APPENDIX F

SUPPLEMENTAL AIR QUALITY INFORMATION

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ATTACHMENTS

F-1.0 INTRODUCTION

The information in this air quality appendix is taken from the Air Quality Technical Support Document prepared by McVehil-Monnett Associates, Inc. for ACC for use in the West Antelope II Coal Lease Application EIS[1]. The Air Quality Technical Support Document (MMA 2007) is a stand-alone document which is available for review. The purpose of this appendix is to provide background information on air quality issues, including the regulatory framework, regional air quality conditions, dispersion model methodologies, and the BACT process.

The air quality discussion in Chapter 3 of this EIS focuses on potential air quality impacts specific to the Antelope Mine and the West Antelope II LBA tract. Cumulative air quality-related impacts associated with coal leasing in the PRB of Wyoming are addressed in Section 4.2.3 of this EIS, which summarizes the results the Task 1A (Current Air Quality Conditions) and Task 3-A (Cumulative Air Quality Effects) Reports of the Powder River Basin Coal Review, prepared by the ENSR Corporation for the BLM Wyoming State Office, BLM Wyoming Casper Field Office, and BLM Montana Miles City Field Office, September 2005.

Analysis methods utilized in preparing the Air Quality Technical Support Document meet or exceed the BLM's "Data Adequacy Standards for the Powder River Coal Region" (1987) and include use of recent and extensive air quality modeling analyses conducted at the Antelope Mine by McVehil-Monnett Associates, Inc. for recent permitting actions. An air quality modeling summary is included as an attachment to this appendix.

F-2.0 REGULATORY BACKGROUND

Ambient air quality and air pollution emissions are regulated under federal and state laws and regulations. In Wyoming, the WDEQ/AQD is responsible for managing air quality through state regulations promulgated in the WAQSR and through the Wyoming SIP. WDEQ/AQD has also been delegated authority by the EPA to implement federal programs of the CAAA of 1990.

The WDEQ/AQD implements WAQSR and CAAA requirements through various air permitting programs. A proponent initiating a project must undergo new source review and obtain a pre-construction permit or a permit waiver authorizing construction of the project. This process ensures that the project will comply with the air quality requirements at the time of construction. To ensure on-going compliance, WDEQ/AQD also implements an operating permit program that can require on-going monitoring of emissions sources and/or source control systems.

[1] Refer to page xvi of the EIS for a list of abbreviations and acronyms used in this document.

F-2.1 National Ambient Air Quality Standards

The CAA requires the EPA to establish National Ambient Air Quality Standards or NAAQS to protect public health and welfare. These standards define the maximum level of air pollution allowed in the ambient air. The Act established NAAQS for six pollutants, known as "criteria" pollutants, which "... cause or contribute to air pollution which may be reasonably anticipated to endanger public health or welfare and the presence of which in the ambient air results from numerous or diverse mobile or stationary sources." The six, present-day criteria pollutants are lead, nitrogen dioxide (NO_2), sulfur dioxide (SO_2), carbon monoxide (CO), ozone (O_3) and particulate matter (PM_{10} and $PM_{2.5}$), where PM_{10} is coarse particulate with mean aerodynamic diameters less than 10 microns and $PM_{2.5}$ is fine particulate with a diameter of 2.5 microns or less.

The CAA and CAAA allow states to promulgate additional ambient air standards that are at least as stringent, or more stringent, than the NAAQS. A list of the criteria pollutants regulated by the CAA, and the currently applicable NAAQS set by the EPA for each, is presented in Table 3-3 of Section 3.4.1.2 of the EIS. The Wyoming Ambient Air Quality Standards, or WAAQS, set by the WDEQ/AQD are also listed in this table. In some instances, the Wyoming standards are more stringent than the NAAQS.

During the new source review process, applicants must demonstrate that the facility will not cause or significantly contribute to exceedance of these standards. These demonstrations are made via atmospheric dispersion modeling or other means, including monitoring data approved by the WDEQ/AQD administrator.

F-2.2 Attainment/Non-Attainment Area Designations

Pursuant to the CAA, the EPA has developed a method for classifying existing air quality in distinct geographic regions known as air basins, or air quality control regions, and/or MSAs. For each federal criteria pollutant, each air basin (or portion of a basin or MSA) is classified as in "attainment" if the area has "attained" compliance with (that is, not exceeded) the adopted NAAQS for that pollutant, or is classified as in "non-attainment" if the levels of ambient air pollution exceed the NAAQS for that pollutant. Areas for which sufficient ambient monitoring data are not available to define attainment status are designated as "unclassified" for those particular pollutants.

States use the EPA method to designate areas within their borders as being in "attainment" or "non-attainment" with the NAAQS. Existing air quality throughout most of the PRB in Wyoming, including the area of the West Antelope II LBA tract, is designated an attainment area for all pollutants. However, the town of Sheridan, Wyoming, located in Sheridan County about 150 miles northwest of the project area, is a moderate non-attainment area for PM_{10} due to localized sources and activity within the town. There are no other non-attainment areas within 150 miles of the project area.

F-2.3 Prevention of Significant Deterioration (PSD)

Under requirements of the CAA, the EPA has established PSD rules, intended to prevent deterioration of air quality in attainment (and unclassifiable) areas. Increases in ambient concentrations of NO_2, SO_2, and PM_{10} are limited to modest increments above the existing or "baseline" air quality in most attainment areas of the country (Class II areas discussed below), and to very small incremental increases in pristine attainment areas (Class I areas discussed below).

For the purposes of PSD, the EPA has categorized each attainment area within the United States into one of three PSD area classifications. PSD Class I is the most restrictive air quality category, and was created by Congress to prevent further deterioration of air quality in national and international parks, national memorial parks and national wilderness areas of a given size threshold which were in existence prior to 1977, or those additional areas which have since been designated Class I under federal regulations (40 CFR 52.21). All remaining areas outside of the designated Class I boundaries were designated Class II areas, which allow a relatively greater deterioration of air quality over that in existence in 1977, although still within the NAAQS. No Class III areas, which would allow further degradation, have been designated.

The federal land managers have also identified certain federal assets with Class II status as "sensitive" Class II areas for which air quality and/or visibility are valued resources.

The closest Class I area to the West Antelope II LBA tract is Wind Cave National Park in South Dakota, located about 94 miles east of the site. The next closest Class I area is the North Absaroka Wilderness, located about 256 miles to the west-northwest. The closest sensitive Class II areas are the Devils Tower National Monument, the Cloud Peak Wilderness Area and the Northern Cheyenne Indian Reservation (in Montana), which are approximately 86, 108 and 155 miles from the Antelope Mine, respectively. See EIS Table 3-8 for a list of Class I and sensitive Class II areas in the vicinity of the PRB and their distance from the Antelope Mine.

