Minnesota Pollution Control Agency
520 Lafayette Road North
St. Paul, MN 55155-4194

Mercury Reduction Plan Submittal (Ferrous Mining/Processing)

Air Quality Permit Program
Minn. R. 7007.0502, subp. 3

Doc Type: Regulated Party Response

Instructions:

- Complete this form to meet the Mercury Reduction Plan requirements for owners and operators of ferrous mining or processing facilities subject to Minn. R. 7007.0502, subp. 3.
- Attach any additional explanatory information, for example, editable spreadsheets with calculations, stack test reports, engineering or design reports, and any other information supporting your reduction plan. Data that is considered to be confidential information must follow the procedures described in item 9 of this form.
- This reduction plan must be approved by the Minnesota Pollution Control Agency (MPCA) prior to submittal of a permit amendment application or development of an enforceable document. It is not a substitution for a permit amendment application.
- **Please submit form to:** Statewide Mercury TMDL Coordinator, Rebecca Place, Minnesota Pollution Control Agency, 520 Lafayette Road North, St. Paul, MN 55155.

Mercury Reduction Plan Submittal and Compliance Deadlines

Type of Source	Mercury Reduction Plan Submittal Deadline	Compliance Deadline
Ferrous mining/processing	December 30, 2018	January 1, 2025

1. Facility Information

1.a. Facility name: Mesabi Metallics Company, LLC
1.b. AQ facility ID number: 06100067
1.c. Facility contact for this reduction plan: Ryan Heule
1.d. Agency Interest ID number: 2929
1.e. Facility contact email address: ryan.heule@mesabimetallics.com
1.f. Facility contact phone number: (218) 885-6148

Mercury Reduction Plan

The goal of the Mercury TMDL is to reduce statewide mercury air emissions to 789 pounds per year. To achieve this goal, the MPCA undertook rulemaking and adopted rules regarding mercury reduction plans in Minn. R. 7007.0502. These rules established a mercury emission reduction, for ferrous mining or processing, of 72% from the amount of mercury emitted in 2008 or 2010. As stated in the Mercury TMDL Implementation Plan and reiterated in the MPCA's Response to Comments for the rulemaking, "*The technology developed to achieve the target must be technically and economically feasible, it must not impair pellet quality, and it must not cause excessive corrosion to pellet furnaces and associated ducting and emission-control equipment. Criteria for determining economic feasibility will be developed through a collaborative effort by the taconite industry and the MPCA.*"

Minn. R. 7007.0502 requires the owners or operators of a ferrous mining or processing facility to prepare a mercury reduction plan that addresses reductions for each indurating furnace or kiln of a taconite processing facility or the rotary hearth furnace of a direct-reduced iron facility. The reduction plan may accomplish reductions at each furnace, across all furnaces at a single stationary source, or across furnaces at multiple stationary sources.

2. Determination of technically achievable

Has the facility determined that the reductions listed in Minn. R. 7007.0502, subp. 6, are technically achievable by the January 1, 2025, compliance date?

☒ Yes. Skip item 3. Go to item 4.

☐ No. Proceed to item 3.

3. Proposal of alternative reduction

If the owner or operator determines that the mercury reductions listed in Minn. R. 7007.0502, subp. 6 are not technically achievable by the identified compliance date; an alternative plan may be submitted under Minn. R. 7007.0502, subp. 5(A)(2). If you are proposing an alternative plan to reduce mercury emissions, please complete the following:

a) Complete Steps 1 through 6 below:

Step 1. Identify all available technologies and rank in descending order of control effectiveness.

Step 2. Eliminate technically infeasible technologies.

Include references and citations supporting the basis for the determination that the reductions are not technically achievable by the compliance date. If the mercury reductions are not technically achievable based solely or partly on economic factors, include references and citations supporting the basis for the determination that the reductions are not economically feasible.

Step 3. Rank remaining technologies in descending order of control effectiveness.

Step 4. Complete an environmental impacts analysis.

Provide an analysis of environmental impacts. Focus on impacts other than direct impacts due to emissions of mercury, such as solid or hazardous waste generation, discharges of polluted water from a control device, demand on local water resources, and emissions of other regulated air pollutants.

Step 5. Complete a cost effectiveness evaluation.

