NORTH CAROLINA DIVISION OF AIR QUALITY

Application Review and Preliminary Determination

Issue Date: TBD

Region: Winston-Salem Regional Office
County: Davidson
NC Facility ID: 2900394
Inspector's Name: N/A
Date of Last Inspection: N/A
Compliance Code: N/A

Facility Data

Applicant (Facility's Name): Nucor Steel Lexington

Facility Address:
Nucor Steel Lexington
6776 East US Highway 64
Lexington, NC 27292

SIC: 3312 / Blast Furnaces And Steel Mills
NAICS: 331110 / Iron and Steel Mills and Ferroalloy Manufacturing

Facility Classification: Before: N/A **After:** Title V
Fee Classification: Before: N/A **After:** Title V

Permit Applicability (this application only)

SIP: 02D: .0516, .0521, .0524, .0530, .0540, .0544, .0614, .1100, .1111, .1806
02Q: .0317, .0504, .0711
NSPS: Subparts AAa, IIII, JJJJ
NESHAP: Subparts ZZZZ, YYYYY, CCCCCC
PSD: New major source
PSD Avoidance: 02Q .0317 (Fluoride)
NC Toxics: 02Q .0711, 02D .1100
112(r): No RMP required
Other: HAP-major source avoidance

Contact Data

Facility Contact	Authorized Contact	Technical Contact
Matt Way Environmental Manager (908) 241-6116 PO Box 687 Lexington, NC 27293	Mike Hess VP and General Manager (704) 360-4051 PO Box 687 Lexington, NC 27293	Matt Way Environmental Manager (908) 241-6116 PO Box 687 Lexington, NC 27293

Application Data

Application Number: 2900394.22A
Date Received: 07/15/2022
Application Type: Greenfield Facility
Application Schedule: PSD

Existing Permit Data

Existing Permit Number: N/A
Existing Permit Issue Date: N/A
Existing Permit Expiration Date: N/A

Total Actual emissions in TONS/YEAR:

CY	SO2	NOX	VOC	CO	PM10	Total HAP	Largest HAP

<No Inventory>

Review Engineer: Russell Braswell

Review Engineer's Signature: **Date**:

Comments / Recommendations:
Issue 10754/R00
Permit Issue Date: TBD
Permit Expiration Date: TBD+8 years

Application Review

Table of Contents

1.0 Introduction and Purpose of Application

1.1 Facility Description

Nucor Corporation ("Nucor") proposes to construct a new steel mill in Lexington, Davidson County, North Carolina. The proposed facility will operate under the name "Nucor Steel Lexington" (hereafter referred to as "the facility" or "the proposed project").

Nucor proposes to build a steel mill consisting of an electric arc furnace (EAF), a secondary furnace (referred to as a "ladle metallurgy furnace" or LMF), a caster, and a rolling mill. In addition, the facility will include several supporting activities, such as scrap receiving and handling, furnace maintenance and repair, silos, haul roads, etc. Nucor will produce steel using recycled scrap; according to the application, iron ore will not be processed at the proposed mill (Application at 1-1). The proposed facility will have an annual capacity of 515,000 tons of steel produced per year and a maximum hourly throughput of 80 tons per hour. Throughout the application, Nucor refers to the facility as a "micro mill." According to the application, micro mills are a subset of "minimills."[1] In the application, Nucor explains the difference:

> "Micro mills are a smaller-sized mini mill. The difference between a mini mill and a micro mill is a mini mill has an intermediate process which includes a reheat furnace which heats the billets allowing them to be rolled into sheets or other materials. Micro mills typically only produce rebar and not reheat it into another product." (Application at Appendix F, page 2-4)

The application also states that the operations at the proposed facility will be similar to Nucor Steel Sedalia and Nucor Steel Florida (Application at 4-2). In correspondence received after the application, Nucor stated that Nucor Steel Sedalia and Nucor Steel Florida both employ a system for continuously charging scrap to the EAF, whereas the EAF at the proposed project will be charged in batches ("buckets"). Additionally, Nucor is constructing another batch-charged EAF in Kingman, AZ, which will be similar to the proposed facility at Lexington (email from Matt Way, December 9, 2022).

Due to the expected emissions of the project, this facility will be a major source under Prevention of Significant Deterioration (PSD). Per 15A NCAC 02D .0530(r), the permit application shall be processed in accordance with the public participation procedures and requirements of 40 CFR 51.166(q). The draft permit will be sent out for public comment for a period of 30 days (to the Region, the US Environmental Protection Agency (US EPA), local newspaper, applicant, affected states, local city/county executives, and FLM as necessary).

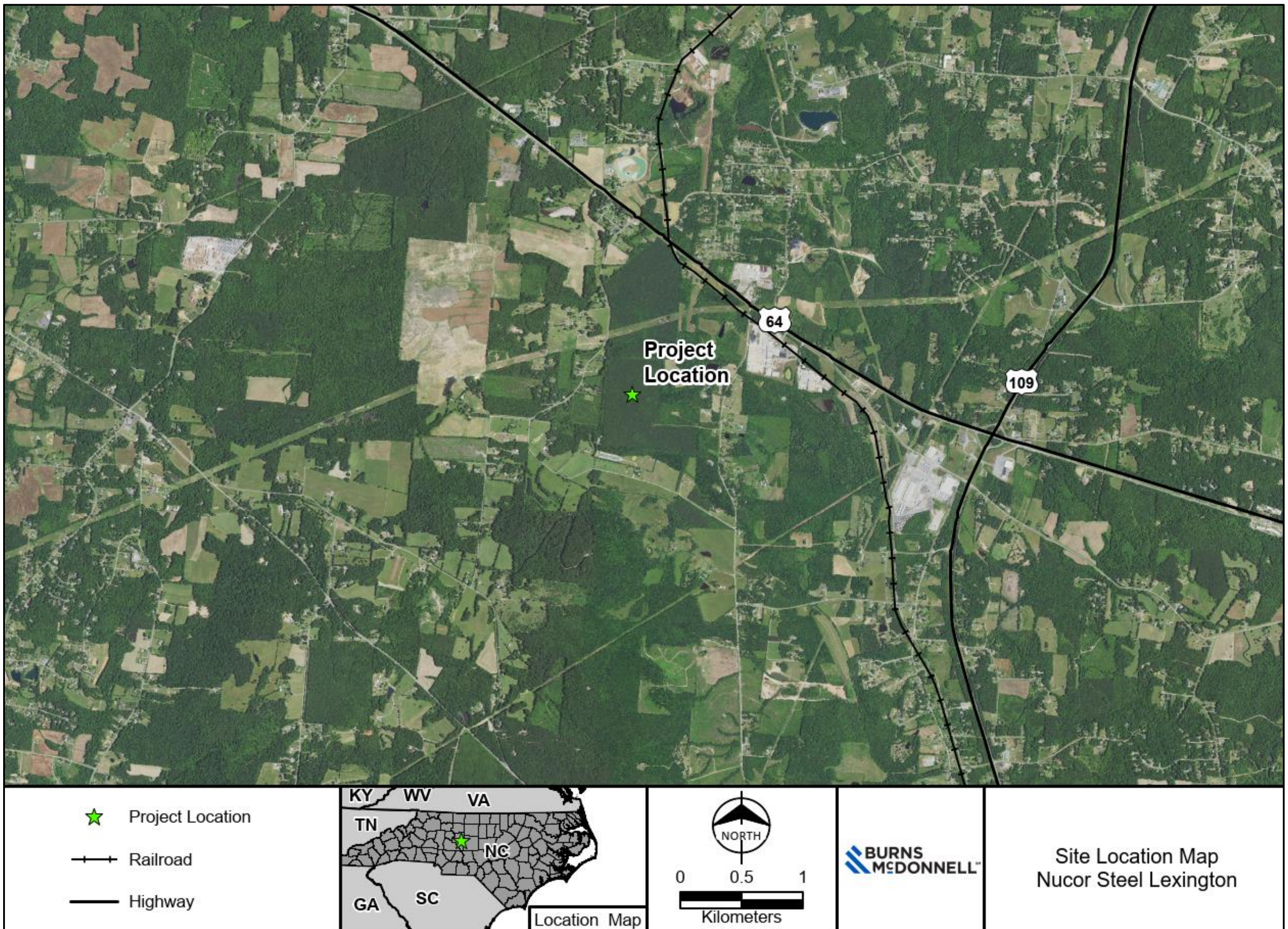
Nucor requested that this application be processed in accordance with 15A NCAC 02Q .0504 (a.k.a. the two-step process). Therefore, DAQ will process this application pursuant to the requirements in 15A NCAC 02Q .0300 and 15A NCAC 02D .0530.

1.2 Facility Location

The facility will be located at 6776 East US Highway 64, Lexington, NC. Lexington is located in Davidson County, which is not classified as nonattainment for any pollutants subject to the National Ambient Air Quality Standards (NAAQS). See Figure 1 for a satellite view of the proposed location.

[1] See AP-42 Chapter 12.5.1 "Steel Minimills" for further discussion of minimills.

Figure 1: Proposed Site Location[2]



1.3 Permitting History

The proposed facility will be new and built on currently undeveloped land (a.k.a. a "greenfield" facility). Nucor Corporation has been issued air quality permits for facilities elsewhere in North Carolina, but not at this proposed location.

1.4 Application Chronology

Date	Event
May 20, 2022	Pre-application meeting with Nucor and DAQ.
July 15, 2022	Application received.
July 26, 2022	Application amendment received. This amendment made minor corrections to the original application submittal.
July 27, 2022	Nucor submitted a copy of zoning consistency determination request sent to the Planning and Zoning Department of Davidson County.

[2] This image was prepared by Burns & McDonnell (a firm representing Nucor) and included in the application as "Appendix B." It was modified slightly to fit the formatting of this application review.

Date	Event
July 29, 2022	Nucor submitted the air dispersion modeling demonstration.
August 19, 2022	DAQ determined that the application, as received, was incomplete. DAQ sent a letter to Nucor requesting: 1. The air dispersion modeling be updated to include emissions from the neighboring wood products factory, 2. More information as to how the parameters used in the air dispersion modeling were developed, 3. An example of a contract signed before May 16, 2022 (for NSPS Subpart AAb applicability), 4. Information as to how the Melt Shop fugitive emissions were calculated, and 5. A more complete BACT determination for the Caster, Caster Spray Stack, and Rolling mill.
September 2, 2022	Nucor submitted a response to the August 19 letter.
September 8, 2022	Nucor submitted an updated modeling demonstration to address item #1 in the August 19 letter.
September 23, 2022	Email sent to Nucor requesting an updated and corrected CAM plan.
September 26, 2022	Nucor submitted an updated CAM plan.
September 28, 2022	Email sent to Nucor requesting the following information: 1. Information regarding the difference in scrap mixes between Nucor Lexington and other micro mills, 2. The basis for fluoride emission factors, and 3. The basis for PM emission factors for the Caster.
October 3, 2022	Nucor submitted a response to the September 28 email.
October 11, 2022	DAQ determined that the application was complete.
October 12, 2022	Comments received from US EPA Region 4 regarding the air dispersion modeling with the application: 1. The SO_2 and NOx modeling is based on a 30-day rolling average limit for the BACT, but both of these pollutants have 1-hour NAAQS. There should either be a 1-hour emission limit, or documentation for paragraph 8.2.2(c) and Table 8-2 of 40 CFR Appendix W. 2. Explain why the SIL for 1-hour NO_2 is different in the application than the interim SIL recommended by EPA. 3. Explain why the SIL for 1-hour SO_2 is different in the application than the interim SIL recommended by EPA. 4. Request additional justification regarding receptor placement along unfenced areas.
October 24, 2022	Nucor provided a response to the Region 4 comments (paraphrased): 1. 30-day rolling averages have been used to demonstrate compliance for EPA rules in the past, such as consent decrees and NSPS limits. Furthermore, the modeled SO_2 and NO_2 emission rates could be multiplied by 10 and still show compliance with the 1-hour NAAQS. 2. NC DEQ adopted state-specific SILs. 3. The entire property will be fenced-in.
October 27, 2022	EPA Region 4 stated concurrence with most of Nucor's responses, but also said Region 4 is "still evaluating" Nucor's response regarding the 30-day averaging times.
November 14, 2022	Email sent to Nucor requesting the following information: 1. More information regarding fluoride emissions from the facility, and 2. More information regarding the difference in emissions from a continuous steel mill versus a batch steel mill.
November 18, 2022	Nucor submitted a response to the November 14 email.

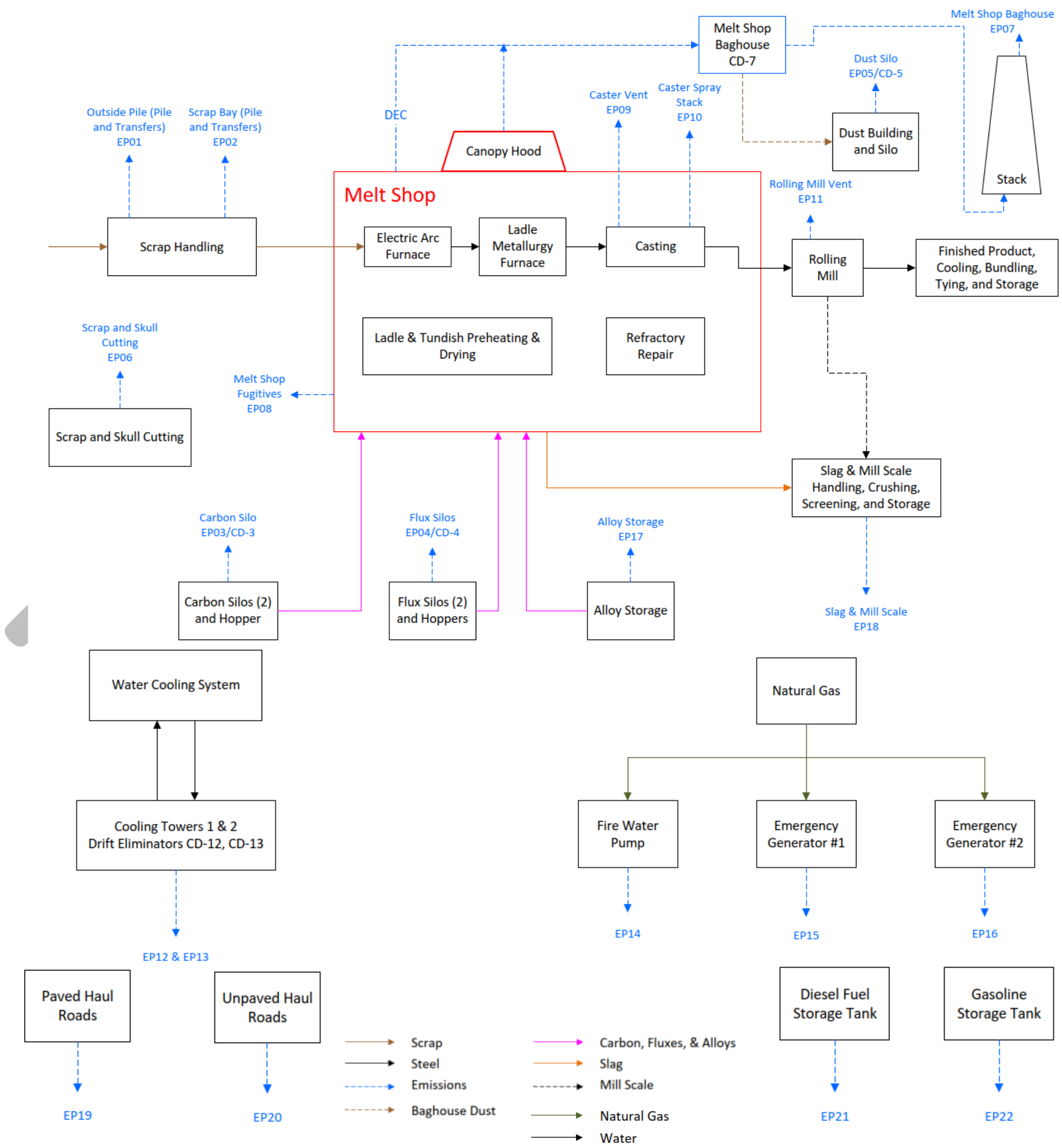
Date	Event
December 6, 2022	Email sent to Nucor requesting the following information: 1. Need to clarify the basis for PM BACT limit for the Melt Shop, 2. General questions regarding Nucor's planned reopening of a micro mill in Kingman, Arizona, 3. Examples of steel mills being converted from a continuous feed method to a batch feed method, 4. The basis for the BACT limit for the drift eliminators in the cooling towers, and 5. Clarify which natural gas-fired sources can be equipped with low-NOx burners.
December 9, 2022	Nucor submitted a response to the December 6 email.
December 14, 2022	Email sent to Nucor regarding: 1. The apparent difference in the PM BACT limit for CMC Steel Oklahoma and this application, and 2. More information regarding sources with low-NOx burners.
December 16, 2022	Nucor submitted a response to the December 14 email. In this email, Nucor proposed an additional BACT limit for PM (filterable) from the Melt Shop.
December 19, 2022	Email sent to Nucor regarding the BACT limit proposed in the December 16 email. Nucor responded by email the same day with a correction to the proposed BACT limit.
January 5, 2023	In-person meeting between Nucor staff and DAQ staff regarding the ongoing status of the application. In addition, Nucor asked questions regarding allowable pre-construction activities.
January 10, 2023	Nucor sent a request for an applicability determination regarding the construction of a finished goods warehouse on-site before the PSD permit was issued. DAQ treated this as a separate application (applicability determination #3912)
January 13, 2023	DAQ responded to applicability determination #3912. DAQ determined that construction of the finished goods warehouse was not allowed before the PSD permit was issued.
February 24, 2023	DAQ issued a memorandum approving the PSD impact analysis and TAP dispersion modeling.
February 24, 2023	An initial internal draft of the permit and preliminary determination were sent to Booker Pullen (PSD Supervisor, DAQ) for review.
February 27, 2023	EPA Region 4 sent an email asking for updated modeling data and stated that the averaging period issue first discussed in October 12 comment was still outstanding.
February 28, 2023	Email sent to Nucor regarding potential limits to demonstrate compliance with the 1-hour NAAQS for SO_2 and NO_2.
March 1, 2023	In a phone call with Matt Way [Environmental Manager, Nucor], Nucor stated that an additional 1-hour "backstop" limit for the SO_2 and NO_2 NAAQS was not desirable. DAQ will instead include additional discussion in the preliminary determination regarding the 1-hour NAAQS for SO_2 and NO_2.
March 3, 2023	Rahul Thaker (Title V Permits Supervisor, DAQ) provided comments on the initial draft permit.
March 6, 2023	An updated internal draft of the permit and preliminary determination were sent to Booker Pullen (PSD Supervisor, DAQ) for review.
March 9, 2023	Booker Pullen (PSD Supervisor, DAQ) provided comments on the preliminary determination.
March 10, 2023	A revised draft of the permit and preliminary determination were sent to Nucor staff, Regional Office staff, and Central Office staff.
March 14, 2023	Samir Parekh (Engineer, Compliance Branch, DAQ) responded with comments on the draft permit and preliminary determination.
March 14, 2023	Email sent to Nucor regarding the CAM plan averaging period.
March 15, 2023	Nucor responded with comments on the draft permit and preliminary determination. This response also included a response to the above CAM plan question.
March 16, 2023	Jim Hafner (Permits Coordinator, WSRO, DAQ) responded with comments on the draft permit.

Date	Event
March 16, 2023	A second draft of the permit was sent to Nucor staff. This draft addressed all comments received on the March 10 draft.
March 17, 2023	Nucor responded to the second draft permit and preliminary determination.
March 20, 2023	A final pre-public notice draft of the permit and preliminary determination were sent to Nucor. This draft addressed the minor comments on the March 17 draft.
XXXXXX	Public notice
XXXXXX	Permit issued

2.0 Proposed Emission Sources and Emission Calculations

This facility will be a steel mill. The broad overview of the steelmaking process at the proposed facility: steel scrap (not iron ore) will be brought on-site and then sent to the electric arc furnace (EAF) where it will be melted into molten steel. The EAF will be charged using buckets (as opposed to a continuous feed present at some other micro mills). The molten steel is poured out of the EAF into a ladle. The full ladle is transported to the ladle metallurgy furnace (LMF) where it will be adjusted with additional materials, such as alloys, until the desired material properties are met. After melting, the molten steel is cast into billets. The billets are cooled in a water spray chamber and then sent to a rolling mill to press and stretch the steel billet into the final desired shape. The final use for the steel produced at this mill will be rebar. See Figure 2 for a process flow diagram of the proposed facility.

Figure 2: Process Flow Diagram[3]



[3] This image was prepared by Burns & McDonnell (a firm representing Nucor) and included in the application as "Appendix C." It was modified slightly to fit the formatting of this application review.

2.1 Proposed Emission Sources

The table below will appear in Section 1 of the Title V permit and include each permitted emission source at the facility. The ID numbers in this table will be used throughout the rest of this application review.

Table 1: List of Permitted Emission Sources

Emission Source ID No.	Emission Source Description	Control Device ID No.	Control Device Description
Melt Shop (ES-1)			
ES-1-1 **NSPS AAa,** **GACT YYYYY,** **PSD BACT**	Electric arc furnace (EAF) equipped with direct evacuation control (DEC), oxy-fuel burners, and natural gas-fired EAF modules and service cutting torches (46.74 million Btu per hour maximum combined heat input)	CD-7	Melt Shop Baghouse
ES-1-2 **GACT YYYYY,** **PSD BACT**	Ladle metallurgy furnace (LMF)		
ES-1-3 **GACT YYYYY,** **PSD BACT**	EAF refractory dumping and repair		
ES-1-4 **GACT YYYYY,** **PSD BACT**	Slag dumping and slag pit		
ES-1-5 **GACT YYYYY,** **PSD BACT**	Melt shop material transfers		
ES-1-6 **GACT YYYYY,** **PSD BACT**	Natural gas-fired nozzle preheater, equipped with a low NOx burner (0.05 million Btu per hour maximum heat input)		
ES-1-FUG **NSPS AAa,** **GACT YYYYY,** **PSD BACT**	Melt shop fugitives	NA	NA
Casting Operations (ES-2)			
ES-2-1 **PSD BACT**	Caster	NA	NA
ES-2-2 **PSD BACT**	Ladle and tundish refractory dumping and repair	NA	NA

Emission Source ID No.	Emission Source Description	Control Device ID No.	Control Device Description
ES-2-3 **PSD BACT**	Natural gas-fired burners for ladle/tundish drying and ladle/tundish preheaters, each equipped with low-NOx burners (61.89 million Btu per hour maximum total heat input)	NA	NA
ES-2-4 **PSD BACT**	Natural gas-fired service cutting torches (0.8 million Btu per hour total heat input)	NA	NA
Water spray chamber below caster and caster spray stack (ES-3)			
ES-3 **PSD BACT**	Water spray chamber below caster and caster spray stack	NA	NA
Rolling Operations (ES-4)			
ES-4-1 **PSD BACT**	Rolling Mill	NA	NA
ES-4-2 **PSD BACT**	Natural gas-fired service cutting torches in the Rolling Mill (0.8 million Btu per hour maximum total heat input)	NA	NA
Torches for scrap cutting and skull cutting (ES-5)			
ES-5 **PSD BACT**	Natural gas-fired torches for scrap cutting and skull cutting (0.5 million Btu per hour maximum total heat input)	NA	NA
Cooling Towers (ES-6)			
ES-6-1 **PSD BACT**	Cooling tower (non-contact)	CD-12	Drift eliminators
ES-6-2 **PSD BACT**	Cooling tower (contact)	CD-13	Drift eliminators
Silos (ES-7)			
ES-7-1 **PSD BACT**	Two silos (carbon storage)	CD-3	Bin vent filter
ES-7-2 **PSD BACT**	Two silos (flux storage)	CD-4	Bin vent filter
ES-7-3 **NSPS AAa, PSD BACT**	Baghouse dust silo and enclosed dust loadout	CD-5	Bin vent filter (silo)
Material handling (ES-8)			
ES-8-1 **PSD BACT**	Scrap handling and storage in an open pile and a pile covered and enclosed on two sides	NA	NA
ES-8-2 **PSD BACT**	Alloy handling and storage pile area covered and enclosed on three sides	NA	NA
ES-8-3 **PSD BACT**	Slag and mill scale handling, pile area, and processing	NA	NA

Emission Source ID No.	Emission Source Description	Control Device ID No.	Control Device Description
Haul roads (ES-9)			
ES-9 **PSD BACT**	Haul roads (paved and unpaved)	NA	NA
Engines (ES-10)			
ES-10-1 **NSPS JJJJ,** **GACT ZZZZ,** **PSD BACT**	Natural gas-fired fire water pump (500 horsepower)	NA	NA
ES-10-2 **NSPS IIII,** **NSPS JJJJ,** **GACT ZZZZ,** **PSD BACT**	Natural gas-fired emergency generator (2,000 kilowatt) -or- Diesel-fired emergency generator (2,000 kilowatt)	NA	NA
ES-10-3 **NSPS IIII,** **NSPS JJJJ,** **GACT ZZZZ,** **PSD BACT**	Natural gas-fired emergency generator (2,000 kilowatt) -or- Diesel-fired emergency generator (2,000 kilowatt)	NA	NA
Storage tanks (ES-11)			
ES-11-1 **PSD BACT**	Diesel storage tanks	NA	NA
ES-11-2 **GACT CCCCCC,** **PSD BACT**	Gasoline storage tank	NA	NA

The ID numbers for each emission source were chosen based on the suggestion of Nucor in the application (see Form B of Nucor's application).

Each emission source will be discussed below in the general order of the material flow at the facility.

2.1.1 Material handling, including Scrap and Alloy Handling, Storage, and Cutting and Slag and Mill Scale Handling (ID No. ES-8)

2.1.1.1 Process Description for ID No. ES-8

Scrap handling and storage (ES-8-1): Nucor Lexington will produce finished steel from recycled material (i.e., steel scrap). Scrap can be generated on-site from off-cuts or other waste processes (referred to by the application as "home scrap") or it can be hauled on-site by truck or rail. The application lists several potential sources of scrap, such as turnings from machine shops, shredded automobiles, and sheet metal. When determining potential emissions from scrap handling, Nucor assumed 100% of scrap would be hauled by truck (this is the most conservative approach). Nucor plans to store scrap within a partially-enclosed scrap bay, but acknowledges that a stockpile may be stored in an outside pile. Cranes and other material handling equipment will transfer scrap to the EAF (discussed below) using a bucket charging system. Based on the emission calculations performed by Nucor, the partially-enclosed scrap bay will be covered and enclosed on two sides (see Appendix 1, Section 8.1).

Nucor will implement a scrap material management program in order to remove mercury switches and other mercury containing materials from scrap. The application includes a draft management plan (see Application at Appendix D).

Alloy handling and storage (ES-8-2): In addition to scrap, the facility will receive and handle various alloys for use in the steelmaking process. The facility will receive alloy materials via truck and will store these materials in a covered pile in a three-sided enclosure (see Appendix 1, Section 8.3). This material will be transferred to the Melt Shop using material handling loaders.

Slag and mill scale processing (ES-8-3): Slag is formed when fluxing agents are added to the molten steel. Slag will be produced in the EAF and LMF. Slag will be removed from the furnaces and emptied into a pit below the furnace (still within the Melt Shop) to cool. Slag will be transported to the slag handling area (outside of the Melt Shop) using mobile equipment.

In the slag handling area, slag and mill scale will be crushed, sorted, stored, and loaded into trucks for sale and shipment off-site.

2.1.1.2 Emission Calculations for ID No. ES-8

Expected emissions from these operations are PM from dust generated by moving material and wind erosion from stored material. In addition, standard combustion pollutants are expected from the use of natural gas-fired cutting torches.

In order to calculate emissions from the scrap handling and storage operations, Nucor used the methods in AP-42 Section 13.2.4 (for material handling) and 13.2.5 (for wind erosion from storage piles). Emissions from the use of natural gas-fired cutting torches were calculated using AP-42 Section 1.4.

See Appendix 1, Section 8.0 for Nucor's emission calculations from material handling.

2.1.2 Material Storage and Handling (ID No. ES-7)

2.1.2.1 Process Description for ID No. ES-7

Two carbon storage silos (ID No. ES-7-1) and two flux storage silos (ID No. ES-7-2): In addition to scrap, Nucor will use several raw materials in the steelmaking process, such as (but not limited to) carbon and lime. These materials will be delivered to the facility by truck.

The facility will have four silos (two for carbon, two for fluxing agents such as lime) which will be filled pneumatically and controlled by bin vent filters.

As an alternative to the silos and three-sided enclosures, the facility may receive these materials in "supersacks" which will be dumped into hoppers within the Melt Shop. Emissions from this hopper loading would be controlled by the Melt Shop Baghouse.

Baghouse dust silo (ID No. ES-7-3): In addition to the four material silos, Nucor will install a silo to store dust collected by the Melt Shop Baghouse. The silo will be loaded pneumatically from the baghouse and emptied via a truck and rail loadout. This loadout will be enclosed.

2.1.2.2 Emission Calculations for ID No. ES-7

Expected emissions from these operations are PM from dust generated by the pneumatic loading of silos. In addition, PM is expected from the unloading of supersacks into hoppers within the Melt Shop. PM emitted by the dust silo will also include metal HAP constituents.

In order to calculate PM emissions from these silos, Nucor used the proposed BACT emission factor for the storage silos (0.005 grains per dry standard cubic foot vented through the filter).

PM emissions generated within the Melt Shop will be controlled by the Melt Shop Baghouse, and are considered separately from the silos.

See Appendix 1, Section 7.0 for Nucor's emission calculations from material handling.

2.1.3 Scrap and skull cutting (ID No. ES-5)

2.1.3.1 Process Description for ID No. ES-5

Some scrap material will be too large to process, so manual cutting of the scrap using natural gas-fired torches will be necessary to break these large pieces into manageable sizes. The combined torch heat input will be 0.5 million Btu per hour.

2.1.3.2 Emission Calculations for ID No. ES-5

Expected emissions from the scrap cutting torches are all of the normal combustion emissions. Nucor calculated emissions from the cutting operations using the emission factors in AP-42 Chapter 1.4. See Appendix 1, Section 5.0 for Nucor's emission calculations for the cutting operations.

2.1.4 Melt Shop (ID No. ES-1)

2.1.4.1 Process Description for ID No. ES-1

Nucor will use an electric arc furnace (EAF) to create steel. In the application, Nucor describes this step of the steelmaking process:

> "After the EAF is filled with scrap and feed material, the furnace electrodes will be lowered and energized. The scrap will be melted using electrical energy from the electrodes and chemical energy in the feed, to achieve a liquid steel temperature of approximately 3,000 degrees Fahrenheit (°F). Once the first batch 'heat' of scrap has been melted, the bucket will feed scrap to the EAF for subsequent batches. Oxygen, carbon, and fluxing agents will be injected into the molten steel in the EAF, resulting in slag formation. Once the desired properties are reached, the molten steel will be poured into a transport vessel lined with refractory material known as a ladle." (Application at 3-3).

The EAF and several supporting activities will be located in a building called the "Melt Shop." The majority of the air in the Melt Shop will be vented to the Melt Shop Baghouse through the DEC used on the EAF or the canopy hood, although a small amount of fugitive emissions is expected.

The EAF and the supporting activities are described in more detail below.

EAF (ID No. ES-1-1): As described above, the EAF will use electricity to melt scrap steel and additives into molten steel. A "direct evacuation control" (DEC) system will capture emissions from the EAF during the melting process. Emissions captured by the DEC will be sent to the Melt Shop Baghouse. In addition to electricity, heat is supplied using "oxy-fuel" burners. These burners use natural gas and pure oxygen. By using pure oxygen, the amount of nitrogen introduced into the furnace is reduced.

In order to extract molten steel, the EAF rocks to pour the steel into a ladle (according to the application, this process can also be called “tapping,” “pouring,” and “slagging”). Emissions from the EAF during the pouring process will be captured by a canopy hood and sent to the Melt Shop Baghouse.

After a ladle is filled, the ladle is moved to the Ladle Metallurgy Furnace (LMF).

LMF (ID No. ES-1-2): Full ladles will be transported to the LMF (located within the Melt Shop) via a track system. While at the LMF, the ladle will be heated with more electricity. At the LMF, additional materials such as flux and alloys will be added to the molten steel. Once finished, the ladle will be sent to the caster.

Emissions from the LMF will be sent to the Melt Shop Baghouse by either the canopy hood or the ladle duct.

Refractory dumping and repair (ID No. ES-1-3): The interior of the EAF is lined with a refractory material to withstand the high temperature of the molten steel. This material must be occasionally removed and repaired.

Slag dumping (ID No. ES-1-4): Slag forms on the EAF when fluxing agents remove impurities from the molten steel. The slag must be removed from EAF by dumping it into a pit below the EAF (but still located within the Melt Shop). Once dumped, slag will be removed from the Melt Shop. Slag handling is discussed below.

Melt shop material transfer (ID No. ES-1-5): In addition to receiving materials pneumatically via silos, materials can be received in supersacks. These supersacks will be opened within the Melt Shop and dumped into gravity hoppers.

Natural gas-fired nozzle preheater with low-NOx burner (ID No. ES-1-6): The EAF will be equipped with a small natural gas-fired preheater.

Fugitive emissions (ID No. ES-1-FUG): A small amount of emissions are expected to escape the Melt Shop through openings other than the Melt Shop Baghouse. Any pollutants emitted in this manner will be uncontrolled. In general, Nucor will be required to minimize fugitive emissions from the Melt Shop when complying with NSPS Subpart AAa and GACT Subpart YYYY.

Melt Shop Baghouse (ID No. CD-7): Emissions from the above activities in the Melt Shop will be routed to the Melt Shop Baghouse, which will serve to control particulate emissions. Note that emissions of other pollutants are expected from the steelmaking process, but the baghouse will only control particulate. Material collected by the baghouse will be transferred to a dust storage silo (ID No. ES-7-3) equipped with a bin vent filter. Dust will be loaded into trucks or railcars and removed from the facility.

2.1.4.2 Emission Calculations for ID No. ES-1

The expected emissions from the Melt Shop include each criteria pollutant, as well as organic and metal hazardous air pollutants.

Nucor estimated emissions from the EAF and LMF based on operations at very similar steel micro mills operated by Nucor (specifically, mills located in Sedalia MO and Frostproof FL). Criteria pollutant emissions are based on the BACT emission rates (discussed in Section 4.0). Emissions of metal HAP from the Melt Shop and elsewhere in the facility are based on a dust analysis performed by Nucor at the Frostproof FL facility.

Nucor estimated emissions from the other Melt Shop operations (like refractory dumping) based on the available emission factors in AP-42 Section 12.5.

Nucor estimated fugitive emissions from the Melt Shop using a percentage of the activities within the Melt Shop. Note that these values were added to the Melt Shop calculations. Doing so conservatively over-estimates total emissions from the Melt Shop.

See Appendix 1, Section 1.0 for Nucor's emission calculations from the Melt Shop activities.

2.1.5 Casting Operations (ID No. ES-2)

2.1.5.1 Process Description for ID No. ES-2

Caster (ID No. ES-2-1): Nucor describes the caster as:

> "At the caster, the molten steel in the ladle will be poured from a slide gate in the bottom of the ladle into a vessel called a tundish. The tundish is a refractory-lined vessel with holes in the bottom that meter the liquid steel into the mold. The molds form and cool the molten steel into a billet. Billets may be octagonal, square, rectangular, or cylindrical in shape, depending upon the mold selected. The billets continue to be cooled in a water spray chamber below the caster." (Application at 3-4)

The caster and supporting activities will be located in a building attached to the Melt Shop, but vented independently via the caster vent and caster spray stack (see Figure 2). There are no control devices associated with the casting operations.

Ladle and Tundish Refractory Repair (ID No. ES-2-2): The interior of the ladles and the tundish (described below) is lined with a refractory material to withstand the high temperature of the molten steel. This material must be occasionally removed and repaired. The refractory repair operations will take place in the caster area and mostly vent through the caster vent.

Natural gas-fired burners for drying and preheating equipped with low-NOx burners (ID No. ES-2-3): Throughout the Caster, natural gas-fired burners will be used for drying and preheating the ladles and tundish.

Natural gas-fired service cutting torches (ID No. ES-2-4): Cutting torches will occasionally be used as necessary throughout the casting operations. The cutting torches will not have low-NOx burners.

2.1.5.2 Emission Calculations for ID No. ES-2

The expected emissions from the Casting Operations are PM and VOC. PM comes from the still-molten steel as it is poured into and moves through the tundish and caster. Nucor used emission factors from similar operations at other Nucor facilities to estimate PM emissions. In addition, this PM will have the same metal HAP constituents as in the EAF and LMF.

VOC comes from the refractory material: "There is a low concentration of VOCs in the resin of the refractory material that will be volatilized during the drying of the refractory lining. Emission estimates for VOC emissions from the drying of refractory resin were calculated using '*EIIP Volume II: Chapter 14 Uncontrolled Emission Factor Listing for Criteria Air Pollutants, July 2001,'* SCC 3-03-009 for steel manufacturing. Emissions are based on maximum refractory rates" (Application at 4-4).

In addition, standard combustion emissions are expected from the natural gas combustion throughout the Caster.

See Appendix 1, Section 2.0 for Nucor's emission calculations for the Casting Operations.

2.1.6 Water spray chamber below caster and caster spray stack (ID No. ES-3)

2.1.6.1 Process Description for ID No. ES-3

As discussed in Section 2.1.5.1, above, after the molten steel leaves the tundish and enters the molds, it is cooled in water spray chamber. The water spray chamber is vented to a separate stack from the rest of the Casting Operations.

2.1.6.2 Emission Calculations for ID No. ES-3

Nucor based the emission factors for this process on emission tests performed at similar Nucor facilities. See Appendix 1, Section 3.0 for Nucor's emission calculations for the water spray chamber and caster spray stack.

Note that the emission calculations for PM from the spray stack are only filterable. Nucor explains: "[due to] the inherent design and operation of caster spray stacks, stack tests can only be completed for filterable PM" (Application at 4-5). Nucor further explained the reason for only calculating filterable PM: "Condensable PM cannot be measured on the caster spray stack due to the super saturated nature of the exhaust stream" (comments on pre-draft permit, received March 15, 2023).

2.1.7 Rolling Operations (ID No. ES-4)

2.1.7.1 Process Description for Rolling Operations (ID No. ES-4)

Rolling Mill (ID No. ES-4-1): After being cooled by the water spray chamber (ES-3), the billets created by the casting operations will be sent to the rolling mill. There, the billets will pass through rollers that will form the billets into the final desired shape. The rollers will be cooled with water and lubricated with oil and grease. Evaporating water, oil, and grease will cause PM, VOC, and HAP emissions. Emissions from the rolling mill will vent through a roofline vent. There will not be any add-on control for the rolling mill.

Natural gas-fired cutting torches (ID No. ES-4-2) In addition to the rolling operations, natural gas-fired cutters may be used to cut steel that does not properly pass the rollers.

2.1.7.2 Emission Calculations for ID No. ES-4

In order to determine emissions from the rolling operations, Nucor used emission tests from other Nucor minimills and a US EPA document "Volatilized Lubricant Emissions from Steel Rolling Operations." Based on this data, emissions of PM, VOC, and HAP are expected from the rolling mill. Nucor based emissions on a potential grease and oil usage rate of 212.70 tons per year.

In addition, standard combustion emissions are expected from the natural gas-fired cutting torches.

See Appendix 1, Section 4.0 for Nucor's emission calculations for the Rolling Operations.

2.1.8 Cooling Towers (ID No. ES-6)

2.1.8.1 Process Description for Cooling Towers (ID No. ES-6)

Two cooling towers will be required to cool the cooling water used at the facility. Makeup water will be supplied by the city. Cooling water used throughout the facility will contain increased amounts of dissolved solids. Any water that evaporates in the cooling towers will cause the entrained solids to be emitted as particulate matter.

2.1.8.2 Emission Calculations for ID No. ES-6

Nucor estimated emissions from the cooling towers using the method in "Calculating Realistic PM_{10} Emissions from Cooling Towers" by Reisman and Frisbie (2004).

See Appendix 1, Section 6.0 for Nucor's emission calculations for the cooling towers.

2.1.9 Haul Roads (ID No. ES-9)

2.1.9.1 Process description for haul roads (ID No. ES-9)

Materials will be brought on-site and shipped off-site via trucks on haul roads and rail. Materials will be transported around the site using trucks and other wheeled vehicles. Driving wheeled vehicles on roads (both paved and unpaved) generates particulate emissions. Based on the emission calculations in the application, the vast majority of miles traveled by vehicles will be on paved roads.

Nucor will implement work practices (such as watering roads) to limit dust generated from haul roads.

2.1.9.2 Emission Calculations for ES-9

In order to calculate PM emissions from the haul roads, Nucor used the emission calculation methods in AP-42 Chapter 13.2.1 and 2. When calculating potential emissions from the haul roads, Nucor conservatively estimated that 100% of material entering and leaving the site is transported by truck.

Nucor's calculations of haul road traffic, total travel distance, and PM emissions from the haul roads are included here in Appendix 1, Section 9.0

2.1.10 Emergency-use Engines (ID No. ES-10)

2.1.10.1 Process description for emergency-use engines (ID No. ES-10)

The facility will install three emergency-use engines: one 500-horsepower fire pump and two 2,000-kilowatt emergency generators. The fire pump will burn natural gas. The emergency engines will burn either natural gas or diesel fuel.

2.1.10.2 Emission Calculations for ID No. ES-10

When calculating potential emissions from emergency-use engines, the annual potential operation of the engines is estimated at 500 hours per year.[4] Note that, outside of emergency situations, these engines will only operate sporadically for maintenance and readiness testing.

When estimating emissions from the emergency engines, the worst-case fuel will be used. The engines will, at a minimum, be certified to meet the applicable New Source Performance Standard for that type of engine; where applicable, these standards were used as emission limits. For all other pollutants, Nucor used the relevant AP-42 factors.

See Appendix 1, Section 10.0 for Nucor's emission calculations for the emergency generators.

2.1.11 Storage Tanks (ID No. ES-11)

2.1.11.1 Process Description for Storage Tanks (ID No. ES-11)

The facility will install a 1,000-gallon gasoline and up to three 3,000-gallon diesel fuel storage tanks. According to the application, two of the diesel storage tanks will only be needed if Nucor chooses to install diesel-fired emergency generators.

2.1.11.2 Emission Calculations for ES-11

Fuel storage tanks emit VOC through breathing and working losses, but these losses are expected to be small due to the small size of these tanks. In order to estimate emissions, Nucor used EPA's TANKS program. The inputs and outputs of this program are included in Appendix 1, Section 11.0.

2.2 Emission Summary

The potential emissions for the proposed steel mill are calculated in Appendix E of the permit application. The emission calculations for the criteria pollutants are summarized in Table 2.

[4] See "*Calculating Potential to Emit (PTE) for Emergency Generators*", John Seitz, Director, OAQPS, EPA, September 6, 1995.

Table 2: Facility-wide Criteria Pollutants

Project Emissions Summary

Pollutant	Project Potential Emissions	Major Stationary Source Threshold[1]	PSD Significance Levels2	Exceed Significance Level?
	(tpy)	(tpy)	(tpy)	
NO_X	110	100	40	Yes
CO	947	100	100	Yes
PM (filterable)[3]	81.6	--	--	--
PM[4]	164	100	25	Yes
PM_{10}[4]	79.2	100	15	Yes
$PM_{2.5}$[4]	70.4	100	10	Yes
SO_2	129	100	40	Yes
VOC	90.6	100	40	Yes
H_2SO_4 Mist	0.05	100	7	No
Lead	0.02	100	0.6	No
Fluorides	2.6	100	3	No
H_2S	--	100	10	No
TRS	--	100	10	No
CO_2e	172,155	--	75,000	Yes

Notes

1 - Steel mills are a listed source pursuant to 40 CFR 51.166(b)(1) and 15A NCAC 2D.0530.

2 - Per 15A NCAC 02D.0530(b) and 40 CFR 52.166(b)(23)(i).

3 - PM (filterable) emissions are provided for reference. Pursuant to 15A NCAC 2D .0530(b)(5), PM also includes filterable and condensable PM for applicability determinations and in establishing emission limitations in PSD permits.

4 - PM, PM10, and PM2.5 include filterable plus condensable.

3.0 Project Regulatory Review

This section will discuss the various State and Federal regulations covering air emissions from Nucor Lexington's proposed facility. In addition, rules that could potentially apply to this facility, but ultimately do not, are also discussed.

Ultimately, the permit will include specific conditions for the following rules:

- 15A NCAC 02D .0516 "Sulfur Dioxide Emissions from Combustion Sources"
- 15A NCAC 02D .0521 "Control of Visible Emissions"
- 15A NCAC 02D .0524 "New Source Performance Standards"
- 15A NCAC 02D .0530 "Prevention of Significant Deterioration"
- 15A NCAC 02D .0540 "Particulates from Fugitive Dust Emission Sources"
- 15A NCAC 02D .0614 "Compliance Assurance Monitoring"
- 15A NCAC 02D .1100 "Control of Toxic Air Pollutants" [State-enforceable Only]
- 15A NCAC 02D .1111 "Maximum Achievable Control Technology"
- 15A NCAC 02D .1806 "Control and Prohibition of Odorous Emissions" [State-enforceable Only]
- 15A NCAC 02Q .0317 "Avoidance Conditions"
- 15A NCAC 02Q .0711 "Emission Rates Requiring a Permit" [State-enforceable Only]

In addition to the above, because Nucor applies for this permit under 15A NCAC 02Q .0501(b)(2) and 15A NCAC 02Q .0504, the permit will include the following specific conditions:

- 15A NCAC 02Q .0304 "Applications"
- 15A NCAC 02Q .0504 "Option for Obtaining Construction and Operation Permit"
- 15A NCAC 02Q .0207 "Annual Emissions Reporting"

3.1 Applicable State Implementation Plan (SIP) Rules

3.1.1 15A NCAC 02D .0516 "Sulfur Dioxide Emissions from Combustion Sources"

Applicability: This rule limits emissions of sulfur dioxide (SO_2) from combustion sources that are not subject to an SO_2 standard under NSPS or MACT. Each combustion sources (*e.g.*, torches, stationary combustion engines) will be subject to this rule.

Emission limit: In all cases, the limit is 2.3 pounds of SO_2 per million BTU heat input.

Compliance requirements for Melt Shop and Electric Arc Furnace: Although the electric arc furnace is primarily heated with electricity, natural gas is burned within the furnace for supplemental heat. Sulfur within the natural gas, plus sulfur present within the EAF, will react to form SO_2. Emissions of SO_2 from the Melt Shop are limited to 0.5 pounds per ton of steel produced (BACT limit, see Section 3.1.4), the EAF has a total heat input of 46.74 million Btu per hour, and the EAF has a maximum hourly throughput of 80 tons of steel per hour. Using this, the expected SO_2 emission rate as a function of heat input can be calculated:

$$\left(\frac{0.5\ \mathrm{lb_{SO_2}}}{\mathrm{ton_{steel}}}\right) \times \left(\frac{80\ \mathrm{ton_{steel}}}{\mathrm{hour}}\right) \div \left(\frac{46.74\ \mathrm{MMBtu}}{\mathrm{hour}}\right) = 0.86\,\frac{\mathrm{lb_{SO_2}}}{\mathrm{MMBtu}}$$

Therefore, the EAF is expected to comply with this rule. Nucor will demonstrate compliance with the BACT SO_2 limit using a continuous emission monitor. Therefore, no further monitoring will be required to demonstrate compliance with this rule.

Compliance requirements for all other natural gas and diesel-fired sources: The only fuels burned at this facility will be natural gas and ultra-low sulfur diesel (USLD). In all cases, these fuels have a low sulfur content. During combustion, SO_2 is formed when sulfur in the fuel reacts with oxygen in the combustion air. Therefore, processes that use fuels with low sulfur content will comply with the limit.

Monitoring, recordkeeping, and reporting: DAQ generally does not require monitoring, recordkeeping, or reporting to demonstrate compliance with 02D .0516 for sources that only burn natural gas and/or diesel fuel. Recordkeeping associated with the SO_2 CEMS records for the Melt Shop will be sufficient to demonstrate compliance with this rule for the Melt Shop.

3.1.2 15A NCAC 02D .0521 "Control of Visible Emissions"

Applicability: This rule limits visible emissions (VE) from emission sources that are not subject to a VE standard under another rule in 02D .0500. The melt shop (ES-1), melt shop baghouse (CD-7), and baghouse dust silo (ES-7-3) will therefore not be subject to this rule because they are subject to a VE limit under 02D .0524. Each other non-fugitive source will be subject to this rule.

Emission limits: In general, this rule limits VE to less than 20% opacity measured on a six-minute average. The rule allows for exceedances of this limit no more than once per hour and four times per day.

Monitoring: Nucor will conduct observations of the following sources based on the schedule below.

- ES-2: Weekly
- ES-3: Weekly[5]
- ES-4: Weekly
- ES-6: Monthly
- ES-7: Monthly

The cooling towers (ES-6) and storage silos (ES-7) are less likely to cause unacceptable VE, so the monitoring schedule for these sources is reduced to monthly, rather than weekly. When Nucor submits the 1st-time Title V permit application (which must be submitted within 12 months of commencing operations, see Section 3.1.11, below), Nucor may request to reduce the weekly observations to monthly based on the VE monitoring results while operating.

If VE above normal is observed, Nucor must make the appropriate corrective actions.

No VE monitoring will be required for the emergency-use engines ES-10 due to the infrequency of their use.

No VE monitoring will be required for the storage tanks (ES-11) because no VE is expected from these sources.

[5] Note that condensed water vapor, likely to be present in the caster spray stack, is not VE. See Appendix A-4 to 40 CFR Part 60 "Method 9 – Visual Determination of the Opacity of Emissions from Stationary Sources." Sections 2.3.1 and 2.3.2 clearly indicate that condensed water vapor is not to be counted.

Recordkeeping: Nucor will keep records of monitoring and corrective actions.

Reporting: Nucor will submit a semiannual summary report.

3.1.3 15A NCAC 02D .0524 "New Source Performance Standards" (NSPS)

This rule incorporates the NSPS rules (40 CFR Part 60) into North Carolina's SIP. Activities at this facility will be subject to NSPS Subparts AAa, IIII, and JJJJ. See Section 3.2 for a discussion of NSPS requirements.

3.1.4 15A NCAC 02D .0530 "Prevention of Significant Deterioration" and 15A NCAC 02D .0544 "Prevention of Significant Deterioration for Greenhouse Gases" (PSD)

Background: In general, these rules incorporate the requirements of PSD into North Carolina's SIP. For the purposes of these rules, references to the CFR are to specifically the July 1, 2019 version of the CFR (see 15A NCAC 02D .0530(v)). Pursuant to the Federal Register (FR) notice on February 23, 1982 (47 FR 7836), North Carolina has full authority from the US Environmental Protection Agency (EPA) to implement the PSD regulations in the State effective May 25, 1982.

United States Congress first established the New Source Review (NSR) program as a part of the 1977 Clean Air Act (CAA) Amendments and modified the program in the 1990 amendments. The NSR program includes requirements for obtaining a pre-construction permit and satisfying all preconstruction review requirements for major stationary sources and major modifications, before beginning actual construction for both attainment areas and non-attainment areas. The NSR program for facilities located in attainment areas is called "Prevention of Significant Deterioration" (PSD). The basic goal for PSD is to ensure that the air quality in attainment areas does not significantly deteriorate while maintaining a margin for future industrial growth. Davidson County is currently not listed as nonattainment for any pollutant, so the PSD program is applicable.

Under PSD, all new or modified major stationary sources of air pollutants as defined in CAA §169 must be reviewed and permitted, prior to construction, in accordance with CAA §165. A "major stationary source" is defined in 40 CFR 51.166(b)(1) as any one of 28 named source categories which emits or has a potential to emit (PTE) of 100 tons per year (tpy) of any "regulated NSR pollutant." This facility will be a steel mill, which is one of the 28 named source categories.

Applicability: Consistent with 40 CFR 51.166(b)(4), the PTE estimates for all emissions units have been based upon the maximum process rate or design capacity, as applicable, and control device efficiency (if applicable). The baseline emissions (pre-change) for all new units resulting from the initial construction will be zero per 40 CFR 51.166(b)(47)(iii). For PTE calculations, Nucor calculated a maximum annual steel throughput of 515,000 tons of steel per year, and based the potential throughput of the rest of the facility (*e.g.*, scrap receiving, slag handling, etc.) on the facility producing 515,000 tons of steel.

Using Nucor's PTE calculations (see Table 2, above), it can be concluded that this facility will be a major stationary source for PSD because the PTE of at least one pollutant is greater than 100 tpy. Furthermore, because this facility will be a major stationary source, per 40 CFR 51.166(b)(23), any pollutant that has a PTE greater than the significance level will be subject to review under PSD. Therefore, PSD requirements were reviewed for:

- NOx
- CO
- PM, PM_{10}, and $PM_{2.5}$

- SO_2,
- VOC, and
- CO_2e (greenhouse gasses)

See Section 4.0 for the PSD review for each pollutant and each source at the proposed facility.

Avoidance: Based on Nucor's calculations, the PTE of fluoride is close to the significance level (3 tpy). In correspondence received after the application, Nucor agreed to include a PSD avoidance limit in the permit for fluorides. Because Nucor will avoid emitting fluoride greater than the significance level, no PSD review is required for fluoride emissions. See Section 3.1.10 for a discussion of PSD avoidance requirements.

PSD Increment Tracking: The Minor Source Baseline Date for a specific county is set by the date that the first complete PSD permit application for that county is submitted to the DAQ. Davidson County has triggered PSD Increment Tracking for PM_{10}, $PM_{2.5}$, and NOx. This application triggers the baseline date for SO_2.

For the purposes of PSD Increment Tracking, hourly emissions will increase by:

Table 3: PSD Increment Tracking emission increases[6]

Pollutant	PSD Increment Tracking Increase (lb/hr)
PM_{10}	22.26
$PM_{2.5}$	19.03
NOx	89.45
SO_2	40.16

These values will be noted on the cover letter of the permit. The cover letter will also note that this new facility will trigger the baseline date for SO_2 in Davidson County.

Compliance requirements: Compliance with PSD will be determined for each individual source at this facility. The compliance requirements will be based on the BACT determination, any modeled emission rates, and actions needed to demonstrate compliance (*e.g.,* operate a CEMS, perform inspections, etc.)

3.1.4.1 PSD requirements for Melt Shop

Nucor will demonstrate compliance with the BACT emission limits for the Melt Shop by operating a CEMS for NOx, CO, SO_2, and CO_2. Nucor will perform annual stack testing for $PM/PM_{10}/PM_{2.5}$ and VOC. Nucor must also limit the total steel throughput of the facility to less than 515,000 tons per year averaged over a rolling 12-month period and 80 tons per hour averaged over any 24-hour block period.[7]

Nucor will perform maintenance and monitoring of the baghouse and Melt Shop according to the requirements of NSPS Subpart AAa, GACT Subpart YYYYY, and CAM.

Nucor must follow the pollution prevention plan required by GACT Subpart YYYYY.

[6] See Application at Appendix E, page 2.
[7] Nucor requested that each 24-hour block period start at 7AM to synchronize with production schedules.

3.1.4.2 PSD requirements for Caster

Nucor proposed BACT for this source as good work practices and a scrap management plan. Nucor will demonstrate compliance with BACT for these sources by complying with the monitoring, recordkeeping, and reporting of GACT Subpart YYYYY, which also requires a scrap management plan (the MACT refers to this as a "pollution prevention plan").

3.1.4.3 PSD requirements for Caster Spray Stack

Nucor proposed BACT for this source as good work practices and a scrap management plan. Nucor will demonstrate compliance with BACT for these sources by complying with the monitoring, recordkeeping, and reporting of GACT Subpart YYYYY, which also requires a scrap management plan (the MACT refers to this as a "pollution prevention plan").

3.1.4.4 PSD requirements for Rolling Mill

Nucor proposed BACT for this source to be good work practices to minimize the amount of oil and grease used. Nucor will demonstrate compliance with the BACT for these sources through recordkeeping and periodic inspections.

3.1.4.5 PSD requirements for Cooling Towers

Nucor proposed BACT for these sources to be drift eliminators rated for 0.001% loss. Nucor will demonstrate compliance with BACT for these sources by performing inspections and maintenance on the cooling towers as recommended by the manufacturer (minimum of one internal inspection per year). Nucor must maintain records of inspections and the manufacturer's certification that the cooling towers meet the BACT limit.

3.1.4.6 PSD requirements for Silos

Nucor proposed BACT for these sources to be bin vent filters rated for 0.005 gr/dscf output loading. Nucor will demonstrate compliance with BACT for these sources by performing inspections and maintenance on the silos and filters as recommended by the manufacturer (minimum of one internal inspection per year and one visual inspection per month). Nucor must maintain records of inspections and the manufacturer's certification that the filters meet the BACT limit.

3.1.4.7 PSD requirements for Material Handling

Nucor proposed BACT for these sources to be a combination of enclosures, minimizing drop heights, and use of wetting agents, as appropriate. Nucor must develop a site-specific plan for building enclosures, minimizing drop height, and using wetting agents. Nucor will demonstrate compliance with the BACT requirements by keeping records of wetting agent usage and performing inspections and maintenance of each enclosure and conveyor drop point.

