

From: [Cordell, Vickie K](#)
To: [Boling, Jean](#)
Subject: CCIHW Boilers 6-8
Date: Monday, March 17, 2025 11:45:17 AM
Attachments: [CCIHW Boilers 6-8 NOx Control Costs with Derate Values.xlsx](#)

Dear Jean,

If you haven't already sent my IHW Boilers 6 – 8 cost calculations to Cleveland Cliffs, please change the derate values that I included on Row 2 of the tabs for Boilers 6 and 7. I copied the Boiler 8 page as my starting point for these two and forgot to revise their derated capacities before I sent the file to you the first time. A revised files is attached with the corrected derate values.

If you've already sent it to them it's not a big deal; the actual emissions aren't based on the derated capacities, anyway. I just thought it might be good to note the derating because (1) they seem to think it matters for the baseline and (2) I believe it underscores the age and unreliability of these units.

Thank you!

Vickie

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CCIHW Boiler No. 6

Permitted Capacity: 454 MMBtu/hr, although reported in RACT submittal as derated to 329 MMBtu/hr due to issues affecting boiler capacity

Total Capital Investment

Total Capital Investment, TCI \$4,525,000

Total Annual Cost

Total direct annual cost, DAC \$60,000

Indirect Annual Costs

Annual administration cost	\$90,500	EPA Control Cost Manual
Property tax	\$45,250	EPA Control Cost Manual
Insurance	\$45,250	EPA Control Cost Manual

capital recovery factor, CRF 0.1204

8.5% 15 years

Capital recovery, CR \$544,903 TCI x CRF

Total annual costs, TAC \$785,903

Emissions Reduction

AECOM Baseline emission factor, BEF 0.200 lb/MMBtu source-derived factor used in RACT Submittal

NG* BFG**

EIS emission factors (lb/MMCF) 280 0.95

Reported fuel usage (MMCF/yr) 2019 346.00 8093

from Emission Inventory Statements 2020 277.00 2680

2021 417.00 2611

2022 903.78 0

2023 438.00 0

Annual NOx emissions (tons/yr) 2019 52.28

from Emission Inventory Statements 2020 40.05

2021 59.62

2022 126.53

2023 61.32

Annual fuel usage as NG, MMCF 2019 373.46

2020 286.09

2021 425.86

2022 903.78

2023 438.00

Max of three most recent years fuel usage as NG 903.78 MMCF/yr

As Reported Max NOx emissions, BLE 126.53 tons/yr

Natural gas HHV*** 1,050.75 MMBtu/MMCF

Emission factor after control 0.08 lb/MMBtu

84.1 lb/MMCF

Emissions after control, EAC 37.99 tons/yr

Emissions reduction, ER 88.54 tons/yr BLE - EAC

Cost effectiveness, TAC/ER \$8,876 /ton

Alternate, using 0.200 lb/MMBtu

94.96421066 tons/yr

1,050.75 MMBtu/MMCF

0.08 lb/MMBtu

84.1 lb/MMCF

18.41 tons/yr

76.56 tons/yr BLE - EAC

\$10,266 /ton

Alternate, using 0.200 lb/MMBtu and 1,020 MMBtu/MMCF

92.185101 tons/yr

1,020 MMBtu/MMCF

0.08 lb/MMBtu

81.6 lb/MMCF

36.87 tons/yr

55.31 tons/yr BLE - EAC

\$14,209 /ton

*Natural gas emission factor is AP 42 NOx value for uncontrolled pre-NSPS boiler >100 MMBtu

** Blast furnace gas emission factor is site-specific

*** Average Annual Heating Value from 2022 SO2 Quarterly Emission Reports

CCIHW Boiler No. 7

Permitted Capacity: 454 MMBtu/hr, although reported in RACT submittal as derated to 356 MMBtu/hr due to issues affecting boiler capacity

Total Capital Investment

Total Capital Investment, TCI \$4,525,000

Total Annual Cost

Total direct annual cost, DAC \$60,000

Indirect Annual Costs

Annual administration cost \$90,500 EPA Control Cost Manual

Property tax \$45,250 EPA Control Cost Manual

Insurance \$45,250 EPA Control Cost Manual

capital recovery factor, CRF 0.1204
8.5% 15 years

Capital recovery, CR \$544,903 TCI x CRF

Total annual costs, TAC \$785,903

Emissions Reduction

AECOM Baseline emission factor, BEF 0.200 lb/MMBtu source-derived factor used in RACT Submittal

NG* BFG**

EIS emission factors (lb/MMCF) 280 0.95

Reported fuel usage (MMCF/yr)	2019	486.00	18990
from Emission Inventory Statements	2020	489.00	13601
	2021	677.00	10173
	2022	1344.46	2520.2136
	2023	1039.52	0

Annual NOx emissions (tons/yr)	2019	77.06
from Emission Inventory Statements	2020	74.92
	2021	99.61
	2022	189.42
	2023	145.53

Annual fuel usage as NG, MMCF	2019	550.43
	2020	535.15
	2021	711.52
	2022	1353.01
	2023	1039.52

