South Dakota
Ambient Air Monitoring
Annual Network Plan 2014

South Dakota Department of Environment and Natural Resources
Air Quality Program

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Executive Summary

The South Dakota Department of Environment and Natural Resources (department) develops an annual ambient air monitoring network plan which is a review of the ambient air monitoring network each year as required by Title 40 of the Code of Federal Regulation (CFR), Part 58. The review finds the state's ambient air quality concentrations are demonstrating attainment with EPA's National Ambient Air Quality Standards (NAAQS).

The annual plan is published in the department's air quality website to provide public review and comments so adjustments can be made to meet the needs of the general public before the annual plan is finalized. The annual plan includes the following major sections:

1. Ambient air monitoring goals, plans and needs are in Sections 3.0 through 5.0, respectively;
2. Proposed modifications to the ambient air monitoring network to meet the changing trends, national requirements, and state needs are in Section 6.0.
3. Purchase replacement plan is in Section 8.0
4. Evaluation of collected data compared to the NAAQS is in Section 9.0; and
5. Determination of air pollution trends are in Sections 10.0 and 11.0.

The department will continue to evaluate the following areas for the need to modify the ambient air monitoring network:

1. With the change in deicing operations in Rapid City, the department will continue to evaluate the need for other air monitoring sites in the city if problems with dust indicate a need; and
2. As monitoring rules are finalized by EPA there may be a need for modifications to the ozone and sulfur dioxide testing site locations.

The department is planning the following site modifications in 2014 and 2015 based on the state's needs:

1. The department plans to close KELO Site because the PM2.5 data collected at this site is duplicating the data collected at the SD School Site, which is the state's NCore location.
2. The co-located PM2.5 monitor will be moved from KELO to the Aberdeen Fire Station #1 Site as it is the next highest concentration location in the state.
3. The department plans to combine the two Brookings County sites by closing the City Hall Site and moving the parameter testing to the Research Farm Site.
4. The department will continue to evaluate locations where continuous particulate matter (PM) monitors can replace manual monitors in the network.
5. Plans are to continue to replace the old TA Series FH 62 C14 Thermo BETA monitors.
6. The department will add the Pierre Airport Site to provide $PM_{2.5}$ sampling data in the central part of the state and to use it as training and testing facility.

1.0 INTRODUCTION

The United States Environmental Protection Agency (EPA) through Title 40 of the Code of Federal Regulation (CFR) and the Performance Partnership Agreement requires the South Dakota Department of Environment and Natural Resources (department) to complete an annual ambient air monitoring network plan. EPA's requirements for the annual plan are listed in 40 CFR § 58.10. The annual plan will cover a review of the ambient air monitoring sites and determine if the network is meeting the monitoring objectives in 40 CFR Part 58, Appendixes A, C, D, and E. The annual plan will identify needed modifications to the network such as the termination or relocation of a monitor, termination of an existing station, addition of new parameters, or the establishment of new stations. The annual plan will update compliance concentrations for comparison to the National Ambient Air Quality Standards and to determine trends for each sampling parameter.

The department is required to public notice the annual ambient air monitoring network plan for 30 days prior to submitting the plan to EPA. The department will comply with this requirement by posting this document on the department's Air Quality Program website at the following location for 30 days:

http://denr.sd.gov/des/aq/airprogr.aspx

All comments received by the department during this 30 day period will be addressed by the department and the appropriate changes will be incorporated in the plan. If a substantial change is made to the plan because of a comment, another 30 day public comment period will be completed. The final annual plan will be submitted to EPA for review including all public comments and the department's responses to the comments.

2.0 AMBIENT AIR MONITORING NETWORK HISTORY

In 1972, South Dakota developed and EPA approved a State Implementation Plan (SIP) which included the establishment and operation of an ambient air monitoring network for the state. In 1980, South Dakota submitted a revision to its SIP to upgrade the program by establishing a network of state and local air monitoring stations (SLAMS) and special purpose monitoring (SPM) stations.

In 1985, the state set up the first samplers to test for levels of particulate matter 10 microns in diameter or less (PM_{10}) in anticipation of EPA adopting a PM_{10} National Ambient Air Quality Standards (NAAQS). In 1987, the total suspended particulate (TSP) standard was replaced with the new PM_{10} standard. South Dakota submitted a revised ambient air monitoring network plan to include sampling sites for the new PM_{10} standard and shutdown the TSP monitoring network in 1987.

A new standard was added by EPA for particulate matter 2.5 microns in diameter or less ($PM_{2.5}$) in 1997. South Dakota submitted a revised ambient air monitoring network plan to include sampling sites for the new $PM_{2.5}$ standard. In 1999, $PM_{2.5}$ samplers were added to the ambient air monitoring network to determine compliance with the new standard.

In 1997, a new standard was also set for ozone that lowered the concentration level and moved from a one hour to an eight hour average standard. Due to the standard change and concern with the modeling results by the Ozone Transport Assessment Group, the state started an ozone monitoring network which by 2006 included sites in Sioux Falls, Rapid City, and Wind Cave National Park. South Dakota submitted an attainment designation to EPA on April 15, 2003, designating each county as attaining the new ozone standard. On April 30, 2004, EPA published a federal register notice designating each county in the state as attainment/unclassifiable.

In 2006, EPA revised the $PM_{2.5}$ standard significantly by reducing the 24-hour standard from 65 to 35 micrograms per cubic meter. South Dakota submitted an attainment designation to EPA on December 11, 2007, designating each county as attaining the new $PM_{2.5}$ standard. On December 22, 2008, EPA notified the department they were designating each county in the state as attainment/unclassifiable.

Also in 2006, EPA revoked the PM_{10} annual standard. The scientific evidence did not suggest an association between long-term exposure to coarse particles at current ambient levels and health effects. EPA revoked the annual standard on October 17, 2006.

In 2008, EPA revised the ozone standard and reduced the standard from 0.08 to 0.075 parts per million (ppm). South Dakota is attaining the new standard and submitted a proposed attainment designation package for all counties in the state to EPA on March 6, 2009. The new presidential administration in 2009 asked EPA to stay the implementation of the new ozone standard and re-evaluate the standard. EPA decided to implement the 2008 standard in 2012 so the current standard is 0.075 ppm. EPA on July 20, 2012, designated all counties in the state as attainment/unclassifiable.

The nitrogen dioxide (NO_2) standard was reviewed and a new one-hour standard was set by EPA in 2009. The annual standard was retained without any change in concentration level. The department began monitoring for nitrogen dioxide in 2003 and currently operates nitrogen dioxide monitors in Sioux Falls, Union County, Badlands, and Rapid City. South Dakota submitted an attainment designation to EPA on January 24, 2011, designating each county as attainment for the new one-hour nitrogen dioxide standard. On January 20, 2012, EPA notified the department they were designating each county in the state as attainment/unclassifiable.

EPA also made changes to the air monitoring requirements for lead in 2009. The final rule did not require lead monitoring at the National Core site and all sources in South Dakota have emission levels less than 0.5 ton per year. Therefore, testing for lead is not required at this time. Based on previous lead monitoring and the types of sources in South Dakota, the department submitted an attainment designation to EPA on October 15, 2009, designated each county as attaining the new lead standard. On November 8, 2011, EPA notified the department they were designating each county in the state as attainment/unclassifiable.

The sulfur dioxide (SO_2) standard was reviewed and the 24-hour and annual standards were replaced by a new 1-hour standard set by EPA in 2010. The department began monitoring for sulfur dioxide in 2002 and currently operates sulfur dioxide monitors in Sioux Falls, Union County, Badlands, and Rapid City. South Dakota submitted an attainment designation to EPA on June 2, 2011, designating each county as attaining the new one-hour sulfur dioxide standard. The department is waiting on EPA's decision on the state's recommended designations.

In 2012, EPA review and revised the $PM_{2.5}$ annual average standard from 15 ug/m^3 to 12 ug/m^3. The department submitted a proposal to EPA requesting an attainment designation for each county in the state in December of 2013. The department is waiting on EPA's decision on the state's recommended designations.

Data collected from the ambient air monitoring network is entered into the federal database called the Air Quality System (AQS). Individuals interested in reviewing the air quality data can go to the EPA website at the following address:

http://www.epa.gov/airdata/

3.0 AIR MONITORING GOALS

The department's Air Quality Program was established with the primary goal of protecting the health, welfare and property of South Dakotans from the detrimental effects of air pollution. The Clean Air Act of 1970 and subsequent amendments define air quality standards for various air pollutants necessary to protect the public from injurious pollution concentrations. Air pollution concentrations that exceed these established standards can cause "a public health hazard, nuisance, annoyance or damage buildings, property, animals, plants, forests, crops, exposed metals or otherwise interfere with the enjoyment of life or property."

In order to attain and maintain the NAAQS, the department developed regulations that restrict air pollution from sources, establishes these restrictions in an air quality permit, requires periodic inspections to ensure compliance, and maintains an ambient air monitoring network to provide air quality information and monitor the success of the Air Quality Program.

4.0 AIR MONITORING PLAN

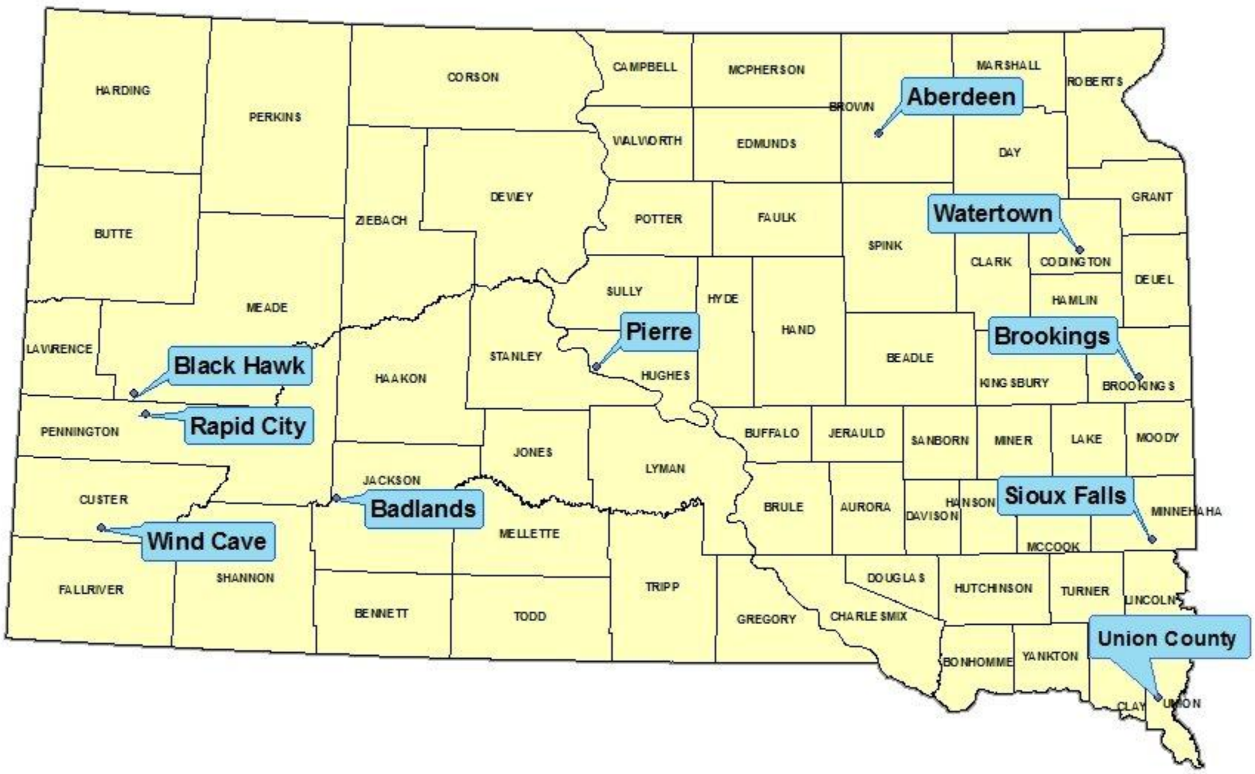
In calendar year 2013, the ambient air monitoring network included 16 ambient air monitoring sites run by the department. Figure 4-1 shows a map of the general locations and cities with ambient air monitoring sites at the beginning of 2013. The following types of ambient air monitors and monitoring sites are operated in South Dakota:

1. State and local air monitoring stations (SLAMS);
2. Special purpose monitors (SPM);
3. Prevention of Significant Deterioration (PSD) monitors;
4. Interagency Monitoring of Protected Visual Environments (IMPROVE) sites;
5. Environmental radiation ambient monitoring systems; and
6. National Core (NCore) multi pollutant sites.

Ambient air monitoring site files are maintained in the department's Pierre office for the SLAMS and SPM sites. The ambient air monitoring site files are available for public review during normal working hours from 8:00 AM to 5:00 PM each workday. The monitoring site files contain at a minimum the following information for each site:

1. AQS site identification form;
2. Sampling location;
3. Sampling and analysis method;
4. Operating schedule;
5. Monitoring objective and spatial scale;
6. Beginning date of operation; and
7. Site maps.

Figure 4-1 – South Dakota Air Monitoring Sites



4.1 State and Local Air Monitoring Stations (SLAMS)

A State and Local Air Monitoring Station consists of an air monitor selected by the state or local air programs to determine compliance with the NAAQS. At the beginning of 2013, 13 of the networks sites have at least one SLAMS monitor for at least one air pollutant parameter. The sites in the network collected PM_{10} data at 12 sites, $PM_{2.5}$ data at 11 sites, sulfur dioxide and nitrogen dioxide at five sites, ozone at six sites and carbon monoxide two sites throughout South Dakota.

4.2 Special Purpose Monitoring (SPM)

A SPM monitor is a generic term for all monitors used for special studies. The data is reported to EPA, the equipment is EPA or non-EPA designated monitoring methods, and the monitoring data is used for special circumstances or needs. Six of the ambient air monitoring network sites operated some kind of SPM monitor in 2013. The parameters tested by the SPM monitors in South Dakota include:

1. Weather stations at the Black Hawk, SD School, Research Farm and UC #1 sites;
2. PM_{coarse} monitor, NOy analyzer, and $PM_{2.5}$ speciation monitors at the SD School Site;
3. RC National Guard Site has a SPM monitor to help define the extent of the PM_{10} high concentration area in western Rapid City; and
4. Radiation monitors operated at the Pierre and RC National Guard sites.

4.3 Prevention of Significant Deterioration (PSD) Monitoring Sites

In 2013, no Prevention of Significant Deterioration monitoring project were started or completed.

4.4 IMPROVE Network

Two Interagency Monitoring of Protected Visual Environments (IMPROVE) sites are being operated by the National Parks Service in South Dakota. The site locations are at the Badlands and Wind Cave National Park. Data results for parameters collected by the National Park Service can be requested from the individual national parks at:

http://vista.cira.colostate.edu/views/Web/Data/DataWizard.aspx.

4.5 Radiation Network (RadNet)

The RadNet sites in Pierre and Rapid City are being operated as a part of the national network of sampling sites. The Pierre Site has been operated since the early 1980s. The state has a limited role in operating the monitor. The state collects the samples, takes preliminary readings of radioactivity levels, and ships the samples to the EPA office of Radiation and Indoor Air. The type of sample collected is airborne particulates and measurements taken are gross beta radiation levels.

In 2009, EPA requested a second site in the state to be located in the Rapid City area. The new RadNet monitor was installed at the RC National Guard Site on May 7, 2009. The site is operated by the department's Rapid City Regional Office in conjunction with the Rapid City National Guard.

The general objectives of the sampling sites are to provide a means of estimating ambient levels of radioactive pollutants in our environment, to follow trends in environmental radioactivity levels, and to assess the impact of fallout and other intrusions of radioactive materials. Specifically, the RadNet monitor was designed to:

1. Provide a direct assessment of the population's intake of radioactive pollutants due to fallout;
2. Provide data for developing a set of dose computational models for specific sources and a national dose computational model to aggregate all sources and determine total population dose;
3. Monitor pathways for significant population exposure from routine, accidental, and terrorist releases of radioactivity from major sources;
4. Provide data for indicating additional sampling needs or other actions required to ensure public health and environmental quality in the event of a major release of radioactivity to the environment; and
5. Serve as a reference for data comparison with other localized and limited monitoring programs.

The radiation data collected at this site may be reviewed at:

http://oaspub.epa.gov/enviro/erams_query.simple_query

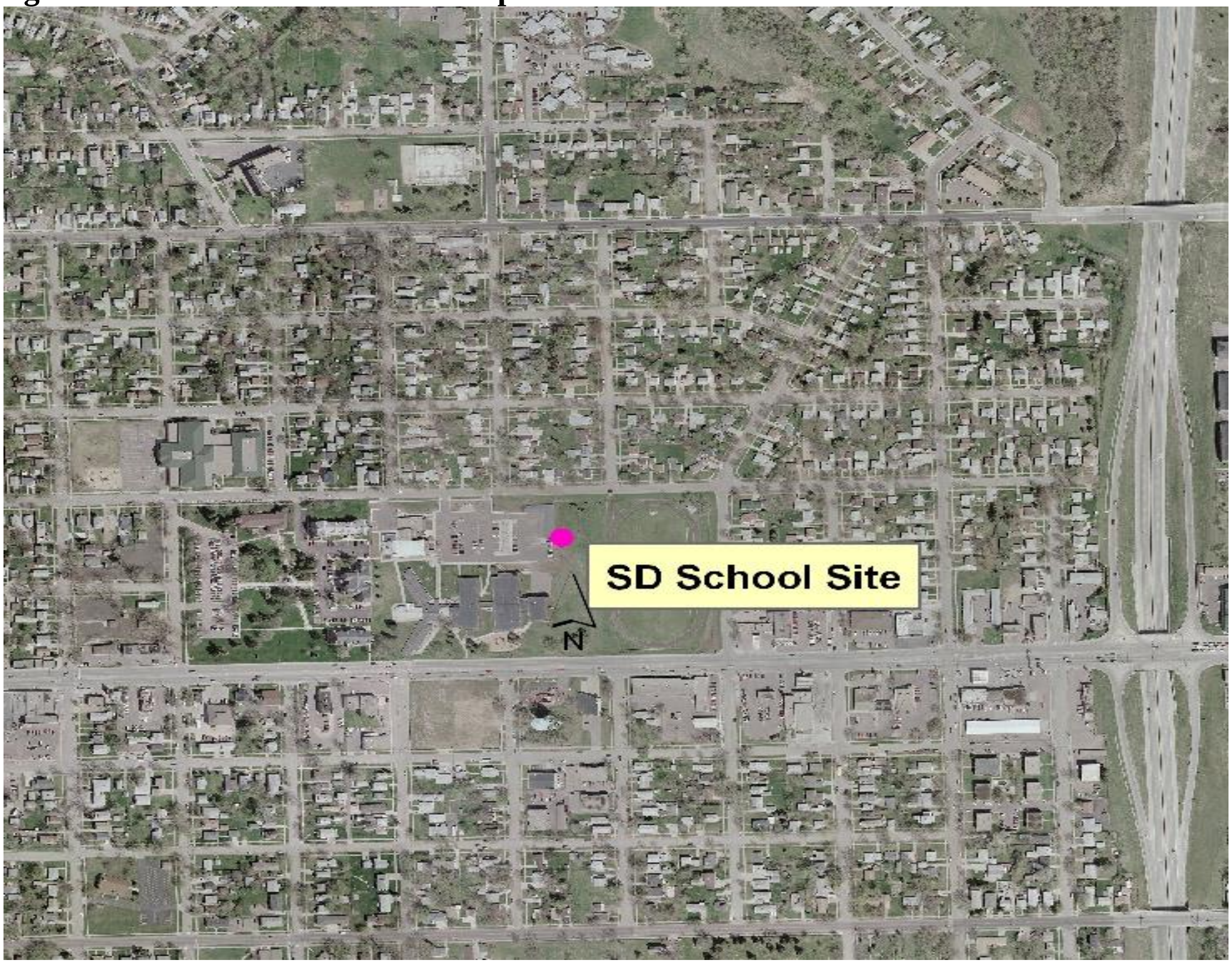
4.6 National Core Multi-Pollutant Site

The National Core (NCore) multi-pollutant monitoring site will provide data on several pollutants at lower detection levels and replaces the National Air Monitoring Station (NAMS) sites that have existed for several years. Each state's ambient air monitoring network is required to have at least one NCore site. At the beginning of 2011, all required parameters were operating at the SD School Site. The NCore site addresses the following monitoring objectives:

1. Timely reporting of data to the public through AirNow for air quality forecasting and other public reporting mechanisms;
2. Support development of emission strategies through air quality model evaluation and other observational methods;
3. Accountability of emission strategy progress through tracking long-term trends of criteria and non-criteria pollutants and their precursors;
4. Support long-term health assessments that contribute to ongoing reviews of the NAAQS;
5. Compliance through establishing nonattainment/attainment areas by comparison with the NAAQS; and
6. Support multiple disciplines of scientific research including public health, atmospheric and ecological.

The NCore site in South Dakota is located on the School for the Deaf campus in Sioux Falls, which is identified as the SD School Site (46-099-0008). This site meets the location requirements to be in an urban residential area. Sioux Falls was selected as the NCore site for South Dakota because it is the largest city in the state and is one of the state's fastest growing communities. See Figure 4-2 for an aerial view of the city around the SD School Site.

Figure 4-2 – SD School Site Area Map



The NCore site collects data for trace level sulfur dioxide (SO_2), nitrogen oxides (NO, NO_2, and NOx), all reactive oxides of nitrogen (NO $NO_{difference}$, and NOy), carbon monoxide (CO), ozone (O_3), $PM_{2.5}$ continuous and filter based manual monitors, $PM_{10-2.5}$ mass, $PM_{2.5}$ speciated, PM_{10} and meteorological parameters of wind speed, wind direction, relative humidity, and ambient temperature.

5.0 AMBIENT AIR MONITORING NEEDS AND REQUIREMENTS

5.1 Monitoring State's Largest Population Centers

South Dakota's industrial base and population centers are typical of the northern plains states. The largest industry in the state is agriculture. Most of the other industries are located in several localized areas. The industries in these locations are typically small (less than 50 employees) and generally do not produce large quantities of air pollutants. Most are considered service oriented businesses or light industrial. The only heavy industrial facilities are the Big Stone Power Plant in Grant County and the quarry area in Rapid City.

The population distribution of the state follows the general industrial distribution. Most of the state's population of 814,180, in the 2010 Census, lives either on the eastern or western third of South Dakota. The two largest cities in South Dakota are Sioux Falls and Rapid City located in southeastern and western South Dakota, respectively. The remaining population is primarily spread across the eastern third of the state with the remaining portion of the state sparsely populated. See Table 5-1 for a list of the 10 largest cities and Table 5-2 for a list of the 10 largest counties in the state.

Table 5-1 – 10 Largest Cities in South Dakota

Ranking	City Name	Counties	Population
1	Sioux Falls	Minnehaha/Lincoln	153,888
2	Rapid City	Pennington /Meade	67,956
3	Aberdeen	Brown	26,091
4	Brookings	Brookings	22,056
5	Watertown	Codington	21,482
6	Mitchell	Davison	15,254
7	Yankton	Yankton	14,454
8	Pierre	Hughes	13,646
9	Huron	Beadle	12,592
10	Vermillion	Clay	10,571

Table 5-2 – 10 Counties with the Highest Populations

Ranking	Counties	Population
1	Minnehaha	169,468
2	Pennington	100,948
3	Lincoln	44,828
4	Brown	36,531
5	Brookings	31,965
6	Codington	27,277
7	Meade	25,434
8	Lawrence	24,097
9	Yankton	22,438
10	Davison	19,504

Given South Dakota's population distribution, most of the air monitoring efforts of the state have in the past been concentrated in the areas of high population. Within these areas of high population, monitoring sites are chosen that will determine areas of high pollution concentration, determine if the NAAQS are being met, identify and attempt to quantify pollutant concentrations emitted by industries, and identify sources that have the potential to release highest amounts of pollutants. Air monitoring sites are currently being operated in or near the five largest cities and seven largest counties in the state.

5.2 Real Time Data

Air monitoring goals have shifted to the collection of data using continuous air monitoring samplers and providing the data as quickly as possible for the public to use. Continuous samplers provide more data at lower operational cost, which is necessary as EPA continues to expand ambient air monitoring programs for the same amount of funding or less. In many cases the continuous emission monitoring can be accessed by telephone and uploaded to a website for public use. The public can then use this data to determine if they need to take extra precautions when doing outdoor activities. The real time information is also used to monitor PM_{10} and $PM_{2.5}$ concentrations when high wind dust alerts are forecasted for Rapid City and is provided to the public on South Dakota’s website at:

http://denr.sd.gov/des/aq/aarealtime.aspx

In 2013, data uploaded from the $PM_{2.5}$ monitors and ozone analyzers at Wind Cave, Badlands, Brookings (Research Farm), Union County (UC #1), Rapid City (RC Credit Union), Watertown, and Sioux Falls (SD School) sites were reporting hourly data to EPA’s AirNow website at:

http://www.airnow.gov/

This data along with other monitoring sites around the nation provides the public and EPA with near real time data to show current air pollution levels and forecast levels for long range transport. The goal for the future is to add other locations in the state to this website and to the department’s website.

5.3 Class I Areas

With the development of coal bed methane and oil and gas from fracking production in North Dakota, Wyoming, Montana and Colorado there is a growing need for data in rural and small cities in the western part of the state. In addition, South Dakota has developed a plan to implement the regional haze regulations required by the federal Clean Air Act. The implementation of these regulations will put more importance on air pollution levels in the state’s two class I areas of Badlands and Wind Cave National Parks.

Ambient air monitors were placed in these areas in order to determine background levels and the impact of long range transport of air pollutants like particulate matter, ozone, sulfur dioxide, and nitrogen dioxide. In addition, continuous data is needed for modeling purposes to help in determining air quality permit requirements. The National Park sites collect data from

IMPROVE monitors for PM_{10}, $PM_{2.5}$, and chemical analysis of the collected particulates. The department collects PM_{10}, $PM_{2.5}$, sulfur dioxide, nitrogen dioxide, and ozone data at the Badlands Site and PM_{10}, $PM_{2.5}$, and ozone data at the Wind Cave Site.

5.4 Ozone Monitoring

Ozone levels in the nation are being impacted by long range transport from within the nation and internationally. In some cases, states are observing rural ozone levels higher than ozone levels in large cities. This is a serious problem for states in the eastern half of the nation in meeting the current ozone standard and is beginning to be a problem in the western half of the nation. Colorado, Wyoming and Utah are recording issues with high ozone levels in their rural areas with some of the highest levels coming in winter months. It will be important to maintain ozone monitoring in all areas of South Dakota to determine if long range transport of air pollution affects ozone concentration in rural and urban areas.

Past national modeling efforts show there is potential for having ozone concentrations near the standard in the east and southeastern parts of the state. Monitoring sites were added in 2008 in Union and Brookings counties to more accurately determine if the population is being exposed to high ozone levels. The eastern third of the state now has three ozone monitoring sites.

The western half of the state has ozone testing sites on the west middle part of the geographic area. Future testing may be needed in the northwest and southwest parts of the state to better characterize ozone levels in the western part of the state.

5.5 $PM_{2.5}$ Monitoring

In 2006, EPA significantly lowered the 24-hour $PM_{2.5}$ standard from 65 micrograms per cubic meter (ug/m^3) to 35 ug/m^3. EPA also lowered the annual standard from 15 ug/m^3 to 12 ug/m^3 in 2012. These revisions of the standards brought the compliance levels close to the concentrations recorded at the monitoring sites in the state's network.

Since then, testing for $PM_{2.5}$ levels is a higher priority in South Dakota because recorded concentrations are significantly closer and may exceed the current 24-hour standard. Sample concentrations in the eastern half of the state are higher than the western half. The southeast part of the state has the highest levels in the state followed by the northeast area.

5.6 Metropolitan Statistical Areas

40 CFR Part 58, Appendix D, contains information used to design an ambient air monitoring network and lists three basic objectives in designing an ambient air monitoring network. The three basic objects are listed below:

1. Provide air pollution data to the general public in a timely manner. The department accomplishes this objective by providing Near Real Time data on the department's website at:

http://denr.sd.gov/des/aq/aarealtime.aspx

The data on this website includes hourly data from the Sioux Falls and Rapid City sites. It also includes other cities like Black Hawk and Watertown sites and rural areas like Union County, Badlands and Wind Cave sites. Specifically in the Rapid City area, High Wind Dust Alerts are called when meteorological conditions are forecasted that could cause high PM_{10} concentrations. This information along with a report graphing hourly concentrations recorded during the alert is also provided to the public through the department's website;

2. Support compliance with ambient air quality standards and emissions strategy development. The department accomplishes this objective by locating the sites throughout the state to assess the permit control measures and pollution emission impacts on the state. For example, the Rapid City air monitoring sites specifically evaluate the permit control measures and the special measures taken to reduce fugitive dust levels; and
3. Support for air pollution research studies. The department supports research by loading the air quality data into EPA's AQS database site and by supporting local studies when requested by the state's colleges.

EPA identified in Appendix D the air monitoring requirements for ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, particulate matter, and lead. The number of required air monitoring sites for ozone and particulate matter is based on the state's Metropolitan Statistical Areas (e.g., determined by the population of the MSA and each pollutant's design value in the MSA). Each design value is specific to the pollutant and form of the standard. To determine the number of monitoring sites, the design value is calculated based on the pollutant concentration and the applicable form of the standard in 40 CFR Part 50, divided by the applicable pollutant's standard in 40 CFR Part 50, and the results multiplied by 100. The percentage is compared to the values in Appendix D to determine the minimum number of monitoring sites.

If there is no ambient air monitoring data for the MSA, only the minimum number of sites listed in Appendix D is required to be operated. If there is a minimum of three years of air quality data for the MSA, a design value is calculated. If the MSA has a design value greater than 85% of the standards for ozone and $PM_{2.5}$ and 80% of the standard for PM_{10} the required number of sampling sites continues to increase as the population increases. If the highest concentration site in a MSA has a design value less than 80% for PM_{10} and 85% of the standard for other pollution parameters the required number of sites may be one or even zero depending on the design value and population of the MSA.

There is one additional ambient air monitoring requirement in Appendix D for an ozone network. If a MSA is required to have one or more ozone monitor, at least one of the ozone monitoring sites is required to be located at the expected high concentration area for the MSA.

Table 5-3 shows the population, design values and the minimum site requirements for the Sioux Falls, Rapid City, and Sioux City MSAs in the state after adding the data for 2013 sampling year.

Table 5-3 – 40 CFR Part 58, Appendix D Requirements for MSA

2010 MSA Population	Counties	Site	AQS ID	Maximum Design Values	> NAAQS Criteria (Yes or No)	Minimum Sites Required
Sioux Falls MSA						
169,468 44,828 5,618 8,347 **Total: 228,261**	Minnehaha Lincoln McCook Turner	SD School	46-099-0008	PM_{10} 24-hour = 47%	No [1]	0
		SD School	46-099-0008	$PM_{2.5}$ 24-hour = 57%	No	0
		KELO	46-099-0006	$PM_{2.5}$ 24-hour = 60%		
		KELO	46-099-0006	$PM_{2.5}$ Annual = 73%	No	0
		SD School	46-099-0008	$PM_{2.5}$ Annual = 64%	No	0
		SD School	46-099-0008	Ozone 8-hr = 91%	Yes	1
Rapid City MSA						
100,948 25,434 **126,382**	Pennington Meade **Total:**	National Guard	46-103-0013	PM_{10} 24-hr = 47%	No	0
		RC Credit Union	46-103-0020	PM_{10} 24-hr = 84%		
		Black Hawk	46-093-0001	PM_{10} 24-hr = 29%		
		RC Library	46-103-1001	PM_{10} 24-hr = 65%		
		RC Credit Union	46-103-0020	$PM_{2.5}$ 24-hr = 43%	No	0
		RC Library	46-103-1001	$PM_{2.5}$ 24-hr = 40%		
		RC Credit Union	46-103-0020	$PM_{2.5}$ Annual = 52%	No	0
		RC Library	46-103-1001	$PM_{2.5}$ Annual = 48%		
		Black Hawk	46-093-0001	Ozone 8-hr = 83%	No	0
Sioux City MSA						
14,399	Union, SD	UC #1	46-129-0001	PM_{10} 24-hr = 55%	No	0
6,000 21,006	Dixon Dakota, NE	UC #2	46-129-0002	PM_{10} 24-hr = 45%		
102,172	Woodbury, IA	UC #1	46-129-0001	$PM_{2.5}$ 24-hr = 63%	No	0
		UC #2	46-129-0002	$PM_{2.5}$		

2010 MSA Population	Counties	Site	AQS ID	Maximum Design Values	> NAACS Criteria (Yes or No)	Minimum Sites Required
143,577	**Total**			24-hr = 63%		
		UC #1	46-129-0001	$PM_{2.5}$ Annual = 78%	No	0
		UC #2	46-129-0002	$PM_{2.5}$ Annual = 73%		
		UC #1	46-129-0003	Ozone 8-hr = 84%	No	0

[1] – Less than three years of data.

The department operates the following additional types of monitors to meet the specific network requirements in 40 CFR Part 58, Appendix D:

1. $PM_{2.5}$ speciation monitor in Sioux Falls at the SD School Site; the largest urban area in the state;
2. $PM_{2.5}$ background and transport monitors at the Badlands and Wind Cave sites; and
3. NCore monitoring equipment located in the city of Sioux Falls at the SD School Site.

Another requirement in Appendix D is providing for a Photochemical Assessment Monitoring Stations (PAMS) which is required in areas classified as serious, severe, or extreme nonattainment for ozone. South Dakota is not required to have a PAMS site.

There is no Appendix D required population air monitoring sites for carbon monoxide. The only carbon monoxide air monitoring site required is at the NCore Site. Carbon monoxide air monitoring started at the SD School Site in 2011.

There are population monitoring requirements for nitrogen dioxide but the core based statistical area (CBSA) must have a population level of 500,000 or greater. There are no population based monitoring sites required by EPA for South Dakota.

Sulfur dioxide has a population based monitoring requirement for a CBSA. The monitoring requirement is based on a calculation using the total amount of sulfur dioxide, in tons, emitted within the counties in the CBSA area and the population within the CBSA counties. The calculation is called the population weighted emissions index for the CBSA. Union County is part of the Sioux City CBSA and is the only area in South Dakota with a population weighted emissions index that has a value high enough to require a monitoring site. The EPA rules require the monitoring site to be located in the parent CBSA or Sioux City, Iowa area in this case. No population weighted emissions index required sulfur dioxide monitoring sites are required in South Dakota.

The minimum requirements for lead are based on the lead air emissions from a source or airport with an annual emissions rate of 0.5 tons per year. There are no sources with an emission rate at or over 0.5 ton per year so there are no required monitoring sites in South Dakota.

5.7 Future Monitoring

There is currently minimal monitoring being completed in other parts of the state that have small, but expanding populations and industries. These areas include the northeastern and the northern Black Hills portions of the state. These areas will continue to be evaluated to determine whether additional monitoring efforts need to be conducted in those areas.

PM_{10}, $PM_{2.5}$ and ozone will be the focus of the ambient air monitoring network as levels of these pollutants have the greatest potential to have concentrations close to the standard as EPA continues to lower the NAAQS for these pollutants.

Also EPA has determined all large sources of sulfur dioxide need to be characterized by either modeling the sources emissions or air monitoring around the source to determine if there are short term high concentrations of Sulfur dioxide that could affect public health. The proposed rule would require states to model or monitor these source areas before EPA will determine the attainment status of the county or area.

South Dakota has one source area, Big Stone Power Plant, indicated by EPA in the proposed rule that could be required to be characterized. If these rules are finalized including the Big Stone Power Plant as a required area to be characterized air monitoring would have to be started by January 1, 2017 and three complete years of data collected by December 31, 2020.

6.0 NETWORK MODIFICATIONS FOR 2014 and 2015

6.1 New Sites

The department will make the following changes and will continue to evaluate the following areas for the need to modify the ambient air monitoring network:

1. The department is planning a new SLAMS site to be located in Pierre, South Dakota. The site will test for $PM_{2.5}$ and will begin operation at the beginning of 2015.
2. With the change in the sanding and deicing operations in Rapid City, the department will continue to evaluate the need for other air monitoring sites in the city if problems with dust are noted.
3. There continues to be a need to collect up to date concentrations in the rural areas of the state. This would include setting up a site and test for four consecutive quarters to provide current background levels in areas such as the northwest and central parts of the state for all parameters and ozone, SO_2 and NO_2 in the northeast area.

6.2 Sites Closed

1. The KELO Site in Sioux Falls collects data for $PM_{2.5}$ and the data results are very close or duplicate the results at the other site in Sioux Falls (SD School Site). The department plans to close the KELO Site at the end of 2014. See Section 13.0 for more information comparing the data from each site.
2. The City Hall Site in Brookings will be closed and the monitors will be moved to the Research Farm Site as a cost saving measure at the end of 2014. High concentration days for PM_{10} and $PM_{2.5}$ at the City Hall Site historically occur when levels are high over the eastern part of the state. Concentrations at this site point to regional transport affecting a large area of the state. Placing the monitors at the rural Research Farm Site will continue to report the highest concentrations expected in Brookings County.

6.3 Modifications

The department is planning the following site modifications:

1. The department will continue to evaluate locations were continuous PM monitors can replace manual monitors in the network.
2. The co-located $PM_{2.5}$ monitor on the KELO Site will be moved to the Aberdeen Site because it is the next highest concentration site with manual monitors in the state.
3. Currently some of the Thermo FH 62 C14 BETA monitors are reaching ten or more years of use. The Thermo 5014i was selected as the replacement and two monitors were purchased to begin the phase out of the old Thermo BETA monitors in 2014. The two new Thermo 5014i’s will be located at UC#1 and Credit Union sites.
4. The department plans to combine the air monitoring sites in Brookings County which includes the Research Farm and City Hall sites as a cost savings measure at the end of 2014. The PM_{10} monitors will be added to the Research Farm Site. The manual $PM_{2.5}$

monitors will be replaced with a continuous Met One BAM providing three times the data being collected with the manual monitors.

