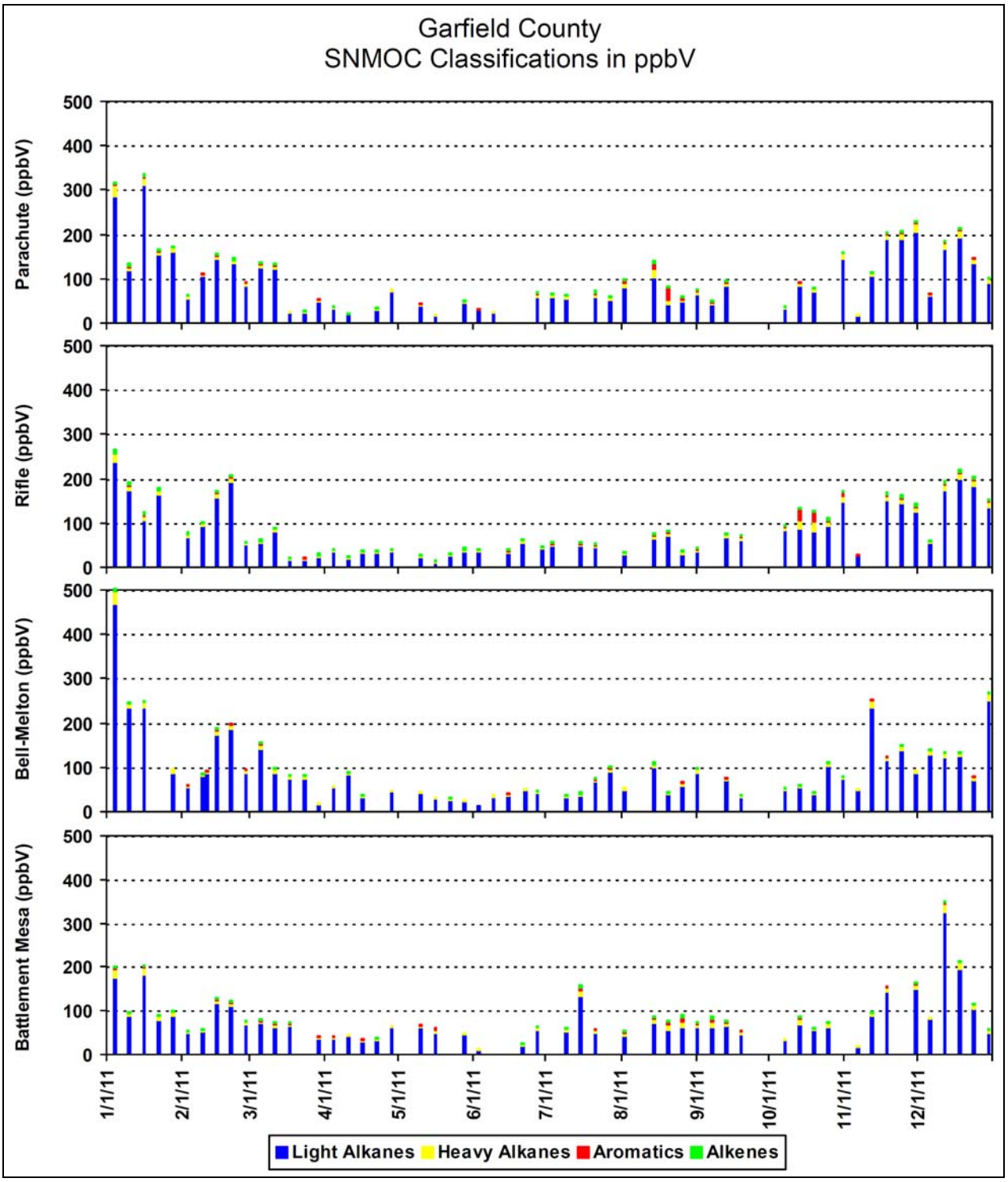


Figure 5-1. 24-Hour SNMOC Measurements by Category in Units of ppbV.

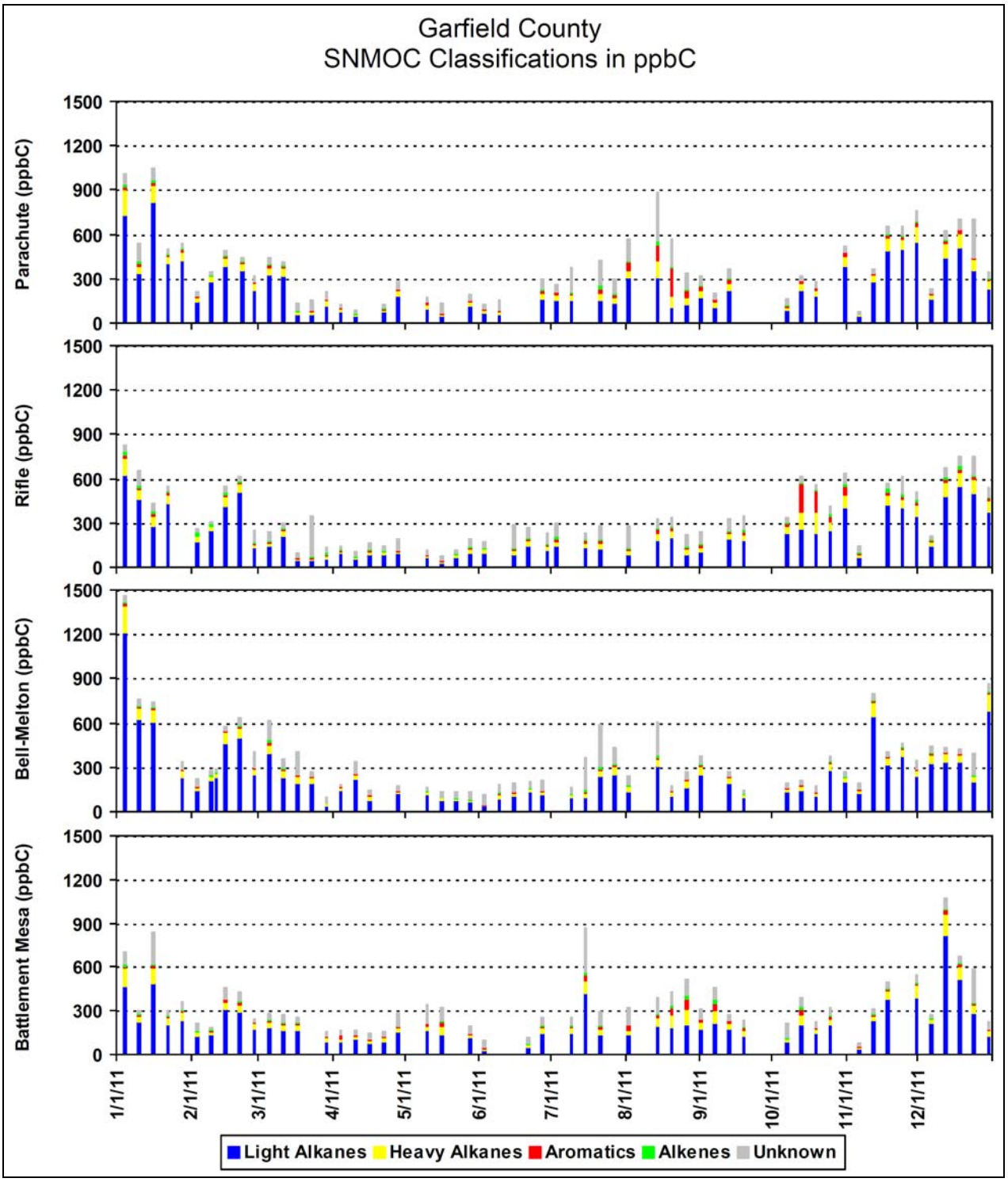


Figure 5-2. 24-Hour SNMOC Measurements by Category in Units of ppbC.

5.2 CARBONYLS

Carbonyl compounds were collected and analyzed according to EPA Compendium Method TO-11A, with 24-hour samples collected at all four sites on a 1-in-12 day schedule. This method includes analysis for twelve (12) different carbonyl compounds.

Carbonyls are highly reactive and play a critical role in the formation of ozone. Some carbonyls, including formaldehyde and acetaldehyde, also have adverse chronic and acute health effects. The major sources of directly emitted carbonyls are fuel combustion, mobile sources, and process emissions from oil refineries (CARB, 2009).

Appendix C lists minimum, maximum, and average concentrations of all detected carbonyl compounds. Major compounds included formaldehyde, acetaldehyde, and acetone. Figure 5-3 presents a time series of the major compounds measured at each site in 2011.

