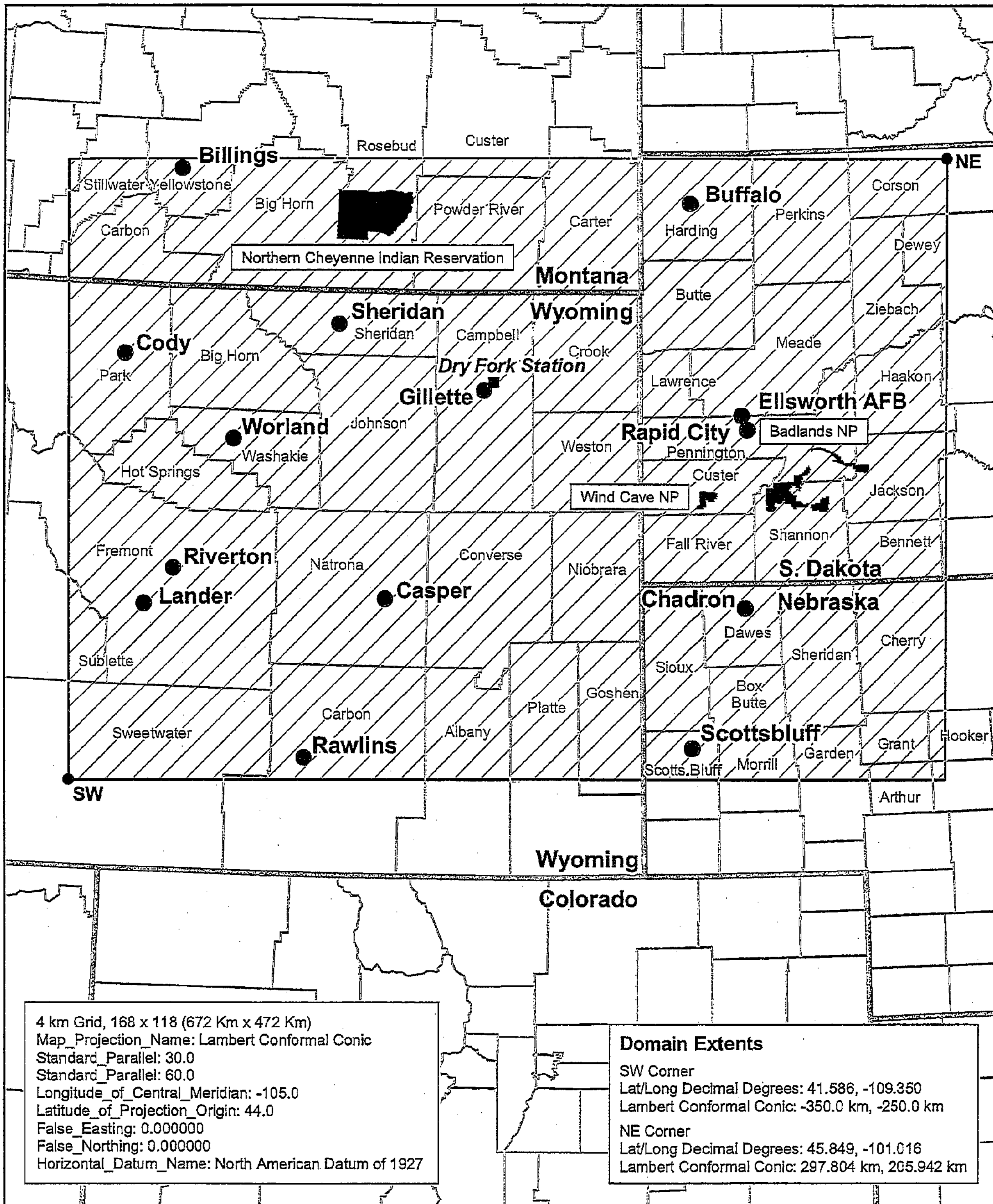
BEFORE THE ENVIRONMENTAL QUALITY COUNCIL
STATE OF WYOMING

IN THE MATTER OF:	)	
BASIN ELECTRICAL POWER COOPERATIVE	)	
DRY FORK STATION,	)	Docket No. 07-2801
AIR PERMIT CT-4631	)	

RESPONDENT DEPARTMENT OF ENVIRONMENTAL QUALITY'S MEMORANDUM IN SUPPORT OF MOTION FOR PARTIAL SUMMARY JUDGMENT

Schlichtemeir Affidavit

EXHIBIT D



N

0 65 130 Miles

Figure 8-2
CALMET Surface Stations

8.3.2.2 Surface Data

Surface data for 2001-2003 were obtained from the National Climatic Data Center (NCDC). CH2M HILL used all available stations from the National Weather Service's (NWS) Automated Surface Observing System (ASOS) network within the modeling domain that contained a high percentage of valid data for a given year.

The surface data were obtained from NCDC in abbreviated DATSAV3 format. A conversion routine available from the Earth Tech website was used to convert the DATSAV3 files to CD-144 format for input to the SMERGE preprocessor and CALMET. Figure 8-2 shows the locations of the surface stations that were used for the 2001-2003 analyses.

8.3.2.3 Upper-Air Data

Upper-air observations from Rapid City, South Dakota were input to CALMET to adjust the initial guess wind field. The Rapid City station is located between the source and two of the Class I areas in question, and therefore represented critical data to add to CALMET. Other upper-air stations such as Riverton, Wyoming and North Platte, Nebraska are located off of the modeling domain or near the edge of the domain, far removed from the source and Class I areas, and were not used in the analysis. Rapid City data for 2001, 2002, and 2003 in FSL format were obtained and processed through the READ62 processor.

8.3.2.4 Geophysical Data

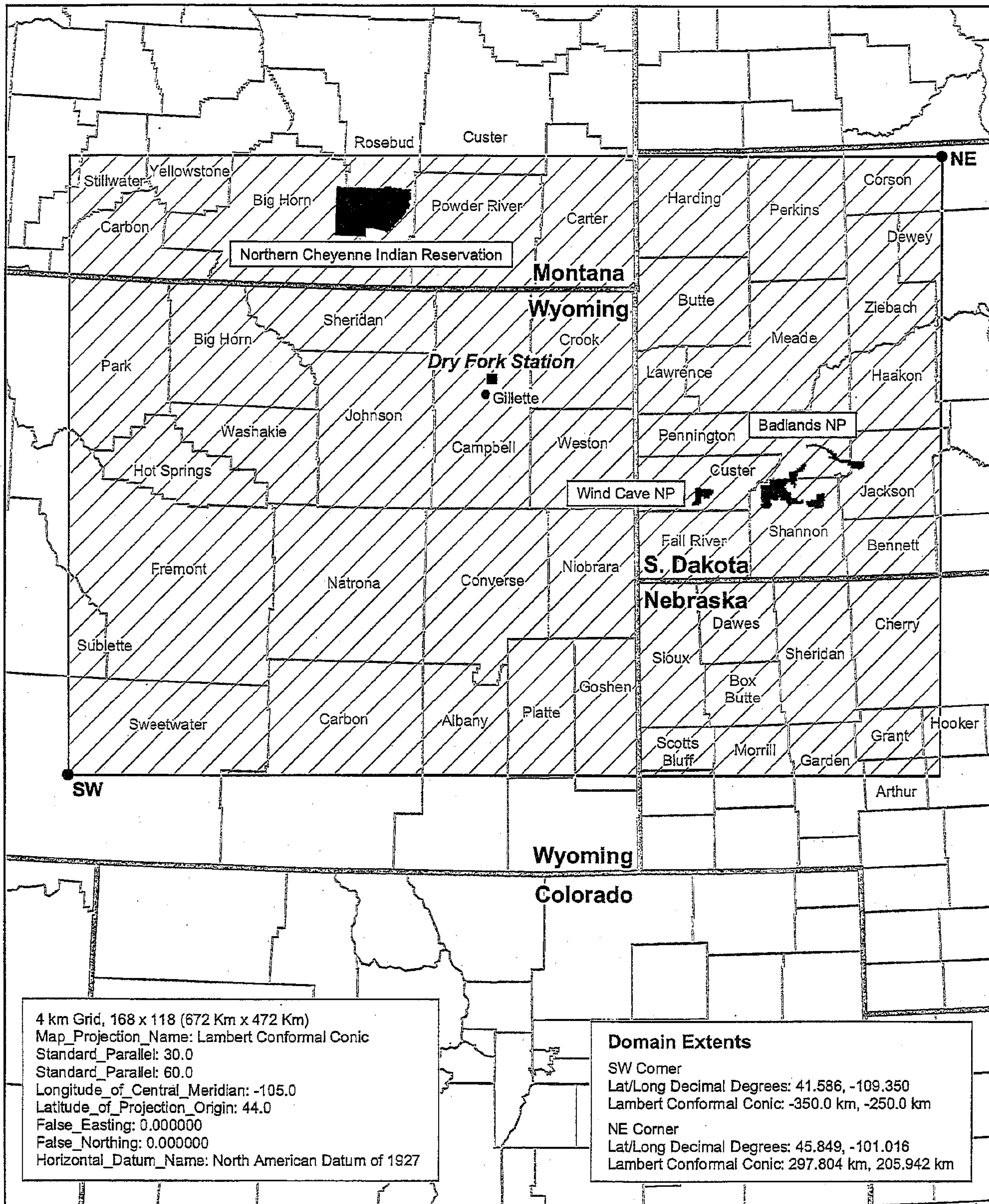
Land use and terrain data to construct the GEO.DAT input to CALMET were obtained from the U.S. Geological Survey (USGS). Land use data were obtained in Composite Theme Grid (CTG) format from the USGS, and the Level I USGS land use categories were mapped into the 14 primary CALMET land use categories. Surface properties such as albedo, Bowen ratio, roughness length, and leaf area index were computed from the land use values. Terrain data were taken from USGS 1-degree Digital Elevation Model (DEM) data, which are primarily derived from USGS 1:250,000 scale topographic maps. A value of 31 (shrub and brush rangeland) was input to the MAKEGEO.INP file for the IMISS parameter. With the IMISS parameter, whenever land use data are missing for a grid cell in the domain, IMISS is attributed to that cell. A figure showing the land use for the domain is included in Appendix H.

8.3.2.5 Precipitation Data

CH2M HILL obtained from NCDC all available TD-3240 precipitation files within the modeling domain. The TD-3240 files were processed through PEXTRACT and PMERGE to prepare the data for input to CALMET. For 2001 and 2002, a total of 62 precipitation stations were input to CALMET. For 2003, 63 stations were used. Figure 8-3 shows the precipitation stations within the modeling domain.

8.3.3 Validation of CALMET Wind Field

CH2M HILL used the CalDESK data display and analysis system (v2.9, Enviromodeling Ltda.) to view plots of wind vectors and other meteorological parameters to evaluate the CALMET wind fields. We used observed weather conditions, as depicted in surface and upper-air weather maps from the National Oceanic and Atmospheric Administration (NOAA) Central Library U.S. Daily Weather Maps Project (http://docs.lib.noaa.gov/rescue/dwm/data_rescue_daily_weather_maps.html), to compare to the CalDESK displays.



N

0 65 130 Miles

Figure 8-1
CALMET/CALPUFF Domain

available on the Earth Tech website (http://www.calgrid.net/calpuff/calpuff1.htm). The latest versions of the primary models include the following:

- CALMET Version 5.53a, Level 040716
- CALPUFF Version 5.711a, Level 040716
- CALPOST Version 5.51, Level 030709

8.3 CALMET

The application of the CALMET model for the production of meteorological input to the CALPUFF model is described in this section.

8.3.1 Dimensions of the CALMET Domain

CH2M HILL used the CALMET model to generate three-dimensional wind fields and other meteorological parameters suitable for use by the CALPUFF model. A modeling domain was established to encompass higher terrain west of Gillette and the Class I areas of interest. The domain covers a region approximately 672 km by 472 km with a grid resolution of 4 km.

CH2M HILL used a Lambert Conformal Conic (LCC) map projection for the analysis due to the large extent of the domain. Figure 8-1 shows the CALMET/CALPUFF modeling domain and provides the key parameters for the LCC map projection.

The default technical options listed in Appendix B of the IWAQM Phase 2 report were used for CALMET. User-specified model options were determined by CH2M HILL's professional staff to produce the most realistic wind field. Vertical resolution of the wind field included nine layers, with vertical cell face heights as follows (in meters):

- 0, 20, 50, 100, 250, 500, 750, 1000, 1500, 3500

8.3.2 CALMET Input Data

8.3.2.1 Mesoscale Prognostic Data

CH2M HILL ran the CALMET model to produce three years of analysis: 2001, 2002 and 2003. For 2001, CH2M HILL used data at 36-km resolution that were obtained from the contractor (Alpine Geophysics) who developed the nationwide data for the EPA. For 2002, nationwide 36-km MM5 data, developed for the Visibility Improvement State and Tribal Association of the Southeast (VISTAS), were obtained from the same EPA contractor. Data for 2003 were also obtained from Alpine Geophysics. These 2003 data, also at 36-km resolution, were developed by the Wisconsin Department of Natural Resources, the Illinois Environmental Protection Agency, and the Lake Michigan Air Directors Consortium. These three datasets were chosen because they are current and because they have all been evaluated for quality. The MM data were used as input to CALMET as the "initial guess" wind field. The initial guess field was adjusted by CALMET for local terrain and land use effects to generate a Step 1 wind field, and then further refined using local surface observations to create a final Step 2 wind field.

the impacts from a proposed project would be considered insignificant. The DAT for Western areas is 0.005 kg/ha/yr for total nitrogen and also for total sulfur (NPS, 2002). Modeled sulfur and nitrogen deposition from the project at each Class I area was compared to the DAT for the western region. Table 8-1 lists the Class I modeling significance levels and PSD increments that apply to the project.

At the request of the NPS, visibility and criteria pollutant impacts were also assessed at Devil's Tower National Monument in Wyoming. Because Devil's Tower is a Class II area, the criteria pollutant impacts were compared to Class II modeling significance levels.

TABLE 8-1
Class I Modeling Significance Levels and Increments

Averaging Period/ Pollutant	Class I Modeling Significance Level ($\mu g/m^3$)*	Class I PSD Increment ($\mu g/m^3$)
Annual NO_2	0.1	2.5
3-hour SO_2	1.0	25**
24-hour SO_2	0.2	5**
Annual SO_2	0.1	2
24-hour PM_{10}	0.3	8**
Annual PM_{10}	0.2	4

* Proposed by U.S. EPA, Federal Register: July 1996 (Vol. 61, Number 142), Proposed Rules, pg. 38249-344.

** Not to be exceeded more than once per year.

Notes:

$\mu g/m^3$ = micrograms per cubic meter
NO_2 = Nitrogen dioxide
NS = No standard
PM_{10} = Particulate matter less than 10 microns
PSD = Prevention of Significant Deterioration
SO_2 = Sulfur dioxide

8.2 Model Selection

Class I areas affected by the project are located more than 50 km from the proposed source. Workgroups that represent the interests of the Federal Land Managers (FLM) in the PSD permitting process (IWAQM, FLAG) recommend that a "far-field analysis" of the effect of a proposed source on air quality and air quality-related values (AQRV) be performed for sources located more than 50 km from affected areas. CH2M HILL used the EPA CALPUFF modeling system, as recommended by the EPA and the FLM for far-field analyses, to obtain predicted impacts. The CALPUFF modeling system includes the CALMET meteorological model, a Gaussian puff dispersion model (CALPUFF) with algorithms for chemical transformation and deposition, and a postprocessor capable of calculating concentrations, visibility impacts, and deposition (CALPOST). The CALPUFF modeling system was applied in a full, refined mode rather than a screening mode.

CH2M HILL used the EPA-approved versions of the CALPUFF modeling system ~~preprocessors and models. Specifically, we used the Beta-test versions that are currently~~

SECTION 8.0

Far-Field Air Quality Impact Analysis

Basin Electric Power Cooperative (BEPC) proposes to construct the Dry Fork Station Project near Gillette, Wyoming. The proposed power plant would include one pulverized coal (PC) boiler that would be capable of generating a maximum 422 MW (gross) of electrical power. Representatives of BEPC and CH2M HILL met with key personnel from the Wyoming Department of Environmental Quality (WDEQ) and the National Park Service (NPS) on August 4, 2005 to discuss the proposed CALPUFF modeling protocol for the project. Changes to the protocol that were suggested by the WDEQ and the NPS were incorporated into the final protocol for the project titled *Protocol for a CALPUFF Modeling Analysis of the Dry Fork Station Project (Northeast Wyoming Generation Project)*(CH2M HILL, 2005). This section presents a detailed description of the far-field (CALPUFF) air quality impact analysis that was conducted for the project pursuant to that protocol.

8.1 Introduction

The proposed Dry Fork Station Project would be located to the northeast of the City of Gillette in Campbell County, Wyoming. The proposed location is approximately four miles to the northeast of the Gillette-Campbell County Airport. Within 250 kilometers (km) of the project, there are three areas in South Dakota and Montana that are classified as Class I areas for the protection of air quality. These areas include Wind Cave and Badlands National Parks in South Dakota, which are located approximately 180 and 220 kilometers (km), respectively, to the east-southeast. The Northern Cheyenne Indian Reservation is located approximately 135 km to the northwest in southern Montana. CH2M HILL used the CALPUFF modeling system to assess the potential air quality impacts at these three Class I areas.

The CALPUFF analysis included an assessment of visibility, atmospheric deposition, and criteria pollutant impacts at each Class I area. Our analyses was performed based on the final modeling protocol for the project, and general guidance found in the following documents: *Federal Land Managers' Air Quality Related Values Workgroup (FLAG) Phase I Report* (FLAG, 2000), and *Interagency Workgroup on Air Quality Modeling (IWAQM) Phase 2 Summary Report and Recommendations for Modeling Long Range Transport Impacts* (EPA, 1998).

The visibility analysis assessed the potential Class I impacts from the proposed project only, in accordance with the WDEQ regulations governing Prevention of Significant Deterioration (PSD) projects. Page 6-64 of Chapter 6, Section 4 of the Air Quality Division (AQD) regulations includes the following: "The owner or operator shall provide an analysis of the impairment to visibility, soils and vegetation that would occur as a result of the facility or modification and general commercial, residential, industrial, and other growth associated with the facility or modification." (WDEQ, 2003).

The NPS has established Deposition Analysis Thresholds (DAT) for Eastern and Western regions of the United States. A DAT is the amount of deposition within an area below which

Section 8

Far-Field Modeling

Table 7-12
Tier 1 Acute Noncancer Risk Estimates for Hazardous Air Pollutants
Site-Specific Risk Assessment
Basin Electric Power Cooperative, Dry Fork Station, Unit 1 Boiler (ES1-01)

						Acute Dose-Response Value (AV)[c]											
Analyte	CAS NO.	HAP No.	Emissions[a] [lbs/hr]	Maximum Short-Term Exposure Concentration[b] [ug/m3]	Maximum Short-Term Exposure Concentration[b] [mg/m3]	AEGL-1 (1-h) [mg/m3]	AEGL-1 (8-h) [mg/m3]	AEGL-2 (1-h) [mg/m3]	AEGL-2 (8-h) [mg/m3]	ERPG-1 [mg/m3]	ERPG-2 [mg/m3]	MRL [mg/m3]	REL [mg/m3]	IDLH/10 [mg/m3]	TEEL-0 [mg/m3]	TEEL-1 [mg/m3]	Exposure Concentration (EC_{ST}) Exceeds AV?
Biphenyl	92-52-4	19	4.14E-04	6.19E-05	6.19E-08										1	3.90	No
Acenaphthene	83-32-9	187	1.24E-04	1.86E-05	1.86E-08										0.400	1.30	No
Acenaphthylene			6.09E-05	9.10E-06	9.10E-09												No
Anthracene	120-12-7	187	5.12E-05	7.65E-06	7.65E-09										2	6	No
Benzo(a)anthracene	56-55-3	187	1.95E-05	2.91E-06	2.91E-09										0.100	0.300	No
Benzo(a)pyrene	50-32-8	187	9.26E-06	1.38E-06	1.38E-09										0.200	0.600	No
Benzo(b,j,k)fluoranthene	205-99-2	187	2.68E-05	4.00E-06	4.00E-09										0.200	0.600	No
Benzo(g,h,i)perylene	191-24-2	187	6.58E-06	9.83E-07	9.83E-10										1	3	No
Chrysene	218-01-9	187	2.44E-05	3.64E-06	3.64E-09										0.200	0.600	No
Fluoranthene	206-44-0	187	1.73E-04	2.58E-05	2.58E-08										0.500	0.150	No
Fluorene	86-73-7	187	2.22E-04	3.31E-05	3.31E-08										7.50	25	No
Ideno(1,2,3-cd)pyrene	193-39-5	187	1.49E-05	2.22E-06	2.22E-09										0.150	0.500	No
Naphthalene	91-20-3	119	3.17E-03	4.73E-04	4.73E-07									13			No
Phenanthrene	85-01-8	187	6.58E-04	9.83E-05	9.83E-08										0.400	1	No
Pyrene	129-00-0	187	8.04E-05	1.20E-05	1.20E-08										15	15	No
5-Methyl chrysene			5.36E-06	8.01E-07	8.01E-10												No
Acetaldehyde	75-07-0	1	1.39E-01	2.08E-02	2.08E-05					18	36			36			No
Acetophenone	98-86-2	4	3.65E-03	5.46E-04	5.46E-07										1	3	No
Acrolein	107-02-8	6	7.07E-02	1.06E-02	1.06E-05	0.690	0.690	0.230	0.230	0.230	1.10	0.110	0.190	0.460			No
Benzene	71-43-2	15	3.17E-01	4.73E-02	4.73E-05	17	29	26	64	16	48	0.160	1.30	16			No
Benzyl chloride	100-44-7	18	1.71E-01	2.55E-02	2.55E-05					5.20	52		0.240	5.20			No
Bis(2-ethylhexyl)phthalate	117-81-7	20	1.78E-02	2.66E-03	2.66E-06										5	1	No
Bromoform	75-25-2	22	9.50E-03	1.42E-03	1.42E-06									88			No
Carbon disulfide	75-15-0	28	3.17E-02	4.73E-03	4.73E-06	12	6.20	5	16	3.10	16		6.20	16			No
2-Chloroacetophenone	532-27-4	36	1.71E-03	2.55E-04	2.55E-07												No
Chlorobenzene	108-90-7	37	5.36E-03	8.01E-04	8.01E-07									46			No
Chloroform	67-66-3	39	1.44E-02	2.15E-03	2.15E-06			31	14		24	0.490	0.150	24			No
Cumene	98-82-8	46	1.29E-03	1.93E-04	1.93E-07									44			No
Cyanide	57-12-5	180	6.09E-01	9.10E-02	9.10E-05									2.50			No
2,4-Dinitrotoluene	121-14-2	71	6.82E-05	1.02E-05	1.02E-08									5			No
Dimethyl sulfate	77-78-1		1.17E-02	1.75E-03	1.75E-06												No
Ethyl benzene	100-41-4	77	2.29E-02	3.42E-03	3.42E-06									35			No
Ethyl chloride	75-00-3	79	1.02E-02	1.53E-03	1.53E-06							4		1			No
Ethylene dichloride	107-06-2	81	9.75E-03	1.46E-03	1.46E-06					2	81			2			No
Ethylene dibromide	106-93-4	80	2.92E-04	4.37E-05	4.37E-08									77			No
Formaldehyde	50-00-0	87	5.85E-02	8.74E-03	8.74E-06	1.10	1.10	17	17	1.20	12	0.490	0.940	2.50			No
Hexane	110-54-3	95	1.63E-02	2.44E-03	2.44E-06									39			No
Isophorone	78-59-1	100	1.41E-01	2.11E-02	2.11E-05										28	28	No
Methyl bromide	74-83-9	105	3.90E-02	5.82E-03	5.82E-06			82	26		19	0.190	3.90	97			No
Methyl chloride	74-87-3	106	1.29E-01	1.93E-02	1.93E-05						83	1		41			No
Methyl ethyl ketone	78-93-3	108	9.50E-02	1.42E-02	1.42E-05	59	59	8	5				13				No
Methyl hydrazine	60-34-4		4.14E-02	6.19E-03	6.19E-06												No
Methyl methacrylate	80-62-6	113	4.87E-03	7.28E-04	7.28E-07	7	7	49	2					41			No
Methyl tert butyl ether	1634-04-4	114	8.53E-03	1.27E-03	1.27E-06							7.20					No
Methylene chloride	75-09-2	116	7.07E-02	1.06E-02	1.06E-05					69	26	2.10	14	8			No
Phenol	108-95-2	130	3.90E-03	5.82E-04	5.82E-07	58	24	89	46	38	19		5.80	96			No
Propionaldehyde	123-38-6		9.26E-02	1.38E-02	1.38E-05												No
Tetrachloroethylene	127-18-4	150	1.05E-02	1.57E-03	1.57E-06	24	24	16	55	68	14	1.40	2	1			No
Toluene	108-88-3	152	5.85E-02	8.74E-03	8.74E-06	75	75	19	19	19	11	3.80	37	19			No
1,1,1-Trichloroethane	79-00-5	158	4.87E-03	7.28E-04	7.28E-07									55			No
Styrene	100-42-5	146	6.09E-03	9.10E-04	9.10E-07	85	85	55	55	21	11		21	3			No
Xylenes	1330-20-7	169	9.02E-03	1.35E-03	1.35E-06	56	56	17	17			4.30	22	39			No
Vinyl acetate	108-05-4	165	1.85E-03	2.77E-04	2.77E-07					18	26						No
Hydrochloric Acid	7647-01-0	97	3.23E00	4.83E-01	4.83E-04	2.70	2.70	33	16	4.50	3		2.10	7.50			No

Table 7-12
Tier 1 Acute Noncancer Risk Estimates for Hazardous Air Pollutants
Site-Specific Risk Assessment
Basin Electric Power Cooperative, Dry Fork Station, Unit 1 Boiler (ES1-01)

						Acute Dose-Response Value (AV)[c]											
Analyte	CAS NO.	HAP No.	Emissions[a] [lbs/hr]	Maximum Short-Term Exposure Concentration[b] [ug/m3]	Maximum Short-Term Exposure Concentration[b] [mg/m3]	AEGL-1 (1-h) [mg/m3]	AEGL-1 (8-h) [mg/m3]	AEGL-2 (1-h) [mg/m3]	AEGL-2 (8-h) [mg/m3]	ERPG-1 [mg/m3]	ERPG-2 [mg/m3]	MRL [mg/m3]	REL [mg/m3]	IDLH/10 [mg/m3]	TEEL-0 [mg/m3]	TEEL-1 [mg/m3]	Exposure Concentration (EC_{ST}) Exceeds AV?
Hydrofluoric Acid	7664-39-3	98	2.62E00	3.92E-01	3.92E-04	0.820	0.820	2	9.80	1.60	16	0.250	0.240	2.50			No
Antimony	7440-36-0	173	3.23E-03	4.82E-04	4.82E-07									5			No
Arsenic	7440-38-2	174	3.23E-03	4.82E-04	4.82E-07								0.190	0.500			No
Beryllium	7440-41-7	175	9.68E-04	1.45E-04	1.45E-07						0.250			0.400			No
Cadmium	7440-43-9	176	6.45E-04	9.64E-05	9.64E-08									0.900			No
Chromium	18540-29-9	177	6.45E-03	9.64E-04	9.64E-07									1.50			No
Cobalt	7440-48-4	178	6.45E-03	9.64E-04	9.64E-07									2			No
Lead	7439-92-1	182	6.45E-03	9.64E-04	9.64E-07									1			No
Manganese	7439-96-5	183	2.58E-02	3.86E-03	3.86E-06									5			No
Mercury	7439-97-6	184	1.13E-02	1.69E-03	1.69E-06						2.10		0.180				No
Molybdenum	7439-98-7		3.23E-03	4.82E-04	4.82E-07												No
Nickel	7440-02-0	186	1.29E-02	1.93E-03	1.93E-06								0.600	1			No
Selenium	7782-49-2	189	3.23E-02	4.82E-03	4.82E-06									0.100			No

Notes:
a : Emissions based on the plant operating at a 100 percent load.
b : The maximum exposure concentration was estimated using ISC modeled maximum predicted 1 hour impact based on a 1 g/s unit emission rate (ug/m3): **1.16553**
c : Source : Office of Air Quality Planning and Standards. Air Toxics Website (http://www.epa.gov/ttn/atw/toxsource/summary.html). Table 2. Acute Dose-Response Values for Screening Risk Assessments (6/02/2005).
AEGL = Acute exposure guideline levels for mild effects (AEGL-1) and moderate effects (AEGL-2) for 1- and 8-hour exposures. Superscripts indicate the AEGL's status: f = final, i=interim, and p=proposed.
ERPG = US DOE Emergency Removal Program guidelines for mild or transient effects (ERPG-1) and irreversible or serious effects (ERPG-2) for 1-hour exposures.
MRL = ATSDR minumum risk levels for no adverse effects for 1 to 14-day exposures.
REL = California EPA reference exposure level for no adverse effects. Most, but not all, RELs are for 1-hour exposures.
IDLH/10 = One-tenth of levels determined by NIOSH to be imminently dangerous to life and health, approximately comparable to mild effects levels for 1-hour exposures.
TEEL = US DOE Temporary emergency exposure limits for no effects (TEEL-0) and mild, transient effects (TEEL-1) for 1-hour exposures. TEELs are derived according to a tiered, formula-like methodology, and do not undergo peer review. They are not recommended as the basis for regulatory desision-making, and are shown here only to inform situations where acute values from other sources are not available.

Table 7-11
Tier 1 Chronic Noncancer Risk Estimates for Hazardous Air Pollutants
Site-Specific Risk Assessment
Basin Electric Power Cooperative, Dry Fork Station, Unit 1 Boiler (ES1-01)

Analyte	CAS NO.	HAP No.	Emissions[a] [lbs/hr]	Continuous Exposure Concentration[b] [ug/m3]	Continuous Exposure Concentration[b] [mg/m3]	Reference Concentration (RFC)[c] [mg/m3]	Reference Concentration (RFC) Source[c]	Hazard Quotient [-]	Percent of HI [%]
Biphenyl	92-52-4	19	4.14E-04	6.19E-05	6.19E-08				
Acenaphthene	83-32-9	187	1.24E-04	1.86E-05	1.86E-08				
Acenaphthylene	206-96-8	187	6.09E-05	9.10E-06	9.10E-09				
Anthracene	120-12-7	187	5.12E-05	7.65E-06	7.65E-09				
Benzo(a)anthracene	56-55-3	187	1.95E-05	2.91E-06	2.91E-09				
Benzo(a)pyrene	50-32-8	187	9.26E-06	1.38E-06	1.38E-09				
Benzo(b,j,k)fluoranthene	205-99-2	187	2.68E-05	4.00E-06	4.00E-09				
Benzo(g,h,i)perylene	191-24-2	187	6.58E-06	9.83E-07	9.83E-10				
Chrysene	218-01-9	187	2.44E-05	3.64E-06	3.64E-09				
Fluoranthene	206-44-0	187	1.73E-04	2.58E-05	2.58E-08				
Fluorene	86-73-7	187	2.22E-04	3.31E-05	3.31E-08				
Ideno(1,2,3-cd)pyrene	193-39-5	187	1.49E-05	2.22E-06	2.22E-09				
Naphthalene	91-20-3	119	3.17E-03	4.73E-04	4.73E-07	0.00300	IRIS	1.58E-04	<1%
Phenanthrene	85-01-8	187	6.58E-04	9.83E-05	9.83E-08				
Pyrene	129-00-0	187	8.04E-05	1.20E-05	1.20E-08				
5-Methyl chrysene	3697-24-3	187	5.36E-06	8.01E-07	8.01E-10				
Acetaldehyde	75-07-0	1	1.39E-01	0.0208	2.08E-05	0.00900	IRIS	0.00231	<1%
Acetophenone	98-86-2	4	3.65E-03	5.46E-04	5.46E-07				
Acrolein	107-02-8	6	7.07E-02	0.01056	1.06E-05	2.00E-05	IRIS	0.528	71%
Benzene	71-43-2	15	3.17E-01	0.0473	4.73E-05	0.0300	IRIS	0.00158	<1%
Benzyl chloride	100-44-7	18	1.71E-01	0.0255	2.55E-05				
Bis(2-ethylhexyl)phthalate	117-81-7	20	1.78E-02	0.00266	2.66E-06	0.0100	P-CAL	2.66E-04	<1%
Bromoform	75-25-2	22	9.50E-03	1.42E-03	1.42E-06				
Carbon disulfide	75-15-0	28	3.17E-02	0.00473	4.73E-06	0.700	IRIS	6.76E-06	<1%
2-Chloroacetophenone	532-27-4	36	1.71E-03	2.55E-04	2.55E-07	3.00E-05	IRIS	0.00849	1%
Chlorobenzene	108-90-7	37	5.36E-03	8.01E-04	8.01E-07	1	CAL	8.01E-07	<1%
Chloroform	67-66-3	39	1.44E-02	0.00215	2.15E-06	0.0980	ATSDR	2.19E-05	<1%
Cumene	98-82-8	46	1.29E-03	1.93E-04	1.93E-07	0.400	IRIS	4.82E-07	<1%
Cyanide	57-12-5	180	6.09E-01	0.0910	9.10E-05				
2,4-Dinitrotoluene	121-14-2	71	6.82E-05	1.02E-05	1.02E-08	0.00700	P-CAL	1.46E-06	<1%
Dimethyl sulfate	77-78-1		1.17E-02	0.00175	1.75E-06				
Ethyl benzene	100-41-4	77	2.29E-02	0.00342	3.42E-06	1	IRIS	3.42E-06	<1%
Ethyl chloride	75-00-3	79	1.02E-02	0.00153	1.53E-06	10	IRIS	1.53E-07	<1%
Ethylene dichloride	107-06-2	81	9.75E-03	1.46E-03	1.46E-06	2.40	ATSDR	6.07E-07	<1%
Ethylene dibromide	106-93-4	80	2.92E-04	4.37E-05	4.37E-08	0.00900	IRIS	4.85E-06	<1%
Formaldehyde	50-00-0	87	5.85E-02	0.00874	8.74E-06	0.00980	ATSDR	8.92E-04	<1%
Hexane	110-54-3	95	1.63E-02	0.00244	2.44E-06	0.200	IRIS	1.22E-05	<1%
Isophorone	78-59-1	100	1.41E-01	0.0211	2.11E-05	2	CAL	1.06E-05	<1%
Methyl bromide	74-83-9	105	3.90E-02	0.00582	5.82E-06	0.00500	IRIS	1.16E-03	<1%
Methyl chloride	74-87-3	106	1.29E-01	0.0193	1.93E-05	0.0900	IRIS	2.14E-04	<1%
Methyl ethyl ketone	78-93-3	108	9.50E-02	0.01420	1.42E-05	5	IRIS	2.84E-06	<1%
Methyl hydrazine	60-34-4		4.14E-02	0.00619	6.19E-06				
Methyl methacrylate	80-62-6	113	4.87E-03	7.28E-04	7.28E-07	0.700	IRIS	1.04E-06	<1%
Methyl tert butyl ether	1634-04-4	114	8.53E-03	1.27E-03	1.27E-06	3	IRIS	4.25E-07	<1%
Methylene chloride	75-09-2	116	7.07E-02	0.01056	1.06E-05	1	ATSDR	1.06E-05	<1%
Phenol	108-95-2	130	3.90E-03	5.82E-04	5.82E-07	0.200	CAL	2.91E-06	<1%
Propionaldehyde	123-38-6		9.26E-02	0.01383	1.38E-05				
Tetrachloroethylene	127-18-4	150	1.05E-02	0.00157	1.57E-06	0.270	ATSDR	5.80E-06	<1%
Toluene	108-88-3	152	5.85E-02	0.00874	8.74E-06	0.400	IRIS	2.18E-05	<1%
1,1,1-Trichloroethane	79-00-5	158	4.87E-03	7.28E-04	7.28E-07	0.400	P-CAL	1.82E-06	<1%
Styrene	100-42-5	146	6.09E-03	9.10E-04	9.10E-07	1	IRIS	9.10E-07	<1%
Xylenes	1330-20-7	169	9.02E-03	1.35E-03	1.35E-06	0.100	IRIS	1.35E-05	<1%
Vinyl acetate	108-05-4	165	1.85E-03	2.77E-04	2.77E-07	0.200	IRIS	1.38E-06	<1%
Hydrochloric Acid	7647-01-0	97	3.23E00	0.483	4.83E-04	0.0200	IRIS	0.0241	3%
Hydrofluoric Acid	7664-39-3	98	2.62E00	0.392	3.92E-04	0.0140	CAL	0.0280	4%
Antimony	7440-36-0	173	3.23E-03	4.82E-04	4.82E-07				
Arsenic	7440-38-2	174	3.23E-03	4.82E-04	4.82E-07	3.00E-05	CAL	0.0161	2%
Beryllium	7440-41-7	175	9.68E-04	1.45E-04	1.45E-07	2.00E-05	IRIS	0.00723	<1%
Cadmium	7440-43-9	176	6.45E-04	9.64E-05	9.64E-08	2.00E-05	CAL	0.00482	<1%
Chromium	18540-29-9	177	6.45E-03	9.64E-04	9.64E-07	1.00E-04	IRIS	0.00964	1%
Cobalt	7440-48-4	178	6.45E-03	9.64E-04	9.64E-07	1.00E-04	ATSDR	0.00964	1%
Lead	7439-92-1	182	6.45E-03	9.64E-04	9.64E-07	0.00150	EPA OAQPS	6.43E-04	<1%
Manganese	7439-96-5	183	2.58E-02	0.00386	3.86E-06	5.00E-05	IRIS	0.0771	10%
Mercury	7439-97-6	184	1.13E-02	1.69E-03	1.69E-06	3.00E-04	IRIS	0.00562	<1%
Molybdenum	7439-98-7		3.23E-03	4.82E-04	4.82E-07				
Nickel	7440-02-0	186	1.29E-02	0.00193	1.93E-06	9.00E-05	D-ATSDR	0.0214	3%
Selenium	7782-49-2	189	3.23E-02	0.00482	4.82E-06	0.0200	CAL	2.41E-04	<1%
								0.7	100%

Notes:

a : Emissions based on the plant operating at a 100 percent load.
b : The maximum exposure concentration was estimated using ISC modeled maximum predicted 1 hour impact for a 103 percent load based on a 1 g/s unit emission rate (ug/m3): 1.18553
c : Source : Office of Air Quality Planning and Standards. Air Toxics Website (http://www.epa.gov/ttn/atw/toxsource/summary.html). Table 1. Prioritized Chronic Dose-Response Values (2/28/05).
CAS NO. = Chemical Abstracts Services number for the compound.
HAP NO. = Position of the compound on the HAP list in the Clean Air Act (112[b][2]). "999" denotes substances under consideration for listing.
IARC WOE = International Agency for Research on Cancer weight-of-evidence for carcinogenicity in humans (1 - carcinogenic; 2A - probably carcinogenic; 2B - possibly carcinogenic; 3 - not classifiable; 4 - probably not carcinogenic).
EPA WOE = US Environmental Protection Agency weight-of-evidence for carcinogenicity under the 1986 EPA cancer guidelines, as superseded for specific compounds by the 1999 interim guidelines (1986 guidelines: A - human carcinogen; B1 - probable carcinogen, limited human evidence; B2 - probable carcinogen, sufficient evidence in animals; C - possible human carcinogen; D - not classifiable E - evidence of noncarcinogenicity. 1999 guidelines: CH - carcinogenic to humans; LH - likely to be carcinogenic; SE - suggestive evidence for carcinogenicity; Inl - inadequate information to determine carcinogenicity; NL - not likely to be carcinogenic).
IRIS : US EPA Integrated Risk Information System.
CAL : California Environmental Protection Agency Reference Exposure Level (REL).
EPA OAQPS : US EPA Office of Air Quality Planning and Standards.
ATDSR : US Agency for Toxic Substances and Disease Registry
P-CAL : Proposed California Environmental Protection Agency Reference Exposure Level (REL).
D-ATDSR : US Agency for Toxic Substances and Disease Registry. Draft Mininum Risk Level (MRL).
Blank = RFC not available.

Table 7-10
Tier 1 Cancer Risk Estimates for Hazardous Air Pollutants
Site-Specific Risk Assessment
Basin Electric Power Cooperative, Dry Fork Station, Unit 1 Boiler (ES1-01)

Analyte	CAS NO.	HAP No.	Emissions[a] [tons/yr]	Maximum Annual Average Exposure Concentration[b] [ug/m3]	Inhalation Unit Risk (IUR)[c] 1/[ug/m3]	Inhalation Unit Risk (IUR) Source[c]	IARC WOE	EPA WOE	Incremental Excess Cancer Risk Estimate [-]	Percent of Total Risk [%]
Biphenyl	92-52-4	19	1.72E-03	4.22E-07				D		
Acenaphthene	83-32-9	187	5.15E-04	1.27E-07				D		
Acenaphthylene	206-96-8	187	2.52E-04	6.21E-08				D		
Anthracene	120-12-7	187	2.12E-04	5.22E-08			3	D		
Benzo(a)anthracene	56-55-3	187	8.08E-05	1.99E-08	1.10E-04	CAL	2A	B2	2.19E-12	<1%
Benzo(a)pyrene	50-32-8	187	3.84E-05	9.44E-09	0.00110	CAL	2A	B2	1.04E-11	<1%
Benzo(b,j,k)fluoranthene	205-99-2	187	1.11E-04	2.73E-08	1.10E-04	CAL	2B	B2	3.01E-12	<1%
Benzo(g,h,i)perylene	191-24-2	187	2.73E-05	6.71E-09			3	D		
Chrysene	218-01-9	187	1.01E-04	2.48E-08	1.10E-05	CAL	3	B2	2.73E-13	<1%
Fluoranthene	206-44-0	187	7.17E-04	1.76E-07			3	D		
Fluorene	86-73-7	187	9.19E-04	2.26E-07			3	D		
Ideno(1,2,3-cd)pyrene	193-39-5	187	6.16E-05	1.52E-08	1.10E-04	CAL	2B	B2	1.67E-12	<1%
Naphthalene	91-20-3	119	1.31E-02	3.23E-06	3.40E-05	CAL		SE	1.10E-10	<1%
Phenanthrene	85-01-8	187	2.73E-03	6.71E-07				D		
Pyrene	129-00-0	187	3.33E-04	8.20E-08				D		
5-Methyl chrysene	3697-24-3	187	2.22E-05	5.46E-09	0.00110	CAL	2B		6.01E-12	<1%
Acetaldehyde	75-07-0	1	5.76E-01	1.42E-04	2.20E-06	IRIS	2B	B2	3.11E-10	<1%
Acetophenone	98-86-2	4	1.51E-02	3.73E-06				D		
Acrolein	107-02-8	6	2.93E-01	7.20E-05			3	Inl		
Benzene	71-43-2	15	1.31E00	3.23E-04	7.80E-06	IRIS	1	CH	2.52E-09	2%
Benzyl chloride	100-44-7	18	7.07E-01	1.74E-04	4.90E-05	CAL	2B	B2	8.52E-09	6%
Bis(2-ethylhexyl)phthalate	117-81-7	20	7.37E-02	1.81E-05	2.40E-06	CAL	2B	B2	4.35E-11	<1%
Bromoform	75-25-2	22	3.94E-02	9.69E-06	1.10E-06	IRIS	3	B2	1.07E-11	<1%
Carbon disulfide	75-15-0	28	1.31E-01	3.23E-05						
2-Chloroacetophenone	532-27-4	36	7.07E-03	1.74E-06						
Chlorobenzene	108-90-7	37	2.22E-02	5.46E-06				D		
Chloroform	67-66-3	39	5.96E-02	1.47E-05			2B	LH		
Cumene	98-82-8	46	5.35E-03	1.32E-06				Inl		
Cyanide	57-12-5	180	2.52E00	6.21E-04				D		
2,4-Dinitrotoluene	121-14-2	71	2.83E-04	6.95E-08	8.90E-05	CAL	2B	B2	6.19E-12	<1%
Dimethyl sulfate	77-78-1		4.85E-02	1.19E-05						
Ethyl benzene	100-41-4	77	9.49E-02	2.33E-05				D		
Ethyl chloride	75-00-3	79	4.24E-02	1.04E-05						
Ethylene dichloride	107-06-2	81	4.04E-02	9.94E-06	2.60E-05	IRIS	2B	B2	2.58E-10	<1%
Ethylene dibromide	106-93-4	80	1.21E-03	2.98E-07	6.00E-04	IRIS	2A	LH	1.79E-10	<1%
Formaldehyde	50-00-0	87	2.42E-01	5.96E-05	5.50E-09	EPA OAQPS	2A	B1	3.28E-13	<1%
Hexane	110-54-3	95	6.77E-02	1.66E-05						
Isophorone	78-59-1	100	5.86E-01	1.44E-04	2.70E-07	Conv. Oral		C	3.89E-11	<1%
Methyl bromide	74-83-9	105	1.62E-01	3.97E-05				D		
Methyl chloride	74-87-3	106	5.35E-01	1.32E-04				Inl		
Methyl ethyl ketone	78-93-3	108	3.94E-01	9.69E-05				Inl		
Methyl hydrazine	60-34-4		1.72E-01	4.22E-05						
Methyl methacrylate	80-62-6	113	2.02E-02	4.97E-06				E		
Methyl tert butyl ether	1634-04-4	114	3.53E-02	8.69E-06	2.60E-07	CAL			2.26E-12	<1%
Methylene chloride	75-09-2	116	2.93E-01	7.20E-05	4.70E-07	IRIS	2B	B2	3.39E-11	<1%
Phenol	108-95-2	130	1.62E-02	3.97E-06			3	Inl		
Propionaldehyde	123-38-6		3.84E-01	9.44E-05						
Tetrachloroethylene	127-18-4	150	4.34E-02	1.07E-05	5.90E-06	CAL	2A	B2-C	6.30E-11	<1%
Toluene	108-88-3	152	2.42E-01	5.96E-05			3	D		
1,1,1-Trichloroethane	79-00-5	158	2.02E-02	4.97E-06	1.60E-05	IRIS	3	C	7.95E-11	<1%
Styrene	100-42-5	146	2.52E-02	6.21E-06			2B			
Xylenes	1330-20-7	169	3.74E-02	9.19E-06				Inl		
Vinyl acetate	108-05-4	165	7.67E-03	1.89E-06			2B			
Hydrochloric Acid	7647-01-0	97	1.38E01	3.40E-03			3			
Hydrofluoric Acid	7664-39-3	98	1.12E01	2.76E-03						
Antimony	7440-36-0	173	1.34E-02	3.29E-06						
Arsenic	7440-38-2	174	1.34E-02	3.29E-06	0.00430	IRIS	1	A	1.41E-08	10%
Beryllium	7440-41-7	175	4.01E-03	9.87E-07	0.00240	IRIS	1	LH	2.37E-09	2%
Cadmium	7440-43-9	176	2.67E-03	6.58E-07	0.00180	IRIS	1	B1	1.18E-09	<1%
Chromium	18540-29-9	177	4.01E-02	9.87E-06	0.0120	IRIS	1	CH	1.18E-07	80%
Cobalt	7440-48-4	178	2.67E-02	6.58E-06						
Lead	7439-92-1	182	2.67E-02	6.58E-06			2B	B2		
Manganese	7439-96-5	183	1.07E-01	2.63E-05				D		
Mercury	7439-97-6	184	4.68E-02	1.15E-05				D		
Molybdenum	7439-98-7		1.34E-02	3.29E-06						
Nickel	7440-02-0	186	5.35E-02	1.32E-05			2B	A		
Selenium	7782-49-2	189	1.34E-01	3.29E-05				D		
								Total Incremental Excess Cancer Risk Estimate:	1E-07	100%

Notes:

a : Emissions based on the plant operating at a 103 percent load.

b : The maximum exposure concentration was estimated using ISC modeled maximum predicted annual impact (100 percent load) based on a 1 g/s unit emission rate (ug/m3): 0.00855

c : Source : Office of Air Quality Planning and Standards. Air Toxics Website (http://www.epa.gov/ttn/atw/toxsource/summary.html). Table 1. Prioritized Chronic Dose-Response Values (2/28/05).

CAS NO. = Chemical Abstracts Services number for the compound.

HAP NO. = Position of the compound on the HAP list in the Clean Air Act (112[b][2]). "999" denotes substances under consideration for listing.

IARC WOE = weight-of-evidence for carcinogenicity in humans (1 - carcinogenic; 2A - probably carcinogenic; 2B - possibly carcinogenic; 3 - not classifiable; 4 - probably not carcinogenic).

EPA WOE = weight-of-evidence for carcinogenicity under the 1986 EPA cancer guidelines, as superseded for specific compounds by the 1999 interim guidelines (1986 guidelines: A - human carcinogen; B1 - probable carcinogen, limited human evidence; B2 - probable carcinogen, sufficient evidence in animals; C - possible human carcinogen; D - not classifiable E - evidence of noncarcinogenicity. 1999 guidelines: CH - carcinogenic to humans; LH - likely to be carcinogenic; SE - suggestive evidence for carcinogenicity; Inl - Inadequate information to determine carcinogenicity; NL - not likely to be carcinogenic).

IRIS : USEPA's Integrated Risk Information System Unit Risk Estimate (URE).

CAL : California Environmental Protection Agency Carcinogenic Unit Risk Estimate (URE).

EPA OAQPS : US EPA Office of Air Quality Planning and Standards.

Conv. Oral : Extrapolated from Oral URE.

Blank = IUR not available.

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where:

HQ_A = the acute hazard quotient for an individual HAP;

EC_{ST} = exposure point concentration based on an estimate of short-term inhalation exposure to that HAP; and

AV = the corresponding acute dose-response value for that HAP.

Available acute dose response values are more diverse than chronic values, because they were developed for different purposes and consider different exposure durations. The characterization of acute risk involves comparing the maximum estimated hourly concentrations with a range of acute dose-response values from sources provided in EPA (2004). Since the EC_{ST} for all the HAPs are lower than the acute benchmarks presented in Table 7-12, meaning the HQ_A is less than one, it is reasonable to conclude that the potential for significant acute risk is low and further analysis is not required.

7.9.5 Uncertainty Discussion

Scientific uncertainty is inherent in the risk assessment process and the numerical estimates of risk and hazard should be placed in context with the uncertainties inherent in the analysis. The purpose of this section is to provide a brief, qualitative discussion of the key areas of uncertainty associated with this Tier 1 risk analysis.

Generally the methods and assumptions used in this Tier 1 risk analysis are conservative and the estimated risks and hazards are intended to be protective of human health. Examples of potential areas of uncertainty are listed below.

- The use of the EC based on the MEI will overestimate risk and hazards for the typical receptor.
- Because individuals do not typically work or leave in the same place for their entire lives, a lifetime (70 year) exposure duration will likely overestimate risk and hazards. And the lack of nearby receptors, even for a 25 or 30 year duration, under current and likely future land use conditions will likely overestimate risks and hazards.
- The use of HAP emission estimates from the proposed boiler are based on industry-wide values rather than facility-specific data and may overestimate risk and hazards.
- Several HAPs lack peer-reviewed dose-response values (see Tables 7-10, 7-11, and 7-12). This may underestimate risks and hazards.

7.9.6 Summary

Further analysis (i.e., performance of a Tier 2 risk analysis) is not necessary because the potential for significant risks and hazards are low based on the results of the Tier 1 risk analysis. The total excess cancer risk estimate of 1E-07 is below the low end of EPA's acceptable risk range (1E-06); the cumulative excess noncancer hazard index is below one; and no acute dose-response values are exceeded by the HAP ECs.

as 1×10^{-6}. Sometimes an exponential notation is used; in this case it would be 1E-06. Because IURs are typically upper-bound estimates, actual risks may be lower than predicted.

As shown in Table 7-10, the $Risk_T$ of 2E-07 is less than lower end of EPA's acceptable risk range of 1E-06, therefore no significant risks are predicted and no further analysis is required.

Chronic Noncancer Hazard

Chronic noncancer hazards for the HAPs are estimated by dividing the exposure concentration (EC) by the reference concentration (RfC) for the HAP to obtain the chronic Hazard Quotient (HQ) using the following equation:

$$\mathbf{HQ = EC_C \div RfC}$$

where:

HQ = chronic hazard quotient for an individual HAP [unitless];

EC_C = exposure concentrations based on an estimate of continuous inhalation exposure to that HAP [$\mu g/m^3$]; and

RfC = noncancer reference concentration for that HAP [$\mu g/m^3$].

Based on the definition of the RfC, a HQ less than or equal to one indicates that adverse noncancer effects are not likely to occur (EPA, 2004).

A chronic cumulative noncancer hazard (the Hazard Index, or HI) is calculated by summing the HQs across all HAPs:

$$\mathbf{HI = HQ_1 + HQ_2 + ... + HQ_i}$$

where

HI = the chronic cumulative hazard index [unitless]; and
HQ = the chronic noncancer hazard quotient for the i_{th} HAP [unitless].

The HI approach is based on the assumption that even when individual HAP concentrations are lower than the corresponding RfCs, some HAPs may work together such that their potential for harm is additive and the combined exposure to the group of HAPs poses greater likelihood of harm. Where the overall HI exceeds one, a more refined analysis is warranted, because interpretation of differences among HQs across HAPs is limited by the fact that the nature of the RfC can vary widely depending on the substance, type of critical effect, and subpopulation exposed. However, as shown in Table 7-11, none of the HQ for individual HAPs, nor the HI, are greater than one, indicating the potential for significant chronic noncancer hazard is low and further analysis is not required.

Acute Noncancer Hazard

Acute noncancer hazard for each HAP are estimated by dividing the short-term exposure concentration (EC_{ST}) by the acute dose-response value (AV) to obtain the acute Hazard Quotient (HQ) using the following equation:

$$\mathbf{HQ_A = EC_{ST} \div AV}$$

EPA provides specific dose-response recommendations for unspeciated HAP data (EPA, 2004). Therefore the inhalation toxicity criteria for chromium compounds are based on 100 percent chromium VI (Cr^{+6}), mercury compounds are assumed to be 100 percent elemental mercury, and nickel compounds are assumed to be Ni_3S_2 for estimating cancer risk and NiO for estimating chronic noncancer hazard.

7.9.4 Risk Characterization

In the risk characterization, the ECs are combined with the applicable dose-response values to generate the risk and hazard estimates. Estimates of excess cumulative cancer risk, chronic noncancer hazard, and acute noncancer hazard are calculated separately. Background risks and risks from exposure via multiple exposure pathways (e.g., ingestion) are not considered in this Tier 1 risk analysis.

Cancer Risk

Excess lifetime cancer risk is calculated by multiplying the EC and IUR for each HAP using the following equation:

$$\mathbf{Risk = EC_L \times IUR}$$

where:

Risk = excess lifetime cancer risk estimate (expressed as an upper-bound risk of contracting cancer over a lifetime) [unitless];

EC_L = exposure concentration based on a lifetime estimate of continuous inhalation exposure to an individual HAP [$\mu g/m^3$]; and

IUR = inhalation unit risk estimate for that HAP [$1/(\mu g/m^3)$].

A lifetime exposure duration, 70 years by convention, is assumed in this Tier 1 risk analysis. While the modeling results and the emissions estimates are based on a one year duration, the resulting EC_L is assumed to be representative of the entire exposure duration of 70 years (EPA, 2004).

The following equation estimates the predicted incremental excess cancer risk from multiple HAPs:

$$\mathbf{Risk_T = Risk_1 + Risk_2 + ... + Risk_i}$$

where:

$Risk_T$ = total incremental excess cancer risk estimate [unitless]; and
$Risk_i$ = incremental excess cancer risk estimate for the ith HAP [unitless].

This approach is based on an assumption of a linear dose response so that the risks associated with individual chemicals in the mixture are additive.

Estimates of cancer risk are expressed as a statistical probability represented in scientific notation as a negative exponent of 10. For example, an additional upper bound risk of contracting cancer of 1 chance in 1,000,000 (or one additional person in 1,000,000) is written

7.9.2 Exposure Assessment

Human exposure via inhalation can be assessed by estimating the ambient air concentration of a hazardous air pollutant (HAP). The emissions estimates presented in Section 3 and the ISC-PRIME dispersion modeling results are used to estimate ambient air concentrations at each modeling node (or interpolated nodes), which are, in turn, used to estimate exposure concentrations (ECs). The EC is the ambient air concentration at a receptor location (sometimes called an exposure point). In a Tier 1 analysis it is assumed that the modeled ambient air concentrations and ECs are the same (EPA, 2004). It is also assumed that the exposure estimates derived from a single year's emissions estimates are commonly used to represent a chronic exposure (EPA, 2004)

The modeled ambient air concentration used in the Tier 1 risk analysis is based on the maximum exposed individual (MEI). The MEI is the modeling receptor where the maximum modeled ambient air concentration occurs, regardless of whether an inhalation target is located there under current (or likely future) land use conditions. The MEI provides a conservative estimate of exposure.

The default assumption is that the receptor population is breathing, over a lifetime (70 years by convention), outdoor air continuously at the MEI location. This is believed to be a conservative assumption since indoor air concentrations of air toxics are expected to be the same or lower than the outdoor concentrations (when the indoor concentrations are produced solely by inflow from outside air).

As described above, the MEI ambient air concentration, predicted using the emissions and the ISC-PRIME modeling results, is used as the EC. The EC for each HAP is calculated by multiplying the 1-hour or annual model results obtained with a modeled emission rate of 1 gram per second (g/s) by the hourly or annual emission rates (in g/s). Exposure concentrations (EC_L) for estimating chronic cancer risk are derived using the average annual emission rate assuming the plant is operating at a 100 percent load (Table 7-10). Exposure concentrations (EC_{ST}) for estimating chronic and acute noncancer hazards are derived using the peak hourly emission rate assuming the plant is operating at a 103 percent load (Tables 7-11 and 7-12, respectively).

7.9.3 Toxicity Criteria used in the Tier 1 Risk Analysis

The screening-level toxicity criteria (i.e., chronic and acute dose-response values) published by EPA's Office of Air Quality Planning and Standards Air Toxics Website (http://www.epa.gov/ttn/atw/toxsource/summary.html) are used in this Tier 1 risk analysis:

- Chronic Cancer Toxicity Criteria
  - Inhalation Unit Risk (IUR) values from *Table 1. Prioritized Chronic Dose-Response Values (2/28/05)* are used.
- Chronic Noncancer Toxicity Criteria
  - Reference Concentration (RfC) values from *Table 1. Prioritized Chronic Dose-Response Values (2/28/05)* are used.
- Acute Noncancer Toxicity Criteria
  - Acute Dose-Response Values (AVs) from *Table 2. Acute Dose-Response Values for Screening Risk Assessments (6/02/2005)* are used.

TABLE 7-9
Pollutant Effects on Species

Species	Sensitivity Category of Plant	4-hour NO_X Concentrations which Result in 5% Foliar Injury	Worst-Case 3-hour NO_X Concentration
Alfalfa, Oats	Sensitive	3.76-11.28 mg/m^3	
Corn, Wheat	Intermediate	9.4-18.8 mg/m^3	0.0147 mg/m^3
Elder, Ash	Tolerant	> 16.92 mg/m^3	

Based on "Air Quality Criteria for Oxides of Nitrogen", EPA/600/8-91049bF, August, 1993.

The predicted impacts for PM_{10} were below the secondary air quality standards, which are set to protect public welfare, including protection against decreased visibility, damage to animals, crops, vegetation, and buildings. Predicted impacts for all other regulated pollutants were well below modeling significance levels and monitoring de minimum levels.

7.8.3 Visibility Impairment Analysis

No near-field assessment of Class II area visibility impacts was conducted for the project. There are no Class II "scenic vistas" established by the WDEQ in the vicinity of the proposed project, nor are there established standards for Class II visibility impacts. Additionally, the visibility screening techniques, such as the EPA VISCREEN model, are not adequate to fully assess the impact of the sources proposed for this project.

7.8.4 Ozone

No ambient impact analysis for ozone was conducted for this project. Currently, there are no modeling techniques that are approved for regulatory use for the assessment of ozone impacts from single point sources in rural areas. Also, the estimated emissions of volatile organic compounds (VOC) from the project are well below the 100 tons per year threshold that would require an ambient impact analysis and/or gathering of ambient air quality data for ozone.

7.9 Air Toxics Analysis

7.9.1 Tier 1 Inhalation Risk Analysis

A Tier 1 inhalation risk analysis was conducted for the Dry Fork Station boiler (ES1-01) following the Facility-Specific Air Toxics Risk Assessment guidance developed by EPA (2004). A Tier 1 inhalation risk analysis is a screening-level assessment that incorporates simplified assumptions and default values to allow a simple, health-protective risk estimate to be calculated. Due to the conservative nature of the analysis, the resulting risk estimates are likely to be higher than actual risks. If the facility passes this screening analysis, a risk manager can be reasonably confident that the likelihood for significant risk is low.

7.8.2 Soils and Vegetation Analysis

CH2M HILL conducted a search for information regarding sensitive soils, sensitive vegetation, and vegetation with commercial or recreational value in the vicinity of the proposed Dry Fork Station.

Based on the most recent U.S. Department of Agriculture (USDA) census, Campbell County had 26,185 acres of cropland in 2002 (USDA, 2002). Crop production consists mostly of hay/forage crops, corn for grain, wheat, oats, and barley. As compared to production in other Wyoming counties, the wheat production in Campbell County ranked 5th, corn and oats production ranked 13th, barley production ranked 16th, and hay/forage crops ranked 18th. Harvested acreages of crops in Campbell County in 2002 were: 2,554 acres of wheat; 22,940 acres of hay/forage crops; and 97 acres of barley. The acreages of corn and oats harvested were not disclosed.

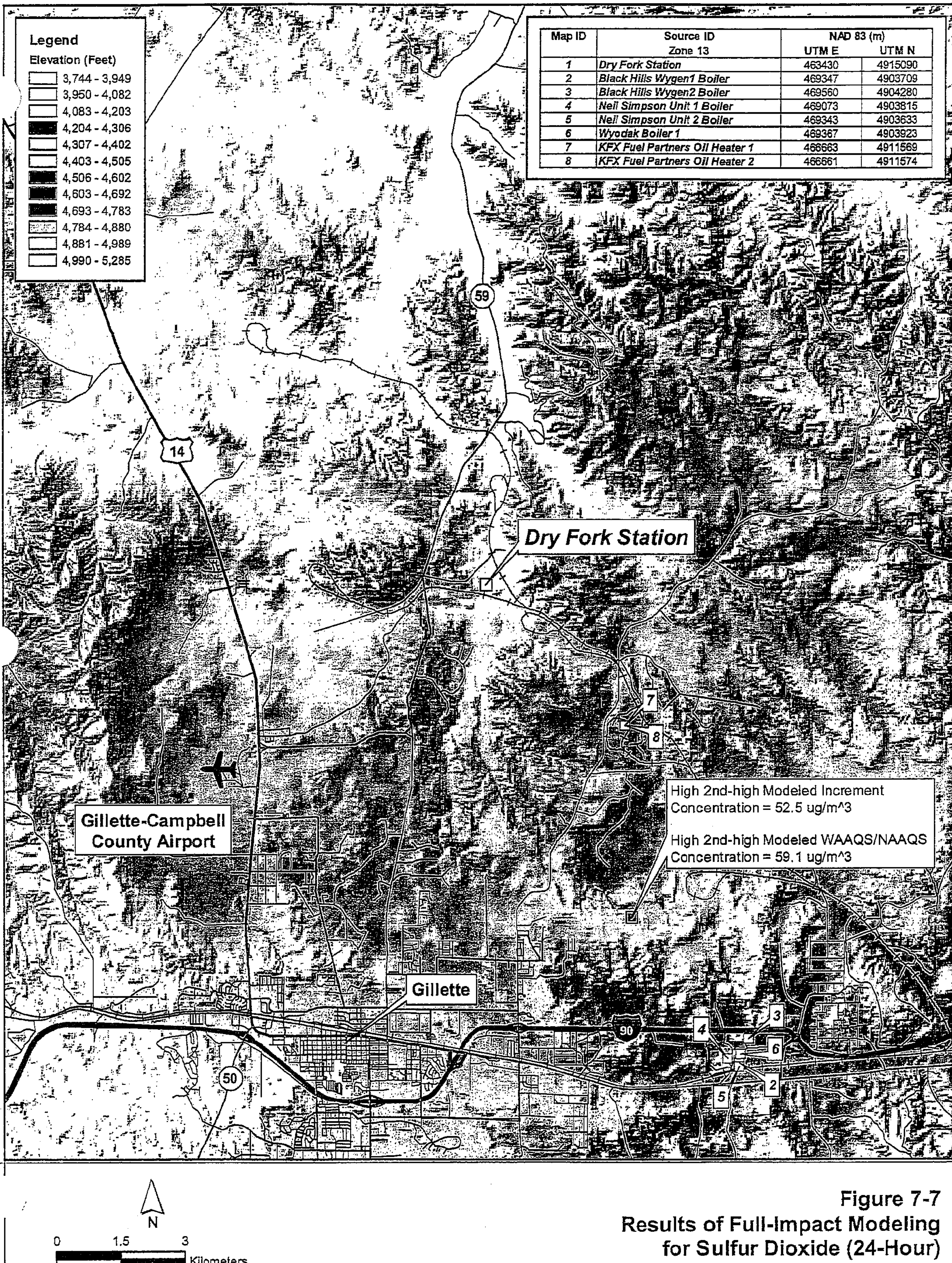
Soil and vegetation classifications within the project area were determined based on existing available data. Dominant vegetation associations characterizing the study area are classified as Wyoming big sagebrush (*Artemesia tridentata Nutt ssp*), mixed grass prairie, and dry land crops (Wyoming GAP, 2005). In addition to the Wyoming big sagebrush community, dominant vegetative species characterizing the mixed grass prairie include buffalo grass (*Buchloe dactyloides*), blue gramma (*Bouteloua gracilis*), sand dropseed (*Sporobolus cryptandrus*), and other plains mixed grass and forb species. None of these species were identified as sensitive.

Soils in the impact area are characterized as plains, dissected plains, and floodplain soil types (USDA, 1979). Dominant plains soils in the study area include the Ustic Haplargids-Ustic Torriorthents associations. These soils are typically fine loams and mesic. The Haplargids occur across broad expanses of the landscape. The Torriorthents occur along eroded drainage ways and around rock outcrops. None of these soils are classified as sensitive by the USDA (USDA, 1979).

Soils within the non-mountainous regions of Wyoming are typically alkaline and would not be sensitive to project impacts (WRDS, 2005). Additionally, depositions should have no adverse effect to vegetation or crops, and may actually have a fertilizing effect (WRDS, 2005).

Of the species identified in the Campbell County vicinity, oats and barley have been identified as crops sensitive to pollutant effects. The exact tolerance of a given crop is dependent on the particular horticultural varieties. Table 7-9 indicates levels of NO_X which have been found to result in plant damage for different species. Photosynthesis is found to be inhibited in alfalfa at 2-hour NO_2 exposures of 4,105 $\mu g/m^3$ (Hill, 1974). In addition, a mixture of approximately 191 $\mu g/m^3$ of NO_X and 265 $\mu g/m^3$ of SO_X administered for 4 hours has been discovered to cause foliar injury to oats (DNR, 2002).

CH2M HILL used the ISC-PRIME model to determine the maximum NO_X and SO_X impacts that would result from the project. The worst-case 3-hour SO_X impact from the proposed unit is 21.1 $\mu g/m^3$ while the worst-case 3-hour NO_X impact is 14.7 $\mu g/m^3$. As a result, the worst-case combined NO_X and SO_X 3-hour impact is 35.8 $\mu g/m^3$. All predicted concentrations are well below those that would be expected to impact vegetation.



Map ID	Source ID Zone 13	NAD 83 (m) UTM E	UTM N
1	*Dry Fork Station*	463430	4915090
2	*Black Hills Wygen1 Boiler*	469347	4903709
3	*Black Hills Wygen2 Boiler*	469560	4904280
4	*Neil Simpson Unit 1 Boiler*	469073	4903815
5	*Neil Simpson Unit 2 Boiler*	469343	4903633
6	*Wyodak Boiler 1*	469367	4903923
7	*KFX Fuel Partners Oil Heater 1*	466663	4911569
8	*KFX Fuel Partners Oil Heater 2*	466661	4911574

Figure 7-7
Results of Full-Impact Modeling for Sulfur Dioxide (24-Hour)

impact is well below the 24-hour WAAQS of 260 µg/m³ and the 24-hour NAAQS of 365 µg/m³.

For the PSD increment analysis, the highest 2nd-high 24-hour modeled impact was 40.9 g/m³. This modeled impact also occurred approximately 9 km southeast of the Dry Fork Station at the same receptor that yielded the maximum coarse-grid WAAQS/NAAQS result. Using a fine-spaced (100-m) receptor grid to further refine the result, the 2nd-high 24-hour modeled impact was 52.5 µg/m³, which is well below the 24-hour PSD increment of 91 µg/m³.

Figure 7-7 shows the location of the modeled maximum concentrations and the locations of all modeled sources. Table 7-8 presents the results of the full-impact analysis for SO_2.

TABLE 7-8
Summary of Full-Impact SO_2 Modeling

Averaging Period/ Pollutant	High 2nd-High Modeled Increment Impact (µg/m³)	Class II PSD Increment (µg/m³)	High 2nd-High Modeled WAAQS/ NAAQS Impact (µg/m³)	Background Concentration (µg/m³)	Total WAAQS/ NAAQS Impact (µg/m³)	Wyoming (National) Ambient Air Quality Standard (µg/m³)
24-hour SO_2	52.5	91	59.1	51.8	110.9	260 (365)

7.8 Additional Impact Analysis

7.8.1 Growth Analysis

CH2M HILL consulted with BEPC personnel to obtain information on labor requirements and labor availability for the project, and made the following determinations. Most of the approximately 623 construction jobs (peak) needed for the project will be filled by workers commuting to the site, many from the greater Gillette area and Campbell County. Of the permanent positions needed for the project (up to 75), it is assumed that the majority will be filled by local workers, with the remainder filled by people who will relocate to the area. Based on the *State of Wyoming, Department of Administration and Information, Economic Analysis Division, 2004* report, the population of Campbell County in 2000 was 33,698. Even if all 75 positions were filled through relocations, this represents less than 0.2 percent of the population of Campbell County (based on population in 2000). Due to the need for temporary and permanent positions for the project, there will be some emissions associated with the construction of housing in the Gillette area. However, these emissions will be temporary and, because of the limited numbers of new homes expected, are considered to be insignificant.

Services and maintenance mechanisms are already in place in the Gillette area to serve existing power generating facilities. Existing firms located in Gillette and Campbell County provide such services. The need for such services due to the addition of Dry Fork Station is expected to present an increased level of activity for such firms, but is not expected to result in any significant new commercial growth in the Gillette area.

To determine compliance with the allowable WAAQS/NAAQS for 24-hour SO_2, CH2M HILL modeled the Dry Fork Station boiler and all appropriate outside sources of SO_2 and added an appropriate background level to arrive at total predicted impacts. The highest predicted 2nd-high 24-hour total impact was compared to the 24-hour WAAQS of 260 µg/m³ and the 24-hour NAAQS of 365 µg/m³.

For background concentrations, CH2M HILL used ambient SO_2 data that have been collected at the WYODAK facility in Gillette. These measured concentrations represent conservative representations of background levels for the Gillette area given the presence of several large sources of SO_2 at the WYODAK complex. For 24-hour background, CH2M HILL used the highest 2nd-high value measured at the site from 2003 through mid-2005 (51.8 µg/m³).

Input data for outside sources in Wyoming were provided by the WDEQ or assembled at WDEQ's offices. The master list of significant sources of SO_2 within the radius of impact plus 50 km included the following sources:

- Wygen1
- Wygen2
- Neil Simpson Unit 1
- Neil Simpson Unit 2
- Wyodak Unit 1
- KFX

All of these source were included in the WAAQS/NAAQS analysis. For PSD increment modeling, all of the listed sources were included with the exception of Wyodak Unit 1. This source was constructed in 1972, which is prior to the major source baseline date for SO_2. In December of 1986, a scrubber was installed to control SO_2 emissions. With the installation of the scrubber, current short-term SO_2 emissions would be lower than the emissions during the baseline period. Therefore, the source would actually expand increment, but rather than account for increment expansion from this source, it was merely removed from the increment analysis. All other Wyoming sources were modeled with their respective allowable short-term SO_2 emissions for the WAAQS/NAAQS analysis, and conservatively modeled with the same allowable emission rates for the PSD increment analyses. Detailed input parameters for each source are provided in Appendix G.

The base ISC-PRIME receptor grid was reduced to include only the receptors that fall within the radius of impact (9.1 km), and this reduced grid was used for the WAAQS/NAAQS and increment analyses (see Figure 7-6). The Dry Fork Station boiler was conservatively modeled with the exhaust parameters for the load (75%) that yielded the highest impacts in the preliminary analysis, along with the emission rate representative of peak (103%) load.

For the WAAQS/NAAQS analysis, the highest 2nd-high 24-hour modeled impact was 55.4 µg/m³. This modeled impact occurred approximately 9 km southeast of the Dry Fork Station at the edge of the receptor grid. Because this maximum receptor is located in an area of 1-km receptor spacing, a fine-spaced receptor grid was constructed around the maximum receptor to further refine the result. Using the fine-spaced (100-m) receptor grid, the 2nd-high 24-hour modeled impact was 59.1 µg/m³. The total predicted impact, consisting of the 24-hour background level of 51.8 µg/m³ added to the modeled impact, was 110.9 µg/m³. This total

7.7.5 Preliminary Analysis for PM_{10}

The preliminary analysis for PM_{10} included the proposed boiler, the auxiliary cooling tower, and sources associated with material handling for the new unit. Dust collectors and bin vent filters will serve as emissions controls for many of the material handling sources. The sources associated with fly ash/FGD waste/bottom ash handling, including the loading of haul trucks, hauling, and the dumping of material into the landfill, were modeled with a 12-hour per day operation (0600-1800 daily). Detailed emissions calculations for all sources are provided in Appendix B.

The highest predicted 24-hour impact of PM_{10} with the base ISC-PRIME receptor grid and 10-m meteorological data was 4.2 $\mu g/m^3$, which is well below the Class II modeling significance level of 5.0 $\mu g/m^3$ for 24-hour PM_{10}. This predicted impact occurred approximately 1 km to the northeast of the boiler stack, at the edge of the portion of the base receptor grid with 100-m spacing. To further refine this estimated impact, a fine-spaced receptor grid with 100-meter spacing was built around the maximum course-grid receptor. With this fine-spaced grid, the maximum estimated 24-hour impact remained at 4.2 $\mu g/m^3$.

The highest predicted annual impact of PM_{10} with the base ISC-PRIME receptor grid and 10-m meteorological data was 0.89 $\mu g/m^3$. This impact was predicted to occur at the facility fenceline to the northeast of the power block. Because this receptor was located in an area of 50-m spacing, no further analysis was required to further refine the impact, which is below the Class II modeling significance level of 1.0 $\mu g/m^3$ for annual PM_{10}.

The preliminary analysis demonstrates that the Dry Fork Station Project will not produce a significant impact of PM_{10}. Table 7-7 presents the results of the preliminary analysis for PM_{10}.

TABLE 7-7
Results of Preliminary Analysis for PM_{10}

Averaging Period	Maximum Project Predicted ($\mu g/m^3$)	Class II Modeling Significance Level ($\mu g/m^3$)
24-Hour PM_{10}	4.20	5
Annual PM_{10}	0.89	1

7.7.6 Full-Impact Analysis for Sulfur Dioxide (SO_2)

Results of the preliminary modeling analysis for SO_2 indicated that predicted impacts from the Dry Fork Station Project would exceed the 24-hour modeling significance level, and therefore the project would trigger a full-impact analysis for 24-hour SO_2. A full-impact analysis includes model runs for the determination of compliance with WAAQS/NAAQS and PSD increments.

To determine compliance with the allowable PSD increment for 24-hour SO_2, CH2M HILL modeled the Dry Fork Station boiler and other increment-consuming sources and compared the highest predicted 2nd-high 24-hour impact to the allowable Class II 24-hour increment of 91 $\mu g/m^3$.

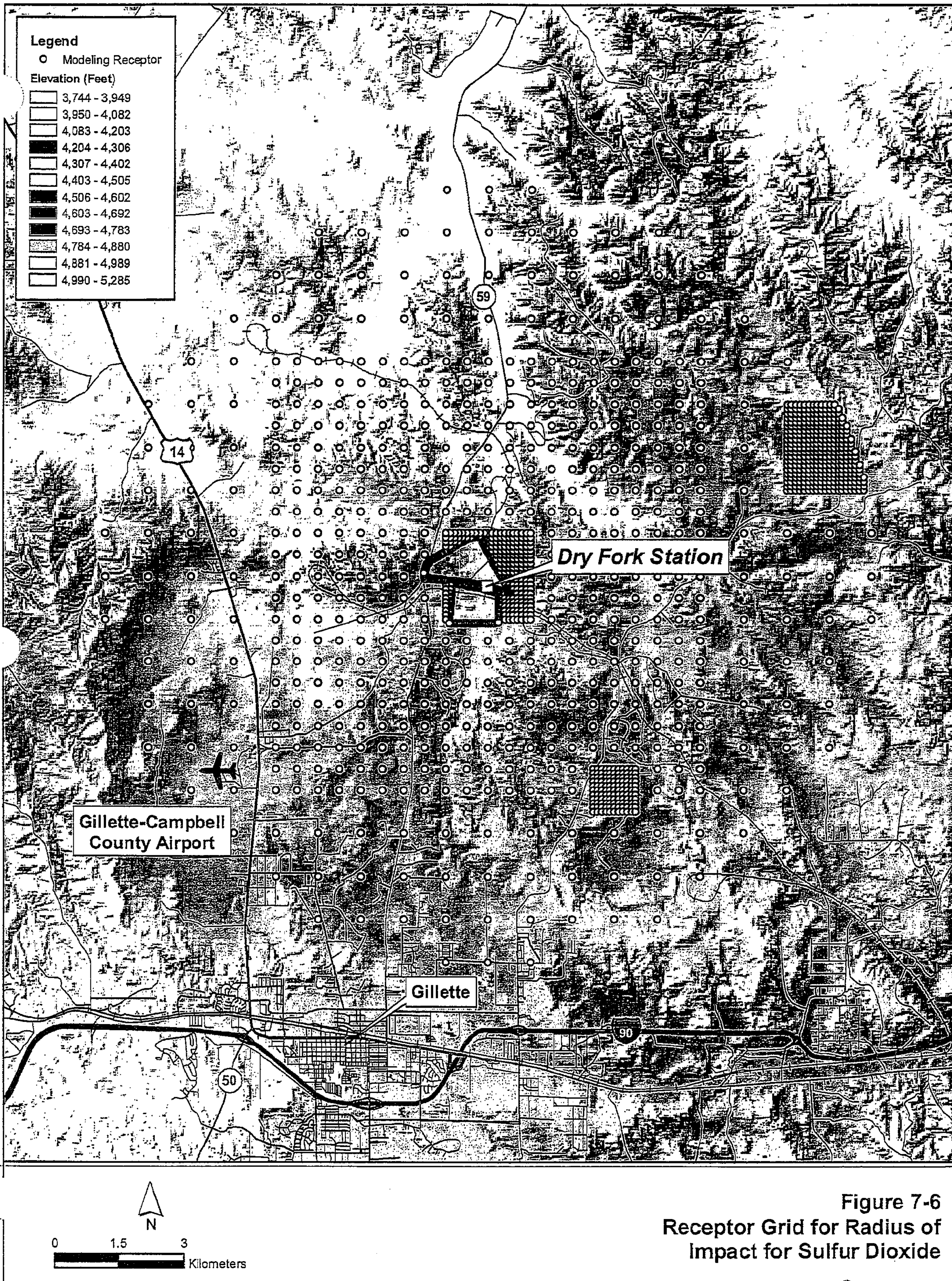


Figure 7-6
Receptor Grid for Radius of Impact for Sulfur Dioxide

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7.7.3 Preliminary Analysis for Nitrogen Oxides (NO_X)

For the preliminary analysis of the impacts of NO_X emissions for the project, the main boiler and the natural-gas fired auxiliary boiler were modeled together, with NO_X emission rates that reflect the potential annual operating conditions for each source. The main boiler was modeled with exhaust parameters and emissions reflective of the load condition (100 percent) that would persist for most of an annual period of operation. For the auxiliary boiler, an annual average emission rate for NO_X was calculated from the potential annual hours of operation (2,000) for the source.

The highest predicted annual impact of NO_X with the base ISC-PRIME receptor grid was well below the Class II modeling significance level of 1.0 $\mu g/m^3$ for annual NO_X. To further refine this estimated impact, a fine-spaced receptor grid with 100-meter spacing was built around the maximum coarse-grid receptor. With this fine-spaced grid, the maximum estimated annual impact was 0.29 $\mu g/m^3$. The preliminary analysis demonstrated that the Dry Fork Station Project will not produce a significant impact of annual NO_X.

7.7.4 Radius of Impact for Sulfur Dioxide (SO_2)

With predicted 24-hour impacts for the main boiler exceeding the Class II modeling significance levels, the impact area for SO_2 was determined. The impact area for a particular pollutant, as described in the draft EPA *New Source Review Workshop Manual* (EPA 1990), is "a circular area extending from the source to the most distant point where approved dispersion modeling predicts a significant impact will occur". The impact area will define the area over which the analyses for WAAQS and NAAQS compliance and PSD increment consumption will be performed. For SO_2, the impact area was determined at each load for the 24-hour averaging period, and the area used for further modeling was the largest of the impact areas. For the project, the largest impact area had a radius of 9.1 kilometers. Table 7-6 presents the results of the radius of impact analysis for SO_2 for the 24-hour averaging period. Figure 7-6 shows the extent of the receptor grid that was used for the full-impact analysis for SO_2. The receptor grid for the full-impact analysis including the fine-spaced receptors that were added to the base grid to refine the results for the preliminary analysis.

TABLE 7-6
Results of Radius of Impact Analysis for SO_2

Boiler Load	Maximum Predicted Impact for Boiler ($\mu g/m^3$)	Radius of Impact (km)
103%	5.53	9.1
100%	5.75	9.1
75%	5.79	7.9
50%	5.38	5.6

TABLE 7-4
Raw Results of Boiler Stack Load Screening (at 1 gram per second)

Parameter	Maximum Predicted Impact for 103 percent Load (µg/m³)	Maximum Predicted Impact for 100 percent Load (µg/m³)	Maximum Predicted Impact for 75 percent Load (µg/m³)	Maximum Predicted Impact for 50 percent Load (µg/m³)
1-Hour	1.19	1.19	1.21	1.51
3-Hours	0.44	0.45	0.50	0.61
8-Hours	0.21	0.21	0.24	0.29
24-Hour	0.16	0.12	0.16	0.21
Annual	n/a	0.0086	n/a	n/a

7.7.2 Preliminary Analysis for Boiler Stack Emissions (Non-PM_{10} Pollutants)

The next step in the analysis was to evaluate the impacts of pollutants that would be emitted only from the boiler stack (non-PM_{10} pollutants). The pollutants and the maximum modeled impacts (independent of boiler load) are presented in Table 7 5. The maximum impacts were determined with the base ISC-PRIME receptor grid supplemented, where needed, with receptors with 100-m spacing. The one exception was CO, which yielded impacts less than 5 percent of the SIL with the base grid. All predicted impacts were well below Class II area SIL and monitoring de minimus levels, with the exception of 24-hour SO_2, for which the predicted impacts exceeded the SIL.

TABLE 7-5
Preliminary Analysis: Maximum Impacts of Non-PM_{10} Pollutants from the Boiler Stack

Pollutant	Averaging Period	Maximum Predicted Project Impacts (µg/m³)	Class II Modeling Significance Level (µg/m³)	Monitoring De Minimus Level (µg/m³)
CO	1-Hour	85.2	2000	n/a
CO	8-Hour	14.9	500	575
NO_2	Annual	0.3	1	14
SO_2	3-Hour	21.1	25	n/a
SO_2	24-Hour	5.8	5	13
SO_2	Annual	0.4	1	n/a
Lead	3 Months*	0.00009	n/a	0.1
Mercury	24-Hour	0.0002	n/a	0.25
Beryllium	24-Hour	0.00004	0.0002	0.001
Fluorides	12-Hour	0.15	3.0E+06**	n/a
Fluorides	24-Hour	0.04	1.8E+06**	0.25
Fluorides	7 days	0.04	0.5E+06**	n/a
Fluorides	30 days	0.04	0.4E+06**	n/a

* Impacts for 3-month/quarterly lead and 7-day fluoride were conservatively modeled with the 24-hour results within ISC-PRIME.

** No modeling significance level is established for fluorides, but the Wyoming Ambient Air Quality Standards are shown for comparison to the modeled impacts for the project.

The point, area, and volume sources were placed where actual operations occur. Figure 7-4 (map pocket) shows the detailed layout of the facility and the location of the various modeled sources. Figure 7-5 (map pocket) shows the complete ambient air quality boundary (fenceline) for the project, included the landfill area. Detailed emissions calculations for each project source are presented in Appendix B. Listings of other source input parameters for point sources and volume sources (source heights, stack diameters, exhaust temperatures, etc.) are presented in Appendix G.

7.7 Preliminary Analysis Overview

For a preliminary analysis of the impacts from the Dry Fork Station, CH2M HILL compared the maximum model-predicted impacts from the sources associated with the project to the modeling significance levels (SIL) for Class II areas. If the predicted impacts were greater than or equal to the SIL for any pollutant, CH2M HILL conducted a full-impact analysis for compliance with the Wyoming Ambient Air Quality Standards (WAAQS) and the National Ambient Air Quality Standards (NAAQS) and PSD increments listed in Table 7-2.The determination of preliminary impacts for the proposed project was made using the highest modeled impact for each pollutant and averaging period.

7.7.1 Load Screening Analysis

CH2M HILL began the preliminary analysis by performing a screening analysis of the boiler stack at various operating conditions. Operation at peak load (103 percent load), full load (100 percent load) and at selected reduced loads (75 percent and 50 percent) was evaluated to determine which operating condition produces the highest predicted impacts. The load condition that yielded the highest impacts for a particular averaging period was used to represent the boiler in subsequent modeling analyses. The 100-m meteorological dataset was used for the load screening. Table 7-3 presents the exhaust characteristics for the boiler screening analysis.

TABLE 7-3
Input Parameters for Boiler Stack Load Screening

Parameter	103 percent Load	100 percent Load	75 percent Load	50 percent Load
Exit Velocity (meters/second)	25.65	24.24	18.97	13.22
Exhaust Temperature (°Kelvin)	350	350	350	350

The load screening model run was conducted with source groups for each load level and an emission rate of 1 gram per second (g/s). This allowed for scaling the raw model results by the actual emission rates for each pollutant. Table 7-4 presents the raw results of the analysis at 1 g/s. Operation at full (100 percent) load would yield impacts for the annual averaging period, and therefore, full load was used to represent the boiler for annual averaging period. Operations at both peak (103 percent) load and full (100 percent) load would yield impacts for the short term averaging periods, with operations at full load more typical than at peak load. A detailed breakdown of the scaling of the raw results with actual emission rates for each pollutant is presented in Appendix G. The maximum scaled results, compared to modeling significance levels and monitoring de minimus levels is presented in Section 7.7.2.

7.5.2 Upper Air Data for Class II Area Modeling

Hourly mixing heights for all of the MPRM scenarios were derived from twice-daily upper air soundings from Rapid City, South Dakota. Twice-daily mixing heights for Rapid City, which is the nearest upper-air station to the modeling domain, were obtained from the National Climatic Data Center (NCDC). If a single AM or PM mixing height was missing, a linear interpolation of the valid data from the previous day and the following day was used to substitute for the missing value. If more than one AM or PM value was missing, the seasonal average value from the EPA Holzworth reference (EPA, 1972) was used as a substitute. The twice-daily mixing heights from Rapid City were combined with the surface data from the 100-m tower and transformed into model-ready format using MPRM.

7.6 Emission Source Characterization

CH2M HILL modeled the various emission sources at Dry Fork Station as point, area, and volume sources, depending on the nature of the particular source. Sources that emit from a stack, including PM_{10} sources from the auxiliary cooling towers cells and material handling dust collectors, were modeled as point sources. Fugitive emissions from the landfill were modeled as an area source within ISC-PRIME. Area source length and width approximated the actual dimensions of an area that could experience landfill dumping and maintenance in a given day. Although the landfill dumping and maintenance will occur well below grade within the landfill (up to 100 feet in depth), the landfill area source was conservatively modeled as a surface-based source. The area source release height was set to 15 feet to represent a typical average height at which dumping and maintenance activities would occur. No initial vertical dimension was input for the landfill area source, which is an additional conservative assumption.

Fugitive particulate emissions from haul roads were modeled as a series of volume sources. Volume source parameters for the haul roads were taken in part from the EPA document *Modeling Fugitive Dust Impacts from Surface Coal Mining Operations – Phase II Model Evaluation Protocol* (EPA, 1994). The source height of the haul road volume sources was set to 2 m, as based on the statement from the EPA document that the maximum mass flux from haul road dust plumes occurs at that height. Initial vertical dispersion terms (3 m) for the haul road volumes were also taken from the EPA document. The initial horizontal dispersion terms were calculated from the separation distance of the volume sources (approximately two road widths, or 100 feet) in accordance with recommendations in the *User's Guide For The Industrial Source Complex (ISC3) Dispersion Models, Volume I – User Instructions* (EPA, 1995). Initial horizontal dimensions for the volume sources were determined from Table 3-1 in the ISC3 User's Guide using the factor for a "line source represented by separated volume sources."

Material transfer emission points that are not controlled by dust collectors or other control equipment were also modeled as volume sources. These volume sources were elevated at an appropriate height representative of the actual release height of the source, and with initial dimensions that approximate the actual lateral and vertical extent of the source. For this project, the only source in this category was the truck loading at the fly ash/FGD waste silo.

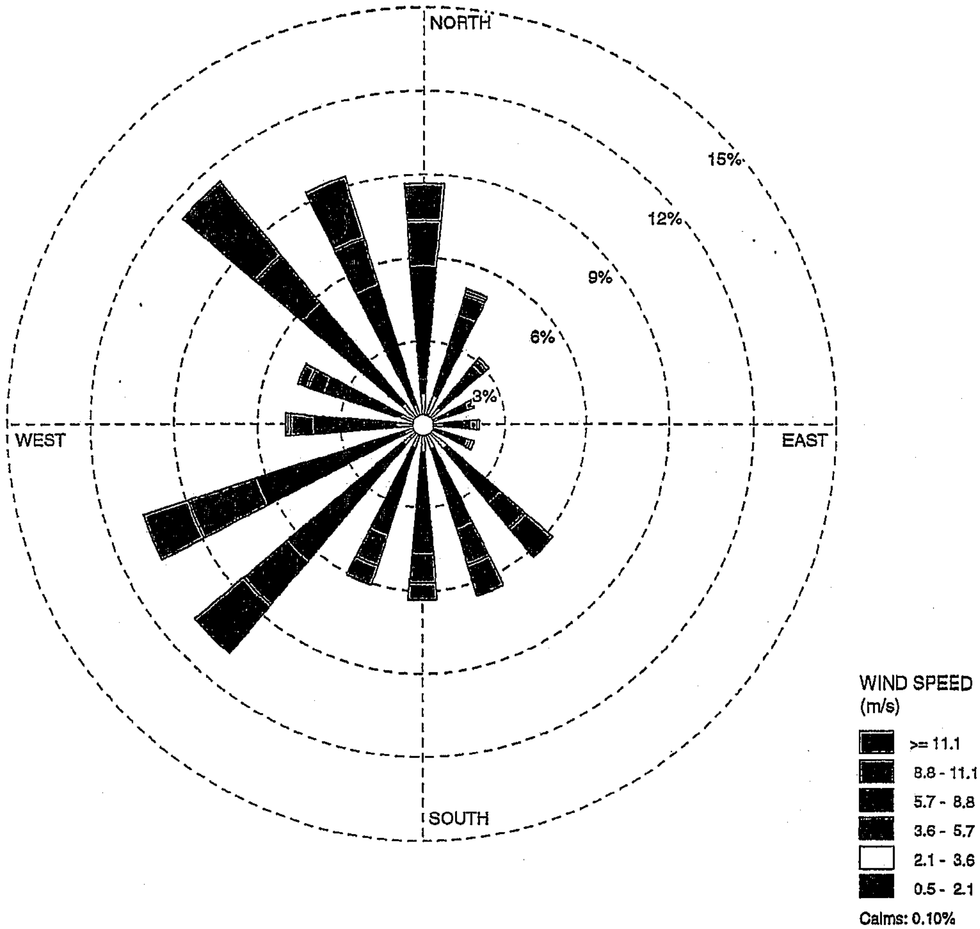
WIND ROSE PLOT:

Station #0 - Basin 100-m Tower: 100-m Winds Gillette, WY

DISPLAY:

Wind Speed

Direction (blowing from)



COMMENTS:	DATA PERIOD: 2002 Jan 1 - Dec 31 00:00 - 23:00	COMPANY NAME:	
		MODELER:	
	CALM WINDS: 0.10%	TOTAL COUNT: 8666 hrs.	
	AVG. WIND SPEED: 7.64 m/s	DATE: 10/28/2005	PROJECT NO.:

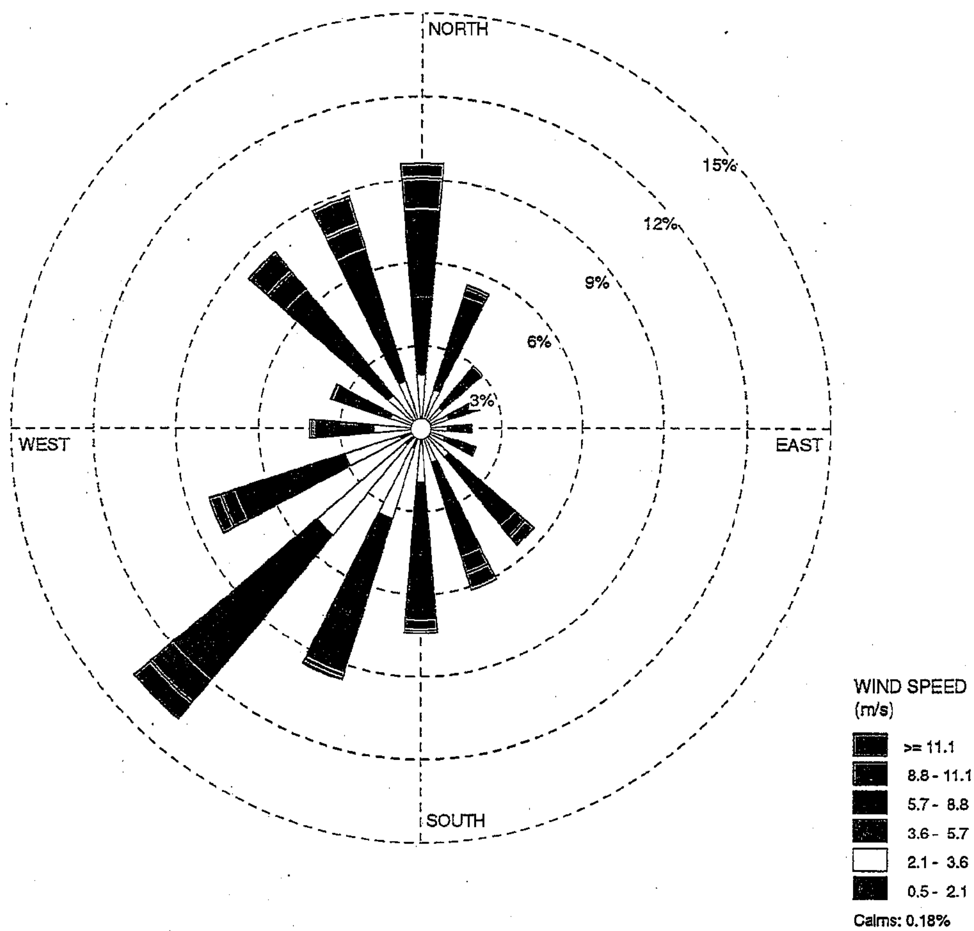
WRPLOT View - Lakes Environmental Software

FIGURE 7-3

Wind Rose for 100-meter Meteorological Input File

WIND ROSE PLOT:
Station #0 - Basin 100-m Tower: 10-m Winds Gillette, WY

DISPLAY:
Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	2002 Jan 1 - Dec 31 00:00 - 23:00	MODELER:	
	CALM WINDS: 0.18%	TOTAL COUNT: 8696 hrs.	
	AVG. WIND SPEED: 5.53 m/s	DATE: 10/28/2005	PROJECT NO.:

WRPLOT View - Lakes Environmental Software

FIGURE 7-2
Wind Rose for 10-meter Meteorological Input File

These multiple techniques were used to determine the hourly Pasquill-Gifford (P-G) atmospheric stability so that the resulting stability distributions could be compared, and the best distribution could be chosen for modeling. For each technique, MPRM used a backup method to determine the stability for any hour that was missing the data needed for the primary technique. For the primary SRDT methods, 10-m sigma theta was used as the backup method. For the primary sigma theta method, the 2-10 m SRDT was used as a backup.

The SRDT method uses the surface layer wind speed (measured at 10 m) in combination with measurements of total solar radiation during the day and low-level vertical temperature difference at night. According to EPA guidance, the temperature difference for use in estimating the P-G stability categories using the SRDT method should be measured between $20z_0$ and $100z_0$, with z_0 representing the surface roughness of the measurement site (EPA, 2000). As shown in Table 3-6 of the MPRM User's Guide (EPA, 1996), the seasonal roughness lengths for terrain types most like the measurement site would range from 0.001 m to 0.10 m for "grassland", and between 0.15 m and 0.30 m for "desert shrubland". Therefore, the most appropriate delta-T measurements available from the tower would be 2-10 m and 2-50 m (rather than 2-100 m), and both of these were used for comparison. After examination of the stability distributions within the model-ready files produced with SRDT and those with sigma theta, the files produced with sigma-theta were chosen for use in the project modeling.

The raw data from Basin's 100-m tower includes a 2-week period in August of 2002 for which all data are missing due to an elevator failure on the tower. CH2M HILL used data collected at the nearby Gillette-Campbell County Airport to fill this data gap. Data from the Gillette airport was processed with the EPA PCRAMMET model to obtain data in model-ready format. For substitution of the Gillette data into the 100-m model-ready file, the 10-m wind speeds from the airport were adjusted to the 100-m level using the power law equation (equation 1-6) in Volume II of the ISC3 User's Guide (EPA, 1995b). CH2M HILL developed site-specific wind profile exponents by solving for the exponent in the power law equation with wind data from the 10-m and 100-m levels from the Basin 100-m tower. The MPRM processing and the use of Gillette-Campbell County Airport to fill this data gap, as discussed above, was determined to be appropriate by WDEQ and approved for use for all ISC-PRIME modeling.

For model runs that included emissions from the proposed boiler stack only, CH2M HILL used the model-ready file that contained winds measured at the 100-m level to allow for the best possible approximation of the winds at the boiler stack height (500 feet). This meteorological input file was also used for the model run for annual NO_x impacts that included the boiler and auxiliary boiler.

For modeling PM_{10} impacts, the project emissions inventory included sources released from near the surface (haul roads and landfill activity) and other point sources with lower release heights than the boiler stack. Because the maximum impacts from PM_{10} were expected to occur near the facility boundary, where the contribution from the boiler stack would be small, CH2M HILL used the model-ready file containing winds measured at the 10-m level for PM_{10} modeling. This allowed for a better approximation of the dispersion from the full suite of PM_{10} sources. Wind roses for the 10-m and 100-m files are presented as Figures 7-2 and 7-3, respectively.

determined with BPIP-Prime, was 167.64 m (550 feet). The GEP height was driven by the boiler building and the proximity of all point sources to that structure.

7.4 Receptor Network

7.4. 1 Receptor Configuration

The base receptor grid for ISC-PRIME consisted of rectangular, Cartesian arrays of receptors with spacing that increased with distance from the origin. The base grid originated at the proposed location of the Dry Fork Station boiler stack. Receptor spacing, in accordance with WDEQ guidance (WDEQ, 2003b), was as follows:

- 50-meter (m) spacing for ambient boundary (fenceline) receptors
- 100-m spacing from the ambient boundary to 1 km from the origin
- 500-m spacing from beyond 1 km to 5 km from the origin
- 1,000-m spacing from beyond 5 km to 50 km from the origin

CH2M HILL supplemented the base receptor grid with receptors at closer (tighter) receptor spacing, where appropriate, to ensure that the maximum points of impact were identified.

7.4.2 Receptor Elevations

Terrain in the vicinity of the Dry Fork Station was accounted for by assigning elevations to each modeling receptor. CH2M HILL used Digital Elevation Model (DEM) data from the U.S. Geological Survey (USGS) to determine receptor elevations. We obtained DEM data from the USGS National Elevation Dataset (NED). For any areas for which 10-m resolution data was not available, CH2M HILL used DEM files with 30-m resolution.

Universal Transverse Mercator (UTM) coordinates for the modeled sources, downwash structures, and receptors were based on the North American Datum of 1983 (NAD 83), and UTM Zone 13.

7.5 Meteorology

7.5.1 Meteorological Data for Class II Area Modeling

CH2M HILL used surface meteorological data collected at a 100-m meteorological tower as input to the ISC-PRIME model. The 100-m tower, located southeast of Gillette, was operated by BEPC from October 2001 through July 2003. The 100-m tower was equipped with meteorological sensors at 2 m, 10 m, 50 m, and 100 m.

CH2M HILL processed the data using the EPA Meteorological Processor for Regulatory Models (MPRM, version 99349). For the air impact analysis for this project, data for the full calendar year from January 1, 2002 through December 31, 2002 were processed into model-ready format. Model-ready files with hourly wind speeds and directions from the 10-m level and 100-m level of the tower were produced. Hourly atmospheric stability was determined with multiple methods. These methods included:

- ~~Standard deviation fluctuations in horizontal wind direction (sigma theta) at 10 m~~
- Solar radiation/delta-T (SRDT) for the temperature difference from 2 m to 10 m
- SRDT for the temperature difference from 2 m to 50 m

decreases that have occurred since the applicable baseline date. The minor source baseline dates for the state of Wyoming for SO_2 and NO_2 are as follows:

SO_2 – February 2, 1978
NO_2 – February 26, 1988

For PM_{10}, there are three baseline areas that have been designated as separate particulate matter attainment areas under Section 107 of the Clean Air Act (WDEQ, 2003a). The proposed project would be located within one of those areas, the Powder River Basin Area. For this area, the minor source baseline date was triggered in 1997. For all other areas in the state, the PM_{10} minor source baseline date is February 22, 1979.

7.3 Modeling Analysis Design

7.3.1 Model Selection

Air quality impacts from the Dry Fork Station were determined with the latest version of the EPA Industrial Source Complex Short-Term (ISCST3) model that incorporates enhanced building downwash algorithms. The enhanced downwash algorithms are referred to as Plume RIse Model Enhancements (PRIME), and the model as ISC-PRIME (version 04269).

7.3.2 Model Input Defaults/Options

The ISC-PRIME model was used with regulatory default options as recommended in the EPA Guideline on Air Quality Models (EPA, 2003) as listed below:

- Use stack tip downwash (except for Schulman Scire downwash)
- Use buoyancy induced dispersion (except for Schulman Scire downwash)
- Do not use gradual plume rise (except for building downwash)
- Use the calms processing routines
- Use upper bound concentration estimates for sources influenced by building downwash from super squat buildings
- Use default wind profile exponents
- Use default vertical potential temperature gradients

CH2M HILL used the non-default model option for processing missing meteorological data. By using the missing data processing routine, the model can recognize the periods of missing data and adjust calculated impacts. This option is similar within ISC-PRIME to the calms processing option.

The land surrounding Dry Fork in all directions is open country with no significant development. Therefore, rural dispersion coefficients were utilized within the ISC-PRIME model.

Point sources were modeled with stack heights that did not exceed good engineering practice (GEP) stack height. Building downwash parameters for the point sources at Dry Fork Station were determined with the latest version of the EPA Building Profile Input Program (BPIP) designed for the ISC-PRIME model (BPIP-Prime). GEP for all of the point sources, as

TABLE 7-2
Air Quality Standards Applicable to the Project

Pollutant (Averaging Period)	Class II Modeling Significance Level ($\mu g/m^3$)	Class II PSD Increment ($\mu g/m^3$)	National Ambient Air Quality Standard ($\mu g/m^3$)	Wyoming Ambient Air Quality Standard ($\mu g/m^3$)	PSD Significant Monitoring Concentrations ($\mu g/m^3$)
24-hour Beryllium	NS	NS	NS	NS	0.001
24-hour Mercury	NS	NS	NS	NS	0.25
12-hour Fluorides	NS	NS	NS	3.0E+06	NS
24-hour Fluorides	NS	NS	NS	1.8E+06	0.25
7-day Fluorides	NS	NS	NS	0.5E+06	NS
30-day Fluorides	NS	NS	NS	0.4E+06	NS

[a] Not to be exceeded more than once per year.

[b] No monitoring "De Minimus" air quality level is provided for ozone. However, any net increase of 100 tons per year or more of volatile organic compounds (VOC) would be required to perform an ambient impact analysis, including the gathering of ambient air quality data.

Notes:

$\mu g/m^3$ = micrograms per cubic meter
CO = Carbon monoxide
NO_2 = Nitrogen dioxide
NS = No standard
PM_{10} = Particulate matter less than 10 microns
PSD = Prevention of Significant Deterioration
SO_2 = Sulfur dioxide

7.2.2 Area Classifications

The Dry Fork Station Project will be located in Campbell County, Wyoming in an area that is designated as attainment for all criteria pollutants. Areas surrounding the station are designated as Class II areas for PSD permitting. The nearest non-attainment area is located near the town of Sheridan, Wyoming. This area was once designated as non-attainment for particulate matter (PM_{10}) but has since applied for redesignation for attainment status. This area is well beyond the impact area of the proposed project.

7.2.3 Baseline Dates

7.2.3.1 Major Source Baseline Date

The major source baseline date is the date after which actual emissions associated with construction at a major stationary source affect the available PSD increment. The major source baseline dates are established dates that have elapsed. These dates are as follows:

PM_{10} – January 6, 1975
SO_2 – January 6, 1975
Nitrogen dioxide (NO_2) – February 8, 1988

7.2.3.2 Minor Source Baseline Date

The minor source baseline date identifies the point in time after which actual emissions changes from all sources (major and minor) affect available increment. The amount of PSD increment consumption within an area is determined from the actual emission increases and

TABLE 7-1
PSD Significant Emission Rates

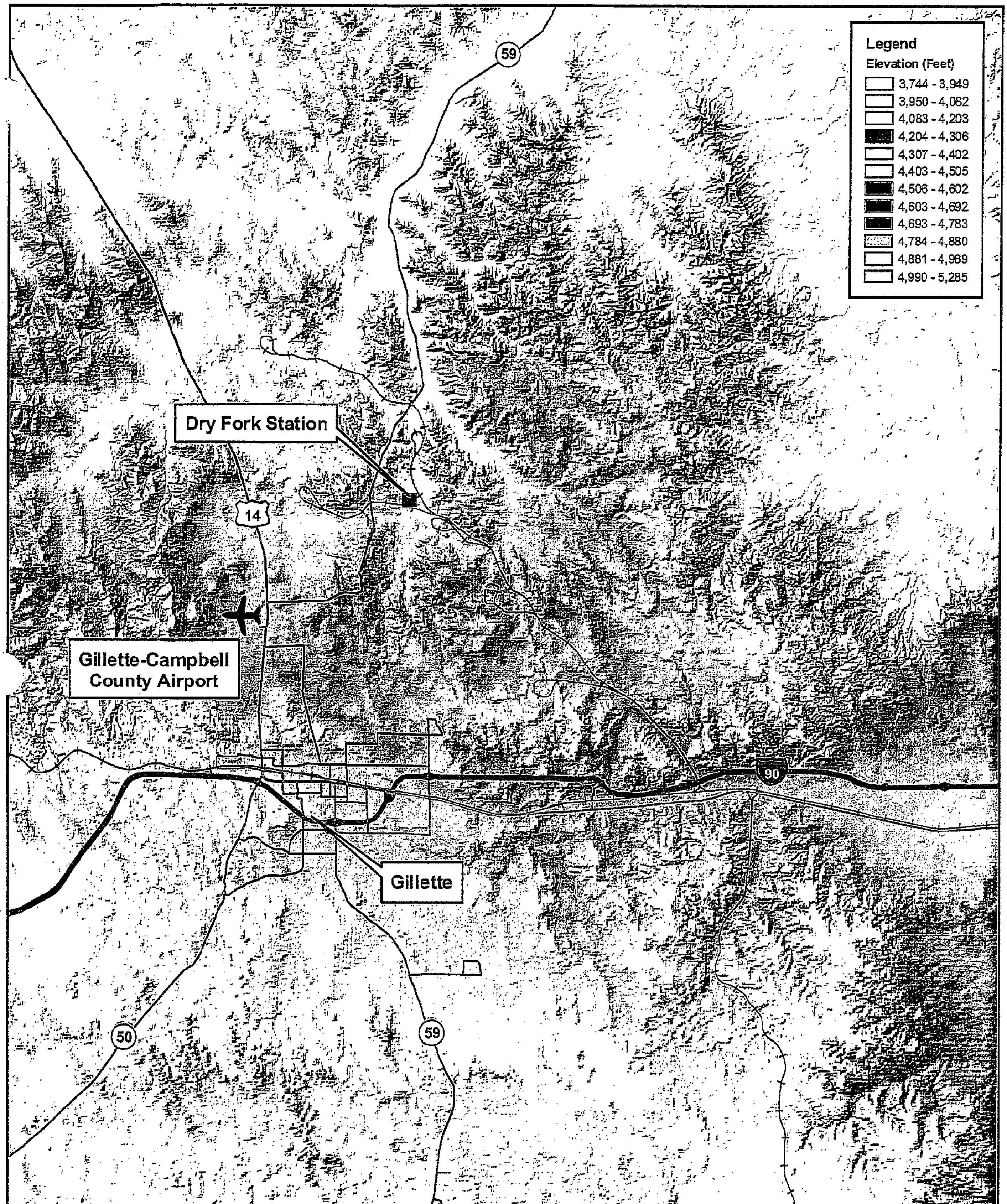
Pollutant	Prevention of Significant Deterioration Significant Emission Rates (tons per year)
Carbon Monoxide (CO)	100
Nitrogen Oxides (NO_x)	40
Sulfur Dioxide (SO_2)	40
Particulate Matter (PM_{10})	15
Ozone	40 (VOC)[1]
Lead	0.6
Asbestos	0.007
Beryllium	0.0004
Mercury	0.1
Vinyl Chloride	1
Fluorides	3
Sulfuric Acid Mist	7
Hydrogen Sulfide	10[2]
Total Reduced Sulfur	10[2]
Reduced Sulfur Compounds	10[2]

[1] No "De Minimus" air quality level is provided for ozone. However, any net increase of 100 tons per year or more of volatile organic compounds (VOC) would be required to perform an ambient impact analysis, including the gathering of ambient air quality data.

[2] The emissions of reduced sulfur compounds for the proposed coal-fired boiler are zero. The boiler will be operated with sufficient excess air to ensure complete combustion and oxidation of sulfur in the coal to SO_2 and SO_3.

TABLE 7-2
Air Quality Standards Applicable to the Project

Pollutant (Averaging Period)	Class II Modeling Significance Level ($\mu g/m^3$)	Class II PSD Increment ($\mu g/m^3$)	National Ambient Air Quality Standard ($\mu g/m^3$)	Wyoming Ambient Air Quality Standard ($\mu g/m^3$)	PSD Significant Monitoring Concentrations ($\mu g/m^3$)
CO (1-hour)	2,000	NS	40,000[a]	40,000[a]	NS
CO (8-hour)	500	NS	10,000[a]	10,000[a]	575
NO_2 (annual)	1	25	100	100	14
SO_2 (3-hour)	25	512	1,300[a]	1,300[a]	NS
SO_2 (24-hour)	5	91	365[a]	260[a]	13
SO_2 (annual)	1	20	80	60	NS
PM_{10} (24-hour)	5	30[a]	150[a]	150[a]	10
PM_{10} (annual)	1	17	50	50	NS
Ozone (1-hour)	NS	NS	0.12	0.12	NS[b]
Ozone (8-hour)	NS	NS	0.08	0.08	NS[b]
Lead (quarterly)	NS	NS	1.5	1.5	0.1



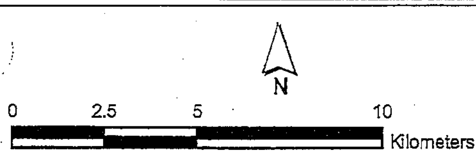


Figure 7-1
Site Location Map for the
Dry Fork Station

CH2MHILL

SECTION 7.0

Near-Field Air Quality Impact Analysis

Basin Electric Power Cooperative (BEPC) proposes to construct the Dry Fork Station Project (project) near Gillette, Wyoming. The proposed power plant would include one pulverized coal (PC) boiler that would be capable of generating a nominal 422 MW (gross) of power.

The source of coal for the project will be the Dry Fork Mine. Coal from the mine, which is adjacent to the proposed location for the project, will be delivered to the power plant via a covered, overland conveyor. Emissions associated with the PC boiler will be controlled through various reduction methods. Specifically, the sulfur dioxide (SO_2) emissions will be reduced with dry scrubber equipment. Boiler particulate emissions will be controlled with a fabric filter, and emissions of nitrogen oxides (NO_X) will be controlled by Selective Catalytic Reduction (SCR). The primary cooling of the unit will be done with an air-cooled (dry) condenser.

7.1 Project and Site Description

BEPC proposes to construct the Dry Fork Station approximately four miles northeast of the Gillette-Campbell County Airport. The proposed location is at an approximate elevation of 4,250 feet above mean sea level (msl), in rolling terrain. In general, the terrain trends upward toward the south. Figure 7-1 presents a location map for the project that also depicts the local terrain.

7.2 Regulatory Status

7.2.1 Source Designation

The proposed project will be a major stationary source with respect to the Prevention of Significant Deterioration (PSD) rules established under the Federal New Source Review program. The source will belong to one of the 28 categorical sources listed under PSD regulations with a major source threshold of 100 tons per year of any regulated pollutant (fossil-fuel boilers, combinations thereof, totaling more than 250 million British thermal units per hour heat input). The goals of the air quality modeling analysis were to demonstrate compliance with state and federal air quality regulations that are applicable to the proposed project. CH2M HILL performed a dispersion modeling analysis for each criteria pollutant for which the annual emission rate was equal to or greater than the significant emission rates for PSD analysis (Table 7-1). Table 7-2 summarizes the modeling significance levels, PSD increments, and air quality standards that apply to criteria pollutant emissions from the project.

Section 7
Near-field
Modeling

HF: 0.00069 lb/mmBtu. Compliance with the HF emission rate will be demonstrated based on the average of three (3) on–hour stack tests using USEPA Test Method 26A as described in Section 9.0 of this permit application.

Mercury: 78 x 10^{-6} lb/MW-hr on an output basis 12 month rolling average. Compliance will be demonstrated with a mercury CEMS per 40 CFR Part 75 requirements.

Compliance with the emission limit will be demonstrated using a SO_2 CEMS compliant with the requirements of 40 CFR Part 75.

SO_2: 1,625 tpy annual 12-month rolling including periods of startup, shutdown and malfunction. Compliance with the emission limit will be demonstrated using a SO_2 CEMS compliant with the requirements of 40 CFR Part 75.

NO_x: 0.07 lb/mmBtu heat input based on a 30 day rolling average as determined by the arithmetic average of all hourly emission rates for the 30 successive boiler operating days, except during periods of startup, shutdown, maintenance/planned outage, or malfunction. Compliance with the emission limit will be demonstrated using a NO_x CEMS compliant with the requirements of 40 CFR Part 75.

NO_x: 1,137 tpy annual 12-month rolling including periods of startup, shutdown and malfunction. Compliance with the emission limit will be demonstrated using a NO_x CEMS compliant with the requirements of 40 CFR Part 75.

PM_{10} (filterable): 0.012 lb/mmBtu heat input except during periods of startup, shutdown, maintenance/planned outage, or malfunction based on the average of three (3) one–hour stack tests conducted annually using USEPA Test Methods 5, 17, 201, or 201A as described in Section 9.0 of this permit application.

PM_{10} (total – including filterable and condensable): 0.017 lb/mmBtu heat input except during periods of startup, shutdown, maintenance/planned outage, or malfunction based on the average of three (3) one–hour stack tests using USEPA Test Methods 201A/202 or modified methods per WDEQ approval, as described in Section 9.0 of this permit application.

Opacity: 20% based on six minute averages except for one 6-minute period per hour that may not exceed 27%.

CO: 0.15 lb/mmBtu heat input based on a 30 day rolling average as determined by the arithmetic average of all hourly emission rates for the 30 successive boiler operating days, except during periods of startup, shutdown, maintenance/planned outage, or malfunction. Compliance with the emission limit will be demonstrated using a CO CEMS compliant with the requirements of 40 CFR Part 60.

CO: 2,437 tpy annual 12-month rolling including periods of startup, shutdown and malfunction. Compliance with the emission limit will be demonstrated using a CO CEMS compliant with the requirements of 40 CFR Part 60.

VOC: 61 tpy on an annualized average based on an emission rate of 0.00385 lb/mmBtu heat input, except during periods of startup, shutdown, maintenance/planned outage, or malfunction. Compliance with the VOC emission rate will be demonstrated based on the average of three (3) on–hour stack tests using USEPA Test Method 25 or 25A as described in Section 9.0 of this permit application.

H_2SO_4: 0.0025 lb/mmBtu. Compliance with the H_2SO_4 emission rate will be demonstrated based on the average of three (3) on–hour stack tests using USEPA Test Method 8 as described in Section 9.0 of this permit application.

- Lead
  - The use of a fabric filter baghouse
- Beryllium
  - The use of a fabric filter baghouse
- H_2SO_4 and HF
  - The use of a dry lime SO_2 flue gas desulfurization system

A summary of the emissions for Unit 1 is shown in Section 3.0. These emission rates are the maximum expected emission rates based on continuous operation of the new unit. These maximum hourly emission rates were the basis for Unit 1 modeling analysis.

6.2 PSD Permitting Applicability

The proposed Unit 1 project will be a new major stationary source. The pollutants subject to the Prevention of Significant Deterioration (PSD) program and their significance levels are listed in Section 3.0. The PTE for all criteria pollutants except Lead exceed the applicable annual PSD significant emission rates. Thus, PSD review is applicable to all criteria pollutants except Lead. Section 4.0 provides detailed information on applicable regulations.

The basic PSD permitting requirements that must be met for a major modification include:

- Application of Best Available Control Technology (BACT)
- Performance of an ambient air quality impacts analysis (dispersion modeling)
- Analysis of impacts to soils, vegetation, and visibility
- Analysis of Class I area impacts, including visibility and other air quality related values (AQRVs)

Section 5.0 of this application contains the BACT analysis. Section 8.0 contains the Class I visibility and other impacts analysis and Section 7.0 contains information on the Class II dispersion modeling results.

6.3 Requested Emission Limits

Based on the results of the BACT analysis, Class I visibility modeling and Class II dispersion modeling, BPEC requests the following emission rate limits for the proposed Unit 1 boiler at Dry Fork Station.

SO_2: 0.10 lb/mmBtu heat input based on a 3-hr block average, except during periods of startup, shutdown, maintenance/planned outage, or malfunction. Compliance with the emission limit will be demonstrated using a SO_2 CEMS compliant with the requirements of 40 CFR Part 75.

SO_2: 0.10 lb/mmBtu heat input based on a 30 day rolling average as determined by the ~~arithmetic average of all hourly emission rates for the 30 successive boiler operating days,~~ except during periods of startup, shutdown, maintenance/planned outage, or malfunction.

SECTION 6.0

Requested Permit Limits

This section presents the permit limits requested in this permit application.

6.1 Potential to Emit for Unit 1

The Potential to Emit (PTE) for Unit 1 were obtained using assumptions on what a newly constructed Unit 1 could achieve through the application of control technology required pursuant to applicable NSPS and BACT for each pollutant under consideration. This includes the following assumptions:

- Fuel and Unit Size
  - A maximum unit size of 422 gross MW and 385 net MW
  - A unit annual capacity factor of 100 percent
  - A maximum design coal sulfur content of 0.47 percent by weight
  - A design coal heating value of 7,800 Btu/lb
- SO_2
  - The use of a dry lime SO_2 flue gas desulfurization system
  - The SO_2 control system will be designed to meet 0.10 lb/mmBtu (3–hour block and 30-day rolling average)
- NO_X
  - The addition of LNBs, overfire air, and SCR control
  - The NO_X control system will be designed to meet 0.07 lb/mmBtu (30-day rolling average)
- Total PM and PM_{10}
  - The use of a fabric filter baghouse
  - The boiler baghouse control system will be designed to meet a filterable PM emission rate of 0.015 lb/mmBtu and a filterable PM_{10} emission limit of 0.012 lb/MMBtu (3-hour rolling average)
- CO
  - The use of good combustion controls to limit CO emissions
- VOC
  - The use of good combustion controls to limit VOC emissions

Section 6
Permit Limits

such as sorbent injection, may be required to achieve compliance with the future emission limits.

5.4 Industrial Boiler MACT for Auxiliary Boiler

This section presents the required MACT analysis for the hazardous air pollutants from the auxiliary boiler subject to the *Industrial Commercial, and Institutional Boilers and Process Heater* NESHAP (40 CFR 60 Subpart DDDDD). The purpose of Subpart DDDDD is to establish national emission limits and work practice standards for hazardous air pollutants (HAP) emitted from industrial, commercial, and institutional boilers and process heaters. This subpart also establishes requirements to demonstrate initial and continuous compliance with the emission limits and work practice standards. This section does not address MACT for Dry Fork Station Unit 1. Unit 1 is an electric utility steam generating unit that is a fossil fuel fired combustion unit of more than 25 MW that serves a generator that produces electricity for sale, therefore, it is not subject to the Industrial Boiler MACT per 40 CFR 63.7491(c).

The auxiliary boiler is located at, or is part of, a major source of HAP emissions and, therefore, meets the criteria of an "affected" source as described in 40 CFR 63.7490 and is subject to this subpart. The auxiliary boiler is considered a new large gaseous fuel boiler and is subject to the emission limitations, work practice standards, performance testing, monitoring, startup shutdown malfunction plan, and notification requirements described in the rule. The auxiliary boiler will be fired using pipeline quality natural gas only, with no backup fuel, therefore, the only applicable emission limits and work practice standards that Dry Fork must comply with for the auxiliary boiler are for the pollutant CO. CO emissions from the unit are limited to 400 ppm by volume, dry basis, @ 3 percent O_2 on a 30-day rolling average. CO is identified as a surrogate to represent a variety of organic compounds for organic HAP emissions because CO is a good indicator of incomplete combustion and there is a direct correlation between CO emissions and the formation of organic HAP emissions. Also, it is significantly easier and less expensive to measure and monitor CO emissions than to measure and monitor emissions of each individual organic HAP. The formation of CO is limited by controlling the combustion of the fuel and providing adequate oxygen for complete combustion. Thus, good combustion control is the technique to be used to limit CO emissions for the auxiliary boiler.

Compliance with the CO emission limitation is demonstrated by an initial performance test for CO emissions followed by subsequent annual testing. In addition, a CO CEMS must be installed as the unit is larger than 100 MmBtu/Hr heat input. The CEMs must be installed, operated and maintained according to the Performance Specification (PS) 4A of 40 CFR part 60, Appendix B, and according to the site specific monitoring plan described in 40 CFR 63.7505.

The other primary variable affecting mercury emissions is the quantity of mercury contained in the particular coal being burned. Western coals exhibit generally lower mercury content than eastern coals.

5.3.2 CAMR Standards

On March 15, 2005, EPA issued the first ever federal rule to permanently cap and reduce mercury emissions from coal-fired power plants. The Clean Air Mercury Rule establishes "standards of performance" limiting mercury emissions from new and existing coal-fired power plants and creates a market-based cap-and-trade program that will reduce nation-wide utility emissions of mercury. Under the CAMR cap-and-trade program, each state is given a budget of mercury emission allowances. Subsequently, the states allocate the allowances to the affected coal-fired power plants. The number of allowances for each state will remain static from 2010 to 2017, with a large reduction in allowances starting in 2018.

The Dry Fork Station is projected to burn only subbituminous coal and will utilize dry flue gas desulfurization (FGD) technology to limit SO_2 emissions from the steam generating unit. Therefore, the proposed boiler will be subject to the 40 CFR 60.45 Da NSPS mercury limitation of 78×10^{-6} lb/MW-hr on an output basis (12 month rolling average).

5.3.3 Mercury Control Technologies

The EPA states that available information indicates that mercury emissions from coal-fired utility units are minimized in some cases through the use of PM controls (fabric filters or ESPs) coupled with an FGD system. For subbituminous coal-fired power generation units in the western U.S. that may face potential water restrictions and, therefore, do not have the option of using a wet FGD system, the best demonstrated technology (BDT) is a combination of either a fabric filter or an ESP coupled with a spray dryer absorber (SDA) [Federal Register Vol. 70, No. 95, May 18, 2005 / Rules and Regulations, page 28614]. Therefore, the Dry Fork Station is being designed with BDT for mercury control.

5.3.4 Dry Fork CAMR Compliance

Assuming an average coal mercury concentration of 0.05 to 0.08 ug/g and the design output rating of the unit, the estimated potential uncontrolled mercury emission rate from the boiler would range from 60.4 to 96.6×10^{-6} lb/MW-hr. Therefore, depending on the mercury content of the coal, the unit will need to achieve up to 20 percent mercury control to meet the applicable mercury NSPS. Emission control devices designed to minimize NOx, SO2 and PM10 emissions will provide some mercury control. Depending on how the mercury speciates in the flue gas, the proposed fabric filter and dry lime FGD is projected to have a mercury control level in the range of 10 to 30 percent, which would meet the applicable NSPS requirement under most operating conditions. The proposed unit is being designed with space for a mercury-specific control system (for example, activated carbon injection), and if needed, the mercury control system may provide 50 to 70 percent additional control.

The projected increase in coal-fired power plant construction in Wyoming coupled with the limited state budget for mercury allowances may cause the mercury emission limitation for coal-fired units to become more stringent. In addition, mercury emission limits will be further reduced by CAMR in the year 2018. Therefore, a mercury-specific control system, The fabric filter is more effective at capturing fine particulate than an ESP because ESPs tend to collect larger particles selectively. Large particles have a high mass to surface area ratio, which allows a charged particle to be dragged efficiently through the flue gas stream for collection on a grounded plate. Ultra fine particles have a low terminal velocity and cannot carry a strong enough electrical charge to result in complete collection.

The fabric filter is also more effective at collecting flyash generated from western low-sulfur coals, such as the coal to be combusted at the Dry Fork Station. ESPs operate by first electrostatically charging for collection and then discharging the flyash particles for removal in the ash-handling system. Western low-sulfur coal flyash has a very high electrical resistivity that makes it difficult for the ESP to first charge and then discharge the particles. One solution that has been attempted on western power plants is the use of a hot side precipitator that operates at approximately 800°F as opposed to approximately 250°F operating temperature used on most ESPs. The electrical resistivity of the flyash is lower at this higher temperature. However, even with this change in operating temperature, the ESP is still less effective at collecting flyash in western power plants than is the fabric filter. The use of a fabric filter is also the preferred particulate control device for following a dry lime scrubber.

Step 4 – Evaluate Most Effective Controls and Document Results

No negative environmental impacts have been identified for use of a fabric filter to control particulate emissions from coal-fired boilers. There is, however, a high energy demand for this system. Energy is required to overcome the system's (fabric filter and associated ductwork) 8- to 12-inch water gauge pressure drop and miscellaneous loads, such as electric hopper heating. Since baghouse filters are thought to represent the most effective PM/PM_{10} control technique that can be applied to PC boilers, no economic evaluation is warranted.

Step 5 – Select BACT

The EPA NSR RBLC clearinghouse database shows six comparable sources related to beryllium. They are shown in Table E-10 in Appendix E. Based on the above analysis and the clearinghouse data, a fabric filter preceded by a dry lime FGD system are selected as BACT for the control of beryllium emissions for this project with an estimated emission rate of 0.00097 lb/hr.

5.3 Clean Air Mercury Rule

As a coal-fired power plant, Dry Fork Station will be subject to the Clean Air Mercury Rule (CAMR). The proposed boiler will be designed to comply with CAMR.

5.3.1 Mercury Emissions

Mercury is a naturally occurring constituent of soil and mineral deposits, including deposits of coal. When coal is burned, any trace quantities of mercury present are vaporized at the high temperatures within the furnace section of the boiler. In the presences of chlorine, a portion of the gaseous mercury may react to form mercuric chloride ($HgCl_2$), with most of the remaining mercury emitted as a gas in elemental form. The speciation of the emitted mercury depends on the coal composition (primarily the ash and chlorine content), the combustion system, and the time and temperature history of the flue gas.

lime scrubber followed by a fabric filter was technology chosen to achieve BACT. The other sources selected an electrostatic precipitator followed by a wet limestone FGD system to achieve BACT emissions levels for fluoride. Sargent & Lundy estimates a 90 percent HF control level with the proposed Dry Fork Unit 1 design.

Based on the technology and clearinghouse database discussion above, a spray dryer FGD system followed by a fabric filter are selected as BACT for the project with a fluoride (as HF) emission rate of 0.00069 lb/mmBtu.