7.0 REQUEST FOR WAIVER

There were no sampling frequency waivers requested for the 2014 sampling year and none are proposed for 2015.

8.0 EQUIPMENT REPLACEMENT PLAN

8.1 Overview

The Air Monitoring Section (AMS) is tasked with monitoring ambient air quality throughout the state of South Dakota to demonstrate compliance with the NAAQS and to do special testing when needs arise or as required by EPA. In 2013, there were thirteen active sites within South Dakota where criteria pollutants are monitored. The monitored pollutants include: particulate matter (PM_{10} and $PM_{2.5}$), Nitrogen Dioxide, Ozone, Carbon Monoxides, Lead, and Sulfur Dioxide.

The reliable operation of the monitors requires significant investment in both staff time and inventory for upkeep which tends to increase as the monitors age. Monitors should be replaced when they reach an age when cost of upkeep meets or exceeds the cost of new purchase makes fiscal sense.

The average operational age of a PM monitor is about 10 years mainly due to detector and software board failures. With some major replacement of monitor components the operational age may be stretched to 14 years.

Monitors also experience catastrophic failures, at which time a determination is made whether replacing core components on an aging instrument is viable. Some instruments are of an age that parts are no longer available.

8.2 Status of Data Loggers

The AMS currently operates six ESC 8832 style data loggers with one as a backup and three ESC 8816 style data loggers with no reliable backup. ESC has discontinued both styles of data loggers and is offering a newer version 8864. The department has received reports from other states as well as Agile Air that the computer-data logger interface is difficult or impossible to use. There is still a limited availability of 8832’s available through Agile Air. A less desirable option would be to purchase used 8816 or 8832 data loggers. The priority for the data loggers is to replace all the 8816 in the network of sites. The department will continue to look for reliable replacement data loggers.

Table 8-1 provides a location and service record of the existing data loggers at the time this document was written.

Table 8-1 - Data Logger Service Records

S/N	Asset #	Location	Purchased	Series	Purchase $	Comments
3901	NA	Brookings City Hall	<2006	8816	no data	
3802	none	Badlands	<2006	8816	no data	Built out of spare parts
4159	NA	Wind Cave	<2006	8816	no data	
4543	339807	Pierre Lab	2005	8816	$5,142	unreliable
2772	347247	Watertown	2008	8832	$8,485	
2771K	347248	UC #1	2008	8832	$8,485	
2770K	347249	Pierre Lab	2008	8832	$8,485	
2331K	NA	SF School	2008	8832	$8,485	
2431	NA	Research Farm	2008	8832	$8,485	
3992K	NA	RC Credit Union	2011	8832	$8,485	
4467K	351778	Black Hawk	2012	8832	$8,485	

8.3 Manual PM Monitors

8.3.1 Partisol Monitors

The AMS currently operates six Thermo Scientific Partisol 2000i monitors with one in backup and five Thermo Scientific Partisol 2000 monitors (see Table 8-2). Because the Partisol 2000 monitors are new there is no current need to purchase any monitors for the $PM_{2.5}$ manual monitor network of sites.

The 2014 annual plan proposes to close the KELO site which would leave two extra Partisol 2000i monitors. The third Partisol 2000 at the KELO Site would be moved to the Aberdeen Site for Quality Assurance co-location checks. The second change to the air monitoring network would combine the Brookings sites into one so the Partisol 2000 monitors could be replace with a PM continuous monitor leaving two more extra Partisol 2000 monitors.

The proposed changes would provide four extra Partisol 2000 monitors plus a backup monitor that could be used for other purposes in the network of sites.

Table 8-2 – Partisol Service Record

S/N	Asset #	Location	Purchased	Purchase $	Style
1041106	0350223	Brookings B	7/2011	$7,271	2000i
1031106	0350222	Brookings A	7/2011	$7,271	2000i
201021106	0350224	Aberdeen B	7/2011	$7,271	2000i
201011106	0350226	Aberdeen A	7/2011	$7,271	2000i

S/N	Asset #	Location	Purchased	Purchase $	Style
201881204	0351195	Sioux Falls	7/2011	$9,580	2000i
1751203	0351196	Library B	6/2012	$9,580	2000i
1891204	0351197	Library A	6/2012	$9,580	2000i
210881007	0349210	KELO C	8/2010	$6,818	2000FRM
210851007	0349214	SFSD B	8/2010	$6,818	2000FRM
210811007	0349212	KELO B	8/2010	$6,818	2000FRM
210771006	0349211	KELO A	8/2010	$6,818	2000FRM
210801007	0349209	SFSD A	8/2010	$6,818	2000FRM

8.3.2 Hi-Vol PM10 Monitors

The Hi-Vol PM monitors were first used at the beginning of the monitoring program back in 1970s. Some of the current monitors still have parts from the original monitors used to collect Total Suspended Particulates. The original Hi-Vol PM monitor design with pitch roof sampling head is still the reference method for the collection of Lead samples.

The currently used Hi-Vol PM monitors with the large mushroom head have had various parts that have been changed over the 35 plus years of service to modify how the flow rate was controlled and a change in the sampling head of the monitor to test for PM_{10}. This sampling method is still one of the reference methods but it has some operation limits that make it harder to compare recorded sampling results to other sites and to what the public would be exposed to during high concentration periods.

One of these limits is the Hi-Vol PM monitors operate at a high flow rate, 40 cubic feet, compared to the newer low flow PM monitors which have a flow rate of 16.67 cubic meters. A change to the lower flow rate monitor method would bring the a flow levels close to what an adult person breaths and would compare to the newer PM monitors which use the same low flow method in most of the state's PM air monitoring network. In addition a change to the low flow method would save operational costs by eliminate the need to have spare parts and supplies for both the Hi-Vol and low flow methods. The change to low flow monitors would also make it simpler for staff to maintain the monitors, keep an inventory of parts and to keep the standard operating procedures current.

The proposed plan in the next one or two years is to use the extra Partisol 2000 monitors from the network changes described in the Partisol Monitor section to replace the remaining Hi-Vol method monitors at Aberdeen, RC Library, and Blackhawk sites. This proposal would require all five extra Partisol 2000 monitors with no backup. The plan is to purchase one additional monitor so there is a backup Partisol 2000 to support both the PM_{10} and $PM_{2.5}$ manual monitor networks. See Table 8-3 for details on which sites still have PM_{10} Hi-Vol monitors.

Table 8-3 – PM10 Hi-Vol Manual Monitor Service Record

Site	# Monitors	Type	Asset #	Purchase Date
Aberdeen	2	SA/GMW1200	None	Unknown
RC Library	2	SA/GMW1200	None	Unknown
Black Hawk	1	SA/GMW1200	None	Unknown

8.3.3 Speciation PM2.5 Monitors

The AMS currently has one speciation monitor at its NCore site and it was purchased on or before 1999. The sampling lines have been replaced several times and the control unit was return to the manufacturer for major repairs in past years.

When the monitor was purchased the required sampling frequency was every 6th day which was the designed testing frequency when the monitor was purchase. In 2009, EPA changed the sampling frequency to every 3rd day. This requires that a staff member go on weekends to setup the monitor for some of the sampling runs. This is a strain on resources and is one of the reasons this monitor should be considered for replacement in the next three years.

8.4 Continuous PM Monitors

The AMS currently runs five BETA monitors in the field and two are located in our lab with systematic problems. The BETA monitor fleet operated by the AMS is aging with the oldest in operation over 12 years old. The current average age of the monitors is ten years old; the newest of these monitors are nine years old. The expected lifespan of the detectors in the monitor is ten years. The detectors can be replaced at $3,043 each. The problem remaining is the operating system is old and could malfunction at any time because of age making the repair costly with little or no additional operation time.

In addition to the age, every two years, each monitor needs to be sent in to clean the measurement chamber at a current cost of $909.87. No other monitor currently has this requirement. For these reasons, the replacement of the BETA monitors is a high priority for the AMS.

8.4.1 Thermo FH64C14 BETA Monitors

The department has seven Thermo FH64C14 BETA continuous monitors. Table 8-4 provides a description of where each Thermo FH64C14 BETA continuous monitor is located.

Table 8-4 – BETA Service Record

S/N	Asset #	Location	Maintenance Due Date	Purchase $	Date Purchased
405	0339810	Wind Cave	01/08/2015	$13,972	2002
E1000	0343701	Badlands	05/30/2015	$15,447	2005
749	0341980	Pierre Lab	01/09/2015	$12,686	2004

S/N	Asset #	Location	Maintenance Due Date	Purchase $	Date Purchased
814	0341981	Watertown	05/02/2015	$12,686	2004
E1011	0343702	Credit Union	05/14/2016	$13,253	2005
727	0341968	Brookings	07/14/2013	$14,820	2004
412	0339809	Pierre Lab	08/27/2014	$14,572	2002

8.4.2 Thermo 5014i BETA Monitors

The department has two Thermo 5014i BETA continuous monitors. These are new monitors. Both have been placed in the field, one in Union County and one in Pierre (see Table 8-5). The department does not anticipate significant upkeep costs associated with these monitors for several years.

Table 8-5 – 5014 Service Record

S/N	Asset #	Location	Comments	Purchase $	Date Purchased
CM13381007	353481	Pierre Lab	Operational problems	$14,300	2014
CM13361013	353480	UC 1	Running in the field	$14,300	2014

8.4.3 Met One BAM 1020 Monitors

The department has seven operating BAM continuous monitors with two in reserve (See Table 8-6). The oldest monitors are six years old. The department has not had many problems with these monitors but expect to begin having more operational problems as the fleet ages. There is no need to purchase replacement monitors at this time for this method.

Table 8-6 – BAM Service Record

S/N	Asset #	Location	Purchase $	Date Purchased
H2949	0346880	Backup	$21,192	2008
H2972	0346881	SF School	$21,192	2008
H7027	0347244	Backup	$19,159	2008
H7028	0347243	UC #1	$19,159	2008
H7051	0347246	Wind Cave	$19,159	2008
H7236	0347245	Badlands	$19,159	2008
K1801	0349383	SF School	$17,027	2010
M5333	0350197	Watertown	$19,747	2011
M12165	0351076	RC Credit Union	$19,597	2012

8.4.4 PM Monitor Priorities for Equipment Replacement

The Thermo FH64C14 BETA PM continuous monitor is the highest priority for upgrade of the PM monitoring network. This style of monitor has reached it useful life and is starting to have issues that may question the data being collected. The purchase of the Thermo 5014 BETAs in

2013 is the start of that replacement process. If two are purchased per year it will take three more years to replace this type of monitor.

The second priority would be to replace the old PM_{10} Hi-Vols with the Partisol 2000 monitors. The replacement can be completed with current equipment after doing the network changes proposed for the start of 2015. But this change would leave no backup monitor to support both the PM_{10} and $PM_{2.5}$ manual monitoring sites. A backup Partisol 2000 monitor should be purchased in the next two years so this change can be made by the start of 2016.

The process of upgrading the group of data loggers has gone on for many years. The main enemy of the data loggers are lighting strikes that come through the meteorological probes or down the power and phone lines. The purchase of a new data logger every one or two years helps maintain the number and quality of data logger systems. The proposed network changes for 2015 will not improve the data logger status as the data logger at the City Hall Site is an old style 8816 with no screen to verify the sampling and operational data being collected from the samplers.

8.5 Continuous Gas Analyzers and Calibrators

The gaseous pollutant air monitoring network consists of continuous gas analyzers and calibrators that date back to 2003. The department has purchased various pieces of equipment nearly every year over the past decade with the last being an ozone analyzer in 2013. The department typically purchases replacement equipment for instruments that are 7 – 10 years old, although some analyzers, such as ozone can have a longer lifespan. Most of the analyzers and calibrators can be purchased for between $9,000 and $13,000.

8.5.1 Ozone Analyzers

The AMS currently operates ozone analyzers at six sites throughout South Dakota. The department currently has one backup analyzer in the lab purchased in 2013, which is also our newest. The department also has one in the lab used to conduct checks on ozone transfer standards, which could be put in the field in case of an emergency. The ozone instruments have been the most reliable and durable instruments in the monitoring network. In fact, the three oldest instruments are an ozone analyzer and two calibrators purchased in 2003. Although the ozone instruments are very reliable, the department will want to consider purchasing a new analyzer and calibrator in the next few years to replace the current ozone instruments at the Badlands National Park. The two ozone instruments currently at the Badlands were provided by the National Park Service, who operated them before the department took over the monitoring at this site. These instruments were altered by the National Park Service consultant, Air Resource Services, and operate a little differently, which makes it difficult to make repairs.

8.5.2 SO2 Analyzers

The AMS operates SO2 analyzers at four sites in South Dakota. The department also has multiple backup analyzers housed in the lab for use when there is a major repair needed. The SO2 analyzers have been fairly reliable and seldom need to be sent in for repair. Occasionally a lamp or detector needs to be replaced, which is something the department can do in-house. As with most Thermo Scientific instruments, the department does replace the pumps and install pump kits on occasion, which is also something the department does in-house. The oldest model is from 2004, but the department does have a couple backups from 2009 and 2011. The department gained another backup analyzer when Union County site #2 was shutdown and with the current inventory, the department should not have to purchase any new analyzers for at least two to three years.

8.5.3 NO2 Analyzers

The AMS operates NO2 analyzers at four sites in South Dakota. The department has two backup analyzers in the lab with the newest being purchased in 2011. NO2 analyzers have been the most difficult to maintain and operate of the gaseous pollutant analyzers. Replacement parts can be very expensive and if the instrument needs to go back to the factory for repair, the cost can easily reach $1,000 - $2,000. Two of the oldest analyzers in our network, which are C-Series instruments, were purchased in 2004 and 2005. At 9 and 10 years of age, these two analyzers should be replaced in the next year or two as Thermo Scientific has indicated they will stop producing parts for the older C-Series instruments.

8.5.4 CO Analyzers

The AMS operates just one CO analyzer at our NCORE site in Sioux Falls. A CO analyzer was located at Union County #1 for a few years, but has since been shut down and that analyzer is now the backup for the NCORE site. The Thermo Scientific CO analyzer in Sioux Falls has been very reliable with very few issues over the years. The monitor has never needed to go back to the factory for repair and very few replacement parts have been needed, making this instrument fairly inexpensive to operate. With no future expansion of CO sites in the plan for South Dakota there does not appear to be a need for additional CO analyzers at this time.

8.5.5 Multi-gas/Ozone Calibrators

The AMS operates a multitude of multi-gas and ozone calibrators at our monitoring sites. The department originally used primarily Thermo Scientific calibrators to flow gas and ozone to the analyzers for weekly checks and quarterly audits. Since then, the department started purchasing Environics 6103 calibrators, which can be used for multi-gas, ozone and photometer operation and are much lighter and easier to transport. Both calibrators have been very reliable and inexpensive to operate. The annual calibration of the flow controllers in these instruments has been the only recurring cost. The department does have a couple Thermo Scientific 146C and 49C PS calibrators that need to be replaced in the next year or two.

8.5.6 Gas Pollutant Sampling Priorities for Equipment Replacement

The number one priority for gas sampling equipment is the replacement of the ozone analyzer and calibrator at Badlands. Both are older equipment and need to be replaced in the next year or two.

The next priority is to replace the older C Series NO_2 analyzers in the next three years before the manufacturer stops making replacement parts.

The third priority is the replacement of the C Series calibrators that will not have repair parts in future years. A replacement for the site calibrator at the Badlands Site will be the first replaced in future years.

9.0 COMPLIANCE WITH NAAQS

This section provides a comparison of the collected data to the NAAQS. The comparison will determine if an area is attaining the standard. In addition, the comparison will assist in determining if more monitoring stations for certain parameters is needed in an area or an area no longer needs to monitor for a certain parameter or parameters.

9.1 Particulate Matter (PM_{10})

The PM_{10} NAAQS is based on a 24-hour average concentration. The maximum 24-hour average concentration allowed is 150 micrograms per cubic meter (ug/m^3). Attainment with the 24-hour standard is demonstrated when there is less than or equal to one expected exceedance per year averaged over three years. A 24-hour average concentration of 154.4 ug/m^3 is the highest level that still attains the 24-hour standard for PM_{10}.

In 2013, the statewide PM_{10} monitoring network included 12 monitoring locations. Three of the sites recorded data using manual monitors providing 24-hour sample concentrations. Nine of the sites have continuous samplers providing 1-hour concentrations. The main distribution of the PM_{10} air monitoring sites is located in Rapid City with three sites. Two sites are operated in central Union County for preconstruction, construction and post construction of the Hyperion Energy Center. Other city locations with one site include the Sioux Falls, Badlands, Wind Cave, Aberdeen, Watertown, Black Hawk, and Brookings.

In 2011, the SD School Site operated a PM_{10} monitor but the data were collected under actual conditions and not reference conditions so the data cannot be used to compare to the national PM_{10} standard. EPA requires that PM_{10} data be corrected to reference conditions for temperature and pressure. The continuous monitors collecting the PM_{10}, $PM_{2.5}$ and $PM_{10-2.5}$ data was set only to collect data in actual conditions for temperature and pressure. The programing was changed to calculate both actual and reference condition concentrations at the start of 2012.

The design value is determined by a function of the total number of valid samples over the last three years and the ranking of daily concentrations from the highest to the lowest. The number of valid samples in three years determines which daily concentration is the design value for the site. Below are examples of the ranking:

Sampling Frequency	total # of samples	Ranking
Every Day	1095	4th Highest
Every 3rd Day	366	2nd Highest
Every 6th Day	183	Highest

Table 9-1 contains a list of the expected exceedance rate, design value, and attainment status for the PM_{10} ambient air monitors throughout the state for calendar years 2011 to 2013. Sites with a PM_{10} design value 80% or greater than the NAAQS have a potential to have a 24-hour sample exceed the PM_{10} standard. Credit Union Site is the only one that has a design values for PM_{10} concentration more than 85% of the 24-hour standard as calculated using the data between 2011 and 2013.

Table 9-1 – Statewide PM_{10} 24-Hour Concentrations

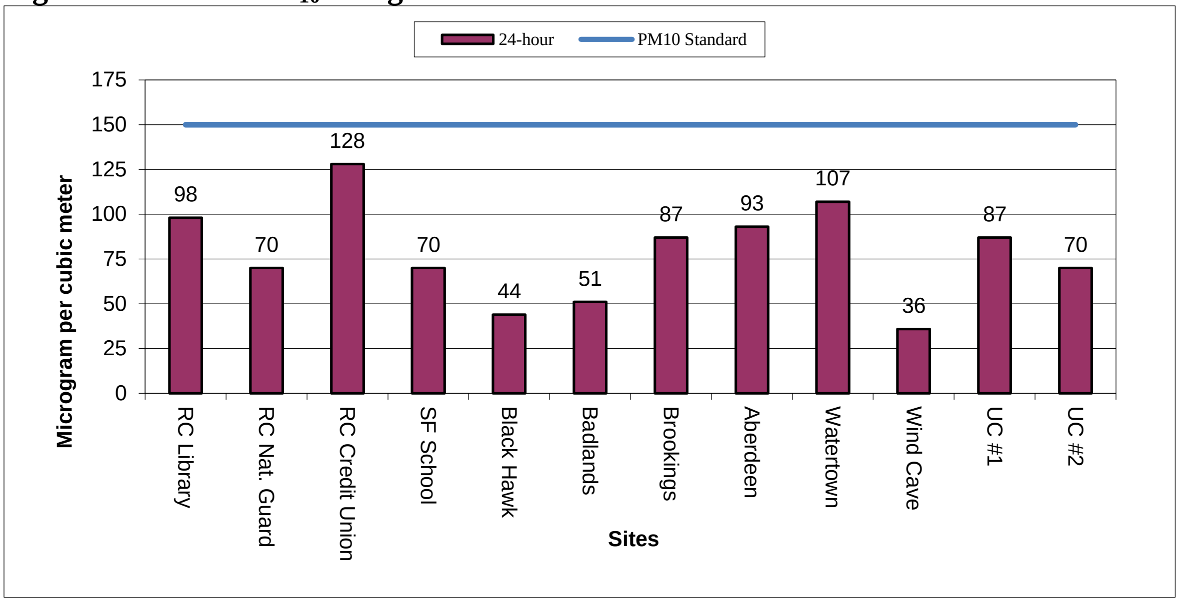
Site	Expected Exceedance Rate	2013 Design Value	Attainment?	Percent Standard
RC Library	0	98 ug/m^3	Yes	65%
RC National Guard	0	70 ug/m^3	Yes	47%
RC Credit Union	0	128 ug/m^3	Yes	85%
Black Hawk	0	44 ug/m^3	Yes	29%
SF School	(2)	70 ug/m^3	NA	47%
Badlands	0	51 ug/m^3	Yes	34%
Brookings	(1)	87 ug/m^3	Yes	58%
Aberdeen	0	93 ug/m^3	Yes	62%
Watertown	(1)	107 ug/m^3	Yes	71%
Wind Cave	0	36 ug/m^3	Yes	24%
UC #1	0	87 ug/m^3	Yes	58%
UC #2	0	70 ug/m^3	Yes	47%

(1) – Site had a 24-hour PM_{10} concentration greater than the standard under exceptional event conditions of high winds in 2011. An exceptional event demonstration is being developed to support the exclusion of this sampling day from a NAAQS calculation for both sites data sets.

(2) - Site has less than three years of data for 24-hour PM10 data.

Figure 9-1 shows a graph of the design value for each PM_{10} site and is based on the data in Table 9-1. The RC Credit Union Site now has the highest PM_{10} design value in the state at 126 ug/m^3 or 84% of the standard. The Credit Union Site increased in concentration by 6 % in 2013. This follows the general trend at this site as the 2013 year recorded several concentrations over 100 ug/m^3 and is the determining factor in the design value for this site. The Watertown Site has the second highest design value at 71% of the standard.

Figure 9-1 – 2013 PM_{10} Design Values Statewide



In 2011, two sites had PM_{10} concentrations greater than the nation standard. Both happened on the same day (October 6, 2011). A high wind event along with very dry soil conditions affected both sites. The Watertown Site had a 24-hour concentration of 157 ug/m^3. The Brookings Site had a 24-hour concentration of 161 ug/m^3. The sampling days affected the attainment status of the Watertown and Brookings sites so the sampling days were flagged by the department and an exceptional event package is being put together. The department will be requesting EPA's concurrence on the high wind event for both the Brookings and Watertown sites if there are any issues with attaining the standard by 2014.

In 2012 and 2013, no PM_{10} concentrations exceeded the 24-hour standard. Currently, all the sites in South Dakota are attaining the PM_{10} 24-hour standard.

9.2 Particulate Matter ($PM_{2.5}$)

The $PM_{2.5}$ NAAQS consists of a 24-hour and annual standard. The 24-hour standard is 35 ug/m^3. Attainment of the 24-hour standard is achieved when the maximum 24-hour average concentration, based on the annual 98th percentile averaged over three years (24-hour average design value), is less than or equal to 35 ug/m^3. The $PM_{2.5}$ annual standard is 12 ug/m^3. Attainment is demonstrated when the maximum annual arithmetic mean averaged over three consecutive years (annual design value) is equal to or less than 12 ug/m^3.

The testing for $PM_{2.5}$ concentrations is one of the major priorities for the state. EPA revised the 24-hour standard significantly lower by 46% in 2006. Sample concentrations that were well under the standard now became levels near the revised standard.

In 2013, there were eleven $PM_{2.5}$ SLAMS sites operated in the state. Federal Reference Method (FRM) manual monitors Partisol 2000 were operated at five of the $PM_{2.5}$ sites. Met One BAM continuous $PM_{2.5}$ monitors with Federal Equivalent Method designation were operated at seven of the sites. The SD School Site operates both methods.

9.2.1 PM2.5 24-Hour Standard

Table 9-2 shows the yearly 24-hour 98th percentile for calendar years 2011 to 2013 used in the calculation of the 24-hour design value for $PM_{2.5}$ in 2013, the 24-hour design value, and designation status of each site. In 2013, the highest 24-hour 98th percentile concentration was 23.5 ug/m^3 or 67% of the standard and was recorded at the UC #2 Site in Union County on a Met One BAM continuous $PM_{2.5}$ monitor. The site with the second highest 24-hour 98th percentile concentration was at the Watertown Site at 23.4 ug/m^3 collected on a Met One BAM continuous $PM_{2.5}$ monitor.

Table 9-2 – Statewide $PM_{2.5}$ 24-Hour Concentrations

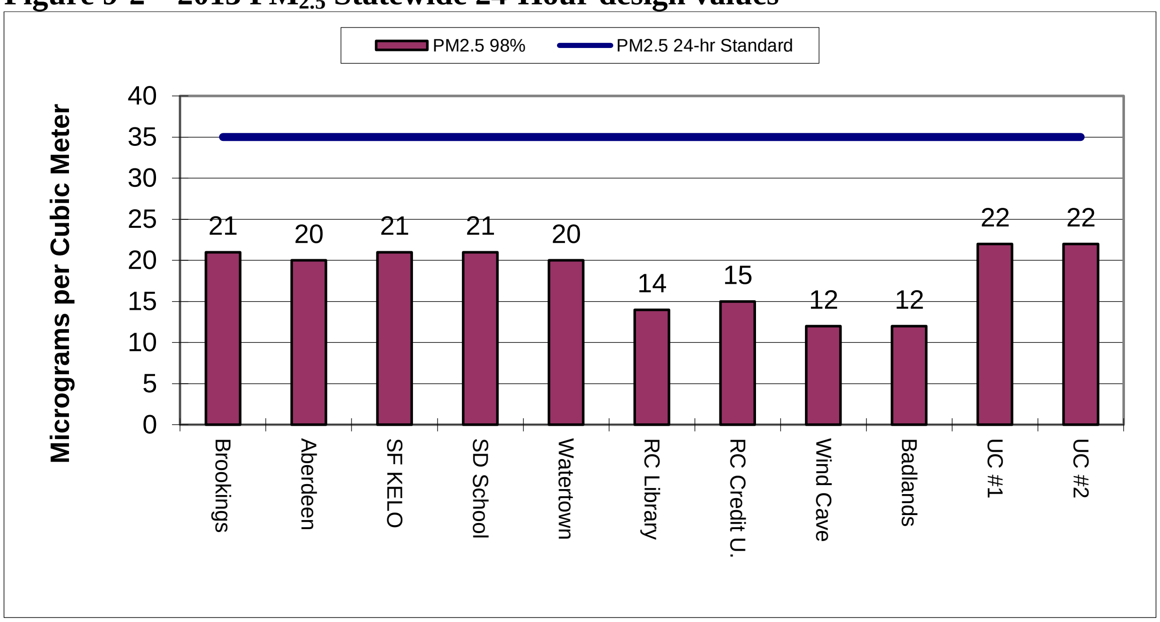
Site	Yearly 98th Percentile	24-hour Design Value 2013	Attainment Status	Percent Standard
RC Library	2011 – 12.3 ug/m^3 2012 – 14.5 ug/m^3 2013 – 14.2 ug/m^3	14 ug/m^3	Yes	40%
RC Credit Union	2011 – 13.1 ug/m^3 2012 – 17.1 ug/m^3 2013 – 15.3 ug/m^3	15 ug/m^3	Yes	43%
Badlands	2011 – 10.0 ug/m^3 2012 – 12.9 ug/m^3 2013 – 13.9 ug/m^3	12 ug/m^3	Yes	35%
SD KELO	2011 – 21.5 ug/m^3 2012 – 20.8 ug/m^3 2013 – 21.8 ug/m^3	21 ug/m^3	Yes	60%
SD School	2011 – 19.4 ug/m^3 2012 – 17.3 ug/m^3 2013 – 23.4 ug/m^3	20 ug/m^3	Yes	57%
Aberdeen	2011 – 15.6 ug/m^3 2012 – 22.6 ug/m^3 2013 – 21.1 ug/m^3	20 ug/m^3	Yes	57%
Brookings	2011 – 18.4 ug/m^3 2012 – 20.6 ug/m^3 2013 – 22.9 ug/m^3	21 ug/m^3	Yes	60%
Watertown	2011 – 18.4 ug/m^3 2012 – 21.5 ug/m^3 2013 – 21.0 ug/m^3	20 ug/m^3	Yes	57%
Wind Cave	2011 – 11.5 ug/m^3 2012 – 14.9 ug/m^3 2013 – 9.4 ug/m^3	12 ug/m^3	Yes	35%
UC #1	2011 – 23.1 ug/m^3 2012 – 19.7 ug/m^3 2013 – 22.6 ug/m^3	22 ug/m^3	Yes	63%

Site	Yearly 98th Percentile	24-hour Design Value 2013	Attainment Status	Percent Standard
UC # 2	2011 – 21.0 ug/m^3 2012 – 20.8 ug/m^3 2013 – 23.5 ug/m^3	22 ug/m^3	Yes	63%

Figure 9-2 contains a graph of the 24-hour design values for each site. The highest design value in 2013 was recorded at the UC #1 and #2 Site with a concentration of 22 ug/m^3 or 63% of the standard. This is a drop in concentration level of 6% from levels in 2012. The Brookings and KELO sites had the next highest design value at 21 ug/m^3. As expected, the background sites at Badlands and Wind Cave had the lowest 24-hour design values for $PM_{2.5}$ at 12 ug/m^3. All sites had a small de-increase or stayed the same in concentration levels with the addition of the 2013 data. All sites are attaining the 24-hour $PM_{2.5}$ standard.

The design values across the state appear to be moving closer to the same concentration levels by region. For example all the east half of state sites are within 2 ug/m^3 of each other. In the western part of the state there is a slightly larger difference of 3 ug/m^3 between sites.

Figure 9-2 – 2013 $PM_{2.5}$ Statewide 24-Hour design values



During 2011 and 2012, none of the monitoring sites had a concentration greater than the 24-hour $PM_{2.5}$ standard. The highest 24-hour $PM_{2.5}$ concentrations in 2013 were recorded in the eastern part of the state on February 24. The two sites in Union County had levels greater than the standard on this day. The other sites in the east part of the state were also high but under the standard.

When using the 98^{th} percentile standard one or two 24-hour $PM_{2.5}$ concentrations greater than the standard at a continuous monitoring site will not affect the 24-hour design value or the area attainment status because the 98^{th} percentile may be the 7^{th} or 8^{th} highest reading for the year.

But these concentrations may affect the annual design value and need to be considered when evaluating the data results for each year.

If a trend develops with high 24-hour concentrations at a site a conceptual theory on what caused the high concentrations can be formed and further developed in future years. In some cases if local sources are causing the problem early actions can be taken to reduce concentration levels and further protect public health from high levels of $PM_{2.5}$.

9.3 PM2.5 Annual Standard

Table 9-3 contains a list of the annual averages, annual design values and attainment status for each of the $PM_{2.5}$ sites using the data from 2011 to 2013 in the state. The highest annual average concentration in 2013 was recorded at UC #2 Site at 10.5 ug/m^3. The second highest annual concentration was at the Watertown Site with an annual average of 9.7 ug/m^3. The Wind Cave Site had the lowest annual average at 3.1 ug/m^3 in 2013, slightly lower than in 2012.

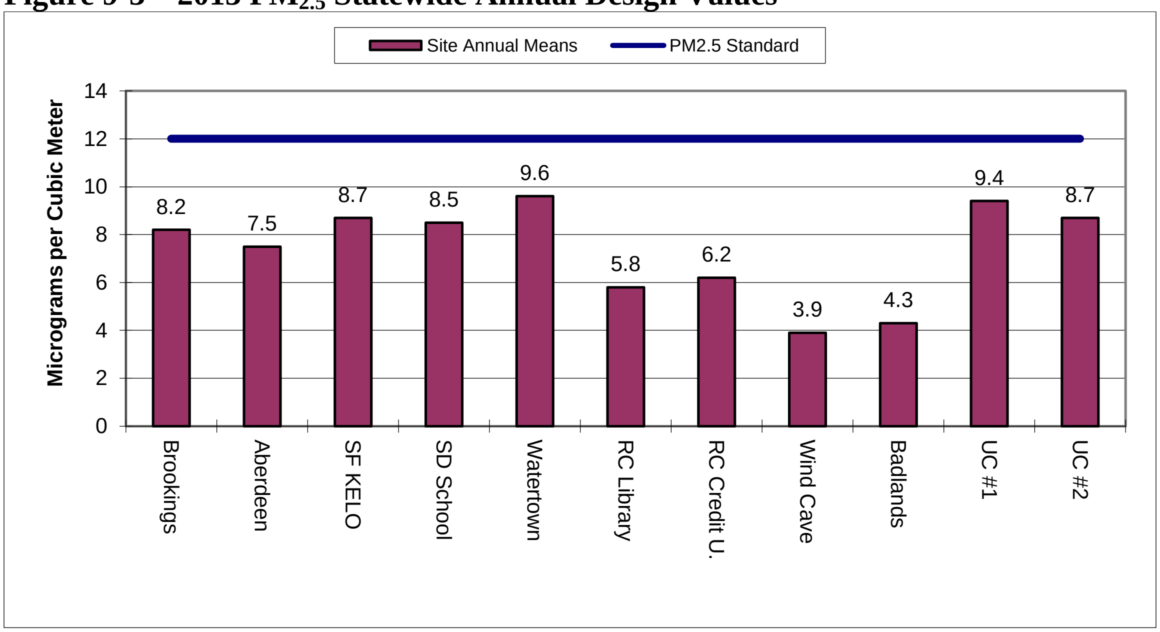
Table 9-3 – Statewide $PM_{2.5}$ Annual Concentrations

Site	Annual Averages	2013 Annual Design Values	Attainment Status	Percent Standard
RC Library	2011 – 5.4 ug/m^3 2012 – 5.8 ug/m^3 2013 – 6.1 ug/m^3	5.8 ug/m^3	Yes	48%
RC Credit Union	2011 – 4.5 ug/m^3 2012 – 6.3 ug/m^3 2013 – 7.9 ug/m^3	6.2 ug/m^3	Yes	52%
Badlands	2011 – 3.5 ug/m^3 2012 – 4.1 ug/m^3 2013 – 5.3 ug/m^3	4.3 ug/m^3	Yes	36%
KELO	2011 – 8.7 ug/m^3 2012 – 8.7 ug/m^3 2013 – 8.6 ug/m^3	8.7 ug/m^3	Yes	73%
SD School	2011 – 8.0 ug/m^3 2012 – 6.0 ug/m^3 2013 – 8.9 ug/m^3	7.7 ug/m^3	Yes	64%
Brookings	2011 – 7.9 ug/m^3 2012 – 8.6 ug/m^3 2013 – 8.2 ug/m^3	8.3 ug/m^3	Yes	69%
Aberdeen	2011 – 7.1 ug/m^3 2012 – 7.5 ug/m^3 2013 – 7.3 ug/m^3	7.3 ug/m^3	Yes	61%
Watertown	2011 – 8.1 ug/m^3 2012 – 11.0 ug/m^3 2013 – 9.7 ug/m^3	9.6 ug/m^3	Yes	80%
Wind Cave	2011 – 3.7 ug/m^3 2012 – 4.9 ug/m^3 2013 – 3.1 ug/m^3	3.9 ug/m^3	Yes	33%

Site	Annual Averages	2013 Annual Design Values	Attainment Status	Percent Standard
UC #1	2011 – 9.3 ug/m^3 2012 – 9.9 ug/m^3 2013 – 8.9 ug/m^3	9.4 ug/m^3	Yes	78%
UC #2	2011 – 8.2 ug/m^3 2012 – 7.5 ug/m^3 2013 – 10.5 ug/m^3	8.7 ug/m^3	Yes	73%

Figure 9-3 contains a graph of the $PM_{2.5}$ annual average design value for each site. None of sites in the network had a 2013 design value that exceeded the annual $PM_{2.5}$ standard. The 2013 annual design value for each site followed the same pattern as the 24-hour levels. The highest design values occur in the eastern third of the state. The highest annual design value occurred at the Watertown Site with a level of 9.6 ug/m^3 which is 80% of the annual standard. The lowest $PM_{2.5}$ annual design value occurred at the Wind Cave Site with a concentration of 3.9 ug/m^3 which is 33% of the annual standard.

Figure 9-3 – 2013 $PM_{2.5}$ Statewide Annual Design Values



9.4 Lead

During the early 1980's, the department conducted lead sampling. The levels detected were well below the NAAQS levels at that time. After passage of the 1990 Clean Air Act Amendments, there were concerns with the way EPA had instructed states in determining if those areas were in attainment of the lead standard. For this reason, a monitoring site was established in April 1992, at the Jaehn's Site in Rapid City to determine compliance with the standard. This site was downwind of GCC Dacotah, which is a cement plant that burns coal and has the potential to emit lead. The results of the analyzed data from the second quarter of 1992 through the first quarter of

1994 showed lead levels well below the NAAQS. Due to the low concentrations of lead in Rapid City, the sampling site was terminated at the end of the first quarter in 1994.

EPA changed the lead NAAQS on October 15, 2008. The change significantly lowers the lead standard from 1.5 ug/m^3 to 0.15 ug/m^3 based on the annual maximum three month rolling average. Attainment of the lead NAAQS is achieved if the annual maximum three month rolling average, averaged over a three year period, is less than or equal to 0.15 ug/m^3.

In 2010, EPA completed a rule change that requires source type testing in addition to network testing if a source has emissions of 0.5 tons or greater per year. The rule originally required lead testing at the NCore Site. The final rule required lead testing at NCore Site only if the site is located in city with a 500,000 and greater population. None of the facilities in the South Dakota emissions inventory have lead emissions at or greater than 0.5 tons per year so no source related testing is required at this time. The NCore site is located in Sioux Falls and the city has a population under 500,000 so no testing is required. Currently, there are no lead sampling sites planned for South Dakota because of the low potential for concentrations of lead pollution.

The lead sampling in the past and current emissions levels indicates that South Dakota is attaining the new lead standard.

9.5 Ozone

Ozone monitoring in South Dakota will continue to be one of the priority air pollutants because concentration are close to the standard. Ozone concentrations have not changed significantly in the state but the revisions of the standard brings the concentration closer to the state’s levels.

In 1999, the first ozone monitor was setup in South Dakota and was located at the Sioux Falls Hilltop Site. In 2000, a second ozone monitor was added at the Robbinsdale Site in Rapid City. In 2005, the Rapid City ozone monitoring site was moved to the RC Credit Union Site because of the planned move of the Robbinsdale sampling shelter to the Wind Cave Site.

