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 2015 air quality cumulative effects for the PRB Coal Review, as presented in this updated Task 3A Report, evaluates the difference between modeled air quality impacts from the base year (2004) to the future year (2015) scenarios based on the projected change in emissions from the identified RFD activities. The model selected to assess cumulative air quality for both current and future conditions is the U.S. Environmental Protection Agency (USEPA) guideline model, CALPUFF. The USEPA's CALPUFF modeling system is a regulatory guideline model that was used in both the original PRB Coal Review (ENSR 2006) and in the Montana Statewide Oil and Gas Supplemental EIS (ALL Consulting 2006). Both of these studies were directed by the BLM and have identical modeling domain and receptor grids.

Since the conclusion of the original Task 3A study, the Montana Statewide Oil and Gas Supplemental EIS (ALL Consulting 2006) was prepared, and newer meteorological data for the modeling domain was available for years 2001, 2002, and 2003. The base year emissions from the study area initially were modeled with each meteorological year, and the meteorological year with the worst-case visibility impact (2003) was selected to model the base year and future year scenarios for this updated study. The CALPUFF base year analysis consisted of a single year of emission inventory data (2004) evaluated with year 2003 meteorological data. The 2015 upper and lower development scenarios subsequently were modeled with meteorological year 2003 to provide a consistent basis for comparison to base year impacts.

The 2004 emission inventory developed for the Montana Statewide Oil and Gas Supplemental EIS (ALL Consulting 2006) was used to develop the revised base year emissions inventory for the updated cumulative air quality analysis. This inventory was selected because extensive work was conducted to consolidate available emissions inventories for coal evaluation studies. This inventory includes all of the same emissions source types (e.g., coal mines, conventional oil and gas, etc.) as used in the Task 1A and original Task 3A studies.

2.2 Air Quality Modeling

The CALPUFF model is a Lagrangian puff model with the capability to simulate regional-scale, long-range dispersion as well as local-scale, short-range dispersion (Scire et al. 2000a). The model was used for the PRB Coal Review to assess impacts over both near-field and far-field receptors. Since completion of the original Task 3A study, the USEPA has released a new guideline version of CALPUF. Both the original PRB Coal Review air quality modeling (ENSR 2006) and the Montana

Statewide Oil and Gas Supplemental EIS (ALL Consulting 2006) used the previous version of CALPUFF; this updated study uses the new guideline version. The modeling approach and technical options are identical between base year (2004) and predictive future year (2015) cumulative analyses.

The CALPUFF modeling system used in this updated study has three main components:

