MINNESOTA POLLUTION CONTROL AGENCY

MPCA Review - Taconite Mercury Reduction Plans

2020 Statewide Mercury TMDL Oversight Committee Meeting

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February 5, 2021

Overview

- Brief history
  - Mercury reduction rule efforts
  - Mercury reduction technology research
- Taconite mercury reduction plans
  - Mercury emissions and taconite production
  - MPCA review
  - Industry response
- Moving forward
- Questions and answers

Mercury reduction rule efforts

- Mercury reduction plans
  - Industrial, Commercial, Institutional Boilers
  - Iron and Steel Melters
  - Ferrous Mining and Processing
  - Other Sources
- Performance standards
- Emissions inventories for mercury

Mercury reduction technology research

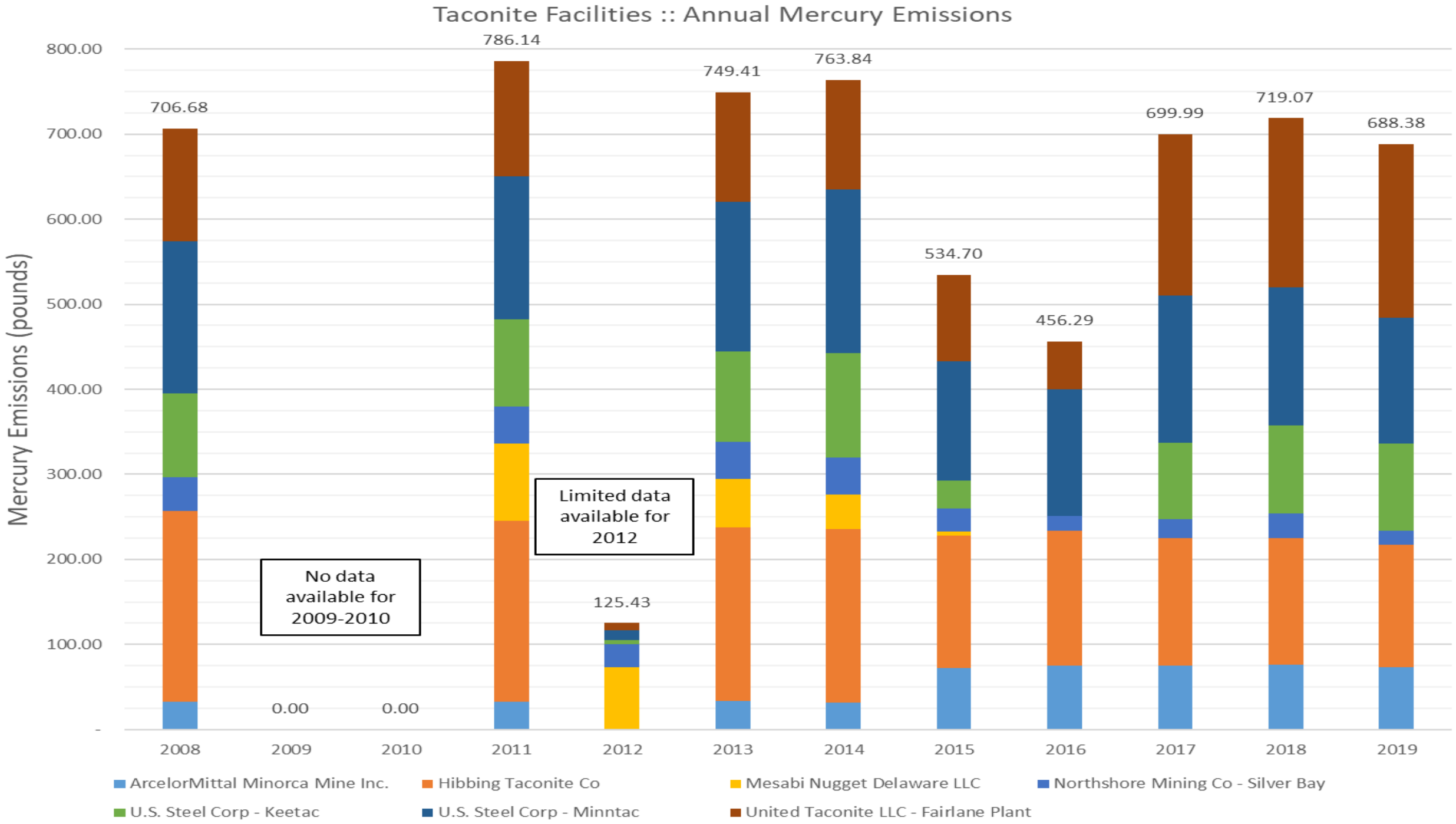
- Pre-TMDL Implementation Plan MN DNR research (1997 - 2009)
- “Phase I” Research - MN Taconite Mercury Control Advisory Committee (2009 - 2012)
  - Activated carbon injection (ACI) and scrubber additives
- “Phase II” Research - Taconite Industry research (2013)
  - Extended ACI testing
- Site-specific research & pilot testing (2014 - 2018)
  - GORE mercury control technology
  - ACI & halide injection testing
  - Scrubber solids wasting

