Wyoming Ambient Air Monitoring Annual Network Plan 2017

Taken by the automated digital camera at Thunder Basin on 8/17/2016

TABLE OF CONTENTS

Figures

Tables

Acronyms

AQD	Wyoming Department of Environmental Quality – Air Quality Division
AQRM	Air Quality Resource Management Program
AQRV	Air Quality Related Value
AQS	EPA's Air Quality System database
BAM	Beta Attenuation Monitor
CFR	United States Code of Federal Regulations
CH_4	Methane
CO	Carbon Monoxide
DRR	SO_2 Data Requirements Rule
EPA	United States Environmental Protection Agency
FEM	Federal Equivalent Method
FRM	Federal Reference Method
IMPACT	The AQD's Inventory, Monitoring, Permitting, And Compliance Tracking data system
IMPROVE	Interagency Monitoring of Protected Visual Environments
IWDW	Intermountain West Data Warehouse
MSA	Metropolitan Statistical Area
$\mu g/m^3$	Micrograms per cubic meter
µSA	Micropolitan Statistical Area
NAAQS	National Ambient Air Quality Standard
NADP	National Atmospheric Deposition Program
NCore	National Core Multi-Pollutant Monitoring Station
NMHC	Non-Methane Hydrocarbons
NO	Nitric Oxide
NO_2	Nitrogen Dioxide
NO_x	Oxides of Nitrogen
NO_y	Reactive Oxides of Nitrogen

NOAA	National Oceanic and Atmospheric Administration
NPAP	National Performance Audit Program
NPS	United States National Park Service
NSR	AQD's New Source Review Program
O_3	Ozone
OAQPS	EPA's Office of Air Quality Planning and Standards
ppb	Parts per billion
ppm	Parts per million
PM_{10}	Particulate Matter less than 10 micrometers in aerodynamic diameter
$PM_{2.5}$	Particulate Matter less than 2.5 micrometers in aerodynamic diameter
POC	Parameter Occurrence Code
PQAO	Primary Quality Assurance Organization
PRB	Powder River Basin
PSD	Prevention of Significant Deterioration
QAPP	Quality Assurance Project Plan
QMP	Quality Management Plan
SLAMS	State and Local Air Monitoring Stations
SO_2	Sulfur Dioxide
SPM	Special Purpose Monitor
TEOM	Tapered element oscillating microbalance
THC	Total Hydrocarbons
TSA	Technical System Audit
UGRB	Upper Green River Basin (Portions of Lincoln and Sweetwater Counties and all of Sublette County)
UGWOS	Upper Green Winter Ozone Study
VOC	Volatile Organic Compounds
VSCC	Very Sharp Cut Cyclone
WAAQS	Wyoming Ambient Air Quality Standards

WDEQ	The Wyoming Department of Environmental Quality
WyVisNet	The AQD's monitoring website, **http://www.wyvisnet.com**

Executive Summary

The Wyoming Department of Environmental Quality – Air Quality Division (AQD) presents its 2017 Annual Network Plan for ambient air and meteorological monitoring as required by Title 40 Part 58.10 of the Code of Federal Regulations (CFR). The 2017 Annual Network Plan summarizes the AQD's monitoring efforts in Wyoming to ensure full compliance with the National Ambient Air Quality Standards (NAAQS). Throughout this document, information is presented on the AQD's State and Local Air Monitoring Stations (SLAMS), Special Purpose Monitors (SPMs), and other special monitoring studies that occurred in Wyoming throughout 2016 and future monitoring plans of the AQD. Complete data from ambient monitoring is provided from 2014-2016 for any monitoring station that operated during this 3-year period. Additionally, the AQD has updated information on industrial monitoring networks established to comply with the SO_2 Data Requirements Rule (DRR).

1.0 Introduction

The AQD presents its Annual Network Plan for 2017 to the United States Environmental Protection Agency (EPA) as required by Title 40, Part 58.10(a)(1) of the CFR. The 2017 Annual Network Plan provides a comprehensive review of the ambient monitoring stations maintained by the AQD. These stations are the SLAMS, SPMs, mobile stations that monitor for particulates and or gaseous pollutants, and the National Core Multi-Pollutant Monitoring Station (NCore). The 2017 Annual Network Plan illustrates how the AQD's ambient monitoring network satisfies the requirements of Title 40, Part 58 Appendices A, C, D, and E of the CFR.

1.1 The AQD's Ambient Monitoring History

Since the early 1970s, the AQD Monitoring Section has been committed to monitoring the air quality of Wyoming with the goal of protecting, conserving, and enhancing the quality of Wyoming's environment for the benefit of current and future generations. The Monitoring Section comprises one third of the Air Quality Resource Management (AQRM) Program, which provides the AQD with valuable information in order to determine future policy considerations. The other two components of the AQRM Program are the Emission Inventory Section and the Planning Section.

As mentioned in the Introduction, the AQD owns and operates different types of ambient monitoring stations: SLAMS, SPMs, mobile stations, and an NCore station. The SLAMS are sited in populated areas to monitor public health and demonstrate compliance with the NAAQS, but may serve other purposes such as:

- provide air pollution data to the general public in a timely manner
- support compliance with air quality standards and emissions strategy development
- support air pollution research studies

The SPM stations collectively have multiple objectives. These objectives include:

- monitoring public health
- investigating pollutant concentrations downwind of sources
- determining background pollutant concentrations

Since 2011, the AQD has operated a fleet of mobile monitoring stations to investigate questions or concerns about air quality on a short-term basis (typically one year). Additionally, the AQD operates an NCore station as part of the national network to evaluate long-term trends in air quality. The AQD also helps fund and evaluate data from Air Quality Related Value (AQRV) monitoring within Wyoming, such as visibility and acid deposition, as well as overseeing industrial monitoring required by air quality permits. Figure 1 shows the number of monitors the AQD runs or oversees from 1999 to May of 2017.

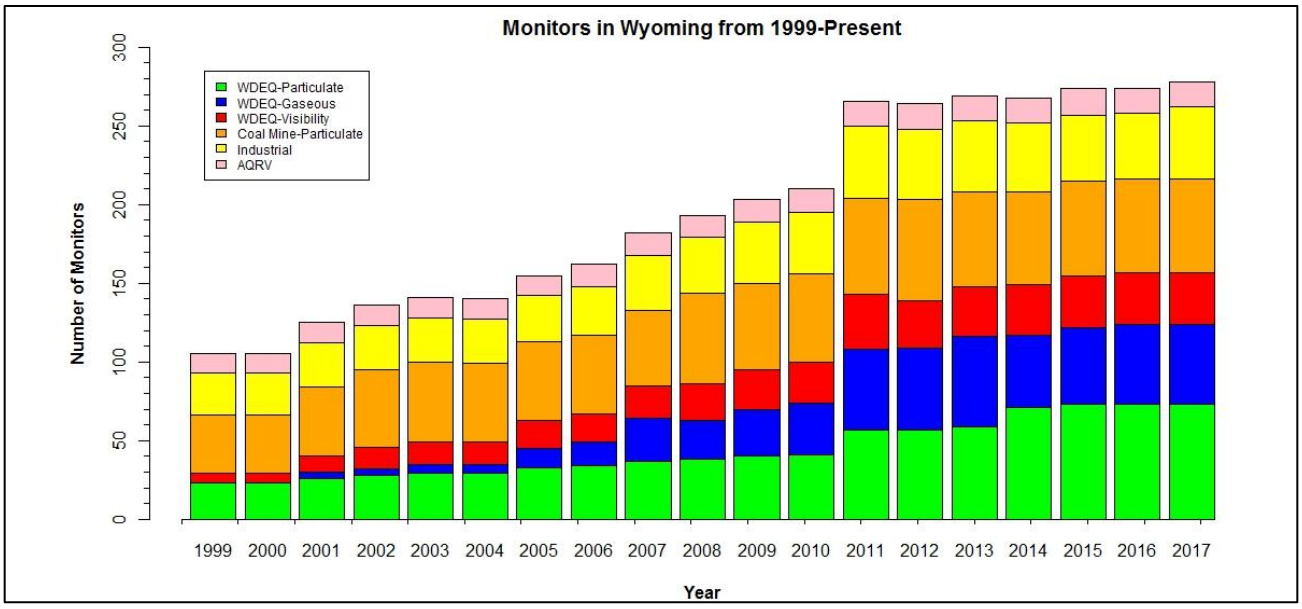


Figure 1. Number of Monitors in Wyoming from 1999-May 2017

There was a slight increase in the number of industrial monitors from 2016 to 2017. This is attributed to the application of the SO_2 DRR of Title 40, Part 51, Subpart BB of the CFR. More information about the SO_2 DRR is found in Section 4.6 of the 2017 Annual Network Plan.

1.2 General Monitoring Goals and Objectives

The AQD and Wyoming Department of Environmental Quality are committed to protect, conserve, and enhance the quality of Wyoming's environment for the benefit of current and future generations. In order to maintain the ambient air quality in accordance with the NAAQS for the seven criteria pollutants, the AQD operates and maintains a network of ambient air quality monitors.

The Wyoming monitoring network, collectively, is designed to meet the following seven basic ambient air monitoring objectives:

1. Determine the representative concentrations in areas of high population density
2. Determine the impact on ambient air quality from significant sources
3. Determine the general background concentration levels
4. Determine the extent of regional pollutant transport among populated areas and in rural and remote areas
5. Determine welfare-related impacts in support of secondary standards
6. Determine the highest concentration expected to occur in the area covered by the network
7. Research pollutant and meteorological behaviors in areas of concern

It is important to acknowledge that not every individual monitor or monitoring station will meet all seven objectives, but the AQD's entire monitoring network will encompass and fulfill all of the objectives. Figure 2, below, is a map that shows the AQD's SLAMs, SPMs, and mobile monitoring locations at the time of this publication.

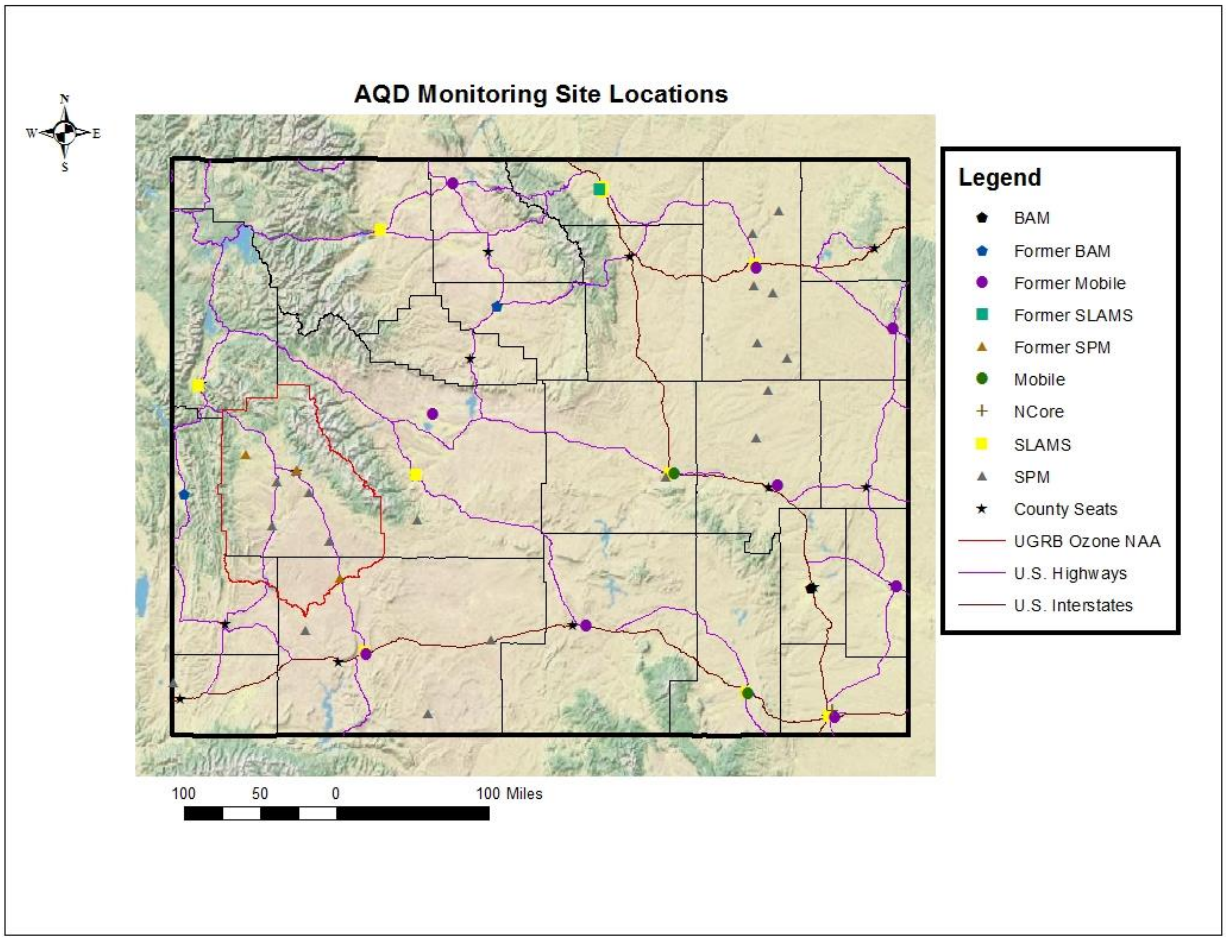


Figure 2. AQD Monitoring Site Locations (Past and Present)

NAME	COUNTY	PARAMETER										
		PM_{10} (manual)	**PM_{10} (continuous)**	**$PM_{2.5}$ (manual)**	**$PM_{2.5}$ (continuous)**	**NO_x**	**O_3**	**SO_2**	**CO**	**Camera**	**Met**	**Other**
Laramie SLAMS	Albany	X		X								
Laramie Mobile	Albany		X		X	X	X	X		X	X	CH_4/NMHC
Belle Ayr BA-4	Campbell				X	X						
Black Thunder BTM-36-2	Campbell				X							
Buckskin Mine	Campbell				X							
Campbell County	Campbell		X			X	X			X	X	
Gillette SLAMS	Campbell	X										
Thunder Basin	Campbell					X	X			X	X	Visibility
Wright Jr-Sr High School	Campbell	X										
Antelope Site 7	Converse				X	X						
Converse County	Converse		X			X	X			X	X	CH_4/NMHC
Lander SLAMS	Fremont	X		X								
South Pass	Fremont				X	X	X			X	X	
Cheyenne SLAMS	Laramie	X		X								
Cheyenne NCore	Laramie		X	X	X	X	X	Trace	Trace	X	X	NO/NO_y, $PM_{10-2.5}$, Speciated $PM_{2.5}$
Casper SLAMS	Natrona	X		X								
Casper Gaseous	Natrona					X	X			X	X	
Casper Mobile	Natrona		X		X	X	X	X		X	X	CH_4/NMHC
Cody SLAMS	Park	X		X								
Wheatland BAM Station	Platte		X		X						X	
Sheridan Meadowlark SLAMS	Sheridan	X		X								
Sheridan Police Station SLAMS	Sheridan		X	X							X	
Big Piney	Sublette					X	X			X	X	
Boulder	Sublette		X			X	X			X	X	NO_y CH_4/NMHC, Photolytic NO_2
Daniel South	Sublette		X			X	X			X	X	
Juel Spring	Sublette					X	X			X	X	
Pinedale Gaseous	Sublette				X	X	X			X	X	
Hiawatha	Sweetwater						X			X	X	

NAME	COUNTY	PARAMETER										
		PM_{10} (manual)	**PM_{10} (continuous)**	**$PM_{2.5}$ (manual)**	**$PM_{2.5}$ (continuous)**	**NO_x**	**O_3**	**SO_2**	**CO**	**Camera**	**Met**	**Other**
Moxa Arch	Sweetwater		X			X	X	X		X	X	
Rock Springs SLAMS	Sweetwater	X		X								
Wamsutter	Sweetwater		X			X	X			X	X	CH_4/NMHC
Jackson SLAMS	Teton	X		X								
Murphy Ridge	Uinta	X				X	X			X	X	

Table 1. Overview of Currently Operating Wyoming Monitors

2.0 Air Monitoring Plan in 2017

2.1 SLAMS

The SLAMS are used for supplying general monitoring data for criteria pollutants and determining compliance with the NAAQS. These are long-term stations that must meet and follow specific quality assurance, monitoring methodology, sampling objectives and siting requirements. The AQD SLAMS are located in Wyoming's most populous towns with the purpose of determining compliance with the NAAQS for the protection of public health. The ten stations specified as Wyoming SLAMS locations are described below. Each description includes a satellite view of the SLAMS in the town or city, a table with site and monitor information, and a graph of annual means of PM_{10} and, if measured at the site, $PM_{2.5}$. Below is a map of SLAMS.

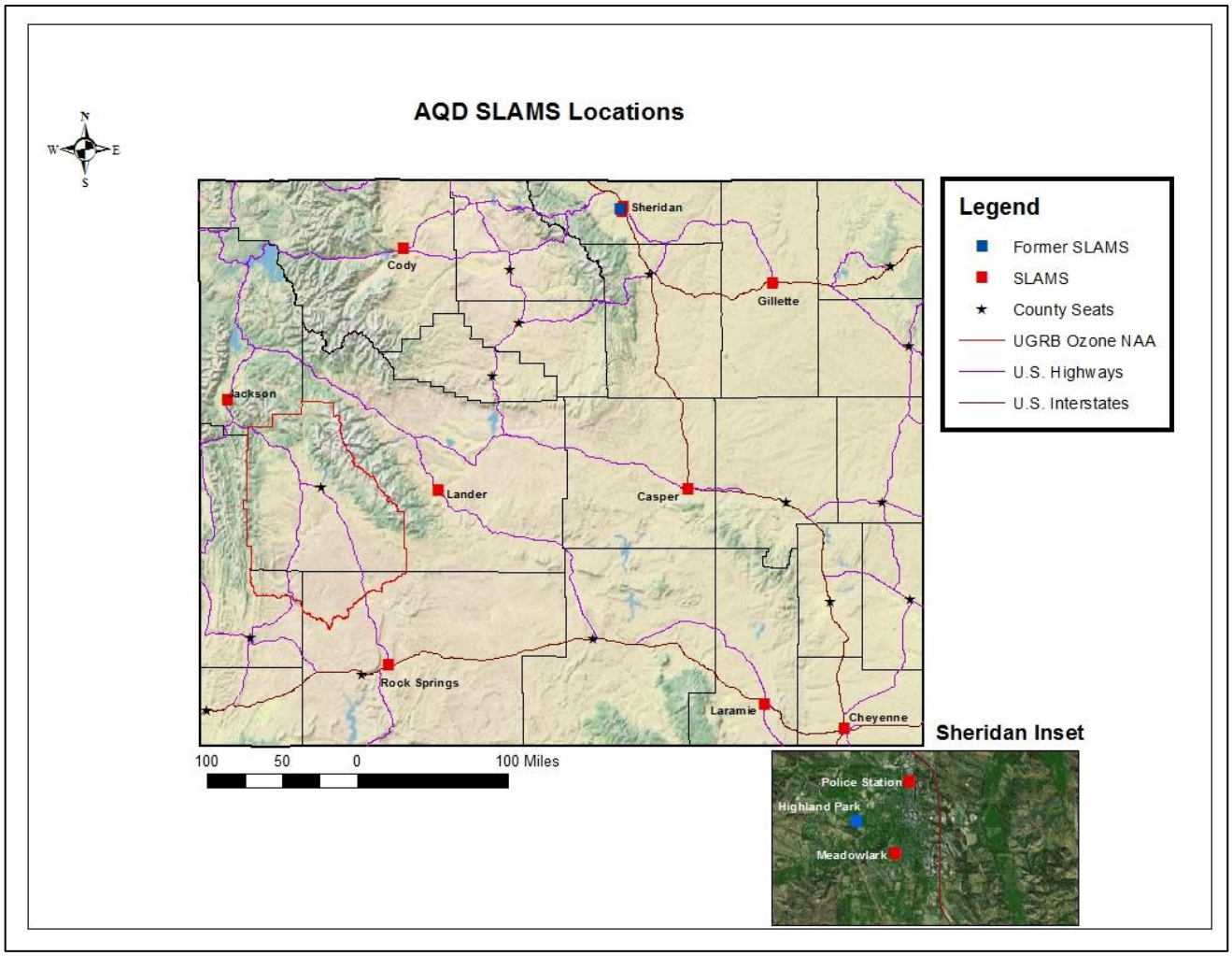


Figure 3. Map of SLAMS Locations

2.1.1 Casper SLAMS

Figure 4. Casper SLAMS satellite view and monitor photo (inset)

Casper – SLAMS Monitoring Site Specifications							
Site Name	**Location**	**AQS ID**	**Parameter**	**Instrument**	**Scale**	**Sample Frequency**	**Operational Status**
Casper SLAMS	City, County Bldg.; Center & C Streets (Casper MSA)	56-025-0001	PM_{10}	R&P Co. Partisol Model 2000 (Manual filter-based)	Neighborhood	1 in 3 days (primary); 1 in 12 days (collocate)	No planned changes
			$PM_{2.5}$	R&P Co. Partisol Model 2000 $PM_{2.5}$ Air Sampler w/ VSCC (Manual filter-based)	Neighborhood	1 in 3 days (offset between the primary & satellite samplers)	No planned changes

Table 2. Casper SLAMS Monitor Information

This station is located in downtown Casper, a city and metropolitan statistical area (MSA) of over 59,000 people. Casper is the second largest city in Wyoming, located in Natrona County near the center of Wyoming. Data collection for PM_{10} began at this station in 1991. A collocated PM_{10} sampler was added in 2001 and the hi-volume PM_{10} samplers were replaced with low-volume partisols in 2010. The AQD enhanced the station by adding $PM_{2.5}$ sampling on May 22, 2009 as the population of Casper increased.

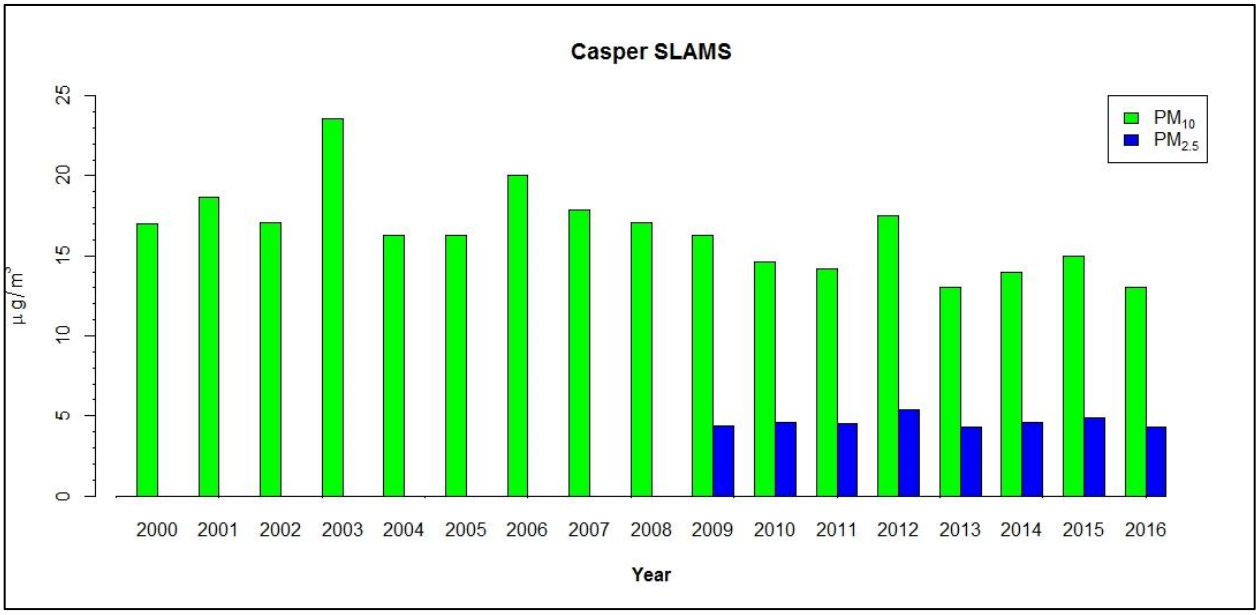


Figure 5. Casper SLAMS Annual Means

2.1.2 Cheyenne SLAMS

Figure 6. Cheyenne SLAMS satellite view and monitor photo (inset)

Cheyenne – SLAMS Monitoring Site Specifications							
Site Name	**Location**	**AQS ID**	**Parameter**	**Instrument**	**Scale**	**Sample Frequency**	**Operational Status**
Cheyenne SLAMS	Emerson Bldg.; 23rd & Central Ave. (Cheyenne MSA)	56-021-0001	PM_{10}	R&P Co. Partisol Model 2000i (Manual filter-based)	Neighborhood	1 in 3 days (primary); 1 in 12 days (collocate)	No planned changes
			$PM_{2.5}$	R&P Co. Partisol Model 2000i $PM_{2.5}$ Air Sampler w/ VSCC (Manual filter-based)	Neighborhood	1 in 3 days (primary); 1 in 12 days (collocate)	No planned changes

Table 3. Cheyenne SLAMS Monitor Information

The Cheyenne monitoring station is located in downtown Cheyenne on the roof of the Emerson Building; a State of Wyoming owned building. Cheyenne is the capital and largest city of Wyoming with an approximate population over 62,000. This population size leads to the classification of Cheyenne, WY as a MSA. The PM_{10} sampling started in 1991. A collocated PM_{10} sampler was added in 2002. The $PM_{2.5}$ monitors were added in 1998. A collocated $PM_{2.5}$ sampler was added in March 2009 to comply with Title 40 Part 58 requirements from the CFR for collocation of samplers. The 2015 Network Assessment revealed a strong correlation of the PM_{10} and $PM_{2.5}$ data between the Cheyenne SLAMS and Cheyenne NCore station. The AQD plans to evaluate these data in late 2017 to determine if the SLAMS and NCore particulate data are redundant and consider options to optimize the network. In 2017, the AQD replaced the older Partisol 2000 sampler with Partisol 2000i samplers.

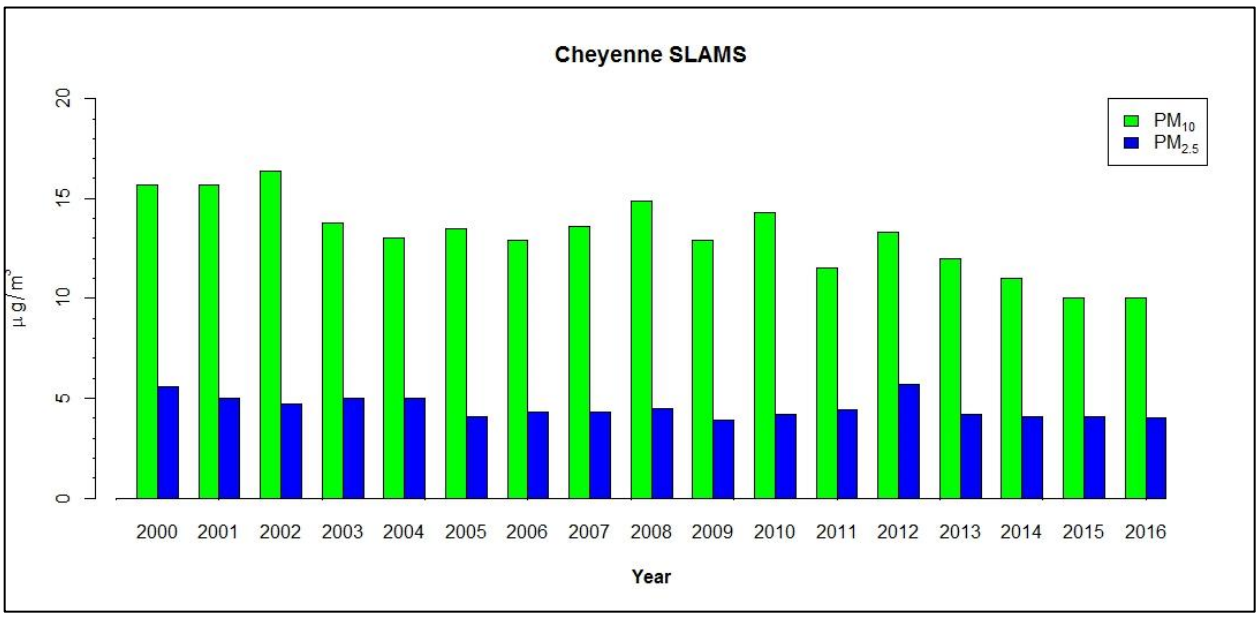


Figure 7. Cheyenne SLAMS Annual Means

2.1.3 Cody SLAMS

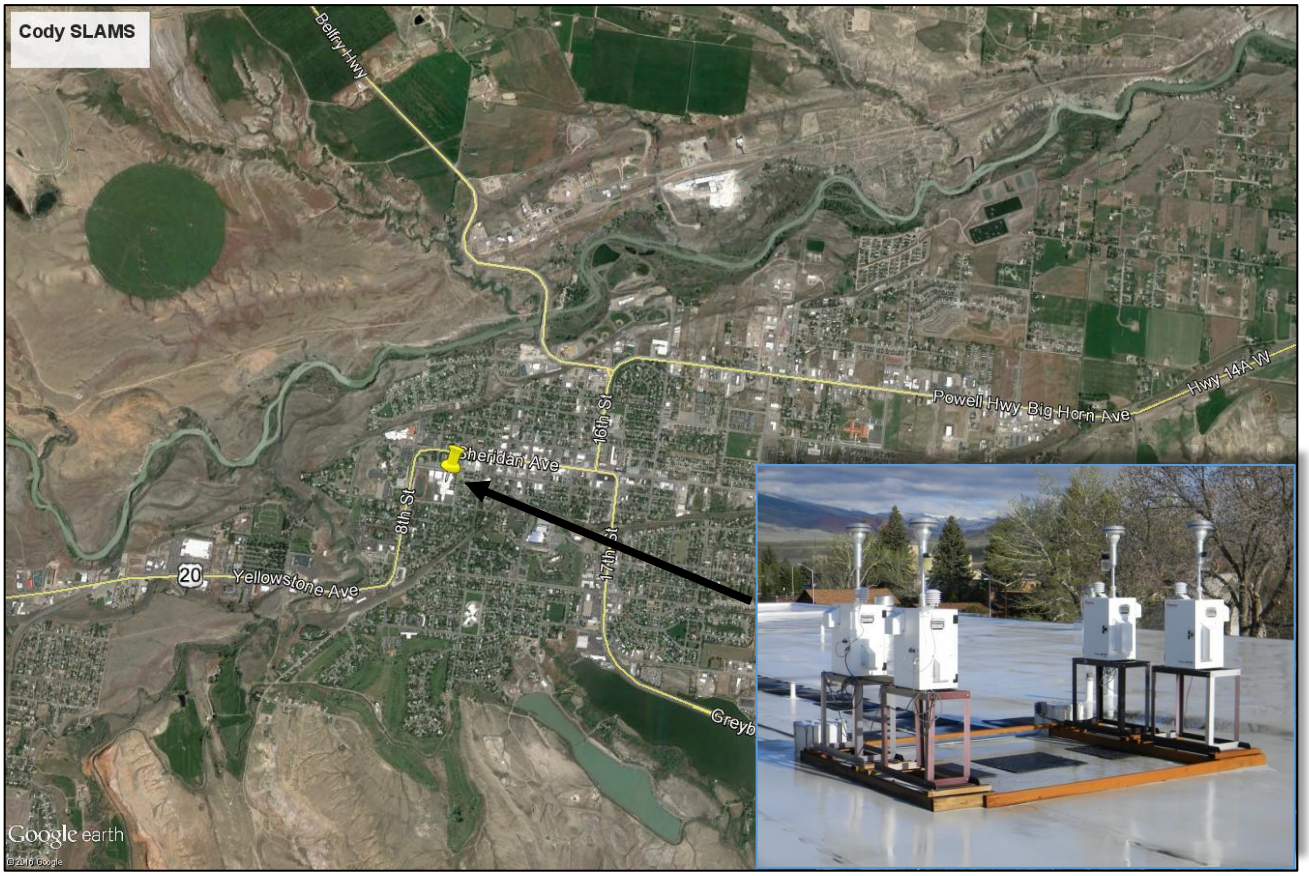


Figure 8. Cody SLAMS satellite view and monitor photo (inset)

Cody – SLAMS Monitoring Site Specifications							
Site Name	**Location**	**AQS ID**	**Parameter**	**Instrument**	**Scale**	**Sample Frequency**	**Operational Status**
Cody SLAMS	1225 10th Street	56-029-0001	PM_{10}	R&P Co. Partisol Model 2000 (Manual filter-based)	Neighborhood	1 in 3 days (offset between the primary & satellite samplers)	No planned changes
			$PM_{2.5}$	R&P Co. Partisol Model 2000 $PM_{2.5}$ Air Sampler w/ VSCC (Manual filter-based)	Neighborhood	1 in 3 days (offset between the primary & satellite samplers)	No planned changes

Table 4. Cody SLAMS Monitor Information

Cody is located in the northwest portion of Wyoming in Park County. Its population is around 9,800. The AQD initiated PM_{10} sampling at this station in 1988. The PM_{10} samplers were upgraded to the current instrument seen in the table above during 2010. In June 2008, $PM_{2.5}$ monitoring began at the Cody SLAMS. The AQD started monitoring ambient $PM_{2.5}$ concentrations in Cody due to impacts from wintertime sanding, wood smoke, summertime wildfires, and the nearby lakebed that can be exposed at low water levels.

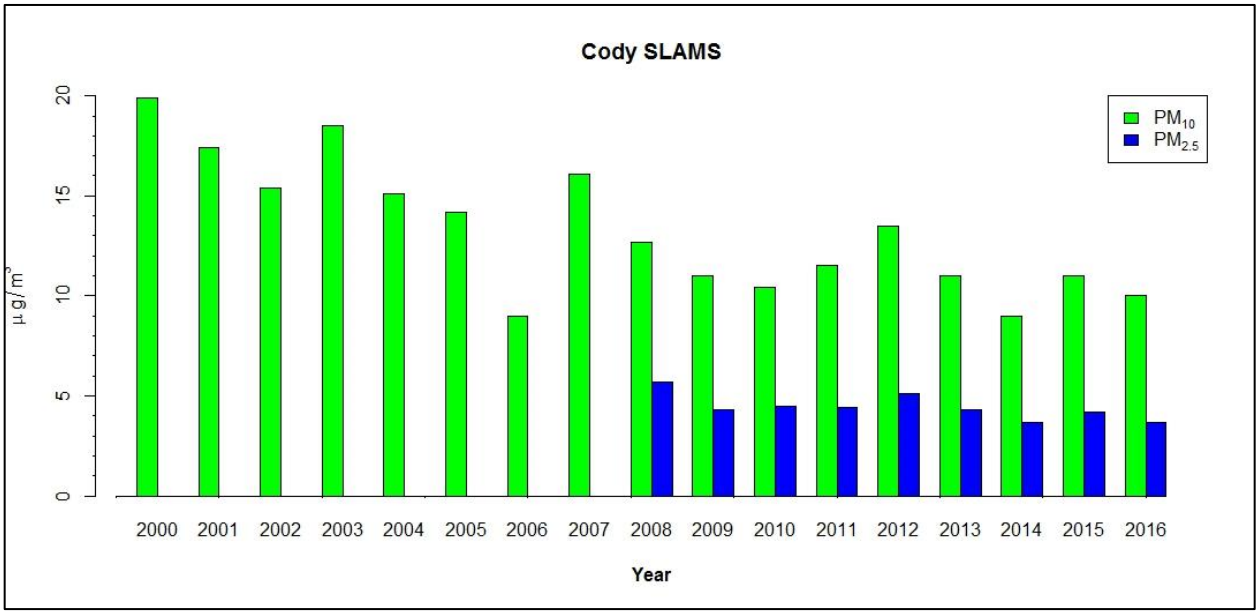


Figure 9. Cody SLAMS Annual Means

2.1.4 Gillette SLAMS

Figure 10. Gillette SLAMS satellite view and monitor photo (inset)

Gillette – SLAMS Monitoring Site Specifications							
Site Name	**Location**	**AQS ID**	**Parameter**	**Instrument**	**Scale**	**Sample Frequency**	**Operational Status**
Gillette SLAMS	1000 W. 8th St.	56-005-1002	PM_{10}	R&P Co. Partisol Model 2000 (Manual filter-based)	Neighborhood	1 in 6 days	No planned changes

Table 5. Gillette SLAMS Monitor Information

Gillette is located in Campbell County, the northeastern part of Wyoming. Its population is approximately 31,800. The population size results in Gillette meeting the classification of micropolitan statistical area (μSA). The AQD has monitored PM_{10} at this location since 1991.