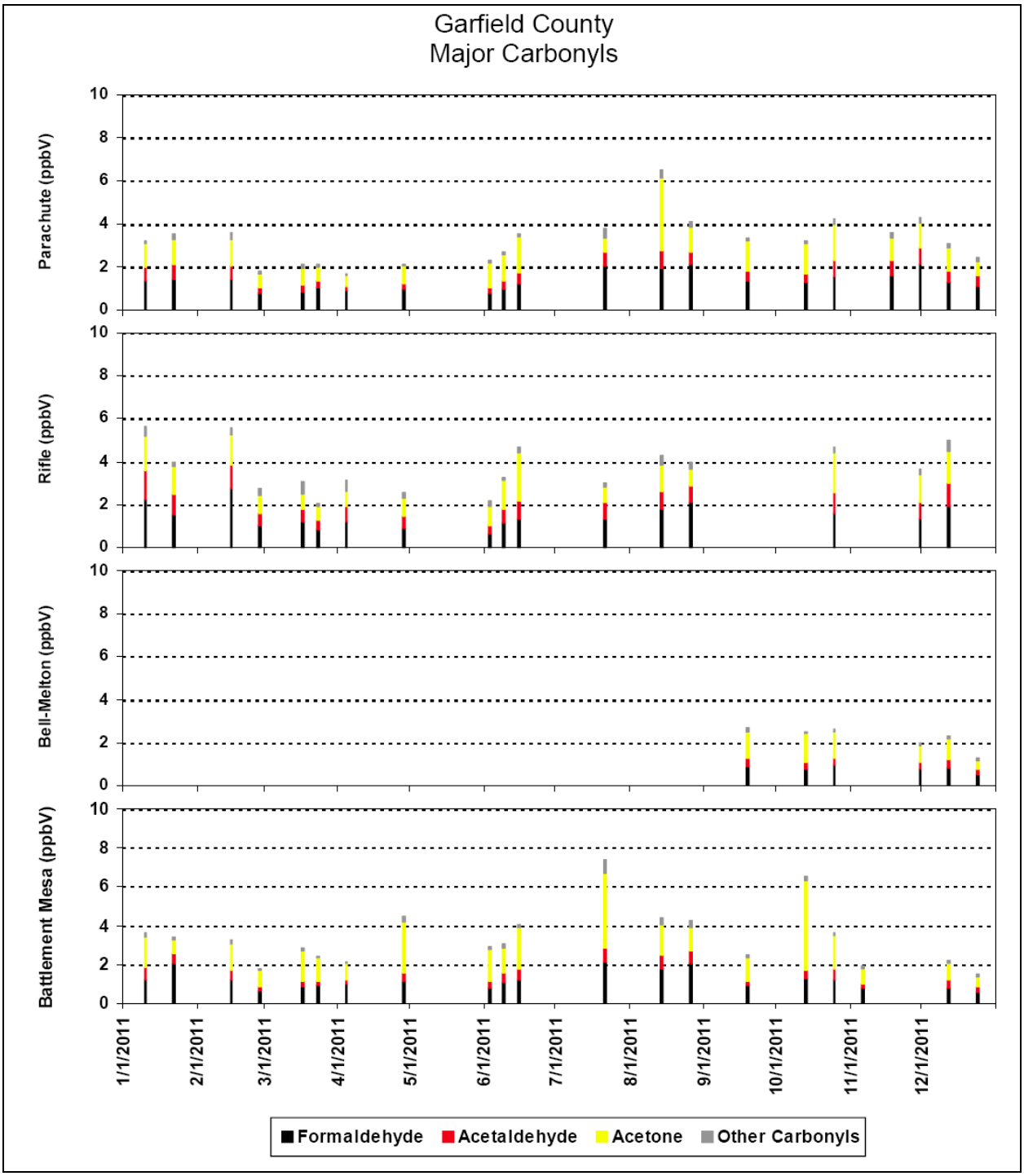


Figure 5-3. 24-Hour Major Carbonyl Compound Concentrations in Units of ppbV.

