APPENDIX D1
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Cumulative Air Quality Impact Analysis for Class I Areas

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November 10, 2006

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CUMULATIVE AIR QUALITY IMPACT ANALYSES FOR CLASS I AREAS

1. Introduction

Air quality modeling was carried out to assess the cumulative impacts of existing and reasonably foreseeable future sources at Class I areas. The analyses addressed the Boundary Waters Canoe Area, Voyageurs National Park, and The Rainbow Lakes Wilderness Area. For each Class I area, model results were obtained to evaluate PSD increment consumption (for SO2, NO2, and PM10), total air quality impact and compliance with ambient air quality standards (for the same pollutants), deposition of sulfur and nitrogen compounds, and visibility impacts. A visibility assessment was not conducted for Rainbow Lakes Wilderness Area, since visibility is not considered a critical value for Rainbow Lakes.

Mercury emissions from major existing and proposed sources were included in modeling. Results for mercury consisted of predicted average concentrations of mercury in air at receptors in each Class I area. The mercury concentration results were obtained to provide a basis for estimation of potential mercury deposition in water bodies and to the land surface.

2. Modeling Methodology

All modeling utilized the CALPUFF model system, the EPA Guideline methodology for simulation of long-range transport and dispersion. The CALPUFF system includes CALMET for preparation of meteorological data, CALPUFF for calculation of pollutant concentrations, and CALPOST for processing of results to generate average concentrations, deposition rates, and visibility impacts. Options and input variables in the models were generally selected per standard guidance from the US EPA and Federal Land Managers (FLMs).

Meteorological data for the modeling represented calendar years 2002, 2003, and 2004. The basic meteorological data consisted of MM5 meteorological fields obtained from the Minnesota Pollution Control Agency (MPCA). These fields have been used by MPCA for their current regional haze and Best Available Retrofit Technology (BART) analyses. For use in the present cumulative modeling analysis, the MM5 data were augmented by regional meteorological observations from surface, upper air, and precipitation monitoring stations. The MM5 and supplemental meteorological data were processed with CALMET to produce complete meteorological input to CALPUFF for each of the three model years.

Receptors for modeling consisted of the high resolution receptor grids provided by the National Park Service for each of the three Class I areas. Model-predicted concentrations for each receptor included all modeled pollutants on an hourly basis.

Post-processing of CALPUFF results provided for each receptor:

- average concentrations for applicable time periods
  - SO2 - 3-hour, 24-hour, annual
  - NO2 - annual
  - PM10 - 24-hour and annual
- annual deposition of sulfur and nitrogen
- annual concentration of mercury
- light extinction and deciview change relative to natural background visibility

The post-processing programs summarize outputs in terms of highest and second-highest concentrations at any receptor in each Class I area, highest annual concentration in each area, and highest visibility impact for each day in each Class I area.

For visibility calculations "Method 6" of CALPOST was applied. This methodology is recommended by EPA for BART analyses and is being used by the State of Minnesota for regional haze modeling. The Method 6 calculation is an alternative to the Method 2 calculation presented in the Federal Land Managers Air Quality Workgroup (FLAG) report, and has recently been accepted by FLMs for alternative analyses. For Method 6 application in the present analyses, monthly average relative humidity values and annual average natural background concentrations were taken from EPA BART guidance for the applicable Class I areas.

Mercury emissions were modeled only for sources for which emissions data were available; these sources were electric generating plants and proposed new sources. Since the speciation of mercury is not defined for most sources, it was not possible to calculate deposition directly with the CALPUFF model. Mercury was modeled as a non-reactive pollutant with no deposition. Model results for mercury therefore represent a conservative estimate of maximum mercury concentration in the ambient air for all mercury species combined.

3.0 Pollutant Sources Modeled

Emissions data and source parameters for significant sources of SO_2, NO_x, and PM10 in northern Minnesota were assembled for the cumulative Class I modeling analyses. Data were provided by the MPCA, and other information was acquired from permit applications and regulatory submittals. Data on increment consuming sources were obtained from MPCA in 2005 for Mesaba permit application modeling; data on other sources were provided by MPCA in October 2006 in response to a specific request for cumulative Class I source information.

