$PM_{2.5}$ SIP Evaluation Report – Nucor-Vulcraft

UTAH $PM_{2.5}$ SIP SERIOUS

Salt Lake City Nonattainment Area

Utah Division of Air Quality

Major New Source Review Section

July 1, 2018

$PM_{2.5}$ SERIOUS SIP EVALUATION REPORT
NUCOR-VULCRAFT

1.0 Introduction

The following is an updated version of the original RACT evaluation that was completed on October 1, 2013 as a part of the Technical Support Documentation for Section IX, Parts H.11, 12 and 13 of the Utah SIP; to address the Salt Lake City $PM_{2.5}$ and Provo, Utah $PM_{2.5}$ Nonattainment Areas.

1.1 Facility Identification

Name: Vulcraft, Division of Nucor Corporation
Address: 1875 West Highway 13 South
P.O. Box 637
Brigham City, Utah 84302
Owner/Operator: Nucor Corporation
UTM coordinates: 411,500 m Easting; 4,598,000 m Northing; Zone 12

Name: Nucor Building Systems, Division of Nucor Corporation
Address: 1050 North Watery Lane
P.O. Box 907
Brigham City, Utah 84302
Owner/Operator: Nucor Corporation
UTM coordinates: 412,800 m Easting; 4,598,200 m Northing; Zone 12

1.2 Facility Process Summary

Vulcraft, a Division of Nucor Corporation (Nucor-Vulcraft) is a steel fabrication operation that consists of two main facilities, including the Joist Plant and Nucor Building Systems (NBS). The Joist Facility consists of the Joist Plant, the Cold Finish area, a stock yard, the maintenance facility and administrative buildings; and NBS Plant consists of the NBS fabrication area, maintenance area, and an administrative building. Nucor-Vulcraft is identified as a Major Source for Volatile Organic Compounds (VOCs), which are considered $PM_{2.5}$ precursors.

Joist Plant:

Joist fabrication consists of taking various steel shapes and cutting to specific dimensions for the top and bottom chords as well as the webbing. The joist is welded together and then using rollers, or overhead crane, the joist is moved to the painting area. There, the joist is picked up by crane and lowered into a dip tank. The joist is then pulled out of the paint tank and moved to a drying rack.

Cold Finish:

The cold finish operation has 3 production lines; a bar line, coil line and wire line where various sizes of steel shapes are processed from 6" rounds down to small diameter wire. Each line conveys the material through a shot-blaster unit to remove excess scale, rust and other surface impurities, and then it is cold drawn through dies and cut to length. The finished material is sprayed with oil and stored inside the building for shipment. The shot blast unit on each line has a high efficiency baghouse that captures the outlet stream from the shot blast units and collects the dust and particles from this operation.

Cold finish also oversees another small operation where steel wire is formed into mesh by passing an electric current through the wires at their connecting points which fuses the wires together. This is a small operation with insignificant emissions.

Nucor Building Systems (NBS):

NBS designs and fabricates pre-engineered structural steel buildings. Solid-web joists, columns and beams components are assembled from precut steel parts and welded together using automated and manual methods. These parts are then spray painted in two booths which utilize high volume air movement to collected overspray.

1.3 Facility 2016 Baseline Emissions

Nucor-Vulcraft plant-wide 2016 Actual Emissions (tons/yr)

$PM_{2.5}$	SO_2	NO_X	VOC	NH_3
9.95	0.58	7.74	41.28	0.05

1.4 Facility Criteria Air Pollutant Emissions Sources

Nucor-Vulcraft has one AO that cover all operations at their site.

Emission Unit	Potential to Emit				
	$PM_{2.5}$	NO_x	SO_2	VOC	NH_3*
Wire Line Shot blasting	0.42	0.00	0.00	0.00	0.00
Coil Line Shot blasting	3.30	0.00	0.00	0.00	0.00
Bar Line Shot blasting	9.61	0.00	0.00	0.00	0.00
Joist Plant Building- Roof Exhaust Vents 6 + 9 roof exhaust vents	2.13	0.00	0.00	0.00	0.00

Cold Finish Building (Roof Exhaust Vents) 2 roof exhaust vents	0.039	0.00	0.00	0.00	0.00
Plasma Cutter (Cold Finish - Dry)	0.035	0.03	0.00	0.00	0.00
Plasma Cutter (Structural Products - Dry)	0.12	1.82	0.00	0.00	0.00
Plasma Cutter (NBS-Wet)	0.30	1.25	0.00	0.00	0.00
Plasma Steel Cutter (Structural Products -Wet)	0.03	0.46	0.00	0.00	0.00
Bridging Line (Spray box)	0.42	0.00	0.00	4.20	0.00
Welding	1.54	0.00	0.00	0.00	0.00
Spray booth (NBS - Built up Line)	1.87	0.00	0.00	55.1	0.00
Spray booth (Structural Products)	0.60	0.00	0.00	17.76	0.00
Drying ovens (Spray Box)	0.08	1.05	0.01	0.06	0.00
Drying Oven (NBS, Built-Up Line)	0.09	1.31	0.008	0.07	0.00
Drying Oven (NBS, Purlin Line)	0.12	1.97	0.011	0.11	0.00
Drying Oven (Structural Products)	0.04	0.45	0.00	0.02	0.00
Fugitive Spray Booth	1.00	0.00	0.00	0.36	0.00
Haul Roads (NBS, Joist Plant)	0.29	0.00	0.00	0.00	0.00
Parts Cleaners (Cold Finish)	0.00	0.00	0.00	0.04	0.00
Parts Cleaners (Joist Plant)	0.00	0.00	0.00	0.07	0.00

Parts Cleaner (NBS)	0.00	0.00	0.00	0.02	0.00
Dip Coating	0.00	0.00	0.00	111.7	0.00
Joist Coating	0.00	0.00	0.00	1.00	0.00
Vacu-Coater (NBS-Purlin Line)	0.00	0.00	0.00	33.0	0.00
Mastic Equipment	0.00	0.00	0.00	8.16	0.00
Lubrication Equipment	0.00	0.00	0.00	9.2	0.00

- There are no measureable ammonia emissions

The following emission units are not source specific. A separate BACT analysis has been conducted on these common emission units. The technical support for these sources is in the PM¬2.5 Serious SIP – BACT for Small Source document.

Cold Solvent Degreasing Washers
Diesel-Fired Emergency Generators

2.0 BACT Election Methodology

The general procedure for identifying and selecting BACT is through use of a process commonly referred to as the "top-down" BACT analysis. The top-down process consists of five steps which consecutively identify control measures, and gradually eliminate less effective or infeasible options until only the best option remains. This process is performed for each emission unit and each pollutant of concern. The five steps are as follows:

1. Identify All Existing and Potential Emission Control Technologies: UDAQ evaluated various resources to identify the various controls and emission rates. These include, but are not limited to: federal regulations, Utah regulations, regulations of other states, the RBLC, recently issued permits, and emission unit vendors.

2. Eliminate Technically Infeasible Options: Any control options determined to be technically infeasible are eliminated in this step. This includes eliminating those options with physical or technological problems that cannot be overcome, as well as eliminating those options that cannot be installed in the projected attainment timeframe.

3. Evaluate Control Effectiveness of Remaining Control Technologies: The remaining control options are ranked in the third step of the BACT analysis. Combinations of various controls are also included.

4. Evaluate Most Effective Controls and Document Results: The fourth step of the

BACT analysis evaluates the economic feasibility of the highest ranked options. This evaluation includes energy, environmental, and economic impacts of the control option.

5. Selection of BACT: The fifth step in the BACT analysis selects the "best" option. This step also includes the necessary justification to support the UDAQ's decision.

Should a particular step reduce the available options to zero (0), no additional analysis is required. Similarly, if the most effective control option is already installed, no further analysis is needed.

The final BACT evaluations for the Nucor-Vulcraft site were performed using data that Nucor-Vulcraft submitted (Environmental Resources Management, 2017), (Environmental Resources Management, 2018), comments received from Techlaw on the Nucor-Vulcraft RACT submittal, comments received from EPA, comments received from the public, AOs, and the Title V permit.

2.1 Emission Unit (EU) and Existing Controls

2.1.1 Wire Line, Coil Line and Bar Line Shot Blasting Operations

Description:

Shot blasting machines are designed for the continuous in-line or batch type descaling of wire or bars. Coils are usually blasted offline in a cabinet blaster.

The Wire Line has a dust collector with an approximate air flow of 2,800 scfm for controlling PM emissions from the Wire Line Shot Blasting operations. The Coil Line has a dust collector with an approximate air flow of 5,500 dscfm for controlling PM emissions from the Coil Line Shot Blasting operations. The Bar Line has a dust collector with an approximate air flow of 14,266 dscfm for controlling PM emissions from the Bar Line Shot Blasting operations.

Pollutant [$PM_{2.5}$]

Shot blasting on the wire line, coil line and bar line produces direct $PM_{2.5}$ emissions. No specific emission factor for $PM_{2.5}$ has been developed by EPA for shot blasting. The current control technology on the wire line is the use of a baghouse with a 99.99% control efficiency. The current control technologies for the coil line shot blasting and the wire line shot blasting are baghouses with a 98% control efficiency.

Nucor-Vulcraft recently identified 99.99% efficiency filters that could replace the existing filters on the Coil and Bar Line Blasting baghouses. These new filters would result in a reduction of the calculated potential to emit (PTE) direct $PM_{2.5}$ of 3.29 tpy and 9.57 tpy, respectively. These filters could be implemented by the end of year 2019.

Control Options:

Scrubbers
Baghouses
Electrostatic Precipitators
Cyclones

Technological Feasibility:

Fabric filtration is the predominant control option for abatement of particulate emissions (PM, PM_{10}, $PM_{2.5}$) from shot blasting operations. Other particulate control options are not considered as effective. Based on a review of the information resources referenced earlier, it was revealed that these other control alternatives have not been successfully implemented to reduce particulate emissions from shot blasting operations. Thus, the projected use of any of these technologies would be considered a down grade in control technologies. Since, only a single control option was ascertained to be technically feasible, no ranking of control alternatives has been provided.

The technical feasibility evaluation showed an additional control technology of using a baghouse filter media with a removal efficiency of 99.99% down to 0.5 μm. Increased efficiency would require higher efficiency filters or a complete replacement of the baghouse with a new model at 99.99% efficiency similar to that installed for wireline shot blasting. Both of these could reduce the PTE impact by the same amounts.

Economic Feasibility:

The economic evaluations for the Coil Line Shot Blasting showed that replacing the current baghouse filters (98% control technology) with higher efficiency filters (99.99% control technology) results in an incremental cost effectiveness ratio of approximately $700 per ton removed and approximately $7,000 per ton removed by replacing with a new baghouse.

Similar to the explanation for the coil line evaluation, installation of the 99.99% removal efficiency filter media on the Bar Line would require using higher efficiency filters or a complete replacement of the baghouse equipment. Either option would result in a potential reduction of 9.57 tpy of $PM_{2.5}$ for this source. The economic evaluations showed that these control technologies have incremental cost effectiveness ratios of approximately $500 and $3,000 per ton removed, respectively.

BACT Selection:

Based on a review of similar applications, the use of the current baghouse with control efficiency filters of 99.99% for controlling $PM_{2.5}$ emissions from the shot blasting operations be selected as BACT.

Implementation Schedule:

The baghouses for both the Coil Line and the Bar Line with a control efficiency of 99.99% will be implemented by December 2019.

Startup/Shutdown Considerations

The filters in the bag houses are not removed during start-up or shut-down activities and would provide the same efficient filtration whether you are just starting the equipment, operating the shot blasters, or shutting down the equipment.

2.1.2 Exhaust Vents (Joist Plant, Cold Finish, and NBS)

Description:

There are 15 roof vents on the Joist Plant, three (3) roof vents on Cold Finish and six (6) main vents on NBS (24 total roof vents). These fan-driven vents exhaust air from the respective production/assembly lines to the atmosphere. As recommended by the American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHAE), 10 to 15 air exchanges per hour should occur for manufacturing buildings.

Pollutant [$PM_{2.5}$]

Approximately 2.16 tpy of $PM_{2.5}$ based on air sampling events, have been estimated to be exhausted from the 24 roof vents. The combined air flow, based on Approved American National Standard Institute (ANSI) is approximately 300,000 cubic feet per minute (cfm) or about 19,700 cfm per exhaust vent.

Control Options:

Scrubbers
Baghouses
Electrostatic Precipitators
Cyclones

Technological Feasibility:

Potential control technologies considered for $PM_{2.5}$ are scrubber, ESP, cyclones, and fabric filters, with filter bags that remove 99% of $PM_{2.5}$. However, roof exhaust vents and related roof structures at Nucor-Vulcraft cannot support these types of equipment. Furthermore, the existing overhead duct systems, cranes, and other process equipment in the buildings would conflict with potential installation of source hoods and ducts to capture emissions discharged at the exhaust vents. Therefore, these options are not technically feasible.

Economic Feasibility:

As outlined above, additional controls are technically infeasible for the roof vents. Therefore, an economic feasibility analysis was not performed.

BACT Selection:

Steel fabrication shops reviewed for this BACT analysis have not successfully implemented any controls besides minimizing $PM_{2.5}$ emissions. The current practice of process management constitutes BACT for the Nucor-Vulcraft operations.

Implementation Schedule:

The emission minimization plan for the Nucor-Vulcraft operations is already being implemented.

Startup/Shutdown Considerations

The operations at the Nucor-Vulcraft site are designed to operate on a continuous basis. The operations are in shutdown or startup modes during scheduled maintenance, plant shutdowns and during periods of natural gas or electric curtailments.

2.1.3 Plasma Cutter – Dry (Cold Finish and Structural Products)

Description:

Plasma cutting is a process that cuts through electrically conductive materials by means of an accelerated jet of hot plasma. Typical materials cut with a plasma torch include steel, Stainless steel, aluminum, brass and copper, although other conductive metals may be cut as well. Plasma cutting is often used in fabrication shops, automotive repair and restoration, industrial construction, and salvage and scrapping operations. Due to the high speed and precision cuts combined with low cost, plasma cutting sees widespread use in large-scale industrial CNC applications.

Higher arc current yielded more particles, while lower arc current was not able to penetrate the metal plates. Hence, the worker should optimize the arc current to balance cut performance and fume emission. The findings indicated that arc current was the dominant factor in fume emission from plasma cutting. Appropriate ventilation and respiratory protection should be used to reduce workers' exposure.

Pollutant [$PM_{2.5}$]

Plasma Cutter (Cold Finish - Dry)

The plasma cutter operation in Cold Finish for maintenance produces direct $PM_{2.5}$ emissions with a PTE of 0.035 tpy. This source has historically been operated less than 40 hours per year. There is no anticipated increase in usage planned for this source.

Plasma Cutter (Structural Products - Dry)

The dry plasma cutter for the Structural Products line has a $PM_{2.5}$ PTE of 0.12 tpy. The current control is a fume collector and control system with 95% removal efficiency (i.e., blended cellulose and polyester fibers).

Nucor-Vulcraft is in the process of re-evaluating welding techniques and plasma cutter operations, to confirm if techniques are optimal to ensure that emissions are minimized.

Control Options:

Cold Finish - Dry
- Limited Use;
- Best Management Practices
- Baghouse

Structural Products - Dry
- Fume collector and control (blended cellulose and polyester fibers)
- HEPA
- ESP

Technological Feasibility:

Cold Finish - Dry

The technical feasibility evaluation showed an additional control technology of using a baghouse with a removal efficiency of 99.99%.

Structural Products - Dry

The technical feasibility evaluation showed that potential additional control technologies include use of the current capture system with addition of HEPA, or ESP. The manufacturer was contacted to determine if these could be added. The manufacturer does not currently support alternative filter technologies; Nucor-Vulcraft will consider control improvements if they become available.

Economic Feasibility:

Cold Finish - Dry

To install a baghouse on the Cold Finish plasma cutter, and if the maximum emission rate was used with an annual emission rate of 0.04 tpy and the reduction was 0.035 tpy, then the cost per ton of $PM_{2.5}$ reduced is $630,000. This cost analysis exceeds BACT and is not economically feasible.

Structural Products – Dry

It has not been determined if an upgrade to a HEPA filter is technically feasible. Therefore, an economic feasibility was not performed.

BACT Selection:

Cold Finish - Dry

Steel fabrication shops reviewed for this BACT analysis have not successfully implemented any controls besides minimizing $PM_{2.5}$ emissions. The current practice of process management constitutes BACT for the Nucor-Vulcraft operations.

Structural Products – Dry

Currently the only feasible control option for controlling $PM_{2.5}$ emissions from the plasma cutter is the current baghouse with a control efficiency of 95%.

Implementation Schedule:

The current controls and the emission minimization plan for the Nucor-Vulcraft operations have already been implemented.

Startup/Shutdown Considerations

The operations at the Nucor-Vulcraft site are designed to operate on a continuous basis. The operations are in shutdown or startup modes during scheduled maintenance, plant shutdowns and during periods of natural gas or electric curtailments.

Pollutant [NO_x]

Plasma Cutter (Cold Finish - Dry)

The plasma cutter operation in Cold Finish for maintenance produces NO_x emissions with a PTE of 0.03 tpy. This source has historically been operated less than 40 hours per year. There is no anticipated increase in usage planned for this source.

Plasma Cutter (Structural Products - Dry)

The dry plasma cutter for the Structural Products line has a NO_x PTE of 0.12 tpy. The current control is a fume collector and control system, and best management practices.

Control Options:

Cold Finish - Dry
- Limited Use;
- Best Management Practices
- Flex duct capture system with wet or dry scrubbers.
- Selective Catalytic Reduction (SCR) or (Selective Non-Catalytic Reduction (SNCR)

Structural Products - Dry
- Limited Use;
- Best Management Practices
- Flex duct capture system with wet or dry scrubbers or ESP.

Technological Feasibility:

Cold Finish - Dry

The technical feasibility evaluation showed that potential additional control technologies include a flex duct capture system with wet or dry scrubbers. The safety and process flow would be critically disrupted with the hoist and carry system if a capture system was installed and would prohibit production. Therefore, these additional technologies are considered technically infeasible.

Structural Products - Dry

The technical feasibility evaluation showed that potential additional control technologies include a flex duct capture system with wet or dry scrubbers or ESPs. The safety and process flow would be critically disrupted with the hoist and carry system if a capture system was installed and would prohibit production. Therefore, these additional technologies are considered technically infeasible.

Plasma cutting occurs at high temperatures, high volumes of air are necessarily exhausted by the collection system to capture the particulate matter (fume) generated by the process. The resulting gas stream is near ambient temperatures and several hundred degrees Fahrenheit lower than the temperatures needed for the use of SCRs and NSCRs. This makes the use of SCR or SNCR technology infeasible.

Economic Feasibility:

Cold Finish - Dry

No additional technologies were identified as technically feasible. Therefore an economic analysis was not performed.

Structural Products – Dry

No additional technologies were identified as technically feasible. Therefore an economic analysis was not performed.

A flex duct capture system with an ESP or fume collector would not be cost effective NO_x control technology for a plasma cutter. Although ESP systems are typically used for controlling particulate matter, it is possible to control NO_x by injecting activated carbon dust or a slurry of powdered limestone and aqueous ammonia and using the ESP to capture the particulate matter that is adsorbed in the carbon or reacted with the ammonia. This is a very expensive and complicated technology and thus not feasible (Sacramento Metropolitan Air Quality Management District, 2017) for small applications such as plasma cutters.

BACT Selection:

Cold Finish - Dry

BACT for the plasma cutter is considered to be the current controls: using a fume collector and control.

Structural Products – Dry

BACT for the plasma cutter is considered to be the current controls: using a fume collector and control.

Implementation Schedule:

The current controls and the emission minimization plan for the Nucor-Vulcraft operations have already been implemented.

Startup/Shutdown Considerations

The operations at the Nucor-Vulcraft site are designed to operate on a continuous basis. The operations are in shutdown or startup modes during scheduled maintenance, plant shutdowns and during periods of natural gas or electric curtailments.

2.1.4 Plasma Cutter – Wet (NBS Finish and Structural Products)

Description:

Plasma cutting is a process that cuts through electrically conductive materials by means of an accelerated jet of hot plasma. Typical materials cut with a plasma torch include steel, Stainless steel, aluminum, brass and copper, although other conductive metals may be cut as well. Plasma cutting is often used in fabrication shops, automotive repair and restoration, industrial construction, and salvage and scrapping operations. Due to the high speed and precision cuts combined with low cost, plasma cutting sees widespread use in large-scale industrial CNC applications.

Under water plasma cutting actually submerges the plate below 2 to 4” of water, so the torch tip and the entire arc are submerged. Cutting under water dramatically reduces noise emitted by the plasma arc. Noise levels from dry plasma cutting can be as high as 120 decibels, by submerging the plate, the noise level can be reduced by as much as 40 dB. Under water plasma cutting significantly reduces the brightness of the arc. On a dry table, the arc is so bright that dark safety glasses or a welding helmet is required.

When plasma cutting under water, the water will absorb the vast majority of the plasma smoke.

Emission of fume when plasma cutting mild and stainless steel

Material	Thickness	Dry Cutting (lb/hr)	Under Water Cutting (lb/hr)
Mild Steel	5/16"	2.65 - 3.44	.01 - .05
Stainless Steel	5/16"	3.97 - 5.29	.03 - .07
Stainless Steel	1-3/8"	.24 - .45	0.003

Pollutant [$PM_{2.5}$]

Plasma Cutter (NBS - Wet)

The plasma cutter operation in NBS produces PM_{10} emissions with a PTE of 0.30 tpy and with no emission factor it is assumed that $PM_{10} = PM_{2.5}$. The particulate emissions are controlled by the water blanket that covers the plasma cutting. Currently the controls implemented are plasma gas selection and manufacture’s recommendation on water submersion techniques.

Plasma Cutter (Structural Products - Wet)

The wet plasma cutter for the Structural Products section has a $PM_{2.5}$ PTE of 0.03 tpy. The particulate emissions are controlled by the water blanket that covers the plasma cutting. Currently the controls implemented are plasma gas selection and manufacture recommendations on water submersion techniques.

Control Options:

NBS - Wet

- Limited Use;
- Manufacture recommendation on water submersion techniques (Best Management Practices)
- Flex Duct Capture System with HEPA or ESP
- Fume Hood with fabric filters (i.e. dry filtration)

Structural Products - Dry

Limited Use;
Manufacture recommendation on water submersion techniques (Best Management Practices)
Flex Duct Capture System with HEPA or ESP
Fume Hood with fabric filters (i.e. dry filtration)

Technological Feasibility:

NBS - Wet

The technical feasibility evaluation showed that potential additional controls could include flex duct capture system with HEPA, ESP, and fume hood with fabric filters. However, these equipment systems require capture systems, which would interfere with process flow, critically disrupt hoist and carry equipment and prohibit production. Therefore, these additional technologies are considered technically infeasible.

