2.0 TECHNICAL APPROACH

2.1 Overview of Assessment Approach

The objective of the study is to evaluate impacts over a wide range of receptors centered over the PRB cumulative effects study area. The evaluation covers receptors within the PRB in both Montana and Wyoming, and it includes individual sensitive receptor groups in the region surrounding the PRB cumulative effects study area. Key aspects of the study include the selection of air emissions within the study area, the selection of a modeling system to conduct that evaluation, the selection of a receptor set (within the model system) to be used for evaluating cumulative impacts, and the selection of criteria for evaluation of impacts.

The air quality cumulative effects study for the PRB Coal Review, as presented in this Task 3A report, addressed the impact of changes in emissions from the previous base year (2002) study, as presented in the Task 1A report (ENSR 2005b), for a range of development scenarios through 2020. The assessment evaluated changes in air quality levels for NO_2, SO_2, and PM_{10} at the identified receptors. The impacts for both a lower production scenario and upper production scenario were assessed at all receptor groups. Since the various source groups were analyzed separately for expected emissions changes, this study reports the modeled effect of emissions from each source group in 2010. Impacts for 2015 and 2020 were evaluated qualitatively based on changes in emissions and associated impacts from the 2010 scenarios. The change in production and related emissions for individual source groups were used to project the impacts for 2015 and 2020.

This section provides a detailed review of the modeling system, the emissions characterization, the receptor grids, and the assessment criteria that were used for evaluation of impacts. The interpretation of the results is limited by the key assumptions discussed below and project objectives that were used for this study. All results need to be interpreted with the understanding that:

- Actual source characteristics were not included for each source;
- No specific facility boundaries (for ambient air) were developed; and
- Emissions were broadly characterized and do not represent actual short-term emission rates.

2.2 Air Quality Modeling

To conduct a formal modeling of impacts, the USEPA guideline model CALPUFF (Scire et al. 1999a) was used to estimate impacts in both the PRB receptors and the sensitive surrounding areas. The CALPUFF modeling system was recommended for a refined modeling analysis of the region in order to assess impacts over near-field and distant receptor areas. The CALPUFF modeling system has three main components:

- CALMET (a diagnostic three-dimensional meteorological model, which develops the meteorological data for modeling input);

- CALPUFF (the transport and dispersion model that carries out calculations of dispersion); and
- CALPOST (a post-processing package that is used to depict overall concentrations and impacts).

The CALPUFF modeling system is designed to treat the time-varying point and area source emissions; model domains at distances from tens of meters to hundreds of kilometers from the sources; predict averaging times from 1 hour to 1 year; predict impacts for inert pollutants that are not chemically changed in the atmosphere; predict impacts of pollutants that may be subject to removal and chemical conversion mechanisms; and be applied to rough terrain situations. Given these strengths and the objectives of the study, the CALPUFF model is aptly suited to carrying out the required atmospheric dispersion modeling.

The CALPUFF modeling domain for the Task 1A report was established to be identical to that used in the PRB Oil and Gas Final EIS (BLM 2003) and the base year study that is part of the overall PRB Coal Review (Task 1 Report for the PRB Coal Review, Current Air Quality Conditions [ENSR 2005b]). A depiction of the CALPUFF modeling domain, along with the depiction of the study area and sensitive receptors, is provided in **Figure 2-1**.

The meteorological data set for 1996 was used in evaluating impacts for all of these referenced studies. As discussed in the Task 1A report (ENSR 2005b), a modeling protocol was submitted to an agency stakeholder group prior to conducting the Task 1A modeling effort. The approach and technical options within that modeling effort were identical to those used for the Task 3A study.

2.3 Receptor Grids and Analyses

Receptor grids were established for various source groups. These included the near-field receptors in both states, which cover the study area in each state. The near-field grid receptors cover grid points within the boundaries of the PRB study area. Near-field receptors were arranged to obtain the maximum estimated concentrations that result from development within the PRB. The purpose of establishing these receptors was to characterize the overall air quality conditions in the PRB as a result of development-related activities, but not to focus on impacts from any individual source. This approach does not address the modeling that would be needed for assessing impacts at any facility fence line, which generally is required for obtaining an air permit from a regulatory agency. The scope of this study did not include a detailed depiction of actual source characteristics; therefore, the modeled impacts very close to each source would not be accurately portrayed. Consequently, all near-field receptors that were located within 1 kilometer (km) of a modeled source were removed from the near-field grid. Overall the near-field receptor grid points were spaced at 1-km intervals over the study area. The elevation of each receptor was obtained from the Digital Elevation Model data for the 1:250,000 quads with 90-meter horizontal resolution (U.S. Geological Survey 2000).