PSD regulations limit the maximum allowable increase (increment) in ambient PM_{10} in a Class I airshed resulting from major stationary sources or major modifications to 4 $\mu g/m^3$ (annual geometric mean) and 8 $\mu g/m^3$ (24-hour average). Increases in other criteria pollutants are similarly limited. Specific types of facilities listed in the PSD rules which emit, or have the PTE, 100 tons per year or more of PM_{10} or other criteria air pollutants, or any other facility which emits, or has the PTE, 250 tons per year or more of PM_{10} or other criteria air pollutants, are considered major stationary sources and must therefore demonstrate compliance with those incremental standards during the new source permitting process. However, fugitive emissions are not counted against the PSD major source applicability threshold unless the source is so designated by federal rule (40 CFR 52.21). As a result, the surface coal mines in the PRB have not been subject to permitting under the PSD regulations because the mine emissions that are subject to PSD applicability levels fall below these thresholds.

F-2.4 Best Available Control Technology (BACT)

All sources being permitted within Wyoming must meet state-specific BACT requirements, regardless of whether the source is subject to state/federal PSD review. During new source review, a BACT analysis is developed for the proposed project. The BACT analysis must evaluate all control options on the basis of technical, economic and environmental feasibility. BACT for mining operations in the PRB is largely dictated by categorical control requirements defined in the WAQSR. BACT decisions are mandated through the new source review pre-construction permit.

F-2.5 New Source Performance Standards (NSPS)

The NSPS are a program of "end-of-stack" technology-based controls/ approaches required by the CAA and adopted by reference into the WAQSR. These standards, which apply to specific types of new, modified or re-constructed stationary sources, require the sources to achieve some base level of emissions control. For surface coal mining in the PRB, this includes certain activities at coal preparation plants. Specifically, the applicable requirements can be found at 40 CFR Part 60, Subpart Y (Standards of Performance for Coal Preparation Plants), and in the WAQSR. However, in Wyoming these standards are typically less stringent than state-level BACT limits.

F-2.6 Federal Operating Permit Program

The CAAA of 1990 required the establishment of a facility-wide permitting program for larger sources of pollution. This program, known as the Federal Operating Permit Program, or "Title V" (codified at Title V of the 1990 CAAA), requires that "major sources" of air pollutants obtain a federal operating permit. Under this program, a "major source" is a facility that has the PTE more than 100 tpy of any regulated pollutant, 10 tpy of any single HAP, or 25 tpy or more of any combination of HAPs, from applicable sources. The operating permit is a compilation of all applicable air quality requirements for a facility and requires an ongoing demonstration of compliance through testing, monitoring, reporting and recordkeeping requirements. Under its proposed permit application, the Antelope Mine's PTE for PM_{10} would be 12.1 tons per year, well below the 100 tpy applicability threshold.

F-2.7 Summary of Pre-Construction Permitting Procedures

The WDEQ/AQD administers a permitting program to assist the agency in managing the state's air resources. Under this program, anyone planning to construct, modify, or use a facility capable of emitting designated pollutants into the atmosphere must obtain an air quality permit to construct. Coal mines fall into this category. A new coal mine, or a modification to an existing mine, must be permitted by WDEQ/AQD, pursuant to the provisions of

WAQSR Chapter 6, Section 2. Under these provisions, a successful permittee must demonstrate that it will comply with all applicable aspects of the WAQSR including state and federal ambient air standards.

When a permittee decides to construct a new surface coal mine or modify operations at an existing surface coal mine that will cause an increase in pollutant emissions, they must submit an application, which is reviewed by WDEQ/AQD new source review staff and the applicable WDEQ/AQD field office. Typically, a company will meet with the WDEQ/AQD prior to submitting an application to determine issues and details that need to be included in the application. A surface coal mining application will include the standard application, BACT measures that will be implemented, an inventory of point and fugitive sources for the mine in question as well as neighboring mines and other sources, and air quality modeling analyses addressing cumulative impacts in the mining region.

BACT must be employed at all sources permitted/exempted in Wyoming. Per WAQSR Chapter 6, Section 2, BACT at large mining operations typically include but may not be limited to: paving of access roads, treating of haul routes with chemical dust suppressant (and water) and storage of large amounts of materials/coal awaiting shipment in enclosures such as silos, troughs or barns. These (and other) mitigation measures are considered in the development of emission inventories used for modeling/permitting.

For the modeling analyses, an applicant must compile an emission inventory of PM_{10} from their mining operation, neighboring mines and other surrounding sources. For PM_{10} from the applicant mine, both point source and fugitive dust emissions are quantified. The emissions are based on the facility's potential to emit in each year of the LOM. The applicant also examines the surrounding coal mining operations and their previous air quality permits to determine their emissions throughout the LOM. Two or more worst-case years (generally with the highest potential emissions) are then modeled in detail. Other surrounding emission sources, such as power plants, compressor stations, paved highways, long-haul railroad lines and municipalities are also considered in the modeling analysis. More information about modeling conducted at Antelope Mine is provided in Attachment A.

Coal mines in the PRB are also required to quantify NO_x emissions from their operations. Dispersion modeling is required to demonstrate compliance with the ambient NO_2 standard. Potential emissions from diesel powered mining equipment, blasting and locomotive emissions (on mine property) are considered in the modeling analyses. In a fashion similar to the PM_{10} analysis, neighboring mining operations and other surrounding sources are also included in the NO_x /NO_2 analysis.

Long-term PM_{10} modeling is conducted for the permit application to demonstrate compliance with the annual PM_{10} standard. For both point and area sources, the Industrial Source Complex Long Term model, version 3 (ISCLT3) is typically used.

The AQD has recently required all mines in the PRB to "submit and justify a background PM_{10} concentration with each permit application" (WDEQ-AQD, 2006b). A site specific PM_{10} background concentration of 12 $\mu g/m^3$ was developed in the modeling analysis and submitted to the AQD in May, 2006, in the Application to Modify the Antelope Mine. The WDEQ approved the permit on April 23, 2007. The modeling results are added to the background and compared to the annual standard. Likewise, compliance with the annual NO_2 standard is verified using ISCLT3 and an NO_2 background concentration of 20 $\mu g/m^3$.

Short-term PM_{10} modeling is not required by WDEQ-AQD, nor does WDEQ-AQD consider it to be an accurate representation of short-term impacts. Section 234 of the 1990 CAAA mandates the administrator of the EPA to analyze the accuracy of short-term modeling of fugitive particulate emissions from surface coal mines. A June 26, 1996 letter from EPA Region VIII to Wyoming state representative, Ms. Barbara Cubin, details the results of an EPA study wherein the short-term model failed to meet evaluation criteria and tended to significantly overpredict 24-hour impacts of surface coal mines. The memorandum of agreement of January 24, 1994 between EPA Region VIII and the state of Wyoming allows WDEQ-AQD to conduct monitoring in lieu of short-term modeling for assessing coal mining-related impacts in the PRB. This agreement remains in effect and ambient particulate monitoring is required of each coal mine through conditions of their respective permits. The 1994 Memorandum of Agreement also requires WDEQ/AQD to implement "Best Available Work Practice" mitigation measures at any mine where an exceedance of the PM_{10} air quality standard has occurred.