5.2.8 Beryllium Analysis

Beryllium emissions will be emitted from the boiler. Beryllium will accumulate as a component of the fly ash and control technologies that are effective in controlling particulate matter emissions will also control beryllium emissions.

Step 1 – Identify All Control Technologies

Two control technologies for PC boilers have been identified for beryllium control:

1. Electrostatic precipitators (ESPs)
2. Fabric filters

Step 2 – Eliminate Technically Infeasible Options

Electrostatic Precipitators

ESP technology is applicable to a variety of coal combustion sources. ESPs remove particulate matter from the flue gas stream by charging flyash particles with a very high DC voltage and attracting these particles to grounded collection plates. A layer of collected particulate matter forms on the collecting plates and is removed by periodically rapping the plates. The collected ash particles drop into hoppers below the precipitator and are removed periodically by the flyash-handling system.

Fabric Filters

Fabric filtration has been applied widely to coal combustion sources since the early 1970s and consists of a number of filtering elements (bags) along with a bag cleaning system contained in a main shell structure incorporating dust hoppers. Fabric filters use fiberglass bags as filters to collect particulate matter. The particulate-laden gas enters a fabric filter compartment and passes through the bags and through a layer of accumulated particulate matter collected on the fabric of the filter bags. The collected particulate matter forms a filter cake layer on the bag that enhances the bag's filtering efficiency. However, excessive caking will increase the pressure drop across the fabric filter. When this occurs, the fabric filter is placed into a cleaning cycle and the dislodged particulate matter is removed by the ash-handling system.

Fabric filters are effective in meeting NSPS emission requirements on coal-fired boilers. Fabric filters have been used as a control technology of choice on projects where LAER review is required. Unlike precipitators, fabric filter design is not based on any physical properties of the flyash.

Step 3 – Rank Remaining Control Technologies by Control Effectiveness

Step 2 – Eliminate Technically Infeasible Options

Wet Limestone/Lime FGD

Wet SO_2 scrubbers operate by flowing the flue gas upward through a large reactor vessel that has an alkaline reagent (i.e., lime or limestone slurry) flowing down from the top. The scrubber mixes the flue gas and alkaline reagent using a series of spray nozzles to distribute the reagent across the scrubber vessel. The calcium in the reagent reacts with the fluoride in the flue gas to form calcium fluoride that is removed from the scrubber with the sludge and is disposed.

The creation of sludge from the scrubber does create a solid waste handling and disposal problem. This sludge needs to be handled in a manner to not result in groundwater contamination. Also, the sludge disposal area needs to be set aside permanently from future surface uses because the disposed sludge can not bear any weight from such uses as buildings or cultivated agriculture.

Dry Lime FGD Followed by Fabric Filter

Spray dryers operate by the flue gas flowing upward through a large vessel. In the top of the vessel is a rapidly rotating atomizer wheel through which lime slurry is flowing. The rapid speed of the atomizer wheel causes the lime slurry to separate into very fine droplets that intermix with the flue gas where the fluorides in the flue gas react with the calcium in the lime slurry to form particulate calcium fluoride. This dry material is captured in the fabric filter along with the flyash and calcium sulfate from the sulfur removal process.

Fabric filtration has been widely applied to coal combustion sources since the early 1970s and consists of a number of filtering elements (bags) along with a bag cleaning system contained in a main shell structure incorporating dust hoppers. Fabric filters use fiberglass bags as filters to collect particulate matter. The particulate-laden gas enters a fabric filter compartment and passes through the bags and through a layer of accumulated particulate matter collected on the fabric of the filter bags. The collected particulate matter forms a filter cake layer on the bag that enhances the bag's filtering efficiency. However, excessive caking will increase the pressure drop across the fabric filter. When this occurs, the fabric filter is placed into a cleaning cycle and the excess particulate matter is removed by the ash-handling system.

Step 3 – Rank Remaining Control Technologies by Control Effectiveness

Either control technology will achieve 90 percent or greater control of fluorides.

Step 4 – Evaluate Most Effective Controls and Document Results

Either approach can achieve 90 percent or greater control of fluorides. No negative environmental impacts have been identified for use of a spray dryer absorber followed by a fabric filter to control fluoride emissions from pulverized coal boilers. The use of a wet scrubber has the negative environmental impacts of wet sludge disposal and increased water use for a project in an arid climate.

Step 5 –Select BACT

The EPA NSR RBLC database shows nine comparable sources related to fluoride. They are shown in Table E-7 in Appendix E. Seven of the sources determined that the use of a dry

Ash/FGD Waste Handling: Storage silos and associated transfer operations can be vented to fabric filters for control. Also water sprays with or without wetting agents can be used to control dust.

Coal/Ash/FGD Waste Haul Roads: Potential technologies for control of fugitive emissions on haul roads are the use of paved roads, the use of covered haul trucks, the use of water sprays, the use of dust suppression chemicals, limitation of the speed of haul trucks, or the use of street sweepers on paved roads.

Step 2 – Coal, Ash, and Lime Handling Systems: Eliminate Technically Infeasible Options

All of the potential control technologies listed in Step 1 are technically feasible.

Step 3 – Coal, Ash, and Lime Handling Systems: Rank Remaining Control Technologies by Control Effectiveness

Generally, the use of total enclosure of the material-handling operation vented to fabric filters is the most effective control option. In locations where fabric filters cannot be used, the use of water sprays and dust suppression chemicals are the most effective control methods.

Step 4 – Coal, Ash, and Lime Handling Systems: Evaluate Most Effective Controls and Document Results

Fabric filter dust collectors will be used on all coal, lime and ash storage and handling systems to prevent fugitive particulate emissions. On site coal storage will be in three concrete silos. The fabric filters will have a design outlet grain loading of 0.005 grain per dry standard cubic foot (gr/dscf).

The Dry Fork plant will use water sprays and dust suppression chemicals for dust control on the coal and ash/FGD waste haul roads and the ash disposal landfill.

Step 5 – Coal, Ash, and Lime Handling Systems: Select BACT

Fabric filters will achieve BACT level emissions for the transfer points, silos, and crusher houses on the coal-handling system. Fabric filters will also achieve BACT emission rates for the transfer points and silos on the ash- and lime-handling systems. For material haul roads, water and dust suppression chemicals will be used for dust control.

5.2.7 Fluoride Analysis

Fluoride compounds will be emitted from the boilers from the combustion of coal. The fluoride compounds will be mainly in the gaseous form of hydrogen fluoride (HF) in the flue gas exiting the boiler.

Step 1 – Identify All Control Technologies

Two control technologies for fluoride control of flue gas from the boilers have been identified:

1. Wet Limestone/Lime FGD
2. Dry Lime FGD followed by fabric filter

is still less effective at collecting flyash in western power plants than is the fabric filter. The use of a fabric filter is also the preferred particulate control device for following a dry lime scrubber.

Step 4 – Boiler: Evaluate Most Effective Controls and Document Results

No negative environmental impacts have been identified for use of a fabric filter to control particulate emissions from coal-fired boilers. There is, however, a high energy demand for this system. Energy is required to overcome the system's (fabric filter and associated ductwork) 8- to 12-inch water gauge pressure drop and miscellaneous loads, such as electric hopper heating. Since baghouse filters are thought to represent the most effective PM/PM_{10} control technique that can be applied to PC boilers, no economic evaluation is warranted.

Step 5 – Boiler: Select BACT

Based on the above analysis and review of the EPA NSR RBLC database (refer to Tables E-3 and E-4 in Appendix E), a fabric filter achieving a filterable PM emission rate of 0.015 lb/mmBtu based on a 3-hour rolling average and a filterable PM_{10} emission rate of 0.012 lb/mmBtu based on a 3-hour rolling average, is selected as BACT for this project.

Unit 1 Auxiliary Wet Cooling Tower

Step 1 – Cooling Tower: Identify All Control Technologies

The only control method for reducing PM/PM_{10} emissions from wet cooling towers is the use of drift eliminators.

Steps 2, 3, and 4 - Cooling Tower - Eliminate Technically Infeasible Options, Rank, and Evaluate

Drift eliminators were the only control technology identified. They are technically feasible and effective. Because there were no other control technologies identified, Steps 3 and 4 were not necessary.

Step 5 – Cooling Tower: Select BACT

Drift eliminators are the only control method identified for control of PM/PM_{10} emissions from cooling towers. Based on the above analysis and the EPA NSR RBLC database available for recent years (refer to Table E-5 in Appendix E), drift eliminators with a control efficiency of 0.0005 percent (gallons of drift per gallon of cooling water flow) are chosen as BACT for the auxiliary wet cooling tower on this project.

Unit 1 Coal, Ash, and Lime Handling Systems

Step 1 – Coal, Ash, and Lime Handling Systems: Identify All Control Technologies

PM and PM_{10} will be emitted from the handling of the coal for the power plant, the ash that results from the combustion process, and lime that is used as a reagent for the dry FGD system. These emissions are fugitive dust that come from the various transfer points in the handling systems for these materials and fugitive dust from the storage and disposal areas. The potential technologies that can be used to control the fugitive dust emissions are as follows for the various operations:

Coal Handling: Potential control technologies for coal storage, transfer, and handling operations include the use of enclosures vented to fabric filters and the use of dry fogging.

Lime Handling: Potential control technologies for lime storage, transfer, and handling operations include the use of enclosures vented to fabric filters.

Unit 1 Boiler

Step 1 – Boiler: Identify All Control Technologies

Two control technologies for PC boilers have been identified for PM/PM_{10} control:

1. Electrostatic precipitators (ESPs)
2. Fabric filters

Step 2 – Boiler: Eliminate Technically Infeasible Options

Electrostatic Precipitators

ESP technology is applicable to a variety of coal combustion sources. ESPs remove particulate matter from the flue gas stream by charging flyash particles with a very high DC voltage and attracting these particles to grounded collection plates. A layer of collected particulate matter forms on the collecting plates and is removed by periodically rapping the plates. The collected ash particles drop into hoppers below the precipitator and are removed periodically by the flyash-handling system.

Fabric Filters

Fabric filtration has been applied widely to coal combustion sources since the early 1970s and consists of a number of filtering elements (bags) along with a bag cleaning system contained in a main shell structure incorporating dust hoppers. Fabric filters use bags of various materials as filters to collect particulate matter. The particulate-laden gas enters a fabric filter compartment and passes through the bags and through a layer of accumulated particulate matter collected on the fabric of the filter bags. The collected particulate matter forms a filter cake layer on the bag that enhances the bag's filtering efficiency. However, excessive caking will increase the pressure drop across the fabric filter. When this occurs, the fabric filter is placed into a cleaning cycle and the dislodged particulate matter is removed by the ash-handling system.

Fabric filters are effective in meeting NSPS emission requirements on coal-fired boilers. Fabric filters have been used as a control technology of choice on projects where LAER review is required. Unlike precipitators, fabric filter design is not based on any physical properties of the flyash.

Step 3 – Boiler: Rank Remaining Control Technologies by Control Effectiveness

The fabric filter is more effective at capturing fine particulate than an ESP because ESPs tend to collect larger particles selectively. Large particles have a high mass to surface area ratio, which allows a charged particle to be dragged efficiently through the flue gas stream for collection on a grounded plate. Ultrafine particles have a low terminal velocity and cannot carry a strong enough electrical charge to result in complete collection.

The fabric filter is also more effective at collecting flyash generated from western low-sulfur coals, such as the coal to be combusted at the Dry Fork Station. ESPs operate by first electrostatically charging for collection and then discharging the flyash particles for removal in the ash-handling system. Western low-sulfur coal flyash has a very high electrical resistivity that makes it difficult for the ESP to first charge and then discharge the particles. One solution that has been attempted on western power plants is the use of a hotside precipitator that operates at approximately 800°F as opposed to approximately 250°F operating temperature used on most ESPs. The electrical resistivity of the flyash is lower at this higher temperature. However, even with this change in operating temperature, the ESP

Step 2 – Eliminate Technically Infeasible Options

Catalytic oxidation has been the control alternative used to obtain the most stringent control level for CO and VOCs emitting from primarily combustion turbines firing natural gas. This alternative, however, has never been applied to a coal-fired unit, and thus has not been actually demonstrated in practice in this application.

For sulfur-containing fuels, such as coal, an oxidation catalyst will convert SO_2 to SO_3 and therefore this conversion would result in unacceptable levels of corrosion to the flue gas system. Generally, oxidation catalysts are designed for a maximum particulate loading of 50 milligrams per cubic meter (mg/M^3). The proposed Dry Fork boiler will have a particulate loading upstream of the fabric filter in excess of 5,000 mg/M^3. In addition, trace elements present in coal, in particular chlorine, may deactivate oxidation catalysts making them ineffective. There are no oxidation catalysts developed that have or can be applied to coal- or oil-fired boilers due to the high levels of particulate matter and trace elements present in the flue gas.

Although the catalyst could be installed downstream of the fabric filter to reduce the particulate loading, the flue gas temperature at that point will be approximately 165°F, which is well below the minimum temperature required (600°F) for operation of an oxidation catalyst. The flue gas would have to be reheated, resulting in significant unfavorable energy and economic impacts.

For these reasons, as well as the generally low level of CO and VOC in coal-fired units, no boilers have been equipped with oxidation catalysts. Use of an oxidation catalyst system in the proposed Dry Fork boiler is thus considered technically infeasible. Thus, this alternative cannot be considered to represent BACT for control of CO and VOCs.

Step 3 – Rank Remaining Control Technologies by Control Effectiveness

Based on the Step 2 analysis, combustion control is the only remaining technology for this application.

Step 4 – Evaluate Most Effective Controls and Document Results

No environmental or energy costs are associated with combustion control in a PC boiler.

Step 5 – Select BACT

The EPA NSR RBLC database for comparable sources related to CO and VOCs is shown in Appendix E, Tables E-1 and E-2. The final step in the top-down BACT analysis process is to select BACT. Based on the above analysis, combustion control in a traditional PC boiler is chosen as the technology to control emissions of CO and VOCs for this project with BACT emission limits of 0.15 lb/mmBtu for CO and 0.0037 lb/mmBtu for VOCs.

5.2.6 PM/PM_{10} Analysis

PM and PM_{10} emissions will be emitted from the main boiler, auxiliary cooling tower, and the coal, ash, sorbent, and lime handling systems. An analysis for the emissions from the boiler is presented, followed by an analysis for the auxiliary cooling tower and then the material-handling systems.

The other environmental impact associated with SCR is disposal of the spent catalyst. Some of the catalyst used in SCR systems must be replaced every two to three years. These catalysts contain heavy metals including vanadium pentoxide. Vanadium pentoxide is an acute hazardous waste under the Resource Conservation and Recovery Act (RCRA), Part 261, Subpart D – Lists of Hazardous Materials. This must be addressed when handling and disposing of the spent catalyst.

The next control technology in the hierarchy is SNCR. The range of control efficiencies for SNCR ranges above the NSPS so it was not evaluated further. The other technologies listed in Table 5-3 were also not determined to achieve a level of control sufficient to meet NSPS and were not considered further. As such, further evaluation of energy, environmental, and cost data is not required.

Step 5 – Select BACT

The final step in the top-down BACT analysis process is to select BACT. EPA's RACT/BACT/LAER Clearinghouse (RBLC), a database of past technology decisions, was again consulted to assist in selecting BACT for this project.

Of the projects found, only SCR with LNBs and Overfire Air is shown to meet NSPS. The installation of low-NO_x burners with Overfire Air, and SCR with a NO_x removal efficiency of 72 percent based on a 0.25 lb/mmBtu NOx inlet will result in an emission rate of 0.07 lb/mmBtu for the Dry Fork Station.

The recent addition of the 750 MW-net MidAmerican Council Bluffs Energy Center (CBEC) Unit 4, which is under construction, was permitted at 0.07 lb/mmBtu based on the use of low-NO_x burners with Overfire Air and SCR. This unit also burns PRB coal. The design NO_x emission rate for Dry Fork is 0.07 lb/mmBtu which is identical to the CBEC Unit 4 design NO_x emission rate, and equal to the lowest emission rate for units in the RBLC. The 950 MW-gross Intermountain Power Project (IPP) Unit 3 was also recently permitted at 0.07 lb/mmBtu based on the use of low-NO_x burners with Overfire Air and SCR. Therefore SCR with Low-NOx Burners and Overfire Air is selected as the technology to achieve the BACT emission limit for this project of 0.07 lb/mmBtu based on a 30-day rolling average.

5.2.5 CO and VOC Analysis

The BACT analysis for CO and VOCs is presented below.

Step 1 – Identify All Control Technologies

Only two control technologies have been identified for control of CO and VOC:

1. Catalytic oxidation
2. Combustion controls

Catalytic oxidation is a post-combustion control device that would be applied to the combustion system exhaust, while combustion controls are part of the combustion system design.

Step 3 – Rank Remaining Control Technologies by Control Effectiveness

Emission rates for each of the technology combinations are required to rank them in order of effectiveness. These emission rates are provided in Table 5-3. The control efficiencies are those shown in the RBLC database (Appendix E, Table E-8).

The PSD NSR regulations require that BACT, at a minimum, meet the applicable NSPS limit. Because there is an NSPS that applies to the boiler, the NSPS emission limit is also included in the ranking.

TABLE 5-3
NO_x Control Technology Emission Rate Ranking

Control Technology	NO_x Emission Rate [a]
SCR and Low NO_x Burners w/Overfire Air	0.067 – 0.15
SNCR and Low NO_x Burners w/Overfire Air	0.09 - 0.17
Low NO_x Burners with Overfire Air	0.15 – 0.33
Low NO_x Burners	0.32 – 0.39
Combustion Controls	0.23 – 0.55
NSPS Limit	0.16 [b]

[a] Pounds per million BTU as found in the RBLC database.
[b] Converted from NSPS limit of 1.6 pounds per megawatt hour assuming a heat rate of 10,000 BTU per kwh.

Nomenclature:

SCR	=	Selective catalytic reduction
SNCR	=	Selective non-catalytic reduction
NSPS	=	New Source Performance Standards

Step 4 – Evaluate Most Effective Controls and Document Results

SCR is being considered for this project, so its environmental, energy, and economic impacts must be examined. SCR is a control technique that uses ammonia to react with the NO_x in the flue gas at the appropriate temperature in the presence of a catalyst to form water and nitrogen.

SCR has two well-documented environmental impacts associated with it, ammonia emissions (sometimes called ammonia slip) and disposal of spent catalyst. Some ammonia emissions from an SCR system are unavoidable because of imperfect distribution of the reacting gases, and ammonia injection control limitations as well as a partially degraded catalyst that results in an incomplete reaction of the available ammonia with NO_x. Also, the NO_x removal efficiency depends on the ratio of ammonia to NO_x. Increasing the amount of ammonia injected increases the control efficiency but also increases the amount of unreacted ammonia that is emitted to the atmosphere. Ammonia emissions from a well-controlled SCR system can likely be limited to 10 ppmv or less. Ammonia emissions are of concern, because ammonia is a significant contributor to regional secondary particulate formation and visibility degradation. In this case reduced NO_x emissions as an environmental benefit would be traded for increased ammonia emissions as an environmental cost.

The 950-gross MW Intermountain Power Project (IPP) Unit 3 was recently permitted at 0.09 lb/mmBtu (30-day rolling average) based on the use of western bituminous coal and a wet limestone FGD. This is equivalent to 92.5 percent SO_2 removal in the wet FGD system when firing the worst case design fuel. Using low sulfur coal and dry FGD, Dry Fork will achieve a controlled emission rate almost equivalent to IPP. As shown above, wet FGD is not incrementally cost effective on this project. Therefore, dry FGD is selected as the technology to achieve the BACT SO_2 emission limit for this project of 0.10 lb/mmBtu based on a 3-hour block average.

The EPA NSR RBLC database shows the comparable sources related to sulfuric acid mist (H_2SO_4). They are shown in Table E-9 in Appendix E. Many of the sources determined that the use of a dry lime scrubber followed by a fabric filter was technology chosen to achieve BACT. Most of the other sources selected wet FGD system to achieve BACT emissions levels for sulfuric acid. Sargent & Lundy estimates a 90 percent sulfuric acid control level with the proposed Dry Fork Unit 1 design.

Based on the technology and clearinghouse database discussion above, a dry lime FGD system followed by a fabric filter are selected as BACT for the project with a sulfuric acid emission rate of 0.0025 lb/mmBtu.

5.2.4 NO_x Analysis

The BACT analysis for Nitrogen Oxides is presented below.

Step 1 – Identify All Control Technologies

NO_x will be emitted by combustion of coal in the boiler. NO_x formed in the combustion process consists of fuel NO_x (NO_x derived from nitrogen in the fuel) and thermal NO_x (which is produced from nitrogen in the combustion air) when the peak flame temperature reaches a sufficiently high temperature (approximately 2500°F).

The first step is to evaluate NO_x controls determined to be BACT by permitting agencies across the United States. This information is available from the EPA RACT/BACT/LAER Clearinghouse (RBLC) database assessable on the Internet. The printout from the database for NO_x is shown in Appendix E, Table E-8. A broad range of other information sources were also reviewed in an effort to identify all potentially applicable emission control technologies.

Potential NO_x control technology options are:

- Selective catalytic reduction (SCR)
- Selective non-catalytic reduction (SNCR)
- Low NO_x burners with overfire air
- Low NO_x Burners
- Good combustion control

Step 2 – Eliminate Technically Infeasible Options

~~All of these technologies are listed in the RBLC for coal-fired utility boilers, and all of the~~ technologies are technically feasible.

TABLE 5-2
Dry Form SO_2 Control Cost Comparison

Factor	Dry Lime FGD	Wet Limestone FGD
Total Installed Capital Costs	$ 63.6 Million	$ 77.4 Million
Total Fixed & Variable O&M Costs	$ 4.4 Million	$ 4.8 Million
Total Annualized Cost	$ 15.0 Million	$ 17.6 Million
FGD Design Control Efficiency	87.8 percent	89.0 percent
Tons SO_2 Removed per Year	11,980	12,144
Cost Effectiveness per Ton of SO_2 Removed	$ 1,248	$ 1,450
Incremental Annualized Cost Difference between Wet LSFO FGD and dry lime FGD	-	$ 2.6 Million
Incremental Tons SO_2 Removed between Wet LSFO FGD and dry lime FGD	-	202
Incremental Cost Effectiveness per Ton of Additional SO_2 Removed by Wet LSFO FGD	-	$ 13,157

Basin Electric believes that the high additional cost of wet limestone/lime scrubbing is not warranted for this project based on the use of low sulfur coal and the limited additional tons of SO_2 removed. Wet FGD also has the disadvantages of waste disposal of a wet FGD sludge, increased water consumption requirements, possible future complications with mercury removal, higher particulate emissions and the fact that dry FGD can meet a SO_2 emission limit that is comparable to BACT as determined in other recent permits listed in the RBLC database.

Step 5 – Select BACT

The final step in the top-down BACT analysis process is to select BACT. EPA's RACT/BACT/LAER Clearinghouse (RBLC), a database of past technology decisions, and recently approved PSD permits were again consulted to assist in selecting BACT for this project.

Both dry FGD and wet limestone scrubbing have been demonstrated at removal efficiencies greater than 90 percent. The installation of a dry FGD system on Dry Fork will result in a SO_2 removal efficiency of 91.7 percent for the design maximum coal sulfur content of 0.47 wt. percent. The highest collection efficiency shown in the RBLC is 95 percent on Santee Cooper Cross Unit No. 1, however, this unit burns high sulfur coal.

The recent addition of the 750-net MW MidAmerican Council Bluffs Energy Center (CBEC) Unit 4, which is under construction, was permitted at 0.10 lb/mmBtu (30-day rolling average) based on the use of low sulfur PRB coal and a lime spray dryer FGD. The design SO_2 emission rate for Dry Fork is 0.10 lb/mmBtu which is identical to the CBEC Unit 4 design SO_2 emission rate, and consistent with the low end of the range of emissions for units in the RBLC.

The CDS process is applicable mostly for base-load applications such as at the Dry Fork Station, as high velocities are required to maintain the bed in suspension. The standard design includes provisions for ID fan recycle to keep the gas velocity high in the CDS vessel to mitigate this shortcoming.

Since dry FGD is being proposed for this project, the environmental, energy and economic impacts must be examined. Sargent & Lundy, the Engineer for the Dry Fork project, developed cost estimates for a dry lime FGD and for a wet limestone FGD installation and operation. The average cost effectiveness of a dry lime FGD system designed to achieve a controlled SO_2 emission rate of 0.10 lb/mmBtu (87.8 percent SO_2 removal efficiency based on 0.33 wt. percent average coal sulfur content) was estimated at $1,248 per ton of SO_2 controlled. The average cost effectiveness of the wet scrubbing system designed to achieve a controlled SO2 emission rate of 0.09 lb/mmBtu (89.0 percent SO2 removal efficiency based on 0.33 wt. percent average coal sulfur content) was estimated to be $1,450 per ton of SO2 controlled.

Based on average cost effectiveness calculations, both wet and dry FGD systems appear to be cost effective. An incremental cost analysis was also prepared to evaluate the incremental cost effectiveness of the wet scrubbing system. The incremental cost effectiveness of the wet limestone FGD (compared to the dry lime FGD) was calculated at $13,157 per additional ton of SO_2. The incremental cost effectiveness reflects the additional capital, O&M, and fabric filter costs associated with the wet FGD system.

With a wet FGD design, the fabric filter would be prior to the FGD system, and the resultant capital and operating costs are higher than a similar fabric filter that follows a dry lime FGD system. A comparison of the costs and SO_2 removed is summarized in Table 5-2. The annualized cost estimate for a wet lime system would be similar to the one prepared for wet limestone with the primary difference being the higher cost of lime reagent. Because wet limestone FGD has a similar removal efficiency to wet lime FGD and the operating costs are lower, it was decided that wet limestone FGD was the appropriate cost comparison alternative to the dry lime FGD system.

Dry FGD has the advantages of producing a dry waste material and requiring less makeup water in the absorber over a wet scrubber. Given that the amount of water available for Dry Fork is quite limited to the point of requiring dry cooling for much of its heat dissipation, the reduced water consumption required for dry FGD is major advantage for this technology.

A Dry FGD system has the additional advantage of requiring less electric power for its operation compared to a Wet FGD system. A dry FGD system at Dry Fork would require approximately 2.8 MW of power compared to approximately 5.3 MW for Wet FGD. This would equate to an annual power savings of approximately 18.6 million kW-Hr for dry FGD versus wet FGD for Dry Fork based on an 85 percent annual plant capacity factor. Instead of this amount of power being used in the power plant, this power can instead be sold to Basin Electric's customers reducing the need to produce this power elsewhere.

The CDS and lime spray dryer FGD systems produce a dry waste product suitable for landfill disposal.

CDS and lime spray dryer systems are in operation at many facilities in Europe, China and the U.S. ranging in size from less than 10 MW to 350 MW. CDS and lime spray dryer FGD are commercially available from multiple process developers/vendors.

The dry FGD systems have a number of advantages when compared to wet FGD technology. The absorber vessel can be constructed of unlined carbon steel, as opposed to lined carbon steel or solid alloy construction for wet FGD, and the capital cost is typically lower than for wet FGD.

The pressure drop across the absorber is typically lower than wet FGD systems. Pumping requirements and overall power consumption are lower than for wet FGD systems. The dry FGD systems use less equipment than does the wet FGD system, resulting in fixed, lower operations and maintenance (O&M) labor requirements.

Sulfur trioxide (SO_3) in the vapor above approximately 300°F, which condenses to liquid sulfuric acid at a lower temperature (below acid dew point), is removed efficiently with a CDS or lime spray dryer system. Wet scrubbers capture less than 40 to 60 percent of SO_3 and may require the addition of a wet ESP, or hydrated lime injection, to remove the balance of SO_3. Otherwise, the emission of sulfuric acid mist, if above a threshold value, may result in a visible plume after the vapor plume dissipates.

Flue gas following a dry FGD system is not saturated with water (30°F to 50°F above dew point), which reduces or eliminates a visible moisture plume. Wet FGD scrubbers produce flue gas that is saturated with water, which would require a gas-gas heat exchanger to reheat the flue gas if it were to operate as a dry stack. Due to the high capital and operating costs associated with heating the flue gas, all recent wet FGD systems in the United States have used wet stack operation.

Waste produced is in a dry form and can be handled with conventional pneumatic fly ash handling equipment. The waste is stable for landfill purposes and can be disposed of concurrently with fly ash.

There is no liquid waste from a dry FGD system, while wet FGD systems may produce a liquid waste stream, especially if the gypsum is to be sold for wallboard. In some cases, a wastewater treatment plant must be installed to treat the liquid waste prior to disposal. The wastewater treatment plant produces a small volume of solid waste, which may be contaminated with toxic metals (including mercury) that must be disposed of in a landfill. The humidification stream of a CDS system provides a way to achieve a dry by-product from process wastewater from other parts of the plant when processing residue for disposal.

Dry FGD technology has only a few disadvantages when compared to wet FGD technology. The dry FGD process uses a more expensive reagent (hydrated lime) than limestone-based FGD systems, and the reagent has to be stored in a steel or concrete silo. Reagent utilization is lower than for wet limestone systems to achieve comparable SO_2 removal. The lime stoichiometric ratio is higher than the limestone stoichiometric ratio (on the same basis) to achieve comparable SO_2 removal.

the reagent across the scrubber vessel. The calcium in the reagent reacts with the SO_2 in the flue gas to form calcium sulfite and/or calcium sulfate that is removed from the scrubber with the sludge and is disposed. Most wet FGD systems utilize forced oxidation to assure that only calcium sulfate sludge is produced. The wet limestone forced oxidation (LSFO) process is used in most new wet FGD installations. Several variations on the wet FGD technology are offered by various process developers. These variations include using a jet bubbling reactor as a combination SO_2 absorber and calcium sulfite oxidation vessel, and using magnesium enhanced lime as the alkaline reagent.

The creation of a wet sludge from the scrubber does create a solid waste handling and disposal problem. This sludge needs to be handled in a manner to not result in ground water contamination. Also, the sludge disposal area needs to be permanently set aside from future surface uses since the disposed sludge can not bear any weight from such uses as buildings or cultivated agriculture. Wet FGD systems can produce salable gypsum if a gypsum market is available, reducing the quantity of solid waste that needs to be disposed of from the power plant.

Other disadvantages associated with wet limestone or lime FGD includes the creation of a wet stack plume, generation of primary particulate matter by the scrubbing process, increased acid gas emissions, incompatibility with mercury removal options and water/wastewater issues. Wet FGD generates more primary particulate emissions leaving the stack than dry FGD systems because the particulate removal device (ESP or Fabric Filter) is upstream of the scrubber instead of downstream as in this case. Sulfuric acid removal for a wet FGD system is in the range of 40 to 60 percent compared to 90 percent for a dry lime absorber/fabric filter combination. The potential future use of activated carbon or sorbent injection for mercury removal is also limited with a wet FGD application since the fabric filter is upstream of the scrubber and the flue gas temperature is higher than the optimum mercury capture range.

Wet FGD also requires more makeup water than Dry FGD, and typically requires a wastewater blowdown stream that must be treated to limit the buildup of chlorides in the absorber scrubbing loop. Given that the amount of water available for the Dry Fork Station is quite limited to the point of requiring dry cooling for much of its heat dissipation, the increased water consumption required for the wet scrubber is a serious concern.

Dry Lime FGD Absorber Followed by Fabric Filter

In CDS and lime spray dryer systems, SO_2 reacts with lime in an absorber vessel. The CDS absorber operates as a circulating fluidized bed of hydrated lime, reaction products and ash. The flue gas is humidified at the venturi inlet in the bottom of the fluidized bed. Dry hydrated lime and recycle solids are injected above the venturi. The hydrated lime reacts with the SO_2 in the flue gas reacts to form particulate calcium sulfate. This dry material is captured in the fabric filter along with the fly ash.

The lime spray dryer typically injects lime slurry in the top of the vessel with a rapidly rotating atomizer wheel. The rapid speed of the atomizer wheel causes the lime slurry to separate into very fine droplets that intermix with the flue gas where the SO_2 in the flue gas ~~reacts with the calcium in the lime slurry to form particulate calcium sulfate. This dry~~ material is captured in the fabric filter along with the fly ash.

The control efficiencies for these technologies range from 73 percent to 95 percent. However, with the exception of two projects in Wyoming using a circulating dry lime scrubber and one project in Wyoming using a lime spray dryer, the reported removal rates are 90 percent to 95 percent. FGD control efficiencies will be in the lower end of this range when used with low sulfur coal.

Step 2 – Eliminate Technically Infeasible Options

Both of these options are technically feasible for use in reducing SO_2 emissions from the Dry Fork Station. Control efficiencies for circulating dry scrubbers (CDS) have not been demonstrated above 80 percent in the RBLC database. However, this technology has demonstrated SO_2 removal efficiencies above 90 percent in European installations. For this reason this technology was included for further consideration.

Step 3 – Rank Remaining Control Technologies by Control Effectiveness

Emission rates for each of the SO_2 removal technologies are ranked in order of their control effectiveness. These effectiveness values are provided in Table 5-1. The PSD NSR regulations require that BACT, at a minimum, meet the applicable NSPS limit, 40 CFR 60 Subpart Da. Because there is an NSPS that applies to the boiler, the NSPS emission limit is also included in the ranking.

TABLE 5-1
SO_2 Control Technology Emission Rate Ranking

Control Technology	SO_2 Emission Rate [a]
Wet Limestone Scrubbing	0.09 – 0.40
Circulating Dry Scrubber	0.10 – 0.32
Lime Spray Dryer	0.10 – 0.32
Wet Lime Scrubbing	0.13 – 0.25
NSPS Limit	0.34[b]

[a] Pounds per million BTU as found in the RBLC database and recently approved PSD permits.
[b] Based on an uncontrolled SO_2 emission rate of 1.12 Lb/MmBtu and a removal efficiency of 70 percent, which is the applicable standard under NSPS subpart Da when SO_2 emissions are less than 0.60 pounds per MmBtu.

Nomenclature:

NSPS = New Source Performance Standards

Step 4 – Evaluate Most Effective Controls and Document Results

This step involves the consideration of energy, environmental, and economic impacts associated with each control technology. The top-down process requires that the evaluation begin with the most effective technology.

Wet Limestone/Lime FGD

~~Wet SO_2 scrubbers operate by flowing the flue gas upward through a large reactor vessel~~ that has an alkaline reagent (i.e. limestone or lime slurry) flowing down from the top. The scrubber mixes the flue gas and alkaline reagent using a series of spray nozzles to distribute limited by controlling the combustion of the fuel and providing adequate oxygen for complete combustion. Thus, good combustion control is the technique to be used to limit CO and VOC emissions.

5.2 BACT Determination

This section presents the required BACT analyses.

5.2.1 Applicability

The requirement to conduct a BACT analysis and determination is set forth in section 165(a)(4) of the Clean Air Act and in federal regulations 40 CFR 52.21(j).

5.2.2 Top-Down BACT Process

EPA has developed a process for conducting BACT analyses. This method is referred to as the "top-down" method. The steps to conducting a "top-down" analysis are listed in EPA's "New Source Review Workshop Manual," Draft, October 1990. The steps are the following:

- Step 1 – Identify All Control Technologies
- Step 2 – Eliminate Technically Infeasible Options
- Step 3 – Rank Remaining Control Technologies by Control Effectiveness
- Step 4 – Evaluate Most Effective Controls and Document Results
- Step 5 – Select BACT

Each of these steps has been conducted for SO_2, H_2SO_4, NOx, CO, VOC, PM, PM_{10}, fluoride and beryllium and are described below.

5.2.3 SO_2 and H_2SO_4 Analysis

The BACT analysis for sulfur dioxide is presented below. The analysis is also applicable to sulfuric acid mist (H_2SO_4).

Step 1 – Identify All Control Technologies

Sulfur dioxide (SO_2) will be emitted from the proposed Dry Fork Station as a result of the combustion of coal that contains sulfur. The first step is to evaluate SO_2 controls determined to be BACT by permitting agencies across the United States. This information is available from the EPA RACT/BACT/LAER Clearinghouse (RBLC) database accessible on the Internet. The printout from the database for SO_2 is shown in Appendix E, Table E-7. The printout from the database for H_2SO_4 is shown in Appendix E, Table E-9. A broad range of other information sources were also reviewed in an effort to identify all potentially applicable emission control technologies.

The potential SO_2 emission reduction options found in the RBLC and other sources that could be applied to the Dry Fork Station are:

- Wet lime/limestone scrubbing
- ~~Dry lime scrubbing~~

fabric filter. The fabric filters will have a particulate removal efficiency of greater than 99 percent.

The fabric filter system will consist of a number of parallel banks of individual filter compartments located downstream of the air preheaters and the flue gas desulfurization system and upstream of the induced draft fans. Individual filter compartments consist of a bottom collection hopper, a collector housing, and an upper plenum. A group of cylindrical filter bags, each covering a cylindrical wire cage retainer, hang from a tubesheet, which separates the upper plenum from the collector housing.

Particle-laden flue gas from the boiler enters the collector housing, just above the bottom collection hopper. The flue gas stream travels up through the collector housing where particles collect on the outside of the cylindrical filter bags. The filtered flue gas then travels up through the inside of the cylindrical filter bags, through the tubesheet, and out through the upper plenum. Particulate matter captured on the filter bags will form a filter cake. The filter cake increases both the filtration efficiency of the cloth and its resistance to gas flow.

Fabric filtration is a constant-emission device. Pressure drop across the filters, inlet particulate loading, or changes in gas volumes may change the rate of filter cake buildup, but will not change the final emission rate. Actual performance of a fabric filter depends on specific items, such as air/cloth ratio, permeability of the filter cake, the loading and nature of the particulate material (e.g., irregular-shaped or spherical), and particle size distribution.

The filter bags must be cleaned periodically to remove accumulated filter cake. The cleaning frequency of the individual compartments will depend, in part, on the inlet grain loading and the flow resistance of the filter cake formed. It is anticipated that the fabric filter system will be designed as a pulse jet-type system. In a pulse jet-type system, gas flow through an isolated compartment is stopped and pulses of compressed air are blown down into the inside of each bag causing the filter bag to puff outward, fracturing and dislodging the accumulated filter cake. The filter cake falls into the collection hopper for transport to the flyash-handling system.

The fabric filter system design involves inlet particulate matter loading rates, flyash characteristics, the selection of the cleaning mechanism, and selection of a suitable bag filter fabric and finish.

5.1.5 Beryllium and Lead

The use of a fabric filter and dry lime FGD system on Dry Fork will reduce potential beryllium and lead emissions by 99 percent. Beryllium and lead are emitted as trace metal constituents in the flyash leaving the boiler. The removal of beryllium and lead correlates with the collection efficiency of the particulate removal device. Because the fabric filter will remove greater than 99 percent of the total particulate matter, the removal efficiency of beryllium and lead will be similar. A fabric filter preceded by a dry lime FGD system is selected as the control technology of beryllium and lead emissions for this project.

5.1.6 Carbon Monoxide and Volatile Organic Compounds

Carbon monoxide (CO) and non-methane volatile organic compounds (VOCs) are formed from the incomplete combustion of the coal in the boiler. The formation of CO and VOCs is been reported, however, these high control efficiencies have been demonstrated on flue gas streams with high HCl and HF concentrations, and not on coal-fired utility boilers with significantly large flue gas flow rates and lower HCl and HF concentrations such as Dry Fork. The level of control is also dependent on the coal properties. Some of the HCl and HF removal occurs in the dry FGD absorber vessel itself due to the reaction with the hydrated lime. Removal also takes place as a result of the flue gas humidification in the absorber and the collection of the reagent and flyash product on the fabric filter bags.

5.1.3 Nitrogen Oxides

NO_x is formed in the boiler in the combustion process, particularly when the peak combustion temperature in the flame exceeds 2,500°F. The emissions of NO_x from Dry Fork will be controlled to BACT levels through the use of Low NO_x Burners (LNB) with Overfire Air and Selective Catalytic Reduction (SCR). Low NO_x burners control the formation of NO_x by staging the combustion of the coal to keep the peak flame temperature below the threshold needed for NO_x formation. The burner initially introduces the coal into the boiler with less air than is needed for complete combustion. The flame is then directed toward an area where additional combustion air is introduced from over-fire air ports allowing final combustion of the fuel.

A selective catalytic reduction unit will also be installed on Dry Fork to further reduce the NO_x emissions. The proposed SCR is designed for high dust loading applications and will be located external from the boiler. The SCR system uses a catalyst and a reductant (ammonia gas, NH_3) to dissociate NO_x into nitrogen gas and water vapor. The catalytic process reactions for this NO_x removal are as follows:

$$4NO + 4NH_3 + O_2 \rightarrow 4N_2 + 6H_2O, \text{ and}$$

$$2NO_2 + 4NH_3 + O_2 \rightarrow 3N_2 + 6H_2O.$$

The optimum temperature window for this catalytic reaction is between approximately 575 and 750°F. Therefore, the SCR reaction chamber will be located between the boiler economizer outlet and air heater flue-gas inlet. The system will be designed to use ammonia as the reducing agent. Anhydrous ammonia will be transported by truck and stored onsite. Gaseous ammonia will be injected into Unit 1 through injection pipes, nozzles, and a mixing grid that will be located upstream of the SCR reaction chamber. A diluted mixture of ammonia gas in air will be dispersed through injection nozzles into the flue-gas stream. The ammonia/flue-gas mixture then enters the reactor where the catalytic reaction occurs.

Based on technical information provided by the boiler vendor, it is anticipated that NO_x emissions from the boiler (prior to the SCR) can be controlled by LNBs with Overfire Air to 0.20 to 0.25 lb/mmBtu while maintaining acceptable levels of CO and VOC. The SCR system will have a design NO_x emission rate of 0.07 lb/mmBtu, which corresponds to an SCR NO_x removal efficiency of 72 percent based on a 0.25 lb/mmBtu NOx inlet.

5.1.4 Particulate Matter and PM_{10}

Particulate matter (PM) and particulate matter smaller than 10 micrometers diameter (PM_{10}) ~~will be controlled at Dry Fork by a fabric filter. The fabric filters operate by passing the~~ particle-laden flue gas through a series of felted fabric bags. The bags accumulate a filter cake that removes the particles from the flue gas, and the cleaned flue gas passes out of the this staged combustion approach, the substoichiometric combustion mechanism also generates some amount of hydrogen sulfide (H_2S) in the flue gases at the vicinity of the burner. However, any H_2S that may have formed is later totally oxidized to SO_2 and SO_3 by further combustion in the overfire excess air which is injected directly above the reducing zone of the boiler. A new pulverized coal boiler, with low-NO_x burners and overfire air, would be instrumented and operated using a distributed control system (DCS) that would insure sufficient oxygen to achieve complete combustion of the fuel and oxidation of any reduced sulfur species formed in the lower combustion zone.

Dry lime scrubbing technology is generally used for low-sulfur coal. Dry FGD processes are typically located after the air preheater, and the waste products are collected in a baghouse or electrostatic precipitator (ESP). Several variations on the dry FGD technology are offered by various process developers. These variations include the lime spray drying, circulating dry scrubbing (CDS) and lime flash drying processes.

In a lime spray drying FGD system, lime (calcium oxide) reagent is slaked with water to form calcium hydroxide slurry. The slurry contacts the flue gas when it is sprayed as finely atomized droplets through a rapidly spinning atomizing wheel into a spray dryer vessel. The spray dryer vessel will be installed in the flue gas ductwork upstream of a baghouse. The flue gas temperature leaving the spray dryer vessel is maintained approximately 35°F above the adiabatic approach to the saturation point. This allows carbon steel construction of the spray dryer vessel.

The spray dryer vessel has sufficient residence time (approximately 10 seconds) to allow the SO_2 in the flue gas to react with the reagent as the water in the slurry droplets evaporates, forming a dry calcium sulfite and calcium sulfate byproduct. This dry byproduct, along with remaining fly ash, is collected in the bottom of the spray dryer vessel and in the downstream baghouse. A portion of the collected dry solids will be re-slurried and re-injected into the spray dryer to improve reagent utilization.

A CDS dry FGD system uses hydrated lime as a reagent. Preparation of the hydrated lime involves an atmospheric lime hydrator. The hydrated lime is stored in a day silo for later use. The hydrated lime is fed to the absorber by means of a rotary screw feeder or a gravimetric feeder may be evaluated for more consistent control. The reagent is fed to the absorber to replenish hydrated lime consumed in the reaction, and the feed rate is typically controlled based on the required removal efficiency.

The waste product from a dry FGD system contains $CaSO_3$, $CaSO_4$, calcium hydroxide, calcium carbonate, and ash. The collected dry solids will be pneumatically conveyed to a storage silo and trucked back to the coal mine for landfill disposal. The dry FGD system for Dry Fork will be designed to meet the SO_2 emission levels described in Section 3 (Emissions Summary) and Section 6 (Requested Permit Limits).

5.1.2 Hydrochloric Acid and Hydrogen Fluoride

The use of the dry flue gas desulfurization system on Dry Fork will also reduce HCl and HF potential emissions by at least 90 percent. Based on operating data at other similar coal-fired ~~utilities and municipal waste combustors (MWC) that utilize combination CDS or lime~~ spray dryer and fabric filter control systems, very high acid gas removal efficiencies have been demonstrated. Removal efficiencies up to 98 to 99 percent for HCl and for HF have

SECTION 5.0

Control Technology Analysis

This section describes the air pollution control equipment that will be utilized on the proposed Dry Fork power plant project, the best available control technology (BACT) analysis for applicable pollutants, the discussion of how the plant will comply with the Clean Air Mercury Rule (CAMR) and the maximum achievable control technology (MACT) demonstration for hazardous air pollutant emissions from the auxiliary boiler.

Basin Electric selected a pulverized coal (PC) boiler design for this project. EPA has not considered the BACT requirement as a means to redefine the design of the source, although some states have chosen to engage in a broader analysis. Therefore, this BACT analysis does not evaluate different combustion designs such as circulating fluidized bed (CFB) or integrated gasification combined cycle (IGCC) since these combustion processes are fundamentally different from the chosen PC boiler design.

Emissions from the Dry Fork Station will exceed PSD significant annual emission rates and will therefore be subject to a best available control technology (BACT) review for carbon monoxide (CO), particulate matter (PM), particulate matter less than 10 microns (PM_{10}), volatile organic compounds (VOC), sulfur dioxide (SO_2), nitrogen oxides (NO_x), sulfuric acid mist (H_2SO_4), beryllium (Be), and fluorides (as HF).

5.1 Pollution Controls

The proposed Dry Fork Station will be equipped with advanced pollution controls to limit the emissions of SO_2, sulfuric acid mist, HCl, fluorides as HF, NO_x, PM, PM_{10}, lead, and beryllium.

5.1.1 Sulfur Dioxide and Related Compounds

Emissions of sulfur dioxide and sulfuric acid mist will be controlled on Dry Fork to BACT levels with the use of a dry lime scrubbing flue gas desulfurization (FGD) system. The FGD system will have a design outlet SO_2 emission rate of 0.10 lb/mmBtu, which corresponds to an SO_2 removal efficiency of 91.7 percent at the design maximum coal sulfur content of 0.47 wt. percent. The dry FGD system will also remove at least 90 percent of the sulfuric acid mist.

There will be no total reduced sulfur (TRS) and reduced sulfur compound (RSC) emissions from the boiler because utility coal-fired boilers are operated with approximately 20 percent excess air to insure complete combustion and oxidation of sulfur in the coal to SO_2 and SO_3. This insures there are no reduced sulfur species in the flue gas exiting the chimney.

Reduced sulfur species could only be formed where oxygen poor substoichiometric combustion occurs. By design, low-NO_x burners create a small substoichiometric combustion zone at the burner to reduce NO_x formation followed by an overfire air zone to allow for the completion of combustion of the fuel. While NO_x reduction is achieved with

Section 5

Control Technology

Accidental Release Program – (40 CFR 68)

Section 112 (r) of the Clean Air Act and 40 CFR 68 require sources to develop a Risk Management Plan (RMP) for any chemicals stored onsite above threshold quantities defined in 40 CFR 68. BEPC plans to use anhydrous ammonia in quantities above the threshold, thus an RMP will be required.

Acid Rain Provisions (40 CFR Parts 72, 73, 75, 76, 77 and 78)

The Acid Rain Deposition Control Program is implemented by the Environmental Protection Agency (EPA), with Phase II administered by the states. Dry Fork Station Unit 1 is an affected unit under the Acid Rain Program, which is governed by 40 CFR Parts 72, 73, 75, 76, 77, and 78. The facility will, therefore, be subject to Phase II of the acid rain program pursuant to Title IV of the CAA and will be required to submit a complete and timely Title IV permit application. The facility will be required to obtain allowances for calendar-year SO_2 emissions. These allowances are expected to be readily available on the open-market trading system. Additionally, the Title IV permit will require emissions monitoring for NO_X and fuel monitoring for sulfur content.

4.2.3 Regulatory Applicability Summary Matrix

Appendices C and D contain tables that summarizes all the Wyoming and Federal applicable requirements. The tables identify all requirements, denote applicability, provide explanations, and compliance methods used if applicable.

The provisions of 40 CFR 60.40 through 60.49 (Subpart D) apply to fossil fuel-fired steam boilers having a heat input of 250 mmBtu per hour or more, and constructed since August 17, 1971. The Dry Fork Station Unit 1 fits this definition; however, similar electric utility units constructed after September 18, 1978, are subject to the requirements of NSPS Subpart Da (see next paragraph) which, for such units, supercedes Subpart D.

The provisions of 40 CFR 60.40a through 60.52a (Subpart Da) apply to electric utility steam generating units having a heat input of 250 mmBtu/hour or more and constructed on or after September 18, 1978. The proposed Unit 1 will be a maximum 422 gross MW PC-fired electric utility steam boiler rated in excess of 250 MMBtu per hour heat input and is therefore subject to the requirements of 40 CFR Subpart Da. According to this subpart, all monitoring activities and reports of emissions should be documented and retained on file, and the following may not be exceeded:

- PM 0.03 lb/mmBtu (§ 60.42a) 30-day rolling average
- Opacity of 20 percent, except for one 6-minute period per hour (§ 60.42a)
- SO_2 1.2 lb/mmBtu (§ 60.43a) 30-day rolling average
- 70 percent reduction of SO_2 because emissions are less than 0.60 lb/mmBtu) (§ 60.43a) 30-day rolling average for emission limit and 24 hour average for percent removal.
- NO_X 1.6 pounds per megawatt hour (MWH)(§ 60.44a d 1) 30-day rolling average
- Mercury 78×10^{-6} lb/MWh on an output basis (§ 60.45a a 1) 12-month rolling average since the Dry Fork Station will utilize only subbituminous coal

COMS and SO_2, NO_X and mercury CEMS must be installed, calibrated, maintained, operated, and recorded in accordance with the requirements in 40 CFR 60.47a through 60.51a. A PM CEMS is not required. Documentation is required to be maintained regarding performance tests, calibration, and maintenance of the equipment. These monitoring systems shall be certified in accordance with the performance specifications provided in Appendix B to Part 60 and maintained in accordance with the QA requirements provided in Appendix G to Part 60. Note that some of the criteria and certification test requirements within these NSPS appendices are, for acid rain sources, superceded by certain provisions within 40 CFR Part 75, which was promulgated later.

The auxiliary boiler that will be used for heating and warm-up is subject to the NSPS for steam generating units with a heat input capacity of greater than 100 MmBtu/hr but less than 250 mmBtu/hr (40 CFR 60, Subpart Db). However, most of the requirements of this subpart apply only to oil- and coal-burning units. The nominal 134.1 mmBtu/hr boiler proposed for the project will use pipeline quality natural gas only with no backup fuel. Therefore, only 40 CFR 60.44b, 60.46b, 60.48b and 60.49b are applicable.

For 40 CFR 60 Subpart Y, Standard of Performance for Coal Preparation Plants applies to new coal-handling units that are constructed after October 24, 1974. A coal-handling system is included for Unit 1. The coal-handling system is subject to NSPS Subpart Y. The affected facilities that are subject to NSPS Subpart Y include the coal handling facilities from the crusher and conveyor into the bunkers at the boiler. Exempt from Subpart Y are the coal-handling facilities from the emergency truck dump.

The diesel fire pump located at the Dry Fork Station does not meet the definition of an affected source per 40 CFR 63.6590(a) in 40 CFR 60 Subpart ZZZZ *Reciprocating Internal Combustion Engines (RICE)*. The unit is not an affected source because the site rated horsepower of the unit is less than 500 hp and the unit meets the definition of an emergency stationary RICE as its purpose is to pump water in case of fire therefore no emission or operating limitations are required.

The diesel emergency generator located at the Dry Fork Station is equipment meeting the criteria of an "affected" source as described in the regulation 40 CFR 63.6590(b) in subpart ZZZZ. An affected source is defined as a source with existing, new, or reconstructed stationary RICE with at site-rated horsepower greater than 500 hp located at a major source of HAP emissions. The RICE unit meets the definition of an emergency stationary RICE a as its purpose is to produce power when electrical power from the local utility is interrupted therefore no emission or operating limitations are required.

Dry Fork Station will comply with the newly promulgated mercury emission standard outlined in 40 CFR 60 Subpart Da, but is not subject to a requirement to perform a maximum achievable control technology (MACT) analysis for this or other HAPs.

Compliance Assurance Monitoring Program (40 CFR Part 64)

Because the proposed facility will be an "affected unit" subject to the federal acid rain program monitoring provisions, codified at 40 CFR Part 75, Dry Fork Station Unit 1 is exempt from the federal Compliance Assurance Monitoring (CAM) program requirements, codified at 40 CFR Part 64, for SO_2 and NO_X, pursuant to 40 CFR 64.2(b)(1)(iii). However, the unit will be subject to CAM requirements for SO_2 and NO_x with respect to Part 60 and WAQS&R permit limitations. The facility will also be subject to CAM requirements for particulates with respect to Part 60, Subparts Da and Y and WAQS&R permit limitations. The applicable CAM plans will be submitted with the Title V Operating Permit application that will be submitted to WDEQ within 12 months following initial startup.

NSPS (40 CFR Part 60)

These rules establish emissions limitations for SO_2, NO_X, PM and mercury and provide a variety of requirements for monitoring, recordkeeping, and reporting of emissions and other information. Any emissions unit subject to an NSPS subpart is also subject to the general provisions under Subpart A (codified at 40 CFR 60.1 through 60.19). The Dry Fork Station will also be subject to the provisions in Appendices B and F of this subpart, which outline requirements and specifications for continuous opacity monitoring systems (COMS), CEMS, and the quality assurance (QA) and quality control (QC) plans required for these monitoring systems. The content of these sections is extremely detailed. Guidance regarding SIPs is given in sections 40 CFR 60.20 through 60.29 (Subpart B); these sections do not apply to the Dry Fork Station.

Sections 40 CFR 60.30 through 60.39 (Subpart C) are specific to waste combustion units, incinerators, solid waste landfills, and sulfuric acid production plants. Dry Fork Station does not conduct any of these processes; therefore, the requirements in this section do not apply to the Dry Fork Station facility.

- The provisions of Chapter 10 in WAQS&R, establish restrictions and requirements on specific burning practices; these provisions do not apply to this facility.
- The provisions of Chapter 11 in WAQS&R, pertain to implementing federal Acid Rain Program. The provisions of 40 CFR 72 – 40 CFR 78 are incorporated by reference in Chapter 11, Section 2.0 and will apply to this facility.
- The provisions of Chapter 12 in WAQS&R, contain regulations designed to prevent the excessive build-up of air pollutants during air pollution episodes; in general, these provisions apply to this facility.
- The provisions of Chapter 13 in WAQS&R, establish minimum requirements for motor vehicle pollution control; these provisions do not apply to this facility.
- The provisions of Chapter 14 in WAQS&R, pertain to generic emission trading and banking. These regulations are general in nature and will not likely apply to the facility.

4.2.2 Other Federal Air Quality Regulations

NESHAPs (40 CFR Parts 61 and 63)

Requirements to receive authorization from the U.S. Environmental Protection Agency (EPA) (or delegated states) before construction or modification of a source are provided in 40 CFR 61.01 through 61.08. This application is being submitted pursuant to these paragraphs. The Dry Fork Station will also be a major emitter of hazardous air pollutants (HAPs) as defined in the Clean Air Act at 42 U.S. C. § 7412(g)(2).

The reporting and monitoring requirements applicable to the Auxiliary boiler and diesel generator are provided in 40 CFR 61.09 through 61.15. The remaining sections of 40 CFR 61 provide guidelines and requirements for specific sources that the Dry Fork Station does not operate; therefore, these sections do not apply to the Dry Fork Station in general.

Unit 1 is not subject to the *Industrial Commercial, and Institutional Boilers and Process Heater* NESHAP (40 CFR 60 Subpart DDDDD) per 40 CFR 63.7491(c). Unit 1 is an electric utility steam generating unit that is a fossil fuel fired combustion unit of more than 25 MW that serves a generator that produces electricity for sale therefore it is not subject to this subpart.

After a review of 40 CFR 60 Subpart DDDDD , the Auxiliary Boiler meets the criteria of an "affected" source as described in 40 CFR 63.7490. The Auxiliary boiler is considered a new large gaseous fuel boiler and is subject to the emission limitations, work practice standards, performance testing, monitoring, startup shutdown malfunction plan, and notification requirements. CO emissions from the unit are limited to 400 ppm by volume dry basis @ 3% O_2 on a 30 day rolling average. A performance test for CO emissions is required annually and CO CEMS must be installed as the unit is larger than 100 mmBtu/hr heat input.

The inlet gas heater is not subject to the emission limitations, work practice standards, performance testing, monitoring, startup shutdown malfunction plan, and notification requirements in 40 CFR 60 Subpart DDDDD. The unit is an affected source as defined in 40 CFR 63.7490 and is defined as a new small gaseous boiler or process heater (less than 10 mmBtu/hr heat input). Per 40 CFR 63.7506(c)(4), the affected boiler is not subject to the requirements of the subpart.

Acid Rain Program (40 CFR Parts 72, 73, 75, 76, and 77)

As a PC-fired electric utility boiler, Unit 1 will be subject to the SO_2 allowance allocation, NO_X emission limitations, and monitoring provisions of the federal acid rain program. BEPC will apply for a acid rain permit for Unit 1. A CEMS will be designed, fabricated, installed, and certified on the new unit, in accordance with the requirements of 40 CFR 75. The State of Wyoming administers the acid rain program through Regulation 11, which is an adoption by reference of the federal code. See Section 9.0 for further details with regard to the federal CEMS requirements.

4.2 Other State and Federal Air Quality Requirements

4.2.1 Overview of State Air Quality Regulations

The following comments pertain to all air quality regulations contained in WAQS&R.

- The Common Provision Chapter 1 in WAQS&R are general in nature and do not provide specific standards, limitations, or other requirements applicable to the Dry Fork Station. However, they do govern other provisions in other articles of this chapter that pertain specifically to the plant now or possibly during future operations.
- The provisions of Chapter 2 in WAQS&R, pertain to ambient air quality standards. Compliance with these regulations must be demonstrated for obtaining a PSD permit for the Dry Fork Station and therefore these requirements apply to the Dry Fork Station.
- The provisions of Chapter 3 in WAQS&R, pertain to general emissions standard for particulate matter, nitrogen oxides, carbon monoxide, volatile organic compounds, sulfur oxides, and hydrogen sulfides; in general, these provisions apply to this facility.
- The provisions of Chapter 4 in WAQS&R, contain regulations for existing sulfuric acid production units, existing nitric acid manufacturing plants, existing municipal solid waste landfills, and existing hospital/medical/infectious was incinerators; these provisions do not apply.
- The provisions of Chapter 5 in WAQS&R, pertain to implementing federal NSPS and NESHAP Program. The provisions of 40 CFR 60 are incorporated by reference in Chapter 5, Section 2.0. These provisions apply to this facility.
- The provisions of Chapter 6 in WAQS&R, establish permitting requirement for all sources constructing and/or operating in the State of Wyoming; these provisions apply to this facility.
- The provisions of Chapter 7 in WAQS&R, establish general monitoring requirements; these provisions apply to this facility.
- The provisions of Chapter 8 in WAQS&R, contain regulations specific to sources operating in nonattainment areas; these provisions do not apply to this facility.
- The provisions of Chapter 9 in WAQS&R, contain regulations specific to visibility impacts in Class I areas; these provisions apply to this facility.

The Dry Fork Station is subject to the provisions in WAQS&R Chapter 6, Section 4.0 – Prevention of Significant Deterioration Program. Pursuant to this regulation, the Dry Fork Station is required to include the following information with the PSD permit application:

- Control Technology Review – Demonstration of application of Best Available Control Technology for Unit 1 for each regulated pollutant for which the emissions are significant. This review is in Section 5.0 of this application.
- Source Impact Analysis – An analysis of the PSD pollutants' air quality impact and a demonstration that the allowable emissions from the proposed project will not contribute to a violation of any NAAQS or PSD increment. This analysis is in Section 7.0 of this application.
- Additional Impact Analysis – An analysis of the PSD pollutants' air quality related impact including an analysis of the impairment to visibility, soils, and vegetation and the projected air quality impact from general commercial, residential, industrial, and other growth associated with the source. This analysis is contained in Sections 7.0 and 8.0 of this application.

Requirements Applicable to Nonattainment Areas (WAQS&R, Chapter 8)

The Dry Fork Station is located in an area classified as attainment; therefore, this rule does not apply.

Visibility (WAQS&R, Chapter 9)

This section describes the requirements for the WDEQ review of the proposed project for the impact of its PSD pollutant emissions on visibility in any mandatory Class I area. WDEQ is required to review the PSD pollutant emission impact analysis results to determine whether the proposed project will have an adverse impact on air quality-related values (including visibility). If the review determines that the PSD pollutants impact will be adverse, pre- or post-construction monitoring may be required for the facility.

Modeling results are provided in Section 8.0 of this application.

4.1.2 Federal Air Permit Requirements

Major Source NSR/PSD (40 CFR 51)

WDEQ has full authority to administer the federal PSD and NSR rules; therefore, these rules are summarized in 4.1.1.

Operating Permit Program (40 CFR Parts 70 and 71)

WDEQ has full authority for administering the federal Title V operating permit program rules; therefore, these rules are summarized in 4.1.1. The requirements of the federal program required under the 40CFR Part 71 do not apply to this project. A Title V operating permit under 40 CFR Part 70 will be applied for within 12 months after the startup of Unit 1.

Operating Permit Requirements (Chapter 6, Section 3)

The federal operating permits program (Title V) is implemented by regulations codified at 40 CFR Parts 70 and 71. The State of Wyoming has been granted authority to implement and enforce the federal Title V program through state regulations outlined under WAQS&R Chapter 6, Section 3.0.

An application for a Title V permit is required within 1 year of commencing operation of the proposed project, as specified in Chapter 6, Section 3.0 (c) (i), Timely Permit Application for Operating Permits. BEPC will submit a separate application for the Title V permit within 12 months after the startup of the Dry Fork Station project. Therefore, this document serves only as an application for the construction permit for the Dry Fork Station project, and it does not request a Title V permit.

PSD (Chapter 6, Section 4)

Within the federal NSR regulations, a subset of rules, which apply to major sources and major modifications within attainment areas, are referred to as the PSD program. Because the proposed Dry Fork Station will be located in an area classified as attainment for all criteria pollutants, the requirements of the federal PSD program will apply to the construction of the proposed project. The WDEQ has full authority to administer the federal PSD rules; consequently, these requirements are codified within the state permitting rules at WAQS&R Chapter 6, Section 4.0.

The PSD program defines a major stationary source as:

1. Any source type belonging to one of 28 listed source categories that has PTE of 100 tpy or more of any criteria pollutant regulated under the CAA, or
2. Any other (non-categorical) source type with a PTE of 250 tpy of any pollutant regulated under the CAA.

The Dry Fork Station belongs to one of the 28 listed source categories (fossil fuel-fired steam electric plants of more than 250 mmBtu/hr heat input) and has a PTE greater than 100 tpy for SO_2, NO_x, PM, PM_{10}, and CO.

The basic PSD permitting requirements that must be met for a major project include the following:

- Application of best available control technology (BACT) (presented in Section 5.0 of this application)
- Performance of an ambient air quality impacts analysis (dispersion modeling) (presented in Section 7.0 of this application)
- Analysis of impacts to soils, vegetation, and visibility (air quality-related values [AQRVs]) (presented in Sections 7.0 and 8.0 of this application)
- Analysis of Class I area impacts (presented in Section 8.0 of this application)

These requirements apply to attainment pollutants for which the project is major. The proposed project is a new major source (subject to the federal and state PSD program requirements) for NO_X, SO_2, CO, H_2SO_4, VOC, Fluorides as HF, Beryllium, PM andPM_{10}.

SECTION 4.0

Regulatory Applicability Review and Requirements

This section provides a regulatory review of the applicability of state and federal air quality permitting requirements and air pollution control regulations for the Dry Fork Station Project proposed by BEPC. The purpose of this section is to provide appropriate explanation and rationale regarding the applicability of these regulations to the Dry Fork Station project. The review is divided into two major sections. The first section addresses state and federal air permitting requirements, and the second section addresses other state and federal air pollution control regulations.

4.1 Air Permitting Requirements

The State of Wyoming has approved authority to implement and enforce the federal Clean Air Act (CAA) pursuant to the state implementation plan (SIP) review and approval process. Federal Prevention of Significant Deterioration (PSD) air-permitting requirements are embodied within the state rules. The Dry Fork Station is a major emitting facility or major stationary source of air emissions, as defined within Wyoming Air Quality Standards and Regulations (WAQS&R) Chapter 6, Section 4.0 and 40 CFR 52.21.

4.1.1 State of Wyoming Air Permitting Requirements

The general requirements for permits and permit revisions are codified under the WAQS&R Chapter 6.

Construction Permit Application (Chapter 6, Section 2)

WAQS&R Chapter 6, Section 2.0 (1) (i) requires that a construction permit be obtained prior to commencing construction of a new or modified source of air emissions. WDEQ issues construction permits to commercial and industrial air pollution sources in Wyoming to ensure compliance with air quality regulations. The permitting process requires submission of forms provided by WDEQ. The application should include site information, plans, descriptions, specifications, and drawings showing the design of the source, the nature and amount of the emissions, and the manner in which it will be operated and controlled. A schedule for the construction or modification to the facility should also be included with the application.

The Dry Fork Station is located in an attainment area for all criteria pollutants. This construction permit application is being submitted to request issuance of a construction permit for the proposed project. Necessary application forms are also provided with this application.

Section 4

Regulatory Review

TABLE 3-20
Inlet Gas Heater HAPs

Pollutant	Annual Emissions (tpy)	Emission Factor Reference
Benzo(g,h,i)perylene	1.23E-08	AP-42, Table 1.4-3
Benzo(k)fluoranthene	1.84E-08	AP-42, Table 1.4-3
Chrysene	1.84E-08	AP-42, Table 1.4-3
Dibenzo(a,h)anthracene	1.23E-08	AP-42, Table 1.4-3
Dichlorobenzene	1.23E-05	AP-42, Table 1.4-3
Fluoranthene	3.07E-08	AP-42, Table 1.4-3
Fluorene	2.87E-08	AP-42, Table 1.4-3
Formaldehyde	7.68E-04	AP-42, Table 1.4-3
Hexane	1.84E-02	AP-42, Table 1.4-3
Indeno(1,2,3-cd)pyrene	1.84E-08	AP-42, Table 1.4-3
Naphthalene	6.25E-06	AP-42, Table 1.4-3
Phenanathrene	1.74E-07	AP-42, Table 1.4-3
Pyrene	5.12E-08	AP-42, Table 1.4-3
Toluene	3.48E-05	AP-42, Table 1.4-3
Total Organic HAPs	**1.93E-02**	**TPY**

3.9.5 Auxiliary Cooling Tower

Unit 1 will be equipped with a wet auxiliary cooling tower. The primary cooling tower related to the steam turbine will be an air cooled condenser (ACC) design and will not have any associated air emissions. The estimated annual controlled particulate emission rates from ES1-04, the wet auxiliary cooling tower, are shown in Table 3-21. The annual emissions are based on a 100 percent capacity factor.

TABLE 3-21
Unit 1 Wet Auxiliary Cooling Tower

Pollutant	Hourly Emissions (lb/hr)	Annual Emissions (tpy)	Emission Factor Reference
Total Particulate Matter	0.26	1.12	Engineering Estimates
Particulate Matter PM_{10}	0.06	0.27	Engineering Estimates

TABLE 3-19
Inlet Gas Heater Criteria Pollutants

Pollutant	Annual Emissions (tpy)	Emission Factor Reference
NO_X	1.02	AP-42, Table 1.4-1
CO	0.86	AP-42, Table 1.4-1
SO_2	6.15E-03	AP-42, Table 1.4-2
PM_{10}	0.08	AP-42, Table 1.4-2
VOC	0.06	AP-42, Table 1.4-2
Lead	5.12E-06	AP-42, Table 1.4-2

TABLE 3-20
Inlet Gas Heater HAPs

Pollutant	Annual Emissions (tpy)	Emission Factor Reference
Arsenic	2.05E-06	AP-42, Table 1.4-4
Beryllium	1.23E-07	AP-42, Table 1.4-4
Cadmium	1.13E-05	AP-42, Table 1.4-4
Chromium	1.43E-05	AP-42, Table 1.4-4
Cobalt	8.61E-07	AP-42, Table 1.4-4
Manganese	3.89E-06	AP-42, Table 1.4-4
Mercury	2.66E-06	AP-42, Table 1.4-4
Nickel	2.15E-05	AP-42, Table 1.4-4
Selenium	2.46E-07	AP-42, Table 1.4-4
Total Metal HAPs	**5.70E-05**	**TPY**
2-Methylnaphthalene	2.46E-07	AP-42, Table 1.4-3
3-Methylchloranthrene	1.84E-08	AP-42, Table 1.4-3
7,12-Dimethylbenz(a)anthracene	1.64E-07	AP-42, Table 1.4-3
Acenaphthene	1.84E-08	AP-42, Table 1.4-3
Acenaphthylene	1.84E-08	AP-42, Table 1.4-3
Anthracene	2.46E-08	AP-42, Table 1.4-3
Benz(a)anthracene	1.84E-08	AP-42, Table 1.4-3
Benzene	2.15E-05	AP-42, Table 1.4-3
Benzo(a)pyrene	1.23E-08	AP-42, Table 1.4-3
Benzo(b)fluoranthene	1.84E-08	AP-42, Table 1.4-3

TABLE 3-17
Generator Criteria Pollutants

Pollutant	Annual Emissions (tpy)	Emission Factor Reference
NO_X	1.43E+01	AP-42, Table 3.4-1
CO	3.27E+00	AP-42, Table 3.4-1
SO_2	2.40E-01	AP-42, Table 3.4-1
PM	4.16E-01	AP-42, Table 3.4-1
VOC	4.19E-01	AP-42, Table 3.4-1

TABLE 3-18
Generator HAPs

Pollutant	Annual Emissions (lb/yr)	Emission Factor Reference
Benzene	6.53E+00	AP-42, Table 3.4-3
Toluene	2.36E+00	AP-42, Table 3.4-3
Xylenes	1.62E+00	AP-42, Table 3.4-3
Formaldehyde	6.64E-01	AP-42, Table 3.4-3
Acetaldehyde	2.12E-01	AP-42, Table 3.4-3
Acrolein	6.63E-02	AP-42, Table 3.4-3
Naphthalene	1.09E+00	AP-42, Table 3.4-4
Total HAPs	**1.25E+01**	**lb/yr**

3.9.4 Inlet Gas Heater

BEPC proposes to install an 8.36 MMBTU/hr natural gas operated inlet gas heater. The hours of operation for the gas heater are estimated at 2,500 hours per year. Table 3-19 and Table 3-20 provide annual emissions for criteria pollutants and HAPs for the inlet gas heater.

3.9.2 Fire Pump

BEPC proposes to install a 360 HP diesel fuel operated fire pump. The expected hours of operation for the fire pump are 500 hours per year for periodic startup testing of the pump. Table 3-15 and Table 3-16 provide annual emissions for criteria pollutants and HAPs for the diesel fire pump.

TABLE 3-15
Fire Pump Criteria Pollutants

Pollutant	Annual Emissions (tpy)	Emission Factor Reference
NO_x	2.79E+00	AP-42, Table 3.3-1
CO	6.01E-01	AP-42, Table 3.3-1
SO_2	1.85E-01	AP-42, Table 3.3-1
PM_{10}	1.98E-01	AP-42, Table 3.3-1
VOC	2.26E-01	AP-42, Table 3.3-1

TABLE 3-16
Fire Pump HAPs

Pollutant	Annual Emissions (lb/yr)	Emission Factor Reference
Benzene	1.30E+00	AP-42, Table 3.3-2
Toluene	5.68E-01	AP-42, Table 3.3-2
Xylenes	3.96E-01	AP-42, Table 3.3-2
Propylene	3.59E+00	AP-42, Table 3.3-2
1,3-Butadiene	5.43E-02	AP-42, Table 3.3-2
Formaldehyde	1.64E+00	AP-42, Table 3.3-2
Acetaldehyde	1.07E+00	AP-42, Table 3.3-2
Acrolein	1.29E-01	AP-42, Table 3.3-2
Naphthalene	1.18E-01	AP-42, Table 3.3-2
Total HAPs	**8.85E+00**	**lb/yr**

3.9.3 Emergency Generator

BEPC proposes to install a 2,377 HP diesel fuel operated emergency generator. The estimated hours of operation for the generator are 500 hours per year for periodic startup testing of the emergency generator. Table 3-17 and Table 3-18 provide annual emissions for criteria pollutants and HAPs for the emergency generator.

TABLE 3-14
Auxiliary Boiler HAPs

Pollutant	Annual Emissions (tpy)	Emission Factor Reference
Arsenic	2.63E-05	AP-42, Table 1.4-4
Beryllium	1.58E-06	AP-42, Table 1.4-4
Cadmium	1.45E-04	AP-42, Table 1.4-4
Chromium	1.84E-04	AP-42, Table 1.4-4
Cobalt	1.10E-05	AP-42, Table 1.4-4
Manganese	5.00E-05	AP-42, Table 1.4-4
Mercury	3.42E-05	AP-42, Table 1.4-4
Nickel	2.76E-04	AP-42, Table 1.4-4
Selenium	3.16E-06	AP-42, Table 1.4-4
Total Metal HAPs	**7.31E-04**	
2-Methylnaphthalene	3.16E-06	AP-42, Table 1.4-3
3-Methylchloranthrene	2.37E-07	AP-42, Table 1.4-3
7,12-Dimethylbenz(a)anthracene	2.10E-06	AP-42, Table 1.4-3
Acenaphthene	2.37E-07	AP-42, Table 1.4-3
Acenaphthylene	2.37E-07	AP-42, Table 1.4-3
Anthracene	3.16E-07	AP-42, Table 1.4-3
Benz(a)anthracene	2.37E-07	AP-42, Table 1.4-3
Benzene	2.76E-04	AP-42, Table 1.4-3
Benzo(a)pyrene	1.58E-07	AP-42, Table 1.4-3
Benzo(b)fluoranthene	2.37E-07	AP-42, Table 1.4-3
Benzo(g,h,i)perylene	1.58E-07	AP-42, Table 1.4-3
Benzo(k)fluoranthene	2.37E-07	AP-42, Table 1.4-3
Chrysene	2.37E-07	AP-42, Table 1.4-3
Dibenzo(a,h)anthracene	1.58E-07	AP-42, Table 1.4-3
Dichlorobenzene	1.58E-04	AP-42, Table 1.4-3
Fluoranthene	3.94E-07	AP-42, Table 1.4-3
Fluorene	3.68E-07	AP-42, Table 1.4-3
Formaldehyde	9.86E-03	AP-42, Table 1.4-3
Hexane	2.37E-01	AP-42, Table 1.4-3
Indeno(1,2,3-cd)pyrene	2.37E-07	AP-42, Table 1.4-3
Naphthalene	8.02E-05	AP-42, Table 1.4-3
Phenanathrene	2.24E-06	AP-42, Table 1.4-3
Pyrene	6.57E-07	AP-42, Table 1.4-3
Toluene	4.47E-04	AP-42, Table 1.4-3
Total Organic HAPs	**2.47E-01**	

ash/FGD waste material and bottom ash from the haul trucks onto the landfill; and maintenance of the landfill.

TABLE 3-12
Ash Landfill

Pollutant	Hourly Emissions (lb/hr)	Annual Emissions (tpy)	Emission Factor Reference
Total Particulate Matter	8.31E-01	1.79E+00	AP-42 and Engineering Estimates
Particulate Matter PM_{10}	2.02E-01	4.28E-01	AP-42 and Engineering Estimates

Includes Maintenance of Landfill (FS1-03a), Fly Ash/FGD Waste Dumping onto the Landfill from Haul Trucks (FS1-03c), and Bottom Ash Dumping onto the Landfill from Haul Trucks (FS1-03d)

3.9 Auxiliary Equipment

The auxiliary equipment at the Dry Fork Station will include an auxiliary boiler, diesel fire pump, emergency generator, inlet gas heater, and auxiliary cooling tower. Both the auxiliary boiler and inlet gas heater will be operated with natural gas. The fire pump and emergency generator will be diesel fuel operated.

3.9.1 Auxiliary Boiler

BEPC proposes to install a 134.1 MMBTU/hr natural gas operated auxiliary boiler. The hours of operation for the auxiliary boiler will not exceed 2,000 hours per year. Table 3-13 and Table 3-14 provide annual emissions for criteria pollutants and HAPs for the auxiliary boiler.

TABLE 3-13
Auxiliary Boiler Criteria Pollutants

Pollutant	Annual Emissions (tpy)	Emission Factor Reference
NO_X	7.24	Vendor Data and Engineering Estimates
CO	14.7	Vendor Data and Engineering Estimates
SO_2	7.89E-02	AP-42, Table 1.4-2
PM_{10}	1.00	AP-42, Table 1.4-2
VOC	0.72	AP-42, Table 1.4-2
Lead	6.57E-05	AP-42, Table 1.4-2

TABLE 3-10
Unit 1 Fly Ash/FGD Waste Handling System

Pollutant	Hourly Emissions (lb/hr)	Annual Emissions (tpy)	Emission Factor Reference
Total Particulate Matter	3.17E-01	5.69E-01	Bin Vent Filter Grain Loading Method, WDEQ Emissions Guidance Document and Engineering Estimates
Particulate Matter PM_{10}	1.62E-01	4.34E-01	Bin Vent Filter Grain Loading Method, WDEQ Emissions Guidance Document and Engineering Estimates

Includes Fly Ash/FGD Waste Silo Separator/Filter Exhaust (ES1-21), Fly Ash/FGD Waste Silo Bin Vent Filter (ES1-22), Fly Ash/FGD Waste Loading into Trucks (FS1-01), Fly Ash/FGD Waste Disposal Paved Haul Road (FS1-02P), and Fly Ash/FGD Waste Disposal Unpaved Haul Road (FS1-02UP)

3.7 Unit 1 Bottom Ash Handling and Hauling

The estimated hourly and annual controlled particulate emission rates from the Unit 1 bottom ash handling systems are shown in Table 3-11. Bottom ash is removed from the boiler furnace by being quenched in water and then and transferred on a continuous basis to the bottom ash storage area using a drag chain conveyor. The storage area will have a concrete floor with concrete walls on three sides. Bottom ash dumped in the storage area will be loaded into haul trucks and taken to the landfill. The handling of the wet granulized bottom ash in the storage area will result in no emissions. Emissions will be generated by the haul trucks transferring material on paved and unpaved roads to the landfill. Annual emissions are based on the annual bottom ash generated at 100 percent capacity factor for the main boiler.

TABLE 3-11
Unit 1 Bottom Ash Handling System

Pollutant	Hourly Emissions (lb/hr)	Annual Emissions (tpy)	Emission Factor Reference
Total Particulate Matter	1.04E-02	2.28E-02	WDEQ Emissions Guidance Document and Engineering Estimates
Particulate Matter PM_{10}	3.13E-03	6.85E-03	WDEQ Emissions Guidance Document and Engineering Estimates

Includes Bottom Ash Disposal Paved Haul Road (FS1-04P) and Bottom Ash Disposal Unpaved Haul Road (FS1-04UP)

3.8 Fly Ash/FGD Waste Landfill

The estimated hourly and annual controlled particulate emission rates from the fly ash/FGD waste landfill are shown in Table 3-12. The table summarizes particulate emissions; details can be found in Appendix B. The sources for fugitive emissions include the dumping of fly

TABLE 3-8
Unit 1 Lime Handling

Pollutant	Hourly Emissions (lb/hr)	Annual Emissions (tpy)	Emission Factor Reference
Total Particulate Matter	2.03	8.89	Dust Collector/Bin Vent Filter Grain Loading Method and Engineering Estimates
Particulate Matter PM_{10}	2.03	8.89	Dust Collector/Bin Vent Filter Grain Loading Method and Engineering Estimates

Includes Pebble Lime Receiving Silo (ES1-12), Pebble Lime Day Silo (ES1-13), Lime Hydrator Mixers (ES1-14, ES1-15), Hydrated Lime Crushers (ES1-16, ES1-17), and Hydrated Lime Silos (ES1-18, ES1-19)

3.5 Unit 1 Sorbent Injection System

The estimated hourly and annual controlled particulate emission rates from the Unit 1 sorbent injection system (if installed) are shown in Table 3-9. The annual emissions are based on 100 percent capacity factor. The emission source will be equipped with bin vent filters to control particulate emissions. Sorbent (activated carbon or another material) will be used to control mercury emissions from the Unit 1 boiler.

TABLE 3-9
Unit 1 Sorbent Injection System

Pollutant	Hourly Emissions (lb/hr)	Annual Emissions (tpy)	Emission Factor Reference
Total Particulate Matter	3.12E-02	1.37E-01	Bin Vent Filter Grain Loading Method and Engineering Estimates
Particulate Matter PM_{10}	3.12E-02	1.37E-01	Bin Vent Filter Grain Loading Method and Engineering Estimates

Includes Sorbent Silo (ES1-20)

3.6 Unit 1 Flyash/FGD Waste Handling and Hauling

The estimated hourly and annual controlled particulate emission rates from the Unit 1 flyash/FGD waste-handling systems are shown in Table 3-10. Flyash and FGD wastes are a combined product that is collected in the fabric filter hoppers following the FGD system. Both flyash and FGD waste are loaded "dry" into the silo from the fabric filter hoppers. The silos will be equipped with bin vent filters to reduce emissions. Water is added to reduce dust emissions when unloading the combined product from the silo into the trucks. The moisture content of the combined product unloaded into the trucks is 20 percent. The combined product is hauled on paved and unpaved roads to the landfill for disposal. Annual emissions are based on the annual flyash/FGD waste generated at 100 percent capacity factor for the main boiler.

TABLE 3-6
Unit 1 Boiler Acid Gas HAPs

Pollutant	Hourly Emissions (lb/hr)	Annual Emissions (tons/yr)	Emission Factor Reference
Hydrogen Chloride	3.23	13.8	Engineering Estimates
Hydrogen Fluoride	2.62	11.2	Engineering Estimates
Total Acid Gas HAPs		**25.0**	**tpy**

3.3 Unit 1 Coal Handling

The estimated hourly and annual controlled particulate emission rates from the Unit 1 coal handling system are shown in Table 3-7. The tables summarize particulate emissions; details on each emission point can be found in Appendix B, entitled Emission Calculations. The annual emissions are based on 100 percent capacity factor. The emission sources will be equipped with fabric filter dust collectors to control particulate emissions.

TABLE 3-7
Unit 1 Coal Handling

Pollutant	Hourly Emissions (lb/hr)	Annual Emissions (tpy)	Emission Factor Reference
Total Particulate Matter	3.81	16.7	Dust Collector Grain Loading Method and Engineering Estimates
Particulate Matter PM_{10}	3.81	16.7	Dust Collector Grain Loading Method and Engineering Estimates

Includes Coal Storage Silos (ES1-07, ES1-08, ES1-09), Coal Crusher (ES1-10), and Plant Coal Transfer Bay Silo (ES1-11)

3.4 Unit 1 Lime Handling

The estimated hourly and annual controlled particulate emission rates from the Unit 1 lime handling system are shown in Table 3-8. The tables summarize particulate emissions; details on each emission point can be found in Appendix B, entitled Emission Calculations. The annual emissions are based on 100 percent capacity factor. The emission sources will be equipped with fabric filter dust collectors and/or bin vent filters to control particulate emissions.

TABLE 3-5
Unit 1 Boiler Organic HAPs

Pollutant	Controlled Hourly Emissions (lb/hr)	Controlled Annual Emissions (tpy)	Emission Factor Reference
Dimethyl sulfate	1.17E-02	4.85E-02	AP-42, Table 1.1-14
Ethyl benzene	2.29E-02	9.49E-02	AP-42, Table 1.1-14
Ethyl chloride	1.02E-02	4.24E-02	AP-42, Table 1.1-14
Ethylene dichloride	9.75E-03	4.04E-02	AP-42, Table 1.1-14
Ethylene dibromide	2.92E-04	1.21E-03	AP-42, Table 1.1-14
Formaldehyde	5.85E-02	2.42E-01	AP-42, Table 1.1-14
Hexane	1.63E-02	6.77E-02	AP-42, Table 1.1-14
Isophorone	1.41E-01	5.86E-01	AP-42, Table 1.1-14
Methyl bromide	3.90E-02	1.62E-01	AP-42, Table 1.1-14
Methyl chloride	1.29E-01	5.35E-01	AP-42, Table 1.1-14
Methyl ethyl ketone	9.50E-02	3.94E-01	AP-42, Table 1.1-14
Methyl hydrazine	4.14E-02	1.72E-01	AP-42, Table 1.1-14
Methyl methacrylate	4.87E-03	2.02E-02	AP-42, Table 1.1-14
Methyl tert butyl ether	8.53E-03	3.53E-02	AP-42, Table 1.1-14
Methylene chloride	7.07E-02	2.93E-01	AP-42, Table 1.1-14
Phenol	3.90E-03	1.62E-02	AP-42, Table 1.1-14
Propionaldehyde	9.26E-02	3.84E-01	AP-42, Table 1.1-14
Tetrachloroethylene	1.05E-02	4.34E-02	AP-42, Table 1.1-14
Toluene	5.85E-02	2.42E-01	AP-42, Table 1.1-14
1,1,1-Trichloroethane	4.87E-03	2.02E-02	AP-42, Table 1.1-14
Styrene	6.09E-03	2.52E-02	AP-42, Table 1.1-14
Xylenes	9.02E-03	3.74E-02	AP-42, Table 1.1-14
Vinyl acetate	1.85E-03	7.67E-03	AP-42, Table 1.1-14
Total Organics	**2.24E+00**	**9.28E+00**	

TABLE 3-5
Unit 1 Boiler Organic HAPs

Pollutant	Controlled Hourly Emissions (lb/hr)	Controlled Annual Emissions (tpy)	Emission Factor Reference
Biphenyl	4.14E-04	1.72E-03	AP-42, Table 1.1-13
Acenaphthene	1.24E-04	5.15E-04	AP-42, Table 1.1-13
Acenaphthylene	6.09E-05	2.52E-04	AP-42, Table 1.1-13
Anthracene	5.12E-05	2.12E-04	AP-42, Table 1.1-13
Benzo(a)anthracene	1.95E-05	8.08E-05	AP-42, Table 1.1-13
Benzo(a)pyrene	9.26E-06	3.84E-05	AP-42, Table 1.1-13
Benzo(b,j,k)fluoranthene	2.68E-05	1.11E-04	AP-42, Table 1.1-13
Benzo(g,h,i)perylene	6.58E-06	2.73E-05	AP-42, Table 1.1-13
Chrysene	2.44E-05	1.01E-04	AP-42, Table 1.1-13
Fluoranthene	1.73E-04	7.17E-04	AP-42, Table 1.1-13
Fluorene	2.22E-04	9.19E-04	AP-42, Table 1.1-13
Ideno(1,2,3-cd)pyrene	1.49E-05	6.16E-05	AP-42, Table 1.1-13
Naphthalene	3.17E-03	1.31E-02	AP-42, Table 1.1-13
Phenanthrene	6.58E-04	2.73E-03	AP-42, Table 1.1-13
Pyrene	8.04E-05	3.33E-04	AP-42, Table 1.1-13
5-Methyl chrysene	5.36E-06	2.22E-05	AP-42, Table 1.1-13
Total PAH	**5.06E-03**	**2.10E-02**	
Acetaldehyde	1.39E-01	5.76E-01	AP-42, Table 1.1-14
Acetophenone	3.65E-03	1.51E-02	AP-42, Table 1.1-14
Acrolein	7.07E-02	2.93E-01	AP-42, Table 1.1-14
Benzene	3.17E-01	1.31E+00	AP-42, Table 1.1-14
Benzyl chloride	1.71E-01	7.07E-01	AP-42, Table 1.1-14
Bis(2-ethylhexyl)phthalate	1.78E-02	7.37E-02	AP-42, Table 1.1-14
Bromoform	9.50E-03	3.94E-02	AP-42, Table 1.1-14
Carbon disulfide	3.17E-02	1.31E-01	AP-42, Table 1.1-14
2-Chloroacetophenone	1.71E-03	7.07E-03	AP-42, Table 1.1-14
Chlorobenzene	5.36E-03	2.22E-02	AP-42, Table 1.1-14
Chloroform	1.44E-02	5.96E-02	AP-42, Table 1.1-14
Cumene	1.29E-03	5.35E-03	AP-42, Table 1.1-14
~~Cyanide~~	~~6.09E-01~~	~~2.52E+00~~	~~AP-42, Table 1.1-14~~
2,4-Dinitrotoluene	6.82E-05	2.83E-04	AP-42, Table 1.1-14

TABLE 3-3
Unit 1 Boiler Criteria Pollutants

Pollutant	Hourly Emissions (pounds per hour [lb/hr])	Annual Emissions (tons per year [tpy])	PSD Significant Emission Rates (tpy)	Emission Factor Reference
Mercury	0.0113	0.047	0.1	Dry Fork Mine Coal Analysis
Sulfuric Acid Mist	9.5	40.6	7	Engineering Estimates
Fluorides (as HF)	2.6	11.2	3	Engineering Estimates

The total PM and PM_{10} emissions include filterable, condensable (hydrogen chloride, hydrogen fluoride, sulfuric acid, ammonium sulfate and organic condensables) and elemental carbon emissions.

3.2 Unit 1 Boiler Hazardous Air Pollutant Emissions

The estimated annual controlled emission rates of trace metal hazardous air pollutants (HAPs), organic compounds, and acid gas HAPs for ES1-01, the Unit 1 stack, are shown in Tables 3-4, 3-5, and 3-6. Unit 1 will be designed to burn coal from the adjacent Dry Fork Mine. The metal concentration was used to estimate the trace metal HAP emissions. Hourly emissions are estimated at peak operation for the boiler; and annual emissions are estimated at 100 percent capacity factor for the boiler.

TABLE 3-4
Unit 1 Boiler Trace Metal HAPs

Pollutant	Hourly Emissions (lb/hr)	Annual Emissions (tons/yr)	Emission Factor Reference
Antimony	3.23E-03	1.34E-02	Coal Analysis
Arsenic	3.23E-03	1.34E-02	Coal Analysis
Beryllium	9.68E-04	4.01E-03	Coal Analysis
Cadmium	6.45E-04	2.67E-03	Coal Analysis
Chromium	9.68E-03	4.01E-02	Coal Analysis
Cobalt	6.45E-03	2.67E-02	Coal Analysis
Lead	6.45E-03	2.67E-02	Coal Analysis
Manganese	2.58E-02	1.07E-01	Coal Analysis
Mercury	1.31E-02	4.68E-02	Coal Analysis
Molybdenum	3.23E-03	1.34E-02	Coal Analysis
Nickel	1.29E-02	5.35E-02	Coal Analysis
Selenium	3.23E-02	1.34E-01	Coal Analysis
Total Trace Metal HAPs		**0.48**	**tpy**

TABLE 3-2
Auxiliary Equipment - Air Emission Sources and Regulated Air Pollutants

Source Number	Emission Point	Regulated Air Pollutants
ES1-02	Auxiliary Boiler	SO_2, NO_x, PM/PM_{10}, CO, VOC, Lead, HAPs
ES1-03	Fire Pump	SO_2, NO_x, PM/PM_{10}, CO, VOC, HAPs
ES1-04	Auxiliary Cooling Tower	PM, PM_{10}
ES1-05	Emergency Generator	SO_2, NO_x, PM/PM_{10}, CO, VOC, HAPs
ES1-06	Inlet Gas Heater	SO_2, NO_x, PM/PM_{10}, CO, VOC, Lead, HAPs

Emissions shown in the sections and tables below represent potential emissions of all pollutants (regulated and unregulated), are being presented to thoroughly describe the proposed facility, however, proposed permit limits are in listed in Section 6.3.

3.1 Unit 1 Boiler Criteria Emissions

The estimated hourly and annual controlled emission rates of criteria pollutants from ES1-01, the Unit 1 stack, are shown in Table 3-3. The hourly emissions are estimated at peak conditions and the annual emissions are estimated at 100 percent load operation for the entire year. The peak operating conditions assume a worst case coal analysis and maximum heat input to the boiler of 3,801 mmBtu/hr. The annual emissions assume an average expected coal analysis, heat input to the boiler of 3,701 mmBtu/hr and annual capacity factor of 100 percent.

TABLE 3-3
Unit 1 Boiler Criteria Pollutants

Pollutant	Hourly Emissions (pounds per hour [lb/hr])	Annual Emissions (tons per year [tpy])	PSD Significant Emission Rates (tpy)	Emission Factor Reference
Sulfur Dioxide	380	1,625	40	Engineering Estimates
Nitrogen Oxides	266	1,137	40	Engineering Estimates
Filterable Particulate Matter	57.0	244		Engineering Estimates
Total Particulate Matter	76.0	325	25	Engineering Estimates
Filterable Particulate Matter PM_{10}	45.6	195		Engineering Estimates
Total Particulate Matter PM_{10}	64.6	276	15	Engineering Estimates
Carbon Monoxide	570	2,437	100	Engineering Estimates
VOCs	14.6	60.6	40	AP-42 Table 1.1-19
Lead	0.006	0.03	0.6	Dry Fork Mine Coal Analysis
~~Beryllium~~	~~0.00097~~	~~0.0040~~	~~0.0004~~	~~Dry Fork Mine Coal~~ Analysis

SECTION 3.0

Emissions Summary

Emission estimates were prepared for all point and fugitive emissions sources from the Dry Fork Station including the main PC boiler, material-handling sources, and auxiliary equipment. The Dry Fork Station will have material-handling operations for coal, flyash, flue gas desulfurization (FGD) waste, lime, sorbent (activated carbon), and ash disposal. Annual emissions were estimated based on 100 percent capacity factor (full load operation for 8,760 hours per year). BEPC may elect to install a sorbent injection system, using a material such as activated carbon, for reducing mercury emissions from the main boiler. Detailed emission calculations are provided in Appendix B.

The major air emission sources and regulated air pollutants for the project are shown in Table 3-1.

TABLE 3-1
Major Air Emission Sources and Regulated Air Pollutants

Source Number	Emission Point	Regulated Air Pollutants
ES1-01	Main Boiler – Unit 1 Stack	SO_2, NO_x, PM, PM_{10}, CO, VOC, Lead, Beryllium, Mercury, H_2SO_4, HF, HAPs
ES1-07, ES1-08, ES1-09, ES1-10, ES1-11	Coal Handling	PM, PM_{10}
ES1-12, ES1-13, ES1-14, ES1-15, ES1-16, ES1-17, ES1-18, ES1-19	Lime Handling	PM, PM_{10}
ES1-20	Mercury Sorbent (Activated Carbon) Handling	PM, PM_{10}
ES1-21, ES1-22, FS1-01	Fly Ash/FGD Waste Handling	PM, PM_{10}
FS1-02P, FS1-02UP	Fly Ash/FGD Waste Haul Roads – Paved and Unpaved	PM, PM_{10}
FS1-04P, FS1-04UP	Bottom Ash Haul Roads – Paved and Unpaved	PM, PM_{10}
FS1-03	Ash/FGD Waste Landfill	PM, PM_{10}

The air emission sources and regulated air pollutants for the auxiliary equipment are shown in Table 3-2.

Section 3
Emissions
Summary

Mill rejects from the coal mill reject hoppers will be conveyed by hydro-ejectors to the SDC trough. The mill rejects will combine with the furnace ash and will be conveyed to a bottom ash storage area as described above.

The Economizer ash will be collected with dry flight conveyors. Economizer ash also be combined with the bottom ash and will be conveyed to a bottom ash storage area as described above.

Material from the bottom ash storage area will be loaded into trucks by a front end loader and hauled to the ash landfill for disposal. Figure A-6 in Appendix A shows the economizer bottom ash and mill rejects ash handling system.

2.4.4 Sorbent Injection System (Activated Carbon Handling)

A sorbent injection system may be installed to remove additional mercury from the flue gas.

Sorbent reagent (e.g. activated carbon) would be delivered to the Station by truck and trailer. The trailers are totally enclosed, over the road, 25-ton capacity trailers. The trucks would park next to the sorbent preparation building and connect a rubber conveyance hose to the truck and to a fixed conveyance pipe for the storage silo. The trucks would use their own compressor system to pneumatically offload the sorbent to the storage silo. While filling the storage silo, an exhaust filter on top of the storage silo filters the displaced air.

To control emissions generated from the handling of the sorbent, the system is equipped with a dust collection system at the discharge of the screw conveyor and along the bucket elevator. This is piped to the bin vent filters on the storage silos.

The sorbent will be taken from the storage silo and metered into an injection system. The injection system will use compressed air to carry the sorbent to a series of injection nozzles located in the boiler flue gas duct upstream of the dry lime FGD system or the baghouse system. The sorbent will capture mercury in the flue gas and will be collected in the baghouse along with the fly ash and waste material from the FGD system. Figure A-9 in Appendix A shows the activated carbon material handling system.

2.4.5 Anhydrous Ammonia Unloading/Storage System

Anhydrous ammonia will be transported to plant by truck and stored in large gas storage vessels. The gaseous ammonia will then be piped to injection nozzles in the boiler flue gas exit duct upstream of the SCR system. The combined ammonia and flue gas will enter the SCR system and pass over the catalyst where the NO_x in the flue gas reacts with the ammonia to form nitrogen gas and water. The use of anhydrous ammonia will require the submittal of a Risk Management Plan (RMP) per 40 CFR Part 68 requirements.

offload the lime to the storage silo. From the storage silo, lime is transferred to the lime day bin.

A day bin with a 24-hour capacity will be located in the reagent preparation building to supply lime to the conditioning equipment. The day bin level will be maintained by pneumatically transferring the lime from the storage silo to a transfer hopper, which then discharges into a conveyance pipe and conveys the lime using positive pressure to the day bin. From the lime day bin, lime is conveyed to mixer seasoning chambers where the lime is hydrated before it is sent to the hydrated lime crusher by screw conveyor. From the hydrated lime crusher, the crushed hydrated lime is pneumatically transferred to one of two hydrated lime silos. From the hydrated lime silos, the material is then utilized by the dry scrubber system to remove SO_2 from the flue gas stream.

To control emissions generated from the lime, the system is equipped with a dust collection system and bin vent filters on the storage silo, and day bin. Figure A-8 in Appendix A shows the lime and hydrated lime material handling system.

2.4.2 Fly Ash and FGD Waste Handling System

Fly ash and dry lime FGD waste entrained in the hot boiler flue gas will be removed from the flue gas using a fabric filter baghouse. Ash will also be collected from other various locations throughout the duct work system by means of ash hoppers located beneath the collection locations where the flue gas becomes stagnate and ash tends to settle out. The flyash/FGD waste handling system will be comprised of an independent pneumatic ash conveyance and storage system. The fabric filter baghouse will have an ash hopper beneath each compartment connected to the ash conveyance system.

The fly ash/FGD waste will be transported through vacuum conveyance lines to the filter separators located on top of the ash storage silo. The filter separators will discharge the collected fly ash/FGD waste into transfer hoppers and then directly into the ash silo. The filter separators will be designed with sufficient bag filtering capacity to control emissions, along with a bin ventilation filter, which will be responsible for filtering the displaced silo air. Electric motor-driven vacuum exhausters will provide conveying air for the system.

As the silo becomes full, ash will be periodically removed from the silo into trucks. The ash will pass through a water and ash mixer (pin mixer) to condition the fly ash/FGD waste prior to loading onto trucks for haulage to the ash landfill. The bottom of the storage silo will also be equipped with a complete fluidizing air system to fluidize the stored ash so it will flow through the conditioning system into the haul truck. The fluidizing air system includes a porous fluidizing media, that will use air from air blowers. Figure A-7 in Appendix A shows the ash and FGD waste handling system.

2.4.3 Bottom Ash Handling System

Furnace ash from the steam generator furnace collects in the bottom of the boiler in a water filled trough. The bottom ash is removed by a submerged drag conveyor (SDC) on a continuous basis. Seal plates secured to the steam generator tubes are suspended in the SDC trough to form the furnace water seal. The collected bottom ash will be dragged along the conveyor up an incline where it will be dewatered before being discharged into an outdoor storage bunker.

2.2.4 Sorbent Injection System

A sorbent injection system using activated carbon or other suitable sorbent material may be provided for Unit 1 to remove mercury from the boiler flue gas stream. Additional details on the mercury removal process are provided in the BACT analysis Section 5.0.

2.3 Coal Handling System

The coal handling system design can be found in Appendix A Figure A-5, Coal Flow Diagram. Coal is received at the station from the Dry Fork mine via a 48-inch-wide overland belt conveyor. The conveyor will be approximately 2,700 feet in length and will transport coal at a rate of 1,350 tons per hour (tph) from the mine to the transfer house (transfer house 2). From the transfer house, coal is then conveyed to the three coal storage silos. Coal can also be sent directly to the coal crusher house from the transfer house via a 42-inch-wide conveyor, bypassing the coal silos. The Crusher House incorporates a surge bin with two vibratory feeders each discharging to a crusher. The coal is then loaded onto one of two 900 tph, 42-inch-wide conveyors. These conveyors convey the coal to the plant's transfer conveyor bay. The coal is discharged from the transfer conveyor bay onto two 900 tph tripper conveyors (K1 and K2). The tripper conveyors feed the six in-plant coal silos for Unit 1 located next to the boiler.

In an emergency, coal can also be delivered via truck into a below ground truck hopper. The coal from the truck hopper is conveyed to transfer house 2, then to the coal silos. From the coal silos, the coal is transferred via enclosed conveyor to the coal crusher house.

2.3.1 Dust Control

The coal handling system employs a number of effective mechanisms for minimizing fugitive dust emissions.

- All coal transfer buildings and the crusher building are enclosed.
- Bag house type dust collection systems are provided for each of the enclosed conveyor transfers and the crushers. Dry fogging may also be used.

2.4 Material Handling

2.4.1 Scrubber Additive (Lime) Handling and Preparation System

The FGD system utilizes lime to remove SO_2 from the flue gas and therefore requires a lime handling system, which receives, stores and processes crushed lime. Although several different technologies are available, this description reflects use of a circulating dry lime FGD system.

Lime will be delivered to the Station by truck and trailer. The trailers are totally enclosed, over the road, 25-ton capacity trailers. The truck will park next to the lime unloading building, and connect a rubber conveyance hose to the trailer and to a fixed conveyance pipe for the lime storage silo. The truck will use its own compressor system to pneumatically

Based on technical information provided by boiler vendors, it is anticipated that NO_x emissions from the boiler (prior to the SCR) can be controlled with low NO_x burners and overfire air to 0.20 to 0.25 lb/mmBtu (approximately 148 to 185 ppmvd at 3 percent O_2) while maintaining acceptable levels of CO and VOC. Assuming a NO_x inlet concentration of 148 to 185 ppmvd at 3 percent O_2, the SCR will be designed to reduce the NO_x concentration to approximately 50 ppmvd at 3 percent O_2, or 0.07 lb/mmBtu. This represents an overall removal efficiency of approximately 65 to 72 percent.

The preliminary SCR operating parameters are summarized in Table 2-4.

TABLE 2-4
SCR Operating Parameters

Parameter	Unit	Estimated Design Value
Maximum Ammonia Feed Rate	lb/hr	196
NOx Inlet Concentration	ppmvd @ 3% O_2	148 -185
NOx Inlet Emission Rate to SCR	lb/mmBtu	0.20 – 0.25
NOx Outlet Concentration	ppmvd @ 3% O_2	50
NOx Outlet Emission Rate	lb/mmBtu	0.07
NOx Control Efficiency	%	66 - 72
Ammonia Slip	ppmvd @ 3% O_2	2
Catalyst Life	years	2 - 3

2.2.3 Fabric Filter

A fabric filter dust collector system (or "baghouse") will be provided for Unit 1 to remove particulate matter from the boiler flue gas stream. The fabric filter system will consist of a number of compartments containing fabric filter bags fitted over a wire cage and suspended from a horizontal tube sheet in the compartment. Additional details on the baghouse particulate removal process are provided in the BACT analysis Section 5.0.

The fabric filter system will be designed to achieve a maximum filterable PM_{10} emission rate of 0.012 lb/MMBtu with a design collection efficiency of 99.8 percent. The maximum filterable PM emission rate will be 0.015 lb/mmBtu. Anticipated fabric filter system parameters are summarized in Table 2-5.

TABLE 2-5
Anticipated Fabric Filter Design Parameters

Parameter	Units	Estimated Design Value
Flue Gas Flow Rate to Fabric Filter	acfm	1,507,797
Inlet Gas Temperature	°F	170
Inlet Total Particulate Loading	lb/hr	18,596
Outlet Total Particulate Loading	lb/hr	45.6
Collection Efficiency	%	99.80
Outlet PM Emission Rate	lb/mmBtu	0.015
~~Outlet PM_{10} Emission Rate~~	~~lb/mmBtu~~	~~0.012~~

2.2 Emissions Control Equipment

2.2.1 Flue Gas Desulfurization System

The Unit 1 boiler unit will be equipped with a dry lime flue gas desulfurization (FGD) system. The FGD system, located upstream from the fabric filter, removes sulfur dioxide (SO_2) from the flue gas stream by use of a lime slurry absorption process. Additional details on the lime FGD process are provided in the BACT analysis section of this application in Section 5.0.

The FGD system will be designed to consistently achieve a controlled SO_2 emission rate of 0.10 lb/mmBtu on a 3-hour block average basis. Assuming a maximum uncontrolled SO_2 emission rate of 1.21 lb/mmBtu, this represents an overall SO_2 removal efficiency of approximately 91.7 percent.

Preliminary design and operating parameters for the FGD system are summarized in Table 2-3.

TABLE 2-3
Flue Gas Desulfurization Operating Parameters

Parameter	Unit	Design
General Description		Dry Lime FGD
Number of Scrubber Modules		2
Flue Gas Flow Rate	acfm	1,477,829
Flue Gas Temperature (inlet)	°F	284
Flue Gas Temperature (outlet)	°F	170
Inlet SO_2 Emission Rate	lb/mmBtu	0.82 to 1.21
Outlet SO_2 Emission Rate	lb/mmBtu	0.10
SO_2 Collection Efficiency	%	92
HCl Collection Efficiency	%	90
HF Collection Efficiency	%	90
Calcium to Sulfur Molar Ratio		1.30
Lime Feed Rate	lb/hr	5,790

2.2.2 Low NO_x Burners and Selective Catalytic Reduction

Unit 1 will have LNBs to reduce the formation of NO_x in the combustion process in the boiler. Low NO_x burners control the formation of NO_x by staging the combustion of the coal to keep the peak flame temperature below the threshold for NO_x formation. The burner initially introduces the coal into the boiler with less air than is needed for complete combustion. The flame is then directed toward an area where additional combustion air is introduced from OFA ports allowing final combustion of the fuel. Unit 1 will also be equipped with a selective catalytic reduction (SCR) reactor to reduce NO_x emissions from the boiler. SCR is the state-of-the-art technology for the reduction of NO_x from flue gas streams. The proposed SCR will be designed for high dust loading applications, and will be located external from the boiler at the outlet of the boiler economizer section. The SCR will use anhydrous ammonia to react with NO_x in the flue gas to produce nitrogen gas and water. Additional details on the SCR process are provided in the BACT analysis in Section 5.0.

along the boiler front, with an enclosed coal tripper gallery. The principal components of the boiler will be:

- membrane wall furnace
- superheater
- reheater
- economizer
- convection pass
- coal feeders
- coal pulverizers
- low NO_x burners (LNBs), overfire air ports, fans, and air heater
- induced draft, forced draft and primary air fans
- air preheaters
- boiler wall cleaning/sootblowing system
- flues and ducts
- piping and valves

TABLE 2-1
Coal Characteristics (As Received Proximate)

Parameter	Unit	Design	Minimum	Maximum
Gross (Higher) Heating Value	Btu/lb	8,045	7,800	8,300
Moisture	wt %	32.1	30.5	33.8
Volatile Matter	wt %	30.1	28.0	32.0
Sulfur Content	wt %	0.33	0.25	0.47
Ash Content	wt %	4.8	4.2	6.5
Maximum Uncontrolled SO_2 Emission Rate	lb/mmBtu	0.82	0.60	1.21

TABLE 2-2
Boiler Parameters

Plant Parameter	Unit	Design Maximum
Gross Plant Output	Gross-kW	422,000
Net Plant Output	Net-kW	385,000
Full Load Heat Input to Boiler	mmBtu/hr	3,801
Coal Feed Rate	lb/hr	487,319

2.1.1.1 Unit #1 Process Description

The source of coal for the project will be the adjacent Dry Fork Mine. Coal from the mine, will be delivered to the power plant via a covered, overland conveyor belt. The proposed primary fuel will be a sub-bituminous coal. Natural gas will be used for light off, startup, and flame stabilization. Coal and natural gas burner configurations and combustion control systems will be designed to provide high combustion efficiency and to control the production of NO_x in the flue gas.

Emissions associated with the PC boiler will be controlled through various reduction methods. The sulfur dioxide (SO_2) emissions will be controlled with a dry lime flue gas desulfurization (FGD) system. Boiler particulate emissions will be controlled with a fabric filter dust collector (baghouse). Emissions of nitrogen oxides (NO_x) will be controlled with a combination of low NO_x burners (LNBs), overfire air (OFA) and Selective Catalytic Reduction (SCR). Mercury will be controlled with the FGD and baghouse system and additional sorbent injection (e.g. activated carbon) as needed.

Cooling of steam to condensate-feedwater will be done through an air cooled condenser. The Dry Fork Station will conserve water by not having a conventional wet cooling tower to assist in the condensation of the steam in the turbine exhaust back into water. There will be a small auxiliary wet cooling tower to cool various pieces of process equipment in the Station such as air compressors, but the main plant cooling will be done with a dry condenser. Process flow diagrams showing details for the various components of the Dry Fork Station are located in Appendix A. Figure A-1 shows the general arrangement of the property and Figure A-2 shows the general arrangement and layout of the plant. Specific emission points and details associated with those emission points are shown on Figures A-3 and A-4.

The flue gas from the boiler will pass through the SCR, FGD and fabric filter emission control systems then through the induced draft fans and will be exhausted through a stack to the atmosphere. The stack will be 500 feet tall and will consist of an outer concrete wind shell and an inner flue. A continuous emission monitoring system (Part 75 CEMS) and COMS will be provided to monitor emissions.

Boiler

The proposed Unit 1 boiler will be an indoor-type pulverized coal fired boiler designed for "base load" operation. The unit will have a maximum gross heat input of approximately 3,801 MMBtu/hr, a maximum gross generation output of 422 MW and a maximum net generation output of 385 MW. The primary fuel for Unit 1will be Dry Fork Mine subbituminous coal. Natural gas will be used as the start-up fuel and for use in the auxiliary boiler. Gross and net generation at average plant conditions is expected to be somewhat lower.

It is anticipated that the Unit 1 boiler will be a dry-bottom, tangentially-fired or wall-fired (front and rear) boiler with low NO_x burners and overfire air ports. Specifications for the proposed boiler are included in Table 2-2. Flue gas from Unit 1 will pass through a series of post-combustion emission control devices, described in Section 2.2 of this permit application, and discharge through one 500-foot stack.

The boiler area will be a totally enclosed design. Burners will be located at various levels either in the four corners or in the front and back furnace walls. The coal silos will be located

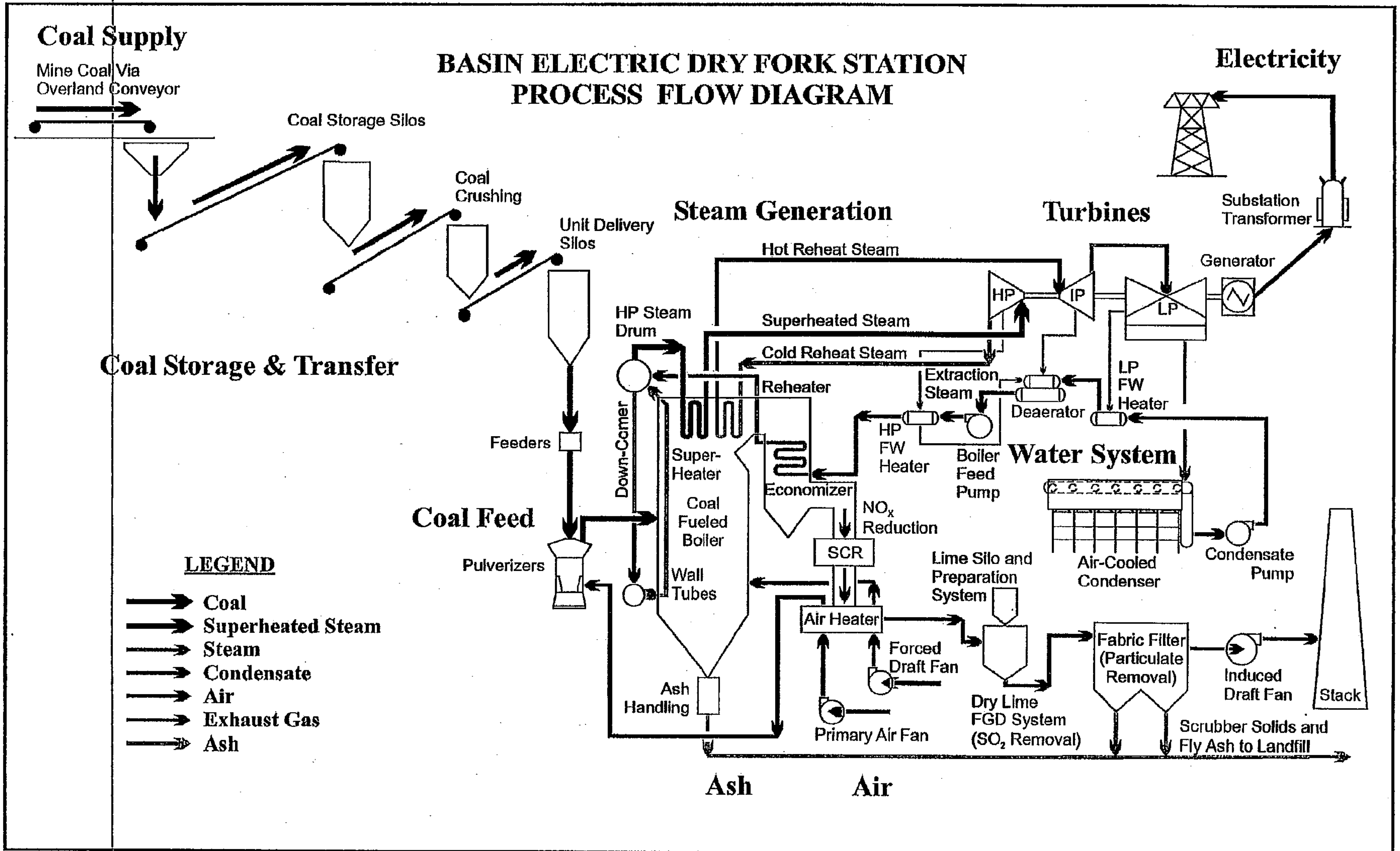


FIGURE 2-2
General Process Diagram for Dry Fork Station

DEQ/AQD 000028

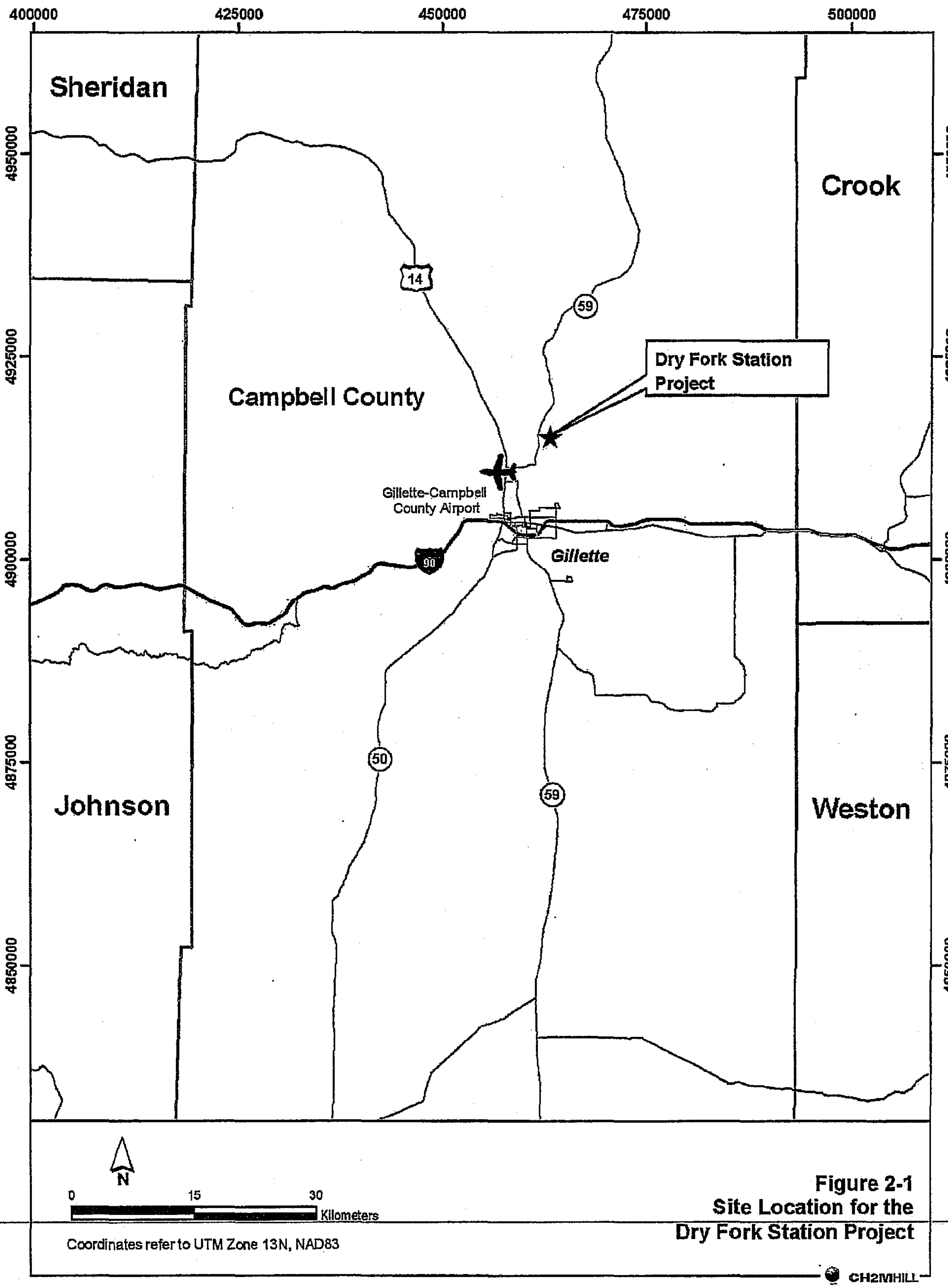


Figure 2-1
Site Location for the Dry Fork Station Project

of the boiler to be made again into steam. The heaters increase the efficiency of the overall process.

The complete water and steam loop from the boiler, through the turbine, into the condenser, through the condensate and feedwater systems, and back to the boiler is called the condensate-feedwater steam cycle.

The major component systems of the proposed Dry Fork Station are as follows:

1. Fuel Handling
2. Generating Unit
3. Emissions Control Equipment
4. Material Handling

These systems consist of the following sub-systems:

Fuel Handling

a. Coal Handling
b. Diesel Fuel System
c. Natural Gas System

Generating Unit

a. Boiler
b. Steam Turbine
c. Boiler Feedwater System
d. Air-cooled Condenser

Emissions Control Equipment

a. Low- NO_x Burners and Overfire Air
b. Selective Catalytic Reduction System
c. Dry Scrubber System
d. Fabric Filter
e. Sorbent injection (e.g. activated carbon) system

Material Handling

a. Fly Ash Collection, Transport and Disposal
b. Bottom Ash Collection, Transport and Disposal
c. Lime Unloading, Storage and Transport
d. Anhydrous Ammonia Unloading, Storage and Transport
e. FGD Waste Collection, Transport and Disposal

The summary description for the Dry Fork Station provided below includes a description of those systems which contain or affect this facility's air emissions. Other systems, not containing or impacting air emissions, or those systems with air emissions deemed insignificant by the WDEQ are not included in this process description.

SECTION 2.0

Process Description

2.1 Facility Description

Basin Electric Power Cooperative (BEPC) proposes to construct the Dry Fork Station Project near Gillette, Wyoming approximately four miles northeast of the Gillette-Campbell County Airport. (Figure 2-1). The proposed power plant would include one pulverized coal (PC) boiler that would be capable of generating a maximum of 422 MW gross and 385 MW net.

2.1.1 General Process Description

Figure 2-2 is a general process flow diagram for the Dry Fork Station. The generating plant produces electricity by combusting coal in a boiler to produce heat to convert water to steam. The steam powers a turbine that turns an attached electric generator producing electricity.

The Dry Fork Station consists of the following components:

1. Boiler
2. Turbine
3. Generator
4. Air-cooled Condenser
5. Auxiliary Equipment (auxiliary boiler, emergency generator, fire pump, fuel gas heater, auxiliary cooling tower)
6. Fuel Handling System
7. Emissions Control Equipment
8. Other Material Handling Systems (ash, lime, sorbent)

In the Dry Fork Station's coal fired boiler, tubes containing water line the inside of the furnace walls. The coal that enters the furnace is ignited and burned. The burning coal releases thermal energy, which is absorbed by the water in the tubes. The temperature of the water rises and the water boils, producing steam. The steam is piped from the boiler to the steam turbine.

The steam turbine is comprised of blades attached to a rotating shaft. The Dry Fork Station steam turbine has both stationary and rotating blades. As the high-pressure steam from the boiler passes through the turbine blades, the pressure and thermal energy of the steam is converted to mechanical energy, causing the rotating set of blades to turn the shaft of the turbine. The steam turbine shaft is coupled to the shaft of the electrical generator. The generator converts the mechanical energy of the rotating shaft into electric energy.

After the steam passes through the turbine, it flows into the air-cooled condenser (ACC). In the ACC, the steam is cooled and condensed back into water. The water is then pumped back to the boiler through a series of low-pressure feedwater (condensate) heaters, a deaerator, and several high-pressure feedwater heaters. The water is then pumped back into the tubes

Section 2

Project Description

- **Appendix B – Emissions Calculations.** This appendix provides the calculations that were used to determine the criteria and HAP emissions for this permit application.
- **Appendix C – Summary of Wyoming (WAQS&R) Regulatory Review Requirements.** This appendix includes regulatory review tables for the Wyoming air quality regulations.
- **Appendix D – Summary of Federal Regulatory Review Requirements.** This appendix includes regulatory review tables for federal air quality regulations.
- **Appendix E – RACT/BACT/LAER Clearinghouse Data.** This appendix includes a list of recently issued PSD permit limits and a print out of RBLC database tables used for the BACT analysis.
- **Appendix F – BACT Cost Analysis.** This appendix includes documentation for the BACT cost analysis.
- **Appendix G – Supporting Documentation for Near-Field Modeling.** This appendix provides supporting documentation for the near-field modeling analysis.
- **Appendix H – Supporting Documentation for Far-Field Modeling.** This appendix provides supporting documentation for the far-field modeling analysis.

State-of-the-art pollution controls are proposed for the Dry Fork Station that will make the project one of the cleanest coal-fired power plants in the nation. Pollution controls include selective catalytic reduction (SCR) to control NO_x, dry lime flue gas desulfurization to control SO_2, a fabric filter to control particulate matter and the ability to add sorbent injection (e.g. activated carbon) for mercury control (if needed at a future date).

1.3 Permit Application Organization

This application document is organized into ten sections and seven appendices:

- **WDEQ Permit Application Form**
- **Section 1.0 – Introduction.** This section provides an overview of the project and describes the report organization.
- **Section 2.0 – Project Description.** This section includes a detailed description of the proposed project including the boiler, emission control equipment, and material handling systems.
- **Section 3.0 – Emissions Summary.** This section provides a summary of emissions related information, including boiler stack and auxiliary equipment emissions, and material handling emission estimates.
- **Section 4.0 – Regulatory Applicability Review.** This section contains a detailed regulatory review of all state and federal air regulations that may impact the permitting, construction, or operation of the proposed project.
- **Section 5.0 – Control Technology Analysis.** This section includes a control technology analysis for criteria pollutants (BACT Analysis), a discussion of the Clean Air Mercury Rule (CAMR) relating to the main boiler and a MACT analysis for the auxiliary boiler.
- **Section 6.0 – Requested Permit Limits.** This section presents a discussion of requested permit limits to reflect consistency with assumptions made in the analysis of project related emissions.
- **Section 7.0 – Near-Field Air Quality Impact Analysis.** This section includes the Class II area (near-field) air quality modeling analyses, including a review of growth impacts and impacts to soils and vegetation.
- **Section 8.0 – Far-Field Air Quality Impact Analysis.** This section includes the modeling analyses for Class I and Class II areas located more than 50 kilometers from the proposed project, including analyses for visibility, criteria pollutant impacts, and deposition.
- **Section 9.0 – Monitoring Information.** This section presents monitoring-related information.
- **Section 10.0 – Compliance Plan and Certification.** This section presents information relative to the compliance plan for the project.
- **Appendix A – Process Flow Diagrams.** This appendix includes process flow diagrams and general arrangement drawings for the project.

SECTION 1.0

Introduction

Basin Electric Power Cooperative (BEPC) proposes to construct a new coal fired electric power generating station adjacent to the Dry Fork Mine northeast of Gillette, Wyoming. The proposed project, the Dry Fork Station Project, would include one pulverized coal (PC) boiler that would be capable of generating a maximum 422 MW of power (gross). This document serves as an application to the Wyoming Department of Environmental Quality (WDEQ) Air Quality Division (AQD) for a construction permit in accordance with Wyoming Air Quality Standards and Regulations (WAQS&R). As a "major emitting facility" as defined in Chapter 6, Section 4.0 of the WAQS&R, the project will be subject to Prevention of Significant Deterioration (PSD) rules.

This application includes the WAQS&R Chapter 6, Section 2.0 permit application form, a project description, emissions information, regulatory review, a Best Available Control Technology (BACT) analysis, a description of requested permit limits, descriptions and results of Class I and Class II area air quality dispersion modeling, monitoring information, and a compliance plan.

1.1 Project Emission Levels

Emissions from the Dry Fork Station will exceed PSD significant annual emission rates and will therefore be subject to review under PSD rules for carbon monoxide (CO), particulate matter (PM), particulate matter less than 10 microns (PM_{10}), volatile organic compounds (VOC), sulfur dioxide (SO_2), nitrogen oxides (NO_x), sulfuric acid mist (H_2SO_4), beryllium (Be), and fluorides (as HF).

The Dry Fork Station will be located in an attainment area for all criteria pollutants. The project will meet all National Ambient Air Quality Standards (NAAQS) and Class II PSD increments in the vicinity of the plant, and Class I increments at distant Class I areas.

The Dry Fork Station will also be a major emitter of hazardous air pollutants (HAPs) as defined in the Clean Air Act at 42 U.S. C. § 7412(g)(2). Dry Fork Station will comply with the newly promulgated mercury emission standard of 78×10^{-6} lbs/MWH but is not subject to a requirement to perform a maximum achievable control technology (MACT) analysis for this or other HAPs.

1.2 Overview

The addition of the Dry Fork Station will result in additional power generating capacity to sustain current and future power demands in the BEPC service area. This project will result in economic benefit through the creation of jobs during facility construction, permanent jobs during startup and operation, and employment opportunities associated with facility support.

Section 1

Introduction

WDEQ Permit Application Form
Table 1

Emission Point	Stack Height (ft.)	Stack Diameter (ft.)	Gas Discharge (SCFM)	Exit Temperature (F)	Gas Velocity (ft./s)
ES1-02	232	4.00	26,582	305	59.4
ES1-03	20.0	0.25	358	845	350
ES1-04	15.0	8.00	54,997	77.0	21.6
ES1-05	20.0	1.00	1,892	855	116
ES1-06	30.0	2.50	1,391	600	11.0
ES1-07	180	2.25	15,060	68.0	73.4
ES1-08	180	2.25	15,060	68.0	73.4
ES1-09	180	1.83	9,724	68.0	71.3
ES1-10	156.0	3.08	27,710	68.0	71.9
ES1-11	210	3.25	30,119	68.0	70.3
ES1-12	100	1.37	800	68.0	49.7
ES1-13	80.0	0.97	1,100	68.0	49.8
ES1-14	88.0	1.67	5,163	200	57.3
ES1-15	88.0	1.67	5,163	200	57.3
ES1-16	88.0	2.25	18,000	68.0	87.3
ES1-17	88.0	2.25	18,000	68.0	87.3
ES1-18	97.0	0.97	1,900	68.0	49.8
ES1-19	97.0	0.97	1,900	68.0	49.8
ES1-20	86.0	0.50	800	68.0	78.6
ES1-21	32.0	0.83	1,200	150	49.4
ES1-22	95.0	0.83	1,250	200	55.7

Notes:
Standard Temperature = 68 F
Standard Pressure = 14.7 psi
Ambient Pressure = 12.65 psi at 4,250 amsl

"I certify to the accuracy of the plans, specifications, and supplementary data submitted with this application. It is my Opinion that any new equipment installed in accordance with these submitted plans and operated in accordance with the manufacturer's recommendations will meet emission limitations specified in the Wyoming Air Quality Standards and Regulations."

