APPENDICES

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EXHIBITS

Exhibit A. Example CALMET input control file for a January CALMET simulation and the PRBEP DM&E railway expansion project.

Exhibit B. Example CALPUFF input file (Route C DM&E Sources, January, 1990)

1. INTRODUCTION

BACKGROUND

The Dakota, Minnesota, and Eastern Railroad Corporation (DM&E) is proposing to construct a new railway line near an existing line across northeastern Wyoming, southern South Dakota, and southern Minnesota as part of the Powder River Basin Expansion Project (PRBEP). Burns and McDonnell (B&M) is the third party contractor to the Surface Transportation Board (STB) who are responsible for developing the PRBEP DM&E Environmental Impact Statement (EIS). B&M retained ENVIRON International Corporation to perform the air quality, visibility, and acid deposition modeling and impact assessment portion of the PRBEP DM&E EIS. The CALMET/CALPUFF modeling system was used to assess the PRBEP DM&E Project and other new source emissions impacts on air quality and air quality related values (AQRVs) in the region.

Two other recent EIS work efforts also used the CALMET/CALPUFF modeling system in the region to assess air quality and AQRVs impacts in the region. The Wyodak Coal Bed Methane (CBM) Project (Wyodak) set up CALMET/CALPUFF for the 1990 calendar year and modeled the incremental impact of the Wyodak CBM Project and cumulative impact from all foreseeable new sources on air quality and AQRVs in the region (BLM, 1999a). The Horse Creek coal mine modification EIS used the Wyodak CALMET/CALPUFF model set-up and updated the emissions inventory, including refining the emission estimates for the PRBEP DM&E railway enhancement and other new sources.

On September 9, 1999, a meeting was held in Denver, Colorado to discuss the approach for estimating the air quality and air quality related values (AQRVs) impacts of the PRBEP DM&E new railway in northeastern Wyoming/southwestern South Dakota area. In attendance were personnel from the regulating agencies, including the National Park Service (NPS), USDA Forest Service (FS), Wyoming Department of Environmental Quality Air Quality Division (WDEQ/AQD), and Region VIII of the Environmental Protection Agency, personnel from the STB third party contractor Burns and McDonnell and their air quality modeling subcontractor ENVIRON, and personnel from PIC Technologies a contractor for DM&E. At this meeting there was a consensus that the air quality modeling for the PRBEP DM&E railway expansion EIS should use the same procedures and build off of the work performed for the Wyodak and Horse Creek EIS modeling. However, there was also a desire to update the modeling from Version 3 of the CALMET/CALPUFF modeling system used in the Wyodak/Horse Creek modeling to the current EPA-released version 5 of the CALMET/CALPUFF modeling system.

A preliminary Modeling Protocol was prepared dated October 26, 1999 that outlined the procedures to be used in the PRBEP DM&E railway expansion EIS CALMET/CALPUFF air quality modeling. Not all information was available at that time concerning the Project alternatives so incomplete information was provided on how the new source emissions would be treated. The draft Modeling Protocol dated November 16, 1999 provided details on the treatment of the Project's emissions. Based on comments received by State and Federal Agencies, the Modeling Protocol was revised (dated January 7, 2000). The PRBEP DM&E railway expansion EIS CALMET/CALPUFF modeling was performed following the procedures in the January 7, 2000 Modeling Protocol.

PURPOSE

This document is the draft Air Quality Technical Support Document (AQTSD) to the PRBEP DM&E railway expansion EIS. It provides details on the assumptions, methodology, approach, and results of the air quality and air quality related values (AQRVs) impact due to the PRBEP DM&E railway expansion as well as the cumulative impacts due to all new sources.

OVERVIEW OF APPROACH

The Wyodak/Horse Creek EIS CALMET Version 3 database was reviewed to determine whether any obvious flaws were present. An error was found in the way the modeling domain was defined that was corrected. The CALMET/CALPUFF modeling domain used in the PRBEP DM&E railway expansion EIS is depicted in Figure 1-1. The Wyodak/Horse Creek EIS CALMET database was then updated to the latest version (Version 5, Level 990130) of CALMET released by EPA. The same 1990 MM4, surface, and upper-air meteorological and precipitation data as used in the Wyodak/Horse Creek EIS modeling were used.

With the exceptions noted below, the Horse Creek CALPUFF cumulative emissions data were used "as is" for the PRBEP EIS air quality modeling. The exceptions are: (1) the emissions for the DM&E railway expansion project (the Project) were removed from the Horse Creek emissions database and new emissions for the Project alternatives calculated; and (2) new permitted or reasonably foreseeable development (RFD) sources in the modeling domain that can be quantified and were not included in the Horse Creek EIS were added to the cumulative emissions database.

The CALPUFF model was used to estimate near-source and far-field air quality and far-field AQRV impacts due to the DM&E railway expansion and the cumulative impacts due to all potential new sources in the region. Air quality impacts due to the PRBEP DM&E proposed railway expansion alone, all other potential new sources alone, and cumulative emissions (proposed railway and other new sources) were compared against the applicable (Class I or II depending on receptor location) PSD increments (see Tables 1-2 and 1-3). The cumulative increment plus the maximum existing background concentration were compared against the applicable National Air Quality Ambient Standards (NAAQS) and state standards (see Table 1-1).

Visibility impacts were assessed using the same procedures as used in the recently completed Pinedale Anticline EIS (BLM, 1999c) as agreed to by the Federal Land Managers. This procedure uses the IWAQM visibility background (i.e., visibility background based on the mean of the 20 percent cleanest days) and the FLAG visibility parameter equations. Visibility background was based on the Badlands National Park IMPROVE reconstructed mass data for receptors east of the most westerly extent of the proposed railway (Campbell County, Wyoming) and by the Bridger IMPROVE data for the sensitive receptor areas west of Campbell County. Acid deposition impacts were estimated at Florence Lake in the Cloud Peak Wilderness Area using the procedures recommended by the USDA Forest Service. Also, at the request of the National Park Service, acid deposition sulfur and nitrogen fluxes were estimated across the Badlands and Wind Cave National parks.

CRITERIA BY WHICH SIGNIFICANCE OF THE AIR IMPACTS ARE ASSESSED

The criteria for evaluating the significance of air impacts are based on current regulatory standards including the health–based ambient standards, Prevention of Significant Deterioration (PSD) increments for Class I and II areas, and significance thresholds for Air Quality Related Values (AQRVs) developed by the Federal land managers. The basis for comparison with the ambient standards differs between the source permitting and National Environmental Policy Act (NEPA) processes. In the source permitting process, the focus is on a demonstration that the standards will never be exceeded due to that particular source operating even under maximum (often artificial) combinations of conditions. On the other hand, the NEPA process is one in which a best estimate is made regarding the source and surrounding cumulative impacts under recorded conditions. In this analysis, the emission inventories are based on best estimates when feasible, rather than absolute maximums.

For air quality regulatory purposes, regions of the country are classified as Class I or Class II, and the two have different criteria for assessment of acceptable impacts. Note that unclassifiable areas are treated as Class II areas for regulatory purposes. Some wilderness areas, national parks, and other special public lands set aside for preservation may be designated as Class I and have more stringent impact requirements in terms of ambient concentration standards. The Federal land managers have also developed guidelines (i.e., not standards) for significant or adverse visibility and acid deposition impacts at sensitive receptor areas. These same stringent standards and guidelines are to be addressed herein. All other regions, public and private, are unclassifiable or are designated as Class II areas and these are protected primarily by ambient concentration standards.

The predicted air quality and AQRV impacts from the PRBEP new DM&E railway project (the Project) alone, other proposed new permitted and reasonable foreseeable development (RFD) sources alone (Other New Sources), and cumulative Project plus other new sources are presented. The impact of each pollutant will be presented, with the predicted concentration compared against the National Ambient Air Quality Standards (NAAQS), Wyoming Ambient Air Quality Standards (WAAQS), and Class I and Class II PSD increments. The NAAQS and WAAQS are absolute upper limits that apply to all areas to which the public has access. In addition to these absolute ambient standards, the PSD program is designed to limit the incremental increase (depending on the location classification) of specific air pollutant concentrations above a legally defined baseline level.

NEPA analysis comparison to the PSD Class I and Class II increments are intended provide a general idea of how much of the increment is consumed by a particular project, and do not represent a regulatory PSD increment consumption analysis, insomuch as the total consumption from the PSD-defined baseline date is not taken into account. The determination of PSD increment consumption is a regulatory agency responsibility conducted as part of the New Source Review (NSR) process, which also includes a Federal land management agency's evaluation of potential impacts to AQRVs, such as visibility degradation and acid deposition.

AMBIENT AIR QUALITY STANDARDS

There are national and Wyoming ambient standards for nitrogen dioxide (NO_2), sulfur oxides (SO_X), particulate matter of less than 10 μm in aerodynamic diameter (PM_{10}) and less than 2.5 μm in aerodynamic diameter ($PM_{2.5}$), carbon monoxide (CO), ozone (O_3), and lead (Pb). The lead standard will not be addressed in the EIS because the Project has no significant lead emission sources.

New national PM_{10} and $PM_{2.5}$ standards were promulgated July 18, 1997. However, on challenge the Court has sent the new PM standards back to EPA for reformulation. The old PM_{10} standard is still applicable in most areas of the United States, including Wyoming and South Dakota, and will be used for comparison, as it is more stringent than the new standard. The old standard allows one exceedance of the 24–hour standard per year; the new standard allows one percent of the values measured in a year to exceed the 24–hour standard. Therefore, if daily impacts are predicted, the new standard allows one percent of 365, or three, exceedances per year instead of the one allowed by the old standard. The new $PM_{2.5}$ standard will be addressed.

On March 30, 2000, the State of Wyoming removed its total suspended particulate (TSP) standard, retained its PM_{10} standard, and added a new $PM_{2.5}$ standard that is identical to the proposed Federal $PM_{2.5}$ standard that was revoked. Thus, in our analysis, we do not address TSP, but do address PM_{10} and $PM_{2.5}$.

A new 8-hour ozone standard was promulgated July 18, 1997. Under challenge, the Court has remanded the new 8-hour ozone standard back to EPA. EPA has reinstated the 1-hour ozone standard in many areas where it was revoked. Northeastern Wyoming and Southern South Dakota currently attain the 1-hour ozone standard and would also attain the 8-hour ozone standard that has been remanded. CALMET/CALPUFF does not treat ozone impacts. Past EISs have used EPA's Point Source Screening tables to demonstrate that the new source emissions would not cause any violations of the ozone standard. However, such an approach is not appropriate for a diffuse source such as locomotive emissions. Thus given that the region is in no danger of violating the ozone standard and there is no quantitative test to estimate the ozone impacts, they are not addressed in this document.

NAAQS and WAAQS to be addressed for all pollutants within and surrounding the project area are given in Table 1–1.

Table 1-1. Ambient Air Quality Standards (AAQS).

Pollutant	Averaging Period				
	Annual ($\mu g/m^3$)	**24-hour ($\mu g/m^3$)**	**8-hour ($\mu g/m^3$)**	**3-hour ($\mu g/m^3$)**	**1-hour ($\mu g/m^3$)**
Nitrogen dioxide	100	-	-	-	-
Sulfur oxides	60*	260 †*	-	1,300 †	-
Particulate Matter (<10 μm)	50	150 †	-	-	-
Particulate Matter (<2.5 μm)	15	65 ‡	-	-	-
Ozone	-	-	160 †	-	235 Φ
Carbon monoxide	-	-	10,000 †	-	40,000 †

† Highest second-high

‡ Highest 98th percentile

Φ Forth highest in three years

* Wyoming AAQS SO_2 standards (more stringent than NAAQS)

PSD INCREMENTS

The estimated Project impacts are compared with the applicable increment level thresholds. The near-source impact analyses will focus on estimated impacts in the immediate vicinity of the railway in key locations with high Project emissions (e.g., railyards) and the resulting impacts will be compared with the Class II increment level thresholds. Note that it is not necessary to compare the impacts from construction (i.e., temporary) emissions with the PSD increment levels. The far-field impact analysis focused on estimated impacts in both Class I and Class II areas, and the resulting impacts were compared with the appropriate increment level thresholds. However, this analyses is not a PSD increment consumption analysis, rather it is an analysis to allow the land managers and other interested parties to see an estimate of how much of a PSD increment a particular Project would consume. For Class I and II areas the PSD increment level thresholds are given in, respectively, Tables 1-2 and 1-3.

Table 1-2. PSD Increment Standards - Class I Areas

Pollutant	Averaging Period		
	Annual ($\mu g/m^3$)	**24-hour ($\mu g/m^3$)**	**3-hour ($\mu g/m^3$)**
Nitrogen dioxide	2.5	-	-
Sulfur oxides	2	5	25
Particulate Matter (< 10 μm)	4	8	-

Table 1-3. PSD Increment Standards - Class II Areas

Pollutant	Averaging Period		
	Annual ($\mu g/m^3$)	24-hour ($\mu g/m^3$)	3-hour ($\mu g/m^3$)
Nitrogen dioxide	25	-	-
Sulfur oxides	20	91	512
Particulate Matter (<10 μm)	17	30	-

AIR QUALITY RELATED VALUES (VISIBILITY AND ACID DEPOSITION)

Visibility degradation and acid deposition in sensitive receptor areas due to the Project alone and cumulative emissions are estimated. The visibility degradation thresholds of concern for the sensitive receptor areas are changes in deciview of 0.5 Δdv and 1.0 Δdv over the baseline and changes of extinction of 5% and 10% over the baseline extinction. The 0.5 Δdv threshold is the USDA Forest Service (FS) Limit of Acceptable Change (LAC) threshold. The 1.0 Δdv and 5% and 10% extinction change over background threshold limits are used in the new Regional Haze Rule and are also used by the National Park Service (NPS). However, the 0.5 Δdv and 1.0 Δdv and 5% and 10% change in extinction are not standards. Any days in which the emissions from the Project, other new sources, and cumulative emissions result in degradation exceeding these significance values at sensitive receptor areas will be identified. Note that the 0.5 Δdv and 5% extinction change over baseline visibility are mathematically nearly equivalent and provide the same information (as well as the 1.0 Δdv and 10% extinction thresholds). Thus, as recommended by the Federal Land Managers (NPS and FS), we are focusing on the changes in extinction that exceed the 5% and 10% thresholds in the body of the report leaving the deciview changes to the appendices.

The acid deposition indicator was chosen to be Acid Neutralizing Capacity (ANC) and a Level of Acceptable Change (LAC) is under consideration by the USDA FS although a 10% LAC has been used in the past. The significance values are indicators of significant degradation, not a standard. Deposition was assessed on an annual basis at sensitive lake receptors identified by the FS and NPS. Florence Lake in the Cloud Peak Wilderness Area was the only sensitive receptor identified for acid deposition impact assessment. The NPS also requested that total sulfur and nitrogen deposition due to the new sources be reported for the National Parks.

AMBIENT AIR QUALITY DATA

Ambient air quality monitoring data are used four ways in the analysis:

(1) To define a NAAQS Background based on the current maximum measured air quality in the region that is combined with the estimated maximum cumulative impacts for comparison with ambient standards;
(2) To define the Visibility Background and Acid Deposition Background with which to judge the significance of the changes in visibility and acid deposition due to the new sources;
(3) Ozone measurements are used as input to the CALPUFF dispersion model; and

(4) Ambient and CALPUFF-estimated sulfate, nitrate/nitric acid, and ammonia/ammonium concentrations are combined with a Chemical Background to perform the sulfate/nitrate/ammonia equilibrium calculation to estimate particulate ammonium nitrate.

Monitored pollutants to be included in the baseline definition are carbon monoxide (CO), particulate matter (PM_{10} and $PM_{2.5}$), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), and ozone (O_3). Table 1-4 provides baseline concentration data that are used as background concentrations in comparing the impacts of the PRBEP DM&E railway expansion and cumulative emissions to Ambient Air Quality Standards.

Ambient data are also used for the estimation of impacts to AQRVs (i.e., visibility degradation and acid deposition) in the sensitive receptor areas. The model for these calculations employs atmospheric chemistry and light extinction modules which use as input real-time hourly concentrations of ozone, total ammonia (ammonium plus ammonia), and total nitrate (particulate nitrate plus nitric acid).

Table 1-4. Regional baseline ambient concentrations ($\mu g/m^3$) to be used as background concentrations for comparison with Ambient Air Quality Standards.

	1-hour	3-hour	8-hour	24-hour	Annual	Source
PM_{10}	---	---	---	46 ‡	16.1 ‡	Gillette, WY
$PM_{2.5}$	---	---	---	16.1 ¥	5.6 ¥	Gillette PM_{10} using Sheridan $PM_{2.5}/PM_{10}$ ratios
NO_2	---	---	---	---	16.5 ¤	Gillette, WY
SO_2	---	8 §	---	8 §	3 §	Devil's Tower, WY
CO	3,500 *f*	---	1,500 *f*	---	---	Riley Ridge
O_3	---	---	130 †	---		CASTNet data from Pinedale

† Fourth-highest maximum daily 8-hour average, averaged over 3-year period (1992-1994); converted from ppb to $\mu g/m^3$ assuming standard temperature and pressure (25°C and 760 mmHg).

‡ Gillette (1995); for 24-hour averaging period, value represents 99th percentile (2nd high).

¥ Sheridan annual $PM_{2.5}/PM_{10}$ ratios for Oct. 1998 – Sep. 1999 applied to Gillette PM_{10} values.

¤ WYDEQ-AQD NO_2 concentrations collected at Gillette, Wyoming from March 27, 1996 to April 28, 1997

§ WYDEQ-AQD SO_2 bubbler data collected at Devil's Tower during 1983 – maximum concentrations.

f Taken from representative data collected by WDEQ and commercial operators, and summarized in the Riley Ridge EIS (BLM, 1983). Values represent maximum concentrations.

Chemical Background

There are two monitoring sites in the vicinity of the modeling domain that collect speciated PM (particulate matter) measurements, the Interagency Monitoring of PROtected Visual Environment (IMPROVE) monitoring sites located near Badlands National Park and the Bridger Wilderness Area. Twice weekly speciated PM samples are collected. The Bridger Wilderness Area and Badlands National Park speciated PM IMPROVE reconstructed mass PM data were processed to generate monthly average PM speciation profiles. The Bridger and Badlands IMPROVE data were used to define the particulate sulfate, nitrate, and ammonium Chemical Background for those sensitive receptor areas located, respectively, west and east of the western

boundary of the Project Area (see Figure 1-1). There are no measurements of gaseous ammonia or nitric acid in the region to define the Chemical Background for these two species. Values of 5 ppb ammonia and 0.4 ppb nitric acid were selected for the Chemical Background to provide conservative (i.e., tending toward overestimates) estimates of the ammonia nitrate impacts from the new sources.

Visibility Background

As recommended by IWAQM, the Visibility Background was based on the mean of the 20 percent cleanest days from the Badlands and Bridger IMPROVE reconstructed PM mass data. These data for the Badlands National Park and Bridger Wilderness Area IMPROVE sites are shown in Table 1-5.

Table 1-5. IWAQM-recommended current visibility conditions (mean of the cleanest 20% from 1987-1997) in Badlands National Park and Bridger Wilderness Area based on IMPROVE monitoring data.

Season	Components of "Dry" Extinction (Mm^{-1})			Particle B_{ext} w/f(RH) (Mm^{-1})	Current Visibility (Mm^{-1})
	Nonhygroscopic	Hygroscopic	Nominal Rayleigh		
Bridger Wilderness Area					
Annual	3.02	1.13	10	5.46	15.46
Autumn	3.63	1.19	10	6.37	16.37
Spring	3.51	1.77	10	7.56	17.56
Summer	6.08	1.79	10	9.05	19.05
Winter	2.68	0.74	10	4.41	14.41
Badlands National Park					
Annual	7.07	2.62	10	14.72	24.72
Autumn	6.60	2.43	10	13.13	23.13
Spring	6.82	3.15	10	16.13	26.13
Summer	9.37	2.92	10	17.35	27.35
Winter	6.34	2.07	10	13.04	23.04

LAKE CHEMISTRY/DEPOSITION DATA

The lake chemistry parameter to be considered is the Acid Neutralizing Capacity (ANC) for several sensitive lakes in sensitive receptor areas. The Level of Acceptable Change (LAC) is under consideration by the USDA FS (a LAC Δ ANC level of 10 percent has been used in the past). The sensitive lakes and the corresponding lake chemistry monitoring data are presented in Table 1-6. The USDA FS ANC equations also require an annual average precipitation rate. The nearest NWS precipitation site to Florence Lake is in Sheridan immediately north of the Clouds Peak Wilderness Area which was used in this analysis.

Table 1-6. Lake acid neutralizing (ANC) capacity for sensitive lakes where acid deposition impacts will be assessed in the PRBEP DM&E railway expansion EIS.

Lake	Number of Observations	10% Most Sensitive ANC (eq)	Watershed Area (hectares)	UTM Easting (m)	UTM Northing (m)
Florence Lake	10	32.7	417	326,174	4,912,630

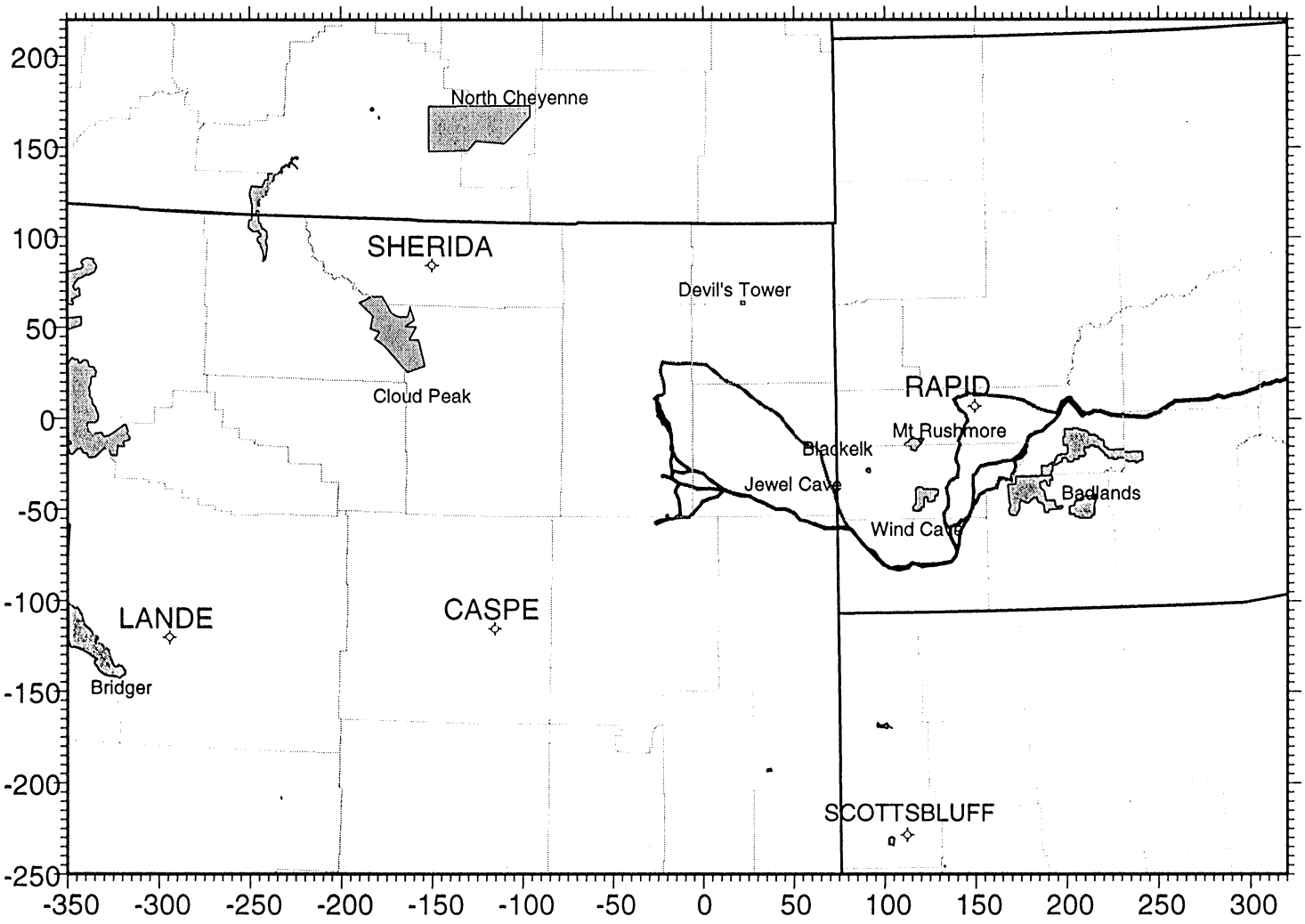

Figure 1-1. CALPUFF/CALMET modeling domain and three Project alternative routes for the PRBEP DM&E railway enhancement project. Also shown are sensitive receptor areas.

2. CALMET METEOROLOGICAL MODELING

The meteorological database used in the PRBEP DM&E railway enhancement project was based on the Wyodak and Horse Creek EIS CALMET/CALPUFF modeling (BLM, 1999a,b). For the meteorological modeling, the Horse Creek EIS used the Wyodak CALMET database "as is". For the PRBEP DM&E railway expansion project CALMET/CALPUFF modeling, we performed a quality assurance of the Wyodak/Horse Creek CALMET modeling database, corrected errors in the definition of the modeling domain, and updated the database from Version 3 to the latest version (Version 5) of CALMET.

CALMET MODELING

Version 5 of the CALMET (Level 990130) meteorological model (Scire et al., 1998) was applied to a modeling domain including northeastern Wyoming, southeastern Montana, southwestern South Dakota, and northwestern Nebraska as depicted in Figures 1-1 and 2-1. CALMET includes a diagnostic wind model (Douglas and Kessler, 1990) that combines surface and upper-air meteorological data with diagnostic effects of terrain and other factors to generate three-dimensional wind fields. CALMET also includes other interpolation algorithms to generate three-dimensional temperature, pressure, stability, and other meteorological variables and two-dimensional precipitation fields. CALMET was exercised on a 134 by 94 grid at a 5-km by 5-km resolution. The CALMET/CALPUFF modeling domain was defined differently for the PRBEP DM&E railway expansion Project than used in the Wyodak/Horse Creek analysis to correct an error in the definition of the origin (lower left hand corner of the grid). The definition of the PRBEP DM&E railway expansion Project CALMET/CALPUFF modeling domain is as follows:

Lambert Conformal Projection (LCP) Grid System

Central Reference LCP Point (Longitude, Latitude) = (-105.0°, 44.0°)

Standard Latitude Parallels at 30° and 60°

Grid Resolution = 5-km by 5-km

Grid Origin Offset from Central Reference Point = (-350-km, -250-km)

Due to the presence of complex terrain, wind fields in the region will be highly variable and complex. Wind observations are sparse and representative of very localized flow conditions. Thus there is little chance that a diagnostic wind model alone, such as CALMET, can accurately depict the complex flow fields using just observations. Thus, output from a coarse grid (80-km) resolution simulation of the MM4 prognostic meteorological model was used as input into CALMET to better define the synoptic-scale flow features The CALMET diagnostic wind algorithms and local observations are then used to better characterize the local wind variations at the 5-km resolution. The MM4 simulation was performed using four dimensional data assimilation (FDDA) of analysis fields generated by interpolation of the standard NWS upper-air meteorological data.

Terrain and Land Use Data

Terrain and land use data from the USGS were processed to obtain average terrain elevation and predominant land use type for each of the 134 by 94 5-km by 5-km grid cells in the CALMET domain. The average terrain elevation in each 5-km by 5-km grid cell was obtained by averaging the terrain elevations in the grid cell from the USGS database, which are provided at an approximately 900-m by 900-m resolution. Figure 2-1 displays the terrain data used in the DM&E EIS CALMET Modeling.

The USGS raw landuse data are provided at a 100-m by 100-m resolution. These data were matched to the CALMET LCP 5-km by 5-km grid and the most predominant landuse type was selected to represent landuse across the grid cell. Table 2-1 summarizes the CALMET default landuse categories.

Table 2-1. Default CALMET land use categories and associated geophysical parameters based on the U.S. Geological Survey Land Use Classification System (14-category system). (Source: Scire et al, 1998).

Land Use Type	Description	Surface Roughness (m)	Albedo	Bowen Ratio	Soil Heat Flux Parameter	Anthropogenic Heat Flux (W/m^2)	Leaf Area Index
10	Urban or built-up land	1.0	0.18	1.5	.25	0.0	0.2
20	Agricultural land – unirrigated	0.25	0.15	1.0	.15	0.0	3.0
-20*	Agricultural land – irrigated	0.25	0.15	0.5	.15	0.0	3.0
30	Rangeland	0.05	0.25	1.0	.15	0.0	0.5
40	Forest land	1.0	0.10	1.0	.15	0.0	7.0
50	Water	0.001	0.10	0.0	1.0	0.0	0.0
51	Small water body	0.001	0.10	0.0	1.0	0.0	0.0
55	Large water body	0.001	0.10	0.0	1.0	0.0	0.0
60	Wetland	1.0	0.10	0.5	.25	0.0	2.0
61	Forested wetland	1.0	0.1	0.5	0.25	0.0	2.0
62	Nonforested wetland	0.2	0.1	0.1	0.25	0.0	1.0
70	Barren land	0.05	0.30	1.0	.15	0.0	0.05
80	Tundra	.20	0.30	0.5	.15	0.0	0.0
90	Perennial snow or ice	.20	.70	0.5	.15	0.0	0.0

*Negative values indicate "irrigated" land use

Surface and Upper-Air Meteorological Database

CALMET requires hourly surface observations of wind speed, wind direction, temperature, cloud cover, ceiling height, surface pressure, relative humidity, and precipitation type (i.e., rain or snow). The Wyodak/Horse Creek CALMET modeling used surface meteorological data for five and precipitation data for four National Weather Service (NWS) stations (see Figure 2-1 for locations):

- Casper, Wyoming (winds and precipitation)
- Lander, Wyoming (winds and precipitation)
- Rapid City, South Dakota (winds and precipitation)

- Scottsbluff, Nebraska (winds and precipitation)
- Sheridan, Wyoming (winds only)

In addition, twice-daily upper-air meteorological observations were used for the two upper-air NWS sites in the region: Lander, Wyoming and Rapid City, South Dakota.

The PRBEP DM&E railway expansion project CALMET modeling used the exact same observed meteorological data listed above as used in the Wyodak EIS and Horse Creek EIS CALMET modeling. The locations for these data sites were mapped to the new DM&E railway expansion Project CALMET/CALPUFF modeling LCP grid system.

CALMET Control File

CALMET contains many options for defining the parameters for the interpolation of the meteorological data. These options are controlled by the CALMET.INP run control file. An example CALMET.INP file for a January CALMET simulation is provided in Exhibit A at the end of this report. This file has some internal documentation describing each parameter. In most cases, the CALMET recommended default parameters were used. Exceptions to this include: 1) no extrapolation of surface wind observations to be upper layers since surface observations are not representative of upper-level winds in complex terrain; and 2) limiting the amount of smoothing and divergence minimization in the wind fields as wind fields in complex terrain are variable and should have divergence. The user is referred to the CALMET user's guide (Scire et al., 1998) for a more detailed description of each of the parameters defined in Exhibit A.

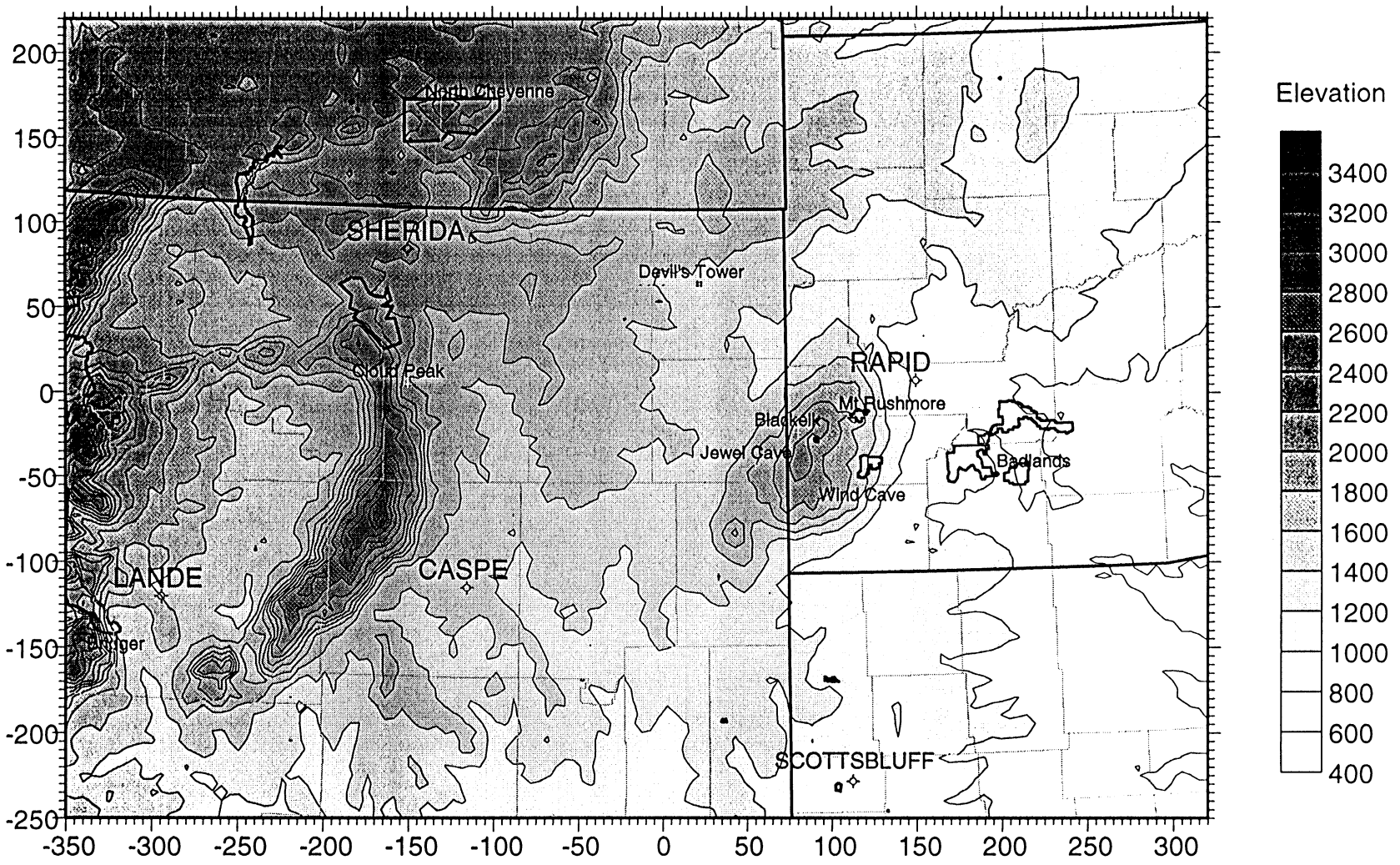

Figure 2-1. Terrain heights used in the PRBEP DM&E railway enhancement EIS CALMET modeling areas, locations of meteorological sites, and sensitive receptor areas.

3. EMISSIONS MODELING

Emissions for potential new permitted and reasonable foreseeable development (RFD) sources in the region of the proposed DM&E railway expansion were based on the emissions database from the Horse Creek EIS modeling analysis (BLM, 1999b), which was an enhancement of the Wyodak EIS emissions inventory (BLM, 1999a). The emissions for the DM&E project were recalculated using new information on fuel use from DM&E for the different Project Alternatives. In addition, the Horse Creek emissions database for the other (non-DM&E) new sources was updated to include any known quantifiable new permitted or RFD sources that were not included in the WYODAK/Horse Creek database.

PERMITTED AND RFD SOURCES

The non-DM&E railway expansion sources (i.e., the Other New Sources) from the Horse Creek EIS cumulative impact emissions database were extracted and mapped to the PRBEP DM&E EIS modeling domain. Three additional potential sources that were not included in the Horse Creek EIS modeling that were considered for inclusion in the cumulative analysis were also identified:

1. A new permit has been submitted to the South Dakota Department of Environmental and Natural Resources (SD DENR) by Black Hills Power and Light Company for two new peaking unit combustion turbines near Rapid City;
2. There is potentially an additional South Dakota Cement Plant source in the region; and
3. Coal Bed Methane (CBM) production in Campbell County, Wyoming west of the coal mines is likely to be expanded.

For the new Black Hills Power and Light source, we obtained emissions and stack parameter information from the SDER from the permit and it was included in the PRBEP DM&E EIS cumulative impacts.

The SDER does not currently have any emissions, location, or other information on the potential new South Dakota Cement Plant source, thus it could not be included in the DM&E Project cumulative impact analysis.

Similarly, emissions and other information on the potential new Wyoming CBM developments are not yet available. In this case, we could guess on the types of the developments since we know approximately where they will be located. However, such estimates would be hyper-speculative. Furthermore, the locations of the potential Wyoming CBM developments would be on the west side of the Powder River Basin far away from the Class I areas where we expect to see the highest impacts due to the DM&E railway expansion (e.g., Badlands). Thus, the new undocumented Wyoming CBM development sources were not included in the cumulative impact assessment. Figure 3-1 displays the CALPUFF modeling domain along with the locations of the non-DM&E Other New Sources point and area emission sources used in the cumulative impacts analysis. These emissions are identical to those used in the Horse Creek EIS, with the exception of the addition of the new Black Hills Power and Light Source to the north of Rapid City (between the letters I and D).

DM&E RAILWAY EXPANSION PROJECT EMISSIONS

DM&E is considering three alternative routes for a new railway from Winona, Minnesota on the Mississippi River in the east to the Powder River Basin coal mines in Campbell County in northeastern Wyoming, to the west. Figure 1-1 displays the routes for the three Project Alternatives under consideration. At around the city of Wall, South Dakota, the three potential alternatives hook up with the existing railway line that heads east to Winona, Minnesota.

