May 23, 2005

Acting Administrator Johnson
U. S. Environmental Protection Agency
USEPA Headquarters (1101A)
Ariel Rios Building
1200 Pennsylvania Ave.
Washington D.C. 20460

Dear Acting Administrator Johnson:

With this submittal, the Fond du Lac Band of Lake Superior Chippewa is petitioning the United States Environmental Protection Agency (EPA) to object to a Title V Operating Permit issued by the Minnesota Pollution Control Agency. The permit was issued to USX Corporation for their U.S. Steel plant in Keewatin, Minnesota on February 22, 2005. The permit number is 13700063-03. If you have any questions on the enclosed petition, please contact Joy Wiecks of my staff at (218) 878-8008. Thank you for your attention in this matter.

Sincerely,

Peter J. Defoe
Chairman, Fond du Lac Band of Lake Superior Chippewa

c.c. Dennis Peterson, FDL Legal Counsel
Chris Berini, FDL Environmental Program Manager
Bharat Mathur, Acting Regional Administrator, EPA Region V
LaTisha Gietzen, Environmental Dept. Manager, USX Corporation
Sheryl Corrigan, Commissioner, Minnesota Pollution Control Agency

BEFORE THE ADMINISTRATOR
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

In the Matter of the Application of
USX Corporation – U.S. Steel Group Inc. Permit ID: 13700063-003
to operate an indurating furnace located
at Keewatin Taconite facility
located in Keewatin, Minnesota

Submitted May 23, 2005

PETITION REQUESTING THE ADMINISTRATOR OBJECT TO THE PROPOSED TITLE V OPERATING PERMIT FOR OPERATION OF AN INDURATING FURNACE AND ASSOCIATED WET SCRUBBERS LOCATED AT US STEEL CORPORATION'S KEEWATIN FACILITY SUBMITTED ON BEHALF OF THE FOND DU LAC BAND OF LAKE SUPERIOR CHIPPEWA.

Pursuant to Clean Air Act § 505(b)(2) and 40 CFR § 70.8(d), the Fond du Lac Band of Lake Superior Chippewa ("Fond du Lac Band" or "Band") hereby petitions the Administrator ("the Administrator") of the United States Environmental Protection Agency ("EPA") to object to the proposed Title V Operating Permit ("permit") for the U.S. Steel Corporation to operate an indurating furnace and associated wet scrubbers, located in Keewatin, Minnesota. The Band expects a response from EPA within sixty days of its receipt of this petition as required by Clean Air Act § 505(b)(2).

The Fond du Lac Indian Reservation is located in northeastern Minnesota, twenty miles from the Twin Ports of Duluth, Minnesota, and Superior, Wisconsin. The Reservation covers 101,000 acres of land and contains populations of white-tailed deer, black bear, ruffed grouse, and various species of waterfowl. It is also home to such animals as river otter, pine marten, fisher, moose, gray wolf, bald eagle, osprey, great gray owl, and northern boreal owl. There are 3,850 enrolled tribal members, with a Band member reservation population of 1,353. A substantial number of non-tribal members also reside on the Reservation, bringing the total reservation population to 3,728 persons.

In addition, Band members retain hunting, fishing, and gathering rights on another eight million acres of land ceded in the Treaties of 1837 and 1854, also located in northeastern Minnesota. Band member are very active and take a great interest in pursuing these rights, with 2004 harvests including 3 bears, 396 deer, and 33 moose, along with at least 6,000 pounds of fish (records were kept for Lake Mille Lacs only). These are very important cultural activities for Band members and have been for generations. For this

reason, the Band has an interest in the permits issued by surrounding permitting authorities, in this case the Keewatin Taconite (Keetac) permit issued by the Minnesota Pollution Control Agency (MPCA) on February 22, 2005.

The Band's main interest is the proposed emission and capture of mercury to the atmosphere per this permit. Mercury emitted into the air methylizes and bioaccumulates in fish and other animals. Band members become exposed to mercury through their higher than average consumption of fish and wild game. As methylmercury can cause neurological problems and has been linked to heart disease, the Fond du Lac Band feels it must take action wherever possible to maintain stringent controls to prevent high amounts of mercury from getting into the environment.

If the Administrator determines that this permit does not comply with applicable requirements or the requirements of 40 CFR Part 70, he must object to issuance of the permit. See 40 CFR § 70.8(c)(1) ("The [U.S. EPA] Administrator will object to the issuance of any permit determined by the Administrator not to be in compliance with applicable requirements or requirements of this part."). We hope that EPA will act expeditiously to respond to the Band's petition, and in any case, will respond within the 60-day timeframe mandated in the Clean Air Act.

In compliance with Clean Air Act § 505(b)(2), the Band's petition is based on objections to the draft permit for this facility that were raised during the comment period provided by the MPCA. This comment period ran from December 11, 2004 through January 10, 2005 (see public notice, Appendix A).

The Band's comments (see Appendix B) were submitted on January 7, 2005. MPCA responded to these comments with a letter dated February 8, 2005 (see Appendix C) but chose not to incorporate our comments into the permit. The Band's review of the adequacy of this proposed permit reveals deficiencies that undermine the public participation goals of Title V and the Band's status as a Tribe with Treatment as an Affected State status. As our comments explain, this proposed permit violates both state and federal laws and regulations. Furthermore, if issued as currently written, this proposed permit will serve as an ineffective tool for monitoring the facility's compliance with air pollution limitations.

The Title V permitting program offers a unique opportunity for tribes to comment on clean air requirements for facilities located in their communities and to determine whether those facilities are complying with these requirements. Unless Title V permits are written correctly, however, these permits cannot be effective. An inadequate Title V permit makes monitoring and enforcement under the Clean Air Act difficult if not impossible and can invalidate the facility's protection under the permit shield, which protects a permittee from enforcement action so long as the facility is complying with its permit, even if the permit is inaccurately written. Thus, a defective permit may prevent the Fond du Lac Band as well as other interested parties from taking legal action against a permittee who is out of compliance. Furthermore, a Title V permit that fails to include appropriate monitoring, recordkeeping, and reporting requirements will prevent the Band

and other affected parties from ever knowing whether a polluter is complying with legal requirements.

Our comments address deficiencies with the permit's provisions regarding the efficiency expected from a control device and the recordkeeping and reporting requirements prescribed for operation of the indurating furnace and its associated wet scrubbers. The Fond du Lac Band believes that these deficiencies serve as grounds requiring the Administrator to object to this permit.

I. Control Efficiency

MPCA has decided to allow the facility expand the fuel types used in its indurating furnace's rotary kiln burner by adding the ability to use coal and petroleum coke. The unit previously burned only natural gas and distillate fuel oil. The expected increase in mercury emissions of 124.75 pounds per year is expected to be offset by adding two wet scrubbers to control mercury by removing 125.65 pounds per year. In its Technical Support Document (Appendix D), MPCA has assumed a control efficiency of 30%. However, this assumed control efficiency is not backed up by a permit requirement or by source testing. The 30% number comes from a study done by the Minnesota Department of Natural Resources (DNR) at other taconite facilities, but not at Keetac (see Appendix E). Although another U.S. Steel facility (Minntac) was studied, the Band has seen no assurances that the Keetac plant is so similar to the other facility that their emissions can properly be compared. Since the mercury capture rates found at the facilities studied ranged from 2.7%-30%, we believe that some kind of proof that Keetac can meet this degree of capture should be required.

We believe that by adding a requirement for 30% mercury control, MPCA was attempting to meet the requirements of its Interim Mercury Policy (Revised July 2001) (see Appendix F) which appears on its web site. This policy states in Section 2.2 New or Expanded Air Emission Sources that two goals need to be achieved concerning any new atmospheric mercury emissions. These goals are:

1) ensure that the facility does not significantly increase fish contamination or exceed water quality criteria through localized impacts; and
2) ensure that total mercury emissions are as low as possible, in order to help reach the statewide mercury emission reductions.

Elsewhere, the Policy goes on to state "To summarize, new or expanded releases to the air are possible, but as with water discharges, any new or increased releases are subject to increased to regulatory scrutiny. Proposed projects with potential increases in mercury releases are subject to standard environmental review, including analysis of the most cost-effective controls possible."

While the Band certainly applauds the efforts of both MPCA and the U.S. Steel Corporation to keep mercury out of the environment by requiring the installation of

control equipment, we see such an action as largely meaningless unless the proper assurances can be made that the control equipment is operating as expected. To this end, The Band would like to see regular testing requirements for mercury recovery on the scrubbers.

II. Re-entrainment

The Fond du Lac Band would also like to see further assurances that the scrubber effluent will not be routed back to the furnace for material recovery purposes, as this can allow the mercury to re-volatilize and be re-emitted. The permit does not have any record keeping or reporting requirements to prove that this is not occurring. The Band would also like to see further analysis of what happens to the mercury after it is entrained in the scrubber effluent. Although the effluent goes to the tailings basin, its ultimate fate is unclear.

III Operating Requirements

The DNR study (Appendix E) looked at mercury emissions from four taconite facilities (including Minntac, another U.S. Steel facility) and found them to vary widely. The Band does not believe MPCA has shown that it is appropriate to use Minntac figures in a Keetac permit. The DNR study itself states "The fraction of mercury captured varied considerably between processing plants and **within individual plants sampled at different times**". MPCA's response letter to the Band's comments states that the DNR's research data collected at Minntac serves as the basis for the design of Keetac's scrubbers. This statement does not provide evidence that the two systems are, in fact, identical, nor does it address the study's findings of variability in capture results within individual plants.

The document goes on to state "Variation in capture rates is likely linked to differences in the temperature distributions in induration furnaces as well as to changes in gas and dust composition...(a) key variable affecting scrubber efficiency appears to be the rate of heating of taconite pellets in induration furnaces". We have seen no data, either in the Technical Support Document or in the permit, to prove that Keetac's induration furnaces are identical to Minntac's. As shown above, the MPCA document states that the difference in collection efficiencies among plants may be related to factors other than temperature distributions, such as gas and dust composition or differences in raw materials. Since MPCA has not ruled out the possibility that these factors may affect mercury capture efficiencies, it is inappropriate for MPCA to assume that the Keetac scrubbers will perform at 30% efficiency. Of course, it may be that the scrubbers would perform at an even higher rate. If so, MPCA should endeavor to find out what rate is achievable and hold Keetac to meeting it. The permit should contain mercury testing requirements. Any test data would also be useful to EPA in re-doing the Taconite NESHAP standard for mercury and fibers, which has been remanded for further action.

The DNR document states "Scrubber efficiency (for Hg capture) was higher when the company was producing standard pellets than when producing fluxed pellets" and "Minntac activates preheat burners during induration of fluxed pellets that are not used during standard pellet production. This additional heating may be the primary mechanism leading to reduced mercury capture...". No mention is made in either the Technical Support Document or in the permit itself of whether Keetac produces standard or fluxed pellets or, if both, in what proportions. Nor is any requirement made as to what type of pellets may be produced. Since the type of pellet appears to be relevant to mercury control, this seems like an appropriate permit condition, especially when the MPCA has decided to use control figures from a separate plant. The Band would like to see this addressed in the permit.

Table I of the DNR's study shows varying degrees of control from the Minntac plant's furnaces, even when testing the same furnace producing the same product. For example, Line L4 tested at 18.9%, 36.7% and 46.5% when producing standard pellets. When looking at the production of fluxed pellets in Line L7, the numbers ranged from 12.0% to 39.4% capture. The science of mercury capture in these processes has not reached a point where any kind of efficiency can be assumed.

IV. Re-entrainment

The MPCA proposes to insure that entrained mercury from scrubber effluent does not re-enter the environment by requiring that scrubber effluent may not be returned to the indurating kiln for further product recovery. Although the Fond du Lac Band agrees with this principle, we find that the permit does not contain any recordkeeping or reporting requirements to prove that this is the case. Thus, the facility will not be able to prove that it has complied with the permit condition.

The Band would also like to see some type of commitment from the plant as to future work on the mercury's ultimate fate. Since EPA will be re-visiting the taconite MACT standard for mercury, such research would be beneficial for all parties involved. The Band suggests that the facility be required to perform a test on the scrubber effluent to determine the amount of capture no later than 60 days after installation of the scrubbers.

In conclusion, the Band would like to see EPA act to require re-issuance of permit #13700063-003 with provisions for: periodic testing of the Keetac wet scrubbers as to mercury capture efficiency; recordkeeping and reporting to ensure that scrubber effluent does not go back to the furnace; further research on the fate of mercury in the tailings basin.

Sincerely,

Peter J. Defoe
Chairman
Fond du Lac Band of Lake Superior Chippewa

Appendix A

Public Notice

MINNESOTA POLLUTION CONTROL AGENCY
PUBLIC NOTICE ON DRAFT AIR EMISSION FACILITY PERMIT

NOTICE IS HEREBY GIVEN, that the Commissioner of the Minnesota Pollution Control Agency (MPCA) proposes to issue Air Emission Permit No. 13700063-003 to US Steel Corporation for their Keewatin Taconite facility located at 1 Mine Rd, Keewatin, St. Louis County, Minnesota.

The permit action is for modification and operation of the facility. The permit action is a major amendment; therefore, the draft permit has been placed on public notice. The MPCA is seeking U.S. Environmental Protection Agency (EPA) concurrent review of this proposed permit and the EPA 45-day review period will begin with the 30-day public review period.

This permit action was taken to process four permit applications, one for Part 70 permit reissuance, two for administrative amendment, and one for major amendment. The major amendment is for the following projects: 1) upgrading indurating furnace waste gas control equipment by adding two new wet scrubbers with powder lime addition (this *in itself* is a minor modification, which is taken to comply with Subpart RRRRR of National Emission Standards for Hazardous Air Pollutants); 2) diversifying indurating fuels by adding coal and petroleum coke for the rotary kiln burner; and 3) increasing taconite pellet production capacity by adding a scrubber-controlled secondary annular cooler to the grate-kiln-cooler indurating furnace.

A summary of the Potential to Emit (PTE) in tons per year is as follows:

Pollutant	NO_x	PM	PM_{10}	SO_2	CO	SO_3	VOC	Pb	HAPs
Net PTE Change for the Projects [1]	35.0	-1379	-287	35.0	90.0	3.50	35.0	0.0491	See foot-note [2]
Total facility PTE with the Projects	6,076	1,899	1,293	951	123	95.1	74.6	0.228	> 25

1. The Projects refer to the three projects for the major amendment. The PM and PM_{10} values in this row resulted from netting. Permittee shall limit emissions on NO_x, SO_2, CO, and VOC to avoid federal PSD review.
2. NESHAP, subp. RRRRR, regulates Front-Half Particulate Matter (PM) as a surrogate for hazardous air pollutants. PTE of mercury for the Projects is a net reduction, 124.75 – 125.65 = - 0.9 lb/year.

NO_x = Nitrogen Oxides — PM = Particulate Matter
PM_{10} = PM smaller than 10 microns — SO_2 = Sulfur Dioxide
CO = Carbon Monoxide — SO_3 = Sulfur Acid Mist
VOC = Volatile Organic Compounds — Pb = Lead
HAPs = Hazardous Air Pollutants

The Permittee is not required to submit a pollution prevention progress report pursuant to Minn. Stat. § 115D.08.

The preliminary determination to issue the air emission permit is tentative. There are four formal procedures for public participation in the MPCA's consideration of the permit application. Interested persons may (1) submit written comments on the proposed permit; (2) request that the MPCA hold a public information meeting; (3) request the MPCA hold a contested case hearing; and/or (4) submit a petition to the Commissioner requesting that the MPCA Board consider the permit matter.