Signature	[signature]	Typed Name	James K. Miller		
Title	Manager, Environmental Services	Company	Basin Electric Power Cooperative		
Mailing Address	1717 East Interstate Avenue	Telephone No.	701-223-0441		
City	Bismarck	State	ND	Zip	58503
P.E. Registration (if applicable)					
State where registered					

18. Continued:

List storage pile (If any): Not Applicable

Type of Material	Particle Size (Diameter or Screen Size)	Pile Size (Average Tons on Pile)	Pile Wetted (Yes or No)	Pile Covered (Yes or No)

19. Using a flow diagram: Please see Appendix A

(1) Illustrate input of raw materials.

(2) Label production processes, process fuel combustion, process equipment, and air pollution control equipment.

(3) Illustrate locations of air contaminant release so that emission points under items 11, 12 and 17 can be identified. For refineries show normal pressure relief and venting systems. Attach extra pages as needed.

20. A site map should be included indicating the layout of facility at the site. All buildings, pieces of equipment, roads, pits, rivers and other such items should be shown on the layout. Please see Appendix A

21. A location drawing should be included indicating location of the facility with respect to prominent highways, cities, towns, or other facilities (include UTM coordinates). Please see Appendix A

16. Products of process or unit:

Products	Quantity/Year
Electricity	3,224,915 Net MW-HR/YR

17. Emissions to the atmosphere (each point of emission should be listed separately and numbered so that it can be located on the flow sheet): Please see attached Table 1

Emission Point	Stack Height (ft)	Stack Diameter (ft)	Gas Discharge SCFM	Exit Temp (°F)	Gas Velocity (ft/s)

18. Does the input material or product from this process or unit contain finely divided materials which could become airborne?

X Yes ___ No

Is this material stored in piles or in some other way as to make possible the creation of dust problems?

___ Yes X No

13. Type of combustion unit: (check if applicable):

A. Coal X

1. *Pulverized* X :

General __; Dry Bottom X ; Wet Bottom __; With Flyash Reinjection __; Without Flyash Reinjection __; Other ______

2. *Spreader Stoker* __:

With Flyash Reinjection __; Without Flyash Reinjection __; Cyclone __; Hand-Fired __; Other ______

B. Fuel Oil __

Horizontally Fired __ Tangentially Fired __

Type of combustion unit:(check if applicable):

C. Natural Gas __

D. If other, please specify ______

Hourly fuel consumption (estimate for new equipment) 487,308 LB /hr.

Size of combustion unit $3,801x10^6$ BTU heat input/hour.

14. Operating Schedule: 24 hours/day; 7 days/week; 52 weeks/year.

Peak production season (if any): ______

15. Fuel analysis:

	COAL	FUEL OIL	NATURAL GAS
% Sulfur	0.47		
% Ash	4.77		
BTU Value	7,800		

10. Materials used in unit or process (include solid fuels):

Type of Material	Process Weight Average (lb/hr)	Process Weight Maximum (lb/hr)	Quantity/Year
Coal	461,156	487,308	2,019,696 tons/yr

11. Air contaminants emitted: Please see Section 3

Emission Point	Pollutant	lb/hr	ton/yr	Basis of Data

12. Air contaminant control equipment:

Emission Point	Type	Pollutant Removed	Efficiency
PC Boiler	Fabric Filters	PM/PM_{10}	See Note Below
	Low NOx Burners & SCR	NOx	See Note Below
	Dry Lime FGD	SO_2	See Note Below
Material Handling Sources	Fabric Filters/Bin Event Filters	PM/PM_{10}	See Note Below
Fugitive Sources	Paving/Water Sprays	PM/PM_{10}	See Note Below

~~Note: Please refer to Section 2 and Section 5 for more information on Control Equipment~~

6. Permit application is made for: X New Construction ___ Modification
___ Relocation ___ Operation

7. Type of equipment to be constructed, modified, or relocated. (List each major piece of equipment separately.)

Pulverized Coal Fired Boiler

Material Handling Dust Collectors

8. If application is being made for operation of an existing source in a new location, list previous location and new location:

Previous Location: Not Applicable

New Location: Not Applicable

9. If application is being made for a crushing unit, is there: (mark all appropriate boxes)

Primary Crushing	Coal Crusher	Control Equipment:	Dust Collector
Secondary Crushing		Control Equipment:	-
Tertiary Crushing		Control Equipment:	-
Recrushing & Screening		Control Equipment:	-
Conveying		Control Equipment:	-
Drying		Control Equipment:	-
Other		Control Equipment:	-

Proposed dates of operation (month/year) January 2011

DEPARTMENT OF ENVIRONMENTAL QUALITY
AIR QUALITY DIVISION

PERMIT APPLICATION FORM

Date of Application: 11/10/2005

1. Name of Firm or Institution: Basin Electric Power Cooperative

2. Mailing Address

Number	Street	City	State
1717 East Interstate Avenue		Bismarck	ND

County	Zip	Telephone
Burleigh	58503	701-223-0441

3. Plant Location

Number	Street	City	State
Highway 59	North of Gillette		Wyoming

County	Zip	Telephone
Campbell		701-355-5655

4. Name of owner or company official to contact regarding air pollution matters

Name	Title	Telephone
Jerry Menge	Air Quality Program Coordinator	701-355-5655

Number	Street	City	State	Zip
1717 East Interstate Avenue		Bismarck	ND	58503

5. General nature of business

Coal Fired Electric Generation

WDEQ

Application

Form

RBLC	RACT/BACT/LAER Clearinghouse
RCRA	Resource Conservation and Recovery Act
RICE	reciprocating internal combustion engines
RMP	Risk Management Plan
RSC	reduced sulfur compound
S	sulfur
SCR	selective catalytic reduction
SDC	submerged drag conveyor
SER	Significant Emissions Rate
SIL	Modeling Significance Level
SIP	State Implementation Plan
SO_2	sulfur dioxide
SO_4	sulfate
SOFA	Separate Overfire Air
SRDT	solar radiation/delta-T
tph	tons per hour
tpy	ton per year
TRS	total reduced sulfur
TSDF	treatment, storage, and disposal facility
TSL	toxic screening level
US	United States
USGS	United States Geological Survey
UTM	Universal Transverse Mercator
UV	ultraviolet
VFD	variable frequency drive
VOC	volatile organic compound
WA	Wilderness Area
WAQS&R	Wyoming Air Quality Standards and Regulations
WAAQS	Wyoming Ambient Air Quality Standards
WDEQ	Wyoming Department of Environmental Quality

N	nitrogen
NAAQS	National Ambient Air Quality Standards
NAD 27	North American Datum of 1927
NCDC	National Climatic Data Center
NDIR	nondispersive infrared
NED	National Elevation Dataset
NESHAP	National Emission Standards for Hazardous Air Pollutants
NETL	National Energy Technology Laboratory
NMOC	nonmethane organic carbon
NO_2	nitrogen dioxide
NO_x	nitrogen oxide
NP	National Park
NPS	National Park Service
NRA	National Recreation Area
NRCS	National Resource Conservation Service
NSPS	New Source Performance Standards
NSR	New Source Review
NWS	National Weather Service
O_2	oxygen
OFA	over-fire air
PAH	poly aromatic hydrocarbons
PAL	plant-wide applicability limit
Pb	lead
PC	pulverized coal
PIC	product of incomplete combustion
PM	particulate matter
PM_{10}	particulate matter less than 10 micrometers in diameter
PPA	Pre-Project Actual
ppb	parts per billion
ppm	parts per million
PPP	Post-Project Potential
PRB	Powder River Basin
PRIME	Plume Rise Model Enhancements
PSD	Prevention of Significant Deterioration
psia	per square inch absolute
psig	per square inch gauge
PTE	potential to emit
PUC	public utility commission
QA	quality assurance
QC	quality control
RACT	Reasonable Available Control Technology

g/s	grams per second
GEP	good engineering practices
gr/dscf	grains per dry standard cubic foot
H_2SO_4	sulfuric acid mist
HAP	hazardous air pollutant
HCl	hydrochloric acid
HF	hydrogen fluoride
Hg	mercury
$HgCl_2$	mercuric chloride
HNO_3	nitric acid
hp	horsepower
ICR	Information Collection Request
IMPROVE	Interagency Monitoring of Protected Visual Environment
ISC3	Industrial Service Complex
ISCST3	Industrial Source Complex Short-Term
IWAQM	Interagency Workgroup on Air Quality Modeling
K	Kelvin
kg/ha/yr	kilograms per hectacre per year
km	kilometer
kW	kilowatt
kWh	kilowatt hour
LAER	lowest achievable emission rate
lb	pound
lb/hr	pound per hour
lb/mmBtu	pounds of emissions per million British Thermal Units heat input
LCC	Lambert Conformal Conic
LNB	low NO_x burner
LOI	loss on ignition
m	meter
m/s	meters per second
MACT	Maximum Achievable Control Technology
MEI	maximum exposed individual
mg/M^3	milligrams per cubic meter
MM4	Mesoscale Model Version 4
MM5	Mesoscale Model Version 5
mmBtu/hr	million British thermal units per hour
MPRM	Meteorological Processor for Regulatory Models
msl	mean sea level
MW	megawatt
MWC	municipal waste combustors
MWH	megawatt per hour

Acronyms and Abbreviations

°F	degrees Fahrenheit
$\mu g/m^3$	micrograms per cubic meter
ACC	Air Cooled Condenser
AQD	Air Quality Division
AQRV	air quality-related values
BACT	Best Available Control Technology
BEPC	Basin Electric Power Cooperative
BPIP	Building Profile Input Program
Btu/yr	British thermal unit per year
CAA	Clean Air Act
CALMET	Meteorological Processor for the CALPUFF Modeling System
CALPOST	Post-Processor for the CALPUFF Modeling System
CALPUFF	Long-Range Transport Air Dispersion Model System
CAM	Compliance Assurance Monitoring
CAMR	Clean Air Mercury Rule
CEMS	continuous emission monitoring system
CDS	circulating dry scrubber
CFM	cubic feet per minute
CFR	Code of Federal Regulations
CO	carbon monoxide
COMS	continuous opacity monitoring system
CPM	condensable particulate matter
CTG	composite theme grid
CVAAS	cold-vapor atomic absorption
CVAFS	cold-vapor atomic fluorescence spectroscopy
DAT	Deposition Analysis Threshold
DEM	Digital Elevation Model
DOE	Department of Energy
EC	Exposure concentration
EC	elemental carbon
EPA	United States Environmental Protection Agency
ESP	electrostatic precipitator
FEL	federally enforceable limit
FGD	flue gas desulfurization
FLAG	Federal Land Managers' Air Quality Related Values Workgroup
FLM	Federal Land Manager
FR	Federal Register

Figures

Appendices

Tables

Contents

BASIN ELECTRIC
POWER COOPERATIVE

1717 EAST INTERSTATE AVENUE
BISMARCK, NORTH DAKOTA 58503-0564
PHONE 701-223-0441
FAX: 701/224-5336

NOV 2005

November 10, 2005

Mr. Bernie Dailey, PE
New Source Review Program Manager
Wyoming Department of Environmental Quality
Air Quality Division
Herschler Building, 4-W
122 West 25th Street
Cheyenne, WY 82002

RE: Application for Permit to Construct Dry Fork Station Project

Dear Mr. Dailey:

Enclosed are five (5) copies of the air quality construction permit application for the Dry Fork Station Project. The proposed unit will be a 422 MW (gross) coal-fired power generating unit constructed northeast of Gillette.

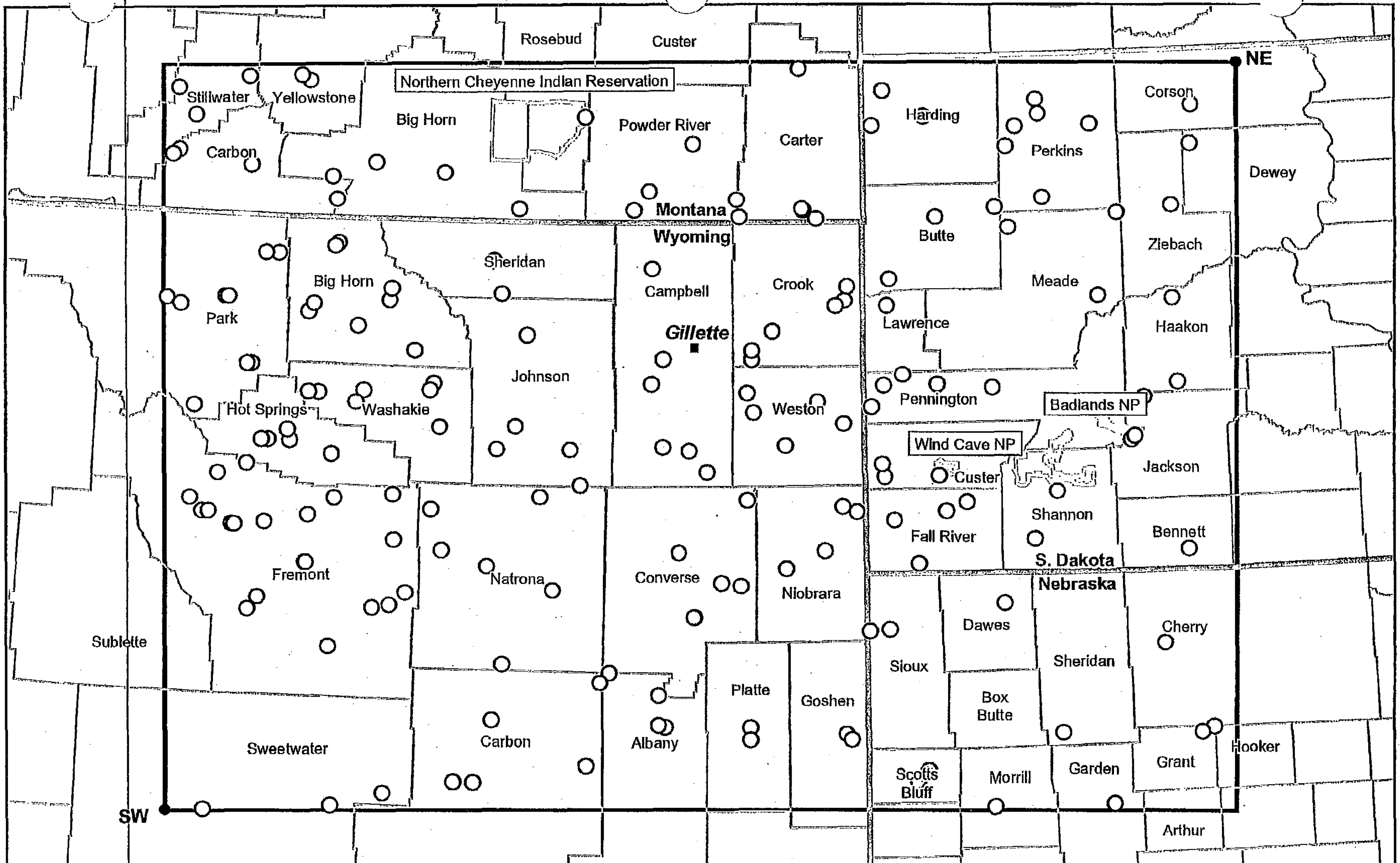
The enclosed documents contain all of the information that the Air Quality Division will need to review this application. Included in the application document are detailed descriptions of the proposed project, its related emissions, an analysis of applicable regulations, BACT analyses of the emissions controls, and near-field (ISC) and far-field (CALPUFF) modeling of the project impacts to evaluate its impact on air quality standards and air quality related values. Also included with this submittal are two (2) copies of the DVDs that contain all of the modeling input and output files.

If you have any questions, please contact me at (701) 355-5655.

Sincerely,

Jerry Menge
Air Quality Program Coordinator

jm:mev
Enclosures



Domain Extents

SW Corner
Lat/Long Decimal Degrees: 41.586, -109.350
Lambert Conformal Conic: -350.0 km, -250.0 km

NE Corner
Lat/Long Decimal Degrees: 45.849, -101.016
Lambert Conformal Conic: 297.804 km, 205.942 km

Figure 8-3
Precipitation Stations for
Montana, Nebraska, S. Dakota and Wyoming

DEQ/AQD 000124

8.3.3.1 2001

The first day we examined for 2001 was January 3. This day was chosen because the surface map showed that high pressure was dominating the area of the modeling domain, and nighttime drainage winds from the higher terrain would be expected. This was reflected in the CalDESK views for the evening hours, which showed winds flowing down the slopes of the Black Hills and the Bighorn and Wind River Mountains. The 500-millibar map showed that the upper-level, high-pressure area was centered on the west coast at 7:00 A.M. EST, with clockwise flow bringing northwest to southeast wind aloft. This flow was reflected in the highest layer of the wind field during this timeframe. July 4 was another day that was dominated by high pressure at the surface, as shown in the NOAA weather maps. Pronounced drainage winds were in evidence on the CalDESK views for the evening hours of July 4, with the flows changing directions with sunrise.

8.3.3.2 2002

For 2002, December 20 was chosen as a day that should show strong downslope flows at night due to high pressure that was in place at the surface according to the NOAA weather map. An examination of the CalDESK views showed that drainage flows were indeed in place. The upper-level ridge was positioned so that winds in the western part of the domain should be west to east, and winds in the eastern part of the domain would be more from the northwest. This was reflected very well in the CalDESK views for the highest layer in the wind field. CH2M HILL chose September 16 as a warm-weather day that should show strong upslope/downslope flows due to high pressure at the surface and an overall quiet weather pattern. Nighttime CalDESK views of the wind field showed pronounced downslope winds that reversed direction (especially near the Bighorns) with sunrise and through the morning hours.

8.3.3.3 2003

For 2003, the NOAA surface weather map for January 6 showed a strong high pressure area centered just to the west of the modeling domain. Nighttime winds during this period, as shown in the CalDESK views, displayed pronounced downslope flows that persisted through mid-morning. The upper-level ridge on this day was positioned so that winds at the highest level of the domain should be blowing nearly north to south, with somewhat lower wind speeds in the east and southeast part of the domain. This wind speed and wind direction pattern was reflected in the CalDESK views for the highest layer in the wind field. CH2M HILL chose July 10 as a warm-weather day that should show strong upslope/ downslope flows due to high pressure at the surface and an overall quiet weather pattern. Nighttime CalDESK views of the wind field showed pronounced, light downslope winds that changed direction with sunrise. The upper-level ridge on this day was positioned to the southwest of the modeling domain in a position that would produce upper-level winds blowing from northwest to southeast. This pattern was shown in the CalDESK views for the highest layer in the wind field.

Based on our review of these test days, we conclude that the use of MM5 and other meteorological data processed through CALMET produced wind fields that are expected and reasonable for the modeling domain.

8.4 CALPUFF

CH2M HILL drove the CALPUFF model with the meteorological wind fields output from CALMET over the modeling domain described earlier. Source emission rates, exhaust parameters, background ozone concentrations, and technical options used within CALPUFF are described below.

8.4.1 Source Emission Rates and Exhaust Parameters

Emissions and exhaust parameters for the proposed boiler stack were derived from engineering estimates for peak load conditions for the boiler. Particulate emissions from the proposed boiler for the project were speciated between filterable particulate (fine PM_{10}/soil), primary emissions of condensable hydrogen fluoride (HF) and hydrogen chloride (HCL), primary sulfate, elemental carbon due to loss on ignition (LOI, 0.5 perecent of filterable), and organic carbon condensables. Primary sulfate emissions consisted of ammonium sulfate and sulfuric acid mist. This speciation allowed for the consideration within the visibility analysis of the different scattering efficiencies of the various species. This apportionment is important because some particles, especially elemental carbon (EC) particles, have a greater impact on visibility. For example, EC particles have a light extinction efficiency of 10 inverse megameters per micrograms per cubic meter ($Mm^{-1}/\mu g/m^3$), while sulfate particles have an extinction efficiency of 3.0 $Mm^{-1}/\mu g/m^3$. Detailed emissions calculations and stack parameters are presented in Attachment 3. Table 8-2 presents the stack parameters modeled for the boiler stack, and Table 8-3 presents the emission rates.

Because the WDEQ intends to establish a 3-hour SO_2 emission limit within the permit for the project (but no 24-hour limit), emission rates for 24-hour SO_2 modeling in CALPUFF were based on the proposed 3-hour SO_2 emission limit. The NO_x emission rate in CALPUFF was based on the expected 30-day NO_x limit that will be established in the permit. WDEQ does not intend to establish a short-term emission limit for NO_x. Detailed emissions calculations and exhaust parameters are presented in Appendix B.

TABLE 8-2
Boiler Stack Parameters

Source	Stack Height: ft (m)	Stack Diameter: ft (m)	Exit Velocity: ft/s (m/s)	Exhaust Temperature: °F (K)
Boiler Stack	500 (152.4)	19.5 (5.94)	84.15 (25.65)	170 (350)

Notes:
°F = Degrees Fahrenheit
ft = Feet
ft/s = Feet per second
K = Kelvin
m = Meters
m/s = Meters per second

TABLE 8-3
Boiler Emissions

Source	NO_x Emission Rate (lb/hr)	SO_2 Emission Rate (lb/hr)	PM_{10} Emission Rate (lb/hr)*	SO_4 Emission Rate (lb/hr)	Organic Carbon (lb/hr)
Boiler Stack	266.1	380.1	51.5	10.4	1.9

Notes:
* Includes filterable particulate (fine PM_{10}/soil), condensable HF and HCL, and elemental carbon (LOI)
lb/hr = pounds per hour
NO_x = Nitrogen oxides
PM_{10} = Particulate matter less than 10 microns
SO_2 = Sulfur dioxide
SO_4 = Sulfate

8.4.2 Technical Options

CH2M HILL drove the CALPUFF model with the meteorological output from CALMET over the modeling domain described earlier. To evaluate the impacts from the proposed project, only the emissions from the proposed Dry Fork Station boiler were modeled.

CH2M HILL used the default CALPUFF technical options that are listed in the IWAQM Phase 2 guidance document and the current sample CALPUFF input file from the Earth Tech website. For wet and dry deposition, CH2M HILL used the CALPUFF default values for particle size parameters and scavenging coefficients for sulfate and nitrate particles. For PM_{10} particles, CH2M HILL used data for baghouse control from Table 1.1-6 from AP-42 Chapter 1.1 (Bituminous and Subbituminous Coal Combustion). The data in the table yield an average particle size diameter of 2.5 microns and a standard deviation of 5.

8.4.3 Background Ozone and Ammonia

Hourly ozone data were input to CALPUFF for chemical transformation. These data were compiled from two stations, Thunder Basin National Grasslands in Wyoming and the Robbinsdale site near Rapid City, South Dakota. The Thunder Basin visibility and air quality monitoring station is located approximately 32 miles north of Gillette. The site is maintained by the WDEQ, and became operational in May 2001. A digital camera, transmissometer, ambient nephelometer, meteorology equipment, ozone analyzer, oxides of nitrogen analyzer and an IMPROVE aerosol sampler are located at this site. The Robbinsdale site is maintained by the South Dakota Department of Environment and Natural Resources. This station collects hourly ozone readings during the "ozone season", which in this case is May through September. Data were available for 2002-2003. CH2M HILL compiled all available hourly data from these two sites into a model-ready ozone input file.

For periods of missing hourly ozone data, the chemical transformation relied on monthly default values that were input to CALPUFF. We determined the monthly default values by calculating monthly average concentrations from all available data, which included data ~~from a National Park Service (NPS) station at Badlands National Park that began operating~~ in August of 2003. The highest monthly average for a given month that was calculated from the available stations was input to CALPUFF as the default value for that month. The calculated monthly values were as follows:

January:	30 ppb
February:	36 ppb
March:	40 ppb
April:	41 ppb
May:	46 ppb
June:	47 ppb
July:	49 ppb
August:	50 ppb
September:	39 ppb
October:	35 ppb
November:	31 ppb
December:	30 ppb

A constant background ammonia concentration of 10 ppb was input to CALPUFF for chemical transformation with the MESOPUFF II chemical transformation scheme.

8.4.4 CALPUFF Receptor Grids

Discrete receptors for the CALPUFF modeling were placed at uniform spacing along the boundary and in the interior of each area of concern. As recommended by the NPS, receptors were taken from the NPS database for Class I area modeling. A copy of this database, along with a conversion routine for various coordinate systems, *NPS Convert Class I Areas;* was provided to CH2M HILL by the NPS. The NPS conversion routine was used to convert all latitude/longitude coordinates to LCC coordinates, including receptors, meteorological stations, and source locations. Because the NPS database does not include the Northern Cheyenne Indian Reservation, those receptors were taken from a sample CALPUFF input file provided by WDEQ that used the same map projection as was used for the Dry Fork Station Project domain. The total number of receptors for Badlands and Wind Cave was 100 and 189, respectively. The number of receptors for Northern Cheyenne was 462.

Receptors for Devils Tower National Monument were placed at 1-km spacing along the boundary and the interior of the monument grounds, resulting in a total of 17 receptors. These receptors were converted to LCC coordinates using the NPS conversion routine.

8.5 CALPOST

8.5.1 Visibility

Visibility impacts were estimated through the use of the modeled concentrations produced by CALPUFF and hourly relative humidity data from the CALMET output, both within the CALPOST postprocessor. CALPOST calculates the percent change in extinction attributable to the project emissions as compared to the natural background extinction in the areas of concern.

The percent change in light extinction (Δ) is calculated using:

$$\Delta = \frac{\Delta b}{b_{back}} * 100$$

Where Δb is the incremental increase in light extinction due to the project emissions and b_{back} is the background light extinction under natural conditions.

The organic carbon condensable fraction was estimated from organic Hazardous Air Pollutants (HAPs) that have boiling temperatures less than 300°F. This approach served to capture all organics that will condense at ambient temperatures below the stack exhaust temperature.

The incremental increases in light extinction from the project were determined from the modeled concentrations of all pollutants that could potentially degrade visibility: nitrate, sulfate, and particulate (filterable and condensable). Particulate emissions from the proposed unit included filterable particulate (fine PM_{10}/soil), condensable HF and HCL, primary sulfate, and elemental carbon (LOI). Organic carbon condensables were modeled as a separate species. Because the total PM_{10} emission rate included the EC emissions, the POSTUTIL program was used to split the PM_{10} concentrations into "soil" and EC for subsequent consideration in the CALPOST program. This allowed for the consideration of the differing light extinction coefficients for ordinary particulate matter (1.0) vs. EC (10).

Because their scattering effects are dependent on relative humidity, sulfates and nitrates are referred to as hygroscopic species. Relative humidity for the consideration of extinction from the hygroscopic particles was calculated on an hourly basis from data in the CALMET file, and then averaged for each 24-hour period. This is Method 2 in CALPOST, which is the recommended method in FLAG for a refined CALPUFF visibility analysis. Background extinction (b_{back}) due to natural aerosols for the areas of concern was calculated within CALPOST using the equation:

$$b_{back} = b_{hygro} \times f(RH) + b_{NonHygro} + Rayleigh$$

Where b_{hygro}, $b_{NonHygro}$, and Rayleigh scattering components are provided in Appendix 2.B of the FLAG Phase I report. As shown in the FLAG report, the values for b_{hygro} (0.6 Mm^{-1}), $b_{NonHygro}$, (4.5 Mm^{-1}), and Rayleigh scattering (10 Mm^{-1}) are the same for Wind Cave and Badlands. These values are the current FLAG-recommended estimates of "natural background" for all western areas. Although such values are not provided for Northern Cheyenne Indian Reservation, CH2M HILL assumed that the background extinction provided within the FLAG document for the Western Class I areas will also apply to the Northern Cheyenne Indian Reservation.

Relative humidity for the consideration of extinction from hygroscopic particles was calculated on an hourly basis from data in the CALMET files. This approach represents Method 2 in CALPOST, which is the recommended method in the FLAG document for a refined CALPUFF visibility analysis. The cap on relative humidity in CALPOST was set at 95 percent. This cap was suggested by the NPS at the August 4, 2005 meeting described earlier.

Table 8-4 presents a summary of the raw visibility results.

TABLE 8-4
Raw Visibility Results

Area	Maximum Modeled Light Extinction	Number of Days with Percentage Change > 5%	Number of Days with Percentage Change > 10%
2001			
Wind Cave NP	8.3%	2	0
Badlands NP	4.4%	0	0
Northern Cheyenne Indian Reservation	11.6%	2	1
2002			
Wind Cave NP	8.8%	1	0
Badlands NP	5.6%	1	0
Northern Cheyenne Indian Reservation	5.7%	2	0
2003			
Wind Cave NP	8.0%	3	0
Badlands NP	5.01%	1	0
Northern Cheyenne Indian Reservation	51.8%	1	1

Notes:
NP = National Park

8.5.2 Refined Visibility Results

The raw visibility results using Method 2 were derived from a calculation of percentage light extinction that uses "natural" background as the denominator. The FLAG document defines natural conditions as "[c]onditions substantially unaltered by humans or human activities. As applied in the context of visibility, natural conditions include naturally occurring phenomena that reduce visibility as measured in terms of light extinction, visual range, contrast, or coloration." Aerosols that occur naturally in the ambient air affect background visibility under natural conditions. Natural background visibility is also affected by water in various physical states that naturally occur in the ambient air in the form of humidity, clouds, and fog or in the form of precipitation as snow or rain.

The recommended FLAG approach provides a method of adjustment of natural background visibility for one form of atmospheric water expressed as relative humidity through the growth of hygroscopic particles. However, FLAG does not provide a method of adjusting natural background visibility for atmospheric water naturally occurring in the other physical states. Therefore, to fully account for the impact on natural visibility due to atmospheric water in all forms and not just relative humidity, CH2M HILL used a method to adjust for background extinction caused by condensed water as well.

The NPS operates the IMPROVE transmissometer at Badlands NP to measure actual background visibility. This transmissometer at Badlands NP measures actual atmospheric light extinction over a path length of approximately 4.15 km. This measurement includes the effects of both natural and human-caused conditions. Because only natural conditions are to be considered in the estimation of natural background, CH2M HILL devised a method to remove the effect of human-caused visibility impairment from the transmissometer data.

The NPS publishes, on the CSU IMPROVE web site for each of the IMPROVE transmissometer sites, an 8-year visibility trends analysis of the 10th, 50th, and 90th percentile averages of reconstructed light extinction and the light scattering of the major aerosol types. The 10th percentile days are the best in terms of visibility and the 90th are the worst. The reconstruction of these light extinction estimates by NPS accounts only for the effect of aerosols measured in the atmosphere at the IMPROVE site and specifically excludes any effect on visibility due to water.

The 1999 90th percentile reconstructed light extinction and the light scattering for each IMPROVE site are reported in the web document titled BEXT_1yr_Mar2002_TXT.htm. The year 1999 is the most recent year available for reconstructed light extinction. For Badlands for 1999, the 90th percentile value reported by NPS for reconstructed visibility impairment is 45.23 Mm^{-1}. This represents the highest average reconstructed light extinction at the Badlands IMPROVE site in 1999 due to measured aerosols that are both natural and human caused.

Hourly transmissometer light extinction readings at Badlands NP for 1999 range from 942 Mm^{-1} (indicating total blockage of the 4.15-km transmissometer light path) to 8 Mm^{-1}. Generally the highest light obscuration events occur when condensed water is present in the atmosphere in the form of clouds, fog, snow, or rain. In order to be conservative, a light extinction level of 50 Mm^{-1} was chosen as the possible transition between aerosol-dominated and condensed water-dominated light extinction at Badlands NP.

CH2M HILL obtained hourly Badlands transmissometer data for any days for which the raw Method 2 result is greater than or equal to 5 percent at Badlands or Wind Cave National Parks. Background light extinction was determined for each hour by examining the Badlands transmissometer data for that hour. If the measured light extinction was 50 Mm^{-1} or more, indicating possible condensed water dominated light extinction, the transmissometer reading was used for background for that hour if other evidence indicates natural obscuration. If the measured extinction is less than 50 Mm^{-1}, indicating aerosol dominated light extinction; the light extinction value calculated using the FLAG-prescribed equation and prescribed background above was used. The transmissometer readings were used along with surface meteorological observations from Rapid City and other available data to verify that visibility obscuration events at Badlands or Wind Cave also occurred at roughly the same time at Rapid City indicating the meteorological events were regional in scale.

For the Northern Cheyenne Indian Reservation, CH2M HILL used the observed visual range at the nearest National Weather Service (NWS) surface station (Sheridan, Wyoming) in a similar fashion to substitute observed visual range as background for obscured conditions. Observations at the NWS station at Billings, Montana and other available data were used to verify that visibility obscuration events at Sheridan and Billings occurred at roughly the same time.

The natural background adjustment described above is similar to the approach used in Montana for the Roundup Power Plant (RPP) project. This is described in a letter from the Department of Interior to the Montana Department of Environmental Quality (Manson, 2003). The letter says "[I]t is our interpretation that 'natural conditions' include significant meteorological events such as fog, precipitation, or naturally occurring haze. Based on the information received and subsequent analysis of that data and the policy guidance, I have concluded that on those days when RPP [Roundup Power Plant] was shown in the original analysis to have resulted in a visibility extinction of 5 percent or more a weather event was the most significant source of the visibility extinction and not the RPP emissions."

The following discussion examines each instance that the raw 24-hour visibility result exceeded 5 percent. Detailed data sheets that summarize observed weather and visibility for these days are presented in Appendix H.

March 22, 2001: Wind Cave NP

The raw, modeled 24-hour average visibility result for this day was 8.34 percent. Transmissometer readings at nearby Badlands NP and surface meteorological observations at Rapid City indicate that pronounced natural obscuration was in place for most of the day. Observed weather at Rapid City included 19 hours of rain, mist, or fog. Visibility at Rapid City was reduced to 0.2 mile for nine hours during the 24-hour period. Hourly transmissometer readings at Badlands were greater than 50 Mm^{-1} for 20 hours of the day, and for 13 of these hours the reading was 942 Mm^{-1}, which indicates total obscuration along the 4.15 km optical path of the instrument. Using the transmissometer data as a substitute for natural background when the hourly reading exceeded 50 Mm^{-1}, the predicted 24-hour visibility impact is reduced to 0.3 percent.

March 23, 2001: Wind Cave NP

For this day, the raw, modeled visibility impact was 5.37 percent. Transmissometer readings at nearby Badlands NP and surface meteorological observations at Rapid City indicate that the weather event of March 22 continued into the first half of March 23. Observed weather at Rapid City included 11 hours of fog, rain, mist, snow, or drizzle. Visibility at Rapid City was reduced to 0.2 mile for four hours during the first half of the day. Hourly transmissometer readings at Badlands were greater than 50 Mm^{-1} for the entire day, with five of these readings at 942 Mm^{-1} (total obscuration). Using the transmissometer reading as a substitute for natural background when the hour exceeded 50 Mm^{-1}, the predicted 24-hour visibility impact is reduced to 0.3 percent.

February 23, 2001: Northern Cheyenne Indian Reservation

The raw, modeled visibility result for this day was 11.6 percent. Surface meteorological observations at Billings, Montana and Sheridan, Wyoming indicate that a weather event is affecting the area that includes strong natural obscuration. Observed weather at Billings included 11 hours of mist, and observed weather at Sheridan included 16 hours of mist or fog. Visibility was reduced at Billings for most of the day, while visibility at Sheridan was reduced for the entire period, with a minimum of 0.2 miles for three hours. To arrive at a predicted visibility impact that accounts for natural obscuration, CH2M HILL took the measured visual range from the nearest NWS surface station (Sheridan) for hours that included obscuring weather, and converted the visual range to units of Mm^{-1}. Using the calculated extinction for the obscured hours as a substitute for natural background, the predicted 24-hour visibility impact is reduced to 0.1 percent.

April 6, 2001: Northern Cheyenne Indian Reservation

The raw, modeled visibility result for this day was 9.4 percent. Surface meteorological observations include three to four hours of thunderstorms and rain at Billings, Montana and Sheridan, Wyoming. Visibility (visual range) readings do not fall below the instrument maximum reading of 10 km at either location, but one cannot conclude from this that visibility was not reduced to some degree because the visual range on a clear day would be much higher than 10 km. A visual range of just 10 km is equivalent to an atmospheric light extinction of 391 Mm^{-1} which is well into the light scattering range due to condensed water. Therefore, even if the actual visual range is somewhat above 10 km, this still indicates natural obscuration from condensed water is occurring. If the visual range for the hour at Sheridan that included rain showers is converted to units of Mm^{-1} and substituted for natural background, the predicted 24-hour visibility impact is reduced to less than 5 percent.

October 26, 2002: Wind Cave NP

The raw, modeled visibility result for this day was 8.8 percent. Transmissometer readings at nearby Badlands NP and surface meteorological observations at Rapid City and Ellsworth AFB near Rapid City indicate that pronounced natural obscuration was in place for more than half of the day. Surface weather observations at Rapid City were missing for the first 10 hours of the day, but the weather station at nearby Ellsworth AFB observed fog for four hours during the morning. Rapid City recorded two hours of mist after the station came back on line at 1100. Visibility at Ellsworth was reduced to 0.2 mile (0.32 km) or less for three hours from 0800-1000. This 0.32 km visual range is equivalent to a light extinction of 12,225 Mm^{-1}. Hourly transmissometer readings at Badlands were greater than 50 Mm^{-1} for the entire day, with three of these readings at 942 Mm^{-1}, which indicates total obscuration of the 4.15-km transmissometer. Using the transmissometer reading as a substitute for natural background when the hourly reading exceeded 50 Mm^{-1}, the predicted 24-hour visibility impact is reduced to 0.5 percent.

October 26, 2002: Badlands NP

The raw, modeled visibility result for this day was 5.6 percent. This predicted impact occurred on the same day as the October 26, 2002 impact predicted at Wind Cave NP (described above). Using Badlands transmissometer data as a substitute for natural background when the hourly reading exceeded 50 Mm^{-1}, the predicted 24-hour visibility impact is reduced to 0.3 percent.

October 27, 2002: Northern Cheyenne Indian Reservation

The raw, modeled visibility result for this day was 5.7 percent. There were no observations of "present weather" or reduced visibility at Billings, Montana or Sheridan, Wyoming on this day. Therefore, there is no evidence of natural obscuration due to condensed water or means to further refine the result for this day.

March 23, 2002: Northern Cheyenne Indian Reservation

The raw, modeled visibility result for this day was 5.3 percent. Surface meteorological observations at Billings, Montana and Sheridan, Wyoming indicate that a weather event is affecting the area that includes strong natural obscuration. Observed weather at Billings included four hours of snow or mist, and observed weather at Sheridan included seven hours of snow or mist. Visibility was reduced at Billings for the later part of the day, and for most of the morning and the later part of the day at Sheridan. To arrive at a predicted visibility impact that accounts for natural obscuration, CH2M HILL took the measured visual range from the nearest surface station (Sheridan) for hours that included observed weather, and converted the visual range to units of Mm^{-1}. Using the calculated extinction for the obscured hours as a substitute for natural background, the predicted 24-hour visibility impact is reduced to 0.5 percent.

March 9, 2003: Wind Cave NP

The raw, modeled visibility result for this day was 8.0 percent. Transmissometer readings from nearby Badlands NP were missing for all but the final five hours of the day, but surface meteorological observations at Rapid City indicate that strong natural obscuration was in place for most of the day. Observed weather at Rapid City included 11 hours of snow, mist, or haze. Visibility at Rapid City was reduced for each of these 11 hours. To arrive at a predicted visibility impact that accounts for natural obscuration, CH2M HILL took the measured visual range from Rapid City for hours that included observed weather, and converted the visual range to units of Mm^{-1}. Using the calculated extinction for the obscured hours as a substitute for natural background, the predicted 24-hour visibility impact is reduced to 0.7 percent.

December 11, 2003: Wind Cave NP

The raw, modeled visibility result for this day was 7.9 percent. Transmissometer readings at nearby Badlands NP and surface meteorological observations at Rapid City indicate that natural obscuration was in place intermittently during the day. Observed weather at Rapid City included seven hours of light snow. Hourly transmissometer readings at Badlands were greater than 50 Mm^{-1} for the entire day, with four readings of 942 Mm^{-1} (total obscuration). Using the transmissometer reading as a substitute for natural background when the hourly reading exceeded 50 Mm^{-1}, the predicted 24-hour visibility impact is reduced to 0.5 percent.

November 5, 2003: Wind Cave NP

The raw, modeled visibility result for this day was 7.8 percent. Transmissometer readings at nearby Badlands NP and surface meteorological observations in and around Rapid City indicate that natural obscuration was in place. Surface observations at Rapid City include traces of precipitation throughout the day. Measured visibility at Ellsworth AFB is reduced from an instrument maximum reading of 30 miles (48 km) to only 7 miles (11 km) for four hours during the day. The equivalent light extinction value for a visual range of 7 miles is 355 Mm^{-1}. Hourly transmissometer readings at Badlands were greater than 50 Mm^{-1} for the entire day, with a maximum reading of 81 Mm^{-1}. Using the transmissometer reading as a substitute for natural background when the hourly reading exceeded 50 Mm^{-1}, the predicted 24-hour visibility impact is reduced to 2.2 percent.

December 12, 2003: Badlands NP

The raw, modeled visibility result for this day was 5.01 percent. Transmissometer readings from Badlands NP and surface meteorological observations at Rapid City indicate that natural obscuration was in place for most of the day. Observed weather at Rapid City included two hours of mist. Visibility at Rapid City was reduced for several hours, with a minimum reading of 1.2 miles. Hourly transmissometer readings at Badlands were greater than 50 Mm^{-1} for the entire day, with two readings of 942 Mm^{-1} (total obscuration). Using the transmissometer reading as a substitute for natural background when the hourly reading exceeded 50 Mm^{-1}, the predicted 24-hour visibility impact is reduced to 0.4 percent.

November 3, 2003: Northern Cheyenne Indian Reservation

The raw, modeled visibility result for this day was 51.8 percent. Surface meteorological observations at Billings, Montana and Sheridan, Wyoming indicate that a weather event is affecting the area with strong natural obscuration. Observed weather at Billings included 10 hours of snow or mist, and observed weather at Sheridan included 11 hours of mist or freezing rain/rain. Visibility was reduced at Sheridan for the hours that weather was observed, with a minimum reading of 1.5 miles. To arrive at a predicted visibility impact that accounts for natural obscuration, CH2M HILL took the measured visual range from the nearest surface station (Sheridan) for hours that included observed weather, and converted the visual range to units of Mm^{-1}. Using the calculated extinction for the obscured hours as a substitute for natural background, the predicted 24-hour visibility impact is reduced to 2.1 percent.

8.5.3 Criteria Pollutant Impacts

CALPOST was also used to produce estimated concentrations of NO_x, SO_2, and PM_{10} for comparison to the Class I modeling significance levels. Modeled impacts for Dry Fork Station for 2001-2003 were below all Class I modeling significance levels (SIL) for all pollutants at Wind Cave NP and Badlands NP. For Northern Cheyenne, the 3-hour significance level for SO_2 of 1.0 µg/m³ was exceeded with 2003 meteorology (1.23 µg/m³). The 24-hour significance level of 0.2 µg/m³ was also exceeded, with a maximum of 0.55 µg/m³ with 2003 meteorology. All other predicted impacts at Northern Cheyenne were below the modeling significance levels. Table 8-5 presents a summary of the predicted criteria pollutant impacts.

TABLE 8-5
Modeled Criteria Pollutant Impacts (µg/m³)

Area	Annual NO_2	3-hour SO_2	24-Hour SO_2	Annual SO_2	24-Hour PM_{10}	Annual PM_{10}
2001						
Wind Cave NP	0.003	0.39	0.13	0.009	0.005	0.0003
Badlands NP	0.001	0.33	0.08	0.005	0.002	0.0001
Northern Cheyenne Indian Reservation	0.003	0.68	0.22	0.008	0.01	0.0004
2002						
Wind Cave NP	0.004	0.45	0.17	0.011	0.006	0.0004
Badlands NP	0.002	0.32	0.09	0.007	0.002	0.0001
Northern Cheyenne Indian Reservation	0.002	0.55	0.20	0.006	0.01	0.0003
2003						
Wind Cave NP	0.004	0.49	0.11	0.012	0.005	0.0004
Badlands NP	0.001	0.23	0.07	0.006	0.002	0.0001
Northern Cheyenne Indian Reservation	0.002	1.23	0.55	0.008	0.02	0.0004
Class I Modeling Significance Levels	0.1	1.0	0.2	0.1	0.3	0.2

Notes:

µg/m³ = micrograms per cubic meter

Class I Modeling Significance Levels were proposed by EPA on July 23, 1996 [61 FR 38250], but were never adopted as a final rule.

It should be pointed out that the modeling Class I area SIL is intended to be a level above which further analysis of the consumption of the Class I increment is warranted. Typically, the SIL is set at about 5 percent of the overlying increment. In the case of the Class I SIL, EPA proposed them in the Federal Register on July 1996 (Vol. 61, Number 142, Proposed Rules, pg. 38249-344). However, EPA has not acted to make the Class I area SIL a requirement by rule as they have the Class II area SIL. Therefore, the Class I SIL are proposed only. Nevertheless, WDEQ has requested that a Class I cumulative increment consumption analysis be done for SO_2 at the Northern Cheyenne Indian Reservation, and such an analysis was conducted. Cumulative modeling of Class I SO_2 increment consumption at Northern Cheyenne is described in Section 8.6.

8.5.4 Atmospheric Deposition

Impacts to both flora and water quality at the areas of concern were assessed through an analysis of total sulfur (S) and nitrogen (N) deposition. Annual deposition rates were determined for the proposed boiler only.

The NPS has established DAT for eastern and western regions of the United States. A DAT is the amount of deposition within an area below which estimated impacts from a proposed new or modified source are considered insignificant. The DAT for western United States areas is 0.005 kg/ha/yr for total N and also for total S (NPS, 2002).

Annual deposition rates of NO_x, nitric acid (HNO_3), and nitrate (NO_3) were calculated by CALPUFF, converted to equivalent levels of N and summed within the POSTUTIL routine, converted to units of g/m^2/s within CALPOST, and then converted finally to units of kg/ha/yr. Likewise, deposition rates of SO_2 and SO_4 were converted to equivalent levels of N and S and summed. Because DAT levels for deposition established by the NPS are expressed in units of kg/ha/yr for total N or S, the CALPUFF deposition fluxes of each of the species of N and S were adjusted to account for the difference in molecular weights between the species and the chemical elements that comprise them. CH2M HILL used the molecular weight ratios shown in Table 8-6 within the POSTUTIL routine to perform the adjustment.

TABLE 8-6
Molecular Weight Ratios for Deposition Calculations in CALPOST

Element	Ratio of Molecular Weights
N from SO_4	0.29167*
N from HNO_3	0.22222
N from NO_3	0.45161**
N from NO_x	0.30435
S from SO_2	0.50000
S from SO_4	0.33333

*Based on two moles of N in $(NH_4)_2SO_4$

**Based on two moles of N in NH_4NO_3

Table 8-7 presents the estimated deposition of N and S compounds for Dry Fork Station. Appendix H provides the raw g/m²/s values for each Class I area and each year.

TABLE 8-7
Modeled Atmospheric Deposition

Area	Total N Deposition (kg/ha/yr)	Total S Deposition (kg/ha/yr)
2001		
Wind Cave NP	0.002	0.006
Badlands NP	0.001	0.003
Northern Cheyenne Indian Reservation	0.002	0.006
2002		
Wind Cave NP	0.002	0.006
Badlands NP	0.001	0.002
Northern Cheyenne Indian Reservation	0.001	0.004
2003		
Wind Cave NP	0.002	0.008
Badlands NP	0.001	0.003
Northern Cheyenne Indian Reservation	0.002	0.006
National Park Service Deposition Analysis Threshold	0.005	0.005

8.5.5 Modeled Impacts at Devils Tower

CH2M HILL also modeled criteria pollutant and visibility impacts at Devils Tower National Monument, a Class II area national monument located approximately 65 km northeast of the proposed Dry Fork Station. Table 8-8 presents the results of the criteria pollutant impacts. All modeled impacts were well below the Class II modeling significance levels.

TABLE 8-8
Modeled Criteria Pollutant Impacts (Devils Tower)

Area	Annual NO_2	3-hour SO_2	24-Hour SO_2	Annual SO_2	24-Hour PM_{10}	Annual PM_{10}
2001	0.02	2.0	0.6	0.04	0.06	0.004
2002	0.03	1.9	0.6	0.05	0.06	0.005
2003	0.03	2.1	0.6	0.05	0.06	0.005
Class II Modeling Significance Levels	1	25	5	1	5	1

Raw, modeled visibility results at Devils Tower for 2001-2003 include a single day that exceeded a 5 percent change as compared to natural background. The maximum predicted impact was 5.3 percent. This result occurred on March 22, 2001, which is the same day that yielded 19 hours of fog, mist, or rain in the Rapid City area. An examination of NOAA surface weather maps for this day shows a stationary weather front that is located directly over the Devils Tower area and extending into the Black Hills region of South Dakota. The presence of this weather-producing front indicates that the modeled result at Devils Tower for this day is influenced by natural obscuration.

8.6 Cumulative SO_2 Modeling at the Northern Cheyenne Indian Reservation

8.6.1 Modeling Domain and Technical Approach

To conduct a cumulative increment consumption analysis at the Northern Cheyenne Indian Reservation in southern Montana, CH2M HILL established a CALMET/CALPUFF modeling domain that was centered on the reservation itself. Figure 8-4 shows the modeling domain, which covers a region 600 km by 600 km. This domain is sized to potentially accommodate any source within the accepted effective distance of the CALPUFF model, which is 300 km.

All CALMET and CALPUFF technical options that were employed for the project-only analysis were also employed for the cumulative modeling. These options include the key LCC map projection parameters and the CALMET grid cell resolution of 4 km. Because the cumulative domain is shifted to the north and west of the project-only domain, several new surface and precipitation files were added to the CALMET analysis. Figure 8-4 shows the surface meteorological stations that were used in the cumulative domain. Figure 8-5 shows the locations of precipitation stations that were considered for the analysis. As with the project-only analysis, upper-air observations from Rapid City, South Dakota were input to CALMET to adjust the initial guess wind field, and CH2M HILL ran the CALMET model to produce three years of analysis: 2001, 2002 and 2003.

8.6.2 Validation of CALMET Wind Field

As with the project-only wind fields, CH2M HILL used the CalDESK data display and analysis system (v2.9, Enviromodeling Ltd.) to view plots of wind vectors to evaluate the CALMET wind fields. The same periods chosen for evaluation with the initial wind fields were also evaluated for the cumulative wind fields to judge the accuracy and consistency of CALMET modeling.

8.6.2.1 2001

The first day examined for 2001 was January 3. This day was chosen because the surface weather map showed that high pressure was in place over the modeling domain, and nighttime drainage winds from the higher terrain would be expected. This was reflected in the CalDESK views for the evening hours, which showed pronounced downslope flows from the Black Hills in South Dakota, the Big Horns in Wyoming, and along the west-central edge of the domain in Montana near the Absaroka Range. The 500-millibar map showed that the upper-level, high-pressure area was centered on the west coast at 7:00 A.M. EST, with clockwise flow bringing northwest to southeast wind aloft. This flow was reflected in the highest layer of the wind field during this timeframe.

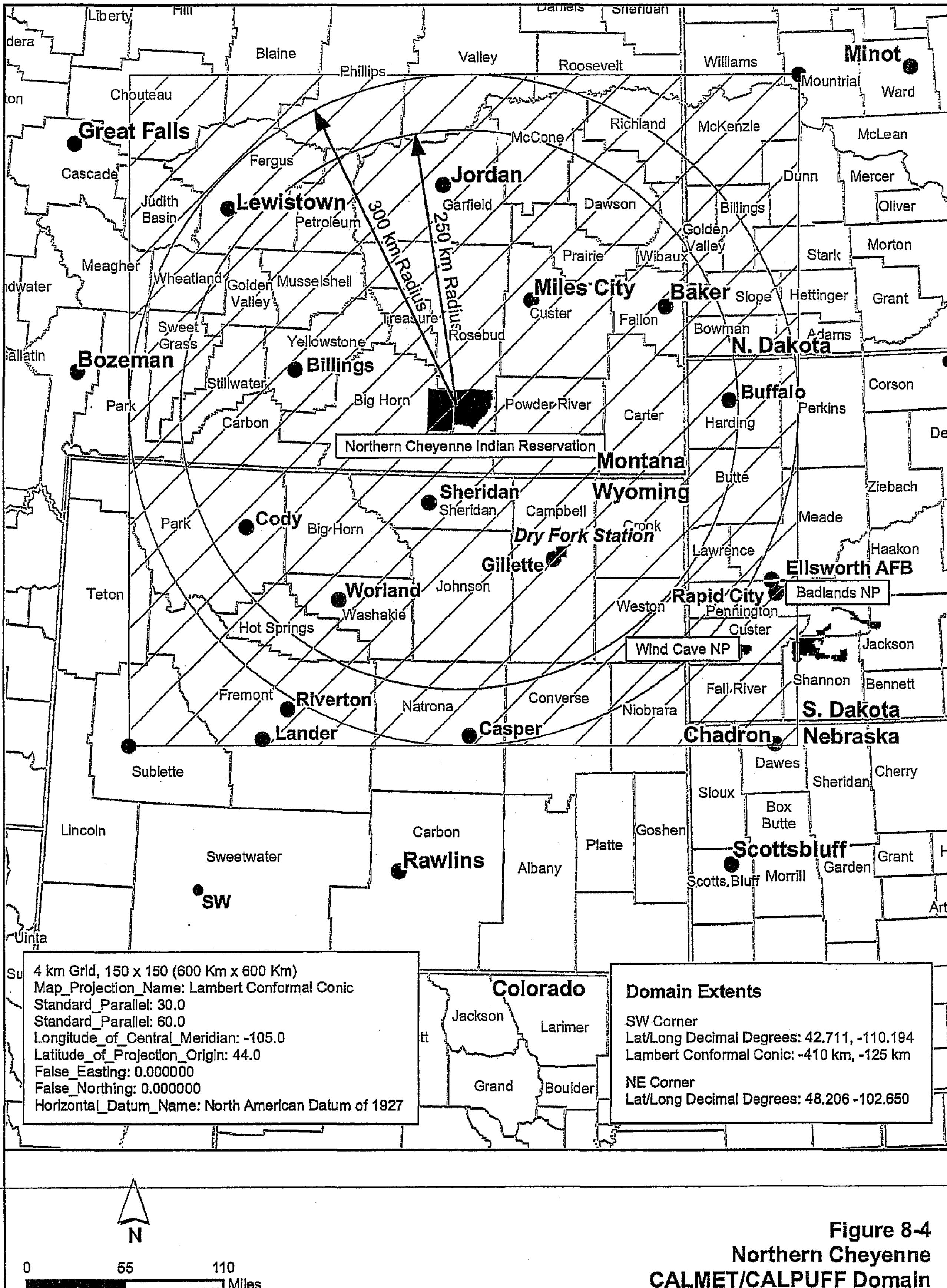


Figure 8-4
Northern Cheyenne
CALMET/CALPUFF Domain

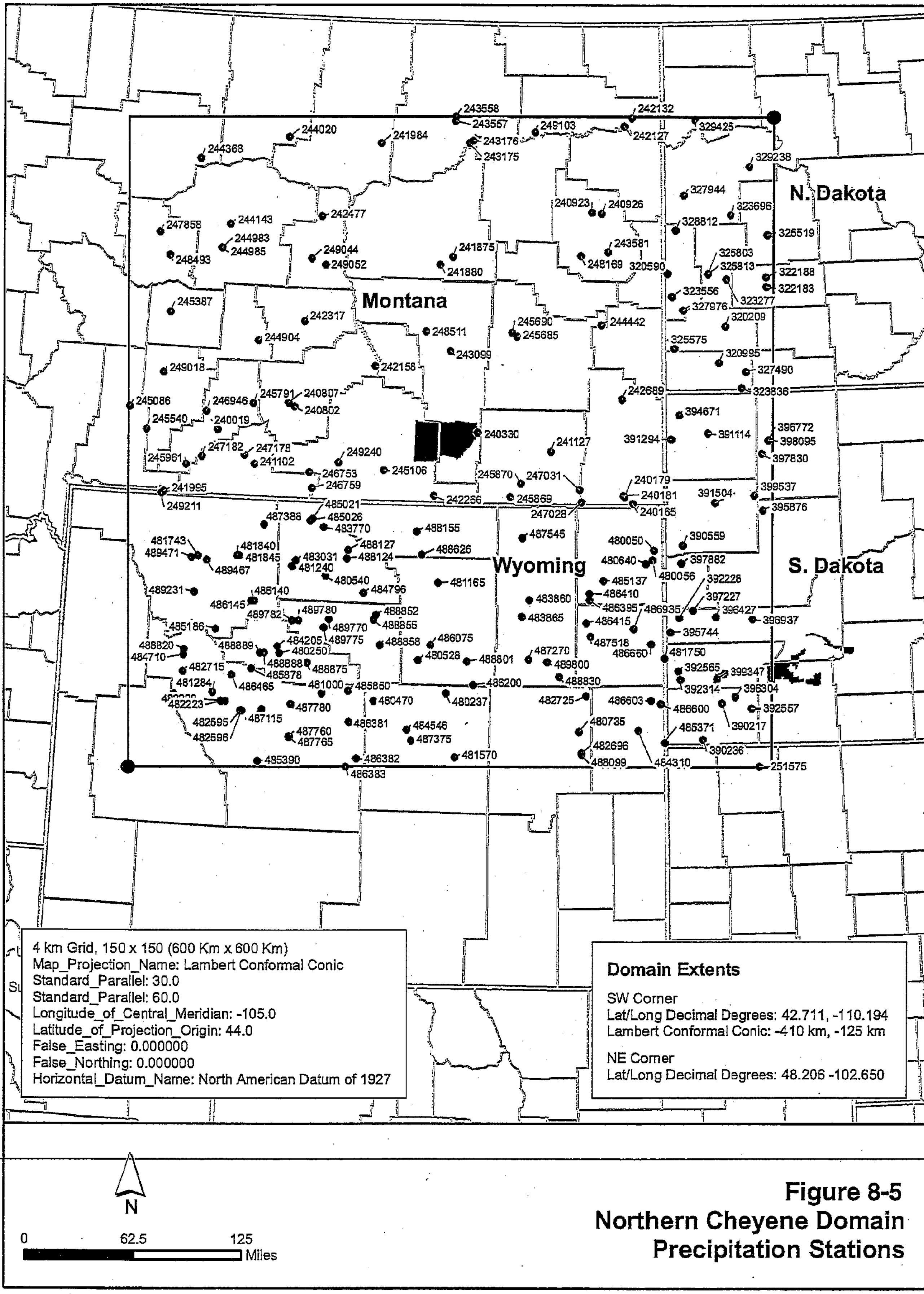


Figure 8-5
Northern Cheyene Domain
Precipitation Stations

July 4 was another day that was dominated by high pressure at the surface, as shown in the NOAA weather maps. Pronounced drainage winds were in evidence on the CalDESK views for the evening hours of July 4, with the flows changing directions with sunrise.

8.6.2.2 2002

December 20, 2002 was a day with high pressure in place at the surface over the modeling domain. As expected, downslope winds were seen in the overnight hours on the CalDESK views, especially from the Big Horns in Wyoming. The upper-level ridge, as seen on the NOAA weather map for the 500-millibar level, was oriented so that winds in the western part of the domain should be west to east and fairly weak, and winds in the eastern part of the domain would be more from the northwest and with higher wind speeds. This was reflected very well in the CalDESK views for the highest layer in the wind field.

CH2M HILL chose September 16 as a warm-weather day that should show strong upslope/downslope flows due to high pressure at the surface and an overall quiet weather pattern. Nighttime CalDESK views of the wind field showed pronounced downslope winds that diminished with sunrise and through the morning hours.

8.6.2.3 2003

The NOAA surface weather map for January 6 showed a strong surface high pressure area centered near the northwest corner of Wyoming. Nighttime winds during this period, as shown in the CalDESK views, displayed pronounced downslope flows from the Black Hills in South Dakota, the Big Horns in Wyoming, and along the west-central edge of the domain in Montana near the Absaroka Range. This downslope wind pattern would be expected with high pressure dominating at the surface and this pattern was also seen with the 2003 windfield that was centered on the Dry Fork Station. The upper-level ridge on this day was positioned so that winds at the highest level of the domain should be blowing nearly north to south in the central portion of the domain, which is clearly evident on the CalDESK views. The shape of the upper-level isobars on the NOAA map indicate that winds near the southeast corner of the domain would be somewhat lighter, with wind directions with more of a component toward the southeast, and that is also reflected on the CalDESK views.

July 10 was chosen as warm-weather day that should show strong upslope/downslope flows due to high pressure at the surface and an overall quiet weather pattern. Nighttime CalDESK views of the wind field showed pronounced, downslope winds that changed direction with sunrise. Daytime winds showed strong upslope flows, especially near the Big Horns and the Absarokas. The upper-level ridge on this day was positioned to the southwest of the modeling domain in a location that would produce upper-level winds blowing from northwest to southeast. This pattern was shown in the CalDESK views for the highest layer in the wind field, with strong winds blowing from the northwest across the entire domain.

Based on our review of these test days, we conclude that the use of MM5 and other meteorological data processed through CALMET produced wind fields that are expected and reasonable for the modeling domain.

8.6.3 Source and Emissions Inventory

To determine the inventory of sources to include in the cumulative Class I SO_2 increment consumption analysis, CH2M HILL considered the states that fall within a 300-km radius of the Northern Cheyenne Indian Reservation. These states include Montana, Wyoming, the northwest corner of South Dakota, and the extreme southwest corner of North Dakota.

For North Dakota sources, CH2M HILL included the Gascoyne Generating Station, a recently permitted coal-fired power plant in Bowman County in extreme southwest North Dakota. For sources in South Dakota, the South Dakota Department of Environment & Natural Resources was contacted, and an extraction from their emissions database was requested. A review of the data extraction provided by the Department revealed that four very small sources of SO_2 were located with 300 km of the reservation. Due to the large distance of these sources from the reservation and the low magnitude of the emissions, none of the South Dakota sources were input to CALPUFF.

Sources in Montana were provided by the Montana Department of Environmental Quality Air Resources Management Bureau. Locations and stack parameters were provided for the following sources in southern Montana:

- Colstrip Units 3 and 4
- Rocky Mountain Power (Hardin)
- Rocky Mountain Ethanol
- Colstrip Energy Limited Partnership
- Roundup Power Project Units 1 and 2

The SO_2 emission rates provided for these sources were based on permit limits. Because PSD rules dictate that the amount of PSD increment consumption within an area is to be based on actual emission increases and decreases, CH2M HILL attempted to find actual emissions that were representative of the largest source, Colstrip. Actual, hourly emissions for Colstrip Units 3 and 4 for the last two full calendar years, 2003 and 2004, were downloaded from the EPA Clean Air Markets website (http://cfpub.epa.gov/gdm/) and imported to an Excel spreadsheet. Using this spreadsheet, 3-hour and 24-hour block averages of the actual emission rates were calculated for the entire 2-year period. Lastly, the 90th percentile of these block averages were calculated:

- Colstrip Unit 3: 878.5 lb/hr for 3-hour, 835.7 lb/hr for 24-hour
- Colstrip Unit 4: 882.9 lb/hr for 3-hour, 838.1 lb/hr for 24-hour

The approach of using 90th percentile emissions to represent short-term, increment-consuming emissions from a given source has used in practice in other recent analyses, and is a conservative representation of simultaneous operation of the two units at Colstrip. All other Montana sources were conservatively modeled at permitted (allowable) short-term emission rates.

Input data for sources in Wyoming were provided by the WDEQ or assembled at WDEQ's offices. The master list of Wyoming source to possibly include in the analysis included the following:

- Wygen1
- Wygen2
- Neil Simpson Unit 1
- Neil Simpson Unit 2
- Wyodak Unit 1
- 2 Elk Unit 1
- KFX

All of these source were include in the analysis with the exception of Wyodak Unit 1. This source was constructed in 1972, which is prior to the major source baseline date for SO_2. In December of 1986, a scrubber was installed to control SO_2 emissions. With the installation of the scrubber, current short-term SO_2 emissions would be lower than the emissions during the baseline period. Therefore, the source would actually expand increment, but was merely removed from the analysis. All other Wyoming sources were conservatively modeled with their respective allowable short-term emissions for SO_2.

Figure 8-6 shows the locations of all of the sources that were included in the cumulative analysis. Detailed input parameters for each source are presented in Appendix H.

8.6.4 Modeling Results

Results of the modeling show that the cumulative impacts of increment-consuming sources in the area surrounding the Northern Cheyenne Indian Reservation are below the allowable increments. The highest 2nd-high 3-hour impact of 16.7 $\mu g/m^3$ was modeled with 2003 meteorology. This modeled impact is well below the Class I PSD increment of 25 $\mu g/m^3$. For 24-hour impacts, the highest 2nd-high impact of 4.0 $\mu g/m^3$ was modeled with 2002 meteorology. This modeled impact is below the Class I PSD increment of 5 $\mu g/m^3$. The results of the cumulative modeling are shown in Table 8-9.

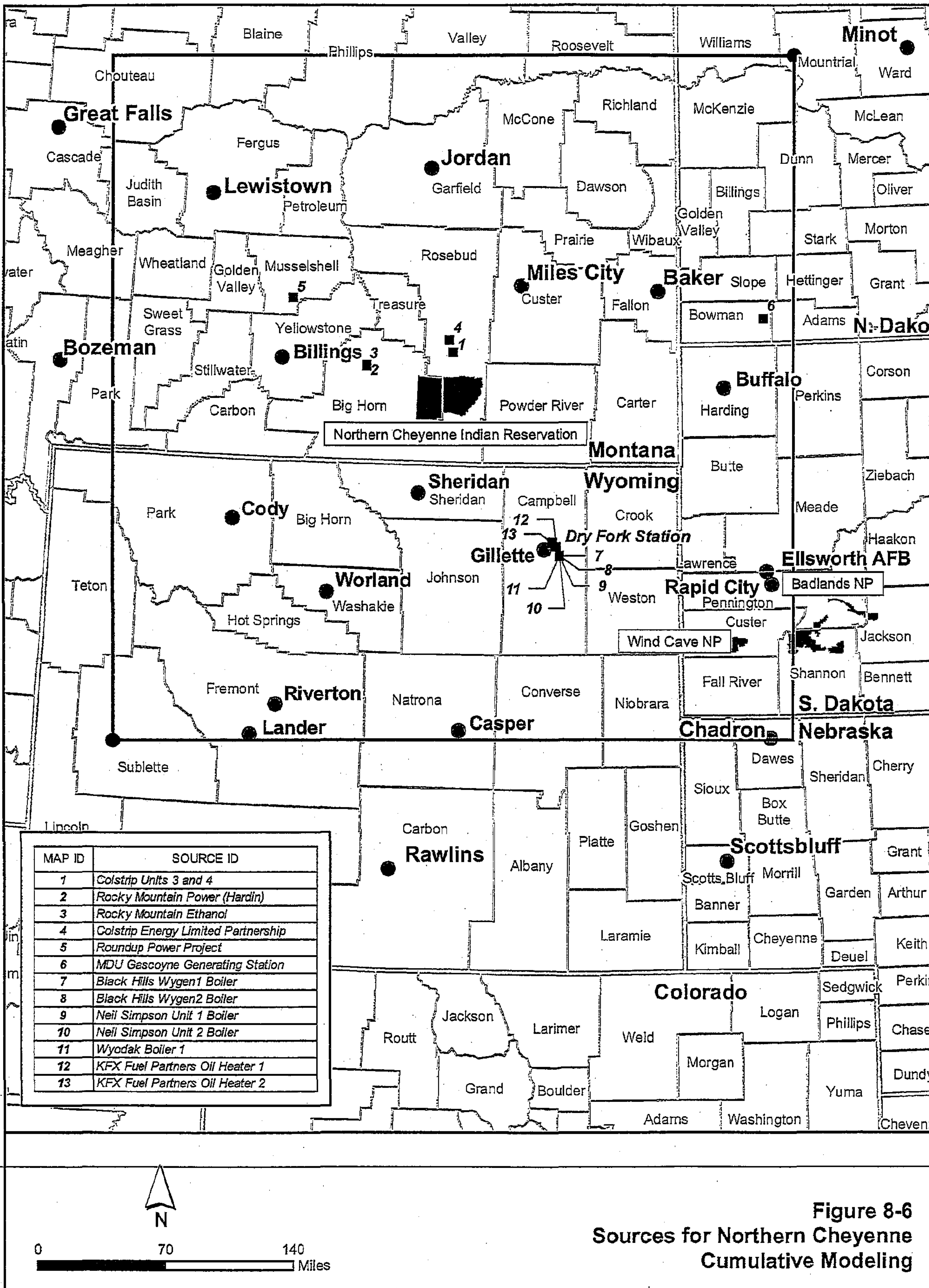
TABLE 8-9
Cumulative Modeled Class I SO_2 Increment Consumption in Northern Cheyenne Indian Reservation ($\mu g/m^3$)

Year of Meteorology	Highest 2nd-High 3-hour SO_2	Highest 2nd-High 24-Hour SO_2
2001	15.3	2.9
2002	15.1	4.0
2003	16.7	3.2
Class I PSD Increment	25	5

Notes:
PSD = Prevention of Significant Deterioration

$\mu g/m^3$ = micrograms per cubic meter

Class I Modeling Significance Levels were proposed by EPA on July 23, 1996 [61 FR 38250], but were never adopted as a final rule.



MAP ID	SOURCE ID
1	Colstrip Units 3 and 4
2	Rocky Mountain Power (Hardin)
3	Rocky Mountain Ethanol
4	Colstrip Energy Limited Partnership
5	Roundup Power Project
6	MDU Gascoyne Generating Station
7	Black Hills Wygen1 Boiler
8	Black Hills Wygen2 Boiler
9	Neil Simpson Unit 1 Boiler
10	Neil Simpson Unit 2 Boiler
11	Wyodak Boiler 1
12	KFX Fuel Partners Oil Heater 1
13	KFX Fuel Partners Oil Heater 2

Figure 8-6
Sources for Northern Cheyenne Cumulative Modeling

8.7 References

CH2M HILL, 2005. *Protocol for a CALPUFF Modeling Analysis of the Dry Fork Station Project (Northeast Wyoming Generation Project).* August 2005.

EPA, 1998. *Interagency Workgroup on Air Quality Modeling (IWAQM) Phase 2 Summary Report and Recommendations for Modeling Long Range Transport Impacts,* Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina, December 1998.

FLAG, 2000. *Federal Land Managers' Air Quality Related Values Workgroup (FLAG) Phase I Report,* December 2000.

NPS, 2002. *Guidance on Nitrogen and Sulfur Deposition Analysis Thresholds,* National Park Service Air Resources Division, Denver, Colorado, January 2002.

WDEQ, 2003. *Wyoming Air Quality Standards & Regulations.* Chapter 6 - Permitting Requirements; Section 4 - Prevention of Significant Deterioration.

Section 9

Monitoring

SECTION 9.0

Monitoring Information

This section describes the compliance monitoring devices and activities that will be employed at the Dry Fork Station. The applicable test methods used for determining compliance are also described.

9.1 Compliance Monitoring Devices and Activities

Unit 1 will be equipped with a CEMS that is compliant with the requirements of 40 CFR Part 75 for the measurement of SO_2 and NO_x and 40 CFR Part 60 for the measurement of CO. Visible emissions (opacity) will be measured with a COMS installed at the outlet of the baghouse. BEPC will install, properly maintain, and operate a continuous mercury emissions monitoring system on Unit 1 as described in 40 CFR Part 60.45a, or a sorbent trap monitoring system as described in 40 CFR Part 72 and 75.

9.2 Applicable Test Methods

Listed below are the EPA test methods from 40 CFR 60, Appendix A, and other test methods that are applicable to this project. These will be used to demonstrate compliance with permit limits.

Method 1 — Sample and Velocity Traverses for Stationary Sources
This method is designed to aid in the representative measurement of pollutant emissions and/or total volumetric flow rate from a stationary source. A measurement site where the effluent stream is flowing in a known direction is selected, and the cross-section of the stack is divided into a number of equal areas. Traverse points are then located within each of these equal areas.

Method 2 — Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube)
This method is applicable for the determination of the average velocity and the volumetric flow rate of a gas stream.

Method 3A — Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from Stationary Sources (Instrumental Analyzer Procedure)
This method is applicable to the determination of O_2 and CO_2 concentrations in emissions from stationary sources only when specified within the regulations.

Method 5 and/ or Method 17 — Determination of Particulate Matter Emissions from Stationary Sources
Particulate matter is withdrawn isokinetically from the source and collected on a glass fiber filter maintained at a temperature of 120 ± 14°C (248 ± 25°F) or such other temperature as specified by an applicable subpart of the standards or approved by the administrator for a particular application. The PM mass, which includes any material that condenses at or

above the filtration temperature, is determined gravimetrically after the removal of uncombined water.

Method 6C — Determination of Sulfur Dioxide Emissions from Stationary Sources (Instrumental Analyzer Procedure)
This method is applicable to the determination of SO_2 concentrations in controlled and uncontrolled emissions from stationary sources. A gas sample is extracted continuously from a stack, and a portion of the sample is conveyed to an instrumental analyzer for determination of SO_2 gas concentration using an ultraviolet (UV), nondispersive infrared (NDIR), or fluorescence analyzer.

Method 7E — Determination of Nitrogen Oxide Emissions from Stationary Sources (Instrumental Analyzer Procedure)
This method is applicable to the determination of NO_x concentrations in emissions from stationary sources. A gas sample is extracted continuously from a stack, and a portion of the sample is conveyed to an instrumental chemiluminescent analyzer for determination of NO_x concentration.

Method 8 — Determination of Sulfuric Acid and Sulfur Dioxide Emissions from Stationary Sources
A gas sample is extracted isokinetically from the stack. The H_2SO_4 and the SO_2 are separated, and both fractions are measured separately by the barium-thorin titration method.

Method 9 — Visual Determination of the Opacity of Emissions from Stationary Sources
This method is applicable for the determination of the opacity of emissions from stationary sources pursuant to § 60.11(b) and for qualifying observers for visually determining opacity of emissions. The opacity of emissions from stationary sources is determined visually by a qualified observer.

Method 10 — Determination of Carbon Monoxide Emissions from Stationary Sources
This method is applicable for the determination of CO emissions from stationary sources only when specified by the test procedures for determining compliance with new source performance standards. The test procedure will indicate whether a continuous or integrated sample is to be used. The integrated or continuous gas sample is extracted from a sampling point and analyzed for CO content using a Luft-type NDIR or equivalent.

Method 19 — Determination of Sulfur Dioxide Removal Efficiency and Particulate Matter, Sulfur Dioxide, and Nitrogen Oxides Emission Rates

1.0 Emission Rates. O_2 or CO_2 concentrations and appropriate F factors (ratios of combustion gas volumes to heat inputs) are used to calculate pollutant emission rates from pollutant concentrations.

2.0 Sulfur Reduction Efficiency and SO_2 Removal Efficiency. An overall SO_2 emission reduction efficiency is computed from the efficiency of fuel pretreatment systems, where applicable, and the efficiency of SO_2 control devices.

2.1 The sulfur removal efficiency of a fuel pretreatment system is determined by fuel sampling and analysis of the sulfur and heat contents of the fuel before and after the pretreatment system.

2.2 The SO_2 removal efficiency of a control device is determined by measuring the SO_2 rates before and after the control device.

2.3 The inlet rates to SO_2 control systems (or, when SO_2 control systems are not used, SO_2 emission rates to the atmosphere) are determined by fuel sampling and analysis.

Method 25 — Determination of Total Gaseous Nonmethane Organic Emissions as Carbon
This method is applicable for the determination of volatile organic compounds (VOC) measured as total gaseous nonmethane organics (TGNMO) and reported as carbon in stationary source emissions. Samples are withdrawn from a stack at a constant rate through a heated filter and chilled condensate trap by means of an evacuated sample tank. The sample concentrations are measured by a FID analyzer.

Method 25A — Determination of Total Gaseous Organic Concentration (Flame Ionization Analyzer Method)
This method is used for the measurement of total organic compounds. A gas sample is extracted from a source through a heated sample line and glass fiber filter to a flame ionization analyzer (FIA). Results are reported as volume concentration equivalents of the calibration gas or as carbon equivalents.

Method 26A — Determination of Hydrogen Halide and Halogen Emissions from Stationary Sources (Isokinetic Method)
This method is applicable for determining emissions of hydrogen halides {HCL, HF, and HBr] and halogens [X_2, CL_2 and Br_2] from stationary sources. This method collects the sample isokinetically and collects the sample on a filter and in absorbing solutions and the analysis is performed via ion chromatograph.

Methods 201 and 201A — Determination of Filterable PM_{10} Emissions
Methods 201 and 201A are used to determine filterable PM_{10} emissions from stationary sources. Method 201, known as the Exhaust Gas Recycle Procedure, extracts a gas sample isokinetically from the source. An in-stack cyclone is used to separate PM greater than PM_{10}, and an in-stack glass fiber filter is used to collect PM_{10}. To maintain isokinetic flow rate conditions at the tip of the probe and a constant flow rate through the cyclone, a clean, dried portion of the sample gas at stack temperature is recycled into the nozzle. The particulate mass is determined gravimetrically after removal of uncombined water. An alternate procedure, Method 201A, known as the Constant Sampling Rate Procedure, extracts a gas sample at a constant flow rate through an in-stack sizing device, which separates PM greater than PM_{10}. The particulate mass is determined gravimetrically after removal of uncombined water.

Method 202 — Determination of Condensable Particulate Emissions From Stationary Sources
This method applies to the determination of condensable particulate matter (CPM) emissions from stationary sources. For this project, it will be applicable to the combustion sources only. The method may be used in conjunction with Method 201 or 201A if the probe is glass-lined. The CPM is collected in the impinger portion of a Method 17 type sampling train. The impinger contents are immediately purged after the run with nitrogen to remove dissolved sulfur dioxide gases from the impinger contents. The impinger solution is then extracted with methylene chloride. The organic and aqueous fractions are then taken to

dryness and the residues weighed. The total of both fractions represents the condensable particulate matter.

Recently, an interference problem has been identified with Method 202 as it is presently performed. The present method can capture gaseous SO_2 in the impingement train and include it along with condensed particles in the analysis. EPA is aware of this interference problem and is researching changes to the method, although none have been proposed. Other organizations, most notably EPRI, have proposed a similar condensable particulate test method which does not have this interference problem. Accordingly, BEPC requests that the condensable particulate fraction be determined by Method 202, if at the time Unit 1 starts up the method has been changed by EPA to eliminate this problem, or by an alternate test method acceptable to the WDEQ.

Ontario Hydro Method — Determination of Mercury Emissions From Stationary Sources

This method applies to the determination of elemental, oxidized, particle-bound, and total mercury emissions from coal-fired stationary sources. A sample is withdrawn from the flue gas stream isokinetically through a probe/filter system, maintained at 120° C or the flue gas temperature, whichever is greater, followed by a series of impingers in an ice bath. Particle-bound mercury is collected in the front half of the sampling train. Oxidized mercury is collected in impingers containing a chilled aqueous potassium chloride solution. Elemental mercury is collected in subsequent impingers (one impinger containing a chilled aqueous acidic solution of hydrogen peroxide and three impingers containing chilled aqueous acidic solutions of potassium permanganate). Samples are recovered, digested, and then analyzed for mercury using cold-vapor atomic absorption (CVAAS) or fluorescence spectroscopy (CVAFS).

Section 10

Compliance

SECTION 10.0

Compliance Plan and Certification

10.1 Evidence of Compliance with Standards

This application is for a PSD Construction permit only and the Title V operating permit application will be filed later, 12 months after startup of Unit 1. Therefore, this section is not yet required. Accordingly, BEPC is providing this section for information purposes only to demonstrate that the construction and operation of the Dry Fork Station will be wholly protective of the environment.

10.2 Compliance Status

BEPC's Dry Fork Station project will be in compliance with applicable environmental laws and regulations. There are no enforcement actions or compliance plans in progress for BEPC.

10.3 Compliance Plan

BEPC's Dry Fork Station will be in compliance with applicable requirements; therefore, no compliance plan is required.

10.3.1 Compliance Schedule

BEPC's Dry Fork Station project will be in compliance with applicable requirements; therefore, there is no compliance schedule is provided.

10.3.2 Other Requirements

BEPC's Dry Fork Station project will meet other applicable requirements that become effective during the term of the permit as required by the WDEQ.

10.4 Compliance Certification

A compliance certification signed by a responsible official of BEPC's Dry Fork Station project will be provided as a part of the Title V permit application filed within 12 months after startup of Unit 1.

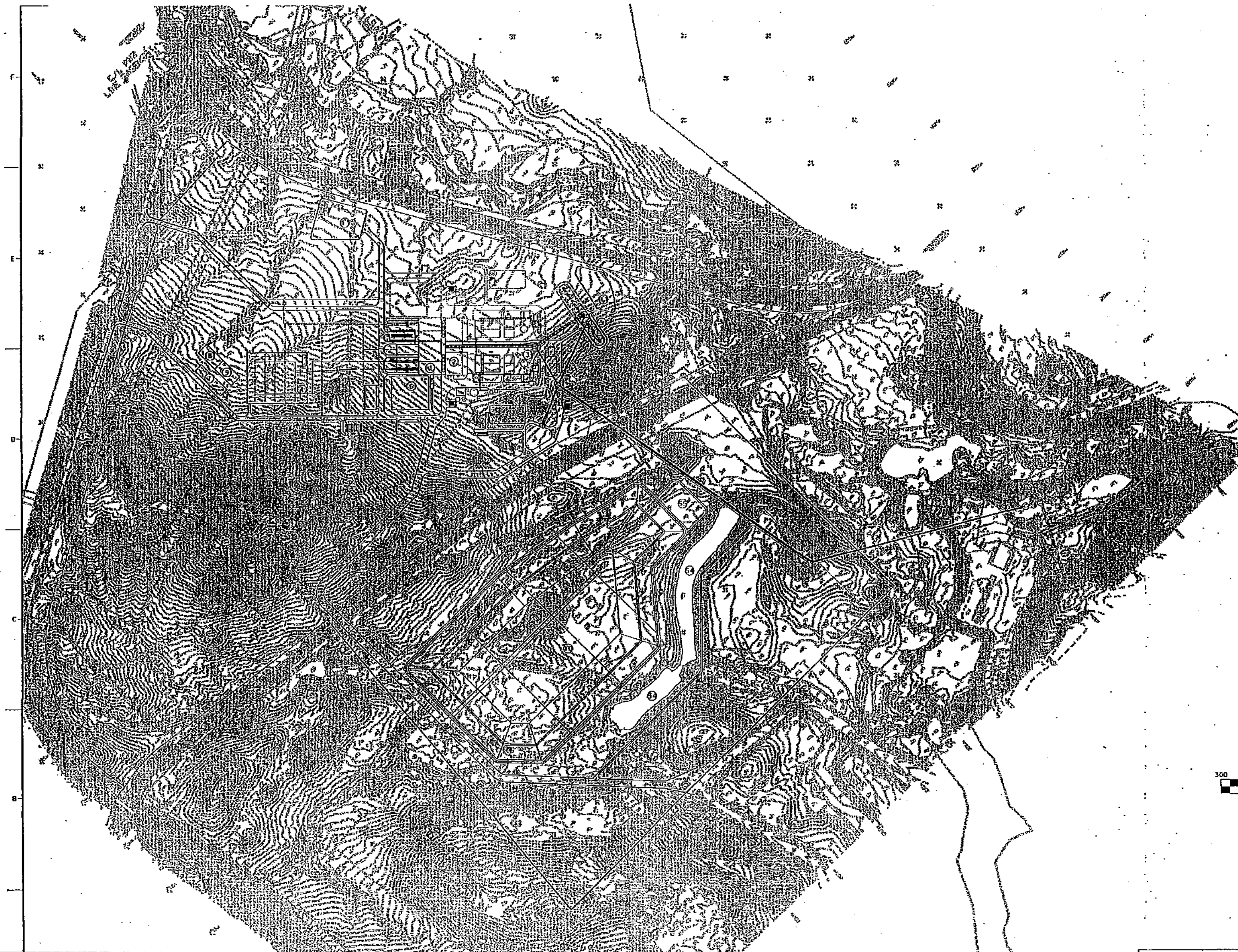
10.5 Acid Rain Compliance Plan

BEPC's Dry Fork Station will be in compliance with Title IV Acid Rain Program requirements. An application and compliance plan (as required) for the Dry Fork Station project acid rain permit will be submitted to WDEQ no later than 24 months before the date on which the unit is to commence operation.

Appendix A

Diagrams

LEGEND		EMISSION LOCATION
1	TURBINE BUILDING	—
2	BOILER BUILDING	X
3	CHIMNEY	X
4	SWITCHYARD	—
5	COAL STORAGE SILOS	X
6	AIR-COOLED CONDENSER	—
7	T&D SHOPS	—
8	T&D WAREHOUSE	—
9	T&D COVERED STORAGE AREA	—
10	SOLID WASTE DISPOSAL AREA	X
11	STORM WATER POND	—
12	OVERPASS	—
54	STORM WATER RUNOFF POND (EXISTING	—
55	LEACHATE COLLECTION POND	—



PROGRESS PRINT

CONTRACTOR/INSTALLER SHALL TAKE ALL APPROPRIATE PRECAUTIONS TO ENSURE THE SAFETY OF ALL PEOPLE LOCATED ON THE WORK SITE, INCLUDING CONTRACTOR'S/INSTALLER'S PERSONNEL FOR THAT OF ITS SUBCONTRACTOR(S) PERFORMING THE WORK.

DRAWING RELEASE RECORD

REV.	DATE REL'D.	PREPARED	REVIEWED	APPROVED	PURPOSE
8	10-14-2005	R.A. MILLER			PROGRESS PRINT

DRAWING RELEASE RECORD

REV.	DATE REL'D.	PREPARED	REVIEWED	APPROVED	PURPOSE
0	06-30-2005	R.A. MILLER			PROGRESS PRINT
1	07-06-2005	R.A. MILLER			PROGRESS PRINT (INTERNAL ISSUE)
2	07-08-2005	R.A. MILLER			PROGRESS PRINT
3	07-20-2005	J. SCHOONOVER			PROGRESS PRINT
4	07-28-2005	R.A. MILLER			PROGRESS PRINT
5	08-09-2005	R.A. MILLER			PROGRESS PRINT
6	08-18-2005	J. SCHOONOVER			PROGRESS PRINT
7	09-21-2005	R.A. MILLER			PROGRESS PRINT

SCALE 1"=300'
PROJECT NUMBER

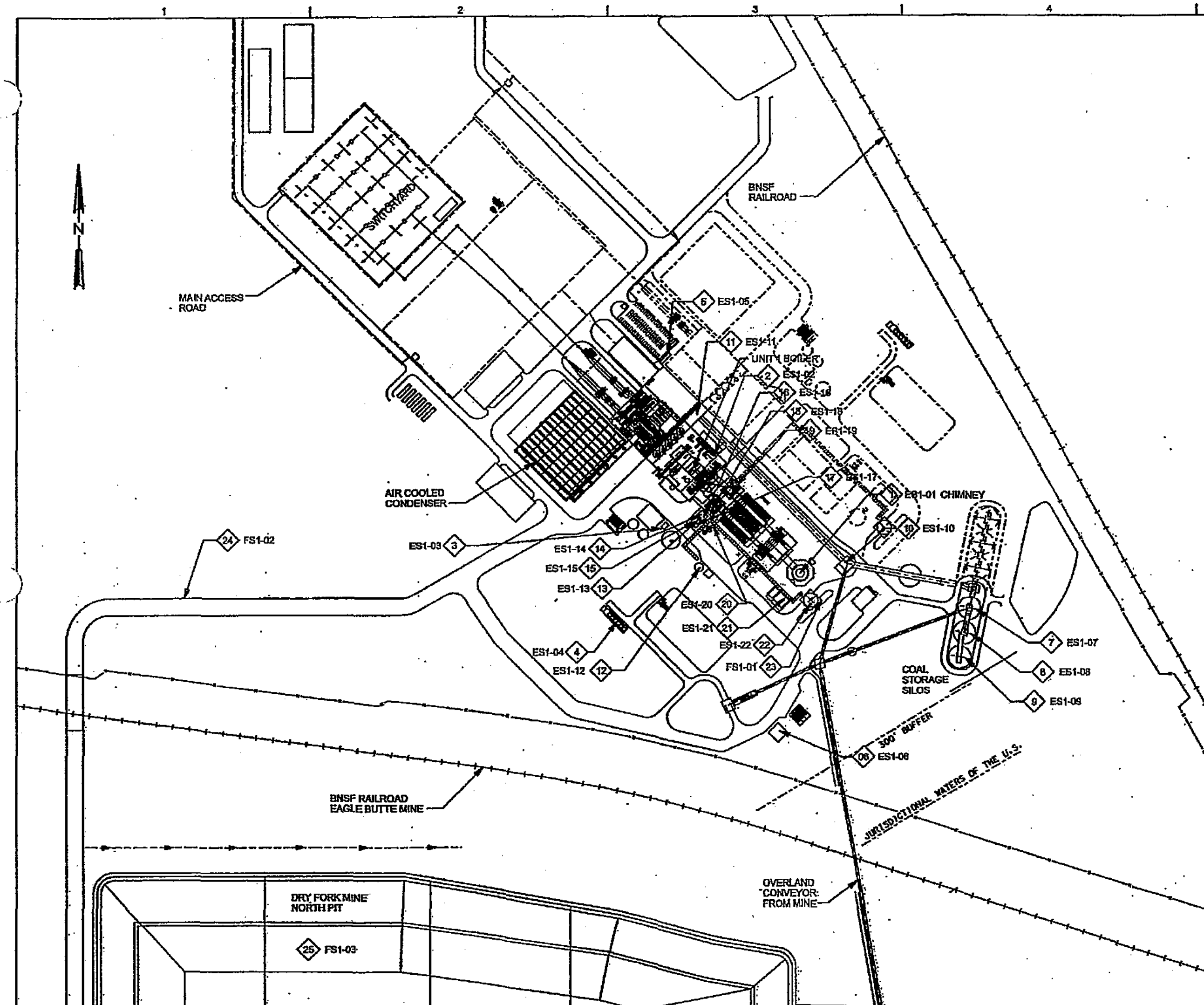
GENERAL ARRANGEMENT
PROPERTY DEVELOPMENT

BASIN ELECTRIC
POWER COOPERATIVE
DRY FORK STATION

Sargent & Lundy

DRAWING NO. MSK-GA-1
REV. 8
SHEET OF

DEQ/AQD 000154



EMISSION SOURCES

SOURCE NUMBER	SOURCE NAME	NORTHING	EASTING	ELEVATION	REF. DWG. NO.
1 ES1-01	UNIT 1 MAIN BOILER	N 4915090.00	E 463430.00	4750' ASL (500' AG)	N/A
2 ES1-02	AUXILIARY BOILER	N 4915220.39	E 463338.25	4482' ASL (232' AG)	DETAIL 7 BE-GA-10-01-05
3 ES1-03	DIESEL FIRE PUMP	N 4915139.48	E 463279.77	4270' ASL (20' AG)	DETAIL 8 BE-GA-10-01-05
4 ES1-04	AUXILIARY COOLING TOWER	N 4915036.36	E 463231.24	4270' ASL (20' AG)	N/A
5 ES1-05	EMERGENCY DIESEL GENERATOR	N 4915331.50	E 463286.32	4270' ASL (20' AG)	DETAIL 8 BE-GA-10-01-05
6 ES1-06	INLET GAS HEATER	N 4914817.41	E 463407.43	4270' ASL (20' AG)	DETAIL 9 BE-GA-10-01-05
7 ES1-07	COAL STORAGE SILO 1 DUST COLLECTOR	N 4915050.23	E 463621.75	4430' ASL (180' AG)	DETAIL 1 BE-GA-10-01-05
8 ES1-08	COAL STORAGE SILO 2 DUST COLLECTOR	N 4915023.28	E 463616.60	4430' ASL (180' AG)	DETAIL 1 BE-GA-10-01-05
9 ES1-09	COAL STORAGE SILO 3 DUST COLLECTOR	N 4914998.52	E 463610.52	4430' ASL (180' AG)	DETAIL 1 BE-GA-10-01-05
10 ES1-10	COAL CRUSHER HOUSE DUST COLLECTOR	N 4915101.91	E 463479.62	4406' ASL (156' AG)	DETAIL 2 BE-GA-10-01-05
11 ES1-11	PLANT COAL SILO TRANSFER BAY DUST COLLECTOR	N 4915264.38	E 463317.28	4460' ASL (210' AG)	DETAIL 1 BE-GA-10-01-05
12 ES1-12	PEBBLE LIME STORAGE SILO BIN VENT FILTER	N 4915095.79	E 463320.30	4350' ASL (100' AG)	DETAIL 3 BE-GA-10-01-05
13 ES1-13	PEBBLE LIME DAY SILO BIN VENT FILTER	N 4915149.28	E 463319.35	4330' ASL (80' AG)	DETAIL 3 BE-GA-10-01-05
14 ES1-14	LIME HYDRATOR MIXER DUST COLLECTOR 1	N 4915155.12	E 463322.35	4338' ASL (88' AG)	DETAIL 4 BE-GA-10-01-05
15 ES1-15	LIME HYDRATOR MIXER DUST COLLECTOR 2	N 4915147.16	E 463314.40	4338' ASL (88' AG)	DETAIL 4 BE-GA-10-01-05
16 ES1-16	HYDRATED LIME CRUSHER DUST COLLECTOR 1	N 4915152.29	E 463325.18	4338' ASL (88' AG)	DETAIL 4 BE-GA-10-01-05
17 ES1-17	HYDRATED LIME CRUSHER DUST COLLECTOR 2	N 4915144.34	E 463317.23	4338' ASL (88' AG)	DETAIL 4 BE-GA-10-01-05
18 ES1-18	HYDRATED LIME SILO 1 BIN VENT FILTER	N 4915158.68	E 463332.73	4347' ASL (97' AG)	DETAIL 5 BE-GA-10-01-05
19 ES1-19	HYDRATED LIME SILO 2 BIN VENT FILTER	N 4915187.23	E 463361.39	4347' ASL (97' AG)	DETAIL 5 BE-GA-10-01-05
20 ES1-20	ACTIVATED CARBON SILO BIN VENT FILTER	N 4915142.00	E 463335.32	4336' ASL (86' AG)	DETAIL 3 BE-GA-10-01-05
21 ES1-21	FLY ASH / FGD - WASTE SILO SEPARATOR / FILTER EXHAUST	N 4915062.21	E 463413.73	4282' ASL (32' AG)	DETAIL 6 BE-GA-10-01-05
22 ES1-22	FLY ASH / FGD - WASTE SILO BIN VENT FILTER	N 4915055.67	E 463441.78	4345' ASL (95' AG)	DETAIL 6 BE-GA-10-01-05
23 FS1-01	FLY ASH/FGD WASTE TRUCK LOADING	N/A	N/A	4250' ASL (GRADE)	N/A
24 FS1-02	FLY ASH/FGD WASTE HAUL ROADS	N/A	N/A	4270' ASL (GRADE)	N/A
25 FS1-03	FLY ASH/FGD WASTE LANDFILL	N/A	N/A	4250' ASL (GRADE)	N/A

NO.	DATE	REVISION	BY	CHK
D	10/20/05	FOR REVIEW	EFC	JH
C	10/17/05	~~FOR REVIEW~~	EFC	JH
B	10/04/05	FOR REVIEW	EFC	RKP
A	08/26/05	FOR REVIEW	EFC	RKP

RESPONSIBLE ENGINEER

REVISION APPROVAL — REV D — DATE 10/20/05 — PRINT DISTRIBUTION

STATUS: ISSUED — REV — DATE — SDE — PEM

FOR REVIEW AND APPROVAL: D 10/20/05

SCALE 1"=200'

BASIN ELECTRIC

NE WYOMING GENERATION

WYOMING

PROJECT NO. 317334

CH2MHILL

GENERAL ARRANGEMENT

DRY FORK STATION EMISSION POINTS

DWG. NO. BE-GA-10-01-06 REV. D

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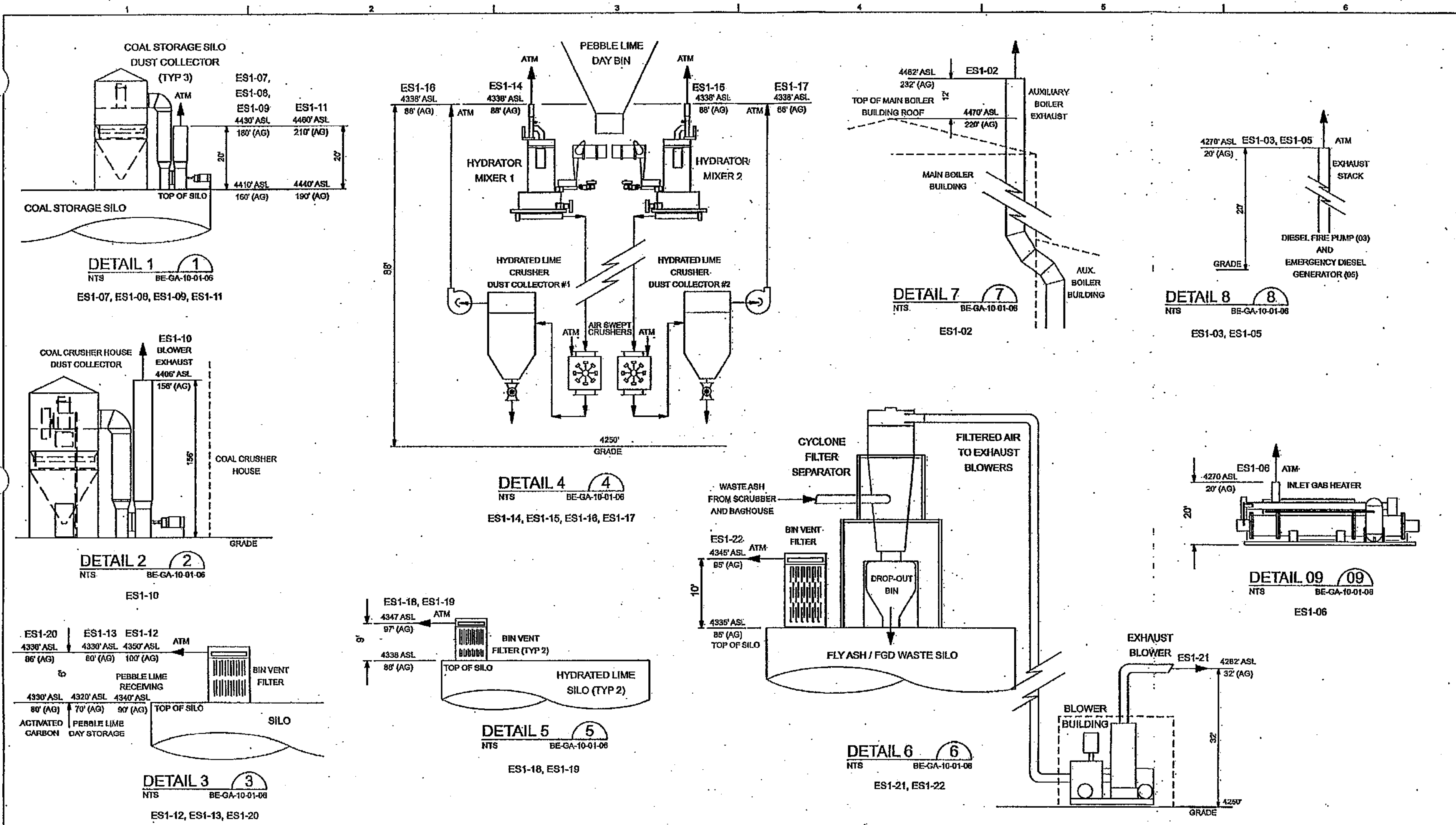

NO.	DATE	REVISION	BY	CHK
E	10/20/05	FOR REVIEW	EFC	JH
D	10/04/05	FOR REVIEW	EFC	RKP
C	09/26/05	FOR REVIEW	EFC	RKP
B	08/04/05	FOR REVIEW	EFC	RKP
A	08/24/05	FOR REVIEW	EFC	RKP

REVISION APPROVAL — REV E DATE 10/20/05

STATUS: ISSUED — REV E — DATE 10/20/05 (FOR REVIEW AND APPROVAL)

SCALE AS SHOWN

BASIN ELECTRIC
NE WYOMING GENERATION
WYOMING
PROJECT NO. 317334

CH2MHILL

GENERAL ARRANGEMENT
DRY FORK STATION
EMISSION SOURCE DETAILS

DWG. NO. BE-GA-10-01-05 REV. E

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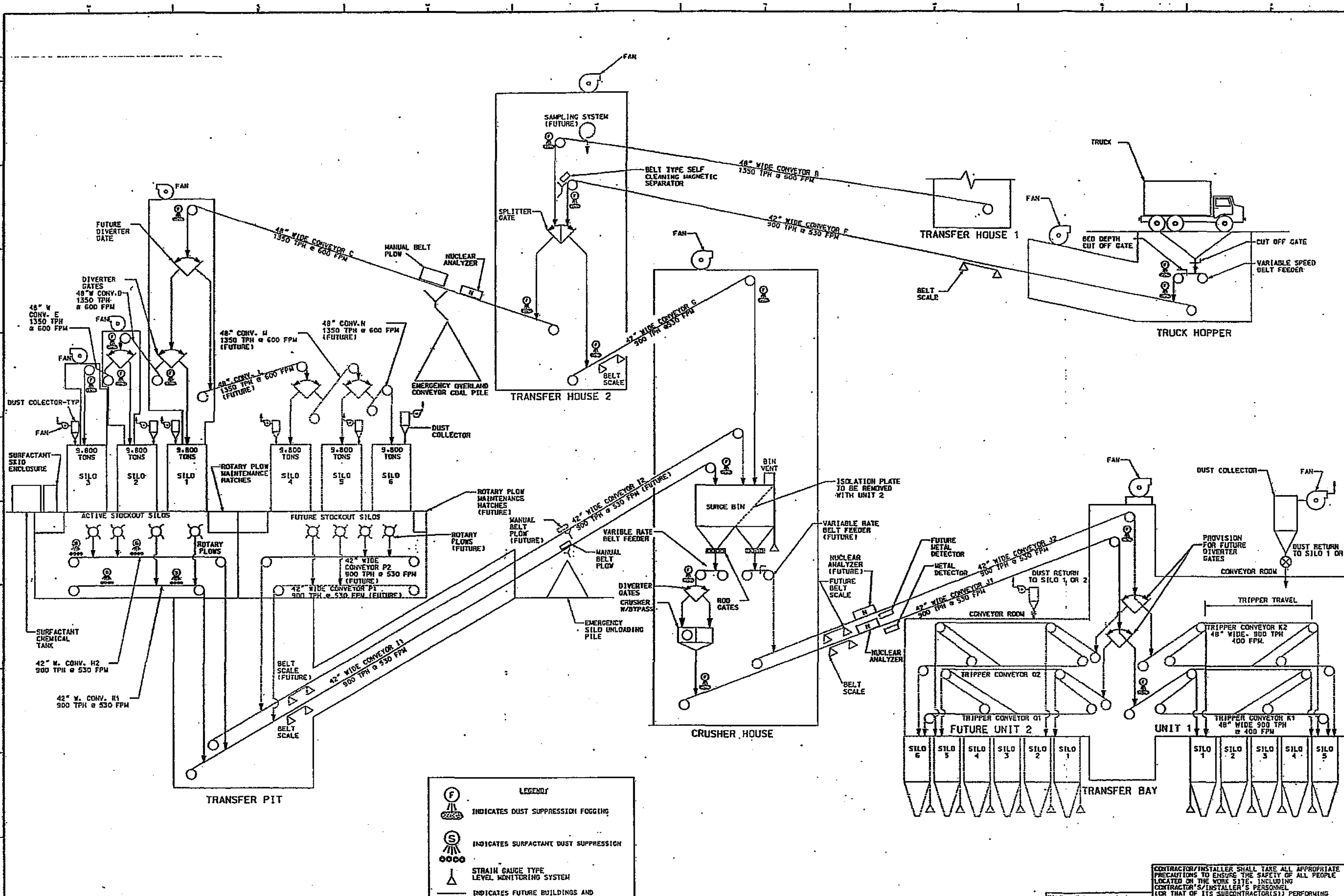


CONTRACTOR/INSTALLER SHALL TAKE ALL APPROPRIATE PRECAUTIONS TO ENSURE THE SAFETY OF ALL PEOPLE LOCATED ON THE WORK SITE, INCLUDING CONTRACTOR'S/INSTALLER'S PERSONNEL (OR THAT OF ITS SUBCONTRACTOR(S)) PERFORMING THE WORK.

DRAWING RELEASE RECORD

REV.	DATE REL'D.	PREPARED	REVIEWED	APPROVED	PURPOSE
0	11-02-2005	K. PEMBERTON	B. SHAH	K. PEMBERTON	FOR PERMIT APPLICATION

FILENAME: bas-mhs-1-1.dgn

SCALE: NONE

PROJECT NUMBER: 11786-001

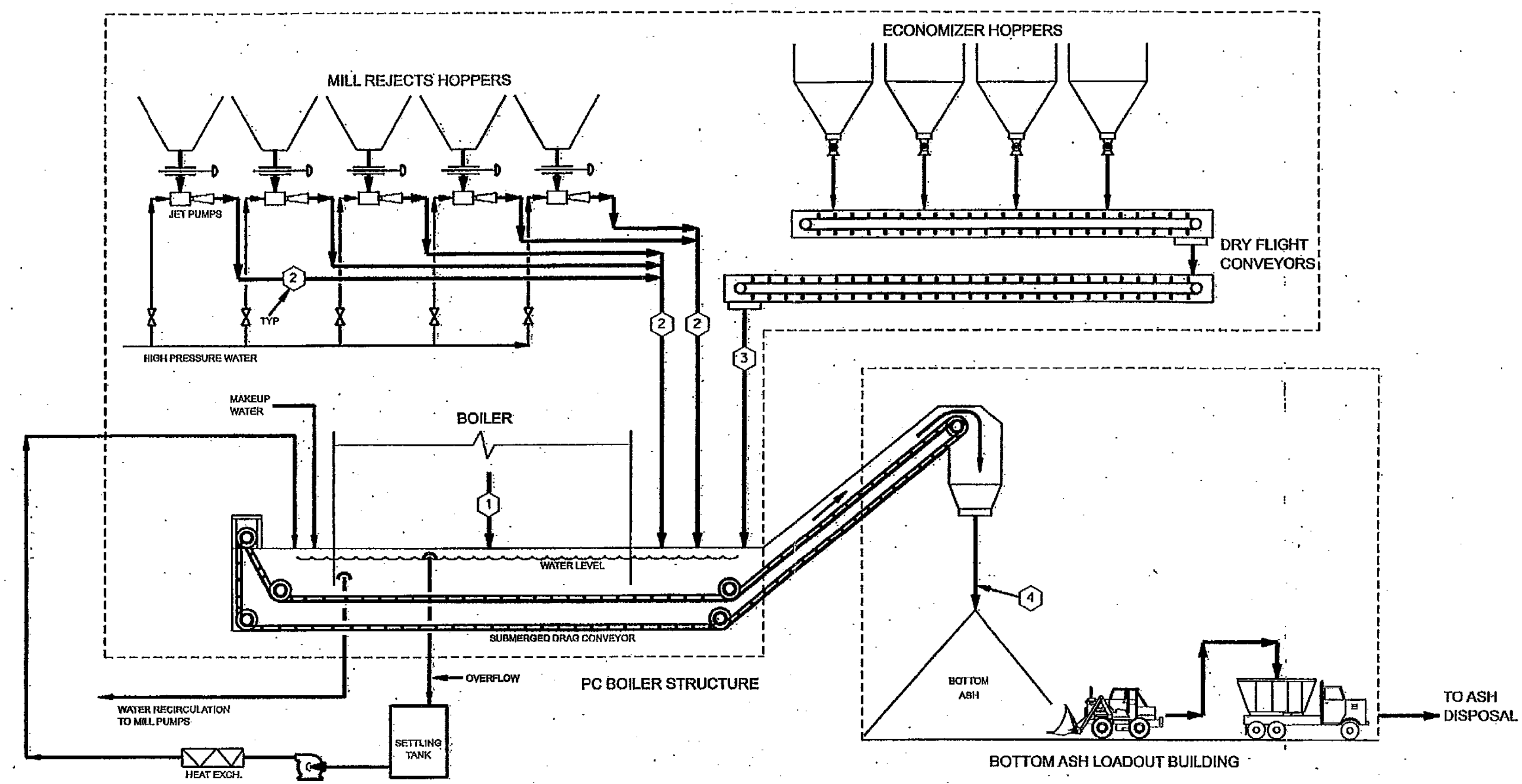
COAL FLOW DIAGRAM

BASIN ELECTRIC POWER COOPERATIVE
NE WYOMING GENERATION PROJECT

Sargent & Lundy

DRAWING NO. BAS-MHS-1-2 REV. 0

SHEET 1 OF 1



	1	2	3	4	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
Material Size																			
Solids Flow Rate - TPH	7	10	2.0	12															
Temperature Deg. F																			
Material Density LB / Cu. Ft.																			

NO.	DATE	REVISION	BY	CHK
C	10/07/05	For Internal Review and Approval	EFC	JH
~~C~~	~~08/26/05~~	~~For Review~~	~~EFC~~	~~LD~~
B	08/08/05	For Review	SAN	LD
A	08/24/05	For Review	EFC	LD

RESPONSIBLE ENGINEER

REVISION APPROVAL: DISCIPLINE / REVIEWED — CIVIL, STRUCTURAL, MECHANICAL, PROCESS, PIPING; ELECTRICAL, INST & CONTROL, ARCHITECTURAL, ENVIRONMENTAL, GEN. ARRANG.

REV D DATE 10/10/05

PRINT DISTRIBUTION: DATE, STATUS, REV., CLIENT, FIELD, INTRA CO.

STATUS				
ISSUED	REV	DATE	SDE	PEM
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FOR REVIEW AND APPROVAL	D	10/10/05		
APPROVED FOR CONSTRUCTION		/ /		
REVISED & APPROVED FOR CONSTRUCTION		/ /		

SCALE NONE

BASIN ELECTRIC
NE WYOMING GENERATION
WYOMING
PROJECT NO. 317334

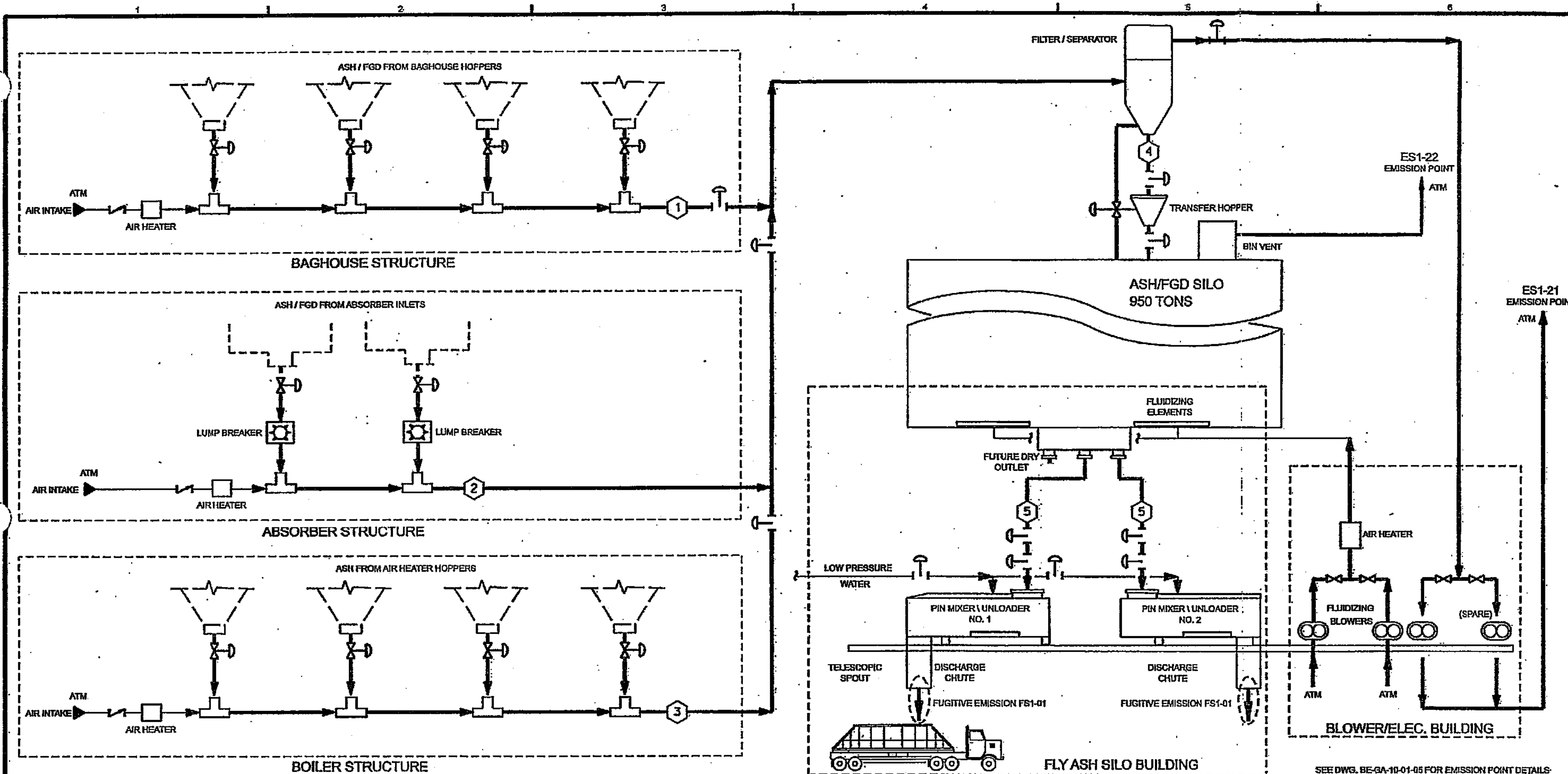
CH2MHILL

PROCESS FLOW DIAGRAM
DRY FORK STATION
ECONOMIZER, BOTTOM ASH
AND MILL REJECTS HANDLING SYSTEM

DWG. NO. BE-PR-10-20-09 REV. D

FILENAME: bepr102009.dlv PLOT DATE: 11-OCT-2005 PLOT TIME:

BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"



	1	2	3	4	5	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
Material Size																			
Solids Flow Rate - TPH	26	26	26	26	150														
Temperature Deg. F																			
Material Density LB / Cu. Ft.																			

NO.	DATE	REVISION	BY	CHK
D	10/07/05	For Internal Review and Approval	EFC	JH
C	08/26/05	For Review	EFC	LD
B	08/08/05	For Review	SAN	LD
A	06/24/05	For Review	EFC	LD

REVISION APPROVAL — REV D DATE 10/07/05

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STATUS	REV	DATE	SDE	PEM
ISSUED				
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FOR REVIEW AND APPROVAL	D	10/07/05		
APPROVED FOR CONSTRUCTION		/ /		
REVISED & APPROVED FOR CONSTRUCTION		/ /		

RESPONSIBLE ENGINEER

PE #

SCALE NONE

BASIN ELECTRIC
NE WYOMING GENERATION
WYOMING

PROJECT NO. 317334

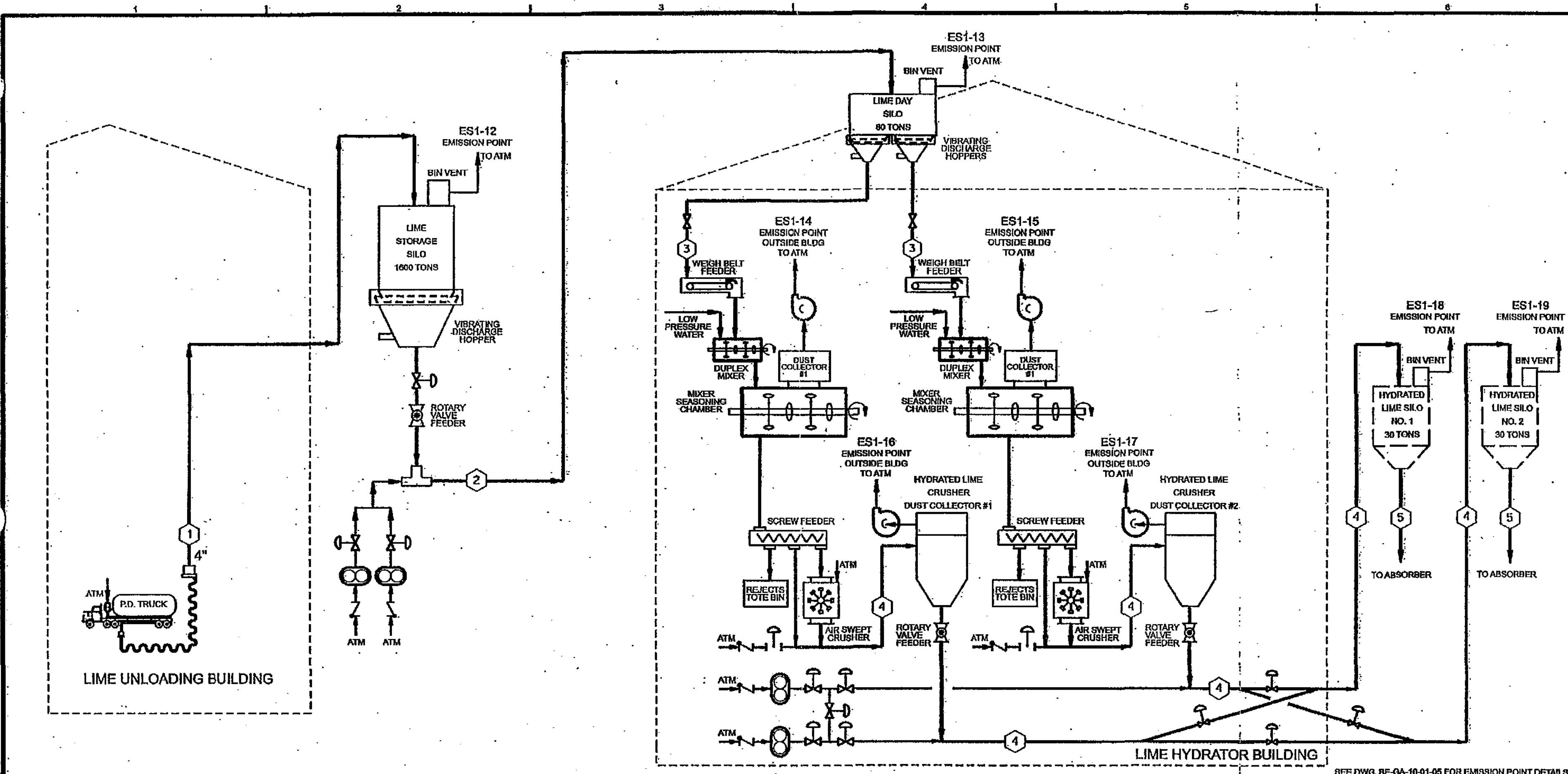
CH2MHILL

PROCESS FLOW DIAGRAM
DRY FORK STATION
FLUE GAS DESULFURIZATION
ASH HANDLING

DWG. NO. BE-PR-10-20-10 REV. D

BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"

FILENAME: bepr102010.dlv PLOT DATE: 11-OCT-2005 PLOT TIME:



	1	2	3	4	5	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
Material Size																			
Solids Flow Rate - TPH	30	20	12	16	2.5														
Temperature Deg. F																			
Material Density LB / Cu. Ft.																			

NO.	DATE	REVISION	BY	CHK
D	10/07/05	FOR INTERNAL REVIEW AND APPROVAL	EFC	JH
C	08/26/05	For Internal Review and Approval	EFC	LDD
B	08/04/05	For Internal Review and Approval	EFC	LDD
A	06/24/05	For Internal Review and Approval	SAN	LDD

REVISION APPROVAL — REV. D DATE 10/07/05

STATUS: ISSUED — REV D — DATE 10/07/05

BASIN ELECTRIC
NE WYOMING GENERATION
WYOMING
PROJECT NO. 317334

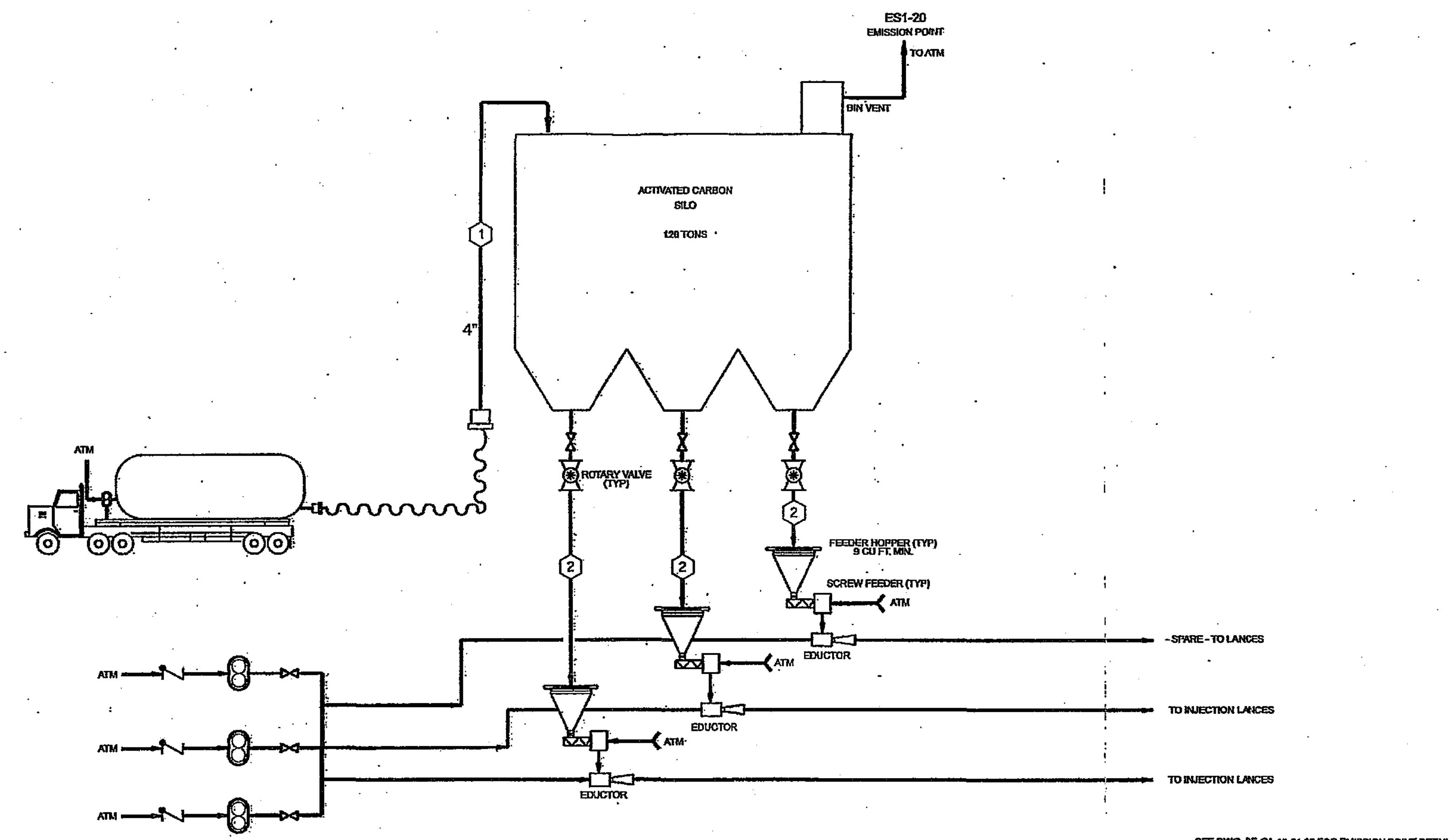
PROCESS FLOW DIAGRAM
DRY FORK STATION
LIME & HYDRATED LIME
MATERIAL HANDLING SYSTEM

SCALE NONE

CH2MHILL

DWG. NO. BE-PR-10-20-11 REV. D

FILENAME: bepr102011.dlv PLOT DATE: 11-OCT-2005 PLOT TIME:



SEE DWG. BE-GA-10-01-05 FOR EMISSION POINT DETAILS

	1	2	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
Material Size																			
Solids Flow Rate - TPH	20	0.3																	
Temperature Deg. F																			
Material Density LB / Cu. Ft.																			

NO.	DATE	REVISION	BY	CHK
D	10/07/05	FOR INTERNAL REVIEW AND APPROVAL.	EFC	JH
C	08/20/05	For Review	EFC	LDD
B	08/08/05	For Review	SAN	LDD
A	08/24/05	For Review	SAN	LDD

RESPONSIBLE ENGINEER

REVISION APPROVAL: DISCIPLINE / REVIEWED: CIVIL, STRUCTURAL, MECHANICAL, PROCESS, PIPING; REV D DATE 10/07/05: ELECTRICAL, INST & CONTROL, ARCHITECTURAL, ENVIRONMENTAL, CIVIL. ARCHIT.