Calculate the cost effectiveness of each control technology (in dollars per pound of mercury emissions reduced). This cost effectiveness must address both an average basis for each measure and combination of measures. If multi-pollutant control strategies were considered that have implications on cost, such as the control technology also reducing emissions of other regulated air pollutants, please provide that information as well. The costs associated with direct energy impacts should be calculated and included in the cost analysis. Direct energy consumption impacts include the consumption of fuel and the consumption of electrical or thermal energy. The emphasis of this analysis is on the cost of control relative to the amount of pollutant removed, rather than economic parameters that provide an indication of the general affordability of the control alternative relative to the source.

Step 6. Of the remaining technologies, propose the best-performing control strategy. Describe the selection of the control strategy.

b) Provide an estimate of the annual mass of mercury emitted under the requirements of Minn. R. 7007.0502, subp. 6.

c) Provide an estimate of the annual mass of mercury emitted and percent reduction achieved under the proposed alternative plan.

d) Complete the information in items 4 through 9 for your alternative proposal.

4. Description of mercury reduction action

Complete the following table for each emission unit that emits mercury. Use a separate row for each specific control, process, material or work practice that will be employed to achieve the applicable control efficiencies, reductions or allowable emissions. Provide a written summary below as needed for context or background. Minn. R. 7007.0502, subp. 5(A)(1)(a), 5(A)(1)(b), or 5(A)(2)(a).

Emission unit	**Element to Reduce Mercury** **(control device, work practice, etc.)**	**Reduction, Control Efficiency, Emission Limit, Operating Limit, or Work Practice*** **(indicate units, i.e., lb. hg/ton material, % control)**	**Describe Element in Detail** **(include manufacturer's data** as applicable)**
Indurating Furnace - Hood Exhaust (EU 038)	Activated Carbon injection, baghouses	1) 72% reduction by 2025 2) 78% reduction by 2025 and after start-up of DRI Facility whichever is later	FL Schmidt design
Indurating Furnace - Waste Gas (EU 039)	Activated Carbon Injection, multi-clones, baghouses, and Gas Suspension Absorber dry scrubber		
DRI Package Boiler Line 1 (EU 065)	Natural gas fuel usage only	0.22 lb/yr	Inherently low mercury content. Higher reduction than required on Indurating Furnace to off-set DRI Package Boiler emission reduction.
DRI Top Gas Purification Line 1 (EU 067)	Natural gas fuel usage only	3.98 lb/yr	Inherently low mercury content. Higher reduction than required on Indurating Furnace to off-set DRI Top Gas Purification emission reduction.

*The permit or enforceable document will include the proposed control efficiency, emission limits, or other requirements that achieve the reduction.
**Attach manufacturer's information and other resources used to document the reduction

Written description:

The Mesabi Metallics Company LLC (Mesabi) project was previously known as Essar Steel (Essar) and before that the Minnesota Steel Industries (MSI). The MSI facility was originally permitted in 2007. Essar purchased the project in 2008 and a modification permit was issued in 2012. Essar started construction thereafter and the facility is still under construction. Therefore, no actual emissions have occurred to date. The 2012 permit included a facility wide mercury emission limit of 77 lbs/yr upon initial start-up. The permit also required installation and operation of an Activated Carbon Injection system on the indurating furnace Waste Gas (EU 039) stack 365 days after initial start-up. No specific mercury permit limits were expressed for the indurating furnace.

Under Minn. R. 7007.0502 Subp. 6(A)(1) the taconite indurating furnace must not exceed 28 percent of the mercury potential to emit included in the permit authorizing construction. The indurating furnace at Mesabi will have two emission points, the Hood Exhaust (EU 038) and the Waste Gas stacks (EU 039). Mercury emissions from the indurating furnace come from the mercury that is inherently in the ore and passes through to the concentrate and is vaporized at the high temperatures in the indurating furnace and a smaller portion from natural gas combustion.

None of the sources at Mesabi meet the definition of iron and steel melter under Minn. R. 7007.0502 Subp. 6(B) because Mesabi will not use motor vehicle scrap or undifferentiated shredded ferrous scrap. The 2012 permit includes conditions that limit the Electric Arc Furnace (EAF) (EU 125) to using only "clean" scrap and specifically excludes the use of scrap that originates from automobile or white good shredding. Therefore, the EAF at Mesabi is not required to have a mercury reduction plan.