3.1.4.8 PSD requirements for Haul Roads

As part of the BACT analysis for the haul roads, Nucor proposed a fugitive dust control plan (FDCP). The plan includes watering, vacuuming, sweeping, and a posted speed limit of 10 miles per hour. Nucor will be required to maintain records of compliance with the FDCP and submit a summary report semiannually.

3.1.4.9 PSD requirements for emergency-use engines

Nucor proposed BACT for these sources to be the use of good work practices, low-sulfur diesel, and NSPS-certified engines. Nucor will demonstrate compliance with PSD for these engines by complying with the applicable NSPS requirements.

3.1.4.10 PSD requirements for storage tanks

Nucor did not propose a BACT for these sources. DAQ proposed BACT for these sources to be the use of good work practices and compliance with the requirements in GACT Subpart CCCCCC (specifically for the gasoline storage tank). Nucor will demonstrate compliance with PSD for these storage tanks by complying with the applicable MACT requirements.

3.1.4.11 PSD requirements for natural gas-fired heaters and torches

Nucor proposed BACT for these sources to be low-NOx burners (where applicable) and use of natural gas as fuel. DAQ additionally proposed BACT to be good work practices, similar to other steel micro mills. Nucor will demonstrate compliance with PSD for these sources by performing maintenance and inspections on these natural gas-fired sources in accordance with manufacturer's recommendations, and operating low-NOx burners where applicable.

Nucor will maintain an estimate of the natural gas fuel burned in these sources. Given that these sources are small, numerous, and spread throughout the facility, a dedicated meter for each of these sources is impractical; Nucor will estimate the fuel usage based on burner capacity and facility operations.

3.1.5 15A NCAC 02D .0540 "Particulates from Fugitive Dust Emission Sources"

This rule requires facilities to not allow its operations to cause fugitive dust emissions to cause or contribute to substantive complaints. DAQ may require a facility to develop a fugitive dust control plan (FDCP) in response to complaints or evidence of that ambient air quality standards are exceeded. This rule will apply to the activities at Nucor.

The material handling processes and haul roads are expected to generate some amount of fugitive dust. However, as part of compliance with PSD, Nucor will already be required to develop and implement a FDCP (see Section 3.1.4). Therefore, Nucor will not have additional requirements under this rule.

Compliance with the FDCP and fugitive dust will be determined by compliance with PSD for the material handling and haul road sources.

3.1.6 15A NCAC 02D .0614 "Compliance Assurance Monitoring" (CAM)

Broadly speaking, this rule incorporates the requirements of CAM (40 CFR Part 64) into North Carolina's SIP. Because this facility is required to develop a CAM plan, the permit will include a specific condition for this rule. See Section 3.2.7 for a discussion of CAM applicability and requirements.

Note that, in general, a CAM plan is only required once an applicable facility submits an application for Title V renewal. However, because this facility is subject to GACT Subpart YYYYY, a CAM plan for this facility is required upon startup (see 40 CFR 63.10686(e)).

3.1.7 15A NCAC 02D .1100 "Control of Toxic Air Pollutants" [State-enforceable Only]

In general, this rule applies to facilities that emit a toxic air pollutant (TAP) at rates greater than the TAP permitting emission rates (TPER) listed in 02Q .0711. Such facilities must first conduct an air dispersion modeling demonstration under 15A NCAC 02D .1104.

The activities at Nucor will emit several different TAPs. Based on Nucor's calculations (see Section 5.0 and Table 16, below), several TAPs will be emitted at rates greater than their TPERs. Therefore, Nucor will be subject to this rule.

Note that, per 15A NCAC 02Q .0704(c), sources exempt pursuant to 02Q .0702 (e.g., sources subject to a MACT rule) are not considered when setting limits to comply with 02D .1100. When excluding the contributions of exempt sources based on Table 16, only the following pollutants exceed their respective TPERs: arsenic, benzene, cadmium, and manganese.

Nucor performed air dispersion modeling as part of this application. As a result, the following emission limits for TAPs must be included in the permit.

Table 4: Modeled emission limits for 15A NCAC 02D .1100

Emission source	Pollutant	Modeled Emission Rate
Baghouse dust silo **(ID No. ES-7-3)**	Arsenic	1.15 E-02 pounds per year
	Cadmium	5.04 E-01 pounds per year
	Manganese	9.46 E-02 pounds per 24-hour period
Natural gas-fired torches for scrap cutting and skull cutting **(ID No. ES-5)**	Arsenic	7.30 E-05 pounds per year
	Benzene	7.72 E-06 pounds per year
	Cadmium	1.46 E-02 pounds per year
	Manganese	1.29 E-05 pounds per 24-hour period
Casting Operations roof vent **(ID No. ES-2)**	Arsenic	1.16 E-01 pounds per year
	Benzene	7.72 E-06 pounds per year
	Cadmium	1.46 E-02 pounds per year
	Manganese	1.89 E+00 pounds per 24-hour period
Rolling Mill roof vent **(ID No. ES-4)**	Arsenic	1.37 E-03 pounds per year
	Benzene	7.72 E-06 pounds per year
	Cadmium	1.46 E-02 pounds per year
	Manganese	7.10 E-06 pounds per 24-hour period

Based on the application, no specific monitoring, recordkeeping, or reporting will be required to demonstrate compliance with these limits because Nucor modeled emissions of these pollutants at the maximum potential emission rate. See Section 5.0 for a discussion of Nucor's TAP modeling efforts and the basis for TAP requirements.

3.1.8 15A NCAC 02D .1111 "Maximum Achievable Control Technology" (MACT)

This rule incorporates the MACT rules (40 CFR Part 63) into North Carolina's SIP. Activities at this facility will be subject to GACT[8] Subparts ZZZZ, YYYYY, and CCCCCC. See Section 3.2 for a discussion of these requirements.

[8] When referring to the area source rules under 40 CFR Part 63 (e.g., Subpart YYYYY), DAQ uses the term "generally available control technology" (GACT).

Note that some MACT rules only apply to "major" sources of hazardous air pollutants (HAP), while other MACT rules only apply to "area" sources of HAP, as defined in 40 CFR 63.2. Nucor will comply with a facility-wide HAP emission limit and therefore be an area source of HAP. Therefore, rules that apply only to major sources of HAP will not apply to this facility.

See Section 3.1.10.2 for a discussion of major source avoidance requirements.

3.1.9 15A NCAC 02D .1806 "Control and Prohibition of Odorous Emissions" [state-enforceable only]

Applicability: This rule requires facilities to not cause or contribute to odor complaints beyond the facility's boundary. DAQ may require a facility to implement odor controls in the event of substantiated odor complaints.

Monitoring, recordkeeping, and reporting: The permit will include a specific condition for 02D .1806, but no specific monitoring, recordkeeping, or reporting. Compliance with this rule will be determined during DAQ's site inspections and complaint investigations (if applicable).

3.1.10 15A NCAC 02Q .0317 "Avoidance Conditions"

3.1.10.1 PSD Avoidance

Background: This rule allows a facility to accept enforceable terms and conditions in order to avoid the applicability of other rules. As specified in 02Q .0317(a)(1), facilities are allowed to avoid the applicability of 15A NCAC 02D .0530.

Emission limits: In general, for a facility to avoid triggering PSD a regulated pollutant, the actual emissions of that pollutant from the facility must be less than the significant emission increase threshold listed in 40 CFR 51.166(b)(23). For fluoride, this limit is 3 tons per year.

Applicability: A facility must request terms and conditions in order to avoid PSD applicability. In correspondence received after the application, Nucor requested a PSD avoidance limit for fluoride:

> "Fluoride emissions were conservatively estimated based on Nucor Sedalia. Nucor Lexington agrees with NCDAQ that a PSD avoidance limit would be appropriate. As such, Nucor requests a fluoride emission limit of less than 3 tons per year. Additionally, Nucor Lexington will use fluoride containing material in various areas of the steel making process. All potential fluoride emissions from the use of fluoride containing materials are considered in the estimated emissions discussed above." (Email from Matt Way [Environmental Manager, Nucor], received November 18, 2022)

Therefore, the air quality permit will include a facility-wide emission limit for fluoride less than 3 tons per year. Note that this avoidance limit will only allow Nucor to avoid PSD applicability for fluoride. PSD still applies for all other triggered pollutants (see Section 3.1.4 for a discussion of PSD requirements).

Compliance: In the application, Nucor calculated potential fluoride emissions based on an emission factor of 0.01 pounds of fluoride emitted per ton of steel produced. The application states "Nucor Corporation conducts similar operations at its Nucor Steel Sedalia and Nucor Steel Florida facilities. Based on experience with these facilities, fluoride emissions will be maintained below the PSD significance threshold of 3 tpy" (Application at page 4-2). In correspondence received after the application, Nucor explained the development of the 0.01 lb/ton emission factor:

> "The fluoride emission factor is based off testing at a similar Nucor micro-mill using a similar scrap and additive mix. To account for potential variability, a conservative factor has been added based on an engineering estimate" (Email from Matt Way [Environmental Manager, Nucor], received October 3, 2022).

The similarity of the Sedalia and Florida facilities to the proposed facility in Lexington is also discussed in Section 4.1.3 below.

According to the Title V permit issued to Nucor Steel Sedalia, LLC, that facility has performed emission testing for fluoride emitted from steelmaking. The results of that test showed an emission factor of 0.0018 lb/ton, which is far less than the 0.01 lb/ton value used in the application.[9] Given the similarity between these facilities, the application's proposed 0.01 lb/ton value appears to be a highly conservative estimate.

Using the annual steel throughput limit of 515,000 tons per year (see Section 3.1.4) and the emission factor of 0.01 lb/ton, the potential annual fluoride emission rate is 2.6 tons per year.

Monitoring, recordkeeping, and reporting: In order to demonstrate compliance with the 3 ton per year limit, Nucor will keep records of the use of fluoride containing materials (to demonstrate that the activities at Lexington are similar to the activities at Sedalia and Florida), the amount of steel made using fluoride containing materials, and the amount of fluoride emitted per year. Nucor will submit a semiannual summary report of these monitoring activities.

3.1.10.2 HAP Major Source avoidance

Background: As stated above, facilities are allowed to accept enforceable terms and conditions in order to avoid the applicability of other rules. In order to be an "area source" of HAP, Nucor must avoid emitting HAP at rates greater than the definition of "major source" in 40 CFR 63.2. A facility is a major source of HAP if it has potential emissions of HAP greater than 10 tpy for any individual HAP or greater than 25 tpy of total combined HAP.

Note that if this facility were not an area source of HAP, the facility would not be subject to 40 CFR Part 63, Subpart YYYYY because that rule applies exclusively to area sources of HAP. There are no other Part 63 rules that would apply to Nucor if it were a major source of HAP. Therefore, if Nucor were a major source HAP, it would trigger the case-by-case MACT requirement under 15A NCAC 02D .1112.

Emission limits: In order to be designated an area source of HAP, Nucor must emit less than 10 tpy of any individual HAP and 25 tpy of total HAP.

Compliance requirements: Based on the facility-wide HAP emissions (see Appendix 1, Section 13.0), the facility will have potential emissions of total HAP less than 10 tpy, and therefore will be an area source of HAP. However, the calculation performed by Nucor is only for post-control emissions. Without the control efficiency of the melt shop baghouse, this facility would have potential emissions greater than the major source threshold due to the metal HAP present in the furnace exhaust. Therefore, in order to be designated

[9] See operating permit number OP112022-002 (pages SB-4 and SB-5), issued by Missouri Department of Natural Resources to Nucor Steel Sedalia, LLC on November 29, 2022. The document states that "The F laboratory results were below the laboratory RDL, the RDL was used to calculate emissions."

an area source of HAP, Nucor must operate the melt shop baghouse. The monitoring, recordkeeping, and reporting requirements associated with NSPS Subpart AAa and GACT Subpart YYYYY will be sufficient to demonstrate compliance with the HAP limit.

Note that for sources designated as an area source, additional recordkeeping and reporting requirements may apply under 40 CFR 63.9 and 63.10.

3.1.11 15A NCAC 02Q .0504 "Option for Obtaining Construction and Operation Permit", 15A NCAC 02Q .0304 "Applications", and 15A NCAC 02Q .0207 "Annual Emissions Reporting"

A facility that would be a major source under Title V may opt to initially obtain an air quality permit following the requirements of 15A NCAC 02Q .0300 "Construction and Operation Permits." This process is allowed under 15A NCAC 02Q .0501(b)(2). In the application, Nucor specifically requested this application process (Application at 5-12). A facility that obtains a permit under 02Q .0504 is required to submit an application for a Title V permit within 12 months of commencing operation.

The permit will require Nucor to submit a notification once operations commence at the facility, and then require Nucor to submit the Title V permit application within 12 months of that date.

Because this permit will be issued under 02Q .0300, the permit will include DAQ's general conditions for a non-Title V facility. As a result, the permit will include specific conditions for applying for a non-Title V permit renewal and non-Title V emission inventory. When the Title V permit is issued (at a future date, after Nucor submits the Title V application), these conditions will all be removed from the permit and replaced with DAQ's general conditions for a Title V facility.

3.1.12 15A NCAC 02Q .0711 "Emission Rates Requiring a Permit" [state-enforceable only]

In general, this rule applies to sources that construct a new facility (see 02Q .0704) or make a modification (see 02Q .0706) that cause an increase in TAP emission rates, and the TAP emission rates are less than the TAP permitting emission rates (TPER) listed in 02Q .0711.

The activities at Nucor will emit several different TAPs. Based on Nucor's calculations (see Section 5.0 and Table 16, below), several TAPs will be emitted at rates greater than their TPERs, and several TAPs will be emitted at rates less than their TPERs. Therefore, Nucor will be subject to this rule.

Note that, when determining compliance with the TPERs for a new facility, emission sources exempted by 02Q .0702 are not considered (see 02Q .0704(c) and (d)).

The permit will include a list of TPERs evaluated in Section 5.0, excluding those pollutants that have been modeled. Because Nucor performed the TAP emission calculations at the maximum potential process rates, no additional monitoring or reporting will be required to demonstrate compliance with this rule.

3.2 NSPS (40 CFR Part 60), MACT/GACT (40 CFR Part 63), and CAM (40 CFR Part 64)

3.2.1 40 CFR Part 60, Subpart AAa "Standards of Performance for Steel Plants: Electric Arc Furnaces and Argon-Oxygen Decarburization Vessels Constructed After August 17, 1983" (NSPS Subpart AAa)

This facility is a greenfield facility. Nucor operates other NSPS-applicable steel mills, and DAQ expects Nucor to be able to comply with this rule. Therefore, compliance with this rule is expected, but cannot be verified until the facility commences operation.

NSPS Subpart AAa's requirements are discussed below:

Applicability: This rule applies to steel plants constructed after August 17, 1983. The affected facilities are listed in 40 CFR 60.270a(a). At the proposed facility, the EAF (ID No. ES-1-1), fugitive emissions from the Melt Shop (ID No. ES-1-FUG) and all activities related to baghouse dust handling (ID No. ES-7 and CD-7) will be subject to this rule.

Note that EPA is currently planning to promulgate NSPS Subpart AAb in May 2023. The draft rule applies to new EAF facilities starting on May 16, 2022. However, NSPS Subpart AAa will still apply to this facility. For a discussion of the non-applicability of NSPS Subpart AAb, see Section 3.3.1.

Emission Standards: The exhaust from the Melt Shop Baghouse (ID No. CD-7) is limited to 0.0052 grains per dry standard cubic foot (gr/dscf) of filterable particulate matter and 3% opacity for visible emissions. Other emissions from the Melt Shop (*i.e.*, fugitive emissions) due solely to operating the EAF, are limited to 6% opacity. In addition, the dust handling systems are limited to 10% opacity.

Monitoring of emissions: Nucor must either install a continuous opacity monitor on the Melt Shop Baghouse, or perform daily Method 9 visible emission (VE) tests on the baghouse and install a bag leak detection system (BLDS) on the baghouse. Based on the CAM plan submitted by Nucor (see Section 3.1.6), Nucor plans to install the BLDS. Nucor must either monitor the furnace static pressure or perform daily Method 9 VE tests on the Melt Shop for any point where VE is observed.

Monitoring of operations: Nucor must install monitoring devices to measure the pressure and flowrate of the atmosphere within the Melt Shop, or conduct the Method 9 VE tests (see 40 CFR 60.273a(d)). Nucor must keep records of the EAF charge weights, heat times, control device logs, and opacity monitoring during any test. Nucor must perform monthly inspections of the equipment involved in capturing emissions, such as ducts and fans.

Testing: Nucor must perform an initial compliance demonstration.

Recordkeeping and reporting: Nucor must keep records of emission monitoring and facility inspections and submit a summary report semiannually.

3.2.2 40 CFR Part 60, Subpart IIII "Standards of Performance for Stationary Compression Ignition Internal Combustion Engines" (NSPS Subpart IIII)

This facility is a greenfield facility. Nucor operates NSPS-affected emergency engines at other facilities, and DAQ expects Nucor to be able to comply with this rule. Therefore, compliance with this rule is expected, but cannot be verified until the facility commences operation.

NSPS Subpart IIII's requirements are discussed below:

Applicability: This rule applies to all stationary compression ignition (CI) internal combustion engines (CI ICE) manufactured after July 11, 2005. Nucor intends to install two emergency generators at this facility. At this time, it is uncertain if these engines will be diesel-fired (*i.e.*, CI ICE) or natural gas-fired (*i.e.*, spark ignition ICE). If Nucor chooses to install diesel-fired engines, they will be subject to NSPS Subpart IIII. In this scenario, the engines will be classified as emergency engines.

Emission standards: Emergency CI engines subject to this rule must be certified to meet the applicable emission standards in 40 CFR 60.4205(b).

Fuel requirements: Diesel fuel must meet the sulfur requirements in 40 CFR 1090.305 (a.k.a. ultra-low sulfur diesel).

Monitoring requirements: Nucor must install a non-resettable hour meter on each emergency engine. The engines must only be operated such that they meet the definition of emergency engine or fire pump, as applicable.

Compliance requirements: The engines must be operated with good work practices and according to manufacturer's instructions. To be designated as an emergency engine, the engine must operate for non-emergency purposes (*e.g.*, maintenance testing) for less than 100 hours per year. Up to 50 of those hours can be for non-emergency use, except for peak-shaving (with rare exceptions).

3.2.3 40 CFR Part 60, Subpart JJJJ "Standards of Performance for Stationary Spark Ignition Internal Combustion Engines" (NSPS Subpart JJJJ)

This facility is a greenfield facility. Nucor operates NSPS-affected emergency engines at other facilities, and DAQ expects Nucor to be able to comply with this rule. Therefore, compliance with this rule is expected, but cannot be verified until the facility commences operation.

NSPS Subpart JJJJ's requirements are discussed below:

Applicability: This rule applies to all stationary spark ignition (SI) internal combustion engines (SI ICE) manufactured after January 1, 2009. Nucor intends to install two emergency generators at this facility. At this time, it is uncertain if these engines will be diesel-fired (*i.e.*, CI ICE) or natural gas-fired (*i.e.*, SI ICE). If Nucor chooses to install natural gas-fired engines, they will be subject to NSPS Subpart JJJJ. In this scenario, the engines will be classified as emergency engines. In addition, Nucor plans to install a natural gas-fired fire pump engine, which will also be subject to this rule.

Emission standards: Based on the expected capacities of the engines (2,000 kW for the generators, 500 hp for the fire pump), these engines must comply with the applicable limits in Table 1 to NSPS Subpart JJJJ. The engines must be certified to meet these standards.

Monitoring requirements: Nucor must install a non-resettable hour meter. The engines must be operated such that they meet the definition of emergency engine.

Compliance requirements: The engines must be operated with good work practices and according to manufacturer's instructions. To be designated as an emergency engine, the engine must operate for non-emergency purposes (*e.g.*, maintenance testing) for less than 100 hours per year. Up to 50 of those hours can be for non-emergency use, except for peak-shaving (with rare exceptions).

3.2.4 40 CFR Part 63, Subpart ZZZZ "National Emissions Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines" (GACT Subpart ZZZZ)

Applicability: In general, this rule applies to all stationary ICE. However, for emergency-use engines that are subject to an NSPS (either Subpart IIII or JJJJ), compliance with GACT Subpart ZZZZ is demonstrated by complying with the applicable NSPS (see 40 CFR 63.6590(c)).

Each engine at this facility will be subject to an NSPS. Therefore, compliance with GACT Subpart ZZZZ will be determined by compliance with the applicable NSPS.

3.2.5 40 CFR Part 63, Subpart YYYYY "National Emission Standards for Hazardous Air Pollutants for Area Sources: Electric Arc Furnace Steelmaking Facilities" (GACT Subpart YYYYY)

This facility is a greenfield facility. Nucor operates other steel mills subject to this rule, and DAQ expects Nucor to be able to comply with this rule. Therefore, compliance with this rule is expected, but cannot be verified until the facility commences operation.

Subpart YYYYY's requirements are discussed below:

Applicability: This rule applies to any facility that operates an EAF and is located at an area source of hazardous air pollutants (HAP). The affected source for this rule is "each steelmaking facility" (40 CFR 63.10680(b)). This rule defines a "steelmaking facility" as:

> 40 CFR 63.10692: *Electric arc furnace (EAF) steelmaking facility* means a steel plant that produces carbon, alloy, or specialty steels using an EAF. This definition excludes EAF steelmaking facilities at steel foundries and EAF facilities used to produce nonferrous metals.

Nucor will produce steel using an EAF, and Nucor will not be a steel foundry or produce nonferrous metals. Therefore, Nucor will be subject to this rule. Furthermore, a facility is "new" if it commenced construction after September 20, 2007. Nucor Lexington will therefore be subject to this rule as a new facility. Based on the definition above, all of the activities within the Melt Shop will be subject to this rule.

Chlorinated plastics, lead, and free organic liquids: Nucor must control emissions of these pollutants by either developing, submitting, and complying with a pollution prevention plan (PPP), or commit to not use the categories of restricted scrap listed in 40 CFR 63.10685(a)(2). Nucor submitted a PPP with the application (see Application at Appendix D).

Mercury: When developing a PPP, a facility must either (1) prepare a site-specific plan for removing mercury switches from autobody scrap, (2) purchase autobody scrap that is either certified to not contain, or not expected to contain mercury switches, or (3), certify that any scrap used does not contain motor vehicle scrap. Based on the PPP, Nucor intends to use option (2).

Requirements for electric arc furnaces: Nucor must install a system that collects emissions from each EAF for the removal of PM. The PM emission standards in this rule are identical to NSPS Subpart AAa. Nucor must perform an initial compliance test and develop a CAM plan for the Melt Shop Baghouse according to 40 CFR Part 64.

Recordkeeping and reporting requirements: Nucor must keep records of compliance with the PPP and other scrap records to demonstrate compliance with the above requirements. Nucor must submit a semiannual compliance report.

3.2.6 40 CFR Part 63, Subpart CCCCCC "National Emission Standards for Hazardous Air Pollutants for Source Category: Gasoline Dispensing Facilities" (GACT Subpart CCCCCC)

This facility is a greenfield facility. Nucor operates other MACT-applicable steel mills, and DAQ expects Nucor to be able to comply with this rule. Therefore, compliance with this rule is expected, but cannot be verified until the facility commences operation.

GACT Subpart CCCCCC's requirements are discussed below.

Applicability: This rule applies to each gasoline dispensing facility located at an area source of HAP. This facility will be an area source of HAP, and the gasoline storage tank ES-11-2 will be a gasoline dispensing facility as defined by 40 CFR 63.11132. Therefore, this rule will apply to this facility. According to the application, the gasoline storage tank will have a monthly throughput less than 10,000 gallons per month.

Requirements: The facility will be required to operate the gasoline storage tank with good work practices. The rule lists several work practice requirements in 40 CFR 63.11116. The facility will keep records of gasoline throughput, but the rule explicitly does not require any notifications or reporting for facilities with throughput less than 10,000 gallons per month.

3.2.7 40 CFR Part 64 "Compliance Assurance Monitoring" (CAM)

Background and applicability: In general, this rule requires certain facilities to develop a CAM plan for control devices that are used to comply with emission standards. A facility subject to this requirement must develop a CAM plan and submit it either when the facility applies for the first-time Title V permit (for large PSEUs) or when Title V permit is first renewed (for all other cases). There are no large PSEUs at the proposed facility. Therefore, if any emission sources at this facility (except the Melt Shop, discussed below) are subject to CAM, Nucor will address the CAM plan during the first Title V permit renewal.

Despite this facility being a greenfield facility, a CAM plan is required for the Melt Shop Baghouse because this facility is subject to GACT Subpart YYYYY (see 40 CFR 63.10686(e)). Therefore, Nucor developed and submitted a CAM plan as part of this application. The proposed CAM plan uses a bag leak detection system as the indicator for excursions and exceedances. The preliminary CAM plan will be incorporated into the permit.

3.3 Nonapplicable Rules

There are several SIP and Federal rules that may appear to apply to this facility, but ultimately do not. A discussion of these rules is included below.

3.3.1 15A NCAC 02D .0515 "Particulates from Miscellaneous Industrial Processes" [not applicable]

This rule applies to PM emission sources that exhaust through a vent or stack and "for which no other emission control standards are applicable."

Each emission source at this facility that exhausts through a vent or stack is subject to a PM emission limit under 02D .0530. Therefore, this rule will not apply to any emission source at this facility.

3.3.2 15A NCAC 02D .0900 "Volatile Organic Compounds" [not applicable]

The rules under 02D .0900 apply to sources of VOC. Except for the rules specifically mentioned in 02D .0902(e), these rules only apply to facilities located in a county listed in 02D .0902(f). Nucor Lexington will be located in Davidson County, which is not one of the listed counties.

The rules listed in 02D .0902(e) apply to specific types of emission sources. Generally, these rules regulate large gasoline terminals and the storage and transfer of VOC materials. The gasoline storage tank (ID No. ES-11-2) will have a capacity of 1,000 gallons and annual throughput of 6,000 gallons per year (see Appendix 1, Section 11.2). Therefore, it will not meet the definition of "bulk gasoline plant," "bulk gasoline terminal," or "gasoline service station."

Therefore, none of the rules under 02D .0900 will apply to this facility.

3.3.3 15A NCAC 02D .1400 "Nitrogen Oxides" [not applicable]

The rules under 02D .1400 apply to sources of NOx. Except for the rules specifically mentioned in 02D .1402(c), these rules only apply to facilities located in a county listed in 02D .1402(d). Nucor Lexington will be located in Davidson County, which is not one of the listed counties.

The rules listed in 02D .1402(c) apply to large electric generating units, large boilers, and large internal combustion engines. The emergency-use engines at this facility (ID Nos. 10-2 and 10-3) are large enough to be potentially subject to these rules. However, both 02D .1418(c) and 02D .1423(a) specifically state that these rules apply to engines "not regulated by 15A NCAC 02D .0530" (*i.e.*, not subject to PSD). Each of the engines at this facility will be subject to PSD, and therefore these rules will not apply.

3.3.4 15A NCAC 02D .2100 "Risk Management Program" (a.k.a. Section 112(r) of the Clean Air Act) [not applicable]

This rule applies to facilities that store materials above their respective thresholds in 40 CFR 68.115. Such facilities are required to prepare and submit a Risk Management Plan (RMP). In the application on Form A3, Nucor states that an RMP will not be required for this facility because it will not "will not produce, process, handle or store materials regulated by such rules or trigger regulatory threshold quantities." Note that other parts of Section 112(r), such as the "general duty" clause, may still apply to this facility.

3.3.5 40 CFR Part 60, Subpart AAb "Standards of Performance for Steel Plants: Electric Arc Furnaces and Argon-Oxygen Decarburization Vessels Constructed After May 16, 2022" (NSPS Subpart AAb) [not applicable]

Note that this rule has not been promulgated. It was initially proposed on May 16, 2022. The proposed rule text is available in the Federal Register at 87 Fed. Reg. 29710. If promulgated as proposed, this rule will apply to EAFs that commence construction after May 16, 2022.

NSPS defines "commence construction" in two steps (see 40 CFR 60.2):

> *Commenced* means, with respect to the definition of *new source* in section 111(a)(2) of the Act, that an owner or operator has undertaken a continuous program of construction or modification or that an owner or operator has entered into a contractual obligation to undertake and complete, within a reasonable time, a continuous program of construction or modification.

> *Construction* means fabrication, erection, or installation of an affected facility.

Under NSPS, a facility can "commence construction" by entering into a contractual obligation to undertake and complete, within a reasonable time, a continuous program of construction or modification. Therefore, if Nucor has entered into such an obligation before May 16, 2022, the facility would have commenced construction for the purposes of NSPS, and NSPS Subpart AAb will not apply.

According to the application, Nucor has entered into the appropriate contractual obligations. For example, Nucor announced on April 11, 2022 that Danieli (a manufacturing company based in Italy) would manufacture the EAF for this facility.[10] This clearly demonstrates the existence of contractual obligations to complete a program of construction. Therefore, this facility has commenced construction for NSPS purposes, and NSPS Subpart AAb (as proposed) will not apply.

3.3.6 40 CFR Part 63, Subpart EEEEE "National Emission Standards for Hazardous Air Pollutants for Iron and Steel Foundries"

This rule applies to iron and steel foundries that are also major sources of HAP. This rule will not apply to this facility for two reasons:

1) This facility will be an area source of HAP because it has accepted a facility-wide HAP emission limit (see Section 3.1.10.2). Area sources of HAP are, by definition, not major sources of HAP.

2) This facility will not meet the definition of "steel foundry" in 40 CFR 63.7765. Nucor explained why the proposed Lexington facility will not be a steel foundry according to the rule:

> "Nucor Steel Lexington is not a "foundry" because it does not "pour[] the resulting molten metal into molds to produce final or near final shape products for introduction into commerce." As the definition of "mold or core making line" makes clear, a mold "is an aggregate of sand and binder chemicals." Nucor does not use sand molds to cast and therefore is not an iron and steel foundry." (comments on pre-draft permit, received March 15, 2023)

[10] News release available at: https://www.danieli.com/en/news-media/news/nucor-corporation-again-selects-danieli-endless-casting-rolling-technology_37_715.htm

4.0 Prevention of Significant Deterioration

The basic goal of the PSD regulations is to ensure the air quality in clean (*i.e.*, attainment) areas does not significantly deteriorate while maintaining a margin for future industrial growth. The PSD regulations focus on industrial facilities, both new and modified, that create large increases in the emission of certain pollutants. The US EPA promulgated final regulations governing the PSD in the Federal Register published August 7, 1980. Effective March 25, 1982, the NCDAQ received full authority from the US EPA to implement PSD regulations in the state. North Carolina has incorporated US EPA's PSD regulations (40 CFR 51.166) into its air pollution control regulations in 15A NCAC 02D .0530 and 02D .0531.

Under PSD requirements, all major new or modified stationary sources of air pollutants regulated and listed in this section of the Clean Air Act must be reviewed and approved prior to construction by the permitting authority. A major stationary source is defined as any one of 28 named source categories that has the potential to emit 100 tpy of any regulated pollutant. Nucor is a steel mill, which is one of the 28 named source categories and therefore has a 100 tpy limit for PSD applicability.

A PSD analysis is required for each pollutant indicated in Table 2, above.

The elements of a PSD review are as follows:

1) A BACT Determination as determined by the permitting agency on a case-by-case basis in accordance with 40 CFR 51.166(j),

2) An Air Quality Impacts Analysis including Class I and Class II analyses, and

3) An Additional Impacts Analysis including effects on soils and vegetation and impacts on local visibility in accordance with 40 CFR 51.166(o).

4.1 BACT Determination

4.1.1 Background

The Clean Air Act (CAA) §169(3) defines BACT as:

> "The term "best available control technology" means an emission limitation based on the maximum degree of reduction of each pollutant subject to regulation under this Act emitted from or which results from any major emitting facility, which the permitting authority, on a case-by-case basis, taking into account energy, environmental, and economic impacts and other costs, determines is achievable for such facility through application of production processes and available methods, systems, and techniques, including fuel cleaning, clean fuels, or treatment or innovative fuel combustion techniques for control of each such pollutant. In no event shall application of "best available control technology" result in emissions of any pollutant which will exceed the emissions allowed by any applicable standard established pursuant to section 111 or 112 of this Act. Emissions from any source utilizing clean fuels, or any other means, to comply with this paragraph shall not be allowed to increase above levels that would have been required under this paragraph as it existed prior to enactment of the federal Clean Air Act Amendments of 1990."

Given the variation between emission sources, facility configuration, local air-sheds, and other case-by-case considerations, Congress determined that it was impossible to establish a single BACT determination for a particular pollutant or source. Economic, energy, and environmental impacts are mandated in the CAA to be considered in the determination of case-by-case BACT for specific emission sources. In most instances, BACT may be defined through an emission limitation. In cases where this is impracticable, BACT can be defined using a particular type of control device, work practice, or fuel type. In no event, can a technology be recommended which would not comply with any applicable standard of performance under CAA §§111 (NSPS) or 112 (NESHAP).

The EPA developed guidance, commonly referred to as “Top-Down” BACT,[11] for PSD applicants for determining BACT. This guidance is a non-binding reference material for permitting agencies, which process PSD applications pursuant to their SIP-approved regulations. As stated in Section 4.1 above, NCDAQ issues PSD permits in accordance with its SIP-approved regulation in 15A NCAC .02D .0530. Therefore, the DAQ does not strictly adhere to EPA's “top-down” guidance. Rather, it implements BACT in accordance with the statutory and regulatory language. As such, NCDAQ's BACT conclusions may differ from those of the EPA.

After establishing the baseline emissions levels required to meet any applicable NSPS, NESHAPs, or SIP limitations, the “top-down” procedure followed for each pollutant subject to BACT is outlined as follows:

Step 1: Identify all available control options - from review of US EPA RACT/BACT/LAER Clearinghouse (RBLC), agency permits for similar sources, literature review and contacts with air pollution control system vendors.

Step 2: Eliminate technically infeasible options - evaluation of each identified control to rule out those technologies that are not technically feasible (i.e., not available and applicable per US EPA guidance).

Step 3: Rank remaining control technologies - “Top-down” analysis, involving ranking of control technology effectiveness.

Step 4: Evaluate most effective controls and document results – Economic, energy, and environmental impact analyses are conducted if the “top” or most stringent control technology is not selected to determine if an option can be ruled out based on unreasonable economic, energy or environmental impacts.

Step 5: Select the BACT – the highest-ranked option that cannot be eliminated is selected, which includes development of an achievable emission limitation based on that technology.

4.1.2 References Used to Identify Control Technology

Using EPA’s RACT/BACT/LAER Clearinghouse (RBLC), an investigation was performed to identify current regulatory BACT/LAER determinations for the proposed emission sources. When searching the RBLC, the following general criteria were used:

- Process type = 81.210 or 81.310 “Electric Arc Furnaces”
- Processes named some variation or “EAF,” “Electric Arc Furnace,” and/or “Melt Shop”

[11] “*Improving New Source Review (NSR) Implementation*”, J. Craig Potter, Assistant Administrator for Air and Radiation US EPA, Washington D.C., December 1, 1987, and “*Transmittal of Background Statement on “Top-Down” Best Available Control Technology*”, John Calcagni, Director, Air Quality Management Division, US EPA, OAQPS, RTP, NC, June 13, 1989.

- SIC code = 3312 - Steel Works, Blast Furnaces (including Coke Ovens), and Rolling Mills
- Within the last 10 years (*i.e.*, issued on or after January 1, 2012)

The above criteria yield more than a thousand results. Further refinement of the results is needed.

4.1.3 Determining Relevant Facilities

When determining available control technologies, and especially BACT emission limits, it is necessary to only compare similar facilities and processes. It is not reasonable, for example, to compare BACT limits for a mill that produces steel and a mill that produces aluminum, or cast iron, or some other smelted metal product.

This facility will be an electric arc furnace steel "minimill." A minimill is fundamentally different than the older, blast furnace-based steel mills. Although still part of the broad SIC and NAICS categories, it is important to not directly compare the two types of steel mills.

Throughout the application, Nucor refers to the proposed project as a "micro mill" instead of a "minimill." Based on the application, Nucor considers a micro mill to be a subset of minimills. There is no convenient distinction between the larger minimills and smaller micro mills using the RBLC database. There does not appear to be a definition of "micro mill" accepted by EPA, but nevertheless the production capacity of the minimills found in the RBLC must be considered when compared to this proposed project.

Furthermore, "minimills exhibit significant variability in product mix, configuration, and production processes, all of which contribute to the type and rate of emissions. For minimills, the primary variables include the following: *(1) Product Type…(2) Furnace Type, Size, and Power…(3) Furnace Design…(4) Type of Scrap/Raw Material Inputs…(5) Scrap Feed Practices…*[and] *(6) Slag Practices*. Differences in these variables lead to wide-ranging emission rates across facilities within the industry."[12] Therefore, when identifying control technologies and BACT emission limits, it is important to consider all aspects of this proposed facility versus any existing steel minimills.

- This facility will produce exclusively rebar. Other minimills produce different kinds of steel products. In particular, plate steel and tubular steel appear to be common products from minimills, and are different from the rebar that will be produced at the proposed facility.

- This facility will not employ a reheat furnace. Many minimills in the RBLC use a reheat or other post-casting furnace. According to the application, reheat furnaces are typically used to heat steel billets before shaping them into the final product. This facility will produce rebar which does not require a reheat furnace.

- This facility will have a single electric arc furnace with an average throughput of 59 tons per hour (with short term process rates of up to 80 tons per hour). This facility will also have one secondary furnace (the "ladle metallurgy furnace"), but the majority of emissions are expected from the single EAF. Other steel minimills in the RBLC database employ much larger EAFs with capacities as high as 250 tons per hour,[13] multiple EAFs, and/or multiple secondary furnaces.

[12] AP-42 Chapter 12.5.1 "Steel Minimills" (pages 12.5.1-5 and 6)
[13] See RBLC entry #OH-0381 for Northstar Bluescope Steel, LLC.

- This facility will have an annual steel production capacity of 515,000 tons per year using a single EAF. Entries for other minimills have annual production capacities as high as 2,000,000 tons per year.[14]

- This facility process exclusively recycled steel scrap. No iron ore will be included in the scrap. Emission profiles can differ based on the contents of the scrap (*e.g.*, more steel from recycled automobiles versus recycled structural steel).

- Many minimills charge scrap to the EAF through a continuous process (sometimes referred to as "endless scrap charging"). The EAF at this facility will be charged in batches ("bucket charging").

Based on the above, RBLC search results were narrowed to find small minimills (comparable to the 515,000 tons per year capacity of this facility), using a single EAF and single LMF, producing rebar (rebar will be the only product of this facility), and issued within the previous 10 years. Based on these criteria, the following facilities have been identified:

- Nucor Florida (RBLC ID: FL-0368)

- CMC Steel Oklahoma (RBLC ID: OK-0173)

In reviewing the statements of basis written by the states of Florida and Oklahoma for these facilities, two other recently issued steel micro mill BACT determinations were discovered. This facility's application considered these facilities, despite not being included in the RBLC.

- Nucor Sedalia (Located in Missouri; not in the RBLC)

- CMC Steel Fabricators Mesa Mill No. 2 (Located in Maricopa County, Arizona; not in the RBLC)[15]

Note that each of these four facilities uses a continuous scrap charging process, whereas the proposed facility will use a batch charging process. In correspondence received after the application, Nucor explains why these facilities are the most relevant to the BACT determination, despite the difference in charging process:

> "Nucor Sedalia and Nucor Florida were the first micro mills constructed and operated by Nucor, and both micro mills use a continuous/endless charging system. As such, the BACT analysis evaluated the micro mills and the continuous charging system. Nucor Lexington will be the first bucket-charge micro mill. Based on Nucor's experience operating the two continuous charge micro mills, Nucor determines the emission profile of the facilities is dependent on the type of product produced and size of the mill. Therefore, Nucor concludes that the most representative emission rates and BACT determinations are those of other micro mills." (Email from Matt Way [Environmental Manager, Nucor], received November 18, 2022)

[14] See RBLC entry #AR-0173 for Big River Steel LLC.
[15] Data for this permit is difficult to obtain. BACT data for this facility is taken from Nucor's application. See Application at Appendix F (specifically, Appendix A *to* Appendix F).

In the application, Nucor notes that the company has encountered difficulties with some aspects of the continuous scrap charging processes:

> "As an example, the Nucor steel plant located in Kingman, AZ originally installed a DC furnace with shaft preheating of the scrap, but this facility experienced exceedingly high CO emissions from the scrap preheating that were so severe that they experienced explosions in the scrap preheating shaft that endangered the operations personnel. This furnace has been mothballed as a result…" (Application at Appendix F, page 2-35)

Therefore, BACT analysis will focus on those four facilities, despite Nucor Lexington not using a continuous scrap charging process. In pre-application meetings, and throughout the application review, Nucor has consistently stated that the operations at Nucor Sedalia and Nucor Florida are similar to the proposed facility based on throughput, scrap mix, and facility design.[16]

4.1.4 Summary of BACT Determinations

The proposed BACT for each of the sources at this facility are summarized in Table 5.

Table 5: BACT Summary

Emission Source	Pollutant	BACT		
		Limit	Averaging period	Control Technology
Melt Shop (ES-1)	PM (filterable and condensable)	0.0052 gr/dscf	Average of three 4-hour test runs (using emission testing)	Baghouse
	PM (filterable only)	0.0015 gr/dscf		
	PM_{10} (filterable and condensable)	0.0024 gr/dscf		
	$PM_{2.5}$ (filterable and condensable)	0.0024 gr/dscf		
	CO	3.5 pounds per ton steel produced (lb/ton)	30-day rolling average (using continuous emissions monitoring system (CEMS))	Direct evacuation control (DEC) and scrap management
	NOx	0.3 lb/ton	30-day rolling average (using CEMS)	Oxy-fired burners and DEC
	VOC	0.3 lb/ton	3-hour average (using emission testing)	Scrap management plan and good work practices
	SO_2	0.5 lb/ton	30-day rolling average (using CEMS)	Low-sulfur carbon-based feed and charge material

[16] Based on discussion with Nucor in the pre-application meeting on May 20, 2022.

Emission Source	Pollutant	BACT		
		Limit	Averaging period	Control Technology
	GHGs	438.2 lb/ton	30-day rolling average (using CEMS)	Good work practices and furnace design: • Adjustable speed drives • Transformer efficiency-ultra-high-power transformers • Bottom stirring/stirring gas injection • Foamy slag practice • Oxy-fuel burners • Post combustion of the flue gases • Engineered refractories • Eccentric bottom tapping on furnace • Energy monitoring and management system
Casting Operations (ES-2)	Particulate Matter PM_{10} $PM_{2.5}$ Carbon Monoxide Nitrogen Oxides Sulfur Dioxide Volatile Organic Compounds GHGs	n/a	n/a	Scrap management plan
Caster Spray Stack (ES-3)	Particulate Matter PM_{10}, $PM_{2.5}$ Volatile Organic Compounds	n/a	n/a	Scrap management plan
Rolling Mill (ES-4)	Particulate Matter PM_{10} $PM_{2.5}$ Carbon Monoxide Nitrogen Oxides Sulfur Dioxide Volatile Organic Compounds GHGs	n/a	n/a	Best management practices to minimize the amount of oil and grease used
Cooling Towers (ES-6)	Particulate matter ($PM/PM_{10}/PM_{2.5}$)	0.001 percent drift loss using cooling water with less than 2,500 ppm total dissolved solids	3-hour average	Drift eliminators
Silos (ES-7)	Particulate matter ($PM/PM_{10}/PM_{2.5}$)	0.005 gr/dscf	3-hour average	Bin vent filters

Emission Source	Pollutant	BACT		
		Limit	Averaging period	Control Technology
Material Handling (ES-8)	Particulate matter ($PM/PM_{10}/PM_{2.5}$)	n/a	n/a	(as applicable) • Minimize drop heights • Covered piles • Partial enclosure • Wetting agents
Haul roads (ES-9)	Particulate matter ($PM/PM_{10}/PM_{2.5}$)	n/a	n/a	Fugitive dust control plan including: • Road watering • Road sweeping • Road vacuuming • Speed limit to 10 mph
Emergency engines (ES-10)	Particulate Matter PM_{10} $PM_{2.5}$ Carbon Monoxide Nitrogen Oxides Sulfur Dioxide Volatile Organic Compounds GHGs	NSPS limits where applicable	3-hour average for emission limits	• Purchase NSPS-certified engines • NSPS work practices • ULSD or natural gas as fuel
Storage tanks (ES-11)	Volatile Organic Compounds	n/a	n/a	• Good design • MACT 6C, where applicable
Facility-wide cutting torches	Particulate Matter PM_{10} $PM_{2.5}$ Carbon Monoxide Nitrogen Oxides Sulfur Dioxide Volatile Organic Compounds GHGs	n/a	n/a	• Good work and maintenance practices
Facility-wide burners with low-NOx burners	Particulate Matter PM_{10} $PM_{2.5}$ Carbon Monoxide Nitrogen Oxides Sulfur Dioxide Volatile Organic Compounds GHGs	n/a	n/a	• Good work and maintenance practices

4.2 Source-by-Source BACT Analysis

In this section, the various control methods available for the emission sources at this facility are discussed. See Appendix 2 for a description of each control method discussed in this section.

4.2.1 BACT Analysis for Melt Shop Processes (ES-1), excluding ES-1-6

The original application proposed BACT limits for the Melt Shop activities (consisting of the EAF, LMF, slag handling, etc.) and the Casting Operations. In some parts of the application, the application mistakenly states that the Casting Operations will exhaust through the Melt Shop baghouse, which will not be true.[17] The application also considered all natural gas-fired sources (such as the ladle preheaters and skull cutting torches) separately.

DAQ agrees with the approach of considering the natural gas-fired sources separately. However, DAQ disagrees with considering the Casting Operations and Melt Shop activities together. The Casting Operations will exhaust through either the caster vent or the caster spray stack, *not* the Melt Shop Baghouse (see Figure 2, above). A CEMS monitoring the intake or exhaust of the Melt Shop Baghouse would not quantify emissions from the Casting Operations.

DAQ requested a separate BACT determination for the Casting Operations and Caster Spray Stack. Nucor submitted the updated BACT determination. The updated BACT determination did not adjust any of the proposed BACT limits for the Melt Shop.

Most of the emissions from the Melt Shop will come from the EAF. However, the Melt Shop will also include the LMF and several supporting activities, all of which will vent through the DEC system and/or canopy hood, ultimately exhausting through the Melt Shop Baghouse. Nucor proposes a BACT limit for all of these combined activities (except natural gas-fired cutting torches and preheaters, which Nucor proposes to consider separately). In order to determine BACT, Nucor considered the Melt Shop as a whole:

> "It should be noted the RBLC database is inconsistent in the setting of BACT limits for the EAF and ladle metallurgy furnace (LMF) at steel mills throughout the United States. In addition, other steel manufacturing facilities may use natural gas combustion as part of their LMF operations. In many cases, the exhaust from the EAF and LMF is combined into a single stream to achieve the highest levels of emission reductions. As a result, it is unclear in many cases whether the limits presented in the RBLC apply to the EAF and LMF individually, or to the combined exhaust stream. In addition, many of the facilities in the RBLC are listed with BACT limits on the EAF, but do not have corresponding BACT limits listed for the LMF…In light of this uncertainty, in this application, the Project compares the proposed BACT limits for the combined EAF and LMF exhaust streams with the EAF limits for facilities listed in the RBLC. This is a conservative approach, since BACT limits for the EAF alone are expected to be lower than the limits for the combined exhaust from the EAF and LMF." (Application at Appendix F, page 2-4)

4.2.1.1 BACT for NOx for Melt Shop Processes

<u>Applicant Proposed BACT:</u>

The application explains the formation of NOx within the Melt Shop:

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[17] This error only occurs within the application narrative (for example, Appendix F, page 2-8). The emission calculations for the Melt Shop and Casting Operations were performed correctly and did not apply the Melt Shop baghouse's control efficiency to the Casting Operations.

"NOx emissions from the EAF are predominantly thermal NOx, which is formed as a result of the high temperature arc used to melt the scrap steel. Temperatures in the EAF during the melting phase, which reach well over 3,000 degrees Fahrenheit (°F), cause the nitrogen and oxygen present in the ambient air to form NOx. Additional NOx formation occurs during oxygen lancing, which introduces oxygen that can combine with nitrogen present in the molten steel to form NOx… Emissions from the molten steel are ducted through the fourth hole (at the top of the EAF) and into a water-cooled exhaust duct. At the juncture of the fourth hole and exhaust duct, an adjustable air gap introduces ambient air to cool the exhaust stream and provide oxygen to combust the CO into CO_2. This ducting system is also referred to as a direct evacuation control (DEC)." (application at Appendix F, page 2-8)

Nucor performed the following BACT analysis:

1: Identify All Potentially Applicable Control Technologies:

- Direct evacuation control
- Oxy-fuel burners
- Low NOx combustion controls (a.k.a low-NOx burners)
- Selective catalytic reduction (SCR)
- Selective non-catalytic reduction (SNCR)
- Non-selective catalytic reduction (NSCR)
- EMx NOx control
- XONON™
- SCONOx™

2: Identify Technically-Feasible Control Technologies:

The application dismisses Low NOx combustion controls as infeasible because this type of control reduces NOx formation by limiting the maximum temperature of combustion, thereby reducing thermal NOx formation. "In an EAF, the peak NOx formation temperature is exceeded by the entire liquid bath near the end of the heat" (Application at Appendix F, page 2-10). In other words, prevention of thermal NOx formation through temperature control is not practical for an EAF. The result is similar for an LMF, which generally operates on the same principle as an EAF. The application also notes that "EAFs need a burner first to preheat solid scrap and a lance later to inject oxygen into the liquid bath. A surface combustion (low NOx) burner cannot fulfill both and would not last very long since the force of the expanding gas from a surface burner configuration is not enough to keep the surface clear from splashing slag/steel" (Application at Appendix F, page 2-9).

The application dismisses catalytic and non-catalytic reduction as technically infeasible due to the nature of the exhaust stream from the Melt Shop. In the application, Nucor explains that the exhaust stream of an EAF would lead to catalyst fouling. In addition, both the exhaust temperature and rate of NOx production fluctuates throughout the melting cycle. As a result, processes that rely on a catalyst, a constant temperature, and/or a constant NOx concentration are generally not feasible controls for NOx emitted from the Melt Shop. Therefore, SCR, NSCR, NSCR, EMx NOx control, and SCONOx™ are not technically feasible.

The application dismisses XONON™ as infeasible because it has only ever been demonstrated on small-scale combustion turbines.

The application states that both DEC and oxy-firing are technically feasible and have been demonstrated in practice.

3. Rank the Technically-Feasible Control Technologies:

Only oxy-firing and DEC are technically feasible. Both have been demonstrated in practice.

4. Evaluate the Most Effective Control Technologies:

Because all of the technically-feasible control technologies will be implemented, no further analysis is required.

5. Nucor Proposed BACT:

In the application, Nucor proposes BACT for NOx from the Melt Shop Processes as Direct Evacuation Control (DEC) and oxy-fuel burners. The application notes that NOx emission rates can vary between facilities. "…NOx emission rates can vary between facilities due to individual process characteristics and differences in the types of steel products produced at each facility. Product specifications at one facility may require greater use of oxygen lancing and longer melt times resulting in higher per ton NOx emissions. Further, NOx emissions can spike due to process variations. Therefore, a longer averaging period is necessary." (Application at Appendix F, page 2-13).

The application proposes the BACT emission limit as 0.30 pounds of NOx per ton steel produced, measured by a continuous emission monitoring system (CEMS) and averaged over a rolling 30-day period.

<u>DAQ Proposed BACT:</u>

In searching the RBLC database for NOx controls applied to electric arc furnaces, there were no instances of add-on control devices being applied to the electric arc furnace or larger melt shop process (even at larger steel minimills). Oxy-firing (and oxy-fuel) is referenced in several applicable BACT determinations. Given that BACT must be demonstrated in practice, and there appear to not be any other demonstrated control techniques, it is not practical to analyze other NOx control methods.

Based on the available data, DAQ concurs that BACT for NOx from the Melt Shop will be oxy-firing and use of the DEC system.

In order to determine the NOx BACT emission limit, limits from the similar steel mills listed above were considered.

Table 6: Melt Shop/EAF NOx BACT Analysis

Facility	Listed Control Method	NOx Emission Limit (lb/ton steel)	Averaging Time
Nucor Sedalia	DEC, Baghouse	0.30	30 days using CEMS
Nucor Florida	Oxy-fuel burners on the EAF, DEC System and baghouse controls.	0.3	Average of three test runs
CMC Steel Oklahoma	Oxy-firing	0.3	Stack testing

Facility	Listed Control Method	NOx Emission Limit (lb/ton steel)	Averaging Time
CMC Steel Fabricators Mesa Mill No. 2	Oxy-fired Burners and DEC system	0.3*	*Not available*

* The data also shows a limit of 0.05 pounds of NOx per MMBtu fired. This limit clearly refers exclusively to the oxy-firing.

Based on the NOx BACT limits at similar facilities, it appears that a limit of 0.30 pounds per ton of steel is a reasonable choice for BACT. The RBLC contains NOx emission limits for other steel minimills that are lower than the proposed BACT, but those limits are not relevant to this specific project because they are for much larger facilities, or facilities that produce a different product (such as tube or plate steel).

In order to justify the proposed 30-day averaging period, Nucor explains that NOx emissions can spike due to process variations and therefore a longer averaging time is necessary. Based on the above information, NOx BACT limits have been demonstrated using annual stack testing and 30-day CEMS averages. The annual emission testing requirement is far less stringent than a 30-day averaging period measured by CEMS. Therefore, DAQ concurs with the proposed 30-day averaging period.

DAQ concurs with Nucor and proposes BACT for NOx from the Melt Shop to be 0.30 lb/ton steel, measured by CEMS on a rolling 30-day average. As discussed above, the BACT determination for the Melt Shop has been separated from the Casting Operations.

4.2.1.2 BACT for CO for Melt Shop Processes

<u>Applicant Proposed BACT:</u>

The application explains the formation of CO within the Melt Shop as:

> "CO emissions are generated mainly during the melting of the scrap metal in the EAF due to combustion of greases and oils present in the scrap, the release of an electrode carbon during the melting process, and from the various forms of carbon added to the steel to achieve the desired carbon content of the steel product… The use of an oxygen lance to introduce oxygen into the molten steel serves as an initial step to reduce CO emissions via oxidation. Emissions from the molten steel are ducted through the fourth hole (at the top of the EAF) and into a water-cooled exhaust duct. At the juncture of the fourth hole and exhaust duct, an adjustable air gap introduces ambient air to cool the exhaust stream and provide oxygen to combust the CO into CO_2. This ducting system is also referred to as a DEC and significantly reduces the amount of CO emissions." (Application at Appendix F, page 2-14)

> "A conventional furnace practice may use 15 to 25 pounds of injection carbon per ton of steel, and it is desirous to utilize post-combustion in the head space of the furnace by injecting oxygen to recover energy by the combustion of CO to CO_2 within the furnace. The hot CO gases laden [*sic*] exit the conventional furnace through the fourth hole direct evacuation control (DEC), where air is inspired by the negative draft at the gap and high CO destruction efficiency is provided by the high temperature and

> violent mixing of the gases and air.” (Application at Appendix F, page 2-16)

Nucor performed the following BACT analysis:

1: Identify All Potentially Applicable Control Technologies:

- Direct evacuation control (DEC)
- Catalytic oxidizers
- Thermal oxidizers
- XONON™
- SCONOx™

2: Identify Technically-Feasible Control Technologies:

The application dismisses catalytic oxidizers, XONON™, and SCONOx™ as technically infeasible because the exhaust stream would lead to catalyst fouling (see also the BACT analysis for NOx from the Melt Shop).

The application dismisses thermal oxidizers as technically infeasible due to the large air flow from the Melt Shop: “The large air flow from the EAF precludes routing air through the oxidizer tip. The heavy particulate loading in the EAF exhaust stream would cause excessive burner fouling and would most likely hinder proper combustion.” The application also notes that such a system would require substantial amounts of natural gas which would lead to higher NOx emissions.

The application identifies DEC as the only technically feasible CO control.

3. Rank the Technically-Feasible Control Technologies:

The application identifies DEC as the only technically feasible control, but also notes that and a scrap management plan (which will reduce the mass of organic material, thereby reducing the amount of carbon available to form CO) will also be active at the facility.

4. Evaluate the Most Effective Control Technologies:

Because all of the technically-feasible control technologies will be implemented, no further analysis is required.

5. Nucor Proposed BACT:

In the application, Nucor proposes BACT for CO from the Melt Shop Processes as DEC with a scrap management plan. The application proposes the BACT limit to be 3.5 pounds of CO per ton of steel produced, measured by CEMS and averaged over a rolling 30-day period.

<u>DAQ Proposed BACT:</u>

In searching the RBLC database for CO controls applied to electric arc furnaces, there were no instances of add-on control devices being applied to the electric arc furnace or larger melt shop process (even at larger steel minimills). DEC, oxy-firing, good combustion practices, and scrap management plans were the only control methods found in the RBLC.