Structural Products - Wet

As discussed above, these additional technologies are considered technically infeasible. The existing wet blanket technique results in a 95% reduction in emissions.

Economic Feasibility:

NBS - Wet

As no additional technologies were identified as technically feasible, no economic analysis was conducted.

Structural Products – Wet

As discussed above, these additional technologies are considered technically infeasible. Therefore, an economic feasibility was not performed.

BACT Selection:

NBS - Wet

The current controls are plasma gas selection and following manufacture recommendations on water submersion techniques. The current controls constitutes BACT for the NBS wet plasma operations.

Structural Products – Wet

The current controls are plasma gas selection and following manufacture recommendations on water submersion techniques. The current controls constitutes BACT for the NBS wet plasma operations.

Implementation Schedule:

The current controls and the emission minimization plan for the Nucor-Vulcraft operations have already been implemented.

Startup/Shutdown Considerations

The operations at the Nucor-Vulcraft site are designed to operate on a continuous basis. The operations are in shutdown or startup modes during scheduled maintenance, plant shutdowns and during periods of natural gas or electric curtailments.

Pollutant [NO_x]

Plasma Cutter (NBS - Wet)

The wet plasma cutter operation in NBS produces NO_x emissions with a PTE of 4.60 tpy. The current control technologies for NO_x are implemented plasma gas selection and manufacture recommendations on water submersion techniques.

Plasma Cutter (Structural Products - Dry)

The wet plasma cutter for Structural Products has a NO_x PTE of 0.46 tpy. The current control technologies for NO_x are implemented plasma gas selection and manufacture recommendations on water submersion techniques.

Control Options:

NBS - Wet

- Plasma Gas Selection
- Manufacture recommendation on water submersion techniques (Best Management Practices)
- Flex Duct Capture System with Wet Scrubber System
- Flex Duct system with Dry Scrubbing
- SCR/SNCR

Structural Products - Wet

- Plasma Gas Selection
- Manufacture recommendation on water submersion techniques (Best Management Practices)
- Flex Duct Capture System with Wet Scrubber System
- Flex Duct system with Dry Scrubbing
- SCR/SNCR

Technological Feasibility:

NBS - Wet

The technical feasibility evaluation showed that potential additional control included flex duct capture system with wet or dry scrubbers, a selective non-catalytic reduction (SNCR), and selective catalytic reduction (SCR). However, this equipment requires capture systems, which would interfere with process flow, critically disrupt hoist and carry equipment and prohibit production. Therefore, these additional control technologies are considered technically infeasible.

Structural Products - Wet

The technical feasibility evaluation showed that potential additional control included flex duct capture system with wet or dry scrubbers, a selective non-catalytic reduction (SNCR), and selective catalytic reduction (SCR). However, this equipment requires capture systems, which would interfere with process flow, critically disrupt hoist and carry equipment and prohibit production. Therefore, these additional control technologies are considered technically infeasible.

Economic Feasibility:

NBS - Wet

No additional technologies were identified as technically feasible. Therefore an economic analysis was not performed.

Structural Products – Wet

No additional technologies were identified as technically feasible. Therefore an economic analysis was not performed.

BACT Selection:

NBS - Wet

BACT for the wet plasma cutter is considered to be the current controls: plasma gas selection and manufacture recommendations on water submersion techniques.

Structural Products – Wet

BACT for the wet plasma cutter is considered to be the current controls: plasma gas selection and manufacture recommendations on water submersion techniques.

Implementation Schedule:

The current controls and the emission minimization plan for the Nucor-Vulcraft operations have already been implemented.

Startup/Shutdown Considerations

The operations at the Nucor-Vulcraft site are designed to operate on a continuous basis. The operations are in shutdown or startup modes during scheduled maintenance, plant shutdowns and during periods of natural gas or electric curtailments.

2.1.5 Plant Wide Torches and Welding

Description:

Steel fabricators transform materials into different shapes and products. Welding is the process of fusing materials such as metals in order to seamlessly join them. The welding process involves applying heat and pressure to the materials being combined, in addition to a filter material.

Nucor-Vulcraft conducts various torching and welding operations throughout the plant. Welding with a torch utilizes acetylene as a fuel. Welding operations with a torch produces PM2.5, NOx, SO2, and VOC emissions.

The different types of welding processes are MIG (Metal Inert Gas) Welding or GMAW (Gas Metal Arc Welding), Arc Welding or SMAW (Shielded Metal Arc Welding), TIG (Tungsten Inert Gas) or GTAW (Gas Tungsten Arc Welding), and FCAW (Flux-Cored Arc Welding).

Pollutant [$PM_{2.5}$, NO_x, SO_2, and VOC]

Particulate matter and particulate-phase hazardous air pollutants are the major concerns in the welding processes. Only electric arc welding generates these pollutants in substantial quantities. The lower operating temperatures of the other welding processes cause fewer fumes to be released. Most of the particulate matter produced by welding is submicron in size and, as such, is considered to be all PM_{10} or smaller such as $PM_{2.5}$.

NO_x, SO_2 and VOC emissions from torches and welding primarily result from combustion by-product of the fuel. Particulate matter emissions from torches primarily result from carryover of non-combustible trace constituents in the fuel and particulate from the burning of steel.

Control Options:

Welding Booths
High Efficiency Filters
Electrostatic Precipitators
Particulate Scrubbers
Activated Carbon Filters

The best way to control welding fumes is to choose the proper process and operating variables for the given task. Also, capture and collection systems may be used to contain the fume at the source and to remove the fume with a collector. Collection systems may be welding booths, hoods, torch fume extractors, flexible ducts, and portable ducts.

The current controls being implemented are inert shielding gas, electrode selection, and using lowest recommended current/low amperes (AMPs).

Technological Feasibility:

Additional control technologies include a flex duct capture system with HEPA or ESP, or a torch fume extraction HEPA or ESP, and scrubbers. However, this equipment requires capture systems, which would interfere with process flow, critically disrupt hoist and carry equipment and prohibit production. Therefore, these additional technologies are considered technically infeasible.

Due to the relatively small emissions from combustion during use of torches, the application of add-on controls is considered infeasible.

Based on a review of the previously listed information, no other control technologies for particulate abatement have been successfully implemented for small torches.

Economic Feasibility:

Torching operations are conducted plant wide both within large buildings and outdoors. Mostly the torching operations are intermittent at various locations where capturing these emissions are not practical, and even if they were at specific locations only, the amounts are very small where add on capture devices are not economically feasible.

Additional controls are technically infeasible for the torches and welding. Therefore, an economic feasibility was not performed.

BACT Selection:

As no additional technologies were identified as technically feasible, no economic analysis was conducted. Therefore, BACT for welding is considered to be the current controls: using an inert shielding gas, the electrode selection, and using the lowest recommended current/low AMPs. Proper operation of the torches constitute BACT for this emission source.

Implementation Schedule:

Proper operations to reduce emissions are already in place.

Startup/Shutdown Considerations

There are no startup/shutdown operations to be considered for these sources.

2.1.6 Bridging Line (Spray Box)

Description:

Nucor-Vulcraft operates a Bridging Line that produces direct PM emissions. The Spray Box is a self-contained chamber that coats parts along the production line.

Pollutant [$PM_{2.5}$]

The majority of particle matter created from the Spray Box is greater than 2.5 μm. Although $PM_{2.5}$ emissions have been calculate, the presences of $PM_{2.5}$ at this operation are highly unlikely. The emissions from the Bridging Line were calculated to have direct $PM_{2.5}$ emissions and a conservative assumption was made for this source that the $PM_{2.5}$ emissions were the same as the PM_{10} emissions because there are no specific emission factors available for $PM_{2.5}$. However, as a result of completing the BACT analysis, literature was discovered that show actual paint emission particulates are generally larger than $PM_{2.5}$. Therefore, to better represent the actual $PM_{2.5}$ emissions, they are assumed to be close to zero.

Control Options:

The technical feasibility evaluation showed one potential additional control technology to control PM emissions and that was a fabric filter.

Technological Feasibility:

Due to the relatively small emissions from the Bridging Line filter box, the application of add-on controls is considered infeasible.

Economic Feasibility:

Additional controls are technically infeasible for the Bridging Line spray box. Therefore, an economic feasibility was not performed.

BACT Selection:

No additional technologies were identified as technically feasible. Therefore, BACT for the bridging line is considered to be the current controls: best management practices.

Implementation Schedule:

Proper operations are already in place.

Startup/Shutdown Considerations

There are no startup/shutdown operations to be considered for these sources.

[Pollutant VOC]

The bridging product, once coated, continues to dry and release VOCs during the drying, rolling, bundling and storage process both inside and outside the building.

Control Options:

The identified control technologies are replacing the vacu-coater with the spray box and reducing the paint VOC content to 2.1 lb/gal.

Technological Feasibility:

The VOCs therefore are considered fugitive and any capture technologies would be not be technically feasible for the Bridging Line spray box.

Economic Feasibility:

There were no additional control technologies that were identified as technically feasible. Therefore, an economic feasibility was not performed.

BACT Selection:

BACT for the spray box is considered to be the current controls: replacement of vacu-coater and the reduction of VOC content to 2.1 lb/gal less water and exempt solvents.

Implementation Schedule:

Proper operations were established in 2017 when the vacu-coater was replaced and the VOC content was reduced.

Startup/Shutdown Considerations

There are no startup/shutdown operations to be considered for these sources.

2.1.7 Drying Ovens (Joist Plant Box, NBS Built-Up Line and NBS Purlin Line, and Structural Products)

Description:

Nucor-Vulcraft operates drying ovens in the Joist Plant after the Bridging Line that produces $PM_{2.5}$ emissions. The ovens are designed to pass the steel products through the heating elements at a slow rate via overhead crane.

Pollutant [$PM_{2.5}$]

The drying ovens produce $PM_{2.5}$ emissions. The amount of $PM_{2.5}$ emission reduced, in tpy, through removal of the drying ovens would be as follows:

Spray Box	0.02
NBS, Built-Up Line	0.03
NBS, Purlin Line	0.04
Structural Products	0.01

Control Options:

Nucor-Vulcraft currently uses flue gas recirculation as an emission control.
Capture systems with a baghouse

Technological Feasibility:

Potential additional control technologies include a capture system with a baghouse. However, this equipment requires capture systems, which would interfere with process flow, critically disrupt hoist and carry equipment and prohibit production. Therefore, these additional technologies are considered technically infeasible.

Economic Feasibility:

Additional controls are technically infeasible for the drying ovens. Therefore, an economic feasibility was not performed.

BACT Selection:

As no additional technologies were identified as technically feasible, no economic Nucor-Vulcraft has been researching the replacement of the spray box and drying ovens used for specific products with a new process that involves electrical induction technology to heat the product through electrical induction prior to painting. This technology would allow complete removal of the drying ovens. If this technology proves technically feasible, improves quality, and provides other market advantages, it would coincidentally eliminate the small amount of $PM_{2.5}$ emission from the drying ovens.

Implementation Schedule:

Proper operations are already in place.

Startup/Shutdown Considerations

There are no startup/shutdown operations to be considered for these sources.

Pollutant [NO_x]

The drying ovens produce NO_x emissions from combustion of natural gas.

Control Options:

Flue Gas Recirculation
Low NO_x Burners
SCR/SNCR

The amount of NO_x emission reduced, in tpy, installation of Low NO_x burners would be as follows:

Spray Box	0.39
NBS, Built-Up Line	0.49
NBS, Purlin Line	0.73
Structural Products	0.17

Technological Feasibility:

The existing overhead duct systems, cranes, and other process equipment in the buildings would conflict with potential installation of the SCR/SNCR technologies for the drying oven. Therefore, these technologies are technically infeasible.

Nucor-Vulcraft has already retrofitted the oven burners with flue gas recirculation control technology.

Economic Feasibility:

Further NOx emission reductions cannot be achieved except through full replacement of the existing oven burners with low NOx burners. The cost effectiveness ratio, in $/tons of NO_x reduced, for replacement of the existing oven burners with low NO_x burners is as follows:

Spray Box	$85,110
NBS, Built-Up Line	$86,575
NBS, Purlin Line	$55,826
Structural Products	$376,726

BACT Selection:

The economic evaluations have showed that the replacement of the existing burners with low NO_x burners is not economically feasible.

Nucor-Vulcraft has been researching the replacement of the spray box and drying ovens used for specific products with a new process that involves electrical induction technology to heat the product through electrical induction prior to painting. This technology would allow complete removal of the drying ovens. If this technology proves technically feasible, improves quality, and provides other market advantages, it would coincidentally eliminate the small amount of $PM_{2.5}$ emission from the drying ovens. The amount of NO_x emission reduced through removal of the ovens would be, in tpy, as follows:

Spray Box	1.05
NBS, Built-Up Line	1.31
NBS, Purlin Line	1.97
Structural Products	0.45

Based on the review of control options for this equipment, the current flue gas recirculation is recommended as BACT.

Implementation Schedule:

Proper operations are already in place.

Startup/Shutdown Considerations

There are no startup/shutdown operations to be considered for these sources.

Pollutant [SO_2, and VOC]

The drying ovens produce SO_2 and VOC emissions from natural gas combustion. There are 0.02 tpy of SO_2 emitted from the combustion of natural gas for all sources at the Nucor-Vulcraft site. The amount of VOC emissions reduced, in tpy, through removal of the drying ovens would be as follows:

	VOC
Spray Box	0.06
NBS, Built-Up Line	0.07
NBS, Purlin Line	0.11
Structural Products	0.02

Control Options:

Capture Systems with Thermal Oxidation

Technological Feasibility:

The potential additional control technologies include a capture system with thermal oxidation. However, this equipment requires capture systems, which would interfere with process flow, critically disrupt hoist and carry equipment and prohibit production.

Therefore, these additional technologies are considered technically infeasible.

Economic Feasibility:

Additional controls are technically infeasible for the drying ovens. Therefore, an economic feasibility was not performed.

BACT Selection:

As no additional technologies were identified as technically feasible, no economic Nucor-Vulcraft has been researching the replacement of the spray box and drying ovens used for specific products with a new process that involves electrical induction technology to heat the product through electrical induction prior to painting. This technology would allow complete removal of the drying ovens. If this technology proves technically feasible, improves quality, and provides other market advantages, it would coincidentally eliminate the small amount of SO_2 and VOC emission from combustion at the drying ovens but would not reduce the fugitive VOC emissions from the paint drying.

Implementation Schedule:

Proper operations are already in place.

Startup/Shutdown Considerations

There are no startup/shutdown operations to be considered for these sources.

2.1.8 Spray Booth (NBS Built Up Line and Structural Products)

Description:

Surface coated products are all around, and coatings are applied to many types of industrial equipment and consumer products to provide decorative and protective finishes as well as functional uses such as adhesives. Surface coating may be performed in a spray booth or in an open environment. The application of these finishes, while improving product performance or extending product life, releases significant emissions of solvents and solids into the environment. Some previously open surface coating operations have been enclosed and the exhaust vented through a stack. Surface coatings may be applied manually or with automatic devices such as spray guns.

Nucor-Vulcraft operates spray booths at the NBS Built Up Line and the Structural Products Line for the purpose of spray coating materials that are being manufactured.

Pollutant [$PM_{2.5}$]

The PTE for $PM_{2.5}$ has been based on the PM_{10} PTE and with the 95% control efficiency of the existing fabric filters. A more exact calculation of $PM_{2.5}$ has not been calculated do to the fact that a specific emission factor for $PM_{2.5}$ is not available for this equipment. The conservative $PM_{2.5}$ PTE estimates from the NBS spray booth has been 1.87 tpy, which is the same as the PM_{10}. However, actual paint emission particulates are generally larger than 2.5 µm, and therefore only a "perception" of $PM_{2.5}$ emissions exists from these sources.

The spray booths produce $PM_{2.5}$ emissions. They have been estimated, in tpy, as follows:

NBS, Built-Up Line	1.87
Structural Products	0.60

Control Options:

High Volume Low Pressure (HVLP) Spray Guns
Filter Pads with 95% efficiency
Baghouse with Higher Efficiency Filters

The current controls for the Spray Booths are HVLP spray guns and 95% efficient filter pads.

Technological Feasibility:

Using a baghouse with higher efficiency cartridges or fabric filters would be non-effective. The spray painting and the associated overspray results in large diameter droplets which would immediately clog higher efficiency filter media. Therefore, these additional technologies are considered technically infeasible.

Economic Feasibility:

Additional controls are technically infeasible for the spray booths. Therefore, an economic feasibility was not performed.

Actual paint emission particulates are generally larger than 2.5 µm, and the actual emissions are considerably lower than the perceived estimation. The conservative calculation shows that there are only 0.6 tpy of $PM_{2.5}$ and if a baghouse were added to the existing controls, the additional emission reduction would result in a cost effectiveness ratio of $1,700,000 per ton. In actuality, the cost may be considerably higher given that the estimate is based on a conservative estimate of the $PM_{2.5}$ emissions when they are actually much lower.

BACT Selection:

Based on the technical analysis and the economic analysis, BACT for the spray booth is considered the currently implemented use of HVLP spray guns and 95% efficient filter pads.

Implementation Schedule:

Proper operations are already in place.

Startup/Shutdown Considerations

There are no startup/shutdown operations to be considered for these sources.

Pollutant [VOC]

Collectively, surface coating operations using paints with hydrocarbon solvents may be the largest industrial source of VOC emissions. Most surface coating operations involve the manual application of paint with spray equipment inside a paint spray booth. The booth exhaust system collects the solvent fumes and then exhausts them through a stack to the atmosphere. Stack emissions are characteristically high in flow rate and low in concentration. Since control equipment is sized based on exhaust flow rate rather than concentration, control of VOC and HAP requires large, expansive abatement equipment.

The spray booths produce VOC emissions. They have been estimated, in tpy, as follows:

NBS, Built-Up Line	55.1
Structural Products	17.76

Control Options:

HVLP spray guns
Paint VOC content reduced to 2.1 lbs/gal
Thermal Oxidization (TO)
Carbon Adsorption

The identified control technologies for VOCs from spray painting operations include the currently implemented use of low-VOC paints, work practice standards to limit overspray, and HVLP spray painting equipment. Potential supplemental controls include VOC capture systems with carbon adsorption and TO technologies

Technological Feasibility:

The technical feasibility evaluation showed that Carbon Adsorption requires a higher concentration of VOCs than the concentration that is being produced in order for the carbon adsorption to be technically effective. This determination is based specifications from the manufacturer.

There is insufficient space available to install a TO in the NBS Built Up Line. Therefore, these additional technologies are considered technically infeasible.

Economic Feasibility:

The TO technology is a viable consideration for spray painting at the Structural Products spray booth operation. The potential VOC reduction from TO has been estimated for this technology by assuming that 30% of the VOCs are emitted during the application process, 60% in the drying oven, and 10% are fugitive emissions as the product continues to dry outside the spray booth and oven. The calculated VOC PTE reduction is 5.06 based on a TO efficiency of 95%.

The feasibility of implementing this technology must consider the number of TO units, the extensive duct work and air movers and the large amount of natural gas that would be required for proper combustion. The economic feasibility evaluation shows that the incremental cost effectiveness for adding a TO for this equipment is approximately $227,000 per ton of VOC removed. Therefore, adding a TO to the Structural Line is considered economically infeasible.

BACT Selection:

BACT for the spray booths is the current controls of using low VOC paints, work practice standards to limit the amount of overspray, and HVLP spray painting technology.

Implementation Schedule:

Proper operations are already in place.

Startup/Shutdown Considerations

There are no startup/shutdown operations to be considered for these sources.

2.1.9 Vacu-Coater (NBS Purlin Line)

Description:

Vacuum coating processes use vacuum technology to create a sub-atmospheric pressure environment and an atomic or molecular condensable vapor source to deposit thin films and coatings. The Purlin Line (secondary structural components) operation has a vacu-coater that provides a protective layer of paint onto horizontal beams. Purlin coating is a specialty type of painting that cannot be achieved with spray booths or dip tanks. The vacu-coater applies the paint on moving beams that immediately enter the Purlin oven.

Pollutant [VOC]

The Vacu-Coater produces VOC emissions. They have been estimated at 33.0 tpy.

Control Options:

Paint VOC content reduced to 2.1 lbs/gal
Thermal Oxidization
Wet Scrubber
Carbon Adsorption

The current control for the Vacu-Coater is reduced VOC content in the paint.

Technological Feasibility:

The identified additional control technologies, besides the already implemented low VOC paints, include scrubbers, carbon adsorption and various applications of TO. After the vacu-coater coats the parts, the parts go to the drying oven which is located 13 feet from the vacu-coater. This is insufficient space to include the required equipment for a TO. Employing TO technology would also create a half ton of pollutants for every ton of VOC removed. Therefore, TO technology is considered infeasible due to space limitations and environmental issues.

Recent advances in wet, packed-tower, scrubbing units for the removal of VOCs might be technically feasible. Further on-site studies would have to be conducted to determine if the VOCs produced at the purlin line are soluble enough for wet scrubbing to be effective.

Based on communications with several manufacturers, carbon adsorption units are ineffective at the high temperatures of 350°F that are used at Nucor-Vulcraft. There are also space restrictions near the Purlin Line oven. Therefore, carbon adsorption is technically infeasible.

Economic Feasibility:

Additional controls are technically infeasible for the Vacu-Coater. Therefore, an economic feasibility was not performed.

BACT Selection:

Nucor-Vulcraft has already significantly reduced the VOC impact from this operation by implementing operational and raw material (painting) practices. Implementation included the following:

> Painting efficiency of 1.7 gallons of paint per ton of steel throughput; and
> VOC content of paint averaging 1.1 pounds of VOC per gallon of paint.

These voluntary operational parameters lead to significant and actual reductions. The main benefit is that it controls VOC emissions at the source. Past estimates assume VOCs are emitted either during the application process (30%) or in the oven (60%). Fugitive VOC emissions occur as soon as the container of paint is opened until final drying of the Purlin Line product in the yard (fugitives estimated at 10%). Controlling the source amount of VOCs that can be emitted is a more effective means for actual VOC reductions. The current practice of process management and limiting VOC content constitutes BACT for the Vacu-Coater operations.

Implementation Schedule:

The current control for the Vacu-Coater is reduced VOC content in the paint and is already in place.

Startup/Shutdown Considerations

There are no startup/shutdown operations to be considered for these sources.

2.1.10 Fugitive Spray

Description:

Nucor-Vulcraft paints approximately 2% of their production in open air space. This results in fugitive emissions of less than one tpy of $PM_{2.5}$ and less than 0.4 tpy of VOCs. Some fugitive spray emissions may be captured in the exhaust vents; however, as described in Section 2.1.2 Exhaust Vents (Joist Plant, Cold Finish, and NBS), above, these options are technically infeasible.