The modeled sources can be classified into the following groups.

(1) Existing sources that have not experienced significant permit or emissions changes since the applicable PSD baseline dates. These sources do not affect PSD increment consumption, and were assumed to continue operation in the future at their current emission rates.

(2) Existing sources that have submitted applications or received permits or permit modifications after the applicable baseline dates. For these sources, emission changes (increases or decreases) since the baseline date were modeled for the cumulative PSD increment analyses. The sources were also included in the future cumulative modeling analyses at their most recent emitting conditions.

(3) Proposed sources not yet in operation. Proposed sources were modeled, at their proposed permit limits, for both PSD increment and future total impact analyses.

(4) Existing sources that are expected to reduce emissions in the future as a result of pollution control projects required for compliance with CAIR, BART, CAMR or other regulations. The sources in this category are the Minnesota Power Boswell, Laskin, and Taconite Harbor generating stations. The planned emission reductions were taken into account for both PSD increment and future total impact modeling analyses.

The emissions data for the sources provided by the MPCA for increment analysis were based on MPCA's records of pollutant-specific baseline dates for northern Minnesota. For visibility and deposition analysis, all existing and proposed sources for which data could be acquired were included. Minor sources and those mining or other sources that emit pollutants at or near the ground were not included in the modeling inventories. Such emissions (mostly PM10) are deposited near the source, and are not expected to have significant impacts at Class I areas. Where reasonable, emissions from multiple stacks or emission points at a single facility were combined for modeling. The total emissions were represented as occurring from one or several stacks with stack parameters typical of the majority of emissions.

For most regional sources, emissions data were available only for SO2, NOx, and PM10. These were therefore the only pollutants modeled for those sources. Where SO4 and/or speciated particulate matter data were available, as for Mesaba One and Mesaba Two, the additional pollutant forms were modeled. Generally only maximum short-term potential emission rates were available. Where rates were given for several averaging times for a given source, the maximum (potential) 24-hour emissions were modeled. For Mesaba One and Mesaba Two, maximum proposed (permit limit) emission rates were modeled for each averaging time.

Table 1 shows all sources and total facility emission rates that were included in the cumulative PSD increment and total impact modeling. Blank spaces in the table indicate that data were not available for the specific pollutant and facility. The "Inc" column in Table 1 shows PSD increment consuming (positive) or expanding (negative) emissions. The "Total" column represents total reasonably foreseeable future emissions. Different emissions inventories were used for the increment modeling and for visibility/deposition modeling. The increment inventories used MPCA data on permitted PSD emissions changes after the pollutant-specific baseline dates. The visibility and deposition analyses included all existing sources for which data were available, proposed new sources, and planned emission reductions at Minnesota Power facilities.

It should be noted that essentially all emission rates in Table 1 represent potential or maximum allowable emissions. For most facilities, actual emissions on any given day are substantially less than maximum emissions allowed by permit. Thus, despite the existence of some missing data, the total emissions included in the modeling are almost certainly a very conservative estimate of actual or typical pollutant contributions to the atmosphere.

Table 1 indicates that total increment emissions are negative for SO_2 and PM10. This result, primarily due to planned emission reductions at Minnesota Power generating stations, means that available PSD increment will expand in the future at the Class I areas of interest, and that air quality can be expected to improve compared to baseline conditions. The planned addition of new sources, including Mesaba One and Mesaba Two, will contribute only a small quantity of SO_2 relative to the projected reduction in future regional emissions.

Table 2 shows a comparison of present emissions from modeled sources to projected future emissions. The totals at the bottom of Table 2 indicate that future emissions of all pollutants will be less than at present. Thus, despite the proposed addition of Mesaba One and Mesaba Two and other new facilities, future regional emissions will be substantially reduced, especially in the case of SO_2. The data in Table 2 reflect only planned emission cuts by Minnesota Power. It is likely that other emission reductions will occur at regional sources as a result of Minnesota BART and other regulatory programs; such reductions could not be quantified for this cumulative analysis.