Given that BACT must be demonstrated in practice, and there appears to not be any other demonstrated control techniques, it is not practical to analyze other CO control methods.

Based on the available data, DAQ concurs that BACT for CO from the Melt Shop will be oxy-firing, use of the DEC system, and a scrap management plan.

In order to determine the CO BACT emission limit, limits from the similar steel mills listed above were considered.

Table 7: Melt Shop/EAF CO BACT Analysis

Facility	Listed Control Method	CO Emission Limit (lb/ton steel)	Averaging Time
Nucor Sedalia	DEC, Baghouse	3.5	30 days using CEMS
Nucor Florida	Oxy-fuel burners on the EAF, DEC System and baghouse controls.	3.5	Average of three test runs
CMC Steel Oklahoma	Oxy-firing	4.0	Stack testing
CMC Steel Fabricators Mesa Mill No. 2	GOOD COMBUSTION PRACTICES & DEC	4	*Not available*

Based on the CO BACT limits at similar facilities, it appears that a limit of 3.5 pounds per ton of steel is a reasonable choice for BACT. The RBLC contains CO emission limits for other steel minimills that are lower than the proposed BACT, but those limits are not relevant to this specific project because they are for much larger facilities, or facilities that produce a different product. The proposed 30-day rolling average is more stringent than the annual stack testing required in Nucor Florida's or CMC Steel Oklahoma's BACT limits. Therefore, DAQ concurs with the proposed 30-day averaging period.

DAQ concurs with Nucor and proposes BACT for CO from the Melt Shop to be 3.5 lb/ton steel, measured by CEMS on a rolling 30-day average. As discussed above, the BACT determination for the Melt Shop has been separated from the Casting Operations.

4.2.1.3 BACT for PM, PM_{10}, and $PM_{2.5}$ from Melt Shop Processes

Applicant Proposed BACT:

The application explains the formation of PM in the Melt Shop:

> "Particulate emissions are generated during the charging of scrap metal in the EAF, the melting of scrap via electric arc, and the tapping of the molten metal into the ladle. A majority of the particulate emissions are generated during the melting of the scrap…Condensable particulate forms primarily from sulfate compounds (produced by sulfur added to the steel) and combustion of VOC present in the scrap steel during the melting phase. The amount of sulfur added will vary significantly due to the various

> grades of steel produced and the amount of grease and oil present in the EAF charge." (Application at Appendix F, page 2-17).

In addition, PM will be generated through activities such as refractory dumping and repair and operating the LMF. Emissions generated from these activities will be collected and vented through the Melt Shop Baghouse, although a small portion will be emitted as fugitives.

Nucor performed the following BACT analysis:

1: Identify All Potentially Applicable Control Technologies:

- Fabric filters (a.k.a. baghouse)
- Electrostatic precipitation (ESP)
- Cyclones
- Wet gas scrubbing

2: Identify Technically-Feasible Control Technologies:

The application states that all four identified control technologies are technically feasible.

3. Rank the Technically-Feasible Control Technologies:

The application ranks fabric filters, dry ESP, and wet ESP as all equally effective, and ranks cyclones and scrubbers as less effective.

4. Evaluate the Most Effective Control Technologies:

The application states that an "ESP is not anticipated to achieve its optimal removal efficiency for the EAF due to the high metallic content of the EAF exhaust. Particulate emissions from the EAF contain significant amounts of iron oxide which, due to its magnetic properties, interferes with the mechanical removal of the particles from the plates, thereby reducing control efficiency" (Application at Appendix F, page 2-19). The application also states that fabric filters are the only approved BACT for PM from an EAF/LMF/Melt shop. Therefore, the application identifies a baghouse as the highest ranked technology.

5. Nucor Proposed BACT:

Nucor proposes BACT for the Melt Shop to be a baghouse.

The application notes that most PM (specifically PM, not $PM_{10}/PM_{2.5}$) entries in the RBLC only account for filterable PM, and that recently permitted minimill PM BACT limits do not include condensable emissions for PM because PM in most states is measured by Method 5.[18] Furthermore, many BACT limits are for an EAF, LMF, or other individual Melt Shop sources, not the Melt Shop as a whole. Therefore, Nucor proposes the following BACT limits:

- PM (filterable plus condensable) = 0.0052 grains per dry standard cubic foot (gr/dscf)

- $PM_{10}/PM_{2.5}$ (filterable plus condensable) = 0.0024 gr/dscf

[18] Per 15A NCAC 02D .2609, when testing for particulates, Method 201/202 must be used (*i.e.*, condensable PM must be included).

The application also notes that BACT entries that reference AP-42 Chapter 1.4 emission rates are obviously only for natural gas combustion, and shouldn't be compared to the whole Melt Shop.

After the application was received, Nucor proposed an additional BACT limit for PM (filterable only) as 0.0015 gr/dscf (email from Matt Way, received December 19, 2022).

<u>DAQ Proposed BACT:</u>

As discussed in Section 3.2.1, the EAF and associated baghouse will be subject to NSPS Subpart AAa (*i.e.*, a §111 emission standard). Any BACT determination must be at least as stringent as an applicable NSPS. The particulate (PM, filterable only) emission limit under NSPS Subpart AAa is 0.0052 gr/dscf.

In searching the RBLC database for particulate controls applied to electric arc furnaces, the only noted add-on control device for particulate emissions from an EAF or Melt Shop are fabric filters. Therefore, based on the available data, DAQ concurs that BACT for all particulate from the Melt Shop will be a baghouse.

In order to determine the appropriate PM/PM_{10}/$PM_{2.5}$ BACT emission limits, limits from the similar steel mills listed above were considered.

Table 8: Melt Shop/EAF PM, PM_{10}, and $PM_{2.5}$ BACT Analysis

Facility	Listed Control Method	Emission Limit (gr/dscf)	Notes	Averaging Time
Nucor Sedalia	Baghouse	0.0015	PM (filterable)	Test method average
		0.0024	PM_{10} total and $PM_{2.5}$ total (*i.e.*, filterable and condensable)	
Nucor Florida	Baghouse	0.0015	PM (filterable)*	Annual stack testing
		0.0024	PM_{10}=$PM_{2.5}$ Filterable and condensable	
CMC Steel Oklahoma	Baghouse	0.0024	PM_{10}/$PM_{2.5}$ Filterable plus condensable**	Stack testing
CMC Steel Fabricators Mesa Mill No. 2	Baghouse	0.0018	PM (filterable)	*Not available*
		0.0024	PM_{10}=$PM_{2.5}$ Filterable and condensable	

* The original PSD determination for this facility included an PM (filterable) limit of 0.0018 gr/dscf. Florida DEP subsequently revised that limit to 0.0015 gr/dscf, but that revision is not included in the RBLC.[19]
** The permit memorandum issued by Oklahoma to CMC Durant (a.k.a. CMC Steel Oklahoma) states that the BACT determination for particulate matter is only for PM_{10} and $PM_{2.5}$. However, the limit listed therein "…is selected as baghouses controlling PM/PM_{10}/$PM_{2.5}$ to 0.0024 gr/DSCF."[20]

[19] See PSD-FL-446 and PSD-FL-446B, issued by Florida DEP.
[20] See permit memorandum 2015-0643-C (page 17) issued by Oklahoma Department of Environmental Quality.

Based on the above analysis, DAQ agrees with the application's proposed BACT. DAQ will propose the following particulate matter BACT limits:

- PM (filterable only): 0.0015 gr/dscf (this is more stringent than the NSPS, which is 0.0052 gr/dscf)
- PM (filterable plus condensable): 0.0052 gr/dscf (this is more stringent than the NSPS, which does not include condensable particulate).
- PM_{10} (filterable plus condensable): 0.0024 gr/dscf
- $PM_{2.5}$ (filterable plus condensable): 0.0024 gr/dscf

Compliance with these limits will be determined with annual emission testing. Nucor requested that the test averaging period be four hours to match NSPS Subpart AAa (comments on pre-draft permit, received March 15, 2023).

Note that this limit only applies to the Melt Shop. The application originally proposed to also include the casting operations under this BACT limit. As discussed above, the BACT determination for the Melt Shop has been separated from the Casting Operations.

4.2.1.4 BACT for SO_2 from Melt Shop Processes

<u>Applicant Proposed BACT:</u>

The application explains the emission of SO_2 from the Melt Shop:

> "SO_2 emissions are mainly associated with combustion of sulfur compounds charged in the EAF. SO_2 is attributable to the sulfur content of the scrap, carbon electrode, the sulfur in the raw material charged in the EAF and to a lesser extent, the sulfur content of the oil on the scrap steel, in addition to the sulfur content in the available fuel." (Application at Appendix F, page 2-21)
>
> "Scrap metal has inherently low sulfur content (0.003 to 0.07 percent), whereas injection coal, tires and petroleum which will be used by Nucor can have sulfur contents in the 2.5 to 3 percent range and potentially higher." (Application at Appendix F, page 2-24)
>
> "Nucor is anticipating that the slightly higher proposed SO_2 emission rate will be required due to scrap mix that will be received at this facility, which will be different than scrap mixes at other micromill sites in the United States." (Application at Appendix F, page 2-26)
>
> "The amount of sulfur added will vary significantly due to the various grades of steel produced and the amount of grease and oil present in the EAF charge." (Application at Appendix F, page 2-17)

Nucor performed the following BACT analysis:

1: Identify All Potentially Applicable Control Technologies:

- Wet gas scrubber
- Flue gas desulfurization (FGD)
- Low-sulfur carbon-based feed and charge material (charge substitution)
- Good combustion and/or process operation

2: Identify Technically-Feasible Control Technologies:

The application dismisses wet scrubbers as technically infeasible because the high particulate content of the exhaust stream would lead to plugging the nozzles, packing plates, and trays used throughout the scrubber system. The low SO_2 concentration of the exhaust, combined with the high flowrate, would prevent efficient scrubbing.

The application dismisses FGD as technically infeasible because the low SO_2 concentration of the exhaust and low temperature of the exhaust (expected to be less than the 300 °F, whereas the minimum temperature of FGD systems is greater than 300 °F).

The application notes that charge substitution and good process operation is feasible.

3. Rank the Technically-Feasible Control Technologies:

Nucor will use natural gas as fuel, use charge substitution where appropriate, and good combustion/process operation as appropriate. Because these are all of the technically-feasible control technologies, no further ranking is required.

4. Evaluate the Most Effective Control Technologies:

Because Nucor will use all of the technically-feasible control technologies, no further evaluation is required.

5. Nucor Proposed BACT:

In the application, Nucor proposes BACT for SO_2 from the Melt Shop Processes as natural gas fuel, low-sulfur carbon-based feed and charge material as well as good combustion and/or process operation. The application proposes the BACT limit to be 0.50 pounds of SO_2 per ton of steel produced, measured by CEMS and averaged over a rolling 30-day period. According to the application, “Nucor is anticipating that the slightly higher proposed SO_2 emission rate will be required due to scrap mix that will be received at this facility, which will be different than scrap mixes at other micromill sites in the United States” (Application at Appendix F, page 2-26).

<u>DAQ Proposed BACT:</u>

In searching the RBLC database for SO_2 controls applied to electric arc furnaces, there were no instances of add-on control devices being applied to the electric arc furnace or larger melt shop process (even at larger steel minimills). Oxy-firing, good combustion practices, and charge substitution appears to be the most common control methods in the RBLC.

Given that BACT must be demonstrated in practice, and there appear to not be any other demonstrated control techniques, it is not practical to analyze other SO_2 control methods.

Based on the available data, DAQ concurs that BACT for SO_2 from the Melt Shop will be use of natural gas fuel, low-sulfur carbon-based feed and charge material as well as good combustion and/or process operation.

In order to determine the SO_2 BACT emission limit, limits from the similar steel mills listed above were considered.

Table 9: Melt Shop/EAF SO_2 BACT Analysis

Facility	Listed Control Method	SO_2 Emission Limit (lb/ton steel)	Averaging Time
Nucor Sedalia	None listed	0.5	30 days
Nucor Florida	Scrap Management Program, Good Combustion and Operating Practices*	0.5*	30 days
CMC Steel Oklahoma	Oxy-firing	0.6	Stack testing
CMC Steel Fabricators Mesa Mill No. 2	Good Process Operation	0.3	*Not available*

* The original PSD determination for this facility included an SO_2 limit of 0.6 lb/ton. Florida DEP subsequently revised that limit to 0.5 lb/ton. Florida DEP also revised the listed control method at that time.[21]

The proposed 0.5 lb/ton limit is not the lowest SO_2 limit available. However, as explained above, the SO_2 limit is primarily a function of the sulfur content of the material being charged to the EAF. The application notes that CMC Mesa 2 should not be a comparable limit due to a different scrap mix. Therefore, given the differences in scrap availability, the limit for CMC Mesa 2 will not be considered here, and the proposed BACT limit appears reasonable.

The 30-day averaging period is the same as in place with Nucor Sedalia and Nucor Florida, and is more stringent than the stack test requirement at CMC Steel Oklahoma.

DAQ concurs with Nucor and proposes BACT for SO_2 from the Melt Shop to be 0.50 lb/ton steel, measured by CEMS on a rolling 30-day average. As discussed above, the BACT determination for the Melt Shop has been separated from the Casting Operations.

4.2.1.5 BACT for VOC from Melt Shop Processes

<u>Applicant Proposed BACT:</u>

The application explains the emission of VOC from the Melt Shop:

> "VOCs result from the melting stage of charge and depend on the degree of contamination of the charge with organic matter, paints and plastics. Other VOC emission sources from EAF include scrap preparation with solvent degreasers, decarburization of scrap, charging of the furnace, tapping of the molten metal and slag, and mold drying. When molten steel is poured into molds, VOCs and organic compounds are emitted, not only when the steel first contacts the cores and molds, but also as the metal

[21] See footnote 19.

> cools. Time and temperature may cause known organic compounds to be modified and recombined to form new previously unknown organic compounds, to be emitted into the steel foundry." (Application at Appendix F, page 2-26)

Nucor performed the following BACT analysis:

1: Identify All Potentially Applicable Control Technologies:

- Thermal oxidizer
- Catalytic oxidizer
- Carbon adsorption
- Biofiltration
- Condenser
- Good combustion and process control
- Scrap management plan

2: Identify Technically-Feasible Control Technologies:

The application dismisses catalytic oxidization as technically infeasible because the exhaust stream would lead to catalyst fouling (see also the BACT analysis for NOx from the Melt Shop).

The application dismisses thermal oxidizers as technically infeasible due to the large air flow from the Melt Shop: "The large air flow from the EAF precludes routing air through the oxidizer tip. The heavy particulate loading in the EAF exhaust stream would cause excessive burner fouling and would most likely hinder proper combustion." The application also notes that such a system would require substantial amounts of natural gas which would lead to higher NOx emissions.

The application dismisses carbon adsorption as technically infeasible due to the high particulate loading of the exhaust and the high temperature of the exhaust (the exhaust is expected to be greater than 150 °F).

The application dismisses biofiltration as technically infeasible due to the high temperature of the exhaust, which will adversely affect the operation of the control device.

The application dismisses a condenser as technically infeasible due to the high particulate loading of the exhaust and need for large temperature drop across the condenser.

3. Rank the Technically-Feasible Control Technologies:

The application notes that good combustion control and process control and a scrap management plan are all feasible. Because all of these control technologies will be implemented, no further ranking is required.

4. Evaluate the Most Effective Control Technologies:

All of the technically feasible technologies will be implemented, so no further evaluation is required.

5. Nucor Proposed BACT:

Nucor proposes BACT for the Melt Shop to be good combustion practices and process control and a scrap management plan. The application proposes a BACT emission limit of 0.30 pounds of VOC per ton of steel produced, measured by annual emission testing.

The application notes that this limit is higher than other BACT listings in the RBLC. Nucor is anticipating higher VOC emissions due to the "varied scrap mix."

DAQ Proposed BACT:

In searching the RBLC database for VOC controls applied to electric arc furnaces, there were no instances of add-on control devices being applied to the electric arc furnace or larger melt shop process (even at larger steel minimills). Scrap management plans and work practices are common listed control methods.

Given that BACT must be demonstrated in practice, and there appear to not be any other demonstrated control techniques, it is not practical to analyze other VOC control methods.

Based on the available data, DAQ agrees that BACT for VOC from the Melt Shop will be a combination of scrap management plan and good work and combustion practices.

In order to determine the VOC BACT emission limit, limits from the similar steel mills listed above were considered.

Table 10: Melt Shop/EAF VOC BACT Analysis

Facility	Listed Control Method	VOC Emission Limit (lb/ton steel)	Averaging Time
Nucor Sedalia	No method listed	0.3	Stack testing
Nucor Florida	good combustion practice and process control along with a scrap management plan	0.3	Stack testing
CMC Steel Oklahoma	Scrap management plan	0.3	Stack testing
CMC Steel Fabricators Mesa Mill No. 2	Good Combustion Practices and/or Process Control	0.3	*Not available*

The proposed 0.30 lb/ton limit is equal to the limits of the similar steel mills.

Note that the proposed BACT limit is higher than many other steel minimills listed in the RBLC. The application states that the higher limit is warranted due to the differences in scrap mix process differences with micro mills versus the more traditional minimill. As discussed above, the larger minimills are not being considered here due to the difference in processes between the minimill and micro mill.

Based on the difference between minimills and micro mills, and the BACT emission limits at the similar micro mills listed above, it appears that the 0.30 lb/ton limit is appropriate.

DAQ concurs with Nucor and proposes BACT for VOC from the Melt Shop to be 0.30 lb/ton steel, measured by CEMS on a rolling 30-day average. As discussed above, the BACT determination for the Melt Shop has been separated from the Casting Operations.

4.2.1.6 BACT for GHG from Melt Shop Processes

Applicant Proposed BACT:

The application explains the emission of GHG (specifically CO_2) from the Melt Shop:

> "As the hot waste gases leave the EAF, combustion air is typically introduced to the ductwork to convert the CO to CO_2, since CO is a regulated criteria pollutant. This practice, called post-combustion, is widely used throughout the industry as the best technology for CO control. This practice is also utilized to cool the exhaust stream, so the baghouse does not catch fire.
>
> "Emissions of CO_2 are also generated from the use of oxy-fuel burners by EAF. These burners increase the effective capacity of the EAF by increasing the speed of the melt and reducing the consumption of electricity and electrode material, which reduces energy-related GHG emissions. Oxy-fuel burners also increase heat transfer while reducing heat losses and reduce tap-to-tap time. These burners are often designed to minimize the increase in NOx emissions that is a known by-product of the technology by deliberately operating the burners at less than their maximum combustion efficiency; however, this practice increases CO emissions to some extent but in turn lowers CO_2 emissions." (Application at Appendix F, page 2-30)

Nucor performed the following BACT analysis:

1: Identify All Potentially Applicable Control Technologies:

- Improved Process Control (Neural Network): Involves the use of a modem control and monitoring system which integrates real-time monitoring of the process variables such as steel bath temperature, carbon levels along. With real-time control systems for graphite injection and lance oxygen practice.

- Adjustable Speed Drives: As the flue gas flow rates vary from the EAF/LMF, there are opportunities to lower the speed of the dust collection fans by using adjustable speed drives to match the demand for these fans. Although there may be a slight reduction in total dust collection amounts, there is a significant power consumption savings to be had from the use of this technology.

- Transformer Efficiency-Ultra-High Power Transformers: Ultra-high-power (UHP) transformers help to reduce energy loss and increase productivity through modem design.

- Bottom Stirring/Stirring Gas Injection: Bottom stirring is accomplished by injecting an inert gas into the bottom of the EAF to increase the heat transfer in a melt.

- Foamy Slag Practice: Foamy slag covers the arc and melt surface to reduce radiation heat losses. Foamy slag can be obtained by injecting carbonaceous material and oxygen or by lancing of oxygen only. Slag foaming increases the electric power efficiency by at least 20 percent in spite of a higher arc voltage. The use of the foamy slag process may also increase productivity through reduced tap-to-tap times.

- Oxy-Fuel Burners: Oxy-fuel burners are used on most EAFs in the U.S. These burners increase the effective capacity of the furnace by increasing the speed of the melt and reducing the consumption of electricity and electrode material, both which reduce emissions of greenhouse gases. The use of oxy-fuels also increases heat transfer, reduces heat losses, reduces electrode consumption and reduces tap-to-tap time. It also helps to remove different elements from the steel bath, like phosphorous, silicon and carbon.

- Post-Combustion of the Flue Gases: Post-combustion is a process for. utilizing the chemical energy in the CO and hydrogen evolving from the steel bath to heat the steel in the EAF ladle or to preheat scrap. Post combustion helps to optimize the benefits of oxygen and fuel injection.

- DC Arc Furnace: The DC Arc Furnace technology replaces the normal three electrodes (one for each phase) with one large electrode that uses direct current instead of alternating current for heating the scrap in the EAF. Based on the distinctive feature of using the heat and magnetic force generated by the current in melting, this arc furnace achieves an energy saving of approximately 5 percent in terms of power unit consumption in comparison to the 3-phase alternating current arc furnace.

- Scrap Preheating Using the ConSteel Process: Preheating the scrap reduces power consumption to the EAF by using the waste heat of the EAF as the energy source for the preheat operation. The ConSteel process consists of a conveyer belt that transports the scrap through a tunnel to the EAF. In addition to energy savings, the ConSteel process can increase productivity by 33 percent, decrease electrode consumption by 40 percent and can reduce dust emissions.

- Scrap Preheating, Post-Combustion—Shaft Furnace: A shaft furnace design can preheat the scrap prior to it being introduced into the EAF for melting. This design was developed as a method of reducing power consumption during the heating process. This potential option is discussed further in step two of the BACT evaluation. In addition to the options listed above, Nucor is proposing an additional measure for the reduction of GHGs from the facility through continuous billet rolling. The design of the Nucor facility incorporates the use of a rolling mill that will roll the steel billet to the final dimensions immediately after the casting process, which eliminates the need for a reheat furnace that would typically be found at a steel mill facility using scrap as the feedstock. This eliminates a significant source of greenhouse gases.

- Engineered Refractories: Refractories in the EAF have to withstand extreme temperatures, oxidation, thermal shock, erosion, and corrosion. These conditions generally lead to an undesired wear of refractories. Through the use of controlled microstructure of the refractories, these factors can be controlled, which results in reduce ladle leakages and formation of slag during transfer operations.

- Airtight Operation: During a heat cycle of the EAF, large quantities of air enter the EAF. This air is at ambient temperature and the air's nitrogen and non-reacted oxygen are heated in the furnace and exit with the fumes at high temperature (around 1,800°F) which results in significant thermal losses. Of the associated cost savings that can be attributed to this technology, 80 percent can be attributed to the reduction in the heat losses from the flue gases and 20 percent can be attributed to the reduced thermal losses due to reduced tap-to-tap time. This technology cannot be utilized 100 percent of the time due to requirements to monitor the material within the EAF during the scrap charging process as well as balancing this requirement against the requirement to control emissions. It is typically necessary to find a balance between air tightness. Scrap density and access to the furnace for sampling the metal.

- Variable Speed Drives Monitoring and Control: The use of variable speed drives (VSDs) can reduce energy usage of the flue gas fans, which in turn, reduces the losses in the flue gas. VSD control systems can help predict problems that occur in the EAF due to the variability in the scrap and also from energy fluctuations.

- Eccentric Bottom Tapping on Existing Furnace: Eccentric bottom tapping leads to slag-free tapping, shorter tap-to-tap times, reduced refractory and electrode consumption, and improved ladle life.

- Carbon Capture and Sequestration: These emerging carbon capture and sequestration (CCS) technologies generally consist of processes that separate CO_2 from combustion process flue gas, compress, transport and then inject it into geologic formations such as oil and gas reservoirs, unmineable coal seams, and underground saline formations. Of the emerging CO_2 capture technologies that have been identified, only amine absorption is currently commercially used for state-of-the art CO_2 separation processes. Amine absorption has been applied to processes in the petroleum refining and natural gas processing industries and for exhausts from gas-fired industrial boilers. Other potential absorption and membrane technologies are currently considered developmental.

2: Identify Technically-Feasible Control Technologies:

The application states that a DC arc furnace would only be applicable to a furnace with a capacity greater than 100 tph. Because the EAF at this facility will have a capacity of 80 tph, a DC arc furnace is not technically feasible.

The application states that the scrap preheating processes like the ConSteel and shaft furnace processes have been implemented in the field. But Nucor has experienced severe issues with such processes:

> "As an example, the Nucor steel plant located in Kingman, AZ originally installed a DC furnace with shaft preheating of the scrap, but this facility experienced exceedingly high CO emissions from the scrap preheating that were so severe that they experienced explosions in the scrap preheating shaft that endangered the operations personnel… Several other steel plants that originally installed shaft furnaces have converted to other means of scrap preheating other than the shaft furnace technique. For this reason, the use of the shaft furnace technology is not applicable" (Application at Appendix F, page 2-35).

Furthermore, Nucor plans to reopen the Kingman facility as a bucket-charge shop (*i.e.*, without preheating). Nucor also points to a steel mill operated by Gerdau in Petersburg, VA as another example of a steel mill converting away from scrap preheating and continuous charging (see email from Matt Way, received December 9, 2022). As a result, Nucor considers these technologies to not be feasible.

The application dismisses CCS as technically infeasible due to the high particulate concentration of the exhaust before the baghouse and relatively low temperature of the exhaust after the baghouse. In addition, there is no available CO_2 sequestration facility near the proposed facility.

The application states that the other technologies identified in Step 1 are feasible.

3. Rank the Technically-Feasible Control Technologies:

The application states that all of the technically-feasible control technologies will be implemented. Therefore, no additional evaluation is necessary.

4. Evaluate the Most Effective Control Technologies:

All of the technically feasible technologies will be implemented, so no further evaluation is required.

5. Nucor Proposed BACT:

Nucor proposes BACT for the Melt Shop to be the following technologies:

- Adjustable speed drives
- Transformer efficiency-ultra-high-power transformers
- Bottom stirring/stirring gas injection
- Foamy slag practice
- Oxy-fuel burners
- Post combustion of the flue gases
- Engineered refractories
- Eccentric bottom tapping on furnace
- Energy monitoring and management system

Nucor proposes the BACT emission limit for GHG from the Melt Shop to be 438.2 pounds of CO_2 per ton of steel produced, measured by CEMS on a rolling 12-month average. The application notes that one RBLC determination is lower (OH-0381), but that limit only covers the EAF at that facility, and not other activities in the melt shop.

<u>DAQ Proposed BACT:</u>

In searching the RBLC database for GHG controls applied to electric arc furnaces, there were no instances of add-on control devices being applied to the electric arc furnace or larger melt shop process (even at larger steel minimills). Various process improvements and the use of good combustion practices appear often in the RBLC. In many cases, there is no listed control technology.

Given that BACT must be demonstrated in practice, and there appear to not be any other demonstrated control techniques, it is not practical to analyze other GHG control methods.

Based on the available data, DAQ agrees that BACT for GHG from the Melt Shop will be the combination of work practices proposed in the application.

In order to determine the GHG BACT emission limit, limits from the similar steel mills listed above were considered.

Table 11: Melt Shop/EAF GHG BACT Analysis

Facility	Listed Control Method	GHG Emission Limit (lb/ton steel)	Averaging Time
Nucor Sedalia	• Adjustable speed drives • Transformer efficiency-ultra-high power transformers • Bottom stirring/stirring gas injection • Foamy slag practice • Oxy-fuel burners • Post combustion of the flue gases • Scrap preheating • Engineered refractories • Eccentric bottom tapping on furnace • Energy monitoring and management system	438.2	12-month rolling average
Nucor Florida	• Adjustable speed drives • Transformer efficiency-ultra-high-power transformers • Bottom stirring/stirring gas injection • Foamy slag practice • Oxy-fuel burners • Post combustion of the flue gases • Scrap preheating • Engineered refractories • Eccentric bottom tapping on furnace • Energy monitoring and management system (includes flue gas monitoring and control)	438	12-month rolling average, using methods in 40 CFR Part 98
CMC Steel Oklahoma	Scrap preheating and continuous billet rolling	535	Emission test
CMC Steel Fabricators Mesa Mill No. 2	GOOD COMBUSTION PRACTICES & DEC	No numerical limit	n/a

It appears that other steel micro mills employ some method of scrap preheating as part of BACT for GHG. As stated in Nucor's BACT analysis for this facility, Nucor no longer considers scrap preheating using the EAF exhaust to be a feasible approach.

The application's statement that the limit in OH-0381 (NorthStar Bluescope Steel, LLC in Fulton County, Ohio) only applies to an EAF appears to be incorrect. According to Ohio EPA's Title V permit P0126431 (page 97), the limit of 292 pounds of CO_2e per ton of steel applies to the EAF and LMF at that facility. However, given that the EAF at that facility has a capacity of 250 tons per hour (more than three times the size of the proposed project), it appears that this facility is not relevant to the BACT determination.

Based on the BACT limits from the similar facilities above, the proposed BACT limit for this facility appears reasonable. Note that both Nucor Florida and Nucor Sedalia use scrap preheating using the furnace exhaust. As stated above, Nucor does not intend to operate such a system at this facility. Regardless, Nucor believes the 438 lb/ton limit is achievable for Nucor Lexington (see email from Matt Way, received December 9, 2022).

Based on the BACT limits at similar steel micro mills, DAQ concurs with Nucor and proposes BACT for GHG from the Melt Shop to be 438 pounds of GHG per ton of steel produced, measured on a rolling 12-month average. As discussed above, the BACT determination for the Melt Shop has been separated from the Casting Operations. However, the Casting Operations in and of themselves are not expected to contribute substantially to GHG emissions.

4.2.2 BACT Analysis for Casting Operations (ES-2)

The casting operations are expected to emit VOC and PM. Natural gas combustion sources throughout the casting operations will emit the usual combustion pollutants, but natural gas-fired sources are being considered separately.

In the original application, Nucor proposed to combine the BACT for the Casting Operations with the Melt Shop. As discussed previously, DAQ disagreed with this proposal because the Melt Shop and Casting Operations will exhaust through separate emission points. Therefore, the Melt Shop Baghouse shouldn't be considered BACT for the Casting Operations, because it will not have any affect on PM or VOC emitted from the Casting Operations.

To address DAQ's concerns, Nucor submitted "Response to Technical Incompleteness Letter" and "Supplement BACT Analysis." This supplement included a BACT analysis for the Casting Operations.

4.2.2.1 BACT For PM, PM_{10}, and $PM_{2.5}$ from the Casting Operations

<u>Applicant Proposed BACT:</u>

The application states that any emissions from the casting operations that are not captured by the Melt Shop's ventilation will be emitted through the caster vent. "Particulate emissions for casting operations are generated during the transfer of molten steel within ladles and while molten steel is poured from ladles into a tundish and then passed through a continuous casting process" (Application at Supplement BACT Analysis, page 1-2). Based on the application and Nucor's similar facilities in Florida and Missouri, the caster vent is a long roof vent, which will have a flow rate of about 700,000 cubic feet per minute. The application bases PM emission calculations for the caster on casting operations at other Nucor facilities.

In Nucor's supplement to the original BACT analysis (received September 2, 2022), Nucor performed the following analysis:

1: Identify All Potentially Applicable Control Technologies:

- Fabric filter
- Electrostatic precipitator (ESP)
- Wet gas scrubber
- Cyclone

2: Identify Technically-Feasible Control Technologies:

The application identifies all four control technologies as technically feasible.

3. Rank the Technically-Feasible Control Technologies:

The application ranked fabric filters and ESPs as equally effective, and scrubbers and cyclones as less effective.

4. Evaluate the Most Effective Control Technologies:

The application states: "In a review of the RBLC, fabric filters (also referred to as baghouses) are the identified/specified BACT methodology for PM/PM10/PM2.5 emissions from casters." (Application at Supplement BACT Analysis, page 1-4) The application examines the cost-effectiveness of a bagfilter for the caster as designed and concludes that a bagfilter is not cost-effective. Based on Nucor's analysis, a baghouse capable of controlling the large caster vent would cost more than $2 million and have an annual operating cost of $5 million per year (Application at Supplement to BACT Analysis, Table B-2-1). "The cost benefit analysis indicates the annual costs are extremely and unreasonably high compared to the control benefits. Nucor Lexington determines this is accurate given the relatively high air flow rates needed to collect emissions and, more importantly to the conclusion, the uncontrolled PM emission rates are estimated to be extremely low" (Application at Supplement BACT Analysis, page 1-5).

5. Nucor Proposed BACT:

The application concludes that no control device would be cost effective, and therefore proposes BACT as good work practices.

DAQ Proposed BACT:

In reviewing data from the RBLC, it appears that particulate emissions from casting operations are generally uncontrolled. BACT determinations that apply specifically to the casting operations are rare among all steel minimill permits, even ones larger than the proposed project. Of the micro mills examined above, only the permit issued to CMC Steel Oklahoma includes a BACT determination for PM from the casting operations. In that permit, the BACT is a limit on the amount of lubricant used per 12-month period, with no specific emission limit or control technology proposed.

Due to the relatively low potential PM emissions from this source, combined with the large air flow necessary to control emissions from the casting operations, DAQ agrees that no control device would be practical for PM emissions from the casting operations. Therefore, DAQ proposes BACT for the casting operations to be good work practices to reduce PM emissions.

4.2.2.2 BACT For VOC from the Casting Operations

Applicant Proposed BACT:

As mentioned above, the application states that any emissions from the casting operations that are not captured by the Melt Shop's ventilation will be emitted through the caster vent. The application states: "Emissions of volatile organic compounds (VOCs) result from the repair materials used within the casting operations to maintain the ladle and tundish refractory. Due to the high temperatures of the molten metal, the contact with VOC compounds may cause known organic compounds to volatize and recombine to form new organic compounds, that are typically released into the steel foundry" (Application at Supplement BACT Analysis, page 1-5).

The application bases VOC emission calculations for the caster on casting operations at other Nucor facilities.

In Nucor's supplement to the original BACT analysis (received September 2, 2022), Nucor performed the following analysis:

1: Identify All Potentially Applicable Control Technologies:

- Thermal Oxidizer
- Catalytic Oxidizer
- Carbon Adsorption
- Biofiltration

- Condenser
- Good Combustion and/or Process Control
- Scrap Management Plan

2: Identify Technically-Feasible Control Technologies:

The application dismisses thermal and catalytic oxidation as technically infeasible due to the necessary exhaust temperature. The caster vent exhaust will be less than 300 ºF, whereas these types of oxidation require temperatures of 1,100 ºF and 400 ºF, respectively (Application at Supplement BACT Analysis, page 1-6).

The application dismisses carbon adsorption and biofiltration as technically infeasible due to the necessary exhaust temperature. The caster vent exhaust will be greater than 130 ºF, whereas these types of controls require temperatures less than 100 ºF (Application at Supplement BACT Analysis, page 1-7).

The application dismisses a condenser as technically infeasible due to the large volume and low VOC concentration of the exhaust from the casting operations. "low concentrations of VOCs in the exhaust stream results in partial pressures of the VOCs that are too low for condensation to occur, resulting in low removal efficiencies and high energy usages…In addition, the low VOC concentration in the exhaust stream reduces the effectiveness of condenser technology" (Application at Supplement BACT Analysis, page 1-8).

The application identifies good combustion and/or process control, and a scrap management plan as technically feasible.

3. Rank the Technically-Feasible Control Technologies:

The application states that both good combustion and/or process control, and a scrap management plan will be implemented at this facility. Therefore, no ranking of these control technologies is necessary.

4. Evaluate the Most Effective Control Technologies:

Because all of the technically-feasible control technologies will be implemented, no further analysis is required.

5. Nucor Proposed BACT:

The application concludes that no control device would be feasible. Therefore, BACT is good operating practices along with a scrap management plan. The application also points out that this is similar to the RBLC results for similar-sized facilities.

<u>DAQ Proposed BACT:</u>

In reviewing data from the RBLC, it appears that VOC emissions from casting operations are generally uncontrolled. As with particulate matter from casting operations (discussed above), BACT determinations that apply specifically to the casting operations are rare among all steel minimill permits, even ones larger than the proposed project. Of the micro mills examined above, only the permit issued to CMC Steel Oklahoma includes a BACT determination for VOC from the casting operations. In that permit, the BACT is a limit on the amount of lubricant used per 12-month period, with no specific emission limit or control technology proposed.

Due to the relatively low potential VOC emissions from this source, combined with the large air flow necessary to control emissions from the casting operations, DAQ agrees that no control device would be practical for VOC emissions from the casting operations. Therefore, DAQ proposes BACT for the casting operations to be good operating practices along with a scrap management plan.

4.2.3 BACT Analysis for Caster Spray Stack (ES-3)

The Caster Spray Stack is expected to emit particulate matter and VOC as water and oils evaporate from the formed steel that cools in the water spray chamber. The water spray chamber is vented through the caster spray stack.

In the original application, Nucor proposed to combine the BACT for the Casting Spray Stack with the Casting Operations and the Melt Shop. As discussed previously, DAQ disagreed with this proposal because the Melt Shop, Casting Operations, and Caster Spray Stack will exhaust through separate emission points. Therefore, the Melt Shop Baghouse shouldn't be considered BACT for the Caster Spray Stack, because it will not have any affect on PM or VOC emitted from the Caster Spray Stack.

To address DAQ's concerns, Nucor submitted "Response to Technical Incompleteness Letter" and "Supplement BACT Analysis." This supplement included a BACT analysis for the Caster Spray Stack.

4.2.3.1 BACT For PM, PM_{10}, and $PM_{2.5}$ from the Caster Spray Stack

<u>Applicant Proposed BACT:</u>

According to the application: "PM/PM_{10}/$PM_{2.5}$ are generated from dissolved solids in the water used to spray and cool the cast metal. As the water containing dissolved solids come into contact with heated surfaces, they flash boil and become airborne in the form of [water] steam" (Application at Supplement BACT Analysis, page 1-9). The application bases PM emission calculations for the caster spray stack on the caster spray stack at other Nucor facilities.

In Nucor's supplement to the original BACT analysis, Nucor performed the following analysis:

1: Identify All Potentially Applicable Control Technologies:

- Fabric filter
- Electrostatic precipitator (ESP)
- Wet gas scrubber
- Cyclone

2: Identify Technically-Feasible Control Technologies:

The application dismisses fabric filters as technically infeasible in this application due to the high water vapor content of the exhaust. "Baghouses are not typically used for wet exhaust streams where the steam [may] condense or may contain compounds that can blind the fabric surfaces" (Application at Supplement BACT Analysis, page 1-10).

The application also dismisses ESPs as technically infeasible due to the high water vapor content. "Due to the very high water vapor content in the exhaust stream of the caster spray stack, short circuiting of the collection plates and increased corrosion of the inner electrical components of the device can occur."

The application dismisses scrubbers and cyclones as technically infeasible due to the combination of high exhaust flow rate, low particulate loading, and presence of grease in the exhaust which will diminish performance.

3. Rank the Technically-Feasible Control Technologies:

The application determined that all add-on control technologies are infeasible. Therefore, good operating practices is the only remaining option.

4. Evaluate the Most Effective Control Technologies:

Good operating practices is the only remaining control technology.

5. Nucor Proposed BACT:

"After performing this analysis and review of the RBLC database for facilities with comparable size and operation, Nucor Lexington proposes good operating practices as BACT for $PM/PM_{10}/PM_{2.5}$ from the caster spray stack."

<u>DAQ Proposed BACT:</u>

In reviewing data from the RBLC, it appears that caster spray stacks, where present at a facility, are generally uncontrolled. Of the micro mills examined above, none of those permits include a BACT determination for the caster spray stack (although each facility does appear to operate such a process).

Due to the relatively low potential VOC emissions from this source, combined with the high moisture content of the exhaust due to the nature of the operation, DAQ agrees that no control device would be practical for VOC emissions from the caster spray stack. Therefore, DAQ proposes BACT for VOC from the caster spray stack to be good operating practices along with a scrap management plan.

4.2.3.2 BACT For VOC from the Caster Spray Stack

<u>Applicant Proposed BACT:</u>

According to the application, lubricant, oil, and grease evaporate from the steel in the caster spray chamber, causing VOC emissions. The application bases VOC emission calculations for the caster spray stack on casting operations at other Nucor facilities.

In Nucor's supplement to the original BACT analysis, Nucor performed the following analysis:

1: Identify All Potentially Applicable Control Technologies:

Nucor identified the same VOC control technologies for the casting operations (discussed previously) and the caster spray stack.

2: Identify Technically-Feasible Control Technologies:

The application dismisses thermal and catalytic oxidation as technically infeasible due to the high moisture content of the spray stack exhaust.

The application dismisses carbon adsorption as technically infeasible due to the high moisture content and low VOC concentration in the spray stack exhaust.

The application dismisses biofiltration as technically infeasible due to the low VOC concentration in the spray stack exhaust and the relatively higher temperature (greater than 100 ºF) of the exhaust, which will adversely affect the operation of the biofilter.

The application dismisses a condenser as technically infeasible due to the low concentration of VOC in the spray stack exhaust and high exhaust flowrate (greater than 200,000 scfm).

3. Rank the Technically-Feasible Control Technologies:

Good operating practices result in the most effective controls for the caster spray stack, as all add-on control technologies were deemed technically infeasible for this operation.

4. Evaluate the Most Effective Control Technologies:

Because all of the technically-feasible control technologies will be implemented, no further analysis is required.

5. Nucor Proposed BACT:

The application concludes that no control device would be feasible. Therefore, BACT is good operating practices along with a scrap management plan. The application also points out that this is similar to the RBLC results for similar-sized facilities.

DAQ Proposed BACT:

In reviewing data from the RBLC, it appears that caster spray stacks, where present at a facility, are generally uncontrolled. Due to the relatively low potential VOC emissions from this source, combined with the high moisture content of the exhaust due to the nature of the operation, DAQ agrees that no control device would be practical for VOC emissions from the caster spray stack. Therefore, DAQ proposes BACT for VOC from the caster spray stack to be good operating practices along with a scrap management plan.

4.2.4 BACT Analysis for Rolling Operations (ES-4)

The Rolling Operation is expected to emit PM and VOC as the steel billets are formed in the rollers.

In the original application, Nucor did not include a BACT determination for the Rolling Operation. Because the Rolling Operation will vent to the atmosphere through a separate emission point, DAQ requested a BACT determination specifically for the Rolling Operation.

To address DAQ's concerns, Nucor submitted "Response to Technical Incompleteness Letter" and "Supplement BACT Analysis." This supplement included a BACT analysis for the Rolling Operations.

4.2.4.1 BACT For PM, PM_{10}, and $PM_{2.5}$ from the Rolling Operations

Applicant Proposed BACT:

The application states that "Particulate emissions in the form of water droplets will be created from the water spraying of steel billets…The emissions will be vented through a natural ventilation ridge ventilator on the roof. To estimate emissions, Nucor performed stack testing of rolling mill vents at several Nucor mini mills to establish emission factors for total PM, PM_{10}, $PM_{2.5}$, VOC, and HAPs" (Application at 4-5). Based on the application, the Rolling Operations will have a long roof vent (separate from the Caster) which will have a flow rate of about 2,000,000 cubic feet per minute (Application at Supplement BACT Analysis, Attachment B-2).

In Nucor's supplement to the original BACT analysis (received September 2, 2022), Nucor performed the following analysis:

1: Identify All Potentially Applicable Control Technologies:

The application states that all PM control technologies identified for the Casting Operations are applicable for the Rolling Operations.

2: Identify Technically-Feasible Control Technologies:

The application states that this step is the same as for the Casting Operations.

3. Rank the Technically-Feasible Control Technologies:

The application ranked fabric filters and ESPs as equally effective, and scrubbers and cyclones as less effective.

4. Evaluate the Most Effective Control Technologies:

The application states: "In a review of the RBLC, fabric filters (also referred to as baghouses) are the identified/specified BACT methodology for $PM/PM_{10}/PM_{2.5}$ emissions from the rolling mill" (Application at Supplement BACT Analysis, page 1-16). The application examines the cost-effectiveness of a bagfilter for the caster as designed and concludes that a bagfilter is not cost-effective. Based on Nucor's analysis, a baghouse capable of controlling the large caster vent would cost more than $4 million and have an annual operating cost of $6 million per year (Application at Supplement to BACT Analysis, Table B-2-2). "The cost benefit analysis indicates the annual costs are extremely and unreasonably high. Nucor Lexington believes this is accurate given the relatively high air flow rates needed to collect emissions and, more importantly to the conclusion, the uncontrolled $PM/PM_{10}/PM_{2.5}$ emission rates are projected to be extremely low" (Application at Supplement BACT Analysis, page 1-16).

5. Nucor Proposed BACT:

The application proposes good work practices to be BACT for PM from the Rolling Operations: "The conclusion from the cost/benefit exercise is that additional controls on the rolling mill exhaust are not cost effective, leading Nucor Lexington to the conclusion that BACT reverts to good work practices. This also is consistent with the RBLC findings for similar sized and configured rolling mill vents."

<u>DAQ Proposed BACT:</u>

In reviewing data from the RBLC, it appears that rolling mills are generally uncontrolled. Due to the relatively low potential PM emissions from this source, combined with the large air flow necessary to control emissions from the casting operations, DAQ agrees that no control device would be practical for PM emissions from the Rolling Operation. Therefore, DAQ proposes BACT for the Rolling Operations to be good work practices to reduce PM emissions, and does not suggest a specific BACT emission limit.

4.2.4.2 BACT For VOC from the Rolling Operations

Applicant Proposed BACT:

As mentioned above, the application states that any emissions from the Rolling Operation rooftop vent on the Rolling Mill. The application states: "VOCs result from the rolling mill operations due to the use of oil and grease in the rolling process" (Application at Supplement BACT Analysis, page 1-17).

The application bases VOC emission calculations for the Rolling Operation on other Nucor facilities.

In Nucor's supplement to the original BACT analysis (received September 2, 2022), Nucor performed the following analysis:

1: Identify All Potentially Applicable Control Technologies:

The application states that all VOC control technologies identified for the Casting Operations are applicable for the Rolling Operations.

2: Identify Technically-Feasible Control Technologies:

The application states that this step is the same as for the Casting Operations. All technologies are considered technically-infeasible.

3. Rank the Technically-Feasible Control Technologies:

Because all of the identified technologies are technically-infeasible, no ranking is required.

4. Evaluate the Most Effective Control Technologies:

No controls are feasible, therefore this step is not required.

5. Nucor Proposed BACT:

The application concludes that no control device would be feasible. Therefore, BACT is good operating practices. The application also points out that this is similar to the RBLC results for similar-sized facilities.

DAQ Proposed BACT:

In reviewing data from the RBLC, it appears that rolling operations are generally uncontrolled. Due to the relatively low potential VOC emissions from this source, combined with the large air flow necessary to control emissions from the Rolling Operations, DAQ agrees that no control device would be practical for VOC emissions from the Rolling Operations. Therefore, DAQ proposes BACT for the Rolling Operation to be good operating practices with no specific BACT emission limit.

4.2.5 BACT Analysis for Cooling towers (ES-6)

The cooling towers are expected to emit particulate matter in the form of water droplets that carry suspended and/or dissolved solids (TDS). This process is known as "drift". No other emissions are expected from the cooling towers. Reducing particulate emissions from cooling towers is normally accomplished by limiting the TDS content of the cooling water, or by designing the cooling towers in such a way as to reduce drift.

4.2.5.1 BACT For PM, PM_{10}, and $PM_{2.5}$ from Cooling Towers

Applicant Proposed BACT:

Nucor performed the following BACT analysis:

1: Identify All Potentially Applicable Control Technologies:

- Use of dry cooling (no water circulation) heat exchanger units
- High-efficiency drift eliminators
- Limitations on TDS concentrations in the circulating water
- Combinations of drift eliminator efficiency rating and TDS limit
- Installation of drift eliminators (no efficiency specified)

2: Identify Technically-Feasible Control Technologies:

The application states that a non-evaporative cooling tower is outside the scope of this project as it would require re-engineering the entire cooling system of the project, and therefore would be technically infeasible.

All other control methods are technically feasible.

3. Rank the Technically-Feasible Control Technologies:

The application ranks the combination of make-up water controls and drift eliminators as the most effective feasible control technologies.

4. Evaluate the Most Effective Control Technologies:

The application notes that there are drift eliminators that can achieve drift limits of as low as 0.0001 percent. However, the application also notes such limits are only present in cooling towers located in PM nonattainment areas. Furthermore, the most stringent BACT limits are seen in connection with larger steel mills with higher water flow rates and many cells.

5. Nucor Proposed BACT:

The application proposes BACT for the cooling towers as drift eliminators to control drift to 0.001 percent of the water flow through the towers, and to limit the TDS of the cooling water to less than 1,500 ppm.[22]

DAQ Proposed BACT:

In reviewing data from the RBLC, it appears that cooling towers at steel mills are typically controlled with drift eliminators.

[22] The TDS number in the application is 2,500 ppm (see Application at Appendix F, page 2-47). However, emission calculations were performed based on 1,500 ppm (see Appendix 1, Section 6.0). Nucor confirmed that 1,500 ppm should be the BACT limit in pre-draft comments received March 15, 2023.

Table 12: Cooling Tower PM BACT Analysis

Facility	Listed Control Method	Limits
Nucor Sedalia	Drift eliminators, TDS water limit	0.001% drift 2,500 mg/L
Nucor Florida	Drift eliminators	0.001% drift
CMC Steel Oklahoma	Drift eliminators	0.001% drift

Based on a review of the similar micro mills, DAQ agrees with the proposed BACT.

DAQ does not intend to require compliance testing for the BACT limits for the cooling towers and associated mist eliminators. The manufacturer's guarantee, plus regular maintenance should be sufficient to demonstrate compliance with the BACT limit.

4.2.6 BACT Analysis for Silos (ES-7)

The only pollutant expected to be emitted from the silos at the facility is particulate matter. Emissions will be caused by the pneumatic loading of these silos. In addition, particulate emissions will occur when the Baghouse Dust Silo is unloaded, but that unloading point is enclosed.

4.2.6.1 PM/PM_{10}/$PM_{2.5}$ from Silos

Applicant Proposed BACT:

Nucor performed the following BACT analysis:

1: Identify All Potentially Applicable Control Technologies:

- Fabric filter baghouse
- Bin vent filters
- Mechanical collector (cyclone)
- Venturi wet scrubber
- Wet dust suppression

2: Identify Technically-Feasible Control Technologies:

All identified control technologies are feasible for a silo.

3. Rank the Technically-Feasible Control Technologies:

The application ranks bin vent filters as the most effective control technology with an outlet loading of 0.005 gr/dscf.[23] Other control technologies are listed as having a control efficiency of 95% or less, which is less than the 0.005 gr/dscf outlet loading.

4. Evaluate the Most Effective Control Technologies:

The application ranks bin vent filters as the most effective control technology.

[23] In some parts of the application, it appears the value "0.005" was accidentally rounded to 0.01. The application's summary of the proposed BACT limits (Appendix F, page 1-3) correctly shows the proposed BACT limit for silos as 0.005.

5. Nucor Proposed BACT:

The application proposes BACT for the storage silos to be bin vent filters with an outlet loading of 0.005 gr/dscf.

DAQ Proposed BACT:

In reviewing data from the RBLC, it appears that storage silos, when used at steel minimills, are normally controlled with bin vent filters. DAQ agrees that bin vent filters are BACT for these storage silos.

In order to determine the PM BACT emission limit for the silos, limits from the similar steel mills listed above were considered.

Table 13: Silo Bin Vent Filter PM BACT Analysis

Facility	Listed Control Method	PM Emission Limit (gr/dscf)
Nucor Sedalia	Exhaust filters, EAF dust silo loadout using a sealed chute and air routed to the silo.	0.005
Nucor Florida	Bin vent filter	0.005
CMC Steel Oklahoma	Bin vent filters, EAF baghouse dust handling in partial enclosure	0.01

Based on a review of the similar micro mills, DAQ agrees that an outlet loading of 0.005 gr/dscf is the appropriate BACT limit. Nucor Sedalia also has a stipulation that the loadout from the EAF dust silo use a sealed chute. At this facility, Nucor states that "Dust loading operations occur within a closed building" (Application at 4-7), which is an equivalent requirement.

DAQ does not intend to require compliance testing for the BACT limits for the silos and associated bin vent filters. The manufacturer's guarantee, plus regular maintenance should be sufficient to demonstrate compliance with the BACT limit.

It should be noted that all BACT emission limits require an averaging period. Therefore, DAQ proposes the averaging period for the PM limit above to be the average of three 1-hour test runs. However, as stated above, DAQ does not intend to require compliance testing for the BACT limits for the silos.

4.2.7 BACT Analysis for Material handling (ES-8)

4.2.7.1 PM/PM_{10}/$PM_{2.5}$ from Material handling

Applicant Proposed BACT:

The facility will handle and store several kinds of materials, such as scrap steel, alloys, and slag. This material handling will occur outside of the Melt Shop. Materials will be stored in piles (enclosed, partially enclosed, or open) and moved using conveyors. PM emissions will occur from wind erosion from the piles and when material is dropped from conveyors.

Nucor performed the following BACT analysis:

1: Identify All Potentially Applicable Control Technologies:

- Wetting piles
- Partial enclosure
- Minimizing drop height

2: Identify Technically-Feasible Control Technologies:

There are several types of material handling at the facility. Nucor provided the following feasibility analysis of the identified control technologies:

Material Handling Source	Wetting/Moisture	Partial Enclosure	Minimizing Drop Height
Scrap yard	Not Feasible	Not Feasible	Feasible
Scrap building	Not Feasible	Feasible	Feasible
Alloy pile	Not Feasible	Feasible	Feasible
Mill scale pile	Feasible	Not Feasible	Feasible
Slag yard	Feasible	Not Feasible	Feasible
Dust loadout	Not Feasible	Not Feasible	Feasible
Conveyor transfer points	Not Feasible	Feasible	Feasible

The application notes that wetting is not feasible for scrap and alloys because "if water contacts molten steel in the EAF a violent and unsafe reaction will occur" (Application at Appendix F, page 2-70).

3. Rank the Technically-Feasible Control Technologies:

The application ranks partial enclosures as the most effective control technology, but also notes that all technically feasible controls will be implemented.

4. Evaluate the Most Effective Control Technologies:

All technically feasible controls will be implemented, so this step is not required.

5. Nucor Proposed BACT:

The application proposes BACT for the material handling sources to be:

Material Handling Source	Proposed BACT
Scrap yard	Minimizing drop height
Scrap building	Partial enclosure, minimizing drop height
Alloy pile	Partial enclosure, minimizing drop height
Mill scale pile	Wetting, minimizing drop height
Slag yard	Wetting, minimizing drop height
Dust loadout	Minimizing drop height
Conveyor transfer points	Partial enclosure, minimizing drop height

<u>DAQ Proposed BACT:</u>

In reviewing data from the RBLC, it appears that the various material handling processes at steel mills are normally controlled with partial enclosures, wetting, and minimizing drop heights when applicable.

In order to determine the PM BACT for the material handling at steel mills, BACT determinations from the similar steel mills listed above were considered.

Table 14: Material Handling PM BACT Analysis

Facility	Listed Control Method
Nucor Sedalia	Slag/Mill scale: water spray
Nucor Florida	• Scrap yard: Minimizing drop height • Scrap building: Partial enclosure, minimizing drop height • Alloy pile: Partial enclosure, minimizing drop height • Slag and mill scale piles: Wetting, minimizing drop height • Dust loadout: Minimizing drop height • Conveyor transfer points: Partial enclosure, minimizing drop height
CMC Steel Oklahoma	Alloy handling/storage: minimize drop height Slagyard: minimize drop height, wetting material Scale piles: minimize drop height, wetting material Scrap yard: minimize drop height Scrap building: partial enclosure

None of the similar micro mills include numerical limits for BACT for the material handling sources.

Based on a review of the similar micro mills, DAQ generally agrees with the application's proposed BACT. Based on the emission calculations for PM from the storage piles, some of the storage piles will be covered in addition to being partially enclosed (see Appendix 1, Section 8.1 and 8.3 for Nucor's emission calculations from these piles based on being covered and partially enclosed).

4.2.8 BACT Analysis for Haul Roads (ES-9)

4.2.8.1 PM/PM_{10}/$PM_{2.5}$ from Haul Roads

The only pollutant expected to be emitted from the haul roads (both paved and unpaved) at the facility is particulate matter. Emissions will be caused by truck and vehicle traffic on these roads. As part of the emission calculations and NAAQS modeling, Nucor estimated the facility-wide vehicle miles traveled (VMT) on paved and unpaved roads. Based on the calculations, approximately 5% of the total VMT at this facility will be on unpaved roads, with the remainder being on paved roads. Nucor then determined PM emission factors in units of lb/VMT based on the weights of the vehicles on those roads.

<u>Applicant Proposed BACT:</u>

In searching the RBLC database, Nucor identified four categories of control for PM emitted from haul roads:

- Chemical dust suppression and surfactant application,
- Watering, sweeping, and vacuuming,
- Reducing silt content, and
- Traffic and speed restrictions

The application states that all of these options are technically feasible, and evaluates them as all similar in control efficiency.

For BACT, the application proposes developing a fugitive dust control plan (FDCP) that includes watering, vacuuming/sweeping paved roads, and speed reduction.