Appendix B

FDL's Comment Letter

Fond du Lac Reservation • 1720 Big Lake Road • Cloquet, MN 55720
Phone: 218-878-8001 • Fax: 218-879-4854

Fond du Lac Environmental Program

January 7, 2005

Hongming Jiang, PhD., P.E.
Industrial Division
Minnesota Pollution Control Agency
520 Lafayette Road North
St. Paul, MN 55155-4194

RE: Air Emissions Permit No. 13700063-003 – USX Corporation – US Steel Group, Inc.

Dear Mr. Jiang:

I am writing to you with regard to MPCA's proposed permit #13700063-003 for US Steel's Keewatin Taconite Operations in Itasca County. The Fond du Lac (FDL) Air Program is concerned with emissions of pollutants in the region because of the effects these pollutants can have on Reservation air quality and natural resources.

FDL is concerned with US Steel's proposal to increase coal usage and, therefore, mercury emissions. Our concerns lie with the control equipment to be installed to control mercury emissions. As you know, mercury control by scrubbers is directly related to the amount of hydrogen chloride (HCl) found in the coal that is burned. It is our understanding that emissions from coal with a moderate HCl content can be well-controlled for mercury. However, emissions from coal types with low or high HCl contents cannot be controlled for mercury with any degree of certainty. We are unaware of any permit conditions specifying what type of coal is to be burned at the facility, therefore we are not satisfied that mercury control and capture rates can be guaranteed. If performance tests indicate that mercury control efforts are not meeting the assumed removal rate of 30%, what actions will be taken? Why is no mercury control efficiency set in the permit, even though a rate of 30% control is assumed in the Technical Support Document? All in all, unless mercury is assumed to be a component of particulate matter, mercury emissions do not appear to be limited in any way.

FDL is also concerned with control equipment monitoring requirements on all of the facility's Control Equipment Devices. The permit specifies that gas stream pressure drop and total water pressure on these control devices only need to be monitored and recorded once every seven days until the Continuous Parameter Monitoring System is in place. We would like to see this changed to a daily requirement, especially since the permit

requires the upcoming O & M plan to establish daily average pressure drop and daily average scrubber water flow rates.

We would also like to see this permit address emissions of dioxin from coal burning. Dioxins are pollutants of concern because they can bioaccumulate in fish and other food products, leading to a variety of health problems including: learning and behavioral disorders, reproductive problems, increased rate of miscarriages, abnormal development of unborn children, and cancer.

If you have any further questions, please call Joy Wiecks of the Fond du Lac Air Program at (218) 878-8008. Thank you for your cooperation in this matter.

Sincerely,

Christine Berini

Christine Berini
Environmental Program Manager

c.c. Ferdinand Martineau – FDL Resource Management Division Director
Ben Giwojna – EPA Region V Tribal Air Coordinator
LaTisha Gietzen, US Steel Environmental Department Manager

Appendix C

MPCA Response Letter

Ms. Christine Berini
Environmental Program Manager
Fond du Lac Band
1720 Big Lake Road
Cloquet, MN 55720

RE: Proposed Air Emission Permit No. 13700063-003

Dear Ms. Berini:

The Minnesota Pollution Control Agency (MPCA) has received and reviewed your letter of January 7, 2005, in which you provide comments on the MPCA's proposal to issue Air Emission Permit No. 13700063-003, to U.S. Steel Keewatin Taconite (Keetac) at Keewatin, MN. In this letter, we will focus our response to three key issues raised in your comment letter.

Mercury Emissions
Your comment letter expressed concerns over mercury emissions as a result of the proposed waste gas stream air pollution control equipment upgrade and indurating fuel diversification (adding coal as a fuel option to the taconite pellet indurating process). You stated that mercury control by scrubbers is directly related to the amount of hydrogen chloride (HCl) found in the coal that is burned; that emissions from coal with a moderate HCl content can be well-controlled for mercury, while emissions from coal types with low or high HCl contents cannot be controlled for mercury with any degree of certainty. You asked why no mercury control efficiency is set in the permit, although an assumed 30% mercury removal is assumed in the emission estimation.

You are correct in that there is a correlation between mercury removal in a wet scrubber and HCl in the flue gas stream for coal fired utility boilers. The chloride need not come from the coal, but it can enter the furnace from other feed sources. In the taconite indurating process, the chloride could come from the process water, bentonite, limestone, dolomite, and taconite concentrate. Research indicates that the presence of HCl in the waste gas oxidizes mercury or allows mercury to be maintained in the oxidized state, which in turn allows mercury capture by the wet scrubber. However, the presence of chloride does not appear to be the only thing in a taconite indurating furnace that allows for the capture of mercury.

This is illustrated by research conducted by John Engesser, a Principal Engineer for the Minnesota Department of Natural Resources (DNR). He and his colleagues found that when U.S. Steel Minntac produces fluxed pellets, the chloride concentration is higher than when it produces acid (standard) pellets, and yet mercury capture is higher during acid pellet production. So chloride might be important, but there also appears to be other interactions in the taconite indurating process that are not present in a coal fired boiler.

As is currently adopted, Subpart RRRRR of National Emission Standards for Hazardous Air Pollutants (NESHAP), which EPA promulgated for the taconite industry to regulate emissions of hazardous air pollutants (HAPs), does not address mercury emissions. Instead, EPA decided to regulate HAP emissions by controlling particulate matter, a surrogate air pollutant. On January

14, 2005, we learned that EPA had agreed to remand taconite NESHAP for mercury and fibers, setting emission limits for these pollutants. We also learned that EPA would not be able to propose these emission limits in calendar year 2005.

Therefore, we do not specify in the permit at this time either a mass mercury emission rate for the stack or a mercury control efficiency value for the powder lime wet scrubbers. We will re-open the permit to implement any applicable mercury emission standard, after it is promulgated.

The assumed mercury removal of 30% is ensured with a permit condition that the solids captured by the powder lime wet scrubbers must not be reintroduced into the agglomerating process. This value is supported with DNR research data collected at U.S. Steel Minntac, which serves as the basis for the design of equipment and operation of Keetac's powder lime wet scrubbers. We have also used in the mercury emission calculation the higher mercury emission factor for coal from the EPA reference known as AP-42 (Table 1.1-17, instead of Table 1.1-18, in the current or September 1998 version). Due to mercury content variability in materials entering and leaving the indurating process, notwithstanding the lack of applicable requirements, we do not require performance testing in the permit at this time to verify the mercury removal value.

Control Equipment Monitoring

Your comment letter expressed concerns over control equipment monitoring requirements on all of the facility's air control Equipment devices. The permit specifies that gas stream pressure drop and total water pressure on these control devices only need to be monitored and recorded once every seven days until the Continuous Parameter Monitoring System (CPMS) is in place. You would like to see this changed to a daily requirement.

Taconite NESHAP requires CPMS for all air pollution control devices except for baghouses, effective October 30, 2006. See 40 CFR 63.9600 (b)(3). In the mean time, the monitoring frequency of once every seven days meets current applicable requirements.

Dioxins/Furans Emissions

Your comment letter expressed the desire to "see this permit address emissions of dioxin from coal burning."

In our review of the permit application, we examined the applicability of state and federal regulations. The emissions from the projects proposed by Keetac are limited below the levels at which the federal Prevention of Significant Deterioration (PSD) regulations (40 CFR 52.21) or the state Environmental Review program apply. There are no applicable federal or state regulations that directly address emissions of dioxins or furans.

For additional information, we looked for references that inventory emissions of these compounds. We found an EPA document and a European Commission document concerning emission sources of dioxins and furans, neither of which mentions iron ore pelletizing plants as an emission source category for dioxins/furans. The first document is, "Exposure and Human Health Reassessment of 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD) and Related Compounds," Part I: Estimating Exposure to Dioxin-Like Compounds, Vol. 2: Sources of Dioxin-Like Compounds in

the United State," December 2003 (see on-line at www.epa.gov/ncea/pdfs/dioxin/nas-review/pdfs/part1_vol1/dioxin_pt1_vol1_ch01_dec2003.pdf). The second document is "Integrated Pollution Prevention and Control (IPPC) - Best Available Techniques Reference Document on the Production of Iron and Steel," European Commission, December 2001 (see on-line at europa.eu.int/comm/environment/ippc/brefs/isp_bref_1201.pdf).

Because Keetac already has the capability to burn fuel oil at the indurating furnace and plans to add the capability to burn coal, we examined the relative emission rates of other types of emission units while they burn each of these fuels. Coal-firing and oil-firing utility boilers release dioxins/furans in the same order of magnitude in mass, from our calculation using emission data taken from the "Study of Hazardous Air Pollutant Emissions from Electric Utility Steam Generating Units – Final Report to Congress," Volume 2. Appendices. EPA-453/R-98-004b, February, 1998, Tables A-4 and A-5 (see on-line at www.epa.gov/ttn/oarpg/t3/reports/eurtc2.pdf).

Because the emissions from oil-burning utility boilers are similar to coal-burning utility boilers, we do not anticipate a major change in the potential emissions of dioxins and furans due to the proposed projects at Keetac. Also, the addition of one powder line wet scrubber downstream of each of the two existing multiclones will reduce the stack gas temperature from 250°F to about 120°F. Thus, the waste gas pollution control equipment upgrade should act to limit the formation of dioxins and furans.

From our examination of the permit application and reference materials, we have decided not to add any new conditions to Keetac's permit regarding dioxins and furans.

We will include your comments and our responses in the permit file so that we all are aware of your concerns. We have also forwarded your comments to the company for their consideration.

We will proceed with the issuance of this amendment. Please let me know if you have any comments or concerns regarding the contents of this letter. You may reach me at (651)296-7711.

Sincerely,

Carolina Espejel-Schutt, P.E.
Supervisor
Air Quality Permit Unit 1
Air Quality Permit Section
Industrial Division

CES: HJ

cc: Jennifer Darrow, USEPA Region V
Bob Beresford, MPCA Duluth Office
Hongming Jiang, MPCA

AQ File No. 62B

bcc: Beverly Conerton, AGO
Rick Cool, AGO
Faye Sleeper, MPCA

Appendix D

Technical Support Document

TECHNICAL SUPPORT DOCUMENT
For DRAFT AIR EMISSION PERMIT NO. 13700063-003

This technical support document is intended for all parties interested in the draft permit and to meet the requirements that have been set forth by the federal and state regulations (40 CFR § 70.7(a)(5) and Minn. R. 7007.0850, subp.1). The purpose of this document is to provide the legal and factual justification for each applicable requirement or policy decision considered in the preliminary determination to issue the draft permit.

1. Facility and Emission Information

1.1. Applicant and Stationary Source Location:

Applicant/Address	Stationary Source/Address (SIC: 1011)
U.S. Steel Corp. Minnesota Ore Operations P.O. Box 217 Keewatin, MN 55753	Keewatin Taconite 1 Mine Road Keewatin; St. Louis County
Contact: LaTisha Gietzen, Environmental Department Manager, Phone: (218) 778-8672	

1.2. Description of the Permit Action

The Permittee operates a taconite (iron ore) mine and processing plant in Keewatin, Minnesota. The facility produces taconite pellets for use as a primary raw ingredient at iron and steel mills. Major activity areas at the facility include: mines and crushers, concentrating, pelletizing, pellet storage and loadout, additive receiving and handling, concentrate storage, loadout and receiving, and support activities. Four permit applications are processed through this permit action (003).

1. Part 70 Permit Reissuance
A plan for Compliance Assurance Monitoring (CAM) was submitted on April 6, 2004, which supplemented the Part 70 permit reissuance application submittal of February 5, 2002.

2. Administrative Amendment for Ownership Change
The application date is July 21, 2003. A temporary measure was taken then by making a new cover page for Permit No. 13700063-002 to reflect facility ownership change. Permit action 003 will make the facility name change in Tables A and B, in addition to the cover page change.

3. Major Permit Amendment for Fuel Diversification and Other Projects – a Major Modification
The August 3, 2004, permit application includes the following three projects.

The first project, pollution control equipment upgrade, *in itself*, does not require a major permit amendment, as per Minn. R. 7007.1150, Item C(1). Phase II induration waste gas stream at the outlets of the two existing multiclones (CE 030 and CE 031) will be connected to two new wet scrubbers (CE 110 and CE 111, respectively) for venting through a new, combined waste gas stack (SV 051). Permittee undertakes this project to meet the requirements of Subpart RRRRR of National Emission Standards for Hazardous Air Pollutants: Taconite Iron Ore Processing

(NESHAP; 40 CFR 63.9580 to 63.9652). On September 27, 2004, Permittee broke ground to begin construction.

Fuel diversification, the second project, will enable the Phase II indurating kiln to burn coal and petroleum coke in addition to natural gas and distillate fuel oil. Coal handling equipment (GP 003), which is subject to Subpart Y of New Source Performance Standards (NSPS; 40 CFR 60.250 to 60.254), is expected to start up initial operation on September 30, 2005.

Adding a scrubber-equipped secondary annular cooler to the Phase II grate-kiln-cooler system (commonly referred to as *grate-kiln system*), the third project, will enable Permittee to make approximately 6.0 million long tons of taconite concentrate pellets per year, a 10% increase from the current level. The new, secondary cooler is expected to start up initial operation on May 31, 2007, after the actual startup of the first project and the compliance date of NESHAP, subp. RRRRR, October 30, 2006. It is subject to both NESHAP, subp. RRRRR, and NSPS, subp. LL.

Permittee has shown through netting that, with the proposed annual emission limits for Phase II waste gas stack on PM, PM_{10}, NO_x, SO_2, CO, and VOC, calculated as their respective 12-month rolling sums, the three projects combined will be a minor modification under Prevention of Significant Deterioration (PSD; 40 CFR 52.21) regulations. A major permit amendment is required for the last two projects, as per Minn. R. 7007.1500, subp. 1. Permittee has proposed wet scrubber monitoring conditions to meet the requirements of NESHAP, subp. RRRRR.

4. Administrative Amendment for Control Equipment Monitoring
In a permit application dated August 20, 2004, in order to meet the requirements of NESHAP, subp. RRRRR, Permittee proposed to phase in, by October 30, 2006, new continuous parametric monitoring systems (CPMS) at designated, existing control devices (*which are not associated with the projects for the Major Permit Amendment described above*), which include wet scrubbers (CE 002, CE 004 - CE 016, CE 020, CE 022, CE 024, CE 032, and CE 034) and centrifugal collectors (CE 001 and CE 003). The O & M plan will be updated with the CPMS.

In this permit action, the six groups of units are revised to exclude idled Phase I equipment. GP 003 is now for solid fuel (coal & petroleum coke) handling equipment; GP 004 for Phase II grate feed and discharge; GP 006 for additive blending (actually fluxstone processing) with more units added. Other groups remain unchanged from previous permit actions. Table A requirements for are now set at facility (FC), group (GP), and emission unit (EU) levels.

1.3 Description of Amendments Issued Since the Issuance of the Last Total Facility Permit

Permit Number & Issuance Date	Action Authorized
13700063-003 August 17, 1998	Revision of performance testing requirements based on initial performance testing results.

