# Appendix K


San Juan Power Plant
Shiprock
The Hogback
San Juan River
Morgan Lake
Four Corners Power Plant
Navajo Nation
Chaco River

# APPENDIX K

## Air Quality Technical Information

# APPENDIX K

# AIR QUALITY TECHNICAL SUPPORT DOCUMENT

## 1.0 Introduction

This Air Quality Technical Support Document (TSD) was prepared by URS Corporation and supports the air quality impacts analysis summarized in Section 4.1 of the Environmental Impact Statement (EIS) for the Desert Rock Energy Project (DREP) prepared pursuant to the National Environmental Policy Act (NEPA) of 1969 (URS 2007). This TSD provides a broader explanation of the analysis procedures used and greater detail with regard to the results. It is assumed that the reader is generally familiar with the proposed project, the format of the EIS, and federal regulations pertaining to ambient air quality, PSD permitting and the design and operation of coal-fired power plants.

## 2.0 Impact Assessment Methodology

## 2.1 General Discussion

Information contained within the air quality permit applications prepared by others, pursuant to the Prevention of Significant Deterioration (PSD) program regulations under the federal Clean Air Act for the Desert Rock Energy Project (Proposed Action B) and the Cottonwood Energy Center (Alternative Action C) were a significant source of technical data pertaining to the design, operation and ambient air quality impacts of the power plant and associated mining operations. However, PSD permit applications are not required to, and traditionally do not, address other air quality impacts associated with the proposed project which must be evaluated under NEPA requirements. Such other impacts include air pollutant emissions resulting from construction activity and workers commuting to and from the project site. In addition, the PSD regulations do not address emissions of hazardous air pollutant (HAP) emissions resulting from the combustion of coal in the boilers at the power plant. Therefore, this TSD presents the impacts analysis for all of these air pollutant sources associated with the proposed and alternate actions.

The air quality permit applications and associated modeling reports for both the 1,500 megawatt (MW) and 550 MW alternatives, which were prepared pursuant to the Federal Prevention of Significant Deterioration (PSD) program, were used as resource information to prepare this EIS. Use of these two documents presented a challenge during preparation of this EIS. The federal PSD program requires analysis of the proposed emission source, including the power plant and mine operations only; an analysis of the impacts of project construction and mobile source emissions associated with each project was not required.  Furthermore, each permit application was prepared for a different facility at different times by different consultants, and may have involved different permitting agency personnel. Consequently, the presentation of analysis methodologies, results and conclusions presented in the application for each project is not consistent with the other.

## 2.2 Designation of Impact Levels

For purposes of the air quality impact analysis, the following qualitative terms described the potential impacts levels associated with construction projects of the magnitude of the proposed action:

- *Major* – Ambient air quality is permanently degraded, as a direct result of the proposed action, to the extent that re-designation of the project area by the USEPA, with respect to one or more of the NAAQS pollutants, from “attainment” or “unclassified” to “non-attainment” is possible; an air quality degradation increment, applicable to attainment and unclassified areas under the Federal Prevention of Significant Deterioration (PSD) program regulations, will be consistently exceeded; regional haze is consistently worsened by 5 percent visibility extinction or more; or cumulative regional emissions increase cause one or more of the items above.

- *Moderate* – Discernible degradation of regional air quality that does not consistently exceed applicable NAAQS, PSD increments, or Federal/State visibility protection standards.
- *Minor* – Insignificant degradation of regional or local ambient air quality at levels less than 20 percent of applicable standards; temporary or transient emissions occurring within a defined time period.
- *Negligible* – Indiscernible or unmeasurable degradation of regional or local ambient air quality or visibility.
- *None* – No air pollutant emissions occur.

# 3.0 Environmental Consequences of Proposed Action Alternative B – 1,500 MW Facility

## 3.1 Construction Activity

URS estimated criteria pollutant emissions associated with construction activity, including fugitive dust due to earthmoving activity, vehicular traffic on roads, and particulate and gaseous pollutant emissions from gasoline and diesel fueled vehicles and equipment.

### 3.1.1 Earthmoving

#### 3.1.1.1 Sources

Fugitive dust emissions due to earthmoving will occur during construction of the power plant, access roads, well field, water supply pipeline and transmission lines.

#### 3.1.1.2 Emissions Estimation Methodology

Earthmoving activity associated with construction projects typically cause emissions of particulate matter, in the form of fugitive dust. For the DREP EIS, the estimation of a $PM_{10}$ emission rate considers the actual level of activity at the site and the effect of controls. For major cut and fill operations in desert soils (water well field and water pipeline), a generally accepted estimate of $PM_{10}$ is 0.42 tons/acre/month (MRI 1999). For general construction activity in desert soils (plant site, transmission lines and access road), a generally accepted estimate of $PM_{10}$ is 0.11 tons/acre/month of total PM (MRI 1999). These emission factors assume continuous application of water to disturbed earthen surfaces during active earthmoving activity. These emission and control factors were used to estimate the $PM_{10}$ emissions resulting from construction activity.

#### 3.1.1.3 Emissions

*Power Plant Site.* URS conservatively assumed that up to 120 acres of ground surface would undergo active earthmoving activity during the first three months of construction. The acres disturbed would then be reduced to 60 acres per month for months 4-6 and finally be reduced to 20 acres per month for the last eight months of the total 14-month earthmoving schedule. Maximum controlled $PM_{10}$ emissions from plant site construction are estimated to be 13.2 tons/month. Based on a 14-month earthmoving schedule, it is estimated that a maximum of 77.0 tons of $PM_{10}$ will be emitted during plant site construction.

*Water Well Field and Water Supply Pipeline.* URS conservatively assumed that twenty production wells will be installed within the well fields for either Water Supply sub-alternative B (proposed) or A. In addition, based on the anticipated geospatial arrangement of the wells, up to 4.75 miles of well field interconnection piping trenches with a width of 25 feet and 9.5 miles of two-track roadways with a width of 16 feet to access the work areas within the well field may be required. A total of 32.8 acres of work area was estimated for the well field associated with each Water Supply sub-alternative. For the preferred Water Supply sub-alternative B, no additional pipeline trenching or access roads would be required, due to the proximity of the wells and interconnection piping to the plant. Under Water Supply sub-alternative A, an additional twelve miles of water supply pipeline would be constructed along the utility corridor to bring the water to the plant site. Maximum controlled $PM_{10}$ emissions from the well field under either preferred Water Supply sub-alternative B or Water Supply sub-alternative A are estimated to be 13.8 tons/month. Based on a six-month earthmoving schedule, it is estimated that a maximum of 82.7 tons of $PM_{10}$ will be emitted during construction of the well field under either Water Supply sub-alternative. For the proposed sub-alternative A, no additional pipeline trenching or access roads would be required, due to the proximity of the wells and interconnection piping to the plant. Under sub-alternative A, an additional 12.4 miles of water supply pipeline would be constructed along the utility corridor to bring the water to the plant site. The adjoining access road would require four (4) months to build with not more than five (5) miles of 25-foot wide right of way. Maximum controlled $PM_{10}$ emissions from installation of the water supply pipeline, within the utility corridor under Water Supply sub-alternative A or within the transmission line corridor under Water Supply sub-alternative A, are estimated to be 15.8 tons/month. Based on a four-month earthmoving schedule, it is estimated that a maximum of 63.2 tons of $PM_{10}$ will be emitted during installation of the water supply pipeline under either Water Supply sub-alternative A.

*Transmission Lines.* The proposed transmission line includes segments A, C and D. Each segment will include five (5) 1-acre work areas per mile, to accommodate the construction of tower footings. In addition, it was assumed that a temporary 10-foot wide two-track road would be used along the full length of each segment, except for Segment D, which has pre-existing roads for access. Segment A is 8.3 miles long, with a total work area of 51.6 acres. Maximum controlled $PM_{10}$ emissions from construction of Segment A are estimated to be 5.7 tons/month. Based on a nine-month construction schedule, it is estimated that a maximum of 51.3 tons of $PM_{10}$ will be emitted during construction of Segment A. Segment C is 6 miles long, with a total work area of 38.5 acres. Maximum controlled $PM_{10}$ emissions from construction of Segment C are estimated to be 4.2 tons/month. Based on a nine-month construction schedule, it is estimated that a maximum of 37.8 tons of $PM_{10}$ will be emitted during construction of Segment C. Segment D is 10.8 miles long, with a total excavation work area of 57.0 acres. Maximum controlled $PM_{10}$ emissions from construction of Segment D are estimated to be 6.3 tons/month. Based on a nine-month construction schedule, it is estimated that a maximum of 56.5 tons of $PM_{10}$ will be emitted during construction of Segment D. A total of 145.7 tons of $PM_{10}$ will be emitted during construction of the proposed transmission line.

The sub-alternative transmission line includes Segments B, C and D. Segment B is 11.1 miles long, with a total work area of 68.9 acres. Maximum controlled $PM_{10}$ emissions from the construction of Segment B are estimated to be 7.6 tons/month. Based on a nine-month construction schedule, it is estimated that a maximum of 68.2 tons of $PM_{10}$ will be emitted during construction of Segment B. A total of 162.8 tons of $PM_{10}$ would be emitted during construction of the alternative transmission line.

*Access Road.* The access road will be approximately 2.25 miles long, with an average work area width of 75 feet, and a total project area of 20.28-acres. Maximum controlled $PM_{10}$ emissions from construction of the road are estimated to be 2.2 tons/month. Based on a twelve-month construction schedule, it is estimated that a maximum of 13.4 tons of $PM_{10}$ will be emitted during construction of the plant access road. The EIS does not identify any alternatives for the access road.

*Summary.* Table K-1 summarizes the estimated $PM_{10}$ emissions due to earthmoving activity from each phase of the proposed project. For the preferred sub-alternatives, the total maximum controlled $PM_{10}$ emissions from construction of the plant site, well field, transmission lines and access road are estimated to be 61.2 tons/month or 381.9 tons for the total project. The sub-alternative water supply system A would result in an additional 63.2 tons of $PM_{10}$ per year. The sub-alternative transmission line (Segments B, C and D) would result in an additional 17.1 tons of $PM_{10}$ per year.

**Table K-1**
**Alternative B - Particulate Matter ($PM_{10}$) Emissions Associated with Earthmoving During Construction of Plant Site, Water Conveyance System, Transmission Lines and Access Roads**

| Sub-alternative\Segment | Length (mile) | Work Area (acre)[1] | Projected Earthmoving Time (months) | $PM_{10}$ EF (tons/acre/month)[2] | Controlled $PM_{10}$ Emission (tons/month)[3] | Total Project Emissions (tons) |
|---|---|---|---|---|---|---|
| **Proposed Desert Rock Plant Site** | | | | | | |
| - | NA | 120.0 [4] | 14.0 | 0.11 | 13.2 | 77.0 |
| **Proposed Water Well Field** | | | | | | |
| Sub-alternative Area B | NA | 32.8 [5] | 6.0 | 0.42 | 13.8 | 82.7 |
| **Proposed Transmission Lines** | | | | | | |
| Segment A | 8.3 | 51.6 [6] | 9.0 | 0.11 | 5.7 | 51.3 |
| Segment C | 6.2 | 38.5 [6] | 9.0 | 0.11 | 4.2 | 37.8 |
| Segment D | 10.8 | 57.1 [6] | 9.0 | 0.11 | 6.3 | 56.5 |
| Subtotal | 25.3 | 147.2 | - | - | 16.2 | 145.7 |
| **Access Road** | | | | | | |
| - | 2.2 | 20.3 [7] | 6.0 | 0.11 | 2.2 | 13.4 |
| | | | | | | |
| **Total – Proposed Project** | | **320.3** | **-** | **-** | **61.2** | **381.9** |
| **Sub-alternatives** | | | | | | |
| Sub-alternative A Well Field | NA | 32.8 [5] | 6.0 | 0.42 | 13.8 | 82.7 |
| Sub-alternative A Water Supply Pipeline | 12.4 | 37.6 [8] | 4.0 | 0.42 | 15.8 | 63.2 |
| Subtotal | - | 70.4 | - | - | 29.6 | 145.8 |
| **Net Change (Water Supply System)** | | | | | **15.8** | **63.2** |
| Segment B Transmission Line [9] | 11.1 | 68.9 [6] | 9.0 | 0.11 | 7.6 | 68.2 |
| **Net Change (Transmission Line)** | | | | | **7.8** | **17.1** |

1 SOURCE: Preliminary DREP EIS Figure 2-1 Base map (URS 2007)
2 From Western Regional Air Partnership (WRAP) *Fugitive Dust Handbook, Chapter 3, Construction and Demolition,* November 2004; (downloaded from www.wrapair.org/forums/)
3 Controlled $PM_{10}$ Emission Rate = EF (tons/acre/month) x total acres
4 Plant Site work area was assumed to be not more than 120 acres per month for the first 3 months, 60 acres per month for months 4-6, and 20 acres per month for the remaining 8 months of the 14-month projected earthmoving schedule.
5 Assumes well spacing is ¼-mile apart requiring 4.75 miles of pipeline in series at a width of 25 feet (14.4 acres) and 9.5 miles of access roads with a width of 16 feet (18.4 acres).
6 Work Area acreages were estimated by assuming five 1-acre excavations for every mile of transmission line for footing construction along with a 10-foot wide two-track road equal to the length of the transmission line. Segment D has pre-existing roads for access and does not require the additional excavation for the two-track road.
7 Work Area acreage was taken form Figure 2-2 of the DREP EIS (URS, Draft 2006)
8 For Sub-alternative A Water Supply Pipeline would require the construction of 5 miles of adjoining access road with a right of way width of 25 feet and the 12.4 miles of pipeline for an estimated total of disturbed land to be 37.6 acres.
9 Alternative Transmission Segment B would replace just Transmission Line Segment A.

### 3.1.2 Tailpipe Emissions From Vehicles and Construction Equipment During Project Construction

#### 3.1.2.1 Sources

During construction, gasoline and diesel fueled vehicles and equipment will be operated, which generate gaseous and particulate tailpipe exhaust emissions.

#### 3.1.2.2 Emissions Estimation Methodology

Emission factors for off-highway diesel fueled vehicle/equipment were calculated following the method outlined in the USEPA report "Exhaust and Crankcase Emission Factors for Non-Road Engine Modeling-Compression-Ignition" (USEPA420-P-04-009, April 2004). For all such vehicles and equipment, Tier 1 emission factors were used. Emission factors for pickup trucks and crew cabs were obtained from the USEPA model MOBILE5, based on national averaged fleet conditions, at a speed of 15 miles per hour and an ambient temperature of 60 degrees Fahrenheit ($^{o}$F). Annual emissions for all diesel-fueled vehicles and equipment were calculated based on average engine horsepower for each type of vehicles and equipment, and an operating schedule of 10 hours/day, 6 days/week and 52 weeks/year. Annual emissions for gasoline-fueled pickup trucks and crew cabs were calculated based on a traveling distance of 10 miles/day during Power Plant construction, 25 miles/day during Access Road Construction, and 50 miles/day during transmission line and water conveyance system construction, all with an operating schedule of 6 days/week and 52 weeks/year. Table K-2 includes a typical roster of equipment to be used during construction of the proposed project. This table also presents the tailpipe emission factors for volatile organic compounds (VOC), carbon monoxide (CO), nitrogen oxides (NOx) and $PM_{10}$ from this equipment, which were used to calculate air pollution emission rates. Note that $PM_{10}$ and $SO_2$ emissions reflect the recent federally mandated sulfur content reduction in diesel fuel to 15 ppm (0.0015%) from approximately 500 ppm (0.05%).

URS conservatively assumed that the peak construction employment will be 1,700 and that employees will use "ride sharing" to get to and from the various jobsites. This "ride sharing" is assumed to reduce the number of gasoline-fueled commuting vehicles by 75% to 425. Emission factors for vans were obtained from a MOBILE5 run based on national averaged fleet conditions, at a speed of 15 miles per hour and an ambient temperature of 60 degrees Fahrenheit ($^{o}$F). Annual emissions were calculated based on a round-trip traveling distance of 50 miles/day (round-trip) with an operating schedule of 6 days/week, 52 weeks/year, for the duration of the 48-month construction.

#### 3.1.2.3 Emissions

Table K-3 summarizes the equipment and vehicle roster and estimated criteria pollutant emission rates for construction of the proposed power plant. Table K-4 summarizes the equipment and vehicle roster and estimated criteria pollutant emission rates for construction of the proposed water well field and water supply pipeline. Table K-5 summarizes the equipment and vehicle roster and estimated criteria pollutant emission rates for construction of the proposed transmission line. Table K-6 summarizes the equipment and vehicle roster and estimated criteria pollutant emission rates for construction of the proposed access road. Table K-7 summarizes the estimated criteria pollutant emission rates for construction worker commuting. Table K-8 summarizes the combined estimated tailpipe criteria pollutant emission rates for all vehicles and equipment used on all phases of construction for the proposed project.

## Table K-2

### Construction Vehicle and Equipment Tailpipe Emission Factors

| Equipment | SCC | Power (HP) | Load Factor | HC | | | | | CO | | | | | NOx | | | | | $PM_{10}$ | | | | | | BSFC | | | $SO_2$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | EFss [2] | TAF [3] | A Factor [4] | DF [5] | EF adj | EFss [2] | TAF [3] | A Factor [4] | DF [5] | EF adj | EFss [2] | TAF [3] | A Factor [4] | DF [5] | EF adj | EFss [2] | TAF [3] | A Factor [4] | DF [5] | $S_{PM}$ [6] | EF adj | BSFC | TAF | BSFC adj | EF[7] adj |
| 2-Ton Trucks | 2270002051 | 250 | 0.8 | 0.3085 | 1.05 | 0.036 | 1.018 | 0.33 | 0.7475 | 1.53 | 0.101 | 1.0505 | 1.20 | 5.5772 | 0.95 | 0.024 | 1.012 | 5.36 | 0.2521 | 1.23 | 0.473 | 1.2365 | 0.07405 | 0.30 | 0.367 | 1.01 | 0.37067 | 0.005 |
| 5-15 Ton Trucks | 2270002051 | 400 | 0.8 | 0.2025 | 1.05 | 0.036 | 1.018 | 0.22 | 1.306 | 1.53 | 0.101 | 1.0505 | 2.10 | 6.0153 | 0.95 | 0.024 | 1.012 | 5.78 | 0.2008 | 1.23 | 0.473 | 1.2365 | 0.07405 | 0.22 | 0.367 | 1.01 | 0.37067 | 0.005 |
| Sideboom (other) | 2270002081 | 500 | 0.59 | 0.2025 | 1.05 | 0.036 | 1.018 | 0.22 | 1.306 | 1.53 | 0.101 | 1.0505 | 2.10 | 6.0153 | 0.95 | 0.024 | 1.012 | 5.78 | 0.2008 | 1.23 | 0.473 | 1.2365 | 0.07405 | 0.22 | 0.367 | 1.01 | 0.37067 | 0.005 |
| Dozer (rubber tire) | 2270002063 | 850 | 0.59 | 0.2861 | 1.05 | 0.036 | 1.018 | 0.31 | 0.7642 | 1.53 | 0.101 | 1.0505 | 1.23 | 6.1525 | 0.95 | 0.024 | 1.012 | 5.92 | 0.1934 | 1.23 | 0.473 | 1.2365 | 0.07405 | 0.21 | 0.367 | 1.01 | 0.37067 | 0005 |
| Large Shovel | 2270002063 | 850 | 0.59 | 0.2861 | 1.05 | 0.036 | 1.018 | 0.31 | 0.7642 | 1.53 | 0.101 | 1.0505 | 1.23 | 6.1525 | 0.95 | 0.024 | 1.012 | 5.92 | 0.1934 | 1.23 | 0.473 | 1.2365 | 0.07405 | 0.21 | 0.367 | 1.01 | 0.37067 | 0.005 |
| Grader | 2270002048 | 600 | 0.59 | 0.2025 | 1.05 | 0.036 | 1.018 | 0.22 | 1.306 | 1.53 | 0.101 | 1.0505 | 2.10 | 6.0153 | 0.95 | 0.024 | 1.012 | 5.78 | 0.2521 | 1.23 | 0.473 | 1.2365 | 0.07405 | 0.30 | 0.367 | 1.01 | 0.37067 | 0.005 |
| Tractor / Backhoe / Loader | 2270002066 | 100 | 0.21 | 0.5213 | 2.29 | 0.036 | 1.018 | 1.22 | 2.3655 | 2.57 | 0.101 | 1.0505 | 6.39 | 5.5988 | 1.10 | 0.024 | 1.012 | 6.23 | 0.473 | 1.97 | 0.473 | 1.2365 | 0.09618 | 1.04 | 0.408 | 1.18 | 0.48144 | 0.006 |
| Welder / Air Compressor / Generator | 2270006025 | 300 | 0.43 | 0.3085 | 1.00 | 0.036 | 1.018 | 0.31 | 0.7475 | 1.00 | 0.101 | 1.0505 | 0.79 | 5.5772 | 1.00 | 0.024 | 1.012 | 5.64 | 0.2521 | 1.00 | 0.473 | 1.2365 | 0.07332 | 0.23 | 0.367 | 1.00 | 0.367 | 0.005 |
| Crane | 2270006015 | 400 | 0.43 | 0.2025 | 1.00 | 0.036 | 1.018 | 0.21 | 1.306 | 1.00 | 0.101 | 1.0505 | 1.37 | 6.0153 | 1.00 | 0.024 | 1.012 | 6.09 | 0.2008 | 1.00 | 0.473 | 1.2365 | 0.07332 | 0.16 | 0.367 | 1.00 | 0.367 | 0.005 |
| Bore / Drill Rig | 2270002033 | 400 | 0.43 | 0.2025 | 1.00 | 0.036 | 1.018 | 0.21 | 1.306 | 1.00 | 0.101 | 1.0505 | 1.37 | 6.0153 | 1.00 | 0.024 | 1.012 | 6.09 | 0.2008 | 1.00 | 0.473 | 1.2365 | 0.07332 | 0.16 | 0.367 | 1.00 | 0.367 | 0.005 |

NOTES:
A Factor = Relative Deterioration Factor
BSFC = Brake Specific Fuel Consumption
CO = Carbon Monoxide
DF = 1 + (A Factor) * (fraction of useful life expended)$^B$ where B equals 1 for diesel nonroad engines
Efss = Steady State Emission Factor (g/hp-hr)
EF adj = Adjusted Emission Factor (g/hp-hr) EF adj = Efss * TAF * DF
HC = Hydrocarbons
HP = Horsepower
NOx = Oxides of Nitrogen
$PM_{10}$ = particulate matter with aerodynamic diameter less than or equal to 10 micrometers
SCC = Source Classification Code
$SO_2$ = Sulfur Dioxide
TAF = Transient Adjustment Factor (unitless)

[1] Tier1 values are used for all equipment.
[2] EFss (steady-state) for Tier 1 are from Table A2 of the USEPA report "Exhaust and Crankcase Emission Factors for Non-Road Engine Modeling-Compression-Ignition," USEPA420-P-04-009, April 2004.
[3] TAF are from Table A3 of USEPA420-P-04-009, April 2004.
[4] A factors are from Table A4 of USEPA420-P-04-009, April 2004.
[5] DF values are calculated assuming half of the median life of a given piece or equipment.
[6] $S_{PM}$ are calculated assuming 0.0015% of sulfur content for the local diesel fuel (the Tier1 sulfur content)
[7] $SO_2$ emission factor calculation assumes diesel sulfur content of 0.001

## Table K-3

### Alternative B - Vehicle and Equipment Tailpipe Emissions During Plant Site Construction

| Vehicle/Equipment | Quantity | Months of use | Fuel | Average Engine Power (hp) | Unit of Emission Factors | Emission Factors [1, 2] | | | | | Maximum Annual Emissions (tons/year) [3, 4] | | | | | Total Emissions (tons) [3, 4] | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | VOC | CO | NOx | $PM_{10}$ | $SO_2$ | VOC | CO | NOx | $PM_{10}$ | $SO_2$ | VOC | CO | NOx | $PM_{10}$ | $SO_2$ |
| Trucks (2-ton) | 5 | 36 | Diesel | 250 | g/hp-hr | 0.33 | 1.20 | 5.36 | 0.30 | 0.005 | 1.42 | 5.16 | 23.05 | 1.27 | 0.02 | 4.25 | 15.49 | 69.15 | 3.82 | 0.06 |
| Trucks (5-15 tons) | 10 | 36 | Diesel | 400 | g/hp-hr | 0.22 | 2.10 | 5.78 | 0.22 | 0.005 | 2.98 | 28.88 | 79.56 | 3.01 | 0.07 | 8.93 | 86.63 | 238.67 | 9.02 | 0.20 |
| Sideboom | 6 | 20 | Diesel | 500 | g/hp-hr | 0.22 | 2.10 | 5.78 | 0.22 | 0.005 | 2.23 | 21.66 | 59.67 | 2.25 | 0.05 | 3.73 | 36.17 | 99.65 | 3.77 | 0.08 |
| Dozer | 6 | 14 | Diesel | 850 | g/hp-hr | 0.31 | 1.23 | 5.92 | 0.21 | 0.005 | 5.36 | 21.54 | 103.75 | 3.64 | 0.09 | 6.28 | 25.21 | 121.39 | 4.25 | 0.10 |
| Large Shovel | 0 | 14 | Diesel | 850 | g/hp-hr | 0.31 | 1.23 | 5.92 | 0.21 | 0.005 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Grader | 4 | 14 | Diesel | 600 | g/hp-hr | 0.22 | 2.10 | 5.78 | 0.30 | 0.005 | 1.79 | 17.33 | 47.73 | 2.45 | 0.04 | 2.09 | 20.27 | 55.85 | 2.86 | 0.05 |
| Tractor / Backhoe / Loader | 6 | 14 | Diesel | 100 | g/hp-hr | 1.22 | 6.39 | 6.23 | 1.04 | 0.006 | 2.51 | 13.18 | 12.86 | 2.14 | 0.01 | 2.93 | 15.42 | 15.05 | 2.51 | 0.02 |
| Welder / Air Compressor / Generator | 15 | 20 | Diesel | 300 | g/hp-hr | 0.31 | 0.79 | 5.64 | 0.23 | 0.005 | 4.86 | 12.15 | 87.35 | 3.49 | 0.08 | 8.12 | 20.30 | 145.88 | 5.83 | 0.13 |
| Crane | 4 | 20 | Diesel | 400 | g/hp-hr | 0.21 | 1.37 | 6.09 | 0.16 | 0.005 | 1.13 | 7.55 | 33.50 | 0.89 | 0.03 | 1.89 | 12.61 | 55.94 | 1.49 | 0.04 |
| Bore/Drill Rig | 0 | 14 | Diesel | 400 | g/hp-hr | 0.21 | 1.37 | 6.09 | 0.16 | 0.005 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Pickup Trucks and Crew Cabs | 12 | 36 | Gasoline | 200 | g/mile | 4.72 | 46.06 | 2.41 | 0.093 | 0.113 | 0.19 | 1.90 | 0.10 | 0.00 | 0.00 | 0.58 | 5.70 | 0.30 | 0.01 | 0.01 |
| **Total Emissions** | | | | | | | | | | | **22.48** | **129.35** | **447.57** | **19.15** | **0.39** | **38.81** | **237.80** | **801.87** | **33.57** | **0.70** |

NOTES:
VOC = volatile organic compounds
CO = carbon monoxide
NOx = nitrogen oxides
$PM_{10}$ = particulate matter with aerodynamic diameter less than or equal to 10 micrometers
$SO_2$ = sulfur dioxide
[1] Emission factors for off-highway diesel fueled vehicle/equipment were calculated following the method outlined in the USEPA report "Exhaust and Crankcase Emission Factors for Non-Road Engine Modeling-Compression-Ignition," USEPA420-P-04-009, April 2004. For all vehicles and equipment, Tier 1 emission factors were used.
[2] Emission factors for pickup trucks and crew cab were obtained from MOBILE5 run based on national averaged fleet conditions, at a speed of 15 miles per hour and an ambient temperature of 60 degrees Fahrenheit ($^oF$).
[3] Annual emissions for all diesel-fueled vehicle/equipment were calculated based on average engine horsepower for each type of vehicle/equipment, and an operating schedule of 10 hours/day, 6 days/week and 52 weeks/year.
[4] Annul emissions for pickup trucks and crew cab were calculated based on a traveling distance of 10 miles/day during Power Plant construction, 25 miles/day during Access Road Construction, and 50 miles/day during transmission line and water conveyance system construction, all with an operating schedule of 6 days/week and 52 weeks/year.

## Table K-4

### Alternative B - Vehicle and Equipment Tailpipe Emissions During Well Field and Pipeline Construction

| Vehicle/Equipment | Quantity | Months of use | Fuel | Average Engine Power (hp) | Unit of Emission Factors | Emission Factors [1, 2] | | | | | Maximum Annual Emissions (tons/year) [3, 4] | | | | | Total Emissions (tons) [3, 4] | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | VOC | CO | NOx | $PM_{10}$ | $SO_2$ | VOC | CO | NOx | $PM_{10}$ | $SO_2$ | VOC | CO | NOx | $PM_{10}$ | $SO_2$ |
| Trucks (2-ton) | 2 | 12 | Diesel | 250 | g/hp-hr | 0.33 | 1.20 | 5.36 | 0.30 | 0.005 | 0.57 | 2.07 | 9.22 | 0.51 | 0.01 | 0.57 | 2.07 | 9.22 | 0.51 | 0.01 |
| Trucks (5-15 tons) | 5 | 12 | Diesel | 400 | g/hp-hr | 0.22 | 2.10 | 5.78 | 0.22 | 0.005 | 1.49 | 14.44 | 39.78 | 1.50 | 0.03 | 1.49 | 14.44 | 39.78 | 1.50 | 0.03 |
| Sideboom | 2 | 12 | Diesel | 500 | g/hp-hr | 0.22 | 2.10 | 5.78 | 0.22 | 0.005 | 0.74 | 7.22 | 19.89 | 0.75 | 0.02 | 0.74 | 7.22 | 19.89 | 0.75 | 0.02 |
| Dozer | 2 | 6 | Diesel | 850 | g/hp-hr | 0.31 | 1.23 | 5.92 | 0.21 | 0.005 | 1.79 | 7.18 | 34.58 | 1.21 | 0.03 | 0.89 | 3.59 | 17.29 | 0.61 | 0.01 |
| Large Shovel | 1 | 6 | Diesel | 850 | g/hp-hr | 0.31 | 1.23 | 5.92 | 0.21 | 0.005 | 0.89 | 3.59 | 17.29 | 0.61 | 0.01 | 0.45 | 1.80 | 8.65 | 0.30 | 0.01 |
| Grader | 2 | 6 | Diesel | 600 | g/hp-hr | 0.22 | 2.10 | 5.78 | 0.30 | 0.005 | 0.89 | 8.66 | 23.87 | 1.22 | 0.02 | 0.45 | 4.33 | 11.93 | 0.61 | 0.01 |
| Tractor / Backhoe / Loader | 5 | 6 | Diesel | 100 | g/hp-hr | 1.22 | 6.39 | 6.23 | 1.04 | 0.006 | 2.09 | 10.98 | 10.72 | 1.79 | 0.01 | 1.04 | 5.49 | 5.36 | 0.89 | 0.01 |
| Welder / Air Compressor / Generator | 5 | 12 | Diesel | 300 | g/hp-hr | 0.31 | 0.79 | 5.64 | 0.23 | 0.005 | 1.62 | 4.05 | 29.12 | 1.16 | 0.03 | 1.62 | 4.05 | 29.12 | 1.16 | 0.03 |
| Crane | 1 | 12 | Diesel | 400 | g/hp-hr | 0.21 | 1.37 | 6.09 | 0.16 | 0.005 | 0.28 | 1.89 | 8.37 | 0.22 | 0.01 | 0.28 | 1.89 | 8.37 | 0.22 | 0.01 |
| Bore/Drill Rig | 2 | 12 | Diesel | 400 | g/hp-hr | 0.21 | 1.37 | 6.09 | 0.16 | 0.005 | 0.57 | 3.77 | 16.75 | 0.45 | 0.01 | 0.57 | 3.77 | 16.75 | 0.45 | 0.01 |
| Pickup Trucks and Crew Cabs | 4 | 12 | Gasoline | 200 | g/mile | 4.72 | 46.06 | 2.41 | 0.093 | 0.113 | 0.32 | 3.17 | 0.17 | 0.01 | 0.01 | 0.32 | 3.17 | 0.17 | 0.01 | 0.01 |
| **Total Emissions** | | | | | | | | | | | **11.26** | **67.02** | **209.75** | **9.43** | **0.19** | **8.43** | **51.81** | **166.52** | **7.02** | **0.15** |

NOTES:
VOC = volatile organic compounds
CO = carbon monoxide
NOx = nitrogen oxides
$PM_{10}$ = particulate matter with aerodynamic diameter less than or equal to 10 micrometers
$SO_2$ = sulfur dioxide
[1] Emission factors for off-highway diesel fueled vehicle/equipment were calculated following the method outlined in the USEPA report "Exhaust and Crankcase Emission Factors for Non-Road Engine Modeling-Compression-Ignition," USEPA420-P-04-009, April 2004. For all vehicles and equipment, Tier 1 emission factors were used.
[2] Emission factors for pickup trucks and crew cab were obtained from MOBILE5 run based on national averaged fleet conditions, at a speed of 15 miles per hour and an ambient temperature of 60 degrees Fahrenheit ($^oF$).
[3] Annual emissions for all diesel-fueled vehicle/equipment were calculated based on average engine horsepower for each type of vehicle/equipment, and an operating schedule of 10 hours/day, 6 days/week and 52 weeks/year.
[4] Annul emissions for pickup trucks and crew cab were calculated based on a traveling distance of 10 miles/day during Power Plant construction, 25 miles/day during Access Road Construction, and 50 miles/day during transmission line and water conveyance system construction, all with an operating schedule of 6 days/week and 52 weeks/year.

