Energy Impact Analysis in Support of Class I Redesignation Requests

Prepared for

Fond du Lac Band of Lake Superior Chippewa
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1.0 INTRODUCTION & BACKGROUND

1.1 OVERVIEW

The Fond du Lac Band of Lake Superior Chippewa (Band) Reservation is one of six reservations inhabited by the Minnesota Chippewa Tribe. The Reservation is located in portions of St. Louis and Carlton Counties in northeastern Minnesota near the town of Cloquet and about 20 miles west of Duluth. Figure 1-1 shows the general location of the Fond du Lac Reservation.

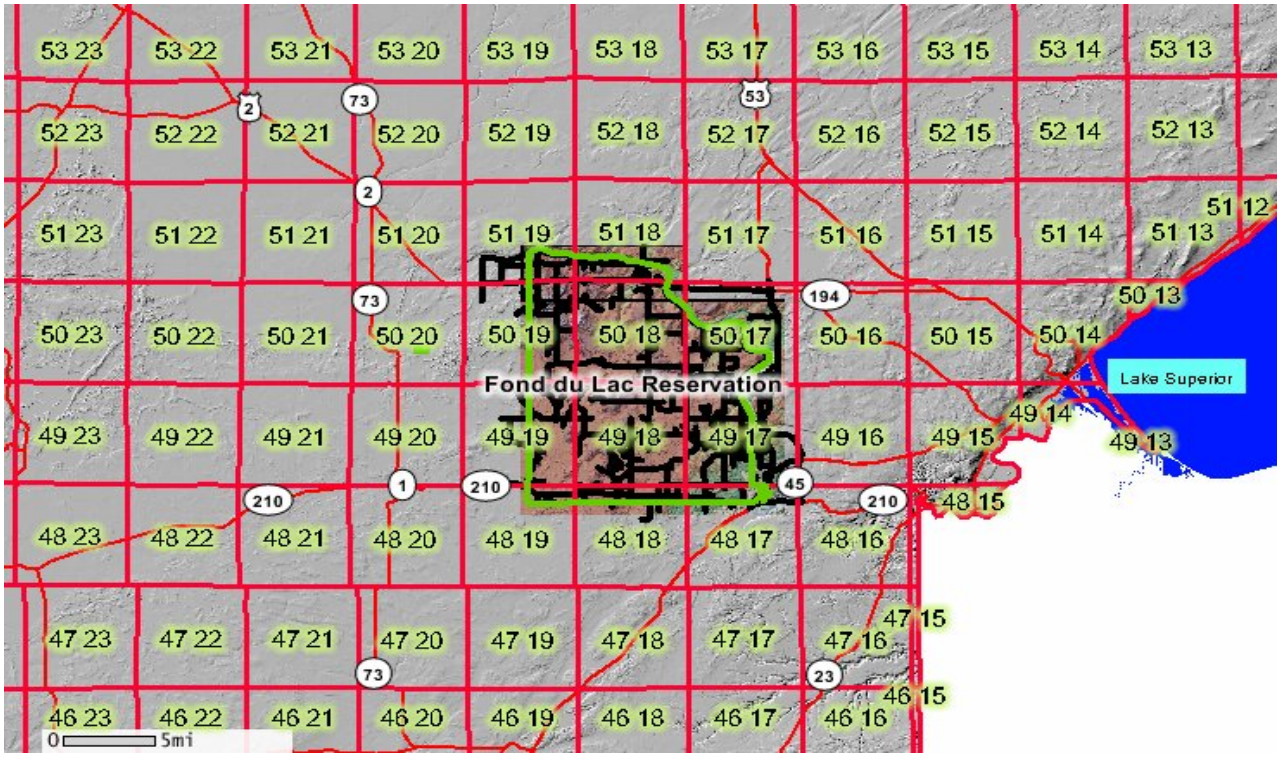

Figure 1-1. Location of Fond du Lac Reservation

The Band is considering requesting redesignation of tribal lands to "Class I" status under the Clean Air Act Prevention of Significant Deterioration (PSD) program. The requirements and procedures for redesignation are outlined in the US Environmental Protection Agency (USEPA) regulations at 40 CFR 51.166. Among the requirements of 40 CFR 51.166 is an "*analysis of the health, environmental, economic, social, and energy effects of the proposed redesignation*." The report here is designed to support the energy impacts analysis described in 40 CFR 51.166.

The Fond du Lac Reservation has been granted authority by USEPA to administer selected portions of the Clean Air Act on tribal lands. The Band performs air monitoring on the reservation, reviews air permits for new, modified, and existing facilities on and near tribal lands, and has an in-house technical program that studies air quality issues and climate change with respect to impacts on tribal members and property.

In performing the energy impact assessment for the planned Class I redesignation, air dispersion models have been applied to hypothetical energy development projects located outside the Reservation to ascertain whether or not such projects would meet the Class I PSD increments on the Reservation. The Class I PSD increments would become enforceable under the Clean Air Act assuming that the proposed redesignation to Class I status were approved. In this manner, the project assesses whether or not redesignation of the Fond du Lac Reservation lands to Class I under the PSD program would hinder potential future energy development in the region.

