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PEGGY M. HATCH
SECRETARY

State of Louisiana
DEPARTMENT OF ENVIRONMENTAL QUALITY
ENVIRONMENTAL SERVICES

Certified Mail No.

Agency Interest (AI) No. 157847
Activity No. PER20080002

Mr. Joe Rutkowski
Vice President
1915 Rexford Rd
Charlotte, NC 28211

RE: Prevention of Significant Deterioration (PSD) Permit, PSD-LA-740
Consolidated Environmental Management Inc - Nucor Steel Louisiana
Convent, St. James Parish, Louisiana

Dear Mr. Rutkowski:

Enclosed is your permit, PSD-LA-740. Construction of the proposed project is not allowed until such time as the corresponding Part 70 Operating Permit is issued.

Should you have any questions, contact Kermit Wittenburg of the Air Permits Division at (225) 219-3008.

Sincerely,

Cheryl Sonnier Nolan
Assistant Secretary

Date

CSN:kcw

c: US EPA Region VI

Agency Interest No. 157847

PSD-LA-740

**AUTHORIZATION TO CONSTRUCT AND OPERATE A NEW FACILITY
PURSUANT TO THE PREVENTION OF SIGNIFICANT DETERIORATION
REGULATIONS IN LOUISIANA ENVIRONMENTAL REGULATORY CODE,
LAC 33:III.509**

In accordance with the provisions of the Louisiana Environmental Regulatory Code, LAC 33:III.509,

Consolidated Environmental Management Inc
1915 Rexford Rd
Charlotte, NC 28211

is authorized to construct the facility at Nucor Steel Louisiana near

From I-10 & Hwy 22 go west on Hwy 22 to Hwy 70
Go west 4.2 Mi on Hwy 70 to Hwy 3125
Go south 2 Mi to Main Gate
Convent, LA 70723

subject to the emissions limitations, monitoring requirements, and other conditions set forth hereinafter.

This permit and authorization to construct shall expire at midnight on _____, 2011, unless physical on site construction has begun by such date, or binding agreements or contractual obligations to undertake a program of construction of the source are entered into by such date.

Signed this _____ day of _____, 2010.

Cheryl Sonnier Nolan
Assistant Secretary
Office of Environmental Services
Louisiana Department of Environmental Quality

BRIEFING SHEET

Consolidated Environmental Management Inc - Nucor Steel Louisiana
Agency Interest No.: 157847
Consolidated Environmental Management Inc
Convent, St. James Parish, Louisiana
PSD-LA-740

PURPOSE

Consolidated Environmental Management Inc., a subsidiary of Nucor Corporation proposes to construct and operate a 6 Million Tonne (6.60 million ton) per year Pig Iron production facility on approximately 4,060+ acres of undeveloped land on the Mississippi River at about mile marker +163 just upstream of Romeville.

RECOMMENDATION

Approval of the proposed construction and issuance of a permit.

REVIEWING AGENCY

Louisiana Department of Environmental Quality, Office of Environmental Services, Air Permits Division

PROJECT DESCRIPTION

The Nucor Steel Louisiana facility will use the blast furnace process to produce high quality pig iron. Nucor plans for the mill to reach an anticipated peak annual production rate of over six million metric tonnes of iron per year. The basic raw materials for the pig iron production process are iron ore, in lump or pellet form; coal; sinter; and flux, which may be limestone, dolomite, or slag. The facility will process the coal into metallurgical-grade coke for use in the blast furnaces at dedicated coke ovens on the site. The blast furnaces themselves are closed units with virtually no atmospheric emissions. The coke ovens follow the heat recovery design. A sinter plant will also be constructed at the site to recycle fine materials and dusts for increased raw material efficiency. By recovering heat from the coking process and combusting blast furnace gas in multiple boilers, the mill will produce enough electricity to completely provide for facility usage and may also provide some electrical export to the public utility grid. Estimated emissions, in tons per year, are as follows:

<u>Pollutant</u>	<u>Emissions</u>	<u>PSD de minimis</u>	<u>Review required?</u>
PM	1,181.97	25	Yes
PM ₁₀	696.60	15	Yes
PM _{2.5}	408.15	15	Yes
SO ₂	3,781.87	40	Yes
NO _x	3,791.83	40	Yes
CO	29,394.48	100	Yes
VOC	401.97	40	Yes
Lead	0.375	0.6	No

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TYPE OF REVIEW

Particulate matter (PM/PM₁₀/PM_{2.5}), sulfur dioxide (SO₂), nitrogen oxide (NO_x), carbon monoxide (CO), and volatile organic compound (VOC) emissions from the proposed facility will be above PSD significance levels. Therefore, the requested permit was reviewed in accordance with PSD regulations for PM/PM₁₀/PM_{2.5}, SO₂, NO_x, CO, and VOC emissions. Emissions of LAC 33:III.Chapter 51-regulated toxic air pollutants (TAP) have been reviewed pursuant to the requirements of the Louisiana Air Quality Regulations.

The initial proposed permit for Nucor Steel Louisiana released on October 15, 2008, did not directly address PM_{2.5}. At that time, this was consistent with federal law and EPA's expectations regarding the implementation of NSR requirements for PM_{2.5} based on the agency's final rule entitled "Implementation of the New Source Review (NSR) Program for Particulate Matter Less Than 2.5 Micrometers (PM_{2.5}) (73 FR 28321, May 16, 2008).

According to the 2008 final rule, EPA is requiring states with SIP-approved PSD programs (like Louisiana) to submit revised PSD programs and revised Nonattainment NSR programs for PM_{2.5} within 3 years from the date of this action (i.e., May 16, 2011). To ensure consistent administration during the transition period, EPA has elected to maintain its existing PM₁₀ surrogate policy which only recommends as an interim measure that sources and reviewing authorities conduct the modeling necessary to show that PM₁₀ emissions will not cause a violation of the PM₁₀ NAAQS as a surrogate for demonstrating compliance with the PM_{2.5} NAAQS.

Moreover, at 40 CFR 52.21(i)(1)(xi), EPA specified that if an application was determined to be complete before July 15, 2008, the PM_{2.5} requirements in effect before that date (i.e., the use of PM₁₀ as a surrogate for PM_{2.5}) shall apply to the source or modification. Nucor's application was deemed administratively complete on May 14, 2008.

However, on September 22, 2009, EPA issued a stay, until June 22, 2010, of the aforementioned grandfathering provision (74 FR 48153). Further, on February 11, 2010, EPA proposed to repeal the grandfathering provision and end the PM₁₀ Surrogate Policy.

Subsequently, by letter dated September 24, 2009, EPA provided input specifically regarding Nucor Steel Louisiana's application.

As noted in the EPA Administrator's recent petition decision in the matter of Louisville Gas and Electric Company (Petition No. IV-2008-3, August 12, 2009) we believe that permit applicants and permitting authorities should determine whether PM₁₀ is a reasonable surrogate for PM_{2.5} under the specific facts and circumstances of specific permitting actions, and not proceed with the general presumption that PM₁₀ is always a reasonable

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surrogate for PM_{2.5}. Therefore, we believe LDEQ should ... address PM_{2.5} emissions directly or show how compliance with the PSD requirements for PM₁₀ will serve as an adequate surrogate for meeting the PSD requirements for PM_{2.5} for this specific facility. Directly addressing PM_{2.5} might including determining the best available control technology (BACT) for PM_{2.5} and determining the proposed source's impact on currently monitored PM_{2.5} concentrations in relation to the current PM_{2.5} NAAQS.

After evaluating EPA's correspondence on the Louisville Gas and Electric Company petition response, LDEQ required Nucor to:

1. Quantify, to the extent possible, PM_{2.5} emissions from each source at the proposed Nucor Steel Louisiana and provide this information, along with calculations and supporting documentation, as necessary, to LDEQ;
2. Provide a top-down Best Available Control Technology (BACT) analysis for PM_{2.5}. For each source, any technically feasible control technology or combination of control technologies capable of controlling PM_{2.5} to a higher level than the PM₁₀ control technology currently proposed must be demonstrated to be infeasible based on adverse energy, environmental, or economic impacts; and
3. Demonstrate, using a model accepted by EPA and LDEQ, that PM_{2.5} emissions, as quantified above, do not cause an exceedance of the PM_{2.5} National Ambient Air Quality Standards of 15 $\mu\text{g}/\text{m}^3$ (annual average) and 35 $\mu\text{g}/\text{m}^3$ (24-hour average). For purposes of this analysis, the ambient concentrations attributed to Nucor Steel Louisiana should be added to PM_{2.5} background concentrations.

Nevertheless, LDEQ does not maintain that the above information is specifically *required* to "show how compliance with the PSD requirements for PM₁₀ will serve as an adequate surrogate for meeting the PSD requirements for PM_{2.5}."

The record demonstrates that there are no feasible control technologies or combination of control technologies capable of controlling PM_{2.5} to a higher level than the PM₁₀ control technology identified as BACT.

BEST AVAILABLE CONTROL TECHNOLOGY

PM/PM₁₀/PM_{2.5}, SO₂, NO_x, CO, and VOC emissions are above PSD significance levels and must undergo PSD analyses. The selection of control technology was based on the BACT analysis using a "top down" approach and included consideration of control of toxic materials.

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BACT was determined to be:

Unit	Unit Identifiers	PM ₁₀ / PM _{2.5} BACT	NO _x BACT	SO ₂ BACT	CO BACT	VOC BACT
Blast Furnace / Hot Blast Stoves	STV-101, 102	Fuel gas cleaning with cyclone and wet scrubber	Low-NO _x fuel combustion	No feasible control technology for Blast Furnace Gas. (BFG) Limit Nat. Gas sulfur content	Good combustion practices	Good combustion practices
Cast House	CST-101, 201	Local collection hoods and fabric filter		No feasible control technology	No feasible control technology	
Coke Oven Gas	COK-111, 211	Fabric filter	Staged combustion	Low Sulfur Coal, Lime spray drying scrubber	Good combustion practices	Good combustion practices
Blast Furnace & Coke Oven Coal Prep.	PCI-101 COK-100, 104, 204	Fabric filter, water suppression and enclosed conveyors	Low-NO _x fuel combustion PCI-101 Only	No feasible control technology for Blast Furnace Gas. (BFG) Limit Nat. Gas sulfur content PCI-101 Only	Good combustion practices PCI-101 Only	Good combustion practices PCI-101 Only
Coke Oven Charging	COK-101, 201	Compacted coal, negative pressure ovens				
Coke Oven Pushing	COK-102, 202	Flat car pushing	Compacted coal and flat car pushing	Compacted coal and flat car pushing	Compacted coal and flat car pushing	Compacted coal and flat car pushing
Coke Quenching	COK-103, 203	Quench Tower Baffles and Low-TDS Water				
Slag Granulation	SLG-101, 102, 201, 202, 301, 306, 401	Water suppression of dust generating sources				
Slag Milling / Processing	SLG-302, 303, 304, 305, 402, 403, 404, 406, 407, 408, 409	Fabric filters	Low-NO _x fuel combustion SLG-402 only	No feasible control technology. Limit Nat. Gas sulfur content SLG-402 only	Good combustion practices SLG-402 only	Good combustion practices SLG-402 only
Diverted Air-Cooled Slag	SLG-104, 105, 106, 204, 205, 206	Wet suppression of dust generating sources				
Topgas Boilers	PWR-101-108	Fuel cleaning with cyclone and wet scrubber	Low-NO _x fuel combustion	No feasible control technology for BFG Limit Nat. Gas sulfur content	Good combustion practices	Good combustion practices

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Unit	Unit Identifiers	PM ₁₀ / PM _{2.5} BACT	NO _x BACT	SO ₂ BACT	CO BACT	VOC BACT
Sinter Plant	SIN-101, 102	Collection systems and fabric filter	No feasible control technology	Lime spray drying scrubber	Good combustion practices	Counterflow injection of additives
Cooling Towers	TWR-101, 102, 103	Cellular drift eliminators and low TDS cooling water				
Storage Piles	PIL-101, 102, 103, 104, 105, 106, 107, 108	Wet suppression of dust generating sources. Paved roads where practicable and reduced speed limit				
Road Dust	FUG-101, 102					
Hot Metal Handling	PIG-101, 102	Collection hood and fabric filter				
Stock House; Sinter Material Handling	SIN-103, 105, 106; STC-101, 201	Fabric filters				
Material Handling and Transfer	COK-112, 113, 212, 213, 214, 215; DOC-101, 102; DST-101, 201; FUG-103; TRN-101	Enclosed conveyors and water suppression				

AIR QUALITY IMPACT ANALYSIS

Prevention of Significant Deterioration regulations require an analysis of air quality for those pollutants emitted in significant amounts from a proposed facility.

Dispersion Model Used: AERMOD

Pollutant	Averaging Period	National Ambient Air Quality Standard {NAAQS}	Calculated Maximum Ground Level Concentration (All sources plus Background)	Allowed Level of Significant Impact	Calculated Maximum Ground Level Concentration (Nucor Contribution)
PM _{2.5}	24-hour	35 µg/m ³	117.93 µg/m ^{3*}	1.2 µg/m ^{3**}	0.9216 µg/m ³
PM _{2.5}	Annual	15 µg/m ³	35.65 µg/m ^{3*}	0.3 µg/m ³	0.0615 µg/m ³
PM ₁₀	24-hour	150 µg/m ³	4152.35 µg/m ^{3*}	5 µg/m ³	1.58 µg/m ³
SO ₂	3-hour	1,300 µg/m ³	8479.19 µg/m ^{3*}	25 µg/m ³	17.28 µg/m ³
SO ₂	24-hour	365 µg/m ³	2181.57 µg/m ^{3*}	5 µg/m ³	3.72 µg/m ³
SO ₂	Annual	80 µg/m ³	361.01 µg/m ^{3*}	1 µg/m ³	0.24 µg/m ³
NO _x	Annual	100 µg/m ³	54.0 µg/m ³	-	-

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Pollutant	Averaging Period	National Ambient Air Quality Standard {NAAQS}	Calculated Maximum Ground Level Concentration (All sources plus Background)	Allowed Level of Significant Impact	Calculated Maximum Ground Level Concentration (Nucor Contribution)
NO _x	1-hour	189 µg/m ³	95.4 µg/m ³ ***	-	-
CO****	1-hour	40,000 µg/m ³	856.2 µg/m ³	-	-
CO****	8-hour	10,000 µg/m ³	475.7 µg/m ³	-	-
Lead****	3 month rolling avg	0.15 µg/m ³	<0.01 µg/m ³		

Dispersion Model Used: AERMOD

Pollutant	Averaging Period	National Ambient Air Quality Standard {NAAQS}	Calculated Maximum Ground Level Concentration*****
PM _{2.5}	24-hour	35 µg/m ³	5.30 µg/m ³
PM _{2.5}	Annual	15 µg/m ³	1.54 µg/m ³
PM ₁₀	24-hour	150 µg/m ³	28.06 µg/m ³
SO ₂	3-hour	1,300 µg/m ³	94.18 µg/m ³
SO ₂	24-hour	365 µg/m ³	38.68 µg/m ³
SO ₂	Annual	80 µg/m ³	8.39 µg/m ³

*The numbers in the permit application represent the original NAAQS modeling. These values represent the highest numbers after refining the model, per the description below.

**Proposed value. EPA proposed a rule entitled "Prevention of Significant Deterioration (PSD) for Particulate Matter Less Than 2.5 Micrometers (PM_{2.5})—Increments, Significant Impact Levels (SILs) and Significant Monitoring Concentration (SMC)" on September 21, 2007 (72 FR 54112). This rule has not been finalized. In the proposal, EPA suggested 3 SIL values – 5.0 µg/m³, 4.0 µg/m³, and 1.2 µg/m³ (options 1 - 3, respectively).

***Includes Nucor sources only. There is no promulgated or proposed SIL for the 1-hour averaging period.

****From significance modeling. Includes Nucor sources only and does not include background.

*****These values represent Nucor's sources only; these values include receptors at which an exceedance did not occur and for which it was not necessary to compare Nucor's contribution to the significance level. For short term standards, this number is

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represented by the highest second high value; this number is used for comparison purposes only. A full description on how compliance was determined follows these tables.

ADDITIONAL IMPACTS

Soils, vegetation, and visibility will not be adversely impacted by the proposed facility, nor will any Class I area be affected. The project will not result in any significant secondary growth effects. Approximately 875 new permanent jobs will be created.

PROCESSING TIME

Application Dated:	May 12, 2008
Application Received:	May 12, 2008
Additional Information Dated:	August 6, 2008, August 7, 2008, August 8, 2008, August 11, 2008, August 12, 2008, August 13, 2008, August 25, 2008, August 26, 2008, September 24, 2008, October 1, 2008, January 6, 2009, February 18, 2009, June 26, 2009, January 27, 2010 and February 8, 2010
Effective Completeness Date:	March 1, 2010

PUBLIC NOTICE

A notice requesting public comment on the permit was published in *The Advocate*, Baton Rouge, and in the *The Enterprise*, Vacherie, on October 15, 2008; and in the *The News Examiner*, Convent on October 16, 2008. A copy of the public notice was mailed to concerned citizens listed in the Office of Environmental Services Public Notice Mailing List on October 13, 2008. A Public Hearing was held on Thursday, November 20, 2008 at the St. James Parish Courthouse, Courtroom A, 5800 LA Hwy 44, Convent, LA. The draft permit was also submitted to US EPA Region VI on October 9, 2008.

After conclusion of the comment period, Nucor revised the permit application for the facility in its entirety.

In addition, the initial PSD permit application submitted by Nucor on May 12, 2008 was done under the longstanding provisions of the PM_{2.5} Surrogate Policy maintained by EPA, which allowed applicants to assume that a determination of BACT for emissions of PM₁₀ from a stationary source was also valid for emissions of PM_{2.5} from the same source. Therefore, PM_{2.5} emissions were not quantified separately from PM₁₀, a review of BACT specific to PM_{2.5} was not conducted, and an air dispersion modeling analysis of PM_{2.5} emissions was not performed for the Nucor Steel Louisiana site in the initial application, consistent with accepted practices at the

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time. However, due to recent judicial review of the surrogate policy, and subsequent rulemaking, EPA Region 6 has asked LDEQ to consider PM_{2.5} prior to issuing a permitting action for the Nucor Steel Louisiana project. Therefore, a second comment period is being provided.

A second notice requesting public comment on the permit was published in *The Advocate*, Baton Rouge, and in the *The Enterprise*, Vacherie, on Month XX, 2010 and in the *The News Examiner*, Convent on Month XX, 2010. A copy of the public notice was mailed to concerned citizens listed in the Office of Environmental Services Public Notice Mailing List on Month XX, 2010. The revised draft permit was also submitted to US EPA Region VI on Month XX, 2010. All comments will be considered prior to the final permit decision.

PRELIMINARY DETERMINATION SUMMARY

Consolidated Environmental Management Inc - Nucor Steel Louisiana
Agency Interest No.: 157847
Consolidated Environmental Management Inc
Convent, St. James Parish, Louisiana
PSD-LA-740
January 31, 2009

I. APPLICANT

Consolidated Environmental Management Inc
1915 Rexford Rd
Charlotte, NC 28211

II. LOCATION

Consolidated Environmental Management Inc - Nucor Steel Louisiana will be located near:

From I-10 & Hwy 22 go west on Hwy 22 to Hwy 70
Go west 4.2 miles on Hwy 70 to Hwy 3125
So south 2 miles on Hwy 3125 to Main Gate
Convent, Louisiana

Approximate coordinates are Latitude 30° 5' 49", Longitude 90° 50' 38".

III. PROJECT DESCRIPTION

The Nucor Steel Louisiana (Nucor) facility will use the blast furnace process to produce high quality pig iron. Nucor plans for the mill to reach an anticipated peak annual production rate of over six million metric tonnes of iron. The basic raw materials for the pig iron production process are iron ore, in lump or pellet form; coal; sinter; and flux, which may be limestone, dolomite, or electric arc furnace slag. The facility will process the coal into metallurgical-grade coke for use in the blast furnaces, at dedicated coke ovens on the site. The blast furnaces themselves are closed units with virtually no atmospheric emissions. The coke ovens follow the heat recovery design. A sinter plant will also be constructed at the site to recycle fine materials and dusts for increased raw material efficiency. By recovering heat from the coking process and combusting blast furnace gas in multiple boilers, the mill will produce enough electricity to completely provide for facility usage and also provide some electrical export to the public utility grid.

The basic raw materials of the blast furnace process will be received by ship, barge, and rail, with additional supplies and materials being delivered by truck. Pig iron produced at the facility will be stored on-site in outdoor storage piles. The iron will be loaded onto trucks or rail cars and transported to the Mississippi River dock for shipment to customers by ship or barge. Coke fines from the coke handling areas will ship to customers, primarily by barge. Granulated slag and slag aggregate from the slag granulation area are proposed to be shipped to customers by barge or rail. Pulverized slag from the slag granulation/milling area will be shipped to customers, primarily by truck. Flue Gas Desulfurization (FGD) dust from the coke plant and sinter plant will be shipped to a landfill, primarily by truck.

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In the coke production process, coal is subjected to high heat in a battery of ovens, with the object of thermally cracking the organic compounds in the coal, leaving only pure carbon, simple carbon compounds, and remaining ash in the resulting coke. During the coking process, the volatile fractions of the coal are liberated and are collectively known as coke oven gas. The gas is ducted from the oven chamber into the refractory oven walls and sole flues beneath the chamber, where combustion of the gas is completed. Nucor will utilize a non-recovery design of coke ovens, instead of the more typical byproduct recovery ovens. In either design, the process of liberating the volatile fraction of the coal is done in an oxygen-deprived atmosphere. In the non-recovery oven design, the coal volatiles are oxidized within the ovens by the addition of combustion air, and incinerated by the intense heat. The heat of combustion is released within the oven system, allowing non-recovery ovens to be self-sufficient with respect to energy. Non-recovery ovens are operated at a negative pressure, which results in no system leaks around oven doors and other interfaces.

The coke production process consists of the following production steps:

- Coal Preparation: coal from the storage piles is crushed, screened, wetted and mixed in the coal preparation area. The coal will then be pressed into the shape of a large brick by hydraulic presses. The coal bricks will then be transported by a rail-mounted charging car to an oven for charging.
- Coal Charging is where a pusher machine drives the coal into the oven.
- Coke Ovens: There will be two batteries of coke ovens with each battery containing 140 ovens. A coking cycle will last approximately fifty-four hours. Heat from the hot refractory in the oven begins the carbonization of the coal, and normally no external fuel is required once the ovens have reached operating temperature. The flue gas system routes the hot gases to heat recovery steam generators (HRSGs). These HRSGs produce high-pressure steam that will be routed to the steam turbine generators.
- Coke Pushing: At the end of each coking cycle, doors on the ends of the oven are opened and the hot coke is pushed from the oven by a ram which is extended from a pusher car. A mobile, flat quench car receives the hot coke. The quench car travels by rail, carrying the coke to the coke quench tower.
- Coke Quenching: The coke in the quench car, from the coke oven, will be positioned beneath one of the coke quench towers. There is one quench tower for each coke oven battery. At the quench tower, the hot coke is deluged with water to minimize any burning with exposure to the air. The hot steam generated from quenching is channeled by natural draft up the quench tower. Baffles in the tower structure help to retain as much of the cooling water as possible. Cooling water from the quenching process is collected beneath the quench car, filtered, and reused.
- Coke Handling and Storage: The quenched coke is discharged onto an inclined coke wharf to allow the coke to drain and cool before a conveyor belt carries it to a crushing and screening system. The sized coke is then transported by conveyor to the Stock House for

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storage. Emissions from the coke screening and crushing facilities are controlled by a baghouse.

The blast furnace is a counter-current reactor in the form of a tall, shaft-type furnace where iron-bearing materials (such as iron ore and sinter) are reduced to iron (pig iron or hot metal). A typical burden feed consists of iron ore pellets, coke, sinter, and flux materials such as limestone or dolomite. The burden material is charged into the top of the furnace and slowly descends as hot metal is removed from the bottom. Hot metal is withdrawn from the furnace and separated into molten iron and slag in the cast house.

Blast furnace gas (BFG) is collected from off-takes at the top of the furnace. This gas contains a large fraction of carbon monoxide generated by the iron making reaction, as well as a sizeable fraction of hydrogen. After exiting the blast furnace, the blast furnace gas (topgas) passes through a cyclone dust catcher and dust removal system, followed by a wet scrubber system. Topgas is combusted in the hot blast stoves in order to heat the incoming blast air. Remaining topgas is burned as a fuel in power boilers to generate steam. The high pressure steam produced in the boilers will be used in steam turbines connected to electric generators. The electricity produced will likely be greater than the total site electrical requirements, and a portion may be transmitted to the public utility power grid.

Estimated emissions, in tons per year, are as follows:

<u>Pollutant</u>	<u>Emissions</u>	<u>PSD de minimis</u>	<u>Review required?</u>
PM	1,181.78	25	Yes
PM ₁₀	696.60	15	Yes
PM _{2.5}	408.15	15	Yes
SO ₂	3,781.87	40	Yes
NO _x	3,791.83	40	Yes
CO	29,394.48	100	Yes
VOC	401.97	40	Yes
Lead	0.375	0.6	No

IV. SOURCE IMPACT ANALYSIS

A proposed net increase in the emission rate of a regulated pollutant above de minimis levels for new major or modified major stationary sources requires review under Prevention of Significant Deterioration regulations, LAC 33:III.509. PSD review entails the following analyses:

- A. A determination of the Best Available Control Technology (BACT);

PRELIMINARY DETERMINATION SUMMARY

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- B. An analysis of the existing air quality and a determination of whether or not preconstruction or postconstruction monitoring will be required;
- C. An analysis of the source's impact on total air quality to ensure compliance with the National Ambient Air Quality Standards (NAAQS);
- D. An analysis of the PSD increment consumption;
- E. An analysis of the source related growth impacts;
- F. An analysis of source related growth impacts on soils, vegetation, and visibility;
- G. A Class I Area impact analysis; and
- H. An analysis of the impact of toxic compound emissions.

A. **BEST AVAILABLE CONTROL TECHNOLOGY**

Under current PSD regulations, an analysis of "top down" BACT is required for the control of each regulated pollutant emitted from each new major stationary source in excess of the specified significant emission rates. The top down approach to the BACT process involves determining the most stringent control technique available for a similar or identical source. If it can be shown that this level of control is infeasible based on technical, environmental, energy, and/or cost considerations, then it is rejected and the next most stringent level of control is determined and similarly evaluated. This process continues until a control level is arrived at which cannot be eliminated for any technical, environmental, or economic reason. A technically feasible control strategy is one that has been demonstrated to function efficiently on identical or similar processes. Additionally, BACT shall not result in emissions of any pollutant which would exceed any applicable standard under 40 CFR Parts 60 and 61.

For this project, BACT analyses are required for PM₁₀/PM_{2.5}, SO₂, NO_x, CO, and VOC emissions from the facility. Where PM₁₀/PM_{2.5} is addressed in the BACT analysis, it is assumed that particulate matter (PM) is also being considered.

In order for Nucor to develop BACT determinations, information from numerous technical sources is typically considered to identify emission limits and control technologies that apply to the types of sources being proposed for Nucor Steel Louisiana. However, in the case of PM_{2.5}, because the PM₁₀ Surrogate Policy has been used to address PM_{2.5} emissions, these resources are not as useful as they are for the other criteria pollutants and additional research was performed in order to address BACT for PM_{2.5}.

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PM_{2.5} Fabric Filter Media (Baghouse):

Recent advances in filter media for fabric filters have seen baghouses become increasingly more efficient at controlling PM_{2.5} emissions from gas streams. The USEPA established the Environmental Technology Verification (ETV) program to test the control efficiency of several commercially available filter media from vendors willing to participate in the program. The ETV has demonstrated that at least 16 different advanced filter media are capable of reaching PM_{2.5} removal efficiencies above 99%.

BACT DETERMINATION FOR EMISSIONS FROM BLAST FURNACE AND HOT BLAST STOVES

The blast furnace is a counter-current reactor in the form of a tall, shaft-type furnace where iron-bearing materials (iron ore, sinter, slag, scrap, etc.) are reduced to iron (pig iron or hot metal). The charge to the top of the blast furnace, known as the burden, consists of alternating layers of iron bearing materials, coke, and flux (basic minerals such as limestone or dolomite). The burden materials are charged through an enclosed bell at the top of the furnace, which is evacuated to the blast furnace gas de-dusting system, a process which is essentially non-emitting. Hot blast air, injected at the bottom of the furnace through nozzles known as tuyeres, serves to heat coke at the bottom of the burden in the furnace. The coke produces the additional heat required for smelting the charge, and it provides the elemental carbon and carbon monoxide required for reducing the iron ore to elemental iron.

The blast furnace itself is a closed unit with almost no atmospheric emissions. The hot blast air reacts with the coke in the furnace to produce more CO than is needed to reduce the iron ore. The excess CO is ducted from the top of the blast furnace with other gaseous products. This blast furnace effluent, called blast furnace gas (BFG), is de-dusted, cooled, and subsequently split into several different streams. A portion of the BFG stream is used as a fuel in the hot blast stoves and topgas boilers. BFG contains as much as 7 percent hydrogen and 27 percent CO and has a heating value of approximately 65 – 110 Btu/scf.

In hot blast stoves, cleaned gas from the blast furnace is burned to heat the refractory checker work, which in turn provides heat for the hot blast, which is then injected into the bottom of the blast furnace. Three hot blast stoves are operated in a continuous cycle consisting of an "on gas" mode to heat up the stoves by firing BFG and natural gas, an "on blast" mode during which cold blast gas is brought to the high temperature needed for the blast furnace (there is no firing during this mode), and a switching mode during which the stoves are depressurized from "on blast" and readied for "on gas" operation. The only time that there are significant emissions is during the heat-up of the stoves. The combustion products from the heat-up cycle are routed to the waste gas chimney and are the only major emissions from the blast furnace/hot blast stove source.

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BACT analyses for PM/PM₁₀/PM_{2.5}

Source ID – Description (EQT #)

STV-101-Blast Furnace 1 Hot Blast Stoves Common Stack (RLP015)

STV-201-Blast Furnace 2 Hot Blast Stoves Common Stack (RLP016)

Potentially Applicable Technology

1. Fabric filter (baghouse)
2. Electrostatic Precipitator (ESP)
3. Wet scrubber
4. Cyclone
5. Good combustion practices

Fabric Filter (baghouse):

A fabric filter or baghouse is one of the most efficient means of separating particles from a gas stream. The advantage of bag filters is that the efficiency is largely insensitive to the physical characteristics of the gas stream and changes in the dust loading. Baghouse installations are an industry standard for particulate controls.

Both positive and negative pressure baghouses have been used in the steel industry. Positive pressure baghouses operate at an internal pressure greater than atmospheric. In this configuration, the exhaust fans are located before the baghouse (i.e. the “dirty side”) and pull the air from the process in order to push the air through the baghouse. These systems vent to ambient air through a continuous ridge vent instead of a stack. Negative pressure baghouses operate at an internal pressure less than atmospheric. In this configuration, the exhaust fans are located after the baghouse (i.e. the “clean side”), pull the air through the baghouse, and exhaust to the ambient air through a central stack.

Electrostatic Precipitator (ESP):

ESPs use an electrostatic field to charge particles contained in the gas stream. The charged particles then migrate to a grounded collection surface. The collection particles are then periodically dislodged from the collection surface by vibrating or rapping the collection surface. The dislodged particles are then collected in a hopper at the bottom of the ESP.