Max of three most recent years fuel usage as NG 1353.01 MMCF/yr

As Reported Max NOx emissions, BLE 189.42 tons/yr

Natural gas HHV*** 1,050.75 MMBtu/MMCF
Emission factor after control 0.08 lb/MMBtu
84.1 lb/MMCF

Emissions after control, EAC 56.87 tons/yr

Emissions reduction, ER 132.55 tons/yr BLE - EAC

Alternate, using 0.200 lb/MMBtu

142.1673 tons/yr

1,050.75 MMBtu/MMCF
0.08 lb/MMBtu
84.1 lb/MMCF

43.69 tons/yr

98.48 tons/yr BLE - EAC

Alternate, using 0.200 lb/MMBtu and 1,020 MMBtu/MMCF

138.0068 tons/yr

1,020 MMBtu/MMCF
0.08 lb/MMBtu
81.6 lb/MMCF

55.20 tons/yr

82.80 tons/yr BLE - EAC

Cost effectiveness, TAC/ER

\$5,929 /ton

\$7,981 /ton

\$9,491 /ton

*Natural gas emission factor is AP 42 NOx value for uncontrolled pre-NSPS boiler >100 MMBtu

** Blast furnace gas emission factor is site-specific

*** Average Annual Heating Value from 2022 SO2 Quarterly Emission Reports

CCIHW Boiler No. 8

Permitted Capacity: 1090 MMBtu/hr, although derated to 612 MMBtu/hr due to issues affecting boiler capacity

Total Capital Investment

Total Capital Investment, TCI	IHW Blr8	\$4,650,000
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Total Annual Cost

Total direct annual cost, DAC		<i>none reported</i>
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Indirect Annual Costs

Annual administration cost	\$93,000	EPA Control Cost Manual
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Property tax	\$46,500	EPA Control Cost Manual
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Insurance	\$46,500	EPA Control Cost Manual
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capital recovery factor, CRF	0.1204	
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8.5%	15 years	
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Capital recovery, CR	\$559,955	TCI x CRF
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Total annual costs, TAC	\$745,955	
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Emissions Reduction

AECOM Baseline emission factor, BEF	0.200 lb/MMBtu	source-derived factor used in RACT Submittal
		NG* BFG**

EIS emission factors (lb/MMCF)	280	0.95
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Reported fuel usage (MMCF/yr)	2019	1417.00	44131
from Emission Inventory Statements	2020	2520.00	23390
	2021	1503.00	35625
	2022	1904.80	7749.236
	2023	3609.08	0

Annual NOx emissions (tons/yr)	2019	219.34
from Emission Inventory Statements	2020	363.91
	2021	227.34
	2022	270.35
	2023	505.27

Annual fuel usage as NG, MMCF	2019	1566.73
	2020	2599.36
	2021	1623.87
	2022	1931.09
	2023	3609.08

Max of three most recent years fuel usage as NG	3609.08 MMCF/yr
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As Reported Max NOx emissions, BLE	505.27 tons/yr
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Natural gas HHV***	1,051 MMBtu/MMCF
Emission factor after control	0.08 lb/MMBtu
	84.1 lb/MMCF

Emissions after control, EAC	151.73 tons/yr
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Emissions reduction, ER	353.55 tons/yr	BLE - EAC
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Cost effectiveness, TAC/ER

\$2,110 /ton

Alternate, using 0.200 lb/MMBtu

379.3145 tons/yr

1,051 MMBtu/MMCF
0.08 lb/MMBtu
84.1 lb/MMCF

151.73 tons/yr

227.59 tons/yr	BLE - EAC
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\$3,278 /ton

Alternate, using 0.200 lb/MMBtu and 1,020 MMBtu/MMCF
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368.1263 tons/yr

1,020 MMBtu/MMCF
0.08 lb/MMBtu
81.6 lb/MMCF

147.25 tons/yr

220.88 tons/yr	BLE - EAC
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\$3,377 /ton

Alternate, using Average of Highest Two Years Heat Input
3104.22 MMCF/yr

434.5908 tons/yr

1,051 MMBtu/MMCF
0.08 lb/MMBtu
84.1 lb/MMCF

130.50 tons/yr

304.09 tons/yr	BLE - EAC
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\$2,453 /ton

*Natural gas emission factor is AP 42 NOx value for uncontrolled pre-NSPS boiler >100 MMBtu

** Blast furnace gas emission factor is site-specific

*** Average Annual Heating Value from 2023 SO2 Quarterly Emission Reports

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From: [Cordell, Vickie K](#)
To: [Boling, Jean](#); [Engdahl, Seth M](#); [DELONEY, SCOTT](#)
Cc: [Logan, Douglas A](#)
Subject: Additional Cleveland-Cliffs NOx Reduction
Date: Tuesday, September 24, 2024 6:27:50 PM
Attachments: [image001.png](#)
[CC IHW Boilers Control Cost per Ton.xlsx](#)
[Cleveland-Cliffs Indiana Harbor NOx RACT Study 2024-0819.pdf](#)

Dear Jean, Seth, and Scott,

The 2019 Compliance Plan averaging notification from ArcelorMittal (now Cleveland-Cliffs) that the inspector shared with us a couple weeks ago started me looking into how the Indiana Harbor West Boilers 6, 7, and 8 were addressed in Cleveland-Cliffs' RACT submittal. Now that he's had time to dig back in after being away, Doug agrees that **additional NOx control IS economically feasible for Boiler 8**.