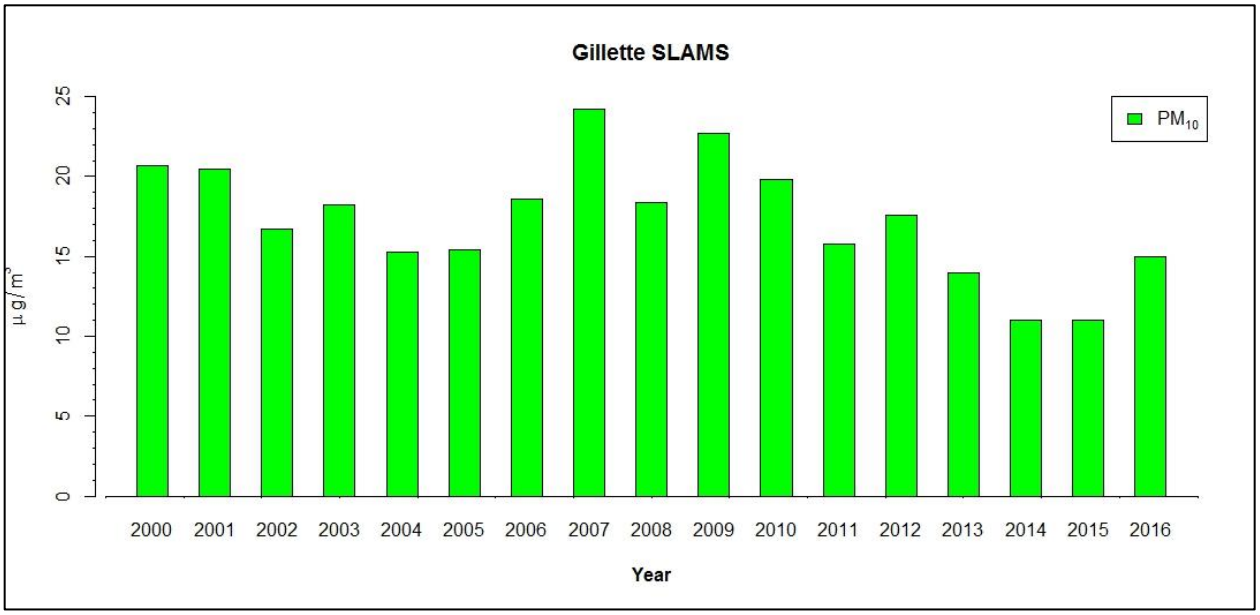


Figure 11. Gillette SLAMS Annual Means

2.1.5 Jackson SLAMS

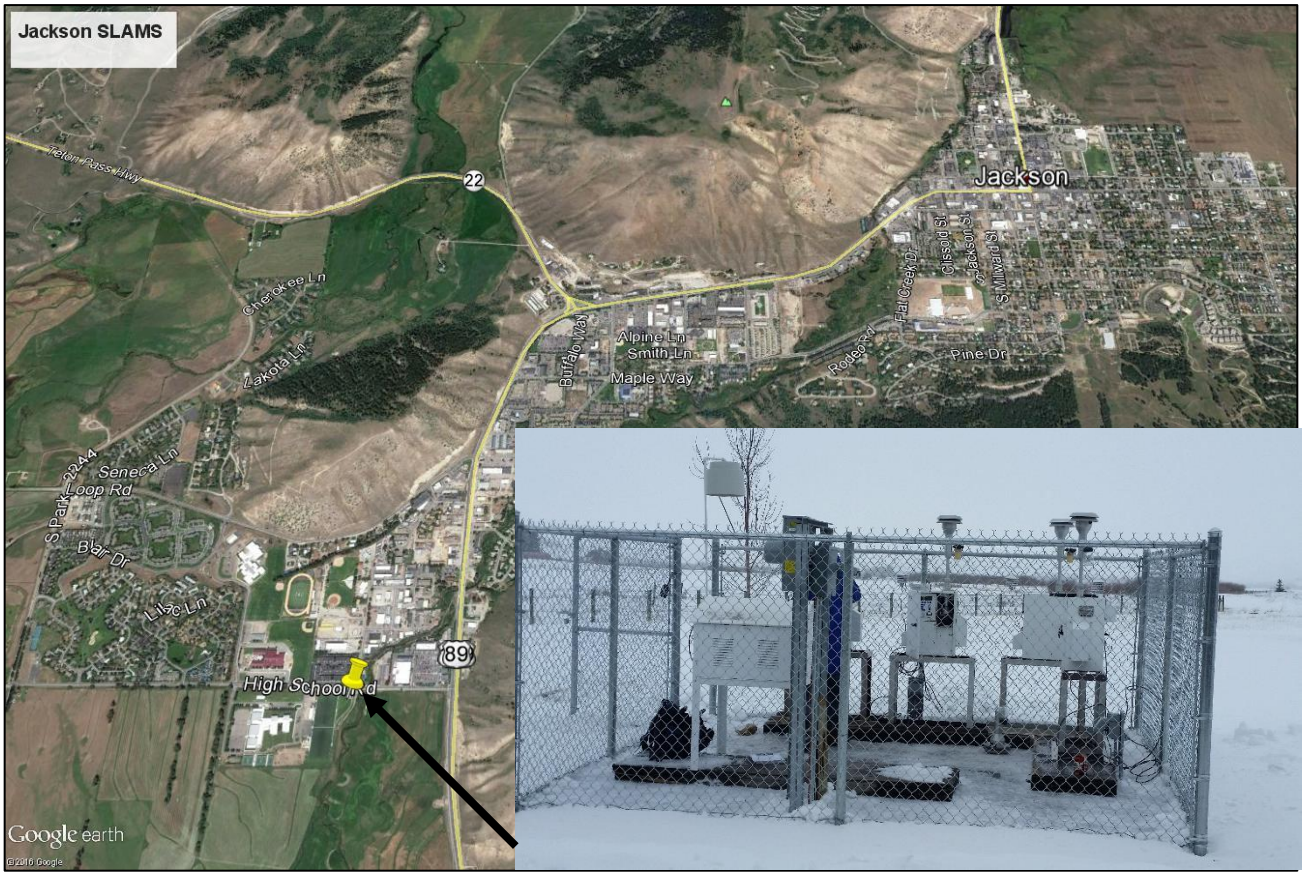


Figure 12. Jackson SLAMS satellite view and monitor photo (inset)

Jackson – SLAMS Monitoring Site Specifications							
Site Name	**Location**	**AQS ID**	**Parameter**	**Instrument**	**Scale**	**Sample Frequency**	**Operational Status**
Jackson SLAMS	40 E. Pearl Ave.	56-039-1006	PM_{10}	R&P Co. Partisol Model 2000 (Manual filter-based)	Neighborhood	1 in 3 days (offset between the primary & satellite samplers)	No planned changes
			$PM_{2.5}$	R&P Co. Partisol Model 2000 $PM_{2.5}$ Air Sampler w/ VSCC (Manual filter-based)	Neighborhood	1 in 3 days (offset between the primary & satellite samplers)	No planned changes

Table 6. Jackson SLAMS Monitor Information

Jackson is located in Teton County in northwest Wyoming. Its population is just over 10,100 as of 2013. Due to its size, Jackson is considered a µSA. PM_{10} and $PM_{2.5}$ sampling began in Jackson in 2001 at the Teton County Building site. The samplers were moved to the Jackson Fire Station site in 2007. On December 11, 2015, the AQD began correspondence with the EPA concerning the relocation of the Jackson SLAMS due to planned renovations of the fire station in 2016. Region VIII of the EPA approved the AQD's request for relocation on January 6, 2016. The initial request and approval of the relocation is in Appendix D of the 2016 Annual Network Plan (**http://deq.wyoming.gov/media/attachments/Air%20Quality/Monitoring/Annual%20Network%20Plans/Annual-Network-Plan_2016-Final.pdf**). The AQD moved the samplers on December 21, 2016 to the current location near Jackson High School at the southwestern region of the town.

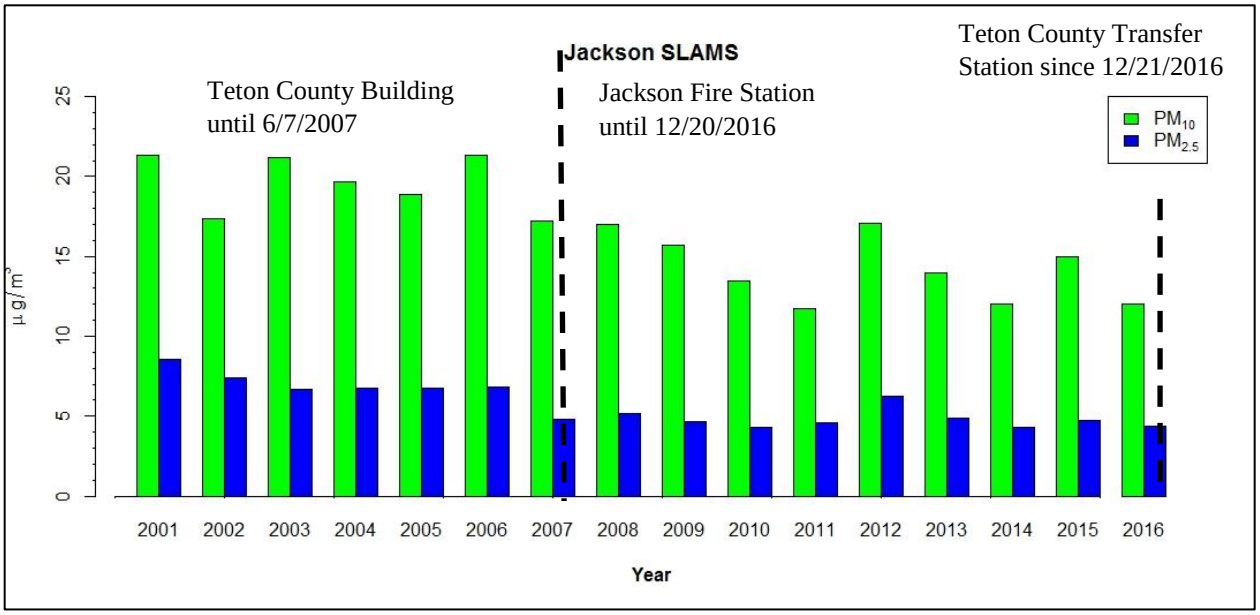


Figure 13. Jackson SLAMS Annual Means

2.1.6 Lander SLAMS

Figure 14. Lander SLAMS satellite view and monitor photo (inset)

Lander – SLAMS Monitoring Site Specifications							
Site Name	**Location**	**AQS ID**	**Parameter**	**Instrument**	**Scale**	**Sample Frequency**	**Operational Status**
Lander SLAMS	600 Washington	56-013-1003	PM_{10}	R&P Co. Partisol Model 2000 (Manual filter-based)	Neighborhood	1 in 3 days (offset between the primary & satellite samplers)	No planned changes
			$PM_{2.5}$	R&P Co. Partisol Model 2000 $PM_{2.5}$ Air Sampler w/ VSCC (Manual filter-based)	Neighborhood	1 in 3 days (offset between the primary & satellite samplers)	No planned changes

Table 7. Lander SLAMS Monitor Information

The Lander SLAMS is located in Fremont County in the central part of the State. There is a population of just over 7,700 in Lander as of 2013. The AQD began PM_{10} sampling at this station in 1989. $PM_{2.5}$ monitors were installed at this location in 2001.

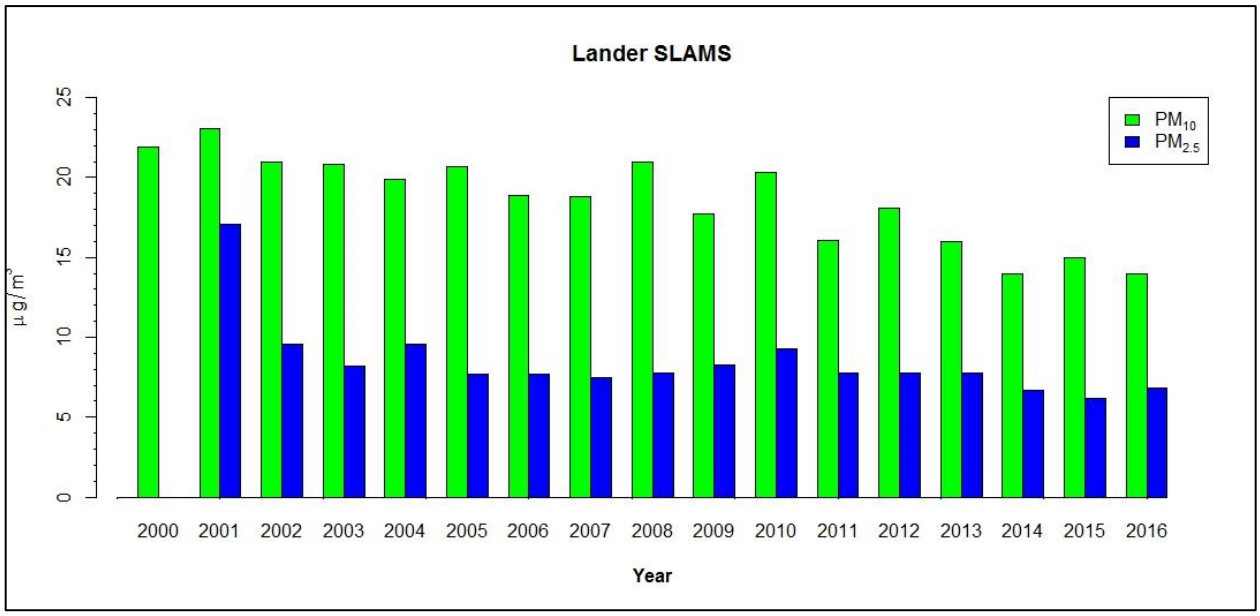


Figure 15. Lander SLAMS Annual Means

2.1.7 Laramie SLAMS

Figure 16. Laramie SLAMS satellite view and monitor photo (inset)

Laramie – SLAMS Monitoring Site Specifications							
Site Name	**Location**	**AQS ID**	**Parameter**	**Instrument**	**Scale**	**Sample Frequency**	**Operational Status**
Laramie SLAMS	406 Ivinson	56-001-0006	PM_{10}	R&P Co. Partisol Model 2000 (Manual filter-based)	Neighborhood	1 in 3 days (offset between the primary & satellite samplers)	No planned changes
			$PM_{2.5}$	R&P Co. Partisol Model 2000 $PM_{2.5}$ Air Sampler w/ VSCC (Manual filter-based)	Neighborhood	1 in 3 days (offset between the primary & satellite samplers)	No planned changes

Table 8. Laramie SLAMS Monitor Information

Laramie is located in Albany County in the southeastern region of Wyoming. Laramie, one of Wyoming's larger populated areas at around 31,800 as of 2013, is classified as a µSA. In 1989, the AQD began PM_{10} sampling in Laramie. The AQD added $PM_{2.5}$ samplers to the Laramie SLAMS in July 2009 to monitor impacts from wintertime sanding, wood smoke, and forest fires in the summer.

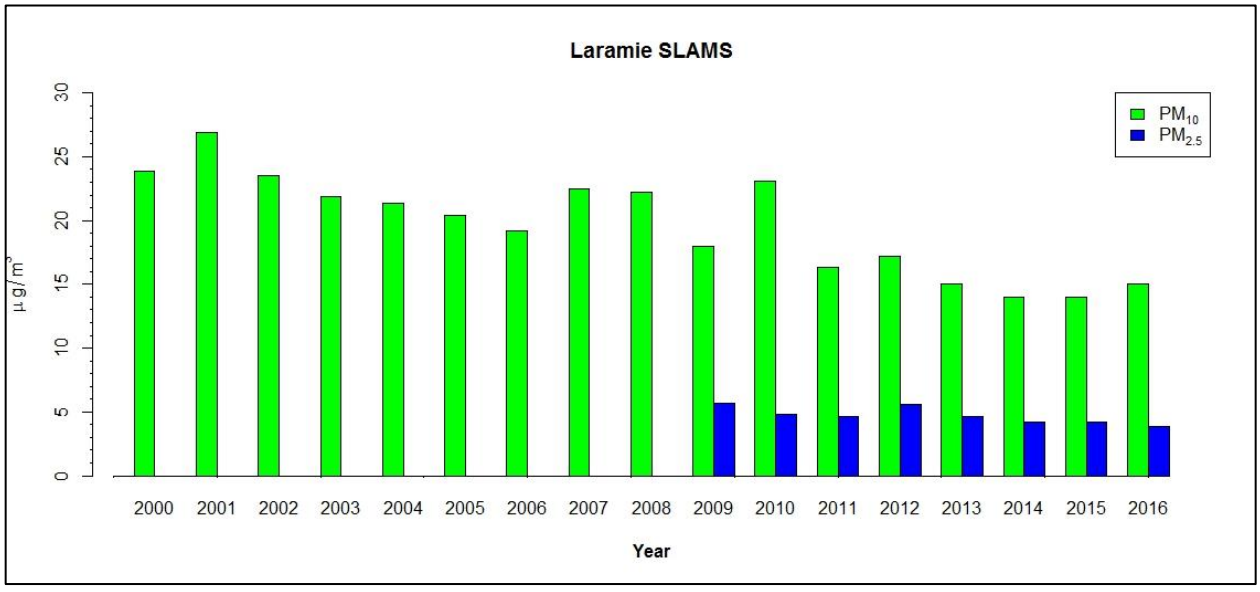


Figure 17. Laramie SLAMS Annual Means

2.1.8 Rock Springs SLAMS

Figure 18. Rock Springs SLAMS satellite view and monitor photo (inset)

Rock Springs – SLAMS Monitoring Site Specifications							
Site Name	**Location**	**AQS ID**	**Parameter**	**Instrument**	**Scale**	**Sample Frequency**	**Operational Status**
Rock Springs SLAMS	625 Ahsay Ave.	56-037-0007	PM_{10}	R&P Co. Partisol Model 2000 (Manual filter-based)	Neighborhood	1 in 3 days (offset between the primary & satellite samplers)	No planned changes
			$PM_{2.5}$	R&P Co. Partisol Model 2000 $PM_{2.5}$ Air Sampler w/ VSCC (Manual filter-based)	Neighborhood	1 in 3 days (offset between the primary & satellite samplers)	No planned changes

Table 9. Rock Springs SLAMS Monitor Information

Rock Springs is located in the southwestern portion of the State in Sweetwater County. Rock Springs is a µSA with a population of just over 24,100 from the 2013 census estimate. The AQD started sampling for PM_{10} at this SLAMS location in 1989. $PM_{2.5}$ monitors were added here in March 2008 due to a growth in population and energy development in the area.

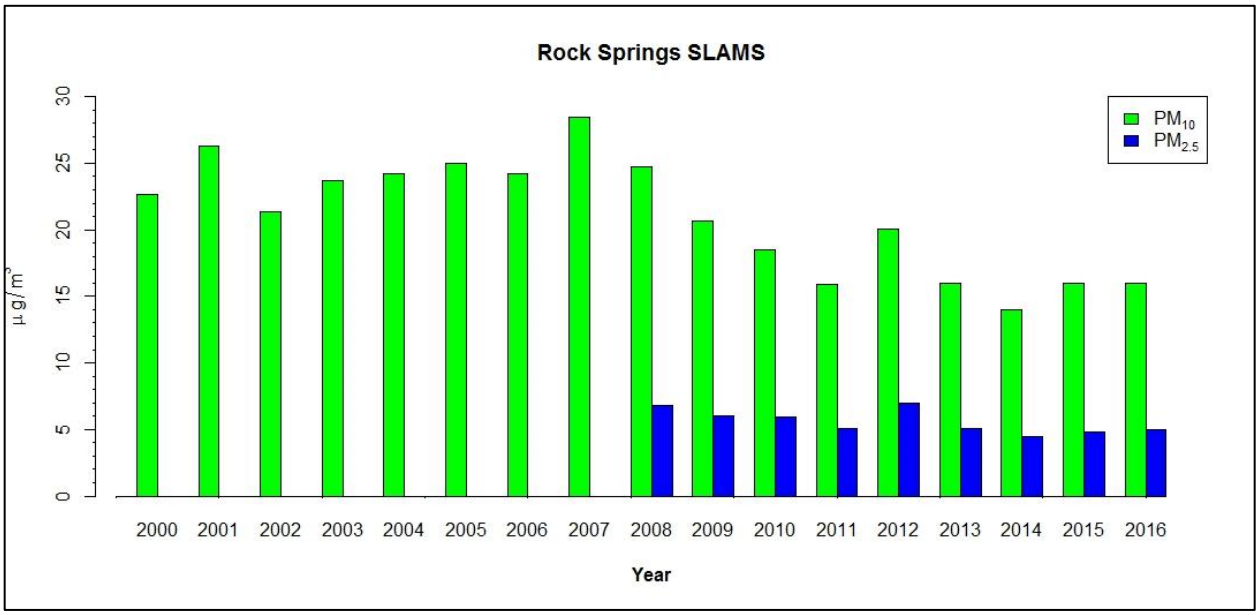


Figure 19. Rock Springs SLAMS Annual Means

2.1.9 Sheridan Meadowlark SLAMS

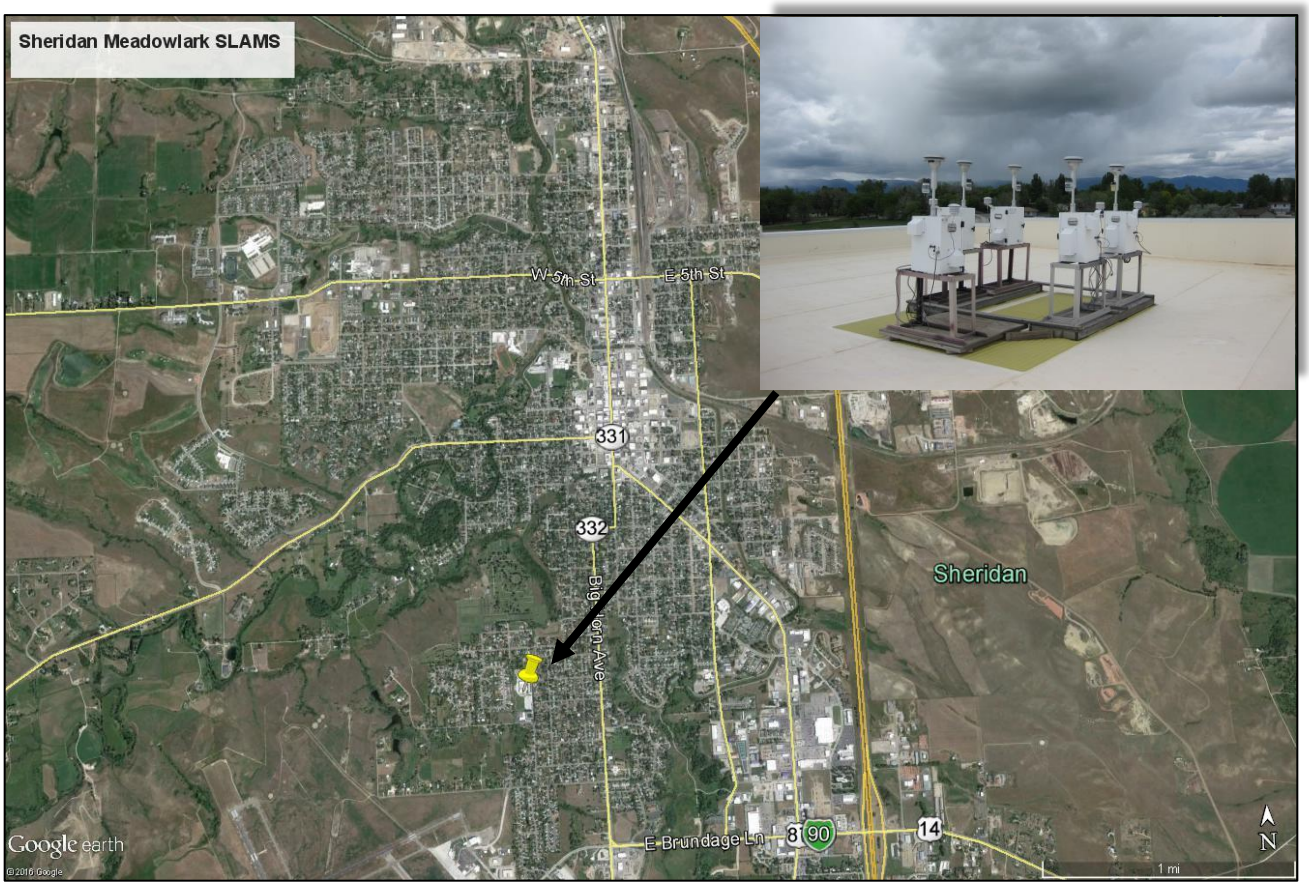


Figure 20. Sheridan Meadowlark SLAMS satellite view with monitor photo (inset)

Sheridan Meadowlark – SLAMS Monitoring Site Specifications							
Site Name	**Location**	**AQS ID**	**Parameter**	**Instrument**	**Scale**	**Sample Frequency**	**Operational Status**
Sheridan Meadowlark SLAMS	1410 DeSmet Ave.	56-033-1003	PM_{10}	R&P Co. Partisol Model 2000 (Manual filter-based)	Neighborhood	1 in 3 days (primary); 1 in 12 days (collocate)	No planned changes
			$PM_{2.5}$	R&P Co. Partisol Model 2000 $PM_{2.5}$ Air Sampler w/ VSCC (Manual filter-based)	Neighborhood	1 in 3 days (offset between the primary & satellite samplers)	No planned changes

Table 10. Sheridan Meadowlark SLAMS Monitor Information

This monitoring location is one of two SLAMS in Sheridan, a µSA. Sheridan is located in north central Wyoming with a population of about 17,800. Wyoming's only nonattainment area for PM_{10} is located within the city limits. The AQD is pursuing the redesignation of this area as "attainment" for PM_{10}.

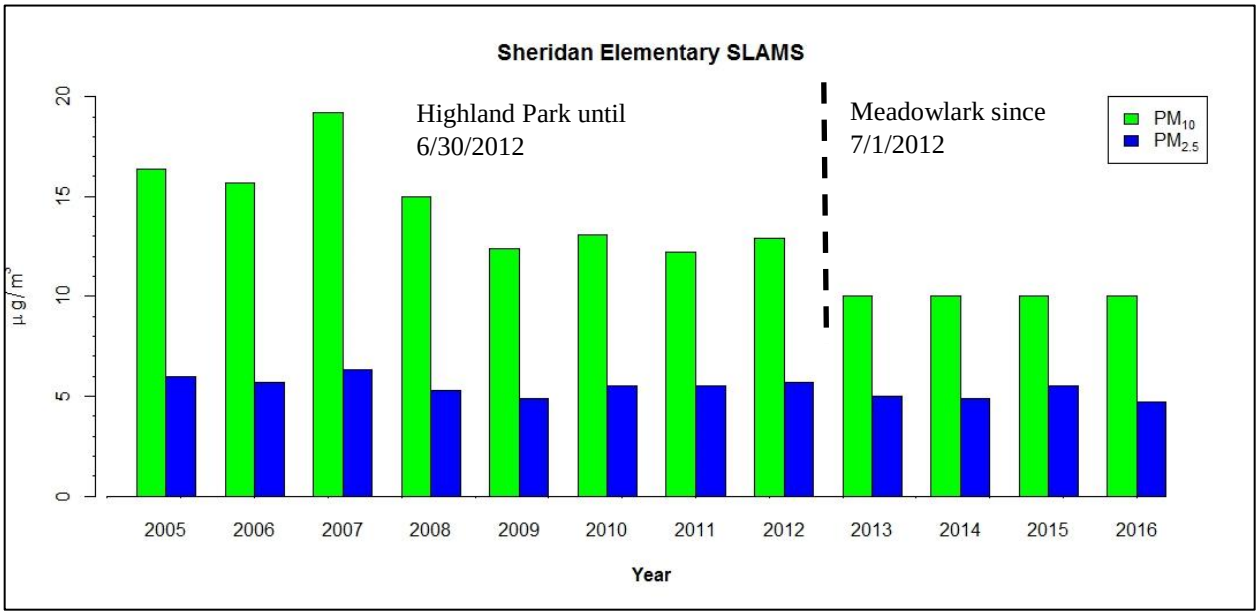


Figure 21. Sheridan Elementary SLAMS Annual Means

2.1.10 Sheridan Police Station SLAMS

Figure 22. Sheridan Police Station SLAMS satellite view and monitor photo (inset)

Sheridan Police Station – SLAMS Monitoring Site Specifications							
Site Name	**Location**	**AQS ID**	**Parameter**	**Instrument**	**Scale**	**Sample Frequency**	**Operational Status**
Sheridan Police Station SLAMS	45 W. 12th St.	56-033-0002	PM_{10}	Continuous TEOM	Neighborhood	Hourly	No planned changes
			$PM_{2.5}$	R&P Co. Partisol Model 2000 $PM_{2.5}$ Air Sampler w/ VSCC (Manual filter-based)	Neighborhood	1 in 3 days (primary); 1 in 12 days (collocate)	No planned changes

Table 11. Sheridan Police Station SLAMS Monitor Information

The Sheridan Police Station SLAMS is one of the oldest monitoring stations in Wyoming. The monitoring objective for this station is to characterize the highest expected concentration of PM_{10} in the nonattainment area. Filter-based PM_{10} sampling began at this station in 1985 but was replaced by a continuous tapered element oscillating microbalance (TEOM) sampler on October 1, 2007. $PM_{2.5}$ sampling at this station began in 1998. Meteorological instrumentation was added in 2008 to monitor local weather conditions that provided the AQD with better information for collaborating with the community to prevent PM_{10} exceedances.

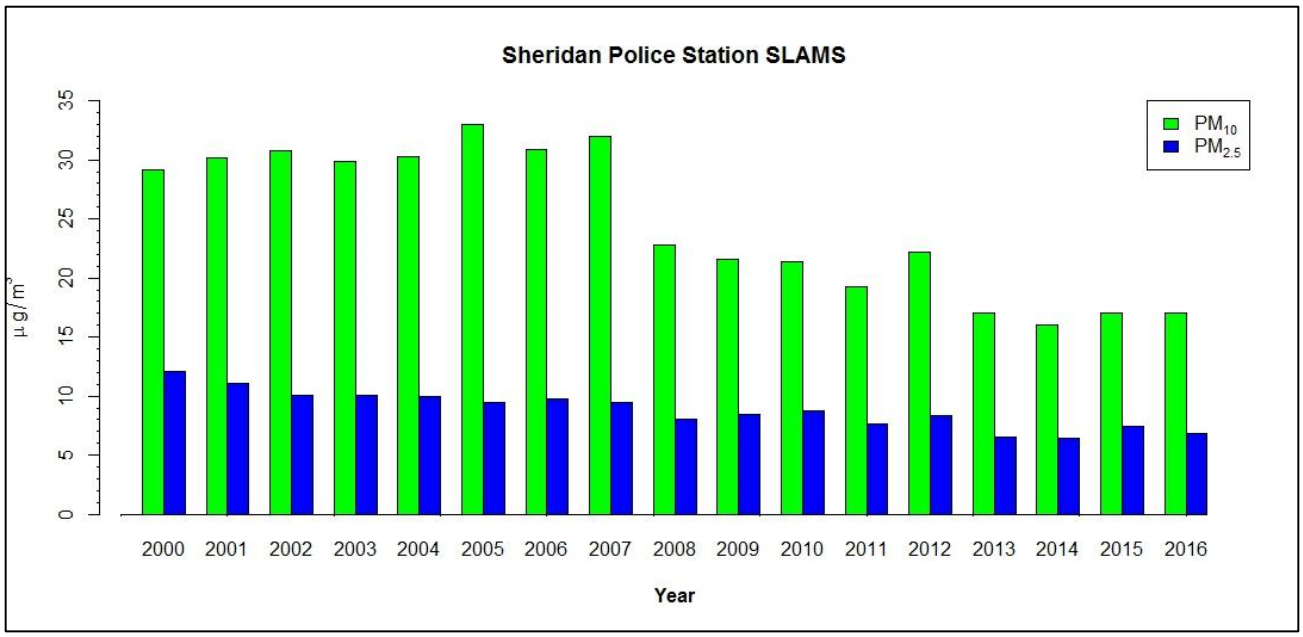


Figure 23. Sheridan Police Station SLAMS Annual Means

2.2 SPM Stations

The SPM stations, as mentioned in Section 1.1, have multiple objectives. The measurement of background and downwind pollutant concentrations, particularly with respect to public health, remain the main objectives for these stations. A description of each SPM station and its objective is provided along with a photo of the site and a table describing site and monitor information. A map of current SPM locations in Wyoming is provided below.

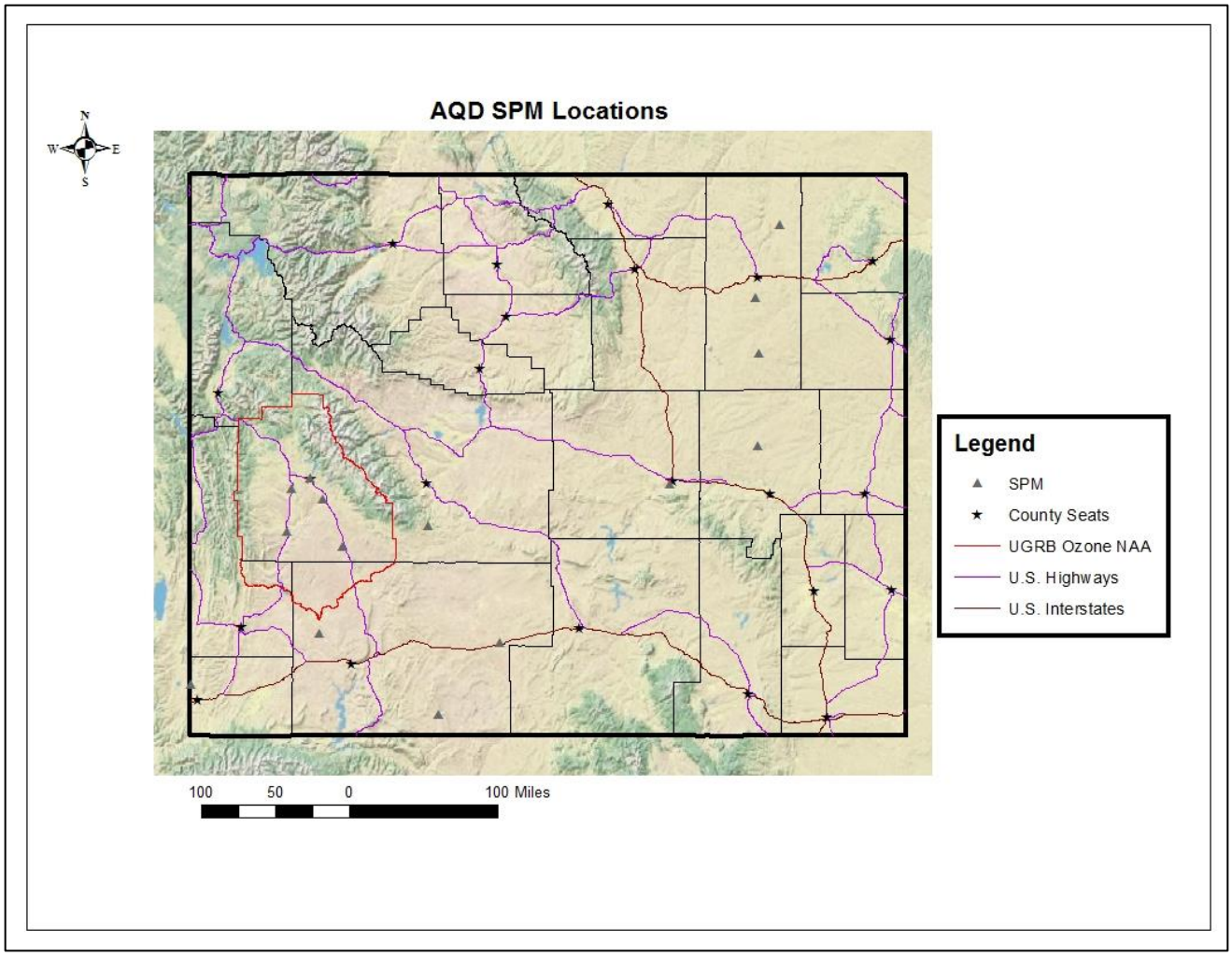


Figure 24. Map of current SPM locations

2.2.1 Big Piney

The Big Piney station is located four miles south of the Town of Big Piney. In March 2011, the AQD placed a mobile monitoring station at this location to monitor near the Big Piney and LaBarge Gas Fields. The mobile monitoring station equipment included a digital camera, ozone analyzer, oxides of nitrogen analyzer, methane/non-methane hydrocarbon (NMHC)/total hydrocarbon (THC) analyzer, continuous PM_{10} Beta Attenuation Monitor (BAM), $PM_{2.5}$ BAM monitor, and meteorological monitor. After two full years of operation, the AQD performed an assessment of the data from the Big Piney station and determined that it would be beneficial to continue monitoring some parameters at this location. On December 10, 2013, the long-term Big Piney station became operational. The station currently monitors ozone, oxides of nitrogen, meteorological parameters, and has a camera for visibility purposes. Since the station was kept in the same location, data from this station continues to be reported under AQS ID 56-035-0700.