## Table K-5

### Alternative B - Vehicle and Equipment Tailpipe Emissions During Transmission Line Construction

| Vehicle/Equipment | Quantity | Months of use | Fuel | Average Engine Power (hp) | Unit of Emission Factors | Emission Factors [1, 2] | | | | | Maximum Annual Emissions (tons/year) [3, 4] | | | | | Total Emissions (tons) [3, 4] | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | VOC | CO | NOx | $PM_{10}$ | $SO_2$ | VOC | CO | NOx | $PM_{10}$ | $SO_2$ | VOC | CO | NOx | $PM_{10}$ | $SO_2$ |
| Trucks (2-ton) | 2 | 9 | Diesel | 250 | g/hp-hr | 0.33 | 1.20 | 5.36 | 0.30 | 0.005 | 0.57 | 2.07 | 9.22 | 0.51 | 0.01 | 0.43 | 1.55 | 6.92 | 0.38 | 0.01 |
| Trucks (5-15 tons) | 5 | 9 | Diesel | 400 | g/hp-hr | 0.22 | 2.10 | 5.78 | 0.22 | 0.005 | 1.49 | 14.44 | 39.78 | 1.50 | 0.03 | 1.12 | 10.83 | 29.83 | 1.13 | 0.03 |
| Sideboom | 6 | 9 | Diesel | 500 | g/hp-hr | 0.22 | 2.10 | 5.78 | 0.22 | 0.005 | 2.23 | 21.66 | 59.67 | 2.25 | 0.05 | 1.67 | 16.24 | 44.75 | 1.69 | 0.04 |
| Dozer | 2 | 9 | Diesel | 850 | g/hp-hr | 0.31 | 1.23 | 5.92 | 0.21 | 0.005 | 1.79 | 7.18 | 34.58 | 1.21 | 0.03 | 1.34 | 5.39 | 25.94 | 0.91 | 0.02 |
| Large Shovel | 0 | 9 | Diesel | 850 | g/hp-hr | 0.31 | 1.23 | 5.92 | 0.21 | 0.005 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Grader | 2 | 9 | Diesel | 600 | g/hp-hr | 0.22 | 2.10 | 5.78 | 0.30 | 0.005 | 0.89 | 8.66 | 23.87 | 1.22 | 0.02 | 0.67 | 6.50 | 17.90 | 0.92 | 0.02 |
| Tractor / Backhoe / Loader | 2 | 9 | Diesel | 100 | g/hp-hr | 1.22 | 6.39 | 6.23 | 1.04 | 0.006 | 0.84 | 4.39 | 4.29 | 0.71 | 0.00 | 0.63 | 3.29 | 3.22 | 0.54 | 0.00 |
| Welder / Air Compressor / Generator | 5 | 9 | Diesel | 300 | g/hp-hr | 0.31 | 0.79 | 5.64 | 0.23 | 0.005 | 1.62 | 4.05 | 29.12 | 1.16 | 0.03 | 1.22 | 3.04 | 21.84 | 0.87 | 0.02 |
| Crane | 0 | 9 | Diesel | 400 | g/hp-hr | 0.21 | 1.37 | 6.09 | 0.16 | 0.005 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bore/Drill Rig | 2 | 9 | Diesel | 400 | g/hp-hr | 0.21 | 1.37 | 6.09 | 0.16 | 0.005 | 0.57 | 3.77 | 16.75 | 0.45 | 0.01 | 0.43 | 2.83 | 12.56 | 0.33 | 0.01 |
| Pickup Trucks and Crew Cabs | 6 | | Gasoline | 200 | g/mile | 4.72 | 46.06 | 2.41 | 0.093 | 0.113 | 0.49 | 4.75 | 0.25 | 0.01 | 0.01 | 0.37 | 3.56 | 0.19 | 0.01 | 0.01 |
| **Total Emissions** | | | | | | | | | | | **10.48** | **70.98** | **217.52** | **9.04** | **0.20** | **7.86** | **53.23** | **163.14** | **6.78** | **0.15** |

NOTES:
VOC = volatile organic compounds
CO = carbon monoxide
NOx = nitrogen oxides
$PM_{10}$ = particulate matter with aerodynamic diameter less than or equal to 10 micrometers
$SO_2$ = sulfur dioxide
[1] Emission factors for off-highway diesel fueled vehicle/equipment were calculated following the method outlined in the USEPA report "Exhaust and Crankcase Emission Factors for Non-Road Engine Modeling-Compression-Ignition," USEPA420-P-04-009, April 2004. For all vehicles and equipment, Tier 1 emission factors were used.
[2] Emission factors for pickup trucks and crew cab were obtained from MOBILE5 run based on national averaged fleet conditions, at a speed of 15 miles per hour and an ambient temperature of 60 degrees Fahrenheit ($^oF$).
[3] Annual emissions for all diesel-fueled vehicle/equipment were calculated based on average engine horsepower for each type of vehicle/equipment, and an operating schedule of 10 hours/day, 6 days/week and 52 weeks/year.
[4] Annul emissions for pickup trucks and crew cab were calculated based on a traveling distance of 10 miles/day during Power Plant construction, 25 miles/day during Access Road Construction, and 50 miles/day during transmission line and water conveyance system construction, all with an operating schedule of 6 days/week and 52 weeks/year.

**Table K-6**

**Alternative B - Vehicle and Equipment Tailpipe Emissions During Access Road Construction**

| Vehicle/Equipment | Quantity | Months of Use | Fuel | Average Engine Power (hp) | Unit of Emission Factors | Emission Factors [1, 2] | | | | | Maximum Annual Emissions (tons/year) [3, 4] | | | | | Total Emissions (tons) [3, 4] | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | VOC | CO | NOx | $PM_{10}$ | $SO_2$ | VOC | CO | NOx | $PM_{10}$ | $SO_2$ | VOC | CO | NOx | $PM_{10}$ | $SO_2$ |
| Trucks (2-ton) | 5 | 6 | Diesel | 250 | g/hp-hr | 0.33 | 1.20 | 5.36 | 0.30 | 0.005 | 1.42 | 5.16 | 23.05 | 1.27 | 0.02 | 0.71 | 2.58 | 11.53 | 0.64 | 0.01 |
| Trucks (5-15 tons) | 5 | 6 | Diesel | 400 | g/hp-hr | 0.22 | 2.10 | 5.78 | 0.22 | 0.005 | 1.49 | 14.44 | 39.78 | 1.50 | 0.03 | 0.74 | 7.22 | 19.89 | 0.75 | 0.02 |
| Sideboom | 1 | 6 | Diesel | 500 | g/hp-hr | 0.22 | 2.10 | 5.78 | 0.22 | 0.005 | 0.37 | 3.61 | 9.94 | 0.38 | 0.01 | 0.19 | 1.80 | 4.97 | 0.19 | 0.00 |
| Dozer | 3 | 6 | Diesel | 850 | g/hp-hr | 0.31 | 1.23 | 5.92 | 0.21 | 0.005 | 2.68 | 10.77 | 51.87 | 1.82 | 0.04 | 1.34 | 5.39 | 25.94 | 0.91 | 0.02 |
| Large Shovel | 0 | 6 | Diesel | 850 | g/hp-hr | 0.31 | 1.23 | 5.92 | 0.21 | 0.005 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Grader | 5 | 6 | Diesel | 600 | g/hp-hr | 0.22 | 2.10 | 5.78 | 0.30 | 0.005 | 2.23 | 21.66 | 59.67 | 3.06 | 0.05 | 1.12 | 10.83 | 29.83 | 1.53 | 0.03 |
| Tractor / Backhoe / Loader | 5 | 6 | Diesel | 100 | g/hp-hr | 1.22 | 6.39 | 6.23 | 1.04 | 0.006 | 2.09 | 10.98 | 10.72 | 1.79 | 0.01 | 1.04 | 5.49 | 5.36 | 0.89 | 0.01 |
| Welder / Air Compressor / Generator | 5 | 6 | Diesel | 300 | g/hp-hr | 0.31 | 0.79 | 5.64 | 0.23 | 0.005 | 1.62 | 4.05 | 29.12 | 1.16 | 0.03 | 0.81 | 2.03 | 14.56 | 0.58 | 0.01 |
| Crane | 0 | 6 | Diesel | 400 | g/hp-hr | 0.21 | 1.37 | 6.09 | 0.16 | 0.005 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bore/Drill Rig | 0 | 6 | Diesel | 400 | g/hp-hr | 0.21 | 1.37 | 6.09 | 0.16 | 0.005 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Pickup Trucks and Crew Cabs | 8 | 6 | Gasoline | 200 | g/mile | 4.72 | 46.06 | 2.41 | 0.093 | 0.113 | 0.32 | 3.17 | 0.17 | 0.01 | 0.01 | 0.16 | 1.58 | 0.08 | 0.00 | 0.00 |
| **Total Emissions** | | | | | | | | | | | **12.23** | **73.84** | **224.32** | **10.99** | **0.20** | **6.11** | **36.92** | **112.16** | **5.49** | **0.10** |

NOTES:
VOC = volatile organic compounds
CO = carbon monoxide
NOx = nitrogen oxides
$PM_{10}$ = particulate matter with aerodynamic diameter less than or equal to 10 micrometers
$SO_2$ = sulfur dioxide
[1] Emission factors for off-highway diesel fueled vehicle/equipment were calculated following the method outlined in the USEPA report "Exhaust and Crankcase Emission Factors for Non-Road Engine Modeling-Compression-Ignition," USEPA420-P-04-009, April 2004. For all vehicles and equipment, Tier 1 emission factors were used.
[2] Emission factors for pickup trucks and crew cab were obtained from MOBILE5 run based on national averaged fleet conditions, at a speed of 15 miles per hour and an ambient temperature of 60 degrees Fahrenheit ($^oF$).
[3] Annual emissions for all diesel-fueled vehicle/equipment were calculated based on average engine horsepower for each type of vehicle/equipment, and an operating schedule of 10 hours/day, 6 days/week and 52 weeks/year.
[4] Annul emissions for pickup trucks and crew cab were calculated based on a traveling distance of 10 miles/day during Power Plant construction, 25 miles/day during Access Road Construction, and 50 miles/day during transmission line and water conveyance system construction, all with an operating schedule of 6 days/week and 52 weeks/year.

**Table K-7**

**Alternative B - Summary of Vehicle Tailpipe Emissions from Construction Work Force**

| Vehicle | Quantity[1] | Fuel | Average Engine Power (hp) | Unit of Emission Factors | Emission Factors (EF) [2] | | | | | Maximum Annual Emissions (TPY) [3] | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | VOC | CO | NOx | $PM_{10}$ | $SO_2$ | VOC | CO | NOx | $PM_{10}$ | $SO_2$ |
| 9-Passenger Van | 425 | Gasoline | 200 | g/mile | 4.72 | 46.06 | 2.41 | 0.093 | 0.113 | 34.5 | 336.3 | 17.6 | 0.68 | 0.83 |

NOTES:
VOC = volatile organic compounds
CO = carbon monoxide
NOx = nitrogen oxides
$PM_{10}$ = particulate matter with aerodynamic diameter less than or equal to 10 micrometers
$SO_2$ = sulfur dioxide
[1] Each of the total estimated 1,700 construction employees is assumed to work 6 days per week (312 days per year). The employees are assumed to participate in "ride sharing", which reduces the number of gasoline powered vehicles to 425.
[2] Emission factors for pickup trucks and crew cab were obtained from MOBILE5 run based on national averaged fleet conditions, at a speed of 15 miles per hour and an ambient temperature of 60 degrees Fahrenheit ($^oF$).
[3] Annual emissions for vans were calculated based on a traveling distance of 50 miles/day for 312 days/year, as follows: TPY= 200 * (EF grams/mile* 50 miles/day * 312 days/year) / (454 grams/pound * 2000 pounds/ton)

## Table K-8

### Alternative B - Summary of Equipment and Vehicle Tailpipe Emissions During Project Construction

| | Quantity | | | | | | | | Emission Factors [1, 2] | | | | | Maximum Annual Emissions (tons/year) [3, 4] | | | | | Total Project Vehicle & Equipment Emissions (tons) [3, 4] | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Vehicle/Equipment | Power Plant | Water Conveyance System | Transmission Line | Access Roads | Ride sharing | Fuel | Average Engine Power (hp) | Unit of Emission Factors | VOC | CO | NOx | $PM_{10}$ | $SO_2$ | VOC | CO | NOx | $PM_{10}$ | $SO_2$ | VOC | CO | NOx | $PM_{10}$ | $SO_2$ |
| Trucks (2-ton) | 5 | 2 | 2 | 5 | 0 | Diesel | 250 | g/hp-hr | 0.33 | 1.20 | 5.36 | 0.30 | 0.005 | 3.97 | 14.46 | 64.54 | 3.57 | 0.06 | 5.95 | 21.69 | 96.81 | 5.35 | 0.09 |
| Trucks (5-15 tons) | 10 | 5 | 5 | 5 | 0 | Diesel | 400 | g/hp-hr | 0.22 | 2.10 | 5.78 | 0.22 | 0.005 | 7.44 | 72.19 | 198.89 | 7.52 | 0.17 | 12.28 | 119.12 | 328.17 | 12.40 | 0.28 |
| Sideboom | 6 | 2 | 6 | 1 | 0 | Diesel | 500 | g/hp-hr | 0.22 | 2.10 | 5.78 | 0.22 | 0.005 | 5.58 | 54.14 | 149.17 | 5.64 | 0.13 | 6.34 | 61.44 | 169.26 | 6.40 | 0.14 |
| Dozer | 6 | 2 | 2 | 3 | 0 | Diesel | 850 | g/hp-hr | 0.31 | 1.23 | 5.92 | 0.21 | 0.005 | 11.62 | 46.68 | 224.79 | 7.88 | 0.19 | 9.85 | 39.57 | 190.55 | 6.68 | 0.16 |
| Large Shovel | 0 | 1 | 0 | 0 | 0 | Diesel | 850 | g/hp-hr | 0.31 | 1.23 | 5.92 | 0.21 | 0.005 | 0.89 | 3.59 | 17.29 | 0.61 | 0.01 | 0.45 | 1.80 | 8.65 | 0.30 | 0.01 |
| Grader | 4 | 2 | 2 | 5 | 0 | Diesel | 600 | g/hp-hr | 0.22 | 2.10 | 5.78 | 0.30 | 0.005 | 5.81 | 56.31 | 155.14 | 7.95 | 0.13 | 4.32 | 41.93 | 115.52 | 5.92 | 0.10 |
| Tractor/backhoe/loader | 6 | 5 | 2 | 5 | 0 | Diesel | 100 | g/hp-hr | 1.22 | 6.39 | 6.23 | 1.04 | 0.006 | 7.52 | 39.54 | 38.58 | 6.43 | 0.04 | 5.65 | 29.70 | 28.98 | 4.83 | 0.03 |
| Welder/air compressor/generator | 15 | 5 | 5 | 5 | 0 | Diesel | 300 | g/hp-hr | 0.31 | 0.79 | 5.64 | 0.23 | 0.005 | 9.72 | 24.31 | 174.70 | 6.99 | 0.15 | 11.76 | 29.41 | 211.39 | 8.45 | 0.18 |
| Crane | 4 | 1 | 0 | 0 | 0 | Diesel | 400 | g/hp-hr | 0.21 | 1.37 | 6.09 | 0.16 | 0.005 | 1.42 | 9.44 | 41.87 | 1.12 | 0.03 | 2.18 | 14.50 | 64.32 | 1.71 | 0.05 |
| Bore/Drill Rig | 0 | 2 | 2 | 0 | 0 | Diesel | 400 | g/hp-hr | 0.21 | 1.37 | 6.09 | 0.16 | 0.005 | 1.13 | 7.55 | 33.50 | 0.89 | 0.03 | 0.99 | 6.61 | 29.31 | 0.78 | 0.02 |
| Pickup trucks and crew cab | 12 | 4 | 6 | 8 | 0 | Gasoline | 200 | g/mile | 4.72 | 46.06 | 2.41 | 0.093 | 0.113 | 1.33 | 12.99 | 0.68 | 0.03 | 0.03 | 1.44 | 14.02 | 0.73 | 0.03 | 0.03 |
| Vans | 0 | 0 | 0 | 0 | 425 | Gasoline | 200 | g/mile | 4.72 | 46.06 | 2.41 | 0.093 | 0.113 | 34.5 | 336.3 | 17.6 | 0.68 | 0.83 | 138 | 1,345.2 | 70.4 | 2.72 | 3.32 |
| **Total Emissions** | | | | | | | | | | | | | | **90.95** | **677.49** | **1,116.76** | **49.29** | **1.80** | **199.21** | **1,724.99** | **1,314.09** | **55.57** | **4.41** |

NOTES:
VOC = volatile organic compounds
CO = carbon monoxide
NOx = nitrogen oxides
$PM_{10}$ = particulate matter with aerodynamic diameter less than or equal to 10 micrometers
$SO_2$ = sulfur dioxide
[1] Emission factors for off-highway diesel fueled vehicle/equipment were calculated following the method outlined in the USEPA report "Exhaust and Crankcase Emission Factors for Non-Road Engine Modeling-Compression-Ignition," USEPA420-P-04-009, April 2004. For all vehicles and equipment, Tier 1 emission factors were used.
[2] Emission factors for pickup trucks and crew cab were obtained from MOBILE5 run based on national averaged fleet conditions, at a speed of 15 miles per hour and an ambient temperature of 60 degrees Fahrenheit ($^oF$).
[3] Annual emissions for all diesel-fueled vehicle/equipment were calculated based on average engine horsepower for each type of vehicle/equipment, and an operating schedule of 10 hours/day, 6 days/week and 52 weeks/year.
[4] Annul emissions for pickup trucks and crew cab were calculated based on a traveling distance of 10 miles/day during Power Plant construction, 25 miles/day during Access Road Construction, and 50 miles/day during transmission line and water conveyance system construction, all with an operating schedule of 6 days/week and 52 weeks/year.

*Summary.* Table K-8 summarizes the combined estimated equipment/vehicle combustion emissions due to construction activity from all phases of the proposed project. The total maximum combustion emissions from construction of the plant site, well field, transmission lines, access road, and "ride sharing" are estimated to be 91 tons per year (tpy) of VOC, 677 tpy of CO, 1,117 tpy of NOx, 49 tpy of $PM_{10}$, and 2 tpy of $SO_2$. Total project vehicle and equipment tailpipe emissions were estimated to be 199 tons of VOC, 1,725 tons of CO, 1,314 tons of NOx, 56 tons of $PM_{10}$, and 4.4 tons of $SO_2$.

### 3.1.3 Fugitive Dust Emissions Due to Vehicle Travel On Paved and Unpaved Surfaces During Construction Activity

#### 3.1.3.1 Sources

During construction, ancillary vehicles will be used to commute to the job sites. During operation of these vehicles fugitive $PM_{10}$ emissions will be generated during travel over unpaved surfaces.

#### 3.1.3.2 Emissions Estimation Methodology

Emission factors for vehicle travel over unpaved surfaces were calculated following the method outlined in USEPA AP-42 Section 13.2.2 *Unpaved Roads* (USEPAx, November 2001). Emission factors were calculated using Equations 1a and 2 based on an average vehicle weight of three tons and surface silt content of 8.5%. A value of 90 mean days with 0.01 inch or more of precipitation was obtained from USEPA AP-42 Figure 13.2.2-1 in order to calculate an unpaved emission factor extrapolated for natural mitigation. Annual emissions were calculated based on the quantity of pickup trucks and crew cabs that were used to calculated tailpipe emissions during construction activities. Annual mileage was calculated using a round-trip traveling distance of 10 miles/day during Power Plant construction, 25 miles/day during Access Road Construction, and 50 miles/day during transmission line, water conveyance system construction, and "ride sharing, all with an operating schedule of 6 days/week and 52 weeks/year.

Emission factors for "ride sharing" was calculated following the method outlined in USEPA AP-42 Section 13.2.1 *Paved Roads* and 13.2.2 *Unpaved Roads* (USEPAx, November 2001). Emission factors from paved road travel were calculated using Equation 2 based on an average vehicle weight of three tons and surface silt content of 8.5%. Emission factors from unpaved road travel was calculated using Equations 1b and 2 based on a surface silt content of 18.4%, a mean vehicle speed of 45 mph, a surface moisture content of 6.5%, and 90 mean days with 0.01 inch or more of precipitation. Annual emissions were calculated based on the quantity of vans that were used to calculated tailpipe emissions "ride sharing". Annual mileage was calculated using a round-trip traveling distance of 50 miles/day with an operating schedule of 6 days/week and 52 weeks/year. It was assumed that of the 50 miles of roads traveled to get to the plant; 20% of the total trip would require traveling on unpaved surfaces, while the remaining 80% would be on paved roads.

#### 3.1.3.3 Emissions

Table K-9 summarizes the estimated $PM_{10}$ pollutant emission rates for vehicle travel on unpaved roads during construction activity. The maximum $PM_{10}$ emissions were estimated to be 14,385 tpy with a project total of 56,634 tons during the 48-month plant construction.

**Table K-9**

**Alternative B - Particulate Matter ($PM_{10}$) Emissions Associated with Vehicle Travel on Paved and Unpaved Surfaces During Construction Activity**

| Construction Operations | Quantity of Vehicles | Miles Per Day Traveled | Road Surface | Durations (months) | Vehicle Miles Traveled (VMT/yr) [1] | Emission Factor (lb/VMT) [2] | Annual Emissions (tpy) |
|---|---|---|---|---|---|---|---|
| Power Plant [3] | 12 | 10 | Unpaved | 36 | 37,440 | 4.156 | 78 |
| Water Supply [3] | 4 | 50 | Unpaved | 6 | 31,200 | 4.156 | 65 |
| Transmission Lines [3] | 6 | 50 | Unpaved | 9 | 70,200 | 4.156 | 146 |
| Access Roads [3] | 8 | 25 | Unpaved | 6 | 31,200 | 4.156 | 65 |
| Ride sharing [4] | 425 | 40 | Paved | 48 | 4,420,000 | 3.605 | 7,966 |
| | | 10 | Unpaved | | 1,326,000 | 9.148 | 6,065 |
| **Total** | **452** | **185** | **-** | **-** | **5,916,040** | **-** | **14,385** |

NOTES:
[1] Vehicle Miles Traveled (VMT) were calculated assuming an operating schedule of 6 days/week 52 weeks/year for the 48-month duration of plant construction.
[2] Emission factor takes into account natural mitigation based on 90 mean days with at least 0.01 inch or more of precipitation as recorded from USEPA AP-42 Figure 13.2.2-1.
[3] Emission Factor was calculated using Equation 1a and 2 of USEPA AP-42 13.2.2 *Unpaved Roads* and assumes a surface silt content of 8.5% and average vehicle weight of 3 tons.
[4] Emission Factor was calculated using Equation 2 in §13.2.1 *Paved Roads* and Equations 1b and 2 in §13.2.2 *Unpaved Roads* of USEPA AP-42.

## 3.1.4 Summary of Construction Emissions

Table K-10 summarizes the total estimated criteria pollutant emissions due to construction activity on the DREP.

**Table K-10**

**Alternative B - Summary of Maximum Pollutant Emissions From Construction Operations**

| Source | VOC (tpy) | CO (tpy) | NOx (tpy) | $SO_2$ (tpy) | $PM_{10}$ (tpy) |
|---|---|---|---|---|---|
| Earthmoving [1] | - | - | - | - | 61.2 |
| Vehicle/Equipment Tailpipe Emissions | 91.0 | 677.5 | 1,116.8 | 1.8 | 49.3 |
| Vehicle Travel on Paved and Unpaved Surfaces | - | - | - | - | 14,385 |
| **Total** | **91.0** | **677.5** | **1,116.8** | **1.8** | **14,495.5** |

[1] Earthmoving emissions listed in Table K-1 for the preferred sub-alternatives.

Since these emissions are generated by earthmoving activity and vehicle/equipment combustion emissions occur at ground level, it is unlikely that the emissions would be transported more than one or two kilometers, except on unusually windy days (see Section 3.7 *Mitigation* for dust control measures during periods of high wind). In addition, the $PM_{10}$ emissions will be spatially distributed over a large area and spread out over construction schedules ranging from 6 to 36 months. Furthermore, the locations of active work areas will be transient, with work activities typically moving to a new location every few days. Finally, the $PM_{10}$ emissions from earthmoving activity will be temporary, ceasing as each phase of the project is completed. Based on the foregoing, the ambient air quality impacts (fugitive dust) of project construction activity are considered to be negligible.

## 3.2 Mine Operations

ENSR estimated criteria pollutant emissions associated with the BNCC coal mining operations and coal handling activities, including fugitive dust due to mining activity and vehicular traffic on roads. URS estimated particulate and gaseous pollutant tailpipe emissions from diesel fueled vehicles and equipment.

### 3.2.1 Fugitive Dust

#### 3.2.1.1 Sources

Fugitive dust will be generated by surface coal mining; coal handling and transport; and vehicle traffic on haulage and access roads during mine operations.

#### 3.2.1.2 Emissions Estimation Methodology

Particulate matter (PM) emission rates for the mining operations, coal handling and coal transport were obtained from the PSD permit application (ENSRx 2006). Table K-11 summarizes the annual $PM_{10}$ emissions from four BNCC mining and coal handling operation options.

For purposes of estimating fugitive dust emissions due to vehicle travel on paved and unpaved roads within and around the mine and power plant, ENSR prepared a spreadsheet that identifies the total annual miles traveled by several broad categories of mining vehicles and equipment. ENSR used USEPA AP-42 §11.9 *Western Surface Coal Mining* and §13.2.2 *Unpaved Roads* to calculated fugitive dust emissions raised due to these vehicles traveling on unpaved roads.

The following text was provided by BHP to aid in the explanation of the different coal handing and transport options available. Note that Option 4 is the preferred option for Alternative B, and was used by ENSR to prepare the PSD permit application for the proposed project.

> The air emission inventory performed for the proposed BNCC Navajo Mine Expansion Project initially included three options for the design of the coal processing facility to be located in Area IV North of the BNCC Lease Area. The emissions inventory included a common Area IV North and IV South mine plan, as the mine plan is independent of the processing option selected. The coal processing options evaluated options were:
>
> - **Option 1** – Coal storage and blending using large concrete silos, coal transport from Area IV South to Area IV North by large haul trucks;
> - **Option 2** – Coal storage and blending using glory holes, coal transport from Area IV South to Area IV North by large haul trucks;

- **Option 3** – Coal storage and blending using slot storage barns, coal transport from Area IV South to Area IV North by large haul trucks; and,
- **Option 4 -** Coal storage and blending using glory holes, coal transport from Area IV South to Area IV North by semi-enclosed overland conveyor.

An initial study was completed to quantify the emissions inventory for the first three options. Subsequently, the fourth coal processing scenario was developed by BNCC. Option 4 relocated the primary and secondary coal crushing from Area IV North to nearer the mining area in Area IV South, and replaced truck transport of the coal to the Area IV North storage and blending facility with transport by overland conveyor. At approximately the same time, ENSR … was conducting air quality dispersion modeling incorporating the results of Option 2 (glory hole coal storage) from the initial emission inventory. It became apparent however, that the revised conveyor-based Option 4 was BNCC's preferred option. Therefore, a new emission inventory was developed for Option 4, and the results of the Option 4 inventory have been added to the overall emission inventory summary [for the PSD permit application]. The Option 4 results were supplied to ENSR and were incorporated into the dispersion modeling performed by ENSR for the DREP project.

Use of fully enclosed coal storage and 'dustless' transfer points for all of the coal processing facility options resulted in significant reduction of uncontrolled particulate emissions (overall reduction of approximately 85 to 87 percent) compared to unenclosed emissions. The controlled emissions were not significantly different among the initial three options. Option 4 coal processing emissions increased compared to Option 1 through 3. This is due to including coal transfer points at each bend in the transfer conveyor, which added an additional five transfer points. The transport conveyor was grouped with the "coal processing" facilities for the purposes of this inventory. However, Option 4 coal mining emissions are significantly lower than for Options 1 through 3. This is a result of far lower vehicle (including coal haul truck) miles traveled. The net effect of Option 4 is a significant decrease in particulate emissions.

Use of passive emission control systems (PECS) in the form of enclosed storage and transfer points engineered for low dust production has become wide-spread in the industry and, in many cases, is considered preferable to active systems based on forced ventilation with baghouse controls. Several recent permitting actions at large surface coal mines in Wyoming have been undertaken specifically to replace previously permitted forced ventilation systems with PECS. The passive emissions controls systems result in low emission rates that aid the overall air permitting process and make it easier to demonstrate compliance with ambient air quality standards and increments in dispersion modeling analysis. Low emissions from the coal processing facility allows greater flexibility in location of the facility with regard to facility boundaries and other neighboring emission sources.

A particulate matter emission inventory was developed for each of the four options. The overall design for Options 1,2 and 3 were similar and the main differences that affected emission inventory calculations was the different number of coal transfer points associated with each option. These differences were relatively minor, however, and there were not large differences in the emissions inventory between these Options. Option 4 shows a larger difference in emissions compare to the other three Options with somewhat higher coal processing emissions due to the additional transport conveyor transfer points and much lower mining emissions due to decreased haul truck traffic. Table K-11 below summarizes the emission inventory results for all four Options.

**Table K-11**

**Summary of Mine Emissions Inventories by Coal Processing Option**

| Emissions Source | TSP Uncontrolled tpy | TSP Controlled tpy | $PM_{10}$ Uncontrolled tpy | $PM_{10}$ Controlled tpy |
|---|---|---|---|---|
| Coal Processing Option 1 (Silo Storage) | 91.9 | 11.7 | 36.4 | 4.8 |
| Coal Processing Option 2 (Glory Hole storage) | 92.8 | 11.8 | 36.4 | 4.9 |
| Coal Processing Option 3 (Slot Storage) | 81.6 | 11.5 | 32.6 | 4.8 |
| Coal Processing Option 4 (Conveyor Option) | 139.7 | 16.5 | 53.9 | 6.6 |
| Mining Operations Area 4 South (Options 1, 2, and 3) | NA | 903 | NA | 252 |
| Mining Operations Area 4 South (Option 4) | NA | 533 | NA | 146 |

SOURCE: ENSR 2006

### 3.2.1.3 Emissions

Particulate matter emission rates for the mining operations and coal handling/transport were obtained from the PSD application (ENSRx 2006). ENSR combined these emission values with the power plant emissions for analysis of near field Class II impacts. Table K-12 summarizes the annual $PM_{10}$ emissions from the BNCC mining, coal handling operations using the overland conveyor (Option 4), and vehicle travel on unpaved roads. The total $PM_{10}$ emissions from mining operations were estimated to be 153.1 tpy.

**Table K-12**

**Alternative B - Annual Air Pollutant Emissions from BHP Navajo Coal Company Associated with Option 4**

| Operation | $PM_{10}$ Emissions (tons per year) |
|---|---|
| **Mining [1]** | |
| Topsoil Removal [2] | 1.26 |
| Overburden Removal [3] | 11.29 |
| Draglines | 46.80 |
| Coal Removal [4] | 19.43 |
| Coal Truck Loading | 0.44 |
| Coal Truck Travel | 22.11 |
| Wind Erosion [5] | 17.21 |
| Other Vehicle Travel [6] | 27.94 |
| Mining Total | 146.5 |
| **Coal Handling** | |
| Truck Unloading | 0.044 |
| Primary Crushing | 2.25 |
| Secondary Crushing | 0.75 |
| Conveyors [7] | 3.54 |
| Coal Handling Total | 6.6 |
| **Total** | **153.1** |

SOURCE: ENSR 2006 (BNCC Coal Processing Facility - Emissions Estimation Summary)
[1] Mining and coal handling emission data were obtained from ENSR predicted emission totals for Area 4 South
[2] Topsoil removal includes excavation and unloading using scrapers
[3] Overburden removal includes drilling, blasting and stockpile management using bulldozers.
[4] Coal removal emissions include drilling, blasting and dust from bulldozer operations.
[5] Wind erosion emissions include the pit and emergency coal storage pile.
[6] Other vehicle travel emissions include water trucks, graders, light/medium vehicles, plant ash haul trucks and plant gypsum trucks.
[7] Conveyors includes dust emissions from transfer points, storage units and transfer stations.