CCIHW presented their RACT analysis for Boilers 6, 7, and 8 as a total project cost for modifications, with low-NOx Burners (LNB) and Flue Gas Recirculation (FGR) for Boilers 6 and 7, and LNB with Overfire Air (OFA) for Boiler 8. The RACT submittal presented a combined control cost divided by a total emissions reduction for all three boilers, resulting in an average control cost above \$6,000 per ton. However, utilization of Boiler 8 is significantly greater than their use of Boilers 6 and 7.

I determined the control cost per ton for each boiler, using CCIHW's total annual cost numbers (provided in their RACT submission) and the expected reductions for each boiler from the actual emissions reported for the past three years and control efficiencies shown in EPA's March 2023 Final Non-EGU Sectors TSD. By that measure, installation of low NOx burners with overfire air is economically feasible for Boiler 8. Please see the attached Excel file. I have also attached their RACT submittal for ready reference.

Based on our second look, Doug and I think that we need to go back to Cleveland-Cliffs and tell them that, based on their cost numbers and the actual emissions levels, we are establishing RACT for **Boiler 8 as Installation of low NOx burners with overfire air to achieve emissions of 0.07 lb NOx/MMBtu**.

Doug and I are thinking there will probably need to be some usage limit established for Boilers 6 and 7, too. We will finalize our thoughts on that promptly and send another email including the basis for the chosen limit.

These three boilers are subject to 326 IAC 10-3-3 requirements when firing blast furnace gas (BFG). However, the decommissioning of the blast furnaces at Indiana Harbor West has resulted in their operation solely on natural gas which has significantly higher NOx emissions per MMBtu than BFG.

NOTE: A consultant for Cleveland-Cliffs' developed a site-specific NOx emission factor for the boilers based on preliminary measurements made by plant personnel using a hand-held portable analyzer and air samples collected from various locations for each boiler including the furnace and ducts for Boilers 6 and 8. There are many missing details regarding the development of this alternate emission factor. Its use results in lower values for the annual actual emissions and the annual tons of NOx controlled. The cost per ton spreadsheet includes a column with Boiler 8 emissions calculated using their alternate emission factor, showing that even with the lower factor the NOx control cost is under \$5,000 per ton.

Sincerely,

Vickie Cordell
Contractor
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Cleveland-Cliffs Steel Indiana Harbor West Boilers 6 - 8 NOx Control Cost/Ton

	<u>Boiler 6</u>	<u>Boiler 7</u>	<u>Boiler 8</u>	Boiler 8 @ 0.2 lb/MMBtu⁽¹⁾
<u>NOx Reported Actual Tons/Year⁽¹⁾</u>				
2021 NOx Emissions BFG ⁽²⁾	1.24	4.83	16.92	16.92
" natural gas	58.38	94.78	210.42	153.306
Annual Total	59.62	99.61	227.34	170.23
2022 NOx Emissions BFG	0	1.20	3.68	3.68
natural gas	126.53	188.22	266.67	194.2897457
Annual Total	126.53	189.42	270.35	197.97
2023 NOx Emissions BFG	none	none	none	
natural gas	61.32	145.53	505.27	368.1263057
Average of Highest 2 Years	93.92	167.48	387.81	283.05
Control Efficiency	60%	60%	65%	65%
Tons of NOx removed	56.4	100.5	252.1	184.0
<u>Annual NOx Control Cost</u>				
Total Capital Investment, TCI	\$4,525,000	\$4,525,000	\$4,650,000	
Direct Annual Costs	\$60,000	\$60,000	\$0	
Indirect Annual Costs				
Admin Cost, 2% of TCI	\$90,500.00	\$90,500.00	\$93,000.00	
Property Tax, 1% of TCI	\$45,250.00	\$45,250.00	\$46,500.00	
Insurance, 1% of TCI	\$45,250.00	\$45,250.00	\$46,500.00	
Capital Recovery, CR⁽³⁾	\$544,810.00	\$544,810.00	\$559,860.00	
TOTAL Annual Cost, TAC	\$785,810	\$785,810	\$745,860	
Annual Control \$/ton	\$13,944.03	\$7,820.08	\$2,958.85	\$4,053.99

(1) The Reported Actual Tons/Year values are from the Annual Emission Statements submitted by Cleveland-Cliffs, except for the column titled "Boiler 8 @ 0.2 lb/MMBtu". The Emission Statements use the AP-42 NOx emission factor of 280 lbs/MMCF for natural gas. Cleveland-Cliffs' RACT submittal instead uses a site-specific average emission factor of 0.20 lb/MMBtu, which is 204 lbs/MMCF (using 1020 Btu/scf for natural gas). The "Boiler 8 @ 0.2 lb/MMBtu" column shows adjusted tons of emissions and \$/ton using this alternate factor.

(2) BFG = Blast Furnace Gas

(3) CR = CRF x TCI

Capital Recovery Factor, CRF = 0.1204

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