ES.1 INTRODUCTION

The Powder River Basin (PRB) of Wyoming and Montana is a major coal-producing region in the United States. It also has produced large quantities of natural gas and oil, and has experienced significant development of coal bed natural gas (CBNG) from its coal seams. The region has a diverse set of environmental values, including proximity to some of the most pristine areas in the United States.

This Task 3A Report for the PRB Coal Review evaluates the air quality-related environmental impacts of ongoing development in the region. Task 1A Report for the PRB Coal Review, Current Air Quality Conditions (ENSR 2005a) documented the air quality impacts of operations during a base year (2002), using actual emissions and operations for that year. The base year analysis evaluated impacts both within the PRB itself and at selected sensitive areas surrounding the region. The analysis specifically looked at impacts of coal mines, power plants, CBNG development, and other activities. Results were provided for both Wyoming and Montana source groups and receptors.

The Task 2 Report for the PRB Coal Review, Past and Present and Reasonably Foreseeable Development Activities (ENSR 2005b) depicted the range of projected coal-related development in the PRB, for a range of source groups. The report identified reasonably foreseeable development (RFD) activities for the years 2010, 2015, and 2020, and was separated into selected source groups, including power plants, coal mine development, conventional oil and gas and CBNG activities, and other coal-related energy development scenarios. The results of that study were used in developing changes in emission rates for the source groups for 2010 and estimating the associated cumulative air quality impacts.

This report evaluates projected changes in impacts on air quality and air quality-related values resulting from the projected RFD activities. Impacts were evaluated for development of different source groups and on the different receptor groups. The development projected for 2010 was modeled using the same model and meteorological data that were used for the base year study in the Task 1A report. Impacts for 2015 and 2020 were projected qualitatively based on expected changes and on modeled impacts for 2010.

ES.2 TECHNICAL APPROACH

The analysis evaluates two levels of coal development for each of the selected years, a lower production (or development) scenario and a higher production scenario. Existing and projected sources in the study area were analyzed using the base year (2002) emissions and an adjustment to those emissions based on the projected development level. Emissions were evaluated for sources in the "study area," which comprises several counties in the PRB in both states:

- Wyoming counties include Campbell County, all of Sheridan and Johnson counties except the Bighorn National Forest lands to the west of the PRB, and the northern portion of Converse County.

- Montana counties include Rosebud, Custer, Powder River, Big Horn, and Treasure counties.

The study evaluates impacts on air quality and air quality-related values resulting from projected development of RFD activities in the study area. A quantitative modeling assessment was used to project ambient air quality impacts for 2010, and qualitative evaluations were made for 2015 and 2020, based largely on the results of the modeling study for 2010.

A state-of-the-art, guideline dispersion model was used to evaluate impacts on several source groups:

- Near-field receptors in Wyoming (within the PRB study area),

- Near-field receptors in Montana (within the PRB study area),

- Receptors in nearby federally designated pristine or "Class I" areas, and

- Receptors at other sensitive areas (Class II sensitive areas)."

The U.S. Environmental Protection Agency (USEPA) guideline CALPUFF model system (Scire et al. 1999a) was used for this study, similar to the approach used in the Task 1A analysis, using the same meteorological data set. Only the impacts for 2010 were directly modeled, including both the lower and upper production scenarios. The modeling domain extends over most of Wyoming, southeastern Montana, southwestern North Dakota, western South Dakota, and western Nebraska. A group of agency stakeholders participated in developing the modeling protocol and related domain that were used for this analysis.

The modeling approach used actual emissions from existing sources representative of 2002 operations and adjusted those emissions for the expected level of development. No specific emissions data were available for the projected levels of development. The base year emissions data were gathered from a variety of sources, but mainly relied on data collected by the Wyoming Department of Environmental Quality (WDEQ) and the Montana Department of Environmental Quality. Only actual emission sources inside the study area were included in the modeling. Key major sources were included, such as the coal-fired power plants, gas-fired power plants, and sources that were included in the Title V (operating permit) program. The Dave Johnston power plant, located in Converse County, is located outside of but adjacent to the study area, and

specifically was included in the base year study and in the projected emissions. Some operational adjustments were made to accommodate small sources that were presumed to be operating at less than full capacity. Emissions from other sources, including estimated fugitive dust construction emissions, were computed based on USEPA emission factors and on input data from WDEQ.

Meteorological data were developed for 1996 for the modeling domain, using the guideline Version V of the CALMET (Scire et al. 1999b) diagnostic model, identical to that used in the PRB Oil and Gas Environmental Impact Statement (Bureau of Land Management 2003) and in the Task 1A report. These data provide a four-dimensional depiction that represents actual meteorological conditions for that year. The data base was enhanced by using data for specific surface station and precipitation data. Terrain and land use data from the USGS also were used. Modeling data settings generally were set to default values, as provided in the technical report. Base year ozone concentrations also were incorporated into the model using measured concentrations representative of the study area, and were not changed for this study.