1.4. Facility Emissions:

Table 1. Summary of Potential to Emit (PTE, ton/year)

Pollutant	NO_x	PM	PM_{10}	SO_2	CO	SO_3	VOC	Pb	HAPs
Net PTE Change for the Projects [1]	35.0	-1379	-287	35.0	90.0	3.50	35.0	0.0491	See foot-note [2]
Total facility PTE with the Projects	6,076	1,899	1,293	951	123	95.1	74.6	0.228	> 25
Total facility PTE with the Projects & [3] Idled Phase I	10,200	4,900	3,730	1,480	170	95.1	103	0.595	> 25

1. The Projects refer to the major modification described in Section 1.2 of this TSD. See Sections 1.4.1 and 1.4.2 for detail. The PM and PM_{10} values in this row resulted from netting, for which fluoride (a PSD pollutant) PTE values were left blank. However, PTE change of fluoride for the projects is expected to be less than 3.0 ton/year.
2. Taconite NESHAP (40 CFR 63, subp. RRRRR) regulate PM (front-half catch of a Method 5 sampling train as a surrogate for hazardous air pollutants (HAPs). PTE of mercury for the Projects is a net reduction, 124.75 – 125.65 = - 0.9 lb/year. See Sections 1.4.3 and 1.4.4 for more detail.
3. Phase I is an older indurating grate-kiln system (with a multiclone-controlled waste gas stack), which has been idled before Permit Action 001. PTE for Phase I and associated equipment was estimated for Permit Action 001 (with an exception – SO3 was not estimated) and has not been changed. While understanding reactivating Phase I would be reviewed under PSD (40 CFR 52.21), Permittee has asked MPCA permit staff to keep "Permit Allowable (ton/year)" values for Phase I equipment in DELTA. As a result, this bottom row is the total values given in DELTA "Facility Description." Note that the corresponding "Actual Emission (ton/year)" values have been set to zero for Phase I and associated equipment since Permit Action 001.

Table 2. Facility Classification

Classification	Major/Affected Source	Synthetic Minor	Minor
PSD	Facility	Projects	
Part 70 Permit Program	✓		
Part 63 NESHAP	✓		

1.4.1. Potential to Emit Calculation

The August 3, 2004, permit application provides tables of baseline actual emissions for point sources (Table 3) and for fugitive sources (Table 4); projected actual emissions for point sources (Table 5) and for fugitive sources (Table 6); the resultant emissions increase for existing point sources and fugitive sources (Table 7).

The permit application also provides tables of future potential emissions for new point sources (Table 8) and for new fugitive sources (Table 9). Finally, Table 10 gives a summary for the major modification.

Table 3. Baseline Actual Emissions for Point Sources

Stack Vent	Pollutant	Emission Factor (lb/ton pellet)	Factor From	% Total	Tons Throughput	Emissions (tons/yr)
001	PM	0.0012	S.T.-' 01	0.30	6091332	1.09
	PM10	0.0012	S.T.-' 01	0.30	6091332	1.09
002	PM	0.00033	S.T.-' 99	0.70	6091332	0.70
	PM10	0.00033	S.T.-' 99	0.70	6091332	0.70
003	PM	0.0084	S.T.-' 01	0.30	6091332	7.64
	PM10	0.0084	S.T.-' 01	0.30	6091332	7.64
004	PM	0.00056	S.T.-' 01	0.70	6091332	1.20
	PM10	0.00056	S.T.-' 01	0.70	6091332	1.20
005-010	PM	0.048	S.T.-' 02	0.6	6091332	87.72
	PM10	0.048	S.T.-' 02	0.6	6091332	87.72
011-014	PM	0.00156	S.T.-' 01	0.4	6091332	1.90
	PM10	0.00156	S.T.-' 01	0.4	6091332	1.90
015	PM	0.037	S.T.-' 01	0.125	44461	0.10
	PM10	0.037	S.T.-' 01	0.125	44461	0.10
016	PM	0.037	S.T.-' 01	0.875	44461	0.72
	PM10	0.037	S.T.-' 01	0.875	44461	0.72
017	PM	0.024	AP-42		66490	0.80
	PM10	0.024	AP-42		66490	0.80
018	PM	0.024	AP-42	0.7	44461	0.37
	PM10	0.024	AP-42	0.7	44461	0.37
020	PM	0.0015	S.T.-' 02		6091332	4.57
	PM10	0.0015	S.T.-' 02		6091332	4.57
022	PM	0.0013	S.T.-' 02		6091332	3.96
	PM10	0.0013	S.T.-' 02		6091332	3.96
024	PM	0.0012	S.T.-' 01		6091332	3.65
	PM10	0.0012	S.T.-' 01		6091332	3.65
026	PM	0.066	S.T.-' 01		6091332	201.01
	PM10	0.021	S.T.-' 01		6091332	63.96
030	PM	0.3446	S.T.-04		6091332	1049.54
030+031	PM10	0.341	S.T.-' 00		6091332	1038.57
	CO	0.0108	S.T.-' 00		6091332	32.89
	Sox	0.3009	S.T.-04		6091332	916.44
	Nox	1.9836	S.T.-' 00		6091332	6041.38
	VOC	0.013	S.T.-' 00		6091332	39.59
	Pb	0.00005872	S.T.-' 99		6091332	0.18
	H2SO4 Mist	0.03009	10% SOx		6091332	91.64
031	PM	0.4098	S.T.-04		6091332	1248.11
032	PM	0.00066	S.T.-' 02		6091332	2.01
	PM10	0.00066	S.T.-' 02		6091332	2.01
034	PM	0.0036	AP-42		6091332	10.96
	PM10	0.0036	AP-42		6091332	10.96
037	PM	0.00053	S.T.-' 00		6091332	1.61
	PM10	0.00053	S.T.-' 00		6091332	1.61
038	PM	0.00053	S.T.-' 00		6091332	1.61
	PM10	0.00053	S.T.-' 00		6091332	1.61
039	PM	0.024	AP-42	0.3	44461	0.16
	PM10	0.024	AP-42	0.3	44461	0.16

TOTAL for Stack Vents

The values for PM10, NOx, CO, and VOC were calculated using the 2000 stack test and dividing the lb/hr value by the TPH at test time (885 GBFR* 0.71 reduction factor = 628 LTPH *1.12 = 703.36 TPH). This value is multiplied by two to represent both waste gas stacks. SOx was calculated the same as above using 2004 data.

PM	2629.46
PM10	1233.32
CO	32.89
VOC	39.59
SOx	916.44
NOx	6041.38

Table 4. Baseline Actual Emissions for Fugitive Sources

Fugitive Source	Pollutant	Emission Factor	Factor From	Throughput	Units	Emissions (tons/yr)
002	PM	671.8	FEW	1.82	Acres	0.61
	PM10	335.9	FEW			0.31
003	PM	0.0026	FEW	19909609.5	Ore	25.88
	PM10	0.0012	FEW			11.95
004	PM	0.00182	FEW	5947708	Ore#1	5.41
	PM10	0.00084	FEW			2.50
005	PM	0.00182	FEW	13961901.5	Ore#2	12.71
	PM10	0.00084	FEW			5.86
007	PM	0.93	FEW	405150.6475	VMT	188.40
	PM10	0.52	FEW			105.34
012	PM	671.8	FEW	3.69	Acres	1.24
	PM10	335.9	FEW			0.62
014	PM	0.0007	FEW	8075414.5	tons ore	2.83
	PM10	0.0003	FEW			1.21
015	PM	0.93	FEW	405150.6475	VMT	188.40
	PM10	0.52	FEW			105.34
016	PM	0.0007	FEW	8075414.5	tons ore	2.83
	PM10	0.0003	FEW			1.21
017	PM	432	FEW	103.05	acres	22.26
	PM10	216	FEW			11.13
018	PM	0.193	FEW	810301.29	VMT	78.19
	PM10	0.108	FEW			43.76
019	PM	432	FEW	172.1	acres	37.17
	PM10	216	FEW			18.59
021	PM	0.0007	FEW	403142.3	tons	0.14
	PM10	0.0003	FEW			0.06
022	PM	0.0007	FEW	403142.3	tons	0.14
	PM10	0.0003	FEW			0.06
023	PM	1130.6	FEW	3.20	acres	1.81
	PM10	565.3	FEW			0.91
027	PM	671.8	FEW	0.51	acres	0.17
	PM10	335.9	FEW			0.09
028	PM	0.00738	FEW	6091332.24	tons	22.48
	PM10	0.00348	FEW			10.60
029	PM	671.8	FEW	1.24	acres	0.42
	PM10	335.9	FEW			0.21
030	PM	1130.6	FEW	2.57	acres	1.45
	PM10	565.3	FEW			0.73
033	PM	0.0123	FEW	6091332.24	tons	37.46
	PM10	0.0058	FEW			17.66
035	PM	0.00052	FEW	19909609.50	ore	5.18
	PM10	0.00024	FEW			2.39
036	PM	0.00156	FEW	22505.93	tons	0.02
	PM10	0.00072	FEW			0.01
039	PM	0.004428	FEW	6091332.24	tons	13.49
	PM10	0.002088	FEW			6.36

TOTAL for Fugitive Sources

PM	**648.67**
PM10	**346.87**

Table 5. Projected Actual Emissions for Point Sources

Stack Vent	Pollutant	Emission Factor (lb/ton pellet)	Factor From	% Total	Tons Throughput	Emissions (tons/yr)
001	PM	0.0012	S.T.-' 01	0.30	6720000	1.20
	PM10	0.0012	S.T.-' 01	0.30	6720000	1.20
002	PM	0.00033	S.T.-' 99	0.70	6720000	0.78
	PM10	0.00033	S.T.-' 99	0.70	6720000	0.78
003	PM	0.0084	S.T.-' 01	0.30	6720000	8.43
	PM10	0.0084	S.T.-' 01	0.30	6720000	8.43
004	PM	0.00056	S.T.-' 01	0.70	6720000	1.32
	PM10	0.00056	S.T.-' 01	0.70	6720000	1.32
005-010	PM	0.048	S.T.-' 02	0.6	6720000	96.77
	PM10	0.048	S.T.-' 02	0.6	6720000	96.77
011-014	PM	0.00156	S.T.-' 01	0.4	6720000	2.10
	PM10	0.00156	S.T.-' 01	0.4	6720000	2.10
015	PM	0.037	S.T.-' 01	0.125	49050	0.11
	PM10	0.037	S.T.-' 01	0.125	49050	0.11
016	PM	0.037	S.T.-' 01	0.875	49050	0.79
	PM10	0.037	S.T.-' 01	0.875	49050	0.79
017	PM	0.024	AP-42		73352	0.88
	PM10	0.024	AP-42		73352	0.88
018	PM	0.024	AP-42	0.7	49050	0.41
	PM10	0.024	AP-42	0.7	49050	0.41
020	PM	0.0015	S.T.-' 02		6720000	5.04
	PM10	0.0015	S.T.-' 02		6720000	5.04
022	PM	0.0013	S.T.-' 02		6720000	4.37
	PM10	0.0013	S.T.-' 02		6720000	4.37
024	PM	0.0012	S.T.-' 01		6720000	4.03
	PM10	0.0012	S.T.-' 01		6720000	4.03
026	PM	0.066	S.T.-' 01		6720000	221.76
	PM10	0.021	S.T.-' 01		6720000	70.56
051	PM	0.02 gr/dscf	596000	LIMIT @ 0.02 GR/DSCF		447.51
replaces	PM10	0.02 gr/dscf	596000	LIMIT @ 0.02 GR/DSCF		447.51
030 and 031	CO	0.0108	S.T.-' 00	LIMIT @ ACTUAL + 90		122.89
	SO2	0.3009	S.T.-04	LIMIT @ ACTUAL + 0		916.44
	NOx	1.9836	S.T.-' 00	LIMIT @ ACTUAL + 35		6076.38
	VOC	0.013	S.T.-' 00	LIMIT @ ACTUAL + 35		74.59
	Pb - pellets	0.00005872	S.T.-' 99		6720000	0.20
	Pb - coal	4.20E-04	AP-42		146105	0.03
	H2SO4 Mist	0.03009	10% of SO2 Emissions			91.64
032	PM	0.00066	S.T.-' 02		6720000	2.22
	PM10	0.00066	S.T.-' 02		6720000	2.22
034	PM	0.0036	AP-42		6720000	12.10
	PM10	0.0036	AP-42		6720000	12.10
037	PM	0.00053	S.T.-' 00		6720000	1.78
	PM10	0.00053	S.T.-' 00		6720000	1.78
038	PM	0.00053	S.T.-' 00		6720000	1.78
	PM10	0.00053	S.T.-' 00		6720000	1.78
039	PM	0.024	AP-42	0.3	49050	0.18
	PM10	0.024	AP-42	0.3	49050	0.18

SO2: +35; = 951.44

TOTAL for Stack Vents

PM	813.56
PM10	662.36
CO	122.89
VOC	74.59
SOx	916.44
NOx	6076.38

Should be: 951.44

Table 6. Projected Actual Emissions for Fugitive Sources

Fugitive Source	Pollutant	Emission Factor	Factor From	Throughput	Units	Emissions (tons/yr)
002	PM	671.8	FEW	4.02	Acres	1.35
	PM10	335.9	FEW			0.67
003	PM	0.0026	FEW	25045700.9	Ore	32.56
	PM10	0.0012	FEW			15.03
004	PM	0.00182	FEW	9461491.6	Ore#1	8.61
	PM10	0.00084	FEW			3.97
005	PM	0.00182	FEW	15584210.4	Ore#2	14.18
	PM10	0.00084	FEW			6.55
007	PM	0.93	FEW	645045.83	VMT	299.95
	PM10	0.52	FEW			167.71
012	PM	671.8	FEW	7.58	Acres	2.55
	PM10	335.9	FEW			1.27
014	PM	0.0007	FEW	10986650.4	tons o	3.85
	PM10	0.0003	FEW			1.65
015	PM	0.93	FEW	645045.83	VMT	299.95
	PM10	0.52	FEW			167.71
016	PM	0.0007	FEW	10986650.4	tons o	3.85
	PM10	0.0003	FEW			1.65
017	PM	432	FEW	160.24	acres	34.61
	PM10	216	FEW			17.31
018	PM	0.193	FEW	1290091.66	VMT	124.49
	PM10	0.108	FEW			69.66
019	PM	432	FEW	220.0	acres	47.52
	PM10	216	FEW			23.76
021	PM	0.0007	FEW	525092.0	tons	0.18
	PM10	0.0003	FEW			0.08
022	PM	0.0007	FEW	525092.0	tons	0.18
	PM10	0.0003	FEW			0.08
023	PM	1130.6	FEW	5.69	acres	3.21
	PM10	565.3	FEW			1.61
027	PM	671.8	FEW	1.10	acres	0.37
	PM10	335.9	FEW			0.18
028	PM	0.00738	FEW	6720000.00	tons	24.80
	PM10	0.00348	FEW			11.69
029	PM	671.8	FEW	2.83	acres	0.95
	PM10	335.9	FEW			0.47
030	PM	1130.6	FEW	3.96	acres	2.24
	PM10	565.3	FEW			1.12
033	PM	0.0123	FEW	6720000.00	tons	41.33
	PM10	0.0058	FEW			19.49
035	PM	0.00052	FEW	25045700.9	ore	6.51
	PM10	0.00024	FEW			3.01
036	PM	0.00156	FEW	64650.43	tons	0.05
	PM10	0.00072	FEW			0.02
039	PM	0.004428	FEW	6720000.00	tons	14.88
	PM10	0.002088	FEW			7.02

TOTAL for Fugitive Sources

PM	**968.16**
PM10	**521.71**

Table 7. Emissions Increase for Existing Point Sources and Fugitive Sources

Stack Vent	Pollutant	Emissions Increase (tons/yr)
001	PM	0.11
	PM10	0.11
002	PM	0.07
	PM10	0.07
003	PM	0.79
	PM10	0.79
004	PM	0.12
	PM10	0.12
005-010	PM	9.05
	PM10	9.05
011-014	PM	0.20
	PM10	0.20
015	PM	0.01
	PM10	0.01
016	PM	0.07
	PM10	0.07
017	PM	0.08
	PM10	0.08
018	PM	0.04
	PM10	0.04
020	PM	0.47
	PM10	0.47
022	PM	0.41
	PM10	0.41
024	PM	0.38
	PM10	0.38
026	PM	20.75
	PM10	6.60
051	PM	-1850.14
replaces	PM10	-591.06
030 and 031	CO	90
	SO2	0
	NOx	35
	VOC	35
	Pb - total	0.05
	H2SO4 Mist	0
032	PM	0.21
	PM10	0.21
034	PM	1.13
	PM10	1.13
037	PM	0.17
	PM10	0.17
038	PM	0.17
	PM10	0.17
039	PM	0.02
	PM10	0.02

Fugitive Source	Pollutant	Emissions Increase (tons/yr)
002	PM	0.74
	PM10	0.37
003	PM	6.68
	PM10	3.08
004	PM	3.20
	PM10	1.48
005	PM	1.48
	PM10	0.68
007	PM	111.55
	PM10	62.37
012	PM	1.31
	PM10	0.65
014	PM	1.02
	PM10	0.44
015	PM	111.55
	PM10	62.37
016	PM	1.02
	PM10	0.44
017	PM	12.35
	PM10	6.18
018	PM	46.30
	PM10	25.91
019	PM	10.35
	PM10	5.18
021	PM	0.04
	PM10	0.02
022	PM	0.04
	PM10	0.02
023	PM	1.40
	PM10	0.70
027	PM	0.20
	PM10	0.10
028	PM	2.32
	PM10	1.09
029	PM	0.53
	PM10	0.27
030	PM	0.79
	PM10	0.39
033	PM	3.87
	PM10	1.82
035	PM	1.34
	PM10	0.62
036	PM	0.03
	PM10	0.02
039	PM	1.39
	PM10	0.66

TOTAL for Stack Vents

PM (increases only)		34.24
PM10 (increases only)		20.10
CO		90
VOC		35
SOx		0
NOx		35
Pb		0.049
H2SO4 Mist		0

TOTAL for Fugitive Sources

PM	319.49
PM10	174.84

Table 8.