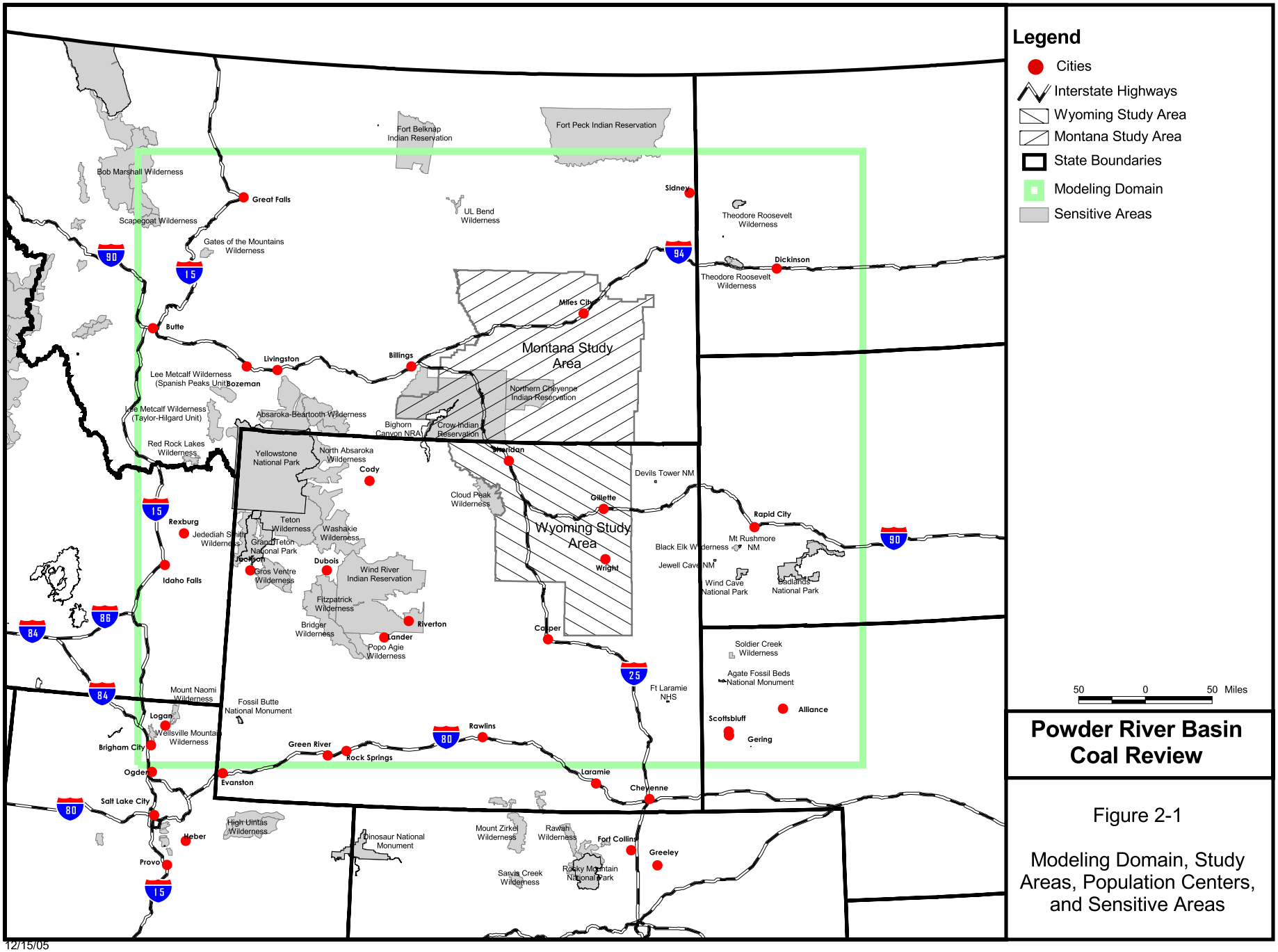
- CALMET Version 5.8, Level 070623 (a diagnostic three-dimensional meteorological model, which develops the meteorological data for modeling input);
- CALPUFF Version 5.8, Level 070623 (the transport and dispersion model that carries out calculations of dispersion); and
- CALPOST Version 5.6394, Level 070622 (a post-processing package that is used to depict overall concentrations and impacts).

The CALPUFF modeling domain report was established to be identical to that used in the PRB Oil and Gas Final EIS (BLM 2003), the original PRB Coal Review (Task 1A Report [ENSR 2005a] and Task 3A Report [ENSR 2006]), and the Montana Statewide Oil and Gas Supplemental EIS (ALL Consulting 2006). The CALPUFF modeling domain, study area, and sensitive areas are shown in **Figure 2-1**. The modeling domain includes most of Wyoming and Montana, and extends into the states of Idaho, Utah, Nebraska, and North and South Dakota.

The receptor sets established for the original PRB Coal Review (Task 1A and Task 3A) are identical to the receptor sets used in this updated study. These selected receptor sets are: near-field receptors in both states, which cover the study area; receptors along boundaries and within the Class I and sensitive Class II areas identified by the technical advisory group; and other sensitive receptors, such as lakes. The locations of all receptors are shown in **Figure 2-2** and are described in detail in the original Task 3A Report (ENSR 2006), as well as the modeling protocols (ENSR 2005c, 2008).

2.3 Meteorological Data and Analyses

Three years of meteorological data (2001, 2002, and 2003) were used to evaluate base year impacts from all emission sources within the PRB study area. The meteorological data set for 2003 was selected as the worst-case meteorological year based on an analysis of visibility impacts at the nearest Class I areas. The meteorological year 2003 was then used to model impacts for all emissions sources for the revised base year and 2015 development scenarios. The analysis included only sources within the PRB study area in order to select the worst-case meteorological year based only on PRB sources. The worst-case meteorological year was defined as the year with the highest visibility impacts, since visibility is often the limiting factor for regional air quality related analyses.