In 2003, the National Parks Service added an ozone monitor to the Badlands Site. It is located in a shelter next to the IMPROVE monitors near the park visitor center/headquarters.

In 2005, a fourth ozone site was added at the Wind Cave Site. The Wind Cave Site was added to determine if a large increase in oil and gas mining in Colorado, Wyoming and Montana would cause impacts on the Wind Cave National Park, which is a Class I area.

Air dispersion modeling results completed by the department showed the RC Credit Union Site does not meet location requirements in 40 CFR Part 58 because it is located in the middle of the one microgram impact area for nitrogen dioxide emissions from industrial sources in Rapid City. Nitrogen dioxide emissions artificially lower ozone levels for a short distance from the source so concentrations will not reflect the actual area levels. Because of the nitrogen dioxide emissions the ozone analyzer was moved from the RC Credit Union Site to the Black Hawk Site in 2007.

Beginning in 2008, the Hilltop Site had to be moved and a new location was found at the School for the Deaf campus. The move to a new location was required because the city of Sioux Falls had to revert the Hilltop property back to the original owner when the water tower system was replaced ending the agreement to use the property.

In 2008, a fifth site was added north of Brookings at the Research Farm. The site was setup and operated in cooperation with Brookings 3M and Valero Renewable Fuels Company as part of the issuance of a Prevention of Significant Deterioration permit.

In 2008, EPA adopted a new ozone standard at 0.075 ppm. The form of the standard remained as the fourth highest, daily 8-hour average, averaged over three years (ozone design value). In 2011, EPA implemented the 0.075 part per million standard. EPA is also completing a 5-year review of the ozone standard in 2012 and when completed could further lower the standard.

In 2009, because of an application for a Prevention of Significant Deterioration permit a sixth site was added in the area of the proposed project in Union County UC #3 Site. After the permit expired with no renewal the department moved the ozone analyzer to UC #1 Site.

The 2013 design value in ppm for each of the sites can be seen in Table 9-4 and Figure 9-4. In 2013, the SD School Site had the highest 3-year average ozone concentrations in the state at 0.068 ppm, which is 91% of the 2008 revised ozone standard. The SD School Site replaced the Wind Cave Site as the state's highest concentration site in the state for the first time in 2010 and continues as the highest ozone site. The second highest location is Research Farm Site at 0.064 ppm also located in the eastern edge of the state. Since 2008, both the Wind Cave and Badlands sites are reporting significantly lower ozone design values with the Badlands now the lowest site in the state. Ozone concentrations had a significant increase from 0.007 to 0.012 ppm for most of the sites statewide in 2012. In 2013, ozone concentrations returned to near each site's average level in some cases dropping 0.005 to 0.008 ppm lower. The 2012 data will continue to keep ozone design values higher until the year falls out of the three year calculation in 2016.

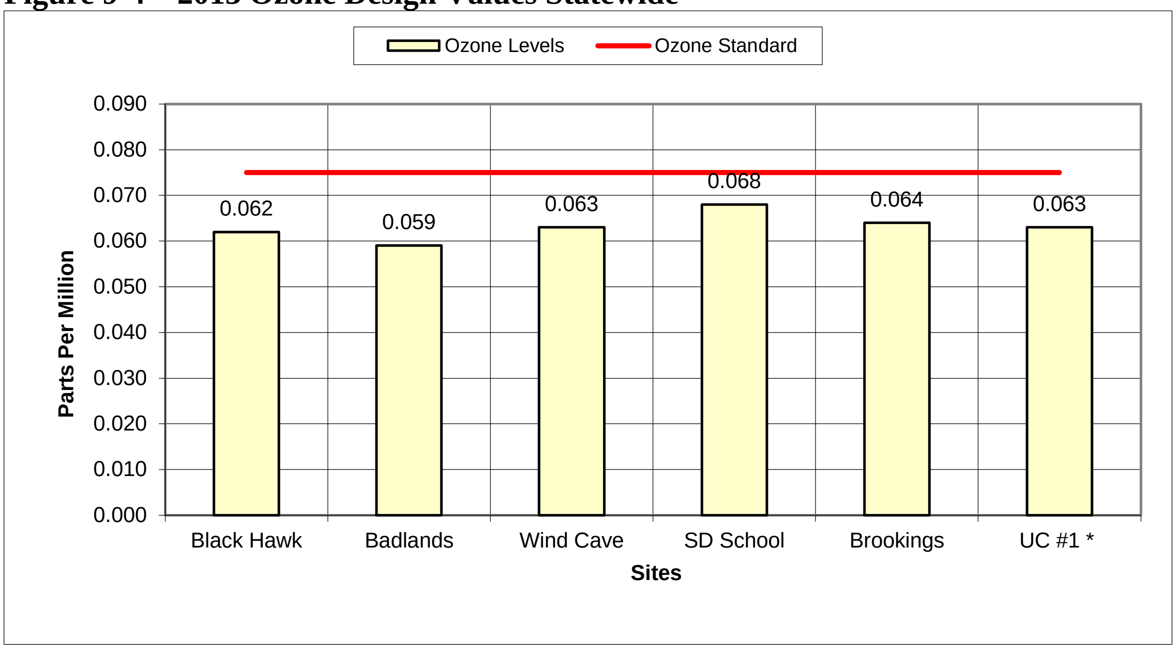
Table 9-4 – Statewide Ozone 4th highest Concentrations

Site	4th Highest Concentration	3-year Average Design Values	Attainment Status	Percent Standard
SD School	2011 – 0.065 ppm 2012 – 0.072 ppm 2013 – 0.067 ppm	0.068 ppm	Yes	91%
Research Farm	2011 – 0.064 ppm 2012 – 0.067 ppm 2013 – 0.063 ppm	0.064 ppm	Yes	85%
Black Hawk	2011 – 0.057 ppm 2012 – 0.068 ppm 2013 – 0.063 ppm	0.062 ppm	Yes	83%
Badlands	2011 – 0.052 ppm 2012 – 0.064 ppm 2013 – 0.062 ppm	0.059 ppm	Yes	79%
Wind Cave	2011 – 0.060 ppm			

Site	4th Highest Concentration	3-year Average Design Values	Attainment Status	Percent Standard
	2012 – 0.069 ppm 2013 – 0.061 ppm	0.063 ppm	Yes	84%
UC #1	2011 – 2012 – 2013 – 0.063 ppm	0.063 ppm	Yes	84%

Currently, the design value at School Site is the highest in the state at 91% of the standard at the end of 2013. This is due to higher than average levels of ozone at all of the sites in 2012. The data collected in the past three years still demonstrates that South Dakota is attaining the national ozone standard but the sites located in the eastern part of the state are close to the 2008 ozone standard.

Figure 9-4 – 2013 Ozone Design Values Statewide



* Less than three years of sampling data.

9.6 Sulfur Dioxide

Concentrations of sulfur dioxide are low in the state where the department believes the greatest sulfur dioxide concentrations should occur and the probability of exceeding the standard is very low. Based on the data collected statewide, testing for this parameter remains a low priority.

Five sulfur dioxide ambient air monitoring sites were operated in 2013. The analyzers were located at SD School, Badlands, RC Credit Union, UC #1, and UC #2 sites. EPA made a major change to the sulfur dioxide standard in 2009 replacing the 24-hour and annual primary standard with a new 1-hour standard. The 1-hour sulfur dioxide standard concentration is 75 parts per billion (ppb) based on the three year average of the yearly 99th percentile level (1-hour design value). The 3-hour secondary standard for sulfur dioxide was not changed by EPA during this review.

9.6.1 Sulfur Dioxide 1-Hour Standard

Table 9-5 contains the yearly 99th percentile concentration, the 1-hour design value, and the attainment status for each site. The site sulfur dioxide design values are based on sulfur dioxide data collected in 2011 to 2013. The highest 99th percentile 1-hour level in 2013 was recorded at the Credit Union, SD School, and Badlands sites at 9 ppb.

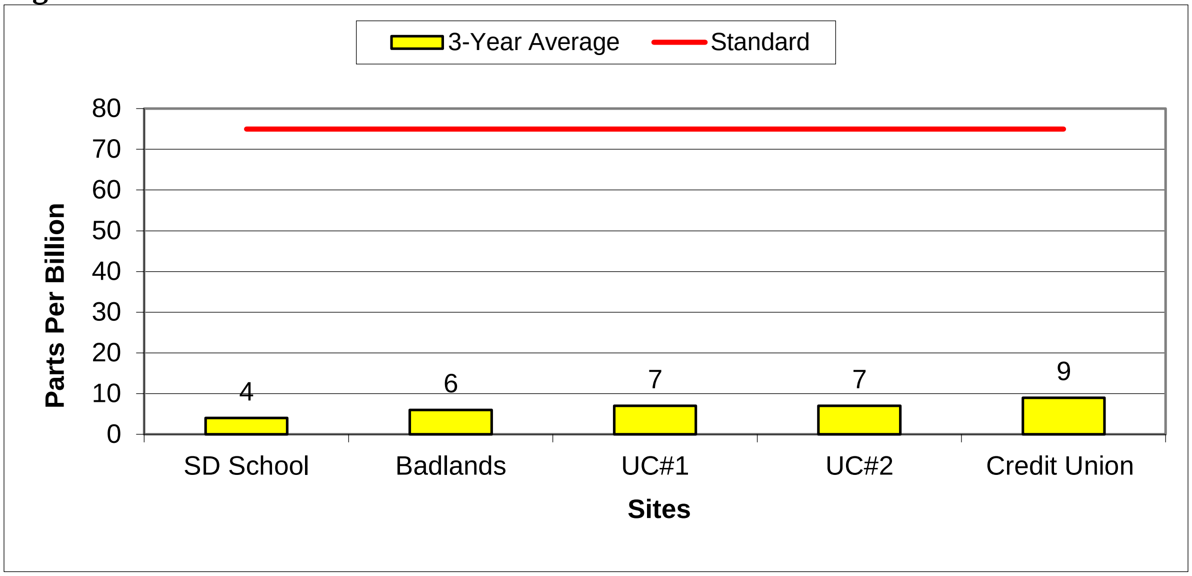
Table 9-5 – 2013 Statewide Sulfur Dioxide 1-hour Design Values

Site	99th Percentile Concentration	3-year Average Design Values	Attainment Status	Percent Standard
SD School	2011 – 4 ppb 2012 – 6 ppb 2013 – 9 ppb	4 ppb	Yes	5%
RC Credit Union	2011 – 8 ppb 2012 – 10 ppb 2013 – 9 ppb	9 ppb	Yes	12%
Badlands	2011 – 6 ppb 2012 – 3 ppb 2013 – 9 ppb	6 ppb	Yes	8%
UC #1	2011 – 7 ppb 2012 – 9 ppb 2013 – 6 ppb	7 ppb	Yes	9%
UC #2	2011 – 8 ppb 2012 – 7 ppb 2013 – 4 ppb	7 ppb	Yes	9%

Figure 9-5 shows the three year average of the yearly 99th percentile or design value for the 1-hour concentration for each of the sites in the network for 2013. All five of the sites recorded concentrations well under the 1-hour standard. The highest 1-hour design value was recorded at the Credit Union Site with a maximum concentration of 9 ppb which is 12% of the standard. The second highest was recorded at the UC #1 and UC #2 sites with a concentration of 7 ppb which is 9% of the standard.

The data collected in the past three years demonstrates that South Dakota is attaining the new 1-hour sulfur dioxide standard.

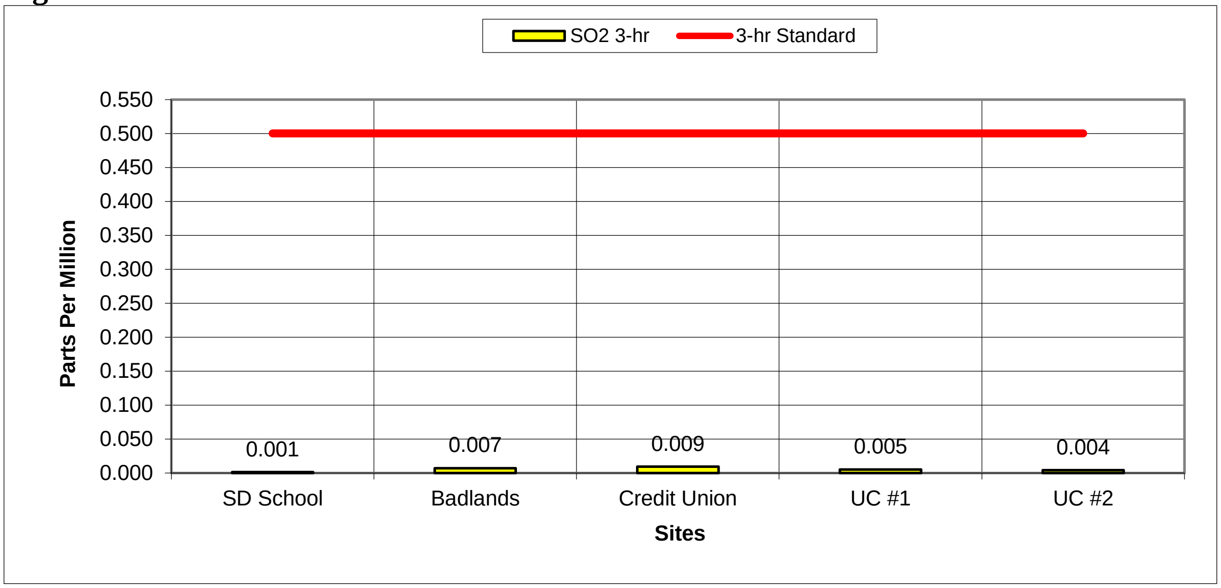
Figure 9-5 – 2013 Sulfur Dioxide 1-Hour Concentrations



9.6.2 Sulfur Dioxide 3-Hour Secondary Standard

The secondary sulfur dioxide standard is based on a 3-hour average concentration of 0.500 ppm, not to be exceeded more than once per year. The graph in Figure 9-6 shows the second maximum 3-hour concentrations for five sites in the network in 2012. The 3-hour sulfur dioxide concentrations for all of the sites are very low. The Credit Union Site recorded the highest 3-hour average in 2013 with a concentration of 0.009 ppm at 2% of the 3-hour standard. Badlands Site had the next highest 3-hour concentration at 0.007 ppm also at 1% of the standard.

Figure 9-6 – 2012 Sulfur Dioxide 3-hour Concentrations



The data collected in 2013 demonstrates that South Dakota is attaining the 3-hour secondary standard for sulfur dioxide. Concentrations at the monitoring sites are very low near the detection level of the analyzer.

9.7 Nitrogen Dioxide

Levels of nitrogen dioxide are very low in the state unless the monitoring site is located close to a major source of emissions. Rural sites like Badlands remain well below the standard. Future priority locations for testing will include one year of testing for current background levels and multiple years of testing near major sources of nitrogen dioxide emissions for compliance with the national standards.

Beginning in 2010 the standard for nitrogen dioxide was revised by adding a 1-hour standard of 100 ppb and keeping the annual arithmetic mean standard of 53 ppb. Attainment is demonstrated when the 3-year average of 98th percentile daily maximum 1-hour concentration is less than or equal to 100 ppb (1-hour design value) and the annual arithmetic mean is less than or equal to 53 ppb (annual design value).

There were five nitrogen dioxide ambient air monitoring sites operated in 2013. The locations were at the SD School, Badlands, RC Credit Union, UC #1, and UC #2 sites.

9.7.1 Nitrogen Dioxide 1-Hour Standard

Table 9-7 contains the 1-hour 98th percentile concentration for each of the last three years, 1-hour design values, and the attainment status for each site. The RC Credit Union Site had the highest yearly 98th percentile 1-hour concentration at 38.8 ppb which is still part of the unusual emission source that affected only this site during the 4th quarter of 2012 and 1st quart of 2013. Concentrations began to rise in last August and continue to increase peaking on December 31, 2012. After that day concentration decrease significantly and then moved slowly back to levels previously recorded at the site by the end of January 2013. The second highest 1-hour concentration for 2013 was recorded at the Credit Union Site at 38.6 ppb.

Table 9-7 – Nitrogen Dioxide 1-hour 98th Percentile Concentrations

Site	98th Percentile Concentration	3-year Average Design Values	Attainment Status	Percent Standard
SD School	2011 – 38.6 ppb 2012 – 36.6 ppb 2013 – 33.8 ppb	36 ppb	Yes	36%
Badlands	2011 – 4.4 ppb 2012 – 6.9 ppb 2013 – 6.0 ppb	6 ppb	Yes	6%
RC Credit Union	2011 – 47.0 ppb 2012 – 42.2 ppb 2013 – 38.6 ppb	43 ppb	Yes	43%
UC #1	2011 – 14.8 ppb 2012 – 15.9 ppb	16 ppb	Yes	16%

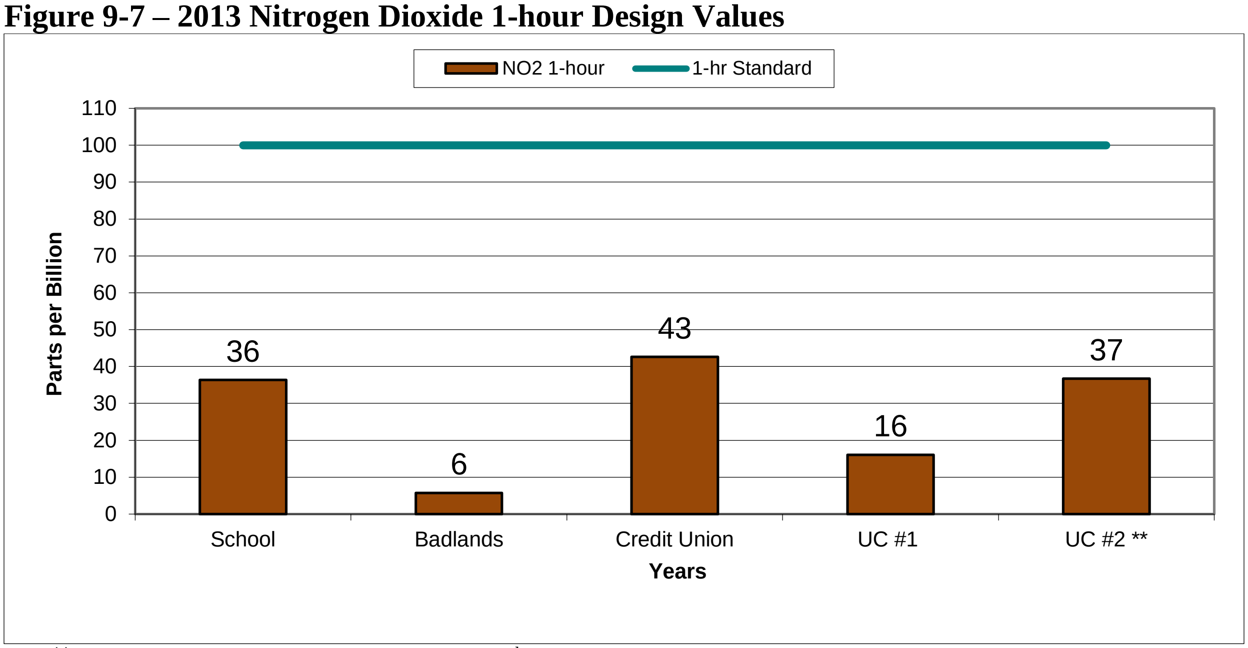
Site	98th Percentile Concentration	3-year Average Design Values	Attainment Status	Percent Standard
	2013 – 17.6 ppb			
UC #2 (1)	2011 – 14.3 ppb 2012 – 57.0 ppb 2013 – 38.8 ppb	37 ppb	Yes	37%

[1] - UC #2 had an unusual event in the 4th quarter of 2012 and 1st quarter of 2013 causing site data to be elevated above normal levels. This site data should not be used for modeling or any other regulatory purpose.

Figure 9-7 shows the nitrogen dioxide 1-hour design values for each of the sites with three years of data. The RC Credit Union Site had the highest concentration at 43 ppb or 43% of the standard. UC #2 site recorded the 2nd highest 1-hour nitrogen dioxide design value at 37 ppb or 37% of the standard. In general the rural areas with background levels have concentrations near the detection level. Rural areas impacted by a large source of nitrogen dioxide emissions like at UC #1 and UC #2 record higher concentrations than background sites but the levels are still well under the standard. The high concentration period at UC #2 does not appear to be caused by large sources of emissions in Iowa because UC #1 didn't show an increase during the same time period.

All sites had concentrations under the 1-hour nitrogen dioxide standard and are attaining the standard using data from 2011 to 2013.

Figure 9-7 – 2013 Nitrogen Dioxide 1-hour Design Values

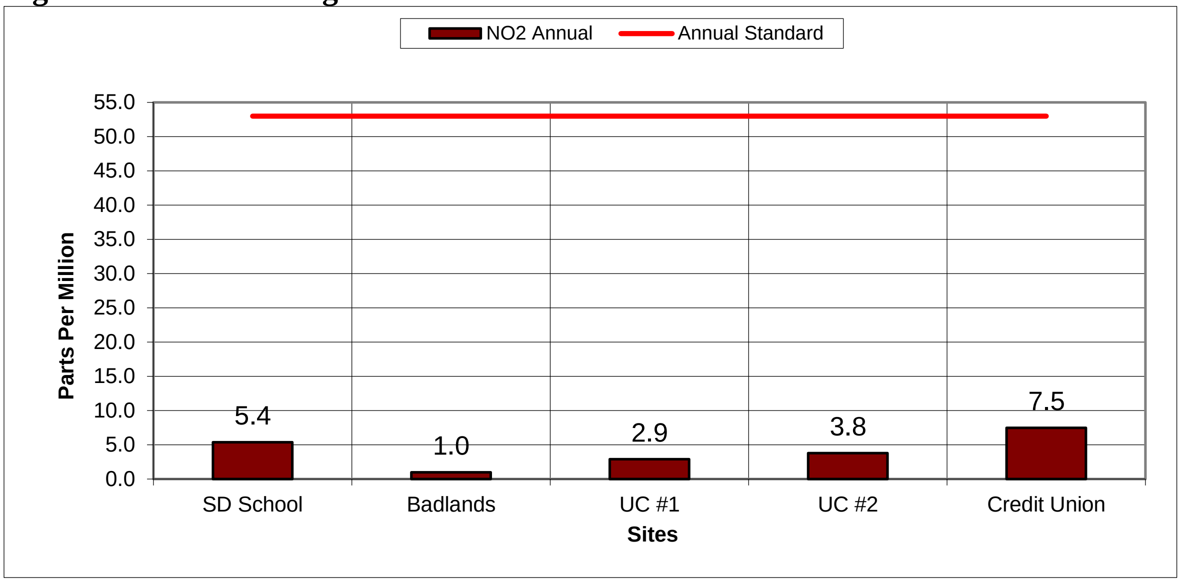


** UC #2 had an unusual event in the 4th quarter of 2012 and 1st quarter in 2013 causing site data to be elevated above normal levels. This site data should not be used for modeling or any other regulatory purpose.

9.7.2 Nitrogen Dioxide Annual Standard

Figure 9-8 shows the annual average for the five sites operated in 2013. The highest nitrogen dioxide annual average was recorded at the Credit Union Site at 7.5 ppb. The Badlands Site remained at about same level near the detection level for the sampling method. In 2013, all five sites attained the annual standard for nitrogen dioxide.

Figure 9-8 – 2013 Nitrogen Dioxide Annual Concentration



* - UC #2 had an unusual event in the 4th quarter of 2012 and 1st quarter in 2013 causing site data to be elevated above normal levels. This site data should not be used for modeling or any other regulatory purpose.

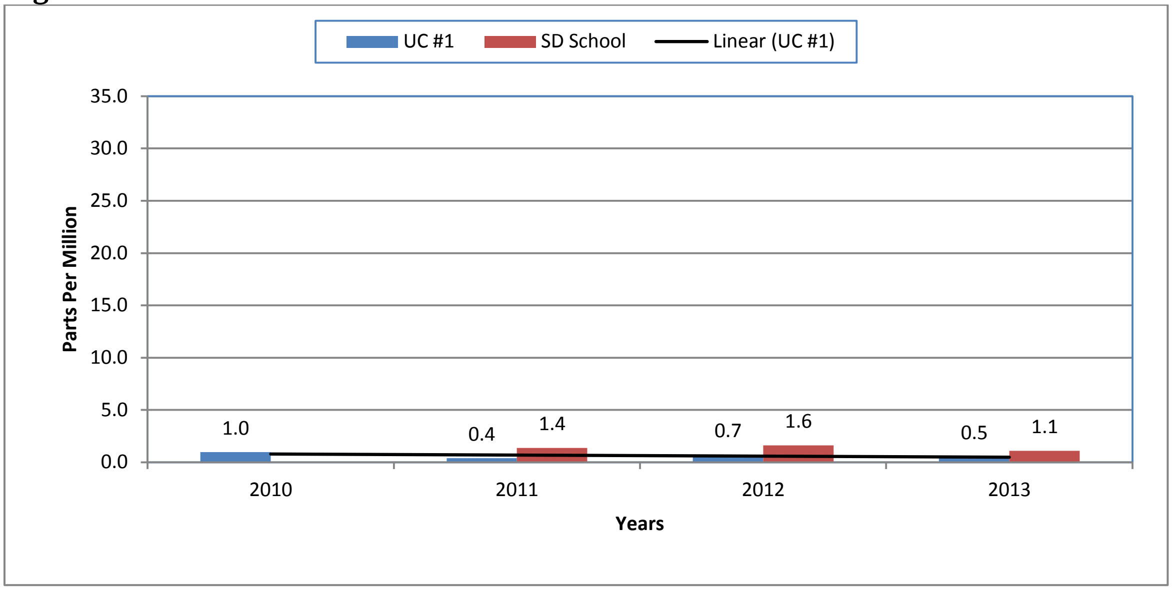
9.8 Carbon Monoxide

Carbon monoxide testing has a low priority in South Dakota. Low population and traffic numbers on the state's roads keep the potential very low for concentrations near or over the standard.

The carbon monoxide standard is based on two primary standards in the form of a one-hour and 8-hour average concentration. The department started the operation of the first carbon monoxide analyzer in January of 2010 at UC #1 Site in Union County. A second analyzer was added to the SD School Site as required by the National Core sampling requirements and began testing at the start of 2011.

The one-hour standard is 35.0 ppm and is not to be exceeded more than once per year. The highest 1-hour concentration of carbon monoxide recorded at the SD School Site was 1.3 ppm in 2013. Figure 9-9 shows the carbon monoxide 1-hour maximum concentrations for both sites. The carbon monoxide concentrations are very low at both sites. The carbon monoxide data shows both sites attaining the 1-hour NAAQS.

Figure 9-9 – Carbon Monoxide 1-Hour Concentration

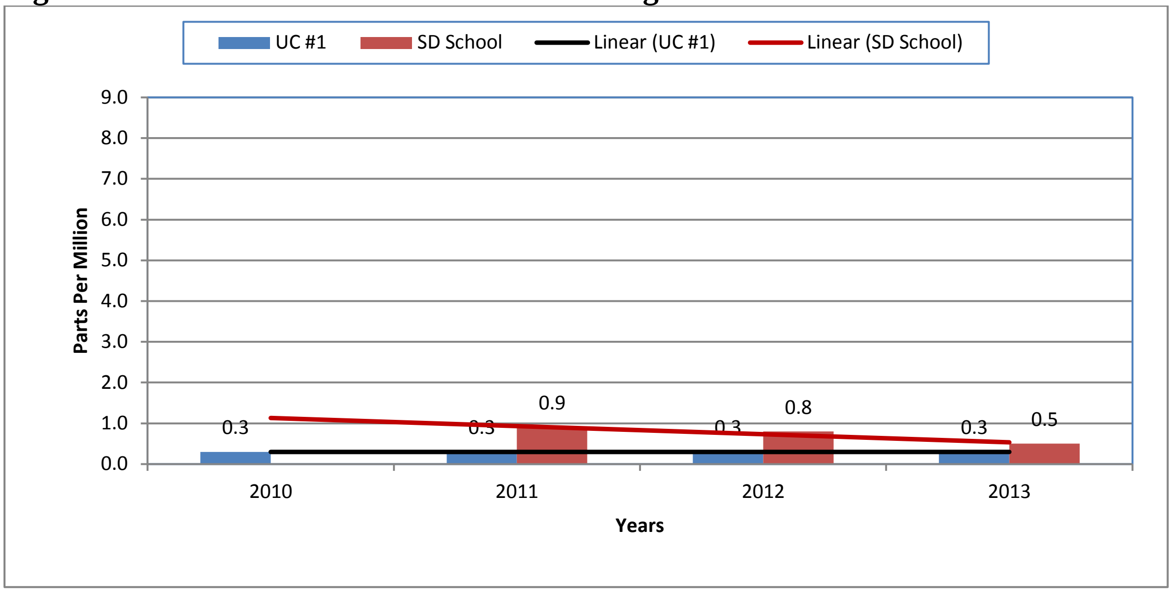


The other standard is an 8-hour average concentration of 9.0 ppm, not to be exceeded more than once per year. The highest 8-hour average recorded at the SD School Site was 0.5 ppm in 2013. The carbon monoxide concentrations are very low at both sites and both areas are attaining the NAAQS. Figure 9-10 shows the carbon monoxide maximum 8-hour average concentrations for both sites.

The data at UC #1 represents background levels of carbon monoxide collected in a rural area in eastern South Dakota. It is anticipated by the department that carbon monoxide levels at UC #1 represent one of the higher concentration locations for a rural area given the traffic counts on Interstate 29 near the sampling site. Other rural areas with less traffic emissions could have lower concentrations.

The carbon monoxide concentrations at the SD School Site represent urban areas being collected in an area that has some of the highest traffic counts in the state. Future sampling may be limited to the collection of a year of data to determine background and population exposure.

Figure 9-10 – Carbon Monoxide 8-Hour Average Concentration



9.9 2013 High Concentrations Summary

High concentration days affect the design values and need to be considered when evaluating the data results for each year. A conceptual theory on what caused the high concentrations can be formed and further developed in future years. In some cases, if local sources are causing the problem, early actions can be taken to reduce concentration levels and further protect public health from high levels. As EPA revises the national standards lower, information on the cause of the high concentration day can be collected soon after the event instead of three years after a standard revision. In some cases, the information may show long range transport or an exceptional event.

The concentrations used for evaluation as a high reading were calculated using a level of 90% of the current standard. This evaluation is different for ozone level as this concentration was proposed as a future standard. The evaluation concentration for each parameter is as follows:

1. Ozone > 0.070 ppm 8-hour average;
2. PM2.5 > 32 ug/m^3 24-hour average;
3. PM10 > 135 ug/m^3 24-hour average;
4. NO_2 > 90.0 ppb 1-hour maximum;
5. SO_2 > 67.0 ppb 1-hour maximum;
6. CO > 8.1 ppm 8-hour average; and
7. CO >31.5 ppm 1-hour average.

None of the gaseous pollutants of SO_2, NO_2, CO and Ozone had concentrations over the evaluation levels in 2013.

A review of the data for PM_{10} showed no high concentrations at the following sites in 2013: Aberdeen, Badlands, Black Hawk, Brookings City Hall, Brookings Research Farm, RC Guard

Camp, RC Library, Watertown, and Wind Cave. Only one sampling day in 2013 had a PM_{10} concentration greater than 90% of the standard and it was recorded at the RC Credit Union Site.

For $PM_{2.5,}$ the Sioux Falls KELO and SD School sites had high readings on February 24^{th} and both Union County sites had high reading on February 24^{th} and 25^{th}. The high readings for $PM_{2.5}$ were all on the eastern part of the state at the Sioux Falls KELO and SD School sites and at the UC #1 and #2 sites.

Two of the monitoring sites had exceedance days for the 24-hour $PM_{2.5}$ standard. On February 24^{th}, the $PM_{2.5}$ monitor at UC #1 had a 24-hour block average of 41 ug/m^3 and the $PM_{2.5}$ monitor at UC #2 had a 24-hour block average of 40 ug/m^3. Figure 9-11 shows the AirNow daily average $PM_{2.5}$ AQI for Sunday, February 24, 2013. These exceedances did not cause a violation of the federal National Ambient Air Quality Standards which means South Dakota is attaining the 24-hour $PM_{2.5}$ standard.

Other areas in the regional also had concentrations over the standard on this day. The air monitoring site in Washington County, Nebraska exceeded the standard with a 24-hour daily average of 36 ug/m^3 and the Woodbury County site in Iowa had a 24-hour daily average of 44 ug/m^3.

Figure 9-12 contains the AirNow-Tech map for February 24^{th} showing the previous 48-hour back trajectory coming from the south and many fires in Kansas and the surrounding areas.

Figure 9-11 - AirNow Map

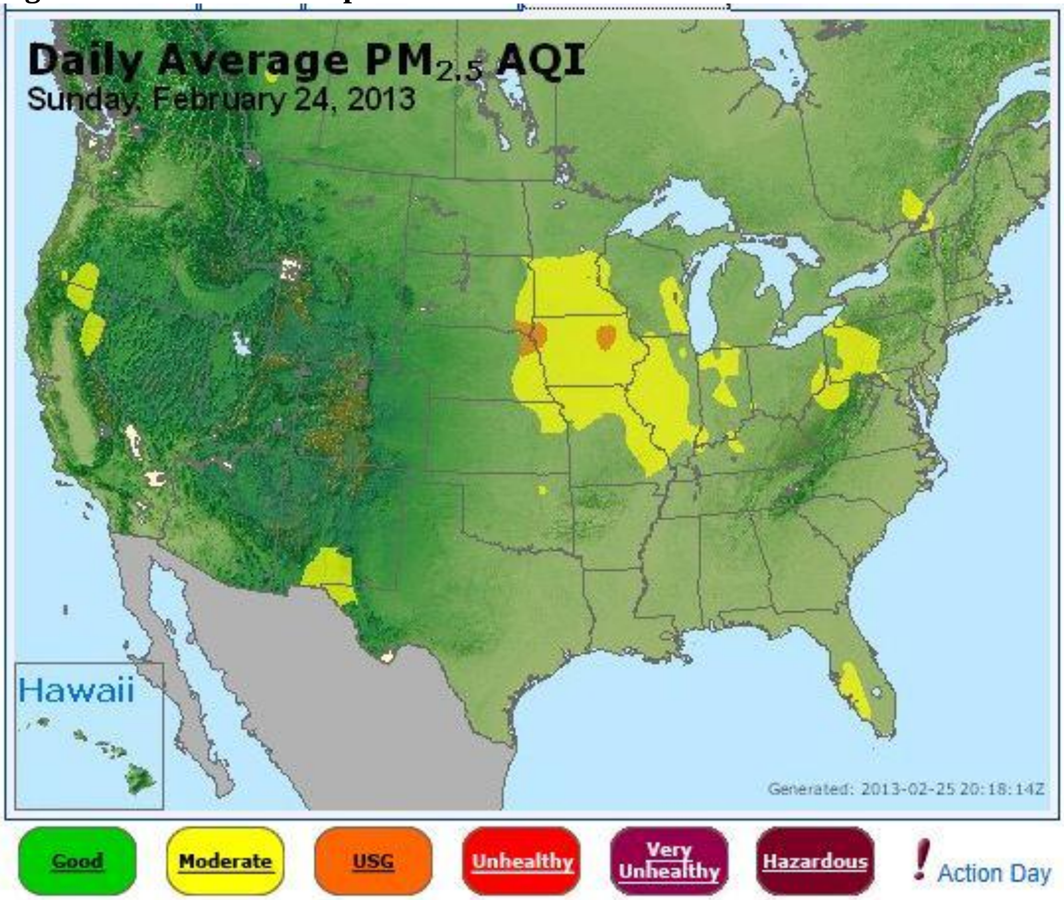
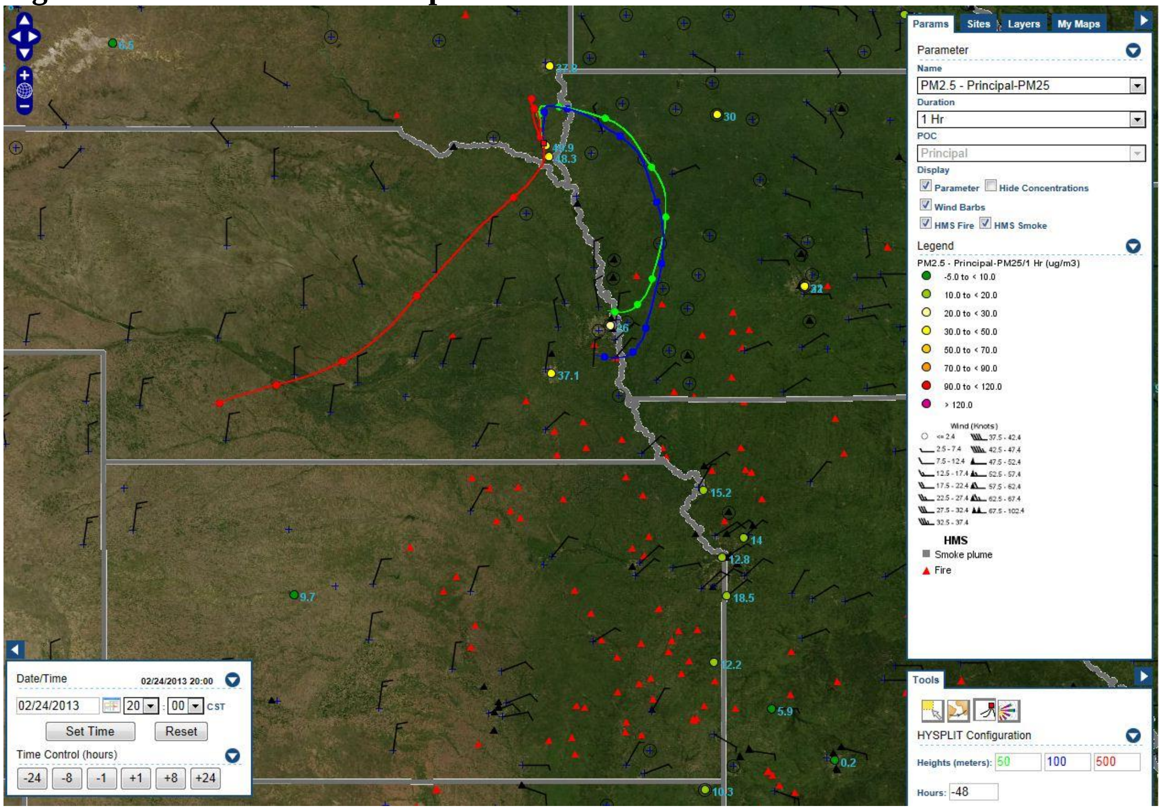


Figure 9-12 - AirNow-Tech Map



10.0 AIR MONITORING SITE EVALUATION AND TRENDS

This section will discuss the goals of each air monitoring site in the network and trends for each pollutant. Through this evaluation a determination is made if site goals are being met and if each testing parameter is needed at the site. This section also has site specific information tables including AQS ID #, location, operation, data use, sampling schedule, monitoring objectives, spatial scale, and sampling and analytical methods required as part of the annual plan requirements in 40 CFR Part 58.

