APPENDIX B

EAGLE ROCK ENRICHMENT FACILITY
DISPERSION MODELING FOR CONSTRUCTION SITE PREPARATION ACTIVITIES

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1.0 INTRODUCTION

Refined dispersion modeling was performed in order to demonstrate that air quality impacts from construction site preparation activities at the proposed Eagle Rock Enrichment Facility (EREF) will not cause exceedances of any National Ambient Air Quality Standards (NAAQS) (CFR, 2008a). The dispersion modeling analysis includes combustion sources, such as support vehicles and construction equipment and fugitive dust generated by activity on unpaved surfaces onsite. This report describes the specific dispersion modeling methods and procedures used in this analysis, which is consistent with the Environmental Protection Agency (EPA) Guideline on Air Quality Models (40 CFR Part 51, Appendix W (CFR, 2008b) and with other modeling guidance. Air quality impacts from the construction activity were determined for the following criteria air pollutants: carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2) and particulate matter (PM_{10} and $PM_{2.5}$). There are no NAAQS for hydrocarbon emissions. As such, hydrocarbon emissions are not included in this Appendix B. Hydrocarbon emissions are discussed in Section 4.6, Air Quality Impacts.

2.0 SITE DESCRIPTION

The proposed EREF is located along Route 20 approximately 300 km (186 mi) east of Boise, Idaho. The topography of the site is primarily flat in relation to the property line receptors and the construction site preparation area. Even though the terrain is unlikely to have a significant effect on plume transport and dispersion, terrain elevations were included in the modeling analysis.

3.0 MODELING METHODOLOGY

3.1 SELECTION OF DISPERSION MODEL

For this modeling analysis, the latest version of the EPA's AERMOD modeling system (version 07026) (EPA, 2008a) was used. AERMOD is a refined, steady-state, multi-source, Gaussian dispersion model that is EPA's preferred model for a wide range of regulatory applications in all types of terrain.

The AERMOD modeling system also includes the following major components:

- AERMET – The AERMOD system's general purpose meteorological preprocessor that organizes and processes meteorological data and estimates the boundary layer parameters necessary for dispersion calculations.
- AERMAP – The AERMOD system's terrain preprocessor module that processes digitized terrain elevation data files to produce terrain base elevations and hill height scale values for each receptor.
- AERSURFACE – A recently developed tool to aid in obtaining realistic and reproducible surface characteristic values for albedo, Bowen ratio, and surface roughness length for AERMET.

All modeling was performed using AERMOD's regulatory default option.

3.2 METEOROLOGICAL DATA AND SURFACE CHARACTERISTICS

The AERMOD modeling analysis was performed using five years (1988-1992) of hourly surface meteorological data from the National Weather Service (NWS) station at Pocatello Municipal Airport in Pocatello, Idaho and concurrent upper air sounding data collected at the Boise

International Airport in Boise, Idaho. The Pocatello Airport surface data for this period are readily available from EPA's Support Center for Regulatory Atmospheric Modeling (SCRAM) website (EPA, 2008b).

Pocatello Airport is located 77 km (48 mi) south of the EREF and both sites are characterized by predominantly rural surroundings with no significant nearby terrain influences. Therefore, the surface data collected at Pocatello Airport was adequately representative to conduct the modeling analysis to evaluate maximum impacts at the EREF site. For the upper air data, Boise Airport was the closest available data and therefore was used in this analysis.

AERMOD requires more detailed meteorological information than predecessor regulatory air quality models. In addition to surface meteorological and upper air sounding data, the AERMET preprocessor also requires values of surface characteristics, including albedo, Bowen ratio, and surface roughness length, that are representative of conditions in the vicinity of the meteorological tower. To aid modelers in obtaining realistic and reproducible surface characteristic values, the AERSURFACE tool was developed by EPA. AERSURFACE requires the input of land cover data from the U.S. Geological Survey (USGS) National Land Cover Data 1992 (NLCD92) archives (USGS, 2008a) in order to identify the land cover for a specific location. Values of surface characteristics are then calculated based on the land cover data for the study area.

