American Iron and Steel Institute

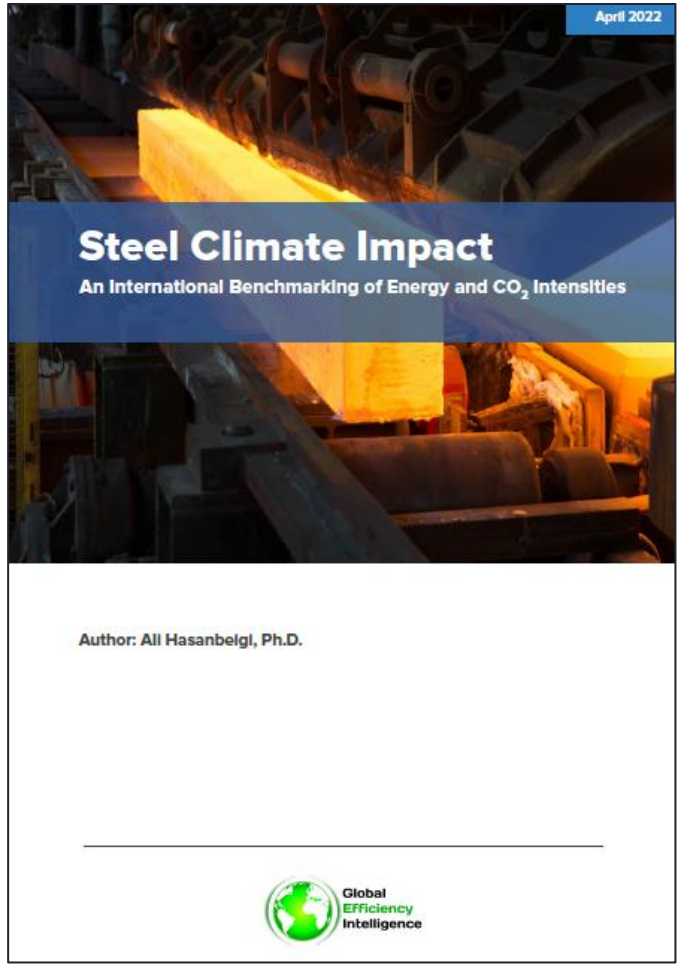
Regional Ozone Transport FIP - Presentation to OMB/OIRA