10.1 Rapid City Area

The Rapid City area had a total of three monitoring sites collecting data in 2013. The high concentration site for PM_{10} was located at the RC Credit Union Site and a continuous PM_{10} monitor was used to determine compliance with the NAAQS standards. In addition, a SO_2 and NO_2 analyzers were operated to determine current concentration levels. The RC Library and RC National Guard sites have manual Andersen PM_{10} monitors collecting 24-hour data using a filter based gravimetric sampling method.

In cooperation with the City, County, and industry, the department is implementing a Natural Events Action Plan for the Rapid City area. Part of this plan is to alert the public of the potential of high dust levels caused by high winds and to advise the public of precautions to take during the high wind events. Under this plan high wind dust alerts are called when the following forecast conditions occur:

1. Hourly wind speeds exceed 20 miles per hour;
2. Peak wind gusts are greater than 40 miles per hour; and
3. Five consecutive days of 0.02 inches or less of precipitation each day excluding dry snow.

During 2013, a total of four high wind dust alerts were called for the Rapid City area. None of the days exceeded the PM_{10} 24-hour standard. The highest 24-hour average concentration recorded during an alert was on May 14, 2013 at 75.4 ug/m^3. This demonstrates the implementation of the Natural Events Action Plan for the Rapid City area is working to maintain PM_{10} concentrations below the NAAQS during high wind events.

The Rapid City area had two monitoring sites collecting data for $PM_{2.5}$ in 2013. The Library Site has manual Andersen $PM_{2.5}$ monitors collecting 24-hour data using a filter based gravimetric sampling method. A continuous Met One BAM $PM_{2.5}$ monitor was operated on the RC Credit Union Site.

In the fall of 2008, a surface water quality problem was found when Rapid Valley began using Rapid Creek for a drinking water source. Testing indicated high levels of chlorides during snow melt events caused the drinking water to smell and the water treatment plant had to stop producing drinking water until chloride levels dropped. Testing indicated liquid deicer used on the streets during snow and ice events was causing the problem. The city of Rapid City began a process of reducing the use of liquid deicer and increasing the use of river sand in the eastern and south eastern parts of Rapid City to help reduce chloride levels in Rapid Creek. The department is working with Rapid City to determine which streets can be changed from chemical deicer to sand so air quality levels have not been affected. Currently, the changes in sanding material at these locations in the city have not cause high concentrations of PM_{10}.

10.1.1 RC Library Site

The RC Library Site is located on the library building in Rapid City. The site was established in 1972, and it is the oldest sampling site in South Dakota still operating. The site is geographically located in the downtown area of the city east of the hogback and in the Rapid Creek river valley. The site purpose is to evaluate population exposure, fugitive dust controls, the success of the street sanding and sweeping methods employed by the city of Rapid City and general concentration levels in the eastern part of the city. Figure 10-1 shows a picture of the RC Library Site.

Figure 10-1 – RC Library Site

PM_{10} sampling began at the site in 1985. $PM_{2.5}$ monitors were added to the site in 1999. An attainment designation for $PM_{2.5}$ was completed for the Rapid City area in 2004.

An attainment designation for PM_{10} was completed and approved by EPA for the Rapid City area in 2006. In 2012, the Andersen RAAS 100 $PM_{2.5}$ monitors were replaced with R&P Partisol 2000i monitors. Table 10-1 contains details on the monitoring site specific to the requirements in 40 CFR Part 58.

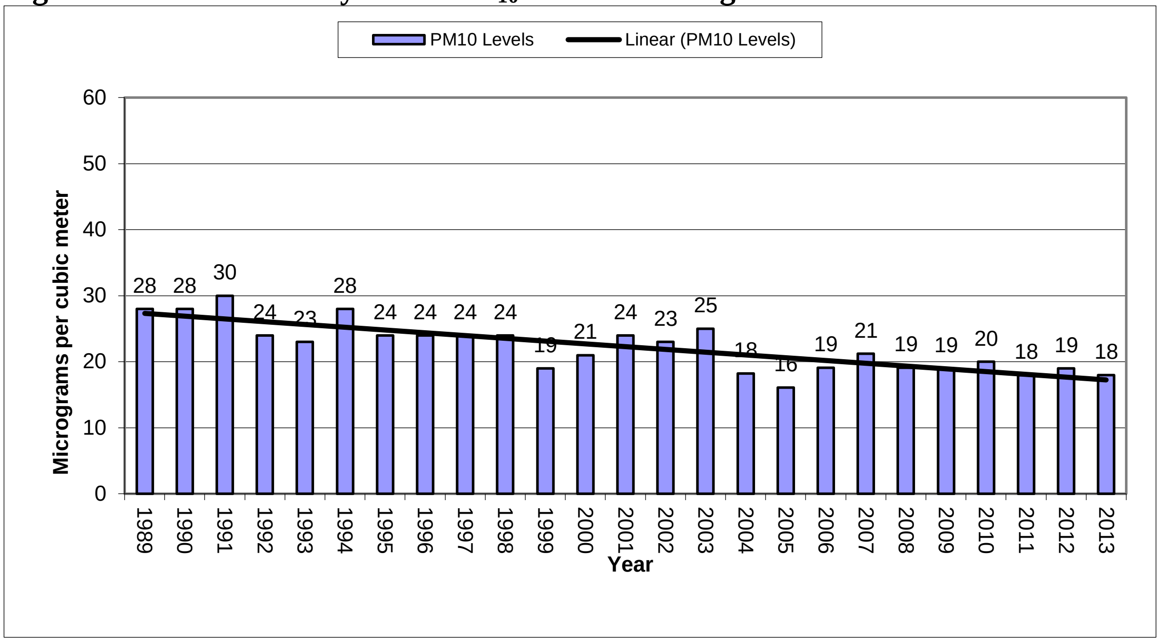
Table 10-1 – RC Library Site Specifics

Parameter	Information
Site Name	RC Library
AQS ID Number	46-103-1001
Street Address	6th and Quincy, Rapid City, South Dakota
Geographic Coordinates	UTM Zone 13, NAD 83, E 641,837.99, N 4,882,111.77
MSA	Rapid City
PM_{10}	**(Manual)**
Sampler Type	Federal Reference Method RFPS-1287-063
Operating Schedule	Every 3rd Day
Scale Representation	Neighborhood
Monitoring Objective	High Concentration and Population
Sampling Method	Hi-Vol SA/GMW-1200
Analysis Methods	Gravimetric
Data Use	SLAMS (Comparison to the NAAQS),
$PM_{2.5}$	**(Manual)**
Sampler Type	Federal Equivalent Method EQPM-0202-143
Operating Schedule	Every 3rd Day
Scale Representation	Neighborhood
Monitoring Objective	Population and High Concentration
Sampling Method	R&P Partisol 2000i $PM_{2.5}$ w/VSC Cyclone
Analysis Methods	Gravimetric
Data Use	SLAMS (Comparison to the NAAQS)

10.1.1.1 *RC Library Site – PM10 Data*

Annual average PM_{10} concentrations for the RC Library Site are shown in Figure 10-2. The PM_{10} concentrations show a gradual decline from a high of 30 ug/m^3 in 1991, to a low of 16 ug/m^3 in 2005. The largest reduction in annual concentrations came when changes were implemented by the city on the street sanding and sweeping operations in the early 1990s. In the last eight years, annual concentrations have leveled off and are almost steady with a 1 or 2 ug/m^3 change per year. The plan is to continue the PM_{10} monitoring because this is the only site east of the hogback in Rapid City and the site will provide a check on PM_{10} levels as the city of Rapid City adjusts its sanding techniques in eastern Rapid City.

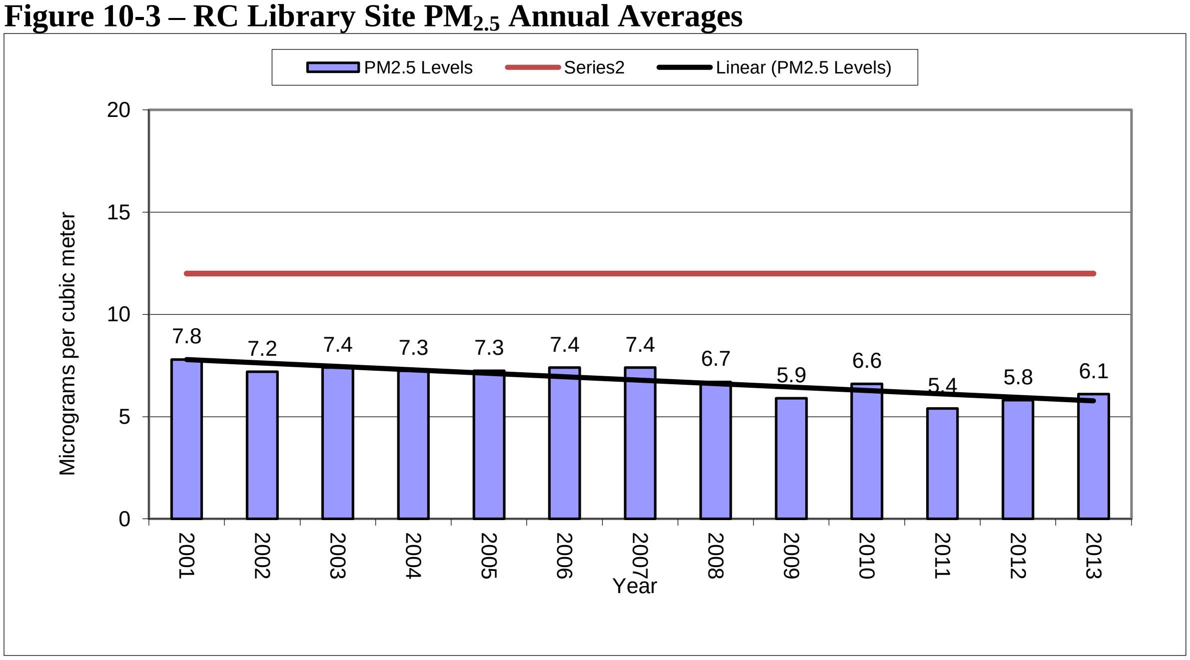
Figure 10-2 – RC Library Site – PM_{10} Annual Averages



10.1.1.2 *RC Library Site – PM2.5 Data*

The graph in Figure 10-3 shows the $PM_{2.5}$ annual average for each sampling year since 2001. The highest annual average was 7.8 ug/m^3 in 2001 and the lowest was 5.4 ug/m^3 in 2011. The annual average concentrations vary in difference from the highest to lowest annual average by 2.4 ug/m^3. The trends indicate a declining $PM_{2.5}$ concentration level for the past six years with 2011 recording the lowest annual average $PM_{2.5}$ concentration for this site. Plans are to continue testing for $PM_{2.5}$ at this site.

Figure 10-3 – RC Library Site $PM_{2.5}$ Annual Averages



10.1.2 RC National Guard Site

The RC National Guard Site is located on the roof of the armory at the Camp Rapid facility in western Rapid City (see Figure 10-4). The site was established at this location in 1992, with PM_{10} the only sampling parameter because a large portion of the particulate matter emissions near this site consists of crustal material. Because the site is located only a few blocks from the high concentration location at the RC Credit Union Site, the site is designated as a SPM site for PM_{10}. The goal of the site is to determine the size of the area being impacted by fugitive dust sources in the quarry area in western Rapid City.

In the spring of 2009 a radiation monitor was added to the site as part of the national RadNet network of sites. The monitor is a SPM site that provides a monitoring system to detect levels of radiation from accidental releases or military activities emitting radiation.

Figure 10-4 – RC National Guard Site

The sampling objectives for the PM_{10} parameter is to measure population exposure and high concentration from source impacts from the quarry area north of the monitoring site. In addition, this monitoring site along with the RC Credit Union Site, define the high PM_{10} concentration area in western Rapid City. Table 10-2 contains details on the monitoring site specific to the requirements in 40 CFR Part 58.

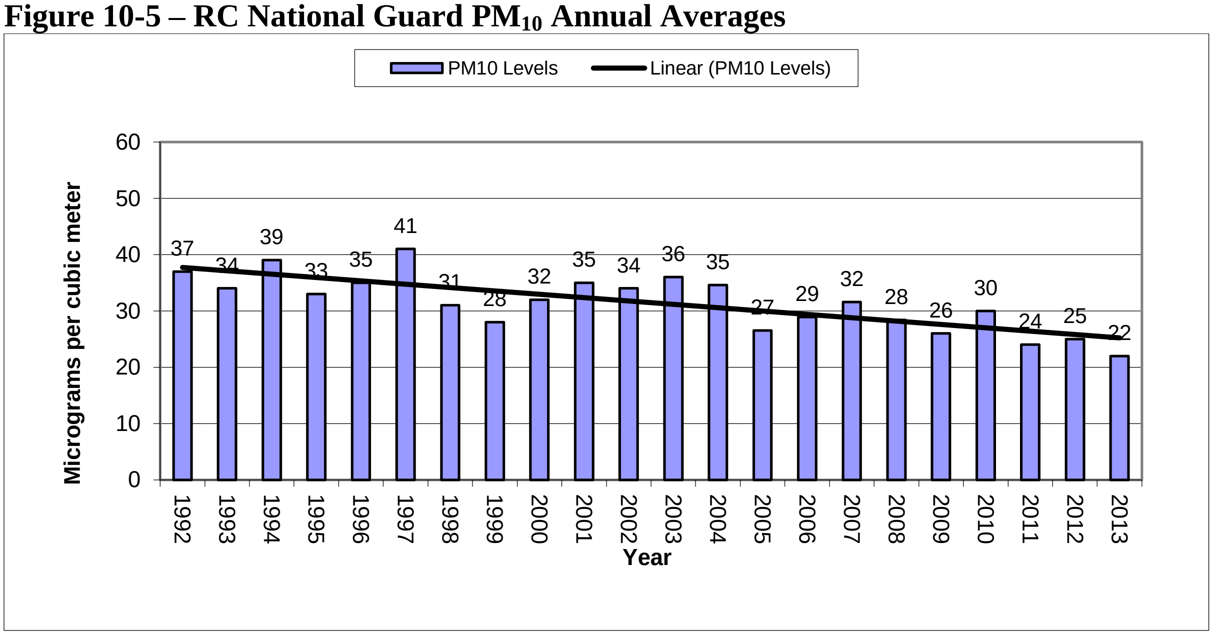
Table 10-2 – RC National Guard Site Specifics

Parameter	Information
Site Name	RC National Guard
AQS ID Number	46-103-0013
Street Address	Camp Rapid Armory West Main Street
Geographic Coordinates	UTM Zone 13, NAD 83, E 638,543.08, N 4,882,373.72
MSA	Rapid City
PM_{10}	(Manual)
Sampler Type	Federal Reference Method RFPS-1287-063
Operating Schedule	Every 3rd Day
Scale Representation	Neighborhood
Monitoring Objective	High Concentration and Population
Sampling Method	Hi-Vol SA/GMW-1200
Analysis Methods	Gravimetric
Data Use	SPMS (No comparison to the NAAQS),

10.1.2.1 *RC National Guard Site PM10 Data*

The RC National Guard Site is the second oldest monitoring location in Rapid City and is a special purpose monitoring site sampling for PM_{10}. The graph in Figure 10-5 shows the annual means for the site since 1992. The annual means vary from a high of 41 ug/m^3 in 1997 to a low of 22 ug/m^3 in 2013. The trends for the annual mean concentrations continue to decline, but do cycle up and down from year to year.

Figure 10-5 – RC National Guard PM_{10} Annual Averages



The RC Credit Union Site is only four city blocks from the RC National Guard Site. The RC National Guard Site's PM_{10} concentrations continue to be well below the levels recorded at the RC Credit Union Site and for this reason the RC National Guard Site PM_{10} testing was closed.

10.1.3 RC Credit Union Site

The RC Credit Union Site is located on a lot next to Fire Station #3 building. The RC Credit Union Site replaced the Fire Station #3 Site in October 2003 and is the high PM_{10} concentration location for the western part of Rapid City. The RC Credit Union Site is located just south of the quarry area and is centrally located in relation to the quarry facilities. Figure 10-6 contains a picture of the monitoring site looking in a northwest direction towards the quarry area. The goal of this site is to determine if the Rapid City area is attaining the PM_{10} standard and population exposure.

Figure 10-6 – RC Credit Union Site

Continuous samplers Thermo BETA PM_{10}, Met One BAM $PM_{2.5}$, Thermo SO_2 and Thermo NO_2 monitors were operated at this site in 2013. The BETA PM_{10} monitor provides hourly concentrations on an everyday sampling schedule. The hourly readings from the continuous PM_{10} monitor are used to assist in the calling of high wind dust alerts for Rapid City and to compare concentrations to the PM_{10} NAAQS. An Andersen PM_{10} Hi-Vol manual monitor is also located at the site to take special samples during high wind dust alerts that can be analyzed to determine potential sources of the dust.

A continuous Met One BAM $PM_{2.5}$ monitor is used to supply hourly data for investigation of high concentration days and to compare to the $PM_{2.5}$ standards. Table 10-3 contains details on the monitoring site specific to the requirements in 40 CFR Part 58.

In 2011, continuous SO_2 and NO_2 analyzers were added to the RC Credit Union Site to provide data on population exposure and source oriented testing near the facilities in the quarry area. Three years of testing were completed at the end of 2013.

Table 10-3 – RC Credit Union Site Specifics

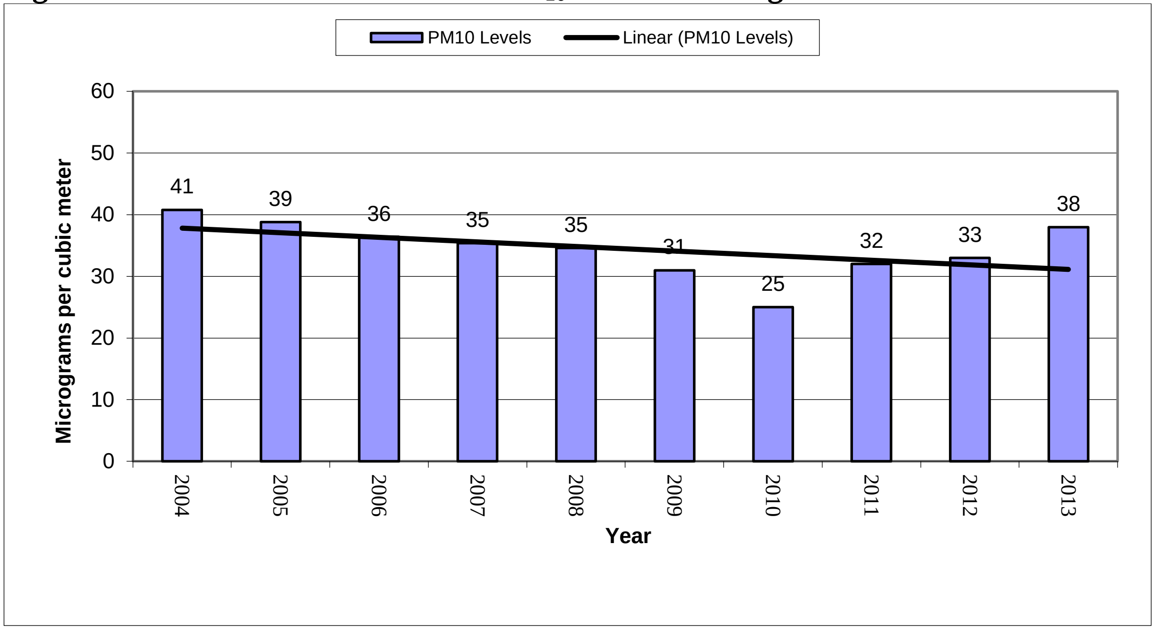
Parameter	Information
Site Name	RC Credit Union
AQS ID Number	46-103-0020
Street Address	106 Kinney Ave.
Geographic Coordinates	UTM Zone 13, NAD 83, E 638,199.75, N 4,882,811.92
MSA	Rapid City
PM_{10}	**(Continuous)**
Sampler Type	Federal Equivalent Method EQPM-1102-150
Operating Schedule	Every Day/co-located FEM to FRM every 12th day
Scale Representation	Neighborhood
Monitoring Objective	High Concentration and Population
Sampling Method	T A Series FH 62 C14 Continuous
Analysis Methods	Beta Attenuation
Data Use	SLAMS (Comparison to the NAAQS) and Real-Time Data
$PM_{2.5}$	**(Continuous)**
Sampler Type	Federal Equivalent Method EQPM-0308-170
Operating Schedule	Every Day
Scale Representation	Neighborhood
Monitoring Objective	Population and High Concentration
Sampling Method	Met One BAM-1020
Analysis Methods	Beta Attenuation
Data Use	SLAMS (Comparison to the NAAQS) Real-Time Data
SO_2	**(Continuous)**
Sampler Type	Federal Equivalent Method EQSA-0486-060
Operation Schedule	Every Day
Scale Representation	Neighborhood
Monitoring Objective	Population and High Concentration
Sampling Method	Instrumental
Analysis Method	Pulsed Fluorescent
Data Use	SLAMS (Comparison to the NAAQS) and Real-Time Data
NO_2	**(Continuous)**
Sampler Type	Federal Reference Method RFNA-1289-074
Operation Schedule	Every Day
Scale Representation	Neighborhood
Monitoring Objective	Population and High Concentration
Sampling Method	Instrumental
Analysis Method	Chemiluminescence
Data Use	SLAMS (Comparison to the NAAQS) and Real-Time Data

10.1.3.1 *RC Credit Union Site – PM10 Data*

The RC Credit Union Site began operation in October of 2003. Only three months of data was collected in 2003, so 2004 is the first complete sampling year. Figure 10-7 shows a graph of the annual average PM_{10} concentration.

The PM_{10} annual average concentration trend shows a declining level each year from 2004 to 2010. In 2011, average concentration levels increased back to the level in 2009. In 2013, average concentration levels increased to the same levels as in 2005. Over the ten year period, annual concentrations declined significantly by 16.0 ug/m^3 for the first six years but increased by 13 ug/m^3 for the last three years. Testing for PM_{10} concentrations is a priority for this site and the parameter will be continued.

Figure 10-7 – RC Credit Union Site PM_{10} Annual Averages



10.1.3.2 *RC Credit Union Site PM2.5 Data*

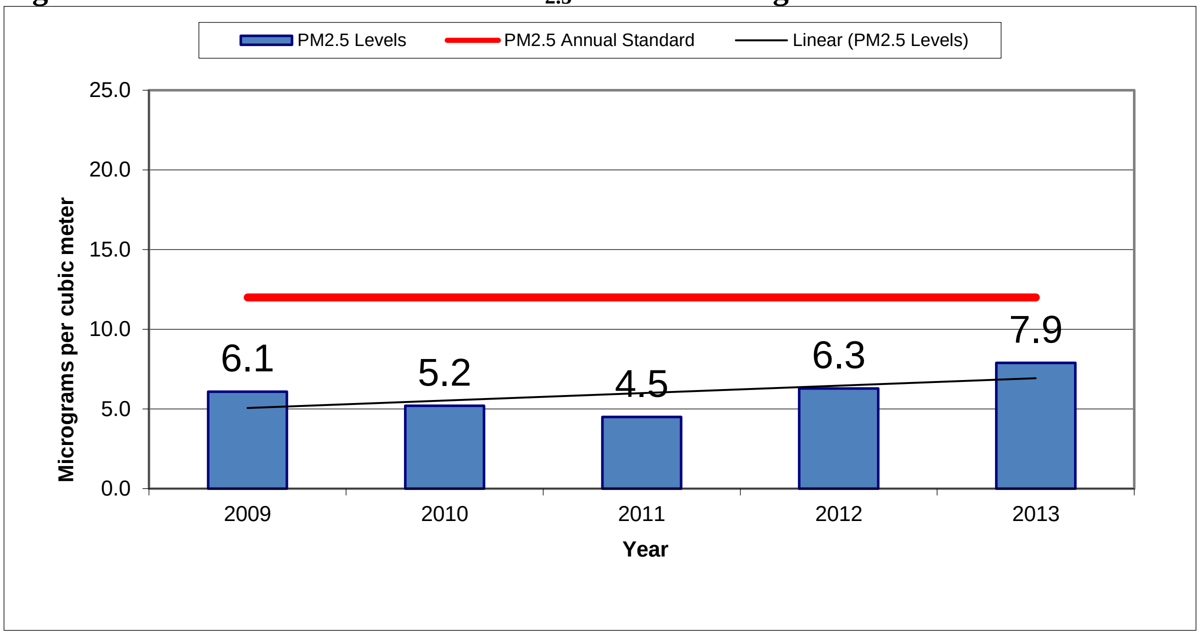
The testing for $PM_{2.5}$ parameter using the manual method began at this site in October 2003 and completed the first full year of testing in 2004. The RC Credit Union Site records the highest $PM_{2.5}$ concentrations in the Rapid City area for both 24-hour and annual concentrations using the manual FRM monitor.

In 2009, a continuous method $PM_{2.5}$ monitor was added to the site as a special purpose monitor. Because the continuous monitor was a new method, EPA allows the operation of the monitor as a special purpose method for up to three years before the data from the monitor is required to be compared to the $PM_{2.5}$ standard. By the end of 2011 the continuous monitor had operated for three years. As a cost savings change the manual $PM_{2.5}$ monitor was removed and the continuous monitor became the SLAMS monitor providing more data at a lower cost per year of operation.

Figure 10-8 shows the annual average for each sampling year since 2009 when the continuous monitor was setup. The annual average concentrations have remained relatively constant over the last four years. In 2011, $PM_{2.5}$ annual concentrations declined to the lowest level since the site began operation with a concentration of 4.5 ug/m^3 for the annual average. The highest annual average for $PM_{2.5}$ at this site was 7.9 ug/m^3 in 2013. Over the five year period, annual concentrations changed by 3.4 ug/m^3. The trends for the four years since the continuous monitor was installed show a slightly increasing concentration level.

The parameter of $PM_{2.5}$ will be continued at this site using the continuous monitor to determine compliance with the NAAQS and to determine any change in concentration levels.

Figure 10-8 – RC Credit Union Site $PM_{2.5}$ Annual Averages

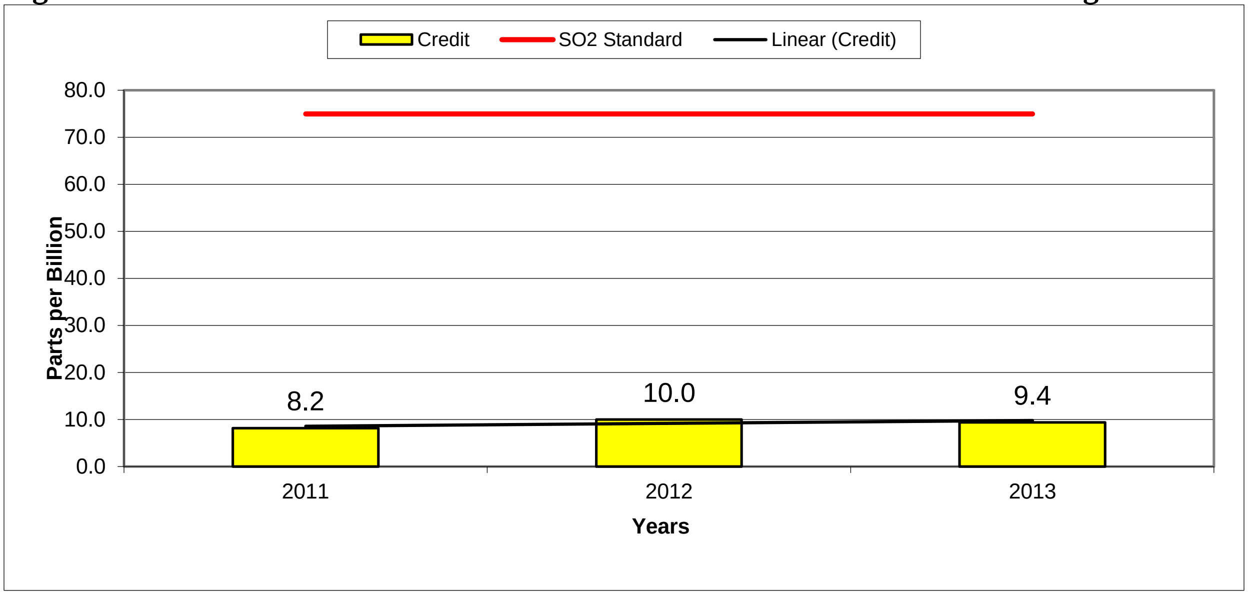


10.1.3.3 *RC Credit Union Site Sulfur Dioxide*

Testing for sulfur dioxide started at the beginning of 2011 for this site. Some testing for the parameters was done in the 1990s but that data is old and there is need for the collection of new data. The annual standard for sulfur dioxide was dropped when the standard was revised so the 1-hour, daily maximum, 99 percentile concentrations will be used to track trends.

See Figure 10-9 for the 1-hour daily maximum concentration of sulfur dioxide recorded at the RC Credit Union Site. The concentration level is low at only 13% of the standard. Trends indicate a steady sulfur dioxide concentration level for this site. Testing for sulfur dioxide will continue at this site to determine if the trend will continue beyond three years.

Figure 10-9 –RC Credit Union Site Sulfur Dioxide 99th Percentile 1-hour Averages

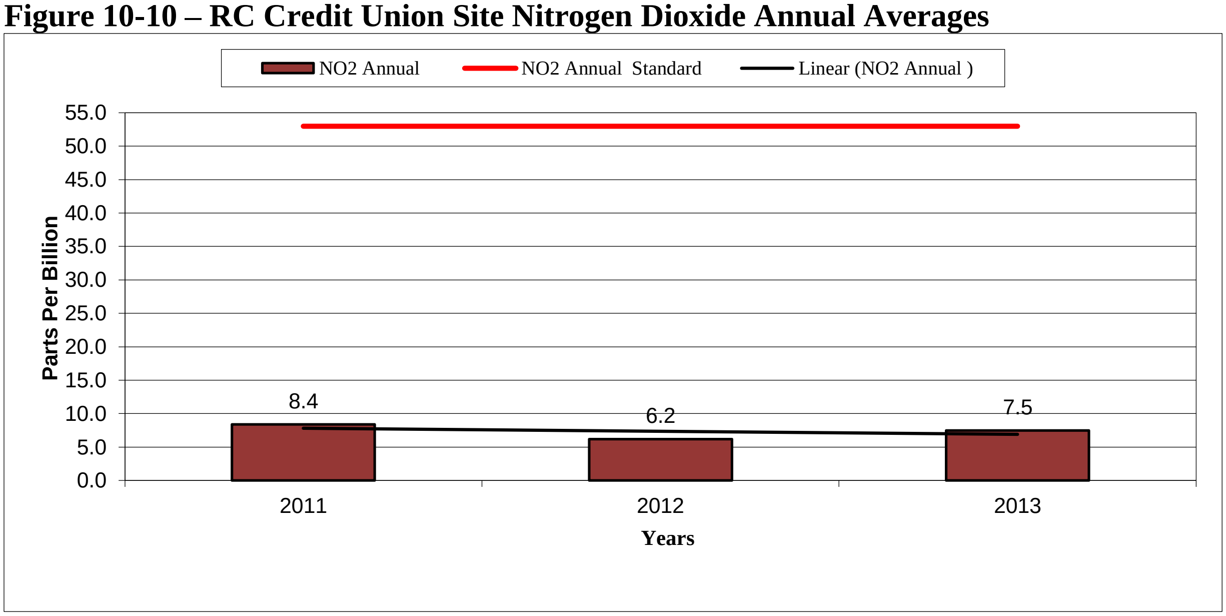


10.1.3.4 *RC Credit Union Site Nitrogen Dioxide*

Testing for nitrogen dioxide started at the beginning of 2011 for this site. Some testing for the parameters was completed in the 1990s but that data is old and there is a need for the collection of new data. The nitrogen dioxide standard includes a 1-hour and annual average concentrations so the annual will be represented to track trends.

See Figure 10-10 for concentrations of nitrogen dioxide at the RC Credit Union Site. The concentration are low only 14% of the standard. The trend shows a slightly declining concentration level. Testing for nitrogen dioxide will continue at this site to further define the pollution level trend for this site.

Figure 10-10 – RC Credit Union Site Nitrogen Dioxide Annual Averages



10.2 Black Hawk Site

Black Hawk is a small town located just north of Rapid City in Meade County north of the quarry area. Black Hawk is not an incorporated city but is a growing subdivision and is part of the Rapid City MSA. The goal of the Black Hawk Site is to determine urban background concentrations for PM_{10} coming into the Rapid City area from the north and determine compliance with the ozone NAAQS in the Rapid City MSA.

The Black Hawk Site was setup in the fall of 2000. The site is located on a small hill east of the Black Hawk Elementary School. PM_{10} and $PM_{2.5}$ monitors were located on a sampling shelter until October 2003 when the sampling shelter was moved to the RC Credit Union Site. The monitors were then located on scaffolding within a fenced area until the fall of 2006 when a shelter was added back to the site.

At the end of 2004 the $PM_{2.5}$ monitors were removed because concentrations were the lowest in the area and the potential for concentrations over the NAAQS were very low. In 2007, the ozone analyzer was moved from RC Credit Union Site to the Black Hawk Site to operate the ozone parameter outside of the modeled one microgram nitrogen dioxide influence area from air quality sources in western Rapid City. See Figure 10-11 for a current picture of the site looking to the northwest.

The land use around the site is mainly residential with a few service type businesses. There are no obstructions around the monitoring site. The limestone quarry industries are located to the south and southeast of the Black Hawk Site and are expanding to ore bodies located closer to this site. The closest new limestone quarry is currently operating about 1.5 miles south of the site.

Figure 10-11 – Black Hawk Site

The site's spatial scale is neighborhood for PM_{10} and ozone sampling. The objectives of the PM_{10} sampling are high concentration, population, and source impact. The objectives of the ozone sampling are high concentration and population. The goals are being met. Table 10-4 contains details on the monitoring site specific to the requirements in 40 CFR Part 58.

Table 10-4 – Black Hawk Site Specifics

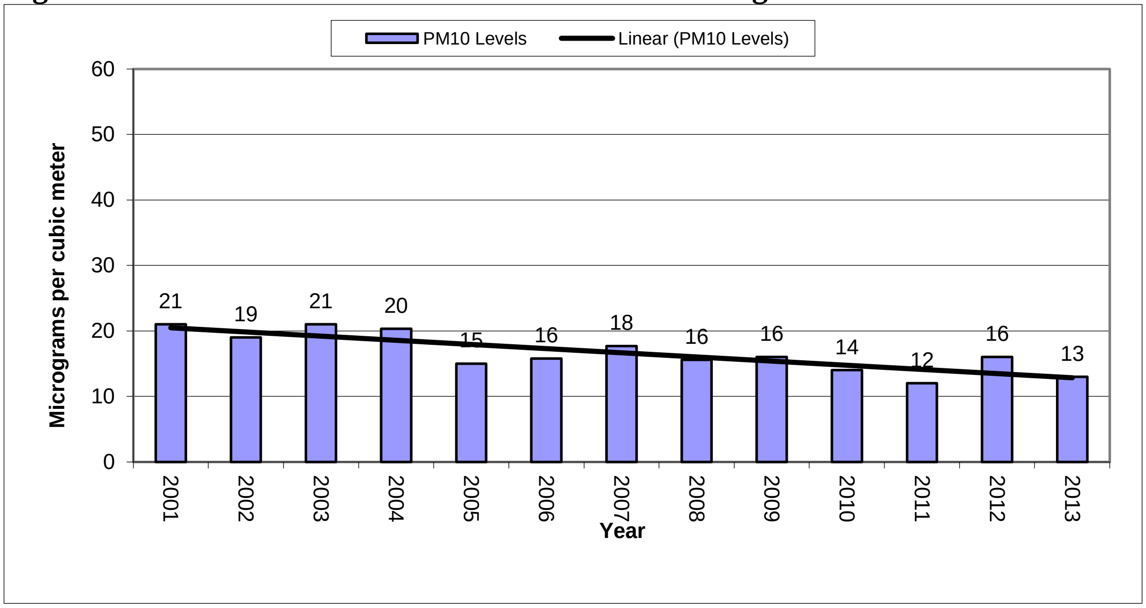
Parameter	Information
Site Name	Black Hawk Elementary
AQS ID Number	46-093-0001
Street Address	7108 Seeaire Street
Geographic Coordinates	UTM Zone 13, NAD 83, E 634,683.07 N 4,890,309.65
MSA	Rapid City
PM_{10}	**(Manual)**
Sampler Type	Federal Reference Method RFPS-1287-063
Operating Schedule	Every Sixth Day
Scale Representation	Neighborhood
Monitoring Objective	Population, Urban Background
Sampling Method	Hi-Vol SA/GMW-1200
Analysis Methods	Gravimetric
Data Use	SLAMS (Comparison to the NAAQS)
Ozone	**(Continuous)**

Parameter	Information
Sampler Type	Federal Equivalent Method EQOA-0880-147
Operating Schedule	Every Day
Scale Representation	Neighborhood
Monitoring Objective	Population and High Concentration
Sampling Method	Instrumental Thermo 49i
Analysis Methods	Ultraviolet
Data Use	SLAMS (Comparison to the NAAQS) and Real-time Data

10.2.1 Black Hawk Site – PM10 Data

Figure 10-12 contains a graph showing the PM_{10} annual averages for the Black Hawk Site. The first four years of PM_{10} concentration levels remained about the same. In 2005, the annual average dropped significantly by approximately 4 ug/m^3 from the 2004 level. The highest annual average was 21 ug/m^3 recorded in both 2001 and 2003. The lowest level of 12 ug/m^3 was recorded in 2011. In 2013, the PM_{10} concentrations decreased by 3 ug/m^3 from the concentration in 2012. The overall trend shows a significant decrease in concentrations over the thirteen year period.