Under Minn. R. 7007.0502 Subp. 6(C) the DRI Package Boiler must have a plan to reduce emissions by 70 percent. The DRI Package Boiler is natural gas fired and only has potential mercury emissions of 0.22 lbs/yr. The DRI and Steel Mill facilities at Mesabi will include various natural gas fired process heaters. Process heaters are excluded in 7007.0502 Subp. 6(C).

Under Minn. R. 7007.0502 Subp. 6(D) mercury emission sources with processes that individually emit three or more pounds of mercury per year and that are not otherwise identified in items A to C must submit a plan showing a 70 percent reduction in mercury emissions. The DRI Top Gas Purification (EU 067) source is the only other source at Mesabi with emissions greater than 3 pounds per year. Mercury emission in the Top Gas Purification stack come from residual mercury in the oxide pellets fed to the DRI furnace and mercury in the natural gas that is used as a reducing agent in the DRI furnace.

Mesabi proposes a combined reduction limit for the Indurating Furnace. Mercury emissions from the Indurating Furnace are based on the difference in mercury concentration in greenball and fired pellet analysis obtained from two pot grate testing samples from 2005. The split of mercury emissions between the Hood Exhaust (36%) and the Waste Gas (64%) are based on design assumptions. The gas flowrate in the Hood Exhaust is also much higher than the Waste Gas stack and therefore the mercury concentration will be very low. Due to these factors a combined reduction limit is proposed.

Mesabi proposes to increase the mercury reduction to 78% on the Indurating Furnace ACI system once the DRI units are operating. This increase in reduction can be obtained by injecting additional activated carbon. The additional reduction at the Indurating Furnace will off-set the 70% reduction required on the DRI Package Boiler (EU 065) and DRI Top Gas Purification (EU 067).

5. Schedule

For each reduction element (specific control, process, material or work practice) described in Item 4 that will be employed as part of the mercury reduction plan, complete the following table. *To create a new row, place your cursor in the last column of the last row, hit tab.*

Emission Unit	Reduction Element	Anticipated Element Construction / Installation Date	Anticipated Startup Date	Anticipated Date for Demonstrating Reduction Target	Date Reduction Needs to be Met	Anticipated Date of Permit Application Submittal (if necessary)
Hood Exhaust (EU 038)	Activated carbon injection (ACI) and baghouses	6 months after issuance of permit modification	ACI start-up 365 days after initial start-up of emission unit	No later than January 1, 2025	No later than January 1, 2025	No later than January 1, 2021
Waste Gas (EU 039)	Activated Carbon Injection (ACI), multiclones, baghouses, and GSA dry scrubber	With initial construction of unit	ACI start-up 365 days after initial start-up of emission unit	No later than January 1, 2025	No later than January 1, 2025	Construction already included in 2012 air permit and in Title V Renewal application anticipated to be submitted in 1st Quarter 2019. Operating conditions to be part of permit modification application submitted no later than January 1, 2021.
DRI Package Boiler Line 1 (EU 065)	Natural gas fuel usage only	With initial construction of unit	With initial start-up of emission unit	No later than January 1, 2025	No later than January 1, 2025	No later than January 1, 2021
DRI Top Gas Purification Line 1 (EU 067)	Natural gas fuel usage only	With initial construction of unit	With initial start-up of emission unit	No later than January 1, 2025	No later than January 1, 2025	No later than January 1, 2021

6. Calculation data

Include all mercury emission calculations for each emissions unit listed in item 4 in an editable electronic spreadsheet. Provide calculations showing the mercury reduction, control efficiency, or emission rate that each emissions unit will achieve once the plan for that emissions unit is fully implemented.

See spreadsheet included with submittal.

6a. Emission Factors

Identify the emission factors and sources of the emission factors used to determine mercury emissions in item 3 in the following table. Please include the rationale behind your decision. *To create a new row, place your cursor in the last column of the last row, hit tab.* Minn. R. 7007.0502, subp. 5(A)(1)(b) or Minn. R. 7007.0502, subp. 5(A)(2)(d).