The air quality and AQRV impacts of the PRBEP new railway line will be assessed at several different levels of coal transport. Currently, annual coal transport levels of 20, 50, and 100 million net tons (MNT) are being considered. These three levels of coal transport are assumed to require 8, 18, and 34 round trip train trips from the Mississippi River to the Powder River Basin, respectively.

The emissions estimates for each of the alternative routes were based on fuel usage provided by DM&E and Locomotive Emissions Standards contained in the USEPA Regulatory Support documentation which provides a range of baseline emission rates and factors for HC, CO, NOx and PM. Currently, locomotive engines have to be built to Tier 0 standards. Any new or rebuilt locomotive engines built between 2002 and 2004 will have to meet the more strict Tier 1 standards. Finally, new or rebuilt locomotive engines after 2005 will have to meet the even more strict Tier 2 locomotive emissions standards. For this analysis, we assumed that 50% of the locomotives will meet Tier 1 and 50% will meet the Tier 0 standards.

DM&E has provided information concerning fuel usage for the three alternative routes for the new railway from the city of Wall west to the Powder River Basin coal mines (see Figure 3-2). These data are presented in Table 3-1 that gives the annual increase in gross tons, total annual fuel consumption in gallons and the total length of railway in miles for each of the proposed alternative routes for the three levels of coal transport being considered. Given a fuel efficiency factor of 993.8 ton miles per gallon and EPA's Tier 0 and Tier 1 emission factors (grams of pollutant/gallon of fuel consumed) emission estimates are obtained as a function of the fuel consumption (per mile) and the length (miles) of each rail segment. Table 3-2 summarizes the EPA's Tier 0, 1 and 2 locomotive emission factors. In addition, the location and length of sidings along each of the proposed routes, as well as the location and number of railyards were also provided. For the emissions from railyard activities, a conservative estimate was made assuming EPA's emission factors for Tier 0 and Tier 1 *line-haul locomotives* for each coal hauling rate being considered.

Table 3-1. Mileage and fuel consumption for each proposed route at various levels of operations.

Alternative/ Operating Level	Total Length of Railway in (miles)	Annual Increase in Gross Tons	Total Annual Fuel Consumed in Gallons	Average Consumption/Mile/ Year
Route B				
20 MNT[a]	300.2	32,329,605	9,765,895.98	32,531.3 gal.
50 MNT	300.2	72,067,118	21,769,519.85	72,516.7 gal.
100 MNT	300.2	137,587,275	41,561,380.51	138,445.6 gal.
Route C				
20 MNT	283.9	32,329,605	9,235,635.8	32,531.3 gal
50 MNT	283.9	72,067,118	20,587,497.28	72,516.7 gal.
100 MNT	283.9	137,587,275	39,304,716.62	138,445.6 gal.
Route D				
20 MNT	374.8	32,329,605	12.192,730.89	32,531.3 gal
50 MNT	374.8	72,067,118	27,179,267.28	72,516.7 gal.
100 MNT	374.8	137,587,275	51,889,425.11	138,445.6 gal.

[a] Million Net Tons

Table 3-2. Tier 0, 1 and 2 emission factors (g/gal) for line-haul locomotives.

Pollutant	Tier 0 (≤ 2002)	Tier 1 (2002-2004)	Tier 2 (2005 +)
HC[a]	10.0	9.8	5.4
CO[a]	26.6	26.6	26.6
NO_x[a]	178.0	139	10.3
PM_{10}[a]	6.7	6.7	3.6
SO_2[b]	16.6	16.6	16.6

[a] EPA's Tier 1 emission factors promulgated 12/97.
[b] based on fuel sulfur content of 0.26 percent by weight and a density of 1.07 lbs per gallon.

The locomotive emissions are approximated as diffuse area sources and modeled in version 5 of CALPUFF model as buoyant area sources with arbitrarily varying emissions parameters. Within the CALPUFF model, buoyant area source are approximated within the modeling domain by arbitrary four-sided polygons and various parameters characteristic of stacked point sources, including exhaust (stack) height, temperature, exit gas velocity, and effective diameter, required for plume rise and expansion computations. Table 3-3 summarizes these inputs as determined from data on exhaust characteristics of typical freight locomotives. In addition, the terrain elevation is required for each area source.. The centroid of each area source was used map the gridded terrain elevation data used in the CALMET modeling to each area source.

Table 3-3. Locomotive buoyant area source parameters for CALPUFF application.

Exhaust height	4.18 m
Exhaust temperature	623 K
Exhaust gas velocity	9.71 m/sec
Exhaust equivalent diameter	1.07 m
Initial sigma Z	1.94 m

The emissions associated with the DM&E railroads were removed from the Horse Creek EIS emissions modeling database and replaced with updated emissions estimates. Digitized links for the existing portion of the rail line, as well as for each of the proposed new alternative routes, were used to locate the locomotive emissions. In order to adequately account for the distribution of the locomotive emissions we have developed the area sources as contiguous segments along the length of the rail line. These rectangular segments were set up to be approximately 5-km in length and approximately 500 meters wide along the majority of the rail line. Some area source treatments limits the maximum aspect ratio to 10:1 or less. It is unclear in the CALPUFF documentation whether its treatment of area sources also contain such a limitation. Thus, we felt it was prudent to limit the aspect ratio to 10:1. Shorter segments than 5-km are used along sections of the rail line with large curvature in order to follow the route as closely as possible. This procedure results in a total number of area sources (included the existing portion of the rail line from Wall east to the boundary of the modeling domain and the area sources representing the rail sidings) for Alternatives B, C, and D of 166, 165, and 196, respectively.

Note that the procedure used to generate the area source segments is based on the actual length of the railway being approximated by the area segments and not by the actual length of the resulting segments. Thus, each area source segment represents a section of railway approximately 5-km in length. While this procedure results in area source of varying length along the route, the resulting emission estimates are more uniformly distributed among the source segments.

Given the data received from DM&E, summarized in Table 3-1, and the emission factors presented in Table 3-2, emission estimates for HC, CO, NO_x, SO_2, and PM_{10} are obtained in terms of total emission increases (tpy) for the existing portion of the railway and for each of the three alternative routes at levels of coal transport operations of 20, 50, and 100 MNT. The emissions are distributed among the area sources based on the length of rail way represented by each area segment and converted to the appropriate CALPUFF input units of g/s. No temporal variation was assumed in this conversion, i.e., the locomotive emissions are treated as constant throughout the day. In addition, an adjustment was made to the emission rates to account for any differences in the digitized lengths of each alternative route and the lengths reported in Table 3-1. The lengths obtained from the digitized routes were consistently less than those presented in Table 3-1 with differences ranging from 17.4 miles for Alternative B to 22.9 miles for Alternative D.

Emission estimates for the rail sidings along each of the proposed routes were obtained using a slightly different method than for the rest of the rail line. It is assumed, given the number of trains operating throughout each day and the total length of each route that as a train passes a siding location, the siding will be in use approximately 50% of the time. This implies that at the location of the sidings, which are coincident with the main rail line, the emission rate will be 1.5

times higher than if there were no siding present. In order to conserve the total mass of pollutant in the modeling domain, the annual gross ton values given in Table 3-1 are renormalized based on the total length of each alternative route plus one half the length of the sidings. This gives a new estimate for the gross ton increase to be used in calculating the emission estimates for the main rail line. Then for the area sources representing the sidings, one half of this adjusted gross ton value, along with the length of the siding, is used in the calculations for the emission rates at the sidings. This procedure results in conservation of total pollutant mass in the domain while providing an emission rate 1.5 times higher along segments with sidings than along the rest of the rail line.

The locations of three railyards along each alternative route were provided along with conservative emission rates based on EPA's Tier 0 and Tier 1 emission factors for line-haul locomotives. Since the railyards vary from approximately 1–2 miles in length, emissions from the railyards are treated in CALPUFF5 as buoyant area sources similar to the main rail line, rather than as concentrated point sources.

The emission estimates for NO_x will be split into NO and NO_2 assuming 90% of the NO_x emission are associated with NO while the remaining 10% are associated with NO_2 emissions. The locomotive PM_{10} emissions will be split into fine particulate ($PM_{2.5}$), elemental carbon (EC), organic carbon (OC) and sulfate (SO_4) in the CALPUFF modeling to account for the differing extinction efficiencies of these species (see Chapter 4). The following PM_{10} split factors are assumed; 20.9% OC, 54.8% EC, 4.9% SO_4 and 19.4% $PM_{2.5}$. The PM_{10} splits used here are based on EPA's speciation profiles for railroads (SCC Code = 2285000000). How the diesel PM is speciated is important for estimating visibility impact due to the much higher extinction coefficients for EC (10) compared to OC (4) and $PM_{2.5}$ (1). We reviewed current diesel PM speciation and found no new data for locomotive diesel PM. What diesel PM data we did find, saw the EC fraction vary from 13 to 75 percent (Morris, 2000). The old EPA railroads diesel PM profile with 58% EC was within the range of uncertainty so was used in this study.

The remaining parameters associated with the locomotive emissions used in the CALPUFF modeling are the molecular weights of each of the modeled pollutants. Table 3-4 presents the molecular weights of each pollutants associated with the locomotive emissions.

Table 3-4. Molecular weights for CALPUFF application (g/mole).

HC	16
NO	30
NO_2	46
SO_2	64
SO_4	96
CO	28
$PM_{2.5}$	1
EC	1
OC	1
Pb	207

SUMMARY OF EMISSIONS

Table 3-5 summarizes the emissions for the three alternative DM&E routes as well as the other new point and area sources used in the cumulative impact analysis. Note the high PM emissions associated with the non-DM&E area sources. These emissions are mainly due to fugitive dust sources from the large rectangular area source covering the Powder River Basin mining and CBM operations shown in Figure 3-1. As noted in the air quality and AQRV impacts sections of this report, we believe treating all of these sources as one large area sources will overstate their impact.

Table 3-5. Summary of total emissions (g/s) for the three DM&E alternative routes (assuming Tier 1 locomotives) and non-DM&E sources.

	VOC	CO	NO	NO2	SO2	PM*	EC	OC	SO4
DM&E Route B**	9.69	26.31	80.71	13.75	16.51	1.28	3.63	1.38	0.32
DM&E Route C**	9.31	25.27	77.52	13.21	15.86	1.23	3.49	1.33	0.31
DM&E Route D**	16.75	45.52	139.70	23.80	28.85	2.22	6.27	2.39	0.56
Non-DM&E Point Sources	0.00	0.00	182.23	31.05	144.64	28.00	0.00	0.00	0.00
Non-DM&E Area Sources	0	0	94.58	16.11	27.86	474.73	6.87	2.63	0.00

* PM_{25} for DME sources, PM_{10} for non-DME sources.
** Based on 50 million tons of coal transported, Tier 1 AC locomotives

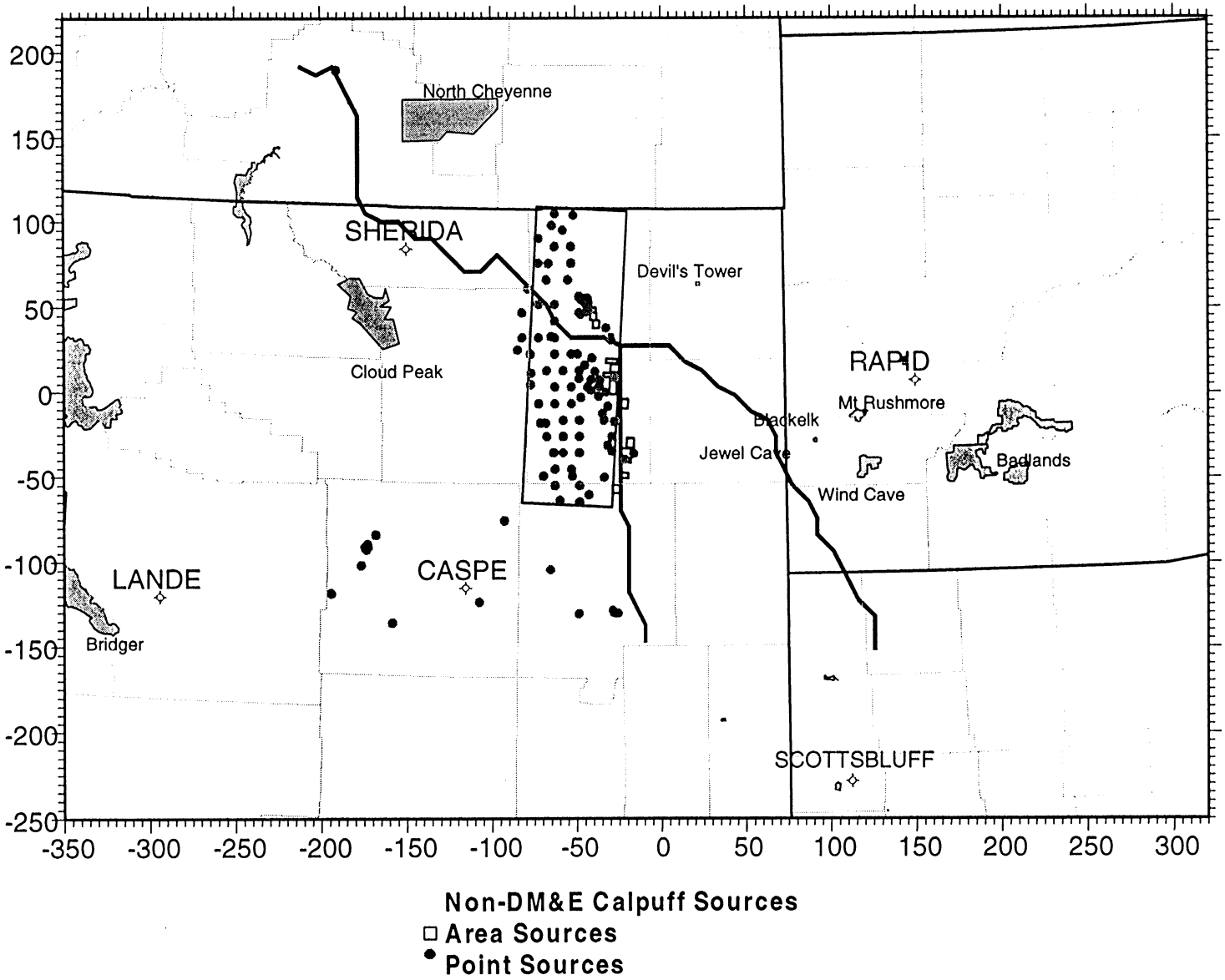

Figure 3-1. Locations of the Other New Sources (non-DM&E Project) area and point sources used in the PRBEP DM&E railway enhancement project EIS CALPUFF modeling.

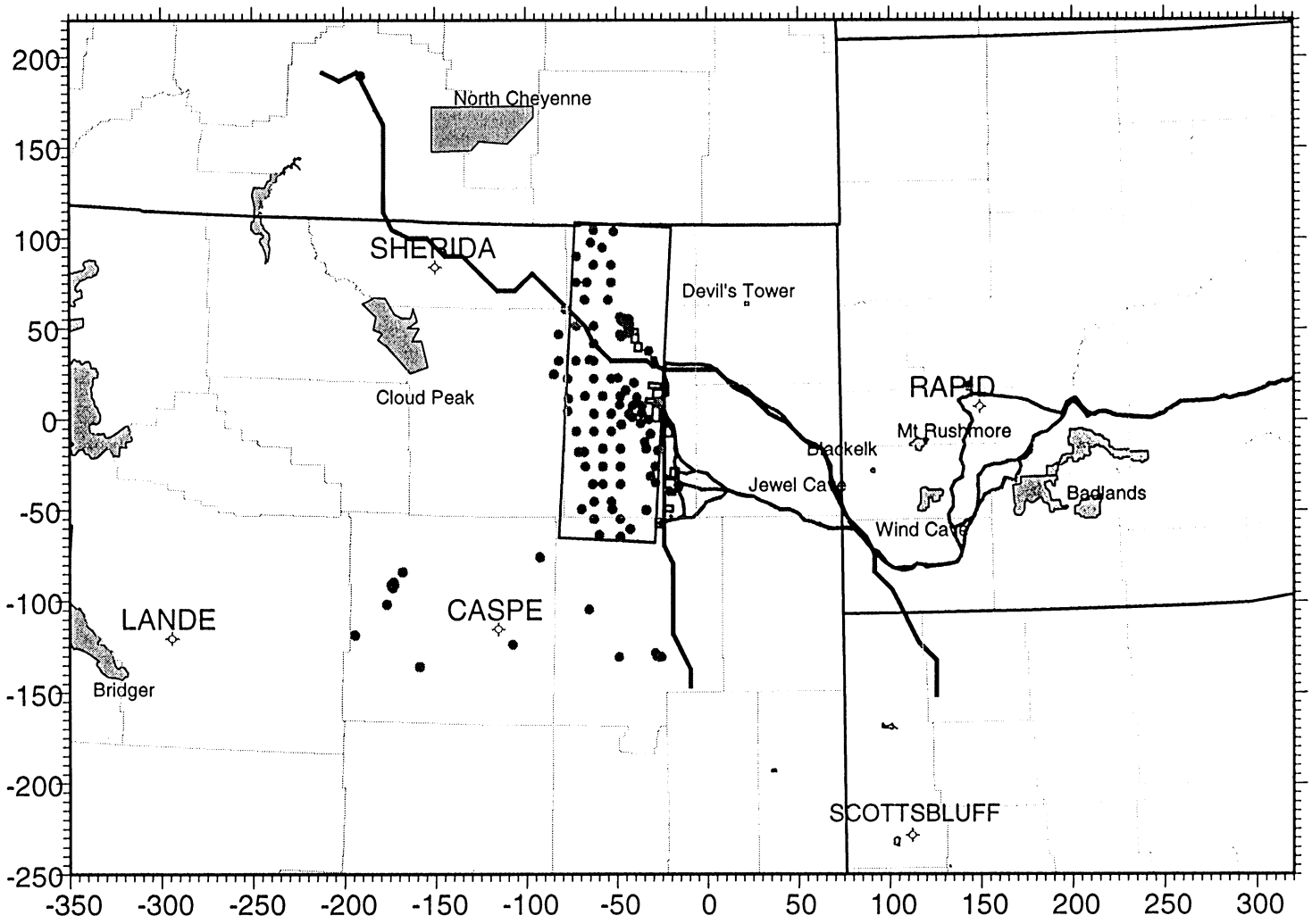

Figure 3-2. Location of all of the new area and point sources used in the PRBEP DM&E railway enhancement project EIS CALPUFF modeling.

4. AIR QUALITY MODELING METHODOLOGY

The CALPUFF model (Version 5, Level 990228) was applied to an area in northeastern Wyoming, southeastern Montana, southwestern South Dakota, and northwestern Nebraska to estimate the air quality and air quality related values (AQRVs) impacts of new pollutant emissions from locomotives operating on the proposed new PRBEP DM&E railway (the Project). Additional analysis was also performed to assess the contributions of other potential new sources (Other New Sources) and reasonable foreseeable development (RFD) sources as defined in the Horse Creek EIS emissions database (augmented by any new quantifiable sources as discussed in Chapter 3), as well as cumulative impacts due to the combined Project and Other New Sources. This Chapter presents the procedures used to perform the CALPUFF modeling and used in the processing of the modeling results for comparison against standards, increments, and level of concern thresholds. The air quality and acid deposition modeling results are then presented in Chapter 5, the DM&E Project visibility impacts are provided in Chapter 6, and the cumulative visibility impacts are given in Chapter 7.

The CALPUFF modeling also estimated the total concentration impacts due to the existing background (current sources) plus the cumulative increment. Impacts on air quality, visibility, and acid deposition were estimated at nearby Class I and Class II sensitive receptor areas. Impacts on air quality were also estimated at several near-source receptor areas related to areas of high emissions due to the Project (e.g., railyards) in order to capture the highest potential near-source concentration impacts due to the Project's emissions. The CALPUFF modeling was performed using daily maximum emissions for the Project and long-term (seasonal maximum) emissions estimates for the other new sources (as defined in the Horse Creek EIS CALPUFF database). CALPUFF was operated using the Interagency Workgroup on Air Quality Modeling (IWAQM) recommended default settings.

The CALPUFF modeling estimated pollutant concentrations and deposition at sensitive receptors in the vicinity of the Project. The Class I and Class II areas of primary interest in these analyses are as follows:

Badlands National Park (Class I),

Wind Cave National Park (Class I),

Northern Cheyenne Reservation (Class I),

Mount Rushmore National Monument (Class II),

Black Elk Wilderness Area (Class II),

Jewel Cave National Monument (Class II),

Devils Tower National Monument (Class II), and

Cloud Peak Wilderness Area (Class II).

The locations of these sensitive receptor areas as well as the remaining Class I areas in the modeling domain are depicted in Figure 4-1. These eight receptor areas represent the closest sensitive Class I and II areas to the proposed Project in the region so would have the highest air quality and AQRV impacts. Note that the Northern Cheyenne Reservation is a redesignated

Class I area, not a federally mandated Class I Area and, as such, visibility impairment within the area is not addressed by the recent regional haze rule for the existing visibility rules for reasonable attribution.

Additional receptors will be located at any sensitive lakes in the region for acid deposition calculations. The only lake so identified by the FS is Florence Lake in the Cloud Peak Wilderness Area.

Additional near-field receptors were located at the locations of maximum emissions for the Project, which are the three railyards in the region.

To address NAAQS, WAAQS, and PSD increments in the Class I and Class II areas, CALPUFF was used to estimate ambient SO_2, NO_2, PM_{10}, $PM_{2.5}$, EC, and OC concentrations, sulfur and nitrogen deposition, and visibility impairment (light extinction by haze aerosols and NO_2). The time frame for the different PSD components varies greatly; deposition totals are usually analyzed on an annual basis whereas visibility requires a 24-hour assessment. The species to be modeled by CALPUFF are NO (nitrous oxide), NO_2 (nitrogen dioxide), HNO_3 (nitric acid), particulate ammonium nitrate, SO_2 (sulfur dioxide), sulfate (SO_4), PM_{10}, $PM_{2.5}$, EC (elemental carbon), and OC (organic carbon).

Ammonia is not directly modeled by CALPUFF, but ambient concentrations can be supplied as input for the internal equilibrium partitioning of total nitrate among nitric acid and aerosol nitrate. However, for the application of CALPUFF, the sulfate/nitrate/ammonia equilibrium calculation was performed on the hourly CALPUFF model outputs using a modified version of the Mount Zirkel Visibility Study (MZVS) CALPUFF post-processor, described later in this Chapter. Currently, the CALPUFF model contains a fundamental flaw for treating the equilibrium between sulfate, nitrate, and ammonia when modeling the incremental impacts of specific sources because the effects of the existing NO_X and SO_X sources are not accounted for. The modified MZVS CALPUFF postprocessor alleviates this deficiency. This approach also allows the assessment of the impacts due to Project sources alone, other new sources alone, cumulative impacts due to the Project plus other new sources, as well as the total concentrations due to all sources (existing baseline plus the Project and other new sources contributions). The model outputted concentrations every hour for the entire year of 1990 from which 3-hour, 8-hour, 24-hour, monthly, seasonal, and annual mean concentration estimates were constructed. Deposition was outputted daily so that annual total sulfur and nitrogen deposition fluxes could be constructed.

Modeling Domain

The CALPUFF computational grid will be the same as the CALMET modeling grid (see Figures 1-1 or 2-1) as defined in Chapters 1 and 2. The CALMET/CALPUFF PRBEP DM&E railway expansion Project domain is based on a Lambert Conformal Projection (LCP) using a 134 x 94 5-km x 5-km resolution grid and is defined with a LCP longitude/latitude centroid at (-105.0°, 44.0°), first and second standard latitude parallels at 30° and 60°, and the southwestern corner origin of the grid offset (-350-km, -250-km) from the LCP centroid (see Figure 2-1).

Meteorology

Hourly three-dimensional meteorological fields were generated using the CALMET diagnostic meteorological model. Due to the presence of complex terrain, wind fields in the region will be highly variable and complex. Wind observations are sparse and representative of very localized flow conditions. Thus there is little chance that a diagnostic wind model alone, such as CALMET, can accurately depict the complex flow fields using just observations. Thus, output from a coarse grid (80 km) resolution simulation of the MM4 prognostic meteorological model were also used as input into CALMET to define the synoptic-scale flow features. The CALMET diagnostic wind algorithms and local observations were then used to refine the local flow characteristics at a 5-km resolution. As described in Chapter 2, and following the procedures used in the Wyodak and Horse Creek EIS analysis, surface meteorological data for five (5) sites and upper-air meteorological data for two (2) sites were used (see Figure 2-1). CALMET also generates hourly precipitation fields, which are used in CALPUFF to scavenge air-borne pollutants (e.g., acid deposition). Following the procedures used in the Wyodak and Horse Creek EIS analysis, precipitation data from four (4) sites were used in the CALMET modeling (see Figure 2-1).

Emissions

Emissions to be treated in the CALPUFF far-field modeling include NO, NO_2, SO_2, coarse and fine particulate matter (PM_{10} - $PM_{2.5}$ and $PM_{2.5}$), and elemental and organic carbon (EC and OC). CALPUFF emission inputs were developed for the Project sources and the three Project Alternatives using information provided by DM&E and EPA guidance documents. CALPUFF emission inputs for the other new sources were based on the (non-DM&E) emissions from the Horse Creek EIS augmented with any new potential sources (see Chapter 3 for more details).

Receptor Locations

CALPUFF estimates air quality and acid deposition impacts at user-defined receptor locations. Receptors were located along the boundaries and within each of the eight (8) sensitive Class I and II areas identified previously in this Chapter. The receptors were defined close enough together to assure that maximum air quality concentration impacts are obtained. In addition, for acid deposition impacts, receptors were located at sensitive lakes as identified by the Land Managers (Florence Lake in the Cloud Peak Wilderness Area is the only lake so identified). Figure 4-2 displays the receptor network over the sensitive Class I and II areas used in the CALPUFF modeling.

Near-source receptors were also specified to obtain the maximum estimated concentrations due to the Project sources. The near-source receptors were placed in the proximity of the railway in areas of highest emissions from the Project (i.e., railyards). Figure 4-3 displays the locations of the near-source receptors.

Other CALPUFF Inputs

In addition to the emissions and meteorological input data files, CALPUFF also requires a user input control file and an ozone data input file. There are also several optional files that were not used in the Project CALPUFF application (e.g., user-specified deposition velocity, chemical conversion rates, turbulence data, and isolated hill files). CALPUFF was operated in a mode recommended by IWAQM. The CALPUFF concentration estimates were post-processed using observed monthly average baseline air quality data (i.e., Chemical Background) to perform the equilibrium calculation between sulfate, nitrate, and ammonia to obtain the estimated particulate sulfate, nitrate, and ammonium.

CALPUFF Control File

IWAQM has developed a set of defaults for the CALPUFF model for performing PSD-type increment and visibility modeling. These recommendations are based on earlier versions of CALPUFF and IWAQM has not formulated any recommendations for some of the new features in CALPUFF5. For the CALPUFF PRBEP DM&E Railway Expansion Project, the IWAQM defaults will be assumed where consistent with CALPUFF5. Thus, the default dry and wet deposition algorithms will be used. In addition, the following CALPUFF options will also be specified:

Gaussian near-field distribution
Transitional plume rise
Stack tip downwash
PG dispersion coefficients (rural areas), McElroy-Pooler coefficients (urban areas)
Transition of horizontal dispersion to time-dependent (Heffter) growth rates
Building downwash effects (ISC3 techniques)
Wet deposition, dry deposition, and chemical transformation will be considered

CALPUFF5 has implemented a new (RIVAD/ARM3) empirical chemical transformation algorithm taken from the ARM3 model (Morris et al., 1988) that contains a separate treatment of NO and NO_2, rather than lumping them together as NO_x as in the old algorithm (MESOPUFF-II). IWAQM has not evaluated the new algorithm and so has not formulated a recommendation. Given the improved ability to separately treat NO_2 in the new algorithm and the more appropriate response of the new algorithm to changes in environmental parameters (e.g., temperature) than the old (MESOPUFF-II) algorithm (Morris, et. al., 1988), the new algorithm was used in the Project CALPUFF modeling.

Exhibit B at the end of this report displays an example CALPUFF input control file used for the DM&E sources and the far-field sensitive receptors. This input file is semi-self-documenting and defines all of the options specified for the CALPUFF simulations. The reader is referred to the CALPUFF User's Guide for more details on these parameters (Scire, et al, 1999).

Air Quality Data

Air quality observations were used to define the ozone input file to CALPUFF for use in the empirical chemical transformation algorithm. The Wyodak and Horse Creek EIS CALPUFF modeling used the default constant background ozone value of 40 ppb. We contacted the State agencies (WY and SD) to determine whether any ozone measurements were available in the region and none were found. Thus, a 40 ppb constant background ozone value was also used in the PRBEP DM&E railway expansion Project CALPUFF modeling.

Ambient measurements of SO_2, NO_2, nitrate, sulfate, ammonia, $PM_{2.5}$, and PM_{10} were used to define baseline air quality. Note that in addition to the background ozone inputs used in the CALPUFF chemical conversion module, there are three other uses of the measured baseline air quality data:

Chemical Background: Background total ammonia, total sulfate, and total nitrate are needed to combined with the CALPUFF-estimated total sulfate and total nitrate to perform the equilibrium calculation to estimate particulate ammonium nitrate;

NAAQS Background: For criteria pollutants, a maximum background concentration is needed to add to the CALPUFF-estimated incremental pollutant concentrations for comparisons with the NAAQS and WAAQS (see Table 1-4); and

Visibility Background: For visibility calculations, a background extinction is needed to estimate whether the changes in extinction due to the Project and other new sources may be perceptible and for calculating changes in deciview (see Table 1-5).

The background concentration values listed in Table 1-4 were used as the NAAQS Background concentrations listed above.

The Badlands National Park and Bridger Wilderness Area IMPROVE measurement program sites measured sulfate, nitrate, and other speciated PM provides the most complete and best characterization of baseline PM conditions in the domain. The Badland and Bridger IMPROVE site reconstructed mass data were used to characterize the Chemical Background and Visibility Background for all sites. However, different procedures were used to obtain the Chemical and Visibility Backgrounds from the IMPROVE data. In addition to the sulfate, nitrate, and reconstructed ammonium PM mass concentrations from the Badlands and Bridger IMPROVE data, the Chemical Background also requires background gaseous free ammonia and nitric acid concentrations in order to properly perform the sulfate/nitrate/ammonium equilibrium calculations. A 5 ppb free ammonia background was assumed in the Wyodak CALPUFF modeling, so will also be assumed here. A relatively clean 0.5 ppb background nitric acid concentration was assumed in t his study in order to obtain a conservative (i.e., tending toward overestimate) estimate of the ammonium nitrate impacts due to the Project and other new sources.

The Visibility Background was defined using the IWAQM recommendation that is based on the mean of the 20 percent cleanest days from a long-term (approximately 10-year) record. The FLAG (Federal Land Manager's Air Quality Related Values Work Group) Visibility Subgroup Report (FLAG 12/10/98 working draft report) has listed the mean of the 20 percent cleanest days

for the Badlands and Bridger IMPROVE reconstructed mass data from 1987-1997 for use as a Visibility Background. These values are shown in Table 1-5.

CALPUFF Postprocessing

NO_X is a major component of the emissions from the Project and other new sources in the region. CALPUFF will simulate the oxidation of NO_X to nitrate. In addition, CALPUFF has an internal algorithm that calculates the equilibrium between sulfate, nitrate, and ammonia to determine how much of the converted NO_X is particulate nitrate and how much is gaseous nitric acid. This equilibrium relationship depends on temperature, humidity, and the total amount of sulfate, particulate nitrate plus nitric acid, and ammonia plus ammonium present in the atmosphere from all sources. These calculations must consider sources currently present (i.e., the Chemical Background baseline air quality measurements) and contributions due to emissions from the Project and other new sources. Thus, the internal CALPUFF equilibrium algorithm is inappropriate for use in this modeling analysis of the contributions due to new source emissions (Project and/or other new sources) because it neglects the contributions of sources that already exist; those concentrations are represented in the Chemical Background concentrations.

A modified version of the MZVS CALPUFF post-processor was used to process the CALPUFF output using the current baseline Chemical Background air quality data to represent the contributions of existing sources and estimate particulate ammonium nitrate due to the Project and other new sources separately and together as the cumulative source contributions. The cumulative nitrate concentration (particulate nitrate plus nitric acid) estimated by CALPUFF (Project and other new sources) were added to the measured nitrate Chemical Background concentrations (representing contributions due to existing sources) to obtain the total nitrate due to all sources. Similarly, the CALPUFF-estimated sulfate cumulative concentrations were added to the measured sulfate Chemical Background concentration to obtain sulfate due to all sources. Total ammonia due to all sources was obtained by adding the IMPROVE Chemical Background particulate ammonium with the Chemical Background gaseous ammonia that was assumed to be 5.0 ppb (part per billion) as used in the Wyodak and Horse Creek EIS CALPUFF modeling. The temperature and humidity dependent equilibrium relationship between nitrate, sulfate, and ammonia was calculated to obtain hourly ammonium sulfate, ammonium nitrate, ammonia, and nitric acid concentrations due to all sources (Project and other new sources). The equilibrium calculation was made on an hourly basis to account for the diurnal variations in temperature and relative humidity. The incremental ammonium nitrate contribution due to the Project and other new sources was based on their relative fraction of the incremental particulate nitrate plus nitric acid concentrations to the total particulate nitrate plus nitric acid concentrations due to all sources (current baseline, Project, and other new sources).

The Badlands National Park and Bridger Wilderness Area IMPROVE reconstructed mass data were used to define the Chemical Background baseline particulate species concentrations for the equilibrium calculations. These measurements are collected twice weekly. Monthly background reconstructed mass speciated PM baseline estimates were generated from the Bridger IMPROVE data to characterize current baseline Chemical Background conditions for particulate sulfate, particulate nitrate, and particulate ammonium. Assumed Chemical Background concentrations for gaseous ammonia and nitric acid were 5.0 and 0.5 ppb, respectively.

For each hour, the CALPUFF-estimated cumulative contributions due to the Project plus other new sources total nitrate (particulate nitrate plus nitric acid are combined with the Chemical Background nitrate (monthly specific IMPROVE particulate nitrate plus an assumed 0.5 ppb nitric acid) to obtain the total nitrate concentration due to all sources. Similarly, total sulfate due to all sources is obtained by summing the CALPUFF estimated cumulative incremental sulfate (Project plus other new sources contributions) with the monthly specific IMPROVE Chemical Background sulfate concentrations. Finally, total ammonia due to all sources is obtained by combining the monthly specific IMPROVE reconstructed mass particulate ammonium concentration with the assumed 5.0 ppb free ammonia concentration. The sulfate/nitrate/ammonia equilibrium calculations are then be performed on an hourly basis using the CALMET-estimated surface RH (relative humidity) and temperature in the grid cell containing the receptor assuming that sulfate preferentially locks up the ammonia first and that the ammonium nitrate and gaseous nitric acid and free ammonia are in equilibrium (Stelson and Seinfeld, 1983):

$$NH_4NO_3\ (pm) \quad \leftrightarrow \quad HNO_3\ (g) + NH_3\ (g)$$

The hourly sulfate, nitrate, and ammonium from the equilibrium calculations and the CALPUFF-estimated and background NO_2 and fine and coarser particulate concentrations are then averaged to obtain 24-hour average concentrations.

Calculations of Visibility, Extinction, and Deciview

The IWAQM recommended approach for defining Baseline Visibility Background (i.e., mean of 20% of the cleanest days) in conjunction with the FLAG visibility parameter equations were used to assess the visibility impacts in the Project EIS. The recommended approach is to calculate extinction due to the incremental source concentrations using seasonal RH adjustments and compare the impacts to a seasonal background visibility based on the average of the 20 percent cleanest days from a long term record (e.g., 1987-1997). Table 1-5 lists the recommended Visibility Background for the Badlands National Park and Bridger Wilderness IMPROVE data. The IWAQM recommendations do not include the effects of absorption by NO_2 in their visibility assessment. Due to the proximity of the railway Project to several sensitive Class I receptor areas, NO_2 may be an important contributor to the incremental extinction budget , thus it was included in the visibility impact assessments. Data from the Badlands National Park and Bridger Wilderness Area were used to represent the Visibility Background for receptors located, respectively, east and west of the most westerly extent of the Project (i.e., Campbell County, Wyoming).

The 24-hour incremental and cumulative total extinction (b_{source}) is calculated from the individual CALPUFF-estimated 24-hour particulate and NO_2 extinction as follows:

$$b_{source} = b_{SO4} + b_{NO3} + b_{fine} + b_{coarse} + b_{EC} + b_{OC} + b_{NO2}$$

Extinction due to each of the particle scattering and NO_2 absorption components is obtained by applying a scattering/absorption efficiency to the concentration [$\mu g/m^3$ (microgram per cubic meter) for particulate and ppb for gaseous species] as follows:

$$b_{SO4} = 3\,[(NH_4)_2SO_4]f(RH)$$
$$b_{NO3} = 3\,[NH_4NO_3]f(RH)$$
$$b_{fine} = 1\,[PM_{2.5} - EC - OC]$$
$$b_{EC} = 10\,[EC]$$
$$b_{OC} = 4\,[OC]$$
$$b_{coarse} = 0.6\,[PM_{10} - PM_{2.5} - EC - OC]$$
$$b_{NO2} = 0.17\,[NO_2]$$

Here, as recommended by IWAQM, the seasonal f(RH) values were used (see Table 1-5).

The estimation of the baseline extinction levels used the seasonal data for clean days from the Badlands National Park and Bridger Wilderness Area IMPROVE sites with baseline extinction obtained as follows:

$$b_{base} = b_{NS\,x}\,f(RH) + b_{dry} + b_{ray}$$

Where b_{NS} is the sulfate-nitrate Hygroscopic component from Table 1-5 for the appropriate season, b_{dry} and b_{ray} are the respectively, nonhygroscopic and Rayleigh scattering components from Table 1-5, and f(RH) is the seasonal average f(RH) value for the day under study (Table 1-5).