Big Piney Monitoring Site Specifications							
Site Name	**Location**	**AQS ID**	**Parameter**	**Instrument**	**Scale**	**Sample Frequency**	**Operational Status**
Big Piney	4 miles south of Big Piney, WY	56-035-0700	O_3	Thermo 49i	Regional	Hourly	No planned changes
			$NO/NO_2/NO_x$	Thermo Fisher Scientific Model 42i-TL	Regional	Hourly	No planned changes

Table 12. Big Piney Monitor Information

2.2.2 Boulder

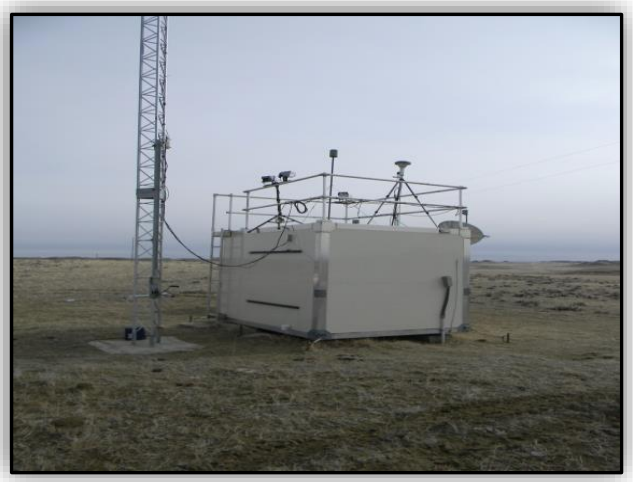
The Boulder station is located approximately five miles southwest of Boulder, Wyoming and is used to track air quality in an area of natural gas development. The Boulder station's ozone monitor is also considered the "design value monitor" for the Upper Green River Basin (UGRB) Ozone Nonattainment Area because Boulder had the highest ozone values in the UGRB and is used as the monitor to determine if the UGRB is attaining the ozone NAAQS.

The Boulder Station began monitoring in February 2005, and includes gaseous (NO_x and ozone), continuous particulate (PM_{10} BAM), camera system and meteorological monitoring. The Boulder Station was also a hub for the AQD's 2007 - 2016 Upper Green Winter Ozone Studies. Additionally, long-term monitoring has been added to the Boulder Station to better understand ozone formation in the Upper Green River Basin Ozone Nonattainment Area. In 2017, this long-term monitoring included photolytic NO_2, methane/non-methane hydrocarbons, speciated VOC monitoring, NO_y monitoring, UV radiometers, and upper air monitoring.

Boulder Monitoring Site Specifications							
Site Name	**Location**	**AQS ID**	**Parameter**	**Instrument**	**Scale**	**Sample Frequency**	**Operational Status**
Boulder	5 miles southwest of Boulder, WY	56-035-0099	O_3	Teledyne-API Model 400 E	Neighborhood	Hourly	No planned changes
			$NO/NO_2/NO_x$	Teledyne-API Model 200E	Neighborhood	Hourly	No planned changes
			PM_{10}	Met One BAM 1020	Neighborhood	Hourly	No planned changes

Table 13. Boulder Monitor Information

2.2.3 Campbell County



The Campbell County station began operation in June 2003 and is located approximately 15 miles southwest of Gillette. This station is used to track air quality in an area of heavy coal-bed methane development. This station includes gaseous (NO_x and ozone), continuous particulate (PM_{10} TEOM), camera system and meteorological monitoring. Campbell County's continuous particulate and NO_x analyzer were both upgraded in 2016. The continuous PM_{10} TEOM was upgraded to a BAM monitor and the Teledyne API 200E NO_x analyzer was upgraded to a Thermo 42i NO_x analyzer. The data analysis from the 2015 Network Assessment led to the determination that the Campbell County station has data from multiple pollutants which correlate well with sites owned by the AQD and by industry. Further analyses conducted in 2016 showed that this site may be decommissioned. These analyses may be viewed in Appendix C. The station will be removed and relocated to eastern Johnson County in 2017.

Campbell County Monitoring Site Specifications							
Site Name	**Location**	**AQS ID**	**Parameter**	**Instrument**	**Scale**	**Sample Frequency**	**Operational Status**
Campbell County	15 miles SSW of Gillette, WY	56-005-0456	O_3	Thermo 49i	Regional	Hourly	Site to be decommissioned
			$NO/NO_2/NO_x$	Thermo Fisher Scientific Model 42i-TL	Regional	Hourly	Site to be decommissioned
			PM_{10}	Met One BAM 1020	Regional	Hourly	Site to be decommissioned

Table 14. Campbell County Monitor Information

2.2.4 Casper Gaseous

The Casper Gaseous station began operations in March 2013. This station was sited to monitor population-based ozone concentrations in Wyoming's second largest city, a MSA. This siting fulfilled a finding in the 2010 Network Assessment regarding the need for population-based ozone monitoring in Casper, WY. The Casper Gaseous station monitors O_3, NO_x, meteorology, and visibility (via a camera system).

During the AQD's 2016 Technical System Audit (TSA), EPA Region VIII issued a draft finding that the ozone monitor at Casper should be reclassified from a SPM to SLAMS monitor type, based on the 3-year ozone (2014, 2015, and 2016) design value of 0.060 ppm. The AQD submitted a request of approval to reclassify the Casper ozone monitor type from SPM to SLAMS on December 14, 2016 and are waiting on approval from the EPA.

Casper Gaseous Monitoring Site Specifications							
Site Name	**Location**	**AQS ID**	**Parameter**	**Instrument**	**Scale**	**Sample Frequency**	**Operational Status**
Casper Gaseous	2800 Pheasant Dr.	56-025-0100	O_3	Teledyne-API Model T400E	Neighborhood/Urban	Hourly	No planned changes
			$NO/NO_2/NO_x$	Teledyne-API Model T200E	Neighborhood	Hourly	No planned changes

Table 15. Casper Gaseous Monitor Information

2.2.5 Converse County

The Converse County station is located approximately 38 miles northwest of Douglas and is used to evaluate ambient air quality in an area of regional oil and gas development. Air quality measurements at the Converse County station include gaseous parameters (NO_x, ozone, and methane/non-methane hydrocarbons), continuous particulate (PM_{10} BAM), a camera system, and meteorological monitoring. The Converse County station began operation in April 2015. The data analysis from the 2015 Network Assessment identified additional monitoring needs in central Converse County.

Converse County Monitoring Site Specifications							
Site Name	**Location**	**AQS ID**	**Parameter**	**Instrument**	**Scale**	**Sample Frequency**	**Operational Status**
Converse County	16 miles west of WY Highway 59 on Highland Loop Rd.	56-009-0010	O_3	Teledyne-API Model T400	Regional	Hourly	No planned changes
			$NO/NO_2/NO_x$	Teledyne-API Model 200E	Regional	Hourly	No planned changes
			PM_{10}	Met One BAM 1020	Regional	Hourly	No planned changes

Table 16. Converse County Monitor Information

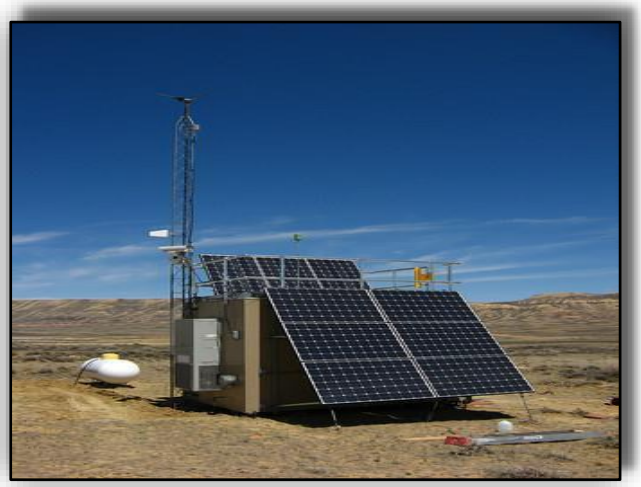
2.2.6 Daniel South

The Daniel South station is located approximately five miles south of the town of Daniel in Sublette County and is used to track air quality upwind of an area of extensive natural gas development. The Daniel South Station includes gaseous (NO_x and ozone), continuous particulate (PM_{10} BAM), camera system and meteorological monitoring. The Daniel South Station began operation in July 2005. Due to the progressive failure of the PM_{10} TEOM, the AQD replaced the instrument with a BAM 1020 in 2016.

Daniel South Monitoring Site Specifications							
Site Name	**Location**	**AQS ID**	**Parameter**	**Instrument**	**Scale**	**Sample Frequency**	**Operational Status**
Daniel South	5 miles south of Daniel, WY	56-035-0100	O_3	Teledyne-API Model T400	Regional	Hourly	No planned changes
			$NO/NO_2/NO_x$	Teledyne-API Model 200E	Regional	Hourly	No planned changes
			PM_{10}	Met One BAM 1020	Regional	Hourly	No planned changes

Table 17. Daniel South Monitor Information

2.2.7 Hiawatha



The Hiawatha station commenced operation on March 30, 2011. This station originated as a result of the 2010 Network Assessment where a need for background monitoring in an area of oil and gas development was discovered. The Hiawatha station is located about 45 miles southeast of Rock Springs, WY. Due to the remote location, the Hiawatha station is the AQD's first ambient monitoring station that uses solar and wind energy as its primary power source. Ozone is the only pollutant that is monitored at Hiawatha. Meteorological conditions and the visibility scene are also observed at this station. The Hiawatha station is a part of the Intermountain West Data Warehouse (IWDW) Project.

Hiawatha Monitoring Site Specifications							
Site Name	**Location**	**AQS ID**	**Parameter**	**Instrument**	**Scale**	**Sample Frequency**	**Operational Status**
Hiawatha	Bitter Creek Rd. 43 miles SE of Rock Springs, WY	56-037-0077	O_3	Teledyne-API Model 400E	Regional	Hourly	No planned changes

Table 18. Hiawatha Monitor Information

2.2.8 Juel Spring

The Juel Spring station began operation in December 2009 and is located approximately 15 miles downwind (southeast) of the Jonah Gas Field. The Juel Spring Station includes gaseous (NO_x and ozone), a camera system and meteorological monitoring. This station is located in conjunction with the Union Cellular Juel Spring Tower station.

Juel Spring Monitoring Site Specifications							
Site Name	**Location**	**AQS ID**	**Parameter**	**Instrument**	**Scale**	**Sample Frequency**	**Operational Status**
Juel Spring	20 miles northwest of Farson, WY	56-035-1002	O_3	Teledyne-API 400A	Urban	Hourly	No planned changes
			$NO/NO_2/NO_x$	Teledyne-API 200A	Urban	Hourly	No planned changes

Table 19. Juel Spring Monitor Information

2.2.9 Moxa Arch

The Moxa Arch station was installed in May 2010. This station is located about 25 miles northwest of Green River. The purpose of this monitoring station is to characterize and monitor meteorology and air quality in an area of heavy energy development. This station includes NO_x, SO_2, O_3, PM_{10} (a BAM instrument), a camera system, and meteorological equipment.

Moxa Arch Monitoring Site Specifications							
Site Name	**Location**	**AQS ID**	**Parameter**	**Instrument**	**Scale**	**Sample Frequency**	**Operational Status**
Moxa Arch	25 miles northwest of Green River, WY	56-037-0300	O_3	Teledyne-API Model 400E	Urban	Hourly	No planned changes
			$NO/NO_2/NO_x$	Teledyne-API Model 200E	Urban	Hourly	No planned changes
			PM_{10}	Met One BAM 1020	Urban	Hourly	No planned changes
			SO_2	Thermo 43i	Urban	Hourly & 5-minute	No planned changes

Table 20. Moxa Arch Monitor Information

2.2.10 Murphy Ridge

Operations at Murphy Ridge were initiated in 2007. The station is located in the town of Bear River, about 10 miles north of Evanston on the Utah/Wyoming border. This site monitors pollutants transported from Utah including NO_x, O_3, PM_{10} via a continuous TEOM instrument, and meteorological parameters. A camera system is mounted on the shelter to provide visibility. The data analysis from the 2015 Network Assessment showed no significant trends in air quality concentrations since 2007 and background data needs for modeling have changed. Given that the station has served its purpose to characterize pollutant transport and with possible budget reductions, the Murphy Ridge station could be decommissioned to satisfy required reductions.

Murphy Ridge Monitoring Site Specifications							
Site Name	**Location**	**AQS ID**	**Parameter**	**Instrument**	**Scale**	**Sample Frequency**	**Operational Status**
Murphy Ridge	Bear River, WY	56-041-0101	O_3	Teledyne-API Model 400E	Regional	Hourly	No planned changes
			$NO/NO_2/NO_x$	Teledyne-API Model 200E	Regional	Hourly	No planned changes
			PM_{10}	Thermo Fisher TEOM 1400ab	Regional	Hourly	No planned changes

Table 21. Murphy Ridge Monitor Information

2.2.11 Pinedale Gaseous

The Pinedale Gaseous station began operations in January 2009 because of the need for population-based monitoring in this location, which was noted in the 2008 Southwest Wyoming Network Assessment. This station includes ozone, NO_x, a continuous $PM_{2.5}$ BAM and meteorology within the town of Pinedale. This station monitors pollutant concentrations in the most populated area in the UGRB Ozone Nonattainment Area. A camera system is also associated with this station on WyVisNet. However, the camera is housed in a different location with the objective of providing an overlook of the town of Pinedale.

Pinedale Gaseous Monitoring Site Specifications							
Site Name	**Location**	**AQS ID**	**Parameter**	**Instrument**	**Scale**	**Sample Frequency**	**Operational Status**
Pinedale Gaseous	West side of City Park & Pine Creek	56-035-0101	O_3	Teledyne-API Model 400E	Urban	Hourly	No planned changes
			$NO/NO_2/NO_x$	Teledyne-API Model 200E	Urban	Hourly	No planned changes
			$PM_{2.5}$	Met One BAM 1020	Urban	Hourly	No planned changes

Table 22. Pinedale Gaseous Monitor Information

2.2.12 South Pass

The South Pass station began operation in 2007. The station is located on South Pass at the southern end of the Wind River Range. The purpose of this station is to monitor air quality on the southern end of the range which sees air masses from both the Upper Green River Basin to the northwest, and from the southwestern corner of the State. The station includes gaseous (NO_x and ozone), continuous particulate ($PM_{2.5}$ BAM), camera system and meteorological monitoring. The PM_{10} TEOM was shut down in 2014 and was replaced with a $PM_{2.5}$ BAM. The switch to $PM_{2.5}$ was made to assist the AQD in studying the impact of wildfires in the area.

South Pass Monitoring Site Specifications							
Site Name	**Location**	**AQS ID**	**Parameter**	**Instrument**	**Scale**	**Sample Frequency**	**Operational Status**
South Pass	South Pass, WY	56-013-0099	O_3	Thermo 49i	Urban	Hourly	No planned changes
			$NO/NO_2/NO_x$	Thermo 42i	Urban	Hourly	No planned changes
			$PM_{2.5}$	Met One BAM 1020	Urban	Hourly	No planned changes

Table 23. South Pass Monitor Information

2.2.13 Thunder Basin

The Thunder Basin station is located approximately 30 miles northeast of Gillette, Wyoming and is used to track visibility, meteorology, and air quality in the area. The Thunder Basin Station began operating in October 1999 and includes gaseous (NO_x and ozone), camera system and meteorological monitoring. A new Thermo 42i $NO/NO_2/NO_x$ analyzer was installed in 2016 to replace the older Thermo 42C $NO/NO_2/NO_x$ analyzer.

Thunder Basin Monitoring Site Specifications							
Site Name	**Location**	**AQS ID**	**Parameter**	**Instrument**	**Scale**	**Sample Frequency**	**Operational Status**
Thunder Basin	30 miles NNE of Gillette, WY	56-005-0123	O_3	Thermo 49i	Regional	Hourly	No planned changes
			$NO/NO_2/NO_x$	Thermo 42i	Regional	Hourly	No planned changes

Table 24. Thunder Basin Monitor Information

2.2.14 Wamsutter

The Wamsutter site is approximately two 2 miles west of the town of Wamsutter. The objective of this station is to track air quality and meteorology in an area of extensive natural gas development. The Wamsutter station includes gaseous (NO_x and O_3), PM_{10} BAM, CH_4, NMHC, THC, and meteorological monitoring. A camera system provides coverage of visibility. This station started operations on March 13, 2006. Due to reliability issues, the existing PM_{10} TEOM was replaced with a BAM 1020 and the original model 42c NO_x analyzer was replaced with a new 42i analyzer in 2016.

Wamsutter Monitoring Site Specifications							
Site Name	**Location**	**AQS ID**	**Parameter**	**Instrument**	**Scale**	**Sample Frequency**	**Operational Status**
Wamsutter	2 miles west of Wamsutter, WY	56-037-0200	O_3	Thermo 49i	Urban	Hourly	No planned changes
			$NO/NO_2/NO_x$	Thermo 42i	Urban	Hourly	No planned changes
			PM_{10}	Met One BAM 1020	Urban	Hourly	No planned changes

Table 25. Wamsutter Monitor Information

2.2.15 Wright Jr-Sr High School

The Wright monitoring station is located in Campbell County in northern Wyoming. Wright is a community located west of the southern group of the Powder River Basin (PRB) coal mines. The purpose of this monitor is to track population exposure to PM_{10} in a community that is downwind of the coal mines. The data analysis from the 2015 Network Assessment revealed that PM_{10} data at Wright correlated significantly with six nearby industrial monitors in the PRB. Further evaluation is necessary with respect to redundancy to other available monitoring data to determine if this station may be decommissioned.

Wright Jr-Sr High School Monitoring Site Specifications							
Site Name	**Location**	**AQS ID**	**Parameter**	**Instrument**	**Scale**	**Sample Frequency**	**Operational Status**
Wright Jr-Sr High School	Adjacent to Wright Jr-Sr High School	56-005-0099	PM_{10}	R&P Co. Partisol Model 2000 (Manual filter-based)	Neighborhood	1 in 6 days	No planned changes

Table 26. Wright Jr-Sr High School Monitor Information

2.2.16 Powder River Basin-NO_x

The Powder River Basin (PRB) NO_x network began operation in January 2001 through a cooperative agreement between the AQD and the Wyoming Mining Association. The network monitors regional NO_2 concentrations in the PRB. The Belle Ayr - BA-4 Station is located near the railroad and represents a "maximum concentration" in and around the coal mines. The Antelope Station is located upwind from mining activities is considered to be background. The AQD also receives data from the Thunder Basin Coal Company's station at Tracy Ranch; this monitoring station is considered downwind of mining activity. The AQD did not list the Tracy Ranch station below because it is funded and operated solely by the Thunder Basin Coal Company. Due to the construction of an oilfield service road less than 100 feet from Antelope Site 3, this site was shut down on July 1, 2013. The Antelope station was moved to a new location, renamed Antelope Site 7, and became operational in February 2015.

PRB NO_x Monitoring Site Specifications							
Site Name	**Location**	**AQS ID**	**Parameter**	**Instrument**	**Scale**	**Sample Frequency**	**Operational Status**
Antelope – Site 7	Antelope Site 7	56-009-0009	$NO/NO_2/NO_x$	Teledyne-API 200A	Regional	Hourly	No planned changes
Belle Ayr – BA-4	Belle Ayr BA-4	56-005-0892	$NO/NO_2/NO_x$	Teledyne-API 200A	Micro Scale	Hourly	No planned changes

Table 27. Powder River Basin NO_x Monitor Information

2.2.17 Powder River Basin-$PM_{2.5}$

The Powder River Basin (PRB) $PM_{2.5}$ Network began operation in 1999. The purpose of the network is to characterize ambient fine particulate at and around the PRB coal mines. One monitor is located at each "group" of mines (north, middle and south) and one monitor is located away from mining activities to represent background levels. Due to the age of the instrumentation in the network, the AQD upgraded the instruments to continuous Thermo 1405DF TEOM monitors in 2010. During the second quarter of 2013, the AQD replaced the 1405DF instruments with Met One BAMs because of reliability issues with the 1405DF instruments. As a result of the construction of an oilfield service road less than 100 feet from Antelope Site 3, it was shut down on July 1, 2013 moved to a new location in February 2015, and renamed Antelope Site 7.

PRB $PM_{2.5}$ Monitoring Site Specifications							
Site Name	**Location**	**AQS ID**	**Parameter**	**Instrument**	**Scale**	**Sample Frequency**	**Operational Status**
Antelope – Site 7	Antelope Site 7	56-009-0009	$PM_{2.5}$	Met One BAM 1020	Regional	Hourly	No planned changes
Belle Ayr – BA-4	Belle Ayr BA-4	56-005-0892	$PM_{2.5}$	Met One BAM 1020	Neighborhood	Hourly	No planned changes
Black Thunder BTM-36-2	BTM-36-2 (Black Thunder Mine)	56-005-0891	$PM_{2.5}$	Met One BAM 1020	Neighborhood	Hourly	No planned changes
Buckskin Mine	Triton Coal Gillette, WY	56-005-1899	$PM_{2.5}$	Met One BAM 1020	Neighborhood	Hourly	No planned changes

Table 28. Powder River Basin $PM_{2.5}$ Monitor Information

2.3 Mobile Monitoring Stations

The AQD has three mobile gaseous monitoring stations that are sited at various locations throughout Wyoming to characterize air quality. As the name of this section implies, these stations are self-contained monitoring shelters that may be moved to different locations in a relatively short period. The stations have gaseous monitors (NO_x, SO_2, O_3, CH_4, and NMHC), continuous PM_{10}, continuous $PM_{2.5}$, a camera system, and meteorological instrumentation. The mobile stations may be used to monitor and characterize events, trends in air quality, or areas downwind of industrial development. The AQD sites and operates the stations at a specific location for approximate durations of one year. The current locations as of mid-May 2017 for the mobile monitoring stations are Laramie (Mobile #1) and Casper (Mobile #3). The Cheyenne station (Mobile #2) was decommissioned on April 4, 2017 and will be relocated to Sheridan in late spring 2017. The complete history of the mobile monitoring stations is found in the table below and is also presented in the accompanying map.

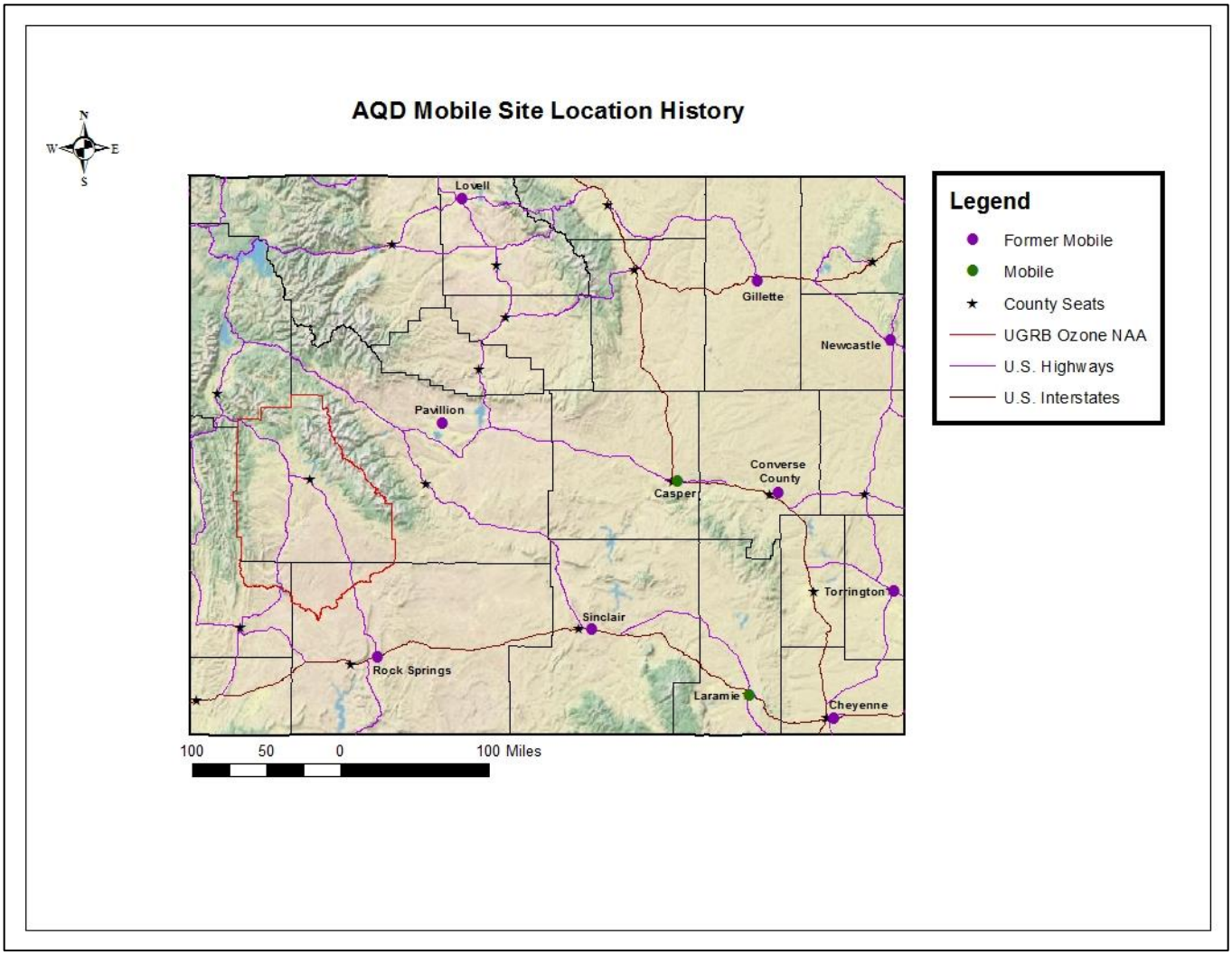


Figure 25. Map of the AQD's Mobile Gaseous Monitoring Stations

Year	Mobile Station #1	Mobile Station #2	Mobile Station #3
2011	Big Piney	Pavillion	Gillette
2012	Big Piney	Pavillion	Converse County
2013	Rock Springs	Sinclair	Converse County
2014	Lovell	Sinclair	Converse County
2015	Lovell / Torrington	Sinclair	Converse County / Newcastle
2016	Torrington	Sinclair / Cheyenne	Newcastle / Casper
2017 YTD	Laramie	Cheyenne / Sheridan	Casper

Table 29. Mobile Gaseous Monitoring Station Location History

2.3.1.1 Mobile Station #1: Torrington

The Torrington air quality mobile monitoring station operated from December 21, 2015 to December 19, 2016. The mobile station was located within the city limits of Torrington, near a residential neighborhood and school. The station's objective was to characterize the population exposure to multiple air quality parameters in the Town of Torrington, located in the vicinity and downwind of a number of Title V and minor emissions sources. A digital camera, ozone analyzer, oxides of nitrogen analyzer, methane/non-methane hydrocarbons, continuous PM_{10} and $PM_{2.5}$ BAMs and meteorological equipment were located at this station. A sulfur dioxide analyzer was added to this station in January 2016. This station was moved to Laramie which commenced operations on April 5, 2017.

Mobile Station #1: Torrington Monitoring Site Specifications							
Site Name	**Location**	**AQS ID**	**Parameter**	**Instrument**	**Scale**	**Sample Frequency**	**Operational Status**
Torrington Mobile (12/21/2015-12/19/2016)	1446 E. N St. Torrington, WY	56-015-0004	O_3	Teledyne-API Model 400E	Neighborhood	Hourly	Moved from Torrington to Laramie
			$NO/NO_2/NO_x$	Teledyne-API Model 200E	Neighborhood	Hourly	Moved from Torrington to Laramie
			PM_{10}	Met One BAM 1020	Neighborhood	Hourly	Moved from Torrington to Laramie
			$PM_{2.5}$	Met One BAM 1020	Neighborhood	Hourly	Moved from Torrington to Laramie
			SO_2	Thermo 43i	Neighborhood	Hourly & 5 minute	Moved from Torrington to Laramie

Table 30. Mobile Station #1 Monitor Information (Torrington)

2.3.1.2 Mobile Station #1: Laramie

The Laramie air quality mobile monitoring station began operations on April 5, 2017, and is slated to operate at this location for one year. The mobile station is located within the city limits of Laramie on the southwest side of town, in a residential neighborhood. The station's objective is to characterize the population exposure to multiple air quality parameters in the City of Laramie, located in the vicinity of a large Title V emissions source. This city was identified in the AQD's 2015 Network Assessment as being home to a number of sensitive populations. A digital camera, ozone analyzer, oxides of nitrogen analyzer, sulfur dioxide, methane/non-methane hydrocarbons, continuous PM_{10} and $PM_{2.5}$ BAMs and meteorology equipment are located at this station.

Mobile Station #1: Laramie Monitoring Site Specifications							
Site Name	**Location**	**AQS ID**	**Parameter**	**Instrument**	**Scale**	**Sample Frequency**	**Operational Status**
Laramie Mobile (4/5/2017-present)	998 Russell St., Laramie, WY	56-001-0010	O_3	Teledyne-API Model 400E	Urban	Hourly	Moved from Torrington to Laramie
			$NO/NO_2/NO_x$	Teledyne-API Model 200E	Urban	Hourly	Moved from Torrington to Laramie
			PM_{10}	Met One BAM 1020	Urban	Hourly	Moved from Torrington to Laramie
			$PM_{2.5}$	Met One BAM 1020	Urban	Hourly	Moved from Torrington to Laramie
			SO_2	Thermo 43C	Urban	Hourly & 5 minute	Moved from Torrington to Laramie

Table 31. Mobile Station #1 Monitor Information (Laramie)

2.3.2.1 Mobile Station #2: Cheyenne

The Cheyenne air quality mobile monitoring station operated from March 29, 2016 to April 4, 2017. The mobile station was located within the city limits of Cheyenne on the southeast side of town, in a residential neighborhood. The station's objective was to characterize the population exposure to sulfur dioxide and other air quality parameters in the City of Cheyenne, located near a large refinery. A digital camera, ozone analyzer, oxides of nitrogen analyzer, sulfur dioxide, methane/non-methane hydrocarbons, continuous PM_{10} and $PM_{2.5}$ BAMs and meteorology equipment were located at this station. This station will be moved to Sheridan likely in late spring 2017.

Mobile Station #2: Cheyenne Monitoring Site Specifications							
Site Name	**Location**	**AQS ID**	**Parameter**	**Instrument**	**Scale**	**Sample Frequency**	**Operational Status**
Cheyenne Mobile (3/15/2016-4/4/2017)	Phoenix Dr. Cheyenne, WY	56-021-0002	O_3	Teledyne-API Model 400E	Urban	Hourly	Moved from Cheyenne to Sheridan
			$NO/NO_2/NO_x$	Teledyne-API Model 200E	Urban	Hourly	Moved from Cheyenne to Sheridan
			PM_{10}	Met One BAM 1020	Urban	Hourly	Moved from Cheyenne to Sheridan
			$PM_{2.5}$	Met One BAM 1020	Urban	Hourly	Moved from Cheyenne to Sheridan
			SO_2	Thermo 43C	Urban	Hourly & 5 minute	Moved from Cheyenne to Sheridan

Table 32. Mobile Station #2 Monitor Information (Cheyenne)

2.3.2.2 Mobile Station #2: Sheridan

The Sheridan air quality mobile monitoring station will begin operations later in 2017 and be in place for one year. The station will be placed in Sheridan in response to a 2015 Network Assessment finding that there is a need for more population based monitoring beyond what already exists. The AQD performed analyses to better characterize the possible influence of emissions from Montana prior to siting this station. These analyses can be found in Appendix D. The mobile station will be located within the city limits of Sheridan. The station's objective is to characterize the population exposure to multiple air quality parameters in the City of Sheridan, located downwind of a number of large emissions sources in Montana in addition to multiple local sources. A digital camera, ozone analyzer, oxides of nitrogen analyzer, sulfur dioxide, methane/non-methane hydrocarbons, continuous PM_{10} and $PM_{2.5}$ BAMs and meteorology equipment will be located at this station.

Mobile Station #2: Sheridan Monitoring Site Specifications							
Site Name	**Location**	**AQS ID**	**Parameter**	**Instrument**	**Scale**	**Sample Frequency**	**Operational Status**
Sheridan Mobile (Unknown Start Time)	Unknown Location Sheridan, WY	56-033-0006	O_3	Teledyne-API Model 400E	Urban	Hourly	Moved from Cheyenne to Sheridan
			$NO/NO_2/NO_x$	Teledyne-API Model 200E	Urban	Hourly	Moved from Cheyenne to Sheridan
			PM_{10}	Met One BAM 1020	Urban	Hourly	Moved from Cheyenne to Sheridan
			$PM_{2.5}$	Met One BAM 1020	Urban	Hourly	Moved from Cheyenne to Sheridan
			SO_2	Thermo 43C	Urban	Hourly & 5 minute	Moved from Cheyenne to Sheridan

Table 33. Mobile Station #2 Monitor Information (Sheridan)

2.3.3.1 Mobile Station #3: Newcastle

The Newcastle air quality mobile monitoring station operated from July 10, 2015 to October 26, 2016. The mobile station was located within the city limits of the Town of Newcastle in the center of town. The station's objective was to characterize the population's exposure to sulfur dioxide and other air quality parameters in the Town of Newcastle, located near a large refinery. A digital camera, ozone analyzer, oxides of nitrogen analyzer, sulfur dioxide, methane/non-methane hydrocarbons, continuous PM_{10} and $PM_{2.5}$ BAMs and meteorology equipment were located at this station. This station was moved to Casper on December 1, 2016.

Mobile Station #3: Newcastle Monitoring Site Specifications							
Site Name	**Location**	**AQS ID**	**Parameter**	**Instrument**	**Scale**	**Sample Frequency**	**Operational Status**
Newcastle Mobile (7/10/2015-10/26/2016)	116 Casper Ave. Newcastle, WY	56-045-0004	O_3	Teledyne-API Model 400E	Neighborhood	Hourly	Moved from Newcastle to Casper
			$NO/NO_2/NO_x$	Teledyne-API Model 200E	Neighborhood	Hourly	Moved from Newcastle to Casper
			PM_{10}	Met One BAM 1020	Neighborhood	Hourly	Moved from Newcastle to Casper
			$PM_{2.5}$	Met One BAM 1020	Neighborhood	Hourly	Moved from Newcastle to Casper
			SO_2	Teledyne-API M100EU	Neighborhood	Hourly & 5 minute	Moved from Newcastle to Casper

Table 34. Mobile Station #3 Monitor Information (Newcastle)

2.3.3.2 Mobile Station #3: Casper

The Casper air quality mobile monitoring station began operations on December 1, 2016, and is slated to operate at this location for one year. The mobile station is located within the city limits of the city of Casper in the center of town. The station's objective is to characterize the population's exposure to sulfur dioxide and other air quality parameters in the city of Casper, located near a large refinery. A digital camera, ozone analyzer, oxides of nitrogen analyzer, sulfur dioxide, methane/non-methane hydrocarbons, continuous PM_{10} and $PM_{2.5}$ BAMs and meteorology equipment are located at this station.