4.0 Results and Discussion

4.1 Pollutant Concentrations in Class I Areas

Table 3 presents CALPUFF model results for Mesaba One and Mesaba Two alone, at both West Range and East Range sites. Highest predicted concentrations for any year are shown for each Class I area, pollutant, and averaging time. Impacts in the Boundary Waters Canoe Area are higher for the East Range site; at the other Class I areas, impacts are generally similar regardless of the Mesaba site.

Mesaba Project concentrations are "significant" under the PSD regulations for short-term SO_2 emissions at all Class I areas. They are marginally significant for 24-hour PM10 impacts at the Boundary Waters and Voyageurs NP. All annual average impacts are insignificant. Even in the cases of short-term SO_2 and PM10, where Mesaba impacts are significant, they are far below the allowable PSD increment.

Cumulative PSD increment model results are shown in Table 4. Cumulative increment consumption is well below PSD Class I increment limits for all pollutants and Class I areas. The effect of overall regional SO_2 emission reductions is shown for the annual SO_2 increment; negative increment consumption is indicated throughout each Class I area. The cumulative increment results demonstrate that there is little or no overall difference between Class I increment consumption for the West and East Range Mesaba sites.

Table 5 gives the results of total air quality impact modeling for all future regional emissions. Predicted total SO_2, NO_2, and PM10 impacts are far below the applicable state and federal ambient air quality standards. Though background concentrations from natural, distant, and minor sources are not included in the Table 5 results, it is clear that there will be no threat to ambient standards in any Class I area. Again, the difference between West and East Range sites is negligible.

It can be concluded from the results in Tables 3, 4, and 5 that the projected future regional emission scenario, including Mesaba One and Mesaba Two, will not pose a threat to Class I PSD increments or ambient air quality standards. Mesaba Project contributions to total cumulative impacts are small relative to total expected concentrations.

Table 1. Modeled Sources and Emission Rates (lb/day)

Source	SO_2		NO_x		PM10		Hg
	Inc.	Total	Inc.	Total	Inc.	Total	Total
Mesaba Project							
Phases I and II	11,294	11,294	15,916	15,916	2,417	2,417	.148
Polymet	522	522	1,354	1,354	6,592	6,592	.004
Mesabi Nugget	2,286	2,286	5,714	5,714	2,619	2,619	.206
Minnesota Steel	3,442	3,442	9,962	9,962	18,035	18,035	.222
Laurentian Energy – Hibbing	137	25,992	825	8,985	160	1,697	.040
Laurentian Energy – Virginia	137	16,438	825	6,097	160	3,192	.040
MN Power – Clay Boswell							
#1,2,3	-349,567	116,520	-40,681	13,560	-49,309	2,596	.030
#4	40,458	40,458	49,046	49,056	12,261	12,261	.053
MN Power – Laskin	0	64,763	-9,505	6,335	0	19,010	.055
MN Power – Tac Harbor	-27,200	14,646			0	10,726	.021
Potlatch – Grand Rapids	0	19	2,286	2,286	720	1077	
Blandin Paper – Grand Rapids	10,008	14,295	19	2,876	1,288	1,291	
US Steel – MN Tac			56,477	56,477			
Hibbing Taconite	18,536	18,536			345	345	
MN Power – Hibbard	10,002	10,002					
Boise Cascade	3,398	8,635	0	8,895	0	1,615	
Potlatch – Cloquet	-815	21,193					
Northshore Mining	-499	49,881	0	38,921	0	3,988	
Potlatch – Cook			1,499	3,415	1,066	1,066	
Ispat Inland Mining			0	43,201	0	20,324	
United Taconite					0	19,734	
Keewatin Taconite					0	69,068	
Total	-277,861	418,922	93,737	273,050	-3,646	197,653	0.820

Table 2. Comparison of Present and Future Emissions (lb/day).