BACT Selection:

BACT is outlined in Section 2.1.2 above.

Implementation Schedule:

Proper operations are already in place.

Startup/Shutdown Considerations

There are no startup/shutdown operations to be considered for these sources.

2.1.11 Haul Roads

Description:

Nucor-Vulcraft has paved and unpaved roads for the transportation of materials and other miscellaneous vehicle travel. Nucor-Vulcraft reduces $PM_{2.5}$ emissions associated with vehicular traffic on paved roadways by periodically vacuum sweeping or water dust suppression and limiting vehicle traffic to 10 mph. Permanent, heavy use, roads have been paved.

Pollutant [$PM_{2.5}$]

There are 0.29 tpy of $PM_{2.5}$ from the paved roads and unpaved roads that are treated with chemical dust suppression.

Control Options:

Paved Roads – Vacuum Sweeping or Water Spray
Unpaved roads – Paving, Water Spray and/or Chemical Treatment

Technological Feasibility:

Unpaved roads that are not suitable for paving are the roads that have scrap steel delivery trucks traveling on the same surfaces that heavy tracked crawler cranes travel. Paved surfaces would immediately be torn up by the tracked equipment on these surfaces. Other roads are infrequent use, or may be relocated. Areas where both scrap steel and finished steel are stored frequently change location making paving unfeasible.

Economic Feasibility:

Based on the amount of unpaved roads currently in use at the facility and the estimated $PM_{2.5}$ emissions from these roads, the cost-effectiveness ratios for implementing additional controls would be approximately $790,000/ton for chemical treatment and approximately $1,450,000/ton for paving the roads

BACT Selection:

BACT for haul roads is considered to be the current controls: enforce 10 mph speed limit, vacuum sweeping, and water dust suppression.

Implementation Schedule:

Proper operations and controls that are already in place.

Startup/Shutdown Considerations

There are no startup/shutdown operations to be considered for these sources.

2.1.12 Dip Coating

Description:

Dip coating operations are performed at the Joist Plant, truss painting equipment, Structural Parts line, NBS and at the Accessory Dip Tank. The weight and irregular shape(s) of many of the truss, beams, rods, structures, etc., (e.g. "parts") to be painted, require dip coating as opposed to spray booth painting. The existing tanks at the facility are long narrow structures, deep enough to submerge a given part.

Pollutant [VOC]

The rate of VOC emissions are based on the VOC content of the paint, the surface area of the parts being painted, and the surface area of the tank's liquid surface. The dip tank process has no energy inputs (i.e. fuel or electricity) so the process does not have a start up or shut down period. By operation, these emissions are fugitive. Drying of large parts occurs at the dip tank and also outside the tanks as overhead cranes transfer parts through the process.

Control Options:

Work Practice Standards
Covering the Tanks
Capture System with TO or Carbon Adsorption

Technological Feasibility:

The potential additional control technologies include a capture system with thermal oxidation. However, this equipment requires capture systems, which would interfere with process flow, critically disrupt hoist and carry equipment and prohibit production. Drying of large parts occurs at the dip tank and also outside the tanks as overhead cranes transfer parts through the process. Therefore, collection of VOCs at point sources is technically infeasible; and installation of collection and treatment controls at the roof vents is technically infeasible because the subject roof structures at Nucor-Vulcraft cannot support these types of equipment.

Economic Feasibility:

Additional controls are technically infeasible for the dip tanks. Therefore, an economic feasibility was not performed.

BACT Selection:

Work practice standards to control VOC emissions currently consist of the tank lids placed back on the tank at the end of each shift and placed back on the tank during the shift if the dip tanks will not be used for one hour or more. Additional work practice standards have reduced emissions because this facility does not offer or provide specialty painting of parts or second/finishing coats. BACT for the dip tanks consists of the current work practices to limit VOC emissions. This includes closing the lids after each shift has ended or if the dip tanks have not been used for over an hour and using low VOC paint.

Implementation Schedule:

Proper operations and controls that are already in place.

Startup/Shutdown Considerations

There are no startup/shutdown operations to be considered for these sources.

2.1.13 Mastic Equipment

Description:

Mastic Equipment is used in NBS on the Standing Seam line. A rust preventer is applied along the moving production line.

Pollutant [VOC]

The VOC content of the material averages 1.75 pounds per gallon. Mastic is applied to roll-formed steel to provide a seal when the roof is erected in the field. The mastic is applied on the steel part and then rolled several hundred feet to a stacking area, and then moved outside for final storage prior to shipment. The VOCs are emitted during staging in the building and while stacked outside. Therefore the emissions would be considered fugitive and cannot be controlled

Control Options:

Work Practice Standards

Technological Feasibility:

The additional control technologies include a capture system. Installation of a capture system is technically infeasible. Therefore, collection of VOCs at point sources is technically infeasible.

Economic Feasibility:

Additional controls are technically infeasible for the Mastic operations. Therefore, an economic feasibility was not performed.

BACT Selection:

Work practice standards to control VOC emissions are currently in place.

Implementation Schedule:

Proper operations and controls that are already in place.

Startup/Shutdown Considerations

There are no startup/shutdown operations to be considered for these sources.

Description:

A highly evaporative lubricant is used to protect the finish of some of the panels in the NBS side panels.

Pollutant [VOC]

Calculations assume 100 % of the oil used evaporates as VOCs (7 lb/gal). A liberal calculation, using just over 2,600 gallons of lubricant, is used to estimate VOC PTE at 9.2 tpy. For actual usage, the amount of emissions and volume of emissions is much less than calculated.

Control Options:

Work Practice Standards

Technological Feasibility:

The potential additional control technologies include a capture system. Installation of a capture system is technically infeasible. The technical feasibility involving capture of these VOC's is not implementable due to challenges of collecting fugitive emissions along the entire production line (emissions continue to emit long after application). There is also a potential safety hazard of collecting and oxidizing the emissions. Therefore, additional control of VOCs at point sources is technically infeasible.

Economic Feasibility:

Additional controls are technically infeasible for the Mastic equipment. Therefore, an economic feasibility was not performed.

BACT Selection:

Work practice standards to control VOC emissions are currently in place.

Implementation Schedule:

Proper operations and controls that are already in place.

Startup/Shutdown Considerations

There are no startup/shutdown operations to be considered for these sources.

2.1.14 Solvent Cleaning

Description:

Solvent degreasers are used to remove various contaminants from pieces of equipment. Solvent degreasing is the physical process of using an organic or inorganic solvent to remove tars, greases, fats, oils, waxes, or soil from metal, plastic, printed circuit boards, or other surfaces. This cleaning is typically done prior to such processes as painting, plating, heat treating, and machining, or as part of maintenance operations. The solvent containers can be horizontal or vertical. The solvent may be agitated. Agitation increases the cleaning efficiency of the solvent. Agitation can be used with pumping, compressed air, vertical motion, or ultrasonics.

Control Options:

- Carbon adsorption
- Refrigerated primary condensers
- Increased freeboard ratio
- Combination of covers
- Water covers
- Internal Draining Rack
- Spray hose/spray nozzle
- Reduced room drafts
- Selected operation and maintenance practices

BACT Selection:

Compliance with the requirements of R307-335 is considered BACT for solvent degreasers ("PM2.5 Serious SIP – BACT for Small Sources.," 2017).

2.1.15 Emergency Generators

Description:

Nucor-Vulcraft operates diesel-fueled, gasoline powered, and natural gas fired generators. As emergency generators, they are seldom used with periodic maintenance firing and occasional use with loss of power. The majority are hand carry sized used to backup UPS systems for computers in the event of extended loss of power. Some larger generators are installed in stationary locations to handle critical operations such as emergency equipment or molten steel. All stationary generators meet the applicable requirements for generators contained in EPA's NESHAP or NSPS, which is BACT for generators. These federal regulations address NO_x, organic emissions, and particulates.

Control Options:

Control Options for $PM_{2.5}$:
- Catalyzed Diesel Particulate Filter (CleanAIR Systems, 2009)
- Diesel Oxidation Catalyst (CS, 2009)
- Diesel Particulate Filter (CS, 2009)

Control Options for NO_x:
- Exhaust Gas Recirculation (CS, 2009)
- NO_x Adsorber Catalyst (CS, 2009)
- Selective Catalytic Reduction (CS, 2009)
- Turbocharging and aftercooling (US EPA, 1993)
- Engine Ignition Timing Retardation (US EPA, 1993)
- Modifying air-to-fuel ratio (US EPA, 1993)

Control Options for SO_2:
- Ultra-Low Sulfur Diesel Fuel (Bradley Nelson, 2010)

Control Options for VOC:
- Catalyzed Diesel Particulate Filter (CS, 2009)
- Diesel Oxidation Catalyst (CS, 2009)

BACT Selection:

Evaluation of Findings & Control Selection:

Control Options for $PM_{2.5}$: The DAQ ("PM2.5 Serious SIP – BACT for Small Sources.," 2017) did not find any PM2.5 controls that were cost effective for controlling PM2.5 emissions. Therefore, BACT for direct PM2.5 emissions is proper maintenance and operation of the emergency stationary diesel engine.

Control Options for NO_x: The installation of a new emergency stationary diesel engine subject to the newest requirements for stationary emergency engines as specified in 40 CFR 60 Subpart IIII could potentially be cost effective and feasible for this source category, depending on a site-by-site analysis. This is assuming an old engine that is not currently subject to 40 CFR 60 Subpart IIII. This control selection is not applicable to newer engines. In the absence of replacing an old engine with a new engine, the installation of exhaust gas recirculation technology on older engines could be cost effective and feasible, again depending on a site-by-site basis of actual cost to retrofit the stationary emergency diesel engine on site. This control selection is assuming an old engine that is not currently subject to 40 CFR 60 Subpart IIII.

Control Options for SO_2: The DAQ recommends the use of ultra-low sulfur diesel fuel as BACT for SO_2 control.

Control Options for VOC: The DAQ did not find any VOC controls that were cost effective for controlling VOC emissions. Depending on the age of the engine and site-specific information, a diesel oxidation catalyst could be cost effective for controlling VOC emissions. However, the DAQ does not recommend a diesel oxidation catalyst as BACT for this source category due to the fact this control option is probably not cost effective. Therefore, the DAQ recommends proper maintenance and operation of the emergency stationary diesel engine as BACT for control of VOC emissions. A site-specific cost/ton removed could be derived for making a determination on the requirement of installing a diesel oxidation catalyst.

2.2 Consideration of Ammonia

The only source of ammonia emissions at the Nucor-Vulcraft site is from the combustion of natural gas. The unreacted ammonia can be treated as a $PM_{2.5}$ precursor. Although currently not being considered as a precursor pollutant in Utah's $PM_{2.5}$ Serious SIP, the source's BACT analysis did include an analysis of BACT for ammonia emissions, which is being included here for completeness.

Control Options:

Good combustion practices are the only control technology for minimizing NH_3 emissions from heaters less than 10 MMBtu/hr.

Technological Feasibility:

All identified control technologies are technically feasible.

Economic Feasibility:

All control technologies are economically feasible.

BACT Selection:

The technology identified for controlling NH_3 emissions from the ovens and heaters is the use of pipeline quality natural gas and good combustion practices.

Implementation Schedule:

Proper operations are already in place.

Startup/Shutdown Considerations

There are no startup/shutdown operations to be considered for these sources.

3.0 Conclusion- Emissions Reduction through BACT implementation

Installation of the high efficiency filters on the Coil Line and the Bar Line blasting baghouses. Installation of the new baghouses will result in a 3.29 tpy reduction in PM2.5 for the Coil Line and a 9.57 tpy reduction in PM2.5 for the Bar Line.

4.0 Implementation Schedule and Testing Requirements

Installation of the high efficiency filters on the Coil Line and the Bar Line blasting baghouses by December 2019.

6.0 New PM2.5 SIP – KUC BCM Specific Requirements

There are no new specific conditions in Section IX.H.12 for the Nucor-Vulcraft site.

6.1 Monitoring, Recordkeeping and Reporting

Monitoring for IX.H.23.b.i.A is specifically outlined in IX.H.23.b.i.B; while IX.H.23.b.ii.A is addressed in IX.H.23.b.ii.B. Recordkeeping is subject to the requirements of IX.H.21.c and IX.H.21.f.

7.0 References

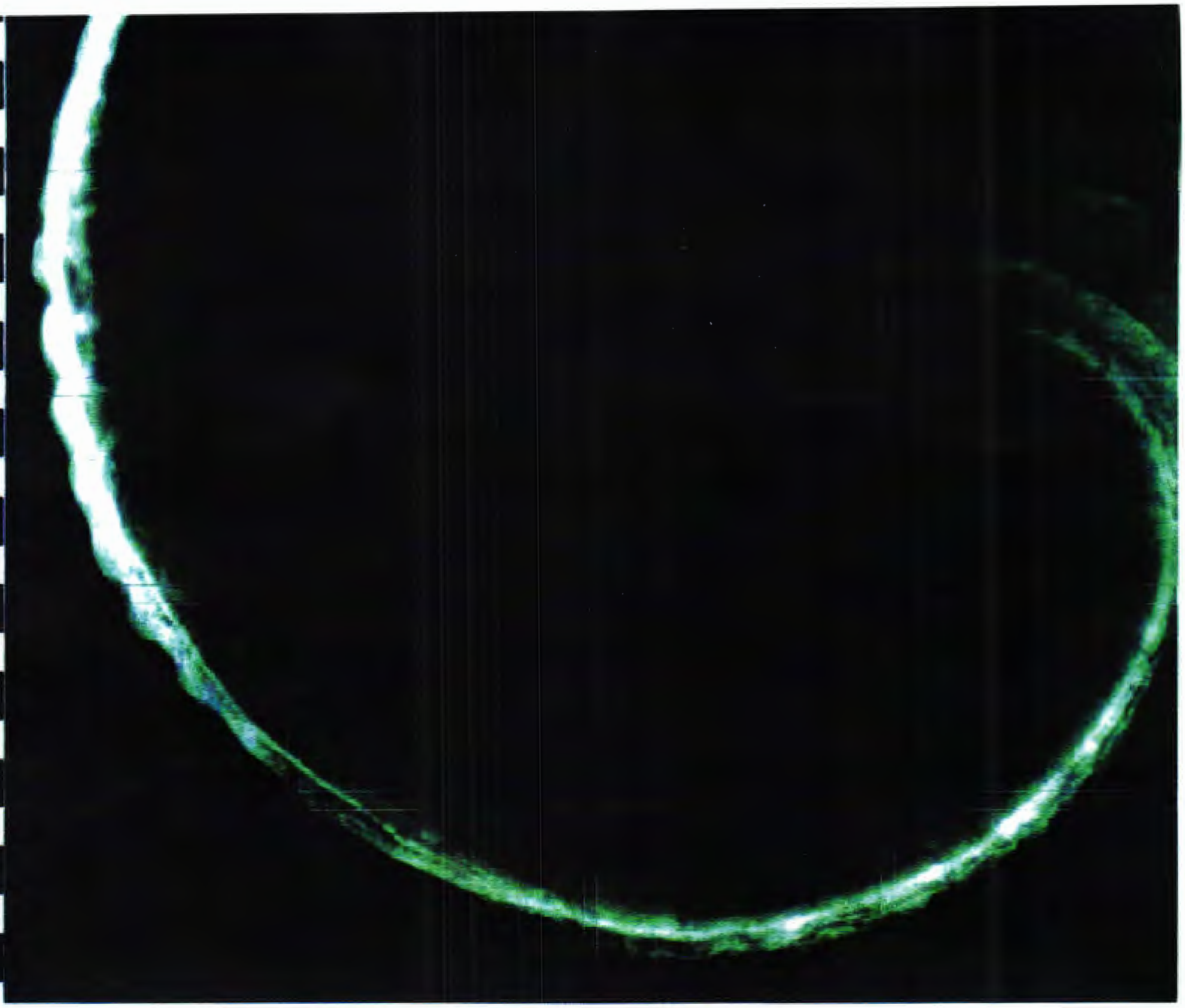
Environmental Resources Management. (2017, April). Best Available Control Technology Evaluation - Utah PM2.5 State Implementation Plan.

Environmental Resources Management. (2018, February). Best Available Control Technology Evaluation – Utah PM2.5 State Implementation Plan.

PM2.5 Serious SIP – BACT for Small Sources. (2017, August 11). Utah DAQ Minor Source NSR.

Sacramento Metropolitan Air Quality Management District. (2017, August 1). BACT Determination for Plasma Cutter.

$PM_{2.5}$ Serious SIP – BACT for Small Sources.



Best Available Control Technology Evaluation – Utah $PM_{2.5}$ State Implementation Plan

Brigham City, Utah

April 2017

Environmental Resources Management
www.erm.com

Prepared for:
Vulcraft-A Division of Nucor Corporation
1875 West Highway 13 South
Brigham City, Utah 84302

The business of sustainability

ERM

Vulcraft, A Division of Nucor Corporation

Best Available Control Technology Evaluation Utah $PM_{2.5}$ State Implementation Plan

Brigham City, Utah

April 2017

David S. Wilson, P.E., P.G.
Partner

Erin Hallenburg, P.E., QEP
Senior Project Engineer

Environmental Resources Management
136 East South Temple, Suite 2150
Salt Lake City, UT 84111
801-204-4300
www.erm.com
Fax: (801) 595-8484

TABLE OF CONTENTS

LIST OF TABLES

LIST OF ACRONYMS

AMPs	amperes
ANSI	American National Standard Institute
ASHAE	American Society of Heating, Refrigeration, and Air Conditioning Engineers
BAAQMD	Bay Area Air Quality Management District
BACT	Best Available Control Technology

BMP	best management practices
cfm	cubic feet per minute
EPA	Environmental Protection Agency
ERM	ERM-West, Inc.
ESP	electrostatic precipitator
EU	emission unit (air pollution producing equipment)
FGR	flue gas recirculation
HVLP	high volume low pressure
LAER	lowest achievable emission rate
lb/gal	pounds per gallon
LEL	lower explosive limit
N	no
N/A	not applicable
NBS	Nucor Building Systems
NAAQS	National Ambient Air Quality Standards
NG	natural gas
NH_3	ammonia
NOI	Notice of Intent
NOx	nitrogen oxides
NSCR	non-selective catalytic reduction
ppm	parts per million
PTE	Potential to Emit
RACT	Reasonably Available Control Technology
RBLC	RACT/BACT/LAER Clearinghouse
SBAPCD	Santa Barbara Air Pollution Control District
SCAQMD	South Coast Air Quality Management District
SCR	selective catalytic reduction
SIC	standard industrial classification
SIP	State Implementation Plan
SNCR	selective non-catalytic reduction
SOx	sulfur oxides

TO	Thermal oxidation
tpy	tons per year
VOC	volatile organic compounds
WGS	wet gas scrubber
Y	yes

EXECUTIVE SUMMARY

This Best Available Control Technology (BACT) Evaluation was completed in accordance with the Utah Department of Air Quality's 23 January 2017 letter requesting this analysis as part of the regulatory agency's fine particular matter (particulate matter 2.5 microns or less in diameter or $PM_{2.5}$) Serious Nonattainment State Implementation Plan (SIP) development process. The top-down BACT process was followed to identify BACT for each source and the following associated emission type: $PM_{2.5}$, sulfur oxides (SOx), nitrogen oxides (NOx), volatile organic compounds (VOC), and ammonia (NH_3).

Vulcraft, a Division of Nucor Corporation (Nucor-Vulcraft) is a steel fabrication facility that consists of two main facilities, including the Joist Plant and Nucor Building Systems (NBS). The Joist Plant consists of the Joist Plant, the Cold Finish area, a stock yard, the maintenance facility and administrative buildings. Nucor-Vulcraft is identified as a Major Source for Volatile Organic Compounds (VOCs), which are considered $PM_{2.5}$ precursors.

The applicable sources at the Nucor-Vulcraft facility were identified as: shot blasting, exhaust vents, plasma cutters, spray boxes, welding, spray booths, drying ovens, dip coating, haul roads, resistance welding, joist coating, parts cleaners, vacu- coater, mastic equipment, and lubrication equipment.

All potential control technologies were listed and evaluated for the relevant emission sources. Technically infeasible technologies were eliminated. The remaining technologies were ranked by control effectiveness. An economic feasibility study was then conducted with a cost effectiveness threshold of $10,000 per ton removed per year. As a part of the BACT process, other issues that could adversely impact the environment, safety and health, and energy demand were included in the evaluation. Table 1 lists controls identified as BACT for the applicable emission sources.

Nucor-Vulcraft has significantly reduced VOC emissions during the last 15 years by implementing the use of lower VOC paints (i.e. water based paints). Since 2005, VOC emissions at the facility have been reduced, mainly from painting operations, from 339 tons to 262 tons per year (tpy). The use of low-VOC paints represents the current baseline condition, and is considered BACT for the facility for painting operations. Nucor-Vulcraft experienced an average increase of $4 per gallon to use the low-VOC paint compared to the prior VOC-based paints, which results in an additional annual cost of about $900,000 per year based on the average annual quantities of paint used (i.e., 225,500 gallons).

In addition, Nucor-Vulcraft proposes to reevaluate welding techniques and plasma cutter operations, to confirm if techniques are optimal to ensure that emissions are minimized.

1.0 INTRODUCTION

On behalf of Vulcraft, a Division of Nucor Corporation (Nucor-Vulcraft), ERM-West, Inc. (ERM) conducted a Best Available Control Technologies (BACT) evaluation for the company's Brigham City facility. This report presents the BACT process and results for submittal to the Utah Department of Environmental Quality, Division of Air Quality (UDAQ). The BACT evaluation was completed in accordance with the UDAQ's 23 January 2017 letter requesting this analysis as part of the regulatory agency's fine particular matter (particulate matter 2.5 microns or less in diameter or $PM_{2.5}$) Serious Nonattainment State Implementation Plan (SIP) development process.

2.0 APPROACH

A top-down BACT analysis was completed for all technologies that would reduce $PM_{2.5}$ emissions and precursors of $PM_{2.5}$ emissions from all regulated sources within the Nucor-Vulcraft facility. The evaluation included assessing all processes from the Cold Finish, Joist Plant, Nucor Building Systems (NBS), and the new Grating and Structural Products lines. All applicable emission control technologies were identified for the emission sources, and they were screened for technical feasibility under the SIP requirements and schedule.

The SIP is designed to regulate and limit $PM_{2.5}$ and its precursors to below the National Ambient Air Quality Standards (NAAQS) based on data to be collected throughout year 2019. This means that control technology improvements will need to be in place before the end of year 2018 to support compliance with the SIP. Therefore, the evaluation and identification of BACT takes into account whether Nucor-Vulcraft can implement the new controls prior to the end of 2018.