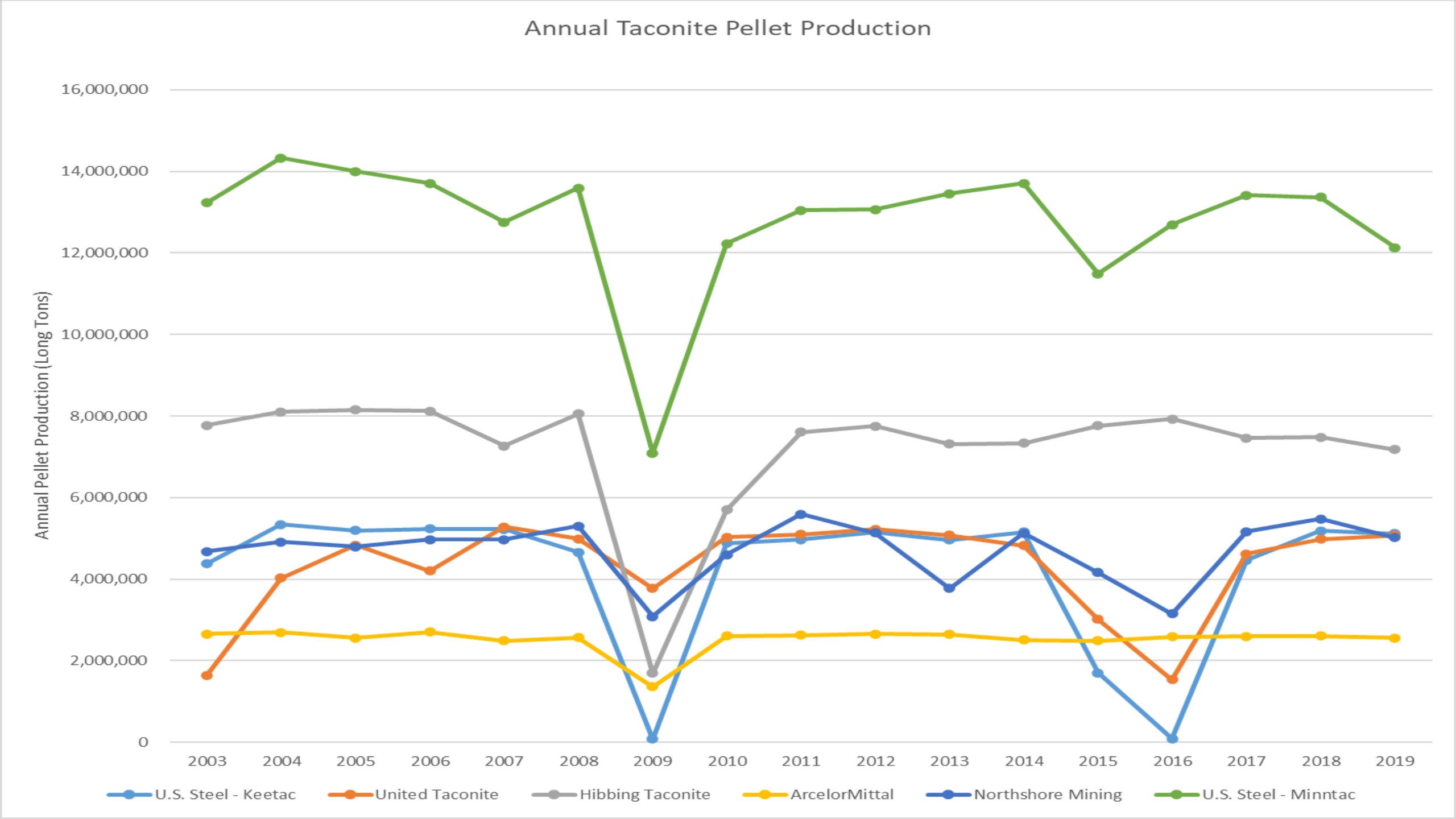
Ferrous mining/processing mercury reduction plans
MPCA staff review update

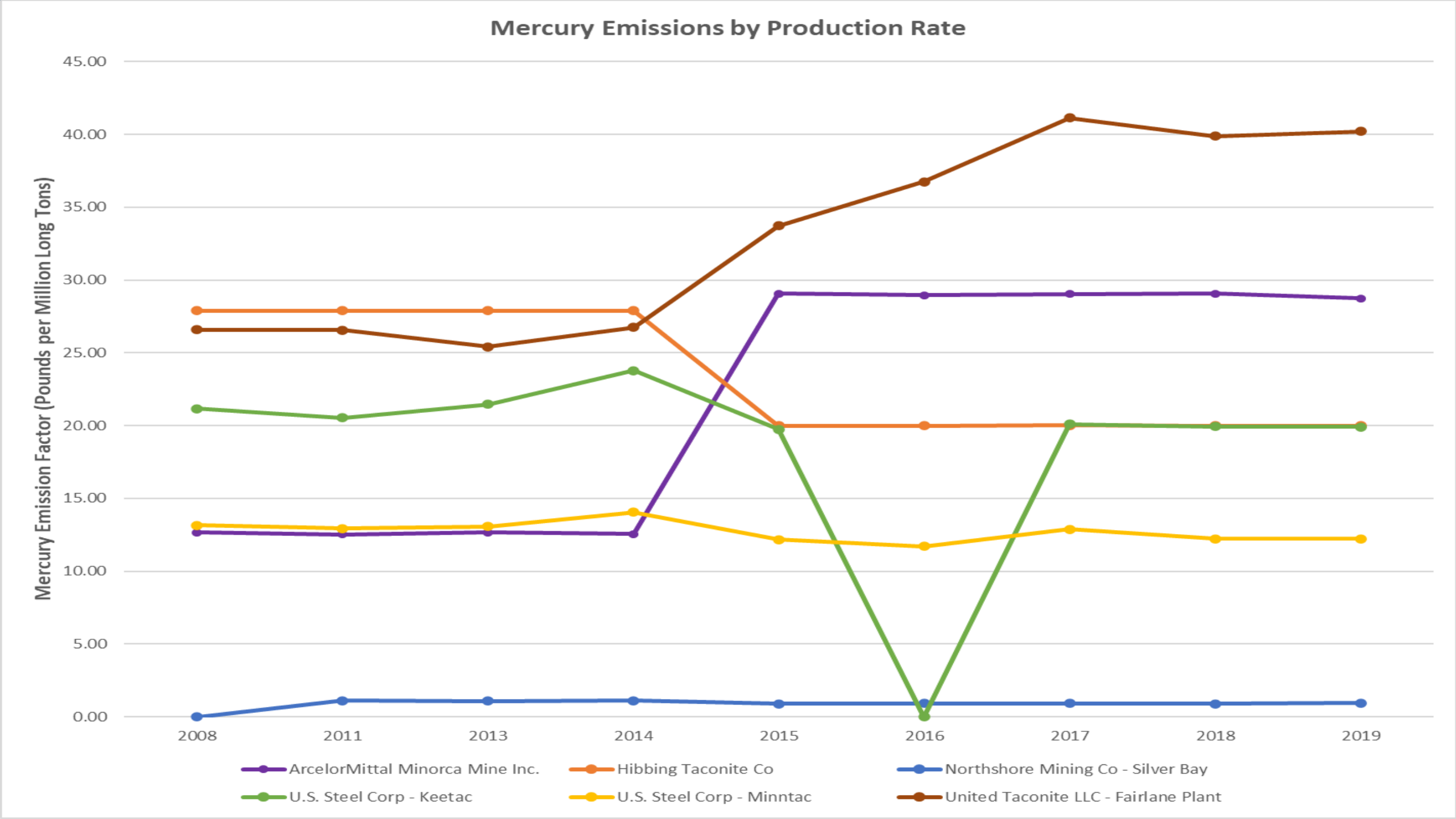
- Each facility submitted a reduction plan and they are available online here:
  - https://www.pca.state.mn.us/air/plan-reduce-mercury-releases-2025
- Reduction plan overview:
  - Two facilities proposed reductions meeting the 72% reduction specified in the rule.
  - Two facilities submitted alternatives plans with less than a 72% reduction.
  - Four facilities submitted alternative plans with no proposed reductions and outlined further evaluations.
- MPCA staff have reviewed each plan and identified deficiencies for the industry.