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STATUS	REV.	DATE	SDE	PEM
ISSUED				
PRELIMINARY				
FOR REVIEW AND APPROVAL	D	10/07/05		
APPROVED FOR CONSTRUCTION				
REVISED & APPROVED FOR CONSTRUCTION				

SCALE NONE

BASIN ELECTRIC
NE WYOMING GENERATION
WYOMING

PROJECT NO. 317334

CH2MHILL

PROCESS FLOW DIAGRAM
DRY FORK STATION
ACTIVATED CARBON
MATERIAL HANDLING SYSTEM

DWG. NO. BE-PR-10-20-12 REV. D

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FILENAME: bepr102012.dlv PLOT DATE: 11-OCT-2005 PLOT TIME:

Appendix B
Emissions Calculations

Basin Electric Power Cooperative
Dry Fork Station
Emissions Calculations

Revision 11 - 11/07/05

Emission Workbook sheets include:

Source Number	Worksheet
	Emission Source List
ES1-01	Unit 1 Main Boiler - Criteria Emissions
ES1-01	Unit 1 Main Boiler - Organic HAPs
ES1-01	Unit 1 Main Boiler - Acid Gas HAPs
ES1-01	Unit 1 Main Boiler - Metal HAPs
ES1-01	Unit 1 Main Boiler - Condensable Organics
ES1-02	Unit 1 Auxiliary Boiler - Criteria Emissions
ES1-02	Unit 1 Auxiliary Boiler - HAPs
ES1-03	Diesel Fire Pump - Criteria Emissions
ES1-03	Diesel Fire Pump - HAPs
ES1-04	Auxiliary Cooling Tower - PM and PM_{10} Emissions
ES1-05	Emergency Diesel Generator - Criteria Emissions
ES1-05	Emergency Diesel Generator - HAPs
ES1-06	Inlet Gas Heater - Criteria Emissions
ES1-06	Inlet Gas Heater - HAPs
ES1-07, ES1-08, ES1-09, ES1-10, ES1-11	Coal Handling Dust Collectors - PM and PM_{10} Emissions
ES1-12, ES1-13, ES1-14, ES1-15, ES1-16, ES1-17, ES1-18, ES1-19	Lime Handling Dust Collectors - PM and PM_{10} Emissions
ES1-20	Activated Carbon Handling Dust Collector - PM and PM_{10} Emissions
ES1-21, ES1-22, FS1-01, FS1-02	Fly Ash/FGD Waste Handling Dust Collectors, Truck Loading and Haul Roads - PM and PM_{10} Emissions
FS1-04	Bottom Ash Handling Haul Roads - PM and PM_{10} Emissions
FS1-03	Ash/FGD Waste Landfill - PM and PM_{10} Emissions
	Stack Parameters - Material Handling and Auxiliary Equipment Sources

Basin Electric Power Cooperative
Dry Fork Station
Emissions Calculations

Revision 11 - 11/07/05

Emission Workbook sheets include:

Source Number	Worksheet
	Area and Volume Sources
	ISC- Prime Modeling Results
	WDEQ Application Form - Table 1 Stack Data

Basin Electric Power Cooperative
Dry Fork Station
Emission Sources
Revised 11-03-05

Source Number	Source Name
ES1-01	Unit 1 Main Boiler
ES1-02	Auxiliary Boiler
ES1-03	Diesel Fire Pump
ES1-04	Auxiliary Cooling Tower
ES1-05	Emergency Diesel Generator
ES1-06	Inlet Gas Heater
ES1-07	Coal Storage Silo 1 Dust Collector
ES1-08	Coal Storage Silo 2 Dust Collector
ES1-09	Coal Storage Silo 3 Dust Collector
ES1-10	Coal Crusher House Dust Collector
ES1-11	Plant Coal Silo Transfer Bay Dust Collector
ES1-12	Pebble Lime Storage Silo Bin Vent Filter
ES1-13	Pebble Lime Day Silo Bin Vent Filter
ES1-14	Lime Hydrator Mixer Dust Collector No. 1
ES1-15	Lime Hydrator Mixer Dust Collector No. 2
ES1-16	Hydrated Lime Crusher Dust Collector No. 1
ES1-17	Hydrated Lime Crusher Dust Collector No. 2
ES1-18	Hydrated Lime Silo 1 Bin Vent Filter
ES1-19	Hydrated Lime Silo 2 Bin Vent Filter
ES1-20	Activated Carbon Silo Bin Vent Filter
ES1-21	Fly Ash/FGD Waste Silo Separator/Filter Exhaust
ES1-22	Fly Ash/FGD Waste Silo Bin Vent Filter
FS1-01	Fly Ash/FGD Waste Disposal Truck Loading
FS1-02	Fly Ash/FGD Waste Disposal Haul Road
FS1-03	Fly Ash/FGD Waste Landfill
FS1-04	Bottom Ash Disposal Haul Road

Basin Electric Power Cooperative
Dry Fork Station
Unit 1 Boiler (ES1-01)
Criteria Pollutant Potential To Emit

	Peak Load	100% Load	75% Load	50% Load	Information Source
Nominal Net Unit Output (MW)	360	368	281	185	S&L Tech Matrix (9-26-05)
Unit Net Heat Rate (Btu/net kWh)	10,527	10,077	10,337	10,955	S&L Tech Matrix (9-26-05)
Coal Feed Rate (tons/hr)	244	231	180	126	Calculated
Coal Feed Rate (tons/yr)		2,019,696			S&L Tech Matrix (10-04-05)
Design Coal Percent Sulfur (%)	0.47	0.33	0.33	0.33	S&L Tech Matrix (9-26-05)
Design Coal Ash Content (%)	4.77	4.77	4.77	4.77	S&L Tech Matrix (9-26-05)
Design Coal Moisture Content (%)	33.80	33.80	33.80	33.80	S&L Tech Matrix (9-26-05)
Heat Input to Boiler (MMBtu/hr)	3,801	3,710	2,902	2,023	S&L Tech Matrix (9-26-05)
Fuel Heat Value (Gross) (Btu/lb)	7,800	8,045	8,045	8,045	S&L Tech Matrix (9-26-05)
Annual Capacity Factor (%)		100			
NOx [PSD sig level = 40 tpy]					
30-day NOx Stack Emissions (lb/MMBtu)	0.07	0.07	0.07	0.07	S&L Tech Matrix (9-26-05)
30-day NOx Stack Emissions (lb/hr)	266	260	203	142	Calculated
Annual NOx Stack Emissions (tpy)		1137			Calculated
SO_2 [PSD sig level = 40 tpy]					
3-hr SO_2 Stack Emissions (lb/MMBtu)	0.10	0.10	0.10	0.10	S&L Tech Matrix (9-26-05)
3-hr SO_2 Stack Emissions (lb/hr)	380	371	290	202	Calculated
Annual SO_2 Stack Emissions (lb/MMBtu)	0.10	0.10	0.10	0.10	S&L Tech Matrix (9-26-05)
Annual SO_2 Stack Emissions (lb/hr)	380	371	290	202	Calculated
Annual SO_2 Stack Emissions (tpy)		1,625			Calculated
CO [PSD sig level = 100 tpy]					
CO Emission Factor (lb/MMBtu)	0.15	0.15	0.15	0.15	S&L Tech Matrix (9-26-05)
CO Stack Emissions (lb/hr)	570	557	435	303	Calculated
Annual CO Stack Emissions (tpy)		2,437			Calculated
PM [PSD sig level = 25 tpy]					
3-hr Filterable PM Stack Emissions (lb/MMBtu)	0.015	0.015	0.015	0.015	S&L Tech Matrix (9-26-05)
3-hr Filterable PM Stack Emissions (lb/hr)	57.02	55.65	43.53	30.35	Calculated
Annual Filterable PM Stack Emissions (tpy)		244			Calculated
Condensible PM					
3-hr Condensible PM Stack Emissions (lb/MMBtu)	0.0050	0.0050	0.0050	0.0050	Calculated
3-hr Condensible PM Stack Emissions (lb/hr)	18.99	18.48	14.45	10.08	Calculated
Annual Condedsible PM Stack Emissions (tpy)		80.94			Calculated
Total PM					
3-hr Total PM Stack Emissions (lb/MMBtu)	0.020	0.020	0.020	0.020	Calculated
3-hr Total PM Stack Emissions (lb/hr)	76.00	74.13	57.98	40.42	Calculated
Annual Total PM Stack Emissions (tpy)		325			Calculated
PM_{10} [PSD sig level = 15 tpy]					
3-hr Filterable PM_{10} Stack Emissions (lb/MMBtu)	0.012	0.012	0.012	0.012	S&L Tech Matrix (9-26-05)
3-hr Filterable PM_{10} Stack Emissions (lb/hr)	45.61	44.52	34.82	24.28	Calculated
Annual Filterable PM_{10} Stack Emissions (tpy)		195			Calculated
Condensible PM_{10}					
3-hr Condensible PM_{10} Stack Emissions (lb/MMBtu)	0.0050	0.0050	0.0050	0.0050	Calculated (See Notes)
3-hr Condensible PM_{10} Stack Emissions (lb/hr)	18.99	18.48	14.45	10.08	Calculated
Annual Condensible PM_{10} Stack Emissions (tpy)		80.94			Calculated
Total PM_{10}					
3-hr Total PM_{10} Stack Emissions (lb/MMBtu)	0.017	0.017	0.017	0.017	Calculated
3-hr Total PM_{10} Stack Emissions (lb/hr)	64.60	63.00	49.28	34.35	Calculated
Annual Total PM_{10} Stack Emissions (tpy)		276			Calculated
Lead [PSD sig level = 0.6 tpy]					
Lead Concentration in Coal, ppm (dry basis)	2.00	2.00	2.00	2.00	Dry Fork Mine Coal Data
Control Efficiency for Lead (%)	99	99	99	99	Controlled with Baghouse
Lead Stack Emissions (lb/hr)	0.00645	0.006	0.005	0.003	Calculated
Lead Stack Emissions (tpy)		0.027			Calculated
Beryllium [PSD sig level = 0.0004 tpy]					
Beryllium Concentration in Coal, ppm (dry basis)	0.30	0.30	0.30	0.30	Dry Fork Mine Coal Data
Control Efficiency for Beryllium (%)	99	99	99	99	Controlled with Baghouse
Beryllium Stack Emissions (lb/hr)	0.00097	0.00092	0.00072	0.00050	Calculated
Beryllium Stack Emissions (tpy)		0.0040			Calculated
Mercury [PSD sig level = 0.1 tpy]					
~~Mercury Concentration in Coal, ppm (dry basis)~~	~~0.05~~	~~0.05~~	~~0.05~~	~~0.05~~	~~Dry Fork Mine Coal Data~~
Control Efficiency for Mercury (%)	30	30	30	30	Controlled with Baghouse
Mercury Stack Emissions (lb/hr)	0.0113	0.0107	0.0084	0.0058	Calculated
Mercury Stack Emissions (tpy)		0.047			Calculated

Basin Electric Power Cooperative
Dry Fork Station
Unit 1 Boiler (ES1-01)
Criteria Pollutant Potential To Emit

	Peak Load	100% Load	75% Load	50% Load	Information Source
VOC [PSD sig level = 40 tpy]					
VOC Emissions (lb/MMBtu)	0.00385	0.00373	0.00373	0.00373	S&L Tech Matrix (9-26-05)
VOC Emissions (lb/hr)	14.63	13.84	10.82	7.55	Calculated
Annual VOC Emissions (tpy)		60.61			Calculated
Sulfuric Acid Mist [PSD sig level = 7 tpy]					
Scrubber Control Efficiency for H_2SO_4 (%)	90	90	90	90	S&L Tech Matrix (9-26-05)
H_2SO_4 Stack Emissions (lb/MMBTU)	0.0025	0.0025	0.0025	0.0025	S&L Tech Matrix (9-26-05)
Controlled H_2SO_4 Emissions (lb/hr)	9.50	9.28	7.26	5.06	Calculated
H_2SO_4 Stack Emissions (tpy)		40.62			Calculated
Fluorides [PSD sig level = 3 tpy]					
F Content in Coal, ppm (dry basis)	80	80	80	80	Dry Fork Mine Coal Data
Scrubber Control Efficiency for HF (%)	90	90	90	90	S&L Tech Matrix (9-26-05)
HF Stack Emissions (lb/MMBtu)	0.00069	0.00069	0.00069	0.00069	S&L Tech Matrix (9-26-05)
HF Stack Emissions (lb/hr)	2.62	2.56	2.00	1.40	Calculated
Annual HF Stack Emissions (tpy)		11.21			Calculated
Hydrogen Chloride [No PSD sig level]					
CL Content in Coal, ppm (dry basis)	100	100	100	100	Dry Fork Mine Coal Data
Scrubber Control Efficiency for HCL (%)	90	90	90	90	S&L Tech Matrix (9-26-05)
HCL Stack Emissions (lb/MMBtu)	0.00085	0.00085	0.00085	0.00085	S&L Tech Matrix (9-26-05)
HCL Stack Emissions (lb/hr)	3.23	3.15	2.47	1.72	Calculated
HCL Stack Emissions (tpy)		13.81			Calculated
Ammonium Sulfate [No PSD sig level]					
$(NH_4)_2SO_4$ Stack Emissions (lb/MMBTU)	0.000402	0.000402	0.000402	0.000402	S&L Tech Matrix (10-04-05)
Control Efficincieny for $(NH_4)_2SO_4$ (%)	90	90	90	90	S&L Tech Matrix (9-26-05)
$(NH_4)_2SO_4$ Stack Emissions (lb/hr)	1.53	1.49	1.17	0.81	Calculated
$(NH_4)_2SO_4$ Stack Emissions (tpy)		6.53			Calculated
Ammonia [No PSD sig level]					
Ammonia Slip, ppmvd	2	2	2	2	S&L Tech Matrix (9-26-05)
Ammonia Emissions (lb/hr)	3.94	3.85	3.01	2.10	S&L Tech Matrix (9-26-05)
Ammonia Emissions (tpy)		16.85			Calculated
Organic Fraction of Condensible [No PSD sig level]					
Condensible Organic Stack Emissions (lb/ton)	0.0077	0.0077	0.0077	0.0077	Calculated (See Notes)
Condensible Organic Stack Emissions (lb/hr)	1.88	1.78	1.39	0.97	Calculated
Condensible Organic Stack Emissions (lb/MMBTU)	0.00049	0.00048	0.00048	0.00048	Calculated
Condensible Organic Stack Emissions (tpy)		7.78			Calculated
Elemental Carbon [No PSD sig level]					
Elemental Carbon Stack Emissions (lb/MMBTU)	0.000060	0.000060	0.000060	0.000060	Calculated (See Notes)
Elemental Carbon Stack Emissions (lb/hr)	0.23	0.22	0.17	0.12	Calculated
Elemental Carbon Stack Emissions (tpy)		0.97			Calculated
Stack Conditions					
Stack Height (feet)	500	500	500	500	S&L Tech Matrix (9-26-05)
Stack Height (m)	152	152	152	152	Calculated
Stack Exit Diameter (feet)	19.50	19.50	19.50	19.50	S&L Tech Matrix (9-26-05)
Stack Exit Diameter (m)	5.94	5.94	5.94	5.94	Calculated
Stack Exit Temperature (degF)	170	170	170	170	S&L Tech Matrix (9-26-05)
Stack Exit Temperature (K)	350	350	350	350	Calculated
Stack Exit Flow (acfm)	1,507,797	1,425,248	1,115,026	777,298	S&L Tech Matrix (9-26-05)
Stack Exit Area (ft^2)	299	299	299	299	Calculated
Stack Exit Velocity (fps)	84.15	79.54	62.23	43.38	Calculated

Basin Electric Power Cooperative
Dry Fork Station
Unit 1 Boiler (ES1-01)
Criteria Pollutant Potential To Emit

	Peak Load	100% Load	75% Load	50% Load	Information Source
Stack Exit Velocity (m/s)	25.65	24.24	18.97	13.22	Calculated

Notes:
1) Annual ton estimate for each pollutant based on 100% capacity factor for unit operation.
2) Lead, Beryllium and Mercury Emissions are estimated based on coal analysis. Control efficiency for trace metals based on expected removal with baghouse. Trace Metal Emissions (lb/hr) = [Metal concentration in coal in ppm / 10^6] x [Coal Burned (tons/hr)] x [1 - Control Eff for Metal] x [2000 lb/ton] x [1-Moisture Content]
3) H_2SO_4 emissions based on 2% conversion of SO_2 to sulfuric acid.
4) No modeling significance level has been established for VOC. From the EPA NSR Workshop Manual: *No significant ambient concentration has been established. Instead any net emission increase of 100 tpy of VOC subject to PSD would be required to perform an ambient impact analysis.*
5) HF Emissions are based on the F content in coal.
6) HCl Emissions are based on the Cl content in coal.

Basin Electric Power Cooperative
Dry Fork Station
Unit 1 Boiler (ES1-01)
Organic HAP Emissions

Coal Burned at Peak Load	244	tons/hr
Annual Coal Burned at 100% Load	2,019,696	tons/yr

Pollutant	Emission Factor (lb/ton)	Controlled Hourly Emissions at Peak Load (lb/hr)	Controlled Annual Emissions (tpy)	Source
Biphenyl	1.70E-06	4.14E-04	1.72E-03	AP-42, Table 1.1-13
Acenaphthene	5.10E-07	1.24E-04	5.15E-04	AP-42, Table 1.1-13
Acenaphthylene	2.50E-07	6.09E-05	2.52E-04	AP-42, Table 1.1-13
Anthracene	2.10E-07	5.12E-05	2.12E-04	AP-42, Table 1.1-13
Benzo(a)anthracene	8.00E-08	1.95E-05	8.08E-05	AP-42, Table 1.1-13
Benzo(a)pyrene	3.80E-08	9.26E-06	3.84E-05	AP-42, Table 1.1-13
Benzo(b,j,k)fluoranthene	1.10E-07	2.68E-05	1.11E-04	AP-42, Table 1.1-13
Benzo(g,h,i)perylene	2.70E-08	6.58E-06	2.73E-05	AP-42, Table 1.1-13
Chrysene	1.00E-07	2.44E-05	1.01E-04	AP-42, Table 1.1-13
Fluoranthene	7.10E-07	1.73E-04	7.17E-04	AP-42, Table 1.1-13
Fluorene	9.10E-07	2.22E-04	9.19E-04	AP-42, Table 1.1-13
Ideno(1,2,3-cd)pyrene	6.10E-08	1.49E-05	6.16E-05	AP-42, Table 1.1-13
Naphthalene	1.30E-05	3.17E-03	1.31E-02	AP-42, Table 1.1-13
Phenanthrene	2.70E-06	6.58E-04	2.73E-03	AP-42, Table 1.1-13
Pyrene	3.30E-07	8.04E-05	3.33E-04	AP-42, Table 1.1-13
5-Methyl chrysene	2.20E-08	5.36E-06	2.22E-05	AP-42, Table 1.1-13
Total PAH		**5.06E-03**	**2.10E-02**	
Acetaldehyde	5.70E-04	1.39E-01	5.76E-01	AP-42, Table 1.1-14
Acetophenone	1.50E-05	3.65E-03	1.51E-02	AP-42, Table 1.1-14
Acrolein	2.90E-04	7.07E-02	2.93E-01	AP-42, Table 1.1-14
Benzene	1.30E-03	3.17E-01	1.31E+00	AP-42, Table 1.1-14
Benzyl chloride	7.00E-04	1.71E-01	7.07E-01	AP-42, Table 1.1-14
Bis(2-ethylhexyl)phthalate	7.30E-05	1.78E-02	7.37E-02	AP-42, Table 1.1-14
Bromoform	3.90E-05	9.50E-03	3.94E-02	AP-42, Table 1.1-14
Carbon disulfide	1.30E-04	3.17E-02	1.31E-01	AP-42, Table 1.1-14
2-Chloroacetophenone	7.00E-06	1.71E-03	7.07E-03	AP-42, Table 1.1-14
Chlorobenzene	2.20E-05	5.36E-03	2.22E-02	AP-42, Table 1.1-14
Chloroform	5.90E-05	1.44E-02	5.96E-02	AP-42, Table 1.1-14
Cumene	5.30E-06	1.29E-03	5.35E-03	AP-42, Table 1.1-14
Cyanide	2.50E-03	6.09E-01	2.52E+00	AP-42, Table 1.1-14
2,4-Dinitrotoluene	2.80E-07	6.82E-05	2.83E-04	AP-42, Table 1.1-14
Dimethyl sulfate	4.80E-05	1.17E-02	4.85E-02	AP-42, Table 1.1-14
Ethyl benzene	9.40E-05	2.29E-02	9.49E-02	AP-42, Table 1.1-14
Ethyl chloride	4.20E-05	1.02E-02	4.24E-02	AP-42, Table 1.1-14
Ethylene dichloride	4.00E-05	9.75E-03	4.04E-02	AP-42, Table 1.1-14
Ethylene dibromide	1.20E-06	2.92E-04	1.21E-03	AP-42, Table 1.1-14
Formaldehyde	2.40E-04	5.85E-02	2.42E-01	AP-42, Table 1.1-14
Hexane	6.70E-05	1.63E-02	6.77E-02	AP-42, Table 1.1-14
Isophorone	5.80E-04	1.41E-01	5.86E-01	AP-42, Table 1.1-14
Methyl bromide	1.60E-04	3.90E-02	1.62E-01	AP-42, Table 1.1-14
Methyl chloride	5.30E-04	1.29E-01	5.35E-01	AP-42, Table 1.1-14
Methyl ethyl ketone	3.90E-04	9.50E-02	3.94E-01	AP-42, Table 1.1-14
Methyl hydrazine	1.70E-04	4.14E-02	1.72E-01	AP-42, Table 1.1-14
Methyl methacrylate	2.00E-05	4.87E-03	2.02E-02	AP-42, Table 1.1-14
Methyl tert butyl ether	3.50E-05	8.53E-03	3.53E-02	AP-42, Table 1.1-14
Methylene chloride	2.90E-04	7.07E-02	2.93E-01	AP-42, Table 1.1-14
Phenol	1.60E-05	3.90E-03	1.62E-02	AP-42, Table 1.1-14
Propionaldehyde	3.80E-04	9.26E-02	3.84E-01	AP-42, Table 1.1-14
Tetrachloroethylene	4.30E-05	1.05E-02	4.34E-02	AP-42, Table 1.1-14
Toluene	2.40E-04	5.85E-02	2.42E-01	AP-42, Table 1.1-14
1,1,1-Trichloroethane	2.00E-05	4.87E-03	2.02E-02	AP-42, Table 1.1-14
Styrene	2.50E-05	6.09E-03	2.52E-02	AP-42, Table 1.1-14
Xylenes	3.70E-05	9.02E-03	3.74E-02	AP-42, Table 1.1-14
Vinyl acetate	7.60E-06	1.85E-03	7.67E-03	AP-42, Table 1.1-14

Basin Electric Power Cooperative
Dry Fork Station
Unit 1 Boiler (ES1-01)
Organic HAP Emissions

Coal Burned at Peak Load	244	tons/hr
Annual Coal Burned at 100% Load	2,019,696	tons/yr

Pollutant	Emission Factor (lb/ton)	Controlled Hourly Emissions at Peak Load (lb/hr)	Controlled Annual Emissions (tpy)	Source
Total Organics		2.24E+00	9.28E+00	

Notes:
1) Short term emissions estimated at peak load conditions and annual emissions are estimated at 100% load condition.

Basin Electric Power Cooperative
Dry Fork Station
Unit 1 Boiler (ES1-01)
Acid Gas HAP Emissions

	Scrubber Control Efficiency	Short Term Emissions (lb/hr)	Annual Emissions (tpy)
HCL	90	3.23	13.81
HF	90	2.62	11.21

Total Acid Gas HAPs **25.02**

Notes:
1) See Unit 1 Boiler Worksheet for HCL and HF emission calculations.
2) Emissions based on 100% Capacity Factor
3) Short term emissions estimated at peak load conditions and annual emissions are estimated at 100% load condition.

Basin Electric Power Cooperative
Dry Fork Station
Unit 1 Boiler (ES1-01)
Trace Metal HAP Emissions

Coal Feed Rate at Peak Load	243.7	tons/hr
Coal Moisture	33.8	%
Annual Coal Feed Rate at 100% Load	2,019,696	tons/yr

	Trace Element Analysis (ppm, dry basis)											
	Antimony (Sb)	Arsenic (As)	Beryllium (Be)	Cadmium (Cd)	Chromium (Cr)	Cobalt (Co)	Lead (Pb)	Manganese (Mn)	Mercury (Hg)	Molybdenum (Mo)	Nickel (Ni)	Selenium (Se)
	1.0	1.0	0.3	0.2	3.0	2.0	2.0	8.0	0.05	1.0	4.0	1.0
Uncontrolled Emissions (lb/hr)	3.23E-01	3.23E-01	9.68E-02	6.45E-02	9.68E-01	6.45E-01	6.45E-01	2.58E+00	1.61E-02	3.23E-01	1.29E+00	3.23E-01
Removal Efficiency (%)	99	99	99	99	99	99	99	99	30	99	99	90
Controlled Emissions (lb/hr)	3.23E-03	3.23E-03	9.68E-04	6.45E-04	9.68E-03	6.45E-03	6.45E-03	2.58E-02	1.13E-02	3.23E-03	1.29E-02	3.23E-02
Controlled Emissions (tpy)	1.34E-02	1.34E-02	4.01E-03	2.67E-03	4.01E-02	2.67E-02	2.67E-02	1.07E-01	4.68E-02	1.34E-02	5.35E-02	1.34E-01

Total Trace Metal HAPs 0.48 tpy

Notes:
1) Emissions for HAPs based on Metal concentrations in coal.
2) Short-term potential to emit emissions (lb/hr) = [Concentration (ppm) / 10^6] x [Coal Burned (tons/hr) at Peak Load] x 2000 lb/ton x [1-Coal Moisture %/100] x [1-control efficiency].
3) Annual potential to emit emissions (tpy) = [Concentration (ppm) / 10^6] x [Coal Burned (tons/yr) at 100% Load] x [1-Coal Moisture %/100] x [1-control efficiency].
4) Assumed 99% control efficiency for the baghouse for all metals except Mercury and Selenium.

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Basin Electric Power Cooperative
Dry Fork Station
Unit 1 Boiler (ES1-01)
Condensable Organic Emissions

Pollutant	Emission Factor (lb/ton)	Boiling Temperature (C) at 1-atm	Boiling Temperature (F)	Emission Factor (lb/ton)	Organic Condensible Emission Factor (lb/ton)
Biphenyl	1.70E-06	255	491.0	-	7.70E-03
Acenaphthene	5.10E-07	279	534.2	-	
Acenaphthylene	2.50E-07	265	509.0	-	
Anthracene	2.10E-07	340	644.0	-	
Benzo(a)anthracene	8.00E-08	437.6	819.7	-	
Benzo(a)pyrene	3.80E-08	495	923.0	-	
Benzo(b,j,k)fluoranthene	1.10E-07	169	336.2	-	
Benzo(g,h,i)perylene	2.70E-08			2.70E-08	
Chrysene	1.00E-07	448	838.4	-	
Fluoranthene	7.10E-07	375	707.0	-	
Fluorene	9.10E-07	295	563.0	-	
Ideno(1,2,3-cd)pyrene	6.10E-08	536	996.8	-	
Naphthalene	1.30E-05	218	424.4	-	
Phenanthrene	2.70E-06	340	644.0	-	
Pyrene	3.30E-07	404	759.2	-	
5-Methyl chrysene	2.20E-08			2.20E-08	
Acetaldehyde	5.70E-04	20.1	68.2	5.70E-04	
Acetophenone	1.50E-05	201.7	395.1	-	
Acrolein	2.90E-04	52.7	126.9	2.90E-04	
Benzene	1.30E-03	80.1	176.2	1.30E-03	
Benzyl chloride	7.00E-04	179.3	354.7	-	
Bis(2-ethylhexyl)phthalate	7.30E-05	286.9	548.4	-	
Bromoform	3.90E-05	149.5	301.1	-	
Carbon disulfide	1.30E-04	46.2	115.2	1.30E-04	
2-Chloroacetophenone	7.00E-06	245	473.0	-	
Chlorobenzene	2.20E-05	130	266.0	2.20E-05	
Chloroform	5.90E-05	61.7	143.1	5.90E-05	
Cumene	5.30E-06	151	303.8	-	
Cyanide	2.50E-03			2.50E-03	
2,4-Dinitrotoluene	2.80E-07	300	572.0	-	
Dimethyl sulfate	4.80E-05	189	372.2	-	
Ethyl benzene	9.40E-05	136.2	277.2	9.40E-05	
Ethyl chloride	4.20E-05	12.3	54.1	4.20E-05	
Ethylene dichloride	4.00E-05	83.5	182.3	4.00E-05	
Ethylene dibromide	1.20E-06	131.7	269.1	1.20E-06	
Formaldehyde	2.40E-04	-19.5	-3.1	2.40E-04	
Hexane	6.70E-05	69	156.2	6.70E-05	
Isophorone	5.80E-04	215.4	419.7	-	
Methyl bromide	1.60E-04	3.56	38.4	1.60E-04	
Methyl chloride	5.30E-04	-11.6	11.1	5.30E-04	
Methyl ethyl ketone	3.90E-04	79.6	175.3	3.90E-04	
Methyl hydrazine	1.70E-04	87.8	190.0	1.70E-04	
Methyl methacrylate	2.00E-05	100	212.0	2.00E-05	
Methyl tert butyl ether	3.50E-05	55.2	131.4	3.50E-05	
Methylene chloride	2.90E-04	39.8	103.6	2.90E-04	
Phenol	1.60E-05	181.7	359.1	-	
Propionaldehyde	3.80E-04	49	120.2	3.80E-04	
Tetrachloroethylene	4.30E-05	121.1	250.0	4.30E-05	
Toluene	2.40E-04	110.6	231.1	2.40E-04	
1,1,1-Trichloroethane	2.00E-05	74.1	165.4	2.00E-05	
Styrene	2.50E-05	145.2	293.4	2.50E-05	
Xylenes	3.70E-05	144	291.2	3.70E-05	
Vinyl acetate	7.60E-06	72.3	162.1	7.60E-06	

Basin Electric Power Cooperative
Dry Fork Station
Unit 1 Auxiliary Boiler (ES1-02)
Criteria Pollutant Potential To Emit

Heat Input Rating (MMBTU/hr)	134.1
Fuel Type	Natural Gas
Maximum NG Consumption (scf/hr)	131,471
Annual Hours of Operation (hr/yr)	2,000
Annual NG Consumption (MMscf/yr))	263
Natural Gas Heating Value (Btu/scf)	1,020

	Emission Factor (lb/MMBTU)	Emission Factor (lb/MMscf)	Maximum Hourly Emissions (lb/hr)	Maximum Hourly Emissions (g/s)	Annual Emissions (tpy)
NO_X	0.05		7.24	9.12E-01	7.24
CO	0.11		14.68	1.85E+00	14.68
SO_2		0.6	7.89E-02	9.94E-03	7.89E-02
PM_{10}		7.6	1.00	1.26E-01	1.00
VOC		5.5	7.23E-01	9.11E-02	0.72
Lead		5.00E-04	6.57E-05	8.28E-06	6.57E-05

Notes:

1) Emission factors for NO_X and CO obtained from vendor design data - Rentech Boiler Systems, January 2005, Page 7 - Predicted Performance at 100% MCR, Natural Gas

2) Emission factors for NO_X and CO were increased by 50% from the data provided by the vendors - as the values provided were design data and not performance guarantees.

3) Emission factors for other criteria pollutants from AP-42 Fifth Edition, Table 1.4-2, Revision 7/98.

4) Assume Total PM Emission Factor in AP-42, Table 1.4-2 as PM_{10} Emission Factor.

Basin Electric Power Cooperative
Dry Fork Station
Unit 1 Auxiliary Boiler (ES1-02)
HAP Emissions

Max Heat Input	134	MMBTU/hr	Natural Gas Burned	0.13	MMscf/hr
Annual Heat Input	1,174,716	MMBTU/yr	Natural Gas Burned	263	MMscf/yr

Pollutant	Emission Factor (lb/MMscf)	Hourly Emissions (lb/hr)	Annual Emissions (tpy)	Source
Arsenic	2.00E-04	2.63E-05	2.63E-05	AP-42, Table 1.4-4
Beryllium	1.20E-05	1.58E-06	1.58E-06	AP-42, Table 1.4-4
Cadmium	1.10E-03	1.45E-04	1.45E-04	AP-42, Table 1.4-4
Chromium	1.40E-03	1.84E-04	1.84E-04	AP-42, Table 1.4-4
Cobalt	8.40E-05	1.10E-05	1.10E-05	AP-42, Table 1.4-4
Manganese	3.80E-04	5.00E-05	5.00E-05	AP-42, Table 1.4-4
Mercury	2.60E-04	3.42E-05	3.42E-05	AP-42, Table 1.4-4
Nickel	2.10E-03	2.76E-04	2.76E-04	AP-42, Table 1.4-4
Selenium	2.40E-05	3.16E-06	3.16E-06	AP-42, Table 1.4-4
Total Metal HAPs		**7.31E-04**	**7.31E-04**	
2-Methylnaphthalene	2.40E-05	3.16E-06	3.16E-06	AP-42, Table 1.4-3
3-Methylchloranthrene	1.80E-06	2.37E-07	2.37E-07	AP-42, Table 1.4-3
7,12-Dimethylbenz(a)anthracene	1.60E-05	2.10E-06	2.10E-06	AP-42, Table 1.4-3
Acenaphthene	1.80E-06	2.37E-07	2.37E-07	AP-42, Table 1.4-3
Acenaphthylene	1.80E-06	2.37E-07	2.37E-07	AP-42, Table 1.4-3
Anthracene	2.40E-06	3.16E-07	3.16E-07	AP-42, Table 1.4-3
Benz(a)anthracene	1.80E-06	2.37E-07	2.37E-07	AP-42, Table 1.4-3
Benzene	2.10E-03	2.76E-04	2.76E-04	AP-42, Table 1.4-3
Benzo(a)pyrene	1.20E-06	1.58E-07	1.58E-07	AP-42, Table 1.4-3
Benzo(b)fluoranthene	1.80E-06	2.37E-07	2.37E-07	AP-42, Table 1.4-3
Benzo(g,h,i)perylene	1.20E-06	1.58E-07	1.58E-07	AP-42, Table 1.4-3
Benzo(k)fluoranthene	1.80E-06	2.37E-07	2.37E-07	AP-42, Table 1.4-3
Chrysene	1.80E-06	2.37E-07	2.37E-07	AP-42, Table 1.4-3
Dibenzo(a,h)anthracene	1.20E-06	1.58E-07	1.58E-07	AP-42, Table 1.4-3
Dichlorobenzene	1.20E-03	1.58E-04	1.58E-04	AP-42, Table 1.4-3
Fluoranthene	3.00E-06	3.94E-07	3.94E-07	AP-42, Table 1.4-3
Fluorene	2.80E-06	3.68E-07	3.68E-07	AP-42, Table 1.4-3
Formaldehyde	7.50E-02	9.86E-03	9.86E-03	AP-42, Table 1.4-3
Hexane	1.80E+00	2.37E-01	2.37E-01	AP-42, Table 1.4-3
Indeno(1,2,3-cd)pyrene	1.80E-06	2.37E-07	2.37E-07	AP-42, Table 1.4-3
Naphthalene	6.10E-04	8.02E-05	8.02E-05	AP-42, Table 1.4-3
Phenanathrene	1.70E-05	2.24E-06	2.24E-06	AP-42, Table 1.4-3
Pyrene	5.00E-06	6.57E-07	6.57E-07	AP-42, Table 1.4-3
Toluene	3.40E-03	4.47E-04	4.47E-04	AP-42, Table 1.4-3
Total Organic HAPs		**2.47E-01**	**2.47E-01**	

Basin Electric Power Cooperative
Dry Fork Station
Fire Pump (ES1-03)

Engine Power (BHP)	360	S&L - 9/26/05
Diesel Fuel Heating Value (Btu/gal)	141,000	
Maximum Fuel Firing Rate (MMBtu/hr)	2.78	Estimated based on BHP
Maximum Hours of Operation (hrs/yr)	500	

	Emission Factor (lbs/hp-hr)	Emissions (lb/hr)	Emissions (tpy)
NO_x	3.10E-02	1.12E+01	2.79E+00
CO	6.68E-03	2.40E+00	6.01E-01
SO_2	2.05E-03	7.38E-01	1.85E-01
PM_{10}	2.20E-03	7.92E-01	1.98E-01
VOC	2.51E-03	9.05E-01	2.26E-01

Notes:
1) Engine power and hours of operation based on Engineering Estimates from S&L received on September 26, 2005.
2) Emission Factors are from AP-42 Table 3.3-1 for Diesel Fuel.

Basin Electric Power Cooperative
Dry Fork Station
Fire Pump (ES1-03)
HAP Emissions

Engine Power (BHP)	360
Maximum Fuel Firing Rate (MMBtu/hr)	2.78
Maximum Hours of Operation (hrs/yr)	500

Pollutant	Emission Factor (lb/MMBtu)	Annual Emissions (lb/yr)	Source
Benzene	9.33E-04	1.30E+00	AP-42, Table 3.3-2
Toulene	4.09E-04	5.68E-01	AP-42, Table 3.3-2
Xylenes	2.85E-04	3.96E-01	AP-42, Table 3.3-2
Propylene	2.58E-03	3.59E+00	AP-42, Table 3.3-2
1,3-Butadiene	3.91E-05	5.43E-02	AP-42, Table 3.3-2
Formaldehyde	1.18E-03	1.64E+00	AP-42, Table 3.3-2
Acetaldehyde	7.67E-04	1.07E+00	AP-42, Table 3.3-2
Acrolein	9.25E-05	1.29E-01	AP-42, Table 3.3-2
Naphthalene	8.48E-05	1.18E-01	AP-42, Table 3.3-2
Total HAPs		**8.85E+00**	

Notes:
1) Emission Factors are from AP-42 Table 3.3-2.

Basin Electric Power Cooperative
Dry Fork Station
Auxilary Cooling Tower (ES1-04)

Water Flow Rate (gal/min)	17,000	S&L - 9/30/2005
Flow of cooling water (lbs/hr)	8,506,800	Calculated
TDS of blowdown (mg/l or ppmw)	6,000	Engineering Estimate
Flow of dissolved solids (lbs/hr)	51,041	Calculated
Fraction of flow producing PM_{10} drift (See Note 2)	0.240	See Note 2
Control efficiency of drift eliminators (gal drift/gal flow)	0.000005	Engineering Estimate
PM emissions from tower (lb/hr)	0.255	Calculated
PM_{10} emissions from tower (lb/hr)	0.061	Calculated
PM emissions from tower (tpy)	1.118	Calculated
PM_{10} emissions from tower (tpy)	0.268	Calculated
PM_{10} emissions from each tower cell (lb/hr)	0.010	Calculated
PM_{10} emissions from each tower cell (g/s)	0.00129	Calculated

Other Parameters

Number of cells per tower (outlet fans)	6	S&L - 9/30/2005
Height at cell release (ft):	15.0	S&L - 9/30/2005
Height at cell release (m):	4.57	Calculated
Discharge flow per cell (ACFM):	65,000	S&L - 9/30/2005
Diameter of each cell (ft):	8.0	S&L - 9/30/2005
Diameter of each cell (m):	2.44	Calculated
Area of cell discharge (ft^2):	50	Calculated
Average Temperature of cell discharge (degF):	77	Engineering Estimate
Average Temperature of cell discharge (K):	298.16	Calculated
Exit Velocity (ft/s):	21.6	Calculated
Exit Velocity (m/s):	6.57	Calculated

Notes:
1) Cooling Tower data based on Engineering Estimates and data from S&L.
2) From "Calculating Realistic PM_{10} Emissions From Cooling Towers" (J. Reisman, G. Frisbie). Presented at 2001 AWMA Annual Meeting.
3) TDS based on Engineering Estimates.

Basin Electric Power Cooperative
Dry Fork Station
Emergency Diesel Generator (ES1-05)

Engine Power (BHP)	2377	S&L - 9/26/05
Diesel Fuel Heating Value (Btu/gal)	141,000	
Maximum Fuel Firing Rate (MMBtu/hr)	16.82	S&L - 9/26/05
Maximum Hours of Operation (hrs/yr)	500	

	Emission Factor (lbs/hp-hr)	Emissions (lb/hr)	Emissions (tpy)
NO_x	2.40E-02	5.70E+01	1.43E+01
CO	5.50E-03	1.31E+01	3.27E+00
SO_2	4.05E-04	9.61E-01	2.40E-01
PM	7.00E-04	1.66E+00	4.16E-01
VOC	7.05E-04	1.68E+00	4.19E-01

Notes:
1) Engine power and hours of operation based on engineering estimates from S&L received on September 26, 2005.
2) Emission Factors are from AP-42 Table 3.4-1 for Diesel Fuel. The emission factor for NOx represents an uncontrolled emission factor.
3) TOC emissions are essentially equal to VOC emissions.
4) Sulfur content was assumed to be 0.05% of diesel fuel.

Basin Electric Power Cooperative
Dry Fork Station
Emergency Diesel Generator (ES1-05)
HAP Emissions

Engine Power (BHP)	2,377
Maximum Fuel Firing Rate (MMBtu/hr)	16.82
Maximum Hours of Operation (hrs/yr)	500

Pollutant	**Emission Factor (lb/MMBtu)**	**Annual Emissions (lb/yr)**	**Source**
Benzene	7.76E-04	6.53E+00	AP-42, Table 3.4-3
Toulene	2.81E-04	2.36E+00	AP-42, Table 3.4-3
Xylenes	1.93E-04	1.62E+00	AP-42, Table 3.4-3
Formaldehyde	7.89E-05	6.64E-01	AP-42, Table 3.4-3
Acetaldehyde	2.52E-05	2.12E-01	AP-42, Table 3.4-3
Acrolein	7.88E-06	6.63E-02	AP-42, Table 3.4-3
Naphthalene	1.30E-04	1.09E+00	AP-42, Table 3.4-4
Total HAPs		**1.25E+01**	

Notes:
1) Emission Factors are from AP-42 Table 3.4-3 and Table 3.4-4.

Basin Electric Power Cooperative
Dry Fork Station
Unit 1 Inlet Gas Heater (ES1-06)
Criteria Pollutant Potential To Emit

Heat Input Rating (MMBTU/hr)	8.36
Fuel Type	Natural Gas
Maximum NG Consumption (scf/hr)	8,196
Annual Hours of Operation (hr/yr)	2,500
Annual NG Consumption (MMscf/yr))	20.5
Natural Gas Heating Value (Btu/scf)	1,020

	Emission Factor (lb/MMscf)	Maximum Hourly Emissions (lb/hr)	Maximum Hourly Emissions (g/s)	Annual Emissions (tpy)
NO_X	100	8.20E-01	1.03E-01	1.02
CO	84	6.88E-01	8.67E-02	0.86
SO_2	0.6	4.92E-03	6.20E-04	6.15E-03
PM_{10}	7.6	6.23E-02	7.85E-03	0.08
VOC	5.5	4.51E-02	5.68E-03	0.06
Lead	5.00E-04	4.10E-06	5.16E-07	5.12E-06

Notes:
1) Information for the Inlet Gas Heater based on the engineering estimates.
2) Emission factors for criteria pollutants from AP-42 Fifth Edition, Table 1.4-1 and Table 1.4-2.
3) Assume Total PM Emission Factor in AP-42, Table 1.4-2 as PM_{10} Emission Factor.

Basin Electric Power Cooperative
Dry Fork Station
Unit 1 Inlet Gas Heater (ES1-06)
HAP Emissions

Max Heat Input	8.36	MMBTU/hr	Natural Gas Burned	0.01	MMscf/hr
Annual Heat Input	20,900	MMBTU/yr	Natural Gas Burned	20.49	MMscf/yr

Pollutant	**Emission Factor (lb/MMscf)**	**Hourly Emissions (lb/hr)**	**Annual Emissions (tpy)**	**Source**
Arsenic	2.00E-04	1.64E-06	2.05E-06	AP-42, Table 1.4-4
Beryllium	1.20E-05	9.84E-08	1.23E-07	AP-42, Table 1.4-4
Cadmium	1.10E-03	9.02E-06	1.13E-05	AP-42, Table 1.4-4
Chromium	1.40E-03	1.15E-05	1.43E-05	AP-42, Table 1.4-4
Cobalt	8.40E-05	6.88E-07	8.61E-07	AP-42, Table 1.4-4
Manganese	3.80E-04	3.11E-06	3.89E-06	AP-42, Table 1.4-4
Mercury	2.60E-04	2.13E-06	2.66E-06	AP-42, Table 1.4-4
Nickel	2.10E-03	1.72E-05	2.15E-05	AP-42, Table 1.4-4
Selenium	2.40E-05	1.97E-07	2.46E-07	AP-42, Table 1.4-4
Total Metal HAPs		**4.56E-05**	**5.70E-05**	
2-Methylnaphthalene	2.40E-05	1.97E-07	2.46E-07	AP-42, Table 1.4-3
3-Methylchloranthrene	1.80E-06	1.48E-08	1.84E-08	AP-42, Table 1.4-3
7,12-Dimethylbenz(a)anthracene	1.60E-05	1.31E-07	1.64E-07	AP-42, Table 1.4-3
Acenaphthene	1.80E-06	1.48E-08	1.84E-08	AP-42, Table 1.4-3
Acenaphthylene	1.80E-06	1.48E-08	1.84E-08	AP-42, Table 1.4-3
Anthracene	2.40E-06	1.97E-08	2.46E-08	AP-42, Table 1.4-3
Benz(a)anthracene	1.80E-06	1.48E-08	1.84E-08	AP-42, Table 1.4-3
Benzene	2.10E-03	1.72E-05	2.15E-05	AP-42, Table 1.4-3
Benzo(a)pyrene	1.20E-06	9.84E-09	1.23E-08	AP-42, Table 1.4-3
Benzo(b)fluoranthene	1.80E-06	1.48E-08	1.84E-08	AP-42, Table 1.4-3
Benzo(g,h,i)perylene	1.20E-06	9.84E-09	1.23E-08	AP-42, Table 1.4-3
Benzo(k)fluoranthene	1.80E-06	1.48E-08	1.84E-08	AP-42, Table 1.4-3
Chrysene	1.80E-06	1.48E-08	1.84E-08	AP-42, Table 1.4-3
Dibenzo(a,h)anthracene	1.20E-06	9.84E-09	1.23E-08	AP-42, Table 1.4-3
Dichlorobenzene	1.20E-03	9.84E-06	1.23E-05	AP-42, Table 1.4-3
Fluoranthene	3.00E-06	2.46E-08	3.07E-08	AP-42, Table 1.4-3
Fluorene	2.80E-06	2.29E-08	2.87E-08	AP-42, Table 1.4-3
Formaldehyde	7.50E-02	6.15E-04	7.68E-04	AP-42, Table 1.4-3
Hexane	1.80E+00	1.48E-02	1.84E-02	AP-42, Table 1.4-3
Indeno(1,2,3-cd)pyrene	1.80E-06	1.48E-08	1.84E-08	AP-42, Table 1.4-3
Naphthalene	6.10E-04	5.00E-06	6.25E-06	AP-42, Table 1.4-3
Phenanathrene	1.70E-05	1.39E-07	1.74E-07	AP-42, Table 1.4-3
Pyrene	5.00E-06	4.10E-08	5.12E-08	AP-42, Table 1.4-3
Toluene	3.40E-03	2.79E-05	3.48E-05	AP-42, Table 1.4-3
Total Organic HAPs		**1.54E-02**	**1.93E-02**	

Basin Electric Power Cooperative
Dry Fork Station
Activated Carbon Handling Emission Points (ES1-20)

Source ID	Source Name	BACT PM and PM_{10} Emission Factor (gr/dscf)	Air Flow (dscfm)	Hours per year	Uncontrolled Emissions (lb PM_{10}/hr)	Uncontrolled Emissions (lb PM/hr)	Control %	Controlled Emissions (lb PM_{10}/hr)	Controlled Emissions (g PM_{10}/s)	Controlled Emissions (lb PM/hr)	Controlled PM_{10} Emissions (tpy)	Controlled PM Emissions (tpy)	Control System and Comments
ES1-20	Activated Carbon Silo Bin Vent Filter	0.005	728	8760	3.12E-02	3.12E-02	0	3.12E-02	3.93E-03	3.12E-02	1.37E-01	1.37E-01	Grain loading emission rates represent a controlled rate.

Conversion
1 lb 7000 grain

Notes:
1) Activated Carbon Handling Source List based on information provided by Joe Hammond on 9/26/2005 via email.
2) Grain Loading based on engineering estimates.

Basin Electric Power Cooperative
Dry Fork Station
Coal Handling Emission Points (ES1-07, ES1-08, ES1-09, ES1-10, ES1-11)

Source ID	Source Name	BACT PM and PM_{10} Emission Factor (gr/dscf)	Air Flow (dscfm)	Hours per year	Uncontrolled Emissions (lb PM_{10}/hr)	Uncontrolled Emissions (lb PM/hr)	Control %	Controlled Emissions (lb PM_{10}/hr)	Controlled Emissions (g PM_{10}/s)	Controlled Emissions (lb PM/hr)	Controlled PM_{10} Emissions (tpy)	Controlled PM Emissions (tpy)	Control System and Comments
ES1-07	Coal Storage Silo 1 Dust Collector	0.005	13,704	8760	5.87E-01	5.87E-01	0	5.87E-01	7.40E-02	5.87E-01	2.57E+00	2.57E+00	Grain loading emission rates represent a controlled rate.
ES1-08	Coal Storage Silo 2 Dust Collector	0.005	13,704	8760	5.87E-01	5.87E-01	0	5.87E-01	7.40E-02	5.87E-01	2.57E+00	2.57E+00	Grain loading emission rates represent a controlled rate.
ES1-09	Coal Storage Silo 3 Dust Collector	0.005	8,849	8760	3.79E-01	3.79E-01	0	3.79E-01	4.78E-02	3.79E-01	1.66E+00	1.66E+00	Grain loading emission rates represent a controlled rate.
ES1-10	Coal Crusher House Dust Collector	0.005	25,216	8760	1.08E+00	1.08E+00	0	1.08E+00	1.36E-01	1.08E+00	4.73E+00	4.73E+00	Grain loading emission rates represent a controlled rate.
ES1-11	Plant Coal Silo Transfer Bay Dust Collector	0.005	27,408	8760	1.17E+00	1.17E+00	0	1.17E+00	1.48E-01	1.17E+00	5.14E+00	5.14E+00	Grain loading emission rates represent a controlled rate.

Conversion
1 lb 7000 grain

Notes:
1) Coal Handling Source List based on information provided by Joe Hammond on 9/26/2005 via email.
2) Grain Loading based on engineering estimates.

Basin Electric Power Cooperative
Dry Fork Station
Pebble Lime and Hydrated Lime Handling Emission Points (ES1-12, ES1-13, ES1-14, ES1-15, ES1-16, ES1-17, ES1-18, E1-19)

Source ID	Source Name	BACT PM and PM_{10} Emission Factor (gr/dscf)	Air Flow (dscfm)	Hours per year	Uncontrolled Emissions (lb PM_{10}/hr)	Uncontrolled Emissions (lb PM/hr)	Control %	Controlled Emissions (lb PM_{10}/hr)	Controlled Emissions (g PM_{10}/s)	Controlled Emissions (lb PM/hr)	Controlled PM_{10} Emissions (tpy)	Controlled PM Emissions (tpy)	Control System and Comments
ES1-12	Pebble Lime Receiving Silo Bin Vent Filter	0.005	728	8760	3.12E-02	3.12E-02	0	3.12E-02	3.93E-03	3.12E-02	1.37E-01	1.37E-01	Grain loading emission rates represent a controlled rate.
ES1-13	Pebble Lime Day Silo Bin Vent Filter	0.005	1,001	8760	4.29E-02	4.29E-02	0	4.29E-02	5.41E-03	4.29E-02	1.88E-01	1.88E-01	Grain loading emission rates represent a controlled rate.
ES1-14	Lime Hydrator Mixer Dust Collector No. 1	0.005	4,698	8760	2.01E-01	2.01E-01	0	2.01E-01	2.54E-02	2.01E-01	8.82E-01	8.82E-01	Grain loading emission rates represent a controlled rate.
ES1-15	Lime Hydrator Mixer Dust Collector No. 2	0.005	4,698	8760	2.01E-01	2.01E-01	0	2.01E-01	2.54E-02	2.01E-01	8.82E-01	8.82E-01	Grain loading emission rates represent a controlled rate.
ES1-16	Hydrated Lime Dust Collector No. 1	0.005	16,380	8760	7.02E-01	7.02E-01	0	7.02E-01	8.85E-02	7.02E-01	3.07E+00	3.07E+00	Grain loading emission rates represent a controlled rate.
ES1-17	Hydrated Lime Dust Collector No. 2	0.005	16,380	8760	7.02E-01	7.02E-01	0	7.02E-01	8.85E-02	7.02E-01	3.07E+00	3.07E+00	Grain loading emission rates represent a controlled rate.
ES1-18	Hydrated Lime Silo 1 Bin Vent Filter	0.005	1,729	8760	7.41E-02	7.41E-02	0	7.41E-02	9.34E-03	7.41E-02	3.25E-01	3.25E-01	Grain loading emission rates represent a controlled rate.
ES1-19	Hydrated Lime Silo 2 Bin Vent Filter	0.005	1,729	8760	7.41E-02	7.41E-02	0	7.41E-02	9.34E-03	7.41E-02	3.25E-01	3.25E-01	Grain loading emission rates represent a controlled rate.

Conversion
1 lb 7000 grain

Notes:
1) Lime Handling Source List based on information provided by Joe Hammond on 9/26/2005 via email.
2) Grain Loading based on engineering estimates.

Basin Electric Power Cooperative
Dry Fork Station
Fly Ash/FGD Waste Handling Emission Sources (ES1-21, ES1-22, FS1-01, FS1-02)

Fly Ash/FGD Waste Silo Dust Collector

Source ID	Source Name	BACT PM and PM_{10} Emission Factor (gr/dscf)	Air Flow (dscfm)	Hours per year	Uncontrolled Emissions (lb PM_{10}/hr)	Uncontrolled Emissions (lb PM/hr)	Control %	Controlled Emissions (lb PM_{10}/hr)	Controlled Emissions (g PM_{10}/s)	Controlled Emissions (lb PM/hr)	Controlled PM_{10} Emissions (tpy)	Controlled PM Emissions (tpy)	Control System and Comments
ES1-21	Fly Ash/FGD Waste Silo Separator/Filter Exhaust	0.005	1,092	8760	4.68E-02	4.68E-02	0	4.68E-02	5.90E-03	4.68E-02	2.05E-01	2.05E-01	Grain loading emission rates represent a controlled rate.
ES1-22	Fly Ash/FGD Waste Silo Bin Vent Filter	0.005	1,138	8760	4.88E-02	4.88E-02	0	4.88E-02	6.14E-03	4.88E-02	2.14E-01	2.14E-01	Grain loading emission rates represent a controlled rate.

Conversion
1 lb 7000 grain

Notes:
1) Fly Ash/FGD Waste Handling Source List based on information provided by Joe Hammond on 9/26/2005 via email.
2) Grain Loading based on engineering estimates.

Ash/FGD Waste Disposal Truck Loading

Emission factor from AP-42, Section 13.2.4: *Aggregate Handling and Storage Piles* (1/95), Equation (1) - batch or continuous drop operation

E (lb PM_{10} per ton material handled) = k (0.0032) (U/5)^1.3 / [(M/2)^1.4]

where:
k = 0.35 [particles < 10um]
k = 0.74 [particles < 30um]
U = 1 [mph, unloading will occur inside a building]
M = 20 [water added while unloading]

E (lb PM_{10} per ton handled) = 5.50E-06
E (lb PM per ton handled) = 1.16E-05

Source ID	Source Name	Process Rate (ton/hour)	Uncontrolled Emissions (lb PM_{10}/hr)	Uncontrolled Emissions (lb PM/hr)	Control %	Short-term Controlled Emissions (lb PM_{10}/hr)	Short-term Controlled Emissions (g PM_{10}/s)	Short-term Controlled Emissions (lb PM/hr)	Annual Controlled PM_{10} Emissions (tpy)	Annual Controlled PM_{10} Emissions (lb/hr)	Annual Controlled PM_{10} Emissions (g/s)	Annual Controlled PM Emissions (tpy)	Control System and Comments
FS1-01	Ash Disposal Truck Loading	79.2	0.0004	0.0009	0	4.36E-04	5.49E-05	9.21E-04	2.96E-04	1.35E-04	1.70E-05	6.26E-04	Trucks are loaded inside the building

Notes:
1) Fly Ash/Scrubber Waste Handling Source List based on information provided by Joe Hammond on 5/26/2005 via email.
2) The Fly Ash/FGD Waste Silo capacity is 950 tons.
3) Loading rate into the trucks assume the silo can be emptied in 12 hours. Hourly Process Rate for loading into trucks = (950 tons) / (12 hrs) = 79.2 tph.
4) The trucks will be loaded inside the Fly Ash Silo Building.
5) Water sprays will be used to reduce fugitive emissions.
6) Annual lb/hr emissions estimated based on 12 hr/day of operations.

Basin Electric Power Cooperative
Dry Fork Station
Fly Ash/FGD Waste Handling Emission Sources (ES1-21, ES1-22, FS1-01, FS1-02)

Ash/FGD Waste Disposal Paved Haul Road

Unpaved Roads emission factor from State of Wyoming, DAQ, *"Guideline for Fugitive Dust Emission Factors for Mining Activities, January 1979"*

E_U (lb per vehicle mile traveled) = $(0.81s(S/30)^2((365-W)/365)0.62)$

where:

s = 8.6	[silt content (%) of road surface material (from WDEQ Guidance)]	
S = 10	[mean vehicle speed in mph]	
W = 100	[number of days with >0.01 inches precip. per year (from WDEQ Guidance Document)]	
E_U = 0.105	[PM_{10} lb/VMT]	[Assume 30% of PM as per WDEQ Guidance Document]
E_U = 0.348	[PM lb/VMT]	

Haul truck maximum load =	50	tons per truck	[Engineering Estimates]
Total Amount hauled (per year) =	107,702	tons	[Provided by S&L]
Total Amount hauled (per hour) =	79.17	tons	[Based on silo design and unloading rate]
Haul road round trip =	1.79	miles	[2877 m = 2877 m x 0.0006214 mi/m = 1.79 miles]
Round trips per hour =	1.58		
Round trips per year =	2,154.0		
VMT (per hour) =	2.8	miles	
VMT (annual) =	3,851	miles	

Source ID	Source Name	Maximum Uncontrolled Emissions (lb PM/hr)	Annual Uncontrolled PM Emissions (tpy)	Maximum Uncontrolled Emissions (lb PM_{10}/hr)	Annual Uncontrolled PM_{10} Emissions (tpy)	Control %	Maximum Controlled Emissions (lb PM_{10}/hr)	Maximum Controlled Emissions (lb PM/hr)	Annual Controlled PM_{10} Emissions (tpy)	Annual Controlled PM_{10} Emissions (lb/hr)	Annual Controlled PM_{10} Emissions (g/s)	Annual Controlled PM Emissions (tpy)	Control System
FS1-02P	Ash Disposal Paved Haul Road	9.86E-01	6.71E-01	2.96E-01	2.01E-01	85	4.44E-02	1.48E-01	3.02E-02	1.38E-02	1.74E-03	1.01E-01	Roads are paved

Notes:
1) Unpaved Roads emission factor from State of Wyoming, DAQ, *"Guideline for Fugitive Dust Emission Factors for Mining Activities, January 1979"*
2) Control efficiencies *from State of Wyoming, DAQ, "Guideline for Fugitive Dust Emission Factors for Mining Activities, January 1979"*
3) Annual lb/hr emissions estimated based on 12 hr/day of operations.
4) Unpaved road emission factors are used in the calculation as per discussions with WDEQ. However, a higher control efficiency is used as the roads are paved.

	24-Hour
Controlled PM_{10} emissions (g/s):	5.59E-03
# Volume sources:	48
Controlled emissions ea. src. (g/s):	1.16E-04

Basin Electric Power Cooperative
Dry Fork Station
Fly Ash/FGD Waste Handling Emission Sources (ES1-21, ES1-22, FS1-01, FS1-02)

Ash Disposal Unpaved Haul Road

FA + BA Combined Hauling
Combined Controlled emissions ea. src. (g/s): 1.23E-04

Unpaved Roads emission factor from State of Wyoming, DAQ, *"Guideline for Fugitive Dust Emission Factors for Mining Activities, January 1979"*

E_U (lb per vehicle mile traveled) = $(0.81s(S/30)^2((365\text{-}W)/365)0.62)$

where:

s = 8.6	[silt content (%) of road surface material (from WDEQ Guidance)]	
S = 10	[mean vehicle speed in mph]	
W = 100	[number of days with >0.01 inches precip. per year (from WDEQ Guidance Document)]	
E_U = 0.105	[PM_{10} lb/VMT]	[Assume 30% of PM as per WDEQ Guidance Document]
E_U = 0.348	[PM lb/VMT]	

Haul truck maximum load =	50 tons per truck	[Engineering Estimates]
Total Amount hauled (per year) =	107,702 tons	[Provided by S&L]
Total Amount hauled (per hour) =	79 tons	[Based on silo design and unloading rate]
Haul road round trip =	0.26 miles	[424.5 m = 424.5 m x 0.0006214 mi/m = 0.26 miles]
Round trips per hour =	1.58	
Round trips per year =	2,154	
VMT (per hour) =	0.4 miles	
VMT (annual) =	568 miles	

Source ID	Source Name	Maximum Uncontrolled Emissions (lb PM/hr)	Annual Uncontrolled PM Emissions (tpy)	Maximum Uncontrolled Emissions (lb PM_{10}/hr)	Annual Uncontrolled PM_{10} Emissions (tpy)	Control %	Maximum Controlled Emissions (lb PM_{10}/hr)	Maximum Controlled Emissions (lb PM/hr)	Annual Controlled PM_{10} Emissions (tpy)	Annual Controlled PM_{10} Emissions (lb/hr)	Annual Controlled PM_{10} Emissions (g/s)	Annual Controlled PM Emissions (tpy)	Control System
FS1-02UP	Ash Disposal Unpaved Haul Road	1.46E-01	9.90E-02	4.37E-02	2.97E-02	50	2.18E-02	7.28E-02	1.48E-02	6.78E-03	8.54E-04	4.95E-02	Water Sprays

Notes:
1) Unpaved Roads emission factor from State of Wyoming, DAQ, *"Guideline for Fugitive Dust Emission Factors for Mining Activities, January 1979"*
2) Control efficiencies *from State of Wyoming, DAQ, "Guideline for Fugitive Dust Emission Factors for Mining Activities, January 1979"*
3) Annual lb/hr emissions estimated based on 12 hr/day of operations.

	24-Hour
Controlled PM_{10} emissions (g/s):	2.75E-03
# Volume sources:	14
Controlled emissions ea. src. (g/s):	1.96E-04

FA + BA Combined Hauling
Combined Controlled emissions ea. src. (g/s): 2.07E-04

Fly Ash and FGD Waste Calculations

Dry Fly Ash/FGD Waste	89,752	tpy at 100% Load [S&L Tech Matrix - 10/04/05]
Wet Fly Ash/FGD Waste	107,702	tpy at 100% Load with 20% moisture

Water will be added to the Fly Ash/FGD Waste while loading the material into the haul trucks.

Basin Electric Power Cooperative
Dry Fork Station
Bottom Ash Handling Emission Sources (FS1-04)

Bottom Ash Disposal Paved Haul Road

Unpaved Roads emission factor from State of Wyoming, DAQ, *"Guideline for Fugitive Dust Emission Factors for Mining Activities, January 1979"*

E_U (lb per vehicle mile traveled) = $(0.81s(S/30)^2((365\text{-}W)/365)0.62)$

where:

s = 8.6	[silt content (%) of road surface material (from WDEQ Guidance)]
S = 10	[mean vehicle speed in mph]
W = 100	[number of days with >0.01 inches precip. per year (from WDEQ Guidance Document)]
E_U = 0.105	[PM_{10} lb/VMT] [Assume 30% of PM as per WDEQ Guidance Document]
E_U = 0.348	[PM lb/VMT]

Haul truck maximum load =	50 tons per truck	[Engineering Estimates]
Total Amount hauled (per year) =	19,268 tons	[Provided by S&L]
Total Amount hauled (per hour) =	4.40 tons	[Based on expected haul rates, assumed material hauled once a day, 12 hrs per day]
Haul road round trip =	1.39 miles	[2236 m = 2236 m x 0.0006214 mi/m = 1.39 miles]
Round trips per hour =	0.09	
Round trips per year =	385.4	
VMT (per hour) =	0.1 miles	
VMT (annual) =	535 miles	

Source ID	Source Name	Maximum Uncontrolled Emissions (lb PM/hr)	Annual Uncontrolled PM Emissions (tpy)	Maximum Uncontrolled Emissions (lb PM_{10}/hr)	Annual Uncontrolled PM_{10} Emissions (tpy)	Control %	Maximum Controlled Emissions (lb PM_{10}/hr)	Maximum Controlled Emissions (lb PM/hr)	Annual Controlled PM_{10} Emissions (tpy)	Annual Controlled PM_{10} Emissions (lb/hr)	Annual Controlled PM_{10} Emissions (g/s)	Annual Controlled PM Emissions (tpy)	Control System
FS1-04P	Bottom Ash Disposal Paved Haul Road	4.26E-02	9.33E-02	1.28E-02	2.80E-02	85	1.92E-03	6.39E-03	4.20E-03	1.92E-03	2.41E-04	1.40E-02	Roads are paved

Notes:
1) Unpaved Roads emission factor from State of Wyoming, DAQ, *"Guideline for Fugitive Dust Emission Factors for Mining Activities, January 1979"*
2) Control efficiencies *from State of Wyoming, DAQ, "Guideline for Fugitive Dust Emission Factors for Mining Activities, January 1979"*
3) Annual lb/hr emissions estimated based on 12 hr/day of operations.
4) Unpaved road emission factors are used in the calculation as per discussions with WDEQ. However, a higher control efficiency is used as the roads are paved.

	24-Hour
Controlled PM_{10} emissions (g/s):	2.41E-04
# Volume sources:	37
Controlled emissions ea. src. (g/s):	6.53E-06

Basin Electric Power Cooperative
Dry Fork Station
Bottom Ash Handling Emission Sources (FS1-04)

Bottom Ash Disposal Unpaved Haul Road

Unpaved Roads emission factor from State of Wyoming, DAQ, *"Guideline for Fugitive Dust Emission Factors for Mining Activities, January 1979"*

E_U (lb per vehicle mile traveled) = $(0.81s(S/30)^2((365-W)/365)0.62)$

where:

s =	8.6	[silt content (%) of road surface material (from WDEQ Guidance)]
S =	10	[mean vehicle speed in mph]
W =	100	[number of days with >0.01 inches precip. per year (from WDEQ Guidance Document)]
E_U =	0.105	[PM_{10} lb/VMT] [Assume 30% of PM as per WDEQ Guidance Document]
E_U =	0.348	[PM lb/VMT]

Haul truck maximum load =	50 tons per truck	[Engineering Estimates]
Total Amount hauled (per year) =	19,268 tons	[Provided by S&L]
Total Amount hauled (per hour) =	4.40 tons	[Based on expected haul rates, assumed material hauled once a week, 12 hrs per week]
Haul road round trip =	0.26 miles	[424.5 m = 424.5 m x 0.0006214 mi/m = 0.26 miles]
Round trips per hour =	0.09	
Round trips per year =	385	
VMT (per hour) =	0.0 miles	
VMT (annual) =	102 miles	

Source ID	Source Name	Maximum Uncontrolled Emissions (lb PM/hr)	Annual Uncontrolled PM Emissions (tpy)	Maximum Uncontrolled Emissions (lb PM_{10}/hr)	Annual Uncontrolled PM_{10} Emissions (tpy)	Control %	Maximum Controlled Emissions (lb PM_{10}/hr)	Maximum Controlled Emissions (lb PM/hr)	Annual Controlled PM_{10} Emissions (tpy)	Annual Controlled PM_{10} Emissions (lb/hr)	Annual Controlled PM_{10} Emissions (g/s)	Annual Controlled PM Emissions (tpy)	Control System
FS1-04UP	Bottom Ash Disposal Unpaved Haul Road	8.09E-03	1.77E-02	2.43E-03	5.31E-03	50	1.21E-03	4.04E-03	2.66E-03	1.21E-03	1.53E-04	8.85E-03	Water Sprays

Notes:
1) Unpaved Roads emission factor from State of Wyoming, DAQ, *"Guideline for Fugitive Dust Emission Factors for Mining Activities, January 1979"*
2) Control efficiencies *from State of Wyoming, DAQ, "Guideline for Fugitive Dust Emission Factors for Mining Activities, January 1979"*
3) Annual lb/hr emissions estimated based on 12 hr/day of operations.

	24-Hour
Controlled PM_{10} emissions (g/s):	1.53E-04
# Volume sources:	14
Controlled emissions ea. src. (g/s):	1.09E-05

Bottom Ash Calculations

Bottom Ash Produced	19,268	tpy at 100% Load [S&L Tech Matrix - 10/04/05]
Bottom Ash Produced	52.79	tons per day at 100% Load
Bottom Ash Hauled	4.40	Assumed BA is hauled 12 hr per day

Basin Electric Power Cooperative
Dry Fork Station
Ash/FGD Waste Landfill Emission Sources (FS1-03)

Maintenance of Ash Landfill

Reference: AP-42, Table 11.9-2

E (lb PM per hour) = 5.7 * s1.2 / M1.3
E (lb PM-10 per hour) = (1.0 * s1.5 / M1.4) * 0.75

where:

s = 19.3 silt content % [Estimated below]
M = 20.0 moisture % [Estimate based on design of silo unloading system]
E = 4.06 lb/hr PM
E = 0.96 lb/hr PM-10

Source ID	Source Name	Uncontrolled Emissions (lb PM_{10}/hr)	Uncontrolled Emissions (lb PM/hr)	Control %	Controlled Emissions (lb PM_{10}/hr)	Controlled Emissions (g PM_{10}/s)	Controlled Emissions (lb PM/hr)	Hours of operation	Controlled PM_{10} Emissions (tpy)	Controlled PM Emissions (tpy)	Control
FS1-03a	Maintenance of ash landfills	0.96	4.06	80%	1.92E-01	2.42E-02	8.11E-01	4,380	4.21E-01	1.78E+00	Water sprays are used for dust suppression

(1) Hours of operation estimated from 12 hrs per day of maintenance operations.
(2) Control efficiency achieved by dust suppression through application of water sprays. The maintenance activities will be performed below grade level.
(3) Annual lb/hr emissions estimated based on 12 hr/day of operations.

Estimation of silt content

Estimated silt content of scrubber sludge is 0 and that of bottom ash is 1%.
Silt content of Fly ash is 31.6% (from S&L Tech Matrix)

Total amount dumped at landfill:	107,702	tons/yr	See Fly Ash-FGD Waste Handling Worksheet
Total fly ash:	77,072	tons/yr	Calculated
Total scrubber waste:	30,631	tons/yr	Calculated
Total Bottom Ash:	19,268	tons/yr	Calculated
Estimated Silt Content (%) =	19.3	[(ash amt x .316) + (bottom ash amt x .01) + (sludge amt x 0)] / total amt]	

Wind Erosion

[FS1-03b] - Wind erosion is negligible because the material forms a crust due to moisture and the chemical composition of the ash and FGD waste material.

Fly Ash/FGD Waste Transfer from Truck to the Landfill

Emission factor from AP-42, Section 13.2.4: *Aggregate Handling and Storage Piles* (1/95), Equation (1) - batch or continuous drop operation

E (lb PM_{10} per ton material handled) = k (0.0032) (U/5)^1.3 / [(M/2)^1.4]

where:

k = 0.35 [particles < 10um]
k = 0.74 [particles < 30um]
U = 10 [mph, average wind speed in mine area]
M = 20 [water added while unloading]

E (lb PM_{10} per ton handled) = 1.10E-04
E (lb PM per ton handled) = 2.32E-04

Basin Electric Power Cooperative
Dry Fork Station
Ash/FGD Waste Landfill Emission Sources (FS1-03)

Source ID	Source Name	Process Rate (ton/hour)	Uncontrolled Emissions (lb PM_{10}/hr)	Uncontrolled Emissions (lb PM/hr)	Control %	Short-term Controlled Emissions (lb PM_{10}/hr)	Short-term Controlled Emissions (g PM_{10}/s)	Short-term Controlled Emissions (lb PM/hr)	Annual Controlled PM_{10} Emissions (tpy)	Annual Controlled PM_{10} Emissions (lb/hr)	Annual Controlled PM_{10} Emissions (g/s)	Annual Controlled PM Emissions (tpy)	Control System and Comments
FS1-03c	Fly Ash/FGD Waste Dumping onto the Landfill from Haul Trucks	79.2	0.0087	0.0184	0	8.69E-03	1.10E-03	1.84E-02	5.91E-03	2.70E-03	3.40E-04	1.25E-02	

Notes:
1) Fly Ash/Scrubber Waste Handling Source List based on information provided by Joe Hammond on 5/26/2005 via email.
2) See Fly Ash-FGD Waste Handling amount for assumptions on process rates.
3) Annual lb/hr emissions estimated based on 12 hr/day of operations.

Bottom Ash Transfer from Truck to the Landfill

Emission factor from AP-42, Section 13.2.4: *Aggregate Handling and Storage Piles* (1/95), Equation (1) - batch or continuous drop operation

E (lb PM_{10} per ton material handled) = k (0.0032) (U/5)^1.3 / [(M/2)^1.4]

where:

k = 0.35	[particles < 10um]
k = 0.74	[particles < 30um]
U = 10	[mph, average wind speed in mine area]
M = 20	[water added while unloading]

E (lb PM_{10} per ton handled) = 1.10E-04
E (lb PM per ton handled) = 2.32E-04

Source ID	Source Name	Process Rate (ton/hour)	Uncontrolled Emissions (lb PM_{10}/hr)	Uncontrolled Emissions (lb PM/hr)	Control %	Short-term Controlled Emissions (lb PM_{10}/hr)	Short-term Controlled Emissions (g PM_{10}/s)	Short-term Controlled Emissions (lb PM/hr)	Annual Controlled PM_{10} Emissions (tpy)	Annual Controlled PM_{10} Emissions (lb/hr)	Annual Controlled PM_{10} Emissions (g/s)	Annual Controlled PM Emissions (tpy)	Control System and Comments
FS1-03d	Bottom Dumping onto the Landfill from Haul Trucks	4.4	0.0005	0.0010	0	4.83E-04	6.09E-05	1.02E-03	1.06E-03	4.83E-04	6.09E-05	2.24E-03	

Notes:
1) Fly Ash/Scrubber Waste Handling Source List based on information provided by Joe Hammond on 5/26/2005 via email.
2) See Fly Ash-FGD Waste Handling amount for assumptions on process rates.
3) Annual lb/hr emissions estimated based on 12 hr/day of operations.

Basin Electric Power Cooperative
Dry Fork Station
Stack Parameters - Material Handling and Auxiliary Equipment Sources

Source ID	Source Name	Release Ht. (ft)	Release Height (m)	Stack Diameter (ft)	Stack Diameter (m)	Air Flow (acfm)	Air Flow (scfm)	Air Flow (dscfm)	Air Flow (actual m^3/min)	Release Velocity (m/s)	Release Velocity (ft/s)	Stack Temperature (F)	Stack Temperature (K)	Notes
ES1-02	Unit 1 Auxiliary Boiler	232	70.71	4.00	1.219	44,763	26,582		1,267.55	18.10	59.37	305.00	424.82	Vertical Stack
ES1-03	Diesel Fire Pump	20	6.10	0.25	0.076	1,030	358		29.17	106.59	349.71	845.00	724.82	Vertical Stack
ES1-04	Auxiliary Cooling Tower	15	4.57	8	2.438	65,000	54,997		1,840.60	6.57	21.55	77.00	298.15	Vertical Stack
ES1-05	Diesel Generator	20	6.10	1.00	0.305	5,477	1,892		155.09	35.42	116.22	855.00	730.37	Vertical Stack
ES1-06	Inlet Gas Heater	30	9.14	2.5	0.762	3,247	1,391	1,277	91.95	3.36	11.02	600.00	588.71	Vertical Stack
ES1-07	Coal Storage Silo 1 Dust Collector	180	54.86	2.25	0.686	17,500	15,060	13,704	495.55	22.36	73.35	68.00	293.15	Vertical Stack
ES1-08	Coal Storage Silo 2 Dust Collector	180	54.86	2.25	0.686	17,500	15,060	13,704	495.55	22.36	73.35	68.00	293.15	Vertical Stack
ES1-09	Coal Storage Silo 3 Dust Collector	180	54.86	1.83	0.559	11,300	9,724	8,849	319.98	21.75	71.34	68.00	293.15	Vertical Stack
ES1-10	Coal Crusher House Dust Collector	156	47.55	3.08	0.940	32,200	27,710	25,216	911.81	21.91	71.87	68.00	293.15	Vertical Stack
ES1-11	Plant Coal Silo Transfer Bay Dust Collector	210	64.01	3.25	0.991	35,000	30,119	27,408	991.09	21.43	70.31	68.00	293.15	Vertical Stack
ES1-12	Pebble Lime Receiving Silo Bin Vent Filter	100	30.48	1.37	0.418	4,400	800	728	124.59	15.16	49.75	68.00	293.15	Horizontal Exhaust
ES1-13	Pebble Lime Day Silo Bin Vent Filter	80	24.38	0.97	0.295	2,200	1,100	1,001	62.30	15.19	49.82	68	293.15	Horizontal Exhaust
ES1-14	Lime Hydrator Mixer Dust Collector No. 1	88	26.82	1.67	0.508	7,500	5,163	4,698	212.38	17.46	57.29	200	366.48	Vertical Stack
ES1-15	Lime Hydrator Mixer Dust Collector No. 2	88	26.82	1.67	0.508	7,500	5,163	4,698	212.38	17.46	57.29	200	366.48	Vertical Stack
ES1-16	Hydrated Lime Dust Collector No. 1	88	26.82	2.25	0.686	20,838	18,000	16,380	590.07	26.62	87.34	68	293.15	Vertical Stack
ES1-17	Hydrated Lime Dust Collector No. 2	88	26.82	2.25	0.686	20,838	18,000	16,380	590.07	26.62	87.34	68	293.15	Vertical Stack
ES1-18	Hydrated Lime Silo 1 Bin Vent Filter	97	29.57	0.97	0.295	2,200	1,900	1,729	62.30	15.19	49.82	68	293.15	Horizontal Exhaust
ES1-19	Hydrated Lime Silo 2 Bin Vent Filter	97	29.57	0.97	0.295	2,200	1,900	1,729	62.30	15.19	49.82	68	293.15	Horizontal Exhaust
ES1-20	Activated Carbon Silo Bin Vent Filter	86	26.21	0.50	0.152	926	800	728	26.22	23.96	78.60	68	293.15	Horizontal Exhaust
ES1-21	Fly Ash/FGD Waste Silo Separator/Filter Exhaust	32	9.75	0.83	0.253	1,605	1,200	1,092	45.45	15.07	49.44	150	338.71	Vertical Stack
ES1-22	Fly Ash/FGD Waste Silo Bin Vent Filter	95	28.96	0.83	0.253	1,809	1,250	1,138	51.23	16.98	55.72	200	366.48	Horizontal Exhaust

Notes:
Relative Humidity (%): 50 From: http://www.wrds.uwyo.edu/wrds/wsc/climateatlas/humidity.html
Moisture Content (%): 9
Atmospheric Pressure (psi): 12.65 From the Pressure_Correction_for_Altitude_Chart.xls worksheet (at 4,250 ft amsl)
~~Std. Pressure (psi): 14.7~~
Std. Temperature (F): 68 Based on dicussions with Joe H.

Basin Electric Power Cooperative
Dry Fork Station
Area and Volume Sources

Volume Sources

Source ID	Source Description	Release Height (ft)	Release Height (m)	Lateral Dimension (ft)	Vertical Dimension (ft)	Lateral Dimension (m)	Vertical Dimension (m)	Lateral Dimension (sigma-Y)	Vertical Dimension (sigma-Z)
FS1-01	Fly Ash/FGD Waste Disposal Truck Loading	10	3.05	47.6	20	14.51	6.10	3.4	2.8
FS1-02	Haul Roads		2.00	100		30.48		14.2	3.0

Notes:
1) Physical dimensions of FS1-01: 20-ft height on silo driveway, 47.6-ft wide silo
2) For FS1-01: Initial lateral dimension equals length of side divided by 4.3 (single volume source), initial vertical dimension equals vertical length divided by 2.15 (elevated source on or adjacent to a building) (per ISC User's Guide).

3) For FS1-02: Haul road dimensions based on 50 ft. road width. Initial lateral dimension equals length of side divided by 2.15 (line source). (per ISC User's Guide).

Area Sources

Source ID	Source Description	Size of Area (Acres)	Area Source Height (ft)	Area Source Height (m)	L (m)	W (m)	r (m)	A (ft^2)	A (m^2)	E Rate (lb/hr)	E Rate (g/s)	E Rate (g/s/m^2)
FS1-03	Fly Ash/FGD Waste Landfill	1.0	15	4.57	63.61	63.61	-	43,558	4,046	0.20	2.539260E-02	6.28E-06

Notes:
1 acre = 43,560 ft^2.

ISC-PRIME Results

Pollutant	Averaging Period	Monitoring De Minimus Level (ug/m^3)	Modeling Significance Level (ug/m^3)	103% Load Emission Rate (lb/hr)	103% Load Emission Rate (g/s)	100% Load Emission Rate (lb/hr)	100% Load Emission Rate (g/s)	75% Load Emission Rate (lb/hr)	75% Load Emission Rate (g/s)	50% Load Emission Rate (lb/hr)	50% Load Emission Rate (g/s)	ISC-PRIME Predicted Impact (ug/m^3) 103% Load	100% Load	75% Load	50% Load
CO	1-Hour	n/a	2000	570	71.8	557	70.1	435.3	54.8	303.5	38.2	85.2	83.4	66.5	57.5
CO	8-Hour	575	500	570	71.8	557	70.1	435.3	54.8	303.5	38.2	14.9	14.8	13.3	11.2
NO_2	3-Hour	n/a	n/a	266	33.5	259.7	32.7	203.1	25.6	141.6	17.8	14.7	14.7	12.9	10.8
NO_2	Annual	14	1	n/a	n/a	259.7	32.7	n/a	n/a	n/a	n/a	n/a	0.3	n/a	n/a
PM_{10} (Boiler Only)	24-Hour	10	5	64.60	8.1	63.0	7.9	49.3	6.2	34.4	4.3	0.94	0.98	0.98	0.91
SO_2	3-Hour	n/a	25	380	47.9	371.0	46.7	290.2	36.6	202.3	25.5	21.1	21.0	18.5	15.5
SO_2	24-Hour	13	5	380	47.9	371.0	46.7	290.2	36.6	202.3	25.5	5.5	5.8	5.8	5.4
SO_2	Annual	n/a	1	n/a	n/a	371.0	46.7	n/a	n/a	n/a	n/a	n/a	0.4	n/a	n/a
Lead	3-Month	0.1	n/a	n/a	n/a	0.01	0.001	n/a	n/a	n/a	n/a	n/a	0.00009	n/a	n/a
Mercury	24-Hour	0.25	n/a	0.007	0.0009	0.007	0.0009	0.007	0.0009	0.007	0.0009	0.0001	0.0001	0.0001	0.0002
Beryllium	24-Hour	0.001	n/a	0.001	0.0002	0.001	0.0002	0.001	0.0002	0.001	0.0002	0.0000	0.0000	0.0000	0.0000
Fluorides	12-Hour	n/a	n/a	2.62	0.3	2.56	0.3	2.0	0.25	1.4	0.18	0.15	0.07	0.13	0.11
Fluorides	24-Hour	0.25	n/a	2.62	0.3	2.56	0.3	2.0	0.25	1.4	0.18	0.04	0.04	0.04	0.04
Fluorides	7-day	n/a	n/a	2.62	0.3	2.56	0.3	2.0	0.25	1.4	0.18	0.04	0.04	0.04	0.04
Fluorides	30-day	n/a	n/a	n/a	n/a	2.6	0.323	n/a	n/a	n/a	n/a	n/a	0.037	n/a	n/a

Raw ISC Results

@ 1 g/s	103% Load	100% Load	75% Load	50% Load
1-hour	1.18553	1.18949	1.21203	1.50501
3-hour	0.43969	0.44888	0.50475	0.607
8-hour	0.20715	0.21114	0.24334	0.29325
24-hour	0.11524	0.12313	0.15819	0.21094
Monthly	n/a	0.11524	n/a	n/a
Annual	n/a	0.00855	n/a	n/a

File name: Load_Fine-10-27-05.BST

WDEQ Permit Application Form
Table 1

Emission Point	Stack Height (ft.)	Stack Diameter (ft.)	Gas Discharge (SCFM)	Exit Temperature (F)	Gas Velocity (ft./s)
ES1-02	232	4.00	26,582	305	59.4
ES1-03	20.0	0.25	358	845	350
ES1-04	15.0	8.00	54,997	77.0	21.6
ES1-05	20.0	1.00	1,892	855	116
ES1-06	30.0	2.50	1,391	600	11.0
ES1-07	180	2.25	15,060	68.0	73.4
ES1-08	180	2.25	15,060	68.0	73.4
ES1-09	180	1.83	9,724	68.0	71.3
ES1-10	156.0	3.08	27,710	68.0	71.9
ES1-11	210	3.25	30,119	68.0	70.3
ES1-12	100	1.37	800	68.0	49.7
ES1-13	80.0	0.97	1,100	68.0	49.8
ES1-14	88.0	1.67	5,163	200	57.3
ES1-15	88.0	1.67	5,163	200	57.3
ES1-16	88.0	2.25	18,000	68.0	87.3
ES1-17	88.0	2.25	18,000	68.0	87.3
ES1-18	97.0	0.97	1,900	68.0	49.8
ES1-19	97.0	0.97	1,900	68.0	49.8
ES1-20	86.0	0.50	800	68.0	78.6
ES1-21	32.0	0.83	1,200	150	49.4
ES1-22	95.0	0.83	1,250	200	55.7

Notes:
Standard Temperature = 68 F
Standard Pressure = 14.7 psi
Ambient Pressure = 12.65 psi at 4,250 amsl

Department of Environmental Quality

1866 S. Sheridan Avenue
Sheridan, WY 82801

Air, Land, & Water Divisions

New Phone: (307) 673-WDEQ (9330)
Fax (307) 672-2213

No. of pages (cover sheet included) 4

Date 4/12/05

To JOSH NALL

CH2M HILL

Fax No.

From J. Shemley

Comments

$\frac{LB}{HR} = \frac{SCF}{m} \times \frac{?\,gr}{dscf} \times \frac{60\,min}{1\,hr} \times \frac{1\#}{7000\,gr}$

1.74 tons/BCY

wet days = 100

TABLE

STATE OF WYOMING
DIVISION OF AIR QUALITY
GUIDELINE FOR FUGITIVE DUST EMISSION FACTORS
FOR MINING ACTIVITIES

January, 1979

(Particulate size 30 um and smaller, no fallout function required)

Mining Activity	(note) Emission Factor (Ref) x % Suspended	Control Technique	Control Efficiency
1. Overburden Removal			
Dragline	0.04 lb/yd^3(1) x 0.75	——	——
Truck/Shovel	0.02 lb/ton(1) x 0.75	——	——
Scraper	[1] 32 lbs/hr(2)	watering	50%
2. Haul Roads S = 8.6% 15 MPH – OB 20 MPH – COAL	[2] $E = 0.81s(S/30)\frac{(365-W)}{365}$ lb/VTM(3) x 0.62 (≈126)	a. watering [3] b. oil or chemical dust suppresant	50% 60%
Access Roads	[2] $E = 0.81s(S/30)\frac{(365-W)}{365}$ lb/VTM(3) x 0.62	a. asphalt paving or equal b. stabilization of base with chip and seal surface	85% 70%
	$\frac{tons}{tons/truck} = \#trips$ $\frac{VMT}{\#trips} = $ miles Roundtrip		
3. Haul Road Repair and Construction			
Gr...	[1] 32 lbs/hr(2)	watering	50%
Scrapers	[1] 32 lbs/hr(2)	watering	50%
4. Wind Erosion = .25 ton/ac/yr	[4] E = AIKCL'V' ton/acre/yr(4)	——	——
5. Product Removal			
Coal-Truck/Shovel	0.003 lb/ton(1) x 0.70	"SO_2" = ton coal x %S x 2	——
Coal-Frontend Loader	[5] 0.003 lb/ton x 0.70	x % retention	——
Uranium-Frontend Loader	[6] 0.003 lb/ton		——
6. Product Dumping			
Coal-Truck Dump	0.017 lb/ton(1) x 0.75		50%
Uranium	[7] 0.017 lb/ton		85%
7. Stockpiles (wind erosion)			
Coal	[8] 1.2 u lb/acre/hr x 0.75	Enclosure	99%
Uranium	[9] E = 0.05(s/1.5)(d/235)(f/15)(D/90)lbs/ton(5)	watering	50%

Truck Dump: 0.017 #/T x 0.75 x TPY/2000 x efficiency = TPY TSP

DEQ/AQD 000198

Mining Activity	Emission Factor (Ref) x % Suspended	Control Technique	Effici
8. Blasting			
Overburden	50 lb/blast(1) x 0.75	prevent overshooting	
Coal	35 lb/blast(1) x 0.75	prevent overshooting	

Notes:

1. If applicant's estimate of grader and scraper hours includes wet days, then reduce emissions by the factor $\frac{365-W}{365}$ where W = no. of days where rain or snow precipitation is 0.01" or greater

2. From Reference 3 $E = 0.81s(S/30)\frac{(365-W)}{365}$ lbs/VMT

 where s = silt content of road surface material(%) 8.6%
 S = vehicle speed in mph
 W = no. of days with 0.01" precipitation or more =100 days = .126
 S/30 factor should be squared for speeds less than 30 mph
 Apply correction for number or width of tires compared to light vehicles

3. Frequency and rate of application as per manufacturer's recommendation or as justified by applicant for site, specif road materials and experience.

4. From Reference 4 $E = AIKCL'V'$ ton/acre/yr
 where A = portion of losses which become suspended
 I = soil erodibility
 K = surface roughness factor
 C = climatic factor
 L' = unsheltered field width factor
 = 0.7 for 1000' & 1.0 for 2000' and greater
 V' = vegetative cover factor (use V' = 1.0)

Soil Type	A	I, ton/acre/yr
Rocky, Gravelly	0.025	38
Sandy	0.010	134
Fine	0.041	52
Clay Loam	0.025	47

K – Varies from 0.5 to 1.0; 1.0 is normally used.
C – Table 3.11 of reference or $C = 0.345\ (u^3) + (P\text{-}E)^2$
 where u = average wind velocity (mph)

5. It was felt that given the similarity of operation of a frontend loader to a shovel that measured emissions from Reference 1 of 10 to 20 times more (loader vs. shovel) were not reasonable, thus the selection of 0.003 lbs/ton.

6. Given the usual wetness of observed uranium ore in surface mines this factor is probably conservative. Factor estimate only – not measured. No correction is made for % suspended material as data is not available.

Notes:

7. Estimate only - not measured. No correction is made for % suspended material as data is not available.

8. 1.2 u lb/acre/hour where u is wind speed in m/sec. Factor includes some equipment activity around and on piles. Total emission should include truck dumping, etc. Adjust by ratio of dry days to total days in existence.

9. From Reference 5 $E = 0.05(s/1.5)(d/235)(f/15)(D/90)$ lbs/ton throughput through pile

where s = silt content of material (%)

d = no. of dry days/yr

f = percentage of time wind speed exceeds 12 mph

D = duration of material in storage (days)

References:

(1) EPA-908/1-78-003, "Survey of Fugitive Dust from Coal Mines", by PEDCo Environmental, Inc., February, 1978.

(2) EPA-908/1-76-008, "Wyoming Air Quality Maintenance Area Analysis", by PEDCo Environmental, Inc., May, 1976.

(3) AP-42 "Compilation of Air Pollutant Emission Factors (Supplements 1-8)", May, 1978.

(4) PEDCo 1976, "Evaluation of Fugitive Dust Emissions from Mining", by PEDCo Environmental, Inc., April, 1976.

(5) C. Cowherd and R.V. Hendriks, "Development of Fugitive Dust Emission Factors for Industrial Sources", Paper No. 78-55.4, Annual Meeting Air Pollution Control Association, Houston, Texas (June, 1978).

Appendix C

Wyoming Regulations

TABLE C-1
Summary of Applicable Requirements – Wyoming Code of Regulations

Citation	Description	Requirement/Standard	Applicable Yes	Applicable No	Explanation/Comments	Methods Used to Demonstrate Compliance
Wyoming Air Quality Standards and Regulations						
Common Provisions, (WAQS&R) Chapter 1, Section 1 - 6	Definitions, Statement of Intent, General Provisions	Definitions and General Intent of the air quality regulations.		x	This is not an applicable standard or limitation; however, these definitions do apply when evaluating other applicable requirements within Air quality regulations provided under WAQS&R Chapters 1- 14.	
Ambient Standards, (WAQS&R) Chapter 2, Section 1 - 11	Ambient Standards	This Chapter establishes standards of ambient air quality necessary to protect public health and welfare.	x		Compliance with these regulations must be demonstrated for obtaining a PSD permit for the Dry Fork Station.	Air emission impact modeling.
General Emission Standards, (WAQS&R) Chapter 3, Section 1.	Introduction to general emission standards	This Chapter establishes limits on the quantity, rate, or concentration of emissions of air pollutants, including any requirements which limit the level of opacity, prescribe equipment, set fuel specifications, or prescribe operation or maintenance procedures. These general emission standards maybe be superceded by specific emission standards required in other Chapters of the WAQS&R.	x		Compliance with these regulations must be demonstrated for obtaining a PSD permit for the Dry Fork Station.	CEMS, Stack Tests
General Emission Standards, (WAQS&R) Chapter 3, Section 2 (a) & (e).	Emission standards for particulate matter.	Visible emissions of any contaminant discharged into the atmosphere from any single new source of emission whatsoever as determined by a qualified observer shall be limited to 20 percent opacity. Unless restricted by more stringent emission limits established elsewhere in the WAQS&R or permit conditions, any single source may discharge for a period or periods aggregating not more than 6 minutes in any hour contaminants having an equivalent opacity of not more than 40 percent as determined by a qualified observer.	x		General limitation of opacity for any emission unit to 20% unless exempted.	EPA method 9 or COMS.

DEQ/AQD 000202

DEQ/AQD 000203

TABLE C-1
Summary of Applicable Requirements – Wyoming Code of Regulations

Citation	Description	Requirement/Standard	Applicable		Explanation/Comments	Methods Used to Demonstrate Compliance
			Yes	No		
General Emission Standards, (WAQS&R) Chapter 3, Section 2 (d).	Emission standards for particulate matter.	The emission of visible air pollutants from diesel engines as determined by a qualified observer shall be limited to 30 percent opacity below 7500 feet elevation except for periods not exceeding ten consecutive seconds. This limitation shall not apply during a reasonable period of warm-up following a cold start or where undergoing repairs and adjustment following a malfunction.	x		General limitation of opacity for the diesel fire pump and diesel emergency generator to 30% unless exempted.	EPA method 9 or COMS.
General Emission Standards, (WAQS&R) Chapter 3, Section 2 (f).	Emission standards for particulate matter.	Fugitive dust sources operating within the State of Wyoming are required to control fugitive dust emissions. Refer to the regulation for specific control measures or any equivalent method approved by the Division Administrator which are considered appropriate for minimizing fugitive dust.	x		Dry Fork Station operations associated with handling and transporting of materials will be incompliance by implementing fugitive dust migration. (water or chemical sprays, baghouses, bin vent filters)	EPA method 9 or COMS.
General Emission Standards, (WAQS&R) Chapter 3, Section 2 (g).	Emission standards for particulate matter.	The emission of particulate matter from any new source shall be limited as indicated in Table I provided in Chapter 3, Section 2 (g). Interpolation and extrapolation of the data for process weight rates in excess of 60,000 lbs/hr shall be accomplished by use of the equation: $E = 17.31\ P^{0.16}$ $P > 30$ tons/hr Where: E = Emissions in pounds per hour. P = Process weight rate in tons per hour.	x		Dry Fork Unit 1 emissions of particulate matter are below this limit.	EPA method 9 or COMS.

TABLE C-1
Summary of Applicable Requirements – Wyoming Code of Regulations

Citation	Description	Requirement/Standard	Applicable Yes	Applicable No	Explanation/Comments	Methods Used to Demonstrate Compliance
General Emission Standards, (WAQS&R) Chapter 3, Section 3 (a)	Emission standards for nitrogen oxides	The emission of nitrogen oxides from new gas fired fuel burning equipment calculated as nitrogen dioxide shall be limited to 0.20 lb/MMBtu of heat input. The emission of nitrogen oxides from existing solid fossil fuel (except lignite) fired fuel burning equipment calculated as nitrogen dioxide shall be limited to 0.75 lb/MMBtu heat input. The requirements of Chapter 3, Section 3(a) do not apply to internal combustion engines having a heat input of less than 200 MMBtu/hr.	x		Dry Fork Unit 1 and the auxiliary boiler emissions of NOx are below these limits.	The emission standards for nitrogen oxides, measured in accordance with Method 7 of 40 CFR part 60, Appendix A or by an equivalent method.
General Emission Standards, (WAQS&R) Chapter 3, Section 4 (b)	Emission standards for sulfur oxides	The emission of sulfur dioxide (SO2) from fuel-burning equipment construction on or after January l, 1985 are limited to the 0.2 lb/MMBtu on a 30-day rolling average and 0.45 lb/MMBtu on a maximum 3-hour basis.	x		Compliance with these emission limitations for Unit 1 shall be determined on a 30-day rolling average basis and a fixed 3-hour basis, using the emission data obtained from an SO2 continuous monitoring system.	The CEMS will be installed and operated in accordance with Chapter 5, Section 2(j) of these regulations.
General Emission Standards, (WAQS&R) Chapter 3, Section 5 (a)	Emission standards for carbon monoxide	The emission of carbon monoxide in stack gases from any stationary source shall be limited as may be necessary to prevent ambient standards described in Chapter 2 from being exceeded.	x		Emissions of CO from Dry Fork Unit 1 and the auxiliary boiler are not exceeding ambient standards.	
General Emission Standards, (WAQS&R) Chapter 3, Section 6 (a)	Emission standards for volatile organic compounds.	VOC emissions shall be limited through the application of Best Available Control Technology (BACT) in accordance with Chapter 6, Section 2 of these regulations.		x	Emissions of VOC from Dry Fork Unit 1 do not require a BACT analysis.	

DEQ/AQD 000204

DEQ/AQD 000205

TABLE C-1
Summary of Applicable Requirements – Wyoming Code of Regulations

Citation	Description	Requirement/Standard	Applicable		Explanation/Comments	Methods Used to Demonstrate Compliance
			Yes	No		
General Emission Standards, (WAQS&R) Chapter 3, Section 7	Emission standards for hydrogen sulfide.	Any exit process gas stream containing hydrogen sulfide which is discharged to the atmosphere from any source shall be vented, incinerated, flared or otherwise disposed of in such a manner that ambient sulfur dioxide and hydrogen sulfide standards described in Chapter 2 are not exceeded.	x		Emissions for hydrogen sulfide from Unit 1 will be collected by the CDS and fabric filter.	
General Emission Standards, (WAQS&R) Chapter 3, Section 8	Emission standards of asbestos for demolition, renovation, manufacturing, spraying and fabricating	Any demolition or renovation activity that has materials insulated or fireproofed with friable asbestos will also be subject to the provisions of Chapter 3, Section 8.		x	Demolition will be minimal at the Dry Fork Station. Dry Fork Station will comply with the fugitive emissions requirement as provided in the emission control plan.	Records will be kept to demonstrate compliance with the fugitive emission control plan.
State performance standards for specific existing sources (WAQS&R) Chapter 4	State performance standards for specific existing sources	The provisions of Chapter 4 in WAQS&R contain regulations for existing sulfuric acid production units, existing nitric acid manufacturing plants, existing municipal solid waste landfills, and existing hospital/medical/infectious was incinerators.		x	This provision does not Dry Fork Station as it is not one of the listed existing sources in the provision.	
National emission standards (WAQS&R) Chapter 5	National emission standards	This Chapter incorporates emission control regulations developed by the EPA for specific source categories. The WAQD adopts these Federal Regulations in order to maintain administrative authority with regards to the standards. Chapter 5, Section 2 contains NSPS which regulate criteria pollutant emissions from specific categories of new sources. Chapter 5, Section 3 contains NESHAP which regulate hazardous air pollutant emissions from specific categories of new and existing sources.	x		The appropriate applicable federal regulations are discussed in the federal regulation part of this document.	

DEQ/AQD 000206

TABLE C-1
Summary of Applicable Requirements -- Wyoming Code of Regulations

Citation	Description	Requirement/Standard	Applicable		Explanation/Comments	Methods Used to Demonstrate Compliance
			Yes	No		
Permitting Requirements (WAQS&R) Chapter 6, Section 2	Permit requirements for construction, modification, and operation	Section 2 covers general air quality permitting requirements for construction and modification as well as minor source permits to operate. Section 2 (1) (i) requires that a construction permit be obtained prior to commencing construction of a new or modified source of air emissions. WDAQ issues construction permits to commercial and industrial air pollution sources in Wyoming to ensure compliance with air quality regulations. The permitting process requires submission of forms provided by WDAQ. The application should include site information, plans, descriptions, specifications, and drawings showing the design of the source, the nature and amount of the emissions, and the manner in which it will be operated and controlled. A schedule for the construction or modification to the facility should also be included with the application.	x		This construction permit application is being submitted to allow issuance of a construction permit for the proposed project. Necessary application forms are also provided with this application.	
Permitting Requirements (WAQS&R) Chapter 6, Section 3	Operating permits	Section 3 is the state operating permit program required under Title V of the Clean Air Act. This section provides applicability and procedures for obtaining operating permit for a new source and modification of operating permit for an existing source.	x		Dry Fork Station is planning to obtain only a construction permit for the proposed project at this time. As provided in Chapter 6, Section 3 (c)(i), Dry Fork Station will apply for a Title V Operating Permit within twelve months of start up.	An application for a Title V operating permit will be submitted within 12 months of startup.
Permitting Requirements (WAQS&R) Chapter 6, Section 4	Prevention of significant deterioration	Section 4 is the prevention of significant deterioration (PSD) program. This section provides applicability and procedures for obtaining a PSD permit for a new source.	x		Because the proposed Dry Fork Station will be located in an area classified as attainment for all criteria pollutants, the requirements of the federal PSD program will apply to the construction of the proposed project.	

TABLE C-1
Summary of Applicable Requirements – Wyoming Code of Regulations

Citation	Description	Requirement/Standard	Applicable		Explanation/Comments	Methods Used to Demonstrate Compliance
			Yes	No		
Permitting Requirements (WAQS&R) Chapter 6, Section 5	Permit requirements for construction and modification of NESHAPs sources	Section 5 covers permitting requirements for major sources of hazardous air pollutants for which a (maximum achievable control technology) MACT standard has been established under Section 112 of the Clean Air Act.	x		Dry Fork Station Auxiliary boiler will comply with the methods of controlling emissions as provided in the applicable MACT standard. See the federal regulation part of this document.	
Monitoring regulations (WAQS&R) Chapter 7	Monitoring regulations	These sections establish general monitoring regulations for existing sources. These regulations may be superceded by specific monitoring requirements under other Chapters of the WAQS&R.		x	Dry Fork Station will be a new source, there for not subject to the provisions of this section.	
Non-attainment area regulations (WAQS&R) Chapter 8	Non-attainment area regulations	Chapter 8 establishes regulations specific to areas not attaining the National Ambient Air Quality Standards. Section 2 applies exclusively to Sweetwater County, Wyoming particulate matter regulations. Section 3 applies to general federal actions, excluding those covered under Section 4, within any federally designated nonattainment area of the State. Section 4 applies to specific transportation projects within any federally designated nonattainment area of the State.		x	The Dry Fork Station is located in an area classified as attainment; therefore, this rule does not apply.	
Visibility impairment/PM fine control (WAQS&R) Chapter 9	Visibility impairment/PM fine control	This chapter establishes regulations to protect visibility and addresses plume blight impairment in Class I Areas.	x		This section describes the requirements for the WDEQ review of the proposed project for the impact of its PSD pollutant emissions on visibility in any mandatory Class I area. Designated Class I areas were reviewed for Ambient Air Quality and visibility impact.	Air Quality Modeling report.

TABLE C-1
Summary of Applicable Requirements – Wyoming Code of Regulations

Citation	Description	Requirement/Standard	Applicable		Explanation/Comments	Methods Used to Demonstrate Compliance
			Yes	No		
Smoke management (WAQS&R) Chapter 10	Smoke management	Chapter 10 establishes restrictions and requirements on specific burning practices. Section 2 regulates refuse burning; open burning of trade wastes, for salvage operations, for fire hazards, and for fire fighting training; and vegetative material open burning. Section 3 specifically regulates emissions from wood waste burners. Section 4 regulates sources of vegetative burning for the management of air quality emissions and impacts from smoke on public health and visibility.		x	The requirements established on specific burning practices do not apply to this facility.	
National acid rain program (WAQS&R) Chapter 11	National acid rain program	This regulation adopts Federal Acid Rain Program requirements of 40 CFR Part 72 through 78.	x		The details of compliance with provisions of Acid Rain program is provided in the Federal program Section in Appendix D.	CEMS and EDR
Emergency Controls (WAQS&R) Chapter 12	Emergency Controls	This Chapter is designed to prevent the excessive build-up of air pollutants during air pollution episodes, thereby preventing the occurrence of an emergency due to the effects of these pollutants on the health of persons.	x		If applicable Dry Fork Station will comply with the methods of controlling emissions as provided by WDEQ.	
Mobile Sources (WAQS&R) Chapter 13	Mobile Sources	Chapter 13 establishes minimum requirements for motor vehicle pollution control.		x	Minimum requirements for motor vehicle pollution control do not apply to the Dry Fork Station	
Emission trading program regulations (WAQS&R) Chapter 14	Emission trading program regulations	Chapter 14 establishes requirements for trading programs authorized under Wyoming Statute 35-11-214.		x	These regulations are general in nature and will not likely apply to the facility	

[a]The summary of applicable requirements is intended to provide a summary of the portion of the applicable requirement applying to the generating units. It is not intended to replace a regulatory document. Please see the actual regulations for specific information.

DEQ/AQD 000208

Appendix D

Federal Regulations

TABLE D-1
Summary of Applicable Requirements - Federal Air Quality Regulations

Applicable Requirement	Summary of Requirement	Applicable to Dry Fork Station		Comments	Methods Used to Demonstrate Compliance[a]
		Yes	No		
Federal Requirements					
40 CFR parts 1 through 54 List various requirements for EPA to operate their environmental programs. These sections do not apply to the Dry Fork Station.					
40 CFR 58, Ambient Air Quality Surveillance					
40 CFR 58	This part sets guidelines and requirements for PSD monitoring stations and air pollution control agencies.		x	Dry Fork Station does not operate a PSD monitoring station nor is it an air pollution control agency; therefore, these rules do not apply.	
40 CFR 60, Subpart A, General Provisions for Standards of Performance for New Sources					
40 CFR 60.1 – 60.4	Specifies applicability, definitions, units and abbreviations, and communication guidelines of 40 CFR 60.	x		This is not an applicable standard or limitation; however, these definitions do apply when evaluating other applicable requirements within 40 CFR 60.	
40 CFR 60.7(a)	Notification, reporting and recordkeeping requirements for the affected units and the CEMS.	x		Notification of the following must be sent to WDEQ: the date construction is commenced (no more than 30 days after), the date of initial startup (no more than 15 days after), physical or operational changes that may increase emission rates (no less than 60 days before), the demonstration of the continuous monitoring system performance (no less than 30 days before), the date for conducting opacity observations (no less than 30 days before), COMS data results will be used to determine compliance with the opacity standard in lieu of Method 9 (no less than 30 days before).	Send required information to WDEQ, and maintain copies on file.

DEQ/AQD 000210

DEQ/AQD 000211

TABLE D-1
Summary of Applicable Requirements - Federal Air Quality Regulations

Applicable Requirement	Summary of Requirement	Applicable to Dry Fork Station		Comments	Methods Used to Demonstrate Compliance[a]
		Yes	No		
40 CFR 60.7(b)	Owners or operators shall maintain records of the occurrence and duration of any startup, shutdown, or malfunction in the operation of an affected facility; any malfunction of the air pollution control equipment; or any periods during which a continuous monitoring system or monitoring device is inoperative.	x		Dry Fork Station is subject to NSPS, and therefore, to this requirement.	Records of these occurrences and subsequent agency notifications will be maintained on file.
40 CFR 60.7(c) & (d)	Owners or operators required to install a continuous monitoring device shall submit excess emissions and monitoring systems performance report and/or summary report form semiannually.	x		Written reports shall include magnitude of excess emissions, conversion factors used, date and time of commencement process operating time, specific identification of each period of excess emissions, nature and cause of any malfunction, corrective action, dates and times when the continuous monitoring system was inoperative, or statement of no excess emissions. Reports will be sent within 30 days of the end of the 6-month period. Also see 40 CFR Part 75.	Reports will be completed and sent to WDAQ via certified mail. Copies will be maintained.
40 CFR 60.7(e)	Adjusts more frequent reporting requirements to the requirements above if the facility meets certain conditions.	x		This can only be accomplished after a minimum of 12 months of monitoring; therefore, this rule does not apply to Dry Fork Station for obtaining construction permit, however this regulation needs to be reevaluated after operation of the facility for some duration.	
40 CFR 60.7(f) – (h)	Owners or operators shall maintain a file of all measurements; continuous monitoring system performance evaluations, calibration checks, adjustments, and maintenance in permanent form suitable for inspection.	x		Files shall be retained for at least 2 years. Note: 40 CFR Part 75 requires a minimum of 3 years retention.	Files shall be retained for at least 3 years.

TABLE D-1
Summary of Applicable Requirements - Federal Air Quality Regulations

Applicable Requirement	Summary of Requirement	Applicable to Dry Fork Station		Comments	Methods Used to Demonstrate Compliance[a]
		Yes	No		
40 CFR 60.8	Within 60 days after achieving the maximum production rate, but not later than 180 days after initial startup and at such other times as may be required by the administrator, the owner or operator shall conduct performance test(s) and furnish the administrator a written report of the results of such performance test(s)	x		Performance tests shall be conducted and data reduced in accordance with the test methods and procedures contained in each applicable subpart or as the administrator shall specify. Notice should be sent to the administrator at least 30 days prior. Adequate performance testing of facilities will be provided. Each test will consist of 3 runs unless otherwise specified.	Copies of agency notifications and testing reports will be maintained on site.
40 CFR 60.10	State Authority- States maintain their authority to impose stricter requirements than the federal regulations.		x	This is guidance for the states and does not apply directly to Dry Fork Station.	Dry Fork Station must comply with all applicable state regulations.
40 CFR 60.11	Performance tests shall determine compliance with standards in this part, except opacity standards which will be determined by conducting observations in accordance with Method 9, using an alternative method approved by the Administrator, or by implementing a COMS. Air pollution control equipment shall be maintained in a manner consistent with good air pollution control practice.	x		Opacity observations shall be conducted concurrently with the initial performance test, or within 60 days after achieving the maximum production rate if performance tests will not be conducted.	Required tests/observations will be recorded and retained on file.
40 CFR 60.12	No owner or operator subject to the provisions of this part shall build, erect, install, or use any article, machine, equipment, or process, the use of which conceals an emission which would otherwise constitute a violation of an applicable standard. Such concealment includes, but is not limited to, the use of gaseous dilutents to achieve compliance with an opacity standard or with a standard which is based on the concentration of a pollutant in the gases discharged to the atmosphere.	x		Dry Fork Station should not use any device to conceal their emissions.	Maintain all building plans and equipment specifications to document compliance.

DEQ/AQD 000212

DEQ/AQD 000213

TABLE D-1
Summary of Applicable Requirements - Federal Air Quality Regulations

Applicable Requirement	Summary of Requirement	Applicable to Dry Fork Station		Comments	Methods Used to Demonstrate Compliance[a]
		Yes	No		
40 CFR 60.13(a), Appendix B (COMS)	COMS installed will meet ASTM 6216-98 and have a certificate of conformance from the manufacturer. COMS will be located where measurements are representative of the total emissions from the facility. All tests and re-tests will be conducted as outlined in 40 CFR 60 Appendix B.	x		Appendix B gives extensive requirements and specifications for COMS and should be referenced to verify compliance. Also see 40 CFR Part 75.	Verify and document that COMS meet ASTM 6216-98, retain certificate of conformance on file. Document all tests, re-test, and all other requirements given in Appendix B.
40 CFR 60.13(a), Appendix B (CEMS)	Procedures for measuring CEMS relative accuracy and calibration drift are outlined. CEMS installation and measurement location specifications, equipment specifications, performance specifications, and data reduction procedures are included. Conformance of the CEMS with the performance specification is determined.	x		Appendix B gives extensive requirements and specifications for CEMS and should be referenced to verify compliance. Also see 40 CFR Part 75.	Verify and document that CEMS meets requirements of this appendix. Document all tests, re-tests, and all other requirements given in Appendix B.

TABLE D-1
Summary of Applicable Requirements - Federal Air Quality Regulations

Applicable Requirement	Summary of Requirement	Applicable to Dry Fork Station		Comments	Methods Used to Demonstrate Compliance[a]
		Yes	No		
40 CFR 60.13(a), Appendix F	This procedure specifies the minimum QA requirements necessary for the control and assessment of the quality of CEMS data submitted to the EPA. Source owners and operators responsible for one or more CEMS used for compliance monitoring must meet these minimum requirements and are encouraged to develop and implement a more extensive QA program or to continue such programs where they already exist. Data collected as a result of QA and QC measures required in this procedure are to be submitted to the EPA. These data are to be used by both the EPA and the CEMS operator in assessing the effectiveness of the CEMS QC and QA procedures in the maintenance of acceptable CEMS operation and valid emission data.	x		Each source owner or operator must develop and implement a QC program. As a minimum, each QC program must include written procedures which should describe in detail, complete, step-by-step procedures and operations for each of the following activities: 1. Calibration of CEMS. 2. CD determination and adjustment of CEMS. 3. Preventive maintenance of CEMS (including spare parts inventory). 4. Data recording, calculations, and reporting. 5. Accuracy audit procedures including sampling and analysis methods. 6. Program of corrective action for malfunctioning CEMS. These written procedures must be kept on record and available for inspection by the enforcement agency. Also see 40 CFR Part 75.	Procedures will be written, implemented, and maintained on file. Activities outlined in procedures should also be documented and records retained.
40 CFR 60.13(b)	CEMS will be installed and operational prior to performance tests. Manufacturer's written requirements or recommendations for installation operation and calibration shall be completed, as a minimum. If COMS data will be submitted, compliance with Performance Specification 1 (see 40 CFR 60 appendix B) must be met before the performance test.	x		Monitoring systems shall be operational and all necessary documentation completed before performance tests. Also see 40 CFR Part 75.	Document and retain records of installation and operational tests. Maintain records of manufacturer's requirements.

DEQ/AQD 000214

DEQ/AQD 000215

TABLE D-1
Summary of Applicable Requirements - Federal Air Quality Regulations

Applicable Requirement	Summary of Requirement	Applicable to Dry Fork Station		Comments	Methods Used to Demonstrate Compliance[a]
		Yes	No		
40 CFR 60.13(c)	If the owner or operator of an affected facility elects to submit COMS data for compliance with the opacity, he shall conduct a performance evaluation of the COMS as specified in Performance Specification 1, Appendix B, of this part before the performance test required under § 60.8 is conducted. Otherwise, the owner or operator of an affected facility shall conduct a performance evaluation of the COMS or CEMS during any performance test required under § 60.8 or within 30 days thereafter in accordance with the applicable performance specification in Appendix B of this part, The owner or operator of an affected facility shall conduct COMS or CEMS performance evaluations at such other times as may be required by the administrator.	x		If COMS data will be submitted for compliance a performance evaluation will be completed before the performance test. Otherwise, performance evaluations shall be conducted during performance tests or within 30 days of performance tests. Also see 40 CFR Part 75.	Document performance evaluations and retain records.

TABLE D-1
Summary of Applicable Requirements - Federal Air Quality Regulations

Applicable Requirement	Summary of Requirement	Applicable to Dry Fork Station Yes	Applicable to Dry Fork Station No	Comments	Methods Used to Demonstrate Compliance[a]
40 CFR 60.13(d)	Owners and operators of a CEMS installed in accordance with the provisions of this part, must automatically check the zero (or low level value between 0 and 20 percent of span value) and span (50 to 100 percent of span value) calibration drifts at least once daily in accordance with a written procedure. The zero and span must, as a minimum, be adjusted whenever either the 24-hour zero drift or the 24-hour span drift exceeds two times the limit of the applicable performance specification. The system must allow the amount of the excess zero and span drift to be recorded and quantified whenever specified. Owners and operators of a COMS installed in accordance with the provisions of this part, must automatically, intrinsic to the opacity monitor, check the zero and upscale (span) calibration drifts at least once daily. For continuous monitoring systems measuring opacity of emissions not using automatic zero adjustments, the optical surfaces exposed to the effluent gases shall be cleaned prior to performing the zero and span drift adjustments. For systems using automatic zero adjustments, the optical surfaces shall be cleaned when the cumulative automatic zero compensation exceeds 4 percent opacity.	x		Owners and operators of COMS and/or CEMS must check the zero and span calibration drifts at least once daily in accordance with a written procedure. Adjustments will be made when necessary. Also see 40 CFR Part 75.	Write and implement a procedure for this requirement. Document all checks, calibrations, adjustments, and cleanings.
40 CFR 60.13(e) – (j)	Guidelines for adjustments, monitoring requirements, tests, and data requirements for CEMS and COMS are outlined in these paragraphs.	x		These paragraphs give extensive requirements and specifications for CEMS and COMS and should be referenced to verify compliance. Also see 40 CFR Part 75.	Compliance with all required activities will be documented and records retained.

DEQ/AQD 000216

TABLE D-1
Summary of Applicable Requirements - Federal Air Quality Regulations

Applicable Requirement	Summary of Requirement	Applicable to Dry Fork Station		Comments	Methods Used to Demonstrate Compliance[a]
		Yes	No		
40 CFR 60.14	Any physical or operational change to an existing facility which results in an increase in the emission rate to the atmosphere of any pollutant to which a standard applies shall be considered a modification. Upon modification, an existing facility shall become an affected facility for each pollutant to which a standard applies and for which there is an increase in the emission rate to the atmosphere.		x	Dry Fork Station is an affected facility; therefore, this rule does not apply.	
40 CFR 60.15	An existing facility, upon reconstruction, becomes an affected facility, irrespective of any change in emission rate.		x	Dry Fork Station is an affected facility; therefore, this rule does not apply.	
40 CFR 60.18	This section contains requirements for control devices used to comply with applicable subparts of Parts 60 and 61. The requirements are placed here for administrative convenience and only apply to facilities covered by subparts referring to this section.		x	The control devices used are not covered by this section; therefore, this section does not apply to the Dry Fork Station.	
40 CFR 60.19	General notification and reporting requirements.	x		Refer to this section for details of all notification and reporting requirements.	All necessary reports will be submitted to WDEQ in the appropriate timeframe.
40 CFR 60, Subpart D, Standards of Performance for Fossil-Fuel-Fired Steam Generators for Which Construction is Commenced After August 17, 1971					
40 CFR 60.40-46	Each fossil-fuel-fired steam generating unit of more than 73 MW heat input rate (250 mmBtu per hour) for which construction is commenced after August 17, 1971. Excludes sources that are subject to Subpart Da.		x	Unit 1 is covered under subpart Da and the Auxiliary Boiler is covered under subpart Db; therefore, subpart D does not apply.	

DEQ/AQD 000217

DEQ/AQD 000218

TABLE D-1
Summary of Applicable Requirements - Federal Air Quality Regulations

Applicable Requirement	Summary of Requirement	Applicable to Dry Fork Station: Yes	Applicable to Dry Fork Station: No	Comments	Methods Used to Demonstrate Compliance[a]
40 CFR 60, Subpart Da, Standards of Performance for Electric Utility Steam Generating Units for Which Construction is Commenced After September 18, 1978					
40 CFR 60.40a	The affected facility to which this subpart applies is each electric utility steam generating unit that is capable of combusting more than 73 MW (250 million mmBtu per hour) heat input of fossil fuel (either alone or in combination with any other fuel); and for which construction or modification is commenced after September 18, 1978.	x		Unit 1 meets the criteria listed and must meet the requirements in this subpart.	No requirements mentioned in this section.
40 CFR 60.41a	Definitions for 40 CFR 60, Subpart Da.	x		This is not an applicable standard or limitation, however, these definitions do apply when evaluating other applicable requirements from Subpart Da.	
40 CFR 60.42a	On and after the date on which the performance test required to be conducted under § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any affected facility any gases which contain PM in excess of: (1) 13 ng/J (0.03 lb/mmBtu) heat input derived from the combustion of solid, liquid, or gaseous fuel; (2) 1 percent of the potential combustion concentration (99 percent reduction) when combusting solid fuel; and (3) 30 percent of potential combustion concentration (70 percent reduction) when combusting liquid fuel. (b) On and after the date the PM performance test required to be conducted under § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any affected facility any gases which exhibit greater than 20 percent opacity (6-minute average), except for one 6-minute period per hour of not more than 27 percent opacity.	x		Unit 1 may not discharge in amounts greater than what is listed in this section.	EPA reference Method 5 will be used to demonstrate compliance with PM emission limit. All monitoring activities and/or reports of emissions will be documented and retained on file. Dry Fork Station will install, certify, and maintain COMS.

TABLE D-1
Summary of Applicable Requirements - Federal Air Quality Regulations

Applicable Requirement	Summary of Requirement	Applicable to Dry Fork Station		Comments	Methods Used to Demonstrate Compliance[a]
		Yes	No		
40 CFR 60.43a	On and after the date on which the initial performance test is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any affected facility which combusts solid fuel or solid-derived fuel any gases which contain SO_2 in excess of 520 ng/J (1.20 lb/mmBtu) heat input and 10 percent of the potential combustion concentration (90 percent reduction), or 30 percent of the potential combustion concentration (70 percent reduction), when emissions are less than 260 ng/J (0.60 lb/mmBtu) heat input.	x		Unit 1 may not discharge in amounts greater than what is listed in this section. Both FGD inlet and outlet SO_2 concentrations will be continuously monitored to determine removal efficiency.	All monitoring activities and/or reports of emissions will be documented and retained on file. Dry Fork Station will install, certify (Appendix B) and maintain (Appendix F) a CEMS for SO_2 and a diluent gas.
40 CFR 60.44a	On and after the date on which the initial performance test is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any affected facility any gases which contain nitrogen oxides (expressed as NO_2) in excess of the following emission limits, based on a 30-day rolling average: Subbituminous coal – 210 (ng/J), 0.50 (lb/mmBtu) Bituminous coal – 260 (ng/J), 0.60 (lb/mmBtu) Anthracite coal - 260 (ng/J), 0.60 (lb/mmBtu) All other fuels – 260 (ng/J), 0.60 (lb/mmBtu). Also emissions of NOx shall not exceed 1.6 pounds per megawatt hour	x		Unit 1 may not discharge in amounts greater than what is listed in this section.	All monitoring activities and/or reports of emissions will be documented and retained on file. Dry Fork Station will install, certify (Appendix B) and maintain (Appendix F) a CEMS for NO_x and a diluent gas.

TABLE D-1
Summary of Applicable Requirements - Federal Air Quality Regulations

Applicable Requirement	Summary of Requirement	Applicable to Dry Fork Station Yes	Applicable to Dry Fork Station No	Comments	Methods Used to Demonstrate Compliance[a]
40 CFR 60.45a	For each coal-fired electric utility steam generating unit other than an integrated gasification combined cycle (IGCC) electric utility steam generating unit, on and after the date on which the initial performance test required to be conducted is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any affected facility for which construction or reconstruction commenced after January 30, 2004, any gases which contain mercury (Hg) emissions in excess of the following emissions limits based on a 12-month rolling average: Subbituminous coal – wet FGD technology, 42×10^{-6} lb/MWh or 0.042 lb/GWh on an output basis Subbituminous coal – dry FGD technology, 78×10^{-6} lb/MWh or 0.078 lb/GWh on an output basis Bituminous coal – 21×10^{-6} lb/MWh or 0.021 lb/GWh on an output basis Lignite - 145×10^{-6} lb/MWh or 0.145 lb/GWh on an output basis	x		Unit 1 may not discharge in amounts greater than what is listed in this section.	All monitoring activities and/or reports of emissions will be documented and retained on file. Dry Fork Station will install, certify (Appendix B) and maintain (Appendix F) a CEMS for Hg and a diluent gas or a sorbent trap monitoring system as required by Part 75.
40 CFR 60.47a	An owner or operator of an affected facility proposing to demonstrate an emerging technology may apply to the Administrator for a commercial demonstration permit. Commercial demonstration permits may be issued only by the Administrator, and this authority will not be delegated.		x	No emerging technologies will be used for Unit 1; therefore, this section does not apply.	

DEQ/AQD 000220

TABLE D-1
Summary of Applicable Requirements - Federal Air Quality Regulations

Applicable Requirement	Summary of Requirement	Applicable to Dry Fork Station: Yes	Applicable to Dry Fork Station: No	Comments	Methods Used to Demonstrate Compliance[a]
40 CFR 60.48a	Compliance with PM, NO_x, and Hg limits listed in 40 CFR 60.42, 60.44, and 60.45 constitutes compliance for these pollutants. During emergency conditions in the principal company, an affected facility with a malfunctioning FGD system may be operated if SO_2 emissions are minimized by operating all operable FGD system modules, and bringing back into operation any malfunctioned module as soon as repairs are completed, bypassing flue gases around only those FGD system modules that have been taken out of operation because they were incapable of any SO_2 emission reduction or which would have suffered significant physical damage if they had remained in operation, and designing, constructing, and operating a spare FGD system module for an affected facility larger than 365 MW (1,250 mmBtu per hr) heat input.	x		If compliance with 40 CFR 60.42, 60.44, or 60.45 can not be maintained, refer to this section for further guidance. If desulfurization system is malfunctioning, operate only if compliance with this section can be maintained.	Maintain documents illustrating compliance with 40 CFR 60.42, 60.44, and 60.45. If compliance cannot be achieved or desulfurization system is malfunctioning, maintain documentation of activities required in this section.
40 CFR 60.49a	The owner or operator of an affected facility shall install, calibrate, maintain, and operate a continuous monitoring system, and record the output of the system, for measuring the opacity of emissions and SO_2 and NO_x and Hg emissions discharged to the atmosphere. If the owner or operator has installed a NO_x and Hg emission rate CEMS to meet the requirements of Part 75 of this chapter and is continuing to meet the ongoing requirements of Part 75 of this chapter, that CEMS may be used to meet the requirements of this section, except that the owner or operator shall also meet the requirements of § 60.49a.	x		Unit 1 must have CEMS and must comply with this section.	Install CEMS and COMS and document calibration and maintenance of equipment, or comply with 40 CFR 75 and 60.49a.
40 CFR 60.50a	In conducting the performance tests required, the owner or operator shall use as reference methods and procedures in Appendix A of this part or the methods and procedures as specified in this section.	x		Dry Fork Station must use these methods to conduct performance tests.	Document methods used to conduct tests.

DEQ/AQD 000221

TABLE D-1
Summary of Applicable Requirements - Federal Air Quality Regulations

Applicable Requirement	Summary of Requirement	Applicable to Dry Fork Station		Comments	Methods Used to Demonstrate Compliance[a]
		Yes	No		
40 CFR 60.51a	For SO_2, NO_x, PM and Hg emissions, the performance test data from the initial performance test and from the performance evaluation of the continuous monitors (including the transmissometer) are submitted to the administrator.	x		Dry Fork Station must submit these documents quarterly if electronic and semiannually if written, except when opacity limits are exceeded which must be submitted every quarter. Specific reporting requirements are listed in this section. Refer to section for specific requirements.	Submit required documents as outlined in this section.
40 CFR 60. 52a	The owner or operator of an affected facility subject to the emissions limitations in §60.45a or §60.46a shall provide notifications in accordance with §60.7(a) and shall maintain records of all information needed to demonstrate compliance including performance tests, monitoring data, fuel analyses, and calculations, consistent with the requirements of §60.7(f).	x		Unit 1 meets the criteria listed and must meet the requirements in this subpart.	All records of all information needed to demonstrate compliance including performance tests, monitoring data, fuel analyses, and calculations, will be documented and retained on file.
40 CFR 60, Subpart Db, Standards of Performance for Industrial-Commercial-Institutional Steam Generating Units					
40 CFR 60.40b	The affected facility to which this subpart applies is each steam generating unit that commences construction, modification, or reconstruction after June 19, 1984, and that has a heat input capacity from fuels combusted in the steam generating unit of greater than 29 MW (100 million Btu/hour)	x		Subpart Db applies to boilers with heat input >100 mmBtu/hour and <250 mmBtu/hour; Dry Fork Station Auxiliary Boiler meets criteria listed and must meet the requirements in this subpart. Unit 1 is much larger. Therefore, this rule does not apply to Unit 1.	No requirements mentioned in this section.
40 CFR 60.41b	Definitions for 40 CFR 60, Subpart Db.	x		This is not an applicable standard or limitation, however, these definitions do apply when evaluating other applicable requirements from Subpart Db.	

DEQ/AQD 000222

TABLE D-1
Summary of Applicable Requirements - Federal Air Quality Regulations

Applicable Requirement	Summary of Requirement	Applicable to Dry Fork Station		Comments	Methods Used to Demonstrate Compliance[a]
		Yes	No		
40 CFR 60.42b	Standard emission limit for sulfur dioxide		x	The Auxiliary Boiler combust natural gas and there is not a provision in the section limiting sulfur dioxide from sources combusting natural gas; therefore this section does not apply to the Auxiliary Boiler.	
40 CFR 60.43b	Standard emission limit for particulate matter		x	The Auxiliary Boiler combust natural gas and there is not a provision in the section limiting particulate matter from sources combusting natural gas; therefore this section does not apply to the Auxiliary Boiler..	
40 CFR 60.44b	On which the initial performance test is completed or is required to be completed under §60.8 of this part, whichever date comes first, no owner or operator of an affected facility that is subject to the provisions of this section and that combusts only coal, oil, or natural gas shall cause to be discharged into the atmosphere from that affected facility any gases that contain nitrogen oxides (expressed as NO_2) in excess of the following emission limits: Natural gas - 86 ng/J or 0.20 lb/MMBtu	x		Auxiliary Boiler may not discharge in amounts greater than what is listed in this section.	All monitoring activities and/or reports of emissions will be documented and retained on file.
40 CFR 60.45b	Compliance and performance test methods and procedures for sulfur dioxide		x	The Auxiliary Boiler combust natural gas and there is not a provision in the section limiting sulfur dioxide from sources combusting natural gas; therefore this section does not apply to the Auxiliary Boiler.	

DEQ/AQD 000223

DEQ/AQD 000224

TABLE D-1
Summary of Applicable Requirements - Federal Air Quality Regulations

Applicable Requirement	Summary of Requirement	Applicable to Dry Fork Station		Comments	Methods Used to Demonstrate Compliance[a]
		Yes	No		
40 CFR 60.46b	To determine compliance with the emission limits for nitrogen oxides required under §60.44b, the owner or operator of an affected facility shall conduct the performance test as required under §60.8 using the continuous system for monitoring nitrogen oxides under §60.48(b). Following the date on which the initial performance test is completed or required to be completed under §60.8 of this part, whichever date comes first, the owner or operator of an affected facility which has a heat input capacity 250 million Btu/hour or less and which combusts natural gas having a nitrogen content of 0.30 weight percent or less shall upon request determine compliance with the nitrogen oxides standards under §60.44b through the use of a 30-day performance test. During periods when performance tests are not requested, nitrogen oxides emissions data collected pursuant to §60.48b(g)(1) or §60.48b(g)(2) are used to calculate a 30-day rolling average emission rate on a daily basis and used to prepare excess emission reports, but will not be used to determine compliance with the nitrogen oxides emission standards. A new 30-day rolling average emission rate is calculated each steam generating unit operating day as the average of all of the hourly nitrogen oxides emission data for the preceding 30 steam generating unit operating days.	x		Dry Fork Station will conduct compliance performance testing and monitoring as required. If compliance with 40 CFR 60.44, can not be maintained, refer to this section for further guidance.	Maintain documents illustrating compliance with 40 CFR 60.44. If compliance cannot be achieved, maintain documentation of activities required in this section.
40 CFR 60.47b	Emission monitoring for sulfur dioxide		x	The Auxiliary Boiler combust natural gas and there is not a provision in the section limiting sulfur dioxide from sources combusting natural gas; therefore this section does not apply to the Auxiliary Boiler.	