Source	SO_2		NO_x		PM10		Hg	
	Present	Future	Present	Future	Present	Future	Present	Future
Mesaba Project Phases I and II	0	11,294	0	15,916	0	2,417	0	.148
Polymet	0	522	0	1,354	0	6,592	0	.004
Mesabi Nugget	0	2,286	0	5,714	0	2,619	0	.206
Minnesota Steel	0	3,442	0	9,962	0	18,035	0	.222
Laurentian Energy – Hibbing	25,785	25,992	8,160	8,985	1,537	1,697	.040	.040
Laurentian Energy – Virginia	16,301	16,438	5,272	6,097	3,055	3,192	.040	.040
MN Power – Clay Boswell #1,2,3 #4	 466,087 40,458	 116,520 40,458	 54,241 49,056	 13,560 49,056	 51,906 12,261	 2,596 12,261	 .311 .534	 .030 .053
MN Power – Laskin	64,763	64,763	15,840	6,335	19,010	19,010	.055	.055
MN Power – Tac Harbor	41,846	14,646			10,726	10,726	.214	.021
Potlatch – Grand Rapids	19	19	2,286	2,286	1,077	1,077		
Blandin Paper – Grand Rapids	14,295	14,295	2,876	2,876	1,291	1,291		
US Steel – MN Tac			56,477	56,477				
Hibbing Taconite	18,536	18,536			345	345		
MN Power – Hibbard	10,002	10,002						
Boise Cascade	8,635	8,635	8,895	8,895	1,615	1,615		
Potlatch – Cloquet	21,193	21,193						
Northshore Mining	49,881	49,881	38,921	38,921	3,988	3,988		
Potlatch – Cook			3,415	3,415	1,066	1,066		
Ispat Inland Mining			43,201	43,201	20,324	20,324		
United Taconite					19,734	19,734		
Keewatin Taconite					69,068	69,068		
Total	777,801	418,922	288,640	273,050	216,913	197,563	1.194	0.820

Table 3. Maximum Predicted Impact of Mesaba Project Phase I and II; Concentrations in $\mu g/m^3$.

Class I Area	Pollutant	Averaging Time	Mesaba Max West Range	Mesaba Max East Range	Significance Level	Allowable Increment	Minn/NAAQS
Boundary Waters Canoe Area	SO_2	3-hour	2.16	4.70	1.0	25.0	915
		24-hour	0.42	1.57	0.2	5.0	365
		annual	0.017	0.072	0.1	2.0	60
	NO_2	annual	0.024	0.125	0.1	2.5	100
	PM10	24-hour	0.28	0.55	0.3	8.0	150
		annual	0.014	0.040	0.2	4.0	50
Voyageurs National Park	SO_2	3-hour	1.74	2.15	1.0	25.0	915
		24-hour	0.43	0.59	0.2	5.0	365
		annual	0.018	0.018	0.1	2.0	60
	NO_2	annual	0.028	0.029	0.1	2.5	100
	PM10	24-hour	0.33	0.31	0.3	8.0	150
		annual	0.014	0.013	0.2	4.0	50
Rainbow Lakes Wilderness Area	SO_2	3-hour	0.64	1.02	1.0	25.0	1300
		24-hour	0.17	0.39	0.2	5.0	365
		annual	0.010	0.013	0.1	2.0	80
	NO_2	annual	0.012	0.018	0.1	2.5	100
	PM10	24-hour	0.14	0.29	0.3	8.0	150
		annual	0.010	0.012	0.2	4.0	50

Note: 3-hour and 24-hour average concentrations are “highest second-high” values; annual concentrations are highest values

Table 4. Maximum Predicted PSD Increment Impact of Mesaba Project and all Existing and Foreseeable Future Sources; Concentrations in $\mu g/m^3$.