Ferrous mining/processing mercury reduction plans
Baseline emission rates

- Establishes the mass emission rate for comparison to the 72% required reduction in Minn. R. 7007.0502
  - Estimated originally in the TMDL implementation plan and the mercury rulemaking, revisions as part of reviewing the reduction plans
- 2008 vs. 2010 baseline emission rates:
  - TMDL Implementation Plan, 75% reduction from 2010 estimates, 841 lb/yr = 210 lb/yr
  - Mercury Reduction Rule, 72% reduction from 2010 estimates, 739 lb/yr = 210 lb/yr
  - Industry provided baseline emissions, 925 lb/yr
  - MPCA revisions to baseline emissions in reduction plans, 806 lb/yr


Taconite Facilities :: Annual Mercury Emissions
Mercury Emissions (pounds)
800.00
700.00
600.00
500.00
400.00
300.00
200.00
100.00
-
706.68
0.00
0.00
786.14
125.43
749.41
763.84
534.70
456.29
699.99
719.07
688.38
No data available for 2009-2010
Limited data available for 2012
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
ArcelorMittal Minorca Mine Inc.
Hibbing Taconite Co
Mesabi Nugget Delaware LLC
Northshore Mining Co - Silver Bay
U.S. Steel Corp - Keetac
U.S. Steel Corp - Minntac
United Taconite LLC - Fairlane Plant


Annual Taconite Pellet Production
16,000,000
14,000,000
12,000,000
10,000,000
8,000,000
6,000,000
4,000,000
2,000,000
0
Annual Pellet Production (Long Tons)
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
U.S. Steel - Keetac
United Taconite
Hibbing Taconite
ArcelorMittal
Northshore Mining
U.S. Steel - Minntac


Mercury Emissions by Production Rate
Mercury Emission Factor (Pounds per Million Long Tons)
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
2008
2011
2013
2014
2015
2016
2017
2018
2019
ArcelorMittal Minorca Mine Inc.
Hibbing Taconite Co
Northshore Mining Co - Silver Bay
U.S. Steel Corp - Keetac
U.S. Steel Corp - Minntac
United Taconite LLC - Fairlane Plant

Ferrous mining/processing mercury reduction plans
Initial MPCA review

- Initial MPCA review:
  - Reviewed mercury stack test data and established baseline emissions rate
  - Reviewed technologies evaluated (ACI, Halide Injection, Scrubber Solids Wasting, etc.)
  - Identified deficiencies and additional information that is needed
- Industry concerns:
  - Technically/economically feasible, maintains pellet quality, doesn’t cause corrosion
  - High costs to implement the evaluated technologies
  - Mercury speciation and deposition
  - Compliance concerns for other regulatory requirements

Approved mercury reduction plan
Mesabi Metallics Company

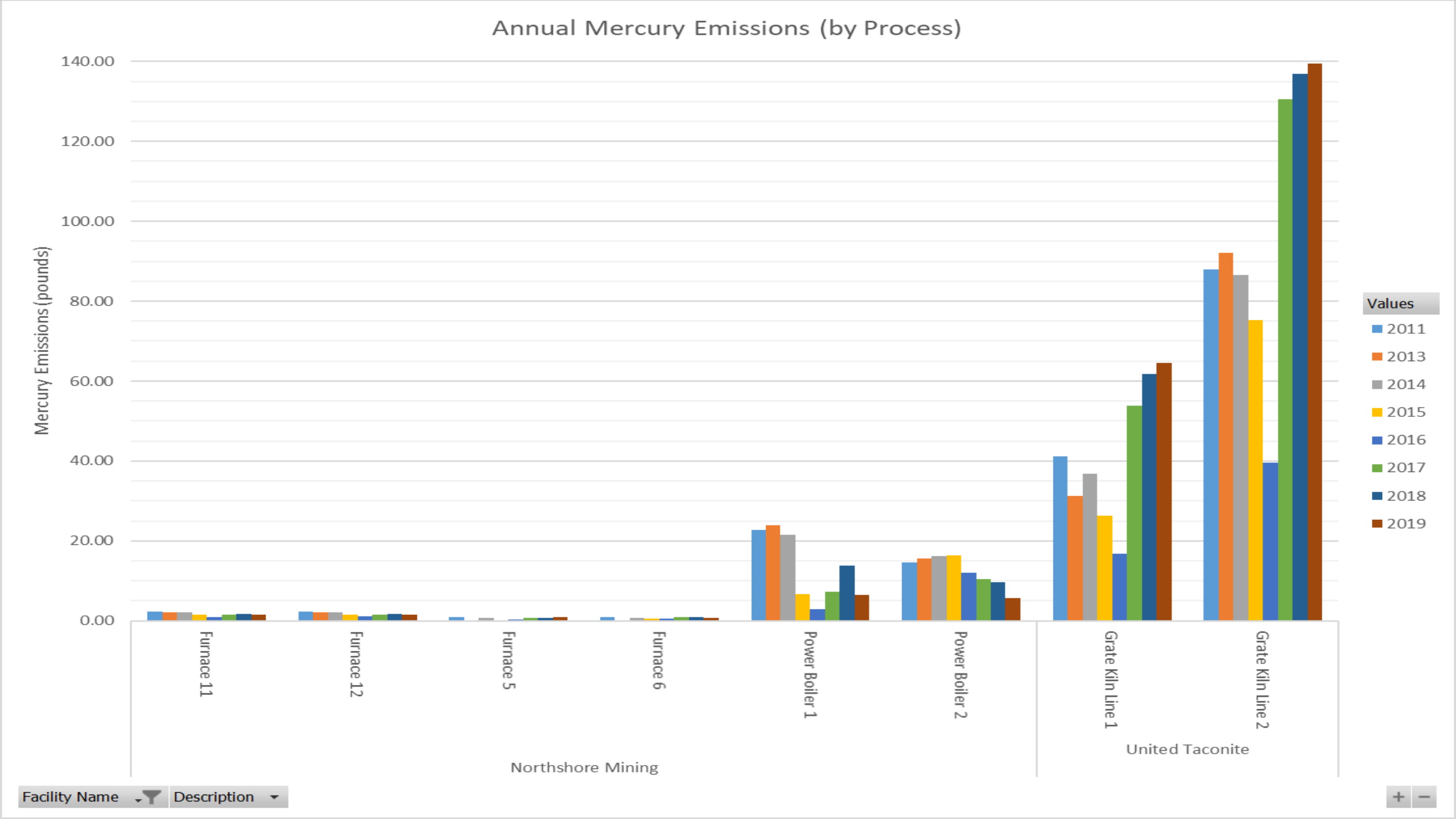
- Implement activated carbon injection (indurating furnace and DRI process)
  - Baseline emissions (Indurating Furnace - 86.12 lb, DRI Process - 4.12 lb)
  - Total limited mercury emissions rate = 25.35 pounds per year
  - Achieves at least 72% reduction at the furnace, with further reductions to account for mercury emitted after the startup of the DRI process
- Actions post facility startup:
  - Reevaluate assumptions that went into estimated mercury emissions
  - Potential revisions to emissions after startup and stack testing occurs