For each day the percent change in extinction due to the Project ($\Delta b_{Project}$), other new sources (Δb_{Other}), and cumulative increment due to the Project plus other new sources ($\Delta b_{Project} + \Delta b_{Other}$) to the baseline extinction was calculated.

$$\Delta b_{Project} = 100 \times [b_{Project} / b_{base}]$$
$$\Delta b_{Other} = 100 \times [b_{Other} / b_{base}]$$
$$\Delta b_{Other + Project} = 100 \times [b_{Other + Project} / b_{base}]$$

Visual Range can be easily from extinction from the formula:

$$VR(km) = 3912 / b_{ext}\,(Mm^{-1})$$

Finally, deciview is also readily calculated from the extinction as follows:

$$dv = 10\,ln_e(b_{ext} / 10\,Mm^{-1})$$

The incremental deciview due to the Project and Post-1995 sources were then calculated as follows:

$$\Delta dv_{Project} = dv_{base + Other + Project} - dv_{base + Other} = 100 \times ln_e\,[1 + (b_{Project} / b_{base})]$$
$$\Delta dv_{Other} = dv_{base + Other} - dv_{base} = 100 \times ln_e\,[1 + (b_{Other} / b_{base})]$$
$$\Delta dv_{Other + Project} = dv_{base + Other + Project} - dv_{base} = 100 \times ln_e\,[1 + (b_{Other + Project} / b_{base})]$$

Estimated Impacts (Modeling Results)

Three types of modeling results were obtained in the PRBEP DM&E railway expansion EIS Project CALPUFF modeling:

(1) Comparison with applicable NAAQS and WAAQS standards and PSD Class I and Class II increments;

(2) Visibility degradation and comparison with the 5% and 10% changes in extinction over background and the 0.5 and 1.0 changes in deciview Limit of Acceptable Change (LAC) thresholds; and

(3) Annual deposition fluxes on sensitive lake receptors were calculated in terms of Acid Neutralizing Capacity (ANC) and compared against the 10% ΔANC LAC threshold. Additionally, total sulfur and nitrogen depositions across National Parks were also obtained.

Although the contribution of the Project emissions, other new sources, and cumulative Project and other new sources increments will be compared against PSD Classes I and Class II increments, it should be reiterated that the study is not intended to be a PSD increment consumption analysis. Rather, the study is intended to convey whether the Project and other new sources separately and together modeled results will result in concentration impacts that approach PSD increments.

It should also be noted that the changes in extinction and Δdv visibility and ΔANC acid deposition LAC thresholds are not regulatory limits or standards. Rather, they are thresholds developed to assist in evaluating the significance of such AQRV impacts.

National and State Standards and PSD Increments

Annual average NO_2, SO_2, PM_{10}, and $PM_{2.5}$ due to the Project, other new sources, and combined sources were added to the baseline NAAQS Background ambient air quality and compared with the appropriate NAAQS and State standards. Annual average concentrations of all pollutants resulting from the Project emissions sources alone were also compared with the NAAQS and WAAQS. The annual average contribution of NO_2, SO_2, and PM_{10} due to Project, other new sources, and combined Project plus other new sources were compared with PSD Classes I and II increments. The Project, other new sources, and cumulative (Project plus other new sources) concentration contributions and total (cumulative plus background) 24-hour SO_2, PM_{10}, and $PM_{2.5}$ impacts were compared against applicable NAAQS and WAAQS standards. 24-hour SO_2 and PM_{10} contributions due to Project sources alone were compared to the PSD Class I and Class II increments.

Similarly, 24-hour SO_2, PM_{10}, and $PM_{2.5}$ and 3-hour SO_2 incremental and total concentrations were compared against the applicable NAAQS, WAAQS. Impacts from Project sources alone were compared with the PSD Class I and Class II increment standards.

Visibility Assessment

As discussed above, estimated 24-hour extinction due to the Project incremental contribution, other new sources incremental contribution, cumulative Project plus other new sources incremental contributions at the sensitive receptors were processed to obtain visibility impairment in terms of extinction and deciview. The frequency of occurrence of impacts from the incremental and cumulative analyses of deciviews exceeding 0.5 Δdv and 1.0 Δdv and extinction exceeding 5 and 10 percent of the baseline visibility background were tabulated for each sensitive receptor area. As the Δdv and change in extinction thresholds give nearly identical results, we report on the change in extinction visibility thresholds in the body of the report and leave the Δdv tables in the appendices.

Acid Deposition Impacts

Annual wet, dry, and total (wet + dry) deposition fluxes of total sulfur and nitrogen at the sensitive lake receptors predicted by CALPUFF for the Project development alone and cumulative sources will be tabulated. Note that this includes all deposited sulfur and nitrogen compounds including CALPUFF-estimated SO_2, sulfate, NO, NO_2, HNO_3, and particulate nitrate deposition as well as an assumed 2 ammonium with each sulfate and 1 ammonium with each nitrate deposited. For the sensitive lake receptor sites, the annual deposition fluxes will be used to estimate the potential change in ANC following the new procedures developed by the USDA Forest Service Rocky Mountain Region (November 1999, Draft). Baseline ANC values for the sensitive lakes are shown in Table 1-6. The results will be compared with the FS LAC threshold change of 10 percent.

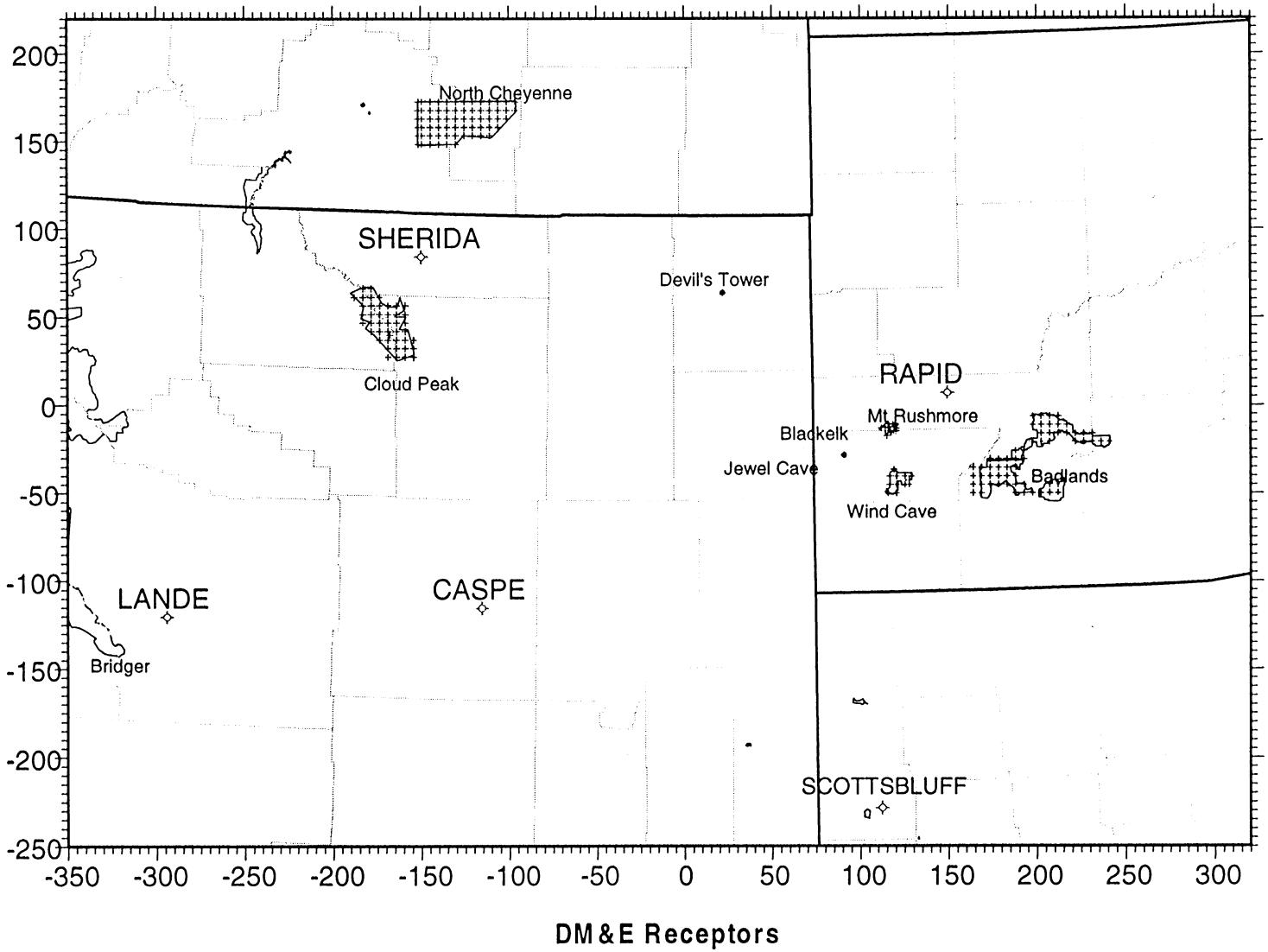

Figure 4-1. Receptor locations located in sensitive Class I and II areas used in the PRBEP DM&E railway enhancement project EIS CALPUFF modeling.

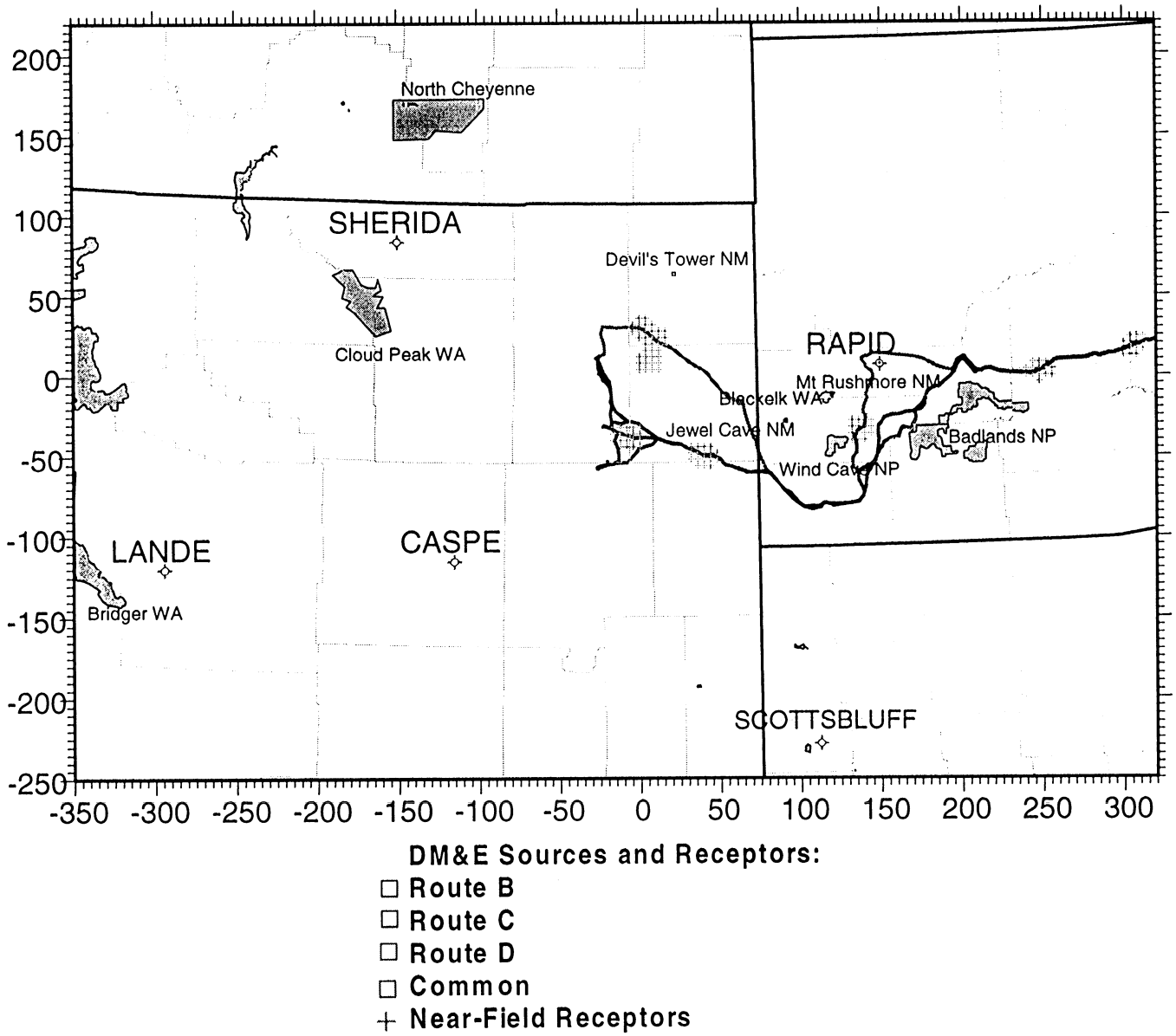

Figure 4-2. Near-Source receptor locations over areas of maximum emissions from the proposed DM&E railway expansion (i.e., the railyards) used in the CALPUFF modeling.

5. ESTIMATED AIR QUALITY AND ACID DEPOSITION IMPACTS

In this chapter we present the estimated air quality and acid deposition impacts of the proposed Powder River Basin Expansion Project (PRBEP) Dakota, Minnesota, and Eastern Railway (DM&E) Railway Expansion Project (the Project). The estimated air quality and acid deposition impacts of other new permitted and reasonable foreseeable development (RFD) sources (Other New Sources) are also presented, along with the estimated cumulative impacts (the Project plus Other New Sources). Near-source and far-field air quality concentration and far-field acid deposition impacts are calculated and compared against the applicable standards and/or thresholds of concern. For the most part, the near-source and far-field air quality and acid deposition impacts are much lower than the applicable standards or thresholds of concern. Thus, in this chapter we just present the air quality impacts are just presented for the worst case Project Alternative (i.e., Project Alternative Route D at 100 MNT coal a year that has the maximum emissions, see Chapter 3). The near-source and far-field air quality impacts for all of the Project Alternatives are presented Appendices A and B, respectively. The visibility impacts due to the Project for some of the Project Alternatives exceed thresholds of concern so they are discussed separately in more detail in Chapter 6. In addition, the visibility impacts due to the Other New Sources and Cumulative Sources (Other New Sources plus the Project Sources) exceed thresholds of concern so they are also discussed separately in more detail in Chapter 7.

EMISSION SCENARIOS

The potential air quality and acid deposition impacts for the PRBEP DM&E railway expansion project were analyzed for 9 different alternatives corresponding to three different potential alternative routes (Routes B, C, and D) hauling three different levels of coal transport (20, 50, and 100 million net tons per year, MNT). Details on these scenarios are provided in Chapter 3.

NEAR-SOURCE PROJECT AIR QUALITY IMPACTS

Table 5-1 summarizes the maximum near-source air quality concentration impacts for criteria pollutants and the worst case emissions Project Alternative (Route D at 100 MNT). Tables of the near-source concentration impacts for all nine Project Alternatives are provided in Appendix A. Shown in Table 5-1 and Appendix A are the near-source concentration impacts due to the DM&E Project sources alone, Other New Sources alone (non-DM&E), and cumulative impacts (Project plus Other New Sources). The cumulative emissions near-source impacts plus existing background concentrations are compared against the National and Wyoming Ambient Air Quality Standards (NAAQS and WAAQS). The estimated near-source concentration impacts due to the DM&E Project alone are always less than 5 percent of the NAAQS and WAAQS. The contribution of DM&E sources is always less than 7 percent and usually less than 1 percent of the PSD Class II increments. With one exception, the cumulative impacts due to the DM&E Project sources plus all Other New Sources are always less than the PSD Class II increments. The one exception is for the PM_{10} 24-hour PSD Class II increment (30 $\mu g/m^3$) that is estimated to be exceeded by the Cumulative Sources by over a factor of 2 (67.43 $\mu g/m^3$). However, this impact is due completely to the Other New Sources (67.41 $\mu g/m^3$) with the DM&E contribution being less than 0.03 percent to this maximum estimated concentration. We suspect that this large impact is due to the treatment of fugitive dust emissions from mining operations in the region by one large area source and the use of

near-source receptors that are actually inside the area source (see Chapter 3). The Other New Sources emissions were based on the emissions inventory from the Horse Creek EIS study that did not separately treat primary $PM_{2.5}$ and PM_{10}. Thus, we do not have any separate primary $PM_{2.5}$ impacts for the Other New Sources.

The estimated maximum Cumulative Contribution (Other New Sources plus the Project Sources) plus the maximum background concentration are always below the relevant NAAQS and WAAQS. The closest any pollutant concentration comes to any national standard is within 75 percent of the 24-hour PM_{10} standard of 150 $\mu g/m^3$. As noted above, the treatment of PM_{10} emissions from all of the mining operations as one large area source and locating receptors within the area source probably overstates these impacts.

The near-source modeling estimates that the DM&E Project along with Other New Sources combined with the existing background will not cause any violations of the NAAQS or WAAQS in the vicinity of the Project.

Table 5-1. Near-source maximum air quality concentration impacts ($\mu g/m^3$) for the PRBEP DM&E Project Alternative Route D hauling 100 MNT coal per year (See Appendix A for other Project Alternatives).

Pollutant	Avg. Time	Non-DM&E	DM&E Project	Cumulative Impacts	PSDClassII Increment	Back-ground	Total Impacts	WAAQS	NAAQS
SO2	Annual	1.14	0.03	1.14	20	3	4.14	60	80
SO2	24-hour	8.35	0.73	8.35	91	8	16.35	260	365
SO2	3-hour	32.55	5.03	32.55	512	8	40.55	1300	1300
PM10	Annual	9.64	0.04	9.65	17	16.1	25.75	50	50
PM10	24-hour	67.41	2.06	67.43	30	46	113.43	150	150
PM25[1]	Annual	0	0	0	-999	5.6	5.6	15	15
PM25[1]	24-hour	6.38	2.06	6.41	-999	16.1	22.51	65	65
NO2	Annual	3.28	0.36	3.35	25	16.5	19.85	100	100
CO	1-hour	0	19.58	19.58	-999	3500	3519.58	40000	40000
CO	8-hour	0	3.65	3.65	-999	1500	1503.65	10000	10000

1 The non-DM&E Other New Sources primary PM is modeled as just PM_{10} with no information of the fraction that is $PM_{2.5}$ so $PM_{2.5}$ due to non-DM&E sources is just the secondary component. There is also no information on background $PM_{2.5}$ levels in the area.

FAR-FIELD AIR QUALITY IMPACTS

Appendix B summaries the maximum CALPUFF-estimated criteria and PSD pollutant concentrations at the sensitive Class I and II receptor areas for the Project, Other New Sources, and Cumulative Sources and all three alternative Project routes (routes B, C, and D) and three alternative levels of coal transport (20MNT, 50MNT, and 100MNT). The largest air quality impacts for any Project Alternative occur for the Route D at 100MNT Project Alternative whose impacts at the sensitive Class I and II areas in the region (National Parks, Wilderness Areas, National Monuments, and a Reservation, see Figure 4-1) are provided in Table 5-2. The maximum CALPUFF-estimated concentrations at the sensitive far-field receptors due to the DM&E Project emissions for all Project Alternatives and pollutants are always less than 1 $\mu g/m^3$, well below the applicable PSD increments (see Appendix B for all Project Alternatives and Table 5-2 for the Route D 100 MNT Alternative). The maximum cumulative concentration impact due to the Project plus Other New Sources are always less than 55% of the applicable PSD Increment for all pollutants and across all of the far-field sensitive receptor areas (Appendix B and Table 5-2). The maximum

amount of PSD "increment consumption" due to the cumulative impacts is 53 percent for 24-hour PM_{10} concentrations at the Northern Cheyenne Reservation Class I area, all of which is due to the Other New Sources. However, as noted previously there are questions regarding the treatment of the Other New Sources mining operation emissions as one large area sources taken from the Wyodak/Horse Creek EIS database. It should also be reiterated that this analysis is not a PSD increment consumption study, rather just a presentation of the estimated level of impacts from the Project and Other New Sources.

When the maximum estimated cumulative concentrations at the far-field receptors are added to the maximum existing background concentrations (which occur away from the sensitive areas), then the estimated total concentrations for all pollutants are always less than 40 percent of the applicable NAAQS and WAAQS (Appendix B and Table 5-2 for the Route D 100MNT Project Alternative).

Thus, the Project and Other New Sources in the region are estimated to not come close to exceeding any PSD Class I or II increments or violating any ambient standards at the sensitive Class I and II receptor areas in the region.

Table 5-2. Maximum air quality concentrations at the sensitive Class I and II receptor areas for the DM&E Project Route D 100 MNT Alternative, Other New Sources, Cumulative, and Total Concentrations and comparison with the applicable PSD Increment and Air Quality Standards.

Pollu-tant	Avg. Time	Receptor Area	Non-DM&E	DM&E Project	Cumu-lative	PSD Inc.	Back-ground	Total Impact	WAAQS	NAAQS
SO2	Annual	Badlands NP	0.05	0.01	0.06	2	3	3.06	60	80
SO2	Annual	Blackelk WA	0.11	0.01	0.11	20	3	3.11	60	80
SO2	Annual	Mt. Rushmore	0.09	0.01	0.1	20	3	3.1	60	80
SO2	Annual	Wind Cave NP	0.11	0.01	0.12	2	3	3.12	60	80
SO2	Annual	Jewel Cave N	0.16	0.01	0.16	20	3	3.16	60	80
SO2	Annual	Devil's Towe	0.14	0	0.14	20	3	3.14	60	80
SO2	Annual	North Cheyenne	0.02	0	0.02	2	3	3.02	60	80
SO2	Annual	Cloud Peak W	0.01	0	0.01	20	3	3.01	60	80
SO2	24-hour	Badlands NP	0.48	0.15	0.58	5	8	8.58	260	365
SO2	24-hour	Blackelk WA	1.12	0.07	1.15	91	8	9.15	260	365
SO2	24-hour	Mt. Rushmore	1.02	0.07	1.05	91	8	9.05	260	365
SO2	24-hour	Wind Cave NP	1.31	0.09	1.32	5	8	9.32	260	365
SO2	24-hour	Jewel Cave N	1.64	0.03	1.65	91	8	9.65	260	365
SO2	24-hour	Devil's Tower	0.95	0.04	0.99	91	8	8.99	260	365
SO2	24-hour	North Cheyenne	1.17	0.04	1.21	5	8	9.21	260	365
SO2	24-hour	Cloud Peak W	0.55	0.01	0.55	91	8	8.55	260	365
SO2	3-hour	Badlands NP	1.8	0.81	1.97	25	8	9.97	1300	1300
SO2	3-hour	Blackelk WA	4.66	0.23	4.66	512	8	12.66	1300	1300
SO2	3-hour	Mt. Rushmore	3.94	0.23	3.95	512	8	11.95	1300	1300
SO2	3-hour	Wind Cave NP	2.69	0.38	2.69	25	8	10.69	1300	1300
SO2	3-hour	Jewel Cave N	4.93	0.15	4.93	512	8	12.93	1300	1300
SO2	3-hour	Devil's Tower	2.5	0.16	2.57	512	8	10.57	1300	1300
SO2	3-hour	North Cheyenne	3.09	0.11	3.19	25	8	11.19	1300	1300
SO2	3-hour	Cloud Peak W	1.71	0.04	1.71	512	8	9.71	1300	1300
PM10	Annual	Badlands NP	0.16	0.04	0.19	4	16.1	16.29	50	50
PM10	Annual	Blackelk WA	0.36	0.03	0.38	17	16.1	16.48	50	50
PM10	Annual	Mt. Rushmore	0.33	0.03	0.35	17	16.1	16.45	50	50
PM10	Annual	Wind Cave NP	0.34	0.03	0.37	4	16.1	16.47	50	50
PM10	Annual	Jewel Cave N	0.48	0.03	0.51	17	16.1	16.61	50	50
PM10	Annual	Devil's Tower	1.05	0.02	1.07	17	16.1	17.17	50	50
PM10	Annual	North Cheyenne	0.17	0.01	0.18	4	16.1	16.28	50	50
PM10	Annual	Cloud Peak W	0.18	0	0.19	17	16.1	16.29	50	50
PM10	24-hour	Badlands NP	1.57	0.75	1.85	8	46	47.85	150	150
PM10	24-hour	Blackelk WA	3.57	0.51	3.68	30	46	49.68	150	150
PM10	24-hour	Mt. Rushmore	3.5	0.51	3.61	30	46	49.61	150	150
PM10	24-hour	Wind Cave NP	2.81	0.56	2.93	8	46	48.93	150	150
PM10	24-hour	Jewel Cave N	4.16	0.35	4.17	30	46	50.17	150	150
PM10	24-hour	Devil's Tower	5.93	0.51	6.16	30	46	52.16	150	150
PM10	24-hour	North Cheyenne	4.25	0.5	4.25	8	46	50.25	150	150
PM10	24-hour	Cloud Peak W	5.23	0.22	5.31	30	46	51.31	150	150
PM25	Annual	Badlands NP	0	0	0	-999	5.6	5.6	15	15
PM25	Annual	Blackelk WA	0	0	0	-999	5.6	5.6	15	15

Pollutant	Avg. Time	Receptor Area	Non-DM&E	DM&E Project	Cumulative	PSD Inc.	Background	Total Impact	WAAQS	NAAQS
PM25	Annual	Mt. Rushmore	0	0	0	-999	5.6	5.6	15	15
PM25	Annual	Wind Cave NP	0	0	0	-999	5.6	5.6	15	15
PM25	Annual	Jewel Cave N	0	0	0	-999	5.6	5.6	15	15
PM25	Annual	Devil's Tower	0	0	0	-999	5.6	5.6	15	15
PM25	Annual	North Cheyenne	0	0	0	-999	5.6	5.6	15	15
PM25	Annual	Cloud Peak W	0	0	0	-999	5.6	5.6	15	15
PM25	24-hour	Badlands NP	0	0.03	0.03	-999	16.1	16.13	65	65
PM25	24-hour	Blackelk WA	0	0.01	0.01	-999	16.1	16.11	65	65
PM25	24-hour	Mt. Rushmore	0	0.01	0.01	-999	16.1	16.11	65	65
PM25	24-hour	Wind Cave NP	0	0.02	0.02	-999	16.1	16.12	65	65
PM25	24-hour	Jewel Cave N	0	0.01	0.01	-999	16.1	16.11	65	65
PM25	24-hour	Devil's Tower	0	0.01	0.01	-999	16.1	16.11	65	65
PM25	24-hour	North Cheyenne	0	0.01	0.01	-999	16.1	16.11	65	65
PM25	24-hour	Cloud Peak W	0	0	0	-999	16.1	16.1	65	65
NO2	Annual	Badlands NP	0.11	0.13	0.24	2	16.5	16.74	100	100
NO2	Annual	Blackelk WA	0.2	0.07	0.27	25	16.5	16.77	100	100
NO2	Annual	Mt. Rushmore	0.19	0.07	0.26	25	16.5	16.76	100	100
NO2	Annual	Wind Cave NP	0.25	0.09	0.33	2	16.5	16.83	100	100
NO2	Annual	Jewel Cave N	0.31	0.06	0.38	25	16.5	16.88	100	100
NO2	Annual	Devil's Tower	0.46	0.04	0.51	25	16.5	17.01	100	100
NO2	Annual	North Cheyenne	0.06	0.01	0.07	2	16.5	16.57	100	100
NO2	Annual	Cloud Peak W	0.03	0	0.03	25	16.5	16.53	100	100

ACID DEPOSITION IMPACTS

Table 5-3 summarizes the total sulfur and nitrogen deposition at Florence Lake and averaged across the Badlands and Wind Cave National Parks due to the cumulative emissions (DM&E Project plus Other New Sources). Also shown in Table 5-3 is the change in Acid Neutralizing Capacity (ANC) at Florence Lake in the Clouds Peak Wilderness Area using the equations and background ANC provided by the USDA Forest Service (FS). The nitrogen deposition calculations include the nitrogen associated with the ammonium attached to the sulfate (two nitrogens) and particulate nitrate (1 nitrogen). In the past, the FS threshold of concern for changes in ANC is 10%. For all Project Alternatives, the cumulative (Project plus Other New Sources) changes in ANC is always less than 2%, well below the 10% threshold of concern.

Table 5-3. Estimated total sulfur and nitrogen deposition impacts at Florence Lake in the Clouds Peak Wilderness Area averaged and across Badlands and Wind Cave National Parks and estimated changes in Acid Neutralizing Capacity (AMC) at Florence due to the Project and Other New Sources.

Receptor Area	Sulfur (kg/ha/yr)	Nitrogen (kg/ha/yr)	Percent ANC Change
	Route B 20 MNT		
Florence_Lake	0.0063	0.0133	1.7
Badlands NP	0.0146	0.0315	
Wind Cave NP	0.0449	0.0845	
	Route C 20 MNT		
Florence_Lake	0.0063	0.0133	1.7
Badlands NP	0.0143	0.0308	
Wind Cave NP	0.0449	0.0842	
	Route D 20 MNT		
Florence_Lake	0.0063	0.0135	1.7
Badlands NP	0.0153	0.0347	
Wind Cave NP	0.0462	0.0882	
	Route B 50 MNT		
Florence_Lake	0.0063	0.0136	1.7
Badlands NP	0.0148	0.0369	
Wind Cave NP	0.0451	0.0915	
	Route C 50 MNT		
Florence_Lake	0.0063	0.0137	1.7
Badlands NP	0.0145	0.0358	
Wind Cave NP	0.0451	0.0912	
	Route D 50 MNT		
Florence_Lake	0.0064	0.0141	1.7
Badlands NP	0.0155	0.042	
Wind Cave NP	0.0465	0.0975	
	Route B 100 MNT		
Florence_Lake	0.0063	0.0142	1.7
Badlands NP	0.0151	0.0455	
Wind Cave NP	0.0455	0.1028	
	Route C 100 MNT		
Florence_Lake	0.0063	0.0144	1.8
Badlands NP	0.0148	0.0437	
Wind Cave NP	0.0454	0.1023	
	Route D 100 MNT		
Florence_Lake	0.0064	0.0149	1.8
Badlands NP	0.016	0.0536	
Wind Cave NP	0.047	0.1124	

6. VISIBILITY IMPACTS OF THE PROPOSED PROJECT

In this section we present the estimated visibility impacts of the proposed Project at sensitive Class I and II areas in the region. Chapter 7 presents the visibility impacts of the Other New Sources and the Cumulative (the Project plus Other New Sources) visibility impacts.

The effects of emissions from the Project Alternatives on visibility degradation at the sensitive receptor areas were evaluated using the IWAQM-recommended visibility background and the FLAG-recommended equations as discussed in Chapter 4. In this method, the visibility degradation due to the Project are compared against a background visibility based on the mean of the 20 percent cleanest days from a long-term record of the IMPROVE reconstructed mass measurement data. For the sensitive receptor areas located east of Campbell County, Wyoming, the Badlands IMPROVE data was used to represent background visibility. Whereas for the sensitive receptor areas located west of Campbell County (i.e., Cloud Peak Wilderness Area and Northern Cheyenne Reservation) the Bridger IMPROVE data were used to define the visibility background.

Two measures of changes in visibility over background have been used in the past to assess the visibility impacts of new sources, changes in extinction and changes in deciview (dv). Threshold levels of concern for the changes in extinction over background are > 5% and >10%, whereas thresholds of concern for the changes in deciview are > 0.5 Δdv and > 1.0 Δdv. The USDA Forest Service has used the 0.5 Δdv change in the past as a level of acceptable change (LAC) threshold in order to protect visibility in sensitive area from visibility changes. The 1.0 Δdv threshold was used in the Regional Haze Regulations as a small but potentially visible change in visibility.

The 5% change in extinction and 0.5 Δdv thresholds are very close to being mathematically equivalent and produce nearly identical number of days of impacts. Similarly, the > 10% change in extinction and > 1.0 Δdv thresholds also produce nearly identical number of days of exceedances. The presentation of both the percent change in extinction and changes in deciview is redundant. Thus, in this section we just discuss the number of days in which the DM&E Project Alternative visibility impacts exceed the 5% and 10% change in extinction over background thresholds at the sensitive areas. The deciview calculations that produce almost identical number of days exceeding the thresholds of concern are provided in Appendix C and will be referred to in the next section (Chapter 7). Note that the 5% and 10% change in extinction and the 0.5 Δdv and 1.0 Δdv thresholds are neither standards nor regulatory limits. Rather, they are used to alert the affected land managers that potential adverse visibility impacts may exist and the land managers may wish to examine the magnitude, duration, frequency, and source of the impacts in more detail in order to make a determination as to whether the impacts are adverse.

CHANGE IN EXTINCTION

The estimated number of days in which each of the Project alternatives is estimated to produce changes in extinction that exceeds 5 percent and 10 percent of the clean (mean of the cleanest 20 percent days) visibility background at each of the sensitive Class I and II areas are provided in Table 6-1. The following are some observations regarding the visibility impacts due to the Project Alternatives at the sensitive Class I and II receptor areas:

- The Route C Project Alternative always has lower visibility impacts than the other two Routes at all levels of coal transport, this is likely due to the fact that it is shorter and has less emissions (see Table 3-5);
- The Routes B and C at 20MNT of coal transport Project Alternatives are estimated to have no days with visibility impacts exceeding the 5% and 10% change in extinction thresholds;
- The Route D at 20MNT Project Alternative is estimated to have only one day of changes in extinction that exceeds the 5% over background threshold (6.0% at Badlands National Park);
- Under the 50MNT coal transport alternative, the Route B, C, and D alternatives are estimated to have, respectively, 5, 4, and 24 sensitive area-days that exceed the 5% threshold. Both the Route B and C alternatives at 50MNT have no days that exceed the 10% threshold and the Route D 50MNT alternative has 1 day that exceeds the 10% threshold (13.4% at Badlands National Park);
- Under the 100MNT coal transport alternative, Routes B, C, and D are estimated to have 36, 31, and 79 sensitive area-days that exceed the 5% extinction threshold and 5, 4, and 20 sensitive area-days that exceed the 10% extinction threshold, respectively;

The CALPUFF modeling estimates that Route D has significantly more days of potentially adverse visibility impacts than either Routes B and C. Route C has slightly less days of visibility impacts that exceed the 5% and 10% thresholds of concern than Route B.

Under the 20MNT alternative, both the Route B and C alternatives estimate that there would be no days in which emissions from the Project would cause visibility degradation to exceed any thresholds of concern at any of the sensitive Class I and II areas. Thus, the Route B and C 20MNT Project Alternatives would not have any adverse visibility impacts by any measure.

Under the 50MNT coal transport alternative, all three alternative routes estimate there would be some days in which the estimated change in extinction over background would exceed the 5% threshold of concern. Under these conditions, in order for the Federal Land Managers to determine whether the visibility impacts are adverse the magnitude, frequency, and duration of the visibility impacts need to be examined more closely which is discussed next.

Table 6-1. Number of days emissions from the Project Alternatives are estimated to cause changes in visibility extinction greater than 5 percent and greater than 10 percent above a clean background visibility at the sensitive Class I and II areas.

	Alternative Route B			Alternative Route C			Alternative Route D		
	Run: rtb-20mnt-T0+1AC			Run: rtc-20mnt-T0+1AC			Run: rtd-20mnt-T0+1AC		
	DM&E_Sources			DM&E_Sources			DM&E_Sources		
	Area	#days >5%	#days >10%	Max %	Area	#days >5%	#days >10%	Max %	Area	#days >5%	#days >10%	Max %
20MNT	Badlands NP	0	0	3.2	Badlands NP	0	0	2.2	Badlands NP	1	0	6.0
	Blackelk WA	0	0	2.2	Blackelk WA	0	0	2.2	Blackelk WA	0	0	4.0
	Mt. Rushmore	0	0	2.1	Mt. Rushmore	0	0	2.1	Mt. Rushmore	0	0	4.0
	Wind Cave NP	0	0	2.8	Wind Cave NP	0	0	2.8	Wind Cave NP	0	0	4.4
	Jewel Cave N	0	0	1.6	Jewel Cave N	0	0	1.6	Jewel Cave N	0	0	2.5
	Devil's Towe	0	0	3.5	Devil's Towe	0	0	3.7	Devil's Towe	0	0	4.1
	North Cheyen	0	0	2.4	North Cheyen	0	0	2.6	North Cheyen	0	0	3.6
	Cloud Peak W	0	0	1.1	Cloud Peak W	0	0	1.2	Cloud Peak W	0	0	1.4
	Run: rtb-50mnt-T0+1AC				Run: rtc-50mnt-T0+1AC				Run: rtd-50mnt-T0+1AC			
	DM&E_Sources				DM&E_Sources				DM&E_Sources			
	Area	#days >5%	#days >10%	Max %	Area	#days >5%	#days >10%	Max %	Area	#days >5%	#days >10%	Max %
50MNT	Badlands NP	1	0	7.0	Badlands NP	0	0	4.5	Badlands NP	10	1	13.4
	Blackelk WA	0	0	4.5	Blackelk WA	0	0	4.4	Blackelk WA	3	0	8.2
	Mt. Rushmore	0	0	4.3	Mt. Rushmore	0	0	4.3	Mt. Rushmore	3	0	8.1
	Wind Cave NP	1	0	5.8	Wind Cave NP	1	0	5.6	Wind Cave NP	2	0	9.0
	Jewel Cave N	0	0	3.3	Jewel Cave N	0	0	3.3	Jewel Cave N	2	0	5.3
	Devil's Towe	1	0	7.5	Devil's Towe	1	0	8.1	Devil's Towe	1	0	9.0
	North Cheyen	2	0	5.4	North Cheyen	2	0	5.9	North Cheyen	3	0	8.0
	Cloud Peak W	0	0	2.5	Cloud Peak W	0	0	2.8	Cloud Peak W	0	0	3.2
	Run: rtb-100mnt-T0+1AC				Run: rtc-100mnt-T0+1AC				Run: rtd-100mnt-T0+1AC			
	DM&E_Sources				DM&E_Sources				DM&E_Sources			
	Area	#days >5%	#days >10%	Max %	Area	#days >5%	#days >10%	Max %	Area	#days >5%	#days >10%	Max %
100MNT	Badlands NP	12	1	13.2	Badlands NP	9	0	8.3	Badlands NP	31	7	25.3
	Blackelk WA	5	0	8.1	Blackelk WA	3	0	8.0	Blackelk WA	9	3	14.9
	Mt. Rushmore	4	0	7.7	Mt. Rushmore	3	0	7.7	Mt. Rushmore	7	3	14.7
	Wind Cave NP	3	1	10.5	Wind Cave NP	3	1	10.2	Wind Cave NP	12	2	16.2
	Jewel Cave N	5	0	6.1	Jewel Cave N	4	0	6.0	Jewel Cave N	8	1	10.0
	Devil's Towe	3	1	14.1	Devil's Towe	4	1	15.0	Devil's Towe	5	1	16.6
	North Cheyen	4	2	10.2	North Cheyen	4	2	11.2	North Cheyen	6	3	15.1
	Cloud Peak W	0	0	4.6	Cloud Peak W	1	0	5.2	Cloud Peak W	1	0	6.1

DETAILED ANALYSIS OF THE PROJECTS VISIBILITY IMPACTS

When it is estimated the Project will have days in which the visibility impacts exceed the thresholds of concern, the Federal Land Managers analyze the frequency, magnitude, and duration of the Project's visibility impacts in order to make an adverse impact determination. In this section we analyze these issues for each day in which the Projects visibility impacts are estimated to be 5-10% over background and > 10% over background. Because the Badlands and Wind Cave National Parks are Federally mandatory Class I areas, they have special protection under the Regional Haze Regulations. Thus, particular attention is played to the visibility impacts at the two NPS mandatory Class I areas.