The objective of this study is to identify the changes in air quality impacts resulting from the projected levels of development. Impacts were assessed for both Wyoming and Montana and at the individual sensitive receptor areas. The impacts were evaluated for the same receptor set that was used in the Task 1A report, using the same dispersion model and the same technical input data. The only difference between the modeling for the base year and for the results presented here is associated with the projected change in emissions as a result of RFD activities.

ES.3 CUMULATIVE IMPACTS

The existing regional air quality conditions generally are very good. The base year (2002) modeling showed that there was a concern about some impacts of particulate matter with an aerodynamic diameter of 10 microns or less (PM_{10}) emissions within the near-field receptors of both Montana and Wyoming. The modeling also showed some substantial base year impacts on visibility at the nearby Class I areas. For regulatory purposes, the Class I evaluations are not directly comparable to the air quality permitting requirements, because the modeling effort does not segregate increment-consuming sources that would need to be evaluated under the Prevention of Significant Deterioration (PSD) program. The cumulative impact analysis focuses on changes in cumulative impacts versus a comparison to PSD-related evaluations, which would apply to specific sources. Changes in impacts for air quality parameters (nitrogen dioxide [NO_2], sulfur dioxide [SO_2], and PM_{10}) were evaluated, along with changes in air quality-related values at Class I areas.

Table ES-1 presents the modeled impacts on ambient air quality at the near-field receptors in Montana and Wyoming. Results indicate the maximum impacts at any point in each receptor group, and data are provided for the base year (2002) analysis and for both development scenarios for 2010.

The results of the modeling depict the anticipated changes under both development scenarios. For the Montana near-field receptors, the impact on the 24-hour PM_{10} levels shows an increase above the National Ambient Air Quality Standard (NAAQS) for the base year as well as for both development scenarios for 2010. The upper development scenario shows an increase in the impact of more than 40 percent above the base year for this parameter. Impacts at all other receptors show compliance with the NAAQS and the Montana Ambient Air Quality Standard (AAQS). There are large percentage increases projected in annual SO_2 impacts, but the impacts themselves are well below the NAAQS.

For the Wyoming near-field receptors, the modeled 24-hour PM_{10} impacts continue to increase above the NAAQS, and, with a noted 32.7 percent increase in annual PM_{10} impacts, the model predicts that the annual PM_{10} standard also would be exceeded under the upper development scenario. Impacts of NO_2 and SO_2 emissions are predicted to be below the NAAQS and Wyoming AAQS at the Wyoming near-field receptors. For both near-field receptor groups (Wyoming and Montana), the maximum modeled impacts above the ambient standard are restricted to one or two receptors over the whole receptor grid.

Table ES-2 provides modeled impacts at the three Class I areas and two Class II areas with the greatest impacts. A comparison to ambient air quality standards and PSD increments is provided; however, it must be noted that the analysis did not separate PSD increment-consuming sources from those that did not consume increment. The PSD-increment comparison is provided for informational purposes only and cannot be directly related to a regulatory interpretation of PSD increment consumption. In the Northern Cheyenne Indian Reservation, modeled impacts are slightly above the PSD Class I increment levels for annual PM_{10}, annual NO_2, 24-hour SO_2, and 3-hour SO_2. Also, at the Northern Cheyenne Indian Reservation, modeled impacts are well above the Class I increments for 24-hour PM_{10}, but are less than the annual SO_2 PSD Class I increment. In the sensitive Class II areas, all modeled impacts are well below the Class II PSD increments, except that the 24-hour PM_{10} impacts are greater than the Class II 24-hour PM_{10} increments at the

Crow Indian Reservation (**Table ES-2**). In the other Class I areas, only the 24-hour PM_{10} impacts are above the comparison to the PSD increment levels.

Table ES-1
Projected Maximum Potential Near-field Impacts
(µg/m^3)

Pollutant	Averaging Time	Base Year (2002) Impacts	2010 Lower Development Scenario Impacts	2010 Upper Development Scenario Impacts	NAAQS	Wyoming AAQS	Montana AAQS	PSD Class II Increments
Wyoming Near-field								
NO_2	Annual	37.3	42.4	49.0	100	100	--	25
SO_2	Annual	3.9	4.8	5.6	80	60	--	20
	24-hour	14.5	33.5	34.8	365	260		91
	3-hour	37.9	148.0	154.2	1,300	1300	--	512
PM_{10}	Annual	42.7	49.0	**56.6**	50	50	--	17
	24-hour	**335.5**	**378.8**	**439.9**	150	150	--	30
Montana Near-field								
NO_2	Annual	8.85	11.3	11.8	100	--	100	25
	1-hour	365.8	415.9	519.5	--	--	564	--
SO_2	Annual	1.3	2.3	2.7	80	--	80	20
	24-hour	18.9	19.5	20.4	365	--	365	91
	3-hour	74.7	76.4	79.8	1,300	--	1,300	512
	1-hour	240.7	246.4	257.3	--	--	1,300	--
PM_{10}	Annual	19.6	22.5	27.7	50	--	50	17
	24-hour	**175.8**	**200.0**	**247.7**	150	--	150	30

Note: -- = No standard or increment.
µg/m^3 = microgram per cubic meter.