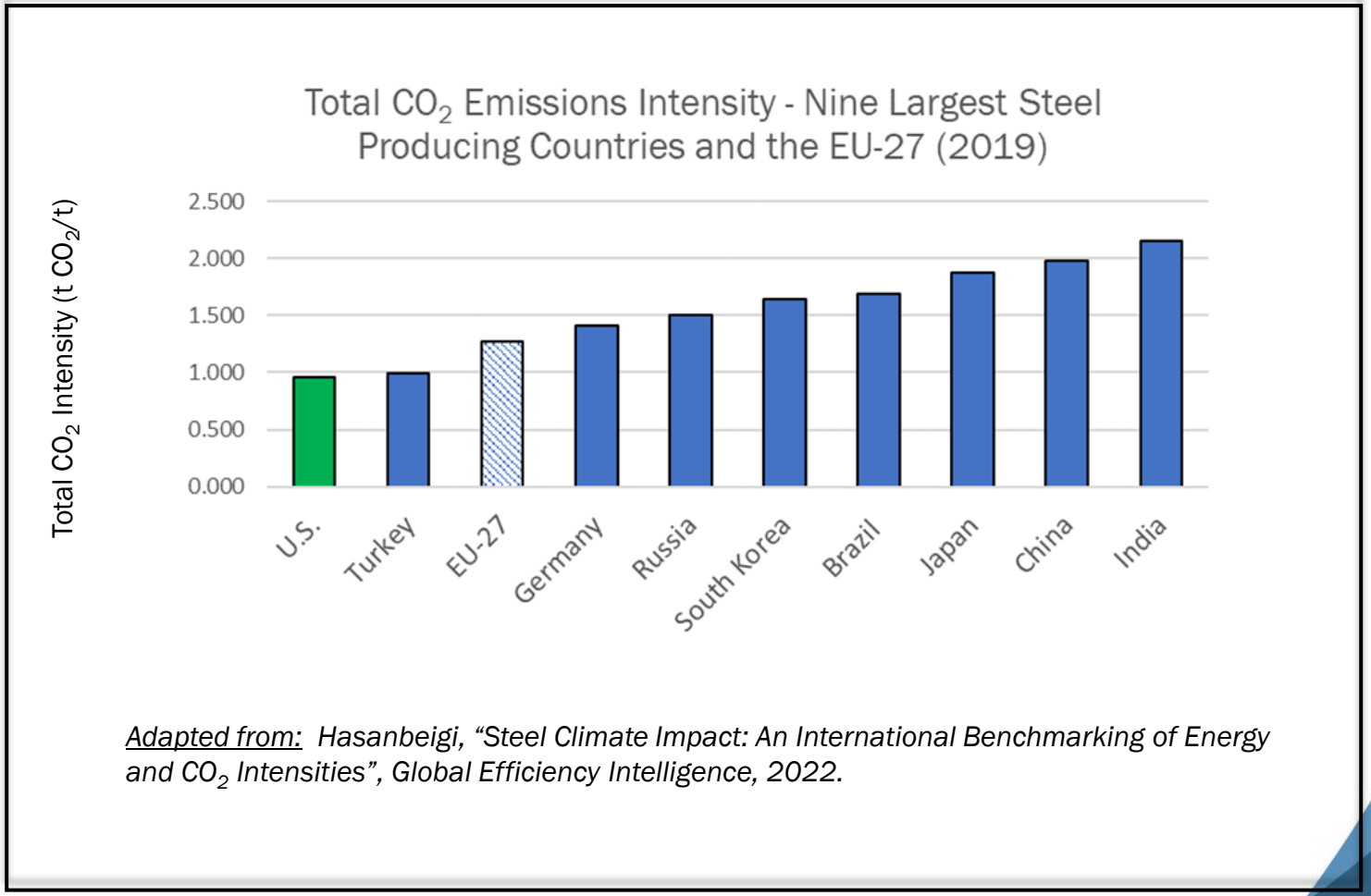
American Iron and Steel Institute
E.O. 12866 Meeting
March 8, 2023

Importance of the Steel Industry

- The steel industry is the backbone of the American economy and a key sector supporting our national defense
  - The industry represents more than $520 billion in economic output and nearly 2 million jobs considering direct and indirect impacts
  - The U.S. is the fourth largest steel producer in the world with EAF and integrated steel facilities located across the country
  - We serve customers in diverse sectors including automotive, transportation, construction, and packaging

American Steel is the Lowest Emitting in the World





Adapted from: Hasanbeigi, "Steel Climate Impact: An International Benchmarking of Energy and CO_2 Intensities", Global Efficiency Intelligence, 2022.

Potential Impact of the Rule

- This rule would be catastrophic to the steel industry as there is no proven technology that can achieve the NOx reductions proposed by EPA
- Engagement with EPA on the NPRM:
  - Public hearing April 21, 2022
  - Submitted written public comments June 21, 2022
  - Met with EPA on September 21, 2022
  - Met with EPA on October 11, 2022
- *Our request* – that EPA would drop the iron and steel sector from the rule or at least re-propose standards for our sector

Proposed Emissions Limits for Iron and Steel

EMISSIONS UNIT	PROPOSED NO_X LIMIT *lbs. per hour or lbs. per million British Thermal Units*
BLAST FURNACE	0.03 lb./mmBtu
BASIC OXYGEN FURNACE	0.07 lb./ton
ELECTRIC ARC FURNACE	0.15 lb./ton steel
LADLE/TUNDISH PREHEATERS	0.06 lb./mmBtu
REHEAT FURNACE	0.05 lb./mmBtu
ANNEALING FURNACE	0.06 lb./mmBtu
VACUUM DEGASSER	0.03 lb./mmBtu
LADLE METALLURGY FURNACE	0.1 lb./ton

EMISSIONS UNIT	PROPOSED NO_X LIMIT *lbs. per hour or lbs. per million British Thermal Units*
TACONITE PRODUCTION KILNS	Work practice standard to install low NO_X technology/ burners, test and set
COKE OVENS (CHARGING AND COKING)	0.6 lb./ton of coal charged
COKE OVENS (PUSHING)	0.015 lb./ton of coal pushed
BOILERS - COAL	0.20 lb./mmBtu
BOILERS - RESIDUAL OIL	0.20 lb./mmBtu
BOILERS - DISTILLATE OIL	0.12 lb./mmBtu
BOILERS - NATURAL GAS	0.08 lb./mmBtu