Table 3-1. Potential to Emit from New Point Sources

Stack Vent/ Emission Unit	Description of Source	Emission Factors	Emission Factor Units	Design Throughput Capacity	Design Throughput Capacity Units	Maximum Uncontrolled Emissions (lb/hr)	Maximum Uncontrolled Emissions (ton/yr)	Pollution Control Efficiency[1,2,3] (%)	Maximum Controlled Emissions (lb/hr)	Maximum Controlled Emissions (ton/yr)	Emission Factor Notes
EU 061	Lime Receiving	2.20E+00	lb PM/ton	25.0	ton/hr	55.00	2.75	99%	0.55	0.03	(4)
EU 057	Coal Receiving (at Hopper)	1.91E-01	lb PM/ton	16.7	ton/hr	3.19	13.96	79%	0.67	2.93	(5)
		2.31E-02	lb PM10/ton	16.7	ton/hr	0.38	1.69	79%	0.08	0.35	(5)
EU 058	Coal Crushing and Transfers	2.20E-01	lb PM/ton	16.7	ton/hr	3.67	16.09	95%	0.18	0.80	(6)
		2.20E-01	lb PM10/ton	16.7	ton/hr	3.67	16.09	95%	0.18	0.80	(6)
EU 059	Coal Pulverizing and Transfers	2.20E-01	lb PM/ton	16.7	ton/hr	3.67	16.09	95%	0.18	0.80	(6)
		2.20E-01	lb PM10/ton	16.7	ton/hr	3.67	16.09	95%	0.18	0.80	(6)
EU 060	Secondary Cooler - **MACT Limit Controlled**	8.00E-03	gr/dscf	350,000	dscfm				24.00	105.12	(7)

Notes:

1. Fabric filter control efficiency per Minn. R. 7011.0070 of 99% for emission unit with total enclosure.
2. Fabric filter control efficiency of 95% is based on 80% capture efficiency of dust collector and remaining amount is captured within the building: (80% x 99%) + (20% x 80% x 99%)
2. Fabric filter control efficiency of 79% is based on 80% capture efficiency of outside dust collector: (80% x 99%)
4. AP-42 Chapter 11.17, Lime Manufacturing, February 1998, Table 11.17-4, for "Product transfer and conveying", (SCC #3-05-016-15)
5. AP-42 Chapter 11.9, Western Surface Coal Mining, October 1998, Table 11.9-1, for "Truck loading"
6. AP-42 Section 12.2, Coke Production, Draft August 2001, Table 12.2-18, "Coal crushing with cyclone". Uncontrolled emissions are back-calculated using assumed 50% control efficiency.
7. Calculated based on Taconite MACT limit of 0.008 gr/dscf. PM assumed to be equal to PM10.

Table 9. 'otential to Emit from New Fugitive Sources

Fugitive Particulate Source ID Number	Description of Fugitive Source	Emission Factors	Emission Factor Units	Maximum Operating Parameter	Maximum Operating Parameter Units	Maximum Uncontrolled Emissions[1] (lb/hr)	Maximum Uncontrolled Emission (ton/yr)	Pollution Control Efficiency (%)	Maximum Controlled Emissions (lb/hr)	Maximum Controlled Emissions (ton/yr)	Emiss Fact Not
FS 040	Coal Delivery	1.04E+01	lb PM/VMT	1314	VMT/yr	1.70	6.86	0%	1.6993	6.86	(2)
		2.77E+00	lb PM10/VMT	1314	VMT/yr	0.45	1.82	0%	0.4498	1.82	(2)
FS 041	Coal Receiving	7.00E-03	lb PM/ton	16.7	ton/hr	0.12	0.51	0%	0.12	0.51	(3)
		1.00E-03	lb PM10/ton	16.7	ton/hr	0.02	0.07	0%	0.02	0.07	(4)
FS 042	Coal Pile[6]	4.75E+02	lb PM/acre/yr	0.95	surface area in acres	0.05	0.23	0%	0.0515	0.23	(5)
		2.37E+02	lb PM10/acre/yr	0.95	surface area in acres	0.03	0.11	0%	0.0257	0.11	(5)

Notes:

1. Coal delivery hourly emissions are calculated from the annual maximum uncontrolled emission rate and assume a 8,078 hours per year of operation.
2. AP-42 Chapter 13.2.2 Unpaved Roads, December 2003, Section 13.2.2.2, Formula 1a
3. AP-42 Chapter 11.9 Western Surface Coal Mining, October 1998, Table 11.9-4, for "End dump truck unloading (batch drop)", (SCC #3-05-010-40)
4. In: PM10 Emission Factors Listing Developed by Technology Transfer and AIRS Source Classification Codes with Documentation, Use EPA-450/4-82-016, Appendix K-13; 15% 10 microns, March 1992, for "End dump truck unloading (batch drop)", (SCC #3-05-010-40)
5. AP-42 Chapter 13.2.5 Industrial Wind Erosion, January 1995, See FASTWIND spreadsheet.
6. Assumes a 10,000 ton conical storage pile, 30 ft high with a diameter at the base of 226 ft.

Estimated Vehicle Miles Traveled

N =	18	Number of Trucks
d =	0.2	Round Trip Distance (miles)
wt =	20	Tons coal/ truck
	360	Tons coal/ day
VMT/yr =	1,314	Estimated Vehicle Miles Traveled/year (Assumes worst case 356 days/yr)

Calculated Emission Factors

Uncontrolled Coal Delivery = $E = k * [(s/12)^a * (W/3)^b]$ =

10.45 lb PM-30/VMT AP-42 Chapter 13.2.2 Unpaved Roads, December 2003, Section 13.2.2.2, Formula
2.77 lb PM-10/VMT

Controlled Coal Delivery = $E_{ext} = E * [(365 - P)/365]$ =

7.01 lb PM-30/VMT
1.86 lb PM-10/VMT

	PM-10	PM-30	
k =	1.5	4.9	Particle size multiplier (lb/VMT)
a =	0.9	0.7	Constant a
b =	0.45	0.45	Constant b
s =	5.8	5.8	Surface material silt content %
W =	50	50	Mean Vehicle weight (tons)
P =	120	120	Number of days with 0.01 inches of precipitation

Table 10. The Major Modification Summary

Column A	Column B	Column C	Column D	Column E
POLLUTANT	Emissions increases from modified, replacement, or debottlenecked units (from Table 2) (tpy)	Emissions from new units (from Table 3) (tpy)	Total Increase (tpy)	Significant Thresholds for major sources
PM	**354**	**117**	**471**	25 [1]
PM_{10}	**195**	**109**	**304**	15
NO_x	**35**		**35**	40
SO_2	**35**		**35**	40
CO	**90**		**90**	100
Ozone (VOC)	**35**		**35**	40
Lead	**0.05**		**0.05**	0.6
Fluorides				3
Sulfuric acid mist	**3.5**		**3.5**	7
Hydrogen Sulfide (H_2S)				10
Total Reduced Sulfur including H_2S				10
Reduced Sulfur Compounds including H_2S				10
MWC Organics [2]				0.0000035
MWC Acid Gas [3]				40
MWC Metals [4]				15
MSW Landfill Gas				50

Note 1 - July 31, 1987, the National Ambient Air Quality Standard for TSP (PM) was repealed and replaced with a standard for PM_{10}. The significant levels in this table are as they appear in the Code of Federal Regulations, March 1994. A source may not be required to comply with Nonattainment NSR for TSP increases above 25 tpy, but may be for PM_{10} above 15 tpy.

Note 2 - MWC Organics means Municipal Waste Combustor Organics. These are defined as total tetra-thro-octa-chlorinated dibenzo-para-dioxins and dibenzofurans.

Note 3 - MWC acid gases are measured as the sum of sulfur dioxide and hydrochloric acid.

Note 4 – MWC Metals are measured as particulate matter

1.4.2. Netting for PSD Applicability Determination

The August 3, 2004, permit application provides netting calculations, as shown in Tables 11 through 13.

Table 11. Project Emissions Increase Compared to PSD Significant Emission Rate

Emission Unit	PM	PM_{10}	SO_2	NO_x	CO	VOC	Pb	Sulfuric Acid Mist
New Coal Handling Facilities (EU 057-059, FS 040-042)	12.1	3.97						
New Secondary Cooler (EU 060)	105	105						
New Lime Receiving Facility (EU 061)	0.0275	0.0275						
Existing Pellet Indurating Furnace (EU 030)	0[(A)]	0[(A)]	35	35	90	35	0.05	3.5
Existing Particulate Sources Associated with Project	354	195						
Project Emissions Increase (ton/yr)	471	304	35	35	90	35	0.05	3.5
PSD Significant Emission Rate (ton/yr)	25	15	40	40	100	40	0.6	7
Is Project Emissions Increase Greater than PSD Significant Emission Rate?	Yes	Yes	No	No	No	No	No	No

[A] Permittee is proposing to decrease actual PM and PM 10 emissions from this unit. However an actual emissions decrease cannot be accounted for when calculation the project emissions increase under PSD rules. An emissions decrease is creditable only when a PSD netting analysis is performed.

Table 12. Netting Analysis Table for PM and PM10 Emissions

Actual or *Expected* Startup Date	Modification Description	Permit No. or Permit Application Submittal	Change in PM Emissions (tpy)	Change in PM10 Emissions (tpy)
May-03	New Bentonite Conveyor (EU 018) Dust Collector (CE 049)	Minn. R. 7007.1250 notification of pollution control equipment replacement	0.18	0.18
Aug-03	Screen House (EU 037) Dust Collector Replacement (CE 037)	Minn. R. 7007.1250 notification of pollution control equipment replacement	0.0	0.0
Apr-04	Cooler Dump Zone (EU 024) Dust Collector Replacement (CE 024)	Minn. R. 7007.1250 notification of pollution control equipment replacement	0.0	0.0
May-05	Wet Scrubber System on Grate/Kiln Furnace	Major permit amendment submitted	-1,850.14	-591.06
Aug-05	Alternative Fuels at Indurating Kiln and Facility Production Increase Project	Major permit amendment submitted	471.01	304.04
		Total Emissions Change in Contemporaneous Period:	**-1,378.95**	**-286.84**

Contemporaneous Time Frame for the Project

May-05	Expected Start of Construction
Sep-05	Expected Date of Start-up
May-00	Start of Contemporaneous Period
Sep-05	End of Contemporaneous Period

Table 13. Summary of Emissions for PSD Applicability Determination

	PM	PM_{10}	SO_2	NO_x	CO	VOC	Pb	Sulfuric Acid Mist
Project Emissions Increase (tpy)	471	304	35	35	90	35	0.05	3.5
PSD significant emission rate (tpy)	25	15	40	40	100	40	0.6	7
Is Project Emissions Increase Greater than PSD significant emission rate?	Yes	Yes	No	No	No	No	No	No
Netting Analysis: Sum of Contemporaneous Creditable Increases and Decreases Excluding Project Emissions Increase (tpy)	-1850	-591	N/A	N/A	N/A	N/A	N/A	N/A
Net Emissions Increase [Project Emissions Increase + Netting Analysis CCI/CCD] (tpy)	-1379	-287	N/A	N/A	N/A	N/A	N/A	N/A
Is Net Emissions Increase Greater than PSD significant emission rate?	No	No	N/A	N/A	N/A	N/A	N/A	N/A

1.4.3. Emission of Mercury Through the New Waste Gas Stack (SV 051)

The August 3, 2004, permit application includes a completed HG-2003 form with supportive process flow diagrams for the fuel diversification project.

These diagrams are presented as Figures 1 and 2. Figure 1 describes the current taconite concentrate pellet making process operations with natural gas as the indurating fuel fired at the grate-kiln furnace (distillate oil as the backup fuel, typically used during natural gas curtailment or other interruptions). Furnace exhaust gas (waste gas) exit through two parallel paths, each goes through a multiclone (a dry, centrifugal particulate control device – having little to no effect on removing mercury from the waste gas stream) before reaching one of the two waste gas stack (SV 030 & SV 031). Figure 2 describes the pellet making process operation, after the completion of new waste gas wet scrubber system and fuel diversification projects. Coal is shown as the indurating fuel for mercury assessment purpose. Waste gas stream at the outlets of the two existing multiclones will be connected to two new wet scrubbers, respectively, for venting through a new, combined waste gas stack (SV 051).

Stack mercury emission is attributed to crude taconite ore in Figure 1, and to crude taconite ore and coal with a certain level of removal effect of the new wet scrubbers (to be discussed in a paragraph below) in Figure 2. While natural gas can be assumed to contribute very little of mercury in the indurating process, coal is expected to contribute to stack mercury emission in Figure 2. A net reduction of stack mercury emission is expected as a result of the major modification; i.e., from the operations of Figure 1 to Figure 2:

124.75 - 125.65 = - 0.90 lb/year.