Wet Scrubber:

In a wet scrubber, the gas stream is brought into contact with a scrubbing liquid, typically by spraying the liquid in a contacting tower to remove the particles, or by some other contact method.

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Inlet gas characteristics and dust properties are of primary importance. Wet scrubbers remove dust particles by capturing them in the liquid droplets, dissolving other pollutants in the liquid droplets, and have the ability to handle gaseous streams with high moisture content.

Cyclones:

Centrifugal collectors use cyclonic action to separate particles from the gas stream. In a typical cyclone, the gas stream enters a vessel at an angle and is spun rapidly. The centrifugal force created by the circular flow throws the particles toward the wall of the cyclone. After striking the wall, these particles fall into a hopper located beneath the cyclone. Single-cyclone separators create a dual vortex to separate coarse particles from fine. The main vortex spirals downward and carries most of the coarser dust particles. The inner vortex created near the bottom of the cyclone spirals upward and carries finer dust particles. Multiclones consist of a number of small-diameter cyclones, operating in parallel and having a common gas inlet and outlet. Multiclones operate on the same principle as cyclones by creating a main downward vortex and an ascending inner vortex. Multiclones are more efficient than single cyclones because they are longer and smaller in diameter. The longer length provides longer residence time while the smaller diameter creates greater centrifugal force. These two factors result in better separation of dust particulates. The pressure drop of multiclone collectors is higher than that of single-cyclone separators.

Good Combustion Practices:

Good combustion practices are used in areas where it is difficult to feasibly implement other control technologies. PM₁₀ emissions from natural gas combustion are usually from large-molecular-weight hydrocarbons that are not fully combusted. Condensable organic PM₁₀ can be best controlled through good combustion practices.

Step 2 – Eliminate Technically Infeasible Options

Fabric Filter (baghouse):

Although fabric filters are very effective at removing particulate matter from gas streams, they are not appropriate for applications at extreme temperatures, or when gas streams carry sparks or burning cinders, due the combustible nature of filter fabrics. For this reason, many baghouses are equipped with a device such as a spark arrestor, to eliminate small or stray sparks from entering the filter compartment. Additionally, baghouses are not a good control option for gas streams which contain free water droplets, or which have a high moisture content. Water condensation on the filter cake makes particulate matter difficult to remove from the bags during the cleaning cycle. Dust build up occurs on the exterior of the filters, resulting in plugging and premature deterioration of the filter bags.

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Fabric filter control of topgas is technically infeasible due to the high temperature of the topgas stream, as well as the fire hazards associated with it. Topgas is collected by ductwork from the top of the furnace under elevated pressure from the incoming blast air to the furnace. The pressure of the blast air entrains particulate, including sparks, into the collected gas. As hot metal is removed from the bottom of the furnace through tapping, the furnace burden moves further down the shaft of the furnace. Burden movement is not steady, and can happen as hollows in the burden collapse, known as burden slip. Burden slips can send large spikes of burning gas, sparks and cinders into the topgas collection system, potentially overwhelming any spark arrestor system. For this reason, baghouses are not used to control dust collected in blast furnace gas.

Electrostatic Precipitator (ESP):

ESP's are capable of 98% or higher particulate removal; however, several factors preclude their application to control PM₁₀ from the blast furnace. ESP's are sensitive to the composition and physical characteristics of the particles to be collected in the gas stream. Iron particles adhere very strongly to the collection plate of the ESP due to their electromagnetic properties. They become very difficult to remove, and thus rapidly reduce ESP efficiency. Zinc and other metal compounds tend to foul ESP electrodes, also reducing effectiveness. In addition, the efficiency of an ESP is highly sensitive to variations in flow rate, solids loading, pressure, and temperature; such variations that are inherent in the blast furnace process.

Additionally, ESPs have a high capital cost, have very high electricity demands, and require large amounts of maintenance, resulting in a relatively high down time compared to other control options. As a result, ESPs have long been considered a technically infeasible control option for PM₁₀ emissions from the combustion of blast furnace gas.

Good combustion practices:

Filterable particulate emissions from gas combustion are low; therefore, it is considered technically infeasible to collect particulate from gas combustion. Particulate from gas combustion is usually from large-molecular-weight hydrocarbons that are not fully combusted. While condensable organic PM₁₀ can be controlled through good combustion practices, dusts from metal ores in the fuel gas stream are typically not able to be fully combusted. Good combustion practices may be technically feasible under the broadest interpretation of its meaning, but will provide only limited PM₁₀ emission reductions (less than 50%) for BFG combustion.

Step 3 – Rank Remaining Technically Feasible Control Options

1. Cyclone and Wet Scrubber Combination - 99%
2. Wet Scrubber - 98%
3. Cyclone - 80%

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4. Good Combustion Practices - < 50%

Potential control alternatives were reviewed for technical feasibility in controlling PM₁₀ emissions from the pig iron production facility. The highest remaining control option was determined to be the combination of a cyclone separator followed by a wet scrubber. PM₁₀ emissions can be reduced by up to 99% with the addition of a cyclone and wet scrubber combination. This combination is common in the industry for the control of PM₁₀ emissions from blast furnace gas combustion.

The combination of a cyclone and a wet scrubber will clean the topgas of inorganic particulate matter prior to the gas being combusted as fuel, preventing the particulate from simply passing through the combustion device to be vented from the waste gas chimney. Since topgas does not contain hydrocarbons or other organic compounds, it does not have the potential to generate significant products of incomplete combustion, which often form PM_{2.5}. Therefore, by capturing particulate entrained in the topgas stream itself, this control strategy will reduce potential PM_{2.5} emissions by at least 99%.

Step 4 – Evaluate Remaining Control Technologies

Combined Cyclone and Wet Scrubber:

The prevalent industry control for blast furnace top gas is a multi-stage cleaning operation. In the multi-stage cleaning operation, blast furnace top gas passes first through a dry cyclone to remove the large particulate and a large percentage of the total particulate (about 60%). The cyclone step is followed by a high efficiency wet scrubber system. The combined controls are capable of achieving a 99% reduction in total particulate matter.

Wet Scrubber:

High-energy wet scrubbers are technically feasible but have some disadvantages. Scrubber systems have very high pressure drops that result in high system operating costs. They also require water treatment and sludge disposal that are not required for other PM₁₀ control options. However, wet scrubbers are able to accommodate large volumes of gas with high moisture contents, which make it a viable option for this application.

Cyclones:

Cyclones are effective at removing large dust particles using centrifugal forces. However, fine dusts are typically not as effectively removed due to the high gas stream velocity that must be established, often keeping smaller particles entrained in the stream. A cyclone would achieve greater efficiency if used in combination with another control technology.

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Good Combustion Practices:

As mentioned previously, good combustion practices for blast furnaces and hot blast stoves will only reduce PM₁₀ emissions by a limited amount (less than 50%). Therefore, it represents the least effective and desirable control option of the technically feasible control technologies under consideration.

Step 5 – Selection of BACT

Based on the top-down BACT analysis, the best available control technology includes a cyclone followed by a wet scrubber. A cyclone will remove coarser particulate that may be difficult for the scrubber to remove on its own and will not typically be affected by high temperatures or burning cinders. A cyclone will not typically be affected by high moisture content in the gas stream. A wet scrubber can accommodate the large volumes of moist gas that are generated by the blast furnace process. Together, these two options provide the most viable scenario for PM₁₀/PM_{2.5} emissions control by cleaning the blast furnace gas fuel stream prior to combustion. PM₁₀/PM_{2.5} emissions are also partially controlled by good combustion practices, but this cannot be relied upon as a primary control due to the nature of the system. BACT for the blast furnace top gas fuel stream is established as a concentration of PM \leq 0.001 gr/dscf.

BACT analyses for NO_x

Source ID – Description (EQT #)

STV-101-Blast Furnace 1 Hot Blast Stoves Common Stack (RLP015)

STV-201-Blast Furnace 2 Hot Blast Stoves Common Stack (RLP016)

Hot blast stoves are a source of NO_x emissions because they consume large quantities of fuel. NO_x formation is often driven by, among other factors, high flame temperatures during combustion. However, the primary fuel is blast furnace gas, which is largely CO, has a low heating value, and contains a large portion of inerts (approximately 65%), factors that reduce flame temperature. Thus, the generation of NO_x during BFG combustion results in uncontrolled NO_x concentrations in the flue gas that tend to be low (27 ppmv or less according to literature sources researched by Nucor), and thus the potential for NO_x reduction is limited.

Use of the BFG as a fuel significantly increases the overall energy efficiency of the blast furnace, since less fossil fuel is used to heat the stoves and the low-BTU BFG is used as fuel instead of being vented to the atmosphere (resulting in high CO emissions) or burned in a thermal oxidizer or flare to control CO emissions, wasting the remaining available energy in the gas.

Potentially Applicable Technology

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A search of USEPA's RBLC database revealed no entries for the control of NO_x from blast furnace stoves. A review of available literature performed by Nucor did not discover any applications of control technology to the combustion of blast furnace gas for the reduction of NO_x emissions. The following list of control technologies represent technologies that have been used for the control of NO_x from other combustion sources and in other industries.

1. Selective Catalytic Reduction (SCR)
2. Selective Non-Catalytic Reduction (SNCR)
3. Non-Selective Catalytic Reduction (NSCR)
4. EM_x (SCONO_x)
5. Low Excess Air (LEA) combustion
6. Low NO_x Burners (LNB)
7. Low NO_x Fuel Combustion (LNC)

Selective Catalytic Reduction (SCR):

SCR is the most advanced of the potential flue-gas control technologies for reducing NO_x emissions and is the technology upon which the great majority of flue gas treatment units are based. SCR units use ammonia (NH₃) to selectively reduce NO_x to nitrogen and water. The ammonia, usually diluted with air or steam, is injected through a grid system into the flue gas stream, upstream of a catalyst bed. Operating temperatures between 500 and 800 °F are required of the gas stream at the catalyst bed in order to carry out the catalytic reduction process. On the catalyst surface, the NH₃ reacts with NO_x to form molecular nitrogen and water. Depending on system design, NO_x removal rates of 80 to 90 percent are achievable.

Selective Non-Catalytic Reduction (SNCR):

SNCR is a post-combustion technique that involves injecting ammonia or urea into specific temperature zones in the upper furnace or connective pass of a boiler. A temperature of between 1,600 °F (870 °C) and 2,100 °F (1,150 °C) is required at the injection site for the process reaction to take place. The ammonia or urea reacts with NO_x in the gas to produce nitrogen and water. Multiple injection locations may be required within several different zones of the boiler to respond to variations in the boiler operating conditions.

Non-Selective Catalytic Reduction (NSCR):

Non-selective catalytic reduction is similar to SCR, yet operates with a different catalyst and under different process conditions. NSCR requires precise adjustments of process conditions such as oxygen content (0.2 – 0.7% O₂) and temperature (800 – 1,200 °F) and works best with certain

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windows of inlet concentration for NO_x (2,000 – 4,000 ppmv), CO (3,000 – 6,000 ppmv), and VOC (1,000 – 2,000 ppmv). These operating windows are necessary because the catalyst acts to react the NO_x, CO, and VOC with one another, reducing the emission of each. The catalytic reaction requires a certain temperature band and the presence of a small amount of oxygen. However, at optimal conditions it has the potential to reduce emissions of NO_x, CO, and VOC simultaneously. It has seen use controlling emissions from internal combustion engines and nitric acid plants.

EM_x (SCONO_x):

EM_x is primarily a NO_x control technology which works by oxidizing NO to NO₂ and trapping the NO₂ molecules as nitrates or nitrites on a potassium carbonate catalyst bed. Carbon monoxide is also oxidized across the catalyst to CO₂. The catalyst bed must then be regenerated with a steam and hydrogen vapor stream, producing water and diatomic nitrogen. EM_x operates best when treating gases that have a steady temperature, in the range of 300 – 700 °F. EM_x has seen use as a Lowest Achievable Emission Rate (LAER) technology applied to combustion turbines.

Low Excess Air (LEA):

LEA is a combustion modification technique in which NO_x formation is inhibited by reducing the excess air to less than normal ratios. It reduces the local flame concentration of oxygen, thus reducing both thermal and fuel NO_x formation. It is easily implemented and is used extensively in both new and retrofit applications, either alone or in combination with other control measures. It can be used with most fuels and firing methods. It decreases the volume of combustion air to be heated, allowing more heat of combustion to be transferred, thus lowering fuel requirements for a given output. To maintain proper control of the furnace pressure, positive pressure must be maintained in the furnace to prevent the influx of tramp air.

Low NO_x Burners (LNB):

LNBs have been used since the early 1970s for thermal NO_x control. These specially designed burners employ a variety of principles including LEA, off-stoichiometric (or staged) combustion (OSC), and flue gas recirculation (FGR). The objective in the application of LNBs is to minimize NO_x formation while maintaining acceptable combustion of carbon and hydrogen in the fuel.

The differences between a low NO_x burner and a burner featuring LEA or FGR, for example, are not always clear. In general, LNBs implement LEA, OSC, FGR, or a combination of these techniques. In a stricter sense, LNBs have been defined as burners that control NO_x formation by carrying out the combustion in stages (OSC) and, further, by controlling the staging at and within the burner rather than in the firebox. Consistent with this definition, there are two distinct types of designs for LNBs: staged air burners and staged fuel burners. Staged air burners are designed to

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reduce flame turbulence, delay fuel/air mixing, and establish fuel-rich zones for initial combustion. The reduced availability of oxygen in the initial combustion zone inhibits fuel NO_x conversion. Radiation of heat from the primary combustion zone results in reduced temperature as the final unburned fuel gases mix with excess air to complete the combustion process. The longer, less intense flames resulting from the staged stoichiometry lower peak flame temperatures and reduce thermal NO_x formation.

Low-NO_x Fuel Combustion (LNC):

A low-NO_x fuel is one which results in a lower generation rate of NO_x over traditional fossil fuels, on an equal energy basis. Blast furnace gas is a low-NO_x fuel, generating less than half of the NO_x per unit of energy as natural gas. This property is due to the low-BTU value of BFG, which burns at a cooler temperature, preventing the formation of a majority of the NO_x seen with natural gas combustion.

Step 2 – Eliminate Technically Infeasible Options

The evaluation of these technologies must review whether the specific technology is available for the application and is effective at reducing NO_x emissions from the hot blast stoves.

Selective Catalytic Reduction (SCR):

Selective catalytic reduction has been demonstrated to control emissions of NO_x in flue gas streams down to a level of about 30 ppmv. Control has not been demonstrated beyond this level at any efficiency. The concentration of NO_x in the hot blast stove flue gas will already be near or below the level of control achievable by SCR. Additionally, large flue gas volume and temperature swings due to the cyclic nature of the stoves firing to heat refractory are fundamentally at odds to the steady state conditions required by the SCR. Therefore, SCR is not a feasible control technology for the control of NO_x from the hot blast stoves.

Selective Non-Catalytic Reduction (SNCR):

SNCR can only be effective when used in applications where the temperature of the gas stream is extraordinarily high, between 1,600 – 2,100 °F. Due to the low heating value of the blast furnace gas combusted in the hot blast stoves, the temperature of the flue gas never reaches temperatures in the effective range. Thus, SNCR is not a feasible control technology for the control of NO_x from hot blast stoves.

Non-Selective Catalytic Reduction (NSCR):

Non-selective catalytic reduction requires specific levels of several process parameters that are

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incompatible with the combustion of blast furnace gas in the hot blast stoves. The low oxygen range required by NSCR can only be achieved by restricting the available combustion air to stoichiometric levels. As discussed for low excess air combustion, the low heating value of the blast gas does not allow for combustion at low levels of combustion air. Additionally, levels of NO_x and VOC in the flue gas stream are not within the range necessary, and the flue gas temperature leaving the stoves will not reach the level required to promote the catalytic reaction. Thus, NSCR is not a feasible control technology for the control of NO_x from hot blast stoves.

EM_x (SCONO_x):

EM_x technology uses catalyst beds with narrow, honeycomb structures, which expand and contract with temperature in a sensitive manner. These expansions and contractions must be allowed for with complex expansion joints. Large temperature swings during operation can render the system ineffective as pass-through leaks develop within the catalyst modules. The hot blast stoves will operate in a cyclic fashion, such that the flue gas leaving the stoves will experience regular temperature swings between 180 – 400 °C (356 – 752 °F). Due to its sensitivity to temperature changes, EM_x is a technically infeasible control technology for NO_x from the hot blast stoves.

Low Excess Air (LEA) combustion:

Flame stability is an inherent problem with burning BFG fuel. Natural gas must be added to the BFG in order to increase the BTU content and obtain a stable flame. The nature of the BFG fuel and the high CO content make low excess air an infeasible option. There were no instances in literature sources researched by Nucor, of LEA use for hot blast stoves.

Low NO_x Burners (LNB):

Low NO_x burners limit the formation of NO_x by staging the addition of air to create a longer, cooler flame. The combustion of BFG in the hot blast stoves requires the supplement of a small amount of natural gas in order to maintain flame stability and prevent flame-outs of the burners. The use of low NO_x burners would attempt to stage fuel gas at the limits of combustibility and would prevent the operation of the hot blast stoves. Thus, Low NO_x burners are not a feasible control technology for the hot blast stoves.

Step 3 – Rank Remaining Technically Feasible Control Options

The available control technologies were ranked according to their efficiencies. The efficiencies listed are in reference to natural gas combustion. No data was available for blast furnace gas combustion efficiency. Blast furnace gas is known to have a lower heating value than natural gas.

1. Low NO_x Fuel Combustion (LNC) – 50% - 67%

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Standard hot blast stove designs inherently incorporate low NO_x technology (reduced flame temperature) and have a proven history. Literature sources reviewed by Nucor cite the NO_x concentration exiting the hot blast stoves at 27 ppmv (avg) or less. There are no instances in literature researched by Nucor where SCR or SNCR have been applied to blast furnace gas combustion, and the technology has not been demonstrated in hot blast stove applications.

Step 4 – Evaluate Remaining Control Technologies

Low NO_x fuel combustion is the only remaining control technology and reduces NO_x by operating at a reduced flame temperature, which minimizes thermal NO_x formation.

Step 5 – Selection of BACT

Using the top-down BACT selection method, the inherent low NO_x fuel combustion qualities of BFG is the only remaining option for controlling NO_x emissions from the hot blast stoves. Additionally, a search of the RBLC produced no results for NO_x emission add-on controls applied to hot blast stoves in the United States. Therefore, BACT is selected to be no additional controls beyond the low NO_x fuel combustion technology inherent in the hot blast stove design. BACT is established as 0.06 lbs/MM Btu.

BACT analyses for SO₂

Source ID – Description (EQT #)

STV-101-Blast Furnace 1 Hot Blast Stoves Common Stack (RLP015)

STV-201-Blast Furnace 2 Hot Blast Stoves Common Stack (RLP016)

The blast furnace gas contains some sulfur dioxide as it exits the blast furnace. Therefore, the analysis of SO₂ removal technologies addresses treatment of the BFG prior to its combustion as fuel.

Potentially Applicable Technology

1. Wet Scrubber
2. Spray Dryer/Absorber (Dry Scrubber)
3. Dry Sorbent Injection

Wet Scrubber:

Wet scrubbers are designed to maximize contact between the exhaust gas and an absorbing liquid. The exhaust gas is scrubbed with a slurry composed of 5 - 15% CaO (lime) or CaCO₃ (limestone)

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in suspension. The SO₂ in the gas stream reacts to form CaSO₃ and CaSO₄. The scrubbing liquor is continuously recycled to the scrubbing tower after fresh CaO or CaCO₃ has been added.

The types of scrubbers that can adequately disperse the scrubbing liquid include packed towers, plate or tray towers, spray chambers, and venturi scrubbers. In addition to CaSO₃ or CaSO₄, numerous other absorbents are available including sodium bicarbonate solutions and NH₃ - based solutions.

Spray Dryer/Absorber (Dry Scrubber):

An alternative to wet scrubbing is a process known as semi-dry scrubbing using a spray dryer. As in wet scrubbing, the gas phase SO₂ is removed by contact with the suitable reactant suspended in water. Typically, this may be an aqueous solution of Na₂CO₃ or Ca(OH)₂. In spray dryer systems, the solution is pumped to atomizers, which create a spray of very fine droplets. The droplets mix with the incoming SO₂ in the flue gas in a very large chamber, and subsequent absorption leads to the formation of sulfites and sulfates in the droplets. Almost simultaneously, the sensible heat of exhaust gas that enters the chamber evaporates the water in the droplets, leaving a fine dry powder before the gas leaves the spray dryer. Typically, baghouses employing Teflon-coated fiberglass bags (to minimize bag corrosion) are used to collect the precipitated particulates, which contain both reacted and unreacted products.

Dry Sorbent Injection:

Dry sorbent injection involves the addition of an alkaline material (usually hydrated lime or soda ash) into the gas stream to react with the acid gases. This control option typically involves the injection of dry powders into either the furnace or post furnace region of boilers. Higher collection efficiencies can be achieved by increasing the flue gas humidity. The technology is generally only effective at controlling gas streams with a high concentration of acid gases.

A search of the RBLC database was conducted to identify which control technologies are in place today in the U.S. for hot blast stoves. The results can be seen in the table below.

RBLC Listings for SO₂ Emissions from Blast Furnace Gas Combustion

Facility	RBLC ID	Unit	Control Technology	Control Efficiency	Emission Limit	Units
Severstal North America, Inc	MI-0377	Blast Furnace Stoves	No Controls Feasible Compliance Verification Via CEMS	NA	16.62	Lb/MMscf

Source: Technology Transfer Network Clean Air Technology Center - RACT/BACT/LAER Clearinghouse

Step 2 - Eliminate Technically Infeasible Options

The design average concentration of SO₂ exiting the blast furnace is very low (14 ppmv) and is below the post-control SO₂ concentrations achieved in coal-fired utility boilers (100 to 150 ppmv)

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typical for new facilities burning 2.5 to 3% sulfur coal). None of the control options discussed below are effective for removal of SO₂ at the low concentrations anticipated at the exit of the blast furnace.

Wet Scrubber:

Wet scrubbers are not effective at removing low concentrations of SO₂ in a gas stream. Additionally, various operating problems are associated with the use of wet scrubbers to control SO₂ emissions from blast furnace and hot blast stove processes. When applied to the BFG prior to use as fuel in the hot blast stoves, there are potential problems with calcium scale plugging of the downstream burners. Particulates can plug scrubber spray nozzles, packing, plates, and trays. Wet scrubbers also require handling, treatment, and disposal of a sludge byproduct. In this case, a small reduction in air emissions would be exchanged for large-scale water treatment and solid waste disposal requirements.

Spray dryer/Absorber (Dry Scrubber):

The spray dryer process does not have the wastewater treatment problem associated with the wet scrubbing system, and the dry dust resulting from SO₂ removal can be easily removed downstream by a baghouse. However, spray dryers are not effective at removing low concentrations of SO₂ in a gas stream. Additionally, a small reduction in air emissions would be exchanged for a larger solid waste disposal requirement.

Dry Sorbent Injection:

Dry sorbent injection would not result in the wastewater treatment and disposal problems associated with the wet scrubbing systems. However, because of the very low SO₂ emission concentrations in the exhaust gas, it would not be feasible to design an efficient system of dry sorbent injection for the blast furnace process.

Step 3- Rank Remaining Technically Feasible Control Options

In the previous analysis, available control technologies were reviewed for application to the SO₂ removal process. There are no technically feasible options for the control of SO₂ from hot blast stoves remaining to be ranked.

Step 4 – Evaluate Remaining Control Technologies

Various control alternatives were reviewed for technical feasibility in controlling SO₂ emissions from the blast furnace and hot blast stoves. The application of each of the potential control options to the process was considered. Each of the available options has been eliminated as

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technically infeasible. A search of the RBLC database did not list any control options in place for SO₂ removal from blast furnaces or blast stoves.

Step 5 – Selection of BACT

A “top-down” BACT analysis was performed for SO₂ removal from the blast furnace / hot blast stoves. This analysis determined that BACT for SO₂ emissions from blast furnaces and hot blast stoves is no add-on or combustion control other than the low-sulfur BFG fuel. BACT is also established as a maximum limit of 0.00874 gr/dscf for the Blast Furnace Top Gas fuel. BACT for natural gas is to purchase natural gas containing no more than 2500 grains of Sulfur per MM scf.

BACT analyses for CO and VOC

Source ID – Description (EQT #)

STV-101-Blast Furnace 1 Hot Blast Stoves Common Stack (RLP015)

STV-201-Blast Furnace 2 Hot Blast Stoves Common Stack (RLP016)

A discussion of CO and VOC controls is combined due to the similarity in approach for control of these emissions. Blast furnace gas leaves the furnace with a large percentage of carbon monoxide and some VOC. These gases are not emitted to the atmosphere from the blast furnace process, but are instead collected, cleaned of particulate matter, and used as fuel for the hot blast stoves as well as the topgas boilers. Because the stoves and boilers are designed specifically for the combustion of a large amount of CO, uncombusted CO leaving the stoves is minimized.

VOC is typically generated by combustion sources when organic fuels such as coal or petroleum-based liquids are incompletely combusted. As a result, emissions can be minimized through the use of good combustion practices, including ensuring sufficient air-to-fuel ratios. Blast furnace gas is largely inorganic and contains only small amounts of VOC. The use of add-on oxidation technologies such as after-burners can also be considered to reduce CO and VOC emissions.

A search of the USEPA’s RACT/BACT/LAER Clearinghouse was conducted to review control technologies that are in place today for several types of boilers. It can be seen that good combustion practices are the industry standard for controlling CO and VOC emissions from boilers. However, there are no recorded control efficiencies for this control. The tables below provide a listing from the RBLC database of CO and VOC emissions limits and controls that are currently in place. The only technology in use for minimizing CO emissions is good combustion practices.

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RBLC Listings for CO Emissions from Blast Furnace /Hot Blast Stoves

Facility	RBLC ID	Unit	Control Technology	Control Efficiency	Emission Limit	Units
Severstal North America, Inc.	MI-0337	Blast Furnace Stoves	Good Combustion Practices	None	84.0	lb/MMscf

Source: Technology Transfer Network. Clean Air Technology Center - RACT/BACT/LAER Clearinghouse

RBLC Listings for VOC Emissions from Blast Furnace /Hot Blast Stoves

Facility	RBLC ID	Unit	Control Technology	Control Efficiency	Emission Limit	Units
Nucor Steel	IN-01018	Boiler, Nat. Gas	Compliance by Using Nat. Gas	NA	0.0026	lb/MMBtu
Steel Corr, Inc.	AR-0077	Boilers, Nat. Gas	Nat. Gas Combustion Only	NA	0.0055	lb/MMBtu
Charter Steel	WI-0181	Boiler	Good Combustion Control, Natural Gas	NA	No Limit	

Source: Technology Transfer Network. Clean Air Technology Center - RACT/BACT/LAER Clearinghouse

Potentially Applicable Technology

1. Catalytic Oxidizer
2. Non-Selective Catalytic Reduction (NSCR)
3. EM_x (SCONO_x)
4. Good Combustion Practices

Catalytic Oxidizer:

Beyond combustion controls, the remaining CO and VOC could be oxidized to carbon dioxide (CO₂) and water in a downstream control device. Gas streams with high concentrations of CO can be controlled by installing a catalytic oxidizer. The oxidation process occurs at a relatively low temperature by moving the gases across a bed of catalyst material consisting of a precious metal such as palladium. This can be practical when CO levels are elevated above 1,000 ppmv, such as in certain chemical processes, or for combustion units that have a wet fuel or for some reason promote incomplete combustion.

Non-Selective Catalytic Reduction (NSCR):

Non-selective catalytic reduction is similar to SCR, yet operates with a different catalyst and under different process conditions. NSCR requires precise adjustments of process conditions such as oxygen content (0.2 - 0.7% O₂) and temperature (800 - 1,200 °F) and works best with certain windows of inlet concentration for NO_x (2,000 - 4,000 ppmv), CO (3,000 - 6,000 ppmv), and VOC (1,000 - 2,000 ppmv). These operating windows are necessary because the catalyst acts to react the NO_x, CO, and VOC with one another, reducing the emission of each. The catalytic reaction requires a certain temperature band and the presence of a small amount of oxygen.

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However, at optimal conditions it has the potential to reduce emissions of NO_x, CO, and VOC simultaneously. It has seen use controlling emissions from internal combustion engines and nitric acid plants.

EM_x (SCONO_x):

EM_x is primarily a NO_x control technology which works by oxidizing NO to NO₂ and trapping the NO₂ molecules as nitrates or nitrites on a potassium carbonate catalyst bed. Carbon monoxide is also oxidized across the catalyst, to CO₂. The catalyst bed must then be regenerated with a steam and hydrogen vapor stream, producing water and N₂. EM_x operates best when treating gases that have a steady temperature, in the range of 300 – 700 °F. EM_x has seen use as a Low Achievable Emission Rate (LAER) technology applied to combustion turbines.

Good Combustion Practices:

Carbon monoxide and VOC are a result of incomplete combustion; therefore, they can typically be minimized through the use of good combustion practices, including assurance of sufficient air-to-fuel ratios. Good combustion practices can be enhanced using staged combustion, which involves the injection of combustion air at different areas of the burners.

A search of the RBLC database was conducted and no records were found for add-on emissions controls for CO or VOC from blast furnaces or hot blast stoves.

Step 2 – Eliminate Technically Infeasible Options

Catalytic Oxidizer:

In the case of a gas-fired burner, an afterburner or downstream oxidizer would not result in an emission reduction because CO emissions typically are less than 1,000 ppmv. Further oxidation would generate more NO_x emissions and have little impact on CO.

Non-Selective Catalytic Reduction (NSCR):

Non-selective catalytic reduction requires specific levels of several process parameters that are incompatible with the combustion of blast furnace gas in the hot blast stoves. The low oxygen range required by NSCR can only be achieved by restricting the available combustion air to stoichiometric levels. As discussed for low excess air combustion, the low heating value of the blast gas does not allow for combustion at low levels of combustion air. Additionally, levels of CO and VOC in the flue gas stream are not within the range necessary, and the flue gas temperature leaving the stoves will not reach the level required to promote the catalytic reaction. Thus NSCR is not a feasible control technology for the control of CO from hot blast stoves.

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EM_x (SCONO_x):

EM_x technology uses catalyst beds with narrow, honeycomb structures, which expand and contract with temperature in a sensitive manner. These expansions and contractions negatively impact the performance of EM_x, and large temperature swings during operation can render the system ineffective. The hot blast stoves will operate in a cyclic fashion, such that the flue gas leaving the stoves will experience regular temperature swings between 180 – 400 °C (356 – 752 °F). Due to its sensitivity to temperature changes, EM_x is a technically infeasible control technology for the hot blast stoves.

Step 3 – Rank Remaining Technically Feasible Control Options

1. Good combustion practices – 98 - 99% CO and 40 – 60% VOC (typical)

Step 4 – Evaluate Remaining Control Technologies

In blast furnaces and hot blast stoves, good combustion practices can lead to an overall CO and VOC reduction efficiency of 98 – 99% and 40 – 60%, respectively. A review of the RBLC database indicates that good combustion practice is the control method of choice for controlling CO and VOC emissions from other types of furnaces. Good combustion operation practices are considered the only feasible control method for reducing CO and VOC emissions.