An AERSURFACE analysis was performed for the Pocatello Airport location. Seasonal surface characteristics were determined for each of twelve 30-degree sectors. Seasonal categories were assigned as follows, using AERSURFACE's default setting:

- "Midsummer" – June, July, August
- "Autumn" – September, October, November
- "Late Autumn/Winter without continuous snow on ground" – December, January, February
- "Transitional spring" – March, April, May.

The site was also identified as an airport site so that the calculated surface characteristics reflect an area more dominated by transportation land cover. In addition, the airport site was noted to be in an arid region and the modeled five years of meteorological data as having a site surface moisture drier than other years when compared to the last 30 years. As recommended in EPA's AERMOD Implementation Guide (revised January 9, 2008) (EPA, 2008c), an upwind distance of 1 km (0.62 mi) was used to determine the effective surface roughness values for input to AERMET. A domain of 10 km (6.2 mi) by 10 km (6.2 mi) was used for the determination of albedo and Bowen ratio.

3.3 LAND USE CLASSIFICATION

AERMOD contains algorithms for evaluating dispersion for source locations in both urban and rural areas. Based on the land use classification procedure described in the AERMOD modeling guidelines and on a review of topographic maps and aerial photographs, the land use in the area within 3 km (1.9 mi) of the EREF is predominantly rural. Therefore, AERMOD was run using the rural dispersion option.

3.4 EMISSION SOURCE DATA

The refined AERMOD dispersion modeling analysis for the construction site preparation activities included vehicle exhaust and fugitive dust generation. Fugitive dust is caused by vehicle traffic on unpaved surfaces, earth moving, excavating and bulldozing and to a lesser extent from wind erosion. Emission rates from vehicle exhaust and fugitive dust were estimated for a 10-hour workday assuming peak construction activity levels would be maintained throughout the day. Refined modeling was also conducted assuming peak construction activity would occur five days per week for the entire calendar year with no activity on weekends. For convenience, all model runs were performed assuming a unit emission rate of 1.0 g/s (7.9 lb/hr). Actual pollutant concentrations were then determined by multiplying the normalized AERMOD results by the actual emission rate of each pollutant. Construction activity was modeled as if emitted uniformly over the entire construction site area. Emission factors and assumptions specific to each of these two sources are discussed separately in the following sections.

Vehicle Exhaust

Vehicles that will be operating on the site during construction consist of support vehicles and construction equipment. The support vehicles will include fifty pickup trucks, forty gators (gas-powered carts), three fuel trucks, four stakebody trucks and three mechanic's trucks. Emission factors in MOBILE6.2 (EPA, 2003) were used to estimate emissions of carbon monoxide and nitrogen oxides for these vehicles. Use of MOBILE6.2 requires that highway mobile sources be categorized by vehicle size. The gators were assumed to be Light Duty Vehicles, the pickup trucks and the mechanic's trucks Category I Light Duty Trucks, the stakebody trucks Category II Light Duty Trucks and the fuel trucks were assumed to be Heavy Duty Trucks. Baseline emission factors for each of the vehicle categories were provided in MOBILE6.2 as a function of the calendar year. Emission factors used included vehicle model years for the last 25 years.

It was assumed that each of the support vehicles would be in use each workday and would travel an average of 16.1 km (10 mi) per day around the construction site. Emission rates (in g/s) for the entire workday for each vehicle were estimated by multiplying the MOBILE6.2 emission factor (in g/mile) by 16.1 km (10 mi) and dividing by the number of seconds in the workday (36,000). Table B-1, Support Vehicle Emission Rates, presents the emission factors used and the resulting emission rates for the support vehicles. The differences in the emission factors provided for the EREF in ER Table B-1 and the emission factors provided for the NEF in their ER Table B-1 are due to differences in the information contained in the referenced models (i.e., MOBILE6.2 for EREF and AP-42 for NEF). U.S. EPA and Idaho Department of Environmental Quality (IDEQ) currently require the use of MOBILE6.2.