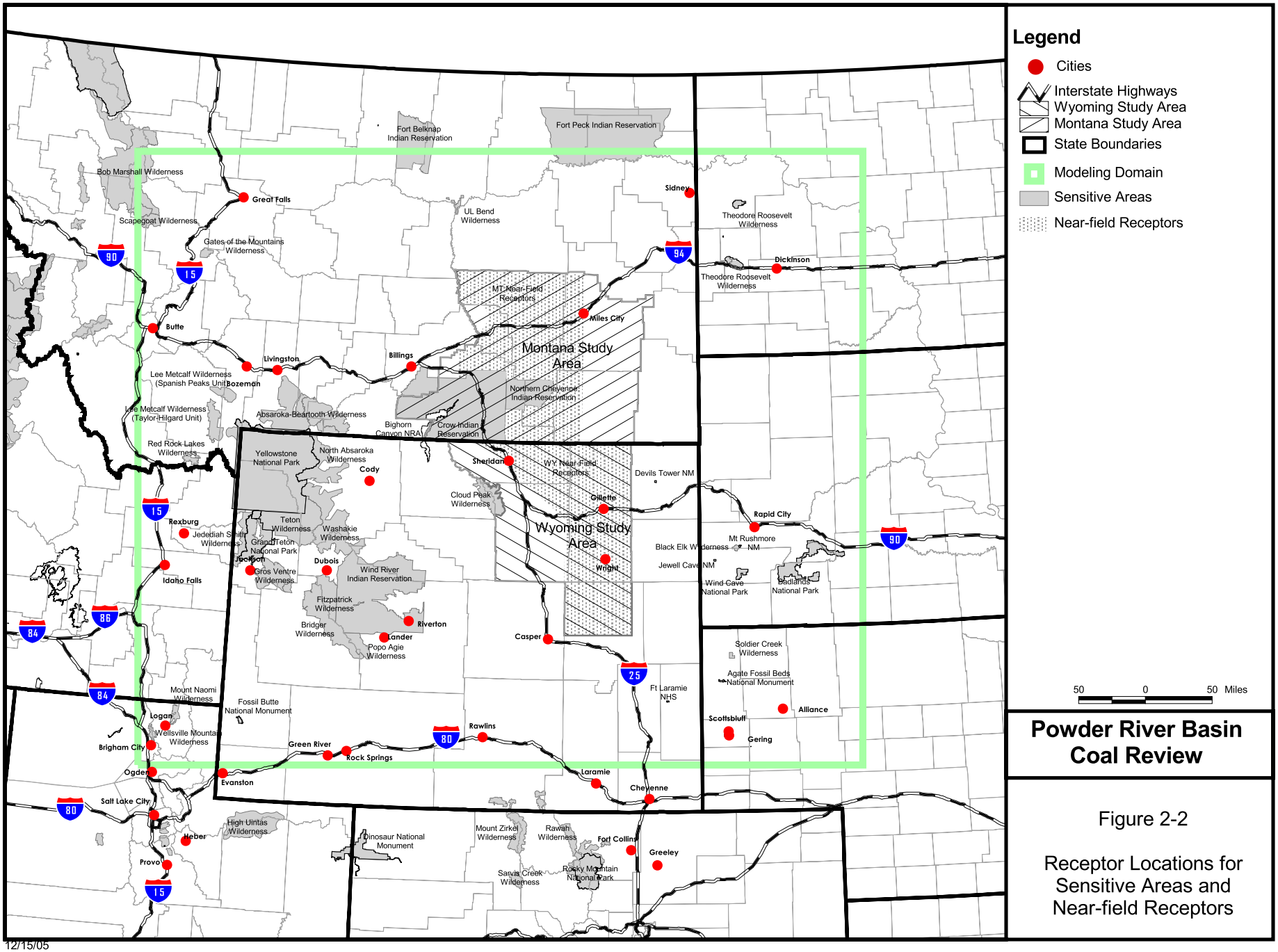


Powder River Basin Coal Review

Figure 2-1

Modeling Domain, Study Areas, Population Centers, and Sensitive Areas

12/15/05



Powder River Basin Coal Review

Figure 2-2

Receptor Locations for Sensitive Areas and Near-field Receptors

12/15/05

2.4 Emissions Input Data

The objective of the air quality component of the PRB Coal Review, including the 2015 update for the Task 3A Report, was to assess the predicted change in air quality and related impacts given a predicted change in RFD-related activities in the PRB. The key assumptions used for the update to the Task 3A Report include the following:

- Where actual source characteristics (e.g., stack height, temperature, etc.) exist in provided emissions inventories, they were used. Where source characteristics were lacking, representative source characteristics generically were developed for each source type;
- A state-specific emission rate, determined by state-specific presumptive-best available control technology (BACT) levels, were applied to minor group sources (e.g. CBNG sources);
- EPA regulations mandating future use of ultra-low sulfur fuels and future model engine emission limits were not incorporated into future year emissions due to the level of uncertainty surrounding the rate of replacement of existing engines and implementation of these regulations;
- No specific facility boundaries (for ambient air) were developed for individual sites; and
- Emissions were broadly characterized and do not represent actual short-term emission rates.