Step 5 – Selection of BACT

Using the top-down BACT selection method, only one option remains for the control of CO and VOC from the blast furnace and hot blast stoves. BACT is selected to be good combustion practices during the operation of the blast furnace and hot blast stoves. BACT is 0.0824 lbs of CO per MM Btu and 0.0054 lbs of VOC per MM Btu.

BACT DETERMINATION FOR CAST HOUSE

BACT analyses for PM/PM₁₀/PM_{2.5}

Source ID – Description (EQT #)

CST-101- Cast House 1 Baghouse Vent (EQT015)

CST-201- Cast House 2 Baghouse Vent (EQT016)

In the cast house, the taphole of the blast furnace is periodically drilled open in an operation called tapping or casting. The iron metal and slag mixture exits at a temperature of 1,300 – 1,500 °C. The hot iron metal and slag is drained from the taphole through a runner system into ladles waiting on wheeled cars. The slag floats to the top of the trough, and a dam separates the hot metal and slag into two separate streams. The slag is drained by separate runners into a granulation system for cooling or to an open pit for later reclaiming and processing.

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Iron oxide dust emissions are frequently generated during casting either by direct vaporization of the compounds or the partial pressure of CO bursting bubbles at the metal to atmosphere interface. Additional emissions are generated from the drilling out of the clay taphole plug and replacement of the taphole plug at the completion of the casting operation.

Casting operations are the main source of emissions at the cast house. Emissions are generated by drilling and plugging the taphole in the hearth of the blast furnace and from casting operations as a result of the transfer of hot metal from the runner to the ladle. Particulate emissions are also generated when the molten iron and slag contact air above their surface.

Step 1 – Identify Potential Control Technologies

The technologies that are potentially available to control PM₁₀ emissions from the cast house are typical of industrial dust control technologies and include local collection hoods venting to one of the following:

1. Fabric Filter (baghouse)
2. Electrostatic Precipitator (ESP)
3. Wet Scrubber
4. Cyclone

A search of the RBLC database was conducted to review what controls are in place today in the United States. The results can be seen in the table below.

RBLC Listings for PM₁₀ Emissions from the Cast House

Facility	RBLC ID	Unit	Control Technology	Control Efficiency	Emission Limit	Units
Quanex Corporation - Macsteel Division	AR-0021	Caster	Fabric Filter	99.5%	0.0018	gr/dscf
Steelcorr, Inc.	AR-0077	Caster	Fabric Filter		0.0018	gr/dscf
Asama Coldwater Manufacturing, Inc.	MI-0385	Casting Cooling and Shot Blast Machine	Hoods, Enclosures, Ductwork and a 65,360 ACFM Baghouse	99%	2.64	lb/hr
Charter Mnfr. Co. Inc.	OII-0276	Continuous Caster	Baghouse	NA	1.1 3.55	lb/hr TPY
Nucor Yamato Steel	AR-0091	Castrip Caster	Baghouse		0.0053	gr/dscf
Nucor Jewett Plant	TX-0398	Continuous Caster	Baghouse		0.29 0.68	lb/t TPY

Source: Technology Transfer Network Clean Air Technology Center - RACT/BACT/LAER Clearinghouse

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Step 2 – Eliminate Technically Infeasible Options

The evaluation for these filtering technologies must review whether the specific technology is available for the application and is effective at reducing PM₁₀ emissions from the casting process.

Electrostatic Precipitator (ESP):

ESP's are capable of 98% or higher particulate removal; however, several factors preclude their application to control PM₁₀ from the cast house. ESPs are sensitive to the physical characteristics of the gas stream, and the control efficiency is highly sensitive to variations in flow rate, solids loading, pressure, and temperature that are inherent in the cast house operations. ESPs are especially sensitive to the composition of the particles to be collected. Iron particles adhere very strongly to the collection plate of an ESP due to their electromagnetic properties. They become very difficult to remove and thus quickly reduce ESP efficiency. Additionally, ESPs have a high capital cost, high electricity demands, and require large amounts of maintenance, resulting in a relatively high down time. ESPs are a technically infeasible control option for this source.

Step 3 – Rank Remaining Technically Feasible Control Options

The control technologies that are potentially available to control PM₁₀ emissions from the cast house are ranked below according to their respective control efficiencies.

1. Fabric Filter (baghouse) – 99%
2. Wet Scrubber – 98%
3. Cyclone – 80%

Various control alternatives were reviewed for technical feasibility in controlling PM₁₀ emissions from the cast house. The highest ranking control option was identified to be the baghouse. PM₁₀ emissions could be reduced by up to 99.5% with the addition of local collection hoods and baghouse filters. PM_{2.5} emissions could be reduced by up to 99% with the addition of local collection hoods and baghouse filters. A review of the RBLC database indicated that fabric filters or baghouses with hoods and enclosures have been routinely accepted as BACT.

Step 4 – Evaluate Remaining Control Technologies

Fabric Filter (baghouse):

Local collection hoods and fabric filters or baghouses are the most efficient means of removing particulate from the cast house sources. The advantage of local collection hoods and bag filters is that air flows can be adjusted individually to accommodate changes in the dust loading. Local

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collection hoods and baghouse installations are the industry standard for particulate controls.

Wet Scrubber:

High-energy wet scrubbers are technically feasible, but have many disadvantages compared to fabric filters, which can achieve better levels of particulate control. Scrubber systems have very high pressure drops that result in high system operating costs. They also require water treatment and sludge disposal, which are not necessary with the other PM₁₀ control options. They also have large space requirements.

Cyclones:

The dust particles could be separated by centrifugal forces imparted in a cyclone; however, high velocities must be established and fine dust would not be effectively removed with the greatest efficiency.

Step 5 – Selection of BACT

A top-down BACT analysis was performed for PM₁₀ emissions from the cast house. The most efficient control of PM₁₀/PM_{2.5} emissions from the cast house is the local collection hoods and fabric filter option. BACT is local collection hoods and baghouse filter to achieve a limit of 0.0065 lbs of PM per ton of hot metal, which is less than the emission standard from NESHAP 40 CFR 63 Subpart FFFFF of 0.003 gr/dscf. PM / PM₁₀ / PM_{2.5} removal efficiency \geq 99.5 % from filter manufacturer's certification.

BACT analyses for SO₂

Source ID – Description (EQT #)

CST-101- Cast House 1 Baghouse Vent (EQT015)

CST-201- Cast House 2 Baghouse Vent (EQT016)

The molten iron and slag tapped from the blast furnace contain sulfur and sulfur compounds dissolved or entrained in the liquid. These compounds, upon contact with air, have the potential to form SO₂. Air above the tapholes and casting runners is collected via large suction hoods, primarily for the purpose of dust control. Although emissions of SO₂ in aggregate are in excess of the PSD significance level, the expected concentration of SO₂ in the Cast House Dedusting vents are very low (~4 ppm). This concentration is a consequence of the enormous volume of air being collected for dedusting from the open hoods above each tap hole (1,200,000 cubic meters per hour per blast furnace).

Step 1 – Identify Potential Control Technologies

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1. No control

A search of the RBLC Database did not find an instance where controls have been applied to SO₂ emissions from casting operations. Similarly, no instances of a control technology or technique were found in a Nucor review of industry and academic literature. Since no technology or technique has been identified with a practical potential for reducing emissions of SO₂ from the casting process, the only remaining option is no control. For this reason, steps 2 – 4 of the BACT analysis have been omitted.

BACT is selected as no additional control and as 0.04 lbs of SO₂ per ton of hot metal.

BACT analyses for CO

Source ID – Description (EQT #)

CST-101- Cast House 1 Baghouse Vent (EQT015)

CST-201- Cast House 2 Baghouse Vent (EQT016)

The molten iron and slag tapped from the blast furnace contain carbon and carbon compounds dissolved or entrained in the liquid. These compounds, upon contact with air, have the potential to form carbon monoxide. Although emissions of CO in aggregate are in excess of the PSD significance level, the expected concentration of CO in the Cast House Dedusting vents are very low (~12 ppm). This concentration is a consequence of the enormous volume of air being collected for dedusting from the open hoods above each tap hole (1,200,000 cubic meters per hour per blast furnace).

Step 1 – Identify Potential Control Technologies

1. No Control

A search of the RBLC Database did not find an instance where controls have been applied to CO emissions from casting operations. Similarly, no instances of a control technology or technique were found in a review of industry and academic literature performed by Nucor. Since no technology or technique has been identified with a practical potential for reducing emissions of CO from the casting process, the only remaining option is no control. For this reason, steps 2 – 4 of the BACT analysis have been omitted. BACT is no additional controls and 0.055 lbs of CO per ton of hot metal.

BACT DETERMINATION FOR EMISSIONS FROM COKE OVENS

BACT analyses for PM/PM₁₀/PM_{2.5}

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Source ID – Description (EQT #)

COK-111-Coke Battery 1 Flue Gas Desulfurization Stack (RLP006)

COK-211-Coke Battery 2 Flue Gas Desulfurization Stack (RLP012)

There are several processes that take place in the coke ovens, including heating, charging, and pushing.

Metallurgical coke is produced by the destructive distillation of coal in coke ovens. Prepared coal is heated in an oxygen-free atmosphere (coked) until most volatile components in the coal are removed. The remaining material is a carbon mass called coke.

There are two types of coke processes:

- The “byproduct” process is designed to recover the organic components gasified during the coking process;
- The “non-recovery” process uses the volatile organics from the coking process as fuel to heat the coal and drive the coking process.

The process for Nucor Steel Louisiana is a non-recovery coke process in which the coke oven gas is combusted in the ovens to drive the coking process.

The proposed coke oven is a non-recovery coke oven battery design. Heating and distillation of the compressed coal to form coke is accomplished in the coke ovens. Coke oven gas, which is generated from the distillation of coal, is combusted as fuel to provide heat for the distillation process. The flue gas stream leaving the coke ovens is sent to heat recovery steam generators (HRSGs) prior to controls.

The non-recovery coke ovens are operated at a negative pressure, and emissions from coke oven battery doors inherent with byproduct recovery ovens largely do not exist.

Flue gas from the coke ovens contains $PM_{2.5}$ generated from the combustion of the coke oven gas. Additionally, coals used as raw materials in the coke ovens contain a certain percentage of sulfur. A portion of the sulfur in the coal is retained in the coke product, and a portion is volatilized and combusted in the coke oven gas. The majority of combusted sulfur becomes SO_2 , which is controlled by a lime slurry-based scrubbing system installed on the coke oven flue gas duct upstream of the particulate control device. A fraction of the sulfur in the gas may be combusted to form ionized SO_3 at the high temperatures of the coke oven process. These SO_3 radicals are known to combine with moisture to form sulfuric acid mist, which may contribute to $PM_{2.5}$ emissions from the coke ovens in a secondary manner. An effective control strategy for $PM_{2.5}$ emissions from the coke ovens should also address the need to reduce emissions of SO_3 .

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Step 1 – Identify Potential Control Technologies

1. Fabric Filters (baghouse)
2. Electrostatic Precipitator (ESP)
3. Wet Scrubber
4. Cyclone

RBLC Listings for PM₁₀ Emissions from Coke Oven Gas

Facility	RBLC ID	Unit	Control Technology	Control Efficiency	Emission Limit	Units
FDS Coke	OH-0297	Coke Oven Batteries	Fabric Filter	99%	39.0 171.0	lb/hr t/yr
Haverhill North Coke Company	OH-0297	Coke Battery Ovens	Baghouse	99%	43.89 0.008	lb/hr gr/dscf
Haverhill North Coke Company	OH-0305	Coke Oven Batteries, Non-recovery	Baghouse	99%	17.14 75.08 0.008	lb/hr t/yr gr/dscf

Source: Technology Transfer Network. Clean Air Technology Center - RACT/BACT/LAER Clearinghouse

Step 2 – Eliminate Technically Infeasible Options

Each PM₁₀ removal option was determined to be technically feasible.

Step 3 – Rank Remaining Technically Feasible Control Options

1. Fabric Filter (baghouse) - 99%
2. Electrostatic Precipitator (ESP) - 98%
3. Wet Scrubber - 98%
4. Cyclone - 80%

Various control alternatives were reviewed for technical feasibility in controlling PM₁₀ emissions from coke oven gas. The highest ranking control option was identified to be a fabric filter. PM₁₀ emissions could be reduced by up to 99% with the addition of baghouse filters.

Step 4 – Evaluate Remaining Control Technologies

Fabric Filter (baghouse):

A fabric filter or baghouse is one of the most efficient means of separating particles from a gas stream. Baghouse effectiveness is frequently 99% or greater under the correct operating conditions. The advantage of bag filters is that the efficiency is largely insensitive to changes in the dust loading. However, baghouse controls can have special capital demands to handle high temperature vent streams. Baghouse installations are the industry standard for particulate controls.

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Recent advances in filter media allow industrial baghouses to operate at higher temperatures and efficiently separate smaller particles than has been demonstrated in the past. Proper operation of a baghouse collecting fine dust seeks to optimize the bag cleaning cycle. Operation of the baghouse such that a filter cake of captured particles builds up on the filter media increases the collection efficiency of the device in the smaller particle size ranges. However, too thick of a filter cake will increase the pressure drop across the filter, create plugging conditions and cause bag breaks and other maintenance problems.

Baghouse filters have an inherent advantage in reducing SO₃ emissions over other particulate control devices when paired with a sulfur treatment technology such as a lime slurry-based dry scrubber. Calcium sulfite particles, the product of SO₂ treatment in the scrubber are by design separated from the flue gas stream by a particulate control device. Residual particles of lime are also captured in this step. When using a baghouse for particulate control, these residual lime particles become part of the filter cake on the filter media. Any remaining SO₃ gas that is not reacted in the scrubber spray tower is forced to pass through the lime-bearing filter cake before being vented to the atmosphere. This arrangement maximizes contact between SO₃ and the lime reactant, a configuration not provided by other control options.

Electrostatic Precipitator (ESP):

ESPs are capable of 98% or higher particulate removal; however, there are several disadvantages to their application to control PM₁₀ from coke oven gas. ESPs have very high electricity demands and require large amounts of maintenance, resulting in a relatively high down time. In addition, ESPs have a high capital cost, and efficiency is highly sensitive to variations in flow rate, solids loading, pressure, and temperature that are inherent in coke oven operations.

Wet Scrubber:

High-energy wet scrubbers are technically feasible, but have many disadvantages compared to fabric filters, which can achieve better levels of particulate control. Scrubber systems have very high pressure drops that result in high system operating costs. They also require water treatment and sludge disposal, which are not necessary with other PM₁₀ control options. They also tend to have large space requirements.

Cyclones:

The dust particles could be separated by centrifugal forces imparted in a cyclone; however, high velocities must be established and fine dust would not be effectively removed with the greatest efficiency.

Step 5 – Selection of BACT

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A top-down BACT analysis was performed for the coke oven gas, and BACT is a fabric filter. The coke oven flue gas will be captured and routed through a baghouse before release to the atmosphere. BACT is 0.00863 lbs of PM₁₀ per ton of coal charged and BACT is 0.0084 lbs of PM_{2.5} per ton of coal charged.

BACT analyses for NO_x

Source ID – Description (EQT #)

COK-111-Coke Battery 1 Flue Gas Desulfurization Stack (RLP006)

COK-211-Coke Battery 2 Flue Gas Desulfurization Stack (RLP012)

Coke ovens produce metallurgical coke from coal by the distillation of volatile matter. A byproduct of the process is coke oven gas, which is used as a fuel to fire the ovens. NO_x emissions from coking or coal combustion are primarily nitric oxide, with only a fraction of the NO_x present as nitrogen dioxide. NO_x is formed from the thermal reaction of nitrogen in combustion air in the combustion flame and from oxidation of nitrogen compounds in the coal. NO_x formed from the thermal reaction is dependent on temperature, oxygen, and residence time. Thermal formation of NO_x is complex, but the rate is significant at temperatures above 2,800 °F.

Although NO_x emissions tend to be minimized by slow mixing in the combustion chamber, they are nonetheless substantial because of the large quantity of fuel consumed. Coke ovens are among the major NO_x emission sources at iron and steel mills.

Step 1 – Identify Potential Control Technologies

1. Selective Catalytic Reduction (SCR)
2. Selective Non-Catalytic Reduction (SNCR)
3. Non-Selective Catalytic Reduction (NSCR)
4. EM_x (SCONO_x)
5. Low NO_x Burners (LNB)
6. Staged Combustion

RBLC Listings for NO_x Emissions from Coke Oven Gas

Facility	RBLC ID	Unit	Control Technology	Control Efficiency	Emission Limit	Units
FDS Coke	OH-0297	Coke Oven Batteries	Staged Combustion	NA	49.6	lb/hr
Haverhill North Coke Co.	OH-0272	Coke Battery Ovens	Staged Combustion	85%	217.2	t/yr
Haverhill North Coke Co.	OH-0305	Coke Oven Batteries	Staged Combustion	NA	675.0	lb/hr
					1.0	lb/T of coal
					120.0	lb/hr
					438.0	t/yr

Source: Technology Transfer Network. Clean Air Technology Center - RACT/BACT/LAER Clearinghouse

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Step 2 – Eliminate Technically Infeasible Options

Low NO_x Burners (LNB):

The effectiveness of a low NO_x burner is different for boilers than for a coke oven. External fuel is burned in a boiler where operating conditions can be carefully controlled. In a coke oven, the volatile fraction of the coal migrates from the coal bed, and the gases are burned inside the oven gas collection system. The coal bed is converted to a coke bed over the cycle and remains in the oven. LNBs are not technically feasible for coke ovens because neither the coke oven gas, nor the coal itself, is combusted through burners.

Selective Catalytic Reduction (SCR):

For SCR to be effective, the waste gas stream must be between the temperatures of 600 – 800 °F. Unlike utility boilers with economizers and air heaters, coke ovens do not contain sections within the unit where the temperature is in the range where SCR can be used. Also, the catalyst bed of an SCR unit is highly sensitive to particulate matter in the gas stream, which plugs and fouls the catalyst. SCR has not been used with the coking process to date for these reasons and is considered to be technically infeasible.

Selective Non-Catalytic Reduction (SNCR):

SNCR requires injection of a reagent into the gas stream. In the case of the coking process, the required temperature window for this to take place (i.e., 1,600 – 2,200 °F) is only available for a brief period of time during the combustion cycle and may occur in any of several ducts along the coke oven battery at different times. It is thus difficult to inject the reagent into the gas stream that is within the temperature window, since the location is highly variable. If the injection takes place outside the temperature window, the SNCR will not be an effective technology. SNCR has not been used with the coke oven process to date for these reasons.

Non-Selective Catalytic Reduction (NSCR):

Non-selective catalytic reduction requires specific levels of several process parameters that are incompatible with the combustion of coke oven gas in the hot blast stoves. Carbon monoxide and VOCs are almost entirely incinerated in the coking ovens, and concentrations in the flue gas stream will not be within the ranges necessary to promote the catalytic reaction. Thus, NSCR is not a feasible control technology for the control of NO_x from the coke ovens.

EM_x (SCONO_x):

EM_x technology uses catalyst beds with narrow, honeycomb structures. These catalyst beds are sensitive to temperature and cannot operate at temperatures in excess of 1,200 °F. Additionally, the catalyst beds are prone to fouling in applications containing significant particulate loadings.

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The coke oven flue gas leaving the ovens will exceed the temperature limitations of EM_x. Additionally, the flue gas leaving the coke oven desulfurization units will contain an amount of lime particulate which would quickly cause plugging and fouling of the intricate catalyst beds, due to scale formation. Therefore, EM_x is a technically infeasible control technology for the coke ovens.

Step 3 – Rank Remaining Technically Feasible Control Options

Staged combustion is the only NO_x control technology that is technically feasible for the coke oven gas.

Step 4 – Evaluate Remaining Control Technologies

Staged Combustion:

Staged combustion controls NO_x by limiting the oxygen present at temperatures where NO_x formation is likely and/or suppressing peak temperatures that increase NO_x formation during gas combustion. The proposed non-recovery coke ovens use two discrete regions for staged combustion of the coal volatiles. The regions are the crown and the sole flues. The crown is the first stage of air addition. This operates in a reducing atmosphere where minimal oxygen is present for NO_x formation. The sole flues receive secondary air and operate in a reducing or oxidizing atmosphere as dictated by the oven gas rates. NO_x formation is minimized in the flues by controlling the temperature and air input.

Step 5 – Selection of BACT

A top-down BACT analysis was performed for control of NO_x from the coke ovens. After review of available control technologies, staged combustion was selected as BACT. BACT is selected as 0.71 lbs of NO_x per ton of coal charged.

BACT analyses for SO₂

Source ID – Description (EQT #)

COK-111-Coke Battery 1 Flue Gas Desulfurization Stack (RLP006)

COK-211-Coke Battery 2 Flue Gas Desulfurization Stack (RLP012)

The primary source of sulfur oxide emissions from the project is the coke oven combusted gas. A top-down BACT analysis was performed for SO₂ from the coke oven flue gases. Due to the non-recovery design selected for the coke ovens, the flue gases will be effectively incinerated as they leave the coke ovens and thus reduced sulfur compounds are not expected.

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Sulfur compounds are released along with the volatile fraction of the coal as the coking cycle proceeds; however, about half of the sulfur in the coal remains in the coke product. Pre-combustion controls are technologies that prevent the formation of SO₂ during the combustion process (e.g., low-sulfur coal), while post-combustion controls work to clean SO₂ from the flue gas. Thus, post-combustion controls are add-on controls that are used to either collect the pollutants or convert the pollutants to another form (e.g., lime added to SO₂ gas) to form solid calcium sulfite (CaSO₃) and calcium sulfate (CaSO₄). Note that these post-combustion controls are also effective at removing PM₁₀ and PM_{2.5}.

Step 1 – Identify Potential Control Technologies

Four options were identified that could potentially be used to control SO₂ from the thermal distillation of coal during the coking process.

1. Wet Scrubber
2. Lime Spray Dryer/Absorber (Dry Scrubber)
3. Dry Sorbent Injection
4. Low-sulfur coal

Wet Scrubber:

Wet scrubbers are designed to maximize contact between the exhaust gas and an absorbing liquid. The exhaust gas is scrubbed with 5 to 15% slurry, composed of CaO or CaCO₃ in suspension. The SO₂ in the exhaust gas reacts with the CaO to form CaSO₃ and CaSO₄. The scrubbing liquor is continuously recycled to the scrubbing tower after fresh CaO or CaCO₃ has been added.

The types of scrubbers that can adequately disperse the scrubbing liquid include packed towers, plate or tray towers, spray chambers, and venturi scrubbers. In addition to CaSO₃ or CaSO₄, numerous other absorbents are available, including sodium solutions and NH₃ based solutions.

Lime Spray Dryer/Absorber (Dry Scrubber):

An alternative to wet scrubbing is a process known as semi-dry scrubbing using a spray dryer. As in wet scrubbing, the gas phase SO₂ is removed by contact with a suitable reactant. Typically, this may be an aqueous solution of Ca(OH)₂ or Na₂CO₃. In spray dryer systems, the solution is pumped through atomizers, which create a spray of very fine droplets. The droplets mix with the incoming SO₂ in the flue gas in a very large chamber, and the subsequent absorption of SO₂ leads to the formation of sulfites and sulfates in the droplets. Almost simultaneously, the sensible heat of exhaust gas that enters the chamber evaporates the water in the droplets, forming a dry powder before the gas leaves the spray dryer. The exhaust gas from the system contains a mixture of

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reacted and unreacted particulate. Typically, baghouses employing Teflon-coated fiberglass bags (to minimize bag corrosion) are used to collect the precipitated particulates. In some applications, the captured particulate is recycled to improve efficiency.

The system is categorized as a "dry" system because the end product of the SO₂ conversion reaction is a dry material. Although termed as a dry system, this air pollution device uses water for evaporative cooling for the SO₂ reaction. Unlike a wet scrubbing system, however, there is no liquid blow-down stream from the dry system. The "dry" system has been used in low-sulfur coal applications to effectively remove SO₂. This control technology is technically feasible for the waste gas stream.

Dry Sorbent Injection:

Limestone injection has been a proven technology when applied to boilers. SO₂ may be removed by injecting a sorbent (lime, limestone, or dolomite) into the combustion gases, typically above the burners or in the backpass before the air heater. Furnace sorbent injection involves injection of the sorbent into the boiler above the combustion zone (preferably where the gas temperature is approximately 1,200 °C, or 2,200 °F) through special injection ports. The sorbent decomposes into lime, which reacts in suspension with SO₂ to form CaSO₄. The CaSO₄, unreacted sorbent, and fly ash are removed at the particulate control device (either an ESP or baghouse) downstream from the boiler. In boilers, SO₂ removal is 30 – 60% (with a calcium-to-sulfur molar ratio of 2:1) when injected into the combustion zone, but this still must be demonstrated on a large scale.

Low-sulfur coal:

A method to reduce SO₂ emissions from fossil fuel combustion is to change to low-sulfur fuels. Stoichiometrically, 2 lb of SO₂ are generated by 1 lb of sulfur in a typical combustion process (i.e., utility boiler). Thus, reducing the sulfur content of the fuel proportionally decreases the generation of SO₂. For example, replacing a coal containing 2% sulfur with a coal containing 1% sulfur (i.e., low-sulfur coal) results in a 50% decrease of SO₂ emissions.

The conversion of coal to coke, however, may not directly parallel a boiler when it comes to low-sulfur fuels. Unlike coal-fired boilers, the coal is heated, not burned, during the coking process, and primarily it is the volatized material from the coal that is combusted. Although most of the sulfur in the coal remains in the coke, the sulfur component of the volatized material will produce SO₂.

RBLC Listings for SO₂ Emissions from Coke Oven Gas

Facility	RBLC ID	Unit	Control Technology	Control Efficiency	Emission Limit	Units
FDS Coke	OH-0297	Coke Oven Batteries	Lime Spray Dryer, Low Sulfur Coal, Combustion Optimization	91%	243.3 1019.0	lb/hr t/yr

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Facility	RBLC ID	Unit	Control Technology	Control Efficiency	Emission Limit	Units
Haverhill North Coke Co.	OH-0272	Coke Battery Ovens	Dry Scrubber, Lime Spray Dryer, and Low Sulfur Coal <1%	92%	265.0	lb/hr, 3hr avg.
Haverhill North Coke Co.		Coke Oven Batteries	Dry Scrubber with wet lime spray injection and low sulfur coal <1%		0.88	lb/ton of coal
Haverhill North Coke Co.	OH-0305	Coke Oven Batteries	Dry Scrubber with wet lime spray injection and low sulfur coal <1%	92%	192.0	lb/hr
Haverhill North Coke Co.					700.8	t/yr
					1.6	lb/ton coal

Source: Technology Transfer Network, Clean Air Technology Center - RACT/BACT/LAER Clearinghouse

Step 2 – Eliminate Technically Infeasible Options

Wet Scrubber:

Wet scrubbing systems can potentially reach high levels of SO₂ removal. However, many applications carry disadvantages for using wet scrubbing techniques. There is a large water use requirement, as well as a large amount of wastewater to be treated. A high capital cost is associated with them because materials must be constructed from expensive alloys to resist corrosion and the equipment required is massive. The large physical size requires a great deal of space for installation, and energy use is much higher than other technologies.

A practical issue associated with a wet scrubber system is the complexity of the system. Additional expertise is often needed in specifying, operating, and maintaining such a system, which is more like a chemical plant than a control device. The systems require more maintenance due to their complexity, and more personnel are required for their operation. A wet scrubbing system is not known to have ever been used for coke ovens and therefore has not been considered a demonstrated or technically feasible control technology for this application.

Dry Sorbent Injection:

Limestone injection has been demonstrated on boilers where combustion takes place in a well-defined and centralized zone and a high degree of control can be applied to the combustion conditions. By the nature of the coke oven process, combustion of the coke oven gas will be dispersed among 280 individual coke ovens, with flue gases collected at ten vents. A system to meter and inject dry sorbent on this basis would be complex and extremely costly. Dry sorbent injection is not known to have ever been used for coke ovens and therefore has not been considered a demonstrated or technically feasible control technology for this application.

Step 3 – Rank Remaining Technically Feasible Control Options

1. Lime Spray Dryer/Absorber (Dry Scrubber) – 90%
2. Low-sulfur coal – 50%

The dry scrubber system has been used in low sulfur coal applications to effectively remove SO₂

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from a gas stream with a removal efficiency of 90%. Wet scrubbers may be designed for efficiency of 80 – 95% SO₂ removal in boiler applications, yet require an enormous capital investment and produce disposal issue for other media.

Step 4 – Evaluate Remaining Control Technologies

Lime Spray Dryer/Absorber (Dry Scrubber):

Spray drying systems have been frequently applied to coke ovens and represent the industry standard for sulfur removal. A significant advantage of dry scrubbing is that it provides a high SO₂ removal efficiency without generating wastewater. Another advantage is that a spray dryer / baghouse system is a very effective particulate removal device.

Low-sulfur Coal:

The use of low sulfur coal in place of a more readily available and higher sulfur coal, often referred to as “fuel switching,” has been a common method of sulfur control from boilers. However, the blast furnace process requires that sulfur reaching the pig iron product be at as low a level as possible for metallurgical reasons of product quality. Coals used for metallurgical coke are typically restricted to coal with a sulfur content of 1.3% or less by weight. Therefore, low-sulfur coal technology is inherent in the coke oven process. However, while Nucor Steel Louisiana proposes to operate the coke ovens with the lowest sulfur coal practicable, coals with < 1 wt% sulfur are simply not available 100% of the time due to market conditions.

The coke ovens at the proposed Nucor Steel Louisiana facility can receive coals from a number of different mines. These coals can be mixed and blended at the coal preparation area of the coke ovens (COK-100) to create compacted coal bricks with uniform properties. The selection of coals will be based on a large number of factors, including price, availability, transportation method and cost, and coal properties such as volatility, ash content, carbon content, moisture content, sulfur content, heating value, and softening temperature, among other properties. Optimization across all of these factors is key to the effective operation of the coke plant.

The control efficiency of SO₂ from lime spray towers is known to be dependent upon the concentration of SO₂ in the coke oven flue gas. At high concentrations of SO₂, a lime scrubber can remove a higher percentage of SO₂ from the flue gas using the same molar ratio of lime to SO₂. However, at low concentrations this efficiency falls off, and progressively higher ratios of lime to SO₂ must be used to obtain the same control efficiency. It may be favorable to use a low-sulfur blend for an extended period of time. In this situation, this could result in having difficulty in meeting a high control efficiency applied to a low concentration of SO₂, creating a situation where compliance is difficult to achieve even though actual SO₂ emissions would be reduced over using a higher sulfur coal blend.

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In light of the above, BACT for SO₂ from the coke oven flue gas stacks is:

1. No material charged to the coke ovens in excess of 1.25% sulfur by weight.
2. A six-month rolling average of sulfur content in the charge material to be recorded on a weekly basis.
3. When the average sulfur content of the charge material is less than 1.0%, a minimum SO₂ control efficiency of 90% will be required.
4. When the average sulfur content of the charge material is equal to or greater than 1.0%, a minimum SO₂ control efficiency of 91% will be required.

Step 5 – Selection of BACT

A top-down BACT analysis was performed for SO₂ removal from coke oven gas. A combination of low-sulfur coal and spray drying technologies will be applied to reduce SO₂ emissions from the coke ovens. A dry scrubber with removal efficiency no less than 90% is BACT for SO₂ emissions. BACT is a maximum content of 1.25% sulfur in the coal.