DAQ Proposed BACT:

The RBLC contains numerous determinations for haul roads (process code 91.140 and 91.150). All of the identified control methods appear to fall into the categories listed in the application. Emission limits, where present, tend to be in units of total PM emitted from haul roads, or limiting truck trips per unit of time, or other site-specific requirements that are only relevant to that specific determination. Only one specific emission limit was found: SC-0181. This determination identifies “good housekeeping practices” as the BACT control method and limits PM emitted from haul roads on a lb/VMT basis. The PM limits in that determination are similar to the values Nucor used to estimate PM emissions for this facility (see Appendix 1, Section 9.0 for VMT calculations).

DAQ concurs with the application. DAQ proposes BACT for the haul roads (paved and unpaved) to be developing a FDCP that includes watering, vacuuming/sweeping paved roads, and speed reduction. Although the application’s BACT analysis does not include a specific speed limit, the application’s emission calculations are based on a speed limit of 10 miles per hour (Application at Appendix F, page 49). This value will be included in the permit.

4.2.9 BACT Analysis for natural gas-fired emergency-use engines (ES-10)

Nucor plans to install three emergency-use engines. At the time of the application, Nucor was certain that one engine would be natural gas-fired (the fire pump engine), but was uncertain if the remaining two engines will be natural gas or diesel-fired (the two emergency generators). This section will consider BACT for all of these engines as though they were natural gas-fired. BACT for diesel-fired engines will be considered separately.

4.2.9.1 BACT for NOx, CO, and VOC from natural gas-fired emergency-use engines

As stated in Section 2.1.10, the maximum potential operations for an emergency-use engine is assumed to be 500 hours per year. In practice, these engines operate far less than this, generally for periods of readiness testing and the occasional short-term emergency. Therefore, the operation of these engines is intermittent. Add-on controls are impractical given the intermittent operation of these sources.

As discussed in Section 3.2.3, each natural gas-fired emergency-use engine at this facility will be subject to NSPS Subpart JJJJ (*i.e.*, a §111 emission standard). Any BACT determination must be at least as stringent as an applicable NSPS.

For each of these pollutants, the application proposes BACT to be good combustion practices and natural gas as a fuel, and proposes the BACT emission limits equal to the applicable NSPS standard.

For NOx, CO, and VOC, NSPS Subpart JJJJ has the following limits:

Excerpt from Table 1 to 40 CFR Part 60, Subpart JJJJ

Engine Type and Fuel	Maximum Engine Power	Manufacture Date	Emission Standards (g/HP-hr)		
			NOx	CO	VOC
Emergency	HP ≥ 130	---	2.0	4.0	1.0

The DAQ review of the RBLC database for emergency engines indicate that typically no add-on technology was identified for NOx, CO, or VOC. The determinations also indicate the BACT were commonly based upon applicable NSPSs, other federal standards, and use of certified engines.

DAQ generally concurs with the application. DAQ proposes BACT for NOx, CO, and VOC from the natural gas-fired emergency engines to be: 1) purchase NSPS-certified engines, 2) good work practices (*i.e.*, comply with NSPS Subpart JJJJ), and 3) use pipeline-quality natural gas. The numerical limits for these pollutants will be equal to the NSPS limits.

It should be noted that all BACT emission limits require an averaging period. Therefore, DAQ proposes the averaging period for these pollutants to be the average of three 1-hour test runs. However, DAQ does not intend to require compliance testing for the BACT limits for natural gas-fired emergency engines because they are expected to be certified by the manufacturer.

4.2.9.2 BACT for PM, SO_2, and CO_2e from natural gas-fired emergency-use engines

As stated previously, add-on controls for emergency engines are generally not practical due to their infrequent use.

The emission rate of PM and SO_2 from combustion sources are generally functions of the sulfur content of the fuel. Natural gas at this facility will meet the standards set by the gas supplier, and is therefore outside the control of Nucor. Therefore, there are no practical control alternatives for PM and SO_2 emitted from natural gas-fired emergency-use engines. Additional PM can be generated due to poor work practices (like poorly maintained air filters).

The emission rate of greenhouse gasses (GHG) is due to the formation of CO_2 during the combustion reaction. There is no practical method of reducing the formation of CO_2 during combustion, and there are no practical control devices for CO_2 from small natural gas-fired emergency engines. Poor work practices could result in an increased need for fuel consumption, thereby increasing the total amount fuel burned and CO_2 emitted.

For each of these pollutants, the application proposes BACT to be good combustion practices (*i.e.*, good work practices). The application proposes an emission limit of 0.048 g/HP-hr for PM, 117 lb/MMBtu for CO_2, and no specific limit for SO_2.

DAQ generally concurs with the application. Like with NOx, CO, and VOC (see above), DAQ proposes BACT to be 1) purchase NSPS-certified engines, 2) good work practices (*i.e.,* comply with NSPS Subpart JJJJ), and 3) use pipeline-quality natural gas. The numerical limits will be the limits proposed in the application.

As stated above, all BACT emission limits require an averaging period. Therefore, DAQ proposes the averaging period for these pollutants to be the average of three 1-hour test runs. However, DAQ does not intend to require compliance testing for the BACT limits for natural gas-fired emergency engines because they are expected to be certified by the manufacturer.

4.2.10 BACT Analysis for diesel-fired emergency-use engines (ES-10)

As stated previously, Nucor plans to install three emergency-use engines. At the time of the application, Nucor was certain that one engine would be natural gas-fired (the fire pump engine), but was still unsure if the remaining two will be natural gas or diesel-fired (the two emergency generators). This section will consider BACT for the two diesel-fired emergency-use engines, should they be installed.

4.2.10.1 BACT for NOx, VOC, PM, and CO from diesel-fired emergency-use engines

As stated in Section 2.1.10, the maximum potential operations for an emergency-use engine is assumed to be 500 hours per year. In practice, these engines operate far less than this, generally for periods of readiness testing and the occasional short-term emergency. Therefore, the operation of these engines is intermittent. Add-on controls are impractical given the intermittent operation of these sources.

As discussed in Section 3.2.2, each diesel-fired emergency-use engine at this facility will be subject to NSPS Subpart IIII (*i.e.*, a §111 emission standard). Any BACT determination must be at least as stringent as an applicable NSPS.

For each of these pollutants, the application proposes BACT to be good combustion practices and low-sulfur diesel fuel, and proposed the following BACT limits:

- NOx: 6.4 g/hp-hr
- CO: 3.5 g/hp-hr
- PM: 0.2 g/hr-hr
- VOC: 0.52 g/hp-hr

These limits mostly appear to be based on the limits in NSPS Subpart IIII. As discussed below, the proposed limits are incorrect, and DAQ will propose a different BACT limit for these pollutants.

For NOx, VOC, PM, and CO from diesel-fired emergency generators (that are not firepumps), NSPS Subpart IIII requires the engine to meet the applicable standard in 40 CFR 60.4202 (see 40 CFR 60.4205(b)). Under 40 CFR 60.4202, engines are required to meet the applicable Tier 2 or Tier 3 standard in 40 CFR Part 1039, Appendix I. In that Appendix, the only applicable standards are the Tier 2 emission standards:

Excerpt from Table 2 to 40 CFR Part 1039, Appendix I

Rated Power (kW)	Model Year	NOx+NMHC (g/kW-hr)	NOx[24] (g/kW-hr)	VOC[24] (g/kW-hr)	CO (g/kW-hr)	PM (g/kW-hr)
kW > 560	2006	6.4	6.08	0.32	3.5	0.20

Note that 1) the NSPS limits are in different units than the application's proposed BACT, 2) the limits for NOx and VOC must be different than the rule's limit for NOx+NMHC because that is not a pollutant for PSD purposes, and 3) the limit for VOC is different than the limit proposed in the application.

DAQ proposes BACT for NOx, CO, PM, and VOC from the diesel-fired emergency engines to be: 1) purchase NSPS-certified engines, 2) good work practices (*i.e.*, comply with NSPS Subpart JJJJ), and 3) use low sulfur diesel fuel. The numerical limits for these pollutants will be equal to the values for NOx, VOC, CO, and PM in the above table.

It should be noted that all BACT emission limits require an averaging period. Therefore, DAQ proposes the averaging period for these pollutants to be the average of three 1-hour test runs. However, DAQ does

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[24] NOx+NMHC is not a PSD pollutant. For PSD purposes, DAQ interprets this as the ratio of 95% NOx and 5% NMHC (NMHC = VOC). Using this ratio yields the values for NOx and VOC. See Bay Area Air Quality Management District Best Available Control Technology (BACT) Guideline for "IC Engine-Compression Ignition: Stationary Emergency, Non-Agricultural, Non-Direct Drive Fire Pump", Document No. 96.1.3, 12/22/2010. Available at http://www.baaqmd.gov/~/media/files/engineering/bact-tbact-workshop/combustion/96-1-3.pdf?la=en.

not intend to require compliance testing for the BACT limits for diesel-fired emergency engines because they are expected to be certified by the manufacturer.

4.2.10.2 BACT for SO_2 and CO_2e from diesel-fired emergency-use engines

As stated previously, add-on controls for emergency engines are generally not practical due to their infrequent use.

The emission rate of SO_2 from combustion sources is generally a function of the sulfur content of the fuel. Diesel used at this facility will meet the definition of low sulfur diesel required by NSPS Subpart IIII. There is no other practical method for reducing SO_2 emitted from diesel-fired emergency-use engines.

The emission rate of greenhouse gasses (GHG) is due to the formation of CO_2 during the combustion reaction. There is no practical method of reducing the formation of CO_2 during combustion, and there are no practical control devices for CO_2 from diesel-fired emergency engines. Poor work practices could result in an increased need for fuel consumption, thereby increasing the total amount fuel burned and CO_2 emitted.

For each of these pollutants, the application proposes BACT to be good combustion practices (*i.e.*, good work practices). The application proposes an emission limit of 170 lb/MMBtu for CO_2 and no specific limit for SO_2.

DAQ generally concurs with the application. Like with NOx, CO, PM, and VOC (see above), DAQ proposes BACT to be 1) purchase NSPS-certified engines, 2) good work practices (*i.e.*, comply with NSPS Subpart IIII), and 3) use low-sulfur diesel. The numerical limits will be the limits proposed in the application.

As stated above, all BACT emission limits require an averaging period. Therefore, DAQ proposes the averaging period for these pollutants to be the average of three 1-hour test runs. However, DAQ does not intend to require compliance testing for the BACT limits for natural gas-fired emergency engines because they are expected to be certified by the manufacturer.

4.2.11 BACT Analysis for Storage tanks (ES-11)

The application does not include a proposed BACT limit for the three storage tanks.

Nucor intends to install one gasoline storage tank (1,000 gallon capacity) and two diesel storage tanks (3,000 gallons, each). Storage tanks are expected to emit VOC from breathing losses and working losses. Because these sources will emit VOC, and this project triggers a PSD review for VOC emissions, a BACT determination is necessary for these storage tanks.

Based on the potential emission calculations for these sources (see Appendix 1, Section 11.0), these sources will have a combined potential VOC emission rate of less than 0.1 tons per year. No add-on controls will ever be feasible for sources with such small VOC emission rates.

VOC emissions from storage tanks can be reduced using good work practices and good design. The gasoline storage tank will also be subject to 40 CFR Part 63, Subpart CCCCCC (*i.e.,* a §112 standard), so any BACT limit must be at least equivalent to that requirement.

DAQ proposes BACT for these sources to be good work practices, and compliance with 40 CFR Part 63, Subpart CCCCCC where applicable.

4.2.12 BACT Analysis for various natural gas-fired torches and heaters (ES-1-6, ES-2-3, ES-2-4, ES-4-2, and ES-5)

The facility will employ several small natural gas-fired sources. These sources include preheaters, such as those found on the EAF and caster, and cutting torches throughout the facility. Such sources will be used on an as-needed basis.

4.2.12.1 BACT for NOx, CO, VOC, PM, SO_2, and CO_2e from natural gas-fired torches and heaters

Applicant Proposed BACT:

The application examines potential controls for these systems using a similar analysis to the use of natural gas in the EAF (see Section 4.2.1). Ultimately, the application proposes the use of low-NOx burners and good combustion practices as the only feasible control technology. The application notes that low-NOx burners may not be feasible in all circumstances; Nucor later clarified that cutting torches will not have low-NOx burners (email from Matt Way, received December 9, 2022). When calculating emissions from these sources, Nucor used the emission factors in AP-42 Chapter 1.4,

DAQ Proposed BACT:

In order to determine the BACT control methods for the torches and heaters, permits issued to the similar steel mills listed above were considered.

Table 15: Natural gas-fired torches and heaters BACT analysis

Facility	Emission Source Description	Listed Control Method
Nucor Sedalia	ladle preheaters, ladle dryers, tundish preheaters and tundish dryers	Low-NOx burners Good operating practices
Nucor Florida	• Ladle and tundish preheaters and dryers • Ladle and tundish skull cutting • Caster torches (Part of EU 002) Scrap cutting (EU 004)	Natural gas as fuel Good combustion practices
CMC Steel Oklahoma	Torch cutting	Natural gas or LPG as fuel
CMC Steel Fabricators Mesa Mill No. 2	Melt shop	Low NOx burners, Use of NG fuel, Good combustion practices

Based on the permits issued to the similar micro steel mills, add-on control devices are not practical for these small natural gas-fired sources. In general, where a specific emission limit for a pollutant is listed, those limits are taken from AP-42 Chapter 1.4.

Notably, in cases where torch cutting is specifically mentioned, such as CMC Steel Oklahoma, low-NOx burners are not included as BACT.

DAQ concurs with the application, and proposes BACT for these sources as good operating practices, natural gas as fuel, and the use of low-NOx burners (except for the cutting torches, where low-NOx burners are not practical). The emission limits for each pollutant will be equal to the emission limits in AP-42 Chapter 1.4.

4.3 PSD Air Quality Impact Analysis

40 CFR 51.166(m)(1) requires that an application for a permit for a new major stationary source include an analysis of the ambient air quality of the area where the source is located for any regulated NSR pollutant exceeding the significant net emissions increase. This analysis is called "pre-application analysis" (generally called the "preconstruction monitoring" requirement). For pollutants with NAAQS, the application must include one year of continuous monitoring data from the date of the receipt of the complete application. The permitting agency may accept ambient monitoring data for a shorter duration, but, data cannot be for less than four months. For pollutants for which no NAAQS exist, the permitting authority can require an analysis containing such data as it determines appropriate to assess the ambient air quality in the area in which the source is located.

40 CFR 51.166(m)(2) includes that the owner or operator of a major stationary source shall, after construction of such source, conduct such ambient monitoring, if the permitting authority determines to be necessary for determining the effect emissions from the stationary source or modification may have, or are having, on air quality in any area. This monitoring is called "post-construction monitoring".

However, 40 CFR 51.166(i)(5) includes that permitting authority may exempt any major modification from the requirements of 40 CFR 51.166(m), with respect to monitoring for a specific pollutant, if net emissions increase of the pollutant from a modification would cause, in any area, air quality impacts less than the following amounts (referred to as "significant monitoring concentrations" or SMC):

- Carbon monoxide - 575 ug/m^3, 8-hour average;
- Nitrogen dioxide - 14 ug/m^3, annual average;
- $PM_{2.5}$ - 0 μg/m^3, 24-hour average;[25]
- PM_{10} -10 μg/m^3, 24-hour average;
- Sulfur dioxide - 13 ug/m^3, 24-hour average;
- Lead - 0.1 μg/m^3, 3-month average;
- Fluorides - 0.25 μg/m^3, 24-hour average;
- Total reduced sulfur - 10 μg/m^3, 1-hour average
- Hydrogen sulfide - 0.2 μg/m^3, 1-hour average; and
- Reduced sulfur compounds - 10 μg/m^3, 1-hour average

Note that for ozone, no *de minimis* air quality level (i.e., SMC) has been provided. EPA has stated that any net emissions increase of 100 tons per year or more of volatile organic compounds or nitrogen oxides subject to PSD would be required to perform an ambient impact analysis, including the gathering of air quality data.

Also note that there are no SMC established for GHG, so no ambient monitoring (both pre- and post-construction) for GHG can be required.

The same provision includes some more exemptions from this air quality analysis requirement (both "pre-construction monitoring" and "post-construction monitoring") for the source (i.e., applicant) as follows: If any regulated NSR pollutant is not listed with the associated impact level (i.e., SMC) or if the concentrations of the pollutant in the area that the major modification would affect is less than the associated SMC.

As shown in Table 2 above, this new facility will be a major source for NOx, CO, PM, PM_{10}, $PM_{2.5}$, SO_2, VOC, and GHG. As shown in Table 4.3.1- 2, below, the predicted air quality impact of CO is less than the

[25] As noted in 40 CFR 51.166(i)(5)(*c*), "In accordance with Sierra Club v. EPA, 706 F.3d 428 (D.C. Cir. 2013), no exemption is available with regard to $PM_{2.5}$."

associated SMC. Therefore, no ambient monitoring (both pre- and post-construction) for that pollutant may be required. For the other pollutants, the associated project impacts are higher than the applicable SMCs. In the context of $PM_{2.5}$ and for other pollutants, the EPA has stated, "applicant[~~s~~] will generally be able to rely on existing representative monitoring data to satisfy monitoring data requirement [i.e. pre-construction monitoring]".[26] Finally, for ozone NAAQS, net significant emissions of NOx are greater than 100 tons per year. In summary, monitoring requirements (pre- and post-construction) may apply for emissions of NO_2, PM_{10}, and $PM_{2.5}$.

4.3.1 Ambient Impact Analysis[27]

4.3.1.1 Introduction:

The PSD ambient impact analysis reviewed in this report, in general, followed all applicable federal and state rules, and applicable federal and state modeling guidance. Modeling methodologies and interpretation of results followed both the modeling protocol received by NC DAQ on May 5, 2022 and the NC DAQ comments on the modeling protocol provided to Nucor Lexington in a letter dated May 24, 2022.

A detailed description of the ambient analysis methodologies and results is provided in the following sections for each relevant component of the ambient impact analysis. A summary of the analysis results is presented in the last section, PSD Air Quality Modeling Result Summary.

4.3.1.2 Project Description / Significant Emission Rate (SER) Analysis:

Nucor Lexington has proposed to construct and operate a steel micro mill in Lexington, Davidson County, NC. The micro mill will manufacture steel products from scrap steel, home scrap, and scrap substitutes. Iron ore will not be processed at the mill. The new Project will consist of electric arc furnace (EAF) melting and refining operations; ladle metallurgy furnace (LMF) operations; casting, rolling, and finishing operations; raw and product material handling; and other associated equipment to produce steel products. The proposed facility will be located approximately 7 miles southeast of Lexington, NC, along U.S. Route 64. The PSD application for the proposed project was originally received on July 15, 2022. Subsequent PM_{10} and $PM_{2.5}$ modeling revisions were received on September 8, 2022, in response to a Technical Incompleteness Letter sent on August 19, 2022.

The proposed Nucor Lexington facility was evaluated under the Prevention of Significant Deterioration (PSD) Permit Program pursuant to North Carolina Regulation 15A NCAC 02D .0530 and U.S. EPA 40 CFR 51.166. The construction and operation of the new facility would result in emission increases above the Prevention of Significant Deterioration (PSD) Significant Emission Rates (SER), as defined under 40 CFR 51.166(b)(23), for carbon monoxide (CO), nitrogen oxides (NO_x), sulfur dioxide (SO_2), volatile organic compounds (VOCs), particulate matter equal to or less than 10 micrometers diameter (PM_{10}), and particulate matter equal to or less than 2.5 micrometers diameter ($PM_{2.5}$). Therefore, per 40 CFR 51.166(m)(1)(i)(a), an ambient impact analysis of project emission impacts was performed for CO, NO_x, VOCs (ozone), PM_{10}, and $PM_{2.5}$. NO_x and volatile organic compounds (VOCs) emission increases were also evaluated in terms of precursor impacts on ozone formation. Additionally, NO_X and SO_2 emission increases were evaluated in terms of precursor impacts on secondary $PM_{2.5}$ formation. Project emissions of total suspended particulate (TSP) were shown to exceed the SER triggering review under the State Ambient Air Quality Standards (SAAQS) as defined by 15A NCAC 02D .0403, and therefore, a facility-wide

[26] DC Circuit Court Decision on $PM_{2.5}$ Significant Impact Levels and Significant Monitoring Concentration, Questions and Answers, US EPA, OAQPS, March 4, 2013.
[27] The information and data in this section is taken from DAQ's memorandum "Review of PSD and Air Toxics Dispersion Modeling Analyses for Nucor Steel Lexington" (issued February 24, 2023).

modeling demonstration for TSP was conducted. Project facility-wide toxic air pollutant (TAP) emission rates (TPERs) were estimated above those outlined in 15A NCAC 02Q.0711. Therefore, ambient impacts from facility-wide emissions of acrolein, arsenic, benzene, 1,3- butadiene, cadmium, formaldehyde, fluorides, manganese, and sulfuric acid were modeled to demonstrate compliance with Acceptable Ambient Levels (AALs) outlined in 15A NCAC 02D .1104. Table 4.3.1- 1 shows the project emissions increases for all PSD pollutants evaluated.

Table 4.3.1- 1: Pollutant Netting Analysis

Pollutant	Annual Emission Rate Increase (tons/yr)	Significant Emission Rate (tons/yr)	PSD Review?
NO_x	110	40	**Y**
$PM_{2.5}$	70.4	10	**Y**
PM_{10}	79.2	15	**Y**
PM (TSP)	164	25	**Y**
SO_2	129	40	Y
VOC's **	90.6	40	**Y**
CO	947	100	**Y**
Fluorides	2.6	3	N
Pb	0.02	0.6	N
H_2SO_4 ***	0.05	7	N

*** VOC is an ozone precursor evaluated under ozone analysis.*
**** No SIL or NAAQS exist; modeled for NC Toxics standards.*

4.3.1.3 Class II Area Significant Impact Air Quality Modeling Analysis:

A significant impact analysis was conducted for the pollutants shown in Table 1 that require PSD analysis and that have established Class II Area Significant Impact Levels (SILs). The modeling results were compared to the applicable Class II Area SILs as defined in the NSR Workshop Manual, NC DAQ memoranda, and EPA guidance to determine if a NAAQS and/or PSD Increment full impact air quality analysis would be required for that pollutant.

The Class II SILs modeling was based on project emission increases for all PSD pollutants showing emissions above the applicable SER. Emissions were modeled assuming facility normal operations. Table 4.3.1- 2 shows modeled project impacts from normal operations compared to Class II Area SILs for each pollutant and averaging period. As shown, modeled impacts from normal operations were above the applicable Class II Area SILs for NO_2, SO_2, PM_{10}, and $PM_{2.5}$. Therefore, NO_2, SO_2, PM_{10}, and $PM_{2.5}$ project emission impacts were evaluated under separate full impact analyses for NAAQS and PSD Increments, as appropriate.

Table 4.3.1- 2: Class II Significant Impact Results (μg/m^3)

Pollutant	Averaging Period	Project Maximum Model Impact	Class II SIL	% of Class II SIL
CO	1-hour	126.7	2000	6.3%
	8-hour	93.1	500	18.6%
NO_2	1-hour	33.3	10	333.0%
	Annual	1.2	1	120.0%

Pollutant	Averaging Period	Project Maximum Model Impact	Class II SIL	% of Class II SIL
SO_2	1-hour	16.8	10	168.0%
	3-hour	13.7	25	54.8%
	24-hour	7.6	5	152.0%
	Annual	0.3	1	30.0%
PM10	24-hour	27.7	5	554.00%
	Annual	2.9	1	290.00%
PM2.5	24-hour	6.2[1]	1.2	516.67%
	Annual	1.2[1]	0.2	600.00%

[1] Includes contribution of secondary formation of PM2.5

4.3.1.4 Class II Area Full Impact NAAQS Modeling Analysis:

A Class II Area full impact NAAQS analysis was conducted for 1-hour and annual NO_2, 1-hour and 24-hour SO_2, 24-hour and annual $PM_{2.5}$, and 24-hour PM_{10}. The spatial extent of the full impact analysis of each NAAQS pollutant and averaging period was based on receptor areas where project impacts were modeled above the SILs. These impacted receptors defined the project Significant Impact Area (SIA). The full impact NAAQS analysis models included development of short-term and annual Nucor Lexington emissions scenarios, SIA receptors, nearby source inventories, representative background concentrations, and additional modeling refinements to address secondary $PM_{2.5}$ formation and NO_X chemistry.

The steel micro mill will operate 24 hours per day and 7 days per week with a maximum annual steel production rate of 515,000 tons per year (tpy) and a short-term, maximum hourly rate of 80 tons per hour (tph). Short-term (e.g., 1-hour and 24-hour) NAAQS modeling assumed Nucor Lexington facility normal operations and associated maximum short-term emissions rates. Annual NAAQS modeling assumed Nucor Lexington facility normal operations. Normal operations on an annual basis include operational and production limits on steel production and emergency engines testing.

The mill will have two emergency engines and one emergency fire pump available to provide power and water in case of emergency. Per NCDEQ guidance, sources that operate for less than 100 hours/year and will continue to operate for less than 100 hours/year in the future are not included in short-term or annual modeling. The engines represented by EP14, EP15, and EP16 will be tested on approximately a monthly basis for approximately one hour, and so each will operate for far less than 100 hours each year and thus fall into this category. Therefore, the three engines are included only in the non-criteria pollutant modeling.

The cumulative off-site inventories for NO_2, SO_2, $PM_{2.5}$, and PM_{10}, were developed based on guidance from Section 8.3.3 (b)(iii) of Appendix W to Part 51 - Guideline on Air Quality Models and Appendix D of the NCDEQ PSD Modeling Guidance, as well as correspondence with NCDEQ. Nucor requested cumulative inventories for all criteria pollutants emissions sources out to 25 km from NCDEQ and the Forsyth County Office of Environmental Assistance & Protection. The SIAs for each pollutant were compared to the sources provided in the inventories to determine which off-site sources were candidates for inclusion in the cumulative modeling. Based on this review, which showed that all SIA's were close to the Project site (4.4 km) the only off-site facility that could potentially impact receptors in the SIA for any pollutant was the Wilderness NC Lumber Yard located immediately to the northeast of the Project site.

The initial PM_{10} and $PM_{2.5}$ NAAQS and increment modeling demonstrations did not include fugitive emissions from the storage piles, material transfers, or approximately 10 acres of haul roads at the Wilderness NC lumber yard. Nucor Lexington characterized fugitive emissions at Wilderness NC and updated the cumulative PM_{10} and $PM_{2.5}$ NAAQS modeling and PM_{10} increment modeling to include the revised fugitive emissions. The Wilderness NC emissions and modeling refinements are described in the Supplemental Response to Technical Incompleteness Letter submitted by Nucor Lexington on September 8, 2022.

4.3.1.5 NO_2 1-hour and Annual Full Impact NAAQS Analysis:

The full impact NAAQS analysis for 1-hour and annual NO_2 included modeling of facility-wide potential emissions from normal operations, a nearby source inventory as determined by the 20D screening approach, and by receptor areas where Nucor Lexington impacts were modeled above the 1-hour and annual NO_2 SILs, NO_2 background concentrations, and the AERMOD Ambient Ratio Method Version 2 (ARM2) NO_2 conversion option.

Background 1-hour and annual NO_2 concentrations were compiled from the Hattie Avenue monitor (AQS ID 37-067-0022) located in Winston-Salem, Forsyth County, NC. This monitor is located in an urban area approximately 36 km north of the Project site and the monitored concentrations are expected to be a conservative estimate of the ambient background concentrations in the rural area around the Project.

Model impacts from facility-wide and nearby source emissions were summed with monitored background concentrations and then compared to the NAAQS to determine if there was a modeled violation of the 1-hour and annual NO_2 NAAQS. Results of the 1-hour and annual NO_2 full impact NAAQS analyses are presented in Table 4.3.1- 3. As shown, there were no modeled violations of the 1-hour or annual NO_2 NAAQS.

Table 4.3.1- 3: NO_2 Class II Full Impact NAAQS Analysis Results ($\mu g/m^3$)

Pollutant	Averaging Period	Model Design Value Criteria	Model Concentration	Monitor Background Concentration	Total Concentration	NAAQS
NO_2	1-hour	Maximum 8^{th}-highest Max Daily 1-hour Value Averaged Over 5 Years	29.1	60.2	89.3	**188**
	Annual	Maximum Annual Average of 5 Years	1.3	12.4	13.7	**100**

The primary source of NO_2 at this facility will be the electric arc furnace (ID No. ES-1-1) within the Melt Shop. The modeled emission rates for this source are based on the BACT limit of 0.30 pounds of NOx per ton of steel produced. For compliance with the 1-hour NAAQS, this factor is multiplied by the maximum steel production rate of the facility, which is 80 tons per hour. Compliance with the BACT limit is based on a 30-day rolling average. As stated in the application, the 30-day rolling average is justified because it has been determined to be BACT for other similar steel mills, and because the steel-making process can lead to intermittent spikes (see Application at Appendix F, page 2-13). Because the 30-day averaging period may hide larger spikes in emission rates, additional scrutiny with regards to the 1-hour NAAQS is required.

In preliminary comments from US EPA regarding this application, received October 12, 2022, US EPA stated:

> "To be consistent with the 1-hour NAAQS for SO_2 and NOx, the permitted emissions limits for the Melt Shop Baghouse for SO_2 and NOx should be based on a 1-hour average (see paragraph 9.2.3.1 of 40 CFR Appendix W). Alternatively, documentation may be provided to demonstrate that the emission rates modeled for SO_2 and NOx are consistent with paragraph 8.2.2(c) and Table 8-2 of 40 CFR Appendix W." (Email from Chris Howard [Regional Meteorologist, US EPA Region 4] to Matt Porter [Meteorologist, NC DAQ], received October 12, 2022)

The creation of the 1-hour NO_2 NAAQS is relatively recent, and US EPA has previously acknowledged the sometimes-difficult task of using air dispersion modeling to demonstrate compliance with the 1-hour NAAQS with regards to intermittent process variations. In the memo "Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hour NO_2 National Ambient Air Quality Standard" (hereafter referred to as "Appendix W Guidance Memo")[28], US EPA has stated:

> "Given the implications of the probabilistic form of the 1-hour NO_2 NAAQS…we are concerned that assuming continuous operations for intermittent emissions would effectively impose an additional level of stringency beyond that intended by the level of the standard itself. As a result, we feel that it would be inappropriate to implement the 1-hour NO_2 standard in such a manner and recommend that compliance demonstrations for the 1-hour NO_2 NAAQS be based on emission scenarios that can logically be assumed to be relatively continuous or which occur frequently enough to contribute significantly to the annual distribution of daily maximum 1-hour concentrations." (Appendix W Guidance Memo, page 9)

> "Another approach that may be considered in cases where there is more uncertainty regarding the applicability of this guidance would be to model impacts from intermittent emissions based on an average hourly rate, rather than the maximum hourly emission. For example, if a proposed permit includes a limit of 500 hours/year or less for an emergency generator, a modeling analysis could be based on assuming continuous operation at the average hourly rate, i.e., the maximum hourly rate times 500/8760. This approach would account for potential worst-case meteorological conditions associated with emergency generator emissions by assuming continuous operation, while use of the average hourly emission represents a simple approach to account for the probability of the emergency generator actually operating for a given hour." (Appendix W Guidance Memo, page 11)

The Appendix W Guidance Memo shows that US EPA is generally aware of the difficulty in accounting for intermittent emissions, and allows for modeling approaches that can simplify the modeling demonstration while still trying to reflect some worst-case conditions.

[28] Memo available at https://www.epa.gov/sites/default/files/2015-07/documents/appwno2_2.pdf

In response to US EPA's concerns with the 1-hour NO_2 NAAQS at this facility, Nucor provided the following information:

> "Similarly, for 1-hour NO_2, the maximum model-predicted concentrations were 29.1 μg/m^3 plus an ambient background of 60.2 μg/m^3 for a total of 89.3 μg/m^3, or 48% of the 1-hour NO_2 NAAQS. However, the maximum contribution of the melt shop baghouse anywhere on the grid (the maxima does not coincide with the highest overall concentrations) was 9.0 μg/m^3. Thus, modeling could support a modeled emission rate more than 10 times higher than the 28.58 [lb/hr] modeled and still be under the standard (90 μg/m3 + 20.1 μg/m^3 + 60.2 μg/m^3 = 170.3 μg/m^3 or 91% of the 1-hour NO_2 NAAQS). As such, a 30-day rolling limit at 28.58 lb/hr will be sufficiently protective of the 1-hour NO_2 NAAQS." (Email from Matt Way [Environmental Manager, Nucor] to Chris Howard [Regional Meteorologist, US EPA Region 4] and NC DAQ, received October 24, 2022)

Based on Nucor's response, the emission rate of the melt shop baghouse (the primary source of NO_2 at this facility) could be increased by a factor of 10, and still comply with the 1-hour NAAQS.[29] Multiplying the emission rate by 10 goes far beyond any intermittent process variation, and therefore is even more conservative than the approach suggested in the Appendix W Guidance Memo. Therefore, even in this worst-case scenario, no exceedance of the 1-hour NO_2 NAAQS is expected due to the proposed NO_2 BACT limit or averaging time.

4.3.1.6 SO_2 1-hour Full Impact NAAQS Analysis:

The full impact NAAQS analysis for 1-hour SO_2 included modeling of facility-wide potential emissions from normal operations, a nearby source inventory as determined by the 20D screening approach, and by receptor areas where Nucor Lexington impacts were modeled above the 1-hour and SO_2 SIL, and SO_2 background concentrations.

Background 1-hour SO_2 concentrations were compiled from the Hattie Avenue monitor (AQS ID 37-067-0022) located in Winston-Salem, Forsyth County, NC. This monitor is located in an urban area approximately 36 km north of the Project site and the monitored concentrations are expected to be a conservative estimate of the ambient background concentrations in the rural area around the Project.

Model impacts from facility-wide and nearby source emissions were summed with monitored background concentrations and then compared to the NAAQS to determine if there was a modeled violation of the 1-hour SO_2 NAAQS. Results of the 1-hour SO_2 full impact NAAQS analyses are presented in Table 4.3.1- 4. As shown, there were no modeled violations of the 1-hour SO_2 NAAQS.

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[29] Technically, this analysis is incorrect because, as Nucor states, the baghouse's maximum impact for NO_2 does not coincide with the overall maximum impact for NO_2. Nucor should have subtracted the baghouse's impact at the point of overall maximum impact, instead of the baghouse's maximum impact. However, even in the absolute worst-case scenario where the baghouse's maximum impact is multiplied by 10, and then simply added onto the point of maximum NO_2 impact, there is still no exceedance of the 1-hour NAAQS:

(model concentration) +	(background concentration) +	(10 × maximum baghouse impact) =	(estimated total conc.)
29.1	60.2	10 × 9.0	179.3

Table 4.3.1- 4: SO_2 Class II Full Impact NAAQS Analysis Results (µg/m³)

Pollutant	Averaging Period	Model Design Value Criteria	Model Concentration	Monitor Background Concentration	Total Concentration	NAAQS
SO_2	1-hour	Maximum 4th-highest Max Daily 1-hour Value Averaged Over 5 Years	15.5	10.5	26	**196**

The primary source of SO_2 at this facility will be the electric arc furnace (ID No. ES-1-1) within the Melt Shop. The modeled emission rates for this source are based on the BACT limit of 0.50 pounds of SO_2 per ton of steel produced. For compliance with the 1-hour NAAQS, this factor is multiplied by the maximum steel production rate of the facility, which is 80 tons per hour. Compliance with the BACT limit is based on a 30-day rolling average. As stated in the application, the 30-day rolling average is justified because it has been determined to be BACT for other similar steel mills, and because the steel-making process can lead to intermittent spikes (see Application at Appendix F, page 2-13). Because the 30-day averaging period may hide larger spikes in emission rates, additional scrutiny with regards to the 1-hour NAAQS is required. In EPA's preliminary comments on this application (discussed in Section 4.3.1.5, above), EPA expressed the same concern with regards to the SO_2 1-hour NAAQS as with the NO_2 1-hour NAAQS.

In response to US EPA's concerns with the 1-hour SO_2 NAAQS at this facility, Nucor provided the following information:

> "As demonstrated in the submitted modeling analysis, the maximum model-predicted contribution of all Nucor and off-site sources for 1-hour SO_2 concentrations was 15.5 µg/m³, which along with the ambient background concentration of 10.5 µg/m³ totaled 25.9 µg/m³ or 13% of the 1-hour SO_2 NAAQS. Even with a modeled emission rate 10 times higher (~400 lb/hr) at the melt shop baghouse, there would be an ample safety margin under the standard (155 µg/m³ + 10.5 µg/m³ = 165.5 µg/m³ or 84.4% of the NAAQS). As such, a 30-day rolling limit at 40.03 lb/hr will be sufficiently protective of the 1-hour SO_2 NAAQS." (Email from Matt Way [Environmental Manager, Nucor] to Chris Howard [Regional Meteorologist, US EPA Region 4] and NC DAQ, received October 24, 2022)

Based on Nucor's response, the emission rate of the melt shop baghouse (the primary source of NO_2 at this facility) could be increased by a factor of 10, and still comply with the 1-hour NAAQS. Multiplying the emission rate by 10 goes far beyond any intermittent process variation and represents a scenario more conservative than any reasonable worst-case scenario. Therefore, no exceedance of the 1-hour SO_2 NAAQS is expected due to the proposed SO_2 BACT limit or averaging time.

4.3.1.7 $PM_{2.5}$ 24-hour and Annual Full Impact NAAQS Analysis:

The full impact NAAQS analysis for 24-hour and annual $PM_{2.5}$ included modeling of facility-wide potential emissions from normal operations, a nearby source inventory as determined by the 20D screening approach and by receptor areas where Nucor Lexington impacts were modeled above the 24-hour and annual $PM_{2.5}$ SILs, representative background concentrations, and inclusion of secondary $PM_{2.5}$ formation impacts produced by NO_X and SO_2 emissions. Details of the 24-hour and annual $PM_{2.5}$ modeling inputs are briefly discussed in the following paragraphs. $PM_{2.5}$ modeling results are summarized in Table 4.3.1- 5. As shown, project impacts do not cause or contribute to a violation of the 24-hour and annual $PM_{2.5}$ NAAQS.

Table 4.3.1- 5: Class II $PM_{2.5}$ NAAQS Full Impact Analysis Results (μg/m^3)

Pollutant	Averaging Period	Secondary $PM_{2.5}$ from NO_X and SO_2	Model Concentration	Monitor Background Concentration	Total Concentration	NAAQS
$PM_{2.5}$	24-hour	0.49	14.89	19.4	34.82	35
	Annual	0.051	1.19	8.8	10.0	12

Nucor Lexington project emissions were modeled assuming normal operations with some annual operational and production limitations as previously discussed. Storage pile emissions from wind erosion and material transfer fugitive emissions were modeled as volume sources. Fugitive road emissions were modeled with each road segment represented as a line of volume sources.

Annual and 24-hour emissions impacts from secondary $PM_{2.5}$ formation were derived from project NO_X and SO_2 emissions scaled according to emissions and secondarily formed PM2.5 concentrations taken from appendix Tables A-2 and A-3 as provided in the US EPA draft *Guidance on the Development of Modeled Emission Rates for Precursors (MERPs) as a Tier I Demonstration Tool for Ozone and $PM_{2.5}$ under the PSD Permitting Program* (December 2, 2016). Nucor Lexington selected the worst-case MERP values for the southeast climate region shown in Table 4-1 of the MERPs guidance for estimating project secondary $PM_{2.5}$ impacts from NO_X and SO_2 emissions. The worst case MERPs, for 24-hour $PM_{2.5}$, are 1,943 tons/year for NO_X and 367 tons/year for SO_2. The worst case MERPs for annual $PM_{2.5}$ in the southeast climate region are 5,679 tons/year for NO_X and 859 tons/year for SO_2. The potential emissions of NO_X (110 tons/year) and SO_2 (129 tons/year) were then used to calculate the impact of secondary $PM_{2.5}$ to be added to the primary 24-hour $PM_{2.5}$ impacts.

Competing, or "nearby", sources were included in the 24-hour and annual $PM_{2.5}$ NAAQS analysis based on the 20D screening approach. As discussed previously, the only off-site facility that could potentially impact receptors in the SIA for any pollutant was the Wilderness NC Lumber Yard. The initial $PM_{2.5}$ NAAQS cumulative modeling did not include fugitive emissions from the storage piles, material transfers, or haul roads at the Wilderness NC lumber yard. Nucor Lexington characterized fugitive emissions at Wilderness NC and updated the cumulative $PM_{2.5}$ NAAQS modeling to include the revised fugitive emissions. The Wilderness NC emissions and modeling refinements are described in the Supplemental Response to Technical Incompleteness Letter submitted by Nucor Lexington on September 8, 2022.

Background 24-hour and annual $PM_{2.5}$ concentrations were taken from the 2015-2017 dataset compiled from the Salisbury Street monitor (AQS ID 37-057-0002) located in Lexington, Davidson County, NC. $PM_{2.5}$ data from this site are expected to be conservatively representative of the ambient background concentrations in the rural area around the Project.

Model impacts from nearby source emissions were summed with emissions impacts from secondary $PM_{2.5}$ formation and monitored background concentrations. Results of the 24-hour and annual $PM_{2.5}$ full impact NAAQS analyses are presented in Table 4.3.1- 5. As shown, there were no modeled violations of the 24-hour or annual $PM_{2.5}$ NAAQS.

4.3.1.8 PM_{10} 24-hour Full Impact NAAQS Analysis:

The full impact NAAQS analysis for 24-hour PM_{10} included modeling of facility-wide potential emissions from normal operations, a nearby source inventory as determined by the 20D screening approach and by receptor areas where Nucor Lexington impacts were modeled above the 24-hour PM_{10} SIL, and representative background concentrations. Details of the 24-hour PM_{10} modeling inputs are briefly discussed in the following paragraphs. PM_{10} modeling results are summarized in Table 4.3.1- 6. As shown, project impacts do not cause or contribute to a violation of the PM_{10} NAAQS.

Table 4.3.1- 6: Class II PM_{10} NAAQS Full Impact Analysis Results (μg/m^3)

Pollutant	Averaging Period	Model Concentration	Monitor Background Concentration	Total Concentration	NAAQS
PM_{10}	24-hour	23.4	60.0	83.4	150

Nucor Lexington project emissions were modeled assuming normal operations with some annual operational and production limitations as previously discussed. Storage pile emissions from wind erosion and material transfer fugitive emissions were modeled as volume sources. Fugitive road emissions were modeled with each road segment represented as a line of volume sources.

Competing, or "nearby", sources were included in the 24-hour and annual PM_{10} NAAQS analysis based on the 20D screening approach. As discussed previously, the only off-site facility that could potentially impact receptors in the SIA for any pollutant was the Wilderness NC Lumber Yard. The initial PM_{10} NAAQS modeling did not include fugitive emissions from the storage piles, material transfers, or haul roads at the Wilderness NC lumber yard. Nucor Lexington characterized fugitive emissions at Wilderness NC and updated the cumulative PM_{10} NAAQS modeling to include the revised fugitive emissions. The Wilderness NC emissions and modeling refinements are described in the Supplemental Response to Technical Incompleteness Letter submitted by Nucor Lexington on September 8, 2022.

Background 24-hour PM_{10} concentrations were compiled from the Hattie Avenue monitor (AQS ID 37-067-0022) located in Winston-Salem, Forsyth County, NC. This monitor is in an urban area approximately 36 km north of the Project site and the monitored concentrations are expected to be a conservative estimate of the ambient background concentrations in the rural area around the Project.

Model impacts from nearby source emissions were summed with monitored background concentrations and then compared to the NAAQS to determine if there was a modeled violation of the 24-hour PM_{10} NAAQS. Results of the 24-hour PM_{10} full impact NAAQS analyses are presented in Table 4.3.1- 6. As shown, there were no modeled violations of the 24-hour PM_{10} NAAQS.

4.3.1.9 Class II Area Full Impact PSD Increment Air Quality Modeling Analysis

Based on the results of the SILs analyses, a Class II Area PSD Increment full impact analysis was conducted to evaluate increment consumption in Davidson County for annual NO_2, 24-hour SO_2, 24-hour and annual $PM_{2.5}$, and 24-hour and annual PM_{10}. Davidson County has a minor source baseline date set for PM_{10} on November 30, 1978. The minor source baseline dates for $PM_{2.5}$ and NO_2 were set on August 8, 2018. The PSD Increment full impact modeling analysis included development of Nucor Lexington short-term and annual emissions scenarios, SIA receptors, nearby source inventories, increment consuming and expanding emission rates, and additional modeling refinements to address secondary $PM_{2.5}$ formation and NO_x chemistry.

Wilderness NC $PM_{2.5}$ emissions were not included in the $PM_{2.5}$ Class II increment modeling. The minor source baseline date for $PM_{2.5}$ in Davidson County was set in August 2018. Wilderness NC's last permit revision was issued in November 2015, prior to the setting of the minor source baseline date for $PM_{2.5}$. Because of this, the $PM_{2.5}$ emissions from Wilderness NC are considered part of the existing baseline that was established in 2018 and are not increment consuming. Wilderness NC is not listed as an increment consuming source of PM_{10} in the NCDEQ inventory. However, since the minor source baseline date for PM_{10} in Davidson County was set in November 1978, it was conservatively assumed that the 100 tons per year of PM_{10} included in the NAAQS modeling for Wilderness NC was also increment consuming and was included in the Class II increment modeling as well.

The NOx chemistry refinements (ARM2) employed for the annual NO_2 increment analysis were identical to those employed for the annual NO_2 NAAQS analysis, as previously discussed. Nucor Lexington normal operations and emissions assumptions were also identical to the annual NO_2 NAAQS analysis. Increment consuming NOx emissions were modeled for the Wilderness NC facility.

Table 4.3.1- 7 shows the modeling results from the PSD Increment full impact analysis for NO_2, SO_2, $PM_{2.5}$, and PM_{10}. The PSD Increment full impact analysis demonstrated that Nucor Lexington project impacts would not cause or contribute to a violation of the Class II Area PSD Increments.

Table 4.3.1- 7: Class II PSD Increment Full Impact Analysis Results (μg/m^3)

Pollutant	Averaging Period	Model Concentration	Secondary $PM_{2.5}$ Contribution	Total Concentration	PSD Increment
NO_2	Annual	1.3	--	1.3	25
SO_2	24-hour	6.5	--	6.5	91
$PM_{2.5}$	24-hour	5.81	0.49	6.3	9
	Annual	1.149	0.051	1.2	4
PM_{10}	24-hour	25.75	--	25.75	30
	Annual	3.26	--	3.26	17

4.3.1.10 Class II Area Tier 1 Screening Analysis for Ozone Precursors

A Tier 1 screening analysis was conducted to evaluate project NOx and VOC emissions impacts on secondary formation of ozone in Class II areas. The screening analysis was based on representative ozone monitoring data paired with conservative ozone modeling data taken from Appendix A of EPA's *Guidance on the Development of Modeled Emission Rates for Precursors (MERPs) as a Tier I Demonstration Tool for Ozone and PM2.5 under the PSD Permitting Program* (April 30, 2019). This Tier I screening approach is consistent with Section 5.3.2(b) of Appendix W.

Nucor chose the lowest illustrative MERP values from Table 4-1 of the MERPs guidance, comparing emissions from the Project to the worst-case MERPs scenario. The worst-case MERPs for 8-hour ozone for the southeast climate region from NOx was 170 tons/year and from VOC was 1,936 tons/year. The potential emissions of NOx (110 tons/year) and VOC (90.6 tons/year) are below the worst-case MERPs values from Table 4-1 in the MERPs guidance. However, the MERPs guidance suggests that the total emission rate of precursors should be cumulatively evaluated with respect to the MERPs levels. The following equation shows the Project's cumulative MERP consumption. A cumulative MERPs consumption of less than 100% indicates that the Project would not be expected to cause ozone concentrations exceeding the ozone SIL.

(Project NOx emissions (110 tons/year)/NOX MERP (170 tons/year) +
(Project VOC emissions (90.6 tons/year)/VOC MERP (1936 tons/year)) = 65%+ 5%
= 70%

The calculated cumulative consumption of the MERPs is 70%. Because this impact is less than 100%, this analysis demonstrates that the proposed Project will not cause ozone impacts greater than the SIL of 1 ppb. Therefore, impacts from project NO_X and VOC emissions are not expected to cause or contribute to a violation of the 8-hour ozone NAAQS.

4.3.1.11 Class I Area Significant Impact Air Quality Modeling Analysis

A significant impact screening analysis was conducted for the pollutants shown in Table 8 that require Class I Area PSD increment analysis and that have established Class I Area Significant Impact Levels (SIL). The modeling results were compared to the applicable Class I Area SIL as defined in the NSR Workshop Manual and EPA guidance to determine if a Class I full impact air quality analysis would be required for that pollutant. Project emissions were modeled to screen for Class I Area impacts. Secondary $PM_{2.5}$ formation assumptions were the same as those used for the Class II NAAQS analysis. AERMOD was selected to screen for modeled impacts at 50 km in all directions around the facility, consistent with screening methodology outlined in EPA guidance released with revisions to Appendix W in January 2017. Table 4.3.1- 8 provides results out to 50 km for NO_2, SO_2, PM_{10}, and $PM_{2.5}$. As demonstrated by the model results summarized in Table 8, project impacts are not expected to cause or contribute to a violation of Class I Area PSD Increments.

Table 4.3.1- 8: 50-km Class I Significant Impact Screening Results (μg/m³)

Pollutant	Averaging Period	Project Maximum Impact at 50 km	Class I SILs	% of Class I SILs
NO_2	Annual	0.008	0.1	8 %
SO_2	3-hour	0.533	1	53 %
	24-hour	0.150	0.2	75 %
	Annual	0.010	0.08	12 %
PM_{10}	24-hour	0.119	0.32	37%
	Annual	0.009	0.2	4 %
$PM_{2.5}$	24-hour	0.15[1]	0.27	56 %
	Annual	0.009[1]	0.05	19 %

[1] Includes contribution of secondary formation of $PM_{2.5}$

4.3.1.12 Air Quality Related Values (AQRV) Visibility and Deposition Impact Analysis

The project includes significant emissions of pollutants with established Class I Area visibility and deposition impact thresholds. AQRV pollutants include significant emissions of NO_X, SO_2, PM_{10}/$PM_{2.5}$ and H_2SO_4 mist. Therefore, analysis of project impacts on Class I Area AQRVs was required.

Federal Land Managers (FLMs) were notified of the PSD project following the pre-application meeting held on May 20, 2022 at NCDEQ Headquarters in Raleigh. Notification of the PSD project was transmitted via email from NCDAQ on June 9, 2022, to representatives of the U.S. Fish and Wildlife Service (FWS), U.S. Forest Service (FS), and the National Parks Service (NPS). No further requests or comments were received since the June 9, 2022, email correspondences.

Nucor Lexington evaluated AQRV impacts based on screening guidance from the 2010 Federal Land Managers' (FLM) air quality related values work group (FLAG): phase I report. Under this guidance, impacts are screened by dividing the total annualized 24-hour emission increases (tpy) by the project distance (km) to the closest Class I Area. The annualized 24-hour emission increases include the sum of all AQRV pollutants, i.e., NO_X, SO_2, PM_{10}, and H_2SO_4, as appropriate. The closest Class I area to the project was determined to be the Linville Gorge Wilderness, located 157 km west of the facility. Accordingly, the AQRV emissions increase (Q) divided by the distance to Linville Gorge Wilderness (D) was calculated as: 665.8 tpy / 157 km = 4.42. The 2010 FLAG guidance indicates that a Q/D value of 10 or less demonstrates project emissions will have negligible impacts with respect to Class I AQRVs. Therefore, the Nucor Lexington project emissions evaluated under this PSD review are expected to show negligible impacts with respect to Class I AQRVs at the Linville Gorge Wilderness, and other Class I areas located farther away.

4.3.2 Additional Impact Analysis

In accordance with the requirements under 40 CFR 51.166(o), additional impact analyses were conducted to assess commercial, residential, industrial, and other growth impacts on air quality, and to assess any significant impairment to soils, vegetation, and visibility that would result from the project. In addition, an ozone impact analysis was conducted.

4.3.2.1 Visibility

The Class II visibility analysis was conducted for the Uwharrie National Forest based on significant project emissions of visibility-impairing pollutants such as NO_X and PM_{10}. The Uwharrie National Forest is located approximately 25 km southeast of the proposed Nucor Lexington facility. Plume perceptibility and contrast impact criteria were analyzed according to the US EPA's Workbook for Plume Visual Impacts Screening and Analysis (Revised, October 1992). Analysis procedures relied on US EPA's VISCREEN model with "Level 1" assumptions to determine if project impacts were below plume perceptibility and contrast criteria. The conclusion of the analysis was that the Nucor Lexington project impacts were below applicable Class II area visibility criteria.

4.3.2.2 Soils and Vegetation

The project impacts on soils and vegetation were analyzed by comparing the maximum modeled concentrations to secondary NAAQS and screening thresholds recommended in EPA's "A Screening Procedure for Impacts of Air Pollution Sources on Plants, Soils and Animals" (EPA-450/2-81-078). The modeled concentrations from the Class II significant impact analysis were well below the secondary NAAQS and screening thresholds. Therefore, little or no significant impacts are anticipated from the project to soils and/or vegetation.

4.3.2.3 Growth Associated with the Source

This facility will be built in Lexington, NC along Highway 64. Highway 64 is already a significant highway. Although this new facility is expected to increase traffic in the area, the size of the existing highway is not expected to change. Therefore, any increase in traffic due the construction of this facility is not expected to be significant with respect to the existing traffic along Highway 64.

According to the application and in-person meetings[30] with Nucor staff, Nucor plans to hire the majority of the approximately 200-person staff from the local area. Therefore, no substantial increase in economic demand from activities such as home construction in the area is expected.

4.3.2.4 Ozone Impact Analysis

The project VOC emissions of 290.6 tons per year and NOx emissions of 110 tons per year exceed the ozone SERs of 40 tons per year applicable to both VOCs and NOx as specified in 40 CFR 51.166(b)(23)(i). Therefore, project VOC and NOx emissions impacts on ambient ozone levels were analyzed and assessed using the MERPs screening approach. MERPs screening for secondary ozone formation is discussed previously in this review report, and shows project impacts do not cause or contribute to a violation of the 8-hour Ozone NAAQS.

[30] Specifically, the January 5, 2023 meeting between Nucor staff and DAQ staff.

5.0 North Carolina Toxic Air Pollutants and State Ambient Air Quality Standards

5.1 Toxic Air Pollutants (TAP)

The rules for toxic air pollutants under 15A NCAC 02D .1100 and 02Q .0700 apply to facilities that emit toxic air pollutants. In general, if a facility would emit a TAP at rates greater than the TAP permitting emission rates (TPER) listed in 02Q .0711, the facility must first conduct an air dispersion modeling demonstration under 15A NCAC 02D .1104.

Note that for new facilities, compliance with the TPERs excludes sources exempted by 15A NCAC 02Q .0702 (see 02Q .0704(c) and (d)). Per 15A NCAC 02Q .0702(a)(27)(B), sources subject to an emission standard under 40 CFR Part 63 (i.e., a MACT standard) are exempt from TAP emission requirements under this rule. The Melt Shop (ES-1), the emergency-use engines (ES-10), and the gasoline storage tank (ES-11-2) are each subject to a rule under 40 CFR Part 63, and therefore cannot be considered when comparing emissions to the TPERs.

However, per 15A NCAC 02Q .0704(c), DAQ is required to review sources exempted by 15A NCAC 02Q .0702(a)(27) pursuant to NCGS 143-215.107(a)(5)b. In order to assist DAQ in performing this required review, Nucor pre-emptively calculated facility-wide TAP emissions and performed air dispersion modeling for those TAPs that exceeded the limits in 02Q .0711. See Table 16 for Nucor's calculations of facility-wide TAP emissions.