### 3.2.2 Mine Operation Vehicle Tailpipe Emissions

#### 3.2.2.1 Sources

During mining operations, diesel fueled vehicles will be operated, which will generate gaseous and particulate exhaust emissions.

#### 3.2.2.2 Emissions Estimation Methodology

Total annual criteria air pollutant tailpipe emissions from mining and coal transport vehicles were estimated based on the roster of vehicles developed by ENSR for the PSD application, and using emission factors for off-highway diesel-fueled vehicles outlined in the USEPA report “Exhaust and Crankcase Emission Factors for Non-Road Engine Modeling-Compression-Ignition” (USEPA420-P-04-009, April 2004). For all such vehicles, Tier 1 emission factors were used. Emission factors for pickup trucks and crew cabs were obtained from the USEPA model MOBILE5, based on national averaged fleet conditions, at a speed of 15 miles per hour and an ambient temperature of 60 degrees Fahrenheit ($^{o}F$). Annual emissions for all diesel-fueled vehicles were calculated based on average engine horsepower for each type of vehicle, and an operating schedule of 10 hours/day, 5 days/week and 52 weeks/year.

#### 3.2.2.3 Emissions

Table K-13 summarizes the vehicle roster and estimated criteria pollutant emission rates during mining operations. The total maximum combustion emissions from mining and coal transport equipment are estimated to be 9 tpy of VOCs, 36 tpy of CO, 175 tpy of NOx, 6 tpy of $PM_{10}$, and 0.15 tpy of $SO_2$. Since these emissions are generated by transient mine vehicle activity and occur at ground level, it is unlikely that the emissions would be transported more than a few kilometers. Based on the foregoing, the ambient air quality impacts of mine vehicle tailpipe emissions are considered to be negligible.

## 3.3 Power Plant Operations

### 3.3.1 Sources

Power plant operation emissions have been estimated for the following sources:

- **Material Handling -** Particulate matter emissions due to plant operations will occur during the handling of coal, fly ash, bottom ash, quicklime, and gypsum;

- **Combustion Sources -** Criteria and hazardous air pollutant (HAP) emissions due to combustion sources located at the plant will occur during the operation of the PC boilers, auxiliary boilers, emergency generators, and fire water pumps;

- **Petroleum Storage Tanks** - VOC emissions due to fuel oil storage;

- **Commuting Employee Vehicle Emissions** – Criteria pollutant emissions due to vehicle combustion emissions from commuting employees.

### 3.3.2 Emissions Estimation Methodology

Predicted emissions associated with material handling, combustion sources, and petroleum storage tanks were obtained from the PSD application (ENSRx 2006). URS conservatively estimated PC boiler HAP emissions and criteria pollutant emissions due to commuting employee vehicles.

Using speciated HAP emission factors provided in Tables 1.1-12, 1.1-14, and 1.1-18 of §1.1 *External Combustion Sources – Bituminous and Sub-Bituminous Coal Combustion* of USEPA AP-42, and the maximum coal combustion rates for the proposed power plant, HAP emission rates were calculated. Six metals, two dioxins and monomethyl hydrazine were selected for the primary purpose of aiding the ecological and human health risk assessment analyses discussed in Sections 4.3 and 4.16 of the EIS. No ambient air quality standards for HAPs apply within the project area; therefore, no separate ambient air quality impacts analysis (i.e. modeling analysis) was performed.

## Table K-13

## Alternative B - Mine Vehicle Tailpipe Emissions (Option 4)

| Vehicle | Vehicle Miles Traveled per Year [1] | Estimated Average Vehicle Speed (mph) | Estimated Hours of Operations per Year [2] | Fuel | Average Engine Power (hp) | Unit of Emission Factors | Emission Factors [3] | | | | | Maximum Annual Emissions (tons/year) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | VOC | CO | NOx | $PM_{10}$ | $SO_2$ | VOC | CO | NOx | $PM_{10}$ | $SO_2$ |
| Large Coal Haul Trucks (150-250 tons) | 79,038 | 10 | 9,880 | Diesel | 1500 | g/hp-hr | 0.31 | 1.23 | 5.92 | 0.21 | 0.005 | 5.00 | 20.06 | 96.63 | 3.43 | 0.08 |
| Water Truck | 8,151 | 10 | 1,019 | Diesel | 400 | g/hp-hr | 0.22 | 2.10 | 5.78 | 0.22 | 0.005 | 0.10 | 0.94 | 2.60 | 0.10 | 0.002 |
| Grader | 1,161 | 10 | 145 | Diesel | 500 | g/hp-hr | 0.22 | 2.10 | 5.78 | 0.22 | 0.005 | 0.02 | 0.17 | 0.46 | 0.02 | 0.0004 |
| Light/Medium Vehicles | 86,586 | 25 | 4,329 | Diesel | 300 | g/hp-hr | 0.31 | 0.79 | 5.64 | 0.23 | 0.005 | 0.45 | 1.12 | 8.08 | 0.33 | 0.01 |
| Plant Ash Trucks | 65,436 | 10 | 8,180 | Diesel | 1000 | g/hp-hr | 0.31 | 1.23 | 5.92 | 0.21 | 0.005 | 2.76 | 11.07 | 53.33 | 1.89 | 0.05 |
| Plant Gypsum Trucks | 17,109 | 10 | 2,139 | Diesel | 1000 | g/hp-hr | 0.31 | 1.23 | 5.92 | 0.21 | 0.005 | 0.72 | 2.90 | 13.94 | 0.50 | 0.01 |
| **Total Emissions** | | | | | | | | | | | | **9.04** | **36.27** | **175.04** | **6.26** | **0.15** |

[1] Vehicle miles traveled per year value was obtained from ENSR BNCC4South PM Emission Spreadsheet.

[2] Estimated hours of operation per year contains an additional correction factor of 1.25 to account for vehicle idling and loading time.

[3] Emission factors were obtained from Table K-2 entitled Construction Vehicle and Equipment Emission Factors

URS conservatively assumed that all 200 employees will work five days per week for Alternative B, and that each person would drive a gasoline-fueled vehicle separately to work each day. Emission factors for vehicles were obtained from USEPA document AP-42, Volume II, Emission Factors for Mobile Sources (USEPA 1995, 5th edition and updates). Emission factors for pickup trucks and crew cabs were obtained from a MOBILE5 run based on national averaged fleet conditions, at a speed of 15 miles per hour and an ambient temperature of 60 degrees Fahrenheit ($^{o}$F). Annual emissions were calculated based on a traveling distance of 45 miles/day with an operating schedule of 5 days/week (Monday through Friday) and 52 weeks/year.

### 3.3.3 Emissions

#### 3.3.3.1 Criteria Pollutants

Table K-14 presents a summary of maximum potential-to-emit (PTE) criteria air pollutant emission rates from the proposed power plant. These emission rates are based on the conservative assumption that both generating units of the plant will operate for 8,760 hours each year, at full-load operation. Based on these PTE values, the proposed power plant will be a major source, as defined under federal New Source Review and Prevention of Significant Deterioration (NSR/PSD) regulations, codified at 40 CFR §51.166, for $PM_{10}$, NOx, $SO_2$, CO, and Ozone (NOx and VOC emissions). The PSD permit application must identify Best Available Control Technology (BACT) requirements, and address the ambient air quality impacts for $PM_{10}$, NOx, $SO_2$, and CO. Note that Alternative B will use dry type cooling towers with a Heller system, which have negligible PM10 emissions due to their design.

**Table K-14**

**Summary of Maximum Potential Criteria Pollutant Emissions from Proposed Power Plant**

| Pollutant | PC Boilers (tpy) | Auxiliary Boilers (tpy) | Emergency Generators (tpy) | Fire Water Pumps (tpy) | Material Handling (tpy) | Storage Tanks (tpy) | Project PTE (tpy) |
|---|---|---|---|---|---|---|---|
| CO | 5,526 | 2.55 | 0.17 | 0.031 | n/a | n/a | 5,529 |
| NOx | 3,315 | 7.13 | 2.26 | 0.41 | n/a | n/a | 3,325 |
| $SO_2$ | 3,315 | 3.61 | 0.068 | 0.012 | n/a | n/a | 3,319 |
| PM | 553 | 1.02 | 0.083 | 0.015 | 22.3 | n/a | 576 |
| $PM_{10}$ | 1,105 | 1.68 | 0.077 | 0.014 | 18.4 | n/a | 1,125 |
| VOC | 166 | 0.17 | 0.11 | 0.019 | n/a | 0.14 | 166 |
| Lead | 1.11 (1) | 0.00064 | 0.000012 | 0.0000022 | n/a | n/a | 0.1 |
| Fluorides | 13.3 | neg | neg | neg | n/a | n/a | 13.3 |
| $H_2SO_4$ | 221 | 0.062 | 0.002 | 0.0004 | n/a | n/a | 221 |
| Mercury | 0.057 | 0.00021 | neg | neg | n/a | n/a | 0.057 |
| Hydrogen Sulfide | neg | neg | neg | neg | n/a | n/a | neg |
| Total Reduced Sulfur | neg | neg | neg | neg | n/a | n/a | neg |
| Reduced Sulfur Compounds | neg | neg | neg | neg | n/a | n/a | neg |

SOURCE: ENSR/AECOM Desert Rock Updated Class I Modeling Report January 2006
n/a – not applicable, neg. – negligible
(1) Has since been revised to be 1.11 tons.

Criteria air pollutant tailpipe emissions resulting from employees driving vehicles to commute to the plant were conservatively estimated and are shown in Table K-15.

## Table K-15

## Alternative B - Summary of Vehicle Tailpipe Emissions from Permanent Work Force

| | Quantity[1] | Fuel | Average Engine Power (hp) | Unit of Emission Factors | Emission Factors (EF) [2] | | | | | Maximum Annual Emissions (TPY) [3] | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | VOC | CO | NOx | $PM_{10}$ | $SO_2$ | VOC | CO | NOx | $PM_{10}$ | $SO_2$ |
| Vehicle | 200 | Gasoline | 200 | g/mile | 4.72 | 46.06 | 2.41 | 0.093 | 0.113 | 13.5 | 132.0 | 6.9 | 2.7 | 0.3 |

NOTES:
VOC = volatile organic compounds
CO = carbon monoxide
NOx = nitrogen oxides
$PM_{10}$ = particulate matter with aerodynamic diameter less than or equal to 10 micrometers
$SO_2$ = sulfur dioxide
[1] Each of the total estimated 200 full-time employees is assumed to work 5 days per week (260 days per year). Each employee is assumed to drive his or her own gasoline powered vehicle to and from work each day.
[2] Emission factors for pickup trucks and crew cab were obtained from MOBILE5 run based on national averaged fleet conditions, at a speed of 15 miles per hour and an ambient temperature of 60 degrees Fahrenheit ($^oF$).
[3] Annual emissions for pickup trucks and crew cabs were calculated based on a traveling distance of 50 miles/day for 260 days/year, as follows: TPY= 200 * (EF * 50 miles/day * 260 days/year) / (454 grams/pound * 2000 pounds/ton)

### 3.3.3.2 Vehicle Travel on Paved and Unpaved Roads During Plant Operations (Employee Commuting)

#### 3.3.3.2.1 Sources

During plant operation, vehicles will be used by employees commuting to the plant site. During operation of these vehicles fugitive $PM_{10}$ emissions will be generated during travel over the paved and unpaved surfaces.

#### 3.3.3.2.2 Emissions Estimation Methodology

Emission factors for vehicle travel over paved and unpaved surfaces were calculated following the method outlined in USEPA AP-42 Section 13.2.1 *Paved Roads* and 13.2.2 *Unpaved Roads* (USEPAx, November 2001). An emission factor from paved road travel was calculated using Equation 2 based on an average vehicle weight of three tons and surface silt content of 8.5%. A value of 90 mean days with 0.01 inch or more of precipitation was obtained from USEPA AP-42 Figure 13.2.2-1 in order to calculate an unpaved emission factor extrapolated for natural mitigation. Emission factors from unpaved road travel was calculated using Equations 1b and 2 based on a surface silt content of 18.4%, a mean vehicle speed of 45 mph, a surface moisture content of 6.5%, and 90 mean days with 0.01 inch or more of precipitation. Annual emissions were calculated based on the quantity of pickup trucks and crew cabs that were used to calculated tailpipe emissions during plant operation. Annual mileage was calculated using a round-trip traveling distance of 50 miles/day with an operating schedule of 5 days/week and 52 weeks/year. It was assumed that of the 50 miles of roads traveled to get to the plant 20% of the total trip would require traveling on unpaved surfaces, while the remaining 80% would be on paved roads.

#### 3.3.3.2.3 Emissions

Table K-16 summarizes the estimated $PM_{10}$ pollutant emission rates for vehicle travel on paved and unpaved roads during plant operation.

**Table K-16**

**Alternative B - Particulate Matter ($PM_{10}$) Emissions Associated with Vehicle Travel on Paved and Unpaved Surfaces During Plant Operation**

| Road Surface | Quantity of Vehicles | Miles Per Day Traveled | Vehicle Miles Traveled (VMT/yr) [1] | Emission Factor (lb/VMT) [2] | Uncontrolled Emissions (tpy) |
|---|---|---|---|---|---|
| Paved | 200 | 40 | 2,080,000 | 3.605 | 3,749 |
| Unpaved | | 10 | 520,000 | 9.148 | 2,379 |
| **Total** | **200** | **50** | **2,600,000** | **-** | **6,128** |

NOTES:
[1] Vehicle Miles Traveled (VMT) were calculated assuming an operating schedule of 5 days/week 52 weeks/year.
2 Emission Factor was calculated using Equation 2 of USEPA AP-42 13.2.1 *Paved Roads* and Equation 1b and 2 of USEPA AP-42 13.2.2 *Unpaved Roads*.

#### 3.3.3.3 HAPs

Table K-17 summarizes the coal combustion emission factors (pounds of air toxic per ton of coal burned) and calculated maximum emission rates, in pound per hour (lb/year) and grams per second (g/sec) for nine air toxics, which were selected by the professional staff involved with the ecological risk assessment and human health risk assessment, described in Sections 4.3 and 4.16 of the EIS, respectively.

**Table K-17**

**Estimated Emission Rates for Selected Air Toxics**

| Contaminant | [1] AP-42 Emission Factor (lb/ton) | Emissions | |
|---|---|---|---|
| | | (lb/yr) [2] | (g/s) |
| Arsenic | 4.1E-04 | 2.54E+03 | 3.66E-02 |
| Cadmium and compounds | 5.1E-05 | 3.16E+02 | 4.555E-03 |
| Chromium VI | 7.9E-05 | 4.90E+02 | 7.05E-03 |
| Lead | 4.2E-04 | 2.60E+03 | 3.75E-02 |
| Mercury (elemental) [3] | NA | 1.14E+02 | 1.64E-03 |
| Methyl Hydrazine | 1.7E-04 | 1.05E+03 | 1.52E-02 |
| Selenium | 1.3E-03 | 8.06E+03 | 1.16E-01 |
| 2,3,7,8-TCDD (dioxin) | 1.43E-11 | 8.87E-05 | 1.28E-09 |
| Total PCDD (dioxins) | 1.76E-09 | 1.09E-02 | 1.57E-07 |

Note: Scientific notation has been used; 4.1E-04 is equivalent to 0.00041

TCDD = Tetrachlorodibenzo-P-Dioxin

PCDD = Polychlorinated Dibenzo-P-Dioxins

[1] From AP-42 for External Combustion Sources - Bituminous and Sub-bituminous Coal Combustion 9/98 (Emission Factors for controlled coal combustion) – Tables 1.1-12 (Dioxins), 1.1-14 (Methyl Hydrazine), and 1.1-18 (Trace Metals)

[2] Based on total maximum annual coal consumption of 6.2 million tons

[3] Based on average mercury emissions of 114 lb/yr presented within the PSD Application (ENSR 2004)

The emission rate for mercury (161 pounds per year) was derived from coal analysis data provided by BHP Billiton (BHP 2006). A total of 71 coal samples, taken from the coal seam designated for the DREP in Areas IV South and V, were analyzed for mercury content. As a conservative approach, all values reported as “non-detect” were assumed to have the numerical magnitude of the analysis methods detection threshold of 0.05 ppm, resulting in a mean mercury concentration of 0.065 ppm. BHP Billiton is currently conducting additional coal sampling and analysis to verify the mean mercury content of the coal in Areas IV South and V. The results of the additional sampling will be incorporated into this EIS prior to issuance of the final document.

Limited mercury data for the Four Corners Power Plant was provided by the USEPA. However, it was rejected in favor of the BHP data, for the following reasons:

- The USEPA data consists of single data values for each generating unit at the plant. This is a strong indication that the samples were taken from the coal feeders on each unit, which receive coal after extensive blending, rather than directly from the mine.

- The USEPA did not provide information on the statistical parameters associated with the data, such as sample population size, standard deviation values or confidence intervals.

The USEPA data is from 1999, and is therefore representative of coal extracted during that time frame. It is unknown whether the coal sampled is from the same coal seam as the coal destined for DREP. The coal consumed at the plant in 1999 was likely excavated five or more miles north of Areas IV South and V. The 71 BHP samples were taken from Areas IV South and V (reserved for DREP).

The emission rates in g/sec were used to extrapolate predicted ambient concentrations and deposition rates, based on ENSR's modeling results for a hypothetical air pollutant emitted at 1 g/sec. The results of these calculations are discussed in Section 3.5.2.

## 3.4 Total Annual Emissions from Operation of Mine and Power Plant

Table K-18 summarizes the estimated total annual mining, plant, and equipment/vehicle combustion emissions due to normal facility operations for the DREP. The total maximum annual emissions due to DREP operations are estimated to be 390.2 tpy of VOC, 5,697.3 tpy of CO, 3,506.9 tpy of NOx, 7,415.1 tpy of PM10, and 3,319.4 tpy of $SO_2$. These emissions are conservatively estimated maximum annual values; actual emissions will be less.

**Table K-18**

**Alternative B - Summary of Maximum Pollutant Emissions From Plant Operations**

| Source | VOC (tpy) | CO (tpy) | NOx (tpy) | $SO_2$ (tpy) | $PM_{10}$ (tpy) |
|---|---|---|---|---|---|
| **Mine Operations** | | | | | |
| Mining, Coal Handling, and Vehicle Travel | - | - | - | - | 153.1 |
| Vehicle Tailpipe Emissions | 9.04 | 36.27 | 175.04 | 0.15 | 6.26 |
| **Plant Operations** | | | | | |
| Power Plant | 166 | 5,529 | 3,325 | 3,319 | 1,125 |
| Vehicle Tailpipe Emissions | 13.5 | 132.0 | 6.9 | 0.3 | 2.7 |
| Vehicle Travel Fugitive Dust Emissions | - | - | - | - | 6,128 |
| **Total** | **390.2** | **5,697.3** | **3,506.9** | **3,319.4** | **7,415.1** |

## 3.5 Predicted Ambient Air Quality Impacts

The impacts of the construction emissions are deemed negligible, as stated in previous sections. This section addresses long-term impacts of plant and mine operations, based on the PSD application (ENSRx 2006).

### 3.5.1 Criteria Pollutant Emissions

#### 3.5.1.1 Class I Area Impacts

The following text is copied from the Executive Summary of the ENSR report, *Desert Rock Energy Facility Application for Prevention of Significant Deterioration Permit – Class I Area Modeling Update,* January 2006:

> Dispersion modeling of the air quality impacts of the proposed Desert Rock Energy Facility has been completed for PSD Class I areas. The results are summarized below.
>
> - The project impacts are above the PSD [significant impact level (SIL)] for $SO_2$ in a number of areas (including three PSD Class II areas that have special Colorado designation as Class I for $SO_2$). The Project has an insignificant impact for $NO_2$ and $PM_{10}$ increment.
> - The project's impact is a small fraction of the total PSD increment (slightly over 20% for $SO_2$ at most). The cumulative analysis shows that the Project does not cause or contribute to a PSD Class I increment violation, and that no Class I increment violations are predicted in the areas modeled. The 3-hour and 24-hour 3-year maximum $SO_2$ impacts are 66% and 74% of the PSD increments, respectively, at Petrified Forest (mainly due to local sources in the area).
> - The project's impacts on sulfur and nitrogen deposition are higher than the [Deposition Analysis Threshold (DAT)] levels that trigger additional review in a few areas. However, the annual cumulative $SO_2$ impacts shown in [Table K-19] indicates that with other emission reductions as of 2004, there is a reduction in the deposition load for many of these areas. It is noteworthy to account for additional large reductions in $SO_2$ and NOx emissions being undertaken at the nearby San Juan Generating Station, fully effective by the year 2010, relative to emissions in 1999:
>     - $SO_2$ annual emissions reduced by nearly 7,000 TPY (vs. about 3,300 TPY Desert Rock)
>     - NOx annual emissions reduced by about 7,000 TPY (vs. about 3,300 TPY Desert Rock)
>     - $PM_{10}$ emissions reduced by nearly 2,500 TPY (vs. about 1,100 TPY Desert Rock)
>
> In addition, recent changes in emissions at the nearby Four Corners Power Plant are also important to account for in the cumulative impact evaluation. These changes appear to be voluntary $SO_2$ emission reductions through 2004 due to increased scrubbing efficiency, and can be seen from the data posted on the USEPA's Acid Rain Database. Annual $SO_2$ emissions appear to be dropping from about 35,000 TPY to about 15,000 TPY, a reduction of some 20,000 TPY.
>
> It is clear from the above tallies of emission reductions in the Four Corners area that an overall reduction in acidic deposition is expected. The data further indicate that the minimal Lake acid neutralizing capacity (ANC) impacts would be further reduced.

For regional haze,

- The project's impacts on regional haze are above the significance threshold of 5% change to background extinction with the use of the FLAG screening procedures and Method 2. The Method 6 results with P-G coefficients indicate that the 98 percentile day has impacts only marginally higher than a 5% change in extinction only at Mesa Verde.
- The results of the sensitivity run with a lower background ammonia concentration during cold weather months show lower impacts, and with the Method 6 results for the 98 percentile day showing one area, Mesa Verde, at the significance threshold and all other areas below that threshold.
- The results of the sensitivity run with turbulence-based dispersion also shows lower impacts than the base case, and the Method 6 results for the 98 percentile day showing all years and areas below the 5% significance threshold.
- The modeling with a finer PSU/NCAR Mesoscale Model Version 3 (MM5) grid shows consistently lower impacts for the worst case year (at least for January), suggesting that better MM5 data may lead to lower predicted impacts. The finer grid MM5 data consistently led to lower impacts at the Grand Canyon than the coarser grid MM5 did.
- The discussion above regarding current plans to reduce emissions from the adjacent plants (FCPP and SJGS) with amounts higher than the proposed project emissions indicates that any cumulative regional haze analysis would result in lower impacts than these reported above, and most likely negative impacts due to the overwhelming levels of emission reductions. The cumulative $SO_2$ increment results for Mesa Verde, for example indicate that with emission reductions as of 2004, there would be, on average, negative impacts for sulfates on a cumulative basis, and this accounts for a large portion of the extinction. With the additional emission reductions being planned by the year 2010, the visibility improvements will be further enhanced, even accounting for the proposed project emissions.

In conclusion, the potential effects on air quality and air quality related values analyzed here due to emissions from the proposed Desert Rock Energy Facility, especially in conjunction with the nearby source emission reductions, are expected to result in no adverse impacts.

Table K-19 presents the maximum predicted ambient concentrations of NOx, $SO_2$ and $PM_{10}$ within 15 Class I areas (located within 300 km of the project site) based on actual meteorlogical conditions in the calendar years 2001, 2002, and 2003. Exceedances of the $SO_2$ SIL for the 3-hour and 24-hour averaging periods occurred at Bandelier NP, Canyonlands NP, Mesa Verde NP, San Pedro Parks Wilderness, and Weminuche Wilderness. Therefore, a cumulative PSD increment analysis for $SO_2$ was performed using all background source emissions within a 50 km (~31 mile) radius and source emissions larger than 1 lb/hr within 300 km (~186 mile) of the affected Class I areas. In order to be in compliance the second highest prediction must be smaller than the $SO_2$ Class I PSD increment or the $SO_2$ contribution of the Alternative B facility needs to be below the $SO_2$ SIL for the same day and at the same receptor. Based on ENSR's analysis, compliance has been met at all Class I areas for the PSD cumulative analyses for $SO_2$. Details regarding the PSD increment analysis can be found in *Desert Rock Energy Facility Application for Prevention of Significant Deterioration Permit – Class I Area Modeling Update,* January 2006 (ENSRx 2006), included in the Administrative Record for the DREP EIS.

**Table K-19**

**Alternative B - Highest Modeled PSD Increment Concentrations ($\mu g/m^3$) Over Three Years (2001-2003)**

| Pollutant | NOx | $SO_2$ | | | $PM_{10}$ | |
|---|---|---|---|---|---|---|
| **Averaging Period** | **Annual** | **3-hour** | **24-hour** | **Annual** | **24-hour** | **Annual** |
| Arches NP | 0.0021 | 0.720 | 0.172 | 0.008 | 0.062 | 0.004 |
| Bandelier NM | 0.0074 | 1.268 | 0.273 | 0.017 | 0.092 | 0.006 |
| Black Canyon of the Gunnison NM | 0.0026 | 0.929 | 0.180 | 0.008 | 0.050 | 0.003 |
| Canyonlands NP | 0.0045 | 1.479 | 0.476 | 0.013 | 0.184 | 0.005 |
| Capitol Reef NP | 0.0010 | 0.711 | 0.159 | 0.005 | 0.072 | 0.002 |
| Grand Canyon NP | 0.0003 | 0.447 | 0.127 | 0.002 | 0.053 | 0.001 |
| Great Sand Dunes NM | 0.0018 | 0.547 | 0.147 | 0.006 | 0.050 | 0.002 |
| La Garita Wilderness | 0.0028 | 0.761 | 0.151 | 0.007 | 0.053 | 0.003 |
| Mesa Verde NP | 0.0261 | 4.706 | 0.790 | 0.044 | 0.263 | 0.016 |
| Pecos Wilderness | 0.0041 | 0.690 | 0.190 | 0.011 | 0.068 | 0.004 |
| Petrified Forest NP | 0.0008 | 0.939 | 0.212 | 0.004 | 0.091 | 0.002 |
| San Pedro Parks Wilderness | 0.0169 | 2.379 | 0.533 | 0.030 | 0.187 | 0.011 |
| Weminuche Wilderness | 0.0086 | 1.803 | 0.207 | 0.017 | 0.093 | 0.007 |
| West Elk Wilderness | 0.0016 | 0.722 | 0.173 | 0.006 | 0.049 | 0.02 |
| Wheeler Peak Wilderness | 0.0028 | 0.727 | 0.092 | 0.008 | 0.046 | 0.003 |
| **SIL**[1] | **0.1** | **1.0** | **0.2** | **0.1** | **0.3** | **0.2** |
| **PSD Increments** | **2.5** | **25.0** | **5.0** | **2.0** | **8.0** | **4.0** |

SIL = Significant Impact Level
SOURCE: ENSR Corporation, *Desert Rock Energy Facility Application for Prevention of Significant Deterioration Permit – Class I Area Modeling Update*, January 2006
[1] Proposed by USEPA (1996; 61 FR 38249)

### 3.5.1.2 Class II Area Impacts

The following text is copied from the Executive Summary of the ENSR report, *Desert Rock Energy Facility Application for Prevention of Significant Deterioration Permit – Class II Area Modeling Update,* June 2006. Note that the “material handling sources” mentioned below include coal extraction, processing and transport between the BNCC mine and the proposed power plant.

> This report documents the results of the updated PSD Class II modeling analysis for the proposed Desert Rock Energy Facility project. The modeled project emissions include the main stack emissions that were included in the Class I modeling, as well as emissions from the following sources: auxiliary boilers, emergency generators, fire water pumps, material handling sources, and emissions from road traffic.
>
> The CALPUFF model was used to compute the project impacts in PSD Class II areas, with consistent meteorological data and technical options that were used in the Class I modeling. Modeling domains and receptor networks appropriate for the Class II analysis were employed.

The results of the modeling analysis are summarized as follows:

- The Project impacts are above PSD Class II [SIL] for a limited area around the facility (about 11 km for $SO_2$ and 1.7 km for $PM_{10}$). [PSD Class II significant impact levels (SIL) are provided within Table 4-17.] The project has insignificant impacts for CO and NOx.
- Emissions data provided by the State of New Mexico was used to compile a nearby background source inventory for $SO_2$ and $PM_{10}$.
- The peak impacts from the facility are located very close to the fenceline (within 1 km in most cases). These impacts are likely due to the emergency generator or auxiliary boilers that do not run continuously.
- The PSD increment consumption due to the facility emissions is well within PSD Class [II] increments. The cumulative modeling analysis shows compliance with PSD Class II increments and the NAAQS.
- The $SO_2$ 3-hour and 24-hour impacts are 19% and 12% of the PSD increments and are located between 1 and 1.5 km from the main stack. The $PM_{10}$ 24-hour and annual impacts are 29% and 12% of the PSD increments and are located within 1 km of the main stack.
- The $SO_2$ 3-hour and 24-hour impacts are 16% and 15% of the NAAQS and are located 11 km from the main stack. Distant impacts from the Four Corners Power Plant and the San Juan Generating Station are likely contributors to this total. The $PM_{10}$ 24-hour and annual impacts are 32% and 39% of the NAAQS and are located within 1 km of the main stack.
- There are no modeled significant impacts from the proposed project in areas beyond the Navajo Nation, including New Mexico lands and the Ute Mountain range to the north.
- Impacts on numerous distant PSD Class II areas (located beyond 50 km) show increment consumption below significance limits. [Increment is defined as the maximum allowed increase in concentration of a pollutant, above a baseline concentration in an area.] Steag has provided regional haze and deposition results for informational purposes, since PSD Class I limits are not applicable in Class II areas. No further modeling analysis for these distant areas is needed.
- The results of the additional impacts analysis indicate no predicted impacts above screening levels for soils and vegetation.

In conclusion, the potential effects on air quality due to emissions from the proposed Desert Rock Energy Facility, in conjunction with nearby area source emissions, are expected to result in predicted concentrations in Class II areas that are in compliance with PSD and NAAQS limits.

Table K-20 summarizes the predicted ambient air quality impacts of the mine and power plant, based on the CALPUFF modeling results. The maximum predicted ambient concentrations for NOx (annual), $SO_2$ (annual) and CO (1-hour and 8-hour) are below the SIL for those pollutants. In accordance with the USEPA document "*Guideline on Air Quality Models*" (EPA 1999), no further analysis of these pollutants (i.e., Class I impacts and increment consumption) for the specified averaging times is required under the PSD regulations. The maximum predicted ambient concentrations for $SO_2$ (3-hour and 24-hour) and $PM_{10}$ (24-hour) are above the corresponding SIL. There are no promulgated SILs for lead. None of the predicted maximum ambient pollutant concentrations exceeded the corresponding PSD Class II degradation increment or the NAAQS.

**Table K-20**

**Alternative B - Maximum Predicted Air Quality Impacts**

| Pollutant | Averaging Period | Maximum Modeled Conc. ($\mu g/m^3$) | Distance (km) | Bearing (Deg.) | SIL ($\mu g/m^3$) | % of SIL | PSD Class II Increment ($\mu g/m^3$) | % of Incr. | NAAQS ($\mu g/m^3$) | % of Ambient Standard |
|---|---|---|---|---|---|---|---|---|---|---|
| $NO_X$ | 24 Hour [1] | 1.40 | 34.2 | 130 | N/A | N/A | N/A | N/A | 191 [(1)] | 1% |
| | Annual | 0.56 | 0.92 | 302 | 1 | 56% | 25 | 25 | 100 | 1% |
| $SO_2$ | 3 Hour | 271.18 | 0.22 | 26 | 25 | 1085% | 512 | 53% | 1,300 | 21% |
| | 24 Hour | 23.59 | 0.22 | 26 | 5 | 472% | 91 | 26% | 365 | 6% |
| | Annual | 0.41 | 0.98 | 307 | 1 | 41% | 20 | 2% | 80 | 1% |
| $PM_{10}$ | 24 Hour | 27.23 | 0.22 | 26 | 5 | 555% | 30 | 92% | 150 | 18% |
| CO | 1 Hour | 1375.70 | 0.22 | 26 | 2000 | 69% | N/A | N/A | 40,000 | 3% |
| | 8 Hour[(2)] | 465.16 | 0.22 | 26 | 500 | 93% | N/A | N/A | 1,000 | 47% |
| Pb | Quarterly | 0.0028 | 1.47 | 94 | N/A | N/A | N/A | N/A | 1.5 | 0.19% |

SOURCE: ENSR Corporation, *Desert Rock Energy Facility Application for Prevention of Significant Deterioration Permit – Class II Area Modeling Update,* June 2006

1. A 24-hour State of New Mexico standard applies for receptors outside of the Navajo Nation
2. National default ratio of 0.75 for $NO_2$/NOx used.
3. For 3-hour averages, an $SO_2$ emission rate of 0.09 lb/MMBtu was assumed to account for short term variability
4. CALPUFF does not provide 8-hour average results, so a conservatively high 3-hour average is provided for CO.