The permit application is reviewed by WDEQ/AQD to determine compliance with all applicable air quality standards and regulations. This includes review of compliance with emission limitations established by NSPS, review of compliance with ambient standards through modeling analyses, and establishment of control measures to meet BACT requirements. The WDEQ/AQD proposed permit conditions are sent to public notice for a 30-day review period after which a final decision on the permit is made (or a public hearing is held prior to a final permit decision).

The Antelope Mine has prepared permit applications and conducted air quality modeling analyses (Attachment A) when mine plan changes have dictated and as required by WDEQ/AQD. These applications and analyses demonstrate that mining operations have complied, and will continue to comply, with all applicable aspects of the WAQSR and the federal CAAA.

In conducting an analysis of air quality impacts in the PRB for the Wyoming and Montana BLM, the Task 1a Report for the Powder River Basin Coal Review reports a background concentration of 5 $\mu g/m^3$ for NO_x for the entire PRB. The air permit action for the Antelope Mine used a background concentration of 12 $\mu g/m^3$ for PM_{10} (See EIS Table 3-3). These concentrations are based on recently monitored values in Gillette, Wyoming and at the Antelope Mine respectively, and include all sources operating at the time the value was measured, including existing coal mine operations located around Gillette.

In 2006, the Antelope Mine submitted detailed modeling analyses to the WDEQ-AQD in support of a request for a permit modification, which addressed the impacts associated with a proposed production increase. These analyses considered all emissions sources and included the neighboring Jacobs Ranch, Black Thunder, and North Antelope Rochelle mines, as well as the former North Rochelle Mine. The WDEQ approved the mine modification in Permit MD-1543 on April 23, 2007.

F-3.0 EXISTING AIR QUALITY

WDEQ monitors air quality through an extensive network of air quality monitors throughout the state. Particulate matter is generally measured as particulate matter with mean aerodynamic diameters smaller than 10 microns (PM_{10}). The eastern portion of the PRB has an extensive network of PM_{10} monitors operated by the mining industry due to the density of coal mines in the region (Figure F-1). There are also monitors in Sheridan, Gillette, Arvada and Wright, Wyoming.

This network is sited to measure ambient air quality and to infer impacts from specific sources. Source-specific monitors may also be used for developing trends in PM_{10} concentrations. WDEQ uses data from this monitoring network to identify potential air quality problems and to anticipate issues related to air quality. With this information, the WDEQ can stop or reverse trends that negatively affect the ambient air. Part of that effort has resulted in the formation of a coalition involving the counties, coal companies and coal bed methane operators to focus on minimizing dust from roads.

The WDEQ may also take enforcement action to remedy a situation where monitoring shows a violation of any standard. If a monitored standard is exceeded at a specific source, the state agency may initiate enforcement against that source. In those instances, the state agency may use a negotiated settlement agreement to seek corrective action.

WDEQ operates two visibility monitoring stations in the PRB, both of which are IMPROVE sites. One of these sites is located north of Gillette. This site includes a nephelometer, a transmissometer, an aerosol monitor (IMPROVE protocol), and meteorological instruments to measure wind speed, direction, temperature, and relative humidity. The site is also equipped with a digital camera and analyzers for ozone and nitrogen oxides (NO, NO_2, NO_x). The second visibility monitoring station is located west of Buffalo and includes a nephelometer, a transmissometer, an aerosol monitor (IMPROVE), meteorological instruments to measure wind speed, direction, temperature, and relative humidity, plus a digital camera.

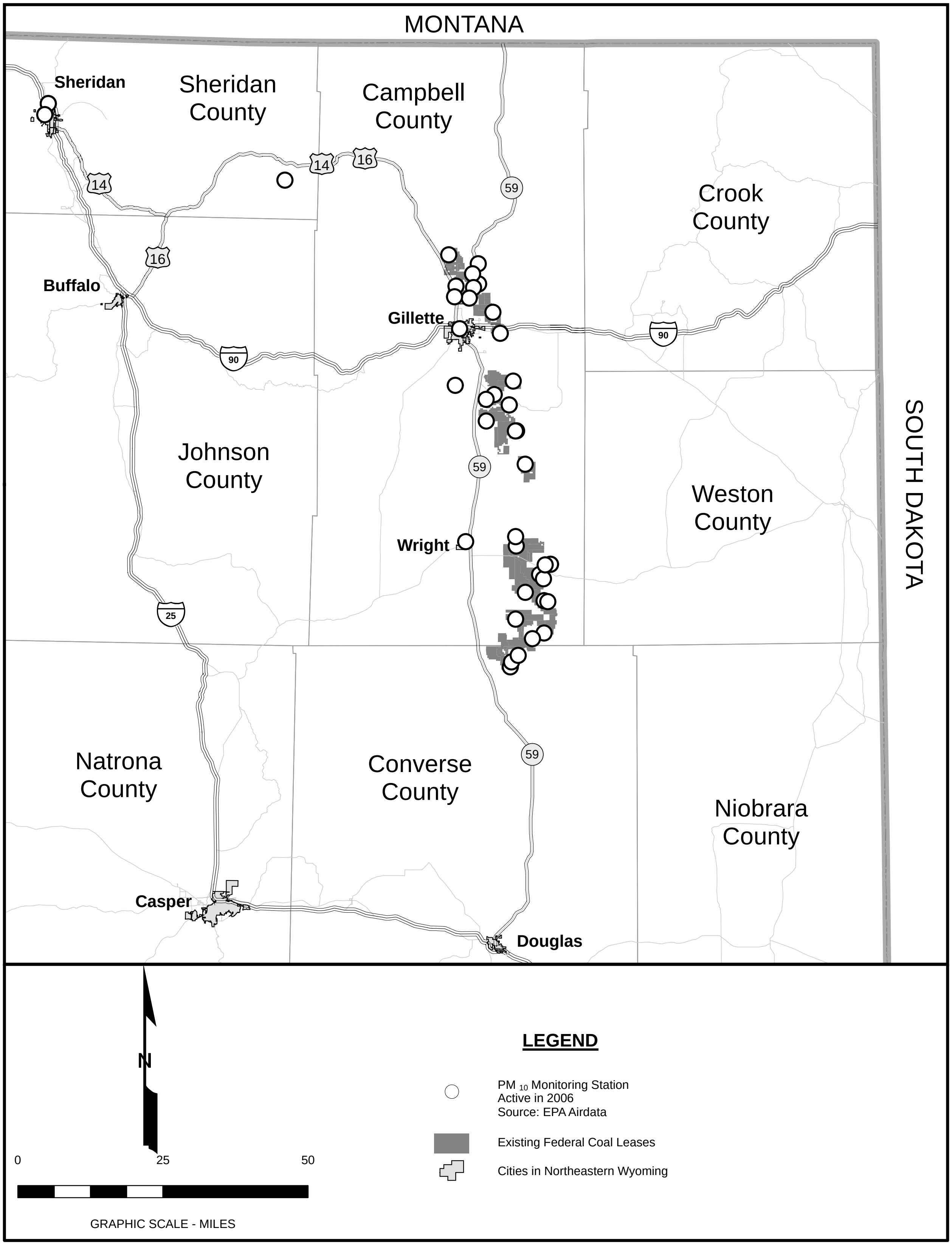

Figure F-1. Active PM_{10} Monitoring Stations in Northeastern Wyoming.