In cases where Nucor-Vulcraft has determined that control technologies are technically feasible, except for the SIP schedule constraints, these controls are not considered BACT, but rather "Additional Feasible Measures" that could be implemented if more time were available. All technologies considered technically feasible as BACT or Additional Feasible Measures were ranked based on their potential emission reduction efficiencies. Energy, environmental, economic impacts and other considerations were evaluated for the feasible technologies; and the most effective, least impactful, cost-effective technologies were identified as BACT or Additional Feasible Measures for the applicable emission units.

2.1 *BACT ANALYSIS PROCESS*

The BACT analysis was organized into the following steps, which are described in the paragraphs that follow:

1. Identify control technologies.
2. Eliminate technically infeasible technologies.
3. Rank technologies by control effectiveness.
4. Evaluate controls for economic feasibility.
5. Recommend BACT.

2.1.1 *Step 1 - Identify Control Technologies*

Nucor-Vulcraft identified its emission sources for $PM_{2.5}$ and precursors; and then identified acceptable control technologies for these sources. The U.S. Environmental Protection Agency (EPA) established the Reasonable Available Control Technologies/BACT/Lowest Achievable Emission Rate (RACT/BACT/LAER) Clearinghouse (RBLC) to provide a central data base of air pollution technology information. Nucor-Vulcraft relied on the RBLC, plus other resources listed in Section 2.2, to identify potentially applicable control technologies. The emission sources and applicable technologies were documented using a BACT Matrix Table for tracking and presentation of the results as presented in Section 3 and the attached tables.

2.1.2 *Step 2 - Eliminate Technically Infeasible Technologies*

Nucor-Vulcraft reviewed the technologies to determine whether they were technically feasible based on site-specific (i.e., real estate) or operational constraints. The SIP time constraints were also taken into account relative to defining technically feasible BACT. Step 3 - Rank Technologies by Control Effectiveness

In most cases, Nucor-Vulcraft conservatively calculated the baseline emissions from its sources using the potential to emit (PTE) calculations used for the Notice of Intent (NOI) submitted 9 February 2017. In select cases, the actual emissions were considered from recent years (e.g., Purlin Line) instead of the PTE calculated values to more accurately account for potential emission reductions. The potential for additional emission reductions was evaluated for the applicable technologies using vendor or EPA provided removal efficiencies. The amount of emissions reductions that could be achieved for the applicable technologies were calculated and the technologies were listed according to rank on the BACT Matrix.

2.1.3 *Step 4 - Evaluate Controls for Economic Feasibility*

Nucor-Vulcraft evaluated the controls for economic feasibility using capital and operating cost estimates provided by the EPA Cost Control Manual, vendor information, ERM experience, and potential project estimates from Nucor-Vulcraft. Energy consumption, environmental and other impacts were considered for the feasible controls to account for all economic impacts. The economic feasibility of increased controls was evaluated using the ratio of the cost for the new controls compared with the incremental emission reductions achieved by the new controls verses the baseline (current) condition in terms of dollars per ton of emissions reduced. Nucor-Vulcraft considered the ratio of $10,000 per ton of emission reductions to represent economically feasible controls.

2.1.4 *Step 5 - Recommend BACT*

Based on the evaluation of control technologies, Nucor-Vulcraft is presenting in this report its analysis and conclusions regarding the controls it believes are technically and economically feasible, and those that can be considered BACT (including compliance with the UDAQ SIP schedule) or Additional Feasible Measures (if more time is permissible for technology implementation). Table 1 presents a summary of BACT selections for each pollutant by source.

2.2 *REGULATORY BACKGROUND*

The following BACT clearinghouses and guidelines were searched as part of Step 1 to identify potentially applicable control technologies for the Nucor-Vulcraft emission sources:

- U.S. EPA RACT/BACT/Lear Clearinghouse (RBLC)
- California Air Resources Board Standard Industrial Classification (SIC) 325180 (other basic inorganic chemical manufacturing) and 2812 (Alkaline and Chlorine)
- Bay Area Air Quality Management District (BAAQMD)
- South Coast Air Quality Management District (SCAQMD)
- Texas Commission of Environmental Quality

The following process types were reviewed for the various operations that are conducted at Nucor-Vulcraft:

- Process Type No. 12.310- Natural Gas -Paint, Heaters, Ovens

- Process Type No. 13.310 - Commercial/Institutional Size Boilers/ Furnace, <100 MMBtu/hr, Natural Gas
- Process Type No. 41.002 - Automobiles and Trucks Surface Coating -Guidecoat and Topcoat Painting
- Process Type No.41.013 - Miscellaneous Metal Parts & Product Surface Coating
- Process Type No. 81.230 - Steel Production Casting & Pouring Processes;
- Process Type No. 81.350 - Steel Foundry Casting & Pouring Processes;
- Process Type No. 81.390 - Other Steel Foundry Processes;
- Process Type No. 81.290 - Other Steel Manufacturing Processes;
- Process Type No. 81.370 - Miscellaneous Melt Shop Operations;
- Process Type No. 99.012- Welding & Grinding
- Process Type No. 99.999 - Other Miscellaneous Sources -Painting Operations

The following regulations were reviewed:

- Code of Federal Regulations Title 40, Part 52
- Code of Federal Regulations Title 40, Part 60
- Code of Federal Regulations Title 40, Part 63
- Utah Air Rules Title 19, Chapter 2 of the Utah Code: R307

To fully evaluate applicable BACT limits for processes with limited RBLC results, based on process type queries, additional RBLC queries were conducted based on process names or key words (e.g., "Blast").

2.3 *BASIS AND STUDY LIMITATION*

Operations were evaluated on a standalone bases per specific emission unit. The prescribed BACT process was followed including further investigation if a control technology appeared feasible, but not economically practical. Costs for these technologies, including implementation costs, were estimated using available regulatory data, vendor information, and best judgement; however, costs for major capital projects like those considered herein can vary by over 100 percent.

The cost effectiveness for BACT was considered at $10,000 per ton removed or less. Nucor-Vulcraft used this value as the basis for determining new BACT selections for this evaluation. The determination of technical feasibility had several criteria that needed to be met such as physical constraints, operational safety, and other environmental protection criteria.

3.0 *BACT EVALUATION*

The BACT Evaluation is summarized for each source in the following sections. Tables 2 through 6 also present the emission sources for direct $PM_{2.5}$ and its precursors (e.g., sulfur oxides (SOx), nitrogen oxides (NOx), volatile organic compounds (VOCs), and ammonia (NH_3)). For each source, these tables list the identified control technologies, if they are technically feasible, the baseline emissions, the estimated emissions reductions, and the cost effectiveness for applicable technologies.

3.1 *WIRE LINE SHOT BLASTING*

3.1.1 *$PM_{2.5}$*

Shot blasting on the wire line produces Direct $PM_{2.5}$ emissions. The identified control technologies are listed on Table 2, including the currently implemented use of a baghouse with 99.99% efficiency.

The technical feasibility evaluation showed that no additional control technologies were feasible for the Wire Line Shot Blasting.

As no additional technologies were identified as technically feasible, no economic analysis was conducted. Therefore, BACT for the Wire Line Shot Blasting is considered to be the current controls: baghouse with 99.99% efficiency.

3.2 *COIL LINE SHOT BLASTING*

3.2.1 *$PM_{2.5}$*

Shot blasting is done on the coil line with possible direct $PM_{2.5}$ emissions. No specific emission factor for $PM_{2.5}$ has been developed for shot blasting and with the absences of combustion in this process, the likelihood of measurable $PM_{2.5}$ being generated is small. Estimated PTE $PM_{2.5}$ emissions equal PM10 emissions, which are 3.3 tons per year (tpy). The identified control technologies are listed on Table 2, including the currently implemented use of a baghouse with 98% efficiency.

The technical feasibility evaluation showed an additional control technology of using a different baghouse filter media which has a removal efficiency of 99.99% down to 0.5 *u*m. Based on limited emission factor data, this could reduce the PTE impact by 1.81 tpy.

The economic evaluation showed that this control technology was economically infeasible as the incremental cost effectiveness ratio exceeded $10,000 per ton. One main reason for this exceedance is because the higher efficiency filter media is not available for the current baghouse used at the facility, and full replacement of the existing baghouse would be required. Therefore, BACT for the Coil Line Shot Blasting is considered to be the current control: baghouse with 98% efficiency.

3.3 *BAR LINE SHOT BLASTING*

3.3.1 $PM_{2.5}$

Installation of the 99.99% removal efficiency filter media presented in Section 3.2.1 could result in an "on-paper reduction" of 5.29 tpy of $PM_{2.5}$ for this source. For the technical and economic discussion for this emission unit, please see Section 3.2.1. BACT for the Bar Line Shot Blasting is considered to be the current control: baghouse with 98% efficiency.

3.4 *EXHAUST VENTS (JOIST PLANT, COLD FINISH, AND NBS)*

3.4.1 $PM_{2.5}$

There are 15 roof vents on the Joist Plant, three (3) roof vents on Cold Finish and six (6) main vents on NBS (24 total roof vents). These fan-driven vents exhaust air from the respective production/assembly lines to the atmosphere. As recommended by the American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHAE), 10 to 15 air exchanges per hour should occur for manufacturing buildings.

Approximately 2.16 tpy of $PM_{2.5}$ based on air sampling events, have been estimated to be exhausted from the 24 roof vents. The combined air flow, based on Approved American National Standard Institute (ANSI) is approximately 300,000 cubic feet per minute (cfm) or about 19,700 cfm per exhaust vent.

Control technologies for $PM_{2.5}$ appear to be limited to fabric filters, with filter bags that remove 99% of $PM_{2.5}$ (Table 2). This technology would involve 15 fabric filters having high volume, high efficiency filters or one large unit with extensive ducting and exhaust fans. Removal of small particulate, high volume air presents several known technical problems. Roof exhaust vents would have to be retrofitted with support structures for on-roof baghouses. Additional structural additions would also need to be made to facilitate servicing the equipment. An alternative approach would be for an extensive duct system to collect and move the exhaust building air down to a centralized baghouse system.

Due to the high volume of air flow that must be maintained, low volume of $PM_{2.5}$ to be removed, extensive structural improvements, and the number of fabric filter housings needed, this technology is neither technologically nor economically feasible.

3.5 *PLASMA CUTTER (COLD FINISH - DRY)*

The Plasma Cutter in Cold Finish produces direct $PM_{2.5}$ emissions and NOx emissions. This source has historically been operated less than 40 hours per year. There is no anticipated increased usage planned for this source.

3.5.1 $PM_{2.5}$

Dry plasma cutter operation in Cold Finish for maintenance produces approximately 0.035 tpy of Direct $PM_{2.5}$ emissions. The identified control technologies are listed on Table 2.

As estimated, with a maximum of 40 hours of operation, only 0.035 tpy are emitted from this unit, no additional controls were identified to be technically feasible. Therefore, BACT for the dry plasma cutter in Cold Finish is considered to be the current controls: limited use and best management practices.

3.5.2 NOx

The dry plasma cutter in Cold Finish produces 0.03 tpy of NOx emissions. The identified control technologies are listed on Table 4.

The technical feasibility evaluation showed one potential additional control technology: flex duct capture system with an ESP or fume collector. However, this is considered economically infeasible due to the limited operation of the dry plasma cutter, which results in insignificant emissions. Therefore, BACT for the dry plasma cutter in Cold Finish is considered to be the current controls: limited use and best management practices.

3.6 *PLASMA CUTTER (NBS - WET)*

3.6.1 $PM_{2.5}$

Nucor-Vulcraft operates a wet plasma cutter at NBS. This source reports emissions of Direct $PM_{2.5}$ although no specific emission factors are available for this operation, thus $PM_{2.5}$ equals PM10. A PTE of 0.30 tpy of $PM_{2.5}$ is estimated. The particulate emissions are controlled by the water blanket that covers the plasma cutting. The identified control technologies are listed on Table 2, including the currently implemented plasma gas selection and manufacture recommendations on water submersion techniques.

The technical feasibility evaluation showed that potential additional controls could include best management practices (BMPs) on water submerging, flex duct capture system with HEPA, ESP, and fume hood with fabric filters. The safety and process flow would be critically disrupted with the hoist and carry technologies if a capture system was installed. Therefore, these additional technologies are considered technically infeasible.

As no additional technologies were identified as technically feasible, no economic analysis was conducted. Therefore, BACT for the plasma cutter is considered to be the current controls: plasma gas selection and following manufacture recommendations on water submersion techniques. A manufacturer's inspection and implementation of BMPs could help minimize emissions.

3.6.2 NOx

The wet plasma cutter at NBS also produces NOx emissions. The identified control technologies for NOx are listed on Table 4, including the currently implemented plasma gas selection and manufacture recommendations on water submersion techniques.

The technical feasibility evaluation showed that potential additional control included additional BMPs such as a flex duct capture system with wet or dry scrubbers, a non-selective catalytic reduction (NSCR), selective catalytic reduction (SCR). A re-evaluation of the operation and current settings (e.g., lowest recommended current, arc voltage, and arc length, travel speed and additional training on proper angle) was also identified as BACT in our literature research. A wet plasma manufacturer' representative professional evaluation would be required to determine if re-evaluating the settings would decrease emissions. The safety and process flow would be critically disrupted with the hoist and carry system if a capture system was installed. There is no flue to inject urea for the NSCR or SCR. Therefore, these additional technologies are considered technically infeasible. The BACT for the wet plasma cutter should be considered the currently implemented plasma gas selection and manufacture recommendations on water submersion techniques.

3.7 PLASMA CUTTER (STRUCTURAL PRODUCTS - WET)

3.7.1 $PM_{2.5}$

A new wet plasma cutter will be installed in the Structural Products section of the Joist Plant. The particulate emissions are controlled by the water blanket that covers the plasma cutting.

The uncontrolled $PM_{2.5}$ PTE is estimated to be 0.03 tpy. The existing wet blanket technique results in a 95% reduction in emissions. Additional controls would result in insignificant amounts of $PM_{2.5}$ removal, thus making additional controls technically and economically infeasible. .

Therefore, BACT for the plasma cutter is considered to be the current controls: plasma gas selection and following manufacture recommendations on water submersion techniques.

See Section 3.6.1.

3.7.2 NOx

See Section 3.6.2.

3.8 PLASMA CUTTER (STRUCTURAL PRODUCTS - DRY)

3.8.1 $PM_{2.5}$

Nucor-Vulcraft is installing a dry plasma cutter for the Structural Products line. This source produces $PM_{2.5}$ emissions. The identified control technologies are listed on Table 2, including the currently implemented fume collector and control (blended cellulose and polyester fibers).

The technical feasibility evaluation showed that potential additional control technologies include additional BMPs such as a flex duct capture system with HEPA, ESP, or fume collector, improved filter efficiency (i.e., dry filtration), and re-evaluating the settings (e.g., lowest recommended current, arc voltage, and arc length, travel speed and additional training on proper angle). An expert evaluation would be required to determine if re-evaluating the settings would decrease emissions. The safety and process flow would be critically disrupted with the hoist and carry system if a capture system was installed. There is no flue to inject urea for the NSCR or SCR. Therefore, these additional technologies are considered technically infeasible.

As no additional technologies were identified as technically feasible, no economic analysis was conducted. Therefore, BACT for the plasma cutter is considered to be the current controls: using a fume collector and control.

3.8.2 NOx

The dry plasma cutter in Structural Products also produces NOx emissions. The identified control technologies are listed on Table 5, including the currently implemented fume collector and control.

The technical feasibility evaluation showed that potential additional control technologies include a flex duct capture system with wet or dry scrubbers. The safety and process flow would be critically disrupted with the hoist and carry system if a capture system was installed. Therefore, these additional technologies are considered technically infeasible.

As no additional technologies were identified as technically feasible, no economic analysis was conducted. Therefore, BACT for the plasma cutter is considered to be the current controls: using a fume collector and control.

3.9 BRIDGING LINE (SPRAY BOX)

3.9.1 $PM_{2.5}$

Nucor-Vulcraft operates a Bridging Line that produces direct $PM_{2.5}$ emissions. The identified control technologies are listed on Table 2, including best management practices.

The technical feasibility evaluation showed one potential additional control technology: fabric filter. However, the majority of particle matter created from the Spray Box is greater than 2.5 μm. The Spray Box is a self-contained chamber that coats parts along the production line. Although $PM_{2.5}$ emissions have been calculated, the presences of $PM_{2.5}$ at this operation are highly unlikely. Effective control of non-existent $PM_{2.5}$ emissions therefore is technically infeasible.

As no additional technologies were identified as technically feasible, no economic analysis was conducted. Therefore, BACT for the bridging line is considered to be the current controls: best management practices.

3.9.2 VOCs

The Bridging Line spray box produces VOC emissions. The identified control technologies are listed on Table 5, including replacing the vacu-coater with the spray box in the NOI submittal dated February 9, 2017 and reducing the paint VOC content to 2.1 lb/gal.

The technical feasibility evaluation showed no additional control technologies were feasible for the spray box.

As no additional technologies were identified as technically feasible, no economic analysis was conducted. Therefore, BACT for the spray box is considered to be the current controls: replacement of vacu-coater and the reduction of VOC content to 2.1 lb/gal.

3.10 WELDING

3.10.1 $PM_{2.5}$

Nucor-Vulcraft performs welding operations. This source produces $PM_{2.5}$ emissions. The identified control technologies are listed on Table 2, including the currently implemented inert shielding gas, the electrode selection, and using lowest recommended current/low amperes (AMPs).

The technical feasibility evaluation showed that potential additional control technologies include additional BMPs such as a flex duct capture system with HEPA or ESP, a torch fume extraction HEPA or ESP, and re-evaluating the settings (e.g., lowest recommended current, arc voltage, and arc length, travel speed and additional training on proper angle). An expert evaluation would be required to determine if re-evaluating the settings would decrease emissions. The safety and process flow would be critically disrupted with the hoist and carry system if a capture system was installed. Therefore, these additional technologies are considered technically infeasible.

As no additional technologies were identified as technically feasible, no economic analysis was conducted. Therefore, BACT for welding is considered to be the current controls: using an inert shielding gas, the electrode selection, and using the lowest recommended current/low AMPs.

3.11 SPRAY BOOTH (NBS - BUILT UP LINE)

3.11.1 $PM_{2.5}$

The PTE for $PM_{2.5}$ is based on the same emission factor as PM10, along with the control efficiency of the existing fabric filters. Given the existing fabric filters are estimated to control $PM_{2.5}$ by 95%, the estimated production of $PM_{2.5}$ from spray painting operations is due to the lack of quality emission factors. As estimated, NBS will produce a maximum of 1.87 tpy of $PM_{2.5}$.

Table 2 lists the identified control technologies for Direct $PM_{2.5}$ including, high-efficiency filter technology. This includes baghouses, cartridge, and fabric filters. However, the characteristics of spray painting and the associated overspray results in large diameter droplets that would immediately clog higher efficiency filter media.

The technological feasibility along with the non-effectiveness of reducing perceived $PM_{2.5}$ makes further controls not implementable. Therefore, BACT for the spray booth is considered the currently implemented use of high volume low pressure (HVLP) spray guns and 95% efficient filter pads.

3.11.2 VOCs

The identified control technologies for the control of VOCs from spray painting operations are carbon adsorption and TO technologies (Table 5). Carbon Adsorption requires a higher concentration of VOCs for this technology to be both cost effective and technically effective. Space restraints on the manufacturing floor also need to be considered for the carbon canisters associated with carbon adsorption.

The technical feasibility evaluation showed that TO technology is a viable consideration for spray painting operations. VOC PTE is estimated at 55.1 tpy for NBS and 17.8 tpy for Structural Products. TO technology could reduce VOC emission by more than 95%.

Feasibility of implementing this technology must consider the number of TO units, the extensive duct work and air movers and the large amount of natural gas that would be required for proper combustion. Environmental feasibility must consider that over 380 pounds of criteria pollutants would be produced for every million cubic feet of natural gas combusted, or that for every pound of VOC destroyed, 0.5 pounds of criteria pollutants are produced.

Economic feasibility evaluation shows that the incremental cost effectiveness exceeds $68,000 per ton destroyed at the NBS booth. Therefore, BACT should be considered the currently implemented lower VOC paints being used; work practice standards to limit the amount of overspray, and HVLP spray painting technology.

3.12 *SPRAY BOOTH (STRUCTURAL PRODUCTS)*

3.12.1 $PM_{2.5}$

The PTE for $PM_{2.5}$ is based on the same emission factor as PM10, along with the control efficiency of the existing fabric filters. Given the existing fabric filters are estimated to control $PM_{2.5}$ by 95%, the estimated production of $PM_{2.5}$ from spray painting operations is due to the lack of quality emission factors. As estimated, 1.0 tpy of $PM_{2.5}$ could be emitted from Structural Products' spray booth.

Table 2 lists the identified control technologies for Direct $PM_{2.5}$ including, high-efficiency filter technology. This includes both baghouse, cartridge and fabric filters. However, the characteristics of spray painting and the associated overspray results in large diameter droplets that would immediately clog higher efficiency filter media.

The technological feasibility along with the non-effectiveness of reducing perceived $PM_{2.5}$ makes further controls not implementable. Therefore, BACT should be considered the currently implemented use of HVLP spray guns and 95% efficient filter pads.

3.12.2 VOCs

The identified control technologies for the control of VOCs from spray painting operations are carbon adsorption and TO technologies (Table 5). Carbon Adsorption requires a higher concentration of VOCs for this technology to be both cost effective and technically effective. Space restraints on the manufacturing floor also need to be considered for the carbon canisters associated with carbon adsorption.

The technical feasibility evaluation showed that TO technology is a viable consideration for spray painting operations. VOC PTE is estimated at 17.8 tpy for Structural Products. TO technology could reduce VOC emission by more than 95%.

Feasibility of implementing this technology must consider the number of TO units, the extensive duct work and air movers and the large amount of natural gas that would be required for proper combustion. Environmental feasibility must consider that over 380 pounds of criteria pollutants would be produced for every million cubic feet of natural gas combusted or that for every pound of VOC destroyed, 0.5 pounds of criteria pollutants are produced.

Economic feasibility evaluation shows that the incremental cost effectiveness exceeds $246,000 at structural parts, exceeding the $10,000 threshold. Therefore

BACT should be considered the lower VOC paints being used; work practice standards to limit the amount of overspray, and HVLP spray painting technology.

3.13 *DRYING OVENS (JOIST PLANT, NBS, STRUCTURAL PRODUCTS)*

3.13.1 $PM_{2.5}$

Nucor-Vulcraft operates drying ovens in the Joist Plant, NBS, and Structural Products that produces $PM_{2.5}$ emissions. The identified control technologies are listed on Table 2, including currently used flue gas recirculation emission control.