Certain national parks, monuments and wildlife areas are not designated as Class I areas, but are considered sensitive receptors by federal and state land managers responsible for these lands. ENSR predicted the maximum ambient concentrations for NOx, $SO_2$ and $PM_{10}$ at 26 such areas within New Mexico, Arizona, Utah and Colorado, based on power plant emissions only (e.g. mine emissions not included). With the exception of the predicted 3-hour $SO_2$ concentration in some of these areas, none of the SILs for these pollutants are predicted to be exceeded. Table K-21 summarizes the predicted ambient concentrations for NOx, $SO_2$ and $PM_{10}$ in the 26 sensitive Class II areas. None of the distant Class II areas modeled in Table 4-18 exceeded the SILs for NOx, $SO_2$, or $PM_{10}$.

**Table K-21**

**Alternative B - Highest Modeled PSD Increment Concentrations (μg/m$^3$) Over Three Years (2001-2003), Distant Class II Areas**

| Pollutant Averaging Period | $NO_X$ | $SO_2$ | | | $PM_{10}$ | |
|---|---|---|---|---|---|---|
| | **Annual** | **3-hour** | **24-hour** | **Annual** | **24-hour** | **Annual** |
| Aztec Ruins Nat. Mon. | 0.011 | 1.638 | 0.331 | 0.026 | 0.117 | 0.011 |
| Canyon de Chelly Nat. Mon. | 0.006 | 2.708 | 0.684 | 0.018 | 0.246 | 0.007 |
| Chaco Culture NHP | 0.063 | 3.758 | 0.842 | 0.091 | 0.330 | 0.035 |
| Colorado Nat. Mon.* | 0.002 | 1.172 | 0.150 | 0.005 | 0.285 | 0.032 |
| Cruces Basin NWA | 0.006 | 1.031 | 0.245 | 0.012 | 0.086 | 0.005 |
| Curecanti NRA | 0.002 | 0.629 | 0.208 | 0.007 | 0.054 | 0.003 |
| El Malpais Nat. Mon. | 0.015 | 1.506 | 0.494 | 0.025 | 0.182 | 0.010 |
| El Morro Nat. Mon. | 0.006 | 1.225 | 0.355 | 0.010 | 0.128 | 0.004 |
| Glen Canyon NRA | 0.007 | 1.300 | 0.430 | 0.020 | 0.163 | 0.008 |
| Hovenweep Nat. Mon. | 0.007 | 1.181 | 0.339 | 0.024 | 0.158 | 0.010 |
| Hubbel Trading Post NHS | 0.002 | 0.575 | 0.167 | 0.007 | 0.067 | 0.003 |
| Lizard Head NWA | 0.004 | 0.981 | 0.263 | 0.011 | 0.085 | 0.004 |
| Mount Sneffels NWA | 0.003 | 0.755 | 0.158 | 0.008 | 0.054 | 0.003 |
| Natural Bridges Nat. Mon. | 0.004 | 0.907 | 0.272 | 0.013 | 0.107 | 0.005 |
| Navajo Nat. Mon. | 0.001 | 0.584 | 0.233 | 0.005 | 0.090 | 0.005 |
| Pecos NHP | 0.003 | 0.292 | 0.130 | 0.008 | 0.044 | 0.003 |
| Petroglyph Nat. Mon. | 0.011 | 1.130 | 0.255 | 0.023 | 0.119 | 0.009 |
| Rainbow Bridge Nat. Mon. | 0.001 | 0.508 | 0.130 | 0.004 | 0.070 | 0.002 |
| Salinas Pueblo Missions Nat. Mon. | 0.004 | 0.455 | 0.143 | 0.009 | 0.059 | 0.004 |
| South San Juan NWA | 0.008 | 1.164 | 0.338 | 0.014 | 0.116 | 0.006 |
| Sunset Crater Nat. Mon. | 0.000 | 0.112 | 0.051 | 0.001 | 0.026 | 0.001 |
| Uncompahgre NWA* | 0.002 | 0.532 | 0.155 | 0.007 | 0.046 | 0.003 |
| Wilson Mountain Primitive Area* | 0.004 | 0.848 | 0.181 | 0.010 | 0.063 | 0.004 |
| Wupatki Nat. Mon. | 0.000 | 0.142 | 0.062 | 0.002 | 0.031 | 0.001 |
| Yucca House Nat. Mon. | 0.007 | 1.193 | 0.296 | 0.021 | 0.128 | 0.009 |
| Zuni-Cibola NHP | 0.004 | 1.045 | 0.262 | 0.009 | 0.112 | 0.004 |
| **SIL[1]** | **1.0** | **25** | **5.0** | **1.0** | **5.0** | **1.0** |
| **PSD Increments** | **25** | **512** | **91** | **20** | **30** | **17** |

SOURCE: ENSR Corporation, *Desert Rock Energy Facility Application for Prevention of Significant Deterioration Permit – Class II Area Modeling Update,* June 2006
* subject under Colorado regulation to Class I $SO_2$ increment protection

Based on the predicted maximum ambient pollutant concentrations presented in Table K-20 and Table K-21 above, the off-site air quality impacts of the proposed power plant would be considered minor. No exceedances of the NAAQS, nor excessive consumption of Class I or II increments, are anticipated to occur. Significant impact levels do not extend more than 1.1 km from the plant stacks.

### 3.5.1.3 Visibility/Regional Haze Impacts

Table K-22 presents the regional haze modeling results, using Industrial Source Complex (ISC)-type dispersion, for calendar years 2001, 2002, and 2003. Table K-23 presents the regional haze modeling results, using the lower cold-season ammonia concentration, for the calendar years 2001, 2002, and 2003. Table K-24 presents the regional haze modeling results, using American Meteorological Society/EPA Regulatory Model (AERMOD)-type dispersion, for the calendar years 2001, 2002, and 2003.

*Summary.* Table K-22 presents regional haze modeling results in terms of the change in light extinction from natural background extinction using Federal Land Managers AQRV Workgroup (FLAG) guidance Method 2 and alternative Method 6 with the 98 percentile results tabulated. The Method 6 results are presented as an alternative so that the sensitivity of the results to very high relative humidity that could be associated with natural meteorological interferences is reduced. The results in show that 2001 is the worst year of the three modeled and that there are a number of Class I areas with several days of modeled extinction above 5% change. The 2001 modeling results for the Class I areas show that there were seven (7) days in the year with extinction changes over 10%. For 2002 and 2003 there are not more than two (2) days in a given year with extinction changes over 10%. All of the peak impacts are under 20% change, using Method 2. The Method 6 results show that is not more than one (1) day per year, if any, at any of the Class I area per year with modeled impacts above 10%. However, one Class I area, Mesa Verde, was modeled with the 98 percentile impact only slightly above 5% (6.36%) for any of the three years, and the 3-year aggregate 98 percentile impact just slightly above 5% (5.18%) change (equivalent to 0.51 deciviews). The Best Available Retrofit Technology (BART) approach indicates that the project's impacts and only marginally noticeable at Mesa Verde.

Table K-23 presents an alternative set of regional haze results using a lower background ammonia concentration (0.1 ppb) for cold-weather months (November thru March). These results show lower impacts for both Method 2 and alternative Method 6. The Method 6 results have only one predicted extinction barely over 10% (10.07%), and the 98 percentile results show that all Class I areas with the 3-year aggregate extinction change are below 5%.  However, Mesa Verde was modeled with the 98 percentile impact only slightly above 5% (5.18%) for any of the three years.

Table K-24 presents AERMOD-type dispersion results. Method 2 results show that there are four (4) days per year in 2001 with predicted extinction change above 10% at the Class I areas. Years 2002 and 2003 did not contain any days with predicted extinction change above 10%. Method 6 results show all predicted extinction changes were below 10%, and the 98 percentile extinction changes were below 5% for all Class I areas for years 2001 thru 2003.

These tables indicate that the project's impacts to visibility and regional haze are very minimal with only a marginally noticeable impact at Mesa Verde.

## Table K-22

## Alternative B - Regional Haze Modeling Results (2001-2003) – ISC-type Dispersion

| Class I Area | 2001 | | | 2002 | | | 2003 | | |
|---|---|---|---|---|---|---|---|---|---|
| | Days > than | | MAX % Change in $B_{ext}$ | Days > than | | MAX % | Days > than | | MAX % |
| | 5% $\Delta B_{ext}$ | 10% $\Delta B_{ext}$ | | 5% $\Delta B_{ext}$ | 10% $\Delta B_{ext}$ | MAX % Change in $B_{ext}$ | 5% $\Delta B_{ext}$ | 10% $\Delta B_{ext}$ | MAX % Change in $B_{ext}$ |
| ***Method 2, USEPA f(RH), FLAG Background*** | | | | | | | | | |
| Arches | 5 | 0 | **9.09** | 1 | 0 | **6.19** | 0 | 0 | 4.21 |
| Bandelier | 3 | 0 | **8.94** | 0 | 0 | 3.73 | 2 | 0 | **6.64** |
| Black Cany. Gun. | 2 | 0 | **5.77** | 0 | 0 | 3.11 | 0 | 0 | 4.02 |
| Canyonlands | 6 | 2 | **18.28** | 0 | 0 | 4.61 | 1 | 0 | **5.87** |
| Capitol Reef | 7 | 1 | **11.69** | 0 | 0 | 4.83 | 0 | 0 | 4.33 |
| Grand Canyon | 1 | 0 | **8.77** | 1 | 0 | **9.17** | 0 | 0 | 4.29 |
| Great Sand Dunes | 0 | 0 | 2.86 | 0 | 0 | 3.68 | 0 | 0 | 3.16 |
| La Garita | 0 | 0 | 4.91 | 0 | 0 | 3.56 | 0 | 0 | 2.25 |
| Mesa Verde | 15 | 1 | **12.52** | 15 | 2 | **16.81** | 2 | 1 | **10.91** |
| Pecos | 0 | 0 | 4.64 | 0 | 0 | 2.99 | 0 | 0 | 4.75 |
| Petrified Forest | 2 | 1 | **11.34** | 1 | 0 | **9.00** | 0 | 0 | 3.25 |
| San Pedro Parks | 5 | 1 | **11.61** | 1 | 0 | **5.02** | 7 | 1 | **11.35** |
| West Elk | 2 | 0 | **6.94** | 0 | 0 | 3.51 | 0 | 0 | 3.91 |
| Weminuche | 4 | 1 | **10.35** | 3 | 0 | **6.67** | 2 | 0 | **6.40** |
| Wheeler Peak | 0 | 0 | 3.23 | 0 | 0 | 2.84 | 0 | 0 | 4.74 |

***Method 6, Monthly f(RH), FLAG Background***

| Class I Area | 2001 | | | 2002 | | | 2003 | | | 2001-2003 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Days > than | | MAX % Change in $B_{ext}$ | Days > than | | MAX % Change in $B_{ext}$ | Days > than | | MAX % Change in $B_{ext}$ | $8^{th}$ High % Change in $B_{ext}$ | $22^{th}$ High % Change in $B_{ext}$ |
| | 5% $\Delta B_{ext}$ | 10% $\Delta B_{ext}$ | | 5% $\Delta B_{ext}$ | 10% $\Delta B_{ext}$ | | 5% $\Delta B_{ext}$ | 10% $\Delta B_{ext}$ | | | |
| Arches | 1 | 0 | **5.10** | 1 | 0 | **6.19** | 0 | 0 | 4.21 | 2.80 | 2.46 |
| Bandelier | 0 | 0 | 4.13 | 0 | 0 | 3.45 | 1 | 0 | **5.20** | 2.45 | 2.07 |
| Black Cany. Gun. | 0 | 0 | 4.09 | 0 | 0 | 3.35 | 0 | 0 | 3.60 | 2.05 | 1.74 |
| Canyonlands | 6 | 1 | **13.37** | 4 | 0 | **6.28** | 1 | 0 | **6.71** | 4.03 | 3.08 |
| Capitol Reef | 2 | 0 | **6.10** | 0 | 0 | 4.29 | 1 | 0 | **5.42** | 3.28 | 2.87 |
| Grand Canyon | 0 | 0 | 4.77 | 1 | 0 | **5.69** | 0 | 0 | 4.70 | 1.50 | 1.25 |
| Great Sand Dunes | 0 | 0 | 2.38 | 0 | 0 | 4.31 | 0 | 0 | 2.51 | 1.50 | 1.16 |
| La Garita | 0 | 0 | 3.88 | 0 | 0 | 2.13 | 0 | 0 | 2.42 | 2.01 | 1.61 |
| Mesa Verde | 16 | 0 | **7.97** | 10 | 0 | **9.68** | 1 | 1 | **11.58** | **6.36** | **5.18** |
| Pecos | 0 | 0 | 2.88 | 0 | 0 | 2.88 | 0 | 0 | 4.77 | 2.05 | 1.79 |
| Petrified Forest | 1 | 0 | **6.06** | 1 | 0 | **7.44** | 1 | 0 | **5.37** | 1.83 | 1.64 |
| San Pedro Parks | 3 | 0 | **6.19** | 0 | 0 | 4.83 | 3 | 0 | **8.65** | 3.71 | 3.24 |
| West Elk | 0 | 0 | 4.09 | 0 | 0 | 2.68 | 0 | 0 | 3.70 | 1.69 | 1.48 |
| Weminuche | 1 | 0 | **5.15** | 0 | 0 | 4.83 | 0 | 0 | 3.32 | 2.89 | 2.76 |
| Wheeler Peak | 0 | 0 | 3.26 | 0 | 0 | 2.42 | 0 | 0 | 3.41 | 1.43 | 1.42 |

SOURCE: ENSR Corporation 2006 – Desert Rock Energy Facility Application for Prevention of Significant Deterioration Permit – Class I Area Modeling Update, January 2006

## Table K-23

### Alternative B - Regional Haze Modeling Results (2001-2003) – Lower Cold-season Background Ammonia Concentration

| Class I Area | 2001 | | | 2002 | | | 2003 | | |
|---|---|---|---|---|---|---|---|---|---|
| | Days > than | | MAX % Change In $B_{ext}$ | Days > than | | MAX % Change In $B_{ext}$ | Days > than | | MAX % Change In $B_{ext}$ |
| | 5% $\Delta B_{ext}$ | 10% $\Delta B_{ext}$ t | | 5% $\Delta B_{ext}$ | 10% $\Delta B_{ext}$ t | | 5% $\Delta B_{ext}$ | 10% $\Delta B_{ext}$ t | |
| ***Method 2, USEPA f(RH), FLAG Background*** | | | | | | | | | |
| Arches | 5 | 0 | **8.82** | 1 | 0 | **5.63** | 0 | 0 | 3.84 |
| Bandelier | 3 | 0 | **8.18** | 0 | 0 | 3.52 | 1 | 0 | **6.07** |
| Black Cany. Gun. | 0 | 0 | 4.87 | 0 | 0 | 2.74 | 0 | 0 | 3.08 |
| Canyonlands | 5 | 2 | **14.16** | 0 | 0 | 3.77 | 1 | 0 | **5.77** |
| Capitol Reef | 5 | 1 | **10.06** | 0 | 0 | 4.83 | 0 | 0 | 3.80 |
| Grand Canyon | 1 | 0 | **7.76** | 1 | 0 | **8.26** | 0 | 0 | 3.98 |
| Great Sand Dunes | 0 | 0 | 2.72 | 0 | 0 | 3.09 | 0 | 0 | 3.10 |
| La Garita | 0 | 0 | 4.91 | 0 | 0 | 3.56 | 0 | 0 | 2.25 |
| Mesa Verde | 13 | 0 | **8.84** | 11 | **1** | **12.98** | 2 | 0 | **7.66** |
| Pecos | 0 | 0 | 4.40 | 0 | 0 | 2.81 | 0 | 0 | 4.31 |
| Petrified Forest | 2 | 1 | **10.19** | 1 | 0 | **7.58** | 0 | 0 | 2.86 |
| San Pedro Parks | 4 | 1 | **10.00** | 0 | 0 | 4.49 | 6 | 1 | **10.20** |
| West Elk | 1 | 0 | **6.34** | 0 | 0 | 3.36 | 0 | 0 | 3.22 |
| Weminuche | 3 | 0 | **8.60** | 2 | 0 | **6.67** | 1 | 0 | **5.87** |
| Wheeler Peak | 0 | 0 | 2.82 | 0 | 0 | 2.62 | 0 | 0 | 4.65 |

***Method 6, Monthly f(RH), FLAG Background***

| Class I Area | 2001 | | | 2002 | | | 2003 | | | 2001-2003 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Days > than | | MAX % Change In $B_{ext}$ | Days > than | | MAX % Change In $B_{ext}$ | Days > than | | MAX % Change In $B_{ext}$ | 8th High % Change in $B_{ext}$ | 22nd Highest % Change in $B_{ext}$ |
| | 5% $\Delta B_{ext}$ | 10% $\Delta B_{ext}$ t | | 5% $\Delta B_{ext}$ | 10% $\Delta B_{ext}$ t | | 5% $\Delta B_{ext}$ | 10% $\Delta B_{ext}$ t | | | |
| Arches | 0 | 0 | 4.88 | 1 | 0 | **5.63** | 0 | 0 | 3.84 | 2.42 | 2.15 |
| Bandelier | 0 | 0 | 3.77 | 0 | 0 | 3.00 | 0 | 0 | 4.59 | 2.15 | 1.96 |
| Black Cany. Gun. | 0 | 0 | 3.68 | 0 | 0 | 2.88 | 0 | 0 | 2.73 | 1.84 | 1.50 |
| Canyonlands | 5 | 1 | **10.07** | **1** | 0 | **5.47** | **1** | 0 | **5.08** | 3.19 | 2.68 |
| Capitol Reef | 1 | 0 | **5.27** | 0 | 0 | 3.76 | 0 | 0 | 4.13 | 2.90 | 2.30 |
| Grand Canyon | 0 | 0 | 4.26 | 1 | 0 | **5.15** | 0 | 0 | 4.23 | 1.40 | 1.08 |
| Great Sand Dunes | 0 | 0 | 2.04 | 0 | 0 | 3.44 | 0 | 0 | 2.31 | 1.33 | 1.09 |
| La Garita | 0 | 0 | 3.88 | 0 | 0 | 2.02 | 0 | 0 | 2.42 | 2.01 | 1.47 |
| Mesa Verde | 10 | 0 | **6.74** | 5 | 0 | **7.63** | 1 | 0 | **7.86** | **5.18** | 4.50 |
| Pecos | 0 | 0 | 2.55 | 0 | 0 | 2.49 | 0 | 0 | 4.30 | 1.83 | 1.64 |
| Petrified Forest | 1 | 0 | **5.49** | 1 | 0 | **6.30** | 0 | 0 | 4.64 | 1.81 | 1.55 |
| San Pedro Parks | 2 | 0 | **5.30** | 0 | 0 | 3.95 | 1 | 0 | **7.44** | 3.59 | 2.96 |
| West Elk | 0 | 0 | 3.69 | 0 | 0 | 2.42 | 0 | 0 | 2.99 | 1.57 | 1.39 |
| Weminuche | 0 | 0 | 4.31 | 0 | 0 | 3.99 | 0 | 0 | 2.90 | 2.76 | 2.53 |
| Wheeler Peak | 0 | 0 | 2.49 | | 0 | 2.23 | 0 | 0 | 2.91 | 1.28 | 1.28 |

SOURCE: ENSR Corporation 2006 – Desert Rock Energy Facility Application for Prevention of Significant Deterioration Permit – Class I Area Modeling Update, January 2006

## Table K-24

### Alternative B - Regional Haze Modeling Results (2001-2003) – AERMOD-type Dispersion

| Class I Area | 2001 | | | 2002 | | | 2003 | | |
|---|---|---|---|---|---|---|---|---|---|
| | Days > than | | MAX % Change In $B_{ext}$ | Days > than | | MAX % Change In $B_{ext}$ | Days > than | | MAX % Change In $B_{ext}$ |
| | 5% $\Delta B_{ext}$ | 10% $\Delta B_{ext}$ t | | 5% $\Delta B_{ext}$ | 10% $\Delta B_{ext}$ t | | 5% $\Delta B_{ext}$ | 10% $\Delta B_{ext}$ t | |
| ***Method 2, USEPA f(RH), FLAG Background*** | | | | | | | | | |
| Arches | 5 | 0 | **8.40** | 1 | 0 | **5.30** | 1 | 0 | **5.51** |
| Bandelier | 2 | 0 | **6.58** | 0 | 0 | 3.06 | 1 | 0 | **5.88** |
| Black Cany. Gun. | 2 | 0 | **5.89** | 0 | 0 | 3.43 | 0 | 0 | 3.30 |
| Canyonlands | 6 | 1 | **13.61** | 0 | 0 | 3.57 | 1 | 0 | **8.71** |
| Capitol Reef | 5 | 1 | **10.67** | 1 | 0 | **6.38** | 0 | 0 | 3.72 |
| Grand Canyon | 2 | 0 | **9.93** | 1 | 0 | **8.30** | 0 | 0 | 3.13 |
| Great Sand Dunes | 0 | 0 | 2.85 | 0 | 0 | 3.43 | 0 | 0 | 4.83 |
| La Garita | 0 | 0 | 4.78 | 0 | 0 | 3.34 | 0 | 0 | 1.95 |
| Mesa Verde | 1 | 0 | **5.83** | 5 | 0 | **8.93** | 1 | 0 | **5.85** |
| Pecos | 0 | 0 | 3.67 | 0 | 0 | 2.54 | 1 | 0 | **5.03** |
| Petrified Forest | 1 | 1 | **10.68** | **1** | 0 | **5.38** | 0 | 0 | 2.50 |
| San Pedro Parks | 2 | 0 | **8.51** | 0 | 0 | 3.42 | 4 | 0 | **6.07** |
| West Elk | 3 | 1 | **12.21** | 0 | 0 | 3.34 | 0 | 0 | 3.43 |
| Weminuche | 1 | 0 | **5.04** | 0 | 0 | 4.14 | 1 | 0 | **5.92** |
| Wheeler Peak | | | 2.81 | 0 | 0 | 2.29 | 0 | 0 | 4.84 |

| ***Method 6, Monthly f(RH), FLAG Background*** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Class I Area | 2001 | | | 2002 | | | 2003 | | | 2001-2003 | |
| | Days > than | | MAX % Change In $B_{ext}$ | Days > than | | MAX % Change In $B_{ext}$ | Days > than | | MAX % Change In $B_{ext}$ | 8"' High % Change in Bext | 22nd Highest Change in Bext |
| | 5% $\Delta B_{ext}$ | 10% $\Delta B_{ext}$ t | | 5% $\Delta B_{ext}$ | 10% $\Delta B_{ext}$ t | | 5% $\Delta B_{ext}$ | 10% $\Delta B_{ext}$ t | | | |
| Arches | 0 | 0 | 4.70 | 1 | 0 | **5.30** | 1 | 0 | **5.51** | 2.68 | 2.38 |
| Bandelier | 0 | 0 | 3.31 | 0 | 0 | 2.41 | 0 | 0 | 4.61 | 2.13 | 1.91 |
| Black Cany. Gun. | 1 | 0 | **5.05** | 0 | 0 | 3.83 | 0 | 0 | 3.35 | 1.74 | 1.59 |
| Canyonlands | 4 | 0 | **7.12** | 1 | 0 | **5.10** | 0 | 0 | 4.84 | 4.08 | 3.25 |
| Capitol Reef | 1 | 0 | **5.68** | 0 | 0 | 3.52 | 0 | 0 | 4.35 | 2.75 | 2.37 |
| Grand Canyon | 1 | 0 | **5.31** | 1 | 0 | **5.19** | 0 | 0 | 3.77 | 1.32 | 1.14 |
| Great Sand Dunes | 0 | 0 | 2.05 | 0 | 0 | 4.00 | 0 | 0 | 4.01 | 1.55 | 1.22 |
| La Garita | 0 | 0 | 3.67 | 0 | 0 | 2.02 | 0 | 0 | 2.10 | 1.87 | 1.42 |
| Mesa Verde | 1 | 0 | **5.29** | **1** | 0 | **5.10** | 0 | 0 | 4.81 | 3.30 | 2.9 |
| Pecos | 0 | 0 | 2.35 | 0 | 0 | 1.95 | 0 | 0 | 3.85 | 1.97 | 1.76 |
| Petrified Forest | 1 | 0 | **5.67** | 0 | 0 | 4.44 | 0 | 0 | 4.26 | 1.90 | 1.59 |
| San Pedro Parks | 0 | 0 | 4.76 | 0 | 0 | 3.19 | 0 | 0 | 3.73 | 2.80 | 2.45 |
| West Elk | 1 | 0 | **6.80** | 0 | 0 | 3.31 | 0 | 0 | 3.70 | 1.75 | 1.5 |
| Weminuche | 0 | 0 | 3.92 | 0 | 0 | 3.77 | 1 | 0 | **5.14** | 2.14 | 2.07 |
| Wheeler Peak | 0 | 0 | 2.81 | 0 | 0 | 1.89 | 0 | 0 | 2.61 | 1.42 | 1.32 |

SOURCE: ENSR Corporation 2006 – Desert Rock Energy Facility Application for Prevention of Significant Deterioration Permit – Class I Area Modeling Update, January 2006

The ENSR report also included a table summarizing the visibility impacts of the power plant emissions within 26 distant Class II areas. Visibility impacts are quantified in terms of change in extinction. Extinction is the attenuation of light due to scattering and absorption as it passes through a medium. Table K-24 presents the data from the ENSR June 2006 modeling update. All of the peak impacts are under 20% change, using Method 2, except for Canyon de Chelly National Monument (21.6%) and Hovenweep National Monument (20.6%). The Method 6 results show that there is no more than one (1) day per year, if any, at any of the Class II areas per year with modeled impacts above 10%. However, four Class II areas, including Chaco Culture National Historic Park, El Malpais National Monument, Glen

Canyon National Recreation Area and Hovenweep National Monument, show the 98 percentile impact only slightly above 5% (highest value is 6.7%) for any of the three years. The Best Available Retrofit Technology (BART) approach indicates that the project's impacts are only marginally noticeable at the four previously mentioned Class II areas.

**Table K-24**

**Alternative B - Distant Class II Areas Regional Haze Impact Analysis (2001-2003)**

| **Class II Area** | **Highest 3-Year Percent (%) Extinction Change** | |
|---|---|---|
| | **FLAG Procedure** | **Alternative "BART" Procedure (Highest 98th Percentage Value)** |
| Aztec Ruins Nat. Mon. | 9.4 | 3.1 |
| Canyon de Chelly Nat. Mon. | 21.6 | 4.9 |
| Chaco Culture NHP | 14.7 | 6.6 |
| Colorado Nat. Mon. | 7.7 | 2.5 |
| Cruces Basin NWA | 6.7 | 2.2 |
| Curecanti NRA | 5.7 | 1.3 |
| El Malpais Nat. Mon. | 11.0 | 5.4 |
| El Morro Nat. Mon. | 9.1 | 3.1 |
| Glen Canyon NRA | 15.2 | 5.9 |
| Hovenweep Nat. Mon. | 20.6 | 6.7 |
| Hubbel Trading Post NHS | 9.2 | 2.8 |
| Lizard Head NWA | 12.7 | 2.2 |
| Mount Sneffels NWA | 7.7 | 1.6 |
| Natural Bridges Nat. Mon. | 8.1 | 3.8 |
| Navajo Nat. Mon. | 13.1 | 2.6 |
| Pecos NHP | 3.7 | 1.3 |
| Petroglyph Nat. Mon. | 9.9 | 3.2 |
| Rainbow Bridge Nat. Mon. | 5.7 | 1.8 |
| Salinas Pueblo Missions Nat. Mon. | 5.6 | 1.9 |
| South San Juan NWA | 8.2 | 2.6 |
| Sunset Crater Nat. Mon. | 4.0 | 0.8 |
| Uncompahgre NWA | 7.1 | 1.6 |
| Wilson Mountain Primitive Area | 7.8 | 1.8 |
| Wupatki Nat. Mon. | 4.3 | 1.0 |
| Yucca House Nat. Mon. | 13.3 | 3.3 |
| Zuni-Cibola NHP | 10.3 | 2.5 |
| FLAG f(RH) Values, MVISBK=2, RHMAX=95%, 10% ranked lowest background extinction | | |

SOURCE: ENSR Corporation 2006 – Desert Rock Energy Facility Application for Prevention of Significant Deterioration Permit – Class II Area Modeling Update, June 2006

### 3.5.1.4 Sulfate/Nitrate Deposition

ENSR modeled the maximum off-site concentrations and deposition rates (24-hour and annual) for sulfates and nitrates (aerosols which form from the oxidation and particle agglomeration of emitted $SO_2$ and NOx in the atmosphere), based on the CALPUFF model output files.

Based on the CALPUFF model output files, ENSR prepared a table showing the location and magnitude of maximum predicted deposition rates for sulfates and nitrates, resulting from $SO_2$ and NOx emitted by the proposed power plant. Table K-25 summarizes the maximum predicted deposition rates, and predicted locations relative to the main stack, for these chemical species. Maximum predicted deposition rate for sulfates and nitrates occurred in 2003. The 2003 sulfate and nitrate results for the 24-hour averaging period were 0.8284 and 0.0947 milligram-seconds per meter squared ($mg/m^2/s$) at distance of 0.36 kilometers (0.22 miles) north of the main stack. The 2003 sulfate and nitrate results for the annual averaging period were 0.0077 and 0.0009 $mg/m^2/s$ at distance of 0.26 kilometers (0.16 miles) northeast of the main stack. Because these maximum predicted deposition rates occur less than a kilometer from the main stack it is assumed that deposition impacts due to power plant operation will be negligible. All of the annual sulfur and nitrogen deposition values are below the Class I Deposition Analysis Threshold (DAT) value of 0.005 kg/ha/yr or 1.59E-12 $mg/m^2/s$.

### 3.5.2 Carbon Dioxide Emissions

As described above, the proposed power plant would emit criteria pollutants, including particulates and gaseous pollutants (sulfur dioxide and nitrogen oxides) that form aerosols in the atmosphere. Although measurable concentrations of emissions from the proposed power plant would likely extend to less than hundred kilometers from the facility, due to global wind patterns, minute quantities of these chemicals could eventually be dispersed across a wider area. In addition, combustion of biomass and all fossil fuels (coal, coke, petroleum and natural gas) result in emissions of carbon dioxide ($CO_2$). $CO_2$ is widely considered to be a "greenhouse gas" (GHG). Greenhouse gases, which also include methane, nitrous oxides, chlorofluorocarbons and other chemicals, play a natural role in maintaining the temperature of the earth's atmosphere, by allowing some sunlight to pass through and heat the surface of the earth and then absorbing a portion of the infrared heat reflected or transmitted from the ground. Natural sources of GHG include volcanic eruptions, plant respiration and decomposition of organic matter.

Carbon dioxide forms when one atom of carbon unites with two atoms of oxygen, either during combustion or in the atmosphere after being emitted from the stack. Because the atomic weight of carbon is 12 and oxygen is 16, the atomic weight of carbon dioxide is 44. Based on that ratio and a 99 percent fraction of fuel oxidized during combustion 72.6 pounds of carbon dioxide is produced for every percent-ton of carbon as shown by the following equation, obtained from AP-42, Volume I, Fifth Edition, Chapter 1: External Combustion Sources - Bituminous And Sub-bituminous Coal Combustion 9/98 (USEPA 1998).

$$(44 \text{ ton } CO_2 / 12 \text{ ton C}) * 0.99 * 2000 (\text{lb } CO_2 / \text{ton } CO_2) * 1/100\% = 72.6 \text{ lb } (CO_2 / \text{ton } \%C)$$

The proposed project would combust sub-bituminous coal, which is assumed to have an average carbon content of 56.38 percent (ENSR 2004). Therefore, using the equation above, the $CO_2$ emission factor for sub-bituminous coal is 4,093.2 pounds of $CO_2$ per ton of coal. Assuming a 90 percent capacity factor, Alternative B (1,500 MW plant) is assumed to combust a maximum of 6.2 million tons of coal per year. Multiplying the average annual coal combustion times the $CO_2$ emission factor results in estimated annual carbon dioxide emissions of 12.7 million tons.