Figure 10-12 – Black Hawk Site – PM10 Annual Averages

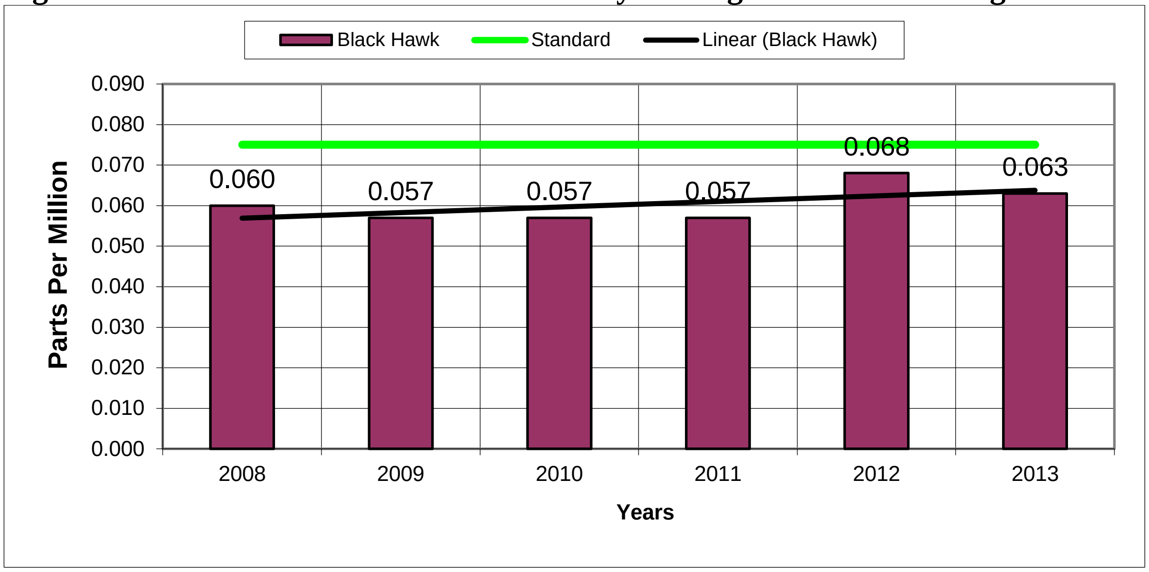


10.2.2 Black Hawk Site – Ozone Data

The 2013 sampling year is the sixth ozone season at the Black Hawk Site (see Figure 10-13). In the first year of testing (2008), the site recorded the second highest ozone level in the state. In 2012, the ozone levels were up statewide by 4 ppb and significantly at this site at 11 ppb. In 2013, ozone levels dropped lower than the previous year. Because of the high ozone concentration in 2012, the overall trends show an increasing ozone concentration level.

The testing results show the area is attaining the ozone standard. Plans are to continue to test for ozone at this location.

Figure 10-13 – Black Hawk Site Ozone Yearly 4th Highest 8-hour Averages



10.3 Badlands Site

The Badlands is one of two Class I areas in South Dakota designated for visibility protection under the Clean Air Act. The Badlands area is a large national park that attracts more than two million visitors each year. The Badlands area is a dry semi-desert area with short prairie grass and beautiful sandstone cliff vistas.

The Badlands Site was established in 2000, with manual monitors for PM_{10} and $PM_{2.5}$. The site is located next to the IMPROVE site which also included an ozone analyzer operated by the National Park Service. The site is in the southeast part of the park near the visitor center. Figure 10-14 shows a current picture of the Badlands Site.

In October of 2004, the number of pollutant parameters was increased by adding continuous monitors for PM_{10}, $PM_{2.5}$, sulfur dioxide, and nitrogen dioxide. The changes increased the amount of data collected and provide additional information on transport of air pollution. At the end of 2007, the department took over the operation of the ozone monitor at this site upon the request made by the National Park Service.

Figure 10-14 –Badlands Site

The IMPROVE data is used to determine what type of sources are impacting the visibility of the national parks in South Dakota. The goal of having a SLAMS site next to the IMPROVE site is to determine how the data compares between the two different sampling methods, to determine air pollution background levels, and to see if pollution trends show long range transport of air pollution into the state. Table 10-5 contains details on the monitoring site specific to the requirements in 40 CFR Part 58.

Table 10-5 – Badlands Site Specifics

Parameter	Information
Site Name	Badlands
AQS ID Number	46-071-0001
Street Address	25216 Ben Reifel Road, Interior, South Dakota 57750
Geographic Coordinates	UTM Zone 14, NAD 83, E 263,173.81 N 4,847,799.95
MSA	None
PM_{10}	**(Continuous)**
Sampler Type	Federal Equivalent Method EQPM-1102-150
Operating Schedule	Every Day
Scale Representation	Regional
Monitoring Objective	Background, Transport
Sampling Method	T A Series FH 62 C14 Continuous
Analysis Method	Beta Attenuation

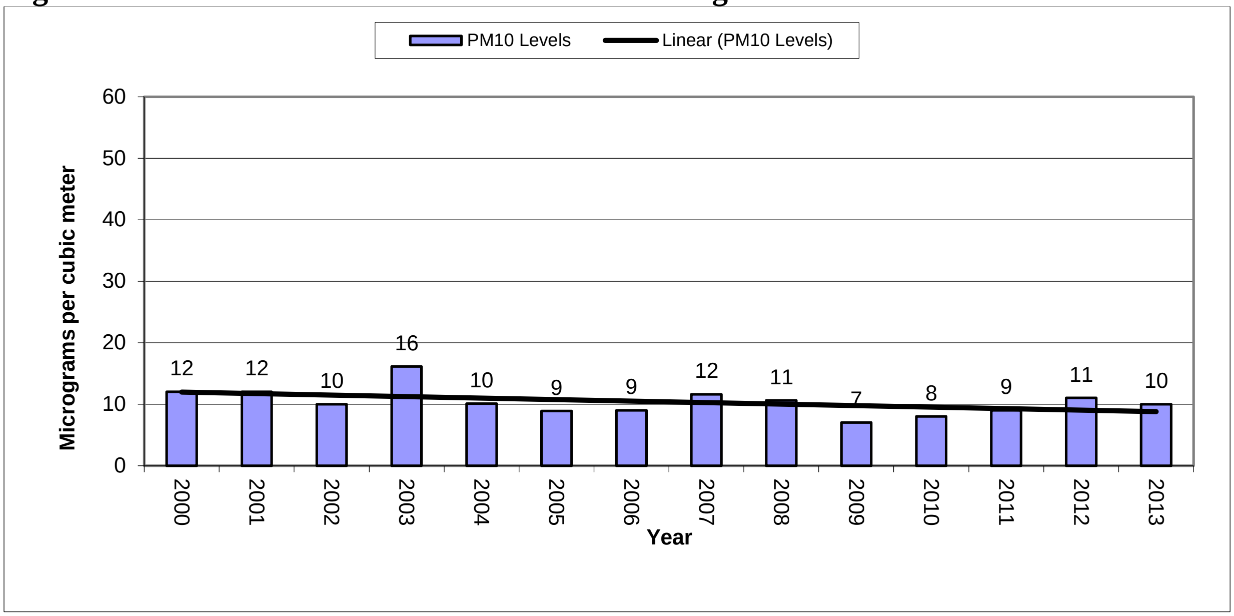
Parameter	Information
Data Use	SLAMS (Comparison to the NAAQS) Real-time Data
$PM_{2.5}$	**(Continuous)**
Sampler Type	Federal Equivalent Method RFPS-0308-170
Operating Schedule	Every Day
Scale Representation	Regional
Monitoring Objective	Background, Transport
Sampling Method	Met One BAM-1020 w/$PM_{2.5}$ VSCC
Analysis Method	Beta Attenuation
Data Use	Real-time Data and SLAMS (Comparison to the NAAQS)
SO_2	**(Continuous)**
Sampler Type	Federal Equivalent Method EQSA-0486-060
Operating Schedule	Every Day
Scale Representation	Regional
Monitoring Objective	Background, Transport
Sampling Method	Instrumental
Analysis Methods	Pulsed Fluorescent
Data Use	SLAMS (Comparison to the NAAQS) Real-time Data
NO_2	**(Continuous)**
Sampler Type	Federal Reference Method RFNA-1289-074
Operating Schedule	Every Day
Scale Representation	Regional
Monitoring Objective	Background, Transport
Sampling Method	Instrumental
Analysis Method	Chemiluminescence
Data Use	SLAMS (Comparison to the NAAQS) Real-time Data
Ozone	**(Continuous)**
Sampler Type	Federal Equivalent Method EQOA-0880-047
Operating Schedule	Every Day
Scale Representation	Regional
Monitoring Objective	Background, Transport
Sampling Method	Instrumental
Analysis Method	Ultraviolet
Data Use	SLAMS (Comparison to the NAAQS) and Real-time Data

10.3.1 Badlands Site – PM10 Data

PM_{10} data has been collected at this site since 2000. The PM_{10} manual monitor was operated on an every sixth day schedule through 2004. Beginning in 2005, a continuous Thermo Beta Gauge PM_{10} monitor replaced the manual monitors.

Figure 10-15 contains a graph of the annual averages for the Badlands Site. The annual average concentration over the last fourteen years varied only slightly overall. The highest annual average concentration of 16 ug/m^3 was recorded in 2003. The lowest annual average concentration of 7 ug/m^3 was recorded in 2009. Trends indicate a light decrease in concentrations over the fourteen years of testing. The PM_{10} concentrations recorded at this site are some of the lowest levels in the state and are considered background for the western half of the state. This parameter is meeting the goals for testing at this site and will be continued.

Figure 10-15 – Badlands Site – PM10 Annual Averages

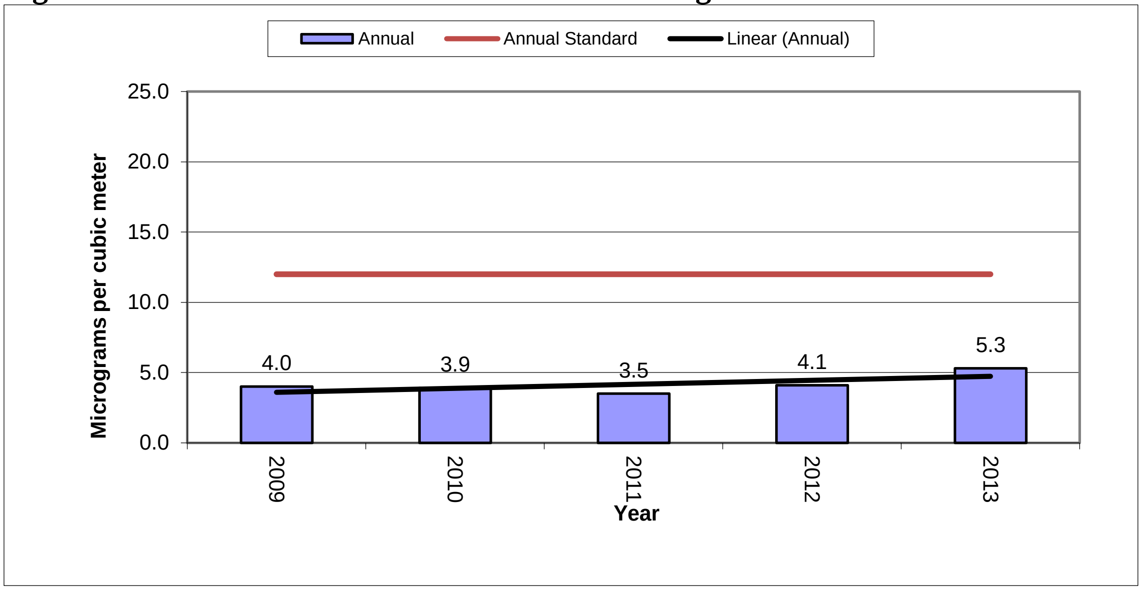


10.3.2 <u>Badlands Site – PM2.5 Data</u>

The $PM_{2.5}$ manual monitors ran on an every third day schedule from 2001 to 2008. With the completion of the 2003 year, the site had three years of $PM_{2.5}$ data and the department was able to make a comparison of the concentration levels to the 24-hour and annual standards. The area was designated as attaining the standard. Beginning in 2009, the Met One BAM-1020 FEM replaced the manual RAAS 100 and the sampling schedule went to every day providing hourly and 24-hour average concentrations.

The annual averages for the Badlands Site show a concentration range with a high of 5.3 ug/m^3 in 2013 and a low of 3.5 ug/m^3 in 2011. The trend for the annual average is a slightly increasing concentration level. $PM_{2.5}$ concentrations at this site are the lowest in the state and represent background levels for western South Dakota. Figure 10-16 contains a graph of the annual averages. This parameter is meeting the goals for testing at this site and will be continued.

Figure 10-16 – Badlands Site PM2.5 Annual Averages

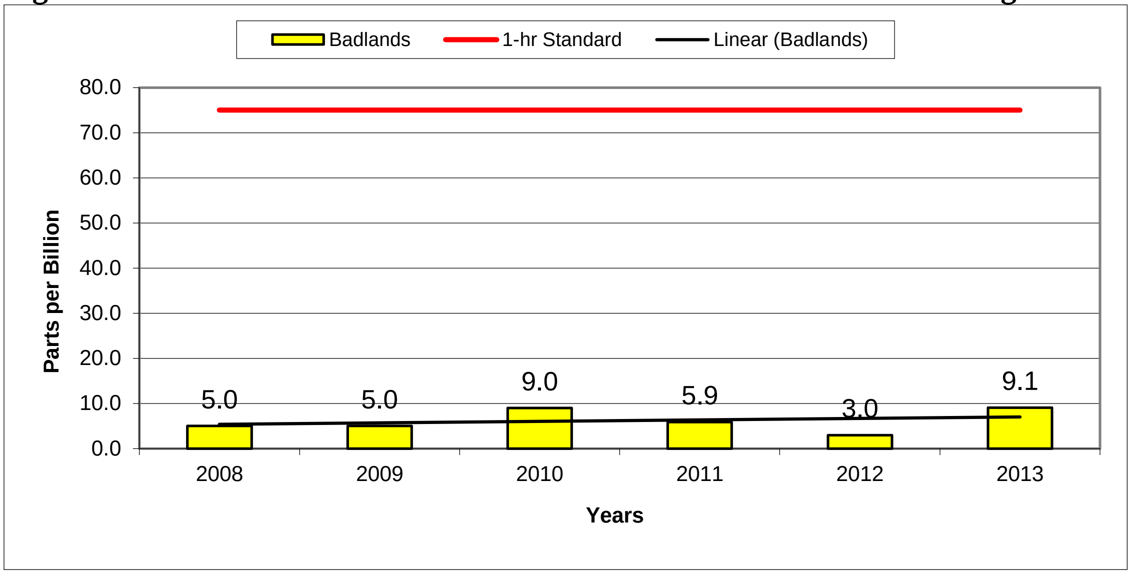


10.3.3 <u>Badlands Site – Sulfur Dioxide Data</u>

The first year of testing at the Badlands Site for sulfur dioxide occurred in 2005. As expected, concentrations for sulfur dioxide are very low and represent background levels. Concentrations are at or near the detection limit for the analyzers at 0.1 ppb for the annual average levels for sulfur dioxide.

In 2013, the annual average was up from 2012 from 3.0 ppb to 9.1 ppb of sulfur dioxide. See Figure 10-17 to view a graph of the annual average concentrations for sulfur dioxide. The linear trend line shows a slight increase in concentrations but levels are very low and indicate minimal concentrations of sulfur dioxide. This parameter is meeting the goals for testing at this site and will be continued.

Figure 10-17 – Badlands Site Sulfur Dioxide 99th Percentile 1-hour Average



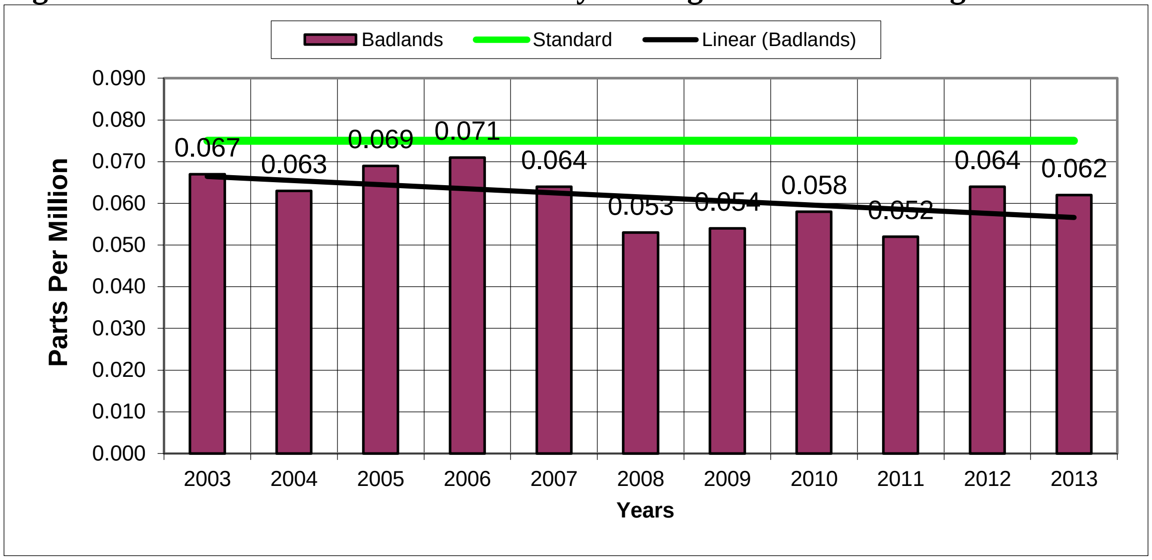
10.3.4 Badlands Site – Ozone Data

The first year of testing at the Badlands Site for ozone was in 2003, with equipment being operated by the National Park Service. The department completed quarterly audits of the ozone analyzer so data could be compared to the NAAQS. At the beginning of 2008 sampling year, the department took over the operation of the ozone analyzer.

Concentrations of ozone at this site have varied over the eight years of testing. The yearly 4th highest 8-hour average ranged from a high of 0.071 ppm in 2006 to a low of 0.052 ppm in 2011. This trend is similar to most of the sites in the western part of the state with lower ozone levels since 2006 and concentrations are down slightly in 2013 from the level in 2012. See Figure 10-18 to view a graph of the yearly 4th highest 8-hour average. The linear trends line shows a declining concentration level due to concentrations in the years from 2007 to 2012.

This parameter will continue to be a priority at this location because of past concentration levels and the testing is meeting the needs to continue the sampling effort.

Figure 10-18 – Badlands Site Ozone Yearly 4th Highest 8-hour Averages

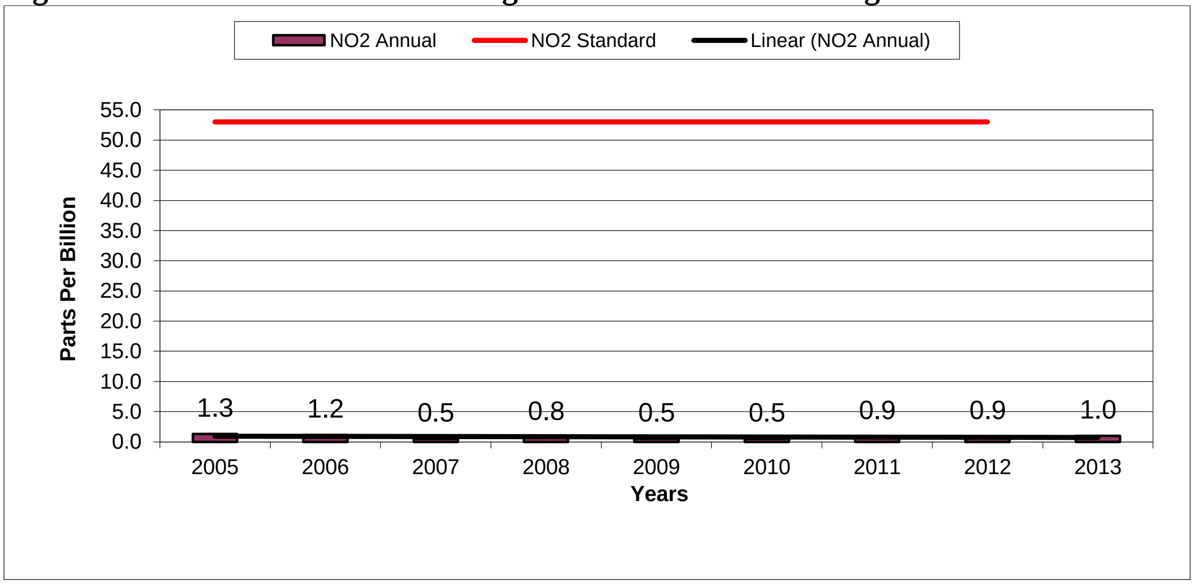


10.3.5 <u>Badlands Site – Nitrogen Dioxide Data</u>

The first year of testing at the Badlands Site for nitrogen dioxide occurred in 2005. As expected, concentrations for nitrogen dioxide are very low and represent background levels. Many hourly concentrations are at the detection limit of the analyzer at 1.0 ppb. The calculated annual average levels for all nine years are close to the detection level for nitrogen dioxide.

See Figure 10-19 to view a graph of the annual average concentrations. The linear trends line shows a stable concentration level. This parameter will continue to be a priority at this location and the testing is meeting the needs to continue the sampling effort.

Figure 10-19 – Badlands Site – Nitrogen Dioxide Annual Averages



10.4 Wind Cave Site

The Wind Cave National Park is one of two Class I areas in South Dakota designated for visibility protection under the Clean Air Act. The Wind Cave area is a large national park located in the southern Black Hills of South Dakota. The Wind Cave Site was established in 2005, with manual monitors for $PM_{2.5}$ and continuous monitors for $PM_{2.5}$, PM_{10}, sulfur dioxide, nitrogen dioxide, and ozone. At the end of 2010, the manual $PM_{2.5}$ monitors were removed from the site leaving only the continuous $PM_{2.5}$ monitor for this parameter.

The monitoring equipment is located in a sampling shelter next to the IMPROVE site operated by the National Park Service. The site is located a short distance west of the visitor center. Figure 10-20 shows a current picture of the Wind Cave Site.

Figure 10-20 – Wind Cave Site

The IMPROVE data will be used to determine what type of sources are impacting the visibility of the national parks in South Dakota. The purpose of having a SLAMS site next to the IMPROVE site is to determine how the data compares between the two different sampling methods, to determine air pollution background levels, and to see if pollution trends show long range transport of air pollution from outside of the state. Table 10-6 contains details on the monitoring site specific to the requirements in 40 CFR Part 58.

Table 10-6 – Wind Cave Site Specifics

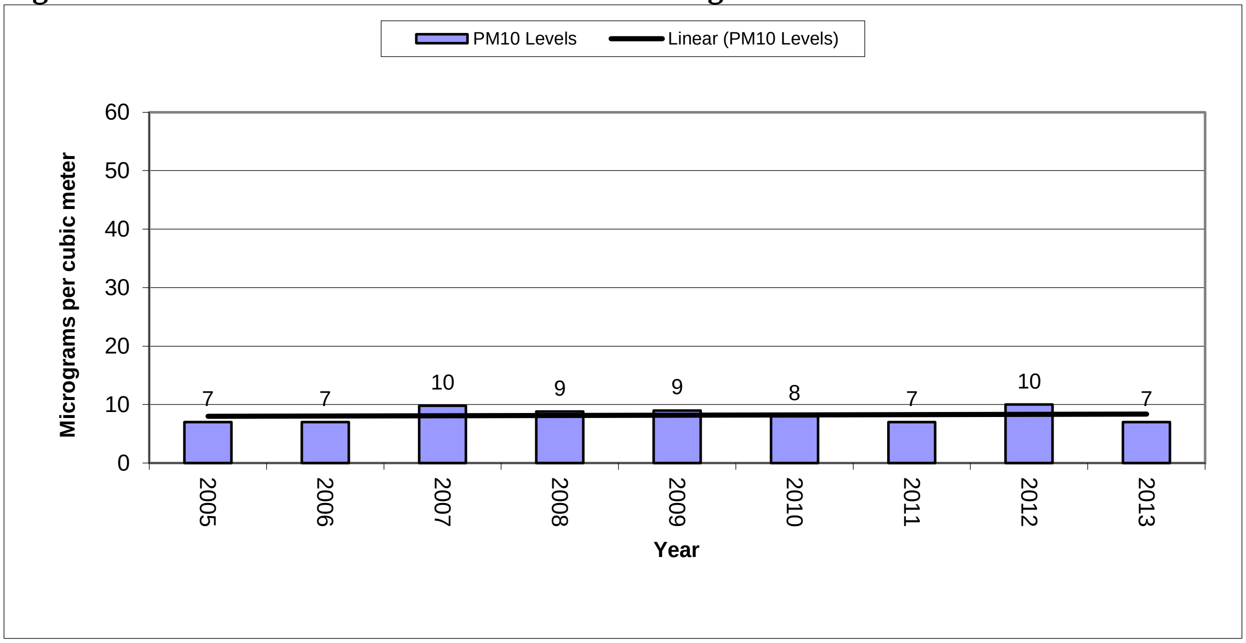
Parameter	Information
Site Name	Wind Cave
AQS ID Number	46-033-0132
Street Address	290 Elk Mountain Camp Road, Hot Springs, South Dakota
Geographic Coordinates	UTM Zone 13, NAD 83, E 622,471.56 N 4,823,856.93
MSA	None
PM_{10}	**(Continuous)**
Sampler Type	Federal Equivalent Method EQPM-1102-150
Operating Schedule	Every Day
Scale Representation	Regional
Monitoring Objective	Background, Transport
Sampling Method	T A Series FH 62 C14 Continuous
Analysis Method	Beta Attenuation
Data Use	SLAMS (Comparison to the NAAQS) Real-time Data
$PM_{2.5}$	**(Continuous)**
Sampler Type	Federal Equivalent Method EQPM-0308-170
Operating Schedule	Every Day
Scale Representation	Regional
Monitoring Objective	Background, Transport
Sampling Method	Met One BAM-1020 FEM
Analysis Method	Beta Attenuation
Data Use	Real-time Data and SPMS
Ozone	**(Continuous)**
Sampler Type	Federal Equivalent Method EQOA-0880-047
Operating Schedule	Every Day
Scale Representation	Regional
Monitoring Objective	Background, Transport
Sampling Method	Instrumental
Analysis Method	Ultra Violet
Data Use	SLAMS (Comparison to the NAAQS) Real-time Data

10.4.1 Wind Cave Site – PM10 Data

The PM_{10} concentrations at this site are one of the lowest in the state and are similar in concentrations as the Badlands Site. The Wind Cave Site is the most remote site in the state and a site that has no influence from industry and agriculture activities near the location. Figure 10-21 contains a graph showing the annual average PM_{10} concentrations.

The 2013, PM_{10} concentrations were down slightly from 2012. The trend line indicates a steady concentration levels over the nine years of testing. The concentrations ranged from 7 to 10 ug/m^3 and are very low representing background levels. This parameter is meeting the goals of background, visibility protection, long range transport, and will be continued.

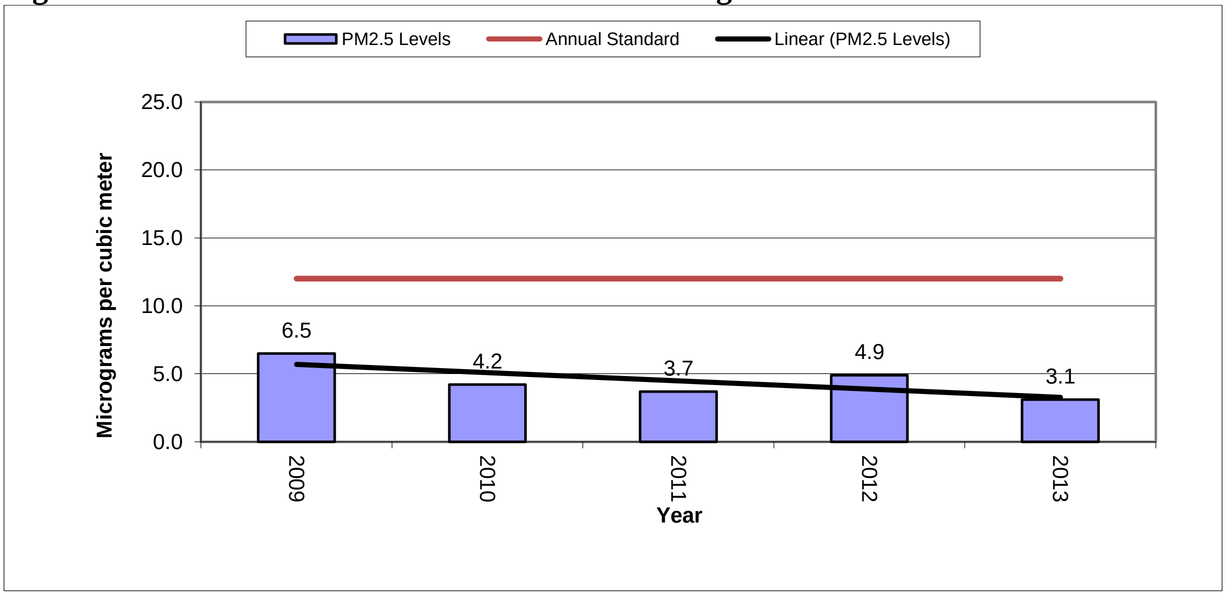
Figure 10-21 - Wind Cave Site PM10 Annual Averages



10.4.2 Wind Cave Site – PM 2.5 Data

The $PM_{2.5}$ concentrations are similar to the levels recorded at the Badlands Site and are some of the lowest in the state. Figure 10-22 contains a graph showing the annual average $PM_{2.5}$ concentration levels.

Figure 10-22 - Wind Cave Site PM2.5 Annual Averages

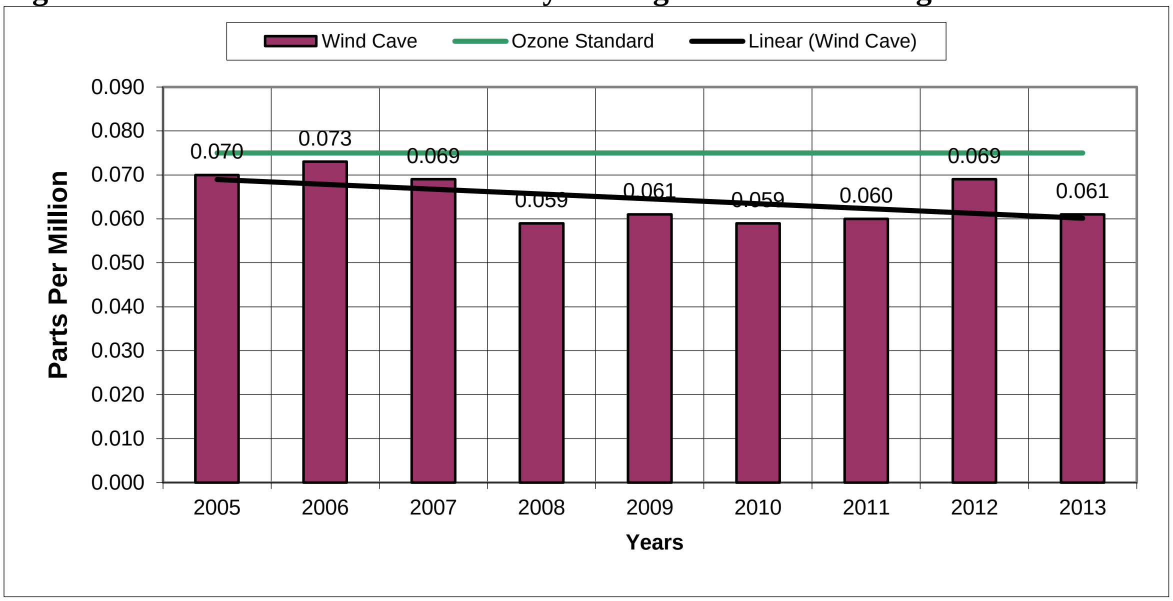


The linear trend line indicates a decrease in concentration level during the last five years of testing. The $PM_{2.5}$ annual average concentration range from 6.5 ug/m^3 in 2009 to 3.1 ug/m^3 in 2013. Concentrations were down slightly in 2013 to a new low for this site. This parameter is meeting the goals of background, visibility protection, and long range transport and will be continued.

10.4.3 <u>Wind Cave Site – Ozone Data</u>

Figure 10-23 contains a graph of the ozone 8-hour concentrations for the Wind Cave Site since 2005. The Wind Cave Site had the highest reported yearly 4th highest 8-hour ozone level in the state at 0.073 ppm recorded in 2006. Ozone levels began to fall in 2007 and the trend line shows decreasing concentrations. In 2012, Wind Cave ozone levels jumped back up to the approximate levels recorded when the department first started monitoring for ozone; but in 2013, Wind Cave ozone levels decreased significantly back to levels collect since 2008.

Figure 10-23 – Wind Cave Ozone Yearly 4th Highest 8-hour Averages



Testing for ozone is meeting the needs of the monitoring network by detecting transport pollution levels for this area of the state. Therefore, this parameter will be continued.

10.5 Sioux Falls Area

In 2013, two sampling sites were operated in the Sioux Falls area: 1) KELO and 2) SD School sites. The criteria pollutant parameters tested at these sites include PM_{10}, $PM_{2.5}$, ozone, carbon monoxide, sulfur dioxide, and nitrogen dioxide. In addition, special purpose parameters are sampled including continuous $PM_{2.5}$, $PM_{10-2.5}$, speciation $PM_{2.5}$ and NO_y. Air monitoring data shows the Sioux Falls area is attaining all of the NAAQS set by EPA.

The city continues to grow and now includes residential areas in two counties: 1) Minnehaha and 2) Lincoln. Sioux Falls is the largest city in the state with a 2010 Census population of 169,468 for Minnehaha County and 44,828 in Lincoln County. The industrial base is mainly service oriented businesses with a small amount of heavy industry.

10.5.1 KELO Site

The KELO Site was established in 1991, as a replacement for the City Hall Site. Figure 10-24 shows a current picture of the monitoring site. The site is located in the downtown, central part of the city and at 23 years of operation is the oldest site still operating in Sioux Falls.

Figure 10-24 – KELO Site

During an oversight review completed by EPA in 2001, it was noted that a tree planted to the west of the sampling site had grown and would require the sampling platform be moved about 10 feet east. The monitors were moved so the tree would not be an obstruction of the 360-degree arch around the monitor. In 2013, the distance between the monitors and the tree is sufficient so the tree is not an obstruction to the site. The height of the tree will be assessed each year to be sure the distance of the monitors from the tree meets the location requirements in 40 CFR Part 58.

In 2002, a $PM_{2.5}$ speciation monitor was added to the site to determine the chemical makeup of the $PM_{2.5}$ pollution. The sampler was located at this site because the $PM_{2.5}$ concentrations are some of the highest in the state and because the city of Sioux Falls is the largest population center in the state. The $PM_{2.5}$ speciation monitor was moved from this site to the SD School, NCore Site for South Dakota, at the beginning of 2009, as required by EPA rule.

At the end of 2010, the PM_{10} parameter was removed from this site because concentrations are low and have a very small chance of exceeding the national standard.

Sampling objectives for these monitoring parameters are population and high concentration. The sampling scale is neighborhood for $PM_{2.5}$. Table 10-7 contains details on the monitoring site specific to the requirements in 40 CFR Part 58.

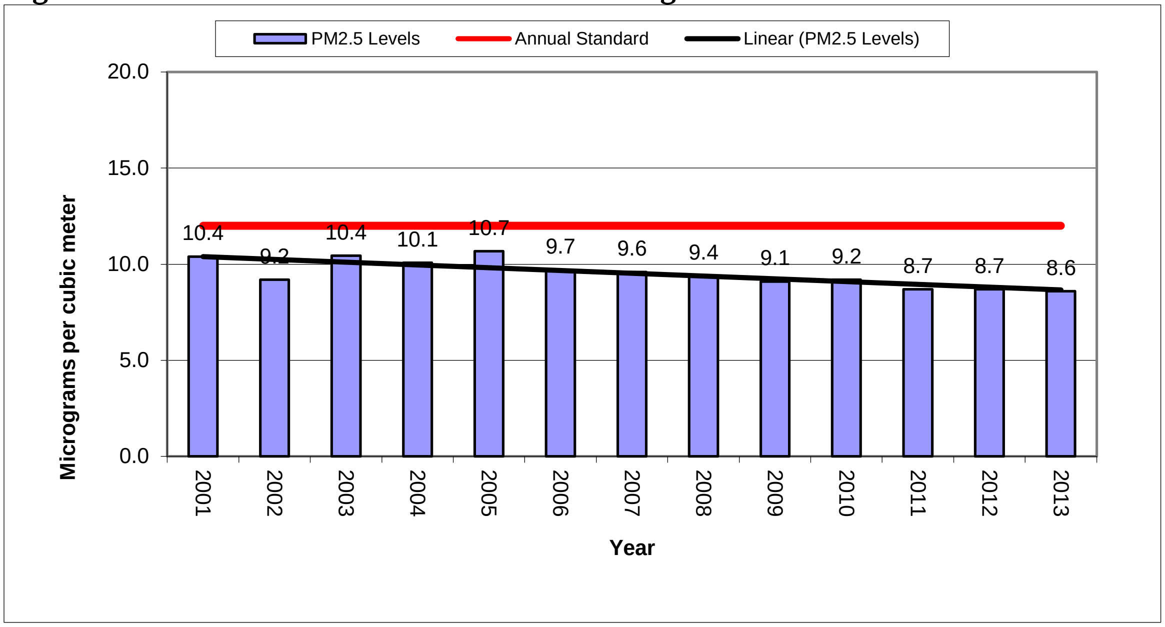
Table 10-7 - KELO Site Specifics

Parameter	Information
Site Name	KELO
AQS ID Number	46-099-0006
Street Address	500 South Phillips, Sioux Falls, SD
Geographic Coordinates	UTM Zone 14, NAD 83, E 683,678.21 N 4,823,550.80
MSA	Sioux Falls
$PM_{2.5}$	**(Manual)**
Sampler Type	Federal Equivalent Method EQPM-0202-143
Operating Schedule	Every 3rd Day
Scale Representation	Neighborhood
Monitoring Objective	Population and High Concentration
Sampling Method	Partisol 2000 $PM_{2.5}$ w/VSCC
Analysis Methods	Gravimetric
Data Use	SLAMS (Comparison to the NAAQS)

10.5.1.1 *KELO Site – PM2.5 Data*

Sampling for $PM_{2.5}$ concentrations began in 2001. Annual averages for the KELO Site have a range from a high of 10.7 ug/m^3 in 2005 to a low of 8.6 ug/m^3 in 2013. Figure 10-25 contains a graph of the annual averages for the KELO Site.