TABLE D-1
Summary of Applicable Requirements - Federal Air Quality Regulations

Applicable Requirement	Summary of Requirement	Applicable to Dry Fork Station		Comments	Methods Used to Demonstrate Compliance[a]
		Yes	No		
40 CFR 60.48b	Install, calibrate, maintain, and operate a continuous monitoring system, and record the output of the system, for measuring nitrogen oxides emissions discharged to the atmosphere. The continuous monitoring systems required under this section shall be operated and data recorded during all periods of operation of the affected facility except for continuous monitoring system breakdowns and repairs. Data is recorded during calibration checks, and zero and span adjustments. The 1-hour average nitrogen oxides emission rates measured by the continuous nitrogen oxides monitor required by this section and required under §60.13(h) shall be expressed in ng/J or lb/million Btu heat input and shall be used to calculate the average emission rates under §60.44b. The 1-hour averages shall be calculated using the data points required under §60.13(b). At least 2 data points must be used to calculate each 1-hour average.	x		Auxiliary Boiler must have a continuous monitoring system installed and must comply with this section.	Install continuous monitoring system and document calibration and maintenance of equipment.
40 CFR 60.49b	The owner or operator of an affected facility shall provide notifications in accordance with §60.7(a) and shall maintain records of all information needed to demonstrate compliance including performance tests, monitoring data, fuel analyses, and calculations, consistent with the requirements of §60.7(f).	x		Auxiliary Boiler meets the criteria listed and must meet the requirements in this subpart.	All records of all information needed to demonstrate compliance including performance tests, monitoring data, fuel analyses, and calculations, will be documented and retained on file.
40 CFR 60, Subpart Y, Standards of Performance for Coal Preparation Plants					

DEQ/AQD 000225

TABLE D-1
Summary of Applicable Requirements - Federal Air Quality Regulations

Applicable Requirement	Summary of Requirement	Applicable to Dry Fork Station		Comments	Methods Used to Demonstrate Compliance[a]
		Yes	No		
40 CFR 60.250	The affected facility to which this subpart applies is preparation plants which process more than 181 Mg (200 tons) per day: Thermal dryers, pneumatic coal-cleaning equipment (air tables), coal processing and conveying equipment (including breakers and crushers), coal storage systems, and coal transfer and loading systems. Any facility under this section that commences construction or modification after October 24, 1974, is subject to the requirements of this subpart.	x		Subpart Y applies to the coal handling operations at the Dry Fork Station. Coal handling operations process more than 200 tons per day of coal.	No requirements mentioned in this section.
40 CFR 60.251	Definitions for 40 CFR 60, Subpart Y.	x		This is not an applicable standard or limitation, however, these definitions do apply when evaluating other applicable requirements from Subpart Y.	
40 CFR 60.252	On and after the date on which the performance test required to be conducted by §60.8 is completed, an owner or operator subject to the provisions of this subpart shall not cause to be discharged into the atmosphere from any coal processing and conveying equipment, coal storage system, or coal transfer and loading system processing coal, gases which exhibit 20 percent opacity or greater.	x		The coal handling system may not discharge in amounts greater than what is listed in this section.	All monitoring activities and/or reports of emissions will be documented and retained on file.
40 CFR 60.253	Monitoring operations		x	The monitoring operation provision in the section does not address operations for the Dry Fork Station coal handling system; therefore this section does not apply.	

DEQ/AQD 000226

TABLE D-1
Summary of Applicable Requirements - Federal Air Quality Regulations

Applicable Requirement	Summary of Requirement	Applicable to Dry Fork Station Yes	No	Comments	Methods Used to Demonstrate Compliance[a]
40 CFR 60.254	In conducting the performance tests required, the owner or operator shall use as reference methods and procedures in Appendix A of this part or the methods and procedures as specified in this section.	x		Dry Fork Station must use these methods to conduct performance tests. Method 5 shall be used to determine the particulate matter concentration. Method 9 and procedures in §60.11 shall be used to determine opacity	Document methods used to conduct tests.
40 CFR 60, Subpart HHHH – Emission Guidelines and compliance times for Coal-Fired Electric Steam Generating Units.					
40 CFR 60.4101 – 60.4178	This subpart establishes the model rule comprising general provisions and the designated representative, permitting, allowance, and monitoring provisions for the State mercury Budget Trading Program, under section 111 of the CAA and § 60.24(h)(6), as a means of reducing national mercury emissions.	x		The Dry Fork Station Unit 1 shall comply with the requirements of this subpart as a matter of Federal law only if the State with jurisdiction over the unit and the source incorporates by reference this subpart or otherwise adopts the requirements of this subpart in accordance with § 60.24(h)(6).	
40 CFR 61, National Emission Standards For Hazardous Air Pollutants					
40 CFR 61.01 – 61.03	Definitions and general information regarding 40 CFR 61.	x		This is not an applicable standard or limitation; however, these definitions do apply when evaluating other applicable requirements within 40 CFR 61.	
40 CFR 61.04	All requests, reports, applications, submittals, and other communications to the administrator pursuant to this part shall be submitted in duplicate to the appropriate regional office of the EPA to: Assistant Regional Administrator, Office of Enforcement, Compliance and Environmental Justice, 999 18th Street, Suite 300, Denver, CO 80202-2466. A copy should also be sent to: Wyoming Department of Environmental Quality, 122 West 25th Street, Herschler Building, Cheyenne, WY 82002.	x		All reports required under 40 CFR 61 shall be submitted to the listed addresses.	Maintain records of all submittals on file.

DEQ/AQD 000228

TABLE D-1
Summary of Applicable Requirements - Federal Air Quality Regulations

Applicable Requirement	Summary of Requirement	Applicable to Dry Fork Station		Comments	Methods Used to Demonstrate Compliance[a]
		Yes	No		
40 CFR 61.05	No owner or operator shall construct or modify any stationary source without first obtaining written approval from the administrator. No owner or operator shall operate a new stationary source in violation of standards, except under an exemption. Ninety days after the effective date of any standard, no owner or operator shall operate any existing source subject to that standard in violation of the standard, except under a waiver granted by the administrator or under an exemption granted by the President. No owner or operator subject to the provisions of this part shall fail to report, revise reports, or report source test results as required under this part.	x		Dry Fork Station may not operate in violation of any applicable standards without a waiver or exemption. All reports required under this part shall be completed and sent to the appropriate regulatory agency as required.	Maintain all reports demonstrating compliance with regulations. Periodically audit internal procedures and practices to ensure compliance.
40 CFR 61.06	Advises facilities that they can request a determination of construction or modification from the administrator.		x	It has already been determined this section does not apply as this source is not subject to a standard.	
40 CFR 61.07	The owner or operator shall submit to the administrator an application for approval of the construction of any new source or modification of any existing source. The application shall be submitted before the construction or modification is planned to commence, or within 30 days after the effective date if the construction or modification had commenced before the effective date and initial startup has not occurred.	x		Dry Fork Station must receive approval for construction.	This permit application is being submitted for approval.
40 CFR 61.09	The owner or operator of each stationary source which has an initial startup after the effective date of a standard shall furnish the administrator with written notification as follows: (1) A notification of the anticipated date of initial startup of the source not more than 60 days nor less than 30 days before that date. (2) A notification of the actual date of initial startup of the source within 15 days after that date.	x		Dry Fork Station must send notification of anticipated and actual startup.	Maintain documentation on file that notification was sent.
40 CFR 61.10 – 61.11	Describes source reporting, waiver requests, and other requirements for existing sources.		x	Dry Fork Station is not an existing source; therefore, these rules do not apply.	

TABLE D-1
Summary of Applicable Requirements - Federal Air Quality Regulations

Applicable Requirement	Summary of Requirement	Applicable to Dry Fork Station		Comments	Methods Used to Demonstrate Compliance[a]
		Yes	No		
40 CFR 61.12	The owner or operator of each stationary source shall maintain and operate the source, including associated equipment for air pollution control, in a manner consistent with good air pollution control practice for minimizing emissions.	x		Dry Fork Station must minimize emissions.	Implementation of BACT along with documentation of proper maintenance and monitoring should demonstrate compliance.
40 CFR 61.13 – 61.14	Each owner or operator shall conduct emission testing and maintain and operate each monitoring system as specified in applicable subparts.	x		Dry Fork Station must complete requirements in applicable subparts. No new requirements mentioned in this section.	Maintain documentation of compliance with subparts.
40 CFR 61.15	Upon modification, an existing source shall become a new source for each HAP for which the rate of emission to the atmosphere increases and to which a standard applies.		x	The Dry Fork Station is a new source and does not constitute a modification and is not subject to this section.	
40 CFR 62, Approval and Promulgation of State Plans for Designated Facilities and Pollutants					
40 CFR 62	This part sets forth the administrator's approval and disapproval of state plans for the control of pollutants and facilities.		x	This is the responsibility of the states and the administrator and does not apply to Dry Fork Station.	
40 CFR 63, National Emission Standards for Hazardous Air Pollutants for Source Categories					
40 CFR 63.1 - 63.3	Definitions and general information regarding 40 CFR 63.	x		This is not an applicable standard or limitation; however, these definitions do apply when evaluating other applicable requirements within 40 CFR 63.	
40 CFR 63.4	No owner or operator subject to the provisions of this part may operate any affected source in violation of the requirements of this part. No owner or operator subject to the provisions of this part shall fail to keep records, notify, report, or revise reports as required under this part.	x		Dry Fork Station will not operate in violation of this part and will maintain records as required.	Record activities showing compliance and maintain on file.

DEQ/AQD 000229

TABLE D-1

Summary of Applicable Requirements - Federal Air Quality Regulations

Applicable Requirement	Summary of Requirement	Applicable to Dry Fork Station		Comments	Methods Used to Demonstrate Compliance[a]
		Yes	No		
40 CFR 63.5	No person may, without obtaining written approval in advance from the administrator do any of the following: construct a new affected source that is major-emitting and subject to such standard; reconstruct an affected source that is major-emitting and subject to such standard; or reconstruct a major source such that the source becomes an affected source that is major-emitting and subject to the standard	x		BEPC must receive approval before constructing Dry Fork Station because the facility is major source of HAPs.	This permit application is being submitted in compliance with this rule.
40 CFR 63.6	The owner or operator of an affected source must develop and implement a written startup, shutdown, and malfunction plan that describes, in detail, procedures for operating and maintaining the source during periods of startup, shutdown, and malfunction; a program of corrective actions for malfunctioning process; and air pollution control and monitoring equipment used to comply with the relevant standard. This plan must be developed by the source's compliance date for that relevant standard.	x		BEPC must implement a startup, shutdown, and malfunction plan as described in this rule for the affected sources at the Dry Fork Station.	Maintain a copy of this plan on file.
40 CFR 63.7	If required to do performance testing by a relevant standard, and a waiver of performance testing is not obtained, the owner or operator of the affected source must perform such tests within 180 days of the compliance date for such source.	x		BEPC must complete all required performance testing at the Dry Fork Station within 180 days of the compliance date.	Document the date all applicable tests are conducted and maintain on file.

DEQ/AQD 000230

TABLE D-1
Summary of Applicable Requirements - Federal Air Quality Regulations

Applicable Requirement	Summary of Requirement	Applicable to Dry Fork Station		Comments	Methods Used to Demonstrate Compliance[a]
		Yes	No		
40 CFR 63.8	The owner or operator of an affected source shall maintain and operate each continuing monitoring system (CMS) in a manner consistent with good air pollution control practices. All CMS must be installed such that representative measures of emissions or process parameters from the affected source are obtained. In addition, CEMS must be located according to procedures contained in the applicable performance specification(s). All CMS shall be installed, operational, and the data verified as specified in the relevant standard either prior to or in conjunction with conducting performance tests. Verification of operational status shall, at a minimum, include completion of the manufacturer's written specifications or recommendations for installation, operation, and calibration of the system. Except for system breakdowns, out-of-control periods, repairs, maintenance periods, calibration checks, and zero (low-level) and high-level calibration drift adjustments, all CMS, including COMS and CEMS, shall be in continuous operation and shall meet minimum frequency of operation requirements.	x		Although Unit1 will be equipped with a COMS and a CEMS, pursuant to the federal NSPS and acid rain programs, continuous monitoring is not required under NESHAP. The Auxiliary Boiler will be equipped with CEMs as required under NESHAP.	
470 CFR 63.9	The owner or operator of a source shall notify the administrator or the designated state authority initial notification when a source becomes subject to a standard, notification of startup, performance tests, opacity and visible emissions, compliance status, and other notifications regarding CMS.	x		This permit application is being submitted in accordance with this rule.	This permit application is being submitted in accordance with this rule.

DEQ/AQD 000231

DEQ/AQD 000232

TABLE D-1
Summary of Applicable Requirements - Federal Air Quality Regulations

Applicable Requirement	Summary of Requirement	Applicable to Dry Fork Station		Comments	Methods Used to Demonstrate Compliance[a]
		Yes	No		
40 CFR 63.10	The owner or operator of an affected source shall submit reports to the delegated state authority. In addition, if the delegated authority is the state, the owner or operator shall send a copy of each report submitted to the state to the appropriate regional office of the EPA, as specified in paragraph (a)(4)(i) of this section. The regional office may waive this requirement for any reports at its discretion.	x		Records shall be maintained of the occurrence and duration of each startup, shutdown, or malfunction of operation; the occurrence and duration of each malfunction of the required air pollution control and monitoring equipment; all required maintenance performed on the air pollution control and monitoring equipment; actions taken during periods of startup, shutdown, and malfunction when such actions are different from the procedures specified in the affected source's startup, shutdown, and malfunction plan; all information necessary to demonstrate conformance with the affected source's startup, shutdown, and malfunction plan when all actions taken during periods of startup, shutdown, and malfunction are consistent with the procedures specified in such plan; each period during which a CMS is malfunctioning or inoperative; and all required measurements needed to demonstrate compliance with a relevant standard.	These records will be created and maintained on file.
40 CFR 63.11	Owners or operators using flares to comply with the provisions of this part shall monitor these control devices to assure that they are operated and maintained in conformance with their designs. Applicable subparts will provide provisions stating how owners or operators using flares shall monitor these control devices.		x	Flares will not be used as control devices; therefore, this rule does not apply.	

TABLE D-1
Summary of Applicable Requirements - Federal Air Quality Regulations

Applicable Requirement	Summary of Requirement	Applicable to Dry Fork Station		Comments	Methods Used to Demonstrate Compliance[a]
		Yes	No		
40 CFR 63.12 – 63.15	General information, authority delegation, and addresses pertaining to 40 CFR 63.	x		These are not applicable standards or limitations; however, these sections do apply when evaluating other applicable requirements within 40 CFR 63.40 – 63.44.	
40 CFR 63.40	The requirements of this subpart apply to any owner or operator who constructs or reconstructs a major source of HAPs after the effective date of Section 112(g)(2)(B) and the effective date of a Title V permit program in the state or local jurisdiction in which the major source is located unless the major source in question has been specifically regulated or exempted from regulation, or the owner or operator of such major source has received all necessary air quality permits for such construction or reconstruction.	x		Coal and oil fired power plants have been included in the 112(c) listing of source categories since December, 2000; therefore, this section does apply to the Dry Fork Station.	
40 CFR 63.41	Definitions applicable to 40 CFR 63.40 – 63.44.	x		This is not an applicable standard or limitation; however, this section will apply when evaluating other applicable requirements within 40 CFR 63.40 – 63.44.	
40 CFR 63.42	Program requirements governing construction or reconstruction of major sources.		x	This rule applies to WDEQ and is not an obligation of Dry Fork Station. However, Dry Fork Station must comply with standards required by WDEQ.	
40 CFR 63.43	The requirements of this section apply to an owner or operator who constructs or reconstructs a major source of HAP subject to a case-by-case determination of MACT.		x	This rule does not apply to the Dry Fork Station.	
40 CFR 63.44	Requirements for constructed or reconstructed major sources subject to a subsequently promulgated MACT standard or MACT requirement.	x		There are no promulgated MACT standards or requirements for coal fired power plants at this time; however, this section does apply to the auxiliary boiler.	

DEQ/AQD 000234

TABLE D-1
Summary of Applicable Requirements - Federal Air Quality Regulations

Applicable Requirement	Summary of Requirement	Applicable to Dry Fork Station		Comments	Methods Used to Demonstrate Compliance[a]
		Yes	No		
40 CFR 63.50 – 63.56	This section implements Section 112(j) of the CAA and includes the "MACT Hammer". In general, permitting authorities must issue or reopen Title V permits when a source becomes subject to Section 112(j).		x	Requirements of 112(j) do not apply to the Dry Fork Station.	
40 CFR 63.60 – 63.62	Deletion and redefinition of specific chemicals on the HAPs list.		x	This is not an applicable standard or limitation.	
40 CFR 63.70 – 63.9942	MACT regulations pertaining to specific industries.	x		PC-fired boilers are not included in these sections; therefore, these rules do not apply to Dry Fork Station Unit 1. The Auxiliary Boiler and the fuel gas heater are both subject to 40 CFR 60 Subpart DDDDD.	
40 CFR 63.7480 – 63.7495	This subpart establishes national emission limits and work practice standards for HAPs emitted from industrial, commercial, and institutional boilers and process heaters. This subpart also establishes requirements to demonstrate initial and continuous compliance with the emission limits and work practice standards.	x		The Auxiliary Boiler and the fuel gas heater are both subject to 40 CFR 60 Subpart DDDDD. The units must be incompliance with the rule upon startup. The Auxiliary boiler is in the large gaseous fuel category. The fuel gas heater is in the small gaseous fuel category.	Required notifications in 63.7545 will be submitted according to the appropriate schedule.

TABLE D-1
Summary of Applicable Requirements - Federal Air Quality Regulations

Applicable Requirement	Summary of Requirement	Applicable to Dry Fork Station Yes	No	Comments	Methods Used to Demonstrate Compliance[a]
40 CFR 63.7499 – 63.7575	Emission limits, work practice standards, continuous compliance, notification, reporting, and recordkeeping: Large gaseous fuel category – CO emissions from the unit are limited to 400 ppm by volume dry basis @ 3% O2 on a 30 day rolling average. Small gaseous fuel category – not subject to emission limits and work practice standards.	x		A CEMs for CO will be installed on the Auxiliary boiler, a performance test will be conducted initially and then annual to demonstrate compliance with the CO limit.	Conduct required performance testing and monitoring. Retain records of all activities specified in the rule, a startup shutdown malfunction plan, hours of operation, and notification requirements
40 CFR 64, Compliance Assurance Monitoring					
40 CFR 64	Compliance Assurance Monitoring.	x		Because the proposed facility will be an "affected unit" subject to the federal acid rain program monitoring provisions, codified at 40 CFR Part 75, Dry Fork Station Unit 1 is exempt from the federal Compliance Assurance Monitoring (CAM) program requirements, codified at 40 CFR Part 64, for SO_2 and NO_X, pursuant to 40 CFR 64.2(b)(1)(iii). However, the unit will be subject to CAM requirements for SO_2 and NO_x with respect to Part 60 and WAQS&R permit limitations. The facility will also be subject to CAM requirements for particulates with respect to Part 60, Subparts Da and Y and WAQS&R permit limitations.	The applicable CAM plans will be submitted with the Title V Operating Permit application that will be submitted to WDEQ within 12 months following initial startup.
40 CFR 65, Consolidated Federal Air Rule					

DEQ/AQD 000235

TABLE D-1
Summary of Applicable Requirements - Federal Air Quality Regulations

Applicable Requirement	Summary of Requirement	Applicable to Dry Fork Station		Comments	Methods Used to Demonstrate Compliance[a]
		Yes	No		
40 CFR 65	The provisions of this subpart apply to owners or operators expressly referenced to this part from a subpart of 40 CFR Parts 60, 61, or 63 for which the owner or operator has chosen to comply with the provisions of this part as an alternative to the provisions in the referencing subpart.		x	Dry Fork Station is not seeking alternate compliance provisions in accordance with this rule; therefore, these rules do not apply.	
40 CFR 66, Assessment and Collection of NonCompliance Penalties by EPA					
40 CFR 66	Applies to all proceedings for the assessment by EPA of noncompliance penalties.		x	Requirements for the EPA, not an obligation of Dry Fork Station.	
40 CFR 67, EPA Approval of State NonCompliance Program					
40 CFR 67	Standards and procedures under which EPA will approve state programs for administering the noncompliance penalty program.		x	EPA's requirements for states to implement a noncompliance penalty program, not an obligation of Dry Fork Station.	
40 CFR 68, Chemical Accident Prevention Provisions					
40 CFR 68	This part sets forth the list of regulated substances and thresholds, gives the petition process for adding or deleting substances to the list of regulated substances, outlines who need a Risk Management Plan (RMP), and sets requirements for RMPs.			A RMP will be submitted to include storage of anhydrous ammonia if necessary.	Submission of RMP.
40 CFR 69, Special Exemptions From the Requirements of the Clean Air Act					
40 CFR 69	Lists special exemptions		x	Dry Fork Station is not eligible for any special exemptions for the CAA.	
40 CFR 70, State Operating Permit Program					

DEQ/AQD 000237

TABLE D-1
Summary of Applicable Requirements - Federal Air Quality Regulations

Applicable Requirement	Summary of Requirement	Applicable to Dry Fork Station		Comments	Methods Used to Demonstrate Compliance[a]
		Yes	No		
40 CFR 70	The regulations in this part provide for the establishment of comprehensive state air quality permitting systems consistent with the requirements of Title V of the CAA. These regulations define the minimum elements required by the CAA for state operating permit programs and the corresponding standards and procedures by which the administrator will approve, oversee, and withdraw approval of state operating permit programs.	x		Dry Fork Station will submit a Title V permit.	A permit application will be submitted for a Title V permit within 12 months of start up of operations of the Dry Fork Station.
40 CFR 71, Federal Operating Permit Programs					
40 CFR 71.1 – 71.23	Specifies applicability, definitions, units and abbreviations, and general guidelines of 40 CFR 71.		x	The State of Wyoming has been delegated authority to implement a federal operating permit pursuant to 40 CFR 70. Therefore, 40 CFR 71 requirements are not applicable requirements for this facility.	
40 CFR 72 Permits Regulation					
40 CFR 72.1-72.5	General provisions of the acid rain program. 40 CFR 72.9 specifies the standard permitting, monitoring, SO_2, NO_x, excess emissions, recordkeeping and reporting, and liability requirements for affected sources.	x		These sections do not include applicable standards or limitations; however, these definitions do apply when evaluating other applicable requirements in 40 CFR 72.	
40 CFR 72.6	Defines facilities and units to which 40 CFR 72 apply.	x		Unit 1 is a new utility unit; therefore, these rules do apply.	
40 CFR 72.7 & 72.8	Outlines exemptions from these rules.		x	Dry Fork Station does not qualify for any exemptions.	
40 CFR 72.9	Specifies that all facilities to which these rules apply must have an acid rain permit.	x		EPA forms should be downloaded, filled out, and submitted to the EPA. The first step is to get an ORIS number assigned. Then the complete package of forms, which identify the DR and the ORIS number goes to the EPA.	Copies of BEPC's acid rain permit application will be submitted to EPA and WDEQ; a copy will be kept on file at the Dry Fork Station.

TABLE D-1
Summary of Applicable Requirements - Federal Air Quality Regulations

Applicable Requirement	Summary of Requirement	Applicable to Dry Fork Station		Comments	Methods Used to Demonstrate Compliance[a]
		Yes	No		
40 CFR 72.10 - 72.13	Definitions and general information regarding 40 CFR 72.	x		These are not applicable standards or limitations; however, these definitions do apply when evaluating other applicable requirements within 40 CFR 72.	
40 CFR 72.20	Each affected source, including all affected units at the source, shall have one and only one designated representative, with regard to all matters under the acid rain program concerning the source or any affected unit at the source.	x		Dry Fork Station must have one and only one representative for issues concerning the acid rain program.	Dry Fork Station will specify one representative, and maintain the certificate listing the representative on file.
40 CFR 72.21	In each submission required to be signed by the designated representative under the acid rain program, the designated representative shall certify, by signature: "I am authorized to make this submission on behalf of the owners and operators of the affected source or affected units for which the submission is made" and "I certify under penalty of law that I have personally examined, and am familiar with, the statements and information submitted in this document and all its attachments. Based on my inquiry of those individuals with primary responsibility for obtaining the information, I certify that the statements and information are to the best of my knowledge and belief true, accurate, and complete. I am aware that there are significant penalties for submitting false statements and information or omitting required statements and information, including the possibility of fine or imprisonment." The representative will provide a copy of the submission or determination to the owners and operators.	x		The designated representative must have the quoted certifications on all documents being submitted or they will not be accepted by the regulatory agency. Owners and operators should be kept informed of submissions and other activities pertaining to these rules.	Documentation of submissions including certification will be kept on file. Documentation of updates to owners / operators will be kept on file (e.g., management review minutes).

DEQ/AQD 000239

TABLE D-1
Summary of Applicable Requirements - Federal Air Quality Regulations

Applicable Requirement	Summary of Requirement	Applicable to Dry Fork Station		Comments	Methods Used to Demonstrate Compliance[a]
		Yes	No		
40 CFR 72.22	The certificate of representation may designate one and only one alternate designated representative, who may act on behalf of the designated representative.	x		One alternate representative may be chosen to act in place of the designated representative.	Procedures for choosing an alternate and certification of the alternate should be maintained.
40 CFR 72.23	The designated representative, alternate designated representative, and owners or operators may be changed at any time upon receipt by the administrator of a superseding complete certificate of representation. A superseding certificate must be received within 30 days of a change in owner or operator.	x		When any of these individuals change, a new certificate must be received.	All representatives and owners / operators must be listed on the most current certificate and certificates retained.
40 CFR 72.24	Requirements for a complete certificate of representation.	x		Specific and extensive requirements. See 40 CFR 72.24 for list of all applicable requirements.	Each certificate of representation issued will contain all required elements and will be retained on file.
40 CFR 72.25	Once a complete certificate of representation has been submitted in accordance with § 72.24, the administrator will rely on the certificate of representation unless and until a superseding complete certificate is received by the administrator.	x		BEPC Dry Fork Station must submit a new certification to change representatives.	BEPC Dry Fork Station will wait to change representatives until a new certificate has been submitted.
40 CFR 72.30 – 72.33	The designated representative of any source with an affected unit shall submit a complete acid rain permit application by the applicable deadline in paragraphs (b) and (c) of this section, and the owners and operators of such source and any affected unit at the source shall not operate the source or unit without a permit that states its acid rain program requirements.	x		BEPC Dry Fork Station will apply for an acid rain permit for Unit 1.	Copies of the acid rain permit application for Unit 1 will be submitted to WDEQ and will be kept on file at BEPC and the Dry Fork Station.

DEQ/AQD 000240

TABLE D-1
Summary of Applicable Requirements - Federal Air Quality Regulations

Applicable Requirement	Summary of Requirement	Applicable to Dry Fork Station		Comments	Methods Used to Demonstrate Compliance[a]
		Yes	No		
40 CFR 72.40	Outlines the requirements of a complete compliance plan.	x		BEPC Dry Fork Station will need to create a complete compliance plan in accordance with this section.	A copy of the compliance plan will be submitted to EPA and WDEQ. The Dry Fork Station will implement and maintain a compliance plan on site.
40 CFR 72.41 – 72.44	Guidelines for substitution plans, extension plans, reduced utilization plans, and repowering extensions.		x	BEPC Dry Fork Station is not conducting any of the activities required for these plans; therefore, these rules do not apply at this time.	
40 CFR 72.50 – 72.51	Acid Rain Permit contents and guidelines for obtaining a Title IV permit.	x		Dry Fork Station will receive a permit. The provisions of 40 CFR 72.50 through 72.74 are applicable to initial permits.	Copies of the acid rain permit application will be submitted to EPA and WDEQ; kept on file at the Dry Fork Station.
40 CFR 72.60 – 72.69	Procedures for federal issuance of Acid Rain permits for Phase I of the Acid Rain Program and Phase II for sources where EPA has authority.	x		Dry Fork Station will receive a permit following the procedures outlined in the provisions in 40 CFR 72.60 through 72.69	
40 CFR 72.70 – 72.74	Implementation of Phase II Acid Rain Permits – State and Federal authority to issue.	x		Dry Fork Station will receive a permit following the procedures outlined in the provisions in 40 CFR 72.70 through 72.74	
40 CFR 72.80 – 72.85	Acid Rain permit revisions guidelines.		x	Dry Fork Station is a new source and will have to obtain an initial permit.	

TABLE D-1
Summary of Applicable Requirements - Federal Air Quality Regulations

Applicable Requirement	Summary of Requirement	Applicable to Dry Fork Station		Comments	Methods Used to Demonstrate Compliance[a]
		Yes	No		
40 CFR 72.90 – 72.96	For each calendar year in which a unit is subject to the acid rain emissions limitations, the designated representative of the source at which the unit is located shall submit to the administrator, within 60 days after the end of the calendar year, an annual compliance certification report for the unit.	x		Dry Fork Station will need to submit an annual compliance certification as long as it is required to have an acid rain permit. Specific requirements for certification are detailed in this part.	Submit certification annually, retain copies on file.
40 CFR 73, Sulfur Dioxide Allowance System					
40 CFR Part 73	SO_2 allowance system.	x		The plant must have sufficient allowances available to account for each ton of annual SO_2 emissions.	CEMS and quarterly EDRs (pursuant to 40 CFR Part 75)
40 CFR 74, Sulfur Dioxide Opt-Ins					
40 CFR 74	Guidelines for Sulfur Dioxide Opt-In program.		x	Dry Fork Station is not eligible for the Opt-In program; therefore, these rules do not apply.	
40 CFR 75 Continuous Emission Monitoring					
40 CFR 75.1 – 75.3	Definitions and general information regarding 40 CFR 75.	x		This is not an applicable standard or limitation; however, these definitions do apply when evaluating other applicable requirements.	
40 CFR 75.4	The owner or operator of each new affected unit shall ensure that all monitoring systems required under this part for monitoring of SO_2, NO_x, CO_2 opacity, and volumetric flow are installed and all certification tests are completed no later than 90 days after the date the unit commences commercial operation.	x		Dry Fork Station must install applicable monitoring equipment within specified time.	Retain documentation of installation and certification testing on file, suitable for agency inspection, for a minimum of 3 years. [10 years is not required by the rules]

DEQ/AQD 000241

DEQ/AQD 000242

TABLE D-1
Summary of Applicable Requirements - Federal Air Quality Regulations

Applicable Requirement	Summary of Requirement	Applicable to Dry Fork Station		Comments	Methods Used to Demonstrate Compliance[a]
		Yes	No		
40 CFR 75.5	Prohibitions – these rules clarify a variety of acts, omissions, or other events that constitute a violation of the CAA, relative to the acid rain monitoring provisions in Part 75.	x			Quarterly EDRs, periodic inspection of CEMS Monitoring Plans.
40 CFR 75.6	Incorporates several ASTM, ASME, and other methods by reference.		x	Not an applicable standard or limitation; however, information does apply when evaluating other applicable requirements.	
40 CFR 75.10	The owner or operator shall install, certify, operate, and maintain, in accordance with all the requirements of this part, a continuous emission monitoring system for SO_2, NO_x, and CO_2, volumetric stack flow and opacity.	x		Specific requirements in this part. Refer to full text of rule.	Retain records of all activities specified.
40 CFR 75.11 – 75.15	Specific provisions for monitoring SO_2, NO_x and CO_2 emissions, stack diluent (O2 or CO_2), stack flow, opacity, and mercury.	x		Specific and extensive provisions. Dry Fork Station will ensure that CEMS meet these requirements.	CEMS Monitoring Plan (required under §75.53) and CEMS certification report. Retain records of all activities specified.
40 CFR 75.16	Special provisions for monitoring SO_2 emissions from (and determining heat input for) common, bypass, and multiple stacks.		x	The generating unit at Dry Fork Station has a single separate stack. Therefore, this rule does not apply.	
40 CFR 75.17	Special provisions for monitoring NO_x from common, bypass, and multiple stacks.		x	The generating unit at Dry Fork Station has a single separate stack. Therefore, this rule does not apply.	
40 CFR 75.18	Special provisions for monitoring opacity from common and bypass stacks.		x	The generating unit at Dry Fork Station has a single separate stack. Therefore, this rule does not apply.	
40 CFR 75.19	Optional SO_2, NO_x, and CO_2 emissions calculation for low mass emission units.		x	PC-fired boilers do not qualify as low mass emission units. Therefore, these rules do not apply.	

TABLE D-1
Summary of Applicable Requirements - Federal Air Quality Regulations

Applicable Requirement	Summary of Requirement	Applicable to Dry Fork Station		Comments	Methods Used to Demonstrate Compliance[a]
		Yes	No		
40 CFR 75.20	The owner or operator shall ensure that each continuous emission or opacity monitoring system required by this part meets the initial certification and recertification requirements of this section and shall ensure that all applicable initial certifications and recertifications are completed by the deadlines specified.	x		Initial certification tests must be conducted for all CEMs, in accordance with this section and Appendix A of this Part.	Copies of initial certification and recertification testing reports will be submitted to EPA and WDEQ, retained on file at The Dry Fork Station. Retain records of all certification tests and activities.
40 CFR 75.21	Details quality control and quality assurance requirements.	x		The CEMS must be operated and maintained in accordance with this section and Appendix B of this part.	Retain records of all QA/QC activities specified.
40 CFR 75.22	Reference test methods.	x		Identifies the EPA Reference Test Methods (provided in Appendix A of 40 CFR Part 60) that shall be used for certification tests, calibrations, and other measurements.	Certification and periodic audit reports will be retained on file at Dry Fork Station.
40 CFR 75.23	Alternatives to standards incorporated by reference.		x	Dry Fork Station has no plans to petition the administrator for an alternative to any standard incorporated by reference, pursuant to §75.66(c).	
40 CFR 75.24	Out-of-control periods and adjustment for system bias.	x		Out-of-control periods can be declared, based on daily calibration, quarterly audit, or linearity check results. During these periods, the data is considered not QA'd and shall not be used in calculating monitor availability.	QA/QC information transmitted with quarterly EDR.

TABLE D-1
Summary of Applicable Requirements - Federal Air Quality Regulations

Applicable Requirement	Summary of Requirement	Applicable to Dry Fork Station		Comments	Methods Used to Demonstrate Compliance[a]
		Yes	No		
40 CFR 75.30 – 75. 39	Subpart D – missing data substitution procedures.	x		This subpart provides extensive guidance and requirements for substituting a variety of empirically-derived emissions values, which are usually much higher than actual emissions, during periods when the CEMS does not accurately measure SO_2, NO_x, CO_2, mercury, heat input, and moisture.	Substituted data will be identified in the quarterly EDR.
40 CFR 75.40 – 75.48	Guidelines for using an alternative monitoring system, which must have the same or better precision, reliability, accessibility and timeliness as that provided by a CEMS meeting the requirements of this part.		x	Dry Fork Station will not use alternative monitoring system; therefore, these rules do not apply.	
40 CFR 75.53	Specific guidelines and requirements for CEMS Monitoring Plans.	x		These provisions are very specific and extensive. Refer to full text of rule.	Monitoring plan submittal, pursuant to §75.62.
40 CFR 75.57	General recordkeeping provisions.	x		These provisions are very specific and extensive. Refer to full text of rule. All records of measurements, data, reports and other information required under Part 75 shall be maintained in a file at the plant, suitable for agency inspection, for a minimum of 3 years.	CEMS records on file at the plant, available for EPA/WDEQ inspection.
40 CFR 75.58	General recordkeeping provisions for specific situations.		x	This section provides recordkeeping provisions for alternative or parametric monitoring allowed for gaseous or liquid fuel-fired units only. Unit 1 is PC-fired; therefore this rule does not apply.	

DEQ/AQD 000244

TABLE D-1
Summary of Applicable Requirements - Federal Air Quality Regulations

Applicable Requirement	Summary of Requirement	Applicable to Dry Fork Station		Comments	Methods Used to Demonstrate Compliance[a]
		Yes	No		
40 CFR 75.59	Certification, QA/QC record provisions.	x		These provisions are very specific and extensive. Refer to full text of rule.	CEMS Monitoring Plan, quarterly EDRs, certification reports, RATA test reports, CEMS O&M records maintained at Dry Fork Station.
40 CFR 75.60	Reporting requirements – general provisions.	x		This section details the schedules and criteria for the submittal of initial certification reports, recertification reports, monitoring plans, EDRs, RATA reports and other communications. In addition, provisions governing the confidentiality of data are provided.	Copies of these submittals will be kept on file at the plant for a minimum of 3 years.
40 CFR 75.61	Reporting requirements – notifications.	x		This section details the schedules and criteria for notifying the EPA and WDEQ of planned testing dates, installation of new units, retiring units, changes in fuels used, or monitoring system components.	Records of notifications will be maintained at the plant, in a file suitable for agency inspection for a minimum of 3 years.
40 CFR 75.62	Monitoring plan submittals.	x		This section details the schedules and criteria for submittal of the electronic and hardcopy CEMS monitoring plan, including any revisions to the monitoring plan.	Records of the monitoring plan submittals will be maintained at the plant, in a file suitable for agency inspection for a minimum of 3 years.

TABLE D-1
Summary of Applicable Requirements - Federal Air Quality Regulations

Applicable Requirement	Summary of Requirement	Applicable to Dry Fork Station		Comments	Methods Used to Demonstrate Compliance[a]
		Yes	No		
40 CFR 75.63	Initial certification or recertification application submittals.	x		This section details the schedules and criteria for the submittal of initial certification reports and recertification applications.	Records of the certification and recertification submittals will be maintained at the plant, in a file suitable for agency inspection for a minimum of 3 years.
40 CFR 75.64	Quarterly electronic data reports.	x		This section details the content and submittal format requirements for the submission of CEMS measurements data, along with a variety of QA/QC activities and results for the proceeding calendar quarter. Each EDR is due on or before the 30th calendar day following the end of the subject calendar quarter.	Electronic copies of each EDR will be maintained at the plant, in a file suitable for agency inspection for a minimum of 3 years.
40 CFR 75.65	Opacity reports.	x		This section requires that excess opacity emissions measured by the CEMS be reported to the local APCD (in this case, WDEQ).	Copies of excess opacity reports submitted to WDEQ will be maintained at the plant, in a file suitable for agency inspection for a minimum of 3 years.
40 CFR 75.66	Petitions to the administrator.	x		This section provides the procedures for petitioning the EPA for alternatives to the monitoring requirements of Part 75. BEPC has no current plans to petition for alternative monitoring arrangements.	

DEQ/AQD 000246

TABLE D-1
Summary of Applicable Requirements - Federal Air Quality Regulations

Applicable Requirement	Summary of Requirement	Applicable to Dry Fork Station		Comments	Methods Used to Demonstrate Compliance[a]
		Yes	No		
40 CFR 75.67	Retired units petitions.		x	This section applies to combustion sources seeking to enter the Opt-In Program and then retired (creating an availability of SO2 allowances for use by other sources). BEPC has no such qualifying units; therefore this rule does not apply.	
40 CFR 75.70 through 75.75	Subpart H - NO_x mass emissions provisions.		x	This section, which was added when the federal acid rain program NO_x limitations were revised, clarifies the source obligations for units subject to a state or federal NO_x mass emissions reduction program. However, the Dry Fork Station plant is not subject to such a state or federal program (other than the federal acid rain NO_x limitations); therefore this rule does not apply. It is presumed that WDEQ permit limits for NO_x mass emissions (e.g., lbs/hour or tpy) do not constitute a "state reduction program".	
40 CFR 75.80	The owner or operator of a unit shall comply with the requirements of this subpart to the extent that compliance is required by an applicable State or Federal mercury (Hg) mass emission reduction program that incorporates by reference, or otherwise adopts the provisions of, this subpart	x		These general provisions apply to the Dry Fork Station Unit 1. Refer to full text of rule.	Copies of submittals described in this provision will be kept on file at the plant for a minimum of 3 years.
40 CFR 75.81	Monitoring of Hg mass emissions and heat input at the unit level	x		General operating requirements are outlined for Hg CEMs. Dry Fork Station will meet these general requirements. Refer to full text of rule.	

DEQ/AQD 000247

TABLE D-1
Summary of Applicable Requirements - Federal Air Quality Regulations

Applicable Requirement	Summary of Requirement	Applicable to Dry Fork Station Yes	Applicable to Dry Fork Station No	Comments	Methods Used to Demonstrate Compliance[a]
40 CFR 75.82	Monitoring of Hg mass emissions and heat input at common and multiple stacks		x	This provision is not applicable to Dry Fork Station as the affected unit does not utilize a common stack with one or more affected units.	
40 CFR 75.83	The owner or operator shall calculate Hg mass emissions and heat input rate in accordance with the procedures in sections 9.1 through 9.3 of appendix F to this part.	x		Dry Fork Station will calculate Hg mass emissions and heat input rate according to the provisions of 40 CFR 75.83	
40 CFR 75.84	The owner or operator of any affected unit shall maintain for each affected unit and each non-affected unit under §75.82(b)(2)(ii) a file of all measurements, data, reports, and other information required by this part at the source in a form suitable for inspection for at least 3 years from the date of each record. Except for the certification data required in §75.57(a)(4) and the initial submission of the monitoring plan required in §75.57(a)(5), the data shall be collected beginning with the earlier of the date of provisional certification or the compliance deadline in §75.80(b). The certification data required in §75.57(a)(4) shall be collected beginning with the date of the first certification test performed.	x		These provisions are very specific and extensive. Refer to full text of rule. All records of measurements, data, reports and other information required under Part 75 shall be maintained in a file at the plant, suitable for agency inspection, for a minimum of 3 years.	CEMS records on file at the plant, available for EPA/WDEQ inspection.
40 CFR 76, Nitrogen Oxides					
40 CFR 76.1 – 76.4	Definitions and general information regarding 40 CFR 76.		x	Not an applicable standard or limitation; however, these definitions do apply when evaluating other applicable requirements.	
40 CFR 76.5 – 76.6	NO_x limitations for Group I, Phase I boilers and for Group II boilers.		x	Unit 1 will be considered a Group I Phase II boiler; therefore, these rules do not apply.	

DEQ/AQD 000248

DEQ/AQD 000249

TABLE D-1
Summary of Applicable Requirements - Federal Air Quality Regulations

Applicable Requirement	Summary of Requirement	Applicable to Dry Fork Station		Comments	Methods Used to Demonstrate Compliance[a]
		Yes	No		
40 C.F.R. 76.7	The owner or operator of a Group 1, Phase II PC-fired utility unit with a tangentially fired boiler or a dry bottom wall-fired boiler shall not discharge, or allow to be discharged, emissions of NO_x to the atmosphere in excess of the following limits, except as provided in §§ 76.8, 76.10, or 76.11: (1) 0.40 lb/mmBtu of heat input on an annual average basis for tangentially fired boilers. (2) 0.46 lb/ mmBtu of heat input on an annual average basis for dry bottom wall-fired boilers (other than units applying cell burner technology).	x		Dry Fork Station may not discharge emissions greater than what is allowed.	CEMS documentation.
40 CFR 76.8	The owner or operator of a Phase II PC-fired utility unit with a Group 1 boiler may elect to have the unit become subject to the applicable emissions limitation for NO_x under § 76.5, starting no later than January 1, 1997.		x	Dry Fork Station Unit 1 will be built after the 1997 deadline; therefore, this rule does not apply.	
40 CFR 76.9	The designated representative of any source with an affected unit subject to this part shall submit, by the applicable deadline under paragraph (b) of this section, a complete acid rain permit application (or, if the unit is covered by an acid rain permit, a complete permit revision) that includes a complete compliance plan for NO_x emissions covering the unit.	x		Dry Fork Station will obtained a Title IV permit that is included as part of the Title V permit.	A permit application is being submitted for the Dry Fork Station.
40 CFR 76.10	The designated representative of an affected unit that is not an early election unit and cannot meet the applicable emission limitation, for Group 1 boilers, either LNB technology or an alternative or, for tangentially fired boilers, separated overfire air, may petition the permitting authority for an alternative emission limitation less stringent than the applicable emission limitation.		x	Unit 1 will be able to meet the applicable emission limitation; therefore, this rule does not apply.	
40 CFR 76.11	Details emissions averaging plan.		x	Dry Fork Station is not eligible for the emissions averaging plan; therefore, this rule does not apply	

TABLE D-1
Summary of Applicable Requirements - Federal Air Quality Regulations

Applicable Requirement	Summary of Requirement	Applicable to Dry Fork Station		Comments	Methods Used to Demonstrate Compliance[a]
		Yes	No		
40 CFR 76.12	Details Phase I NO_x compliance extension.		x	Unit 1 is a Phase II boiler; therefore, this rule does not apply.	
40 CFR 76.13	Provides calculations for excess emissions of NO_x.	x		If Unit 1 has excess emissions of NO_x, the guidelines detailed in this section must be followed.	If NO_x is ever exceeded, document actions required by this section.
40 CFR 76.14 – 76.15	Details requirements for alternative monitoring equipment and alternative emission limitations.		x	Dry Fork Station will not have either alternative; therefore, these rules do not apply.	
40 CFR 77, Excess Emissions					
40 CFR 77.01 – 77.06	This part of the acid rain regulations specifies the requirements for addressing excess emissions of SO_2 (exceeding allowances) and NOx.	x		If Dry Fork Station has excess emissions of SO_2 in any calendar year it shall be liable to offset the amount of such excess emissions by an equal amount of allowances from the unit's Allowance Tracking System account in accordance with these rules. If Dry Fork Station has any excess emissions of SO_2 or NOx in any calendar year, it shall be required to pay a penalty of $2000 per ton, adjusted for inflation.	If emissions are ever exceeded, the requirements set forth in these rules will be followed and documentation retained.

[a]The summary of applicable requirements is intended to provide a summary of the portion of the applicable requirement applying to the generating units. It is not intended to replace a regulatory document. Please see the actual regulations for specific information.

DEQ/AQD 000250

Appendix E

RBLC Data

Pulverized Coal Electric Utility Boilers
Recently Issued PSD Permits
NO_x Limits

Name	Type/Size	NO_x Limit	Comments
Hawthorne Unit 5 Missouri	Pulverized Coal 570 MW	0.08 lb/mmbtu (30 day rolling avg) 0.10 lb/mmbtu (24 hour avg)	Final Permit 08-17-99 Low-NOx Burners with SCR Initial limit of 0.12 lb/mmbtu for first 36 months.
Springerville Units 3 and 4 Arizona	Pulverized Coal 450 MW each	1.6 lb/gross MWh (30 day rolling avg) 9,600 tpy Units 1, 2, 3 & 4	Final Permit 04-29-02 Low-NOx Burners with SCR. Netted with Units 1 and 2 – no increase in facility NOx emissions.
Holcomb Unit 2 Kansas	Pulverized Coal 660 MW	0.08 lb/mmbtu (30 day rolling avg)	Final Permit 10-08-02 Low-NOx Burners with SCR Initial limit of 0.12 lb/mmbtu for first 18 months.
Thoroughbred Units 1 and 2 Kentucky	Pulverized Coal 750 MW each	0.08 lb/mmbtu (30 day rolling avg)	Final Permit 10-11-02 Low-NOx Burners with SCR
Bull Mountain Roundup Units 1 and 2 Montana	Pulverized Coal 390 MW each	0.07 lb/mmbtu (24 hour avg) 0.10 lb/mmbtu (1 hour avg)	Final Permit 07-21-03 Low-NOx Burners with SCR
Plum Point Energy Station Unit 1 Arkansas	Pulverized Coal 550 – 800 MW	0.09 lb/mmbtu (30 day rolling avg)	Final Permit 08-20-03 Low-NOx Burners with SCR
Rocky Mountain Power, Hardin Unit 1 Montana	Pulverized Coal 113 MW	0.09 lb/mmbtu (30 day rolling avg)	Final Permit 06-11-02 Low-NOx Burners with SCR
Council Bluffs Energy Center Unit 4 Iowa	Pulverized Coal 750 MW	0.07 lb/mmbtu (30 day rolling avg) 2,353 tpy	Final Permit 06-17-03 Low-NOx Burners with SCR
Elm Road Generating Station, Units 1 and 2 Wisconsin	Pulverized Coal 600 MW each (6,180 mmbtu/hr)	0.07 lb/mmbtu (30 day rolling avg)	Final Permit 01-14-04 Low-NOx Burners with SCR. Must comply with 0.07 lb/mmbtu 12 month rolling average that includes startup and shutdown.
Longview Power Unit 1 West Virginia	Pulverized Coal 600 MW (6,114 mmbtu/hr)	0.07 lb/mmbtu (30 day rolling avg) 0.065 lb/mmbtu (annual avg)	Final Permit 03-02-04 Low-NOx Burners with SCR
Prairie State Generating Station Units 1 and 2 Illinois	Pulverized Coal 750 MW each (7,450 mmbtu/hr)	0.08 lb/mmbtu (30 day rolling avg)	Draft Permit 03-08-04 Low-NOx Burners with SCR
Hastings Utilities Whelan Energy Center Unit 2 Nebraska	Pulverized Coal 220 MW 2,210 mmbtu/hr	0.08 lb/mmbtu (30 day rolling avg)	Final Permit 03-30-04 Low-NOx Burners with SCR
Santee Cooper Cross Generating Station Units 3 and 4 South Carolina	Pulverized Coal 660 MW each (5,400 mmbtu/hr)	0.08 lb/mmbtu (30 day rolling avg)	Final Permit 08-05-04 Low-NOx Burners with SCR
Intermountain Power Project Unit 3 Utah	Pulverized Coal 950 MW (9,050 mmbtu/hr)	0.07 lb/mmbtu (30 day rolling avg) 633.5 lb/hr (24 hr block avg)	Final Permit 10-15-04 Low-NOx Burners with SCR Specific startup plan

Pulverized Coal Electric Utility Boilers
Recently Issued PSD Permits
NO_x Limits (continued)

Name	Type/Size	NO_x Limit	Comments
Wisconsin Public Service Weston Power Plant Unit 4 Wisconsin	Pulverized Coal 500 MW (5,173 mmbtu/hr)	0.07 lb/mmbtu (30 day rolling avg) 0.06 lb/mmbtu (12 month rolling avg)	Final Permit 10-18-04 Low-NOx Burners with SCR 12 month rolling avg limit includes periods of startup and shutdown
Xcel Comanche Unit 3 Colorado	Pulverized Coal 750 MW 7,421 mmbtu/hr	0.08 lb/mmbtu (30 day rolling avg)	Final Permit 07-05-05 Low-NOx Burners with SCR Specific startup provisions
Black Hills WYGEN Unit 2 Wyoming	Pulverized Coal 100 MW	0.07 lb/mmbtu (30 day rolling avg)	Revised Permit 07-11-05 Unit size reduced to 100 MW Low-NOx Burners with SCR

All the permits above, except Bull Mountain Roundup and Xcel Comanche, exempt startup, shutdown and malfunction in the short term (1 hour, 3 hour, 24 hour and 30 day) emission limits.

Pulverized Coal Electric Utility Boilers
Recently Issued PSD Permits
SO_2 Limits

Name	Type/Size	SO_2 Limit	Comments
Hawthorne Unit 5 Missouri	Pulverized Coal 570 MW	0.12 lb/mmbtu (30 day rolling avg) 0.13 lb/mmbtu (3 hour avg)	Final Permit 08-17-99 Dry Lime FGD
Springerville Units 3 and 4 Arizona	Pulverized Coal 450 MW each	8,448 lb/hr Units 1, 2, 3 & 4 (3 hour rolling avg) 10,800 tpy Units 1, 2, 3 & 4	Final Permit 04-29-02 Dry Lime FGD Netted with Units 1 and 2 – no increase in facility SO2 emissions.
Holcomb Unit 2 Kansas	Pulverized Coal 660 MW	0.12 lb/mmbtu (30 day rolling avg)	Final Permit 10-08-02 Dry Lime FGD
Thoroughbred Units 1 and 2 Kentucky	Pulverized Coal 750 MW each	0.167 lb/mmbtu (30 day rolling avg) 0.41 lb/mmbtu (24 hour avg)	Final Permit 10-11-02 Wet Limestone FGD
Bull Mountain Roundup Units 1 and 2 Montana	Pulverized Coal 390 MW each	0.12 lb/mmbtu (24 hour avg) 0.15 lb/mmbtu (1 hour avg)	Final Permit 07-21-03 Dry Lime FGD
Plum Point Energy Station Unit 1 Arkansas	Pulverized Coal 550 – 800 MW	0.16 lb/mmbtu (3 hour rolling avg)	Final Permit 08-20-03 Dry Lime FGD
Rocky Mountain Power, Hardin Unit 1 Montana	Pulverized Coal 113 MW	0.15 lb/mmbtu (30 day rolling avg)	Final Permit 06-11-02 Wet Lime FGD
Council Bluffs Energy Center Unit 4 Iowa	Pulverized Coal 750 MW	0.10 lb/mmbtu (30 day rolling avg) 3,362 tpy	Final Permit 06-17-03 Dry Lime FGD
Elm Road Generating Station, Units 1 and 2 Wisconsin	Pulverized Coal 600 MW each (6,180 mmbtu/hr)	0.15 lb/mmbtu (30 day rolling avg) 1,150 lb/hr (3 hr rolling avg) 1,050 lb/hr (24 hr rolling avg)	Final Permit 01-14-04 Wet Limestone FGD Emission limit includes normal operation, startup and shutdown.
Longview Power Unit 1 West Virginia	Pulverized Coal 600 MW (6,114 mmbtu/hr)	0.12 lb/mmbtu (24 hour rolling avg) 0.15 lb/mmbtu (3 hour rolling avg) 0.095 lb/mmbtu (annual avg)	Final Permit 03-02-04 Wet Limestone FGD
Prairie State Generating Station Units 1 and 2 Illinois	Pulverized Coal 750 MW each (7,450 mmbtu/hr)	0.182 lb/mmbtu (30 day rolling avg)	Draft Permit 03-08-04 Wet Limestone FGD
Hastings Utilities Whelan Energy Center Unit 2 Nebraska	Pulverized Coal 220 MW 2,210 mmbtu/hr	0.12 lb/mmbtu (30 day rolling avg)	Final Permit 03-30-04 Dry Lime FGD
Santee Cooper Cross Generating Station Units 3 and 4 South Carolina	Pulverized Coal 660 MW each (5,400 mmbtu/hr)	0.25 lb/mmbtu (30 day rolling avg) 0.13 lb/mmbtu (365 day rolling avg)	Final Permit 08-05-04 Wet Limestone FGD
Intermountain Power Project Unit 3 Utah	Pulverized Coal 950 MW (9,050 mmbtu/hr)	0.09 lb/mmbtu (30 day rolling avg) 0.10 lb/mmbtu (24 hr block avg) 1,357.5 lb/hr (3 hr block avg)	Final Permit 10-15-04 Wet Limestone FGD Specific startup plan

Pulverized Coal Electric Utility Boilers
Recently Issued PSD Permits
SO_2 Limits (continued)

Name	Type/Size	SO_2 Limit	Comments
Wisconsin Public Service Weston Power Plant Unit 4 Wisconsin	Pulverized Coal 500 MW (5,173 mmbtu/hr)	0.10 lb/mmbtu (30 day rolling avg) 0.09 lb/mmbtu (12 month rolling avg)	Final Permit 10-18-04 Dry Lime FGD Limits include periods of startup and shutdown
Xcel Comanche Unit 3 Colorado	Pulverized Coal 750 MW 7,421 mmbtu/hr	0.10 lb/mmbtu (30 day rolling avg)	Final Permit 07-05-05 Dry Lime FGD Specific startup provisions
Black Hills WYGEN Unit 2 Wyoming	Pulverized Coal 100 MW	0.10 lb/mmbtu (30 day rolling avg) 0.12 lb/mmbtu (3 hour block avg)	Revised Permit 07-11-05 Unit size reduced to 100 MW Dry Lime FGD

All the permits above, except Bull Mountain Roundup, Elm Road Generating Station, Weston Unit 4 and Xcel Comanche, exempt startup, shutdown and malfunction in the short term (1 hour, 3 hour, 24 hour and 30 day) emission limits.

Pulverized Coal Electric Utility Boilers
Recently Issued PSD Permits
CO Limits

Name	Type/Size	CO Limit	Comments
Hawthorne Unit 5 Missouri	Pulverized Coal 570 MW	0.16 lb/mmbtu	Final Permit 08-17-99 Combustion control CEMS not required Stack test used for compliance
Springerville Units 3 and 4 Arizona	Pulverized Coal 450 MW each	0.15 lb/mmbtu (30 day rolling average)	Final Permit 04-29-02 Combustion control CEMS used for compliance
Holcomb Unit 2 Kansas	Pulverized Coal 660 MW	0.15 lb/mmbtu	Final Permit 10-08-02 Combustion control CEMS not required Stack test used for compliance If CO and NOx limit cannot be met simultaneously, State will revise CO limit.
Thoroughbred Units 1 and 2 Kentucky	Pulverized Coal 750 MW each	0.10 lb/mmbtu (30 day rolling avg)	Final Permit 10-11-02 Combustion control CEMS used for compliance
Bull Mountain Roundup Units 1 and 2 Montana	Pulverized Coal 390 MW each	0.15 lb/mmbtu	Final Permit 07-21-03 Combustion control CEMS not required Stack test used for compliance
Plum Point Energy Station Unit 1 Arkansas	Pulverized Coal 550 – 800 MW	0.16 lb/mmbtu	Final Permit 08-20-03 Combustion control CEMS used for compliance
Rocky Mountain Power, Hardin Unit 1 Montana	Pulverized Coal 113 MW	0.15 lb/mmbtu	Final Permit 06-11-02 Combustion control CEMS not required Stack test used for compliance
Council Bluffs Energy Center Unit 4 Iowa	Pulverized Coal 750 MW	0.154 lb/mmbtu (1 day avg) 5,177 tpy	Final Permit 06-17-03 Combustion control CEMS used for compliance If CO and NOx limit cannot be met simultaneously, State will revise CO limit.
Elm Road Generating Station, Units 1 and 2 Wisconsin	Pulverized Coal 600 MW each (6,180 mmbtu/hr)	0.12 lb/mmbtu (24 hr rolling avg) 742 lb/hr (24 hr rolling avg) 2,400 lb/hr (1 hr avg) 3,250 tons (12 month rolling total)	Final Permit 01-14-04 Combustion control CEMS used for compliance. Emission limit excludes startup and shutdown. 12 month rolling total includes all operation, startup and shutdown.
Longview Power Unit 1 West Virginia	Pulverized Coal 600 MW (6,114 mmbtu/hr)	0.11 lb/mmbtu (3 hr rolling avg)	Final Permit 03-02-04 Combustion control CEMS used for compliance
Prairie State Generating Station Units 1 and 2 Illinois	Pulverized Coal 750 MW each (7,450 mmbtu/hr)	0.12 lb/mmbtu (24 hour block avg)	Draft Permit 03-08-04 Combustion control CEMS used for compliance
Hastings Utilities Whelan Energy Center Unit 2 Nebraska	Pulverized Coal 220 MW 2,210 mmbtu/hr	0.15 lb/mmbtu (3 hr avg)	Final Permit 03-30-04 Combustion control CEMS used for compliance

Pulverized Coal Electric Utility Boilers
Recently Issued PSD Permits
CO Limits (continued)

Name	Type/Size	CO Limit	Comments
Santee Cooper Cross Generating Station Units 3 and 4 South Carolina	Pulverized Coal 660 MW each (5,400 mmbtu/hr)	0.16 lb/mmbtu	Final Permit 08-05-04 Combustion control CEMS not required Stack test used for compliance
Intermountain Power Project Unit 3 Utah	Pulverized Coal 950 MW (9,050 mmbtu/hr)	0.15 lb/mmbtu (30 day rolling avg) 3,000 lb/hr (8 hr block avg)	Final Permit 10-15-04 Combustion control CEMS (or equivalent) used for compliance
Wisconsin Public Service Weston Power Plant Unit 4 Wisconsin	Pulverized Coal 500 MW (5,173 mmbtu/hr)	0.15 lb/mmbtu (1 day avg) 3,399 tons/yr (12 month rolling avg)	Final Permit 10-18-04 Combustion control CEMS used for compliance 12 month rolling avg limit includes periods of startup and shutdown
Xcel Comanche Unit 3 Colorado	Pulverized Coal 750 MW 7,421 mmbtu/hr	0.13 lb/mmbtu (8 hr rolling avg) 0.30 lb/mmbtu (during startup)	Final Permit 07-05-05 Combustion control CEMS used for compliance Specific startup provisions
Black Hills WYGEN Unit 2 Wyoming	Pulverized Coal 100 MW	0.15 lb/mmbtu	Revised Permit 07-11-05 Unit size reduced to 100 MW Combustion control CEMS not required Stack test used for compliance

All the permits above, except Bull Mountain Roundup and Xcel Comanche, exempt startup, shutdown and malfunction in the short term
(1 hour, 3 hour, 24 hour and 30 day) emission limits.

Pulverized Coal Electric Utility Boilers
Recently Issued PSD Permits
VOC Limits

Name	Type/Size	VOC Limit	Comments
Hawthorne Unit 5 Missouri	Pulverized Coal 570 MW	0.0036 lb/mmbtu	Final Permit 08-17-99 Combustion control Stack test used for compliance
Springerville Units 3 and 4 Arizona	Pulverized Coal 450 MW each	0.06 lb/ton coal (3 hr avg)	Final Permit 04-29-02 Combustion control Stack test used for compliance
Holcomb Unit 2 Kansas	Pulverized Coal 660 MW	0.0035 lb/mmbtu	Final Permit 10-08-02 Combustion control Stack test used for compliance If VOC and NOx limit cannot be met simultaneously, State will revise VOC limit
Thoroughbred Units 1 and 2 Kentucky	Pulverized Coal 750 MW each	0.0072 lb/mmbtu (30 day rolling avg)	Final Permit 10-11-02 Combustion control Compliance with CO limit used to demonstrate compliance with VOC limit
Bull Mountain Roundup Units 1 and 2 Montana	Pulverized Coal 390 MW each	0.0030 lb/mmbtu	Final Permit 07-21-03 Combustion control Stack tests not required
Plum Point Energy Station Unit 1 Arkansas	Pulverized Coal 550 – 800 MW	0.02 lb/mmbtu	Final Permit 08-20-03 Combustion control Initial Stack test used for compliance
Rocky Mountain Power, Hardin Unit 1 Montana	Pulverized Coal 113 MW	0.0034 lb/mmbtu	Final Permit 06-11-02 Combustion control Stack tests not required
Council Bluffs Energy Center Unit 4 Iowa	Pulverized Coal 750 MW	0.0036 lb/mmbtu	Final Permit 06-17-03 Combustion control Initial Stack test used for compliance
Elm Road Generating Station, Units 1 and 2 Wisconsin	Pulverized Coal 600 MW each (6,180 mmbtu/hr)	0.0035 lb/mmbtu (24 hr rolling avg)	Final Permit 01-14-04 Combustion control Initial Stack test used for compliance Emission limit excludes startup and shutdown
Longview Power Unit 1 West Virginia	Pulverized Coal 600 MW (6,114 mmbtu/hr)	0.004 lb/mmbtu (3 hr rolling avg)	Final Permit 03-02-04 Combustion control Stack tests used for compliance
Prairie State Generating Station Units 1 and 2 Illinois	Pulverized Coal 750 MW each (7,450 mmbtu/hr)	0.004 lb/mmbtu (3 hr block avg)	Draft Permit 03-08-04 Combustion control Stack tests used for compliance
Hastings Utilities Whelan Energy Center Unit 2 Nebraska	Pulverized Coal 220 MW 2,210 mmbtu/hr	No limit	Final Permit 03-30-04 Under PSD threshold for VOC
Santee Cooper Cross Generating Station Units 3 and 4 South Carolina	Pulverized Coal 660 MW each (5,400 mmbtu/hr)	0.0024 lb/mmbtu	Final Permit 08-05-04 Combustion control Initial Stack test used for compliance
Intermountain Power Project Unit 3 Utah	Pulverized Coal 950 MW (9,050 mmbtu/hr)	0.0027 lb/mmbtu (3 test run avg)	Final Permit 10-15-04 Annual stack test for compliance

Pulverized Coal Electric Utility Boilers
Recently Issued PSD Permits
VOC Limits (continued)

Name	Type/Size	VOC Limit	Comments
Wisconsin Public Service Weston Power Plant Unit 4 Wisconsin	Pulverized Coal 500 MW (5,173 mmbtu/hr)	0.0036 lb/mmbtu (1 day avg) 81.6 tons/yr (12 month rolling avg)	Final Permit 10-18-04 Combustion control Stack tests used for compliance 12 month rolling avg limit includes periods of startup and shutdown
Xcel Comanche Unit 3 Colorado	Pulverized Coal 750 MW 7,421 mmbtu/hr	0.0035 lb/mmbtu	Final Permit 07-05-05 Combustion control Stack tests used for compliance
Black Hills WYGEN Unit 2 Wyoming	Pulverized Coal 100 MW	0.01 lb/mmbtu	Revised Permit 07-11-05 Unit size reduced to 100 MW Combustion control Initial Stack test used for compliance

All the permits above, except Bull Mountain Roundup, exempt startup, shutdown and malfunction in the short term (1 hour, 3 hour, 24 hour and 30 day) emission limits.

Pulverized Coal Electric Utility Boilers
Recently Issued PSD Permits
PM_{10} and Opacity Limits

Name	Type/Size	PM_{10} / Opacity Limit	Comments
Hawthorne Unit 5 Missouri	Pulverized Coal 570 MW	0.018 lb/mmbtu 20% Opacity	Final Permit 08-17-99 Fabric Filter Compliance based on annual test Condensable PM_{10} not specified
Springerville Units 3 and 4 Arizona	Pulverized Coal 450 MW each	0.015 lb/mmbtu (PM) (3 hr rolling avg) 0.055 lb/mmbtu (PM_{10}) (3 hr rolling avg) 15% Opacity	Final Permit 04-29-02 Fabric Filter Compliance based on annual test PM limit is filterable only. PM_{10} limit. includes filterable and condensable
Holcomb Unit 2 Kansas	Pulverized Coal 660 MW	0.018 lb/mmbtu 20% Opacity	Final Permit 10-08-02 Fabric Filter Compliance based on 3 2-hr stack tests Condensable PM_{10} not specified
Thoroughbred Units 1 and 2 Kentucky	Pulverized Coal 750 MW each	0.018 lb/mmbtu (3 hr avg) 20% Opacity	Final Permit 10-11-02 Electrostatic Precipitator Limit is filterable PM_{10} only
Bull Mountain Roundup Units 1 and 2 Montana	Pulverized Coal 390 MW each	0.015 lb/mmbtu 20% Opacity	Final Permit 07-21-03 Fabric Filter Limit may be reduced to 0.012 lb/MMBtu based on performance test Condensable PM_{10} not specified
Plum Point Energy Station Unit 1 Arkansas	Pulverized Coal 550 – 800 MW each	0.018 lb/mmbtu 10% Opacity	Final Permit 08-20-03 Fabric Filter Limit is filterable PM_{10} only
Rocky Mountain Power, Hardin Unit 1 Montana	Pulverized Coal 113 MW	0.015 lb/mmbtu 20% Opacity	Final Permit 06-11-02 Multiclones and Wet Lime FGD Limit is filterable PM_{10} only.
Council Bluffs Energy Center Unit 4 Iowa	Pulverized Coal 750 MW	0.025 lb/mmbtu 5% Opacity (1 hr avg)	Final Permit 06-17-03 Fabric Filter Limit is filterable plus condensable PM_{10}
Elm Road Generating Station, Units 1 and 2 Wisconsin	Pulverized Coal 600 MW each (6,180 mmbtu/hr)	0.018 lb/mmbtu (3 hr rolling avg) 20% Opacity	Final Permit 01-14-04 Fabric Filter Stack tests used for compliance (initial and every 24 months thereafter). Test Methods 5/5B and 202 to be used to demonstrate compliance
Longview Power Unit 1 West Virginia	Pulverized Coal 600 MW (6,114 mmbtu/hr)	0.018 lb/mmbtu (6 hr rolling avg) 10% Opacity (6 minute avg)	Final Permit 03-02-04 Dry Sorbent Injection/Fabric Filter Limit is filterable plus condensable PM_{10} Stack tests used for compliance
Prairie State Generating Station Units 1 and 2 Illinois	Pulverized Coal 750 MW each (7,450 mmbtu/hr)	0.015 lb/mmbtu (3 hr block avg) 20% Opacity	Draft Permit 03-08-04 Electrostatic Precipitator/Wet Limestone FGD/Wet Electrostatic Precipitator Limit is filterable PM_{10} only Stack tests used for compliance
Hastings Utilities Whelan Energy Center Unit 2 Nebraska	Pulverized Coal 220 MW 2,210 mmbtu/hr	0.018 lb/mmbtu (3 test run avg) 20% Opacity	Final Permit 03-30-04 Fabric Filter
Santee Cooper Cross Generating Station Units 3 and 4 South Carolina	Pulverized Coal 660 MW each (5,400 mmbtu/hr)	0.018 lb/mmbtu (30 day rolling avg) 20% Opacity	Final Permit 08-05-04 Electrostatic Precipitator Limit includes filterable and condensable PM10 Initial Stack test used for compliance

Pulverized Coal Electric Utility Boilers
Recently Issued PSD Permits
PM_{10} and Opacity Limits (continued)

Name	Type/Size	PM_{10} / Opacity Limit	Comments
Intermountain Power Project Unit 3 Utah	Pulverized Coal 950 MW (9,050 mmbtu/hr)	0.012 lb/mmbtu (3 test run avg) 221 lb/hr filterable & condensable (24 hr block avg) 10% Opacity	Final Permit 10-15-04 Fabric Filter Annual stack test Specific startup plan
Wisconsin Public Service Weston Power Plant Unit 4 Wisconsin	Pulverized Coal 500 MW (5,173 mmbtu/hr)	0.018 lb/mmbtu (3 hour rolling avg) 20% Opacity	Final Permit 10-18-04 Fabric Filter Limit includes filterable and condensable PM_{10} Stack tests used for compliance
Xcel Comanche Unit 3 Colorado	Pulverized Coal 750 MW 7,421 mmbtu/hr	0.012 lb/mmbtu (filterable) (3 hr rolling avg) 0.020 lb/mmbtu (filterable & condensable) (3 hr rolling avg) 10% Opacity	Final Permit 07-05-05 Fabric Filter Annual stack tests used for compliance Opacity during startup limited to 20%
Black Hills WYGEN Unit 2 Wyoming	Pulverized Coal 100 MW	0.012 lb/mmbtu 20% Opacity	Revised Permit 07-11-05 Unit size reduced to 100 MW Fabric Filter Limit is filterable PM_{10} only

All the permits above, except Bull Mountain Roundup, exempt startup, shutdown and malfunction in the short term (1 hour, 3 hour, 24 hour and 30 day) emission limits.

Pulverized Coal Electric Utility Boilers
Recently Issued PSD Permits
H_2SO_4 Limits

Name	Type/Size	H_2SO_4 Limit	Comments
Hawthorne Unit 5 Missouri	Pulverized Coal 570 MW	No Limit	Final Permit 08-17-99 Dry Lime FGD
Springerville Units 3 and 4 Arizona	Pulverized Coal 450 MW each	0.0115 lb/mmbtu	Final Permit 04-29-02 Dry Lime FGD
Holcomb Unit 2 Kansas	Pulverized Coal 660 MW	No Limit	Final Permit 10-08-02 Dry Lime FGD Under PSD threshold for H_2SO_4
Thoroughbred Units 1 and 2 Kentucky	Pulverized Coal 750 MW each	0.00497 lb/mmbtu	Final Permit 10-11-02 Wet Limestone FGD
Bull Mountain Roundup Units 1 and 2 Montana	Pulverized Coal 390 MW each	0.0064 lb/mmbtu	Final Permit 07-21-03 Dry Lime FGD
Plum Point Energy Station Unit 1 Arkansas	Pulverized Coal 550 – 800 MW	0.0061 lb/mmbtu	Final Permit 08-20-03 Dry Lime FGD
Rocky Mountain Power, Hardin Unit 1 Montana	Pulverized Coal 113 MW	No Limit	Final Permit 06-11-02 Wet Lime FGD Under PSD threshold for H_2SO_4
Council Bluffs Energy Center Unit 4 Iowa	Pulverized Coal 750 MW	0.00421 lb/mmbtu	Final Permit 06-17-03 Dry Lime FGD
Elm Road Generating Station, Units 1 and 2 Wisconsin	Pulverized Coal 600 MW each (6,180 mmbtu/hr)	0.010 lb/mmbtu (24-hour average)	Final Permit 01-14-04 Wet Limestone FGD and Wet ESP Stack tests used for compliance (initial and every 60 months thereafter)
Longview Power Unit 1 West Virginia	Pulverized Coal 600 MW (6,114 mmbtu/hr)	0.0075 lb/mmbtu (3 hr rolling avg)	Final Permit 03-02-04 Dry Sorbent Injection/Fabric Filter/Wet Limestone FGD Stack tests used for compliance
Prairie State Generating Station Units 1 and 2 Illinois	Pulverized Coal 750 MW each (7,450 mmbtu/hr)	0.005 lb/mmbtu (3 hr block avg)	Draft Permit 03-08-04 Electrostatic Precipitator/Wet Limestone FGD/Wet Electrostatic Precipitator Limit is filterable PM_{10} only Stack tests used for compliance
Hastings Utilities Whelan Energy Center Unit 2 Nebraska	Pulverized Coal 220 MW 2,210 mmbtu/hr	No limit	Final Permit 03-30-04 Dry Lime FGD Under PSD threshold for H_2SO_4
Santee Cooper Cross Generating Station Units 3 and 4 South Carolina	Pulverized Coal 660 MW each (5,400 mmbtu/hr)	0.0014 lb/mmbtu (365 day rolling avg)	Final Permit 08-05-04 Wet Limestone FGD Initial Stack test used for compliance
Intermountain Power Project Unit 3 Utah	Pulverized Coal 950 MW (9,050 mmbtu/hr)	0.0044 lb/mmbtu (24 hr block avg)	Final Permit 10-15-04 Wet Limestone FGD Annual stack test used for compliance

Pulverized Coal Electric Utility Boilers
Recently Issued PSD Permits
H_2SO_4 Limits (continued)

Name	Type/Size	H_2SO_4 Limit	Comments
Wisconsin Public Service Weston Power Plant Unit 4 Wisconsin	Pulverized Coal 500 MW (5,173 mmbtu/hr)	0.005 lb/mmbtu (24 hour avg)	Final Permit 10-18-04 Dry Lime FGD Initial stack test used for compliance
Xcel Comanche Unit 3 Colorado	Pulverized Coal 750 MW 7,421 mmbtu/hr	0.0042 lb/mmbtu	Final Permit 07-05-05 Dry Lime FGD Annual stack test used for compliance Limit could be reduced to 0.0034 lb/mmbtu based on test results
Black Hills WYGEN Unit 2 Wyoming	Pulverized Coal 100 MW	No Limit	Revised Permit 07-11-05 Unit size reduced to 100 MW Dry Lime FGD Initial stack test

TABLE E-1
NSR RACT/BACT/LAER Clearinghouse Database
BACT-PSD Sources for CO
Coal Fired PC Boilers

RBLC ID	Company Name and Location	# of Units	Unit and Size	Control Technology	Control Efficiency	Emission Limit		Averaging Period	Permit Date and Permit No.
NV-0036	Newmont Nevada Energy Investment, Inc. TS Power Plant Nevada	1	Coal Fired Boiler 2030 MMBTU/HR	Good Combustion Controls	not given	0.15	lb/MMBTU	24-hour	5/05/2005 No. AP4911-1349
NE-0018	Hastings Utilities Whelan Energy Center Nebraska	1	Coal Fired Boiler 2210 MMBTU/HR	Good Combustion Controls	not given	0.15 lb/MMBTU		Not Provided	3/30/2004 No. 58048
SC-0104	Santee Cooper Santee Cooper Cross Generation Station South Carolina	2	Coal Fired Boiler 5700 MMBTU/HR	Good Combustion Controls	not given	0.16 lb/MMBTU		Not Provided	02/05/2004 No. 0420-0030-CI
TX-0298	Reliant Energy Inc WA Parish Electric Generating Station Texas	2	Coal Fired Boiler 7400 MMBTU/HR	Combustion Controls	not given	0.292	lb/MMBTU Each Unit	Not Provided	10/15/2003 No. PSD-TX-901
TX-0298	Reliant Energy Inc WA Parish Electric Generating Station Texas	1	Coal Fired Boiler 6700 MMBTU/HR	Combustion Controls	not given	0.282	lb/MMBTU	Not Provided	10/15/2003 No. PSD-TX-33M1
AR-0074	Plum Point Associates, LLC Plum Point Energy Arkansas	1	Coal Fired Boiler 800 MW	Combustion Controls	not given	0.16	lb/MMBTU	Not Provided	8/20/2003 No. 1995-AOP-R0
MT-0022	Bull Mountain Development Company Bull Mountain, No. 1, LLC - Roundup Power Project Montana	2	Pulverized Coal Fired Boiler 390 MW	Not Given	not given	Primary = 602 lb/hr	Secondary = 0.15 lb/MMBTU	Not Provided	7/21/2003 No. 3182-00
IA-0067	Mid American Energy Company Council Bluffs Energy Council Iowa	1	Pulverized Coal Fired Boiler 7675 MMBTU/HR	Combustion Controls	not given	Primary =0.154 lb/MMBTU (1 calendar average)	Secondary = 5177 tons/yr		6/17/2003 No. 02-528
TX-0358	Reliant Energy, Inc. Washington Parish Electric Generating Station Texas	2	Coal Fired Boiler 6750 MMBTU/HR	Combustion Controls	not given	Primary = 2168 lb/hr	Secondary = 9496 tons/yr	Not Provided	10/15/2002 PSD-TX-33 M1
TX-0356	Reliant Energy, Inc. Washington Parish Electric Generating Station Texas	1	Coal Fired Boiler 6700 MMBTU/HR	Combustion Controls	not given	Primary = 1891 lb/hr	Secondary = 8281 tons/yr	Not Provided	10/15/2002 PSD-TX-33 M1
KY-0084	Thoroughbred Generating Company, LLC Thoroughbred Generating Station Kentucky	2	Coal Fired Boiler 7446 MMBTU/HR	Boiler Design and Operation	not given	0.10	MMBTU/hr	30-day rolling average	10/11/2002 No. V-02-001
WY-0057	Black Hills Corporation Wygen Wyoming	1	Pulverized Coal Fired Boiler 500 MW	Good Combustion Controls	not given	0.15	lb/MMBTU	Not Provided	9/25/2002 No. CT-3030
MT-0027	Rocky Mountain Power, Inc. Hardin Generator Project Montana	1	Pulverized Coal Fired Boiler 1304 MMBTU/HR	Not Given	not given	0.15	lb/MMBTU	Not Provided	6/11/2002 No. 3185-00
FL-0003	Tampa Electric Company TECO-Big Bend Station Tampa, Florida	1	Dry Bottom Tangentially Fired Boiler 4330 MMBTU/HR	Boiler Design and Operation	not given	Primary = 0.029 lb/MMBTU	Secondary = 124 lb/hr	Not Provided	01/01/2001 No. PSD-FL-040
MO-0050	Kansas City Power & Light Co. Hawthorn Station Kansas City, Missouri	1	Coal Fired Boiler 384 TPH	Good Combustion Practices	not given	0.16	lb/MMBTU	Not Provided	8/17/1999 No. 886

TABLE E-1
NSR RACT/BACT/LAER Clearinghouse Database
BACT-PSD Sources for CO
Coal Fired PC Boilers

RBLC ID	Company Name and Location	# of Units	Unit and Size	Control Technology	Control Efficiency	Emission Limit		Averaging Period	Permit Date and Permit No.
UT-0053	Deseret Generation and Transmission Company Near Bonanza, Utah	1	Coal Fired Boiler 500 MW	Not Given	not given	602.45	TPY	Not Provided	3/16/1998 No. DAQE-186-98
AR-0069	Entergy-Arkansas, Inc. Independence Arkansas	1	Coal Fired Boiler 8700 MMBTU/hr	Good Combustion Practice	not given	Primary = 100 ppm (24-hr average)	Secondary = 3232 lb/hr	Not Provided	3/10/1998 No. 449-AOP-R0
WY-0039	Two Elk Generation Partners, LTD Wright, Wyoming	1	Pulverized Coal Fired Boiler 250 MW	No Controls Feasible	not given	0.15	lb/MMBTU	Not Provided	2/27/1998 No. CT-1352
WY-0047	ENCOAL Corporation North Rochelle Facility 15 miles SE Wright, Wyoming	1	Pulverized Coal Fired Boiler 3960 MMBTU/HR 240 MW	Combustion Technology	not given	0.15	lb/MMBTU	Not Provided	10/10/1997 No. CT-1324
WY-0048	Black Hills Power and Light Company Wygen Plant Gillette, Wyoming	1	Pulverized Coal Fired Boiler 80 MW	No Controls Feasible	not given	0.15	lb/MMBTU	Not Provided	9/6/1996 No. CT-1236
PA-0133	Mon Valley Energy LTD Poland Mines, Pennsylvania	1	Pulverized Coal Fired Boiler 966 MMBTU/hr 80 MW Cogen	No Controls Feasible	not given	Primary = .20 lb/MMBTU	Secondary = 847 TPY	Not Provided	8/8/1995 No. 30-306-001
NJ-0019	Crown/Vista Energy Project (CVEP) West Deptford, New Jersey	2	Pulverized Coal Fired Boilers 1789 MMBTU/hr each 181 MW each	Good Combustion Practice	not given	Primary = .11 lb/MMBTU	Secondary = 100 ppmvd @ 7%O_2	Not Provided	10/1/1993 No. 01-92-0857
VA-0213	SEI Birchwood King George, Virginia SIC Code: 4931	1	Pulverized Coal Fired Boiler 2200 MMBTU/hr	Combustion Technology	not given	Primary = 440 lb/hr	Secondary = 1927 TPY	Not Provided	8/23/1993 No.40809
WY-0046	Black Hills Power and Light Company Neil Simpson Plant Gillette, Wyoming	1	Pulverized Coal Fired Boiler Steam Electric Power 80 MW	Combustion Control	not given	Primary = .15 lb/MMBTU	Secondary = 152.0 lb/hr	Not Provided	4/14/1993 No. CT-1028
MI-0228	INDELK Energy Services of Otsego Michigan	1	Coal Fired Boiler 778 MMBTU/HR	Combustion Control	not given	0.10	lb/MMBTU	Not Provided	3/16/1993 No. 143-90
NC-0057	Roanoke Valley Project II Weldon Township, North Carolina	1	Pulverized Coal Fired Boiler 517 MMBTU/hr	Combustion Technology	not given	0.20	lb/MMBTU	Not Provided	11/20/1992 No. 6984R2
SC-0027	South Carolina Electric and Gas Company Cope, South Carolina	3	Pulverized Coal Fired Boiler Units 1, 2 and 3 385 MW each	Combustion Efficiency	not given	0.15	lb/MMBTU	Not Provided	7/15/1992 No. 1860-0044
FL-0044	Orlando Utilities Commission Stanton Energy Center, Unit 2 Orlando, Florida	1	Pulverized Coal Fired Boiler 4286 MMBTU/HR	Combustion Control	not given	0.15	lb/MMBTU	Not Provided	12/23/1991
NJ-0015	Keystone Cogeneration Systems, Inc. New Jersey	1	Pulverized Coal Fired Boiler 2116 MMBTU/hr	Advanced Combustion Control	not given	0.11	lb/MMBTU	Not Provided	9/6/1991 No.01-89-3983

DEQ/AQD 000265

TABLE E-1
NSR RACT/BACT/LAER Clearinghouse Database
BACT-PSD Sources for CO
Coal Fired PC Boilers

RBLC ID	Company Name and Location	# of Units	Unit and Size	Control Technology	Control Efficiency	Emission Limit		Averaging Period	Permit Date and Permit No.
VA-0181	Old Dominion Electric Cooperative Clover, Virginia	1	Coal Fired Boiler 4085 MMBTU/hr (≈ 400 MW)	Boiler Design	not given	0.10	lb/MMBTU	Not Provided	4/29/1991 No. 30867
NC-0054	Roanoke Valley Project Weldon, North Carolina	1	Pulverized Coal Fired Boiler 1700 MMBTU/HR	Combustion Control	not given	0.20	lb/MMBTU	Not Provided	1/24/1991 No. 6964
NJ-0014	Chambers Cogeneration Limited Partnership Carneys Point, New Jersey	2	Pulverized Coal Fired Boiler 1389 MMBTU/hr each	Advanced Combustion Control	not given	0.11	lb/MMBTU	Not Provided	12/26/1990 No. 01-89-3086
SC-0028	Santee Cooper Public Service Authority Moncks Corner, South Carolina	1	Pulverized Coal Fired Boiler Cross Unit No. 1 5200 MMBTU/hr (500 MW)	Combustion Efficiency	not given	0.10	lb/MMBTU	Not Provided	11/28/1990 No. 0420-0030
VA-0171	Mecklenburg Cogeneration Limited Mecklenburg, Virginia	4	Pulverized Coal Fired Boiler 834.5 MMBTU/hr each	Good Combustion Practices	not given	Primary = .20 lb/MMBTU	Secondary = 166.9 lb/hr	Not Provided	5/9/1990 No. 30861

Notes:
NSR RACT/BACT/LAER Clearinghouse database (http://www.epa.gov/ttn/catc) was queried for the following:
- RBLC Determinations added during or after January 1995
- SIC Code: 4911
- Process Type Code: 11.100 - Coal Combustion

DEQ/AQD 000266

TABLE E-2
NSR RACT/BACT/LAER Clearinghouse Database
BACT-PSD Sources for VOC
Coal Fired PC Boilers

RBLC ID	Company Name and Location	# of Units	Unit and Size	Control Technology	Control Efficiency	Emission Limit		Averaging Period	Permit Date and Permit No.
SC-0104	Santee Cooper Santee Cooper Cross Generation Station South Carolina	2	Coal Fired Boiler 5700 MMBTU/HR	Good Combustion Controls	not given	0.0024	lb/MMBTU	Not Provided	02/05/2004 No. 0420-0030-CI
AR-0074	Plum Point Associates, LLC Plum Point Energy Arkansas	1	Coal Fired Boiler 800 MW	Combustion Controls	not given	0.02	lb/MMBTU	Not Provided	8/20/2003 No. 1995-AOP-R0
MT-0022	Bull Mountain Development Company Bull Mountain, No. 1, LLC - Roundup Power Project Montana	2	Pulverized Coal Fired Boiler 390 MW	Not Given	not given	Primary = 12 lb/hr	Secondary = 0.003 lb/MMBTU	Not Provided	7/21/2003 No. 3182-00
IA-0067	Mid American Energy Company Council Bluffs Energy Council Iowa	2	Pulverized Coal Fired Boiler 7675 MMBTU/HR	Combustion Controls	not given	Primary =0.0036 lb/MMBTU (1-hr average)	Secondary = 121 tons/yr		6/17/2003 No. 02-528
KY-0084	Thoroughbred Generating Company, LLC Thoroughbred Generating Station Kentucky	1	Coal Fired Boiler 7446 MMBTU/HR	Boiler Design and Operation	not given	0.0072	lb/MMBTU	30-day rolling average	10/11/2002 No. V-02-001
WY-0057	Black Hills Corporation Wygen Wyoming	1	Pulverized Coal Fired Boiler 500 MW	Good Combustion Control	not given	0.010	lb/MMBTU	Not Provided	9/25/2002 No. CT-3030
MT-0027	Rocky Mountain Power, Inc. Hardin Generator Project Montana	1	Pulverized Coal Fired Boiler 1304 MMBTU/HR	Good Combustion Control	not given	0.0034	lb/MMBTU	Not Provided	6/11/2002 No. 3185-00
MO-0050	Kansas City Power & Light Co. Hawthorn Station Kansas City, Missouri	1	Coal Fired Boiler 384 TPH	Good Combustion Practices	not given	0.0036	lb/MMBTU	Not Provided	8/17/1999 No. 888
UT-0053	Deseret Generation and Transmission Company Near Bonanza, Utah	1	Coal Fired Boiler 500 MW	Good Combustion	not given	70.89	TPY	Not Provided	3/16/1998 No. DAQE-186-98
WY-0039	Two Elk Generation Partners, LTD Wright, Wyoming	1	Pulverized Coal Fired Boiler 250 MW	No Controls Feasible	not given	0.015	lb/MMBTU	Not Provided	2/27/1998 No. CT-1352
WY-0047	ENCOAL Corporation North Rochelle Facility 15 miles SE Wright, Wyoming	1	Pulverized Coal Fired Boiler 3960 MMBTU/HR 240 MW	Combustion Technology	not given	0.05	lb/MMBTU	Not Provided	10/10/1997 No. CT-1324
WY-0048	Black Hills Power and Light Company Wygen Plant Gillette, Wyoming	1	Pulverized Coal Fired Boiler 80 MW	No Controls Feasible	not given	0.015	lb/MMBTU	Not Provided	9/6/1996 No. CT-1236
PA-0133	Mon Valley Energy LTD Poland Mines, Pennsylvania	1	Pulverized Coal Fired Boiler 966 MMBTU/hr 80 MW Cogen	No Controls Feasible	not given	Primary = 0.01 lb/MMBTU	Secondary = 42.3 TPY.	Not Provided	8/8/1995 No. 30-306-001

DEQ/AQD 000267

TABLE E-2
NSR RACT/BACT/LAER Clearinghouse Database
BACT-PSD Sources for VOC
Coal Fired PC Boilers

RBLC ID	Company Name and Location	# of Units	Unit and Size	Control Technology	Control Efficiency	Emission Limit		Averaging Period	Permit Date and Permit No.
NJ-0019	Crown/Vista Energy Project (CVEP) West Deptford, New Jersey	2	Pulverized Coal Fired Boilers 1789 MMBTU/hr each 181 MW each	Good Combustion Practice	not given	Primary = .0031 lb/MMBTU	Secondary = 4.5 ppmvd @ 7%O_2	Not Provided	10/1/1993 No. 01-92-0857 Methane
VA-0213	SEI Birchwood King George, Virginia SIC Code: 4931	1	Pulverized Coal Fired Boiler 2200 MMBTU/hr	Combustion Technology	not given	Primary = 22 lb/hr	Secondary = 96.4 TPY	Not Provided	8/23/1993 No.40809
WY-0046	Black Hills Power and Light Company Neil Simpson Plant Gillette, Wyoming	1	Pulverized Coal Fired Boiler 80 MW	Combustion Control	not given	Primary = 0.015 lb/MMBTU	Secondary = 15.0 lb/hr	Not Provided	4/14/1993 No. CT-1028
MI-0228	INDELK Energy Services of Otsego Michigan	1	Coal Fired Boiler 778 MMBTU/HR	Combustion Control	not given	0.01	lb/MMBTU	Not Provided	3/16/1993 No. 143-90
NC-0057	Roanoke Valley Project II Weldon Township, North Carolina	1	Pulverized Coal Fired Boiler 517 MMBTU/hr	Combustion Technology	not given	0.03	lb/MMBTU	Not Provided	11/20/1992 No. 6964R2
SC-0027	South Carolina Electric and Gas Company Cope, South Carolina	3	Pulverized Coal Fired Boiler Units 1, 2 and 3 385 MW each	Combustion Efficiency	not given	0.01	lb/MMBTU	Not Provided	7/15/1992 No. 1860-0044
FL-0044	Orlando Utilities Commission Stanton Energy Center, Unit 2 Orlando, Florida	1	Pulverized Coal Fired Boiler 4286 MMBTU/HR	Combustion Control	not given	0.015	lb/MMBTU	Not Provided	12/23/1991
NJ-0015	Keystone Cogeneration Systems, Inc. New Jersey	1	Coal Fired Boiler 2116 MMBTU/hr	Advanced Combustion Control	not given	0.0036	lb/MMBTU	Not Provided	9/6/1991 No.01-89-3983
VA-0181	Old Dominion Electric Cooperative Clover, Virginia	1	Coal Fired Boiler 4085 MMBTU/hr (≈ 400 MW)	Boiler Design	not given	0.01	lb/MMBTU	Not Provided	4/29/1991 No. 30867
NC-0054	Roanoke Valley Project Weldon, North Carolina	1	Pulverized Coal Fired Boiler 1700 MMBTU/HR	Combustion Control	not given	0.03	lb/MMBTU	Not Provided	1/24/1991 No. 6964
NJ-0014	Chambers Cogeneration Limited Partnership Carneys Point, New Jersey	2	Pulverized Coal Fired Boiler 1389 MMBTU/hr each	Advanced Combustion Control	not given	0.0036	lb/MMBTU	Not Provided	12/26/1990 No. 01-89-3086
SC-0028	Santee Cooper Public Service Authority Moncks Corner, South Carolina	1	Pulverized Coal Fired Boiler Cross Unit No. 1 5200 MMBTU/hr (500 MW)	Combustion Efficiency	not given	0.012	lb/MMBTU	Not Provided	11/28/1990 No. 0420-0030
VA-0171	Mecklenburg Cogeneration Limited Mecklenburg, Virginia	4	Pulverized Coal Fired Boiler 834.5 MMBTU/hr each	Good Combustion Practices	not given	Primary = 0.0027 lb/MMBTU	Secondary = 2.3 lb/hr	Not Provided	5/9/1990 No. 30861

Notes:

TABLE E-3
NSR RACT/BACT/LAER Clearinghouse Database
BACT-PSD Sources for PM
Coal Fired PC Boilers

RBLC ID	Company Name and Location	# of Units	Unit and Size	Control Technology	Control Efficiency	Emission Limit		Averaging Period	Permit Date and Permit No.
SC-0104	Santee Cooper Santee Cooper Cross Generation Station South Carolina	2	Coal Fired Boiler 5700 MMBTU/HR	ESP	not given	0.015	lb/MMBTU	Not Provided	02/05/2004 No. 0420-0030-CI
TX-0298	Reliant Energy Inc WA Parish Electric Generating Station Texas	2	Coal Fired Boiler 7400 MMBTU/HR	Combustion Controls	not given	0.088	lb/MMBTU Each Unit	Not Provided	10/15/2003 No. PSD-TX-901
TX-0298	Reliant Energy Inc WA Parish Electric Generating Station Texas	1	Coal Fired Boiler 6700 MMBTU/HR	Combustion Controls	not given	0.085	lb/MMBTU	Not Provided	10/15/2003 No. PSD-TX-33M1
IA-0067	Mid American Energy Company Council Bluffs Energy Council Iowa	1	Pulverized Coal Fired Boiler 7675 MMBTU/HR	Baghouse	99.70%	0.027	lb/MMBTU	Not Provided	6/17/2003 No. 02-528
KY-0084	Thoroughbred Generating Company, LLC Thoroughbred Generating Station Kentucky	2	Coal Fired Boiler 7446 MMBTU/HR	ESP and WESP	99%	0.0180	lb/MMBTU	3-hour average	10/11/2002 No. V-02-001
WY-0057	Black Hills Corporation Wygen Wyoming	1	Pulverized Coal Fired Boiler 500 MW	Fabric Filter	not given	0.012	lb/MMBTU	Not Provided	9/25/2002 No. CT-3030
WY-0039	Two Elk Generation Partners, LTD Wright, Wyoming	1	Pulverized Coal Fired Boiler 250 MW	Fabric Filter	99.50%	0.02	lb/MMBTU	Not Provided	2/27/1998 No. CT-1352
WY-0047	ENCOAL Corporation North Rochelle Facility 15 miles SE Wright, Wyoming	1	Pulverized Coal Fired Boiler 3960 MMBTU/HR 240 MW	Fabric Filter	99%	0.02	lb/MMBTU	Not Provided	10/10/1997 No. CT-1324
WY-0048	Black Hills Power and Light Company Wygen Plant Gillette, Wyoming	1	Pulverized Coal Fired Boiler 80 MW	Electrostatic Precipitator	99%.	0.02	lb/MMBTU	Not Provided	9/6/1996 No. CT-1236
NJ-0019	Crown/Vista Energy Project (CVEP) West Deptford, NJ	2	Pulverized Coal Fired Boilers 1789 MMBTU/hr each 181 MW each	Fabric Filters	99.9%	Primary = 32.2 lb/hr	Secondary = 0.018 lb/MMBTU	Not Provided	10/1/1993 No. 01-92-0857
VA-0213	SEI Birchwood King George, VA SIC Code: 4931	1	Pulverized Coal Fired Boiler 2200 MMBTU/hr	Fabric Filter	99.9%	Primary = 44 lb/hr	Secondary = 192.7 TPY	Not Provided	8/23/1993 No.40809
WY-0046	Black Hills Power and Light Company Neil Simpson Plant Gillette, Wyoming	1	Pulverized Coal Fired Boiler 80 MW	Electrostatic Precipitator	99%	Primary = .02 lb/MMBTU	Secondary = 20.0 lb/hr	Not Provided	4/14/1993 No. CT-1028
MI-0228	INDELK Energy Services of Otsego Michigan	1	Coal Fired Boiler 778 MMBTU/HR	Fabric Filter	99.9%	0.03	lb/MMBTU	Not Provided	3/16/1993 No. 143-90

TABLE E-3
NSR RACT/BACT/LAER Clearinghouse Database
BACT-PSD Sources for PM
Coal Fired PC Boilers

RBLC ID	Company Name and Location	# of Units	Unit and Size	Control Technology	Control Efficiency	Emission Limit		Averaging Period	Permit Date and Permit No.
NC-0057	Roanoke Valley Project II Weldon Township, NC	1	Pulverized Coal Fired Boiler 517 MMBTU/hr	Fabric Filter	99.75%	0.02	lb/MMBTU	Not Provided	11/20/1992 No. 6964R2
SC-0027	South Carolina Electric and Gas Company Cope, South Carolina	3	Pulverized Coal Fired Boiler 385 MW each	Fabric Filters	99.5%	0.02	lb/MMBTU	Not Provided	7/15/1992 No. 1860-0044
FL-0044	Orlando Utilities Commission Stanton Energy Center, Unit 2 Orlando, Florida	1	Pulverized Coal Fired Boiler 4286 MMBTU/HR	Electrostatic Precipitator	not given	0.02	lb/MMBTU	Not Provided	12/23/1991
VA-0181	Old Dominion Electric Cooperative Clover, Virginia	1	Coal Fired Boiler 4085 MMBTU/hr (400 MW)	Fabric Filter	99.9%	0.02	lb/MMBTU	Not Provided	4/29/1991 No. 30867
NC-0054	Roanoke Valley Project Weldon, North Carolina	1	Pulverized Coal Fired Boiler 1700 MMBTU/HR	Fabric Filter	99%	0.02	lb/MMBTU	Not Provided	1/24/1991 No. 6964
SC-0028	Santee Cooper Public Service Authority Moncks Corner, South Carolina	1	Pulverized Coal Fired Boiler Cross Unit No. 1 5200 MMBTU/hr (500 MW)	Electrostatic Precipitator	99.5%	0.03	lb/MMBTU[1]	Not Provided	11/28/1990 No. 0420-0030
VA-0171	Mecklenburg Cogeneration Limited, Mecklenburg, VA	4	Pulverized Coal Fired Boiler 834.5 MMBTU/hr each	Fabric Filters	99.9%	Primary = .02 lb/MMBTU	Secondary = 16.7 lb/hr	Not Provided	5/9/1990 No. 30861

Notes:

DEQ/AQD 000270

TABLE E-4
NSR RACT/BACT/LAER Clearinghouse Database
BACT-PSD Sources for PM_{10}
Coal Fired PC Boilers

RBLC ID	Company Name and Location	# of Units	Unit and Size	Control Technology	Control Efficiency	Emission Limit		Averaging Period	Permit Date and Permit No.
NV-0036	Newmont Nevada Energy Investment, Inc. TS Power Plant Nevada	1	Coal Fired Boiler 2030 MMBTU/HR	Fabric Filter	not given	0.038	lb/MMBTU	24-hour	5/05/2005 No. AP4911-1349
SC-0104	Santee Cooper Santee Cooper Cross Generation Station South Carolina	2	Coal Fired Boiler 5700 MMBTU/HR	ESP	not given	0.018	lb/MMBTU	Not Provided	02/05/2004 No. 0420-0030-CI
AR-0074	Plum Point Associates, LLC Plum Point Energy Arkansas	1	Coal Fired Boiler 800 MW	Baghouse	not given	0.018	lb/MMBTU	Not Provided	8/20/2003 No. 1995-AOP-R0
MT-0022	Bull Mountain Development Company Bull Mountain, No. 1, LLC - Roundup Power Project	2	Pulverized Coal Fired Boiler 390 MW	Fabric Filters	99.82%	Primary = 60.2 lb/hr	Secondary = 0.015 lb/MMBTU	Not Provided	7/21/2003 No. 3182-00
IA-0067	Mid American Energy Company Council Bluffs Energy Council Iowa	1	Pulverized Coal Fired Boiler 7675 MMBTU/HR	Baghouse	98.20%	0.025	lb/MMBTU	Not Provided	6/17/2003 No. 02-528
TX-0358	Reliant Energy, Inc. Washington Parish Electric Generating Station Texas	2	Coal Fired Boiler 6750 MMBTU/HR	not given	not given	Primary = 657 lb/hr	Secondary = 2878 tons/yr	Not Provided	10/15/2002 PSD-TX-33 M1
TX-0358	Reliant Energy, Inc. Washington Parish Electric Generating Station Texas	1	Coal Fired Boiler 6700 MMBTU/HR	Combustion Control	not given	Primary = 573 lb/hr	Secondary = 2509 tons/yr	Not Provided	10/15/2002 PSD-TX-33 M1
MO-0050	Kansas City Power & Light Co. Hawthorn Station Kansas City, Missouri	1	Coal Fired Boiler 384 TPH	Fabric Filter	not given	0.018	lb/MMBTU	Not Provided	8/17/1999 No. 888
MT-0027	Rocky Mountain Power, Inc. Hardin Generator Project Montana	1	Pulverized Coal Fired Boiler 1304 MMBTU/HR	Multicyclone used in conjunction with wet scrubber	not given	0.015	lb/MMBTU	Not Provided	6/11/2002 No. 3185-00
FL-0178	JEA Northside Generating Station Jacksonville, Florida	1	Coal Fired Boiler 2764 MMBTU/hr	Fabric Filter or Electrostatic Precipitator	not given	0.011	lb/MMBTU	3-hour average	7/14/1999 No.PSD-FL-265
UT-0053	Deseret Generation and Transmission Company Near Bonanza, Utah	1	Coal Fired Boiler 500 MW	Fabric Filter	99.8%	0.0286	lb/MMBTU[1]	Not Provided	3/16/1998 No. DAQE-186-98
PA-0133	Mon Valley Energy LTD Poland Mines, Pennsylvania	1	Pulverized Coal Fired Boiler (Unit 2) 966 MMBTU/hr (97 MW)	Fabric Filter	99.95%	Primary = 0.15 lb/MMBTU	Secondary = 63.5 TPY	Not Provided	8/8/1995 No. 30-306-001
UT-0060	Desert Generation and Transmission Co. Utah	1	Coal Fired Boiler 4381 MMBTU/hr	Fabric Filter	not given	0.03	lb/MMBTU	Not Provided	6/14/1995 No.DAQE-523-95

TABLE E-4
NSR RACT/BACT/LAER Clearinghouse Database
BACT-PSD Sources for PM_{10}
Coal Fired PC Boilers

RBLC ID	Company Name and Location	# of Units	Unit and Size	Control Technology	Control Efficiency	Emission Limit		Averaging Period	Permit Date and Permit No.
NJ-0019	Crown/Vista Energy Project (CVEP) West Deptford, New Jersey	2	Pulverized Coal Fired Boilers 1769 MMBTU/hr each 181 MW each	Fabric Filters	99.9%	Primary = 32.2 lb/hr	Secondary = 0.018 lb/MMBTU	Not Provided	10/1/1993 No. 01-92-0857
VA-0213	SEI Birchwood King George, Virginia SIC Code: 4931	1	Pulverized Coal Fired Boiler 2200 MMBTU/hr	Fabric Filter	99.9%	Primary = 39.6 lb/hr	Secondary = 173.5 TPY	Not Provided	8/23/1993 No.40809
NC-0057	Roanoke Valley Project II Weldon Township, North Carolina	1	Pulverized Coal Fired Boiler 517 MMBTU/hr	Fabric Filter	99.75%	0.018	lb/MMBTU	Not Provided	11/20/1992 No. 6964R2
SC-0027	South Carolina Electric and Gas Company Cope, South Carolina	3	Pulverized Coal Fired Boiler 385 MW each	Fabric Filters	99.5%	0.018	lb/MMBTU	Not Provided	7/15/1992 No. 1860-0044
FL-0044	Orlando Utilities Commission Stanton Energy Center, Unit 2 Orlando, Florida	1	Pulverized Coal Fired Boiler 4286 MMBTU/HR	Electrostatic Precipitator	not given	0.02	lb/MMBTU	Not Provided	12/23/1991
NJ-0015	Keystone Cogeneration Systems, Inc. New Jersey	1	Coal Fired Utility Boiler 2116 MMBTU/hr	Fabric Filter	99.9%	0.018	lb/MMBTU	Not Provided	9/6/1991 No.01-89-3983
VA-0181	Old Dominion Electric Cooperative Clover, Virginia	1	Coal Fired Boiler 4085 MMBTU/hr (400 MW)	Fabric Filter	99.9%	0.018	lb/MMBTU	Not Provided	4/29/1991 No. 30867
NC-0054	Roanoke Valley Project Weldon, North Carolina	1	Pulverized Coal Fired Boiler 1700 MMBTU/HR	Fabric Filter	99%	0.018	lb/MMBTU	Not Provided	1/24/1991 No. 6964
NJ-0014	Chambers Cogeneration Limited Partnership Carneys Point, New Jersey	2	Pulverized Coal Fired Boiler 1389 MMBTU/hr each	Fabric Filters	99.9%	0.018	lb/MMBTU	Not Provided	12/26/1990 No. 01-89-3086
SC-0028	Santee Cooper Public Service Authority Moncks Corner, South Carolina	1	Pulverized Coal Fired Boiler Cross Unit No. 1 5200 MMBTU/hr (500 MW)	Electrostatic Precipitator	99.5%	0.023	lb/MMBTU	Not Provided	11/28/1990 No. 0420-0030
VA-0171	Mecklenburg Cogeneration Limited Mecklenburg, Virginia	4	Pulverized Coal Fired Boiler 834.5 MMBTU/hr each	Fabric Filters	99.9%	Primary = 0.018 lb/MMBTU	Secondary = 15.0 lb/hr	Not Provided	5/9/1990 No. 30861

Notes:

NSR RACT/BACT/LAER Clearinghouse database (http://www.epa.gov/ttn/catc) was queried for the following:

DEQ/AQD 000272

TABLE E-5
NSR RACT/BACT/LAER Clearinghouse Database
BACT-PSD Sources for Lead
Coal Fired PC Boilers

RBLC ID	Company Name and Location	# of Units	Unit and Size	Control Technology	Control Efficiency	Emission Limit		Averaging Period	Permit Date and Permit No.
SC-0104	Santee Cooper Santee Cooper Cross Generation Station	2	Coal Fired Boiler 5700 MMBTU/HR	ESP	99.75%	1.69E-05	lb/MMBTU	Not Provided	02/05/2004 No. 0420-0030-CI
AR-0074	Plum Point Associates, LLC Plum Point Energy Arkansas	1	Coal Fired Boiler 800 MW	Fabric Filter	not given	2.56E-05	lb/MMBTU	Not Provided	8/20/2003 No. 1995-AOP-R0
IA-0067	Mid American Energy Company Council Bluffs Energy Council Iowa	1	Pulverized Coal Fired Boiler 7675 MMBTU/HR	Baghouse	99.00%	2.60E-05	lb/MMBTU	Not Provided	6/17/2003 No. 02-528
NJ-0019	Crown/Vista Energy Project (CVEP) West Deptford, New Jersey	2	Pulverized Coal Fired Boilers 1789 MMBTU/hr each 181 MW each	Spray Dryer Absorber and Fabric Filter	93.0%	0.03	lb/hr	Not Provided	10/1/1993 No. 01-92-0857
VA-0213	SEI Birchwood, Inc. King George, Virginia	1	Pulverized Coal Fired Boiler 2,200 MMBTU/HR	Lime Spray Dryer Absorber and Fabric Filter	95.0%	Primary = 0.2 lb/hr	Secondary = 0.9 TPY	Not Provided	8/23/1993 No. 40809
VA-0161	Old Dominion Electric Cooperative Clover, Virginia	1	Coal Fired Boiler 4085 MMBTU/hr (400 MW)	FGD and Fabric Filter	99.9%	Primary = 0.00042 lb/mmbtu	Secondary = 7.5 TPY	Not Provided	4/29/1991 No. 30867
SC-0028	Santee Cooper Public Service Authority Moncks Corner, South Carolina	1	Pulverized Coal Fired Boiler Cross Unit No. 1 5200 MMBTU/hr (500 MW)	Limestone FGD and Electrostatic Precipitator	75.0%	0.00033	lb/MMBTU	Not Provided	11/28/1990 No. 0420-0030

Notes:

DEQ/AQD 000273

TABLE E-6
NSR RACT/BACT/LAER Clearinghouse Database
BACT-PSD Sources for Fluorides
Coal Fired PC Boilers

RBLC ID	Company Name and Location	# of Units	Unit and Size	Control Technology	Control Efficiency	Emission Limit		Averaging Period	Permit Date and Permit No.
NV-0036	Newmont Nevada Energy Investment, Inc. TS Power Plant	1	Coal Fired Boiler 2030 MMBTU/HR	Dry Spray Scrubber and Fabric Filter	not given	4.88	tons/yr	annual	5/05/2005 No. AP4911-1349
SC-0104	Santee Cooper Santee Cooper Cross Generation Station	2	Coal Fired Boiler 5700 MMBTU/HR	Wet FGD	95.00%	3.00E-04	lb/MMBTU	Not Provided	02/05/2004 No. 0420-0030-CI
AR-0074	Plum Point Associates, LLC Plum Point Energy Arkansas	1	Coal Fired Boiler 800 MW	Dry FGD/Fabric Filter	90	4.00E-04	lb/MMBTU	Not Provided	8/20/2003 No. 1995-AOP-R0
IA-0067	Mid American Energy Company Council Bluffs Energy Council Iowa	1	Pulverized Coal Fired Boiler 7675 MMBTU/HR	Dry FGD	95.00%	9.00E-04	lb/MMBTU	Not Provided	6/17/2003 No. 02-528
KY-0084	Thoroughbred Generating Company, LLC Thoroughbred Generating Station Kentucky	2	Coal Fired Boiler 7446 MMBTU/HR	Wet FGD, WESP, and Boiler Design	not given	1.59E-04	lb/MMBTU	Not Provided	10/11/2002 No. V-02-001
NJ-0019	Crown/Vista Energy Project (CVEP) West Deptford, New Jersey	2	Pulverized Coal Fired Boilers 1789 MMBTU/hr each 181 MW each	Spray Dryer Absorber and Fabric Filter	93%	4.31	lb/hr	Not Provided	10/1/1993 No. 01-92-0857
VA-0213	SEI Birchwood, Inc. King George, Virginia	1	Pulverized Coal Fired Boiler 2,200 MMBTU/HR	Lime Spray Dryer Absorber and Fabric Filter	94%*	3.6	lb/hr	Not Provided	8/23/1993 No. 40809
SC-0027	South Carolina Electric and Gas Company Cope, South Carolina	3	Pulverized Coal Fired Boiler 385 MW each	Spray Dryer Absorber and Fabric Filter	93%*	0.01	lb/MMBTU	Not Provided	7/15/1992 No. 1860-0044
NC-0054	Roanoke Valley Project Weldon, North Carolina	1	Pulverized Coal Fired Boiler 1700 MMBTU/HR	Lime Spray Dryer Absorber and Fabric Filter	90%	0.000538	lb/MMBTU	Not Provided	1/24/1991 No. 6964
SC-0028	Santee Cooper Public Service Authority Moncks Corner, South Carolina	1	Pulverized Coal Fired Boiler Cross Unit No. 1 5200 MMBTU/hr (500 MW)	Limestone FGD and Electrostatic Precipitator	82%	0.01	lb/MMBTU	Not Provided	11/28/1990 No. 0420-0030
VA-0165	Hadson Power II Southampton, Virginia	2	Coal Fired Boiler 379 MMBTU/HR each	Spray Dryer Absorber and Fabric Filter	92%*	9.7	lb/day	Not Provided	1/1/1990 No. 61093

Notes:

DEQ/AQD 000274

TABLE E-7
NSR RACT/BACT/LAER Clearinghouse Database
BACT-PSD Sources for SO_2
Coal Fired PC Boilers

RBLC ID	Company Name and Location	# of Units	Unit and Size	Control Technology	Control Efficiency	Emission Limit		Averaging Period	Permit Date and Permit No.
NV-0036	Newmont Nevada Energy Investment, Inc. TS Power Plant Nevada	1	Coal Fired Boiler 2030 MMBTU/HR	Lime Spray Dryer Scrubber	not given	0.09 0.065	lb/MMBTU lb/MMBTU	24-hour (Coal S >= 0.45%) - 95% removal eff, 30-day period 24-hour (Coal S <0.45%) - 91% removal eff, 30-day period	5/05/2005 No. AP4911-1349
NE-0018	Hastings Utilities Whelan Energy Center Nebraska	1	Coal Fired Boiler 2210 MMBTU/HR	Spray Dryer Adsorber	not given	0.12 1.1	lb/MMBTU lb/MMBTU	30-day average 3-hr Average	3/30/2004 No. 58048
AR-0074	Plum Point Associates, LLC Plum Point Energy Arkansas	1	Coal Fired Boiler 800 MW	Dry Flue Gas Desulfurization	not given	0.16	lb/MMBTU	Not Provided	8/20/2003 No. 1995-AOP-R0
MT-0022	Bull Mountain Development Company Bull Mountain, No. 1, LLC - Roundup Power Project Montana	2	Pulverized Coal Fired Boiler 390 MW	Dry Flue Gas Desulfurization	94.5%	Primary = 481.6 lb/hr (24-hr rolling average)	Secondary = 0.12 lb/MMBTU (24-hr rolling average)		7/21/2003 No. 3182-00
IA-0067	Mid American Energy Company Council Bluffs Energy Council Iowa	1	Pulverized Coal Fired Boiler 7675 MMBTU/HR	Lime Spray Dryer Flue Gas Desulfurization	92.00%	Primary =0.1 lb/MMBTU (30-day rolling average)	Secondary = 3362 tons/yr	Not Provided	6/17/2003 No. 02-528
KY-0084	Thoroughbred Generating Company, LLC Thoroughbred Generating Station Kentucky	2	Coal Fired Boiler 7446 MMBTU/HR	Wet FGD, WESP, and Boiler Design	not given	Primary = 0.167 lb/MMBTU (30-day rolling average)	Secondary = 0.41 lb/MMBTU (24-hr average)		10/11/2002 No. V-02-001
WY-0057	Black Hills Corporation Wygen Wyoming	1	Pulverized Coal Fired Boiler 500 MW	Semi-dry Lime Spray Dryer Absorber	not given	Primary = 0.1 lb/MMBTU (30-day rolling average)	Secondary = 0.1 lb/MMBTU (3-hr block)		9/25/2002 No. CT-3030
MT-0027	Rocky Mountain Power, Inc. Hardin Generator Project Montana	1	Pulverized Coal Fired Boiler 1304 MMBTU/HR	Wet Venturi Scrubber	not given	0.14	lb/MMBTU 30-day average		6/11/2002 No. 3185-00
MO-0050	Kansas City Power & Light Co. Hawthorn Station Kansas City, Missouri	1	Coal Fired Boiler 384 TPH	Dry FGD and Low Sulfur Coal	not given	0.12	lb/MMBTU 30-day average	Not Provided	8/17/1999 No. 888
FL-0178	JEA Northside Generating Station Jacksonville, Florida	1	Coal Fired Boiler 2764 MMBTU/hr	Circulating Fluidized Bed Scrubber or Spray Dryer Absorber	not given	0.20	lb/MMBTU	24-hour average	7/14/1999 No.PSD-FL-265
PA-0162	Edison Mission Energy Homer City, Pennsylvania	1	Pulverized Coal Fired Boiler Unit 3 6600 MMBTU/hr	Wet Limestone FGD	92%	0.40	lb/MMBTU	Not Provided	5/25/1999 No. 32-0055C
UT-0053	Deseret Generation and Transmission Company Near Bonanza, Utah	1	Coal Fired Boiler 500 MW	Wet Limestone FGD	90%	0.0976	lb/MMBTU	12-month average	3/16/1998 No. DAQE-186-98

DEQ/AQD 000275

TABLE E-7
NSR RACT/BACT/LAER Clearinghouse Database
BACT-PSD Sources for SO_2
Coal Fired PC Boilers

RBLC ID	Company Name and Location	# of Units	Unit and Size	Control Technology	Control Efficiency	Emission Limit		Averaging Period	Permit Date and Permit No.
WY-0039	Two Elk Generation Partners, LTD Wright, Wyoming	1	Pulverized Coal Fired Boiler 250 MW	Lime Spray Dryer	91%	0.20	lb/MMBTU	2-hour fixed	2/27/1998 No. CT-1352
WY-0047	ENCOAL Corporation North Rochelle Facility 15 miles SE Wright, Wyoming	1	Pulverized Coal Fired Boiler 3960 MMBTU/HR 240 MW	Lime Spray Dryer	73%	0.20	lb/MMBTU	2-hour fixed	10/10/1997 No. CT-1324
WY-0048	Black Hills Power and Light Company Wygen Plant Gillette, Wyoming	1	Pulverized Coal Fired Boiler 80 MW	Circulating Dry Scrubber	80% **	0.20	lb/MMBTU	2-hour rolling	9/6/1996 No. CT-1236
PA-0133	Mon Valley Energy LTD Poland Mines, Pennsylvania	1	Pulverized Coal Fired Boiler 966 MMBTU/hr 80 MW Cogen	Spray Dryer Absorber	92%	0.25	lb/MMBTU	Not Provided	8/8/1995 No. 30-306-001
UT-0060	Desert Generation and Transmission Co. Utah	1	Coal Fired Boiler 4381 MMBTU/hr	Scrubber	90.0%	Primary = 0.1 lb/MMBTU (rolling year average)	Secondary = 0.15 lb/MMBTU (rolling month average)	Not Provided	6/14/1995 No.DAQE-523-95
NJ-0019	Crown/Vista Energy Project (CVEP) West Deptford, New Jersey	2	Pulverized Coal Fired Boilers 1789 MMBTU/hr each 181 MW each	Spray Dryer Absorber	93%	0.18	lb/MMBTU	Not Provided	10/1/1993 No. 01-92-0857
VA-0213	SEI Birchwood King George, Virginia SIC Code: 4931	1	Pulverized Coal Fired Boiler 2200 MMBTU/hr	Lime Spray Dryer	94%	220	lb/hr	Not Provided	8/23/1993 No.40809
WY-0046	Black Hills Power and Light Company Neil Simpson Plant Gillette, Wyoming	1	Pulverized Coal Fired Boiler Steam Electric Power 80 MW	Circulating Dry Scrubber	80% **	0.20	lb/MMBTU	2-hour rolling	4/14/1993 No. CT-1028
MI-0228	INDELK Energy Services of Olsego Michigan	1	Coal Fired Boiler 778 MMBTU/HR	Dry Scrubber	90%	0.32	lb/MMBTU	Not Provided	3/16/1993 No. 143-90
NC-0057	Roanoke Valley Project II Weldon Township, North Carolina	1	Pulverized Coal Fired Boiler 517 MMBTU/hr	Dry Lime Scrubber	93%	0.187	lb/MMBTU	Not Provided	11/20/1992 No. 6964R2
SC-0027	South Carolina Electric and Gas Company Cope, South Carolina	2	Pulverized Coal Fired Boiler Units 2 and 3 385 MW each	Spray Dryer Absorber	93%	0.17	lb/MMBTU	Not Provided	7/15/1992 No. 1860-0044
SC-0027	South Carolina Electric and Gas Company Cope, South Carolina	1	Pulverized Coal Fired Boiler Unit 1 385 MW each	Spray Dryer Absorber	93%	0.25	lb/MMBTU	Not Provided	7/15/1992 No. 1860-0044
FL-0044	Orlando Utilities Commission Stanton Energy Center, Unit 2 Orlando, Florida	1	Pulverized Coal Fired Boiler 4286 MMBTU/HR	Wet Lime FGD	92%	0.25	lb/MMBTU	Not Provided	12/23/1991
NJ-0015	Keystone Cogeneration Systems, Inc. New Jersey	1	Pulverized Coal Fired Boiler 2116 MMBTU/hr	Spray Dryer Absorber	93%	0.16	lb/MMBTU	Not Provided	9/6/1991 No.01-89-3983

TABLE E-7
NSR RACT/BACT/LAER Clearinghouse Database
BACT-PSD Sources for SO_2
Coal Fired PC Boilers

RBLC ID	Company Name and Location	# of Units	Unit and Size	Control Technology	Control Efficiency	Emission Limit		Averaging Period	Permit Date and Permit No.
VA-0181	Old Dominion Electric Cooperative Clover, Virginia	1	Coal Fired Boiler 4085 MMBTU/hr (≈ 400 MW)	FGD and 1.0-1.3% Bituminous Sulfur Coal	94%	0.10	lb/MMBTU	Not Provided	4/29/1991 No. 30867
NC-0054	Roanoke Valley Project Weldon, North Carolina	1	Pulverized Coal Fired Boiler 1700 MMBTU/HR	Dry Lime FGD	92%	0.213	lb/MMBTU	Not Provided	1/24/1991 No. 6964
NJ-0014	Chambers Cogeneration Limited Partnership Carneys Point, New Jersey	2	Pulverized Coal Fired Boiler 1389 MMBTU/hr each	Spray Dryer Absorber	93%	0.22	lb/MMBTU	Not Provided	12/26/1990 No. 01-89-3086
SC-0028	Santee Cooper Public Service Authority Moncks Corner, South Carolina	1	Pulverized Coal Fired Boiler Cross Unit No. 1 5200 MMBTU/hr (500 MW)	Promoted Limestone FGD	95%	0.34	lb/MMBTU	Not Provided	11/28/1990 No. 0420-0030
VA-0171	Mecklenburg Cogeneration Limited Mecklenburg, Virginia	4	Pulverized Coal Fired Boiler 834.5 MMBTU/hr each	Spray Dryer Absorber	92%	0.172	lb/MMBTU	Not Provided	5/9/1990 No. 30861

Notes:

DEQ/AQD 000277

TABLE E-8
NSR RACT/BACT/LAER Clearinghouse Database
BACT-PSD Sources for NO_x
Coal Fired PC Boilers

RBLC ID	Company Name and Location	# of Units	Unit and Size	Control Technology	Control Efficiency	Emission Limit		Averaging Period	Permit Date and Permit No.
NV-0036	Newmont Nevada Energy Investment, Inc. TS Power Plant Nevada	1	Coal Fired Boiler 2030 MMBTU/HR	SCR and Low NOx Burners	not given	0.067	lb/MMBTU	24-hour rolling	5/05/2005 No. AP4911-1349
NE-0018	Hastings Utilities Whelan Energy Center Nebraska	1	Coal Fired Boiler 2210 MMBTU/HR	SCR	not given	0.08	lb/MMBTU	30-day average	3/30/2004 No. 58048
AR-0074	Plum Point Associates, LLC Plum Point Energy Arkansas	1	Coal Fired Boiler 800 MW	Low-NOx Burners	not given	0.09	lb/MMBTU	Not Provided	8/20/2003 No. 1995-AOP-R0
MT-0022	Bull Mountain Development Company Bull Mountain, No. 1, LLC - Roundup Power Project Montana	2	Pulverized Coal Fired Boiler 390 MW	Low-NOx Burners, Overfire Air and SCR	90%	Primary = 280.9 lb/hr (24-hr rolling average)	Secondary = 0.07 lb/MMBTU (24-hr rolling average)		7/21/2003 No. 3182-00
IA-0067	Mid American Energy Company Council Bluffs Energy Council Iowa	1	Pulverized Coal Fired Boiler 7675 MMBTU/HR	Low-NOx Burners, Overfire Air and SCR	60.00%	Primary =0.07 lb/MMBTU (30-day rolling average)	Secondary = 2353 tons/yr	Not Provided	6/17/2003 No. 02-528
KY-0084	Thoroughbred Generating Company, LLC Thoroughbred Generating Station Kentucky	2	Coal Fired Boiler 7446 MMBTU/HR	LNBs, SCR, and Boiler Design	not given	0.08	lb/MMBTU	30-day rolling average	10/11/2002 No. V-02-001
WY-0057	Black Hills Corporation Wygen Wyoming	1	Pulverized Coal Fired Boiler 500 MW	Low-NOx Burners and SCR	not given	0.07	lb/MMBTU	30-day rolling average	9/25/2002 No. CT-3030
MT-0027	Rocky Mountain Power, Inc. Hardin Generator Project Montana	1	Pulverized Coal Fired Boiler 1304 MMBTU/HR	SCR	not given	0.09	lb/MMBTU	30-day rolling average	6/11/2002 No. 3185-00
PA-0183	AES Beaver Valley, Inc. Pennsylvania	1	Coal Fired Boiler 2155 MMBTU/HR	SNCR	not given	955.15	tons/yr	Not Provided	11/21/2001 No. PA-04-446C
FL-0003	Tampa Electric Company TECO-Big Bend Station Florida	1	Dry Bottom Tangentially Fired Boiler 4330 MMBTU/HR	Boiler Design and Operation	not given	Primary = 0.6 lb/MMBTU	Secondary = 2598 lb/hr	Not Provided	01/01/2001 No. PSD-FL-040
MO-0050	Kansas City Power & Light Co. Hawthorn Station Kansas City, Missouri	1	Coal Fired Boiler 384 TPH	SCR and Good Combustion	not given	0.08	lb/MMBTU	Not Provided	8/17/1999 No. 888
FL-0178	JEA Northside Generating Station Jacksonville, Florida	1	Coal Fired Boiler 2764 MMBTU/hr	SNCR	not given	0.09	lb/MMBTU	30-day rolling average	7/14/1999 No.PSD-FL-265
PA-0162	Edison Mission Energy Homer City, Pennsylvania	3	Pulverized Coal Fired Boiler Units 1 & 2 (5700 MMBTU/hr each) Unit 3 (6600 MMBTU/hr)	SCR	70%	0.15	lb/MMBTU	Not Provided	5/26/1999 No. 32-0065C
UT-0053	Deseret Generation and Transmission Company Near Bonanza, Utah	1	Coal Fired Boiler 500 MW	Boiler Design	99.6%	0.55	lb/MMBTU	30-day average	3/16/1998 No. DAQE-186-98
WY-0039	Two Elk Generation Partners, LTD Wright, Wyoming	1	Pulverized Coal Fired Boiler 250 MW	Low-NOx Burners, Overfire Air and SCR	75%	0.15	lb/MMBTU	30-day rolling average	2/27/1998 No. CT-1352

DEQ/AQD 000278

TABLE E-8
NSR RACT/BACT/LAER Clearinghouse Database
BACT-PSD Sources for NO_x
Coal Fired PC Boilers

RBLC ID	Company Name and Location	# of Units	Unit and Size	Control Technology	Control Efficiency	Emission Limit		Averaging Period	Permit Date and Permit No.
UT-0060	Desert Generation and Transmission Co. Utah	1	Coal Fired Boiler 4381 MMBTU/hr	Low NOX Burners	not given	0.55	lb/MMBTU	Not Provided	6/14/1995 No.DAQE-523-95
WY-0047	ENCOAL Corporation North Rochelle Facility 15 miles SE Wright, Wyoming	1	Pulverized Coal Fired Boiler 3960 MMBTU/HR 240 MW	Low NOx Burners with Flue Gas Recirculation	not given	0.16	lb/MMBTU	Not Provided	10/10/1997 No. CT-1324
WY-0048	Black Hills Power and Light Company Wygen Plant Gillette, Wyoming	1	Pulverized Coal Fired Boiler 80 MW	Low NOx Burners with Overfire Air	56%	0.22	lb/MMBTU	Not Provided	9/6/1996 No. CT-1236
PA-0133	Mon Valley Energy LTD Poland Mines, Pennsylvania	1	Pulverized Coal Fired Boiler 966 MMBTU/hr 80 MW Cogen	Low NOx Burners and SCR	50%	0.15	lb/MMBTU	Not Provided	8/8/1995 No. 30-306-001
NJ-0019	Crown/Vista Energy Project (CVEP) West Deptford, New Jersey	2	Pulverized Coal Fired Boilers 1789 MMBTU/hr each 181 MW each	Low NOx Burners and SCR	48%	0.17	lb/MMBTU	Not Provided	10/1/1993 No. 01-92-0857
VA-0213	SEI Birchwood King George, Virginia SIC Code: 4931	1	Pulverized Coal Fired Boiler 2200 MMBTU/hr	SCR	80%	330	lb/hr	Not Provided	8/23/1993 No.40809
WY-0046	Black Hills Power and Light Company Neil Simpson Plant Gillette, Wyoming	1	Pulverized Coal Fired Boiler Steam Electric Power 80 MW	Combustion Control	not given	0.23	lb/MMBTU	30-day rolling average	4/14/1993 No. CT-1028
MI-0228	INDELK Energy Services of Otsego Michigan	1	Coal Fired Boiler 778 MMBTU/HR	SNCR/Dry Control	50%	0.25	lb/MMBTU	Not Provided	3/16/1993 No. 143-90
NC-0057	Roanoke Valley Project II Weldon Township, North Carolina	1	Pulverized Coal Fired Boiler 517 MMBTU/hr	Low NOx Burners, Advanced Overfire Air and SNCR	not given	0.17	lb/MMBTU	Not Provided	11/20/1992 No. 6964R2
SC-0027	South Carolina Electric and Gas Company Cope, South Carolina	3	Pulverized Coal Fired Boiler Units 1, 2 and 3 385 MW each	Low NOx Burners with Overfire Air	not given	0.32	lb/MMBTU	Not Provided	7/15/1992 No. 1860-0044
FL-0044	Orlando Utilities Commission Stanton Energy Center, Unit 2 Orlando, Florida	1	Pulverized Coal Fired Boiler 4286 MMBTU/HR	Low NOx Burners and SCR	70%	0.17	lb/MMBTU	Not Provided	12/23/1991
NJ-0015	Keystone Cogeneration Systems, Inc. New Jersey	1	Pulverized Coal Fired Boiler 2116 MMBTU/hr	SNCR or SCR	37%	0.17	lb/MMBTU	Not Provided	9/6/1991 No.01-89-3983
VA-0181	Old Dominion Electric Cooperative Clover, Virginia	1	Coal Fired Boiler 4085 MMBTU/hr (≈ 400 MW)	Low NOx Burners and Advanced Overfire Air	50%	0.30	lb/MMBTU	Not Provided	4/29/1991 No. 30867
NC-0054	Roanoke Valley Project Weldon, North Carolina	1	Pulverized Coal Fired Boiler 1700 MMBTU/HR	Low NOx Burners and Advanced Overfire Air	not given	0.39	lb/MMBTU	Not Provided	1/24/1991 No. 6964

DEQ/AQD 000279

TABLE E-8
NSR RACT/BACT/LAER Clearinghouse Database
BACT-PSD Sources for NO_x
Coal Fired PC Boilers

RBLC ID	Company Name and Location	# of Units	Unit and Size	Control Technology	Control Efficiency	Emission Limit		Averaging Period	Permit Date and Permit No.
NJ-0014	Chambers Cogeneration Limited Partnership Carneys Point, New Jersey	2	Pulverized Coal Fired Boiler 1389 MMBTU/hr each	SCR	37%	0.17	lb/MMBTU	Not Provided	12/26/1990 No. 01-89-3086
SC-0028	Santee Cooper Public Service Authority Moncks Corner, South Carolina	1	Pulverized Coal Fired Boiler Cross Unit No. 1 5200 MMBTU/hr (500 MW)	Low NOx Burners	not given	0.39	lb/MMBTU	Not Provided	11/28/1990 No. 0420-0030
VA-0171	Mecklenburg Cogeneration Limited	4	Pulverized Coal Fired Boiler	Low NOx Burners and	45%	0.33	lb/MMBTU	Not Provided	5/9/1990

Notes:

DEQ/AQD 000280

TABLE E-9
NSR RACT/BACT/LAER Clearinghouse Database
BACT-PSD Sources for H_2SO_4
Coal Fired PC Boilers

RBLC ID	Company Name and Location	# of Units	Unit and Size	Control Technology	Control Efficiency	Emission Limit		Averaging Period	Permit Date and Permit No.
NV-0036	Newmont Nevada Energy Investment, Inc. TS Power Plant Nevada	1	Coal Fired Boiler 2030 MMBTU/HR	Dry Spray Scrubber and Fabric Filter	not given	9.03	tons/yr	annual	5/05/2005 No. AP4911-1349
AR-0074	Plum Point Associates, LLC Plum Point Energy Arkansas	1	Coal Fired Boiler 800 MW	Dry FGD/Fabric Filter	not given	0.0061	lb/MMBTU	Not Provided	8/20/2003 No. 1995-AOP-R0
MT-0022	Bull Mountain Development Company Bull Mountain, No. 1, LLC - Roundup Power Project Montana	2	Pulverized Coal Fired Boiler 390 MW	Dry FGD	90.00%	Primary = 25.7 lb/hr	Secondary = 0.0064 lb/MMBTU	Not Provided	7/21/2003 No. 3182-00
IA-0067	Mid American Energy Company Council Bluffs Energy Council Iowa	1	Pulverized Coal Fired Boiler 7675 MMBTU/HR	Dry FGD	not given	4.20E-03	lb/MMBTU	Not Provided	6/17/2003 No. 02-528
KY-0084	Thoroughbred Generating Company, LLC Thoroughbred Generating Station Kentucky	2	Coal Fired Boiler 7446 MMBTU/HR	Wet FGD, ESP, WESP, and Boiler Design	not given	4.97E-03	lb/MMBTU	Not Provided	10/11/2002 No. V-02-001
TX-0275	Reliant Energy Parish Unit 8 Thompson, Texas	1	Coal Fired Boiler 6700 MMBTU/hr Retrofit 590 MW to 650 MW	FGD/Fabric Filter	Not Listed	0.0015	lb/MMBTU	Not Provided	12/21/2000 No. PSD-TX-234
MO-0050	Kansas City Power & Light Co. Hawthorn Station Kansas City, Missouri	1	Coal Fired Boiler 384 TPH	Dry FGD and Low Sulfur Coal		No Limit			8/17/1999 No. 888
FL-0178	JEA Northside Generating Station Jacksonville, Florida	1	Coal Fired Boiler 2764 MMBTU/hr	Circulating Fluidized Bed Scrubber or Spray Dryer Absorber		No Limit			7/14/1999 No.PSD-FL-265
PA-0162	Edison Mission Energy Homer City, Pennsylvania	1	Pulverized Coal Fired Boiler Unit 3 6600 MMBTU/hr	Wet Limestone FGD		No Limit			5/25/1999 No. 32-0055C
UT-0053	Deseret Generation and Transmission Company Near Bonanza, Utah	1	Coal Fired Boiler 500 MW	Wet Limestone FGD		No Limit			3/16/1998 No. DAQE-186-98
WY-0039	Two Elk Generation Partners, LTD Wright, Wyoming	1	Pulverized Coal Fired Boiler 250 MW	Lime Spray Dryer		No Limit			2/27/1998 No. CT-1352
WY-0047	ENCOAL Corporation North Rochelle Facility 15 miles SE Wright, Wyoming	1	Pulverized Coal Fired Boiler 3960 MMBTU/HR 240 MW	Lime Spray Dryer		No Limit			10/10/1997 No. CT-1324
WY-0048	Black Hills Power and Light Company Wygen Plant Unit 1 Gillette, Wyoming	1	Pulverized Coal Fired Boiler 80 MW	Circulating Dry Scrubber		No Limit			9/6/1996 No. CT-1236
PA-0133	Mon Valley Energy LTD Poland Mines, Pennsylvania	1	Pulverized Coal Fired Boiler 966 MMBTU/hr 80 MW Cogen	Spray Dryer Absorber		No Limit			8/8/1995 No. 30-306-001

DEQ/AQD 000281

TABLE E-9
NSR RACT/BACT/LAER Clearinghouse Database
BACT-PSD Sources for H_2SO_4
Coal Fired PC Boilers

RBLC ID	Company Name and Location	# of Units	Unit and Size	Control Technology	Control Efficiency	Emission Limit		Averaging Period	Permit Date and Permit No.
NJ-0019	Crown/Vista Energy Project (CVEP) West Deptford, New Jersey	2	Pulverized Coal Fired Boilers 1789 MMBTU/hr each 181 MW each	Spray Dryer Absorber		No Limit			10/1/1993 No. 01-92-0857
VA-0213	SEI Birchwood King George, Virginia SIC Code: 4931	1	Pulverized Coal Fired Boiler 2200 MMBTU/hr	Lime Spray Dryer	Not Listed	4.8	lb/hr (6.4 tpy)	Not Provided	8/23/1993 No.40809
WY-0046	Black Hills Power and Light Company Neil Simpson Plant Gillette, Wyoming	1	Pulverized Coal Fired Boiler Steam Electric Power 80 MW	Circulating Dry Scrubber		No Limit			4/14/1993 No. CT-1028
MI-0228	INDELK Energy Services of Otsego Michigan	1	Coal Fired Boiler 778 MMBTU/HR	Dry Scrubber		No Limit			3/16/1993 No. 143-90
NC-0057	Roanoke Valley Project II Weldon Township, North Carolina	1	Pulverized Coal Fired Boiler 517 MMBTU/hr	Dry Lime Scrubber		No Limit			11/20/1992 No. 6964R2
SC-0027	South Carolina Electric and Gas Company Cope, South Carolina	2	Pulverized Coal Fired Boiler Units 2 and 3 385 MW each	Spray Dryer Absorber	Not Listed	0.011	lb/MMBTU	Not Provided	7/15/1992 No. 1860-0044
SC-0027	South Carolina Electric and Gas Company Cope, South Carolina	1	Pulverized Coal Fired Boiler Unit 1 385 MW each	Spray Dryer Absorber	Not Listed	0.011	lb/MMBTU	Not Provided	7/15/1992 No. 1860-0044
FL-0044	Orlando Utilities Commission Stanton Energy Center, Unit 2 Orlando, Florida	1	Pulverized Coal Fired Boiler 4286 MMBTU/HR	Wet Lime FGD		No Limit			12/23/1991
NJ-0015	Keystone Cogeneration Systems, Inc. New Jersey	1	Pulverized Coal Fired Boiler 2116 MMBTU/hr	Spray Dryer Absorber		No Limit			9/6/1991 No.01-89-3983
VA-0181	Old Dominion Electric Cooperative Clover, Virginia	1	Coal Fired Boiler 4085 MMBTU/hr (≈ 400 MW)	FGD and 1.0-1.3% Bituminous Sulfur Coal		No Limit			4/29/1991 No. 30867
NC-0054	Roanoke Valley Project Weldon, North Carolina	1	Pulverized Coal Fired Boiler 1700 MMBTU/HR	Dry Lime FGD		No Limit			1/24/1991 No. 6964
NJ-0038	Chambers Cogeneration Limited Partnership Carneys Point, New Jersey	2	Pulverized Coal Fired Boiler 1389 MMBTU/hr each	Spray Dryer Absorber	Not Listed	1.12	lb/hr (both units)	Not Provided	12/28/1990 No. 01-89-3086
SC-0028	Santee Cooper Public Service Authority Moncks Corner, South Carolina	1	Pulverized Coal Fired Boiler Cross Unit No. 1 5200 MMBTU/hr (500 MW)	Promoted Limestone FGD	50%	0.04	lb/MMBTU	Not Provided	11/28/1990 No. 0420-0030
VA-0171	Mecklenburg Cogeneration Limited Mecklenburg, Virginia	4	Pulverized Coal Fired Boiler 834.5 MMBTU/hr each	Spray Dryer Absorber		No Limit			5/9/1990 No. 30861

DEQ/AQD 000282

TABLE E-9
NSR RACT/BACT/LAER Clearinghouse Database
BACT-PSD Sources for H_2SO_4
Coal Fired PC Boilers

RBLC ID	Company Name and Location	# of Units	Unit and Size	Control Technology	Control Efficiency	Emission Limit		Averaging Period	Permit Date and Permit No.
VA-0165	Hadson Power II Southampton, Virginia	2	Coal Fired Boiler 379 MMBTU/HR each	Spray Dryer Absorber and Fabric Filter	Not Listed	149.2	lb/day	Not Provided	1/1/1990 No. 61093

Notes:

DEQ/AQD 000283

TABLE E-10
NSR RACT/BACT/LAER Clearinghouse Database
BACT-PSD Sources for Beryllium
Coal Fired PC Boilers

RBLC ID	Company Name and Location	# of Units	Unit and Size	Control Technology	Control Efficiency	Emission Limit		Averaging Period	Permit Date and Permit No.
SC-0104	Santee Cooper Santee Cooper Cross Generation Station South Carolina	2	Coal Fired Boiler 5700 MMBTU/HR	ESP	99.75	8.44E-07	lb/MMBTU	Not Provided	02/05/2004 No. 0420-0030-CI
TX-0298	Reliant Energy Inc WA Parish Electric Generating Station Texas	2	Coal Fired Boiler 7400 MMBTU/HR	not given	not given	Primary = 0.24 lb/hr	Secondary = 0.03 tons/yr	Not Provided	10/15/2003 No. PSD-TX-901
TX-0298	Reliant Energy Inc WA Parish Electric Generating Station Texas	1	Coal Fired Boiler 6700 MMBTU/HR	not given	not given	Primary = 0.21 lb/hr	Secondary = 0.03 tons/yr	Not Provided	10/15/2003 No. PSD-TX-902
TX-0358	Reliant Energy, Inc. Washington Parish Electric Generating Station Texas	2	Coal Fired Boiler 6750 MMBTU/HR	not given	not given	Primary = 0.24 lb/hr	Secondary = 0.03 tons/yr	Not Provided	10/15/2002 PSD-TX-33 M1
TX-0358	Reliant Energy, Inc. Washington Parish Electric Generating Station Texas	1	Coal Fired Boiler 6700 MMBTU/HR	not given	not given	Primary = 0.21 lb/hr	Secondary = 0.03 tons/yr	Not Provided	10/15/2002 PSD-TX-33 M1
KY-0084	Thoroughbred Generating Company, LLC Thoroughbred Generating Station Kentucky	2	Coal Fired Boiler 7446 MMBTU/HR	Wet FGD, WESP, and ESP	not given	9.44E-07	lb/MMBTU	Not Provided	10/11/2002 No. V-02-001

Notes:
NSR RACT/BACT/LAER Clearinghouse database (http://www.epa.gov/ttn/catc) was queried for the following:
- RBLC Determinations added during or after January 1995
- SIC Code: 4911
- Process Type Code: 11.110 - Coal Combustion

DEQ/AQD 000284

Appendix F
BACT Cost Analysis

Dry Fork Generating Station Unit 1
Dry Lime FGD SO2 Removal Calculation - PRB Coal

Average Coal Heating Value =	**8,045** Btu/lb	Provided by Basin Electric
Unit Capacity Factor =	**100** %	Provided by Basin Electric
Annual Heat Input (at 100% CF) =	33,296,760 MMBtu/year	3,801 MMBtu/hr x 8760 hours x 100%
Annual Coal Use (at 100% CF) =	2,069,407 tons/year	Calculated
Average Coal Sulfur Content =	**0.33** %	Provided by Basin Electric
Dry Lime FGD Design SO2 Collection Efficiency =	**87.8** %	Input
SO_2 emission rate before FGD =	0.82 lb/MMBtu	Calculated
SO_2 annual tons before FGD =	13,644 tons/year	Calculated
SO_2 emission rate after FGD =	0.10 lb/MMBtu	Calculated
SO_2 annual tons after FGD =	1,665 tons/year	Calculated
SO_2 annual tons removed by FGD =	11,980 tons/year	Calculated

Dry Fork Generating Station Unit 1
Dry Lime Flue Gas Desulfurization System
Cost Estimate - PRB Coal

Capital Cost Estimate

(1) PROCESS CAPITAL COSTS							
(a)	Reagent Preparation System				=	$	4,253,541
(b)	Absorber/Reaction System				=	$	10,821,977
(c)	By-Product Management System				=	$	3,189,837
(d)	Baghouse				=	$	15,097,200
(e)	Flue Gas System/Stack				=	$	6,782,707
(f)	Support Equipment and Miscellaneous				=	$	2,231,993
	TOTAL PROCESS CAPITAL COST (TPC)				=	$	42,377,255
(2) INDIRECT COSTS							
(a)	General Facilities	0.05	*	(TPC)	=	$	2,118,863
(b)	Engineering & Construction Management	0.20	*	(TPC)	=	$	8,475,451
Total Indirect Costs (TIC)					=	$	10,594,314
TOTAL DIRECT AND INDIRECT COSTS (TDIC)		(TPC)	+	(TIC)	=	$	52,971,569
(3) PROJECT CONTINGENCY		0.20	*	(TDIC)	=	$	10,594,314
TOTAL INSTALLED CAPITAL COSTS (TICC)					=	$	63,565,883

Annualized Costs

DIRECT COSTS						
Fixed O&M Costs						
(1) Operating Labor				=	$	520,000
(2) Maintenance Materials				=	$	748,000
(3) Maintenance Labor				=	$	498,000
(4) Administrative and Support Labor				=	$	305,000
Total Fixed O&M Costs				=	$	2,071,000
Variable O&M Costs						
(5) Reagent				=	$	1,093,000
(6) FGD Waste Disposal				=	$	249,000
(7) Fabric Filter Bag Replacement				=	$	239,000
(8) Fabric Filter Cage Replacement				=	$	15,000
(9) Makeup Water				=	$	134,000
(10) Auxiliary Power				=	$	606,000
Total Variable O&M Costs					$	2,336,000
TOTAL DIRECT COSTS (TDAC)				=	$	4,407,000
INDIRECT COSTS						
(11) Overhead	60%	of	Fixed O&M Costs	=	$	1,242,600
(12) Property Tax	1%	of	(TICC)	=	$	635,659
(13) Insurance	1%	of	(TICC)	=	$	635,659
(14) G&A Charges	2%	of	(TICC)	=	$	1,271,318
(15) Capital Recovery	0.106	*	(TICC)	=	$	6,760,409
TOTAL INDIRECT COSTS (TIAC)				=	$	10,545,644
TOTAL ANNUALIZED COSTS		TDAC + TIAC		=	$	14,952,644
TOTAL TONS REMOVED PER YEAR (SO_2)				=		11,980
COST EFFECTIVENESS ($ per ton of pollutant removed)				=	$	1,248

Notes:

1) Cost factors - from OAQPS Control Cost Manual, Chapter 3

2) Capital Recovery Factor for System - Based on a 15-year equipment life and interest rate of 6.5%.