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Table 16: Facility-wide TAP emissions[31]

Emissions (tpy)[1]

TAPs (non-HAPs)	Dust Silo EP05	Dust Loadout EP05	Torch Cutting EP06	EAF EP07	Natural Gas Combustion EP07	Meltshop Uncaptured EP08	Caster EP09	Natural Gas Combustion EP09	Roll Mill EP11	Emergency Fire Pump EP14	Emergency Generators EP15	Emergency Generators EP16	Gasoline Storage Tank EP22
Fluoride				2.58E+00		2.58E-03							
H2SO4			1.97E-04		1.85E-02	8.73E-04		2.52E-02		1.43E-05	7.68E-05	7.68E-05	
Methyl Ethyl Ketone									2.34E-01				
TAPs (HAPs)													
1,1,2,2-Tetrachloroethane										4.02E-06	3.41E-05	3.41E-05	
1,3-Butadiene									5.52E-03	1.05E-04	2.28E-04	2.28E-04	
1,4-Dioxane									7.45E-03				
Acetaldehyde									3.41E-01	4.44E-04	7.13E-03	7.13E-03	
Acrolein									1.42E-01	4.18E-04	4.38E-03	4.38E-03	
Arsenic	5.35E-06	4.05E-07	3.65E-08	1.18E-03	4.02E-05	3.06E-06	4.17E-06	5.38E-05	6.83E-07				
Benzene			3.86E-09		4.22E-04	1.97E-05		5.65E-04	2.19E-02	2.51E-04	7.34E-04	7.34E-04	1.94E-03
Benzo(a)pyrene			5.15E-09		2.41E-07	1.13E-08		3.23E-07	4.10E-09				
Beryllium			1.07E-08		2.41E-06	1.13E-07		3.23E-06	4.10E-08				
Cadmium	2.34E-04	1.77E-05	7.30E-06	5.16E-02	2.21E-04	6.19E-05	2.98E-04	2.96E-04	3.76E-06				
Carbon Disulfide									1.75E-01				
Carbon Tetrachloride									1.40E-02	2.81E-06	3.13E-05	3.13E-05	
Chlorobenzene										2.05E-06	2.59E-05	2.59E-05	
Chloroform									1.91E-02	2.18E-06	2.43E-05	2.43E-05	
Dichlorobenzene			3.86E-09		2.41E-04	1.13E-05		3.23E-04	4.10E-06				
Ethylene Dibromide										3.39E-06	3.78E-05	3.78E-05	
Formaldehyde			2.58E-06		1.51E-02	7.05E-04		2.02E-02	2.56E-04	3.26E-03	4.50E-02	4.50E-02	
Hexane			6.44E-09		3.62E-01	1.69E-02		4.84E-01	4.17E-01		9.47E-04	9.47E-04	2.75E-03
Manganese	3.67E-03	2.78E-04	2.36E-06	8.11E-01	7.64E-05	8.14E-04	2.53E-01	1.02E-04	1.30E-06				
Mercury	9.73E-07	7.36E-08	3.01E-06	2.15E-04	5.22E-05	2.66E-06	2.09E-06	7.00E-05	8.88E-07				
Methyl Isobutyl Ketone									1.25E-02				
Methylene Chloride									2.71E-01	6.55E-06	1.71E-05	1.71E-05	
Nickel	1.99E-05	1.51E-06	1.80E-07	4.41E-03	4.22E-04	2.41E-05	4.07E-03	5.65E-04	7.17E-06				
Phenol											2.05E-05	2.05E-05	
Styrene									9.46E-03	1.89E-06	2.01E-05	2.01E-05	1.47E-04
Toluene			1.31E-06		6.83E-04	3.20E-05		9.15E-04	6.64E-02	8.87E-05	3.48E-04	3.48E-04	8.70E-03
Trichloroethene									1.19E-02				
Vinyl Chloride										1.14E-06	1.27E-05	1.27E-05	
Xylene										3.10E-05	1.82E-04	1.82E-04	
m-/p-Xylenes									3.34E-02				6.08E-03
o-Xylenes									1.49E-02				2.22E-03

TAPs (non-HAPs)	Total tpy	Total lb/yr	TPER .0711(a)[2] lb/yr	TPER .0711(a)[2] Modeling Required?	Totals lb/hr	TPER .0711(a)[2] lb/hr	TPER .0711(a)[2] Modeling Required?	Total lb/day	TPER .0711(a)[2] lb/day	TPER .0711(a)[2] Modeling Required?
Fluoride	2.58E+00				8.01E-01	0.06	YES	19.22	0.3	YES
H2SO4	4.49E-02				1.36E-02	0.03	No	0.33	0.3	YES
Methyl Ethyl Ketone	2.34E-01				5.33E-02	22.40	No	1.28	78.0	No
TAPs (HAPs)										
1,1,2,2-Tetrachloroethane	7.23E-05	0.14	430	No	1.45E-03					
1,3-Butadiene	6.08E-03	12.17	11	YES	1.25E-02					
1,4-Dioxane	7.45E-03				1.70E-03			0.04	12.0	No
Acetaldehyde	3.55E-01				3.72E-01	6.80	No			
Acrolein	1.51E-01				0.216134	0.02	YES			
Arsenic	1.29E-03	2.58	0.053	YES	2.99E-04					
Benzene	2.66E-02	53.14	8.1	YES	3.96E-02					
Benzo(a)pyrene	5.85E-07	0.00	2.2	No	1.33E-07					
Beryllium	5.81E-06	0.01	0.28	No	1.33E-06					
Cadmium	5.27E-02	105.42	0.37	YES	1.23E-02					
Carbon Disulfide	1.75E-01				4.01E-02			0.96	3.9	No
Carbon Tetrachloride	1.40E-02	28.03	460	No	4.49E-03					
Chlorobenzene	5.39E-05				1.08E-03			0.03	46.0	No
Chloroform	1.92E-02	38.32	290	No	5.38E-03					
Dichlorobenzene	5.80E-04				1.32E-04	16.80	No			
Ethylene Dibromide	7.90E-05	0.16	27	No	1.58E-03					
Formaldehyde	1.30E-01				1.88E+00	0.04	YES			
Hexane	1.28E+00				3.30E-01			7.92	23.0	No
						92.00	No			
Manganese	1.07E+00				2.68E-01			6.43	0.0	YES
Mercury	3.47E-04				8.02E-05			0.00	0.0	No
Methyl Isobutyl Ketone	1.25E-02				2.86E-03	7.60	No	0.07	52.0	No
Methylene Chloride	2.71E-01	542.75	1600	No	6.28E-02	0.39	No			
Nickel	9.51E-03				2.52E-03			0.06	0.1	No
Phenol	4.09E-05				8.19E-04	0.24	No			
Styrene	9.65E-03				3.00E-03	2.70	No			
Toluene	7.75E-02				3.12E-02	14.40	No	0.75	98.0	No
Trichloroethene	1.19E-02	23.84	4000	No	2.72E-03					
Vinyl Chloride	2.66E-05	0.05	26	No	5.31E-04					
Xylene	5.70E-02				1.89E-02	16.40	No	0.45	57.0	No
m-/p-Xylenes	3.95E-02		See Xylene		7.62E-03	See Xylene			See Xylene	
o-Xylenes	1.71E-02		See Xylene		3.41E-03	See Xylene			See Xylene	

[31] These tables were included in the Application at Appendix E, page 4. The format was modified to fit this document.

The calculations in Table 16 are based on an hourly steel production rate of 80 tons per hour and annual steel production rate of 515,000 tons per year. These production limits will be included in the permit as part of compliance with 15A NCAC 02D .0530. Nucor did not propose any emission limits or control specifically to reduce TAP emissions.

NCGS 143-215.107(a)(5)b requires DAQ to determine if emissions of TAP from the facility would present an unacceptable risk to human health. For TAPs with emission rates below their respective TPERs, it is reasonable to assume that those emissions would not present an unacceptable risk to human health. These TAPs and their respective TPERs will be listed in the permit under a specific condition for 15A NCAC 02Q .0711.

For TAPs with emission rates greater than their respective TPER, the results of air dispersion modeling (regardless of exemptions under 02Q .0702) can show that there is not an unacceptable risk to human health. If the results of modeling show that there is no exceedance of an acceptable ambient level (AAL) listed in 15A NCAC 02D .1104, then it is reasonable to conclude that there is no unacceptable risk to human health.

The air toxics dispersion modeling analysis was conducted to evaluate ambient impacts from facility-wide TAPs estimated to exceed TPERs outlined in 15A NCAC 02Q .0711. The modeling of maximum-allowable TAPs emissions adequately demonstrates compliance with the AALs, on a source-by-source basis, for acrolein, arsenic, benzene, 1,3-butadiene, cadmium, formaldehyde, fluorides, manganese, and sulfuric acid. The modeling establishes maximum-allowable emission limits for each TAP on a source-by-source basis. See Table 17 and Table 18 for emission rates used in the air dispersion modeling. The modeled impacts from facility-wide TAPs emissions as a percentage of AALs are presented in Table 19.

Table 17: TAP emission rates for short-term modeling

Description	Model ID	Fluorides		H2SO4		Acrolein		Formaldehyde		Manganese	
		lb/hr	(g/s)	lb/hr	(g/s)	lb/hr	(g/s)	lb/hr	(g/s)	lb/hr	(g/s)
Melt shop Baghouse	EP07	8.00E-01	1.01E-01	4.21E-03	5.31E-04	n/a	n/a	3.44E-03	4.34E-04	1.85E-01	2.33E-02
Emergency Fire Water Pump	EP14	n/a	n/a	2.86E-04	3.61E-05	8.36E-03	1.05E-03	6.52E-02	8.22E-03	n/a	n/a
Emergency Generator 1	EP15	n/a	n/a	1.54E-03	1.93E-04	8.77E-02	1.10E-02	9.01E-01	1.14E-01	n/a	n/a
Emergency Generator 1	EP16	n/a	n/a	1.54E-03	1.93E-04	8.77E-02	1.10E-02	9.01E-01	1.14E-01	n/a	n/a
Dust Loadout - north door	EP05_A	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1.97E-03	2.49E-04
Dust Loadout - south door	EP05_B	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1.97E-03	2.49E-04
Scrap and Skull Cutting	EP06	n/a	n/a	4.50E-05	5.67E-06	n/a	n/a	5.88E-07	7.41E-08	5.39E-07	6.79E-08
Melt shop Fugitives	EP08_1	1.90E-04	2.40E-05	4.75E-05	5.98E-06	n/a	n/a	3.83E-05	4.83E-06	4.43E-05	5.58E-06
Melt shop Fugitives	EP08_2	2.12E-04	2.67E-05	5.27E-05	6.64E-06	n/a	n/a	4.26E-05	5.37E-06	4.92E-05	6.20E-06
Melt shop Fugitives	EP08_3	1.71E-04	2.16E-05	4.27E-05	5.38E-06	n/a	n/a	3.45E-05	4.35E-06	3.98E-05	5.02E-06
Melt shop Fugitives	EP08_4	1.52E-04	1.92E-05	3.80E-05	4.78E-06	n/a	n/a	3.07E-05	3.86E-06	3.54E-05	4.46E-06
Melt shop Fugitives	EP08_5	7.41E-05	9.33E-06	1.85E-05	2.33E-06	n/a	n/a	1.49E-05	1.88E-06	1.72E-05	2.17E-06
Gasoline Storage Tank	EP22	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Rolling mill monovent	EP11	n/a	n/a	n/a	n/a	3.24E-02	4.08E-03	5.85E-05	7.37E-06	2.96E-07	3.73E-08
Caster monovent	EP09	n/a	n/a	5.75E-03	7.25E-04	n/a	n/a	4.61E-03	5.81E-04	7.88E-02	9.92E-03

Table 18: TAP emission rates for long-term modeling

Description	Model ID	Arsenic		Benzene		Cadmium		1,3-Butadiene	
		tpy	(g/s)	tpy	(g/s)	tpy	(g/s)	tpy	g/s
Melt shop Baghouse	EP07	1.22E-03	3.52E-05	4.22E-04	1.21E-05	5.18E-02	1.49E-03	n/a	n/a
Emergency Fire Water Pump	EP14	n/a	n/a	2.51E-04	7.23E-06	n/a	n/a	1.05E-04	3.03E-06
Emergency Generator 1	EP15	n/a	n/a	7.34E-04	2.11E-05	n/a	n/a	2.28E-04	6.55E-06
Emergency Generator 1	EP16	n/a	n/a	7.34E-04	2.11E-05	n/a	n/a	2.28E-04	6.55E-06
Dust Loadout - north door	EP05_A	2.88E-06	8.28E-08	n/a	n/a	1.26E-04	3.61E-06	n/a	n/a
Dust Loadout - south door	EP05_B	2.88E-06	8.28E-08	n/a	n/a	1.26E-04	3.61E-06	n/a	n/a
Scrap and Skull Cutting	EP06	3.65E-08	1.05E-09	3.86E-09	1.11E-10	7.30E-06	2.10E-07	n/a	n/a
Melt shop Fugitives	EP08_1	7.29E-07	2.10E-08	4.70E-06	1.35E-07	1.47E-05	4.24E-07	n/a	n/a
Melt shop Fugitives	EP08_2	8.10E-07	2.33E-08	5.22E-06	1.50E-07	1.64E-05	4.71E-07	n/a	n/a
Melt shop Fugitives	EP08_3	6.56E-07	1.89E-08	4.23E-06	1.22E-07	1.33E-05	3.82E-07	n/a	n/a
Melt shop Fugitives	EP08_4	5.83E-07	1.68E-08	3.76E-06	1.08E-07	1.18E-05	3.39E-07	n/a	n/a
Melt shop Fugitives	EP08_5	2.84E-07	8.16E-09	1.83E-06	5.26E-08	5.73E-06	1.65E-07	n/a	n/a
Gasoline Storage Tank	EP22	n/a	n/a	1.94E-03	5.58E-05	n/a	n/a	n/a	n/a
Rolling mill monovent	EP11	6.83E-07	1.97E-08	2.19E-02	6.30E-04	3.76E-06	1.08E-07	5.52E-03	1.59E-04
Caster monovent	EP09	5.80E-05	1.67E-06	5.65E-04	1.63E-05	5.94E-04	1.71E-05	n/a	n/a

Table 19: TAP modeling results versus AALs

Pollutant	Averaging Period	AAL (µg/m^3)	Maximum Modeled Impacts % of AAL
Acrolein	1-hour	80.0	10 %
Arsenic	Annual	2.1E-03	0.3 %
Benzene	Annual	0.12	6 %
1,3-butadiene	Annual	0.44	0.1 %
Cadmium	Annual	0.0055	5 %
Formaldehyde	1-hour	150	52 %
Fluorides	1-hour	250	0.1 %
	24-hour	16	0.9 %
Manganese	24-hour	31	0.6 %
Sulfuric Acid	1-hour	100	0.2 %
	24-hour	12	0.03 %

Based on Table 19, even considering the emission sources exempt under 02Q .0702, no AAL will be exceeded for any TAP. Therefore, it can be concluded that there will not be an unacceptable risk to human health.

The air quality permit will include specific conditions for 15A NCAC 02D .1100 and 02Q .0711.

Note: Per 15A NCAC 02Q .0704(c), sources exempt pursuant to 02Q .0702 are not considered when setting limits to comply with 02D .1100. Therefore, although Nucor modeled for several pollutants and emission sources, those modeled rates will not necessarily appear in the permit. When excluding the contributions of exempt sources based on Table 16, only the following pollutants exceed their respective TPERs: arsenic, benzene, cadmium, and manganese. Therefore, only these pollutants and the non-exempt sources that emit them will be referenced in the permit under 02D .1100.

5.2 State Ambient Air Quality Standards

Total suspended particulate (TSP) project emissions were estimated above the SER of 25 tpy as specified under 40 CFR 51.166(b)(23). While the TSP NAAQS was revised in 1987 to narrow focus on the regulation of PM_{10}, North Carolina State Ambient Air Quality Standards (SAAQS) currently still require evaluation of both PM_{10} and TSP separately in accordance with 15A NCAC 02D .0403. As such, Nucor Lexington modeled facility-wide TSP project emissions using AERMOD to demonstrate that project impacts were below the 24-hour and annual TSP SAAQS. Table 20 shows the results of the modeling analyses and that the modified facility-wide emissions impacts will not cause or contribute to a violation of the TSP SAAQS. Maximum TSP modeled impacts were based on the normal operations emissions scenario.

Table 20: TSP modeled results versus SAAQS

Pollutant	Averaging Period	SAAQS	Modeled Impacts as % of SAAQS
TSP	24-hour	150	56 %
	Annual	75	17 %

6.0 Other Application Requirements

6.1 Zoning Consistency Determination

Per 15A NCAC 02Q .0304(b)(1), a zoning consistency determination is required for new facilities according to NCGS 143-215.108(f). Nucor submitted a zoning consistency determination to the Planning and Zoning Department of Davidson County on July 27, 2022.

6.2 Professional Engineer's Seal

Pursuant to 15A NCAC 02Q .0112 "Application requiring a Professional Engineering Seal," a professional engineer's seal (PE Seal) is required to seal technical portions of air permit applications for new sources and modifications of existing sources as defined in 02Q .0103.

The application submitted by Nucor included Form D5 "Technical Analysis to Support Permit Application," which includes a PE seal from Amy M. Marshall (#027844). According to the North Carolina Board of Examiners for Engineers and Surveyors' license lookup tool, the PE license is "current" through December 31, 2023.

6.3 Application Fee

Applications for new PSD facilities require an application fee. The required fee of $16,100 was received by ePay on July 20, 2022.

7.0 Public Notice/EPA and Affected State(s) Review

This permit application processing is conforming to the public participation requirements, pursuant to both 15A NCAC 0530 “Prevention of Significant Deterioration” and 15A NCAC 02Q .0300 “Construction and Operation Permits.” As this application is not processed pursuant to 15A NCAC 02Q .0500 “Title V Procedures,” none of the public participation requirements contained therein apply to the application.

A public notice for the availability of preliminary determination and the draft Title V will be published in a local newspaper of general circulation (The Dispatch, located in Lexington NC) for 30 days for review and comments. A copy of the public notice will be provided to the EPA, and all local and state authorities having authority over the location at which the proposed modification is to be constructed. Draft permit documents will also be provided to EPA, affected states, and all interested persons in mailing list, maintained by the DAQ. Finally, all documents will be placed on the DEQ’s website and a complete administrative record for the draft permit documents will be kept for public review at the DEQ’s Winston-Salem Regional Office for the entire public notice period (30 days).

As this application is not processed pursuant to 15A NCAC 02Q .0500 “Title V procedures”, none of the public participation requirements contained therein apply to the application.

Appendix 4 includes the public notice and a listing of both the entities and the documents to be sent to each listed entity for the proposed PSD major modification, satisfying the requirements in §51.166(q) “public participation”.

8.0 Conclusions

Based on the application submitted and the review of this proposal, NCDAQ is making a preliminary determination that the project can be approved and the proposed permit issued. After consideration of all comments, a final determination will be made.

Appendix 1: Emission Calculations and Emission Factors

The following calculations were performed by Nucor and included in the application as Appendix E. Any additional information supplied by Nucor after the application was received will be clearly indicated. See Figure 2 and Table 1 in the application review for a list of emission point ID numbers and emission source ID numbers. The formatting of these tables has been changed slightly to fit the format of this document.

1.0 Calculations for Melt Shop Sources (ID No. ES-1)

1.1 EAF (ID No. ES-1.1) and LMF (ID No. ES-1.2)

EAF/LMF - Vents to EP07

Inputs

Description	Value	Units	Notes
Annual Operating Hours	8,760	hr/yr	
Air Flowrate	596,227	dscfm	Maximum air flowrate
Annual Steel Production Rate[1]	515,000	tpy	Maximum annual production rate (avg 59 tph)
Hourly Steel Production Rate[2]	80	tph	Maximum hourly production rate

Emissions

Pollutant	Emission Factor		Emissions[1]	Emissions[2]	Source
	lb/ton	(gr/dscf)	lb/hr	tpy	
PM (filterable)	--	0.0015	7.67	33.58	
PM (filterable and condensable)	--	0.0052	26.57	116	BACT
PM_{10} (filterable and condensable)	--	0.0024	12.27	53.72	BACT
$PM_{2.5}$ (filterable and condensable)	--	0.0024	12.27	53.72	BACT
NO_X	0.3	--	24	77	BACT
CO	3.5	--	280	901	BACT
SO_2	0.5	--	40	129	BACT
VOC	0.3	--	24	77	BACT
CO_2e	438	--	35,040	112,785	BACT
Fluoride	0.01	--	0.80	2.58	3
	(%)[4]		lb/hr	tpy	Source
Antimony	0.0107%	--	1.31E-03	5.75E-03	5
Arsenic	0.0022%	--	2.70E-04	1.18E-03	5
Cadmium	0.0960%	--	1.18E-02	5.16E-02	5
Chromium	0.2355%	--	2.89E-02	1.27E-01	5
Cobalt	0.0014%	--	1.72E-04	7.52E-04	5
Lead	--	3.29E-07	1.68E-03	7.38E-03	6
Manganese	1.5093%	--	1.85E-01	8.11E-01	5
Mercury	0.0004%	--	4.91E-05	2.15E-04	5
Nickel	0.0082%	--	1.01E-03	4.41E-03	5
Selenium	0.0002%	--	2.45E-05	1.07E-04	5
Total HAPs (includes Pb)	--	--	--	1.01	--

Notes

1 - Hourly emissions based on a steel production rate of 80 tph and 8,760 hr/yr.

2 - Annual emissions based on a steel production rate of 515,000 tpy and 8,760 hr/yr.

3 - Estimated based on experience at other Nucor facilities.

4 - The percent metal in the dust sample is used to represent the percent metal in the emitted PM10.

5 - Based on baghouse dust analysis for similar facility (NSFL). Emision factor = average + 2 standard devations from dust analysis.

6 - Based on stack testing for Nucor facility with similar operation. Emission factor based on stack test result plus 100% conservative factor.

Addendum to Note 3:

The following information was received on October 3, 2022 by email:

"The fluoride emission factor is based off testing at a similar Nucor micro-mill using a similar scrap and additive mix. To account for potential variability, a conservative factor has been added based on an engineering estimate."

The following information was received on November 18, 2022 by email:

"Fluoride emissions were conservatively estimated based on Nucor Sedalia. Nucor Lexington agrees with NCDAQ that a PSD avoidance limit would be appropriate. As such, Nucor requests a fluoride emission limit of less than 3 tons per year. Additionally, Nucor Lexington will use fluoride containing material in various areas of the steel making process. All potential fluoride emissions from the use of fluoride containing materials are considered in the estimated emissions discussed above."

1.2 Refractory dumping and repair (ID No. ES-1.3)

EAF Dumping - Vents to EP07

Inputs

Description	Value	Units	Notes
Annual Operating Hours	8,760	hr/yr	
Annual Steel Production Rate[1]	515,000	tpy	Maximum annual production rate (avg 59 tph)
Hourly Steel Production Rate[2]	80	tph	Maximum hourly production rate
Annual Refractory Rate	600	tpy	
Hourly Refractory Rate	0.09	tph	

Emissions

Pollutant	Emission Factor	Emissions[1]	Emissions[2]	Notes
	lb/ton	lb/hr	tpy	
Total PM	8.80E-03	8.20E-04	2.64E-03	3
PM_{10}	4.30E-03	4.01E-04	1.29E-03	3
$PM_{2.5}$	1.60E-03	1.49E-04	4.80E-04	3

Notes
1 - Hourly emissions based on a steel production rate of 80 tph and 8,760 hr/yr.
2 - Annual emissions based on a steel production rate of 515,000 tpy and 8,760 hr/yr.
3 - Uncontrolled PM emission factors for open dust sources at iron and steel mills. Batch Drop, front end loader, low silt slag - AP-42 Table 12.5-4

EAF Repair - Vents to EP07

Inputs

Description	Value	Units	Notes
Annual Operating Hours	8,760	hr/yr	
Annual Steel Production Rate[1]	515,000	tpy	Maximum annual production rate (avg 59 tph)
Hourly Steel Production Rate[2]	80	tph	Maximum hourly production rate
Annual Refractory Rate	600	tpy	
Hourly Refractory Rate	0.09	tph	

Emissions

Pollutant	Emission Factor	Emissions[1]	Emissions[2]	Notes
	lb/ton	lb/hr	tpy	
Total PM	8.80E-03	8.20E-04	2.64E-03	3
PM_{10}	4.30E-03	4.01E-04	1.29E-03	3
$PM_{2.5}$	1.60E-03	1.49E-04	4.80E-04	3
VOC	2.00E-03	1.86E-04	6.00E-04	4

Notes
1 - Hourly emissions based on a steel production rate of 80 tph and 8,760 hr/yr.
2 - Annual emissions based on a steel production rate of 515,000 tpy and 8,760 hr/yr.
3 - Uncontrolled PM emission factors for open dust sources at iron and steel mills. Batch Drop, front end loader, low silt slag - AP-42 Table 12.5-4
4 - Uncontrolled Emission Factor Listing for Criteria Air Pollutants - EIIP - 2001. (3-03-009).

1.3 Slag dumping (ID No. ES-1.4)

Slag Dumping inside the Melt Shop - Vents to EP07

Inputs

Description	Value	Units	Notes
Annual Operating Hours	8,760	hr/yr	
Annual Steel Production Rate[1]	515,000	tpy	Maximum annual production rate (avg 59 tph)
Hourly Steel Production Rate[2]	80	tph	Maximum hourly production rate
Slag Produced Rate	0.10	ton slag/ton steel	
Annual Slag Dumping Rate	51,500	ton slag/yr	
Hourly Slag Dumping Rate	8.00	ton slag/hr	
Control Efficiency	70.0%	%	Control Efficiency for dumping inside enclosed space

Emissions

Pollutant	Emission Factor	Control Efficiency	Emissions[1]	Emissions[2]	Source
	lb/ton slag	%	lb/hr	tpy	
Total PM	0.026	70.0%	0.06	0.20	3
PM_{10}	0.013	70.0%	0.03	0.10	3
$PM_{2.5}$	4.60E-03	70.0%	0.01	0.04	3

Notes
1 - Hourly emissions based on a steel production rate of 80 tph and 8,760 hr/yr.
2 - Annual emissions based on a steel production rate of 515,000 tpy and 8,760 hr/yr.
3 - AP-42 Table 12.5-4, high silt slag batch drop

1.4 Melt Shop Fugitives (ID No. ES-1.5)

Meltshop Uncaptured - EP08

HOURLY EMISSIONS[1],[3]

Emission Source	PM (filterable)	PM (filterable and condensable)	PM10	PM2.5	NOx	CO	VOC	SO2	CO2e	Fluoride	Lead	H2SO4	Mercury
	lb/hr	lb/hr	lb/hr	lb/hr	lb/hr	lb/hr	lb/hr	lb/hr	lb/hr	lb/hr	lb/hr	lb/hr	lb/hr
EAF/LMF	7.67E-03	2.66E-02	1.23E-02	1.23E-02	2.40E-02	2.80E-01	4.00E-02	4.00E-02	35.04	2.58E-03	1.68E-06	--	4.91E-08
Natural Gas Combustion	1.08E-02	1.08E-02	1.08E-02	1.08E-02	1.30E-01	1.77E-01	1.13E-02	1.30E-03	259	--	1.07E-06	1.99E-04	5.58E-07
Caster	1.30E-01	1.30E-01	8.32E-02	6.56E-02	--	--	--	--	--	--	7.39E-05	--	1.30E-08
Caster Spray Stack	4.27E-02	4.27E-02	6.83E-03	8.54E-04	1.91E-04	1.54E-02	6.06E-04	5.74E-04	--	--	--	--	--
EAF Dump	1.64E-05	1.64E-05	8.02E-06	2.98E-06	--	--	--	--	--	--	--	--	--
EAF Repair	1.64E-05	1.64E-05	8.02E-06	2.98E-06	--	--	3.73E-06	--	--	--	--	--	--
Ladle Dump	4.93E-05	4.93E-05	2.41E-05	8.96E-06	--	--	--	--	--	--	--	--	--
Ladle Repair	4.93E-05	4.93E-05	2.41E-05	8.96E-06	--	--	1.12E-05	--	--	--	--	--	--
Tundish Dump	4.22E-05	4.22E-05	2.06E-05	7.68E-06	--	--	--	--	--	--	--	--	--
Tundish Repair	4.22E-05	4.22E-05	2.06E-05	7.68E-06	--	--	9.60E-06	--	--	--	--	--	--
Slag Dump	1.25E-03	1.25E-03	6.24E-04	2.21E-04	--	--	--	--	--	--	--	--	--
Meltshop Material Transfers[4]	1.99E-06	1.99E-06	9.43E-07	1.43E-07									
Total (lb/hr)	**0.19**	**0.21**	**0.11**	**0.09**	**0.15**	**0.47**	**0.05**	**0.04**	**294**	**2.58E-03**	**7.66E-05**	**1.99E-04**	**6.20E-07**

ANNUAL EMISSIONS[2],[3]

Emission Source	PM (filterable)	PM (filterable and condensable)	PM10	PM2.5	NOx	CO	VOC	SO2	CO2e	Fluoride	Lead	H2SO4	Mercury
	tpy	tpy	tpy	tpy	tpy	tpy	tpy	tpy	tpy	tpy	tpy	tpy	tpy
EAF/LMF	3.36E-02	1.16E-01	5.37E-02	5.37E-02	7.73E-02	9.01E-01	1.29E-01	1.29E-01	113	8.00E-04	7.38E-06	--	2.15E-07
Natural Gas Combustion	4.73E-02	4.73E-02	4.73E-02	4.73E-02	5.71E-01	7.77E-01	4.96E-02	5.71E-03	1,135	--	4.70E-06	8.73E-04	2.44E-06
Caster	4.17E-01	4.17E-01	2.68E-01	2.11E-01	--	--	--	--	--	--	2.38E-04	--	4.17E-08
Caster Spray Stack	1.87E-01	1.87E-01	2.99E-02	3.74E-03	6.16E-04	4.94E-02	1.95E-03	1.85E-03	--	--	--	--	--
EAF Dump	5.28E-05	5.28E-05	2.58E-05	9.60E-06	--	--	--	--	--	--	--	--	--
EAF Repair	5.28E-05	5.28E-05	2.58E-05	9.60E-06	--	--	1.20E-05	--	--	--	--	--	--
Ladle Dump	1.59E-04	1.59E-04	7.75E-05	2.88E-05	--	--	--	--	--	--	--	--	--
Ladle Repair	1.59E-04	1.59E-04	7.75E-05	2.88E-05	--	--	3.61E-05	--	--	--	--	--	--
Tundish Dump	1.36E-04	1.36E-04	6.64E-05	2.47E-05	--	--	--	--	--	--	--	--	--
Tundish Repair	1.36E-04	1.36E-04	6.64E-05	2.47E-05	--	--	3.09E-05	--	--	--	--	--	--
Slag Dump	4.02E-03	4.02E-03	2.01E-03	7.11E-04	--	--	--	--	--	--	--	--	--
Melt shop Material Transfers[4]	8.73E-06	8.73E-06	4.13E-06	6.26E-07									
Total (tpy)	**0.69**	**0.77**	**0.40**	**0.32**	**0.65**	**1.73**	**0.18**	**0.14**	**1,248**	**8.00E-04**	**2.50E-04**	**8.73E-04**	**2.70E-06**

HOURLY EMISSIONS[1],[3]

Emission Source	CO_2	N20	CH4
	lb/hr	lb/hr	lb/hr
EAF/LMF	35	0.00	0.00
Natural Gas Combustion	257.59	4.72E-03	4.94E-03
Caster	--	--	--
Caster Spray Stack	--	--	--
EAF Dump	--	--	--
EAF Repair	--	--	--
Ladle Dump	--	--	--
Ladle Repair	--	--	--
Tundish Dump	--	--	--
Tundish Repair	--	--	--
Slag Dump	--	--	--
Meltshop Material Transfers[4]			
Total (lb/hr)	293	4.72E-03	4.94E-03

ANNUAL EMISSIONS[2],[3]

Emission Source	CO_2	N20	CH4
	tpy	tpy	tpy
EAF/LMF	113	0.00	0.00
Natural Gas Combustion	1,128	2.07E-02	2.16E-02
Caster	--	--	--
Caster Spray Stack	--	--	--
EAF Dump	--	--	--
EAF Repair	--	--	--
Ladle Dump	--	--	--
Ladle Repair	--	--	--
Tundish Dump	--	--	--
Tundish Repair	--	--	--
Slag Dump	--	--	--
Melt shop Material Transfers[4]			
Total (tpy)	1,241	2.07E-02	2.16E-02

Notes [to Melt Shop Fugitives]
1 - Hourly emissions based on a steel production rate of 80 tph and 8,760 hr/yr.
2 - Annual emissions based on a steel production rate of 515,000 tpy and 8,760 hr/yr.
3 - Fugitive emissions assume a percentage of the total emissions are emitted as fugitive emissions. This percentage is in addition to the total emissions and, as such, represents worst-case emissions.
4 - Includes material transfers of carbon, fluxes, and alloys from bags to hoppers in meltshop.

Addendum to Note 3:

The following information was received by email on September 2, 2022:

"To reflect a conservative emissions scenario for modeling purposes, melt shop fugitive emissions were estimated by designating a percentage of emissions from each emission source within the meltshop building to also be released as uncaptured emissions from the melt shop building. This approach represents a worst-case emissions scenario from both the melt shop building (*i.e.*, melt shop fugitives) and the emission points.

The specific percentages used for such emissions and associated with such melt shop equipment/activities were based on engineering estimates to reinforce a worst-case scenario, and were as follows:

Melt Shop Source	Percentage Uncaptured
EAF/LMF	0.10%
Natural Gas Combustion	2%
Caster	2%
Caster Spray Stack	2%
EAF Dump	2%
EAF Repair	2%
Ladle Dump	2%
Ladle Repair	2%
Tundish Dump	2%

Tundish Repair	2%
Slag Dump	2%
Melt shop Material Transfers	0.10%

1.5 Natural gas use in Melt Shop (ID No. ES-1.6)

See Section 12.0 for emission calculations for natural gas combustion.

2.0 Calculations for Casting Operations (ID No. ES-2)

2.1 Caster (ID No. ES-2-1)

Caster - Vents to EP09

Inputs

Description	Value	Units	Notes
Annual Operating Hours	8,760	hr/yr	
Annual Steel Production Rate[1]	515,000	tpy	Maximum annual production rate (avg 59 tph)
Hourly Steel Production Rate[2]	80	tph	Maximum hourly production rate

Emissions

Pollutant	Emission Factor	Emissions[1]	Emissions[2]	Source
	lb/ton	lb/hr	tpy	
Total PM	0.081	6.48	20.86	3
PM_{10}	0.052	4.16	13.39	3
$PM_{2.5}$	0.041	3.28	10.56	3
	(%)[4]	(lb/hr)	(tpy)	Source
Antimony	0.00008%	5.18E-06	1.67E-05	5
Arsenic	0.00002%	1.30E-06	4.17E-06	5
Cadmium	0.00143%	9.27E-05	2.98E-04	5
Chromium	0.06750%	4.37E-03	1.41E-02	5
Cobalt	0.00330%	2.14E-04	6.88E-04	5
Lead	0.05700%	3.69E-03	1.19E-02	5
Manganese	1.21500%	7.87E-02	2.53E-01	5
Mercury	0.0000100%	6.48E-07	2.09E-06	5
Nickel	0.01950%	1.26E-03	4.07E-03	5
Selenium	0.00015%	9.72E-06	3.13E-05	5
Total HAPs	--	--	2.84E-01	--

Notes

1 - Hourly emissions based on a steel production rate of 80 tph and 8,760 hr/yr.

2 - Annual emissions based on a steel production rate of 515,000 tpy and 8,760 hr/yr.

3 - Nucor SC. Emission factors developed based on production operations.

4 - The percent metal in the dust sample is used to represent the percent metal in the emitted PM10.

5 - Based on crane rail dust analysis for similar facility (NSFL). Emission factor = sample result x 1.5 (conservative factor)

Emission factor development

Fugitive emissions from Nucor Steel, Huger, SC

Nucor SC Process Rate	**500.00**	**ton/hr**
Caster Hood Capture Efficiency	**98.00%**	**%**

Pollutant	Emission Rate (lb/hr)	Fugitive Emission Factor (lb/ton)	Total Emission Factor (lb/ton)
Total PM	0.81	1.62E-03	0.081
PM10	0.52	1.04E-03	0.052
PM2.5	0.41	8.20E-04	0.041

Addendum to Emission factor development:

The following information was received on October 3, 2022 by email:

"Quantifying emissions from the caster is difficult. To better understand emissions from the caster, Nucor conducted an engineering study to quantify uncaptured emissions from the caster at Nucor SC. Since there is no hood at Nucor Lexington, the uncaptured emission rate is converted to a total emission factor using a capture efficiency of 98%. Nucor believes this is the best available data to represent emissions from the caster. Furthermore, Nucor SC is a much larger facility (500 tph) than Nucor Lexington (80 tph), and thus, represents a conservative estimate."

2.2 Ladle and tundish refractory dumping (ID No. ES-2-2)

Ladle Dumping - Vents to EP09

Inputs

Description	Value	Units	Notes
Annual Operating Hours	8,760	hr/yr	
Annual Steel Production Rate[1]	515,000	tpy	Maximum annual production rate (avg 59 tph)
Hourly Steel Production Rate[2]	80	tph	Maximum hourly production rate
Annual Refractory Rate	1,803	tpy	
Hourly Refractory Rate	0.28	tph	

Emissions

Pollutant	Emission Factor	Emissions[1]	Emissions[2]	Notes
	lb/ton	lb/hr	tpy	
Total PM	8.80E-03	2.46E-03	7.93E-03	3
PM_{10}	4.30E-03	1.20E-03	3.88E-03	3
$PM_{2.5}$	1.60E-03	4.48E-04	1.44E-03	3

Notes

1 - Hourly emissions based on a steel production rate of 80 tph and 8,760 hr/yr.

2 - Annual emissions based on a steel production rate of 515,000 tpy and 8,760 hr/yr.

3 - Uncontrolled PM emission factors for open dust sources at iron and steel mills. Batch Drop, front end loader, low silt slag - AP-42 Table 12.5-4

Tundish Dumping - Vents to EP09

Inputs

Description	Value	Units	Notes
Annual Operating Hours	8,760	hrs/yr	
Annual Steel Production Rate[1]	515,000	tpy	Maximum annual production rate (avg 59 tph)
Hourly Steel Production Rate[2]	80	tph	Maximum hourly production rate
Annual Refractory Rate	1,545	tpy	
Hourly Refractory Rate	0.24	tph	

Emissions

Pollutant	Emission Factor	Emissions[1]	Emissions[2]	Notes
	lb/ton	lb/hr	tpy	
Total PM	8.80E-03	2.11E-03	6.80E-03	3
PM_{10}	4.30E-03	1.03E-03	3.32E-03	3
$PM_{2.5}$	1.60E-03	3.84E-04	1.24E-03	3

Notes

1 - Hourly emissions based on a steel production rate of 80 tph and 8,760 hr/yr.

2 - Annual emissions based on a steel production rate of 515,000 tpy and 8,760 hr/yr.

3 - Uncontrolled PM emission factors for open dust sources at iron and steel mills. Batch Drop, front end loader, low silt slag - AP-42 Table 12.5-4

2.3 Ladle and tundish refractory repair (ID No. ES-2-3)

Ladle Repair Station - Vents to EP09

Inputs

Description	Value	Units	Notes
Annual Operating Hours	8,760	hr/yr	
Annual Steel Production Rate[1]	515,000	tpy	Maximum annual production rate (avg 59 tph)
Hourly Steel Production Rate[2]	80	tph	Maximum hourly production rate
Annual Refractory Rate	1,803	tpy	
Hourly Refractory Rate	0.28	tph	

Emissions

Pollutant	Emission Factor	Emissions	Emissions	Notes
	lb/ton	lb/hr	tpy	
Total PM	8.80E-03	2.46E-03	7.93E-03	3
PM_{10}	4.30E-03	1.20E-03	3.88E-03	3
$PM_{2.5}$	1.60E-03	4.48E-04	1.44E-03	3
VOC	2.00E-03	5.60E-04	1.80E-03	4

Notes

1 - Hourly emissions based on a steel production rate of 80 tph and 8,760 hr/yr.

2 - Annual emissions based on a steel production rate of 515,000 tpy and 8,760 hr/yr.

3 - Uncontrolled PM emission factors for open dust sources at iron and steel mills. Batch Drop, front end loader, low silt slag - AP-42 Table 12.5-4.

4 - Uncontrolled Emission Factor Listing for Criteria Air Pollutants - EIIP - 2001. (3-03-009).

Tundish Repair Station - Vents to EP09

Inputs

Description	Value	Units	Notes
Annual Operating Hours	8,760	hr/yr	
Annual Steel Production Rate[1]	515,000	tpy	Maximum annual production rate (avg 59 tph)
Hourly Steel Production Rate[2]	80	tph	Maximum hourly production rate
Annual Refractory Rate	1,545	tpy	
Hourly Refractory Rate	0.24	tph	

Pollutant	Emission Factor	Emissions	Emissions	Notes
	lb/ton	lb/hr	tpy	
Total PM	8.80E-03	2.11E-03	6.80E-03	3
PM_{10}	4.30E-03	1.03E-03	3.32E-03	3
$PM_{2.5}$	1.60E-03	3.84E-04	1.24E-03	3
VOC	2.00E-03	4.80E-04	1.55E-03	4

Notes

1 - Hourly emissions based on a steel production rate of 80 tph and 8,760 hr/yr.

2 - Annual emissions based on a steel production rate of 515,000 tpy and 8,760 hr/yr.

3 - Uncontrolled PM emission factors for open dust sources at iron and steel mills. Batch Drop, front end loader, low silt slag - AP-42 Table 12.5-4.

4 - Uncontrolled Emission Factor Listing for Criteria Air Pollutants - EIIP - 2001. (3-03-009).

2.4 Natural gas usage in Casting Operations (ID No. ES-2.4)

See Section 12.0 for emission calculations for natural gas combustion.

3.0 Calculations for Water spray chamber below caster and caster spray stack (ID No. ES-3)

Caster Spray Stack - EP10

Inputs

	Value	Units	Source
Annual Hours of Operation	8,760	hr/yr	
Exhaust Flow Rate	26,486	scfm	Design specifications
Annual Steel Production Rate[1]	515,000	tpy	Maximum annual production rate (avg 59 tph)
Hourly Steel Production Rate[2]	80	tph	Maximum hourly production rate
Percent of Filterable PM that is PM_{10}	16%	%	Reisman and Frisbie PM factors on spray vents
Percent of Filterable PM that is $PM_{2.5}$	2%	%	Reisman and Frisbie PM factors on spray vents

Emissions

Pollutant	Emission Factor	Emissions[1]	Emissions[2]	Source
	gr/dscf	lb/hr	tpy	
Total PM (filterable)	9.40E-03	2.13	9.35	3
PM_{10} (filterable)	1.50E-03	0.34	1.50	3, 4
$PM_{2.5}$ (filterable)	1.88E-04	0.04	0.19	3, 4
Pollutant	**lb/ton**	**lb/hr**	**tpy**	
NOx	1.20E-04	0.01	0.03	5
CO	9.60E-03	0.77	2.47	5
VOC	3.78E-04	0.03	0.10	5
SO2	3.59E-04	0.03	0.09	5

Notes

1 - Hourly emissions based on a steel production rate of 80 tph and 8,760 hr/yr.

2 - Annual emissions based on a steel production rate of 515,000 tpy and 8,760 hr/yr.

3 - Based on stack testing data (2018 to 2020) for similar operations. Emission factor based average result plus 2 standard deviations.

4 - PM_{10} and $PM_{2.5}$ emission factors developed from PM emission factor and Reisman and Frisbie factors. Compliance with PM_{10} and $PM_{2.5}$ emission rates for spray stacks is based on PM emission rate and Resiman and Frisbie factor.

5 - Emission factor developed using data from Nucor Crawfordsville, IN, stack test.

Addendum to Note 3, 4, and 5

"[due to] the inherent design and operation of caster spray stacks, stack tests can only be completed for filterable PM. As such, emission factors for PM were based on the average of stack tests conducted between 2018 and 2020 plus two standard deviations. Emissions factors for PM_{10} and $PM_{2.5}$ were quantified using Reisman and Frisbie factors for the percent of filterable PM that is PM_{10} or $PM_{2.5}$." (Application at 4-5)

4.0 Calculations for Rolling Operations (ID No. ES-4)

4.1 Rolling Mill

Rolling Mill Vent - EP11

Inputs

Description	Value	Units	Notes
Annual Operating Hours	8,760	hrs/yr	
Annual Steel Production Rate[1]	515,000	ton/yr	Maximum annual production rate (avg 59 tph)
Hourly Steel Production Rate[2]	80	tons/hr	Maximum hourly production rate
Oil Purchased Per Steel Produced	4.13E-04	ton oil/ton steel	Based on oil usage rates from similar facility
Oil and Grease Total	212.70	tons/yr	Oil/Steel rate from NE x annual production rate
Design Air Turnover Rate	55.1	volumes/hr	Accepted Industry Standard for Mini Mill Rolling Mills
Building Volume	2,320,890	ft^3	
Monovent Exhaust Flow Rate	2,130,202	acfm	
Monovent Exhaust Flow Rate	1,894,210	dscfm	
Moisture Content	0.019	%	
Actual Pressure	14.3	psi	
Temp	108.0	°F	
Percent of Total PM that is PM_{10}	95%	%	1
Percent of Total PM that is $PM_{2.5}$	37%	%	1

4.1 Rolling Mill (continued)

Emissions	Oil and Grease Usage				Service Cutting Torches[4]		Total Roll Mill		
Pollutant	Emission Factor		Emissions	Emissions	Emissions	Emissions	Emissions	Emissions	Notes
	lb/ton	(Wt % of Oil & Grease)	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	
Total PM	1.58E-02	--	1.27	4.08	5.93E-03	2.60E-02	1.27	4.11	1, 3
Filterable PM	1.43E-02	--	1.14	3.68	--	--	1.14	3.68	1
Condensable PM	1.58E-03	--	0.13	0.41	--	--	0.13	0.41	1
PM_{10}	1.51E-02	--	1.20	3.88	5.93E-03	2.60E-02	1.21	3.90	1, 3
$PM_{2.5}$	5.86E-03	--	0.47	1.51	5.93E-03	2.60E-02	0.48	1.54	1, 3
NO_x	--	--	--	--	7.80E-02	0.34	0.08	0.34	3
CO	--	--	--	--	6.55E-02	0.29	6.55E-02	0.29	3
SO2	--	--	--	--	4.68E-04	2.05E-03	4.68E-04	2.05E-03	3
VOC	--	4.63%	2.25	9.85	4.29E-03	1.88E-02	2.25	9.87	2, 3
H2SO4	--	--	--	--	7.16E-05	3.14E-04	7.16E-05	3.14E-04	--
Lead	--	--	--	--	3.90E-07	1.71E-06	3.90E-07	1.71E-06	3
CO_2	--	--	--	--	93.60	410	93.60	410	3
N_2O	--	--	--	--	1.72E-03	7.52E-03	1.72E-03	7.52E-03	3
Methane	--	7.06%	3.43	15.02	1.79E-03	7.86E-03	3.43	15.03	2, 3
CO_2e	--	--	85.74	376	94.16	412	180	788	40 CFR 98 Subpart A
Methyl Ethyl Ketone	--	0.110%	5.33E-02	0.23	--	--	5.33E-02	0.23	2
HAPs (oil and grease usage)									
1,3-Butadiene	--	0.003%	1.26E-03	5.52E-03	--	--	1.26E-03	5.52E-03	2
1,4-Dioxane	--	0.004%	1.70E-03	7.45E-03	--	--	1.70E-03	7.45E-03	2
Acetaldehyde	--	0.160%	7.77E-02	0.34	--	--	7.77E-02	0.34	2
Acetonitrile	--	0.010%	5.01E-03	2.20E-02	--	--	5.01E-03	2.20E-02	2
Acrolein	--	0.067%	3.24E-02	0.14	--	--	3.24E-02	0.14	2
Benzene	--	0.010%	5.00E-03	2.19E-02	1.64E-06	7.17E-06	5.00E-03	2.19E-02	2, 3
Bromoform	--	0.012%	5.99E-03	2.62E-02	--	--	5.99E-03	2.62E-02	2
Carbon Disulfide	--	0.082%	4.01E-02	0.18	--	--	4.01E-02	0.18	2
Carbon Tetrachloride	--	0.007%	3.19E-03	1.40E-02	--	--	3.19E-03	1.40E-02	2
Chloroethane	--	0.004%	1.81E-03	7.91E-03	--	--	1.81E-03	7.91E-03	2
Chloroform	--	0.009%	4.36E-03	1.91E-02	--	--	4.36E-03	1.91E-02	2
Chloromethane	--	0.012%	5.65E-03	2.47E-02	--	--	5.65E-03	2.47E-02	2
Ethylbenzene	--	0.006%	2.94E-03	1.29E-02	--	--	2.94E-03	1.29E-02	2
Hexane	--	0.193%	9.38E-02	0.41	1.40E-03	6.15E-03	9.52E-02	0.42	2, 3
m-/p-Xylenes	--	0.016%	7.62E-03	3.34E-02	--	--	7.62E-03	3.34E-02	2
Methanol	--	0.091%	4.43E-02	0.19	--	--	4.43E-02	0.19	2
Methylene Chloride	--	0.128%	6.19E-02	0.27	--	--	6.19E-02	0.27	2
Methyl Isobutyl Ketone	--	0.006%	2.86E-03	1.25E-02	--	--	2.86E-03	1.25E-02	2
Naphthalene	--	0.006%	2.89E-03	1.27E-02	4.76E-07	2.08E-06	2.90E-03	1.27E-02	2, 3
o-Xylenes	--	0.007%	3.41E-03	1.49E-02	--	--	3.41E-03	1.49E-02	2
Styrene	--	0.004%	2.16E-03	9.46E-03	--	--	2.16E-03	9.46E-03	2
Toluene	--	0.031%	1.52E-02	6.64E-02	2.65E-06	1.16E-05	1.52E-02	6.64E-02	2, 3
Trichloroethene	--	0.006%	2.72E-03	1.19E-02	--	--	2.72E-03	1.19E-02	2
HAPs (natural gas combustion)									
2-Methylnaphthalene	--	--	--	--	1.87E-08	8.20E-08	1.87E-08	8.20E-08	3
3-Methylcholanthrene	--	--	--	--	1.40E-09	6.15E-09	1.40E-09	6.15E-09	3
7,12-Dimethylbenz(a)anthracene	--	--	--	--	1.25E-08	5.47E-08	1.25E-08	5.47E-08	3
Acenaphthene	--	--	--	--	1.40E-09	6.15E-09	1.40E-09	6.15E-09	3
Acenaphthylene	--	--	--	--	1.40E-09	6.15E-09	1.40E-09	6.15E-09	3
Anthracene	--	--	--	--	1.87E-09	8.20E-09	1.87E-09	8.20E-09	3
Benz(a)anthracene	--	--	--	--	1.40E-09	6.15E-09	1.40E-09	6.15E-09	3
Benzo(a)pyrene	--	--	--	--	9.36E-10	4.10E-09	9.36E-10	4.10E-09	3
Benzo(b)fluoranthene	--	--	--	--	1.40E-09	6.15E-09	1.40E-09	6.15E-09	3
Benzo(g,h,i)perylene	--	--	--	--	9.36E-10	4.10E-09	9.36E-10	4.10E-09	3
Benzo(k)fluoranthene	--	--	--	--	1.40E-09	6.15E-09	1.40E-09	6.15E-09	3
Chrysene	--	--	--	--	1.40E-09	6.15E-09	1.40E-09	6.15E-09	3
Dibenzo(a,h)anthracene	--	--	--	--	9.36E-10	4.10E-09	9.36E-10	4.10E-09	3
Dichlorobenzene	--	--	--	--	9.36E-07	4.10E-06	9.36E-07	4.10E-06	3
Fluoranthene	--	--	--	--	2.34E-09	1.02E-08	2.34E-09	1.02E-08	3
Fluorene	--	--	--	--	2.18E-09	9.57E-09	2.18E-09	9.57E-09	3
Formaldehyde	--	--	--	--	5.85E-05	2.56E-04	5.85E-05	2.56E-04	3
Indeno(1,2,3-cd)pyrene	--	--	--	--	1.40E-09	6.15E-09	1.40E-09	6.15E-09	3
Phenanthrene	--	--	--	--	1.33E-08	5.81E-08	1.33E-08	5.81E-08	3
Pyrene	--	--	--	--	3.90E-09	1.71E-08	3.90E-09	1.71E-08	3
Arsenic	--	--	--	--	1.56E-07	6.83E-07	1.56E-07	6.83E-07	3
Beryllium	--	--	--	--	9.36E-09	4.10E-08	9.36E-09	4.10E-08	3
Cadmium	--	--	--	--	8.58E-07	3.76E-06	8.58E-07	3.76E-06	3
Chromium	--	--	--	--	1.09E-06	4.78E-06	1.09E-06	4.78E-06	3
Cobalt	--	--	--	--	6.55E-08	2.87E-07	6.55E-08	2.87E-07	3
Manganese	--	--	--	--	2.96E-07	1.30E-06	2.96E-07	1.30E-06	3
Mercury	--	--	--	--	2.03E-07	8.88E-07	2.03E-07	8.88E-07	3
Nickel	--	--	--	--	1.64E-06	7.17E-06	1.64E-06	7.17E-06	3
Selenium	--	--	--	--	1.87E-08	8.20E-08	1.87E-08	8.20E-08	3
Total HAPs	--	--	--	1.86	--	6.45E-03	--	1.86	--

Notes
1 - PM10/PM2.5 is 95%/37% of Total PM (filterable and condensable) per testing and speciation data collected at Nucor Texas facility.
2 - Based on an analysis of monovent testing for VOC and speciated HAP/TAP conducted at several Nucor facilities and the EPA paper Volatilized Lubricant Emissions from Steel Rolling Operations by Mackus and Joshi, 1980.
3 - Natural gas combustion emissions for service cutting torches from AP-42 Tables 1.4-1 to 3 and 40 CFR 98, Subpart A.
4 - Emission factors for natural gas combustion emissions for service cutting torches are shown on the Natural Gas Summary worksheet.

4.2 Natural gas usage in the Rolling Mill (ID No. ES-4.2)

See Section 12.0 for emission calculations for natural gas combustion.