Approved mercury reduction plan
Northshore Mining Company

- Established a mercury emissions cap (power boilers & indurating furnaces)
  - Baseline emissions (Boilers - 36.72 lb, Indurating Furnaces - 4.53 lb)
  - Total limited mercury emissions rate = 12.28 pounds per year calculated annually
  - Achieves a 70% reduction at the boilers and an equivalent 72% at the indurating furnaces
- Power boilers currently idled through 2031; if they return to service:
  - If there are changes, a request to modify the approved reduction plan is required
  - Required to implement additional testing, sampling, and/or monitoring requirements to provide assurance that the facility is in compliance with the emissions cap

Pending mercury reduction plans
United Taconite

- Proposal: No additional controls proposed
  - Further evaluation of scrubber solids wasting to improve iron capture
- MPCA review
  - Baseline emissions (Indurating Furnaces) = 123.86 lb
  - Mercury emissions rate = 34.68 lb (72% reduction)
  - Reoccurring evaluations to make progress towards the 72% reduction
  - Additional stack tests for halide injection
  - Greenball sampling for additional methods of verifying mercury content

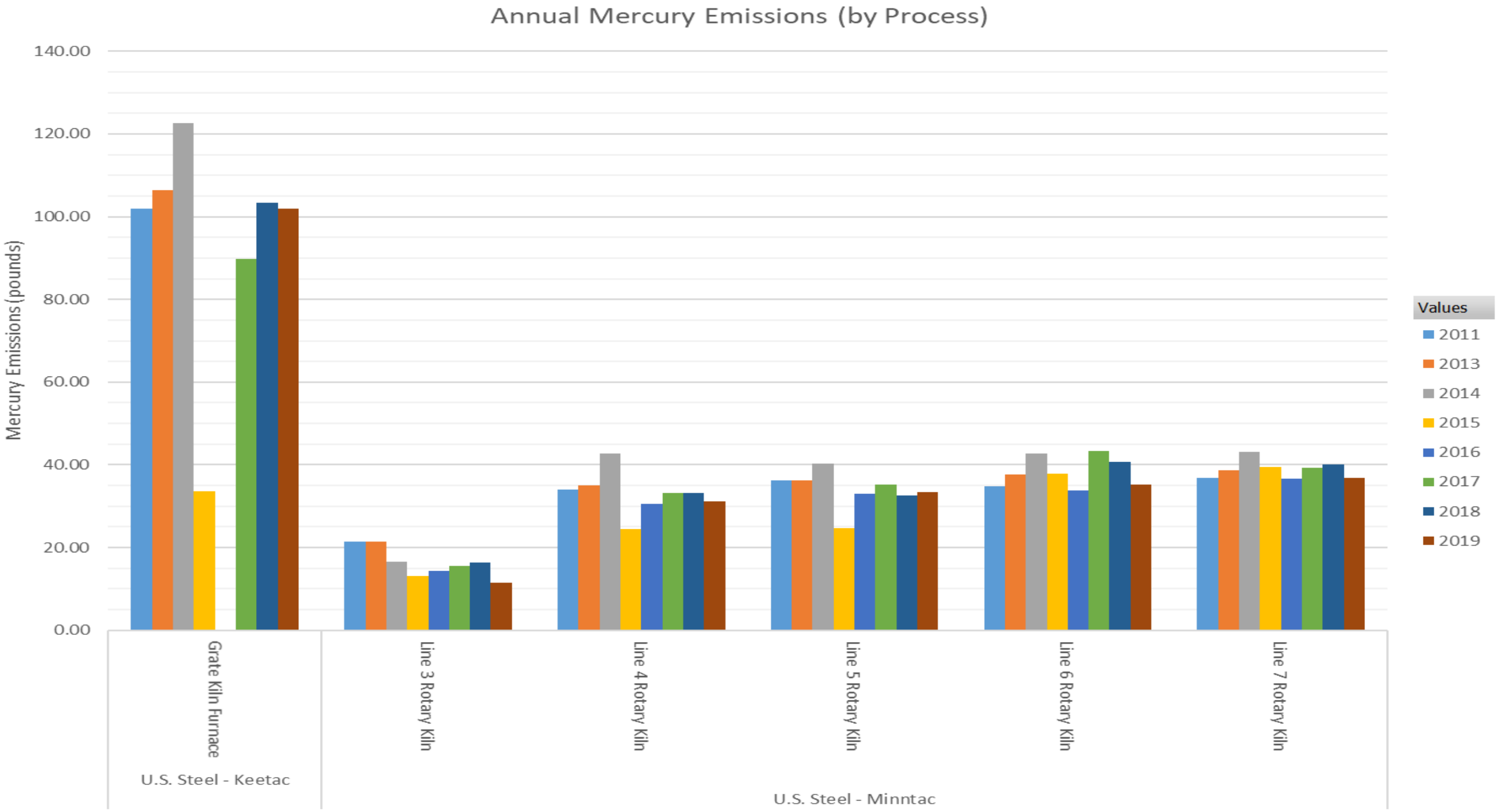

Annual Mercury Emissions (by Process)
Mercury Emissions (pounds)
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
Furnace 11
Furnace 12
Furnace 5
Furnace 6
Power Boiler 1
Power Boiler 2
Grate Kiln Line 1
Grate Kiln Line 2
Northshore Mining
United Taconite
Values
2011
2013
2014
2015
2016
2017
2018
2019
Facility Name
Description