Class I Area	Pollutant	Averaging Time	Mesaba West Range	Mesaba East Range	Significance Level	Allowable Increment	Minn/NAAQS
Boundary Waters Canoe Area	SO_2	3-hour	8.31	6.83	1.0	25.0	915
		24-hour	1.48	1.80	0.2	5.0	365
		annual	-0.150	-0.124	0.1	2.0	60
	NO_2	annual	0.699	0.732	0.1	2.5	100
	PM10	24-hour	2.10	2.16	0.3	8.0	150
		annual	0.174	0.195	0.2	4.0	50
Voyageurs National Park	SO_2	3-hour	5.94	5.94	1.0	25.0	915
		24-hour	1.40	1.40	0.2	5.0	365
		annual	-0.123	-0.117	0.1	2.0	60
	NO_2	annual	0.341	0.347	0.1	2.5	100
	PM10	24-hour	1.13	1.09	0.3	8.0	150
		annual	0.060	0.062	0.2	4.0	50
Rainbow Lakes Wilderness Area	SO_2	3-hour	2.93	2.69	1.0	25.0	1300
		24-hour	0.79	0.71	0.2	5.0	365
		annual	-0.134	-0.131	0.1	2.0	80
	NO_2	annual	0.071	0.078	0.1	2.5	100
	PM10	24-hour	0.65	0.71	0.3	8.0	150
		annual	0.007	0.009	0.2	4.0	50
Note: 3-hour and 24-hour average concentrations are “highest second-high” values; annual concentrations are highest values							

Table 5. Maximum Predicted Total Impact of Mesaba Project and All Existing and Foreseeable Future Sources; Concentrations in μg/m^3

Class I Area	Pollutant	Averaging Time	Mesaba West Range	Mesaba East Range	Minn/NAAQS
Boundary Waters Canoe Area	SO_2	3-hour	35.97	37.87	915
		24-hour	11.89	12.95	365
		annual	1.646	1.704	60
	NO_2	annual	1.646	1.680	100
	PM10	24-hour	8.28	8.11	150
		annual	1.004	1.014	50
Voyageurs National Park	SO_2	3-hour	33.99	33.99	915
		24-hour	5.64	5.72	365
		annual	0.854	0.843	60
	NO_2	annual	0.753	0.758	100
	PM10	24-hour	5.62	5.46	150
		annual	0.493	0.494	50
Rainbow Lakes Wilderness Area	SO_2	3-hour	9.44	9.26	1300
		24-hour	4.72	4.60	365
		annual	0.732	0.733	80
	NO_2	annual	0.259	0.261	100
	PM10	24-hour	2.92	3.27	150
		annual	0.275	0.278	50

Note: 3-hour and 24-hour average concentrations are “highest second-high” values; annual concentrations are highest values

4.2 Deposition of Sulfur and Nitrogen

The CALPUFF/CALPOST programs generate calculations of total annual sulfur and nitrogen deposition to the ground surface by summing contributions from all sulfur and nitrogen species (gaseous and particulate) at each Class I receptor. Results presented here are the highest annual deposition value for any receptor and any of the three years modeled, for each Class I area.

Table 6 shows deposition predictions for Mesaba One and Mesaba Two alone, and Table 7 shows maximum total cumulative deposition from all sources. The highest Mesaba deposition relative to total cumulative deposition ranges from 1.2 percent for West Range sulfur impacts in the Boundary Waters, to 9.6% for East Range nitrogen impacts in the Boundary Waters.

For National Park Service Class I areas (Voyageurs NP) no acceptable deposition values for impacts on soils or waters have been established. A "deposition analysis threshold" of 0.01 kg/ha-yr is given as a level below which no adverse impacts are expected. Model results in Tables 6 and 7 show deposition rates exceeding this significance threshold.

The US Forest Service has defined screening criteria for terrestrial and aquatic impacts of deposition. The "Green Line" criteria define levels "at which it was reasonably certain that no significant change would be observed in ecosystems that contain large numbers of sensitive components". The USFS Green Line levels for the BWCA and Rainbow Lakes are shown in Table 8. Though no similar thresholds are available for Voyageurs NP, it is reasonable to assume that ranges of the same order as those for BWCA and RLWA are appropriate. Table 8 indicates that total sulfur and nitrogen deposition, including background, will be within the acceptable Green Line ranges. It should be noted that the background values shown probably include the current impacts of some of the modeled sources. Therefore the predicted future total deposition data in Table 8 are expected to be conservative.