Mobile Station #3: Casper Monitoring Site Specifications							
Site Name	**Location**	**AQS ID**	**Parameter**	**Instrument**	**Scale**	**Sample Frequency**	**Operational Status**
Casper Mobile (12/1/2016-present)	500 South Walsh Dr., Casper, WY	56-025-0005	O_3	Teledyne-API Model 400E	Neighborhood	Hourly	No planned changes
			$NO/NO_2/NO_x$	Teledyne-API Model 200E	Neighborhood	Hourly	No planned changes
			PM_{10}	Met One BAM 1020	Neighborhood	Hourly	No planned changes
			$PM_{2.5}$	Met One BAM 1020	Neighborhood	Hourly	No planned changes
			SO_2	Teledyne-API M100EU	Neighborhood	Hourly & 5 minute	No planned changes

Table 35. Mobile Station #3 Monitor Information (Casper)

2.4 Cheyenne NCore

The Wyoming NCore monitoring station is located in Cheyenne near the North Soccer Complex Park. The NCore station was established during the summer of 2010 and became fully operational on January 1, 2011. This station was incorporated as part of the National Core Monitoring Network. The NCore stations will be the basis for developing a representative report card on air quality across the nation, capable of delineating differences among geographic and climatological regions. The monitored data will be used to characterize and monitor trends in air quality, compliance with the NAAQS, and may be used for national health assessments, model evaluations, and comparison with other ambient air monitoring data.

As specified in Title 40 Part 58.13(a) of the CFR, the Cheyenne NCore station hosts a large suite of air quality and meteorological parameters. Gaseous parameters include: ozone, $NO/NO_2/NO_x$, trace CO, trace SO_2, and NO_y, total reactive oxides of nitrogen. In 2016, the AQD replaced the chemiluminescent $NO/NO_2/NO_x$ analyzer (a Teledyne-API T200U) with a Teledyne-API 200 EU/501 analyzer.

Particulate monitoring is a substantial part of routine operations at the NCore station. Currently, this station has a MetOne BAM Coarse system (includes PM_{10} and $PM_{2.5}$ instruments). This setup provides continuous data and an economical way to monitor PM_{10}, $PM_{10-2.5}$, and $PM_{2.5}$. The primary monitor for $PM_{2.5}$ is a filter-based Very Sharp Cut Cyclone (VSCC) gravimetric monitor. Two Thermo Partisol 2000i Federal Reference Method (FRM) monitors were installed and began sampling on a one in three day schedule on January 1, 2014. This new setup helps fulfill the Wyoming $PM_{2.5}$ monitor network FRM and Federal Equivalent Method (FEM) collocation requirements.

Figure 26. Cheyenne NCore station image

Cheyenne NCore Monitoring Site Specifications							
Site Name	**Location**	**AQS ID**	**Parameter**	**Instrument**	**Scale**	**Sample Frequency**	**Operational Status**
Cheyenne NCore	6909 Chief Washakie Ave. Cheyenne, WY	56-021-0100	O_3	Teledyne-API Model 400E	Neighborhood	Hourly	New analyzer planned for 2017
			$NO/NO_2/NO_x$	Teledyne-API 200 EU/501	Neighborhood	Hourly	No planned changes
			NO_y	Teledyne-API M200EU NOY	Regional	Hourly	No planned changes
			Trace SO_2	Teledyne-API T100U	Neighborhood	Hourly	No planned changes
			Trace CO	Thermo Electron 48i-TLE	Neighborhood	Hourly	No planned changes
			PM_{10}	Met One BAM 1020	Neighborhood	Hourly	No planned changes
			Speciated $PM_{10-2.5}$	Met One BAM 1020	Neighborhood	Hourly	No planned changes
			$PM_{2.5}$	Met One BAM 1020	Neighborhood	Hourly	No planned changes
			$PM_{2.5}$ (Primary)	R&P Model 2000 $PM_{2.5}$ Air Sampler w/ VSCC (filter-based)	Neighborhood	1 in 3 days (primary); 1 in 12 days (collocate)	No planned changes
			Speciated $PM_{2.5}$	URG 3000N (filter-based)	Neighborhood	1 in 3 days	No planned changes

Table 36. Cheyenne NCore Monitor Information

2.5 Industrial Monitoring Sites

Historically, the AQD has required several industrial sources in Wyoming to conduct ambient monitoring for criteria pollutants at and near specific facilities. The AQD's largest industrial monitoring network is at the Powder River Basin coal mines and has 59 PM_{10} monitors. In southwest Wyoming, there is an extensive network of PM_{10} monitors associated with Trona facilities and coal mines. As facilities obtain construction or modification permits from the AQD's New Source Review (NSR) program, the facilities are often required to monitor for compliance with the NAAQS downwind of their facilities. These facilities submit quarterly data to the AQD. The data is checked for compliance with the NAAQS and adherence to proper quality assurance protocols.

2.6 IMPROVE Network

The purpose of the Interagency Monitoring of Protected Visual Environments (IMPROVE) network is to establish current visibility and aerosol conditions along with the characterizing broad regional trends and visibility conditions using monitoring data collected at or near Class I areas across the United States. There are four IMPROVE locations in Wyoming: Yellowstone National Park, Est. 1988; Bridger Wilderness Areas, Est. 1988; North Absaroka Wilderness Area, Est. 2000; Thunder Basin National Grasslands, Est. 2002.

3.0 Compliance with NAAQS

The primary purpose of the AQD's SLAMS and SPM networks is to evaluate compliance with the NAAQS. These monitoring networks utilize FRM and FEM technologies and operate according to the SLAMS or Prevention of Significant Deterioration (PSD) quality assurance specifications in order to be used for NAAQS comparison. The AQD's SLAMS and SPM networks also operate under project-specific quality assurance project plans (QAPPs) which are available in the Cheyenne office for inspection. The following tables in Section 3 also contain data from the mobile gaseous stations. These stations do operate according to the EPA's specifications for NAAQS comparison, but they are typically deployed for no more than 12 months and usually do not possess a complete calendar year of data. The mobile gaseous stations, therefore, are generally not comparable to the design value, the true test of compliance with the NAAQS.

The following tables in Section 3 show 2014-2016 data and design values for each SLAMS and SPM monitoring station. All stations that operated in 2016 are included in the tables. All stations operated by the AQD comply with the NAAQS from 2014-2016.

3.1 Particulate Matter (PM_{10})

There were 24 stations that monitored for PM_{10} at any time in 2016. The SLAMS network has nine stations that use manual samplers and one that uses a continuous sampler. There is 30% collocation among the SLAMS that use the manual samplers. This fulfills the collocation requirements of Title 40, Part 58 Appendix A of the CFR. The remainder of the AQD monitoring network (NCore and SPMs) use continuous monitoring.

To comply with the 24-hour PM_{10} NAAQS, a monitor may only have one exceedance (a 24-hour average concentration greater than 150 $\mu g/m^3$) per year on average over a three-year period. The design value is the average number of exceedances per year from 2014-2016. A design value of zero means the station has not recorded any values over 150 $\mu g/m^3$ during the three-year period. Wyoming also has an ambient air quality standard for PM_{10} in its state regulations. Compliance with the annual Wyoming Ambient Air Quality Standards (WAAQS) is determined by the three-year average of the annual mean. The three-year average of the mean must be below 50 $\mu g/m^3$. The two tables in Section 3.1 show PM_{10} values with respect to the NAAQS and the WAAQS. The tables throughout Section 3 may contain special notations in place of values. These notations are explained below in the footer.

PM_{10} Compliance with NAAQS of 150 µg/m^3					
Highest 24-Hour Average (µg/m^3)					
Site Name	**2014**	**2015**	**2016**	**Design Value (2014-2016)**	**In Compliance**
SLAMS					
Casper	30	59	46	0	Yes
Cheyenne	33	44	28	0	Yes
Cody	29	44	53	0	Yes
Gillette	25	39	40	0	Yes
Jackson	36	53	48	0	Yes
Lander	62	53	30	0	Yes
Laramie	42	41	33	0	Yes
Rock Springs	39	54	41	0	Yes
Sheridan-Meadowlark	20	68	54	0	Yes
Sheridan-Police Station	47	94	72	0	Yes
SPM					
Boulder	31	40	40	0	Yes
Campbell County	52	135	63	0	Yes
Converse County	N/A	42	62	N/A	N/A
Daniel South	26	36	27	0	Yes
Moxa Arch	67	52	41	0	Yes
Murphy Ridge	39	59	42	0	Yes
South Pass	15*	N/A	N/A	N/A	N/A
Wamsutter	41	47	32	0	Yes
Wright Jr-Sr High School	56	66	29	0	Yes
NCore					
Cheyenne NCore	34	78	34	0	Yes
Mobile Stations**					
Casper	N/A	N/A	N/A	N/A	N/A
Cheyenne	N/A	N/A	40*	N/A	N/A
Converse County	36	71*	N/A	N/A	N/A
Lovell	45*	86*	N/A	N/A	N/A
Newcastle	N/A	42*	39*	N/A	N/A
Rock Springs	40*	N/A	N/A	N/A	N/A
Sinclair	106	82	27*	N/A	N/A
Torrington	N/A	N/A	110	N/A	N/A

Table 37. PM_{10} 24-hr NAAQS Comparison

- N/A – Site was not in operation at all for the year of study.
- * - The value did not meet data completeness requirements per Title 40 Part 50 of the CFR.
- ** - Mobile Stations are in one location for approximately one year.
- *** - Site changed from a Mobile Station to a permanent location in 2013.
- ^ - For the three-year average, incomplete data years were used per WAQSR Chapter 2 Appendix 1.

PM_{10} Compliance with WAAQS of 50 µg/m^3					
Annual Arithmetic Mean (µg/m^3)					
Site Name	**2014**	**2015**	**2016**	**Average (2014-2016)^**	**In Compliance**
SLAMS					
Casper	14	15	13	14	Yes
Cheyenne	11	10	10	10	Yes
Cody	9*	11	10	10*	Yes
Gillette	11*	11	13	11*	Yes
Jackson	12	15	12	13	Yes
Lander	14	15	14	14	Yes
Laramie	14	14	15	14	Yes
Rock Springs	14	16	16	15	Yes
Sheridan-Meadowlark	10	10	10	10	Yes
Sheridan-Police Station	16	17	17	16	Yes
SPM					
Boulder	7	6	6	6*	Yes
Campbell County	11	12	10	11	Yes
Converse County	N/A	7*	6	N/A	Yes
Daniel South	5	6	5*	5*	Yes
Moxa Arch	7	6	7	6	Yes
Murphy Ridge	9	9	8	8	Yes
South Pass	5*	N/A	N/A	N/A	N/A
Wamsutter	10	10	8*	9*	Yes
Wright Jr-Sr High School	14	15	11*	13*	Yes
NCore					
Cheyenne NCore	10	9	10*	10*	Yes
Mobile Stations**					
Casper	N/A	N/A	N/A	N/A	N/A
Cheyenne	N/A	N/A	15*	N/A	N/A
Converse County	8	8*	N/A	N/A	N/A
Lovell	20*	15*	N/A	N/A	N/A
Newcastle	N/A	14*	11*	N/A	N/A
Rock Springs	6*	N/A	N/A	N/A	N/A
Sinclair	11	10	5*	N/A	N/A
Torrington	N/A	N/A	25	N/A	N/A

Table 38. PM_{10} Annual WAAQS Comparison

3.2 Particulate Matter ($PM_{2.5}$)

Twenty-one AQD-owned monitoring stations collected $PM_{2.5}$ data at some point during 2016. Within the $PM_{2.5}$ SLAMS network, the AQD has 22.2% of the monitors collocated to meet the 15% collocation requirement of Title 40, Part 58 Appendix A of the CFR. The AQD uses manual samplers to collect the data at the SLAMS locations. The SPMs, NCore, and mobile locations use continuous samplers to monitor $PM_{2.5}$. The annual standard is attained when the three-year average does not exceed 12.0 µg/m^3. The 24-hour $PM_{2.5}$ NAAQS is 35 µg/m^3. Compliance with

- N/A – Site was not in operation at all for the year of study.
- * - The value did not meet data completeness requirements per Title 40 Part 50 of the CFR.
- ** - Mobile Stations are in one location for approximately one year.
- *** - Site changed from a Mobile Station to a permanent location in 2013.
- ^ - For the three-year average, incomplete data years were used per WAQSR Chapter 2 Appendix 1.

this standard is determined from the 3-year average of the 98th percentile concentration. Below are two tables that compare $PM_{2.5}$ data under the different standards.

$PM_{2.5}$ Compliance with NAAQS of 35 µg/m³					
98% 24-Hour Average					
Site Name	**2014**	**2015**	**2016**	**Average (2014-2016)**	**In Compliance**
SLAMS					
Casper	14.1	14.7	11.0*	13*	Yes
Cheyenne	12.7	25.0	12.8	17	Yes
Cody	9.8*	19.4	21.9	17*	Yes
Jackson	13.2	14.9	11.6	13	Yes
Lander	26.3	20.1	22.0	23	Yes
Laramie	13.2	15.2	10.9	13	Yes
Rock Springs	9.6	18.6	16.6	15	Yes
Sheridan-Meadowlark	16.5	24.0	17.7	19	Yes
Sheridan-Police Station	20.0*	35.8	23.5	26*	Yes
SPM					
Antelope Site 7 (PRB-$PM_{2.5}$ Network)	N/A	18.5	9.6	N/A	N/A
Belle Ayr BA-4 (PRB-$PM_{2.5}$ Network)	10.5	18.5	13.7	14	Yes
Black Thunder BTM-36-2 (PRB-$PM_{2.5}$ Network)	9.9	21.6*	11.0*	14*	Yes
Buckskin (PRB-$PM_{2.5}$ Network)	12.2	21.0	9.4	14	Yes
Pinedale Gaseous	12.1	14.3	13.0	13	Yes
South Pass	9.2*	11.6	7.8	10*	Yes
NCore					
Cheyenne NCore	11.7	20.9	10.3	14	Yes
Mobile Stations**					
Casper	N/A	N/A	N/A	N/A	N/A
Cheyenne	N/A	N/A	11.5*	N/A	N/A
Converse County	8.0	9.9*	N/A	N/A	N/A
Lovell	18.2*	14.5*	N/A	N/A	N/A
Newcastle	N/A	22.8*	9.9*	N/A	N/A
Rock Springs	3.2*	N/A	N/A	N/A	N/A
Sinclair	7.3	11.2	17.2*	N/A	N/A
Torrington	N/A	N/A	11.2	N/A	N/A

Table 39. $PM_{2.5}$ 24-hr NAAQS Comparison 98th Percentile

- N/A – Site was not in operation at all for the year of study.
- * - The value did not meet data completeness requirements per Title 40 Part 50 of the CFR.
- ** - Mobile Stations are in one location for approximately one year.
- *** - Site changed from a Mobile Station to a permanent location in 2013.
- ^ - For the three-year average, incomplete data years were used per WAQSR Chapter 2 Appendix 1.

$PM_{2.5}$ Compliance with NAAQS of 12.0 µg/m³					
Annual Arithmetic Mean (µg/m³)					
Site Name	**2014**	**2015**	**2016**	**Average (2014-2016)**	**In Compliance**
SLAMS					
Casper	4.6	4.9	4.3*	4.6*	Yes
Cheyenne	4.1*	4.1	4.0	4.1*	Yes
Cody	3.7*	4.2	3.7	3.9*	Yes
Jackson	4.3	4.7	4.4	4.5	Yes
Lander	6.7	6.2	6.8	6.6	Yes
Laramie	4.2	4.2	3.9	4.1	Yes
Rock Springs	4.5	4.8	5.0	4.8	Yes
Sheridan-Meadowlark	4.9	5.5	4.7	5.0	Yes
Sheridan-Police Station	6.4	7.4	6.8	6.9	Yes
SPM					
Antelope Site 7 (PRB-$PM_{2.5}$ Network)	N/A	4.2	2.8	N/A	N/A
Belle Ayr BA-4 (PRB-$PM_{2.5}$ Network)	5.3	5.1	4.3	4.9	Yes
Black Thunder BTM-36-2 (PRB-$PM_{2.5}$ Network)	3.9	5.0*	3.5*	4.1*	Yes
Buckskin (PRB-$PM_{2.5}$ Network)	5.5	2.2	2.7	3.5	Yes
Pinedale Gaseous	5.5	5.0	4.7	5.1	Yes
South Pass	2.7*	2.5	2.4	2.5*	Yes
NCore					
Cheyenne NCore	3.9	4.4	4.5	4.3	Yes
Mobile Stations**					
Casper	N/A	N/A	N/A	N/A	N/A
Cheyenne	N/A	N/A	5.1*	N/A	N/A
Converse County	2.3	6.9*	N/A	N/A	N/A
Lovell	7.2*	8.6*	N/A	N/A	N/A
Newcastle	N/A	6.8*	2.8*	N/A	N/A
Rock Springs	0.4*	N/A	N/A	N/A	N/A
Sinclair	1.7	2.2	2.6*	N/A	N/A
Torrington	N/A	N/A	3.7	N/A	N/A

Table 40. $PM_{2.5}$ Annual NAAQS Comparison

3.3 Nitrogen Dioxide (NO_2)

In 2016, 21 AQD-owned stations monitored NO_2. Compliance with the annual primary NO_2 NAAQS is achieved when the annual average concentration in the calendar year is less than or equal to 53 ppb. The primary standard one-hour average concentration is 100 ppb. The maximum one-hour concentration per year is listed in the second NO_2 table below. The NO_2 calculated design value is the three-year average of the 98th Percentile of the daily maximum one-hour concentrations. The design value is met when it does not exceed 100 ppb. The calculated three-year design value is located in the second NO_2 table below.

- N/A – Site was not in operation at all for the year of study.
- * - The value did not meet data completeness requirements per Title 40 Part 50 of the CFR.
- ** - Mobile Stations are in one location for approximately one year.
- *** - Site changed from a Mobile Station to a permanent location in 2013.
- ^ - For the three-year average, incomplete data years were used per WAQSR Chapter 2 Appendix 1.

NO_2 Compliance with NAAQS of 53 ppb				
Annual Arithmetic Mean (ppb)				
Site Name	**2014**	**2015**	**2016**	**In Compliance**
Antelope Site 7 (PRB-NO_x Network)	N/A	3	2	Yes
Belle Ayr BA-4 (PRB-NO_x Network)	7	6	4	Yes
Big Piney***	1	1	1	Yes
Boulder	2	1	1	Yes
Campbell County	3	3	2	Yes
Casper Gaseous	4	5	4	Yes
Converse County	N/A	0*	0	Yes
Daniel South	1	0	1	Yes
Juel Spring	1	1	1	Yes
Moxa Arch	2	2	1	Yes
Murphy Ridge	2	2	2	Yes
Pinedale Gaseous	1	2	3	Yes
South Pass	1	1	0	Yes
Thunder Basin	1	1	1	Yes
Wamsutter	3	3	4	Yes
NCore				
Cheyenne NCore	4	4	4	Yes
Mobile Stations**				
Casper	N/A	N/A	N/A	N/A
Cheyenne	N/A	N/A	8*	N/A
Converse County	3	3*	N/A	N/A
Lovell	5*	3*	N/A	N/A
Newcastle	N/A	5*	3*	N/A
Rock Springs	2*	N/A	N/A	N/A
Sinclair	6	6	8*	N/A
Torrington	N/A	N/A	4	N/A

Table 41. NO_2 Comparison with the Annual NAAQS

- N/A – Site was not in operation at all for the year of study.
- * - The value did not meet data completeness requirements per Title 40 Part 50 of the CFR.
- ** - Mobile Stations are in one location for approximately one year.
- *** - Site changed from a Mobile Station to a permanent location in 2013.
- ^ - For the three-year average, incomplete data years were used per WAQSR Chapter 2 Appendix 1.

NO_2 Compliance with NAAQS of 100 ppb					
Annual 98% of Daily Maximum 1-hour average (ppb)				3-year 98% 1-hour Design Value (ppb)	
Site Name	2014	2015	2016	Design Value (2014-2016)	In Compliance
Antelope Site 7 (PRB-NO_x Network)	N/A	34.9*	29.9	N/A	N/A
Belle Ayr BA-4 (PRB-NO_x Network)	34.8	31.7	27.5	31	Yes
Big Piney***	8.6	7.9	7.7	8	Yes
Boulder	14.2	11.6	9.6	12	Yes
Campbell County	32.4*	31.5*	28.8	31	Yes
Casper Gaseous	38.0	42.3	39.1	40	Yes
Converse County	N/A	7.7*	8.2	N/A	N/A
Daniel South	3.2	2.8	3.2	3	Yes
Juel Spring	12.6	9.7	8.0	10	Yes
Moxa Arch	17.6	18.6	22.5	20	Yes
Murphy Ridge	11.7	11.6	11.7	12	Yes
Pinedale Gaseous	21.2	19.6	19.1	20	Yes
South Pass	4.2	5.1	5.0	5	Yes
Thunder Basin	9.8	7.9	6.4	8	Yes
Wamsutter	31.9	34.7	29.8	32	Yes
NCore					
Cheyenne NCore	33.6	37.5	33.2	35	Yes
Mobile Stations**					
Casper	N/A	N/A	N/A	N/A	N/A
Cheyenne	N/A	N/A	43.7*	N/A	N/A
Converse County	23.6	23.6*	N/A	N/A	N/A
Lovell	31.7*	24.1*	N/A	N/A	N/A
Newcastle	N/A	28.1*	23.2*	N/A	N/A
Rock Springs	24.0*	N/A	N/A	N/A	N/A
Sinclair	36.7	35.9	57.0*	N/A	N/A
Torrington	N/A	N/A	24.8*	N/A	N/A

Table 42. NO_2 Comparison with the Hourly NAAQS

- N/A – Site was not in operation at all for the year of study.
- * - The value did not meet data completeness requirements per Title 40 Part 50 of the CFR.
- ** - Mobile Stations are in one location for approximately one year.
- *** - Site changed from a Mobile Station to a permanent location in 2013.
- ^ - For the three-year average, incomplete data years were used per WAQSR Chapter 2 Appendix 1.

3.4 Sulfur Dioxide (SO_2)

During 2016, six AQD-owned monitoring stations monitored for SO_2 at some point. The NAAQS one-hour primary standard is met when the three-year average of the annual 99th percentile of the daily maximum one-hour average concentration does not exceed 75 ppb.

SO_2 Compliance with NAAQS of 75 ppb					
Annual 99% 1-hour average (ppb)				3-year 99% 1-hour average (ppb)	
Site Name	2014	2015	2016	Design Value (2014-2016)	In Compliance
Moxa Arch	16	18	29	21	Yes
NCore					
Cheyenne NCore	4	19	3	9	Yes
Mobile Stations**					
Casper	N/A	N/A	N/A	N/A	N/A
Cheyenne	N/A	N/A	30*	N/A	N/A
Newcastle	N/A	6*	2*	N/A	N/A
Sinclair	8*	6*	5*	N/A	N/A
Torrington	N/A	N/A	2	N/A	N/A

Table 43. SO_2 1-hr NAAQS Comparison

3.5 Carbon Monoxide (CO)

The AQD operated one trace CO monitor at the Cheyenne NCore station in 2016. The AQD monitored for CO at an additional station, Murphy Ridge, from 2007-2008. The CO levels were minimal and the benefit of monitoring at SPM locations was not justified for a long-term period. The level for the eight-hour NAAQS for CO is 9 ppm. The level for the one-hour NAAQS for CO is 35 ppm.

CO Compliance with NAAQS							
35 ppm Maximum 1-hour average concentration (ppm)				9 ppm Maximum 8-hour average concentration (ppm)			In Compliance
Site Name	2014	2015	2016	2014	2015	2016	
NCore							
Cheyenne NCore	0.53	0.49	0.40	0.3	0.5	0.3	Yes

Table 44. CO NAAQS Comparison

- N/A – Site was not in operation at all for the year of study.
- * - The value did not meet data completeness requirements per Title 40 Part 50 of the CFR.
- ** - Mobile Stations are in one location for approximately one year.
- *** - Site changed from a Mobile Station to a permanent location in 2013.
- ^ - For the three-year average, incomplete data years were used per WAQSR Chapter 2 Appendix 1.

3.6 Ozone (O_3)

The AQD monitored for ozone at 20 stations in Wyoming at some point in 2016. Hourly ozone readings from a monitor are used to compute the daily maximum eight-hour ozone average at the station. These daily maximum eight-hour ozone averages are ranked throughout the calendar year. The 4th highest annual value in a calendar year is then averaged with 4th highest annual values from two more years to compute a three-year average referred to as the design value. The design value must not exceed 0.070 ppm. On December 28, 2015, the EPA promulgated the new ozone NAAQS in Title 40, Part 50.19(a) of the CFR. In addition to the new NAAQS, the EPA updated the calculation methodology to compute the design value. The exact methodology can be found in Title 40, Part 50 Appendix U of the CFR.

On July 20, 2012, the EPA designated all of Sublette County and parts of Lincoln and Sweetwater Counties as a marginal nonattainment area for ozone and on July 20, 2015 the EPA issued a finding of attainment for this area, with respect to the 2008 Ozone NAAQS of 0.075 ppm. The remainder of Wyoming is designated as unclassifiable/attainment.

- N/A – Site was not in operation at all for the year of study.
- * - The value did not meet data completeness requirements per Title 40 Part 50 of the CFR.
- ** - Mobile Stations are in one location for approximately one year.
- *** - Site changed from a Mobile Station to a permanent location in 2013.
- ^ - For the three-year average, incomplete data years were used per WAQSR Chapter 2 Appendix 1.

O_3 Compliance with NAAQS of 0.070 ppm 4th Highest 8-Hour Average (ppm)					
Site Name	**2014**	**2015**	**2016**	**Design Value (2014-2016)**	**In Compliance**
Big Piney***	0.060	0.059	0.065	0.061	Yes
Boulder	0.060	0.055	0.060	0.058	Yes
Campbell County	0.059	0.062	0.060	0.060	Yes
Casper Gaseous	0.061	0.060	0.061	0.060	Yes
Converse County	N/A	0.060	0.059	N/A	N/A
Daniel South	0.062	0.062	0.063	0.062	Yes
Hiawatha	0.062	0.062	0.061	0.061	Yes
Juel Spring	0.062	0.061	0.059	0.060	Yes
Moxa Arch	0.063	0.071	0.064	0.066	Yes
Murphy Ridge	0.059	0.066	0.060	0.061	Yes
Pinedale Gaseous	0.057	0.059	0.059	0.058	Yes
South Pass	0.065	0.062	0.062	0.063	Yes
Thunder Basin	0.058	0.059	0.057	0.058	Yes
Wamsutter	0.060	0.060	0.045	0.055	Yes
NCore					
Cheyenne NCore	0.065	0.063	0.061	0.063	Yes
Mobile Stations**					
Casper	N/A	N/A	N/A	N/A	N/A
Cheyenne	N/A	N/A	0.060*	N/A	N/A
Converse County	0.059	0.060*	N/A	N/A	N/A
Lovell	0.049*	0.056*	N/A	N/A	N/A
Newcastle	N/A	0.059*	0.060*	N/A	N/A
Rock Springs	0.050*	N/A	N/A	N/A	N/A
Sinclair	0.060	0.061	0.047*	N/A	N/A
Torrington	N/A	N/A	0.059	N/A	N/A

Table 45. O_3 8-hr NAAQS Comparison

- N/A – Site was not in operation at all for the year of study.
- * - The value did not meet data completeness requirements per Title 40 Part 50 of the CFR.
- ** - Mobile Stations are in one location for approximately one year.
- *** - Site changed from a Mobile Station to a permanent location in 2013.
- ^ - For the three-year average, incomplete data years were used per WAQSR Chapter 2 Appendix 1.

4.0 Special Studies

4.1 UGWOS

In the winters of 2005 and 2006, specifically February, the AQD measured 8-hour ozone concentrations greater than 80 ppb at the Daniel South, Jonah, and Boulder monitoring stations. This precipitated a study to research the winter ozone phenomenon. The purposes of the study were, originally, to better understand the reaction mechanisms and collect sufficient data to form a conceptual model of the winter ozone formation. Since 2007, the objectives of the study have been modified to minimize gaps in the data and to conceptually understand the formation of winter ozone with the ultimate intent of developing a working photochemical grid model for the UGRB.

During the summer of 2014, the AQD critically evaluated the Upper Green Winter Ozone Study (UGWOS) with respect to the current ozone reduction objective. The AQD reduced short-term winter monitoring for 2015 to Volatile Organic Compounds (VOC) and aldehydes only, based on this evaluation. The goal of the 2016 winter monitoring study was ongoing regulatory monitoring supplemented with six locations for canister and cartridge collection with speciated VOC and aldehyde analyses to track changes in species with emission reductions. After 2016, funding was no longer budgeted for this study.

Quality Assurance Plans, data, and final reports from the UGWOS campaigns are available for download from this AQD website (**http://deq.wyoming.gov/aqd/winter-ozone/resources/winter-ozone-study/).** Additionally, the AQD presented findings based on the UGWOS results at the Air and Waste Management Association's conference on *Atmospheric Optics: Aerosols, Visibility, and the Radiative Balance* in September 2016. This hyperlink (**http://visibility.awma.org/wp-content/uploads/2016/10/40post.pdf**) has these findings.

Due to early winter 2017 monitored ozone values, the AQD performed a series of speciated VOC measurements at Juel Spring, Boulder, Big Piney and Moxa. While not officially part of the UGWOS program, the study objectives were similar to evaluate VOC speciation inside and outside of the nonattainment area.

4.2 VOC Monitoring

The AQD continues to perform continuous methane/non-methane hydrocarbon measurements at the Boulder location in addition to pulling periodic speciated VOC canisters. The AQD also operates methane/non-methane hydrocarbon analyzers at its mobile gaseous stations and the Wamsutter and Converse County SPM locations.

4.3 Mobile BAM Station

The AQD has equipped a mobile monitoring station with continuous BAM PM_{10} and $PM_{2.5}$ monitors for deployment in communities possibly affected by windblown dust or smoke from agricultural burning or wildfire activity. This station allows the AQD to monitor near-real time PM_{10} and $PM_{2.5}$ concentrations, in addition to meteorological conditions, so the AQD can properly inform the public when particulate levels may cause adverse health effects.

4.3.1 Worland

The AQD deployed the mobile BAM monitoring station to monitor particulate matter concentrations and meteorological conditions in a residential area of Worland, WY, specifically at Newell Sargent Park, that may be affected by agricultural activities. Data collection began on July 1, 2015 and ended on August 31, 2016.

4.3.2 Wheatland

The AQD mobile BAM monitoring station was deployed to Wheatland on March 1, 2017 to monitor particulate matter concentrations and meteorological conditions. The objective of this station is to monitor particulate matter concentrations in a populated area that has registered complaints regarding windblown dust and smoke.

4.4 Grand Teton

The AQD and National Park Service (NPS) work cooperatively to fund a portion of the Grand Teton Monitoring Station located near the Teton Science School in the Grand Teton National Park. This monitoring station includes ozone, the National Atmospheric Deposition Program (NADP) wet deposition, a Nephelometer, camera system, and meteorological instrumentation.

4.5 Intermountain West Data Warehouse Project

Since 2010, the AQD has participated in the Intermountain West Data Warehouse (IWDW); previously known as the Three-State Study. The IWDW provides high quality tools for understanding and assessing the effects of current and future energy development and associated emissions. The IWDW is a cooperative venture between the Wyoming AQD, state agencies from Colorado, Utah, and New Mexico, Federal Land Managers, and the EPA. As part of this

project, the Federal Government partially funded the Hiawatha station and contributed funding to install a methane/non-methane hydrocarbon analyzer along with special canisters at the Wamsutter monitoring station. The AQD is continuing to fund the Hiawatha Monitoring Station and the methane/non-methane hydrocarbon analyzer at Wamsutter in 2017. These and other data from the IWDW project can be viewed at the IWDW website: **http://views.cira.colostate.edu/TSDW/**.

4.6 SO_2 Data Requirements Rule

On September 21, 2015 the EPA's "Data Requirements Rule for the 2010 1-hour Sulfur Dioxide (SO_2) Primary National Ambient Air Quality Standard (NAAQS)" (SO_2 DRR) became effective. This rule directs state agencies to "provide data to characterize current air quality in areas with large sources of sulfur dioxide (SO_2) emissions to identify maximum 1-hr SO_2 concentrations in ambient air (80FR51052 August 21, 2015). Characterization can be done through three different pathways: modeling, ambient monitoring, or emissions limitation. The AQD has delegated to the sources subject to the rule the responsibility to select and implement their selected characterization pathway. Table 46 lists the sources subject to this rule and their selected pathway.

Emissions Sources Subject to the Data Requirements Rule		Pathway Chosen to Satisfy Rule	
Company	**Facility**	**Model**	**Monitor**
Basin Electric	Laramie River Station	X	
Multiple	Campbell County Electric Generating Units	X	
Burlington Resources	Lost Cabin Gas Plant		X
PacifiCorp	Dave Johnston	X	X
PacifiCorp	Naughton	X	
PacifiCorp	Jim Bridger		X
Sinclair Wyoming Refining Company	Sinclair Refinery		X
Multiple	Trona Group		X

Table 46. DRR Pathway for all Affected Facilities and Emissions Groups in Wyoming

After discussions in mid-2016, PacifiCorp and the AQD submitted and certified SO_2 data from the Jim Bridger Power Plant collected between 2013 and 2015 to satisfy the characterization and compliance with the 2010 SO_2 NAAQS. More information can be found in Section 4.6.3.

To comply with the rule, Wyoming's 2016 Annual Network Plan that was approved by EPA Region VIII on November 10, 2016 provided a detailed plan and justification of monitoring locations for those facilities that selected the monitoring pathway. The EPA's approval included the State's implementation of a SLAMS equivalent network under this rule. In a March 8, 2017 letter, the EPA Region VIII Air Program Acting Director notified the AQD that Section 4.6.1.2 of Wyoming's 2016 Annual Network Plan must be revised when the 2017 Annual Network Plan is submitted to the EPA for review and approval to reflect that "industrial monitoring entities in Region 8 which are subject to 40 CFR Part 58, Appendix A, Section 2.1.1 must submit their

QMPs and QAPPs to EPA Region 8 for review and approval." An attached copy of this letter is available in Appendix E of the 2017 Annual Network Plan. While the AQD maintains that the 2016 Annual Network Plan is consistent with Title 40 Part 58, Appendix A, Section 2.1.1 of the CFR, this 2017 Annual Network Plan includes the language directed by EPA Region VIII for review and approval, the updated 2016 Section 4.6.1 can be found in Appendix G.

4.6.1 Lost Cabin Gas Plant

The Lost Cabin Gas Plant air quality monitoring station began operations on January 1, 2017, and is being operated to satisfy the requirements of the SO_2 DRR. The station is located on an existing well pad approximately 0.4 miles south of the Lost Cabin Gas Plant facility in Fremont County. The station's objective is to characterize maximum 1-hr SO_2 impacts from the Lost Cabin Gas Plant, a facility subject to the DRR, and a SO_2 analyzer is located at this station.

Lost Cabin Monitoring Site Specifications							
Site Name	**Location**	**AQS ID**	**Parameter**	**Instrument**	**Scale**	**Sample Frequency**	**Operational Status**
Lost Cabin	43.272, -107.59891	56-013-0003	SO_2	Thermo 43i	Neighborhood	Continuous	No planned changes

Table 47. Lost Cabin Monitor Information

4.6.2 Dave Johnston Power Plant

The Dave Johnston Power Plant air quality monitoring station began operations on January 1, 2017, and is being operated to satisfy the requirements of the DRR. The station is located on state land approximately 4.3 miles south of the Dave Johnston Power Plant near Glenrock. The station's objective is to characterize maximum 1-hr SO_2 impacts from the Dave Johnston Power Plant, a facility subject to the DRR, and a SO_2 analyzer is located at this station.

Dave Johnston Monitoring Site Specifications							
Site Name	**Location**	**AQS ID**	**Parameter**	**Instrument**	**Scale**	**Sample Frequency**	**Operational Status**
Dave Johnston	42.776122, -105.798214	56-009-0011	SO_2	API T100	Urban	Continuous	No planned changes

Table 48. Dave Johnston Power Plant Monitor Information

4.6.3 Jim Bridger Power Plant

The Jim Bridger Power Plant has an existing SO_2 monitoring station which has been used to satisfy the DRR. The station is located approximately 30 miles east of Rock Springs on County Route 15 in Sweetwater County, Wyoming. This station began operations on January 5, 2012. The station's objective is to characterize maximum 1-hr SO_2 impacts from the Jim Bridger Power Plant, a facility subject to the DRR, and a SO_2 analyzer is located at this station. On January 13, 2017, Governor Mead recommended to EPA Region VIII to designate the Jim Bridger Power Plan in attainment based on 2013-2015 data. Appendix F of the 2017 Annual Network Plan has the signed letter from Governor Mead on this matter. The average 99th percentile of 1-hr SO_2 concentrations from 2013-2015 was 31 ppb as seen in the table below.