Air quality monitoring equipment for NO_2 within the PRB includes a WARMS operated by the BLM to detect sulfur and nitrogen concentrations near Buffalo, Sheridan, and Newcastle and a NADP monitoring system for precipitation chemistry in Newcastle.

F-3.1 Particulates

The federal and state standards for particulate matter pollutant are discussed in Chapter 3, Section 3.4.2.1 of the EIS.

F-3.1.1 Regional Particulate Emissions

WDEQ/AQD requires monitoring data to document the air quality at all of the PRB mines. Each mine monitored PM_{10} for a 24-hour period every six days at multiple monitoring sites through the end of 2001. This frequency was increased by the WDEQ/AQD to one in every three days beginning in 2002. Available monitoring data for TSP began in 1980 and data for PM_{10} began in 1989. As a result, over 57,000 TSP and 27,000 PM_{10} samples have been collected through 2004 making the eastern PRB one of the most densely monitored areas in the country (See Figure F-1). Table F-1 uses the annual arithmetic average of all sites to summarize these data.

As indicated in Table F-1**,** the long-term trend in particulate emissions was relatively flat through 1998. TSP concentration from 1980 through 2003 averaged 37.7 $\mu g/m^3$, ranging between 27.8 $\mu g/m^3$ and 57.5 $\mu g/m^3$. There were increases in 1988 and 1996, which may have been the result of fires in the region during those years. Increases from 1999 to 2003 may be related to drought conditions as well as increases in coal and overburden production and increases in other natural resource development activities, including CBNG, during that period. PM_{10} concentrations from 1989 through 2004 averaged 20.0 $\mu g/m^3$, ranging between 12.9 and 27.2 $\mu g/m^3$.

Significant surface coal mining growth occurred in the PRB during the period 1980-2004. Coal production increased from about 59 mmtpy to over 380 mmtpy (an increase of over 331 mmtpy), and associated overburden production increased from 105 mmbcy to over 1184 mmbcy. From 1980 through 2005, the annual coal production increased six-fold, while annual overburden production increased ten-fold over the same period. The proportionately larger annual increase in overburden production is probably because mines are gradually moving into areas of higher stripping ratios.

The relatively flat trend in particulate emissions from 1980 through 1998 is due in large part to the BACT requirements of the Wyoming air quality program. These control measures include watering and chemical treatment of roads, limiting the amount of area disturbed, temporary revegetation of disturbed areas to reduce wind erosion, and expedited final reclamation.

The average annual TSP concentration increased from 33.9 g/m³ in 1998 to 55.3 g/m³ in 1999 and 57.5 µg/m³ in 2001. The 2003 average annual TSP concentration was 53.0 µg/m³.

The average annual PM_{10} concentration increased from 15.9 µg/m³ in 1998 to 21.6 µg/m³ in 1999 and reached 27.2 µg/m³ in 2001; one of the largest increases in PM_{10} since it has been monitored in the PRB. The monitored concentrations have decreased since 2001. In 2004, the average annual concentration dropped to 20.0 µg/m³.

Table F-1. Summary of Air Quality Monitoring in Wyoming's Powder River Basin, 1980-2004

Year	Coal Produced (mmtpy)	Yards Moved (mmbcy)	Number of Mines Operating/Monitoring TSP/Monitoring PM_{10}	Number of Sites TSP/PM_{10}	TSP Average (µg/m³)	PM_{10} Average (µg/m³)
1980	58.7	105.3	10/14/0	34/0	35.3	
1981	71.0	133.4	11/13/0	35/0	39.4	
1982	76.1	141.1	11/14/0	40/0	31.2	
1983	84.9	150.9	13/14/1	41/1	32.6	11.2
1984	105.3	169.5	14/16/1	42/1	33.9	11.1
1985	113.0	203.4	16/17/0	49/0	32.3	
1986	111.2	165.7	16/17/0	45/0	29.3	
1987	120.7	174.6	16/17/0	43/0	31.7	
1988	138.8	209.7	16/17/0	43/0	37.7	
1989	147.5	215.6	15/17/3	40/3	32.1	15.9
1990	160.7	223.5	17/17/5	47/5	34.3	14.8
1991	171.4	245.9	17/17/5	46/6	32.7	16.5
1992	166.1	296.0	17/17/7	41/7	31.7	15.9
1993	188.8	389.5	17/17/8	40/11	27.8	14.5
1994	213.6	483.9	17/18/8	44/11	31.7	15.5
1995	242.6	512.7	16/18/8	41/12	29.6	12.9
1996	257.0	605.4	17/18/8	41/12	35.4	16.0
1997	259.7	622.0	16/17/10	39/15	33.3	15.9
1998	308.6	710.7	16/17/12	36/17	33.9	15.9
1999	317.1	758.0	15/17/12	36/18	55.3	21.6
2000	322.5	845.3	15/15/12	31/17	56.1	23.4
2001	354.1	927.1	12/11/12	29/29	57.5	27.2
2002	359.7	1032.1	13/11/13	23/38	56.0	23.3
2003	363.7	1043.6	13/10/11	15/30	53.0	22.7
2004	381.6	1184.4	13/5/13	6/36	--*	20.0

Sources:
1980-1996 emissions and production data: April 1997 WMA report for WDEQ/AQD.
1997-2004 emissions: EPA AirData/ WDEQ/AQD databases (EPA 2005a, WDEQ/AQD 2005b).
1997-2004 data: WDEQ/AQD and Wyoming State Inspector of Mines (WDEQ/AQD 2005c and Wyoming Department of Employment 1997-2004).

*Data no longer pertinent due to paucity of monitoring sites

Emissions control measures that are used to control particulate emissions at the PRB mines, including the Antelope Mine, are discussed in Chapter 3, Section 3.4.2.3 of the EIS.