The baghouse selected for PM₁₀ control, discussed above, will also control the dust generated by the spray dryer technology, providing a very effective use of resources. The combination of spray drying and low-sulfur coal has become an industry standard for SO₂ control from coke ovens.

BACT analyses for CO and VOC

Source ID – Description (EQT #)

COK-111-Coke Battery 1 Flue Gas Desulfurization Stack (RLP006)
 COK-211-Coke Battery 2 Flue Gas Desulfurization Stack (RLP012)

A discussion of CO and VOC controls is combined due to the similarity in approach for control of these emissions during the coking process and related activities. CO and VOC emissions are generated during the conversion of coal to coke and during pushing activities. The concentrations of CO and VOC are less than 5 ppm in the charging emissions.

Step 1 – Identify Potential Control Technologies

Good Combustion Practices:

During the coking process, coal is heated and volatile matter is released from the coal bed. In the non-recovery coking process, coke oven gases are combusted within the coke oven sole flues in the oven walls and floor to provide the energy for heating the coal to produce coke. This approach naturally produces low emissions of CO and VOCs.

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RBLC Listings for CO Emissions from Coke Oven Gas

Facility	RBLC ID	Unit	Control Technology	Control Efficiency	Emission Limit	Units
FDS Coke	OH-0297	Coke Oven Batteries	Combustion Optimization	NA	49.6 217.2	lb/hr t/yr
Haverhill North Coke Co.	OH-0272	Coke Battery Ovens	NA	NA	55.84 20.0	lb/hr ppm
Haverhill North Coke Co.	OH-0305	Coke Oven Batteries	Combustion Optimization	NA	21.81 95.54	lb/hr t/yr

Source: Technology Transfer Network. Clean Air Technology Center - RACT/BACT/LAER Clearinghouse

RBLC Listings for VOC Emissions from Coke Oven Gas

Facility	RBLC ID	Unit	Control Technology	Control Efficiency	Emission Limit	Units
FDS Coke	OH-0297	Coke Oven Batteries	Combustion Optimization	NA	10.6 46.5	lb/hr t/yr
Haverhill North Coke Company	OH-0272	Coke Battery Ovens	NA	NA	11.97 10.0	lb/hr ppm
Haverhill North Coke Company	OH-0305	Coke Oven Batteries	Combustion Optimization	NA	4.67 20.47	lb/hr t/yr

Step 2 – Eliminate Technically Infeasible Options

The evaluation of these technologies must review whether the specific technology is available for the application and is effective at reducing CO and VOC emissions from the coking process. Good combustion is technically feasible for the treatment of coke oven gas.

Step 3 – Rank Remaining Technically Feasible Control Options

The destruction of CO and VOCs is expected to be very high, as the non-recovery coke oven design acts to incinerate these compounds during a long residence time. This destruction is inherent to the non-recovery oven coking process in which the coke oven volatiles are combusted under controlled conditions to provide the heat required for the coking process.

Step 4 – Evaluate Remaining Control Technologies

During the process, the coke oven gas combustion in the sole flues naturally produces low emissions of CO and VOCs. The coke oven gas remains in the sole flues and common tunnel approximately seven seconds where the gases are exposed to oxidizing conditions and temperatures from 1,600 – 2,500 °F. These operating conditions can be compared to controlled-air incineration.

Controlled-air incineration combustion occurs in two stages. In the first stage, the low air-to-fuel ratio dries and facilitates volatilization of waste material, and most of the residual carbon burns.

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In the second stage, excess air is added to the volatile gases formed in the primary chamber to complete combustion. This type of system is recognized as state-of-the-art for destroying organic compounds and CO. Typical secondary chamber residence times are 0.5 seconds and range from 1,800 – 2,000 °F.

Step 5 – Selection of BACT

BACT is good combustion practices that promote complete combustion of volatile organic compounds and CO. BACT is 0.0035 lbs of VOC per ton of coal charged – wet basis. BACT is 0.05 lbs of CO per ton of coal charged (wet basis).

BACT DETERMINATION FOR BLAST FURNACE AND COKE OVEN COAL PREPARATION

BACT analyses for PM/PM₁₀/PM_{2.5}

Source ID – Description (EQT #)

PCI-101 - PCI Mill Vent (RLP013)

COK-100 - Coke Ovens Coal Handling, Crushing, and Compacting (ARE001)

COK-104 - Coke Battery 1 Coke Handling (EQT004)

COK-204 - Coke Battery 2 Coke Handling (EQT010)

Pulverized coal is often injected along with the hot blast to provide additional heating value. This technology increases the overall efficiency of the blast furnace operation. First, the coal is ground to a fine powder. The pulverized coal is stored under a controlled atmosphere, brought up to furnace pressure in feed tanks, and pneumatically conveyed to the blast furnace area.

In the coal preparation step, coal is crushed, screened, and blended in order to produce a homogenous mixture for charging to the coke ovens. The mixture is then wetted to approximately 9% moisture by weight, loaded into a form, and compacted into a brick-like shape. The bricks are then transferred to charging cars for transportation to the individual ovens.

Step 1 – Identify Potential Control Technologies

Crushing, Screening, and Blending

1. Enclosed conveyors
2. Water sprays and/or chemical dust suppression; and
3. Indoor crushing operations vented to fabric filters

The table below provides the USEPA RBLC data for PM₁₀ controls for aggregate handling and

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storage operations. It is evident that the range of technologies cited above has been used as BACT for the various material handling operations. All of the above options are considered technically feasible.

RBLC Listings for PM₁₀ Emissions from Coal Preparation

Facility	RBLC ID	Unit	Control Technology	Control Efficiency	Emission Limit	Units
American Municipal Power	OH-0310	Coal Conveying, Handling, and Crushing	Baghouse with Option of Enclosures, Fogging, Wet Suppression	NA	9.0	t/yr
Louisiana Generating, LLC	LA-0223	Fuel Crusher House	Fabric Filters	NA	0.04 0.06	lb/hr t/yr
Western Farmers Electric Co-op – Hugo Generating Station	OK-0118	Material Handling	Fabric Filter Baghouse	NA	0.01	gr/dscf
Western Greenbrier CO-generation, LLC	WV-0024	Coal Handling	Fabric Filters	NA	0.01	gr/dscf
NRG Texas – NRG Coal Handling Plant	TX-0507	Crusher House, Transfer Tower 2, Silos A-D	Fabric Filter	NA	0.36	lb/hr
Lamar Utilities Board – Lamar Light & Power	CO-0055	Coal Handling and Preparation	High Efficiency Fabric Filter Baghouses	99.5%	0.02	Lb/ton

Source: Technology Transfer Network. Clean Air Technology Center - RACT/BACT/LAER Clearinghouse

Step 2 – Eliminate Technically Infeasible Options

All of the above mentioned technologies can be applied to control PM₁₀ and PM_{2.5} emission sources due to coal processing. There are areas where water suppression may not be practical, such as those that are enclosed. There are also areas where enclosures are not practical, such as transporting, where water suppression might be a more effective means of controlling emissions.

Step 3 – Rank Remaining Technically Feasible Control Options

1. Indoor crushing operations vented to fabric filters – 99%
2. Water sprays and/or chemical dust suppression – 90%
3. Enclosed Conveyors – 50%

Step 4 – Evaluate Remaining Control Technologies

Local collection with fabric filter control demonstrates the highest degree of particulate control, and is an industry standard. Control efficiencies of 99% are attainable with a baghouse and enclosed processing area.

A search of the RBLC database indicates that a control efficiency of 90% can be achieved in areas where water suppression is applied. Water suppression is mainly used in storage piles areas. Dust suppression chemicals need not be used in areas where water suppression can achieve the same

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control efficiencies. Water suppression could be applied to the finished coal and is indeed a necessary process step for the oven design.

Enclosed conveyors help to prevent material from becoming airborne from wind passing across the conveyor. Estimated control efficiencies for enclosed conveyors are about 50%.

Step 5 – Selection of BACT

BACT is a combination of control technologies for distinct steps in the process. Enclosures on the conveyors will be used to eliminate emissions from the conveyors during transfer operations. Coal crushing, screening, and blending will be controlled by fabric filters. Wet suppression will be applied to the finished coal blend. BACT for coke handling operations using baghouses for control is a removal efficiency $\geq 99.5\%$ based on the filter manufacturer's certification.

BACT analyses for NO_x

Source ID – Description (EQT #)
PCI-101 - PCI Mill Vent (RLP013)

The Pulverized Coal Injection (PCI) Mill increases the efficiency of the blast furnaces by injection of small particles of coal entrained in the hot blast. As the coal burns, it provides some of the heat necessary for the reduction of iron ore, saving the more valuable coke in the blast furnace burden from use as a fuel rather than as a reductant.

The PCI Mill grinds coal within a closed system to sizes appropriate for injection through the tuyeres. A hot gas generator burns natural gas to provide a constant stream of hot flue gas. The ground coal is conveyed pneumatically by the hot flue gas, which both transports and dries the coal. The ground coal is then separated from the flue gas stream by means of a fabric filter, and the filtered flue gas is exhausted to the atmosphere. The PCI mill dryer is a NO_x emissions source due to the combustion of natural gas fuel which provides heat to dry coal.

Step 1 – Identify Potential Control Technologies

1. Selective Catalytic Reduction (SCR)
2. Low NO_x Burners (LNB)

The table below summarizes RBLC control technologies for NO_x emissions from steel production facility dryers.

RBLC Listings for NO_x Emissions from Steel Production Facility Dryers

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Facility	RBLC ID	Unit	Control Technology	Control Efficiency	Emission Limit	Units
Nucor Steel	AR-0090	Miscellaneous Natural Gas Fired Burners and Dryers	Low NO _x Burners	NA	0.0620	lb/MMBtu
Auburn Nugget	IN-0119	Green Ball Dryer	Low NO _x Burners	NA	0.2200 33.80	lb/ton lb/hr
Ellwood National Steel	PA-0251	Vertical Dryer	No controls feasible	NA	100.0	lb/MMcf
Auburn Nugget	IN-0119	Product Separator Dryer	Low NO _x Burners	NA	0.0370 1.2200	lb/ton lb/hr
Auburn Nugget	IN-0119	Ore Dryer	Low NO _x Burners	NA	0.0100 1.2500	lb/ton lb/hr
Mesabi Nugget, LLC	MN-0061	Green Ball Dryer	Low NO _x Burners	NA	6.8000 0.0900	lb/hr lb/MMBtu

Source: Technology Transfer Network. Clean Air Technology Center - RACT/BACT/LAER Clearinghouse

Step 2 – Eliminate Technically Infeasible Options

All of the potential technologies listed in step 1 are considered technically feasible control options.

Step 3 – Rank Remaining Technically Feasible Control Options

1. Selective Catalytic Reduction (SCR) – 80% - 90%
2. Low NO_x Burners (LNB) – 50%

Step 4 – Evaluate Remaining Control Technologies

While SCR technology may be technically feasible in controlling emissions of NO_x from the PCI mill dryer, energy costs associated with operation of an SCR solely exceed the costs for NO_x control which normally justify the requirement to install a control technology under PSD BACT criteria. An economic assessment of the energy costs associated with the use of SCR technology to control NO_x emissions from the PCI mill dryer is included in Table 1 of this permit.

The dryer outlet gas temperature will be substantially below that required for proper SCR operation; thus, a new fired source for reheating the gas stream would be required. An additional 118.1 MMBtu/hr would be required to achieve a gas stream temperature of 410 °C. This temperature was selected as the lowest temperature for which an SCR unit is known to operate and

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achieve meaningful reductions in NO_x emissions and is therefore conservative. The lowest industrial price of natural gas in Louisiana for the past five years was selected from data provided by the United States Energy Information Administration, which was determined to be \$4.34/10³ scf. The annual cost of natural gas energy required to reheat the PCI Mill Dryer flue gas stream, per ton of potential NO_x emission reductions, is estimated to be \$109,701.40 per ton of NO_x removed. Although the calculation of fuel costs above is not a complete economic feasibility analysis, this energy cost estimate alone is well outside of the normally accepted range of control costs associated with BACT control.

Step 5 – Selection of BACT

Using the top-down selection method, BACT is the use of Low NO_x Burners for the PCI mill dryer. BACT is 0.049 lbs/MM Btu.

BACT analyses for SO₂

Source ID – Description (EQT #)
 PCI-101 - PCI Mill Vent (RLP013)

The PCI mill dryer SO₂ emissions originate from the combustion of natural gas.

Step 1 – Identify Potential Control Technologies

1. Fuel Specification

SO₂ emissions from combustion are a function of the sulfur content of the fuel, with virtually all fuel sulfur converted to SO₂. Coal generally has the highest sulfur content, followed by crude oils, sewage gas, waste fuels, and refined fuel oils (including No. 2). Natural gas is considered a clean fuel containing only trace amounts of sulfur and is the only fuel proposed for the PCI mill dryer.

RBLC Listings for SO₂ Emissions from Steel Production Facility Dryers

Facility	RBLC ID	Unit	Control Technology	Control Efficiency	Emission Limit	Units
Nucor Steel	AR-0091	Castrip Miscellaneous Dryers and Preheaters	Fuel Specification: Natural Gas	NA	0.0006	lb/MMBtu
Republic Engineered Products, Inc.	OH-0302	Ladle Dryers/Preheaters (2)	Good Engineering Practices; use of natural gas with sulfur content less than 0.6 percent by weight	NA	0.0100 0.0800	lb/hr t/yr

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Arkansas Steel Associates	AR- 0030	Ladle Dryer	Natural Gas	NA	0.1000	lb/hr
Nucor Steel	AR-0090	Ladle Dryer	No controls feasible	NA	0.0006	lb/MMBtu
Auburn Nugget	IN-0119	Green Ball Dryer	No controls feasible	NA	0.1400	lb/hr
Ellwood National Steel	PA-0251	Vertical Dryer	No controls feasible	NA	0.6000	lb/MMcf
Auburn Nugget	IN-0119	Ore Dryer	No controls feasible	NA	0.0130	lb/hr

Source: Technology Transfer Network. Clean Air Technology Center - RACT/BACT/LAER Clearinghouse

Step 2 - Eliminate Technically Infeasible Options

There are no technically infeasible options for the control of SO₂ from the PCI mill dryer.

Step 3- Rank Remaining Technically Feasible Control Options

There are no technically feasible options remaining to be ranked for the control of SO₂ from the PCI mill dryer.

Step 4 – Evaluate Remaining Control Technologies

A search of the RBLC database did not list any control options in place for SO₂ removal from dryer exhaust; thus, the use of sweet natural gas fuel is the only remaining feasible control option.

Step 5 – Selection of BACT

BACT for SO₂ emissions is no add-on or combustion control other than the use of sweet natural gas fuel.

BACT analyses for CO and VOC

Source ID – Description (EQT #)
PCI-101 - PCI Mill Vent (RLP013)

A discussion of CO and VOC controls is combined here due to the similarity in approach for control of these emissions.

Step 1 – Identify Potential Control Technologies

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1. Good Combustion Practices
2. Oxidizers

Step 2 – Eliminate Technically Infeasible Options

Oxidizers:

In the case of a gas-fired burner, an afterburner or downstream oxidizer would not result in an emission reduction because CO emissions typically are less than 1,000 ppm. Further oxidation would generate more NO_x emissions and have little impact on CO. Add-on controls, even if feasible, are not typically required for combustion sources fired with natural gas. During the review of available control technologies for combustion sources in the steel industry, no information was found that discussed the use of add-on controls for the reduction of VOC or CO emissions from natural gas-fired equipment.

Step 3 – Rank Remaining Technically Feasible Control Options

In natural gas combustion sources, good combustion practices can lead to an overall CO and VOC reduction; thus, good combustion practices is the only remaining technically feasible control option.

Step 4 – Evaluate Remaining Control Technologies

A review of the RBLC database indicates that good combustion practice is the control method of choice for controlling CO and VOC emissions from other types of dryers. Good combustion operation practices are considered the only feasible control method for reducing CO and VOC emissions.

Step 5 – Selection of BACT

Using the top-down BACT selection method, only one option remains for CO and VOC emissions control from the PCI mill dryer. BACT is good combustion practices during the operation of the PCI mill dryer.

BACT DETERMINATION FOR COKE OVEN COAL CHARGING

BACT analyses for PM/PM₁₀/PM_{2.5}

Source ID – Description (EQT #)

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COK-101 - Coke Battery 1 Coal Charging (EQT001)

COK-201 - Coke Battery 2 Coal Charging (EQT007)

Charging is the process of adding coal to the ovens. In typical operations, the door is opened from one end of the oven and coal is charged using a horizontal ram. In this application, Nucor proposes to charge the oven with a compacted "brick" of coal instead of dumping "loose" coal into the oven as in older designs. An opening sized to the coal brick is opened in the charging door, and the coal brick is then moved on a charging bed into the coke oven by a horizontal ram, while a negative pressure is maintained on the oven. The charging bed is then retracted, sliding out from under the brick of coal. The emissions of particulate to the atmosphere are thereby minimized.

Step 1 – Identify Potential Control Technologies

1. Fabric Filters (baghouse)
2. Electrostatic Precipitator (ESP)
3. Wet Scrubbers
4. Cyclone
5. Negative Pressure Ovens
6. Compacted Coal

Negative Pressure Ovens:

Negative pressure ovens operate at a vacuum, minimizing the escape of particulate matter and gases as the oven doors are opened. The bricks of coal charged into the ovens are pushed in while stationary on a charging bed. The bed is then removed by sliding it out from under the coal. Thus, the potential to generate particulate emissions is minimized.

Compacted Coal:

Historical coke oven designs loaded loose, lump coal into the ovens, either by dumping the coal into the top of the oven from a larry car or dropping it in by horizontal conveyor. These methods generate particulate emissions from the coal transfer steps. The coke oven design proposed by Nucor processes the coal prior to charging, such that it is wetted with water, mixed with a binding agent such as tar, and compressed into the shape of a large brick. The moisture, binder, and cohesive shape of the brick minimize particulate emissions from coal charging by preventing the generation of these emissions. Additionally, there are fewer exposed coal transfer steps, such as the filling of a larry car and subsequent dumping into the ovens from an open location on top of the coke oven battery.

RBLC Listings for PM₁₀ Emissions from Coke Oven Charging

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Facility	RBLC ID	Unit	Control Technology	Control Efficiency	Emission Limit	Units
Haverhill North Coke Company	OH-0305	Coke Oven Batteries	Baghouse with Traveling Hood	70%	1.17 Fugitive 4.36	lb/hr t/yr
Haverhill North Coke Company	OH-0272	Coke Battery Ovens	Baghouse with Traveling Hood	93%	1.2	lb/hr PM/PM10
Haverhill North Coke Company	OH-0272	Coke Battery Ovens	Baghouse with a shed extending the length of the battery capturing all emissions	98%	26.33 0.039	lb/hr lb/ton coal
FDS Coke	OH-0297	Coke Oven Batteries	Fabric Filter with Traveling Hood, Oven Negative Pressure	99%	0.32 1.0 0.008	lb/hr t/yr gr/dscf

Source: Technology Transfer Network. Clean Air Technology Center - RACT/BACT/LAER Clearinghouse

Step 2 – Eliminate Technically Infeasible Options

Wet Scrubber:

Wet scrubbers collect particles by contacting or scrubbing gases with a liquid, usually water. To be effective on small particles, wet scrubbers must produce a high pressure drop and contain a large internal surface area. This typically requires a tall column coupled with a large blower motor. The length of travel required from end to end of the oven battery presents a problem in supplying power and water to the scrubber and in collecting and routing the scrubber effluent to treatment. For these reasons, a wet scrubber is not technically feasible for coal oven charging PM₁₀ emissions.

Step 3 – Rank Remaining Technically Feasible Control Options

1. Fabric Filter – 99%
2. Electrostatic Precipitator (ESP) – 98%
3. Cyclone – 80%
4. Negative Pressure Ovens – Prevention of Airborne Particles
5. Compacted Coal – Prevention of Airborne Particles

Step 4 – Evaluate Remaining Control Technologies

Fabric Filter (baghouse):

Fabric filtration has been widely applied to industrial sources, including coal handling, since the early 1970s. Control efficiencies of fabric filters (baghouses) can easily attain 99% of the particulate collected. Variability in overall control efficiencies associated with baghouses is due to the efficiency of the capture device (e.g. hood) used to route the air stream to the baghouse.

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Baghouses of modest size have been mounted to traveling hoods attached to charging cars, collecting from each car individually. However, a traveling hood does not allow for ideal collection efficiencies for Nucor's proposed coal charging design because particulate emissions are minimized while the coal brick is on the charging car.

Electrostatic Precipitator (ESP):

ESP is a proven technology for a variety of coal combustion sources. Because of their modular design, ESPs, like baghouses, can be applied to a wide range of system sizes. ESP technology offers a control efficiency that is comparable to baghouses for some applications. The operating parameters that influence ESP performance include mass loading, particle size distribution, particulate electrical resistivity, and precipitator voltage and current. The resistivity of charging emissions from coking is not known. Data for ESPs applied to coal-fired sources show fractional collection efficiencies greater than 99% for fine (less than 0.1 micrometer) and coarse particles (greater than 10 micrometers). These data show a reduction in collection efficiency for particle diameters between 0.1 and 10 micrometers. Applied to coal charging, an ESP system would face similar challenges to baghouse filters in that the collection efficiencies of traveling hoods are less than ideal when applied to compacted coal charging. When compared only to a baghouse application, fabric filters offer slightly more effective control efficiency than an ESP.

Cyclones:

Cyclones are seldom used as primary or sole dust collectors because of their low efficiency. While they can be used to remove coarse particles, fine particulates are not effectively removed. A practical use is as pre-cleaners for more efficient collectors.

Negative Pressure Ovens:

The negative pressure oven design captures particulate emissions generated immediately adjacent to and within the oven during charging. The door opening provides a small gap around the brick as it is charged. Particulates that are generated in the oven throat are captured by the oven gas collection system and removed in the flue gas baghouse. This technology is inherent in the design of the coke ovens like that being proposed at Nucor Steel Louisiana.

As a pollution prevention technology, assigning a specific control efficiency to negative pressure ovens is problematic. It is expected that this design meets the criteria for being an Inherently Lower Polluting Process or Practice, as described in Section IV.A.3 of USEPA's *New Source Review Workshop Manual* published in October, 1990. Negative pressure ovens have the potential to be more environmentally effective than add-on controls due to greatly reduced energy requirements and reduced handling steps of captured particulate.

Compacted Coal:

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Compact coal charging is a process method which helps to prevent the generation of particulate emissions from occurring. This practice begins by bringing the moisture content of the coal up to approximately 9 wt%. This reduces the potential for dust emissions when compared with the dried coal typically charged to coke ovens. The wetted coal is metered in layers into a large metal form and then compacted by large hydraulic presses. The compaction process produces a cohesive brick of coal very close to the size and shape of the coke oven, which is then transferred to a charging car for use in the process.

As a pollution prevention technology, assigning a specific control efficiency to compacted coal charging is problematic. It is expected that this practice meets the criteria for being an Inherently Lower Polluting Process or Practice, as described in Section IV.A.3 of USEPA's *New Source Review Workshop Manual* published in October, 1990. Compacted coal charging has the potential to be more environmentally effective than add-on controls due to greatly reduced energy requirements and greatly reduced quantities of particulate.

Adding traveling hoods on top of compacted coal was evaluated by Nucor and accepted by LDEQ. This option was determined to have excessive costs for the additional incremental PM control achievable. See Table 1 of this PSD permit.

Step 5 – Selection of BACT

A top-down BACT analysis was performed for the coal charging operations, and the combination of negative pressure ovens and compacted coal charging, which represent Inherently Lower Polluting Processes, is BACT. Compacted coal charging technology will meet the MACT emission limitation of 0.0081 lb/ton of dry coal charged, required under 40 CFR 63.303(d)(2). Thus, BACT will not be less stringent than MACT.

BACT DETERMINATION FOR COKE OVEN PUSHING

Pushing is the process of moving the coke out of the oven. Flat car pushing will be used to remove the coke from the oven at the end of the coking cycle. Flat car pushing is different than pushing from a typical byproduct coke oven battery. With flat car pushing, the still-cohesive coke bed is pushed onto a flat receiving car. When a byproduct coke oven is pushed, the loose coke bed falls into a receiving car, breaking apart the mass of coke and having the potential to generate large plumes of dust. The advantage of flat car pushing, as feasible with a heat recovery coke oven, is that the mass of coke in the oven stays intact and a large dust plume is not generated.

BACT analyses for PM/PM₁₀/PM_{2.5}

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Source ID – Description (EQT #)

COK-102 - Coke Battery 1 Coke Pushing (EQT002)

COK-202 - Coke Battery 2 Coke Pushing (EQT008)

Flat car pushing will be used to remove the coke from the oven at the end of the cycle. Flat car pushing is different than conventional pushing. With conventional pushing, the coke bed falls into a hot car where it breaks apart and produces a large, hot plume of dust. The plume may be collected by either a mobile shed or by a large stationary coke-side shed. With flat car pushing, the coke bed is pushed onto a flat car as a cohesive mass. The car then travels by rail to the coke quench tower. The coke bed will be transferred, intact, to a quench car and quenched with contact cooling water in a conventional wet quench tower. The advantage of flat car pushing is that the coke bed stays intact and there is no large thermal dust plume.

Worker safety is also improved in several ways with the flat car push. With flat car pushing, visibility is improved since operators are not working inside a dark shed. With a zero fall height, operators do not have to work on an elevated bench. Without the large thermal plume, operators are less exposed to emissions and heat.

The air pollution control method used for flat car pushing must be chosen with two considerations. The coke bed is approximately 2,000 °F, so the gases exiting the hood are normally extremely hot. Second, any add-on system must be short enough to pass below the hot ducts of the heat recovery system and narrow enough to fit on a rail car.

The air pollution control technology must also meet the PM₁₀ emission limitation set forth in the MACT for Pushing, Quenching, and Battery Stacks (40 CFR 63, Subpart CCCCC). The limit is 0.04 lb PM/ton coke for filterable PM, that equates to 0.08 lb total (filterable and condensable) PM if a mobile control device that captures emissions during travel to the quench tower is used.

Step 1 – Identify Potential Control Technologies

1. Fabric Filter (baghouse)
2. Electrostatic Precipitator (ESP)
3. Wet Scrubber
4. Cyclone
5. Flat Car Pushing

Flat Car Pushing:

Using the flat car pushing process, the coke bed is pushed from the oven as a cohesive mass,

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resulting in greatly reduced particulate emissions when compared to traditional methods. With conventional pushing, the loose coke bed tumbles into a pile in a hot car, where it produces a large, hot plume of dust as it falls and breaks apart. Therefore, traditional control methods focus on the collection and removal of particulate from the pushing plume. With flat car pushing, the coke bed will be transferred, intact, to a quench car. The advantage of flat car pushing is that the coke bed stays intact and does not generate the large thermal dust plume typical of traditional coke oven pushing processes.

RBLC Listings for PM₁₀ Emissions from Coke Oven Pushing

Facility	RBLC ID	Unit	Control Technology	Control Efficiency	Emission Limit	Units
Haverhill North Coke Company	OH-0305	Coke Oven Batteries	Multiclone Dust Collector	80%	13.72 12.53	lb/hr t/yr
Haverhill North Coke Company	OH-0272	Coke Battery Ovens	Baghouse with a shed extending the length of the battery capturing all emissions	98%	26.33 0.039	lb/hr lb/t
FDS Coke	OH-0297	Coke Oven Batteries	Fabric Filter with traveling hood, oven negative pressure, flat bed pushing	NA	2.1 6.3	lb/hr t/yr

Source: Technology Transfer Network Clean Air Technology Center - RACT/BACT/LAER Clearinghouse

Step 2 – Eliminate Technically Infeasible Options

Electrostatic Precipitator (ESP):

An ESP charges particles in a gas stream so that they are attracted to, and collected by, neutral or oppositely charged collector plates. A major factor in the performance of an ESP is resistivity of the particles, which must be within a certain range. With high resistivity, it is difficult to charge the particles. With low resistivity, the particles are not held tightly to the collector plates and re-entrainment can be severe. Resistivity is strongly affected by temperature, moisture, gas composition, particle composition, and surface characteristics. The resistivity of pushing emissions from coking is not known.

High temperatures are not as much of an obstacle with ESPs as with baghouses since ESPs are usually constructed out of metal. As with baghouses, ESPs are typically large because the gas stream velocity traveling through the ESP must be low enough to avoid re-entrainment. Another difficulty is designing a system that is physically short enough to pass below the hot ducts, narrow enough to fit on a rail car, and mobile. An ESP is not a technically feasible choice.

Wet Scrubber:

Wet scrubbers collect particles by contacting or scrubbing gases with a liquid, usually aqueous. To be effective on small particles, wet scrubbers must produce a high pressure drop. This would require a large motor. The design of a non-recovery coke oven battery prevents mounting and supplying power to such a large motor on the hot car track.

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With wet scrubber systems, handling and disposal of the collected wet sludge is necessary. Use of a wet scrubber would not only require a wastewater treatment system, but would also add a wastewater discharge. Other concerns include the effect on materials and worker safety from the low level release of a hot saturated steam plume. Therefore, a wet scrubber is not technically feasible for coke oven pushing operations.

Step 3 – Rank Remaining Technically Feasible Control Options

1. Flat car pushing – Prevention of Airborne Particles
2. Fabric Filter (baghouse) – 98%
3. Cyclone – 80%

Step 4 – Evaluate Remaining Control Technologies

Flat Car Pushing:

Flat car pushing acts to prevent the creation of coke pushing plumes by moving the coke as a cohesive mass rather than allowing it to tumble into a pile. As a pollution prevention technology, assigning a specific control efficiency to flat car pushing is problematic. However, this practice meets the criteria for being an Inherently Lower Polluting Process or Practice, as described in Section IV.A.3 of USEPA’s *New Source Review Workshop Manual* published in October, 1990. Flat car pushing has the potential to be more environmentally effective than add-on controls, due to greatly reduced energy requirements and greatly reduced quantities of particulate, which are not generated to require control.

Fabric Filters (baghouse):

A fabric filter removes dust by passing the gas stream through a porous fabric. Many natural and synthetic fabrics are used to form the filter bags. Most baghouses used to control pushing emissions use polyester bags. Polyester bags have a temperature limit of approximately 275 °F. The fabrics most often used for high-temperature applications are Teflon, Nomex, carbon fibers, and fiberglass. Fiberglass can be used at temperatures up to 500 °F. Ceramic and metal filters have been used in a few high-temperature specialty applications, but with the large surface area needed for this type of application, they are not practical. A baghouse system could be designed to cool the gases to 500 °F. However, even a short temperature excursion would destroy the bags.

Baghouses are typically large air pollution control devices because, in order to work effectively, the velocity at the fabric face must be orders of magnitude slower than in the ductwork conveying the gases to the baghouse. Another consideration is that, since the hot car and its air pollution control device will travel to the quench tower, it will periodically catch water droplets and steam that typically causes bag blinding. The capture efficiency of a mobile hood is not considered to be

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ideal. Another obstacle is the difficulty in designing a baghouse system that is physically short enough to pass below the hot ducts, narrow enough to fit on a rail car, and mobile. With the gas temperature and size constraints, a baghouse is not an ideal control for coke oven pushing emissions.