Pending mercury reduction plan
U.S. Steel - Keetac

- Proposal: No additional controls proposed
  - Previously achieved a ~30% reduction via existing scrubbers and solids wasting (~2005)
- MPCA Review
  - Baseline emissions (Indurating Furnace) = 96.16 lb
  - Mercury emissions rate = 26.92 lb (72% reduction)
  - Reoccurring evaluations to make progress towards the 72% reduction
  - Additional data on the capabilities of the existing wet scrubber
  - Additional stack tests for halide injection
  - Evaluations to explore improved particulate capture to address problems for activated carbon injection
  - Greenball sampling for additional methods of verifying mercury content

Pending mercury reduction plan
U.S. Steel - Minntac

- Proposal: No additional controls proposed
  - Previously achieved a ~30% reduction via existing scrubbers and solids wasting (~2005, Line 3)
- MPCA Review
  - Baseline emissions (Indurating Furnaces) = 161.46 lb
  - Mercury emissions rate = 45.21 lb (72% reduction)
  - Reoccurring evaluations to make progress towards the 72% reduction
  - Additional data, or testing, on the capabilities of the existing wet scrubbers with magnetic separation and solids wasting to achieve a 27% reduction
  - Additional stack tests for halide injection
  - Evaluations to explore improved particulate capture to address problems for activated carbon injection
  - Greenball sampling for additional methods of verifying mercury content


Annual Mercury Emissions (by Process)
Mercury Emissions (pounds)
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
Grate Kiln Furnace
Line 3 Rotary Kiln
Line 4 Rotary Kiln
Line 5 Rotary Kiln
Line 6 Rotary Kiln
Line 7 Rotary Kiln
U.S. Steel - Keetac
U.S. Steel - Minntac
Values
2011
2013
2014
2015
2016
2017
2018
2019
Facility Name
Description

Pending mercury reduction plan
Mesabi Nugget

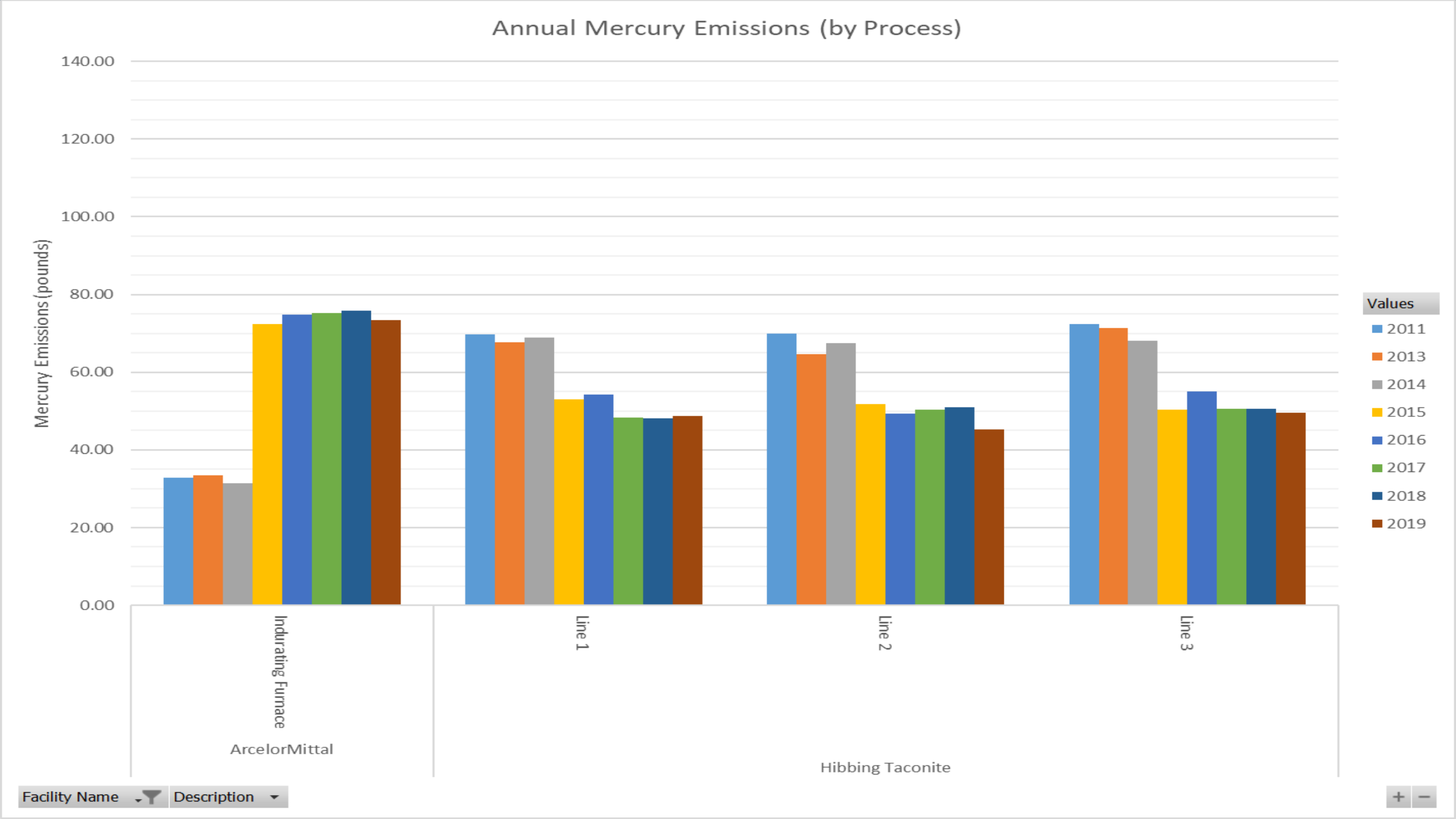
- Proposal: Switch raw materials used to a lower mercury option (50% reduction)
- MPCA review
  - Baseline emissions (Rotary Hearth Furnace) = 75.34 lb
  - Mercury emissions rate = 37.67 lb (50% reduction) vs. 21.09 lb (72% reduction)
  - Reoccurring evaluations to make progress towards the 72% reduction
  - Provide additional information regarding cost estimates for evaluated reduction strategies
  - Conduct additional evaluations of raw material switches as identified in the plan
    - Further changes may make additional evaluations for addon controls unnecessary
  - Conduct additional testing of halide injection, activated carbon injection, and Gore technology as outlined in the plan

Pending mercury reduction plan
Minorca Mine

- Proposal: Scrubber solids wasting with existing wet scrubbers (22% reduction)
- MPCA review
  - Baseline emissions (Indurating Furnace) = 66.93 lb
  - Mercury emissions rate = 52.21 lb (22% reduction) vs. 18.74 lb (72% reduction)
  - Reoccurring evaluations to make progress towards the 72% reduction
  - Additional stack tests for scrubber solids wasting and halide injection
  - Evaluations to explore improved particulate capture to address problems for activated carbon injection
  - Greenball sampling for additional methods of verifying mercury content

