APPENDIX B

Review of Mitigation Measures

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REVIEW OF MITIGATION MEASURES

Model results have indicated the potential for PM_{10} to exceed the 24-hour regulatory standard. In addition, both PM_{10} and NO_x have the potential to impact visibility within PSD Class I and Class II areas. The following mitigation measures for PM and NO_x are those that are commonly employed to control air emissions. Other mitigation measures could be employed to achieve a desired control, including in tribal designated Class I areas, such as the Northern Cheyenne Indian Reservation. Additionally, through the air permitting process regulatory agencies may require specific controls based on the volume and type of emissions or the location of the emission source.

Mitigation of PM: Emissions of $PM_{2.5}$ and PM_{10} from industrial operations can be subjected to a wide range of mitigation activities or controls. Emissions of these pollutants from industrial sources, including stacks or vents, are often controlled satisfactorily by employing bag filters or electrostatic precipitators. Emissions of $PM_{2.5}$ and PM_{10} from these sources is generally subjected to review by air permitting agencies, because the nature of the source would trigger the need to obtain an air permit to construct such a facility. Any modifications to those facilities would also trigger the need to obtain such a permit. As a part of the review of those permits, agencies ensure that emissions are controlled and that impacts are with acceptable concentrations.

The $PM_{2.5}$ and PM_{10} emissions from fugitive sources, such as material stockpiles, construction operations, and material handling operations are also subject to potential mitigating controls. As impacts are identified, any impacts of concern can be addressed by imposing the related mitigation measures.

In general the mitigation measures that can be employed for materials handling, construction, hauling operations, and storage activities can be summarized as in the list of activities below.

(1) Surface exposure. When vegetation is removed from the right-of-ways for hauling or construction activities, applicants shall clear the smallest possible amount of cover to minimize the impact of wind erosion and fugitive dust.

(2) Revegetation. Where vegetation has been removed, and soils exposed, begin revegetation as soon as possible, and enhance revegetation with mulching or matting to stabilize the surface and promote plant growth.

(3) Construction or soil excavation. For exposed active construction surfaces and related stockpiles, include dust suppression activities such as surface watering or stabilization with chemical surfactants.

(4) Construction and handling during windy periods. Restrict construction or material handling operations during periods with high winds, such as a threshold of 30 miles per hour. Enhance surface water sprays as an option.

(5) Hauling operations. Maintain all haul roads that are continually active by surface watering, chemical stabilization, restricted vehicle speeds, and removal of all spillage onto the roadway surface. Cover and maintain the roadways with dust-inhibiting material to include gravel or small rocks.

(6) Construction equipment operations. Require the use of high quality (low sulfur) diesel fuel in all diesel-fired construction or operational engines. Maintain all engines in satisfactory operating conditions.

Mitigation of NO_x: NO_x, which includes nitrogen oxide (NO) and nitrogen dioxide (NO_2), is produced as a byproduct of combustion. Efforts aimed at controlling NO_x emissions and ambient air impacts can be focused on either decreasing the emissions or increasing the dispersion.

The EPA has researched mechanisms that govern the formation of NO_x during combustion as a basis for reducing NO_x emissions from combustion sources. EPA's early efforts focused on the prevention of NO_x through modification of the combustion process, since this approach held the promise of higher emissions reductions and greater economic efficiency than the use of flue gas treatment for NO_x control. There have been significant advances in combustion technology which can reduce the primary production of NO_2 at the combustion source. Control of NO_x is a complex process affected by the nitrogen content of the fuel, the amount and distribution of air in the combustion process, temperature, unit load, and burner design, among other factors. Therefore, NO_x emissions can vary significantly with changes in temperature and air/fuel mixing, and are controlled primarily by modifying the basic combustion process, with the result that combustion modification NO_x controls directly affect not only emissions, but often the efficiency and operability of the unit as well.

Flue gas control of NO_x consists of adding secondary control systems to the exhaust gas from a combustion process. Types of secondary control systems include selective catalytic systems, non-selective catalytic systems, chemical scrubbers, and wet scrubbers. In most cases, these types of control systems require periodic replacement, regeneration, or disposal of wastes resulting from their actions, which leads to increased costs for operation.

Another alternative for NO_x emissions control is to eliminate the combustion source and replace it with an electric process. Electric motors can be used to replace combustion driven engines.

Increased dispersion of NO_x emissions does not reduce emissions at the source, but acts to reduce near field impacts by spreading the emissions over a larger area. Enhanced dispersion can be achieved by increasing the buoyancy of the emissions or increasing the height of the emissions release in relation to the topographic surroundings. Buoyancy can be increased by increasing the temperature of the exhaust or by increasing the exhaust flow velocity. Release height is governed by good engineering practices, which limits the actual stack height allowed in relation to existing surrounding features, or a maximum allowable height, whichever is less.

Another mitigation alternative includes the regulatory permitting process, which would act to protect ambient air quality by preventing the issuance of permits in areas that would experience significant impacts from additional permitted sources.

The following mitigation measure are commonly employed to prevent potential impacts from NO_x which could lead to exceedances of federal or state ambient air quality standards:

(1) Implement Best Available Control Technology (BACT) for the emissions unit. For compressor engines, this can result in NO_x emission rate of 1 g/bhp-hr, which is lower than the 1.5 g/bhp-hr rate used in the modeling.

(2) Utilize electric powered compressor engines in place of fuel combustion sources. Using electric-powered compressor motors in place of the typical natural gas-fired compressor engines could eliminate primary NO_x emissions from compressor stations.

(3) Use alternative fuels, which have lower fuel nitrogen content. Natural gas-fired compressor engines typically have lower NO_x emissions than diesel-fired engines.

(4) Increase dispersion of NOx emissions to reduce near field impacts by spreading emissions over a larger area.

(5) Use of regulatory permitting to prevent new or additional sources into areas where their emissions would cause significant impacts to ambient air quality identified through the permitting process.