### 3.5.3 Hazardous Air Pollutants

No ambient air quality standards for HAPs are in effect in the region surrounding the proposed project site. In addition, the PSD regulations do not require an analysis of HAP emissions. Therefore, an ambient air quality impacts analysis (i.e. dispersion modeling) of HAP emissions was not included in the PSD permit application. Most HAP-related regulations consist of source-specific Maximum Achievable Control Technology (MACT) standards applicable to major HAP sources, which are codified at 40 CFR Part 63 and include emission limitations and work practice standards. The proposed power plant will not be a major source of HAPs. URS estimated emissions of selected air toxics, for the sole purpose of facilitating the ecological and human health risk assessments discussed in Sections 4.3 and 4.16 of the EIS.

ENSR prepared a table showing the magnitude and location of the maximum concentration and deposition rates (wet, dry and total flux) for a hypothetical air toxic emitted at one gram per second (1 g/s), based on the California Puff (CALPUFF) model output files. The CALPUFF Model is preferred by EPA and is a state-of-the-art model that simulates the effects of varying meteorological conditions. CALPUFF can use both three-dimensional meteorological fields from dedicated meteorological models and wind data from a single observation point as input. CALPUFF contains algorithms for building downwash and allows modeling of long-range effects, such as wet and dry pollutant removal and chemical transformations. Wet deposition of aerosols results from precipitation events, such as rain or snow. Dry deposition results from natural gravitational settling of aerosols without any precipitation event. Total deposition includes both wet and dry deposition at a particular location. The predicted locations for the maximum wet, dry and total deposition rates could occur in three separate locations. URS extrapolated these values, using the maximum annual HAP emission rates for the six metals and two dioxins, to estimate maximum ambient concentrations and deposition rates for these eight toxics.

Table K-26 summarizes the maximum predicted concentration and deposition rates (wet, dry and total), including the predicted location of each maximum value, for a hypothetical air toxic emitted at 1.0 g/sec. The highest modeled impact for ground level concentrations of an air toxic occurred in 2003. The 24-hour average concentration was 0.0894 microgram per cubic meter ($\mu g/m^3$) at a distance of 0.96 kilometers (0.6 miles) southwest of the main stack. The annual average concentration was 0.003451 $\mu g/m^3$ at a distance of 5.33 kilometers (3.3 miles) southeast of the main stack. ENSR's analysis considered the varying deposition velocities of each toxic. The deposition results have been modeled for two types of particulate-bound air toxics, both fine and particle mass weighted. Organics (i.e. methyl hydrazine, 2,3,7,8-tetrachlorodibenzo-P-dioxin, and total polychlorinated dibenzo-P-dioxins) and elemental mercury vapor have been modeled as fine particles, as they tend to vaporize during combustion and then condense. Other metals (i.e. arsenic, cadmium, chromium, lead, oxidized particulate mercury and selenium) do not entirely vaporize and are conservatively assumed to be distributed in accordance with the filterable particulate size distribution.

The emission rate for mercury (114 pounds per year) was obtained from the PSD application for Alternative B (ENSR 2004x). The following comments are important considerations regarding the estimation of mercury emissions and deposition rates:

- It was assumed that 80% of the mercury generated by the combustion process is of an oxidized, particulate form, and that the remaining 20% consists of elemental mercury vapor. The control efficiency of the baghouse and wet scrubber, with respect to oxidized particulate mercury, will be no less than 95%, thus a maximum of 4% of the amount initially generated will be emitted, or approximately 19 pounds per year. Consequently, the balance of the total emissions (approximately 95 pounds per year) will be comprised of elemental mercury vapor (which is not removed by the control equipment); hence the total mercury removal efficiency of the control equipment is approximately 80%.

- Deposition of a majority of the residual oxidized particulate mercury (about 19 pounds per year) will occur within 25 kilometers from the proposed power plant. Due to its gaseous properties, only a small percentage of the elemental mercury vapor will settle out within 25 kilometers from the plant.

The foregoing assumptions are supported by the USEPA *Technical Support Document: Methodology Used to Generate Deposition, Fish Tissue Methylmercury Concentrations, and Exposure for Determining Effectiveness of Utility Emission Controls* (need EPA document number and date from Gus)

Table K-27 presents the maximum predicted concentrations and deposition rates (wet, dry and total) of the selected air toxics, for calendar years 2001, 2002, and 2003, respectively. Section 4.3 of the DREP EIS includes a discussion of the ecological risk assessment for these air toxics. Section 4.16 of the DREP EIS includes a discussion of the human health risk assessment for these air toxics.

*Ammonia Emissions from Selective Catalytic Reduction (SCR) System.* When SCR is used to control NOx emissions, a small portion of the injected reagent (ammonia) does not get reacted and remains in the flue gas. Although ammonia is not listed as a Federal HAP, it is regulated as an Extremely Hazardous Substance under Sections 302, 304 and 313 of the Federal Emergency Planning and Community Right-to-Know Act (EPCRA), and must be reported annually under the Toxic Release Inventory (TRI) requirements. In addition, ammonia is regulated by the Process Safety Management (PSM) requirements under OSHA and the Risk Management Program (RMP) requirements under Section 112(r) of the Federal Clean Air Act. Most of the excess reagent used is consumed through various chemical reactions within the SCR equipment. However, a small portion remains in the flue gas and is emitted to the atmosphere as "ammonia slip." A number of factors can affect ammonia slip, including reaction temperature, residence time, degree of mixing, and molar ratio of $NH_3$. T he USEPA document *Emission Inventory Improvement Program - Estimating Ammonia Emissions from Anthropogenic Nonagricultural Sources* (USEPAa 2004) provides recommended emission factors for calculating ammonia emissions based on tons of coal combusted. For coal-fired boilers constructed since 1997, the document prescribes a maximum ammonia slip emission factor of 0.08 lb $NH_3$ per ton of coal, which is based on a 5 ppmv $NH_3$ slip.

Multiplying the average annual coal combustion of 6.2 million tpy (assuming a 90 percent correction factor) by the $NH_3$ emission factor (0.08 lb $NH_3$ / ton coal) results in a maximum annual ammonia emissions rate of 236 tons for Alternative B. This annual emission rate equates to a maximum short-term emission rate of 6.8 grams per second (g/s). Based on ENSR's modeling results for the hypothetical pollutant, as described above, the maximum 24-hour ambient ammonia concentration would be 0.69 microgram per cubic meter ($\mu g/m^3$), and the maximum annual ambient ammonia concentration would be 0.02 $\mu g/m^3$. These values are less than 1 percent of the ambient air toxic "guidelines" published by the NMED and other western states. Therefore, the ambient air quality impacts associated with ammonia slip emissions from the power plant will be negligible.

**Table K-25**

**Alternative B - Maximum Predicted Deposition Rates for Sulfates and Nitrate**

| Modeled Parameter | Averaging Period | Flux Units | Highest Modeled Total Wet and Dry Deposition Flux and Location Relative to the Main Stack[1] | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2001 | | | | | | | 2002 | | | | | | | 2003 | | | | | | |
| | | | Flux | X* (km) | Y* (km) | delta X (km) | delta Y (km) | Dist. (km) | Bearing (deg) | Flux | X* (km) | Y* (km) | delta X (km) | delta Y (km) | Dist. (km) | Bearing (deg) | Flux | X* (km) | Y* (km) | delta X (km) | delta Y (km) | Dist. (km) | Bearing (deg) |
| Sulfur | 24-hour | $mg/m^2/s$ | 0.3900 | 127.50 | 55.10 | 0.250 | 0.099 | 0.27 | 22 | 0.3948 | 127.44 | 55.17 | 0.191 | 0.172 | 0.26 | 42 | 0.8284 | 127.25 | 55.35 | -0.005 | 0.355 | 0.36 | 359 |
| | Annual | $mg/m^2/s$ | 0.0050 | 127.47 | 55.13 | 0.220 | 0.136 | 0.26 | 32 | 0.0025 | 127.44 | 55.17 | 0.191 | 0.172 | 0.26 | 42 | 0.0077 | 127.47 | 55.13 | 0.220 | 0.136 | 0.26 | 32 |
| Nitrogen | 24-hour | $mg/m^2/s$ | 0.0444 | 126.67 | 55.37 | -0.579 | 0.367 | 0.69 | 302 | 0.0438 | 127.44 | 55.17 | 0.191 | 0.172 | 0.26 | 42 | 0.0947 | 127.25 | 55.35 | -0.005 | 0.355 | 0.36 | 359 |
| | Annual | $mg/m^2/s$ | 0.0006 | 127.47 | 55.13 | 0.220 | 0.136 | 0.26 | 32 | 0.0004 | 127.44 | 55.17 | 0.191 | 0.172 | 0.26 | 42 | 0.0009 | 127.47 | 55.13 | 0.220 | 0.136 | 0.26 | 32 |

**Main Stack Location[2]**

| | | |
|---|---|---|
| x | 127.25 | km |
| y | 54.998 | km |

SOURCE: ENSR
Bearing (deg) = Direction of highest flux relative to the main stack in degrees
Delta X (km) = Distance in X direction from the main stack in kilometers
Delta Y (km) = Distance in Y direction from the main stack in kilometers
Dist. (km) = Distance from the main stack in kilometers
Flux = Deposition rate of the modeled parameter in $mg/m^2/s$
$mg/m^2/s$ = milligrams per square meter per second
X* = Flux X coordinate in kilometers
Y* = Flux Y coordinate in kilometers
Note: The main stack was modeled as a dual flue stack representing stack parameters for both boiler flues.
(1) Highest modeled impacts are based on actual emissions for both boilers.
(2) Coordinates reflect a Lambert conformal coordinate system used for the CALPUFF modeling and units are km.

**Table K-26**

**Alternative B - Modeled Concentrations and Deposition Rates for Hypothetical Air Toxic Emitted at 1 gram/second**

| Modeled Parameter | Averaging Period | Conc./ Flux Units | Highest Modeled Impact and Location Relative to the Main Stack[1] 2001 Conc./Flux | 2001 Dist. (km) | 2001 Bering (deg) | 2002 Conc./Flux | 2002 Dist. (km) | 2002 Bering (deg) | 2003 Conc./Flux | 2003 Dist. (km) | 2003 Bering (deg) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Ground Level Concentration [3] | 24-hour | μg/m³ | 6.245E-02 | 1.36 | 131 | 7.978E-02 | 3.94 | 227 | 8.940E-02 | 0.96 | 240 |
| | Annual | μg/m³ | 3.214E-03 | 5.33 | 124 | 3.451E-03 | 5.33 | 124 | 3.379E-03 | 1.00 | 314 |
| Wet Deposition (Particle Mass Weighted) | 24-hour | μg/m²/s | 6.665E-02 | 0.26 | 52 | 9.430E-02 | 0.27 | 21 | 1.054E-01 | 0.36 | 359 |
| | Annual | μg/m²/s | 9.245E-04 | 0.27 | 22 | 8.743E-04 | 0.27 | 22 | 6.425E-04 | 0.26 | 52 |
| Dry Deposition (Particle Mass Weighted) | 24-hour | μg/m²/s | 2.801E-04 | 3.35 | 301 | 2.786E-04 | 6.15 | 61 | 2.283E-04 | 7.49 | 78 |
| | Annual | μg/m²/s | 1.044E-05 | 5.33 | 124 | 1.283E-05 | 5.33 | 124 | 9.088E-06 | 3.62 | 308 |
| Total Deposition (Particle Mass Weighted) | 24-hour | μg/m²/s | 6.665E-02 | 0.26 | 52 | 9.430E-02 | 0.27 | 21 | 1.054E-01 | 0.36 | 359 |
| | Annual | μg/m²/s | 9.255E-04 | 0.27 | 22 | 8.757E-04 | 0.27 | 22 | 6.463E-04 | 0.26 | 52 |
| Wet Deposition (Fine Particle) | 24-hour | μg/m²/s | 1.225E-02 | 0.26 | 52 | 2.604E-02 | 0.29 | 13 | 3.140E-02 | 0.36 | 359 |
| | Annual | μg/m²/s | 1.718E-04 | 0.27 | 22 | 1.831E-04 | 0.27 | 22 | 1.767E-04 | 0.26 | 52 |
| Dry Deposition (Fine Particle) | 24-hour | μg/m²/s | 3.671E-06 | 1.41 | 267 | 4.117E-06 | 1.42 | 90 | 5.538E-06 | 0.96 | 240 |
| | Annual | μg/m²/s | 2.424E-07 | 5.33 | 124 | 2.802E-07 | 5.33 | 124 | 2.090E-07 | 1.00 | 314 |
| Total Deposition (Fine Particle) | 24-hour | μg/m²/s | 1.225E-02 | 0.26 | 52 | 2.604E-02 | 0.29 | 13 | 3.140E-02 | 0.36 | 359 |
| | Annual | μg/m²/s | 1.718E-04 | 0.27 | 22 | 1.832E-04 | 0.27 | 22 | 1.768E-04 | 0.26 | 52 |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

**Main Stack Location**[2]

| | | |
|---|---|---|
| x | 127.25 | km |
| y | 54.998 | km |

SOURCE: ENSR
Note: Scientific notation has been used; 6.245E-02 is equivalent to 0.06245
Bearing (deg) = Direction of highest flux relative to the main stack in degrees
μg/m³ = micrograms per cubic meter
μg/m²/s = micrograms per square meter per second
Note: The main stack was modeled as a dual flue stack representing stack parameters for both boiler flues at 100% load for short-term and annual.
(1) Highest modeled impacts are based on a 1 g/s emissions rate for the main stack only.
(2) Coordinates reflect a Lambert conformal coordinate system used for the CALPUFF modeling and units are km.
(3) Concentrations are based on the emissions of the smallest particle size of 0.48 microns.

**Table K-27**

**Alternative B – Highest Modeled Concentrations and Deposition Rates for Selected Air Toxics (2001 - 2003)**

| Contaminant | AP-42 Emission Factor (lb/ton)[1] | Emissions | | Max Concentration [2] | | Max Wet Deposition Flux [3] | | Max Dry Deposition Flux [3] | | Total Deposition Max Rate [3] | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | (lb/yr) | (g/s) | 24-hour Avg. (micro g/m$^3$) | Annual Avg. (micro g/m$^3$) | 24-hour Avg. (mg/m$^2$ day) | Annual Avg. (mg/m$^2$ yr) | 24-hour Avg. (mg/m$^2$ day) | Annual Avg. (mg/m$^2$ yr) | 24-hour Avg. (mg/m$^2$ day) | Annual Avg. (mg/m$^2$ yr) |
| Arsenic | 4.1E-04 | 2.54E+03 | 3.66E-02 | 3.27E-03 | 1.26E-04 | 3.33E-01 | 1.07E+00 | 8.85E-04 | 1.48E-02 | 3.33E-01 | 1.07E+00 |
| Cadmium and compounds | 5.1E-05 | 3.16E+02 | 4.55E-03 | 4.07E-04 | 1.57E-05 | 4.14E-02 | 1.33E-01 | 1.10E-04 | 1.84E-03 | 4.14E-02 | 1.33E-01 |
| Chromium VI | 7.9E-05 | 4.90E+02 | 7.05E-03 | 6.30E-04 | 2.439E-05 | 6.42E-02 | 2.05E-01 | 1.70E-04 | 2.85E-03 | 6.42E-02 | 2.06E-01 |
| Lead | 4.2E-04 | 2.60E+03 | 3.75E-02 | 3.35E-03 | 1.29E-04 | 3.41E-01 | 1.09E+00 | 9.06E-04 | 1.52E-02 | 3.41E-01 | 1.09E+00 |
| Mercury (elemental) [4] | NA | 1.14E+02 | 1.64E-03 | 1.47E-04 | 5.66E-06 | 4.45E-03 | 9.47E-03 | 7.85E-07 | 1.45E-05 | 4.45E-03 | 9.47E-03 |
| Methyl Hydrazine | 1.7E-04 | 1.05E+03 | 1.52E-02 | 1.36E-03 | 5.23E-05 | 4.11E-02 | 8.75E-02 | 7.25E-06 | 1.34E-04 | 4.11E-02 | 8.76E-02 |
| Selenium | 1.3E-03 | 8.06E+03 | 1.16E-01 | 1.04E-02 | 4.00E-04 | 1.06E+00 | 3.38E+00 | 2.81E-03 | 4.69E-02 | 1.06E+00 | 3.38E+00 |
| 2,3,7,8-TCDD (dioxin) | 1.43E-11 | 8.87E-05 | 1.28E-09 | 1.14E-10 | 4.40E-12 | 3.46E-09 | 7.36E-09 | 6.10E-13 | 1.13E-11 | 3.46E-09 | 7.37E-09 |
| Total PCDD/PCDF | 1.76E-09 | 1.09E-02 | 1.57E-07 | 1.40E-08 | 5.42E-10 | 4.26E-07 | 9.06E-07 | 7.51E-11 | 1.39E-09 | 4.26E-07 | 9.07E-07 |

Based on Modeled Concentrations and Deposition Rates for Hypothetical Pollutant Emitted at 1 μg/m$^3$ provided by ENSR
Note: Scientific notation has been used; 4.1E-04 is equivalent to 0.00041
PCDD = Polychlorinated Dibenzo-P-Dioxins
PCDF = Polychlorinated Dibenzofurans
[1] AP-42 for External Combustion Sources - Bituminous and Sub-bituminous Coal Combustion 9/98 (Emission Factors for controlled coal combustion)
[2] Max Concentration = the highest predicted concentration at any receptor for a 24-hour or annual average[3] Max Deposition Flux = Maximum predicted deposition rate per unit of soil area, at any receptor, over a daily or annual averaging period.
[3] Max Deposition Flux = Maximum predicted deposition rate per unit of soil area, at any receptor, over a daily or annual averaging period
[4] Mercury value obtained from the PSD Application (ENSR 2004)

### 3.6 Cumulative Impacts

A cumulative Class I increment modeling analysis is included in §4.5 of the ENSR Report *Desert Rock Energy Facility Application for Prevention of Significant Deterioration Permit – Class I Area Modeling Update*, January 2006. The ENSR Class I modeling report also discusses the planned and ongoing emission reductions at the Four Corners and San Juan Generating Stations, finds that the magnitude of the $SO_2$, NOx and $PM_{10}$ emission reductions at these plants will exceed the magnitude of maximum potential emissions of these same pollutants at DREP, and concludes that the cumulative impacts of the proposed project will be overall lower emissions in the Four Corners region.

Table 3-6 of the DREP EIS provides actual annual emissions of criteria and selected hazardous air pollutants from six coal-fired power plants in the Four Corners region. For comparison purposes, Table K-28 contrasts the maximum potential emissions from DREP with the actual reported emissions from the other power plants; (maximum emissions would be expected to exceed actual emissions by one or more orders of magnitude, since maximum potential emissions do not take unit outages into account). With the exception of CO and VOC, the DREP emissions represent a small fraction of the emissions from the existing plants. With respect to CO and VOC emissions, emission of these pollutants is associated with off-stoichiometric (rich burn) combustion, which is generally avoided by plant operators for efficiency and safety purposes.

**Table K-28**

**Comparison of Proposed Project Emissions to Existing Regional Power Plant Emissions**

| Pollutants | Unit of Measure | Total Emissions of 6 Area Power Plants | Proposed Desert Rock Plant | DREP Percent of Total |
|---|---|---|---|---|
| | | Avg. of 2002 thru 2004 Emission Inventories [1] | PTE Estimate [2] | |
| NOx | tons/year | 140,634 | 3,325 | 2.3 |
| $SO_2$ | Tons/year | 113,765 | 3,319 | 2.8 |
| $PM_{10}$ | Tons/year | 7,217 | 1,125 | 13.5 |
| CO | Tons/year | 6,362 | 5,529 | 46.5 |
| VOC | Tons/year | 605 | 166 | 21.5 |

NA = Not Available
[1] See Table 3.2.5 of the DREP EIS for detailed summary of criteria and HAP emissions from 6 coal-fired plants in northwest New Mexico and northeast Arizona.
[2] See Table K-13 for total criteria pollutant emissions from the proposed plant.

**Global Air Quality Impacts**

As described above, the proposed power plant will emit criteria pollutants, including particulates and gaseous pollutants (sulfur dioxide and nitrogen oxides) that form aerosols in the atmosphere. Although measurable concentrations of emissions from the proposed power plant would likely extend to less than hundred kilometers from the facility, due to global wind patterns, minute quantities of these chemicals could eventually be dispersed across a wider area. In addition, combustion of biomass and all fossil fuels (coal, coke, petroleum and natural gas) result in emissions of carbon dioxide ($CO_2$). $CO_2$ is widely considered to be a “greenhouse gas” (GHG). Greenhouse gases, which also include methane, nitrous oxides, chlorofluorocarbons and other chemicals, play a natural role in maintaining the temperature of the earth's atmosphere, by allowing some sunlight to pass through and heat the surface of the earth and then absorbing a portion of the infared heat reflected or transmitted from the ground. Natural sources of GHG include volcanic eruptions, plant respiration and decomposition of organic matter.

Global temperatures have increased significantly in the last 50 years. This phenomenon is referred to as "Global Warming". Increased emissions of GHGs from anthropogenic (i.e. human) activity over the last 100 years are suspected of playing a role in the observed global warming, although the precise mechanisms and magnitude of their effect remains subject to debate within the scientific community. However, there currently is broad consensus within those members of the scientific community who have researched this issue that GHG emissions associated with such anthropogenic activity has contributed to the observed global warming phenomenon.

The following text is excerpted from the USEPA website on global warming:

> According to the National Academy of Sciences, the Earth's surface temperature has risen by about 1 degree Fahrenheit in the past century, with accelerated warming during the past two decades. There is new and stronger evidence that most of the warming over the last 50 years is attributable to human activities. Human activities have altered the chemical composition of the atmosphere through the buildup of greenhouse gases – primarily carbon dioxide, methane, and nitrous oxide. The heat-trapping property of these gases is undisputed although uncertainties exist about exactly how earth's climate responds to them.
>
> Since the beginning of the industrial revolution, atmospheric concentrations of carbon dioxide have increased nearly 30%, methane concentrations have more than doubled, and nitrous oxide concentrations have risen by about 15%. These increases have enhanced the heat-trapping capability of the earth's atmosphere. Sulfate aerosols, a common air pollutant, cool the atmosphere by reflecting light back into space; however, sulfates are short-lived in the atmosphere and vary regionally.
>
> Scientists generally believe that the combustion of fossil fuels and other human activities are the primary reason for the increased concentration of carbon dioxide. Plant respiration and the decomposition of organic matter release more than 10 times the CO2 released by human activities; but these releases have generally been in balance during the centuries leading up to the industrial revolution with carbon dioxide absorbed by terrestrial vegetation and the oceans.
>
> Estimating future emissions is difficult, because it depends on demographic, economic, technological, policy, and institutional developments. Several emissions scenarios have been developed based on differing projections of these underlying factors. For example, by 2100, in the absence of emissions control policies, carbon dioxide concentrations are projected to be 30-150% higher than today's levels.
>
> In short, scientists think rising levels of greenhouse gases in the atmosphere are contributing to global warming, as would be expected; but to what extent is difficult to determine at the present time. Calculations of climate change for specific areas are much less reliable than global ones, and it is unclear whether regional climate will become more variable.

Some members of the scientific community and the general public suspect that particulates and aerosols may also have an opposite effect on global temperatures, by absorbing and reflecting solar radiation back into space and by increasing the formation of clouds, which in turn reflect solar radiation, due to water vapor condensing around the small, solid nuclei. This phenomenon, which has undergone less evaluation by the scientific community than the global warming phenomenon, is referred to as “Global Dimming”.

The following text is excerpted from §2.2.6 of the EPA report *Review of the National Ambient Air Quality Standard for Particulate matter, Policy Assessment of Scientific and technical Information, OAQPS Staff Report*, (EPA-425 / R-05-005a), December 2005:

> In addition to the optical properties related to visibility….., ambient particles scatter and absorb radiation across the full electromagnetic spectrum, including ultraviolet, visible and infrared wavelenghts, affecting climate processes and the amount of ultraviolet radiation that reaches the earth. [The]….effects of ambient particles on the transmission of these segments of the electromagnetic spectrum depend on the radiative propeties of the particles, which in turn are dependent on the size and shape of the particles, their composition, the distribution of componenets within individual particles, and the vertical and horizontal distribution in the atmosphere.
>
> The effects of PM on the transfer of radiation in the visible and infrared spectral regions play a role in global and regional climate. Direct effects of paticles on climatic processes are the result of the same processes responsible for visibility degradtion, namely radiative scattering and absorption. However, while visibility impairment is caused by particle scattering in all directions, climate effects result mainly from scattering light away from the earth and into space.This reflection of solar radiation back to space decreased the transmission of visible radiation to the surface and results in a decrease in the heating rate of the surface and the lower atmosphere. At the same time, absorption of either incoming solar radiation or outgoing terrestrial radiation by particles, primarily elemental carbon, results in an increase in the heating rate of the lower atmosphere.

The electric power generating industry is participating in extensive research on further defining the extent to which emissions of anthropogenic GHG contributes to global warming. In addition, technological approaches to reducing GHG emissions from industrial facilities are the subject of numerous research projects around the world. The Edison Electric Institute (EEI) has called for increased international cooperation with regard to research and technology development (EEI, 2006). One possible means to reduce atmospheric emissions of $CO_2$ is to compress and inject it deep underground; however, this technology, and the means to concentrate $CO_2$ in a gasification process, are in the experimental stage.

Within the context of the DREP EIS, it is important to note that, due to its unique and innovative design, the proposed power plant will be considerably more efficient, in terms of power output versus fuel combusted, than other similar coal-fired power plants in the region. Furthermore, the primary reagent used in the $SO_2$ scrubber is quicklime (calcium oxide), which does not add further $CO_2$ to the plant emissions, as would FGD systems using limestone (calcium carbonate). Consequently, the proposed plant will emit less GHG per unit of energy produced, than these other facilities.

## 3.7 Mitigation

*Construction Emissions*-The predicted PM emission rates described herein from earthmoving and other construction activity were calculated assuming an aggressive surface watering schedule during all on-site activity. The following additional measures will be employed, as appropriate, during the construction phase of the project.

- Restriction of vehicle travel only on designated routes within the site;
- Restriction of vehicle speeds within the plant site and on access roads;
- Ensure that diesel-powered construction equipment is properly tuned and maintained, and shut off when not in direct use. Employ periodic, unscheduled inspections to limit unnecessary idling and to ensure that construction equipment is properly maintained, tuned, and modified consistent with established specifications.
- Prohibit engine tampering to increase horsepower, except when meeting manufacturer's recommendations.
- Locate diesel engines, motors, and equipment staging areas as far as possible from residences.
- Reduce construction-related trips of workers and equipment, including trucks. Develop a construction traffic and parking management plan that minimizes traffic interference and maintains traffic flow.
- Restriction of vehicles and equipment with excessive visible emissions resulting from age or poor maintenance;
- Lease or buy newer, cleaner equipment (1996 or newer model), using a minimum of 75 percent of the equipment's total horsepower.
- Ensure visible emissions from all heavy duty off road diesel equipment not exceed 20 percent opacity for more than three minutes in any hour of operation.
- Restriction of open burning, including vegetation and refuse disposal, outdoor comfort heating;
- Stabilization of material piles with chemical palliatives, woven fabrics or plastic sheeting; and
- Restriction of earthmoving activity and vehicle travel during periods of high winds (e.g. >30 mph).

### 3.7.1 Mitigation Agreement Between Sithe and Federal Land Managers

The following text provides the April 2006, Mitigation Proposal for the Desert Rock Energy Project.

Sithe Global Power, LLC (Sithe) Mitigation Proposal

for the Desert Rock Energy Project (DREP)[1]

April 2006

Option A: For the purposes of mitigating potential air quality impacts, including potential visibility and acid deposition impacts, of the DREP at Class I and Class II air quality areas in the region potentially affected by DREP, Sithe[2] shall obtain Emission Reduction Credits from physical and/or operational changes that result in real emission reductions at one or more Electric Generating Units[3] (EGUs) within 300 km of the DREP and retire sulfur dioxide[4] Allowances in accordance with the following:

- The number of sulfur dioxide Emission Reduction Credits required for the respective calendar year shall be determined by DREP's actual sulfur dioxide emissions, in tons, plus 10%.

- The amount of Emission Reduction Credits achieved would be determined by comparing the emission rate (in tons) during the year for which the reduction is claimed to a baseline emission rate. The baseline emission rate shall be the average emission rate (in tons per year) during the two-year period prior to any emission reduction taking place.

- Acceptable sulfur dioxide Emission Reduction Credits under this condition shall be from facilities that were allocated sulfur dioxide Allowances under 40 CFR 73[5] and that are located within 300 km of the DREP facility.

- The vintage year of the Emission Reduction Credits shall correspond to the year that is being mitigated. Sithe shall retire the required Emission Reduction Credits by transferring an equivalent number of Allowances into account #XXX with the U.S. EPA Clean Air Markets Division[6]. Except for Sithe's purposes under Title IV, these retired Allowances can never be used by any source to meet any compliance requirements under the Clean Air Act, State

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[1] For purposes of measuring distances from the DREP as set forth in this Agreement, DREP shall mean the property boundary of the DREP lease site.

[2] References to Sithe include its subsidiary "Desert Rock Energy Company, LLC" which will be the owner of DREP (referred to herein as the Desert Rock Project Company).

[3] Provided that Sithe proposes a method acceptable to the Federal Land Managers for determining emission reductions, Sithe may obtain real emission reductions at sources other than EGUs.

[4] Provided that Sithe proposes a method acceptable to the Federal Land Managers for determining and tracking emission reductions, nitrogen oxides reductions may be substituted for sulfur dioxide reductions by a ratio of three tons of nitrogen oxides to one ton of sulfur dioxide.

[5] Provided that Sithe proposes a method acceptable to the Federal Land Managers for determining emission reductions, Sithe may obtain physical emission reductions at sources not granted allowances under 40 CFR 73.

[6] Provided that Sithe proposes a method acceptable to the Federal Land Managers for determining and tracking Emission Reduction Credits, Sithe may obtain real emission reductions at sources other than EGUs. Nitrogen oxides reductions may be substituted for sulfur dioxide reductions by a ratio of three tons of nitrogen oxides to one ton of sulfur dioxide.

Implementation Plan, Federal Implementation Plan, Best Available Retrofit Technology requirements, or to "net-out" of PSD. However, surplus Emission Reduction Credits could be used at the discretion of the holder of the credits.

- Sithe shall submit a report to the EPA Region 9 Administrator (or another party acceptable to the Federal Land Managers) no later than 30 days after the end of each calendar year which shall contain the amount of sulfur dioxide emitted; amount, facility, location of facility, vintage of Emission Reduction Credits retired; proof Emission Reduction Credits/Allowances have been transferred into account #XXX; and any applicable serial or other identification associated with the retired Emission Reduction Credits/Allowances.

Due to the actual emission reductions obtained from nearby sources under this Option, the Federal Land Managers prefer this approach to mitigating DREP's air quality impacts.

Or,

Option B: For the purposes of mitigating potential air quality impacts, including potential visibility and acid deposition impacts, of the DREP at Class I and Class II air quality areas in the region potentially affected by DREP, Sithe shall obtain and retire sulfur dioxide "Mitigation Allowances" from one or more EGUs within 300 km of the DREP in accordance with the following:

- In addition to those Allowances required under Title IV, the required number of sulfur dioxide "Mitigation Allowances" for the respective calendar year shall equal DREP's actual total sulfur dioxide emissions, in tons.

- Acceptable sulfur dioxide "Mitigation Allowances" under this condition shall be from facilities that were allocated sulfur dioxide Allowances under 40 CFR 73 and that are located within 300 km of the DREP. However, the total annual cost of "Mitigation Allowances" purchased beyond those regular Allowances required by Title IV is not to exceed three million dollars[7]. Provided that Sithe proposes a method acceptable to the Federal Land Managers for determining emission reductions, Sithe may obtain physical emission reductions at sources not granted allowances under 40 CFR 73.

- The vintage year of the "Mitigation Allowances" shall correspond to the year that is being mitigated. Sithe shall retire these "Mitigation Allowances" by transferring them into account #XXX with the U.S. EPA Clean Air Markets Division. These retired "Mitigation Allowances" beyond Title IV can never be used by any source to meet any compliance requirements under the Clean Air Act, State Implementation Plan, Federal Implementation Plan, Best Available Retrofit Technology requirements, or to "net-out" of PSD.

- Sithe shall submit a report to the EPA Region 9 Administrator (or another party subject to approval of the Federal Land Managers) no later than 30 days after the end of each calendar year which shall contain the amount of sulfur dioxide emitted from the DREP; amount, facility, location of facility, vintage of Allowances retired; proof Allowances have been transferred into account #XXX; and any applicable serial or other identification associated with the retired Allowances.

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[7] All costs referenced in this document are base-year 2006 dollars that will be adjusted for inflation by using the consumer price index.

