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

Mercury Reduction Plan Submittal

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 subject to Minn. R. 7007.0502, subp. 3.
- Attach any additional explanatory information, for example, editable spreadsheets with calculations (on a CD), stack test reports, engineering or design reports, and any other information supporting your reduction plan.
- 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
Existing mercury emission source The source does not qualify as an exemption under Minn. R. 7007.0502, subp. 3	June 30, 2015	
• Industrial Boilers		January 1, 2018
• Iron Melting		June 30, 2018
• Sources otherwise not identified		January 1, 2025
Ferrous mining/processing	December 30, 2018	January 1, 2025

Facility Information

1.a. Facility name: Gerdau - St. Paul Mill

1.b. AQ facility ID number: 12300055-004

1.c. Main contact name for this reduction plan: John Skelley

1.d. Contact phone number: 563-732-4585

1.e. Contact email address: John.Skelley@gerdau.com

2. 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) and (b).

This table has an example of information that the MPCA is seeking for industrial boilers. The table is designed to help address each element needed when composing enforceable emission limits, control efficiencies or other conditions to meet mercury reductions. To create a new row, place your cursor in the last column of the last row, hit tab.

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)
Electric Arc Furnace (EU002)	*Primary: New Brominated Powdered Activated Carbon (BPAC) InjectionSystem in conjunction with the existing baghouse* *Alternative Technology if Proven: New calcium polysulfide liquid injection system in conjunction with the existing baghouse.*	*Reduction to 35 mg Hg/ton steel*	*Primary: Install BPAC injection system prior to baghouse. The system consists of carbon storage silo or trailer, day hopper, gravimetric feeder, pneumatic conveyance system, feed rate controller, and injection lances installed at the baghouse inlet. The manufacturer has not been selected as of this plan. No baghouse modifications will be required to implement this control option.* *Alternative Technology If Proven: Install calcium polysulfide liquid injection system in fume system upstream of the baghouse. The system would include tanks or totes, pumps, delivery lines, control units, and spray injection nozzles. Heat tracing would also be required for freeze protection. No baghouse modification will be required.*

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

Written description:

Refer to attached Supplemental Information (SI) sheet SI-1 for further detailed information. Gerdau is proposing BPAC as a tentative technology choice for reasons discussed in SI-1. Gerdau reserves the option to revise this plan replacing BPAC with another technology selection pending ongoing technology evaluation.

3. Calculation data

Include all mercury emission calculations for the emission rates listed in item 2 in an editable spreadsheet on CD. Provide the PTE for mercury emissions, and an estimate of actual emissions the first full calendar year of operation.

3a. Emission Factors

Identify the emission factors and sources of the emission factors used to determine mercury emissions in item 3 in the 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.*

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
Electric Arc Furnace (EU002)	*132.1 mg/ton (See attached spreadsheet)*	*Baseline testing conducted in 2013 (summarized in attached spreadsheet)*	*35 mg/ton*	*Regulatory*

4. Monitoring and Recordkeeping Plan

4a. 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). *[Examples can be deleted]*

This table and following description has example material for a facility with two coal fired boilers. To create a new row, place *your cursor in the last column of the last row, hit tab.*

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 this monitoring is adequate
Electric Arc Furnace (EU002)	*Primary: New BPAC injection System + Existing Baghouse* *Alternative Technology:* *New Calcium Polysulfide Polymer Injection System + Existing Baghouse*	*35 mg/ton*	*BPAC injection rate*	*Periodic stack testing—Method 30B* *Primary: Load cell on carbon hopper to track BPAC consumption.* *Alternative Technology: Liquid consumption monitoring on totes or tanks or flow meters if alternative liquid technology is used.*	*15 to 25 lbs BPAC/hr*	*Initial and periodic performance tests at baghouse inlet and stack*	*Written log*	*Primary: Tracking of carbon feed rate (lb/hr) is an industry standard for BPAC injection.* *Alternative Technology: Tracking of liquid volume injected if alternative technology is used.*

Additional Discussion:

Refer to SI-4a for additional discussion.