The construction equipment that will be operating on the site during peak construction consists of five bulldozers, four graders, five pans (diesel-powered fill transporters), twenty dump trucks, nine backhoes, eight loaders, six rollers, four water trucks, five telehandelers, 16 manlifts, nine track drills, three 25-ton cranes and four cranes at 250-ton or greater, three concrete pump trucks, nine concrete delivery trucks and one tractor. Emission factors, in units of grams per hour of operation, provided in MOBILE6.2 for diesel-powered construction equipment, were compiled. The emission rates used in this modeling analysis are shown in Table B-2, Emission Rates for All Construction Vehicles, along with the number of pieces of equipment used onsite during construction activities. In calculating emissions, it was conservatively assumed that all the equipment shown in Table B-2 would be in continuous operation throughout the 10-hour workday.

Fugitive Dust

Fugitive dust emissions are dependent on the area of land being worked on and also the level of construction vehicle operations occurring at any given time. A fugitive dust emission factor of 2.69 Mg per hectare (1.2 tons per acre) per month of construction activity is provided in AP-42 (EPA, 2008d) for heavy construction operation activities. This factor includes all site-related sources of particulates. The value is most applicable to construction sites with: (1) medium activity level, (2) moderate silt content and (3) a semi-arid climate.

The AP-42 emission factor applies to total suspended particulates (TSP), whereas the NAAQS for particulates applies to PM_{10} (i.e., particles 10 µm or less in size) and $PM_{2.5}$ (i.e., particles 2.5 µm or less in size). Based on particle size multipliers presented in AP-42 for fugitive dust sources, a correction factor of 0.5 was applied to the TSP construction emission factor in order to determine the PM_{10} emission factor. Similarly, AP-42 provides an adjustment factor to determine the amount of $PM_{2.5}$ present in the fugitive dust. Based on AP-42, a correction factor of 0.15 was applied to the PM_{10} emission factor to make the adjustment to $PM_{2.5}$. Therefore, a correction factor of 0.08 (i.e., 0.5 x 0.15 = 0.08) was applied to the TSP construction emission factor to obtain $PM_{2.5}$.

Since the derivation of the AP-42 emission factor assumed construction activity on 30 days per month, a second correction factor to account for actual number of workdays was applied. The average number of workdays per month will be 21.4 (4 major holidays were excluded). The second correction factor that was used is 21.4/30 or 0.71.

The AP-42 emission factor also assumes uncontrolled emissions, whereas the EREF construction site will undergo watering for dust suppression. Water conservation will be considered when deciding how often dust suppression sprays will be applied. The EPA suggests that a twice-daily watering program will reduce dust emissions by up to 90%. Therefore, a third correction factor of 0.1 was applied to the AP-42 emission factor to account for fugitive dust controls.

An additional factor to account for the high silt content of the site soil was also included since AP-42 considers moderate silt content in the emission factor value. Since the site soil silt content is estimated to be approximately 70% and the fact that moderate silt content used in the AP-42 emission factor is defined to be about 30%, a silt content correction factor was established by taking the ratio of the “high to moderate” silt content. Therefore, a correction factor for silt content that was used is 70% / 30% = 2.3.

The workday emission rate (in g/s) was calculated assuming approximately 75 hectares (185 acres) of the construction site would be under construction at any given time and that emissions occur entirely within the 10-hour workday. This workday emission rate was assumed to occur 214 hours per month (i.e., 21.4 average work days/month x 10-hour work day) for the entire year.

The resulting estimate of workday emission rate for PM_{10} was determined to be 21.8 g/s (172.7 lb/hr) and 3.3 g/s (25.9 lb/hr) for $PM_{2.5}$ emissions.

3.5 RECEPTORS

Sixty-two property line receptors were selected for the refined modeling analysis to determine the maximum air quality impacts caused by construction site preparation activity.