And,

If Sithe chooses Option A, they will contribute $300,000 annually toward environmental improvement projects that would benefit the area affected by emissions from DREP, including the Class I areas and the Navajo Nation. If Sithe chooses Option B, they will contribute toward environmental improvement projects an amount equal to the $3 million cap minus the cost of the Mitigation Allowances, up to a maximum of $300,000. Appropriate projects will be determined jointly by the Federal Land Managers, Navajo Nation EPA, the Desert Rock Project Company and Dine Power Authority, and may include projects that would reduce or prevent air pollution or greenhouse gases, purchasing and retiring additional emission reduction credits or allowances, or other studies that would provide a foundation for air quality management programs. Up to 1/5 of the contributions can be dedicated to air quality management programs. The remaining contributions shall be used to support projects that mitigate greenhouse gas emissions or other criteria pollutants impacts. The Desert Rock Project Company shall have the ability to bank the emission reduction credits achieved through these projects and be entitled to these credits to comply with future greenhouse gas emission mitigation programs. Mitigation and contributions toward environmental improvement projects shall not occur before operation of the Desert Rock Energy project begins.

And,

Sithe will agree to reduce mercury emissions by a minimum of 80% on an annual average using the air pollution control technologies as proposed in the permit application, i.e. SCR, wet FGD, hydrated lime injection, and baghouse. In addition, Sithe will agree to raise the mercury control efficiency to a minimum of 90% provided that the incremental cost effectiveness of the additional controls (such as activated carbon injection or other mercury control technologies) does not exceed $13,000/lb of incremental mercury removed. Compliance with this provision will be determined by installation and operation of an EPA-approved mercury monitoring and/or testing program. In operating periods when a minimum of 80% mercury control (or 90% as noted above) is not technically feasible due to extreme low mercury concentrations in the burned coal, Sithe agrees to work with EPA to establish a stack mercury emission limit in lieu of a percent reduction, for the purposes of demonstrating compliance.

## 4.0 Environmental Consequences of Alternative C – 550 MW Facility

The Alternative C facility includes one 550 MW generation unit, as well as a plant-cooling system, coal handling facilities, power transmission interconnection facilities, a water-supply system, access to the plant site, and waste-management operations. There will also be a diesel-powered emergency generator and firewater pump along with a distillate oil storage tank. The alternative sized project is located in the same location as the proposed project, approximately 30 miles southwest of Farmington in San Juan County, New Mexico and is entirely on the Navajo Nation.

This alternative would have lower efficiency and higher air pollutant emissions and water usage per unit of power produced but would have lower overall emissions and water consumption because of the reduced size of the unit. The lower efficiency and higher emissions per unit produced for the smaller unit are a result of following:

- Supercritical Technology is not used in smaller units
- Economics of scale of the two units offsets some of the additional investments in water efficiency and emissions control that would not be cost effective for a smaller unit.

### 4.1 Construction Activity

URS estimated criteria pollutant emissions associated with construction activity, including fugitive dust due to earthmoving activity and vehicular traffic on roads, and particulate and gaseous pollutant emissions from gasoline and diesel fueled vehicles and equipment. Particulate matter emissions due to vehicular traffic on roads were estimated.

#### 4.1.1 Earthmoving

##### 4.1.1.1 Sources

Fugitive dust emissions due to earthmoving will occur during construction of the power plant, access roads, well field, water supply pipeline and transmission lines.

##### 4.1.1.2 Emissions Estimation Methodology

Predicted PM emissions associated with construction of the proposed project were calculated in accordance with the procedures described in Section 3.1.1.2. For purposes of this impact analysis, it was assumed that disturbed ground surfaces would undergo watering every 3.2 hours, during periods of active earthmoving activity.

##### 4.1.1.3 Emissions

*Power Plant.* The alternative sized power plant site would be located at the same site as the proposed Desert Rock Project within a 592-acre area east of the Chaco River and north of the Pinabete Wash. Within that 592-acre area, the footprint of the power plant facilities would require approximately 110 acres, a reduction of 10 acres compared to Alternative B. The earthmoving schedule would also be reduced to 12 months compared to 14 months for Alternative B. A similar acres disturbed distribution used for Alternative B was also used on Alternative C. It was assumed that not more than 110 acres per month would be disturbed during the first three months of earthmoving. Then the acreage would be reduced be to 55 acres per month for months 4-6 and finally be reduced to 20 acres per month for the last six months of the total 12-month earthmoving schedule. Maximum controlled $PM_{10}$ emissions from plant site construction are estimated to be 12.1 tons/month. Based on a 12-month earthmoving schedule, it is estimated that a maximum of 67.7 tons of $PM_{10}$ will be emitted during plant site construction.

*Water Well Field and Water Supply Pipeline.* The water requirements for the Alternative C facility would be 500 acre feet less than the Proposed Action, 4,000 acre feet versus 4,500 acre feet. Therefore, the well field would be 11% smaller. However, the supply pipeline and ROW will be similarly designed. Maximum controlled $PM_{10}$ emissions from the well field under either preferred sub-alternative B or sub-alternative A are estimated to be 12.3 tons/month. Based on a six-month construction schedule, it is estimated that a maximum of 73.8 tons of $PM_{10}$ will be emitted during construction of the well field under either sub-alternative. Maximum controlled $PM_{10}$ emissions from installation of the water supply pipeline, within the utility corridor under sub-alternative A, are estimated to be 15.8 tons/month. Based on a six-month construction schedule, it is estimated that a maximum of 63.2 tons of $PM_{10}$ will be emitted during installation of the water supply pipeline under either sub-alternative.

*Transmission Lines.* There would also be only one transmission line that would extend to the Four Corners Generating Station switchyard and then to the NTP line at the Shiprock Substation. Therefore, the number of acres disturbed during transmission line construction under Alternative C (27 line miles) is assumed to be 36 percent less than under Alternative B (42 line miles). Maximum controlled $PM_{10}$ emissions from construction of Segment A (8.3 miles) are estimated to be 3.6 tons/month. Based on a nine-month construction schedule, it is estimated that a maximum of 32.4 tons of $PM_{10}$ will be emitted during construction of Segment A. Segment C is 6 miles long, with a total work area of 24.6 acres. Maximum controlled $PM_{10}$ emissions from construction of Segment C are estimated to be 2.7 tons/month. Based on a nine-month construction schedule, it is estimated that a maximum of 24.3 tons of $PM_{10}$ will be emitted during construction of Segment C. Segment D is 10.8 miles long, with a total work area of 36.5 acres. Maximum controlled $PM_{10}$ emissions from construction of Segment D are estimated to be 4.0 tons/month. Based on a nine-month construction schedule, it is estimated that a maximum of 36.0 tons of $PM_{10}$ will be emitted during construction of Segment D.

*Access Roads.* Earthmoving emissions due to access road construction would be essentially the same as calculated for the preferred alternative. Maximum controlled $PM_{10}$ emissions from construction of the road are estimated to be 8.4 tons/month. Based on a twelve-month construction schedule, it is estimated that a maximum of 100.8 tons of $PM_{10}$ will be emitted during construction of the plant access road.

*Summary.* Table K-29 summarizes the estimated $PM_{10}$ emissions due to earthmoving activity from each phase of the proposed project. For the preferred water supply and transmission line sub-alternatives, the total maximum controlled $PM_{10}$ emissions from construction of the plant site, well field, transmission lines and access road are estimated to be 36.9 tons per month. The Water Supply System sub-alternative A would increase $PM_{10}$ emissions by 15.8 tons per month. Transmission line Segment B would increase $PM_{10}$ emissions by 1.2 ton per month.

**Table K-29**

**Alternative C - Particulate Matter ($PM_{10}$) Emissions Associated with Earthmoving During Construction of Alterative C Plant Site, Water Conveyance System, Transmission Lines and Access Roads**

| Sub-alternative \ Segment | Length (mile) | Work Area (acre)[1] | Projected Construction Time (months) | $PM_{10}$ EF (tons/acre/month) [2] | Controlled $PM_{10}$ Emission (tons/month) [3] | Total Project Emissions (tons) |
|---|---|---|---|---|---|---|
| **Proposed Desert Rock Plant Site** | | | | | | |
| - | NA | 110.0 [4] | 12.0 | 0.11 | 12.1 | 67.7 |
| **Water Well Field** | | | | | | |
| Sub-alternative Area B | NA | 29.2 [5] | 6.0 | 0.42 | 12.3 | 73.8 |
| **Transmission Lines** | | | | | | |
| Segment A | 8.3 | 33.0[6] | 9.0 | 0.11 | 3.6 | 32.4 |
| Segment C | 6.2 | 24.6 [6] | 9.0 | 0.11 | 2.7 | 24.3 |
| Segment D | 10.8 | 36.5 [6] | 9.0 | 0.11 | 4.0 | 36.0 |
| Subtotal | 25.3 | 94.1 | - | - | 10.3 | 92.7 |
| **Roads** | | | | | | |
| - | 2.2 | 20.3 [7] | 6.0 | 0.11 | 2.2 | 13.4 |
| | | | | | | |
| **Proposed Project Totals** | | **253.6** | **-** | **-** | **36.9** | **247.6** |
| **Sub-alternatives** | | | | | | |
| Sub-alternative A Well Field | NA | 29.2 [5] | 6.0 | 0.42 | 12.3 | 73.8 |
| Sub-alternative A Water Supply Pipeline | 12.4 | 37.6 [8] | 4.0 | 0.42 | 15.8 | 63.2 |
| Subtotal | - | 66.8 | - | - | 28.1 | 137.0 |
| **Net Change (Water Supply System)** | | | | | **15.8** | **63.2** |
| Segment B Transmission Line [9] | 11.1 | 44.1 [6] | 9.0 | 0.11 | 4.8 | 43.2 |
| **Net Change (Transmission Line)** | | | | | **1.2** | **10.8** |

[1] SOURCE: URS 2007
[2] From Western Regional Air Partnership (WRAP) *Fugitive Dust Handbook, Chapter 3, Construction and Demolition*, November 2004; (downloaded from www.wrapair.org/forums/)
[3] Controlled $PM_{10}$ Emission Rate = EF (tons/acre/month) x total acres
[4] Plant Site work area was assumed to be not more than 110 acres per month for the first three months, 55 acres per month for month 4-6, and 20 acres per month for the remaining 8 months of the 12-month projected earthmoving schedule.
[5] Assumes water requirements for the Alternative C facility would be 500-acre feet less than Alternative B, reducing the size requirements for the well field by about 11 percent.
[6] Assumes construction area 36 percent smaller than estimated for Alternative B.
[7] Work Area acreages are generally based on Figure 2-1 Base Map from Chapter 2 of the DREP EIS (URS 2007) since they are not expected to change greatly for Alternative C.
[8] For Sub-alternative A Water Supply Pipeline would require the construction of 5 miles of adjoining access road with a right of way width of 25 feet and the 12.4 miles of pipeline for an estimated total of disturbed land to be 37.6 acres.
[9] Alternative Transmission Segment B would replace Transmission Line Segment A.

### 4.1.2 Tailpipe Emissions From Vehicles and Construction Equipment

#### 4.1.2.1 Sources

During construction, gasoline and diesel fueled vehicles and equipment, which generate gaseous and particulate exhaust emissions, will be operated at the project site.

#### 4.1.2.2 Emissions Estimation Methodology

Predicted emissions associated with vehicle/equipment operation were calculated in accordance with the procedures described in Section 3.1.2.2. Tailpipe emissions from vehicles and equipment used during construction of the proposed project were estimated, based on a typical roster of such equipment for similar projects and using published emission factors.

#### 4.1.2.3 Emissions

Tables K-30 through K-34 provide equipment and vehicle emissions associated with the construction of the plant site, well field and pipeline, transmission line, access roads, and employee commuting. The plant site for Alternative C is approximately the same size as Alternative B and all other construction activities are assumed to be the same as for Alternative B. Therefore, construction vehicle and equipment criteria pollutant emissions are predicted to be exactly the same as Alternative B on an annual basis. However, the total emissions were estimated to be slightly less than estimated for Alternative B, because the construction schedule would be 30 months as opposed to 36 months.

*Summary.* Table K-35 summarizes the estimated vehicle and equipment combustion emissions due to construction activity from each phase of the Alternative C project. The total maximum combustion emissions from construction of the plant site, well field, transmission lines, access road, and employee commuting are estimated to be 91 tons per year (tpy)of VOCs, 677 tpy of CO, 1,117 tpy of NOx, 49 tpy of $PM_{10}$, and 1.8 tpy of $SO_2$. Total emissions for the duration of the construction activities were estimated to be 158 tons of VOCs, 1,348 tons of CO, 1,156 tons of NOx, 49 tons of $PM_{10}$, and 3.5 tons of $SO_2$.

## Table K-30

### Alternative C - Plant Site Vehicle and Equipment Tailpipe Emissions During Construction

| Vehicle/Equipment | Quantity | Months of Use | Fuel | Average Engine Power (hp) | Unit of Emission Factors | Emission Factors [1, 2] | | | | | Maximum Annual Emissions (tons/year) [3, 4] | | | | | Total Emissions (tons) [3, 4] | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | VOC | CO | NOx | $PM_{10}$ | $SO_2$ | VOC | CO | NOx | $PM_{10}$ | $SO_2$ | VOC | CO | NOx | $PM_{10}$ | $SO_2$ |
| Trucks (2-ton) | 5 | 30 | Diesel | 250 | g/hp-hr | 0.33 | 1.20 | 5.36 | 0.30 | 0.005 | 1.42 | 5.16 | 23.05 | 1.27 | 0.02 | 3.54 | 12.91 | 57.63 | 3.19 | 0.05 |
| Trucks (5-15 tons) | 10 | 30 | Diesel | 400 | g/hp-hr | 0.22 | 2.10 | 5.78 | 0.22 | 0.005 | 2.98 | 28.88 | 79.56 | 3.01 | 0.07 | 7.44 | 72.19 | 198.89 | 7.52 | 0.17 |
| Sideboom | 6 | 16 | Diesel | 500 | g/hp-hr | 0.22 | 2.10 | 5.78 | 0.22 | 0.005 | 2.23 | 21.66 | 59.67 | 2.25 | 0.05 | 2.97 | 28.80 | 79.36 | 3.00 | 0.07 |
| Dozer | 6 | 12 | Diesel | 850 | g/hp-hr | 0.31 | 1.23 | 5.92 | 0.21 | 0.005 | 5.36 | 21.54 | 103.75 | 3.64 | 0.09 | 5.36 | 21.54 | 103.75 | 3.64 | 0.09 |
| Large Shovel | 0 | 12 | Diesel | 850 | g/hp-hr | 0.31 | 1.23 | 5.92 | 0.21 | 0.005 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Grader | 4 | 12 | Diesel | 600 | g/hp-hr | 0.22 | 2.10 | 5.78 | 0.30 | 0.005 | 1.79 | 17.33 | 47.73 | 2.45 | 0.04 | 1.79 | 17.33 | 47.73 | 2.45 | 0.04 |
| Tractor / Backhoe / Loader | 6 | 12 | Diesel | 100 | g/hp-hr | 1.22 | 6.39 | 6.23 | 1.04 | 0.006 | 2.51 | 13.18 | 12.86 | 2.14 | 0.01 | 2.51 | 13.18 | 12.86 | 2.14 | 0.01 |
| Welder / Air Compressor / Generator | 15 | 16 | Diesel | 300 | g/hp-hr | 0.31 | 0.79 | 5.64 | 0.23 | 0.005 | 4.86 | 12.15 | 87.35 | 3.49 | 0.08 | 6.46 | 16.16 | 116.18 | 4.65 | 0.10 |
| Crane | 4 | 16 | Diesel | 400 | g/hp-hr | 0.21 | 1.37 | 6.09 | 0.16 | 0.005 | 1.13 | 7.55 | 33.50 | 0.89 | 0.03 | 1.51 | 10.04 | 44.55 | 1.19 | 0.04 |
| Bore/Drill Rig | 0 | 12 | Diesel | 400 | g/hp-hr | 0.21 | 1.37 | 6.09 | 0.16 | 0.005 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Pickup Trucks and Crew Cabs | 12 | 30 | Gasoline | 200 | g/mile | 4.72 | 46.06 | 2.41 | 0.093 | 0.113 | 0.19 | 1.90 | 0.10 | 0.00 | 0.00 | 0.49 | 4.75 | 0.25 | 0.01 | 0.01 |
| **Total Emissions** | | | | | | | | | | | **22.48** | **129.35** | **447.57** | **19.15** | **0.39** | **32.08** | **196.91** | **661.20** | **27.77** | **0.58** |

NOTES:
VOC = volatile organic compounds
CO = carbon monoxide
NOx = nitrogen oxides
$PM_{10}$ = particulate matter with aerodynamic diameter less than or equal to 10 micrometers
$SO_2$ = sulfur dioxide
[1] Emission factors for off-highway diesel fueled vehicle/equipment were calculated following the method outlined in the USEPA report "Exhaust and Crankcase Emission Factors for Non-Road Engine Modeling-Compression-Ignition," USEPA420-P-04-009, April 2004. For all vehicles and equipment, Tier 1 emission factors were used.
[2] Emission factors for pickup trucks and crew cab were obtained from MOBILE5 run based on national averaged fleet conditions, at a speed of 15 miles per hour and an ambient temperature of 60 degrees Fahrenheit ($^oF$).
[3] Annual emissions for all diesel-fueled vehicle/equipment were calculated based on average engine horsepower for each type of vehicle/equipment, and an operating schedule of 10 hours/day, 6 days/week and 52 weeks/year.
[4] Annul emissions for pickup trucks and crew cab were calculated based on a traveling distance of 10 miles/day during Power Plant construction, 25 miles/day during Access Road Construction, and 50 miles/day during transmission line and water conveyance system construction, all with an operating schedule of 6 days/week and 52 weeks/year.

## Table K-31

### Alternative C - Well Field and Pipeline Vehicle and Equipment Tailpipe Emissions During Construction

| Vehicle/Equipment | Quantity | Months of Use | Fuel | Average Engine Power (hp) | Unit of Emission Factors | Emission Factors [1, 2] | | | | | Maximum Annual Emissions (tons/year) [3, 4] | | | | | Total Emissions (tons) [3, 4] | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | VOC | CO | NOx | $PM_{10}$ | $SO_2$ | VOC | CO | NOx | $PM_{10}$ | $SO_2$ | VOC | CO | NOx | $PM_{10}$ | $SO_2$ |
| Trucks (2-ton) | 2 | 12 | Diesel | 250 | g/hp-hr | 0.33 | 1.20 | 5.36 | 0.30 | 0.005 | 0.57 | 2.07 | 9.22 | 0.51 | 0.01 | 0.57 | 2.07 | 9.22 | 0.51 | 0.01 |
| Trucks (5-15 tons) | 5 | 12 | Diesel | 400 | g/hp-hr | 0.22 | 2.10 | 5.78 | 0.22 | 0.005 | 1.49 | 14.44 | 39.78 | 1.50 | 0.03 | 1.49 | 14.44 | 39.78 | 1.50 | 0.03 |
| Sideboom | 2 | 12 | Diesel | 500 | g/hp-hr | 0.22 | 2.10 | 5.78 | 0.22 | 0.005 | 0.74 | 7.22 | 19.89 | 0.75 | 0.02 | 0.74 | 7.22 | 19.89 | 0.75 | 0.02 |
| Dozer | 2 | 6 | Diesel | 850 | g/hp-hr | 0.31 | 1.23 | 5.92 | 0.21 | 0.005 | 1.79 | 7.18 | 34.58 | 1.21 | 0.03 | 0.89 | 3.59 | 17.29 | 0.61 | 0.01 |
| Large Shovel | 1 | 6 | Diesel | 850 | g/hp-hr | 0.31 | 1.23 | 5.92 | 0.21 | 0.005 | 0.89 | 3.59 | 17.29 | 0.61 | 0.01 | 0.45 | 1.80 | 8.65 | 0.30 | 0.01 |
| Grader | 2 | 6 | Diesel | 600 | g/hp-hr | 0.22 | 2.10 | 5.78 | 0.30 | 0.005 | 0.89 | 8.66 | 23.87 | 1.22 | 0.02 | 0.45 | 4.33 | 11.93 | 0.61 | 0.01 |
| Tractor / Backhoe / Loader | 5 | 6 | Diesel | 100 | g/hp-hr | 1.22 | 6.39 | 6.23 | 1.04 | 0.006 | 2.09 | 10.98 | 10.72 | 1.79 | 0.01 | 1.04 | 5.49 | 5.36 | 0.89 | 0.01 |
| Welder / Air Compressor / Generator | 5 | 12 | Diesel | 300 | g/hp-hr | 0.31 | 0.79 | 5.64 | 0.23 | 0.005 | 1.62 | 4.05 | 29.12 | 1.16 | 0.03 | 1.62 | 4.05 | 29.12 | 1.16 | 0.03 |
| Crane | 1 | 12 | Diesel | 400 | g/hp-hr | 0.21 | 1.37 | 6.09 | 0.16 | 0.005 | 0.28 | 1.89 | 8.37 | 0.22 | 0.01 | 0.28 | 1.89 | 8.37 | 0.22 | 0.01 |
| Bore/Drill Rig | 2 | 12 | Diesel | 400 | g/hp-hr | 0.21 | 1.37 | 6.09 | 0.16 | 0.005 | 0.57 | 3.77 | 16.75 | 0.45 | 0.01 | 0.57 | 3.77 | 16.75 | 0.45 | 0.01 |
| Pickup Trucks and Crew Cabs | 4 | 12 | Gasoline | 200 | g/mile | 4.72 | 46.06 | 2.41 | 0.093 | 0.113 | 0.32 | 3.17 | 0.17 | 0.01 | 0.01 | 0.32 | 3.17 | 0.17 | 0.01 | 0.01 |
| **Total Emissions** | | | | | | | | | | | **11.26** | **67.02** | **209.75** | **9.43** | **0.19** | **8.43** | **51.81** | **166.52** | **7.02** | **0.15** |

NOTES:
VOC = volatile organic compounds
CO = carbon monoxide
NOx = nitrogen oxides
$PM_{10}$ = particulate matter with aerodynamic diameter less than or equal to 10 micrometers
$SO_2$ = sulfur dioxide
[1] Emission factors for off-highway diesel fueled vehicle/equipment were calculated following the method outlined in the USEPA report “Exhaust and Crankcase Emission Factors for Non-Road Engine Modeling-Compression-Ignition,” USEPA420-P-04-009, April 2004. For all vehicles and equipment, Tier 1 emission factors were used.
[2] Emission factors for pickup trucks and crew cab were obtained from MOBILE5 run based on national averaged fleet conditions, at a speed of 15 miles per hour and an ambient temperature of 60 degrees Fahrenheit ($^oF$).
[3] Annual emissions for all diesel-fueled vehicle/equipment were calculated based on average engine horsepower for each type of vehicle/equipment, and an operating schedule of 10 hours/day, 6 days/week and 52 weeks/year.
[4] Annul emissions for pickup trucks and crew cab were calculated based on a traveling distance of 10 miles/day during Power Plant construction, 25 miles/day during Access Road Construction, and 50 miles/day during transmission line and water conveyance system construction, all with an operating schedule of 6 days/week and 52 weeks/year.

## Table K-32

### Alternative C - Transmission Line Vehicle and Equipment Tailpipe Emissions During Construction

| Vehicle/Equipment | Quantity | Months of Use | Fuel | Average Engine Power (hp) | Unit of Emission Factors | Emission Factors [1, 2] | | | | | Maximum Annual Emissions (tons/year) [3, 4] | | | | | Total Emissions (tons) [3, 4] | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | VOC | CO | NOx | $PM_{10}$ | $SO_2$ | VOC | CO | NOx | $PM_{10}$ | $SO_2$ | VOC | CO | NOx | $PM_{10}$ | $SO_2$ |
| Trucks (2-ton) | 2 | 9 | Diesel | 250 | g/hp-hr | 0.33 | 1.20 | 5.36 | 0.30 | 0.005 | 0.57 | 2.07 | 9.22 | 0.51 | 0.01 | 0.43 | 1.55 | 6.92 | 0.38 | 0.01 |
| Trucks (5-15 tons) | 5 | 9 | Diesel | 400 | g/hp-hr | 0.22 | 2.10 | 5.78 | 0.22 | 0.005 | 1.49 | 14.44 | 39.78 | 1.50 | 0.03 | 1.12 | 10.83 | 29.83 | 1.13 | 0.03 |
| Sideboom | 6 | 9 | Diesel | 500 | g/hp-hr | 0.22 | 2.10 | 5.78 | 0.22 | 0.005 | 2.23 | 21.66 | 59.67 | 2.25 | 0.05 | 1.67 | 16.24 | 44.75 | 1.69 | 0.04 |
| Dozer | 2 | 9 | Diesel | 850 | g/hp-hr | 0.31 | 1.23 | 5.92 | 0.21 | 0.005 | 1.79 | 7.18 | 34.58 | 1.21 | 0.03 | 1.34 | 5.39 | 25.94 | 0.91 | 0.02 |
| Large Shovel | 0 | 9 | Diesel | 850 | g/hp-hr | 0.31 | 1.23 | 5.92 | 0.21 | 0.005 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Grader | 2 | 9 | Diesel | 600 | g/hp-hr | 0.22 | 2.10 | 5.78 | 0.30 | 0.005 | 0.89 | 8.66 | 23.87 | 1.22 | 0.02 | 0.67 | 6.50 | 17.90 | 0.92 | 0.02 |
| Tractor / Backhoe / Loader | 2 | 9 | Diesel | 100 | g/hp-hr | 1.22 | 6.39 | 6.23 | 1.04 | 0.006 | 0.84 | 4.39 | 4.29 | 0.71 | 0.00 | 0.63 | 3.29 | 3.22 | 0.54 | 0.00 |
| Welder / Air Compressor / Generator | 5 | 9 | Diesel | 300 | g/hp-hr | 0.31 | 0.79 | 5.64 | 0.23 | 0.005 | 1.62 | 4.05 | 29.12 | 1.16 | 0.03 | 1.22 | 3.04 | 21.84 | 0.87 | 0.02 |
| Crane | 0 | 9 | Diesel | 400 | g/hp-hr | 0.21 | 1.37 | 6.09 | 0.16 | 0.005 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bore/Drill Rig | 2 | 9 | Diesel | 400 | g/hp-hr | 0.21 | 1.37 | 6.09 | 0.16 | 0.005 | 0.57 | 3.77 | 16.75 | 0.45 | 0.01 | 0.43 | 2.83 | 12.56 | 0.33 | 0.01 |
| Pickup Trucks and Crew Cabs | 6 | 9 | Gasoline | 200 | g/mile | 4.72 | 46.06 | 2.41 | 0.093 | 0.113 | 0.49 | 4.75 | 0.25 | 0.01 | 0.01 | 0.37 | 3.56 | 0.19 | 0.01 | 0.01 |
| **Total Emissions** | | | | | | | | | | | **10.48** | **70.98** | **217.52** | **9.04** | **0.20** | **7.86** | **53.23** | **163.14** | **6.78** | **0.15** |

NOTES:
VOC = volatile organic compounds
CO = carbon monoxide
NOx = nitrogen oxides
$PM_{10}$ = particulate matter with aerodynamic diameter less than or equal to 10 micrometers
$SO_2$ = sulfur dioxide
[1] Emission factors for off-highway diesel fueled vehicle/equipment were calculated following the method outlined in the USEPA report "Exhaust and Crankcase Emission Factors for Non-Road Engine Modeling-Compression-Ignition," USEPA420-P-04-009, April 2004. For all vehicles and equipment, Tier 1 emission factors were used.
[2] Emission factors for pickup trucks and crew cab were obtained from MOBILE5 run based on national averaged fleet conditions, at a speed of 15 miles per hour and an ambient temperature of 60 degrees Fahrenheit ($^oF$).
[3] Annual emissions for all diesel-fueled vehicle/equipment were calculated based on average engine horsepower for each type of vehicle/equipment, and an operating schedule of 10 hours/day, 6 days/week and 52 weeks/year.
[4] Annul emissions for pickup trucks and crew cab were calculated based on a traveling distance of 10 miles/day during Power Plant construction, 25 miles/day during Access Road Construction, and 50 miles/day during transmission line and water conveyance system construction, all with an operating schedule of 6 days/week and 52 weeks/year.

**Table K-33**

**Alternative C - Access Road Vehicle and Equipment Tailpipe Emissions During Construction**

| Vehicle/Equipment | Quantity | Months of Use | Fuel | Average Engine Power (hp) | Unit of Emission Factors | Emission Factors [1, 2] | | | | | Maximum Annual Emissions (tons/year) [3, 4] | | | | | Total Emissions (tons) [3, 4] | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | VOC | CO | NOx | $PM_{10}$ | $SO_2$ | VOC | CO | NOx | $PM_{10}$ | $SO_2$ | VOC | CO | NOx | $PM_{10}$ | $SO_2$ |
| Trucks (2-ton) | 5 | 6 | Diesel | 250 | g/hp-hr | 0.33 | 1.20 | 5.36 | 0.30 | 0.005 | 1.42 | 5.16 | 23.05 | 1.27 | 0.02 | 0.71 | 2.58 | 11.53 | 0.64 | 0.01 |
| Trucks (5-15 tons) | 5 | 6 | Diesel | 400 | g/hp-hr | 0.22 | 2.10 | 5.78 | 0.22 | 0.005 | 1.49 | 14.44 | 39.78 | 1.50 | 0.03 | 0.74 | 7.22 | 19.89 | 0.75 | 0.02 |
| Sideboom | 1 | 6 | Diesel | 500 | g/hp-hr | 0.22 | 2.10 | 5.78 | 0.22 | 0.005 | 0.37 | 3.61 | 9.94 | 0.38 | 0.01 | 0.19 | 1.80 | 4.97 | 0.19 | 0.00 |
| Dozer | 3 | 6 | Diesel | 850 | g/hp-hr | 0.31 | 1.23 | 5.92 | 0.21 | 0.005 | 2.68 | 10.77 | 51.87 | 1.82 | 0.04 | 1.34 | 5.39 | 25.94 | 0.91 | 0.02 |
| Large Shovel | 0 | 6 | Diesel | 850 | g/hp-hr | 0.31 | 1.23 | 5.92 | 0.21 | 0.005 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Grader | 5 | 6 | Diesel | 600 | g/hp-hr | 0.22 | 2.10 | 5.78 | 0.30 | 0.005 | 2.23 | 21.66 | 59.67 | 3.06 | 0.05 | 1.12 | 10.83 | 29.83 | 1.53 | 0.03 |
| Tractor / Backhoe / Loader | 5 | 6 | Diesel | 100 | g/hp-hr | 1.22 | 6.39 | 6.23 | 1.04 | 0.006 | 2.09 | 10.98 | 10.72 | 1.79 | 0.01 | 1.04 | 5.49 | 5.36 | 0.89 | 0.01 |
| Welder / Air Compressor / Generator | 5 | 6 | Diesel | 300 | g/hp-hr | 0.31 | 0.79 | 5.64 | 0.23 | 0.005 | 1.62 | 4.05 | 29.12 | 1.16 | 0.03 | 0.81 | 2.03 | 14.56 | 0.58 | 0.01 |
| Crane | 0 | 6 | Diesel | 400 | g/hp-hr | 0.21 | 1.37 | 6.09 | 0.16 | 0.005 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bore/Drill Rig | 0 | 6 | Diesel | 400 | g/hp-hr | 0.21 | 1.37 | 6.09 | 0.16 | 0.005 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Pickup Trucks and Crew Cabs | 8 | 6 | Gasoline | 200 | g/mile | 4.72 | 46.06 | 2.41 | 0.093 | 0.113 | 0.32 | 3.17 | 0.17 | 0.01 | 0.01 | 0.16 | 1.58 | 0.08 | 0.00 | 0.00 |
| **Total Emissions** | | | | | | | | | | | **12.23** | **73.84** | **224.32** | **10.99** | **0.20** | **6.11** | **36.92** | **112.16** | **5.49** | **0.10** |

NOTES:
VOC = volatile organic compounds
CO = carbon monoxide
NOx = nitrogen oxides
$PM_{10}$ = particulate matter with aerodynamic diameter less than or equal to 10 micrometers
$SO_2$ = sulfur dioxide
[1] Emission factors for off-highway diesel fueled vehicle/equipment were calculated following the method outlined in the USEPA report "Exhaust and Crankcase Emission Factors for Non-Road Engine Modeling-Compression-Ignition," USEPA420-P-04-009, April 2004. For all vehicles and equipment, Tier 1 emission factors were used.
[2] Emission factors for pickup trucks and crew cab were obtained from MOBILE5 run based on national averaged fleet conditions, at a speed of 15 miles per hour and an ambient temperature of 60 degrees Fahrenheit ($^oF$).
[3] Annual emissions for all diesel-fueled vehicle/equipment were calculated based on average engine horsepower for each type of vehicle/equipment, and an operating schedule of 10 hours/day, 6 days/week and 52 weeks/year.
[4] Annul emissions for pickup trucks and crew cab were calculated based on a traveling distance of 10 miles/day during Power Plant construction, 25 miles/day during Access Road Construction, and 50 miles/day during transmission line and water conveyance system construction, all with an operating schedule of 6 days/week and 52 weeks/year.