4b. Optimization

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, the development and upkeep of operation and maintenance manuals. The MPCA is not requesting that such programs or manuals be included with this element, 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).

Refer to discussion in SI-4b.

4c. 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 4a above. If it is not selected for monitoring of mercury emissions, please discuss the evaluation of the use of CEMS below:

Gerdau will provide for periodic testing at the baghouse inlet and stack using Method 30B to monitor Hg emissions from the EAF. A portable Hg CEMs may be used as necessary for troubleshooting and during engineering testing, but will not be used for routine monitoring. 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 Gerdau proposes periodic testing using EPA Method 30B.

5. 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. Stat. § 7007.0502, subp. 5A(2). If you are proposing an alternative plan to reduce mercury emissions, please complete the following.

a) Provide a detailed explanation of why the mercury reductions are not technically achievable. Describe the reduction required by the rule and your alternative proposal. Include references and citations supporting the basis for the determination that the reductions are not technically feasible.

Not applicable

b) Complete the information above for your alternative proposal.

Not applicable

c) Provide an estimate of the annual mass of mercury emitted under the requirements of Minn. R. 7007.0502, subp. 6 and the proposed alternative plan.

Not applicable

6. 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:

Modifications addressed in this plan to provide a BPAC injection system will be encorporated into to existing air pollution control equipment to effect additional Hg emission reductions. Because no new emission sources will be added, it is anticipated that an Administrative modification will be made to the existing permit to incorporate the additional features. Further discussion of the mechanism to make the reduction plan enforceable is provided in SI-6.

7. Schedule

For each reduction element (specific control, process, material or work practice) described in Item 5 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 date	Anticipated	Anticipated date for	Date reduction needs to	Anticipated date of permit application

		to start of element	completion of element	demonstrating reduction target	be met	submittal
Electric Arc Furnace (EU002)	*BPAC Injection System*	*Begin Engineering: 2/1/2016*	*Complete Installation: 6/1/2017*	*Submit testing protocol for approval by 9/18/2017. Conduct initial demonstration test by 3/17/2018, and submit test report to MPCA by 5/1/2018.*	*June 30, 2018*	*Gerdau anticipates that an administrative permit modification will be made to incorporate necessary permit constraints as discussed in this Reduction Plan to provide enforceable conditions.*

8. Additional information

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

Gerdau is in the process of reviewing additional technologies due to a potential issue at one of its other plants using BPAC. Gerdau plans to complete this technology evaluation on or before June 30, 2018, and reserves the option to modify this plan as might be required to implement an altenrative technology selection

9. 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: John Skelley

Title: Corporate Environmental Affairs Mgr. Date 6/12/2015

Signature: John R. Skelley Digitally signed by John R. Skelley DN: cn=John R. Skelley, o=Gerdau, ou=GLN Corp Env, email=john.skelley@gerdau.com, c=US Date: 2015.06.15 09:40:03 -05'00'

Phone: (563) 732-4585 Fax:

Co-permittee responsible official (if applicable)

Print name:

Title: Date:

Signature:

Phone: Fax:

Supplemental Information

The State of Minnesota has recently adopted new rules to meet the statewide mercury (Hg) emission goal of 789 pounds per year. This requirement is based on water deposition considerations used to determine total daily loads to water bodies in the State of Minnesota, and as approved by the U.S. Environmental Protection Agency (EPA). The associated requirements for air emission sources of Hg are codified in Minnesota Rule 7007.0502 – Mercury Emission Reduction Plans (MERP).

The Minnesota Pollution Control Agency (MPCA) has prepared a form, AQ-EI2-04 to provide the regulatory community with a consistent format for their MERPs. This document provides information as an attachment to and supplementing Form AQ-EI2-04.

SI-2 Description of Mercury Reduction Action

Gerdau has tentatively selected BPAC injection as the preferred control technology to meet the mercury reduction standard specified in Minnesota Rule 7007.0502. The selection of BPAC is based on a field technology evaluation conducted in 2013 that demonstrated that BPAC injection combined with capture in the existing baghouse will meet the 35 mg/ton limit. Subsequent to this test Gerdau found that another mill that has used BPAC injection for Hg control since 2007 started experiencing difficulties in meeting its Hg reduction requirements to the same 35 mg/ton standard, and the cause is still under investigation. Until the cause is determined and corrected at this other facility, Gerdau is proposing BPAC injection as a tentative option. In the interim Gerdau is evaluating another injection technology based on calcium sulfide, that would chemically bind the Hg as a non-volatile particulate. This particulate would ultimately be collected as dust in the existing baghouse.