County roads are also responsible for some portion of the fugitive dust related to transportation. To help address this problem, the Campbell County Commissioners, coal bed methane and oil production companies and coal mine operators have formed a coalition to implement the most effective dust control measures on a number of county roads. Measures taken have ranged from the implementation of speed limits to paving of heavily traveled roads. The coalition has utilized chemical treatments to control dust as well as closing roads where appropriate or necessary and rebuilding existing roads to higher specifications. The coalition requested money from the Wyoming State Legislature to fund acquisition of Rotomill (ground up asphalt) to be mixed with gravel for use in treating some of the roads in the PRB. The Rotomill/gravel mixture has been demonstrated to be effective in reducing dust; the life of the mixture on treated roads is estimated to be from five to six years (Bott, 2006).

F-3.2 Nitrogen Dioxide (NO_2)

The federal and state standards for NO_2 are discussed in Chapter 3, Section 3.4.3.1 of the EIS.

F-3.2.1 <u>Regional NO_2 Concentrations</u>

As discussed in Section 3.4.3.3 of the EIS, annual mean NO_2 concentrations have been periodically measured in the PRB since 1975. The annual mean NO_2 concentrations recorded by those monitoring efforts have all been well below the 100 $\mu g/m^3$ standard. The highest annual mean concentration recorded to date was 22 $\mu g/m^3$ at two separate sites between March 1996 and April 1997.

NO_2 is a product of incomplete combustion at sources such as gasoline- and diesel-burning engines or from mine blasting activities. Incomplete combustion during blasting may be caused by wet conditions, incompetent or fractured geological formations, deformation of bore holes, and other factors. Generally, blasting-related NO_x emissions are more prevalent at operations that use the blasting technique referred to as cast blasting (Chancellor 2003). Cast blasting refers to a type of direct blasting in which the blast is designed to cast the overburden from on top of the coal into the previously mined area.

In the mid-to late-1990s, OSM received complaints from several citizens about blasting clouds from several mines in the PRB. EPA expressed concerns that NO_2 levels in some of those blasting clouds may have been sufficiently high at times to cause human health effects. In response to those concerns, several studies have been conducted, the mines have modified their blasting techniques, and the WDEQ has imposed additional blasting restrictions at a limited number of mines. More information about these studies and restrictions is presented in the following discussion.

On the order of the Director of the WDEQ, members of the mining industry in the PRB conducted a comprehensive, multi-year monitoring and modeling study of NO_2 exposures from blast clouds. Results of the study (TBCC 2002), conducted pursuant to protocols reviewed and approved by the WDEQ, were provided to the WDEQ and the public in July 2002.

Using a combination of NO_2 measurements collected near 91 blast sites (78 valid runs) and a conservative modeling/extrapolation approach, the authors developed a series of "safe" setback curves for coal, overburden and cast shots for various wind speed classes. The curves were derived from the sampled data, conservative projections of concentrations at greater/lesser distances than measured and an assumed safe level (based on a comprehensive review of available health effects data) of 5.0 ppm for 10 minutes.

Subsequently, the data in the 2002 report (collected at the Black Thunder Mine) were augmented with monitored data/analyses from an additional 45 validated blast events at the Eagle Butte, North Antelope Rochelle, Buckskin and Cordero-Rojo mines. New curves, based on the entire basin-wide data set encompassing 123 valid tests, were developed but differed only slightly from the original Black Thunder curves.

Measures that are used by the mines to control NO_2 emissions related to blasting by the PRB mines are discussed in Chapter 3, Section 3.4.3.3 of the EIS.

ATTACHMENT A – AIR QUALITY MODELING SUMMARY

for **Bureau of Land Management**

BLM Wyoming State Office
Casper Field Office
Casper, Wyoming

Air Quality Modeling Summary
Antelope Mine Permit MD-1543

May 2008
MMA Project Number P-2106-07

by McVehil-Monnett Associates, Inc.

44 Inverness Drive East, Building C
Englewood, CO 80112
(303) 790-1332

1.0 Introduction

In May 2006, McVehil-Monnett Associates, Inc. (MMA) submitted a modeling study to the Wyoming Department of Environmental Quality, Air Quality Division (AQD) on behalf of the Antelope Coal Company (ACC). This study was performed in support of an ACC permit application to increase annual coal production at the ACC Antelope Mine from 36 MMTPY to 42 MMTPY and to install control equipment on all existing point sources at the preparation plant area. Based on the modeling and permit application, Permit MD-1543 was subsequently issued on April 23, 2007 by the AQD. This document summarizes the modeling process and results from that study, that has been referenced in the WAII Environmental Impact Study.

Since mine plan changes were necessitated by this coal production increase, the goal of this modeling study was to demonstrate that the proposed changes would not prevent the attainment or maintenance of the PM_{10} or NO_2 air quality standard in Wyoming. To that end, air quality modeling in Wyoming consists of the following steps:

- Development of an updated mine plan to account for the coal production increase
- Update list of equipment required to achieve production increase
- Determination of "open acreage" requirements
- Determination of BACT for qualifying fugitive and point sources
- Determination of miscellaneous emission control practices
- Development of emission inventory and "worst-case" year determination
- Model selection, execution and results

The following sections describe this process for the ACC Antelope Mine in greater detail.

2.1 Mine Plan

ACC Antelope Mine is an existing multiple pit, surface coal mine that utilizes one dragline and traditional truck and shovel techniques to mine coal. To account for the proposed production increase, ACC developed an updated coal sequence, which would allow for coal extraction at the Antelope Mine through the year 2020. This mine plan was finalized and subsequently submitted to MMA for use in the model.

2.2 Mine Equipment List

ACC developed an inventory of mine equipment required to attain the proposed production increase. This inventory varies from year to year depending on haul distance, overburden thickness, and other factors. The percentage of larger equipment generally increases through time as older, smaller equipment is retired. There will be no equipment added to the existing coal preparation facilities at the Mine under this production increase. This information was submitted to MMA for use in the model.

2.3 Open Acreage

Permitting requirements established by AQD in 2002 include a discussion of open acreage potentially subject to wind erosion. More specifically, the requirement is to discuss, summarize, and map the land status for the current year and for the years modeled. This is similar to a Wyoming Department of Environmental Quality, Land Quality Division (LQD) annual report requirement. Much of the information used in the model was obtained from the annual report to LQD for the 2004/2005 reporting year, which represented the "current year" for the application.

Detailed plan information was not available for the modeled years of 2010 and 2012. Current conditions or information were assumed to represent a reasonable estimate for those years. Because of this assumption, the information has not been mapped, but may be assumed to generally resemble the configuration of the operation in 2005. Once this information was determined, it was used in the specific modeled year's emission inventory.