Jim Bridger Monitoring Site Specifications							
Site Name	**Location**	**AQS ID**	**Parameter**	**Instrument**	**Scale**	**Sample Frequency**	**Operational Status**
Jim Bridger	41.74649, -108.80374	56-037-0020	SO_2	Teledyne-API 100E	Neighborhood	Continuous	No planned changes

Table 49. Jim Bridger Power Plant Monitor Information

	99th percentile of 1-hr daily maximum concentrations (ppb)			2015 DV
Year	**2013**	**2014**	**2015**	**Average**
Concentration (ppb)	31	32	29	31

Table 50. Jim Bridger SO_2 Monitor 2015 Design Value

4.6.4 Sinclair Oil Refinery

The Sinclair Oil Refinery has an existing SO_2 monitoring network, which will be used to help satisfy the DRR. The Sinclair In-Town station is located about 0.2 miles west of the Sinclair Oil Refinery facility with the objective of characterizing population exposure to SO_2 impacts within the Town of Sinclair. This station began operations on December 10, 2015. A SO_2 analyzer is located at this station. The Sinclair North East station is located directly north of the facility's fenceline with the objective of characterizing SO_2 impacts downwind of the facility. This station was relocated and began operations at the present site on December 18, 2015. There are SO_2 and NO_x analyzers located at this station. In addition to these existing sites, Sinclair installed another SO_2 monitor southwest of the facility, which began operations on January 1, 2017 and will be operated to satisfy the requirements of the DRR. The station is located at the Sinclair employee parking lot approximately 164 feet southwest of the facility. This station's objective is to characterize maximum 1-hr SO_2 impacts from the Sinclair Oil Refinery, a facility subject to the DRR, and a SO_2 analyzer is located at this station.

Sinclair Refinery Monitoring Network Site Specifications							
Site Name	**Location**	**AQS ID**	**Parameter**	**Instrument**	**Scale**	**Sample Frequency**	**Operational Status**
Sinclair In-Town	41.78270, -107.12088	56-007-0008	SO_2	Thermo 43i	Middle	Continuous	No planned changes
Sinclair North East	41.79358, -107.08339	56-007-0009	SO_2	API M-100E	Neighborhood	Continuous	No planned changes
Sinclair South Site	41.77876, -107.10899	56-007-0010	SO_2	Thermo 43C	Middle	Continuous	No planned changes

Table 51. Sinclair Oil Refinery Monitor Information

4.6.5 Trona Environmental Subcommittee

The Trona Environmental Subcommittee consisting of; Tronox Alkali Wyoming Corporation (including the Westvaco and Granger Soda Ash Plants); Solvay Soda Ash Joint Venture and TATA Chemicals (Soda Ash) Partners began SO_2 network operations on January 1, 2017, and is being operated to satisfy the requirements of the DRR. Two monitoring stations are included within the network, one located on the ridge east of TATA and Westvaco, the other located between TATA and Westvaco. The network's objective is to characterize maximum 1-hr SO_2 impacts from the Green River Basin trona producing area. A SO_2 analyzer is located at each station.

Trona Environmental Subcommittee Monitoring Network Site Specifications							
Site Name	**Location**	**AQS ID**	**Parameter**	**Instrument**	**Scale**	**Sample Frequency**	**Operational Status**
Site 2	41.63001, -109.70159	56-037-0021	SO_2	Thermo 43i	Neighborhood	Continuous	No planned changes
Site 11	41.58532, -109.76861	56-037-0014	SO_2	Thermo 43i	Neighborhood	Continuous	No planned changes

Table 52. Trona Environmental Subcommittee Monitor Information

5.0 Future Ambient Monitoring Modifications

5.1 Sheridan Mobile

The AQD will soon deploy a mobile gaseous station to Sheridan, WY. The 2015 Network Assessment identified Sheridan as a possible future site location. Specifically, the finding stated that there is a need for population-based monitoring in Sheridan beyond the existing particulate monitoring conducted by the SLAMS.

Previously, this mobile station was located in Cheyenne, WY and was sited downwind of a large refinery. The siting of the Cheyenne Mobile station was chosen as part of an ongoing study of ambient air and meteorological conditions near local refineries.

5.2 Eastern Johnson County

The AQD is decommissioning the Campbell County station due to results from the 2015 Network Assessment. Components of the Campbell County station will be used to establish an ambient monitoring station in Eastern Johnson County between Buffalo and Gillette. An initial siting trip to Johnson County to determine ideal locations has been conducted. It is expected that the new site will be operable later in 2017.

6.0 Conclusion

As required by Title 40, Part 58.10(a) of the CFR, the AQD has completed its 2017 Annual Network Plan. The 2017 Annual Network Plan demonstrates sufficient coverage throughout Wyoming. As population and industrial concerns change, the AQD strives to verify that the monitoring needs of Wyoming are satisfied.

Data collected at the AQD's monitoring stations through 2016 shows that all monitors are attaining the NAAQS for PM_{10}, $PM_{2.5}$, NO_2, SO_2, O_3, and CO. Further, the operation of each monitoring site has met the requirements of Title 40, Part 58 Appendices A-E.

The AQD continually evaluates data collected at the AQD, industrial, and AQRV monitors to determine if changes in policy are needed to continue managing the air resource in Wyoming.

Any comments pertaining to the Wyoming Ambient Air Monitoring 2017 Annual Network Plan should be sent to the following contact:

Ms. Cara Keslar
Monitoring Section Supervisor
Wyoming Air Quality Division
200 West 17th Street
Cheyenne, WY 82002

Appendix A: AQD Monitoring Site Metadata

AQS ID	Site Name	Address	Land Use Type	Location Type	Monitor Type	Meets 40 CFR § 58 Appendix A, C, D & E Requirements*	Monitor Objective	Longitude	Latitude	Site Start Date
56-025-0001	Casper	City County Bldg. – Center & C Streets	Commercial	Urban & Center City	SLAMS	X	Population Exposure	-106.32509	42.85106	10/15/1998
56-021-0001	Cheyenne	Emerson Bldg. 23rd & Central Ave.	Residential	Urban & Center City	SLAMS	X	Population Exposure	-104.81766	41.13687	1/1/1979
56-029-0001	Cody	1225 10th St.	Residential	Suburban	SLAMS	X	Population Exposure	-109.06851	44.52464	1/1/1975
56-005-1002	Gillette	1000 W. 8th St.	Commercial	Urban & Center City	SLAMS	X	Population Exposure	-105.51702	44.28801	1/1/1978
56-039-1006	Jackson	40 E. Pearl Ave.	Commercial	Urban & Center City	SLAMS	X	Population Exposure	-110.79799	43.45776	6/8/2007
56-013-1003	Lander	600 Washington	Residential	Suburban	SLAMS	X	Population Exposure	-108.73556	42.84223	1/1/1987
56-001-0006	Laramie	406 Ivinson	Commercial	Urban & Center City	SLAMS	X	Population Exposure	-105.59173	41.31159	1/1/1968
56-037-0007	Rock Springs	625 Ahsay Ave.	Residential	Urban & Center City	SLAMS	X	Population Exposure	-109.22013	41.59259	1/1/1983
56-033-0002	Sheridan – Police Station	45 West 12th St.	Commercial	Urban & Center City	SLAMS	X	Highest Concentration, Population Exposure	-106.95593	44.81514	10/5/1983
56-033-1003	Sheridan Meadowlark	1410 DeSmet Ave.	Commercial	Urban & Center City	SLAMS	X	Population Exposure	-106.96432	44.78275	7/1/2012
56-009-0009	Antelope Site 7 (PRB Network)	Antelope Site 7	Industrial	Rural	SPM	X	General/Background	-105.38857	43.42542	2/18/2015
56-005-0892	Belle Ayr BA-4 (PRB Network)	Belle Ayr BA-4	Industrial	Rural	SPM	X	Highest Concentration, Source Oriented	-105.34316	44.09707	7/9/1991
56-035-0700	Big Piney	4 miles south of Big Piney, WY	Residential	Rural	SPM	X	Source Oriented, General/Background	-110.09890	42.48640	3/30/2011

AQS ID	Site Name	Address	Land Use Type	Location Type	Monitor Type	Meets 40 CFR § 58 Appendix A, C, D & E Requirements*	Monitor Objective	Longitude	Latitude	Site Start Date
56-005-0891	Black Thunder BTM-36-2 (PRB Network)	BTM-36-2 (Black Thunder Mine)	Industrial	Rural	SPM	X	Source Oriented	-105.21330	43.64830	1/1/1985
56-035-0099	Boulder	5 miles SW of Boulder, WY	Desert	Rural	SPM	X	Source Oriented, Highest Concentration	-109.75300	42.71900	2/1/2005
56-005-1899	Buckskin Mine (PRB Network)	Triton Coal Gillette, WY	Industrial	Rural	SPM	X	Source Oriented	-105.53976	44.50268	9/4/2008
56-005-0456	Campbell County	15 miles SSW of Gillette, WY	Industrial	Rural	SPM	X	Source Oriented, General/Background	-105.52999	44.14696	7/15/2003
56-025-0100	Casper Gaseous	2800 Pheasant Dr. Casper, WY	Commercial	Urban & Center City	SPM	X	Population Exposure	-106.36501	42.82231	3/1/2013
56-025-0005	Casper Mobile	500 S. Walsh Dr.	Residential	Suburban	SPM	X	Population Exposure	-106.27767	42.84630	12/1/2016
56-021-0100	Cheyenne NCore	6909 Washakie Ave.	Residential	Suburban	NCore	X	National Core Monitoring Site	-104.77842	41.18235	1/1/2011
56-009-0010	Converse County	16 miles west of WY Highway 59 on Highland Loop Rd.	Industrial	Rural	SPM	X	General/Background	-105.49896	43.10108	4/10/2015
56-035-0100	Daniel South	5 miles south of Daniel, WY	Desert	Rural	SPM	X	General/Background	-110.05510	42.79070	7/1/2015
56-037-0077	Hiawatha	Bitter Creek Rd. 43 miles SE of Rock Springs, WY	Desert	Rural	SPM	X	General/Background	-108.61900	41.15800	3/30/2011
56-035-1002	Juel Spring	20 miles NW of Farson, WY	Desert	Rural	SPM	X	Source Oriented, General/Background	-109.56050	42.37350	12/11/2009
56-001-0010	Laramie Mobile	998 Russell St., Laramie, WY	Residential	Suburban	SPM	X	Population Exposure	-105.586	41.30283056	4/5/2017

AQS ID	Site Name	Address	Land Use Type	Location Type	Monitor Type	Meets 40 CFR § 58 Appendix A, C, D & E Requirements*	Monitor Objective	Longitude	Latitude	Site Start Date
56-037-0300	Moxa Arch	25 miles NW of Green River, WY	Desert	Rural	SPM	X	Source Oriented	-109.78833	41.75056	5/27/2010
56-041-0101	Murphy Ridge	Bear River, WY	Agricultural	Rural	SPM	X	General/Background	-111.04238	41.37300	1/1/2007
56-035-0101	Pinedale Gaseous	West side of City Park & Pine Creek	Residential	Suburban	SPM	X	Population Exposure	-109.87076	42.86982	1/1/2009
56-013-0099	South Pass	South Pass, WY	Forest	Rural	SPM	X	General/Background	-108.72000	42.53000	3/12/2007
56-005-0123	Thunder Basin	30 miles NNE of Gillette, WY	Desert	Rural	SPM	X	General/Background	-105.29030	44.65220	5/1/2001
56-037-0200	Wamsutter	2 miles west of Wamsutter, WY	Desert	Rural	SPM	X	Source Oriented, General/Background	-108.02458	41.67745	3/1/2006
NOT IN AQS	Wheatland BAM Station	West Mariposa Parkway & 27th St.	Residential	Rural	SPM	X	Population Exposure	-104.9786	42.0481	2/7/2017
56-005-0099	Wright Jr-Sr High School	Adjacent to Wright Jr-Sr High School	Residential	Rural	SPM	X	General/Background, Population Exposure	-105.49149	43.75615	11/1/2002

Table 53. Metadata for Current AQD Sites

Appendix B: 2016 SLAMS Precision and Accuracy

$PM_{2.5}$

AQS ID	POC	Site Name	Precision Checks (Number-Type)	Accuracy Audit				Flow Verification			
				Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
56-021-0100	POC-1	Cheyenne NCore	0	1	0	1	0	3	3	3	3
	POC-11		0	1	0	1	0	3	3	3	3
	POC-2		0	1	0	1	0	3	3	3	3
	POC-3		57 – Analytical 12 – Flow Rate	1	0	1	0	3	4	4	3
56-021-0001	POC-1	Cheyenne SLAMS	30 - Analytical	0	1	0	1	4	3	3	3
	POC-11		0	0	1	0	1	3	3	3	3
	POC-2		0	0	1	0	1	3	4	3	3
56-025-0001	POC-1	Casper SLAMS	0	0	1	1	0	3	4	3	3
	POC-11		0	0	1	1	0	3	3	3	3
56-039-1006	POC-1	Jackson SLAMS	0	0	1	0	1	4	3	3	3
	POC-11		0	0	1	0	1	3	3	3	3
56-029-0001	POC-1	Cody SLAMS	0	0	1	0	1	3	3	3	3
	POC-11		0	0	1	0	1	3	4	3	3
56-013-1003	POC-1	Lander SLAMS	0	0	1	0	1	4	3	3	3
	POC-11		0	0	1	0	1	3	3	3	3
56-001-0006	POC-1	Laramie SLAMS	0	0	1	0	1	3	3	3	3
	POC-11		0	0	1	0	1	3	3	3	3
56-037-0007	POC-1	Rock Springs SLAMS	0	0	1	1	0	3	3	3	3
	POC-11		0	0	1	1	0	3	3	3	3
56-033-0002	POC-1	Sheridan Police Station SLAMS	22 - Analytical	1	0	1	0	3	4	3	3
	POC-11		0	1	0	1	0	3	4	3	3
	POC-2		0	1	0	1	0	3	4	3	3
56-033-1003	POC-1	Sheridan Meadowlark School SLAMS	0	1	0	1	0	3	4	3	3
	POC-11		0	1	0	1	0	3	4	3	3

Table 54. $PM_{2.5}$ SLAMS Precision and Accuracy

PM_{10}

AQS ID	POC	Site Name	Precision Checks (Number-Type)	Accuracy Audit				Flow Verification			
				Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
56-025-0001	POC-4	Casper SLAMS	29 – Analytical	0	1	1	0	3	3	3	3
	POC-5		0	0	1	1	0	3	3	3	3
	POC-44		0	0	1	1	0	3	3	3	3
56-021-0001	POC-1	Cheyenne SLAMS	30 – Analytical	0	1	0	1	3	3	3	3
	POC-11		0	0	1	0	1	3	4	3	3
	POC-2		0	0	1	0	1	3	3	3	3
56-021-0100	POC-3	Cheyenne NCore	0	1	0	1	0	3	3	3	3
56-029-0001	POC-3	Cody SLAMS	0	0	1	0	1	4	4	3	3
	POC-33		0	0	1	0	1	3	4	3	3
56-005-1002	POC-5	Gillette SLAMS	0	0	1	0	1	3	3	3	3
56-039-1006	POC-1	Jackson SLAMS	0	0	1	0	1	3	3	3	3
	POC-11		0	0	1	0	1	3	3	3	3
56-013-1003	POC-3	Lander SLAMS	0	0	1	0	1	3	3	3	3
	POC-33		0	0	1	0	1	3	3	3	3
56-001-0006	POC-5	Laramie SLAMS	0	0	1	0	1	3	3	3	3
	POC-55		0	0	1	0	1	3	3	3	3
56-037-0007	POC-2	Rock Springs SLAMS	0	0	1	0	1	3	3	3	3
	POC-22		0	0	1	0	1	3	3	3	3
56-033-0002	POC-1	Sheridan Police Station SLAMS	0	1	0	1	0	3	4	3	4
56-033-1003	POC-1	Sheridan Meadowlark School SLAMS	28 – Analytical	1	0	1	0	3	4	3	3
	POC-11		0	1	0	1	0	3	4	3	3
	POC-2		0	1	0	1	0	3	4	4	3

Table 55. PM_{10} SLAMS Precision and Accuracy

Appendix C: Campbell County SPM Data Analysis Memorandum

Wyoming Department of Environmental Quality
Air Quality Division
Memorandum

To: Nancy Vehr, AQD Administrator 1/31/17

Through: Darla Potter, AQRM Program Manager 1/31/17
Cara Keslar, Monitoring Program Supervisor 1/31/17

From: Kristina Hooper, Natural Resource Analyst-Ambient Air Monitoring Project Manager

CC: Tanner Shatto, District 3 Engineer

Date: January 30, 2017

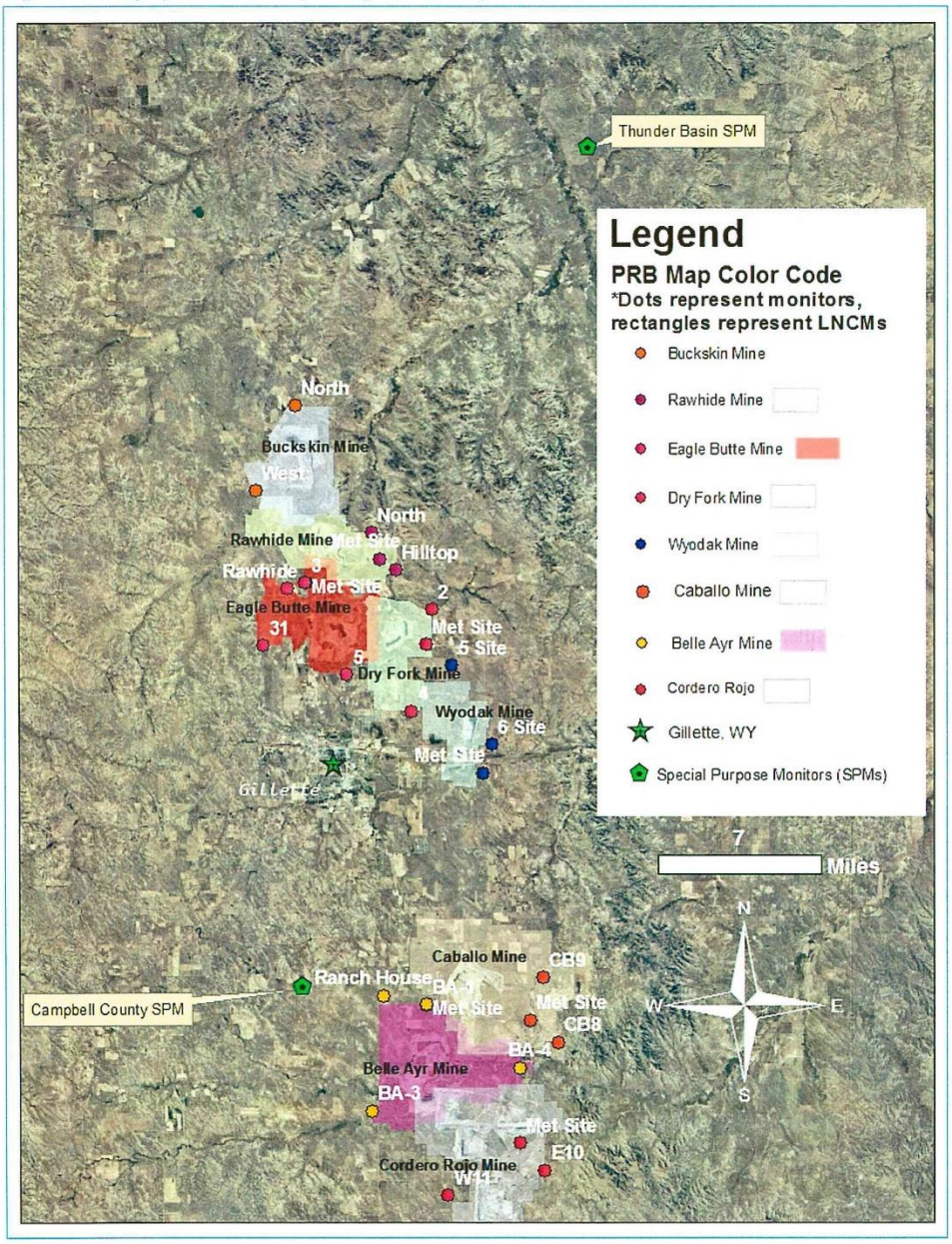
Subject: Campbell County Data Analysis

Background

The Campbell County Station is a special purpose monitor (SPM) located approximately 10 miles southwest of Gillette, WY. Since beginning its operation in June 2003, the Campbell County Station has been used to track air quality in an area of heavy industrial activity. Equipment currently at this station monitors ozone (O_3), nitrogen dioxide (NO_2), continuous particulate matter (PM_{10}), visibility via a camera, and meteorological parameters. In 2008, the high-volume particulate matter (PM_{10}) sampler was replaced with a continuous PM_{10} tapered element oscillating microbalance (TEOM) monitor. In 2009, a high resolution camera was added to the station. In 2016, a new continuous PM_{10} beta attenuation monitor (BAM) replaced the PM_{10} TEOM and a new model Thermo 42i oxides of nitrogen (NO_x) analyzer was also installed.

An analysis of the data collected at the Campbell County Station for the 2015 Network Assessment (for the years 2009-2013) revealed a high amount of correlation between Campbell County's monitors and other monitors in the area (see Figure 1). The purpose of the following analysis is to examine trends in the data, correlation between the Campbell County Station and nearby sites, and to inform decisions about monitoring in northeast Wyoming.

Figure 1. Map of Northeast Wyoming Monitoring Locations



Station Summary

The Campbell County Station's objective is to collect air quality and meteorological data to monitor background conditions and possible impacts from coal-bed methane development in the area. A review of the data from June 2003 to June 2016 show that there were no exceedances of the National Ambient Air Quality Standards (NAAQS) for nitrogen dioxide (NO_2), particulate matter (PM_{10}), or ozone. The NAAQS for NO_2 include a 1-hour average standard of 100 parts per billion (ppb) and an annual mean of 53 ppb. Before 2010, there was no 1-hour average standard for NO_2, only an annual standard of 53 ppb. The highest 1-hour NO_2 average collected at the Campbell County Station was 48 ppb collected on January 24, 2008 and the highest annual average was 4.88 ppb during 2003. From 1987 until 2006, the NAAQS for PM_{10} were set at 150 micrograms per meter cubed ($\mu g/m^3$) for 24-hour averaging time and 50 $\mu g/m^3$ for the annual averaging time. In 2006, the NAAQS annual standard of 50 $\mu g/m^3$ was revoked while the 24-hour standard of 150 $\mu g/m^3$ was retained. However, Wyoming preserved the annual standard of 50 $\mu g/m^3$ in the Wyoming Ambient Air Quality Standards (WAAQS). The highest PM_{10} 24-hour average was 136 $\mu g/m^3$ which occurred on July 10, 2006. The NAAQS level for 8-hour average ozone have evolved over the years: from 1997 until 2008 the level was 0.08 parts per million (ppm), in 2008 the level was changed to 0.075 ppm, and in 2015 the level of the NAAQS became 0.07 ppm. The highest 8-hour ozone value for Campbell County was 83 ppb which was collected on August 16, 2003.

Data Collection

A summary of parameters monitored at this station, along with the data collection efficiency for those parameters, can be found in Tables 1 and 2 in Appendix A. The Campbell County Station data collection objective is 90% data completeness per quarter for all parameters. For NO_2 and PM_{10} parameters associated with an Ambient Air Quality Standard the data collection must meet 75% data completeness per quarter to be valid. Ozone must meet 90% data completeness for a three year period, with a minimum of 75% within the ozone monitoring season. Wyoming's ozone monitoring season was April through October up until the 2015 NAAQS rule changed Wyoming's monitoring season to January through September. Campbell County Station has collected year round ozone data since the station's establishment in 2003.

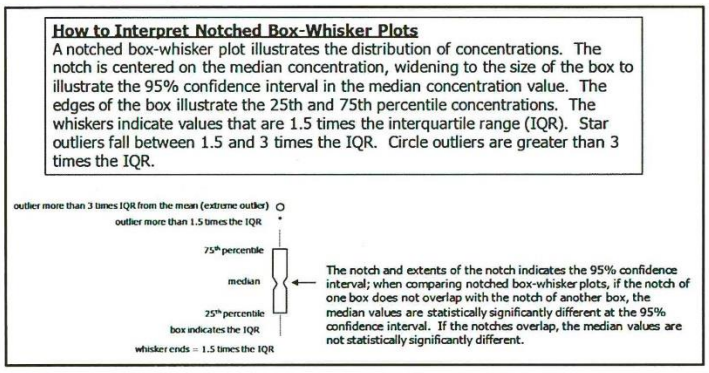
Data Summary

Data analysis focused on data collected between June 2003 and June 2016. To better visualize the data box-and-whisker plots, histograms, and time series graphs have been included for each pollutant. Figure 2 shows how to interpret a box-and-whisker plot.

To analyze the data for the Campbell County Station, it is important to compare data sets for each gaseous parameter with other AQD monitors in the area. PM_{10} data were compared to Powder River Basin industrial monitors; Caballo Mine monitor CB9 (a downwind monitor) and Eagle Butte Mine monitor EB 31 (an upwind monitor). These industrial monitors are the nearest PM_{10} monitors of the same type and collection frequency and are part of the Powder River Basin PM_{10} monitoring network. Campbell County ozone and NO_2 data have been compared to the Thunder Basin Station's monitors. The Thunder Basin

Station has the nearest ozone and NO_2 monitors for comparison. The Campbell County Station is located about 53 miles SW from the Thunder Basin Station, about 10 miles from Caballo Mine monitor CB-9, and approximately 14 miles from Eagle Butte Mine monitor EB-31.

Figure 2. Box-and-whisker plot explanation



Ozone: The NAAQS for ozone is met when the annual 4th highest daily maximum 8-hour rolling average over 3 years is equal to or less than the NAAQS value. From 1997 to 2008 the ozone 8-hour average NAAQS level was 0.08 ppm, then from 2008 to 2015 the NAAQS level was 0.075 ppm. In 2015, the ozone NAAQS level was revised to the current level of 0.070 ppm. Over the entire duration of data collection at the Campbell County Station only twenty (20) out of 4,590 values for ozone 8-hour averages have surpassed 70 ppb (Figure 3) and no values have exceeded 70 ppb since 2012. The highest 8-hour daily maximum concentration was 83 ppb on August 16, 2003. The fourth highest 8-hour daily maximums for 2003 through 2016 are shown in Figure 6. Campbell County Station's 2013-2015 design value is 62 ppb. There were no exceedances of the NAAQS levels.

Figure 3. The highest 8-hour average values of ozone for Campbell County

Date	Ozone (ppb)
7/22/2003	77
7/23/2003	77
7/27/2003	77
8/12/2003	71
8/13/2003	72
8/14/2003	76
8/15/2003	76
8/16/2003	83
9/5/2003	74
8/18/2004	70
7/20/2007	72
7/21/2007	75
7/24/2007	71
7/29/2007	70
7/30/2007	73
7/31/2007	71
8/13/2007	71
8/15/2007	76
6/6/2012	75
6/18/2012	74

Figure 4. Campbell County Station daily maximum 8-hour average ozone box-and-whisker plot (2003-2016)

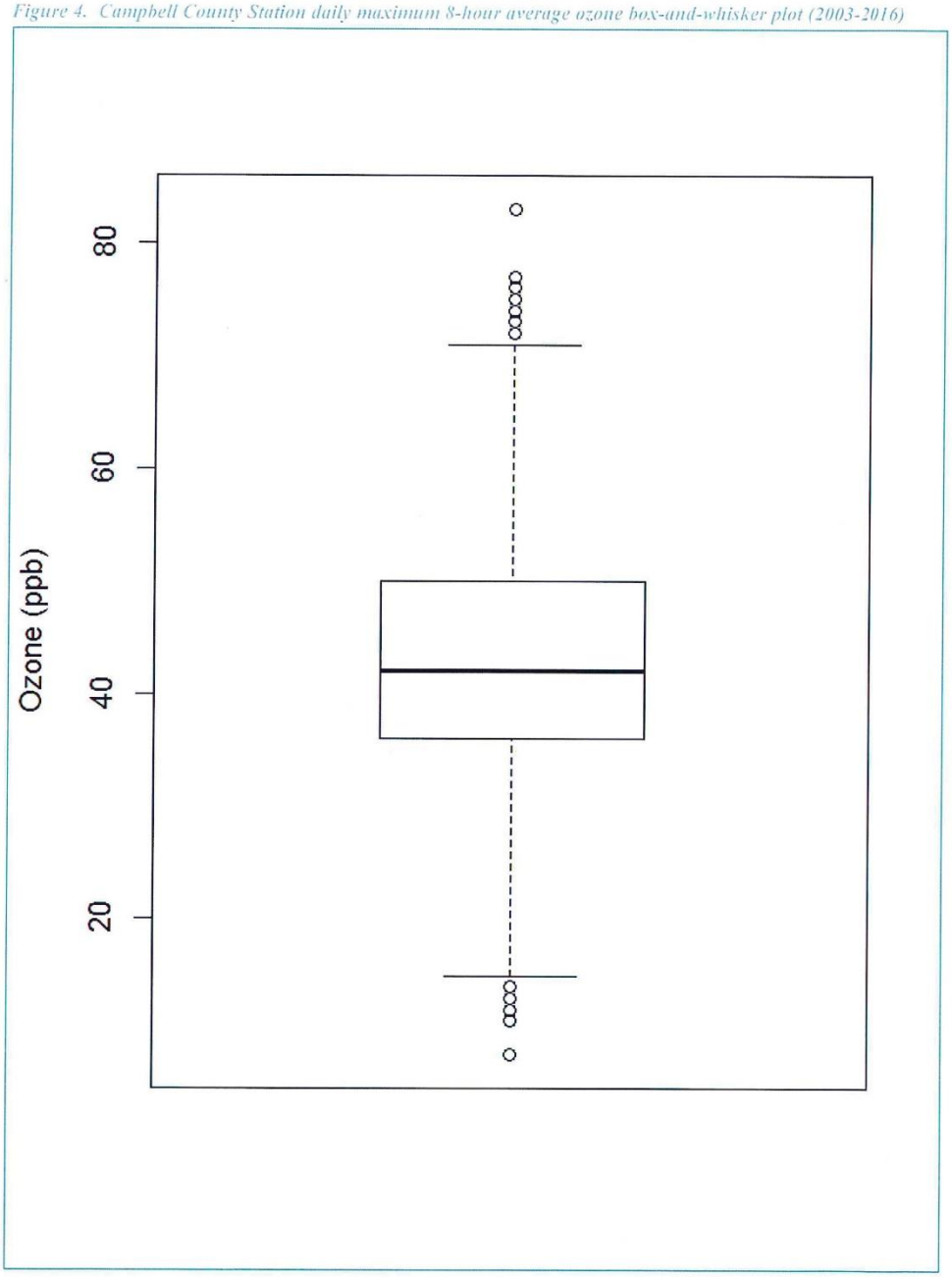
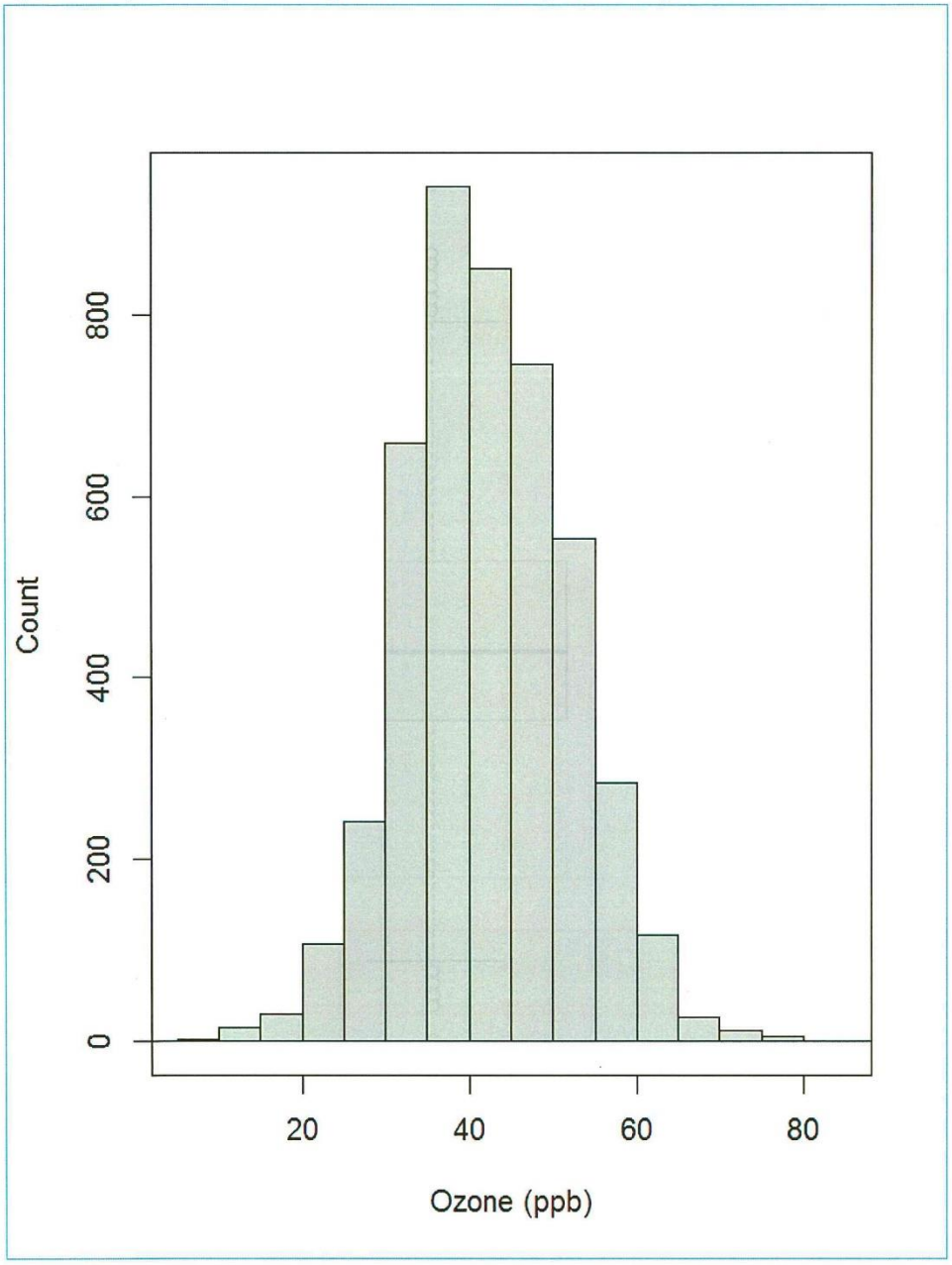
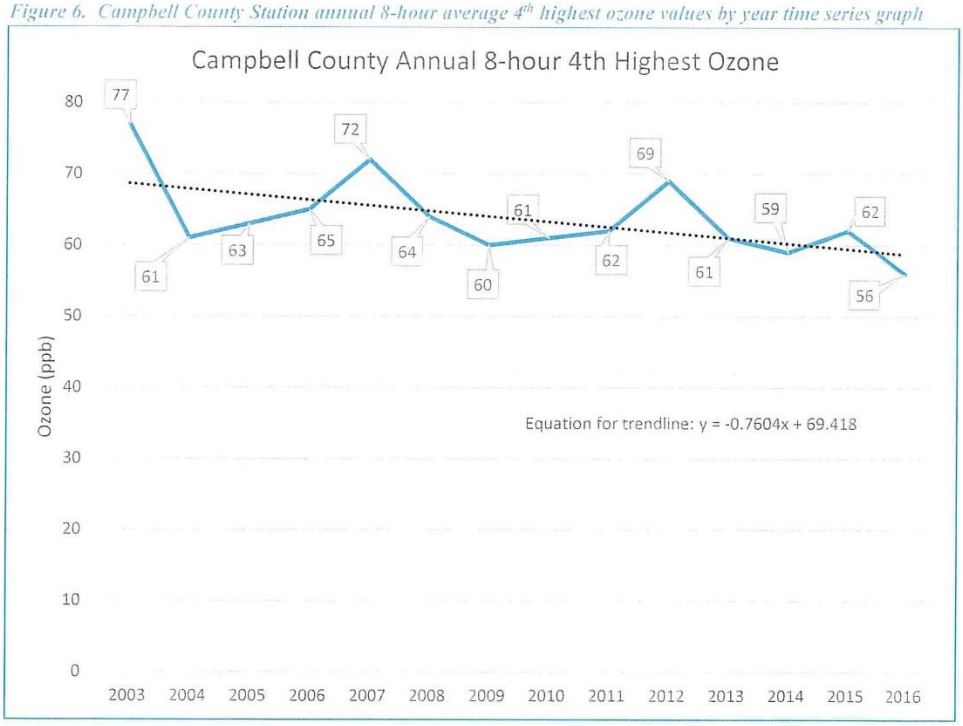


Figure 5. Campbell County Station daily maximum 8-hour average ozone histogram (2003-2016)



The 8-hour average ozone data set for this station show that a majority of the measured values fell between 25 ppb and 65 ppb (Figures 4 and 5). These data are consistent with general background values expected for the Western United States. There were minimal occurrences of values near 0 ppb and values near or exceeding the current NAAQS of 70 ppb. Figure 6 shows the 4th highest 8-hour ozone value by year from 2003 to 2016. The values for the 4th highest 8-hour ozone have been generally declining since 2003 and all of the values have been between 50 and 80 ppb. No values have exceeded 70 ppb since 2012.