Upon approval of this plan Gerdau will submit annual progress reports to the Commissioner by April 1 of each year starting with the year following plan approval until one full year after achievement of the reduction as described in this plan. The report will provide the status of facility modifications and actions taken in the preceding 12 months on each of the plan elements addressed in Subpart 5 of the Mercury Emissions Reduction Plans Rule.

Gerdau has prepared an internal schedule for tracking progress, and this schedule is provided below for information purposes:

#	Activity/Milestone	Date		Notes
1	Initiate Review of Alternative Hg Control Technologies	5/1/15	*	If additional review is required.
2	Hg Emission Reduction Plan Due to MPCA	6/30/15	*	Plan must be delivered on or before
3	Complete Review of Alternative Hg Control Technologies	8/31/15	*	
4	Obtain Quote for Installed Cost of BPAC System	10/1/15	*	
5	Conduct Testing of Calcium Polysulfide Technology	10/31/15	*	Test window August - October.
6	Obtain Quote for Calcium Polysulfide Technology if Effective	11/30/15	*	
7	Decision on Final Technology Selection	12/15/15	*	
8	Incorporated Equipment in CAP-X Plan	12/31/15	*	
9	Update Hg Emission Reduction Plan	1/31/16	*	Update in needed to finalize technology selection
10	Begin Engineering	2/1/16	*	
11	Complete 1150(C) Notification or Permit Modification Request	3/31/16	*	May only require notification (need to verify)
12	Begin Equipment Purchase	5/31/16		4 months after initiation of engineering
13	Complete Engineering	7/30/16		6 months for engineering
14	Obtain Air Permit Modification for Construction	8/28/16		Allow 5 months for permit modification
15	Complete Equipment Purchase	2/25/17		9 months total
16	Install New Hg Control Equipment	3/1/17	*	Begin installation of equipment
17	Complete Hg Control Equipment Installation	6/1/17	*	3 months for installation
18	Submit Compliance Test Protocol to State	9/18/17		6 months before compliance test
19	Conduct Compliance Test	3/17/18		45 days prior to final report
20	Compliance Test Report to MPCA	5/1/18		2 months before compliance deadline
21	Compliance Deadline	6/30/18	*	

Regulatory

SI-3 Calculation Data

Calculation data for Hg emissions are provided as an attachment and CD in this plan. The calculations used to establish an initial Hg emission factor are based on initial Baseline and Short-Term Field Trial testing conducted during 2013. The uncontrolled Hg emission results from these tests are summarized on EXCEL worksheets. The uncontrolled Hg emission factor is based on the 95% confidence interval for the mean using the 2013 data set. On a separate worksheet uncontrolled emissions are calculated using the uncontrolled emission factor (mg/ton), and the annual steel production capacity. Controlled emissions are calculated in the same manner using the regulatory limit of 35 mg/ton steel.

SI-4a Proposed Monitoring and Record Keeping

The following is proposed to satisfy monitoring and record keeping requirements:

Initial Testing

Upon BPAC injection system completion, Gerdau will conduct an initial performance test. This test will be conducted prior to the compliance deadline, and a test protocol will be submitted for approval by MPCA prior to conducting the test. The test will involve testing at both the baghouse inlet and outlet (i.e., stack) using Method 30B in conjunction with EPA Methods 1-4 to determine flow rate and composition. Testing to demonstrate compliance will be conducted over at least three full production periods tap to tap to allow proper correlation of steel production data to emissions (3 runs per test). During the testing period the BPAC injection rate will be set at a constant rate. Gerdau will also conduct testing at other rates as necessary to verify performance, and to establish a dosing curve.

A test report will be submitted to MPCA documenting compliance and specifying the BPAC injection rate upon which successful testing was achieved.