4.3 Visibility Impacts

The CALPUFF model results for 24-hour average concentrations of particulate pollutants that affect light extinction and visibility were processed using CALPOST Method 6 to define maximum visibility impacts of Mesaba One and Mesaba Two and all regional sources. The results are presented as the number of days per year in each Class I area on which visibility impact (the change from natural or pristine background visibility) exceeds 0.5 deciview (dv), and the 98th percentile (8th highest per year) deciview change. A threshold of 0.5 dv is considered the level at which visibility change is potentially perceptible to a viewer, and is considered the lowest level at which a source is considered to contribute to visibility degradation.

Table 9 shows visibility modeling results for Mesaba One and Mesaba Two alone. For the West Range site, possible visibility impacts are indicated on 17 to 22 days per year in both BWCA and VNP. The 98th percentile (highest) impact is approximately 0.7 dv in both Class I areas. This deciview change corresponds to a potential visibility reduction from 187 km to 175 km in BWCA, and from 190 km to 176 km in VNP. For the East Range site, Mesaba impacts are higher at BWCA because of proximity to that Class I area, and lower at VNP. The 98th percentile visibility impacts represent a potential reduction in clear day visibility from 187 km to 157 km at BWCA, and from 190 km to 177 km at VNP.

The CALPUFF visibility calculations are quite conservative, and tend to indicate the greatest number and magnitude of potential impacts, rather than actual observable impacts. The calculations do not explicitly account for natural visibility degradation due to fog, clouds, or precipitation. Prior analyses have shown that a large fraction of the days on which visibility impacts are predicted for northern Minnesota are days of very low temperature, fog, and/or precipitation on which natural visibility is severely limited.

Results for the cumulative visibility modeling are presented in Table 10. It is clear that visibility issues are significant for the Boundary Waters and Voyageurs Class I areas. Table 9 suggests that possible impacts could occur on two-thirds of all days, and maximum impacts could potentially be as high as 8.7 dv in BWCA, and 8.6 dv in VNP. These correspond to potential visibility reductions from 190 km in pristine conditions to 80 km under worst-case conditions.

As noted above, the visibility calculations tend to overstate the potential for impairment. It should also be recognized that the cumulative modeling assumed maximum allowable pollutant emissions from all sources on every day of the year, a situation that is unrealistic. The visibility processing did not include use of the “ammonia limiting” calculation procedure due to time constraints. This calculation is appropriate where many sources contribute to visibility impacts, and available ammonia may limit the production of nitrate particles. Use of ammonia limiting was shown in a trial run to reduce predicted visibility impacts significantly. Thus, the results presented here should be considered as a worst-case scenario rather than an estimate of actual current or future visibility conditions.

The State of Minnesota is currently addressing visibility in BWCA and VNP under the Regional Haze Rule, and will require BART emission reductions from many sources in the state. Only potential actions at Minnesota Power facilities in northern Minnesota were considered in this analysis. It is expected that many other actions, both voluntary and in response to regulatory requirements, will be taken in the near future to reduce the potential for visibility degradation.

To assess the effectiveness of Minnesota Power’s planned emission controls at Boswell, Laskin, and Tac Harbor, an additional model run was conducted to define cumulative visibility impacts in the absence of those controls. Predicted 98th percentile impacts averaged 1.0 dv higher without the projected Minnesota power emission reductions. Thus, present emissions from those sources, which will be eliminated in the near future, account for approximately 10% of current visibility impacts in BWCA and VNP. The reduced visibility

impacts resulting from Minnesota Power controls exceed projected impacts of Mesaba One and Mesaba Two by a significant amount (20 to 80%) for all cases except for East Range Mesaba impacts in BWCA. For that case, Minnesota Power reductions will offset approximately 50% of projected maximum Mesaba impacts.

4.4 Mercury Concentrations

Table 11 gives results of mercury concentration modeling. The concentrations shown, in $\mu g/m^3$, represent the 3-year average highest ambient mercury concentration at any point in each Class I area. There are no accepted standards for ambient mercury levels in air. The predicted values, which estimate maximum levels of combined mercury forms, may be used with assumptions on speciation and deposition velocity to derive conservative estimates of mercury deposition.