Figure 10-25 – KELO Site PM2.5 Annual Averages



Annual averages show some variation from year to year, but the trend line shows a decreasing concentration level. In 2013, the annual average concentration dropped to the lowest concentration level since the testing began in 2001.

The KELO and SD School sites have concentrations that are very similar and appear to be duplicating the sampling effort in Sioux Falls. The plan is to terminate the KELO Site at the end of 2014 and use the sampling resources in other locations in the state. See Attachment A for more details on the comparison of the two sites in Sioux Falls for $PM_{2.5}$ testing.

10.5.2 SD School Site

The SD School Site replaced the SF Hilltop Site on January 1, 2008. The site is the National Core site for the state. Operating sampling parameters at the SD School Site include PM_{10}, $PM_{2.5}$, ozone, sulfur dioxide, nitrogen dioxide, carbon monoxide, NO_y, $PM_{10-2.5}$, meteorology, and $PM_{2.5}$ speciation in 2013. The setup of sampling equipment for $PM_{10-2.5}$ includes results for PM_{10} and $PM_{2.5}$ without adding any additional monitors to the site. This is a very busy monitoring site collecting more than 140,000 data points per year all loaded to the EPA national database. Figure 10-26 shows a current picture of the SD School Site.

The SD School Site is located on the east central part of the city. The site is about 1.2 miles southeast of the main industrial area in Sioux Falls. The area around the site is mainly residential. Interstate 229 which is a major commuting road runs north and south about three city blocks east of the monitoring site. Table 10-8 contains details on the monitoring site specific to the requirements in 40 CFR Part 58. In addition to the parameters listed in Table 10-8, a $PM_{2.5}$ speciation monitor is operated at an every 3rd day sampling schedule.

Figure 10-26 – SD School Site

Table 10-8 – SD School Site Specifics

Parameter	Information
Site Name	SD School
AQS ID Number	46-099-0008
Street Address	2009 East 8th Street, Sioux Falls, SD
Geographic Coordinates	UTM Zone 14, NAD 83, E 687,288.70 N 4,822,930.29
MSA	Sioux Falls
PM_{10}/PM_{coarse}	**(Continuous)**
Sampler Type	Federal Equivalent Method EQPM-0798-122
Operating Schedule	Every Daily/Hourly
Scale Representation	Neighborhood
Monitoring Objective	Population and High Concentration
Sampling Method	Met One BAM-1020
Analysis Methods	beta attenuation
Data Use	SLAMS (Comparison to the NAAQS)
$PM_{2.5}$	**(Manual)**
Sampler Type	Federal Reference Method RFPS-0202-143
Operating Schedule	Every 3rd Day
Scale Representation	Neighborhood
Monitoring Objective	Population and High Concentration

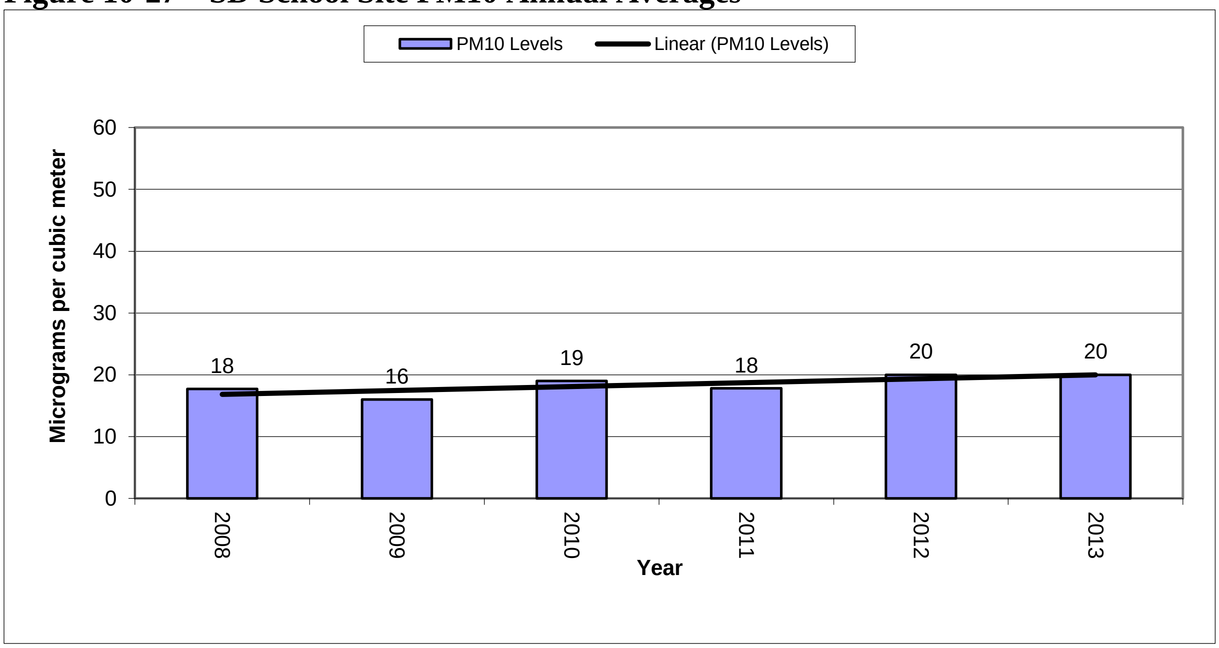
Parameter	Information
Sampling Method	Partisol 2000 w/VSCC
Analysis Methods	Gravimetric
Data Use	SLAMS (Comparison to the NAAQS)
$PM_{2.5}$	**(Continuous)**
Sampler Type	Federal Equivalent Method EQPM-0308-170
Operating Schedule	Every Daily/Hourly
Scale Representation	Neighborhood
Monitoring Objective	Population and High Concentration
Sampling Method	Met One BAM-1020
Analysis Methods	beta attenuation
Data Use	SLAMS (Comparison to the NAAQS)
Ozone	**(Continuous)**
Sampler Type	Federal Equivalent Method EQOA-0880-047
Operating Schedule	Hourly
Scale Representation	Neighborhood
Monitoring Objective	High Concentration and Population
Sampling Method	Instrumental Thermo 49C
Analysis Methods	Ultraviolet
Data Use	SLAMS (Comparison to the NAAQS), Real-time Data
NO_2	**(Continuous)**
Sampler Type	Federal Reference Method RFNA-1289-074
Operating Schedule	Hourly
Scale Representation	Neighborhood
Monitoring Objective	High Concentration and Population
Sampling Method	Automated Analyzer Thermo 42c
Analysis Methods	Ultraviolet Fluorescence
Data Use	SLAMS (Comparison to the NAAQS), Real-time Data
NO_y	**(Continuous)**
Sampler Type	None
Operating Schedule	Hourly
Scale Representation	Neighborhood
Monitoring Objective	Population
Sampling Method	Automated Analyzer Thermo 42i
Analysis Methods	Chemiluminescence NO-Dif-NO_y
Data Use	SPMs
SO_2	**(Continuous)**
Sampler Type	Federal Equivalent Method EQSA-0486-060
Operating Schedule	Hourly
Scale Representation	Neighborhood
Monitoring Objective	High Concentration and Population
Sampling Method	Instrumental Thermo 43i TL
Analysis Methods	Pulsed Fluorescence
Data Use	SLAMS (Comparison to the NAAQS), Real-time Data
CO	**(Continuous)**

Parameter	Information
Sampler Type	Federal Equivalent Method EQSA-0486-060
Operating Schedule	Hourly
Scale Representation	Neighborhood
Monitoring Objective	High Concentration and Population
Sampling Method	Instrumental Thermo 48i TLE
Analysis Methods	Gas/Filter/Correlation
Data Use	SLAMS (Comparison to the NAAQS), Real-time Data

10.5.2.1 *SD School Site – PM10 Data*

Figure 10-27 shows a graph of the PM_{10} annual averages since 2008. The annual averages at the SD School Site range from a high of 20 ug/m^3 in 2012 to a low of 16 ug/m^3 in 2009. In 2013, PM_{10} concentrations were the same as the previous year. The trend line indicates a slightly increasing concentration level. This parameter is meeting the goals of high concentration and population and will be continued.

Figure 10-27 – SD School Site PM10 Annual Averages

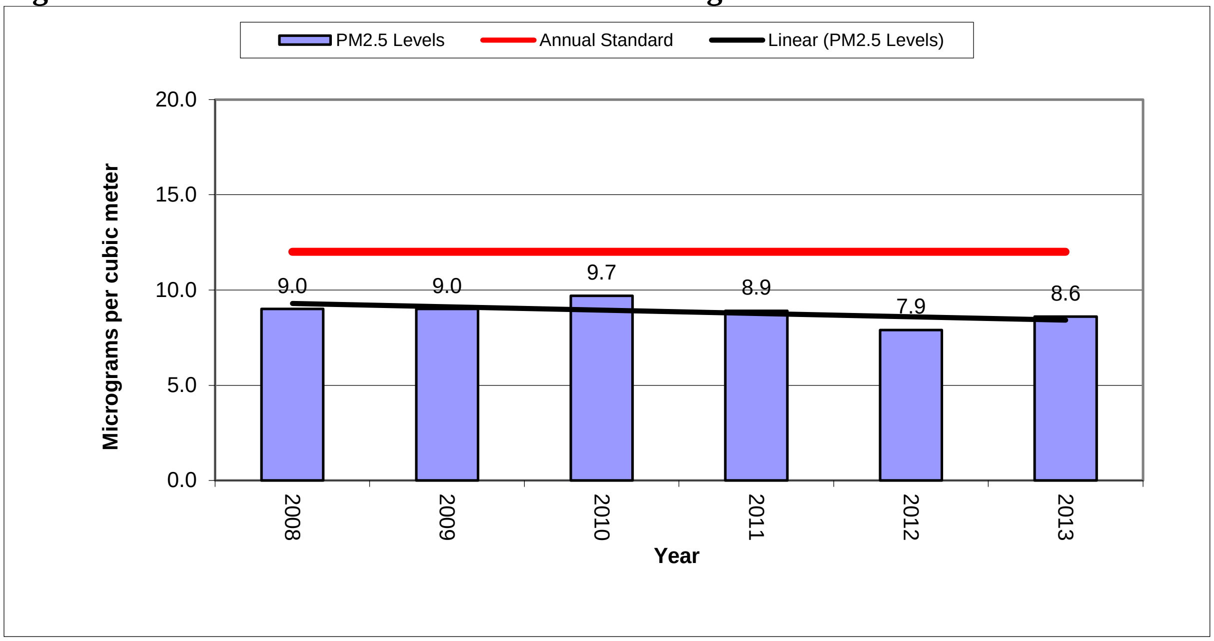


10.5.2.2 *SD School Site – PM2.5 Data*

$PM_{2.5}$ data has been collected at this site since 2008. Annual averages for the SD School Site range from a low of 7.9 ug/m^3 in 2012 to a high of 9.7 ug/m^3 in 2010. The 2013 sampling year recorded a slightly higher concentration as was recorded in 2012. Figure 10-28 contains a graph of the annual averages.

Concentrations of $PM_{2.5}$ are some of the highest in the state at this site. In 2013, the SD School Site had concentrations of $PM_{2.5}$ that ranked as the 3rd highest in the state but in some previous years is the highest site statewide. This parameter will remain a priority because of past high concentrations levels for the annual and 24-hour standards. Testing for this parameter is meeting the goals of high concentration and population and will be continued.

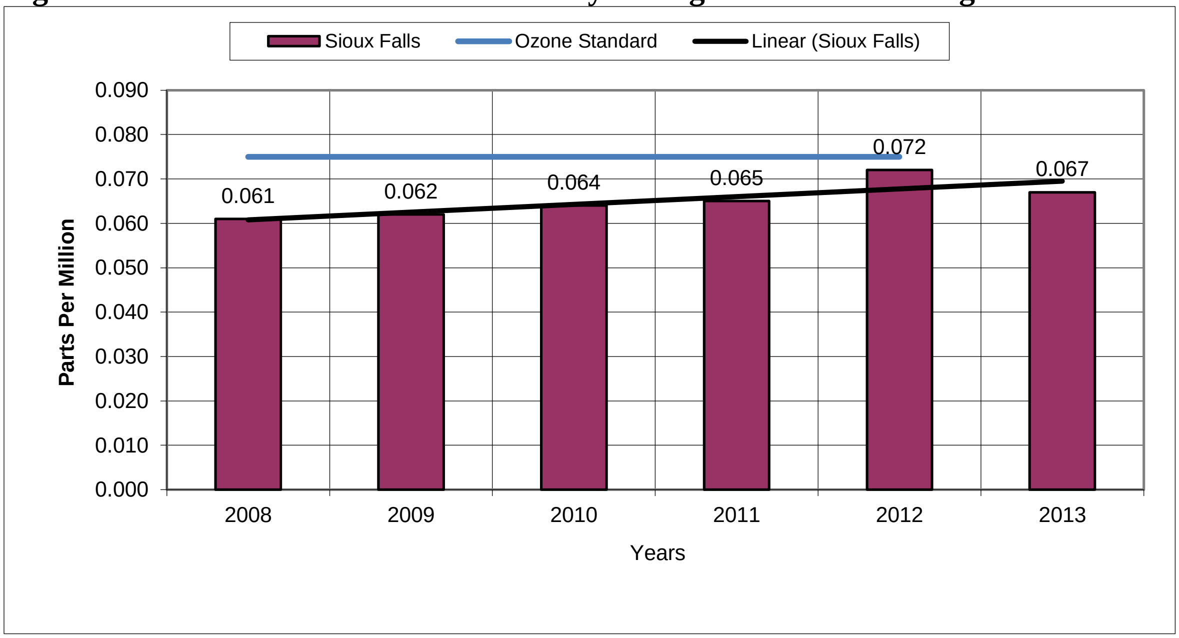
Figure 10-28 – SD School Site PM2.5 Annual Averages



10.5.2.3 *SD School Site – Ozone Data*

Figure 10-29 contains a graph of each year's 4^{th} highest ozone concentration level. The ozone analyzer runs on a continuous sampling schedule providing hourly concentrations to the data logger. The official yearly ozone season for South Dakota runs from June 1 to September 30.

Figure 10-29 – SD School Site Ozone Yearly 4^{th} Highest 8-Hour Averages



Past sampling experience shows that some of the high ozone readings can occur outside of the official ozone season. The department operates the monitor year around instead of just during the ozone season.

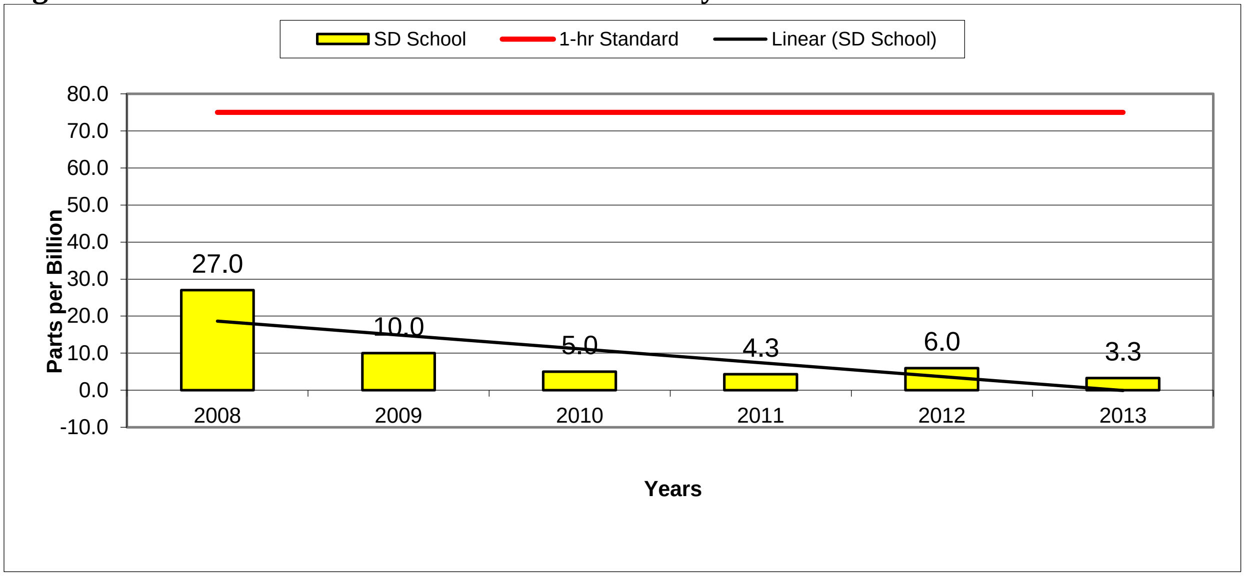
Sampling began for ozone at this site in 2008. The highest annual 4th highest 8-hour ozone concentration recorded at this site was in 2012 at 0.072 ppm. The lowest annual 4th highest 8-hour ozone concentration was recorded at 0.061 ppm in 2008. The trend line shows an increasing level of ozone over the five years of testing. In 2013, concentrations of ozone decreased by 0.005 ppm from the level in 2012. This parameter is meeting the goals of high concentration and population testing and is one of the highest sites in the state so the testing will be continued at this site.

10.5.2.4 *SD School Site – Sulfur Dioxide Data*

Testing for sulfur dioxide started in 2008 at this site. A continuous analyzer is operated providing hourly concentration levels. The levels of sulfur dioxide have dropped in concentration since the first year of testing. The type of analyzer was changed to a trace level sulfur dioxide analyzer in 2011. The detection level of this analyzer is now 0.1 ppb.

In 2013, concentrations of sulfur dioxide continued to decrease from the previous years. The trend line shows a drop in concentrations of sulfur dioxide over the six years of testing. This parameter is meeting the goals of high concentration and population and testing will be continued at this site. Figure 10-30 contains a graph of the sulfur dioxide yearly 1-hour 99th percentile for each sampling year.

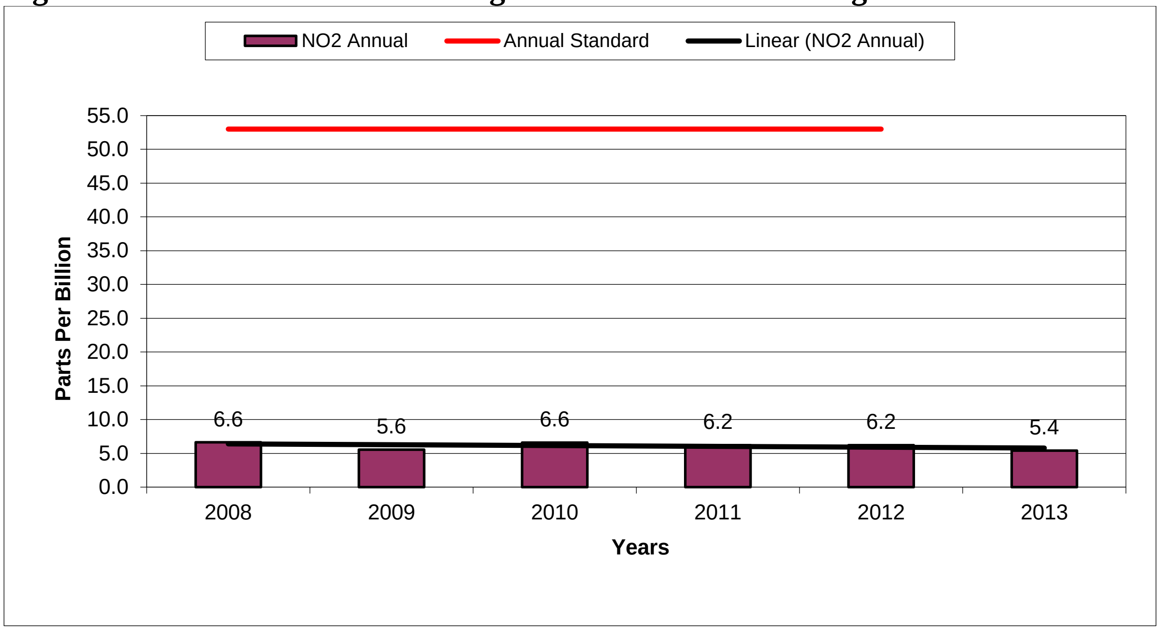
Figure 10-30 – SD School Site Sulfur Dioxide Yearly 1-hour 99th Percentile



10.5.2.5 *SD School Site – Nitrogen Dioxide Data*

The SD School Site began testing for nitrogen dioxide in 2008. The nitrogen dioxide analyzer provides hourly concentration levels. The SD School Site is the second highest nitrogen dioxide concentration areas in the state. There is only 1.2 ppb difference in annual concentration levels from highest annual average of 6.6 in 2008 and the lowest of 5.4 in 2013. Trends show concentrations are declining slightly at this site. Figure 10-31 shows the annual average for each of the years that data was collected. This parameter is meeting the goals of high concentration and population and will be continued.

Figure 10-31 – SD School Site Nitrogen Dioxide Annual Averages



10.6 Aberdeen Area

In 2013, one sampling site was operated in the city of Aberdeen at the Fire Station #1 Site. The Fire Station #1 Site was established in 2000 as part of the implementation of the $PM_{2.5}$ air monitoring network. The parameters tested at the site include PM_{10} and $PM_{2.5}$. The monitoring site is located in the center of the city on top of the fire station roof just east of the main downtown business area. The area around the site has service type businesses, county and city offices, and residential area to the east. See Figure 10-32 for a picture of the monitoring site.

Figure 10-32 – Aberdeen's Fire Station #1 Site

In 2009, Fire Station #1 was renovated and a small addition was added to the south side of the building. The addition required no changes at the site so the location requirements in 40 CFR Part 58 are still met. Table 10-9 contains details on the monitoring site specific to the requirements in 40 CFR Part 58.

Table 10-9 – Fire Station #1 Site Specifics

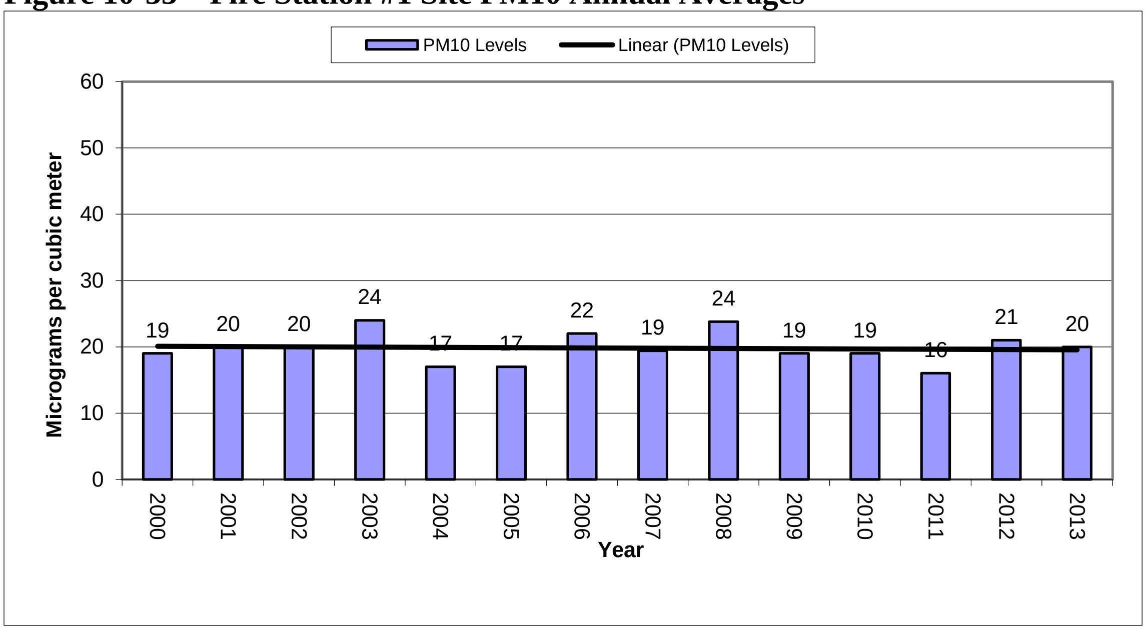
Parameter	Information
Site Name	Fire Station #1
AQS ID Number	46-013-0003
Street Address	111 2nd Ave SE, Aberdeen, SD
Geographic Coordinates	UTM Zone 14, NAD 83, E 540,216.92 N 5,034,545.94
MSA	None
PM_{10}	**(Manual)**
Sampler Type	Federal Reference Method RFPS-1287-063
Operating Schedule	Every 6th Day
Scale Representation	Neighborhood
Monitoring Objective	High Concentration and Population
Sampling Method	Hi-Vol SA/GMW-1200
Analysis Methods	Gravimetric
Data Use	SLAMS (Comparison to the NAAQS),
$PM_{2.5}$	**(Manual)**

Parameter	Information
Sampler Type	Federal Equivalent Method EQPM-0804-153
Operating Schedule	Every 3rd Day
Scale Representation	Neighborhood
Monitoring Objective	Population and High Concentration
Sampling Method	Partisol 2000 w/VSCC
Analysis Methods	Gravimetric
Data Use	SLAMS (Comparison to the NAAQS)

10.6.1 Fire Station #1 Site – PM10 Data

In 2009 the sampling schedule for PM_{10} changed from every third day to every 6th day because concentrations at the site continue to be low and the chance of recording a concentration over the current standard are very low. Figure 10-33 contains a graph of the annual averages since the site was setup in 2000.

Figure 10-33 – Fire Station #1 Site PM10 Annual Averages



The annual average concentrations change from year to year but with the addition of the annual average for 2013 the trends line indicates a steady levels over the fourteen years of testing. The annual averages range from a low of 16 ug/m^3 in 2011 to a high concentration level of 24 ug/m^3 recorded in 2003 and 2008. The testing for this parameter is meeting the goals of high concentration and population and will be continued.

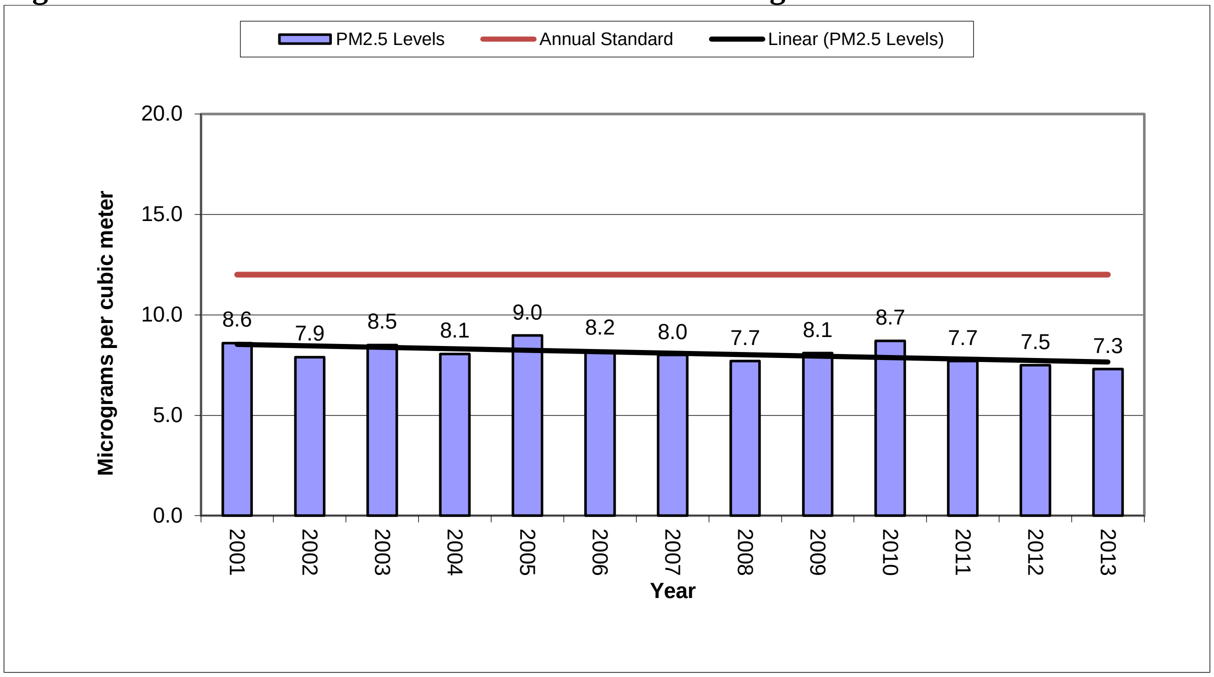
10.6.2 Fire Station #1 Site – PM2.5 Data

Sampling began for $PM_{2.5}$ at this site in 2001. The $PM_{2.5}$ monitors run on an every third day sampling schedule. Annual averages for the Fire Station #1 Site in Aberdeen have ranged from

7.3 ug/m^3 in 2013 to 9.0 ug/m^3 in 2005. The 2013 annual average concentration was slightly lower then was recorded in 2012 by 0.2 ug/m^3.

The trend line shows that annual average is declining slightly in concentration level over the last thirteen years. The testing for this parameter is meeting the goals of high concentration and population and will be continued. Figure 10-34 contains a graph of the annual average concentrations.

Figure 10-34 – Fire Station #1 Site PM2.5 Annual Averages



10.7 Brookings Area

In 2013 two air monitoring sites were operated in the Brookings County. The oldest site is located at the City Hall building in the center of the city of Brookings. Testing at this site includes PM_{10} and $PM_{2.5}$ parameters. The Research Farm Site was setup in 2008 and is located at the Soil Conservation Farm northwest of the city of Brookings. Testing at this site includes ozone and meteorological data.

10.7.1 City Hall Site

The City Hall Site was established in 1989 and sampled for levels of PM_{10}. The site is the result of a cooperative effort between the department and the city of Brookings. The area to the west of the site is residential and the areas north, east, and south have service oriented businesses and light industry. Brookings is a growing community with a population of 22,056 and has a growing industrial base. In 1999, $PM_{2.5}$ monitors were added to the site. The sampling frequency in 2012 was changed for PM_{10} to every day and $PM_{2.5}$ continues as every third day testing. Figure 10-35 shows a current picture of the monitoring site. Table 10-10 contains details on the monitoring site specific to the requirements in 40 CFR Part 58.

Figure 10-35 – City Hall Site

Table 10-10 – City Hall Site Specifics

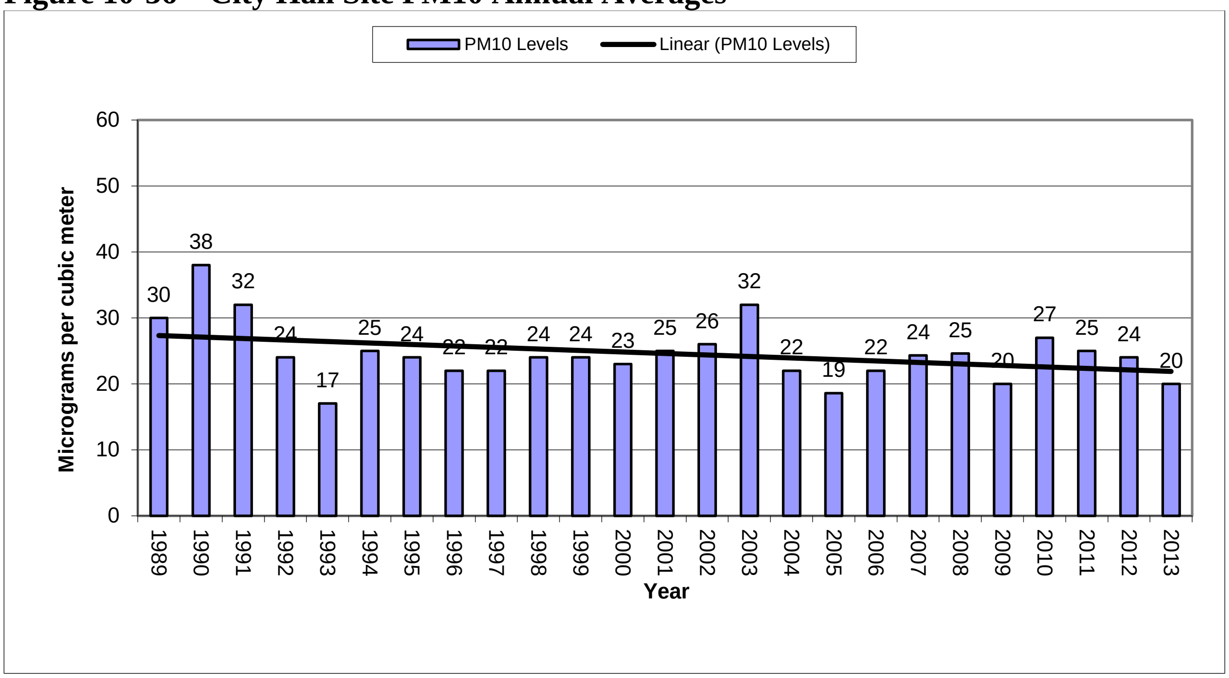
Parameter	Information
Site Name	City Hall
AQS ID Number	46-011-0002
Street Address	311 3rd Avenue, Brookings, SD
Geographic Coordinates	UTM Zone 14, NAD 83, E 675,410.76 N 4,908,468.06
MSA	None
PM_{10}	**(Continuous)**
Sampler Type	Federal Equivalent Method EQPM-1102-150
Operating Schedule	Every Day
Scale Representation	Neighborhood
Monitoring Objective	High Concentration and Population
Sampling Method	T A Series FH 62 C14 Continuous
Analysis Methods	Beta Attenuation
Data Use	SLAMS (Comparison to the NAAQS) Real-Time Data
$PM_{2.5}$	**(Manual)**
Sampler Type	Federal Equivalent Method EQPM-0202-143
Operating Schedule	Every 3rd Day
Scale Representation	Neighborhood

Parameter	Information
Monitoring Objective	Population and High Concentration
Sampling Method	R&P Partisol 2000 w/VSCC
Analysis Methods	Gravimetric
Data Use	SLAMS (Comparison to the NAAQS)

10.7.1.1 *City Hall Site – PM10 Data*

PM_{10} sampling began at this site in 1989. At the beginning of 2012 the manual monitors were replaced with a continuous. The annual averages range from a high of 38 ug/m^3 in 1990 to a low of 17 ug/m^3 in 1993. The trend line shows concentration levels declining over the 24 years the site has been operating. In 2013, PM_{10} concentrations were down from the previous year by 4 ug/m^3. In Figure 10-36, there is a graph of the annual averages since the site was setup in 1989.

Figure 10-36 – City Hall Site PM10 Annual Averages



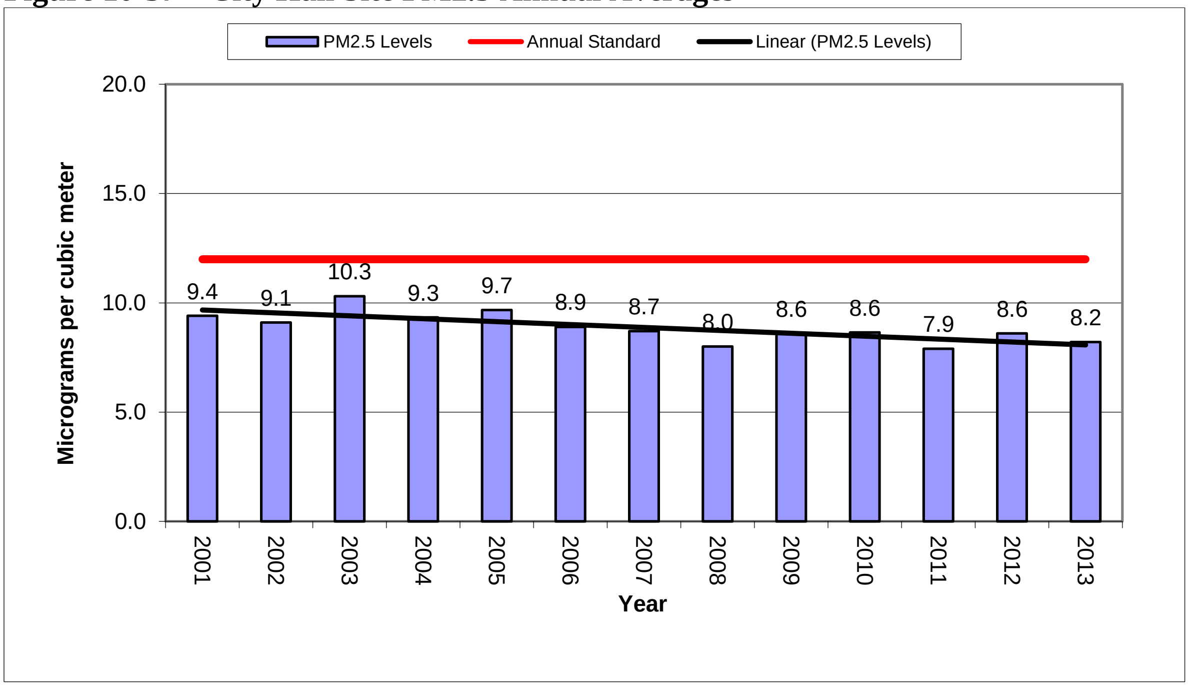
The current plan is to combine the two air monitoring sites in Brookings County into one. The goal would be to close the City Hall Site and mover the sampling parameters to the Research Farm Site. In preparation to combine the sites a continuous PM_{10} monitor will be set up and run by midyear 2014, so data can be compared. If the data comparison is close in concentration level the two sites will be combined by the start of 2015.