20MNT Project Alternatives

Tables 6-2 through 6-4 summarize the contributions of extinction due to the Project Alternatives at, respectively, 20MNT, 50MNT, and 100MNT levels of coal transport. These tables show the contributions to the total extinction by each pollutant for every day in which the Project is estimated to produces changes in extinction that are between 5-10% and > 10% over background visibility. Under the 20MNT coal transport alternative, that is assumed to require 8 round trip trains a day, both alternative routes B and C have no days that exceed the visibility thresholds of concern and route D has one day when the change in extinction over background is in the 5-10% range. This occurs on January 16, 1990 at the Badlands National Park where the Route D 20MNT alternative is estimated to cause a change in extinction of 6.0% over the clean background level. The 6.0% change in extinction due to the Project at Badlands is 80% due to particle scattering from ammonium nitrate followed by 12 percent due to particle absorption by elemental carbon (EC) and 3 percent each due to absorption by NO_2 and particle scattering by sulfate.

50MNT Project Alternatives

The 50MNT Project Alternatives are assumed to use 18 locomotives on each train for coal hauling as compared to 8 locomotives for the 20MNT scenario resulting in over twice as many emissions. Thus there are more days in which the change in extinction is estimated to exceed the 5% and 10% thresholds of concern (Table 6-3). The 50MNT Route B and C alternatives have, respectively 5 and 4 sensitive area-days in which the change in extinction over clean background is estimated to be in the 5-10% range. The breakdown in the pollutant contributions to the Project's extinction increment is approximately 80% ammonium nitrate, 10% elemental carbon, 5 percent sulfate, and 1-2% each NO_2 and organic carbon. That is, ammonium nitrate is the dominant contributor to the Projects visibility impairment at the sensitive Class I and II areas. The Route D 50MNT alternative has more visibility impairment impacts at the sensitive Class I and II areas than the other two routes. It is estimated that the Route D 50MNT Project Alternative would produce 24 sensitive-area days covering 15 unique days in which the 5% extinction threshold of concern would be exceeded, and one day in which the 10% threshold would be exceeded. In terms of the protected mandatory Class I areas (i.e., Badlands and Wind Cave NP), the 50MNT Route B, C, and D Project Alternatives are estimated to exceed the 5% change in extinction threshold of concern on, respectively, 2, 1, and 12 days.

100MNT Project Alternatives

Each of the alternative routes has > 30 sensitive area-days in which the 5% change in extinction threshold of concern is exceeded under the 100MNT coal transport alternative (Table 6-4). Again, the Route D alternative has more sensitive area-days in which the 5% change in extinction over background visibility threshold is exceeded (79 days) than Routes B and C, which have a comparable number of sensitive area-days exceeding the 5% over background-extinction threshold (36 and 31, respectively). At 100MNT of coal transport, the 10% change in extinction over background threshold of concern is exceeded 5, 4, and 20 sensitive area-days for routes B, C, and D, respectively. As seen for the other levels of coal transport, ammonium nitrate always contributes the largest amount to the extinction budget with contributions ranging from 54 to 91 percent for the Route D 100MNT Project Alternative. The second most important species is elemental carbon that contributes from 3 to 27 percent (Route D 100MNT). Across all sensitive area-days in which the 5% change in extinction threshold over background was exceeded for the Route D 100MNT scenario, the average contribution of the various species to the extinction budget are as follows: 77.3% ammonium nitrate; 12.1% elemental carbon; 5.8% sulfate; 2.7% NO_2; 1.8% organic carbon; and 0.4% other PM. The contribution by species results for the other Project Alternatives are similar.

Table 6-2a. Days when emissions from the proposed DM&E Project are estimated to cause visibility extinction to be between 5-10 percent and over 10 percent of background visibility for the Route B 20MNT project alternative.

Days When Extinction due to DM&E Sources are Between 5-10% of Background (Route B 20MNT)
None
Days When Extinction due to DM&E Sources are > 10% of Background (Route B 20MNT)
None

Table 6-2b. Days when emissions from the proposed DM&E Project are estimated to cause visibility extinction to be between 5-10 percent and over 10 percent of background visibility for the Route C 20MNT project alternative.

Days When Extinction due to DM&E Sources are Between 5-10% of Background (Route C 20MNT)
None
Days When Extinction due to DM&E Sources are > 10% of Background (Route C 20MNT)
None

Table 6-2c. Days when emissions from the proposed DM&E Project are estimated to cause visibility extinction to be between 5-10 percent and over 10 percent of background visibility for the Route D 20MNT project alternative.

Days When Extinction due to DM&E Sources are Between 5-10% of Background (Route D 20MNT)

Date	SensitiveArea	%Change	Background Bext	DM&E Bext	%Contributions SO4	NO3	PM	EC	OC	NO2
1/16/90	Badlands N	6.0	14.4	0.9	2.8	79.5	0.4	12.4	1.9	3.1

Days When Extinction due to DM&E Sources are > 10% of Background (Route D 20MNT)
None

Table 6-3a. Days when emissions from the proposed DM&E Project are estimated to cause visibility extinction to be between 5-10 percent and over 10 percent of background visibility for the Route B 50MNT project alternative.

Days When Extinction due to DM&E Sources are Between 5-10% of Background (Route B 50MNT)

Date	SensitiveArea	%Change	Background Bext	DM&E Bext	%Contributions SO4	NO3	PM	EC	OC	NO2
2/ 1/90	North Chey	5.4	14.4	0.8	5.8	82.3	0.3	9.0	1.4	1.2
2/ 2/90	North Chey	5.3	14.4	0.8	6.3	81.8	0.3	9.2	1.4	1.0
2/25/90	Devil's To	7.6	14.4	1.1	5.4	83.3	0.3	8.3	1.3	1.4
3/13/90	Badlands N	7.1	17.6	1.2	3.6	80.5	0.4	11.0	1.7	2.8
4/12/90	Wind Cave	5.8	17.6	1.0	5.5	83.5	0.3	7.8	1.2	1.6

Days When Extinction due to DM&E Sources are > 10% of Background (Route B 50MNT)

None

Table 6-3b. Days when emissions from the proposed DM&E Project are estimated to cause visibility extinction to be between 5-10 percent and over 10 percent of background visibility for the Route C 50MNT project alternative.

Days When Extinction due to DM&E Sources are Between 5-10% of Background (Route C 50MNT)

Date	SensitiveArea	%Change	Background Bext	DM&E Bext	%Contributions SO4	NO3	PM	EC	OC	NO2
2/ 1/90	North Chey	5.9	14.4	0.9	5.8	82.3	0.3	9.0	1.4	1.2
2/ 2/90	North Chey	5.5	14.4	0.8	6.3	81.8	0.3	9.2	1.4	1.0
2/25/90	Devil's To	8.1	14.4	1.2	5.3	83.6	0.3	8.2	1.3	1.3
4/12/90	Wind Cave	5.6	17.6	1.0	5.6	83.9	0.3	7.6	1.2	1.5

Days When Extinction due to DM&E Sources are > 10% of Background (Route C 50MNT)

None

Table 6-3c. Days when emissions from the proposed DM&E Project are estimated to cause visibility extinction to be between 5-10 percent and over 10 percent of background visibility for the Route D 50MNT project alternative.

Days When Extinction due to DM&E Sources are Between 5-10% of Background (Route D 50MNT)

Date	SensitiveArea	%Change	Background Bext	DM&E Bext	%Contributions SO4	NO3	PM	EC	OC	NO2
1/16/90	North Chey	6.1	14.4	0.9	7.5	69.3	0.6	16.5	2.5	3.6
1/17/90	Badlands N	5.0	14.4	0.7	5.4	80.4	0.4	10.1	1.5	2.2
1/19/90	Badlands N	6.0	14.4	0.9	4.6	69.3	0.6	17.9	2.7	4.9
2/ 1/90	North Chey	8.0	14.4	1.2	5.8	81.9	0.3	9.3	1.4	1.3
2/ 2/90	North Chey	6.1	14.4	0.9	6.3	81.8	0.3	9.1	1.4	1.0
2/25/90	Devil's To	9.0	14.4	1.3	5.2	83.2	0.3	8.6	1.3	1.4
3/13/90	Badlands N	7.0	17.6	1.2	4.0	85.3	0.3	7.6	1.2	1.6
4/12/90	Blackelk W	8.2	17.6	1.4	5.3	84.8	0.3	7.2	1.1	1.3
4/12/90	Mt. Rushmo	8.1	17.6	1.4	5.4	84.9	0.3	7.1	1.1	1.3
4/12/90	Wind Cave	9.0	17.6	1.6	5.5	83.8	0.3	7.7	1.2	1.6
4/12/90	Jewel Cave	5.2	17.6	0.9	5.9	85.5	0.2	6.5	1.0	0.9
4/28/90	Badlands N	8.1	17.6	1.4	3.6	85.6	0.3	7.6	1.2	1.8
4/28/90	Blackelk W	7.7	17.6	1.4	4.3	91.3	0.1	3.3	0.5	0.5
4/28/90	Mt. Rushmo	7.8	17.6	1.4	4.3	91.2	0.1	3.3	0.5	0.5
4/28/90	Wind Cave	6.7	17.6	1.2	4.4	91.0	0.1	3.5	0.5	0.5
4/28/90	Jewel Cave	5.3	17.6	0.9	4.4	91.2	0.1	3.3	0.5	0.5
5/18/90	Blackelk W	6.6	17.6	1.2	6.8	76.4	0.4	12.1	1.8	2.5
5/18/90	Mt. Rushmo	6.6	17.6	1.2	6.8	76.2	0.4	12.1	1.8	2.5
5/27/90	Badlands N	6.9	17.6	1.2	3.7	79.7	0.4	11.5	1.8	2.9
6/15/90	Badlands N	5.5	18.9	1.0	3.8	69.9	0.6	18.2	2.8	4.7
8/19/90	Badlands N	5.2	18.9	1.0	4.8	60.6	0.9	25.3	3.9	4.5
11/19/90	Badlands N	6.0	16.3	1.0	6.4	70.8	0.6	16.7	2.5	3.0
12/11/90	Badlands N	7.7	14.4	1.1	5.6	66.1	0.7	19.5	3.0	5.2

Days When Extinction due to DM&E Sources are > 10% of Background (Route D 50MNT)

Date	SensitiveArea	%Change	Background Bext	DM&E Bext	%Contributions SO4	NO3	PM	EC	OC	NO2
1/16/90	Badlands N	13.4	14.4	1.9	2.8	79.5	0.4	12.4	1.9	3.1

Table 6-4a. Days when emissions from the proposed DM&E Project are estimated to cause visibility extinction to be between 5-10 percent and over 10 percent of background visibility for the Route B 100MNT project alternative.

Days When Extinction due to DM&E Sources are Between 5-10% of Background (Route B 100MNT)

Date	SensitiveArea	%Change	Background Bext	DM&E Bext	%Contributions SO4	NO3	PM	EC	OC	NO2
1/16/90	Badlands N	6.8	14.4	1.0	4.6	63.7	0.8	21.9	3.3	5.8
1/16/90	Jewel Cave	6.1	14.4	0.9	5.5	76.9	0.4	12.7	1.9	2.5
1/16/90	Devil's To	7.6	14.4	1.1	5.9	77.7	0.4	11.2	1.7	3.1
1/16/90	North Chey	8.2	14.4	1.2	7.5	68.9	0.6	16.8	2.6	3.6
1/17/90	Badlands N	5.1	14.4	0.7	6.4	76.1	0.4	12.4	1.9	2.7
2/ 1/90	Devil's To	5.5	14.4	0.8	5.9	82.2	0.3	8.7	1.3	1.6
2/ 2/90	Badlands N	8.4	14.4	1.2	5.9	69.9	0.6	16.7	2.6	4.3
2/25/90	Blackelk W	6.6	14.4	1.0	5.4	82.2	0.3	9.1	1.4	1.7
2/25/90	Mt. Rushmo	6.5	14.4	0.9	5.4	82.0	0.3	9.2	1.4	1.7
2/25/90	Jewel Cave	5.4	14.4	0.8	5.3	80.7	0.4	10.0	1.5	2.0
3/ 5/90	North Chey	7.6	17.6	1.3	4.7	83.5	0.3	8.2	1.3	2.0
3/13/90	Blackelk W	5.0	17.6	0.9	4.4	86.0	0.2	6.8	1.0	1.4
3/13/90	Wind Cave	8.0	17.6	1.4	4.2	84.9	0.3	7.7	1.2	1.8
3/13/90	Jewel Cave	5.4	17.6	1.0	4.5	85.9	0.2	7.0	1.1	1.4
4/12/90	Badlands N	7.5	17.6	1.3	5.9	86.0	0.2	6.1	0.9	0.9
4/12/90	Blackelk W	8.1	17.6	1.4	6.0	83.8	0.3	7.4	1.1	1.4
4/12/90	Mt. Rushmo	7.7	17.6	1.4	6.0	83.9	0.3	7.3	1.1	1.3
4/12/90	Jewel Cave	6.0	17.6	1.1	6.1	85.1	0.2	6.5	1.0	1.0
4/24/90	Badlands N	5.2	17.6	0.9	8.4	81.8	0.3	7.4	1.1	1.1
4/28/90	Blackelk W	5.6	17.6	1.0	4.4	88.5	0.2	5.1	0.8	1.0
4/28/90	Mt. Rushmo	5.4	17.6	0.9	4.4	88.1	0.2	5.4	0.8	1.1
4/28/90	Wind Cave	5.3	17.6	0.9	4.4	88.6	0.2	5.1	0.8	1.0
4/28/90	Jewel Cave	5.7	17.6	1.0	4.4	90.4	0.1	3.8	0.6	0.7
5/18/90	Blackelk W	5.4	17.6	0.9	7.8	71.2	0.5	14.9	2.3	3.4
5/18/90	Mt. Rushmo	5.3	17.6	0.9	7.7	71.1	0.5	15.0	2.3	3.4
5/27/90	Badlands N	7.2	17.6	1.3	2.8	76.3	0.5	14.2	2.2	4.0
11/19/90	Badlands N	8.7	16.3	1.4	7.0	63.5	0.7	21.1	3.2	4.5
12/11/90	Badlands N	6.9	14.4	1.0	7.7	58.2	0.8	23.5	3.6	6.2
12/17/90	Badlands N	6.0	14.4	0.9	5.9	62.4	0.8	22.2	3.4	5.4
12/22/90	Badlands N	6.6	14.4	1.0	6.7	59.5	0.9	24.1	3.7	5.2
12/26/90	Badlands N	8.4	14.4	1.2	7.6	67.8	0.6	17.9	2.7	3.3

Days When Extinction due to DM&E Sources are > 10% of Background (Route B 100MNT)

Date	SensitiveArea	%Change	Background Bext	DM&E Bext	%Contributions SO4	NO3	PM	EC	OC	NO2
2/ 1/90	North Chey	10.2	14.4	1.5	5.8	82.3	0.3	9.0	1.4	1.2
2/ 2/90	North Chey	10.0	14.4	1.4	6.3	81.7	0.3	9.2	1.4	1.0
2/25/90	Devil's To	14.1	14.4	2.0	5.5	83.1	0.3	8.5	1.3	1.4
3/13/90	Badlands N	13.2	17.6	2.3	3.7	80.2	0.4	11.2	1.7	2.8
4/12/90	Wind Cave	10.5	17.6	1.8	5.8	82.9	0.3	8.2	1.2	1.7

Table 6-4b. Days when emissions from the proposed DM&E Project are estimated to cause visibility extinction to be between 5-10 percent and over 10 percent of background visibility for the Route C 100MNT project alternative.

Days When Extinction due to DM&E Sources are Between 5-10% of Background (Route C 100MNT)

Date	SensitiveArea	%Change	Background Bext	DM&E Bext	%Contributions SO4	NO3	PM	EC	OC	NO2
1/16/90	Jewel Cave	5.8	14.4	0.8	5.6	76.9	0.4	12.6	1.9	2.5
1/16/90	Devil's To	7.9	14.4	1.1	5.7	78.4	0.4	10.8	1.7	3.0
1/16/90	North Chey	9.2	14.4	1.3	7.2	70.1	0.6	16.2	2.5	3.4
1/16/90	Cloud Peak	5.2	14.4	0.8	6.4	79.4	0.4	10.4	1.6	1.9
2/ 1/90	Devil's To	5.3	14.4	0.8	5.9	82.4	0.3	8.6	1.3	1.5
2/ 2/90	Badlands N	7.4	14.4	1.1	6.1	70.9	0.6	16.2	2.5	3.7
2/ 2/90	Wind Cave	5.0	14.4	0.7	6.9	79.8	0.3	9.7	1.5	1.7
2/25/90	Blackelk W	6.3	14.4	0.9	5.4	82.7	0.3	8.7	1.3	1.5
2/25/90	Mt. Rushmo	6.2	14.4	0.9	5.4	82.4	0.3	8.9	1.4	1.6
2/25/90	Jewel Cave	5.3	14.4	0.8	5.4	80.7	0.4	10.0	1.5	2.0
3/ 5/90	North Chey	7.2	17.6	1.3	4.7	83.4	0.3	8.2	1.3	2.0
3/13/90	Badlands N	7.9	17.6	1.4	4.3	82.1	0.3	9.6	1.5	2.2
3/13/90	Blackelk W	5.4	17.6	0.9	4.4	86.1	0.2	6.8	1.0	1.4
3/13/90	Mt. Rushmo	5.2	17.6	0.9	4.4	85.7	0.3	7.1	1.1	1.5
3/13/90	Wind Cave	7.3	17.6	1.3	4.3	85.5	0.3	7.2	1.1	1.6
3/13/90	Jewel Cave	5.5	17.6	1.0	4.4	86.1	0.2	6.8	1.0	1.4
3/13/90	Devil's To	5.0	17.6	0.9	4.1	83.4	0.3	8.7	1.3	2.1
4/12/90	Badlands N	6.8	17.6	1.2	6.0	86.7	0.2	5.6	0.8	0.7
4/12/90	Blackelk W	8.0	17.6	1.4	6.0	84.1	0.3	7.3	1.1	1.3
4/12/90	Mt. Rushmo	7.7	17.6	1.4	6.0	84.2	0.3	7.2	1.1	1.3
4/12/90	Jewel Cave	6.0	17.6	1.1	6.1	85.0	0.2	6.6	1.0	1.0
4/24/90	Badlands N	5.0	17.6	0.9	8.0	82.9	0.2	6.8	1.0	1.0
11/19/90	Badlands N	8.3	16.3	1.3	7.0	64.4	0.7	20.5	3.1	4.2
12/11/90	Badlands N	7.1	14.4	1.0	7.4	61.0	0.8	21.8	3.3	5.7
12/17/90	Badlands N	5.2	14.4	0.7	6.1	65.4	0.7	20.2	3.1	4.6
12/22/90	Badlands N	6.0	14.4	0.9	6.8	61.2	0.8	22.9	3.5	4.8
12/26/90	Badlands N	8.2	14.4	1.2	7.6	67.8	0.6	18.0	2.7	3.3

Days When Extinction due to DM&E Sources are > 10% of Background (Route C 100MNT)

Date	SensitiveArea	%Change	Background Bext	DM&E Bext	%Contributions SO4	NO3	PM	EC	OC	NO2
2/ 1/90	North Chey	11.2	14.4	1.6	5.8	82.3	0.3	9.0	1.4	1.2
2/ 2/90	North Chey	10.4	14.4	1.5	6.3	81.8	0.3	9.2	1.4	1.0

2/25/90	Devil's To	15.0	14.4	2.2	5.4	83.3	0.3	8.3	1.3	1.4
4/12/90	Wind Cave	10.2	17.6	1.8	5.9	83.2	0.3	7.9	1.2	1.6

Table 6-4c. Days when emissions from the proposed DM&E Project are estimated to cause visibility extinction to be between 5-10 percent and over 10 percent of background visibility for the Route D 100MNT project alternative.

Days When Extinction due to DM&E Sources are Between 5-10% of Background (Route D 100MNT)

Date	SensitiveArea	%Change	Background Bext	DM&E Bext	%Contributions SO4	NO3	PM	EC	OC	NO2
1/13/90	Badlands N	6.5	14.4	0.9	6.3	53.6	1.0	26.9	4.1	8.2
1/15/90	Badlands N	7.3	14.4	1.1	3.6	65.6	0.7	21.1	3.2	5.7
1/16/90	Blackelk W	6.3	14.4	0.9	5.2	79.9	0.4	10.6	1.6	2.3
1/16/90	Mt. Rushmo	6.2	14.4	0.9	5.2	79.8	0.4	10.7	1.6	2.3
1/16/90	Jewel Cave	5.9	14.4	0.8	5.7	78.3	0.4	11.6	1.8	2.3
1/16/90	Devil's To	9.1	14.4	1.3	5.9	79.0	0.4	10.4	1.6	2.8
1/16/90	Cloud Peak	6.1	14.4	0.9	6.6	79.0	0.4	10.5	1.6	1.9
1/17/90	Badlands N	9.5	14.4	1.4	5.4	80.4	0.4	10.1	1.5	2.2
1/17/90	Wind Cave	5.6	14.4	0.8	6.4	79.7	0.3	9.9	1.5	2.1
1/20/90	Badlands N	5.4	14.4	0.8	5.8	70.2	0.6	17.0	2.6	3.8
2/ 1/90	Badlands N	5.1	14.4	0.7	4.5	59.4	0.9	25.2	3.8	6.2
2/ 1/90	Blackelk W	5.1	14.4	0.7	5.9	79.2	0.4	10.7	1.6	2.1
2/ 1/90	Wind Cave	5.3	14.4	0.8	6.2	74.5	0.5	13.7	2.1	3.0
2/ 1/90	Jewel Cave	5.6	14.4	0.8	6.1	78.9	0.4	10.8	1.6	2.3
2/ 1/90	Devil's To	7.2	14.4	1.0	5.9	82.4	0.3	8.5	1.3	1.5
2/ 2/90	Badlands N	9.1	14.4	1.3	6.1	77.0	0.4	12.0	1.8	2.6
2/ 2/90	Blackelk W	6.0	14.4	0.9	7.0	80.7	0.3	9.1	1.4	1.4
2/ 2/90	Mt. Rushmo	5.9	14.4	0.8	6.9	80.8	0.3	9.2	1.4	1.4
2/ 2/90	Wind Cave	7.0	14.4	1.0	7.0	78.6	0.4	10.5	1.6	1.9
2/ 2/90	Jewel Cave	6.5	14.4	0.9	7.1	79.6	0.3	9.8	1.5	1.7
2/ 2/90	Devil's To	5.7	14.4	0.8	7.1	80.6	0.3	9.1	1.4	1.4
2/14/90	North Chey	5.2	14.4	0.7	5.1	83.9	0.3	8.2	1.2	1.3
2/18/90	Badlands N	6.1	14.4	0.9	5.4	76.0	0.5	13.2	2.0	3.0
2/25/90	Blackelk W	8.0	14.4	1.2	5.3	82.4	0.3	9.0	1.4	1.7
2/25/90	Mt. Rushmo	8.0	14.4	1.1	5.3	82.3	0.3	9.1	1.4	1.7
2/25/90	Jewel Cave	5.8	14.4	0.8	5.3	81.1	0.3	9.8	1.5	2.0
2/28/90	Badlands N	5.5	14.4	0.8	4.9	81.4	0.3	9.7	1.5	2.2
3/ 5/90	North Chey	6.4	17.6	1.1	4.7	83.8	0.3	8.0	1.2	2.0
3/ 7/90	Badlands N	6.9	17.6	1.2	3.7	79.3	0.4	11.5	1.7	3.4
3/ 8/90	Blackelk W	5.0	17.6	0.9	4.1	89.9	0.2	4.5	0.7	0.7
3/ 8/90	Wind Cave	5.1	17.6	0.9	4.1	89.3	0.2	4.9	0.7	0.8
3/13/90	Blackelk W	7.0	17.6	1.2	4.4	86.1	0.2	6.9	1.1	1.3

3/13/90	Mt. Rushmo	6.5	17.6	1.1	4.4	85.8	0.3	7.1	1.1	1.3
3/13/90	Wind Cave	7.7	17.6	1.3	4.3	85.1	0.3	7.5	1.1	1.7
3/13/90	Jewel Cave	7.1	17.6	1.2	4.3	86.5	0.2	6.7	1.0	1.3
3/13/90	Devil's To	5.9	17.6	1.0	4.4	78.8	0.4	11.6	1.8	3.0
4/12/90	Badlands N	8.5	17.6	1.5	5.9	88.3	0.2	4.5	0.7	0.4
4/12/90	Jewel Cave	9.6	17.6	1.7	6.1	85.0	0.2	6.7	1.0	0.9
4/24/90	Badlands N	7.3	17.6	1.3	8.0	83.0	0.2	6.8	1.0	1.0
5/11/90	Badlands N	6.8	17.6	1.2	3.7	89.5	0.1	4.2	0.6	1.8
5/13/90	Badlands N	7.0	17.6	1.2	4.7	77.1	0.4	12.4	1.9	3.4
5/18/90	Wind Cave	6.7	17.6	1.2	7.5	73.2	0.5	13.5	2.1	3.2
5/18/90	Jewel Cave	6.6	17.6	1.2	9.9	77.5	0.3	9.5	1.4	1.4
5/26/90	Badlands N	5.4	17.6	1.0	11.8	71.0	0.4	12.6	1.9	2.2
5/27/90	Wind Cave	5.2	17.6	0.9	8.2	61.3	0.7	19.9	3.0	6.8
5/28/90	North Chey	7.7	17.6	1.3	8.8	82.0	0.2	6.9	1.0	1.0
6/15/90	Badlands N	9.8	18.9	1.9	3.7	67.8	0.7	19.7	3.0	5.1
6/15/90	Wind Cave	7.3	18.9	1.4	4.8	58.9	0.9	25.1	3.8	6.4
8/19/90	Badlands N	9.1	18.9	1.7	5.2	57.7	1.0	27.1	4.1	4.8
9/28/90	Badlands N	7.3	16.3	1.2	4.5	79.6	0.4	11.7	1.8	2.0
9/29/90	Badlands N	6.3	16.3	1.0	6.5	83.7	0.3	7.2	1.1	1.2
9/29/90	Wind Cave	5.6	16.3	0.9	6.9	80.8	0.3	9.1	1.4	1.6
12/10/90	Badlands N	6.4	14.4	0.9	8.6	53.5	0.9	26.5	4.0	6.4
12/11/90	Wind Cave	5.1	14.4	0.7	7.6	61.9	0.8	21.6	3.3	4.8
12/16/90	Badlands N	6.9	14.4	1.0	4.3	57.4	0.9	25.5	3.9	8.0
12/17/90	Badlands N	7.4	14.4	1.1	5.8	66.3	0.7	19.6	3.0	4.7
12/22/90	Badlands N	5.8	14.4	0.8	7.2	63.0	0.8	21.6	3.3	4.2
12/25/90	Badlands N	5.6	14.4	0.8	6.2	65.1	0.7	21.0	3.2	3.7
12/26/90	Badlands N	9.4	14.4	1.4	7.7	60.3	0.8	22.4	3.4	5.3

Days When Extinction due to DM&E Sources are > 10% of Background (Route D 100MNT)

Date	SensitiveArea	%Change	Background	DM&E	%Contributions					
			Bext	Bext	SO4	NO3	PM	EC	OC	NO2
1/16/90	Badlands N	25.3	14.4	3.7	2.8	79.5	0.4	12.4	1.9	3.1
1/16/90	North Chey	11.5	14.4	1.7	7.5	69.2	0.6	16.6	2.5	3.6
1/19/90	Badlands N	11.2	14.4	1.6	4.6	69.1	0.6	18.0	2.7	4.9
2/ 1/90	North Chey	15.1	14.4	2.2	5.8	81.9	0.3	9.3	1.4	1.3
2/ 2/90	North Chey	11.5	14.4	1.7	6.3	81.8	0.3	9.1	1.4	1.0
2/25/90	Devil's To	16.6	14.4	2.4	5.3	82.9	0.3	8.7	1.3	1.4
3/13/90	Badlands N	13.0	17.6	2.3	4.0	85.1	0.3	7.7	1.2	1.7

4/12/90	Blackelk W	14.9	17.6	2.6	5.6	84.2	0.3	7.5	1.1	1.4
4/12/90	Mt. Rushmo	14.6	17.6	2.6	5.6	84.3	0.3	7.4	1.1	1.4
4/12/90	Wind Cave	16.2	17.6	2.8	5.7	83.0	0.3	8.1	1.2	1.7
4/28/90	Badlands N	15.3	17.6	2.7	3.6	85.6	0.3	7.6	1.2	1.8
4/28/90	Blackelk W	14.6	17.6	2.6	4.3	91.3	0.1	3.3	0.5	0.5
4/28/90	Mt. Rushmo	14.7	17.6	2.6	4.3	91.2	0.1	3.3	0.5	0.5
4/28/90	Wind Cave	12.6	17.6	2.2	4.4	91.0	0.1	3.5	0.5	0.5
4/28/90	Jewel Cave	10.0	17.6	1.8	4.4	91.2	0.1	3.3	0.5	0.5
5/18/90	Blackelk W	11.3	17.6	2.0	7.6	73.7	0.5	13.4	2.0	2.8
5/18/90	Mt. Rushmo	11.1	17.6	2.0	7.6	73.5	0.5	13.5	2.1	2.8
5/27/90	Badlands N	12.1	17.6	2.1	4.0	78.1	0.4	12.4	1.9	3.2
11/19/90	Badlands N	11.0	16.3	1.8	6.6	69.8	0.6	17.3	2.6	3.1
12/11/90	Badlands N	14.2	14.4	2.1	5.5	65.5	0.7	19.9	3.0	5.4

DISCUSSION OF WHETHER THE IMPACTS ARE ADVERSE

There is no bright line on what defines an adverse visibility impact at a sensitive Class I or II receptor area. The 5% and 10% change in extinction over background thresholds of concern have been developed to alert the Federal Land Managers that potentially adverse visibility impacts may have occurred at which point the frequency, duration, and magnitude of the impacts are analyzed in more detail to assess whether they are significant.

Two recent similar EISs in the area have been conducted that assessed the air quality impacts of the proposed projects, the Wyodak CBM Project EIS (BLM, 199a) and the Horse Creek Coal Lease Application EIS (BLM, 199b). Although the Horse Creek EIS did not do a separate visibility assessment of the project alone, the Wyodak CBM Project did. In addition, the National Park Service (NPS) made comments on whether the Wyodak Project visibility impacts were adverse, which is used here to help interpret the visibility impacts of the proposed DM&E Project.

The NPS provided the BLM with a comment letter on the estimated visibility impacts in the Badlands and Wind Cave National Parks of the Wyodak CBM Project (letter from John Bunyak NPS to Richard Zander BLM dated July 14, 1999, reference N3615 (2350)). In this letter the NPS determines that: "The visibility analysis indicates that the Wyodak project alone would cause a change greater than 0.5 deciview (or a 5% change in background extinction) for 4 days at Badlands NP and for 3 days at Wind Cave NP. Based on the frequency, magnitude, and duration of the impacts, the NPS has determined that the impacts from the Wyodak project alone are not adverse." (Bunyak, 1999). The comment letter went on to say, "The NPS considers that a 10% change in extinction (1.0 deciview change) is an adverse impact in a NPS Class I area."

Table 6-5 compares the number of days the 5% and 10% change in extinction thresholds are exceeded for the various DM&E Project Alternatives with those from the Wyodak Project EIS that the NPS has determined do not have an adverse visibility impact at Badlands and Wind Cave National Parks. Clearly, the DM&E Project Alternatives at 20MNT annual coal hauling for all three alternative routes have lower visibility impacts then the Wyodak CBM Project, so therefore the visibility impacts of the DM&E Project at 20MNT would be considered not adverse based on past analysis.

At the DM&E 50MNT coal hauling level, the Routes B and C Project Alternative visibility impacts are both less than the Wyodak Project, so therefore would also not be considered adverse. The visibility impacts for the Route D 50MNT Project Alternative are slightly greater than seen for the Wyodak CBM Project. We cannot say whether the NPS would determine that the Route D 50MNT Project Alternative visibility impacts are adverse. However, based on the fact that this Project Alternative did exceed the 10% change in extinction threshold at the Badlands NP, it seems it would likely be determined to be adverse.

Finally, the visibility impacts of the proposed Project at 100MNT are greater than those from the Wyodak CBM Project for all three Project Alternative routes, all three routes have days that exceed the 10% threshold. Thus, again we can not say for sure whether the NPS would consider this level of impacts adverse but it would be very likely.

In summary, based on previous determinations by Federal Land Managers on what constitutes an adverse visibility impact we conclude the following:

- The DM&E Project Alternatives at 20MNT for all three alternative routes and at 50MNT for Routes B and C have visibility impacts that are less than visibility impacts in the past that were considered not adverse;
- The DM&E Project Alternative Route D at 50MNT have visibility impacts that are greater than those that have been determined are not adverse in the past and may be considered adverse; and
- The DM&E Project Alternatives at 100MNT for all three routes are greater than what has been determined to be not adverse in the past and would likely be considered adverse with Routes B and C visibility impacts being much less than for Route D, and the Route C impacts being slightly less than Route B.

Table 6-5. Comparison with the DM&E Project Alternatives visibility impacts with those from the Wyodak CBM EIS that the NPS has determined were not adverse for Badlands and Wind Cave National Parks.

	20MNT Project Alternative			50MNT Project Alternative			100MNT Project Alternative			WYODAK CMB EIS
	Rt. B	Rt. C	Rt. D	Rt. B	Rt. C	Rt. D	Rt. B	Rt. C	Rt. D	(BLM, 1999a)
Sensitive Area-Days > 5% (days)	0	0	1	5	4	24	36	31	79	18
Unique Days > 5% (days)	0	0	1	5	4	15	17	13	37	NA
Sensitive Area-Days Between 5-10% (days)	0	0	1	5	4	23	31	27	59	17
Sensitive Area-Days > 10% (days)	0	0	0	0	0	1	5	4	20	1
Badlands NP Between 5-10% (days)	0	0	1	1	0	9	11	9	24	4
Wind Cave NP Between 5-10% (days)	0	0	0	1	1	2	2	2	10	3
Badlands NP > 10% (days)	0	0	0	0	0	1	1	0	7	0
Wind Cave NP > 10% (days)	0	0	0	0	0	0	1	1	2	0
Maximum at Badlands NP (%)	3.2	2.2	6.0	7.1	4.6	13.4	13.2	8.3	25.3	NA
Maximum at Wind Cave NP (%)	2.8	2.8	4.4	5.8	5.6	9.0	10.5	10.2	16.2	NA

7. CUMULATIVE VISIBILITY IMPACTS

In this section we analyze the visibility impacts due to: (1) new permitted and reasonably foreseeable developed (RFD) sources since 1996 (Other New Sources); (2) the DM&E Project Alternatives (the Project); and (3) the Cumulative Impacts (Other New Sources plus the Project). In the previous section we discussed the visibility impacts of the Project in detail, so in this Chapter we focus on the Other New Sources and Cumulative Sources impacts and the contributions of the Project to the Cumulative Impacts.

CHANGES IN EXTINCTION

Table 7-1 and Appendix C summarizes the number of days per year the changes in extinction are estimated to exceed 5% and 10% of a clean background at the sensitive receptor areas due to the Other New Sources, the DM&E Project, and the Cumulative Sources (Other New plus DM&E Project Sources). Similar results for the number of days in which the Other New Sources, the DM&E Project, and the Cumulative visibility impacts are estimated to exceed the 0.5 Δdv and 1.0 Δdv thresholds are provided in Appendix D. Emissions from the Other New Sources are estimated to result in 525 and 230 sensitive area-days in which the changes in extinction over background are estimated to exceed the 5% and 10% thresholds, respectively. At the Badlands National Park, the 5% and 10% extinction thresholds are estimated to be exceeded 61 and 25 days per year, respectively, due to the Other New Sources. Similar results for Wind Cave National Park are 72 and 23 days per year, respectively.

The visibility impacts due to the Other New Sources appear to be quite high. The emissions for the Other New Sources were taken from the Wyodak CBM and Horse Creek Coal Lease Application EIS studies (BLM, 1999a,b). Thus, their accuracy and validity are not known. As has been pointed out in Chapter 5, the fugitive dust emissions from all mining and related activities in the Powder River Basin (Campbell County, Wyoming) were treated using one very large area source rectangle (see Figure 3-1). CALPUFF will treat this source as one very large coherent puff that will be advected using a single wind, even though there may be wind shear across the puff. This treatment will likely overstate its impacts at far downwind receptors.