1.2 SUMMARY OF TECHNICAL APPROACH

The energy impact assessment required under 40 CFR 51.166 was conducted by evaluating potential energy development projects with respect to compliance with Class I PSD increments on the Fond du Lac Reservation lands. If the proposed redesignation becomes effective, the Class I PSD increments would become maximum allowable concentration increases enforceable under the Clean Air Act. As such, the energy impact analysis provided here attempts to discover to what extent, if any, the proposed redesignation to Class I would have on restricting future energy development in the region.

The energy projects evaluated for the Fond du Lac Reservation study include a hypothetical natural gas/oil-fired turbine electric generating plant located in close proximity to the Reservation (less than 50 km distant) and a hypothetical coal-fired electric generating plant located more distant to the Reservation (beyond 50 km). The hypothetical plants have been modeled after other similar projects proposed elsewhere in Minnesota. As such, although the projects analyzed for this report are hypothetical in nature, the information used for the hypothetical energy development projects are based on "real-world" examples of new energy development in terms of expected emissions and emission release characteristics. The specific projects analyzed for this report are described in Chapter 2.

For the hypothetical gas turbine project, the source location is within 50 kilometers (km) of the Fond du Lac Reservation. As such, the dispersion model of choice for the energy impacts evaluation was the AMS/EPA Regulatory Model or AERMOD [*Reference 1*]. AERMOD is the recommended regulatory air dispersion model by USEPA's "Guideline on Air Quality Models" [*Reference 2*] for the "near-field" or receptors within 50 km of the emission source.

For the hypothetical coal-fired project, the source location is more than 50 km from the Fond du Lac Reservation. Here, the model of choice was the USEPA CALPUFF dispersion modeling system [*Reference 3*]. CALPUFF is EPA's recommended regulatory air dispersion model for "far field" analyses, or where the receptors are more than 50 km from the emission source.

All modeling followed the technical procedures recommended in USEPA's Guideline on Air Quality Models. The modeling results were compared to the Class I PSD increments, which are shown in Table 1-1.

Table 1-1

Class I PSD Increments
(from 40 CFR 52.21(c))

Pollutant/Averaging Time	Maximum Allowable Increase (Micrograms Per Cubic Meter)
$PM_{2.5}$:	
Annual arithmetic mean	1
24-hr maximum	2
PM_{10}:	
Annual arithmetic mean	4
24-hr maximum	8
Sulfur dioxide:	
Annual arithmetic mean	2
24-hr maximum	5
3-hr maximum	25
Nitrogen dioxide:	
Annual arithmetic mean	2.5

Except for the annual average, the maximum allowable increase may be exceeded one time per year at any location.

1.3 SUMMARY OF RESULTS

Based on the hypothetical projects evaluated for this study, neither project would interfere with maintaining the Class I PSD increments on the Fond du Lac Reservation. The air dispersion modeling for both the hypothetical near-field gas/oil turbine project and the hypothetical far-field coal-fired IGCC project would comply with the Class I PSD increments at the Fond du Lac Reservation.

Although the hypothetical projects modeled for this report are representative of possible energy development project in the region, this study does not cover all possible future energy development projects. Projects with high air pollutant emissions and/or projects located very close to the Fond du Lac Reservation could be adversely impacted and face difficulty meeting the Class I PSD increments.

In addition, this modeling study has not looked at potential cumulative effects on PSD increment consumption. If the redesignation is approved, new/modified air pollution sources in the region will start to consume part of the available Class I PSD increment and future energy sources may have to compete with non-energy sources for the available increment. Any assessment of cumulative impacts at this time would be speculative and this requires knowledge about existing and future PSD increment consuming sources.

2.0 SELECTION OF HYPOTHETICAL ENERGY PROJECTS

The hypothetical energy projects evaluated include a natural gas/oil-fired turbine electric generating plant located in close proximity to the Reservation (less than 50 km distant) and a coal-fired electric generating plant located more distant to the Reservation (beyond 50 km distant). The hypothetical plants selected for this study have been modeled after other similar projects proposed elsewhere in Minnesota. As such, although the projects analyzed for this report are hypothetical in nature, the information used for the dispersion modeling are based on "real-world" examples of new energy development. The specific projects analyzed for this report are described later in this section.

Although the projects used in the Fond du Lac energy assessment are based on "real-world" projects, they are still only hypothetical projects developed specifically for the purpose of this study. There are no known plans to actually develop these projects and this report should not be interpreted as promoting any of the energy projects used for this assessment.

Also, other potential engineering or environmental constraints (water resources, transmission capacity, land use/zoning, etc.) have not been considered in the development and selection of the hypothetical energy development projects used for this analysis.