10.7.1.2 *City Hall Site – PM2.5 Data*

The $PM_{2.5}$ monitors run on an every third day schedule since the site was setup in 1999. Annual averages for the City Hall Site range from a high of 10.3 ug/m^3 in 2003 to a low of 7.9 ug/m^3 in 2011. The trends for the thirteen years of testing show a decrease in $PM_{2.5}$ levels overall. In 2013, $PM_{2.5}$ annual average concentration was down slightly from the levels recorded in 2012.

Testing for this parameter is meeting the goals of high concentration and population. Most of the high 24-hour concentrations occur on days that are regional in scale. Annual averages are well under the standard and similar to the levels as the other eastern edge of the state sites. Therefore, the plan is to continue to test for $PM_{2.5}$ in Brookings County but move the testing to the Research Farm Site so the manual method monitor can be replaced with a continuous monitor at the start of 2015. Figure 10-37 contains a graph of the annual average concentrations.

Figure 10-37 – City Hall Site PM2.5 Annual Averages



10.7.2 <u>Research Farm Site</u>

The Research Farm Site was set up in cooperation with the 3M Company in Brookings and Valero Renewable Fuels Company near the city of Aurora which provided the equipment for the site. The sampling was a requirement of the Prevention of Significant Deterioration permits for both facilities. The department is operating the site and provided data to the facilities. The 3M Company has completed their air monitoring report using the data for 2008. Valero Renewable Fuels Company decided not to complete the facility upgrade under its Prevention of Significant Deterioration permit and no longer needs data from the Research Farm Site. Ozone data collected between 2008 and 2010 was added as a SLAMS site to the National Database in 2010.

The site location is outside of the nitrogen dioxide one microgram area modeled for the facilities in the Brookings area. The site collects data for ozone and meteorological parameters. The goals of the monitoring site were the evaluation of impacts to the ozone concentrations from modification at the 3M Company and Valero Renewable Fuels Company and to date the goals have been met. New goals have been added to collect ozone data downwind of a small city and for comparison to the NAAQS. The completion of the 2013 sampling year provides six years of testing and a better idea of trends for the ozone data. Figure 10-38 shows a current picture of the monitoring site. Table 10-11 contains details on the monitoring site specific to the requirements in 40 CFR Part 58.

Figure 10-38 – Research Farm Site

Table 10-11 – Research Farm Site Specifics

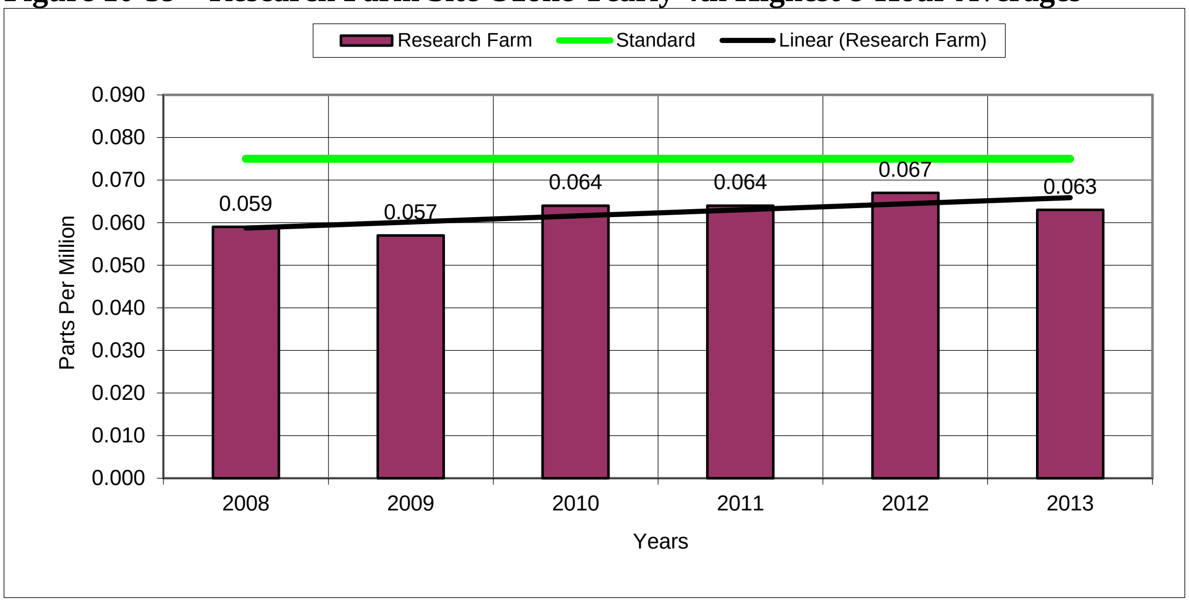
Parameter	Information
Site Name	Research Farm
AQS ID Number	46-011-0003
Street Address	3714 Western Ave.
Geographic Coordinates	UTM Zone 14, NAD 83, E 674766.316 N 4912930.911
MSA	None
Ozone	**(Continuous)**
Sampler Type	Federal Equivalent Method EQOA-0880-047
Operating Schedule	Every Day
Scale Representation	Regional
Monitoring Objective	High Concentration, Population, and Background
Sampling Method	Thermo 49i
Analysis Methods	ultraviolet
Data Use	SLAMS (Comparison to the NAAQS),

10.7.2.1 *Research Farm Site – Ozone Data*

The 2013 sampling year is the 6th ozone season of testing. In 2013, the Research Farm Site had a fourth highest 8-hour average for the year under the standard of 0.075 ppm. The ozone data trend indicates an increasing level. The ozone sampling sites along the eastern edge of state have all shown an increase in ozone levels the last six years.

The testing for this parameter is meeting the goals of a SLAMS location and will be continued because it is one of three sites recording the highest concentrations in the state. It is meeting the goal of high concentration and population. The graph in Figure 10-39 shows the yearly 4th highest ozone concentration level for the last six years.

Figure 10-39 – Research Farm Site Ozone Yearly 4th Highest 8-Hour Averages



10.8 Watertown Area

In 2013, one sampling site was operated in the city of Watertown. Watertown is the fourth largest city in South Dakota with a population of 21,482. The city has an increasing growth rate and industrial base. The industrial base is a mixture of service-oriented business and light industry. One other air monitoring site was operated in Watertown starting in 1974 and closed 1987. No other air monitoring data has been operated in the city. Figure 10-40 shows a picture of the monitoring site.

The current Watertown Site was established in 2003 as part of the implementation of the $PM_{2.5}$ network. The parameters tested at the site include PM_{10} on a sampling frequency of every day and $PM_{2.5}$ at a sampling frequency of every third day. In 2012, the manual $PM_{2.5}$ monitors were replaced with a continuous monitor.

The monitoring site is located in the western third of the city just east of an industrial park area. The site is located on the roof of a monitoring shelter. The area around the site has service type businesses and light industry to the west and south. Residential areas are located to the north and east of the site. There have been no significant changes noted in buildings or trees around the site during this review. Table 10-12 contains details on the monitoring site specific to the requirements in 40 CFR Part 58.

Figure 10-40 – Watertown Site

Table 10-12 – Watertown Site Specifics

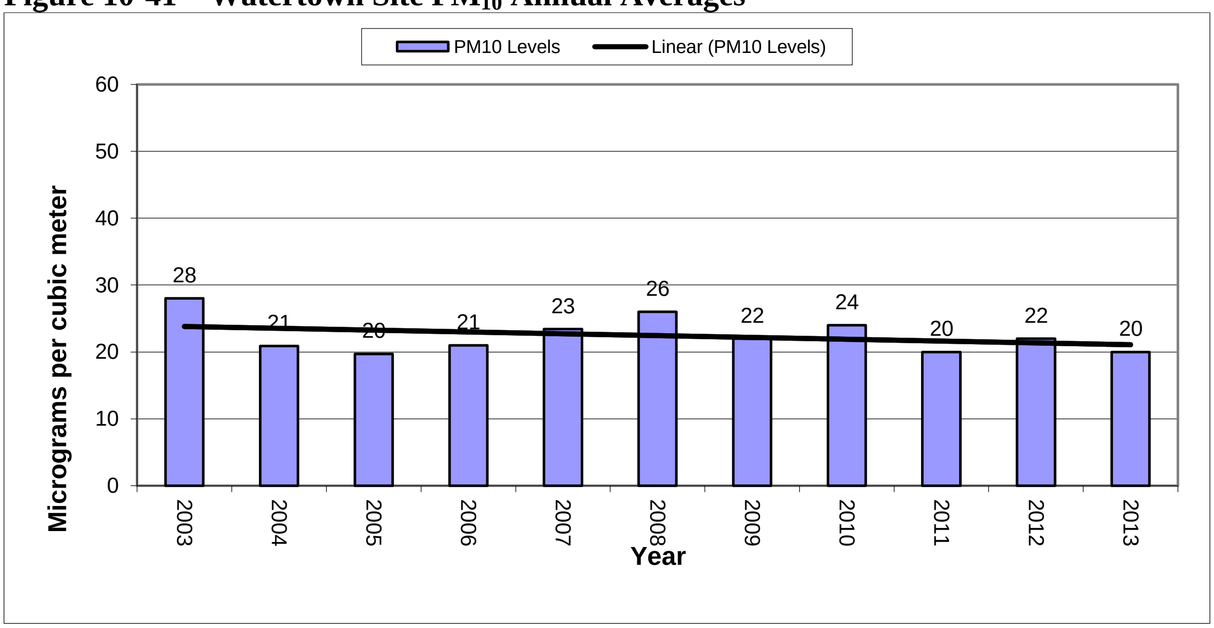
Parameter	Information
Site Name	Watertown
AQS ID Number	46-029-0002
Street Address	801 4th Ave. SW, Watertown, SD
Geographic Coordinates	UTM Zone 14, NAD 83, E 647,740.74 N 4,973,300.25
MSA	None
PM_{10}	**(Continuous)**
Sampler Type	Federal Equivalent Method EQPM-1102-150
Operating Schedule	Every Day
Scale Representation	Neighborhood
Monitoring Objective	High Concentration and Population
Sampling Method	T A Series FH 62 C14 Continuous
Analysis Methods	Beta Attenuation
Data Use	SLAMS (Comparison to the NAAQS) Real-Time Data

Parameter	Information
$PM_{2.5}$	**(Continuous)**
Sampler Type	Federal Equivalent Method RFPS-0598-0119
Operating Schedule	Every Day
Scale Representation	Regional
Monitoring Objective	Background, Transport
Sampling Method	Met One BAM-1020 w/$PM_{2.5}$ VSCC
Analysis Method	Beta Attenuation
Data Use	Real-time Data and SPMS

10.8.1 Watertown Site PM10 Data

The PM_{10} monitor operated on an every third day sampling schedule until 2006 when a continuous PM_{10} monitor replaced the manual monitors and an everyday sampling schedule began. The highest recorded annual average for PM_{10} concentrations was 28 ug/m^3 recorded in 2003. The lowest annual average concentration of 20 ug/m^3 was recorded on the manual monitor in 2005 and continuous monitor in 2011 and 2013. The 2013, concentration was down slightly from the previous year of 22 ug/m^3. The annual average indicates concentration levels are slightly decreasing during the 11 years of testing. Testing for this parameter is meeting the goals of high concentration and population and will be continued. Figure 10-41 contains a graph of the annual averages.

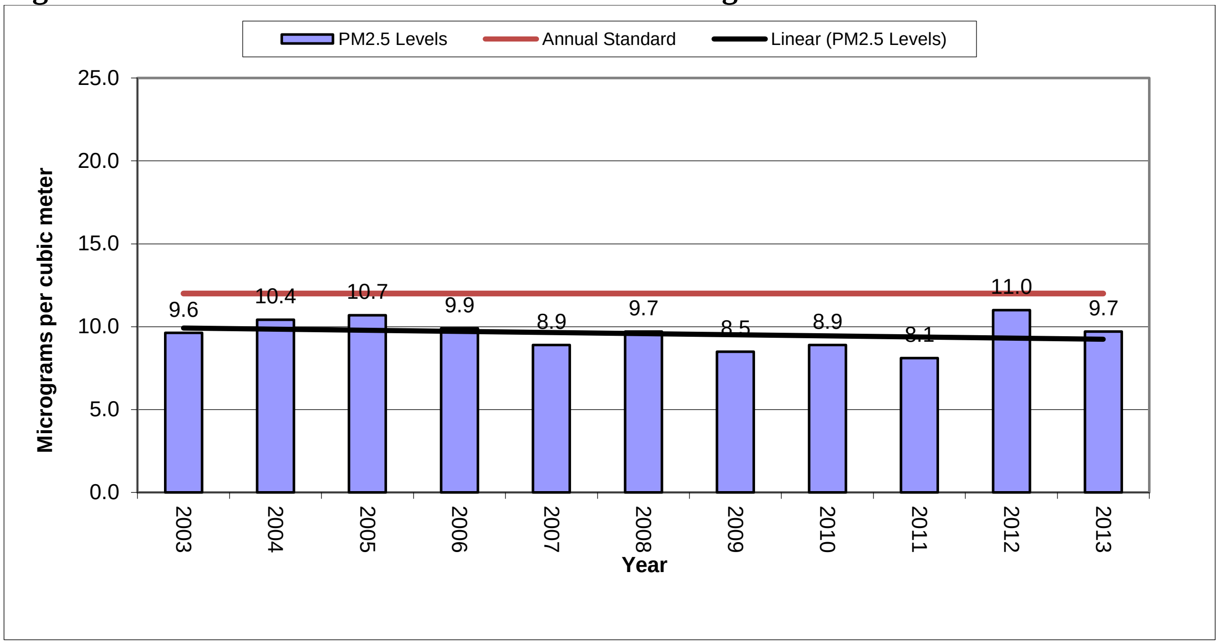
Figure 10-41 – Watertown Site PM_{10} Annual Averages



10.8.2 Watertown Site PM2.5 Data

The $PM_{2.5}$ monitors run on an every third day schedule since the $PM_{2.5}$ monitors were setup in 2003. Beginning in 2012 a continuous monitor was installed and the site reported hourly concentrations on an everyday schedule. Annual averages for the Watertown Site range from a high of 11.0 ug/m^3 in 2005 to a low of 8.1 ug/m^3 in 2011. The 2013 annual average was down from the previous year. The annual average shows a decrease in $PM_{2.5}$ concentration levels over the 11 years of testing even when including the 2012 year. Testing for this parameter is meeting the goals of high concentration and population and will be continued. Figure 10-42 contains a graph showing the annual average concentration for each year of operation.

Figure 10-42 – Watertown Site PM2.5 Annual Averages



10.9 Union County Area

At the beginning of 2009, three new monitoring sites were set up in Union County. No ambient air quality testing had ever been completed in this county. All three sites are located north of Elk Point. The sampling goals for the new sites were to determine air pollution levels near the location of the proposed Hyperion Energy Center prior to construction, during construction, and post construction. Currently, the proposed project's Prevention of Significant Deterioration air quality permit has expired, no new application was submitted by the company and purchase easements on the property in Union County have all expired. By the end of 2013, the sites will have collected five years of data so there is an adequate amount of data for use to showing background levels and the difference in sampling locations for future use. With no current project pending there is only need for one site to continue to show currently levels in rural Union County.

In 2012, UC #3 Site was closed with the ozone parameter moved to UC #1. At the end of 2013 UC #2 was closed because it was a duplicate site to UC #1. At the end of 2013, the carbon monoxide testing at UC #1 was discontinued because recorded concentrations were very low and there was no indication concentrations would ever get close to the standard level.

10.9.1 UC #1 Site

UC #1 Site is located about 3 miles south of the proposed Hyperion Energy Center. Sampling began on or near January 1, 2009 for all but carbon monoxide. By the beginning of 2010, the carbon monoxide analyzer was added to the site. The goals of the site are background and for comparison to the NAAQS. Figure 10-43 provides a picture of the monitoring site looking to the North. Table 10-13 contains details on the monitoring site specific to the requirements in 40 CFR Part 58.

Figure 10-43 – UC #1 Site

Table 10-13 – UC #1 Site Specifics

Parameter	Information
Site Name	UC #1
AQS ID Number	46-127-0001
Street Address	31988 457th Ave.
Geographic Coordinates	Lat. + 42.751518 Long. – 96.707208
MSA	Sioux City, IA-NE-SD
PM_{10}	**(Continuous)**
Sampler Type	Federal Equivalent Method EQPM-1102-150
Operating Schedule	Every Day
Scale Representation	Regional
Monitoring Objective	Background, Transport
Sampling Method	T A Series FH 62 C14 Continuous

Parameter	Information
Analysis Method	Beta Attenuation
Data Use	Real-time Data and SLAMS (Comparison to the NAAQS)
$PM_{2.5}$	**(Continuous)**
Sampler Type	Federal Equivalent Method RFPS-0598-0119
Operating Schedule	Every Day
Scale Representation	Regional
Monitoring Objective	Background, Transport
Sampling Method	Met One BAM-1020 w/$PM_{2.5}$ VSCC
Analysis Method	Beta Attenuation
Data Use	Real-time Data and SLAMS (Comparison to the NAAQS)
SO_2	**(Continuous)**
Sampler Type	Federal Equivalent Method EQSA-0486-060
Operating Schedule	Every Day
Scale Representation	Regional
Monitoring Objective	Background, Transport
Sampling Method	Instrumental 43i Trace Level Thermo
Analysis Methods	Pulsed Fluorescent
Data Use	Real-time Data and SLAMS (Comparison to the NAAQS)
NO_2	**(Continuous)**
Sampler Type	Federal Reference Method RFNA-1289-074
Operating Schedule	Every Day
Scale Representation	Regional
Monitoring Objective	Background, Transport
Sampling Method	Instrumental 42i Thermo/Fisher
Analysis Method	Chemiluminescence
Data Use	Real-time Data and SLAMS (Comparison to the NAAQS)
Ozone	**(Continuous)**
Sampler Type	Federal Equivalent Method EQOA-0880-047
Operating Schedule	Every Day
Scale Representation	Regional
Monitoring Objective	Background, Transport
Sampling Method	Thermo 49i
Analysis Method	Ultraviolet
Data Use	Real-time Data and SLAMS (Comparison to the NAAQS)

10.9.2 UC #2 Site

UC#2 Site is located about 1 ½ miles north northwest of the proposed Hyperion Energy Center. Table 10-14 contains details on the monitoring site specific to the requirements in 40 CFR Part 58. At the end of 2011, the manual $PM_{2.5}$ monitors were removed so only the continuous monitor was operated. UC #2 Site was terminated at the end of 2013. Figure 10-44 contains a picture of the monitoring site looking west.

Figure 10-44 – UC #2 Site

Table 10-14 – UC #2 Site Specifics

Parameter	Information
Site Name	UC #2
AQS ID Number	46-127-0002
Street Address	31307 473 Ave.
Geographic Coordinates	Lat. + 42.850975 Log. – 96.747325
MSA	Sioux City, IA-NE-SD
PM_{10}	**(Continuous)**
Sampler Type	Federal Equivalent Method EQPM-1102-150
Operating Schedule	Every Day
Scale Representation	Regional
Monitoring Objective	Background, Transport
Sampling Method	T A Series FH 62 C14 Continuous
Analysis Method	Beta Attenuation
Data Use	Real-time Data and SLAMS (Comparison to the NAAQS)
Operational Status	No change planned for 2010
$PM_{2.5}$	**(Continuous)**
Sampler Type	Federal Equivalent Method RFPS-0598-0119
Operating Schedule	Every Day
Scale Representation	Regional
Monitoring Objective	Background, Transport

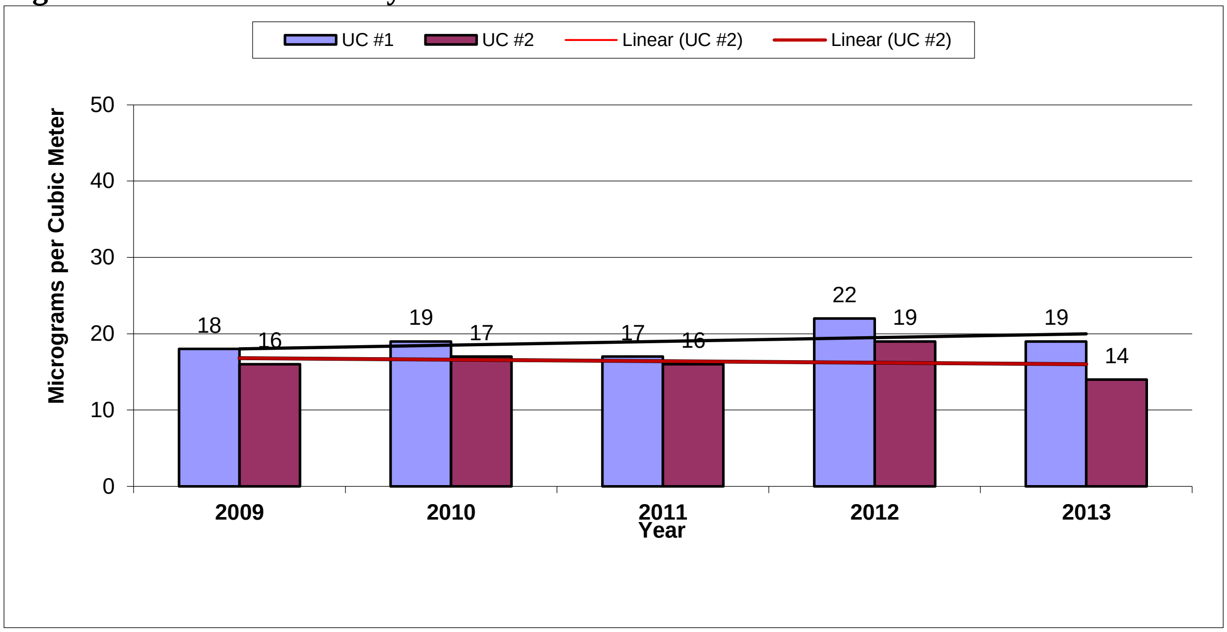
Parameter	Information
Sampling Method	Met One BAM-1020 w/$PM_{2.5}$ VSCC
Analysis Method	Beta Attenuation
Data Use	Real-time Data and SLAMS (Comparison to the NAAQS)
SO_2	**(Continuous)**
Sampler Type	Federal Equivalent Method EQSA-0486-060
Operating Schedule	Every Day
Scale Representation	Regional
Monitoring Objective	Background, Transport
Sampling Method	Instrumental 43i Trace Level Thermo/Fisher
Analysis Methods	Pulsed Fluorescent
Data Use	Real-time Data and SLAMS (Comparison to the NAAQS)
NO_2	**(Continuous)**
Sampler Type	Federal Reference Method RFNA-1289-074
Operating Schedule	Every Day
Scale Representation	Regional
Monitoring Objective	Background, Transport
Sampling Method	Instrumental 42i Thermo
Analysis Method	Chemiluminescence
Data Use	Real-time Data and SLAMS (Comparison to the NAAQS)

10.9.3 UC #1 and UC #2 Sites – PM10 Data

The average concentrations of PM_{10} in Union County represent concentration levels similar to other sites in eastern South Dakota. The annual average concentrations in eastern part of the state range from 15 to 22 ug/m^3. The Union County sites annual averages ranked in the middle to the lower end of this range. See the annual averages for the two sites in Union County in Figure 10-45.

PM_{10} point source emissions have localized impacts due to the size and weight of the particles. Therefore, low annual averages close to the same concentration level at both sites would be expected in a rural area with only fugitive dust sources. Because of differences in localized fugitive dust sources such as tilling of agricultural fields, gravel roads, and associated wind speed and direction during the activities can have a larger effect on differences in 24-hour concentration levels between the two sites. Trends indicate concentrations are up slightly for UC #1 and down slightly for UC #2. The UC #1 has the highest annual average concentration level between the two sites. Both sites had lower PM_{10} levels in 2013.

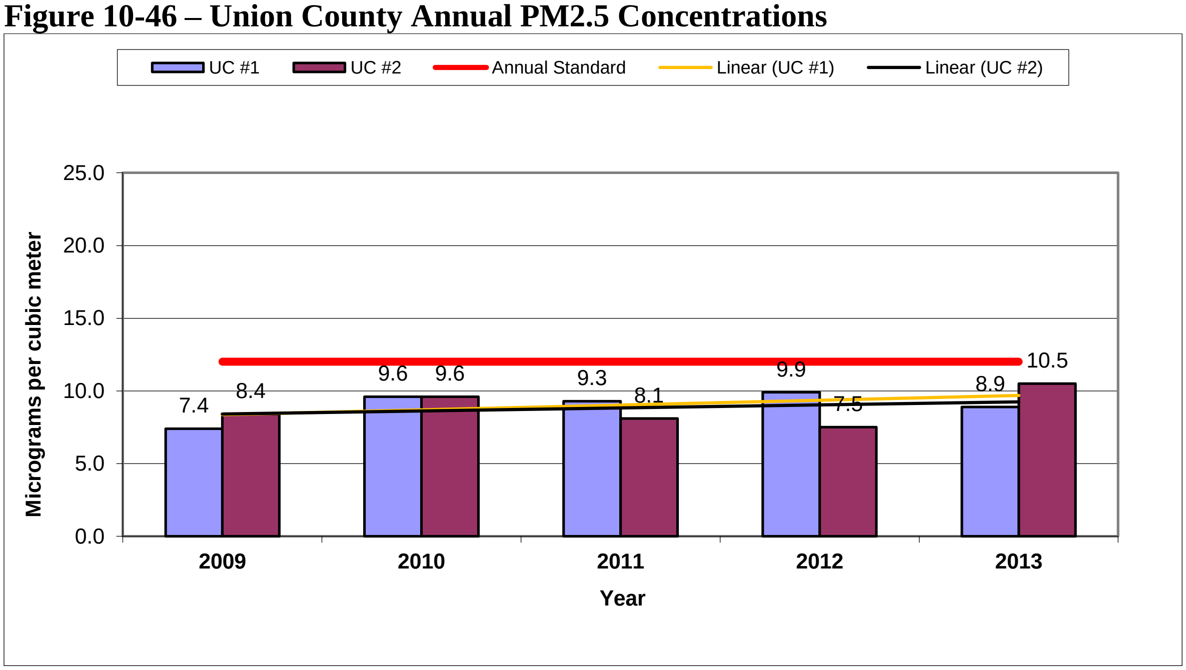
Figure 10-45 – Union County Annual PM10 Concentrations



10.9.4 UC #1 and UC #2 Sites – PM2.5 Data

The annual average concentrations for $PM_{2.5}$ at the two sites would be expected to be close to the same level. In this case the annual averages were compared between both continuous monitors. See Figure 10-46 to view a graph of the annual averages.

Figure 10-46 – Union County Annual PM2.5 Concentrations



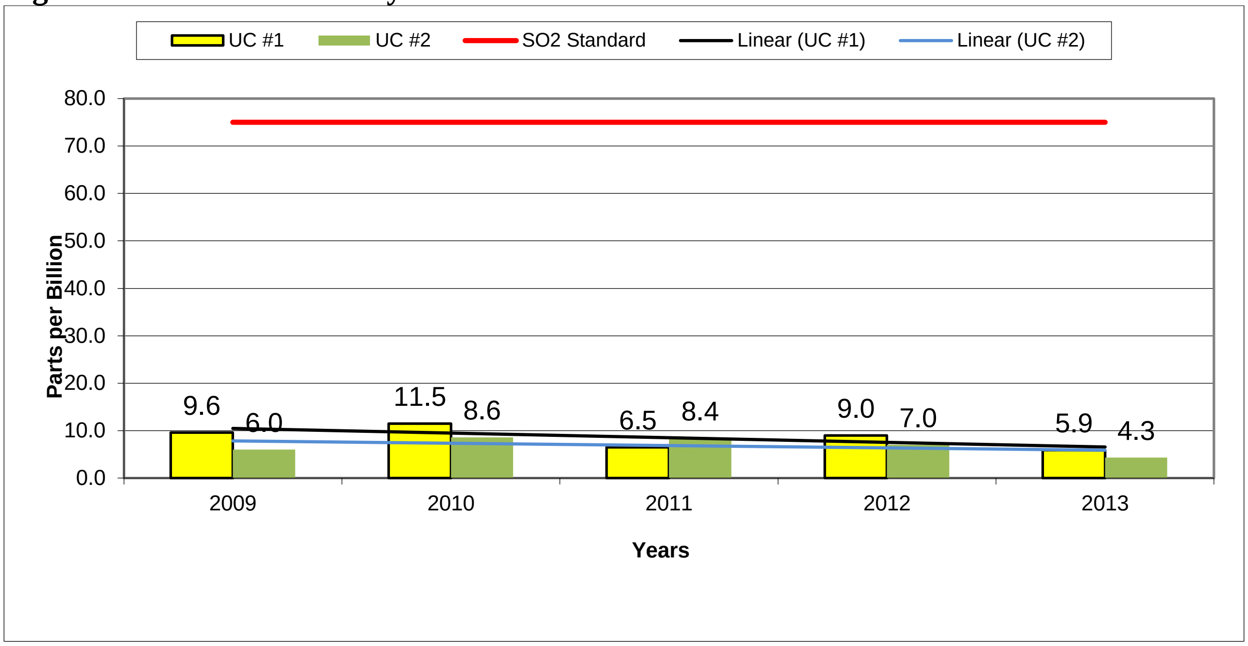
The first year of testing UC #2 had the highest annual average. In the following years the highest concentration site switched back and forth between the two sites. The trend lines show concentrations slightly increasing for both sites over the five year period.

When comparing the activities around the two sites the differences include a highway running just north of UC #2 and a small group of homes and business near this site. UC #1 has only one home near the site but has Interstate 29 about 1.5 miles to the southwest. Therefore, there may be some concentration difference between the two sites. It appears the differences did not affect the annual average levels as the 3-year average of annual means shows UC #1 only 0.7 ug/m^3 higher than UC #2 between the two sites in 2013.

10.9.5 UC #1 and UC #2 Sites – Sulfur Dioxide Data

Concentrations of sulfur dioxide follow the same trend as other sites in the state with many hour average concentrations low near the detection level (0.1 ppb) for the analyzer method being used to collect the data. Trace level sulfur dioxide analyzers are operated at both sites beginning in 2009. See Figure 10-47 for a graph showing the 1-hour 99th percentile for both sites.

Figure 10-47 – Union County Sulfur Dioxide 1-hour Concentrations

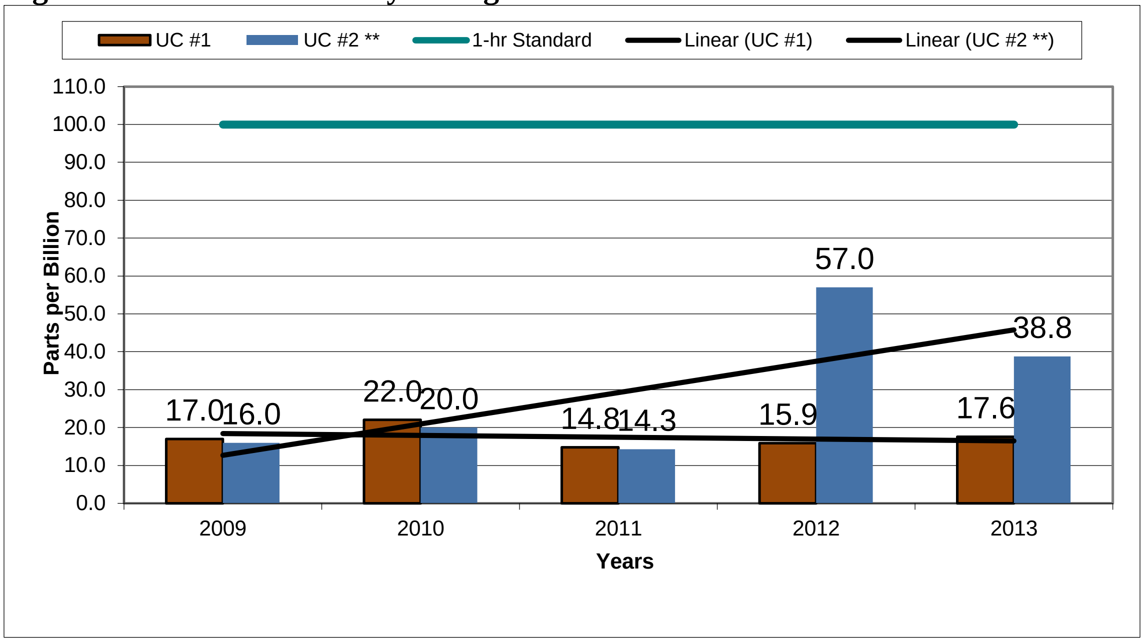


Trends indicate sulfur dioxide levels are dropping slightly for both sites. Differences in concentration levels are noted between the two sites when comparing the 1-hour averages but the 3-year average of the 99th percentile for both sites shows the same concentration level.

10.9.6 UC #1 and UC #2 Sites – Nitrogen Dioxide Data

Concentrations of nitrogen dioxide follow the same trends as other rural areas in the state like the Badlands and Wind Cave sites. Annual average concentrations are very low near the detection level for the analyzer method being used to collect the data. Just as the sulfur dioxide parameter, the nitrogen dioxide parameter differences are noted when comparing a 1-hour average but the annual averages are very close in concentration. The only exception was an unusual event at UC #2 starting in late August and to the end of December in 2012. NO_2 concentrations were significantly higher than in previous years. An investigation did not find a cause to the high concentration period. Even with higher levels in the fourth quarter of 2012, annual concentrations were still well below the standard at UC #2. By end of January 2013, NO_2 concentrations were back to past year's levels. Trends indicate an increasing concentration level for UC #2 because of the above normal concentration levels in 2012 and a slightly decreasing level for UC #1 over the five years of testing. Figure 10-48 shows a graph of the annual average concentrations for both sites. Data indicates in general UC #1 would provide data that would represent Union County rural NO_2 concentrations.

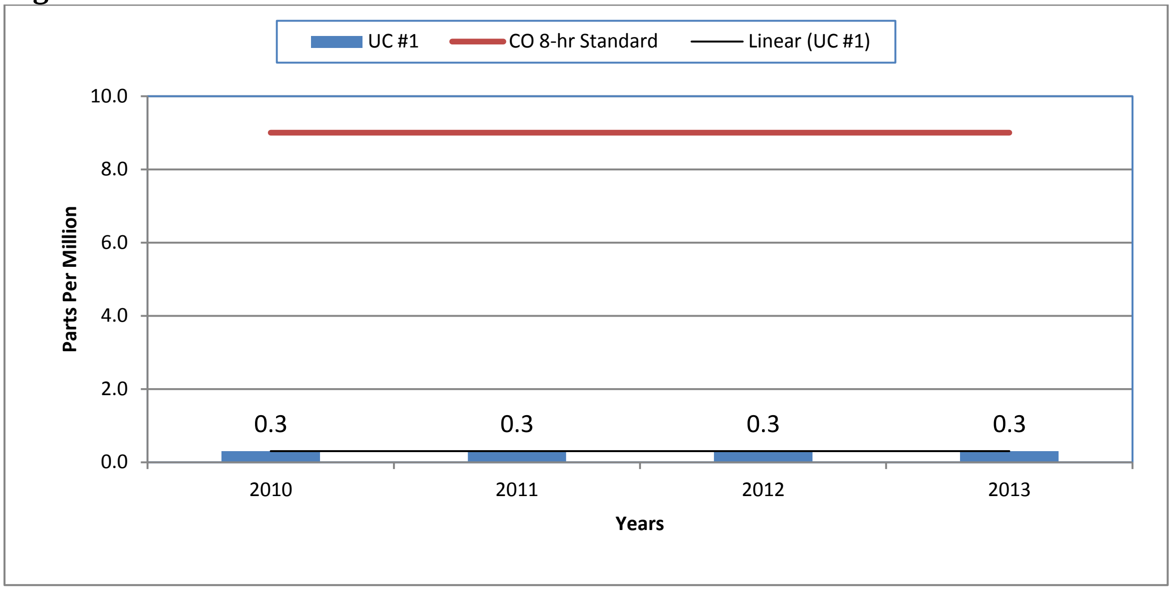
Figure 10-48 – Union County Nitrogen Dioxide Concentrations



10.9.7 UC #1 Site – Carbon Monoxide Data

The testing for carbon monoxide was only at the UC #1 Site. Testing began in 2010 and at the end of 2012 three years of testing was completed. Carbon monoxide concentrations are very low in Union County. The concentrations of carbon monoxide represent background for a rural area in southeastern part of the state and may represent most of the rural areas in the state. Figure 10-49 shows the results of testing for carbon monoxide 8-hour averages for UC #1 Site. Since the carbon monoxide concentrations are so low, the department shutdown the site at the end of 2013.