2.4 BACT

For this modeling study, a BACT analysis was performed by MMA to take into account control measures, such as chemical applications to roads, enclosing silos, bins and other storage areas and treatment of active work areas. These active work areas include those for scrapers, blasting, overburden/coal loading areas, coal dumping, haul road repair and areas susceptible to wind erosion. Once these control measures were determined, they were used in the development of the emission inventory.

2.5 Miscellaneous Emission Control Practices

Other control practices contained in the emission inventory include a coal fire mitigation program and a haul road dust suppression program. Both of these programs act to minimize fugitive emissions at the mine.

2.6 Emission Inventory Development and Worst-Case Year Selection

Fugitive and point source emission inventories for PM_{10} and NO_x were developed for Antelope Mine based on site-specific information provided by the mine. Fugitive and point source emissions for PM_{10} and NO_x from nearby mines (North Antelope Rochelle, Black Thunder, and Jacobs Ranch Mines) were also developed. The resultant particulate emission inventories were used to determine the years that would be modeled.

It is important to note that future mine-wide emissions from Antelope and other regional sources are based on methodologies prescribed by the AQD. Specifically, those methodologies were discussed with AQD staff in a pre-application conference on March 17, 2006. It was decided to use the most recent Memorandum, *PRB Coal Mine Permitting Guidance*, issued by WDEQ-AQD on February 27, 2006 (WDEQ-AQD, 2006a). One additional requirement discussed was to add updated Coal Bed Methane (CBM) NO_X emissions from regional sources which were provided by AQD on March 24, 2006 (WDEQ-AQD, 2006b). This memo forms the primary basis for how the permitting analysis was performed.

2.6.1 Fugitive and Point Source PM_{10} Emission Inventory

Antelope provided life-of-mine (LOM) coal production, overburden handling and related operational parameters needed for emission inventory development for the 42 MMTPY mine plan evaluated for this study. The parameters were used in conjunction with a set of emission factors endorsed by the AQD (WDEQ-AQD, 1979) and EPA's AP-42 to calculate annual emissions of PM_{10} and NO_x from each emission-producing activity. Note that the AQD emission factors calculate TSP emissions, which are then multiplied by AQD's factor of 0.30 to arrive at the PM_{10} emission factors.

The Antelope coal preparation and processing facilities include crushers, material transfers and loadouts. All existing point sources at the coal preparation facilities will be outfitted with Passive Enclosure Systems (PECS). The PECS will eliminate the points' potential to emit fugitive emissions. Such controls are deemed by WDEQ-AQD to be zero emitters.

2.6.2 Mobile and Stationary Source PM_{10} Emission Inventory

Mobile PM_{10} emission sources include scrapers, haul trucks, graders, dozers, water trucks, locomotives, drills and loaders. Emissions were calculated using AP-42 emission factors for all sources except locomotives, where the emission factor was taken from the WDEQ-AQD 2000 database.

PM_{10} emissions from stationary engines were calculated using operating hours from calendar year 2005, which were increased to reflect a maximum coal production level of 42 million tons per year. The engines include light plants, compressors, pumps, welders and generators.

2.6.2 Mobile and Fugitive Source NO_x Emission Inventory

Emission sources included in this inventory are mobile source mining equipment, such as scrapers, haul trucks, graders, dozers, water trucks and locomotives, and fugitive sources such as overburden and coal blasting events. Mobile source (tailpipe) NO_x emissions were calculated using estimated operating hours necessary to mine coal at the future projected production rate and EPA approved mobile source emission factors. NO_x emissions from blasting were calculated using estimated explosive usage necessary to mine coal at the future projected rate and an EPA approved emission factor.

2.6.2 Stationary Engine NO_x Emission Inventory

Emissions from stationary engines were calculated using actual operating hours from calendar year 2005, which have been increased to reflect a maximum coal production level of 42 million tons per year.

2.7 Regional Source Emission Inventories

The following neighboring mines in the South Group were included in the PM_{10} modeling analysis: North Antelope Rochelle, Black Thunder (formerly North Rochelle and Black

Thunder), and Jacobs Ranch. These mines, plus regional sources provided by AQD (regional power plants and point sources, CBM sources, mainline trains, urban areas, and road emissions), were considered in the NO_x analysis. All regional NO_x sources and emissions were obtained in accordance with methodologies defined during the AQD pre-application conference.

2.7.1 Railroad, Road, Power Plant, Urban, Coal Bed Methane and Regional Point Sources

The information for railroads, highways, power plants, urban areas, and regional point sources were taken from the previously completed permit application for Antelope Mine (MMA, 2005). Specifically, the north/south main line railroad, Highway 59 and other small road segments, Two Elk Power Plant, Neil Simpson I and II Power Plants, Wyodak Power Plant, WYGEN Units I and II Power Plants, the town of Wright and several compressor stations supporting oil/gas are included in this category (these sources were not included in the list of Coal Bed Methane sources provided by the state (WDEQ-AQD, 2006b). The Coal Bed Methane sources consist of approximately 300 point sources within a 31 km radius of Antelope. Only NO_x emissions were considered from these sources and it is important to note that no scale-up factors were used on any of these sources; they were used as provided by the AQD.

2.8 Selection of Worst-Case Years

AQD policy requires that the maximum PM_{10} and NO_x impacts (during the life-of-mine) from all mine sources be identified and compared to the applicable air quality standards. Because it is not practical to model all of the years in the life-of-mine, years with maximum annual emissions from mining operations are determined and then modeled. Model results for these "worst-case" emission years are then compared to the applicable ambient air quality standards. If the maximum impact is below the air quality standard, it can be assumed that the standard will be achieved throughout the LOM.

Based on mine plan parameters and emission inventories, LOM years 2010 and 2012 were chosen as worst-cases to be modeled. Year 2012 was selected primarily because it represents the highest annual PM_{10} emission year (11,110 tons/year) for all South Group mines combined and the maximum year of PM_{10} emissions from Antelope alone (1,422 tons/year). Year 2010 was selected because it represents the second highest year of PM_{10} emissions from Antelope alone (1,268 tons/year). In addition to the maximum emission levels, in 2010 the Antelope Horse Creek Mine Area pit is located less than 150 meters from the LNCM boundary. Also, North Antelope Rochelle's pit is located close to both Antelope's and North Antelope Rochelle's LNCM boundary. Therefore the selection of these two years should ensure that the maximum potential PM_{10} impacts on ambient air quality are addressed.

These model years are also worst-case for Antelope NO_x emissions, with 2012 having the highest annual emissions (1,593 tons/year), and 2010 having the second highest annual emissions (1,422 tons/year). Therefore, the selection of these worst-case years will also provide the maximum potential NO_x impacts on the South Group modeling area.

2.9 Dispersion Modeling Methodology

Cumulative PM_{10} impacts from Antelope Mine and neighboring mines were modeled using the Industrial Source Complex Long-Term (ISCLT3) Model. PM_{10} impacts were modeled for all facilities for the two worst-case years, and concentrations were calculated at receptors located along the LNCMs for the South Group mines. The cumulative PM_{10} concentrations at each receptor location were compared to the Wyoming and Federal annual ambient air quality standard of 50 $\mu g/m^3$ to determine compliance with that standard.