The emission sources were separated into various emission source groups for separate analyses. For regional modeling of this magnitude, it is not expected that a single source would dominate predicted impacts. Rather, for a more detailed understanding of projected changes in 2015, it is beneficial to compare impacts resulting from source types (e.g., CBNG, coal mining, etc.), or source locations (e.g., Montana, Wyoming, or other states). In this manner, the dominant source types or source locations can be more easily identified for future planning efforts. The emission source groups for which separate modeling results were analyzed included:

- All sources combined
- Coal production-related sources (from both states, including mines, power plants, railroads, and coal conversion facilities) (Note: the Tongue River Railroad only was included in the upper development scenario for 2015)
- Coal mines (in both states)
- Montana sources (all sources located in Montana)
- Wyoming sources (all sources located in Wyoming)
- CBNG sources (all CBNG producing sources)
- Power plants (includes coal- and gas-fired power plants in Wyoming and Montana) (Note: At the request of the Montana BLM, the Roundup Power Plant, which is outside the PRB Coal

Review study area, was included in a separate post-processing model run. Model results with the inclusion of the Roundup Power Plant are presented in Appendix A.)

- Non-coal sources (roads, urban areas, miscellaneous sources, conventional oil and gas, non coal power plants [excludes CBNG sources]).

Current emissions from other non-coal sources, such as major roads, railroads, and urban areas, were included as separate source groups; however, it should be noted that this study only includes non-coal sources within the study area (Campbell, Johnson, Sheridan, and most of Converse counties in Wyoming; Rosebud, Custer, Powder River, Big Horn, and Treasure counties in Montana) (see **Figure 1-1**).

The 2004 emission inventory developed for the Montana Statewide Oil and Gas Supplemental EIS (ALL Consulting 2006) was used as the revised base year emissions inventory for the updated cumulative air quality analysis.

Although, $PM_{2.5}$ emission rates were not uniformly available in the provided emission inventory, with the promulgation of $PM_{2.5}$ national and state ambient air quality standards (NAAQS and SAAQS, respectively), an estimate of total $PM_{2.5}$ impacts was valuable for a comprehensive evaluation of the PRB cumulative air quality effects. Therefore, total $PM_{2.5}$ impacts were indirectly estimated based on a ratio of monitored PM_{10} concentrations that were representative of impacts from sources in the region. The Lame Deer monitoring station, a site representative of the PRB study area, measures both ambient PM_{10} and $PM_{2.5}$ at a co-located site. The annual average ratio of ambient $PM_{2.5}$ to PM_{10} was calculated to be 0.35 during 2005, the only recent year with data recovery over 80 percent for both $PM_{2.5}$ and PM_{10}. This ratio was used to scale the modeled PM_{10} impacts to estimate $PM_{2.5}$ impacts. While evaluation of short-term $PM_{2.5}$ was limited by this technique, it is anticipated that annual $PM_{2.5}$ impacts would be appropriately representative for a region with similar sources.

Previously, Task 2 projected future year production estimates for various resources. The results from the Task 2 report are presented in **Table 2-1**. The changes in production were used to project emissions for the base year for this report (2004) to 2015. The methodology used to calculate emission rates for each emission source group is presented below.

Coal Production-related Sources

For coal production-related sources, which included mines, power plants (discussed separately below), railroads, and coal conversion sources, 2004 data were used to establish representative base year conditions. Two coal development scenarios were analyzed to estimate emissions rates for the future year, a lower production scenario and an upper production scenario. The projected increase in coal production under the lower and upper production scenarios were used to scale the base year emissions to the future year emissions, as a ratio of the base year production to the projected production.

Table 2-1
Emissions Calculations for 2015 by Source Group

Source Group	Production Data			Adjustment Ratio		
	Base (2004)	Lower Scenario (2015)	Upper Scenario (2015)	Base (2004)	Lower Scenario (2015)	Upper Scenario (2015)
Conventional Oil and Gas Sources	39.9 BCF	39.0 BCF	39.0 BCF	1.0	0.977	0.977
CBNG Sources	338 BCF	694 BCF	694 BCF	1.0	2.053	2.053
Coal Production (Wyoming)	363 mmtpy	467 mmtpy	543 mmtpy	1.0	1.287	1.496
Coal Hauling (Wyoming)	363 mmtpy	467 mmtpy	543 mmtpy	1.0	1.287	1.496
Coal Production (Montana)	36.1 mmtpy	48 mmtpy	74 mmtpy	1.0	1.330	2.050
Power Plants	Individual Plant Adjustments					
Urban Areas	No Adjustment					
Miscellaneous	No Adjustment					

Note: BCF = billion cubic feet
mmtpy = million tons per year

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 2005b), and the lower and upper coal production values for Montana are presented in Tables A-3 and A-4 of the Task 2 Report.