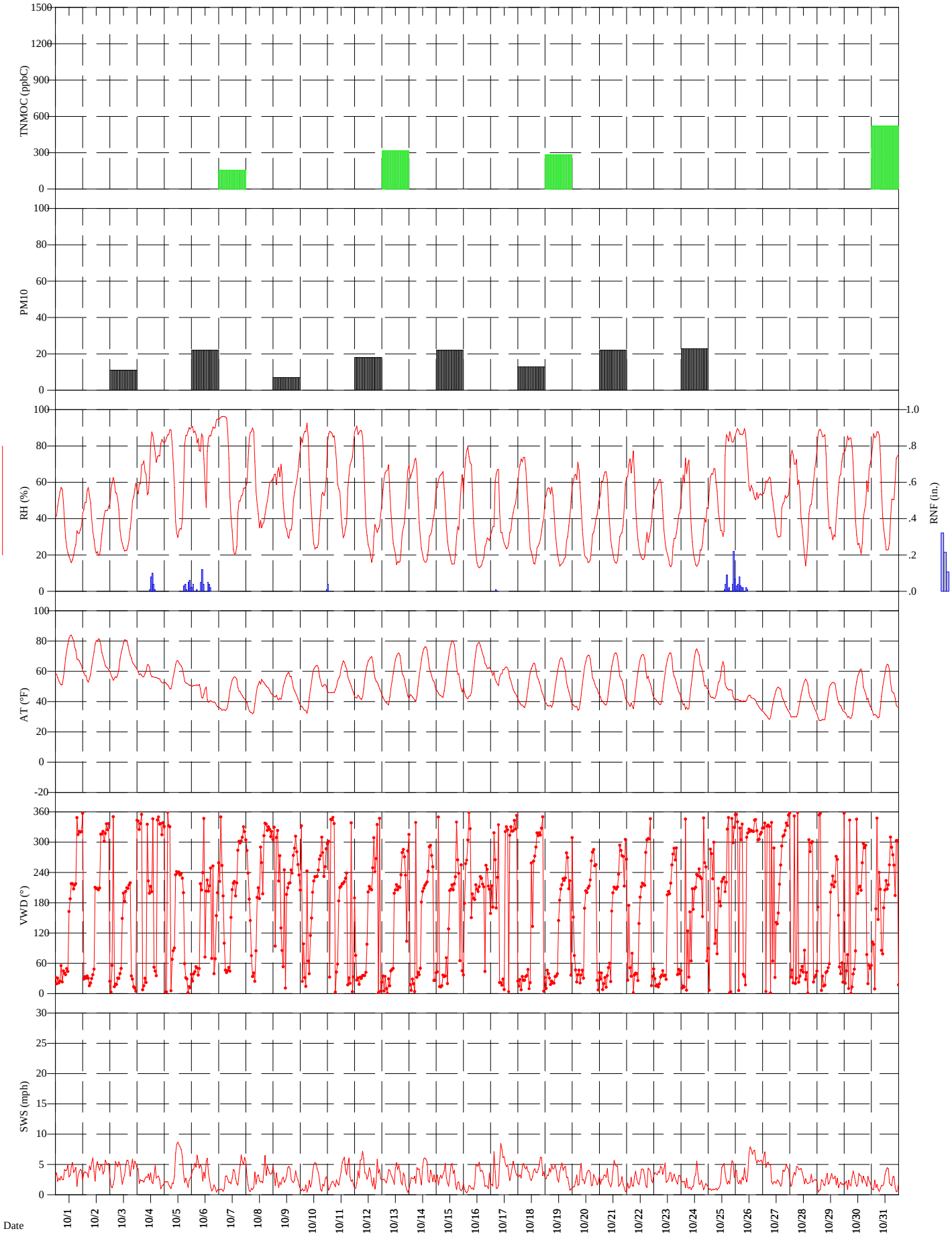
APPENDIX A

Garfield County

Stackplots
October 1, 2011 – December 31, 2011

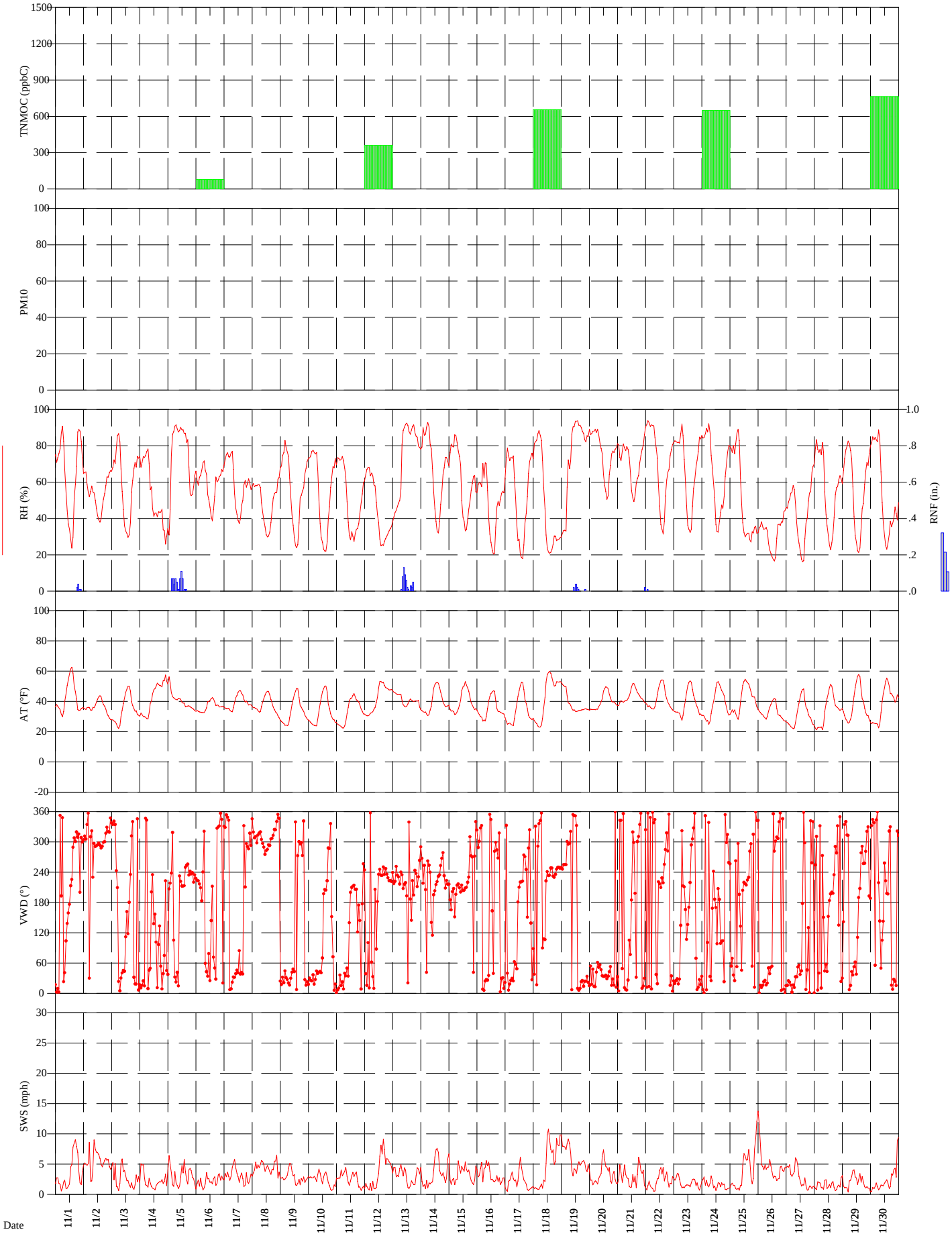
Garfield County, CO

Parachute Site



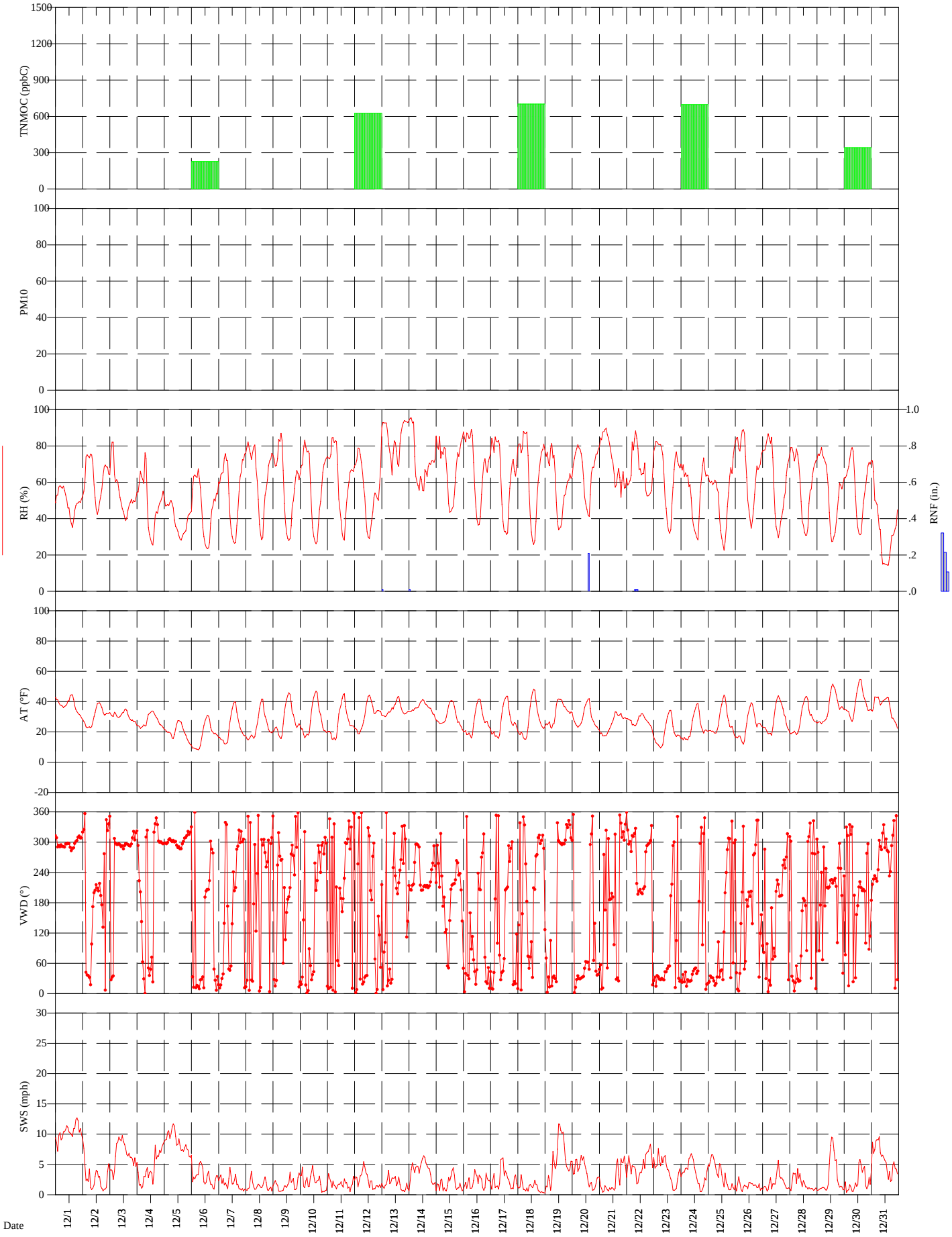
Garfield County, CO

Parachute Site



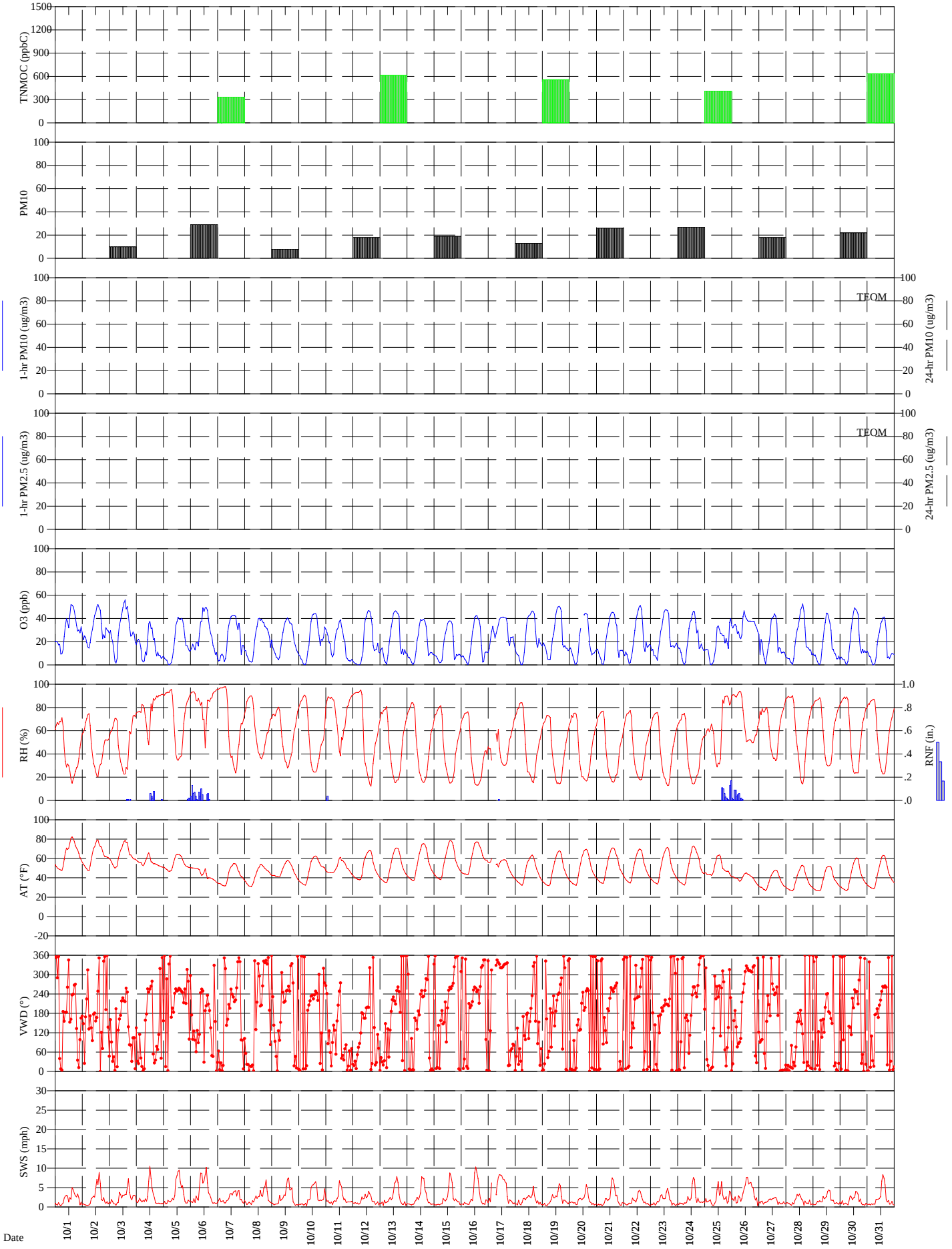
Garfield County, CO

Parachute Site



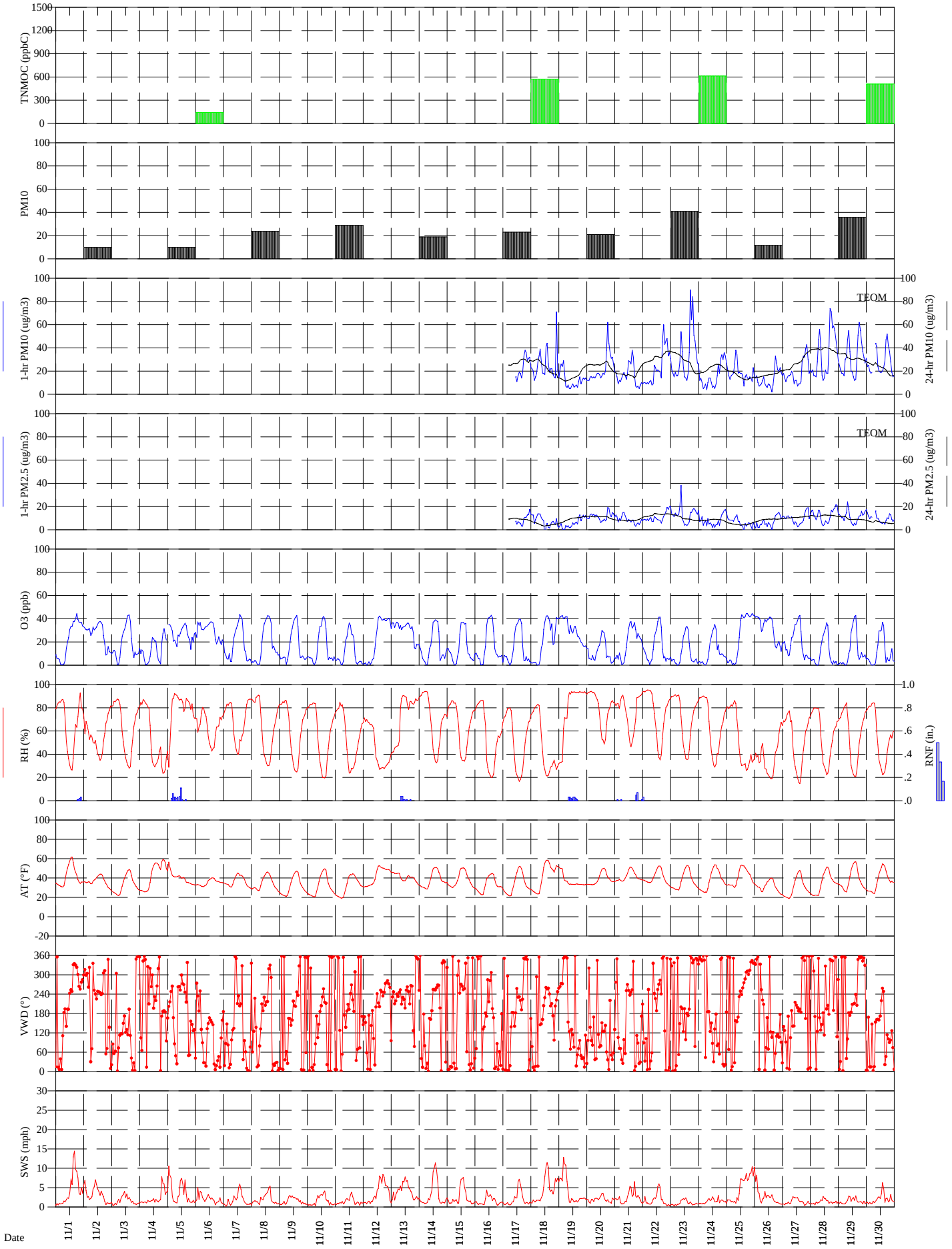