5.0 Calculations for Natural gas-fired torches for scrap and skull cutting (ID No. ES-5)

Scrap Cutting - EP06

Inputs

Description	Value	Units
Natural Gas Heating Value	1,020	Btu/scf
Annual Hours of Operation	8,760	hr/yr
Total Rated Heat Capacity (maximum, all cutting torches)	0.50	MMBtu/hr

Summary of Equipment

Unit	Peak Flowrate	Peak Power
	(scf/min)	(MMBtu/hr)
Cutting Torches (maximum, all cutting torches torch)	8.17	0.50

Emissions

Pollutant	Emission Factor		Emissions	Emissions	Source
Scrap Cutting	lb/10^6 scf	lb/MMBtu	lb/hr	tpy	
Total PM	7.6	7.45E-03	3.73E-03	0.02	AP-42 Table 1.4-2
PM_{10}	7.6	7.45E-03	3.73E-03	0.02	AP-42 Table 1.4-2
$PM_{2.5}$	7.6	7.45E-03	3.73E-03	0.02	AP-42 Table 1.4-2
NO_x	100	9.80E-02	0.05	0.21	AP-42 Table 1.4-1
CO	84	8.24E-02	0.04	0.18	AP-42 Table 1.4-1
VOC	5.5	5.39E-03	2.70E-03	1.18E-02	AP-42 Table 1.4-2
SO_2	0.6	5.88E-04	2.94E-04	1.29E-03	AP-42 Table 1.4-2
H2SO4	--	--	4.50E-05	1.97E-04	Mass Balance
Lead	5.00E-04	4.90E-07	2.45E-07	1.07E-06	AP-42 Table 1.4-2
CO_2	120,000	118	59	258	AP-42 Table 1.4-2
N_2O	2.2	2.16E-03	1.08E-03	4.72E-03	AP-42 Table 1.4-2
CH_4	2.3	2.25E-03	1.13E-03	4.94E-03	AP-42 Table 1.4-2
CO_2e	--	--	59.17	259.18	40 CFR 98 Subpart A
2-Methylnaphthalene	2.40E-05	2.4E-08	1.2E-08	5.2E-08	AP-42 Table 1.4-3
3-Methylcholanthrene	1.80E-06	1.8E-09	8.8E-10	3.9E-09	AP-42 Table 1.4-3
7,12-Dimethylbenz(a)anthracene	1.60E-05	1.6E-08	7.8E-09	3.4E-08	AP-42 Table 1.4-3
Acenaphthene	1.80E-06	1.8E-09	8.8E-10	3.9E-09	AP-42 Table 1.4-3
Acenaphthylene	1.80E-06	1.8E-09	8.8E-10	3.9E-09	AP-42 Table 1.4-3
Anthracene	2.40E-06	2.4E-09	1.2E-09	5.2E-09	AP-42 Table 1.4-3
Benz(a)anthracene	1.80E-06	1.8E-09	8.8E-10	3.9E-09	AP-42 Table 1.4-3
Benzene	2.1E-03	2.1E-06	1.0E-06	4.5E-06	AP-42 Table 1.4-3
Benzo(a)pyrene	1.2E-06	1.2E-09	5.9E-10	2.6E-09	AP-42 Table 1.4-3
Benzo(b)fluoranthene	1.8E-06	1.8E-09	8.8E-10	3.9E-09	AP-42 Table 1.4-3
Benzo(g,h,i)perylene	1.2E-06	1.2E-09	5.9E-10	2.6E-09	AP-42 Table 1.4-3
Benzo(k)fluoranthene	1.8E-06	1.8E-09	8.8E-10	3.9E-09	AP-42 Table 1.4-3
Chrysene	1.8E-06	1.8E-09	8.8E-10	3.9E-09	AP-42 Table 1.4-3
Dibenzo(a,h)anthracene	1.2E-06	1.2E-09	5.9E-10	2.6E-09	AP-42 Table 1.4-3
Dichlorobenzene	1.2E-03	1.2E-06	5.9E-07	2.6E-06	AP-42 Table 1.4-3
Fluoranthene	3.0E-06	2.9E-09	1.5E-09	6.4E-09	AP-42 Table 1.4-3
Fluorene	2.8E-06	2.7E-09	1.4E-09	6.0E-09	AP-42 Table 1.4-3
Formaldehyde	7.5E-02	7.4E-05	3.7E-05	1.6E-04	AP-42 Table 1.4-3
Hexane	1.8E+00	1.8E-03	8.8E-04	3.9E-03	AP-42 Table 1.4-3
Indeno(1,2,3-cd)pyrene	1.8E-06	1.8E-09	8.8E-10	3.9E-09	AP-42 Table 1.4-3
Naphthalene	6.1E-04	6.0E-07	3.0E-07	1.3E-06	AP-42 Table 1.4-3
Phenanthrene	1.7E-05	1.7E-08	8.3E-09	3.7E-08	AP-42 Table 1.4-3
Pyrene	5.0E-06	4.9E-09	2.5E-09	1.1E-08	AP-42 Table 1.4-3
Toluene	3.4E-03	3.3E-06	1.7E-06	7.3E-06	AP-42 Table 1.4-3
Arsenic	2.0E-04	2.0E-07	9.8E-08	4.3E-07	AP-42 Table 1.4-3
Beryllium	1.2E-05	1.2E-08	5.9E-09	2.6E-08	AP-42 Table 1.4-3
Cadmium	1.1E-03	1.1E-06	5.4E-07	2.4E-06	AP-42 Table 1.4-3
Chromium	1.4E-03	1.4E-06	6.9E-07	3.0E-06	AP-42 Table 1.4-3
Cobalt	8.4E-05	8.2E-08	4.1E-08	1.8E-07	AP-42 Table 1.4-3
Manganese	3.8E-04	3.7E-07	1.9E-07	8.2E-07	AP-42 Table 1.4-3
Mercury	2.6E-04	2.5E-07	1.3E-07	5.6E-07	AP-42 Table 1.4-3
Nickel	2.1E-03	2.1E-06	1.0E-06	4.5E-06	AP-42 Table 1.4-3
Selenium	2.4E-05	2.4E-08	1.2E-08	5.2E-08	AP-42 Table 1.4-3
Total HAPs (including Pb)	--	--	--	4.1E-03	--

SO2 Mist (EAF, Preheaters, Dryers, Torches)
SO2 + 1/2 O2 = SO3
SO2 + H2O = H2SO4

M.W. SO2	64.1
M.W. SO3	80.1
M.W. H2SO4	98.1
*Percent SO2 to SO3 (%)	10%
*Percent SO3 to H2SO4 (%)	100%

SO2	SO2 converted to SO3	SO3 created	H2SO4 created
(lb/hr)	(lb/hr)	(lb/hr)	(lb/hr)
2.94E-04	2.94E-05	3.68E-05	4.50E-05

*Assumes 10% of SO2 is converted to SO3 and 100% of SO3 is converted to H2SO4

6.0 Calculations for Cooling Towers (ID No. ES-6)

6.1 Cooling Tower 1 (ID No. ES-6-1)

Cooling Tower 1 - EP12

* non-contact

Cooling Tower Emissions

Cooling Tower Circulation =	18,113	Design Specification (gpm)
Drift =	0.001%	
Cells =	4	
Water lost due to drift =	0.18	gpm
Water density =	8.34	lb/gallon
Pounds of water lost =	1.51	lb H2O per minute
Solids density =	300	ppm
Cycles of Concentration =	5	
	1.50E-03	lb solids per pound H2O
Emissions PM	2.27E-03	lb per minute
	0.136	lb per hour
	3.40E-02	lb per hour per cell
	0.60	**ton per year**
	0.149	**ton per year per cell**
Emissions PM10/PM2.5	1.64E-03	lb per minute
	0.10	lb per hour
	2.47E-02	lb per hour per cell
	0.43	**ton per year**
	0.108	**ton per year per cell**

*It is assumed PM2.5 is equal to PM10

Reisman & Frisbie Method (Calculating Realistic PM10 Emissions from Cooling Towers)

EPRI Droplet Diameter (µm)	Droplet Volume (µm³) [2]	Droplet Mass (µg) [3]	Particle Mass (Solids) (µg) [4]	Solid Particle Volume (µm)	Solid Particle Diameter (µm) [7]	EPRI % Mass Smaller
10	524	5.24E-04	7.85E-07	0.36	0.880	0
20	4,189	4.19E-03	6.28E-06	2.86	1.760	0.196
30	14,137	1.41E-02	2.12E-05	9.64	2.640	0.226
40	33,510	3.35E-02	5.03E-05	22.85	3.521	0.514
50	65,450	6.54E-02	9.82E-05	44.62	4.401	1.816
60	113,097	1.13E-01	1.70E-04	77.11	5.281	5.702
70	179,594	1.80E-01	2.69E-04	122.45	6.161	21.348
90	381,704	3.82E-01	5.73E-04	260.25	7.921	49.812
110	696,910	6.97E-01	1.05E-03	475.17	9.682	70.509
130	1,150,347	1.15E+00	1.73E-03	784.33	11.442	82.023
150	1,767,146	1.77E+00	2.65E-03	1,204.87	13.202	88.012
180	3,053,628	3.05E+00	4.58E-03	2,082.02	15.843	91.032
210	4,849,048	4.85E+00	7.27E-03	3,306.17	18.483	92.468
240	7,238,229	7.24E+00	1.09E-02	4,935.16	21.124	94.091
270	10,305,995	1.03E+01	1.55E-02	7,026.81	23.764	94.689
300	14,137,167	1.41E+01	2.12E-02	9,638.98	26.404	96.288
350	22,449,298	2.24E+01	3.37E-02	15,306.34	30.805	97.011
400	33,510,322	3.35E+01	5.03E-02	22,847.95	35.206	98.34
450	47,712,938	4.77E+01	7.16E-02	32,531.55	39.607	99.071
500	65,449,847	6.54E+01	9.82E-02	44,624.90	44.007	99.071
600	113,097,336	1.13E+02	1.70E-01	77,111.82	52.809	100

PM10

y2 = ((x2-x1)*(y3-y1))/(x3-x1) + y1

x1	9.682
y1	70.509
x2	10
y2	72.591
x3	11.442
y3	82.023

6.2 Cooling Tower 2 (IE. No. ES-6-2)

Cooling Tower 2 - EP13

* contact

Cooling Tower Emissions

Cooling Tower Circulation =	3,848	Design Specification (gpm)
Drift =	0.001%	
Cells =	2	
Water lost due to drift =	0.04	gpm
Water density =	8.34	lb/gallon
Pounds of water lost =	0.32	lb H2O per minute
Solids density =	300	ppm
Cycles of Concentration =	5	
	1.50E-03	lb solids per pound H2O
Emissions PM	4.81E-04	lb per minute
	0.029	lb per hour
	0.014	lb per hour per cell
	0.13	**ton per year**
	0.063	**ton per year per cell**
Emissions PM10/PM2.5	3.49E-04	lb per minute
	0.02	lb per hour
	1.05E-02	lb per hour per cell
	0.09	**ton per year**
	0.046	**ton per year per cell**

*It is assumed PM2.5 is equal to PM10

Reisman & Frisbie Method (Calculating Realistic PM10 Emissions from Cooling Towers)

EPRI Droplet Diameter (µm)	Droplet Volume (μm^3) [2]	Droplet Mass (µg) [3]	Particle Mass (Solids) (µg) [4]	Solid Particle Volume (µm)	Solid Particle Diameter (µm) [7]	EPRI % Mass Smaller
10	524	5.24E-04	7.85E-07	0.36	0.880	0
20	4,189	4.19E-03	6.28E-06	2.86	1.760	0.196
30	14,137	1.41E-02	2.12E-05	9.64	2.640	0.226
40	33,510	3.35E-02	5.03E-05	22.85	3.521	0.514
50	65,450	6.54E-02	9.82E-05	44.62	4.401	1.816
60	113,097	1.13E-01	1.70E-04	77.11	5.281	5.702
70	179,594	1.80E-01	2.69E-04	122.45	6.161	21.348
90	381,704	3.82E-01	5.73E-04	260.25	7.921	49.812
110	696,910	6.97E-01	1.05E-03	475.17	9.682	70.509
130	1,150,347	1.15E+00	1.73E-03	784.33	11.442	82.023
150	1,767,146	1.77E+00	2.65E-03	1,204.87	13.202	88.012
180	3,053,628	3.05E+00	4.58E-03	2,082.02	15.843	91.032
210	4,849,048	4.85E+00	7.27E-03	3,306.17	18.483	92.468
240	7,238,229	7.24E+00	1.09E-02	4,935.16	21.124	94.091
270	10,305,995	1.03E+01	1.55E-02	7,026.81	23.764	94.689
300	14,137,167	1.41E+01	2.12E-02	9,638.98	26.404	96.288
350	22,449,298	2.24E+01	3.37E-02	15,306.34	30.805	97.011
400	33,510,322	3.35E+01	5.03E-02	22,847.95	35.206	98.34
450	47,712,938	4.77E+01	7.16E-02	32,531.55	39.607	99.071
500	65,449,847	6.54E+01	9.82E-02	44,624.90	44.007	99.071
600	113,097,336	1.13E+02	1.70E-01	77,111.82	52.809	100

PM10

y2 = ((x2-x1)*(y3-y1))/(x3-x1) + y1

x1	9.682
y1	70.509
x2	10
y2	72.591
x3	11.442
y3	82.023

7.0 Calculations for Silos (ID No. ES-7)

7.1 Two carbon storage silos (ID No. ES-7-1)

Carbon Silo 1 - EP03

Inputs

Description	Value	Units
Annual Operating Hours	8,760	hr/yr
Stack Exhaust Flow Rate	600	dscfm

Emissions

Pollutant	Emission Factor (gr/dscf)	Emissions (lb/hr)	Emissions (tpy)	Source
PM	0.005	0.03	0.11	1
PM_{10}	0.005	0.03	0.11	1
$PM_{2.5}$	0.005	0.03	0.11	1

Notes

1 - BACT rate of 0.005 gr/dscf = grain loading on bin vent filters

Carbon Silo 2 - EP03

Inputs

Description	Value	Units
Annual Operating Hours	8,760	hr/yr
Stack Exhaust Flow Rate	600	dscfm

Emissions

Pollutant	Emission Factor (gr/dscf)	Emissions (lb/hr)	Emissions (tpy)	Source
PM	0.005	0.03	0.11	1
PM_{10}	0.005	0.03	0.11	1
$PM_{2.5}$	0.005	0.03	0.11	1

Notes

1 - BACT rate of 0.005 gr/dscf = grain loading on bin vent filters

7.2 Two flux storage silos (ID No. ES-7-2)

Flux Silo 1 - EP04

Inputs

Description	Value	Units
Annual Operating Hours	8,760	hr/yr
Stack Exhaust Flow Rate	600	dscfm

Emissions

Pollutant	Emission Factor (gr/dscf)	Emissions (lb/hr)	Emissions (tpy)	Source
PM	0.005	0.03	0.11	1
PM_{10}	0.005	0.03	0.11	1
$PM_{2.5}$	0.005	0.03	0.11	1

Notes

1 - BACT rate of 0.005 gr/dscf = grain loading on bin vent filters

Flux Silo 2 - EP04

Inputs

Description	Value	Units
Annual Operating Hours	8,760	hr/yr
Stack Exhaust Flow Rate	600	dscfm

Emissions

Pollutant	Emission Factor (gr/dscf)	Emissions (lb/hr)	Emissions (tpy)	Source
PM	0.005	0.03	0.11	1
PM_{10}	0.005	0.03	0.11	1
$PM_{2.5}$	0.005	0.03	0.11	1

Notes

1 - BACT rate of 0.005 gr/dscf = grain loading on bin vent filters

7.3 Baghouse dust silo and dust loadout (ID No. ES-7-3)

Dust Silo - EP05

Inputs

Description	Value	Units
Annual Operating Hours	8,760	hr/yr
Stack Exhaust Flow Rate	1,296	dscfm
Control Efficiency[1]	0%	%

Emissions

Pollutant	Emission Factor	Emissions	Emissions	Source
	gr/dscf	lb/hr	tpy	
PM	0.005	5.55E-02	2.43E-01	2
PM_{10}	0.005	5.55E-02	2.43E-01	2
$PM_{2.5}$	0.005	5.55E-02	2.43E-01	2
Metals	**%**	**lb/hr**	**tpy**	**Source**
Antimony	0.0107%	5.94E-06	2.60E-05	3
Arsenic	0.0022%	1.22E-06	5.35E-06	3
Cadmium	0.0960%	5.33E-05	2.34E-04	3
Chromium	0.2355%	1.31E-04	5.73E-04	3
Cobalt	0.0014%	7.78E-07	3.41E-06	3
Lead	0.9072%	5.04E-04	2.21E-03	3
Manganese	1.5093%	8.38E-04	3.67E-03	3
Mercury	0.0004%	2.22E-07	9.73E-07	3
Nickel	0.0082%	4.55E-06	1.99E-05	3
Selenium	0.0002%	1.11E-07	4.87E-07	3
Total HAPs	--	--	6.74E-03	--

Notes
1 - Bin vent on silo vents inside building. No emissions reduction taken for this control.
2 - BACT rate of 0.005 gr/dscf = grain loading on bin vent filters
3 - HAP metals estimated based on analysis of baghouse dust for NSFL (2021-2022). The percent metal in the dust sample is used to represent the percent metal in the emitted PM.

Baghouse Dust Loadout - EP05

Inputs

Description	Value	Units	Notes
Annual Operating Hours	8,760	hr/yr	
Annual Steel Production Rate[1]	515,000	tpy	Maximum annual production rate (avg 59 tph)
Hourly Steel Production Rate[2]	80	tph	Maximum hourly production rate
Dust Production Rate	55	lb dust/ton steel	
Annual Dust Loadout Rate	14,163	ton dust/yr	Annual steel production rate x dust production rate
Hourly Dust Loadout Rate	2.20	ton dust/hr	Hourly steel production rate x dust production rate
Control Efficiency	90%	ton dust/hr	Loadout occurs within enclosed building

Emissions

Pollutant	Emission Factor	Emissions[1]	Emissions[2]	Source
	(lb/ton dust)	(lb/hr)	(tpy)	
PM	0.0260	5.72E-03	1.84E-02	3
PM_{10}	0.013	2.86E-03	9.21E-03	3
$PM_{2.5}$	0.0046	1.01E-03	3.26E-03	3
Metals	**%**	**(lb/hr)**	**(tpy)**	**Source**
Antimony	0.0107%	6.12E-07	1.97E-06	4
Arsenic	0.0022%	1.26E-07	4.05E-07	4
Cadmium	0.0960%	5.49E-06	1.77E-05	4
Chromium	0.2355%	1.35E-05	4.34E-05	4
Cobalt	0.0014%	8.01E-08	2.58E-07	4
Lead	0.9072%	5.19E-05	1.67E-04	4
Manganese	1.5093%	8.63E-05	2.78E-04	4
Mercury	0.0004%	2.29E-08	7.36E-08	4
Nickel	0.0082%	4.69E-07	1.51E-06	4
Selenium	0.0002%	1.14E-08	3.68E-08	4
Total HAPS	--	--	5.10E-04	--

Notes

1 - Hourly emissions based on a steel production rate of 80 tph and 8,760 hr/yr.

2 - Annual emissions based on a steel production rate of 515,000 tpy and 8,760 hr/yr.

3 - AP-42 Table 12.5-4, high silt slag batch drop

4 - HAP metals estimated based on analysis of baghouse dust for NSFL (2021-2022). The percent metal in the dust sample is used to represent the percent metal in the emitted PM.

8.0 Calculations for material handling (ID No. ES-8)

8.1 Scrap storage in an open pile and a pile covered and enclosed on two sides (part of ID No. ES-8-1)

Scrap Pile 2 - EP01

Emissions[1]

Surface Area	16,400	ft2
Surface Area	1,524	m2
Height	20	ft
Base Length	140	ft
Height to Base Ratio	0.14	<0.2, do not need to divide into subareas - assume relatively flat pile
Control Efficiency	0%	Exposed pile (scrap surplus)

Threshold Friction Velocity (m/s)= 1.33 Table 13.2.5-2 Used a higher threshold velocity (scoria) since scrap steel is not a granular material

Greensboro, NC[2]		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann_{avg}
	DIR	SSW	SSW	SSW	SSW	SW	SSW	SSW	SSW	NNE	NNE	SSW	SSW	SSW
mph	SPD	8.0	9.0	9.0	9.0	8.0	7.0	7.0	6.0	7.0	7.0	8.0	7.0	7.7
mph	PGU	63.0	48.0	43.0	46.0	59.0	51.0	59.0	39.0	54.0	6.0	53.0	47.0	47.3
m/sec	PGU	28.4	21.6	19.4	20.7	26.6	23.0	26.6	17.6	24.3	2.7	23.9	21.2	21.3

Anemometer height 10.00 m

Month	u^+_{10} (m/s)	u^+_{10} (m/s)	u^* (m/s)	u* - ut* (m/s)	P (g/m^2/yr)	E (g/yr) - PM emissions		Total Controlled	
						Uncontrolled	Controlled	lb/yr	tpy
Jan	28.4	28.4	1.50	0.17	6.04	9203.54	9203.54	20.29	0.01
Feb	21.6	21.6	1.14	0.00	0.00	0.00	0.00	0.00	0.00
Mar	19.4	19.4	1.03	0.00	0.00	0.00	0.00	0.00	0.00
Apr	20.7	20.7	1.10	0.00	0.00	0.00	0.00	0.00	0.00
May	26.6	26.6	1.41	0.08	2.27	3464.65	3464.65	7.64	0.00
Jun	23.0	23.0	1.22	0.00	0.00	0.00	0.00	0.00	0.00
Jul	26.6	26.6	1.41	0.08	2.27	3464.65	3464.65	7.64	0.00
Aug	17.6	17.6	0.93	0.00	0.00	0.00	0.00	0.00	0.00
Sep	24.3	24.3	1.29	0.00	0.00	0.00	0.00	0.00	0.00
Oct	2.7	2.7	0.14	0.00	0.00	0.00	0.00	0.00	0.00
Nov	23.9	23.9	1.26	0.00	0.00	0.00	0.00	0.00	0.00
Dec	21.2	21.2	1.12	0.00	0.00	0.00	0.00	0.00	0.00
					PM SUM	**16,133**	**16,133**	**35.57**	**0.018**

Notes
1 - Based on equations from AP-42 Chapter 13.2.5 Industrial Wind Erosion
2 - https://www.ncdc.noaa.gov/monitoring-content/societal-impacts/wind/docs/wind1996.pdf

Pile Dimensions	
Height (ft)	20
Height (m)	6.1
Length (ft)	140.0
Length (m)	42.7
Width (ft)	60.0
Width (m)	18.3
Surface Area (r	1,524

8.1 Scrap storage in an open pile and a pile enclosed on two sides (part of ID No. ES-8.1), continued

Scrap Pile 1 (Scrap Bay) - EP02

Emissions[1]

Surface Area	13,200	ft2	
Surface Area	1,226	m2	
Height	20	ft	
Base Length	108	ft	
Height to Base Ratio	0.19	<0.2, do not need to divide into subareas - assume relatively flat pile	
Control Efficiency	50%	Scrap pile within scrap bay, covered, closed 2 sides	

Threshold Friction Velocity (m/s)= 1.33 Table 13.2.5-2 Used a higher threshold velocity (scoria) since scrap steel is not a granular material

Greensboro, NC[2]		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann_{avg}
	DIR	SSW	SSW	SSW	SSW	SW	SSW	SSW	SSW	NNE	NNE	SSW	SSW	SSW
mph	SPD	8.0	9.0	9.0	9.0	8.0	7.0	7.0	6.0	7.0	7.0	8.0	7.0	7.7
mph	PGU	63.0	48.0	43.0	46.0	59.0	51.0	59.0	39.0	54.0	6.0	53.0	47.0	47.3
m/sec	PGU	28.4	21.6	19.4	20.7	26.6	23.0	26.6	17.6	24.3	2.7	23.9	21.2	21.3

Anemometer height 10.00 m

Month	u^{+}_{10} (m/s)	u^{+}_{10} (m/s)	u^{*} (m/s)	u* - ut* (m/s)	P (g/m^2/yr)	E (g/yr) - PM emissions		Total Controlled	
						Uncontrolled	Controlled	lb/yr	tpy
Jan	28.4	28.4	1.50	0.17	6.04	7407.73	3703.86	8.17	0.00
Feb	21.6	21.6	1.14	0.00	0.00	0.00	0.00	0.00	0.00
Mar	19.4	19.4	1.03	0.00	0.00	0.00	0.00	0.00	0.00
Apr	20.7	20.7	1.10	0.00	0.00	0.00	0.00	0.00	0.00
May	26.6	26.6	1.41	0.08	2.27	2788.62	1394.31	3.07	0.00
Jun	23.0	23.0	1.22	0.00	0.00	0.00	0.00	0.00	0.00
Jul	26.6	26.6	1.41	0.08	2.27	2788.62	1394.31	3.07	0.00
Aug	17.6	17.6	0.93	0.00	0.00	0.00	0.00	0.00	0.00
Sep	24.3	24.3	1.29	0.00	0.00	0.00	0.00	0.00	0.00
Oct	2.7	2.7	0.14	0.00	0.00	0.00	0.00	0.00	0.00
Nov	23.9	23.9	1.26	0.00	0.00	0.00	0.00	0.00	0.00
Dec	21.2	21.2	1.12	0.00	0.00	0.00	0.00	0.00	0.00
					PM SUM	**12,985**	**6,492**	**14.31**	**0.007**

Notes
1 - Based on equations from AP-42 Chapter 13.2.5 Industrial Wind Erosion
2 - https://www.ncdc.noaa.gov/monitoring-content/societal-impacts/wind/docs/wind1996.pdf

Pile Dimensions	
Height (ft)	20
Height (m)	6.1
Length (ft)	108.0
Length (m)	32.9
Width (ft)	60.0
Width (m)	18.3
Surface Area (r	1,226

8.2 Scrap material handling (part of ID No. ES-8-1)

Scrap Drop Points at EP01 and EP02

Inputs

General Information	Value	Units	Basis
Operating Hours	8,760	hr/yr	
Annual Steel Production Rate[1]	515,000	tpy	Maximum annual production rate (avg 59 tph)
Scrap to Steel Ratio	1.07	ton scrap/ton steel	
Scrap Overflow Pile (Pile 2)	10,568	tpy	
Annual Scrap Feed Rate (Scrap Bay)	561,618	ton scrap/yr	Combined annual scrap + overflow
Moisture Content, M	2.0	%	Site-specific
Control Efficiency	0	%	No controls
Emission Factor Information			
PM Particle Size Multiplier, k	0.74		2
PM_{10} Particle Size Multiplier, k	0.35		2
$PM_{2.5}$ Particle Size Multiplier, k	0.053		2
Annual Outdoor Wind Speed, U	7.7	mph	3

$$E = \frac{k\,(0.0032)\,(U/5)^{1.3}}{(M/2)^{1.4}}$$

Emissions

Emissions Summary	Emissions[1] lb/hr	Emissions[1] tpy
PM	0.142	0.62
PM_{10}	0.067	0.29
$PM_{2.5}$	0.010	0.04

Throughput

Emission/ Drop ID	Percent of Feed Rate	Drop Throughput (ton/hr)	Drop Throughput (ton/yr)
EP02 - Scrap Pile 1 (Scrap Bay)			
Scrap Bay Drop 1	50.0%	32.1	280,809
Scrap Bay Drop 2	50.0%	32.1	280,809
EP01- Scrap Pile			
Scrap Pile 2 Unloading to Pile	100.0%	1.2	10,568
Scrap Pile 2 Loadout	100.0%	1.2	10,568

PM Emissions

Emission/ Drop ID	Control Efficiency (%)	Control Description	PM Emission Factor (lb/ton)	PM Emissions (lb/hr)	PM Emissions (ton/year)
EP02 - Scrap Pile 1 (Scrap Bay)					
Scrap Bay Transfer Point 1	50%	covered, open 2-sides	4.1E-03	6.62E-02	0.290
Scrap Bay Transfer Point 2	50%	covered, open 2-sides	4.1E-03	6.62E-02	0.290
EP01- Scrap Pile 2					
Scrap Pile 2 Unloading to Pile	0%	none	4.1E-03	4.98E-03	0.022
Scrap Pile 2 Loadout	0%	none	4.1E-03	4.98E-03	0.022
			Total	**0.142**	**0.623**

Scrap Drop Points at EP01 and EP02

PM10 Emissions

Emission/ Drop ID	Control Efficiency (%)	Control Description	PM10 Emission Factor (lb/ton)	PM10 Emissions (lb/hr)	PM10 Emissions (ton/year)
EP02 - Scrap Pile 1 (Scrap Bay)					
Scrap Bay Transfer Point 1	50%	covered, open 2-sides	2.0E-03	3.13E-02	0.137
Scrap Bay Transfer Point 2	50%	covered, open 2-sides	2.0E-03	3.13E-02	0.137
EP01- Scrap Pile 2					
Scrap Pile 2 Unloading to Pile	0%	none	2.0E-03	2.36E-03	0.010
Scrap Pile 2 Loadout	0%	none	2.0E-03	2.36E-03	0.010
			Total	**0.067**	**0.295**

PM25 Emissions

Emission/ Drop ID	Control Efficiency (%)	Control Description	PM25 Emission Factor (lb/ton)	PM25 Emissions (lb/hr)	PM25 Emissions (ton/year)
EP02 - Scrap Pile 1 (Scrap Bay)					
Scrap Bay Transfer Point 1	50%	covered, open 2-sides	2.956E-04	4.74E-03	0.021
Scrap Bay Transfer Point 2	50%	covered, open 2-sides	2.956E-04	4.74E-03	0.021
EP01- Scrap Pile 2					
Scrap Pile 2 Unloading to Pile	0%	none	2.956E-04	3.57E-04	0.002
Scrap Pile 2 Loadout	0%	none	2.956E-04	3.57E-04	0.002
			Total	**0.010**	**0.045**

Notes

1 - Annual and hourly emissions based on a steel production rate of 515,000 tpy and 8,760 hr/yr.

2 - Calculated per AP-42, Section 13.2.4: Aggregate Handling and Storage Piles (11/2006), Equation 1

3 - Average mean wind speed from https://www.ncdc.noaa.gov/monitoring-content/societal-impacts/wind/docs/wind1996.pdf

Emission Calculations

Emission Factor = Particle Size Multiplier * 0.0032 * [Mean Wind Speed (mph) / 5]$^{1.3}$ / [Moisture Content (%) /2]$^{1.4}$

Emissions = Emission Factor (lb/ton dropped) * Drop Throughput (ton/yr) * (1-Baghouse Control Efficiency (if applicable))

8.3 Alloy storage piles covered and enclosed on three sides (Part of ID No. ES-8-2)

Alloy Pile 1 - EP17

Emissions[1]

	Surface Area	
Surface Area	800	ft2
Surface Area	74	m2
Height	10	ft
Base Length	20	ft
Height to Base Ratio	0.50	>0.2, divide into subareas
Control Efficiency	75%	3-sided enclosure, covered

Subarea (Pile B1):

Pile Subarea	% of Pile Surface
0.2a	5
0.2b	2
0.2c	29
0.6a	26
0.6b	24
0.9	14
1.1	NA

Pile Subarea	Area (m2)
0.2	26.8
0.6	37.2
0.9	10.4
1.1	0.0

Threshold Friction Velocity (m/s) = 1.12 Table 13.2.5-2 Based on Uncrusted Coal Pile

Greensboro, NC[2]		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
	DIR	SSW	SSW	SSW	SSW	SW	SSW	SSW	SSW	NNE	NNE	SSW	SSW	SSW
mph	SPD	8.0	9.0	9.0	9.0	8.0	7.0	7.0	6.0	7.0	7.0	8.0	7.0	7.7
mph	PGU	63.0	48.0	43.0	46.0	59.0	51.0	59.0	39.0	54.0	6.0	53.0	47.0	47.3
m/sec	PGU	28.35	21.60	19.35	20.70	26.55	22.95	26.55	17.55	24.30	2.70	23.85	21.15	21.30

Anemometer height 10.00 m

Month	u^+_{10} (m/s)	u^+_{10} (m/s)	u* (m/s)				u* - ut* (m/s)				P (g/m^2/yr)				E (g/yr) - PM emissions (uncontrolled)					Total Controlled	
			0.2	0.6	0.9	1.1	0.2	0.6	0.9	1.1	0.2	0.6	0.9	1.1	0.2	0.6	0.9	1.1	Total	lb/yr	tpy
Jan	28.4	28.4	0.57	1.70	2.55	3.12	0.00	0.58	1.43	2.00	0.00	34.10	154.64	281.61	0.00	633.66	804.53	0.00	1438.19	0.79	0.000
Feb	21.6	21.6	0.43	1.30	1.94	2.38	0.00	0.18	0.82	1.26	0.00	6.20	59.98	122.90	0.00	115.14	312.05	0.00	427.19	0.24	0.000
Mar	19.4	19.4	0.39	1.16	1.74	2.13	0.00	0.04	0.62	1.01	0.00	1.12	37.94	84.20	0.00	20.86	197.39	0.00	218.25	0.12	0.000
Apr	20.7	20.7	0.41	1.24	1.86	2.28	0.00	0.12	0.74	1.16	0.00	3.91	50.59	106.57	0.00	72.71	263.22	0.00	335.93	0.19	0.000
May	26.6	26.6	0.53	1.59	2.39	2.92	0.00	0.47	1.27	1.80	0.00	24.80	125.21	233.04	0.00	460.82	651.42	0.00	1112.25	0.61	0.000
Jun	23.0	23.0	0.46	1.38	2.07	2.52	0.00	0.26	0.95	1.40	0.00	10.26	75.49	149.52	0.00	190.56	392.73	0.00	583.29	0.32	0.000
Jul	26.6	26.6	0.53	1.59	2.39	2.92	0.00	0.47	1.27	1.80	0.00	24.80	125.21	233.04	0.00	460.82	651.42	0.00	1112.25	0.61	0.000
Aug	17.6	17.6	0.35	1.05	1.58	1.93	0.00	0.00	0.46	0.81	0.00	0.00	23.73	58.36	0.00	0.00	123.48	0.00	123.48	0.07	0.000
Sep	24.3	24.3	0.49	1.46	2.19	2.67	0.00	0.34	1.07	1.55	0.00	15.08	92.71	178.71	0.00	280.12	482.32	0.00	762.44	0.42	0.000
Oct	2.7	2.7	0.05	0.16	0.24	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000
Nov	23.9	23.9	0.48	1.43	2.15	2.62	0.00	0.31	1.03	1.50	0.00	13.38	86.78	168.70	0.00	248.70	451.46	0.00	700.16	0.39	0.000
Dec	21.2	21.2	0.42	1.27	1.90	2.33	0.00	0.15	0.78	1.21	0.00	5.01	55.19	114.59	0.00	93.14	287.14	0.00	380.28	0.21	0.000
																		PM SUM	7,194	4.0	0.002

Notes
1 - Based on equations from AP-42 Chapter 13.2.5 Industrial Wind Erosion
2 - https://www.ncdc.noaa.gov/monitoring-content/societal-impacts/wind/docs/wind1996.pdf

Pile Dimensions	
Height (ft)	10.0
Height (m)	3.0
Length (ft)	20.0
Length (m)	6.1
Width (ft)	10.0
Width (m)	3.0
Surface Area	74.3

8.3 Alloy storage piles enclosed on three sides (Part of ID No. ES-8-2) continued

Alloy Pile 2 - EP17

Emissions[1]

	Surface Area	
Surfce Area	800	ft2
Surfce Area	74	m2
Height	10	ft
Base Length	20	ft
Height to Base Ratio	0.50	>0.2, divide into subareas
Control Efficiency	75%	3-sided enclosure, covered

Subarea (Pile B1):

Pile Subarea	% of Pile Surface
0.2a	5
0.2b	2
0.2c	29
0.6a	26
0.6b	24
0.9	14
1.1	NA

Pile Subarea	Area (m2)
0.2	26.8
0.6	37.2
0.9	10.4
1.1	0.0

Threshold Friction Velocity (m/s) = 1.12 Table 13.2.5-2 Based on Uncrusted Coal Pile

Greensboro, NC[2]		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
	DIR	SSW	SSW	SSW	SSW	SW	SSW	SSW	SSW	NNE	NNE	SSW	SSW	SSW
mph	SPD	8.0	9.0	9.0	9.0	8.0	7.0	7.0	6.0	7.0	7.0	8.0	7.0	7.7
mph	PGU	63.0	48.0	43.0	46.0	59.0	51.0	59.0	39.0	54.0	6.0	53.0	47.0	47.3
m/sec	PGU	28.35	21.60	19.35	20.70	26.55	22.95	26.55	17.55	24.30	2.70	23.85	21.15	21.30

Anemometer height 10.00 m

Month	u^+_{10}	u^+_{10}	u* (m/s)				u* - ut* (m/s)				P (g/m^2/yr)				E (g/yr) - PM emissions (uncontrolled)					Total Controlled	
	(m/s)	(m/s)	0.2	0.6	0.9	1.1	0.2	0.6	0.9	1.1	0.2	0.6	0.9	1.1	0.2	0.6	0.9	1.1	Total	lb/yr	tpy
Jan	28.4	28.4	0.57	1.70	2.55	3.12	0.00	0.58	1.43	2.00	0.00	34.10	154.64	281.61	0.00	633.66	804.53	0.00	1438.19	0.79	0.00
Feb	21.6	21.6	0.43	1.30	1.94	2.38	0.00	0.18	0.82	1.26	0.00	6.20	59.98	122.90	0.00	115.14	312.05	0.00	427.19	0.24	0.00
Mar	19.4	19.4	0.39	1.16	1.74	2.13	0.00	0.04	0.62	1.01	0.00	1.12	37.94	84.20	0.00	20.86	197.39	0.00	218.25	0.12	0.00
Apr	20.7	20.7	0.41	1.24	1.86	2.28	0.00	0.12	0.74	1.16	0.00	3.91	50.59	106.57	0.00	72.71	263.22	0.00	335.93	0.19	0.00
May	26.6	26.6	0.53	1.59	2.39	2.92	0.00	0.47	1.27	1.80	0.00	24.80	125.21	233.04	0.00	460.82	651.42	0.00	1112.25	0.61	0.00
Jun	23.0	23.0	0.46	1.38	2.07	2.52	0.00	0.26	0.95	1.40	0.00	10.26	75.49	149.52	0.00	190.56	392.73	0.00	583.29	0.32	0.00
Jul	26.6	26.6	0.53	1.59	2.39	2.92	0.00	0.47	1.27	1.80	0.00	24.80	125.21	233.04	0.00	460.82	651.42	0.00	1112.25	0.61	0.00
Aug	17.6	17.6	0.35	1.05	1.58	1.93	0.00	0.00	0.46	0.81	0.00	0.00	23.73	58.36	0.00	0.00	123.48	0.00	123.48	0.07	0.00
Sep	24.3	24.3	0.49	1.46	2.19	2.67	0.00	0.34	1.07	1.55	0.00	15.08	92.71	178.71	0.00	280.12	482.32	0.00	762.44	0.42	0.00
Oct	2.7	2.7	0.05	0.16	0.24	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nov	23.9	23.9	0.48	1.43	2.15	2.62	0.00	0.31	1.03	1.50	0.00	13.38	86.78	168.70	0.00	248.70	451.46	0.00	700.16	0.39	0.00
Dec	21.2	21.2	0.42	1.27	1.90	2.33	0.00	0.15	0.78	1.21	0.00	5.01	55.19	114.59	0.00	93.14	287.14	0.00	380.28	0.21	0.00
																		PM SUM	7,194	4.0	0.002

Notes
1 - Based on equations from AP-42 Chapter 13.2.5 Industrial Wind Erosion
2 - https://www.ncdc.noaa.gov/monitoring-content/societal-impacts/wind/docs/wind1996.pdf

Pile Dimensions	
Height (ft)	10.0
Height (m)	3.0
Length (ft)	20.0
Length (m)	6.1
Width (ft)	10.0
Width (m)	3.0
Surface Area	74.3

8.4 Alloy material handling (Part of ID No. ES-8-2)

Alloy Transfer Points - EP17

Inputs

General Information	Value	Units	Basis
Operating Hours	8,760	hr/yr	
Annual Alloy Used[1]	8,286	ton/yr	
Alloy Moisture Content, M	5.40	%	Site-specific
Emission Factor Information			
PM Particle Size Multiplier, k	0.74		2
PM_{10} Particle Size Multiplier, k	0.35		2
$PM_{2.5}$ Particle Size Multiplier, k	0.053		2
Annual Outdoor Wind Speed, U	7.7	mph	3

$$E = \frac{k\,(0.0032)\,(U/5)^{1.3}}{(M/2)^{1.4}}$$

Emissions

Emissions Summary	Emissions[1] lb/hr	Emissions[1] tpy
PM	5.35E-04	2.34E-03
PM_{10}	2.53E-04	1.11E-03
$PM_{2.5}$	3.83E-05	1.68E-04

Throughput

Emission/ Drop ID	Percent of Feed Rate	Drop Throughput (ton/hr)	Drop Throughput (ton/yr)
Alloy Unloading to Pile 1	50%	0.5	4,143
Alloy Loading from Pile 1	50%	0.5	4,143
Alloy Unloading to Pile 2	50%	0.5	4,143
Alloy Loading from Pile 2	50%	0.5	4,143
Melt shop alloy load-in	100%	0.9	8,286

PM Emissions

Emission/ Drop ID	Control Efficiency (%)	Control Description	PM Emission Factor (lb/ton)	PM Emissions (lb/hr)	PM Emissions (ton/year)
Alloy Unloading to Pile 1	75%	3-sided enclosure, covered	1.028E-03	1.21E-04	5.32E-04
Alloy Loading from Pile 1	75%	3-sided enclosure, covered	1.028E-03	1.21E-04	5.32E-04
Alloy Unloading to Pile 2	75%	3-sided enclosure, covered	1.028E-03	1.21E-04	5.32E-04
Alloy Loading from Pile 2	75%	3-sided enclosure, covered	1.028E-03	1.21E-04	5.32E-04
Melt shop alloy load-in	95%	melt shop canopy hood	1.028E-03	4.86E-05	2.13E-04
			Total	**5.35E-04**	**2.34E-03**

PM10 Emissions

Emission/ Drop ID	Control Efficiency (%)	Control Description	PM10 Emission Factor (lb/ton)	PM10 Emissions (lb/hr)	PM10 Emissions (ton/year)
Alloy Unloading to Pile 1	75%	3-sided enclosure, covered	4.860E-04	5.75E-05	2.52E-04
Alloy Loading from Pile 1	75%	3-sided enclosure, covered	4.860E-04	5.75E-05	2.52E-04
Alloy Unloading to Pile 2	75%	3-sided enclosure, covered	4.860E-04	5.75E-05	2.52E-04
Alloy Loading from Pile 2	75%	3-sided enclosure, covered	4.860E-04	5.75E-05	2.52E-04
Melt shop alloy load-in	95%	melt shop canopy hood	4.860E-04	2.30E-05	1.01E-04
			Total	**2.53E-04**	**1.11E-03**

PM25 Emissions

Emission/ Drop ID	Control Efficiency (%)	Control Description	PM25 Emission Factor (lb/ton)	PM25 Emissions (lb/hr)	PM25 Emissions (ton/year)
Alloy Unloading to Pile 1	75%	3-sided enclosure, covered	7.359E-05	8.70E-06	3.81E-05
Alloy Loading from Pile 1	75%	3-sided enclosure, covered	7.359E-05	8.70E-06	3.81E-05
Alloy Unloading to Pile 2	75%	3-sided enclosure, covered	7.359E-05	8.70E-06	3.81E-05
Alloy Loading from Pile 2	75%	3-sided enclosure, covered	7.359E-05	8.70E-06	3.81E-05
Melt shop alloy load-in	95%	melt shop canopy hood	7.359E-05	3.48E-06	1.52E-05
			Total	**3.83E-05**	**1.68E-04**

Notes

1 - Emissions based on annual alloy usage. Alloy usage conservatively estimated.

2 - Calculated per AP-42, Section 13.2.4: Aggregate Handling and Storage Piles (11/2006), Equation 1

3 - Average mean wind speed from https://www.ncdc.noaa.gov/monitoring-content/societal-impacts/wind/docs/wind1996.pdf

Emission Calculations

Emission Factor = Particle Size Multiplier * 0.0032 * [Mean Wind Speed (mph) / 5] $^{1.3}$ / [Moisture Content (%) /2] $^{1.4}$

Emissions = Emission Factor (lb/ton dropped) * Drop Throughput (ton/yr) * (1-Baghouse Control Efficiency (if applicable))

8.5 Slag and mill scale storage pile (part of ID No. ES-8-3)

Slag/Mill Scale Pile - EP18

Emissions[1]

	Surface Area	
	202,800	ft2
	18,841	m2
Height	20	ft
Base Length	544	ft
Height to base ratio	0.04	<0.2, do not need to divide into subareas - assume relatively flat pile

Threshold Friction Velocity (m/s) = 1.33 Table 13.2.5-2 Threshold Friction Velocities - used Scoria material (type of slag)

Greensboro, NC[2]		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
	DIR	SSW	SSW	SSW	SSW	SW	SSW	SSW	SSW	NNE	NNE	SSW	SSW	SSW
mph	SPD	8.0	9.0	9.0	9.0	8.0	7.0	7.0	6.0	7.0	7.0	8.0	7.0	7.7
mph	PGU	63.0	48.0	43.0	46.0	59.0	51.0	59.0	39.0	54.0	6.0	53.0	47.0	47.3
m/sec	PGU	28.35	21.60	19.35	20.70	26.55	22.95	26.55	17.55	24.30	2.70	23.85	21.15	21.30

Anemometer height 10.00 m

Month	u^*_{10} (m/s)	u^*_{10} (m/s)	u^* (m/s)	u* - ut* (m/s)	P (g/m^2/yr)	E (g/yr), PM Emissions	Total	
							lb/yr	tpy
Jan	28.4	28.4	1.50	0.17	6.04	113809.60	250.90	0.13
Feb	21.6	21.6	1.14	0.00	0.00	0.00	0.00	0.00
Mar	19.4	19.4	1.03	0.00	0.00	0.00	0.00	0.00
Apr	20.7	20.7	1.10	0.00	0.00	0.00	0.00	0.00
May	26.6	26.6	1.41	0.08	2.27	42843.33	94.45	0.05
Jun	23.0	23.0	1.22	0.00	0.00	0.00	0.00	0.00
Jul	26.6	26.6	1.41	0.08	2.27	42843.33	94.45	0.05
Aug	17.6	17.6	0.93	0.00	0.00	0.00	0.00	0.00
Sep	24.3	24.3	1.29	0.00	0.00	0.00	0.00	0.00
Oct	2.7	2.7	0.14	0.00	0.00	0.00	0.00	0.00
Nov	23.9	23.9	1.26	0.00	0.00	0.00	0.00	0.00
Dec	21.2	21.2	1.12	0.00	0.00	0.00	0.00	0.00
					PM SUM	**199,496**	**440**	**0.220**

Notes
1 - Based on equations from AP-42 Chapter 13.2.5 Industrial Wind Erosion
2 - https://www.ncdc.noaa.gov/monitoring-content/societal-impacts/wind/docs/wind1996.pdf

Pile Dimensions	
Height (ft)	**20.0**
Height (m)	**6.1**
Length (ft)	**544.0**
Length (m)	**165.8**
Width (ft)	**310.0**
Width (m)	**94.5**
Surface Area (r	**18,840.7**

8.6 Slag and mill scale handling (part of ID No. ES-8-3)

Slag & Mill Scale Transfer Points - EP18

$$E = k\,(0.0032)\,\frac{(U/5)^{1.3}}{(M/2)^{1.4}}$$

Inputs

General Information	Value	Units	Basis
Operating Hours	8,760	hr/yr	
Annual Steel Production Rate[1]	515,000	tpy	Maximum annual production rate (avg 59 tph)
Slag Production Ratio	0.10	ton slag/ton steel	
Annual Slag Produced	51,500	ton slag/yr	Steel produced x slag production ratio
Mill Scale Production Rate	0.01	ton/ton finished product	
Annual Mill Scale Produced	5,150	ton/yr	Steel produced x mill scale production rate
Slag Moisture Content, M	2.81	%	Site-specific
Mill Scale Moisture Content, M	2.00	%	Site-specific
Control Efficiency	0	%	No controls
Emission Factor Information			
PM Particle Size Multiplier, k	0.74		2
PM_{10} Particle Size Multiplier, k	0.35		2
$PM_{2.5}$ Particle Size Multiplier, k	0.053		2
Annual Outdoor Wind Speed, U	7.7	mph	3

Emissions

Emissions Summary	Emissions[1]	Emissions[1]
	lb/hr	tpy
PM	0.083	0.362
PM_{10}	0.039	0.17
$PM_{2.5}$	0.006	0.03

Throughput

Emission/ Drop ID	Percent of Feed Rate	Drop Throughput (ton/hr)	Drop Throughput (ton/yr)
Slag Unloading to Pile (2 drops)	200%	11.8	103,000
Slag Loading from Pile (2 drops)	200%	11.8	103,000
Mill Scale Loading to Pile	100%	0.6	5,150
Mill Scale Loading From Pile	100%	0.6	5,150
Mill Scale Dewatering Loadout	100%	0.6	5,150
Melt shop Slag Loadout	100%	5.9	51,500

PM Emissions

Emission/ Drop ID	PM Emission Factor (lb/ton)	PM Emissions (lb/hr)	PM Emissions (ton/year)
Slag Unloading to Pile	2.564E-03	3.015E-02	0.132
Slag Loading from Pile	2.564E-03	3.015E-02	0.132
Mill Scale Loading to Pile	4.128E-03	2.427E-03	0.011
Mill Scale Loading From Pile	4.128E-03	2.427E-03	0.011
Mill Scale Dewatering Loadout	4.128E-03	2.427E-03	0.011
Melt shop Slag Loadout	2.564E-03	1.508E-02	0.066
	Total	0.083	0.362

PM_{10} Emissions

Emission/Drop ID	PM_{10} Emission Factor (lb/ton)	PM_{10} Emissions (lb/hr)	PM_{10} Emissions (ton/year)
Slag Unloading to Storage Pile	1.213E-03	1.426E-02	0.062
Slag Loading from Storage Pile	1.213E-03	1.426E-02	0.062
Mill Scale Loading to Storage Pile	1.952E-03	1.148E-03	0.005
Mill Scale Loading From Storage Pile	1.952E-03	1.148E-03	0.005
Mill Scale Dewatering Loadout	1.952E-03	1.148E-03	0.005
Melt shop Slag Loadout	1.213E-03	7.130E-03	0.031
	Total	0.039	0.171

$PM_{2.5}$ Emissions

Emission/Drop ID	$PM_{2.5}$ Emission Factor (lb/ton)	$PM_{2.5}$ Emissions (lb/hr)	$PM_{2.5}$ Emissions (ton/year)
Slag Unloading to Pile	1.837E-04	2.159E-03	0.009
Slag Loading from Pile	1.837E-04	2.159E-03	0.009
Mill Scale Loading to Pile	2.956E-04	1.738E-04	0.001
Mill Scale Loading From Pile	2.956E-04	1.738E-04	0.001
Mill Scale Dewatering Loadout	2.956E-04	1.738E-04	0.001
Melt shop Slag Loadout	1.837E-04	1.080E-03	0.005
	Total	5.92E-03	0.026

Notes

1 - Annual and hourly emissions based on a steel production rate of 515,000 tpy and 8,760 hr/yr.
2 - Calculated per AP-42, Section 13.2.4: Aggregate Handling and Storage Piles (11/2006), Equation 1
3 - Average mean wind speed from https://www.ncdc.noaa.gov/monitoring-content/societal-impacts/wind/docs/wind1996.pdf

Emission Calculations

Emission Factor = Particle Size Multiplier * 0.0032 * [Mean Wind Speed (mph) / 5]$^{1.3}$ / [Moisture Content (%) /2]$^{1.4}$
Emissions = Emission Factor (lb/ton dropped) * Drop Throughput (ton/yr) * (1-Baghouse Control Efficiency (if applicable))

8.7 Slag and mill scale processing (part of ID No. ES-8-3)

Debris/Mill Scale/Slag Processing - Screening - EP18

Inputs

Description	Value	Units
Annual Operating Hours	8,760	hr/yr

Emissions Summary

Emissions Summary	Emissions	Emissions
	lb/hr	tpy
PM	0.23	1.00
PM_{10}	0.08	0.34
$PM_{2.5}$	0.01	0.02

Emission Factor (lb/ton)

Source	PM	PM_{10}	$PM_{2.5}$
Screening[1]	0.0022	0.00074	0.000050

Annual Particulate (PM) Emissions from Screening

	Throughput[2]	Emission Factor	Emissions	Emissions
	(tons/hr)	(lb/ton)	(lb/hr)	(tpy)
Slag Processing - Screening	104	2.20E-03	0.23	1.00

Annual Particulate (PM_{10}) Emissions from Screening

	Throughput[2]	Emission Factor	Emissions	Emissions
	(tons/hr)	(lb/ton)	(lb/hr)	(tpy)
Slag Processing - Screening	104	7.40E-04	0.08	0.34

Annual Particulate ($PM_{2.5}$) Emissions from Screening

	Throughput[2]	Emission Factor	Emissions	Emissions
	(tons/hr)	(lb/ton)	(lb/hr)	(tpy)
Slag Processing - Screening	104	5.00E-05	5.20E-03	2.28E-02

Notes

1 - Emission factors from AP-42 Table 11.19.2-2 Crushed Stone Processing and Pulverized Mineral Processing (08/04) for controlled screening.

2 - Throughput of screenings conservatively estimated based on experience with screening operations at other Nucor mini/micro mills.

8.7 Slag and mill scale processing (part of ID No. ES-8-3) continued

Debris/Mill Scale/Slag Processing - Conveyor Transfer - EP18

Inputs

Description	Value	Units
Annual Operating Hours	8,760	hr/yr
Average Throughput	Varies	ton/hr

Emissions Summary

Emissions Summary	Emissions	Emissions
	lb/hr	tpy
PM	0.04	0.19
PM_{10}	0.01	0.06
$PM_{2.5}$	4.1E-03	0.02

Emission Factor (lb/ton)

Source	PM	PM_{10}	$PM_{2.5}$
Conveyor Transfer[1]	0.00014	0.000046	0.000013

Average Annual Particulate (PM) Emissions from Conveyor Transfer

Transfer Location	Average Throughput[2]	Emission Factor	Emissions	Emissions
	(tons/hr)	(lb/ton)	(lb/hr)	(tpy)
Feeder	24.12	1.40E-04	3.38E-03	1.48E-02
30" Conveyor	24.12	1.40E-04	3.38E-03	1.48E-02
30" Conveyor	12.06	1.40E-04	1.69E-03	7.40E-03
24" Conveyor	12.06	1.40E-04	1.69E-03	7.40E-03
Grizzly/Feeder	36.18	1.40E-04	5.07E-03	2.22E-02
Conveyor #9	36.18	1.40E-04	5.07E-03	2.22E-02
Conveyor #7	45.23	1.40E-04	6.33E-03	2.77E-02
Conveyor #6	12.06	1.40E-04	1.69E-03	7.40E-03
Conveyor #5A	13.27	1.40E-04	1.86E-03	8.14E-03
Conveyor #5B	13.27	1.40E-04	1.86E-03	8.14E-03
Conveyor #8	3.02	1.40E-04	4.22E-04	1.85E-03
Conveyor #5	36.18	1.40E-04	5.07E-03	2.22E-02
Conveyor #1	10.86	1.40E-04	1.52E-03	6.66E-03
Stacker #1	10.86	1.40E-04	1.52E-03	6.66E-03
Stacker #2	13.27	1.40E-04	1.86E-03	8.14E-03
Stacker #3	4.82	1.40E-04	6.75E-04	2.96E-03
Stacker #4	7.24	1.40E-04	1.01E-03	4.44E-03
TOTAL			**0.04**	**0.19**

Notes

1 - Emission factors from AP-42 Table 11.19.2-2 Crushed Stone Processing and Pulverized Mineral Processing (08/04) for controlled conveyor t

2 - Throughput of screenings conservatively estimated based on experience with crushing operations at other Nucor mini mills.

8.7 Slag and mill scale processing (part of ID No. ES-8-3) continued

Average Annual Particulate (PM_{10}) Emissions from Conveyor Transfer

Transfer Location	Average Throughput[2]	Emission Factor	Emissions	Emissions
	(tons/hr)	(lb/ton)	(lb/hr)	(tpy)
Feeder	24.12	4.60E-05	1.11E-03	4.86E-03
30" Conveyor	24.12	4.60E-05	1.11E-03	4.86E-03
30" Conveyor	12.06	4.60E-05	5.55E-04	2.43E-03
24" Conveyor	12.06	4.60E-05	5.55E-04	2.43E-03
Grizzly/Feeder	36.18	4.60E-05	1.66E-03	7.29E-03
Conveyor #9	36.18	4.60E-05	1.66E-03	7.29E-03
Conveyor #7	45.23	4.60E-05	2.08E-03	9.11E-03
Conveyor #6	12.06	4.60E-05	5.55E-04	2.43E-03
Conveyor #5A	13.27	4.60E-05	6.10E-04	2.67E-03
Conveyor #5B	13.27	4.60E-05	6.10E-04	2.67E-03
Conveyor #8	3.02	4.60E-05	1.39E-04	6.08E-04
Conveyor #5	36.18	4.60E-05	1.66E-03	7.29E-03
Conveyor #1	10.86	4.60E-05	4.99E-04	2.19E-03
Stacker #1	10.86	4.60E-05	4.99E-04	2.19E-03
Stacker #2	13.27	4.60E-05	6.10E-04	2.67E-03
Stacker #3	4.82	4.60E-05	2.22E-04	9.72E-04
Stacker #4	7.24	4.60E-05	3.33E-04	1.46E-03
TOTAL			**0.01**	**0.06**

Average Annual Particulate ($PM_{2.5}$) Emissions from Conveyor Transfer

Transfer Location	Average Throughput[2]	Emission Factor	Emissions	Emissions
	(tons/hr)	(lb/ton)	(lb/hr)	(tpy)
Feeder	24.12	1.30E-05	3.14E-04	1.37E-03
30" Conveyor	24.12	1.30E-05	3.14E-04	1.37E-03
30" Conveyor	12.06	1.30E-05	1.57E-04	6.87E-04
24" Conveyor	12.06	1.30E-05	1.57E-04	6.87E-04
Grizzly/Feeder	36.18	1.30E-05	4.70E-04	2.06E-03
Conveyor #9	36.18	1.30E-05	4.70E-04	2.06E-03
Conveyor #7	45.23	1.30E-05	5.88E-04	2.58E-03
Conveyor #6	12.06	1.30E-05	1.57E-04	6.87E-04
Conveyor #5A	13.27	1.30E-05	1.72E-04	7.55E-04
Conveyor #5B	13.27	1.30E-05	1.72E-04	7.55E-04
Conveyor #8	3.02	1.30E-05	3.92E-05	1.72E-04
Conveyor #5	36.18	1.30E-05	4.70E-04	2.06E-03
Conveyor #1	10.86	1.30E-05	1.41E-04	6.18E-04
Stacker #1	10.86	1.30E-05	1.41E-04	6.18E-04
Stacker #2	13.27	1.30E-05	1.72E-04	7.55E-04
Stacker #3	4.82	1.30E-05	6.27E-05	2.75E-04
Stacker #4	7.24	1.30E-05	9.41E-05	4.12E-04
TOTAL			**0.00**	**0.02**

Notes

1 - Emission factors from AP-42 Table 11.19.2-2 Crushed Stone Processing and Pulverized Mineral Processing (08/04) for controlled conveyor t

2 - Throughput of screenings conservatively estimated based on experience with crushing operations at other Nucor mini mills.

8.7 Slag and mill scale processing (part of ID No. ES-8-3) continued

Debris/Mill Scale/Slag Processing - Crushing - EP18

Inputs

Description	Value	Units
Annual Operating Hours	8,760	hrs/yr
Average Throughput	Varies	tons/hr

Emissions Summary

Emissions Summary	Emissions lb/hr	Emissions tpy
PM	3.0E-02	0.13
PM_{10}	1.4E-02	0.06
$PM_{2.5}$	2.5E-03	1.1E-02

Emission Factor (lb/ton)

Source	PM	PM_{10}	$PM_{2.5}$
Crushing[1]	0.0012	0.00054	0.00010

Average Annual Particulate (PM) Emissions from Crushing

Crusher Name	Average Throughput[2]	Emission Factor	Emissions	Emissions
	(tons/hr)	(lb/ton)	(lb/hr)	(tpy)
Kue-Ken Crusher	12	0.0012	1.44E-02	6.31E-02
Nordberg Crusher	13.2	0.0012	1.58E-02	6.94E-02
TOTAL			**3.02E-02**	**1.32E-01**

Average Annual Particulate (PM_{10}) Emissions from Crushing

Crusher Name	Average Throughput[2]	Emission Factor	Emissions	Emissions
	(tons/hr)	(lb/ton)	(lb/hr)	(tpy)
Kue-Ken Crusher	12	5.4E-04	6.5E-03	2.84E-02
Nordberg Crusher	13.2	5.4E-04	7.1E-03	3.12E-02
TOTAL			**1.4E-02**	**5.96E-02**

Average Annual Particulate ($PM_{2.5}$) Emissions from Crushing

Crusher Name	Average Throughput[2]	Emission Factor	Emissions	Emissions
	(tons/hr)	(lb/ton)	(lb/hr)	(tpy)
Kue-Ken Crusher	12	1.0E-04	1.2E-03	5.26E-03
Nordberg Crusher	13.2	1.0E-04	1.3E-03	5.78E-03
TOTAL			**2.5E-03**	**1.10E-02**

Notes
1 - Emission factors from AP-42 Table 11.19.2-2 Crushed Stone Processing and Pulverized Mineral Processing (08/04) for controlled tertiary crushing.
2 - Throughput of screenings conservatively estimated based on experience with crushing operations at other Nucor mini mills.