Pending mercury reduction plan
Hibbing Taconite

- Proposal: No additional controls proposed
- MPCA review
  - Baseline emissions (Indurating Furnaces) = 187.28 lb
  - Mercury emissions rate = 52.44 lb (72% reduction)
  - Reoccurring evaluations to make progress towards the 72% reduction
  - Provide additional information regarding cost estimates
  - Agreed scrubber solids wasting unlikely to provide a reduction (requested additional stack test data if available)
  - Cost estimates for halide injection, ability to improved oxidized mercury capture for the technology
  - Evaluations to explore improved particulate capture to address problems for activated carbon injection
  - Greenball sampling for additional methods of verifying mercury content


Annual Mercury Emissions (by Process)
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
Mercury Emissions (pounds)
Values
2011
2013
2014
2015
2016
2017
2018
2019
Indurating Furnace
Line 1
Line 2
Line 3
ArcelorMittal
Hibbing Taconite
Facility Name
Description

Ferrous mining/processing mercury reduction plans
Industry proposal vs. Required rule reduction

- Baseline emissions
  - Mercury rulemaking
    - 817.1 lb (2008 emissions)
    - 739.2 lb (2010 estimate)
    - 823.2 lb (max of 2008/2010)
  - Industry submittal
    - 925.0 lb (as submitted)
  - MPCA review
    - 805.8 lb (max of 2008/2010)
- Future emissions
  - Mercury rulemaking
    - 210.0 lb (reductions as envisioned)
  - Industry submittal
    - 809.8 lb (reductions as submitted)
  - MPCA review
    - 685.3 lb (reductions as submitted)
    - 225.7 lb (reductions as envisioned)

Different control scenarios
Reference control scenarios

- Reference control scenarios
  - Industry proposal (Scenario 1) = 685 lb (~15% reduction)
  - Required rule reduction (Scenario 2) = 226 lb (~72% reduction)

Different control scenarios
Activated carbon injection

- Activated carbon injection (Installation scenarios)
  - ACI w/ new particulate controls (Scenarios 3-5)
    - All sources (Scenario 3) = 161 lb (~80% reduction)
    - Fewer sources (Scenario 4) = 255 lb (~68% reduction)
    - Fewer sources (Scenario 5) = 338 lb (~58% reduction)

Different control scenarios
Gore mercury control technology

- Gore mercury control technology (Installation scenarios)
  - Gore modules (Scenarios 6-7)
    - All sources (Scenario 6) = 242 lb (~70% reduction)
    - Fewer sources (Scenario 7) = 320 lb (~60% reduction)

Different control scenarios
Wasting scrubber solids & halide injection

- Additional strategies (Installation scenarios)
  - Wasting scrubber solids (Scenario 8)
    - All able sources (Scenario 8) = 633 lb (~21% reduction)
  - Halide injection (Scenario 9)
    - All sources (Scenario 9) = 502 lb (~38% reduction)

Economic analyses

- Reduction plans included an estimate of costs for technologies
- Facilities identified a threshold for evaluating cost effectiveness
  - $7,100 per pound of mercury removed (based on EPA rulemaking cost estimates)
- Examined costs for ACI, Gore, fixed carbon beds, wasting scrubber solids
- MPCA reviewing cost information currently
- Costs vs. affordability

Costs overview

Mercury Reduction Technology	Total Capital Costs ($)	Annual Operating Costs ($ per year)	Cost Effectiveness ($ per lb Hg removed)
Activated Carbon Injection (w/ dry controls)	$33 - $62 Million	$6 - $12 Million	$102 - $200 Thousand
Activated Carbon Injection (w/ wet controls)	$33 - $65 Million	$7 - $14 Million	$111 - $464 Thousand
Fixed Carbon Bed	$47 - $90 Million	$7 - $14 Million	$117 - $356 Thousand
Gore Technology	$41 - $82 Million	$5 - $10 Million	$100 - $364 Thousand
Wasting Scrubber Solids	$0 - $3 Million	$120 - $513 Thousand	$102 - $200 Thousand

- Based on the mercury emissions as submitted in the reduction plans
- All dollar values are per indurating furnace

Moving forward

- Greater emissions reductions are needed to meet the goal of the statewide mercury TMDL.
- Following review completion, MPCA staff provided comments to facilities and requested resubmittal of portions found deficient
  - Now working through the cost analyses provided and reviewing topics like affordability
  - MPCA will be in communication with the ferrous mining and processing facilities regarding their reduction plans
- Path forward discussion session to close this year's meeting
- Future conversations with Tribes, industry, and other interested parties

Reference Slides

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Ferrous mining/processing mercury reduction plans

Industry proposal vs. Required rule reduction

			Reference Scenario 1. Taconite Industry Proposal			Reference Scenario 2. Required Rule Reduction Percentage		
Facility Name	**Emission Unit Description**	**MPCA Revised Baseline Emissions [1] (pounds)**	**Identified Reduction**	**Method of Compliance**	**Future Emissions (pounds)**	**Identified Reduction**	**Method of Compliance**	**Future Emissions (pounds)**
ArcelorMittal Minorca Mine Inc.	Indurating Furnace	66.93	22.0%	Utilize existing wet scrubbers with mercury capture by solids removal.	52.21	72.0%	Theoretical control strategy.	18.74
Hibbing Taconite Company	Line 1	55.71	0.0%	No additional controls proposed.	55.71	72.0%	Theoretical control strategy.	15.60
	Line 2	70.90	0.0%	No additional controls proposed.	70.90	72.0%		19.85
	Line 3	60.67	0.0%	No additional controls proposed.	60.67	72.0%		16.99
Mesabi Metallics Company LLC	Indurating Furnace	86.12	72.0%	Activated carbon injection with a greater reduction after the start-up of the DRI facility.	24.11	72.0%	Industry Proposal is sufficient.	24.11
	DRI Process	4.12	70.0%		1.24	70.0%		1.24
Mesabi Nugget Delaware LLC	Rotary Hearth Furnace	75.34	50.0%	Raw material substitution (lower Hg-content flux material).	37.67	72.0%	Theoretical control strategy.	21.09
Northshore Mining Company - Silver Bay	Furnace 5	0.44	72.0%	No direct reduction at furnaces. Proposed to achieve additional reductions at power boilers through an enforceable emissions cap.	0.12	72.0%	Industry Proposal is sufficient.	0.12
	Furnace 6	0.64	72.0%		0.18	72.0%		0.18
	Furnace 11	1.75	72.0%		0.49	72.0%		0.49
	Furnace 12	1.71	72.0%		0.48	72.0%		0.48
U.S. Steel Corp - Keetac	Grate Kiln Furnace	96.16	0.0%	No additional controls proposed.	96.16	72.0%	Theoretical control strategy.	26.92
U.S. Steel Corp - Minntac	Line 3 Rotary Kiln	14.82	0.0%	No additional controls proposed.	14.82	72.0%	Theoretical control strategy.	4.15
	Line 4 Rotary Kiln	34.21	0.0%	No additional controls proposed.	34.21	72.0%		9.58
	Line 5 Rotary Kiln	32.62	0.0%	No additional controls proposed.	32.62	72.0%		9.13
	Line 6 Rotary Kiln	39.85	0.0%	No additional controls proposed.	39.85	72.0%		11.16
	Line 7 Rotary Kiln	39.95	0.0%	No additional controls proposed.	39.95	72.0%		11.19
United Taconite LLC - Fairlane Plant	Grate Kiln Line 1	37.90	0.0%	No additional controls proposed.	37.90	72.0%	Theoretical control strategy.	10.61
	Grate Kiln Line 2	85.95	0.0%	No additional controls proposed.	85.95	72.0%		24.07
	Total	**805.80**			**685.25**			**225.71**