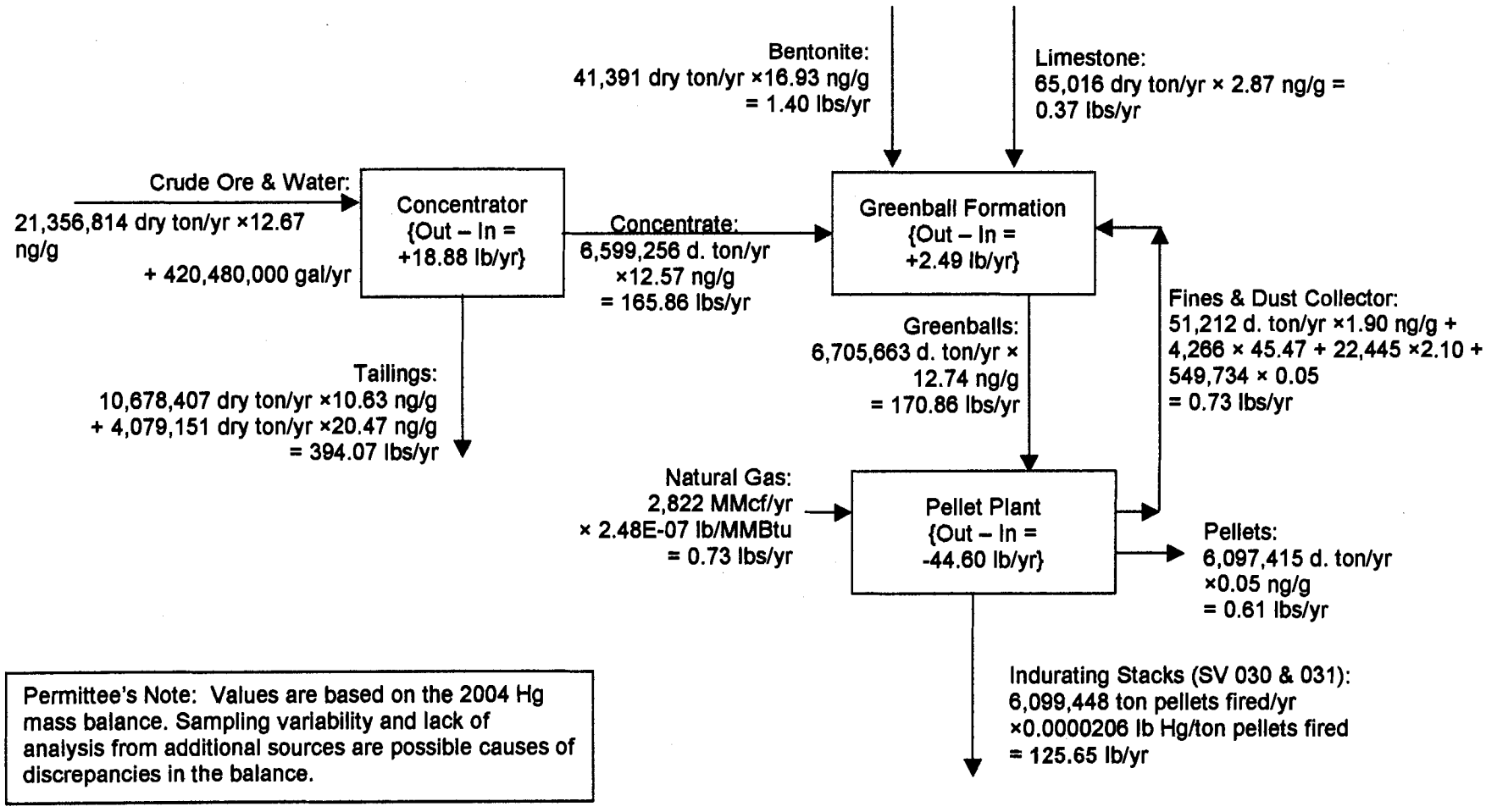
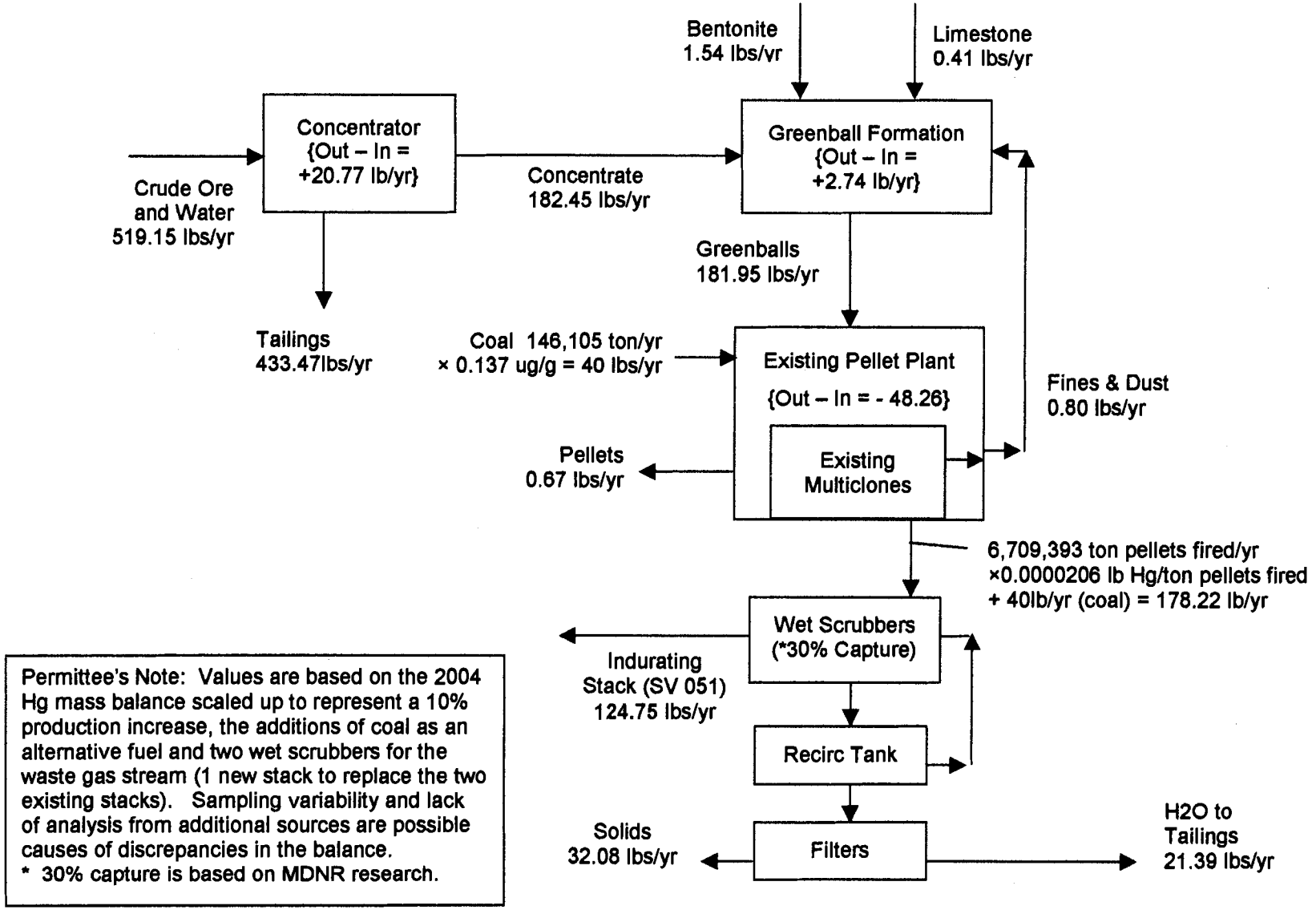


Figure 1. Keewatin Taconite Current Mercury Mass Balance



Permittee's Note: Values are based on the 2004 Hg mass balance scaled up to represent a 10% production increase, the additions of coal as an alternative fuel and two wet scrubbers for the waste gas stream (1 new stack to replace the two existing stacks). Sampling variability and lack of analysis from additional sources are possible causes of discrepancies in the balance.
* 30% capture is based on MDNR research.

Figure 2. Keewatin Taconite Future Actual Mercury Mass Balance

Mass balance data (*material mercury content multiplied by material usage rates*), as shown in Figures 1 and 2, are not suitable for deriving stack mercury emission. This is due in part to the variability in materials, which becomes apparent in the mass balance gaps (the non-zero values of "out*flows* - in*flows*" marked in the boxes in Figures 1 and 2).

As a contrast, stack mercury emission tests for the waste gas stream, when the indurating furnace was fired with natural gas, reported very close values, as shown in Table 14. Consequently, the 2004 stack mercury emission factor is used to estimate stack mercury emission in Figure 1, and to estimate stack mercury emission attributed to crude taconite ore in Figure 2.

Table 14. Stack Testing Results of EU 030 (Phase II Furnace): Total Mercury

Test Date	8/10/1999	1/27/2004
Mass emission rate (lb/hr)	0.0149	0.0146
Emission factor (lb Hg/ton pellets fired)	0.0000198	0.0000206
Emission factor (ng Hg/g pellets fired)	9.92	10.3

Stack mercury emission attributed to coal combustion is estimated using a mercury emission factor for external coal combustion from AP-42 (9/98) Table 1.1-17 and the expected fuel usage. The MPCA permit staff accepts 30% as the *mercury control efficiency* for the new wet scrubbers

1.4.3. Mercury Control Efficiency

According to a preliminary report from Minnesota Department of Natural Resources, saved in DELTA as "TSD info - DNR Hg report 2004," waste gas wet scrubbers at U.S. Steel Minntac remove an average of 30% of mercury from the waste gas stream, while waste gas wet scrubbers at United Taconite remove an average of 2.7% of mercury. These are calculated with data from samples taken in 2003 and 2004. Fine dust captured in the wet scrubber is found to contain an elevated amount of mercury.

U.S. Steel Keewatin Taconite (Permittee) is planning for a new waste gas wet scrubber system not only similar to those at Minntac, but also with added sulfur removal capability (because of powdered lime addition to scrubber water and filtration of scrubber water downstream of the wet scrubbers). Permittee also accepts a state-only requirement that reads, "Permittee shall not reintroduce the solid material (fine dust) captured in the waste gas wet scrubber system (CE 110 and CE 111) into the agglomerating process" (*this permit condition is set at EU 030*). Thus, the 30% mercury control efficiency assumed in Figure 2 is reasonable to the MPCA permit staff.

The larger particles (containing high iron units and low mercury) will continue to be reclaimed from the pellet plant (including the existing multiclones) and reintroduced into the grinding circuits and the subsequent agglomerating process.

* *The language used in the state-only requirement for EU 030, "This is a state-only requirement and is not enforceable by the EPA Administrator and citizens under the Clean Air Act," refers to permit requirements that are mandated by state law rather than by the federal Clean Air*

Act. The language is to clarify the distinction between permit conditions that are required by federal law and those that are required by state law. State law requirements are not enforceable by U.S. EPA or by citizens under the federal Clean Air Act, but are fully enforceable by the MPCA and citizens under provisions of state law.

1.4.4. Idled Phase I and Associated Equipment

This permit action has two requirements in Table A, Item G. Permittee is aware that reactivating Phase I and associated equipment (**CE** 019, 021, 023, 027, 028, 029, and 033; **EU** 019, 021, 023, 025, 027, 028, and 029; **SV** 019, 021, 023, 025, 027, 028, and 029) will likely be reviewed under NSR/PSD rule. For this reason, additional requirements relating to air dispersion modeling, which existed in previous permit actions, have been removed.

2. Regulatory and/or Statutory Basis

New Source Review

The facility is an existing major source under New Source Review regulations. Netting and emission limits taken for Phase II indurating furnace make the Projects in this permit action a minor modification for New Source Review. NSR Reform rule is used in the applicability determination.

Part 70 Permit Program

The facility is a major source under the Part 70 permit program. A CAM plan was reviewed for Part 70 permit reissuance.

New Source Performance Standards (NSPS)

Subparts Y and LL of New Source Performance Standards are applicable to parts of the operations at this facility.

National Emission Standards for Hazardous Air Pollutants (NESHAP)

Subpart RRRRR of National Emission Standards for Hazardous Air Pollutants: Taconite Iron Ore Processing (40 CFR 63.9580 to 63.9652) is applicable to parts of the operations at this facility. Subpart RRRRR becomes effective on October 30, 2006.

Environmental Review

Minn. R. 4410.4300, subp. 15.A, requires a mandatory Environmental Assessment Worksheet (EAW) when potential emissions increase by 100 ton/year or more of any single air pollutant after installation of air pollution control equipment. The projects of the major modification include the installation of new emission units that will exceed the 100 ton/year threshold for PM and PM_{10}. However, in accordance with MPCA's guidance, "Calculating Air Emissions Increases for EAW Applicability," dated November 2003, an emissions decrease in PM and PM_{10} will occur with the installation and operation of the new waste gas wet scrubber system. The increase in emissions at maximum capacity from the new emissions units and the decrease in emissions at maximum capacity from installation of the new wet scrubber system are calculated to determine the net

emissions change under these rules. For simplification, the actual emissions decrease is used in Table 15 for the new wet scrubber system.

Because the new wet scrubber system will be installed concurrently with physical changes that will allow fuel diversification and a production increase, these projects should be considered together to determine the net emissions change. As shown Table 15, the net emissions change is less than the 100 ton/year increase threshold; therefore, a mandatory EAW is not required.

Table 15. EAW Applicability

	PM (ton/yr)	PM_{10} (ton/yr)
Controlled potential to emit from new emission units (lime receiving, coal handling, secondary cooler)	117	109
Actual emissions decrease from pellet indurating kiln after wet scrubber installed	-1850	-591
Project emissions change under Minn. R. 7007.1200, subp. 3	**-1733**	**-482**

Minnesota State Rules

Parts of the operations at this facility are subject to the following Minnesota Standards of Performance:

- Minn. R. 7011.0610 Standards of Performance for Fossil-Fuel-Burning Direct Heating Equipment
- Minn. R. 7011.0710 Standards of Performance for Pre-1969 Industrial Process Equipment
- Minn. R. 7011.0715 Standards of Performance for Post-1969 Industrial Process Equipment
- Minn. R. 7011.1150 Standards of Performance for Coal Preparation Plants
- Minn. R. 7011.2700 Standards of Performance for Metallic Mineral Processing Plants

Table 16. Regulatory Overview of Facility

Unit ID	Applicable Regulations	Comments
FC	NESHAP, subp. RRRRR	A reminder is placed at the Facility Level in Table A for the compliance date for this new, federal rule.
GP 001	Minn. R. 7011.0710	Standards of Performance for Pre-1969 Industrial Process Equipment
GP 002	Minn. R. 7011.0715	Standards of Performance for Post-1969 Industrial Process Equipment
GP 003	NSPS, subp. Y and Minn. R. 7011.1150	Standards of Performance for Coal Preparation Plants
GP 004	Minn. R. 7011.0715	Standards of Performance for Post-1969 Industrial Process Equipment
GP 005	NSPS, subp. LL and Minn. R. 7011.2700	Standards of Performance for Metallic Mineral Processing Plants
GP 006	Minn. R. 7011.0710; Minn. R. 7011.0715	Standards of Performance for Pre- and Post- 1969 Industrial Process Equipment
EU 001	Minn. R. 7011.0710	Standards of Performance for Pre-1969 Industrial Process Equipment
EU 002	Minn. R. 7011.0715	Standards of Performance for Post-1969 Industrial Process Equipment
EU 003	Minn. R. 7011.0710	Standards of Performance for Pre-1969 Industrial Process Equipment
EU 004	Minn. R. 7011.0715	Standards of Performance for Post-1969 Industrial Process Equipment
EU 024	Minn. R. 7011.0715	Standards of Performance for Post-1969 Industrial Process Equipment
EU 026	Minn. R. 7011.0715	Standards of Performance for Post-1969 Industrial Process Equipment. More frequent testing due to lack of control.
EU 030	Title I Conditions related to 40 CFR 52.21 & Minn. R. 4410.4300, subp. 15.A; and a state-only requirement	Netting is performed & "synthetic minor" limits are proposed to avoid a significant net emissions increase; to avoid EAW. There is a "state-only" requirement* – for mercury removal consideration, fine dust, which is to be captured in wet scrubbers, must not be reintroduced into the agglomerating process.

* The language "This is a state-only requirement and is not enforceable by the EPA Administrator and citizens under the Clean Air Act" refers to permit requirements that are mandated by state law rather than by the federal Clean Air Act. The language is to clarify the distinction between permit conditions that are required by federal law and those that are required by state law. State law requirements are not enforceable by U.S. EPA or by citizens under the federal Clean Air Act, but are fully enforceable by the MPCA and citizens under provisions of state law.