The technical feasibility evaluation showed that potential additional control technologies for the drying oven include a capture system. This oven is designed to pass the steel products through the heating elements at a slow rate via overhead crane. Capture systems are not feasible due to the movement and weight of the products being processed.

As no additional technologies were identified as technically feasible, no economic analysis was conducted. Therefore, BACT for the drying oven in Joist Plant is considered to be the current control: flue gas recirculation.

3.13.2 SOx

The drying ovens are natural gas fired using pipeline quality natural gas. Other potential control technologies include a wet scrubber and a capture system with a flue gas desulphurization (Table 3). However, the amount of SOx emitted for the entire facility is <0.02 tpy. Therefore, the additional control technologies are considered technically and economically infeasible.

3.13.3 NOx

The drying ovens produce NOx emissions. The identified control technologies are listed on Table 4, including currently used flue gas recirculation emission control.

The technical feasibility evaluation showed that potential additional control technologies for the drying oven including SCR/SNCR and a LNB. However, to implement these would produce unacceptable safety and process mechanism issues, and they are therefore technically infeasible.

As no additional technologies were identified as technically feasible, no economic analysis was conducted. Therefore, BACT for the drying oven in Joist Plant is considered to be the current controls: flue gas recirculation.

3.13.4 VOC

The drying ovens produce VOC emissions. The identified control technologies are listed on Table 5, including currently used flue gas recirculation emission control.

The technical feasibility evaluation showed that additional control technologies for the drying oven include capture systems, except for the Purlin Line. To implement add-on controls would produce unacceptable safety and process mechanism issues, and therefore are technically infeasible.

The Purlin Line oven receives freshly painted beams and it is estimated that 90% of the VOC emissions are released during the baking process. The Purlin oven is already equipped with ducts that exhaust combustion and paint emissions to ambient air. Please see Section 3.20 for further discussion on controls.

As no additional technologies were identified as technically feasible, no economic analysis was conducted. Therefore, BACT for the drying oven in the Joist Plant is considered to be the current controls: flue gas recirculation.

3.13.5 NH_3

Ammonia emissions are not of concern because of insignificant emission rates from the Nucor-Vulcraft facility (Table 6).

3.14 FUGITIVE SPRAY

3.14.1 $PM_{2.5}$

The ability to paint 2% of the production was requested in the recent NOI submittal dated 9 February 2017. As the fugitive spray emissions are less than 1 tpy of direct $PM_{2.5}$, no BACT technologies were identified.

3.14.2 VOCs

The ability to paint 2% of the production was requested in the recent NOI submittal dated February 9, 2017. As the fugitive spray emissions are less than 0.4 tpy of VOC, no BACT technologies were identified.

3.15 *HAUL ROADS (NBS)*

3.15.1 *$PM_{2.5}$*

Nucor-Vulcraft has both paved and unpaved haul roads that produce direct $PM_{2.5}$ emissions. The identified control technologies are listed on Table 2, including the currently implemented 10 mph speed limit, vacuum sweeping, and water dust suppression.

The technical feasibility evaluation identified one potential additional control technology for haul roads: quarterly chemical treatment. However, UDAQ adopted chemical treatment emission factors that will not result in documented lower emissions. This technology is therefore considered technically and economically infeasible.

Paving additional areas that experience heavy traffic may reduce the amount of dust particulate matter. However, the total $PM_{2.5}$ emissions are less than 0.2 tpy. Therefore no additional BACT technologies were identified.

BACT for haul roads is considered to be the current controls: enforce 10 mph speed limit, vacuum sweeping, and water dust suppression.

3.16 *HAUL ROADS (JOIST PLANT)*

3.16.1 *$PM_{2.5}$*

Nucor-Vulcraft has both paved and unpaved haul roads that produce direct $PM_{2.5}$ emissions. The identified control technologies are listed on Table 2, including the currently implemented recent increase of paved road length, 10 mph speed limit, vacuum sweeping, and water dust suppression.

The technical feasibility evaluation showed that potential additional control technologies include vacuum sweeping on a more frequent basis and quarterly chemical treatment. However, these will not lower emissions and are therefore considered technically and economically infeasible.

As no additional technologies were identified as technically feasible, no economic analysis was conducted. Therefore, BACT for haul roads is considered to be the current controls: the recent increase of paved road length, 10 mph speed limit, vacuum sweeping, and water dust suppression.

3.17 *RESISTANCE WELDING*

3.17.1 $PM_{2.5}$

Nucor-Vulcraft uses resistance welding as a part of the Grating Line, which may produce direct $PM_{2.5}$ emissions. Nucor-Vulcraft could not identify any documentation on emission factors in order to quantify emissions from this process. Several resource documents indicate that resistance welding produces insignificant amounts of criteria pollutants. The identified control practice is listed on Table 2; this includes the currently implemented operation according to manufacturing specifications.

The technical feasibility evaluation showed that potential additional control technologies include a reevaluation to lower the current intensity. However, further evaluation beyond BACT would be required to determine if this would indeed lower emissions.

As no additional technologies were identified as technically feasible, no economic analysis was conducted. Therefore, BACT for resistance welding is considered to be the current control: operation according to manufacturing specifications.

3.18 *PARTS CLEANERS (NBS, JOIST PLANT, COLD FINISH)*

3.18.1 VOCs

Nucor-Vulcraft has parts cleaners in NBS, Joist Plant, and Cold Finish that produce VOC emissions. The identified control technologies are listed on Table 5 including the currently implemented replacement of Stoddard solvent with Safety-Kleen's Type II Solvent and the 2017 retirement of four parts cleaner units.

The technical feasibility evaluation showed one potential additional control for the parts cleaners: replace Safety-Kleen Type II solvent with extremely low VOC solvent solutions (e.g. citrus cleaner & degreaser). This replacement could decrease current emissions by a PTE estimated total of 0.171 tpy. To determine if this is technically feasible, testing various surface washing agents would need to be evaluated in these three areas (NBS, Joist Plant and Cold Finish) to determine the performance.

If surface washing agent can perform well enough to use, this would be considered BACT. Economic feasibility appears to be valid. However, until it can be tested, BACT is considered the current controls: using Safety-Kleen Type II solvent and the retirement of four parts cleaners.

3.19 DIP COATING (JOIST PLANT, NBS)

3.19.1 VOCs

Dip coating operations are performed at the Joist Plant, truss painting equipment, Structural Parts line, NBS and at the Accessory Dip Tank. The weight and irregular shape(s) of many of the truss, beams, rods, structures, etc., (e.g. "parts") to be painted, require dip coating as opposed to spray booth painting. The existing tanks at the facility are long narrow structures, deep enough to submerge a given part. The rate of VOC emissions are based on the VOC content of the paint, the surface area of the parts being painted, and the surface area of the tank's liquid surface. The dip tank process has no energy inputs (i.e. fuel or electricity) so the process does not have a start up or shut down period. By operation, these emissions are fugitive.

The identified control technologies for VOC mitigation are listed on Table 5 and are discussed below. Thermal oxidation (TO) technologies have been implemented for large metal painting operations and the control of VOCs. Up to 95% control has been achieved using TO. Carbon Adsorption requires a higher concentration of VOCs for this technology to be both cost effective and technically effective.

The technical feasibility evaluation showed that TO technologies determined to be economically infeasible with incremental cost effectiveness ratios exceeding:

- $143,800 to $252,700 per ton of VOC removed for the Joist Plant painting operations; and
- $40,300 to $70,500 per ton of VOC removed for the NBS painting operations.

Collecting these fugitive VOCs while maintaining functional operations is one of the main drivers for the high estimated cost.

Work practice standards to control VOC emissions currently consist of the tank lids placed back on the tank at the end of each shift and placed back on the tank during the shift if the dip tanks will not be used for one hour or more. Additional work practice standards have reduced emissions because this facility does not offer or provide specialty painting of parts or second/finishing coats.

A significant reduction in VOC emissions has occurred during the last 15 years through Nucor-Vulcraft's use of lower VOC paints (i.e., water based paints) that provide the needed attributes for steel structures and parts while reducing VOC concentrations. Since 2005, annual VOC emissions at the facility have been reduced, mainly from painting operations, from 339 tons to 262 tpy based on the 9 February 2017 PTE calculations. Nucor-Vulcraft experienced an average increase of $4 per gallon to use the low-VOC paint compared to the prior VOC-based paints, which results in an additional annual cost of about $900,000 per year based on the average annual quantities of paint used.

3.20 VACU-COATER (NBS - PURLIN LINE)

The Purlin Line (secondary structural components) production line has a vacu-coater that provides a protective layer of paint onto the horizontal beams. The vacu-coater applies the paint on moving beams and then the beam immediately enters the Purlin oven.

Purlin coating is a specialty type of painting that cannot be achieved with spray booths or dip tanks.

As estimated for PTE purposes, the paint applied from the vacu-coater produces up to 33 tpy of VOC emissions. This is based on 1.7 gallons of paint applied per ton of steel, and 2.1 pounds of VOCs per gallon of paint, and 31,475 gallons of paint used at the Purlin Line.

However, actual current emissions from the Purlin Line operation are significantly lower than the PTE estimated values. Actual data show that the painting efficiency is correct at 1.7 gallons of paint per ton of steel; however, the paint at the Purlin Line has lower VOC content at 1.1 pounds of VOC per gallon of paint, and paint usage averaged only of 13,600 gallons. This results in an actual emission rate for VOCs of 9.3 tons per year.

The identified control technologies for VOCs are listed on Table 5. The identified additional control technologies, besides the already implemented low VOC paints, include scrubbers, carbon adsorption and various applications of thermal oxidation (TO). The technical feasibility evaluation showed that two control technologies to be technically implementable: wet scrubber and carbon adsorption. The characteristics of TO technology result in spatial and safety issues due to limited space, plumbing in a natural gas line and ignition sources. Employing TO technology will also create a half ton of pollutants for every ton of VOC removed. Therefore, TO technology is considered infeasible due to space limitations and safety and environmental issues.

Recent advances in wet, packed-tower, scrubbing units for the removal of VOCs might be technically and economically feasible. Further on site studies would have to be conducted to determine if the VOCs produced at the purlin line are soluble enough for wet scrubbing to be effective.

Carbon adsorption systems may also be technically feasible but the limited floor space available is a concern. Either a series of 55-gallon drums or a Carbtrol Hi-Flow G-14-PPL may be a functional control technology for this system.

An evaluation of these technologies shows that either control technology could be installed immediately following the Purlin vacu-coater. The Purlin oven already is equipped with exhaust ducts that are estimated to capture 90% of the paint VOCs and combustion gases from the oven. The construction of an augmented collection system would be possible. Existing exhaust fans/ducts could be plumbed to a control unit.

The BACT economic analyses results in an economic feasibility ratio for the carbon adsorption control at approximately $12,000 per ton of VOC removed, and the wet scrubber control at approximately $14,000 per ton of VOC removed.

Nucor-Vulcraft has already significantly reduced the VOC impact from this operation by implementing operational and raw material (painting) practices. Implementation included the following:

- Painting efficiency of 1.7 gallons of paint per ton of steel throughput; and
- VOC content of paint averaging 1.1 pounds of VOC per gallon of paint.

These voluntary operational parameters lead to significant and actual reductions. The main benefit is that it controls VOC emissions at the source. Past estimates assume VOCs are emitted either during application process (10%) or in the oven (90%). Actually, fugitive VOC emissions occur as soon as the container of paint is opened until final drying of the Purlin Line product in the yard. Controlling the amount of VOCs that can be emitted is a more effective means for actual VOC reductions, and these operational controls are considered BACT for this operation without further equipment controls.

3.21 MASTIC EQUIPMENT

3.21.1 VOCs

Mastic Equipment is used in NBS on the Standing Seam line. A rust preventer is applied along the moving production line. The VOC content of the material averages 1.75 pounds per gallon. The capture system for the VOCs would have to extend along the line to capture the continuous evaporation of the mastic. Control technologies were not identified for this application, although typical VOC control techniques likely should be considered. As previously discussed, carbon adsorption requires a more concentrated captured VOC stream and TO technology will require additional natural gas usage. Natural gas combustion to control the VOCs will create 0.5 tons of criteria pollutants and GHGs for every million cubic feet of natural gas flow. No control technologies were identified as future product development would be required.

3.22 *LUBRICATION EQUIPMENT*

3.22.1 *VOCs*

A highly evaporative lubricant is used to protect the finish of some of the panels in the NBS side panels. Calculations assume 100 % of the oil used evaporates as VOCs (7 lb/gal). A liberal calculation, using just over 2,600 gallons of lubricant, is used to estimate VOC emissions at 9.2 tpy. For actual usage, the amount of emissions and volume of emissions is much less than calculated.

The technical feasibility of this approach appears not to be implementable due to challenges of collecting emissions along the entire production line (emissions continue to emit long after application) and the potential safety hazards of collecting and oxidizing the emissions.

4.0 *BACT RECOMMENDATIONS*

Based on the UDAQ expectation that BACT be defined as control technologies that could be installed and made operational by the end of 2018, Nucor-Vulcraft has determined that baseline conditions represent BACT for practically all emission sources. The enhanced use of low-VOC paints during the past 15 years is considered BACT for the painting operations, which has reduced VOC emissions from 339 tons to 262 tons per year (tpy). In addition, Nucor-Vulcraft proposes to evaluate welding techniques and plasma cutter operations, to confirm if techniques are optimal to ensure that emissions are minimized.

The emission limits and monitoring outlined in the 9 February 2017 NOI take into account the continuous reduction in emissions being achieved at Nucor-Vulcraft and are believed to represent BACT for the facility with the amendments acknowledged herein.

Tables

Table 1 BACT ***Selection for each Pollutant by Source***

Source	$PM_{2.5}$	SOx	NOx	VOC	NH_3
Wire Line Shot Blasting	Currently implemented: Baghouse 99.99% efficiency				
Coil Line Shot Blasting	Currently implemented: Baghouse with 98% efficiency				
Bar Line Shot Blasting	Currently implemented: Baghouse with 98% efficiency				
Exhaust Vents (Joist Plant)					
Exhaust Vents (Cold Finish)					
Plasma Cutter (Cold Finish – Dry)	Currently implemented: Limited use, BMPs		Currently implemented: Limited use, BMPs		
Plasma Cutter (NBS – Wet)	Currently implemented: Plasma gas selection, follow manufacture recommendation on water submersion techniques		Currently implemented: Plasma gas selection, follow manufacture recommendation on water submersion techniques		
Plasma Cutter (Structural Products – Wet)	Same as NBS-Wet		Same as NBS-Wet		
Plasma Cutter (Structural Products – Dry)	Currently implemented: Fume collector and control		Currently implemented: Fume collector and control		
Bridging Line (Spray Box)	Currently implemented: BMPs			Currently implemented: Replacement of vacu-coater, reduce VOC content to 2.1 lb/gal	
Welding	Currently implemented: Inert shielding gas, electrode selection, lowest recommended current/low AMPs				

Source	$PM_{2.5}$	SOx	NOx	VOC	NH_3
Spray Booth (NBS - Built up Line)	Currently implemented: HVLP spray guns, high efficiency filter system		Currently implemented: HVLP spray guns, reduce VOC content to 2.1 lb/gal, high efficiency filter system		
Spray Booth (Structural Products)	Same as NBS		Same as NBS		
Drying Oven (Joist Plant)	Currently implemented: FGR	Currently implemented: NG fired using pipeline quality NG	Currently implemented: FGR	Currently implemented: FGR	Insignificant emission rate
Drying Oven (NBS)	Same as Joist Plant	Same as Joist Plant	Same as Joist Plant	Same as Joist Plant	Same as Joist Plant
Drying Oven (Structural Products)	Same as Joist Plant	Same as Joist Plant	Same as Joist Plant	Same as Joist Plant	Same as Joist Plant
Fugitive Spray Booth	Currently implemented: No more than 2% will be sprayed outside the booth			Currently implemented: No more than 2% will be sprayed outside the booth	
Haul Roads (NBS)	Currently implemented: Water dust suppression, speed limit, vacuum sweeping				
Haul Roads (Joist Plant)	Currently implemented: Increase paved road length, water dust suppression, speed limit, vacuum sweeping				
Resistance Welding	Currently implemented: Operating according to manufacturing specifications				
Parts Cleaners (NBS)				Test Simple Green	
Parts Cleaners (Joist Plant)				Same as NBS	

Source	$PM_{2.5}$	SOx	NOx	VOC	NH_3
Parts Cleaners (Cold Finish)				Same as NBS	
Dip Coating				Currently implemented: Reduce VOC content to 2.1 lb/gal, Cover tanks when not in use	
Joist Coating				Currently implemented: Reduce VOC content to 2.1 lb/gal	
Vacu- Coater (NBS - Purlin Line)				Currently implemented: Operational controls	
Accessory Dip Tanks				Same as Joist Coating	
Mastic Equipment				Future Product development needed	
Lubrication Equipment				Same as Mastic Equipment	

Table 2 Potential BACT Technologies for Direct $PM_{2.5}$ – Particulate Matter

Source / Process Area	Existing Control Technology	Potential Control Technologies	Potential Technically Feasible? (Y / N)	Comment	Incremental Emissions Reduction (TPY)	Incremental Cost Effectiveness ($/ton)
Wire Line Shot blasting [A]	Wire Line Baghouse - 99.99% down to 0.5*u*m.		Y	Currently implemented	N/A	N/A
Coil Line Shot blasting [A]	Baghouse w/ 98% removal		Y	Currently implemented	N/A	N/A
		Filter media = 99.99% down to 0.5 *u*m	Y		0.07	$767,044
Bar Line Shot blasting [A]	Bar Line Baghouse 98%		Y	Currently implemented	N/A	N/A
		Filter media = 99.99% down to 0.5 *u*m	Y		0.19	$263,671
Joist Plant Building- Roof Exhaust Vents 6 + 9 roof exhaust vents		Scrubber	N	Vents would have to be retrofitted with support structures	N/A	N/A
		HEPA	N	Blower fans on roof at each roof exhaust or extensive duct system plumbing into one HEPA	N/A	N/A
		ESP	N	Works best on high and wet particles; large space requirements, not applicable to other pollutants and high operating cost	N/A	N/A
Cold Finish Building (Roof Exhaust Vents) 2 roof exhaust vents		Scrubber	N	Vents would have to be retrofitted with support structures	N/A	N/A
		HEPA	N	Blower fans on roof at each roof exhaust or extensive duct system plumbing into one HEPA	N/A	N/A

Source / Process Area	Existing Control Technology	Potential Control Technologies	Potential Technically Feasible? (Y / N)	Comment	Incremental Emissions Reduction (TPY)	Incremental Cost Effectiveness ($/ton)
		ESP	N	Works best on hot and wet particles; large space requirements, not applicable to other pollutants and high operating cost	N/A	N/A
Plasma Cutter (Cold Finish - Dry)	Limited Use; BMPs		Y	Currently implemented	N/A	N/A
Plasma Cutter (Structural Parts - Dry)	Fume collector and control (blended cellulose and polyester fibers)		Y	Currently implemented	N/A	N/A
		Flex duct Capture system with HEPA, ESP, or fume collector	N	Safety and process flow would be critically disrupted with hoist and carry system.	N/A	N/A
		Improved filter efficiency (i.e. Dry Filtration)	N	Safety and process flow would be critically disrupted with hoist and carry system.		
		Re-evaluate lowest recommended current, arc voltage, and arc length. Reevaluate travel speed and additional training on proper angle	Y	Expert evaluation required	N/A	N/A
Plasma Cutter (NBS-Wet)	Plasma Gas Selection		Y	Currently implemented	N/A	N/A
	Follow Manufacture recommendation on water submersion techniques		Y	Currently implemented	N/A	N/A

Source / Process Area	Existing Control Technology	Potential Control Technologies	Potential Technically Feasible? (Y / N)	Comment	Incremental Emissions Reduction (TPY)	Incremental Cost Effectiveness ($/ton)
		Additional BMPs on Water Submerging (i.e. Re-evaluate optimal distance between tip and workpiece, correct tip, amperage setting, cutting speed, and material exit angle.)	Y	Expert evaluation required	N/A	N/A
		Flex Duct Capture System with HEPA or ESP	N	Safety and process flow would be critically disrupted with hoist and carry system.	N/A	N/A
		Fume Hood with fabric filters (i.e. dry filtration)	N	Safety and process flow would be critically disrupted with hoist and carry system		
Plasma Steel Cutter (Structural Products -Wet)	Plasma Gas Selection		Y	Currently implemented	N/A	N/A
	Follow Manufacture recommendation on water submersion techniques		Y	Currently implemented	N/A	N/A
		Flex Duct Capture System with HEPA or ESP	N	Safety and process flow would be critically disrupted with hoist and carry system.	N/A	N/A
		BMPs on Water Submerging (i.e. Re-evaluate optimal distance between tip and workpiece, correct tip, amperage setting, cutting speed, and material exit angle)	Y	Expert evaluation required	N/A	N/A

Source / Process Area	Existing Control Technology	Potential Control Technologies	Potential Technically Feasible? (Y / N)	Comment	Incremental Emissions Reduction (TPY)	Incremental Cost Effectiveness ($/ton)
		Fume Hood with fabric filters (i.e. dry filtration)	N	Safety and process flow would be critically disrupted with hoist and carry system.		
Bridging Line (Spray box) A	BMPs		Y	Currently implemented	N/A	N/A
		Fabric Filter	N	Majority of PM > 2.5um	N/A	N/A
Welding	Inert Shielding Gas		Y	Currently implemented	N/A	N/A
	Electrode Selection		Y	Currently implemented	N/A	N/A
	Lowest Recommended Current/ Low AMPs		Y	Currently implemented	N/A	N/A
		1.Flex Duct Capture System HEPA or ESP	N	Safety and process flow would be critically disrupted with hoist and carry system.	N/A	N/A
		2.Torch Fume Extraction HEPA or ESP	N	Safety and process flow would be critically disrupted with hoist and carry system.	N/A	N/A
		3. Re-evaluate lowest recommended current, arc voltage, and arc length. Reevaluate travel speed and additional training on proper angle	Y	Experts required	N/A	N/A
Spray booth (NBS - Built up Line)	Source Control: HVLP spray guns		Y	Currently implemented	N/A	N/A
	Exhaust Control: 95% Filter Pads		Y	Currently implemented	N/A	N/A