The visibility impacts due to the Cumulative Sources are estimated to exceed the 10% extinction thresholds anywhere from 236 (Route C at 20MNT) to 292 (Route D at 100MNT) sensitive area-days per year. At Badlands National Park, the 10% extinction threshold is estimated to be exceeded 12 times per year due to the Other New Sources, which is increased by 1 (Route C at 20MNT) to 5 (Route D at 50MNT) days per year for the 20MNT and 50MNT Project Alternatives. The 100MNT Route B and C alternatives are estimated to increase the number of days the 10% threshold is exceeded over those due to just the Other New Sources by 9-10 days per year (from 12 to 21 and 22 days per year), but the Route D 100MNT alternative is estimated to increase it by 21 days per year (from 12 to 33 days per year).

COMPARISON WITH PREVIOUS STUDIES

The analysis of the cumulative visibility impacts due to the DM&E Project and Other New Sources estimates 236-293 sensitive area-days of impacts in which the changes in extinction are estimated to exceed 10%. The Wyodak CBM and Horse Creek EISs also provided cumulative visibility impacts to almost the identical set of proposed new sources and estimated cumulative visibility impacts of, respectively, 500 and 237 sensitive area-days. Thus, the DM&E Project cumulative visibility impacts are within the range of the Horse Creek and much less than the Wyodak cumulative emissions impact. At the Badlands National Park, the DM&E Project EIS (15-33 days) estimates much fewer days that the 10% change in extinction threshold would be exceeded than the Wyodak (78 days) or Horse Creek (70 days) estimate. We believe that this is due to the more accurate calculations and refined representation of the DM&E railway expansion Project emissions in this study.

DETAILED ANALYSIS OF THE DM&E PROJECT CONTRIBUTION TO THE CUMULATIVE IMPACTS

Appendices E and F display the breakdown in contributions between the Other New Sources and the DM&E Project for every sensitive area day in which the 10% change in extinction threshold is exceeded for the, respectively, Route C 50MNT and Route D 100MNT Project Alternatives. These two Project Alternatives were selected to represent the range of potential impacts due to the Project Alternatives. From a fairly low scenario (Route C at 50MNT) whose visibility impacts alone are below those that have been determined in the past to not be adverse (see Section 6), to the maximum emissions scenario (Route D 100MNT). Their selection does not indicate a preference for either of these two alternatives over the Other Project Alternatives rather they are use for illustrative purposes only.

For the Route C 50MNT Project Alternative (Appendix E), the average change in extinction across all 248 days in which the 10% change in extinction threshold was exceeded is 16.6% over background visibility. Of this, the Other New Sources are estimated to contribute on average15.4% over background visibility and the DM&E Project contributes on average 1.2% over background visibility. That is, on average the cumulative visibility impacts at the sensitive Class I and II areas are primarily (97 percent) due to the Other New Sources.

For the worst case Project Alternative (Route D at 100MNT), on average the DM&E Project is estimated to contribute 19 percent and the Other New Sources 81 percent to the average of the change in extinction greater than 10% over background. That is, even in the worst case scenario, a majority of the visibility degradation is due to the Other New Sources on average.

Table 7-1. Number of days per year that the Other New Sources, the Project Sources, and the cumulative emission sources are estimated to cause visibility to exceed 5% and 10% over the clean background at the sensitive Class I and II receptor areas.

Sensitive Area	Other New Sources			DM&E Project			Cumulative Sources			Date of Max	Contrib to Max	
	#days >5%	#days >10%	Max %	#days >5%	#days >10%	Max %	#days >5%	#days >10%	Max %		Other %	DM&E %
Route B at 20MNT												
Badlands NP	33	12	18.1	0	0	3.2	40	14	19.3	12/26/90	17.3	2.0
Blackelk WA	61	25	23.6	0	0	2.2	66	25	24.3	1/20/90	23.6	0.8
Mt. Rushmore	59	22	22.3	0	0	2.1	59	22	23	1/20/90	22.3	0.7
Wind Cave NP	72	23	22.9	0	0	2.8	78	25	23.8	1/17/90	22.9	0.9
Jewel Cave N	87	38	28.3	0	0	1.6	92	40	29.3	1/20/90	28.3	0.9
Devil's Towe	143	69	60.9	0	0	3.5	143	70	64.4	2/25/90	60.9	3.5
North Cheyen	38	24	73.2	0	0	2.4	38	24	75.2	1/16/90	73.2	1.9
Cloud Peak W	32	17	41.1	0	0	1.1	33	17	42.2	1/16/90	41.1	1.1
Route C at 20MNT												
Badlands NP	33	12	18.1	0	0	2.2	39	13	19.3	1/17/90	18.1	1.1
Blackelk WA	61	25	23.6	0	0	2.2	66	25	24.5	1/20/90	23.6	1.0
Mt. Rushmore	59	22	22.3	0	0	2.1	59	22	23.2	1/20/90	22.3	0.9
Wind Cave NP	72	23	22.9	0	0	2.8	78	25	23.9	1/17/90	22.9	1.0
Jewel Cave N	87	38	28.3	0	0	1.6	93	40	29.5	1/20/90	28.3	1.2
Devil's Towe	143	69	60.9	0	0	3.7	143	70	64.6	2/25/90	60.9	3.7
North Cheyen	38	24	73.2	0	0	2.6	38	24	75.4	1/16/90	73.2	2.2
Cloud Peak W	32	17	41.1	0	0	1.2	33	17	42.3	1/16/90	41.1	1.2
Route D at 20MNT												
Badlands NP	33	12	18.1	1	0	6.0	45	14	19.8	1/17/90	18.1	1.7
Blackelk WA	61	25	23.6	0	0	4.0	68	25	24.5	1/20/90	23.6	0.9
Mt. Rushmore	59	22	22.3	0	0	4.0	63	22	23.2	1/20/90	22.3	0.9
Wind Cave NP	72	23	22.9	0	0	4.4	79	27	24.2	1/17/90	22.9	1.2
Jewel Cave N	87	38	28.3	0	0	2.5	92	40	29.4	1/20/90	28.3	1.0
Devil's Towe	143	69	60.9	0	0	4.1	144	70	65	2/25/90	60.9	4.1
North Cheyen	38	24	73.2	0	0	3.6	38	24	76	1/16/90	73.2	2.7
Cloud Peak W	32	17	41.1	0	0	1.4	33	17	42.5	1/16/90	41.1	1.4
Route B at 500MNT												
Badlands NP	33	12	18.1	1	0	7.1	51	15	21.7	12/26/90	17.3	4.4
Blackelk WA	61	25	23.6	0	0	4.5	72	28	25.3	1/20/90	23.6	1.7
Mt. Rushmore	59	22	22.3	0	0	4.3	65	23	23.8	1/20/90	22.3	1.6
Wind Cave NP	72	23	22.9	1	0	5.8	79	29	24.9	1/17/90	22.9	2.0
Jewel Cave N	87	38	28.3	0	0	3.3	96	40	30.5	1/20/90	28.3	2.1
Devil's Towe	143	69	60.9	1	0	7.6	144	70	68.4	2/25/90	60.9	7.6
North Cheyen	38	24	73.2	2	0	5.4	39	24	77.6	1/16/90	73.2	4.4
Cloud Peak W	32	17	41.1	0	0	2.5	33	19	43.5	1/16/90	41.1	2.5
Route C at 50MNT												
Badlands NP	33	12	18.1	0	0	4.6	52	15	21.6	12/26/90	17.3	4.3
Blackelk WA	61	25	23.6	0	0	4.4	73	28	25.7	1/20/90	23.6	2.2
Mt. Rushmore	59	22	22.3	0	0	4.3	65	23	24.3	1/20/90	22.3	2.0
Wind Cave NP	72	23	22.9	1	0	5.6	79	28	25.1	1/17/90	22.9	2.2
Jewel Cave N	87	38	28.3	0	0	3.3	96	40	31	1/20/90	28.3	2.6
Devil's Towe	143	69	60.8	1	0	8.1	144	71	68.9	2/25/90	60.8	8.1
North Cheyen	38	24	73.2	2	0	5.9	39	24	78.1	1/16/90	73.2	4.9
Cloud Peak W	32	17	41.1	0	0	2.8	33	19	43.8	1/16/90	41.1	2.8
Route D at 50MNT												
Badlands NP	33	12	18.1	10	1	13.4	58	17	22.6	12/11/90	14.9	7.7
Blackelk WA	61	25	23.6	3	0	8.2	75	28	25.6	1/20/90	23.6	2.1
Mt. Rushmore	59	22	22.3	3	0	8.1	70	23	24.3	1/20/90	22.3	2.0
Wind Cave NP	72	23	22.9	2	0	9.0	82	29	25.7	1/17/90	22.9	2.8
Jewel Cave N	87	38	28.3	2	0	5.3	98	41	30.7	1/20/90	28.3	2.3
Devil's Towe	143	69	60.8	1	0	9.0	146	71	69.8	2/25/90	60.8	9.0

Sensitive Area	Other New Sources			DM&E Project			Cumulative Sources			Date of Max	Contrib to Max	
	#days >5%	#days >10%	Max %	#days >5%	#days >10%	Max %	#days >5%	#days >10%	Max %		Other %	DM&E %
North Cheyen	38	24	73.2	3	0	8.0	40	24	79.3	1/16/90	73.2	6.1
Cloud Peak W	32	17	41.1	0	0	3.2	34	20	44.3	1/16/90	41.1	3.2
Route B at 100MNT												
Badlands NP	33	12	18.1	12	1	13.2	60	21	25.7	12/26/90	17.3	8.4
Blackelk WA	61	25	23.6	5	0	8.1	77	29	26.8	1/20/90	23.6	3.2
Mt. Rushmore	59	22	22.3	4	0	7.7	74	26	25.2	1/20/90	22.3	3.0
Wind Cave NP	72	23	22.9	3	1	10.5	84	30	26.7	1/17/90	22.9	3.8
Jewel Cave N	87	38	28.3	5	0	6.1	99	41	32.3	1/20/90	28.3	4.0
Devil's Towe	143	69	60.8	3	1	14.1	147	72	74.9	2/25/90	60.8	14.1
North Cheyen	38	24	73.2	4	2	10.2	40	24	81.5	1/16/90	73.2	8.2
Cloud Peak W	32	17	41.1	0	0	4.6	35	20	45.7	1/16/90	41.1	4.6
Route C at 100MNT												
Badlands NP	33	12	18.1	9	0	8.3	57	22	25.4	12/26/90	17.3	8.2
Blackelk WA	61	25	23.6	3	0	8.0	78	30	27.6	1/20/90	23.6	4.1
Mt. Rushmore	59	22	22.3	3	0	7.7	74	28	26.1	1/20/90	22.3	3.8
Wind Cave NP	72	23	22.9	3	1	10.2	84	32	27.1	1/17/90	22.9	4.2
Jewel Cave N	87	38	28.3	4	0	6.0	99	41	33.3	1/20/90	28.3	5.0
Devil's Towe	143	69	60.8	4	1	15.0	146	72	75.8	2/25/90	60.8	15
North Cheyen	38	24	73.2	4	2	11.2	40	24	82.5	1/16/90	73.2	9.2
Cloud Peak W	32	17	41.1	1	0	5.2	35	20	46.3	1/16/90	41.1	5.2
Route D at 100MNT												
Badlands NP	33	12	18.1	31	7	25.3	82	33	29.1	12/11/90	14.9	14.2
Blackelk WA	61	25	23.6	9	3	14.9	85	33	27.5	1/20/90	23.6	3.9
Mt. Rushmore	59	22	22.3	7	3	14.7	80	30	26.1	1/20/90	22.3	3.8
Wind Cave NP	72	23	22.9	12	2	16.2	92	34	29.7	4/12/90	14.8	15.0
Jewel Cave N	87	38	28.3	8	1	10.0	105	44	32.7	1/20/90	28.3	4.4
Devil's Towe	143	69	60.8	5	1	16.6	150	74	77.4	2/25/90	60.8	16.6
North Cheyen	38	24	73.2	6	3	15.1	41	24	84.7	1/16/90	73.2	11.5
Cloud Peak W	32	17	41.1	1	0	6.1	35	20	47.1	1/16/90	41.1	6.1

Table 7-2. Comparison of the number of days per year the 10% change in extinction (or 1.0 Δdv) threshold is estimated to be exceeded in the DM&E Project EIS and the Wyodak and Horse Creek EIS.

	DM&E EIS		Wyodak CBM EIS	Horse Creek EIS
	Other	Cumulative (Route C 50MNT)	Cumulative (Route D 100MNT)	Cumulative	Cumulative
Badlands NP	12	15	33	78	70
Black Elk WA	25	28	33	52	28
Mt. Rushmore NM	22	23	30	47	22
Wind Cave NP	23	28	34	89	45
Jewel Cave NM	38	40	44	64	32
Devil's Tower NM	69	71	74	70	28
N. Cheyenne Res.	24	24	24	74	8
Cloud Peak WA	17	19	20	26	4
Total	230	248	292	500	237

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APPENDIX A

Near-Source Air Quality Impacts
Maximum CALPUFF Estimated Concentrations ($\mu g/m^3$)

PRBEP DM&E Railway Expansion Project Impacts
Three Alternative Railway Routes (rtb, rtc, and rtd)
Three Levels of Annual Coal Transport (20mnt, 50mnt, and 100mnt)

Project Impacts
Impacts Due to Other New Sources
Cumulative Impacts (Project + Other New Sources)
Total Concentration (Project + Other New Sources + Background)

Run: rtb-20mnt-T0+1AC 1990_Concentrations(ug/m^3)

Pollutant	Avg_Time	Area	Non-DM&E	DM&E	All	PSD	Background	Total	WAAQS	NAAQS
SO2	Annual	Near_Source	1.14	0.01	1.14	20	3.00	4.14	60.0	80.0
SO2	24-hour	Near_Source	8.35	0.16	8.35	91	8.00	16.35	260.0	365.0
SO2	3-hour	Near_Source	32.55	0.73	32.55	512	8.00	40.55	1300.0	1300.0
PM10	Annual	Near_Source	9.64	0.01	9.64	17	16.10	25.74	50.0	50.0
PM10	24-hour	Near_Source	67.41	0.13	67.42	30	46.00	113.42	150.0	150.0
PM25	Annual	Near_Source	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	24-hour	Near_Source	6.38	0.13	6.39	-999	16.10	22.49	65.0	65.0
NO2	Annual	Near_Source	3.28	0.02	3.29	25	16.50	19.79	100.0	100.0
CO	1-hour	Near_Source	0.00	2.56	2.56	-999	3500.00	3502.56	40000.0	40000.0
CO	8-hour	Near_Source	0.00	0.85	0.85	-999	1500.00	1500.85	10000.0	10000.0

Run: rtc-20mnt-T0+1AC 1990_Concentrations(ug/m^3)

Pollutant	Avg_Time	Area	Non-DM&E	DM&E	All	PSD	Background	Total	WAAQS	NAAQS
SO2	Annual	Near_Source	1.14	0.01	1.14	20	3.00	4.14	60.0	80.0
SO2	24-hour	Near_Source	8.35	0.12	8.35	91	8.00	16.35	260.0	365.0
SO2	3-hour	Near_Source	32.55	0.75	32.55	512	8.00	40.55	1300.0	1300.0
PM10	Annual	Near_Source	9.64	0.01	9.64	17	16.10	25.74	50.0	50.0
PM10	24-hour	Near_Source	67.41	0.15	67.43	30	46.00	113.43	150.0	150.0
PM25	Annual	Near_Source	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	24-hour	Near_Source	6.38	0.15	6.39	-999	16.10	22.49	65.0	65.0
NO2	Annual	Near_Source	3.28	0.02	3.29	25	16.50	19.79	100.0	100.0
CO	1-hour	Near_Source	0.00	3.90	3.90	-999	3500.00	3503.90	40000.0	40000.0
CO	8-hour	Near_Source	0.00	0.68	0.68	-999	1500.00	1500.68	10000.0	10000.0

Run: rtd-20mnt-T0+1AC 1990_Concentrations(ug/m^3)

Pollutant	Avg_Time	Area	Non-DM&E	DM&E	All	PSD	Background	Total	WAAQS	NAAQS
SO2	Annual	Near_Source	1.14	0.03	1.14	20	3.00	4.14	60.0	80.0
SO2	24-hour	Near_Source	8.35	0.73	8.35	91	8.00	16.35	260.0	365.0
SO2	3-hour	Near_Source	32.55	5.03	32.55	512	8.00	40.55	1300.0	1300.0
PM10	Annual	Near_Source	9.64	0.01	9.64	17	16.10	25.74	50.0	50.0
PM10	24-hour	Near_Source	67.41	0.49	67.42	30	46.00	113.42	150.0	150.0
PM25	Annual	Near_Source	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	24-hour	Near_Source	6.38	0.49	6.38	-999	16.10	22.48	65.0	65.0
NO2	Annual	Near_Source	3.28	0.08	3.30	25	16.50	19.80	100.0	100.0
CO	1-hour	Near_Source	0.00	19.58	19.58	-999	3500.00	3519.58	40000.0	40000.0
CO	8-hour	Near_Source	0.00	3.65	3.65	-999	1500.00	1503.65	10000.0	10000.0

Run: rtb-50mnt-T0+1AC 1990_Concentrations(ug/m^3)

Pollutant	Avg_Time	Area	Non-DM&E	DM&E	All	PSD	Background	Total	WAAQS	NAAQS
SO2	Annual	Near_Source	1.14	0.01	1.14	20	3.00	4.14	60.0	80.0
SO2	24-hour	Near_Source	8.35	0.16	8.35	91	8.00	16.35	260.0	365.0
SO2	3-hour	Near_Source	32.55	0.73	32.55	512	8.00	40.55	1300.0	1300.0
PM10	Annual	Near_Source	9.64	0.01	9.64	17	16.10	25.74	50.0	50.0
PM10	24-hour	Near_Source	67.41	0.28	67.43	30	46.00	113.43	150.0	150.0
PM25	Annual	Near_Source	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	24-hour	Near_Source	6.38	0.28	6.41	-999	16.10	22.51	65.0	65.0
NO2	Annual	Near_Source	3.28	0.05	3.30	25	16.50	19.80	100.0	100.0
CO	1-hour	Near_Source	0.00	2.56	2.56	-999	3500.00	3502.56	40000.0	40000.0
CO	8-hour	Near_Source	0.00	0.85	0.85	-999	1500.00	1500.85	10000.0	10000.0

Run: rtc-50mnt-T0+1AC 1990_Concentrations(ug/m^3)

Pollutant	Avg_Time	Area	Non-DM&E	DM&E	All	PSD	Background	Total	WAAQS	NAAQS
SO2	Annual	Near_Source	1.14	0.01	1.14	20	3.00	4.14	60.0	80.0
SO2	24-hour	Near_Source	8.35	0.12	8.35	91	8.00	16.35	260.0	365.0
SO2	3-hour	Near_Source	32.55	0.75	32.55	512	8.00	40.55	1300.0	1300.0
PM10	Annual	Near_Source	9.64	0.01	9.65	17	16.10	25.75	50.0	50.0
PM10	24-hour	Near_Source	67.41	0.31	67.44	30	46.00	113.44	150.0	150.0
PM25	Annual	Near_Source	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	24-hour	Near_Source	6.38	0.31	6.41	-999	16.10	22.51	65.0	65.0
NO2	Annual	Near_Source	3.28	0.04	3.31	25	16.50	19.81	100.0	100.0
CO	1-hour	Near_Source	0.00	3.90	3.90	-999	3500.00	3503.90	40000.0	40000.0
CO	8-hour	Near_Source	0.00	0.68	0.68	-999	1500.00	1500.68	10000.0	10000.0

Run: rtd-50mnt-T0+1AC 1990_Concentrations(ug/m^3)

Pollutant	Avg_Time	Area	Non-DM&E	DM&E	All	PSD	Background	Total	WAAQS	NAAQS
SO2	Annual	Near_Source	1.14	0.03	1.14	20	3.00	4.14	60.0	80.0
SO2	24-hour	Near_Source	8.35	0.73	8.35	91	8.00	16.35	260.0	365.0
SO2	3-hour	Near_Source	32.55	5.03	32.55	512	8.00	40.55	1300.0	1300.0
PM10	Annual	Near_Source	9.64	0.02	9.65	17	16.10	25.75	50.0	50.0
PM10	24-hour	Near_Source	67.41	1.09	67.42	30	46.00	113.42	150.0	150.0
PM25	Annual	Near_Source	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	24-hour	Near_Source	6.38	1.09	6.39	-999	16.10	22.49	65.0	65.0
NO2	Annual	Near_Source	3.28	0.19	3.32	25	16.50	19.82	100.0	100.0
CO	1-hour	Near_Source	0.00	19.58	19.58	-999	3500.00	3519.58	40000.0	40000.0
CO	8-hour	Near_Source	0.00	3.65	3.65	-999	1500.00	1503.65	10000.0	10000.0

Run: rtb-100mnt-T0+1AC 1990_Concentrations(ug/m^3)

Pollutant	Avg_Time	Area	Non-DM&E	DM&E	All	PSD	Background	Total	WAAQS	NAAQS
SO2	Annual	Near_Source	1.14	0.01	1.14	20	3.00	4.14	60.0	80.0
SO2	24-hour	Near_Source	8.35	0.16	8.35	91	8.00	16.35	260.0	365.0
SO2	3-hour	Near_Source	32.55	0.73	32.55	512	8.00	40.55	1300.0	1300.0
PM10	Annual	Near_Source	9.64	0.03	9.65	17	16.10	25.75	50.0	50.0
PM10	24-hour	Near_Source	67.41	0.52	67.45	30	46.00	113.45	150.0	150.0
PM25	Annual	Near_Source	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	24-hour	Near_Source	6.38	0.52	6.45	-999	16.10	22.55	65.0	65.0
NO2	Annual	Near_Source	3.28	0.10	3.32	25	16.50	19.82	100.0	100.0
CO	1-hour	Near_Source	0.00	2.56	2.56	-999	3500.00	3502.56	40000.0	40000.0
CO	8-hour	Near_Source	0.00	0.85	0.85	-999	1500.00	1500.85	10000.0	10000.0

Run: rtc-100mnt-T0+1AC 1990_Concentrations(ug/m^3)

Pollutant	Avg_Time	Area	Non-DM&E	DM&E	All	PSD	Background	Total	WAAQS	NAAQS
SO2	Annual	Near_Source	1.14	0.01	1.14	20	3.00	4.14	60.0	80.0
SO2	24-hour	Near_Source	8.35	0.12	8.35	91	8.00	16.35	260.0	365.0
SO2	3-hour	Near_Source	32.55	0.75	32.55	512	8.00	40.55	1300.0	1300.0
PM10	Annual	Near_Source	9.64	0.02	9.65	17	16.10	25.75	50.0	50.0
PM10	24-hour	Near_Source	67.41	0.58	67.46	30	46.00	113.46	150.0	150.0
PM25	Annual	Near_Source	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	24-hour	Near_Source	6.38	0.58	6.45	-999	16.10	22.55	65.0	65.0
NO2	Annual	Near_Source	3.28	0.08	3.33	25	16.50	19.83	100.0	100.0
CO	1-hour	Near_Source	0.00	3.90	3.90	-999	3500.00	3503.90	40000.0	40000.0
CO	8-hour	Near_Source	0.00	0.68	0.68	-999	1500.00	1500.68	10000.0	10000.0

Run: rtd-100mnt-T0+1AC 1990_Concentrations(ug/m^3)

Pollutant	Avg_Time	Area	Non-DM&E	DM&E	All	PSD	Background	Total	WAAQS	NAAQS
SO2	Annual	Near_Source	1.14	0.03	1.14	20	3.00	4.14	60.0	80.0
SO2	24-hour	Near_Source	8.35	0.73	8.35	91	8.00	16.35	260.0	365.0
SO2	3-hour	Near_Source	32.55	5.03	32.55	512	8.00	40.55	1300.0	1300.0
PM10	Annual	Near_Source	9.64	0.04	9.65	17	16.10	25.75	50.0	50.0
PM10	24-hour	Near_Source	67.41	2.06	67.43	30	46.00	113.43	150.0	150.0
PM25	Annual	Near_Source	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	24-hour	Near_Source	6.38	2.06	6.41	-999	16.10	22.51	65.0	65.0
NO2	Annual	Near_Source	3.28	0.36	3.35	25	16.50	19.85	100.0	100.0
CO	1-hour	Near_Source	0.00	19.58	19.58	-999	3500.00	3519.58	40000.0	40000.0
CO	8-hour	Near_Source	0.00	3.65	3.65	-999	1500.00	1503.65	10000.0	10000.0

APPENDIX B

Far-Field Air Quality Impacts at Sensitive Class I and II Areas
Maximum CALPUFF Estimated Concentrations ($\mu g/m^3$)

PRBEP DM&E Railway Expansion Project Impacts
Three Alternative Railway Routes (rtb, rtc, and rtd)
Three Levels of Annual Coal Transport (20mnt, 50mnt, and 100mnt)

Project Impacts
Impacts Due to Other New Sources
Cumulative Impacts (Project + Other New Sources)
Total Concentration (Project + Other New Sources + Background)

Run: rtb-20mnt-T0+1AC 1990_Concentrations(ug/m^3)

Pollutant	Avg_Time	Area	Non-DM&E	DM&E	All	PSD	Background	Total	WAAQS	NAAQS
SO2	Annual	Badlands NP	0.05	0.01	0.05	2	3.00	3.05	60.0	80.0
SO2	Annual	Blackelk WA	0.11	0.00	0.11	20	3.00	3.11	60.0	80.0
SO2	Annual	Mt. Rushmore	0.09	0.00	0.10	20	3.00	3.10	60.0	80.0
SO2	Annual	Wind Cave NP	0.11	0.01	0.11	2	3.00	3.11	60.0	80.0
SO2	Annual	Jewel Cave N	0.16	0.00	0.16	20	3.00	3.16	60.0	80.0
SO2	Annual	Devil's Towe	0.14	0.00	0.14	20	3.00	3.14	60.0	80.0
SO2	Annual	North Cheyen	0.02	0.00	0.02	2	3.00	3.02	60.0	80.0
SO2	Annual	Cloud Peak W	0.01	0.00	0.01	20	3.00	3.01	60.0	80.0
SO2	24-hour	Badlands NP	0.48	0.10	0.54	5	8.00	8.54	260.0	365.0
SO2	24-hour	Blackelk WA	1.12	0.04	1.15	91	8.00	9.15	260.0	365.0
SO2	24-hour	Mt. Rushmore	1.02	0.04	1.05	91	8.00	9.05	260.0	365.0
SO2	24-hour	Wind Cave NP	1.31	0.05	1.32	5	8.00	9.32	260.0	365.0
SO2	24-hour	Jewel Cave N	1.64	0.03	1.65	91	8.00	9.65	260.0	365.0
SO2	24-hour	Devil's Towe	0.95	0.04	0.96	91	8.00	8.96	260.0	365.0
SO2	24-hour	North Cheyen	1.17	0.03	1.20	5	8.00	9.20	260.0	365.0
SO2	24-hour	Cloud Peak W	0.55	0.01	0.55	91	8.00	8.55	260.0	365.0
SO2	3-hour	Badlands NP	1.80	0.54	1.87	25	8.00	9.87	1300.0	1300.0
SO2	3-hour	Blackelk WA	4.66	0.14	4.66	512	8.00	12.66	1300.0	1300.0
SO2	3-hour	Mt. Rushmore	3.94	0.14	3.94	512	8.00	11.94	1300.0	1300.0
SO2	3-hour	Wind Cave NP	2.69	0.21	2.69	25	8.00	10.69	1300.0	1300.0
SO2	3-hour	Jewel Cave N	4.93	0.12	4.93	512	8.00	12.93	1300.0	1300.0
SO2	3-hour	Devil's Towe	2.50	0.09	2.51	512	8.00	10.51	1300.0	1300.0
SO2	3-hour	North Cheyen	3.09	0.09	3.17	25	8.00	11.17	1300.0	1300.0
SO2	3-hour	Cloud Peak W	1.71	0.03	1.72	512	8.00	9.72	1300.0	1300.0
PM10	Annual	Badlands NP	0.16	0.01	0.16	4	16.10	16.26	50.0	50.0
PM10	Annual	Blackelk WA	0.36	0.01	0.36	17	16.10	16.46	50.0	50.0
PM10	Annual	Mt. Rushmore	0.33	0.01	0.33	17	16.10	16.43	50.0	50.0
PM10	Annual	Wind Cave NP	0.34	0.01	0.34	4	16.10	16.44	50.0	50.0
PM10	Annual	Jewel Cave N	0.48	0.01	0.49	17	16.10	16.59	50.0	50.0
PM10	Annual	Devil's Towe	1.05	0.00	1.05	17	16.10	17.15	50.0	50.0
PM10	Annual	North Cheyen	0.17	0.00	0.17	4	16.10	16.27	50.0	50.0
PM10	Annual	Cloud Peak W	0.18	0.00	0.18	17	16.10	16.28	50.0	50.0

PM10	24-hour	Badlands NP	1.57	0.11	1.61	8	46.00	47.61	150.0	150.0
PM10	24-hour	Blackelk WA	3.57	0.08	3.59	30	46.00	49.59	150.0	150.0
PM10	24-hour	Mt. Rushmore	3.50	0.07	3.52	30	46.00	49.52	150.0	150.0
PM10	24-hour	Wind Cave NP	2.81	0.10	2.84	8	46.00	48.84	150.0	150.0
PM10	24-hour	Jewel Cave N	4.16	0.06	4.17	30	46.00	50.17	150.0	150.0
PM10	24-hour	Devil's Towe	5.93	0.10	5.94	30	46.00	51.94	150.0	150.0
PM10	24-hour	North Cheyen	4.25	0.09	4.25	8	46.00	50.25	150.0	150.0
PM10	24-hour	Cloud Peak W	5.23	0.04	5.25	30	46.00	51.25	150.0	150.0
PM25	Annual	Badlands NP	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	Annual	Blackelk WA	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	Annual	Mt. Rushmore	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	Annual	Wind Cave NP	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	Annual	Jewel Cave N	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	Annual	Devil's Towe	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	Annual	North Cheyen	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	Annual	Cloud Peak W	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	24-hour	Badlands NP	0.56	0.11	0.59	-999	16.10	16.69	65.0	65.0
PM25	24-hour	Blackelk WA	0.71	0.08	0.77	-999	16.10	16.87	65.0	65.0
PM25	24-hour	Mt. Rushmore	0.65	0.07	0.72	-999	16.10	16.82	65.0	65.0
PM25	24-hour	Wind Cave NP	0.73	0.10	0.77	-999	16.10	16.87	65.0	65.0
PM25	24-hour	Jewel Cave N	0.84	0.06	0.90	-999	16.10	17.00	65.0	65.0
PM25	24-hour	Devil's Towe	1.69	0.10	1.79	-999	16.10	17.89	65.0	65.0
PM25	24-hour	North Cheyen	1.58	0.09	1.67	-999	16.10	17.77	65.0	65.0
PM25	24-hour	Cloud Peak W	0.89	0.04	0.91	-999	16.10	17.01	65.0	65.0
NO2	Annual	Badlands NP	0.11	0.02	0.14	2	16.50	16.64	100.0	100.0
NO2	Annual	Blackelk WA	0.20	0.01	0.21	25	16.50	16.71	100.0	100.0
NO2	Annual	Mt. Rushmore	0.19	0.01	0.20	25	16.50	16.70	100.0	100.0
NO2	Annual	Wind Cave NP	0.25	0.02	0.27	2	16.50	16.77	100.0	100.0
NO2	Annual	Jewel Cave N	0.31	0.01	0.32	25	16.50	16.82	100.0	100.0
NO2	Annual	Devil's Towe	0.46	0.01	0.47	25	16.50	16.97	100.0	100.0
NO2	Annual	North Cheyen	0.06	0.00	0.06	2	16.50	16.56	100.0	100.0
NO2	Annual	Cloud Peak W	0.03	0.00	0.03	25	16.50	16.53	100.0	100.0

Run: rtc-20mnt-T0+1AC 1990_Concentrations(ug/m^3)

Pollutant	Avg_Time	Area	Non-DM&E	DM&E	All	PSD	Background	Total	WAAQS	NAAQS
SO2	Annual	Badlands NP	0.05	0.01	0.05	2	3.00	3.05	60.0	80.0
SO2	Annual	Blackelk WA	0.11	0.00	0.11	20	3.00	3.11	60.0	80.0
SO2	Annual	Mt. Rushmore	0.09	0.00	0.10	20	3.00	3.10	60.0	80.0
SO2	Annual	Wind Cave NP	0.11	0.01	0.11	2	3.00	3.11	60.0	80.0
SO2	Annual	Jewel Cave N	0.16	0.00	0.16	20	3.00	3.16	60.0	80.0
SO2	Annual	Devil's Towe	0.14	0.00	0.14	20	3.00	3.14	60.0	80.0
SO2	Annual	North Cheyen	0.02	0.00	0.02	2	3.00	3.02	60.0	80.0
SO2	Annual	Cloud Peak W	0.01	0.00	0.01	20	3.00	3.01	60.0	80.0
SO2	24-hour	Badlands NP	0.48	0.08	0.54	5	8.00	8.54	260.0	365.0
SO2	24-hour	Blackelk WA	1.12	0.03	1.14	91	8.00	9.14	260.0	365.0
SO2	24-hour	Mt. Rushmore	1.02	0.03	1.04	91	8.00	9.04	260.0	365.0
SO2	24-hour	Wind Cave NP	1.31	0.04	1.32	5	8.00	9.32	260.0	365.0
SO2	24-hour	Jewel Cave N	1.64	0.03	1.65	91	8.00	9.65	260.0	365.0
SO2	24-hour	Devil's Towe	0.95	0.04	0.96	91	8.00	8.96	260.0	365.0
SO2	24-hour	North Cheyen	1.17	0.03	1.20	5	8.00	9.20	260.0	365.0
SO2	24-hour	Cloud Peak W	0.55	0.01	0.55	91	8.00	8.55	260.0	365.0
SO2	3-hour	Badlands NP	1.80	0.39	1.87	25	8.00	9.87	1300.0	1300.0
SO2	3-hour	Blackelk WA	4.66	0.12	4.66	512	8.00	12.66	1300.0	1300.0
SO2	3-hour	Mt. Rushmore	3.94	0.11	3.94	512	8.00	11.94	1300.0	1300.0
SO2	3-hour	Wind Cave NP	2.69	0.19	2.69	25	8.00	10.69	1300.0	1300.0
SO2	3-hour	Jewel Cave N	4.93	0.10	4.93	512	8.00	12.93	1300.0	1300.0
SO2	3-hour	Devil's Towe	2.50	0.09	2.53	512	8.00	10.53	1300.0	1300.0
SO2	3-hour	North Cheyen	3.09	0.10	3.18	25	8.00	11.18	1300.0	1300.0
SO2	3-hour	Cloud Peak W	1.71	0.03	1.71	512	8.00	9.71	1300.0	1300.0
PM10	Annual	Badlands NP	0.16	0.01	0.16	4	16.10	16.26	50.0	50.0
PM10	Annual	Blackelk WA	0.36	0.01	0.36	17	16.10	16.46	50.0	50.0
PM10	Annual	Mt. Rushmore	0.33	0.01	0.33	17	16.10	16.43	50.0	50.0
PM10	Annual	Wind Cave NP	0.34	0.01	0.34	4	16.10	16.44	50.0	50.0
PM10	Annual	Jewel Cave N	0.48	0.01	0.49	17	16.10	16.59	50.0	50.0
PM10	Annual	Devil's Towe	1.05	0.00	1.05	17	16.10	17.15	50.0	50.0
PM10	Annual	North Cheyen	0.17	0.00	0.17	4	16.10	16.27	50.0	50.0
PM10	Annual	Cloud Peak W	0.18	0.00	0.18	17	16.10	16.28	50.0	50.0

PM10	24-hour	Badlands NP	1.57	0.07	1.61	8	46.00	47.61	150.0	150.0
PM10	24-hour	Blackelk WA	3.57	0.08	3.59	30	46.00	49.59	150.0	150.0
PM10	24-hour	Mt. Rushmore	3.50	0.07	3.52	30	46.00	49.52	150.0	150.0
PM10	24-hour	Wind Cave NP	2.81	0.10	2.84	8	46.00	48.84	150.0	150.0
PM10	24-hour	Jewel Cave N	4.16	0.06	4.17	30	46.00	50.17	150.0	150.0
PM10	24-hour	Devil's Towe	5.93	0.11	5.94	30	46.00	51.94	150.0	150.0
PM10	24-hour	North Cheyen	4.25	0.10	4.25	8	46.00	50.25	150.0	150.0
PM10	24-hour	Cloud Peak W	5.23	0.04	5.25	30	46.00	51.25	150.0	150.0
PM25	Annual	Badlands NP	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	Annual	Blackelk WA	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	Annual	Mt. Rushmore	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	Annual	Wind Cave NP	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	Annual	Jewel Cave N	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	Annual	Devil's Towe	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	Annual	North Cheyen	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	Annual	Cloud Peak W	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	24-hour	Badlands NP	0.56	0.07	0.59	-999	16.10	16.69	65.0	65.0
PM25	24-hour	Blackelk WA	0.71	0.08	0.77	-999	16.10	16.87	65.0	65.0
PM25	24-hour	Mt. Rushmore	0.65	0.07	0.71	-999	16.10	16.81	65.0	65.0
PM25	24-hour	Wind Cave NP	0.73	0.10	0.78	-999	16.10	16.88	65.0	65.0
PM25	24-hour	Jewel Cave N	0.84	0.06	0.90	-999	16.10	17.00	65.0	65.0
PM25	24-hour	Devil's Towe	1.69	0.11	1.80	-999	16.10	17.90	65.0	65.0
PM25	24-hour	North Cheyen	1.58	0.10	1.68	-999	16.10	17.78	65.0	65.0
PM25	24-hour	Cloud Peak W	0.89	0.04	0.92	-999	16.10	17.02	65.0	65.0
NO2	Annual	Badlands NP	0.11	0.02	0.14	2	16.50	16.64	100.0	100.0
NO2	Annual	Blackelk WA	0.20	0.01	0.21	25	16.50	16.71	100.0	100.0
NO2	Annual	Mt. Rushmore	0.19	0.01	0.20	25	16.50	16.70	100.0	100.0
NO2	Annual	Wind Cave NP	0.25	0.02	0.27	2	16.50	16.77	100.0	100.0
NO2	Annual	Jewel Cave N	0.31	0.01	0.32	25	16.50	16.82	100.0	100.0
NO2	Annual	Devil's Towe	0.46	0.01	0.47	25	16.50	16.97	100.0	100.0
NO2	Annual	North Cheyen	0.06	0.00	0.06	2	16.50	16.56	100.0	100.0
NO2	Annual	Cloud Peak W	0.03	0.00	0.03	25	16.50	16.53	100.0	100.0