Different control scenarios
Activated carbon injection

			Scenario 3. Activated Carbon Injection (All Sources)			Scenario 4. Activated Carbon Injection (Alternate 1)		
Facility Name	**Emission Unit Description**	**MPCA Revised Baseline Emissions [1] (pounds)**	**Identified Reduction**	**Method of Compliance**	**Future Emissions (pounds)**	**Identified Reduction**	**Method of Compliance**	**Future Emissions (pounds)**
ArcelorMittal Minorca Mine Inc.	Indurating Furnace	66.93	88.1%	ACI w/ Fabric Filter	7.96	88.1%	ACI w/ Fabric Filter	7.96
Hibbing Taconite Company	Line 1	55.71	88.1%	ACI w/ Fabric Filter	6.63	0.0%		55.71
	Line 2	70.90	88.1%	ACI w/ Fabric Filter	8.44	88.1%	ACI w/ Fabric Filter	8.44
	Line 3	60.67	88.1%	ACI w/ Fabric Filter	7.22	88.1%	ACI w/ Fabric Filter	7.22
Mesabi Metallics Company LLC	Indurating Furnace	86.12	72.0%	Industry Proposal is sufficient.	24.11	72.0%	Industry Proposal is sufficient.	24.11
	DRI Process	4.12	70.0%		1.24	70.0%		1.24
Mesabi Nugget Delaware LLC	Rotary Hearth Furnace	75.34	50.0%	Raw material substitution (lower Hg-content flux material).	37.67	50.0%	Raw material substitution (lower Hg-content flux material).	37.67
Northshore Mining Company - Silver Bay	Furnace 5	0.44	72.0%	Industry Proposal is sufficient.	0.12	72.0%	Industry Proposal is sufficient.	0.12
	Furnace 6	0.64	72.0%		0.18	72.0%		0.18
	Furnace 11	1.75	72.0%		0.49	72.0%		0.49
	Furnace 12	1.71	72.0%		0.48	72.0%		0.48
U.S. Steel Corp - Keetac	Grate Kiln Furnace	96.16	80.0%	ACI w/ Wet ESP	19.23	80.0%	ACI w/ Wet ESP	19.23
U.S. Steel Corp - Minntac	Line 3 Rotary Kiln	14.82	80.0%	ACI w/ Wet ESP	2.96	0.0%		14.82
	Line 4 Rotary Kiln	34.21	80.0%	ACI w/ High Efficiency Scrubbers	6.84	80.0%	ACI w/ High Efficiency Scrubbers	6.84
	Line 5 Rotary Kiln	32.62	80.0%	ACI w/ High Efficiency Scrubbers	6.52	80.0%	ACI w/ High Efficiency Scrubbers	6.52
	Line 6 Rotary Kiln	39.85	80.0%	ACI w/ High Efficiency Scrubbers	7.97	80.0%	ACI w/ High Efficiency Scrubbers	7.97
	Line 7 Rotary Kiln	39.95	80.0%	ACI w/ High Efficiency Scrubbers	7.99	80.0%	ACI w/ High Efficiency Scrubbers	7.99
United Taconite LLC - Fairlane Plant	Grate Kiln Line 1	37.90	88.1%	ACI w/ Fabric Filter	4.51	0.0%		37.90
	Grate Kiln Line 2	85.95	88.1%	ACI w/ Fabric Filter	10.23	88.1%	ACI w/ Fabric Filter	10.23
	Total	**805.80**			**160.80**			**255.13**

Different control scenarios
Activated carbon injection

Scenario 5. Activated Carbon Injection (Alternate 2)

Facility Name	Emission Unit Description	MPCA Revised Baseline Emissions [1] (pounds)	Identified Reduction	Method of Compliance	Future Emissions (pounds)
ArcelorMittal Minorca Mine Inc.	Indurating Furnace	66.93	88.0%	ACI w/ Fabric Filter	8.03
Hibbing Taconite Company	Line 1	55.71	0.0%		55.71
	Line 2	70.90	0.0%		70.90
	Line 3	60.67	0.0%		60.67
Mesabi Metallics Company LLC	Indurating Furnace	86.12	72.0%	Industry Proposal is sufficient.	24.11
	DRI Process	4.12	70.0%		1.24
Mesabi Nugget Delaware LLC	Rotary Hearth Furnace	75.34	50.0%	Raw material substitution (lower Hg-content flux material).	37.67
Northshore Mining Company - Silver Bay	Furnace 5	0.44	72.0%	Industry Proposal is sufficient.	0.12
	Furnace 6	0.64	72.0%		0.18
	Furnace 11	1.75	72.0%		0.49
	Furnace 12	1.71	72.0%		0.48
U.S. Steel Corp - Keetac	Grate Kiln Furnace	96.16	80.0%	ACI w/ ESP	19.23
U.S. Steel Corp - Minntac	Line 3 Rotary Kiln	14.82	0.0%		14.82
	Line 4 Rotary Kiln	34.21	80.0%	ACI w/ High Efficiency Scrubbers	6.84
	Line 5 Rotary Kiln	32.62	80.0%	ACI w/ High Efficiency Scrubbers	6.52
	Line 6 Rotary Kiln	39.85	80.0%	ACI w/ High Efficiency Scrubbers	7.97
	Line 7 Rotary Kiln	39.95	80.0%	ACI w/ High Efficiency Scrubbers	7.99
United Taconite LLC - Fairlane Plant	Grate Kiln Line 1	37.90	88.0%	ACI w/ Fabric Filter	4.55
	Grate Kiln Line 2	85.95	88.0%	ACI w/ Fabric Filter	10.31
	Total	**805.80**			**337.84**