Routine Recordkeeping

During routine operation Gerdau will verify the carbon feed controller set point and visually inspect the carbon system (supply, day hopper, gravimetric feeder, and educator system) daily for signs of improper operation. This inspection will be documented on a log or in a log book that will be maintained onsite. The BPAC injection rate will be logged daily for purposes of determining the average BPAC dosing between test periods.

As an option to daily monitoring of BPAC injection rate, Gerdau will calculate the total carbon used in pounds for each calendar quarter by the weight of carbon delivered to the plant. Hours of injection system operation will also be documented over the same period.

Specified documentation required to demonstrate compliance will be maintained onsite in files readily available for MPCA inspection.

Routine Compliance Monitoring

Gerdau will conduct testing of baghouse inlet and stack Hg emissions on a quarterly basis in the same manner as the initial compliance test. The Hg emission results from each quarterly test will be weighted based on the steel produced during that quarter (up to the date of each test) to demonstrate the 35 mg/ton limit on an annual basis. More than the 4 quarterly tests may be conducted at Gerdau's discretion, and additional test results would be production-weighted in the same manner as the quarterly tests.

The Hg emission limit for steel melting is 35 mg/ton of steel produced. The term "steel produced" is not specifically defined in the regulation. Gerdau proposes that steel produced be based on the scrap steel charge rate to the EAF rather than that final steel produced. Hg emissions are related to the mass rate

of scrap steel entering the process, not the final produced steel. Therefore, it is appropriate to use the "charge" rate as opposed to the final mass rate of steel ultimately produced. In determining the charge mass rate, fluxes will be excluded from the charge rate determination.

SI-4b Optimization

Operation of Control System

The BPAC injection control system will be a PLC with Human Machine Interface (HMI) to allow tracking of setpoints, alarms, and status. The control system will allow the operator to establish a setpoint and will display actual carbon feed rate in pounds per hour. The system will also include an operating time meter that tracks the number of hours the injection system has operated.

Gerdau will establish an initial performance curve using at least 3 different BPAC injection rates. The emission test results will be plotted against lb BPAC/million actual cubic feet of flow and lb BPAC/lb inlet Hg, to allow an assessment of required BPAC feed. The BPAC feed rate will inititally be set based on the BPAC feed rate during the initial performance demonstration test conducted in 2013 of 25 lb/hr. After each routine compliane demonstration test, the BPAC injection rate will be adjusted based on the inlet Hg measured during that test, and normally maintained at that value until the next test. However, if the injection rate is changed during a period, the next test will be conducted at the production weighted BPAC rate during the period since the last test.

System Alarms and Safeguards

In addition to routine operator inspections (previously described) the injection control system will include both visual and audible alarms that will indicate when the system is not operating within manufacturer prescribed tolerances. These will include pneumatic conveyance pressure monitor and alarm, and a carbon screw feeder rotation monitor and alarm.

Operator Training

BPAC Injection System operators will receive initial training from the BPAC injection system manufacturer. New employees will receive on-the-job training by a properly trained employee.

Development and Upkeep of Operation and Maintenance Manuals

Gerdau will specify that the manufacturer provide O&M manuals, and will comply with at least the manufacturer required maintenance requirements. Such maintenance is documented through work orders. O&M manuals will be maintained up-to-date if equipment modifications are made.

How Operation Will be Monitored to Address Variability

Gerdau proposes quarterly monitoring of EAF Hg emissions, measured at the baghouse inlet and stack. BPAC dosing will be adjusted based on the Hg emissions versus dosing curves established during the initial test. The required dosing rate for the next quarter will be selected based on the inlet Hg result from the pervious quarter. This rate will typically maintained until the next quarterly test. If BPAC

dosing rate adjustments are made between tests the stack test for the next quarter will be conducted at the steel production-weighted average BPAC injection rate during the period since the last test.

SI-6 Mechanism to Make Reduction Plan Enforceable

The following requirements will be necessary to provide the mechanism to make the reduction plan enforceable:

Emission Limit

Gerdau will meet an emission limit for Hg as measured at the stack of 35 mg/ton of steel charged, and on an annual calendar basis.