2.1 HYPOTHETICAL GAS/OIL-FIRED TURBINE PROJECT

The hypothetical gas/oil-fired turbine electric generating plant project is modeled after the Mankato Energy Center, operated by Calpine Corporation in Mankato, MN (Blue Earth County). Information on the plant was taken from the Minnesota Pollution Control Agency (MPCA) air emissions permit and associated MPCA Technical Support Document (Permit # 01300098-001) [*Reference 4*].

The Mankato Energy Center is a 630 megawatt (MW) electric generating plant consisting of twin Siemens-Westinghouse combined cycle combustion turbine generators (CTGs) fired primarily on natural gas. Fuel oil can be used as a back-up fuel when the natural gas supply is interrupted. Each CTG is equipped with a heat recovery steam generator (HRSG) and natural gas-fired duct burners to supply steam to a common steam turbine electric generator. Each CTG also has the capability of power augmentation through steam injection into the CTG just downstream of the combustor. This process increases the mass flow through the CTG, thereby increasing the power output.

The hypothetical gas/oil-fired turbine project was assumed to be located at the existing ML Hibbard Energy Station, operated by Minnesota Power and located at 4913 Main Street in Duluth, MN. This location was selected for the hypothetical project due to the proximity of the ML Hibbard plant to the Fond du Lac Reservation.

It should be noted that a hypothetical plant at this location probably far exceeds any real energy needs at this site going out through the foreseeable future. The Minnesota Power 2010 Resource Plan filed with the Minnesota Public Utilities Commission [*Reference 5*] states that the

utility expects to meet future generation capacity demands through acquisition and/or construction of renewable resources such as wind energy and/or hydroelectric power. Minnesota Power does not list any new fossil-fuel fired electric generation capacity in its Resource Plan through the planning period, which ends in 2024.

Table 2-1 summarizes the emissions and stack information for the hypothetical gas/oil electric turbine project as taken from the MPCA permit and supporting information for the Mankato Energy Center. Given the level of sulfur dioxide (SO_2) emissions from the MPCA permit, the listed emissions appear to be based on oil-firing. During most operating hours, with firing on natural gas, plant emissions would be lower, especially for SO_2.

Table 2-1

Emissions and Stack Data for Hypothetical Gas/Oil Turbine Project

Stack	Height (meters)	Diameter (meters)	Temperature (°K)	Exit Velocity (m/sec)	NO_x	SO_2	PM_{10}
					lb/hr	lb/hr	lb/hr
Turbine #1 (SV001)	60.96	5.79	344.26	12.27	63.12	96.77	72.80
Turbine #2 (SV002)	60.96	5.79	344.26	12.27	63.12	96.77	72.80

Ancillary facilities at the Mankato Energy Center such as an auxiliary boiler, emergency generator and fire pump engines, and cooling tower were not modeled as these emissions are minor compared to the combustion turbines.

2.2 HYPOTHETICAL COAL-FIRED ELECTRIC GENERATING PROJECT

The hypothetical coal-fired electric generating plant is modeled after the proposed Mesaba Energy Project, proposed by Excelsior Energy. Information on the plant was taken from the US Department of Energy Environmental Impact Statement (EIS) for the project [*Reference 6*]. The proposed location for this project is near Grand Rapids, MN.

This project is a nominal 1,200 MW electric generating station using integrated gasification combined cycle (IGCC) technology. In IGCC, the fuel (coal, petroleum coke, and/or a blend) is crushed, slurried with water, and pumped to a pressurized gasifier vessel along with oxygen. The gasifier converts the solid fuels (coal and/or petroleum coke) into a syngas. The syngas is cooled and cleaned of contaminants before being routed to a combustion turbine, which is directly connected to an electric generator. The expansion of the hot combustion gasses inside the combustion turbine creates rotational energy that spins the generator and produces electricity. Similar to the gas/oil turbine, the exhaust gasses pass through an HRSG to create steam that is routed to a steam turbine for producing additional electricity.

The IGCC technology is believed to offer several environmental advantages compared to more conventional coal-fired technologies where solid fuel is combusted directly in the boiler. At present, IGCC is believed to generate lower air emissions compared to conventional coal-fired technologies because the main pollutant contaminants are removed prior to combustion rather than downstream of the boiler. IGCC also provides improved opportunities for carbon capture and sequestration.

Based on the Mesaba Project EIS, the plant is to be constructed in two phases of 600 MW each. This report evaluates the project at maximum build-out (1,200 MW). Plant emissions during "normal operations" (as documented by the EIS) were considered for this modeling evaluation. Also, for the purposes of this study, the project was modeled at the "West Range Site", which is in Itasca County northeast of Grand Rapids, MN. The West Range Site was the preferred alternative listed in the Mesaba Project EIS.

The emissions and stack parameter information for the hypothetical coal-fired electric generating plant are shown in Table 2-2. These data were taken from the Mesaba Energy Project EIS. Similar to the gas/oil turbine project, auxiliary equipment such as the cooling tower, auxiliary boiler, flare, etc. were not modeled.