Table ES-3 provides a detailed listing of visibility impacts for all analyzed Class I and sensitive Class II areas. Modeled visibility impacts at the identified Class I areas continue to show the same pattern as exhibited for the base year, with a high number of days with impacts above 1 deciview at the most impacted Class I areas. It should be noted, however, that the increase in impacts is relatively small. Visibility impacts show the largest increases at the Badlands, Theodore Roosevelt, and Wind Cave National Parks, but overall the maximum increases (in the number of days exceeding 1 deciview) are all below 26 days per year.

For acid deposition, all predicted impacts are below the deposition threshold values for both nitrogen and sulfur compounds. There are substantial percentage increases in deposition under the lower and upper development scenarios; however, impacts remain well below the threshold values. The acid neutralizing capacity of sensitive lakes also was analyzed, and results are summarized in **Table ES-4**. The base year study indicated that none of the lakes had predicted significant impacts; however, the lower and upper development scenarios for 2010 show an increased impact at one of the lakes, leading to an impact that is above the 10 percent acid neutralizing capacity (ANC) of Florence Lake. Impacts also are predicted to be above the 1 micro-equivalent per liter (µeq/L) for Upper Frozen Lake.

The study also modeled impacts of selected hazardous air pollutant emissions (benzene, ethyl benzene, formaldehyde, n-hexane, toluene, and xylene) on the near-field receptors in Montana and Wyoming. Model results for the 2010 upper development scenario show that impacts were predicted to be above the acute REL for formaldehyde (94 µg/m^3) at only two receptors in Wyoming but continued to be below all Reference Exposure Level and RfC levels in Montana and for other

compounds in Wyoming. Essentially, the modeled impacts for 2010 showed a continuation of the patterns exhibited for the base year analysis.

Table ES-2
Maximum Predicted PSD Class I and Sensitive Class II Area Impacts
($\mu g/m^3$)

Location	Pollutant	Averaging Period	Base Year (2002) Impacts	2010 Lower Development Scenario	2010 Upper Development Scenario	PSD Class I Increments
Class I Areas						
Northern Cheyenne Indian Reservation	NO_2	Annual	**2.0**	**2.3**	**2.7**	2.5
	SO_2	Annual	0.6	0.8	0.9	2
		24-hour	**6.1**	**6.5**	**6.9**	5
		3-hour	**26.8**	**27.9**	**29.3**	25
	PM_{10}	Annual	**5.0**	**5.8**	**7.0**	4
		24-hour	**42.0**	**47.8**	**59.4**	8
Washakie Wilderness Area (WA)	NO_2	Annual	0.1	0.1	0.1	2.5
	SO_2	Annual	0.0	0.1	0.1	2
		24-hour	1.0	3.0	3.3	5
		3-hour	2.0	5.1	5.6	25
	PM_{10}	Annual	0.3	0.4	0.4	4
		24-hour	**14.5**	**16.5**	**16.9**	8
Wind Cave National Park	NO_2	Annual	1.2	1.5	1.7	2.5
	SO_2	Annual	0.2	0.4	0.5	2
		24-hour	1.2	3.5	3.8	5
		3-hour	3.5	9.9	10.3	25
	PM_{10}	Annual	1.3	1.7	1.9	4
		24-hour	**10.7**	**14.0**	**15.7**	8
Sensitive Class II Areas						
Crow Indian Reservation	NO_2	Annual	5.7	6.2	6.7	25
	SO_2	Annual	0.8	0.9	0.9	20
		24-hour	4.7	5.1	5.3	91
		3-hour	14.7	15.1	15.7	512
	PM_{10}	Annual	3.0	3.7	4.0	17
		24-hour	**30.5**	**35.1**	**36.7**	30
Cloud Peak WA	NO_2	Annual	0.5	0.7	0.7	25
	SO_2	Annual	0.1	0.2	0.3	20
		24-hour	1.4	3.3	3.7	91
		3-hour	3.6	6.5	7.9	512
	PM_{10}	Annual	0.8	1.1	1.2	17
		24-hour	13.3	17.1	17.9	30