Table 16. Regulatory Overview of Facility (Continued)

Unit ID	Applicable Regulations	Comments
EU 032	Minn. R. 7011.0715	Standards of Performance for Post-1969 Industrial Process Equipment
EU 034	Minn. R. 7011.0710	Standards of Performance for Pre-1969 Industrial Process Equipment
EU 060	NSPS, subp. LL and Minn. R. 7011.2700	Standards of Performance for Metallic Mineral Processing Plants
EU 061	Minn. R. 7011.0715	Standards of Performance for Post-1969 Industrial Process Equipment

3. Technical Information Notes

- Baseline Actual Emissions and Projected Actual Emissions are used in the analysis for the permit. For detail, see Sections 1.4.1 and 1.4.2. The information was presented in those sections to smooth reading, after the reader sees the summary of emissions in Table 1.

- Stack mercury emission change is discussed in Sections 1.4.3 and 1.4.4, in support of the state-only requirement – "Permittee shall not reintroduce the solid material (fine dust) captured in the waste gas wet scrubber system (CE 110 and CE 111) into the agglomerating process" – and the fuel diversification project. TSD info - DNR Hg report 2004 is a Word document, saved in DELTA, serves as supporting information in Section 1.4.4.

- Emission calculations presented in Tables 3 through 15 have been verified by MPCA permit staff using an Excel workbook (saved as "PTE calculation spreadsheet" in DELTA). As a result of the verification, the permit application was revised to improve presentation of the projects.

- TSD info - CAM Plan 4/6/2004 is a spreadsheet document, saved in DELTA, which was submitted by Permittee to meet the Compliance Assurance Monitoring requirements (40 CFR 64).

- Team Development Document and Community Involvement Form are saved in DELTA, which provide additional internal discussion at the MPCA for this permit action.

4. Comments Received and Responses Provided

Document the official start/end dates of EPA's review period if they are different than the default (i.e., start of the notice + 45 days) and explain why the EPA review period is different. Document whether or not EPA agreed that we could go ahead and issue the permit prior to the end of their official review period by stating how and when this was communicated (or by attaching e-mails/letters).

Public Notice Period: <start date> - <end date>
EPA 45-day Review Period: <start date> - <end date>

If comments were received during the public notice period from the public or if comments are received from EPA, they should be described briefly here, as well as any changes made to the permit as a result of the comments. Generally, the comment letters should also be provided as attachments to the TSD.

Comments were <not> received from the public during the public notice period. <The comments received did <not> include adverse comments on any applicable requirements of the permit. Changes to the permit were <not> made as a result of the comments. *Provide summary of changes.* >

<The revised permit was sent to EPA for their 45-day review on <date>.> Comments were <not> received from EPA during their review period. Changes to the permit were <not> made as a result of the comments. *Provide summary of changes.* >

5. Conclusion

Based on the information provided by U.S. Steel Keewatin Taconite, the MPCA has reasonable assurance that the proposed operation of the emission facility, as described in the Air Emission Permit No. 13700063-003 and this technical support document, will not cause or contribute to a violation of applicable federal regulations and Minnesota Rules.

Staff Members on Permit Team:

Hongming Jiang (permit engineer)
Bob Beresford (enforcement)
Sarah Kilgriff (compliance)
Dick Cordes (peer reviewer)

Attachments (all saved in DELTA):

1. PTE calculation spreadsheet
2. TSD info - DNR Hg report 2004
3. TSD info - CAM Plan 4/6/2004
4. Team Development Document
5. Community Involvement Form (this is the case form for a decision meeting)

Appendix E

DNR Report

Mercury Capture at Taconite Processing Facilities:

Update on DNR Research Activities

Michael Berndt[1] and John Engesser[2]

Minnesota Department of Natural Resources
Division of Lands and Minerals

[1]500 Lafayette Road
St. Paul, Minnesota 55155

[2]1525 Third Avenue E.
Hibbing Minnesota 55746

October 1, 2004

Table of Contents

Introduction

The Minnesota Department of Natural Resources (DNR) has been studying wet scrubbers and process lines at four taconite processing facilities to evaluate potential mercury control options for stack emissions. Projects are funded by Iron Ore Cooperative Research (IOCR) and the Environmental Protection Agency-Great Lakes National Program Office (EPA-GLNPO). In addition, this research is supplemented by funds from the Department of Natural Resources-Environmental Cooperative Research (DNR-ECR) fund. The IOCR project is more concerned with evaluating mercury release and capture mechanisms while the EPA-GLNPO funds were solicited with the objective of evaluating the ultimate fate of oxidized mercury once it has been captured by the wet scrubbers. However, because processes of capture and fate have been found to be inextricably linked, we combine and discuss details from each study in a single document for distribution to all concerned parties. Results are also combined with data from our earlier study (Berndt and Engesser, 2003) and essential findings are summarized here. It is important to recognize that data and discussion in this document have not been through the review process and should therefore be considered as preliminary.

Mercury Capture by Wet Scrubbers

Four taconite companies have participated in our study: Hibtac, Minntac, United Taconite (formerly Evtac), and Ispat-Inland. Scrubber water and other samples were collected from each company to help estimate the fraction of mercury released from pellets that is captured by the wet scrubber (Table 1, Figure 1). The fraction of mercury captured varied considerably between processing plants and within individual plants sampled at different times. Note that in this discussion, we only evaluate the mercury captured by the wet scrubber without regard to its ultimate fate. As we show in a later section, much of the mercury can be recycled to the induration furnace and re-released. Nevertheless, the data have important use as a means to provide information on processes that lead, respectively, to low and high mercury capture rates.

Variation in capture rates is likely linked to differences in the temperature distributions in induration furnaces as well as to changes in gas and dust composition. Thus, we focused on these parameters when comparing data from different taconite processing lines.

Scrubber efficiency and possible link to heating rate

A key variable affecting scrubber efficiency appears to be the rate of heating of taconite pellets in induration furnaces. For example, Minntac generates both standard and fluxed pellets in their "line 4" processing line. Scrubber efficiency (for Hg capture) was higher when the company was producing standard pellets than when producing fluxed pellets. Fluxed pellet production involves additional heating, and therefore, higher furnace temperatures than standard pellet production. This is because the heating of the flux material ($CaCO_3$/CaO) is highly endothermic (requiring heat), while oxidation of

magnetite is exothermic (generates heat). Thus, Minntac activates preheat burners during induration of fluxed pellets that are not used during standard pellet production. This additional heating may be the primary mechanism leading to reduced mercury capture, although differences in scrubber dust and gas composition cannot be ruled out.

In addition, we note great differences in the rate of mercury capture by otherwise similar wet scrubbers at Minntac for lines 4 and 7 during production of fluxed pellets. Line 4 employs a standard kiln while line 7 employs a sophisticated ported kiln. Because the ported kiln makes more effective use of the chemical heat derived from magnetite oxidation, less heat is added throughout the process, and the heating in the kiln takes place under smaller thermal gradients. Thus, our observation of significantly greater mercury capture by the scrubber system in line 7 compared to line 4 during fluxed pellet production (Table 1) suggests a possible link between heating rate and mercury capture. Because the product being generated is the same for this particular comparison, the dust particles and gas chemistry would be expected to be similar among the two lines. Thus, most of the difference in mercury capture is probably related to differences in temperature distribution.

Finally, we note the relative efficiencies for mercury capture for Hibtac and Minntac wet scrubbers (Fig. 1). Owing to differences in system design (straight grate for Hibtac, grate-kiln for Minntac), significant differences in heat input are required for induration of standard pellets at these plants. Analysis of furnace temperatures during production of standard pellets show that heating in Minntac's line occurs much more evenly than it does at Hibtac (Fig. 2). The increased heating rate at Hibtac, specifically above a temperature of 500C may be partially responsible for the less efficient mercury capture rates at Hibtac compared to Minntac, however, we also notice that the amount of dust generated at Minntac is also higher than that at Hibbtac. Taken together with the observed dependence of scrubber efficiency for production of fluxed and non-fluxed pellets in ported and non-ported kilns at Minntac, the results suggest a possible (but non-conclusive) link between heating rate and mercury capture by wet scrubbers.

Mercury oxidation state and maghemite

Any link between temperature distribution in the furnace and scrubber efficiency for Hg implies a link between temperature and mercury oxidation state in the gas phase. This is because oxidized mercury, Hg(II), is captured in wet scrubber systems while reduced mercury, Hg(0), is not. Thus, any factor affecting the oxidation state of mercury in gases passing through the scrubber system affects the scrubber efficiency in terms of Hg removal.

One model to account for our observations would involve a relationship between heating rate and the oxidation state of mercury released from pellets during heating. If, for example, faster heating and higher temperatures result in release of mercury with high Hg(0)/Hg(II) ratio, then mercury capture rates should decrease with increased heating rate, as has been observed. Alternatively, a temperature dependence for the oxidation rate of reduced mercury (*in-flight)* could account for the observed trends. Thus, current and future DNR research efforts have been designed to evaluate whether mercury capture is related to differences in the primary oxidation state of mercury released from pellets in furnaces or to subsequent oxidation of mercury within the gas phase.

Of potential significance for taconite processing facilities is the Fe-oxide mineral maghemite. This mineral has been identified as a powerful oxidant for reduced mercury when it exists in the flue-gases of coal fired power plants (Zygarlicke, et al. 2003). This phase is also expected to form during moderate heating of taconite pellets up to temperatures of approximately 750 F (Papanatassiou, 1970). If this phase is generated and released (as dust) into process gases, it potentially impacts the oxidation state of mercury and mercury capture rate in wet scrubbers. Because of the potential importance of this phase, the DNR conducted a mossbauer spectroscopic study to determine whether maghemite was present in dust samples and, if so, whether a link could be established between mercury capture and maghemite abundance. Mossbauer spectroscopy is a sensitive technique that can distinguish maghemite from other Fe-oxide minerals in mixed samples of hematite, magnetite, and/or other phases.

In this case, studies were designed to specifically evaluate temperature, mercury capture, and maghemite in dust produced under normal mineral processing conditions at Hibtac and Minntac.

At Hibtac, dust samples were collected from wind boxes at various locations along the straight grate (Fig. 3) as the pellets were heated to high temperatures. Dust from the pellets becomes trapped beneath the grate in "wind boxes" in the approximate temperature zones where the dust was generated. The dust samples from these windboxes were dry-sieved to remove the larger chips, and subsequently analyzed for mercury concentration and maghemite abundance. Mercury concentration in dust increased greatly in windboxes 12 through 16 with a large peak for dust from windbox 14. The average temperature (average in gas from above and below the pellet bed) was approximately 750 F at the peak mercury concentration. Interestingly, magnetite is oxidized to maghemite in air between 400 and 750 F but to hematite at temperatures above 750 F (Papanatassiou, 1970). Peak mercury concentration was found in a zone where maghemite formation is expected to occur.

Mossbauer analysis of selected samples from Hibtac revealed formation of a small but significant component of maghemite in the sample from windbox 14. However, maghemite was not detected in the unheated green-ball feed sample (Fig. 4). Thus, the maghemite must have formed during heating of the pellets. Maghemite was also found in the dust collected from higher temperature zones in the furnace (windbox 18), but in this case, the hematite fraction had also increased significantly above that for the greenball feed sample. We hypothesize, therefore, that the maghemite formed at temperatures below 750 F is overprinted by hematite on the surfaces of dust grains heated to temperatures above 750 F. This overprinting may "deactivate" the dust grains with respect to mercury oxidation (Fig. 4) and prevent capture of mercury. If correct, this could help to account for observed relationships between temperature distribution and mercury capture in taconite processing plants.

Two samples from Minntac were also analyzed by mossbauer spectroscopy for maghemite to determine if a link exists between scrubber efficiency and maghemite abundance in scrubber dust. Dust filtered from scrubber water collected at a time when mercury capture rate was high contained a small amount of maghemite as well as some hematite, and was similar in composition to the sample collected from Hibtac in windbox 14. Dust filtered from scrubber water collected at a time when mercury capture rate was

relatively low revealed enhanced hematite formation and was similar in composition to the Hibtac sample from windbox 18 (hot). These data suggest a possible link between maghemite formation and mercury capture in taconite processing facilities. If substantiated, a promising technique to reduce mercury emissions may involve control and distribution of maghemite and hematite dust in taconite process gases.

Samples were also recently collected from beneath the grate and preheat zones at Minntac in July, 2004 (Figure 5). The samples revealed that unlike the case at Hibtac, mercury is concentrated more generally throughout the pellet bed. Plans are currently underway to subject these and other scrubber dust solids to Mossbauer spectroscopic analysis to determine whether the association between maghemite and mercury capture at taconite processing plants is robust.

While the mossbauer results suggest a possible correlation between maghemite formation and mercury capture efficiency in taconite processing plants, our results are not yet conclusive. It is still possible that maghemite formation and mercury capture are affected by temperature distributions for reasons that are independent from each other. Indeed, the reaction rates for Hg(0) and maghemite may well be too slow for significant oxidation to occur in the short residence times applicable to taconite processing gas streams. To better understand mercury emissions in taconite process streams the DNR plans to determine relationships between heating rate, release temperatures (of mercury to air), and the primary oxidation state of the mercury released to the gas phase. While we are not equipped to perform the needed experiments, we have been making efforts to secure funds for this research and to identify a laboratory to do the needed additional work.

On the Fate of Captured Mercury

Once captured by a wet scrubber, mercury needs to be disposed in a manner where it does not enter the environment through other pathways. Thus, an important component of the DNR Hg research program has been to evaluate the fate of mercury captured by the scrubber systems. Samples have been collected "downstream" from the scrubber systems in taconite processing plants in order to determine the fraction of captured mercury that is currently routed to the tailings basin. For the purposes of our study, we consider mercury to be permanently disposed of only after it reaches the tailings basin.

We note that the mercury captured by scrubber systems occurs in two states (1) dissolved in water and (2) adsorbed to particulates (Fig. 6). It is important to consider both forms of mercury, especially in plants where the distribution of mercury is relatively evenly divided between dissolved and adsorbed components. In addition, experiments conducted by our group on samples from Minntac and Hibtac indicate that mercury adsorption to solids in scrubber waters is a dynamic process, occurring with reaction times measured in minutes to hours (Figs. 7,8). This time frame is important because it impacts the manner in which mercury removal systems might be studied and subsequently designed. Furthermore, these results imply that samples collected for mercury analysis may need to be filtered immediately upon collection to prevent misleading results on dissolved and particulate loads. Collecting samples at the plant, and waiting to filter back at the lab will typically result in an over-reporting of the particulate fraction and under-representation of the dissolved component for scrubber waters.

Each of the four taconite companies in our study routes their scrubber waters differently, but the overall results for at least three of the companies appears to be the same: most of the captured mercury is recycled back to the induration furnaces and not currently routed to tailings basins.

Minntac sends their scrubber solids to a thickener where they are mixed with chip regrind and other solids. Most of the scrubber water overflows the scrubber thickener. Sample analyses indicate that most of the mercury that was in the scrubber water adsorbs to the solids in the scrubber-thickener underflow. These scrubber-thickener underflow solids eventually mix with the concentrate which is rolled into greenballs. This means that most of the mercury captured in the scrubbers is recycled back to the greenballs. Thus, the percentage of captured mercury that is currently sent to the tailings basin at this plant appears to be small.

Ispat-Inland sends their scrubber solids to the concentrate filter and we find that little mercury remains dissolved in the water following the process. Thus, most of the captured mercury at this plant also appears to recycle back to the induration furnace and probably only a small fraction is directed to the tailings basin.