Table 2-2

Emissions and Stack Data for Hypothetical Coal-Fired Project

Stack	**Height (meters)**	**Diameter (meters)**	**Temperature (ºK)**	**Exit Velocity (m/sec)**	**NO_x**	**SO_2**	**PM_{10}**
					lb/hr	**lb/hr**	**lb/hr**
Turbine #1	45.72	6.1	394.3	20.1	158.0	74.0	25.0
Turbine #2	45.72	6.1	394.3	20.1	158.0	74.0	25.0
Turbine #3	45.72	6.1	394.3	20.1	158.0	74.0	25.0
Turbine #4	45.72	6.1	394.3	20.1	158.0	74.0	25.0

3.0 AIR MODELING STUDY – TECHNICAL APPROACH

This section provides an overview of the technical procedures used to conduct the Fond du Lac air quality modeling analysis.

3.1 HYPOTHETICAL GAS/OIL TURBINE PROJECT (AERMOD)

Dispersion modeling for near-field receptors (less than 50 km from the emission source) was conducted using the AMS/EPA Regulatory Model (AERMOD) Version 09292. The model inputs used five years of meteorological data collected for the years 1998, 1999, 2000, 2001, and 2002 from the Duluth International Airport located approximately 5 miles northwest of downtown Duluth, MN. These are the closest AERMOD-compatible data which are publicly available and were downloaded from the Wisconsin Department of Natural Resources website at http://dnr.wi.gov/air/permits/modeling/meteorological_data_duluth.htm.

Typically, meteorological data from a standard period of time are preferred to drive air dispersion model calculations rather than using the most recent five-year time period. Using a standard time period makes all dispersion modeling calculations repeatable. Finally, the five-year time period matches the recommendations from EPA's Guideline on Air Quality Models [*Reference 2*] and provides a reasonable robust data set that assures that the worst-case transport and dispersion conditions are identified.

The hypothetical gas/oil-fired turbine electric generating plant modeling sources are turbines SV001 and SV002, collocated for modeling purposes. In the model, the turbines were located approximately 25 miles (40 kilometers) directly east of the proposed Fond du Lac Reservation at the location of the ML Hibbard Energy Station in Duluth, MN.

Technical options for the AERMOD modeling followed standard regulatory guidance for use of AERMOD in regulatory applications, including EPA's Guideline on Air Quality Models [*Reference 2*] and EPA's AERMOD Implementation Guide [*Reference 7*].

Because modeled concentrations in the immediate vicinity of the emissions source were not of interest in this modeling study, the AERMOD modeling described here did not consider any downwash effects introduced by plant buildings or other structures.

Figure 3-1 provides the model layout, including the Fond du Lac receptor grid and the hypothetical source location. The receptor grid is a reasonable representation of the Fond du Lac Reservation, though not a direct translation of the actual Reservation boundaries. The receptor resolution across the Reservation was 1.0 kilometer (km). Also, the model inputs incorporated terrain information for the source and receptor locations as obtained from US Geological Survey (USGS) digital topographic files.