Garfield County, CO

Rifle Site



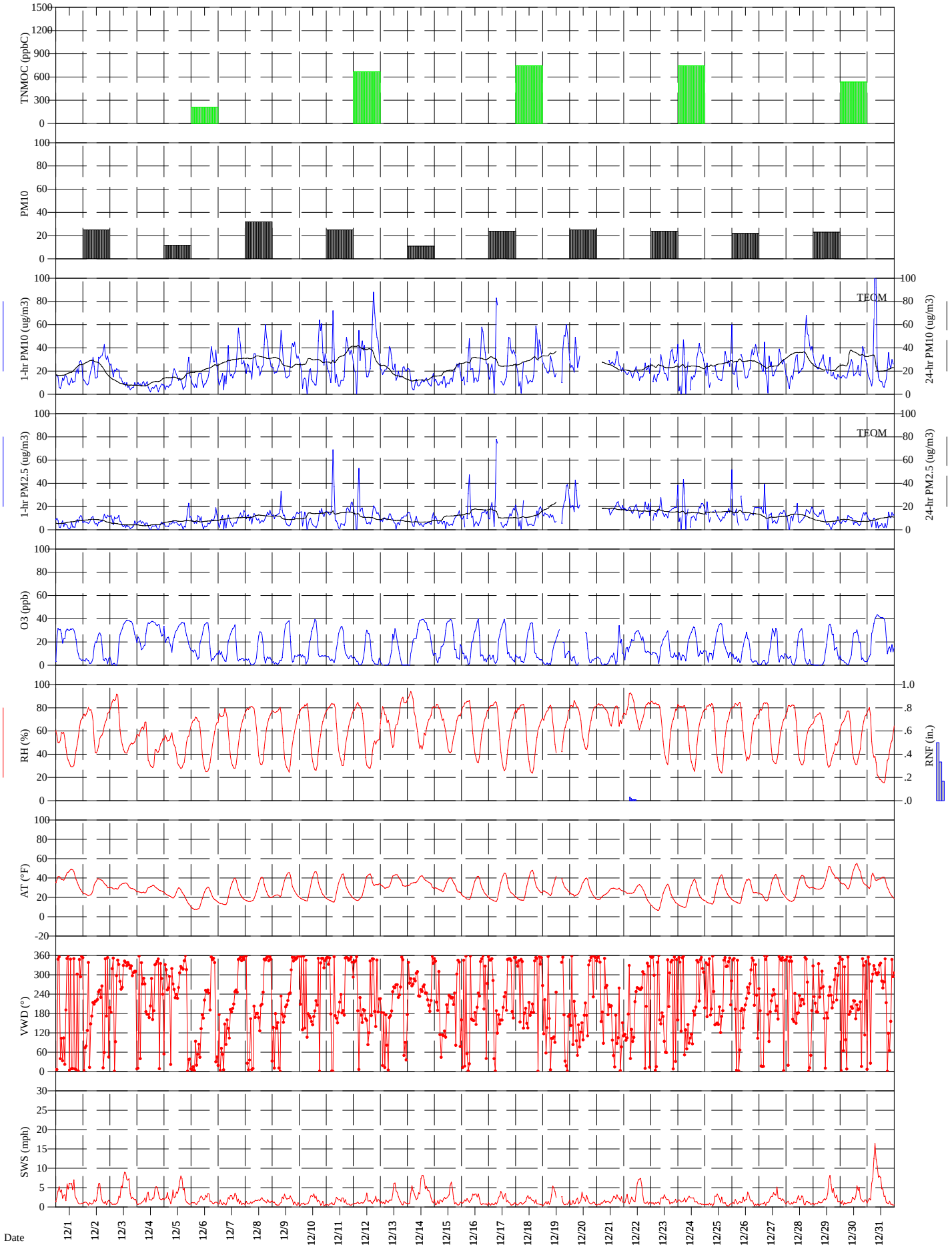
Garfield County, CO

Rifle Site

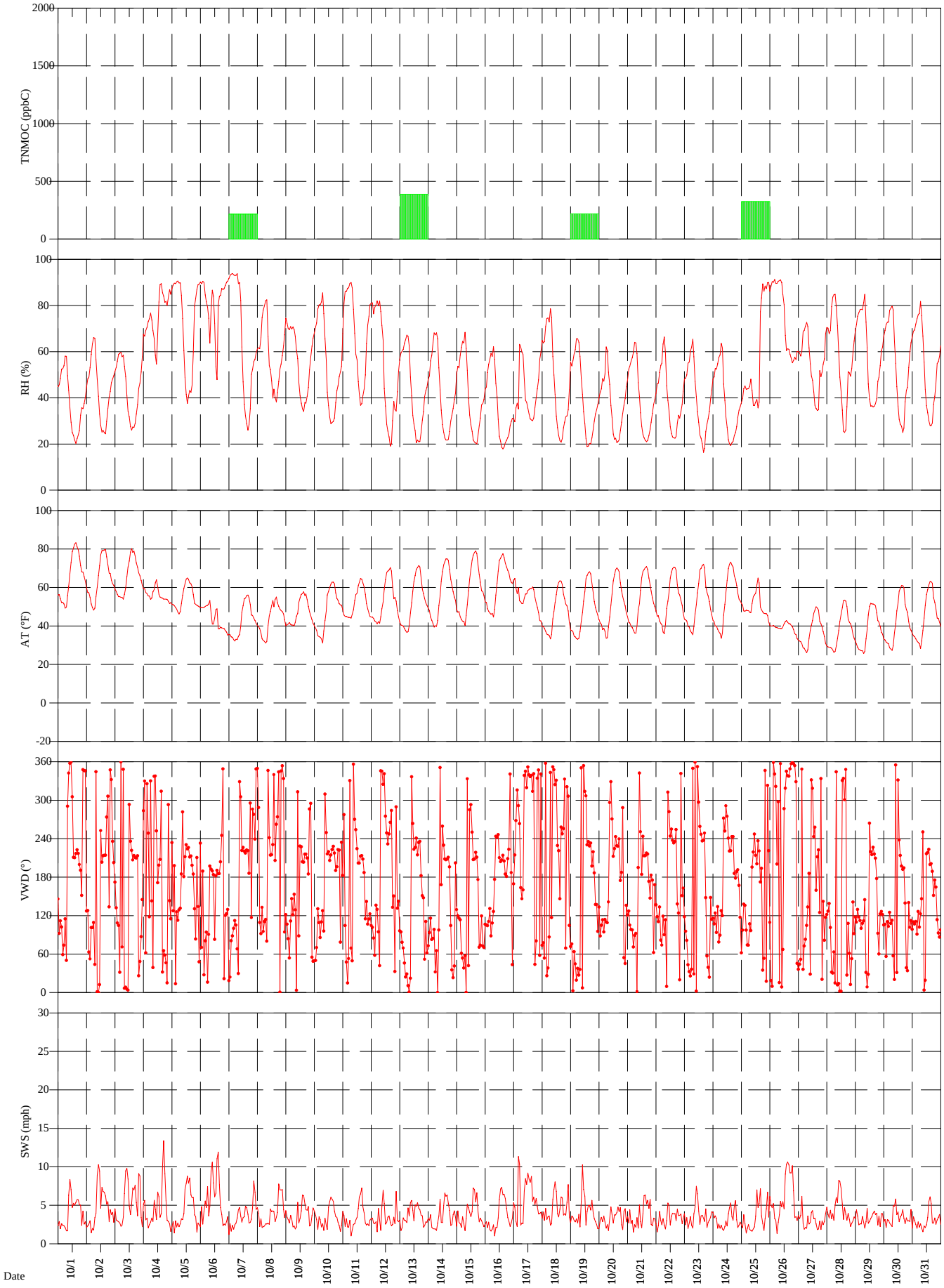


Garfield County, CO

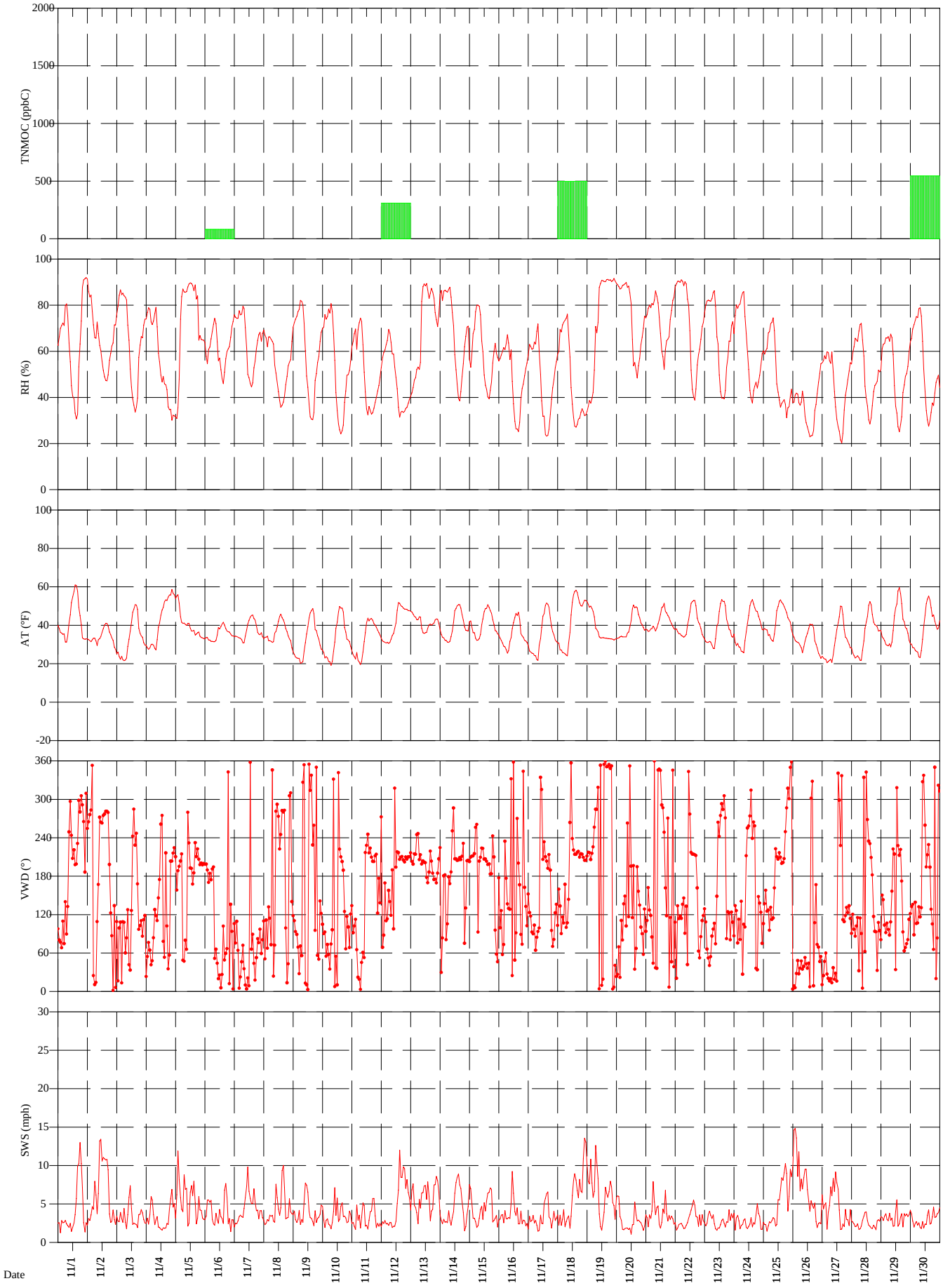
Rifle Site



Garfield County, CO
Battlement Mesa Site



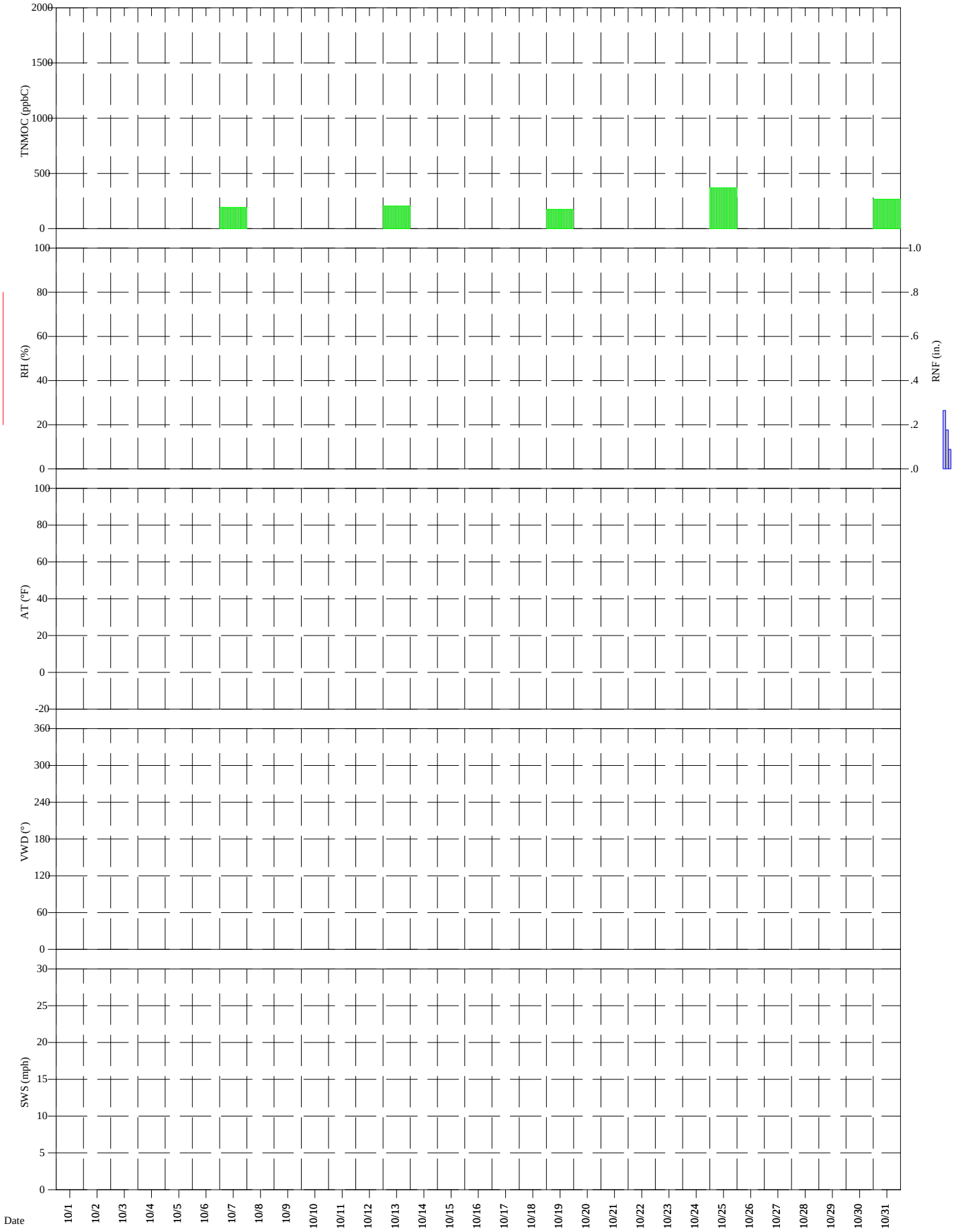
Garfield County, CO
Battlement Mesa Site