Overall Concerns With EPA Standard-Setting Process

- For the vast majority of iron and steel units, the proposed controls identified by EPA to set the emission limit are technically infeasible.
  - In most circumstances, EPA identified BACT emission limits, applied an additional control efficiency on top of that, and just adopted that resulting emission limit for the proposal. So, it is substantially more stringent than BACT (and unachievable)
  - For the few emissions units where AISI was able to obtain sufficient data, the proposed controls are cost prohibitive.
- With barely any exception, the proposed controls are not in use anywhere on iron and steel emission units.
  - In fact, EPA's proposal is contradicted by EPA's own past RACT and BACT determinations at steel production facilities
- EPA did not consider already applied control strategies (i.e., low NOx burners) when establishing baseline emission rates.
  - EPA thereafter assumed an overall control efficiency, randomly selecting the percent reduction. This compounding of assumptions calls into question the validity of the limits, as well as the cost/benefit analysis.

Overall Concerns With EPA Standard-Setting Process

Emissions unit	Proposed NO_X emissions standard or requirement (lbs/hour or lb/mmBtu)	Additional information
Blast Furnace	0.03 lb/mmBtu	OH NO_X RACT rules limit NO_X emissions from blast furnaces to 0.06 lb/mmBtu without requiring specific control technology. Control NO_X at stoves (typically 3 or 4 per blast furnace), assuming 40–50% reduction) by burner replacement plus SCR.
Basic Oxygen Furnace	0.07 lb/ton	Potential 25–50% reduction by SCR/SNCR from 0.14 lb/ton based on emissions testing.
Electric Arc Furnace	0.15 lb/ton steel	Example permit limits at around 0.2 lb/ton. Assumes 25% reduction by SCR to achieve 0.15 lb/ton steel.
Ladle/tundish Preheaters	0.06 lb/mmBtu	Nucor Kankakee BACT permit limit issued January 2021 is 0.1 lb/mmBtu, 2021. Assume 40% reduction by SCR.
Reheat furnace	0.05 lb/mmBtu	Sterling Steel permit, issued 2019: Low-NO_X natural gas fired burners designed to emit no more than 0.073 lb NO_X/mmBtu, Ohio RACT limit is 0.09 lb/mmBtu. Assume 40% reduction by SCR.
Annealing Furnace	0.06 lb/mmBtu	Big River Steel (AR) 2018 limit and Benteler Steel (LA) 2019 limit (0.11 lb/mmBtu), 85 mmBtu/hr and 13 mmBtu/hr, respectively. Lowest was 0.0915 lb/mmBtu, Nucor AR. Assume 40% reduction by SCR.
Vacuum Degasser	0.03 lb/mmBtu	0.05 lb/mmBtu Nucor Darlington (SC) and Nucor Tuscaloosa (AL). Assume 40% reduction by SCR.
Ladle Metallurgy Furnace	0.1 lb/ton	Assume 40% reduction by SCR.
Taconite Production Kilns	Work practice standard to install and operate low NO_X burners.	Consistent with requirements in Minnesota Taconite FIP *See 81 FR 21671.*
Coke Ovens (charging)	0.15 lb/ton of coal charged	Assume 50% reduction staged combustion and/or limited use SCR/SNCR during charging operations from AP–42 0.3 lb/ton emission factor.
Coke Ovens (pushing)	0.015 lb/ton of coal pushed	SunCoke Middletown limit is 0.02 lb/ton of coal. Assume 25% reduction by SCR.
Boilers—Coal	0.20 lb/mmBtu	See explanation in Section VII.C.5.
Boilers—Residual oil	0.20 lb/mmBtu	See explanation in Section VII.C.5.
Boilers—Distillate oil	0.12 lb/mmBtu	See explanation in Section VII.C.5.

Proposed Rule Record Review

- In order to determine EPA's support for application of NOx controls (in particular SCR) to iron and steel process, AISI reviewed the rulemaking record, including the Non-EGU TSD and the referenced sources (Menu of Control Options, Control Measures Database, and Control Strategies Tool).