Run: rtd-20mnt-T0+1AC 1990_Concentrations(ug/m^3)

Pollutant	Avg_Time	Area	Non-DM&E	DM&E	All	PSD	Background	Total	WAAQS	NAAQS
SO2	Annual	Badlands NP	0.05	0.01	0.06	2	3.00	3.06	60.0	80.0
SO2	Annual	Blackelk WA	0.11	0.01	0.11	20	3.00	3.11	60.0	80.0
SO2	Annual	Mt. Rushmore	0.09	0.01	0.10	20	3.00	3.10	60.0	80.0
SO2	Annual	Wind Cave NP	0.11	0.01	0.12	2	3.00	3.12	60.0	80.0
SO2	Annual	Jewel Cave N	0.16	0.01	0.16	20	3.00	3.16	60.0	80.0
SO2	Annual	Devil's Towe	0.14	0.00	0.14	20	3.00	3.14	60.0	80.0
SO2	Annual	North Cheyen	0.02	0.00	0.02	2	3.00	3.02	60.0	80.0
SO2	Annual	Cloud Peak W	0.01	0.00	0.01	20	3.00	3.01	60.0	80.0
SO2	24-hour	Badlands NP	0.48	0.15	0.58	5	8.00	8.58	260.0	365.0
SO2	24-hour	Blackelk WA	1.12	0.07	1.15	91	8.00	9.15	260.0	365.0
SO2	24-hour	Mt. Rushmore	1.02	0.07	1.05	91	8.00	9.05	260.0	365.0
SO2	24-hour	Wind Cave NP	1.31	0.09	1.32	5	8.00	9.32	260.0	365.0
SO2	24-hour	Jewel Cave N	1.64	0.03	1.65	91	8.00	9.65	260.0	365.0
SO2	24-hour	Devil's Towe	0.95	0.04	0.99	91	8.00	8.99	260.0	365.0
SO2	24-hour	North Cheyen	1.17	0.04	1.21	5	8.00	9.21	260.0	365.0
SO2	24-hour	Cloud Peak W	0.55	0.01	0.55	91	8.00	8.55	260.0	365.0
SO2	3-hour	Badlands NP	1.80	0.81	1.97	25	8.00	9.97	1300.0	1300.0
SO2	3-hour	Blackelk WA	4.66	0.23	4.66	512	8.00	12.66	1300.0	1300.0
SO2	3-hour	Mt. Rushmore	3.94	0.23	3.95	512	8.00	11.95	1300.0	1300.0
SO2	3-hour	Wind Cave NP	2.69	0.38	2.69	25	8.00	10.69	1300.0	1300.0
SO2	3-hour	Jewel Cave N	4.93	0.15	4.93	512	8.00	12.93	1300.0	1300.0
SO2	3-hour	Devil's Towe	2.50	0.16	2.57	512	8.00	10.57	1300.0	1300.0
SO2	3-hour	North Cheyen	3.09	0.11	3.19	25	8.00	11.19	1300.0	1300.0
SO2	3-hour	Cloud Peak W	1.71	0.04	1.71	512	8.00	9.71	1300.0	1300.0
PM10	Annual	Badlands NP	0.16	0.01	0.17	4	16.10	16.27	50.0	50.0
PM10	Annual	Blackelk WA	0.36	0.01	0.36	17	16.10	16.46	50.0	50.0
PM10	Annual	Mt. Rushmore	0.33	0.01	0.33	17	16.10	16.43	50.0	50.0
PM10	Annual	Wind Cave NP	0.34	0.01	0.35	4	16.10	16.45	50.0	50.0
PM10	Annual	Jewel Cave N	0.48	0.01	0.49	17	16.10	16.59	50.0	50.0
PM10	Annual	Devil's Towe	1.05	0.01	1.05	17	16.10	17.15	50.0	50.0
PM10	Annual	North Cheyen	0.17	0.00	0.17	4	16.10	16.27	50.0	50.0
PM10	Annual	Cloud Peak W	0.18	0.00	0.18	17	16.10	16.28	50.0	50.0

PM10	24-hour	Badlands NP	1.57	0.18	1.64	8	46.00	47.64	150.0	150.0
PM10	24-hour	Blackelk WA	3.57	0.14	3.59	30	46.00	49.59	150.0	150.0
PM10	24-hour	Mt. Rushmore	3.50	0.14	3.52	30	46.00	49.52	150.0	150.0
PM10	24-hour	Wind Cave NP	2.81	0.15	2.84	8	46.00	48.84	150.0	150.0
PM10	24-hour	Jewel Cave N	4.16	0.09	4.16	30	46.00	50.16	150.0	150.0
PM10	24-hour	Devil's Towe	5.93	0.13	5.96	30	46.00	51.96	150.0	150.0
PM10	24-hour	North Cheyen	4.25	0.12	4.25	8	46.00	50.25	150.0	150.0
PM10	24-hour	Cloud Peak W	5.23	0.06	5.25	30	46.00	51.25	150.0	150.0
PM25	Annual	Badlands NP	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	Annual	Blackelk WA	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	Annual	Mt. Rushmore	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	Annual	Wind Cave NP	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	Annual	Jewel Cave N	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	Annual	Devil's Towe	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	Annual	North Cheyen	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	Annual	Cloud Peak W	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	24-hour	Badlands NP	0.00	0.01	0.01	-999	16.10	16.11	65.0	65.0
PM25	24-hour	Blackelk WA	0.00	0.00	0.00	-999	16.10	16.10	65.0	65.0
PM25	24-hour	Mt. Rushmore	0.00	0.00	0.00	-999	16.10	16.10	65.0	65.0
PM25	24-hour	Wind Cave NP	0.00	0.00	0.00	-999	16.10	16.10	65.0	65.0
PM25	24-hour	Jewel Cave N	0.00	0.00	0.00	-999	16.10	16.10	65.0	65.0
PM25	24-hour	Devil's Towe	0.00	0.00	0.00	-999	16.10	16.10	65.0	65.0
PM25	24-hour	North Cheyen	0.00	0.00	0.00	-999	16.10	16.10	65.0	65.0
PM25	24-hour	Cloud Peak W	0.00	0.00	0.00	-999	16.10	16.10	65.0	65.0
NO2	Annual	Badlands NP	0.11	0.03	0.14	2	16.50	16.64	100.0	100.0
NO2	Annual	Blackelk WA	0.20	0.02	0.22	25	16.50	16.72	100.0	100.0
NO2	Annual	Mt. Rushmore	0.19	0.02	0.21	25	16.50	16.71	100.0	100.0
NO2	Annual	Wind Cave NP	0.25	0.02	0.27	2	16.50	16.77	100.0	100.0
NO2	Annual	Jewel Cave N	0.31	0.02	0.33	25	16.50	16.83	100.0	100.0
NO2	Annual	Devil's Towe	0.46	0.01	0.47	25	16.50	16.97	100.0	100.0
NO2	Annual	North Cheyen	0.06	0.00	0.06	2	16.50	16.56	100.0	100.0
NO2	Annual	Cloud Peak W	0.03	0.00	0.03	25	16.50	16.53	100.0	100.0

Run: rtb-50mnt-T0+1AC 1990_Concentrations(ug/m^3)

Pollutant	Avg_Time	Area	Non-DM&E	DM&E	All	PSD	Background	Total	WAAQS	NAAQS
SO2	Annual	Badlands NP	0.05	0.01	0.05	2	3.00	3.05	60.0	80.0
SO2	Annual	Blackelk WA	0.11	0.00	0.11	20	3.00	3.11	60.0	80.0
SO2	Annual	Mt. Rushmore	0.09	0.00	0.10	20	3.00	3.10	60.0	80.0
SO2	Annual	Wind Cave NP	0.11	0.01	0.11	2	3.00	3.11	60.0	80.0
SO2	Annual	Jewel Cave N	0.16	0.00	0.16	20	3.00	3.16	60.0	80.0
SO2	Annual	Devil's Towe	0.14	0.00	0.14	20	3.00	3.14	60.0	80.0
SO2	Annual	North Cheyen	0.02	0.00	0.02	2	3.00	3.02	60.0	80.0
SO2	Annual	Cloud Peak W	0.01	0.00	0.01	20	3.00	3.01	60.0	80.0
SO2	24-hour	Badlands NP	0.48	0.10	0.54	5	8.00	8.54	260.0	365.0
SO2	24-hour	Blackelk WA	1.12	0.04	1.15	91	8.00	9.15	260.0	365.0
SO2	24-hour	Mt. Rushmore	1.02	0.04	1.05	91	8.00	9.05	260.0	365.0
SO2	24-hour	Wind Cave NP	1.31	0.05	1.32	5	8.00	9.32	260.0	365.0
SO2	24-hour	Jewel Cave N	1.64	0.03	1.65	91	8.00	9.65	260.0	365.0
SO2	24-hour	Devil's Towe	0.95	0.04	0.96	91	8.00	8.96	260.0	365.0
SO2	24-hour	North Cheyen	1.17	0.03	1.20	5	8.00	9.20	260.0	365.0
SO2	24-hour	Cloud Peak W	0.55	0.01	0.55	91	8.00	8.55	260.0	365.0
SO2	3-hour	Badlands NP	1.80	0.54	1.87	25	8.00	9.87	1300.0	1300.0
SO2	3-hour	Blackelk WA	4.66	0.14	4.66	512	8.00	12.66	1300.0	1300.0
SO2	3-hour	Mt. Rushmore	3.94	0.14	3.94	512	8.00	11.94	1300.0	1300.0
SO2	3-hour	Wind Cave NP	2.69	0.21	2.69	25	8.00	10.69	1300.0	1300.0
SO2	3-hour	Jewel Cave N	4.93	0.12	4.93	512	8.00	12.93	1300.0	1300.0
SO2	3-hour	Devil's Towe	2.50	0.09	2.51	512	8.00	10.51	1300.0	1300.0
SO2	3-hour	North Cheyen	3.09	0.09	3.17	25	8.00	11.17	1300.0	1300.0
SO2	3-hour	Cloud Peak W	1.71	0.03	1.72	512	8.00	9.72	1300.0	1300.0
PM10	Annual	Badlands NP	0.16	0.01	0.17	4	16.10	16.27	50.0	50.0
PM10	Annual	Blackelk WA	0.36	0.01	0.37	17	16.10	16.47	50.0	50.0
PM10	Annual	Mt. Rushmore	0.33	0.01	0.34	17	16.10	16.44	50.0	50.0
PM10	Annual	Wind Cave NP	0.34	0.01	0.35	4	16.10	16.45	50.0	50.0
PM10	Annual	Jewel Cave N	0.48	0.01	0.49	17	16.10	16.59	50.0	50.0
PM10	Annual	Devil's Towe	1.05	0.01	1.05	17	16.10	17.15	50.0	50.0
PM10	Annual	North Cheyen	0.17	0.00	0.17	4	16.10	16.27	50.0	50.0
PM10	Annual	Cloud Peak W	0.18	0.00	0.18	17	16.10	16.28	50.0	50.0

PM10	24-hour	Badlands NP	1.57	0.24	1.67	8	46.00	47.67	150.0	150.0
PM10	24-hour	Blackelk WA	3.57	0.16	3.61	30	46.00	49.61	150.0	150.0
PM10	24-hour	Mt. Rushmore	3.50	0.15	3.54	30	46.00	49.54	150.0	150.0
PM10	24-hour	Wind Cave NP	2.81	0.20	2.87	8	46.00	48.87	150.0	150.0
PM10	24-hour	Jewel Cave N	4.16	0.13	4.17	30	46.00	50.17	150.0	150.0
PM10	24-hour	Devil's Towe	5.93	0.23	5.95	30	46.00	51.95	150.0	150.0
PM10	24-hour	North Cheyen	4.25	0.20	4.25	8	46.00	50.25	150.0	150.0
PM10	24-hour	Cloud Peak W	5.23	0.08	5.28	30	46.00	51.28	150.0	150.0
PM25	Annual	Badlands NP	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	Annual	Blackelk WA	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	Annual	Mt. Rushmore	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	Annual	Wind Cave NP	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	Annual	Jewel Cave N	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	Annual	Devil's Towe	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	Annual	North Cheyen	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	Annual	Cloud Peak W	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	24-hour	Badlands NP	0.56	0.24	0.67	-999	16.10	16.77	65.0	65.0
PM25	24-hour	Blackelk WA	0.71	0.16	0.84	-999	16.10	16.94	65.0	65.0
PM25	24-hour	Mt. Rushmore	0.65	0.15	0.79	-999	16.10	16.89	65.0	65.0
PM25	24-hour	Wind Cave NP	0.73	0.20	0.83	-999	16.10	16.93	65.0	65.0
PM25	24-hour	Jewel Cave N	0.84	0.13	0.96	-999	16.10	17.06	65.0	65.0
PM25	24-hour	Devil's Towe	1.69	0.23	1.90	-999	16.10	18.00	65.0	65.0
PM25	24-hour	North Cheyen	1.58	0.20	1.78	-999	16.10	17.88	65.0	65.0
PM25	24-hour	Cloud Peak W	0.89	0.08	0.94	-999	16.10	17.04	65.0	65.0
NO2	Annual	Badlands NP	0.11	0.05	0.16	2	16.50	16.66	100.0	100.0
NO2	Annual	Blackelk WA	0.20	0.02	0.23	25	16.50	16.73	100.0	100.0
NO2	Annual	Mt. Rushmore	0.19	0.02	0.22	25	16.50	16.72	100.0	100.0
NO2	Annual	Wind Cave NP	0.25	0.04	0.28	2	16.50	16.78	100.0	100.0
NO2	Annual	Jewel Cave N	0.31	0.03	0.34	25	16.50	16.84	100.0	100.0
NO2	Annual	Devil's Towe	0.46	0.01	0.47	25	16.50	16.97	100.0	100.0
NO2	Annual	North Cheyen	0.06	0.00	0.06	2	16.50	16.56	100.0	100.0
NO2	Annual	Cloud Peak W	0.03	0.00	0.03	25	16.50	16.53	100.0	100.0

Run: rtc-50mnt-T0+1AC 1990_Concentrations(ug/m^3)

Pollutant	Avg_Time	Area	Non-DM&E	DM&E	All	PSD	Background	Total	WAAQS	NAAQS
SO2	Annual	Badlands NP	0.05	0.01	0.05	2	3.00	3.05	60.0	80.0
SO2	Annual	Blackelk WA	0.11	0.00	0.11	20	3.00	3.11	60.0	80.0
SO2	Annual	Mt. Rushmore	0.09	0.00	0.10	20	3.00	3.10	60.0	80.0
SO2	Annual	Wind Cave NP	0.11	0.01	0.11	2	3.00	3.11	60.0	80.0
SO2	Annual	Jewel Cave N	0.16	0.00	0.16	20	3.00	3.16	60.0	80.0
SO2	Annual	Devil's Towe	0.14	0.00	0.14	20	3.00	3.14	60.0	80.0
SO2	Annual	North Cheyen	0.02	0.00	0.02	2	3.00	3.02	60.0	80.0
SO2	Annual	Cloud Peak W	0.01	0.00	0.01	20	3.00	3.01	60.0	80.0
SO2	24-hour	Badlands NP	0.48	0.08	0.54	5	8.00	8.54	260.0	365.0
SO2	24-hour	Blackelk WA	1.12	0.03	1.14	91	8.00	9.14	260.0	365.0
SO2	24-hour	Mt. Rushmore	1.02	0.03	1.04	91	8.00	9.04	260.0	365.0
SO2	24-hour	Wind Cave NP	1.31	0.04	1.32	5	8.00	9.32	260.0	365.0
SO2	24-hour	Jewel Cave N	1.64	0.03	1.65	91	8.00	9.65	260.0	365.0
SO2	24-hour	Devil's Towe	0.95	0.04	0.96	91	8.00	8.96	260.0	365.0
SO2	24-hour	North Cheyen	1.17	0.03	1.20	5	8.00	9.20	260.0	365.0
SO2	24-hour	Cloud Peak W	0.55	0.01	0.55	91	8.00	8.55	260.0	365.0
SO2	3-hour	Badlands NP	1.80	0.39	1.87	25	8.00	9.87	1300.0	1300.0
SO2	3-hour	Blackelk WA	4.66	0.12	4.66	512	8.00	12.66	1300.0	1300.0
SO2	3-hour	Mt. Rushmore	3.94	0.11	3.94	512	8.00	11.94	1300.0	1300.0
SO2	3-hour	Wind Cave NP	2.69	0.19	2.69	25	8.00	10.69	1300.0	1300.0
SO2	3-hour	Jewel Cave N	4.93	0.10	4.93	512	8.00	12.93	1300.0	1300.0
SO2	3-hour	Devil's Towe	2.50	0.09	2.53	512	8.00	10.53	1300.0	1300.0
SO2	3-hour	North Cheyen	3.09	0.10	3.18	25	8.00	11.18	1300.0	1300.0
SO2	3-hour	Cloud Peak W	1.71	0.03	1.71	512	8.00	9.71	1300.0	1300.0
PM10	Annual	Badlands NP	0.16	0.01	0.17	4	16.10	16.27	50.0	50.0
PM10	Annual	Blackelk WA	0.36	0.01	0.37	17	16.10	16.47	50.0	50.0
PM10	Annual	Mt. Rushmore	0.33	0.01	0.34	17	16.10	16.44	50.0	50.0
PM10	Annual	Wind Cave NP	0.34	0.01	0.35	4	16.10	16.45	50.0	50.0
PM10	Annual	Jewel Cave N	0.48	0.01	0.49	17	16.10	16.59	50.0	50.0
PM10	Annual	Devil's Towe	1.05	0.01	1.05	17	16.10	17.15	50.0	50.0
PM10	Annual	North Cheyen	0.17	0.00	0.17	4	16.10	16.27	50.0	50.0
PM10	Annual	Cloud Peak W	0.18	0.00	0.18	17	16.10	16.28	50.0	50.0

PM10	24-hour	Badlands NP	1.57	0.15	1.66	8	46.00	47.66	150.0	150.0
PM10	24-hour	Blackelk WA	3.57	0.15	3.62	30	46.00	49.62	150.0	150.0
PM10	24-hour	Mt. Rushmore	3.50	0.15	3.56	30	46.00	49.56	150.0	150.0
PM10	24-hour	Wind Cave NP	2.81	0.19	2.88	8	46.00	48.88	150.0	150.0
PM10	24-hour	Jewel Cave N	4.16	0.13	4.17	30	46.00	50.17	150.0	150.0
PM10	24-hour	Devil's Towe	5.93	0.24	5.96	30	46.00	51.96	150.0	150.0
PM10	24-hour	North Cheyen	4.25	0.22	4.25	8	46.00	50.25	150.0	150.0
PM10	24-hour	Cloud Peak W	5.23	0.09	5.27	30	46.00	51.27	150.0	150.0
PM25	Annual	Badlands NP	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	Annual	Blackelk WA	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	Annual	Mt. Rushmore	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	Annual	Wind Cave NP	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	Annual	Jewel Cave N	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	Annual	Devil's Towe	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	Annual	North Cheyen	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	Annual	Cloud Peak W	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	24-hour	Badlands NP	0.56	0.15	0.66	-999	16.10	16.76	65.0	65.0
PM25	24-hour	Blackelk WA	0.71	0.15	0.84	-999	16.10	16.94	65.0	65.0
PM25	24-hour	Mt. Rushmore	0.65	0.15	0.79	-999	16.10	16.89	65.0	65.0
PM25	24-hour	Wind Cave NP	0.73	0.19	0.84	-999	16.10	16.94	65.0	65.0
PM25	24-hour	Jewel Cave N	0.84	0.13	0.97	-999	16.10	17.07	65.0	65.0
PM25	24-hour	Devil's Towe	1.69	0.24	1.92	-999	16.10	18.02	65.0	65.0
PM25	24-hour	North Cheyen	1.58	0.22	1.79	-999	16.10	17.89	65.0	65.0
PM25	24-hour	Cloud Peak W	0.89	0.09	0.95	-999	16.10	17.05	65.0	65.0
NO2	Annual	Badlands NP	0.11	0.05	0.16	2	16.50	16.66	100.0	100.0
NO2	Annual	Blackelk WA	0.20	0.02	0.23	25	16.50	16.73	100.0	100.0
NO2	Annual	Mt. Rushmore	0.19	0.02	0.22	25	16.50	16.72	100.0	100.0
NO2	Annual	Wind Cave NP	0.25	0.04	0.28	2	16.50	16.78	100.0	100.0
NO2	Annual	Jewel Cave N	0.31	0.03	0.34	25	16.50	16.84	100.0	100.0
NO2	Annual	Devil's Towe	0.46	0.01	0.48	25	16.50	16.98	100.0	100.0
NO2	Annual	North Cheyen	0.06	0.00	0.06	2	16.50	16.56	100.0	100.0
NO2	Annual	Cloud Peak W	0.03	0.00	0.03	25	16.50	16.53	100.0	100.0

Run: rtd-50mnt-T0+1AC 1990_Concentrations(ug/m^3)

Pollutant	Avg_Time	Area	Non-DM&E	DM&E	All	PSD	Background	Total	WAAQS	NAAQS
SO2	Annual	Badlands NP	0.05	0.01	0.06	2	3.00	3.06	60.0	80.0
SO2	Annual	Blackelk WA	0.11	0.01	0.11	20	3.00	3.11	60.0	80.0
SO2	Annual	Mt. Rushmore	0.09	0.01	0.10	20	3.00	3.10	60.0	80.0
SO2	Annual	Wind Cave NP	0.11	0.01	0.12	2	3.00	3.12	60.0	80.0
SO2	Annual	Jewel Cave N	0.16	0.01	0.16	20	3.00	3.16	60.0	80.0
SO2	Annual	Devil's Towe	0.14	0.00	0.14	20	3.00	3.14	60.0	80.0
SO2	Annual	North Cheyen	0.02	0.00	0.02	2	3.00	3.02	60.0	80.0
SO2	Annual	Cloud Peak W	0.01	0.00	0.01	20	3.00	3.01	60.0	80.0
SO2	24-hour	Badlands NP	0.48	0.15	0.58	5	8.00	8.58	260.0	365.0
SO2	24-hour	Blackelk WA	1.12	0.07	1.15	91	8.00	9.15	260.0	365.0
SO2	24-hour	Mt. Rushmore	1.02	0.07	1.05	91	8.00	9.05	260.0	365.0
SO2	24-hour	Wind Cave NP	1.31	0.09	1.32	5	8.00	9.32	260.0	365.0
SO2	24-hour	Jewel Cave N	1.64	0.03	1.65	91	8.00	9.65	260.0	365.0
SO2	24-hour	Devil's Towe	0.95	0.04	0.99	91	8.00	8.99	260.0	365.0
SO2	24-hour	North Cheyen	1.17	0.04	1.21	5	8.00	9.21	260.0	365.0
SO2	24-hour	Cloud Peak W	0.55	0.01	0.55	91	8.00	8.55	260.0	365.0
SO2	3-hour	Badlands NP	1.80	0.81	1.97	25	8.00	9.97	1300.0	1300.0
SO2	3-hour	Blackelk WA	4.66	0.23	4.66	512	8.00	12.66	1300.0	1300.0
SO2	3-hour	Mt. Rushmore	3.94	0.23	3.95	512	8.00	11.95	1300.0	1300.0
SO2	3-hour	Wind Cave NP	2.69	0.38	2.69	25	8.00	10.69	1300.0	1300.0
SO2	3-hour	Jewel Cave N	4.93	0.15	4.93	512	8.00	12.93	1300.0	1300.0
SO2	3-hour	Devil's Towe	2.50	0.16	2.57	512	8.00	10.57	1300.0	1300.0
SO2	3-hour	North Cheyen	3.09	0.11	3.19	25	8.00	11.19	1300.0	1300.0
SO2	3-hour	Cloud Peak W	1.71	0.04	1.71	512	8.00	9.71	1300.0	1300.0
PM10	Annual	Badlands NP	0.16	0.02	0.18	4	16.10	16.28	50.0	50.0
PM10	Annual	Blackelk WA	0.36	0.02	0.37	17	16.10	16.47	50.0	50.0
PM10	Annual	Mt. Rushmore	0.33	0.02	0.34	17	16.10	16.44	50.0	50.0
PM10	Annual	Wind Cave NP	0.34	0.02	0.35	4	16.10	16.45	50.0	50.0
PM10	Annual	Jewel Cave N	0.48	0.01	0.50	17	16.10	16.60	50.0	50.0
PM10	Annual	Devil's Towe	1.05	0.01	1.06	17	16.10	17.16	50.0	50.0
PM10	Annual	North Cheyen	0.17	0.00	0.18	4	16.10	16.28	50.0	50.0
PM10	Annual	Cloud Peak W	0.18	0.00	0.18	17	16.10	16.28	50.0	50.0

PM10	24-hour	Badlands NP	1.57	0.40	1.72	8	46.00	47.72	150.0	150.0
PM10	24-hour	Blackelk WA	3.57	0.28	3.63	30	46.00	49.63	150.0	150.0
PM10	24-hour	Mt. Rushmore	3.50	0.28	3.56	30	46.00	49.56	150.0	150.0
PM10	24-hour	Wind Cave NP	2.81	0.31	2.87	8	46.00	48.87	150.0	150.0
PM10	24-hour	Jewel Cave N	4.16	0.18	4.17	30	46.00	50.17	150.0	150.0
PM10	24-hour	Devil's Towe	5.93	0.27	5.99	30	46.00	51.99	150.0	150.0
PM10	24-hour	North Cheyen	4.25	0.27	4.25	8	46.00	50.25	150.0	150.0
PM10	24-hour	Cloud Peak W	5.23	0.12	5.28	30	46.00	51.28	150.0	150.0
PM25	Annual	Badlands NP	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	Annual	Blackelk WA	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	Annual	Mt. Rushmore	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	Annual	Wind Cave NP	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	Annual	Jewel Cave N	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	Annual	Devil's Towe	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	Annual	North Cheyen	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	Annual	Cloud Peak W	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	24-hour	Badlands NP	0.00	0.01	0.01	-999	16.10	16.11	65.0	65.0
PM25	24-hour	Blackelk WA	0.00	0.01	0.01	-999	16.10	16.11	65.0	65.0
PM25	24-hour	Mt. Rushmore	0.00	0.01	0.01	-999	16.10	16.11	65.0	65.0
PM25	24-hour	Wind Cave NP	0.00	0.01	0.01	-999	16.10	16.11	65.0	65.0
PM25	24-hour	Jewel Cave N	0.00	0.00	0.00	-999	16.10	16.10	65.0	65.0
PM25	24-hour	Devil's Towe	0.00	0.01	0.01	-999	16.10	16.11	65.0	65.0
PM25	24-hour	North Cheyen	0.00	0.01	0.01	-999	16.10	16.11	65.0	65.0
PM25	24-hour	Cloud Peak W	0.00	0.00	0.00	-999	16.10	16.10	65.0	65.0
NO2	Annual	Badlands NP	0.11	0.07	0.18	2	16.50	16.68	100.0	100.0
NO2	Annual	Blackelk WA	0.20	0.03	0.24	25	16.50	16.74	100.0	100.0
NO2	Annual	Mt. Rushmore	0.19	0.03	0.23	25	16.50	16.73	100.0	100.0
NO2	Annual	Wind Cave NP	0.25	0.05	0.29	2	16.50	16.79	100.0	100.0
NO2	Annual	Jewel Cave N	0.31	0.03	0.35	25	16.50	16.85	100.0	100.0
NO2	Annual	Devil's Towe	0.46	0.02	0.49	25	16.50	16.99	100.0	100.0
NO2	Annual	North Cheyen	0.06	0.00	0.06	2	16.50	16.56	100.0	100.0
NO2	Annual	Cloud Peak W	0.03	0.00	0.03	25	16.50	16.53	100.0	100.0

Run: rtb-100mnt-T0+1AC 1990_Concentrations(ug/m^3)

Pollutant	Avg_Time	Area	Non-DM&E	DM&E	All	PSD	Background	Total	WAAQS	NAAQS
SO2	Annual	Badlands NP	0.05	0.01	0.05	2	3.00	3.05	60.0	80.0
SO2	Annual	Blackelk WA	0.11	0.00	0.11	20	3.00	3.11	60.0	80.0
SO2	Annual	Mt. Rushmore	0.09	0.00	0.10	20	3.00	3.10	60.0	80.0
SO2	Annual	Wind Cave NP	0.11	0.01	0.11	2	3.00	3.11	60.0	80.0
SO2	Annual	Jewel Cave N	0.16	0.00	0.16	20	3.00	3.16	60.0	80.0
SO2	Annual	Devil's Towe	0.14	0.00	0.14	20	3.00	3.14	60.0	80.0
SO2	Annual	North Cheyen	0.02	0.00	0.02	2	3.00	3.02	60.0	80.0
SO2	Annual	Cloud Peak W	0.01	0.00	0.01	20	3.00	3.01	60.0	80.0
SO2	24-hour	Badlands NP	0.48	0.10	0.54	5	8.00	8.54	260.0	365.0
SO2	24-hour	Blackelk WA	1.12	0.04	1.15	91	8.00	9.15	260.0	365.0
SO2	24-hour	Mt. Rushmore	1.02	0.04	1.05	91	8.00	9.05	260.0	365.0
SO2	24-hour	Wind Cave NP	1.31	0.05	1.32	5	8.00	9.32	260.0	365.0
SO2	24-hour	Jewel Cave N	1.64	0.03	1.65	91	8.00	9.65	260.0	365.0
SO2	24-hour	Devil's Towe	0.95	0.04	0.96	91	8.00	8.96	260.0	365.0
SO2	24-hour	North Cheyen	1.17	0.03	1.20	5	8.00	9.20	260.0	365.0
SO2	24-hour	Cloud Peak W	0.55	0.01	0.55	91	8.00	8.55	260.0	365.0
SO2	3-hour	Badlands NP	1.80	0.54	1.87	25	8.00	9.87	1300.0	1300.0
SO2	3-hour	Blackelk WA	4.66	0.14	4.66	512	8.00	12.66	1300.0	1300.0
SO2	3-hour	Mt. Rushmore	3.94	0.14	3.94	512	8.00	11.94	1300.0	1300.0
SO2	3-hour	Wind Cave NP	2.69	0.21	2.69	25	8.00	10.69	1300.0	1300.0
SO2	3-hour	Jewel Cave N	4.93	0.12	4.93	512	8.00	12.93	1300.0	1300.0
SO2	3-hour	Devil's Towe	2.50	0.09	2.51	512	8.00	10.51	1300.0	1300.0
SO2	3-hour	North Cheyen	3.09	0.09	3.17	25	8.00	11.17	1300.0	1300.0
SO2	3-hour	Cloud Peak W	1.71	0.03	1.72	512	8.00	9.72	1300.0	1300.0
PM10	Annual	Badlands NP	0.16	0.03	0.18	4	16.10	16.28	50.0	50.0
PM10	Annual	Blackelk WA	0.36	0.02	0.38	17	16.10	16.48	50.0	50.0
PM10	Annual	Mt. Rushmore	0.33	0.02	0.35	17	16.10	16.45	50.0	50.0
PM10	Annual	Wind Cave NP	0.34	0.02	0.36	4	16.10	16.46	50.0	50.0
PM10	Annual	Jewel Cave N	0.48	0.02	0.50	17	16.10	16.60	50.0	50.0
PM10	Annual	Devil's Towe	1.05	0.01	1.06	17	16.10	17.16	50.0	50.0
PM10	Annual	North Cheyen	0.17	0.00	0.18	4	16.10	16.28	50.0	50.0
PM10	Annual	Cloud Peak W	0.18	0.00	0.19	17	16.10	16.29	50.0	50.0

PM10	24-hour	Badlands NP	1.57	0.45	1.76	8	46.00	47.76	150.0	150.0
PM10	24-hour	Blackelk WA	3.57	0.28	3.65	30	46.00	49.65	150.0	150.0
PM10	24-hour	Mt. Rushmore	3.50	0.27	3.59	30	46.00	49.59	150.0	150.0
PM10	24-hour	Wind Cave NP	2.81	0.36	2.93	8	46.00	48.93	150.0	150.0
PM10	24-hour	Jewel Cave N	4.16	0.24	4.18	30	46.00	50.18	150.0	150.0
PM10	24-hour	Devil's Towe	5.93	0.42	6.06	30	46.00	52.06	150.0	150.0
PM10	24-hour	North Cheyen	4.25	0.38	4.25	8	46.00	50.25	150.0	150.0
PM10	24-hour	Cloud Peak W	5.23	0.15	5.31	30	46.00	51.31	150.0	150.0
PM25	Annual	Badlands NP	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	Annual	Blackelk WA	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	Annual	Mt. Rushmore	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	Annual	Wind Cave NP	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	Annual	Jewel Cave N	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	Annual	Devil's Towe	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	Annual	North Cheyen	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	Annual	Cloud Peak W	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	24-hour	Badlands NP	0.56	0.45	0.83	-999	16.10	16.93	65.0	65.0
PM25	24-hour	Blackelk WA	0.71	0.28	0.95	-999	16.10	17.05	65.0	65.0
PM25	24-hour	Mt. Rushmore	0.65	0.27	0.91	-999	16.10	17.01	65.0	65.0
PM25	24-hour	Wind Cave NP	0.73	0.36	0.93	-999	16.10	17.03	65.0	65.0
PM25	24-hour	Jewel Cave N	0.84	0.24	1.08	-999	16.10	17.18	65.0	65.0
PM25	24-hour	Devil's Towe	1.68	0.42	2.09	-999	16.10	18.19	65.0	65.0
PM25	24-hour	North Cheyen	1.58	0.38	1.96	-999	16.10	18.06	65.0	65.0
PM25	24-hour	Cloud Peak W	0.89	0.15	0.99	-999	16.10	17.09	65.0	65.0
NO2	Annual	Badlands NP	0.11	0.10	0.21	2	16.50	16.71	100.0	100.0
NO2	Annual	Blackelk WA	0.20	0.05	0.25	25	16.50	16.75	100.0	100.0
NO2	Annual	Mt. Rushmore	0.19	0.05	0.24	25	16.50	16.74	100.0	100.0
NO2	Annual	Wind Cave NP	0.25	0.07	0.31	2	16.50	16.81	100.0	100.0
NO2	Annual	Jewel Cave N	0.31	0.05	0.36	25	16.50	16.86	100.0	100.0
NO2	Annual	Devil's Towe	0.46	0.02	0.49	25	16.50	16.99	100.0	100.0
NO2	Annual	North Cheyen	0.06	0.01	0.07	2	16.50	16.57	100.0	100.0
NO2	Annual	Cloud Peak W	0.03	0.00	0.03	25	16.50	16.53	100.0	100.0

Run: rtc-100mnt-T0+1AC 1990_Concentrations(ug/m^3)

Pollutant	Avg_Time	Area	Non-DM&E	DM&E	All	PSD	Background	Total	WAAQS	NAAQS
SO2	Annual	Badlands NP	0.05	0.01	0.05	2	3.00	3.05	60.0	80.0
SO2	Annual	Blackelk WA	0.11	0.00	0.11	20	3.00	3.11	60.0	80.0
SO2	Annual	Mt. Rushmore	0.09	0.00	0.10	20	3.00	3.10	60.0	80.0
SO2	Annual	Wind Cave NP	0.11	0.01	0.11	2	3.00	3.11	60.0	80.0
SO2	Annual	Jewel Cave N	0.16	0.00	0.16	20	3.00	3.16	60.0	80.0
SO2	Annual	Devil's Towe	0.14	0.00	0.14	20	3.00	3.14	60.0	80.0
SO2	Annual	North Cheyen	0.02	0.00	0.02	2	3.00	3.02	60.0	80.0
SO2	Annual	Cloud Peak W	0.01	0.00	0.01	20	3.00	3.01	60.0	80.0
SO2	24-hour	Badlands NP	0.48	0.08	0.54	5	8.00	8.54	260.0	365.0
SO2	24-hour	Blackelk WA	1.12	0.03	1.14	91	8.00	9.14	260.0	365.0
SO2	24-hour	Mt. Rushmore	1.02	0.03	1.04	91	8.00	9.04	260.0	365.0
SO2	24-hour	Wind Cave NP	1.31	0.04	1.32	5	8.00	9.32	260.0	365.0
SO2	24-hour	Jewel Cave N	1.64	0.03	1.65	91	8.00	9.65	260.0	365.0
SO2	24-hour	Devil's Towe	0.95	0.04	0.96	91	8.00	8.96	260.0	365.0
SO2	24-hour	North Cheyen	1.17	0.03	1.20	5	8.00	9.20	260.0	365.0
SO2	24-hour	Cloud Peak W	0.55	0.01	0.55	91	8.00	8.55	260.0	365.0
SO2	3-hour	Badlands NP	1.80	0.39	1.87	25	8.00	9.87	1300.0	1300.0
SO2	3-hour	Blackelk WA	4.66	0.12	4.66	512	8.00	12.66	1300.0	1300.0
SO2	3-hour	Mt. Rushmore	3.94	0.11	3.94	512	8.00	11.94	1300.0	1300.0
SO2	3-hour	Wind Cave NP	2.69	0.19	2.69	25	8.00	10.69	1300.0	1300.0
SO2	3-hour	Jewel Cave N	4.93	0.10	4.93	512	8.00	12.93	1300.0	1300.0
SO2	3-hour	Devil's Towe	2.50	0.09	2.53	512	8.00	10.53	1300.0	1300.0
SO2	3-hour	North Cheyen	3.09	0.10	3.18	25	8.00	11.18	1300.0	1300.0
SO2	3-hour	Cloud Peak W	1.71	0.03	1.71	512	8.00	9.71	1300.0	1300.0
PM10	Annual	Badlands NP	0.16	0.03	0.18	4	16.10	16.28	50.0	50.0
PM10	Annual	Blackelk WA	0.36	0.02	0.38	17	16.10	16.48	50.0	50.0
PM10	Annual	Mt. Rushmore	0.33	0.02	0.35	17	16.10	16.45	50.0	50.0
PM10	Annual	Wind Cave NP	0.34	0.02	0.36	4	16.10	16.46	50.0	50.0
PM10	Annual	Jewel Cave N	0.48	0.02	0.50	17	16.10	16.60	50.0	50.0
PM10	Annual	Devil's Towe	1.05	0.01	1.06	17	16.10	17.16	50.0	50.0
PM10	Annual	North Cheyen	0.17	0.00	0.18	4	16.10	16.28	50.0	50.0
PM10	Annual	Cloud Peak W	0.18	0.00	0.19	17	16.10	16.29	50.0	50.0