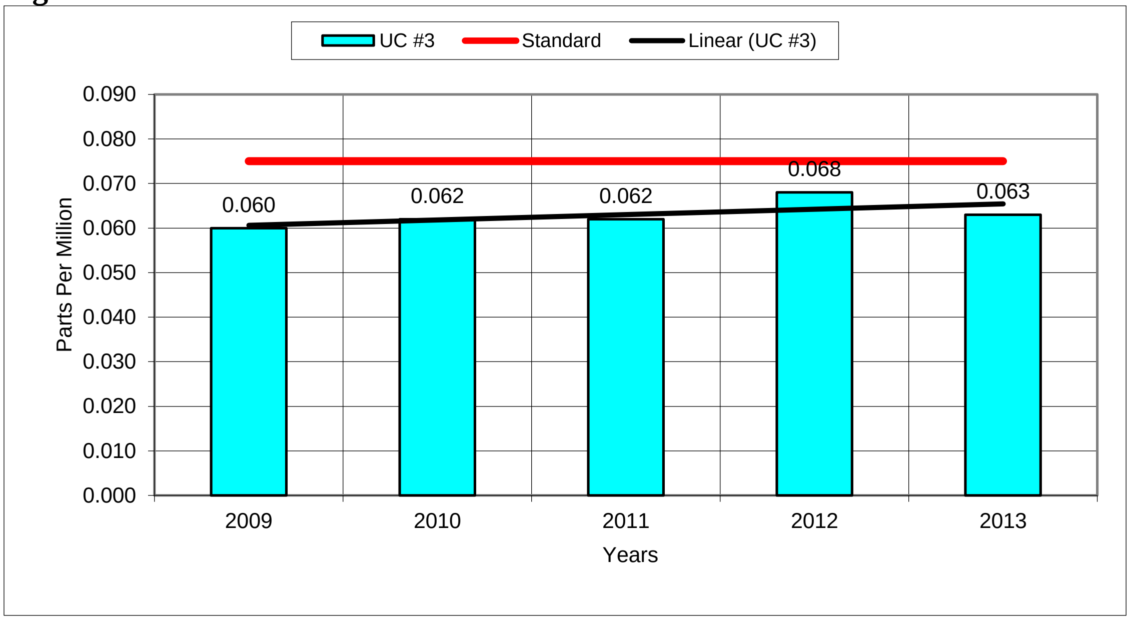
Figure 10-49 – UC #1 Site Carbon Monoxide Concentrations



10.9.8 <u>UC #1 and #3 Sites – Ozone Data</u>

The ozone 8-hour average for the UC #1 and #3 sites recorded a concentration that was similar to levels recorded at the other two sites in the eastern part of the state in 2013. The trend line shows a slight increase in concentrations over the last five years. This is similar to the trends for the other two sites in the eastern part of the state. See Figure 10-50 for a graph of the ozone concentrations at the UC #1 and #3 sites.

Figure 10-50 – UC #1 and #3 Site Ozone Concentrations



11.0 SPECIAL AIR QUALITY MONITORING

11.1 $PM_{2.5}$ Speciation Monitoring Program

Speciation Monitoring Program

The chemical speciation network will quantify mass concentrations and significant PM2.5 constituents which include trace elements, sulfate, nitrate, sodium, potassium, ammonium, and carbon. This series of analytes is very similar to those measured within the Interagency Monitoring of Protected Visual Environments (IMPROVE) program.

Physical and chemical speciation data are anticipated to provide valuable information for:

1. Assessing trends in mass component concentrations and related emissions, including specific source categories.
2. Characterizing annual and seasonal spatial variation of aerosols.
3. Determining the effectiveness of implementation control strategies.
4. Helping to implement the PM2.5 standard by using speciated data as input to air quality modeling analyses.
5. Aiding the interpretation of health studies by linking effects to PM2.5 constituents.
6. Understanding the effects of atmospheric constituents on visibility impairment and regional haze.

South Dakota has one site that collects samples as part of the Speciation Network. This site collects 24-hour air samples on a 3-day schedule. The site is in Sioux Falls, located in southeastern South Dakota. Sioux Falls is the largest city in the state. The speciation monitor was moved from the KELO site to the SD School Site at the beginning of 2009. The School Site is located on the east central part of the city. The site is about 1.5 miles southeast of the main industrial area in Sioux Falls. The area around the site is mainly residential. Interstate 229 which is a major commuting road runs north and south about three city blocks east of the monitoring site. The predominant wind direction is northwest for most of the year with southeast winds during the summer months. Carbon samples were taken by the Met One SASS monitor at the KELO Site. In September 2009, the IMPROVE URG 3000N sampler was set up to do the carbon sampling to standardize the sampling method and make the data from the National Parks sites comparable to the speciation network nationwide.

Figure 11-1 shows a comparison of the PM2.5 concentrations between the speciation monitor, the manual monitor, and the continuous monitor located since 2009 when all three methods were being run at this site. The continuous monitor shows a decrease in concentrations over the five years of testing. The manual monitors also show a decreasing concentration but at a slightly less level. The speciation monitor shows a slightly increasing concentration level. This is an unusual trend between the monitor types.

It appears that sampling frequency and method type is affecting the difference in concentration levels and overall trend for the speciation monitor. The first two years of testing the speciation monitor ran on an every sixth day schedule. In 2011 to 2013, the schedule was changed to every third day. This reduced some of the difference in annual average concentration and brings the speciation monitor annual average comparable to the manual monitor annual average. The continuous monitor annual average is calculated using three times more samples so a difference in the annual mean is expected.

Figure 11-1 - Average PM2.5 Concentration

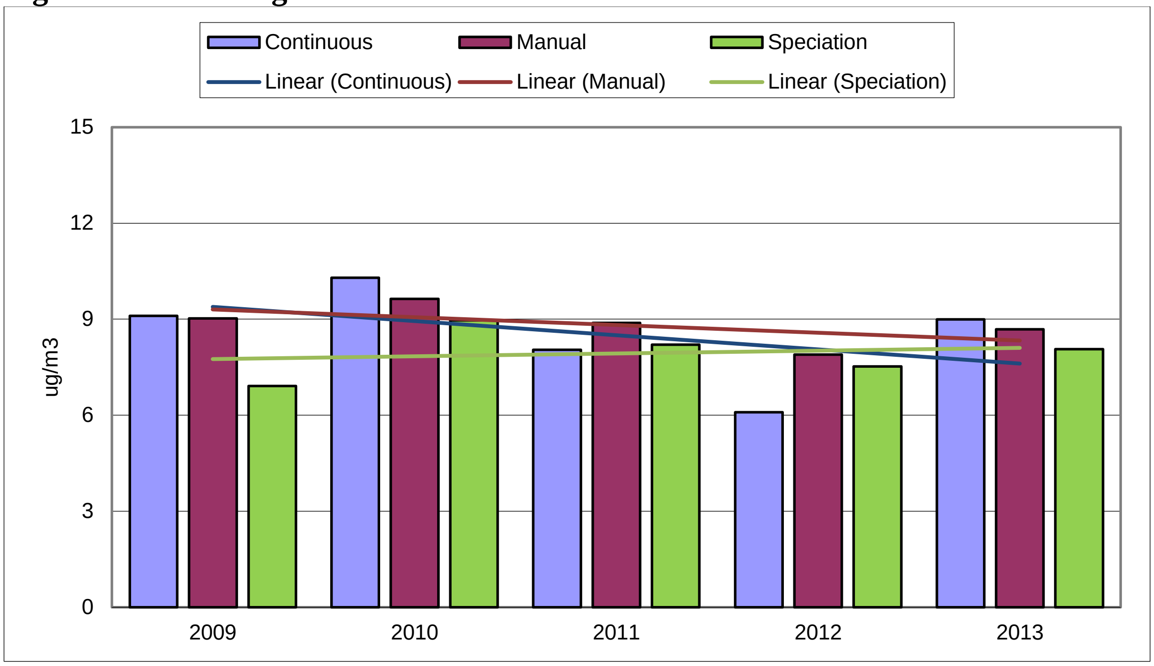
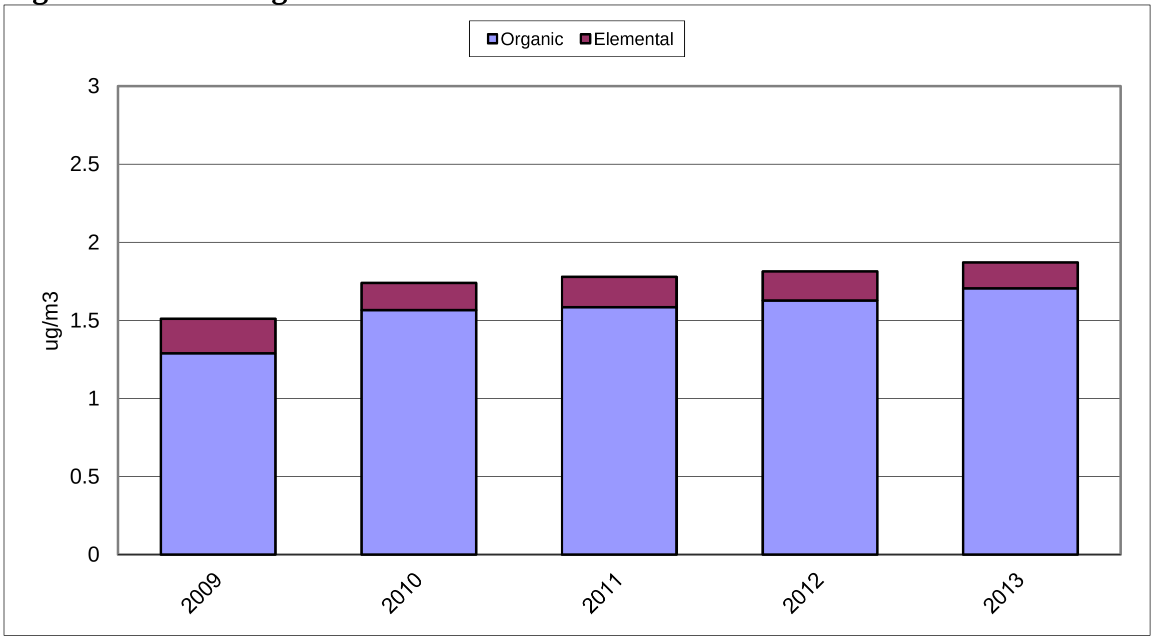


Figure 11-2 shows the average total organic carbon and elemental carbon concentrations for the URG. Concentrations of carbon are low. The organic carbon concentrations on the average

Figure 11-2 - Average URG Total Carbon Concentrations

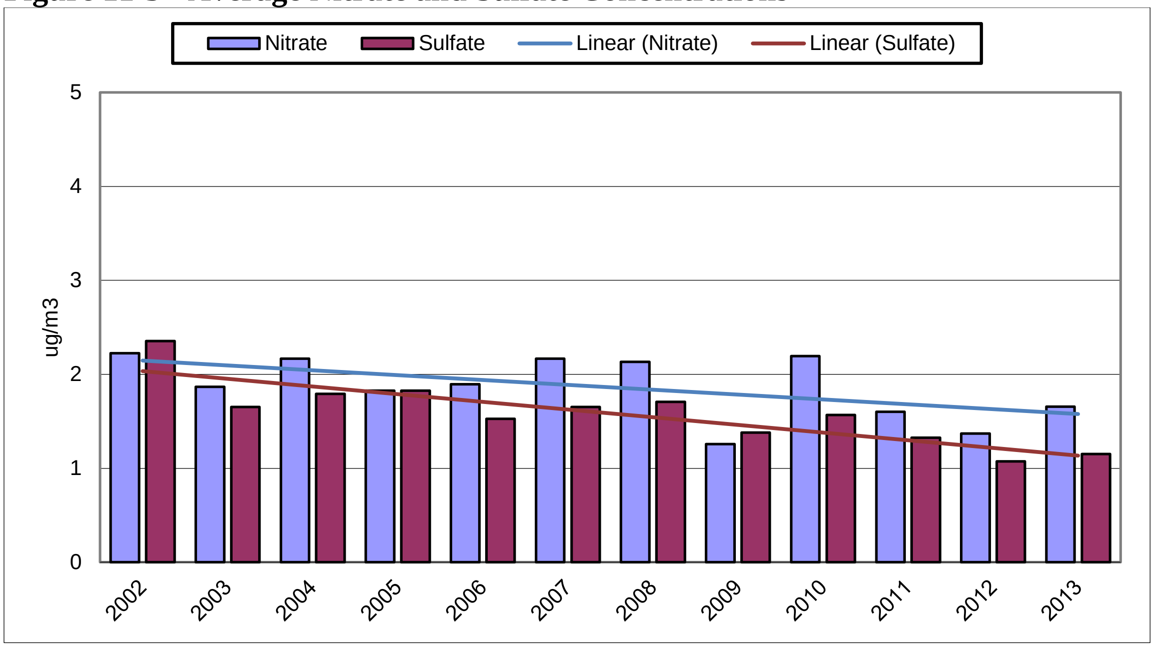


were slightly higher in 2013 than in 2012. The average contribution of elemental carbon to the overall concentration remained about the same from 2011 to 2013 and less than in 2009. The overall trend for total carbon shows a slight increase in total carbon levels in the five years of testing.

Figure 11-3 shows the average nitrate and sulfate concentrations analyzed from the $PM_{2.5}$ samples. The graph shows trends for the concentration of nitrates are declining over all but recorded a slight increase in concentration in 2013 over the level in 2012.

Sulfates in the $PM_{2.5}$ samples increased slightly in 2013. The trend line in the graph shows an overall declining sulfate levels by more than 50% during the twelve years of testing in Sioux Falls.

Figure 11-3 - Average Nitrate and Sulfate Concentrations



12.0 CONCLUSIONS

The ambient air quality monitoring network has demonstrated that South Dakota is currently attaining the federal NAAQS. The Air Quality Program is working to ensure that any changes in the air quality of the state are reviewed for possible health effects to the public. The ambient air quality monitoring network is continually reviewed to ensure that there is adequate coverage of populated areas in the state. As the state's population and industry changes, monitoring sites will be added or moved to new locations.

Major modifications to the sampling network include:

- Closing of KELO Site because it duplicates the data collected at the School NCore Site;
- Close the Brookings City Hall Site and move the parameters to the Research Farm Site; and
- Add a new site at the Pierre Airport to provide data in central part of the state and to use as a testing and training facility for AMS staff.

Equipment Purchase Priorities include the following items:

- Replace old Thermo PM BETA monitors;
- Replace old PM_{10} Hi-Vol monitors method;
- Replace ESC 8816 data loggers;
- Replace Nitrogen dioxide analyzers;
- Replace C series calibrators and analyzers;
- Maintain the NCore site; and
- Purchase new equipment as required to meet EPA requirements.

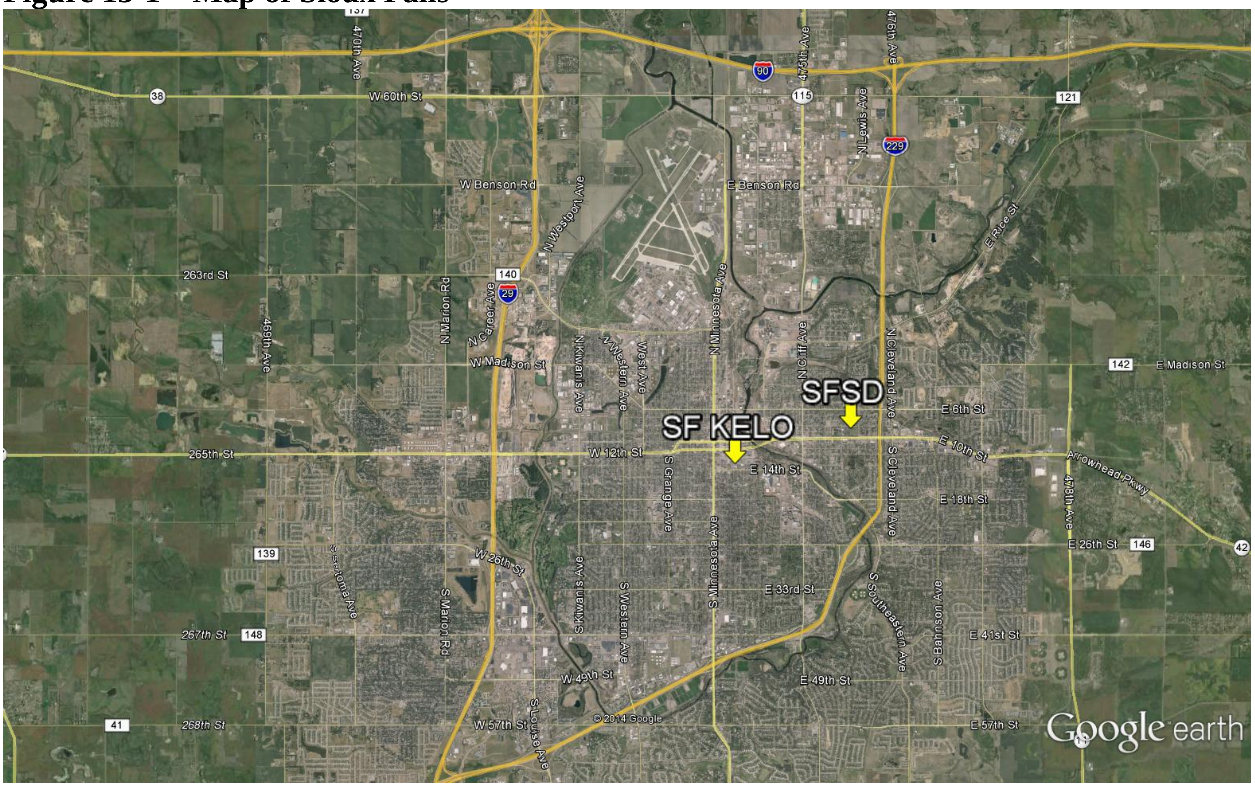
There is an ongoing effort to maintain staff training regarding the latest monitoring techniques and procedures to perform these studies. It is anticipated that the ambient air monitoring network will operate in much the same manner as it has in the past. This will include the identification of pollution problems, measurement and evaluation of the extent of the problem, and determination of action to be taken to protect the environment and the health of the people of South Dakota.

13.0 Comparison of the $PM_{2.5}$ Data SD School to KELO sites Sioux Falls, SD

13.1 Introduction

Operating two $PM_{2.5}$ manual monitoring sites near the same location is resource intensive. This appendix looks at the data collected at both sites to determine if one site can be closed to save resources and staff time. See Figure A-1 for a location map of the two air monitoring sites in Sioux Falls.

Figure 13-1 – Map of Sioux Falls



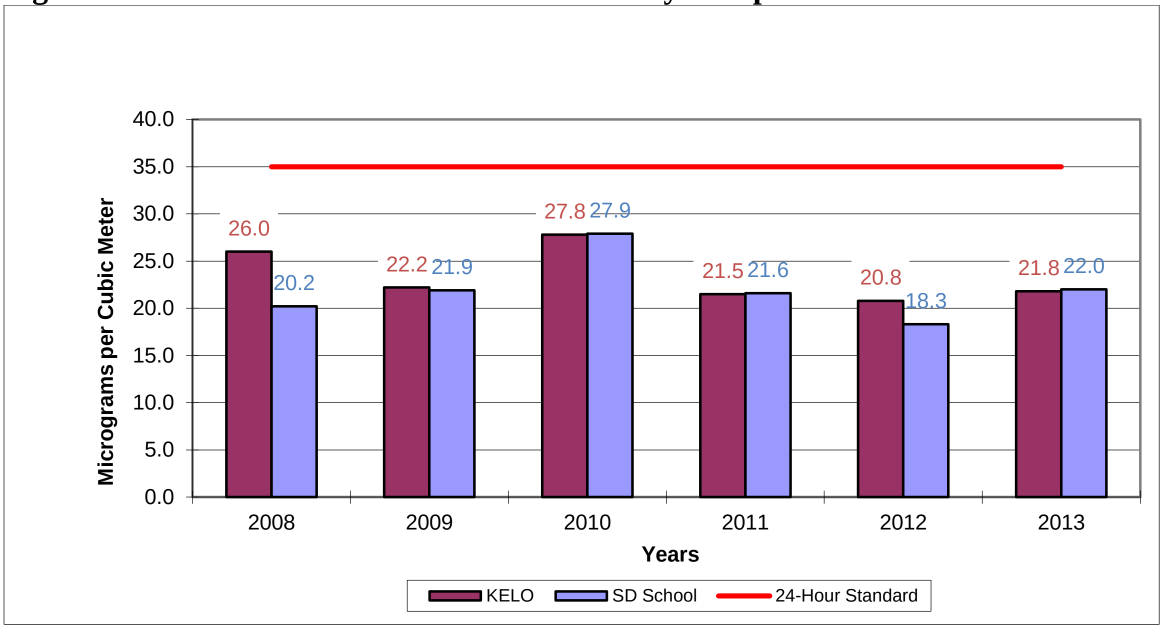
The SD School Site is the mandatory NCore site for South Dakota and contains all the required sampling parameters. The two sites are being compared to determine if concentration levels are equal or very close to each other allowing the KELO site to be closed and the resources used in a different location.

The KELO Site has collected $PM_{2.5}$ data since the start of the network in 2001. The current 24-hour design value for KELO is 61% of the standard. The current annual design value is 73% of the standard. With 13 years of data showing attainment of the standard it is assured the area is meeting and will continue to meet the standard unless there is a significant change in emission levels in this area.

13.2 Comparison of SD School to KELO $PM_{2.5}$ Data

Except for 2008, the yearly 24-hour compliance values are very close. Three of the last six years, KELO has the highest value and the SD School Site has the highest values the other three years. The average of the six years of 24-hour values shows the KELO Site having a slightly higher concentration of 23.4 ug/m^3 compared to the SD School Site at 22.0 ug/m^3. Figure A-2 shows the comparison of the SD School and KELO sites 24-hour yearly compliance values.

Figure 13-2 - SD School to KELO 24-hour Yearly Compliance Value

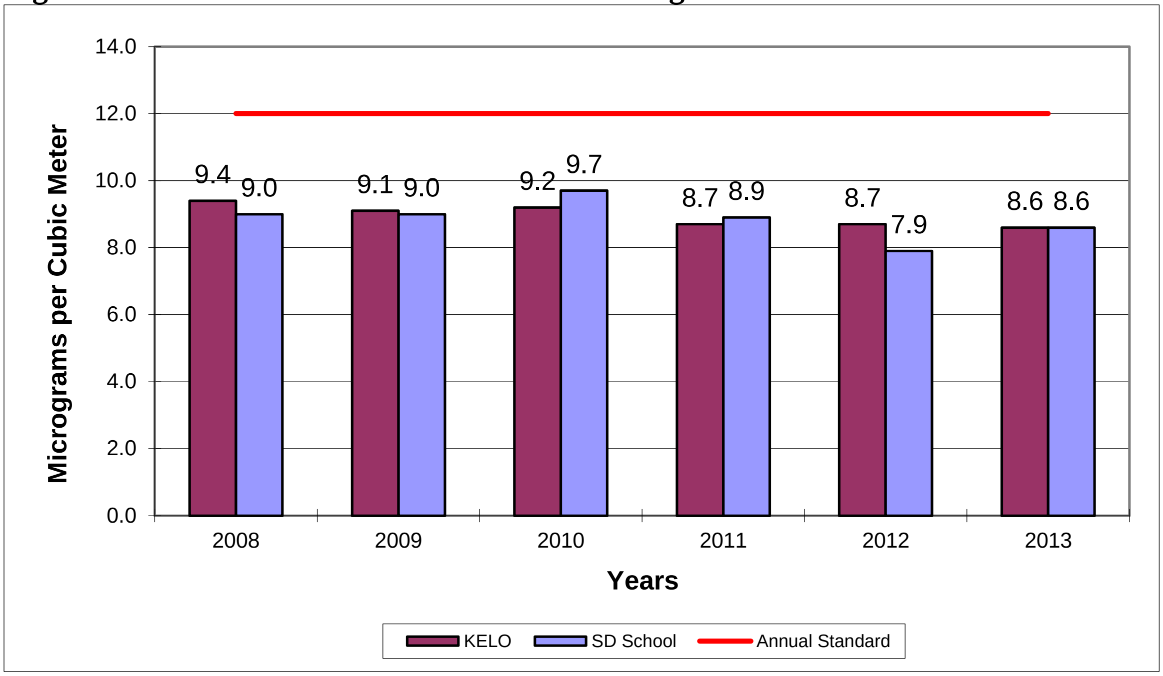


The 24-hour design values for both sites in 2013 show a 0.4 ug/m^3 difference with KELO slightly higher than SD School. Again the concentration levels are very close.

A comparison of the annual average finds the same results. The annual averages are the highest at one site and then the other site the next year. The average of the annual averages is very close with a difference of 0.1 ug/m^3 over six years of comparison. Figure A-3 shows a comparison of the annual averages for both sites.

A comparison of the design value calculated from the latest three year average of the annual compliance values shows a 0.2 ug/m^3 difference between the two sites.

Figure 13-3 – SD School to KELO Annual Average



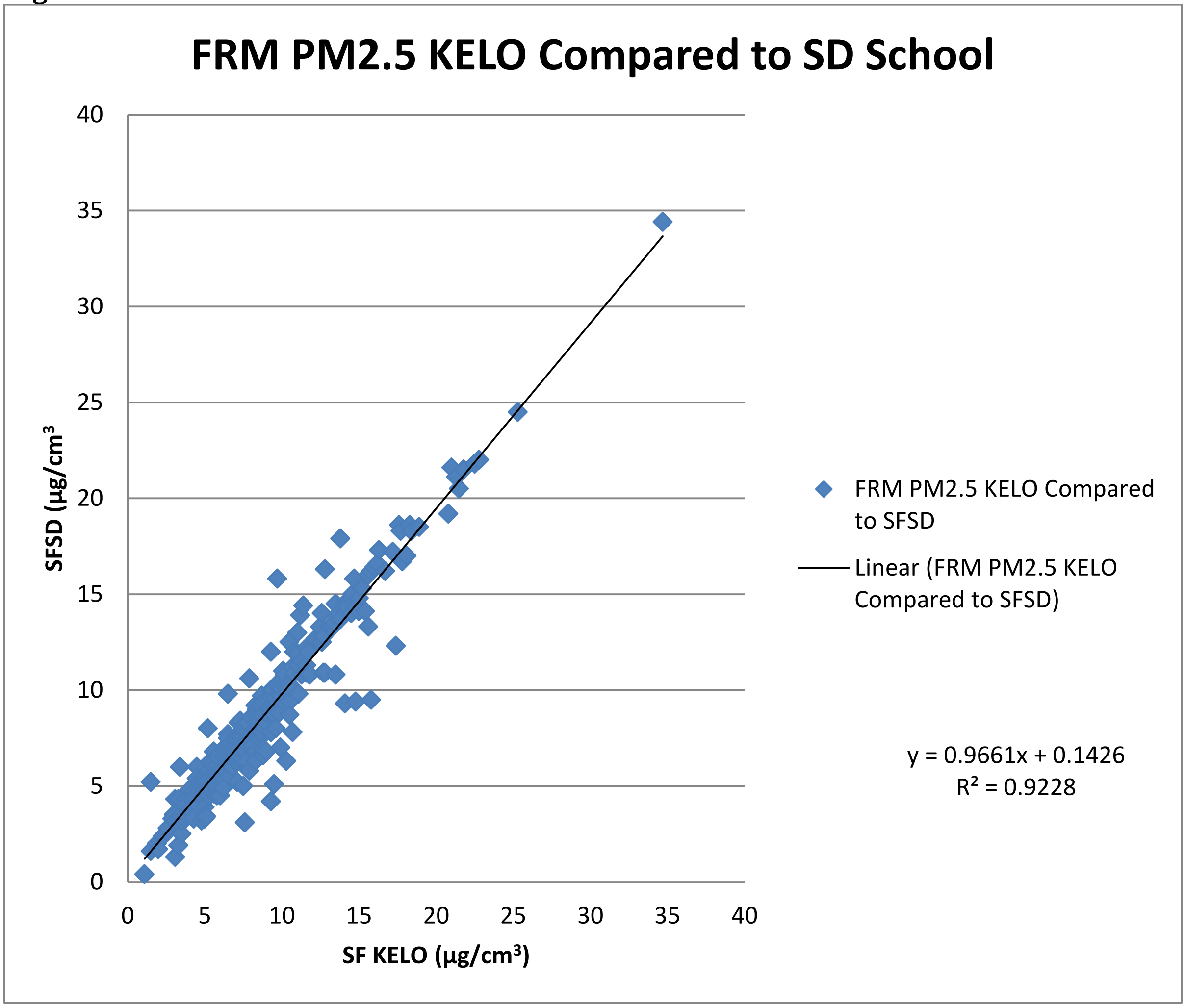
13.3 Comparison of Daily 24-hour Concentrations

Three years of daily $PM_{2.5}$ averages were compared between the monitoring sites at KELO and SD School. The two sites are located approximately 1.35 miles apart in Sioux Falls, South Dakota. The purpose of this data comparison was to determine if the sites' measured $PM_{2.5}$ concentrations varied significantly from one another. The results of the comparison would provide supporting evidence for the closure of KELO.

13.4 Data correlation

Data from both monitoring sites were compared to determine if the two sites monitored similar results. For example, if KELO monitored 5 ug/m^3 on Monday July 5, 2013, did SD School monitor also monitor approximately 5 ug/m^3 on Monday July 5, 2013? To make this comparison, data was gathered from the US EPA AQS database from the most recent valid and complete three year period: January 1, 2010 – December 31, 2013. Each daily average value was paired. Data points with missing pairs were removed. Data were organized by day then sorted from lowest to highest concentrations and graphed as a scatter plot in Figure A-4. One outlier was removed using visual observation (KELO 4.3, SD School 18.3).

Figure 13-4 – SD School to KELO Scatter Plot



The correlation coefficient is 0.9228 indicating a strong correlation where 92% of SD School's data is explained with KELO data. The remaining 8% is not explained, or explained by unknown variability.

13.5 Comparison of three year average between KELO and SD School

To determine if the data collected from the monitoring sites at KELO and SD School are significantly different, a statistical analysis called a T-test is performed. Two different T-tests may be performed depending on how much variability there is in the monitoring data from the two sites. The variability also referred to standard deviation is how far the data points are away from the average monitored concentration. To determine which T-test should be used to compare the data, a statistical analysis called an F-Test is performed. The F-test determines if the monitoring data at the two sites have the similar variability or is the variability significantly different.

Part of the F-test is to develop an assumption also referred to as a null hypothesis. If F-test fails, the given assumption is wrong and the opposite outcome of the null hypothesis is considered correct. The null hypothesis is: "the variability in the KELO monitoring data is the same as the variability in SD School monitoring data." The alternative hypothesis is "There is a difference in the variability in the monitoring data at KELO and SD School." Because the **F value < F Critical one-tail**, the null hypothesis (meaning there is not enough evidence to show variation between the populations) is considered correct. Therefore the "t-test assuming equal variances" is used.

If the "F value" was greater than the "F Critical one-tail," the null hypothesis would have been considered wrong and the alternative hypothesis would have been considered correct.

F-Test Two-Sample for Variances

	SD School	*KELO*
Mean	8.3716374	8.5175439
Variance	19.908255	19.681334
Observations	342	342
df	341	341
F	**1.0115298**	
P(F<=f) one-tail	0.457883	
F Critical one-tail	**1.1952989**	

Variances are assumed equal for this test

*if F > F Critical one-tail, we reject the null hypothesis

13.6 t-Test between KELO and SD School

The T-test also develops an assumption referred to as a null hypothesis. If T-test fails, the given assumption is wrong and the opposite outcome of the null hypothesis is considered correct. The null hypothesis between data is: "the monitoring data from KELO and SD School are the same." Whereas, the alternative hypothesis is: "the monitoring data from KELO and SD school are not the same." Because **t Stat** < **t Critical two-tail**, the null hypothesis is considered correct and the average daily concentration values at KELO and SD School represent the same monitored concentration.

t-Test: Two-Sample Assuming Equal Variances

	KELO	*SD School*
Mean	8.51754386	8.371637427
Variance	19.68133354	19.90825479
Observations	342	342
Pooled Variance	19.79479416	
Hypothesized Mean Difference	0	
df	682	
t Stat	**0.428841691**	
P(T<=t) one-tail	0.334086928	
t Critical one-tail	1.647090949	
P(T<=t) two-tail	0.668173856	
t Critical two-tail	**1.963448464**	

*If t Stat < -t Critical two-tail or t Stat > t Critical two-tail, we reject the null hypothesis
Fail to reject null hypothesis; There is no significant difference between groups (95% Confidence interval (CI))

13.7 Yearly comparison of concentrations at KELO and SD School

The data was separated by year and compared between KELO and SD School. The statistical tests used on the three-year comparison above were used again between each year. No significant differences were found in any year between KELO and SD School (95% CI).

Figure 13-5 – Comparison of Yearly Annual Averages

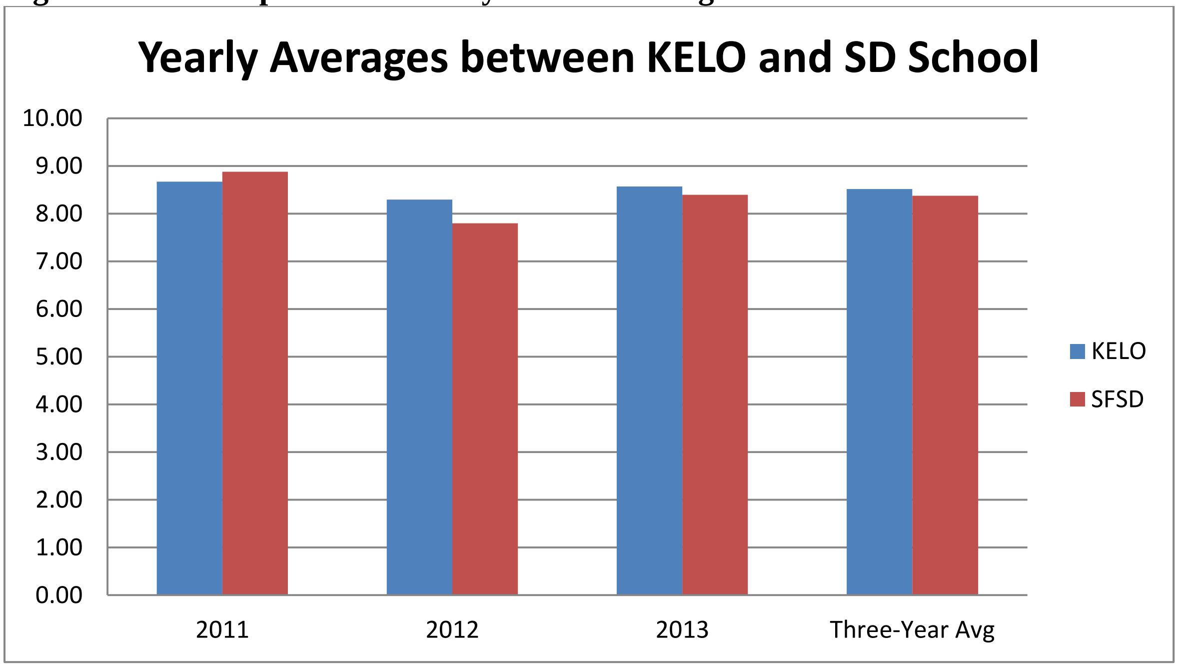


Table 13-1 – Site Yearly Averages

	KELO	SD School
2011	8.67	8.88
2012	8.30	7.80
2013	8.57	8.39
Three-Year Avg.	8.52	8.37

2011

F-Test Two-Sample for Variances

	SD School	*KELO*
Mean	8.878333333	8.670833333
Variance	19.63902241	18.87905812
Observations	120	120
df	119	119
F	**1.040254354**	
P(F<=f) one-tail	0.414962074	
F Critical one-tail	**1.353610209**	

Assume equal variance

t-Test: Two-Sample Assuming Equal Variances

	KELO	*SD School*
Mean	8.670833	8.878333
Variance	18.87906	19.63902
Observations	120	120
Pooled Variance	19.25904	
Hypothesized Mean Difference	0	
df	238	
t Stat	**-0.36625**	
P(T<=t) one-tail	0.357252	
t Critical one-tail	1.651281	
P(T<=t) two-tail	0.714505	
t Critical two-tail	**1.969982**	

Fail to reject Ho, no significant difference

2012

F-Test Two-Sample for Variances

	KELO	*SD School*
Mean	8.295454545	7.795454545
Variance	15.59566722	14.07456631
Observations	110	110
df	109	109
F	**1.108074443**	
P(F<=f) one-tail	0.296543608	
F Critical one-tail	**1.372282589**	

Assume equal Variance

t-Test: Two-Sample Assuming Equal Variances

	KELO	*SD School*
Mean	8.295455	7.795455
Variance	15.59567	14.07457
Observations	110	110
Pooled Variance	14.83512	
Hypothesized Mean Difference	0	
df	218	
t Stat	**0.962733**	
P(T<=t) one-tail	0.168374	
t Critical one-tail	1.651873	
P(T<=t) two-tail	0.336748	
t Critical two-tail	**1.970906**	

Fail to reject Ho, no significant difference

2013

F-Test Two-Sample for Variances

	KELO	*SD School*
Mean	8.571428571	8.394642857
Variance	24.83088803	25.67708816
Observations	112	112
df	111	111
F	**0.967044545**	
P(F<=f) one-tail	0.430096918	
F Critical one-tail	**0.730821016**	

Assume unequal variance

t-Test: Two-Sample Assuming Unequal Variances

	KELO	*SD School*
Mean	8.571429	8.394643
Variance	24.83089	25.67709
Observations	112	112
Hypothesized Mean Difference	0	
df	222	
t Stat	**0.263255**	
P(T<=t) one-tail	0.396299	
t Critical one-tail	1.651746	
P(T<=t) two-tail	0.792598	
t Critical two-tail	**1.970707**	

Fail to reject Ho, no significant difference

13.8 Conclusion

The data correlation is striking with 92% of SD School's data being explained by KELO. Neither the three-year pooled comparison nor the individual year comparisons showed a significant difference between average daily concentrations at KELO or SD School based on a 95% confidence interval. Regardless of the inherent variability between sites of each year, statistical tests show there is no difference between sites during each of the last three years (individual years or pooled). It appears that KELO Site is well-represented by SD School Site and is a suitable surrogate.

Based on this information, it is the recommendation of the South Dakota Air Monitoring program to close KELO and redistribute its resources to increase the efficiency of the monitoring network.

14.0 REFERENCES

1. Environmental Protection Agency, May 1977. Quality Assurance Handbook for Air Pollution Measurement Systems Volume II, Ambient Air Specific Methods (as amended), EPA-600/4-77-027a, Office of Air Quality Planning and Standards, Research Triangle Park, N.C.;
2. Environmental Protection Agency, January 2003. Title 40 Code of Federal Regulation, Parts 50 and 58 (as amended), United States Government Printing Office, Superintendent of Documents, Washington, D.C.; and
3. Environmental Protection Agency, March 1998. SLAMS / NAMS / PAMS Network Review Guidance, EPA-454/R-98-003, Office of Air Quality Planning and Standards, Research Triangle Park, N.C.