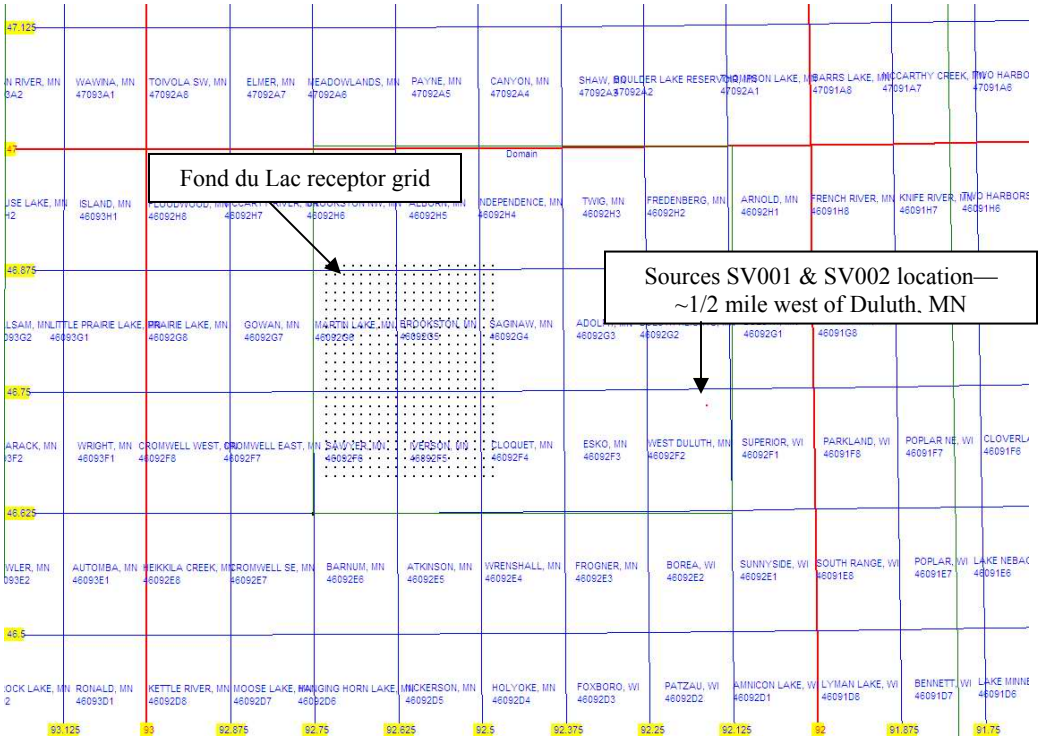

Figure 3-1. Fond du Lac AERMOD model layout and receptor grid

3.2 HYPOTHETICAL COAL-FIRED IGCC PROJECT (CALPUFF)

The air quality modeling for far-field receptors (more than 50 km downwind) used the EPA CALPUFF modeling system, applying gridded meteorological fields that varied both spatially and temporally. Current EPA-approved versions of the CALPUFF modeling system were used:

- CALMET Version 5.8 (level 070623)
- CALPUFF Version 5.8 (level 070623)
- CALPOST Version 5.6394 (level 070622)

CALMET generates the gridded meteorological data fields for later use by CALPUFF. CALPUFF performs the concentration calculations. CALPOST averages and ranks the concentration data. CALPOST can also perform calculations related to deposition and visibility impacts, but these features were not used for the Fond du Lac CALPUFF modeling.

3.2.1 Meteorological Data Processing (CALMET)

The meteorological data input to CALMET included three (3) years of mesoscale meteorological (MM5) data, consisting of 2002-2004 hourly meteorological data. These MM5 data files were also used for the Mesaba Energy Project Environmental Impact Statement (EIS) CALPUFF modeling and are the standard meteorological input data for CALPUFF analyses in

northern Minnesota. Thirty-six (36) separate CALMET runs were performed, one run per month for each of the three (3) years of meteorological data.

Similar to AERMOD, the common practice in CALPUFF dispersion modeling is to use a standard meteorological data set rather than data from the most recent time period in order to provide for repeatability in the model calculations. Also, due to the time and expense involved in developing gridded MM5 data, EPA's Guideline on Air Quality Models [*Reference 2*] requires only three years of data for modeling in long-range transport situations.

The modeling options selected in CALMET followed current EPA guidance [*Reference 8*]. Except as noted below, CALMET inputs were generally the same as those used for the Mesaba EIS. The EIS air quality modeling encompassed a large area covering eastern North and South Dakota, Minnesota, most of Wisconsin, and parts of Michigan. Because the only area of concern for this analysis is the Fond du Lac Reservation, CALMET was run using the same Lambert Conformal projection as used in the Mesaba EIS, but with a much smaller modeling domain, as shown below in Figure 3-2.

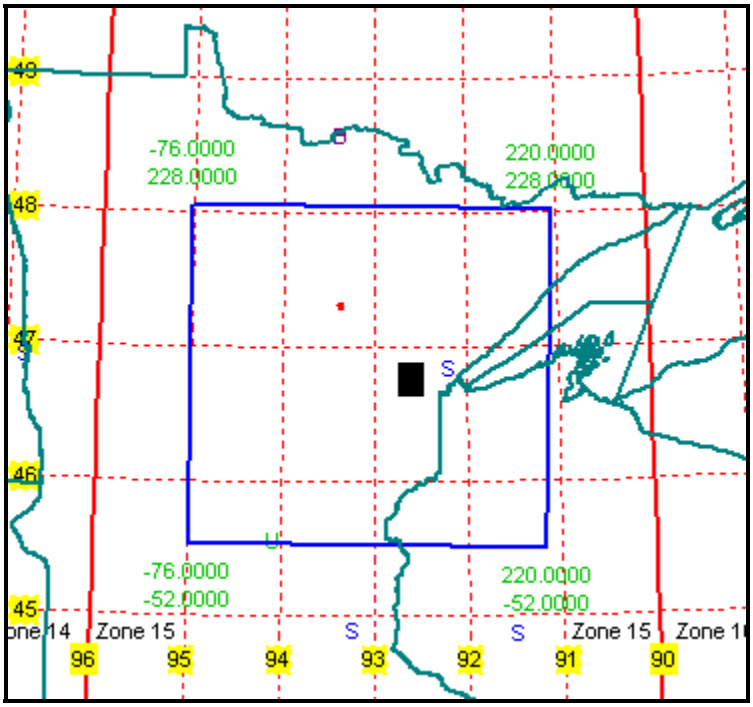

Figure 3-2. CALPUFF modeling domain for Fond du Lac (outlined in blue).

No upper air stations are located within the boundaries of the Fond du Lac modeling domain. However, in an effort to keep this modeling as similar as possible to the Mesaba EIS, all five (5) of the upper air stations used for the EIS – Gaylord, MI; Green Bay, WI; Minneapolis/St. Paul, MN; Aberdeen, SD; and International Falls, MI -- were input to CALMET. However, these stations are sufficiently distant from Fond du Lac that these data probably have only a minimal effect on the resultant meteorological fields derived by CALMET.