Source / Process Area	Existing Control Technology	Potential Control Technologies	Potential Technically Feasible? (Y / N)	Comment	Incremental Emissions Reduction (TPY)	Incremental Cost Effectiveness ($/ton)
		Fabric Filter / Baghouse	N	Characteristics of spray painting and the associated overspray results in large diameter droplets that would immediately clog filter media	N/A	N/A
Spray booth (Structural Products)	Source Control: HVLP spray guns		Y	Currently implemented	N/A	N/A
	Exhaust Control: 95% Filter Pads		Y	Currently implemented	N/A	N/A
		Fabric Filter / Baghouse	N	Characteristics of spray painting and the associated overspray results in large diameter droplets that would immediately clog filter media	N/A	N/A
Drying ovens (Joist Plant)	Flue gas recirculation emission control		Y	Currently implemented	N/A	N/A
		Capture Systems	N	Safety and process flow would be critically disrupted with hoist and carry system.	N/A	N/A
Drying Oven (NBS)	Flue gas recirculation emission control		Y	Currently implemented	N/A	N/A
		Capture Systems	N	Safety and process flow would be critically disrupted with hoist and carry system.	N/A	N/A
Drying Oven (Structural Parts)	Flue gas recirculation emission control		Y	Currently implemented	N/A	N/A
		Capture Systems	N	Safety and process flow would be critically disrupted with hoist and carry system.	N/A	N/A
Fugitive Spray Booth	-	-	-	2% of the production will be allowed to be painted outside the paint booth. Total emissions <1 tpy.	N/A	N/A
Haul Roads (NBS) [1]	Increased paved road length		N	Total emissions <0.2 tpy	N/A	N/A

Source / Process Area	Existing Control Technology	Potential Control Technologies	Potential Technically Feasible? (Y / N)	Comment	Incremental Emissions Reduction (TPY)	Incremental Cost Effectiveness ($/ton)
	10 mph Speed limit		Y	Currently implemented	N/A	N/A
	Vacuum Sweeping for paved areas on a monthly basis		Y	Currently implemented	N/A	N/A
	Water dust suppression		Y	Currently implemented	N/A	N/A
		Quarterly Chemical treatment	N	Does not lower emissions[2]	N/A	N/A
Haul Roads (Joist Plant)[1]	Increased paved road length		Y	Currently implemented	N/A	N/A
	Water dust suppression		Y	Currently implemented	N/A	N/A
	10 mph Speed limit		Y	Currently implemented	N/A	N/A
	Vacuum Sweeping		Y	Currently proposed as an "on as needed basis"	N/A	N/A
		Vacuum Sweeping on more frequent basis	N	Does not lower emissions[2]	N/A	N/A
		Quarterly Chemical treatment	N	Does not lower emissions[2]	N/A	N/A
Resistance Welding	Operating according to Manufacturing Specifications		Y	<0.1 *um*	N/A	N/A
		Reevaluate lower current intensity	Y	Expert	N/A	N/A

Notes:

1) Most particulate size >2.5

2) https://deq.utah.gov/Permits/air/docs/2015/01Jan/EmissionPavedUnpavedHaulRoads.pdf

Table 3 Potential BACT Technologies for SOx – Sulfur Oxides

Source / Process Area	Existing Control Technology	Potential Control Technologies	Technically Feasible? (Y / N)	Comments	Incremental Emissions Reduction (TPY)	Incremental Cost Effectiveness ($/ton)
Drying Oven (Joist Plant)	Natural Gas Fired using pipeline quality NG.		Y	<0.02 tpy	N/A	N/A
		Wet Scrubbing	N	Very little SOx to remove	N/A	N/A
		Capture Systems with FGD (Flue gas desulphurization)	N	Very little SOx to remove	N/A	N/A
Drying Oven (NBS)	Natural Gas Fired using pipeline quality NG.		Y	<0.02 tpy	N/A	N/A
		Wet Scrubbing	N	Very little SOx to remove	N/A	N/A
		Capture Systems with FGD (Flue gas desulphurization)	N	Very little SOx to remove	N/A	N/A
Drying Oven (Structural Parts)	Natural Gas Fired using pipeline quality NG.		Y	<0.02 tpy	N/A	N/A
		Capture Systems with FGD (Flue gas desulphurization)	N	Very little SOx to remove	N/A	N/A
		Wet Scrubbing	N	Very little SOx to remove	N/A	N/A

Table 4 Potential BACT Technologies for NOx – Nitrogen Oxides

Source / Process Area	Existing Control Technology	Potential Control Technologies	Technically Feasible? (Y / N)	Comment	Incremental Emissions Reduction (TPY)	Incremental Cost Effectiveness ($/ton)
Plasma Cutter (Cold Finish - Dry)	Limited Use		Y	Currently Implemented	N/A	N/A
		Flex duct Capture system with HEPA, ESP, or fume collector	N	Dry Plasma Cutter operation is sporadic and results in insignificant emissions	N/A	N/A
Drying Oven (Joist Plant)	Flue gas recirculation emission control		Y	Currently Implemented	N/A	N/A
		SCR/SNCRs	N	Hoist and process mechanism issues	N/A	N/A
		Low NOx Burner	N	Hoist and process mechanism issues	N/A	N/A
Drying Oven (NBS)	Flue gas recirculation emission control		Y	Currently Implemented	N/A	N/A
		SCR/SNCRs	N	Hoist and process mechanism issues	N/A	N/A
		Low NOx Burner	N	Hoist and process mechanism issues	N/A	N/A
Drying Oven (Structural Parts)	Flue gas recirculation emission control		Y	Currently Implemented	N/A	N/A
		SCR/SNCRs	N	Hoist and process mechanism issues	N/A	N/A
		Low NOx Burner	N	Hoist and process mechanism issues	N/A	N/A
Plasma Steel Cutter (Structural	Plasma Gas Selection		Y	Currently Implemented	N/A	N/A

Source / Process Area	Existing Control Technology	Potential Control Technologies	Technically Feasible? (Y / N)	Comment	Incremental Emissions Reduction (TPY)	Incremental Cost Effectiveness ($/ton)
Products -Wet)	Follow Manufacture recommendation on water submersion techniques		Y	Currently Implemented	N/A	N/A
		Flex Duct Capture System with Wet Scrubbers	N	Hoist and process mechanism issues	N/A	N/A
		Flex Duct Capture System with Dry Scrubbers	N	Hoist and process mechanism issues	N/A	N/A
		Non-Selective Catalytically Reduction (NSCR)	N	No flue to inject urea	N/A	N/A
		Selective Catalytically Reduction (SCR)	N	No flue to inject urea	N/A	N/A
		Re-evaluate optimal distance between tip and workpiece, correct tip, amperage setting, cutting speed, and material exit angle.	Y	Expert evaluation required	N/A	N/A
Plasma Steel Cutter (NBS - Wet)	Plasma Gas Selection		Y	Currently Implemented	N/A	N/A
	Follow Manufacture recommendation on water submersion techniques		Y	Currently Implemented	N/A	N/A

Source / Process Area	Existing Control Technology	Potential Control Technologies	Technically Feasible? (Y / N)	Comment	Incremental Emissions Reduction (TPY)	Incremental Cost Effectiveness ($/ton)
		Flex Duct Capture System with Wet Scrubber System	N	Hoist and process mechanism issues	N/A	N/A
		Flex Duct system with Dry Scrubbing	N	Hoist and process mechanism issues	N/A	N/A
		Re-evaluate optimal distance between tip and workpiece, correct tip, amperage setting, cutting speed, and material exit angle.	Y	Expert evaluation required	N/A	N/A
		Non-Selective Catalytically Reduction (NSCR)	N	No flue to inject urea	N/A	N/A
		Selective Catalytically Reduction (SCR)	N	No flue to inject urea	N/A	N/A
Plasma Cutter (Structural Products -Dry)	Fume collector and control		Y	Currently Implemented	N/A	N/A
		Flex Duct Capture System with Wet Scrubber System	N	Hoist and process mechanism issues	N/A	N/A
		Flex Duct system with Dry Scrubbing	N	Hoist and process mechanism issues	N/A	N/A

Table 5 Potential BACT Technologies for VOCs - Volatile Organic Compounds

Source / Process Area	Existing Control Technology	Potential Control Technologies	Technically Feasible? (Y / N)	Comment	Incremental Emissions Reduction (TPY)	Incremental Cost Effectiveness ($/ton)
Parts Cleaners (NBS)	Retired 4 from NBS; Replace Stoddard solvent with Safety-Kleen		Y	Currently Implemented	N/A	N/A
		Replace Safety-Kleen with Simple Green	Y		0.06	-
Parts Cleaners (Joist Plant)	Replace Stoddard solvent with Safety-Kleen		Y	Currently Implemented	N/A	N/A
		Replace Safety-Kleen with Simple Green	Y		0.071	-
Parts Cleaners (Cold Finish)	Replace Stoddard solvent with Safety-Kleen		Y	Currently Implemented	N/A	N/A
		Replace Safety-Kleen with Simple Green	Y		0.04	-
Dip Coating	Paint VOC content reduced to 2.1 lb/gal		Y	Currently Implemented	N/A	N/A
	Covering dip tanks when not in use		Y	Currently Implemented	N/A	N/A
		Capture System with Thermal Oxidization	Y		114	$40,300 - $252,700
		Capture System with Carbon Adsorption	N	Higher concentration of VOCs is required	N/A	N/A
Joist Coating	Paint VOC content reduced to 2.1 lb/gal		Y	Currently Implemented	N/A	N/A

Source / Process Area	Existing Control Technology	Potential Control Technologies	Technically Feasible? (Y / N)	Comment	Incremental Emissions Reduction (TPY)	Incremental Cost Effectiveness ($/ton)
Bridging Line (Spray box)	Replace vacu-coater; Paint VOC content reduced to 2.1 lb/gal		Y	Currently Implemented	N/A	N/A
Drying Oven (Joist Plant)	Flue gas recirculation emission control		Y	Currently Implemented	N/A	N/A
		Capture Systems	N	Safety and process flow would be critically disrupted with hoist and carry system.	N/A	N/A
Drying Oven (NBS)	Flue gas recirculation emission control		Y	Currently Implemented	N/A	N/A
		Capture Systems	N	Safety and process flow would be critically disrupted with hoist and carry system.	N/A	N/A
Drying Oven (Structural Parts)	Flue gas recirculation emission control		Y	Currently Implemented	N/A	N/A
		Capture Systems	N	Safety and process flow would be critically disrupted with hoist and carry system.	N/A	N/A
Spray Booth (NBS - Built up Line)	HVLP spray guns		Y	Currently Implemented	N/A	N/A
	Paint VOC content reduced to 2.1 lb/gal		Y	Currently Implemented	N/A	N/A
	High efficiency filter systems		Y	Currently Implemented	N/A	N/A
		Thermal Oxidization	Y		52.3	$68,000
		Carbon Adsorption	N	Higher concentration of VOCs is required	N/A	N/A

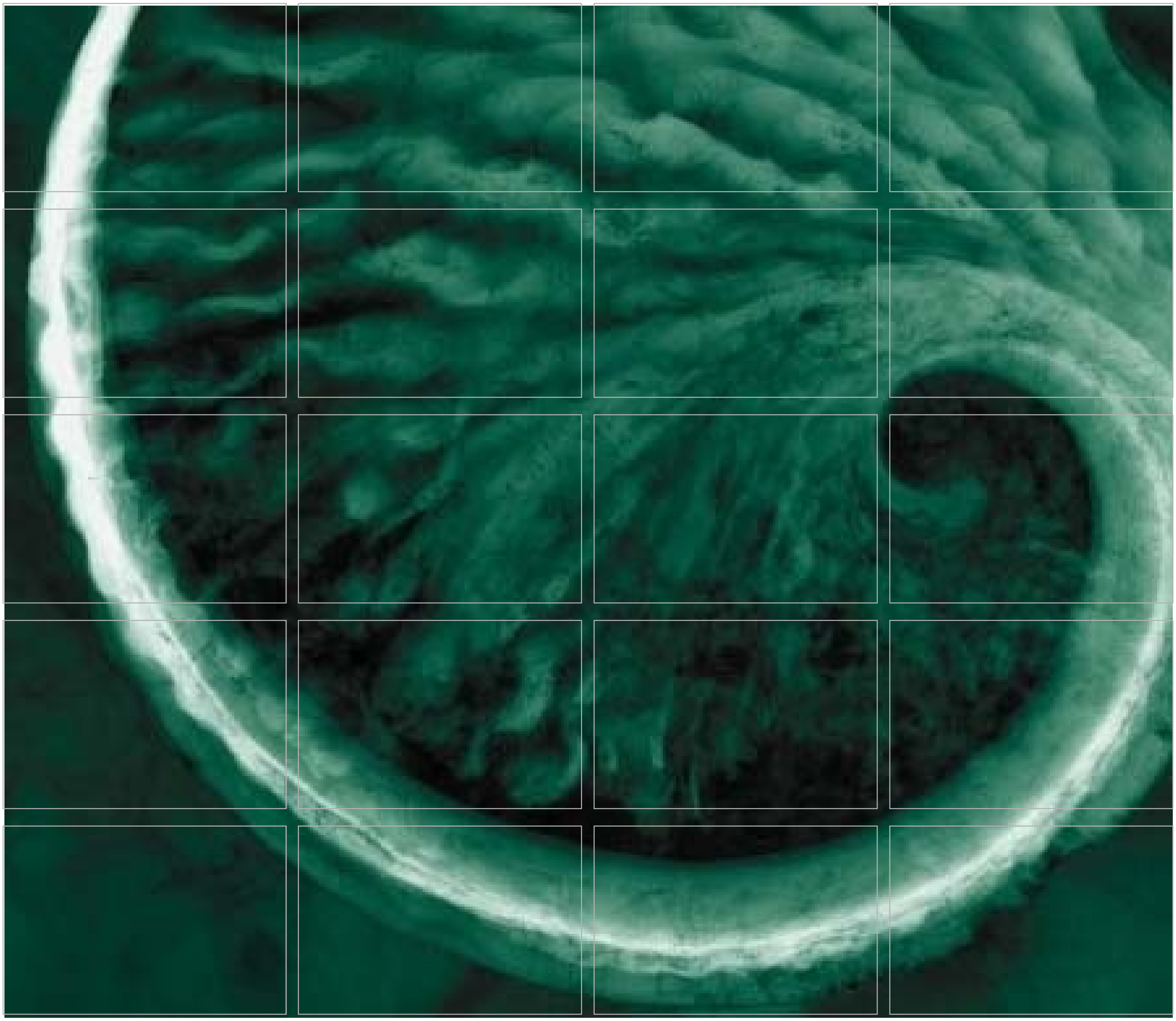
Source / Process Area	Existing Control Technology	Potential Control Technologies	Technically Feasible? (Y / N)	Comment	Incremental Emissions Reduction (TPY)	Incremental Cost Effectiveness ($/ton)
Spray Booth (Structural Products)	HVLP spray guns		Y	Currently Implemented	N/A	N/A
	Paint VOC content reduced to 2.1 lb/gal		Y	Currently Implemented	N/A	N/A
	High efficiency filter systems		Y	Currently Implemented	N/A	N/A
		Thermal Oxidization	Y		17.8	$68,000
		Carbon Adsorption	N	Higher concentration of VOCs is required	N/A	N/A
Flow Coater (NBS - Purlin Line)	Paint VOC content reduced to 1.1 lb/gal (paint specific to Purlin Line)		Y	Currently Implemented	N/A	N/A
		Thermal Oxidization	N	Space limitations, safety, and other environmental issues.	N/A	N/A
		Carbon Adsorption	Y		7.8	$12,000
		Wet Scrubber	Y		7.6	$14,000
Mastic Equipment				Future product development relevant	N/A	N/A
Lubrication Equipment				Future product development relevant	N/A	N/A
Fugitive Spray Booth				2% of the production will be allowed to be painted outside the paint booth. Total emissions <0.4 tpy.		

Table 6 Potential BACT Technologies for NH_3 – Ammonia

Source / Process Area	Existing Control Technology	Potential Control Technologies	Technically Feasible? (Y / N)	Comment	Incremental Emissions Reduction (TPY)	Incremental Cost Effectiveness ($/ton)
Drying Oven (Joist Plant)	Flue gas recirculation emission control			NH3 emissions are not of concern because of insignificant emission rate from this facility		
	Capture Systems			NH3 emissions are not of concern because of insignificant emission rate from this facility		
Drying Oven (NBS)	Flue gas recirculation emission control			NH3 emissions are not of concern because of insignificant emission rate from this facility		
	Capture Systems			NH3 emissions are not of concern because of insignificant emission rate from this facility		
Drying Oven (Structural Parts)	Flue gas recirculation emission control			NH3 emissions are not of concern because of insignificant emission rate from this facility		
	Capture Systems			NH3 emissions are not of concern because of insignificant emission rate from this facility		

ERM has over 145 offices across the following countries worldwide

Argentina	The Netherlands
Australia	New Zealand
Belgium	Panama
Brazil	Peru
Canada	Poland
Chile	Portugal
China	Puerto Rico
Colombia	Romania
France	Russia
Germany	Singapore
Hong Kong	South Africa
Hungary	Spain
India	Sweden
Indonesia	Taiwan
Ireland	Thailand
Italy	United Arab Emirates
Japan	United Kingdom
Kazakhstan	United States
Korea	Venezuela
Malaysia	Vietnam
Mexico	



Best Available Control Technology Evaluation – Utah $PM_{2.5}$ State Implementation Plan

Brigham City, Utah

February 2018

Prepared for:
Vulcraft-A Division of Nucor Corporation
1875 West Highway 13 South
Brigham City, Utah 84302

Environmental Resources Management
www.erm.com

The business of sustainability

ERM

Vulcraft, A Division of Nucor Corporation

Best Available Control Technology Evaluation Utah $PM_{2.5}$ State Implementation Plan

Brigham City, Utah

February 2018

David S. Wilson, P.E., P.G.
Partner

Erin Hallenburg, P.E., QEP
Senior Project Engineer

Environmental Resources Management
136 East South Temple, Suite 2150
Salt Lake City, UT 84111
801-204-4300
www.erm.com
Fax: (801) 595-8484

TABLE OF CONTENTS

LIST OF TABLES

LIST OF ACRONYMS

AMPs	amperes
ANSI	American National Standard Institute
ASHAE	American Society of Heating, Refrigeration, and Air Conditioning Engineers
BAAQMD	Bay Area Air Quality Management District
BACT	Best Available Control Technology
BMP	best management practices
cfm	cubic feet per minute
EPA	Environmental Protection Agency
ERM	ERM-West, Inc.
ESP	electrostatic precipitator
EU	emission unit (air pollution producing equipment)
FGR	flue gas recirculation
HVLP	high volume low pressure
LAER	lowest achievable emission rate
lb/gal	pounds per gallon
LEL	lower explosive limit
N	no
N/A	not applicable
NBS	Nucor Building Systems
NAAQS	National Ambient Air Quality Standards
NG	natural gas
NH_3	ammonia
NOI	Notice of Intent
NOx	nitrogen oxides
ppm	parts per million
PTE	Potential to Emit
RACT	Reasonably Available Control Technology
RBLC	RACT/BACT/LAER Clearinghouse
SBAPCD	Santa Barbara Air Pollution Control District

SCAQMD	South Coast Air Quality Management District
SCR	selective catalytic reduction
SIC	standard industrial classification
SIP	State Implementation Plan
SNCR	selective non-catalytic reduction
SOx	sulfur oxides
TO	Thermal oxidation
tpy	tons per year
VOC	volatile organic compounds
WGS	wet gas scrubber
Y	yes

EXECUTIVE SUMMARY

This Best Available Control Technology (BACT) Evaluation was completed in accordance with the Utah Department of Air Quality's 23 January 2017 letter requesting this analysis as part of the regulatory agency's fine particular matter (particulate matter 2.5 microns or less in diameter or $PM_{2.5}$) Serious Nonattainment State Implementation Plan (SIP) development process. The top-down BACT process was followed to identify BACT for each source and the following associated emission type: $PM_{2.5}$, sulfur oxides (SOx), nitrogen oxides (NOx), volatile organic compounds (VOC), and ammonia (NH_3).

Vulcraft, a Division of Nucor Corporation (Nucor-Vulcraft) is a steel fabrication facility that consists of two main facilities, including the Joist Plant and Nucor Building Systems (NBS). The Joist Plant consists of the Joist Plant, the Cold Finish area, a stock yard, the maintenance facility and administrative buildings; and NBS Plant consists of the NBS fabrication area, maintenance area, and an administrative building. Nucor-Vulcraft is identified as a Major Source for Volatile Organic Compounds (VOCs), which are considered $PM_{2.5}$ precursors.

The applicable sources at the Nucor-Vulcraft facility were identified as: shot blasting, exhaust vents, plasma cutters, spray boxes, welding, spray booths, drying ovens, dip coating, haul roads, resistance welding, joist coating, parts cleaners, vacu- coater, mastic equipment, and lubrication equipment.

All potential control technologies were listed and evaluated for the relevant emission sources. Technically infeasible technologies were eliminated from consideration. The remaining technologies were ranked by control effectiveness. An economic feasibility study was then conducted with a cost effectiveness per ton removed per year. As a part of the BACT process, other issues that could adversely impact the environment, safety and health, and energy demand were included in the evaluation.

Nucor-Vulcraft has significantly reduced VOC emissions during the last 15 years by implementing the use of lower VOC paints (i.e. water based paints). Since 2005, VOC emissions at the facility have been reduced, mainly from painting operations, from 339 tons to 262 tons per year (tpy). The use of low-VOC paints represents the current baseline condition, and is considered BACT for the facility for painting operations. Nucor-Vulcraft experienced an average increase of $4 per gallon to use the low-VOC paint compared to the prior VOC-based paints, which results in an additional annual cost of about $900,000 per year based on the average annual quantities of paint used (i.e., 225,500 gallons).

In addition, Nucor-Vulcraft proposes to reevaluate welding techniques and plasma cutter operations, to confirm if techniques are optimal to ensure that emissions are minimized.

1.0 INTRODUCTION

On behalf of Vulcraft, a Division of Nucor Corporation (Nucor-Vulcraft), ERM-West, Inc. (ERM) conducted a Best Available Control Technologies (BACT) evaluation for the company's Brigham City facility. This report presents the BACT process and results for submittal to the Utah Department of Environmental Quality, Division of Air Quality (UDAQ). The BACT evaluation was completed in accordance with the UDAQ's 23 January 2017 letter requesting this analysis as part of the regulatory agency's fine particular matter (particulate matter 2.5 microns or less in diameter or $PM_{2.5}$) Serious Nonattainment State Implementation Plan (SIP) development process. Nucor-Vulcraft submitted an original BACT report dated May 2, 2017; and this revision is provided in response to comments from the UDAQ.

2.0 APPROACH

A top-down BACT analysis was completed for all technologies that would reduce $PM_{2.5}$ emissions and precursors of $PM_{2.5}$ emissions from all regulated sources within the Nucor-Vulcraft facility. The evaluation included assessing all processes from the Cold Finish, Joist Plant, Nucor Building Systems (NBS), and the new Grating and Structural Products lines. All applicable emission control technologies were identified for the emission sources, and they were screened for technical feasibility under the SIP requirements and schedule.