Receptors also were located along boundaries and within each of the following Class I and specified Class II sensitive areas of concern within the modeling domain:

- Badlands National Park
- Wind Cave National Park

- Bridger Wilderness Area (WA)
- Fitzpatrick WA
- Washakie WA
- North Absoroka WA
- Northern Cheyenne Indian Reservation (Class 1, Northern Cheyenne Tribal Council)
- Devils Tower National Monument
- Mount Rushmore National Memorial
- Jewel Cave National Monument
- Agate Fossil Beds National Monument
- Fort Laramie National Historic Site
- Black Elk WA
- Soldier Creek WA
- Cloud Peak WA
- Yellowstone National Park
- Grand Teton National Park
- Teton WA
- Absaroka Beartooth WA
- Bighorn Canyon National Recreation Area
- Popo Agie WA
- Crow Indian Reservation (Class II Crow Tribal Council)
- Theodore Roosevelt National Park

The following areas are near the edge of the modeling domain. Modeled impacts at receptors within these areas near the edge of the modeling domain might be associated with model inaccuracies and uncertainties due to edge effects of the modeling. Therefore, estimates of potential impacts to these areas near the edge of the modeling domain were made by placing representative receptors no nearer than 25 km from the edge of the modeling domain:

- Bob Marshall WA
- Gates of the Mountains WA
- Lee Metcalf WA, Spanish Peaks Unit
- Lee Metcalf WA, Taylor Hillgard Unit
- Red Rock Lakes WA
- Jedediah Smith WA
- Mount Naomi WA
- Wellsville Mountain WA
- U.L. Bend WA
- Fort Peck Indian Reservation
- Scapegoat WA
- Fort Belknap Indian Reservation

These locations as well as other sensitive receptors, such as lakes, are shown in **Figure 2-2**. The near-field receptor area also is shown in this figure. The receptors were determined with sufficient accuracy to assure that the maximum potential air quality impacts were evaluated. All sensitive receptors were identified and reviewed in the modeling protocol by the stakeholder group, prior to initiating the modeling.

2.4 Emissions Input Data

Source characterization and emissions data are key inputs to conducting a successful modeling analysis. For this study, sources that were modeled were limited to those in the study areas, with the exception of the Dave Johnston Power Plant in Converse County, which is near the edge of the study area. For the Task 1A study, emissions were determined for 2002 based on data provided by the regulatory agencies (WDEQ and MDEQ). Similar to the Task 1A study, the emission sources for the Task 3A study were separated into various emission source groups, which were analyzed separately. The emission source groups that were analyzed focused on certain air pollutant emissions including SO_2, sulfate (SO_4), oxides of nitrogen (NO_x), and PM_{10}. The emission source groups that were analyzed also focused on certain HAP emissions including benzene, n-hexane, toluene, ethyl-benzene, xylene, and formaldehyde. It should be noted that HAP emissions were not analyzed for the CBNG source category since information for that source category was not provided. The following emission source groups were analyzed as part of the Task 3A study:

- All sources combined
- CBNG sources (all CBNG producing sources)
- Coal production-related sources (from both states, including mines, power plants, railroads, and conversion facilities)
- Coal mines (in both states)
- Montana sources (all sources located in Montana)
- Wyoming sources (all sources located in Wyoming)
- Non-coal sources (roads, urban areas, miscellaneous sources, conventional oil and gas, non-coal power plants [excludes CBNG sources])
- Power plants (includes coal- and gas-fired power plants in Wyoming and Montana)

Emission rates for 2010 were calculated in a different manner for each emission source group. The methodology used to calculate emission rates for each emission source group is presented below.

<u>Coal Production-related Sources</u>

For coal production-related sources, which included mines, mine roads, railroads, and coal conversion sources, the base year data (2002) was used to establish the baseline emissions. For Montana, coal transportation data were not available at the time, and, as a result, no specific coal transportation emissions on impacts were evaluated. Two scenarios were analyzed to estimate emissions rates in 2010, a lower production scenario and an upper production scenario. The lower production scenario emissions were based on the lower range of development projected to occur. The upper production scenario emissions were based on the upper range of development projected to occur. The projected increase in production under the lower and upper production scenarios were used to scale the base year (2002) emissions to the emissions in 2010, as a ratio of the base year production in 2002 to the projected production in 2010.

Different lower production and upper production values used in the ratio of emissions were applied for sources in Wyoming and Montana. The lower and upper coal production values for Wyoming are presented in Tables A-1 and A-2 of the Task 2 report (ENSR 2005a), and the lower and upper coal production values for Montana are presented in Tables A-3 and A-4 of the Task 2 report. These values also are presented in **Table 2-1** of this report.