- None of the referenced sources provided any support for the control technology decisions included in the proposed rule. The majority of the referenced sources only discussed reheat furnaces and annealing furnaces, not any of the other iron and steel processes.

- Due to the lack of support in the rulemaking record on technical feasibility, AISI undertook its own technical analysis.

- The AISI comment letter demonstrates that there is no information that could be put into the record to support the application of NOx control technologies such as SCR to the vast majority of iron and steel process units.

State Comment Letters in Support of the Steel Industry

- Eight states submitted comment letters for the proposed rule in support of the iron and steel industry (Indiana, Kentucky, Mississippi, Ohio, Pennsylvania, Texas, Virginia and West Virginia).
- Comments included objection to the infeasible “beyond BACT” limits for EAFs; the unreasonable BOF Shop lower applicability threshold; lack of data and wide use of assumptions for applying control technologies to develop limits; inconsistencies between the proposed rule and the RBLC; and inability to apply SCR to batch operations or processes without a stack.

Response to Agency Question on NOx Controls

- AISI's presentation to EPA last fall focused on the technical and economic infeasibility of SCR/SNCR; at that time, EPA inquired what NOx controls were technically and economically feasible.
- There has been considerable analysis of technical and economic feasibility of NOx controls for iron and steel emissions units in conjunction with New Source Review "top-down" BACT analyses, as well as case-by-case RACT assessments.
- Those BACT and RACT assessments have included consideration of NOx controls such as SCR, SNCR, Non-Selective Catalytic Reduction (NSCR), SCONOX Catalytic Absorption System, Xonon Cool Combustion, Oxy-Fuel Burners, Low-NOx Burners (LNBs).

Response to Agency Question on NOx Controls

- AISI's comment letter at page 29 contains a table with extensive citations to permit records and NOx RACT assessments that contain extensive detailed discussion on the technical infeasibility of add-on NOx controls for almost all of the iron and steel sources.

Summary of Recent RACT/BACT Determinations for the Iron and Steel Sector

Facility	Affected Unit	Determination
Nucor Steel Louisiana 2011 BACT [LDEP Permit No.PSD-LA-751]	Blast Furnace Stoves	SCR technically infeasible
Nucor West Virginia Mill 2022 BACT [WV DEP Permit No. 14-0039]	EAF	SCR technically infeasible
	Reheat Furnaces	SCR economically infeasible
	LMF	SCR technically infeasible
	Annealing Furnace	SCR technically infeasible
Cleveland Cliffs Coatesville 2016 PA RACT [EPA-R03-OAR-2022-0165]	EMS Boiler	SCR economically infeasible ($35,600/ton)
	Batch Heat Treat Furnaces	SCR economically infeasible ($28,900 - $37,500/ton)
	NAB Continuous Heat Treat Furnaces	SCR economically infeasible ($19,800 - $36,800/ton)
Cleveland Cliffs Monessen 2016 PA RACT [EPA-R03-OAR-2022-0165]	Boilers	SCR economically infeasible ($11,000 - $12,000/ton)
Cleveland Cliffs Cleveland Works 2008 Ohio RACT [Final RACT limits at OAC 3745-110-03(N)]	Reheat Furnace	SCR technically infeasible
	Batch Annealing	SCR technically infeasible
	Blast Furnaces	SCR technically infeasible
	BOF	SCR technically infeasible
	Ladle Preheater	SCR technically infeasible
U.S. Steel Edgar Thomson 2020 PA RACT [EPA-R03-OAR-2020-0575]	Blast Furnaces	SCR technically infeasible
	Boilers	SCR economically infeasible
U.S. Steel Irvin 2020 PA RACT [EPA-R03-OAR-2020-0575]	Reheat Furnaces	SCR technically infeasible
Cleveland Cliffs Conshohocken 2016 PA RACT [EPA-R03-OAR-2021-0380]	Annealing Furnace	SCR economically infeasible ($22,300/ton)
Cleveland Cliffs Steelton 2017 PA RACT [EPA-R03-OAR-2021-0531]	Reheat Furnace	SCR economically infeasible ($11,385 - $23,025/ton)
	Electric Arc Furnace	SCR technically infeasible