The AERMAP terrain preprocessor was used to define the receptor terrain elevations based on USGS Digital Elevation Model (DEM) data (USGS, 2008b). The DEM data consist of arrays of regularly spaced elevations and correspond to the 7.5-minute (1:24,000 scale) topographic quadrangle map series. The points in the elevation data arrays are spaced at approximately 30-m (98-ft) intervals and were interpolated by AERMAP to determine the elevation at each defined receptor. AERMAP also computes the hill height scale associated with each receptor to estimate the influence of complex terrain. The AERMAP processing domain was selected to cover all property line receptors and included any important terrain features located onsite.

3.6 BACKGROUND AIR QUALITY CONCENTRATIONS

In order to demonstrate that the construction site preparation activities comply with the applicable NAAQS concentration levels, maximum predicted air quality impacts for each pollutant must be added to representative background air quality concentrations that represent the contribution from all un-modeled emissions sources. Background concentrations must be obtained for each pollutant and each averaging period for which an NAAQS exists.

There is a network of air pollutant monitoring sites throughout the State of Idaho. The nearest monitoring sites to the EREF are located in Pocatello, Idaho, where multiple monitoring sites are in operation for most of the criteria pollutants. Because of the general proximity of the Pocatello monitors to the EREF site, the air quality data at these sites will be assumed to be representative of air quality at the EREF site. For criteria pollutants not monitored in Pocatello, the next closest monitoring location was selected. In order to determine background concentrations for the modeling analysis, monitoring data reports for the most recent two years (2006 and 2007) were obtained from EPA's AirData website (EPA, 2008).

Table B-3, Background Air Quality Concentrations for AERMOD Modeling Analysis, summarizes the monitored concentration data that were used in the background analysis and presents the calculated background concentrations that were used in the AERMOD modeling analysis. Because the NAAQS typically allow for a single exceedance of a short-term (24-hour average or less) standard without causing a violation, the short-term background concentrations for CO and SO_2 are based on the second-highest concentration measured at each monitor during each year. The higher of the two second-highest values was selected as the background concentration. In addition, based on modeling guidelines, the 24-hour average background concentrations for PM_{10} are based on the 3rd highest concentration measured over the two-year period and $PM_{2.5}$ are based on the 98th percentile monitored concentration (i.e., 98 percent of the monitored concentrations are less than that value).

4.0 MODELING RESULTS AND CONCLUSIONS

The results of the air quality impact AERMOD dispersion modeling analysis for the EREF construction site preparation activities are presented in Table B-4, Results of Air Quality Impact AERMOD Dispersion Modeling for EREF Construction Site Preparation Activity. All predicted concentrations shown in Table B-4 include an ambient background level noted in Table B-3.

As shown in Table B-4, the maximum predicted one- and eight-hour CO concentrations for the EREF construction site preparation were 4.6 ppm and 2.1 ppm, respectively. All CO concentrations were generated by vehicle exhaust from support vehicles and construction equipment utilized onsite. None of the modeled CO concentrations exceed the NAAQS noted in Table B-4.

The maximum predicted annual NO_2 concentration was estimated to be 11.6 μg/m^3. As with CO concentrations, all NO_2 concentrations were generated from vehicle exhaust and do not exceed the NAAQS.

For SO_2 concentrations, the estimated maximum annual concentration was 15.7 μg/m^3, 63.4 μg/m^3 for the 24-hour averaging period and 163.1 μg/m^3 for the 3-hour averaging period. SO_2 concentrations were generated by vehicle exhaust from construction equipment. None of the predicted SO_2 concentrations exceeded the NAAQS.

PM_{10} concentrations were mainly generated by fugitive dust caused by construction activity. To a lesser extent, vehicle exhaust from construction equipment contributed to the PM_{10} concentrations. As can be seen in Table B-4, the maximum predicted annual PM_{10} concentration was 25.8 μg/m^3 while the 24-hour PM_{10} concentration was estimated to be 150 μg/m^3. The 24-hour PM_{10} concentration is at the NAAQS but does not exceed the limit noted in Table B-4. The NAAQS for the annual averaging period was revoked in 2006 and therefore does not apply.

Similarly, predicted maximum $PM_{2.5}$ annual concentrations were estimated to be 7.1 μg/m^3 and the 24-hour concentration was 30 μg/m^3. These concentrations do not exceed the annual and 24-hour NAAQS shown in Table B-4. Fugitive dust generated by construction activity and vehicle exhaust are both contributors to the $PM_{2.5}$ concentrations.