Figure 6. Campbell County Station annual 8-hour average 4th highest ozone values by year time series graph



Regression statistics show that the 8-hour 4th highest ozone data (Figure 6) has a p-value of 1.19×10^{-15} which indicates that the trend in this graph is statistically significant. The R^2 value of 0.99 shows a strong correlation between the data points and their occurrence over time. The trend indicates that the 4th highest daily maximum ozone value is declining at this site.

Figure 7. Comparison between the Campbell County and Thunder Basin Stations for 8-hour average ozone box-and-whisker plots (2003-2016)

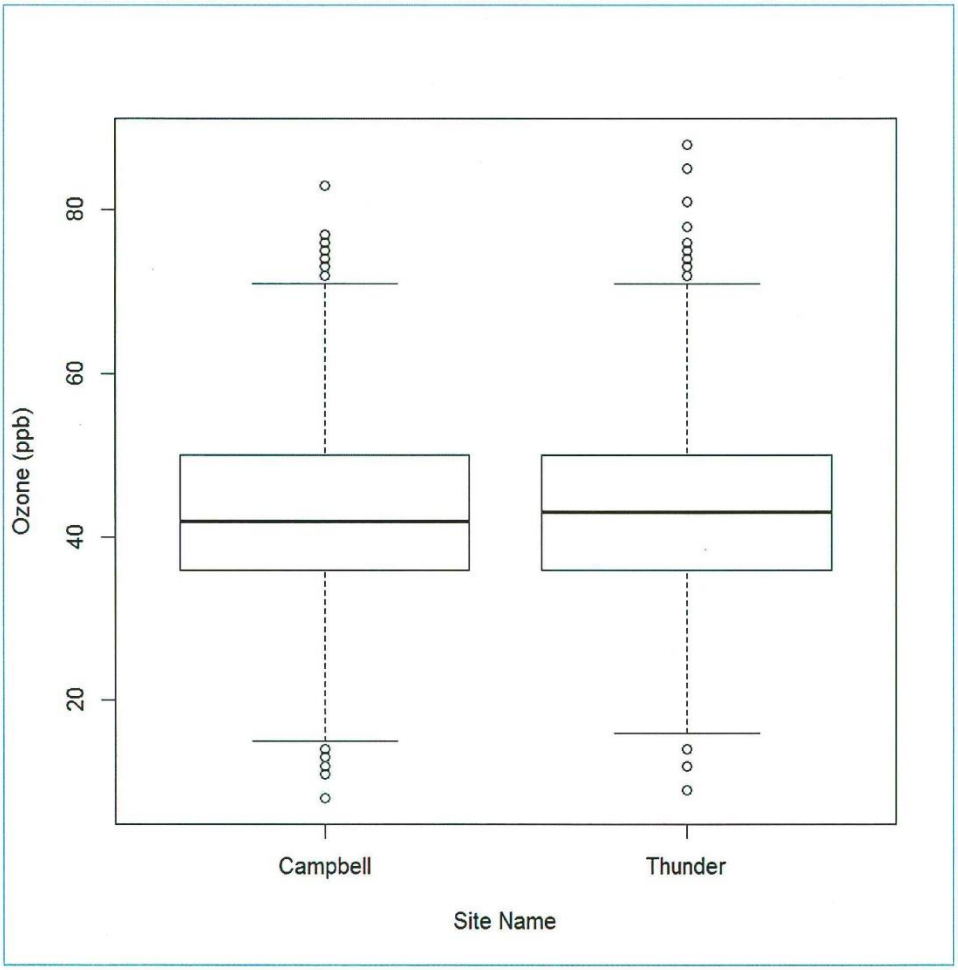


Figure 7 shows the 8-hour ozone average values from the Campbell County and Thunder Basin monitoring stations fell between 35 and 50 ppb. The data from each site is from the dates July 17, 2003 to June 30, 2016. The quartiles of both sites are nearly identical and the means of Campbell County and Thunder Basin stations are not significantly differing. The Pearson Correlation value of the Campbell County and Thunder Basin ozone 8-hour maximum data comes to 0.54, indicating a moderately strong positive correlation between the two stations. The Pearson Correlation value of the Campbell County and Thunder Basin ozone hourly data is 0.80, indicating a strong positive correlation (the strongest Pearson correlation values are +1 for total positive correlation, 0 for no correlation, and -1 for a total negative correlation).

Nitrogen Dioxide: As of 2010 the attainment of the NAAQS for nitrogen dioxide is met when the 98th percentile of the 1-hour daily maximum concentration, averaged over 3 years is at or below 100 ppb and when the annual average is less than 53 ppb. Before 2010, there was no 1-hour standard for NO_2, only an annual standard of 53 ppb. From 2003 to 2016, the station showed no concentrations above the 1-hour (100 ppb) or the annual standards (53 ppb), respectively. The highest overall 1-hour average was 48 ppb collected on January 24, 2008. The annual averages by year are shown in Figure 10. Campbell County Station's NO_2 1-hour, three year (2013-2015) design value is 32 ppb. The 2015 design value for 1-hour NO_2 is 31.5 ppb and the 2015 NO_2 annual average is 2.73 ppb.

Figure 8. Campbell County Station 1-hour average NO_2 box-and-whisker plot (2003-2016)

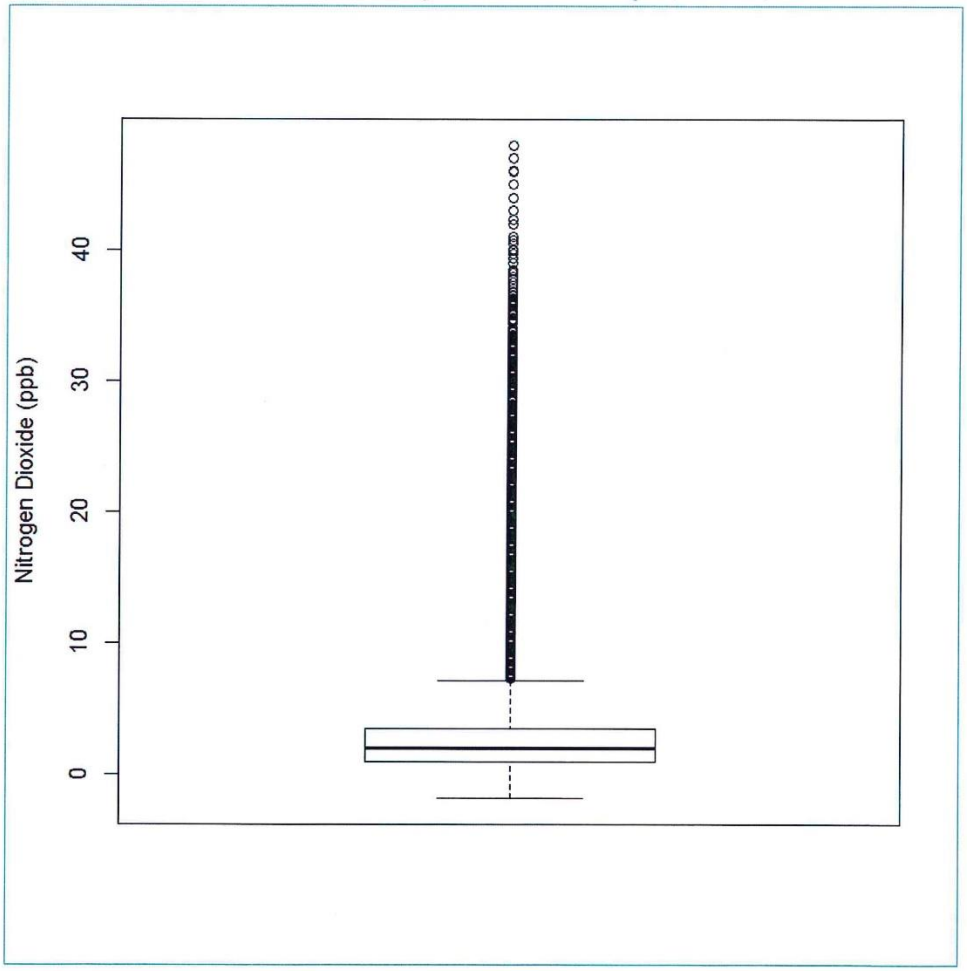
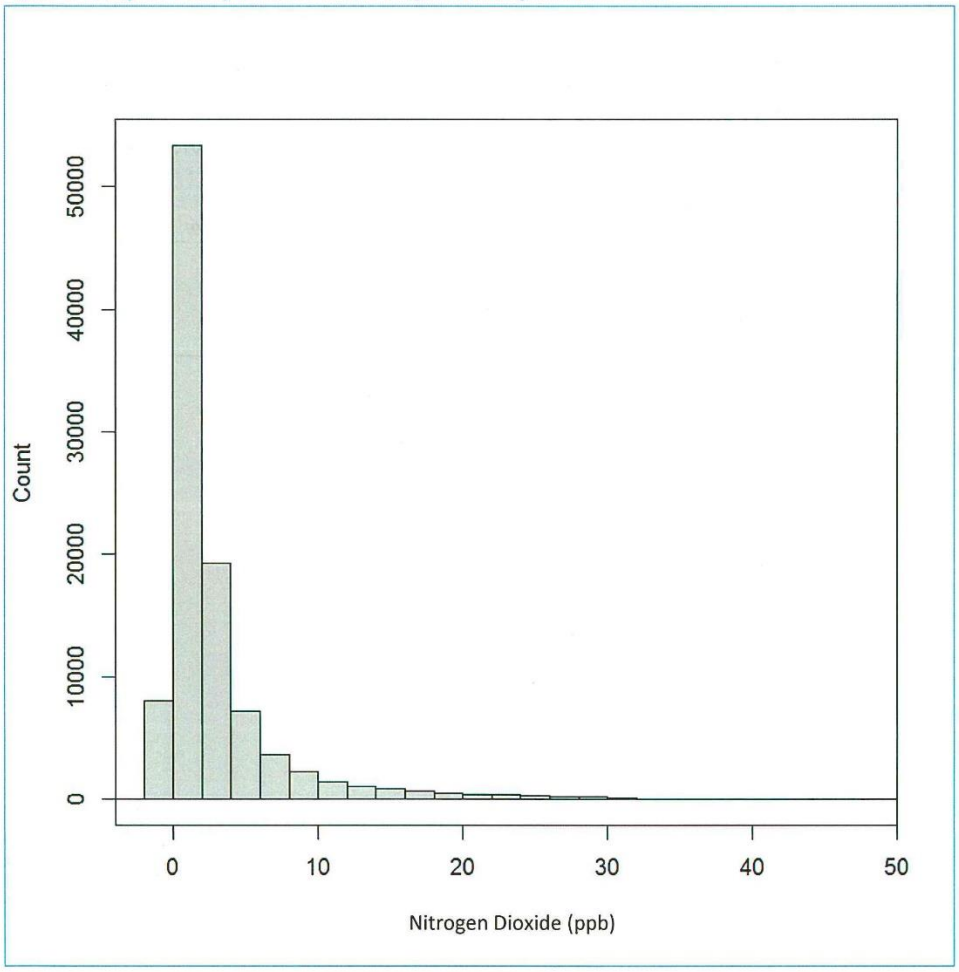
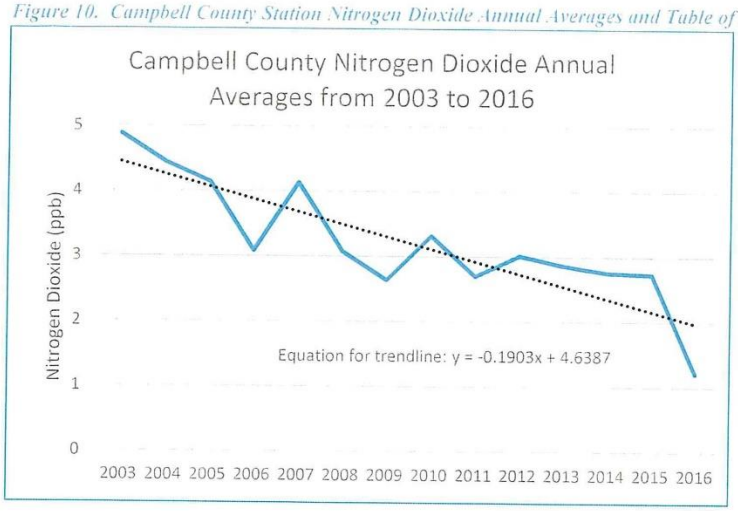


Figure 9. Campbell County Station 1-hour average NO_2 histogram (2003-2016)



The 2003 though 2016 1-hour average NO_2 data set for this station show that the majority of the measured values fell below 10 ppb (Figures 8 and 9). These data are consistent with values expected from a rural, sparsely populated area for background measurements. There were a small amount of occurrences above 20 ppb, which is well below the 1-hour NAAQS 100 ppb level.

Figure 10. Campbell County Station Nitrogen Dioxide Annual Averages and Table of Annual Average values



Year	Annual Average
2003	4.88
2004	4.44
2005	4.14
2006	3.08
2007	4.13
2008	3.07
2009	2.63
2010	3.32
2011	2.70
2012	3.01
2013	2.86
2014	2.76
2015	2.73
2016	1.21

Figure 10 shows the annual averages of nitrogen dioxide were all below 5 ppb, which is well below the NAAQS level of 53 ppb for the annual average. The associated table provides the values of the annual averages. Regression statistics show that the data has a p-value of 1.52×10^{-8} indicating that the trend in this graph is statistically significant. The R^2 value of 0.94 indicates a strong correlation between the data points and their occurrence over time. The annual averages for nitrogen dioxide are generally decreasing at the Campbell County site.

Figure 11. Campbell County Station daily maximum 1-hour average Nitrogen Dioxide histogram

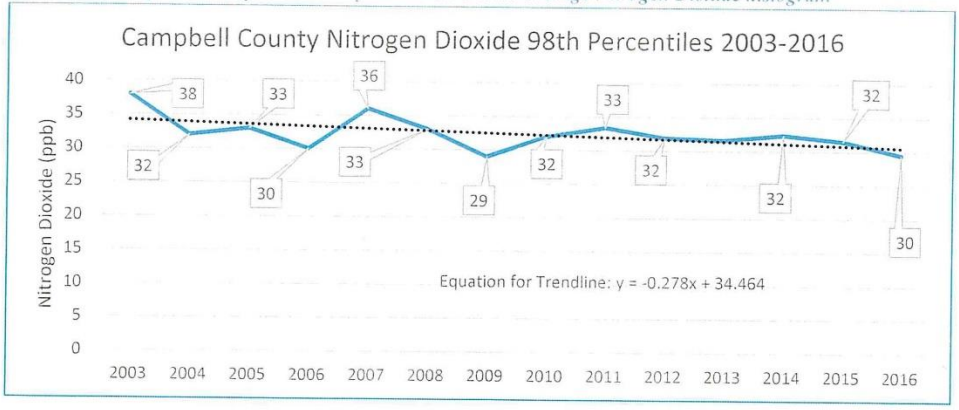
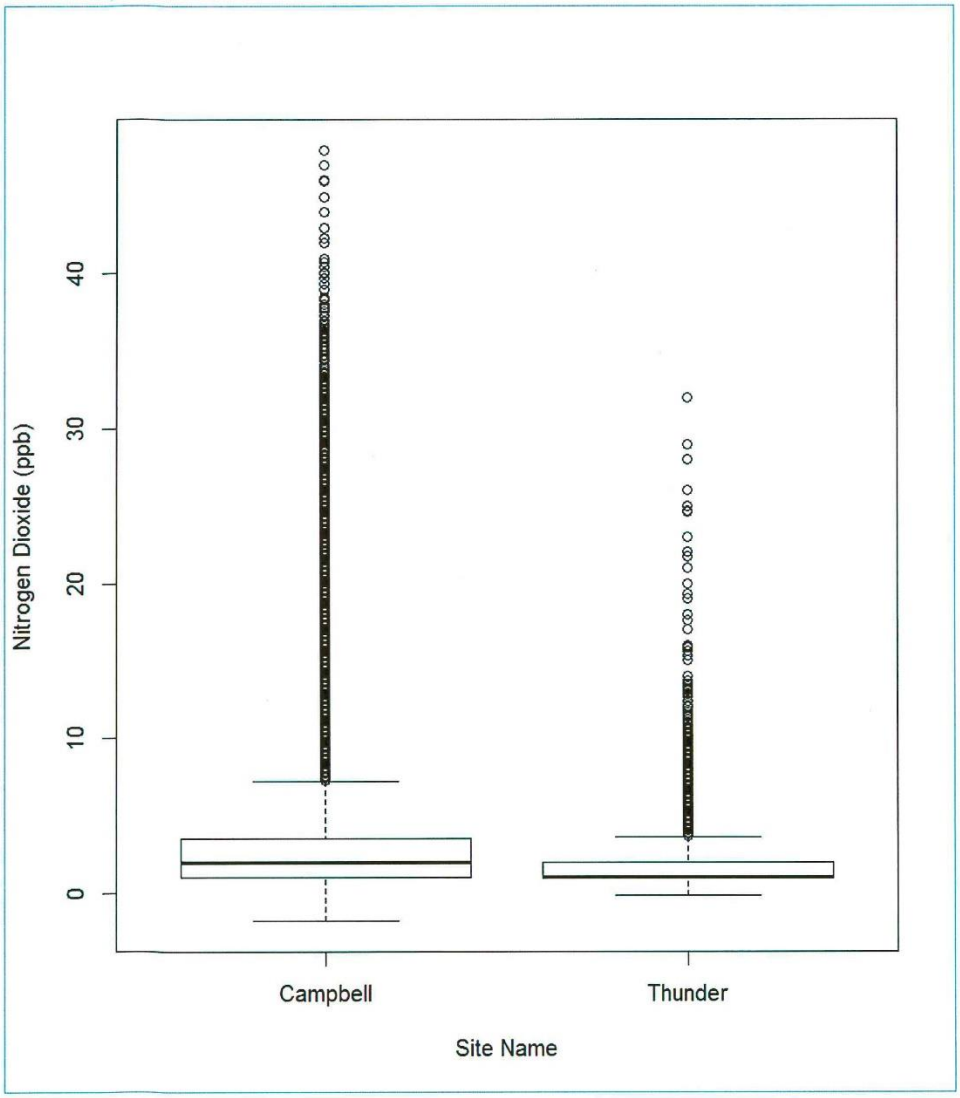


Figure 11 depicts the NO_2 1-hour average 98th percentile values from 2003 to 2016. After analyzing the regression statistics for Figure 11 data, the resulting p-value of 0.299 suggests that the trend results are not statistically significant. The R^2 value of 0.079 indicates a weak relationship between the data points and their occurrence over time. However, while there is not a strong decreasing trend of 1-hour average NO_2 values, all values are well below the level of the NAAQS.

Figure 12. Comparison between the Campbell County and Thunder Basin Stations for 1-hour average NO_2 box-and-whisker plots (2003-2016)



A comparison of the 1-hour average NO_2 data at the Campbell County and Thunder Basin Stations (Figure 12) shows that most values are less than 10 ppb for both stations. The means of both stations are very close to one another while the quartiles of Campbell County spans a wider range than the quartiles of Thunder Basin. The Pearson Correlation value of the Campbell County and Thunder Basin NO_2 hourly data is 0.19, indicating a weak positive correlation (the strongest Pearson correlation values are +1 or -1).

PM_{10}: The NAAQS for PM_{10} is met when the 24-hour average is less than 150 $\mu g/m^3$, not to be exceeded more than once per year on average over a 3 year period. The NAAQS for PM_{10} were set at 150 $\mu g/m^3$ for 24 hour averaging time and 50 $\mu g/m^3$ for the annual averaging time standards from 1987 until 2006. In 2006, the NAAQS annual standard of 50 $\mu g/m^3$ was revoked while the 24-hour standard of 150 $\mu g/m^3$ was retained. However, Wyoming preserved the annual standard of 50 $\mu g/m^3$ in the Wyoming Ambient Air Quality Standards (WAAQS). The highest 24-hour average was 136 $\mu g/m^3$, which occurred on July 10, 2006. The highest annual average was 16 $\mu g/m^3$ and occurred for the year 2012. Campbell County Station's 2013-2015 design value report from EPA's Air Quality System (AQS) database shows that there were zero exceedances, all quarters were complete, and all data were certified during the 3 year period. The 2015 annual average was 9 $\mu g/m^3$.

Figure 13. Campbell County Station 24-hour average PM_{10} box-and-whisker plot (2003-2016)

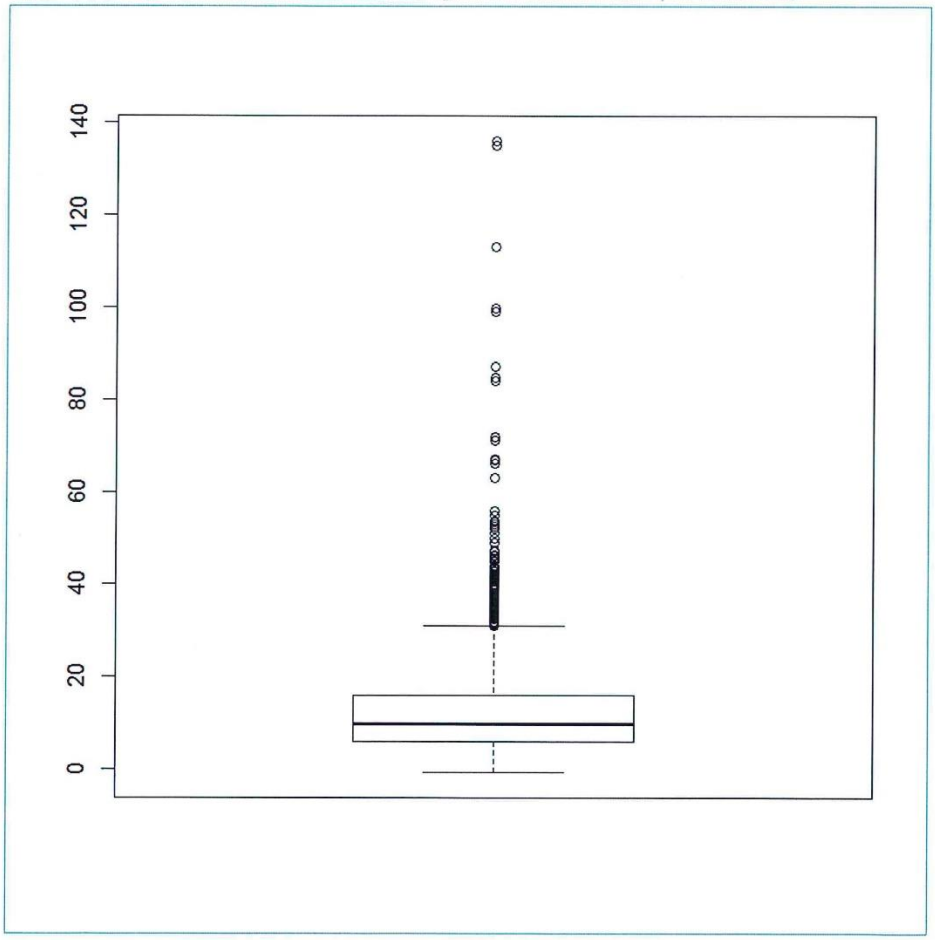
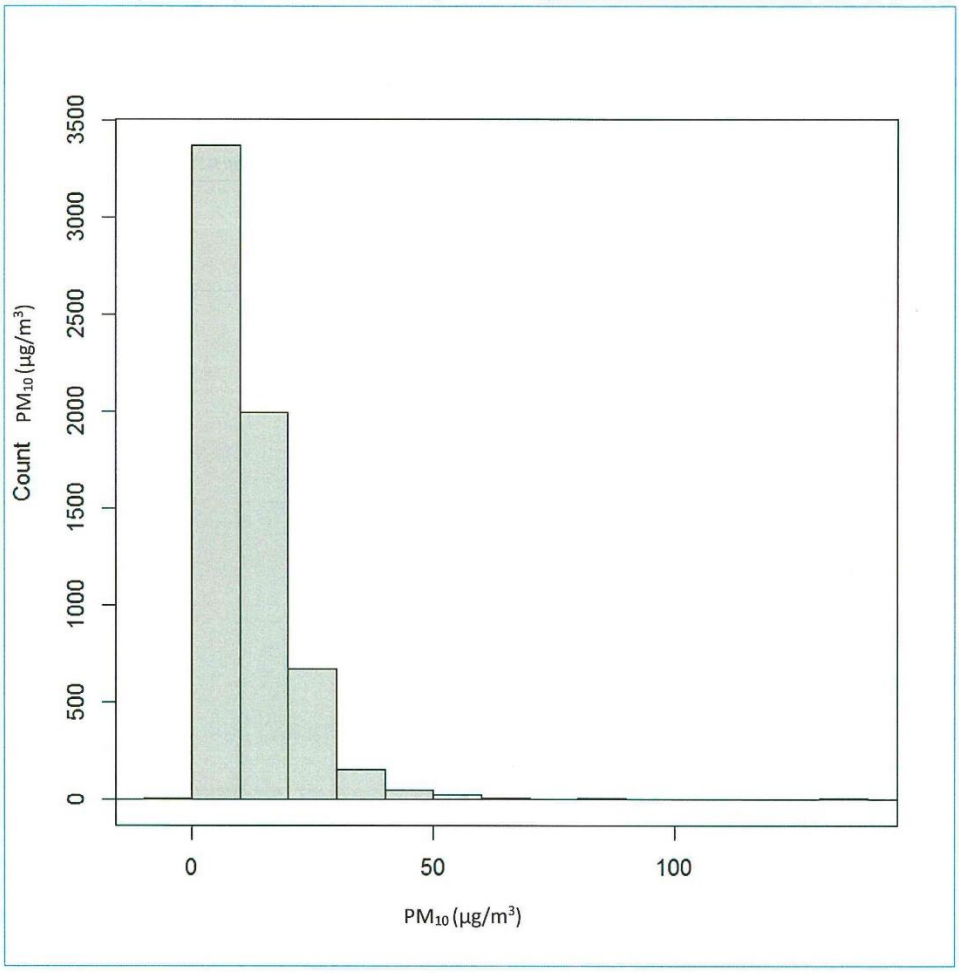
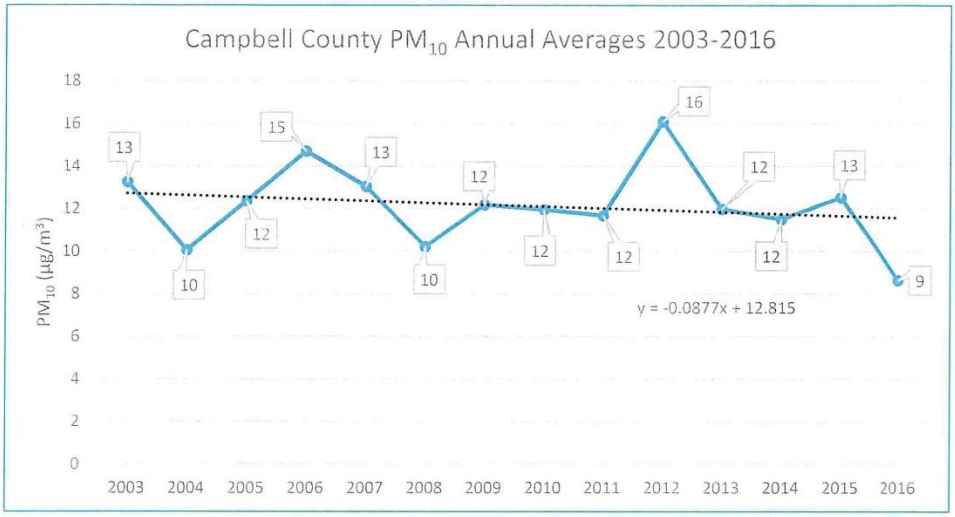


Figure 14. Campbell County Station 24-hour average PM_{10} histogram (2003-2016)



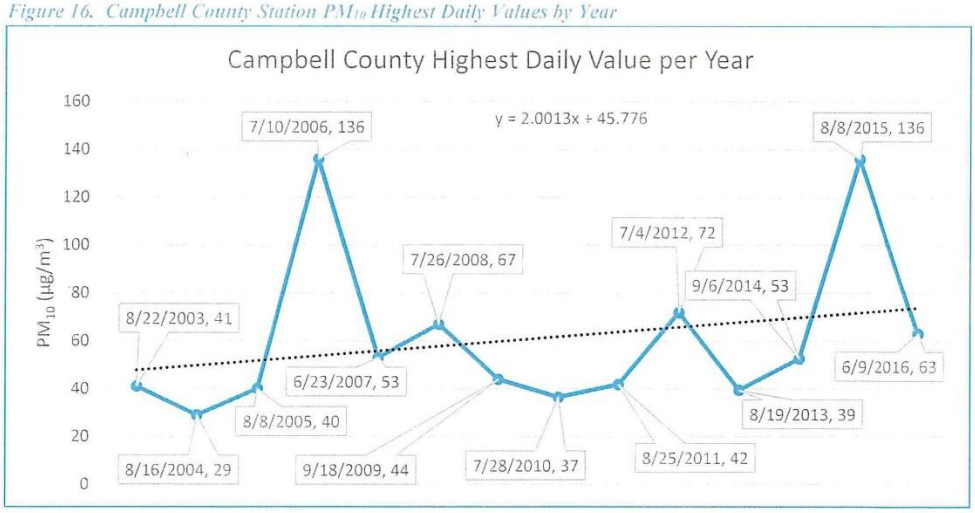
The majority of the PM_{10} 24 hour average data points occur below 30 µg/m^3 (Figures 13 and 14). These data are consistent with values expected from a rural, sparsely populated area for background measurements. There were a small amount of occurrences above 50 µg/m^3, which is well below the PM_{10} 24-hour NAAQS 150 µg/m^3 level.

Figure 15. Campbell County Station PM_{10} Annual Averages 2003-2016 time series graph



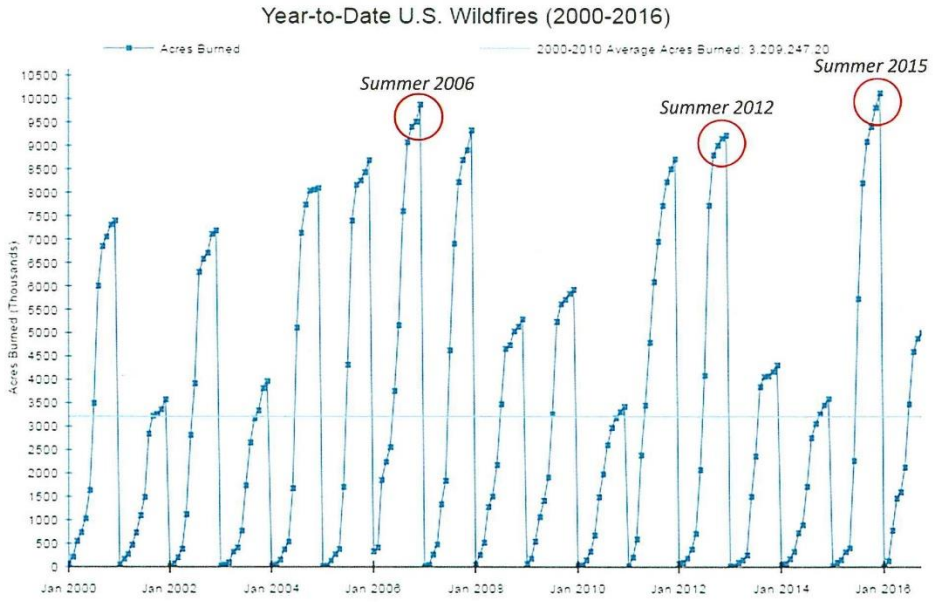
Regression statistics show that the PM_{10} annual average data (Figure 15) has a p-value of 0.00053 indicating that the trend in this graph is statistically significant. The R^2 value of 0.96 indicates a strong correlation between the data points and their occurrence over time. The PM_{10} annual averages at the Campbell County site are generally decreasing.

Figure 16. Campbell County Station PM_{10} Highest Daily Values by Year



Regression statistics show that the PM_{10} highest daily value data (Figure 16) has a p-value of 0.0000293 indicating that the trend in this graph is statistically significant. The R^2 value of 0.78 shows a strong correlation between the data points and their occurrence over time. The trend shows that the highest daily value of PM_{10} values are increasing at the Campbell County site. The higher PM_{10} values of 2006, 2012, and 2015 can be explained by wildfire reports of the western United States during the late summer months of the years in question. Figure 17 shows acres burned in the United States during wildfires from National Oceanic and Atmospheric Administration (NOAA). The wildfire information presented corresponds with the higher values observed in Figure 16. Figures 18, 19, and 20 provide additional information about wildfire occurrences during 2006, 2012, and 2015 when elevated PM_{10} levels were detected at the Campbell County Station.

Figure 17. Acres Burned during wildfires in United States (2000-2016)



*Information obtained from https://www.ncdc.noaa.gov/societal-impacts/wildfires/ytd/0?params[]=acres

Figure 18. Large Incident Wildfires during July 2006.

*Information obtained from www.ncdc.noaa.gov

Figure 19. July 4, 2012 HMS, Smoky Sky Over Gillette, and Ash Creek Fire Image

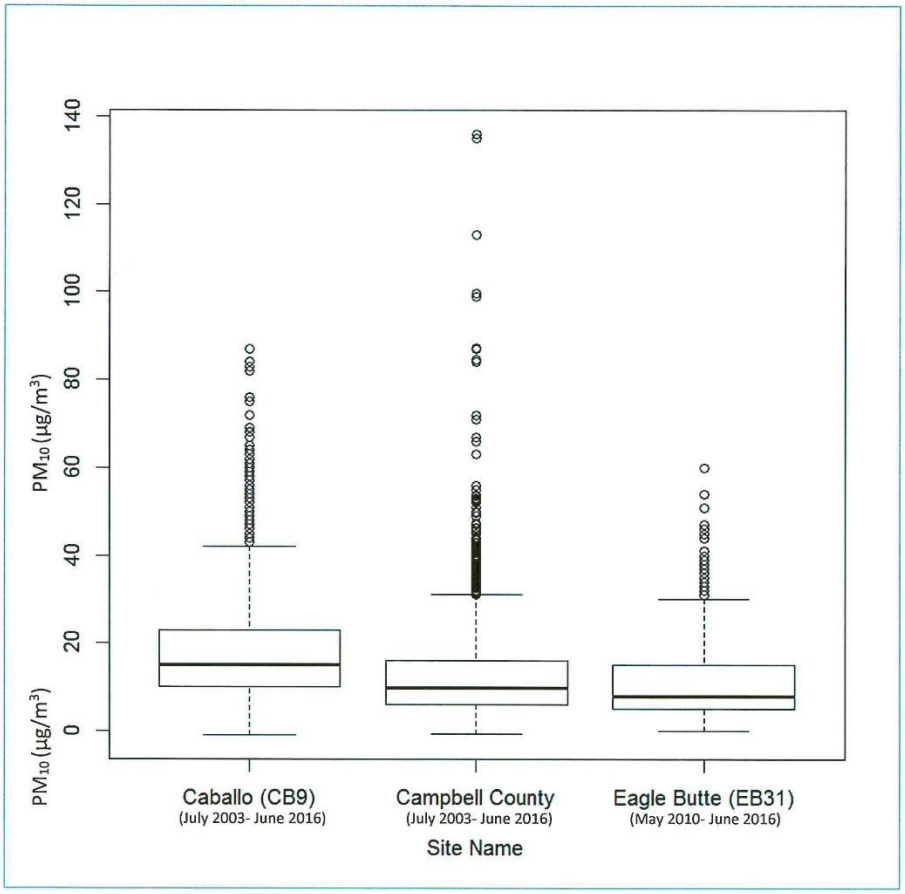
Images obtained from Inciweb and Rob Across America 2012

*Information obtained from "Wyoming Wildfire Exceptional Event Demonstration, June 26, 2012- July 5, 2012". Submitted to EPA on July 3, 2015.