United Taconite sends their scrubber waters and solids to a chip regrind mill where it is reground, rolled into greenballs, and sent to the induration furnace. Because only a very small fraction of the mercury captured at United Taconite is initially dissolved in the water, most of the captured mercury at this plant is probably recycled back to the induration furnace.

The case for mercury recycling back to the induration furnace is less clear at Hibtac because a high fraction of the mercury is dissolved, and because scrubber waters are introduced into the grinding mills where background mercury in the primary ore interferes with the analyses. While our present studies have demonstrated that the dissolved mercury from the added scrubber water adsorbs to phases in the grinding mills, the percentage adsorbing to magnetic versus nonmagnetic minerals is more difficult to evaluate. However, experiments recently conducted by us at United Taconite (Table 2) may have bearing on this issue. The results showed that most mercury in tailings/scrubber water mixtures at this plant are adsorbed to the nonmagnetic fraction. If mercury in scrubber waters from Hibtac adsorbs to the nonmagnetic fraction during grinding, it will eventually be routed to the tailings basin and, thus, not recycled to the furnace.

The DNR mercury research program will continue to evaluate mercury partitioning during exposure of scrubber waters and other components of taconite processing streams (tailings, raw process waters) to typical mineral processing procedures (e.g., magnetic separation, elutriation, thickeners, grinding).

Summary

Scrubber efficiency for mercury released during taconite processing has been studied and found to vary widely across the iron range. The capture rate for mercury appears to be plant- and product-dependent owing to differences in heating characteristics associated with process line design (straight-grate versus grate-kiln, ported versus non-ported kiln) and product heat requirements (fluxed versus standard pellets). There is preliminary evidence pointing to possible importance of a maghemite-catalyzed mercury

oxidation process to account for some of the variability between mercury capture rates. One facet of future DNR research will, therefore, study primary processes that control mercury oxidation in taconite process gas streams.

Although each of the four processing plants in our study routes their scrubber water blow down differently, it appears that most of the mercury captured by scrubbers at three of the taconite plants reports back to the induration furnace, where it is likely revolatilized. The fate of mercury at the fourth plant (Hibtac) is less certain, but initial results on mercury partitioning between magnetic and non-magnetic minerals suggest that introducing scrubber water to the grinding mills (as is their practice) may have some benefit in permanent mercury removal. This is because captured mercury appears to adsorb preferentially to the non-magnetic fraction which is, ultimately, routed to the tailings basin.

Optimally, systems will need to be designed to direct higher percentages of the mercury captured by wet scrubbers to the tailing basin. Thus, future DNR research will also focus on evaluating partitioning of dissolved and particulate mercury from scrubber waters during commonly used mineral processing techniques (elutriation, thickening, magnetic separation). Because mercury adsorption to solids is a dynamic process, taking place in minutes to hours, these studies will be conducted on time scales reflecting those of mineral processing at taconite plants.

References

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Papanatassiou, D. J. (1970) Mechanisms and Kinetics Underlying the Oxidation of Magnetite in the Induration of Iorn Ore Pellets. University of Minnesota, Duluth, Unpublished PHD Thesis. 134 p.

Zygarlicke, et al. (2003) Experimental Investigations of Mercury Transformations in Pilot-Scale Combustion Systems and a Bench-Scale Entrained-Flow Reactor. University of North Dakota Energy and Environmental Research Center Technical Report. 22 p.

Tables

Table 1: Mercury capture data for taconite wet scrubbers.

Plant/Line	Date	Pellet Type	TSS (wt %)	Hg Tot (ng/L)	% Hg Dissolved[1]	% Hg Captured[2]
Minntac L4	2/19/03	Std	0.086	1221	9.5	18.9
Minntac L4	5/9/03	Flux	0.387	700	11.6	12.0
Minntac L4	9/10/03	Std	0.217	1415	33.4	36.7
Minntac L4	1/28/04	Std	0.145	2422	6.8	46.5
Minntac L7	1/28/04	Flux	0.041	1251	17.8	25.0
Minntac L7	5/11/04	Flux	0.052	1707	17.0	39.4
Minntac L7	7/27/04	Flux	0.095	2744	11.1	34.8
Hibtac	2/20/03	Std	0.007	354	72.2	5.1
Hibtac	5/8/03	Std	0.035	769	44.1	11.1
Hibtac	9/11/03	Std	0.038	690	66.9	10.9
Hibtac	1/27/04	Std	0.018	556	52.5	10.2
Hibtac	5/12/04	Std	0.013	501	47.1	9.0
Hibtac	7/27/04	Std	0.014	684	42.9	8.3
Evtac	2/18/03	Std	1.340	13183	0.5	4.9
United Tac	1/28/04	Std	0.903	6140	1.6	2.4
United Tac	5/11/04	Std	1.270	7709	2.1	2.4
United Tac	7/28/04	Std	2.260	10485	1.1	3.3
Ispat-Inland	2/20/03	Std	0.328	3239	37.5	23.0
Ispat-Inland	5/8/03	Flux	0.142	3060	27.6	15.4
Ispat-Inland	9/11/03	Flux	0.175	4685	21.6	14.6
Ispat-Inland	1/27/04	Flux	0.137	3169	32.3	5.3
Ispat-Inland	5/12/04	Flux	0.095	3730	88.8	11.3

[1] "% Hg dissolved" is the percentage of mercury present in scrubber waters that is in the dissolved state (not bound to particulates) immediately after sampling.

[2] "% Hg captured" is the scrubber efficiency and represents the total mercury captured by the scrubber system (measured) divided by the total mercury available (estimated using mass balance).

Table 2: Results from experiments performed on tailings/scrubber solid mixtures from United Taconite. The solids were mixed together and allowed to react overnight. The magnetic fraction was then separated from the non-magnetic fraction and both separates analyzed for total mercury.

Experiment	Magnetic Fraction (wt%)	% Hg on Magnetic Fraction	Nonmagnetic Fraction (wt%)	%Hg on Nonmagnetic Fraction
Tails	4.3	6.3	95.7	93.7
Tails + Scrubber Solids	14.4	11.6	85.6	88.4
Tails + Scrubber Solids	12.7	10.2	87.3	89.8
Tails + Scrubber Solids	13.4	14.0	86.6	86.0
Scrubber Solids	67.7	23.6	32.3	76.4

Figures

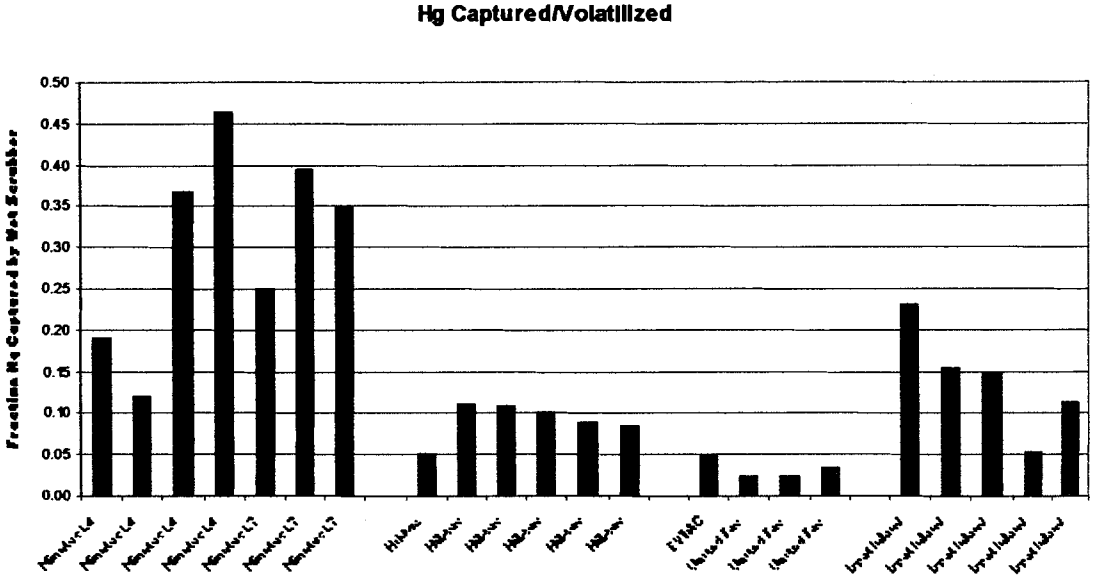

Figure 1. Scrubber efficiency estimates for taconite plants. These values are calculated by dividing the rate of mercury capture by the rate at which mercury is being volatilized in the induration furnace. The rate of capture is estimated by multiplying the scrubber blow-down rate by the concentration of mercury (dissolved plus particulate) in the scrubber water. The volatilization rate is calculated by using an assumed or measured value for green-ball mercury concentration and feed rate, allowing for greenball moisture as well as loss of some mercury via other pathways (green ball attrition and mercury in the final product). These scrubber efficiencies do not necessarily reflect permanent removal of mercury from taconite processing because much of the captured mercury in current plant configurations may be recycled back to the induration furnace and re-released.

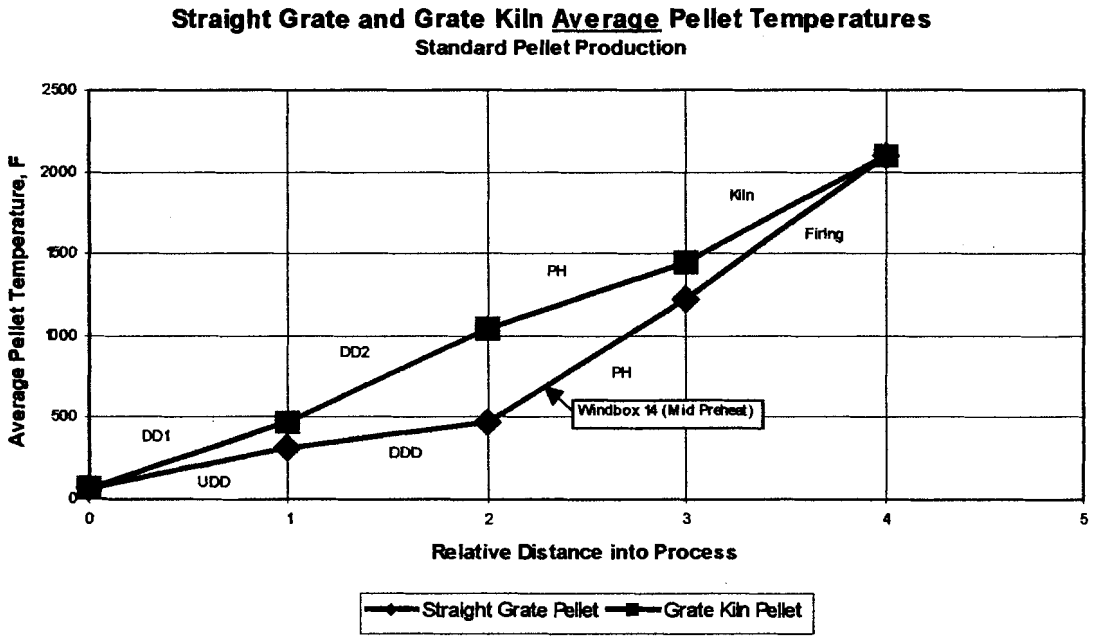

Figure 2. Representative temperature profiles during production of standard pellets at Minntac (Grate-Kiln, Line 4) and Hibtac (Straight Grate).

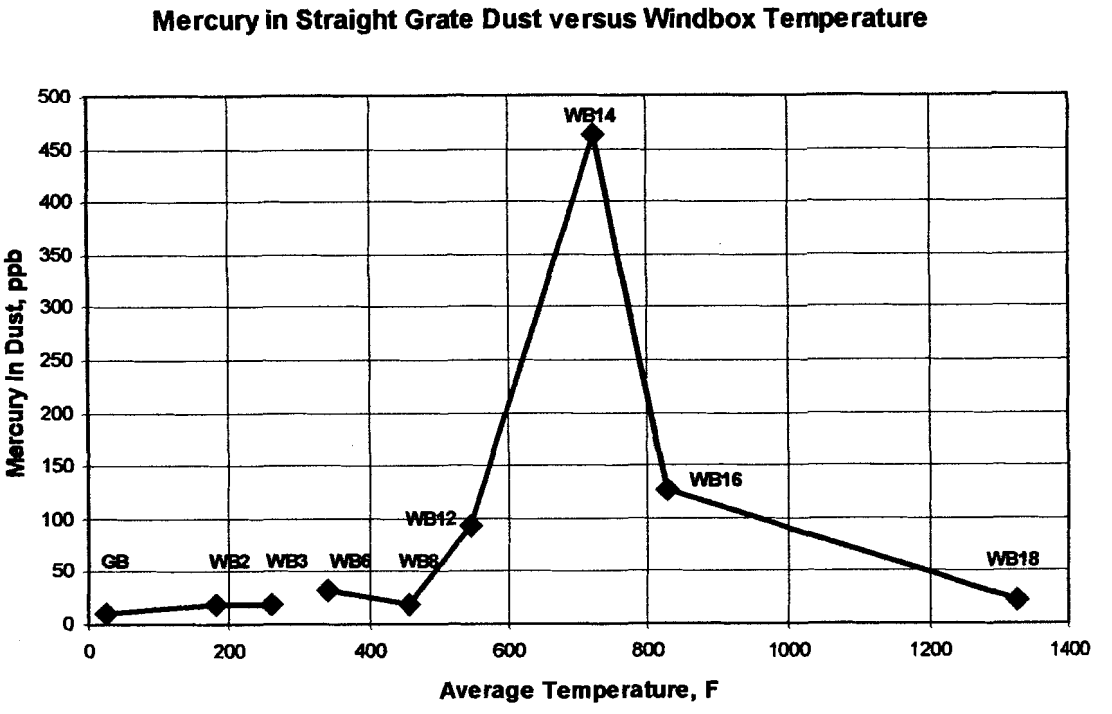

Figure 3. Measured mercury in dust captured from beneath the straight-grate at Hibtac. The temperature was calculated as the average of measurements made above and beneath the grate. The maximum in mercury takes place in the portion of the furnace where average temperature is about 700F. This suggests mercury is released at temperatures of about 800F and above and captured at temperatures below this.