Cyclones:

Cyclones use inertial separation to remove particles from gas streams. Large cyclones are generally not very efficient on small particles because the inertial force is inversely proportional to the diameter, or turning radius, of the device. Cyclones are optimized for high collection efficiency by using small diameters, long cylinders, and high inlet velocities. A number of small cyclones may be operated in parallel for high efficiency and large gas volumes. These are referred to as multi-tube cyclones, or multiclones. High temperatures are not as much of an obstacle with mechanical collectors since they are typically constructed out of metal. However, the capture efficiency of a mobile hood is not considered to be ideal. Multiclones can also tolerate moist gas streams. Since the individual cyclones are small, a multiclone can be configured to meet the size criteria of the battery.

Step 5 – Selection of BACT

A top-down BACT analysis was performed for PM₁₀ emissions from coke oven pushing operations. BACT is flat car pushing, which represents an Inherently Lower Polluting Process. Flat car pushing technology will meet the MACT emission limitation of 0.04 lb of filterable PM₁₀ per ton of coke pushed (0.08 lb PM₁₀/ton coke total PM₁₀), required under 40 CFR 63.7290. Thus, BACT will not be less stringent than MACT.

BACT analyses for SO₂

- Source ID – Description (EQT #)**
- COK-102 - Coke Battery 1 Coal Pushing (EQT002)
- COK-202 - Coke Battery 2 Coal Pushing (EQT008)

BACT is selected to be compacted coal and flat car pushing, which represents an Inherently Lower Polluting Process. BACT is 0.098 lbs SO₂ /ton.

During and immediately after the coke is pushed, the coke temperature averages about 2000 °F. At this temperature, nitrogen, carbon and oxygen in the air have the potential to oxidize and form CO and NO_x. A search of the RLBC database did not find an instance where controls were applied to CO or NO_x emissions. A review by Nucor of technology literature found no other control mechanism. The only practical approach to CO and NO_x control is to lower the coke temperature which is inherent in the coke quenching operation.

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BACT analyses for NO_x

Source ID – Description (EQT #)

COK-102 - Coke Battery 1 Coal Pushing (EQT002)

COK-202 - Coke Battery 2 Coal Pushing (EQT008)

BACT is compacted coal and flat car pushing, which represents an Inherently Lower Polluting Process. BACT is 0.019 lbs NO_x /ton.

BACT analyses for CO

Source ID – Description (EQT #)

COK-102 - Coke Battery 1 Coal Pushing (EQT002)

COK-202 - Coke Battery 2 Coal Pushing (EQT008)

BACT is compacted coal and flat car pushing, which represents an Inherently Lower Polluting Process. BACT is 0.0638 lbs CO /ton.

During the coking process, coal is thermally cracked to distill and remove volatile compounds. While this process is mostly completed when the coke is pushed, some VOC emissions still occur. A search of the RLBC database did not find an instance where controls were applied to VOC emissions. A review of technology literature performed by Nucor found no other control mechanism.

BACT analyses for VOC

Source ID – Description (EQT #)

COK-102 - Coke Battery 1 Coal Pushing (EQT002)

COK-202 - Coke Battery 2 Coal Pushing (EQT008)

BACT is compacted coal and flat car pushing, which represents an Inherently Lower Polluting Process. BACT is 0.077 lbs VOC /ton.

BACT DETERMINATION FOR COKE QUENCHING

BACT analyses for PM/PM₁₀/PM_{2.5}

Source ID – Description (EQT #)

COK-103 - Coke Battery 1 Coke Quench Tower (EQT003)

COK-203 - Coke Battery 2 Coke Quench Tower (EQT009)

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The coke pushed from the coke ovens remains at a very high temperature, as high as 2,000 °F. The coke must be quenched before it can be processed and transported for use. The quenching process involves contacting the brick of coke with controlled sprays of cooling water. The hot air and steam evolved from quenching are funneled through a large chimney structure known as a coke quench tower.

Step 1 – Identify All Control Technologies

1. Quench tower with internal baffles
2. Low-Total Dissolved Solids (TDS) cooling water

Quench Tower with Internal Baffles:

A coke quench tower draws hot air and steam by natural convection, much like a chimney. By installing a series of baffles to slow and contort the air flow, quench towers help to stop steam and entrained particles from exiting the top of the tower. The quenching steam and particles drain down the interior walls of the tower as the steam condenses.

Low TDS Cooling Water:

By maintaining a low level of total dissolved solids in the cooling water, the amount of particulate matter generated by the steam drift can be greatly reduced. A TDS concentration of 1,100 ppm or less is typically considered to be a low concentration in cooling water.

RBLC Listings for PM₁₀ Emissions from Coke Quench Towers

Facility	RBL C ID	Unit	Control Technology	Control Efficiency	Emission Limit	Units
Sun Coke Company - Haverhill North Coke Company	OH-0305	Quench Towers (2)	Quench Towers	N/A	24	lb/hr (per tower)
Sun Coke Company - Haverhill North Coke Company	OH-0272	Quench Tower (6)	Low-TDS Quenching Water	N/A	1,100	mg/L (Max TDS)
U.S. Coking Group I.L.C, FDS Coke	OH-0297	Quenching Towers	Internal Baffles	NA	16.82	lb/hr (per tower)

Source: Technology Transfer Network, Clean Air Technology Center - RACT/BACT/LAER Clearinghouse

Step 2 – Eliminate Technically Infeasible Options

The evaluation of these technologies must review whether the specific technology is available for the application and is effective at reducing PM₁₀ emissions from the quench towers. BACT will be chosen as the most efficient and economical option. There are no technically infeasible options that were identified for the control of PM₁₀ or PM_{2.5} from coke quenching.

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Step 3 – Rank Remaining Technically Feasible Control Options

1. Low TDS cooling water
2. Drift eliminators

Low TDS Cooling Water:

By reducing the TDS concentration to less than 1,100 ppm, the generation of particulate can typically be prevented to a high degree. Low TDS quenching water is obtained by installing good water quality control processes, such as settling tanks, filtration, and water treatment chemicals.

Quench Towers with Internal Baffles:

Baffles provide a structural method of reducing the steam plume generated during quenching, thus reducing the amount of particulate which escapes the quench tower.

Step 4 – Evaluate Remaining Control Technologies

Due to their nature as pollution prevention controls, specific control efficiencies cannot be applied directly to either low TDS cooling water or to quench towers with internal baffles. However, these methods represent current industry standards for the control of particulate emissions from coke quenching operations. Additionally, low TDS cooling water is required by an applicable NESHAP and must therefore be considered a floor in establishing BACT.

Step 5 – Selection of BACT

A top-down BACT analysis was performed for PM₁₀ and PM_{2.5} control from cooling towers. Both remaining options are effective and technically achievable. Therefore, BACT is a combination of less than or equal to 1,100 milligrams per liter TDS concentration in the cooling water and quench towers with internal baffles. This technology will meet the MACT emission limitation of $\leq 1,100$ milligrams per liter TDS concentration required under 40 CFR 63.7295(a)(1)(i). Thus, BACT will not be less stringent than MACT.

BACT DETERMINATION FOR SLAG GRANULATION / PROCESSING AND MILLING

BACT analyses for PM/PM₁₀/PM_{2.5}

Source ID – Description (EQT #)

SLG-101 - Slag Granulator 1 Granulation Tank 1 (EQT036) [WS]
SLG-102 - Slag Granulator 1 Granulation Tank 2 (EQT037) [WS]
SLG-201 - Slag Granulator 2 Granulation Tank 1 (EQT038) [WS]
SLG-202 - Slag Granulator 2 Granulation Tank 2 (EQT039) [WS]

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SLG-301 - Air-Cooled Slag Processing Load Bin (EQT040) [WS]
 SLG-302 - Air-Cooled Slag Processing Primary Crusher (EQT041) [WS]
 SLG-303 - Air-Cooled Slag Processing Primary Screening (EQT042) [WS]
 SLG-304 - Air-Cooled Slag Processing Secondary Crusher (EQT043) [WS]
 SLG-305 - Air-Cooled Slag Processing Secondary Screen (EQT044) [WS]
 SLG-306 - Air-Cooled Slag Processing Stockpiles (ARE011) [WS]
 SLG-401 - Slag Mill Wet Slag Feed Bin (EQT045) [WS]
 SLG-402 - Slag Mill Dryer Stack (RLP014) [FF]
 SLG-403 - Slag Mill Dryer Baghouse Vent (EQT046) [FF]
 SLG-404 - Slag Mill Dry Slag Feed Bin Baghouse Vent (EQT047) [FF]
 SLG-405 - Slag Mill Crushers/Screeners Baghouse Vent (EQT048) [FF]
 SLG-406 - Slag Mill Building Baghouse Vent (EQT049) [FF]
 SLG-407 - Slag Mill Transfer Points Baghouse Vent (EQT050) [FF]
 SLG-408 - Slag Mill Product Silo Baghouse Vent (EQT051) [FF]
 SLG-409 - Slag Mill Loading Collector Baghouse Vent (EQT052) [FF]

Normal Operation: (For Diverted Slag, see section titled Diverted Air Cooled Slag)

Molten slag is rapidly cooled and granulated by high pressure water jets while falling freely from the end of the blast furnace slag runner. The slag/water mixture falls into a granulation chute and is directed into a granulator tank. The slag cooling process releases steam which rises and is discharged through a stack directly above the granulator tank.

The slag comes from the blast furnace still in a molten form. As the liquid slag falls from the slag runners onto the granulation chutes, it is hit with jets of high pressure water. The force of the water jets breaks up the liquid slag mass into small particles, while at the same time cooling and solidifying it. The solid slag granules fall into the water at the bottom of the vessel. Steam is generated when liquid water contacts and cools the slag in the chute and in the tank; it is not process steam generated elsewhere and applied to the process, it is steam generated only by the contact of molten slag with cooling water. This steam rises to a stack at the top of the tank, which contains baffles to knock out and recover as much water and particulate as is feasible, similar to the coke quench towers. Additionally, some cooling water is sprayed near the top of the vessel to knock out rising steam. The solid slag leaves as a slurry from the bottom of the tank and is transported a short distance to the dewatering station, where it fills a hopper prior to entering the dewatering wheel. The granulated slag is then conveyed to storage piles.

A portion of the granulated slag is further processed into pulverized slag for specialty uses. The wet granulated slag is picked up by a mechanical loader and loaded into a hopper at the dryer. The slag is dried and then fed to a mill in which the material is pulverized to a fine powder. The pulverized slag is conveyed to silos where it is stored for product loading. The pulverized slag is often mixed with, and used as a substitute for, portland cement.

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Step 1 – Identify Potential Control Technologies

1. Fabric Filter (FF) (baghouse) – milling only
2. Electrostatic Precipitator (ESP)– milling only
3. Wet Scrubber– milling only
4. Cyclone– milling only
5. Water suppression (WS) – granulation, handling, and milling

Water Suppression:

Water spray onto the molten slag is an inherent part of the slag granulation process and also functions to suppress particulate emissions. The granulated slag remains wetted following the dewatering step. The use of water suppression and chemical surfactants can control PM₁₀ emissions by up to 90%.

Each of these technologies is considered viable alternatives to controlling PM₁₀ emissions from the slag milling process. The slag granulation process includes water suppression as part of the means of granulation of the slag. The slag granulation process also involves wetted material handling as part of the inherent process as well.

The slag milling process produces a dry powder product, pulverized slag. The pulverized slag is cementitious, and as such contact with water destroys product quality. Due to the nature of the product, water suppression is not a feasible control option for slag milling.

The following table displays which control technologies are being used in the United States to control PM₁₀ emissions from slag granulation.

RBLC Listings for PM₁₀ Emissions from Slag Granulation / Processing and Milling

Facility	RBLC ID	Unit	Control Technology	Control Efficiency	Emission Limit	Units
Nucor Steel, Arkansas	AR-0090	Slag Processing	Water Sprays	NA	1.5 2.2	lb/hr t/yr
Steel Dynamics, Inc.	IN-0079	Slag, Handling and Processing	Water Suppression and Minimizing Drop Heights	NA	55.4	lb/hr
Charter Manufacturing Co. Inc.	OH-0276	Slag Processing Operation	Enclosure Where Practical	NA	0.79 0.56	lb/hr t/yr
Nucor Yamato Steel	AR-0055	Slag Processing	Wet Suppression	80%	1.2	lb/hr
Arkansas Steel Associates	AR-0044	Slag Processing	Water Application to Control Fugitive Emissions		5.7 8.3	lb/hr t/yr
Quanex Corporation-Macsteel Div.	AR-0021	Slag Processing	Throughput Limit on Slag, Water Sprays on Transfer Points	70%	3.8	t/yr

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Facility	RBL/C ID	Unit	Control Technology	Control Efficiency	Emission Limit	Units
SteelCorr, Inc	AR-0077	Slag/Mill Processing	Water Application and Limited Drop Heights		3.5	t/yr
Recmix of PA, Inc.	KY-0095	Raw Slag Handling	Watering	90%	0.78	t/yr
Recmix of PA, Inc.	KY-0095	Raw Slag Handling, Hopper	Enclosure Tunnel	90%	0.78	t/yr
Recmix of PA, Inc.	KY-0095	Slag Skull Processing	Watering, High Moisture Content	90%	0.78	t/yr
Structural Metals, Inc.	TX-0445	Slag Crusher-Transfer to Feeder	NA	NA	0.0544 0.0248	lb/hr t/yr
Structural Metals, Inc.	TX-0445	Slag Crusher-Jaw Crusher	NA	NA	0.005 0.0009	lb/hr t/yr
Structural Metals, Inc.	TX-0445	Slag Crusher Discharge	NA	NA	0.128 0.0052	lb/hr t/yr

Source: Technology Transfer Network, Clean Air Technology Center - RACT/BACT/LAER Clearinghouse

Step 2 – Eliminate Technically Infeasible Options

Each control technology was evaluated to decide whether it would be technically feasible to apply the control to the slag granulation / processing or milling processes. The evaluation for these particulate control technologies must review whether the specific technology is available for the application and is effective at reducing PM₁₀ emissions from the process.

Fabric Filter (baghouse):

Fabric filters are an industry standard when applied to relatively dry gas streams, with a large range of acceptable particulate loading. Fabric filter control is achievable for the slag milling operations, where fine dusts are generated at stationary sources, allowing for good collection efficiencies. However, baghouses are sensitive to temperature and moisture extremes. Moisture generated by steam of the slag granulation process would cause caking on the filter and clog passageways, rendering the filter ineffective. Fabric filters would also be applied in a post-control manner because water suppression is inherent in the granulation process. Therefore, the increased moisture content makes fabric filters a technically infeasible control option for the slag granulation process.

Electrostatic Precipitator (ESP):

ESPs are capable of 98% or higher particulate removal; however, several factors preclude their application to control PM₁₀ from the slag granulation process. ESPs have very high electricity demands and require large amounts of maintenance, resulting in a relatively high down time. In addition, ESPs have a high capital cost, and efficiency is highly sensitive to variations in flow rate,

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solids loading, pressure, temperature, and moisture that are inherent in the slag granulation processes.

ESPs are also sensitive to the physical characteristics of the gas stream. A key parameter is the composition of the particles to be collected. Iron particles adhere very strongly to the collection plate of the ESP due to their electromagnetic properties. They become very difficult to remove and thus reduce ESP efficiency. Zinc and other metal compounds tend to foul ESP electrodes, also reducing effectiveness.

ESPs are a technically infeasible control option for the slag granulation process since the technology would be post-control. Water suppression control is inherent to the granulation process and handling of wet granulated slag.

ESP control of the slag milling process is technically feasible. However, compared only to the fabric filter control, the efficiency of ESP devices are slightly lower, and capital and operating costs are greatly increased. Baghouse control is typically preferred over ESP control absent factors which make fabric filters infeasible.

Wet Scrubber:

With wet scrubber systems, handling and disposal of the collected wet sludge is necessary. Use of a wet scrubber would not only require a wastewater treatment system, but would also add the need for a wastewater discharge. Wet scrubbers are a technically infeasible control option for the slag granulation or slag processing processes since the technology would be post-control.

Cyclone (Granulation only):

Although cyclones are generally not sensitive to the vapor-phase moisture content of a gas stream, they are generally not applicable to processes that entrain a constant amount of liquid moisture. Liquid water in a cyclone separator can interfere with the airflow within the cyclone, cause caking of the particulate against the sides of the vessel, and contribute to plugging of the dustcatcher bottom. The slag granulation process will generate a great deal of steam and mist, making the application of cyclone separators infeasible to the process.

Water Suppression (Milling only):

Water suppression is inherent to the slag granulation and granulated slag handling processes. However, water reacts with pulverized slag in a manner similar to cement. Therefore, water suppression would destroy the pulverized powder that the milling process is engaged in producing. Water suppression is an infeasible technology for the slag milling process.

Step 3 – Rank Remaining Technically Feasible Control Options

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1. Water Suppression – 90% (slag granulation and processing only)

Water suppression remains the most stringent control option that can be applied to the slag granulation and processing processes. Water suppression is also a feature inherent in the slag granulation process. It can be seen from the table above that a 90% efficiency can be achieved due to the material having a high moisture content.

1. Fabric Filter – 99% (slag milling only)
2. Electrostatic Precipitator (ESP) – 98% (slag milling only)
3. Cyclones – 80% (slag milling only)

Fabric filters are the most stringent control option that can be applied to the dried and milled granulated slag. Fabric filters operate at high control efficiencies for this material.

Step 4 – Evaluate Remaining Control Technologies

Water Suppression (slag granulation only):

Water suppression has been used at a number of facilities around the country for controlling dust generation due to slag processing. Water suppression is an inherent part of the slag granulation process.

Fabric Filters (slag milling only):

Fabric filters are routinely used for dust control in the milling process. The milled granulated slag is a fine, dry material which is ideal for control by baghouses.

Step 5 – Selection of BACT

BACT is selected to be wet suppression of dust generating sources (slag granulation) by water sprays. This technology is inherent to the granulated slag process.

BACT for the granulated slag milling process is collection and control by fabric filters.

Note: For more details of the following analysis, see the PCI-101 - PCI Mill Vent (RLP013).

BACT analyses for NO_x

Source ID – Description (EQT #)
 SLG-402 - Slag Mill Dryer Stack (RLP014)

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A portion of the granulated slag is further processed into pulverized slag for specialty uses. The wet granulated slag is picked up by a mechanical loader and loaded into a hopper at the dryer. The slag is dried and then fed to a mill in which the material is pulverized to a fine powder. The slag mill dryer is a NO_x emissions source due to the combustion of natural gas fuel which provides heat to dry the wet granulated slag.

Step 1 – Identify Potential Control Technologies

1. Selective Catalytic Reduction (SCR)
2. Low NO_x Burners (LNB)

Step 2 – Eliminate Technically Infeasible Options

All of the potential technologies listed in step 1 are considered technically feasible control options.

Step 3 – Rank Remaining Technically Feasible Control Options

1. Selective Catalytic Reduction (SCR) – 80% - 90%
2. Low NO_x Burners (LNB) – 50%

Step 4 – Evaluate Remaining Control Technologies

While SCR technology may be technically feasible in controlling emissions of NO_x from the Slag Mill Dryer, energy costs associated with operation of an SCR solely exceed the costs for NO_x control which normally justify the requirement to install a control technology under PSD BACT criteria. An economic assessment of the energy costs associated with the use of SCR technology to control NO_x emissions from the Slag Mill Dryer is included in Table 1 of this PSD permit..

The dryer outlet gas temperature will be substantially below that required for proper SCR operation; thus, a new fired source for reheating the gas stream would be required. An additional 5.61 MMBtu/hr would be required to achieve a gas stream temperature of 410 °C. The annual cost of natural gas energy required to reheat the Slag Mill Dryer flue gas stream, per ton of potential NO_x emission reductions, is estimated to be \$20,173.33 per ton of NO_x removed. Although the calculation of fuel costs above is not a complete economic feasibility analysis, this energy cost estimate alone is well outside of the normally accepted range of control costs associated with BACT control.

Step 5 – Selection of BACT

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Using the top-down selection method, BACT is the use of Low NO_x Burners for the Slag Mill Dryer. BACT is 0.049 lbs/MM Btu.

BACT analyses for SO₂

Source ID – Description (EQT #)
 SLG-402 - Slag Mill Dryer Stack (RLP014)

The Slag Mill Dryer SO₂ emissions originate from the combustion of natural gas.

Step 1 – Identify Potential Control Technologies

1. Fuel Specification

Step 2 - Eliminate Technically Infeasible Options

There are no technically infeasible options for the control of SO₂ from the Slag Mill Dryer.

Step 3- Rank Remaining Technically Feasible Control Options

There are no technically feasible options remaining to be ranked for the control of SO₂ from the Slag Mill Dryer.

Step 4 – Evaluate Remaining Control Technologies

A search of the RBLC database did not list any control options in place for SO₂ removal from dryer exhaust; thus, the use of sweet natural gas fuel is the only remaining feasible control option.

Step 5 – Selection of BACT

BACT for SO₂ emissions is no add-on or combustion control other than the use of sweet natural gas fuel.

BACT analyses for CO and VOC

Source ID – Description (EQT #)
 SLG-402 - Slag Mill Dryer Stack (RLP014)

A discussion of CO and VOC controls is combined here due to the similarity in approach for control of these emissions.

Step 1 – Identify Potential Control Technologies

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1. Good Combustion Practices
2. Oxidizers

Step 2 – Eliminate Technically Infeasible Options

Oxidizers:

In the case of a gas-fired burner, an afterburner or downstream oxidizer would not result in an emission reduction because CO emissions typically are less than 1,000 ppm. Further oxidation would generate more NO_x emissions and have little impact on CO. Add-on controls, even if feasible, are not typically required for combustion sources fired with natural gas. During the review of available control technologies for combustion sources in the steel industry, no information was found that discussed the use of add-on controls for the reduction of VOC or CO emissions from natural gas-fired equipment.

Step 3 – Rank Remaining Technically Feasible Control Options

In natural gas combustion sources, good combustion practices can lead to an overall CO and VOC reduction; thus, good combustion practices is the only remaining technically feasible control option.

Step 4 – Evaluate Remaining Control Technologies

A review of the RBLC database indicates that good combustion practice is the control method of choice for controlling CO and VOC emissions from other types of dryers. Good combustion practices are considered the only feasible control method for reducing CO and VOC emissions.

Step 5 – Selection of BACT

Using the top-down BACT selection method, only one option remains for CO and VOC emissions control from the Slag Mill Dryer. BACT is good combustion practices during the operation of the Slag Mill Dryer.

BACT DETERMINATION FOR DIVERTED AIR-COOLED SLAG

Emissions associated with air-cooled slag processing include the generation of fugitive dust emissions during the diversion and air cooling of the slag. Slag that cannot be immediately processed is diverted into slag pits. The slag flows by gravity over a large area, cools, and hardens. A water mist may be applied to speed the cooling of the slag. Once the slag cools and hardens, it can be picked up in chunks by a mechanical loader. The slag chunks are then loaded

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into a crushing and screening operation to produce an aggregate material of similar size as the granulated slag. The air-cooled slag is then combined with the granulated slag in storage piles.

BACT analyses for PM/PM₁₀/PM_{2.5}

Source ID – Description (EQT #)

- SLG-104 - Blast Furnace 1 Slag Pit 1 (ARE005)
- SLG-105 - Blast Furnace 1 Slag Pit 2 (ARE006)
- SLG-106 - Blast Furnace 1 Slag Pit 3 (ARE007)
- SLG-204 - Blast Furnace 2 Slag Pit 1 (ARE008)
- SLG-205 - Blast Furnace 2 Slag Pit 2 (ARE009)
- SLG-206 - Blast Furnace 2 Slag Pit 3 (ARE010)

The diverted slag flows by gravity over a large area, cools through contact with air, and solidifies. Once the slag hardens, it can be picked up in chunks by a mechanical loader. The air-cooled slag is then loaded into a crushing operation, which reduces the material size to that of aggregate. The crushed material is combined with the granulated slag, and the crushed/granulated material is sold primarily as a substitute for gravel aggregates in asphalt or concrete.

Step 1 – Identify Potential Control Technologies

Water sprays and/or chemical dust suppression

It is evident that the technologies cited above have been used as BACT for the various aggregate handling operations. All of the above options are considered technically feasible.

RBLC Listings for PM₁₀ Emissions from Air-Cooled Slag Processing

Facility	RBLC ID	Unit	Control Technology	Control Efficiency	Emission Limit	Units
Recmix of PA, Inc.	KY-0095	Conveyor to Stockpile	Watering	90%	0.78	t/yr
Recmix of PA, Inc.	KY-0095	Final Aggregate Handling, Exit Pile	High Moisture Content	90%	0.78	t/yr
Steel Dynamics, Inc	IN-0079	Slag, Handling and Processing	Water Suppression and Minimizing Drop Heights	NA	55.4	lb/hr

Source: Technology Transfer Network, Clean Air Technology Center - RACT/BACT/LAER Clearinghouse

Step 2 – Eliminate Technically Infeasible Options

All of the above mentioned technologies can be applied to control PM₁₀ and PM_{2.5} emission sources due to aggregate handling.

Step 3 – Rank Remaining Technically Feasible Control Options

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Water sprays – 90%

A search of the RBLC database indicates that a control efficiency of 90% can be achieved in areas where water suppression is applied.

Step 4 – Evaluate Remaining Control Technologies

Water sprays are effective at controlling dusts by weighing down the dust particles. Water sprays are generally used in local areas such as load bins and drop points when dealing with dusty materials.

Step 5 – Selection of BACT

BACT is determined to be wet suppression of dust generating sources by water sprays at the slag pits after air cooling and prior to removal by a mechanical loader.

BACT DETERMINATION FOR TOPGAS-FIRED BOILERS

Blast furnace gas (BFG) is utilized as fuel gas in the topgas boilers, along with a small amount of natural gas utilized to increase the BTU content of the fired gas to a stable combustion range. The blast furnace is discussed in detail above.

A portion of the BFG stream is used as a fuel in the hot blast stoves and a larger portion is used as fuel in the topgas boilers. BFG contains as much as 7 percent hydrogen and 27 percent CO and has a heating value of approximately 2,540 - 4,300 kJ/Nm (65 - 110 Btu/scf).

Use of the BFG as a fuel in the topgas boilers significantly increases the overall energy efficiency of the pig iron production process. BFG is used to fire boilers that sequentially drive steam turbines to generate electricity and steam for facility processes. The remaining energy of the low-BTU BFG is used as fuel instead of being vented, which would result in high CO emissions, or being discarded in a thermal oxidizer or flare to control CO emissions, as in older blast furnace designs.

BACT analyses for PM/PM₁₀/PM_{2.5}

Source ID – Description (EQT #)

PWR-101 - Topgas Boiler No. 1 (EQT023)

PWR-102 - Topgas Boiler No. 2 (EQT024)

PWR-103 - Topgas Boiler No. 3 (EQT025)

PWR-104 - Topgas Boiler No. 4 (EQT026)

PWR-105 - Topgas Boiler No. 5 (EQT027)

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PWR-106 - Topgas Boiler No. 6 (EQT028)

PWR-107 - Topgas Boiler No. 7 (EQT029)

PWR-108 - Topgas Boiler No. 8 (EQT030)

The blast furnace gas contains incombustible particulate matter in the stream as it leaves the blast furnace. Therefore, the control of particulate from the topgas boilers addresses the cleaning of the BFG prior to its combustion as a fuel.

Step 1 – Identify Potential Control Technologies

1. Fabric filter (baghouse)
2. Electrostatic Precipitator (ESP)
3. Wet scrubber
4. Cyclone
5. Good combustion practices

Good Combustion Practices:

Good combustion practices are used in areas where it is difficult to feasibly implement other control technologies. PM₁₀ emissions from natural gas combustion are usually from large-molecular-weight hydrocarbons that are not fully combusted. Condensable organic PM₁₀ can be best controlled through good combustion practices. Inorganic particulate inherent in the fuel gas stream cannot be controlled by good combustion practices.

Step 2 – Eliminate Technically Infeasible Options

Electrostatic Precipitator (ESP):

ESPs are capable of 99% or higher particulate removal; however, several factors preclude their application to control PM₁₀ from the topgas boilers. ESPs have a high capital cost, have very high electricity demands and require large amounts of maintenance, resulting in a relatively high down time. In addition, the efficiency of an ESP is highly sensitive to variations in flow rate, solids loading, pressure, and temperature, variations that are inherent in the blast furnace process.

ESPs are also sensitive to the composition and physical characteristics of the particles to be collected in the gas stream. Iron particles adhere very strongly to the collection plate of the ESP due to their electromagnetic properties. They become very difficult to remove, and thus rapidly reduce ESP efficiency. Zinc and other metal compounds tend to foul ESP electrodes, also reducing effectiveness. ESPs have long been considered a technically infeasible control option for this source.

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Fabric Filter (baghouse):

Fabric filters are the standard in the iron and steel industry for most PM₁₀ control applications. Baghouses often are capable of 99% removal efficiencies. Baghouse removal efficiency is relatively level across the particle size range. Although fabric filters are very effective at removing particulate matter from gas streams, they are not appropriate for applications at extreme temperatures, or when gas streams carry sparks or burning cinders, due the combustible nature of filter fabrics. For this reason, many baghouses are equipped with a device such as a spark arrestor, to eliminate small or stray sparks from entering the filter compartment. Additionally, baghouses are not a good control option for gas streams which contain free water droplets, or which have a high moisture content. Water condensation on the filter cake makes particulate matter difficult to remove from the bags during the cleaning cycle. Dust build up occurs on the exterior of the filters, resulting in plugging and premature deterioration of the filter bags.

Fabric filter control of topgas is technically infeasible due to the high temperature of the topgas stream, as well as the fire hazards associated with it. Topgas is collected by ductwork from the top of the furnace under elevated pressure from the incoming blast air to the furnace. The pressure of the blast air entrains particulate, including sparks, into the collected gas. As hot metal is removed from the bottom of the furnace through tapping, the furnace burden moves further down the shaft of the furnace. Burden movement is not steady, and can happen as hollows in the burden collapse, known as burden slip. Burden slips can send large spikes of burning gas, sparks and cinders into the topgas collection system, potentially overwhelming any spark arrestor system. For this reason, baghouses are not used to control dust collected in blast furnace gas.

Step 3 – Rank Remaining Technically Feasible Control Options

1. Cyclone and Wet Scrubber Combination - 99%
2. Wet Scrubber - 98%
3. Cyclone - 80%
4. Good Combustion Practices

Potential control alternatives were reviewed for technical feasibility in controlling PM₁₀ and PM_{2.5} emissions from the pig iron production facility. The highest remaining control option is a combination of cyclone separator followed by a wet scrubber. PM₁₀ and PM_{2.5} emissions can be reduced by up to 99% with the addition of a cyclone and wet scrubber combination.

Step 4 – Evaluate Remaining Control Technologies

Combined Cyclone and Wet Scrubber:

The prevalent industry control for blast furnace top gas is a multi-stage cleaning operation. In the

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multi-stage cleaning operation, blast furnace top gas passes first through a dry cyclone to remove the large particulate and a large percentage of the total particulate (about 60%). The cyclone step is followed by a high efficiency wet scrubber system. The combined controls are capable of achieving a 99% reduction in total particulate matter.

Wet Scrubber:

High-energy wet scrubbers are technically feasible, but have some disadvantages. Scrubber systems have very high pressure drops that result in high system operating costs. They also require water treatment and sludge disposal, which are not necessary with the other PM₁₀ control options. However, wet scrubbers are able to accommodate large volumes of gas with high moisture contents, which make it a viable option for this application.