The SIP is designed to regulate and limit $PM_{2.5}$ and its precursors to below the National Ambient Air Quality Standards (NAAQS) based on data to be collected throughout year 2019. This means that control technology improvements will need to be in place before the end of year 2018 to support compliance with the SIP. Therefore, the evaluation and identification of BACT takes into account whether Nucor-Vulcraft can implement the new controls prior to the end of 2018.

In cases where Nucor-Vulcraft has determined that control technologies are technically feasible, except for the SIP schedule constraints, these controls are not considered BACT, but rather "Additional Feasible Measures" that could be implemented if more time were available. All technologies considered technically feasible as BACT or Additional Feasible Measures were ranked based on their potential emission reduction efficiencies. Energy, environmental, economic impacts and other considerations were evaluated for the feasible technologies; and the most effective, least impactful, cost-effective technologies were identified as BACT or Additional Feasible Measures for the applicable emission units. This analysis has also been revised to include requested information by UDAQ in its correspondence dated September 21, 2017, which is BACT technologies and additional feasible measures that could be installed in whole or in part at Nucor-Vulcraft by 2024.

2.1 BACT ANALYSIS PROCESS

The BACT analysis was organized into the following steps, which are described in the paragraphs that follow:

1. Identify control technologies.
2. Eliminate technically infeasible technologies.
3. Rank technologies by control effectiveness.
4. Evaluate controls for economic feasibility.
5. Recommend BACT.

2.1.1 Step 1 - Identify Control Technologies

Nucor-Vulcraft identified its emission sources for $PM_{2.5}$ and precursors; and then identified acceptable control technologies for these sources. The U.S. Environmental Protection Agency (EPA) established the Reasonable Available Control Technologies/BACT/Lowest Achievable Emission Rate (RACT/BACT/LAER) Clearinghouse (RBLC) to provide a central data base of air pollution technology information. Nucor-Vulcraft relied on the RBLC, plus other resources listed in Section 2.2, to identify potentially applicable control technologies. The emission sources and applicable technologies were documented using a BACT Matrix Table for tracking and presentation of the results as presented in Section 3 and the attached tables.

2.1.2 Step 2 - Eliminate Technically Infeasible Technologies

Nucor-Vulcraft reviewed the technologies to determine whether they were technically feasible based on site-specific (i.e., real estate) or operational constraints. The SIP time constraints were also taken into account relative to defining technically feasible BACT. Step 3 - Rank Technologies by Control Effectiveness

In most cases, Nucor-Vulcraft conservatively calculated the baseline emissions from its sources using the potential to emit (PTE) calculations used for the Notice of Intent (NOI) submitted 9 February 2017. In select cases, the actual emissions were considered from recent years (e.g., Purlin Line) instead of the PTE calculated values to more accurately account for potential emission reductions. The potential for additional emission reductions was evaluated for the applicable technologies using vendor or EPA provided removal efficiencies. The amount of emissions reductions that could be achieved for the applicable technologies were calculated and the technologies were listed according to rank on the BACT Matrix.

2.1.3 Step 4 - Evaluate Controls for Economic Feasibility

Nucor-Vulcraft evaluated the controls for economic feasibility using capital and operating cost estimates provided by the EPA Cost Control Manual, vendor information, ERM experience, and potential project estimates from Nucor-Vulcraft. Energy consumption, environmental and other impacts were considered for the feasible controls to account for all economic impacts. The economic feasibility of increased controls was evaluated using the ratio of the cost for the new controls compared with the incremental emission reductions achieved by the new controls verses the baseline (current) condition in terms of dollars per ton of emissions reduced.

2.1.4 Step 5 - Recommend BACT

Based on the evaluation of control technologies, Nucor-Vulcraft is presenting in this report its analysis and conclusions regarding the controls it believes are technically and economically feasible, and those that can be considered BACT (including compliance with the UDAQ SIP schedule) or Additional Feasible Measures (if more time is permissible for technology implementation). In cases where new technologies are considered BACT, implementation timeframes are provided in this report.

2.2 REGULATORY BACKGROUND

The following BACT clearinghouses and guidelines were searched as part of Step 1 to identify potentially applicable control technologies for the Nucor-Vulcraft emission sources:

- U.S. EPA RACT/BACT/Lear Clearinghouse (RBLC)
- California Air Resources Board Standard Industrial Classification (SIC) 325180 (other basic inorganic chemical manufacturing) and 2812 (Alkaline and Chlorine)
- Bay Area Air Quality Management District (BAAQMD)
- South Coast Air Quality Management District (SCAQMD)
- Texas Commission of Environmental Quality

The following process types were reviewed for the various operations that are conducted at Nucor-Vulcraft:

- Process Type No. 12.310- Natural Gas -Paint, Heaters, Ovens

- Process Type No. 13.310 – Commercial/Institutional Size Boilers/ Furnace, <100 MMBtu/hr, Natural Gas
- Process Type No. 41.002 – Automobiles and Trucks Surface Coating -Guidecoat and Topcoat Painting
- Process Type No.41.013 – Miscellaneous Metal Parts & Product Surface Coating
- Process Type No. 81.230 – Steel Production Casting & Pouring Processes;
- Process Type No. 81.350 – Steel Foundry Casting & Pouring Processes;
- Process Type No. 81.390 – Other Steel Foundry Processes;
- Process Type No. 81.290 – Other Steel Manufacturing Processes;
- Process Type No. 81.370 – Miscellaneous Melt Shop Operations;
- Process Type No. 99.012- Welding & Grinding
- Process Type No. 99.999 – Other Miscellaneous Sources -Painting Operations

The following regulations were reviewed:

- Code of Federal Regulations Title 40, Part 52
- Code of Federal Regulations Title 40, Part 60
- Code of Federal Regulations Title 40, Part 63
- Utah Air Rules Title 19, Chapter 2 of the Utah Code: R307

To fully evaluate applicable BACT limits for processes with limited RBLC results, based on process type queries, additional RBLC queries were conducted based on process names or key words (e.g., "Blast").

2.3 BASIS AND STUDY LIMITATION

Operations were evaluated on a standalone bases per specific emission unit. The prescribed BACT process was followed including further investigation if a control technology appeared feasible, but not economically practical. Costs for these technologies, including implementation costs, were estimated using available regulatory data, vendor information, and best judgement; however, costs for major capital projects like those considered herein can vary by over 100 percent.

The determination of technical feasibility had several criteria that needed to be met such as physical constraints, process and product flow, operational safety, and other environmental protection criteria.

3.0 BACT EVALUATION

The BACT Evaluation is summarized for each source in the following sections. Tables 1 through 3 also present the emission sources for direct $PM_{2.5}$ and its precursors (e.g., nitrogen oxides (NOx) and volatile organic compounds (VOCs)); there are no sources of ammonia (NH_3) at Nucor-Vulcraft. For each source, the tables list the identified control technologies, if they are technically feasible, the baseline emissions, the estimated emissions reductions, the cost effectiveness for applicable technologies, and the year when such technology could be implemented.

3.1 WIRE LINE SHOT BLASTING

3.1.1 PM2.5

Shot blasting on the wire line produces Direct $PM_{2.5}$ emissions. The identified control technologies are listed on Table 1, including the currently implemented use of a baghouse with 99.99% efficiency.

According to the manufacturer in a call on 17 April 2017, these filter bags have the highest efficiency for the specific model of baghouse; furthermore, an efficiency of 99.99% is the highest efficiency baghouse available from any vendor that provides dust collectors to control steel shot blasting. The technical feasibility evaluation showed that no additional control technologies were feasible for the Wire Line Shot Blasting.

As no additional technologies were identified as technically feasible, no economic analysis was conducted. Therefore, BACT for the Wire Line Shot Blasting is considered to be the current controls: baghouse with 99.99% efficiency.

3.2 COIL LINE SHOT BLASTING

3.2.1 PM2.5

Shot blasting is done on the coil line with possible direct $PM_{2.5}$ emissions. No specific emission factor for $PM_{2.5}$ has been developed for shot blasting and with the absences of combustion in this process, the likelihood of measurable $PM_{2.5}$ being generated is small. Estimated PTE $PM_{2.5}$ emissions equal PM10 emissions, which are 3.3 tons per year (tpy). The identified control technologies are listed on Table 1, including the currently implemented use of a baghouse with 98% efficiency.

The technical feasibility evaluation showed an additional control technology of using a different baghouse filter media with a removal efficiency of 99.99% down to

0.5 *u*m. The manufacturer stated in a call on 17 April 2017 that the filter bags used currently on this equipment have the highest efficiency for the specific model of baghouse. Increased efficiency would require complete replacement of the baghouse with a new model at 99.99% efficiency similar to that proposed for wireline shot blasting. This could reduce the PTE impact by 0.066 tpy.

The economic evaluation showed that replacing the current baghouse (98% control technology) with a new baghouse (99.99% control technology) results in an incremental cost effectiveness ratio calculated at approximately $370,000 per ton (as presented on Table 1). Based on this ratio, Nucor-Vulcraft recommends that BACT for the Coil Line Shot Blasting is the current control: baghouse with 98% efficiency.

3.3 BAR LINE SHOT BLASTING

3.3.1 $PM_{2.5}$

The current control technology for the Bar Line Shot Blasting operation is use of a baghouse with 98% efficiency.

Similar to the explanation for the coil line evaluation, installation of the 99.99% removal efficiency filter media would require complete replacement of the baghouse equipment. This replacement would result in a reduction of 0.19 tpy of $PM_{2.5}$ for this source. The economic evaluation showed that this control technology has an incremental cost effectiveness ratio of approximately $150,000 per ton (as presented on Table 1). Based on this ratio, Nucor-Vulcraft recommends that BACT for the Bar Line Shot Blasting is the current control: baghouse with 98% efficiency.

3.4 EXHAUST VENTS (JOIST PLANT, COLD FINISH, AND NBS)

3.4.1 $PM_{2.5}$

There are 15 roof vents on the Joist Plant, three (3) roof vents on Cold Finish and six (6) main vents on NBS (24 total roof vents). These fan-driven vents exhaust air from the respective production/assembly lines to the atmosphere. As recommended by the American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHAE), 10 to 15 air exchanges per hour should occur for manufacturing buildings.

Approximately 2.16 tpy of $PM_{2.5}$ based on air sampling events, have been estimated to be exhausted from the 24 roof vents. The combined air flow, based on Approved American National Standard Institute (ANSI) is approximately 300,000 cubic feet per minute (cfm) or about 19,700 cfm per exhaust vent.

Potential control technologies considered for $PM_{2.5}$ are scrubber, ESP, and fabric filters, with filter bags that remove 99% of $PM_{2.5}$ (Table 1). However, roof exhaust vents and related roof structures at Nucor-Vulcraft cannot support these types of equipment. Furthermore, the existing overhead duct systems, cranes, and other process equipment in the buildings would conflict with potential installation of source hoods and ducts to capture emissions discharged at the exhaust vents. Therefore, these options are not technically feasible, and no economic analysis was conducted.

3.5 PLASMA CUTTER (COLD FINISH – DRY)

The Plasma Cutter in Cold Finish produces direct $PM_{2.5}$ emissions and NOx emissions. This source has historically been operated less than 40 hours per year. There is no anticipated increase in usage planned for this source.

3.5.1 $PM_{2.5}$

Dry plasma cutter operation in Cold Finish for maintenance produces approximately 0.035 tpy of Direct $PM_{2.5}$ emissions. The identified control technologies are listed on Table 1.

The technical feasibility evaluation showed an additional control technology of using a baghouse with a removal efficiency of 99.99%. To install a baghouse on the plasma cutter would have a cost effectiveness of approximately $630,000 per ton of $PM_{2.5}$ removed as shown on Table 1. Based on this ratio, Nucor-Vulcraft recommends that BACT for this plasma cutter is the current control: limited use and best management practices.

3.5.2 NOx

The dry plasma cutter in Cold Finish produces 0.03 tpy of NOx emissions. The identified control technologies are listed on Table 2.

The technical feasibility evaluation showed no additional control technologies.Therefore, BACT for the dry plasma cutter in Cold Finish is considered to be the current controls: limited use and best management practices.

3.6 PLASMA CUTTER (NBS – WET)

3.6.1 $PM_{2.5}$

Nucor-Vulcraft operates a wet plasma cutter at NBS. This source reports emissions of Direct $PM_{2.5}$ although no specific emission factors are available for this operation, thus $PM_{2.5}$ equals PM10. A PTE of 0.30 tpy of $PM_{2.5}$ is estimated. The particulate emissions are controlled by the water blanket that covers the plasma cutting. The identified control technologies are listed on Table 1, including the currently implemented plasma gas selection and manufacture recommendations on water submersion techniques.

The technical feasibility evaluation showed that potential additional controls could include flex duct capture system with HEPA, ESP, and fume hood with fabric filters. However, these equipment require capture systems, which would interfere with process flow, critically disrupt hoist and carry equipment and prohibit production. Therefore, these additional technologies are considered technically infeasible.

As no additional technologies were identified as technically feasible, no economic analysis was conducted. Therefore, BACT for the NBS wet plasma cutter is considered to be the current controls: plasma gas selection and following manufacture recommendations on water submersion techniques.

3.6.2 NOx

The wet plasma cutter at NBS also produces NOx emissions. The identified control technologies for NOx are listed on Table 2, including the currently implemented plasma gas selection and manufacture recommendations on water submersion techniques.

The technical feasibility evaluation showed that potential additional control included flex duct capture system with wet or dry scrubbers, a selective non-catalytic reduction (SNCR), and selective catalytic reduction (SCR). However, this equipment requires capture systems, which would interfere with process flow, critically disrupt hoist and carry equipment and prohibit production. Therefore, these additional technologies are considered technically infeasible. The BACT for the wet plasma cutter should be considered the currently implemented plasma gas selection and manufacture recommendations on water submersion techniques.

3.7 PLASMA CUTTER (STRUCTURAL PRODUCTS – WET)

3.7.1 $PM_{2.5}$

A new wet plasma cutter will be installed in the Structural Products section of the Joist Plant. The particulate emissions are controlled by the water blanket that covers the plasma cutting.

The uncontrolled $PM_{2.5}$ PTE is estimated to be 0.03 tpy. The existing wet blanket technique results in a 95% reduction in emissions. Additional controls were identified, however, they are technically infeasible as discussed in Section 3.6.1.

Therefore, BACT for the plasma cutter is considered to be the current controls: plasma gas selection and following manufacture recommendations on water submersion techniques.

3.7.2 NOx

The uncontrolled NOx PTE is estimated to be 0.46 tpy. Additional controls were identified, however, they are technically infeasible as discussed in Section 3.6.2.

Therefore, BACT for the plasma cutter is considered to be the current controls: plasma gas selection and following manufacture recommendations on water submersion techniques.

3.8 PLASMA CUTTER (STRUCTURAL PRODUCTS – DRY)

3.8.1 $PM_{2.5}$

Nucor-Vulcraft has installed a dry plasma cutter for the Structural Products line. This source produces $PM_{2.5}$ emissions. The identified control technologies are listed on Table 1, including the currently implemented fume collector and control system with 95% removal efficiency (i.e., blended cellulose and polyester fibers). The $PM_{2.5}$ PTE is estimated to be 0.12 tpy.

The technical feasibility evaluation showed that potential additional control technologies include use of the current capture system with addition of HEPA, or ESP. The manufacturer was contacted to determine if these could be added; Nucor-Vulcraft is currently waiting to hear back if a HEPA filter can be put in place of the current 95% efficiency filter. It is noted that with a HEPA filter, the PTE could only be reduced by 0.006 tpy. Because only a small incremental $PM_{2.5}$ can be achieved with addition of a HEPA filter, and until the manufacturer can prove that a HEPA filter can be added to the existing equipment, Nucor-Vulcraft recommends the current controls, i.e., using a fume collector with 95% efficiency control, be consider BACT for the plasma cutter.

3.8.2 NOx

The dry plasma cutter in Structural Products also produces NOx emissions. The identified control technologies are listed on Table 2, including the currently implemented fume collector and control.

The technical feasibility evaluation showed that potential additional control technologies include a flex duct capture system with wet or dry scrubbers. The safety and process flow would be critically disrupted with the hoist and carry system if a capture system was installed and would prohibit production. Therefore, these additional technologies are considered technically infeasible.

As no additional technologies were identified as technically feasible, no economic analysis was conducted. Therefore, BACT for the plasma cutter is considered to be the current controls: using a fume collector and control.

3.9 WELDING

3.9.1 $PM_{2.5}$

Nucor-Vulcraft performs welding operations. This source produces $PM_{2.5}$ emissions. The identified control technologies are listed on Table 1, including the currently implemented inert shielding gas, the electrode selection, and using lowest recommended current/low amperes (AMPs).

The technical feasibility evaluation showed that potential additional control technologies include a flex duct capture system with HEPA or ESP, or a torch fume extraction HEPA or ESP. However, this equipment requires capture systems, which would interfere with process flow, critically disrupt hoist and carry equipment and prohibit production. Therefore, these additional technologies are considered technically infeasible.

As no additional technologies were identified as technically feasible, no economic analysis was conducted. Therefore, BACT for welding is considered to be the current controls: using an inert shielding gas, the electrode selection, and using the lowest recommended current/low AMPs.

3.10 BRIDGING LINE (SPRAY BOX)

3.10.1 $PM_{2.5}$

Nucor-Vulcraft operates a Bridging Line that was calculated to have direct $PM_{2.5}$ emissions. However, during development of PTE calculations, a conservative assumption was made for this source that the $PM_{2.5}$ emissions are the same as the PM_{10} emissions because there are no specific emission factors available for $PM_{2.5}$. However, as a result of completing this BACT analysis, literature was discovered that show actual paint emission particulates are generally larger than 2.5 μm; and therefore, Nucor-Vulcraft proposes to better represent $PM_{2.5}$ emissions by recalculating the PTE value to near zero (0.0) tons per year. Therefore, no controls are needed for this source as there are no direct $PM_{2.5}$ emissions.

3.10.2 VOCs

The Bridging Line spray box produces VOC emissions. The identified control technologies are listed on Table 3, including replacing the vacu-coater with the spray box in the NOI submittal dated February 9, 2017 and reducing the paint VOC content to 2.1 lb/gal.

The bridging product, once coated, continues to dry and release VOCs during the drying, rolling, bundling and storage process both inside and outside the building. The VOCs therefore are considered fugitive and any capture technologies would be not be technically feasible for the bridging line spray box.

As no additional technologies were identified as technically feasible, no economic analysis was conducted. Therefore, BACT for the spray box is considered to be the current controls: replacement of vacu-coater and the reduction of VOC content to 2.1 lb/gal less water and exempt solvents.

3.11 DRYING OVEN (SPRAY BOX)

3.11.1 $PM_{2.5}$

Nucor-Vulcraft operates drying ovens in the Joist Plant after the Bridging Line that produces $PM_{2.5}$ emissions. The identified control technologies are listed on Table 1, including the currently used flue gas recirculation emission control.

The technical feasibility evaluation showed that potential additional control technologies for the drying oven could include a capture system. However, the bridging oven has limited process space, and product is moved throughout this bay with overhead cranes, and any capture system would prohibit production, and therefore is not technically feasible.

Additionally, Nucor-Vulcraft is considering replacement of the spray box and drying oven used for specific products with a new process that involves electrical induction technology to heat the product through electrical induction prior to painting. This technology would allow complete removal of the drying oven. If this technology proves technically feasible, improves quality, and provides other market advantages, it would coincidentally eliminate the small amount of $PM_{2.5}$ emission from the bridging drying process. The amount of $PM_{2.5}$ emission reduced through removal of the oven would be 0.02 tpy.

Based on the review of control options for this equipment, the current flue gas recirculation is recommended as BACT; however, if electrical induction is determined to improve quality and provide other production benefits, then the drying oven will be removed and the related emissions will be eliminated.

3.11.2 SOx

The drying oven is natural gas fired using pipeline quality natural gas. The facility PTE for SOx emissions is less than 0.02 tpy from all sources at the entire site. Because Nucor-Vulcraft is a very insignificant source of SOx, it was clear that any additional control technologies would be extremely costly per ton reduced . Further technology research and economic cost evaluation associated with this BACT request did not seem justified for this pollutant at this time. However, if electrical induction is determined to improve quality and provide other production benefits, then the drying oven will be removed and the related emissions will be eliminated.

3.11.3 NOx

The drying oven produces NOx emissions. The identified control technologies are listed on Table 2, including currently used flue gas recirculation emission control. The technical feasibility evaluation showed that potential additional control technologies for the drying oven includes SCR/SNCR and a LNB,. However, the existing overhead duct systems, cranes, and other process equipment in the buildings would conflict with potential installation of the SCR/SNCR technologies for the drying oven. Therefore, these technologies are technically infeasible.

Nucor-Vulcraft has already retrofitted the oven burners with flue gas recirculation control technology. Further NOx emission reductions cannot be achieved except through full replacement of the existing oven burners with low NOx burners with a reduction of 0.39 tpy. The cost effectiveness ratio for replacement of the oven is calculated on Table 2 at approximately $85,000 per ton of NOx reduced.

Additionally, Nucor-Vulcraft is considering replacement of the spray box and drying oven used for specific products with a new electrical induction technology as described above for the direct $PM_{2.5}$ emissions. If this technology proves technically feasible, improves quality, and provides other market advantages, it would coincidentally eliminate the drying oven and small amount of $PM_{2.5}$ emission from the bridging drying process. The amount of NOx emission reduced through removal of the oven would be 1.05 tpy.

Based on the review of control options for this equipment, the current flue gas recirculation is recommended as BACT; however, if electrical induction is determined to improve quality and provide other production benefits, then the drying oven will be removed and the related emissions will be eliminated.

3.11.4 VOC

The drying oven produces VOC emissions. The identified control technologies are listed on Table 3, including currently used flue gas recirculation emission control, which limits the VOCs to 0.06 tpy. The technical feasibility evaluation showed that additional capture control systems would be technically infeasible. The existing overhead duct systems, cranes, and other process equipment in the buildings would conflict with potential installation of a supplemental capture system for the drying oven and would prohibit production.

As described above, Nucor-Vulcraft is considering replacement of the spray box and drying oven used for specific products with a new electrical induction technology. If this technology proves technically feasible, improves quality, and provides other market advantages, it would coincidentally eliminate the drying oven and small amount of $PM_{2.5}$ emission from the bridging drying process. The amount of VOC emission reduced through removal of the oven would be 0.06 tpy.

Based on the review of control options for this equipment, the current flue gas recirculation is recommended as BACT; however, if electrical induction is determined to improve quality and provide other production benefits, then the drying oven will be removed and the related emissions will be eliminated.