Dry Fork Generating Station Unit 1
Wet Limestone FGD SO_2 Removal Calculation - PRB Coal

Average Coal Heating Value =	**8,045** Btu/lb	Provided by Basin Electric
Unit Capacity Factor =	**100** %	Provided by Basin Electric
Annual Heat Input (at 100% CF) =	33,296,760 MMBtu/year	3,801 MMBtu/hr x 8760 hours x 100%
Annual Coal Use (at 100% CF) =	2,069,407 tons/year	Calculated
Average Coal Sulfur Content =	**0.33** %	Provided by Basin Electric
Wet Limestone FGD Design SO2 Collection Efficiency	**89.0** %	Input
SO_2 emission rate before FGD =	0.82 lb/MMBtu	Calculated
SO_2 annual tons before FGD =	13,644 tons/year	Calculated
SO_2 emission rate after FGD =	0.09 lb/MMBtu	Calculated
SO_2 annual tons after FGD =	1,501 tons/year	Calculated
SO_2 annual tons removed by FGD =	12,144 tons/year	Calculated

Dry Fork Generating Station Unit 1
Wet Limestone Flue Gas Desulfurization System
Cost Estimate - PRB Coal

Capital Cost Estimate

(1) PROCESS CAPITAL COSTS							
(a)	Reagent Preparation System				=	$	6,007,249
(b)	Absorber/Reaction System				=	$	12,621,601
(c)	By-Product Management System				=	$	5,063,435
(d)	Baghouse				=	$	12,453,245
(e)	Flue Gas System/Stack				=	$	11,670,134
(f)	Support Equipment and Miscellaneous				=	$	3,775,257
	TOTAL PROCESS CAPITAL COST (TPC)				=	$	51,590,921
(2) INDIRECT COSTS							
(a)	General Facilities	0.05	*	(TPC)	=	$	2,579,546
(b)	Engineering & Construction Management	0.20	*	(TPC)	=	$	10,318,184
Total Indirect Costs (TIC)					=	$	12,897,730
TOTAL DIRECT AND INDIRECT COSTS (TDIC)		(TPC)	+	(TIC)	=	$	64,488,651
(3) PROJECT CONTINGENCY		0.20	*	(TDIC)	=	$	12,897,730
TOTAL INSTALLED CAPITAL COSTS (TICC)					=	$	77,386,382

Annualized Costs

DIRECT COSTS						
Fixed O&M Costs						
(1) Operating Labor				=	$	520,000
(2) Maintenance Materials				=	$	971,000
(3) Maintenance Labor				=	$	647,000
(4) Administrative and Support Labor				=	$	350,000
Total Fixed O&M Costs				=	$	2,488,000
Variable O&M Costs						
(5) Reagent				=	$	469,000
(6) FGD Waste Disposal				=	$	267,000
(7) Fabric Filter Bag Replacement				=	$	188,000
(8) Fabric Filter Cage Replacement				=	$	16,000
(9) Makeup Water				=	$	202,000
(10) Auxiliary Power				=	$	1,157,000
Total Variable O&M Costs					$	2,299,000
TOTAL DIRECT COSTS (TDAC)				=	$	4,787,000
INDIRECT COSTS						
(11) Overhead	60%	of	Fixed O&M Costs	=	$	1,492,800
(12) Property Tax	1%	of	(TICC)	=	$	773,864
(13) Insurance	1%	of	(TICC)	=	$	773,864
(14) G&A Charges	2%	of	(TICC)	=	$	1,547,728
(15) Capital Recovery	0.106	*	(TICC)	=	$	8,230,257
TOTAL INDIRECT COSTS (TIAC)				=	$	12,818,512
TOTAL ANNUALIZED COSTS		TDAC + TIAC		=	$	17,605,512
TOTAL TONS REMOVED PER YEAR (SO_2)				=		12,144
COST EFFECTIVENESS ($ per ton of pollutant removed)				=	$	1,450

INCREMENTAL COST ANALYSIS BETWEEN DRY LIME FGD AND WET LIMESTONE FGD

INCREMENTAL ANNUALIZED COSTS (Wet Limestone FGD Total Annualized Costs - Dry Lime FGD Total Annualized Costs)	=	$	2,652,868
INCREMENTAL TONS OF SO2 REMOVED (Wet Limestone FGD - Dry Lime FGD)	=		202
INCREMENTAL COST EFFECTIVENESS ($ per ton of pollutant removed differential between Wet FGD and Dry Lime FGD)	=	$	13,157

Notes:

1) Cost factors - from OAQPS Control Cost Manual, Chapter 3

2) Capital Recovery Factor for System - Based on a 15-year equipment life and interest rate of 6.5%.

Appendix G

Modeling Documentation:

Near-field

Protocol for a Near-Field Air Quality Modeling Analysis of the Dry Fork Station Project (Northeast Wyoming Generation Project)

Prepared for

BASIN ELECTRIC POWER COOPERATIVE

Prepared by

CH2MHILL

September 2005

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SECTION 1.0

Introduction

Basin Electric Power Cooperative (BEPC) proposes to construct the Dry Fork Station Project (project) near Gillette, Wyoming. The proposed power plant would include one pulverized coal (PC) boiler that would be capable of generating a nominal 390 MW (gross) of power. This modeling protocol describes the proposed methodology for the near-field air quality impact analysis for the project. After review and approval by the Wyoming Department of Environmental Quality (WDEQ), this protocol will provide the basis of the air quality impact analysis that will be included in the permit application for the project.

The source of coal for the project will be the Dry Fork Mine. Coal from the mine, which is adjacent to the proposed location for the project, will be delivered to the power plant via a covered, overland conveyor. Emissions associated with the PC boiler will be controlled through various reduction methods. Specifically, the sulfur dioxide (SO_2) emissions will be reduced with dry scrubber equipment. Boiler particulate emissions will be controlled with a fabric filter, and emissions of nitrogen oxides (NO_x) will be controlled by Selective Catalytic Reduction (SCR). Cooling of process water will be done through dry cooling towers.

1.1 Project and Site Description

BEPC proposes to construct the Dry Fork Station Project approximately four miles northeast of the Gillette-Campbell County Airport. The proposed location is at an approximate elevation of 4,250 feet above mean sea level (msl), in rolling terrain. In general, the terrain trends upward toward the south. Figure 1-1 presents a location map for the project.

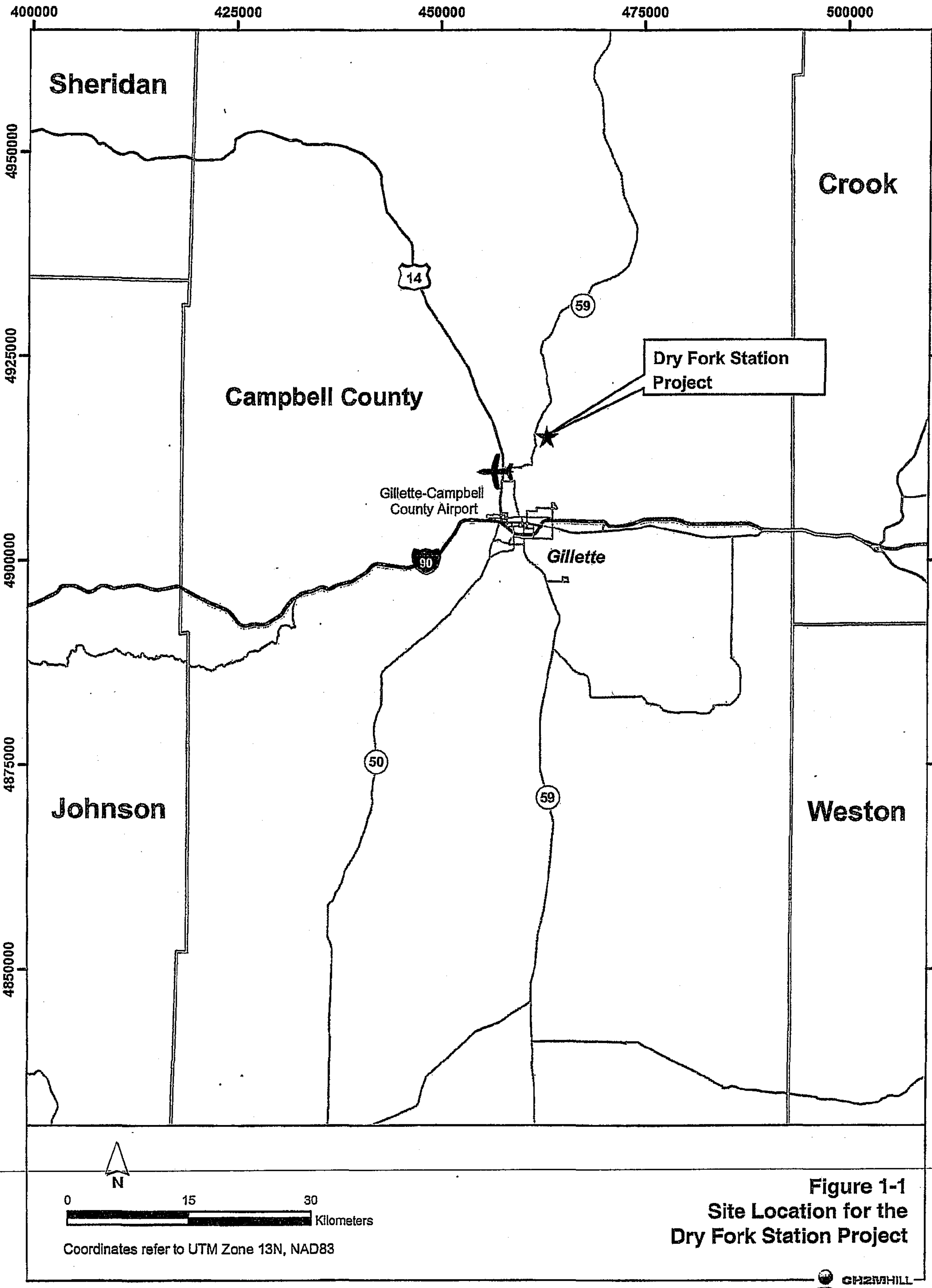

Figure 1-1
Site Location for the Dry Fork Station Project

SECTION 2.0

Regulatory Status

2.1 Source Designation

The proposed project will be a major stationary source with respect to the Prevention of Significant Deterioration (PSD) rules established under the Federal New Source Review program. The source will belong to one of the 28 categorical sources listed under PSD regulations with a major source threshold of 100 tons per year of any regulated pollutant (fossil-fuel boilers, combinations thereof, totaling more than 250 million British thermal units per hour heat input). Table 2-1 presents preliminary estimates of annual emissions for the proposed boiler, along with the significant emission rates for pollutants regulated under the PSD program. Each PSD pollutant with emissions greater than or equal to the PSD significant emission rates will be subject to PSD review, and will be included in the air quality impact analysis. Table 2-2 presents the air quality standards associated with the pollutants regulated under PSD.

TABLE 2-1
Summary of Estimated Annual Emissions

Pollutant	Estimated Controlled Emissions (tons per year)	Prevention of Significant Deterioration Significant Emission Rates (tons per year)
Carbon Monoxide (CO)	2,564	100
Nitrogen Oxides (NO_X)	999	40
Sulfur Dioxide (SO_2)	1,332	40
Particulate Matter (PM_{10})	266[1]	15
Ozone	62 (VOC)[2]	40 (VOC)[2]
Lead	0.1	0.6
Asbestos	0	0.007
Beryllium	0.01	0.0004
Mercury	0.05	0.1
Vinyl Chloride	0	1
Fluorides	12	3
Sulfuric Acid Mist	31	7
Hydrogen Sulfide	0[3]	10
Total Reduced Sulfur	0[3]	10
Reduced Sulfur Compounds	0[3]	10

[1] Includes filterable and condensable particulate emissions.

[2] No "De Minimus" air quality level is provided for ozone. However, any net increase of 100 tons per year or more of volatile ~~organic compounds (VOC) would be required to perform an ambient impact analysis, including the gathering of ambient air~~ quality data.

[3] The emissions of reduced sulfur compounds for the proposed coal-fired boiler are zero. The boiler will be operated with sufficient excess air to ensure complete combustion and oxidation of sulfur in the coal to SO_2 and SO_3.

TABLE 2-2
Air Quality Standards Applicable to the Project

Pollutant (Averaging Period)	Class II Modeling Significance Level (μg/m³)	Class II PSD Increment (μg/m³)	National Ambient Air Quality Standard (μg/m³)	Wyoming Ambient Air Quality Standard (μg/m³)	PSD Significant Monitoring Concentrations (μg/m³)
CO (1-hour)	2,000	NS	40,000[a]	40,000[a]	NS
CO (8-hour)	500	NS	10,000[a]	10,000[a]	575
NO_2 (annual)	1	25	100	100	14
SO_2 (3-hour)	25	512	1,300[a]	1,300[a]	NS
SO_2 (24-hour)	5	91	365[a]	260[a]	13
SO_2 (annual)	1	20	80	60	NS
PM_{10} (24-hour)	5	30[a]	150[a]	150[a]	10
PM_{10} (annual)	1	17	50	50	NS
Ozone (1-hour)	NS	NS	0.12	0.12	NS[b]
Ozone (8-hour)	NS	NS	0.08	0.08	NS[b]
Lead (quarterly)	NS	NS	1.5	1.5	0.1
24-hour Beryllium	NS	NS	NS	NS	0.001
24-hour Mercury	NS	NS	NS	NS	0.25
12-hour Fluorides	NS	NS	NS	3.0E+06	NS
24-hour Fluorides	NS	NS	NS	1.8E+06	0.25
7-day Fluorides	NS	NS	NS	0.5E+06	NS
30-day Fluorides	NS	NS	NS	0.4E+06	NS

[a] Not to be exceeded more than once per year.

[b] No monitoring "De Minimus" air quality level is provided for ozone. However, any net increase of 100 tons per year or more of volatile organic compounds (VOC) would be required to perform an ambient impact analysis, including the gathering of ambient air quality data.

Notes:

μg/m³ = micrograms per cubic meter
CO = Carbon monoxide
NO_2 = Nitrogen dioxide
NS = No standard
PM_{10} = Particulate matter less than 10 microns
PSD = Prevention of Significant Deterioration
SO_2 = Sulfur dioxide

2.2 Area Classifications

The Dry Fork Station Project will be located in Campbell County, Wyoming in an area that is designated as attainment for all criteria pollutants. Areas surrounding the station are designated as Class II areas for PSD permitting. The nearest non-attainment area is located near the town of Sheridan, Wyoming. This area was once designated as non-attainment for particulate matter (PM_{10}) but has since applied for redesignation for attainment status. This area is well beyond the impact area of the proposed project.

2.3 Baseline Dates

2.3.1 Major Source Baseline Date

The major source baseline date is the date after which actual emissions associated with construction at a major stationary source affect the available PSD increment. The major source baseline dates are established dates that have elapsed. These dates are as follows:

PM_{10} - January 6, 1975
SO_2 - January 6, 1975
Nitrogen dioxide (NO_2) - February 8, 1988

2.3.2 Minor Source Baseline Date

The minor source baseline date identifies the point in time after which actual emissions changes from all sources (major and minor) affect available increment. The amount of PSD increment consumption within an area is determined from the actual emission increases and decreases that have occurred since the applicable baseline date. The minor source baseline dates for the state of Wyoming for SO_2 and NO_2 are as follows:

SO_2 - February 2, 1978
NO_2 - February 26, 1988

For PM_{10}, there are three baseline areas that have been designated as separate particulate matter attainment areas under Section 107 of the Clean Air Act (WDEQ, 2003a). The proposed project would be located within one of those areas, the Powder River Basin Area. For this area, the minor source baseline date was triggered in 1997. For all other areas in the state, the PM_{10} minor source baseline date is February 22, 1979.

2.4 Increment Consumption and Expansion

If preliminary modeling yields predicted impacts that exceed the Class II modeling significance levels for a particular pollutant, CH2M HILL will conduct a full-impact analysis that will include a PSD increment analysis for that pollutant. CH2M HILL will work with WDEQ staff to identify increment-affecting sources that need to be included in the analysis of increment consumption, if such an analysis is required.

SECTION 3.0

Ambient Data Requirements

3.1 Pre-Construction Monitoring

Background concentrations for SO_2, NO_2, and PM_{10} are available from monitoring stations in the Gillette area. If such concentrations are needed for full-impact modeling analyses for the project, the background concentrations can be taken from these existing data sources. Therefore, pre-construction monitoring for those pollutants will not be required for the project. The impacts of carbon monoxide (CO) from the project are expected to be well below the Class II modeling significance levels, and therefore no pre-construction monitoring is needed for CO.

Background concentrations used for a dispersion modeling exercise represent all air pollution sources other than those that are explicitly modeled. Commonly, the impacts of distant background sources are accounted for by using appropriate, monitored air quality data (i.e., a background concentration). If a full-impact analysis is required for a particular pollutant to demonstrate compliance with National Ambient Air Quality Standards (NAAQS), CH2M HILL will use suitable background concentration data.

3.2 Post-Construction Air Quality Monitoring

Post-construction monitoring may be required if estimated air quality impacts exceed the PSD significant monitoring concentrations listed in Table 2-2.

3.3 Meteorological Monitoring

BEPC proposes to use meteorological data that have been collected at a nearby site for modeling air quality impacts for this project. Section 6.0 presents a detailed description of the meteorological data that are proposed for the analysis.

SECTION 4.0

Emissions Inventory

The emission inventory for the Dry Fork Station Project will include the coal-fired boiler, a natural gas-fired auxiliary boiler, a natural gas-fired inlet gas heater, a diesel emergency generator, a diesel fire pump engine, and material handling sources.

Filterable and condensable particulate emissions will be quantified from the proposed boiler stack. Filterable emissions will be input to the model for the analysis of particulate matter (PM_{10}) impacts. Based on WDEQ discretion, the emission rate for PM_{10} may also include the condensable emissions.

Most of the material handling systems will include dust collectors for control of particulate emissions. For these sources, CH2M HILL will use the expected limits on grain loading and the expected air flow through the dust collector to arrive at estimates of particulate emissions.

CH2M HILL contacted WDEQ to obtain emissions factors and control efficiencies that should be used for the material handling sources. Judy Shamley of the WDEQ office in Sheridan, Wyoming sent an e-mail to CH2M HILL on April 8, 2005 with several such emission factors (see Appendix A). CH2M HILL will use the WDEQ formulas for haul roads to determine emissions for those sources.

For fugitive emissions of fly ash unloading and the transfer of coal on conveyors, CH2M HILL will use equation from AP-42, Section 13.2.4: *Aggregate Handling and Storage Piles (1/95), Equation (1) - batch or continuous drop operation.*

Detailed emissions calculations and documentation will be provided in the permit application package.

Modeling Analysis Design

5.1 Model Selection

CH2M HILL will use the EPA Industrial Source Complex Short-Term (ISCST3) dispersion model to evaluate Class II air quality impacts. The ISCST3 model (Version 02035) is the latest generation of the EPA's ISC short-term model that is recommended for predicting impacts from industrial point sources as well as area and volume sources. The model combines simple terrain and complex terrain algorithms, which make it ideal for the terrain surrounding the project.

5.2 Model Input Defaults/Options

The ISCST3 model will be used with regulatory default options as recommended in the EPA Guideline on Air Quality Models (EPA, 2003) as listed below:

- Use stack-tip downwash (except for Schulman-Scire downwash)
- Use buoyancy-induced dispersion (except for Schulman-Scire downwash)
- Do not use gradual plume rise (except for building downwash)
- Use the calms processing routines
- Use upper-bound concentration estimates for sources influenced by building downwash from super-squat buildings
- Use default wind profile exponents
- Use default vertical potential temperature gradients

CH2M HILL will make use of the non-default model option for processing missing meteorological data (MSGPRO). By using the missing data processing routine, the model can recognize periods of missing data and adjust calculated impacts in the same manner that calm winds are processed.

CH2M HILL will initially assume that modeled emissions of nitrogen oxides (NO_x) will convert completely to nitrogen dioxide (NO_2). If this assumption leads to predicted exceedances of the NO_2 air standards, the national default factor of 0.75 for NO_2/NO_x will be applied to predicted impacts to arrive at NO_2 concentrations.

5.3 Rural/Urban Classification

The land surrounding the project in all directions is open country with no significant development. Therefore, rural dispersion coefficients will be utilized within the ISCST3 model.

5.4 Receptor Network

5.4.1 ISCST3 Receptors

The base receptor grid for ISCST3 modeling will consist of rectangular, Cartesian arrays of receptors with spacing that increases with distance from the origin. The grid will originate at the approximate location of the proposed boiler stack. Receptor spacing, in accordance with WDEQ guidance (WDEQ, 2003b), will be as follows:

- 50-meter (m) spacing for ambient boundary receptors
- 100-m spacing from the ambient boundary to 1 km from the origin
- 500-m spacing from beyond 1 km to 5 km from the origin
- 1,000-m spacing from beyond 5 km to 50 km from the origin

Because the recognized, effective distance of the ISCST3 model is 50 kilometers (km), we will not extend the receptor grid beyond that radius. All receptors that are located beyond a 50-km radius from the origin will be removed from the receptor grid. If the air quality impact analysis yields maximum impacts that occur in receptor spacing greater than 100-m (coarse spacing), we will supplement the grid with fine-spaced receptors (spacing of 100-m or less).

CH2M HILL will account for terrain in the vicinity of the project by assigning base elevations to each receptor. We will use Digital Elevation Model (DEM) data from the U.S. Geological Survey (USGS) to determine receptor elevations. We will obtain DEM data from the USGS National Elevation Dataset (NED). For most of the modeling domain, DEM files with 10-m resolution are available from the USGS. For any areas for which 10-m data are not available, CH2M HILL will use DEM files with 30-m resolution. CH2M HILL will use ArcView software to determine the receptor elevations. For a given receptor, ArcView will assign the elevation that corresponds to the DEM cell that the receptor is contained within. The receptor elevations will be compared with USGS 7.5 minute quadrangle maps to ensure consistency.

Universal Transverse Mercator (UTM) coordinates for the modeled sources, downwash structures, and receptors will all be based on the North American Datum of 1983 (NAD 83), and UTM Zone 13.

5.5 Source Characterization

5.5.1 Point Sources

The proposed boiler will be modeled as a point source within ISCST3. Other sources that emit from a vent, such as dust collectors that control particulate emissions from material handling, will also be modeled as point sources.

The modeling analysis will include a load screening to determine which operating condition expected for the boiler would yield the highest ground-level concentrations. CH2M HILL will follow the procedure for load screening described in Section 9.1.2 of the EPA Guideline on Air Quality Models (EPA, 2003). Operation of the boiler will be modeled at 100 percent load, 75 percent load, and 50 percent load.

5.5.2 Volume Sources

Fugitive particulate emissions from haul roads will be modeled as a series of volume sources. Volume source parameters for the haul roads will be taken in part from the EPA document *Modeling Fugitive Dust Impacts from Surface Coal Mining Operations – Phase II Model Evaluation Protocol* (EPA, 1994). The source height of the haul road volume sources will be 2 m, as based on the statement from the EPA document that the maximum mass flux from haul road dust plumes occurs at that height. Initial vertical dispersion terms (3 m) for the haul road volumes will also be taken from the EPA document.

Initial horizontal dispersion terms will be calculated from the separation distance of the volume sources (approximately two road widths), in accordance with recommendations in the *User's Guide For The Industrial Source Complex (ISC3) Dispersion Models, Volume I – User Instructions* (EPA, 1995a). Initial horizontal dimensions for the volume sources will be determined from Table 3-1 in the ISC3 User's Guide using the factor for a "line source represented by separated volume sources".

Fugitive emissions from material handling sources will be modeled as volume sources, with source dimensions that reflect actual operations. The actual source dimensions will be converted to volume source inputs in accordance with EPA guidance for the ISCST3 model.

5.6 Source Locations and Parameters

The point and volume sources will be placed where operations for the project dictate. Material transfer volume sources will be elevated at an appropriate height representative of the actual release height of the source.

5.7 Building Wake Downwash and GEP

Point sources will be modeled with stack heights that do not exceed good engineering practice (GEP) stack height. Building downwash effects for point sources will be determined with the U.S. Environmental Protection Agency (EPA) Building Profile Input Program (BPIP).

SECTION 6.0

Meteorology

6.1 Meteorology

6.1.1 Meteorological Data for Class II Area Modeling

CH2M HILL will use surface meteorological data collected at a 100-m meteorological tower as input to the ISCST3 model. The 100-m tower, located southeast of Gillette, was operated by BEPC from October 2001 through July 2003. The 100-m tower was equipped with meteorological sensors at 2 m, 10 m, 50 m, and 100 m.

CH2M HILL has processed the data using the EPA Meteorological Processor for Regulatory Models (MPRM, version 99349). For the air impact analysis for this project, data for the full calendar year from January 1, 2002 through December 31, 2002 were processed into model-ready format. Model-ready files with hourly wind speed and wind direction from the 100-m level of the tower were produced. This level was chosen because it is the tower level closest to the proposed boiler stack height for the project (500 feet). Hourly atmospheric stability was determined with multiple methods. These methods included:

- Standard deviation fluctuations in horizontal wind direction (sigma theta) at 10 m
- Solar radiation/delta-T (SRDT) for the temperature difference from 2 m to 10 m
- SRDT for the temperature difference from 2 m to 50 m

Multiple techniques were used to determine the hourly Pasquill-Gifford (P-G) atmospheric stability so that the resulting distributions could be compared, and the best distribution could be chosen for modeling. For each case, MPRM used a backup method to determine the stability for any hour that was missing the data needed for the primary method. For the primary SRDT methods, 10-m sigma theta was used as the backup method. For the primary sigma theta method, the 2-10 m SRDT was used as a backup.

The SRDT method uses the surface layer wind speed (measured at 10 m) in combination with measurements of total solar radiation during the day and low-level vertical temperature difference at night. According to EPA guidance, the temperature difference for use in estimating the P-G stability categories using the SRDT method should be measured between $20z_0$ and $100z_0$, with z_0 representing the surface roughness of the measurement site (EPA, 2000). As shown in Table 3-6 of the MPRM User's Guide (EPA, 1996), the seasonal roughness lengths for terrain types most like the measurement site would range from 0.001 m to 0.10 m for "grassland", and between 0.15 m and 0.30 m for "desert shrubland". Therefore, the most appropriate delta-T measurements available from the tower would be 2-10 m and 2-50 m (rather than 2-100 m), and both of these were used for comparison.

The WDEQ has reviewed the MPRM processing for the project, and determined that the model-ready file that utilized sigma theta measurements for atmospheric stability would be most appropriate to use for the project. CH2M HILL will use this file for all ISCST3 modeling for the project.

The raw data from Basin's 100-m tower includes a 2-week period in August of 2002 for which all data are missing due to an elevator failure on the tower. CH2M HILL will use data collected at the nearby Gillette-Campbell County Airport to fill this data gap. Data from the Gillette airport will be processed with the EPA PCRAMMET model to obtain data in model-ready format. The 10-m wind speeds from the airport will be adjusted to the 100-m level using the power law equation (equation 1-6) in Volume II of the ISC3 User's Guide (EPA, 1995b). CH2M HILL will develop site-specific wind profile exponents by solving for the exponent in the power law equation with wind data from the 10-m and 100-m levels from the Basin 100-m tower.

6.1.2 Upper Air Data for Class II Area Modeling

Hourly mixing heights for all of the MPRM scenarios were derived from twice-daily upper-air soundings from Rapid City, South Dakota. Twice-daily mixing heights for Rapid City were obtained from the National Climatic Data Center (NCDC). If a single AM or PM mixing height was missing, a linear interpolation of the valid data from the previous day and the following day was used to substitute for the missing value. If more than one AM or PM value was missing, the seasonal average value from the EPA Holzworth reference (EPA, 1972) was used as a substitute. The twice-daily mixing heights from Rapid City were combined with the surface data from the 100-m tower and transformed into model-ready format using MPRM.

SECTION 7.0

Dispersion Modeling Impact Analysis

7.1 Preliminary Analysis

CH2M HILL will compare the impacts from the proposed project to the modeling significance levels for Class II areas. If any of the impacts equal or exceed the modeling significance levels for a particular pollutant, a full-impact analysis will be performed for that pollutant. The determination of preliminary impacts for the proposed project sources will be made using the highest modeled impact for each pollutant and averaging period.

The health effects of HAP emitted by the facility will be determined through a comparison of the maximum predicted ground-level impacts to threshold concentration values taken from the EPA Region III Risk-Based Concentration Table and the National Air Toxics Information Clearinghouse (NATICH). Determination of facility HAP emissions will be based on the speciated VOC, carcinogens, and non-carcinogens associated with the combustion of coal in the boiler.

CH2M HILL provided the WDEQ with preliminary emissions estimates for the auxiliary equipment that will be associated with the project.

WDEQ examined the emissions estimates for the auxiliary equipment and determined that the annual NO_x emissions (tpy) from the auxiliary boiler should be modeled in the near-field impact assessments involving NO_2 impacts. WDEQ concluded that there would be no need to model the other criteria pollutants from the auxiliary boiler. Additionally, based on the emission rates provided for the fire pump, diesel generator, and the inlet gas heater, and because these are backup or emergency sources, these sources would not be included in any of the modeling assessments.

7.2 Full-Impact Analysis

If a full-impact analysis is required to demonstrate compliance with NAAQS and PSD increments, CH2M HILL will model the sources at the proposed project and other outside source as appropriate. For the NAAQS analysis only, CH2M HILL will use background concentrations to account for outside sources that are not explicitly modeled (see Section 3.1).

SECTION 8.0

Additional Impact Analysis

8.1 Growth Analysis

An analysis of the air quality impacts from commercial, residential, industrial, and other growth associated with the project will be conducted as required by WDEQ/PSD regulations.

8.2 Soils and Vegetation Analysis

CH2M HILL will conduct a search for information regarding sensitive soils, sensitive vegetation, and vegetation with commercial or recreational value in the Class II areas surrounding the project area. A literature search will be conducted to determine the ambient air pollution levels that may cause damage to sensitive species or vegetation with commercial or recreational value. If no information is available from the literature search for a particular species, the secondary NAAQS will be assumed to be protective for the pollutant under consideration. CH2M HILL will then compare the maximum impacts predicted with the ISCST3 model for the proposed project to the levels of criteria pollutants that are known to produce damage to soil and vegetation.

8.3 Visibility Impairment Analysis

No near-field assessment of Class II area visibility impacts will be conducted for the project. There are no Class II "scenic vistas" established by the WDEQ in the vicinity of the proposed project, nor are there established standards for Class II visibility impacts. Additionally, the visibility screening techniques, such as the EPA VISCREEN model, are not adequate to fully assess the impact of the sources proposed for this project.

8.4 Ozone

No ambient impact analysis for ozone will be conducted for this project. Currently, there are no modeling techniques that are approved for regulatory use for the assessment of ozone impacts from single point sources in rural areas. Also, the estimated emissions of volatile organic compounds (VOC) from the project are well below the 100 tons per year threshold that would require an ambient impact analysis and/or gathering of ambient air quality data for ozone (see Table 2-1).

SECTION 9.0

References

EPA, 1972. *Mixing Heights, Wind Speeds, and Potential for Urban Air Pollution throughout the Contiguous United States*, Office of Air Programs, Research Triangle Park, North Carolina. January, 1972.

EPA, 1994. *Modeling Fugitive Dust Impacts from Surface Coal Mining Operations – Phase II Model Evaluation Protocol*, Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina. October 25, 1994.

EPA, 1995a. User's Guide for the Industrial Source Complex (ISC3) Dispersion Model, Volume I – User Instructions (EPA-454/B-95-003a), Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina. September, 1995.

EPA, 1995b. User's Guide for the Industrial Source Complex (ISC3) Dispersion Model, Volume II – Description of Model Algorithms (EPA-454/B-95-003b), Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina. September, 1995.

EPA, 2000. *Meteorological Monitoring Guidance for Regulatory Modeling Applications, EPA-454/R-99-005*, Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina. February, 2000.

EPA, 2003. Appendix W of 40 CFR Part 51 - *Guideline On Air Quality Models (Revised)*, Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina. July 2003.

WDEQ, 2003a. *Wyoming Air Quality Standards and Regulations, Chapter6 – Permitting Requirements, Section 4 – Prevention of Significant Deterioration*, Wyoming Department of Environmental Quality, Air Quality Division. February 7, 2003.

WDEQ, 2003b. *Wyoming DEQ/Air Division Quality Requirements for Submitting Modeling Analyses*, Wyoming Department of Environmental Quality, Air Quality Division. September 8, 2003.

APPENDIX A

WDEQ Emission Formulas for Material Handling

Department of Environmental Quality

1866 S. Sheridan Avenue
Sheridan, WY 82801

Air, Land, & Water Divisions

New Phone: (307) 673-WDEQ (9330)
Fax (307) 672-2213

No. of pages (cover sheet included) 4

Date 4/12/05

To JOSH NALL

CH2M HILL

Fax No.

From J Shamley

Comments

$LB/HR = \frac{SCF}{m} \times \frac{?\,gr}{dscf} \times \frac{60\,min}{1\,hr} \times \frac{1\,lb}{7000\,gr}$

1.74 tons/BCY

#wet days = 100

TABLE
STATE OF WYOMING
DIVISION OF AIR QUALITY
GUIDELINE FOR FUGITIVE DUST EMISSION FACTORS
FOR MINING ACTIVITIES

January, 1979

(Particulate size 30 um and smaller, no fallout function required)

Mining Activity	(note) Emission Factor (Ref) x % Suspended	Control Technique	Control Efficiency
1. Overburden Removal			
Dragline	0.04 lb/yd^3(1) x 0.75	———	———
Truck/Shovel	0.02 lb/ton(1) x 0.75	———	———
Scraper	[1]32 lbs/hr(2)	watering	50%
2. Haul Roads S = 8.6% 15 mph – OB 30 mph – COAL	[2]E = 0.81s(S/30)$\frac{(365-W)}{365}$ lb/VTM(3) (= .136) x 0.62	a. watering	50%
		[3]b. oil or chemical dust suppresant	60%
Access Roads	[2]E = 0.81s(S/30)$\frac{(365-W)}{365}$ lb/VTM(3) x 0.62	a. asphalt paving or equal	85%
		b. stabilization of base with chip and seal surface	70%
	$\frac{tons}{tons/truck}$ = #trips $\frac{VMT}{\#trips}$ = miles Roundtrip		
3. Haul Road Repair and Construction			
Gr...	[1]32 lbs/hr(2)	watering	50%
Scrapers	[1]32 lbs/hr(2)	watering	50%
4. Wind Erosion = .25 ton/ac/yr	[4]E = AIKCL'V' ton/acre/yr(4)	———	———
5. Product Removal			
Coal-Truck/Shovel	0.003 lb/ton(1) x 0.70		———
Coal-Frontend Loader	[5]0.003 lb/ton x 0.70		———
Uranium-Frontend Loader	[6]0.003 lb/ton		———
6. Product Dumping			
Coal-Truck Dump	0.017 lb/ton(1) x 0.75		50%
Uranium	[7]0.017 lb/ton		85%
7. Stockpiles (wind erosion)			
Coal	[8]1.2 u lb/acre/hr x 0.75	Enclosure	99%
Uranium	[9]E = 0.05(s/1.5)(d/235)(f/15)(D/90)lbs/ton(5)	watering	50%

SO_2 = ton coal × %S × 2 × % retention

Truck Dump: 0.017 #/t × 0.75 × $\frac{TPY}{2000}$ × efficiency = TPY_{TSP}

Mining Activity	Emission Factor (EF) x % Suspended	Control Technique	Effici
8. Blasting			
Overburden	50 lb/blast(1) x 0.75	prevent overshooting	
Coal	35 lb/blast(1) x 0.75	prevent overshooting	

Notes:

1. If applicant's estimate of grader and scraper hours includes wet days, then reduce emissions by the factor $\frac{365-W}{365}$ where W = no. of days where rain or snow precipitation is 0.01" or greater

2. From Reference 3 $E = 0.81s(S/30)\frac{(365-W)}{365}$ lbs/VMT

   where s = silt content of road surface material(%) 8.6%
   S = vehicle speed in mph
   W = no. of days with 0.01" precipitation or more =100 = .126 days
   S/30 factor should be squared for speeds less than 30 mph
   Apply correction for number or width of tires compared to light vehicles

3. Frequency and rate of application as per manufacturer's recommendation or as justified by applicant for site, specif road materials and experience.

4. From Reference 4 E = AIKCL'V' ton/acre/yr
   where A = portion of tonnes which become suspended
   I = soil erodibility
   K = surface roughness factor
   C = climatic factor
   L' = unsheltered field width factor
   = 0.7 for 1000' & 1.0 for 2000' and greater
   V' = vegetative cover factor (use V' = 1.0)

Soil Type	A	I, ton/acre/yr
Rocky, Gravelly	0.025	38
Sandy	0.010	134
Fine	0.041	52
Clay Loam	0.025	47

K - Varies from 0.5 to 1.0; 1.0 is normally used.
C - Table 3.11 of reference or $C = 0.345 (u^3) + (P-E)^2$
where u = average wind velocity (mph)

5. It was felt that given the similarity of operation of a frontend loader to a shovel that measured emissions from Reference 1 of 10 to 20 times more (loader vs. shovel) were not reasonable, thus the selection of 0.003 lbs/ton.

6. Given the usual wetness of observed uranium ore in surface mines this factor is probably conservative. Factor estimate only - not measured. No correction is made for % suspended material as data is not available.

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Notes:

7. Estimate only - not measured. No correction is made for % suspended material as data is not available.

8. 1.2 u lb/acre/hour where u is wind speed in m/sec. Factor includes some equipment activity around and on piles. Total emission should include truck dumping, etc. Adjust by ratio of dry days to total days in existence.

9. From Reference 5 E = 0.05(s/1.5)(d/235)(f/15)(D/90)lbs/ton throughput through pile
   where s = silt content of material (%)
   d = no. of dry days/yr
   f = percentage of time wind speed exceeds 12 mph
   D = duration of material in storage (days)

References:

(1) EPA-908/1-78-003, "Survey of Fugitive Dust from Coal Mines", by PEDCo Environmental, Inc., February, 1978.

(2) EPA-908/1-76-008, "Wyoming Air Quality Maintenance Area Analysis", by PEDCo Environmental, Inc., May, 1976.

(3) AP-42 "Compilation of Air Pollutant Emission Factors (Supplements 1-8)", May, 1978.

(4) PEDCo 1976, "Evaluation of Fugitive Dust Emissions from Mining", by PEDCo Environmental, Inc., April, 1976.

(5) C. Cowherd and R.V. Hendriks, "Development of Fugitive Dust Emission Factors for Industrial Sources", Paper No. 78-55.4, Annual Meeting Air Pollution Control Association, Houston, Texas (June, 1978).

Basin Electric Dry Fork Station Project: ISC-PRIME Files	
File Name	**Description**
\ISCPRIME\LOAD	
Load Analysis	
Load_Fine-10-27-05.DTA (.LST) (.GRF)	ISCPRIME input (output) (graphics) file for the load analysis (fine and full grid combined)
Receptors_Load.REC	Discrete receptor file used in the analysis
\ISCPRIME\NOX	
NO_X Analysis	
DF_NOxAnn_102505_PR.DTA (.LST) (.GRF)	ISCPRIME input (output) (graphics) file for the annual NO_X analysis (fine and full grid combined)
Receptors_NOx.REC	Discrete receptor file used in the analysis
\ISCPRIME\PM10	
PM_{10} Analysis	
DF_PM10_102505fullgrid_PR.DTA (.LST) (.GRF)	ISCPRIME input (output) (graphics) file for the 24-hr PM10 analysis (full grid)
DF_PM10_102505finegrid_PR.DTA (.LST) (.GRF)	ISCPRIME input (output) (graphics) file for the 24-hr PM10 analysis (fine grid)
Receptors_fullgrid_PM10.REC	Discrete receptor file used in the analysis
Receptors_finegrid_PM10.REC	Discrete receptor file used in the analysis
\ISCPRIME\SO2ROI	
Preliminary 24-hr SO_2 Analysis	
DF_SO2_103_102505_PR.DTA (.LST) (.GRF)	ISCPRIME input (output) (graphics) file for the 24-hr SO2 analysis at 103% main boiler load (full and fine grid combined)
DF_SO2_75_102505_PR.DTA (.LST) (.GRF)	ISCPRIME input (output) (graphics) file for the 24-hr SO2 analysis at 75% main boiler load (full and fine grid combined)
DF_SO2_50_102505_PR.DTA (.LST) (.GRF)	ISCPRIME input (output) (graphics) file for the 24-hr SO2 analysis at 50% main boiler load (full and fine grid combined)
Receptors_SO2_ROI.REC	Discrete receptor file used in the analysis
\ISCPRIME\SO2Cumulative	
Increment 24-hr SO_2 Analysis	
DF_SO2_Cum_Incr_PR.DTA (.LST) (.GRF)	ISCPRIME input (output) (graphics) file for the 24-hr Cumulative Increment SO2 analysis (full and fine grid combined)
Receptors_SO2_Cum.REC	Discrete receptor file used in the analysis
NAAQS 24-hr SO_2 Analysis	
DF_SO2_Cum_NAAQS_PR.DTA (.LST) (.GRF)	ISCPRIME input (output) (graphics) file for the 24-hr Cumulative NAAQS SO2 analysis (full and fine grid combined)
\ISCPRIME\BPIP	
DF_PM10_102505fullgrid_PR.PIP	BPIP Input and Output Files
DF_PM10_102505fullgrid_PR.SO	
DF_PM10_102505fullgrid_PR.TAB	
DF_PM10_102505fullgrid_PR.SUM	

Basin Electric Dry Fork Station Project: PCRAMMET and MPRM Files	
Filename	**Description**
\Final_Met	
BASIN100_02.MET	ISC-ready file with 100-m data from Basin tower + 10-m Gillette data for substitution in Aug 02 (wind speeds scaled)
BASIN10_02.MET	ISC-ready file with 10-m data from Basin tower + 10-m Gillette data for substitution in Aug 02
\Final_Met\PCRAMMET	
GILLETTE2002.INP	PCRAMMET input file
RAPID2002.SAV	Mixing heights for Rapid City
94023kgcc.144	CD-144 file for Gillette, WY airport
PCRAM.LOG	PCRAMMET log file
PCRAMMET.EXE	PCRAMMET executable
Gillette02.MET	ISC-ready PCRAMMET output file
BasinExp_100m_SG.XLS	Spreadsheet used to determine site-specific power law exponents from Basin 10-m vs. 100-m wind speeds
Gillette02_100_SPsigma.XLS	Spreadsheet used to scale 10-m Gillette winds to the 100-m level
Wind100_SPSigma.PRN	ASCII file of adjusted wind speeds
Gillette02_100_SPsigma.MET	ISC-ready file for Gillette with wind speeds adjusted to 100-m level
GAPworking.TXT	ISC-ready file for Gillette with wind speeds adjusted to 100-m level (Aug 02, includes MPRM-type missing codes)
\Final_Met\MPRM	
BASINOS.OUT	Extracted hourly data for MPRM Stage 1 processing
HAS000144360mixapp_op.htm	Rapid City Mixing Heights from NCDC (Jan95 - Aug04)
RAPIDC.SAV	Formatted mixing height file read by MPRM for Stage 1
UA01.INP	Stage 1 input file for upper-air extraction
UA01.LIS	Stage 1 status report for upper-air extraction
UA01.ERR	Stage 1 error listing for upper-air extraction
RAPIDC.OUT	Stage 1 IQA output file for upper-air extraction
RAPIDC.DAT	Stage 1 OQA output file for upper-air extraction
OSSA.INP	Stage 1 input file for on-site extraction (10-m sigma theta)
OSSA.LIS	Stage 1 status report for on-site extraction
OSSA.ERR	Stage 1 error listing for on-site extraction
OSSA.DAT	Stage 1 OQA output file for on-site extraction
OSSR10.INP	Stage 1 input file for on-site extraction (2m-10m SRDT)
OSSR10.LIS	Stage 1 status report for on-site extraction
OSSR10.ERR	Stage 1 error listing for on-site extraction
OSSR10.DAT	Stage 1 OQA output file for on-site extraction
OSSR50.INP	Stage 1 input file for on-site extraction (2m-50m SRDT)
OSSR50.LIS	Stage 1 status report for on-site extraction
OSSR50.ERR	Stage 1 error listing for on-site extraction
OSSR50.DAT	Stage 1 OQA output file for on-site extraction

Basin Electric Dry Fork Station Project: PCRAMMET and MPRM Files

Filename	**Description**
MRSA.INP	Stage 2 input file for data merge (10-m sigma theta)
MRSA.LIS	Stage 2 status report for data merge
MRSA.ERR	Stage 2 error listing for data merge
MRSA.DAT	Stage 2 output file
MRSR10.INP	Stage 2 input file for data merge (2m-10m SRDT)
MRSR10.LIS	Stage 2 status report for data merge
MRSR10.ERR	Stage 2 error listing for data merge
MRSR10.DAT	Stage 2 output file
MRSR50.INP	Stage 2 input file for data merge (2m-50m SRDT)
MRSR50.LIS	Stage 2 status report for data merge
MRSR50.ERR	Stage 2 error listing for data merge
MRSR50.DAT	Stage 2 output file
MPSA.INP	Stage 3 input file (10-m sigma-theta)
MPSA.LIS	Stage 3 status report
MPSA.ERR	Stage 3 error listing
BASINSA.MET	ISC-ready file for Jan02 - Dec02 (100-m winds)
MPSR10.INP	Stage 3 input file (2m-10m SRDT)
MPSR10.LIS	Stage 3 status report
MPSR10.ERR	Stage 3 error listing
BASNSR10.MET	ISC-ready file for Jan02 - Dec02 (100-m winds)
MPSR50.INP	Stage 3 input file (2m-50m SRDT)
MPSR50.LIS	Stage 3 status report
MPSR50.ERR	Stage 3 error listing
BASNSR50.MET	ISC-ready file for Jan02 - Dec02 (100-m winds)
MPSA10m.INP	Stage 3 input file (10-m sigma-theta)
MPSA10.LIS	Stage 3 status report
MPSA10.ERR	Stage 3 error listing
BASINSA1.MET	ISC-ready file for Jan02 - Dec02 (10-m winds)

Outside Wyoming Sources of SO_2 for Cumulative Analysis

Source ID	UTM E NAD27 (m)	UTM N NAD27 (m)	LCC E (km)	LCC N (km)	Elev. (m)	Stack H. (m)	Temp. (K)	Vel. (m/s)	Dia. (m)	Permitted Emissions Levels: 3-hr SO_2 (g/s)	24-hr SO_2 (g/s)	3-hr SO_2 (lb/hr)	24-hr SO_2 (lb/hr)
Sources in Wyoming:													
Black Hills Wygen1 Boiler	Zone 13												
WYGEN1	469,390	4,903,494	-29.492	30.786	1344	89.9	342	27.44	2.82	25.6	25.6	202.8	202.8
Black Hills Wygen2 Boiler	Zone 13												
WYGEN2	469,603	4,904,065	-29.287	31.338	1346	121.0	344	22.9	3.43	19.7	19.7	156.0	156.0
Neil Simpson Unit 1 Boiler	Zone 13												
NSU1	469,116	4,903,600	-29.756	30.889	1345	76.2	443	22.04	1.83	44.3	44.3	351.6	351.6
Neil Simpson Unit 2 Boiler	Zone 13												
NSU2	469,386	4,903,418	-29.496	30.713	1344	89.9	342	27.45	2.82	25.6	25.6	203.0	203.0
Wyodak Boiler 1	Zone 13												
WYDK	469,410	4,903,708	-29.473	30.993	1347	122.0	358	22.56	6.1	258.6	258.6	2052.0	2052.0
2 Elk Unit 1	Zone 13												
2ELK	482,623	4,833,505	-16.749	-36.898	1451	103.6	344	27.4	4.94	57.3	57.3	454.5	454.5
KFX Source #1	Zone 13												
EP28	466,706	4,911,354	-32.077	38.386	1349	76.2	419	18.13	2.18	6.52	6.52	51.7	51.7
KFX Source #2	Zone 13												
EP29	466,704	4,911,359	-32.079	38.391	1349	76.2	419	18.13	2.18	6.52	6.52	51.7	51.7

WYGEN1:
NAD83 UTM = 469347, 4903709 — UTMs determined w/ aerial photo and CAD drawing of Wyodak complex — heat input: 1,014 MMBtu/hr (WDEQ Permit MD-510)
source: ISC input file (WAAQSS.in) provided by WDEQ — short-term SO_2: 0.2 lb/MMBtu (WDEQ Permit MD-510)

WYGEN2:
NAD83 UTM = 469560, 4904280
Source: CH2M HILL Modeling

NSU1:
NAD83 UTM = 469073, 4903815 — UTMs determined w/ aerial photo and CAD drawing of Wyodak complex — heat input: 293 MMBtu/hr (WDEQ Permit 31-004-1)
source: ISC input file (WAAQSS.in) provided by WDEQ — short-term SO_2: 1.2 lb/MMBtu (WDEQ Permit 31-004-1)

NSU2:
NAD83 UTM = 469343, 4903633 — UTMs determined w/ aerial photo and CAD drawing of Wyodak complex — (WDEQ Permit 31-158)
source: ISC input file (WAAQSS.in) provided by WDEQ

WYDK:
NAD83 UTM = 469367, 4903923 — UTMs determined w/ aerial photo and CAD drawing of Wyodak complex — heat input: ~4100 MMBtu/hr
source: ISC input file (WAAQSS.in) provided by WDEQ — short-term SO_2: 0.5 MMBtu/hr (WDEQ Permit 31-101)
Constructed 1972. PPL installed SO_2 scrubber in Dec. 1986, WYODAK1 does not consume SO_2 increment

2ELK:
NAD83 UTM = 482580, 4833716
source: PowerPlantSO2_NEWY_2.xls provided by WDEQ (UTMs assumed to be NAD83)
note: source is more than SO_2 ROI + 50km from Dry Fork Station. Not included in ISC modeling.

EP28:
NAD83 UTM = 466663, 4911569
source: so2.00.st.in provided by WDEQ (UTMs assumed to be NAD83)

EP29:
NAD83 UTM = 466661, 4911574
source: so2.00.st.in provided by WDEQ (UTMs assumed to be NAD83)

Basin Electric Power Cooperative
Dry Fork Station
Stack Parameters - Material Handling and Auxiliary Equipment Sources

Source ID	Source Name	Release Ht. (ft)	Release Height (m)	Stack Diameter (ft)	Stack Diameter (m)	Air Flow (acfm)	Air Flow (scfm)	Air Flow (dscfm)	Air Flow (actual m^3/min)	Release Velocity (m/s)	Release Velocity (ft/s)	Stack Temperature (F)	Stack Temperature (K)	Notes
ES1-02	Unit 1 Auxiliary Boiler	232	70.71	4.00	1.219	44,763	26,582		1,267.55	18.10	59.37	305.00	424.82	Vertical Stack
ES1-03	Diesel Fire Pump	20	6.10	0.25	0.076	1,030	358		29.17	106.59	349.71	845.00	724.82	Vertical Stack
ES1-04	Auxiliary Cooling Tower	15	4.57	8	2.438	65,000	54,997		1,840.60	6.57	21.55	77.00	298.15	Vertical Stack
ES1-05	Diesel Generator	20	6.10	1.00	0.305	5,477	1,892		155.09	35.42	116.22	855.00	730.37	Vertical Stack
ES1-06	Inlet Gas Heater	30	9.14	2.5	0.762	3,247	1,391	1,277	91.95	3.36	11.02	600.00	588.71	Vertical Stack
ES1-07	Coal Storage Silo 1 Dust Collector	180	54.86	2.25	0.686	17,500	15,060	13,704	495.55	22.36	73.35	68.00	293.15	Vertical Stack
ES1-08	Coal Storage Silo 2 Dust Collector	180	54.86	2.25	0.686	17,500	15,060	13,704	495.55	22.36	73.35	68.00	293.15	Vertical Stack
ES1-09	Coal Storage Silo 3 Dust Collector	180	54.86	1.83	0.559	11,300	9,724	8,849	319.98	21.75	71.34	68.00	293.15	Vertical Stack
ES1-10	Coal Crusher House Dust Collector	156	47.55	3.08	0.940	32,200	27,710	25,216	911.81	21.91	71.87	68.00	293.15	Vertical Stack
ES1-11	Plant Coal Silo Transfer Bay Dust Collector	210	64.01	3.25	0.991	35,000	30,119	27,408	991.09	21.43	70.31	68.00	293.15	Vertical Stack
ES1-12	Pebble Lime Receiving Silo Bin Vent Filter	100	30.48	1.37	0.418	4,400	800	728	124.59	15.16	49.75	68.00	293.15	Horizontal Exhaust
ES1-13	Pebble Lime Day Silo Bin Vent Filter	80	24.38	0.97	0.295	2,200	1,100	1,001	62.30	15.19	49.82	68	293.15	Horizontal Exhaust
ES1-14	Lime Hydrator Mixer Dust Collector No. 1	88	26.82	1.67	0.508	7,500	5,163	4,698	212.38	17.46	57.29	200	366.48	Vertical Stack
ES1-15	Lime Hydrator Mixer Dust Collector No. 2	88	26.82	1.67	0.508	7,500	5,163	4,698	212.38	17.46	57.29	200	366.48	Vertical Stack
ES1-16	Hydrated Lime Dust Collector No. 1	88	26.82	2.25	0.686	20,838	18,000	16,380	590.07	26.62	87.34	68	293.15	Vertical Stack
ES1-17	Hydrated Lime Dust Collector No. 2	88	26.82	2.25	0.686	20,838	18,000	16,380	590.07	26.62	87.34	68	293.15	Vertical Stack
ES1-18	Hydrated Lime Silo 1 Bin Vent Filter	97	29.57	0.97	0.295	2,200	1,900	1,729	62.30	15.19	49.82	68	293.15	Horizontal Exhaust
ES1-19	Hydrated Lime Silo 2 Bin Vent Filter	97	29.57	0.97	0.295	2,200	1,900	1,729	62.30	15.19	49.82	68	293.15	Horizontal Exhaust
ES1-20	Activated Carbon Silo Bin Vent Filter	86	26.21	0.50	0.152	926	800	728	26.22	23.96	78.60	68	293.15	Horizontal Exhaust
ES1-21	Fly Ash/FGD Waste Silo Separator/Filter Exhaust	32	9.75	0.83	0.253	1,605	1,200	1,092	45.45	15.07	49.44	150	338.71	Vertical Stack
ES1-22	Fly Ash/FGD Waste Silo Bin Vent Filter	95	28.96	0.83	0.253	1,809	1,250	1,138	51.23	16.98	55.72	200	366.48	Horizontal Exhaust

Notes:

Relative Humidity (%):	50	From: http://www.wrds.uwyo.edu/wrds/wsc/climateatlas/humidity.html
Moisture Content (%):	9	
Atmospheric Pressure (psi):	12.65	From the Pressure_Correction_for_Altitude_Chart.xls worksheet (at 4,250 ft amsl)
Std. Pressure (psi):	14.7	
Std. Temperature (F):	68	Based on dicussions with Joe H.

Basin Electric Power Cooperative
Dry Fork Station
Area and Volume Sources

Volume Sources

Source ID	Source Description	Release Height (ft)	Release Height (m)	Lateral Dimension (ft)	Vertical Dimension (ft)	Lateral Dimension (m)	Vertical Dimension (m)	Lateral Dimension (sigma-Y)	Vertical Dimension (sigma-Z)
FS1-01	Fly Ash/FGD Waste Disposal Truck Loading	10	3.05	47.6	20	14.51	6.10	3.4	2.8
FS1-02	Haul Roads		2.00	100		30.48		14.2	3.0

Notes:
1) Physical dimensions of FS1-01: 20-ft height on silo driveway, 47.6-ft wide silo
2) For FS1-01: Initial lateral dimension equals length of side divided by 4.3 (single volume source), initial vertical dimension equals vertical length divided by 2.15 (elevated source on or adjacent to a building) (per ISC User's Guide).

3) For FS1-02: Haul road dimensions based on 50 ft. road width. Initial lateral dimension equals length of side divided by 2.15 (line source). (per ISC User's Guide).

Area Sources

Source ID	Source Description	Size of Area (Acres)	Area Source Height (ft)	Area Source Height (m)	L (m)	W (m)	r (m)	A (ft^2)	A (m^2)	E Rate (lb/hr)	E Rate (g/s)	E Rate (g/s/m^2)
FS1-03	Fly Ash/FGD Waste Landfill	1.0	15	4.57	63.61	63.61	-	43,558	4,046	0.20	2.539260E-02	6.28E-06

Notes:
1 acre = 43,560 ft^2.

ISC-PRIME Results

Pollutant	Averaging Period	Monitoring De Minimus Level (ug/m^3)	Modeling Significance Level (ug/m^3)	103% Load Emission Rate (lb/hr)	103% Load Emission Rate (g/s)	100% Load Emission Rate (lb/hr)	100% Load Emission Rate (g/s)	75% Load Emission Rate (lb/hr)	75% Load Emission Rate (g/s)	50% Load Emission Rate (lb/hr)	50% Load Emission Rate (g/s)	ISC-PRIME Predicted Impact (ug/m^3) 103% Load	100% Load	75% Load	50% Load
CO	1-Hour	n/a	2000	570	71.8	557	70.1	435.3	54.8	303.5	38.2	85.2	83.4	66.5	57.5
CO	8-Hour	575	500	570	71.8	557	70.1	435.3	54.8	303.5	38.2	14.9	14.8	13.3	11.2
NO_2	3-Hour	n/a	n/a	266	33.5	259.7	32.7	203.1	25.6	141.6	17.8	14.7	14.7	12.9	10.8
NO_2	Annual	14	1	n/a	n/a	259.7	32.7	n/a	n/a	n/a	n/a	n/a	0.3	n/a	n/a
PM_{10} (Boiler Only)	24-Hour	10	5	64.60	8.1	63.0	7.9	49.3	6.2	34.4	4.3	0.94	0.98	0.98	0.91
SO_2	3-Hour	n/a	25	380	47.9	371.0	46.7	290.2	36.6	202.3	25.5	21.1	21.0	18.5	15.5
SO_2	24-Hour	13	5	380	47.9	371.0	46.7	290.2	36.6	202.3	25.5	5.5	5.8	5.8	5.4
SO_2	Annual	n/a	1	n/a	n/a	371.0	46.7	n/a	n/a	n/a	n/a	n/a	0.4	n/a	n/a
Lead	3-Month	0.1	n/a	n/a	n/a	0.01	0.001	n/a	n/a	n/a	n/a	n/a	0.00009	n/a	n/a
Mercury	24-Hour	0.25	n/a	0.007	0.0009	0.007	0.0009	0.007	0.0009	0.007	0.0009	0.0001	0.0001	0.0001	0.0002
Beryllium	24-Hour	0.001	n/a	0.001	0.0002	0.001	0.0002	0.001	0.0002	0.001	0.0002	0.00002	0.00002	0.00003	0.00004
Fluorides	12-Hour	n/a	n/a	2.62	0.3	2.56	0.3	2.0	0.25	1.4	0.18	0.15	0.07	0.13	0.11
Fluorides	24-Hour	0.25	n/a	2.62	0.3	2.56	0.3	2.0	0.25	1.4	0.18	0.04	0.04	0.04	0.04
Fluorides	7-day	n/a	n/a	2.62	0.3	2.56	0.3	2.0	0.25	1.4	0.18	0.04	0.04	0.04	0.04
Fluorides	30-day	n/a	n/a	n/a	n/a	2.6	0.323	n/a	n/a	n/a	n/a	n/a	0.037	n/a	n/a

Raw ISC Results

@ 1 g/s	103% Load	100% Load	75% Load	50% Load
1-hour	1.18553	1.18949	1.21203	1.50501
3-hour	0.43969	0.44888	0.50475	0.607
8-hour	0.20715	0.21114	0.24334	0.29325
24-hour	0.11524	0.12313	0.15819	0.21094
Monthly	n/a	0.11524	n/a	n/a
Annual	n/a	0.00855	n/a	n/a

File name: Load_Fine-10-27-05.BST

Nall, Josh/DEN

From: Cole Anderson [CANDER3@state.wy.us]
Sent: Friday, October 14, 2005 4:53 PM
To: Nall, Josh/DEN
Cc: Ken Rairigh
Subject: Class II Analysis for Risk Assessment with HAPs

The Division is requiring a risk analysis for the emitted HAPs from the Northeast Power plant Project. In the past, the NATICH was used to compare concentrations of pollutants to referenced regional concentrations. This is no longer the methodology used. Pollutant emissions are modeled to determine maximum impacts, which are then either (1) compared to a carcinogenic risk factor, if the pollutant is a known carcinogen, or (2) contrasted to a reference dose used for non-carcinogenic pollutants.

Below are EPA references to assist your efforts:

Air Toxics Risk Assessment

http://www.epa.gov/ttn/fera/risk_atoxic.html

Risk Based Analyses - Air Toxics Risk Assessment Reference Library, Volumes I and II

http://www.epa.gov/ttn/fera/risk_atra_vol2.html

IRIS Database for Risk Assessment

http://www.epa.gov/iris/index.html

If you have any questions or concerns, please do not hesitate to contact me at your convenience.

Sincere regards,

Cole Anderson
307-777-3776
cander3@state.wy.us

P.S. Ken mentioned that the Division has not received the 10 meter meteorological data used in the Northeast Power plant Project. Please submit the data to Ken at your earliest convenience.

Appendix H

Modeling Documentation Far-field

Protocol for a CALPUFF Modeling Analysis of the Dry Fork Station Project (Northeast Wyoming Generation Project)

Prepared for

BASIN ELECTRIC POWER COOPERATIVE

Prepared by

CH2MHILL

August 2005

Contents

Tables

Figures

Appendices

SECTION 1.0

Introduction

Basin Electric Power Cooperative (BEPC) proposes to construct the Dry Fork Station Project (formerly known as the Northeast Wyoming Generation Project) near Gillette, Wyoming. The proposed power plant would include one pulverized coal (PC) boiler that would be capable of generating a nominal 390 MW (gross). This modeling protocol describes the proposed methodology for the far-field air quality impact analysis.

The emissions associated with the PC boiler will be controlled through various reduction methods. Specifically, the SO_2 emissions will be reduced with Circulating Dry Scrubber (CDS) equipment. Boiler particulate emissions will be controlled with a fabric filter, and NO_x emissions will be controlled by Selective Catalytic Reduction (SCR). Table 1-1 presents preliminary estimates of annual emissions for the project.

Representatives of BEPC and CH2M HILL met with key personnel from the Wyoming Department of Environmental Quality (WDEQ) and the National Park Service (NPS) on August 4, 2005 to discuss the proposed CALPUFF modeling protocol for the project. Changes to the protocol that were suggested by the WDEQ and the NPS have been incorporated into this document. Appendix A presents a summary of the meeting.

TABLE 1-1
Summary of Estimated Annual Emissions

Pollutant	Estimated Controlled Emissions (tons per year)
Nitrogen Oxides (NO_x)	999
Sulfur Dioxide (SO_2)	1,332
Carbon Monoxide (CO)	2,564
Fine Particulate Matter (PM_{10})	266[1]

[1] Includes filterable and condensable particulate emissions

SECTION 2.0

Class I Area Impact Analysis

The proposed Dry Fork Station Project would be located to the northeast of the City of Gillette in Campbell County, Wyoming. The proposed location is approximately four miles to the northeast of the Gillette-Campbell County Airport. Within 250 kilometers (km) of the project, there are three areas in South Dakota and Montana that are classified as Class I areas for the protection of air quality. These areas include Wind Cave and Badlands National Parks in South Dakota, which are located approximately 180 and 220 kilometers (km), respectively, to the east-southeast. Northern Cheyenne Indian Reservation is located approximately 135 km to the northwest in southern Montana. CH2M HILL will use the CALPUFF modeling system to assess the potential impacts at these three Class I areas.

The CALPUFF analysis will include an assessment of visibility, atmospheric deposition, and criteria pollutant impacts at each Class I area. Our analyses will be performed based on guidance found in the following documents: *Federal Land Managers' Air Quality Related Values Workgroup (FLAG) Phase I Report* (FLAG, 2000), and *Interagency Workgroup on Air Quality Modeling (IWAQM) Phase 2 Summary Report and Recommendations for Modeling Long Range Transport Impacts* (EPA, 1998).

The visibility analysis will assess the potential Class I impacts from the proposed project only, in accordance with the WDEQ regulations governing Prevention of Significant Deterioration (PSD) projects. Page 6-64 of Chapter 6, Section 4 of the Air Quality Division (AQD) regulations includes the following: "The owner or operator shall provide an analysis of the impairment to visibility, soils and vegetation that would occur as a result of the facility or modification and general commercial, residential, industrial, and other growth associated with the facility or modification." (WDEQ, 2003).

The NPS has established Deposition Analysis Thresholds (DAT) for Eastern and Western regions of the United States. A DAT is the amount of deposition within an area below which the impacts from a proposed project would be considered insignificant. The DAT for Western areas is 0.005 kg/ha/yr for total nitrogen and also for total sulfur (NPS, 2002). Modeled sulfur and nitrogen deposition from the new unit at each Class I area will be compared to the DAT for the western region. Table 2-1 lists the modeling significance levels and PSD increments that apply to the project.

At the request of the NPS, visibility and criteria pollutant impacts will also be assessed at Devil's Tower Monument in Wyoming. Because this is a Class II area, the criteria pollutant impacts will be compared to Class II modeling significance levels.

SECTION 3.0

Model Selection

Class I areas nearest to the project are located more than 50 km from the proposed source. Workgroups that represent the interests of the Federal Land Managers (FLM) in the PSD permitting process (IWAQM, FLAG) recommend that a "far-field analysis" of the effect of a proposed source on air quality and air quality related values (AQRV) be performed for sources located more than 50 km from affected areas. CH2M HILL will use the EPA CALPUFF modeling system, as recommended by the EPA and the FLM for far-field analyses, to obtain predicted impacts. The CALPUFF modeling system includes the CALMET meteorological model, a gaussian puff dispersion model (CALPUFF) with algorithms for chemical transformation and deposition, and a postprocessor capable of calculating concentrations, visibility impacts, and deposition (CALPOST). The CALPUFF modeling system will be applied in a full, refined mode rather than a screening mode.

CH2M HILL will use the EPA-approved versions of the CALPUFF modeling system preprocessors and models. Specifically, we will use the Beta-test versions that are currently available on the Earth Tech website (http://www.calgrid.net/calpuff/calpuff1.htm). The latest versions of the primary models include:

- CALMET Version 5.53a, Level 040716
- CALPUFF Version 5.711a, Level 040716
- CALPOST Version 5.51, Level 030709

CALMET Methodology

4.1 Dimensions of the Modeling Domain

CH2M HILL will use the CALMET model to generate a three-dimensional wind field and other meteorological parameters suitable for use by the CALPUFF model. A modeling domain will be established to encompass higher terrain west of Gillette and the Class I areas of interest. The domain will cover a region approximately 672 km by 472 km with a grid resolution of 4 km.

CH2M HILL will use a Lambert Conformal Conic (LCC) map projection for the analysis due to the large extent of the domain. Figure 1 shows the CALMET/CALPUFF modeling domain and provides the key parameters for the LCC map projection.

The default technical options listed in Appendix B of the IWAQM Phase 2 report will be used for CALMET. User-specified model options will be determined by CH2M HILL's professional staff to produce the most realistic wind field. Vertical resolution of the wind field will include nine layers, with vertical cell face heights as follows (in meters):

- 0, 20, 50, 100, 250, 500, 750, 1000, 1500, 3500

4.2 CALMET Input Data

CH2M HILL will run the CALMET model to produce three years of analysis: 2001, 2002 and 2003. For 2001, we will use data at 36-km resolution that were obtained from the contractor (Alpine Geophysics) who developed the nationwide data for the EPA. For 2002, nationwide 36-km MM5 data, developed for the Visibility Improvement State and Tribal Association of the Southeast (VISTAS), were obtained from the same EPA contractor. Data for 2003 were also obtained from Alpine Geophysics. These 2003 data, also at 36-km resolution, were developed by the Wisconsin Department of Natural Resources, the Illinois Environmental Protection Agency, and the Lake Michigan Air Directors Consortium. These three datasets were chosen because they are current and because they have all been evaluated for quality. The MM data will be used as input to CALMET as the "initial guess" wind field. The initial guess field will be adjusted by CALMET for local terrain and land use effects to generate a Step 1 wind field, and then further refined using local surface observations to create a final Step 2 wind field.

Upper-air observations from Rapid City, South Dakota will be input to CALMET to adjust the initial guess wind field. The Rapid City station is located between the source and two of the Class I areas in question, and therefore represents critical data to add to CALMET. Other upper-air stations such as Riverton, Wyoming and North Platte, Nebraska are located off of the modeling domain or near the edge of the domain, far removed from the source and Class I areas, and will not be used in the analysis. Rapid City data for 2001, 2002, and 2003 in FSL format will be obtained and processed through the READ62 processor.

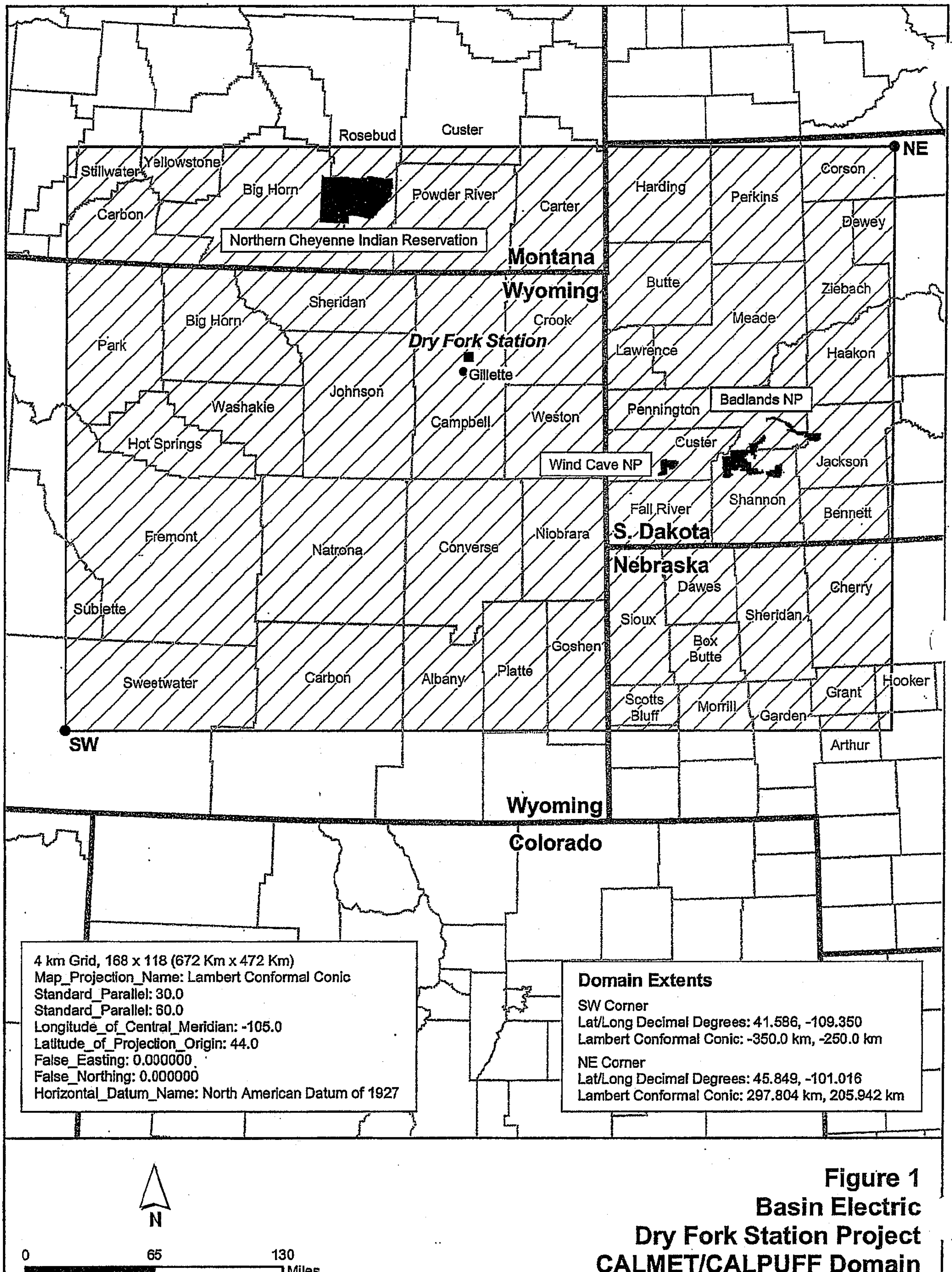


Figure 1
Basin Electric
Dry Fork Station Project
CALMET/CALPUFF Domain

Surface and precipitation data for 2001-2003 will be obtained from the National Climatic Data Center (NCDC). CH2M HILL will use all stations within the modeling domain that contain a high percentage of valid data for a given year. Figure 2 shows the locations of the surface stations within the modeling domain, and Figure 3 shows the location of the precipitation stations.

Land use and terrain data to construct the GEO.DAT input to CALMET will be obtained from the U.S. Geological Survey (USGS). Land use data will be obtained in Composite Theme Grid (CTG) format from the USGS, and the Level I USGS land use categories will be mapped into the 14 primary CALMET land use categories. Surface properties such as albedo, Bowen ratio, roughness length, and leaf area index will be computed from the land use values. Terrain data will be taken from USGS 1-degree Digital Elevation Model (DEM) data, which are primarily derived from USGS 1:250,000 scale topographic maps. Missing land use data will be filled with a value that is appropriate for the missing area.

4.3 Validation of CALMET Wind Field

CH2M HILL will use visualization software to examine the CALMET wind fields to determine if the various "user defined" CALMET technical options were chosen properly. Documentation of the wind field evaluation will be included in the final report for the analysis. A sample CALMET input file is included as Appendix B of this protocol. This input file lists all of the technical CALMET switches that we propose to use for our analyses.

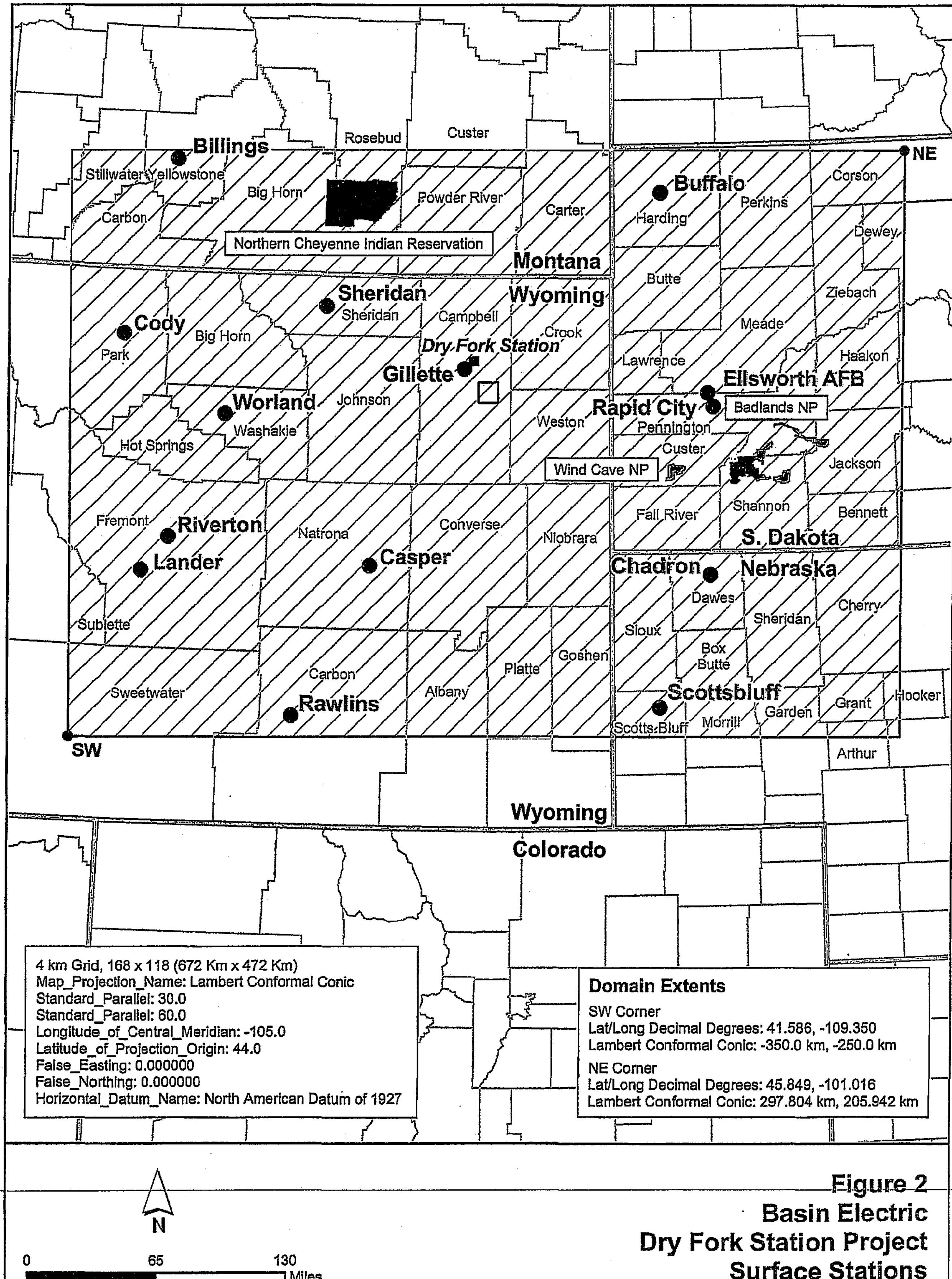
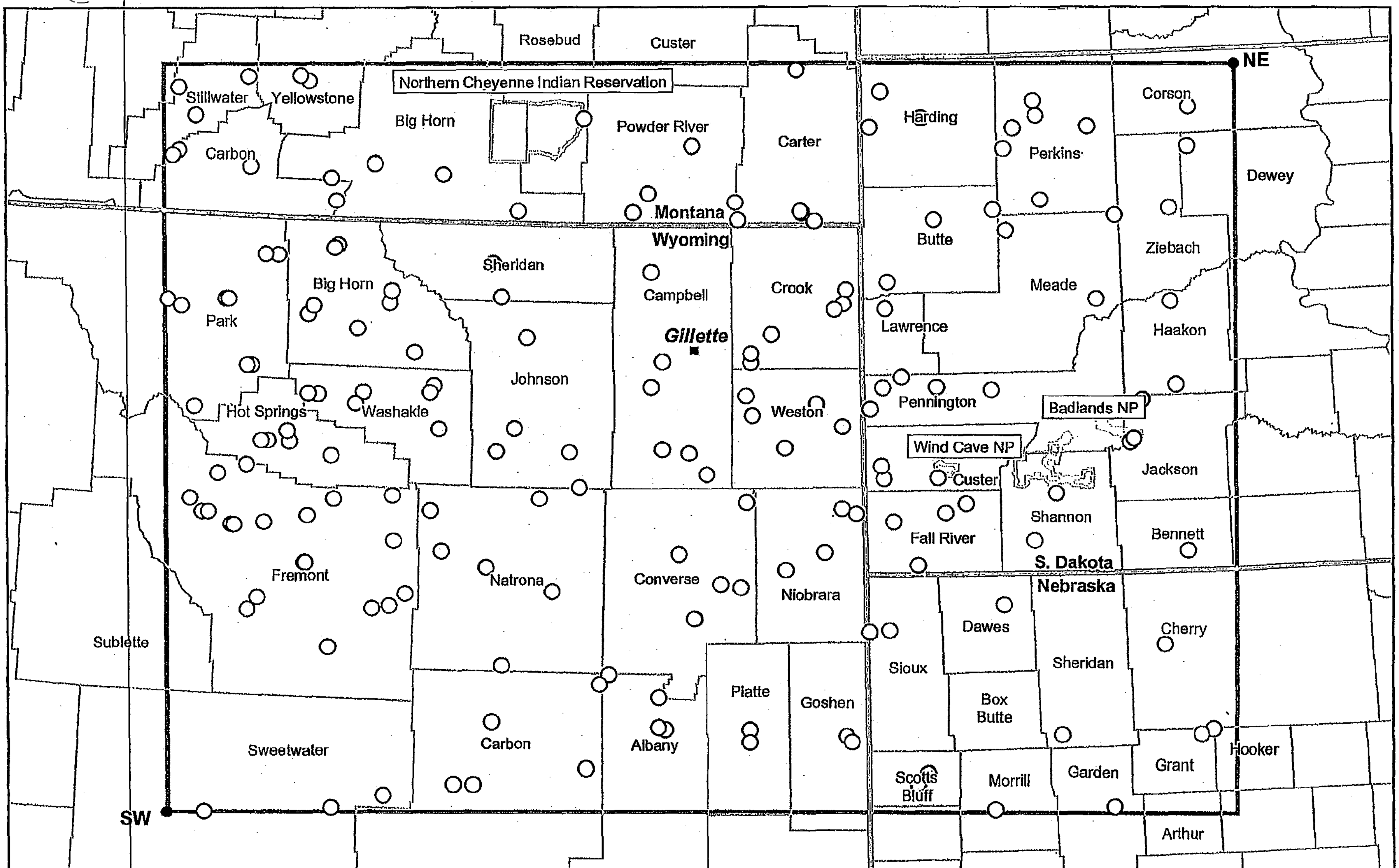


Figure 2
Basin Electric
Dry Fork Station Project
Surface Stations



N

Domain Extents

SW Corner
Lat/Long Decimal Degrees: 41.586, -109.350
Lambert Conformal Conic: -350.0 km, -250.0 km

NE Corner
Lat/Long Decimal Degrees: 45.849, -101.016
Lambert Conformal Conic: 297.804 km, 205.942 km

Figure 3
Precipitation Stations for Montana, Nebraska, S. Dakota and Wyoming

DEQ/AQD 000332

SECTION 5.0

CALPUFF Methodology

5.1 CALPUFF Technical Options

CH2M HILL will drive the CALPUFF model with the meteorological output from CALMET over the modeling domain described earlier. To evaluate the impacts from the proposed project, only the emissions from the proposed project will be modeled.

CH2M HILL will use the default CALPUFF technical options that are listed in the IWAQM Phase 2 guidance document and the current sample CALPUFF input file from the Earth Tech website. For wet and dry deposition, CH2M HILL will use the CALPUFF default values for particle size parameters and scavenging coefficients for sulfate and nitrate particles. For PM_{10} particles, CH2M HILL will use data for baghouse control from Table 1.1-6 from AP-42 Chapter 1.1 (Bituminous and Subbituminous Coal Combustion). The data in the table yield an average particle size diameter of 2 microns and a standard deviation of 5.

Hourly ozone data will be input to CALPUFF for chemical transformation. These data will be compiled from two stations, Thunder Basin National Grasslands in Wyoming and the Robbinsdale site near Rapid City, South Dakota. The Thunder Basin visibility and air quality monitoring station is located approximately 32 miles north of Gillette. The site is maintained by the WDEQ, and became operational in May 2001. A digital camera, transmissometer, ambient nephelometer, meteorology equipment, ozone analyzer, oxides of nitrogen analyzer and an IMPROVE aerosol sampler are located at this site. The Robbinsdale site is maintained by the South Dakota Department of Environment and Natural Resources. This station collects hourly ozone readings during the "ozone season", which in this case is May through September. Data is available for 2002-2003. CH2M HILL will compile all available hourly data from these two sites into a model-ready ozone input file.

For periods of missing hourly ozone data, the chemical transformation will rely on monthly default values that will be input to CALPUFF. We will determine the monthly default values by calculating monthly average concentrations from all available data, which includes data from a National Park Service (NPS) station at Badlands National Park that began operating in August of 2003. The highest monthly average for a given month that is calculated from the available stations will be input to CALPUFF as the default value for that month. The calculated monthly values are as follows:

January:	30 ppb
February:	36 ppb
March:	40 ppb
April:	41 ppb
May:	46 ppb
June:	47 ppb
July:	49 ppb
August:	50 ppb

September: 39 ppb
October: 35 ppb
November: 31 ppb
December: 30 ppb

A constant background ammonia concentration of 10 ppb will be input to CALPUFF for chemical transformation with the MESOPUFF II chemical transformation scheme.

5.1 Receptor Grids

Discrete receptors for the CALPUFF modeling will be placed at uniform spacing along the boundary and in the interior of each area of concern. As recommended by the NPS, receptors will be taken from the NPS database for Class I area modeling. A copy of this database, along with a conversion routine for various coordinate systems, *NPS Convert Class I Areas*, was provided to CH2M HILL by the NPS. The NPS conversion routine will be used to convert all latitude/longitude coordinates to LCC coordinates, including receptors, meteorological stations, and source locations. Because the NPS database does not include the Northern Cheyenne Indian Reservation, those receptors will be taken from a sample CALPUFF input file provided by WDEQ.

A sample CALPUFF input file is provided in Appendix C.

SECTION 6.0

CALPOST Methodology

6.1 Visibility

The visibility analysis will make use of the concentrations generated by CALPUFF, hourly relative humidity data, and the CALPOST postprocessor to calculate the percent change in extinction attributable to the project emissions as compared to background extinction. Emissions for the visibility analysis will be based on 24-hour rates for the project source.

Relative humidity for the consideration of extinction from hygroscopic particles will be calculated on an hourly basis from data in the CALMET files. This approach represents Method 2 in CALPOST, which is the recommended method in the FLAG document for a refined CALPUFF visibility analysis. The cap on relative humidity in CALPOST will be set at 95%. This cap was suggested by the NPS at the August 4, 2005 meeting described earlier.

Particulate emissions from the project will be speciated between filterable particulate (fine PM10/soil), condensable hydrogen fluoride (HF) and hydrogen chloride (HCL), primary sulfate, elemental carbon due to loss on ignition (LOI), and organic carbon condensables. Primary sulfate emissions will consist of ammonium sulfate, sulfuric acid mist, and ammonium bi-sulfate. This speciation allowed for the consideration within the visibility analysis of the different scattering efficiencies of the various species. This apportionment is important because some particulates, especially elemental carbon (EC) particles, have a greater impact on visibility. For example, EC particles have an extinction efficiency of 10 inverse megameters per micrograms per cubic meter ($Mm^{-1}/\mu g/m^3$), while sulfate particles have an extinction efficiency of 3.0 $Mm^{-1}/\mu g/m^3$. Filterable PM_{10} from the proposed source will be treated within CALPOST as "fine"particulate (extinction efficiency of 1.0).

The organic carbon condensable fraction will be estimated from organic Hazardous Air Pollutants (HAPs) that have boiling temperatures less than 300° F. This approach will serve to capture all organics that will condense at temperatures below the stack exhaust temperature. Elemental carbon will be based on the expected LOI from the boiler stack.

Background extinction (b_{back}) for the areas of concern will be calculated within CALPOST using the equation:

$$b_{back} = b_{hygro} \times f(RH) + b_{NonHygro} + Rayleigh$$

Values for b_{hygro}, $b_{NonHygro}$, and Rayleigh scattering components are provided in Appendix 2.B of the FLAG report. As shown in the FLAG report, the values for b_{hygro} (0.6 Mm^{-1}), $b_{NonHygro}$, (4.5 Mm^{-1}) and Rayleigh scattering (10 Mm^{-1}) are the same for each of the Class I areas of concern. These values are the current FLAG-recommended estimates of "natural background" for all western areas. CH2M HILL will use these values for each of the Class I ~~areas of concern.~~

A sample CALPOST input file is provided in Appendix D.

The raw visibility results using Method 2 will be derived from a calculation of percentage light extinction that uses "natural" background as the denominator. The FLAG document defines natural conditions as "[c]onditions substantially unaltered by humans or human activities. As applied in the context of visibility, natural conditions include naturally occurring phenomena that reduce visibility as measured in terms of light extinction, visual range, contrast, or coloration." Aerosols that occur naturally in the ambient air affect background visibility under natural conditions. Natural background visibility is also affected by water in various physical states that naturally occur in the ambient air in the form of humidity, clouds, and fog or in the form of precipitation as snow or rain.

The recommended FLAG approach provides a method of adjustment of natural background visibility for one form of atmospheric water expressed as relative humidity through the growth of hygroscopic particles. However, FLAG does not provide a method of adjusting natural background visibility for atmospheric water naturally occurring in other physical states. Therefore, to fully account for the impact on natural visibility due to atmospheric water in all forms and not just relative humidity, CH2M HILL will use a method to adjust for background extinction caused by condensed water as well.

The NPS operates the IMPROVE transmissometer at Badlands NP to measure actual background visibility. This transmissometer at Badlands NP measures actual atmospheric light extinction over a path length of approximately 4.15 km. This measurement includes the effects of both natural and human-caused conditions. Because only natural conditions are to be considered in the estimation of natural background, CH2M HILL devised a method to remove the effect of human-caused visibility impairment from the transmissometer data.

The NPS publishes, on the CSU IMPROVE web site for each of the IMPROVE transmissometer sites, a 5-year visibility trends analysis of the 10th, 50th, and 90th percentile averages of reconstructed light extinction and the light scattering of the major aerosol types. The 10th percentile days are the best in terms of visibility and the 90th are the worst. The reconstruction of these light extinction estimates by NPS accounts only for the effect of aerosols measured in the atmosphere at the IMPROVE site and specifically excludes any effect on visibility due to water.

The 1996 90th percentile reconstructed light extinction and the light scattering for each IMPROVE site are reported in the web document titled BEXT_5yr_Mar2002_TXT.htm. For Badlands for 1996, the 90th percentile value reported by NPS for reconstructed visibility impairment is 48.48 Mm^{-1}. This represents the highest average reconstructed light extinction at the Badlands IMPROVE site in 1996 due to measured aerosols that are both natural and human caused.

Hourly transmissometer light extinction readings at Badlands NP for 1996 range from 942 Mm^{-1} (indicating total blockage of the 4.15-km transmissometer light path) to 11 Mm^{-1}. Generally the highest light obscuration events occur when condensed water is present in the atmosphere in the form of clouds, fog, snow, or rain. In order to be conservative, a light extinction level of 50 Mm^{-1} will be chosen as the transition between aerosol-dominated and condensed water-dominated light extinction at Badlands NP.

CH2M HILL will obtain hourly Badlands transmissometer data for any days for which the raw Method 2 result is greater than or equal to 5% at Badlands or Wind Cave National

Parks. Background light extinction will be determined for each hour by examining the Badlands transmissometer data for that hour. If the measured light extinction is 50 Mm^{-1} or more, indicating possible condensed water dominated light extinction, the transmissometer reading will be used for background for that hour if other evidence indicates natural obscuration. If the measured extinction is less than 50 Mm^{-1}, indicating aerosol dominated light extinction; the light extinction value calculated using the FLAG-prescribed equation above will be used. The transmissometer readings will be used along with surface observations from Rapid City and other available data to verify that visibility obscuration events at Badlands or Wind Cave occurred at roughly the same time at Rapid City.

For Northern Cheyenne Indian Reservation, CH2M HILL will use the observed visual range at the nearest surface station (Sheridan, Wyoming) in a similar fashion to substitute observed visual range as background for obscured conditions. Observations at Billings, Montana and other available data will be used to verify that visibility obscuration events at Sheridan and Billings occurred at roughly the same time.

The natural background adjustment described above is similar to the approach used in Montana for the Roundup Power Plant (RPP) project. This is described in a letter from the Department of Interior to the Montana Department of Environmental Quality (Manson, 2003). The letter says "[I]t is our interpretation that 'natural conditions' include significant meteorological events such as fog, precipitation, or naturally occurring haze. Based on the information received and subsequent analysis of that data and the policy guidance, I have concluded that on those days when RPP was shown in the original analysis to have resulted in a visibility extinction of 5 percent or more a weather event was the most significant source of the visibility extinction and not the RPP emissions."

6.2 Atmospheric Deposition

Atmospheric deposition at the areas of concern will be assessed through an analysis of total sulfur (S) and nitrogen (N) deposition. Annual deposition rates will be determined based on the annual emission rates from the proposed project.

Annual deposition rates (wet and dry) of NO_x, HNO_3, and NO_3^- will be calculated by CALPUFF, then converted to equivalent levels of nitrogen and summed using the POSTUTIL and CALPOST postprocessors. Likewise, deposition rates of SO_2 and SO_4^{-2} will be converted to equivalent levels of nitrogen and sulfur and summed. Because DAT levels for deposition established by the NPS are expressed in units of kg/ha/yr for total N or S, the CALPUFF deposition fluxes of each of the species of N and S must be adjusted to account for the difference in molecular weights between the species and the elements. CH2M HILL will use the molecular weight ratios shown in Table 6-1 within the CALPOST module to perform the adjustment.

TABLE 6-1
Molecular Weight Ratios for Deposition Calculations in CALPOST

Element	Ratio of Molecular Weights
N from SO_4	0.29167*
N from HNO_3	0.22222
N from NO_3	0.45161**
N from NO_x	0.30435
S from SO_2	0.50000
S from SO_4	0.33333

*Based on two moles of N in $(NH_4)_2SO_4$
**Based on two moles of N in NH_4NO_3

6.3 Criteria Pollutants

CH2M HILL will also use the CALPUFF modeling system to estimate the impact of the project relative to the criteria pollutants for which a Class I PSD increment has been established: NO_2, SO_2, and PM_{10}. Modeled impacts will be compared to Class I modeling significance levels that have been proposed by the EPA. At the direction of the NPS, if Class I significance levels are exceeded at Wind Cave or Badlands for a particular pollutant and averaging period, a cumulative increment analysis will be performed for only that averaging period. For example, if modeled 3-hour SO_2 exceeds the Class I modeling significance level, but 24-hour does not, a cumulative analysis would be performed for 3-hour SO_2 only.

If a cumulative analysis is required for any criteria pollutant, CH2M HILL will produce a supplement to this protocol that addresses the sources to be included, emissions rates to be input to the model, and other considerations.

We will use the POSTUTIL routine to sum the impacts of primary and secondary particulate to arrive at the total impact of PM_{10}.

Because the WDEQ intends to establish a 3-hour SO_2 emission limit within the permit for the project (but no 24-hour limit), emission rates for 24-hour SO_2 modeling in CALPUFF will be based on the proposed 3-hour SO_2 emission limit. The NO_x emission rate in CALPUFF will be based on the expected 30-day NO_x limit that will be established in the permit. WDEQ does not intend to establish a short-term emission limit for NO_x.

SECTION 7.0

Presentation of Results

The methodology and results of the CALPUFF modeling analyses will be presented in a technical report. Input and output files for the CALMET, CALPUFF, POSTUTIL, and CALPOST modeling, as well as program executables and source code will be provided in electronic format on CD or DVD.

References

EPA, 1998. *Interagency Workgroup on Air Quality Modeling (IWAQM) Phase 2 Summary Report and Recommendations for Modeling Long Range Transport Impacts*, Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina, December 1998.

FLAG, 2000. *Federal Land Managers' Air Quality Related Values Workgroup (FLAG) Phase I Report*, December 2000.

NPS, 2002. *Guidance on Nitrogen and Sulfur Deposition Analysis Thresholds*, National Park Service Air Resources Division, Denver, Colorado, January 2002.

WDEQ, 2003. *Wyoming Air Quality Standards & Regulations*. Chapter 6 - Permitting Requirements; Section 4 - Prevention of Significant Deterioration.

APPENDIX A

Summary of Pre-Application Meeting

CH2MHILL

Subject: Basin Electric Northeast Wyoming Generation Project

Date: Thursday, August 4th, 2005; 10:00 am MDT

Location: WDEQ Offices – Cheyenne, WY

MEETING SUMMARY

Attendees: Clyde Bush, Jerry Menge, Jim K Miller, and Bob Williams (Basin Electric); Bob Pearson and Josh Nall (CH2M HILL); John Notar and Don Shepherd (NPS); Ken Rairigh and Chad Schlichtemeier (WDEQ). [Bernie Dailey (ill) and Dan Olsen of WDEQ not in attendance.]

The meeting began with introductions and a project overview from Clyde from Basin Electric. After some brief exchanges between Don Shepherd and others on control technology and emission rates, CH2M HILL went into a summary of the CALPUFF protocol. Josh Nall presented the default ozone levels that were selected from the highest monthly averages from all stations and the figure that showed Devils Tower is beyond 50 km. John Notar said that the proposed ozone and NH3 and most aspects of the protocol were OK including the three years of MM5 data (2001, 2002 and 2003). He then listed his suggested changes to the protocol:

1. Add a vertical CALMET layer between 1000m and 3000m (1500m?), increase top Z face because maximum mixing height and top Z are both set to 3000. John suggested top Z at 3500.

2. Notar does not like the no obs CALMET option (without upper-air data) as proposed in the protocol. He asked that NWS upper-air data from Lander, WY and North Platte, NE be processed and added to the CALMET. Lander is in the SW corner of the modeling domain and North Platte is out of the domain to the SE but CALMET can still use it. John suggested a large radius of influence so North Platte could still influence the windfield. Josh Nall later asked if Rapid City, SD could be used instead of N Platte, and thus radius of influence could be reduced. Notar agreed. Josh Nall asked how to substitute for missing data (always a problem with upper air processing), and Notar suggested we contact Tim Allen of US Fish & Wildlife (303.914.3802).

3. For visibility CALPOST using Method 2, NPS now allows an RH cap of 95% instead of the 98% cap listed in FLAG. Notar said they will look at our adjustments to natural background using transmissometer (Bad Lands and Wind Cave) and Sheridan/Billings NWS data (N Cheyenne Reservation). He wants to see meteorological evidence of obscuration for each event rather than blanket acceptance of 50 Mm^{-1} as the minimum transmissometer threshold for a natural obscuration/weather event.

4. For criteria pollutants, if Class I SILs are tripped at Wind Cave or Badlands for a particular pollutant and averaging period, a cumulative increment analysis should be performed for only that averaging period. For example, if 3-hour SO_2 trips the SIL, but 24-hour does not, the cumulative analysis should be performed for 3-hour only. All major sources within the domain should be included (some can be screened out), and minor sources within 50 km of each Class I area should also be included. Notar suggested that Basin produce a "mini" protocol before cumulative analysis is attempted.

5. Miscellaneous technical switches (proposed protocol vs. NPS suggestions):
a) Rmax1 (max radius of influence for surface stations), protocol=20, NPS=30.
b) Rmax2 (max radius of influence for upper air stations), protocol=50, NPS=250.
c) R1 (distance at which MM5 and surface observations weighed equally), protocol=5, NPS=10-20
d) R2 (distance at which MM5 and upper air observations weighed equally), protocol=25, NPS=100-150
e) TERRAD (radius of influence of terrain features), protocol=15, NPS=15-20

[note: suggested radii for upper air stations were chosen by Notar to provide adequate influence for N Platte. If N Platte is not included, revert to Rmax2=100 and R2=50 as accepted by NPS for Comanche? Ask Ken R.]

6. NPS would like us to model using CALPUFF Class II SILs and visibility at Devils Tower. He said a receptor spacing of 1 km would suffice. NPS has no legal "leverage" if adverse impacts are modeled, but impacts should be reported for public informational purposes. NPS does not have the boundary coordinates for Devils Tower, nor does WDEQ. We will try to get them from BLM electronic maps.

John Notar also mentioned that the option to use ammonia limiting (MNITRATE in POSTUTIL) is available to Basin if they wish to use it.

Don Shepherd agreed with the use of the 3-hour emission rate for SO_2 for 24-hour modeling since a 24-hour limit will not be established by WDEQ. Don suggested that Basin model an estimated 24-hour rate for NOx rather than modeling the 30-day value. Chad S stated that Bernie D does not agree with setting a 24-hour value for NOx.

Don also asked for a particle emission speciation breakdown. After some discussion, this was agreed to be composed of fine, elemental carbon, and condensable fractions. Don also raised the matter of using a monthly RH adjustment as proposed for the BART rules. This was not discussed further.

John Notar and Ken R agreed that Basin/CH2 should produce a revised "final" protocol that includes changes from today's meeting and a sample CALPUFF and CALPOST input file (only CALMET file provided with initial protocol). Notar will provide his written comments to DEQ in a couple of weeks.

The application should be provided to WDEQ in five sets with two sets of electronic modeling files. One of each will be forwarded to the NPS.

<u>Additional Communications Following Meeting with WDEQ</u>

05 Aug 05: Josh Nall spoke to Ken R. He did not indicate that he would oppose the NPS suggestions. He did say that if Rapid City UA data available, Lander (Riverton) can be dropped. Also, if R City is available, the RMAX2 and R2 could be reduced. I suggested we drop them to

the levels approved by the NPS for Comanche, and Ken didn't object. Ken said that he and his assistant on the near-field modeling will provide us comments by 16 Aug.