Essential Requirements for Successful Application of SCR

- Relatively constant gas flow volume to allow uniform velocity over the catalyst.
- Ability to control the gas temperature over time.
- Avoidance of excursions above the design catalyst temperature to prevent sinter of the catalyst.
- Minimization of calcium and metal particles to avoid fouling the catalyst pore structure.
- Sufficient NOx inlet concentrations to avoid higher ammonia slip.
- Existence of a stack or the physical ability to add a stack.
- SCR “Scorecard” used for this presentation:

Constant Gas Flow	Control Gas Temp.	Avoid High Temp.	Minimize PM	Sufficient NOx	Stack

Technical Infeasibility – SCR Scorecard

Emissions Unit	Constant Gas Flow	Control Gas Temperature	Avoid High Temp	Minimize PM	Sufficient NOx	Stack
EAF	No	No	No	No	No	Yes
BF Stove	No	No	No	No	No	Yes
BOF	No	No	No	No	No	Yes
Batch Annealing Furnace	No	No	No	Unknown	No	No
Ladle Metallurgy Furnace	No	No	Unknown	Unknown	No	Yes
Ladle/Tundish Preheater	No	No	Unknown	Unknown	No	No
Vacuum Degasser	No	No	Unknown	Unknown	No	No
Coal Charging/Coke Pushing	No	No	Unknown	Unknown	No	No
Multi-fuel Boiler	No	No	Unknown	Unknown	No	Yes

Reheat Furnace - Economic Infeasibility

- SCR is economically infeasible for Reheat Furnaces. Cost effectiveness was estimated to be $14,500/ton to $40,000/ton, in excess of EPA's threshold of $7,500/ton. Prior RACT/BACT/LAER assessments have concluded that SCR is not economically feasible for Reheat Furnaces (see comment letter and RBLC).
- In addition to economic infeasibility, there are technical feasibility questions regarding the ability to retrofit SCR into an existing reheat furnace that require case-by-case determinations, compared to the ability to design it into a new reheat furnace. Prior RACT/BACT/LAER assessments have concluded that SCR is not technically feasible for Reheat Furnaces (see comment letter and RBLC).

Taconite Sources

- EPA incorrectly identified “Taconite Production Kilns as affected units under the “Iron and Steel Mills and Ferroalloy Manufacturing” category in the Proposed FIP.
  - The Proposed FIP listed the NAICS code for Iron and Steel Mills and Ferroalloys Manufacturing as 3311. However, the code for Iron Ore Mining (taconite) is 2122. The first two digits signify the overall sector. 21 for mining, quarrying, etc. and 33 for manufacturing.
  - EPA has consistently and historically identified in multiple publications that integrated iron and steel mills consist of blast furnaces, BOFs, EAFs, finishing operations, etc.. Raw material providers such as taconite producers are not included in EPA’s literature or in practice.
  - Taconite operations are not co-located with iron and steel manufacturing facilities.
- As noted by EPA in the proposed FIP, taconite production kilns are already adequately regulated and subject to stringent NOx BART controls in the Taconite Regional Haze FIP.
  - The Proposed FIP is redundant to the Taconite Regional Haze FIP and conflicts with components of the Taconite Regional Haze FIP. Further, it is not appropriate for the Proposed FIP to incorporate another FIP (Taconite Regional Haze) by reference.
  - In addition, Minnesota and Michigan must consider as part of the second decadal review period for Regional Haze (2018-2028) if additional NOx controls are warranted for Taconite sources.
- If EPA does decide to proceed with also regulating Taconite Production Kilns under the Proposed FIP, additional work is needed to correct inconsistencies and deficiencies in the rule language as noted by Cleveland-Cliffs and others.

Requested Action

- Given the fundamental problems with the proposal as it addresses the iron and steel sector, AISI requests that EPA remove the iron and steel emission units from the final rule.
    - AISI also requests the removal of taconite indurating furnaces as affected units within the iron and steel category.
- To the extent EPA nonetheless intends to regulate iron and steel emission units under the Regional Ozone Transport program, AISI requests that EPA start over with an assessment of technical and economic feasibility, soliciting input from the industry on what (if anything) is possible for NOx controls.
    - AISI should then have the opportunity to review and comment on the new proposal/record.