CBNG Sources

CBNG activity was separated from conventional oil and gas production for this study. CBNG impacts were evaluated separately. Conventional oil and gas impacts were included in non-coal sources (see below). For CBNG, the base year (2002) data were used to establish the baseline emissions. The projected increase in CBNG production was used to scale the baseline (2002) emissions to the emissions in 2010, as a ratio of the baseline year gas production in 2002 to the projected gas production in 2010. The projections of CBNG production activity for 2010 (as used for the air quality model) are presented in **Table 2-1** of this report. The CBNG production projections for this study were being refined concurrently with the air quality modeling conducted for this report. As a result, the initial production numbers used in the air quality model and shown in **Table 2-1** differ somewhat from the final production projections presented in the Task 2 report (ENSR 2005a). The final Task 2 projections for CBNG production in 2010 under both scenarios is 640 BCF. This production level would result in incrementally greater CBNG-related air quality impacts than presented in this report.

Table 2-1
Emissions Calculations for 2010 by Source Group

Source Group	Production Data			Adjustment Ratio		
	Base (2002)	Lower Scenario (2010)	Upper Scenario	Base (2002)	Lower Scenario (2010)	Upper Scenario (2010)
Conventional Oil and Gas Sources	39.9 BCF	42.7 BCF	42.7 BCF	1.0	1.065	1.065
CBNG Sources	338 BCF	554 BCF	554 BCF	1.0	1.639	1.639
Coal Production (Wyoming)	363 mmtpy	411 mmtpy	479 mmtpy	1.0	1.129	1.316
Coal Hauling (Wyoming)	363 mmtpy	411 mmtpy	479 mmtpy	1.0	1.129	1.316
Coal Production (Montana)	36.1 mmtpy	41 mmtpy	51 mmtpy	1.0	1.136	1.413
Power Plants	Individual Plant Adjustments					
Urban Areas	No Adjustment					
Miscellaneous	No Adjustment					

Power Plant Sources

For coal-fired power plants, the projected 2010 emission rates for power plants that were not operational in 2002 but are expected to be operational in 2010 were derived from the actual power plant permit application or the power plant permit from the specified facility. This information should allow for a conservative estimate since the permitted emission rates will be the allowable emission rates, and actual emission rates from these new power plants could be less than the allowable emissions but cannot be higher. Where stack parameters were available, those data were used for input into the model. Emissions of NO_x, SO_2, and PM_{10} from the power plant permits were determined from expected levels with best available control technology that would be applied to those sources. If a coal-fired power plant permit application or permit was not obtainable, emissions

from a coal-fired power plant of the equivalent size was used to estimate 2010 emissions. The coal-fired power plants for which emissions were estimated for 2010 include the following:

- WYGEN 2
- Two Elk Unit 1
- Basin Electric/Gillette
- Hardin Generating Station

These coal-fired power plants were included as individual sources, in addition to the existing coal-fired facilities which also were analyzed. For existing coal-fired power plant sources that were operational in 2002, a scaling factor was used to increase the capacity of these sources from an 88 percent capacity factor in 2002 to a 90 percent capacity factor in 2010 to account for a possible increase in capacity between the baseline year (2002) and 2010. There were no projected increase in emissions for gas-fired power plants.

Other Non-coal Sources

Other non-coal sources include conventional oil and gas production, for which projected emissions increases were based on data developed from **Table 2-1**. For other sources (urban areas, non-coal highways, and miscellaneous sources), there was no adjustment to the emission rates from the base year (2002). For all non-coal sources, the same emission rates were used for both the lower and upper production scenarios.

The modeled location for the projections for cumulative impacts did not change from the base year (2002) modeling for any sources except for the new power plants.

The emissions from the Tongue River Railroad were not included in the base year (2002) or in the 2010 modeling. As reported in the final Task 2 report, it is projected that this railroad would not be constructed under the lower production scenario. Construction of this railroad under the upper production scenario would be dependent on development of the Otter Creek Mine. The modeling for the upper production scenario was not revised to accommodate this source. However, the modeling results did show that impacts in the area of the Tongue River Railroad line are well below the standards and increments for all criteria pollutants (see **Figure 3-2**). The analysis in the Draft Supplemental EIS for the Tongue River Railroad (Surface Transportation Board 2004) concluded that air quality-related impacts from railroad operations would not adversely affect the Northern Cheyenne Indian Reservation. The projected maximum emissions rates for the Miles City to Decker line via the Four Mile Creek Alternative is 1.8 tons per mile per year for PM_{10}, 5.6 tons per mile per year for SO_2 and 6.9 tons per mile per year for NO_X. Over this 29.4-mile line route, the total emissions would amount to 53 tons per year of PM_{10}, 165 tons per year of SO_2, and 203 tons per year for NO_X. Compared to other stationary sources, the impacts are expected to be negligible. For comparison, total stationary source coal mine emissions in Montana for 2002 are 1,099 tons per year of PM_{10}, 109 tons per year for SO_2, and 924 ton/year of NO_X emissions. Since the sources for the railroad would be spread out over a long line, it was concluded that the impact in 2010 from the Tongue River Railroad would be negligible and would not affect the findings of this analysis.