5.0 REFERENCES

CFR, 2008a. Title 40, Code of Federal Regulations Part 50, National primary and secondary ambient air quality standards, 2008.

CFR, 2008b. Title 40 Code of Federal Regulations Part 51, Appendix W, Guideline of Air Quality Models, 2008.

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USGS, 2008a. Land Cover Data 1992 (NLCD92), U.S. Geological Survey, Website: http://edcftp.cr.usgs.gov/pub/data/landcover/states, Date accessed: August 2008.

USGS, 2008b. U.S. Geological Survey Digital Elevation Model (DEM) Data obtained from WEBGIS, Website: http://www.webgis.com/terr_pages/terr_dem75_id.html, Date accessed: August 2008.

Table B-1 Support Vehicle Emission Rates
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Vehicle Type	Emission Factor g/km (g/mi)	Number	Daily Mileage km (mi)	Daily Emissions g (lb)	Workday Emission Rate g/s (lb/hr)
CARBON MONOXIDE:					
Light Duty Vehicles	13.31 (21.413)	40	16.1 (10)	8,572 (18.90)	0.23810 (1.8897)
Light Duty Truck I	15.55 (25.031)	53	16.1 (10)	13,269 (29.25)	0.36858 (2.9253)
Light Duty Truck II	15.60 (25.101)	4	16.1 (10)	1,005 (2.22)	0.02791 (0.2215)
Heavy Duty Truck	2.80 (4.503)	3	16.1 (10)	135 (0.30)	0.00376 (0.0298)
Total				**22,981 (50.67)**	**0.63835 (5.0663)**
NITROGEN OXIDES:					
Light Duty Vehicles	0.66 (1.067)	40	16.1 (10)	425 (0.94)	0.01807 (0.1434)
Light Duty Truck I	0.69 (1.112)	53	16.1 (10)	589 (1.30)	0.01636 (0.1298)
Light Duty Truck II	0.88 (1.419)	4	16.1 (10)	57 (0.13)	0.00157 (0.0125)
Heavy Duty Truck	5.82 (9.371)	3	16.1 (10)	281 (0.62)	0.09370 (0.7437)
Total				**1,352 (2.99)**	**0.12970 (1.0294)**

Table B-2 Emission Rates for All Construction Vehicles
(Page 1 of 1)

Equipment	Number	Work Day Emission Rate in g/s (lb/hr)			
		Carbon Monoxide	Nitrogen Oxides	Sulfur Oxides	Particulates
Wheeled Tractor	1	0.0055 (0.0437)	0.0147 (0.1164)	0.0009 (0.0071)	0.0001 (0.0010)
Grader	4	0.0214 (0.1701)	0.0567 (0.4500)	0.0035 (0.0275)	0.0006 (0.0044)
Pans	5	0.0233 (0.1846)	0.0582 (0.4622)	0.0038 (0.0301)	0.0006 (0.0050)
Wheeled Loader	8	0.0440 (0.3496)	0.1174 (0.9316)	0.0071 (0.0567)	0.0010 (0.0079)
Bulldozer	5	0.0797 (0.6327)	0.0478 (0.3797)	0.0071 (0.0563)	0.0019 (0.0148)
Dump-Truck	20	0.3189 (2.5309)	0.1914 (1.5190)	0.0284 (0.2253)	0.0075 (0.0593)
Roller	6	0.0051 (0.0406)	0.1508 (1.1971)	0.0070 (0.0556)	0.0017 (0.0133)
Water Truck	4	0.0220 (0.1748)	0.0587 (0.4658)	0.0036 (0.0284)	0.0005 (0.0039)
Backhoes	9	0.0364 (0.2894)	0.0941 (0.7490)	0.0062 (0.0490)	0.0013 (0.0102)
25 Ton Crane	3	9.0371 (0.2945)	0.0954 (0.7571)	0.0040 (0.0321)	0.0010 (0.0081)
+250 Ton Crane	4	0.0638 (0.5062)	00383 (0.3038)	0.0057 (0.0451)	0.0015 (0.0119)
Manlifts	16	1.1185 (8.8774)	0.0613 (0.4868)	0.0021 (0.0163)	0.0002 (0.0014)
Telehandelers	5	0.3495 (2.7742)	0.0192 (0.1521)	0.0006 (0.0051)	0.0001 (0.0004)
Concrete Trucks	9	0.1435 (1.1389)	0.0861 (0.6835)	0.0128 (0.1014)	0.0034 (0.0267)
Concrete Pump Trucks	3	0.0161 (0.1276)	0.0425 (0.3875)	0.0026 (0.0206)	0.0004 (0.0033)
Miscellaneous (Track Drills)	9	0.6292 (4.9935)	0.0345 (0.2738)	0.0012 (0.0092)	0.0001 (0.0008)
Total	**111**	**2.9141 (23.1285)**	**1.1672 (9.2634)**	**0.0965 (0.7658)**	**0.0217 (0.1725)**