NO_2 impacts from Antelope and neighboring sources were also modeled for the two worst-case years. However, an initial model run was first performed for each worst-case year to determine the significant impact area ($\geq 1 \mu g/m^3$ annual NO_x impact) produced on a regional receptor grid from sources within the Antelope Mine only. Then, additional model runs for each worst-case year considered all sources from the area mines, as well as the regional sources, to determine cumulative NO_2 impacts at receptors within the significant impact area. The cumulative NO_2 concentrations were compared to the Wyoming and Federal ambient air quality standard of 100 $\mu g/m^3$ to determine compliance. Emissions were modeled as NO_x, and the final concentrations were multiplied by 0.75 to account for chemical conversion to NO_2.

2.9.1 Dispersion Model

The Industrial Source Complex Long-Term (ISCLT3) Model dated 96113 [i.e., the year (96) and Julian day (113) that the model was released for public use] was used to model annual average PM_{10} and NO_2 concentrations from both fugitive emission sources and point sources per AQD directive (WDEQ-AQD, 2006a). ISCLT3 was run in regulatory default mode with rural dispersion parameters. In addition, the model was run using elevations for all sources and receptors. Elevations were determined from USGS 7.5-minute digital elevation models (DEM's).

2.9.2 Terrain Data

The DEM's, all source locations, and receptor locations for each worst-case year were used as inputs into the EPA's terrain processor, AERMAP. AERMAP uses the input data to extract elevations in meters for all sources and receptors. These elevations were then used in each respective ISCLT3 input file.

2.9.3 Meteorological Data

Hourly on-site meteorological data collected at the Antelope Mine was used in this modeling analysis. AQD provided MMA with the Antelope six-year (1995 – 2000) Joint Frequency Distribution (JFD) of wind speed, wind direction, and atmospheric stability class for use in this analysis (WDEQ-AQD, 2006b).

2.9.4 Receptors

For PM_{10} modeling, receptors were placed at approximate 500-meter intervals along mine LNCM boundaries. The AQD "Mine A/Mine B" policy for cumulative impacts did not apply to this analysis because none of the mines adjacent to Antelope have LNCM boundaries that overlap with Antelope's boundary. However, Antelope Mine and the North Antelope Rochelle Mine do share the same LNCM boundary (with no overlap) in places. The receptors for these two mines were placed along their entire boundaries and are shared at certain locations. Black Thunder and Jacobs Ranch Mines do not have LNCM boundaries that overlap Antelope's and therefore, are also not applicable to the "Mine A/Mine B" procedures. Receptors for each of these mines were not placed along the entire LNCM boundaries, but were placed only along the LNCM outline of the two mines.

For NO_2 significant impact area modeling, additional receptors were placed outside Antelope's LNCM boundary. The significant impact area modeling utilized a regional grid extending out at least 17 km from the center of Antelope's LNCM. This large receptor grid size ensures that the modeling result will show the significant impact area inside the regional grid. The cumulative modeling analysis utilized a subset of the regional grid contained within the significant impact area. All NO_2 modeling receptors were spaced at 500-meter intervals.

2.9.5 Emission Apportioning

Fugitive PM_{10} and NO_x emissions for each of the worst-case years were apportioned into area sources based on the activity type. The number and location of the area sources, as well as their dimensions and orientation, were based on the pit configuration and road orientation provided in the coal progression map. Emissions were divided by the area of each area source in which they occurred to arrive at an emission rate in grams/second/square meter. NO_x emissions for the regional roads and mainline trains were also apportioned into area sources.

2.9.6 Point Source Modeling Parameters

For this study, Antelope Mine removed all baghouses at their coal preparation facilities and replaced them with PECS. This type of control is considered a zero emission control, effectively eliminating all point source emissions at Antelope. Point source parameters from regional mines were used in the model as identified in each mine's most recent permit or pending application.

2.9.7 PM_{10} and NO_2 Background Concentration

The AQD has required all mines in the PRB to "submit and justify a background PM_{10} concentration with each permit application" (WDEQ-AQD, 2006a). Antelope Mine submitted an analysis to the AQD on August 11, 2005. A site-specific PM_{10} background concentration of 12 $\mu g/m^3$ was developed in this analysis and approved by the AQD on November 29, 2005 in the Application Analysis (AP-3630) and subsequent Air Quality Permit MD-1304.

A background value of 20 μg/m^3 NO_2 was added to modeled NO_2 concentrations. The NO_2 background value was determined from NO_2 monitoring conducted by AQD in 1996 at four locations in the southern PRB (Gillette, Belle Ayr Mine, Black Thunder Mine, and the town of Bill). This background value is conservative, as three of the four monitors that determined the values were located in areas that were directly impacted by either mining activity or train emissions. Thus, some double counting occurred, as these emissions were also included within the model.

2.10 Modeling Results

2.10.1 PM_{10} Modeling Analysis and Results

The area source, haul road, and point source PM_{10} information for Antelope Mine and other sources in the area were input into ISCLT3 for each worst-case year. The LNCM receptors and JFD were also input to the model. The site-specific background concentration of 12 μg/m^3 was added to the results from the model to obtain the total impact from the fugitive and point sources.

All model results from the Antelope Mine impact analysis show concentrations, after adding background, below the Federal and Wyoming annual PM_{10} air quality standard of 50 μg/m^3. The maximum cumulative concentration predicted in 2010 was 47.84 μg/m^3 (including 12.0 μg/m^3 background) and occurred along the Antelope LNCM. For year 2012, the maximum predicted cumulative concentration of 51.59 μg/m^3 (including background) occurred along the Black Thunder LNCM. Note that sources within the Antelope Mine contributed only 0.19 μg/m^3 to this cumulative concentration. Since Antelope contributes an insignificant amount (<1 μg/m^3) to the total PM_{10} concentration at this receptor, the receptor can be eliminated from this modeling analysis with respect to compliance with the annual PM_{10} standard of 50 μg/m^3. The maximum predicted concentration in 2012 for which Antelope has a significant contribution was 49.88 μg/m^3, occurring at receptor 78 on the Antelope LNCM.

2.10.2 NO_2 Modeling Analysis and Results

Antelope mine emission sources were modeled for each worst-case year in order to determine the extent of the annual average 1 μg/m^3 contour defining the significant impact area. Receptors within the significant impact areas were then modeled to determine compliance with the ambient air standard in the cumulative impact modeling assessment, as discussed below.