**Table K-34**

**Alternative C - Summary of Vehicle Tailpipe Emissions from Construction Work Force**

| | Quantity[1] | Fuel | Average Engine Power (hp) | Unit of Emission Factors | Emission Factors (EF) [2] | | | | | Maximum Annual Emissions (TPY) [3] | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | VOC | CO | NOx | $PM_{10}$ | $SO_2$ | VOC | CO | NOx | $PM_{10}$ | $SO_2$ |
| Vehicle | 425 | Gasoline | 200 | g/mile | 4.72 | 46.06 | 2.41 | 0.093 | 0.113 | 34.5 | 336.3 | 17.6 | 0.68 | 0.83 |

NOTES:
VOC = volatile organic compounds
CO = carbon monoxide
NOx = nitrogen oxides
$PM_{10}$ = particulate matter with aerodynamic diameter less than or equal to 10 micrometers
$SO_2$ = sulfur dioxide
[1] Each of the total estimated 1,700 construction employees is assumed to work 6 days per week (312 days per year). The employees are assumed to participate in "ride sharing", which reduces the number of gasoline powered vehicles to 425.
[2] Emission factors for pickup trucks and crew cab were obtained from MOBILE5 run based on national averaged fleet conditions, at a speed of 15 miles per hour and an ambient temperature of 60 degrees Fahrenheit ($^oF$).
[3] Annual emissions for vans were calculated based on a traveling distance of 50 miles/day for 312 days/year, as follows: TPY= 200 * (EF grams/mile* 50 miles/day * 312 days/year) / (454 grams/pound * 2000 pounds/ton)

**Table K-35**

**Alternative C - Summary of Equipment and Vehicle Tailpipe Emissions During Construction**

| Vehicle/Equipment | Quantity | | | | Fuel | Average Engine Power (hp) | Unit of Emission Factors | Emission Factors [1, 2] | | | | | Maximum Annual Emissions (tons/year) [3, 4] | | | | | Total Emissions (tons) [3, 4, 5] | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Power Plant | Water Conveyance System | Transmission Line | Access Roads | | | | VOC | CO | NOx | $PM_{10}$ | $SO_2$ | VOC | CO | NOx | $PM_{10}$ | $SO_2$ | VOC | CO | NOx | $PM_{10}$ | $SO_2$ |
| Trucks (2-ton) | 5 | 2 | 2 | 5 | Diesel | 250 | g/hp-hr | 0.33 | 1.20 | 5.36 | 0.30 | 0.005 | 3.97 | 14.46 | 64.54 | 3.57 | 0.06 | 5.25 | 19.11 | 85.29 | 4.72 | 0.08 |
| Trucks (5-15 tons) | 10 | 5 | 5 | 5 | Diesel | 400 | g/hp-hr | 0.22 | 2.10 | 5.78 | 0.22 | 0.005 | 7.44 | 72.19 | 198.89 | 7.52 | 0.17 | 10.79 | 104.68 | 288.40 | 10.90 | 0.25 |
| Sideboom | 6 | 2 | 6 | 1 | Diesel | 500 | g/hp-hr | 0.22 | 2.10 | 5.78 | 0.22 | 0.005 | 5.58 | 54.14 | 149.17 | 5.64 | 0.13 | 5.58 | 54.07 | 148.97 | 5.63 | 0.13 |
| Dozer | 6 | 2 | 2 | 3 | Diesel | 850 | g/hp-hr | 0.31 | 1.23 | 5.92 | 0.21 | 0.005 | 11.62 | 46.68 | 224.79 | 7.88 | 0.19 | 8.94 | 35.91 | 172.92 | 6.06 | 0.14 |
| Large Shovel | 0 | 1 | 0 | 0 | Diesel | 850 | g/hp-hr | 0.31 | 1.23 | 5.92 | 0.21 | 0.005 | 0.89 | 3.59 | 17.29 | 0.61 | 0.01 | 0.45 | 1.80 | 8.65 | 0.30 | 0.01 |
| Grader | 4 | 2 | 2 | 5 | Diesel | 600 | g/hp-hr | 0.22 | 2.10 | 5.78 | 0.30 | 0.005 | 5.81 | 56.31 | 155.14 | 7.95 | 0.13 | 4.02 | 38.98 | 107.40 | 5.51 | 0.09 |
| Tractor/backhoe/loader | 6 | 5 | 2 | 5 | Diesel | 100 | g/hp-hr | 1.22 | 6.39 | 6.23 | 1.04 | 0.006 | 7.52 | 39.54 | 38.58 | 6.43 | 0.04 | 5.22 | 27.45 | 26.79 | 4.47 | 0.03 |
| Welder/air compressor/generator | 15 | 5 | 5 | 5 | Diesel | 300 | g/hp-hr | 0.31 | 0.79 | 5.64 | 0.23 | 0.005 | 9.72 | 24.31 | 174.70 | 6.99 | 0.15 | 10.11 | 25.28 | 181.69 | 7.27 | 0.16 |
| Crane | 4 | 1 | 0 | 0 | Diesel | 400 | g/hp-hr | 0.21 | 1.37 | 6.09 | 0.16 | 0.005 | 1.42 | 9.44 | 41.87 | 1.12 | 0.03 | 1.79 | 11.93 | 52.93 | 1.41 | 0.04 |
| Bore/Drill Rig | 0 | 2 | 2 | 0 | Diesel | 400 | g/hp-hr | 0.21 | 1.37 | 6.09 | 0.16 | 0.005 | 1.13 | 7.55 | 33.50 | 0.89 | 0.03 | 0.99 | 6.61 | 29.31 | 0.78 | 0.02 |
| Pickup trucks and crew cab | 12 | 4 | 6 | 8 | Gasoline | 200 | g/mile | 4.72 | 46.06 | 2.41 | 0.093 | 0.113 | 1.33 | 12.99 | 0.68 | 0.03 | 0.03 | 1.34 | 13.07 | 0.68 | 0.03 | 0.03 |
| Vans | 0 | 0 | 0 | 425 | Gasoline | 200 | g/mile | 4.72 | 46.06 | 2.41 | 0.093 | 0.113 | 34.5 | 336.3 | 17.6 | 0.68 | 0.83 | 103.5 | 1,008.9 | 52.8 | 2.04 | 2.49 |
| **Total Emissions** | | | | | | | | | | | | | **90.95** | **677.49** | **1,116.76** | **49.29** | **1.80** | **157.98** | **1,347.78** | **1,155.82** | **49.10** | **3.47** |

NOTES:
VOC = volatile organic compounds
CO = carbon monoxide
NOx = nitrogen oxides
$PM_{10}$ = particulate matter with aerodynamic diameter less than or equal to 10 micrometers
$SO_2$ = sulfur dioxide
[1] Emission factors for off-highway diesel fueled vehicle/equipment were calculated following the method outlined in the USEPA report “Exhaust and Crankcase Emission Factors for Non-Road Engine Modeling-Compression-Ignition,” USEPA420-P-04-009, April 2004. For all vehicles and equipment, Tier 1 emission factors were used.
[2] Emission factors for pickup trucks and crew cab were obtained from MOBILE5 run based on national averaged fleet conditions, at a speed of 15 miles per hour and an ambient temperature of 60 degrees Fahrenheit ($^oF$).
[3] Annual emissions for all diesel-fueled vehicle/equipment were calculated based on average engine horsepower for each type of vehicle/equipment, and an operating schedule of 10 hours/day, 6 days/week and 52 weeks/year.
[4] Annul emissions for pickup trucks and crew cab were calculated based on a traveling distance of 10 miles/day during Power Plant construction, 25 miles/day during Access Road Construction, and 50 miles/day during transmission line and water conveyance system construction, all with an operating schedule of 6 days/week and 52 weeks/year.
[5] Total emissions from “Ride sharing” are based on 36 months of construction.

### 4.1.3 Fugitive Dust Emissions Due to Vehicle Travel On Paved and Unpaved Surfaces During Construction Activity

#### 4.1.3.1 Sources

During construction, vehicles will be used by workers to commute to the job sites. During operation of these vehicles fugitive $PM_{10}$ emissions will be generated during travel over unpaved surfaces.

#### 4.1.3.2 Emissions Estimation Methodology

Predicted PM emissions associated with construction of the proposed project were calculated in accordance with the procedures described in Section 3.1.4.2.

#### 4.1.3.3 Emissions

Table K-36 summarizes the estimated $PM_{10}$ pollutant emission rates for vehicle travel on unpaved roads during construction activity. The maximum $PM_{10}$ emissions were estimated to be 14,307 tpy with a project total of 26,632 tons during the 36-month plant construction.

**Table K-36**

**Alternative C - Particulate Matter ($PM_{10}$) Emissions Associated with Vehicle Travel on Unpaved Surfaces During Construction Activity**

| Construction Operations | Quantity of Vehicles | Miles Per Day Traveled | Road Surface | Durations (months) | Vehicle Miles Traveled (VMT/yr) [1] | Emission Factor (lb/VMT) [2] | Annual Emissions (tpy) |
|---|---|---|---|---|---|---|---|
| Power Plant [3] | 12 | 10 | Unpaved | 30 | 37,440 | 4.156 | 78 |
| Water Supply [3] | 4 | 50 | Unpaved | 6 | 31,200 | 4.156 | 65 |
| Transmission Lines [3] | 6 | 50 | Unpaved | 9 | 70,200 | 4.156 | 146 |
| Access Roads [3] | 8 | 25 | Unpaved | 6 | 31,200 | 4.156 | 65 |
| Ride sharing [4] | 425 | 40 | Paved | 36 | 4,420,000 | 3.605 | 7,966 |
| | | 10 | Unpaved | | 1,326,000 | 9.148 | 6,065 |
| **Total** | **452** | **185** | **-** | **-** | **5,978,440** | **-** | **14,307** |

NOTES:
[1] Vehicle Miles Traveled (VMT) were calculated assuming an operating schedule of 6 days/week 52 weeks/year.
[2] Emission factor takes into account natural mitigation based on 90 mean days with at least 0.01 inch or more of precipitation as recorded from USEPA AP-42 Figure 13.2.2-1.
[3] Emission Factor was calculated using Equation 1a and 2 of USEPA AP-42 13.2.2 *Unpaved Roads* and assumes a surface silt content of 8.5% and average vehicle weight of 3 tons.
[4] Emission Factor was calculated using Equation 2 of USEPA AP-42 13.2.1 *Paved Roads* and Equation 1b and 2 of USEPA AP-42 13.2.2 *Unpaved Roads.*

### 4.1.4 Ambient Impacts

Table K-37 summarizes the estimated emissions due to earthmoving, vehicle travel and vehicle/equipment operations during construction activity for the Alternative C facility.

**Table K-37**

**Alternative C - Summary of Maximum Pollutant Emissions From Construction Operations in TPY**

| Source | VOC | CO | NOx | $SO_2$ | $PM_{10}$ |
|---|---|---|---|---|---|
| Earthmoving [1] | - | - | - | - | 36.9 |
| Vehicle/Equipment Tailpipe Emissions | 91.0 | 677.5 | 1,116.8 | 1.8 | 49.3 |
| Vehicle Travel on Paved and Unpaved Surfaces | - | - | - | - | 14,307 |
| **Total** | **91.0** | **677.5** | **1,116.8** | **1.8** | **14,393.2** |

[1] Earthmoving emissions listed in Table K-29 are for the preferred alternatives.

Since the $PM_{10}$ emissions generated by earthmoving activity and vehicle travel over paved and unpaved roads occur at ground level and mostly consist of relatively large particles, it is unlikely that the $PM_{10}$ would be transported more than a few kilometers, except on unusually windy days (see Mitigation section for dust control measures during periods of high wind). In addition, all of these emissions will be spatially distributed over a large area and spread out over construction schedules ranging from 6 to 30 months. Furthermore, the locations of active work areas will be transient, with work activities typically moving to a new location every few days. Finally, these emissions will be temporary, ceasing as each phase of the project is completed. Based on the foregoing, the ambient air quality impacts of project construction activity are considered to be negligible.

## 4.2 Mine Operations

### 4.2.1 Fugitive Dust

#### 4.2.1.1 Sources

Fugitive dust will be generated by surface coal mining; coal handling and transport; and vehicle traffic on haulage and access roads during operations.

#### 4.2.1.2 Emissions Estimation Methodology

Particulate matter (PM) emission rates for the mining operations and coal handling/transport were obtained from the PSD application (ENSRx 2006). Table K-38 summarizes the annual $PM_{10}$ emissions from the BNCC mining and coal handling operations assuming the use of haul trucks rather than the overland conveyor system proposed under Alternative B. Note these emissions estimates were originally prepared as options for the Alternative B facility and have been multiplied by the ratio of maximum annual coal usage of Alternative C over Alternative B (2,732,605 tpy/ 7,025,615 tpy or 39%). The maximum annual coal consumption was used to calculate this ration rather than mega-watt output, because Alternative C is a slightly less efficient unit and requires more the combustion of more coal per mega-watt hour when compared with Alternative B.

#### 4.2.1.3 Emissions

The total $PM_{10}$ emissions from mining and coal handling operations are estimated to be 100.16 tpy.

**Table K-38**

**Alternative C - Annual Air Pollutant Emissions from BHP Navajo Coal Company Option 2**

| **Operation** | **$PM_{10}$ Emissions (tons per year)** |
|---|---|
| **Mining** [1] | |
| Topsoil Removal [2] | 1.05 |
| Overburden Removal [3] | 5.48 |
| Draglines | 28.17 |
| Coal Removal [4] | 7.67 |
| Coal Truck Loading | 0.17 |
| Coal Truck Travel | 28.95 |
| Wind Erosion [5] | 10.28 |
| Overland Conveyor System | NA |
| Other Vehicle Travel [6] | 16.49 |
| Mining Total | **98.3** |
| **Coal Handling** | |
| Truck Unloading | 0.02 |
| Primary Crushing | 0.88 |
| Secondary Crushing | 0.29 |
| Conveyors [7] | 0.71 |
| Coal Handling Total | **1.9** |
| **Total** | **100.16** |

SOURCE: ENSR 2006 (BNCC Coal Processing Facility - Emissions Estimation Summary)
[1] Mining and coal handling emission data for Area 4 South were prepared by ENSR.
[2] Topsoil removal includes excavation and unloading using scrapers
[3] Overburden removal includes drilling, blasting and stockpile management using bulldozers.
[4] Coal removal emissions include drilling, blasting and dust from bulldozer operations.
[5] Wind erosion emissions include the pit and emergency coal storage pile.
[6] Other vehicle travel emissions include water trucks, graders, light/medium vehicles, plant ash haul trucks and plant gypsum trucks.
[7] Conveyors includes dust emissions from transfer points, storage units and transfer stations.

### 4.2.2 Mining Vehicle Tailpipe Emissions

#### 4.2.2.1 Sources

During mining operations, diesel fueled vehicles will be operated which generate gaseous and particulate exhaust emissions.

#### 4.2.2.2 Emissions Estimation Methodology

Total annual criteria air pollutant tailpipe emissions from mining and coal transport vehicles were estimated based on the roster of vehicles developed by ENSR for the PSD application, and using emission factors from the USEPA report "Exhaust and Crankcase Emission Factors for Non-Road Engine Modeling-Compression-Ignition" (USEPA420-P-04-009, April 2004), in the same manner as previously described for Alternative B.

#### 4.2.2.3 Emissions

Table K-39 summarizes the vehicle roster and estimated criteria pollutant emission rates during mining operations. The total maximum combustion emissions from mining and coal transport equipment are estimated to be 8.6 tpy of VOCs, 33.9 tpy of CO, 166.5 tpy of NOx, 6.0 tpy of $PM_{10}$, and 0.14 tpy of $SO_2$. Since these emissions are generated by mine vehicle activity and occur at ground level, it is unlikely that the emissions would be transported more than a few kilometers. The locations of active mine areas will be transient, with work activities moving to new locations frequently. Based on the foregoing, the ambient air quality impacts of vehicle tailpipe emissions are considered to be negligible.

## Table K-39

## Alternative C - Mine Vehicle Tailpipe Emissions

| Vehicle | Vehicle Miles Traveled per Year [1] | Estimated Average Vehicle Speed (mph) | Estimated Hours of Operations per Year [2] | Fuel | Average Engine Power (hp) | Unit of Emission Factors | Emission Factors [3] | | | | | Maximum Annual Emissions (tons/year) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | VOC | CO | NOx | $PM_{10}$ | $SO_2$ | VOC | CO | NOx | $PM_{10}$ | $SO_2$ |
| Large Coal Haul Trucks (150-250 tons) | 103,516 | 10 | 12,939 | Diesel | 1500 | g/hp-hr | 0.31 | 1.23 | 5.92 | 0.21 | 0.005 | 6.54 | 26.28 | 126.55 | 4.49 | 0.11 |
| Water Truck | 2,711 | 10 | 339 | Diesel | 400 | g/hp-hr | 0.22 | 2.10 | 5.78 | 0.22 | 0.005 | 0.03 | 0.31 | 0.86 | 0.03 | 0.001 |
| Grader | 386 | 10 | 48 | Diesel | 500 | g/hp-hr | 0.22 | 2.10 | 5.78 | 0.22 | 0.005 | 0.01 | 0.06 | 0.15 | 0.01 | 0.0001 |
| Light/Medium Vehicles | 135,527 | 25 | 6,776 | Diesel | 300 | g/hp-hr | 0.31 | 0.79 | 5.64 | 0.23 | 0.005 | 0.70 | 1.76 | 12.65 | 0.52 | 0.01 |
| Plant Ash Trucks | 25,520 | 10 | 3,190 | Diesel | 1000 | g/hp-hr | 0.31 | 1.23 | 5.92 | 0.21 | 0.005 | 1.08 | 4.32 | 20.80 | 0.74 | 0.02 |
| Plant Gypsum Trucks | 6,673 | 10 | 834 | Diesel | 1000 | g/hp-hr | 0.31 | 1.23 | 5.92 | 0.21 | 0.005 | 0.28 | 1.13 | 5.44 | 0.19 | 0.005 |
| **Total Emissions** | | | | | | | | | | | | **8.64** | **33.86** | **166.45** | **5.98** | **0.14** |

[1] Vehicle miles traveled per year value was obtained from ENSR BNCC4South PM Emission Spreadsheet.
[2] Estimated hours of operation per year contains an additional correction factor of 1.25 to account for vehicle idling and loading time.
[3] Emission factors were obtained from Table K-2 entitled Construction Vehicle and Equipment Emission Factors

## 4.3 Power Plant Operations

### 4.3.1 Source

Alternative C power plant operation emissions have been estimated for the following sources:

- **Material Handling -** Particulate matter emissions due to plant operations will occur during the handling of coal, fly ash, bottom ash, quicklime, and gypsum;

- **Combustion Sources -** Criteria and hazardous air pollutant emissions due to combustion sources located at the plant will occur during the operation of the PC boilers, auxiliary boilers, emergency generators, and fire water pumps;

- **Petroleum Storage Tanks -** VOC emissions due to fuel oil storage;

- **Cooling Towers** – Particulate matter emissions due to cooling tower operation;

- **Commuting Employee Vehicle Emissions** – Criteria pollutant emissions due to vehicle combustion emissions from commuting employees.

### 4.3.2 Emissions Estimation Methodology

Predicted emissions due to material handling, combustion sources, petroleum storage tanks, and cooling towers were obtained from the PSD application (RTP, 2004). URS conservatively estimated PC boiler HAP emissions and criteria pollutant emissions due to commuting employee vehicles, in the same manner described previously for Alternative B.

Using USEPA AP-42 emission factors, found in Tables 1.1-12, 1.1-14, and 1.1-18 of *External Combustion Sources – Bituminous and Sub-Bituminous Coal Combustion* and the maximum coal combustion rates for the proposed power plant, HAP emission rates were calculated. Six metals, two dioxins and monomethyl hydrazine were selected for human health and ecological risk assessment analysis.

Criteria air pollutant emissions resulting from employees driving vehicles to commute to the plant were conservatively estimated. URS conservatively assumed that all 125 employees will work five days per week and that each person would drive a gasoline-fueled vehicle separately to work each day. Emission factors for vehicles were obtained from USEPA document AP-42, Volume II, Emission Factors for Mobile Sources (USEPA 1995, 5$^{th}$ edition and updates). Emission factors for pickup trucks and crew cabs were obtained from a MOBILE5 run based on national averaged fleet conditions, at a speed of 15 miles per hour and an ambient temperature of 60 degrees Fahrenheit ($^{o}$ F). Annual emissions were calculated based on a traveling distance of 45 miles/day with an operating schedule of 5 days/week (Monday through Friday) and 52 weeks/year.

### 4.3.3 Emissions

#### 4.3.3.1 Criteria Pollutants

Criteria air pollutant emission rates were obtained from the PSD application (RTP 2004). Table K-40 presents a summary of maximum potential-to-emit (PTE) criteria air pollutant emission rates from the Alternative C power plant. These emission rates are based on the conservative assumption that the generating unit of the plant will operate for 8,760 hours each year, at full-load operation. Based on these PTE values, the proposed power plant will be a major source, as defined under federal New Source Review and Prevention of Significant Deterioration (NSR/PSD) regulations, codified at 40 CFR §51.166, for $PM_{10}$, NOx, $SO_2$, and CO. Accordingly, the PSD permit application must identify Best Available Control Technology (BACT) requirements, and address the ambient air quality impacts for each of these criteria pollutants. Mercury emission were not addressed in the PSD application. However, URS conservatively estimated mercury emissions by applying the ratio of maximum annual coal usage of Alternative C over Alternative B (2,732,605 tpy/ 7,025,615 tpy or 39%) to the estimated mercury emissions estimated for Alternative B on Table K-14.

**Table K-40**

**Summary of Maximum Potential Criteria Pollutant Emissions from Power Plant (Alternative C)**

| Pollutant | PC Boilers (tpy) | Cooling Towers (tpy) | Auxiliary Boilers (tpy) | Emergency Generator (tpy) | Fire Water Pump (tpy) | Material Handling (tpy) | Storage Tank (tpy) | Project PTE (tpy) |
|---|---|---|---|---|---|---|---|---|
| CO | 3,134 | n/a | 4.4 | 0.6 | 0.3 | n/a | n/a | 3,139 |
| NOx | 1,343 | n/a | 7.3 | 0.7 | 0.3 | n/a | n/a | 1,351 |
| $SO_2$ | 1,343 | n/a | 6.9 | 0.04 | 0.02 | n/a | n/a | 1,350 |
| PM | 269 | 3.37 | 1.8 | 0.03 | 0.02 | n/a | n/a | 284 |
| $PM_{10}$ | 448 | 3.37 | 2.9 | 0.03 | 0.02 | 5.85 | n/a | 464 |
| VOC | 161 | n/a | 0.2 | 0.3 | 0.1 | n/a | 0.03 | 162 |
| Lead | 0.59 | n/a | 0.001 | 0.00001 | 0.000003 | n/a | n/a | 0.59 |
| Fluorides | 18 | n/a | neg | neg | neg | n/a | n/a | 18 |
| $H_2SO_4$ | 114 | n/a | 0.3 | n/a | n/a | n/a | n/a | 114 |
| Mercury[1] | 0.02 | n/a | 0.00008 | n/a | n/a | n/a | n/a | 0.02 |

SOURCE: RTP Environmental Associates, Inc. *Cottonwood Energy Center PSD Permit Application,* March 2004
n/a – not applicable, neg. – negligible
[1] Mercury emissions were estimated by URS to be the ratio of maximum annual coal usage of Alt C over Alt B multiplied times the estimated mercury emissions for Alternative B.

The number of employees required to operate the Alternative 550 MW plant (125) is roughly 62% of what is needed for the Proposed 1,500 MW facility (200). Therefore, the predicted maximum annual tailpipe emissions resulting from power plant employees commuting to work would be approximately 38% less than the emissions estimated for Alternative B. Table K-41 presents a summary of criteria air pollutant tailpipe emissions resulting from employees while commuting to the plant site.

## Table K-41

## Alternative C - Summary of Vehicle Tailpipe Emissions from Permanent Work Force

| | Quantity[1] | Fuel | Average Engine Power (hp) | Unit of Emission Factors | Emission Factors (EF) [2] | | | | | Maximum Annual Emissions (TPY) [3] | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | VOC | CO | NOx | $PM_{10}$ | $SO_2$ | VOC | CO | NOx | $PM_{10}$ | $SO_2$ |
| Vehicle | 125 | Gasoline | 125 | g/mile | 4.72 | 46.06 | 2.41 | 0.093 | 0.113 | 8.45 | 82.43 | 4.31 | 0.17 | 0.20 |

NOTES:
VOC = volatile organic compounds
CO = carbon monoxide
NOx = nitrogen oxides
$PM_{10}$ = particulate matter with aerodynamic diameter less than or equal to 10 micrometers
$SO_2$ = sulfur dioxide
[1] Each of the total estimated 200 full-time employees is assumed to work 5 days per week (260 days per year). Each employee is assumed to drive his or her own gasoline powered vehicle to and from work each day.
[2] Emission factors for pickup trucks and crew cab were obtained from MOBILE5 run based on national averaged fleet conditions, at a speed of 15 miles per hour and an ambient temperature of 60 degrees Fahrenheit ($^oF$).
[3] Annual emissions for pickup trucks and crew cabs were calculated based on a traveling distance of 50 miles/day for 260 days/year, as follows: TPY= 200 * (EF * 50 miles/day * 260 days/year) / (454 grams/pound * 2000 pounds/ton)

### 4.3.3.2 Vehicle Travel on Paved and Unpaved Roads During Plant Operations (Employee Commuting)

#### 4.3.3.2.1 Sources

During plant operation, vehicles will be used by employees commuting to the plant site. During operation of these vehicles fugitive $PM_{10}$ emissions will be generated during travel over the paved and unpaved surfaces.

#### 4.3.3.2.2 Emissions Estimation Methodology

Predicted fugitive PM10 emissions associated with employee commuting were calculated in accordance with the procedures described in Section 3.3.3.2.2.

#### 4.3.3.2.3 Emissions

Table K-42 summarizes the estimated $PM_{10}$ pollutant emission rates for vehicle travel on paved and unpaved roads during plant operation.

**Table K-42**

**Alternative C - Particulate Matter ($PM_{10}$) Emissions Associated with Vehicle Travel on Paved and Unpaved Surfaces During Plant Operation**

| Road Surface | Quantity of Vehicles | Miles Per Day Traveled | Vehicle Miles Traveled (VMT/yr) [1] | Emission Factor (lb/VMT) [2] | Uncontrolled Emissions (tpy) |
|---|---|---|---|---|---|
| Paved | 125 | 40 | 1,300,000 | 3.605 | 2,343 |
| Unpaved | | 10 | 325,000 | 9.148 | 1,487 |
| **Total** | **125** | **50** | **1,625,000** | **-** | **3,830** |

NOTES:
[1] Vehicle Miles Traveled (VMT) were calculated assuming an operating schedule of 5 days/week 52 weeks/year.
[2] Emission Factor was calculated using Equation 2 of USEPA AP-42 13.2.1 *Paved Roads* and Equations 1b and 2 of USEPA AP-42 13.2.2 *Unpaved Roads.*

### 4.3.3.3 Hazardous Air Pollutants

Six metals, two dioxins and monomethyl hydrazine were selected for human health and ecological risk assessment analysis. Using AP-42 emission factors for HAPs from coal combustion and the maximum coal combustion rates for the proposed power plant, HAP emission rates were calculated. Table K-43 summarizes the coal combustion emission factors and calculated maximum emission rates, in pound per hour (lb/hour) and grams per second (g/sec) for these nine air toxics. Note these emissions estimates were originally prepared for the Alternative B facility and have been multiplied by the ratio of total tons of coal usage of Alternative C over Alternative B (2,732,605 tpy / 7,025,615 tpy or 39%).

**Table K-43**

**Alternative C - Estimated Emission Rates for Selected Air Toxics**

| Contaminant | AP-42 Emission Factor (lb/ton) [1] | Emissions (lb/yr) [2] | Emissions (g/s) |
|---|---|---|---|
| Arsenic | 4.1E-04 | 9.50E+02 | 1.37E-02 |
| Cadmium and compounds | 5.1E-05 | 1.18E+02 | 1.70E-03 |
| Chromium VI | 7.9E-05 | 1.83E+02 | 2.63E-03 |
| Lead | 4.2E-04 | 9.73E+02 | 1.40E-02 |
| Mercury (elemental) [3] | NA | 1.92E+02 | 2.77E-03 |
| Methyl Hydrazine | 1.7E-04 | 3.94E+02 | 5.67E-03 |
| Selenium | 1.3E-03 | 3.01E+03 | 4.33E-02 |
| 2,3,7,8-TCDD (dioxin) | 1.43E-11 | 3.31E-05 | 4.77E-10 |
| Total PCDD (dioxins) | 6.66E-09 | 1.54E-02 | 2.22E-07 |

Note: Scientific notation has been used; 4.1E-04 is equivalent to 0.00041
TCDD = Tetrachlorodibenzo-P-Dioxin
PCDD = Polychlorinated Dibenzo-P-Dioxins
[1] From AP-42 for External Combustion Sources - Bituminous and Sub-bituminous Coal Combustion 9/98 (Emission Factors for controlled coal combustion) – Tables 1.1-18 (Trace Metals) and 1.1-12 (Dioxins)
[2] Based on an average annual coal consumption of 2,317,143 tons
3 Based on average mercury emissions of 40 lb/yr as calculated for Table K-40

## 4.4 Total Annual Emissions from Operation of Mine and Power Plant

Table K-44 summarizes the estimated total annual emissions resulting from mining, plant, and commuting vehicle operations for Alternative C. The total maximum annual emissions due to Alternative C operations are estimated to be 179.1 tpy of VOC, 3,255.3 tpy of CO, 1,521.8 tpy of NOx, 1,350.3 tpy of $SO_2$, and 4,400.3 tpy of PM10. These emissions are estimated maximum annual values; actual emissions will be less.

**Table K-44**

**Alternative C - Summary of Maximum Pollutant Emissions From Plant Operations in TPY**

| Source | VOC | CO | NOx | $SO_2$ | $PM_{10}$ |
|---|---|---|---|---|---|
| **Mine Operations** | | | | | |
| Mining, Coal Handling, & Vehicle Travel | - | - | - | - | 100.16 |
| Vehicle Tailpipe Emissions | 8.64 | 33.86 | 166.45 | 0.14 | 5.98 |
| **Plant Operations** | | | | | |
| Power Plant | 162 | 3,139 | 1,351 | 1,350 | 464 |
| Commuting Vehicle Tailpipe Emissions | 8.45 | 82.43 | 4.31 | 0.20 | 0.17 |
| Commuting Vehicle Travel Fugitive Dust Emissions | - | - | - | - | 3,830 |
| **Total** | **179.1** | **3,255.3** | **1,521.8** | **1,350.3** | **4,400.3** |

## 4.5 Predicted Ambient Air Quality Impacts

### 4.5.1 Criteria Pollutant Emissions

#### 4.5.1.1 Class I Area Impacts

Table K-45 presents the maximum predicted ambient concentrations of NOx, $SO_2$ and $PM_{10}$ within 12 Class I areas (located within 300 km of the project site) during the calendar years 1992, 1996, and 2003. Exceedances of the $SO_2$ 3-hour and 24-hour averaging periods occurred at Canyonlands NP, Capital Reef NP, Great Sand Dunes NM, Mesa Verde NP, San Pedro Parks Wilderness, and Weminuche Wilderness. Therefore, a cumulative PSD increment analysis for $SO_2$ was performed using all background source emissions within a 50 km (~31 miles) radius and source emissions larger than 1 lb/hr within 300 km (~186 miles) of the affected Class I areas. Based on RTP's analysis compliance has been met at all Class I areas for the $SO_2$ PSD cumulative analyses. Details regarding the PSD increment analysis can be found in Section 6.2 of *PSD Class I Cumulative Impact Results of Assessment of Air Quality Impacts from the Proposed Cottonwood Energy Center, San Juan County, New Mexico* (RTP 2004), included in the Administrative Record of the DREP EIS.

