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 2020 air quality cumulative effects assessment 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 (2020) 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 USEPA guideline model, CALPUFF. The USEPA's CALPUFF modeling system is a regulatory guideline model that was used in the original PRB Coal Review Task 3A (ENSR 2006), the 2015 Update (ENSR 2008a), and in the Montana Statewide Oil and Gas Supplemental EIS (ALL Consulting 2006). All of these studies were directed by the BLM and have identical modeling domain and receptor grids.

This update of the Task 3A report uses an identical model setup, meteorological input data, and base year emissions inventory as was used for the 2015 Update. Detailed information regarding the development of this input information is available in the 2015 Update report (ENSR 2008a) and its corresponding Technical Support Document (ENSR 2008d).

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 original PRB Coal Review Task 3A (ENSR 2006), the Montana Statewide Oil and Gas Supplemental EIS (ALL Consulting 2006), and the 2015 Update Report (ENSR 2008a) to assess impacts over both near-field and far-field receptors. Since completion of the original Task 3A study (ENSR 2006), the USEPA has released a new guideline version of CALPUFF. The 2015 Update report, as well as this update to the Task 3A report, used the most recent approved version of CALPUFF. The modeling approach and technical options are identical between base year (2004) and predictive future year (previous 2015 Update and current 2020) 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 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 include: 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, 2008b).

2.3 Meteorological Data and Analyses

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 for the base year (2004). The meteorological year 2003 was used to model all impacts presented in this updated report.

2.4 Emissions Input Data

The objective of the air quality component of the PRB Coal Review, including the 2020 update for the Task 3A report, is 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:

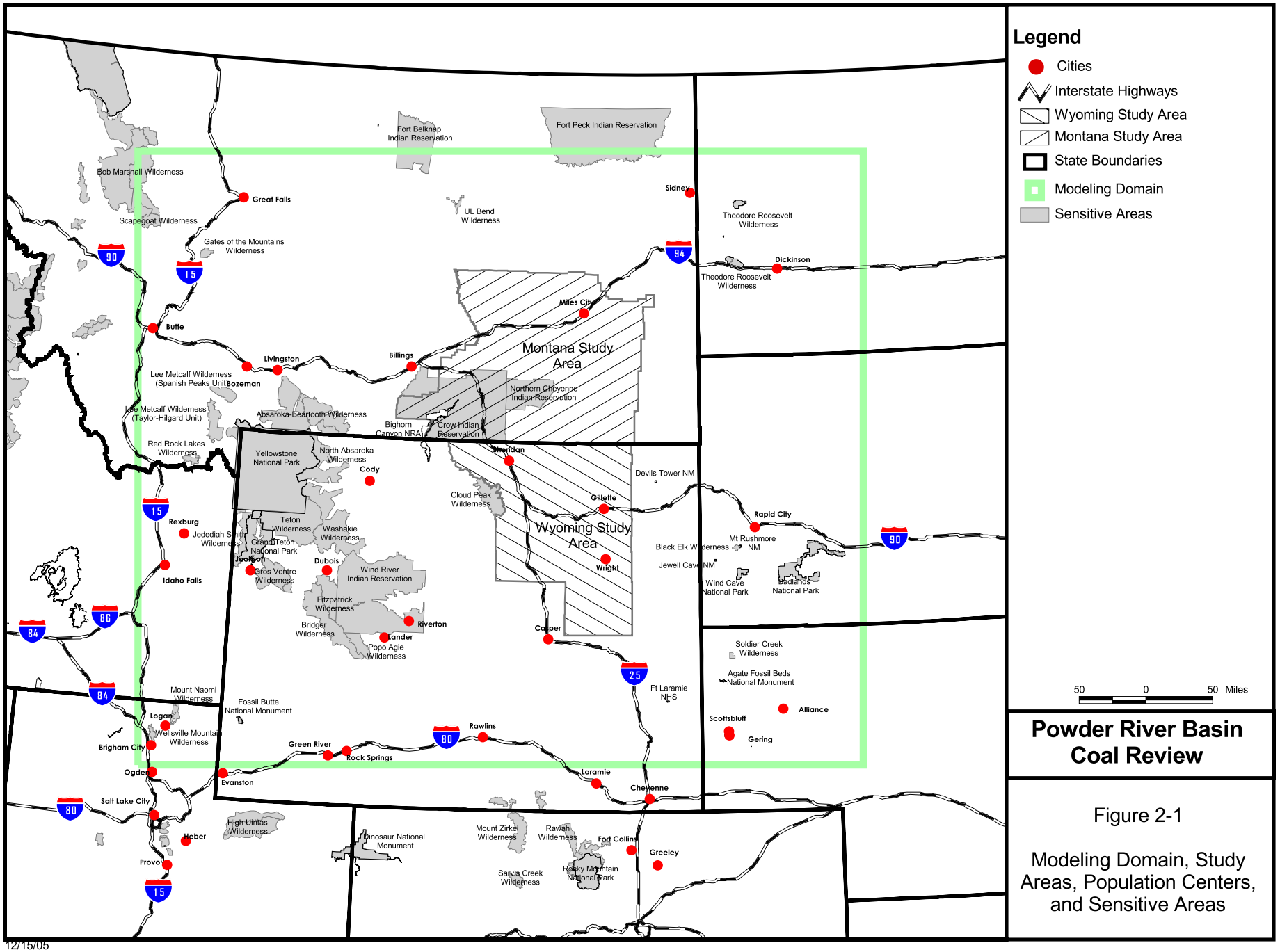
- Where actual source characteristics (e.g., stack height, temperature, etc.) exist in provided emissions inventories, they were used. Where source characteristics were lacking, representative source characteristics generically were developed for each source type;