APPENDIX B

Sample CALMET Input File

```
Northeast Wyoming 2001
CALMET: 4 km Grid Spacing
---------------- Run title (3 lines) ------------------------------------------

                         CALMET MODEL CONTROL FILE
                         --------------------------

-------------------------------------------------------------------------------

INPUT GROUP: 0 -- Input and Output File Names


Subgroup (a)
------------
Default Name  Type          File Name
------------  ----          ---------
GEO.DAT       input    ! GEODAT= geo4km.dat!
SURF.DAT      input    ! SRFDAT= surf\surf01.dat!
CLOUD.DAT     input    * CLDDAT=           *
PRECIP.DAT    input    ! PRCDAT= precip\precip01.dat !
MM4.DAT       input    ! MM4DAT= mm5\WY0101.mm5 !
WT.DAT        input    * WTDAT=            *

CALMET.LST    output   ! METLST= wyo0101.lst !
CALMET.DAT    output   ! METDAT= wyo0101.dat !
PACOUT.DAT    output   * PACDAT=            *

All file names will be converted to lower case if LCFILES = T
Otherwise, if LCFILES = F, file names will be converted to UPPER CASE
         T = lower case      ! LCFILES = T !
         F = UPPER CASE

NUMBER OF UPPER AIR & OVERWATER STATIONS:

    Number of upper air stations (NUSTA)  No default     ! NUSTA =  1  !
    Number of overwater met stations
                                 (NOWSTA) No default     ! NOWSTA =  0  !

                        !END!

-------------------------------------------------------------------------------
Subgroup (b)
---------------------------------
Upper air files (one per station)
---------------------------------
Default Name  Type        File Name
------------  ----        ---------
UP1.DAT    input     1  ! UPDAT=upa\RAPID01.DAT!    !END!

-------------------------------------------------------------------------------
Subgroup (c)
-----------------------------------------
Overwater station files (one per station)
-----------------------------------------
Default Name  Type        File Name
------------  ----        ---------
-------------------------------------------------------------------------------
Subgroup (d)
----------------
Other file names
----------------

Default Name  Type        File Name
```

```
------------   ----    ---------
DIAG.DAT       input   * DIADAT=                    *
PROG.DAT       input   * PRGDAT=                    *

TEST.PRT       output  * TSTPRT=                    *
TEST.OUT       output  * TSTOUT=                    *
TEST.KIN       output  * TSTKIN=                    *
TEST.FRD       output  * TSTFRD=                    *
TEST.SLP       output  * TSTSLP=                    *

--------------------------------------------------------------------------------
NOTES: (1) File/path names can be up to 70 characters in length
       (2) Subgroups (a) and (d) must have ONE 'END' (surround by
           delimiters) at the end of the group
       (3) Subgroups (b) and (c) must have an 'END' (surround by
           delimiters) at the end of EACH LINE

                         !END!


-------------------------------------------------------------------------------

INPUT GROUP: 1 -- General run control parameters
--------------

    Starting date:   Year (IBYR) -- No default       ! IBYR=  2001  !
                    Month (IBMO) -- No default       ! IBMO=  1  !
                      Day (IBDY) -- No default       ! IBDY=  1  !
                     Hour (IBHR) -- No default       ! IBHR=  1  !

    Base time zone        (IBTZ) -- No default       ! IBTZ=  7  !
       PST = 08, MST = 07
       CST = 06, EST = 05

    Length of run (hours) (IRLG) -- No default       ! IRLG=  744 !

    Run type            (IRTYPE) -- Default: 1       ! IRTYPE=  1  !

       0 = Computes wind fields only
       1 = Computes wind fields and micrometeorological variables
           (u*, w*, L, zi, etc.)
       (IRTYPE must be 1 to run CALPUFF or CALGRID)

    Compute special data fields required
    by CALGRID (i.e., 3-D fields of W wind
    components and temperature)
    in additional to regular            Default: T    ! LCALGRD = T !
    fields ? (LCALGRD)
    (LCALGRD must be T to run CALGRID)

     Flag to stop run after
     SETUP phase (ITEST)             Default: 2       ! ITEST=  2   !
     (Used to allow checking
     of the model inputs, files, etc.)
     ITEST = 1 - STOPS program after SETUP phase
     ITEST = 2 - Continues with execution of
                 COMPUTATIONAL phase after SETUP

!END!
-------------------------------------------------------------------------------
```

```
INPUT GROUP: 2 -- Map Projection and Grid control parameters
--------------

      Projection for all (X,Y):
      -------------------------

      Map projection
      (PMAP)                        Default: UTM     ! PMAP = LCC !

          UTM :  Universal Transverse Mercator
          TTM :  Tangential Transverse Mercator
          LCC :  Lambert Conformal Conic
          PS  :  Polar Stereographic
          EM  :  Equatorial Mercator
          LAZA:  Lambert Azimuthal Equal Area

      False Easting and Northing (km) at the projection origin
      (Used only if PMAP= TTM, LCC, or LAZA)
      (FEAST)                       Default=0.0      ! FEAST  = 0.0 !
      (FNORTH)                      Default=0.0      ! FNORTH = 0.0 !

      UTM zone (1 to 60)
      (Used only if PMAP=UTM)
      (IUTMZN)                      No Default       * IUTMZN =  *

      Hemisphere for UTM projection?
      (Used only if PMAP=UTM)
      (UTMHEM)                      Default: N       * UTMHEM =  *
          N   :  Northern hemisphere projection
          S   :  Southern hemisphere projection

      Latitude and Longitude (decimal degrees) of projection origin
      (Used only if PMAP= TTM, LCC, PS, EM, or LAZA)
      (RLAT0)                       No Default       ! RLAT0 = 44.0N !
      (RLON0)                       No Default       ! RLON0 = 105.00W !

          TTM :  RLON0 identifies central (true N/S) meridian of projection
                 RLAT0 selected for convenience
          LCC :  RLON0 identifies central (true N/S) meridian of projection
                 RLAT0 selected for convenience
          PS  :  RLON0 identifies central (grid N/S) meridian of projection
                 RLAT0 selected for convenience
          EM  :  RLON0 identifies central meridian of projection
                 RLAT0 is REPLACED by 0.0N (Equator)
          LAZA:  RLON0 identifies longitude of tangent-point of mapping plane
                 RLAT0 identifies latitude of tangent-point of mapping plane

      Matching parallel(s) of latitude (decimal degrees) for projection
      (Used only if PMAP= LCC or PS)
      (XLAT1)                       No Default       ! XLAT1 = 30.0N !
      (XLAT2)                       No Default       ! XLAT2 = 60.0N !

          LCC :  Projection cone slices through Earth's surface at XLAT1 and XLAT2
          PS  :  Projection plane slices through Earth at XLAT1
                 (XLAT2 is not used)

      ----------
      Note:  Latitudes and longitudes should be positive, and include a
             letter N,S,E, or W indicating north or south latitude, and
             east or west longitude.  For example,
             35.9  N Latitude  =  35.9N
             118.7 E Longitude = 118.7E
```

```
Datum-Region
------------

The Datum-Region for the coordinates is identified by a character
string.  Many mapping products currently available use the model of the
Earth known as the World Geodetic System 1984 (WGS-G ).  Other local
models may be in use, and their selection in CALMET will make its output
consistent with local mapping products.  The list of Datum-Regions with
official transformation parameters is provided by the National Imagery and
Mapping Agency (NIMA).

NIMA Datum - Regions(Examples)
------------------------------------------------------------------------------
WGS-G     WGS-84 GRS 80 Spheroid, Global coverage (WGS84)
NAS-C     NORTH AMERICAN 1927 Clarke 1866 Spheroid, MEAN FOR CONUS (NAD27)
NWS-27    NWS 6370KM Radius, Sphere
NWS-84    NWS 6370KM Radius, Sphere
ESR-S     ESRI REFERENCE 6371KM Radius, Sphere

Datum-region for output coordinates
(DATUM)                      Default: WGS-G      ! DATUM = NAS-C   !


Horizontal grid definition:
---------------------------

Rectangular grid defined for projection PMAP,
with X the Easting and Y the Northing coordinate

       No. X grid cells (NX)      No default      ! NX =   168   !
       No. Y grid cells (NY)      No default      ! NY =   118   !

Grid spacing (DGRIDKM)            No default      ! DGRIDKM = 4. !
                                  Units: km

Reference grid coordinate of
SOUTHWEST corner of grid cell (1,1)

   X coordinate (XORIGKM)         No default      ! XORIGKM = -350.000 !
   Y coordinate (YORIGKM)         No default      ! YORIGKM = -250.000 !
                                  Units: km

Vertical grid definition:
-------------------------

   No. of vertical layers (NZ)    No default      ! NZ =   9   !

   Cell face heights in arbitrary
   vertical grid (ZFACE(NZ+1))    No defaults
                                  Units: m
   ! ZFACE = 0.,20.,50.,100.,250.,500.,750.,1000.,1500., 3500. !

!END!

--------------------------------------------------------------------------------

INPUT GROUP: 3 -- Output Options
--------------
```

```
DISK OUTPUT OPTION

    Save met. fields in an unformatted
    output file ?             (LSAVE)  Default: T      ! LSAVE = T !
    (F = Do not save, T = Save)

    Type of unformatted output file:
    (IFORMO)                           Default: 1     ! IFORMO =  1  !

         1 = CALPUFF/CALGRID type file (CALMET.DAT)
         2 = MESOPUFF-II type file     (PACOUT.DAT)


LINE PRINTER OUTPUT OPTIONS:

    Print met. fields ?  (LPRINT)      Default: F      ! LPRINT = F !
    (F = Do not print, T = Print)
    (NOTE: parameters below control which
           met. variables are printed)

    Print interval
    (IPRINF) in hours                  Default: 1      ! IPRINF =  1  !
    (Meteorological fields are printed
     every  1  hours)


    Specify which layers of U, V wind component
    to print (IUVOUT(NZ)) -- NOTE: NZ values must be entered
    (0=Do not print, 1=Print)
    (used only if LPRINT=T)         Defaults: NZ*0
    ! IUVOUT =  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0, 0  !
    -----------------------


    Specify which levels of the W wind component to print
    (NOTE: W defined at TOP cell face --  8  values)
    (IWOUT(NZ)) -- NOTE: NZ values must be entered
    (0=Do not print, 1=Print)
    (used only if LPRINT=T & LCALGRD=T)
    -----------------------------------
                                        Defaults: NZ*0
     ! IWOUT =  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0, 0  !


    Specify which levels of the 3-D temperature field to print
    (ITOUT(NZ)) -- NOTE: NZ values must be entered
    (0=Do not print, 1=Print)
    (used only if LPRINT=T & LCALGRD=T)
    -----------------------------------
                                        Defaults: NZ*0
     ! ITOUT =  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0, 0  !

    Specify which meteorological fields
    to print
    (used only if LPRINT=T)            Defaults: 0 (all variables)
    -----------------------


      Variable            Print ?
                      (0 = do not print,
                        1 = print)
      --------        ------------------
```

```
!  STABILITY  =           0          ! - PGT stability class
!  USTAR      =           0          ! - Friction velocity
!  MONIN      =           0          ! - Monin-Obukhov length
!  MIXHT      =           0          ! - Mixing height
!  WSTAR      =           0          ! - Convective velocity scale
!  PRECIP     =           0          ! - Precipitation rate
!  SENSHEAT   =           0          ! - Sensible heat flux
!  CONVZI     =           0          ! - Convective mixing ht.

Testing and debug print options for micrometeorological module

   Print input meteorological data and
   internal variables (LDB)           Default: F       ! LDB = F !
   (F = Do not print, T = print)
   (NOTE: this option produces large amounts of output)

   First time step for which debug data
   are printed (NN1)                  Default: 1       ! NN1 =  1  !

   Last time step for which debug data
   are printed (NN2)                  Default: 1       ! NN2 =  1  !


Testing and debug print options for wind field module
(all of the following print options control output to
 wind field module's output files: TEST.PRT, TEST.OUT,
 TEST.KIN, TEST.FRD, and TEST.SLP)

   Control variable for writing the test/debug
   wind fields to disk files (IOUTD)
   (0=Do not write, 1=write)          Default: 0       ! IOUTD =  0  !

   Number of levels, starting at the surface,
   to print (NZPRN2)                  Default: 1       ! NZPRN2 =  0  !

   Print the INTERPOLATED wind components ?
   (IPR0) (0=no, 1=yes)               Default: 0       !  IPR0 =  0  !

   Print the TERRAIN ADJUSTED surface wind
   components ?
   (IPR1) (0=no, 1=yes)               Default: 0       !  IPR1 =  0  !

   Print the SMOOTHED wind components and
   the INITIAL DIVERGENCE fields ?
   (IPR2) (0=no, 1=yes)               Default: 0       !  IPR2 =  0  !

   Print the FINAL wind speed and direction
   fields ?
   (IPR3) (0=no, 1=yes)               Default: 0       !  IPR3 =  0  !

   Print the FINAL DIVERGENCE fields ?
   (IPR4) (0=no, 1=yes)               Default: 0       !  IPR4 =  0  !

   Print the winds after KINEMATIC effects
   are added ?
   (IPR5) (0=no, 1=yes)               Default: 0       !  IPR5 =  0  !

   Print the winds after the FROUDE NUMBER
   adjustment is made ?
   (IPR6) (0=no, 1=yes)               Default: 0       !  IPR6 =  0  !
```

```
        Print the winds after SLOPE FLOWS
        are added ?
        (IPR7) (0=no, 1=yes)              Default: 0       !  IPR7 =  0  !

        Print the FINAL wind field components ?
        (IPR8) (0=no, 1=yes)              Default: 0       !  IPR8 =  0  !

!END!

-------------------------------------------------------------------------------

INPUT GROUP: 4 -- Meteorological data options
--------------

   NO OBSERVATION MODE              (NOOBS)  Default: 0     ! NOOBS = 0  !
        0 = Use surface, overwater, and upper air stations
        1 = Use surface and overwater stations (no upper air observations)
            Use MM5 for upper air data
        2 = No surface, overwater, or upper air observations
            Use MM5 for surface, overwater, and upper air data

   NUMBER OF SURFACE & PRECIP. METEOROLOGICAL STATIONS

      Number of surface stations    (NSSTA)  No default     ! NSSTA =  13 !

      Number of precipitation stations
      (NPSTA=-1: flag for use of MM5 precip data)
                                    (NPSTA)  No default     ! NPSTA =  62  !

   CLOUD DATA OPTIONS
      Griddid cloud fields:
                                   (ICLOUD)  Default: 0     ! ICLOUD =  0  !
      ICLOUD = 0 - Gridded clouds not used
      ICLOUD = 1 - Gridded CLOUD.DAT generated as OUTPUT
      ICLOUD = 2 - Gridded CLOUD.DAT read as INPUT

   FILE FORMATS

      Surface meteorological data file format
                                   (IFORMS)  Default: 2     ! IFORMS =  2  !
      (1 = unformatted (e.g., SMERGE output))
      (2 = formatted   (free-formatted user input))

      Precipitation data file format
                                   (IFORMP)  Default: 2     ! IFORMP =  2  !
      (1 = unformatted (e.g., PMERGE output))
      (2 = formatted   (free-formatted user input))

      Cloud data file format
                                   (IFORMC)  Default: 2     ! IFORMC =  2  !
      (1 = unformatted - CALMET unformatted output)
      (2 = formatted   - free-formatted CALMET output or user input)

!END!

-------------------------------------------------------------------------------

INPUT GROUP: 5 -- Wind Field Options and Parameters
--------------

   WIND FIELD MODEL OPTIONS
```

```
Model selection variable (IWFCOD)     Default: 1       ! IWFCOD =  1  !
   0 = Objective analysis only
   1 = Diagnostic wind module

Compute Froude number adjustment
effects ? (IFRADJ)                    Default: 1       ! IFRADJ =  1  !
(0 = NO, 1 = YES)

Compute kinematic effects ? (IKINE)   Default: 0       ! IKINE  =  0  !
(0 = NO, 1 = YES)

Use O'Brien procedure for adjustment
of the vertical velocity ? (IOBR)     Default: 0       ! IOBR =  0  !
(0 = NO, 1 = YES)

Compute slope flow effects ? (ISLOPE) Default: 1       ! ISLOPE  =  1  !
(0 = NO, 1 = YES)

Extrapolate surface wind observations
to upper layers ? (IEXTRP)            Default: -4      ! IEXTRP =  -4  !
(1 = no extrapolation is done,
 2 = power law extrapolation used,
 3 = user input multiplicative factors
     for layers 2 - NZ used (see FEXTRP array)
 4 = similarity theory used
 -1, -2, -3, -4 = same as above except layer 1 data
     at upper air stations are ignored

Extrapolate surface winds even
if calm? (ICALM)                      Default: 0       ! ICALM  =  0  !
(0 = NO, 1 = YES)

Layer-dependent biases modifying the weights of
surface and upper air stations (BIAS(NZ))
  -1<=BIAS<=1
Negative BIAS reduces the weight of upper air stations
  (e.g. BIAS=-0.1 reduces the weight of upper air stations
by 10%; BIAS= -1, reduces their weight by 100 %)
Positive BIAS reduces the weight of surface stations
  (e.g. BIAS= 0.2 reduces the weight of surface stations
by 20%; BIAS=1 reduces their weight by 100%)
Zero BIAS leaves weights unchanged (1/R**2 interpolation)
Default: NZ*0
                         ! BIAS = 0, 0, 0, 0, 0, 0, 0, 0, 0 !

Minimum distance from nearest upper air station
to surface station for which extrapolation
of surface winds at surface station will be allowed
(RMIN2: Set to -1 for IEXTRP = 4 or other situations
 where all surface stations should be extrapolated)
                                       Default: 4.     ! RMIN2 =  4 !

Use gridded prognostic wind field model
output fields as input to the diagnostic
wind field model (IPROG)              Default: 0       ! IPROG =  14  !
(0 = No, [IWFCOD = 0 or 1]
 1 = Yes, use CSUMM prog. winds as Step 1 field, [IWFCOD = 0]
 2 = Yes, use CSUMM prog. winds as initial guess field [IWFCOD = 1]
 3 = Yes, use winds from MM4.DAT file as Step 1 field [IWFCOD = 0]
 4 = Yes, use winds from MM4.DAT file as initial guess field [IWFCOD = 1]
 5 = Yes, use winds from MM4.DAT file as observations [IWFCOD = 1]
 13 = Yes, use winds from MM5.DAT file as Step 1 field [IWFCOD = 0]
 14 = Yes, use winds from MM5.DAT file as initial guess field [IWFCOD = 1]
```

```
 15 = Yes, use winds from MM5.DAT file as observations [IWFCOD = 1]

Timestep (hours) of the prognostic
model input data   (ISTEPPG)            Default: 1        ! ISTEPPG =  1   !


RADIUS OF INFLUENCE PARAMETERS

Use varying radius of influence         Default: F        ! LVARY =  F!
(if no stations are found within RMAX1,RMAX2,
 or RMAX3, then the closest station will be used)

Maximum radius of influence over land
in the surface layer (RMAX1)            No default        ! RMAX1 = 30. !
                                        Units: km
Maximum radius of influence over land
aloft (RMAX2)                           No default        ! RMAX2 = 100. !
                                        Units: km
Maximum radius of influence over water
(RMAX3)                                 No default        ! RMAX3 = 500. !
                                        Units: km


OTHER WIND FIELD INPUT PARAMETERS

Minimum radius of influence used in
the wind field interpolation (RMIN)     Default: 0.1      ! RMIN = 0.1 !
                                        Units: km
Radius of influence of terrain
features (TERRAD)                       No default        ! TERRAD = 20. !

                                        Units: km
Relative weighting of the first
guess field and observations in the
SURFACE layer (R1)                      No default        ! R1 = 10. !
(R1 is the distance from an             Units: km
observational station at which the
observation and first guess field are
equally weighted)

Relative weighting of the first
guess field and observations in the
layers ALOFT (R2)                       No default        ! R2 = 50. !
(R2 is applied in the upper layers      Units: km
in the same manner as R1 is used in
the surface layer).

Relative weighting parameter of the
prognostic wind field data (RPROG)      No default        ! RPROG = 0. !
(Used only if IPROG = 1)                Units: km
------------------------

Maximum acceptable divergence in the
divergence minimization procedure
(DIVLIM)                                Default: 5.E-6    ! DIVLIM= 5.0E-06 !

Maximum number of iterations in the
divergence min. procedure (NITER)       Default: 50       ! NITER =  50   !

Number of passes in the smoothing
procedure (NSMTH(NZ))
NOTE: NZ values must be entered
      Default: 2,(mxnz-1)*4 ! NSMTH =   2 ,  4 ,  4 ,  4 ,  4 ,  4 ,  4 ,  4,
```

```
4 !

      Maximum number of stations used in
      each layer for the interpolation of
      data to a grid point (NINTR2(NZ))
      NOTE: NZ values must be entered       Default: 99.     ! NINTR2 = 9*99  !

      Critical Froude number (CRITFN)       Default: 1.0     ! CRITFN = 1. !

      Empirical factor controlling the
      influence of kinematic effects
      (ALPHA)                               Default: 0.1     ! ALPHA = 0.1 !

      Multiplicative scaling factor for
      extrapolation of surface observations
      to upper layers (FEXTR2(NZ))          Default: NZ*0.0 ! FEXTR2 = 9*0.0 !
      (Used only if IEXTRP = 3 or -3)


    BARRIER INFORMATION

      Number of barriers to interpolation
      of the wind fields (NBAR)             Default: 0       ! NBAR =   0   !

      THE FOLLOWING 4 VARIABLES ARE INCLUDED
      ONLY IF NBAR > 0
      NOTE: NBAR values must be entered     No defaults
            for each variable               Units: km

         X coordinate of BEGINNING
         of each barrier (XBBAR(NBAR))      ! XBBAR = 0. !
         Y coordinate of BEGINNING
         of each barrier (YBBAR(NBAR))      ! YBBAR = 0. !

         X coordinate of ENDING
         of each barrier (XEBAR(NBAR))      ! XEBAR = 0. !
         Y coordinate of ENDING
         of each barrier (YEBAR(NBAR))      ! YEBAR = 0. !


    DIAGNOSTIC MODULE DATA INPUT OPTIONS

      Surface temperature (IDIOPT1)         Default: 0       ! IDIOPT1 =  0  !
         0 = Compute internally from
             hourly surface observations
         1 = Read preprocessed values from
             a data file (DIAG.DAT)

         Surface met. station to use for
         the surface temperature (ISURFT)   No default      ! ISURFT =  13 !
         (Must be a value from 1 to NSSTA)
         (Used only if IDIOPT1 = 0)
         --------------------------

      Domain-averaged temperature lapse
      rate (IDIOPT2)                        Default: 0      ! IDIOPT2 =  0  !
         0 = Compute internally from
             twice-daily upper air observations
         1 = Read hourly preprocessed values
             from a data file (DIAG.DAT)

         Upper air station to use for
         the domain-scale lapse rate (IUPT) No default      ! IUPT   =  1  !
```

```
    (Must be a value from 1 to NUSTA)
    (Used only if IDIOPT2 = 0)
    --------------------------

    Depth through which the domain-scale
    lapse rate is computed (ZUPT)      Default: 200.  ! ZUPT = 200. !
    (Used only if IDIOPT2 = 0)         Units: meters
    --------------------------

 Domain-averaged wind components
 (IDIOPT3)                             Default: 0      ! IDIOPT3 =  0  !
    0 = Compute internally from
        twice-daily upper air observations
    1 = Read hourly preprocessed values
        a data file (DIAG.DAT)

    Upper air station to use for
    the domain-scale winds (IUPWND)    Default: -1     ! IUPWND =  -1 !
    (Must be a value from -1 to NUSTA)
    (Used only if IDIOPT3 = 0)
    --------------------------

    Bottom and top of layer through
    which the domain-scale winds
    are computed
    (ZUPWND(1), ZUPWND(2))        Defaults: 1., 1000. ! ZUPWND= 1., 1000. !
    (Used only if IDIOPT3 = 0)    Units: meters
    --------------------------

 Observed surface wind components
 for wind field module (IDIOPT4)  Default: 0     ! IDIOPT4 =  0  !
    0 = Read WS, WD from a surface
        data file (SURF.DAT)
    1 = Read hourly preprocessed U, V from
        a data file (DIAG.DAT)

 Observed upper air wind components
 for wind field module (IDIOPT5)  Default: 0     ! IDIOPT5 =  0  !
    0 = Read WS, WD from an upper
        air data file (UP1.DAT, UP2.DAT, etc.)
    1 = Read hourly preprocessed U, V from
        a data file (DIAG.DAT)

 LAKE BREEZE INFORMATION

    Use Lake Breeze Module  (LLBREZE)
                                          Default: F      ! LLBREZE = F !

     Number of lake breeze regions (NBOX)                 ! NBOX =  0  !

  X Grid line 1 defining the region of interest
                                                      ! XG1 = 0. !
  X Grid line 2 defining the region of interest
                                                      ! XG2 = 0. !
  Y Grid line 1 defining the region of interest
                                                      ! YG1 = 0. !
  Y Grid line 2 defining the region of interest
                                                      ! YG2 = 0. !

   X Point defining the coastline (Straight line)
             (XBCST)  (KM)   Default: none    ! XBCST = 0. !

   Y Point defining the coastline (Straight line)
```

```
                 (YBCST)   (KM)   Default: none     ! YBCST = 0. !

        X Point defining the coastline (Straight line)
                 (XECST)   (KM)   Default: none     ! XECST = 0. !

        Y Point defining the coastline (Straight line)
                 (YECST)   (KM)   Default: none     ! YECST = 0. !


      Number of stations in the region     Default: none  NLB = *1 *
      (Surface stations + upper air stations)

      Station ID's  in the region   (METBXID(NLB))
      (Surface stations first, then upper air stations)
         METBXID = *0 *

!END!

-------------------------------------------------------------------------------

INPUT GROUP: 6 -- Mixing Height, Temperature and Precipitation Parameters
--------------

    EMPIRICAL MIXING HEIGHT CONSTANTS

       Neutral, mechanical equation
       (CONSTB)                             Default: 1.41    ! CONSTB = 1.41 !
       Convective mixing ht. equation
       (CONSTE)                             Default: 0.15    ! CONSTE = 0.15 !
       Stable mixing ht. equation
       (CONSTN)                             Default: 2400.   ! CONSTN = 2400.!
       Overwater mixing ht. equation
       (CONSTW)                             Default: 0.16    ! CONSTW = 0.16 !
       Absolute value of Coriolis
       parameter (FCORIOL)                  Default: 1.E-4   ! FCORIOL = 1.0E-04!
                                            Units: (1/s)

    SPATIAL AVERAGING OF MIXING HEIGHTS

       Conduct spatial averaging
       (IAVEZI)  (0=no, 1=yes)              Default: 1       ! IAVEZI =  1  !

       Max. search radius in averaging
       process (MNMDAV)                     Default: 1       ! MNMDAV =  1  !
                                            Units: Grid
                                                   cells

       Half-angle of upwind looking cone
       for averaging (HAFANG)               Default: 30.     ! HAFANG = 30. !
                                            Units: deg.

       Layer of winds used in upwind
       averaging (ILEVZI)                   Default: 1       ! ILEVZI =  1  !
       (must be between 1 and NZ)

    OTHER MIXING HEIGHT VARIABLES

       Minimum potential temperature lapse
       rate in the stable layer above the
       current convective mixing ht.        Default: 0.001   ! DPTMIN = 0.001 !
       (DPTMIN)                             Units: deg. K/m
       Depth of layer above current conv.
       mixing height through which lapse    Default: 200.    ! DZZI = 200. !
       rate is computed (DZZI)              Units: meters
```

```
Minimum overland mixing height          Default:  50.    ! ZIMIN = 50. !
(ZIMIN)                                 Units: meters
Maximum overland mixing height          Default: 3000.   ! ZIMAX = 3000. !
(ZIMAX)                                 Units: meters
Minimum overwater mixing height         Default:   50.   ! ZIMINW = 50. !
(ZIMINW) -- (Not used if observed       Units: meters
overwater mixing hts. are used)
Maximum overwater mixing height         Default: 3000.   ! ZIMAXW = 3000. !
(ZIMAXW) -- (Not used if observed       Units: meters
overwater mixing hts. are used)


TEMPERATURE PARAMETERS

   3D temperature from observations or
   from prognostic data? (ITPROG)       Default:0         !ITPROG = 0 !

      0 = Use Surface and upper air stations
          (only if NOOBS = 0)
      1 = Use Surface stations (no upper air observations)
          Use MM5 for upper air data
          (only if NOOBS = 0,1)
      2 = No surface or upper air observations
          Use MM5 for surface and upper air data
          (only if NOOBS = 0,1,2)

   Interpolation type
   (1 = 1/R ; 2 = 1/R**2)               Default:1         ! IRAD =  1  !

   Radius of influence for temperature
   interpolation (TRADKM)               Default: 500.     ! TRADKM = 500. !
                                        Units: km

   Maximum Number of stations to include
   in temperature interpolation (NUMTS) Default: 5        ! NUMTS = 5  !

   Conduct spatial averaging of temp-
   eratures (IAVET)  (0=no, 1=yes)        Default: 1     ! IAVET =  1  !
   (will use mixing ht MNMDAV,HAFANG
    so make sure they are correct)

   Default temperature gradient       Default: -.0098 ! TGDEFB = -0.0098 !
   below the mixing height over
   water (K/m) (TGDEFB)

   Default temperature gradient       Default: -.0045 ! TGDEFA = -0.0045 !
   above the mixing height over
   water (K/m) (TGDEFA)

   Beginning (JWAT1) and ending (JWAT2)
   land use categories for temperature                   ! JWAT1 =  999  !
   interpolation over water -- Make                      ! JWAT2 =  999  !
   bigger than largest land use to disable

PRECIP INTERPOLATION PARAMETERS

   Method of interpolation (NFLAGP)     Default = 2     ! NFLAGP =  2  !
    (1=1/R,2=1/R**2,3=EXP/R**2)
   Radius of Influence (km) (SIGMAP)    Default = 100.0  ! SIGMAP = 100. !
    (0.0 => use half dist. btwn
     nearest stns w & w/out
     precip when NFLAGP = 3)
```

```
        Minimum Precip. Rate Cutoff (mm/hr)    Default = 0.01   ! CUTP = 0.01 !
         (values < CUTP = 0.0 mm/hr)
!END!

----------------------------------------------------------------------------

INPUT GROUP: 7 -- Surface meteorological station parameters
--------------

     SURFACE STATION VARIABLES
     (One record per station --  5  records in all)


                1      2
             Name    ID             X coord.   Y coord.   Time    Anem.
                                      (km)       (km)     zone    Ht.(m)
          ----------------------------------------------------------

! SS1  ='ncdc'    24006       146.399      17.847    7     10   !
! SS2  ='ncdc'    24017       149.756    -123.609    7     10   !
! SS3  ='ncdc'    24021      -294.233    -120.245    7     10   !
! SS4  ='ncdc'    24028       112.168    -228.289    7     10   !
! SS5  ='ncdc'    24029      -149.933      84.208    7     10   !
! SS6  ='ncdc'    24033      -265.619     199.159    7     10   !
! SS7  ='ncdc'    24045      -307.440      63.236    7     10   !
! SS8  ='ncdc'    24057      -176.447    -234.054    7     10   !
! SS9  ='ncdc'    24061      -272.117     -94.344    7     10   !
! SS10 ='ncdc'    24062      -227.996       0.656    7     10   !
! SS11 ='ncdc'    24089      -115.500    -117.126    7     10   !
! SS12 ='ncdc'    24090       150.512       7.203    7     10   !
! SS13 ='ncdc'    94023       -42.247      35.908    7     10   !
-------------------
      1
        Four character string for station name
        (MUST START IN COLUMN 9)

      2
        Five digit integer for station ID

!END!

----------------------------------------------------------------------------

INPUT GROUP: 8 -- Upper air meteorological station parameters
--------------

     UPPER AIR STATION VARIABLES
     (One record per station --  2  records in all)

                1      2
             Name     ID      X coord.    Y coord.   Time zone
                                (km)        (km)
           -------------------------------------------------

! US1  ='rap'   94043      150.512       7.203       7  !

-------------------
      1
        Four character string for station name
        (MUST START IN COLUMN 9)

      2
```

```
      Five digit integer for station ID

!END!

--------------------------------------------------------------------------------

INPUT GROUP: 9 -- Precipitation station parameters
--------------

     PRECIPITATION STATION VARIABLES
     (One record per station --  4  records in all)
     (NOT INCLUDED IF NPSTA = 0)

            1          2
          Name     Station    X coord.  Y coord.
                    Code       (km)      (km)
          ------------------------------------

! PS1  = 'MT01'   240019    -329.358     175.448    !
! PS2  = 'MT02'   240165      44.248     109.369    !
! PS3  = 'MT03'   240330     -95.167     172.553    !
! PS4  = 'MT04'   240807    -265.619     199.159    !
! PS5  = 'MT05'   241102    -296.010     144.690    !
! PS6  = 'MT06'   241127     -30.126     155.771    !
! PS7  = 'MT07'   241995    -376.736     120.896    !
! PS8  = 'MT08'   242689      33.630     202.275    !
! PS9  = 'MT09'   245106    -180.036     138.729    !
! PS10 = 'MT10'   245791    -296.885     198.801    !
! PS11 = 'MT11'   246946    -339.706     192.153    !
! PS12 = 'MT12'   249240    -221.374     145.472    !
! PS13 = 'NE01'   251145     152.731    -248.978    !
! PS14 = 'NE02'   251575     157.679    -125.136    !
! PS15 = 'NE03'   253620      76.438    -142.769    !
! PS16 = 'NE04'   257665     570.499    -203.529    !
! PS17 = 'NE05'   259262     284.672    -199.691    !
! PS18 = 'SD01'   391114     108.911     172.785    !
! PS19 = 'SD02'   391294      77.661     166.932    !
! PS20 = 'SD03'   391972     242.134       1.193    !
! PS21 = 'SD04'   392557      91.256     -74.533    !
! PS22 = 'SD05'   392565      84.226     -40.570    !
! PS23 = 'SD06'   392852     225.133     113.379    !
! PS24 = 'SD07'   394184     236.610     -22.346    !
! PS25 = 'SD08'   394268     269.030     156.330    !
! PS26 = 'SD09'   394651     346.270     125.850    !
! PS27 = 'SD10'   395544     258.950      60.994    !
! PS28 = 'SD11'   396304     135.276     -62.989    !
! PS29 = 'SD12'   396427     117.060       8.305    !
! PS30 = 'SD13'   396636     214.220      62.810    !
! PS31 = 'SD14'   396937     150.512       7.203    !
! PS32 = 'SD15'   397882      86.747      56.136    !
! PS33 = 'SD16'   399347     118.113     -47.219    !
! PS34 = 'WY01'   481000    -247.168     -59.564    !
! PS35 = 'WY02'   481570    -115.500    -117.126    !
! PS36 = 'WY03'   481675      16.217    -306.425    !
! PS37 = 'WY04'   482693     -30.234    -134.236    !
! PS38 = 'WY05'   482696     -13.138    -112.798    !
! PS39 = 'WY06'   482725       2.575     -62.627    !
! PS40 = 'WY07'   485371      26.160    -103.837    !
! PS41 = 'WY08'   485390    -294.233    -120.245    !
! PS42 = 'WY09'   486120     -96.091    -224.998    !
! PS43 = 'WY10'   486395       5.157      23.308    !
! PS44 = 'WY12'   486603      59.893     -65.994    !
```

```
! PS45 = 'WY13'   486660     60.651     -15.815  !
! PS46 = 'WY14'   486875   -252.046    -150.800  !
! PS47 = 'WY15'   486935     45.056      -1.661  !
! PS48 = 'WY16'   487105   -146.725    -163.040  !
! PS49 = 'WY17'   487375   -155.765    -101.962  !
! PS50 = 'WY18'   487388   -286.977      90.834  !
! PS51 = 'WY19'   487533   -176.447    -234.054  !
! PS52 = 'WY20'   487545    -54.691      78.960  !
! PS53 = 'WY21'   487760   -265.682     -98.278  !
! PS54 = 'WY22'   487845   -327.182    -249.689  !
! PS55 = 'WY23'   488070   -152.854    -196.995  !
! PS56 = 'WY24'   488155   -149.933      84.208  !
! PS57 = 'WY25'   488192    -87.395    -174.886  !
! PS58 = 'WY26'   488626   -145.296      64.333  !
! PS59 = 'WY27'   488852   -186.493      10.011  !
! PS60 = 'WY28'   488858   -183.429     -16.944  !
! PS61 = 'WY29'   488875   -248.669     -32.625  !
! PS62 = 'WY30'   488888   -287.166     -23.762  !

-------------------
      1
        Four character string for station name
        (MUST START IN COLUMN 9)

      2
        Six digit station code composed of state
        code (first 2 digits) and station ID (last
        4 digits)

!END!
```

APPENDIX C

Sample CALPUFF Input File

```
Basin Electric NE WYO Project
11Aug05, Case 7A-1
4-km CALMET Grid, Hourly Ozone
---------------- Run title (3 lines) ------------------------------------------

                    CALPUFF MODEL CONTROL FILE
                    --------------------------

-------------------------------------------------------------------------------

INPUT GROUP: 0 -- Input and Output File Names

--------------
Default Name  Type          File Name
------------  ----          ---------
CALMET.DAT    input    * METDAT =              *
    or
ISCMET.DAT    input    * ISCDAT =              *
    or
PLMMET.DAT    input    * PLMDAT =              *
    or
PROFILE.DAT   input    * PRFDAT =              *
SURFACE.DAT   input    * SFCDAT =              *
RESTARTB.DAT  input    * RSTARTB=              *
--------------------------------------------------------------------------------
CALPUFF.LST   output   ! PUFLST = .\Case7A-1\NEWYO_U1.LST     !
CONC.DAT      output   ! CONDAT = .\Case7A-1\NEWYO_U1.CON     !
DFLX.DAT      output   ! DFDAT  = .\Case7A-1\NEWYO_U1_DF.DAT  !
WFLX.DAT      output   ! WFDAT  = .\Case7A-1\NEWYO_U1_WF.DAT  !

VISB.DAT      output   ! VISDAT = NEWYO_U1_VIS.DAT  !
RESTARTE.DAT  output   * RSTARTE=              *
--------------------------------------------------------------------------------
Emission Files
--------------
PTEMARB.DAT   input    * PTDAT  =              *
VOLEMARB.DAT  input    * VOLDAT =              *
BAEMARB.DAT   input    * ARDAT  =              *
LNEMARB.DAT   input    * LNDAT  =              *
--------------------------------------------------------------------------------
Other Files
-----------
OZONE.DAT     input    ! OZDAT = E:\AIR\NALL\BASINWYO\OZONE\Wyo01_O3.DAT!
VD.DAT        input    * VDDAT =               *
CHEM.DAT      input    * CHEMDAT=              *
H2O2.DAT      input    * H2O2DAT=              *
HILL.DAT      input    * HILDAT=               *
HILLRCT.DAT   input    * RCTDAT=               *
COASTLN.DAT   input    * CSTDAT=               *
FLUXBDY.DAT   input    * BDYDAT=               *
BCON.DAT      input    * BCNDAT=               *
DEBUG.DAT     output   * DEBUG =               *
MASSFLX.DAT   output   * FLXDAT=               *
MASSBAL.DAT   output   * BALDAT=               *
FOG.DAT       output   * FOGDAT=               *
--------------------------------------------------------------------------------
All file names will be converted to lower case if LCFILES = T
Otherwise, if LCFILES = F, file names will be converted to UPPER CASE
         T = lower case      ! LCFILES = F !
         F = UPPER CASE
NOTE: (1) file/path names can be up to 70 characters in length
```

```
Provision for multiple input files
----------------------------------

     Number of CALMET.DAT files for run (NMETDAT)
                                      Default: 1         ! NMETDAT =   12   !

     Number of PTEMARB.DAT files for run (NPTDAT)
                                      Default: 0         ! NPTDAT =   0  !

     Number of BAEMARB.DAT files for run (NARDAT)
                                      Default: 0         ! NARDAT =   0  !

     Number of VOLEMARB.DAT files for run (NVOLDAT)
                                      Default: 0         ! NVOLDAT =  0  !

!END!

-------------
Subgroup (0a)
-------------

  The following CALMET.DAT filenames are processed in sequence if NMETDAT>1

Default Name  Type          File Name
------------  ----          ---------
none          input    ! METDAT=E:\AIR\NALL\WYOCMET\CALMET01\WYO0101.DAT  !    !END!
none          input    ! METDAT=E:\AIR\NALL\WYOCMET\CALMET01\WYO0102.DAT  !    !END!
none          input    ! METDAT=E:\AIR\NALL\WYOCMET\CALMET01\WYO0103.DAT  !    !END!
none          input    ! METDAT=E:\AIR\NALL\WYOCMET\CALMET01\WYO0104.DAT  !    !END!
none          input    ! METDAT=E:\AIR\NALL\WYOCMET\CALMET01\WYO0105.DAT  !    !END!
none          input    ! METDAT=E:\AIR\NALL\WYOCMET\CALMET01\WYO0106.DAT  !    !END!
none          input    ! METDAT=E:\AIR\NALL\WYOCMET\CALMET01\WYO0107.DAT  !    !END!
none          input    ! METDAT=E:\AIR\NALL\WYOCMET\CALMET01\WYO0108.DAT  !    !END!
none          input    ! METDAT=E:\AIR\NALL\WYOCMET\CALMET01\WYO0109.DAT  !    !END!
none          input    ! METDAT=E:\AIR\NALL\WYOCMET\CALMET01\WYO0110.DAT  !    !END!
none          input    ! METDAT=E:\AIR\NALL\WYOCMET\CALMET01\WYO0111.DAT  !    !END!
none          input    ! METDAT=E:\AIR\NALL\WYOCMET\CALMET01\WYO0112.DAT  !    !END!

--------------------------------------------------------------------------------

INPUT GROUP: 1 -- General run control parameters
--------------

    Option to run all periods found
    in the met. file     (METRUN)   Default: 0       ! METRUN =    0  !

         METRUN = 0 - Run period explicitly defined below
         METRUN = 1 - Run all periods in met. file

     Starting date:    Year (IBYR) -- No default       ! IBYR = 2001!
     (used only if    Month (IBMO) -- No default       ! IBMO =    1 !
      METRUN = 0)        Day (IBDY) -- No default       ! IBDY =    1 !
                        Hour (IBHR) -- No default       ! IBHR =    1 !

     Base time zone           (XBTZ) -- No default       ! XBTZ = 7.0 !
        PST = 8., MST = 7.
        CST = 6., EST = 5.

     Length of run (hours) (IRLG) -- No default       ! IRLG = 8760!

     Number of chemical species (NSPEC)
                                      Default: 5       ! NSPEC =  7 !
```

```
Number of chemical species
to be emitted  (NSE)            Default: 3        ! NSE =    5 !

Flag to stop run after
SETUP phase (ITEST)             Default: 2        ! ITEST =  2 !
(Used to allow checking
of the model inputs, files, etc.)
      ITEST = 1 - STOPS program after SETUP phase
      ITEST = 2 - Continues with execution of program
                  after SETUP

Restart Configuration:

   Control flag (MRESTART)      Default: 0        ! MRESTART =  0   !

      0 = Do not read or write a restart file
      1 = Read a restart file at the beginning of
          the run
      2 = Write a restart file during run
      3 = Read a restart file at beginning of run
          and write a restart file during run

   Number of periods in Restart
   output cycle (NRESPD)        Default: 0        ! NRESPD =  0   !

      0 = File written only at last period
     >0 = File updated every NRESPD periods

Meteorological Data Format (METFM)
                                Default: 1        ! METFM =  1   !

      METFM = 1 - CALMET binary file (CALMET.MET)
      METFM = 2 - ISC ASCII file (ISCMET.MET)
      METFM = 3 - AUSPLUME ASCII file (PLMMET.MET)
      METFM = 4 - CTDM plus tower file (PROFILE.DAT) and
                  surface parameters file (SURFACE.DAT)

PG sigma-y is adjusted by the factor (AVET/PGTIME)**0.2
Averaging Time (minutes) (AVET)
                                Default: 60.0     ! AVET = 60. !
PG Averaging Time (minutes) (PGTIME)
                                Default: 60.0     ! PGTIME = 60. !

!END!

-------------------------------------------------------------------------------

INPUT GROUP: 2 -- Technical options
--------------

     Vertical distribution used in the
     near field (MGAUSS)                  Default: 1     ! MGAUSS =  1   !
        0 = uniform
        1 = Gaussian

     Terrain adjustment method
     (MCTADJ)                             Default: 3     ! MCTADJ =  3   !
        0 = no adjustment
        1 = ISC-type of terrain adjustment
        2 = simple, CALPUFF-type of terrain
```

```
          adjustment
      3 = partial plume path adjustment

   Subgrid-scale complex terrain
   flag (MCTSG)                        Default: 0     ! MCTSG =   0   !
      0 = not modeled
      1 = modeled

   Near-field puffs modeled as
   elongated 0 (MSLUG)                 Default: 0     ! MSLUG =   0   !
      0 = no
      1 = yes (slug model used)

   Transitional plume rise modeled ?
   (MTRANS)                            Default: 1     ! MTRANS =  1   !
      0 = no  (i.e., final rise only)
      1 = yes (i.e., transitional rise computed)

   Stack tip downwash? (MTIP)          Default: 1     ! MTIP =    1   !
      0 = no  (i.e., no stack tip downwash)
      1 = yes (i.e., use stack tip downwash)

   Method used to simulate building
   downwash? (MBDW)                    Default: 1     ! MBDW =    1   !
      1 = ISC method
      2 = PRIME method

   Vertical wind shear modeled above
   stack top? (MSHEAR)                 Default: 0     ! MSHEAR =  0   !
      0 = no  (i.e., vertical wind shear not modeled)
      1 = yes (i.e., vertical wind shear modeled)

   Puff splitting allowed? (MSPLIT)    Default: 0     ! MSPLIT =  0   !
      0 = no (i.e., puffs not split)
      1 = yes (i.e., puffs are split)

   Chemical mechanism flag (MCHEM)     Default: 1     ! MCHEM =   1   !
      0 = chemical transformation not
          modeled
      1 = transformation rates computed
          internally (MESOPUFF II scheme)
      2 = user-specified transformation
          rates used
      3 = transformation rates computed
          internally (RIVAD/ARM3 scheme)
      4 = secondary organic aerosol formation
          computed (MESOPUFF II scheme for OH)

   Aqueous phase transformation flag (MAQCHEM)
   (Used only if MCHEM = 1, or 3)      Default: 0     ! MAQCHEM =  0  !
      0 = aqueous phase transformation
          not modeled
      1 = transformation rates adjusted
          for aqueous phase reactions

   Wet removal modeled ? (MWET)        Default: 1     ! MWET =     1  !
      0 = no
      1 = yes

   Dry deposition modeled ? (MDRY)     Default: 1     ! MDRY =     1  !
      0 = no
      1 = yes
      (dry deposition method specified
```

```
    for each species in Input Group 3)

Method used to compute dispersion
coefficients (MDISP)                   Default: 3     ! MDISP =    3  !

   1 = dispersion coefficients computed from measured values
       of turbulence, sigma v, sigma w
   2 = dispersion coefficients from internally calculated
       sigma v, sigma w using micrometeorological variables
       (u*, w*, L, etc.)
   3 = PG dispersion coefficients for RURAL areas (computed using
       the ISCST multi-segment approximation) and MP coefficients in
       urban areas
   4 = same as 3 except PG coefficients computed using
       the MESOPUFF II eqns.
   5 = CTDM sigmas used for stable and neutral conditions.
       For unstable conditions, sigmas are computed as in
       MDISP = 3, described above.  MDISP = 5 assumes that
       measured values are read

Sigma-v/sigma-theta, sigma-w measurements used? (MTURBVW)
(Used only if MDISP = 1 or 5)          Default: 3     ! MTURBVW =  3  !
   1 = use sigma-v or sigma-theta measurements
       from PROFILE.DAT to compute sigma-y
       (valid for METFM = 1, 2, 3, 4)
   2 = use sigma-w measurements
       from PROFILE.DAT to compute sigma-z
       (valid for METFM = 1, 2, 3, 4)
   3 = use both sigma-(v/theta) and sigma-w
       from PROFILE.DAT to compute sigma-y and sigma-z
       (valid for METFM = 1, 2, 3, 4)
   4 = use sigma-theta measurements
       from PLMMET.DAT to compute sigma-y
       (valid only if METFM = 3)

Back-up method used to compute dispersion
when measured turbulence data are
missing (MDISP2)                       Default: 3     ! MDISP2 =  3  !
(used only if MDISP = 1 or 5)
   2 = dispersion coefficients from internally calculated
       sigma v, sigma w using micrometeorological variables
       (u*, w*, L, etc.)
   3 = PG dispersion coefficients for RURAL areas (computed using
       the ISCST multi-segment approximation) and MP coefficients in
       urban areas
   4 = same as 3 except PG coefficients computed using
       the MESOPUFF II eqns.

PG sigma-y,z adj. for roughness?       Default: 0     ! MROUGH =  0  !
(MROUGH)
   0 = no
   1 = yes

Partial plume penetration of           Default: 1     ! MPARTL =  1  !
elevated inversion?
(MPARTL)
   0 = no
   1 = yes

Strength of temperature inversion      Default: 0     ! MTINV =  0  !
provided in PROFILE.DAT extended records?
(MTINV)
   0 = no (computed from measured/default gradients)
```

```
   1 = yes

PDF used for dispersion under convective conditions?
                                            Default: 0     ! MPDF =  0  !
(MPDF)
   0 = no
   1 = yes

Sub-Grid TIBL module used for shore line?
                                            Default: 0     ! MSGTIBL = 0  !
(MSGTIBL)
   0 = no
   1 = yes

Boundary conditions (concentration) modeled?
                                            Default: 0     ! MBCON = 0  !
(MBCON)
   0 = no
   1 = yes, using formatted BCON.DAT file
   2 = yes, using unformatted CONC.DAT file

Note:  MBCON > 0 requires that the last species modeled
       be 'BCON'.  Mass is placed in species BCON when
       generating boundary condition puffs so that clean
       air entering the modeling domain can be simulated
       in the same way as polluted air.  Specify zero
       emission of species BCON for all regular sources.


Analyses of fogging and icing impacts due to emissions from
arrays of mechanically-forced cooling towers can be performed
using CALPUFF in conjunction with a cooling tower emissions
processor (CTEMISS) and its associated postprocessors.  Hourly
emissions of water vapor and temperature from each cooling tower
cell are computed for the current cell configuration and ambient
conditions by CTEMISS. CALPUFF models the dispersion of these
emissions and provides cloud information in a specialized format
for further analysis. Output to FOG.DAT is provided in either
'plume mode' or 'receptor mode' format.

Configure for FOG Model output?
                                            Default: 0     ! MFOG =  0  !
(MFOG)
   0 = no
   1 = yes  - report results in PLUME Mode format
   2 = yes  - report results in RECEPTOR Mode format


Test options specified to see if
they conform to regulatory
values? (MREG)                              Default: 1     ! MREG =  1  !

   0 = NO checks are made
   1 = Technical options must conform to USEPA
       Long Range Transport (LRT) guidance
                  METFM    1 or 2
                  AVET     60. (min)
                  PGTIME   60. (min)
                  MGAUSS   1
                  MCTADJ   3
                  MTRANS   1
                  MTIP     1
                  MCHEM    1 or 3 (if modeling SOx, NOx)
```

```
               MWET       1
               MDRY       1
               MDISP      2 or 3
               MPDF       0 if MDISP=3
                          1 if MDISP=2
               MROUGH     0
               MPARTL     1
               SYTDEP     550. (m)
               MHFTSZ     0

!END!

-------------------------------------------------------------------------------

INPUT GROUP: 3a, 3b -- Species list
-------------------

------------
Subgroup (3a)
------------

  The following species are modeled:

! CSPEC =          SO2 !          !END!
! CSPEC =          SO4 !          !END!
! CSPEC =          NOX !          !END!
! CSPEC =          HNO3!          !END!
! CSPEC =          NO3 !          !END!
! CSPEC =          PM10!          !END!
! CSPEC =          SOA!           !END!

                                                           Dry                OUTPUT
GROUP
    SPECIES          MODELED          EMITTED          DEPOSITED              NUMBER
     NAME         (0=NO, 1=YES)    (0=NO, 1=YES)    (0=NO,                 (0=NONE,
   (Limit: 12                                        1=COMPUTED-GAS         1=1st
CGRUP,
    Characters                                       2=COMPUTED-PARTICLE    2=2nd
CGRUP,
    in length)                                       3=USER-SPECIFIED)      3= etc.)

!          SO2  =         1,                1,              1,             0    !
!          SO4  =         1,                1,              2,             0    !
!          NOX  =         1,                1,              1,             0    !
!          HNO3 =         1,                0,              1,             0    !
!          NO3  =         1,                0,              2,             0    !
!          PM10 =         1,                1,              2,             0    !
!          SOA  =         1,                1,              2,             0    !

!END!

  Note:  The last species in (3a) must be 'BCON' when using the
         boundary condition option (MBCON > 0).  Species BCON should
         typically be modeled as inert (no chem transformation or
         removal).

-------------
Subgroup (3b)
-------------
```

```
The following names are used for Species-Groups in which results
for certain species are combined (added) prior to output.  The
CGRUP name will be used as the species name in output files.
Use this feature to model specific particle-size distributions
by treating each size-range as a separate species.
Order must be consistent with 3(a) above.



--------------------------------------------------------------------------------


INPUT GROUP: 4 -- Map Projection and Grid control parameters
--------------

     Projection for all (X,Y):
     -------------------------

     Map projection
     (PMAP)                     Default: UTM    ! PMAP = LCC  !

         UTM :  Universal Transverse Mercator
         TTM :  Tangential Transverse Mercator
         LCC :  Lambert Conformal Conic
          PS :  Polar Stereographic
          EM :  Equatorial Mercator
        LAZA :  Lambert Azimuthal Equal Area

     False Easting and Northing (km) at the projection origin
     (Used only if PMAP= TTM, LCC, or LAZA)
     (FEAST)                    Default=0.0     ! FEAST  = 0.000  !
     (FNORTH)                   Default=0.0     ! FNORTH = 0.000  !

     UTM zone (1 to 60)
     (Used only if PMAP=UTM)
     (IUTMZN)                   No Default      ! IUTMZN =  0 !

     Hemisphere for UTM projection?
     (Used only if PMAP=UTM)
     (UTMHEM)                   Default: N      ! UTMHEM = N  !
         N   :  Northern hemisphere projection
         S   :  Southern hemisphere projection

     Latitude and Longitude (decimal degrees) of projection origin
     (Used only if PMAP= TTM, LCC, PS, EM, or LAZA)
     (RLAT0)                    No Default      ! RLAT0 =  44.0N  !
     (RLON0)                    No Default      ! RLON0 = 105.0W  !

         TTM :  RLON0 identifies central (true N/S) meridian of projection
                RLAT0 selected for convenience
         LCC :  RLON0 identifies central (true N/S) meridian of projection
                RLAT0 selected for convenience
         PS  :  RLON0 identifies central (grid N/S) meridian of projection
                RLAT0 selected for convenience
         EM  :  RLON0 identifies central meridian of projection
                RLAT0 is REPLACED by 0.0N (Equator)
         LAZA:  RLON0 identifies longitude of tangent-point of mapping plane
                RLAT0 identifies latitude of tangent-point of mapping plane

     Matching parallel(s) of latitude (decimal degrees) for projection
     (Used only if PMAP= LCC or PS)
     (XLAT1)                    No Default      ! XLAT1 =  30.0N  !
     (XLAT2)                    No Default      ! XLAT2 =  60.0N  !
```

```
      LCC :  Projection cone slices through Earth's surface at XLAT1 and XLAT2
      PS  :  Projection plane slices through Earth at XLAT1
             (XLAT2 is not used)

    ----------
    Note:  Latitudes and longitudes should be positive, and include a
           letter N,S,E, or W indicating north or south latitude, and
           east or west longitude.  For example,
           35.9  N Latitude  =  35.9N
           118.7 E Longitude = 118.7E


    Datum-region
    ------------

    The Datum-Region for the coordinates is identified by a character
    string.  Many mapping products currently available use the model of the
    Earth known as the World Geodetic System 1984 (WGS-G ).  Other local
    models may be in use, and their selection in CALMET will make its output
    consistent with local mapping products.  The list of Datum-Regions with
    official transformation parameters is provided by the National Imagery and
    Mapping Agency (NIMA).

    NIMA Datum - Regions(Examples)
    ------------------------------------------------------------------------------
    WGS-G     WGS-84 GRS 80 Spheroid, Global coverage (WGS84)
    NAS-C     NORTH AMERICAN 1927 Clarke 1866 Spheroid, MEAN FOR CONUS (NAD27)
    NWS-27    NWS 6370KM Radius, Sphere
    NWS-84    NWS 6370KM Radius, Sphere
    ESR-S     ESRI REFERENCE 6371KM Radius, Sphere

    Datum-region for output coordinates
    (DATUM)                     Default: WGS-G     ! DATUM = NAS-C  !


METEOROLOGICAL Grid:

    Rectangular grid defined for projection PMAP,
    with X the Easting and Y the Northing coordinate

           No. X grid cells (NX)      No default     ! NX =  168   !
           No. Y grid cells (NY)      No default     ! NY =  118   !
        No. vertical layers (NZ)      No default     ! NZ =  9   !

          Grid spacing (DGRIDKM)      No default     ! DGRIDKM = 4 !
                                      Units: km

               Cell face heights
                  (ZFACE(nz+1))       No defaults
                                      Units: m
  ! ZFACE = 0., 20., 50., 100., 250., 500., 750., 1000., 1500., 3500. !

           Reference Coordinates
          of SOUTHWEST corner of
               grid cell(1, 1):

           X coordinate (XORIGKM)     No default     ! XORIGKM = -350.000!
           Y coordinate (YORIGKM)     No default     ! YORIGKM = -250.000!
                                     Units: km

COMPUTATIONAL Grid:
```

```
     The computational grid is identical to or a subset of the MET. grid.
     The lower left (LL) corner of the computational grid is at grid point
     (IBCOMP, JBCOMP) of the MET. grid.  The upper right (UR) corner of the
     computational grid is at grid point (IECOMP, JECOMP) of the MET. grid.
     The grid spacing of the computational grid is the same as the MET. grid.

        X index of LL corner (IBCOMP)      No default     ! IBCOMP =  1    !
                  (1 <= IBCOMP <= NX)

        Y index of LL corner (JBCOMP)      No default     ! JBCOMP =  1    !
                  (1 <= JBCOMP <= NY)


        X index of UR corner (IECOMP)      No default     ! IECOMP =  168   !
                  (1 <= IECOMP <= NX)

        Y index of UR corner (JECOMP)      No default     ! JECOMP =  118   !
                  (1 <= JECOMP <= NY)


SAMPLING Grid (GRIDDED RECEPTORS):

     The lower left (LL) corner of the sampling grid is at grid point
     (IBSAMP, JBSAMP) of the MET. grid.  The upper right (UR) corner of the
     sampling grid is at grid point (IESAMP, JESAMP) of the MET. grid.
     The sampling grid must be identical to or a subset of the computational
     grid.  It may be a nested grid inside the computational grid.
     The grid spacing of the sampling grid is DGRIDKM/MESHDN.

        Logical flag indicating if gridded
        receptors are used (LSAMP)         Default: T     ! LSAMP = F !
        (T=yes, F=no)

        X index of LL corner (IBSAMP)      No default     ! IBSAMP =  1    !
         (IBCOMP <= IBSAMP <= IECOMP)

        Y index of LL corner (JBSAMP)      No default     ! JBSAMP =  1    !
         (JBCOMP <= JBSAMP <= JECOMP)


        X index of UR corner (IESAMP)      No default     ! IESAMP =  168   !
         (IBCOMP <= IESAMP <= IECOMP)

        Y index of UR corner (JESAMP)      No default     ! JESAMP =  118   !
         (JBCOMP <= JESAMP <= JECOMP)


       Nesting factor of the sampling
        grid (MESHDN)                      Default: 1     ! MESHDN =  1  !
        (MESHDN is an integer >= 1)

!END!

-------------------------------------------------------------------------------

INPUT GROUP: 5 -- Output Options
--------------
                                                  *                       *
     FILE                              DEFAULT VALUE             VALUE THIS RUN
```

```
     ----                                 -------------          --------------

Concentrations (ICON)                1                  !  ICON  =  1    !
Dry Fluxes (IDRY)                    1                  !  IDRY  =  1    !
Wet Fluxes (IWET)                    1                  !  IWET  =  1    !
Relative Humidity (IVIS)             1                  !  IVIS  =  1    !
 (relative humidity file is
  required for visibility
  analysis)
Use data compression option in output file?
(LCOMPRS)                             Default: T        ! LCOMPRS = T !

*
 0 = Do not create file, 1 = create file


 DIAGNOSTIC MASS FLUX OUTPUT OPTIONS:

    Mass flux across specified boundaries
    for selected species reported hourly?
    (IMFLX)                           Default: 0        ! IMFLX =  0   !
      0 = no
      1 = yes (FLUXBDY.DAT and MASSFLX.DAT filenames
               are specified in Input Group 0)

    Mass balance for each species
    reported hourly?
    (IMBAL)                           Default: 0        ! IMBAL =  0   !
      0 = no
      1 = yes (MASSBAL.DAT filename is
           specified in Input Group 0)


 LINE PRINTER OUTPUT OPTIONS:

    Print concentrations (ICPRT)      Default: 0        ! ICPRT =  0    !
    Print dry fluxes (IDPRT)          Default: 0        ! IDPRT =  0    !
    Print wet fluxes (IWPRT)          Default: 0        ! IWPRT =  0    !
    (0 = Do not print, 1 = Print)

    Concentration print interval
    (ICFRQ) in hours                  Default: 1        ! ICFRQ =  1    !
    Dry flux print interval
    (IDFRQ) in hours                  Default: 1        ! IDFRQ =  1    !
    Wet flux print interval
    (IWFRQ) in hours                  Default: 1        ! IWFRQ =  1    !

    Units for Line Printer Output
    (IPRTU)                           Default: 1        ! IPRTU =  1    !
                     for           for
                Concentration   Deposition
        1 =        g/m**3        g/m**2/s
        2 =       mg/m**3       mg/m**2/s
        3 =       ug/m**3       ug/m**2/s
        4 =       ng/m**3       ng/m**2/s
        5 =      Odour Units

    Messages tracking progress of run
    written to the screen ?
    (IMESG)                           Default: 2        ! IMESG =  2    !
      0 = no
      1 = yes (advection step, puff ID)
      2 = yes (YYYYJJJHH, # old puffs, # emitted puffs)
```

```
      SPECIES (or GROUP for combined species) LIST FOR OUTPUT OPTIONS

                          ---- CONCENTRATIONS ----    ------ DRY FLUXES ------    ------ WET
FLUXES ------        -- MASS FLUX --
   SPECIES
   /GROUP             PRINTED?  SAVED ON DISK?    PRINTED?  SAVED ON DISK?    PRINTED?
SAVED ON DISK?      SAVED ON DISK?
   -------            ------------------------    ------------------------
------------------------   ---------------
!          SO2 =     0,           1,            0,           1,            0,
 1,            0    !

!          SO4 =     0,           1,            0,           1,            0,
 1,            0    !

!          NOX =     0,           1,            0,           1,            0,
 1,            0    !

!          HNO3=     0,           1,            0,           1,            0,
 1,            0    !

!          NO3 =     0,           1,            0,           1,            0,
 1,            0    !

!          PM10=     0,           1,            0,           1,            0,
 1,            0    !

!          SOA =     0,           1,            0,           1,            0,
 1,            0    !

  Note:  Species BCON (for MBCON > 0) does not need to be saved on disk.

      OPTIONS FOR PRINTING "DEBUG" QUANTITIES (much output)

        Logical for debug output
        (LDEBUG)                                   Default: F      ! LDEBUG = F !

        First puff to track
        (IPFDEB)                                   Default: 1      ! IPFDEB =  1  !

        Number of puffs to track
        (NPFDEB)                                   Default: 1      ! NPFDEB =  1  !

        Met. period to start output
        (NN1)                                      Default: 1      ! NN1 =  1   !

        Met. period to end output
        (NN2)                                      Default: 10     ! NN2 =  10  !

!END!

-------------------------------------------------------------------------------


INPUT GROUP: 6a, 6b, & 6c -- Subgrid scale complex terrain inputs
-------------------------

---------------
Subgroup (6a)
```

```
---------------
       Number of terrain features (NHILL)        Default: 0      ! NHILL =  0    !

       Number of special complex terrain
       receptors  (NCTREC)                       Default: 0      ! NCTREC =  0    !

       Terrain and CTSG Receptor data for
       CTSG hills input in CTDM format ?
       (MHILL)                                   No Default      ! MHILL =  0    !
       1 = Hill and Receptor data created
           by CTDM processors & read from
           HILL.DAT and HILLRCT.DAT files
       2 = Hill data created by OPTHILL &
           input below in Subgroup (6b);
           Receptor data in Subgroup (6c)

       Factor to convert horizontal dimensions   Default: 1.0    ! XHILL2M = 1.0 !
       to meters (MHILL=1)

       Factor to convert vertical dimensions     Default: 1.0    ! ZHILL2M = 1.0 !
       to meters (MHILL=1)

       X-origin of CTDM system relative to       No Default      ! XCTDMKM = 0.0E00 !
       CALPUFF coordinate system, in Kilometers (MHILL=1)

       Y-origin of CTDM system relative to       No Default      ! YCTDMKM = 0.0E00 !
       CALPUFF coordinate system, in Kilometers (MHILL=1)

! END !

---------------
Subgroup (6b)
---------------

                                   1 **
     HILL information

HILL           XC        YC        THETAH   ZGRID   RELIEF    EXPO 1    EXPO 2    SCALE
1    SCALE 2    AMAX1     AMAX2
 NO.          (km)      (km)       (deg.)    (m)      (m)       (m)       (m)       (m)
      (m)        (m)       (m)
----          ----      ----       ------   -----   ------    ------    ------
-------    -------    -----     -----

---------------
Subgroup (6c)
---------------

    COMPLEX TERRAIN RECEPTOR INFORMATION

                     XRCT          YRCT          ZRCT            XHH
                     (km)          (km)           (m)
                    ------         -----         ------          ----


-------------------
1
     Description of Complex Terrain Variables:
          XC, YC  = Coordinates of center of hill
          THETAH  = Orientation of major axis of hill (clockwise from
                    North)
          ZGRID   = Height of the  0  of the grid above mean sea
```

```
                 level
        RELIEF  = Height of the crest of the hill above the grid elevation
        EXPO 1  = Hill-shape exponent for the major axis
        EXPO 2  = Hill-shape exponent for the major axis
        SCALE 1 = Horizontal length scale along the major axis
        SCALE 2 = Horizontal length scale along the minor axis
        AMAX    = Maximum allowed axis length for the major axis
        BMAX    = Maximum allowed axis length for the major axis

        XRCT, YRCT = Coordinates of the complex terrain receptors
        ZRCT    = Height of the ground (MSL) at the complex terrain
                  Receptor
        XHH     = Hill number associated with each complex terrain receptor
                  (NOTE: MUST BE ENTERED AS A REAL NUMBER)

   **
     NOTE: DATA for each hill and CTSG receptor are treated as a separate
           input subgroup and therefore must end with an input group terminator.

---------------------------------------------------------------------------------


INPUT GROUP: 7 -- Chemical parameters for dry deposition of gases
--------------

      SPECIES     DIFFUSIVITY      ALPHA STAR      REACTIVITY    MESOPHYLL
RESISTANCE    HENRY'S LAW COEFFICIENT
       NAME       (cm**2/s)                                                (s/cm)
     (dimensionless)
      -------     -----------      ----------      ----------
--------------------    ------------------------

!        SO2 =     0.1509,          1000.,           8.,                  0.,
      0.04 !
!        NOX =     0.1656,             1.,           8.,                  5.,
       3.5 !
!       HNO3 =     0.1628,             1.,          18.,                  0.,
   0.00000008 !
!END!

---------------------------------------------------------------------------------


INPUT GROUP: 8 -- Size parameters for dry deposition of particles
--------------

     For SINGLE SPECIES, the mean and standard deviation are used to
     compute a deposition velocity for NINT (see group 9) size-ranges,
     and these are then averaged to obtain a mean deposition velocity.

     For GROUPED SPECIES, the size distribution should be explicitly
     specified (by the 'species' in the group), and the standard deviation
     for each should be entered as 0.  The model will then use the
     deposition velocity for the stated mean diameter.

      SPECIES      GEOMETRIC MASS MEAN        GEOMETRIC STANDARD
       NAME             DIAMETER                  DEVIATION
                        (microns)                 (microns)
      -------      -------------------        ------------------
!        SO4 =          0.48,                       2.   !
!        NO3 =          0.48,                       2.   !
!       PM10 =          2.5 ,                       5.   !
!        SOA =          0.48,                       2.   !
!END!
```

```
-------------------------------------------------------------------------------

INPUT GROUP: 9 -- Miscellaneous dry deposition parameters
--------------

     Reference cuticle resistance (s/cm)
     (RCUTR)                            Default: 30    !  RCUTR = 30.0 !
     Reference ground resistance  (s/cm)
     (RGR)                              Default: 10    !    RGR = 10.0 !
     Reference pollutant reactivity
     (REACTR)                           Default: 8     ! REACTR = 8.0 !

     Number of particle-size intervals used to
     evaluate effective particle deposition velocity
     (NINT)                             Default: 9     !  NINT =  9   !

     Vegetation state in unirrigated areas
     (IVEG)                             Default: 1     !  IVEG =  1   !
        IVEG=1 for active and unstressed vegetation
        IVEG=2 for active and stressed vegetation
        IVEG=3 for inactive vegetation

!END!

-------------------------------------------------------------------------------

INPUT GROUP: 10 -- Wet Deposition Parameters
---------------


                      Scavenging Coefficient -- Units: (sec)**(-1)

       Pollutant      Liquid Precip.      Frozen Precip.
       ---------      --------------      --------------
!          SO2 =        3.0E-05,             0.0E00 !
!          SO4 =        1.0E-04,            3.0E-05 !
!         HNO3 =        6.0E-05,             0.0E00 !
!          NO3 =        1.0E-04,            3.0E-05 !
!         PM10 =        1.0E-04,            3.0E-05 !
!          SOA =        1.0E-04,            3.0E-05 !
!END!

-------------------------------------------------------------------------------

INPUT GROUP: 11 -- Chemistry Parameters
---------------

     Ozone data input option (MOZ)     Default: 1            ! MOZ =  1   !
     (Used only if MCHEM = 1, 3, or 4)
        0 = use a monthly background ozone value
        1 = read hourly ozone concentrations from
            the OZONE.DAT data file

     Monthly ozone concentrations
     (Used only if MCHEM = 1, 3, or 4 and
      MOZ = 0 or MOZ = 1 and all hourly O3 data missing)
```

```
     (BCKO3) in ppb                           Default: 12*80.
     !  BCKO3 = 30.00, 36.00, 40.00, 41.00, 46.00, 47.00, 49.00, 50.00, 39.00,
35.00, 31.00, 30.00 !

     Monthly ammonia concentrations
     (Used only if MCHEM = 1, or 3)
     (BCKNH3) in ppb                          Default: 12*10.
     !  BCKNH3 = 10.00, 10.00, 10.00, 10.00, 10.00, 10.00, 10.00, 10.00, 10.00,
10.00, 10.00, 10.00 !

     Nighttime SO2 loss rate (RNITE1)
     in percent/hour                          Default: 0.2          ! RNITE1 = .2 !

     Nighttime NOx loss rate (RNITE2)
     in percent/hour                          Default: 2.0          ! RNITE2 = 2.0 !

     Nighttime HNO3 formation rate (RNITE3)
     in percent/hour                          Default: 2.0          ! RNITE3 = 2.0 !

     H2O2 data input option (MH2O2)           Default: 1            ! MH2O2 =  1   !
     (Used only if MAQCHEM = 1)
        0 = use a monthly background H2O2 value
        1 = read hourly H2O2 concentrations from
            the H2O2.DAT data file

     Monthly H2O2 concentrations
     (Used only if MQACHEM = 1 and
      MH2O2 = 0 or MH2O2 = 1 and all hourly H2O2 data missing)
     (BCKH2O2) in ppb                         Default: 12*1.
     !  BCKH2O2 = 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00,
1.00 !


 --- Data for SECONDARY ORGANIC AEROSOL (SOA) Option
     (used only if MCHEM = 4)

     The SOA module uses monthly values of:
          Fine particulate concentration in ug/m^3 (BCKPMF)
          Organic fraction of fine particulate     (OFRAC)
          VOC / NOX ratio (after reaction)         (VCNX)
     to characterize the air mass when computing
     the formation of SOA from VOC emissions.
     Typical values for several distinct air mass types are:

        Month    1    2    3    4    5    6    7    8    9    10   11   12
                Jan  Feb  Mar  Apr  May  Jun  Jul  Aug  Sep  Oct  Nov  Dec

     Clean Continental
        BCKPMF   1.   1.   1.   1.   1.   1.   1.   1.   1.   1.   1.   1.
        OFRAC   .15  .15  .20  .20  .20  .20  .20  .20  .20  .20  .20  .15
        VCNX    50.  50.  50.  50.  50.  50.  50.  50.  50.  50.  50.  50.

     Clean Marine (surface)
        BCKPMF  .5   .5   .5   .5   .5   .5   .5   .5   .5   .5   .5   .5
        OFRAC   .25  .25  .30  .30  .30  .30  .30  .30  .30  .30  .30  .25
        VCNX    50.  50.  50.  50.  50.  50.  50.  50.  50.  50.  50.  50.

     Urban - low biogenic (controls present)
        BCKPMF  30.  30.  30.  30.  30.  30.  30.  30.  30.  30.  30.  30.
        OFRAC   .20  .20  .25  .25  .25  .25  .25  .25  .20  .20  .20  .20
        VCNX     4.   4.   4.   4.   4.   4.   4.   4.   4.   4.   4.   4.

     Urban - high biogenic (controls present)
```

```
      BCKPMF  60.   60.   60.   60.   60.   60.   60.   60.   60.   60.   60.   60.
      OFRAC  .25   .25   .30   .30   .30   .55   .55   .55   .35   .35   .35   .25
      VCNX    15.   15.   15.   15.   15.   15.   15.   15.   15.   15.   15.   15.

   Regional Plume
      BCKPMF  20.   20.   20.   20.   20.   20.   20.   20.   20.   20.   20.   20.
      OFRAC  .20   .20   .25   .35   .25   .40   .40   .40   .30   .30   .30   .20
      VCNX    15.   15.   15.   15.   15.   15.   15.   15.   15.   15.   15.   15.

   Urban - no controls present
      BCKPMF 100.  100.  100.  100.  100.  100.  100.  100.  100.  100.  100.  100.
      OFRAC  .30   .30   .35   .35   .35   .55   .55   .55   .35   .35   .35   .30
      VCNX     2.    2.    2.    2.    2.    2.    2.    2.    2.    2.    2.    2.

   Default: Clean Continental
   !  BCKPMF = 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00,
1.00 !
   !  OFRAC  = 0.15, 0.15, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20,
0.15 !
   !  VCNX   = 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00,
50.00, 50.00, 50.00 !

!END!

-------------------------------------------------------------------------------

INPUT GROUP: 12 -- Misc. Dispersion and Computational Parameters
---------------

     Horizontal size of puff (m) beyond which
     time-dependent dispersion equations (Heffter)
     are used to determine sigma-y and
     sigma-z (SYTDEP)                           Default: 550.   ! SYTDEP = 5.5E02 !

     Switch for using Heffter equation for sigma z
     as above (0 = Not use Heffter; 1 = use Heffter
     (MHFTSZ)                                   Default: 0      ! MHFTSZ =  0   !

     Stability class used to determine plume
     growth rates for puffs above the boundary
     layer (JSUP)                               Default: 5      ! JSUP =  5   !

     Vertical dispersion constant for stable
     conditions (k1 in Eqn. 2.7-3)  (CONK1)     Default: 0.01   ! CONK1 = .01 !

     Vertical dispersion constant for neutral/
     unstable conditions (k2 in Eqn. 2.7-4)
     (CONK2)                                    Default: 0.1    ! CONK2 = .1 !

     Factor for determining Transition-point from
     Schulman-Scire to Huber-Snyder Building Downwash
     scheme (SS used for Hs < Hb + TBD * HL)
     (TBD)                                      Default: 0.5    ! TBD = .5 !
        TBD < 0    ==> always use Huber-Snyder
        TBD = 1.5 ==> always use Schulman-Scire
        TBD = 0.5 ==> ISC Transition-point

     Range of land use categories for which
     urban dispersion is assumed
     (IURB1, IURB2)                             Default: 10     ! IURB1 =  10  !
```

```
                                                    19      ! IURB2 =  19  !

Site characterization parameters for single-point Met data files ---------
(needed for METFM = 2,3,4)

   Land use category for modeling domain
   (ILANDUIN)                              Default: 20      ! ILANDUIN =  20  !

   Roughness length (m) for modeling domain
   (Z0IN)                                  Default: 0.25    ! Z0IN = .25 !

   Leaf area index for modeling domain
   (XLAIIN)                                Default: 3.0     ! XLAIIN = 3.0 !

   Elevation above sea level (m)
   (ELEVIN)                                Default: 0.0     ! ELEVIN = .0 !

   Latitude (degrees) for met location
   (XLATIN)                                Default: -999.   ! XLATIN = -999.0 !

   Longitude (degrees) for met location
   (XLONIN)                                Default: -999.   ! XLONIN = -999.0 !

Specialized information for interpreting single-point Met data files -----

   Anemometer height (m) (Used only if METFM = 2,3)
   (ANEMHT)                                Default: 10.     ! ANEMHT = 10.0 !

   Form of lateral turbulance data in PROFILE.DAT file
   (Used only if METFM = 4 or MTURBVW = 1 or 3)
   (ISIGMAV)                               Default: 1       ! ISIGMAV =  1  !
       0 = read sigma-theta
       1 = read sigma-v

   Choice of mixing heights (Used only if METFM = 4)
   (IMIXCTDM)                              Default: 0       ! IMIXCTDM =  0  !
       0 = read PREDICTED mixing heights
       1 = read OBSERVED mixing heights

Maximum length of a slug (met. grid units)
(XMXLEN)                                   Default: 1.0     ! XMXLEN = 1.0 !

Maximum travel distance of a puff/slug (in
grid units) during one sampling step
(XSAMLEN)                                  Default: 1.0     ! XSAMLEN = 1.0 !

Maximum Number of slugs/puffs release from
one source during one time step
(MXNEW)                                    Default: 99      ! MXNEW =  99   !

Maximum Number of sampling steps for
one puff/slug during one time step
(MXSAM)                                    Default: 99      ! MXSAM =  99   !

Number of iterations used when computing
the transport wind for a sampling step
that includes gradual rise (for CALMET
and PROFILE winds)
(NCOUNT)                                   Default: 2       ! NCOUNT =  2   !

Minimum sigma y for a new puff/slug (m)
(SYMIN)                                    Default: 1.0     ! SYMIN = 1.0  !
```

```
     Minimum sigma z for a new puff/slug (m)
     (SZMIN)                                       Default: 1.0     ! SZMIN = 1.0  !

     Default minimum turbulence velocities
     sigma-v and sigma-w for each
     stability class (m/s)
     (SVMIN(6) and SWMIN(6))        Default SVMIN : .50,  .50,  .50,  .50,  .50,  .50
                                    Default SWMIN : .20,  .12,  .08,  .06,  .03,  .016

                                  Stability Class :  A     B     C     D     E     F
                                                    ---   ---   ---   ---   ---   ---
                                        ! SVMIN = 0.500, 0.500, 0.500, 0.500, 0.500,
 0.500!
                                        ! SWMIN = 0.200, 0.120, 0.080, 0.060, 0.030,
 0.016!

     Divergence criterion for dw/dz across puff
     used to initiate adjustment for horizontal
     convergence (1/s)
     Partial adjustment starts at CDIV(1), and
     full adjustment is reached at CDIV(2)
     (CDIV(2))                                     Default: 0.0,0.0   ! CDIV = 0.0, 0.0
 !

     Minimum wind speed (m/s) allowed for
     non-calm conditions. Also used as minimum
     speed returned when using power-law
     extrapolation toward surface
     (WSCALM)                                      Default: 0.5     ! WSCALM = .5 !

     Maximum mixing height (m)
     (XMAXZI)                                      Default: 3000.   ! XMAXZI = 3000.0 !

     Minimum mixing height (m)
     (XMINZI)                                      Default: 50.     ! XMINZI = 50.0 !

     Default wind speed classes --
     5 upper bounds (m/s) are entered;
     the 6th class has no upper limit
     (WSCAT(5))                         Default   :
                                        ISC RURAL : 1.54, 3.09, 5.14, 8.23, 10.8
 (10.8+)

                                 Wind Speed Class :  1     2     3     4     5
                                                    ---   ---   ---   ---   ---
                                        ! WSCAT = 1.54, 3.09, 5.14, 8.23, 10.80 !

     Default wind speed profile power-law
     exponents for stabilities 1-6
     (PLX0(6))                          Default   : ISC RURAL values
                                        ISC RURAL : .07, .07, .10, .15, .35, .55
                                        ISC URBAN : .15, .15, .20, .25, .30, .30

                                  Stability Class :  A     B     C     D     E     F
                                                    ---   ---   ---   ---   ---   ---
                                         ! PLX0 = 0.07, 0.07, 0.10, 0.15, 0.35, 0.55
 !

     Default potential temperature gradient
     for stable classes E, F (degK/m)
     (PTG0(2))                          Default: 0.020, 0.035
                                         ! PTG0 = 0.020,   0.035 !
```

```
Default plume path coefficients for
each stability class (used when option
for partial plume height terrain adjustment
is selected -- MCTADJ=3)
(PPC(6))                  Stability Class :  A     B     C     D     E     F
                            Default  PPC : .50,  .50,  .50,  .50,  .35,  .35
                                           ---   ---   ---   ---   ---   ---
                                   !  PPC = 0.50, 0.50, 0.50, 0.50, 0.35, 0.35
!

Slug-to-puff transition criterion factor
equal to sigma-y/length of slug
(SL2PF)                           Default: 10.        ! SL2PF = 10.0 !

Puff-splitting control variables ------------------------

  VERTICAL SPLIT
  --------------

  Number of puffs that result every time a puff
  is split - nsplit=2 means that 1 puff splits
  into 2
  (NSPLIT)                        Default:   3        ! NSPLIT =  3  !

  Time(s) of a day when split puffs are eligible to
  be split once again; this is typically set once
  per day, around sunset before nocturnal shear develops.
  24 values: 0 is midnight (00:00) and 23 is 11 PM (23:00)
  0=do not re-split    1=eligible for re-split
  (IRESPLIT(24))                  Default:  Hour 17 = 1
  !  IRESPLIT = 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,1,0,0,0,0,0,0 !

  Split is allowed only if last hour's mixing
  height (m) exceeds a minimum value
  (ZISPLIT)                       Default: 100.       ! ZISPLIT = 100.0 !

  Split is allowed only if ratio of last hour's
  mixing ht to the maximum mixing ht experienced
  by the puff is less than a maximum value (this
  postpones a split until a nocturnal layer develops)
  (ROLDMAX)                       Default: 0.25       ! ROLDMAX = 0.25 !


  HORIZONTAL SPLIT
  ----------------

  Number of puffs that result every time a puff
  is split - nsplith=5 means that 1 puff splits
  into 5
  (NSPLITH)                       Default:   5        ! NSPLITH =  5  !

  Minimum sigma-y (Grid Cells Units) of puff
  before it may be split
  (SYSPLITH)                      Default:  1.0       ! SYSPLITH = 1.0 !

  Minimum puff elongation rate (SYSPLITH/hr) due to
  wind shear, before it may be split
  (SHSPLITH)                      Default:  2.        ! SHSPLITH = 2.0 !

  Minimum concentration (g/m^3) of each
  species in puff before it may be split
  Enter array of NSPEC values; if a single value is
  entered, it will be used for ALL species
```

```
   (CNSPLITH)                            Default:  1.0E-07    ! CNSPLITH = 1.0E-07
!

  Integration control variables ------------------------

    Fractional convergence criterion for numerical SLUG
    sampling integration
    (EPSSLUG)                            Default:   1.0e-04  ! EPSSLUG = 1.0E-04 !

    Fractional convergence criterion for numerical AREA
    source integration
    (EPSAREA)                            Default:   1.0e-06  ! EPSAREA = 1.0E-06 !

    Trajectory step-length (m) used for numerical rise
    integration
    (DSRISE)                             Default:   1.0      ! DSRISE = 1.0 !

  Boundary Condition (BC) Puff control variables ------------------------

    Minimum height (m) to which BC puffs are mixed as they are emitted
    (MBCON=2 ONLY).  Actual height is reset to the current mixing height
    at the release point if greater than this minimum.
    (HTMINBC)                            Default:   500.     ! HTMINBC = 500. !

    Search radius (km) about a receptor for sampling nearest BC puff.
    BC puffs are typically emitted with a spacing of one grid cell
    length, so the search radius should be greater than DGRIDKM.
    (RSAMPBC)                            Default:   10.      ! RSAMPBC = 10. !

    Near-Surface depletion adjustment to concentration profile used when
    sampling BC puffs?
    (MDEPBC)                             Default:   1        ! MDEPBC = 1. !
       0 = Concentration is NOT adjusted for depletion
       1 = Adjust Concentration for depletion

!END!

-------------------------------------------------------------------------------

INPUT GROUPS: 13a, 13b, 13c, 13d -- Point source parameters
--------------------------------

---------------
Subgroup (13a)
---------------

     Number of point sources with
     parameters provided below      (NPT1)  No default  !  NPT1 =   1  !

     Units used for point source
     emissions below                (IPTU)  Default: 1  !  IPTU =   3  !
           1 =        g/s
           2 =       kg/hr
           3 =       lb/hr
           4 =     tons/yr
           5 =     Odour Unit * m**3/s  (vol. flux of odour compound)
           6 =     Odour Unit * m**3/min
           7 =     metric tons/yr

     Number of source-species
     combinations with variable
```

```
     emissions scaling factors
     provided below in (13d)        (NSPT1) Default: 0   !  NSPT1 =  0  !

     Number of point sources with
     variable emission parameters
     provided in external file      (NPT2)  No default   !  NPT2 =  0  !

     (If NPT2 > 0, these point
     source emissions are read from
     the file: PTEMARB.DAT)

!END!

---------------
Subgroup (13b)
---------------
                                            a
          POINT SOURCE: CONSTANT DATA
          -----------------------------
                                                                              b
     c
  Source     X UTM       Y UTM      Stack    Base      Stack    Exit  Exit     Bldg.
Emission
    No.    Coordinate Coordinate Height Elevation Diameter  Vel.  Temp.    Dwash
Rates
              (km)        (km)       (m)      (m)        (m)  (m/s) (deg. K)
  ------  ---------- ---------- ------  ------   -------- ----- -------- -----
--------
   1 ! SRCNAM = UNIT1!
   1 ! X =    -35.27, 41.80,  152.4, 1292.6,    5.72,    30.54, 377.6,    0, XX, XX,
XX,
   0.0, 0.0, XX, XX !
   1 ! FMFAC  =      1.0 !   !END!

   --------

    a
     Data for each source are treated as a separate input subgroup
     and therefore must end with an input group terminator.

     SRCNAM  is a 12-character name for a source
             (No default)
     X       is an array holding the source data listed by the column headings
             (No default)
     SIGYZI  is an array holding the initial sigma-y and sigma-z (m)
             (Default: 0.,0.)
     FMFAC   is a vertical momentum flux factor (0. or 1.0) used to represent
             the effect of rain-caps or other physical configurations that
             reduce momentum rise associated with the actual exit velocity.
             (Default: 1.0  -- full momentum used)

    b
     0. = No building downwash modeled, 1. = downwash modeled
     NOTE: must be entered as a REAL number (i.e., with decimal point)

    c
     An emission rate must be entered for every pollutant modeled.
     Enter emission rate of zero for secondary pollutants that are
     modeled, but not emitted.  Units are specified by IPTU
     (e.g. 1 for g/s).

---------------
Subgroup (13c)
```

```
---------------

        BUILDING DIMENSION DATA FOR SOURCES SUBJECT TO DOWNWASH
        -------------------------------------------------------
Source                                                                  a
 No.    Effective building height, width, length and X/Y offset (in meters)
        every 10 degrees.  LENGTH, XBADJ, and YBADJ are only needed for
        MBDW=2 (PRIME downwash option)
------  --------------------------------------------------------------------


   a
    Building height, width, length, and X/Y offset from the source are treated
    as a separate input subgroup for each source and therefore must end with
    an input group terminator.

---------------
Subgroup (13d)
---------------
                                                  a
       POINT SOURCE: VARIABLE EMISSIONS DATA
       ---------------------------------------

    Use this subgroup to describe temporal variations in the emission
    rates given in 13b.  Factors entered multiply the rates in 13b.
    Skip sources here that have constant emissions.  For more elaborate
    variation in source parameters, use PTEMARB.DAT and NPT2 > 0.

    IVARY determines the type of variation, and is source-specific:
    (IVARY)                                Default: 0
          0 =       Constant
          1 =       Diurnal cycle (24 scaling factors: hours 1-24)
          2 =       Monthly cycle (12 scaling factors: months 1-12)
          3 =       Hour & Season (4 groups of 24 hourly scaling factors,
                                   where first group is DEC-JAN-FEB)
          4 =       Speed & Stab. (6 groups of 6 scaling factors, where
                                   first group is Stability Class A,
                                   and the speed classes have upper
                                   bounds (m/s) defined in Group 12
          5 =       Temperature   (12 scaling factors, where temperature
                                   classes have upper bounds (C) of:
                                   0, 5, 10, 15, 20, 25, 30, 35, 40,
                                   45, 50, 50+)


--------
   a
    Data for each species are treated as a separate input subgroup
    and therefore must end with an input group terminator.


-------------------------------------------------------------------------------

INPUT GROUPS: 14a, 14b, 14c, 14d -- Area source parameters
--------------------------------

---------------
Subgroup (14a)
---------------

    Number of polygon area sources with
```

```
     parameters specified below (NAR1)       No default  !  NAR1 =  0   !

     Units used for area source
     emissions below            (IARU)       Default: 1  !  IARU =   1  !
           1 =        g/m**2/s
           2 =       kg/m**2/hr
           3 =       lb/m**2/hr
           4 =     tons/m**2/yr
           5 =     Odour Unit * m/s  (vol. flux/m**2 of odour compound)
           6 =     Odour Unit * m/min
           7 =     metric tons/m**2/yr

     Number of source-species
     combinations with variable
     emissions scaling factors
     provided below in (14d)        (NSAR1) Default: 0  !  NSAR1 =  0  !

     Number of buoyant polygon area sources
     with variable location and emission
     parameters (NAR2)                        No default  !  NAR2 =  0   !
     (If NAR2 > 0, ALL parameter data for
     these sources are read from the file: BAEMARB.DAT)

!END!

---------------
Subgroup (14b)
---------------
                                            a
          AREA SOURCE: CONSTANT DATA
          ----------------------------
                                                               b
Source           Effect.    Base      Initial    Emission
 No.             Height   Elevation   Sigma z     Rates
                   (m)       (m)        (m)
-------          ------    ------     --------   ---------

--------
    a
     Data for each source are treated as a separate input subgroup
     and therefore must end with an input group terminator.
    b
     An emission rate must be entered for every pollutant modeled.
     Enter emission rate of zero for secondary pollutants that are
     modeled, but not emitted.  Units are specified by IARU
     (e.g. 1 for g/m**2/s).

---------------
Subgroup (14c)
---------------

           COORDINATES (UTM-km) FOR EACH VERTEX(4) OF EACH POLYGON
           --------------------------------------------------------
Source                                                                a
 No.       Ordered list of X followed by list of Y, grouped by source
------     ------------------------------------------------------------

--------
    a
     Data for each source are treated as a separate input subgroup
     and therefore must end with an input group terminator.
```

```
---------------
Subgroup (14d)
---------------
                                                  a
          AREA SOURCE: VARIABLE EMISSIONS DATA
          --------------------------------------

     Use this subgroup to describe temporal variations in the emission
     rates given in 14b.  Factors entered multiply the rates in 14b.
     Skip sources here that have constant emissions.  For more elaborate
     variation in source parameters, use BAEMARB.DAT and NAR2 > 0.

     IVARY determines the type of variation, and is source-specific:
     (IVARY)                                 Default: 0
           0 =       Constant
           1 =       Diurnal cycle (24 scaling factors: hours 1-24)
           2 =       Monthly cycle (12 scaling factors: months 1-12)
           3 =       Hour & Season (4 groups of 24 hourly scaling factors,
                                    where first group is DEC-JAN-FEB)
           4 =       Speed & Stab. (6 groups of 6 scaling factors, where
                                    first group is Stability Class A,
                                    and the speed classes have upper
                                    bounds (m/s) defined in Group 12
           5 =       Temperature   (12 scaling factors, where temperature
                                    classes have upper bounds (C) of:
                                    0, 5, 10, 15, 20, 25, 30, 35, 40,
                                    45, 50, 50+)


--------
    a
     Data for each species are treated as a separate input subgroup
     and therefore must end with an input group terminator.


-------------------------------------------------------------------------------

INPUT GROUPS: 15a, 15b, 15c -- Line source parameters
---------------------------

---------------
Subgroup (15a)
---------------

     Number of buoyant line sources
     with variable location and emission
     parameters (NLN2)                              No default  !  NLN2 =  0   !

     (If NLN2 > 0, ALL parameter data for
      these sources are read from the file: LNEMARB.DAT)

     Number of buoyant line sources (NLINES)        No default   ! NLINES =  0  !

     Units used for line source
     emissions below                (ILNU)          Default: 1  !  ILNU =   1  !
           1 =        g/s
           2 =       kg/hr
           3 =       lb/hr
           4 =     tons/yr
           5 =     Odour Unit * m**3/s  (vol. flux of odour compound)
```

```
         6 =     Odour Unit * m**3/min
         7 =     metric tons/yr

      Number of source-species
      combinations with variable
      emissions scaling factors
      provided below in (15c)        (NSLN1) Default: 0  !  NSLN1 =  0  !

      Maximum number of segments used to model
      each line (MXNSEG)                           Default: 7   ! MXNSEG =  7  !

      The following variables are required only if NLINES > 0.  They are
      used in the buoyant line source plume rise calculations.

         Number of distances at which              Default: 6   ! NLRISE =  6  !
         transitional rise is computed

         Average building length (XL)              No default   ! XL = .0 !
                                                   (in meters)

         Average building height (HBL)             No default   ! HBL = .0 !
                                                   (in meters)

         Average building width (WBL)              No default   ! WBL = .0 !
                                                   (in meters)

         Average line source width (WML)           No default   ! WML = .0 !
                                                   (in meters)

         Average separation between buildings (DXL) No default  ! DXL = .0 !
                                                   (in meters)

         Average buoyancy parameter (FPRIMEL)      No default   ! FPRIMEL = .0 !
                                                   (in m**4/s**3)

!END!

---------------
Subgroup (15b)
---------------

          BUOYANT LINE SOURCE: CONSTANT DATA
          ----------------------------------

     a
Source    Beg. X      Beg. Y      End. X      End. Y     Release    Base
Emission
 No.    Coordinate  Coordinate  Coordinate  Coordinate   Height    Elevation
Rates
           (km)        (km)        (km)        (km)        (m)        (m)
------  ----------  ----------  ----------  ----------  -------   ---------
---------

--------

    a
     Data for each source are treated as a separate input subgroup
     and therefore must end with an input group terminator.

    b
     An emission rate must be entered for every pollutant modeled.
     Enter emission rate of zero for secondary pollutants that are
     modeled, but not emitted.  Units are specified by ILNTU
```

```
     (e.g. 1 for g/s).

---------------
Subgroup (15c)
---------------
                                                    a
        BUOYANT LINE SOURCE: VARIABLE EMISSIONS DATA
        ---------------------------------------------

    Use this subgroup to describe temporal variations in the emission
    rates given in 15b.  Factors entered multiply the rates in 15b.
    Skip sources here that have constant emissions.

    IVARY determines the type of variation, and is source-specific:
    (IVARY)                                Default: 0
         0 =       Constant
         1 =       Diurnal cycle (24 scaling factors: hours 1-24)
         2 =       Monthly cycle (12 scaling factors: months 1-12)
         3 =       Hour & Season (4 groups of 24 hourly scaling factors,
                                  where first group is DEC-JAN-FEB)
         4 =       Speed & Stab. (6 groups of 6 scaling factors, where
                                  first group is Stability Class A,
                                  and the speed classes have upper
                                  bounds (m/s) defined in Group 12
         5 =       Temperature   (12 scaling factors, where temperature
                                  classes have upper bounds (C) of:
                                  0, 5, 10, 15, 20, 25, 30, 35, 40,
                                  45, 50, 50+)


--------
    a
    Data for each species are treated as a separate input subgroup
    and therefore must end with an input group terminator.


-------------------------------------------------------------------------------


INPUT GROUPS: 16a, 16b, 16c -- Volume source parameters
---------------------------

---------------
Subgroup (16a)
---------------

    Number of volume sources with
    parameters provided in 16b,c (NVL1)     No default  !  NVL1 =  0   !

    Units used for volume source
    emissions below in 16b       (IVLU)     Default: 1  !  IVLU =   1  !
         1 =        g/s
         2 =       kg/hr
         3 =       lb/hr
         4 =      tons/yr
         5 =      Odour Unit * m**3/s  (vol. flux of odour compound)
         6 =      Odour Unit * m**3/min
         7 =      metric tons/yr

    Number of source-species
    combinations with variable
    emissions scaling factors
```

```
     provided below in (16c)       (NSVL1)     Default: 0   !   NSVL1 =  0   !

     Number of volume sources with
     variable location and emission
     parameters                    (NVL2)      No default   !   NVL2 =   0   !

     (If NVL2 > 0, ALL parameter data for
      these sources are read from the VOLEMARB.DAT file(s) )

!END!

---------------
Subgroup (16b)
---------------
                                             a
           VOLUME SOURCE: CONSTANT DATA
           ------------------------------
                                                                                 b
        X UTM       Y UTM      Effect.    Base      Initial    Initial    Emission
     Coordinate  Coordinate    Height   Elevation   Sigma y    Sigma z     Rates
        (km)        (km)         (m)       (m)        (m)        (m)
     ----------  ----------    ------    ------    --------   --------   --------


--------
    a
     Data for each source are treated as a separate input subgroup
     and therefore must end with an input group terminator.

    b
     An emission rate must be entered for every pollutant modeled.
     Enter emission rate of zero for secondary pollutants that are
     modeled, but not emitted.  Units are specified by IVLU
     (e.g. 1 for g/s).

---------------
Subgroup (16c)
---------------
                                                      a
          VOLUME SOURCE: VARIABLE EMISSIONS DATA
          ---------------------------------------

     Use this subgroup to describe temporal variations in the emission
     rates given in 16b.  Factors entered multiply the rates in 16b.
     Skip sources here that have constant emissions.  For more elaborate
     variation in source parameters, use VOLEMARB.DAT and NVL2 > 0.

     IVARY determines the type of variation, and is source-specific:
     (IVARY)                                Default: 0
           0 =        Constant
           1 =        Diurnal cycle (24 scaling factors: hours 1-24)
           2 =        Monthly cycle (12 scaling factors: months 1-12)
           3 =        Hour & Season (4 groups of 24 hourly scaling factors,
                                     where first group is DEC-JAN-FEB)
           4 =        Speed & Stab. (6 groups of 6 scaling factors, where
                                     first group is Stability Class A,
                                     and the speed classes have upper
                                     bounds (m/s) defined in Group 12
           5 =        Temperature   (12 scaling factors, where temperature
                                     classes have upper bounds (C) of:
                                     0, 5, 10, 15, 20, 25, 30, 35, 40,
                                     45, 50, 50+)
```

----
a
Data for each species are treated as a separate input subgroup
and therefore must end with an input group terminator.

INPUT GROUPS: 17a & 17b -- Non-gridded (discrete) receptor information

---

Subgroup (17a)

Number of non-gridded receptors (NREC) No default ! NREC = 751 !

!END!

Subgroup (17b)

NON-GRIDDED (DISCRETE) RECEPTOR DATA [a]

Receptor No.		X UTM Coordinate (km)	Y UTM Coordinate (km)	Ground Elevation (m)	Height [b] Above Ground (m)		
1!	X =	200.0833,	-23.1826,	853,	0!	!END!	Badlands NP
2!	X =	201.3758,	-23.1408,	865,	0!	!END!	Badlands NP
3!	X =	202.6682,	-23.0988,	850,	0!	!END!	Badlands NP
4!	X =	200.0256,	-21.3932,	853,	0!	!END!	Badlands NP
5!	X =	201.3177,	-21.3515,	853,	0!	!END!	Badlands NP
6!	X =	202.6098,	-21.3094,	853,	0!	!END!	Badlands NP
7!	X =	203.902,	-21.2671,	852,	0!	!END!	Badlands NP
8!	X =	205.194,	-21.2245,	853,	0!	!END!	Badlands NP
9!	X =	221.9904,	-20.6466,	791,	0!	!END!	Badlands NP
10!	X =	223.2824,	-20.6002,	789,	0!	!END!	Badlands NP
11!	X =	224.5744,	-20.5536,	789,	0!	!END!	Badlands NP
12!	X =	225.8663,	-20.5067,	792,	0!	!END!	Badlands NP
13!	X =	227.1583,	-20.4596,	789,	0!	!END!	Badlands NP
14!	X =	228.4502,	-20.4122,	768,	0!	!END!	Badlands NP
15!	X =	198.6762,	-19.6453,	853,	0!	!END!	Badlands NP
16!	X =	199.968,	-19.6039,	853,	0!	!END!	Badlands NP
17!	X =	201.2597,	-19.5621,	853,	0!	!END!	Badlands NP
18!	X =	202.5514,	-19.5201,	853,	0!	!END!	Badlands NP
19!	X =	203.8432,	-19.4778,	860,	0!	!END!	Badlands NP
20!	X =	205.1349,	-19.4352,	910,	0!	!END!	Badlands NP
21!	X =	206.4266,	-19.3924,	853,	0!	!END!	Badlands NP
22!	X =	207.7183,	-19.3493,	848,	0!	!END!	Badlands NP
23!	X =	209.01,	-19.3059,	853,	0!	!END!	Badlands NP
24!	X =	220.6349,	-18.9035,	792,	0!	!END!	Badlands NP
25!	X =	221.9265,	-18.8574,	792,	0!	!END!	Badlands NP
26!	X =	223.2181,	-18.8111,	792,	0!	!END!	Badlands NP
27!	X =	224.5096,	-18.7645,	792,	0!	!END!	Badlands NP
28!	X =	227.0928,	-18.6705,	792,	0!	!END!	Badlands NP
29!	X =	201.2017,	-17.7728,	853,	0!	!END!	Badlands NP
30!	X =	202.493,	-17.7308,	853,	0!	!END!	Badlands NP
31!	X =	203.7844,	-17.6885,	853,	0!	!END!	Badlands NP

```
32!    X =    205.0758,   -17.6459,    853,    0!    !END!  Badlands NP
33!    X =    206.3671,   -17.6031,    914,    0!    !END!  Badlands NP
34!    X =    207.6584,     -17.56,    853,    0!    !END!  Badlands NP
35!    X =    208.9497,   -17.5167,    853,    0!    !END!  Badlands NP
36!    X =      219.28,   -17.1601,    810,    0!    !END!  Badlands NP
37!    X =    220.5712,   -17.1143,    828,    0!    !END!  Badlands NP
38!    X =    201.1436,   -15.9835,    852,    0!    !END!  Badlands NP
39!    X =    202.4346,   -15.9415,    852,    0!    !END!  Badlands NP
40!    X =    203.7256,   -15.8992,    851,    0!    !END!  Badlands NP
41!    X =    205.0166,   -15.8566,    852,    0!    !END!  Badlands NP
42!    X =    206.3076,   -15.8138,    853,    0!    !END!  Badlands NP
43!    X =    207.5985,   -15.7708,    853,    0!    !END!  Badlands NP
44!    X =    208.8895,   -15.7274,    853,    0!    !END!  Badlands NP
45!    X =    217.9259,   -15.4165,    823,    0!    !END!  Badlands NP
46!    X =    198.5043,   -14.2773,    845,    0!    !END!  Badlands NP
47!    X =     199.795,   -14.2359,    828,    0!    !END!  Badlands NP
48!    X =    201.0856,   -14.1942,    835,    0!    !END!  Badlands NP
49!    X =    202.3762,   -14.1522,    848,    0!    !END!  Badlands NP
50!    X =    203.6669,   -14.1099,    843,    0!    !END!  Badlands NP
51!    X =    204.9575,   -14.0674,    844,    0!    !END!  Badlands NP
52!    X =    206.2481,   -14.0246,    851,    0!    !END!  Badlands NP
53!    X =    207.5386,   -13.9815,    853,    0!    !END!  Badlands NP
54!    X =    208.8292,   -13.9382,    853,    0!    !END!  Badlands NP
55!    X =    210.1198,   -13.8946,    900,    0!    !END!  Badlands NP
56!    X =    211.4104,   -13.8507,    853,    0!    !END!  Badlands NP
57!    X =    212.7009,   -13.8066,    849,    0!    !END!  Badlands NP
58!    X =    213.9914,   -13.7622,    845,    0!    !END!  Badlands NP
59!    X =     215.282,   -13.7175,    853,    0!    !END!  Badlands NP
60!    X =    216.5725,   -13.6725,    841,    0!    !END!  Badlands NP
61!    X =    198.4471,    -12.488,    842,    0!    !END!  Badlands NP
62!    X =    199.7373,   -12.4466,    810,    0!    !END!  Badlands NP
63!    X =    201.0276,   -12.4049,    803,    0!    !END!  Badlands NP
64!    X =    202.3178,   -12.3629,    825,    0!    !END!  Badlands NP
65!    X =    203.6081,   -12.3207,    814,    0!    !END!  Badlands NP
66!    X =    204.8983,   -12.2781,    807,    0!    !END!  Badlands NP
67!    X =    206.1885,   -12.2354,    846,    0!    !END!  Badlands NP
68!    X =    207.4788,   -12.1923,    852,    0!    !END!  Badlands NP
69!    X =     208.769,    -12.149,    853,    0!    !END!  Badlands NP
70!    X =    210.0592,   -12.1054,    853,    0!    !END!  Badlands NP
71!    X =    211.3493,   -12.0615,    853,    0!    !END!  Badlands NP
72!    X =    212.6395,   -12.0174,    853,    0!    !END!  Badlands NP
73!    X =    213.9297,    -11.973,    911,    0!    !END!  Badlands NP
74!    X =    215.2199,   -11.9283,    853,    0!    !END!  Badlands NP
75!    X =    198.3898,   -10.6987,    847,    0!    !END!  Badlands NP
76!    X =    199.6797,   -10.6573,    792,    0!    !END!  Badlands NP
77!    X =    200.9696,   -10.6156,    792,    0!    !END!  Badlands NP
78!    X =    202.2594,   -10.5736,    803,    0!    !END!  Badlands NP
79!    X =    203.5493,   -10.5314,    794,    0!    !END!  Badlands NP
80!    X =    204.8392,   -10.4889,    796,    0!    !END!  Badlands NP
81!    X =     206.129,   -10.4461,    828,    0!    !END!  Badlands NP
82!    X =    207.4189,   -10.4031,    851,    0!    !END!  Badlands NP
83!    X =    208.7087,   -10.3598,    853,    0!    !END!  Badlands NP
84!    X =    209.9985,   -10.3162,    853,    0!    !END!  Badlands NP
85!    X =    211.2883,   -10.2724,    853,    0!    !END!  Badlands NP
86!    X =    212.5781,   -10.2283,    914,    0!    !END!  Badlands NP
87!    X =    213.8679,   -10.1839,    924,    0!    !END!  Badlands NP
88!    X =     199.622,   -8.86805,    809,    0!    !END!  Badlands NP
89!    X =    200.9115,   -8.82637,    792,    0!    !END!  Badlands NP
90!    X =     202.201,   -8.78441,    792,    0!    !END!  Badlands NP
91!    X =    203.4905,   -8.74219,    792,    0!    !END!  Badlands NP
92!    X =      204.78,    -8.6997,    792,    0!    !END!  Badlands NP
93!    X =    206.0695,   -8.65694,    841,    0!    !END!  Badlands NP
94!    X =     207.359,   -8.61391,    853,    0!    !END!  Badlands NP
```

95!	X =	208.6484,	-8.57062,	853,	0!	!END! Badlands NP
96!	X =	209.9379,	-8.52705,	869,	0!	!END! Badlands NP
97!	X =	202.1426,	-6.99519,	796,	0!	!END! Badlands NP
98!	X =	203.4318,	-6.95298,	829,	0!	!END! Badlands NP
99!	X =	204.7209,	-6.9105,	853,	0!	!END! Badlands NP
100!	X =	206.01,	-6.86776,	860,	0!	!END! Badlands NP
101!	X =	117.1725,	-50.3709,	1280,	0!	!END! Wind Cave NP
102!	X =	117.8216,	-50.3587,	1280,	0!	!END! Wind Cave NP
103!	X =	118.4706,	-50.3464,	1271,	0!	!END! Wind Cave NP
104!	X =	115.8577,	-49.5,	1280,	0!	!END! Wind Cave NP
105!	X =	116.5067,	-49.4879,	1280,	0!	!END! Wind Cave NP
106!	X =	117.1557,	-49.4758,	1280,	0!	!END! Wind Cave NP
107!	X =	117.8046,	-49.4636,	1280,	0!	!END! Wind Cave NP
108!	X =	118.4536,	-49.4513,	1219,	0!	!END! Wind Cave NP
109!	X =	119.1026,	-49.4389,	1219,	0!	!END! Wind Cave NP
110!	X =	119.7516,	-49.4265,	1252,	0!	!END! Wind Cave NP
111!	X =	115.8411,	-48.6049,	1280,	0!	!END! Wind Cave NP
112!	X =	116.4899,	-48.5928,	1280,	0!	!END! Wind Cave NP
113!	X =	117.1388,	-48.5807,	1280,	0!	!END! Wind Cave NP
114!	X =	117.7877,	-48.5684,	1280,	0!	!END! Wind Cave NP
115!	X =	118.4366,	-48.5561,	1244,	0!	!END! Wind Cave NP
116!	X =	119.0855,	-48.5438,	1244,	0!	!END! Wind Cave NP
117!	X =	119.7344,	-48.5314,	1236,	0!	!END! Wind Cave NP
118!	X =	120.3833,	-48.5189,	1226,	0!	!END! Wind Cave NP
119!	X =	121.0322,	-48.5063,	1209,	0!	!END! Wind Cave NP
120!	X =	115.8244,	-47.7098,	1341,	0!	!END! Wind Cave NP
121!	X =	116.4732,	-47.6977,	1330,	0!	!END! Wind Cave NP
122!	X =	117.122,	-47.6855,	1307,	0!	!END! Wind Cave NP
123!	X =	117.7708,	-47.6733,	1280,	0!	!END! Wind Cave NP
124!	X =	118.4196,	-47.661,	1274,	0!	!END! Wind Cave NP
125!	X =	119.0684,	-47.6487,	1271,	0!	!END! Wind Cave NP
126!	X =	119.7172,	-47.6362,	1274,	0!	!END! Wind Cave NP
127!	X =	120.366,	-47.6238,	1280,	0!	!END! Wind Cave NP
128!	X =	121.0148,	-47.6112,	1224,	0!	!END! Wind Cave NP
129!	X =	116.4565,	-46.8026,	1341,	0!	!END! Wind Cave NP
130!	X =	117.1052,	-46.7904,	1336,	0!	!END! Wind Cave NP
131!	X =	117.7539,	-46.7782,	1290,	0!	!END! Wind Cave NP
132!	X =	118.4026,	-46.7659,	1256,	0!	!END! Wind Cave NP
133!	X =	119.0513,	-46.7536,	1219,	0!	!END! Wind Cave NP
134!	X =	119.7,	-46.7411,	1219,	0!	!END! Wind Cave NP
135!	X =	120.3487,	-46.7286,	1219,	0!	!END! Wind Cave NP
136!	X =	120.9974,	-46.7161,	1177,	0!	!END! Wind Cave NP
137!	X =	117.0884,	-45.8953,	1340,	0!	!END! Wind Cave NP
138!	X =	117.737,	-45.8831,	1290,	0!	!END! Wind Cave NP
139!	X =	118.3856,	-45.8708,	1280,	0!	!END! Wind Cave NP
140!	X =	119.0342,	-45.8585,	1280,	0!	!END! Wind Cave NP
141!	X =	119.6828,	-45.846,	1219,	0!	!END! Wind Cave NP
142!	X =	120.3314,	-45.8336,	1271,	0!	!END! Wind Cave NP
143!	X =	120.98,	-45.821,	1251,	0!	!END! Wind Cave NP
144!	X =	117.0716,	-45.0002,	1334,	0!	!END! Wind Cave NP
145!	X =	117.7201,	-44.988,	1298,	0!	!END! Wind Cave NP
146!	X =	118.3686,	-44.9757,	1280,	0!	!END! Wind Cave NP
147!	X =	119.0171,	-44.9634,	1280,	0!	!END! Wind Cave NP
148!	X =	119.6656,	-44.9509,	1280,	0!	!END! Wind Cave NP
149!	X =	120.3142,	-44.9385,	1280,	0!	!END! Wind Cave NP
150!	X =	120.9627,	-44.9259,	1219,	0!	!END! Wind Cave NP
151!	X =	123.5567,	-44.875,	1186,	0!	!END! Wind Cave NP
152!	X =	124.2052,	-44.8621,	1158,	0!	!END! Wind Cave NP
153!	X =	124.8537,	-44.8492,	1140,	0!	!END! Wind Cave NP
154!	X =	125.5022,	-44.8361,	1145,	0!	!END! Wind Cave NP
155!	X =	126.1507,	-44.823,	1152,	0!	!END! Wind Cave NP
~~156!~~	~~X =~~	~~126.7992,~~	~~-44.8099,~~	~~1158,~~	~~0!~~	~~!END! Wind Cave NP~~
157!	X =	127.4477,	-44.7966,	1158,	0!	!END! Wind Cave NP

158!	X =	117.0548,	-44.1051,	1344,	0!	!END! Wind Cave NP
159!	X =	117.7032,	-44.0929,	1294,	0!	!END! Wind Cave NP
160!	X =	118.3516,	-44.0806,	1280,	0!	!END! Wind Cave NP
161!	X =	119,	-44.0683,	1280,	0!	!END! Wind Cave NP
162!	X =	119.6485,	-44.0559,	1280,	0!	!END! Wind Cave NP
163!	X =	120.2969,	-44.0434,	1280,	0!	!END! Wind Cave NP
164!	X =	120.9453,	-44.0308,	1220,	0!	!END! Wind Cave NP
165!	X =	123.539,	-43.9799,	1219,	0!	!END! Wind Cave NP
166!	X =	124.1874,	-43.967,	1158,	0!	!END! Wind Cave NP
167!	X =	124.8358,	-43.9541,	1153,	0!	!END! Wind Cave NP
168!	X =	125.4842,	-43.9411,	1156,	0!	!END! Wind Cave NP
169!	X =	126.1326,	-43.928,	1158,	0!	!END! Wind Cave NP
170!	X =	126.781,	-43.9148,	1157,	0!	!END! Wind Cave NP
171!	X =	127.4294,	-43.9016,	1219,	0!	!END! Wind Cave NP
172!	X =	117.0379,	-43.21,	1341,	0!	!END! Wind Cave NP
173!	X =	117.6863,	-43.1978,	1306,	0!	!END! Wind Cave NP
174!	X =	118.3346,	-43.1855,	1304,	0!	!END! Wind Cave NP
175!	X =	118.9829,	-43.1732,	1341,	0!	!END! Wind Cave NP
176!	X =	119.6313,	-43.1608,	1289,	0!	!END! Wind Cave NP
177!	X =	120.2796,	-43.1483,	1272,	0!	!END! Wind Cave NP
178!	X =	120.9279,	-43.1357,	1219,	0!	!END! Wind Cave NP
179!	X =	121.5762,	-43.1231,	1280,	0!	!END! Wind Cave NP
180!	X =	122.2246,	-43.1104,	1280,	0!	!END! Wind Cave NP
181!	X =	122.8729,	-43.0977,	1220,	0!	!END! Wind Cave NP
182!	X =	123.5212,	-43.0849,	1218,	0!	!END! Wind Cave NP
183!	X =	124.1695,	-43.072,	1184,	0!	!END! Wind Cave NP
184!	X =	124.8178,	-43.059,	1158,	0!	!END! Wind Cave NP
185!	X =	125.4662,	-43.046,	1158,	0!	!END! Wind Cave NP
186!	X =	126.1145,	-43.0329,	1158,	0!	!END! Wind Cave NP
187!	X =	126.7628,	-43.0197,	1158,	0!	!END! Wind Cave NP
188!	X =	127.4111,	-43.0065,	1212,	0!	!END! Wind Cave NP
189!	X =	117.0211,	-42.3149,	1411,	0!	!END! Wind Cave NP
190!	X =	117.6694,	-42.3027,	1341,	0!	!END! Wind Cave NP
191!	X =	118.3176,	-42.2905,	1348,	0!	!END! Wind Cave NP
192!	X =	118.9658,	-42.2781,	1347,	0!	!END! Wind Cave NP
193!	X =	119.6141,	-42.2657,	1297,	0!	!END! Wind Cave NP
194!	X =	120.2623,	-42.2532,	1284,	0!	!END! Wind Cave NP
195!	X =	120.9105,	-42.2407,	1284,	0!	!END! Wind Cave NP
196!	X =	121.5588,	-42.228,	1280,	0!	!END! Wind Cave NP
197!	X =	122.207,	-42.2154,	1236,	0!	!END! Wind Cave NP
198!	X =	122.8552,	-42.2026,	1219,	0!	!END! Wind Cave NP
199!	X =	123.5035,	-42.1898,	1221,	0!	!END! Wind Cave NP
200!	X =	124.1517,	-42.1769,	1202,	0!	!END! Wind Cave NP
201!	X =	124.7999,	-42.1639,	1158,	0!	!END! Wind Cave NP
202!	X =	125.4481,	-42.1509,	1158,	0!	!END! Wind Cave NP
203!	X =	126.0964,	-42.1378,	1158,	0!	!END! Wind Cave NP
204!	X =	126.7446,	-42.1247,	1219,	0!	!END! Wind Cave NP
205!	X =	127.3928,	-42.1114,	1219,	0!	!END! Wind Cave NP
206!	X =	128.041,	-42.0982,	1191,	0!	!END! Wind Cave NP
207!	X =	128.6892,	-42.0848,	1152,	0!	!END! Wind Cave NP
208!	X =	117.0043,	-41.4199,	1402,	0!	!END! Wind Cave NP
209!	X =	117.6525,	-41.4077,	1402,	0!	!END! Wind Cave NP
210!	X =	118.3006,	-41.3954,	1402,	0!	!END! Wind Cave NP
211!	X =	118.9487,	-41.383,	1376,	0!	!END! Wind Cave NP
212!	X =	119.5969,	-41.3706,	1341,	0!	!END! Wind Cave NP
213!	X =	120.245,	-41.3581,	1336,	0!	!END! Wind Cave NP
214!	X =	120.8932,	-41.3456,	1322,	0!	!END! Wind Cave NP
215!	X =	121.5413,	-41.333,	1280,	0!	!END! Wind Cave NP
216!	X =	122.1894,	-41.3203,	1274,	0!	!END! Wind Cave NP
217!	X =	122.8376,	-41.3075,	1274,	0!	!END! Wind Cave NP
218!	X =	123.4857,	-41.2947,	1280,	0!	!END! Wind Cave NP
219!	X =	124.1338,	-41.2818,	1219,	0!	!END! Wind Cave NP
220!	X =	124.782,	-41.2689,	1177,	0!	!END! Wind Cave NP

221!	X =	125.4301,	-41.2559,	1158,	0!	!END! Wind Cave NP
222!	X =	126.0782,	-41.2428,	1163,	0!	!END! Wind Cave NP
223!	X =	126.7264,	-41.2296,	1219,	0!	!END! Wind Cave NP
224!	X =	127.3745,	-41.2164,	1165,	0!	!END! Wind Cave NP
225!	X =	128.0226,	-41.2031,	1166,	0!	!END! Wind Cave NP
226!	X =	128.6707,	-41.1897,	1158,	0!	!END! Wind Cave NP
227!	X =	116.9875,	-40.5248,	1402,	0!	!END! Wind Cave NP
228!	X =	117.6355,	-40.5126,	1402,	0!	!END! Wind Cave NP
229!	X =	118.2836,	-40.5003,	1451,	0!	!END! Wind Cave NP
230!	X =	118.9316,	-40.488,	1360,	0!	!END! Wind Cave NP
231!	X =	119.5797,	-40.4755,	1341,	0!	!END! Wind Cave NP
232!	X =	120.2277,	-40.4631,	1341,	0!	!END! Wind Cave NP
233!	X =	120.8758,	-40.4505,	1341,	0!	!END! Wind Cave NP
234!	X =	121.5238,	-40.4379,	1288,	0!	!END! Wind Cave NP
235!	X =	122.1719,	-40.4252,	1280,	0!	!END! Wind Cave NP
236!	X =	122.8199,	-40.4125,	1280,	0!	!END! Wind Cave NP
237!	X =	123.468,	-40.3997,	1280,	0!	!END! Wind Cave NP
238!	X =	124.116,	-40.3868,	1273,	0!	!END! Wind Cave NP
239!	X =	124.764,	-40.3738,	1280,	0!	!END! Wind Cave NP
240!	X =	125.4121,	-40.3608,	1201,	0!	!END! Wind Cave NP
241!	X =	126.0601,	-40.3477,	1211,	0!	!END! Wind Cave NP
242!	X =	126.7082,	-40.3346,	1219,	0!	!END! Wind Cave NP
243!	X =	127.3562,	-40.3213,	1219,	0!	!END! Wind Cave NP
244!	X =	128.0042,	-40.3081,	1214,	0!	!END! Wind Cave NP
245!	X =	128.6522,	-40.2947,	1170,	0!	!END! Wind Cave NP
246!	X =	129.3003,	-40.2813,	1158,	0!	!END! Wind Cave NP
247!	X =	116.9707,	-39.6297,	1402,	0!	!END! Wind Cave NP
248!	X =	117.6186,	-39.6175,	1455,	0!	!END! Wind Cave NP
249!	X =	118.2666,	-39.6052,	1402,	0!	!END! Wind Cave NP
250!	X =	118.9145,	-39.5929,	1399,	0!	!END! Wind Cave NP
251!	X =	119.5625,	-39.5805,	1390,	0!	!END! Wind Cave NP
252!	X =	120.2105,	-39.568,	1350,	0!	!END! Wind Cave NP
253!	X =	120.8584,	-39.5555,	1341,	0!	!END! Wind Cave NP
254!	X =	121.5064,	-39.5428,	1283,	0!	!END! Wind Cave NP
255!	X =	122.1543,	-39.5302,	1289,	0!	!END! Wind Cave NP
256!	X =	122.8023,	-39.5174,	1291,	0!	!END! Wind Cave NP
257!	X =	123.4502,	-39.5046,	1291,	0!	!END! Wind Cave NP
258!	X =	124.0982,	-39.4917,	1280,	0!	!END! Wind Cave NP
259!	X =	124.7461,	-39.4788,	1280,	0!	!END! Wind Cave NP
260!	X =	125.3941,	-39.4658,	1219,	0!	!END! Wind Cave NP
261!	X =	126.042,	-39.4527,	1218,	0!	!END! Wind Cave NP
262!	X =	126.6899,	-39.4395,	1252,	0!	!END! Wind Cave NP
263!	X =	127.3379,	-39.4263,	1219,	0!	!END! Wind Cave NP
264!	X =	127.9858,	-39.413,	1189,	0!	!END! Wind Cave NP
265!	X =	128.6338,	-39.3997,	1158,	0!	!END! Wind Cave NP
266!	X =	129.2817,	-39.3862,	1153,	0!	!END! Wind Cave NP
267!	X =	116.9539,	-38.7346,	1445,	0!	!END! Wind Cave NP
268!	X =	117.6017,	-38.7224,	1402,	0!	!END! Wind Cave NP
269!	X =	118.2496,	-38.7102,	1462,	0!	!END! Wind Cave NP
270!	X =	118.8975,	-38.6978,	1402,	0!	!END! Wind Cave NP
271!	X =	119.5453,	-38.6854,	1441,	0!	!END! Wind Cave NP
272!	X =	120.1932,	-38.6729,	1395,	0!	!END! Wind Cave NP
273!	X =	120.841,	-38.6604,	1341,	0!	!END! Wind Cave NP
274!	X =	121.4889,	-38.6478,	1320,	0!	!END! Wind Cave NP
275!	X =	122.1368,	-38.6351,	1322,	0!	!END! Wind Cave NP
276!	X =	122.7846,	-38.6224,	1296,	0!	!END! Wind Cave NP
277!	X =	123.4325,	-38.6096,	1280,	0!	!END! Wind Cave NP
278!	X =	124.0803,	-38.5967,	1276,	0!	!END! Wind Cave NP
279!	X =	124.7282,	-38.5837,	1274,	0!	!END! Wind Cave NP
280!	X =	125.376,	-38.5707,	1280,	0!	!END! Wind Cave NP
281!	X =	126.0239,	-38.5576,	1269,	0!	!END! Wind Cave NP
~~282!~~	~~X =~~	~~126.6717,~~	~~-38.5445,~~	~~1217,~~	~~0!~~	~~!END! Wind Cave NP~~
283!	X =	127.3196,	-38.5313,	1210,	0!	!END! Wind Cave NP

284!	X =	127.9674,	-38.518,	1173,	0!	!END! Wind Cave NP
285!	X =	117.5848,	-37.8274,	1402,	0!	!END! Wind Cave NP
286!	X =	118.2326,	-37.8151,	1387,	0!	!END! Wind Cave NP
287!	X =	118.8804,	-37.8028,	1346,	0!	!END! Wind Cave NP
288!	X =	119.5281,	-37.7904,	1341,	0!	!END! Wind Cave NP
289!	X =	120.1759,	-37.7779,	1341,	0!	!END! Wind Cave NP
290!	X =	-152.493,	147.4289,	1247.7,	0!	!END! N Cheyenne Res
291!	X =	-150.567,	147.429,	1247.7,	0!	!END! N Cheyenne Res
292!	X =	-148.642,	147.4289,	1280,	0!	!END! N Cheyenne Res
293!	X =	-146.716,	147.4288,	1250.2,	0!	!END! N Cheyenne Res
294!	X =	-144.79,	147.4286,	1280,	0!	!END! N Cheyenne Res
295!	X =	-142.865,	147.4284,	1410.2,	0!	!END! N Cheyenne Res
296!	X =	-140.939,	147.4281,	1395.1,	0!	!END! N Cheyenne Res
297!	X =	-139.013,	147.4277,	1309,	0!	!END! N Cheyenne Res
298!	X =	-137.087,	147.4279,	1313.8,	0!	!END! N Cheyenne Res
299!	X =	-135.162,	147.4274,	1242.9,	0!	!END! N Cheyenne Res
300!	X =	-133.235,	147.4275,	1158.8,	0!	!END! N Cheyenne Res
301!	X =	-131.31,	147.4276,	1128,	0!	!END! N Cheyenne Res
302!	X =	-150.567,	149.3609,	1279.5,	0!	!END! N Cheyenne Res
303!	X =	-148.642,	149.3609,	1263.2,	0!	!END! N Cheyenne Res
304!	X =	-146.716,	149.3607,	1323.3,	0!	!END! N Cheyenne Res
305!	X =	-144.79,	149.3605,	1314.1,	0!	!END! N Cheyenne Res
306!	X =	-142.864,	149.3603,	1341.5,	0!	!END! N Cheyenne Res
307!	X =	-140.939,	149.36,	1371,	0!	!END! N Cheyenne Res
308!	X =	-139.013,	149.3603,	1286.6,	0!	!END! N Cheyenne Res
309!	X =	-137.087,	149.3598,	1255.8,	0!	!END! N Cheyenne Res
310!	X =	-135.161,	149.36,	1189,	0!	!END! N Cheyenne Res
311!	X =	-133.235,	149.3594,	1209.7,	0!	!END! N Cheyenne Res
312!	X =	-131.309,	149.3601,	1189.5,	0!	!END! N Cheyenne Res
313!	X =	-113.976,	149.3593,	970,	0!	!END! N Cheyenne Res
314!	X =	-150.567,	151.2935,	1206.8,	0!	!END! N Cheyenne Res
315!	X =	-148.641,	151.2928,	1234.4,	0!	!END! N Cheyenne Res
316!	X =	-146.716,	151.2927,	1308.9,	0!	!END! N Cheyenne Res
317!	X =	-144.79,	151.2932,	1371.8,	0!	!END! N Cheyenne Res
318!	X =	-142.864,	151.2929,	1280,	0!	!END! N Cheyenne Res
319!	X =	-140.938,	151.2926,	1353.8,	0!	!END! N Cheyenne Res
320!	X =	-139.012,	151.2928,	1292.5,	0!	!END! N Cheyenne Res
321!	X =	-137.086,	151.2923,	1250.5,	0!	!END! N Cheyenne Res
322!	X =	-135.161,	151.2918,	1211.3,	0!	!END! N Cheyenne Res
323!	X =	-133.235,	151.2926,	1237.2,	0!	!END! N Cheyenne Res
324!	X =	-131.309,	151.2926,	1246.3,	0!	!END! N Cheyenne Res
325!	X =	-119.753,	151.2926,	1011.9,	0!	!END! N Cheyenne Res
326!	X =	-117.827,	151.2921,	1010.9,	0!	!END! N Cheyenne Res
327!	X =	-115.901,	151.2916,	1033.2,	0!	!END! N Cheyenne Res
328!	X =	-113.976,	151.2917,	975,	0!	!END! N Cheyenne Res
329!	X =	-112.05,	151.2917,	942,	0!	!END! N Cheyenne Res
330!	X =	-150.567,	153.2255,	1199.4,	0!	!END! N Cheyenne Res
331!	X =	-148.641,	153.2248,	1263.9,	0!	!END! N Cheyenne Res
332!	X =	-146.715,	153.2253,	1255.5,	0!	!END! N Cheyenne Res
333!	X =	-144.789,	153.2244,	1219,	0!	!END! N Cheyenne Res
334!	X =	-142.864,	153.2248,	1340.2,	0!	!END! N Cheyenne Res
335!	X =	-140.937,	153.2244,	1408,	0!	!END! N Cheyenne Res
336!	X =	-139.012,	153.2247,	1360,	0!	!END! N Cheyenne Res
337!	X =	-137.086,	153.2242,	1311,	0!	!END! N Cheyenne Res
338!	X =	-135.16,	153.2243,	1331.3,	0!	!END! N Cheyenne Res
339!	X =	-133.235,	153.2244,	1251,	0!	!END! N Cheyenne Res
340!	X =	-131.308,	153.2244,	1219,	0!	!END! N Cheyenne Res
341!	X =	-129.383,	153.2243,	1238.4,	0!	!END! N Cheyenne Res
342!	X =	-127.457,	153.2242,	1179,	0!	!END! N Cheyenne Res
343!	X =	-125.531,	153.224,	1119.1,	0!	!END! N Cheyenne Res
344!	X =	-123.605,	153.2244,	1128,	0!	!END! N Cheyenne Res
345!	X =	-121.679,	153.2247,	1201,	0!	!END! N Cheyenne Res
346!	X =	-119.753,	153.2243,	1054.2,	0!	!END! N Cheyenne Res

347!	X =	-117.827,	153.2245,	1073,	0!	!END!	N Cheyenne Res
348!	X =	-115.901,	153.224,	1100.4,	0!	!END!	N Cheyenne Res
349!	X =	-113.975,	153.2241,	1006,	0!	!END!	N Cheyenne Res
350!	X =	-112.049,	153.2234,	947.8,	0!	!END!	N Cheyenne Res
351!	X =	-110.124,	153.224,	933.3,	0!	!END!	N Cheyenne Res
352!	X =	-150.566,	155.1575,	1215.3,	0!	!END!	N Cheyenne Res
353!	X =	-148.64,	155.1574,	1239.7,	0!	!END!	N Cheyenne Res
354!	X =	-146.715,	155.1572,	1301.1,	0!	!END!	N Cheyenne Res
355!	X =	-144.789,	155.157,	1340.7,	0!	!END!	N Cheyenne Res
356!	X =	-142.863,	155.1574,	1373.5,	0!	!END!	N Cheyenne Res
357!	X =	-140.937,	155.157,	1391.1,	0!	!END!	N Cheyenne Res
358!	X =	-139.012,	155.1572,	1343.5,	0!	!END!	N Cheyenne Res
359!	X =	-137.085,	155.1567,	1388,	0!	!END!	N Cheyenne Res
360!	X =	-135.16,	155.1569,	1382.4,	0!	!END!	N Cheyenne Res
361!	X =	-133.234,	155.1569,	1340.7,	0!	!END!	N Cheyenne Res
362!	X =	-131.308,	155.1569,	1346.7,	0!	!END!	N Cheyenne Res
363!	X =	-129.382,	155.1568,	1219,	0!	!END!	N Cheyenne Res
364!	X =	-127.456,	155.1567,	1246.7,	0!	!END!	N Cheyenne Res
365!	X =	-125.531,	155.1564,	1229,	0!	!END!	N Cheyenne Res
366!	X =	-123.605,	155.1568,	1217.3,	0!	!END!	N Cheyenne Res
367!	X =	-121.679,	155.1572,	1162,	0!	!END!	N Cheyenne Res
368!	X =	-119.753,	155.1568,	1214.4,	0!	!END!	N Cheyenne Res
369!	X =	-117.827,	155.157,	1248.2,	0!	!END!	N Cheyenne Res
370!	X =	-115.901,	155.1571,	1139.7,	0!	!END!	N Cheyenne Res
371!	X =	-113.975,	155.1565,	1012.1,	0!	!END!	N Cheyenne Res
372!	X =	-112.049,	155.1565,	983.7,	0!	!END!	N Cheyenne Res
373!	X =	-110.123,	155.1564,	973.7,	0!	!END!	N Cheyenne Res
374!	X =	-108.197,	155.1563,	922.7,	0!	!END!	N Cheyenne Res
375!	X =	-150.566,	157.0894,	1149.1,	0!	!END!	N Cheyenne Res
376!	X =	-148.64,	157.0893,	1232.6,	0!	!END!	N Cheyenne Res
377!	X =	-146.714,	157.0891,	1306.1,	0!	!END!	N Cheyenne Res
378!	X =	-144.789,	157.0896,	1312.3,	0!	!END!	N Cheyenne Res
379!	X =	-142.863,	157.0893,	1365.6,	0!	!END!	N Cheyenne Res
380!	X =	-140.937,	157.0889,	1380.2,	0!	!END!	N Cheyenne Res
381!	X =	-139.011,	157.0891,	1311,	0!	!END!	N Cheyenne Res
382!	X =	-137.085,	157.0893,	1316.5,	0!	!END!	N Cheyenne Res
383!	X =	-135.16,	157.0894,	1340.7,	0!	!END!	N Cheyenne Res
384!	X =	-133.234,	157.0894,	1310.5,	0!	!END!	N Cheyenne Res
385!	X =	-131.308,	157.0894,	1310.5,	0!	!END!	N Cheyenne Res
386!	X =	-129.382,	157.0886,	1341,	0!	!END!	N Cheyenne Res
387!	X =	-127.456,	157.0891,	1250.3,	0!	!END!	N Cheyenne Res
388!	X =	-125.53,	157.0889,	1250.3,	0!	!END!	N Cheyenne Res
389!	X =	-123.604,	157.0886,	1228,	0!	!END!	N Cheyenne Res
390!	X =	-121.679,	157.0889,	1249,	0!	!END!	N Cheyenne Res
391!	X =	-119.753,	157.0892,	1252,	0!	!END!	N Cheyenne Res
392!	X =	-117.827,	157.0887,	1227,	0!	!END!	N Cheyenne Res
393!	X =	-115.901,	157.0888,	1152.6,	0!	!END!	N Cheyenne Res
394!	X =	-113.975,	157.0889,	1018.8,	0!	!END!	N Cheyenne Res
395!	X =	-112.049,	157.0888,	999.5,	0!	!END!	N Cheyenne Res
396!	X =	-110.123,	157.0888,	975.5,	0!	!END!	N Cheyenne Res
397!	X =	-108.197,	157.0886,	945,	0!	!END!	N Cheyenne Res
398!	X =	-106.271,	157.0891,	913.7,	0!	!END!	N Cheyenne Res
399!	X =	-150.565,	159.0214,	1126,	0!	!END!	N Cheyenne Res
400!	X =	-148.639,	159.022,	1236.7,	0!	!END!	N Cheyenne Res
401!	X =	-146.714,	159.0218,	1317.1,	0!	!END!	N Cheyenne Res
402!	X =	-144.788,	159.0215,	1291.6,	0!	!END!	N Cheyenne Res
403!	X =	-142.863,	159.0219,	1341,	0!	!END!	N Cheyenne Res
404!	X =	-140.937,	159.0215,	1390.6,	0!	!END!	N Cheyenne Res
405!	X =	-139.011,	159.0217,	1341,	0!	!END!	N Cheyenne Res
406!	X =	-137.085,	159.0218,	1340.2,	0!	!END!	N Cheyenne Res
407!	X =	-135.16,	159.0212,	1287.1,	0!	!END!	N Cheyenne Res
~~408!~~	~~X =~~	~~-133.233,~~	~~159.0219,~~	~~1323.4,~~	~~0!~~	~~!END!~~	~~N Cheyenne Res~~
409!	X =	-131.308,	159.0212,	1218.5,	0!	!END!	N Cheyenne Res