Garfield County, CO
Battlement Mesa Site

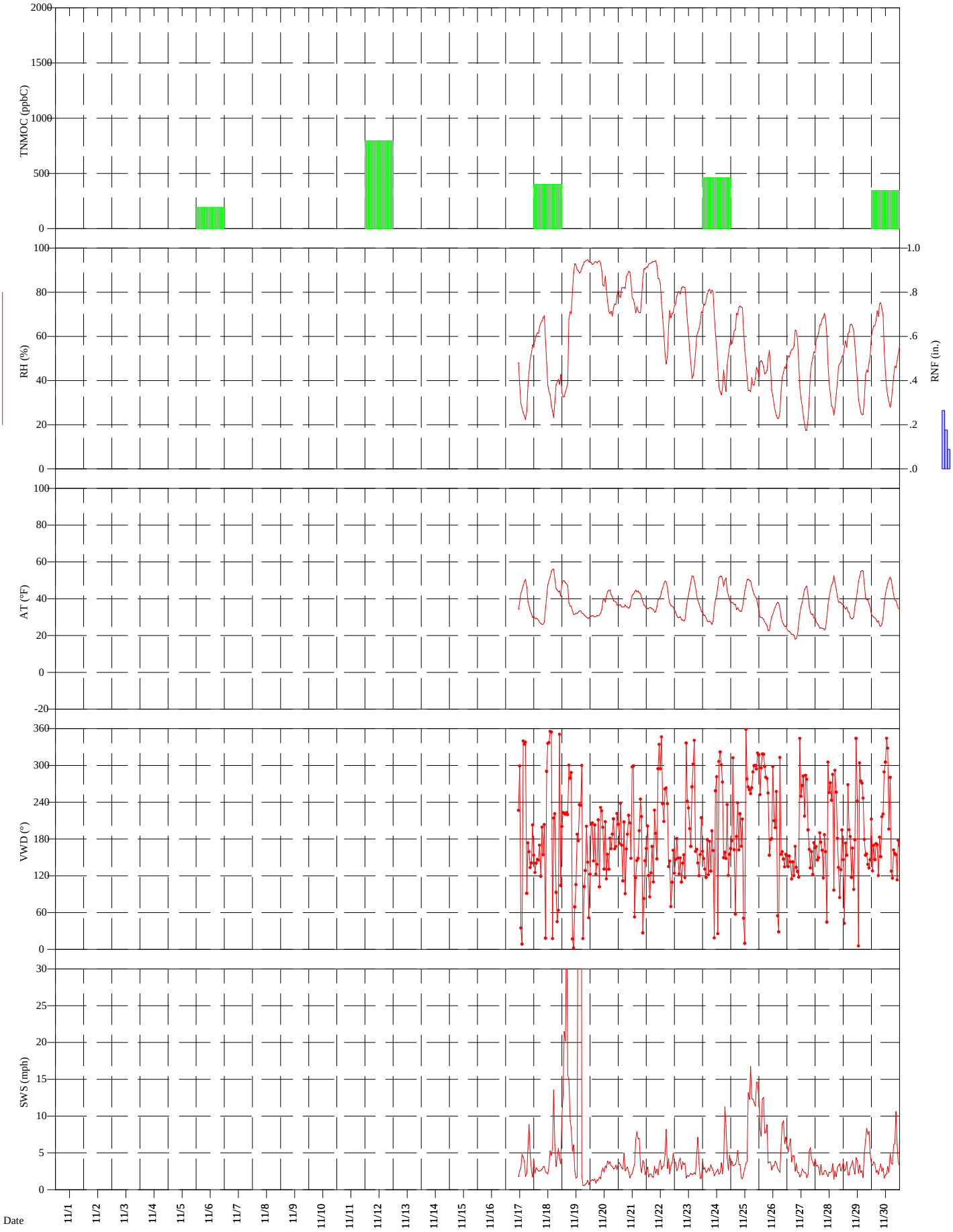
Garfield County, CO

Bell Melton Site



Garfield County, CO

Bell Melton Site



Garfield County, CO

Bell Melton Site

APPENDIX B

Garfield County

SNMOC Concentrations
October 1, 2011 – December 31, 2011

Table B-1
Garfield County SNMOC Monitoring
Parachute (PACO)
10/7/2011-12/30/2011 (every sixth day)