Surface, precipitation, and buoy data input to CALMET for 2002-2004 were also the same as those used for the Mesaba EIS. Surface wind observations are used by CALMET to adjust the "initial guess" windfields derived from the MM5 data. Precipitation observations were used by CALMET to generate gridded hourly precipitation fields.

3.2.2 Transport and Dispersion Calculations (CALPUFF)

CALPUFF performs calculations for pollutant transport and dispersion, including parameterization of secondary aerosol formation (sulfate and nitrate).

The CALPUFF modeling domain, shown above in Figure 3-1, included a generous "buffer zone" beyond the hypothetical coal-fired project site and the Fond du Lac receptors. The modeling domain covered a region of over 300 km (east-west) by 280 km (north-south) with a 4 km grid element size and ten (10) vertical levels extending up 4,000 meters. The vertical levels chosen for the CALMET modeling are based on current EPA guidance [*Reference 8*]. The southwest corner of the grid is located at approximately 45.5.0° N latitude and 95.0° W longitude.

CALPUFF model input files were set up for each year of CALMET meteorological data. Inputs to the CALPUFF modeling system included three years of gridded CALMET data, the source location, receptor locations, land elevation data, and land use data.

Technical options for CALPUFF generally followed EPA's Guidelines on Air Quality Models (40 CFR 51, Appendix W) [*Reference 2*] and the Interagency Workshop on Air Quality Modeling Phase 2 Report [*Reference 9*]. CALPUFF used approved "default" parameters where available, including EPA's recommended "regulatory default" switch (MREG = 1).

CALPUFF also requires background pollutant concentrations for ozone and ammonia, which are used in the parameterization of secondary aerosol formation. Ozone data were the same as those used for Mesaba's EIS modeling.

For background ammonia, the Interagency Workgroup on Air Quality Modeling [*Reference 9*] recommends three ammonia background values for CALPUFF modeling:

- 0.5 ppb for forested lands
- 1.0 ppb for arid lands
- 10 ppb for grasslands

A monthly background ammonia level of 1.0 ppb was used, consistent with the Mesaba EIS and other regulatory applications of CALPUFF in northern Minnesota. Land along the plume trajectory toward the Fond du Lac Reservation appears to be mostly forested lands with some open pasture or grasslands, so this selected background ammonia level is a reasonable value.

The receptors used in the CALPUFF analysis were the same as those used in the AERMOD example, and covered the Fond du Lac Reservation at a density of 1 km.

The CALPUFF modeling described above generated information on the expected air quality impacts for concentrations of NO_X, SO_2, and $PM_{10}/PM_{2.5}$ at Fond du Lac; these impacts were then compared to the Class I PSD increments.

3.2.3 Processing of Results

CALPOST was used to process ambient concentration files for the criteria pollutants of interest (NO_X, SO_2, PM_{10}, and $PM_{2.5}$) by performing the appropriate averaging for the air quality standard of interest (3-hour, 24-hour, or annual). CALPOST then ranks the calculated average concentrations to determine the peak concentration values. While 1-hour NAAQS for NO_2 and SO_2 have been recently established, there are presently no 1-hour PSD increment levels for these pollutants, so 1-hour impacts for NO_2 and SO_2 are not addressed in this analysis. Similarly, there are no PSD increments for CO, so CO impacts were not addressed in the modeling.

4.0 AIR MODELING STUDY RESULTS

This section summarizes the modeling results for each of the hypothetical energy projects evaluated in this study. Electronic copies of the modeling input/output files for AERMOD and CALPUFF are provided as an Appendix to the report.

4.1 HYPOTHETICAL GAS/OIL TURBINE PROJECT (AERMOD)

This section summarizes the results of the near-field AERMOD modeling analysis for the hypothetical gas-oil turbine project. Air quality concentrations of PM-10 (as compared to the $PM_{2.5}$ increment standard), NO_X, and SO_2 were addressed as these pollutants are the ones covered by the Class I PSD increments.

For the short-term average PSD increments (24-hours or less), the regulations allow one exceedance per year at any receptor. The modeling addresses this by calculating the "highest-second-highest" (H2H) concentration, which represents the highest concentration overall in the subset of second-highest concentrations at each receptor. For the annual mean, the highest predicted concentration at any receptor is used for comparison.

Table 4-1 shows the modeled AERMOD impacts for PM_{10} at the Fond du Lac Reservation from the hypothetical gas-oil turbine project. Predicted model impacts for each of the five years of meteorological data are shown for comparison purposes. For this study, it was conservatively assumed that all PM_{10} emissions were smaller than 2.5 microns. As such, the applicable $PM_{2.5}$ Class I PSD increment is used for comparison. Because the PSD increments for $PM_{2.5}$ are below those for $PM_{10,}$ compliance with the $PM_{2.5}$ increment also means compliance with the PM_{10} increment. The modeled impacts from the hypothetical gas-oil turbine project are less than the applicable $PM_{2.5}$ Class I PSD increment.