For 2015 and 2020, the Task 3A report provides a qualitative analysis of potential impacts, based on the changes from 2002 to 2010 for the respective production scenarios. The predicted production from conventional oil and gas and CBNG activities are projected to peak at 2010, with slight declines predicted over the following decade. Therefore, from these sources, expected impacts would decrease slightly from 2010 to 2015 and 2020. The coal mining sources would be the major contributors to PM_{10} impacts in the near-field, and these impacts would result from the proximity of the receptors to the coal mining operations. If coal mines expand or relocate, those impacts likely would follow that development; however, the specific impacts would need to be addressed with a more refined modeling effort, specifically including accurate source parameters. Power plants currently are the major contributors to all SO_2 impacts in the near-field in both states. However, the impacts are well below any ambient standard or PSD increment, and continued

expansion should not jeopardize the attainment of those standards. Impacts on NO_2 concentrations are the result of emissions from all the source groups. No one source group dominates the NO_2 impacts in the near-field.

Table ES-3
Modeled Change in Visibility Impacts at Class I and Sensitive Class II Areas

Location	Base Year (2002) No. of Days >10%	2010 Lower Development Scenario Change in No. of Days > 10%	2010 Upper Development Scenario Change in No. of Days > 10%
Class I Areas			
Badlands National Park	238	19	26
Bob Marshall WA	12	2	4
Bridger WA	47	4	7
Fitzpatrick WA	42	3	5
Fort Peck Indian Reservation	69	8	9
Gates of the Mountain WA	14	6	7
Grand Teton National Park	26	2	5
North Absaorka WA	47	6	6
North Cheyenne Indian Reservation	305	5	10
Red Rock Lakes	16	3	5
Scapegoat WA	14	4	4
Teton WA	40	4	5
Theodore Roosevelt National Park	98	15	22
UL Bend WA	49	4	5
Washakie WA	53	2	3
Wind Cave National Park	261	11	15
Yellowstone National Park	42	7	8
Sensitive Class II Areas			
Absaorka Beartooth WA	53	3	5
Agate Fossil Beds National Monument	199	26	30
Big Horn Canyon National Recreation Area	108	7	8
Black Elk WA	263	16	22
Cloud Peak WA	137	8	8
Crow Indian Reservation	284	10	15
Devils Tower National Monument	279	15	21
Fort Belknap Indian Reservation	46	3	4
Fort Laramie National Historic Site	153	27	30
Jedediah Smith WA	23	1	2
Jewel Cave National Monument	267	14	18
Lee Metcalf WA	25	2	4
Mount Naomi WA	8	6	8
Mount Rushmore National Monument	248	19	25
Popo Agie WA	47	7	8
Soldier Creek WA	223	23	29
Wellsville Mountain WA	6	5	7
Wind River Indian Reservation	66	12	15

A pattern that is similar to the near-field receptors also holds true for the Class I and sensitive Class II receptor groups. Essentially, the mine operations would continue to dominate the PM_{10} impacts, the power plants would continue to dominate the SO_2 impacts (although they would continue to be below the standards), and the overall source groups would continue to contribute to NO_2 impacts, but impacts should remain below the NO_2 standard.

Table ES-4
Predicted Total Cumulative Change in Acid Neutralizing Capacity of Sensitive Lakes

Location	Lake	Background ANC (µeq/L)	Area (hectares)	Base Year (2002) Change (percent)	2010 Lower Development Scenario Change (percent)	2010 Upper Development Scenario Change (percent)	Thresholds (percent)
Bridger WA	Black Joe	67	890	1.3	1.88	1.97	10
	Deep	60	205	1.4	2.08	2.18	10
	Hobbs	70	293	0.9	1.37	1.43	10
	Upper Frozen	5	64.8	0.7[1]	0.99[1]	1.04[1]	1[1]
Cloud Peak WA	Emerald	55.3	293	5.3	6.59	6.89	10
	Florence	32.7	417	8.9	11.52	12.03	10
Fitzpatrick WA	Ross	53.5	4,455	0.9	1.37	1.43	10
Popo Agie WA	Lower Saddlebag	55.5	155	1.9	2.58	2.7	10

[1]Data for Upper Frozen Lake presented in changes in µeq/L. (For lakes with less than 25 µeq/L background ANC.)

Based on modeling results, none of the acid deposition thresholds were exceeded at Class I areas for either the base year or for the lower or upper development scenarios for 2010. In general, the projected increases in coal development (and power plants) are not expected to raise the deposition levels above the threshold, extended into 2020. The only concern relates to the acid deposition into sensitive lakes. The model results showed that the increased deposition, largely from SO_2 emissions from power plants, exceeded the thresholds of significance for the ANC at two sensitive (high alpine) lakes. The results indicate that with increased growth in power plant operations, the reduced ANC of the sensitive lakes would become significant and would need to be addressed carefully for each proposed major development project.