	Sample Count		Concentration (ppbV)		
Detected Compound (CAS Number)	**# Samples**	**# Detects**	**Minimum**	**Maximum**	**Average***
1,2,3-Trimethylbenzene (526-73-8)	14	10	0.01	0.02	0.01
1,2,4-Trimethylbenzene (95-63-6)	14	14	0.03	0.10	0.07
1,3,5-Trimethylbenzene (108-67-8)	14	13	0.03	0.10	0.06
1,3-Butadiene (106-99-0)	14	10	0.01	0.14	0.06
1-Dodecene (112-41-4)	14	12	0.01	0.06	0.02
1-Heptene (592-76-7)	14	11	0.04	0.26	0.11
1-Hexene (592-41-6)	14	6	0.01	0.05	0.03
1-Nonene (124-11-8)	14	4	0.01	0.02	0.01
1-Octene (111-66-0)	14	10	0.02	0.06	0.03
1-Pentene (109-67-1)	14	12	0.02	0.06	0.03
1-Undecene (821-95-4)	14	2	0.02	0.02	0.01
2,2,3-Trimethylpentane (564-02-3)	14	6	0.02	0.06	0.02
2,2,4-Trimethylpentane (540-84-1)	14	2	0.14	0.21	0.03
2,2-Dimethylbutane (75-83-2)	14	14	0.02	0.30	0.18
2,3,4-Trimethylpentane (565-75-3)	14	9	0.01	0.02	0.01
2,3-Dimethylbutane (79-29-8)	14	14	0.03	0.55	0.30
2,3-Dimethylpentane (565-59-3)	14	14	0.02	0.20	0.12
2,4-Dimethylpentane (108-08-7)	14	14	0.01	0.15	0.09
2-Methyl-1-butene (563-46-2)	14	7	0.02	0.12	0.04
2-Methyl-2-butene (513-35-9)	14	9	0.03	0.11	0.04
2-Methylheptane (592-27-8)	14	14	0.02	0.26	0.16
2-Methylhexane (591-76-4)	14	14	0.08	0.62	0.35
2-Methylpentane (107-83-5)	14	14	0.16	2.23	1.15
3-Methylheptane (589-81-1)	14	14	0.02	0.19	0.12
3-Methylhexane (589-34-4)	14	13	0.08	0.61	0.34
3-Methylpentane (96-14-0)	14	14	0.09	1.26	0.66
Acetylene (74-86-2)	14	14	0.37	1.50	0.82
a-Pinene (80-56-8)	14	3	0.01	0.02	0.01
Benzene (71-43-2)	14	14	0.12	0.88	0.48
b-Pinene (127-91-3)	14	5	0.01	0.06	0.02
cis-2-Butene (590-18-1)	14	11	0.01	0.26	0.05
cis-2-Pentene (627-20-3)	14	5	0.02	0.04	0.02
Cyclohexane (110-82-7)	14	14	0.11	1.56	0.86
Cyclopentane (287-92-3)	14	13	0.08	0.36	0.20
Cyclopentene (142-29-0)	14	2	0.02	0.02	0.02
Ethane (74-84-0)	14	14	10.35	121.50	71.00
Ethylbenzene (100-41-4)	14	14	0.02	0.10	0.06
Ethylene (74-85-1)	14	14	0.66	2.28	1.48
Isobutane (75-28-5)	14	14	0.80	13.15	7.21
Isopentane (78-78-4)	14	14	0.50	7.72	4.24
Isoprene (78-79-5)	14	7	0.02	0.05	0.03
Isopropylbenzene (98-82-8)	14	4	0.02	0.02	0.01

*Samples reported as non-detects (ND) were included in averages as 1/2 minimum detection limits.

Table B-1 (continued)
Garfield County SNMOC Monitoring
Parachute (PACO)
10/7/2011-12/30/2011 (every sixth day)

	Sample Count		Concentration (ppbV)		
Detected Compound (CAS Number)	**# Samples**	**# Detects**	**Minimum**	**Maximum**	**Average***
m-Diethylbenzene (141-93-5)	14	10	0.02	0.05	0.02
Methylcyclohexane (108-87-2)	14	14	0.23	2.60	1.51
Methylcyclopentane (96-37-7)	14	14	0.10	1.32	0.71
m-Ethyltoluene (620-14-4)	14	14	0.01	0.07	0.04
m-Xylene/p-Xylene (108-38-3 / 106-42-3)	14	14	0.08	0.63	0.39
n-Butane (106-97-8)	14	14	0.91	13.30	7.42
n-Decane (124-18-5)	14	14	0.02	0.18	0.10
n-Dodecane (112-40-3)	14	14	0.01	0.06	0.04
n-Heptane (142-82-5)	14	14	0.09	0.95	0.58
n-Hexane (110-54-3)	14	14	0.15	2.32	1.21
n-Nonane (111-84-2)	14	14	0.03	0.31	0.18
n-Octane (111-65-9)	14	14	0.07	0.65	0.38
n-Pentane (109-66-0)	14	14	0.37	5.34	2.73
n-Propylbenzene (103-65-1)	14	7	0.02	0.03	0.02
n-Tridecane (629-50-5)	14	2	0.01	0.01	0.02
n-Undecane (1120-21-4)	14	13	0.01	0.10	0.05
o-Ethyltoluene (611-14-3)	14	13	0.01	0.05	0.03
o-Xylene (95-47-6)	14	14	0.02	0.13	0.08
p-Diethylbenzene (105-05-5)	14	9	0.01	0.04	0.02
p-Ethyltoluene (622-96-8)	14	13	0.02	0.05	0.03
Propane (74-98-6)	14	14	4.00	43.67	26.36
Propylene (115-07-1)	14	13	0.16	0.50	0.30
Propyne (74-99-7)	14	1	0.04	0.04	0.02
Styrene (100-42-5)	14	1	0.01	0.01	0.02
Toluene (108-88-3)	14	14	0.19	1.30	0.79
trans-2-Butene (624-64-6)	14	13	0.02	0.31	0.06
trans-2-Pentene (646-04-8)	14	9	0.02	0.07	0.03

*Samples reported as non-detects (ND) were included in averages as 1/2 minimum detection limits.

Table B-2
Garfield County SNMOC Monitoring
Rifle (RICO)
10/7/2011-12/30/2011 (every sixth day)

	Sample Count		Concentration (ppbV)		
Detected Compound (CAS Number)	**# Samples**	**# Detects**	**Minimum**	**Maximum**	**Average***
1,2,3-Trimethylbenzene (526-73-8)	14	14	0.01	0.04	0.02
1,2,4-Trimethylbenzene (95-63-6)	14	14	0.03	0.18	0.11
1,3,5-Trimethylbenzene (108-67-8)	14	14	0.02	0.10	0.06
1,3-Butadiene (106-99-0)	14	14	0.04	0.23	0.13
1-Decene (872-05-9)	14	1	0.06	0.06	0.01
1-Dodecene (112-41-4)	14	11	0.01	0.04	0.02
1-Heptene (592-76-7)	14	12	0.07	0.24	0.15
1-Hexene (592-41-6)	14	9	0.02	0.06	0.04
1-Nonene (124-11-8)	14	3	0.02	0.06	0.02
1-Octene (111-66-0)	14	10	0.02	0.07	0.03
1-Pentene (109-67-1)	14	14	0.04	0.12	0.08
1-Undecene (821-95-4)	14	2	0.01	0.02	0.01
2,2,3-Trimethylpentane (564-02-3)	14	6	0.03	0.09	0.03
2,2,4-Trimethylpentane (540-84-1)	14	5	0.01	0.14	0.03
2,2-Dimethylbutane (75-83-2)	14	14	0.03	0.29	0.19
2,3,4-Trimethylpentane (565-75-3)	14	14	0.01	0.04	0.02
2,3-Dimethylbutane (79-29-8)	14	14	0.06	0.55	0.37
2,3-Dimethylpentane (565-59-3)	14	14	0.04	0.19	0.15
2,4-Dimethylpentane (108-08-7)	14	14	0.02	0.14	0.10
2-Methyl-1-butene (563-46-2)	14	13	0.04	0.17	0.10
2-Methyl-1-pentene (763-29-1)	14	1	0.01	0.01	0.03
2-Methyl-2-butene (513-35-9)	14	13	0.05	0.66	0.14
2-Methylheptane (592-27-8)	14	14	0.02	0.35	0.15
2-Methylhexane (591-76-4)	14	14	0.17	0.52	0.38
2-Methylpentane (107-83-5)	14	14	0.28	2.47	1.61
3-Methylheptane (589-81-1)	14	14	0.03	0.30	0.11
3-Methylhexane (589-34-4)	14	13	0.07	0.54	0.34
3-Methylpentane (96-14-0)	14	14	0.16	3.68	1.17
Acetylene (74-86-2)	14	14	0.74	3.02	1.85
a-Pinene (80-56-8)	14	4	0.02	0.02	0.01
Benzene (71-43-2)	14	14	0.21	0.78	0.55
b-Pinene (127-91-3)	14	4	0.02	0.05	0.02
cis-2-Butene (590-18-1)	14	11	0.05	0.30	0.15
cis-2-Pentene (627-20-3)	14	13	0.01	0.06	0.04
Cyclohexane (110-82-7)	14	14	0.15	1.41	0.84
Cyclopentane (287-92-3)	14	14	0.09	0.39	0.25
Cyclopentene (142-29-0)	14	7	0.03	0.05	0.03
Ethane (74-84-0)	14	14	11.45	104.50	61.24
Ethylbenzene (100-41-4)	14	14	0.04	0.20	0.11
Ethylene (74-85-1)	14	14	1.40	4.34	2.88
Isobutane (75-28-5)	14	14	1.47	13.78	8.56
Isobutene/1-Butene (115-11-7 / 106-98-9)	14	1	1.42	1.42	0.12

*Samples reported as non-detects (ND) were included in averages as 1/2 minimum detection limits.