Table 4-1

Predicted PM-10 Concentrations at Fond du Lac using AERMOD
Hypothetical Gas-Oil Turbine Project

	Concentration ($\mu g/m^3$)					
Averaging Period	**Class I PSD Increment**	**1998**	**1999**	**2000**	**2001**	**2002**
24-Hour	2	0.977	0.904	0.762	1.004	0.583
Annual	1	0.055	0.035	0.044	0.039	0.036

Although the predicted $PM_{10}/PM_{2.5}$ impacts are about 50% of the allowable Class I increment, please understand that the predicted model impact for short-term averages (24-hour or less) is specific to the receptor location and worst-case meteorological time period. PSD increments from multiple sources are only additive to the extent that individual source impacts are paired in space and time. For an individual source that impacts Reservation lands at a different location or under different meteorological conditions, most or all of the Class I PSD increment would still be available.

Table 4-2 summarizes the dispersion modeling results with respect to the Class I PSD increment for nitrogen dioxide (NO_2). Again, model results for all five years of meteorological data are shown for comparison purposes. For this modeling, all NOx emissions from the project are conservatively assumed to be in the form of NO_2 (or convert to NO_2 during transport to the receptor). The AERMOD modeling predicts that the highest annual average NO_2 concentration will be substantially below the PSD Class I increment.

Table 4-2

Predicted NO_x (NO_2) Concentrations at Fond du Lac using AERMOD
Hypothetical Gas-Oil Turbine Project

	Concentration ($\mu g/m^3$)					
Averaging Period	**Class I PSD Increment**	**1998**	**1999**	**2000**	**2001**	**2002**
Annual	2.5	0.047	0.030	0.038	0.033	0.031

The 3-hour, 24-hour, and annual average SO_2 impacts using AERMOD for the hypothetical gas-oil turbine project are presented in Table 4-3 for each of the five years of meteorological data. All of the AERMOD concentration predictions for SO_2 were significantly below the Class I PSD increments. Again, for the short-term (3-hour and 24-hour) increments, the predicted impacts listed in the table are specific to the time and location of the modeled impact. Impacts from other emission sources may not be additive unless such impacts are paired in space and time.

Table 4-3

Predicted SO_2 Concentrations at Fond du Lac using AERMOD
Hypothetical Gas-Oil Turbine Project

	Concentration ($\mu g/m^3$)					
Averaging Period	**Class I PSD Increment**	**1998**	**1999**	**2000**	**2001**	**2002**
3-Hour	25	7.305	6.727	6.373	6.942	4.518
24-Hour	5	1.298	1.201	1.013	1.334	0.775
Annual	2	0.073	0.047	0.058	0.051	0.048

4.2 HYPOTHETICAL COAL-FIRED IGCC PROJECT (CALPUFF)

This section summarizes the results of the far-field modeling analysis using CALPUFF for the hypothetical coal-fired electric generating station project. Air quality impacts for concentrations of NO_X, SO_2, and $PM_{10}/PM_{2.5}$ have been estimated using CALPUFF and compared to the Class I PSD increments.

Like with the AERMOD modeling, the short-term average PSD increments allow one exceedance per year at any receptor. The modeling addresses this by calculating the "highest-second-highest" (H2H) concentration, which represents the highest concentration overall in the subset of second-highest concentrations at each receptor. For the annual mean, the highest predicted concentration at any receptor is used for comparison to the applicable increment.

The modeled $PM_{2.5}$ impacts from the hypothetical coal-fired project using CALPUFF are presented in Table 4-4. Particulate emissions are conservatively assumed to be below 2.5 microns in size and as such were modeled as $PM_{2.5}$. Because the PSD increments for $PM_{2.5}$ are below those for PM_{10}, compliance with the $PM_{2.5}$ increment also means compliance with the PM_{10} increment. The modeled CALPUFF concentrations are well below the applicable Class I increments for $PM_{2.5}$.

Table 4-4

Predicted $PM_{2.5}$ Concentrations at Fond du Lac using CALPUFF
Hypothetical Coal-Fired Project

	Concentration ($\mu g/m^3$)			
Averaging Period	**Class I PSD Increment**	**2002**	**2003**	**2004**
24-Hour	2.0	0.108	0.111	0.0794
Annual	1.0	0.00931	0.00984	0.00825

Table 4-5 summarizes the modeled NO_X impacts using CALPUFF from the hypothetical coal-fired project. In the NOx modeling, all of the emissions are conservatively assumed to be released as NO_2 (or convert to NO_2 during transport to the receptor). The maximum annual average NO_X impact is also well below the applicable Class I PSD increment.