Different control scenarios
Gore mercury control technology

			Scenario 6. GORE Technology (All Sources)			Scenario 7. GORE Technology (Alternate 1)		
Facility Name	**Emission Unit Description**	**MPCA Revised Baseline Emissions [1] (pounds)**	**Identified Reduction**	**Method of Compliance**	**Future Emissions (pounds)**	**Identified Reduction**	**Method of Compliance**	**Future Emissions (pounds)**
ArcelorMittal Minorca Mine Inc.	Indurating Furnace	66.93	72.0%	GORE Technology	18.74	72.0%	GORE Technology	18.74
Hibbing Taconite Company	Line 1	55.71	72.0%	GORE Technology	15.60	0.0%		55.71
	Line 2	70.90	72.0%	GORE Technology	19.85	72.0%	GORE Technology	19.85
	Line 3	60.67	72.0%	GORE Technology	16.99	72.0%	GORE Technology	16.99
Mesabi Metallics Company LLC	Indurating Furnace	86.12	72.0%	Industry Proposal is sufficient.	24.11	72.0%	Industry Proposal is sufficient.	24.11
	DRI Process	4.12	70.0%		1.24	70.0%		1.24
Mesabi Nugget Delaware LLC	Rotary Hearth Furnace	75.34	50.0%	Raw material substitution (lower Hg-content flux material).	37.67	50.0%	Raw material substitution (lower Hg-content flux material).	37.67
Northshore Mining Company - Silver Bay	Furnace 5	0.44	72.0%	Industry Proposal is sufficient.	0.12	72.0%	Industry Proposal is sufficient.	0.12
	Furnace 6	0.64	72.0%		0.18	72.0%		0.18
	Furnace 11	1.75	72.0%		0.49	72.0%		0.49
	Furnace 12	1.71	72.0%		0.48	72.0%		0.48
U.S. Steel Corp - Keetac	Grate Kiln Furnace	96.16	72.0%	GORE Technology	26.92	72.0%	GORE Technology	26.92
U.S. Steel Corp - Minntac	Line 3 Rotary Kiln	14.82	72.0%	GORE Technology	4.15	0.0%		14.82
	Line 4 Rotary Kiln	34.21	72.0%	GORE Technology	9.58	72.0%	GORE Technology	9.58
	Line 5 Rotary Kiln	32.62	72.0%	GORE Technology	9.13	72.0%	GORE Technology	9.13
	Line 6 Rotary Kiln	39.85	72.0%	GORE Technology	11.16	72.0%	GORE Technology	11.16
	Line 7 Rotary Kiln	39.95	72.0%	GORE Technology	11.19	72.0%	GORE Technology	11.19
United Taconite LLC - Fairlane Plant	Grate Kiln Line 1	37.90	72.0%	GORE Technology	10.61	0.0%		37.90
	Grate Kiln Line 2	85.95	72.0%	GORE Technology	24.07	72.0%	GORE Technology	24.07
	Total	**805.80**			**242.28**			**320.35**

Different control scenarios
Wasting scrubber solids & halide injection

			Scenario 8. Wasting Scrubber Solids (All Possible Sources)			Scenario 9. Halide Injection (All Sources)		
Facility Name	**Emission Unit Description**	**MPCA Revised Baseline Emissions [1] (pounds)**	**Identified Reduction**	**Method of Compliance**	**Future Emissions (pounds)**	**Identified Reduction**	**Method of Compliance**	**Future Emissions (pounds)**
ArcelorMittal Minorca Mine Inc.	Indurating Furnace	66.93	22.0%	Wasting Scrubber Solids	52.21	33.0%	Halide Injection	44.84
Hibbing Taconite Company	Line 1	55.71	0.0%	No control (MPCA agreed wasting scrubber solids would not result in significant reductions at Hibbing).	55.71	33.3%	Halide Injection	37.16
	Line 2	70.90	0.0%		70.90	33.3%	Halide Injection	47.29
	Line 3	60.67	0.0%		60.67	33.3%	Halide Injection	40.47
Mesabi Metallics Company LLC	Indurating Furnace	86.12	72.0%	Industry Proposal is sufficient.	24.11	72.0%	Industry Proposal is sufficient.	24.11
	DRI Process	4.12	70.0%		1.24	70.0%		1.24
Mesabi Nugget Delaware LLC	Rotary Hearth Furnace	75.34	50.0%	Raw material substitution (lower Hg-content flux material).	37.67	50.0%	Raw material substitution (lower Hg-content flux material).	37.67
Northshore Mining Company - Silver Bay	Furnace 5	0.44	72.0%	Industry Proposal is sufficient.	0.12	72.0%	Industry Proposal is sufficient.	0.12
	Furnace 6	0.64	72.0%		0.18	72.0%		0.18
	Furnace 11	1.75	72.0%		0.49	72.0%		0.49
	Furnace 12	1.71	72.0%		0.48	72.0%		0.48
U.S. Steel Corp - Keetac	Grate Kiln Furnace	96.16	0.0%	Previously implemented scrubber solids wasting.	96.16	25.0%	Halide Injection	72.12
U.S. Steel Corp - Minntac	Line 3 Rotary Kiln	14.82	0.0%	Previously implemented scrubber solids wasting.	14.82	25.0%	Halide Injection	11.11
	Line 4 Rotary Kiln	34.21	27.0%	Wasting Scrubber Solids	24.97	25.0%	Halide Injection	25.66
	Line 5 Rotary Kiln	32.62	27.0%	Wasting Scrubber Solids	23.81	25.0%	Halide Injection	24.47
	Line 6 Rotary Kiln	39.85	27.0%	Wasting Scrubber Solids	29.09	25.0%	Halide Injection	29.89
	Line 7 Rotary Kiln	39.95	27.0%	Wasting Scrubber Solids	29.17	25.0%	Halide Injection	29.97
United Taconite LLC - Fairlane Plant	Grate Kiln Line 1	37.90	10.0%	Wasting Scrubber Solids	34.11	40.0%	Halide Injection	22.74
	Grate Kiln Line 2	85.95	10.0%	Wasting Scrubber Solids	77.36	40.0%	Halide Injection	51.57
	Total	**805.80**			**633.27**			**501.57**