9.0 Calculations for Haul roads (ID No. ES-9)

Haul Road Summary Information - EP19 and EP20

Material	Type of Truck	Unloaded (tons) (truck weight)	Loaded (tons) (truck weight plus material)	Truck Capacity (tons)	Annual Consumption Rate (tons)	Max # of Trucks per year	ROUNDUP - Max # of Trucks per year
Slag Hauling & Mill Scale Hauling Off-site	Tractor Trailer	19	41	22	56,650	2,575	2,600
Slag Hauling Off-site	Tractor Trailer	--	--	--	51,500	--	--
Mill Scale Hauling Off-site	Tractor Trailer	--	--	--	5,150	--	--
Scrap Delivery - North	Tractor Trailer	19	41	22	280,809	12,764	12,800
Scrap Delivery - South	Tractor Trailer	19	41	22	280,809	12,764	12,800
Spent Refractory & Other Waste	Tractor Trailer	19	41	22	3,948	179	200
Alloy Aggregate Delivery, Fluxing Agent Delivery, Carbon Delivery	Tractor Trailer	19	41	22	60,529	2,751	2,800
Alloy Aggregate Delivery	Tractor Trailer	--	--	--	8,286	--	--
Fluxing Agent Delivery	Tractor Trailer	--	--	--	37,905	--	--
Carbon Delivery	Tractor Trailer	--	--	--	14,338	--	--
Melt Shop Baghouse Dust Hauling Off-site	Tractor Trailer	19	41	22	14,163	644	700
Product Hauled Off-site - Spooler Route	Tractor Trailer	19	41	22	103,000	4,682	4,700
Product Hauled Off-site - Straight Route (FG Door 5)	Tractor Trailer	19	41	22	412,000	18,727	18,800
Misc. Delivery to Warehouse	Tractor Trailer	19	41	22	--	21	100
Water Truck	Tractor Trailer	19	41	22	--	1,095	1,100
Sweeper	Tractor Trailer	19	41	22	--	1,095	1,100
Slag hauling from melt shop to slag yard	Front End Loader	12	24	12	51,500	4,292	4,300
Alloy hauling from pile to melt shop	Front End Loader	12	24	12	8,286	691	700
Scrap hauling from pile 2 to scrap building	Heavy Duty Truck	36	79	43	10,568	246	300
Mill scale hauling from melt shop to slag yard	Front End Loader	12	24	12	5,150	429	500

Material	Type of Truck	Unloaded (tons) (truck weight)	Loaded (tons) (truck weight plus material)	Truck Capacity (tons)	Annual Consumption Rate (tons)	Max # Trucks per day	Max # Trucks per hour for a 24-Hour Period	ROUNDUP Max # Trucks per hour for a 24-Hour Period
Slag Hauling & Mill Scale Hauling Off-site	Tractor Trailer	19	41	22	56,650	10	0.41	1
Slag Hauling Off-site	Tractor Trailer	--	--	--	51,500	--	--	--
Mill Scale Hauling Off-site	Tractor Trailer	--	--	--	5,150	--	--	--
Scrap Delivery - North	Tractor Trailer	19	41	22	280,809	49	2.05	3
Scrap Delivery - South	Tractor Trailer	19	41	22	280,809	49	2.05	3
Spent Refractory & Other Waste	Tractor Trailer	19	41	22	3,948	0.69	0.03	1
Alloy Aggregate Delivery, Fluxing Agent Delivery, Carbon Delivery	Tractor Trailer	19	41	22	60,529	11	0.44	1
Alloy Aggregate Delivery	Tractor Trailer	--	--	--	8,286	--	--	--
Fluxing Agent Delivery	Tractor Trailer	--	--	--	37,905	--	--	--
Carbon Delivery	Tractor Trailer	--	--	--	14,338	--	--	--
Melt Shop Baghouse Dust Hauling Off-site	Tractor Trailer	19	41	22	14,163	2	0.10	1
Product Hauled Off-site - Spooler Route	Tractor Trailer	19	41	22	103,000	18	0.75	1
Product Hauled Off-site - Straight Route (FG Door 5)	Tractor Trailer	19	41	22	412,000	72	3.00	4
				22	515,000	90	3.75	4
Misc. Delivery to Warehouse	Tractor Trailer	19	41	22	--	1	0.04	1
Water Truck	Tractor Trailer	19	41	22	--	3	0.13	1
Sweeper	Tractor Trailer	19	41	22	--	3	0.13	1
Slag hauling from melt shop to slag yard	Front End Loader	12	24	12	51,500	17	0.69	1
Alloy hauling from pile to melt shop	Front End Loader	12	24	12	8,286	3	0.11	1
Scrap hauling from pile 2 to scrap building	Heavy Duty Truck	36	79	43	10,568	1	0.04	1
Mill scale hauling from melt shop to slag yard	Front End Loader	12	24	12	5,150	2	0.07	1

9.0 Calculations for Haul roads (ID No. ES-9), continued

Paved Haul Road Emissions - EP19

$E = k * (sL)^{0.91} * (W)^{1.02}$
where E is the particulate emission factor having the units matching k

Equation 1 from AP 42 Section 13.2.1.3.

Parameter	Value	Description of parameter
sL	0.6	Ubiquitous Silt Loading Default Value, g/m^2
W	see below	Mean vehicle weight [(loaded truck weight + unloaded truck weight)/2], tons
VMT	see below	Vehicle miles traveled (length traveled round trip)
VMT/hr	see below	Vehicle miles traveled per hour = VMT*maximum trips per hour
VMT/yr	see below	Vehicle miles traveled per year = VMT*maximum trips per year

	PM30 (TSP)	PM10	PM2.5
k (lb/VMT)	0.011	0.0022	0.00054

Notes: Constant k, lb/VMT is from AP 42 Table 13.2.1-1

EPA Control of Open Fugitive Dust Sources
Table 2-4: Measured Efficiency Values for Paved Road Controls

Water flushing followed by sweeping = 96 - 0.263 * V

Paved Road	
72	V = number of vehicle passes since application
9	= Number of vehicle passes per hour- based on realistic maximum w/o causing traffic jam
8	= Time between water applications in hours
77%	

Unpaved (Gravel) Roads - EP20

$E = k * (s/12)^a * (W/3)^b$
where E is the size specific emission factor, lb/VMT

Equation 1a from AP 42 Section 13.2.2.2.

Parameter	Value	Description of parameter
s	6	Surface material silt content, % (Plant road - Iron & steel production)
W	see below	Mean vehicle weight [(loaded truck weight + unloaded truck weight)/2], tons
VMT	see below	Vehicle miles traveled (length traveled round trip)
VMT/hr	see below	Vehicle miles traveled per hour = VMT*maximum trips per hour
VMT/yr	see below	Vehicle miles traveled per year = VMT*maximum trips per year
Vehicle Speed Reduction	0.67	Changing average vehicle speed from 15 mph to 10 mph.

Notes: Vehicle speed reduction discussed on page 4-25 of Emission Factor Documentation for AP-42 Section 13.2.2, Unpaved Roads (September 1998). *See also*, page 4-12 of the PSD Air Permit Application.

	PM30 (TSP)	PM10	PM2.5
k	4.9	1.5	0.15
a	0.7	0.9	0.9
b	0.45	0.45	0.45

Notes: Constants k, a, and b are from AP 42 Table 13.2.2-2

Mojave Desert Air Quality Management District Antelope Valley Air Pollution Control District
Emissions Inventory Guidance Mineral Handling and Processing Industries (April 10, 2000)
K, Dust Entrainment from Unpaved Roads

$$Cf = 100 - (0.0012 \times ((A \times D \times T)/I))$$

	Cf = Control efficiency of watering application in percent
49.54	A = Average annual class A pan evaporation in inches
4	D = Average hourly traffic rate in vehicles per hour
8	T = Time between water applications in hours
0.11	I = Water application intensity in gallons per square yard
83%	Control efficiency of watering application in percent

9.0 Calculations for Haul roads (ID No. ES-9), continued

Haul Road Emissions - EP19 and EP20

	Vehicle Type	Paved or Unpaved	Max # Trips/hour	Max # Trips/yr	VMT - Length meters	VMT - Length (miles)	Truck Weight Loaded tons	Truck Weight Unloaded tons	Control (%)	Factor "E" lb PM/VMT	Factor "E" lb PM10/VMT	Factor "E" lb PM2.5/VMT	Traveled VMT/hr	Traveled VMT/yr	Emissions Uncontrolled lb PM/hr	Controlled lb PM/hr	Uncontrolled PM tpy	Controlled PM tpy	Emissions Uncontrolled lb PM10/hr	Controlled lb PM10/hr	Uncontrolled PM10 tpy	Controlled PM10 tpy	Emissions Uncontrolled lb PM2.5/hr	Controlled lb PM2.5/hr	Uncontrolled PM2.5 tpy	Controlled PM2.5 tpy	# miles
Slag Hauling & Mill Scale Hauling Off-site	Tractor Trailer	--	1	2,600	--	--	41	19	--	--	--	--	--	--	0.93	0.18	1.22	0.23	0.23	0.04	0.30	0.06	0.03	0.01	0.04	0.01	1.60
	Tractor Trailer	Paved	1	2,600	0	1.49	41	19	77%	0.22	0.04	0.01	1.49	3,871.93	0.33	0.08	0.43	0.10	0.07	0.02	0.09	0.02	0.02	0.004	0.021	0.005	1.49
	Tractor Trailer	Unpaved	1	2,600	0	0.11	41	19	83%	5.67	1.51	0.15	0.11	277.23	0.60	0.10	0.79	0.14	0.16	0.03	0.21	0.04	0.02	0.003	0.021	0.004	0.11
Scrap Delivery - North	Tractor Trailer	--	3	12,800	--	--	41	19	--	--	--	--	--	--	5.04	0.93	10.75	1.98	1.28	0.23	2.73	0.50	0.16	0.03	0.33	0.06	1.70
	Tractor Trailer	Paved	3	12,800	0	1.46	41	19	77%	0.22	0.04	0.01	4.37	18,632.73	0.97	0.22	2.07	0.47	0.19	0.04	0.41	0.09	0.05	0.01	0.10	0.02	1.46
	Tractor Trailer	Unpaved	3	12,800	0	0.24	41	19	83%	5.67	1.51	0.15	0.72	3,064.24	4.07	0.70	8.68	1.50	1.08	0.19	2.31	0.40	0.11	0.02	0.23	0.04	0.24
Scrap Delivery - South	Tractor Trailer	--	3	12,800	--	--	41	19	--	--	--	--	--	--	1.17	0.27	2.49	0.57	0.23	0.05	0.50	0.11	0.06	0.01	0.12	0.03	1.75
	Tractor Trailer	Paved	3	12,800	0	1.75	41	19	77%	0.22	0.04	0.01	5.25	22,419.39	1.17	0.27	2.49	0.57	0.23	0.05	0.50	0.11	0.06	0.01	0.12	0.03	1.75
	Tractor Trailer	Unpaved	3	12,800	0	0.00	41	19	83%	5.67	1.51	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Spent Refractory & Other Waste	Tractor Trailer	--	1	200	--	--	41	19	--	--	--	--	--	--	1.73	0.32	0.17	0.03	0.43	0.08	0.04	0.01	0.06	0.01	0.01	0.00	2.07
	Tractor Trailer	Paved	1	200	1	1.84	41	19	77%	0.22	0.04	0.01	1.84	367.80	0.41	0.09	0.04	0.01	0.08	0.02	0.01	0.00	0.02	0.00	0.00	0.00	1.84
	Tractor Trailer	Unpaved	1	200	0	0.23	41	19	83%	5.67	1.51	0.15	0.23	46.63	1.32	0.23	0.13	0.02	0.35	0.06	0.04	0.01	0.04	0.01	0.00	0.00	0.23
Alloy Aggregate Delivery, Fluxing Agent Delivery, Carbon Delivery	Tractor Trailer	--	1	2,800	--	--	41	19	--	--	--	--	--	--	1.26	0.24	1.76	0.33	0.31	0.06	0.44	0.08	0.04	0.01	0.06	0.01	1.77
	Tractor Trailer	Paved	1	2,800	1	1.61	41	19	77%	0.22	0.04	0.01	1.61	4,503.33	0.36	0.08	0.50	0.11	0.07	0.02	0.10	0.023	0.02	0.004	0.02	0.006	1.61
	Tractor Trailer	Unpaved	1	2,800	0	0.16	41	19	83%	5.67	1.51	0.15	0.16	446.52	0.90	0.16	1.27	0.22	0.24	0.04	0.34	0.058	0.02	0.004	0.03	0.006	0.16
Melt Shop Baghouse Dust Hauling Off-site	Tractor Trailer	--	1	700	--	--	41	19	--	--	--	--	--	--	1.19	0.23	0.42	0.08	0.29	0.05	0.10	0.02	0.04	0.01	0.01	0.00	1.77
	Tractor Trailer	Paved	1	700	0	1.63	41	19	77%	0.22	0.04	0.01	1.63	1,137.90	0.36	0.08	0.13	0.03	0.07	0.02	0.03	0.01	0.02	0.004	0.006	0.001	1.63
	Tractor Trailer	Unpaved	1	700	0	0.15	41	19	83%	5.67	1.51	0.15	0.15	102.08	0.83	0.14	0.29	0.05	0.22	0.04	0.08	0.01	0.02	0.004	0.008	0.001	0.15
Product Hauled Off-site - Spooler Route	Tractor Trailer	--	1	4,700	--	--	41	19	--	--	--	--	--	--	0.69	0.15	1.63	0.36	0.15	0.03	0.35	0.07	0.03	0.01	0.07	0.02	2.54
	Tractor Trailer	Paved	1	4,700	0	2.52	41	19	77%	0.22	0.04	0.01	2.52	11,828.33	0.56	0.13	1.31	0.30	0.11	0.03	0.26	0.06	0.03	0.01	0.06	0.01	2.52
	Tractor Trailer	Unpaved	1	4,700	0	0.02	41	19	83%	5.67	1.51	0.15	0.02	112.16	0.14	0.02	0.32	0.05	0.04	0.01	0.08	0.01	0.00	0.00	0.01	0.00	0.02
Product Hauled Off-site - FG Door 5 Route	Tractor Trailer	--	4	18,800	--	--	41	19	--	--	--	--	--	--	2.33	0.53	5.47	1.25	0.47	0.11	1.09	0.25	0.11	0.03	0.27	0.06	2.62
	Tractor Trailer	Paved	4	18,800	0	2.62	41	19	77%	0.22	0.04	0.01	10.49	49,307.27	2.33	0.53	5.47	1.25	0.47	0.11	1.09	0.25	0.11	0.03	0.27	0.06	2.62
	Tractor Trailer	Unpaved	4	18,800	0	0.00	41	19	83%	5.67	1.51	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Misc. Delivery to Warehouse	Tractor Trailer	--	1	100	--	--	41	19	--	--	--	--	--	--	0.46	0.11	0.02	0.01	0.09	0.02	0.00	0.00	0.02	0.01	0.00	0.00	2.07
	Tractor Trailer	Paved	1	100	0	2.07	41	19	77%	0.22	0.04	0.01	2.07	207.27	0.46	0.11	0.02	0.005	0.09	0.02	0.00	0.001	0.02	0.005	0.001	0.0003	2.07
	Tractor Trailer	Unpaved	1	100	0	0.00	41	19	83%	5.67	1.51	0.15	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.00	0.00	0.000	0.00	0.000	0.000	0.0000	0.00
Water Truck	Tractor Trailer	--	1	1,100	--	--	41	19	--	--	--	--	--	--	6.12	1.10	3.37	0.61	1.58	0.28	0.87	0.16	0.18	0.03	0.10	0.02	4.39
	Tractor Trailer	Paved	1	1,100	2	3.45	41	19	77%	0.22	0.04	0.01	3.45	3,791.67	0.76	0.18	0.42	0.10	0.15	0.035	0.08	0.019	0.04	0.009	0.02	0.005	3.45
	Tractor Trailer	Unpaved	1	1,100	1	0.94	41	19	83%	5.67	1.51	0.15	0.94	1,039.38	5.36	0.93	2.95	0.51	1.43	0.25	0.78	0.14	0.14	0.02	0.08	0.014	0.94
Sweeper	Tractor Trailer	--	1	1,100	--	--	41	19	--	--	--	--	--	--	0.73	0.17	0.40	0.09	0.15	0.03	0.08	0.02	0.04	0.01	0.02	0.00	3.29
	Tractor Trailer	Paved	1	1,100	0	3.29	41	19	77%	0.22	0.04	0.01	3.29	3,622.08	0.73	0.17	0.40	0.09	0.15	0.034	0.08	0.018	0.04	0.008	0.02	0.005	3.29
	Tractor Trailer	Unpaved	1	1,100	0	0.00	41	19	83%	5.67	1.51	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.00
Slag hauling from melt shop to slag yard	Front End Loader	--	1	4,300	--	--	24	12	--	--	--	--	--	--	1.38	0.24	2.97	0.51	0.37	0.06	0.79	0.14	0.04	0.01	0.08	0.01	0.31
	Front End Loader	Paved	1	4,300	0	0.00	24	12	77%	0.13	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00
	Front End Loader	Unpaved	1	4,300	0	0.31	24	12	83%	4.50	1.20	0.12	0.31	1,317.69	1.38	0.24	2.97	0.51	0.37	0.06	0.79	0.14	0.04	0.01	0.08	0.014	0.31
Alloy hauling from pile to melt shop	Front End Loader	--	1	700	--	--	24	12	--	--	--	--	--	--	0.88	0.15	0.31	0.053	0.23	0.041	0.08	0.014	0.02	4.06E-03	8.21E-03	1.42E-03	0.20
	Front End Loader	Paved	1	700	2	0.00	24	12	77%	0.13	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00
	Front End Loader	Unpaved	1	700	0	0.20	24	12	83%	4.50	1.20	0.12	0.20	136.82	0.88	0.15	0.31	0.05	0.23	0.04	0.08	0.01	0.02	0.00	0.01	0.001	0.20
Scrap hauling from pile 2 to scrap building	Heavy Duty Truck	--	1	300	--	--	79	36	--	--	--	--	--	--	0.70	0.12	0.11	0.02	0.19	0.03	0.03	0.00	0.02	0.00	0.00	0.00	0.09
	Heavy Duty Truck	Paved	1	300	0	0.00	79	36	77%	0.43	0.09	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00
	Heavy Duty Truck	Unpaved	1	300	0	0.09	79	36	83%	7.60	2.02	0.20	0.09	27.84	0.70	0.12	0.11	0.02	0.19	0.03	0.03	0.00	0.02	0.00	0.00	0.000	0.09
Mill scale hauling from melt shop to slag yard	Front End Loader	--	1	500	--	--	24	12	--	--	--	--	--	--	2.26	0.39	0.56	0.10	0.60	0.10	0.15	0.03	0.06	0.01	0.02	0.003	0.50
	Front End Loader	Paved	1	500	2	0.00	24	12	77%	0.13	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00
	Front End Loader	Unpaved	1	500	2	0.50	24	12	83%	4.50	1.20	0.12	0.50	250.38	2.26	0.39	0.56	0.10	0.60	0.10	0.15	0.03	0.06	0.01	0.02	0.003	0.50

	Traveled VMT/hr	Traveled VMT/yr	Uncontrolled lb PM/hr	Controlled lb PM/hr	Uncontrolled PM tpy	Controlled PM tpy	Uncontrolled lb PM10/hr	Controlled lb PM10/hr	Uncontrolled PM10 tpy	Controlled PM10 tpy	Uncontrolled lb PM2.5/hr	Controlled lb PM2.5/hr	Uncontrolled PM2.5 tpy	Controlled PM2.5 tpy
Paved Haul Routes	38.00	119689.72	8.43	1.93	13.28	3.05	1.69	0.39	2.66	0.61	0.41	0.09	0.65	0.15
Unpaved Haul Routes	3.43	6820.97	18.44	3.19	18.36	3.18	4.91	0.85	4.89	0.85	0.49	0.08	0.49	0.08
Total	41.4	126510.7	26.9	5.1	31.6	6.2	6.6	1.24	7.5	1.46	0.9	0.18	1.1	0.234

9.0 Calculations for Haul roads (ID No. ES-9), continued

Haul Road Summary - EP19 and EP20

No. of passes over each paved/unpaved section

Section(Measured Section from Figure)	Number of miles	R1 Slag Hauling and Mill Scale Hauling Off-site	R2 Scrap Delivery (North)	R3 Scrap Delivery (South)	R4 Spent Refractory & Other Waste	R5 Alloy, Fluxing, Carbon Delivery	R6 Melt Shop Baghouse Dust Hauling Off-site	R7A Product Hauled Off-site - Spooler Route	R7B Product Hauled Off-site - Straight (FG Door 5)	R8 Misc. Delivery to Warehouse	R9 Water Truck	R10 Sweeper	R11 Slag Hauling from Melt shop to Slag Yard	R12 Alloy Hauling from Pile to Melt shop	R13 Scrap Hauling from Pile to Scrap Building	R14 Mill Scale Hauling from Melt shop to Slag Yard
P1	0.68	2	2	2	2	2	2	2	2	2	2	2				
P2	0.03	2	2		1			2	1		1	1				
P3	0.03	1			1			2	1		2	1				
P4	0.27				1			2	1		1	1				
P5	0.12							2	1		2	1				
P6	0.12							1	1		1	1				
P7	0.10								1		1	1				
P8	0.06								1		1	1				
P9	0.04								1		1	1				
P10	0.12										1	1				
P11	0.04										1	1				
P12	0.06										1	1				
P13	0.22										1	1				
P14	0.06			2	1	2	1		1	2	2	2				
P15	0.07			1			1		1	2	2	2				
P16	0.05								1	2	1	1				
P17	0.15										1	1				
P18	0.00															
P19	0.04															
P20	0.02									2	1	1				
P21	0.02									2						
P22	0.01															
P23	0.07								1	2	1	1				
P24	0.02								1							
P25	0.04															
P26	0.05								1							
P27	0.04								1							
P28	0.01															
P29	0.05								1							
P30	0.05															
P31	0.05															
P32	0.05							1								
P33	0.02										1	1				
P34	0.04			2												
P35	0.02	2	2	2	2	2	2	2	2	2	3	3				
P36	0.03															
P37	0.03							1								
P38	0.05			2	1	2	2		1	2	2	2				
U1	0.11	1									1					
U2	0.08				1						2			2		2
U3	0.04										1					2
U4	0.08										1					
U5	0.05										1					
U6	0.01										1					
U7	0.02							1			1					
U8	0.12										2					
U9	0.03				1						1					
U10	0.04				1						1					
U11	0.02													2		
U12	0.02															2
U13	0.01															
U14	0.01															
U15	0.15						1									
U16	0.12		2										2			
U17	0.08				1	2					2					
U18	0.11															2
U19	0.05														2	
U21	0.0335												2			

	R1	R2	R3	R4	R5	R6	R7A	R7B	R8	R9	R10	R11	R12	R13	R14
Total Paved (miles)	1.49	1.46	1.75	1.84	1.61	1.63	2.52	2.62	2.07	3.45	3.29	0.00	0.00	0.00	0.00
Total Unpaved (miles)	0.11	0.24	0.00	0.23	0.16	0.15	0.02	0.00	0.00	0.94	0.00	0.31	0.20	0.09	0.50

9.0 Calculations for Haul roads (ID No. ES-9), continued

Haul Road Model Inputs - EP19 and EP20

	Feet	Meters	
vehicle height (VH)	12.0	3.66	
Road width	30.0	9.14	assumed two lane road

Volume Sources	Feet	Meters	
Top of Plume Height=1.7 x VH	20.4	6.22	
Volume Source Release Height = 0.5 x Top of Plume height	10.2	3.11	
Width of Plume = Road width + 6 m	49.7	15.14	
Initial Sigma Z = Top of Plume / 2.15	9.5	2.89	initial vertical dimension
Initial Sigma Y =Width of Plume / 2.15	23.1	7.04	horizontal
Exclusion zone = (2.15 x sigma y)+1m	53.0	16.14	
Volume Source Spacing = W = sigma yo*2.15	49.7	15.14	

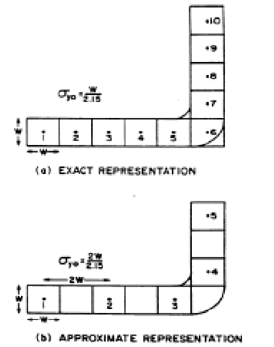

FIGURE 1-8. EXACT AND APPROXIMATE REPRESENTATIONS OF A LINE SOURCE BY MULTIPLE VOLUME SOURCES
1-82

Process Weight Rate Rule - Compliance Check

Description of Emissions Unit	Process Weight Rate (P)[1] Source/Equation	(tons/hr)	Emission Limit (lbs/hr)	Emission Rate (lbs/hr)	Compliance (Y/N)
Melt shop (EP07, EP08, EP09, EP10)	Hourly steel production	80.00	49.06	36.02	Y
Rolling Mill (EP11)	Hourly steel production	80.00	49.06	1.27	Y
Scrap Storage and Handling (EP01, EP02, EP06)	Annual scrap usage / annual operating hours	85.60	49.73	0.15	Y
Alloy Storage (EP17)	Annual alloy usage / annual operating hours	0.95	3.95	0.00	Y
Silos (EP03, EP04, EP05)	(Annual carbon usage + flux usage + dust produced) / anr	5.99	13.61	0.16	Y
Slag Yard (EP18)	(Slag + mill scale produced) / annual operating hours	6.47	14.32	1.16	Y
Cooling Tower 1 (EP12)	Cooling Water	4537.41	98.87	0.14	Y
Cooling Tower 2 (EP13)	Cooling Water	963.95	77.11	0.03	Y
Emergency Equipment (EP14, EP15, EP16)	Not applicable - gas/liquid fuel				
Roads (EP19, EP20)	Not applicable - fugitive				
Tanks (EP21, EP22)	Not applicable - no PM emissions				

Notes
1 - Process weight rate rules found in 15A NCAC 02D.0515(a)

10.0 Calculations for Stationary engines (ID No. ES-10)

10.1 Natural gas-fired fire water pump (ID No. ES-10-1)

Emergency Firewater Pump - EP14

Inputs

Size	500.0	HP
	3.18	MMBtu/hr
Natural Gas	1020	MMBtu/mmscf
Fuel Usage	0.0031	mmscf/hr
Operation	100	hours/year

Emissions

Pollutant	Emission Factors				Emissions	
	lb/hp hr	g/hp-hr	lb/MMBtu	Source	lb/hr	tpy
PM	--	--	0.019	AP-42[1]	6.17E-02	3.09E-03
PM10	--	--	0.019	AP-42[1]	6.17E-02	3.09E-03
PM2.5	--	--	0.019	AP-42[1]	6.17E-02	3.09E-03
NOx	4.41E-03	2.00	--	NSPS[2]	2.20	0.11
CO	8.82E-03	4.00	--	NSPS[2]	4.41	0.22
VOC	2.20E-03	1.00	--	NSPS[2]	1.10	0.06
SO_2	--	--	5.88E-04	AP-42[1]	1.87E-03	9.35E-05
H_2SO_4	--	--	--	Mass Balance	2.86E-04	1.43E-05
CO_2	--	--	116.98	Part 98[3]	372	18.60
N_2O	--	--	2.20E-04	Part 98[3]	7.01E-04	3.51E-05
CH_4	--	--	2.20E-03	Part 98[3]	7.01E-03	3.51E-04
CO_2e			--	Part 98[3]	372	18.62

Notes
1 - AP-42 Section 3.2 (10/96) Table 3.2-2 or -3 (worst-case of 4-stroke lean burn or rich burn)
2 - NSPS Subpart JJJJ Limit.
3 - Greenhouse Gas Reporting Rule- Subpart C of Part 98

SO2 Mist
SO2 + 1/2 O2 = SO3
SO3 + H2O = H2SO4

M.W. SO2	64.1
M.W. SO3	80.1
M.W. H2SO4	98.1
*Percent SO2 to SO3 (%)	10.0%
*Percent SO3 to H2SO4 (%)	100.0%

SO2 (lb/hr)	SO2 converted to SO3 (lb/hr)	SO3 created (lb/hr)	H2SO4 created (lb/hr)
1.87E-03	1.87E-04	2.34E-04	2.86E-04

*Assumes 10% of SO2 is converted to SO3 and 100% of SO3 is converted to H2SO4

From Table 1 to Subpart JJJJ of Part 60—NO_x, CO, and VOC Emission Standards for Stationary Emergency SI Engines HP ≥130

Engine type and fuel	Maximum engine power	Manufacture date	Emission standards[1]					
			g/HP-hr			ppmvd at 15% O_2		
			NO_x	CO	VOC	NO_x	CO	VOC
Emergency	HP≥130	TBD	2	4	1	160	540	86

Notes
1 - Owners and operators of stationary non-certified SI engines may choose to comply with the emission standards in units of either g/HP-hr or ppmvd at 15 percent O_2.

HAP Emissions

HAP	Emission Factor lb/MMBtu	Emission Rate (lb/hr)	Annual Emissions (tpy)	Source
1,1,2,2-Tetrachloroethane	2.53E-05	8.05E-05	4.02E-06	AP-42 Table 3.2-3
1,1,2-Trichloroethane	1.53E-05	4.87E-05	2.43E-06	AP-42 Table 3.2-3
1,3-Butadiene	6.63E-04	2.11E-03	1.05E-04	AP-42 Table 3.2-3
1,3-Dichloropropene	1.27E-05	4.04E-05	2.02E-06	AP-42 Table 3.2-3
Acetaldehyde	2.79E-03	8.87E-03	4.44E-04	AP-42 Table 3.2-3
Acrolein	2.63E-03	8.36E-03	4.18E-04	AP-42 Table 3.2-3
Benzene	1.58E-03	5.03E-03	2.51E-04	AP-42 Table 3.2-3
Carbon Tetrachloride	1.77E-05	5.63E-05	2.81E-06	AP-42 Table 3.2-3
Chlorobenzene	1.29E-05	4.10E-05	2.05E-06	AP-42 Table 3.2-3
Chloroform	1.37E-05	4.36E-05	2.18E-06	AP-42 Table 3.2-3
Ethylbenzene	2.48E-05	7.89E-05	3.94E-06	AP-42 Table 3.2-3
Ethylene Dibromide	2.13E-05	6.77E-05	3.39E-06	AP-42 Table 3.2-3
Formaldehyde	2.05E-02	6.52E-02	3.26E-03	AP-42 Table 3.2-3
Methanol	3.06E-03	9.73E-03	4.87E-04	AP-42 Table 3.2-3
Methylene Chloride	4.12E-05	1.31E-04	6.55E-06	AP-42 Table 3.2-3
Naphthalene	9.71E-04	3.09E-03	1.54E-04	AP-42 Table 3.2-3
PAH	1.41E-04	4.48E-04	2.24E-05	AP-42 Table 3.2-3
Styrene	1.19E-05	3.78E-05	1.89E-06	AP-42 Table 3.2-3
Toluene	5.58E-04	1.77E-03	8.87E-05	AP-42 Table 3.2-3
Vinyl Chloride	7.18E-06	2.28E-05	1.14E-06	AP-42 Table 3.2-3
Xylene	1.95E-04	6.20E-04	3.10E-05	AP-42 Table 3.2-3
Total HAP	0.033		0.005	

10.2 Two emergency generators (ID Nos. ES-10-2 and ES-10-3)

Calculations for natural gas-fired generators (one possible configuration of ID No. ES-10-2 and ES-10-3)

Emergency Generators - EP15, EP16 (Natural Gas)

** Facility will install a maximum of 2 emergency generators, either natural gas or diesel. Emission calculations for both options are presented.*

Inputs

Size	2682	HP
	2000	kW
	17.06	MMBtu/hr[1]
Natural Gas	1020	MMBtu/mmscf
Fuel Usage	0.017	mmscf/hr
Operation	100	hours/year
Number of Units	2	units

Notes
1 - Assuming efficiency of 40%, similar to 2-MW CAT CG170-20

Emissions

Pollutant	Emission Factors				Emissions (per engine)		Emissions (2 engines)	
	lb/hp hr	g/hp-hr	lb/MMBtu	Source	lb/hr	tpy	lb/hr	tpy
PM	--	--	0.010	AP-42[1]	0.17	0.01	0.34	0.02
PM_{10}	--	--	0.010	AP-42[1]	0.17	0.01	0.34	0.02
$PM_{2.5}$	--	--	0.010	AP-42[1]	0.17	0.01	0.34	0.02
NOx	4.41E-03	2.00	--	NSPS[2]	11.83	0.59	23.65	1.18
CO	8.82E-03	4.00	--	NSPS[2]	23.65	1.18	47.30	2.37
VOC	2.20E-03	1.00	--	NSPS[2]	5.91	0.30	11.83	0.59
SO_2	--	--	0.000588	AP-42[1]	0.01	0.00	0.02	0.00
H_2SO_4	--	--	--	Mass Balance	1.54E-03	0.00	0.00	0.00
CO_2	--	--	116.98	Part 98[3]	1996	99.79	3991.42	199.57
N_2O	--	--	2.20E-04	Part 98[3]	3.76E-03	1.88E-04	7.52E-03	3.76E-04
CH_4	--	--	2.20E-03	Part 98[3]	3.76E-02	1.88E-03	7.52E-02	3.76E-03
CO_2e			--	Part 98[3]	1,998	99.89	3995.55	199.78

Notes
1 - AP-42 Section 3.2 (10/96) Table 3.2-2 (4-stroke lean burn)
2 - NSPS Subpart JJJJ Limits
3 - Greenhouse Gas Reporting Rule- Subpart C of Part 98

SO2 Mist
SO2 + 1/2 O2 = SO3
SO3 + H2O = H2SO4

M.W. SO2	64.1
M.W. SO3	80.1
M.W. H2SO4	98.1
*Percent SO2 to SO3 (%)	10%
*Percent SO3 to H2SO4 (%)	100%

SO2	SO2 converted to SO3	SO3 created	H2SO4 created
(lb/hr)	(lb/hr)	(lb/hr)	(lb/hr)
1.00E-02	1.00E-03	1.25E-03	1.54E-03

*Assumes 10% of SO2 is converted to SO3 and 100% of SO3 is converted to H2SO4

From Table 1 to Subpart JJJJ of Part 60—NOX, CO, and VOC Emission Standards for Stationary Emergency SI Engines ≥100 HP (Except Gasoline and Rich Burn LPG), Stationary SI Landfill/Digester Gas Engines, and Stationary Emergency Engines >25 HP

Engine type and fuel	Maximum engine power	Manufacture date	Emission standards[1]					
			g/HP-hr			ppmvd at 15% O_2		
			NO_x	CO	VOC[2]	NO_x	CO	VOC[2]
Emergency	HP≥130	TBD	2	4	1	160	540	86

Notes
1 - Owners and operators of stationary non-certified SI engines may choose to comply with the emission standards in units of either g/HP-hr or ppmvd at 15 percent O_2.
2 - For purposes of this subpart, when calculating emissions of volatile organic compounds, emissions of formaldehyde should not be included.

HAP Emissions (per engine)

HAP	Emission Factor	Emission Rate	Annual Emissions	Source
	lb/MMBtu	(lb/hr)	(tpy)	
1,1,2,2-Tetrachloroethane	4.00E-05	6.82E-04	3.41E-05	AP-42 Table 3.2-2
1,1,2-Trichloroethane	3.18E-05	5.43E-04	2.71E-05	AP-42 Table 3.2-2
1,3-Butadiene	2.67E-04	4.56E-03	2.28E-04	AP-42 Table 3.2-2
1,3-Dichloropropene	2.64E-05	4.50E-04	2.25E-05	AP-42 Table 3.2-2
2-Methylnaphthalene	3.32E-05	5.66E-04	2.83E-05	AP-42 Table 3.2-2
2,2,4-Trimethylpentane	2.50E-04	4.27E-03	2.13E-04	AP-42 Table 3.2-2
Acenaphthene	1.25E-06	2.13E-05	1.07E-06	AP-42 Table 3.2-2
Acenaphthylene	5.53E-06	9.43E-05	4.72E-06	AP-42 Table 3.2-2
Acetaldehyde	8.36E-03	1.43E-01	7.13E-03	AP-42 Table 3.2-2
Acrolein	5.14E-03	8.77E-02	4.38E-03	AP-42 Table 3.2-2
Benzene	4.40E-04	7.51E-03	3.75E-04	AP-42 Table 3.2-2
Benzo(b)fluoranthene	1.66E-07	2.83E-06	1.42E-07	AP-42 Table 3.2-2
Benzo(e)pyrene	4.15E-07	7.08E-06	3.54E-07	AP-42 Table 3.2-2
Benzo(g,h,i)perylene	4.14E-07	7.06E-06	3.53E-07	AP-42 Table 3.2-2
Biphenyl	2.12E-04	3.62E-03	1.81E-04	AP-42 Table 3.2-2
Carbon Tetrachloride	3.67E-05	6.26E-04	3.13E-05	AP-42 Table 3.2-2
Chlorobenzene	3.04E-05	5.19E-04	2.59E-05	AP-42 Table 3.2-2
Chloroform	2.85E-05	4.86E-04	2.43E-05	AP-42 Table 3.2-2
Chrysene	6.93E-07	1.18E-05	5.91E-07	AP-42 Table 3.2-2
Ethylbenzene	3.97E-05	6.77E-04	3.39E-05	AP-42 Table 3.2-2
Ethylene Dibromide	4.43E-05	7.56E-04	3.78E-05	AP-42 Table 3.2-2
Fluoranthene	1.11E-06	1.89E-05	9.47E-07	AP-42 Table 3.2-2
Fluorene	5.67E-06	9.67E-05	4.84E-06	AP-42 Table 3.2-2
Formaldehyde	5.28E-02	9.01E-01	4.50E-02	AP-42 Table 3.2-2
Methanol	2.50E-03	4.27E-02	2.13E-03	AP-42 Table 3.2-2
Methylene Chloride	2.00E-05	3.41E-04	1.71E-05	AP-42 Table 3.2-2
Hexane	1.11E-03	1.89E-02	9.47E-04	AP-42 Table 3.2-2
Naphthalene	7.44E-05	1.27E-03	6.35E-05	AP-42 Table 3.2-2
PAH	2.69E-05	4.59E-04	2.29E-05	AP-42 Table 3.2-2
Phenanthrene	1.04E-05	1.77E-04	8.87E-06	AP-42 Table 3.2-2
Phenol	2.40E-05	4.09E-04	2.05E-05	AP-42 Table 3.2-2
Pyrene	1.36E-06	2.32E-05	1.16E-06	AP-42 Table 3.2-2
Styrene	2.36E-05	4.03E-04	2.01E-05	AP-42 Table 3.2-2
Tetrachloroethane	2.48E-06	4.23E-05	2.12E-06	AP-42 Table 3.2-2
Toluene	4.08E-04	6.96E-03	3.48E-04	AP-42 Table 3.2-2
Vinyl Chloride	1.49E-05	2.54E-04	1.27E-05	AP-42 Table 3.2-2
Xylene	1.84E-04	3.14E-03	1.57E-04	AP-42 Table 3.2-2
Total HAP	0.072		0.062	

Calculations for diesel-fired generators (one possible configuration of ID No. ES-10-2 and ES-10-3)

Emergency Generators - EP15, EP16 (Diesel)

** Facility will install a maximum of 2 emergency generators, either natural gas or diesel. Emission calculations for both options are presented.*

Inputs

Size	2682	HP
	2000	kW
	18.91	MMBtu/hr
Diesel Fuel Heating Value[1]	137,000	Btu/gal
Fuel Usage[2]	138	gal/hr
Sulfur Content[3]	0.0015%	%
Operation	100	hours/year
Number of Units	2	units

Notes
1 - Heating value for diesel fuel from AP-42, Appendix A.
2 - Estimated assuming 2,000-kW CAT C3156C, or similar unit.
3 - Ultra-low sulfur diesel fuel (15 ppm)

Emissions

Pollutant	Emission Factors				Emissions (per engine)		Emissions (2 engines)	
	lb/kW-hr	g/kW-hr	lb/MMBtu	Source	lb/hr	tpy	lb/hr	tpy
PM	4.41E-04	0.20	--	NSPS[2]	0.88	0.04	1.76	0.09
PM_{10}	4.41E-04	0.20	--	NSPS[2]	0.88	0.04	1.76	0.09
$PM_{2.5}$	4.41E-04	0.20	--	NSPS[2]	0.88	0.04	1.76	0.09
NOx	1.41E-02	6.40	--	NSPS[2]	28.22	1.41	56.44	2.82
CO	7.72E-03	3.50	--	NSPS[2]	15.43	0.77	30.86	1.54
VOC	--	--	0.082	AP-42[1]	1.55	0.08	3.10	0.15
SO_2	--	--	1.52E-05	AP-42[1]	0.00	0.00	0.00	0.00
H_2SO_4	--	--	--	Mass Balance	4.38E-05	2.19E-06	8.77E-05	4.38E-06
CO_2	--	--	163.05	Part 98[3]	3083	154.13	6165.39	308.27
N_2O	--	--	1.32E-03	Part 98[3]	2.50E-02	1.25E-03	5.00E-02	2.50E-03
CH_4	--	--	6.61E-03	Part 98[3]	1.25E-01	6.25E-03	2.50E-01	1.25E-02
CO_2e			--	Part 98[3]	3,093	154.66	6186.55	309.33

Notes
1 - AP-42 Section 3.4 (10/96) Table 3.4-1
2 - NSPS Subpart IIII Limits
3 - Greenhouse Gas Reporting Rule- Subpart C of Part 98

SO2 Mist
SO2 + 1/2 O2 = SO3
SO3 + H2O = H2SO4

M.W. SO2	64.1
M.W. SO3	80.1
M.W. H2SO4	98.1
*Percent SO2 to SO3 (%)	10%
*Percent SO3 to H2SO4 (%)	100%

SO2	SO2 converted to SO3	SO3 created	H2SO4 created
(lb/hr)	(lb/hr)	(lb/hr)	(lb/hr)
2.86E-04	2.86E-05	3.58E-05	4.38E-05

*Assumes 10% of SO2 is converted to SO3 and 100% of SO3 is converted to H2SO4

Tier 2 standards pursuant to 40 CFR 60.4202(a)(2) and from 40 CFR 1042, Appendix I.

Engine type and fuel	Displacement	Engine Size	Emission standards g/kW-hr		
			NOx + NMHC	CO	PM
Emergency	<10 L/cyl	1000 kW/2000 kW	6.4	3.5	0.2

HAP Emissions (per engine)

HAP	Emission Factor	Emission Rate	Annual Emissions	Source
	lb/MMBtu	(lb/hr)	(tpy)	
Acenaphthene	4.68E-06	8.85E-05	4.42E-06	AP-42 Table 3.4-4
Acenaphthylene	9.23E-06	1.75E-04	8.73E-06	AP-42 Table 3.4-4
Acetaldehyde	2.52E-05	4.76E-04	2.38E-05	AP-42 Table 3.4-3
Acrolein	7.88E-06	1.49E-04	7.45E-06	AP-42 Table 3.4-3
Anthracene	1.23E-06	2.33E-05	1.16E-06	AP-42 Table 3.4-4
Benzene	7.76E-04	1.47E-02	7.34E-04	AP-42 Table 3.4-3
Benzo(a)anthracene	6.22E-07	1.18E-05	5.88E-07	AP-42 Table 3.4-4
Benzo(a)pyrene	2.57E-07	4.86E-06	2.43E-07	AP-42 Table 3.4-4
Benzo(b)fluoranthene	1.11E-06	2.10E-05	1.05E-06	AP-42 Table 3.4-4
Benzo(g,h,i)perylene	5.56E-07	1.05E-05	5.26E-07	AP-42 Table 3.4-4
Benzo(k)fluoranthene	2.18E-07	4.12E-06	2.06E-07	AP-42 Table 3.4-4
Chrysene	1.53E-06	2.89E-05	1.45E-06	AP-42 Table 3.4-4
Dibenz(a,h)anthracene	3.46E-07	6.54E-06	3.27E-07	AP-42 Table 3.4-4
Fluoranthene	4.03E-06	7.62E-05	3.81E-06	AP-42 Table 3.4-4
Fluorene	1.28E-05	2.42E-04	1.21E-05	AP-42 Table 3.4-4
Formaldehyde	7.89E-05	1.49E-03	7.46E-05	AP-42 Table 3.4-3
Indeno(1,2,3-cd)pyrene	4.14E-07	7.83E-06	3.91E-07	AP-42 Table 3.4-4
Naphthalene	1.30E-04	2.46E-03	1.23E-04	AP-42 Table 3.4-4
Phenanthrene	4.08E-05	7.71E-04	3.86E-05	AP-42 Table 3.4-4
Pyrene	3.71E-06	7.01E-05	3.51E-06	AP-42 Table 3.4-4
Toluene	2.81E-04	5.31E-03	2.66E-04	AP-42 Table 3.4-3
Xylene	1.93E-04	3.65E-03	1.82E-04	AP-42 Table 3.4-3
Total HAP	0.002		0.001	

11.0 Calculations for Storage tanks (ID No. ES-11)

11.1 Two diesel storage tanks (ID No. ES-11-1)

Diesel Fuel Storage Tanks - EP21

TANKS 4.0.9d Inputs

Description	Value	Units
Tank Type	Horizontal	
Location (meteorological data)	Greensboro, NC	
Tank Contents	Distillate Fuel Oil #2	
Shell Length	20.00	ft
Diameter	5.00	ft
Volume	3000	gal
Turnovers	28.33	
Throughput[a]	85,000	gal
Tank heated (y/n)	n	
Tank underground (y/n)	n	
Shell Color/Shade	White	
Shell Condition	Good	
Vacuum Settings (psig)	-0.03	
Pressure Settings (psig)	0.03	
Working Loss	0.58	lb/yr
Breathing Loss	0.09	lb/yr
Total Emissions (per tank)	9.85E-04	tpy
	1.97	lb/yr
Total Emissions (up to 3 tanks)	**2.96E-03**	**tpy**
	5.91	**lb/yr**

TANKS 4.0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank

Nucor Lexington - Dist Fuel Oil #2 - Horizontal Tank
Lexington, Kentucky

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Distillate fuel oil no. 2	All	56.60	51.55	61.65	54.88	0.0058	0.0048	0.0069	130.0000			188.00	Option 1: VP50 = .0045 VP60 = .0065

TANKS 4.0.9d
Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: Annual

Nucor Lexington - Dist Fuel Oil #2 - Horizontal Tank
Lexington, Kentucky

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Distillate fuel oil no. 2	1.53	0.44	1.97

11.2 Gasoline storage tank (ID No. ES-11-2)

Gasoline Storage Tank - EP22

TANKS 4.0.9d Inputs

Description	Value	Units
Tank Type	Horizontal	
Location (meteorological data)	Greensboro, NC	
Tank Contents	Gasoline RVP 9	
Shell Length	6.00	ft
Diameter	5.33	ft
Volume	1000	gal
Turnovers	6.0	
Throughput	6,000	gal
Tank heated (y/n)	n	
Tank underground (y/n)	n	
Shell Color/Shade	White	
Shell Condition	Good	
Vacuum Settings (psig)	-0.03	
Pressure Settings (psig)	0.03	
Working Loss	43.8	lb/yr
Breathing Loss	82.29	lb/yr
Total Emissions	**0.081**	**tpy**
	162.97	**lb/yr**

TANKS 4.0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank

Nucor Lexington - RVP9 - Horizontal Tank
Lexington, Kentucky

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Gasoline (RVP 9)	All	56.60	51.55	61.65	54.88	4.3108	3.8937	4.7632	67.0000			92.00	Option 4: RVP=9, ASTM Slope=3

TANKS 4.0.9d
Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: Annual

Nucor Lexington - RVP9 - Horizontal Tank
Lexington, Kentucky

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Gasoline (RVP 9)	41.26	121.71	162.97

12.0 Facility-wide natural gas usage (excluding stationary engines)

Combined emissions for natural gas usage in Melt Shop (ID No. ES-1.6), Casting Operations (ID No. ES-2.4), and Rolling Operations (ID No. ES-4.2).