Emission unit	Emission factors for current mercury emissions rate, if applicable	Source of emission factor	Target emission rate	Source of emission factors for target emission rate
Indurating Furnace Hood Exhaust (EQUI 257 / EU 038)	3.52 E-06 lb Hg / ton pellets	EPA Natural gas combustion factor Indurating furnace mass balance (see attached)	1) 20.17 lbs/yr by 2025 2) 16.62 lbs/yr by 2025 and after start-up of DRI Facility whichever is later	Material balance based on 2005 pot grate testing and assumption that 36% on mercury reports to the Hood Exhaust stack
Indurating Furnace Waste Gas (EQUI 258 / EU 039)	6.25 E-06 lb Hg / ton pellets	EPA Natural gas combustion factor Indurating furnace mass balance (see attached)		Material balance based on 2005 pot grate testing and assumption that 64% on mercury reports to the Waste Gas stack

DRI Package Boiler (EQUI 181 / EU 065)	2.60 E-04 lb Hg / MMCF	Natural gas combustion	0.22 lbs/yr	EPA Natural gas combustion emission factor
DRI Top Gas Purification (EQUI 186 / EU 067)	1.82 E-06 lb Hg / ton pellets	Natural gas combustion and material balance	3.98 lbs/yr	EPA Natural gas combustion emission factor used for natural gas used as reducing agent. Material balance based on 2005 pot grate and DRI testing for the portion of mercury coming from the residual mercury in the oxide pellet feed.

7. Operation, Monitoring, and Recordkeeping Plan

7a. Operation and Optimization Plan

For each control device used to achieve the overall mercury reduction of the plan, describe how you will operate the control system such that mercury reductions are maintained. Explain how an operator might adjust the control system at the facility. Describe system alarms or safeguards to ensure optimal operation of the mercury control system. Optimization also includes training of individuals responsible for operating the control system, and the development and upkeep of operation and maintenance manuals. The MPCA is not requesting that such programs or manuals be included here, rather that they are summarized. Discuss potential variability of mercury emissions and how operations will be monitored to address variability. Minn. R. 7007.0502, subp. 5(A)(1)(c) or Minn. R. 7007.0502, subp. 5(A)(2)(c).

Mesabi will submit an Activated Carbon Injection (ACI) Operation and Maintenance (O&M) plan and a Mercury Reduction Technology Demonstration Plan 90 days before Initial Startup of the ACI system. The O&M Plan shall specify the operating parameters to be monitored to ensure proper operation of the mercury reduction technology and shall at a minimum provide details on how the carbon injection rate will be monitored. The O&M Plan shall also include, at a minimum, technical specifications for any oxidizing and adsorption agents to be used, as allowed by the equipment vendor considering any patented or proprietary information, target injection rates, routine and long-term maintenance and inspection requirements that are consistent with the manufacturer's specifications.

Mesabi will conduct a Mercury Reduction Technology Demonstration (MRTD) for the ACI system. The MRTD will initiate 180 days after initial start-up of the ACI system. Testing will occur once a quarter for 4 quarters per the MRTD Plan. The MRTD Plan will include details for measuring the mercury concentration in the greenballs, oxide pellets, Hood Exhaust stack, and Waste Gas stack along with operating parameters including carbon injection rate, pellet production rate, airflow, and natural gas firing rate. A MRTD Report will be submitted 90 days after completion of the fourth quarterly test, and no later than July 1, 2024. The MRTD Report will establish the operating parameters necessary to achieve the required mercury reduction.

Mesabi will also operate and maintain the baghouses and GSA dry scrubber per the air permit in effect at the time.

7b. Proposed Monitoring and Record Keeping

For each reduction element (specific control equipment, emission limit, operating limit, material or work practice), describe monitoring to provide a reasonable assurance of continuous control of mercury emissions. If the plan includes control equipment, attach MPCA Air Quality Permit Forms GI-05A and CD-05. Minn. R. 7007.0502, subp. 5(A)(1)(d).