Table 4-5

Predicted NO_X (NO_2) Concentrations at Fond du Lac using CALPUFF
Hypothetical Coal-Fired Project

	Concentration ($\mu g/m^3$)			
Averaging Period	**Class I PSD Increment**	**2002**	**2003**	**2004**
Annual	2.5	0.0429	0.0437	0.0387

Modeled 3-hour, 24-hour, and annual SO_2 impacts using CALPUFF for the hypothetical coal-fired project are presented in Table 4-6. SO_2 impacts are modeled to be well below their respective PSD Increments.

Table 4-6

Predicted SO_2 Concentrations at Fond du Lac using CALPUFF
Hypothetical Coal-Fired Project

	Concentration ($\mu g/m^3$)			
Averaging Period	**Class I PSD Increment**	**2002**	**2003**	**2004**
3-Hour	25	2.89	1.86	1.63
24-Hour	5	0.462	0.489	0.343
Annual	2	0.0253	0.0264	0.0225

5.0 SUMMARY & CONCLUSIONS

The Fond du Lac Band of Lake Superior Chippewa is considering requesting redesignation of tribal lands to "Class I" status under the Clean Air Act Prevention of Significant Deterioration (PSD) program. The report here is designed to support the energy impacts analysis required by 40 CFR 51.166 for any such redesignation request.

In performing the energy impact assessment, air dispersion models have been applied to hypothetical energy development projects located outside the Reservation to ascertain whether or not such projects would meet the Class I PSD increments on the Reservation. The Class I PSD increments would become enforceable under the Clean Air Act assuming that the proposed redesignation to Class I status were approved. In this manner, the project assesses whether or not redesignation of the Fond du Lac Reservation lands to Class I status under the PSD program would hinder potential future energy development in the region.

The energy projects evaluated for this study included a hypothetical natural gas/oil-fired turbine electric generating plant located in close proximity to the Reservation (less than 50 km distant) and a hypothetical coal-fired electric generating plant located more distant to the Reservation (beyond 50 km). The air quality impacts from both hypothetical projects were compared to the applicable Class I PSD increments for the pollutants of concern.

The hypothetical gas turbine project was a 630 MW electric generating combustion turbine, fired on natural gas with fuel oil as a backup. The project is modeled after the Mankato Energy Center in Mankato, MN. The hypothetical project location is at the HL Hibbard Energy Center in Duluth. As the source location is within 50 kilometers (km) of the Fond du Lac Reservation, the dispersion model of choice was the AMS/EPA Regulatory Model or AERMOD.

The hypothetical coal-fired project was a 1,200 MW Integrated Gasification Combined Cycle (IGCC) plant modeled after the proposed Mesaba Energy Project in northern Minnesota. The hypothetical site is at the Mesaba "West Range Site" near Grand Rapids, MN, as described in the Mesaba Environmental Impact Statement (EIS). As the source location is more than 50 km from the Fond du Lac Reservation, the model of choice was the USEPA CALPUFF dispersion modeling system.

Based on the hypothetical projects evaluated, the air dispersion modeling demonstrated that neither project would interfere with maintaining the Class I PSD increments on the Fond du Lac Reservation. Although the hypothetical projects modeled for this report are representative of possible energy development project in the region, this study does not cover all possible future energy development projects. Projects with high air pollutant emissions and/or projects located very close to the Fond du Lac Reservation could still be adversely impacted and face difficulty meeting the Class I PSD increments.

In addition, this modeling study has not looked at potential cumulative effects on PSD increment consumption. If the Class I redesignation is approved, new/modified air pollution sources in the region will start to consume part of the available Class I PSD increment and future energy sources may have to compete with non-energy sources for the available increment.

6.0 REFERENCES

1. USEPA, 2004. User's Guide for the AMS/EPA Regulatory Model – AERMOD. US Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC. EPA-454/B-03-001.

2. USEPA, 2005. Guideline of Air Quality Models. US Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC. Codified at 40 CFR 51, Appendix W.

3. USEPA, 2000. A User's Guide for the CALPUFF Dispersion Model (Version 5). Prepared on behalf of the US Environmental Protection Agency by Earth Tech, Inc., January 2000.

4. Minnesota Pollution Control Agency, 2004. Air Emissions Permit Number 01300098-001 issued to Mankato Energy Center LLC.

5. Minnesota Power, 2010. 2010 Resource Plan Summary.

6. US Department of Energy, 2009. Final Environmental Impact Statement – Mesaba Energy Project. Prepared by the US Department of Energy in association with the Minnesota Department of Commerce. DOE/EIS-0382 & Minnesota Public Utilities Commission Docket #E6472/GS-06-668.

7. USEPA, 2009a. AERMOD Implementation Guide. Prepared by AERMOD Implementation Workgroup, US Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC. Revised March 19, 2009.

8. USEPA 2009b. Clarification on EPA-FLM Recommended Setting for CALMET. Memorandum from Tyler Fox, Group Leader, Air Quality Modeling Group, US Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC.

9. USEPA, 1998. Interagency Workgroup on Air Quality Modeling – Phase 2 Summary Report and Recommendations for Modeling Long-Range Transport Impacts. US Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC. EPA-454/R-98-019.