Table B-3 Background Air Quality Concentrations for AERMOD Modeling Analysis (Page 1 of 1)

Pollutant	Averaging Period	Closest Selected Station	Ambient Background Concentration 2006	Ambient Background Concentration 2007	Selected Background Concentration
Carbon Monoxide	1-Hour	Eastman Bldg/ 166 N. 9th St. Boise, Idaho Site ID 160010014	3.5 ppm	4.3 ppm	4.3 ppm
	8-Hour		2.1 ppm	1.6 ppm	2.1 ppm
Nitrogen Dioxide	Annual	N. of Lancaster Rd. Hayden, Idaho Site ID 16055003	11.3 μg/m^3	11.3 μg/m^3	11.3 μg/m^3
Sulfur Dioxide	3-Hour	Stp/Batiste & Chubbuck Rd. Pocatello, Idaho Site ID 160050004	159.7 μg/m^3	133.5 μg/m^3	159.7 μg/m^3
	24-Hour		62.8 μg/m^3	62.8 μg/m^3	62.8 μg/m^3
	Annual		13.1 μg/m^3	15.7 μg/m^3	15.7 μg/m^3
Particulates -PM_{10}	24-Hour	G&G/Corner of Garret & Gould Pocatello, Idaho Site ID 160050015	52 μg/m^3	45 μg/m^3	52 μg/m^3
	Annual		21 μg/m^3	22 μg/m^3	22 μg/m^3
Particulates -$PM_{2.5}$	24-Hour	G&G/Corner of Garret & Gould Pocatello, Idaho Site ID 160050015	21 μg/m^3	No Data Available	21 μg/m^3
	Annual		6.4 μg/m^3	No Data Available	6.4 μg/m^3

Source: EPA, 2008e.

Table B-4 Results of Air Quality Impact AERMOD Dispersion Modeling for EREF Construction Site Preparation Activity (Page 1 of 1)

Pollutant	Averaging Period	Standard	Modeled Maximum Concentration	Units	Exceedance
Carbon Monoxide (CO)	8-Hour	9 ppm	2.1	ppm	No
	1-Hour	35 ppm	4.6	ppm	No
Nitrogen Dioxide (NO_2)	Annual	100 μg/m^3	11.6	ug/m^3	No
Sulfur Dioxide (SO_2)	Annual	80 μg/m^3	15.7	ug/m^3	No
	24-Hour	365 μg/m^3	63.4	ug/m^3	No
	3-Hour	1300 μg/m^3	163.1	ug/m^3	No
Particulate Matter -PM_{10}	Annual	Revoked 2006	25.8	ug/m^3	Not Applicable
	24-Hour	150 μg/m^3	150.0	ug/m^3	No
Particulate Matter - $PM_{2.5}$	Annual	15 μg/m^3	7.1	ug/m^3	No
	24-Hour	35 μg/m^3	30.0	ug/m^3	No

Note: All Modeled Maximum Concentrations include an ambient background concentration (see Table B-3).