Cyclones:

Cyclones are effective at removing large dust particles using centrifugal forces. However, fine dusts are typically not as effectively removed due to the high gas stream velocity that must be established, often keeping smaller particles entrained in the stream. A cyclone would achieve greater efficiency if used in combination with another control technology.

Good combustion practices:

While condensable organic PM₁₀ and PM_{2.5} can be controlled through good combustion practices, dusts from metal ores in the fuel gas stream are typically not able to be fully combusted. Filterable particulate emissions generated from gas combustion are low. Particulate from gas combustion is usually from large-molecular-weight hydrocarbons in the fuel that are not fully combusted. These hydrocarbons do not exist in blast furnace gas and exist at very low concentrations in natural gas. Good combustion practices are limited as a control technology for BFG combustion.

Step 5 – Selection of BACT

Based on the top-down BACT analysis, the best available control technology includes a cyclone followed by a wet scrubber. A cyclone will remove coarser particulate that may be difficult for the scrubber to remove on its own and will not typically be affected by high moisture content in the gas stream. A wet scrubber can accommodate the large volumes of moist gas which are generated by the blast furnace process. Together, these two options provide the most viable scenario for PM₁₀ emissions control by cleaning the blast furnace gas fuel stream prior to combustion. BACT for the blast furnace top gas fuel stream is established as a concentration of PM ≤ 0.002 gr/dscf.

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BACT DETERMINATION FOR NO_x EMISSIONS FROM TOPGAS-FIRED BOILERS

The topgas boilers are a NO_x emissions concern because they consume large quantities of fuel. NO_x formation is often driven by, among other factors, high flame temperatures during combustion. However, the primary fuel is blast furnace gas, which is largely CO, has a low heating value, and contains a large portion of inerts (approximately 65 wt%), factors that reduce flame temperature. Thus, the generation of NO_x during BFG combustion results in uncontrolled NO_x concentrations in the flue gas that tend to be low (27 ppmv or less according to literature sources reviewed by Nucor), and thus the potential for NO_x reduction is considered to be small.

Use of the BFG as a fuel significantly increases the overall energy efficiency of the blast furnace, since less fossil fuel is used to power the facility and the low-BTU BFG is used as fuel instead of being vented to the atmosphere (resulting in high CO emissions) or burned in a thermal oxidizer or flare to control CO emissions, wasting the remaining available energy in the gas.

BACT analyses for NO_x

Source ID – Description (EQT #)

- PWR-101 - Topgas Boiler No. 1 (EQT023)
- PWR-102 - Topgas Boiler No. 2 (EQT024)
- PWR-103 - Topgas Boiler No. 3 (EQT025)
- PWR-104 - Topgas Boiler No. 4 (EQT026)
- PWR-105 - Topgas Boiler No. 5 (EQT027)
- PWR-106 - Topgas Boiler No. 6 (EQT028)
- PWR-107 - Topgas Boiler No. 7 (EQT029)
- PWR-108 - Topgas Boiler No. 8 (EQT030)

Step 1 – Identify Potential Control Technologies

1. Selective Catalytic Reduction (SCR)
2. Selective Non-catalytic Reduction (SNCR)
3. Non-Selective Catalytic Reduction (NSCR)
4. EM_x (SCONO_x)
5. Low Excess Air (LEA) combustion
6. Low NO_x Burners (LNB)
7. Low NO_x Fuel Combustion (LNC)

Step 2 – Eliminate Technically Infeasible Options

The evaluation of these technologies must review whether the specific technology is available for

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the application and is effective at reducing NO_x emissions from the topgas boilers.

Low Excess Air (LEA) combustion:

Flame stability is an inherent problem with burning BFG fuel. Natural gas must be added to the BFG in order to increase the BTU content and obtain a stable flame. The nature of the BFG fuel and the high CO content make low excess air an infeasible option. There were no instances in literature sources reviewed by Nucor, of LEA use for boilers firing blast furnace gas.

Selective Catalytic Reduction (SCR):

Selective catalytic reduction has not been demonstrated to control emissions of NO_x from boilers burning blast furnace gas as the primary fuel. The concentration of NO_x in the topgas boiler flue gas is expected to be low, near 50 ppm under normal operating conditions. NO_x control has not been demonstrated at high efficiency at this level of NO_x concentration, and attempts at increased efficiency come with the probability of ammonia slip. Additionally, SCR would require that the boiler flue gas be reheated into the effective range of the catalyst, which is between 500 – 800 °F, by burning natural gas or some other fossil fuel. For these reasons, SCR is not a feasible control technology for the control of NO_x from the topgas boilers.

Selective Non-Catalytic Reduction (SNCR):

SNCR can only be effective when used in applications where the temperature of the gas stream is extraordinarily high, between 1,600 – 2,100 °F. Due to the low heating value of the blast furnace gas combusted in the hot blast stoves, the temperature of the flue gas never reaches temperatures in the effective range. Thus, SNCR is not a feasible control technology for the control of NO_x from hot blast stoves.

Non-Selective Catalytic Reduction (NSCR):

Non-selective catalytic reduction requires specific levels of several process parameters that are incompatible with the combustion of blast furnace gas in the topgas boilers. The low oxygen range required by NSCR can only be achieved by restricting the available combustion air to stoichiometric levels. As discussed for low excess air combustion, the low heating value of the blast gas does not allow for combustion at low levels of combustion air. Additionally, levels of NO_x and VOC in the flue gas stream are not within the range necessary, and the flue gas temperature leaving the boilers will not reach the level required to promote the catalytic reaction. Thus, NSCR is not a feasible control technology for the control of NO_x from topgas boilers.

EM_x (SCONO_x):

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EM_x technology uses catalyst beds with narrow, honeycomb structures, which expand and contract with temperature in a sensitive manner. These expansions and contractions must be allowed for with complex expansion joints. Large temperature swings during operation can render the system ineffective as pass-through leaks develop within the catalyst modules. The hot blast stoves will operate in a cyclic fashion, such that the flue gas leaving the stoves will experience regular temperature swings between 180 – 400 °C (356 – 752 °F). Due to its sensitivity to temperature changes, EM_x is a technically infeasible control technology for the topgas boilers.

Low NO_x Burners (LNB):

Low NO_x burners limit the formation of NO_x by staging the addition of air to create a longer, cooler flame. The combustion of BFG in the topgas boilers requires the supplement of natural gas in order to maintain flame stability and prevent flame-outs of the burners. The use of low NO_x burners would attempt to stage fuel gas at the limits of combustibility and potentially prevent combustion of the fuel from occurring. Thus, Low NO_x burners are not a feasible control technology for the topgas boilers.

Step 3 – Rank Remaining Technically Feasible Control Options

The available control technologies were ranked according to their efficiencies. The efficiencies listed are in reference to natural gas combustion. No data was available for blast furnace gas combustion efficiency. Blast furnace gas is known to have a lower heating value than natural gas.

1. Low-NO_x Fuel Combustion (LNC) – 35% - 55%

Standard BFG boilers are inherently designed to operate at reduced flame temperature that minimizes NO_x formation as a result of firing a low heating value primary fuel. There are no instances in literature reviewed by Nucor where SCR or SNCR have been added to boilers firing blast furnace gas, and the technology has not been demonstrated in BFG boiler applications.

Step 4 – Evaluate Remaining Control Technologies

Low-NO_x fuel combustion is the only remaining NO_x control technology. BFG burns at a lower temperature than natural gas or most other fuels, limiting the formation of thermal NO_x. The generation of NO_x from BFG combustion is expected to be 35 – 55% lower than the NO_x generated by an equal energy consumption of natural gas.

Step 5 – Selection of BACT

Using the top-down BACT selection method, the inherent low-NO_x fuel combustion of BFG is the only remaining option for controlling NO_x emissions from the topgas boilers. Additionally, a

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search of the RBLC produced no results for NO_x emission add-on controls applied to boilers burning blast furnace gas in the United States. Therefore, BACT is selected to be no additional controls beyond the low-NO_x fuel combustion technology inherent to the topgas boiler design. BACT is also established as 0.092 lbs/MM Btu total fuel combusted.

BACT analyses for SO₂

Source ID – Description (EQT #)

PWR-101 - Topgas Boiler No. 1 (EQT023)

PWR-102 - Topgas Boiler No. 2 (EQT024)

PWR-103 - Topgas Boiler No. 3 (EQT025)

PWR-104 - Topgas Boiler No. 4 (EQT026)

PWR-105 - Topgas Boiler No. 5 (EQT027)

PWR-106 - Topgas Boiler No. 6 (EQT028)

PWR-107 - Topgas Boiler No. 7 (EQT029)

PWR-108 - Topgas Boiler No. 8 (EQT030)

The blast furnace gas contains some sulfur dioxide as it exits the blast furnace and very little in the way of any reduced sulfur compounds. Therefore, the analysis of SO₂ removal technologies address cleanup of the BFG prior to its combustion as fuel.

Step 1 – Identify Potential Control Technologies

1. Wet Scrubber
2. Spray Dryer/Absorber (Dry Scrubber)
3. Dry Sorbent Injection

RBLC Listings for SO₂ Emissions from Blast Furnace Gas Combustion

Facility	RBLC ID	Unit	Control Technology	Control Efficiency	Emission Limit	Units
Severstal North America, Inc	MI-0377	Blast Furnace Stoves	No Controls Feasible Compliance Verification Via CEMS	NA	14.37 6.62	Lb/MMscf Lb/MMscf

Source: Technology Transfer Network Clean Air Technology Center - RACT/BACT/LAER Clearinghouse

Step 2 - Eliminate Technically Infeasible Options

The design average concentration of SO₂ exiting the blast furnace is very low (14 ppmv) and is below the post-control SO₂ concentrations achieved in coal-fired utility boilers (100 to 150 ppmv typical for new facilities burning 2.5 to 3% sulfur coal). None of the control options discussed below are effective for removal of SO₂ at the low concentrations anticipated at the exit of the blast furnace.

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Wet Scrubber:

Wet scrubbers are not effective at removing low concentration of SO₂ (14 ppmv range) in a gas stream. Additionally, various operating problems are associated with the use of wet scrubbers to control SO₂ emissions from the combustion of blast furnace gas. When applied to the BFG prior to use as fuel in the hot blast stoves, there are potential problems with plugging of the downstream burners. Particulates can plug scrubber spray nozzles, packing, plates, and trays. Wet scrubbers also require handling, treatment, and disposal of a sludge by-product. In this case, air emissions would be exchanged for large scale water treatment and solid waste disposal requirements.

Spray dryer/Absorber (Dry Scrubber):

The spray dryer process would not have the wastewater treatment and disposal problems associated with the wet scrubbing systems, and the dried slurry resulting from SO₂ removal can be easily removed downstream by a baghouse. However, spray dryers are not effective at removing low concentrations of SO₂ in a gas stream.

Dry Sorbent Injection:

Dry sorbent injection would not result in the wastewater treatment and disposal problems associated with wet scrubbing systems. However, it would not be feasible to design an efficient system of dry sorbent injection to the blast furnace process due to the very low SO₂ emission concentrations in the exhaust gas.

Step 3- Rank Remaining Technically Feasible Control Options

In the previous analysis, available control technologies were reviewed for application to the SO₂ removal process. There are no technically feasible options remaining to be ranked for the control of SO₂ from BFG combustion in the topgas boilers.

Step 4 – Evaluate Remaining Control Technologies

Various control alternatives were reviewed for technical feasibility in controlling SO₂ emissions from the topgas boilers. The application of each of the potential control options to the process was considered. Each of the available options has been eliminated as technically infeasible.

Step 5 – Selection of BACT

A “top-down” BACT analysis was performed for SO₂ removal from the topgas boilers. This analysis determined that there are no add-on or combustion controls that represent BACT for SO₂ emissions from the combustion of blast furnace gas. BACT for top gas fuel is selected as no control. BACT for natural gas is to purchase natural gas containing no more than 2500 gr of Sulfur per MM scf.

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BACT analyses for CO and VOC

Source ID – Description (EQT #)

- PWR-101 - Topgas Boiler No. 1 (EQT023)
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- PWR-103 - Topgas Boiler No. 3 (EQT025)
- PWR-104 - Topgas Boiler No. 4 (EQT026)
- PWR-105 - Topgas Boiler No. 5 (EQT027)
- PWR-106 - Topgas Boiler No. 6 (EQT028)
- PWR-107 - Topgas Boiler No. 7 (EQT029)
- PWR-108 - Topgas Boiler No. 8 (EQT030)

Step 1 – Identify Potential Control Technologies

1. Good Combustion Practices
2. Oxidizers

CO and VOCs are a result of incomplete combustion; as a result, emissions can be minimized through the use of good combustion practices, including ensuring sufficient air to fuel ratios. The use of add-on oxidation technologies such as after-burners can also be considered to reduce CO and VOC emissions.

A search of the USEPA’s RACT/BACT/LAER Clearinghouse was conducted to review control technologies that are in place today for several types of boilers. It can be seen that good combustion practices are the industry standard for controlling CO and VOC emissions from boilers. However, there are no recorded control efficiencies for this control.

RBLC Listings for CO Emissions from TopGas-Fired Boilers

Facility	RBLC ID	Unit	Control Technology	Control Efficiency	Emission Limit	Units
Nucor Steel	IN-01018	Boiler, Nat. Gas	Good Combustion Practices, Natural Gas	NA	0.0610	lb/MMBtu
Steel Corr, Inc.	AR-0077	Boilers, Nat. Gas	Good Combustion Practice	NA	0.84	lb/MMBtu
Charter Steel	WI-0181	Boiler	Good Combustion Practice, Natural Gas	NA	No Emission Limit	

Source: Technology Transfer Network, Clean Air Technology Center - RACT/BACT/LAER Clearinghouse

RBLC Listings for VOC Emissions from Top Gas-Fired Boilers

Facility	RBLC ID	Unit	Control Technology	Control Efficiency	Emission Limit	Units
Nucor Steel	IN-01018	Boiler, Nat. Gas	Compliance by Using Natural Gas	NA	0.0026	lb/MMBtu
Steel Corr, Inc.	AR-0077	Boilers, Nat. Gas	Natural Gas Combustion Only	NA	0.0055	lb/MMBtu
Charter Steel	WI-0181	Boiler	Good Combustion Control, Natural Gas	NA	No Limit	

Source: Technology Transfer Network, Clean Air Technology Center - RACT/BACT/LAER Clearinghouse

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Step 2 – Eliminate Technically Infeasible Options

Oxidizers:

In the case of a gas-fired burner, an afterburner or downstream oxidizer would not result in an emission reduction because CO emissions typically are less than 1,000 ppm. Further oxidation would generate more NO_x emissions and have little impact on CO.

Step 3 – Rank Remaining Technically Feasible Control Options

Like incineration, the destruction of CO and VOCs is expected to be in the 98-99% range for the boilers. This destruction is inherent to the boiler process, which has the aim to liberate all heat within the boiler.

Step 4 – Evaluate Remaining Control Technologies

In boilers firing blast furnace gas, good combustion practices can lead to an overall CO reduction efficiency of 98 – 99%. A review of the RBLC database indicates that good combustion practice is the control method of choice for controlling CO emissions from other types of furnaces. Good combustion operation practices are considered the only feasible control method for reducing CO emissions.

Step 5 – Selection of BACT

Using the top-down BACT selection method, only one option remains for CO and VOC emissions control from the topgas boilers. BACT is good combustion practices during the operation of the topgas-fired boilers and as 0.0824 lbs of CO per MM Btu and 0.0054 lbs of VOC per MM Btu.

BACT DETERMINATION FOR SINTER PLANTS

The sintering process converts fine-sized raw materials, including iron ore, coke breeze, limestone, mill scale, and flue dust, into an agglomerated product called sinter of suitable size for charging into the blast furnace. The raw materials are sometimes mixed with water to provide a cohesive matrix and then placed on a continuous, traveling grate called the sinter strand. A burner hood at the beginning of the sinter strand ignites the coke in the mixture, after which the combustion is self-supporting. The combustion of the coke breeze provides sufficient heat, 1,300 – 1,480 °C (2,400 – 2,700 °F), to cause surface melting and agglomeration of the mix. On the underside of the sinter strand is a series of wind boxes that draw combusted air down through the material bed into a common duct, leading to a gas cleaning device.

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The fused sinter is discharged at the end of the sinter strand, where it is crushed and screened. Undersize sinter is recycled to the mixing mill and back to the strand. The remaining sinter product is cooled in a circular cooler with mechanical fans or water sprays. The cooled sinter is crushed and screened for a final time, with the fines being recycled to the sintering process, and the product is sent to be charged to the blast furnaces. Generally, 2.3 Mg (2.5 tons) of raw materials, including water and fuel, are required to produce 0.9 Mg (1 ton) of product sinter.

Nucor has proposed to install an emerging technology for controlling multiple pollutants from the sintering process known as the Maximized Emission Reduction Of Sintering (MEROS) system, which is currently installed and operating at the VoestAlpine steel works located in Linz, Austria. The MEROS system represents a state-of-art in sinter plant emissions control and will provide BACT control for several pollutants.

BACT analyses for PM/PM₁₀/PM_{2.5}

Source ID – Description (EQT #)

SIN-101 - MEROS System Sinter Vent Stack (EQT031)

SIN-102 - Sinter Plant Main Dedusting Baghouse Vent (EQT032)

The sinter plant wind box exhaust is the primary source of particulate emissions, mainly iron oxides, sulfur oxides, carbonaceous compounds, aliphatic hydrocarbons, and chlorides. Feed material is loaded in a uniform layer on a moving grate called a sinter strand. Near the feed end of the strand, the bed is ignited on the surface by natural gas burners and, as the mixture moves along the traveling grate, air is pulled down through the mixture to burn the fuel by downdraft combustion. The firing ignites the undersize coke (coke breeze) in the feed, which forms a combustion front burning downward through the material layer as the grate moves toward the discharge end of the strand. As it moves, the strand passes through a series of windboxes which recycle hot flue gas through the sinter, which helps create sufficient heat and temperature to agglomerate the fine particles, forming a cake of porous clinker. The emissions from these wind boxes are routed to Source SIN-101. At the sinter strand discharge, emissions are mainly iron oxide and calcium oxide dusts. The cake of porous clinker is discharged from the sinter strand to a breaker which reduces the sinter to small pieces. The crushed product is then air-cooled and screened. NESHAP 40 CFR 63 Subpart FFFFF identifies the Sinter Discharge End and the Sinter Cooler as separate affected facilities. At the Nucor facility, both of these areas of the Sinter Plant will be routed to the same control device identified as SIN-102, the Sinter Plant Main Dedusting Baghouse Vent.

Step 1- Identify Potential Control Technologies

1. Fabric Filter (baghouse)
2. Electrostatic Precipitator (ESP)

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- 3. Wet Scrubber
- 4. Cyclone

Step 2 - Eliminate Technically Infeasible Options

The evaluation for these filtering technologies must review whether the specific technology is available for the application and is effective at reducing PM₁₀ and PM_{2.5} emissions from the sintering process.

Electrostatic Precipitator (ESP):

ESPs are sensitive to the physical characteristics of the particles to be collected. Iron and iron oxide particles adhere very strongly to the collection plate of the ESP due to their electromagnetic properties. They become very difficult to remove and thus reduce ESP efficiency. Zinc and other metal compounds tend to foul ESP electrodes, also reducing effectiveness. ESPs are considered technically infeasible as an available control technology for the sintering process.

Step 3- Rank Remaining Technically Feasible Control Options

The control technologies that are potentially available to control PM₁₀ emissions from the sinter plant are ranked below according to their respective control efficiencies.

- 1. Fabric Filter (baghouse) – 99%
- 2. Wet Scrubber – 98%
- 3. Cyclone – 80%

Various control alternatives were reviewed for technical feasibility in controlling PM₁₀ and PM_{2.5} emissions from the sinter plant. The highest ranking control option was identified to be the baghouse. PM₁₀ and PM_{2.5} emissions could be reduced by up to 99% with the addition of baghouse filters.

Step 4 – Evaluate Remaining Control Technologies

Fabric Filter (baghouse):

Fabric filters or baghouses are an industry standard for PM₁₀ and PM_{2.5} control in many applications. Baghouses often are capable of 99% removal efficiencies. Baghouse removal efficiency is relatively level across the particle size range so that excellent control of all particle sizes can be obtained. Baghouses can be effectively applied to dust emissions from both the sinter strand discharge and the windbox. A fabric filter is integral to the MEROS control system.

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Wet Scrubber:

Wet scrubbing systems can achieve 98% particulate removal efficiencies when properly applied. The primary obstacle to use of a wet scrubber system is handling and disposal of the collected wet sludge. One advantage of the sinter plant is that there is no wastewater to discharge. Use of a wet scrubber would not only require a wastewater treatment system, but would add the need for a wastewater discharge. Therefore, a wet scrubber is not a technically feasible control for the sinter plant.

Cyclones:

The dust particles could be separated by centrifugal forces imparted in a cyclone; however, high velocity must be established and fine dust would not be effectively removed with the greatest efficiency. Multiple cyclones have overall mass removal efficiencies of 70-90%. However, cyclone collection efficiencies fall off rapidly with particle size so that control of fine particulate (PM_{2.5}) is limited.

Step 5 – Selection of BACT

Using the top-down BACT selection method, three options remain for control of PM₁₀ and PM_{2.5} emissions from the sinter plant. Therefore, BACT is the most stringent control option, a baghouse filter. The baghouse will also act as a PM₁₀ and PM_{2.5} removal device for dust generated by SO₂ removal as part of the MEROS system. BACT for the Sinter Flue Gas Scrubber Stack is PM₁₀ ≤ 0.002 gr/dscf (5 mg/dry std cubic meters). This emission rate will meet the MACT emission limitation of 0.3 lb/ton of product sinter required under 40 CFR 63.7790(a). Thus, BACT will not be less stringent than MACT. BACT for the Sinter Plant Main Dedusting Baghouse Vent is PM₁₀ ≤ 0.005 gr/dscf (12 mg/dry std cubic meters). This emission rate will meet the MACT emission limitation of 0.01 gr/dscf required under 40 CFR 63.7790(a) for both the sinter end discharge and the sinter cooler. Thus, BACT will not be less stringent than MACT.

BACT analyses for NO_x

Source ID – Description (EQT #)

SIN-101 - Sinter Flue Gas Scrubber Stack (EQT031)

Sinter plant NO_x originates with the combustion of coke and supplemental natural gas. Potential sinter plant NO_x control technologies are listed and described below.

Step 1 – Identify Potential Control Technologies

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1. Low NO_x Burners (LNB)
2. Selective Catalytic Reduction (SCR)
3. Selective Non-Catalytic Reduction (SNCR)
4. Non-Selective Catalytic Reduction (NSCR)
5. EM_x (SCONO_x)

Step 2 – Eliminate Technically Infeasible Options

Low-NO_x Burners (LNB):

External fuel is typically burned in a boiler that can be controlled using a low NO_x burner as previously described. There is no external fuel source, other than the ignition source, that can be controlled during the sinter process. The coke breeze in the sinter mix burns in a smoldering fashion so that the various materials are agglomerated by the heat. LNBs are not technically feasible for application to the sintering process because the combustion of the coke breeze is not done through the burning of external fuel.

Selective Catalytic Reduction (SCR):

SCR requires the injection of ammonia into a gas stream upstream of a catalyst bed at a specific temperature range. Frequently, excess unreacted ammonia will remain in the gas beyond the catalyst bed, an occurrence known as ammonia slip. Ammonia slip is incompatible with the sulfur control technology chosen as BACT for sintering. Ammonia is known to react with hydrated lime to form complex compounds. These compounds are viscous and have been known to plug piping and foul catalysts. SCR is not technically feasible because a complete separation of ammonia for NO_x control and hydrated lime for SO₂ control cannot be achieved.

Selective Non-Catalytic Reduction (SNCR):

SNCR requires injection of a reagent into the gas stream. The required temperature window for this to take place (i.e., 1,600 – 2,200 °F) is only available for a short period of time during the process and only occurs within the burning zone. It is technically infeasible to control the injection of the reagent into the gas stream that is within the temperature window since the size and location is highly variable. If the injection takes place outside the temperature window (i.e., at less than 1,600 °F), the SNCR controls will not result in reduced NO_x emissions. For these reasons, SNCR is not technically feasible for the sintering process.

Non-Selective Catalytic Reduction (NSCR):

Non-selective catalytic reduction requires specific levels of several process parameters that are

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incompatible with the flue gas stream leaving the sinter plant. The flue gas will contain some lime and metal particulates which will scale and plug the catalyst beds used for NSCR. Additionally, the flue gas will not be within the temperature range required by NSCR when it leaves the desulfurization unit. Thus, NSCR is not a feasible control technology for the control of CO from topgas boilers.

EM_x (SCONO_x):

EM_x technology uses catalyst beds with narrow, honeycomb structures. The flue gas stream leaving the sinter plant will contain some lime and metal particulates which will scale and plug the catalyst beds used for EM_x. Additionally, the flue gas will not be within the temperature range required by EM_x when it leaves the desulfurization unit. Thus, EM_x is a technically infeasible control technology for the sinter plant.

Step 3 – Rank Remaining Technically Feasible Control Options

There are no remaining control options which are technically feasible.

Step 4 – Evaluate Remaining Control Technologies

There are no remaining control options to evaluate.

Step 5 – Selection of BACT

A top-down BACT analysis was performed for NO_x emissions from the sinter plant. There are no feasible options for NO_x control from the sinter plant; therefore, BACT is no control. BACT is 0.495 lbs/ton of finished sinter.

BACT analyses for SO₂

Source ID – Description (EQT #)

SIN-101 - Sinter Flue Gas Scrubber Stack (EQT031)

Sinter plant SO₂ emissions originate from the combustion of coke and supplemental natural gas. Potential sinter plant SO₂ control technologies are listed and described below.

Step 1- Identify Potential Control Technologies

1. Wet Scrubber Flue Gas Desulfurization
2. Spray Dryer/Absorber (Lime Spray Dryer)

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3. Dry Sorbent Injection

Step 2 - Eliminate Technically Infeasible Options

The evaluation of these technologies must review whether the specific technology is available for the application and is effective at reducing SO₂ emissions from the sintering process. All of the above mentioned technologies are technically feasible and are able to be applied to the sinter plant. However, the wet scrubber will result in higher PM₁₀ emissions than the baghouse control technology chosen as BACT for PM₁₀ control from this source and therefore is eliminated as a technically feasible option.

Step 3 – Rank Remaining Technically Feasible Control Options

1. Spray Dryer/Absorber (Lime Spray Dryer) – 70 – 90%
2. Dry Sorbent Injection – 40 – 60%

Step 4 – Evaluate Remaining Control Technologies

Spray Dryer/Absorber (Lime Spray Dryer):

One advantage of the sintering process is that it produces no process wastewater. A significant advantage of dry scrubbing is that it provides high SO₂ removal without generating wastewater. Another advantage is that a spray dryer and baghouse system combination is a very effective particulate removal device.

Dry Sorbent Injection:

The SO₂ control efficiency of existing dry injection systems range from 40 to 60 percent when using lime or limestone. Other sorbents have been used at higher efficiency in other desulfurization applications but are still considered to be a developing rather than demonstrated technology.

Step 5 – Selection of BACT

A top-down BACT analysis was performed for SO₂ removal from the sinter plant. With the considerations noted above, a dry scrubber with a removal efficiency of 90%, is BACT for SO₂ emissions. The baghouse selected for PM₁₀ control discussed above is also BACT for dust generated by SO₂ removal. BACT is 1.0573 lbs/ton of finished sinter.

BACT analyses for CO

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Source ID – Description (EQT #)
SIN-101 - Sinter Flue Gas Scrubber Stack (EQT031)

Sinter plant CO emissions originate from the combustion of coke and supplemental natural gas fuel. Potential sinter plant CO control technologies are listed and described below.

Step 1- Identify Potential Control Technologies

- 1. Good Combustion Practices
- 2. Catalytic Oxidizer
- 3. Thermal Oxidizer
- 4. Ultra low emission Flare

Catalytic Oxidizer:

Beyond combustion controls, the remaining CO could be oxidized to carbon dioxide (CO₂) in a second downstream control device. Gas streams with high concentrations of CO can be controlled by installing a catalytic oxidizer downstream of the device. The oxidation process occurs at a relatively low temperature by moving the gases across a bed of catalyst material consisting of a precious metal such as palladium. This can be practical when CO levels are elevated above 1,000 ppmv, such as in certain chemical processes or combustion units that have a wet fuel or for some reason promote incomplete combustion.

Thermal Oxidizer:

A thermal oxidizer works in a similar manner to catalytic oxidation devices, combusting pollutants to CO₂ and water prior to being released to the atmosphere. Thermal oxidizers generally operate at a higher temperature than catalytic devices, requiring the gas stream to be heated during treatment. Typically, the gas is heated to a temperature of at least 1,400 °F, and a minimum residence time at this temperature is required (typically between 0.5 - 2.0 seconds). These parameters can be practically achieved when emissions contain high concentrations of VOC or other combustible compounds and the gas flow is relatively low.

Ultra-Low Emission Flare

Combusting a waste gas stream is a common method of removing CO or other combustible matter from a gas stream. Flares come in many forms and designs and generally operate by igniting a waste gas stream directly. Flares may be steam-assisted, air-assisted, or non-assisted, and typically require a minimum fuel value of the waste gas in order to operate effectively.

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Step 2 - Eliminate Technically Infeasible Options

Catalytic Oxidizer:

A catalytic oxidizer relies upon expensive catalyst beds to promote the oxidation of CO to CO₂. The catalyst beds are made of precious metals such as palladium or platinum. These catalysts are frequently poisoned by certain materials, particularly other metals such as iron, lead, and silicon. Iron particles are heavily prevalent in the sinter flue gas, and catalyst poisoning is a severe obstacle to the application of catalytic oxidation to sinter plant flue gas. Catalytic oxidation has never been demonstrated as effective for treating CO from sinter plants and is therefore determined to be technically infeasible.

Ultra-Low Emission Flare

For emission flares to be effective, the process gas must be combustible. The flue gas in the sintering process has very little fuel value, with only minor concentrations of CO and VOC present in the gas. An Ultra-Low Emission Flare is not feasible because the concentrations of flammable compounds in the sinter flue gas are not adequate for combustion to take place. If the flare cannot be ignited, it can not perform its function and the technique is therefore determined to be technically infeasible.

Step 3 – Rank Remaining Technically Feasible Control Options

Good combustion practice is the only technically feasible control for CO emissions from the sinter plant. A review of publicly available information for the reduction of CO from the sintering process did not reveal any currently applied control technologies.

Step 4 – Evaluate Remaining Control Technologies

1. Thermal Oxidizer – 99%
2. Good Combustion Practices – N/A

Thermal Oxidizer:

Thermal oxidation is technically feasible for the control of CO from the sintering process. As an active control measure, it is generally capable of 99% control of combustibles such as CO and VOCs.

A thermal oxidizer applied to the sintering process would require a large amount of energy to heat the flue gas to a temperature at which thermal oxidation could take place. The only effective means of supplying this energy would be through the combustion of natural gas or other gaseous fuels. The combustion of natural gas necessarily entails the generation of air pollutants, with NO_x production of particular concern.