<table>
<tr><th>Emission Unit</th><th>Reduction Element</th><th>Reduction, Control Efficiency or Emission Rate (include units)</th><th>Operating Parameters</th><th>Monitoring Method</th><th>Parameter Range (include units, if applicable)</th><th>Monitoring Frequency</th><th>Proposed Recordkeeping</th><th>Discussion of Why Monitoring is Adequate</th></tr>
<tr><td>Hood Exhaust (EU 038)</td><td>Baghouses and activated carbon injection</td><td rowspan="2">1) 72% reduction by 2025
2) 78% reduction 2025 and after start-up of DRI Facility whichever is later</td><td rowspan="2">1) Greenball mercury content
2) Oxide pellet mercury content
3) Carbon injection rate
4) Oxide pellet production rate
5) Natural gas firing</td><td rowspan="2">Per O&M Plan and MRTD Report</td><td>Carbon injection rate for Hood Exhaust to be determine from Mercury Reduction Technology Demonstration</td><td rowspan="2">1) Carbon injection rate to be monitored continuously
2) Greenball and oxide pellet mercury concentration monthly composite
3) Pellet production rate to be monitored continuously
4) Natural gas firing monitored continuously</td><td rowspan="2">1) Carbon injection rate
2) Monthly and annual mercury emissions
3) Monthly natural gas fired
4) Monthly oxide pellet production</td><td rowspan="2">1) The difference between the greenball and oxide pellet mercury concentrations and oxide pellet production rate will be used to calculate the total amount of mercury liberated from the oxide pellets.
2) The natural gas fired will be used to calculate the amount of mercury from combustion
3) The carbon injection rate will be used as parametric monitoring of the ACI percent reduction.</td></tr>
<tr><td>Waste Gas (EU 039)</td><td>Activated Carbon Injection, multiclones, baghouses, and GSA dry scrubber</td><td>Carbon injection rate for Waste Gas to be determine from Mercury Reduction Technology Demonstration</td></tr>
</table>

Emission Unit	Reduction Element	Reduction, Control Efficiency or Emission Rate (include units)	Operating Parameters	Monitoring Method	Parameter Range (include units, if applicable)	Monitoring Frequency	Proposed Recordkeeping	Discussion of Why Monitoring is Adequate
DRI Package Boiler Line 1 (EU 065)	Natural gas fuel usage only	0.22 lb/yr	Natural gas firing rate	Natural gas meter	12-month rolling total natural gas fired <850 MMCF/yr	Continuous	Monthly calculation of 12-month rolling total of natural gas fired	Only emission from package boiler are from natural gas combustion.
DRI Top Gas Purification Line 1 (EU 067)	Natural gas fuel usage only	3.98 lb/yr	1) Natural gas firing rate 2) DRI pellet production 3) DRI pellet mercury content	1) Natural gas meter 2) DRI Production records 3) DRI pellet composite sample	12-month rolling total natural gas used <15,321 MMCF/yr	1) Continuous for natural gas usage 2) Monthly DRI pellet production 3) Monthly composite DRI pellet sample	Monthly and annual mercury emissions	1) The difference between the oxide pellet and DRI pellet mercury concentrations and DRI pellet production rate will be used to calculate the total amount of mercury liberated from the DRI pellets. 2) The natural gas fired will be used to calculate the amount of mercury natural gas usage.

Additional Discussion:

7c. Evaluation of the use of Continuous Emissions Monitoring Systems (CEMS).

Evaluate the use of CEMS for mercury, both the sorbent tube method (U.S. Environmental Protection Agency [EPA] Method 30B) and an extractive "continuous" system. Describe if either method has been used at the mercury emissions source for parametric monitoring or for compliance determination. If CEMS is selected for monitoring of mercury emissions, please include in item 6a above. If it is not selected for monitoring of mercury emissions, please discuss the evaluation of the use of CEMS below:

Mesabi will provide for periodic testing at the baghouse inlet and stack using Method 30B to monitor Hg emissions. Mesabi will also collect composite samples on a monthly basis of the greenballs, oxide pellets, and DRI pellets and calculate mercury emissions using a mass balance approach and ACI system percent reduction. Since a majority of the mercury in the greenballs is liberated in the indurating furnace measuring the mercury input and output will provide for adequate accounting of the uncontrolled mercury emissions. This monitoring in conjunction with stack testing results and carbon injection rate monitoring will be more reliable and less expensive than a mercury CEM.

Because a Hg CEMs must be operated under very close tolerances the instruments are not as reliable from an O&M perspective a traditional CEMS (eg., NOx, CO). Due to the specialized nature of a Hg CEMs, installation and operating costs as well as replacement parts and labor are very expensive. For these reasons Mesabi proposes the approach described above.

Mercury emissions from the natural gas combustion sources and particulates from material handling sources are so low they would not be detectable by a mercury CEM.