The area source and point source NO_x information for Antelope and other South Group mines were input into ISCLT3 for each worst-case year along with the significant impact area receptor grid and JFD. Annual NO_x emissions from other regional sources were also input into the model. Emissions were modeled as NO_x, with the resulting concentrations multiplied by 0.75 to account for chemical conversion to NO_2. The AQD-specified background concentration of 20 $\mu g/m^3$ NO_2 was then added to the model results to obtain the total impact.

The Wyoming and Federal annual NO_2 air quality standard, to which the model results are compared, is 100 $\mu g/m^3$. All model results for the Antelope impact analysis show concentration predictions below this value.

The maximum cumulative concentration predicted in 2010 was 65.13 $\mu g/m^3$ (including background) and occurred along the Antelope LNCM boundary. For 2012, the maximum predicted cumulative concentration was 67.54 $\mu g/m^3$ (including background) and also occurred along the Antelope LNCM boundary.

2.10.3 Short-term Particulates

AQD does not require modeling of fugitive dust emissions to predict compliance with the 24-hour PM_{10} standard (which is 150 $\mu g/m^3$, not to be exceeded more than one time per year). Neither EPA nor the AQD have been able to demonstrate that available modeling tools and emission factors are adequate for this task. Section 234 of the 1990 Clean Air Act Amendments required EPA to demonstrate that it had adequate modeling tools before the agency could require states to employ 24-hour modeling at surface coal mines. To date, that demonstration has not been made.

Instead, it has been AQD's position that ambient air monitoring data collected by the mines demonstrates that compliance with short-term ambient standards can be achieved when a mine employs BACT. In 2002 the agency also began requiring a demonstration that "…mining operations will not cause or contribute to ambient violations…" (WDEQ-AQD, 2006a). The following discussion is a demonstration that Antelope will not cause or contribute to a 24-hour PM_{10} ambient air violation in the area of the South Group.

2.10.4.1 Historical Ambient Air Quality

2.10.4.2 Antelope Mine

Ambient PM_{10} concentrations are monitored at three locations at the Antelope Mine. These locations are identified as Site 4, Site 5, and Site 6. Concentrations of PM_{10} are currently monitored using Partisol low volume type monitors at the three monitoring sites. The samplers are collecting 24-hour samples on a 1-in-3 day sampling schedule. The highest second-high measured PM_{10} concentration at the Antelope Mine was 114 $\mu g/m^3$, which occurred in 2005.

While none of the highest second-high PM_{10} concentrations at the Antelope Mine have ever been over the 24-hour standard, one monitored concentration (first-high) in 2005 did exceed the standard. On September 19, 2005, the Partisol sampler at Site 5 recorded an elevated concentration. Maintenance of the main railroad line in the vicinity of the sampler is most likely responsible for this high value. Burlington Northern/Santa Fe and Union Pacific maintenance activities on the main line occurred as close as 250 feet from the sampler, while mining activities on that day were nearly 3 miles away to the northwest. The wind direction data from September 19 do not support the transport of Antelope mining activity dust in the direction of this particulate sampler. Therefore, it is clear that mining activities did not cause or necessarily contribute to the elevated concentration.

2.10.4.3 South Group Mines (Jacobs Ranch, Black Thunder and North Antelope Rochelle)

The three other mines in the South Group currently operate a total of 12 PM_{10} monitors. Jacobs Ranch and North Antelope Rochelle mines did not record a monitored exceedance of the 24-hr PM_{10} standard during the years 2003-2005. North Antelope Rochelle recorded an elevated measurement in 2005 of 149 $\mu g/m^3$ at site NA-5, but averaged around 60% of the standard at the remainder of the sites during the previous three years. Monitored concentrations for Jacobs Ranch averaged about 50% of the standard. Black Thunder recorded two measurements that exceeded the 24-hour PM_{10} standard in 2004 and 2005 of 436 μg/m^3 and 167 μg/m^3, respectively. All other measurements at Black Thunder have been averaging around 70% of the standard.

To help prevent any future exceedances, Black Thunder Mine has instituted internal activities to mitigate high concentrations, such as replacing existing controls on a large number of their fugitive dust sources with zero emission control systems. Other regional mines have voluntarily taken action to help understand and improve air quality in the South Group.

2.10.4.4 Compliance Demonstration

Under the revised mining operation modeled in this application, the Antelope Mine will not cause or contribute to a violation of the 24-hour ambient air standard. The following points form the reasoning for this conclusion.

- By virtue of monitored concentrations collected at the Antelope Mine over the past three years, it is clear that mining activities at the Antelope Mine do not cause or significantly contribute to violations of the 24-hour ambient air standard. The maximum highest second-high 24-hour PM_{10} concentration monitored at the Antelope Mine during the past three years was below the standard at 114 μg/m^3, and the average of the highest second-high concentrations was 64 μg/m^3. The maximum first-high concentration that exceeded the standard in 2005 was due to BNSF and UP main railroad line maintenance activities occurring very near the sampler, while mining activities were nearly 3 miles away.
- The replacement of baghouse controls with zero-emission PECS on all existing point sources will reduce dust emissions at Antelope Mine. This will have a beneficial effect on air quality and monitored concentrations.
- It is unlikely that the Antelope Mine has contributed in the past, or that it will contribute in the future, to a violation. Given the predominant wind directions for the South Group, and the geographic locations of the nearest neighboring mines, it is clear that emissions from the Antelope Mine are most frequently blown towards open rangeland away from other mining activities. Wind directions which would potentially transport dust from the Antelope Mine across the other mines in the South Group include those blowing towards the east through north. Winds blowing towards these directions occurred only 33% of the

time. The remaining wind directions (winds blowing towards the east-southeast clockwise through the north-northwest, occurring about 67% of the time) would transport dust generated from mining activities at the Antelope Mine over open rangeland away from other mining activities.

- During the times when mining emissions from the Antelope Mine do blow towards neighboring mines, it is unlikely that such emissions would contribute to a violation because of the nature of the emissions released and the distance that they must travel before impacting an air monitor. Mining emissions are typically low-level releases consisting of particulate matter that is subject to gravitational settling. Emissions from current Antelope mining operations would have to travel about 2.5 miles before reaching North Antelope Rochelle, which is the closest mine to Antelope. Particulate settling over these distances will minimize possible contributions to violations.

REFERENCES

MMA, 2005. Permit Application to Modify the Antelope Mine. McVehil-Monnett Associates Inc., Englewood, CO. July. 2005 (MMA Project # 1899-05).

WDEQ-AQD, 2006a, (2/27/06) Memorandum From Bernie Dailey to Powder River Basin Coal Mine Operators. *PRB Coal Mine Permitting Guidance.*

WDEQ-AQD, 2006b, (3/24/06) Email from Andrew Keyfauver transmitting meteorological data and CBM sources for South Group modeling.

WDEQ-AQD, 1979, Memorandum from Charles Collins. (Wyoming) *Fugitive Dust Emission Factors*.