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410!   X =   -129.382,   159.0218,   1276.3,   0!   !END! N Cheyenne Res
411!   X =   -127.456,   159.0216,   1250.3,   0!   !END! N Cheyenne Res
412!   X =    -125.53,    159.022,   1283.3,   0!   !END! N Cheyenne Res
413!   X =   -123.604,   159.0217,   1283.3,   0!   !END! N Cheyenne Res
414!   X =   -121.678,   159.0214,   1236.2,   0!   !END! N Cheyenne Res
415!   X =   -119.752,   159.0216,   1200.2,   0!   !END! N Cheyenne Res
416!   X =   -117.826,   159.0211,   1110.1,   0!   !END! N Cheyenne Res
417!   X =   -115.901,   159.0212,   1058.8,   0!   !END! N Cheyenne Res
418!   X =   -113.974,   159.0212,   1064.6,   0!   !END! N Cheyenne Res
419!   X =   -112.049,   159.0212,   1179.6,   0!   !END! N Cheyenne Res
420!   X =   -110.123,   159.0211,   1047.4,   0!   !END! N Cheyenne Res
421!   X =   -108.197,   159.0217,    977.2,   0!   !END! N Cheyenne Res
422!   X =    -106.27,   159.0214,      931,   0!   !END! N Cheyenne Res
423!   X =   -104.345,   159.0218,    911.5,   0!   !END! N Cheyenne Res
424!   X =   -150.565,   160.9534,     1097,   0!   !END! N Cheyenne Res
425!   X =   -148.639,   160.9539,   1201.4,   0!   !END! N Cheyenne Res
426!   X =   -146.714,   160.9537,   1216.7,   0!   !END! N Cheyenne Res
427!   X =   -144.788,   160.9541,   1243.4,   0!   !END! N Cheyenne Res
428!   X =   -142.862,   160.9538,   1363.9,   0!   !END! N Cheyenne Res
429!   X =   -140.936,    160.954,     1342,   0!   !END! N Cheyenne Res
430!   X =   -139.011,   160.9536,   1290.7,   0!   !END! N Cheyenne Res
431!   X =   -137.085,   160.9537,   1235.8,   0!   !END! N Cheyenne Res
432!   X =   -135.159,   160.9538,   1344.8,   0!   !END! N Cheyenne Res
433!   X =   -133.233,   160.9538,   1265.8,   0!   !END! N Cheyenne Res
434!   X =   -131.307,   160.9537,     1206,   0!   !END! N Cheyenne Res
435!   X =   -129.381,   160.9536,     1219,   0!   !END! N Cheyenne Res
436!   X =   -127.456,   160.9534,   1253.3,   0!   !END! N Cheyenne Res
437!   X =    -125.53,   160.9532,   1295.3,   0!   !END! N Cheyenne Res
438!   X =   -123.604,   160.9535,   1256.3,   0!   !END! N Cheyenne Res
439!   X =   -121.678,   160.9538,     1250,   0!   !END! N Cheyenne Res
440!   X =   -119.752,    160.954,   1207.5,   0!   !END! N Cheyenne Res
441!   X =   -117.826,   160.9535,   1128.5,   0!   !END! N Cheyenne Res
442!   X =     -115.9,   160.9536,   1239.1,   0!   !END! N Cheyenne Res
443!   X =   -113.975,   160.9536,   1123.1,   0!   !END! N Cheyenne Res
444!   X =   -112.048,   160.9536,   1157.3,   0!   !END! N Cheyenne Res
445!   X =   -110.123,   160.9535,   1091.4,   0!   !END! N Cheyenne Res
446!   X =   -108.196,    160.954,   1017.8,   0!   !END! N Cheyenne Res
447!   X =    -106.27,   160.9538,    951.3,   0!   !END! N Cheyenne Res
448!   X =   -104.345,   160.9535,      945,   0!   !END! N Cheyenne Res
449!   X =   -102.419,   160.9538,    909.7,   0!   !END! N Cheyenne Res
450!   X =   -150.564,    162.886,   1086.7,   0!   !END! N Cheyenne Res
451!   X =   -148.639,   162.8858,   1121.7,   0!   !END! N Cheyenne Res
452!   X =   -146.713,   162.8856,   1141.6,   0!   !END! N Cheyenne Res
453!   X =   -144.788,    162.886,   1154.5,   0!   !END! N Cheyenne Res
454!   X =   -142.862,   162.8863,   1318.3,   0!   !END! N Cheyenne Res
455!   X =   -140.936,   162.8859,   1259.6,   0!   !END! N Cheyenne Res
456!   X =    -139.01,   162.8861,   1180.1,   0!   !END! N Cheyenne Res
457!   X =   -137.084,   162.8862,   1281.7,   0!   !END! N Cheyenne Res
458!   X =   -135.159,   162.8863,   1239.6,   0!   !END! N Cheyenne Res
459!   X =   -133.233,   162.8863,   1248.7,   0!   !END! N Cheyenne Res
460!   X =   -131.307,   162.8862,     1231,   0!   !END! N Cheyenne Res
461!   X =   -129.381,   162.8861,   1184.6,   0!   !END! N Cheyenne Res
462!   X =   -127.455,   162.8859,   1229.9,   0!   !END! N Cheyenne Res
463!   X =    -125.53,   162.8863,   1276.8,   0!   !END! N Cheyenne Res
464!   X =   -123.604,    162.886,   1268.5,   0!   !END! N Cheyenne Res
465!   X =   -121.678,   162.8862,   1270.8,   0!   !END! N Cheyenne Res
466!   X =   -119.752,   162.8865,   1276.8,   0!   !END! N Cheyenne Res
467!   X =   -117.826,   162.8859,   1249.3,   0!   !END! N Cheyenne Res
468!   X =     -115.9,    162.886,     1249,   0!   !END! N Cheyenne Res
469!   X =   -113.974,    162.886,   1215.4,   0!   !END! N Cheyenne Res
470!   X =   -112.048,    162.886,   1158.3,   0!   !END! N Cheyenne Res
471!   X =   -110.122,   162.8859,   1152.8,   0!   !END! N Cheyenne Res
472!   X =   -108.196,   162.8864,   1032.6,   0!   !END! N Cheyenne Res
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473!	X =	-106.27,	162.8861,	992.8,	0!	!END! N Cheyenne Res
474!	X =	-104.345,	162.8858,	975,	0!	!END! N Cheyenne Res
475!	X =	-102.418,	162.8861,	921.3,	0!	!END! N Cheyenne Res
476!	X =	-100.492,	162.8864,	941.2,	0!	!END! N Cheyenne Res
477!	X =	-150.564,	164.818,	1055.5,	0!	!END! N Cheyenne Res
478!	X =	-148.639,	164.8178,	1082,	0!	!END! N Cheyenne Res
479!	X =	-146.713,	164.8176,	1097,	0!	!END! N Cheyenne Res
480!	X =	-144.787,	164.8179,	1132.9,	0!	!END! N Cheyenne Res
481!	X =	-142.861,	164.8182,	1192,	0!	!END! N Cheyenne Res
482!	X =	-140.936,	164.8178,	1250.3,	0!	!END! N Cheyenne Res
483!	X =	-139.01,	164.818,	1163.3,	0!	!END! N Cheyenne Res
484!	X =	-137.084,	164.8188,	1192,	0!	!END! N Cheyenne Res
485!	X =	-135.159,	164.8181,	1158.5,	0!	!END! N Cheyenne Res
486!	X =	-133.233,	164.8181,	1141.2,	0!	!END! N Cheyenne Res
487!	X =	-131.307,	164.8181,	1112.5,	0!	!END! N Cheyenne Res
488!	X =	-129.381,	164.8186,	1173.1,	0!	!END! N Cheyenne Res
489!	X =	-127.455,	164.8184,	1265.1,	0!	!END! N Cheyenne Res
490!	X =	-125.529,	164.8188,	1277.6,	0!	!END! N Cheyenne Res
491!	X =	-123.603,	164.8184,	1249,	0!	!END! N Cheyenne Res
492!	X =	-121.678,	164.818,	1249.5,	0!	!END! N Cheyenne Res
493!	X =	-119.752,	164.8182,	1280,	0!	!END! N Cheyenne Res
494!	X =	-117.826,	164.8183,	1251.5,	0!	!END! N Cheyenne Res
495!	X =	-115.9,	164.8184,	1280,	0!	!END! N Cheyenne Res
496!	X =	-113.974,	164.8184,	1277.8,	0!	!END! N Cheyenne Res
497!	X =	-112.048,	164.8184,	1158.5,	0!	!END! N Cheyenne Res
498!	X =	-110.122,	164.8189,	1193.9,	0!	!END! N Cheyenne Res
499!	X =	-108.196,	164.8187,	1078.7,	0!	!END! N Cheyenne Res
500!	X =	-106.27,	164.8192,	1042.9,	0!	!END! N Cheyenne Res
501!	X =	-104.344,	164.8188,	977.2,	0!	!END! N Cheyenne Res
502!	X =	-102.418,	164.8185,	945.8,	0!	!END! N Cheyenne Res
503!	X =	-100.492,	164.8187,	903,	0!	!END! N Cheyenne Res
504!	X =	-150.564,	166.75,	1050.5,	0!	!END! N Cheyenne Res
505!	X =	-148.638,	166.7504,	1049,	0!	!END! N Cheyenne Res
506!	X =	-146.713,	166.7502,	1066.7,	0!	!END! N Cheyenne Res
507!	X =	-144.787,	166.7499,	1067,	0!	!END! N Cheyenne Res
508!	X =	-142.861,	166.7502,	1158,	0!	!END! N Cheyenne Res
509!	X =	-140.935,	166.7504,	1194.1,	0!	!END! N Cheyenne Res
510!	X =	-139.01,	166.7499,	1202.2,	0!	!END! N Cheyenne Res
511!	X =	-137.084,	166.75,	1218.3,	0!	!END! N Cheyenne Res
512!	X =	-135.158,	166.75,	1183,	0!	!END! N Cheyenne Res
513!	X =	-133.233,	166.75,	1100.4,	0!	!END! N Cheyenne Res
514!	X =	-131.307,	166.7505,	1132,	0!	!END! N Cheyenne Res
515!	X =	-129.381,	166.7504,	1263.1,	0!	!END! N Cheyenne Res
516!	X =	-127.455,	166.7502,	1248.2,	0!	!END! N Cheyenne Res
517!	X =	-125.529,	166.7505,	1235.9,	0!	!END! N Cheyenne Res
518!	X =	-123.603,	166.7509,	1145.1,	0!	!END! N Cheyenne Res
519!	X =	-121.678,	166.7504,	1306.5,	0!	!END! N Cheyenne Res
520!	X =	-119.751,	166.7513,	1246.4,	0!	!END! N Cheyenne Res
521!	X =	-117.826,	166.7501,	1245.7,	0!	!END! N Cheyenne Res
522!	X =	-115.9,	166.7508,	1267.9,	0!	!END! N Cheyenne Res
523!	X =	-113.974,	166.7508,	1250.8,	0!	!END! N Cheyenne Res
524!	X =	-112.048,	166.7507,	1268.1,	0!	!END! N Cheyenne Res
525!	X =	-110.122,	166.7506,	1280,	0!	!END! N Cheyenne Res
526!	X =	-108.196,	166.7511,	1279.7,	0!	!END! N Cheyenne Res
527!	X =	-106.27,	166.7508,	1118.4,	0!	!END! N Cheyenne Res
528!	X =	-104.344,	166.7505,	1006,	0!	!END! N Cheyenne Res
529!	X =	-102.418,	166.7508,	945,	0!	!END! N Cheyenne Res
530!	X =	-100.492,	166.751,	926.8,	0!	!END! N Cheyenne Res
531!	X =	-98.5661,	166.7505,	910,	0!	!END! N Cheyenne Res
532!	X =	-150.564,	168.6826,	1072.2,	0!	!END! N Cheyenne Res
533!	X =	-148.638,	168.6824,	1093,	0!	!END! N Cheyenne Res
~~534!~~	~~X =~~	~~-146.713,~~	~~168.6821,~~	~~1031.3,~~	~~0!~~	~~!END! N Cheyenne Res~~
535!	X =	-144.787,	168.6825,	1059.5,	0!	!END! N Cheyenne Res

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536!     X =     -142.861,    168.6827,       1070,        0!     !END!  N Cheyenne Res
537!     X =     -140.935,     168.683,     1121.8,        0!     !END!  N Cheyenne Res
538!     X =      -139.01,    168.6824,     1103.6,        0!     !END!  N Cheyenne Res
539!     X =     -137.084,    168.6825,       1200,        0!     !END!  N Cheyenne Res
540!     X =     -135.158,    168.6825,       1102,        0!     !END!  N Cheyenne Res
541!     X =     -133.232,    168.6832,       1063,        0!     !END!  N Cheyenne Res
542!     X =     -131.306,    168.6824,     1176.9,        0!     !END!  N Cheyenne Res
543!     X =     -129.381,    168.6829,     1123.5,        0!     !END!  N Cheyenne Res
544!     X =     -127.454,    168.6833,     1241.5,        0!     !END!  N Cheyenne Res
545!     X =     -125.529,     168.683,     1174.9,        0!     !END!  N Cheyenne Res
546!     X =     -123.603,    168.6826,     1166.1,        0!     !END!  N Cheyenne Res
547!     X =     -121.677,    168.6836,     1241.5,        0!     !END!  N Cheyenne Res
548!     X =     -119.751,    168.6831,     1165.4,        0!     !END!  N Cheyenne Res
549!     X =     -117.825,    168.6832,       1237,        0!     !END!  N Cheyenne Res
550!     X =       -115.9,    168.6832,       1280,        0!     !END!  N Cheyenne Res
551!     X =     -113.973,    168.6839,     1251.7,        0!     !END!  N Cheyenne Res
552!     X =     -112.047,    168.6831,       1250,        0!     !END!  N Cheyenne Res
553!     X =     -110.121,    168.6837,     1230.3,        0!     !END!  N Cheyenne Res
554!     X =     -108.196,    168.6835,       1097,        0!     !END!  N Cheyenne Res
555!     X =      -106.27,    168.6832,     1030.4,        0!     !END!  N Cheyenne Res
556!     X =     -104.344,    168.6835,      984.3,        0!     !END!  N Cheyenne Res
557!     X =     -102.418,    168.6838,        975,        0!     !END!  N Cheyenne Res
558!     X =     -100.492,     168.684,      971.4,        0!     !END!  N Cheyenne Res
559!     X =     -98.5654,    168.6835,      903.5,        0!     !END!  N Cheyenne Res
560!     X =     -96.6395,    168.6835,        945,        0!     !END!  N Cheyenne Res
561!     X =     -150.563,    170.6146,       1072,        0!     !END!  N Cheyenne Res
562!     X =     -148.638,    170.6143,       1067,        0!     !END!  N Cheyenne Res
563!     X =     -146.712,    170.6147,       1060,        0!     !END!  N Cheyenne Res
564!     X =     -144.787,    170.6144,     1024.3,        0!     !END!  N Cheyenne Res
565!     X =     -142.861,    170.6147,     1033.2,        0!     !END!  N Cheyenne Res
566!     X =     -140.935,    170.6149,       1036,        0!     !END!  N Cheyenne Res
567!     X =     -139.009,     170.615,     1088.9,        0!     !END!  N Cheyenne Res
568!     X =     -137.083,    170.6151,       1158,        0!     !END!  N Cheyenne Res
569!     X =     -135.158,    170.6151,     1125.1,        0!     !END!  N Cheyenne Res
570!     X =     -133.232,     170.615,     1097.8,        0!     !END!  N Cheyenne Res
571!     X =     -131.306,    170.6149,     1106.5,        0!     !END!  N Cheyenne Res
572!     X =      -129.38,    170.6154,     1187.4,        0!     !END!  N Cheyenne Res
573!     X =     -127.454,    170.6151,       1127,        0!     !END!  N Cheyenne Res
574!     X =     -125.529,    170.6155,     1124.2,        0!     !END!  N Cheyenne Res
575!     X =     -123.603,    170.6151,     1080.2,        0!     !END!  N Cheyenne Res
576!     X =     -121.677,    170.6153,     1142.6,        0!     !END!  N Cheyenne Res
577!     X =     -119.751,    170.6155,     1256.5,        0!     !END!  N Cheyenne Res
578!     X =     -117.825,    170.6149,     1254.3,        0!     !END!  N Cheyenne Res
579!     X =     -115.899,    170.6156,     1244.7,        0!     !END!  N Cheyenne Res
580!     X =     -113.973,    170.6156,     1193.8,        0!     !END!  N Cheyenne Res
581!     X =     -112.048,    170.6155,     1119.1,        0!     !END!  N Cheyenne Res
582!     X =     -110.122,    170.6153,     1085.8,        0!     !END!  N Cheyenne Res
583!     X =     -108.196,    170.6158,       1038,        0!     !END!  N Cheyenne Res
584!     X =      -106.27,    170.6162,       1006,        0!     !END!  N Cheyenne Res
585!     X =     -104.344,    170.6158,       1007,        0!     !END!  N Cheyenne Res
586!     X =     -102.418,    170.6154,      972.3,        0!     !END!  N Cheyenne Res
587!     X =     -100.492,    170.6163,        945,        0!     !END!  N Cheyenne Res
588!     X =     -98.5653,    170.6158,        906,        0!     !END!  N Cheyenne Res
589!     X =     -96.6395,    170.6158,        945,        0!     !END!  N Cheyenne Res
590!     X =     -150.563,    172.5465,       1128,        0!     !END!  N Cheyenne Res
591!     X =     -148.638,    172.5463,       1075,        0!     !END!  N Cheyenne Res
592!     X =     -146.712,    172.5467,       1067,        0!     !END!  N Cheyenne Res
593!     X =     -144.786,     172.547,     1037.5,        0!     !END!  N Cheyenne Res
594!     X =      -142.86,    172.5466,     1066.5,        0!     !END!  N Cheyenne Res
595!     X =     -140.935,    172.5468,     1017.8,        0!     !END!  N Cheyenne Res
596!     X =     -139.009,    172.5469,     1038.2,        0!     !END!  N Cheyenne Res
597!     X =     -137.083,    172.5469,     1090.9,        0!     !END!  N Cheyenne Res
598!     X =     -135.158,    172.5469,     1138.6,        0!     !END!  N Cheyenne Res
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599!	X =	-133.231,	172.5468,	1031.6,	0!	!END! N Cheyenne Res
600!	X =	-131.306,	172.5474,	1152,	0!	!END! N Cheyenne Res
601!	X =	-129.38,	172.5472,	1133.2,	0!	!END! N Cheyenne Res
602!	X =	-127.454,	172.5476,	1079.7,	0!	!END! N Cheyenne Res
603!	X =	-125.528,	172.5473,	1034.2,	0!	!END! N Cheyenne Res
604!	X =	-123.603,	172.5475,	1127.7,	0!	!END! N Cheyenne Res
605!	X =	-121.677,	172.5471,	1215,	0!	!END! N Cheyenne Res
606!	X =	-119.751,	172.5472,	1236.2,	0!	!END! N Cheyenne Res
607!	X =	-117.825,	172.548,	1280,	0!	!END! N Cheyenne Res
608!	X =	-115.899,	172.548,	1257,	0!	!END! N Cheyenne Res
609!	X =	-113.973,	172.548,	1175.1,	0!	!END! N Cheyenne Res
610!	X =	-112.047,	172.5479,	1123.1,	0!	!END! N Cheyenne Res
611!	X =	-110.121,	172.5484,	1127.3,	0!	!END! N Cheyenne Res
612!	X =	-108.195,	172.5475,	1132.3,	0!	!END! N Cheyenne Res
613!	X =	-106.269,	172.5479,	1108.4,	0!	!END! N Cheyenne Res
614!	X =	-104.343,	172.5482,	1006,	0!	!END! N Cheyenne Res
615!	X =	-102.417,	172.5484,	975,	0!	!END! N Cheyenne Res
616!	X =	-100.492,	172.548,	975,	0!	!END! N Cheyenne Res
617!	X =	-98.5652,	172.5481,	941.7,	0!	!END! N Cheyenne Res
618!	X =	-96.6394,	172.5481,	891.2,	0!	!END! N Cheyenne Res
619!	X =	-150.563,	174.4785,	1121.5,	0!	!END! N Cheyenne Res
620!	X =	-148.638,	174.4789,	1101,	0!	!END! N Cheyenne Res
621!	X =	-146.712,	174.4793,	1125.8,	0!	!END! N Cheyenne Res
622!	X =	-144.786,	174.4789,	1067,	0!	!END! N Cheyenne Res
623!	X =	-142.86,	174.4791,	1067,	0!	!END! N Cheyenne Res
624!	X =	-140.934,	174.4793,	1051.8,	0!	!END! N Cheyenne Res
625!	X =	-139.009,	174.4794,	1024.6,	0!	!END! N Cheyenne Res
626!	X =	-137.083,	174.4795,	1004.5,	0!	!END! N Cheyenne Res
627!	X =	-135.157,	174.4794,	1034.8,	0!	!END! N Cheyenne Res
628!	X =	-133.232,	174.4794,	1006.2,	0!	!END! N Cheyenne Res
629!	X =	-131.305,	174.4799,	1086,	0!	!END! N Cheyenne Res
630!	X =	-129.38,	174.4797,	1095.2,	0!	!END! N Cheyenne Res
631!	X =	-127.454,	174.4801,	1043.3,	0!	!END! N Cheyenne Res
632!	X =	-125.528,	174.4797,	1036.3,	0!	!END! N Cheyenne Res
633!	X =	-123.603,	174.48,	1088.7,	0!	!END! N Cheyenne Res
634!	X =	-121.677,	174.4802,	1221.2,	0!	!END! N Cheyenne Res
635!	X =	-119.751,	174.4797,	1245.6,	0!	!END! N Cheyenne Res
636!	X =	-117.825,	174.4804,	1246.2,	0!	!END! N Cheyenne Res
637!	X =	-115.899,	174.4804,	1259.5,	0!	!END! N Cheyenne Res
638!	X =	-113.973,	174.4804,	1250.6,	0!	!END! N Cheyenne Res
639!	X =	-112.047,	174.481,	1235.7,	0!	!END! N Cheyenne Res
640!	X =	-110.121,	174.4808,	1216.4,	0!	!END! N Cheyenne Res
641!	X =	-108.195,	174.4805,	1097.5,	0!	!END! N Cheyenne Res
642!	X =	-106.269,	174.4802,	1067,	0!	!END! N Cheyenne Res
643!	X =	-104.343,	174.4805,	1010.2,	0!	!END! N Cheyenne Res
644!	X =	-102.417,	174.4808,	1004.3,	0!	!END! N Cheyenne Res
645!	X =	-100.491,	174.4809,	975.5,	0!	!END! N Cheyenne Res
646!	X =	-98.565,	174.4811,	943.3,	0!	!END! N Cheyenne Res
647!	X =	-96.6392,	174.4811,	910.5,	0!	!END! N Cheyenne Res
648!	X =	-150.563,	176.4111,	1217.5,	0!	!END! N Cheyenne Res
649!	X =	-148.637,	176.4109,	1170.9,	0!	!END! N Cheyenne Res
650!	X =	-146.712,	176.4106,	1128,	0!	!END! N Cheyenne Res
651!	X =	-144.786,	176.4108,	1097,	0!	!END! N Cheyenne Res
652!	X =	-142.86,	176.4111,	1067.8,	0!	!END! N Cheyenne Res
653!	X =	-140.934,	176.4112,	1055.8,	0!	!END! N Cheyenne Res
654!	X =	-139.009,	176.4113,	1043.1,	0!	!END! N Cheyenne Res
655!	X =	-137.083,	176.4113,	1097.7,	0!	!END! N Cheyenne Res
656!	X =	-135.157,	176.4113,	1090.2,	0!	!END! N Cheyenne Res
657!	X =	-133.231,	176.4119,	990,	0!	!END! N Cheyenne Res
658!	X =	-131.306,	176.4117,	1006,	0!	!END! N Cheyenne Res
659!	X =	-129.38,	176.4115,	1043.5,	0!	!END! N Cheyenne Res
~~660!~~	~~X =~~	~~-127.454,~~	~~176.4119,~~	~~1032.5,~~	~~0!~~	~~!END! N Cheyenne Res~~
661!	X =	-125.528,	176.4122,	1068.9,	0!	!END! N Cheyenne Res

```
662!  X =  -123.602,  176.4125,   1067,    0!  !END!  N Cheyenne Res
663!  X =  -121.676,  176.412,    1097,    0!  !END!  N Cheyenne Res
664!  X =   -119.75,  176.4121,   1184.9,  0!  !END!  N Cheyenne Res
665!  X =  -117.824,  176.4122,   1274.8,  0!  !END!  N Cheyenne Res
666!  X =  -115.899,  176.4122,   1310,    0!  !END!  N Cheyenne Res
667!  X =  -113.973,  176.4121,   1310,    0!  !END!  N Cheyenne Res
668!  X =  -112.047,  176.4126,   1280,    0!  !END!  N Cheyenne Res
669!  X =  -110.121,  176.4125,   1256.2,  0!  !END!  N Cheyenne Res
670!  X =  -108.195,  176.4129,   1104.8,  0!  !END!  N Cheyenne Res
671!  X =  -106.269,  176.4133,   1037.5,  0!  !END!  N Cheyenne Res
672!  X =  -104.343,  176.4129,   996.8,   0!  !END!  N Cheyenne Res
673!  X =  -102.417,  176.4138,   975,     0!  !END!  N Cheyenne Res
674!  X =  -100.491,  176.4133,   945,     0!  !END!  N Cheyenne Res
675!  X =  -98.5648,  176.4134,   914,     0!  !END!  N Cheyenne Res
676!  X =  -96.6391,  176.4134,   914,     0!  !END!  N Cheyenne Res
677!  X =  -150.562,  178.3424,   1323.9,  0!  !END!  N Cheyenne Res
678!  X =  -148.637,  178.3428,   1158,    0!  !END!  N Cheyenne Res
679!  X =  -146.711,  178.3432,   1128,    0!  !END!  N Cheyenne Res
680!  X =  -144.786,  178.3428,   1097,    0!  !END!  N Cheyenne Res
681!  X =   -142.86,  178.343,    1067,    0!  !END!  N Cheyenne Res
682!  X =  -140.934,  178.3431,   1066.5,  0!  !END!  N Cheyenne Res
683!  X =  -139.009,  178.3432,   1085,    0!  !END!  N Cheyenne Res
684!  X =  -137.082,  178.3439,   1078.8,  0!  !END!  N Cheyenne Res
685!  X =  -135.157,  178.3432,   1068.2,  0!  !END!  N Cheyenne Res
686!  X =  -133.231,  178.3437,   1086.5,  0!  !END!  N Cheyenne Res
687!  X =  -131.305,  178.3435,   1017.2,  0!  !END!  N Cheyenne Res
688!  X =   -129.38,  178.344,    1002.2,  0!  !END!  N Cheyenne Res
689!  X =  -127.454,  178.3437,   1011.9,  0!  !END!  N Cheyenne Res
690!  X =  -125.528,  178.344,    1069,    0!  !END!  N Cheyenne Res
691!  X =  -123.602,  178.3442,   1224.5,  0!  !END!  N Cheyenne Res
692!  X =  -121.676,  178.3444,   1274.6,  0!  !END!  N Cheyenne Res
693!  X =   -119.75,  178.3445,   1227.4,  0!  !END!  N Cheyenne Res
694!  X =  -117.824,  178.3446,   1258.7,  0!  !END!  N Cheyenne Res
695!  X =  -115.898,  178.3446,   1335,    0!  !END!  N Cheyenne Res
696!  X =  -113.973,  178.3452,   1226.8,  0!  !END!  N Cheyenne Res
697!  X =  -112.047,  178.345,    1231.1,  0!  !END!  N Cheyenne Res
698!  X =  -110.121,  178.3448,   1204.4,  0!  !END!  N Cheyenne Res
699!  X =  -108.195,  178.3452,   1067,    0!  !END!  N Cheyenne Res
700!  X =  -106.269,  178.3449,   1011.5,  0!  !END!  N Cheyenne Res
701!  X =  -104.343,  178.3452,   996.2,   0!  !END!  N Cheyenne Res
702!  X =  -102.417,  178.3454,   1006,    0!  !END!  N Cheyenne Res
703!  X =  -100.491,  178.3456,   973.8,   0!  !END!  N Cheyenne Res
704!  X =  -98.5652,  178.3457,   894.1,   0!  !END!  N Cheyenne Res
705!  X =   -96.639,  178.3457,   963.8,   0!  !END!  N Cheyenne Res
706!  X =  -150.563,  180.2744,   1189,    0!  !END!  N Cheyenne Res
707!  X =  -148.637,  180.2748,   1138.6,  0!  !END!  N Cheyenne Res
708!  X =  -146.711,  180.2751,   1097.8,  0!  !END!  N Cheyenne Res
709!  X =  -144.786,  180.2747,   1097,    0!  !END!  N Cheyenne Res
710!  X =   -142.86,  180.2749,   1097,    0!  !END!  N Cheyenne Res
711!  X =  -140.934,  180.2757,   1100.9,  0!  !END!  N Cheyenne Res
712!  X =  -139.008,  180.2758,   1106.5,  0!  !END!  N Cheyenne Res
713!  X =  -137.083,  180.8272,   1068.8,  0!  !END!  N Cheyenne Res
714!  X =  -135.157,  180.2757,   1036,    0!  !END!  N Cheyenne Res
715!  X =  -133.231,  180.2756,   1029,    0!  !END!  N Cheyenne Res
716!  X =  -131.305,  180.276,    1042.1,  0!  !END!  N Cheyenne Res
717!  X =  -129.379,  180.2758,   969.5,   0!  !END!  N Cheyenne Res
718!  X =  -127.453,  180.2762,   1037.5,  0!  !END!  N Cheyenne Res
719!  X =  -125.528,  180.2765,   1078.5,  0!  !END!  N Cheyenne Res
720!  X =  -123.602,  180.2767,   1124.6,  0!  !END!  N Cheyenne Res
721!  X =  -121.676,  180.2769,   1097,    0!  !END!  N Cheyenne Res
722!  X =   -119.75,  180.2763,   1216.1,  0!  !END!  N Cheyenne Res
723!  X =  -117.824,  180.277,    1217.5,  0!  !END!  N Cheyenne Res
724!  X =  -115.898,  180.277,    1188.5,  0!  !END!  N Cheyenne Res
```

```
725!   X =   -113.973,   180.2769,   1251.5,   0!   !END! N Cheyenne Res
726!   X =   -112.047,   180.2774,   1155.9,   0!   !END! N Cheyenne Res
727!   X =    -110.12,   180.2772,   1165.9,   0!   !END! N Cheyenne Res
728!   X =   -108.195,   180.2776,     1067,   0!   !END! N Cheyenne Res
729!   X =   -106.269,   180.2773,   1009.3,   0!   !END! N Cheyenne Res
730!   X =   -104.343,   180.2775,      975,   0!   !END! N Cheyenne Res
731!   X =   -102.417,   180.2778,    969.8,   0!   !END! N Cheyenne Res
732!   X =   -100.491,   180.2779,    974.8,   0!   !END! N Cheyenne Res
733!   X =    -98.565,    180.278,    883.5,   0!   !END! N Cheyenne Res
734!   X =   -96.6388,    180.278,    924.7,   0!   !END! N Cheyenne Res
735!   X =   -150.562,   182.2064,   1273.1,   0!   !END! N Cheyenne Res
736!   X =   -148.637,   182.2074,     1169,   0!   !END! N Cheyenne Res
737!   X =   -146.711,   182.2071,     1148,   0!   !END! N Cheyenne Res
738!   X =   -144.785,   182.2073,     1161,   0!   !END! N Cheyenne Res
739!   X =    -142.86,   182.2975,   1183.5,   0!   !END! N Cheyenne Res
740!   X =   -140.934,   182.2076,   1114.8,   0!   !END! N Cheyenne Res
741!   X =   -139.008,   182.2083,     1067,   0!   !END! N Cheyenne Res
742!   X =    -119.75,   182.2094,   1113.8,   0!   !END! N Cheyenne Res
743!   X =   -117.824,   182.2094,   1171.1,   0!   !END! N Cheyenne Res
744!   X =   -115.898,   182.2094,   1119.5,   0!   !END! N Cheyenne Res
745!   X =   -113.973,     182.21,   1094.8,   0!   !END! N Cheyenne Res
746!   X =   -112.046,   182.2098,     1097,   0!   !END! N Cheyenne Res
747!   X =    -110.12,   182.2096,   1136.6,   0!   !END! N Cheyenne Res
748!   X =   -108.195,     182.21,   1127.1,   0!   !END! N Cheyenne Res
749!   X =   -106.268,   182.2103,   1008.7,   0!   !END! N Cheyenne Res
750!   X =   -104.343,   182.2106,      975,   0!   !END! N Cheyenne Res
751!   X =   -150.562,   184.1384,   1309.5,   0!   !END! N Cheyenne Res
```

----

a
Data for each receptor are treated as a separate input subgroup
and therefore must end with an input group terminator.

b
Receptor height above ground is optional. If no value is entered,
the receptor is placed on the ground.

APPENDIX D

Sample CALPOST Input File

```
Basin NE WYO: Badlands NP Vis

---------------- Run title (3 lines) ------------------------------------------

                     CALPOST MODEL CONTROL FILE
                     --------------------------

-------------------------------------------------------------------------------

INPUT GROUP: 0 -- Input and Output File Names
--------------

Input Files
-----------

File                      Default File Name
----                      -----------------
Conc/Dep Flux File        MODEL.DAT              ! MODDAT = NEWYO_VIS.CON!
Relative Humidity File    VISB.DAT               ! VISDAT = ..\NEWYO_U1_VIS.DAT!
Background Data File      BACK.DAT               *BACKDAT =    *
Transmissometer/          VSRN.DAT               *VSRDAT =    *
Nephelometer or
DATSAV Data File

Output Files
------------

File                      Default File Name
----                      -----------------
List File                 CALPOST.LST            ! PSTLST = U1_BL-V.LST!

Pathname for Timeseries Files   (blank)          * TSPATH =    *
(activate with exclamation points only if
providing NON-BLANK character string)

Pathname for Plot Files   (blank)                * PLPATH =    *
(activate with exclamation points only if
 providing NON-BLANK character string)

User Character String (U) to augment default filenames
(activate with exclamation points only if
 providing NON-BLANK character string)

Timeseries                TSttUUUU.DAT           * TSUNAM =    *

Top Nth Rank Plot         RttUUUUU.DAT
                       or RttiiUUU.GRD           * TUNAM =    *

Exceedance Plot           XttUUUUU.DAT
                       or XttUUUUU.GRD           * XUNAM =    *

Echo Plot                 jjjtthhU.DAT
(Specific Days)        or jjjtthhU.GRD           * EUNAM =    *

Visibility Plot           V24UUUUU.DAT           * VUNAM =VTEST    *
(Daily Peak Summary)

-------------------------------------------------------------------------------
All file names will be converted to lower case if LCFILES = T
Otherwise, if LCFILES = F, file names will be converted to UPPER CASE
         T = lower case      ! LCFILES = F !
         F = UPPER CASE
NOTE: (1) file/path names can be up to 70 characters in length
```

```
NOTE: (2) Filenames for ALL PLOT and TIMESERIES FILES are constructed
          using a template that includes a pathname, user-supplied
          character(s), and fixed strings (tt,ii,jjj, and hh), where
                tt = Averaging Period (e.g. 03)
                ii = Rank (e.g. 02)
                jjj= Julian Day
                hh = Hour(ending)
          are determined internally based on selections made below.
          If a path or user-supplied character(s) are supplied, each
          must contain at least 1 non-blank character.

!END!
-------------------------------------------------------------------------------

INPUT GROUP: 1 -- General run control parameters
--------------

    Option to run all periods found
    in the met. file(s)  (METRUN)        Default: 0    ! METRUN =   0  !

       METRUN = 0 - Run period explicitly defined below
       METRUN = 1 - Run all periods in CALPUFF data file(s)

    Starting date:    Year  (ISYR) --    No default    ! ISYR  =  2001!
    (used only if     Month (ISMO) --    No default    ! ISMO  =  1   !
     METRUN = 0)      Day   (ISDY) --    No default    ! ISDY  =  1   !
                      Hour  (ISHR) --    No default    ! ISHR  =  1   !

    Number of hours to process (NHRS) -- No default    ! NHRS  =  8760!

    Process every hour of data?(NREP) -- Default: 1    ! NREP  =  1  !
     (1 = every hour processed,
      2 = every 2nd hour processed,
      5 = every 5th hour processed, etc.)

Species & Concentration/Deposition Information
----------------------------------------------

     Species to process (ASPEC)       -- No default    ! ASPEC = VISIB  !
     (ASPEC = VISIB for visibility processing)

     Layer/deposition code (ILAYER)   -- Default: 1    ! ILAYER =  1  !
       '1'  for CALPUFF concentrations,
       '-1' for dry deposition fluxes,
       '-2' for wet deposition fluxes,
       '-3' for wet+dry deposition fluxes.

     Scaling factors of the form:     -- Defaults:     ! A =  0.0    !
          X(new) = X(old) * A + B         A = 0.0      ! B =  0.0    !
       (NOT applied if A = B = 0.0)       B = 0.0

     Add Hourly Background Concentrations/Fluxes?
                              (LBACK)  -- Default: F   ! LBACK =  F !

Receptor information
--------------------

  Gridded receptors processed?    (LG) -- Default: F   ! LG  = F  !
  Discrete receptors processed?   (LD) -- Default: F   ! LD  = T  !
  CTSG Complex terrain receptors processed?
                                 (LCT) -- Default: F   ! LCT = F  !

--Report results by DISCRETE receptor RING?
```

```
 (only used when LD = T)      (LDRING) -- Default: F    ! LDRING = F  !

--Select range of DISCRETE receptors (only used when LD = T):

  Select ALL DISCRETE receptors by setting NDRECP flag to -1;
                                    OR
  Select SPECIFIC DISCRETE receptors by entering a flag (0,1) for each
     0 = discrete receptor not processed
     1 = discrete receptor processed
  using repeated value notation to select blocks of receptors:
     23*1, 15*0, 12*1
  Flag for all receptors after the last one assigned is set to 0
  (NDRECP) -- Default: -1
                                                  ! NDRECP =  100*1!


--Select range of GRIDDED receptors (only used when LG = T):

       X index of LL corner (IBGRID) -- Default: -1     ! IBGRID = -1  !
           (-1 OR 1 <= IBGRID <= NX)

       Y index of LL corner (JBGRID) -- Default: -1     ! JBGRID = -1  !
           (-1 OR 1 <= JBGRID <= NY)

       X index of UR corner (IEGRID) -- Default: -1     ! IEGRID = -1  !
           (-1 OR 1 <= IEGRID <= NX)

       Y index of UR corner (JEGRID) -- Default: -1     ! JEGRID = -1  !
           (-1 OR 1 <= JEGRID <= NY)

  Note: Entire grid is processed if IBGRID=JBGRID=IEGRID=JEGRID=-1


--Specific gridded receptors can also be excluded from CALPOST
  processing by filling a processing grid array with 0s and 1s.  If the
  processing flag for receptor index (i,j) is 1 (ON), that receptor
  will be processed if it lies within the range delineated by IBGRID,
  JBGRID,IEGRID,JEGRID and if LG=T. If it is 0 (OFF), it will not be
  processed in the run.  By default, all array values are set to 1 (ON).

  Number of gridded receptor rows provided in Subgroup (1a) to
  identify specific gridded receptors to process
                                (NGONOFF) -- Default: 0     ! NGONOFF =  0  !

!END!


--------------
Subgroup (1a) -- Specific gridded receptors included/excluded
--------------

    Specific gridded receptors are excluded from CALPOST processing
    by filling a processing grid array with 0s and 1s.  A total of
    NGONOFF lines are read here.  Each line corresponds to one 'row'
    in the sampling grid, starting with the NORTHERNMOST row that
    contains receptors that you wish to exclude, and finishing with
    row 1 to the SOUTH (no intervening rows may be skipped).  Within
    a row, each receptor position is assigned either a 0 or 1,
    starting with the westernmost receptor.
       0 = gridded receptor not processed
       1 = gridded receptor processed

    Repeated value notation may be used to select blocks of receptors:
```

```
    23*1, 15*0, 12*1

  Because all values are initially set to 1, any receptors north of
  the first row entered, or east of the last value provided in a row,
  remain ON.

  (NGXRECP) -- Default: 1

-------------------------------------------------------------------------------

INPUT GROUP: 2 -- Visibility Parameters (ASPEC = VISIB)
--------------

  Maximum relative humidity (%) used in particle growth curve
                           (RHMAX) -- Default: 98    ! RHMAX   = 95.0 !

  Modeled species to be included in computing the light extinction
   Include SULFATE?          (LVSO4) -- Default: T    ! LVSO4   = T   !
   Include NITRATE?          (LVNO3) -- Default: T    ! LVNO3   = T   !
   Include ORGANIC CARBON?   (LVOC)  -- Default: T    ! LVOC    = T   !
   Include COARSE PARTICLES? (LVPMC) -- Default: T    ! LVPMC   = F   !
   Include FINE PARTICLES?   (LVPMF) -- Default: T    ! LVPMF   = T   !
   Include ELEMENTAL CARBON? (LVEC)  -- Default: T    ! LVEC    = T   !

  And, when ranking for TOP-N, TOP-50, and Exceedance tables,
   Include BACKGROUND?       (LVBK)  -- Default: T    ! LVBK    = F   !

  Species name used for particulates in MODEL.DAT file
               COARSE    (SPECPMC) -- Default: PMC ! SPECPMC = PMC  !
               FINE      (SPECPMF) -- Default: PMF ! SPECPMF = SOIL !

Extinction Efficiency (1/Mm per ug/m**3)
----------------------------------------
  MODELED particulate species:
              PM  COARSE     (EEPMC) -- Default: 0.6 ! EEPMC   = 0.6 !
              PM  FINE       (EEPMF) -- Default: 1.0 ! EEPMF   = 1.0 !
  BACKGROUND particulate species:
              PM  COARSE   (EEPMCBK) -- Default: 0.6 ! EEPMCBK = 0.6 !
  Other species:
             AMMONIUM SULFATE (EESO4) -- Default: 3.0 ! EESO4   = 3.0 !
             AMMONIUM NITRATE (EENO3) -- Default: 3.0 ! EENO3   = 3.0 !
             ORGANIC CARBON   (EEOC)  -- Default: 4.0 ! EEOC    = 4.0 !
             SOIL             (EESOIL)-- Default: 1.0 ! EESOIL  = 1.0 !
             ELEMENTAL CARBON (EEEC)  -- Default: 10. ! EEEC    = 10.0 !

Background Extinction Computation
---------------------------------

  Method used for background light extinction
                          (MVISBK) -- Default: 2    ! MVISBK =  2  !

       1 =  Supply single light extinction and hygroscopic fraction
            - IWAQM (1993) RH adjustment applied to hygroscopic background
              and modeled sulfate and nitrate
       2 =  Compute extinction from speciated PM measurements (A)
            - Hourly RH adjustment applied to observed and modeled sulfate
              and nitrate
            - RH factor is capped at RHMAX
       3 =  Compute extinction from speciated PM measurements (B)
            - Hourly RH adjustment applied to observed and modeled sulfate
              and nitrate
            - Receptor-hour excluded if RH>RHMAX
```

```
                - Receptor-day excluded if fewer than 6 valid receptor-hours
         4 =  Read hourly transmissometer background extinction measurements
                - Hourly RH adjustment applied to modeled sulfate and nitrate
                - Hour excluded if measurement invalid (missing, interference,
                  or large RH)
                - Receptor-hour excluded if RH>RHMAX
                - Receptor-day excluded if fewer than 6 valid receptor-hours
         5 =  Read hourly nephelometer background extinction measurements
                - Rayleigh extinction value (BEXTRAY) added to measurement
                - Hourly RH adjustment applied to modeled sulfate and nitrate
                - Hour excluded if measurement invalid (missing, interference,
                  or large RH)
                - Receptor-hour excluded if RH>RHMAX
                - Receptor-day excluded if fewer than 6 valid receptor-hours
         6 =  Compute extinction from speciated PM measurements
                - FLAG RH adjustment factor applied to observed and
                  modeled sulfate and nitrate
         7 =  Compute extinction from speciated PM measurements as in [2]
              for 'unobstructed' conditions;  replace with extinction from
              observed visual range for fog/precipitation conditions
                - Hourly RH adjustment applied to observed and modeled sulfate
                  and nitrate
                - RH factor is capped at RHMAX
                - When fog/precip is observed, replace computed Bext with:
                    Bext(1/Mm) = 3912/VR(km)

Additional inputs used for MVISBK = 1:
--------------------------------------
 Background light extinction (1/Mm)
                          (BEXTBK) -- No default    ! BEXTBK = 12.0 !
 Percentage of particles affected by relative humidity
                          (RHFRAC) -- No default    ! RHFRAC = 10.0 !

Additional inputs used for MVISBK = 6:
--------------------------------------
 Extinction coefficients for hygroscopic species (modeled and
 background) are computed using a monthly RH adjustment factor
 in place of an hourly RH factor (VISB.DAT file is NOT needed).
 Enter the 12 monthly factors here (RHFAC).  Month 1 is January.

 (RHFAC)  -- No default     ! RHFAC = 0.0, 0.0, 0.0, 0.0,
                                      0.0, 0.0, 0.0, 0.0,
                                      0.0, 0.0, 0.0, 0.0 !

Additional inputs used for MVISBK = 7:
--------------------------------------
 The weather data file (DATSAV abbreviated space-delimited) that
 is identified as VSRN.DAT may contain data for more than one
 station.  Identify the stations that are needed in the order in
 which they will be used to obtain valid weather and visual range.
 The first station that contains valid data for an hour will be
 used.  Enter up to MXWSTA (set in PARAMS file) integer station IDs
 of up to 6 digits each as variable IDWSTA, and enter the corresponding
 time zone for each, as variable TZONE.

 (IDWSTA)    -- No default    ! IDWSTA = 690230, 080020, 080140!
 (TZONE)     -- No default    ! TZONE =      5.,      5.,      5.!

 Identify the Base Time Zone for the CALPUFF simulation
 (BTZONE)    -- No default    ! BTZONE =     6.!

Additional inputs used for MVISBK = 2,3,6,7:
--------------------------------------------
```

```
Background extinction coefficients are computed from monthly
CONCENTRATIONS of ammonium sulfate (BKSO4), ammonium nitrate (BKNO3),
coarse particulates (BKPMC), organic carbon (BKOC), soil (BKSOIL), and
elemental carbon (BKEC).  Month 1 is January.
(ug/m**3)

(BKSO4)  -- No default     ! BKSO4 = 0.2, 0.2, 0.2, 0.2,
                                     0.2, 0.2, 0.2, 0.2,
                                     0.2, 0.2, 0.2, 0.2 !
(BKNO3)  -- No default     ! BKNO3 = 0.0, 0.0, 0.0, 0.0,
                                     0.0, 0.0, 0.0, 0.0,
                                     0.0, 0.0, 0.0, 0.0 !
(BKPMC)  -- No default     ! BKPMC = 0.0, 0.0, 0.0, 0.0,
                                     0.0, 0.0, 0.0, 0.0,
                                     0.0, 0.0, 0.0, 0.0 !
(BKOC)   -- No default     ! BKOC  = 0.0, 0.0, 0.0, 0.0,
                                     0.0, 0.0, 0.0, 0.0,
                                     0.0, 0.0, 0.0, 0.0 !
(BKSOIL) -- No default     ! BKSOIL= 4.5, 4.5, 4.5, 4.5,
                                     4.5, 4.5, 4.5, 4.5,
                                     4.5, 4.5, 4.5, 4.5 !
(BKEC)   -- No default     ! BKEC  = 0.0, 0.0, 0.0, 0.0,
                                     0.0, 0.0, 0.0, 0.0,
                                     0.0, 0.0, 0.0, 0.0 !

Additional inputs used for MVISBK = 2,3,5,6,7:
----------------------------------------------
 Extinction due to Rayleigh scattering is added (1/Mm)
                         (BEXTRAY) -- Default: 10.0 ! BEXTRAY = 10.0 !

!END!
-------------------------------------------------------------------------------

INPUT GROUP: 3 -- Output options
--------------

Output Units
------------
   Units for All Output       (IPRTU) -- Default: 1    ! IPRTU =  1  !
                   for             for
              Concentration     Deposition
     1 =         g/m**3          g/m**2/s
     2 =        mg/m**3         mg/m**2/s
     3 =        ug/m**3         ug/m**2/s
     4 =        ng/m**3         ng/m**2/s
     5 =       Odour Units

   Visibility: extinction expressed in 1/Mega-meters (IPRTU is ignored)


Averaging time(s) reported
--------------------------

   1-hr averages            (L1HR) -- Default: T   !   L1HR = F !

   3-hr averages            (L3HR) -- Default: T   !   L3HR = F  !

   24-hr averages          (L24HR) -- Default: T   !  L24HR = T  !

   Run-length averages     (LRUNL) -- Default: T   !  LRUNL = F  !

   User-specified averaging time in hours - results for
   an averaging time of NAVG hours are reported for
```

```
NAVG greater than 0:
                              (NAVG) -- Default: 0   !  NAVG =   0  !
```

Types of tabulations reported

```
   1) Visibility: daily visibility tabulations are always reported
                  for the selected receptors when ASPEC = VISIB.
                  In addition, any of the other tabulations listed
                  below may be chosen to characterize the light
                  extinction coefficients.
                  [List file or Plot/Analysis File]


   2) Top 50 table for each averaging time selected
      [List file only]
                              (LT50) -- Default: T   !  LT50 = T  !

   3) Top 'N' table for each averaging time selected
      [List file or Plot file]
                             (LTOPN) -- Default: F   ! LTOPN = F  !

        -- Number of 'Top-N' values at each receptor
           selected (NTOP must be <= 4)
                              (NTOP) -- Default: 4   ! NTOP =  1  !

        -- Specific ranks of 'Top-N' values reported
           (NTOP values must be entered)
                     (ITOP(4) array) -- Default:     ! ITOP =  1  !
                                        1,2,3,4


   4) Threshold exceedance counts for each receptor and each averaging
      time selected
      [List file or Plot file]
                             (LEXCD) -- Default: F   ! LEXCD = F  !

        -- Identify the threshold for each averaging time by assigning a
           non-negative value (output units).

                                    -- Default: -1.0
           Threshold for  1-hr averages   (THRESH1) !  THRESH1 = 1.0E01 !
           Threshold for  3-hr averages   (THRESH3) !  THRESH3 = -1.0   !
           Threshold for 24-hr averages  (THRESH24) ! THRESH24 = -1.0   !
           Threshold for NAVG-hr averages (THRESHN) !  THRESHN = -1.0   !


        -- Counts for the shortest averaging period selected can be
           tallied daily, and receptors that experience more than NCOUNT
           counts over any NDAY period will be reported.  This type of
           exceedance violation output is triggered only if NDAY > 0.

           Accumulation period(Days)
                              (NDAY) -- Default: 0   !   NDAY =   0  !
           Number of exceedances allowed
                            (NCOUNT) -- Default: 1   ! NCOUNT =   1  !

   5) Selected day table(s)

      Echo Option -- Many records are written each averaging period
      selected and output is grouped by day
```

```
     [List file or Plot file]
                             (LECHO) -- Default: F     !  LECHO = F   !

     Timeseries Option -- Averages at all selected receptors for
     each selected averaging period are written to timeseries files.
     Each file contains one averaging period, and all receptors are
     written to a single record each averaging time.
     [TSttUUUU.DAT files]
                             (LTIME) -- Default: F     !  LTIME = F   !

       -- Days selected for output
                        (IECHO(366)) -- Default: 366*0
          ! IECHO  = 366*0  !
          (366 values must be entered)

Plot output options
-------------------

     Plot files can be created for the Top-N, Exceedance, and Echo
     tables selected above.  Two formats for these files are available,
     DATA and GRID.  In the DATA format, results at all receptors are
     listed along with the receptor location [x,y,val1,val2,...].
     In the GRID format, results at only gridded receptors are written,
     using a compact representation.  The gridded values are written in
     rows (x varies), starting with the most southern row of the grid.
     The GRID format is given the .GRD extension, and includes headers
     compatible with the SURFER(R) plotting software.

     A plotting and analysis file can also be created for the daily
     peak visibility summary output, in DATA format only.

     Generate Plot file output in addition to writing tables
     to List file?
                                 (LPLT) -- Default: F    ! LPLT   = F !

     Use GRID format rather than DATA format,
     when available?
                                 (LGRD) -- Default: F    ! LGRD   = F !


Additional Output Options
-------------------------

   Output selected information to List file
    for debugging?
                               (LDEBUG) -- Default: F  ! LDEBUG  = F !

   Output hourly extinction information to REPORT.HRV?
    (Visibility Method 7)
                              (LVEXTHR) -- Default: F  ! LVEXTHR = F !

!END!
```

JD 307 (308,0): November 3

YEAR	DAY	TIME	REC#	TOT EXT	MODEL EXT	FLAG BGRND	% CHANGE	RH-FAC	Billings Weather	Billings VR	Sheridan Weather	Sheridan VR	Sheridan VR (km)	FLAG or Method7 BGRND*	% CHANGE (Method 7)
2003	307	100	312	18.155	1.879	16.276	11.54	2.959						16.276	
2003	307	200	312	20.479	3.363	17.116	19.65	4.359	light snow	9				17.116	
2003	307	300	312	20.748	3.632	17.116	21.22	4.359	light snow	10				17.116	
2003	307	400	312	27.765	7.397	20.368	36.32	9.779	light snow	9	mist	3	4.8	810	
2003	307	500	312	28.042	7.674	20.368	37.68	9.779	light snow	9	mist	1.7	2.7	1480	
2003	307	600	312	29.028	8.66	20.368	42.52	9.779	light snow	8.7	mist	2.5	4.0	972	
2003	307	700	312	22.854	4.789	18.065	26.51	5.941	light snow	9	mist	2.5	4.0	972	
2003	307	800	312	24.056	5.991	18.065	33.16	5.941			mist	2.5	4.0	972	
2003	307	900	312	25.99	7.925	18.065	43.87	5.941			mist	1.5	2.4	1621	
2003	307	1000	312	27.792	9.727	18.065	53.84	5.941			mist	2	3.2	1215	
2003	307	1100	312	29.71	11.645	18.065	64.46	5.941			mist	2.5	4.0	972	
2003	307	1200	312	40.495	20.127	20.368	98.82	9.779						20.368	
2003	307	1300	312	39.957	19.589	20.368	96.18	9.779			mist	2	3.2	1215	
2003	307	1400	312	40.156	19.788	20.368	97.15	9.779						20.368	
2003	307	1500	312	39.815	19.447	20.368	95.48	9.779						20.368	
2003	307	1600	312	38.867	18.499	20.368	90.82	9.779						20.368	
2003	307	1700	312	24.701	7.585	17.116	44.32	4.359						17.116	
2003	307	1800	312	21.876	5.358	16.518	32.44	3.364						16.518	
2003	307	1900	312	20.472	4.196	16.276	25.78	2.959						16.276	
2003	307	2000	312	32.355	11.987	20.368	58.85	9.779	light snow, mist	5				20.368	
2003	307	2100	312	32.377	12.009	20.368	58.96	9.779	light snow, mist	1				20.368	
2003	307	2200	312	30.761	10.393	20.368	51.03	9.779	light snow, mist	1				20.368	
2003	307	2300	312	29.35	8.982	20.368	44.10	9.779	light snow, mist	2.5	freezing rain, mist	5	8.0	486	
2003	308	0	312	22.21	4.145	18.065	22.94	5.941	light snow, mist	3	freezing rain	8	12.9	304	
				28.667	9.78	18.884	51.8	7.31						467.254	2.1

* When fog/precip, etc. is observed, BGRND (1/Mm) = 3912/VR(km). CALPOST Method 7.

YEAR	DAY	HR	RECEF	COORDIN. (km)		TYPE	BEXT(Mod	BEXT(BKG	BEXT(Total)	%CHANG	F(RH)	bxSO4	bxNO3	bxOC	bxEC	bxPMC	bxPMF
		Modeler	Extinctic by	Species													
2003	308	0	312	-131.309	149.36	D	9.78	18.884	28.667	51.8	7.31	5.5	4.251	0.015	0.001	0	0.016

DEQ/AQD 000415

JD 68 (69,0): March 9 [Wind Cave]

YEAR	DAY	TIME	REC#	TOT EXT	MODEL EXT	FLAG BGRND	% CHANGE	RH-FAC	BGRND (FLAG/BAD)**	%CHNG (FLAG/BAD)**	Rapid City Weather	Rapid City Visibility (miles)	Rapid City Visibility (km)	FLAG or Method7 BGRND**	% CHANGE (Method 7)
2003	68	100	101	19.488	2.717	16.771	16.20	3.785	*		light snow	9	14.5	270	
2003	68	200	101	19.479	2.708	16.771	16.15	3.785	*					16.771	
2003	68	300	101	19.184	2.413	16.771	14.39	3.785	*					16.771	
2003	68	400	101	18.72	1.949	16.771	11.62	3.785	*					16.771	
2003	68	500	101	18.25	1.479	16.771	8.82	3.785	*					16.771	
2003	68	600	101	16.715	0.654	16.061	4.07	2.601	*					16.061	
2003	68	700	101	16.642	0.581	16.061	3.62	2.601	*					16.061	
2003	68	800	101	22.749	2.381	20.368	11.69	9.779	*					20.368	
2003	68	900	101	17.918	1.147	16.771	6.84	3.785	*		mist	4	6.4	608	
2003	68	1000	101	17.951	1.18	16.771	7.04	3.785	*		light snow	7	11.3	347	
2003	68	1100	101	16.443	0.707	15.736	4.49	2.06	*		light snow	4	6.4	608	
2003	68	1200	101	16.557	0.821	15.736	5.22	2.06	*		light snow	9	14.5	270	
2003	68	1300	101	16.629	0.893	15.736	5.67	2.06	*					15.736	
2003	68	1400	101	16.697	0.961	15.736	6.11	2.06	*		haze	5	8.0	486	
2003	68	1500	101	16.369	0.821	15.548	5.28	1.747	*		haze	6	9.7	405	
2003	68	1600	101	17.348	1.208	16.14	7.48	2.733	*		light snow	3	4.8	810	
2003	68	1700	101	16.206	0.658	15.548	4.23	1.747	*					16.140	
2003	68	1800	101	16.666	0.752	15.914	4.73	2.356	*					15.548	
2003	68	1900	101	18.183	1.255	16.928	7.41	4.047	*		light snow, mist	6	9.7	405	
2003	68	2000	101	18.182	1.254	16.928	7.41	4.047	50					16.928	
2003	68	2100	101	18.165	1.237	16.928	7.31	4.047	51		light snow, mist	4	6.4	61	
2003	68	2200	101	18.13	1.202	16.928	7.10	4.047	16.928		light snow	8	12.9	304	
2003	68	2300	101	18.117	1.189	16.928	7.02	4.047	16.928					16.928	
2003	69	0	101	19.258	1.574	17.684	8.90	5.307	17.684					17.684	
				17.92	1.32	16.596	7.97	3.493						199.294	0.66

* transmissometer data missing
** when fog/precip, etc. is observed, BGRND (1/Mm) = 3912/VR(km). CALPOST Method 7 or
% change based on background from IMPROVE transmissometer at Badlands NP (if >50 1/Mm)

Modele Extincti by Species

YEAR	DAY	HR	RECEP	COORDIN	(km)	TYPE	BEXT(Mod	BEXT(BKG	BEXT(Total)	%CHANGE	F(RH)	bxSO4	bxNO3	bxOC	bxEC	bxPMC	bxPMF
2003	69	0	101	117.172	-50.371	D	1.32	16.596	17.92	7.97	3.493	0.688	0.629	0.004	0	0	0.002

DEQ/AQD 000416

DEQ/AQD 000417

JD 345 (346,0): Dec 11 [Wind Cave]

YEAR	DAY	TIME	REC#	TOT EXT	MODEL EXT	FLAG BGRND	% CHANGE	RH-FAC	(FLAG/BAD)	%CHNG (FLAG/BAD)*	Rapid City Weather	Rapid City Visibility (miles)
2003	345	100	267	18.177	0.112	18.065	0.62	5.941	942		light snow	3
2003	345	200	267	18.153	0.088	18.065	0.49	5.941	942		light snow, mist	2.5
2003	345	300	267	18.145	0.08	18.065	0.44	5.941	942			
2003	345	400	267	16.479	0.044	16.435	0.27	3.224	942			
2003	345	500	267	18.148	0.083	18.065	0.46	5.941	469			
2003	345	600	267	16.985	0.057	16.928	0.34	4.047	128			
2003	345	700	267	18.15	0.085	18.065	0.47	5.941	216		light snow	9
2003	345	800	267	18.151	0.086	18.065	0.48	5.941	178			
2003	345	900	267	18.156	0.091	18.065	0.50	5.941	229			
2003	345	1000	267	18.194	0.129	18.065	0.71	5.941	180		light snow, mist	4
2003	345	1100	267	18.287	0.222	18.065	1.23	5.941	469			
2003	345	1200	267	18.455	0.39	18.065	2.16	5.941	133			
2003	345	1300	267	16.767	0.332	16.435	2.02	3.224	117			
2003	345	1400	267	16.913	0.478	16.435	2.91	3.224	100			
2003	345	1500	267	16.397	0.483	15.914	3.04	2.356	90			
2003	345	1600	267	16.521	0.607	15.914	3.81	2.356	88			
2003	345	1700	267	17.524	1.089	16.435	6.63	3.224	98			
2003	345	1800	267	20.713	2.648	18.065	14.66	5.941	98			
2003	345	1900	267	19.178	2.25	16.928	13.29	4.047	93		mist	1.7
2003	345	2000	267	26.984	6.616	20.368	32.48	9.779	84		mist	1.2
2003	345	2100	267	20.137	3.209	16.928	18.96	4.047	82			
2003	345	2200	267	22.396	4.712	17.684	26.65	5.307	90		mist	1
2003	345	2300	267	22.6	4.916	17.684	27.80	5.307	77			
2003	346	0	267	22.196	4.512	17.684	25.51	5.307	75			
				18.91	1.388	17.52	7.92	5.033	285.92	0.49		

* % change based on background from IMPROVE transmissometer at Badlands NP (if >50 1/Mm)

YEAR	Modele DAY	Extincti HR	by RECEP	Species COORDIN (km)		TYPE	BEXT(Mod	BEXT(BKG	BEXT(Total)	%CHANGE	F(RH)	bxSO4	bxNO3	bxOC	bxEC	bxPMC	bxPMF
2003	346	0	267	116.954	-38.735	D	1.388	17.52	18.91	7.92	5.033	0.759	0.625	0.002	0	0	0.001

JD 309 (310,0): Nov 5th [Wind Cave]

YEAR	DAY	TIME	REC#	TOT EXT	MODEL EXT	FLAG BGRND	% CHANGE	RH-FAC	(FLAG/BAD)	%CHNG (FLAG/BAD)*	Rapid City Weather	Rapid City Visibility (miles)
2003	309	100	101	16.435	0.295	16.14	1.83	2.733	52			10
2003	309	200	101	16.461	0.321	16.14	1.99	2.733	52			10
2003	309	300	101	16.49	0.35	16.14	2.17	2.733	16.14			10
2003	309	400	101	16.53	0.39	16.14	2.42	2.733	52			10
2003	309	500	101	16.587	0.447	16.14	2.77	2.733	52			10
2003	309	600	101	16.661	0.521	16.14	3.23	2.733	55			9.9
2003	309	700	101	18.873	1.189	17.684	6.72	5.307	55			10
2003	309	800	101	17.259	0.908	16.351	5.55	3.085	57			10
2003	309	900	101	17.488	1.137	16.351	6.95	3.085	58			10
2003	309	1000	101	18.752	1.824	16.928	10.78	4.047	53			10
2003	309	1100	101	16.886	1.117	15.769	7.08	2.115	52			10
2003	309	1200	101	17.308	1.394	15.914	8.76	2.356	52			9.9
2003	309	1300	101	16.768	1.189	15.579	7.63	1.798	53			10
2003	309	1400	101	16.902	1.323	15.579	8.49	1.798	53			10
2003	309	1500	101	16.945	1.366	15.579	8.77	1.798	55			10
2003	309	1600	101	16.755	1.264	15.491	8.16	1.652	57			10
2003	309	1700	101	16.814	1.235	15.579	7.93	1.798	60			10
2003	309	1800	101	18.545	2.11	16.435	12.84	3.224	59			9.9
2003	309	1900	101	17.268	1.41	15.858	8.89	2.263	61			10
2003	309	2000	101	18.203	1.852	16.351	11.33	3.085	67			10
2003	309	2100	101	20.869	3.185	17.684	18.01	5.307	71			10
2003	309	2200	101	18.219	1.868	16.351	11.42	3.085	76			10
2003	309	2300	101	19.058	2.287	16.771	13.64	3.785	81			10
2003	310	0	101	17.185	1.327	15.858	8.37	2.263	75			9.9
				17.469	1.263	16.206	7.79	2.844	57.26	2.21		

* % change based on background from IMPROVE transmissometer at Badlands NP (if >50 1/Mm)

YEAR	DAY	HR	RECEP	COORDIN (km)		TYPE	BEXT(Mod	BEXT(BKG	BEXT(Total)	%CHANGE	F(RH)	bxSO4	bxNO3	bxOC	bxEC	bxPMC	bxPMF
							Modele Extincti by Species										
2003	310	0	101	117.172	-50.371	D	1.263	16.206	17.469	7.79	2.844	0.787	0.473	0.003	0	0	0.001

DEQ/AQD 000418

DEQ/AQD 000419

JD 346 (347.0): Dec 12 [Badlands]

YEAR	DAY	TIME	REC#	TOT EXT	MODEL EXT	FLAG BGRND	% CHANGE	RH-FAC	(FLAG/BAD)	%CHNG (FLAG/BAD)*	Rapid City Weather	Rapid City Visibility (miles)
2003	346	100	28	16.604	0.543	16.061	3.38	2.601	98			
2003	346	200	28	17.788	1.017	16.771	6.06	3.785	111		mist	2.5
2003	346	300	28	17.413	1.062	16.351	6.50	3.085	113			10
2003	346	400	28	18.44	1.669	16.771	9.95	3.785	140			10
2003	346	500	28	18.854	2.083	16.771	12.42	3.785	192			10
2003	346	600	28	18.33	1.979	16.351	12.10	3.085	751			9.9
2003	346	700	28	18.429	2.078	16.351	12.71	3.085	403			10
2003	346	800	28	19.153	2.382	16.771	14.20	3.785	180			10
2003	346	900	28	18.796	2.025	16.771	12.07	3.785	104			10
2003	346	1000	28	24.043	3.675	20.368	18.04	9.779	82			10
2003	346	1100	28	18.092	1.164	16.928	6.88	4.047	68			10
2003	346	1200	28	15.835	0.344	15.491	2.22	1.652	67			9.9
2003	346	1300	28	15.868	0.255	15.613	1.63	1.855	61			10
2003	346	1400	28	15.759	0.146	15.613	0.94	1.855	54			10
2003	346	1500	28	15.702	0.089	15.613	0.57	1.855	942			10
2003	346	1600	28	15.658	0.045	15.613	0.29	1.855	942			10
2003	346	1700	28	16.969	0.041	16.928	0.24	4.047	79			10
2003	346	1800	28	16.946	0.018	16.928	0.11	4.047	85			9.9
2003	346	1900	28	18.076	0.011	18.065	0.06	5.941	99			10
2003	346	2000	28	20.373	0.005	20.368	0.02	9.779	110			10
2003	346	2100	28	20.368	0	20.368	-	9.779	135			
2003	346	2200	28	20.368	0	20.368	-	9.779	417			8
2003	346	2300	28	17.684	0	17.684	-	5.307	333		mist	1.2
2003	347	0	28	16.928	0	16.928	-	4.047	141			9.9
				18.02	0.86	17.16	5.01	4.434	237.79	0.36		

* % change based on background from IMPROVE transmissometer at Badlands NP (if >50 1/Mm)

YEAR	Modele DAY	Extincti HR	by RECEP	Species COORDIN (km)		TYPE	BEXT(Mod	BEXT(BKG	BEXT(Total)	%CHANGE	F(RH)	bxSO4	bxNO3	bxOC	bxEC	bxPMC	bxPMF
2003	347	0	28	227.093	-18.671	D	0.86	17.16	18.02	5.01	4.434	0.467	0.39	0.002	0	0	0.001

North Cheyenne: 2002

JD 300 (301,0): Oct 27

YEAR	DAY	TIME	REC#	TOT EXT	MODEL EXT	FLAG BGRND	% CHANGE	RH-FAC	Billings Weather	Billings VR	Sheridan Weather	Sheridan VR	Sheridan (km)	FLAG or Method7 BGRND*	% CHANGE (Method 7)
2002	300	100	560	17,616	1,098	16,518	6,65	3,364		10+		10+		16,518	
2002	300	200	560	18,308	1,38	16,928	8.15	4,047		10+		10+		16.928	
2002	300	300	560	18,402	1,474	16,928	8.71	4.047		10+		10+		16.928	
2002	300	400	560	20,417	2,352	18,065	13.02	5,941		10+		10+		18,065	
2002	300	500	560	17,931	1.413	16.518	8,55	3.364		10+		10+		16.518	
2002	300	600	560	20.602	2,537	18.065	14,04	5.941		9.9		9.9		18.065	
2002	300	700	560	24,465	4,097	20,368	20,11	9,779		10+		10+		20,368	
2002	300	800	560	24,334	3.966	20,368	19,47	9,779		10+		10+		20,368	
2002	300	900	560	17,658	1,282	16.276	7.88	2,959		10+		10+		16,276	
2002	300	1000	560	16.404	0,757	15,647	4.84	1,911		10+		10+		15,647	
2002	300	1100	560	16,162	0.614	15,548	3,95	1,747		10+		10+		15,548	
2002	300	1200	560	15,652	0,371	15,281	2.43	1,302		9.9		9.9		15,281	
2002	300	1300	560	15,516	0,273	15,242	1.79	1,237		10+		10+		15,242	
2002	300	1400	560	15,436	0,219	15,217	1,44	1,196		10+		10+		15.217	
2002	300	1500	560	15,373	0,182	15,191	1.20	1.153		10+		10+		15.191	
2002	300	1600	560	15.274	0,138	15.136	0,91	1,06		10+		10+		15.136	
2002	300	1700	560	15,271	0.096	15.175	0,63	1,125		10+		10+		15,175	
2002	300	1800	560	15,422	0,067	15,355	0,44	1.424		9.9		9.9		15,355	
2002	300	1900	560	16,345	0,069	16.276	0,42	2,959		10+		10+		16.276	
2002	300	2000	560	15,811	0,009	15.802	0,06	2,17		10+		10+		15,802	
2002	300	2100	560	17,124	0,008	17,116	0,05	4,359		10+		10+		17,116	
2002	300	2200	560	16.281	0.005	16,276	0.03	2,959		10+		10+		16,276	
2002	300	2300	560	16,523	0.005	16,518	0,03	3,364		10+		10+		16,518	
2002	301	0	560	16,522	0.004	16,518	0.02	3.364		9.9		9.9		16,518	
				17.448	0,934	16,514	5,66	3,356						16.514	5.66

* When fog/precip, etc. is observed, BGRND (1/Mm) = 3912/VR(km). CALPOST Method 7.

Model Extinction by Species

YEAR	DAY	HR	RECE	COORDIN (km)		TYPE	BEXT(Mod	BEXT(BKG	BEXT(Total)	%CHANGE	F(RH)	bxSO4	bxNO3	bxOC	bxEC	bxPMC	bxPMF
2002	301	0	560	-96.64	168.684	D	0.934	16.514	17.448	5.66	3.356	0.511	0.42	0.002	0	0	0.001

DEQ/AQD 000420

11/08/2005

JD 82 (83,0): Mar 23

YEAR	DAY	TIME	REC#	TOT EXT	MODEL EXT	FLAG BGRND	% CHANGE	RH-FAC	Billings Weather	Billings VR	Sheridan Weather	Sheridan VR	Sheridan (km)	FLAG or Method7 BGRND*	% CHANGE (Method 7)
2002	82	100	526	21.42	3.355	18.065	18.57	5.941		10+		10+		18.065	
2002	82	200	526	20.467	3.351	17.116	19.58	4.359		10+		8		17.116	
2002	82	300	526	19.409	2.293	17.116	13.40	4.359		10+		8		17.116	
2002	82	400	526	18.858	1.742	17.116	10.18	4.359		10+		7		17.116	
2002	82	500	526	17.772	0.844	16.928	4.99	4.047		10+		9		16.928	
2002	82	600	526	16.829	0.768	16.061	4.78	2.601		9.9	mist	6	9.7	405	
2002	82	700	526	16.403	0.545	15.858	3.44	2.263		10+	mist	5	8.0	486	
2002	82	800	526	16.54	0.479	16.061	2.98	2.601		10+	mist	6	9.7	405	
2002	82	900	526	20.82	0.452	20.368	2.22	9.779		10+	mist	5	8.0	486	
2002	82	1000	526	20.779	0.411	20.368	2.02	9.779		10+		10+		20.368	
2002	82	1100	526	16.161	0.303	15.858	1.91	2.263		10+		7		15.858	
2002	82	1200	526	16.338	0.277	16.061	1.72	2.601		9.9		9.9		16.061	
2002	82	1300	526	16.303	0.242	16.061	1.51	2.601		10+		10+		16.061	
2002	82	1400	526	17.352	0.236	17.116	1.38	4.359		10+		10+		17.116	
2002	82	1500	526	16.276	0.215	16.061	1.34	2.601		10+		10+		16.061	
2002	82	1600	526	16.729	0.211	16.518	1.28	3.364		10+		9		16.518	
2002	82	1700	526	16.704	0.186	16.518	1.13	3.364		10+		10+		16.518	
2002	82	1800	526	15.957	0.155	15.802	0.98	2.17		9.9		9.9		15.802	
2002	82	1900	526	18.106	0.041	18.065	0.23	5.941		10+				18.065	
2002	82	2000	526	16.518	0	16.518	-	3.364	slight, continuous fall of snowflakes	6		10+		16.518	
2002	82	2100	526	16.518	0	16.518	-	3.364	slight, continuous fall of snowflakes, mist	5		7		16.518	
2002	82	2200	526	15.982	0	15.982	-	2.469	slight, continuous fall of snowflakes, mist	3	slight continuous fall of snowflakes, mist	3	4.8	810	
2002	82	2300	526	18.285	0.22	18.065	1.22	5.941	mist, slight, continuous fall of snowflakes	2	mist	5	8.0	486	
2002	83	0	526	23.336	5.271	18.065	29.18	5.941		9.9	slight continuous fall of snowflakes, mist	3	4.8	810	
				17.911	0.900	17.011	5.29	4.185					0.46	174.050	0.52

Model Extincti by Species

YEAR	DAY	HR	RECE	COORDIN (km)		TYPE	BEXT(Mod	BEXT(BKG	BEXT(Total)	%CHANGE	F(RH)	bxSO4	bxNO3	bxOC	bxEC	bxPMC	bxPMF
2002	83	0	526	-108.196	166.751	D	0.900	17.011	17.911	5.29	4.185	0.412	0.481	0.002	0	0	0.004

DEQ/AQD 000421

JD 299 (300,0): Oct 26 [Wind Cave]

YEAR	DAY	TIME	REC#	TOT EXT	MODEL EXT	FLAG BGRND	% CHANGE	RH-FAC	BGRND (FLAG/BAD)	%CHNG (FLAG/BAD)*	Rapid City Weather	Rapid City Visibility (miles)
2002	299	100	103	15.456	0.223	15.233	1.46	1.222	190		missing	missing
2002	299	200	103	22.414	2.046	20.368	10.05	9.779	228		missing	missing
2002	299	300	103	22.669	2.301	20.368	11.30	9.779	181		missing	missing
2002	299	400	103	22.838	2.47	20.368	12.13	9.779	189		missing	missing
2002	299	500	103	22.948	2.58	20.368	12.67	9.779	495		missing	missing
2002	299	600	103	23.006	2.638	20.368	12.95	9.779	498		missing	missing
2002	299	700	103	23.002	2.634	20.368	12.93	9.779	942		missing	missing
2002	299	800	103	23.264	2.896	20.368	14.22	9.779	495		missing	missing
2002	299	900	103	23.342	2.974	20.368	14.60	9.779	376		missing	missing
2002	299	1000	103	23.24	2.872	20.368	14.10	9.779	942		missing	missing
2002	299	1100	103	19.647	1.582	18.065	8.76	5.941	942		mist	4
2002	299	1200	103	23.326	2.958	20.368	14.52	9.779	428		mist	5
2002	299	1300	103	19.982	1.917	18.065	10.61	5.941	125			8
2002	299	1400	103	17.656	1.138	16.518	6.89	3.364	563			10
2002	299	1500	103	17.263	0.987	16.276	6.06	2.959	62			10
2002	299	1600	103	16.574	0.716	15.858	4.52	2.263	257			10
2002	299	1700	103	16.476	0.618	15.858	3.90	2.263	85			10
2002	299	1800	103	17.335	0.817	16.518	4.95	3.364	95			9.9
2002	299	1900	103	19.3	1.235	18.065	6.84	5.941	92			10
2002	299	2000	103	19.084	1.019	18.065	5.64	5.941	86			10
2002	299	2100	103	18.896	0.831	18.065	4.60	5.941	82			9
2002	299	2200	103	18.704	0.639	18.065	3.54	5.941	67			7
2002	299	2300	103	18.545	0.48	18.065	2.66	5.941	59			7
2002	300	0	103	18.435	0.37	18.065	2.05	5.941	52			6.8
				20.14	1.623	18.519	8.76	6.698	313.79	0.52		

* % change based on background from IMPROVE transmissometer at Badlands NP (if >50 1/Mm)

Modele Extinctio by Species

YEAR	DAY	HR	RECEI	COORDIN (km)		TYPE	BEXT(Mod	BEXT(BKG	BEXT(Total)	%CHANGE	F(RH)	bxSO4	bxNO3	bxOC	bxEC	bxPMC	bxPMF
2002	300	0	103	118.471	-50.346	D	1.623	18.519	20.14	8.76	6.698	0.932	0.688	0.002	0	0	0

DEQ/AQD 000422

JD 299 (300.0): Oct 26 [Badlands]

YEAR	DAY	TIME	REC#	TOT EXT	MODEL EXT	FLAG BGRND	% CHANGE	RH-FAC	BGRND (FLAG/BAD)	%CHNG (FLAG/BAD)*	Rapid City Weather	Rapid City Visibility (miles)
2002	299	100	1	15.327	0.094	15.233	0.62	1.222	190		missing	missing
2002	299	200	1	21.172	0.804	20.368	3.95	9.779	228		missing	missing
2002	299	300	1	21.248	0.88	20.368	4.32	9.779	181		missing	missing
2002	299	400	1	21.386	1.018	20.368	5.00	9.779	189		missing	missing
2002	299	500	1	21.578	1.21	20.368	5.94	9.779	495		missing	missing
2002	299	600	1	21.761	1.393	20.368	6.84	9.779	498		missing	missing
2002	299	700	1	21.937	1.569	20.368	7.70	9.779	942		missing	missing
2002	299	800	1	22.31	1.942	20.368	9.53	9.779	495		missing	missing
2002	299	900	1	22.546	2.178	20.368	10.69	9.779	376		missing	missing
2002	299	1000	1	22.791	2.423	20.368	11.90	9.779	942		missing	missing
2002	299	1100	1	19.689	1.624	18.065	8.99	5.941	942		mist	4
2002	299	1200	1	23.211	2.843	20.368	13.96	9.779	428		mist	5
2002	299	1300	1	19.747	1.682	18.065	9.31	5.941	125			8
2002	299	1400	1	17.425	0.907	16.518	5.49	3.364	563			10
2002	299	1500	1	16.986	0.71	16.276	4.36	2.959	62			10
2002	299	1600	1	16.325	0.467	15.858	2.94	2.263	257			10
2002	299	1700	1	16.234	0.376	15.858	2.37	2.263	85			10
2002	299	1800	1	16.988	0.47	16.518	2.85	3.364	95			9.9
2002	299	1900	1	18.745	0.68	18.065	3.76	5.941	92			10
2002	299	2000	1	18.609	0.544	18.065	3.01	5.941	86			10
2002	299	2100	1	18.5	0.435	18.065	2.41	5.941	82			9
2002	299	2200	1	18.395	0.33	18.065	1.83	5.941	67			7
2002	299	2300	1	18.313	0.248	18.065	1.37	5.941	59			7
2002	300	0	1	18.257	0.192	18.065	1.06	5.941	52			6.8
				19.56	1.042	18.519	5.63	6.698	313.79	0.33		

DEQ/AQD 000423

* % change based on background from IMPROVE transmissometer at Badlands NP (if >50 1/Mm)

Modele Extinctio by Species

YEAR	DAY	HR	RECEI	COORDIN (km)		TYPE	BEXT(Mod	BEXT(BKG	BEXT(Total)	%CHANGE	F(RH)	bxSO4	bxNO3	bxOC	bxEC	bxPMC	bxPMF
2002	300	0	1	200.083	-23.183	D	1.042	18.519	19.56	5.63	6.698	0.6	0.441	0.001	0	0	0

JD 54 (55,0); Feb 23

YEAR	DAY	TIME	REC#	TOT EXT	MODEL EXT	FLAG BGRND	% CHANGE	RH-FAC	Billings Weather	Billings VR	Sheridan Weather	Sheridan VR	Sheridan (km)	FLAG or Method7 BGRND*	% CHANGE (Method 7)
2001	54	100	448	18.212	0.147	18.065	0.81	5.941		10+		7		18.065	
2001	54	200	448	18.075	0.01	18.065	0.06	5.941		10+	mist	1.2	1.9	2026	
2001	54	300	448	20.368	0	20.368	-	9.779		10+	fog, depositing rime, sky not	0.2	0.3	12154	
2001	54	400	448	16.52	0.002	16.518	0.01	3.364		10+	fog, depositing rime, sky not	0.5	0.8	4862	
2001	54	500	448	20.378	0.01	20.368	0.05	9.779		9	fog, depositing rime, sky not	0.2	0.3	12154	
2001	54	600	448	18.102	0.037	18.065	0.20	5.941	Mist	5	fog, depositing rime, sky not	0.2	0.3	12154	
2001	54	700	448	18.699	0.634	18.065	3.51	5.941	Mist	5	mist	4	6.4	608	
2001	54	800	448	19.167	1.102	18.065	6.10	5.941	Mist	6	mist	5	8.0	486	
2001	54	900	448	16.666	0.148	16.518	0.90	3.364	Mist	5	mist	5	8.0	486	
2001	54	1000	448	25.375	5.007	20.368	24.58	9.779	Mist	4	mist	4	6.4	608	
2001	54	1100	448	22.292	4.227	18.065	23.40	5.941	Mist	5	mist	4	6.4	608	
2001	54	1200	448	20.028	3.1	16.928	18.31	4.047		8.7	mist	3.7	6.0	657	
2001	54	1300	448	23.366	5.301	18.065	29.34	5.941		10+	mist	5	8.0	486	
2001	54	1400	448	22.196	5.08	17.116	29.68	4.359		9	mist	6	9.7	405	
2001	54	1500	448	29.57	9.202	20.368	45.18	9.779	Mist	5	mist	3	4.8	810	
2001	54	1600	448	21.361	4.245	17.116	24.80	4.359	Mist	5	mist	5	8.0	486	
2001	54	1700	448	21.478	4.362	17.116	25.48	4.359	Mist	5		8		17.116	
2001	54	1800	448	19.424	2.906	16.518	17.59	3.364	Mist	5		8.7		16.518	
2001	54	1900	448	19.346	2.23	17.116	13.03	4.359	Mist	6		9		17.116	
2001	54	2000	448	18.217	1.101	17.116	6.43	4.359		8		9		17.116	
2001	54	2100	448	18.776	0.711	18.065	3.94	5.941		10+		7		18.065	
2001	54	2200	448	18.331	0.266	18.065	1.47	5.941		10+		9		18.065	
2001	54	2300	448	18.137	0.072	18.065	0.40	5.941		8		9		18.065	
2001	55	0	448	18.075	0.01	18.065	0.06	5.941		6.8	mist	5.6	9.0	434	
					2.080	18.01	11.55	5.85						2065.209	0.10

DEQ/AQD 000424

* When fog/precip, etc is observed, BGRND (1/Mm) = 3912/VR(km). CALPOST Method 7.

Model Extinctk by Species

YEAR	DAY	HR	RECEF	COORDIN, (km)		TYPE	BEXT(Mod	BEXT(BKG	BEXT(Total)	%CHANGE	F(RH)	bxSO4	bxNO3	bxOC	bxEC	bxPMC	bxPMF
2001	55	0	448	-104.345	160.954	D	2.08	18.01	20.09	11.55	5.85	1.217	0.851	0.006	0	0	0.005

JD 96 (97,0): Apr 6

YEAR	DAY	TIME	REC#	TOT EXT	MODEL EXT	FLAG BGRND	% CHANGE	RH-FAC	Billings Weather	Billings VR	Sheridan Weather	Sheridan VR	Sheridan (km)	FLAG or Method7 BGRND*	% CHANGE (Method 7)
2001	96	100	448	18.244	1.128	17.116	6.59	4.359		10+		10+		17.116	6.6%
2001	96	200	448	20.314	3.198	17.116	18.68	4.359		10+		10+		17.116	18.7%
2001	96	300	448	30.182	9.814	20.368	48.18	9.779		10+		10+		20.368	48.2%
2001	96	400	448	28.818	8.45	20.368	41.49	9.779		10+		10+		20.368	41.5%
2001	96	500	448	21.532	3.467	18.065	19.19	5.941		10+		10+		18.065	19.2%
2001	96	600	448	19.681	1.616	18.065	8.95	5.941		9.9		9.9		18.065	8.9%
2001	96	700	448	16.761	0.243	16.518	1.47	3.364		10+		10+		16.518	1.5%
2001	96	800	448	18.679	0.001	18.678	0.01	6.963		10+		10+		18.678	0.0%
2001	96	900	448	16.195	0.055	16.14	0.34	2.733		10+		10+		16.140	0.3%
2001	96	1000	448	15.584	0.065	15.519	0.42	1.699		10+		10+		15.519	0.4%
2001	96	1100	448	15.48	0.102	15.378	0.66	1.463		10+		10+		15.378	0.7%
2001	96	1200	448	15.516	0.178	15.338	1.16	1.397		9.9		9.9		15.338	1.2%
2001	96	1300	448	15.385	0.175	15.21	1.15	1.183		10+		10+		15.210	1.2%
2001	96	1400	448	15.497	0.287	15.21	1.89	1.183		10+		10+		15.210	1.9%
2001	96	1500	448	15.689	0.408	15.281	2.67	1.302		10+	slight, continuous rain	10	16.1	243	0.2%
2001	96	1600	448	16.001	0.482	15.519	3.11	1.699		10+		10+		15.519	3.1%
2001	96	1700	448	15.644	0.266	15.378	1.73	1.463		10+	Thunderstorm, no precipitation	10+		15.378	1.7%
2001	96	1800	448	15.754	0.141	15.613	0.90	1.855		9.9	Thunderstorm, no precipitation	9.9		15.613	0.9%
2001	96	1900	448	15.366	0.028	15.338	0.18	1.397		10+		10+		15.338	0.2%
2001	96	2000	448	15.775	0.006	15.769	0.04	2.115	Thunderstorms with no precipitation	10+		10+		15.769	0.0%
2001	96	2100	448	15.769	0	15.769	-	2.115	Thunderstorms, slight rain showers	10+		10+		15.769	0.0%
2001	96	2200	448	15.769	0	15.769	-	2.115	Thunderstorms, Slight, Continuous rain	10+		10+		15.769	0.0%
2001	96	2300	448	15.858	0	15.858	-	2.263	Slight, Continuous rain	10+		10+		15.858	0.0%
2001	97	0	448	15.579	0	15.579	-	1.798		9.9		9.9		15.579	0.0%
				17.711	1.255	16.457	7.62	3.261						25.949	4.83

* When fog/precip, etc. is observed, BGRND (1/Mm) = 3912/VR(km). CALPOST Method 7.

Model Extinctic by Species

YEAR	DAY	HR	RECEF	COORDIN. (km)		TYPE	BEXT(Mod	BEXT(BKG	BEXT(Total)	%CHANGE	F(RH)	bxSO4	bxNO3	bxOC	bxEC	bxPMC	bxPMF
2001	97	0	448	-104.345	160.954	D	1.255	16.457	17.711	7.62	3.261	0.694	0.557	0.002	0	0	0.002

DEQ/AQD 000425

Wind 2001

JD 81 (82,0): Mar 22

YEAR	DAY	TIME	REC#	TOT EXT	MODEL EXT	FLAG BGRND	% CHANGE	RH-FAC	BGRND (FLAG/BAD)	%CHNG (FLAG/BAD)*	Rapid City Weather	Rapid City Visibility (miles)
2001	81	100	285	15.779	0.103	15.676	0.66	1.96	15.676		rain, thunderstorm	10
2001	81	200	285	16.416	0.14	16.276	0.86	2.959	16.276			10
2001	81	300	285	17.345	0.229	17.116	1.34	4.359	17.116			10
2001	81	400	285	16.73	0.212	16.518	1.28	3.364	16.518			10
2001	81	500	285	16.799	0.281	16.518	1.70	3.364	63			10
2001	81	600	285	16.918	0.4	16.518	2.42	3.364	157			9.9
2001	81	700	285	17.784	0.668	17.116	3.90	4.359	942		mist, fog	0.2
2001	81	800	285	22.308	1.94	20.368	9.52	9.779	942		fog	0.2
2001	81	900	285	22.643	2.275	20.368	11.17	9.779	942		fog	0.2
2001	81	1000	285	22.854	2.486	20.368	12.21	9.779	942		fog	0.2
2001	81	1100	285	23.167	2.799	20.368	13.74	9.779	942		mist, fog	0.2
2001	81	1200	285	23.53	3.162	20.368	15.52	9.779	407		mist, fog	0.5
2001	81	1300	285	23.664	3.296	20.368	16.18	9.779	561		mist	1.7
2001	81	1400	285	23.519	3.151	20.368	15.47	9.779	414		mist	1.7
2001	81	1500	285	19.809	1.744	18.065	9.65	5.941	789		mist	6
2001	81	1600	285	22.849	2.481	20.368	12.18	9.779	818		mist	6
2001	81	1700	285	22.553	2.185	20.368	10.73	9.779	942		mist	3
2001	81	1800	285	22.303	1.935	20.368	9.50	9.779	942		mist	3
2001	81	1900	285	22.085	1.717	20.368	8.43	9.779	942		mist	0.8
2001	81	2000	285	21.574	1.206	20.368	5.92	9.779	942		mist	0.8
2001	81	2100	285	22.033	1.665	20.368	8.17	9.779	942		fog	0.2
2001	81	2200	285	21.989	1.621	20.368	7.96	9.779	942		fog	0.2
2001	81	2300	285	21.579	1.211	20.368	5.95	9.779	942		fog	0.2
2001	82	0	285	21.785	1.417	20.368	6.96	9.779	942		fog	0.2
				20.75	1.597	19.15	8.34	7.756	647.52	0.25		

* % change based on background from IMPROVE transmissometer at Badlands NP (if >50 1/Mm)

Model Extinctio by Species

YEAR	DAY	HR	RECEP	COORDIN (km)		TYPE	BEXT(Mod	BEXT(BKG	BEXT(Total)	%CHANGE	F(RH)	bxSO4	bxNO3	bxOC	bxEC	bxPMC	bxPMF
2001	82	0	285	117.585	-37.827	D	1.597	19.15	20.75	8.34	7.756	1.032	0.562	0.001	0	0	0.001

DEQ/AQD 000426

11/08/2005

JD 82 (83,0): Mar 23

YEAR	DAY	TIME	REC#	TOT EXT	MODEL EXT	FLAG BGRND	% CHANGE	RH-FAC	BGRND (FLAG/BAD)	%CHNG (FLAG/BAD)*	Rapid City Weather	Rapid City Visibility (miles)
2001	82	100	104	21.773	1.405	20.368	6.90	9.779	942		fog	0.2
2001	82	200	104	21.95	1.582	20.368	7.77	9.779	921		mist	0.8
2001	82	300	104	22.138	1.77	20.368	8.69	9.779	942		fog	0.2
2001	82	400	104	22.305	1.937	20.368	9.51	9.779	942		fog	0.2
2001	82	500	104	22.44	2.072	20.368	10.17	9.779	942		fog, mist	0.2
2001	82	600	104	22.521	2.153	20.368	10.57	9.779	942		snow	5
2001	82	700	104	22.533	2.165	20.368	10.63	9.779	368		drizzle, mist	5
2001	82	800	104	22.563	2.195	20.368	10.78	9.779	214		mist	7
2001	82	900	104	22.43	2.062	20.368	10.12	9.779	216		mist, snow	2.5
2001	82	1000	104	22.227	1.859	20.368	9.13	9.779	124		mist	6
2001	82	1100	104	19.045	0.98	18.065	5.42	5.941	121		mist	6
2001	82	1200	104	18.882	0.817	18.065	4.52	5.941	99		mist	3.7
2001	82	1300	104	21.441	1.073	20.368	5.27	9.779	72			10+
2001	82	1400	104	21.191	0.823	20.368	4.04	9.779	72			10+
2001	82	1500	104	16.732	0.214	16.518	1.30	3.364	68			10+
2001	82	1600	104	16.682	0.164	16.518	0.99	3.364	108			10+
2001	82	1700	104	16.645	0.127	16.518	0.77	3.364	118			10+
2001	82	1800	104	16.613	0.095	16.518	0.58	3.364	68			9.9
2001	82	1900	104	16.59	0.072	16.518	0.44	3.364	68			10+
2001	82	2000	104	16.583	0.065	16.518	0.39	3.364	74			10+
2001	82	2100	104	16.602	0.084	16.518	0.51	3.364	70			10+
2001	82	2200	104	16.605	0.087	16.518	0.53	3.364	80			10+
2001	82	2300	104	18.222	0.157	18.065	0.87	5.941	82			10+
2001	83	0	104	18.221	0.156	18.065	0.86	5.941	77			9.9
				19.71	1.005	18.701	5.37	7.001	322.08	0.31		

* % change based on background from IMPROVE transmissometer at Badlands NP (if >50 1/Mm)

Model Extinctio by Species

YEAR	DAY	HR	RECEP	COORDIN (km)		TYPE	BEXT(Mod	BEXT(BKG	BEXT(Total)	%CHANGE	F(RH)	bxSO4	bxNO3	bxOC	bxEC	bxPMC	bxPMF
2001	83	0	104	115.858	-49.5	D	1.005	18.701	19.71	5.37	7.001	0.705	0.299	0.001	0	0	0

DEQ/AQD 000427

Basin Electric Power Cooperative
Dry Fork Project
CALPUFF Analysis

2001

Wind Cave NP

YEAR	Modeled DAY	Extinction HR	by RECEPTO	Species COORDIN.(km)		TYPE	BEXT(Mod	BEXT(BKG	BEXT(Tota	%CHANGE	F(RH)	bxSO4	bxNO3	bxOC	bxEC	bxPMC	bxPMF
2001	82	0	285	117.585	-37.827	D	1.597	19.153	20.75	8.34	7.756	1.032	0.562	0.001	0	0	0.001
2001	83	0	104	115.858	-49.5	D	1.005	18.701	19.705	5.37	7.001	0.705	0.299	0.001	0	0	0

Badlands NP

YEAR	Modeled DAY	Extinction HR	by RECEPTO	Species COORDIN.(km)	TYPE	BEXT(Mod	BEXT(BKG	BEXT(Tota	%CHANGE	F(RH)	bxSO4	bxNO3	bxOC	bxEC	bxPMC	bxPMF

[none > 5%]

N Cheyenne

YEAR	Modeled DAY	Extinction HR	by RECEPTO	Species COORDIN.(km)		TYPE	BEXT(Mod	BEXT(BKG	BEXT(Tota	%CHANGE	F(RH)	bxSO4	bxNO3	bxOC	bxEC	bxPMC	bxPMF
2001	55	0	448	-104.345	160.954	D	2.08	18.01	20.09	11.55	5.85	1.217	0.851	0.006	0	0	0.005
2001	97	0	519	-121.678	166.75	D	1.543	16.457	17.999	9.38	3.261	0.763	0.773	0.003	0	0	0.004

Devils Tower

YEAR	Modeled DAY	Extinction HR	by RECEPTO	Species COORDIN.(km)		TYPE	BEXT(Mod	BEXT(BKG	BEXT(Tota	%CHANGE	F(RH)	bxSO4	bxNO3	bxOC	bxEC	bxPMC	bxPMF
2001	82	0	770	21.82	63.4	D	0.843	16.005	16.847	5.27	2.508	0.451	0.372	0.006	0.001	0	0.013

2002

Wind Cave NP

YEAR	Modeled DAY	Extinction HR	by RECEPTO	Species COORDIN.(km)		TYPE	BEXT(Mod	BEXT(BKG	BEXT(Tota	%CHANGE	F(RH)	bxSO4	bxNO3	bxOC	bxEC	bxPMC	bxPMF
2002	300	0	103	118.471	-50.346	D	1.623	18.519	20.141	8.76	6.698	0.932	0.688	0.002	0	0	0

Badlands NP

YEAR	Modeled DAY	Extinction HR	by RECEPTO	Species COORDIN.(km)		TYPE	BEXT(Mod	BEXT(BKG	BEXT(Tota	%CHANGE	F(RH)	bxSO4	bxNO3	bxOC	bxEC	bxPMC	bxPMF
2002	300	0	1	200.083	-23.183	D	1.042	18.519	19.561	5.63	6.698	0.6	0.441	0.001	0	0	0

N Cheyenne

YEAR	Modeled DAY	Extinction HR	by RECEPTO	Species COORDIN.(km)		TYPE	BEXT(Mod	BEXT(BKG	BEXT(Tota	%CHANGE	F(RH)	bxSO4	bxNO3	bxOC	bxEC	bxPMC	bxPMF
2002	301	0	560	-96.64	168.684	D	0.934	16.514	17.448	5.66	3.356	0.511	0.42	0.002	0	0	0.001
2002	83	0	526	-108.196	166.751	D	0.9	17.011	17.911	5.29	4.185	0.412	0.481	0.002	0	0	0.004

Devils Tower

YEAR	Modeled DAY	Extinction HR	by RECEPTO	Species COORDIN.(km)	TYPE	BEXT(Mod	BEXT(BKG	BEXT(Tota	%CHANGE	F(RH)	bxSO4	bxNO3	bxOC	bxEC	bxPMC	bxPMF

[none > 5%]

Basin Electric Power Cooperative
Dry Fork Project
CALPUFF Analysis

2003

Wind Cave NP

YEAR	Modeled DAY	Extinction HR	by RECEPTO	Species COORDIN. (km)		TYPE	BEXT(Mod	BEXT(BKG	BEXT(Tota	%CHANGE	F(RH)	bxSO4	bxNO3	bxOC	bxEC	bxPMC	bxPMF
2003	69	0	101	117.172	-50.371	D	1.322	16.596	17.918	7.97	3.493	0.688	0.629	0.004	0	0	0.002
2003	346	0	267	116.954	-38.735	D	1.388	17.52	18.908	7.92	5.033	0.759	0.625	0.002	0	0	0.001
2003	310	0	101	117.172	-50.371	D	1.263	16.206	17.469	7.79	2.844	0.787	0.473	0.003	0	0	0.001

Badlands NP

YEAR	Modeled DAY	Extinction HR	by RECEPTO	Species COORDIN. (km)		TYPE	BEXT(Mod	BEXT(BKG	BEXT(Tota	%CHANGE	F(RH)	bxSO4	bxNO3	bxOC	bxEC	bxPMC	bxPMF
2003	347	0	28	227.093	-18.671	D	0.86	17.16	18.02	5.01	4.434	0.467	0.39	0.002	0	0	0.001

N Cheyenne

YEAR	Modeled DAY	Extinction HR	by RECEPTO	Species COORDIN. (km)		TYPE	BEXT(Mod	BEXT(BKG	BEXT(Tota	%CHANGE	F(RH)	bxSO4	bxNO3	bxOC	bxEC	bxPMC	bxPMF
2003	308	0	312	-131.309	149.36	D	9.783	18.884	28.667	51.8	7.307	5.5	4.251	0.015	0.001	0	0.016

Devils Tower

YEAR	Modeled DAY	Extinction HR	by RECEPTO	Species COORDIN. (km)		TYPE	BEXT(Mod	BEXT(BKG	BEXT(Tota	%CHANGE	F(RH)	bxSO4	bxNO3	bxOC	bxEC	bxPMC	bxPMF
[none > 5%]																	

DEQ/AQD 000429

in Dry Fork Station
CALPUFF Results

Area	Visibility: Days with Extinction Change > 5%	> 10%	Max. Day	Max. % Change	f(RH)	Model Extinction by Species: bxSO4	bxNO3	bxOC	bxEC	bxPMC	bxPMF	3-Hour SO_2 (ug/m^3)	24-Hour SO_2 (ug/m^3)	Annual SO_2 (ug/m^3)	24-Hour PM_{10} (ug/m^3)	Annual PM_{10} (ug/m^3)	Annual NOx (ug/m^3)	N Dep ($g/m^2/s$)	S Dep ($g/m^2/s$)	N Dep kg/ha/yr	S Dep kg/ha/yr
2001 Results																					
Wind Cave NP	2	0		8.34%								0.39	0.13	0.009	0.005	0.0003	0.003	7.0534E-12	2.0199E-11	0.002	0.006
Badlands NP	0	0		4.42%								0.33	0.08	0.005	0.002	0.0001	0.001	3.8961E-12	9.3940E-12	0.001	0.003
N Cheyenne Indian Res	2	1		11.55%								0.68	0.22	0.008	0.01	0.0004	0.003	4.7919E-12	1.8001E-11	0.002	0.006
Devils Tower	1	0		5.27%								2.00	0.57	0.04	0.06	0.004	0.021				
2002 Results																					
Wind Cave NP	1	0		8.76%								0.45	0.17	0.011	0.006	0.0004	0.004	6.3214E-12	2.0360E-11	0.002	0.006
Badlands NP	1	0		5.63%								0.32	0.09	0.007	0.002	0.0001	0.002	2.2801E-12	7.0214E-12	0.001	0.002
N Cheyenne Indian Res	2	0		5.66%								0.55	0.198	0.006	0.01	0.0003	0.002	3.0785E-12	1.2227E-11	0.001	0.004
Devils Tower	0	0		4.22%								1.85	0.61	0.052	0.06	0.005	0.029				
Results																					
Wind Cave NP	3	0		7.97%								0.49	0.11	0.012	0.005	0.0004	0.004	7.5460E-12	2.3989E-11	0.002	0.008
Badlands NP	1	0		5.01%								0.23	0.07	0.006	0.002	0.0001	0.0013	3.4972E-12	8.5251E-12	0.001	0.003
N Cheyenne Indian Res	1	1		51.80%								[illegible]	0.55	0.008	0.02	0.0004	0.002	5.8886E-12	2.0167E-11	0.002	0.006
Devils Tower	0	0		3.10%								2.09	0.64	0.051	0.06	0.005	0.029				
Deposition Multiplier:																					
# hours in model run:	8760	2001																			
$g/m^2/s$ to kg/ha/yr:	315,360,000	2001																			
# hours in model run:	8760	2002																			
$g/m^2/s$ to kg/ha/yr:	315,360,000	2002																			
# hours in model run:	8741	2003																			
$g/m^2/s$ to kg/ha/yr:	314,676,000	2003																			

Outside Wyoming Sources of SO_2 for Cumulative Analysis

Source ID	UTM E NAD27 (m)	UTM N NAD27 (m)	LCC E (km)	LCC N (km)	Elev. (m)	Stack H. (m)	Temp. (K)	Vel. (m/s)	Dia. (m)	Permitted Emissions Levels 3-hr SO_2 (g/s)	24-hr SO_2 (g/s)	3-hr SO_2 (lb/hr)	24-hr SO_2 (lb/hr)

Sources in Wyoming:

Black Hills Wygen1 Boiler

	Zone 13												
WYGEN1	469,390	4,903,494	-29.492	30.786	1344	89.9	342	27.44	2.82	25.6	25.6	202.8	202.8

NAD83 UTM = 469347, 4903709 — UTMs determined w/ aerial photo and CAD drawing of Wyodak complex — heat input: 1,014 MMBtu/hr (WDEQ Permit MD-510)

source: ISC input file (WAAQSS.in) provided by WDEQ — short-term SO_2: 0.2 lb/MMBtu (WDEQ Permit MD-510)

Black Hills Wygen2 Boiler

	Zone 13												
WYGEN2	469,603	4,904,065	-29.287	31.338	1346	121.0	344	22.9	3.43	19.7	19.7	156.0	156.0

NAD83 UTM = 469560, 4904280

Source: CH2M HILL Modeling

Neil Simpson Unit 1 Boiler

	Zone 13												
NSU1	469,116	4,903,600	-29.756	30.889	1345	76.2	443	22.04	1.83	44.3	44.3	351.6	351.6

NAD83 UTM = 469073, 4903815 — UTMs determined w/ aerial photo and CAD drawing of Wyodak complex — heat input: 293 MMBtu/hr (WDEQ Permit 31-004-1)

source: ISC input file (WAAQSS.in) provided by WDEQ — short-term SO_2: 1.2 lb/MMBtu (WDEQ Permit 31-004-1)

Neil Simpson Unit 2 Boiler

	Zone 13												
NSU2	469,386	4,903,418	-29.496	30.713	1344	89.9	342	27.45	2.82	25.6	25.6	203.0	203.0

NAD83 UTM = 469343, 4903633 — UTMs determined w/ aerial photo and CAD drawing of Wyodak complex — (WDEQ Permit 31-158)

source: ISC input file (WAAQSS.in) provided by WDEQ

Wyodak Boiler 1

	Zone 13												
WYDK	469,410	4,903,708	-29.473	30.993	1347	122.0	358	22.56	6.1	258.6	258.6	2052.0	2052.0

NAD83 UTM = 469367, 4903923 — UTMs determined w/ aerial photo and CAD drawing of Wyodak complex — heat input: ~4100 MMBtu/hr

source: ISC input file (WAAQSS.in) provided by WDEQ — short-term SO_2: 0.5 MMBtu/hr (WDEQ Permit 31-101)

Constructed 1972. PPL installed SO_2 scrubber in Dec. 1986, WYODAK1 does not consume SO_2 increment

2 Elk Unit 1

	Zone 13												
2ELK	482,623	4,833,505	-16.749	-36.898	1451	103.6	344	27.4	4.94	57.3	57.3	454.5	454.5

NAD83 UTM = 482580, 4833718

source: PowerPlantSO2_NEWY_2.xls provided by WDEQ (UTMs assumed to be NAD83)

note: source is more than SO_2 ROI + 50km from Dry Fork Station. Not included in ISC modeling.

KFX Source #1

	Zone 13												
EP28	466,706	4,911,354	-32.077	38.386	1349	76.2	419	18.13	2.18	6.52	6.52	51.7	51.7

NAD83 UTM = 466663, 4911569

source: so2.00.st.in provided by WDEQ (UTMs assumed to be NAD83)

KFX Source #2

	Zone 13												
EP29	466,704	4,911,359	-32.079	38.391	1349	76.2	419	18.13	2.18	6.52	6.52	51.7	51.7

NAD83 UTM = 466661, 4911574

source: so2.00.st.in provided by WDEQ (UTMs assumed to be NAD83)

Outside Source of SO_2 for Cumulative Analysis in N Cheyenne Indian Res.

Source ID	UTM E NAD27 (m)	UTM N NAD27 (m)	LCC E (km)	LCC N (km)	Elev. (m)	Stack H. (m)	Temp. (K)	Vel. (m/s)	Dia. (m)	Permitted Emissions Levels 3-hr SO_2 (g/s)	24-hr SO_2 (g/s)	3-hr SO_2 (lb/hr)	24-hr SO_2 (lb/hr)	90th Percentile Actuals for 2003-04 3-hr SO_2 (lb/hr)	24-hr SO_2 (lb/hr)
PSD Increment-Consuming Sources in Southeast Montana															
List prepared by Montana DEQ on August 23, 2005, updated October 19, 2005:															
Colstrip Units 3 and 4	Zone 13									*0513-05*	*0513-05*	*0513-05*	*0513-05*		
PPLSTK3	374,914	5,082,000	-120.464	203.304	987.9	210.9	362	28.5	7.32	260.82	171.74	2069.97	1362.98	878.5	835.7
PPLSTK4	375,014	5,081,997	-120.368	203.301	987.9	210.9	364	33.71	7.32	260.82	171.74	2069.97	1362.98	882.9	838.1
Rocky Mountain Power (Hardin)	Zone 13									*1-hr limit*	*1-hr limit*	*1-hr limit*	*1-hr limit*		
RMP1, after 18 mo.	298,074	5,070,935	-194.446	192.604	878.0	76.2	344	35.9	2.7	23.007	23.007	182.60	182.60		
Rocky Mountain Ethanol	Zone 13														
RME1 (Coal Boiler)	297,848	5,069,904	-194.663	191.609	881	51.8	403	20.84	1.83	6.064	6.064	48.13	48.13		
Colstrip Energy Limited Partnership	Zone 13														
CELP1 (Coal Boiler)	371,558	5,092,424	-123.696	213.374	948	61.0	433	22.43	2.51	5.293	5.293	42.01	42.01		
Roundup Power Project	Zone 12									*1-hr limit*	*3182-00*	*1-hr limit*	*3182-00*		
MP1 (Coal Boiler)	696,255	5,126,856	n/a	n/a	1217.7	175.0	355	30.48	5.1511	75.852	60.732	602.00	482.00		
MP2 (Coal Boiler)	696,305	5,126,808	n/a	n/a	1217.7	175.0	355	30.48	5.1511	75.852	60.732	602.00	482.00		
	Zone 13														
	233,912	5,129,501	-256.206	249.135											
	233,959	5,129,449	-256.161	249.085											
Sources in North Dakota:															
MDU Gascoyne Generating Station	Zone 13														
Gascoyne	647,744	5,111,290	142.283	231.596	847	109.7	350	26.97	3.91	21.329	17.563	169.3	139.4		

source: EPA Clean Air Markets website (http://cfpub.epa.gov/gdm/)

NAD 83 = 647705, 5111508; heat input = 2112 MMbtu/hr

.08 lb/MMBtu .066 lb/MMBtu

Basin Electric Dry Fork Station Project: List of Far-Field Modeling Files	
File Name	Description
DVD1:	MM5 Files for the 2001 Dry Fork Project Wind Field
\MM5	
WY0101.MM5	MM5 Data for January 2001
WY0102.MM5	MM5 Data for February 2001
WY0103.MM5	MM5 Data for March 2001
WY0104.MM5	MM5 Data for April 2001
WY0105.MM5	MM5 Data for May 2001
WY0106.MM5	MM5 Data for June 2001
WY0107.MM5	MM5 Data for July 2001
WY0108.MM5	MM5 Data for August 2001
WY0109.MM5	MM5 Data for September 2001
WY0110.MM5	MM5 Data for October 2001 (split between DVD1 and DVD2)
DVD2:	MM5 Files for the 2001 Dry Fork Project Wind Field
\MM5	
WY0110.MM5	MM5 Data for October 2001 (split between DVD1 and DVD2)
WY0111.MM5	MM5 Data for November 2001
WY0112.MM5	MM5 Data for December 2001
DVD3:	MM5 Files for the 2002 Dry Fork Project Wind Field
\MM5	
WY0201.MM5	MM5 Data for January 2002
WY0202.MM5	MM5 Data for February 2002
WY0203.MM5	MM5 Data for March 2002
WY0204.MM5	MM5 Data for April 2002
WY0205.MM5	MM5 Data for May 2002
WY0206.MM5	MM5 Data for June 2002
WY0207.MM5	MM5 Data for July 2002
WY0208.MM5	MM5 Data for August 2002
WY0209.MM5	MM5 Data for September 2002
WY0210.MM5	MM5 Data for October 2002
WY0211.MM5	MM5 Data for November 2002
WY0212.MM5	MM5 Data for December 2002
DVD4:	MM5 Files for the 2003 Dry Fork Project Wind Field
\MM5	
WY0301.MM5	MM5 Data for January 2003
WY0302.MM5	MM5 Data for February 2003
WY0303.MM5	MM5 Data for March 2003
WY0304.MM5	MM5 Data for April 2003
WY0305.MM5	MM5 Data for May 2003
WY0306.MM5	MM5 Data for June 2003
WY0307.MM5	MM5 Data for July 2003
WY0308.MM5	MM5 Data for August 2003
WY0309.MM5	MM5 Data for September 2003
WY0310.MM5	MM5 Data for October 2003 (split between DVD4 and DVD5)

Basin Electric Dry Fork Station Project: List of Far-Field Modeling Files	
File Name	Description
DVD5	MM5 Files for the 2003 Dry Fork Project Wind Field
\MM5	
WY0310.MM5	MM5 Data for October 2003 (split between DVD4 and DVD5)
WY0311.MM5	MM5 Data for November 2003
WY0312.MM5	MM5 Data for December 2003
DVD6	CALMET Input and Output Files for the 2001-03 Dry Fork Project Wind Fields
\WyoCMET-Calmet1	CALMET Files for 2001
\PRECIP	Raw Precipitation Files and Processing Files for 2001
\SURF	Raw Surface Files and Processing Files for 2001
\UPA	Raw Upper-Air Files and Processing Files for 2001
\WyoCMET-Calmet2	CALMET Files for 2002
\PRECIP	Raw Precipitation Files and Processing Files for 2002
\SURF	Raw Surface Files and Processing Files for 2002
\UPA	Raw Upper-Air Files and Processing Files for 2002
\WyoCMET-Calmet3	CALMET Files for 2003
\PRECIP	Raw Precipitation Files and Processing Files for 2003
\SURF	Raw Surface Files and Processing Files for 2003
\UPA	Raw Upper-Air Files and Processing Files for 2003
DVD7	MM5 Files for the 2001 Cumulative Analysis
\WyoCMET2-Calmet1 MM5	
\MM5	
WY20101.MM5	MM5 Data for January 2001
WY20102.MM5	MM5 Data for February 2001
WY20103.MM5	MM5 Data for March 2001
WY20104.MM5	MM5 Data for April 2001
WY20105.MM5	MM5 Data for May 2001
WY20106.MM5	MM5 Data for June 2001
WY20107.MM5	MM5 Data for July 2001
WY20108.MM5	MM5 Data for August 2001
WY20109.MM5	MM5 Data for September 2001
WY20110.MM5	MM5 Data for October 2001
WY20111.MM5	MM5 Data for November 2001
WY20112.MM5	MM5 Data for December 2001
DVD8	MM5 Files for the 2002 Cumulative Analysis
\WyoCMET2-Calmet2 MM5	
\MM5	
WY20201.MM5	MM5 Data for January 2002
WY20202.MM5	MM5 Data for February 2002
WY20203.MM5	MM5 Data for March 2002
WY20204.MM5	MM5 Data for April 2002
WY20205.MM5	MM5 Data for May 2002
WY20206.MM5	MM5 Data for June 2002
WY20207.MM5	MM5 Data for July 2002
WY20208.MM5	MM5 Data for August 2002
WY20209.MM5	MM5 Data for September 2002
WY20210.MM5	MM5 Data for October 2002
WY20211.MM5	MM5 Data for November 2002 (split between DVD8 and DVD9)

Basin Electric Dry Fork Station Project: List of Far-Field Modeling Files

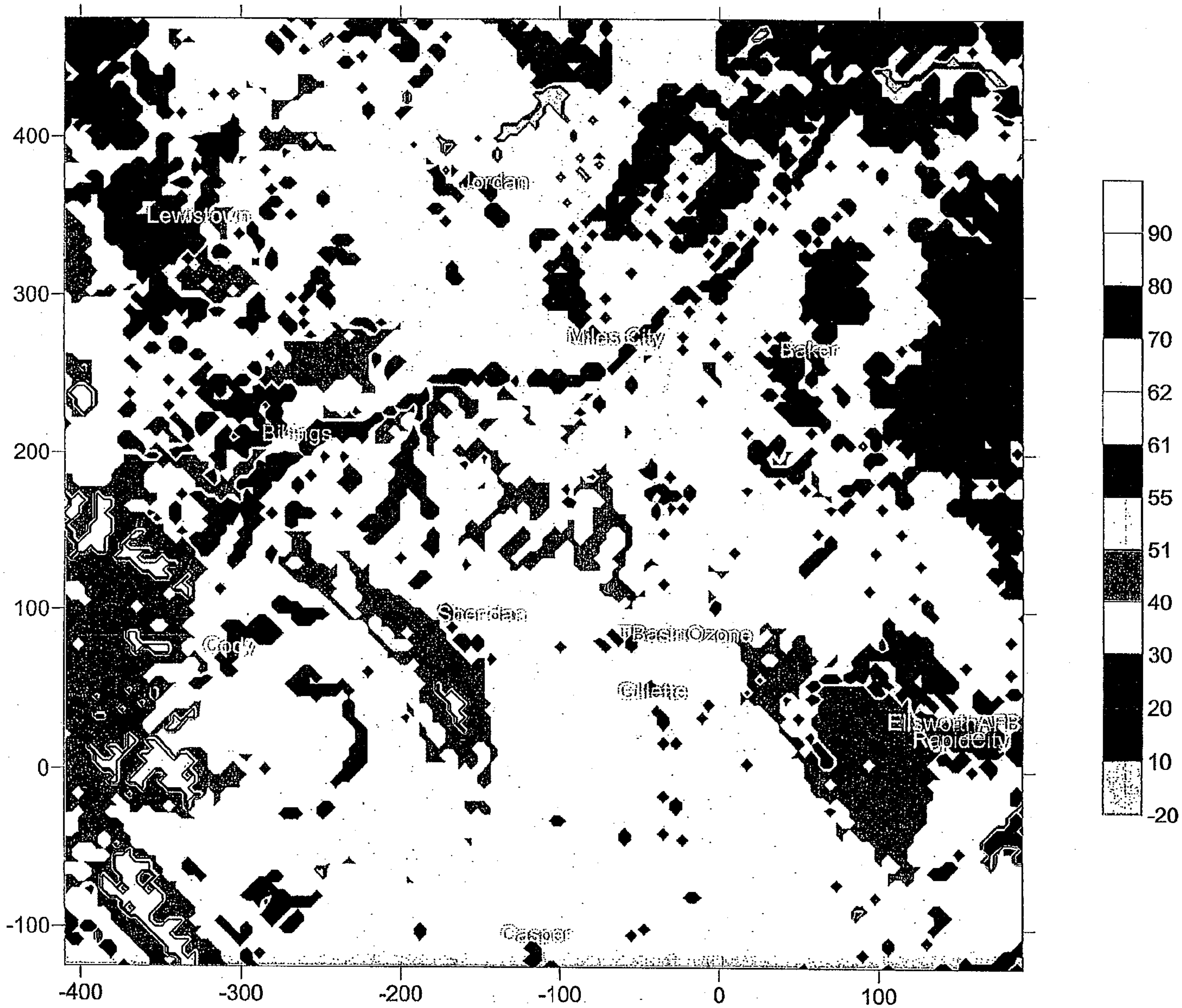
File Name	Description
DVD9:	MM5 Files for the 2002 Cumulative Analysis
\WyoCMET2-Calmet2 MM5	
\MM5	
WY20211.MM5	MM5 Data for November 2002 (split between DVD8 and DVD9)
WY20212.MM5	MM5 Data for December 2002
\WyoCMET_GEO	Terrain and Land Use Files and Processing Files (Dry Fork Station Base Grid)
DVD10:	MM5 Files for the 2003 Cumulative Analysis
\WyoCMET2-Calmet3 MM5	
\MM5	
WY20301.MM5	MM5 Data for January 2003
WY20302.MM5	MM5 Data for February 2003
WY20303.MM5	MM5 Data for March 2003
WY20304.MM5	MM5 Data for April 2003
WY20305.MM5	MM5 Data for May 2003
WY20306.MM5	MM5 Data for June 2003
WY20307.MM5	MM5 Data for July 2003
WY20308.MM5	MM5 Data for August 2003
WY20309.MM5	MM5 Data for September 2003
WY20310.MM5	MM5 Data for October 2003
WY20311.MM5	MM5 Data for November 2003 (split between DVD10 and DVD11)
DVD11:	MM5 Files for the 2003 Cumulative Analysis
\WyoCMET2-Calmet3 MM5	
\MM5	
WY20311.MM5	MM5 Data for November 2003 (split between DVD10 and DVD11)
WY20312.MM5	MM5 Data for December 2003
DVD12:	CALMET Input and Output Files for the 2001-03 Cumulative Analysis
\WyoCMET2-Calmet1	CALMET Files for 2001
\PRECIP	Raw Precipitation Files and Processing Files for 2001
\SURF	Raw Surface Files and Processing Files for 2001
\UPA	Raw Upper-Air Files and Processing Files for 2001
\WyoCMET2-Calmet2	CALMET Files for 2002
\PRECIP	Raw Precipitation Files and Processing Files for 2002
\SURF	Raw Surface Files and Processing Files for 2002
\UPA	Raw Upper-Air Files and Processing Files for 2002
\WyoCMET2-Calmet3	CALMET Files for 2003
\PRECIP	Raw Precipitation Files and Processing Files for 2003
\SURF	Raw Surface Files and Processing Files for 2003
\UPA	Raw Upper-Air Files and Processing Files for 2003
DVD13:	Source Code, Etc.
\CodeEtc\BetaZips	BETA-Test Version of EPA-Approved CALPUFF System (zipped)
\CodeEtc\Exe	Executables
\CodeEtc\Recompiled	Files Used to Recompile
DVD14:	Ozone and MAKEGEO Files for 2001, 2002, and 2003
\OZONE	Raw and Processed Ozone Files
\WyoCMET2_GEO	Raw Terrain and Land Use Files and Processing Files (Cumulative CALMET)

Basin Electric Dry Fork Station Project: List of Far-Field Modeling Files	
File Name	Description
DVD15	CALPUFF, POSTUTIL, and CALPOST Files for 2001
\Final_2001	CALPUFF, POSTUTIL, and CALPOST Files for 2001 (Dry Fork Station Project)
DRYFORK.*	CALPUFF Run for the Dry Fork Station Project
DF_DepPst.*	POSTUTIL Run for S and N Deposition
DF_VisPst.*	POSTUTIL Run for Visibility
DF_BL-*.*	CALPOST Run for Badlands NP (N=NO2, ND=N Dep, P=PM10, S=SO2, SD=S Dep, V=Visibility
DF_WC-*.*	CALPOST Run for Wind Cave NP (N=NO2, ND=N Dep, P=PM10, S=SO2, SD=S Dep, V=Visibility
DF_NR-*.*	CALPOST Run for Northern Cheyenne Indian Reservation (N=NO2, ND=N Dep, P=PM10, S=SO2, SD=S Dep, V=Visibility
DF_DT-*.*	CALPOST Run for Devils Tower (N=NO2, ND=N Dep, P=PM10, S=SO2, SD=S Dep, V=Visibility
\Final_2001\Cumulative	CALPUFF, POSTUTIL, and CALPOST Files for 2001 (Cumulative)
DF_*.*	CALPUFF Runs (DF=Dry Fork, MT=Montana, ND=N.Dakota, WY=Wyoming, CS3=Colstrip 3-hour, CS24=Colstrip 24-hour
CALSUM_3hr.*	CALSUM for 3-Hour Impacts
CALSUM_24hr.*	CALSUM for 24-Hour Impacts
Pst_NRC3_SO2.*	CALPOST Run for 3-Hour SO2 Impacts at N. Cheyenne
Pst_NRC24_SO2.*	CALPOST Run for 24-Hour SO2 Impacts at N. Cheyenne
DVD16	CALPUFF, POSTUTIL, and CALPOST Files for 2002
\Final_2002	CALPUFF, POSTUTIL, and CALPOST Files for 2002 (Dry Fork Station Project)
DRYFORK.*	CALPUFF Run for the Dry Fork Station Project
DF_DepPst.*	POSTUTIL Run for S and N Deposition
DF_VisPst.*	POSTUTIL Run for Visibility
DF_BL-*.*	CALPOST Run for Badlands NP (N=NO2, ND=N Dep, P=PM10, S=SO2, SD=S Dep, V=Visibility
DF_WC-*.*	CALPOST Run for Wind Cave NP (N=NO2, ND=N Dep, P=PM10, S=SO2, SD=S Dep, V=Visibility
DF_NR-*.*	CALPOST Run for Northern Cheyenne Indian Reservation (N=NO2, ND=N Dep, P=PM10, S=SO2, SD=S Dep, V=Visibility
DF_DT-*.*	CALPOST Run for Devils Tower (N=NO2, ND=N Dep, P=PM10, S=SO2, SD=S Dep, V=Visibility
\Final_2002\Cumulative	CALPUFF, POSTUTIL, and CALPOST Files for 2002 (Cumulative)
DF_*.*	CALPUFF Runs (DF=Dry Fork, MT=Montana, ND=N.Dakota, WY=Wyoming, CS3=Colstrip 3-hour, CS24=Colstrip 24-hour
CALSUM_3hr.*	CALSUM for 3-Hour Impacts
CALSUM_24hr.*	CALSUM for 24-Hour Impacts
Pst_NRC3_SO2.*	CALPOST Run for 3-Hour SO2 Impacts at N. Cheyenne
Pst_NRC24_SO2.*	CALPOST Run for 24-Hour SO2 Impacts at N. Cheyenne

Basin Electric Dry Fork Station Project: List of Far-Field Modeling Files	
File Name	Description
DVD17	CALPUFF, POSTUTIL, and CALPOST Files for 2003
\Final_2003	CALPUFF, POSTUTIL, and CALPOST Files for 2003 (Dry Fork Station Project)
DRYFORK.*	CALPUFF Run for the Dry Fork Station Project
DF_DepPst.*	POSTUTIL Run for S and N Deposition
DF_VisPst.*	POSTUTIL Run for Visibility
DF_BL-*.*	CALPOST Run for Badlands NP (N=NO2, ND=N Dep, P=PM10, S=SO2, SD=S Dep, V=Visibility
DF_WC-*.*	CALPOST Run for Wind Cave NP (N=NO2, ND=N Dep, P=PM10, S=SO2, SD=S Dep, V=Visibility
DF_NR-*.*	CALPOST Run for Northern Cheyenne Indian Reservation (N=NO2, ND=N Dep, P=PM10, S=SO2, SD=S Dep, V=Visibility
DF_DT-*.*	CALPOST Run for Devils Tower (N=NO2, ND=N Dep, P=PM10, S=SO2, SD=S Dep, V=Visibility
\Final_2003\Cumulative	CALPUFF, POSTUTIL, and CALPOST Files for 2003 (Cumulative)
DF_*.*	CALPUFF Runs (DF=Dry Fork, MT=Montana, ND=N.Dakota, WY=Wyoming, CS3=Colstrip 3-hour, CS24=Colstrip 24-hour
CALSUM_3hr.*	CALSUM for 3-Hour Impacts
CALSUM_24hr.*	CALSUM for 24-Hour Impacts
Pst_NRC3_SO2.*	CALPOST Run for 3-Hour SO2 Impacts at N. Cheyenne
Pst_NRC24_SO2.*	CALPOST Run for 24-Hour SO2 Impacts at N. Cheyenne

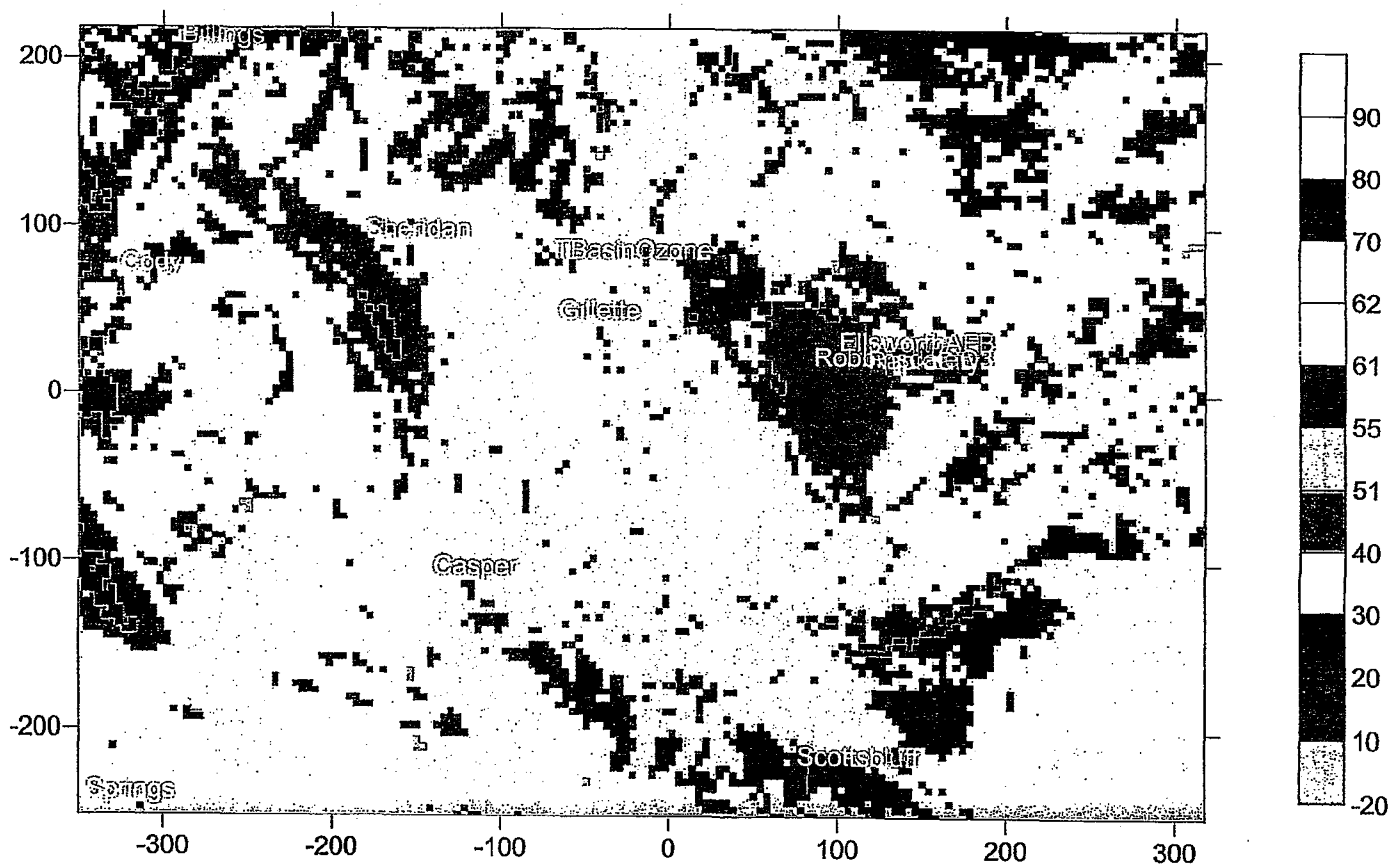
DEQ/AQD 000438

Basin Dry Fork Land Use Plot (Cumulative CALMET Grid)



DEQ/AQD 000439

Basin Wyo Land Use Plot (Base CALMET Grid)



DEQ/AQD 000440

Table 6-6
Default CALMET Land Use Categories and Associated Geophysical Parameters
Based on the U.S. Geological Survey Land Use Classification System
(14-Category System)

Land Use Type	Description	Surface Roughness (m)	Albedo	Bowen Ratio	Soil Heat Flux Parameter	Anthropogenic Heat Flux (W/m²)	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
51	Small Water Body	0.001	0.10	0.0	1.0	0.0	0.0
54	Bays and Estuaries	0.001	0.01	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	0.70	0.5	.15	0.0	0.0

* Negative values indicate "irrigated" land use

SEE MAP:

Figure 7-1
Emission Sources and Structures

Dry Fork Station
Gillette Wyoming

SEE MAP:

Figure 7-5
Ambient Boundary and Landfill Sources

Dry Fork Station
Gillette Wyoming