8. Mechanism to make reduction plan enforceable.

The elements of the reduction plan will be included in your air emissions permit. If a permit amendment is needed in order to install or implement the control plan, please explain:

The ACI system construction on the Waste Gas (EU 39), and natural gas firing in the DRI Package Boiler (EU 065) and DRI Top Gas Purification (EU 067) were included in the 2012 air emission permit and will be in the Title V Renewal application anticipated to be submitted 1st Quarter of 2019. The ACI system will be expanded to the Hood Exhaust (EU 038) by running pneumatic piping from the carbon bin to the duct work prior to the baghouse. This construction was not included in the 2012 air emission permit and therefore requires submittal of an air permit modification application. The proposed operating conditions are not in the existing 2012 air permit and will also need to be incorporated into the air permit modification. The air permit modification application for the Hood Exhaust construction and incorporation of the operating requirements will be submitted not later than January 1, 2021. This schedule will provide ample time for the permit to be issued, the piping to the Hood Exhaust to be constructed, the Mercury Reduction Demonstration Testing to occur, and the Mercury Reduction Demonstration Report to be submitted to MCPA for review prior to the January 1, 2025 deadline.

9. Additional information

Please provide additional information that will assist in reviewing your Mercury Reduction Plan.

Attached is supporting information for the development of the emission factors for the Indurating furnace Hood Exhaust and Waste Gas stacks and the DRI Top Gas Purification.

10. Confidentiality

If your mercury reduction plan submittal includes confidential information, submit two versions of the mercury reduction plan. One version with the confidential information and one public version with the confidential information redacted.

10a. Confidentiality statement

☒ This submittal does not contain material claimed to be confidential under Minn. Stat. §§ 13.37 subd. 1(b) and 116.075. Skip item 10b, go to item 11.

☐ This submittal contains material which is claimed to be confidential under Minn. Stat. §§ 13.37 subd. 1(b) and 116.075. Complete Item 10b. Your submittal must include both Confidential and Public versions of your submittal.

☐ Confidential copy of submittal attached ☐ Public copy of submittal attached

10b. Confidentiality certification

To certify data for the confidential use of the MPCA, a responsible official must read the following, certify to its truth by filling in the signature block in this item, and provide the stated attachments.

☐ I certify that the enclosed submittal(s) and all attachments have been reviewed by me and do contain confidential material. I understand that only specific data can be considered confidential and not the entire submittal. I certify that I have enclosed the following to comply with the proper procedure for confidential material:

- ☐ I have enclosed a statement identifying which data contained in my submittal I consider confidential, and I have explained why I believe the information qualifies for confidential (or non-public) treatment under Minnesota Statutes.
- ☐ I have explained why the data for which I am seeking confidential treatment should not be considered "emissions data" which the MPCA is required to make available to the public under federal law.
- ☐ I have enclosed a submittal containing all pertinent information to allow for review and approval of my submittal. This document has been clearly marked "confidential".
- ☐ I have enclosed a second copy of my submittal with the confidential data blacked out (not omitted or deleted entirely). It is evident from this copy that information was there, but that it is not for public review. This document has been clearly marked "public copy".

Permittee responsible official

Print name: ____________________

Title: ____________________ Date ____________

Signature: ____________________

Phone: ____________ Fax: ____________

Co-permittee responsible official (if applicable)

Print name: ____________________

Title: ____________________ Date: ____________

Signature: ____________________

Phone: ____________ Fax: ____________

11. Submittal certification

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete.

Permittee responsible official

Print name: Gary Heasley

Title: Chief Executive Officer Date 12/18/2018

Signature: Gary E Heasley

Phone: 218 865 6900 Fax:

Co-permittee responsible official (if applicable)

Print name:

Title: Date:

Signature:

Phone: Fax:

Emission Sources Subject to Mercury Reduction Plan (Minn. R. 7007.0502)	EQUI #	EU #	Emission Factor	Units	Potential Throughput[1] (ston/yr)	Projected Throughput[2] (ston/yr)	Units	Potential Uncontrolled Emission Rate (lb/yr)	Projected Uncontrolled Emission Rate (lb/yr)	Control Efficieny	Potential Controlled Emission Rate (lb/yr)	Projected Controlled Emission Rate (lb/yr)
Indurating Furnace Hood Exhaust - Pellets	257	38	3.46E-06	lb/ton	9,387,922	7,716,100	tons/yr	32.51	26.72	78.00%	20.13	16.59
Indurating Furnace Hood Exhaust - Natural Gas	257	38	2.60E-04	lb/MMcf	233	233	MMcf/yr	0.06	0.06			
Indurating Furnace Waste Gas - Pellets	258	39	6.16E-06	lb/ton	9,387,922	7,716,100	tons/year	57.79	47.50			
Indurating Furnace Waste Gas - Natural Gas	258	39	2.60E-04	lb/MMcf	4,422	4,422	MMcf/yr	1.15	1.15			
DRI Package Boiler	181	65	2.60E-04	lb/MMcf	850	850	MMcf/yr	0.22	0.22	0.00%	0.22	0.22
DRI Top Gas Purification (pellets)	186	67	1.12E-07	lb/ton	2,336,788	1,984,140	tons/yr	0.26	0.22	0.00%	0.26	0.22
DRI Top Gas Purification (natural gas reducing agent)	186	67	2.60E-04	lb/MMcf	15,330	15,330	MMcf/yr	3.99	3.99	0.00%	3.99	3.99
Total								95.97	79.85		24.60	21.02

(1) Potential throughput of pellets based on capacity of material handling equipment. Throughput of natural gas based on burner sizing. Throughput of reducing gas based on
(2) Projected throughput of pellets based on projected production capacity.

Reduction Plan Requirements

1) 72% reduction on the Hood and Waste Gas
2) 70% redcution on DRI Package Boiler and Top Gas Purification

Reduction Goal for Potential Emissions (lb/yr) = 25.77
Potential Emissions - Goal = -1.17

Reduction Goal for Projected Emissions (lb/yr) = 21.25

Projected Emissions - Goal = -0.23

Indurating Furnace Emission Factor Derivation
(lb Hg/ton oxide pellets) = 9.75E-06

Hood Exhaust @ 36% = 3.51E-06
Waste Gas @ 64% = 6.24E-06

Top Gas Purificaiton Emission Factor
Derivation (lb Hg/ton DRI pellets) = 1.82E-06

Carbon Injection (kg/h) = 30
Carbon Injection (lbs/hr) = 66

Carbon Injection (ilbs/ton pellets) = 0.062

Mesabi Metallics
Criteria EI Inputs

Annual Capacities

Process/Material	metric tonnes/yr	Mesabi Metallics Capacities [1] metric tonnes/yr	short tons/yr	long tons/yr
Crusher/Crude Ore Rock		23,981,961	26,435,584	23,603,200
Concentrator/Concentrate - DRI feed	7,000,000	7,000,000	7,716,100	6,889,375
Concentrator/Concentrate - Blast furnace		6,500,000	7,164,950	6,397,277
Pelletizer/Oxide Pellets - DRI feed		7,000,000	7,716,100	6,889,375
Pelletizer/Oxide Pellets - Blast furnace		6,500,000	7,164,950	6,397,277
DRI/DRI pellets	1,800,000	1,800,000	1,984,140	1,771,554
Steel Mill/Steel Product	1,500,000	1,500,000	1,653,450	1,476,295

Maximum Hourly Capacities		Scheduled Up Time	Utilization	Operating Hours	Nameplate Rate	Max. Rate Increase	Maximum Hourly Rate for Permitting		
Process		hours/year	%	hours/year	metric tonnes/hr	%	metric tonnes/hr	short tons/hr	long tons/hr
Crusher		8130	108	8,760			4,341	4,785	4,272
Concentrator		8760	93	8,147	859	10	945	1,042	930
Pelletizer - oxide pellet rate		7920	100	7,920	884	10	972	1,072	957
Pelletizer - Blast furnace pellets		0	100	0	821	10	903	995	889
DRI		7998	93	7,438	242	0	242	267	238
Steel Mill		8671.522719	93	8,065	186	0	186	205	183

Concentrator scheduled down time: Annual shutdown = 10 days, plus 7 holidays, plus weekly downtime of 8 hours per week; Utilization (unscheduled downtime): (from Kaar Model, page 31 (3/2/2004)
Pelletizer scheduled up time is 330 hrs/yr for making DRI pellets and 340 hrs/yr for making blast pellets. The furnace may not be able to produce high quality BF High Flux pellets at the design rate in 330 days. In this case, the hourly rate would be
Essar DRI & Steel Mill nameplate rates are the same as the MSI nameplate rates. For that reason, max rate increase of 10% was removed; scheduled uptime calculated based on nameplate rate and utilization rate.