**Table K-45**

**Alternative C - Highest Modeled PSD Increment Concentrations ($\mu g/m^3$) Over Three Years (1992, 1996, and 2003)**

| **Pollutant** | **NOx** | **$SO_2$** | | | **$PM_{10}$** | |
|---|---|---|---|---|---|---|
| **Averaging Period** | **Annual** | **3-hour** | **24-hour** | **Annual** | **24-hour** | **Annual** |
| Bandelier NM | 0.0027 | 0.638 | 0.192 | 0.011 | 0.0420 | 0.0036 |
| Black Canyon of the Gunnison NM | 0.0005 | 0.466 | 0.193 | 0.003 | 0.0473 | 0.0009 |
| Canyonlands NP | 0.0015 | 0.843 | 0.215 | 0.005 | 0.0565 | 0.0015 |
| Capitol Reef NP | 0.0009 | 1.064 | 0.222 | 0.003 | 0.0401 | 0.0010 |
| Great Sand Dunes NM | 0.0023 | 0.683 | 0.300 | 0.007 | 0.0749 | 0.0021 |
| La Garita Wilderness | 0.0012 | 0.659 | 0.131 | 0.004 | 0.0314 | 0.0014 |
| Mesa Verde NP | 0.0060 | 2.007 | 0.443 | 0.020 | 0.1023 | 0.0057 |
| Pecos Wilderness | 0.0012 | 0.421 | 0.119 | 0.008 | 0.0317 | 0.0026 |
| Petrified Forest NP | 0.0002 | 0.356 | 0.098 | 0.003 | 0.0380 | 0.0012 |
| San Pedro Parks Wilderness | 0.0057 | 1.158 | 0.266 | 0.018 | 0.0613 | 0.0053 |
| Weminuche Wilderness | 0.0042 | 1.559 | 0.287 | 0.012 | 0.0721 | 0.0034 |
| Wheeler Peak Wilderness | 0.0016 | 0.345 | 0.099 | 0.007 | 0.0379 | 0.0024 |
| **SIL**[1] | **0.1** | **1.0** | **0.2** | **0.1** | **0.3** | **0.2** |
| **PSD Increments** | **2.5** | **25.0** | **5.0** | **2.0** | **8.0** | **4.0** |

SIL = Significant Impact Level

SOURCE: RTP, *Assessment of Air Quality Impacts from the Proposed Cottonwood Energy Center, San Juan County, New Mexico,* June 2004

[1] Proposed by USEPA (1996; 61 FR 38249)

Note: Highest modeled increment concentrations for Arches, NP, Grand Canyon NP, and West Elk WA (included in the ENSR modeling report for Alternative B) were not included in the RTP modeling report for Alternative C.

### 4.5.1.2 Class II Area Impacts

Table K-46 summarizes the predicted ambient air quality impacts of Alternative C, based on the CALPUFF modeling results. The maximum predicted ambient concentrations for CO (1-hour and 8-hour) are below the Significance Impact Level (SIL). In accordance with the USEPA document "*Guideline on Air Quality Models*" (EPA 1999), no further analysis of this pollutant (i.e., Class I impacts and increment consumption), for the specified averaging times, is required under the PSD regulations. The maximum predicted ambient concentrations for NOx (annual), $SO_2$ (3-hour and 24-hour) and $PM_{10}$ (24-hour and annual) are above the corresponding SIL. All pollutants and averaging periods were below the PSD Increment for all receptors within the modeling domain, with the exception of the 24-hour PM10 value. A maximum of 63.0 µg/m$^3$ was predicted, which exceeds the PSD Increment standard of 30 µg/m$^3$. However, at none of the receptors is the Alternative C facility a significant contributor of 24-hour $PM_{10}$, as all of the concentrations for the facility are below the $PM_{10}$ SIL of 5 µg/m$^3$. Detailed results of the analysis of receptors in excess of the 24-hour $PM_{10}$ increment can be found within section 6.5 –Results of Class II PSD Increment Analysis, specifically Table 6-20 of the Cottonwood Energy Center Modeling Results. Therefore, all of the receptors have demonstrated to be in compliance with the Class II PSD Increments.

**Table K-46**

**Alternative C - Maximum Predicted Air Quality Impacts**

| Pollutant | Averaging Period | Maximum Modeled Conc. (µg/m$^3$) | SIL (µg/m$^3$) | % of SIL | PSD Class II Increment (µg/m$^3$) | % of Incr. | NAAQS (µg/m$^3$) | % of Ambient Standard |
|---|---|---|---|---|---|---|---|---|
| $NO_X$ | 24 Hour [(1)] | 102.2 | N/A | N/A | N/A | N/A | 191 [(1)] | 54% |
| | Annual | 12.9 | 1 | 1,290% | 25 | 52% | 100 | 13% |
| $SO_2$ | 3 Hour | 420.6 | 25 | 1,682% | 512 | 82% | 1,300 | 32% |
| | 24 Hour | 65.1 | 5 | 1,302% | 91 | 72% | 365 | 18% |
| | Annual | 11.5 | 1 | 1,157% | 20 | 1% | 80 | 14% |
| $PM_{10}$ | 24 Hour | 63.0 | 5 | 1,260% | 30 | 210% | 150 | 42% |
| CO [(3)] | 1 Hour | 505.4 | 2000 | 25% | N/A | N/A | 40,000 | 1% |
| | 8 Hour[(2)] | 114.8 | 500 | 23% | N/A | N/A | 1,000 | 11% |

SOURCE: RTP, *Assessment of Air Quality Impacts from the Proposed Cottonwood Energy Center, San Juan County, New Mexico,* June 2004

[1] A 24-hour State of New Mexico standard applies for receptors outside of the Navajo Nation

[2] CALPUFF does not provide 8-hour average results, so a conservatively high 3-hour average is provided for CO.

[3] CO averages only include emissions from the 550 MW facility. No cumulative modeling was performed because no receptors were predicted to be above the SIL for CO.

Certain national parks, monuments and wildlife areas are not designated as Class I areas, but are considered sensitive receptors by federal and state land managers responsible for these lands. RTP predicted the maximum ambient concentrations for NOx, $SO_2$ and $PM_{10}$ at 26 such areas within New Mexico, Arizona, Utah and Colorado, based on power plant emissions only (e.g. mine emissions not included). Table K-47 summarizes the predicted ambient concentrations for NOx, $SO_2$ and $PM_{10}$ in the 26 sensitive Class II areas. The SILs for NOx, $PM_{10}$, and $SO_2$ were not exceeded at any of these 26 sensitive receptors.

**Table K-47**

**Alternative C - Highest Modeled PSD Increment Concentrations (μg/m$^3$) Over Three Years (1992, 1996, and 2003), Distant Class II Areas**

| Pollutant Averaging Period | $NO_X$ | $SO_2$ | | | $PM_{10}$ | |
|---|---|---|---|---|---|---|
| | Annual | 3-hour | 24-hour | Annual | 24-hour | Annual |
| Aztec Ruins Nat. Mon. | 0.0061 | 1.25 | 0.27 | 0.023 | 0.08 | 0.007 |
| Canyon de Chelly Nat. Mon. | 0.0065 | 2.17 | 0.55 | 0.02 | 0.14 | 0.006 |
| Chaco Culture NHP | 0.0264 | 2.91 | 0.99 | 0.060 | 0.15 | 0.015 |
| Colorado Nat. Mon.[1] | 0.0004 | 0.48 | 0.15 | 0.003 | 0.02 | 0.001 |
| Cruces Basin NWA | 0.0032 | 0.58 | 0.15 | 0.010 | 0.04 | 0.003 |
| Curecanti NRA | 0.0005 | 0.45 | 0.21 | 0.003 | 0.05 | 0.001 |
| El Malpais Nat. Mon. | 0.0031 | 1.2 | 0.27 | 0.010 | 0.06 | 0.003 |
| El Morro Nat. Mon. | 0.0025 | 0.83 | 0.14 | 0.009 | 0.04 | 0.003 |
| Glen Canyon NRA | 0.0034 | 1.28 | 0.23 | 0.011 | 0.06 | 0.003 |
| Hovenweep Nat. Mon. | 0.0028 | 0.89 | 0.34 | 0.012 | 0.09 | 0.003 |
| Hubbel Trading Post NHS | 0.0013 | 0.85 | 0.28 | 0.006 | 0.08 | 0.002 |
| Lizard Head NWA | 0.0015 | 0.63 | 0.30 | 0.006 | 0.08 | 0.002 |
| Mount Sneffels NWA | 0.0008 | 0.47 | 0.22 | 0.004 | 0.06 | 0.001 |
| Natural Bridges Nat. Mon. | 0.0021 | 0.66 | 0.17 | 0.007 | 0.04 | 0.002 |
| Navajo Nat. Mon. | 0.0006 | 0.55 | 0.14 | 0.003 | 0.04 | 0.001 |
| Pecos NHP | 0.0011 | 0.28 | 0.12 | 0.007 | 0.03 | 0.002 |
| Petroglyph Nat. Mon. | 0.0051 | 0.45 | 0.17 | 0.018 | 0.05 | 0.005 |
| Rainbow Bridge Nat. Mon. | 0.0003 | 0.49 | 0.13 | 0.003 | 0.03 | 0.005 |
| Salinas Pueblo Missions Nat. Mon. | 0.0021 | 0.37 | 0.18 | 0.008 | 0.05 | 0.002 |
| South San Juan NWA | 0.0041 | 1.32 | 0.28 | 0.011 | 0.07 | 0.003 |
| Sunset Crater Nat. Mon. | 0.0001 | 0.18 | 0.05 | 0.001 | 0.02 | 0.000 |
| Uncompahgre NWA [1] | 0.0009 | 0.47 | 0.17 | 0.004 | 0.04 | 0.001 |
| Wilson Mountain Primitive Area [1] | 0.0011 | 0.47 | 0.27 | 0.005 | 0.08 | 0.001 |
| Wupatki Nat. Mon. | 0.0001 | 0.17 | 0.05 | 0.001 | 0.02 | 0.001 |
| Yucca House Nat. Mon. | 0.0022 | 1.03 | 0.30 | 0.014 | 0.08 | 0.004 |
| Zuni-Cibola NHP | 0.0030 | 1.14 | 0.27 | 0.011 | 0.08 | 0.003 |
| **SIL** | **1.0** | **25** | **5.0** | **1.0** | **5.0** | **1.0** |
| **PSD Increments** | **25** | **512** | **91** | **20** | **30** | **17** |

SOURCE: RTP, *Assessment of Air Quality Impacts from the Proposed Cottonwood Energy Center, San Juan County, New Mexico,* June 2004

[1] subject under Colorado regulation to Class I $SO_2$ increment protection

Based on the predicted maximum ambient pollutant concentrations presented in Table K-45, Table K-46, and Table K-47 above, the off-site air quality impacts of the proposed power plant would be considered minor. No exceedances of the NAAQS, nor excessive consumption of Class I or II increments, are anticipated to occur.

### 4.5.1.3 Visibility/Regional Haze Impacts

Table K-48 presents the regional haze modeling results, using Industrial CALPOST, in terms of the change in light extinction from natural background extinction using Federal Land Managers AQRV Workgroup (FLAG) guidance Method 2 and Method 7 for calendar years 1992, 1996, and 2003. The predicted percent changes in light extinction for each Class I area was compared to the NPS Class I Screening Level Value (SLV) of 5 %. Method 2 implements the Interagency Workgroup on Air Quality Modeling (IWAQM) visibility methodology (EPA, 1998) and uses an hourly relative humitidy (RH) adjustment, which is applied to the hygroscopic components of the modeled and background extinction. Method 7 makes use of weather observations to augment the procedures used in Method 2. Method 7 allows local weather observations to be used to obtain the background extinction coefficient during hours in which natural weather events are observed, while the procedures of Method 2 are retained for all other hours. This means that for hours with precipitation or natural fogging, the observed visual range values for estimating natural extinction are used. At some of the parks where more localized precipitation data were available, this information was used to supplement the Method 7 analysis. The results in Table K-48 show that 1992 is the worst year of the three modeled and that there are a number of Class I areas with several days of modeled extinction above 5% change. The 1992 modeling results for the Class I areas show that there were three (3) days in the year with extinction changes over 10%. For 1996 there was only one (1) day with light extinction change over 10% and in 2003 there where none. All of the peak impacts are under 20% change, using Method 2. When Method 7 + weather events are taken into consideration, no extinction changes are above the 10% threshold; the maximum is observed at San Pedro WA with 6.99% extinction change. No exceedances of the 5% $b_{ext}$ criteria are observed at Black Canyon NP, Pecos NWF and Weminuche WA for any year. One exceedance is still observed at Wheeler Peak (5.30%) in 1992, and San Pedro (6.99%) in 2003. Two exceedances each are still observed in 1992 at Canyonland NP, Great Sand Dunes NP, Mesa Verde NP, and Petrified Forest NP.

This table indicates that the project’s impacts to visibility and regional haze are very minimal with only a marginally noticeable impact at Mesa Verde.

## Table K-48

### Alternative C - Regional Haze Modeling Results (1992, 1996, and 2003) – CALPOST

| Class I Area | 1992 Days > than 5% $\Delta B_{ext}$ | 1992 Days > than 10% $\Delta B_{ext}$ | 1992 MAX % Change in $B_{ext}$ | 1996 Days > than 5% $\Delta B_{ext}$ | 1996 Days > than 10% $\Delta B_{ext}$ | 1996 MAX % MAX % Change in $B_{ext}$ | 2003 Days > than 5% $\Delta B_{ext}$ | 2003 Days > than 10% $\Delta B_{ext}$ | 2003 MAX % MAX % Change in $B_{ext}$ |
|---|---|---|---|---|---|---|---|---|---|
| ***Method 2, USEPA f(RH), FLAG Background*** | | | | | | | | | |
| Bandelier | 0 | 0 | **4.41** | 0 | 0 | 2.05 | 0 | 0 | **2.94** |
| Black Cany. Gun. | 0 | 0 | **3.30** | 1 | 1 | 11.21 | 0 | 0 | 1.26 |
| Canyonlands | 5 | 0 | **7.14** | 0 | 0 | 3.46 | 0 | 0 | **2.79** |
| Capitol Reef | 0 | 0 | **2.67** | 0 | 0 | 3.34 | 0 | 0 | 3.00 |
| Great Sand Dunes | 3 | 1 | 17.29 | 1 | 0 | 6.31 | 0 | 0 | 1.24 |
| La Garita | 0 | 0 | 3.65 | 0 | 0 | 4.60 | 0 | 0 | 1.85 |
| Mesa Verde | 4 | 0 | **6.77** | 3 | 0 | **8.34** | 1 | 0 | **5.70** |
| Pecos | 2 | 0 | 6.59 | 0 | 0 | 3.65 | 0 | 0 | 2.04 |
| Petrified Forest | 6 | 1 | **11.40** | 0 | 0 | **1.68** | 0 | 0 | 1.28 |
| San Pedro Parks | 0 | 0 | **4.73** | 0 | 0 | **2.62** | 4 | 0 | **9.06** |
| Weminuche | 3 | 1 | **10.50** | 0 | 0 | **4.95** | 0 | 0 | **2.85** |
| Wheeler Peak | 2 | 0 | 6.90 | 0 | 0 | 3.28 | 0 | 0 | 1.63 |

***Method 7+, Monthly f(RH), FLAG Background***

| Class I Area | 1992 Days > than 5% $\Delta B_{ext}$ | 1992 Days > than 10% $\Delta B_{ext}$ | 1992 MAX % Change in $B_{ext}$ | 1996 Days > than 5% $\Delta B_{ext}$ | 1996 Days > than 10% $\Delta B_{ext}$ | 1996 MAX % Change in $B_{ext}$ | 2003 Days > than 5% $\Delta B_{ext}$ | 2003 Days > than 10% $\Delta B_{ext}$ | 2003 MAX % Change in $B_{ext}$ |
|---|---|---|---|---|---|---|---|---|---|
| Bandelier | - | - | - | - | - | - | - | - | - |
| Black Cany. Gun. | - | - | - | 0 | 0 | 1.10 | - | - | - |
| Canyonlands | 2 | 0 | **6.08** | - | - | - | - | - | - |
| Capitol Reef | - | - | - | - | - | - | - | - | - |
| Great Sand Dunes | 2 | 0 | 5.51 | * | * | * | - | - | - |
| La Garita | - | - | - | - | - | - | - | - | - |
| Mesa Verde | 2 | 0 | **5.13** | 0 | 0 | **4.68** | * | * | * |
| Pecos | * | * | * | - | - | - | - | - | - |
| Petrified Forest | 2 | 0 | **5.52** | - | - | - | - | - | - |
| San Pedro Parks | - | - | - | - | - | - | 1 | 0 | **6.99** |
| Weminuche | 0 | 0 | **4.85** | - | - | - | - | - | - |
| Wheeler Peak | 1 | 0 | 5.31 | - | - | - | - | - | - |

SOURCE: ENSR Corporation 2006 – *Desert Rock Energy Facility Application for Prevention of Significant Deterioration Permit – Class I Area Modeling Update,* January 2006

The following text is excerpted from Section 6.7 of *Assessment of Air Quality Impacts from the Proposed Cottonwood Energy Center, San Juan County, New Mexico*. (*RTP 2004)* and addresses the affects on visibility:

> The Project has the potential to affect visibility near the site primarily as a result of condensed water vapor from the wet mechanical draft cooling tower plume. The pulverized coal (PC) boiler stack plume may also occasionally contain condensed water vapor.
>
> Due to the very low facility emissions of particulates and other pollutants that may impact local visibility, no visible plume is expected as a resulting of pollutant emissions from the PC

boiler stack under normal operating conditions, as a result of the use of high efficiency emission control systems.

The cooling tower will dissipate heat by evaporating water and discharging the water vapor into the atmosphere. If the ambient air is cold and/or moist, a portion of the emitted water vapor will condense to form water droplets. This condition results in a visible, white plume emanating from the cooling system. The plume evaporates downwind because of mixing with unsaturated air. Similarly, moisture emitted from the project's stack may also condense at times, resulting in a visible plume. The frequency, persistence, and size of a visible plume depends on the type of cooling system or stack conditions, local climate, and season. Visible plume formation occurs more frequently during the cooler seasons or during periods with high relative humidity when ambient conditions are less conducive to evaporation of the condensed water droplets.

A visible plume of condensed water vapor exhausted from the cooling tower during winter months, or during other cool weather periods with high humidity, may extend hundreds of meters or more from the tower. During warmer and dryer periods, a very short plume is typically observed.

Stack plumes have significantly less water vapor than cooling tower plumes, and as such are typically observed to extend less than several hundred meters from the stack, even under colder or more humid conditions.

#### 4.5.1.4 Sulfate/Nitrate Deposition

Based on the CALPUFF model output files, RTP prepared a table of predicted deposition rates for sulfates and nitrates (in Class I areas only), resulting from $SO_2$ and NOx emitted by Alternative C. Table K-49 summarizes the maximum predicted deposition rates for these chemical species. There were a few instances when comparing the total annual nitrogen and sulfur deposition (i.e. wet plus dry deposition) was higher than the corresponding NPS Deposition Analysis Threshold (DAT) of 0.005 kg/ha/year, triggering additional analysis requirements. Note that the table of results only shows the highest values for each year. Nitrate deposition is higher than the DAT at Mesa Verde in 1992 and 1996. The sulfate deposition exceeds the SIL at a number of parks for all three years. All nitrate depositions are below 0.01 kg /ha/yr. All sulfate deposition values are below 0.02 kg /ha/yr.

#### Carbon Dioxide Emissions

$CO_2$ emissions that would occur under Alternative C were calculated in the same manner described above for Alternative B. Based on a average annual coal consumption rate of 2,317,143 tons (assuming a 90% capacity factor) annual $CO_2$ emissions would be 4.74 million tons.

**Table K-49**
**Alternative C - Summary of maximum annual Sulfate and Nitrate deposition at Class I areas for 1992, 1996 and 2003.**

| Class I Area | Averaging Period | 1992 | | 1996 | | 2003 | |
|---|---|---|---|---|---|---|---|
| | | Maximum Sulfate Deposition (kg S/ha/yr) | Maximum Nitrate Deposition (kg N/ha/yr) | Maximum Sulfate Deposition (kg S/ha/yr) | Maximum Nitrate Deposition (kg N/ha/yr) | Maximum Sulfate Deposition (kg S/ha/yr) | Maximum Nitrate Deposition (kg N/ha/yr) |
| Bandelier NP | Annual | **0.0094** | 0.0030 | **0.0070** | 0.0023 | **0.0080** | 0.0024 |
| Black Canyon NP | Annual | 0.0023 | 0.0009 | 0.0032 | 0.0015 | 0.0023 | 0.0008 |
| Canyonlands NP | Annual | 0.0048 | 0.0021 | 0.0044 | 0.0014 | 0.0036 | 0.0013 |
| Capital Reef NP | Annual | 0.0021 | 0.0010 | 0.0016 | 0.0007 | 0.0013 | 0.0004 |
| Great Sands Dunes NP | Annual | 0.0043 | 0.0018 | 0.0040 | 0.0017 | 0.0024 | 0.0011 |
| La Garita WA | Annual | **0.0051** | 0.0021 | 0.0041 | 0.0015 | 0.0027 | 0.0011 |
| Mesa Verde NP | Annual | **0.0180** | **0.0062** | **0.0170** | 0.0050 | **0.0123** | 0.0038 |
| Pecos WA | Annual | **0.0067** | 0.0023 | 0.0049 | 0.0018 | **0.0052** | 0.0015 |
| Petrified Forest NP | Annual | 0.0011 | 0.0004 | 0.0007 | 0.0003 | 0.0016 | 0.0006 |
| San Pedro WA | Annual | **0.0120** | 0.0037 | **0.0083** | 0.0028 | **0.0108** | 0.0033 |
| Weminuche WA | Annual | **0.0110** | 0.0040 | **0.0099** | 0.0032 | **0.0060** | 0.0021 |
| Wheeler Peak WA | Annual | **0.0062** | 0.0023 | **0.0055** | 0.0020 | 0.0044 | 0.0014 |

SOURCE: PSD Permit Application (RTP, 2004)
Note: **Bold** values exceed DAT of 0.005 kg/ha/yr

### 4.5.2 Hazardous Air Pollutants

For the DREP EIS hazardous air pollutant (HAP) emissions were calculated primarily for purposes of preparing ecological and human health risk assessments, and to assess the potential for surface water contamination, due to deposition of selected air toxics. HAP emission factors (in pounds emitted per ton of coal burned) for bituminous and sub-bituminous coal combustion were obtained from Tables 1.1-12 and 1.1-18 in AP-42 (USEPA 1998). These factors were multiplied against the maximum total annual coal combustion quantities for Alternative B (see Table K-50) to derive maximum annual HAP emission rates, in pound per year. For purposes of the ecological and human health risk assessments, six metals, methyl hydrazine and two dioxins were selected from the complete list of HAPs for evaluation, based on the factors described below:

- Most of the HAPs are volatile organic compounds (VOC), which do not persist in soils and vegetation, due to their tendency to evaporate, and thus were eliminated from consideration.
- Specific HAPs were selected on the basis of relatively higher emissions rates from coal combustion (compared to other coal combustion HAPs), relatively higher toxicity in biotic individuals and communities, relatively higher bioaccumulative and/or heightened public concern and regulatory scrutiny.

Arsenic, cadmium, chromium, lead, mercury, selenium, 2,3,7,8 tetracholodibenzo-P-dioxin and total polychlorinated dibenzo-P-dioxins were not selected for further analysis as modeling was only completed for Alternative B. Due to the varying stack heights the ambient concentrations and deposition rates were not estimated. Further more the Alternative B analysis shows the results of a much larger plant burning almost three times as much coal.

*Ammonia Emissions from SCR System*. Ammonia slip emissions from the power plant under Alternative C were estimated in the same manner as described above for Alternative B. Annual ammonia emissions would be 92.7 tpy (2.7 g/s). The maximum 24-hour ambient concentration of ammonia would be 0.24 µg/s, and the maximum annual ambient concentration of ammonia would be 0.01 µg/s. These values are proportionally lower than the corresponding ambient concentrations estimated for Alternative C, which are less than 1 percent of state guidelines.

## 4.6 Cumulative Impacts

The following text is excerpted from §6 of the RTP Report *Assessment of Air Quality Impacts from the Proposed Cottonwood Energy Center, San Juan County, New Mexico*, June 2004, in the Administrative Record for the DREP EIS).:

> A cumulative Prevention of Significant Deterioration (PSD) increment impact analysis for $SO_2$ was performed using appropriate background source emissions inventory data near those Class I areas, which exceeded the $SO_2$ short term averaging SILs in the Class I modeling analysis. The results of the PSD increment modeling are described below.
>
> In the Class I modeling analysis, the predicted $SO_2$ concentrations for both the 3-hour and 24-hour averages were above the SILs (Table 6-1) for Mesa Verde NP (all 3 years), Weminuche WA (1992, 1996), San Pedro WA (1992, 2003), Canyonlands NP (1992, 1996), Great Sand Dunes NP (1996) and Capitol Reef NP (1996). Therefore, a cumulative PSD increment impact analysis for $SO_2$ was performed at these Class I areas using all background source emissions within a 50 km radius and background source emissions larger than 1 lb/hr within a 300 km radius of the affected Class I areas. The results presented here are the total net increment consumption for $SO_2$ from all these background sources plus those emissions from the Cottonwood Energy Center.
>
> The background sources were split according to their location to the facility and their emission rate. First background sources with emissions greater than 1 lb/hr and occurring within a 300 km radius of the affected Class I areas were modeled. Secondly, background sources with emissions smaller than 1 lb/hr (0.126 g/s), but which occurred within a 50 km radius of each of the affected Class I areas were also modeled and then added together along with the Cottonwood Energy Center $SO_2$ concentrations. The $SO_2$ PSD increment for Class I areas are 25 $\mu g/m^3$ for 3-hour averages, 5 $\mu g/m^3$ for 24-hour averages, and 2 $\mu g/m^3$ for annual averages. Table 6-9 provides a PSD increment compliance summary for highest prediction and second highest prediction. If at least, the second highest prediction is smaller than the $SO_2$ class I PSD increment, results are in compliance. If not, the $SO_2$ contribution of the Cottonwood Energy Center needs to be below the $SO_2$ SIL (1.0 $\mu g/m^3$ for 3-hour average, 0.2 $\mu g/m^3$ for 24-hour average and 0.1$\mu g/m^3$ for the annual average) for the same day and at the same receptor.

The highest predicted cumulative $SO_2$ is below the $SO_2$ PSD increment for [3-hour average, 24-hour average] and annual for 1992 and 2003 at Mesa Verde, for the years 1992 and 1996 at Weminuche WA, for the years 1992 and 2003, at San Pedro WA and for the year 1996 at Great Sand Dunes NP. Thus, the cumulative $SO_2$ PSD increment is in compliance at these four Class I areas for these specific years: Mesa Verde NP (1992, 2003), Weminuche WA (1992, 1996), San Pedro WA (1992, 2003) and Great Sand dunes NP (1996).

For the [3-hour average] at Canyonland NP for 1992 and 1996, the highest predicted cumulative $SO_2$ is below the $SO_2$ PSD increment. For the [24-hour average] at Canyonland NP in 1996 and the [3-hour average] at Capitol Reef NP in 1996, the second highest cumulative $SO_2$ is below the Class I PSD increment, so these two Class I areas; Canyonlands NP and Capit ol Reef NP are in compliance for these specific averages.

Only the [24-hour average] in 1992 at Canyonland NP and [24-hour average] in 1996 at Mesa Verde NP and Capitol reef NP do not show a second highest cumulative $SO_2$ PSD increment below the Class I PSD increment. Only the fourth highest is below the Class I PSD increment in 1992 at Canyonland NP, the third highest is below the Class I PSD increment in 1996 at Mesa Verde NP and the fifth highest is below the Class I PSD increment in 1996 at Capitol Reef NP. But in none of these days Cottonwood Energy center contributes to the $SO_2$ cumulative impact (see explanation in Appendix H, Table H-1 for 1992 at Canyonland NP, Table H-3 for 1996 at Mesa Verde NP and Table H-5a and Table H-5b for 1996 at Capitol Reef NP). Thus, these three class I areas, Canyonland NP and Capitol Reef NP and Mesa Verde NP for the 24-hour average in 1992 and 1996, respectively, are also considered to be in compliance.

In conclusion, compliance has been met for all three years, 1992, 1996 and 2003 at all Class I areas for the $SO_2$ PSD cumulative analyses. For information purposes only, Table 6-10 shows the cumulative PSD increment impact analyses when the Desert Rock Energy Center is added to the background sources inventory. Information on stack parameters and emission rates of Desert Rock Energy Center can be found in Appendix I. In Appendix H, Table H-2 and Table H-4 shows that Cottonwood Energy Center doesn't contributes to the impact or is below the 0.2 $\mu g/m^3$ SILs when PSD $SO_2$ increment is violated. All three years, 1992, 1996 and 2003 at all Class I areas for the $SO_2$ PSD cumulative analyses are still in compliance when Desert Rock Energy Center is added to the background sources inventory.

## 4.7 Mitigation

Mitigation measures for Alternative C would be the same as Alternative B and can be found in Section 3.7, above.

## 5.0 Summary Comparison of Alternatives B and C

Local and regional ambient air quality impacts associated with Alternative B and C projects will result from the combustion of sub-bituminous coal mined from the adjacent BNCC mine. Information pertaining to maximum annual coal combustion at the proposed plant was derived from the PSD permit applications (ENSR 2006 and RTP 2004). Table K-50 summarizes the maximum possible annual coal combustion for the proposed power plant under each alternative.

**Table K-50**

**Estimate of Total Coal Usage**

| **New Mexico Coal Specs** | **Alternative B** | **Alternative C** |
|---|---|---|
| LHV (Btu/lb) [1] | 8,479 | |
| HHV (Btu/lb) [1] | 8,910 | |
| AHV (Btu/lb) | 8,695 | |
| **Boiler Specs** | | |
| Combined Unit Gross Output (MW) | 1,500 | 550 |
| Plant Heat Rate, Design (Btu/kWh) | 8,792 | 9,618 |
| Combined Boiler Input Rating (MMBtu/hr) | 13,600 | 5,111 |
| Maximum Annual Coal Use at LHV, 100% CF | 7,025,615(2) | 2,732,605 (2) |
| Average Annual Coal Use at AHV, 90% CF | 6,165,750 (3) | 2,317,143 (3) |

AHV = Average Coal Heating Value
CF = Capacity Factor
HHV = Higher Coal Heating Value
LHV = Lower Coal Heating Value
[1] Coal Specs obtained from ENSR PSD Application dated April 15, 2004
[2] This is the theoretical maximum annual amount of coal that could be combusted, based on the LHV and using a 100% CF. While this value is required for the PSD application it is overly conservative.
[3] This is a realistic estimate of average annual coal combustion, based on the AHV and a 90% CF.

Table K-51 compares the maximum emissions due to construction operations from Alternative B and C. The emissions of VOC, CO, NOx, and $SO_2$ are equal as the roster of construction vehicles/equipment used for the alternatives remain the same on a tpy basis. Total emissions over the entire duration of the construction activities would be higher for the Alternative B as it is estimated to take 36 months to construct the larger 1,500 MW facility rather than 30 months for the 550 MW plant. However, $PM_{10}$ emissions from construction operations were estimated to be 14,495 tpy for Alternative B and 14,393 tpy for Alternative C, respectively. The difference in $PM_{10}$ emissions can be attributed to a slightly smaller plant footprint and only one transmission line for Alternative C. It is important to note that the majority of the $PM_{10}$ emissions (~99%) are due to earthmoving and fugitive dust raised by employee commuting vehicles. Since these emissions occur at ground level, it is unlikely that the emissions would be transported more than a few kilometers, except on unusually windy days (see Section 3.7 *Mitigation* for dust control measures during periods of high wind). In addition, all of these emissions will be temporary, spatially distributed over a large area and spread out over construction schedules ranging from 6 to 36 months.

Table K-52 compares the maximum emissions due to plant and mine operations from Alternative B and C. The maximum annual coal combustion under Alternative C would be approximately 39% of the maximum annual coal combustion under Alternative B. Consequently, the total annual emissions of VOC, CO, NOx, $SO_2$, and $PM_{10}$ for Alternative C are all less than estimated for Alternative B. However, Alternative C would have lower efficiency and higher emissions per unit of power produced but would have lower overall lower emissions because of the smaller size of the unit.

## Table K-51

## Comparison of Maximum Pollutant Emissions for the Duration of Construction Activities

| Criteria Pollutant | Alternative B (1,500 MW Plant) (tons) | Alternative C (550 MW Plant) (tons) |
|---|---|---|
| VOC | 199 | 158 |
| CO | 1,725 | 1,348 |
| NOx | 1,314 | 1,156 |
| $SO_2$ | 4.4 | 3.5 |
| $PM_{10}$ | 57,072 | 26,929 |

Note: Construction duration of project elements vary (see text)

## Table K-52

## Comparison of Maximum Pollutant Emissions From Plant and Mine Operations

| Criteria Pollutant | Alternative B (1,500 MW Plant) (tpy) | Alternative C (550 MW Plant) (tpy) |
|---|---|---|
| VOC | 390 | 179 |
| CO | 5,697 | 3,255 |
| NOx | 3,507 | 1,522 |
| $SO_2$ | 3,319 | 1,350 |
| $PM_{10}$ | 7,415 | 4,400 |
| $CO_2$ | 12,700,000 | 4,740,000 |
| $NH_3$ | 236 | 92.7 |
| HAPs | 7 | 3 |