Natural Gas Summary - Vent to EP07, EP09, and EP11

Inputs

Description	Value	Units
Natural Gas Heating Value	1,020	Btu/scf
Annual Hours of Operation	8,760	hrs/yr
Meltshop Baghouse (EP7)		
Heat Capacity of Preheaters and Dryers	0.05	MMBtu/hr
EAF Modules and Torches	46.74	MMBtu/hr
Total Rated heat Capacity	46.79	MMBtu/hr
Caster Vent (EP9)		
Heat Capacity of Preheaters and Dryers	61.89	MMBtu/hr
Torches	0.80	MMBtu/hr
Total Rated heat Capacity	62.68	MMBtu/hr
Roll Mill (EP11)		
Torches	0.80	MMBtu/hr

Summary of Equipment

Unit	Peak Flowrate (scf/min)	Peak Power (MMBtu/hr)	Source
Melt shop (to Baghouse, EP7)			**Design Specifications**
EAF modules	761	46.57	
EAF service cutting torches for EBT	1.9	0.12	
EAF service cutting torches for slag door area	0.9	0.06	
Nozzle preheater	0.8	0.05	
Continuous Casting Machine (to Caster Vent, EP9)			
Ladle drying station	164.8	10.09	
Ladle horizontal preheaters (2)	412	25.21	
Ladle vertical preheater	210	12.85	
Service cutting torches	13	0.80	
Tundish drying station	74.8	4.58	
Tundish preheating station	149.6	9.16	
Roll Mill (EP11)			
Service cutting torches	13	0.80	

12.0 Facility-wide natural gas usage (excluding stationary engines), continued

Emissions

Pollutant	Emission Factor		Vents to EP7 Emissions	Vents to EP7 Emissions	Vents to EP9 Emissions	Vents to EP9 Emissions	Vents to EP11 Emissions	Vents to EP11 Emissions	
Preheaters and Dryers	**($lb/10^6$ scf)**	**(lb/MMBtu)**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**Source**
Total PM	--	3.00E-03	1.50E-04	6.57E-04	1.86E-01	8.13E-01	--	--	Vendor Specification
PM_{10}	--	3.00E-03	1.50E-04	6.57E-04	1.86E-01	8.13E-01	--	--	Vendor Specification
$PM_{2.5}$	--	3.00E-03	1.50E-04	6.57E-04	1.86E-01	8.13E-01	--	--	Vendor Specification
NO_x	--	3.00E-02	1.50E-03	6.57E-03	1.86E+00	8.13E+00	--	--	Vendor Specification
CO	--	8.00E-02	4.00E-03	1.75E-02	4.95E+00	2.17E+01	--	--	Vendor Specification
SO_2	--	6.00E-04	3.00E-05	1.31E-04	3.71E-02	1.63E-01	--	--	Vendor Specification
VOC	--	5.00E-03	2.50E-04	1.10E-03	3.09E-01	1.36E+00	--	--	Vendor Specification
EAF Modules and Torches	**($lb/10^6$ scf)**	**(lb/MMBtu)**	**(lb/hr)**	**tpy**	**(lb/hr)**	**tpy**	**(lb/hr)**	**tpy**	**Source**
Total PM	7.6	7.45E-03	3.48E-01	1.53E+00	5.93E-03	2.60E-02	5.93E-03	2.60E-02	AP-42 Table 1.4-2
PM_{10}	7.6	7.45E-03	3.48E-01	1.53E+00	5.93E-03	2.60E-02	5.93E-03	2.60E-02	AP-42 Table 1.4-2
$PM_{2.5}$	7.6	7.45E-03	3.48E-01	1.53E+00	5.93E-03	2.60E-02	5.93E-03	2.60E-02	AP-42 Table 1.4-2
NO_x	100	9.80E-02	4.58E+00	2.01E+01	7.80E-02	3.42E-01	7.80E-02	3.42E-01	AP-42 Table 1.4-1
CO	84	8.24E-02	3.85E+00	1.69E+01	6.55E-02	2.87E-01	6.55E-02	2.87E-01	AP-42 Table 1.4-1
SO_2	0.6	5.88E-04	2.75E-02	1.20E-01	4.68E-04	2.05E-03	4.68E-04	2.05E-03	AP-42 Table 1.4-2
VOC	5.5	5.39E-03	2.52E-01	1.10E+00	4.29E-03	1.88E-02	4.29E-03	1.88E-02	AP-42 Table 1.4-2
All Natural Gas Units Combined	**($lb/10^6$ scf)**	**(lb/MMBtu)**	**(lb/hr)**	**tpy**	**(lb/hr)**	**tpy**	**(lb/hr)**	**tpy**	**Source**
Total PM	--	--	0.35	1.53	0.19	0.84	5.93E-03	2.60E-02	--
PM_{10}	--	--	0.35	1.53	0.19	0.84	5.93E-03	2.60E-02	--
$PM_{2.5}$	--	--	0.35	1.53	0.19	0.84	5.93E-03	2.60E-02	--
NO_x	--	--	4.58	20.08	1.93	8.47	7.80E-02	0.34	--
CO	--	--	3.85	16.88	5.02	21.97	6.55E-02	0.29	--
SO_2	--	--	0.03	0.12	0.04	0.16	4.68E-04	2.05E-03	--
VOC	--	--	0.25	1.11	0.31	1.37	4.29E-03	1.88E-02	--
H2SO4	--	--	4.21E-03	1.85E-02	5.75E-03	2.52E-02	7.16E-05	3.14E-04	Mass Balance
Lead	5.00E-04	4.90E-07	2.29E-05	1.00E-04	3.07E-05	1.35E-04	3.90E-07	1.71E-06	AP-42 Table 1.4-2
CO_2	120,000	118	5,505	24,113	7,374	32,299	93.60	410	AP-42 Table 1.4-2
N_2O	2.2	2.16E-03	0.10	0.44	0.14	0.59	1.72E-03	7.52E-03	AP-42 Table 1.4-2
CH_4	2.3	2.25E-03	0.11	0.46	0.14	0.62	1.79E-03	7.86E-03	AP-42 Table 1.4-2
CO_2e	--	--	5,538	24,256	7,418	32,491	94.16	412	40 CFR 98 Subpart A
2-Methylnaphthalene	2.40E-05	2.4E-08	1.10E-06	4.82E-06	1.47E-06	6.46E-06	1.87E-08	8.20E-08	AP-42 Table 1.4-3
3-Methylcholanthrene	1.80E-06	1.8E-09	8.26E-08	3.62E-07	1.11E-07	4.84E-07	1.40E-09	6.15E-09	AP-42 Table 1.4-3
7,12-Dimethylbenz(a)anthracene	1.60E-05	1.6E-08	7.34E-07	3.22E-06	9.83E-07	4.31E-06	1.25E-08	5.47E-08	AP-42 Table 1.4-3
Acenaphthene	1.80E-06	1.8E-09	8.26E-08	3.62E-07	1.11E-07	4.84E-07	1.40E-09	6.15E-09	AP-42 Table 1.4-3
Acenaphthylene	1.80E-06	1.8E-09	8.26E-08	3.62E-07	1.11E-07	4.84E-07	1.40E-09	6.15E-09	AP-42 Table 1.4-3
Anthracene	2.40E-06	2.4E-09	1.10E-07	4.82E-07	1.47E-07	6.46E-07	1.87E-09	8.20E-09	AP-42 Table 1.4-3
Benz(a)anthracene	1.80E-06	1.8E-09	8.26E-08	3.62E-07	1.11E-07	4.84E-07	1.40E-09	6.15E-09	AP-42 Table 1.4-3
Benzene	2.1E-03	2.1E-06	9.63E-05	4.22E-04	1.29E-04	5.65E-04	1.64E-06	7.17E-06	AP-42 Table 1.4-3
Benzo(a)pyrene	1.2E-06	1.2E-09	5.51E-08	2.41E-07	7.37E-08	3.23E-07	9.36E-10	4.10E-09	AP-42 Table 1.4-3
Benzo(b)fluoranthene	1.8E-06	1.8E-09	8.26E-08	3.62E-07	1.11E-07	4.84E-07	1.40E-09	6.15E-09	AP-42 Table 1.4-3
Benzo(g,h,i)perylene	1.2E-06	1.2E-09	5.51E-08	2.41E-07	7.37E-08	3.23E-07	9.36E-10	4.10E-09	AP-42 Table 1.4-3
Benzo(k)fluoranthene	1.8E-06	1.8E-09	8.26E-08	3.62E-07	1.11E-07	4.84E-07	1.40E-09	6.15E-09	AP-42 Table 1.4-3
Chrysene	1.8E-06	1.8E-09	8.26E-08	3.62E-07	1.11E-07	4.84E-07	1.40E-09	6.15E-09	AP-42 Table 1.4-3
Dibenzo(a,h)anthracene	1.2E-06	1.2E-09	5.51E-08	2.41E-07	7.37E-08	3.23E-07	9.36E-10	4.10E-09	AP-42 Table 1.4-3
Dichlorobenzene	1.2E-03	1.2E-06	5.51E-05	2.41E-04	7.37E-05	3.23E-04	9.36E-07	4.10E-06	AP-42 Table 1.4-3
Fluoranthene	3.0E-06	2.9E-09	1.38E-07	6.03E-07	1.84E-07	8.07E-07	2.34E-09	1.02E-08	AP-42 Table 1.4-3
Fluorene	2.8E-06	2.7E-09	1.28E-07	5.63E-07	1.72E-07	7.54E-07	2.18E-09	9.57E-09	AP-42 Table 1.4-3
Formaldehyde	0.08	7.4E-05	3.44E-03	1.51E-02	4.61E-03	2.02E-02	5.85E-05	2.56E-04	AP-42 Table 1.4-3
Hexane	1.80	1.8E-03	8.26E-02	0.36	0.11	0.48	1.40E-03	6.15E-03	AP-42 Table 1.4-3
Indeno(1,2,3-cd)pyrene	1.8E-06	1.8E-09	8.26E-08	3.62E-07	1.11E-07	4.84E-07	1.40E-09	6.15E-09	AP-42 Table 1.4-3
Naphthalene	6.1E-04	6.0E-07	2.80E-05	1.23E-04	3.75E-05	1.64E-04	4.76E-07	2.08E-06	AP-42 Table 1.4-3
Phenanthrene	1.7E-05	1.7E-08	7.80E-07	3.42E-06	1.04E-06	4.58E-06	1.33E-08	5.81E-08	AP-42 Table 1.4-3
Pyrene	5.0E-06	4.9E-09	2.29E-07	1.00E-06	3.07E-07	1.35E-06	3.90E-09	1.71E-08	AP-42 Table 1.4-3
Toluene	3.4E-03	3.3E-06	1.56E-04	6.83E-04	2.09E-04	9.15E-04	2.65E-06	1.16E-05	AP-42 Table 1.4-3
Arsenic	2.0E-04	2.0E-07	9.18E-06	4.02E-05	1.23E-05	5.38E-05	1.56E-07	6.83E-07	AP-42 Table 1.4-3
Beryllium	1.2E-05	1.2E-08	5.51E-07	2.41E-06	7.37E-07	3.23E-06	9.36E-09	4.10E-08	AP-42 Table 1.4-3
Cadmium	1.1E-03	1.1E-06	5.05E-05	2.21E-04	6.76E-05	2.96E-04	8.58E-07	3.76E-06	AP-42 Table 1.4-3
Chromium	1.4E-03	1.4E-06	6.42E-05	2.81E-04	8.60E-05	3.77E-04	1.09E-06	4.78E-06	AP-42 Table 1.4-3
Cobalt	8.4E-05	8.2E-08	3.85E-06	1.69E-05	5.16E-06	2.26E-05	6.55E-08	2.87E-07	AP-42 Table 1.4-3
Manganese	3.8E-04	3.7E-07	1.74E-05	7.64E-05	2.34E-05	1.02E-04	2.96E-07	1.30E-06	AP-42 Table 1.4-3
Mercury	2.6E-04	2.5E-07	1.19E-05	5.22E-05	1.60E-05	7.00E-05	2.03E-07	8.88E-07	AP-42 Table 1.4-3
Nickel	2.1E-03	2.1E-06	9.63E-05	4.22E-04	1.29E-04	5.65E-04	1.64E-06	7.17E-06	AP-42 Table 1.4-3
Selenium	2.4E-05	2.4E-08	1.10E-06	4.82E-06	1.47E-06	6.46E-06	1.87E-08	8.20E-08	AP-42 Table 1.4-3
Total HAPs (including Pb)	--	--	--	0.38	--	0.51		6.45E-03	--

SO2 Mist (EAF, Preheaters, Dryers, Torches)
SO2 + 1/2 O2 = SO3
SO2 + H2O = H2SO4

M.W. SO2	64.1
M.W. SO3	80.1
M.W. H2SO4	98.1
*Percent SO2 to SO3 (%)	10%
*Percent SO3 to H2SO4 (%)	100.00%

SO2	SO2 converted to SO3	SO3 created	H2SO4 created	
(lb/hr)	(lb/hr)	(lb/hr)	(lb/hr)	
2.75E-02	2.75E-03	3.44E-03	4.21E-03	*vents to EP7*
3.76E-02	3.76E-03	4.70E-03	5.75E-03	*vents to EP9*
4.68E-04	4.68E-05	5.85E-05	7.16E-05	*vents to EP11*

*Assumes 10% of SO2 is converted to SO3 and 100% of SO3 is converted to H2SO4

13.0 Facility-wide total HAP emissions (after controls)

Hazardous Air Pollutants (HAPs)

	Emissions (tpy)															
Hazardous Air Pollutant	Dust Silo **EP05**	Dust Loadout **EP05**	Scrap Cutting **EP06**	EAF **EP07**	Natural Gas Combustion **EP07 & EP09**	Meltshop Uncaptured **EP08**	Caster **EP09**	Roll Mill **EP11**	Emergency Fire Pump **EP14**	Emergency Generator **EP15**	Emergency Generator **EP16**	Diesel Tank **EP21**	Diesel Tank **EP21**	Diesel Tank **EP21**	Gasoline Storage Tank **EP22**	Total
1,1,2,2-Tetrachloroethane									4.02E-06	3.41E-05	3.41E-05					7.23E-05
1,1,2-Trichloroethane									2.43E-06	2.71E-05	2.71E-05					5.67E-05
1,3-Butadiene								5.52E-03	1.05E-04	2.28E-04	2.28E-04					6.08E-03
1,3-Dichloropropene									2.02E-06	2.25E-05	2.25E-05					4.71E-05
1,4-Dioxane								7.45E-03								7.45E-03
2,2,4-Trimethylpentane										2.13E-04	2.13E-04				5.38E-03	5.80E-03
2-Methylnaphthalene			5.15E-08		1.13E-05	2.26E-07		8.20E-08		2.83E-05	2.83E-05	5.45E-06	5.45E-06	5.45E-06		8.46E-05
3-Methylcholanthrene			3.86E-09		8.46E-07	1.69E-08		6.15E-09								8.73E-07
7,12-Dimethylbenz(a)anthracene			3.44E-08		7.52E-06	1.50E-07		5.47E-08								7.76E-06
Acenaphthene			3.86E-09		8.46E-07	1.69E-08		6.15E-09		4.42E-06	1.07E-06					6.36E-06
Acenaphthylene			3.86E-09		8.46E-07	1.69E-08		6.15E-09		8.73E-06	4.72E-06					1.43E-05
Acetaldehyde								3.41E-01	4.44E-04	7.13E-03	7.13E-03					3.55E-01
Acetonitrile								2.20E-02								2.20E-02
Acrolein								1.42E-01	4.18E-04	4.38E-03	4.38E-03					1.51E-01
Anthracene			5.15E-09		1.13E-06	2.26E-08		8.20E-09		1.16E-06		2.78E-08	2.78E-08	2.78E-08		2.41E-06
Antimony	2.60E-05	1.97E-06		5.75E-03		6.08E-06	1.67E-05									5.80E-03
Arsenic	5.35E-06	4.05E-07	4.29E-07	1.18E-03	9.40E-05	3.15E-06	4.17E-06	6.83E-07								1.29E-03
Benz(a)anthracene			3.86E-09		8.46E-07	1.69E-08		6.15E-09		5.88E-07						1.46E-06
Benzene			4.51E-06		9.87E-04	1.97E-05		2.19E-02	2.51E-04	7.34E-04	3.75E-04				1.94E-03	2.62E-02
Benzo(a)pyrene			2.58E-09		5.64E-07	1.13E-08		4.10E-09		2.43E-07						8.25E-07
Benzo(e)pyrene										3.54E-07	3.54E-07					7.08E-07
Benzo(b)fluoranthene			3.86E-09		8.46E-07	1.69E-08		6.15E-09		1.05E-06	1.42E-07					2.06E-06
Benzo(g,h,i)perylene			2.58E-09		5.64E-07	1.13E-08		4.10E-09		5.26E-07	3.53E-07					1.46E-06
Benzo(k)fluoranthene			3.86E-09		8.46E-07	1.69E-08		6.15E-09		2.06E-07						1.08E-06
Beryllium			2.58E-08		5.64E-06	1.13E-07		4.10E-08								5.82E-06
Biphenyl										1.81E-04	1.81E-04					3.62E-04
Bromoform								2.62E-02								2.62E-02
Cadmium	2.34E-04	1.77E-05	2.36E-06	5.16E-02	5.17E-04	6.79E-05	2.98E-04	3.76E-06								5.27E-02
Carbon Disulfide								1.75E-01								1.75E-01
Carbon Tetrachloride								1.40E-02	2.81E-06	3.13E-05	3.13E-05					1.40E-02
Chlorobenzene									2.05E-06	2.59E-05	2.59E-05					5.39E-05
Chloroethane								7.91E-03								7.91E-03
Chloroform								1.91E-02	2.18E-06	2.43E-05	2.43E-05					1.92E-02
Chloromethane								2.47E-02								2.47E-02
Chromium	5.73E-04	4.34E-05	3.01E-06	1.27E-01	6.58E-04	4.21E-04	1.41E-02	4.78E-06								1.42E-01
Chrysene			3.86E-09		8.46E-07	1.69E-08		6.15E-09		1.45E-06	5.91E-07					2.91E-06
Cobalt	3.41E-06	2.58E-07	1.80E-07	7.52E-04	3.95E-05	1.53E-05	6.88E-04	2.87E-07								1.50E-03
Cumene															1.06E-04	1.06E-04
Dibenzo(a,h)anthracene			2.58E-09		5.64E-07	1.13E-08		4.10E-09		3.27E-07						9.09E-07
Dichlorobenzene			2.58E-06		5.64E-04	1.13E-05		4.10E-06								5.82E-04
Ethylbenzene								1.29E-02	3.94E-06	3.39E-05	3.39E-05				1.52E-03	1.44E-02
Ethylene Dibromide									3.39E-06	3.78E-05	3.78E-05					7.90E-05
Fluoranthene			6.44E-09		1.41E-06	2.82E-08		1.02E-08		3.81E-06	9.47E-07					6.21E-06
Fluorene			6.01E-09		1.32E-06	2.63E-08		9.57E-09		1.21E-05	4.84E-06	2.89E-07	2.89E-07	2.89E-07		1.92E-05
Formaldehyde			1.61E-04		3.53E-02	7.05E-04		2.56E-04	3.26E-03	4.50E-02	4.50E-02					1.30E-01
Hexane			3.86E-03		8.46E-01	1.69E-02		4.17E-01		9.47E-04	9.47E-04				2.75E-03	1.29E+00
Indeno(1,2,3-cd)pyrene			3.86E-09		8.46E-07	1.69E-08		6.15E-09		3.91E-07						1.26E-06
Lead	2.21E-03	1.67E-04	1.07E-06	7.38E-03	2.35E-04	2.50E-04	1.19E-02	1.71E-06								2.21E-02
m-/p-Xylenes								3.34E-02							6.08E-03	3.95E-02
Manganese	3.67E-03	2.78E-04	8.16E-07	8.11E-01	1.79E-04	5.88E-03	2.53E-01	1.30E-06								1.07E+00
Mercury	9.73E-07	7.36E-08	5.58E-07	2.15E-04	1.22E-04	2.70E-06	2.09E-06	8.88E-07								3.44E-04
Methanol								1.94E-01	4.87E-04	2.13E-03	2.13E-03					1.99E-01
Methyl Isobutyl Ketone								1.25E-02								1.25E-02
Methyl tert-butyl ether															8.36E-03	8.36E-03
Methylene Chloride								2.71E-01	6.55E-06	1.71E-05	1.71E-05					2.71E-01
Naphthalene			1.31E-06		2.87E-04	5.74E-06		1.27E-02	1.54E-04	1.23E-04	6.35E-05	3.34E-06	3.34E-06	3.34E-06		1.33E-02
Nickel	1.99E-05	1.51E-06	4.51E-06	4.41E-03	9.87E-04	1.05E-04	4.07E-03	7.17E-06								9.60E-03
o-Xylenes								1.49E-02							2.22E-03	1.71E-02
PAH									2.24E-05	2.29E-05	2.29E-05	5.12E-05	5.12E-05	5.12E-05		2.22E-04
Phenanthrene			3.65E-08		7.99E-06	1.60E-07		5.81E-08		3.86E-05	8.87E-06	3.17E-07	3.17E-07	3.17E-07		5.66E-05
Phenol										2.05E-05	2.05E-05					4.09E-05
Pyrene			1.07E-08		2.35E-06	4.70E-08		1.71E-08		3.51E-06	1.16E-06	3.56E-07	3.56E-07	3.56E-07		8.16E-06
Selenium	4.87E-07	3.68E-08	5.15E-08	1.07E-04	1.13E-05	9.59E-07	3.13E-05	8.20E-08								1.52E-04
Styrene								9.46E-03	1.89E-06	2.01E-05	2.01E-05				1.47E-04	9.65E-03
Tetrachloroethane										2.12E-06	2.12E-06					4.23E-06
Toluene			7.30E-06		1.60E-03	3.20E-05		6.64E-02	8.87E-05	3.48E-04	3.48E-04				8.70E-03	7.75E-02
Trichloroethene								1.19E-02								1.19E-02
Vinyl Chloride									1.14E-06	1.27E-05	1.27E-05					2.66E-05
Xylene									3.10E-05	1.82E-04	1.57E-04					3.70E-04
Total HAPs																**4.25**

Appendix 2: Control Method Explanations

In order to avoid lengthy repetition when discussing the control methods identified in Section 4.2, the various control methods identified as BACT candidates are listed here.

The control methods are listed in alphabetical order. Refer to Section 4.2 of the application review for discussion of how these control methods apply to the emission sources at this proposed facility.

1) Biofiltration

"Biofiltration is an air pollution control technology in which exhaust gases containing biodegradable organic compounds are vented, under controlled temperature and humidity, through a biologically active material. The microorganisms contained in the bed of compost like material digest or biodegrade the organics to CO_2 and water. This technology has been successfully applied in full-scale applications to control odors, VOC, and air toxic emissions from a range of industrial and public-sector sources. However, biofilters are limited to organic concentrations of approximately 1,000 ppm or less. Biofiltration can provide significant economic advantages over other air pollution control technologies if applied to exhaust streams that contain readily biodegradable pollutants in low concentrations… A limiting parameter of a biofilter is its operating temperature. The maximum operating temperature of biofilters is approximately 100°F due to the requirements of the microorganisms that comprise the biofilter" (Application at Appendix F, page 2-28).

2) Carbon adsorption

Carbon adsorption systems can potentially be used to remove VOC from exhaust gas streams. The core component of a carbon adsorption system is an activated carbon bed contained in a steel vessel. The VOC-laden gas passes through the carbon bed where the VOC is adsorbed on the activated carbon. The cleaned gas is discharged to the atmosphere. The spent carbon is regenerated either at an on-site regeneration facility or by an off-site activated carbon supplier. Spent carbon is regenerated by using steam to displace adsorbed organic compounds at high temperatures. Carbon adsorption is not recommended for exhaust streams with greater than 50 percent relative humidity and temperatures greater than 150 °F.

3) Catalytic oxidizers (a.k.a. catalytic incinerators)

"Catalytic incinerators operate very similar to thermal/recuperative incinerators, with the primary difference that the gas, after passing through the flame area, passes through a catalyst bed. The catalyst has the effect of increasing the oxidation reaction rate, enabling conversion at lower reaction temperatures than in thermal incinerator units. Catalysts, therefore, also allow for smaller incinerator size… Particulate matter can rapidly coat the catalyst so that the catalyst active sites are prevented from aiding in the oxidation of pollutants in the gas stream. This effect of PM on the catalyst is called blinding, and will deactivate the catalyst over time. Because essentially all the active surface of the catalyst is contained in relatively small pores, the PM need not be large to blind the catalyst" (EPA-CICA Fact Sheet: Catalytic Incinerator [EPA-452/F-03/018], page 4)

4) Condenser

"Condensers convert a gas or vapor stream to a liquid, allowing the organics within the stream to be recovered, refined, or reused and preventing the release of organic streams into the ambient air. Condensers are relatively inexpensive devices that typically use water or air to cool and condense the vapor stream. Condensers are typically used as pretreatment devices. Condensers are generally not capable of reaching temperatures below 100°F. High removal rates of gaseous pollutants are generally not possible unless the vapors will condense at high temperatures… Large quantities of particulate in the exhaust stream will increase fouling leading to excessive maintenance requirements and decreased efficiency. Furthermore, low concentrations of VOCs in the exhaust stream results in partial pressures of the VOCs that are too low for condensation to occur, resulting in low removal efficiencies and high energy usages" (Application at Appendix F, page 2-29).

5) Cyclones

"Cyclones use inertia to remove particles from the gas stream. The cyclone imparts centrifugal force on the gas stream, usually within a conical shaped chamber. Cyclones operate by creating a double vortex inside the cyclone body. The incoming gas is forced into circular motion down the cyclone near the inner surface of the cyclone tube. At the bottom of the cyclone, the gas turns and spirals up through the center of the tube and out of the top of the cyclone (AWMA, 1992).

"Particles in the gas stream are forced toward the cyclone walls by the centrifugal force of the spinning gas but are opposed by the fluid drag force of the gas traveling through and out of the cyclone. For large particles, inertial momentum overcomes the fluid drag force so that the particles reach the cyclone walls and are collected. For small particles, the fluid drag force overwhelms the inertial momentum and causes these particles to leave the cyclone with the exiting gas" (EPA-CICA Fact Sheet: Cyclones [EPA-452/F-03-005], page 3).

6) Direct Evacuation Control (DEC)

"The EAF is comprised of bottom, sidewall, and roof sections. Each shell bottom is lined with refractory and is equipped with a sump burner for preheating the shell. The furnace bottom also contains the tap hole through which the molten steel will be drained into waiting ladles. This hole is typically plugged with free-flowing sand during the melting process. The roof section has a precast refractory section known as a delta ring containing three holes for each of the three electrodes. Another hole in the roof, the fourth hole, connects the DEC system to the EAF. Furnace gases are evacuated to the emission control system through the fourth hole." (Application at Appendix F, page 2-9)

"The hot CO-laden exit the conventional furnace through the fourth hole direct evacuation control (DEC), where air is inspired by the negative draft at the gap and high CO destruction efficiency is provided by the high temperature and violent mixing of the gases and air" (Application at Appendix F, page 2-16).

7) Electrostatic precipitation (ESP)

"An ESP is a particulate control device that uses electrical forces to move particles entrained within an exhaust stream onto collector plates. The entrained particles are given an electrical charge when they pass through a corona, a region where gaseous ions flow. Electrodes in the center of the flow lane are maintained at high voltage and generate the electrical field that forces the particles to the collector walls" (EPA-CICA Fact Sheet: Dry Electrostatic Precipitator (ESP) [EPA-452/F-03-028], page 3).

There are two general types of ESPs: wet and dry. The general method operation is the same for both types. The application claims, with regards to the EAF, "Particulate emissions from the EAF contain significant amounts of iron oxide which, due to its magnetic properties, interferes with the mechanical removal of the particles from the plates, thereby reducing control efficiency" (Application at Appendix F, page 2-19).

8) EM_x NO_x Control

"EmeraChem's EM_x NO_x control has been effectively employed on gas turbines for control of NO_x, as well as other gaseous pollutants and particulate matter. However, gas turbines generally have steady-state exhaust flow with a consistent temperature range that allows for proper catalytic control. By contrast, the EAF exhaust stream characteristics are highly variable, and the temperature fluctuations would prevent the catalyst from effectively controlling emissions. Additionally, the highly dense particulate loading in an EAF exhaust stream is orders of magnitude greater than the particulate loading of a gas turbine exhaust stream, which would cause plugging and fouling of the catalyst" (Application at Appendix F, page 2-11).

9) Fabric Filters (a.k.a. "baghouses")

"Fabric filters, also known as "baghouses," remove particulate by passing the gas stream through porous fabric filters (bags) which trap the particles on the fabric. The particles collect on the fabric filters, forming a porous dust cake layer which results in a high collection efficiency, even for smaller particles" (Application at Appendix F, page 2-18).

"Practical application of fabric filters requires the use of a large fabric area in order to avoid an unacceptable pressure drop across the fabric. Baghouse size for a particular unit is determined by the choice of air-to-cloth ratio, or the ratio of volumetric air flow to cloth area. The selection of air-to-cloth ratio depends on the particulate loading and characteristics, and the cleaning method used. A high particulate loading will require the use of a larger baghouse in order to avoid forming too heavy a dust cake, which would result in an excessive pressure drop" (EPA-CICA Fact Sheet: Fabric Filter [EPA-452/F-03-024], page 4).

10) Flue gas desulfurization (FGD)

"The FGD or SO_2 scrubbing process typically uses a calcium or sodium based alkaline reagent. The reagent is injected in the flue gas in a spray tower or directly into the duct. The SO_2 is absorbed, neutralized and/or oxidized by the alkaline reagent into a solid compound, either calcium or sodium sulfate. The solid is removed from the waste gas stream using downstream equipment" (EPA-CICA Fact Sheet: Flue Gas Desulfurization [EPA-452/F-03-034], page 3). According to the EPA-CICA Fact Sheet, the temperature of the inlet gas must be at the very least 150 °C, depending on the specific type of FGD employed.

The application offers additional information regarding FGD: "FGDs differ from the wet scrubbing technology described above in that FGD technology is based on using an alkaline reagent to absorb and react with SO_2 to produce a solid compound, which is later removed with particulate controls" (Application at Appendix F, page 2-23).

11) Good combustion and process operation

The results of combustion can be improved, and emissions from combustion reduced, through good management and operating practices. These practices can include operator training, following manufacturer's recommendations, and performing regular maintenance and tune-ups.

12) Low-sulfur carbon-based feed and charge material (charge substitution)

This method of SO_2 control applies only to the EAF. SO_2 emissions are directly related to the amount of sulfur charged to the EAF. Therefore, the facility could charge materials with lower sulfur content in order to meet an emission limit.

13) Low-NOx burners

"Low NOx combustion controls consist of strategies to reduce the formation of NOx either by cooling the flame temperature or limiting the amount of oxygen to form NOx. These strategies include overfire air (OFA), low excess air (LEA), and flue gas recirculation (FGR). These methods of control are commonly used on boilers having a steady-state exhaust flow, controllable fuel/air flows, and a generally consistent temperature range" (Application Appendix F, page 2-9). Low-NOx burners are generally not practical in situations where extremely high temperatures is the goal of the operation, such as in a furnace or for cutting torches.

14) Non-selective catalytic reduction (NSCR)

"NSCR employs a catalyst (typically platinum/rhodium) to reduce NOx to nitrogen and water. NSCR has been effectively used on automobiles and reciprocating engines in fuel-rich mode with very low oxygen levels. Proper operation of NSCR requires the fuel/air ratio be at or close to stoichiometric proportions" (Application at Appendix F, page 2-11). According to the application, in the context of controlling NOx emissions from an electric arc furnace, a particulate-laden exhaust would plug any catalyst.

15) Oxy-Fuel Burners

"Oxy-fired burners achieve combustion using oxygen rather than air, which reduces nitrogen levels in the furnace. The lower nitrogen levels result in a reduction in NOx emissions" (Application at Appendix F, page 2-9). "These burners increase the effective capacity of the furnace by increasing the speed of the melt and reducing the consumption of electricity and electrode material, both which reduce emissions of greenhouse gases. The use of oxy-fuels also increases heat transfer, reduces heat losses, reduces electrode consumption and reduces tap-to-tap time. It also helps to remove different elements from the steel bath, like phosphorous, silicon and carbon" (Application at Appendix F, page 2-32).

Note that this method requires a supply of pure oxygen for combustion.

16) SCONOx™

"The SCONOx™ system is an add-on control device that reduces multiple pollutants. The SCONOx™ system utilizes a single catalyst for the conversion of CO, VOC, and NOx emissions into CO_2, water, and nitrogen gas. The system does not use ammonia and operates most effectively at temperatures ranging from 300°F to 700°F. The SCONOx™ system requires natural gas, water, steam, electricity and ambient air to operate, and no special chemicals or processes are necessary. Steam is used periodically to regenerate the catalyst bed and is an integral part of the process" (Application at Appendix F, page 2-12).

17) Scrap management plan

Nucor will receive various kinds of scrap metal from various sources. GACT Subpart YYYY requires Nucor to develop a "pollution prevention plan" (a.k.a. a scrap management plan) in order to reduce the amount of plastics, oils, and other contaminants being charged to the EAF. If such materials were changed to the EAF, they would quickly volatilize and be emitted as VOC.

18) Selective Catalytic Reduction (SCR)

"The SCR process chemically reduces the NOx molecule into molecular nitrogen and water vapor. A nitrogen based reagent such as ammonia or urea is injected into the ductwork, downstream of the combustion unit. The waste gas mixes with the reagent and enters a reactor module containing catalyst. The hot flue gas and reagent diffuse through the catalyst. The reagent reacts selectively with the NOx within a specific temperature range and in the presence of the catalyst and oxygen…The catalyst is composed of active metals or ceramics with a highly porous structure. Catalysts configurations are generally ceramic honeycomb and pleated metal plate (monolith) designs. The catalyst composition, type, and physical properties affect performance, reliability, catalyst quantity required, and cost. The SCR system supplier and catalyst supplier generally guarantee the catalyst life and performance." (EPA-CICA Fact Sheet: Selective Catalytic Reduction [EPA-452/F-03-032], page 3).

The EPA-CICA Fact Sheet also notes that the catalyst can be deactivated by "blinding/plugging/fouling of active sites by ammonia-sulfur salts and particulate matter," and that "SCR may be applied after PM and sulfur removal equipment (cold-side), however, reheating of the flue gas may be required, which significantly increases the operational costs."

19) Selective Non-Catalytic Reduction (SNCR)

"SNCR is based on the chemical reduction of the NOx molecule into molecular nitrogen (N_2) and water vapor (H_2O). A nitrogen based reducing agent (reagent), such as ammonia or urea, is injected into the post combustion flue gas. The reduction reaction with NOx is favored over other chemical reaction processes at temperatures ranging between 1600°F and 2100°F (870°C to 1150°C), therefore, it is considered a selective chemical process" (EPA-CICA Fact Sheet: Selective Non-Catalytic Reduction [EPA-452/F-03-031], page 2).

20) Thermal oxidizers

"Incineration, or thermal oxidation is the process of oxidizing combustible materials by raising the temperature of the material above its auto-ignition point in the presence of oxygen, and maintaining it at high temperature for sufficient time to complete combustion to carbon dioxide and water… It is the temperature at which the combustion reaction rate exceeds the rate of heat losses, thereby raising the temperature of the gases to some higher value. Thus, any organic/air mixture will ignite if its temperature is raised to a sufficiently high level… Incinerators, in general, are not recommended for controlling gases containing halogen- or sulfur-containing compounds because of the formation of highly corrosive acid gases" (EPA-CICA Fact Sheet: Thermal Incinerator [EPA-452/F-03-022], page 4 and 5).

Note that in addition to the simple thermal incinerator (a.k.a. thermal oxidizer) described in the EPA-CICA Fact Sheet, there also exist "regenerative" thermal oxidizers. These systems are designed to retain some amount of the heat generated by oxidation, thereby reducing the need for additional heat input. However, the basic principles of operation remain the same.

21) Wet scrubbers

In general, wet scrubbers control particulate by forcing a particulate-laden gas stream to interact with a scrubbing liquid (often water) that absorbs the particulate. There are several approaches to accomplish this; common methods are packed bed/tower, which uses several beds of media and liquid, and venturi, which forces the gas stream along with a scrubbing liquid through a venturi nozzle.

Wet scrubbers can also be used to absorb gaseous organic compounds, provided those compounds are soluble in the scrubbing liquid.

Wet scrubbers can also be used to absorb a pollutant through a chemical reaction. For example, a wet scrubber can, in theory, control SO_2 emissions (The exhaust gas is scrubbed with a 5 percent to 15 percent slurry, composed of lime (CaO) or limestone ($CaCO_3$) in suspension. The SO_2 in the exhaust gas reacts with the CaO or $CaCO_3$ to form calcium sulfite ($CaCO_3$) and calcium sulfate ($CaSO_4$). The scrubbing liquor is continuously recycled to the scrubbing tower after fresh CaO or $CaCO_3$ has been added" (Application at Appendix F, page 2-22).

22) XONON™

"The XONON™ system controls NOx emissions by preventing their formation. The key to the XONON™ system is the utilization of a chemical process versus a flame to combust fuel, thus limiting temperature and NOx formation. The XONON™ system is an integral part of the combustor. The fuel and air that are supplied to the combustor are thoroughly mixed before entering the catalyst. The catalyst is responsible for combusting the fuel to release its energy… XONON™ has only been reviewed for use on combustion turbines. Currently, the XONON™ system has not had wide-scale application. It has been demonstrated on a 1.5 MW combustion turbine unit in California, with the unit operating in a base load capacity" (Application at Appendix F, 2-12).

Appendix 3: Application Correspondence

Emails referenced in the preliminary determination are attached here. In certain cases, the formatting has been changed to either fit the format of this document, or to clarify what text was added by Nucor.

October 3, 2022

From: Way, Matt (NSLX) <matt.way@nucor.com>
Sent: Monday, October 3, 2022 2:13 PM
To: Braswell, Russell
Cc: Morrow, Corey (NSAR)
Subject: [External] Re: Followup questions for Nucor Lexington

Russell,

Please see my responses to your questions below in blue. Please let me know if you have further questions or give me a call to discuss if needed.

1. Scrap mix (referenced several times throughout appendix G)
   The BACT determination for the EAF mentions several times that BACT limits from several other facilities are not comparable due to a different scrap mix. Can you explain exactly how the planned scrap mix for Lexington (as described in the project description) is different from these other facilities, and why the different scrap mix can justify a higher BACT for SO2, CO, and VOC?

   Note that I have not seen any add-on control devices for these pollutants (nor am I proposing any) when looking at other facilities. I'm just trying to get a better understanding of why Nucor Lexington will be so different for these pollutants.
   The Nucor Lexington mill will produce construction-grade rebar which uses a scrap mix that has been optimized to produce rebar. The scrap mix used for construction-grade rebar is considered obsolete scrap that potentially contains residuals which can result in higher emissions of VOCs, SO2, and CO. Mills producing higher value products require a prime scrap mix with less residuals, and thus lower emissions, than what will be produced at and emitted by the Nucor Lexington mill.

2. Fluorides from Meltshop Baghouse (pg 6 of appendix E)
   The application calculates fluoride emissions from the furnace based on "experience at other Nucor facilities." Does this mean emission testing? If so, when/where was the testing performed?
   How did the scrap and additive mix at those other facilities impact fluoride emissions?
   The fluoride emission factor is based off testing at a similar Nucor micro-mill using a similar scrap and additive mix. To account for potential variability, a conservative factor has been added based on an engineering estimate.

3. PM emissions from Caster (pg 11 of appendix E):
   The application states PM emission factors were developed based on production operations at Nucor SC. Does this mean emission testing? If so, are the casting operations at the SC facility equivalent to the proposed operations at Lexington? Given that there is no Caster Hood planned for this facility, is this comparison still valid?
   Quantifying emissions from the caster is difficult. To better understand emissions from the caster, Nucor conducted an engineering study to quantify uncaptured emissions from the caster at Nucor SC. Since there is no hood at Nucor Lexington, the uncaptured emission rate is converted to a total emission factor using a capture efficiency of 98%. Nucor believes this is the best available data to represent emissions from the caster. Furthermore, Nucor SC is a much larger facility (500 tph) than Nucor Lexington (80 tph), and thus, represents a conservative estimate.

Thank you,

Matt Way Environmental Manager

October 24, 2022

[letter to] Christopher Howard [via email]
Environmental Protection Agency
Atlanta Federal Center
61 Forsyth Street, SW
Atlanta, GA 30303-3104
Howard.Chris@epa.gov

Re: EPA Region 4 Comments on Nucor Lexington PSD Modeling
Nucor Steel – Lexington
Lexington, Davidson County, NC
Facility ID: 2900384
Application ID 2900394.22A

Dear Mr. Howard:
In response to your email dated October 12, 2022, Nucor Steel Lexington – A Division of Nucor Corporation (Nucor Lexington) submits the following information related to the Nucor Lexington Prevention of Significant Deterioration (PSD) Modeling performed in support of the PSD Air Construction Permit Application (Application) for the new steel micro mill located in Lexington, North Carolina. Nucor's response follows each of the 4 comments received below:

<u>Section 3.1.3 – Source Descriptions</u>

- ***<u>Comment #1</u>*** *- Table B-2 of the July 2022 PSD Air Dispersion Modeling Report lists the PTE short-term emission rates that were modeled. The table lists the short-term PTE for SO2 for the Melt Shop Baghouse as 40 pounds per hour. The table lists the short-term PTE for NOx for the Melt Shop Baghouse as 28.6 pounds per hour. Table 1-2 of the July 2022 PSD Permit Application lists proposed permit limits for the various proposed sources and applicable pollutants. The proposed permit limits for SO2 and NOx listed in Table 1-2 for the Melt Shop Baghouse are the same as the value modeled for SO2 and slightly less than the value modeled for NOx. Table 1-2 of the PSD permit application also indicates that the proposed SO2 and NOx permit limits for the Melt Shop Baghouse will be based on a 30-day rolling average. To be consistent with the 1-hour NAAQS for SO2 and NOx, the permitted emissions limits for the Melt Shop Baghouse for SO2 and NOx should be based on a 1-hour average (see paragraph 9.2.3.1 of 40 CFR Appendix W). Alternatively, documentation may be provided to demonstrate that the emission rates modeled for SO2 and NOx are consistent with paragraph 8.2.2(c) and Table 8-2 of 40 CFR Appendix W.*

In response to the comment relating to the use of a 30-day averaging period for SO2 and NOx in lieu of a 1-hour averaging period, Nucor finds the use of a 30-day averaging period is an appropriate averaging period and is protective of the SO2 and NOx NAAQS.

The U.S. Environmental Protection Agency (EPA) guidance and regulations allow for the use of 30-day periods for emission rates and production limits. In a Consent Decree between the EPA and Virginia Electric and Power Company1[1], compliance demonstrations are based on 30-day rolling average emission rates. Furthermore, compliance demonstrations with operating parameters, concentration-based emission limits, and emission limits for various New Source Performance Standards (NSPS) are based on 30-day rolling average periods, such as that reflected in the definition of "rolling average" in 40 CFR 60.61 (Subpart F), as well as methods for demonstrating compliance with emissions standards for fuel-fired/steam generating unit NSPSs (40 CFR 60, Subparts D, Da, Db, and Dc).

As demonstrated in the submitted modeling analysis, the maximum model-predicted contribution of all Nucor and off-site sources for 1-hour SO2 concentrations was 15.5 µg/m3, which along with the ambient background concentration of 10.5 µg/m3 totaled 25.9 µg/m3 or 13% of the 1-hour SO2 NAAQS. Even with a modeled emission rate 10 times higher (~400 lb/hr) at the melt shop baghouse, there would be an ample safety margin under the standard (155 µg/m3 + 10.5 µg/m3 = 165.5 µg/m3 or 84.4% of the NAAQS). As such, a 30-day rolling limit at 40.03 lb/hr will be sufficiently protective of the 1-hour SO2 NAAQS.

[1] https://www.deq.virginia.gov/home/showpublisheddocument/1485/637399092948000000

Similarly, for 1-hour NO2, the maximum model-predicted concentrations were 29.1 $\mu g/m^3$ plus an ambient background of 60.2 $\mu g/m^3$ for a total of 89.3 $\mu g/m^3$,or 48% of the 1-hour NO2 NAAQS. However, the maximum contribution of the melt shop baghouse anywhere on the grid (the maxima does not coincide with the highest overall concentrations) was 9.0 $\mu g/m^3$. Thus, modeling could support a modeled emission rate more than 10 times higher than the 28.58 $\mu g/m^3$ modeled and still be under the standard (90 $\mu g/ m^3$+ 20.1 $\mu g/ m^3$ + 60.2 $\mu g/ m^3$ = 170.3 $\mu g/m^3$ or 91% of the 1-hour NO2 NAAQS). As such, a 30-day rolling limit at 28.58 lb/hr will be sufficiently protective of the 1-hour NO2 NAAQS.

<u>Section 4.2 Ambient Air Quality Standards</u>

- ***<u>Comment #2</u>*** *- Table 4-1 lists a Significant Impact Level (SIL) for 1-hour NO2 (10 µg/m3) that is different from the interim SIL recommended by EPA (7.5 µg/m3) in the June 28, 2010, "**General Guidance for Implementing the 1-hour N02 National Ambient Air Quality Standard in Prevention of Significant Deterioration Permits, Including an Interim 1-hour N02 Significant Impact Level".** As this guidance indicates, states may elect to use another value that they believe is appropriate. The guidance further states that the application of any SIL that is not reflected in a promulgated regulation should be supported by a record in each instance that shows the value represents a de minimis impact on the 1-hour N02 standard, as described in the referenced June 28, 2010, memo.*

- ***<u>Comment #3</u>*** *- Table 4-1 lists a Significant Impact Level (SIL) for 1-hour SO2 (10 $\mu g/m^3$) that is different from the interim SIL recommended by EPA (7.8 $\mu g/m^3$) in the August 23, 2010, memorandum from Anna Marie Wood "**General Guidance for Implementing the 1-hour SO2 NAAQS in PSD Permits, Including an Interim 1-hour SO2 Significant Impact Level**". As this guidance indicates, states may elect to use another value that they believe is appropriate. The guidance further states that the application of any SIL that is not reflected in a promulgated regulation should be supported by a record in each instance that shows the value represents a de minimis impact on the 1-hour S02 standard, as described in the referenced August 23, 2010, memo.*

Related to both Comment #2 and Comment #3: NCDEQ adopted their SIL's for the 1-hour SO2 and NO2 National Ambient Air Quality Standards (NAAQS) on June 7th, and May 25th, 2010, respectively[2,3]. The adopted SIL's were initially developed by Northeast States for Coordinated Air Use Management (NESCAUM) as outlined in "NESCAUM Recommendations on the Use of an Interim Significant Impact Level (SIL) in Modeling the 1-Hour NO_2 NAAQS".[4]

<u>Section 4.4 – Receptor Grids</u>

- ***<u>Comment #4</u>*** *- We request additional justification regarding how ambient air was determined for the purpose of receptor placement along any unfenced areas of the facility's property boundary. Ambient air should be determined in a manner consistent with EPA's ambient air policy dated December 2, 2019.*

Nucor will install fencing around the entire extent modeled area as the ambient air barrier. Public access to the property will be prohibited at all points around the perimeter of the property.
Please contact Matt Way (903-241-6116, matt.way@nucor.com) or Jessica Morrison (603-793-8696, jmorrison@burnsmcd.com) if you have any questions or require additional information.

Thank you,
[signed]
Matt Way
Environmental Manager
Nucor Steel Lexington

[2] https://deq.nc.gov/water-quality/chemistry-lab/certification/memos/interim-1-hr-so2-sil/download
[3] https://deq.nc.gov/water-quality/chemistry-lab/certification/memos/interim-1-hr-no2-sil/download
[4] https://www.nescaum.org/documents/nescaum-no2-sil-guidance-4_21_10-revised.pdf

November 18, 2022

From: Way, Matt (NSLX) <matt.way@nucor.com>
Sent: Friday, November 18, 2022 8:46 AM
To: Braswell, Russell
Subject: [External] Re: Concerns regarding the BACT determination for Nucor Lexington

Good morning Russell,

Fluoride emissions were conservatively estimated based on Nucor Sedalia. Nucor Lexington agrees with NCDAQ that a PSD avoidance limit would be appropriate. As such, Nucor requests a fluoride emission limit of less than 3 tons per year. Additionally, Nucor Lexington will use fluoride containing material in various areas of the steel making process. All potential fluoride emissions from the use of fluoride containing materials are considered in the estimated emissions discussed above.

In regard to your questions pertaining to the BACT determinations, Nucor Sedalia and Nucor Florida were the first micro mills constructed and operated by Nucor, and both micro mills use a continuous/endless charging system. As such, the BACT analysis evaluated the micro mills and the continuous charging system. Nucor Lexington will be the first bucket-charge micro mill. Based on Nucor's experience operating the two continuous charge micro mills, Nucor determines the emission profile of the facilities is dependent on the type of product produced and size of the mill. Therefore, Nucor concludes that the most representative emission rates and BACT determinations are those of other micro mills. Nucor modeled emission rates based on the BACT determination which demonstrated compliance and protection of the NAAQs.

Please let me know if you have and further questions.

Thank you,

Matt Way
Environmental Manager
Cell: 903.241.6116

December 9, 2022

From: Way, Matt (NSLX) <matt.way@nucor.com>
Sent: Friday, December 9, 2022 5:06 PM
To: Braswell, Russell
Cc: Morrow, Corey (NSAR)
Subject: Re: [External] Re: Concerns regarding the BACT determination for Nucor Lexington

Good afternoon Russell,

Please see my responses below in blue. Please let me know if you have any questions during your review.

1. For the Melt Shop Baghouse, the application proposes the following BACT limit: PM (filterable plus condensable) = 0.0052 gr/dscf
   Given that CMC Steel Oklahoma (referenced within the application) has accepted a PM (filterable plus condensable) limit of 0.0024 gr/dscf, shouldn't that value be the BACT limit?
   Nucor Lexington proposes the 0.0024 gr/dscf as the PM10/PM2.5 (filterable plus condensable) BACT rate, as reflected in the BACT summary table. Consistent with the Nucor Lexington application, CMC Steel Oklahoma accepted a BACT limit of 0.0024 gr/dscf for PM10/PM2.5 (filterable plus condensable). Nucor Lexington is proposing a total PM (filterable plus condensable) limit of 0.0052 gr/dscf, which is the minimum emission rate required by NSPS, 40 CFR 60, Subpart AAa. Recently permitted mini mills PM BACT limits for EAFs do not include filterable plus condensable emissions, since the definition of PM in most states is measured by Method 5 only (filterable emissions). Based on Nucor's prior experience at their facilities, a total PM limit (filterable plus condensable in accordance with 15A 02D .0530(b)(5)) of 0.0052 gr/dscf is proposed.

2. Regarding the scrap preheating and continuous charging:
   I'm trying to get a better understanding of Nucor's transition away from the continuous charging process for the micro mills. I want to be clear: I am not proposing Nucor Lexington be a continuous process. This information is only to support the BACT analysis.

   Regarding shaft preheating, the application states that the Nucor plant in Kingman, AZ experienced high CO emissions and explosions as a result of the scrap preheating system. It looks like Nucor plans to construct a new melt shop at that facility (https://www.azcommerce.com/news-events/news/2022/8/nucor-announces-100-million-steel-production-facility-expansion-in-kingman/) with a similar capacity and product to Lexington. Do you know if the new Kingman melt shop will also have a bucket-charge EAF?
   The Nucor Kingman facility will be a bucket-charge shop. Scrap charges at Nucor Kingman will be approximately 60 tons compared to 45 tons at Lexington.

   Regarding shaft preheating, the application states: "Several other steel plants that originally installed shaft furnaces have converted to other means of scrap preheating other than the shaft furnace technique." Do you know of any specific examples of facilities converting away from this preheating method?
   Shaft preheating has gone to the wayside for preferred scrap charging methods such as bucket charging. The main drivers for conversion/modification away from shaft furnaces was increased emissions along with operational costs associated with the shaft furnace. Kingman's previous owner, North Star Steel, mothballed the shaft furnace EAF in the past, and Nucor Kingman will be installing a bucket charge shop. In addition, Gerdau in Petersburg, VA is an EAF melt shop that converted from a shaft furnace to a bucket charge scrap delivery system.

   According to Florida's review of the Frostproof facility, the scrap preheating system results in higher efficiency and therefore lower GHG emissions. Can you confirm that Nucor believes the proposed GHG BACT limit is still achievable without a scrap preheating system?
   Correct, Nucor Lexington determines its GHG BACT limit is achievable.

3. For the BACT limit for the cooling towers, the application proposes a BACT limit of 0.001% drift. Why is the BACT limit from Nucor Arkansas (0.0005%) not achievable here? The application explains that the BACT limit from CMC Mesa is not a fair comparison because it is located in a PM nonattainment area, but does not address Nucor Arkansas's lower limit.
The 0.0005% drift is one of the most stringent BACT rates for cooling towers typically seen at large power plants and steel mills with high water flow and many cells. The Nucor Arkansas facility is a larger facility than Nucor Lexington with larger cooling towers with more cells and higher flow rates. The smaller cooling towers at Nucor Lexington would require substantial changes in tower design and substantial costs for an incremental improvement. As summarized in the BACT analysis and RBLC tables, the 0.001% drift is an appropriate BACT rate for cooling towers of this size.

4. For the BACT limits for the NG-fired preheaters and skull cutting, the application states: "the NOx BACT for natural gas combustion is proposed to be 0.05 lb/MMBtu except for units where low NOx burners can only achieve 0.1 lb/MMBtu." Based on the similar operations at Frostproof and Sedalia, can you provide more specifics as to which of these NG-fired preheaters are expected to use low NOx burners?
The preheaters and dryers in EP-7 and EP-9 are expected to use low-NOx burners.

5. Below is my draft equipment list with emission source and control device IDs. I will be using this as I draft the permit. Please review this list and let me know if there are any necessary changes. This will hopefully save us some time when reviewing the initial draft of the permit.

Emission Source ID No.	Emission Source Description	Control Device ID No.	Control Device Description	*Update Notes*
Melt Shop (ES-1)				
ES-1-1 **NSPS AAa, GACT YYYYY, PSD BACT**	Electric arc furnace (EAF) equipped with direct evacuation control (DEC) and oxy-fuel burners *and EAF service cutting torches* (46.74 million Btu per hour maximum heat input)	CD-7	Melt Shop Baghouse	*Added service cutting torches which are included in the maximum heat input.*
ES-1-2 **PSD BACT**	Ladle metallurgy furnace (LMF)			*No change*
ES-1-3 **PSD BACT**	EAF refractory dumping and repair			*No change*
ES-1-4 **PSD BACT**	Slag dumping and slag pit			*No change*
ES-1-X ***PSD BACT***	*Melt shop material transfers*			*This is an activity which contributes to the melt shop baghouse emissions. See, emissions calculations Melt Shop Baghouse EP07 worksheet.*
ES-1-5 **NSPS AAa, GACT YYYYY, PSD BACT**	Melt shop fugitives	NA	NA	*No change*

Emission Source ID No.	Emission Source Description	Control Device ID No.	Control Device Description	*Update Notes*
ES-1-6 **PSD BACT**	Natural gas-fired nozzle preheater, equipped with a low NOx burner (0.05 million Btu per hour maximum heat input)	NA	NA	*The service cutting torches were included in the heat input from ES-1-1. The 0.05 MMBtu/hr heat input applies to the preheater.*
Casting Operations (ES-2)				
ES-2-1 **PSD BACT**	Caster	NA	NA	*No change*
ES-2-2 **PSD BACT**	Ladle and tundish refractory dumping and repair	NA	NA	*No change*
ES-2-3 **PSD BACT**	Natural gas-fired burners for ladle/tundish drying, ladle/tundish preheaters, each equipped with low-NOx burners, *and service cutting torches* (62.68 million Btu per hour total heat input capacity)	NA	NA	*Service cutting torches do not have low-NOx burners.*
ES-3 **PSD BACT**	Water spray chamber below caster and caster spray stack	NA	NA	*No change*
Rolling Operations (ES-4)				
ES-4-1 **PSD BACT**	Rolling Mill	NA	NA	*No change*
ES-4-2 **PSD BACT**	Natural gas-fired service cutting torches in the Rolling Mill (0.8 million Btu per hour maximum total heat input)	NA	NA	*Removed burners and reference to low NOx burners.*
ES-5 **PSD BACT**	Natural gas-fired torches for scrap cutting and skull cutting *(0.5 million Btu per hour maximum total heat input)*	NA	NA	*Removed reference to low NOx burners. Added maximum heat input.*
Cooling Towers (ES-6)				
ES-6-1 **PSD BACT**	Cooling tower (non-contact)	CD-12	Drift eliminators	*No change*
ES-6-2 **PSD BACT**	Cooling tower (contact)	CD-13	Drift eliminators	*No change*
Silos (ES-7)				
ES-7-1 **PSD BACT**	Two silos (carbon storage)	CD-3	Bin vent filter	*No change*
ES-7-2 **PSD BACT**	Two silos (flux storage)	CD-4	Bin vent filer	*No change*
ES-7-3 **NSPS AAa, PSD BACT**	Baghouse dust silo and enclosed dust loadout	CD-5	Bin vent filter (silo)	*Added silo to clarify bin vent filter is for the silo*

Emission Source ID No.	Emission Source Description	Control Device ID No.	Control Device Description	*Update Notes*
Material handling (ES-8)				
ES-8-1 **PSD BACT**	Scrap handling and storage in an open pile and a pile enclosed on two sides	NA	NA	*No change*
ES-8-2 **PSD BACT**	Alloy handling and storage pile *area* enclosed on three sides	NA	NA	*This is a pile area.*
ES-8-3 **PSD BACT**	Slag and mill scale handling, pile, and processing	NA	NA	*No change*
~~*ES-8-4*~~ ~~***PSD BACT***~~	~~*Natural gas-fired cutting torches for scrap cutting (0.5 million Btu per hour combined heat input)*~~	~~*NA*~~	~~*NA*~~	*Removed. This is a duplicate of ES-5.*
ES-9 **PSD BACT**	Haul roads (paved and unpaved)	NA	NA	*No change*
Engines (ES-10)				
ES-10-1 **NSPS JJJJ, GACT ZZZZ, PSD BACT**	Natural gas-fired fire water pump (500 horsepower)	NA	NA	*No change*
ES-10-2 **NSPS IIII, NSPS JJJJ, GACT ZZZZ, PSD BACT**	Natural gas-fired emergency generator (2,000 kilowatt) -or- Diesel-fired emergency generator (2,000 kilowatt)	NA	NA	*No change*
ES-10-3 **NSPS IIII, NSPS JJJJ, GACT ZZZZ, PSD BACT**	Natural gas-fired emergency generator (2,000 kilowatt) -or- Diesel-fired emergency generator (2,000 kilowatt)	NA	NA	*No change*
Storage tanks (ES-11)				
ES-11-1 **PSD BACT**	Diesel storage tanks	NA	NA	*No change*
ES-11-2 **GACT CCCCCC, PSD BACT**	Gasoline storage tank	NA	NA	*No change*

Thank you,

Matt Way
Environmental Manager
Cell: 903.241.6116

December 16, 2022

From: Way, Matt (NSLX) <matt.way@nucor.com>
Sent: Friday, December 16, 2022 3:05 PM
To: Braswell, Russell; Morrow, Corey (NSAR)
Subject: Re: [External] Re: Concerns regarding the BACT determination for Nucor Lexington

Russell,

In the CMC Technical Memorandum (2015-0643-C), the proposed BACT limit of 0.0024 gr/dscf is only for PM10/PM2.5. As you noted, the baghouse controls PM/PM10/PM2.5. To address your concerns, Nucor proposes a separate PM (filterable only) limit of 0.0018 gr/dscf. Additionally, the total PM limit (filterable) of 0.0052 gr/dscf also applies pursuant to the NSPS - 40 CFR 60, Subpart AAa.

For the separation of the natural gas cutting torches (w/o Low NOx burners) vs the dryers and preheaters, please see the numbers in green.

ES-2-3 **PSD BACT**	Natural gas-fired burners for ladle/tundish drying and ladle/tundish preheaters, each equipped with low-NOx burners (***61.89*** million Btu per hour total heat input capacity)
ES-2-4 **PSD BACT**	Natural gas-fired service cutting torches (***0.8*** million Btu per hour total heat input capacity)

Thank you,

Matt Way
Environmental Manager
Cell: 903.241.6116

December 19, 2022

From: Way, Matt (NSLX) <matt.way@nucor.com>
Sent: Monday, December 19, 2022 2:08 PM
To: Braswell, Russell; Morrow, Corey (NSAR)
Subject: Re: [External] Re: Concerns regarding the BACT determination for Nucor Lexington

Russell,

Apologies, but I was referencing an old version of the permit. I agree that the PM (filterable only) BACT limit should be 0.0015 gr/dscf for Nucor Lexington.

Thank you,

Matt Way
Environmental Manager
Cell: 903.241.6116

Appendix 4: Public Notice Documents

A draft of the permit and this determination were made available to the public and EPA. Below is the public notice published by DAQ, and the entities directly notified by DAQ.

PUBLIC NOTICE
PUBLIC NOTICE ON PRELIMINARY DETERMINATION REGARDING APPROVAL FOR AN APPLICATION SUBMITTED UNDER THE REGULATIONS FOR THE "PREVENTION OF SIGNIFICANT DETERIORATION OF AIR QUALITY"

Nucor Steel Lexington has applied to the North Carolina Department of Environmental Quality, Division of Air Quality (DAQ), Permitting Section, to construct a new facility located at 6776 East US Highway 64, Lexington in Davidson County. The proposed project includes, but is not limited to, the approval to construct a new electric arc furnace steel mill.

The project is subject to review and processing under North Carolina Administrative Code, Title 15A, Subchapter 02D .0530, "Prevention of Significant Deterioration". The facility is defined as a "major stationary source." The proposed project will result in a significant emissions increase of PM_{10}, $PM_{2.5}$, NOx, SO_2, CO, VOC, and GHG.

The Nucor Steel Lexington application has been reviewed by the DAQ, Air Quality Permitting Section in Raleigh, North Carolina to determine compliance with the requirements of the North Carolina Environmental Management Commission air pollution regulations.

A preliminary review, including analysis of the impact of the facility emissions on local air quality, has led to the determination that the project can be approved, and the DAQ air permit issued, if certain permit conditions are met.

Davidson County is classified as an attainment area for all pollutants. Compliance with all ambient air quality standards and the PSD increments is projected.

Persons wishing to submit written comments or request a public hearing regarding the Air Quality Permit are invited to do so. Requests for a public hearing must be in writing and include a statement supporting the need for such a hearing, an indication of your interest in the facility, and a summary of the information intended to be offered at such hearing.

Written comment or requests for a public hearing should be postmarked no later than April 27, 2023 and addressed to daq.publiccomments@ncdenr.gov (please type "NucorLexington.22A" in the subject line) or mail written comments to: NC DEQ, Division of Air Quality, 1641 Mail Service Center, Raleigh, NC 27699-1641.

All comments received or postmarked by this date will be considered in the final determination regarding the Air Quality Permit. A public hearing may be held if the Director of the DAQ determines that significant public interest exists or that the public interest will be served.

A copy of all data and the application submitted by Nucor Steel Lexington, and other material used by the DAQ in making this preliminary determination are available for public inspection during normal business hours at the following locations:

NC DEQ
Division of Air Quality
Air Quality Permitting Section
217 West Jones Street, Suite 4000
Raleigh, NC 27603

or

NC DEQ
Winston-Salem Regional Office
450 West Hanes Mill Road
Suite 300
Winston-Salem, NC 27105

Information on the proposed permit, the permit application, and the staff review is available on the DAQ website (https://deq.nc.gov/about/divisions/air-quality/events) or by writing or calling:

NC DEQ
Mark J. Cuilla, EIT, CPM
Chief, Permitting Section
North Carolina Division of Air Quality
1641 Mail Service Center
Raleigh, North Carolina 27699-1641
Telephone: 919-707-8400

After weighing relevant comments received by April 27, 2023 and other available information on the project, the DAQ will act on the PSD application.

Michael A. Abraczinskas, Director
Division of Air Quality, NCDEQ

Listing of Entities and Documents to be Sent

Entity	Address	Documents to be Sent
Newspaper	The Dispatch 30 E. First Ave. Lexington, NC 27292 the-dispatch.com	Public Notice
Officials	Terra Greene Lexington City Manager 28 West Center Street, Lexington, NC 27292	Public Notice
	Casey Smith Davidson County Manager 913 Greensboro Street Lexington, NC 27292	Public Notice
Source	Mike Hess VP and General Manager Nucor Steel Lexington PO Box 687 Lexington, NC 2729	Preliminary Determination Draft Permit Public Notice
EPA	Brad Akers, EPA Region 4 Air Permitting Section Chief, Air Permitting Section US EPA Region 4 61 Forsyth Street, SW Atlanta, GA 30303	Preliminary Determination Draft Permit Public Notice
FLM	Andrea Stacy National Park Service, Air Resources Division PO Box 25287 Denver, CO 80225 (303) 969-2816	Preliminary Determination Draft Permit Public Notice
Winston-Salem Regional Office	Davis Murphy Winston Salem Regional Office 450 West Hanes Mill Road Suite 300 Winston Salem, NC 27105	Preliminary Determination Draft Permit Public Notice