- 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);

- USEPA 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.



Powder River Basin Coal Review

Figure 2-1

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

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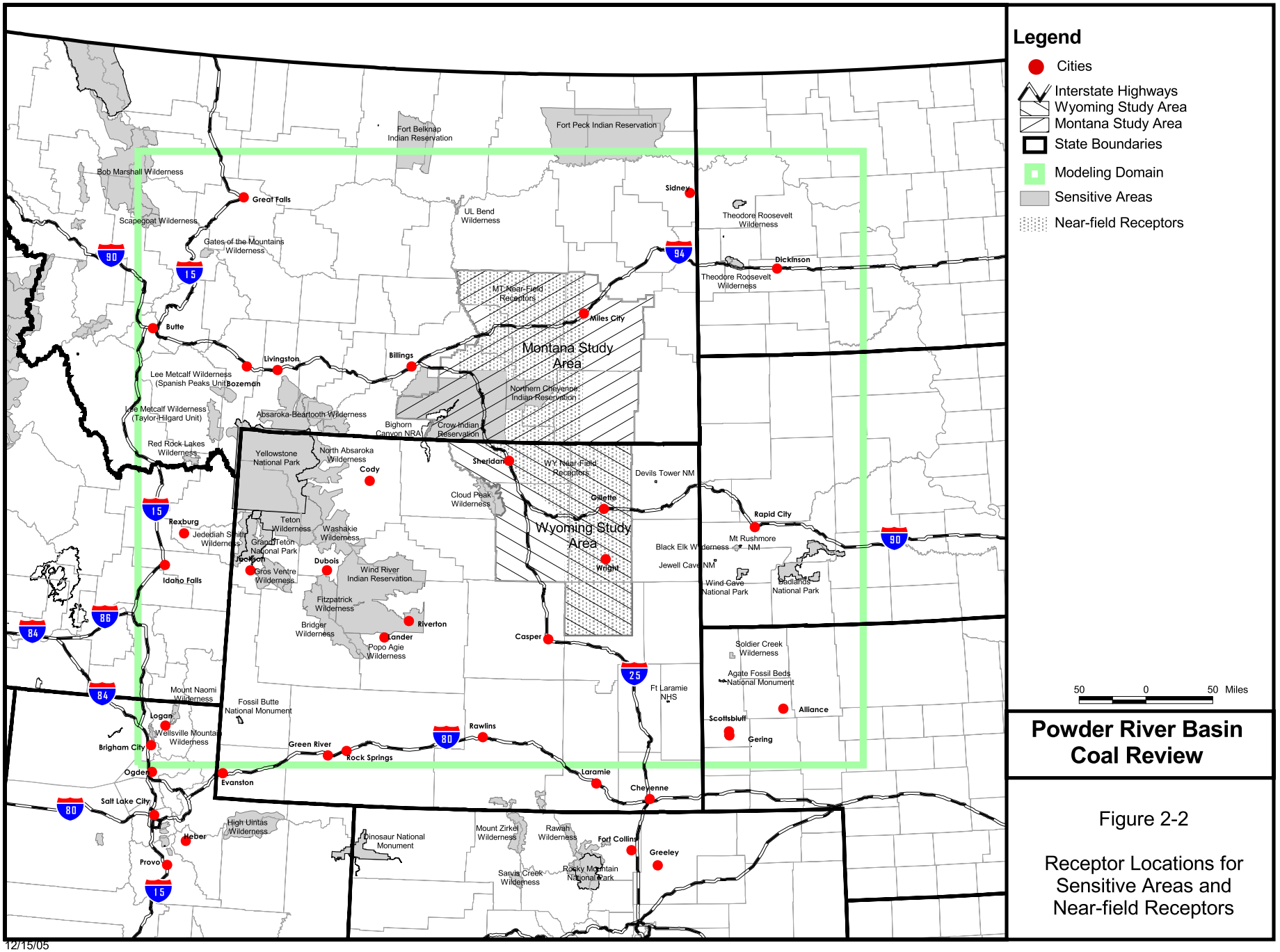
Legend
Cities
Interstate Highways
Wyoming Study Area
Montana Study Area
State Boundaries
Modeling Domain
Sensitive Areas
Near-field Receptors
50 0 50 Miles
Powder River Basin Coal Review
Figure 2-2
Receptor Locations for Sensitive Areas and Near-field Receptors
Montana Study Area
Wyoming Study Area
MT Near-Field Receptors
WY Near-Field Receptors
Fort Belknap Indian Reservation
Fort Peck Indian Reservation
Bob Marshall Wilderness
Great Falls
Scapegoat Wilderness
Gates of the Mountains Wilderness
UL Bend Wilderness
Sidney
Theodore Roosevelt Wilderness
Dickinson
Miles City
Butte
Livingston
Billings
Bozeman
Lee Metcalf Wilderness (Spanish Peaks Unit)
Lee Metcalf Wilderness (Taylor Hilgard Unit)
Absaroka-Beartooth Wilderness
Bighorn Canyon NRA
Crow Indian Reservation
Northern Cheyenne Indian Reservation
Red Rock Lakes Wilderness
Yellowstone National Park
North Absaroka Wilderness
Cody
Sheridan
Devils Tower NM
Cloud Peak Wilderness
Gillette
Rapid City
Rexburg
Teton Wilderness
Washakie Wilderness
Grand Teton National Park
Jedediah Smith Wilderness
Jackson
Dubois
Wind River Indian Reservation
Gros Ventre Wilderness
Wright
Mt Rushmore NM
Black Elk Wilderness
Jewell Cave NM
Wind Cave National Park
Badlands National Park
Idaho Falls
Fitzpatrick Wilderness
Bridger Wilderness
Riverton
Lander
Popo Agie Wilderness
Casper
Soldier Creek Wilderness
Agate Fossil Beds National Monument
Ft Laramie NHS
Alliance
Scottsbluff
Gering
Mount Naomi Wilderness
Fossil Butte National Monument
Logan
Wellsville Mountain Wilderness
Brigham City
Green River
Rock Springs
Rawlins
Ogden
Evanston
Laramie
Cheyenne
Salt Lake City
High Uintas Wilderness
Heber
Provo
Dinosaur National Monument
Mount Zirkel Wilderness
Rawah Wilderness
Fort Collins
Greeley
Sarvis Creek Wilderness
Rocky Mountain National Park
90
15
94
84
86
80
25

12/15/05

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 2020, 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 2020)
- 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)
- 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 current update of the 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, which is 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, the Task 2 analysis projected future year production estimates for various resources. The results summary 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 2020. The methodology used to calculate emission rates for each emission source group is presented below.