Figure 20. Wildfires near Campbell County Station in August of 2015

*Information obtained from www.nifc.gov

Figure 21. Comparison between the Campbell County Station, Eagle Butte EB31, and Caballo Mine CB9 Monitors for 24-hour average PM_{10} box-and-whisker plots (2003-2016)



A comparison of the 24-hour averages of PM_{10} data at the Campbell County, Caballo, and Eagle Butte monitoring stations (Figure 21) shows that most values are less than 45 $\mu g/m^3$ for all stations. The medians for all three stations are very similar, spanning between approximately 6 and 15 $\mu g/m^3$. Caballo's CB9 monitor captures higher values of the area due to CB9 being downwind of mining activities at Caballo Mine. Eagle Butte and Campbell County have the strongest relationship with medians which almost overlap and quartiles ranges that are nearly identical. This observation is logical since both sites are located upwind of the Powder River Basin Coal Mine Network. The Eagle Butte and Caballo monitoring stations both reflect similar data collection values as Campbell County, excluding a few outliers. The Pearson Correlation value of the Campbell County and Caballo 24-hour average PM_{10} data is 0.54 (the strongest Pearson Correlation values are +1 for perfect positive correlation and -1 for a perfect negative correlation). The Pearson Correlation value of the Campbell County and Eagle Butte is 0.74. Both Caballo and Eagle Butte monitors have slight positive correlation with Campbell County.

Conclusion

During the monitoring period, from July 2003 through June 2016, the Campbell County Station operated and collected monitoring data for the following parameters: ozone, oxides of nitrogen, PM_{10}, wind speed, wind direction, precipitation, solar radiation, and relative humidity. There was also a camera on site for scene monitoring. Data collected and analyzed from Campbell County indicate that there have been no exceedances of the NAAQS levels at this site for ozone, nitrogen dioxide, and PM_{10}.

The Campbell County Station is a long-term monitoring station in northeast Wyoming. During the 2015 Network Assessment it was determined that this station could justifiably be moved due to high correlation with other stations in the area. This correlation indicated that the data collected at this site may be redundant and that the monitoring equipment might be more useful in eastern Johnson County. This correlation was confirmed for the Thunder Basin and Campbell County stations for ozone and NO_2 and also for Campbell County PM_{10} and industrial PM_{10} monitors from Eagle Butte Mine and Caballo Mine.

This data analysis was conducted to inform decisions on monitoring in northeast Wyoming. Taking into account anticipated development, findings of the 2015 Network Assessment, and redundancy between nearby monitors, there may be a greater need for the equipment at the Campbell County monitoring station to be relocated to a more high priority and less monitored area.

Appendix A: Data Completeness Report Summary

*Data completeness reported as percentages.

Table 1. Campbell County Station data completion report 2003-2009

Year	2003		2004				2005				2006				2007				2008				2009			
Quarter	*Q3*	*Q4*	*Q1*	*Q2*	*Q3*	*Q4*	*Q1*	*Q2*	*Q3*	*Q4*	*Q1*	*Q2*	*Q3*	*Q4*	*Q1*	*Q2*	*Q3*	*Q4*	*Q1*	*Q2*	*Q3*	*Q4*	*Q1*	*Q2*	*Q3*	*Q4*
Ozone	73.0	91.0	91.3	94.0	90.3	93.3	94.7	91.6	94.7	93.7	93.0	94.3	91.3	59.0	90.7	96.3	94.0	95.0	90.3	91.3	82.3	59.3	91.0	91.0	81.3	91.0
NO2	58.3	91.0	91.3	94.3	93.3	83.3	94.7	91.6	67.7	93.7	93.0	87.0	91.3	52.0	75.7	70.3	79.7	95.3	91.0	91.7	64.3	94.3	91.0	91.0	81.0	91.3
PM10	73.7	90.0	89.0	86.7	87.0	96.7	97.0	83.3	63.3	0.0	70.0	73.3	28.3	63.7	69.0	70.0	51.7	53.3	74.7	53.3	10.0	60.0	98.0	98.3	98.3	98.7

Table 2. Campbell County Station data completion report 2010-2016

Year	2010				2011				2012				2013				2014				2015				2016	
Quarter	*Q1*	*Q2*	*Q3*	*Q4*	*Q1*	*Q2*	*Q3*	*Q4*	*Q1*	*Q2*	*Q3*	*Q4*	*Q1*	*Q2*	*Q3*	*Q4*	*Q1*	*Q2*	*Q3*	*Q4*	*Q1*	*Q2*	*Q3*	*Q4*	*Q1*	*Q2*
Ozone	92.0	94.0	93.7	95.3	97.0	96.3	92.3	95.3	93.3	97.0	92.3	98.3	98.7	98.3	94.7	98.3	97.3	98.3	93.3	83.7	91.7	98.7	81.3	98.7	97.3	97.7
NO2	92.0	94.0	93.3	87.0	97.0	96.3	95.0	95.3	89.3	99.0	93.7	98.3	98.7	96.0	83.0	96.7	96.0	98.7	75.0	82.0	98.6	98.7	68.7	71.7	82.7	97.7
PM10	98.7	93.7	98.3	97.3	98.3	98.0	97.3	87.0	79.7	99.0	98.7	98.7	99.0	98.0	96.0	98.0	89.3	96.3	92.0	99.3	94.0	95.3	95.7	99.7	99.7	99.3

Appendix D: Sheridan Analyses

Wyoming Department of Environmental Quality
Air Quality Division
Memorandum

To: Nancy E. Vehr, Air Quality Administrator 3-20-17

Through: Darla Potter, Air Quality Resource Management Program Manager 3-15-17
Cara Keslar, Monitoring Section Supervisor 3/13/17

From: Daniel Sharon, Monitoring Project Manager D.S. 3/9/17

Cc: Tanner Shatto, District 3 Engineer

Date: March 13, 2017

Subject: Wyoming Department of Environmental Quality, Air Quality Division
Sheridan Analysis to Support 2015 Network Assessment

I. Background

The Air Quality Division's (AQD) 2015 Network Assessment included a finding that the city of Sheridan, WY was a potential location for future gaseous monitoring, but that further analysis was necessary to describe the effects of emissions from Montana on the city. The language from the Network Assessment is as follows:

"***Section 4.2.5 Sheridan***

The city of Sheridan is a micropolitan statistical area without any historical gaseous monitoring. The city is downwind of many small, local, point and oil and gas sources, in addition to out-of-state emissions that are currently unquantified. A Veteran's Affairs hospital is located in town that is likely to serve a population statistically more sensitive to pollution levels.

Further analyses are necessary to better characterize the impacts of emissions from Montana on this area."

The following analysis fulfills this data need by analyzing Montana's Emissions Inventory to identify large sources of gaseous and particulate pollutants proximate to or upwind of Sheridan and presenting HYSPLIT forward-trajectory modeling runs from these sources to determine if pollutants from these sources are expected to impact the city.

II. Meteorological Information

Wind Speed and Wind Direction information were collected from the Sheridan Police Department State and Local Air Monitoring Station (SLAMS) and the Young's Creek Mine meteorological station. The location of these two monitors is displayed in Figure 1, below.

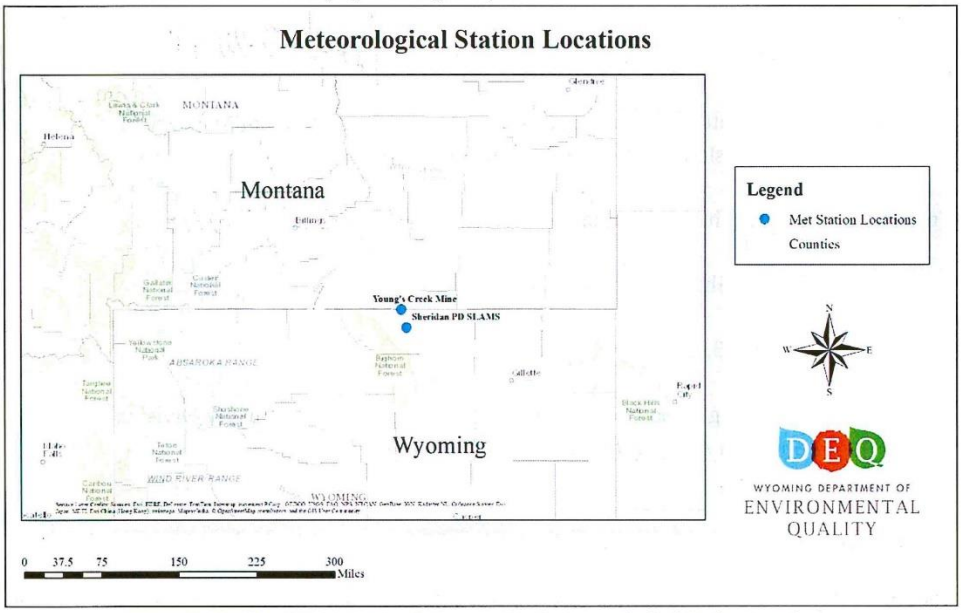


Figure 1. Sheridan PD SLAMS and Young's Creek Meteorological Station Locations

Wind roses were generated for both stations for the monitoring period of 2013-2015 (the most recent three-year period of available data for both sites). These wind roses are displayed in Figures 2 and 3, below.

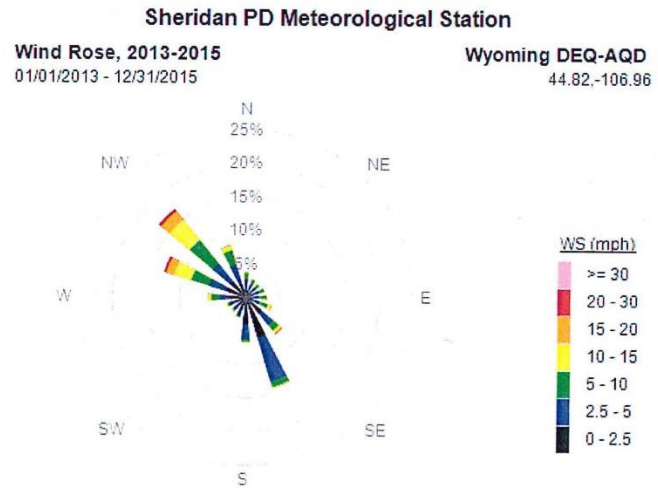


Figure 2. Sheridan PD SLAMS 2013-2015 Wind Rose

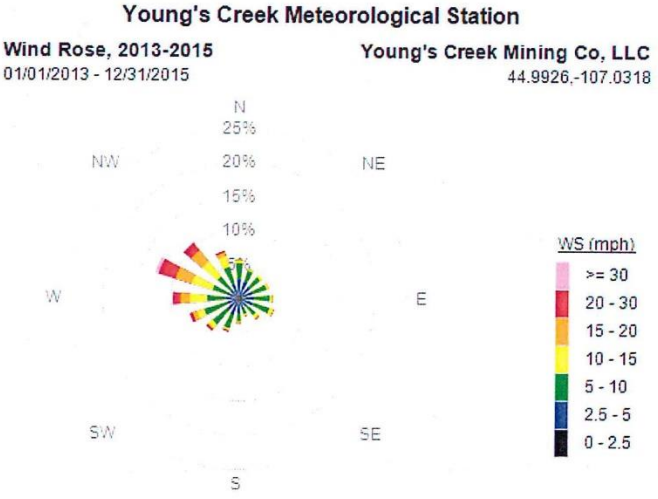


Figure 3. Young's Creek 2013-2015 Wind Rose

Based on these figures, the strongest winds in Sheridan and north central Wyoming are expected out of the NW and WNW, while winds are most likely to occur out of the NW in Sheridan and most likely to occur out of the WNW in the area around Young's Creek. This indicates that the Montana counties most likely to have an impact on Sheridan air quality are Big Horn, Yellowstone, and Carbon, which are directly upwind of the city.

III. Montana Emissions Inventory Analysis

Data for this analysis were sourced from the Environmental Protection Agency's (EPA) triennial 2014 National Emissions Inventory (NEI) data page (https://www.epa.gov/air-emissions-inventories/2014-national-emissions-inventory-nei-data). Only point sources were evaluated because this is the only category where accurate latitude/longitude information is provided by pollutant. The data were placed into 10 kilometer (km) by 10 km grids according to the source locations provided. The pollutants assessed were PM_{10}, $PM_{2.5}$, VOCs, NO_x, and SO_2. The resulting gridded emission inventory maps are displayed in Figures 4 through 8, below.

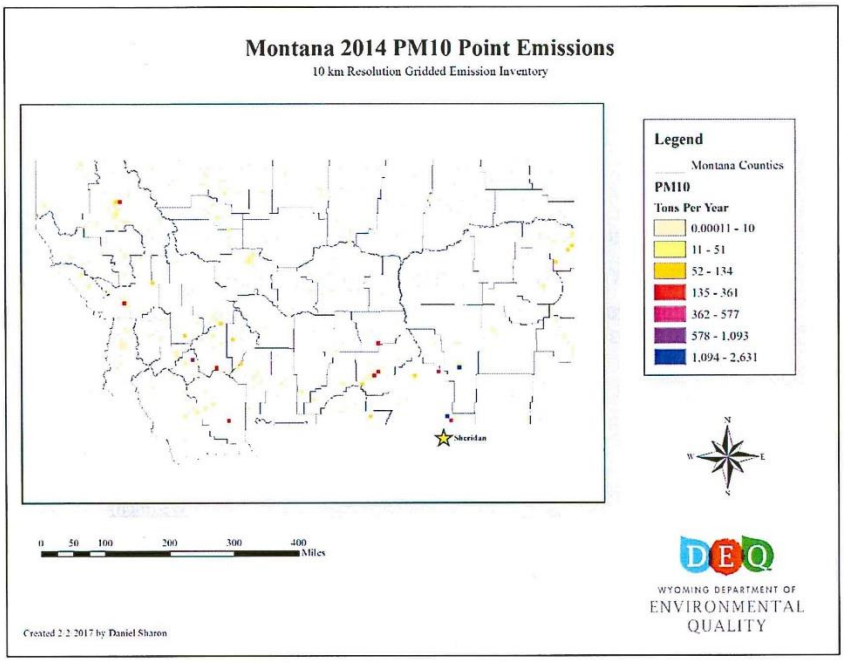


Figure 4. PM_{10} Emissions from Point Sources

The top ten point sources with the highest PM_{10} emissions in the counties directly upwind of Sheridan are listed in Table 1, below.

Facility	County	Latitude	Longitude	PM_{10} Emissions (TPY)
Spring Creek Mine	Big Horn	45.112	-106.904	1,095.1
Absaloka Mine	Big Horn	45.804	-107.079	564.7
Decker Mine	Big Horn	45.054	-106.822	426
J.E. Corette Power Plant	Yellowstone	45.775	-108.481	133.5
Exxon Mobil Billings Refinery	Yellowstone	45.814	-108.433	124.3
Phillips 66 Billings Refinery	Yellowstone	45.781	-108.489	98.7
RMP Hardin Generating Station	Big Horn	45.764	-107.6	86.1
CHS Laurel Refinery	Yellowstone	45.659	-108.768	63.8
MT Limestone Co. Quarry	Carbon	45.118	-108.596	52.2
Western Sugar Coop Billings Sugar Mill	Yellowstone	45.769	-108.498	47.2

Table 1. Montana PM_{10} Point Sources Upwind of Sheridan

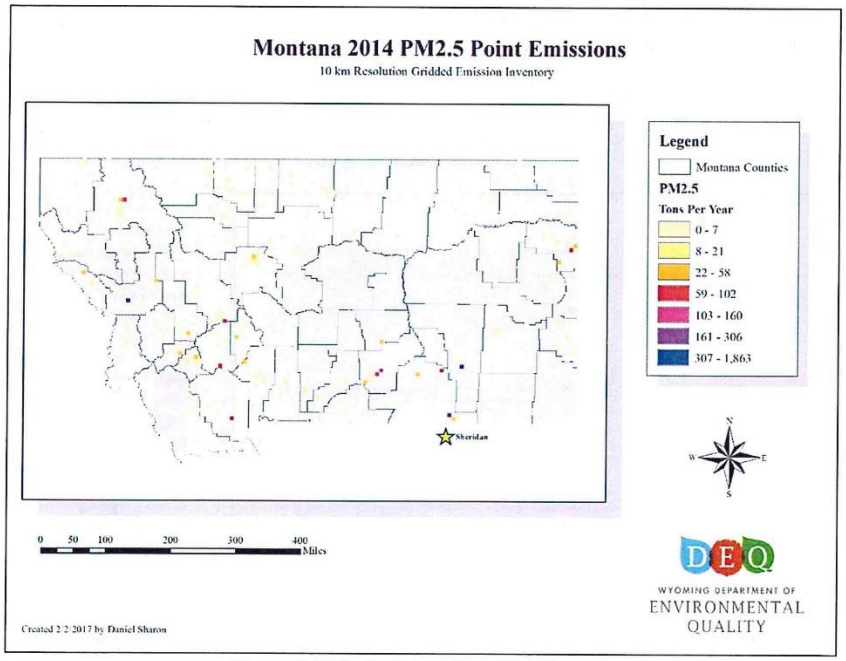


Figure 5. $PM_{2.5}$ Emissions from Point Sources

The top ten point sources with the highest $PM_{2.5}$ emissions in the counties directly upwind of Sheridan are listed in Table 2, below.

Facility	County	Latitude	Longitude	$PM_{2.5}$ Emissions (TPY)
Spring Creek Mine	Big Horn	45.112	-106.904	248.6
Exxon Mobil Billings Refinery	Yellowstone	45.814	-108.433	120.4
Phillips 66 Billings Refinery	Yellowstone	45.781	-108.489	78.77
Absaloka Mine	Big Horn	45.804	-107.079	74.3
J.E. Corette Power Plant	Yellowstone	45.775	-108.481	57.5
CHS Laurel Refinery	Yellowstone	45.659	-108.768	49.2
Decker Mine	Big Horn	45.054	-106.822	44.6
RMP Hardin Generating Station	Big Horn	45.764	-107.6	39.4
Western Sugar Coop Billings Sugar Mill	Yellowstone	45.769	-108.498	22
Billings Logan International Airport	Yellowstone	45.809	-108.56	7

Table 2. Montana $PM_{2.5}$ Point Sources Upwind of Sheridan

Because O_3 is a secondary pollutant formed through chemical interactions with precursor pollutants including NO_x and VOC emissions, the AQD examined gridded emission inventory data maps for these pollutant groups as approximate temporal indications of O_3 formation.

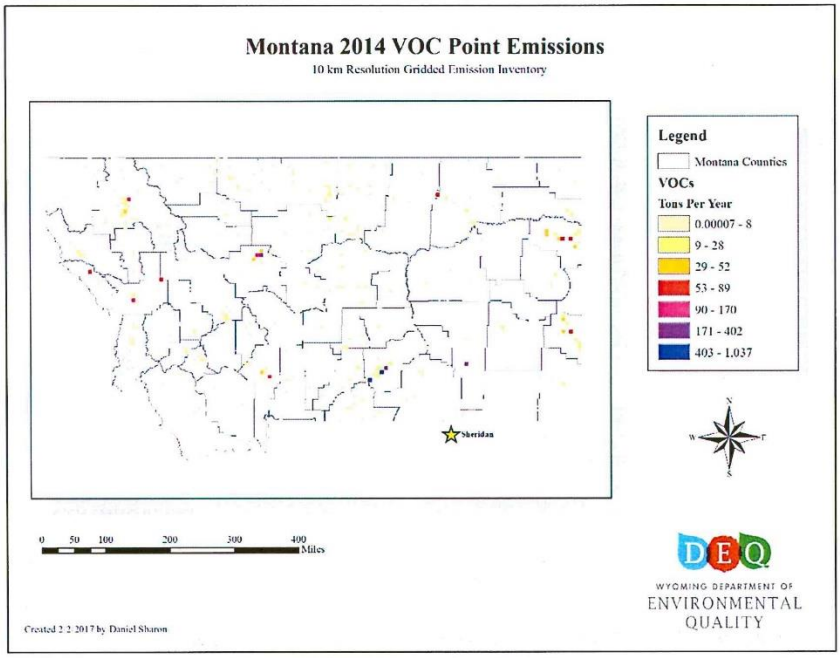


Figure 6. VOC Emissions from Point Sources

The top ten point sources with the highest VOC emissions in the counties directly upwind of Sheridan are listed in Table 3, below.

Facility	County	Latitude	Longitude	VOC Emissions (TPY)
CHS Laurel Refinery	Yellowstone	45.659	-108.768	981.9
Exxon Mobil Billings Refinery	Yellowstone	45.814	-108.433	384.6
Phillips 66 Billings Refinery	Yellowstone	45.781	-108.489	336.9
Fiberglass Structures, Inc. Tank	Yellowstone	45.668	-108.755	38.8
Billings Bakery	Yellowstone	45.749	-108.545	32.5
Billings Logan International Airport	Yellowstone	45.809	-108.56	27.6
Billings Landfill Gas Production Facility	Yellowstone	45.715	-108.549	18.7
Fiberglass Structures, Inc.	Yellowstone	45.668	-108.762	16.1
Billings Transportation Operations	Yellowstone	45.783	-108.494	13.7
J.E. Corette Power Plant	Yellowstone	45.775	-108.481	13.6

Table 3. Montana VOC Point Sources Upwind of Sheridan

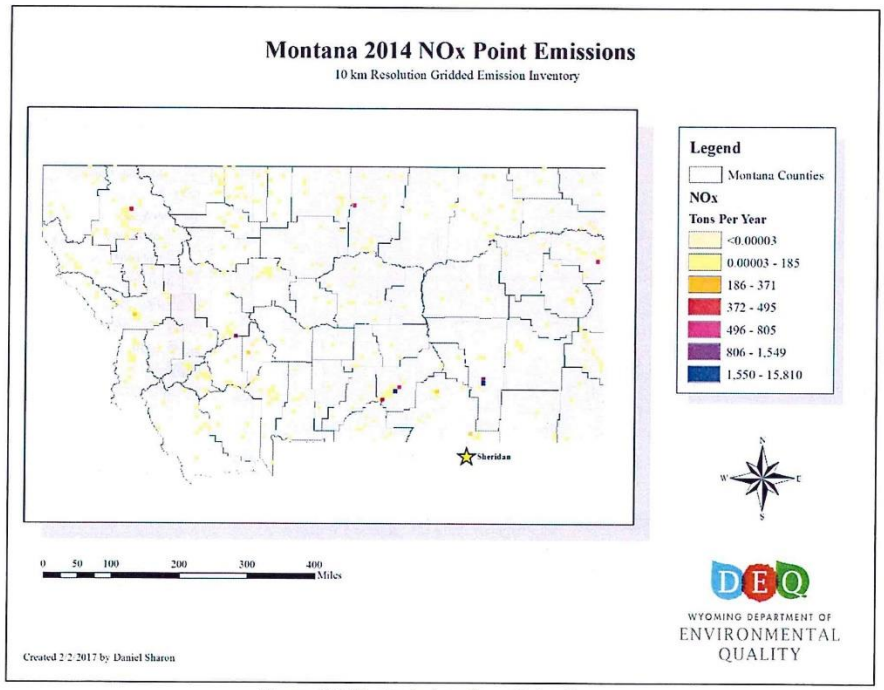


Figure 7. NO_x Emissions from Point Sources

The top ten point sources with the highest NO_x emissions in the counties directly upwind of Sheridan are listed in Table 4, below.

Facility	County	Latitude	Longitude	NO_x Emissions (TPY)
J.E. Corette Power Plant	Yellowstone	45.775	-108.481	786.4
Phillips 66 Billings Refinery	Yellowstone	45.781	-108.489	560.8
Yellowstone Power Plant	Yellowstone	45.811	-108.429	445.7
CHS Laurel Refinery	Yellowstone	45.659	-108.768	401.2
RMP Hardin Generating Station	Big Horn	45.764	-107.6	350.8
Exxon Mobil Billings Refinery	Yellowstone	45.814	-108.433	304.1
Western Sugar Coop Billings Sugar Mill	Yellowstone	45.769	-108.498	235.2
Spring Creek Mine	Big Horn	45.112	-106.904	194.5
Huntley Rail Yard	Yellowstone	45.9	-108.298	138.2
Billings Logan International Airport	Yellowstone	45.809	-108.56	75.3

Table 4. Montana NO_x Point Sources Upwind of Sheridan

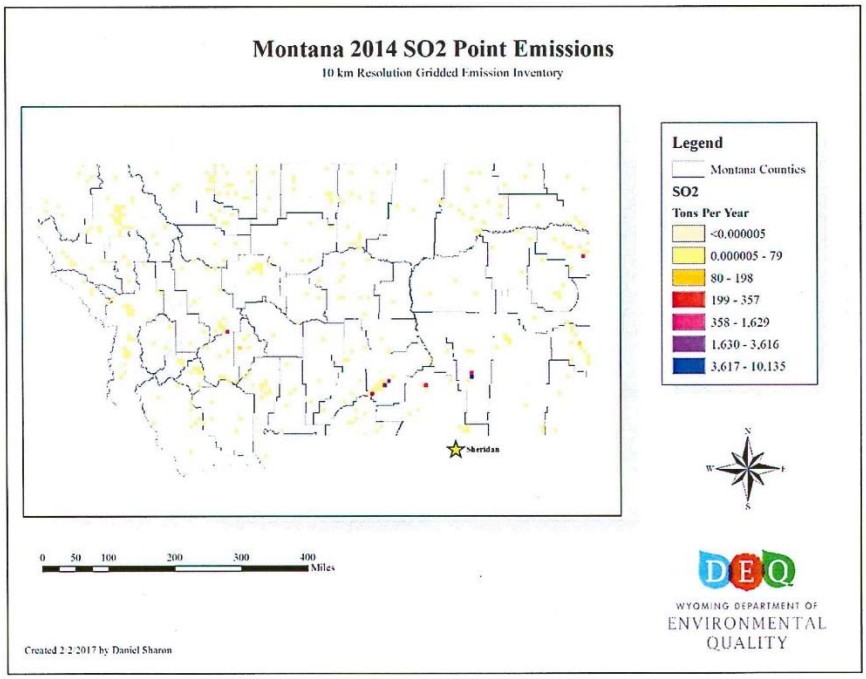


Figure 8. SO_2 Emissions from Point Sources

The top ten point sources with the highest SO_2 emissions in the counties directly upwind of Sheridan are listed in Table 5, below.

Facility	County	Latitude	Longitude	SO_2 Emissions (TPY)
Yellowstone Power Plant	Yellowstone	45.811	-108.429	1,525.4
Montana Sulphur and Chemical Co. Plant	Yellowstone	45.814	-108.428	1,436.4
J.E. Corette Power Plant	Yellowstone	45.775	-108.481	1,433.1
Exxon Mobil Billings Refinery	Yellowstone	45.814	-108.433	652.2
RMP Hardin Generating Station	Big Horn	45.764	-107.6	381.8
CHS Laurel Refinery	Yellowstone	45.659	-108.768	236
Western Sugar Coop Billings Sugar Mill	Yellowstone	45.769	-108.498	122.9
Phillips 66 Billings Refinery	Yellowstone	45.781	-108.489	87.8
Spring Creek Mine	Big Horn	45.112	-106.904	22.9
Billings Wastewater Treatment Plant	Yellowstone	45.803	-108.47	21.5

Table 5. Montana SO_2 Point Sources Upwind of Sheridan

IV. HYSPLIT Trajectory Analyses

HYSPLIT (Hybrid Single Particle Lagrangian Integrated Trajectory) Model Analyses generate wind trajectories up to forty-eight (48) hours prior to (backwards trajectory) or after (forwards trajectory) a chosen start date of interest. A backwards trajectory is a valuable indicator of what could affect a stationary location such as a city or monitoring station. A forwards trajectory is beneficial to view possible dispersion from an emission source. Both types of trajectories were performed for this analysis, with two (2) starting heights: 250 and 500 meters.

For the purposes of this analysis, the top 20 emissions sources described in Section III above were grouped by relative location. These HYSPLIT source groups are shown in Figure 9, below.

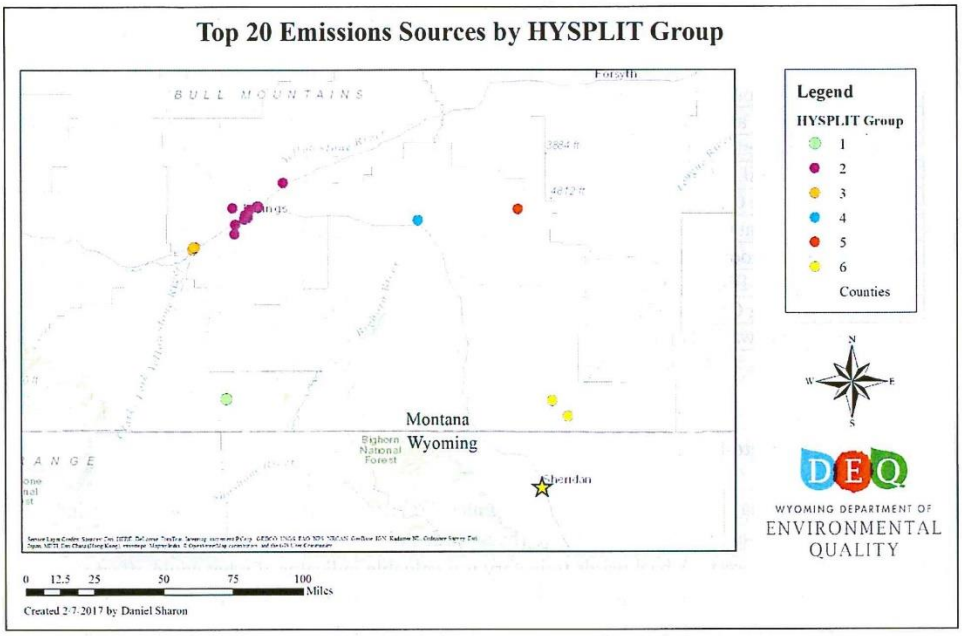


Figure 9. Emissions Point Sources Grouped by Location

The locations, starting dates, and trajectory information is found below in Table 6. Starting dates for HYSPLIT runs were chosen based on meteorological conditions conducive to pollutant transport. The locations of each HYSPLIT run is shown in Figure 10, below.

Site Location	County	Latitude	Longitude	Start Date	HYSPLIT Run	Trajectory Type
Bridger, MT	Carbon	45.118	-108.596	3/11/2013	1	Forwards
Billings, MT	Yellowstone	45.783	-108.494	1/20/2013	2	Forwards
Laurel, MT	Yellowstone	45.6643	-108.7616	4/14/2013	3	Forwards
Hardin, MT	Big Horn	45.764	-107.6	2/1/2014	4	Forwards
Hysham, MT	Big Horn	45.804	-107.079	4/8/2013	5	Forwards
Decker, MT	Big Horn	45.086	-106.8611	4/9/2013	6	Forwards
Sheridan, WY	Sheridan	44.7975	-106.9545	8/24/2014	7	Backwards

Table 6. HYSPLIT Run Information

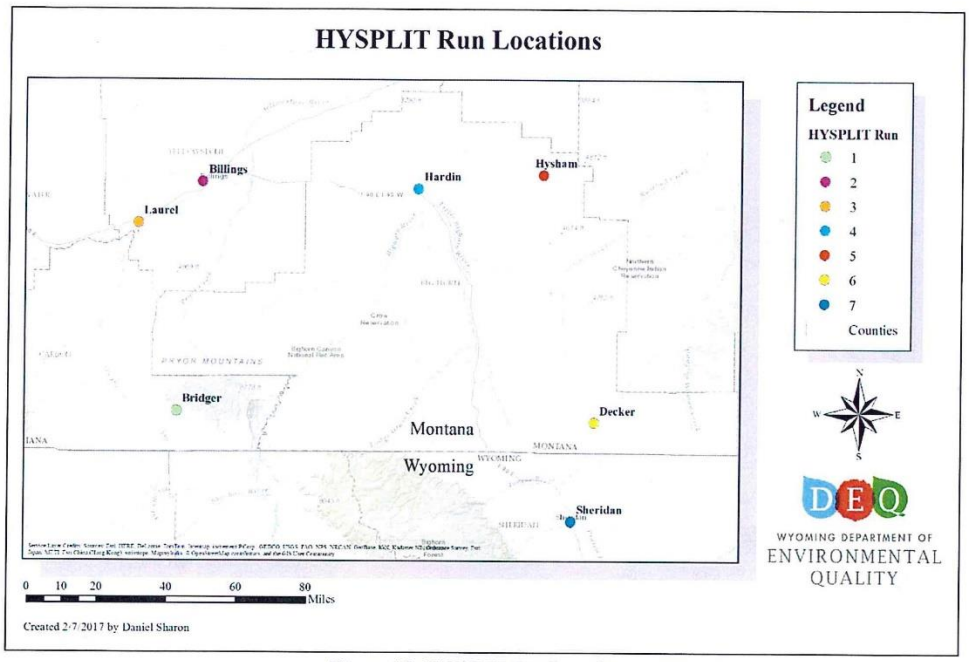


Figure 10. HYSPLIT Run Locations

Trajectory data were obtained from NOAA's Air Resource Laboratory HYSPLIT Model, available here: http://www.arl.noaa.gov/HYSPLIT_info.php[1]. The trajectory results of these model runs are shown in Figures 11 through 17, below.

[1] Stein, A.F., Draxler, R.R, Rolph, G.D., Stunder, B.J.B., Cohen, M.D., and Ngan, F., (2015). NOAA's HYSPLIT atmospheric transport and dispersion modeling system, Bull. Amer. Meteor. Soc., **96**, 2059-2077, http://dx.doi.org/10.1175/BAMS-D-14-00110.1

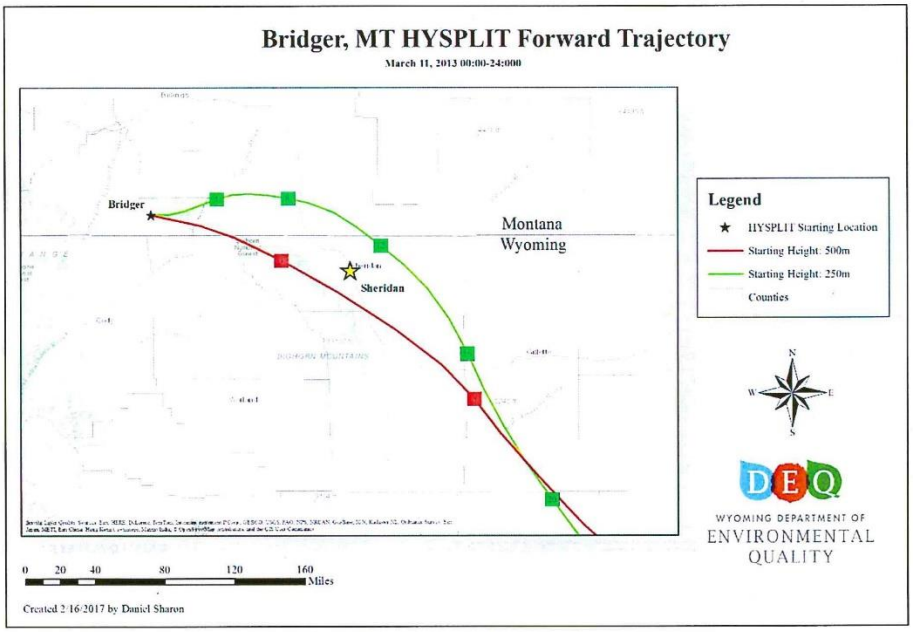


Figure 11. HYSPLIT Run 1 (Bridger)

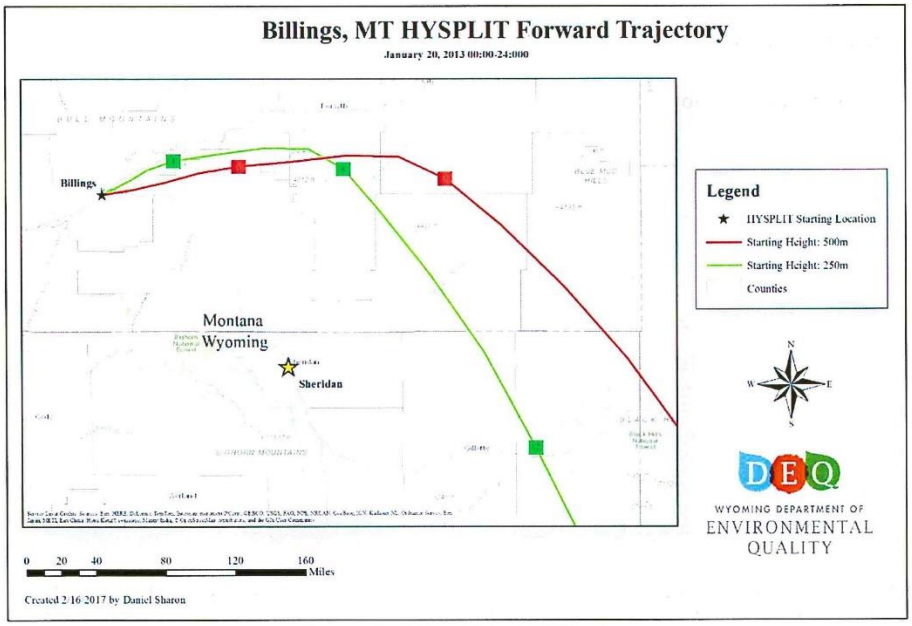


Figure 12. HYSPLIT Run 2 (Billings)

12.