PM10	24-hour	Badlands NP	1.57	0.29	1.76	8	46.00	47.76	150.0	150.0
PM10	24-hour	Blackelk WA	3.57	0.28	3.68	30	46.00	49.68	150.0	150.0
PM10	24-hour	Mt. Rushmore	3.50	0.27	3.61	30	46.00	49.61	150.0	150.0
PM10	24-hour	Wind Cave NP	2.81	0.35	2.94	8	46.00	48.94	150.0	150.0
PM10	24-hour	Jewel Cave N	4.16	0.25	4.18	30	46.00	50.18	150.0	150.0
PM10	24-hour	Devil's Towe	5.93	0.45	6.10	30	46.00	52.10	150.0	150.0
PM10	24-hour	North Cheyen	4.25	0.41	4.25	8	46.00	50.25	150.0	150.0
PM10	24-hour	Cloud Peak W	5.23	0.16	5.31	30	46.00	51.31	150.0	150.0
PM25	Annual	Badlands NP	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	Annual	Blackelk WA	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	Annual	Mt. Rushmore	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	Annual	Wind Cave NP	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	Annual	Jewel Cave N	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	Annual	Devil's Towe	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	Annual	North Cheyen	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	Annual	Cloud Peak W	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	24-hour	Badlands NP	0.56	0.29	0.79	-999	16.10	16.89	65.0	65.0
PM25	24-hour	Blackelk WA	0.71	0.28	0.95	-999	16.10	17.05	65.0	65.0
PM25	24-hour	Mt. Rushmore	0.65	0.27	0.90	-999	16.10	17.00	65.0	65.0
PM25	24-hour	Wind Cave NP	0.73	0.35	0.93	-999	16.10	17.03	65.0	65.0
PM25	24-hour	Jewel Cave N	0.84	0.25	1.09	-999	16.10	17.19	65.0	65.0
PM25	24-hour	Devil's Towe	1.68	0.45	2.12	-999	16.10	18.22	65.0	65.0
PM25	24-hour	North Cheyen	1.58	0.41	1.99	-999	16.10	18.09	65.0	65.0
PM25	24-hour	Cloud Peak W	0.89	0.16	1.01	-999	16.10	17.11	65.0	65.0
NO2	Annual	Badlands NP	0.11	0.10	0.21	2	16.50	16.71	100.0	100.0
NO2	Annual	Blackelk WA	0.20	0.05	0.25	25	16.50	16.75	100.0	100.0
NO2	Annual	Mt. Rushmore	0.19	0.05	0.24	25	16.50	16.74	100.0	100.0
NO2	Annual	Wind Cave NP	0.25	0.07	0.31	2	16.50	16.81	100.0	100.0
NO2	Annual	Jewel Cave N	0.31	0.05	0.36	25	16.50	16.86	100.0	100.0
NO2	Annual	Devil's Towe	0.46	0.03	0.49	25	16.50	16.99	100.0	100.0
NO2	Annual	North Cheyen	0.06	0.01	0.07	2	16.50	16.57	100.0	100.0
NO2	Annual	Cloud Peak W	0.03	0.00	0.03	25	16.50	16.53	100.0	100.0

Run: rtd-100mnt-T0+1AC 1990_Concentrations(ug/m^3)

Pollutant	Avg_Time	Area	Non-DM&E	DM&E	All	PSD	Background	Total	WAAQS	NAAQS
SO2	Annual	Badlands NP	0.05	0.01	0.06	2	3.00	3.06	60.0	80.0
SO2	Annual	Blackelk WA	0.11	0.01	0.11	20	3.00	3.11	60.0	80.0
SO2	Annual	Mt. Rushmore	0.09	0.01	0.10	20	3.00	3.10	60.0	80.0
SO2	Annual	Wind Cave NP	0.11	0.01	0.12	2	3.00	3.12	60.0	80.0
SO2	Annual	Jewel Cave N	0.16	0.01	0.16	20	3.00	3.16	60.0	80.0
SO2	Annual	Devil's Towe	0.14	0.00	0.14	20	3.00	3.14	60.0	80.0
SO2	Annual	North Cheyen	0.02	0.00	0.02	2	3.00	3.02	60.0	80.0
SO2	Annual	Cloud Peak W	0.01	0.00	0.01	20	3.00	3.01	60.0	80.0
SO2	24-hour	Badlands NP	0.48	0.15	0.58	5	8.00	8.58	260.0	365.0
SO2	24-hour	Blackelk WA	1.12	0.07	1.15	91	8.00	9.15	260.0	365.0
SO2	24-hour	Mt. Rushmore	1.02	0.07	1.05	91	8.00	9.05	260.0	365.0
SO2	24-hour	Wind Cave NP	1.31	0.09	1.32	5	8.00	9.32	260.0	365.0
SO2	24-hour	Jewel Cave N	1.64	0.03	1.65	91	8.00	9.65	260.0	365.0
SO2	24-hour	Devil's Towe	0.95	0.04	0.99	91	8.00	8.99	260.0	365.0
SO2	24-hour	North Cheyen	1.17	0.04	1.21	5	8.00	9.21	260.0	365.0
SO2	24-hour	Cloud Peak W	0.55	0.01	0.55	91	8.00	8.55	260.0	365.0
SO2	3-hour	Badlands NP	1.80	0.81	1.97	25	8.00	9.97	1300.0	1300.0
SO2	3-hour	Blackelk WA	4.66	0.23	4.66	512	8.00	12.66	1300.0	1300.0
SO2	3-hour	Mt. Rushmore	3.94	0.23	3.95	512	8.00	11.95	1300.0	1300.0
SO2	3-hour	Wind Cave NP	2.69	0.38	2.69	25	8.00	10.69	1300.0	1300.0
SO2	3-hour	Jewel Cave N	4.93	0.15	4.93	512	8.00	12.93	1300.0	1300.0
SO2	3-hour	Devil's Towe	2.50	0.16	2.57	512	8.00	10.57	1300.0	1300.0
SO2	3-hour	North Cheyen	3.09	0.11	3.19	25	8.00	11.19	1300.0	1300.0
SO2	3-hour	Cloud Peak W	1.71	0.04	1.71	512	8.00	9.71	1300.0	1300.0
PM10	Annual	Badlands NP	0.16	0.04	0.19	4	16.10	16.29	50.0	50.0
PM10	Annual	Blackelk WA	0.36	0.03	0.38	17	16.10	16.48	50.0	50.0
PM10	Annual	Mt. Rushmore	0.33	0.03	0.35	17	16.10	16.45	50.0	50.0
PM10	Annual	Wind Cave NP	0.34	0.03	0.37	4	16.10	16.47	50.0	50.0
PM10	Annual	Jewel Cave N	0.48	0.03	0.51	17	16.10	16.61	50.0	50.0
PM10	Annual	Devil's Towe	1.05	0.02	1.07	17	16.10	17.17	50.0	50.0
PM10	Annual	North Cheyen	0.17	0.01	0.18	4	16.10	16.28	50.0	50.0
PM10	Annual	Cloud Peak W	0.18	0.00	0.19	17	16.10	16.29	50.0	50.0

PM10	24-hour	Badlands NP	1.57	0.75	1.85	8	46.00	47.85	150.0	150.0
PM10	24-hour	Blackelk WA	3.57	0.51	3.68	30	46.00	49.68	150.0	150.0
PM10	24-hour	Mt. Rushmore	3.50	0.51	3.61	30	46.00	49.61	150.0	150.0
PM10	24-hour	Wind Cave NP	2.81	0.56	2.93	8	46.00	48.93	150.0	150.0
PM10	24-hour	Jewel Cave N	4.16	0.35	4.17	30	46.00	50.17	150.0	150.0
PM10	24-hour	Devil's Towe	5.93	0.51	6.16	30	46.00	52.16	150.0	150.0
PM10	24-hour	North Cheyen	4.25	0.50	4.25	8	46.00	50.25	150.0	150.0
PM10	24-hour	Cloud Peak W	5.23	0.22	5.31	30	46.00	51.31	150.0	150.0
PM25	Annual	Badlands NP	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	Annual	Blackelk WA	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	Annual	Mt. Rushmore	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	Annual	Wind Cave NP	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	Annual	Jewel Cave N	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	Annual	Devil's Towe	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	Annual	North Cheyen	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	Annual	Cloud Peak W	0.00	0.00	0.00	-999	5.60	5.60	15.0	15.0
PM25	24-hour	Badlands NP	0.00	0.03	0.03	-999	16.10	16.13	65.0	65.0
PM25	24-hour	Blackelk WA	0.00	0.01	0.01	-999	16.10	16.11	65.0	65.0
PM25	24-hour	Mt. Rushmore	0.00	0.01	0.01	-999	16.10	16.11	65.0	65.0
PM25	24-hour	Wind Cave NP	0.00	0.02	0.02	-999	16.10	16.12	65.0	65.0
PM25	24-hour	Jewel Cave N	0.00	0.01	0.01	-999	16.10	16.11	65.0	65.0
PM25	24-hour	Devil's Towe	0.00	0.01	0.01	-999	16.10	16.11	65.0	65.0
PM25	24-hour	North Cheyen	0.00	0.01	0.01	-999	16.10	16.11	65.0	65.0
PM25	24-hour	Cloud Peak W	0.00	0.00	0.00	-999	16.10	16.10	65.0	65.0
NO2	Annual	Badlands NP	0.11	0.13	0.24	2	16.50	16.74	100.0	100.0
NO2	Annual	Blackelk WA	0.20	0.07	0.27	25	16.50	16.77	100.0	100.0
NO2	Annual	Mt. Rushmore	0.19	0.07	0.26	25	16.50	16.76	100.0	100.0
NO2	Annual	Wind Cave NP	0.25	0.09	0.33	2	16.50	16.83	100.0	100.0
NO2	Annual	Jewel Cave N	0.31	0.06	0.38	25	16.50	16.88	100.0	100.0
NO2	Annual	Devil's Towe	0.46	0.04	0.51	25	16.50	17.01	100.0	100.0
NO2	Annual	North Cheyen	0.06	0.01	0.07	2	16.50	16.57	100.0	100.0
NO2	Annual	Cloud Peak W	0.03	0.00	0.03	25	16.50	16.53	100.0	100.0

APPENDIX C

Far-Field Visibility Impacts
Number of Days Per Year the Change in Extincition
are > 5% and > 10% over Background

PRBEP DM&E Railway Expansion Project Impacts
Three Alternative Railway Routes (rtb, rtc, and rtd)
Three Levels of Annual Coal Transport (20mnt, 50mnt, and 100mnt)

Project Impacts
Impacts Due to Other New Sources
Cumulative Impacts (Project + Other New Sources)

Change in Extinction. DM&E 1990.
Run: **rtb-20mnt**-T0+1AC

Sensitive Area	Non-DM&E_Sources			DM&E_Sources			All_Sources			Date of_Max	Chg on Max Date		Visual Range	
	#days >5%	#days >10%	Max %	#days >5%	#days >10%	Max %	#days >5%	#days >10%	Max %		Non-DM&E %	DM&E %	Base (km)	Lowest (km)
Badlands NP	33	12	18.1	0	0	3.2	40	14	19.3	12/26/90	17.3	2.0	162.6	139.5
Blackelk WA	61	25	23.6	0	0	2.2	66	25	24.3	1/20/90	23.6	0.8	162.6	140.1
Mt. Rushmore	59	22	22.3	0	0	2.1	59	22	23.0	1/20/90	22.3	0.7	162.6	140.2
Wind Cave NP	72	23	22.9	0	0	2.8	78	25	23.8	1/17/90	22.9	0.9	162.6	134.5
Jewel Cave N	87	38	28.3	0	0	1.6	92	40	29.3	1/20/90	28.3	0.9	162.6	135.5
Devil's Towe	143	69	60.9	0	0	3.5	143	70	64.4	2/25/90	60.9	3.5	162.6	112.0
North Cheyen	38	24	73.2	0	0	2.4	38	24	75.2	1/16/90	73.2	1.9	207.3	154.7
Cloud Peak W	32	17	41.1	0	0	1.1	33	17	42.2	1/16/90	41.1	1.1	207.3	161.5

Change in Extinction. DM&E 1990.
Run: **rtc-20mnt**-T0+1AC

Sensitive Area	Non-DM&E_Sources			DM&E_Sources			All_Sources			Date of_Max	Chg on Max Date		Visual Range	
	#days >5%	#days >10%	Max %	#days >5%	#days >10%	Max %	#days >5%	#days >10%	Max %		Non-DM&E %	DM&E %	Base (km)	Lowest (km)
Badlands NP	33	12	18.1	0	0	2.2	39	13	19.3	1/17/90	18.1	1.1	162.6	139.4
Blackelk WA	61	25	23.6	0	0	2.2	66	25	24.5	1/20/90	23.6	1.0	162.6	140.0
Mt. Rushmore	59	22	22.3	0	0	2.1	59	22	23.2	1/20/90	22.3	0.9	162.6	140.1
Wind Cave NP	72	23	22.9	0	0	2.8	78	25	23.9	1/17/90	22.9	1.0	162.6	134.3
Jewel Cave N	87	38	28.3	0	0	1.6	93	40	29.5	1/20/90	28.3	1.2	162.6	135.3
Devil's Towe	143	69	60.9	0	0	3.7	143	70	64.6	2/25/90	60.9	3.7	162.6	111.9
North Cheyen	38	24	73.2	0	0	2.6	38	24	75.4	1/16/90	73.2	2.2	207.3	154.5
Cloud Peak W	32	17	41.1	0	0	1.2	33	17	42.3	1/16/90	41.1	1.2	207.3	161.4

Change in Extinction. DM&E 1990.
Run: **rtd-20mnt**-T0+1AC

Sensitive Area	Non-DM&E_Sources			DM&E_Sources			All_Sources			Date of_Max	Chg on Max Date		Visual Range	
	#days >5%	#days >10%	Max %	#days >5%	#days >10%	Max %	#days >5%	#days >10%	Max %		Non-DM&E %	DM&E %	Base (km)	Lowest (km)
Badlands NP	33	12	18.1	1	0	6.0	45	14	19.8	1/17/90	18.1	1.7	162.6	139.1
Blackelk WA	61	25	23.6	0	0	4.0	68	25	24.5	1/20/90	23.6	0.9	162.6	139.8
Mt. Rushmore	59	22	22.3	0	0	4.0	63	22	23.2	1/20/90	22.3	0.9	162.6	139.9
Wind Cave NP	72	23	22.9	0	0	4.4	79	27	24.2	1/17/90	22.9	1.2	162.6	134.4
Jewel Cave N	87	38	28.3	0	0	2.5	92	40	29.4	1/20/90	28.3	1.0	162.6	135.0
Devil's Towe	143	69	60.9	0	0	4.1	144	70	65.0	2/25/90	60.9	4.1	162.6	111.6
North Cheyen	38	24	73.2	0	0	3.6	38	24	76.0	1/16/90	73.2	2.7	207.3	154.0
Cloud Peak W	32	17	41.1	0	0	1.4	33	17	42.5	1/16/90	41.1	1.4	207.3	161.3

Change in Extinction. DM&E 1990.
Run: **rtb-50mnt**-T0+1AC

Sensitive Area	Non-DM&E_Sources #days >5%	#days >10%	Max %	DM&E_Sources #days >5%	#days >10%	Max %	All_Sources #days >5%	#days >10%	Max %	Date of_Max	Chg on Max Date Non-DM&E %	DM&E %	Visual Range Base (km)	Lowest (km)
Badlands NP	33	12	18.1	1	0	7.1	51	15	21.7	12/26/90	17.3	4.4	162.6	137.0
Blackelk WA	61	25	23.6	0	0	4.5	72	28	25.3	1/20/90	23.6	1.7	162.6	139.3
Mt. Rushmore	59	22	22.3	0	0	4.3	65	23	23.8	1/20/90	22.3	1.6	162.6	139.4
Wind Cave NP	72	23	22.9	1	0	5.8	79	29	24.9	1/17/90	22.9	2.0	162.6	133.6
Jewel Cave N	87	38	28.3	0	0	3.3	96	40	30.5	1/20/90	28.3	2.1	162.6	135.1
Devil's Towe	143	69	60.9	1	0	7.6	144	70	68.4	2/25/90	60.9	7.6	162.6	109.3
North Cheyen	38	24	73.2	2	0	5.4	39	24	77.6	1/16/90	73.2	4.4	207.3	152.6
Cloud Peak W	32	17	41.1	0	0	2.5	33	19	43.5	1/16/90	41.1	2.5	207.3	161.0

Change in Extinction. DM&E 1990.
Run: **rtc-50mnt**-T0+1AC

Sensitive Area	Non-DM&E_Sources #days >5%	#days >10%	Max %	DM&E_Sources #days >5%	#days >10%	Max %	All_Sources #days >5%	#days >10%	Max %	Date of_Max	Chg on Max Date Non-DM&E %	DM&E %	Visual Range Base (km)	Lowest (km)
Badlands NP	33	12	18.1	0	0	4.6	52	15	21.6	12/26/90	17.3	4.3	162.6	138.4
Blackelk WA	61	25	23.6	0	0	4.4	73	28	25.7	1/20/90	23.6	2.2	162.6	139.2
Mt. Rushmore	59	22	22.3	0	0	4.3	65	23	24.3	1/20/90	22.3	2.0	162.6	139.3
Wind Cave NP	72	23	22.9	1	0	5.6	79	28	25.1	1/17/90	22.9	2.2	162.6	133.3
Jewel Cave N	87	38	28.3	0	0	3.3	96	40	31.0	1/20/90	28.3	2.6	162.6	134.7
Devil's Towe	143	69	60.8	1	0	8.1	144	71	68.9	2/25/90	60.8	8.1	162.6	109.0
North Cheyen	38	24	73.2	2	0	5.9	39	24	78.1	1/16/90	73.2	4.9	207.3	152.1
Cloud Peak W	32	17	41.1	0	0	2.8	33	19	43.8	1/16/90	41.1	2.8	207.3	160.8

Change in Extinction. DM&E 1990.
Run: **rtd-50mnt**-T0+1AC

Sensitive Area	Non-DM&E_Sources #days >5%	#days >10%	Max %	DM&E_Sources #days >5%	#days >10%	Max %	All_Sources #days >5%	#days >10%	Max %	Date of_Max	Chg on Max Date Non-DM&E %	DM&E %	Visual Range Base (km)	Lowest (km)
Badlands NP	33	12	18.1	10	1	13.4	58	17	22.6	12/11/90	14.9	7.7	162.6	137.8
Blackelk WA	61	25	23.6	3	0	8.2	75	28	25.6	1/20/90	23.6	2.1	162.6	137.2
Mt. Rushmore	59	22	22.3	3	0	8.1	70	23	24.3	1/20/90	22.3	2.0	162.6	137.6
Wind Cave NP	72	23	22.9	2	0	9.0	82	29	25.7	1/17/90	22.9	2.8	162.6	132.1
Jewel Cave N	87	38	28.3	2	0	5.3	98	41	30.7	1/20/90	28.3	2.3	162.6	134.0
Devil's Towe	143	69	60.8	1	0	9.0	146	71	69.8	2/25/90	60.8	9.0	162.6	108.4
North Cheyen	38	24	73.2	3	0	8.0	40	24	79.3	1/16/90	73.2	6.1	207.3	151.1
Cloud Peak W	32	17	41.1	0	0	3.2	34	20	44.3	1/16/90	41.1	3.2	207.3	160.6

Change in Extinction. DM&E 1990.
Run: **rtb-100mnt**-T0+1AC

Sensitive Area	Non-DM&E_Sources #days >5%	#days >10%	Max %	DM&E_Sources #days >5%	#days >10%	Max %	All_Sources #days >5%	#days >10%	Max %	Date of_Max	Chg on Max Date Non-DM&E %	DM&E %	Visual Range Base (km)	Lowest (km)
Badlands NP	33	12	18.1	12	1	13.2	60	21	25.7	12/26/90	17.3	8.4	162.6	130.4
Blackelk WA	61	25	23.6	5	0	8.1	77	29	26.8	1/20/90	23.6	3.2	162.6	137.4
Mt. Rushmore	59	22	22.3	4	0	7.7	74	26	25.2	1/20/90	22.3	3.0	162.6	138.0
Wind Cave NP	72	23	22.9	3	1	10.5	84	30	26.7	1/17/90	22.9	3.8	162.6	130.7
Jewel Cave N	87	38	28.3	5	0	6.1	99	41	32.3	1/20/90	28.3	4.0	162.6	134.5
Devil's Towe	143	69	60.8	3	1	14.1	147	72	74.9	2/25/90	60.8	14.1	162.6	105.3
North Cheyen	38	24	73.2	4	2	10.2	40	24	81.5	1/16/90	73.2	8.2	207.3	149.3
Cloud Peak W	32	17	41.1	0	0	4.6	35	20	45.7	1/16/90	41.1	4.6	207.3	160.2

Change in Extinction. DM&E 1990.
Run: **rtc-100mnt**-T0+1AC

Sensitive Area	Non-DM&E_Sources #days >5%	#days >10%	Max %	DM&E_Sources #days >5%	#days >10%	Max %	All_Sources #days >5%	#days >10%	Max %	Date of_Max	Chg on Max Date Non-DM&E %	DM&E %	Visual Range Base (km)	Lowest (km)
Badlands NP	33	12	18.1	9	0	8.3	57	22	25.4	12/26/90	17.3	8.2	162.6	135.5
Blackelk WA	61	25	23.6	3	0	8.0	78	30	27.6	1/20/90	23.6	4.1	162.6	137.4
Mt. Rushmore	59	22	22.3	3	0	7.7	74	28	26.1	1/20/90	22.3	3.8	162.6	137.9
Wind Cave NP	72	23	22.9	3	1	10.2	84	32	27.1	1/17/90	22.9	4.2	162.6	130.8
Jewel Cave N	87	38	28.3	4	0	6.0	99	41	33.3	1/20/90	28.3	5.0	162.6	133.8
Devil's Towe	143	69	60.8	4	1	15.0	146	72	75.8	2/25/90	60.8	15.0	162.6	104.7
North Cheyen	38	24	73.2	4	2	11.2	40	24	82.5	1/16/90	73.2	9.2	207.3	148.5
Cloud Peak W	32	17	41.1	1	0	5.2	35	20	46.3	1/16/90	41.1	5.2	207.3	159.9

Change in Extinction. DM&E 1990.
Run: **rtd-100mnt**-T0+1AC

Sensitive Area	Non-DM&E_Sources #days >5%	#days >10%	Max %	DM&E_Sources #days >5%	#days >10%	Max %	All_Sources #days >5%	#days >10%	Max %	Date of_Max	Chg on Max Date Non-DM&E %	DM&E %	Visual Range Base (km)	Lowest (km)
Badlands NP	33	12	18.1	31	7	25.3	82	33	29.1	12/11/90	14.9	14.2	162.6	131.8
Blackelk WA	61	25	23.6	9	3	14.9	85	33	27.5	1/20/90	23.6	3.9	162.6	129.9
Mt. Rushmore	59	22	22.3	7	3	14.7	80	30	26.1	1/20/90	22.3	3.8	162.6	130.4
Wind Cave NP	72	23	22.9	12	2	16.2	92	34	29.7	4/12/90	14.8	15.0	162.6	125.3
Jewel Cave N	87	38	28.3	8	1	10.0	105	44	32.7	1/20/90	28.3	4.4	162.6	132.6
Devil's Towe	143	69	60.8	5	1	16.6	150	74	77.4	2/25/90	60.8	16.6	162.6	103.8
North Cheyen	38	24	73.2	6	3	15.1	41	24	84.7	1/16/90	73.2	11.5	207.3	146.7
Cloud Peak W	32	17	41.1	1	0	6.1	35	20	47.1	1/16/90	41.1	6.1	207.3	159.5

APPENDIX D

Far-Field Visibility Impacts
Number of Days Per Year the Change in Deciview
are > 0.5 Δdv and > 1.0 Δdv over Background

PRBEP DM&E Railway Expansion Project Impacts
Three Alternative Railway Routes (rtb, rtc, and rtd)
Three Levels of Annual Coal Transport (20mnt, 50mnt, and 100mnt)

Project Impacts
Impacts Due to Other New Sources
Cumulative Impacts (Project + Other New Sources)

Deciview Change. DM&E 1990
Run: **rtb-20mnt**-T0+1AC

Sensitive Area	Non-DM&E Sources			DM&E Sources			All Sources			Date of Max	Change on Max Date	
	#days	#days	Max	#days	#days	Max	#days	#days	Max		Non-DM&E	DM&E
.	>0.5dv	>1.0dv	dv	>0.5dv	>1.0dv	dv	>0.5dv	>1.0dv	dv		dv	dv
Badlands NP	33	10	1.7	0	0	0.3	36	12	1.8	12/26/90	1.594	0.196
Blackelk WA	61	22	2.1	0	0	0.2	63	23	2.2	1/20/90	2.115	0.076
Mt. Rushmore	57	18	2.0	0	0	0.2	59	21	2.1	1/20/90	2.011	0.070
Wind Cave NP	69	20	2.1	0	0	0.3	76	23	2.1	1/17/90	2.064	0.095
Jewel Cave N	83	33	2.5	0	0	0.2	90	36	2.6	1/20/90	2.496	0.094
Devil's Towe	140	63	4.8	0	0	0.3	143	65	5.0	2/25/90	4.755	0.341
North Cheyen	37	21	5.5	0	0	0.2	37	21	5.6	1/16/90	5.495	0.193
Cloud Peak W	32	16	3.4	0	0	0.1	32	16	3.5	1/16/90	3.441	0.109

Deciview Change. DM&E 1990
Run: **rtc-20mnt**-T0+1AC

Sensitive Area	Non-DM&E Sources			DM&E Sources			All Sources			Date of Max	Change on Max Date	
	#days	#days	Max	#days	#days	Max	#days	#days	Max		Non-DM&E	DM&E
.	>0.5dv	>1.0dv	dv	>0.5dv	>1.0dv	dv	>0.5dv	>1.0dv	dv		dv	dv
Badlands NP	33	10	1.7	0	0	0.2	36	12	1.8	1/17/90	1.667	0.116
Blackelk WA	61	22	2.1	0	0	0.2	63	23	2.2	1/20/90	2.115	0.096
Mt. Rushmore	57	18	2.0	0	0	0.2	59	21	2.1	1/20/90	2.011	0.089
Wind Cave NP	69	20	2.1	0	0	0.3	76	22	2.1	1/17/90	2.064	0.100
Jewel Cave N	83	33	2.5	0	0	0.2	89	35	2.6	1/20/90	2.496	0.117
Devil's Towe	140	63	4.8	0	0	0.4	143	66	5.0	2/25/90	4.755	0.366
North Cheyen	37	21	5.5	0	0	0.3	38	22	5.6	1/16/90	5.495	0.216
Cloud Peak W	32	16	3.4	0	0	0.1	33	16	3.5	1/16/90	3.441	0.123

Deciview Change. DM&E 1990
Run: **rtd-20mnt**-T0+1AC

Sensitive Area	Non-DM&E Sources			DM&E Sources			All Sources			Date of Max	Change on Max Date	
	#days	#days	Max	#days	#days	Max	#days	#days	Max		Non-DM&E	DM&E
.	>0.5dv	>1.0dv	dv	>0.5dv	>1.0dv	dv	>0.5dv	>1.0dv	dv		dv	dv
Badlands NP	33	10	1.7	1	0	0.6	42	13	1.8	1/17/90	1.667	0.220
Blackelk WA	61	22	2.1	0	0	0.4	67	24	2.2	1/20/90	2.115	0.093
Mt. Rushmore	57	18	2.0	0	0	0.4	61	22	2.1	1/20/90	2.011	0.090
Wind Cave NP	69	20	2.1	0	0	0.4	77	23	2.2	1/17/90	2.064	0.131
Jewel Cave N	83	33	2.5	0	0	0.3	91	37	2.6	1/20/90	2.496	0.103
Devil's Towe	140	63	4.8	0	0	0.4	143	67	5.0	2/25/90	4.754	0.406
North Cheyen	37	21	5.5	0	0	0.3	38	22	5.7	1/16/90	5.495	0.269
Cloud Peak W	32	16	3.4	0	0	0.1	33	16	3.5	1/16/90	3.441	0.143

Deciview Change. DM&E 1990
Run: **rtb-50mnt**-T0+1AC

Sensitive Area	Non-DM&E Sources			DM&E Sources			All Sources			Date of Max	Change on Max Date	
	#days	#days	Max	#days	#days	Max	#days	#days	Max		Non-DM&E	DM&E
.	>0.5dv	>1.0dv	dv	>0.5dv	>1.0dv	dv	>0.5dv	>1.0dv	dv		dv	dv
Badlands NP	33	10	1.7	1	0	0.7	50	15	2.0	12/26/90	1.594	0.435
Blackelk WA	61	22	2.1	0	0	0.4	70	24	2.3	1/20/90	2.115	0.170
Mt. Rushmore	57	18	2.0	0	0	0.4	64	21	2.1	1/20/90	2.011	0.156
Wind Cave NP	69	20	2.1	1	0	0.6	78	25	2.2	1/17/90	2.064	0.212
Jewel Cave N	83	33	2.5	0	0	0.3	91	37	2.7	1/20/90	2.496	0.209
Devil's Towe	140	63	4.8	1	0	0.7	143	67	5.2	2/25/90	4.753	0.728
North Cheyen	37	21	5.5	2	0	0.5	39	22	5.7	1/16/90	5.495	0.428
Cloud Peak W	32	16	3.4	0	0	0.2	33	16	3.6	1/16/90	3.441	0.243

Deciview Change. DM&E 1990
Run: **rtc-50mnt**-T0+1AC

Sensitive Area	Non-DM&E Sources			DM&E Sources			All Sources			Date of Max	Change on Max Date	
	#days	#days	Max	#days	#days	Max	#days	#days	Max		Non-DM&E	DM&E
.	>0.5dv	>1.0dv	dv	>0.5dv	>1.0dv	dv	>0.5dv	>1.0dv	dv		dv	dv
Badlands NP	33	10	1.7	0	0	0.4	50	15	2.0	12/26/90	1.594	0.423
Blackelk WA	61	22	2.1	0	0	0.4	69	24	2.3	1/20/90	2.115	0.215
Mt. Rushmore	57	18	2.0	0	0	0.4	63	22	2.2	1/20/90	2.011	0.200
Wind Cave NP	69	20	2.1	1	0	0.5	78	25	2.2	1/17/90	2.064	0.223
Jewel Cave N	83	33	2.5	0	0	0.3	93	39	2.7	1/20/90	2.496	0.261
Devil's Towe	140	63	4.8	1	0	0.8	143	67	5.2	2/25/90	4.753	0.777
North Cheyen	37	21	5.5	2	0	0.6	39	22	5.8	1/16/90	5.495	0.478
Cloud Peak W	32	16	3.4	0	0	0.3	33	16	3.6	1/16/90	3.441	0.273

Deciview Change. DM&E 1990
Run: **rtd-50mnt**-T0+1AC

Sensitive Area	Non-DM&E Sources			DM&E Sources			All Sources			Date of Max	Change on Max Date	
	#days	#days	Max	#days	#days	Max	#days	#days	Max		Non-DM&E	DM&E
.	>0.5dv	>1.0dv	dv	>0.5dv	>1.0dv	dv	>0.5dv	>1.0dv	dv		dv	dv
Badlands NP	33	10	1.7	9	1	1.3	57	16	2.0	12/11/90	1.393	0.740
Blackelk WA	61	22	2.1	3	0	0.8	73	25	2.3	1/20/90	2.115	0.207
Mt. Rushmore	57	18	2.0	3	0	0.8	68	22	2.2	1/20/90	2.011	0.201
Wind Cave NP	69	20	2.1	2	0	0.9	80	27	2.3	1/17/90	2.064	0.292
Jewel Cave N	83	33	2.5	2	0	0.5	96	39	2.7	1/20/90	2.496	0.228
Devil's Towe	140	63	4.8	1	0	0.9	145	70	5.3	2/25/90	4.752	0.857
North Cheyen	37	21	5.5	3	0	0.8	39	22	5.8	1/16/90	5.495	0.593
Cloud Peak W	32	16	3.4	0	0	0.3	34	17	3.7	1/16/90	3.441	0.317

Deciview Change. DM&E 1990
Run: **rtb-100mnt**-T0+1AC

Sensitive Area	Non-DM&E Sources			DM&E Sources			All Sources			Date of Max	Change on Max Date	
	#days	#days	Max	#days	#days	Max	#days	#days	Max		Non-DM&E	DM&E
.	>0.5dv	>1.0dv	dv	>0.5dv	>1.0dv	dv	>0.5dv	>1.0dv	dv		dv	dv
Badlands NP	33	10	1.7	11	1	1.2	58	19	2.3	12/26/90	1.594	0.806
Blackelk WA	61	22	2.1	4	0	0.8	76	28	2.4	1/20/90	2.115	0.319
Mt. Rushmore	57	18	2.0	4	0	0.7	73	25	2.3	1/20/90	2.011	0.292
Wind Cave NP	69	20	2.1	3	0	1.0	83	29	2.4	1/17/90	2.064	0.396
Jewel Cave N	83	33	2.5	5	0	0.6	97	40	2.8	1/20/90	2.495	0.391
Devil's Towe	140	63	4.8	3	1	1.3	145	68	5.6	2/25/90	4.751	1.316
North Cheyen	37	21	5.5	4	0	1.0	40	23	6.0	1/16/90	5.495	0.792
Cloud Peak W	32	16	3.4	0	0	0.5	34	18	3.8	1/16/90	3.441	0.454

Deciview Change. DM&E 1990
Run: **rtc-100mnt**-T0+1AC

Sensitive Area	Non-DM&E Sources			DM&E Sources			All Sources			Date of Max	Change on Max Date	
	#days	#days	Max	#days	#days	Max	#days	#days	Max		Non-DM&E	DM&E
.	>0.5dv	>1.0dv	dv	>0.5dv	>1.0dv	dv	>0.5dv	>1.0dv	dv		dv	dv
Badlands NP	33	10	1.7	8	0	0.8	56	16	2.3	12/26/90	1.594	0.784
Blackelk WA	61	22	2.1	3	0	0.8	77	28	2.4	1/20/90	2.115	0.401
Mt. Rushmore	57	18	2.0	3	0	0.7	72	24	2.3	1/20/90	2.011	0.374
Wind Cave NP	69	20	2.1	2	0	1.0	82	30	2.4	1/17/90	2.064	0.417
Jewel Cave N	83	33	2.5	4	0	0.6	97	40	2.9	1/20/90	2.495	0.487
Devil's Towe	140	63	4.8	3	1	1.4	146	69	5.6	2/25/90	4.750	1.401
North Cheyen	37	21	5.5	4	1	1.1	40	23	6.0	1/16/90	5.495	0.884
Cloud Peak W	32	16	3.4	1	0	0.5	34	19	3.8	1/16/90	3.441	0.510

Deciview Change. DM&E 1990
Run: **rtd-100mnt**-T0+1AC

Sensitive Area	Non-DM&E Sources			DM&E Sources			All Sources			Date of Max	Change on Max Date	
	#days	#days	Max	#days	#days	Max	#days	#days	Max		Non-DM&E	DM&E
.	>0.5dv	>1.0dv	dv	>0.5dv	>1.0dv	dv	>0.5dv	>1.0dv	dv		dv	dv
Badlands NP	33	10	1.7	30	7	2.3	79	27	2.6	12/11/90	1.392	1.328
Blackelk WA	61	22	2.1	7	3	1.4	84	29	2.4	1/20/90	2.115	0.387
Mt. Rushmore	57	18	2.0	7	3	1.4	78	26	2.3	1/20/90	2.011	0.376
Wind Cave NP	69	20	2.1	11	2	1.5	90	33	2.6	4/12/90	1.395	1.501
Jewel Cave N	83	33	2.5	8	0	1.0	98	42	2.8	1/20/90	2.495	0.427
Devil's Towe	140	63	4.7	5	1	1.5	150	70	5.7	2/25/90	4.749	1.539
North Cheyen	37	21	5.5	6	3	1.4	40	23	6.1	1/16/90	5.495	1.090
Cloud Peak W	32	16	3.4	1	0	0.6	34	20	3.9	1/16/90	3.441	0.590

APPENDIX E

Daily Analysis of Far-Field Visibility Impacts
Number of Days Per Year the Change in Extinction
are > 10% over Background

Route C at 50MNT Project Alternative

Cumulative Impacts (Project + Other New Sources)
Contribution of Other New Sources
Contribution of DM&E Project Sources