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The sinter plant design calls for a normal exhaust gas flow rate from the windbox of approximately 466,160 actual cubic feet per minute (acfm) at 160 °F. In order to treat this waste gas, containing approximately 1% CO by volume, a gas stream of nearly 28,000,000 cubic feet per hour must be heated by approximately 1,250 °F. Even granting generous assumptions of thermal efficiency and economy, the energy requirements for a thermal oxidizer of this size would be very large, requiring tens of thousands of cubic feet of natural gas. The consequent generation of NO_x emissions from this use of fuel, a precursor of ozone formation, counteracts and outweighs any potential environmental benefit from reduced emissions of CO.

Although thermal oxidation is a feasible control technology for emissions of CO, the reduction in CO is greatly outweighed by energy and environmental costs associated with this type of control. Therefore, this technology is eliminated from consideration because it has unacceptable energy and environmental impacts.

Good Combustion Practices:

Carbon monoxide (CO) is a result of incomplete combustion; therefore, it can typically be minimized through the use of good combustion practices including assurance of sufficient air to fuel ratios. Good combustion practices can be enhanced using staged combustion, which involves the injection of combustion air at different areas of the burners. Therefore, good combustion practices will be utilized to partially control CO emissions from the sinter plant.

Step 5 – Selection of BACT

A top-down BACT analysis was performed for CO removal from the sinter plant. BACT is good combustion practices, which represents the only remaining means of reducing CO emissions from the sinter plant. BACT is CO ≤ 17.9416 lb/ton of finished sinter.

BACT analyses for VOC

Source ID – Description (EQT #)
SIN-101 - Sinter Flue Gas Scrubber Stack (EQT031)

Sinter plant VOC emissions originate from the combustion of coke and supplemental natural gas fuel. Potential sinter plant VOC control technologies are listed and described below.

Step 1- Identify Potential Control Technologies

1. Good combustion practices
2. Thermal Oxidizer
3. Ultra-Low Emission Flare

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4. Countercurrent flow injection of additives

Good Combustion Practices:

Near the feed end of the grate, the bed is ignited on the surface by gas burners and, as the mixture moves along the traveling grate, air is pulled down through the mixture to burn the fuel by downdraft combustion. This creates sufficient heat and temperate to agglomerate the fine particles, forming a cake of porous clinker and providing the strength and other properties needed for use in the blast furnace. VOC compounds are formed as products of combustion as the coke is burned to melt the sinter and flux. VOC can generally be combusted in equipment utilizing burners in different stages of combustion processes. However, the sintering process is a self-sustaining burn that only uses a burner to ignite the mass. The VOC concentration in the flue gas is typically low.

Countercurrent flow injection of additives:

VOC compounds can be controlled with the injection of additives in the flow stream which adsorb them. The MEROS system mixes coke breeze particles with the lime spray such that the coke breeze acts as activated carbon injected into the flue gas. The injection of additives in this manner has not been demonstrated to be particularly effective at VOC control, with removal efficiency estimated to be about 12%. However, the coke breeze injection is highly effective at the removal of several Hazardous Air Pollutants and thus will be an integral part of the MEROS control system.

Step 2 - Eliminate Technically Infeasible Options

Ultra-Low Emission Flare

For emission flares to be effective, the process gas must be combustible. The flue gas in the sintering process has very little fuel value, with only minor concentrations of CO and VOC present in the gas. An Ultra-Low Emission Flare is not feasible because the concentrations of flammable compounds in the sinter flue gas are not adequate for combustion to take place. If the flare cannot be ignited, it can not perform its function and the technique is therefore determined to be technically infeasible.

Step 3- Rank Remaining Technically Feasible Control Options

1. Thermal Oxidizer – 99%
2. Countercurrent flow injection of additives – 12%
3. Good combustion practices – N/A

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Step 4 – Evaluate Remaining Control Technologies

Thermal oxidation is technically feasible for the control of VOC from the sintering process. As an active control measure, it is generally capable of 99% control of combustibles such as CO and VOCs.

A thermal oxidizer applied to the sintering process would require a large amount of energy to heat the flue gas to a temperature at which thermal oxidation could take place. The only effective means of supplying this energy would be through the combustion of natural gas or other gaseous fuels. The combustion of natural gas necessarily entails the generation of air pollutants, with NO_x production of particular concern.

The sinter plant design calls for a normal exhaust gas flow rate from the windbox of approximately 466,160 actual cubic feet per minute (acfm) at 160 °F. In order to treat this waste gas, containing approximately 200 ppm of VOCs, a gas stream of nearly 28,000,000 cubic feet per hour must be heated by approximately 1,250 °F. Even granting generous assumptions of thermal efficiency and economy, the energy requirements for a thermal oxidizer of this size would be very large, requiring tens of thousands of cubic feet of natural gas. The consequent generation of NO_x emissions from this use of fuel, a precursor of ozone formation, counteracts and outweighs any potential environmental benefit from reduced emissions of VOC.

Although thermal oxidation is a feasible control technology for emissions of VOC, the reduction in VOC is greatly outweighed by energy and environmental costs associated with this type of control. Therefore, this technology is eliminated from consideration because it has unacceptable energy and environmental impacts.

A review of publicly available information for the reduction of VOC from the sintering process did not reveal any currently applied control technologies. Because the expected control efficiency of additive injection is not high, a combined approach of additive injection and good combustion practices would provide the best control of VOC.

Step 5 – Selection of BACT

A top down BACT analysis was conducted for VOC reduction from the sinter plant. BACT is selected to be countercurrent flow injection of additives combined with good combustion practices to control VOC emissions from the sinter plant. BACT is VOC, Total ≤ 0.0945 lb/ton of finished Sinter.

BACT DETERMINATION FOR COOLING TOWERS

Most industrial cooling towers use clarified river water or well water as their source of fresh

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cooling water. The cross-flow cooling towers continuously circulate cooling water through heat exchangers and other equipment where the water absorbs heat. That heat is then rejected to the atmosphere by the partial evaporation of the water in cooling towers where up-flowing air is contacted with the circulating down-flow of water. The loss of evaporated water into the air exhausted to the atmosphere is replaced by "make-up" water. Since the evaporation of pure water is replaced by make-up water containing carbonates and other dissolved salts, a portion of the circulating water is also continuously discarded as "blowdown" water to prevent the excessive build-up of salts in the circulating water.

BACT analyses for PM/PM₁₀/PM_{2.5}

Source ID – Description (EQT #)

TWR-101 - Blast Furnace Cooling Tower (EQT060)

TWR-102 - Iron Solidification Cooling Tower (EQT061)

TWR-103 - Air Separation Plant Cooling Tower (EQT062)

Step 1 – Identify All Control Technologies

1. High-efficiency drift eliminators
2. Low TDS cooling water

Drift Eliminators:

Water droplets that are carried out of the cooling tower with the exhaust air are known as drift droplets. PM is created when the water evaporates from the droplet, leaving the previously dissolved salt behind as particulate matter. The drift rate is typically reduced by employing baffle-like devices, called drift eliminators, through which the air must travel after leaving the fill and spray zones of the tower. In the drift eliminators, small droplets are agglomerated into large droplets and removed from the air stream discharged from the cooling tower.

Low TDS Cooling Water:

By maintaining a low level of total dissolved solids in the circulating cooling water, the amount of particulate matter generated by the drift can be greatly reduced. A TDS concentration of 1,100 ppmv or less is typically considered to be a low concentration in cooling tower water.

A search of the U.S. EPA RBLC database was conducted to review control options for PM₁₀ emissions for cooling towers in use today. The most common type of control device is a drift eliminator.

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RBLC Listings for PM₁₀ Emissions from Cooling Towers

Facility	RBLC ID	Unit	Control Technology	Control Efficiency	Emission Limit	Units
CLECO Power, LLC - Rodemacher Brownfield Unit 3	LA-0202	Cooling Tower (16 Cells)	Drift Eliminators	99.995%	0.005%	Cooling Water Drift
Nucor Steel	NC-0112	Cooling Towers	Mist Eliminators	99.992%	0.008%	Cooling Water Drift
Nucor Steel	NC-0113	Cooling Towers	Mist Eliminators	99.992%	0.008%	Cooling Water Drift
Western Greentriber Co-Generation, LLC	WV-0024	Cooling Tower	Drift Eliminators	99.9995%	0.0005%	Cooling Water Drift
Great River Energy - Spiritwood Station	ND-024	Cooling Tower	Drift Eliminator	99.9995%	0.0005%	Cooling Water Drift

Source: Technology Transfer Network, Clean Air Technology Center - RACT/BACT/LAER Clearinghouse

Step 2 – Eliminate Technically Infeasible Options

The evaluation of these technologies must review whether the specific technology is available for the application and is effective at reducing PM₁₀ emissions from the cooling towers. BACT will be chosen as the most efficient and economical option.

High-Efficiency Drift Eliminators:

Drift eliminators are technically feasible and are able to be applied to reduce PM₁₀ emissions from cooling towers. Drift eliminators are an industry standard and are supplied with the cooling tower by most vendors.

Low TDS Cooling Water:

Total dissolved solids are normally maintained at a reasonably low level in cooling towers to prevent deposition and fouling. Reduction in TDS to very low levels requires a significant increase in makeup water usage and treatment chemicals due to a significant increase in the blow-down required. Low TDS concentration is a technically feasible option for PM control from cooling towers.

Step 3 – Rank Remaining Technically Feasible Control Options

1. Low TDS Cooling Water – 50 – 90%
2. High-Efficiency Drift Eliminators – 50 – 80%

Low TDS Cooling Water:

By reducing the TDS concentration to less than 1,100 ppm, particulate can typically be controlled to a high degree.

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High-Efficiency Drift Eliminators:

Drift eliminators are often used to reduce the amount of drift in the exiting air flow. The four main types of drift eliminators are blade-type, herringbone, waveform, and cellular or honeycomb. Blade-type and herringbone drift eliminators are usually the least efficient; waveform drift eliminators are typically moderately efficient; cellular units are the most efficient.

Step 4 – Evaluate Remaining Control Technologies

Most of the emissions from cooling towers are a result of drift droplets, liquid water entrained in the air stream which are carried out of the tower. The amount of drift escaping the cooling tower depends on the type and model, the capacity, the velocity of the air, the temperature of the inlet and outlet flow, and the density of the air in the cooling tower. Drift loss can usually be obtained by requesting the drift loss from the manufacturer or vendor. Drift droplets can be reduced to less than 0.005% by effectively using a drift eliminator.

Step 5 – Selection of BACT

A top-down BACT analysis was performed for PM₁₀ and PM_{2.5} control from cooling towers. Both remaining options are effective depending upon specific process conditions. Therefore, BACT is a combination of less than or equal to 1,100 milligrams per liter TDS concentration in the cooling water and drift eliminators employing a drift maximum of 0.0005%.

BACT DETERMINATION FOR STORAGE PILES

Storage piles are usually left uncovered, partially because of the need for frequent material transfer into or out of storage. Dust emissions occur at several points in the storage cycle, such as material loading onto the pile, disturbances by strong wind currents, and loadout from the pile.

BACT analyses for PM/PM₁₀/PM_{2.5}

Source ID – Description (EQT #)

PIL-101 - Coal Storage Piles (FUG001)

PIL-102 - Iron Ore Pellet Storage Piles (FUG002)

PIL-103 - Flux Storage Piles (FUG003)

PIL-104 - Pig Iron Storage Piles (FUG004)

PIL-105 - Granulated Slag Storage Piles (FUG005)

PIL-106 - Sinter Storage Piles (FUG006)

PIL-107 - Coke Breeze Storage Piles (FUG007)

PIL-108 - Mill Scale Storage Piles (FUG008)

Step 1 – Identify Potential Control Technologies

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1. Application of surfactants, cover, wet suppression, and or stabilizers to exposed surfaces
2. Minimize handling of storage pile materials

RBLC Listings for PM₁₀ Emissions from Storage Piles

Facility	RBLC ID	Unit	Control Technology	Control Efficiency	Emission Limit	Units
Recmix of PA, Inc.	KY-0095	Stockpiles	Material has high moisture content	90%	0.78	t/yr
Recmix of PA, Inc.	KY-0095	Storage	High moisture content	90%	0.78	t/yr
Chaparral Steel Midlothian LP	TX-0332	Stockpiles	NA	NA	0.21	t/yr

Source: Technology Transfer Network, Clean Air Technology Center - RACT/BACT/LAER Clearinghouse

Step 2 – Eliminate Technically Infeasible Options

The evaluation for these control options must review whether the specific technology is available for the application and is effective at reducing PM₁₀ and PM_{2.5} emissions from storage piles. All of the above mentioned controls are technically feasible controls for reducing PM₁₀ and PM_{2.5} emissions from storage piles.

Step 3 – Rank Remaining Technically Feasible Control Options

The use of water suppression can control PM₁₀ and PM_{2.5} emissions by up to 90%. Dust generation can also be reduced by minimizing the handling of storage pile materials.

Step 4 – Evaluate Remaining Control Technologies

Watering and the use of chemical wetting agents are the principal means for control of storage pile emissions. Watering is useful mainly to reduce emissions from vehicle traffic in the storage pile area. Watering of the storage piles themselves typically has only a very temporary slight effect on total emissions. A much more effective technique is to apply chemical agents such as surfactants that permit more extensive wetting. Continuous chemical treating of material loaded onto piles, coupled with watering or treatment of roadways, can reduce total particulate emissions from storage operations by up to 90 percent.

Step 5 – Selection of BACT

A top-down BACT analysis was performed for storage pile emissions. BACT is wet suppression of dust generating sources by water sprays at each storage pile site. Roadways shall be paved where practicable, reduced speed limits shall be utilized and roadways shall be sprayed to reduce emissions.

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BACT DETERMINATION FOR ROADWAYS

Motor vehicle traffic has the potential to generate airborne dust during dry conditions due to the action of wheels upon haul roads. Additionally, bulk material in storage piles will be managed with earth-moving equipment, which has the potential to generate fugitive dust in a similar manner to road traffic.

BACT analyses for PM/PM₁₀/PM_{2.5}

Source ID – Description (EQT #)

FUG-101 - Unpaved Road Fugitive Dust (ARE002)

FUG-102 - Paved Road Fugitive Dust (ARE003)

Step 1 – Identify Potential Control Technologies

1. Road Paving
2. Road Watering and Dust Suppression Chemicals
3. Reduced Speed Limits
4. Road Sweep or Washing

RBLC Listings for PM₁₀ Emissions from Fugitive Road Dust

Facility	RBLC ID	Unit	Control Technology	Control Efficiency	Emission Limit	Units
Valero Refining, St Charles Refinery	LA-0213	Road Dust	Pave roads to extent practicable, wet unpaved areas as necessary	NA	5.24	Lbs/hr
Big River Industries	LA-0209	Unpaved Roads	Watering and reduced speed limit	95.5%	0.7	Lbs/hr
Nucor Steel	NC-0112	Unpaved Roads	Dust Suppression and speed limit of 10 mph	NA	-	-
Shintech Louisiana, LLC	LA-0204	Road-Fugitive Dust	Paving Roads as much as Practicable	NA	0.22	Lbs/hr
Southwest Electric Power Company	AR-0094	Unpaved Roads	Watering/ Dust Suppression Chemicals	90%	1.1	Lbs/hr
Louisiana Generating, LLC Big Cajun 1	LA-0223	Paved Roads	Paved Roads	NA	1.21 3.54	Lbs/hr tpy
Archer Daniels Midland ADM Corn Processing – Cedar Rapids	IA-0088	Haul Roads	Daily Sweeping and/or Washing	80%	-	-
Sun Coke Company Haverhill North Coke Company	OH-0272	Roadways and Parking	Watering	NA	1.56	tpy

Source: Technology Transfer Network, Clean Air Technology Center - RACT/BACT/LAER Clearinghouse

Road Paving:

Paving reduces dust generated by on plant roads by providing a solid, stable, and clean road surface for wheeled vehicles.

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Reduced Speed Limits:

Reducing the speed of vehicles on a road has been shown to reduce the quantity of dust which becomes airborne by vehicle traffic. Although the reduction of dust from this method cannot be accurately quantified and may be subject to many site-specific factors, it is considered to be a best management practice.

Road Sweeping or Washing:

Road cleaning activities reduce the amount of particulate on the road surface which has the potential to become airborne. By their nature, sweeping and washing are generally only effective on paved road surfaces.

Step 2 – Eliminate Technically Infeasible Options

All of the identified technologies are considered to be technically feasible.

Step 3 – Rank Remaining Technically Feasible Control Options

1. Road Paving – 90%
2. Road Watering and Dust Suppression Chemicals – 90%
3. Road Sweep or Washing – 90%
4. Reduced Speed Limits - BMP

Step 4 – Evaluate Remaining Control Technologies

Road Paving:

Paving reduces dust generated by on plant roads by providing a solid, stable road surface for wheeled vehicles. Paved roads must be maintained free of mud, dirt, and other materials in order to remain an effective option for controlling the creation of fugitive dusts. For this reason, road paving is frequently combined with road sweeping or washing activities in order to maintain a clean road surface.

Paved roads are appropriate for areas which handle up to moderate volumes of heavy duty wheeled vehicles, such as tractor trailers. However, road paving is subject to excessive wear and tear in areas trafficked by earth moving machines and extra heavy duty haul trucks (greater than 50 tons in weight).

Step 5 – Selection of BACT

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Roadways shall be paved where practicable including areas where the extra heavy vehicles (greater than 50 tons in weight) will not cause damage to paving. Sweeping will be used on paved roads along with reduced speed limits. Unpaved roads shall utilize water spray or dust suppression chemicals to reduce emissions. Additionally, reduced speed limits will be enforced on all unpaved roadways.

BACT DETERMINATION FOR HOT METAL HANDLING

PM₁₀ and PM_{2.5} is emitted as a result of the transfer of molten metal from one vessel to the other. The transfer of molten metal accounts for significantly more particulate emissions than are generated from the melting processes themselves. The following analysis provides the BACT determination for PM₁₀ emissions.

BACT analyses for PM/PM₁₀/PM_{2.50}

Source ID – Description (EQT #)

PIG-101 - Pig Iron Desulfurization Station Baghouse Vent (EQT021)

PIG-102 - Pig Iron Solidification Baghouse Vent (EQT022)

Step 1 – Identify Potential Control Technologies

The options that are potentially available to control PM₁₀ emissions from the hot metal handling operations include the following:

1. Fabric Filter (baghouse)
2. Electrostatic Precipitator (ESP)
3. Wet Scrubber

RBLC Listings for PM₁₀ Emissions from Hot Metal Handling

Facility	RBLC ID	Unit	Control Technology	Control Efficiency	Emission Limit	Units
Asama Coldwater Manufacturing, Inc.	MI-0385	Melting and Pouring (EU-MP)	(A) Hoods, Enclosures, Ductwork and a 37,500 ACFM Baghouse	99%	0.3	lb/hr

Source: Technology Transfer Network. Clean Air Technology Center - RACT/BACT/LAER Clearinghouse

Step 2 – Eliminate Technically Infeasible Options

Electrostatic Precipitator (ESP):

ESPs are capable of 99% or higher particulate removal; however, several factors preclude their

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application to control PM₁₀ or PM_{2.5} from hot metal handling processes. ESPs are sensitive to the physical characteristics of the particles to be collected. Iron particles adhere very strongly to the collection plate of the ESP due to their electromagnetic properties. They become very difficult to remove and thus reduce ESP efficiency. Zinc and other metal compounds tend to foul ESP electrodes, also reducing effectiveness. ESPs are considered technically infeasible as an available control technology for hot metal handling processes.

Step 3 – Rank Remaining Technically Feasible Control Options

1. Fabric Filter (baghouse) – 99%
2. Wet Scrubber – 98%

Step 4 – Evaluate Remaining Control Technologies

Fabric Filter (baghouse):

Fabric filters are the standard in the iron and steel industry for PM₁₀ and PM_{2.5} control. Baghouses often are capable of 99% removal efficiencies. Baghouse removal efficiency is relatively level across the particle size range so that excellent control of PM₁₀ and PM_{2.5} can be obtained. Baghouse installations are technically feasible and are the industry standard for controlling PM₁₀ and PM_{2.5} emissions from hot metal handling.

Wet Scrubber:

High-energy wet scrubbers are technically feasible but have many disadvantages compared to fabric filters, which can achieve better levels of particulate control. Scrubber systems have very high pressure drops that result in high system operating costs. They also require water treatment and sludge disposal, which are not necessary with other PM₁₀ control options. They also have large space requirements.

Step 5 – Selection of BACT

A top-down BACT analysis was performed for PM₁₀ control from hot metal handling. BACT for controlling filterable PM₁₀ emissions from hot metal handling processes is a baghouse with a vent hood. This combination offers a capture and control efficiency of 99% for PM₁₀. BACT is established as 0.009 lbs/ton of hot metal processed for the PIG-101 - Pig Iron Desulfurization Station Baghouse Vent. BACT is established as 0.00084 lbs/ton of hot metal processed for the PIG-102 - Pig Iron Solidification Baghouse Vent.

BACT DETERMINATION FOR STOCK HOUSE AND SINTER MATERIAL HANDLING

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PM₁₀ and PM_{2.5} is emitted as a result of the transfer of various products from the stock houses and after the Sinter is finished being cooled. The Stock House materials consist of the following products: Iron ore, Ore fines, Coke, and Nut coke. The Sinter materials consist of Lime used to control sulfur dioxide emission from the Sinter Plant and fine and other materials. The following analysis provides the BACT determination for PM₁₀ and PM_{2.5} emissions.

BACT analyses for PM/PM₁₀/PM_{2.5}

Source ID – Description (EQT #)

STC-101 - Stock House 1 Baghouse Vent (EQT053)

STC-201 - Stock House 2 Baghouse Vent (EQT054)

SIN-103 - Coke and Petcoke Crushing Dedusting Baghouse Vent (EQT033)

SIN-105 - Sinter FGD Lime Silo Unloading (EQT034)

SIN-106 - Sinter FGD Waste Loading (EQT035)

Step 1 – Identify Potential Control Technologies

The options that are potentially available to control PM₁₀ emissions from the material handling operations include the following:

1. Fabric Filter (baghouse)
2. Electrostatic Precipitator (ESP)
3. Wet Scrubber

Step 2 – Eliminate Technically Infeasible Options

Electrostatic Precipitator (ESP):

ESPs are capable of 99% or higher particulate removal; however, several factors preclude their application to control PM₁₀ or PM_{2.5} from these processes. ESPs are sensitive to the physical characteristics of the particles to be collected. Iron particles adhere very strongly to the collection plate of the ESP due to their electromagnetic properties. They become very difficult to remove and thus reduce ESP efficiency. Zinc and other metal compounds tend to foul ESP electrodes, also reducing effectiveness. ESPs are considered technically infeasible as an available control technology for hot metal handling processes.

Step 3 – Rank Remaining Technically Feasible Control Options

1. Fabric Filter (baghouse) – 99%
2. Wet Scrubber – 98%

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Step 4 – Evaluate Remaining Control Technologies

Fabric Filter (baghouse):

Fabric filters are the standard in the iron and steel industry for PM₁₀ control. Baghouses often are capable of 99% removal efficiencies. Baghouse removal efficiency is relatively level across the particle size range so that excellent control of PM₁₀ and PM_{2.5} can be obtained. Baghouse installations are technically feasible and are the industry standard for controlling PM₁₀ emissions from hot metal handling.

Electrostatic Precipitator (ESP):

ESP control of the Sinter Plant material handling is technically feasible. However, compared only to the fabric filter control, the efficiency of ESP devices are slightly lower and capital and operating costs are greatly increased. Baghouse control is typically preferred over ESP control absent factors which make fabric filters infeasible.

Wet Scrubber:

High-energy wet scrubbers are technically feasible but have many disadvantages compared to fabric filters, which can achieve better levels of particulate control. Scrubber systems have very high pressure drops that result in high system operating costs. They also require water treatment and sludge disposal, which are not necessary with other PM₁₀ and PM_{2.5} control options. They also have large space requirements.

Step 5 – Selection of BACT

A top-down BACT analysis was performed for PM₁₀ and PM_{2.5} control from the products handled in the Stock Houses and the Sinter Plant. BACT for controlling filterable PM₁₀ emissions is a baghouse. This offers a control efficiency of $\geq 99.5\%$ for PM₁₀.

BACT DETERMINATION FOR MATERIAL HANDLING AND TRANSFER

Large quantities of raw materials will be received at Nucor Steel Louisiana, and then transported for use within the facility. Most materials will be received at the Mississippi River dock, which will have the capability to berth large, ocean-going vessels and river barges. Two gantry cranes will work the receiving dock, unloading materials by clamshell bucket. Materials may also be received by rail and by truck. A dedicated wagon tipper will be installed and operated for unloading rail cars. Within the facility, the bulk of material handling and transport will be accomplished using conveyors. Dedicated stacker/reclaimer machines will form storage piles of raw materials as they are received and reclaim them for use in the process as operations demand.

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PM₁₀ and PM_{2.5} is emitted as a result of handling and transporting bulk quantities of raw materials. Materials such as coal, iron ore pellets, limestone and others generate dusts as the individual pieces impact one another. These raw materials will be unloaded from ships and barges using a clamshell unloader mounted to a gantry crane or from rail cars employing a wagon tipper. Materials will primarily be moved about the Nucor Steel Louisiana facility by conveyor, which has the potential to generate fugitive dusts at drop points and due to wind. Inevitably, materials will also be transported by truck or managed with earth-moving equipment, which have the potential to generate fugitive road dust. The following analysis provides the BACT determination for PM₁₀ emissions.

BACT analyses for PM/PM₁₀/PM_{2.5}

Source ID – Description (EQT #)

DOC-101 - Dock 1 Loading/Unloading Gantry Crane (EQT017)
 DOC-102 - Dock 2 Loading/Unloading Gantry Crane (EQT018)
 DST-101-Blast Furnace 1 Topgas Dust Catcher (EQT019)
 DST-201-Blast Furnace 2 Topgas Dust Catcher (EQT020)
 FUG-103 - Conveyor Fugitives (ARE004)
 COK-112 - Coke Battery 1 FGD Lime Silo Unloading (EQT005) [FF]
 COK-113 - Coke Battery 1 FGD Waste Loading (EQT006) [FF]
 COK-212 - Coke Battery 2 FGD Lime Silo Unloading (EQT011) [FF]
 COK-213 - Coke Battery 2 FGD Waste Loading (EQT012) [FF]
 COK-214 - Coke Bin Tower (EQT013) [FF]
 COK-215 - Coke Screening (EQT014) [FF]
 TRN-101 - Wagon Tipper (EQT059)

Step 1 – Identify Potential Control Technologies

1. Fabric Filter [FF] (baghouse)
2. Wind screens and partial enclosures
3. Water sprays or wet suppression
4. Enclosed (hooded) conveyors and transfer points

RBLC data for PM₁₀ controls for material handling operations is seen in the table below. It is evident that the range of technologies cited above has been used as BACT for the various aggregate handling operations. All of the above options are considered technically feasible.

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RBLC Listings for PM₁₀ Emissions from Material Handling

Facility	RBLC ID	Unit	Control Technology	Control Efficiency	Emission Limit	Units
Louisiana Generating – Big Cajun 1 Power Plant	LA-0223	Transfer Points – Barge Unloader, Unloading Hopper to Conveyor C-1	Wind Screens and Dry Fogging	NA	0.13	Lb/hr
Entergy Louisiana, LLC – Little Gypsy Generating Plant	LA-0221	Raw Material Handling Conveyors	Wind Screens and Wet Suppression	NA	37.42	Lb/hr
Big River Industries, Inc.	LA-0209	Conveyor Systems and Stockpiles	Water Sprays and/or Partial Enclosure	90%	0.1	lb/hr
NRG Texas	TX-0507	Limestone Conveyors	No controls	NA	0.77	Lb/hr
CLECO Power, LLC	LA-0202	Outside Conveyors	Hooded Conveyors	95%	3.6	lb/hr

Source: Technology Transfer Network. Clean Air Technology Center - RACT/BACT/LAER Clearinghouse

Step 2 – Eliminate Technically Infeasible Options

All of the above mentioned technologies can be applied to control PM₁₀ and PM_{2.5} emission sources due to aggregate handling. There are areas where water suppression may not be practical such as areas that are enclosed. There are also areas where enclosures are not practical, such as process loading bins, where water suppression might be a more effective means of controlling emissions.

Step 3 – Rank Remaining Technically Feasible Control Options

1. Fabric Filter (baghouse) – 99%
2. Enclosed conveyors and transfer points – 95%
3. Water sprays and wet suppression – 90%
4. Wind screens and partial enclosures – 60%

Step 4 – Evaluate Remaining Control Technologies

Fabric Filter (baghouse):

Fabric filters are the standard in the iron and steel industry for PM₁₀ control. Baghouses often are capable of 99% removal efficiencies. Baghouse removal efficiency is relatively level across the particle size range, so that excellent control of PM₁₀ and PM_{2.5} can be obtained. Baghouse installations are technically feasible and are the industry standard for controlling PM₁₀ emissions from some types of material handling.

Enclosed Conveyors and Transfer Points:

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Enclosed conveyor systems prevent strong winds from lifting silt and dust from raw materials as they are moved on a conveyor belt. Enclosed conveyors are frequently used when conveyor systems are designed for dry materials such as coal, aggregates, or grain.

Water Sprays and Wet Suppression:

Water sprays are frequently employed at specific dust-generating points where dry materials are dropped or transferred, such as load bins and transfer/drop points. Water sprays cannot be employed upon materials which have an adverse reaction to water, such as materials with cementitious properties. Water sprays are very effective at controlling dusts by weighing down the dust particles.

Wind Screens and Partial Enclosures:

Wind screens and partial enclosures work in a manner similar to enclosed conveyors, but are not specific to one type of equipment and are frequently erected at drop points and transfer areas to minimize the possibility of strong wind entraining dust particles.

Step 5 – Selection of BACT

BACT is selected to be enclosed conveyors and water sprays at transfer points as the most stringent control option for material handling conveyors. Water sprays, wind shields or partial enclosures are additional control methods which will be employed at specific transfer, conveyance, and drop points where full enclosure is not practical. BACT for the various loading and unloading operations and similar sources as identified by [FF] is collection and control by fabric filters.

B. ANALYSIS OF EXISTING AIR QUALITY

Prevention of Significant Deterioration regulations require an analysis of existing air quality for those pollutants to be emitted in significant amounts from a proposed facility. PM₁₀, PM_{2.5}, SO₂, NO_x, CO, lead and VOC are pollutants of concern in this case.

AERMOD modeling of CO and lead emissions from the proposed project indicates that the maximum offsite ground level concentrations of these pollutants will be below their respective PSD significance levels and preconstruction monitoring level. Therefore, pre-construction monitoring and refined NAAQS modeling for CO and lead were not required.

However, the model predicted that PM₁₀, PM_{2.5}, NO_x, and SO₂ emissions would exceed the significance level; consequently, refined NAAQS modeling and increment consumption analyses were required. There is currently no PSD increment for PM_{2.5}, and so, only further analysis of the

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NAAQS was required.

VOC and NO_x emissions from the proposed facility will exceed 100 tons per year; therefore, an ambient air quality analysis and preconstruction monitoring are required for ozone. A CAMx model was run and showed compliance with the ozone NAAQS.

C. NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS) ANALYSIS

CO and lead were below the respective modeling significance levels for each averaging period in the screening models; NO_x, PM₁₀, PM_{2.5}, and SO₂ were above the modeling significance levels and refined modeling was conducted for these pollutants. The NO_x refined modeling demonstrated compliance with the NAAQS at all receptor locations. PM₁₀, PM_{2.5}, and SO₂ refined modeling demonstrated exceedances at receptor locations in the NAAQS model.

To further refine the PM₁₀, PM_{2.5}, and SO₂ models, Nucor first determined if it had an impact above the significance level at the receptors of concern. Where Nucor's contribution was deemed significant and the receptor was located on other industrial property, the emissions for the facility to which the property belongs were removed from the model. The model was then rerun to determine if any exceedances of the NAAQS occurred. If Nucor's contribution was deemed significant and the receptor was not located on other industrial property, Nucor analyzed whether it had an impact above the significance level at the receptor of concern at the time during which the receptor exceeded the respective standards. Based on the modeling received by LDEQ, no exceedances occur on other industrial property when the property owner's emissions are removed and Nucor is not significant at any of the modeled receptors at the time of an exceedance. The determination of significant contribution to an existing exceedance was performed in accordance with the July 5, 1988 memorandum, subject: "Air Quality Analysis for Prevention of Significant Deterioration", from Gerald A. Emison, Director, Office of Air Quality Planning and Standards to Thomas J. Maslany, Director, Air Management Division.

On November 19, 2009, Nucor submitted a revised modeling protocol for the assessment of PM_{2.5}. The revised protocol proposed the use of the maximum modeled annual average and maximum 8th highest 24-hour average PM_{2.5} concentration to be added to the representative background concentration and compared with the PM_{2.5} NAAQS. For purpose of assessing Nucor's contribution to modeled exceedances, LDEQ selected the most stringent of the proposed SILs, 1.2 µg/m³, despite EPA's acknowledgement that the "SILs derived under this option [option 3] are very stringent for Class II and III areas compared to options 1 and 2" (72 FR 54140). On January 12, 2010, EPA Region 6 approved ERM's modeling protocol.

On February 8, 2010, Nucor submitted an NO₂ dispersion modeling analysis to address the new 1-hour NO₂ NAAQS (100 ppb) signed on January 22, 2010. The final rule entitled "Primary National Ambient Air Quality Standards for Nitrogen Dioxide" was promulgated on February 9,

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2010 (75 FR 6474). At 75 FR 6525, EPA stipulates that:

First, major new and modified sources applying for NSR/PSD permits will initially be required to demonstrate that their proposed emissions increases of NO_x will not cause or contribute to a violation of either the annual or 1-hour NO₂ NAAQS and the annual PSD increment.

EPA, however, has not developed a SIL for the 1-hour averaging period. EPA also addresses the need for a SIL at 75 FR 6525:

We also believe that there may be a need to revise the screening tools currently used under the NSR/PSD program for completing NO₂ analyses. These screening tools include the significant impact levels (SILs), as mentioned by one commenter, but also include the significant emissions rate for emissions of NO_x and the significant monitoring concentration (SMC) for NO₂. EPA intends to evaluate the need for possible changes or additions to each of these important screening tools for NO_x/NO₂ due to the addition of a 1-hour NO₂ NAAQS. If changes or additions are deemed necessary, EPA will propose any such changes for public notice and comment in a separate action.

The maximum permitted emissions from Nucor's sources were modeled on a one-hour averaging period. The empirically derived NO₂/NO_x value of 0.75, as presented in USEPA's "Guidelines on Air Quality Models," was applied to the results. The maximum 8th highest 1-hour average NO₂ concentration was added to the three-year average of the second highest concentration from a background monitor and compared with the NAAQS. Outside sources were not taken into account in the modeling.

Dispersion Model Used: AERMOD

Pollutant	Averaging Period	National Ambient Air Quality Standard {NAAQS}	Calculated Maximum Ground Level Concentration (All sources plus Background)	Allowed Level of Significant Impact	Calculated Maximum Ground Level Concentration (Nucor Contribution)
PM _{2.5}	24-hour	35 µg/m ³	117.93 µg/m ^{3*}	1.2 µg/m ^{3**}	0.9216 µg/m ³
PM _{2.5}	Annual	15 µg/m ³	35.65 µg/m ^{3*}	0.3 µg/m ³	0.0615 µg/m ³
PM ₁₀	24-hour	150 µg/m ³	4152.35 µg/m ^{3*}	5 µg/m ³	1.58 µg/m ³
SO ₂	3-hour	1,300 µg/m ³	8479.19 µg/m ^{3*}	25 µg/m ³	17.28 µg/m ³
SO ₂	24-hour	365 µg/m ³	2181.57 µg/m ^{3*}	5 µg/m ³	3.72 µg/m ³
SO ₂	Annual	80 µg/m ³	361.01 µg/m ^{3*}	1 µg/m ³	0.24 µg/m ³

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Pollutant	Averaging Period	National Ambient Air Quality Standard {NAAQS}	Calculated Maximum Ground Level Concentration (All sources plus Background)	Allowed Level of Significant Impact	Calculated Maximum Ground Level Concentration (Nucor Contribution)
NO _x	Annual	100 µg/m ³	54.0 µg/m ³	-	-
NO _x	1-hour	189 µg/m ³	95.4 µg/m ³ ***	-	-
CO****	1-hour	40,000 µg/m ³	856.2 µg/m ³	-	-
CO****	8-hour	10,000 µg/m ³	475.7 µg/m ³	-	-
Lead****	3 month rolling avg	0.15 µg/m ³	<0.01 µg/m ³	-	-

Dispersion Model Used: AERMOD

Pollutant	Averaging Period	National Ambient Air Quality Standard {NAAQS}	Calculated Maximum Ground Level Concentration*****
PM _{2.5}	24-hour	35 µg/m ³	5.30 µg/m ³
PM _{2.5}	Annual	15 µg/m ³	1.54 µg/m ³
PM ₁₀	24-hour	150 µg/m ³	28.06 µg/m ³
SO ₂	3-hour	1,300 µg/m ³	94.18 µg/m ³
SO ₂	24-hour	365 µg/m ³	38.68 µg/m ³
SO ₂	Annual	80 µg/m ³	8.39 µg/m ³

*The numbers in the permit application represent the original NAAQS modeling. These values represent the highest numbers after refining the model, per the description above.

** Proposed value. EPA proposed a rule entitled "Prevention of Significant Deterioration (PSD) for Particulate Matter Less Than 2.5 Micrometers (PM2.5)—Increments, Significant Impact Levels (SILs) and Significant Monitoring Concentration (SMC)" on September 21, 2007 (72 FR 54112). This rule has not been finalized. In the proposal, EPA suggested 3 SIL values – 5.0 µg/m³, 4.0 µg/m³, and 1.2 µg/m³ (options 1 - 3, respectively).

***Includes Nucor sources only. There is no promulgated or proposed SIL for the 1-hour averaging period.

****From significance modeling. Includes Nucor sources only and does not include background.

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*****These values represent Nucor's sources only; these values include receptors at which an exceedance did not occur and for which it was not necessary to compare Nucor's contribution to the significance level. For short term standards, this number is represented by the highest second high value; this number is used for comparison purposes only. A full description on how compliance was determined is above these tables.

D. PSD INCREMENT ANALYSIS

Because the maximum modeled NO_x, PM₁₀, and SO₂ impacts exceeded their PSD significance level, a determination of PSD increment consumption was required. The NO_x refined modeling demonstrated compliance with the PSD increment level at all receptor locations. PM₁₀ and SO₂ refined modeling demonstrated exceedances at receptor locations in the PSD increment models.

To further refine the PM₁₀ and SO₂ models, Nucor first determined if it had an impact above the significance level at the receptors of concern. Where Nucor's contribution was deemed significant and the receptor was located on other industrial property, the emissions for the facility to which the property belongs were removed from the model. The model was then rerun to determine if any exceedances of the PSD increment occurred. If Nucor's contribution was deemed significant and the receptor was not located on other industrial property, Nucor analyzed whether it had an impact above the significance level at the receptor of concern at the time during which the receptor exceeded the respective standards. Based on the modeling received by LDEQ, no exceedances occur on other industrial property when the property owner's emissions are removed and Nucor is not significant at any of the modeled receptors at the time of an exceedance. The determination of significant contribution to an existing exceedance was performed in accordance with the July 5, 1988 memorandum, subject: "Air Quality Analysis for Prevention of Significant Deterioration", from Gerald A. Emison, Director, Office of Air Quality Planning and Standards to Thomas J. Maslany, Director, Air Management Division.

A Class I area impact analysis was performed to determine the effect of this proposed project on the Breton Sound Class I Area. This Class I area is located approximately 187 kilometers from the Nucor Steel Louisiana Facility. The protocol for the Class I area impact analysis was reviewed and approved by the Federal Land Manager of the Caney Creek Wilderness Area and LDEQ. The Class I area impact analysis included air quality impact, deposition impact, and visibility impairment analyses. The results of these analyses showed that for the three different operating scenarios (normal operation, maintenance case 1A, and maintenance case 2A) the facility will not have an adverse impact on the Class I area. When the modeled value from all surrounding facilities and Nucor's contribution exceed the allowed Class I PSD Increment, then EPA allows Nucor's contribution to be compared to the allowed Level of Significant Impact. At locations where Nucor's contribution was deemed significant, the model determined that the contribution from Nucor and all surrounding facilities did not exceed the allowed Class I PSD Increment.

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Dispersion Model Used: CALPUFF (Class I)

Pollutant	Averaging Period	Allowed Class I PSD Increment	Modeled Class I Increment* (All modeled facilities)	Allowed Level of Significant Impact	NUCOR contribution to Increment
PM ₁₀	24 - hour	8 µg/m ³	0.18 µg/m ³		
SO ₂	3 -hour	25 µg/m ³	62.9 µg/m ³	1.0 µg/m ³	< 1.0 µg/m ³
SO ₂	24 - hour	5 µg/m ³	31.9 µg/m ³	0.2 µg/m ³	< 0.2 µg/m ³
SO ₂	Annual	2 µg/m ³	0.010 µg/m ³		
NO _x	Annual	2.5 µg/m ³	0.0069 µg/m ³		

* When the modeled value from all surrounding facilities and Nucor's contribution exceed the allowed Class I PSD Increment, then EPA allows Nucor's contribution to be compared to the allowed Level of Significant Impact. At locations where Nucor's contribution was deemed significant, the model determined that the contribution from Nucor and all surrounding facilities did not exceed the allowed Class I PSD Increment.

Dispersion Model Used: AERMOD (Class II)

Pollutant	Averaging Period	Class II PSD Increment	Modeled Class II Increment** (All modeled facilities)	Allowed Level of Significant Impact	NUCOR contribution to Increment
PM ₁₀	24 - hour	30 µg/m ³	14,022.9 µg/m ^{3****}	5 µg/m ³	3.22 µg/m ³
SO ₂	3 -hour	512 µg/m ³	8471.4 µg/m ^{3****}	25 µg/m ³	17.28 µg/m ³
SO ₂	24 - hour	91 µg/m ³	2036.1 µg/m ^{3****}	5 µg/m ³	3.73 µg/m ³
SO ₂	Annual	20 µg/m ³	306.1 µg/m ^{3****}	1 µg/m ³	0.24 µg/m ³
NO _x	Annual	25 µg/m ³	7.43 µg/m ³		

Dispersion Model(s) Used: AERMOD (Class II)

Pollutant	Averaging Period	Class II PSD Increment	Modeled Class II Increment****
PM ₁₀	24 - hour	30 µg/m ³	28.06 µg/m ³
SO ₂	3 -hour	512 µg/m ³	94.18 µg/m ³
SO ₂	24 - hour	91 µg/m ³	38.68 µg/m ³
SO ₂	Annual	20 µg/m ³	8.39 µg/m ³

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** When the modeled value from all surrounding facilities and Nucor's contribution exceed the allowed Class II PSD Increment, then EPA allows Nucor's contribution to be compared to the Allowed Level of Significant Impact. Where Nucor's contribution was deemed significant and the receptor was located on other industrial property, the emissions for the facility to which the property belongs were removed from the model. The model was then rerun to determine if any exceedances of the NAAQS or PSD increment occurred. If Nucor's contribution was deemed significant and the receptor was not located on other industrial property, Nucor analyzed whether it had an impact above the significance level at the receptor of concern at the time during which the receptor exceeded the respective standards.

*** The numbers in the permit application represent the original PSD increment modeling. These values represent the highest numbers after refining the model, per the description above.

**** These values represent Nucor's sources only; these values include receptors at which an exceedance did not occur and for which it was not necessary to compare Nucor's contribution to the significance level. For short term standards, this number is represented by the highest second high value; this number is used for comparison purposes only. A full description on how compliance was determined is above these tables.

E. SOURCE RELATED GROWTH IMPACTS

Operation of this facility is expected to have some effect on residential growth and industrial/commercial development in the area of the facility. The surrounding area contains a higher than normal level of unemployment for the state. The resulting jobs will be able to employ many of the area residents. During Phase I, a peak of 2,000 construction workers will be directly employed in erecting the project facilities. During the construction of Phase II, an additional 1,250 construction jobs will be directly created by the project.

In addition to direct employment at the facility, local employment will be indirectly generated because of the project. Indirect employment results from businesses, contractors and suppliers that will be required to support the people and activities present during both construction and operation of the project. Examples of indirect jobs may be freight transportation of concrete and other construction materials, warehousing, professional services such as engineering and surveying, and infrastructure construction.

Additionally, the spending of direct, indirect, and public monies generates additional employment in the local economy, a phenomenon often referred to as the multiplier effect. This employment, defined as induced employment, results from increased spending on:

- housing;
- food;
- clothing;
- leisure activities;

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- personal services, such as hairdressing and cleaning;
- business services, such as banking;
- transportation;
- utilities; and
- public services, such as education and healthcare.

The project is expected to generate almost 2,500 indirect and induced jobs in the region as a result of the two construction phases. Indirect jobs will be related primarily to construction at the plant and induced jobs will be associated mostly with the wholesale and retail trade sector and the professional, scientific, and technical sector. As a result, there will not be any significant increases in pollutant emissions indirectly associated with Consolidated Environmental Management Inc's proposal. Secondary growth effects will include temporary construction related jobs and approximately 795 permanent jobs.

F. SOILS, VEGETATION, AND VISIBILITY IMPACTS

Currently, the majority usage of the property is for sugar cane production, although a portion of the Entergy and Peabody properties are undeveloped except for pipeline and utility easements. The vast majority of wetland areas on the property will be undisturbed. However, some small impacts to wetlands on the property will be unavoidable. Small portions of existing wetland areas will need to be removed from the existing system for construction of the entrance road, site grading, building construction, and pile driving for the Mississippi River docks. Any wetlands removed from the property will be mitigated as required under the Section 404 of the Clean Water Act (CWA), as administered by the US Army Corps of Engineers.

The extreme northeastern corner of the proposed site is within 1,000 feet of the boundary of the Maurepas Swamp State Wildlife Management Area (WMA), which is considered a critical habitat. Given its distance from the site, and the zero-discharge design of the facility, impacts to the Maurepas Swamp WMA due to project construction or operational activities are not expected.

Operational plans at Nucor Steel Louisiana do not include the production or storage of large quantities of chemicals at the site and the risks of soil impacts are expected to be small during both the construction and operational phases of the facility. During operation, Nucor shall collect and use rain water to the maximum extent possible, mitigating the potential for erosion or sedimentation. The construction team shall use dust suppression techniques (i.e., water spraying) on construction roadways and corridors if and whenever necessary to prevent or mitigate nuisance dust. There will be no significant impact on area soils, vegetation, or visibility.

G. CLASS I AREA IMPACTS

Louisiana's Breton Wildlife Refuge, the nearest Class I area, is over 100 kilometers from the site. The

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Federal Land Manager has designated criteria for determining the impact of industrial activities upon air quality-related values upon Class I areas, including visibility, and which facilities are subject to such review. Air dispersion modeling for receptor points at Breton was performed using methods and protocols approved by the FLM. The air dispersion modeling does not indicate any significant impacts to visibility or visual amenity of Breton Island.

H. TOXIC EMISSIONS IMPACT

The selection of control technology based on the BACT analysis included consideration of control of toxic emissions. In addition, many of the emission sources are subject to either 40 CFR 63 Subpart L, CCCCC or FFFFF. Many of the BACT limitations are more stringent than those established by NESHAP.

V. CONCLUSION

The Air Permits Division has made a preliminary determination to approve the construction of Consolidated Environmental Management Inc - Nucor Steel Louisiana near Convent, St. James Parish, Louisiana, subject to the attached specific conditions. In the event of a discrepancy in the provisions found in the application and those in this Preliminary Determination Summary, the Preliminary Determination Summary shall prevail.

SPECIFIC CONDITIONS

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- The permittee is authorized to operate in conformity with the specifications submitted to the Louisiana Department of Environmental Quality (LDEQ) as analyzed in LDEQ's document entitled "Preliminary Determination Summary" dated September 25, 2008 and subject to the following emissions limitations and other specified conditions. Specifications submitted are contained in the application and Emission Inventory Questionnaire dated July 26, 2009.

MAXIMUM ALLOWABLE EMISSIONS RATES

Unit	ID No.	Description		PM ₁₀	SO ₂	NO _x	CO	VOC
Blast Furnace / Hot Blast Stoves	RLP015	STV-101-Blast Furnace 1 Hot Blast Stoves Common Stack	lb/MM Btu BFG gr/dscf	0.001	0.00874	0.06	0.0824	0.0054
	RLP016	STV-201-Blast Furnace 2 Hot Blast Stoves Common Stack	Nat. Gas gr/MMscf Specific Condition #		2500 # 2, # 3		# 4	# 4
Cast House	EQT015	CST-101- Cast House 1 Baghouse Vent	gr/dscf	0.003 ¹	0.04		0.055	
	EQT016	CST-201- Cast House 2 Baghouse Vent	lbs/ton hot metal	0.00155				
Coke Oven Gas	RLP006	COK-111-Coke Battery 1 Flue Gas Desulfurization Stack	lbs/ton wet coal charged	0.00863	# 2, # 3	0.71	0.05	0.0035
	RLP012	COK-211-Coke Battery 2 Flue Gas Desulfurization Stack	Specific Condition #					
Blast Furnace and Coke Oven Coal Preparation	RLP013	PCI-101 - PCI Mill Vent	Specific Condition #	# 12	# 3	PCI-101 only	# 4	# 4
	ARE001	COK-100 - Coke Ovens Coal Handling, Crushing, and Compacting			PCI-101 only		PCI-101 only	PCI-101 only
	EQT004	COK-104 - Coke Battery 1 Coke Handling					PCI-101 only	
	EQT010	COK-204 - Coke Battery 2 Coke Handling	lb/MM Btu		0.049			
Coke Oven Charging	EQT001	COK-101 - Coke Battery 1 Coal Charging	lbs/ton dry coal charged	0.0081 ²				
	EQT007	COK-201 - Coke Battery 2 Coal Charging						
Coke Oven Pushing	EQT002	COK-102 - Coke Battery 1 Coal Pushing	lbs/ton coke pushed	0.04 ¹	0.098	0.019	0.0638	0.077
	EQT008	COK-202 - Coke Battery 2 Coal Pushing	Specific Condition #	# 5	# 5	# 5	# 5	# 5
Coke Quenching	EQT003	COK-103 - Coke Battery 1 Coke Quench Tower	Milligrams/liter TDS	≤1100 ⁴				
	EQT009	COK-203 - Coke Battery 2 Coke Quench Tower						

¹NESHAP Limit

²LDEQ has determined that compacted coal charging technology will meet the MACT emission limitation of 0.0081lb/ton of dry coal charged, required under 40 CFR 63.303(d)(2).

³LDEQ has determined that flat car pushing technology will meet the MACT emission limitation of 0.04 lb of filterable PM₁₀ per ton of coke pushed required under 40 CFR 63.7290.

⁴This technology will meet the MACT emission limitation of ≤ 1,100 milligrams per liter TDS concentration, required under 40 CFR 63.7295(a)(1)(i).

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Unit	ID No.	Description		PM ₁₀	SO ₂	NO _x	CO	VOC
Slag Granulation & Slag Milling	EQT036	SLG-101 - Slag Granulator 1 Granulation Tank 1	Specific Condition #	# 6				
	EQT037	SLG-102 - Slag Granulator 1 Granulation Tank 2	Specific Condition #	# 6				
	EQT038	SLG-201 - Slag Granulator 2 Granulation Tank 1	Specific Condition #	# 6				
	EQT039	SLG-202 - Slag Granulator 2 Granulation Tank 2	Specific Condition #	# 6				
	EQT040	SLG-301 - Air-Cooled Slag Processing Load Bin	Specific Condition #	# 6				
	EQT041	SLG-302 - Air-Cooled Slag Processing Primary Crusher	Specific Condition #	# 6				
	EQT042	SLG-303 - Air-Cooled Slag Processing Primary Screening	Specific Condition #	# 6				
	EQT043	SLG-304 - Air-Cooled Slag Processing Secondary Crusher	Specific Condition #	# 6				
	EQT044	SLG-305 - Air-Cooled Slag Processing Secondary Screen	Specific Condition #	# 6				
	ARE011	SLG-306 - Air-Cooled Slag Processing Stockpiles	Specific Condition #	# 6				
	EQT045	SLG-401-Slag Mill Wet Slag Feed Bin	Specific Condition #	# 6				
	RLP014	SLG-402 - Slag Mill Dryer Stack	Specific Condition #	# 7	# 3	0.049 lbs/MM Btu.	# 4	# 4
	EQT046	SLG-403 - Slag Mill Dryer Baghouse Vent	Specific Condition #	# 7				
	EQT047	SLG-404 - Slag Mill Dry Slag Feed Bin Baghouse Vent	Specific Condition #	# 7				
	EQT048	SLG-405 - Slag Mill Crushers/Screeners Baghouse Vent	Specific Condition #	# 7				
	EQT049	SLG-406 - Slag Mill Building Baghouse Vent	Specific Condition #	# 7				
	EQT050	SLG-407 - Slag Mill Transfer Points Baghouse Vent	Specific Condition #	# 7				
	EQT051	SLG-408 - Slag Mill Product Silo Baghouse Vent	Specific Condition #	# 7				
EQT052	SLG-409 - Slag Mill Loading Collector Baghouse Vent	Specific Condition #	# 7					
Blast Furnace Slag Pits	ARE005 ARE006 ARE007 ARE008 ARE009 ARE010	SLG-104 - Blast Furnace 1 Slag Pit 1 SLG-105 - Blast Furnace 1 Slag Pit 2 SLG-106 - Blast Furnace 1 Slag Pit 3 SLG-204 - Blast Furnace 2 Slag Pit 1 SLG-205 - Blast Furnace 2 Slag Pit 2 SLG-206 - Blast Furnace 2 Slag Pit 3	Specific Condition #	# 8				

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Unit	ID No.	Description		PM ₁₀	SO ₂	NO _x	CO	VOC
Topgas Boilers	EQT023	PWR-101 - Topgas Boiler No. 1	gr/dscf	0.007 ⁵				
	EQT024	PWR-102 - Topgas Boiler No. 2						
	EQT025	PWR-103 - Topgas Boiler No. 3	lb/MM Btu			0.092	0.0824	0.0054
	EQT026	PWR-104 - Topgas Boiler No. 4						
	EQT027	PWR-105 - Topgas Boiler No. 5						
	EQT028	PWR-106 - Topgas Boiler No. 6						
	EQT029	PWR-107 - Topgas Boiler No. 7						
	EQT030	PWR-108 - Topgas Boiler No. 8	Specific Condition #		# 2, # 3		# 4	# 4
Sinter Plant	EQT031	SIN-101 - MEROS System Vent Stack	lbs/ton finished sinter	0.3 ⁶		0.495	17.942	0.0945
	EQT032	SIN-102 - Sinter Plant Main Dedusting Baghouse Vent	gr/dscf	0.002	0.437			
Cooling Towers	EQT060	TWR-101 - Blast Furnace Cooling Tower	milligrams/liter TDS	≤1100				
	EQT061	TWR-102 - Iron Solidification Cooling Tower						
	EQT062	TWR-103 - Air Separation Plant Cooling Tower	Specific Condition #	# 9				
Storage Piles	FUG001	PIL-101 - Coal Storage Piles						
	FUG002	PIL-102 - Iron Ore Pellet Storage Piles						
	FUG003	PIL-103 - Flux Storage Piles						
	FUG004	PIL-104 - Pig Iron Storage Piles						
	FUG005	PIL-105 - Granulated Slag Storage Piles						
	FUG006	PIL-106 - Sinter Storage Piles	Specific Condition #	# 10				
	FUG007	PIL-107 - Coke Breeze Storage Piles						
	FUG008	PIL-108 - Mill Scale Storage Piles						
Road Dust	ARE002	FUG-101 - Unpaved Road Fugitive Dust						
	ARE003	FUG-102 - Paved Road Fugitive Dust	Specific Condition #	# 11				
Hot Metal Handling	EQT021	PIG-101 - Pig Iron Desulfurization Station Baghouse Vent	lbs/ton hot metal processed	0.009				
	EQT022	PIG-102 - Pig Iron Solidification Baghouse Vent	lbs/ton hot metal processed	0.00084				
Stock House; Sinter Material Handling	EQT033	SIN-103 - Coke and Petcoke Crushing Dedusting Baghouse Vent						
	EQT034	SIN-105 - Sinter FGD Lime Silo Unloading						
	EQT035	SIN-106 - Sinter FGD Waste Loading						
	EQT053	STC-101 - Stock House 1 Baghouse Vent	Specific Condition #	# 12				
	EQT054	STC-201 - Stock House 2 Baghouse Vent						

⁵ When firing 90% Blast Furnace TopGas and 10% natural gas.

⁶ This emission rate is the MACT emission limitation of 0.3 lb/ton of product sinter, required under 40 CFR 63.7790(a).

⁷ This is the MACT emission limitation for the discharge end and sinter cooler at a new sinter plant, required under 40 CFR 63.7790(a).

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Unit	ID No.	Description		PM ₁₀	SO ₂	NO _x	CO	VOC
Material Handling and Transfer	EQT017	DOC-101 - Dock 1 Loading/Unloading Gantry Crane	Specific Condition #	# 13				
	EQT018	DOC-102 - Dock 2 Loading/Unloading Gantry Crane						
	EQT019	DST-101-Blast Furnace 1 Topgas Dust Catcher						
	EQT020	DST-201-Blast Furnace 2 Topgas Dust Catcher						
	ARE004	FUG-103 - Conveyor Fugitives						
	EQT059	TRN-101 - Wagon Tipper						
Material Handling and Transfer	EQT005	COK-112 - Coke Battery 1 FGD Lime Silo Unloading	Specific Condition #	# 12				
	EQT006	COK-113 - Coke Battery 1 FGD Waste Loading						
	EQT011	COK-212 - Coke Battery 2 FGD Lime Silo Unloading						
	EQT012	COK-213 - Coke Battery 2 FGD Waste Loading						
	EQT013	COK-214 - Coke Bin Tower						
	EQT014	COK-215 - Coke Screening						

2. BACT is also selected as a maximum content of 1.25% sulfur in the coal.
3. BACT for SO₂ from natural gas combustion is to purchase natural gas containing no more than 2500 gr of Sulfur per MM scf for the Blast Furnace/Hot Blast Stoves/Top Gas Boilers/PCI Mill Vent/ Slag Mill Dryer Stack.
4. BACT for CO and VOC is selected to be good combustion practices during the operation of the Blast Furnace/Hot Blast Stoves/Top Gas Boilers/PCI Mill Vent/Slag Mill Dryer Stack.
5. BACT is selected to be compacted coal and flat car pushing, which represents an Inherently Lower Polluting Process.
6. BACT is selected to be wet suppression of dust generating sources (slag granulation) by water sprays. This technology is inherent to the granulated slag process.
7. BACT for the granulated slag milling process is selected as collection and control by fabric filters. The bag filters will have a minimum of 99.5% control efficiency.
8. BACT is determined to be wet suppression of dust generating sources by water sprays at the slag pits after air cooling and prior to removal by a mechanical loader.
9. BACT is selected to be a combination of less than 1,100 milligrams per liter TDS concentration in the cooling water and drift eliminators employing a drift maximum of 0.0005%.

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10. BACT is selected to be implementation of wet suppression of dust generating sources by water sprays at each storage pile site. Roadways shall be sprayed to reduce emissions.
11. BACT for road dust is to pave roadways where practicable including areas where the extra heavy vehicles (greater than 50 tons in weight) will not cause damage to paving. Watering and sweeping will be used on paved roads along with reduced speed limits of less than or equal to 15 mph. Unpaved roads shall utilize water spray or dust suppression chemicals to reduce emissions. Additionally, reduced speed limits of less than or equal to 15 mph will be enforced on all unpaved roadways.
12. BACT is selected as collection and control by fabric filters.
13. BACT is selected to be enclosed conveyors as the most stringent control option for material handling conveyors. Water sprays and partial enclosures are additional control methods which will be employed at specific transfer and drop points. BACT for the various loading and unloading operations and similar sources is selected as collection and control by fabric filters.

TABLE I: BACT COST SUMMARY

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NOTE: No alternatives were eliminated solely due to costs, however, additional information was prepared for some costs of control

Control Alternatives	Availability/ Feasibility	Negative Impacts (a)	Control Efficiency	Emissions Reduction (TPY)	Capital Cost (\$)	Annualized Cost (\$)	Cost Effectiveness (\$/ton)	Notes
STV-101 – Hot Blast Stoves (RLP0015)								
NO _x	Not Feasible			161.23	Not considered		\$59,101.48/ton	Fuel cost only
COK-102 – Coke Oven Pushing (EQT0002)								
PM ₁₀	Not most effective	1,3,4	95%	6.8	\$388,400	\$199,645	\$33,439	Emission reduction is after coal combustion
SIN-101 – MEROS System Vent (EQT0032)								
CO		451.27 tpy NO _x						Excessive NO _x

Notes: a) Negative impacts: 1) economic, 2) environmental, 3) energy, 4) safety

TABLE II: AIR QUALITY ANALYSIS SUMMARY

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For additional explanation of this Table, see Sections B, C and D from the Preliminary Determination Summary and the Air Quality Impact Analysis from the Briefing Sheet sections.

Pollutant	Averaging Period	Preliminary Screening Concentration (µg/m ³)	NAAQS (µg/m ³)	Current Monitored Background Concentration (µg/m ³)	Maximum Modeled Concentration (µg/m ³)	Modeled + Background Concentration (µg/m ³)	Modeled PSD Increment Consumption (µg/m ³)	Allowable Class II PSD Increment (µg/m ³)	Level of Significant Impact (µg/m ³)	Calculated Maximum Ground Level Concentration (Nucor Contribution) (µg/m ³)
PM ₁₀	24-hour	35.9	150	56	4152.35	4208.35	14,022.9	30	5	1.58 µg/m ³
SO ₂	3-hour	94.5	1300	91.7	8479.19	8570.89	8,471.4	512	25	17.28 µg/m ³
	24-hour	43.8	365	44.5	2181.57	2239.17	2,036.1	91	5	3.72 µg/m ³
NO _x	Annual	8.4	80	13.1	361.01	374.11	306.1	20	1	0.24 µg/m ³
	Annual	2.2	100	9.4	44.6	54.0	7.43	25	1	-
CO	1-hour	856.2	40,000	NR	NR	NR	NR	-	2000	-
	8-hour	475.7	10,000	NR	NR	NR	NR	-	500	-

NR = Not required