Table B-2 (continued)
Garfield County SNMOC Monitoring
Rifle (RICO)
10/7/2011-12/30/2011 (every sixth day)

	Sample Count		Concentration (ppbV)		
Detected Compound (CAS Number)	**# Samples**	**# Detects**	**Minimum**	**Maximum**	**Average***
Isopentane (78-78-4)	14	14	1.62	13.16	6.50
Isoprene (78-79-5)	14	13	0.03	0.07	0.05
Isopropylbenzene (98-82-8)	14	6	0.02	0.02	0.02
m-Diethylbenzene (141-93-5)	14	10	0.02	0.05	0.03
Methylcyclohexane (108-87-2)	14	14	0.27	2.00	1.28
Methylcyclopentane (96-37-7)	14	14	0.19	3.58	1.15
m-Ethyltoluene (620-14-4)	14	14	0.02	0.11	0.07
m-Xylene/p-Xylene (108-38-3 / 106-42-3)	14	14	0.16	0.80	0.46
n-Butane (106-97-8)	14	14	2.30	17.00	9.86
n-Decane (124-18-5)	14	14	0.02	0.12	0.07
n-Dodecane (112-40-3)	14	14	0.01	0.06	0.04
n-Heptane (142-82-5)	14	14	0.13	0.85	0.57
n-Hexane (110-54-3)	14	14	0.27	11.32	2.67
n-Nonane (111-84-2)	14	14	0.02	0.32	0.12
n-Octane (111-65-9)	14	14	0.09	0.81	0.32
n-Pentane (109-66-0)	14	14	0.91	5.90	3.59
n-Propylbenzene (103-65-1)	14	13	0.01	0.04	0.02
n-Undecane (1120-21-4)	14	14	0.01	0.06	0.04
o-Ethyltoluene (611-14-3)	14	14	0.01	0.07	0.04
o-Xylene (95-47-6)	14	14	0.05	0.26	0.14
p-Diethylbenzene (105-05-5)	14	10	0.01	0.03	0.02
p-Ethyltoluene (622-96-8)	14	14	0.02	0.09	0.05
Propane (74-98-6)	14	14	5.83	43.00	27.43
Propylene (115-07-1)	14	14	0.36	1.06	0.73
Propyne (74-99-7)	14	3	0.04	0.07	0.03
Styrene (100-42-5)	14	5	0.01	0.07	0.02
Toluene (108-88-3)	14	14	0.43	24.86	4.41
trans-2-Butene (624-64-6)	14	12	0.05	0.36	0.17
trans-2-Hexene (4050-45-7)	14	4	0.01	0.02	0.02
trans-2-Pentene (646-04-8)	14	14	0.03	0.12	0.08

*Samples reported as non-detects (ND) were included in averages as 1/2 minimum detection limits.

Table B-3
Garfield County SNMOC Monitoring
Bell-Melton (BRCO)
10/7/2011-12/30/2011 (every sixth day)

	Sample Count		Concentration (ppbV)		
Detected Compound (CAS Number)	**# Samples**	**# Detects**	**Minimum**	**Maximum**	**Average***
1,2,3-Trimethylbenzene (526-73-8)	15	7	0.01	0.03	0.01
1,2,4-Trimethylbenzene (95-63-6)	15	15	0.02	0.06	0.04
1,3,5-Trimethylbenzene (108-67-8)	15	13	0.01	0.05	0.02
1,3-Butadiene (106-99-0)	15	5	0.01	0.07	0.03
1-Dodecene (112-41-4)	15	8	0.01	0.10	0.02
1-Heptene (592-76-7)	15	13	0.04	0.26	0.09
1-Hexene (592-41-6)	15	8	0.02	0.06	0.03
1-Nonene (124-11-8)	15	1	0.02	0.02	0.01
1-Octene (111-66-0)	15	12	0.01	0.05	0.03
1-Pentene (109-67-1)	15	10	0.02	0.04	0.03
1-Tridecene (2437-56-1)	15	1	0.01	0.01	0.02
1-Undecene (821-95-4)	15	1	0.01	0.01	0.01
2,2,3-Trimethylpentane (564-02-3)	15	5	0.02	0.04	0.02
2,2,4-Trimethylpentane (540-84-1)	15	3	0.02	0.13	0.02
2,2-Dimethylbutane (75-83-2)	15	15	0.05	0.27	0.13
2,3,4-Trimethylpentane (565-75-3)	15	8	0.01	0.02	0.01
2,3-Dimethylbutane (79-29-8)	15	15	0.10	0.59	0.26
2,3-Dimethylpentane (565-59-3)	15	15	0.05	0.19	0.10
2,4-Dimethylpentane (108-08-7)	15	15	0.02	0.14	0.07
2-Methyl-1-butene (563-46-2)	15	3	0.07	0.12	0.04
2-Methyl-2-butene (513-35-9)	15	4	0.02	0.07	0.02
2-Methylheptane (592-27-8)	15	15	0.03	0.21	0.09
2-Methylhexane (591-76-4)	15	15	0.14	0.56	0.28
2-Methylpentane (107-83-5)	15	15	0.31	2.67	1.07
3-Methylheptane (589-81-1)	15	15	0.02	0.13	0.06
3-Methylhexane (589-34-4)	15	14	0.12	0.60	0.25
3-Methylpentane (96-14-0)	15	15	0.20	1.41	0.57
Acetylene (74-86-2)	15	15	0.31	1.14	0.67
a-Pinene (80-56-8)	15	3	0.01	0.02	0.01
Benzene (71-43-2)	15	15	0.16	0.46	0.27
b-Pinene (127-91-3)	15	2	0.02	0.10	0.02
cis-2-Butene (590-18-1)	15	4	0.02	0.06	0.02
cis-2-Pentene (627-20-3)	15	5	0.02	0.04	0.02
Cyclohexane (110-82-7)	15	15	0.25	1.62	0.70
Cyclopentane (287-92-3)	15	15	0.09	0.40	0.18
Cyclopentene (142-29-0)	15	1	0.03	0.03	0.02
Ethane (74-84-0)	15	15	20.50	131.00	58.72
Ethylbenzene (100-41-4)	15	15	0.01	0.05	0.03
Ethylene (74-85-1)	15	15	0.68	1.98	1.07
Isobutane (75-28-5)	15	15	2.42	17.30	7.26
Isopentane (78-78-4)	15	15	1.95	9.22	4.03
Isoprene (78-79-5)	15	7	0.02	0.05	0.03

*Samples reported as non-detects (ND) were included in averages as 1/2 minimum detection limits.

Table B-3 (continued)
Garfield County SNMOC Monitoring
Bell-Melton (BRCO)
10/7/2011-12/30/2011 (every sixth day)

	Sample Count		Concentration (ppbV)		
Detected Compound (CAS Number)	**# Samples**	**# Detects**	**Minimum**	**Maximum**	**Average***
Isopropylbenzene (98-82-8)	15	6	0.01	0.02	0.01
m-Diethylbenzene (141-93-5)	15	12	0.02	0.05	0.03
Methylcyclohexane (108-87-2)	15	15	0.34	2.34	1.07
Methylcyclopentane (96-37-7)	15	15	0.18	1.37	0.56
m-Ethyltoluene (620-14-4)	15	13	0.01	0.05	0.02
m-Xylene/p-Xylene (108-38-3 / 106-42-3)	15	15	0.07	0.36	0.17
n-Butane (106-97-8)	15	15	2.68	19.40	8.07
n-Decane (124-18-5)	15	15	0.01	0.11	0.04
n-Dodecane (112-40-3)	15	13	0.01	0.04	0.03
n-Heptane (142-82-5)	15	15	0.17	0.99	0.45
n-Hexane (110-54-3)	15	15	0.38	2.93	1.17
n-Nonane (111-84-2)	15	15	0.03	0.20	0.07
n-Octane (111-65-9)	15	15	0.10	0.46	0.21
n-Pentane (109-66-0)	15	15	0.94	7.30	2.80
n-Propylbenzene (103-65-1)	15	7	0.01	0.02	0.01
n-Tridecane (629-50-5)	15	1	0.19	0.19	0.03
n-Undecane (1120-21-4)	15	12	0.01	0.06	0.02
o-Ethyltoluene (611-14-3)	15	9	0.01	0.03	0.02
o-Xylene (95-47-6)	15	15	0.02	0.07	0.04
p-Diethylbenzene (105-05-5)	15	8	0.01	0.03	0.01
p-Ethyltoluene (622-96-8)	15	13	0.01	0.03	0.02
Propane (74-98-6)	15	15	9.20	63.00	27.20
Propylene (115-07-1)	15	14	0.13	0.31	0.19
Toluene (108-88-3)	15	15	0.17	1.11	0.42
trans-2-Butene (624-64-6)	15	5	0.02	0.06	0.02
trans-2-Pentene (646-04-8)	15	6	0.02	0.03	0.02

*Samples reported as non-detects (ND) were included in averages as 1/2 minimum detection limits.