			EXTINCTION				
Date	SensitiveArea	%Change	Total	Non-DM&E	(%)	DM&E	(%)
1/ 7/90	Devil's To	13.2	24.04	2.80	13.2	0.00	0.0
1/14/90	Blackelk W	11.5	23.70	2.40	11.3	0.06	0.3
1/14/90	Mt. Rushmo	10.5	23.49	2.19	10.3	0.05	0.2
1/14/90	Wind Cave	14.2	24.26	2.93	13.8	0.09	0.4
1/14/90	Jewel Cave	13.7	24.16	2.84	13.4	0.07	0.3
1/14/90	Devil's To	30.9	27.82	6.57	30.9	0.00	0.0
1/15/90	Cloud Peak	20.2	17.35	2.79	19.3	0.13	0.9
1/16/90	Blackelk W	10.1	23.39	1.67	7.9	0.47	2.2
1/16/90	Jewel Cave	17.3	24.93	3.03	14.3	0.65	3.1
1/16/90	Devil's To	30.6	27.74	5.61	26.4	0.88	4.2
1/16/90	North Chey	78.1	25.71	10.57	73.2	0.71	4.9
1/16/90	Cloud Peak	43.8	20.76	5.93	41.1	0.40	2.8
1/17/90	Badlands N	20.7	25.63	3.85	18.1	0.54	2.5
1/17/90	Blackelk W	19.4	25.38	3.75	17.6	0.38	1.8
1/17/90	Mt. Rushmo	17.8	25.04	3.42	16.1	0.37	1.7
1/17/90	Wind Cave	25.1	26.58	4.87	22.9	0.47	2.2
1/17/90	Jewel Cave	23.6	26.27	4.63	21.8	0.39	1.8
1/18/90	Devil's To	28.3	27.25	5.70	26.8	0.31	1.5
1/19/90	Devil's To	17.2	24.91	3.64	17.2	0.02	0.1
1/20/90	Badlands N	16.2	24.68	2.94	13.8	0.49	2.3
1/20/90	Blackelk W	25.7	26.71	5.00	23.6	0.46	2.2
1/20/90	Mt. Rushmo	24.3	26.41	4.73	22.3	0.43	2.0
1/20/90	Wind Cave	24.5	26.46	4.70	22.1	0.52	2.4
1/20/90	Jewel Cave	31.0	27.83	6.02	28.3	0.56	2.6
1/20/90	Devil's To	18.3	25.14	3.89	18.3	0.00	0.0
1/21/90	Badlands N	11.7	23.74	2.25	10.6	0.25	1.2
1/21/90	Blackelk W	10.1	23.39	2.13	10.0	0.01	0.1
1/22/90	Blackelk W	12.5	23.91	2.59	12.2	0.07	0.3
1/22/90	Mt. Rushmo	12.5	23.90	2.58	12.2	0.07	0.3
1/22/90	Devil's To	11.4	23.66	2.41	11.4	0.00	0.0
1/30/90	North Chey	10.9	16.00	1.53	10.6	0.04	0.3
1/31/90	Devil's To	10.9	23.56	2.15	10.1	0.16	0.7
1/31/90	Cloud Peak	16.7	16.85	2.27	15.7	0.15	1.0
2/ 1/90	Devil's To	19.7	25.43	3.59	16.9	0.60	2.8
2/ 1/90	North Chey	66.6	24.04	8.78	60.9	0.82	5.7
2/ 1/90	Cloud Peak	25.6	18.12	3.45	23.9	0.24	1.7
2/ 2/90	Badlands N	14.1	24.25	2.21	10.4	0.79	3.7
2/ 2/90	Blackelk W	16.2	24.69	2.95	13.9	0.49	2.3
2/ 2/90	Mt. Rushmo	15.3	24.50	2.78	13.1	0.48	2.3
2/ 2/90	Wind Cave	19.1	25.30	3.49	16.4	0.56	2.7
2/ 2/90	Jewel Cave	20.8	25.67	3.88	18.3	0.54	2.6
2/ 2/90	Devil's To	24.9	26.54	4.79	22.5	0.50	2.3
2/ 2/90	North Chey	37.9	19.91	4.68	32.4	0.79	5.5
2/ 3/90	Blackelk W	12.7	23.95	2.56	12.0	0.15	0.7
2/ 3/90	Mt. Rushmo	12.1	23.82	2.42	11.4	0.15	0.7
2/ 3/90	Wind Cave	11.6	23.70	2.30	10.8	0.15	0.7
2/ 3/90	Jewel Cave	12.0	23.80	2.41	11.4	0.14	0.6
2/ 3/90	Devil's To	12.2	23.83	2.57	12.1	0.02	0.1
2/ 6/90	Devil's To	19.4	25.36	4.02	18.9	0.10	0.5
2/ 7/90	Wind Cave	10.7	23.51	2.15	10.1	0.11	0.5
2/ 7/90	Jewel Cave	11.0	23.57	2.27	10.7	0.06	0.3
2/ 8/90	Badlands N	11.3	23.65	2.19	10.3	0.21	1.0
2/ 8/90	Blackelk W	10.7	23.52	2.20	10.3	0.08	0.4
2/ 8/90	Wind Cave	13.9	24.19	2.78	13.1	0.17	0.8
2/ 8/90	Jewel Cave	13.4	24.10	2.75	13.0	0.10	0.5

2/14/90	North Chey	17.7	16.99	2.30	15.9	0.27	1.8
2/14/90	Cloud Peak	12.4	16.22	1.63	11.3	0.15	1.0
2/15/90	North Chey	13.8	16.43	1.77	12.2	0.23	1.6
2/15/90	Cloud Peak	10.1	15.89	1.32	9.1	0.13	0.9
2/18/90	Badlands N	13.7	24.17	2.45	11.5	0.47	2.2
2/18/90	Wind Cave	10.4	23.46	2.04	9.6	0.17	0.8
2/18/90	Jewel Cave	11.8	23.75	2.30	10.8	0.20	1.0
2/19/90	Devil's To	22.8	26.09	4.53	21.3	0.32	1.5
2/20/90	Devil's To	10.7	23.52	2.22	10.4	0.05	0.2
2/25/90	Blackelk W	21.3	25.77	3.84	18.1	0.69	3.2
2/25/90	Mt. Rushmo	19.5	25.39	3.43	16.1	0.71	3.4
2/25/90	Wind Cave	13.9	24.20	2.51	11.8	0.45	2.1
2/25/90	Jewel Cave	23.7	26.27	4.41	20.8	0.61	2.9
2/25/90	Devil's To	68.9	35.89	12.93	60.8	1.72	8.1
2/26/90	Badlands N	13.7	24.15	2.54	11.9	0.37	1.7
2/26/90	Blackelk W	17.6	24.98	3.29	15.5	0.44	2.1
2/26/90	Mt. Rushmo	16.7	24.79	3.10	14.6	0.44	2.1
2/26/90	Wind Cave	18.8	25.23	3.56	16.8	0.43	2.0
2/26/90	Jewel Cave	21.6	25.84	4.16	19.6	0.44	2.1
2/26/90	Devil's To	19.4	25.37	3.81	17.9	0.32	1.5
2/28/90	Devil's To	40.6	29.87	8.13	38.3	0.49	2.3
3/ 1/90	Devil's To	14.3	27.51	3.35	13.9	0.09	0.4
3/ 2/90	Jewel Cave	12.0	26.95	2.79	11.6	0.10	0.4
3/ 2/90	Devil's To	17.0	28.16	4.09	17.0	0.00	0.0
3/ 3/90	Devil's To	16.6	28.06	3.54	14.7	0.45	1.9
3/ 4/90	Jewel Cave	12.2	26.99	2.59	10.7	0.34	1.4
3/ 4/90	Devil's To	31.0	31.53	7.23	30.0	0.24	1.0
3/ 5/90	North Chey	45.2	25.53	7.28	41.4	0.67	3.8
3/ 5/90	Cloud Peak	13.7	19.99	2.32	13.2	0.09	0.5
3/ 7/90	North Chey	13.7	20.00	2.40	13.7	0.01	0.1
3/ 7/90	Cloud Peak	10.4	19.41	1.81	10.3	0.02	0.1
3/ 8/90	North Chey	20.0	21.09	3.42	19.4	0.10	0.5
3/ 9/90	Devil's To	10.3	26.55	2.43	10.1	0.05	0.2
3/10/90	Devil's To	13.2	27.23	3.07	12.8	0.09	0.4
3/12/90	Badlands N	17.5	28.27	3.81	15.8	0.40	1.7
3/12/90	Blackelk W	14.2	27.48	3.24	13.5	0.17	0.7
3/12/90	Mt. Rushmo	11.9	26.93	2.74	11.4	0.12	0.5
3/12/90	Wind Cave	21.9	29.34	4.86	20.2	0.42	1.7
3/12/90	Jewel Cave	20.7	29.04	4.74	19.7	0.24	1.0
3/13/90	Badlands N	16.6	28.05	3.06	12.7	0.93	3.9
3/13/90	Blackelk W	15.5	27.80	3.08	12.8	0.65	2.7
3/13/90	Mt. Rushmo	15.5	27.79	3.06	12.7	0.66	2.8
3/13/90	Wind Cave	13.2	27.25	2.25	9.4	0.94	3.9
3/13/90	Jewel Cave	12.5	27.06	2.29	9.5	0.70	2.9
3/13/90	Devil's To	31.8	31.71	7.00	29.1	0.65	2.7
3/14/90	Wind Cave	10.3	26.55	2.29	9.5	0.19	0.8
3/19/90	Devil's To	20.2	28.92	4.45	18.5	0.40	1.7
3/20/90	Devil's To	12.2	27.00	2.89	12.0	0.05	0.2
3/21/90	Jewel Cave	14.7	27.61	3.40	14.1	0.14	0.6
3/21/90	Devil's To	13.6	27.33	3.17	13.2	0.10	0.4
3/25/90	Wind Cave	10.3	26.53	2.32	9.7	0.14	0.6
3/25/90	Jewel Cave	10.9	26.69	2.55	10.6	0.08	0.3
3/26/90	Devil's To	19.4	28.73	4.36	18.1	0.30	1.3
3/29/90	Devil's To	15.6	27.82	3.27	13.6	0.48	2.0
3/30/90	Devil's To	16.8	28.11	3.80	15.8	0.25	1.0
3/31/90	Jewel Cave	11.1	26.73	2.56	10.6	0.10	0.4
3/31/90	Devil's To	13.3	27.27	3.17	13.2	0.03	0.1

4/ 2/90	North Chey	13.7	19.98	2.40	13.6	0.00	0.0
4/ 6/90	Badlands N	11.0	26.71	2.17	9.0	0.47	2.0
4/ 6/90	Blackelk W	13.7	27.36	2.92	12.1	0.38	1.6
4/ 6/90	Mt. Rushmo	11.8	26.92	2.50	10.4	0.35	1.4
4/ 6/90	Wind Cave	17.2	28.21	3.67	15.3	0.47	2.0
4/ 6/90	Jewel Cave	18.7	28.56	4.13	17.1	0.37	1.5
4/ 6/90	Devil's To	10.9	26.70	2.62	10.9	0.01	0.0
4/12/90	Badlands N	15.1	27.69	2.74	11.4	0.88	3.7
4/12/90	Blackelk W	14.7	27.60	2.47	10.2	1.07	4.4
4/12/90	Mt. Rushmo	14.3	27.52	2.43	10.1	1.02	4.3
4/12/90	Wind Cave	20.0	28.89	3.56	14.8	1.26	5.2
4/12/90	Jewel Cave	15.3	27.74	2.87	11.9	0.80	3.3
4/15/90	Devil's To	11.5	26.84	2.76	11.5	0.01	0.0
4/17/90	North Chey	13.9	20.02	2.33	13.3	0.11	0.6
4/24/90	Jewel Cave	11.0	26.70	2.25	9.4	0.39	1.6
4/24/90	Devil's To	17.9	28.37	4.20	17.5	0.10	0.4
4/26/90	Blackelk W	16.8	28.11	3.63	15.1	0.42	1.7
4/26/90	Mt. Rushmo	16.7	28.09	3.61	15.0	0.42	1.7
4/26/90	Wind Cave	12.8	27.14	2.72	11.3	0.35	1.5
4/26/90	Jewel Cave	11.7	26.87	2.53	10.5	0.28	1.1
4/28/90	Cloud Peak	10.7	19.46	1.85	10.5	0.03	0.2
5/ 1/90	Blackelk W	10.1	26.49	2.18	9.1	0.25	1.0
5/ 1/90	Jewel Cave	10.8	26.67	2.44	10.1	0.17	0.7
5/ 2/90	Devil's To	10.4	26.56	2.19	9.1	0.30	1.2
5/12/90	North Chey	14.9	20.20	2.49	14.2	0.13	0.7
5/12/90	Cloud Peak	38.4	24.33	6.56	37.3	0.19	1.1
5/13/90	Devil's To	12.8	27.15	2.83	11.8	0.25	1.0
5/17/90	Jewel Cave	13.0	27.20	2.98	12.4	0.16	0.7
5/18/90	North Chey	17.1	20.59	2.82	16.0	0.19	1.1
5/18/90	Cloud Peak	17.5	20.66	2.89	16.4	0.19	1.1
5/20/90	Devil's To	12.6	27.11	2.51	10.4	0.54	2.2
5/23/90	North Chey	17.7	20.70	2.82	16.0	0.30	1.7
5/28/90	North Chey	22.7	21.58	3.50	19.9	0.50	2.8
5/28/90	Cloud Peak	28.5	22.59	4.76	27.1	0.25	1.4
5/29/90	Cloud Peak	16.1	20.41	2.80	15.9	0.03	0.2
5/30/90	North Chey	12.2	19.73	2.12	12.0	0.03	0.2
6/15/90	North Chey	13.0	21.33	2.18	11.5	0.28	1.5
6/15/90	Cloud Peak	14.2	21.55	2.40	12.7	0.27	1.4
6/16/90	Devil's To	13.8	27.23	3.17	13.3	0.14	0.6
6/29/90	Devil's To	10.4	26.41	2.36	9.9	0.12	0.5
6/30/90	Cloud Peak	14.2	21.55	2.65	14.1	0.03	0.1
7/ 5/90	Cloud Peak	13.7	21.46	2.45	13.0	0.14	0.7
7/ 9/90	North Chey	13.3	21.37	2.30	12.2	0.20	1.1
7/24/90	North Chey	17.3	22.13	3.25	17.2	0.00	0.0
8/ 1/90	Devil's To	10.4	26.42	2.50	10.4	0.00	0.0
8/ 4/90	Cloud Peak	16.1	21.90	3.02	16.0	0.01	0.1
8/ 6/90	North Chey	11.2	20.98	2.08	11.0	0.03	0.2
8/ 7/90	Devil's To	12.8	26.99	3.05	12.7	0.01	0.1
8/16/90	North Chey	10.4	20.84	1.94	10.3	0.02	0.1
8/21/90	North Chey	10.5	20.85	1.95	10.4	0.02	0.1
8/26/90	Cloud Peak	10.6	20.87	2.00	10.6	0.00	0.0
9/17/90	North Chey	10.5	17.97	1.70	10.5	0.01	0.1
9/19/90	North Chey	23.4	20.06	3.50	21.5	0.30	1.8
9/19/90	Cloud Peak	10.4	17.95	1.55	9.5	0.14	0.9
9/21/90	Blackelk W	12.2	24.65	2.68	12.2	0.00	0.0
9/21/90	Mt. Rushmo	11.5	24.50	2.53	11.5	0.00	0.0
9/21/90	Wind Cave	12.7	24.75	2.77	12.6	0.01	0.0

9/21/90	Jewel Cave	10.4	24.27	2.29	10.4	0.00	0.0
9/23/90	Devil's To	15.2	25.31	3.33	15.2	0.00	0.0
9/24/90	Devil's To	13.7	24.99	3.02	13.7	0.00	0.0
9/25/90	Devil's To	13.6	24.96	2.99	13.6	0.00	0.0
9/26/90	Devil's To	15.5	25.38	3.41	15.5	0.00	0.0
9/30/90	Wind Cave	11.0	24.38	2.14	9.7	0.27	1.2
9/30/90	Jewel Cave	12.8	24.79	2.53	11.5	0.29	1.3
9/30/90	Devil's To	13.2	24.88	2.85	13.0	0.06	0.3
10/ 8/90	Devil's To	11.4	24.48	2.28	10.4	0.23	1.0
10/ 9/90	Blackelk W	18.3	26.00	3.98	18.1	0.05	0.2
10/ 9/90	Mt. Rushmo	18.0	25.92	3.90	17.8	0.05	0.2
10/ 9/90	Wind Cave	14.5	25.15	3.10	14.1	0.08	0.4
10/ 9/90	Jewel Cave	19.0	26.15	4.13	18.8	0.06	0.3
10/ 9/90	Devil's To	10.9	24.37	2.39	10.9	0.00	0.0
10/10/90	Blackelk W	13.2	24.87	2.85	13.0	0.06	0.3
10/10/90	Mt. Rushmo	11.2	24.43	2.39	10.9	0.06	0.3
10/10/90	Devil's To	12.0	24.61	2.64	12.0	0.00	0.0
10/13/90	Jewel Cave	10.8	24.33	2.23	10.1	0.13	0.6
10/13/90	Devil's To	11.1	24.41	2.44	11.1	0.00	0.0
10/16/90	Devil's To	14.9	25.25	3.26	14.8	0.03	0.1
10/21/90	Blackelk W	12.8	24.79	2.77	12.6	0.06	0.3
10/21/90	Wind Cave	15.3	25.32	3.28	14.9	0.07	0.3
10/21/90	Jewel Cave	20.4	26.46	4.43	20.2	0.06	0.3
10/24/90	Devil's To	18.1	25.94	3.96	18.0	0.01	0.0
10/25/90	Jewel Cave	13.6	24.96	2.93	13.3	0.06	0.3
10/25/90	Devil's To	15.4	25.36	3.39	15.4	0.00	0.0
10/29/90	Blackelk W	12.7	24.76	2.66	12.1	0.14	0.6
10/29/90	Mt. Rushmo	12.1	24.62	2.51	11.4	0.14	0.6
10/29/90	Wind Cave	11.0	24.38	2.23	10.2	0.18	0.8
10/29/90	Jewel Cave	12.8	24.78	2.64	12.0	0.17	0.8
10/29/90	Devil's To	10.9	24.37	2.38	10.8	0.02	0.1
10/30/90	Devil's To	15.3	25.34	3.27	14.9	0.10	0.4
11/ 4/90	Devil's To	21.8	26.77	4.77	21.7	0.03	0.1
11/ 5/90	Badlands N	11.3	24.44	2.17	9.9	0.31	1.4
11/ 5/90	Blackelk W	12.0	24.61	2.44	11.1	0.20	0.9
11/ 5/90	Mt. Rushmo	11.5	24.49	2.31	10.5	0.22	1.0
11/ 5/90	Wind Cave	14.8	25.22	3.08	14.0	0.17	0.8
11/ 5/90	Jewel Cave	15.6	25.39	3.30	15.0	0.12	0.5
11/ 7/90	Devil's To	13.0	24.82	2.83	12.9	0.02	0.1
11/ 9/90	Devil's To	10.5	24.29	2.32	10.5	0.00	0.0
11/12/90	Devil's To	13.5	24.95	2.98	13.5	0.00	0.0
11/15/90	Jewel Cave	13.3	24.90	2.93	13.3	0.00	0.0
11/16/90	Wind Cave	10.6	24.30	2.29	10.4	0.05	0.2
11/16/90	Jewel Cave	11.8	24.57	2.56	11.6	0.04	0.2
11/16/90	Devil's To	10.8	24.35	2.36	10.8	0.01	0.1
11/18/90	Wind Cave	11.8	24.57	2.46	11.2	0.14	0.6
11/18/90	Jewel Cave	14.7	25.21	3.12	14.2	0.12	0.5
11/18/90	Devil's To	20.1	26.39	4.33	19.7	0.09	0.4
11/19/90	Devil's To	39.9	30.73	8.58	39.1	0.18	0.8
11/25/90	Devil's To	25.0	27.47	5.49	25.0	0.01	0.1
12/ 4/90	Devil's To	11.0	23.59	2.34	11.0	0.00	0.0
12/ 6/90	Jewel Cave	10.5	23.48	2.21	10.4	0.03	0.1
12/ 8/90	Devil's To	26.0	26.78	5.53	26.0	0.00	0.0
12/ 9/90	Devil's To	17.0	24.87	3.61	17.0	0.01	0.0
12/10/90	Blackelk W	10.3	23.44	2.03	9.5	0.16	0.8
12/10/90	Mt. Rushmo	10.0	23.37	1.97	9.3	0.16	0.8
12/10/90	Devil's To	14.6	24.34	3.08	14.5	0.01	0.1

12/11/90	Badlands N	17.4	24.94	3.12	14.7	0.57	2.7
12/11/90	Blackelk W	16.8	24.82	3.20	15.0	0.38	1.8
12/11/90	Mt. Rushmo	16.8	24.82	3.20	15.1	0.38	1.8
12/11/90	Wind Cave	17.9	25.04	3.31	15.6	0.48	2.3
12/11/90	Jewel Cave	13.8	24.17	2.63	12.4	0.29	1.4
12/11/90	Devil's To	21.1	25.74	4.46	21.0	0.03	0.1
12/17/90	Blackelk W	13.2	24.05	2.41	11.3	0.39	1.9
12/17/90	Mt. Rushmo	12.7	23.95	2.31	10.9	0.40	1.9
12/17/90	Jewel Cave	11.7	23.73	2.23	10.5	0.25	1.2
12/17/90	Devil's To	17.4	24.95	3.70	17.4	0.00	0.0
12/22/90	Badlands N	11.7	23.74	1.82	8.6	0.68	3.2
12/22/90	Blackelk W	16.2	24.69	2.94	13.8	0.50	2.3
12/22/90	Mt. Rushmo	16.2	24.69	2.95	13.9	0.49	2.3
12/22/90	Wind Cave	12.8	23.96	2.29	10.8	0.42	2.0
12/22/90	Jewel Cave	16.4	24.73	3.09	14.6	0.39	1.8
12/22/90	Devil's To	12.1	23.81	2.56	12.1	0.00	0.0
12/26/90	Badlands N	21.6	25.84	3.67	17.3	0.92	4.3
12/26/90	Blackelk W	16.3	24.70	3.04	14.3	0.42	2.0
12/26/90	Mt. Rushmo	16.0	24.64	2.94	13.8	0.46	2.2
12/26/90	Wind Cave	18.9	25.25	3.62	17.0	0.39	1.8
12/26/90	Jewel Cave	16.9	24.85	3.36	15.8	0.24	1.1
12/26/90	Devil's To	27.6	27.10	5.78	27.2	0.07	0.3

APPENDIX F

Far-Field Visibility Impacts
Number of Days Per Year the Change in Extincition
are > 10% over Background

Route D at 100MNT Project Alternative

Cumulative Impacts (Project + Other New Sources)
Contribution of Other New Sources
Contribution of DM&E Project Sources

			EXTINCTION				
Date	SensitiveArea	%Change	Total	Non-DM&E	(%)	DM&E	(%)
1/ 7/90	Devil's To	13.2	24.04	2.80	13.2	0.00	0.0
1/13/90	Badlands N	12.5	23.91	1.34	6.3	1.32	6.2
1/14/90	Blackelk W	12.2	23.83	2.40	11.3	0.18	0.9
1/14/90	Mt. Rushmo	11.1	23.61	2.19	10.3	0.17	0.8
1/14/90	Wind Cave	14.8	24.39	2.93	13.8	0.21	1.0
1/14/90	Jewel Cave	14.3	24.29	2.84	13.4	0.20	1.0
1/14/90	Devil's To	30.9	27.82	6.57	30.9	0.00	0.0
1/15/90	Cloud Peak	21.3	17.51	2.79	19.3	0.29	2.0
1/16/90	Badlands N	26.1	26.78	0.15	0.7	5.39	25.3
1/16/90	Blackelk W	13.9	24.19	1.67	7.9	1.27	6.0
1/16/90	Mt. Rushmo	12.5	23.90	1.32	6.2	1.33	6.2
1/16/90	Wind Cave	12.0	23.79	1.59	7.5	0.95	4.5
1/16/90	Jewel Cave	20.1	25.52	3.03	14.3	1.25	5.9
1/16/90	Devil's To	35.5	28.78	5.61	26.4	1.93	9.1
1/16/90	North Chey	84.7	26.67	10.57	73.2	1.66	11.5
1/16/90	Cloud Peak	47.1	21.24	5.93	41.1	0.88	6.1
1/17/90	Badlands N	25.2	26.59	3.85	18.1	1.49	7.0
1/17/90	Blackelk W	22.5	26.03	3.75	17.6	1.03	4.9
1/17/90	Mt. Rushmo	20.9	25.69	3.42	16.1	1.02	4.8
1/17/90	Wind Cave	28.2	27.24	4.87	22.9	1.12	5.3
1/17/90	Jewel Cave	26.4	26.86	4.63	21.8	0.98	4.6
1/18/90	Devil's To	29.7	27.55	5.70	26.8	0.61	2.8
1/19/90	Badlands N	14.7	24.36	0.73	3.5	2.38	11.2
1/19/90	Devil's To	17.4	24.95	3.64	17.2	0.06	0.3
1/20/90	Badlands N	19.3	25.34	2.94	13.8	1.15	5.4
1/20/90	Blackelk W	27.5	27.09	5.00	23.6	0.84	3.9
1/20/90	Mt. Rushmo	26.1	26.79	4.73	22.3	0.81	3.8
1/20/90	Wind Cave	26.4	26.85	4.70	22.1	0.91	4.3
1/20/90	Jewel Cave	32.7	28.19	6.02	28.3	0.93	4.4
1/20/90	Devil's To	19.0	25.29	3.89	18.3	0.15	0.7
1/21/90	Badlands N	12.9	23.98	2.21	10.4	0.53	2.5
1/21/90	Blackelk W	10.2	23.42	2.13	10.0	0.04	0.2
1/21/90	Mt. Rushmo	10.0	23.37	2.08	9.8	0.04	0.2
1/22/90	Blackelk W	12.8	23.97	2.59	12.2	0.13	0.6
1/22/90	Mt. Rushmo	12.8	23.96	2.58	12.2	0.13	0.6
1/22/90	Devil's To	11.4	23.68	2.41	11.4	0.02	0.1
1/30/90	North Chey	11.6	16.11	1.53	10.6	0.15	1.0
1/31/90	Devil's To	11.8	23.76	2.15	10.1	0.36	1.7
1/31/90	Cloud Peak	18.2	17.06	2.27	15.7	0.36	2.5
2/ 1/90	Jewel Cave	10.5	23.47	1.04	4.9	1.19	5.6
2/ 1/90	Devil's To	24.1	26.37	3.59	16.9	1.54	7.2
2/ 1/90	North Chey	75.3	25.30	8.73	60.5	2.14	14.8
2/ 1/90	Cloud Peak	27.9	18.46	3.45	23.9	0.57	4.0
2/ 2/90	Badlands N	19.5	25.39	2.21	10.4	1.93	9.1
2/ 2/90	Blackelk W	19.9	25.47	2.95	13.9	1.27	6.0
2/ 2/90	Mt. Rushmo	18.9	25.27	2.78	13.1	1.25	5.9
2/ 2/90	Wind Cave	23.4	26.21	3.49	16.4	1.48	7.0
2/ 2/90	Jewel Cave	24.8	26.51	3.88	18.2	1.39	6.5
2/ 2/90	Devil's To	28.2	27.24	4.79	22.5	1.21	5.7
2/ 2/90	North Chey	43.9	20.77	4.68	32.4	1.65	11.5
2/ 3/90	Badlands N	10.2	23.41	1.23	5.8	0.93	4.4
2/ 3/90	Blackelk W	13.3	24.07	2.56	12.0	0.26	1.2
2/ 3/90	Mt. Rushmo	12.7	23.95	2.42	11.4	0.28	1.3
2/ 3/90	Wind Cave	12.1	23.82	2.30	10.8	0.27	1.3
2/ 3/90	Jewel Cave	12.3	23.87	2.41	11.4	0.21	1.0

2/ 3/90	Devil's To	12.3	23.86	2.57	12.1	0.05	0.2
2/ 6/90	Devil's To	20.2	25.53	4.02	18.9	0.26	1.2
2/ 7/90	Wind Cave	11.8	23.75	2.15	10.1	0.35	1.6
2/ 7/90	Jewel Cave	11.7	23.72	2.27	10.7	0.21	1.0
2/ 8/90	Badlands N	13.0	24.00	2.19	10.3	0.57	2.7
2/ 8/90	Blackelk W	11.5	23.68	2.20	10.3	0.24	1.1
2/ 8/90	Mt. Rushmo	10.1	23.39	1.93	9.1	0.21	1.0
2/ 8/90	Wind Cave	15.4	24.51	2.78	13.1	0.49	2.3
2/ 8/90	Jewel Cave	14.1	24.25	2.75	13.0	0.25	1.2
2/14/90	North Chey	21.0	17.46	2.30	15.9	0.73	5.1
2/14/90	Cloud Peak	13.5	16.38	1.63	11.3	0.32	2.2
2/15/90	North Chey	15.3	16.65	1.77	12.2	0.44	3.1
2/15/90	Cloud Peak	11.1	16.03	1.32	9.1	0.28	2.0
2/17/90	Badlands N	11.7	23.74	1.49	7.0	1.00	4.7
2/18/90	Badlands N	17.6	24.98	2.45	11.5	1.29	6.1
2/18/90	Blackelk W	10.4	23.46	1.94	9.1	0.27	1.3
2/18/90	Mt. Rushmo	10.4	23.46	1.95	9.2	0.27	1.3
2/18/90	Wind Cave	10.6	23.50	2.04	9.6	0.22	1.0
2/18/90	Jewel Cave	11.8	23.76	2.30	10.8	0.22	1.0
2/19/90	Devil's To	25.4	26.65	4.53	21.3	0.88	4.1
2/20/90	Devil's To	11.6	23.70	2.22	10.4	0.24	1.1
2/25/90	Badlands N	10.2	23.41	1.62	7.6	0.54	2.6
2/25/90	Blackelk W	25.1	26.58	3.84	18.1	1.50	7.0
2/25/90	Mt. Rushmo	24.1	26.37	3.43	16.1	1.69	8.0
2/25/90	Wind Cave	16.4	24.73	2.51	11.8	0.98	4.6
2/25/90	Jewel Cave	26.6	26.89	4.41	20.8	1.24	5.8
2/25/90	Devil's To	77.4	37.69	12.91	60.8	3.53	16.6
2/26/90	Badlands N	15.5	24.54	2.53	11.9	0.76	3.6
2/26/90	Blackelk W	19.7	25.43	3.29	15.5	0.90	4.2
2/26/90	Mt. Rushmo	18.9	25.26	3.10	14.6	0.91	4.3
2/26/90	Wind Cave	20.6	25.62	3.56	16.7	0.81	3.8
2/26/90	Jewel Cave	23.5	26.25	4.16	19.6	0.85	4.0
2/26/90	Devil's To	21.3	25.77	3.81	17.9	0.71	3.4
2/28/90	Jewel Cave	11.5	23.68	1.71	8.0	0.73	3.4
2/28/90	Devil's To	43.2	30.42	8.13	38.3	1.05	4.9
3/ 1/90	Devil's To	15.0	27.69	3.35	13.9	0.27	1.1
3/ 2/90	Wind Cave	10.8	26.65	2.10	8.7	0.49	2.0
3/ 2/90	Jewel Cave	13.3	27.26	2.79	11.6	0.41	1.7
3/ 2/90	Devil's To	17.0	28.16	4.09	17.0	0.01	0.0
3/ 3/90	Devil's To	17.7	28.33	3.54	14.7	0.72	3.0
3/ 4/90	Jewel Cave	14.2	27.48	2.58	10.7	0.83	3.5
3/ 4/90	Devil's To	33.1	32.02	7.23	30.0	0.73	3.0
3/ 5/90	North Chey	47.6	25.96	7.27	41.4	1.10	6.3
3/ 5/90	Cloud Peak	14.1	20.06	2.32	13.2	0.16	0.9
3/ 7/90	North Chey	14.1	20.05	2.40	13.7	0.07	0.4
3/ 7/90	Cloud Peak	10.7	19.47	1.81	10.3	0.08	0.5
3/ 8/90	North Chey	20.7	21.22	3.40	19.3	0.24	1.4
3/ 9/90	Devil's To	11.5	26.83	2.43	10.1	0.33	1.4
3/10/90	Devil's To	13.8	27.39	3.07	12.8	0.25	1.1
3/12/90	Badlands N	19.8	28.83	3.81	15.8	0.96	4.0
3/12/90	Blackelk W	16.5	28.03	3.24	13.5	0.73	3.0
3/12/90	Mt. Rushmo	13.6	27.34	2.74	11.4	0.53	2.2
3/12/90	Wind Cave	23.4	29.70	4.84	20.1	0.80	3.3
3/12/90	Jewel Cave	22.6	29.51	4.73	19.7	0.71	2.9
3/13/90	Badlands N	23.4	29.69	2.50	10.4	3.12	13.0
3/13/90	Blackelk W	19.3	28.71	3.08	12.8	1.57	6.5
3/13/90	Mt. Rushmo	19.2	28.70	3.06	12.7	1.57	6.5

3/13/90	Wind Cave	16.5	28.03	2.22	9.2	1.75	7.3
3/13/90	Jewel Cave	16.6	28.06	2.29	9.5	1.70	7.1
3/13/90	Devil's To	35.0	32.49	7.00	29.1	1.43	5.9
3/14/90	Badlands N	10.7	26.63	1.89	7.9	0.67	2.8
3/14/90	Wind Cave	11.9	26.92	2.29	9.5	0.57	2.4
3/19/90	Devil's To	21.1	29.14	4.45	18.5	0.63	2.6
3/20/90	Badlands N	10.6	26.61	1.87	7.8	0.67	2.8
3/20/90	Devil's To	12.3	27.04	2.89	12.0	0.09	0.4
3/21/90	Jewel Cave	15.2	27.73	3.40	14.1	0.26	1.1
3/21/90	Devil's To	14.4	27.53	3.17	13.2	0.30	1.2
3/25/90	Wind Cave	12.4	27.04	2.32	9.7	0.65	2.7
3/25/90	Jewel Cave	12.5	27.07	2.55	10.6	0.45	1.9
3/26/90	Devil's To	19.5	28.76	4.36	18.1	0.33	1.4
3/29/90	Devil's To	17.1	28.19	3.27	13.6	0.86	3.6
3/30/90	Devil's To	18.1	28.41	3.80	15.8	0.55	2.3
3/31/90	Jewel Cave	11.6	26.85	2.56	10.6	0.23	0.9
3/31/90	Devil's To	13.4	27.30	3.17	13.2	0.06	0.3
4/ 2/90	North Chey	13.7	19.99	2.40	13.6	0.01	0.0
4/ 6/90	Badlands N	13.0	27.19	2.13	8.8	1.00	4.1
4/ 6/90	Blackelk W	16.0	27.91	2.91	12.1	0.93	3.8
4/ 6/90	Mt. Rushmo	14.4	27.54	2.50	10.4	0.97	4.1
4/ 6/90	Wind Cave	18.0	28.41	3.68	15.3	0.66	2.7
4/ 6/90	Jewel Cave	19.6	28.78	4.13	17.1	0.58	2.4
4/ 6/90	Devil's To	11.5	26.82	2.62	10.9	0.13	0.6
4/12/90	Badlands N	19.9	28.85	2.74	11.4	2.04	8.5
4/12/90	Blackelk W	25.1	30.11	2.46	10.2	3.59	14.9
4/12/90	Mt. Rushmo	24.6	29.99	2.42	10.1	3.51	14.6
4/12/90	Wind Cave	29.7	31.22	3.55	14.8	3.60	15.0
4/12/90	Jewel Cave	21.5	29.23	2.87	11.9	2.30	9.6
4/15/90	Devil's To	11.7	26.89	2.76	11.5	0.07	0.3
4/17/90	North Chey	14.5	20.12	2.33	13.3	0.21	1.2
4/24/90	Wind Cave	11.7	26.88	1.66	6.9	1.15	4.8
4/24/90	Jewel Cave	13.7	27.35	2.25	9.3	1.04	4.3
4/24/90	Devil's To	18.4	28.50	4.20	17.5	0.24	1.0
4/26/90	Badlands N	10.3	26.55	1.71	7.1	0.78	3.2
4/26/90	Blackelk W	18.8	28.60	3.63	15.1	0.90	3.8
4/26/90	Mt. Rushmo	18.7	28.58	3.61	15.0	0.90	3.8
4/26/90	Wind Cave	14.2	27.47	2.72	11.3	0.68	2.8
4/26/90	Jewel Cave	12.6	27.11	2.53	10.5	0.51	2.1
4/28/90	Badlands N	15.8	27.87	0.13	0.5	3.68	15.3
4/28/90	Blackelk W	17.3	28.22	0.64	2.7	3.51	14.6
4/28/90	Mt. Rushmo	17.3	28.23	0.64	2.6	3.53	14.7
4/28/90	Wind Cave	15.4	27.76	0.73	3.0	2.97	12.4
4/28/90	Jewel Cave	14.0	27.43	0.94	3.9	2.42	10.0
4/28/90	Cloud Peak	11.5	19.60	1.85	10.5	0.16	0.9
5/ 1/90	Blackelk W	10.3	26.55	2.18	9.1	0.31	1.3
5/ 1/90	Jewel Cave	10.9	26.70	2.44	10.1	0.19	0.8
5/ 2/90	Devil's To	11.6	26.85	2.19	9.1	0.59	2.5
5/10/90	Devil's To	10.1	26.49	1.87	7.8	0.55	2.3
5/12/90	North Chey	16.2	20.43	2.49	14.1	0.36	2.1
5/12/90	Cloud Peak	39.5	24.52	6.56	37.3	0.38	2.1
5/13/90	Badlands N	10.7	26.64	0.90	3.7	1.68	7.0
5/13/90	Devil's To	13.5	27.32	2.83	11.8	0.42	1.7
5/17/90	Jewel Cave	13.1	27.22	2.98	12.4	0.18	0.8
5/18/90	Blackelk W	13.8	27.38	0.61	2.5	2.71	11.3
5/18/90	Mt. Rushmo	13.6	27.34	0.60	2.5	2.68	11.1
5/18/90	Devil's To	10.1	26.50	1.30	5.4	1.13	4.7