Emissions from the Tongue River Railroad were not included in the base year. Per the Task 2 Report, it was projected that this railroad would not be constructed under the lower 2010 production scenario; however, it was included in the upper 2010 production scenario. This same approach was used in this updated analysis for 2015. Construction of this railroad under the upper production scenario would be dependent on development of the Otter Creek Mine in Montana. 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 (IR).

Emissions from the proposed Dakota, Minnesota, and Eastern (DM&E) rail line expansion into the PRB were not included in the base year. Per the Task 2 Report, it was projected that this railroad would not be operational until 2015. Emissions from the DM&E were included in this updated analysis for the 2015 upper and lower production scenarios. Only the portion of the DM&E expansion line located in the PRB study area was included in this updated analysis. Emissions were based on information presented in the Draft EIS (Surface Transportation Board 2000) for the proposed rail line.

CBNG Sources

CBNG activity is evaluated separately from conventional oil and gas production for this study. Conventional oil and gas impacts were included in non-coal sources (see below). For CBNG sources, 2004 base year emissions data were scaled based on projected increases in production. The projected increase in CBNG production is based on the ratio of base year gas production to projected gas production, as presented in the Task 2 Report (ENSR 2005b), shown in **Table 2-1**.

Other Non-coal Sources

Other non-coal sources included conventional oil and gas production, for which projected emissions increases were based on data developed from expected increases in conventional oil and gas. For other sources (urban areas, non-coal highways, and miscellaneous sources), there was no adjustment to the emission rates from the base year. For all non-coal sources, the same emission rates were used for both the lower and upper production scenarios. Many of these source emissions were developed from the original PRB Coal Review 2002 source emissions data base.

Power Plant Sources

Emissions from existing power plants in the study area, and the Dave Johnson Power Plant located outside of but adjacent to the study area, are included in the base year. For existing coal-fired power plant sources that were operational in the base year, a scaling factor was used to increase the capacity of these sources from an 88 percent capacity factor in the base year to a 90 percent capacity factor in both future year scenarios to account for a potential increase in capacity. There were no projected increases in emissions for gas-fired power plants.

For coal-fired power plants, the projected emission rates for power plants that were not operational in the base year but were projected to be operational in future years were derived from the actual power plant permit application or the power plant permit from the specified facility. This information provides for a conservative estimate since permitted emission rates are the maximum allowable emission rates. Actual emission rates from RFD power plants could be less than the allowable emissions. 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 based on expected levels with BACT that would be applied to those sources. Where a coal-fired power plant permit application or permit was not available, emissions from a coal-fired power plant of equivalent size were used to estimate future year emissions. The RFD coal-fired power plants for which emissions were estimated include the following:

- WYGEN 2 and 3
- Two Elk Unit 1 and 2
- Dry Fork (also known as Basin Electric/Gillette)
- Hardin Generating Station

These coal-fired power plants were included as individual sources, in addition to the existing coal-fired facilities that also were analyzed.

As part of this update to the Task 3A Report, projected RFDs previously identified in the Task 2 Report (ENSR 2005b) were re-evaluated, and updated information was incorporated into this report, as appropriate. Since development of the Task 2 Report, two coal-fired power plants have modified their permits. WYGEN 2 and Two Elk Unit 1 previously were identified RFDs in the Task 2 Report and were included in the original Task 3A Report. For this updated study, modifications to these permits and the addition of WYGEN 3 and Two Elk Unit 2 are incorporated in this analysis. WYGEN 2 originally was permitted as a 500-megawatt (MW) facility. Since the original Task 2 and Task 3A reports, a revised permit has been issued for a 100-MW facility, and a subsequent permit application for WYGEN 3 has been approved for an additional 100-MW facility (WDEQ 2006). Similarly, Two Elk Unit 1 originally was permitted as a 250-MW facility; however, a revised permit

was issued for Unit 1 as a 280-MW facility. Additionally, an application for Two Elk Unit 2, a 750-MW facility, was submitted in November 2007 and revised in January 2008 (ENSR 2008b). The revisions associated with these RFD sources have been incorporated into the emission calculations and modeling activities for the 2015 upper and lower development scenarios.