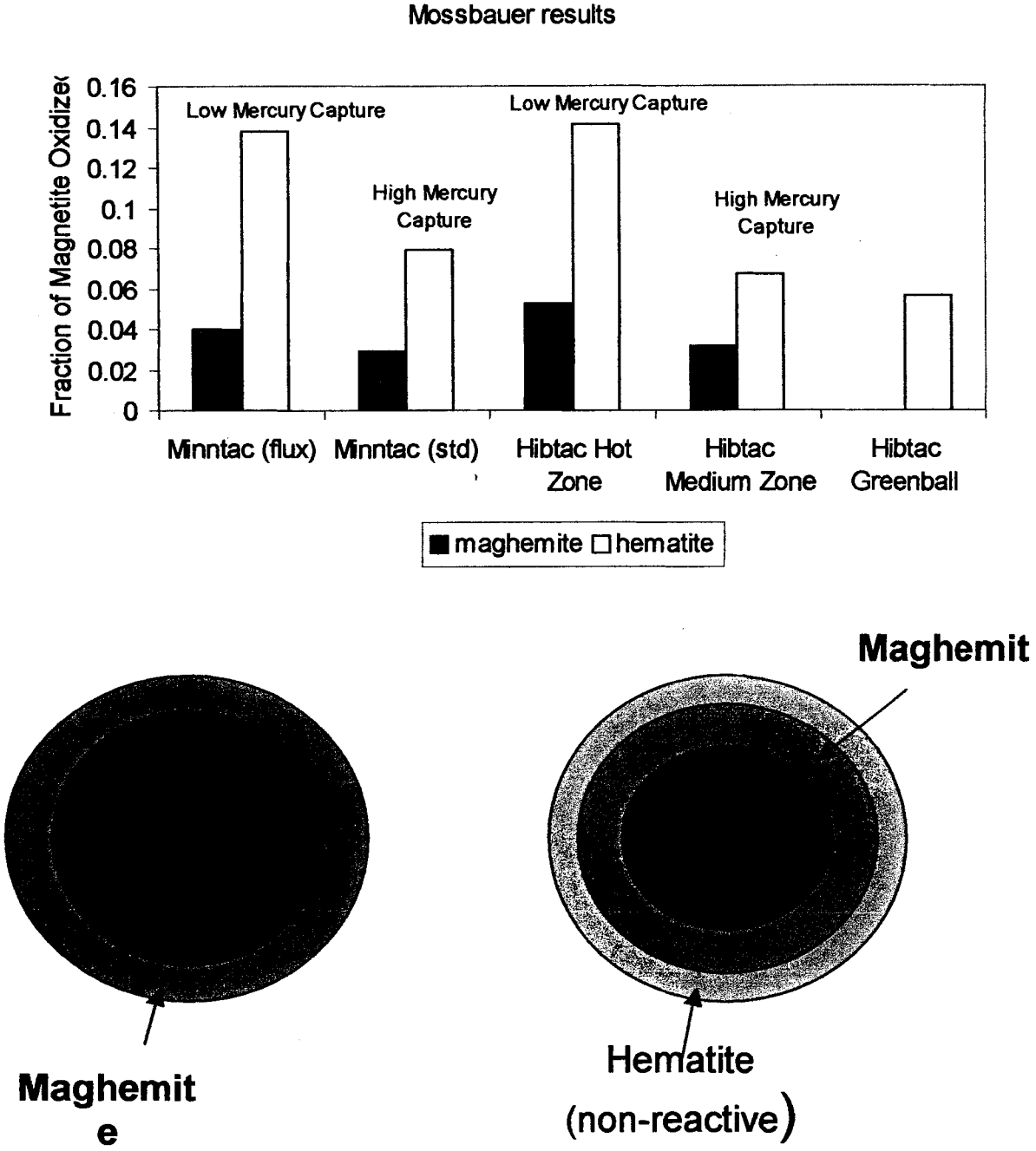

Figure 4. Results and interpretation of Mossbauer study of dust samples collected from Hibtac and Minntac. High mercury capture may result when outer surfaces of dust grains are converted to maghemite which is known to rapidly oxidize Hg(0) to Hg(II). When the dust grains are exposed to high temperature, the outer surfaces are converted to hematite, which does not react with Hg(0).

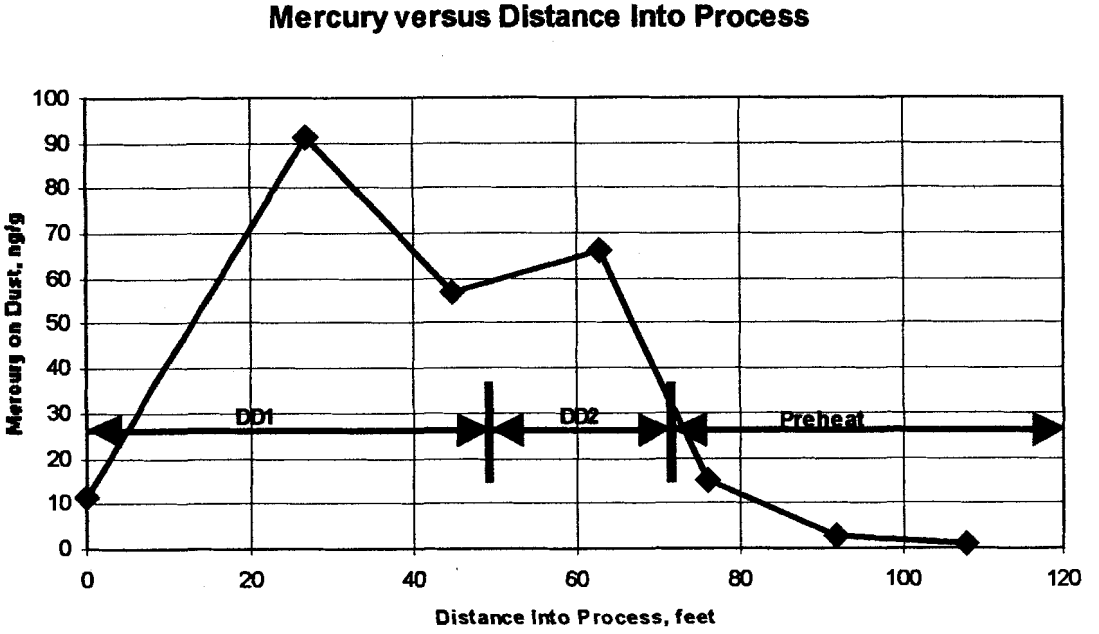

Figure 5. Mercury distribution in dust collected from Minntac's operation. Unlike the case at Hibtac where one distinct mercury maximum was found, there appears to be two mercury maximum zones. Process gas in this case is routed from right to left while pellets move into the process from left to right. Dust from the preheat zone has no mercury, but that in the down draft zones (DD1 and DD2) is enriched in mercury relative to the pellets. These data provide evidence that sufficient oxidized mercury exists in the process gas to dramatically affect the concentration of mercury in particles (by adsorption). Experiments will soon be underway to determine whether this mercury is released in oxidized state or if it is oxidized *in-flight*.

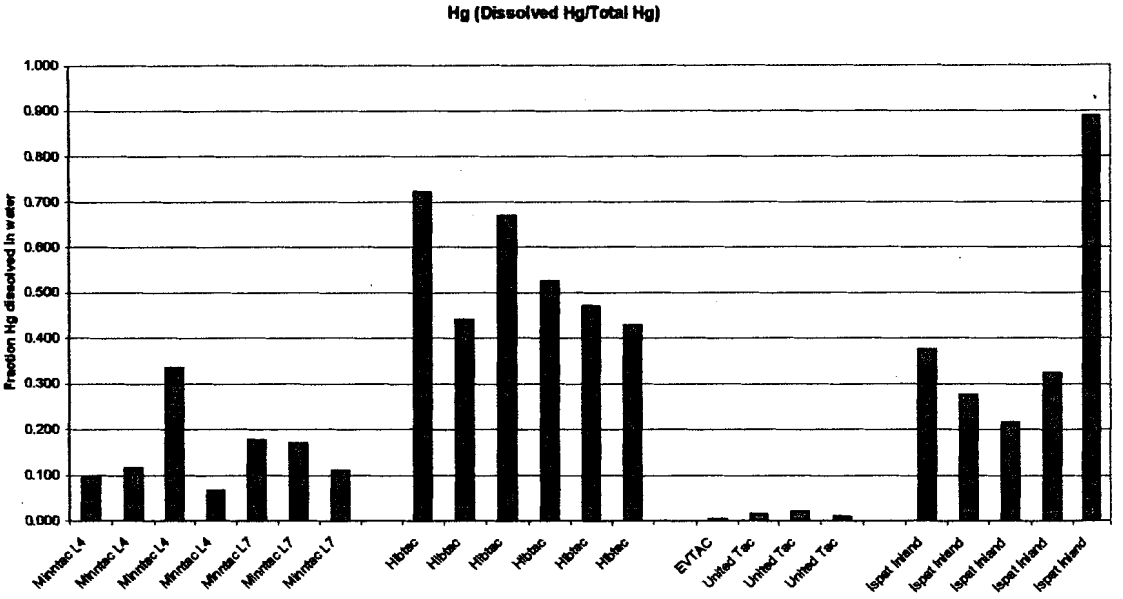

Figure 6. Fraction of mercury in scrubber waters that was initially present in dissolved form. Dissolved and adsorbed forms of mercury must be taken into account when designing mineral processing schemes to focus mercury into tailings basins. The dissolved fraction is higher at Hibtac and Ispat-Inland than it is at Minntac and United Taconite (Formerly Evtac). It is thought that the difference may be chemistry related (SO_2 and HCl).

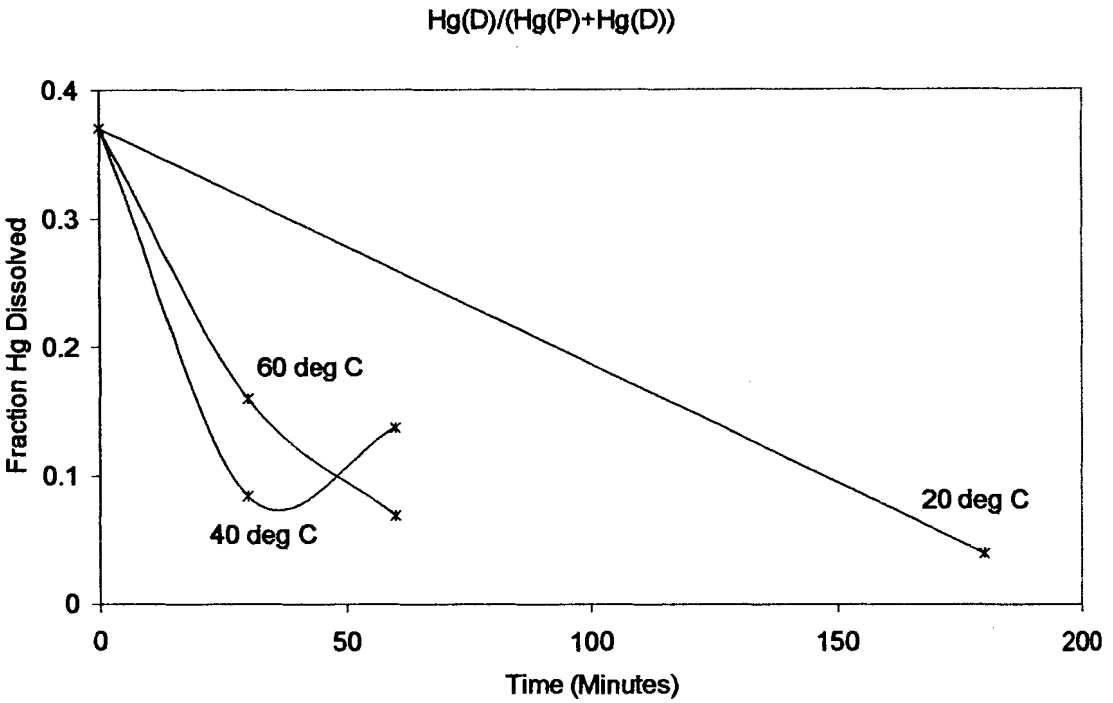

Figure 7. Results from adsorption experiments performed previously at Minntac showing that mercury present in scrubber water adsorbs to scrubber solids over time. These results indicate that filtration must take place immediately upon sampling for applications where knowledge of the fraction of dissolved mercury is needed.

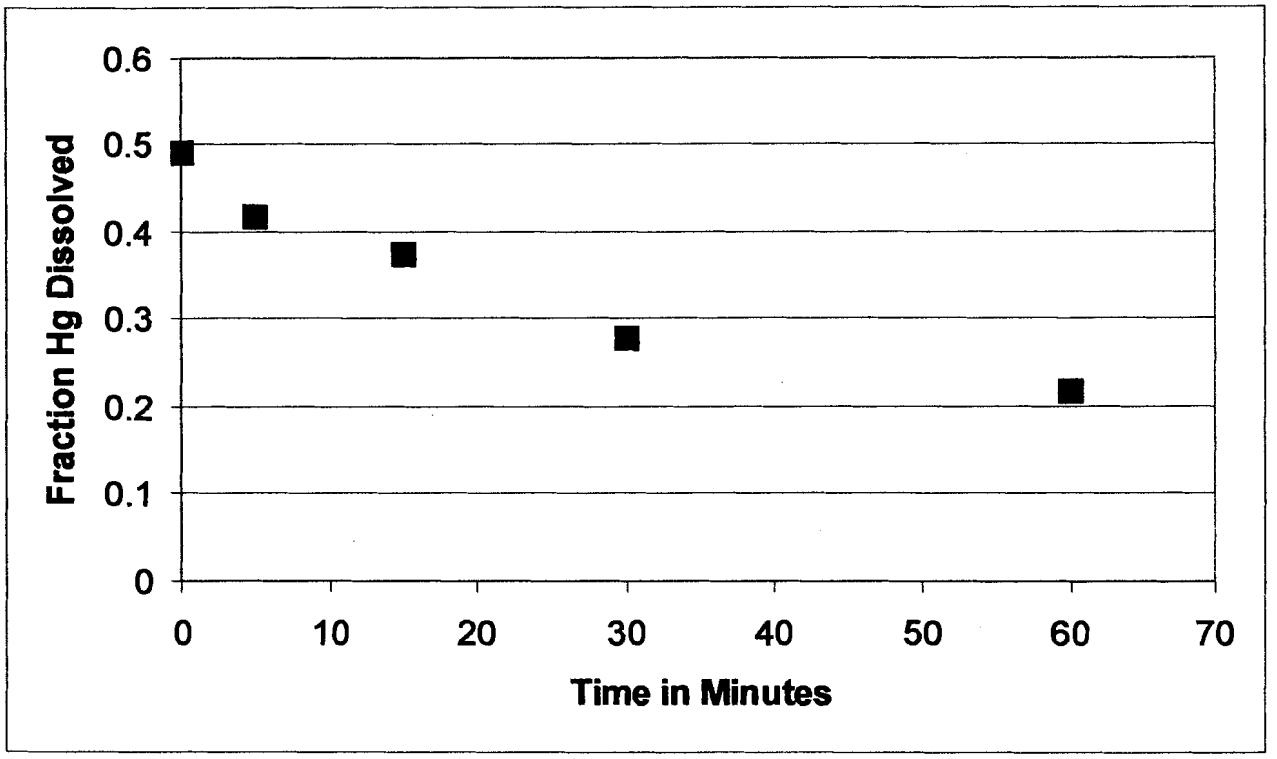

Fig. 8. Results of adsorption experiments performed on scrubber solids at Hibtac. While approximately half of the mercury captured by plant scrubbers in this plant is dissolved (the other half is adsorbed to particulates), the fraction of mercury dissolved decreases to approximately 20% in one hour, even without addition of adsorbing solids.

Appendix F

MPCA Interim Mercury Policy

Interim
MPCA Mercury Policy
Revised
July, 2001
STAFF DRAFT

Table of Contents

2. Releases to Air

2.2 New or Expanded Air Emission Sources

The 1999 Minnesota mercury reduction law does not directly address new or expanded operations that result in increased mercury emissions. In some sectors, such as solid waste incineration, there are state standards that regulate additions of mercury to the statewide total. In other sectors, such as coal combustion, taconite processing, or sludge incineration, there are either no standards (i.e., coal fired boilers and taconite processing) or the standards are so high as to be ineffectual (i.e., sludge incineration). Other activities were sometimes ignored as mercury sources during the MPCA permitting process (e.g., electric arc furnaces; land application of sludge; oil refining; soil roasting).

There are two goals that the MPCA needs to achieve concerning any new atmospheric mercury emissions:

1. ensure that the facility does not significantly increase fish contamination or exceed water quality criteria through localized impacts and
2. ensure that total mercury emissions are as low as possible, in order to help reach the statewide mercury emission reductions.

The full text of this report can be found at: http://www.pca.state.mn.us/air/pubs/mercury-policy01.pdf