Notes
1 Capacity as determined in 'Minnesota Steel Tonnage Number by Type' (November 16, 2005 Update); the capacity of each plant area is also referred to as nameplate capacity
DRI and Steel Mill throughputs include an added 10% as a safety factor. This is how MSI was permitted. The extra 10% is not being included for the other capacities since throughputs are more refined for the Essar application.
2 Percentage beyond maximum annual production 10%

Yield Ratios and Recovery

Average concentrate weight recovery from crude ore	29.19%
Yield ratio, green ball:oxide pellet	1.00 : 1.00
Yield ratio, oxide:DRI	1.0858 : 1.00
Yield ratio, DRI:liquid steel	1.103 : 1.00
Yield ratio, liquid steel:finished steel	1.007 : 1.00
Annual stripping ratio, waste:ore	0.40 : 1.00 (Ratio for first 20 years)
Overburden ratio, overburden:waste	0.3 : 1.00
Waste rock ratio, waste rock:waste	0.70 : 1.00

These yield ratios are based on 'Minnesota Steel Tonnage Number by Type' (November 16, 2005 Update)

Furnace Flow Rates

	Exhaust at APC Outlet (scfm)	dscfm	Stack Temp (°F)	Stack Moisture at APC Outlet (%)	Stack Pressure (psi)
EQUI 257 - Hood Exhaust	833,984	794,703	113	4.7%	14.696
EQUI 258 - Waste Gas	606,965	539,046	113	11.2%	14.696

Material	Assumed % of Material or Product ® %	Basis Material or Product Type	Production Rates for Permitting metric tonnes/yr	short tons/yr	metric tonnes/hr	short tons/hr
Indurating Furnace						
Limestone used **9**	5.38%	Oxide Pellets	376,600	415,126	52.3	57.7

Chemical Name	Green ball[1]	Pellet[1]	DRI[1]	Limestone (CaCO3)[2]	Indurating Furnace Emission Factors		Top Gas Purification Emission Factor
					EQUI 257	EQUI 258	EQUI 186
	(wt. %)	(wt. %)	(wt. %)	(wt. %)	lb/ton	lb/ton	lb/ton
Mercury Compounds	5.29E-07	7.00E-09	2.00E-09	6.95E-08	3.46E-06	6.16E-06	1.12E-07

(1) Composition data from 2005 Minnesota Steel pilot plant study

(2) Hg conc. of (0.91+0.48)/2 ppb from Northshore Mining limestone (Engesser and Niles 1997), found in "Mercury Mining in Minnesota" 10/15/05 report

EQUI ID	EU ID	EU Description	Natural Gas Usage MMscf/hr	MMscf/yr	MMBtu/hr	MMBtu/yr	Notes
EQUI 257	EU 038	Indurating Furnace Hood Exhaust - DRI pell	0.531	4655	542	4,747,920	DRI grade natural gas usage is given as 420,000 btu/ton of pellets (LHV)
EQUI 258	EU 039	Indurating Furnace Waste Gas - DRI pellets					
EQUI 181	EU 065	DRI Package Boiler	0.0971	850	99.0	867,240	
EQUI 186	**EU 067**	**DRI Top Gas Purification**	**1.75**	**15,330**	**1785**	**15,636,600**	**Natural gas is a methane source for DRI process and is a reducing agent and is not combusted.**

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December 8, 2005

Barr Engineering
Attn: Keith Pilgrim
4700 West 77th Street
Minneapolis, MN 55435

Dear Keith,

The table below gives the chemical analyses for the samples of green balls (in duplicate), fired pellets (in duplicate) and DRI pellets.

Sample	% S	% Cl	% Ca	% Mg	% Mn	Ng/g Hg
Green Balls A	0.013	0.008	0.68	0.23	-	5.52
Green Balls B	0.015	0.008	0.70	0.23	-	5.06
Fired Pellets A	0.009	0.004	0.68	0.23	-	0.05
Fired Pellets B	0.009	0.004	0.68	0.23	-	0.09
DRI Pellets	0.005	0.001	0.64	0.19	0.74	<0.02

I believe that this completes our portion of the project. If you need any additional information please give me a call.

Sincerely,

Blair R. Benner
Program Director