Table 2-1
Emissions Calculations for 2020 by Source Group

	Production Data			Adjustment Ratio		
Source Group	**Base (2004)**	**Lower Scenario (2020)**	**Upper Scenario (2020)**	**Base (2004)**	**Lower Scenario (2020)**	**Upper Scenario (2020)**
Conventional Oil and Gas Sources	39.9 BCF	35.1 BCF	35.1 BCF	1.0	0.880	0.880
CBNG Sources	338 BCF	631 BCF	631 BCF	1.0	1.867	1.867
Coal Production (Wyoming)	363 mmtpy	495 mmtpy	576 mmtpy	1.0	1.364	1.587
Coal Hauling (Wyoming)	363 mmtpy	495 mmtpy	576 mmtpy	1.0	1.364	1.587
Coal Production (Montana)	36.1 mmtpy	56 mmtpy	83 mmtpy	1.0	1.551	2.299
Power Plants	Individual Plant Adjustments					
Urban Areas	No Adjustment					
Miscellaneous	No Adjustment					

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

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.

As shown in **Table 2-1**, different lower production and upper production values were applied to 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.

Several RFD coal production-related sources were identified for future year 2020 as part of the Task 2 report (ENSR 2005b). These sources were not operational during the base year (2004) and, therefore, were not included in the base year emissions inventory. An emissions inventory for these RFD sources was developed and incorporated into the 2020 modeling for this updated Task 3A report. RFD coal production-related sources include: new coal mines, new rail lines to transport the coal, coal conversion facilities, and coal-fired power plants (new power plants are described in the power plant section of this chapter).

Three RFD mines were included in the emissions inventory for this 2020 analysis. The Otter Creek Mine and Kinsey Mine in Montana are projected to be developed under the upper 2020

development scenario, but not under the lower development scenario. Figures A-3 and A-4 of the Task 2 report show the projected locations of these mines. The School Creek Mine (a newly identified RFD mine) is projected to be developed in the Subregion 3 coal mine area near Wright, Wyoming. The School Creek Mine was included in both the upper and lower development scenarios. Per information provided by the BLM (2009) the RFD estimated 2020 coal production from the Wyoming mines (**Table 2-1**) would not change as a result of the School Creek Mine development; rather the projected coal production from this new RFD mine would be offset by reduced production at the existing mines in Subregion 3. Therefore, the total coal mining emissions are consistent with Task 2 2020 projections; however, the spatial distribution of emissions differs slightly from the base year due the addition of these three new production areas.

Per the Task 2 report, it was projected that the Tongue River 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 2020. 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 the upper and lower production scenarios for the 2015 Update and this current update for 2020. 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.

Several existing rail lines are projected to increase their capacity in Wyoming by 2020. The increase in emissions associated with expanded carrying capacity is modeled using the scaling factor for coal hauling activities shown in **Table 2-1**. It is expected that there would be no change in the spatial location of these existing rail lines.

Two RFD coal conversion facilities are projected to be developed by 2020 based on the update of the Task 2 report (AECOM 2009). One coal to liquid plant (CTL) would be developed in Wyoming, and another coal conversion plant would be built in Montana. In the absence of additional information, the modeled emissions and release parameters were developed based on the North Rochelle CTL plant permit. Both coal production-related RFD sources were included in upper and lower development modeling as part of the “coal-related” source group (not listed in **Table 2-1**).

CBNG Sources

CBNG activity was 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 was based on the ratio of base year gas production to projected gas production, as presented in the Task 2 report (ENSR 2005b) and shown in **Table 2-1**.

It is projected that the spatial distribution of CBNG wells in the Wyoming PRB would change between the base year and 2020. For this updated Task 3A report, a new spatial distribution of wells was modeled for Wyoming CBNG sources. Similar to the CBNG emissions inventory for the base year in the original Task 3A report and the 2015 Update, well locations were gridded, and emissions from all wells within a single cell were modeled at the center point of the cell. This approach produces conservative results as the emissions are more spatially concentrated.

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 activity. 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
- Otter Creek Power Plant
- One additional 700-kilowatt of energy production (2020 upper production development scenario only)

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

Projected RFDs previously identified in the Task 2 Report (ENSR 2005b) were re-evaluated as part of the 2015 Update, and updated information was incorporated into the 2015 Update report. No changes to RFD power plants were identified since the 2015 Update, with the exception of adding two RFD power plants: Otter Creek and an additional power plant in Wyoming.