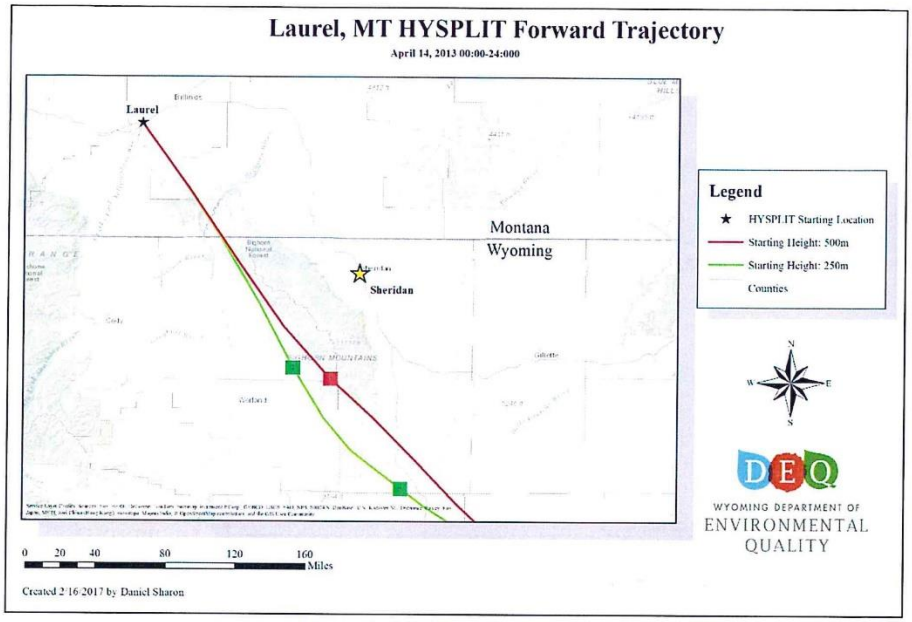


Figure 13. HYSPLIT Run 3 (Laurel)

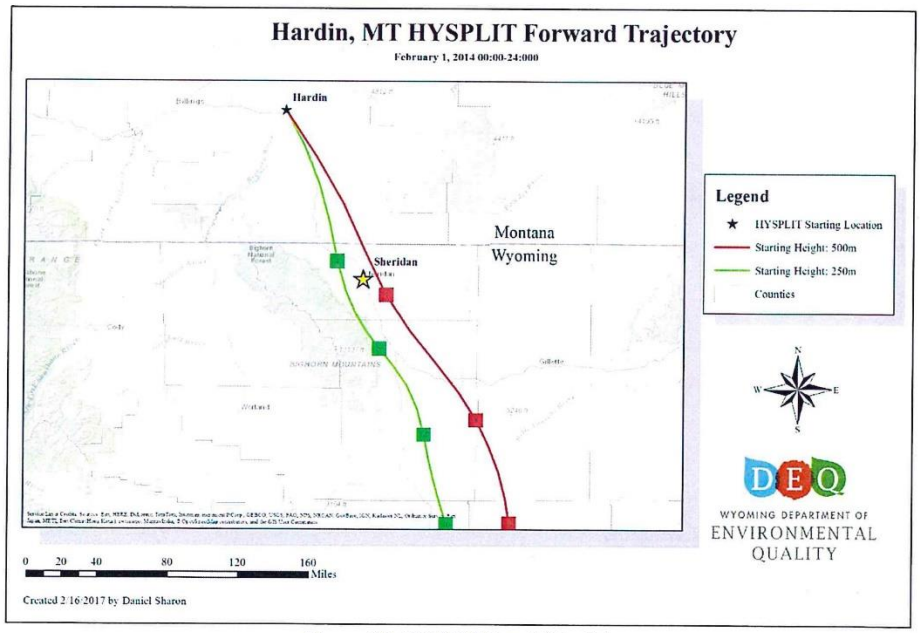


Figure 14. HYSPLIT Run 4 (Hardin)

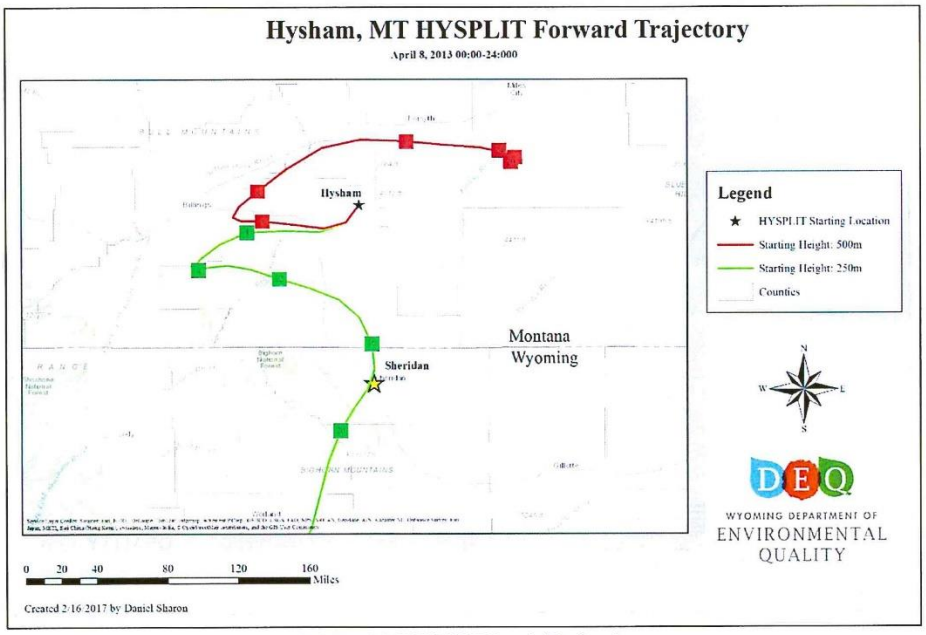


Figure 15. HYSPLIT Run 5 (Hysham)

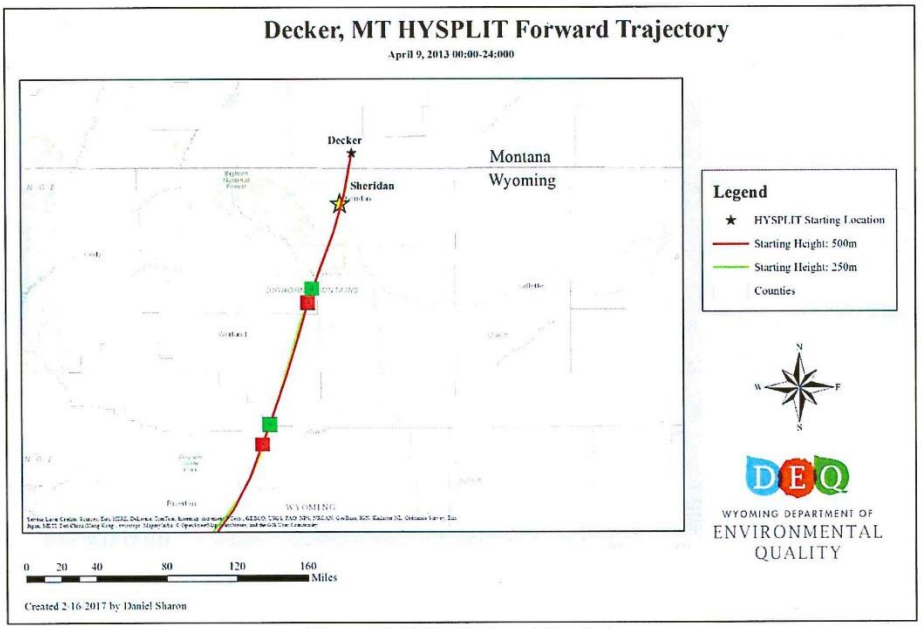


Figure 16. HYSPLIT Run 6 (Decker)

14.

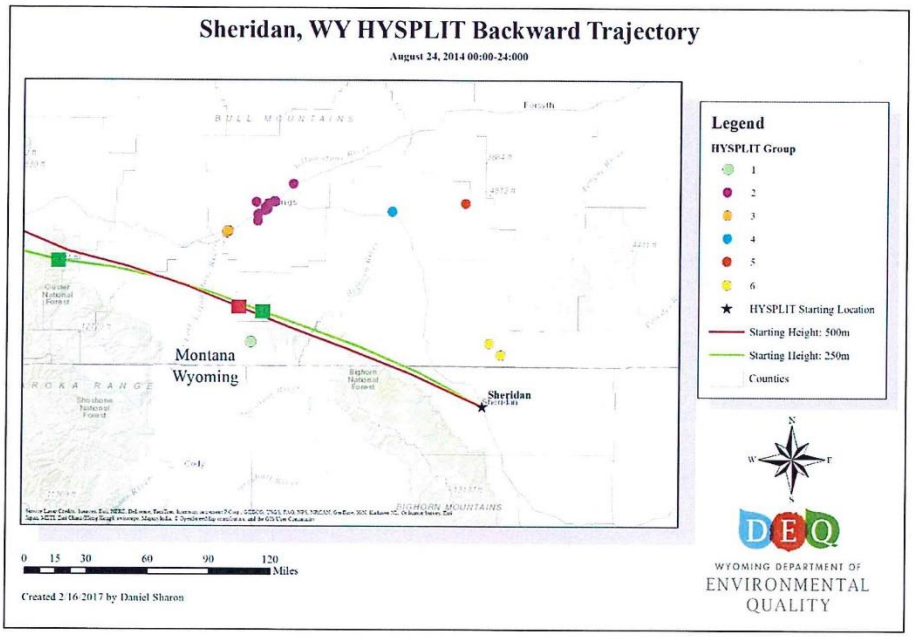


Figure 17. HYSPLIT Run 7 (Sheridan)

Based on these modeled trajectories, emissions from Montana's Carbon, Yellowstone, and Big Horn Counties can reasonably be expected to impact air quality in Sheridan under prevailing meteorological conditions. According to the Figures 12 and 13, it appears that the Big Horn mountain range, running northwest to the west of Sheridan, influences the movement of air masses between Bridger and Laurel, MT, and Sheridan, WY.

V. Summary and Conclusion

Winds in Sheridan and along the Wyoming-Montana border are predominantly out of the NW and WNW, with the strongest components from these same directions. Some of the largest emissions sources in Montana for PM_{10}, $PM_{2.5}$, VOCs, NO_x, and SO_2 are located directly upwind of Sheridan, Wyoming in Carbon, Yellowstone, and Big Horn Counties. Modeling analyses from these emissions sources demonstrate that under typical meteorological conditions air masses are reasonably expected to travel to, and influence air quality in Sheridan, Wyoming.

This conclusion validates and enhances the finding in the AQD's Network Assessment that future gaseous monitoring is needed to characterize air quality in the city of Sheridan, WY. The AQD plans to site a mobile monitoring station in or around the city of Sheridan in early 2017.

Appendix E: EPA Region VIII Letter to the AQD on the 2016 Annual Network Plan

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 8
1595 Wynkoop Street
Denver, CO 80202-1129
Phone 800-227-8917
www.epa.gov/region8

Ref: 8P-AR

MAR 06 2017

Received
MAR - 9 2017
Air Quality Division

Nancy E. Vehr Administrator
Air Quality Division
Wyoming Department of Environmental Quality
200 West 17th Street, Third Floor
Cheyenne, Wyoming 82002

Re: Clarification on 2016 Wyoming Annual Monitoring Network Plan

Dear Ms. Vehr:

In our letter to you dated November 3, 2016, EPA approved the 2016 Wyoming Annual Monitoring Network Plan (AMNP) with a couple of clarifications. Those clarifications pertained to Section 4.6 of the AMNP which details how the state plans to meet the requirements of the Sulfur Dioxide (SO_2) Data Requirements Rule (DRR) for characterizing SO_2 air quality through the monitoring option. Recent discussions with the EPA Office of Air Quality Planning and Standards (OAQPS) have informed us that a further clarification to Section 4.6 of the 2016 AMNP is required pertaining to approval authority for a combined Quality Management Plan/Quality Assurance Project Plan (QMP/QAPP).

At section 4.6.1.2 of the 2016 AMNP, in a paragraph titled, "Quality System Independence," the following language is found: "The industrial monitoring entity must submi: a combined QMP/QAPP to the AQD for approval by October 31, 2016. Approved QMP/QAPPs will be supplied to EPA Region VIII per Title 40 Part 58 Appendix A2 of the CFR." This language is contradictory to 40 CFR part 58, appendix A, section 2.1.1 which states in part: "The QMP must be suitably documented in accordance with EPA requirements (reference 2 of this appendix), and approved by the appropriate Regional Administrator" and also "Smaller organizations, organizations that do infrequent work with the EPA or have monitoring programs of limited size or scope may combine the QMP with the QAPP if approved by, and subject to any conditions of the EPA." We are clarifying with this letter and with OAQPS concurrence that industrial monitoring entities in Region 8 which are subject to 40 CFR part 58, appendix A, section 2.1.1 must submit their QMPs and QAPPs to EPA Region 8 for review and approval.

Albion Carlson, of my monitoring staff, informed Ms. Cara Keslar, of your staff, about this clarification in a telephone conversation and a follow-up email on January 12, 2017. In a February 7, 2017 email, Ms. Keslar indicated the WDEQ would continue to follow its AMNP until additional official communications between the EPA and the WDEQ were conducted. We anticipate this letter is sufficient communication for the WDEQ to begin submitting the QMPs and QAPPs received from industrial monitoring entities to Region 8 for review and approval. We encourage you to conduct and document your own review of these plans prior to submitting them to Region 8. You should plan to revise Section

4.6 when the 2017 AMNP is routinely updated and submitted to the EPA for review and approval. Maintaining a copy of this letter as an addendum to the 2016 AMNP is sufficient to document this required deviation from the AMNP in the interim.

We appreciate your continued efforts as we work together on implementing the DRR and addressing Wyoming's unique circumstances. If you have any questions on this issue, please contact me at (303) 312-6936 or Albion Carlson, of my staff, at (303) 312-6207.

Sincerely,

Monica Morales, Acting Director
Air Program

cc: Cara Keslar, Wyoming DEQ

Appendix F: SO_2 NAAQS Designation Recommendation Letter

MATTHEW H. MEAD
GOVERNOR

THE STATE OF WYOMING

2323 Carey Avenue
CHEYENNE, WY 82002

Office of the Governor

January 13, 2017

Shaun McGrath
Region 8 Administrator
U.S. Environmental Protection Agency
1595 Wynkoop Street
Denver, CO 80202-1129

Re: Wyoming's Designation Recommendations for the 2010 one-hour Sulfur Dioxide Primary National Ambient Air Quality Standard - Areas Subject to the Data Requirements Rule (EPA Round 3 Designations)

Dear Administrator McGrath,

Pursuant to the Clean Air Act, the State of Wyoming provides the following designation recommendations for the 2010 one-hour Sulfur Dioxide (SO_2) Primary National Ambient Air Quality Standard (NAAQS) for areas subject to the Data Requirements Rule (DRR). 42 U.S.C. § 7407(d)(3); 40 C.F.R. §§ 51.1200 - 51.1205. The Environmental Protection Agency (EPA) commonly refers to these as "Round 3" designations. Wyoming's recommendations are based on modeling analyses performed pursuant to 40 CFR 51 Subpart BB, otherwise known as the Data Requirements Rule, and other EPA guidance. Additionally, the State of Wyoming recommends the area surrounding the Jim Bridger Power Plant be designated based on existing monitored SO_2 data. These updated recommendations supplement my initial recommendations made on May 24, 2011.

I. Background

On June 22, 2010, the EPA replaced the 24-hour and annual SO_2 national standard with a new one-hour standard of 75 parts per billion (ppb). Primary National Ambient Air Quality Standard for Sulfur Dioxide; Final Rule, 75 Fed. Reg. 35520 (June 22, 2010); (codified at 40 C.F.R. § 50.17pt. 50). The EPA's adoption of this new national standard also triggered the requirement for each state governor to submit designation recommendations to EPA. 42 U.S.C. § 74107(d). Therefore, on May 24, 2011, I recommended that EPA designate all counties within Wyoming as "unclassifiable," excepting those portions under Tribal jurisdiction. *See* Letter from Governor Matt Mead to James B. Martin, Regional Administrator, EPA Region 8 (May 24, 2011).

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On August 3, 2012, the EPA announced that it had extended its deadline to complete the designations. Extensions of Deadline for Promulgating Designations for the 2010 Primary Sulfur Dioxide National Ambient Air Quality Standard, 77 Fed. Reg. 46295 (Aug. 3, 2012). Six months after extending the deadline, EPA Region 8 responded to my recommendations submitted back in May 2011. *See* Letter from James B. Martin, EPA Region 8 Administrator, to Governor Matt Mead (Feb. 6, 2013). EPA determined that its "review of the most recent monitored air quality data from 2009-2011 shows no violations of the 2010 SO_2 standard in any areas in Wyoming. . . and is, therefore, currently deferring action to designate areas in Wyoming." *Id.* at 1. Wyoming concurred with EPA's "no violations" determination. *See* Letter from Todd Parfitt, Wyoming DEQ Director, submitted to Docket ID No. EPA-HQ-OAR-2012-0233 (March 29, 2013). However, Wyoming disagreed with EPA's deferral decision and renewed its request that EPA act on my 2011 recommendations and designate all areas within Wyoming as "unclassifiable." *Id.* The EPA has not yet acted on my 2011 recommendations. However, the EPA noted that it would address these areas in "separate future actions." Air Quality Designations for the 2010 Sulfur Dioxide (SO2) Primary National Ambient Air Quality Standard, 78 Fed. Reg. 47191 (Aug. 5, 2013).

The deadlines by which the EPA must complete its designations for the one-hour SO_2 standard were established via Consent Decree. *See* Order Granting Joint Motion to Approve and Enter Consent Decree and Denying Other Motions as Moot, *Sierra Club v. McCarthy,* No. 3:13-cv-03953 (N.D. Cal. Mar. 2, 2015). The Court Order directed the EPA to complete designations in three additional rounds: July 2, 2016 (Round 2), December 31, 2017 (Round 3), and December 31, 2020 (Round 4). With respect to Round 2, I recommended that Carbon County remain unclassified and be included in the EPA's final round of designations. *See* Letter from Governor Matt Mead to Shaun McGrath, EPA Administrator Region 8 (Oct. 27, 2015). The EPA concurred and did not designate any areas in Wyoming as part of Round 2. Air Quality Designations for the 2010 Sulfur Dioxide (SO2) Primary National Ambient Air Quality Standard – Round 2, 81 Fed. Reg. 45039 (July 12, 2016).

The EPA has also promulgated several rules and issued guidance and technical documents that address factors and information that the EPA intends to use in its "separate future actions" for those additional designation rounds. Specifically, the EPA promulgated a rule that directed states to provide additional modeling or monitoring information on a schedule consistent with the deadlines in the Consent Decree. Data Requirements Rule for the 2010 1-Hour Sulfur Dioxide (SO2) Primary National Ambient Air Quality Standard (NAAQS), 80 Fed. Reg. 51052 (Aug. 21, 2015); (codified at 40 C.F.R. pt. 51, subpt. BB). In accordance with the DRR, the Wyoming Department of Environmental Quality, Air Quality Division (DEQ-AQD or Division) submitted a list of applicable SO_2 sources within Wyoming and the methods for air quality characterization. *See* Letters from Wyoming Air Quality Division to EPA Region 8, dated Jan. 13, 2016 and July 1, 2016; *see also* Wyoming Ambient Air Monitoring Annual Network Plan 2016, submitted June 15, 2016,

supplemented August 8, 2016. The DEQ-AQD also tasked facilities subject to the DRR with providing data to characterize their ambient air quality, either through modeling or monitoring. Those facilities that have pursued the modeling pathway or have existing monitored data to characterize peak one-hour SO_2 concentrations are discussed below, along with the State of Wyoming's designation recommendations based on that data.

II. Designation Recommendations

Basin Electric – Laramie River Station

Basin Electric Power Cooperative (Basin Electric) has chosen to characterize the peak SO_2 concentrations at the Laramie River Station through modeling. The modeling protocol for the Laramie River Station was determined by the EPA Region 8 to align with EPA's DRR modeling guidance on October 18, 2016. The EPA model used to predict ambient impacts of SO2 (AERMOD) produces output in terms of microgram per cubic meter (µg/m3). Therefore, the modeled results are compared to the µg/m3 equivalent of the 1-hour NAAQS for SO2 (75 part per billion), which is 196 µg/m3.

Basin Electric provided the final modeling analysis to DEQ-AQD on November 4, 2016. The Division reviewed the modeling analysis for accuracy and determined that it followed the associated DRR modeling protocol and other EPA guidance. This analysis shows that the 1-hour modeled concentration for comparison to the NAAQS, a concentration of 84.9 $\mu g/m^3$, is well below the 1-hour SO_2 NAAQS of 196.0 $\mu g/m^3$. Details on the modeling analysis can be found in Enclosure 1 on the attached compact disc.

Based on the modeling analysis, the State of Wyoming recommends that the area surrounding the Laramie River Station be classified as Attainment.

Campbell County Electric Generating Unit

The Campbell County Electric Generating Unit (EGU) Group, which includes PacifiCorp's Wyodak plant, Basin Electric's Dry Fork Station, and Black Hills' Neil Simpson II, WyGen I, WyGen II, and WyGen III plants, has chosen to characterize their peak SO_2 concentrations through modeling. The modeling protocol for the group was found by EPA Region 8 to align with EPA's DRR modeling guidance on November 28, 2016.

Campbell County EGU Group provided a final modeling analysis to DEQ-AQD on December 14, 2016. The Division reviewed the modeling analysis for accuracy and determined that it followed the associated DRR modeling protocol and other EPA guidance. This analysis shows that the 1-hour modeled concentration for comparison to the NAAQS, a concentration of 93.7 $\mu g/m^3$, is well

below the 1-hour SO_2 NAAQS of 196.0 $\mu g/m^3$. Details on the modeling analysis can be found in Enclosure 2 on the attached compact disc.

Based on the modeling analysis, the State of Wyoming recommends that the area surrounding the Campbell County EGU Group be classified as Attainment.

PacifiCorp – Naughton

PacifiCorp has chosen to characterize the peak SO_2 concentrations at the Naughton Power Plant through modeling. PacifiCorp provided DEQ-AQD with a modeling protocol which DEQ-AQD reviewed and approved and then submitted to EPA Region 8 for further review. The protocol was acceptable to EPA Region 8 with the exception of PacifiCorp's proposed exclusion of modeling receptors over the nearby Kemmerer Mine. DEQ-AQD had advised PacifiCorp to exclude these receptors because the DEQ-AQD does not consider the area over the nearby mine as ambient air for purposes of the DRR. *See* Enclosure 3 on the attached compact disc (Email from James Thurman, Ph.D., U.S. EPA/OAQPS/AQAD – Air Quality Modeling Group; to Bob Paine, Associate Vice President, AECOM (January 26, 2016, 8:56AM) stating that EPA's policy for purposes of the area designation process was that "receptors should not be sited where a monitor could not be placed. Accordingly, receptors are not to be placed . . . on the secured property of another industrial source").

PacifiCorp proceeded with a modeling analysis that excluded receptors over the Kemmerer Mine, and this analysis is supported by the DEQ-AQD. A final modeling report was provided to DEQ-AQD on December 22, 2016. The Division reviewed the modeling analysis for accuracy and determined that it followed the associated DRR modeling protocol and other EPA guidance. This analysis shows that the 1-hour modeled concentration for comparison to the NAAQS, a concentration of 147.5 $\mu g/m^3$, is well below the 1-hour SO_2 NAAQS of 196.0 $\mu g/m^3$. Details on the modeling analysis can be found in Enclosure 4 on the attached compact disc.

PacifiCorp also provided DEQ-AQD with a modeling analysis that accounts for the proposed conversion of Naughton Unit 3 to a natural gas-fired unit. PacifiCorp will be required to cease coal-firing on Unit 3 in January of 2019 and complete the conversion to natural gas firing by June of 2019. This additional modeling analysis included actual emissions from the current operation of Units 1 and 2 and the potential emissions from Unit 3 after the natural gas conversion. This analysis shows that the 1-hour modeled concentration for comparison to the NAAQS, a concentration of 60.6 $\mu g/m^3$, is well below the 1-hour SO_2 NAAQS of 196.0 $\mu g/m^3$.

Based on the modeling analyses performed, the State of Wyoming recommends that the area surrounding the Naughton Power Plant be classified as Attainment.

PacifiCorp – Dave Johnston
PacifiCorp has chosen to characterize the peak SO_2 concentrations at the Dave Johnston Power Plant through modeling. Several versions of a DRR modeling protocol for Dave Johnston were provided to EPA Region 8 for review, with a final modeling protocol for the plant submitted in early December 2016. The EPA has not provided a formal determination on the acceptability of the protocol, but the final protocol included changes that accounted for all EPA comments on previous protocols.

PacifiCorp provided a final modeling analysis to DEQ-AQD on December 27, 2016. The Division reviewed the modeling analysis for accuracy and determined that it followed the associated DRR modeling protocol and other EPA guidance. This analysis shows that the 1-hour modeled concentration for comparison to the NAAQS, a concentration of 193.7 $\mu g/m^3$, is below the 1-hour SO_2 NAAQS of 196.0 $\mu g/m^3$. Details on the modeling analysis can be found in Enclosure 5 on the attached compact disc.

Based on the modeling analysis performed, the State of Wyoming recommends that the area surrounding the Dave Johnston Power Plant be classified as Attainment.

PacifiCorp – Jim Bridger Power Plant
On September 15, 2016, the DEQ-AQD's Monitoring Section had a call with EPA Region 8 to discuss facilities pursuing the monitoring pathway under the DRR. On this call, Region 8 indicated that it could be possible to make a designation determination under the DRR based on existing 2013-2015 SO_2 data for the Jim Bridger Power Plant in lieu of continuing monitoring at this facility from 2017-2019 as proposed in Wyoming's 2016 Ambient Monitoring Network Plan. In subsequent communications with Region 8, further guidance on pursuing this option was provided. 2013-2015 SO_2 data were submitted by the facility, reviewed by the DEQ-AQD's Monitoring Section, uploaded to the EPA's Air Quality System (AQS) database, and certified. The certification letter was provided by the facility on December 20, 2016 and will be forwarded to Region 8 under separate cover.

After reviewing these data, the DEQ-AQD's Monitoring Section is confident that the quality of the data is sufficient to satisfy the quality assurance requirements of 40 C.F.R. pt. 58, Appendix A and that a designation determination can be made based on the 2013-2015 SO_2 data for the Jim Bridger Power Plant in Air Quality System (AQS). The DEQ-AQD hereby requests that the EPA make a designation determination for the area surrounding the Jim Bridger Power Plant based on the 2013-2015 SO_2 data. The AQS ID number for this site is 56-037-0020, POC-1. The 2015 design value for this monitor is 31 ppb, well below the NAAQS for 1-hour SO_2 of 75 ppb (see Table 1, below).

Table 1: Jim Bridger SO_2 Monitor 2015 Design Value

	99th percentile of 1-hr daily maximum concentrations (ppb)			**2015 DV**
Year	**2013**	**2014**	**2015**	**Average**
Concentration (ppb)	31	32	29	31

Based on a review of the quality of these data, as well as the 2015 design value for this monitor, the State of Wyoming recommends that the area surrounding the Jim Bridger Power Plant be classified as Attainment.

The remaining SO_2 sources in Wyoming to which the DRR applies will be characterizing their peak SO_2 concentrations through monitoring established on January 1, 2017. The EPA has indicated that this monitoring data will be considered in making Round Four designations by December 31, 2020.

Please accept Wyoming's updated recommendations. I look forward to working with the EPA to finalize attainment designations for these areas of Wyoming.

Sincerely,

Matthew H. Mead
Governor

MHM:dp

Encl.

1. Laramie River Modeling Analysis
2. Campbell County EGU Group Modeling Analysis
3. E-mail from EPA-OAQPS on DRR receptor placement
4. Naughton Modeling Analysis
5. Dave Johnston Modeling Analysis

cc: Todd Parfitt, Director, Wyoming Department of Environmental Quality

Appendix G: Updated Section 4.6.1 from the 2016 Network Plan

4.6.1 SO_2 DRR Networks and Delegation of Operations to Industrial Sources

The following plan details how the AQD will delegate and oversee operations of the SO_2 DRR Networks in a manner equivalent to a SLAMS network per Title 40 Part 51.1203(c) of the CFR:

> "…the required monitors shall be sited and operated as a SLAMS or in a manner equivalent to a SLAMS. In either case, monitors shall meet applicable criteria in 40 CFR Part 58, appendices A, C, and E and their data shall be subject to data certification and reporting requirements as prescribed in 40 CFR Part 58.15 and 58.16."

4.6.1.1 History

The AQD's Ambient and Emission Monitoring Section has long worked with EPA Region VIII and facilities to oversee ambient monitoring and requires operations of ambient monitors at facilities to collect data directly comparable to the NAAQS. The AQD's industrial monitoring program has existed since the 1980's and has been developed with EPA Region VIII through several mechanisms including the "Memorandum of Agreement on Procedures for Protecting PM_{10} NAAQS in the Powder River Basin" and the WDEQ – EPA Performance Partnership Agreement. The AQD has a standardized approach to cooperative monitor siting, approving quality assurance plans, oversight of quarterly reporting, reporting and uploading data to AQS, and responding to EPA inquiries for permit-required industrial monitoring stations. The AQD proposes to build upon this approach to implement the SO_2 DRR Network.

4.6.1.2 Title 40 Part 58 Implementation

For implementation of the SO_2 DRR network, the AQD has delegated the responsibility of procurement, siting, and operation of monitoring to facilities that are required to characterize SO_2 concentrations under Title 40 Part 51.1203 of the CFR and have chosen the ambient monitoring pathway in Section (c). The EPA's Office of Air Quality Planning and Standards (OAQPS) has issued a memo discussing the options for implementing a network operated by industry. This proposal outlines the AQD's choices for implementation.

Primary Quality Assurance Organization

The Primary Quality Assurance Organization (PQAO) is defined as

> "a monitoring organization, a group of organizations or other organization that is responsible for a set of stations that monitor the same pollutant and for which data quality assessments can be pooled. Each criteria pollutant sampler/monitor at a monitoring station must be associated with one PQAO."

Furthermore, Title 40 Part 58 Appendix A 1.2.1 of the CFR outlines the common factors that should be considered when defining a PQAO:

> "a) Operation by a common team of field operators according to a common set of procedures;
>
> b) Use of a common quality assurance project plan (QAPP) or standard operating procedures;
>
> c) Common calibration facilities and standards;
>
> d) Oversight by a common quality assurance organization; and
>
> e) Support by a common management organization (i.e. state agency) or laboratory."

Based on the definition and common factors, it is most appropriate to name the industrial facility, company or group of companies (known as "industrial monitoring entity" from here forward) as the PQAO for Wyoming's SO_2 DRR networks. Each industrial monitoring entity is choosing its own contractors to operate the station and perform quality control and quality assurance activities. Each of these entities will therefore have common laboratory facilities, standards, QAPPs, data validation practices and management to some degree. Therefore, the AQD will manage these networks consistent with existing industrial monitoring networks in Wyoming, with the industrial monitoring entity being the PQAO.

Coverage in Network Plans and Network Assessments

The AQD, through oversight of and cooperation with the industrial monitoring entity, will include the SO_2 DRR networks in the AQD's Annual Network Plan beginning in 2016 with the initial siting justification for EPA approval. The AQD will include these sites as a section in subsequent Network Plans and will ensure monitors are meeting the requirements stated under Title 40 Part 58.10 of the CFR. The AQD will also include these networks in the 5-year Network Assessment due in 2020 and subsequent years, if necessary.

Annual Data Certification, Data Submittal, and Archiving Requirements

The industrial monitoring entity will be responsible for appropriate quarterly reporting of validated data to the AQD including:

1) AQS formatted "Raw Data" file including hourly and 5-min SO_2 (or 5-min hourly max) data;
2) AQS formatted "QA/QC file" including all precision checks and any performance audits conducted during the quarter;
3) Written quarterly data summary.

These quarterly reporting items, which include a certification by the Responsible Official, will be submitted to AQD through the AQD's Inventory, Monitoring, Permitting, And Compliance Tracking (IMPACT) system portal no later than 60 days after the end of the quarter. The AQD will review the data and upload the raw and QA/QC data to AQS per Title 40 Part 58.16 of the CFR.

The industrial monitoring entity will be responsible for the Annual Data Certification, by letter to EPA Region VIII, per Title 40 Part 58.15 of the CFR. The AQD will provide necessary annual reports from AQS through the IMPACT system. The AQD will provide training for industrial monitoring entities prior to 2018 on how to properly perform a data certification.

Quality System Documentation

The WDEQ has an approved Quality Management Plan (QMP) in place that allows the AQD to review and approve environmental data collection activities described and covered under QMPs and QAPPs. The AQD has a checklist and review system in place for QAPP approval from industrial monitoring entities. The industrial monitoring entity must submit a draft combined QMP/QAPP to the AQD for approval by October 31, 2016. Final AQD approved QMP/QAPPs will be supplied to EPA Region VIII per Title 40 Part 58 Appendix A2 of the CFR for the Region's review and approval.

Quality System Independence

The AQD plans for industrial monitoring entities to achieve quality independence through a combination of oversight by the AQD Quality Assurance Program and independent contracted performance evaluations. This combination will allow for consistent, qualified oversight with the appropriate levels of management separation. Details are in sections to follow.

Technical Systems Audit Program

EPA Region VIII will perform Technical Systems Audits on the industrial monitoring entities on the three-year schedule as specified in Title 40 Part 58 Appendix A of the CFR.

Measurement Quality Checks

One–point quality control checks will be implemented by the industrial monitoring entity as will an independent contracted annual performance audit. These items will be specified in the approved QAPP and reported to the AQD for upload into AQS.

The implementation of the National Performance Audit Program (NPAP) will be the responsibility of the industrial monitoring entity. Each entity will contract with EPA Region VIII's NPAP auditor or another certified auditor to audit their monitoring networks.

Meeting Probe and Path Siting Requirements

The AQD has worked with industrial monitoring entities and EPA Region VIII during the siting process to ensure that probe and monitoring path siting requirements stated in Title 40 Part 58 Appendix E of the CFR are met and locations represented in the 2016 AQD Annual Network Plan are appropriate for meeting the needs of the SO_2 DRR. Probe and path criteria will be reevaluated during AQD Technical Systems Audits.

4.6.1.3 Conclusion

The AQD has documented a straightforward plan, based on over thirty years of industrial monitoring oversight, that will ensure operations of the SO_2 DRR Networks in a manner equivalent to SLAMS. This proposal addresses all of the major requirements in the Revised Title 40 Part 58 of the CFR as well as considerations addressed in the OAQPS memo including data submittal and certification, quality system documentation, probe and path siting requirements, and measurement quality checks.