Initial Compliance

Initial compliance will be demonstrated by conducting a compliance test, conducted in accordance with a pre-approved compliance plan prior to the compliance date.

Routine Monitoring Documentation

Gerdau will maintain records of routine monitoring of system inspections that document that the system is functioning as designed. Gerdau will also document either daily BPAC feed rates or as an option quarterly rates.

Recordkeeping

Gerdau will, prior to April 1, of each year, document through calculations that the emisison limit has been achieved for the previous year. Gerdau will also document periods where the Hg injection system is not operational. If the system is not operational during a period, the missing data will be filled in with the average emissions from the most recent inlet test. These calculations will be maintained onsite and available for review or submittal, as requested by MPCA.

Other records that will be maintained include copies of progress reports, routine inspection logs, and test reports.

Reporting

Gerdau will report any instance where the annual limit is not achieved, immediately upon such determination.

Corrective Action

- Routine Operation. During routine operation, if inlet testing dictates the need for a higher carbon feed, Gerdau will make adjustments in the BPAC injection rate. If an operator determines that the system is not operating wihtin manufacturer prescribed limits, Gerdau will take actions to correct the issue in an expedient manner. Gerdau will document the time out of operating bounds.

- Exceedance of Annual Limit. If during the course of a calendar year, Gerdau's results show trends indicating potential annual exceedance of the established emission limit, Gerdau will make adjustments in the carbon feed rate, and other actions such as increased frequency of testing. Other actions may be taken on a case-by-case basis.

If the annual Hg limit is exceeded Gerdau will, immediately upon discovery, begin an investigtaion into the cause. Wthin 30 days of such exceedance Gerdau will submit a report to MPCA documenting the investigation, poential cause, mitigative actions, schedule, and follow-up testing.

Mercury Emission Calculations

Gerdau - St. Paul Mill

(Mercury Emission Reduction Plan)

1.0 Uncontrolled Emissions

Steel Production Capacity	416,000	tons/yr	
Emission Factor	134.52	mg/ton	(From Baseline Testing Results Worksheet)
Annual Uncontrolled Emissions	123.37	lb/yr	
	0.062	ton/yr	

2.0 Controlled Emissions

Emission Factor	35	mg/ton
Annual Controlled Emissions	32.10	lb/hr
	0.016	ton/yr

Mercury Emission Calculations

Gerdau - St. Paul Mill

(Mercury Emission Reduction Plan)

Uncontrolled Emissions				
Date	Run #	ug/dscm	mg/ton	Source
4/9/13	1	11.74	120.06	1
4/9/13	2	13.89	138.72	1
4/9/13	3	7.93	128.33	1
6/17/13	1		82.72	2
6/17/13	2		91.13	2
6/18/13	1		263.2	2
6/18/13	2		102	2
6/19/13	1		81.21	2
6/19/13	2		196.65	2
6/19/13	3		58.37	2
6/24/13	1		138.06	2
6/25/13	1		35.17	2
6/25/13	2		36.54	2
6/26/13	1		124.09	2
6/26/13	2		168.45	2
Mean			117.65	mg/ton
Confidence %			95	single tail
Standard Dev.			60.60	mg/ton
n			15	
t a/2			2.51	
Confidence Interval (95%)			16.88	mg/ton
95% UCL of Mean			**134.52**	**mg/ton**

Formula:

If (n>=30), CI = $x \pm Z_{\alpha/2} \times (\sigma/\sqrt{n})$

If (n<30), CI = $x \pm t\alpha/2 \times (\sigma/\sqrt{n})$

Where, x = Mean

σ = Standard Deviation

α = 1 - (Confidence Level/100)

$Z\alpha/2$ = Z-table value

$t\alpha/2$ = t-table value

Sources:

1. *Summary Report of Baseline Testing to Support Future Mercury Technology Evaluation, Shaw Enviornmental & Infrastructure, 2013*
2. *Mercury Compliance Evaluation Short-Term Field Trial at Gerdau - St. Paul Steel Mill, CB&I, Projet 152983, October 2014*