Table B-4
Garfield County SNMOC Monitoring
Battlement Mesa (BMCO)
10/7/2011-12/30/2011 (every sixth day)

	Sample Count		Concentration (ppbV)		
Detected Compound (CAS Number)	**# Samples**	**# Detects**	**Minimum**	**Maximum**	**Average***
1,2,3-Trimethylbenzene (526-73-8)	13	10	0.01	0.05	0.02
1,2,4-Trimethylbenzene (95-63-6)	13	13	0.02	0.23	0.07
1,3,5-Trimethylbenzene (108-67-8)	13	12	0.01	0.12	0.05
1,3-Butadiene (106-99-0)	13	6	0.03	0.07	0.04
1-Dodecene (112-41-4)	13	9	0.01	0.04	0.02
1-Heptene (592-76-7)	13	13	0.03	0.39	0.13
1-Hexene (592-41-6)	13	3	0.03	0.06	0.03
1-Nonene (124-11-8)	13	1	0.03	0.03	0.01
1-Octene (111-66-0)	13	8	0.01	0.05	0.02
1-Pentene (109-67-1)	13	11	0.02	0.14	0.04
1-Undecene (821-95-4)	13	2	0.02	0.03	0.01
2,2,3-Trimethylpentane (564-02-3)	13	5	0.02	0.05	0.02
2,2,4-Trimethylpentane (540-84-1)	13	3	0.02	0.05	0.01
2,2-Dimethylbutane (75-83-2)	13	13	0.03	0.31	0.15
2,3,4-Trimethylpentane (565-75-3)	13	10	0.01	0.05	0.02
2,3-Dimethylbutane (79-29-8)	13	13	0.05	0.61	0.27
2,3-Dimethylpentane (565-59-3)	13	13	0.03	0.24	0.11
2,4-Dimethylpentane (108-08-7)	13	13	0.01	0.17	0.08
2-Methyl-1-butene (563-46-2)	13	5	0.04	0.25	0.06
2-Methyl-2-butene (513-35-9)	13	6	0.03	0.34	0.07
2-Methylheptane (592-27-8)	13	13	0.02	0.39	0.13
2-Methylhexane (591-76-4)	13	13	0.09	0.73	0.32
2-Methylpentane (107-83-5)	13	13	0.18	2.53	1.10
3-Methyl-1-butene (563-45-1)	13	1	0.15	0.15	0.03
3-Methylheptane (589-81-1)	13	13	0.02	0.30	0.10
3-Methylhexane (589-34-4)	13	12	0.10	0.74	0.30
3-Methylpentane (96-14-0)	13	13	0.10	1.43	0.62
Acetylene (74-86-2)	13	13	0.23	0.96	0.58
a-Pinene (80-56-8)	13	2	0.03	0.04	0.01
Benzene (71-43-2)	13	13	0.12	0.81	0.38
b-Pinene (127-91-3)	13	2	0.03	0.06	0.01
cis-2-Butene (590-18-1)	13	10	0.02	0.58	0.10
cis-2-Hexene (7688-21-3)	13	1	0.03	0.03	0.03
cis-2-Pentene (627-20-3)	13	5	0.01	0.16	0.04
Cyclohexane (110-82-7)	13	13	0.11	2.07	0.75
Cyclopentane (287-92-3)	13	13	0.05	0.38	0.19
Cyclopentene (142-29-0)	13	5	0.02	0.06	0.02
Ethane (74-84-0)	13	13	10.10	209.00	62.19
Ethylbenzene (100-41-4)	13	13	0.02	0.23	0.07
Ethylene (74-85-1)	13	13	0.62	1.11	0.91
Isobutane (75-28-5)	13	13	0.80	15.95	6.04
Isopentane (78-78-4)	13	13	0.64	8.12	4.15

*Samples reported as non-detects (ND) were included in averages as 1/2 minimum detection limits.

Table B-4 (continued)
Garfield County SNMOC Monitoring
Battlement Mesa (BMCO)
10/7/2011-12/30/2011 (every sixth day)

	Sample Count		Concentration (ppbV)		
Detected Compound (CAS Number)	**# Samples**	**# Detects**	**Minimum**	**Maximum**	**Average***
Isoprene (78-79-5)	13	5	0.02	0.05	0.03
Isopropylbenzene (98-82-8)	13	4	0.02	0.03	0.01
m-Diethylbenzene (141-93-5)	13	10	0.02	0.05	0.03
Methylcyclohexane (108-87-2)	13	13	0.22	3.91	1.30
Methylcyclopentane (96-37-7)	13	13	0.12	1.60	0.64
m-Ethyltoluene (620-14-4)	13	13	0.01	0.15	0.05
m-Xylene/p-Xylene (108-38-3 / 106-42-3)	13	13	0.06	0.92	0.36
n-Butane (106-97-8)	13	13	1.01	16.10	6.84
n-Decane (124-18-5)	13	13	0.01	0.29	0.09
n-Dodecane (112-40-3)	13	13	0.01	0.07	0.04
n-Heptane (142-82-5)	13	13	0.10	1.50	0.52
n-Hexane (110-54-3)	13	13	0.17	3.00	1.15
n-Nonane (111-84-2)	13	13	0.02	0.55	0.16
n-Octane (111-65-9)	13	13	0.06	1.11	0.33
n-Pentane (109-66-0)	13	13	0.45	6.14	2.77
n-Propylbenzene (103-65-1)	13	8	0.01	0.06	0.02
n-Undecane (1120-21-4)	13	13	0.01	0.13	0.05
o-Ethyltoluene (611-14-3)	13	11	0.01	0.08	0.03
o-Xylene (95-47-6)	13	13	0.01	0.27	0.08
p-Diethylbenzene (105-05-5)	13	9	0.01	0.04	0.01
p-Ethyltoluene (622-96-8)	13	12	0.01	0.09	0.03
Propane (74-98-6)	13	13	3.31	67.33	22.52
Propylene (115-07-1)	13	12	0.10	0.32	0.19
Toluene (108-88-3)	13	13	0.18	1.89	0.68
trans-2-Butene (624-64-6)	13	12	0.02	0.67	0.13
trans-2-Hexene (4050-45-7)	13	1	0.05	0.05	0.03
trans-2-Pentene (646-04-8)	13	10	0.02	0.29	0.06

*Samples reported as non-detects (ND) were included in averages as 1/2 minimum detection limits.

APPENDIX C

Garfield County

Carbonyl Concentrations
October 1, 2011 – December 31, 2011

Table C-1
Garfield County Carbonyl Monitoring
Parachute (PACO)
10/13/2011-12/24/2011 (every twelfth day)

	Sample Count		Concentration (ppbV)		
Compound (CAS Number)	**# Samples**	**# Detects**	**Minimum**	**Maximum**	**Average***
2,5-Dimethylbenzaldehyde (5779-94-2)	6	0	ND	ND	0.00
Acetaldehyde (75-07-0)	6	6	0.34	0.78	0.60
Acetone (67-64-1)	6	6	0.65	1.70	1.18
Benzaldehyde (100-52-7)	6	6	0.01	0.03	0.02
Butyraldehyde (123-72-8)	6	6	0.01	0.07	0.05
Crotonaldehyde (123-73-9)	6	5	0.02	0.04	0.02
Formaldehyde (50-00-0)	6	6	1.12	2.09	1.49
Hexaldehyde (66-25-1)	6	6	0.00	0.03	0.02
Isovaleraldehyde (590-86-3)	6	0	ND	ND	0.00
Propionaldehyde (123-38-6)	6	5	0.06	0.08	0.06
Tolualdehydes (NA)	6	6	0.02	0.03	0.02
Valeraldehyde (110-62-3)	6	6	0.00	0.04	0.02

*Samples reported as non-detects (ND) are included in averages as 1/2 minimum detection limits.

Table C-2
Garfield County Carbonyl Monitoring
Rifle (RICO)
10/25/2011-12/12/2011 (every twelfth day)

	Sample Count		Concentration (ppbV)		
Compound (CAS Number)	**# Samples**	**# Detects**	**Minimum**	**Maximum**	**Average***
2,5-Dimethylbenzaldehyde (5779-94-2)	3	0	ND	ND	0.00
Acetaldehyde (75-07-0)	3	3	0.79	1.11	0.96
Acetone (67-64-1)	3	3	1.23	1.84	1.51
Benzaldehyde (100-52-7)	3	3	0.03	0.04	0.04
Butyraldehyde (123-72-8)	3	3	0.04	0.18	0.09
Crotonaldehyde (123-73-9)	3	3	0.02	0.05	0.04
Formaldehyde (50-00-0)	3	3	1.35	1.91	1.62
Hexaldehyde (66-25-1)	3	3	0.02	0.02	0.02
Isovaleraldehyde (590-86-3)	3	0	ND	ND	0.00
Propionaldehyde (123-38-6)	3	3	0.04	0.12	0.07
Tolualdehydes (NA)	3	3	0.03	0.06	0.04
Valeraldehyde (110-62-3)	3	3	0.01	0.09	0.06

*Samples reported as non-detects (ND) are included in averages as 1/2 minimum detection limits.

Table C-3
Garfield County Carbonyl Monitoring
Bell-Melton (BRCO)
10/13/2011-12/24/2011 (every twelfth day)

	Sample Count		Concentration (ppbV)		
Compound (CAS Number)	**# Samples**	**# Detects**	**Minimum**	**Maximum**	**Average***
2,5-Dimethylbenzaldehyde (5779-94-2)	5	0	ND	ND	0.00
Acetaldehyde (75-07-0)	5	5	0.21	0.41	0.33
Acetone (67-64-1)	5	5	0.43	1.33	0.93
Benzaldehyde (100-52-7)	5	5	0.01	0.03	0.01
Butyraldehyde (123-72-8)	5	5	0.01	0.06	0.03
Crotonaldehyde (123-73-9)	5	4	0.01	0.02	0.01
Formaldehyde (50-00-0)	5	5	0.53	0.94	0.76
Hexaldehyde (66-25-1)	5	5	0.01	0.01	0.01
Isovaleraldehyde (590-86-3)	5	0	ND	ND	0.00
Propionaldehyde (123-38-6)	5	4	0.02	0.06	0.03
Tolualdehydes (NA)	5	5	0.01	0.02	0.02
Valeraldehyde (110-62-3)	5	5	0.00	0.02	0.01

*Samples reported as non-detects (ND) are included in averages as 1/2 minimum detection limits.

Table C-4
Garfield County Carbonyl Monitoring
Battlement Mesa (BMCO)
10/13/2011-12/24/2011 (every twelfth day)

	Sample Count		Concentration (ppbV)		
Compound (CAS Number)	**# Samples**	**# Detects**	**Minimum**	**Maximum**	**Average***
2,5-Dimethylbenzaldehyde (5779-94-2)	5	0	ND	ND	0.00
Acetaldehyde (75-07-0)	5	5	0.21	0.56	0.37
Acetone (67-64-1)	5	5	0.53	4.60	1.71
Benzaldehyde (100-52-7)	5	5	0.01	0.13	0.04
Butyraldehyde (123-72-8)	5	5	0.02	0.06	0.03
Crotonaldehyde (123-73-9)	5	4	0.01	0.03	0.01
Formaldehyde (50-00-0)	5	5	0.58	1.27	0.92
Hexaldehyde (66-25-1)	5	5	0.01	0.01	0.01
Isovaleraldehyde (590-86-3)	5	0	ND	ND	0.00
Propionaldehyde (123-38-6)	5	4	0.03	0.06	0.03
Tolualdehydes (NA)	5	4	0.01	0.04	0.02
Valeraldehyde (110-62-3)	5	5	0.00	0.02	0.01

*Samples reported as non-detects (ND) are included in averages as 1/2 minimum detection limits.