Table 6. Deposition Modeling Results (Maximum Annual Deposition) – Mesaba Alone

Class I Area	West Range Site		East Range Site	
	S (kg/ha-yr)	N (kg/ha-yr)	S (kg/ha-yr)	N (kg/ha-yr)
Boundary Waters Canoe Area	1.379 E-2	1.120 E-2	5.618 E-2	4.873 E-2
Voyageurs National Park	1.540 E-2	1.187 E-2	1.988 E-2	1.394 E-2
Rainbow Lakes Wilderness Area	6.826 E-3	5.687 E-3	9.204 E-3	8.176 E-3

Table 7. Deposition Modeling Results (Maximum Annual Deposition) – All Future Sources

Class I Area	West Range Site		East Range Site	
	S (kg/ha-yr)	N (kg/ha-yr)	S (kg/ha-yr)	N (kg/ha-yr)
Boundary Waters Canoe Area	1.146	0.501	1.194	0.508
Voyageurs National Park	0.628	0.267	0.622	0.267
Rainbow Lakes Wilderness Area	0.453	0.124	0.453	0.128

Table 8. Comparison of Projected S and N Deposition Rates to Green Line Criteria for Impacts to Terrestrial and Aquatic Ecosystems.

Class I Area	Parameter	Background [1] (kg/ha-yr)	Maximum Cumulative Impact (kg/ha-yr)	Total (kg/ha-yr)	Green Line [2] Value (kg/ha-yr)
BWC	Terrestrial				
	Total S Depo	2.85	1.194	4.04	5-7
	Total N Depo	4.75	.508	5.26	5-8
	Aquatic				
	Total S Depo	2.85	1.194	4.04	7.5-8
	S + 20% N	3.80	1.296	5.10	9-10
RLWA	Terrestrial				
	Total S Depo	2.98	.453	3.43	5-7
	Total N Depo	5.88	.128	6.01	5-8
	Aquatic				
	Total S Depo	2.98	.453	3.43	3.5-4.5
	S + 20% N	4.16	.479	4.64	4.5-5.5

[1] Background values from Mesabi Nugget Class I Air Modeling Report. Barr Engineering Company, May 2005.

(2) Green Line Values from Screening Procedure to Evaluate Effects of Air Pollution on Eastern Region Wilderness Cited as Class I Air Quality Areas. USFS. 1991.

Table 9. Results of CALPUFF Visibility Modeling for the Mesaba Plant Alone

	2002 (Num Values >.5 DV)	2003 (Num Values >.5 DV)	2004 (Num Values >.5 DV)	2002 8th Highest DV	2003 8th Highest DV	2004 8th Highest DV
East Range Site						
Boundary Waters	129	124	115	1.989	1.655	1.578
Voyageurs	14	13	14	0.699	0.652	0.633
West Range Site						
Boundary Waters	22	22	17	0.647	0.712	0.732
Voyageurs	18	19	20	0.729	0.694	0.708

Table 10. CALPUFF Cumulative Visibility Modeling

	2002 (Num Values >.5 DV)	2003 (Num Values >.5 DV)	2004 (Num Values >.5 DV)	2002 8th Highest DV	2003 8th Highest DV	2004 8th Highest DV
East Range Site						
Boundary Waters	238	244	245	8.734	8.407	7.481
Voyageurs	190	205	189	7.156	6.354	5.713
West Range Site						
Boundary Waters	231	242	244	8.600	8.420	7.635
Voyageurs	189	206	191	6.959	6.340	5.740

Table 11. Results of Mercury Modeling; Average Concentration (μg/m^3)

Class I Area	Mesaba Project Alone		Cumulative – All Sources	
	West Range	East Range	West Range	East Range
Boundary Waters Canoe Area	4.438 E-7	14.960 E-7	6.118 E-6	7.042 E-6
Voyageurs National Park	4.580 E-7	4.489 E-7	2.825 E-6	2.919 E-6
Rainbow Lakes Wilderness Area	2.294 E-7	3.295 E-7	1.492 E-6	1.595 E-6

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