3.12 SPRAY BOOTH (NBS – BUILT UP LINE)

3.12.1 $PM_{2.5}$

The PTE for $PM_{2.5}$ is based on the same emission factor as PM_{10}, along with the 95% control efficiency of the existing fabric filters; a specific emission factor for $PM_{2.5}$ is not available for this equipment. The conservative PTE estimates that the NBS spray booth will produce up to 1.87 tpyof $PM_{2.5}$. However, actual paint emission particulates are generally larger than 2.5 µm, and therefore only a "perception" of $PM_{2.5}$ emissions exists from this source.

Table 1 lists the identified control technologies for Direct $PM_{2.5}$ including, high-efficiency filter technology. This includes baghouses, cartridge, and fabric filters. However, the characteristics of spray painting and the associated overspray results in large diameter droplets that would immediately clog higher efficiency filter media. Therefore, this technology is considered infeasible.

Nucor-Vulcraft recommends that BACT for the Spray Booth is the current control: high volume low pressure (HVLP) spray guns and 95% efficient filter pads.

3.12.2 VOCs

The identified control technologies for VOCs from spray painting operations include the currently implemented use of low-VOC paints, work practice standards to limit overspray, and HVLP spray painting equipment. Potential supplemental controls include VOC capture systems with carbon adsorption and TO technologies (Table 3).

The technical feasibility evaluation showed that Carbon Adsorption requires a higher concentration of VOCs for this technology to be technically effective based on manufacturer specifications; therefore, this technology is considered infeasible.

The TO technology was also determined to not be feasible for spray painting operations becausethere is insufficient space at the Built Up Line for a TO. Additionally, it is not possible to capture VOC emissions before the oven because the distance from the spray booth to the oven is 6 feet, and very little drying occurs in this space to result in VOC emissions.

As no additional technologies were identified as being technically feasible, no economic analysis was performed. Therefore, BACT should be considered the currently implemented lower VOC paints being used; work practice standards to limit the amount of overspray, and HVLP spray painting technology.

3.13 DRYING OVEN (NBS - BUILT UP LINE)

3.13.1 $PM_{2.5}$

Nucor-Vulcraft operates a drying oven at NBS after the Built Up Line spray booth that produces $PM_{2.5}$ emissions. The identified control technologies are listed on Table 1, including currently used flue gas recirculation emission control.

The technical feasibility evaluation showed that potential additional control technologies for the drying oven include a capture system. However, this oven is designed to pass the steel products through the heating elements at a slow rate via overhead crane systems. Capture systems are not feasible due to the movement and weight of the products being processed.

Although electrical induction is being considered for replacement of spray booths and drying ovens for some product lines, it has only been tested on small, similar shaped, light guage steel, and has not been shown to be technically achievable for heavy and various sizes of steel products that use overhead cranes to move product through the drying pocess.

As no additional technologies were identified as technically feasible, no economic analysis was conducted. Therefore, BACT for the drying oven is considered to be the current control: flue gas recirculation.

3.13.2 SOx

The drying oven is natural gas fired using pipeline quality natural gas. The facility PTE for SOx emissions is less than 0.02 tpy from all sources at the entire site. We are a very insignificant source of SOx, and as a result it was clear that any additional control technologies would be extremely costly per ton reduced . Further technology research and economic cost evaluation associated with this BACT request did not seem justified for this pollutant at this time.

3.13.3 NOx

The drying oven produces NOx emissions. The identified control technologies are listed on Table 2, including currently used flue gas recirculation emission control.

The technical feasibility evaluation showed that potential additional control technologies for the drying oven include SCR/SNCR and a LNB. However, the existing overhead duct systems, cranes, and other process equipment in the buildings would conflict with potential installation of these technologies for the drying oven.

Nucor-Vulcraft has already retrofitted the oven burners with flue gas recirculation control technology. Further NOx emission reductions cannot be achieved except through full replacement of the existing oven burners with low NOx burners with a reduction of 0.49 tpy. The cost effectiveness ratio for this replacement on each oven is calculated on Table 2 at approximately $87,000 per ton of NOx reduced. Based on this ratio, Nucor-Vulcraft recommends that BACT for the drying oven is the current control: flue gas recirculation.

3.13.4 VOC

The drying ovens produce VOC emissions. The identified control technologies are listed on Table 3, including currently used flue gas recirculation emission control and a capture system with aa TO.

The technical feasibility evaluation showed that additional capture control systems would be technically infeasible. The existing overhead duct systems, cranes, and other process equipment in the buildings would conflict with potential installation of these technologies for the drying ovens and would prohibit production, and therefore are technically infeasible.

As no additional technologies were identified as technically feasible, no economic analysis was conducted. Therefore, BACT for the drying oven in the Joist Plant is considered to be the current controls: flue gas recirculation.

3.14 SPRAY BOOTH (STRUCTURAL PRODUCTS)

3.14.1 $PM_{2.5}$

The PTE for $PM_{2.5}$ is based on the same emission factor as PM10, along with the control efficiency of the existing fabric filters. Given the existing fabric filters are estimated to control $PM_{2.5}$ by 95%, the estimated production of $PM_{2.5}$ from spray painting operations is due to the lack of quality emission factors. As estimated with current 95% control only 0.03 tons of PM2.5 are emitted from Structural Products' spray booth.

Table 1 lists the identified control technologies for Direct $PM_{2.5}$ including, high-efficiency filter technology. This includes both baghouse, cartridge and fabric filters. However, the characteristics of spray painting and the associated overspray results in large diameter droplets that would immediately clog higher efficiency filter media. Therefore, BACT should be considered the currently implemented use of HVLP spray guns and 95% efficient filter pads.

3.14.2 VOCs

The identified control technologies for VOCs from spray painting operations are carbon adsorption and TO (Table 3). Carbon Adsorption requires a higher concentration of VOCs for this technology to be both cost effective and technically effective.

The technical feasibility evaluation showed that TO technology is a viable consideration for spray painting at this operation. The potential VOC reduction from TO has been estimated for this technology by assuming that 30% of the VOCs are emitted during the application process, 60% in the drying oven, and 10% are fugitive emissions as the product continues to dry outside the spray booth and oven. The calculated VOC PTE reduction is 5.06 based on a TO efficiency of 95%..

The feasibility of implementing this technology must consider the number of TO units, the extensive duct work and air movers and the large amount of natural gas that would be required for proper combustion. Environmental feasibility must consider that over 380 pounds of criteria pollutants (NOx, etc.) would be produced for every million cubic feet of natural gas combusted or that for every pound of VOC destroyed, 0.5 pounds of criteria pollutants are produced.

The economic feasibility evaluation shows that the incremental cost effectiveness for adding a TO for this equipment is approximately $227,000 per ton of VOC removed. Based on this high ratio and the additional pounds of criteria pollutants emitted through use of a TO, Nucor-Vulcraft recommends that BACT for this spray booth is the current controls:use of low VOC paints, work practice standards to limit the amount of overspray, and HVLP spray painting technology.

3.15 DRYING OVEN (STRUCTURAL PRODUCTS)

3.15.1 $PM_{2.5}$

Nucor-Vulcraft operates drying ovens in the Joist Plant, NBS, and Structural Products that produce $PM_{2.5}$ emissions. The identified control technologies are listed on Table 1, including currently used flue gas recirculation emission control.

The technical feasibility evaluation showed that potential additional control technologies for the drying oven include a capture system with applicable controls. However, this oven is designed to pass the steel products through the heating elements at a slow rate via overhead crane systems. Capture systems are not feasible due to the movement and weight of the products being processed.

Although electrical induction is being considered for replacement of spray booths and drying ovens for some product lines, it has only been tested on small, similar shaped, light guage steel, and has not been shown to be technically achievable for heavy and various sizes of steel products that use overhead cranes to move product through the drying pocess.

As no additional technologies were identified as technically feasible, no economic analysis was conducted. Therefore, BACT for the drying ovens in these areas is considered to be the current control: flue gas recirculation.

3.15.2 SOx

The drying ovens are natural gas fired using pipeline quality natural gas. The facility PTE for SOx emissions is less than 0.02 tpy from all sources at the entire site. We are a very insignificant source of SOx, and as a result it was clear that any additional control technologies would be extremely costly per ton reduced . Further technology research and economic cost evaluation associated with this BACT request did not seem justified for this pollutant at this time.

3.15.3 NOx

The drying ovens produce NOx emissions. The identified control technologies are listed on Table 2, including currently used flue gas recirculation emission control.

The technical feasibility evaluation showed that potential additional control technologies for the structural drying oven include SCR/SNCR and a LNB. However, the existing overhead duct systems, cranes, and other process equipment in the buildings would conflict with potential installation of these technologies for the drying oven.

Nucor-Vulcraft has already retrofitted the oven burners with flue gas recirculation control technology. Further NOx emission reductions cannot be achieved except through full replacement of the existing oven burners with low NOx burners with a total reduction of 0.17 tpy. The cost effectiveness ratio for this replacement on this oven is calculated on Table 2 at approximately $380,000 per ton of NOx reduced. Based on this ratio, Nucor-Vulcraft recommends that BACT for the ovens in these areas is the current control: flue gas recirculation.

3.15.4 VOC

The drying ovens produce VOC emissions. The identified control technologies are listed on Table 3, including currently used flue gas recirculation emission control.

The technical feasibility evaluation showed that additional capture control systems would be technically infeasible. The existing overhead duct systems, cranes, and other process equipment in the buildings would conflict with potential installation of these technologies for the drying ovens and would prohibit production, and therefore are technically infeasible.

As no additional technologies were identified as technically feasible, no economic analysis was conducted. Therefore, BACT for the drying ovens in these areas is considered to be the current control: flue gas recirculation.

3.16 VACU-COATER (NBS – PURLIN LINE)

3.16.1 VOC

The Purlin Line (secondary structural components) operation has a vacu-coater that provides a protective layer of paint onto horizontal beams. Purlin coating is a specialty type of painting that cannot be achieved with spray booths or dip tanks. The vacu-coater applies the paint on moving beams that immediately enter the Purlin oven.

The identified control technologies for VOCs are listed on Table 3. The identified additional control technologies, besides the already implemented low VOC paints, include scrubbers, carbon adsorption and various applications of TO. . After the vacu-coater coats the parts, the parts go to the drying oven which is located 13 feet from the vacu-coater. This is insufficient space to include the required equipment for a TO. Employing TO technology would also create a half ton of pollutants for every ton of VOC removed. Therefore, TO technology is considered infeasible due to space limitations and environmental issues.

Recent advances in wet, packed-tower, scrubbing units for the removal of VOCs might be technically feasible. Further on-site studies would have to be conducted to determine if the VOCs produced at the purlin line are soluble enough for wet scrubbing to be effective.

Based on communcations with several manufacturers, carbon adsorption units are ineffective at the high temperatures of 350°F that are used at Nucor-Vulcraft. There are also space restrictions near the Purlin Line oven. Therefore, carbon adsorption is technically infeasible.

Nucor-Vulcraft has already significantly reduced the VOC impact from this operation by implementing operational and raw material (painting) practices. Implementation included the following:

- Painting efficiency of 1.7 gallons of paint per ton of steel throughput; and
- VOC content of paint averaging 1.1 pounds of VOC per gallon of paint.

These voluntary operational parameters lead to significant and actual reductions. The main benefit is that it controls VOC emissions at the source. Past estimates assume VOCs are emitted either during the application process (30%) or in the oven (60%). Fugitive VOC emissions occur as soon as the container of paint is opened until final drying of the Purlin Line product in the yard (fugitives estated at 10%). Controlling the source amount of VOCs that can be emitted is a more effective means for actual VOC reductions, and Nucor-Vulcraft recommends these operational controls are considered BACT for this operation without further equipment controls.

3.17 DRYING OVEN (NBS – PURLIN LINE)

3.17.1 $PM_{2.5}$

Nucor-Vulcraft operates a drying oven in in connection with the NBS Purline Line, which produces $PM_{2.5}$ emissions. The identified control technologies are listed on Table 1, including currently used flue gas recirculation emission control.

The purlin line oven passes product through via rollers, such that an additional high efficiency capture system with a baghouse could be technically achievable. Removal of the remaining 0.04 tons of $PM_{2.5}$ emissions from the ovenwould result in a cost ratio of approximately $550,000 per ton removed.

The potential for induction heating of the Purlin Line parts prior to painting has been not proven technically feasible at this time so it has not been considered as a potential control technology.

3.17.2 SOx

The drying ovens are natural gas fired using pipeline quality natural gas. The facility PTE for SOx emissions is less than 0.02 tpy from all sources at the entire site. We are a very insignificant source of SOx, and as a result it was clear that any additional control technologies would be extremely costly per ton reduced . Further technology research and economic cost evaluation associated with this BACT request did not seem justified for this pollutant at this time.

3.17.3 NOx

The drying ovens produce NOx emissions. The identified control technologies are listed on Table 2, including the currently used flue gas recirculation emission control.

The technical feasibility evaluation showed that potential additional control technologies for the Purlin Line oven include SCR/SNCR and a LNB. According to the EPA Air Pollution Control Technology Fact Sheets, for an SCR or SNCR to have effective removal, the temperature of the heater must be within a certain temperature range. The exit temperature of the drying oven is less than the required temperature. Furthermore, SCR/SNCRs are most efficient on larger industrial boilers and process heaters operating at high to moderate capacity factors. Therefore, these technologies are considered technically infeasible.

Nucor-Vulcraft has already retrofitted the oven burners with flue gas recirculation control technology. Further NOx emission reductions cannot be achieved except through full replacement of the existing oven burners with low NOx burners with a total reduction of 0.73 tpy. The cost effectiveness ratio for this replacement on the oven is calculated on Table 2 at approximately $56,000 per ton of NOx reduced. Based on this ratio, Nucor-Vulcraft recommends that BACT for the drying oven is the current control: flue gas recirculation.

3.17.4 VOC

The drying ovens produce VOC emissions. The identified control technologies are listed on Table 3, including currently used flue gas recirculation emission control and TO.

This oven is in the center of the facility and therefore cannot be vented to an outside TO; and there is insufficient space near this equipment to vent it through the roof. Therefore, a TO is technically infeasible to add a TO. Feasibility of implementing this technology must also consider the number of TO units, the extensive duct work and air movers and the large amount of natural gas that would be required for proper combustion. Environmental feasibility must consider that over 380 pounds of criteria pollutants would be produced for every million cubic feet of natural gas combusted or that for every pound of VOC destroyed, 0.5 pounds of criteria pollutants are produced.

As no additional technologies were identified as technically feasible, no economic analysis was conducted. Therefore, BACT for the drying oven on the NBS Purlin Lineis considered to be the current controls: flue gas recirculation.

3.18 FUGITIVE SPRAY

3.18.1 $PM_{2.5}$

The ability to paint 2% of the production was requested in the recent NOI submittal dated 9 February 2017, resulting in a PTE of less than 1 tpy. Some fugitive spray emissions may be captured in the exhaust vents; however, as described in Section 3.4.1, these options are technically infeasible. No other BACT technologies were identified.

3.18.2 VOCs

The ability to paint 2% of the production was requested in the recent NOI submittal dated February 9, 2017. The fugitive spray could be captured in the exhaust vents; however, as described in Section 3.4.1, these options are technically infeasible. As the fugitive spray emissions are less than 0.4 tpy of VOC, no additional BACT technologies were identified.

3.19 HAUL ROADS (NBS, JOIST PLANT)

3.19.1 $PM_{2.5}$

Nucor-Vulcraft has both paved and unpaved haul roads that produce direct $PM_{2.5}$ emissions. The identified control technologies are listed on Table 1, including the currently implemented 10 mph speed limit, vacuum sweeping, and water dust suppression.

Nucor-Vulcraft already employs vaccum sweeping and watering on paved surfaces, which has the highest available emission reduction control with 95% efficiency (per UDAQ's emission factors). Nucor currently employs basic watering and road base to unpaved surfaces (75% efficiency), which could be improved by chemical treatment (85% efficiency) or paving more road surfaces (95% efficiency). Based on the amount of unpaved roads currently in use at the facility and the estimated $PM_{2.5}$ emissions from these roads, the cost-effectiveness ratios for implementing additional controls would be approximately $790,000/ton for chemical treatment and approximately $1,450,000/ton for paving the roads, as shown on Table 1.

BACT for haul roads is considered to be the current controls: enforce 10 mph speed limit, vacuum sweeping, and water dust suppression.

3.20 PARTS CLEANERS (NBS, JOIST PLANT, COLD FINISH)

3.20.1 VOCs

Nucor-Vulcraft has parts cleaners in NBS, Joist Plant, and Cold Finish that produce VOC emissions. The identified control technologies are listed on Table 3 including the currently implemented replacement of Stoddard solvent with Safety-Kleen's Type II Solvent and the 2017 retirement of four parts cleaner units.

The technical feasibility evaluation showed one potential additional control for the parts cleaners: replace Safety-Kleen Type II solvent with extremely low VOC solvent solutions (e.g. citrus cleaner & degreaser). This replacement could decrease current emissions by PTE estimated values of 0.06 tpy, 0.071, and 0.04 tpy for NBS, Joist Plant, and Cold Finish, respectively for a total of 0.171 tpy. To determine if this is technically feasible, testing various surface washing agents would need to be evaluated in these three areas (NBS, Joist Plant and Cold Finish) to determine the performance. This testing will be done by December 2018.

If surface washing agent can perform well enough to use, this would be considered BACT. Economic feasibility appears to be valid. However, until it can be tested, BACT is considered the current controls: using Safety-Kleen Type II solvent and the retirement of four parts cleaners.

3.21 DIP COATING (JOIST PLANT, NBS)

3.21.1 VOCs

Dip coating operations are performed at the Joist Plant, truss painting equipment, Structural Parts line, NBS and at the Accessory Dip Tank. The weight and irregular shape(s) of many of the truss, beams, rods, structures, etc., (e.g. "parts") to be painted, require dip coating as opposed to spray booth painting. The existing tanks at the facility are long narrow structures, deep enough to submerge a given part. The rate of VOC emissions are based on the VOC content of the paint, the surface area of the parts being painted, and the surface area of the tank's liquid surface. The dip tank process has no energy inputs (i.e. fuel or electricity) so the process does not have a start up or shut down period. By operation, these emissions are fugitive. Drying of large parts occurs at the dip tank and also outside the tanks as overhead cranes transfer parts through the process. Therefore, collection of VOCs at point sources is technically infeasible; and installation of collection and treatment controls at the roof vents is technically infeasible because the subject roof structures at Nucor-Vulcraft cannot support these types of equipment.

Work practice standards to control VOC emissions currently consist of the tank lids placed back on the tank at the end of each shift and placed back on the tank during the shift if the dip tanks will not be used for one hour or more. Additional work practice standards have reduced emissions because this facility does not offer or provide specialty painting of parts or second/finishing coats.

A significant reduction in VOC emissions has occurred during the last 15 years through Nucor-Vulcraft's use of lower VOC paints (i.e., water based paints) that provide the needed attributes for steel structures and parts while reducing VOC concentrations. Since 2005, annual VOC emissions at the facility have been reduced, mainly from painting operations, from 339 tons to 262 tpy based on the 9 February 2017 PTE calculations. Nucor-Vulcraft experienced an average increase of $4 per gallon to use the low-VOC paint compared to the prior VOC-based paints, which results in an additional annual cost of about $900,000 per year based on the average annual quantities of paint used.

3.22 MASTIC EQUIPMENT

3.22.1 VOCs

Mastic Equipment is used in NBS on the Standing Seam line. A rust preventer is applied along the moving production line. The VOC content of the material averages 1.75 pounds per gallon. Mastic is applied to roll-formed steel to provide a seal when the roof is erected in the field. The mastic is applied on the steel part and then rolled several hundred feet to a stacking area, and then moved outside for final storage prior to shipment. The VOCs are emitted during staging in the building and while stacked outside. Therefore the emissions would be considered fugitive and cannot be controlled.

3.22.2 VOCs

A highly evaporative lubricant is used to protect the finish of some of the panels in the NBS side panels. Calculations assume 100 % of the oil used evaporates as VOCs (7 lb/gal). A liberal calculation, using just over 2,600 gallons of lubricant, is used to estimate VOC PTE at 9.2 tpy. For actual usage, the amount of emissions and volume of emissions is much less than calculated.

The technical feasibility involving capture of these VOC's is not implementable due to challenges of collecting fugitive emissions along the entire production line (emissions continue to emit long after application). There is also a potential safety hazard of collecting and oxidizing the emissions.

4.0 BACT RECOMMENDATIONS

Based on the UDAQ expectation that BACT be defined as control technologies that could be installed and made operational by the end of 2018, Nucor-Vulcraft has determined that baseline conditions represent BACT for practically all emission sources. The enhanced use of low-VOC paints during the past 15 years is considered BACT for the painting operations, which has reduced VOC emissions from 339 tons to 262 tons per year (tpy). In addition, Nucor-Vulcraft proposes to evaluate welding techniques and plasma cutter operations, to confirm if techniques are optimal to ensure that emissions are minimized.

The emission limits and monitoring outlined in the 9 February 2017 NOI take into account the continuous reduction in emissions being achieved at Nucor-Vulcraft and are believed to represent BACT for the facility with the amendments acknowledged herein.

Tables

Table 1 Potential BACT Technologies for Direct $PM_{2.5}$ - Particulate Matter							
Source / Process Area	**Existing Control Technology**	**Potential Control Technologies**	**Potential Technically Feasible? (Y / N)**	**Comment**	**Incremental Emissions Reduction (TPY)**	**Incremental Cost Effectiveness ($/ton)**	**Implementation Year**
Wire Line Shot blasting [A]	Wire Line Baghouse - 99.99% down to 0.5*u* m.		Y	Currently implemented	N/A	N/A	Currently implemented
Coil Line Shot blasting [A]	Baghouse w/ 98% removal		Y	Currently implemented	N/A	N/A	Currently implemented
		Filter media = 99.99% down to 0.5 *u* m	Y		0.07	$369,651	Year 2021
Bar Line Shot blasting [A]	Bar Line Baghouse 98%		Y	Currently implemented	N/A	N/A	Currently implemented
		Filter media = 99.99% down to 0.5 *u* m	Y		0.19	$147,881	Year 2021
Joist Plant Building- Roof Exhasut Vents		Scrubber	N	Impact to equipment that prohibits production; Roof vents cannot support equipment	N/A	N/A	N/A
6 + 9 roof exhasut vents		HEPA	N	Impact to equipment that prohibits production; Roof vents cannot support equipment	N/A	N/A	N/A
		ESP	N	Impact to equipment that prohibits production; Roof vents cannot support equipment	N/A	N/A	N/A
Cold Finish Buidling (Roof Exhasut Vents)		Scrubber	N	Impact to equipment that prohibits production; Roof vents cannot support equipment	N/A	N/A	N/A
2 roof exhaust vents		HEPA	N	Impact to equipment that prohibits production; Roof vents cannot support equipment	N/A	N/A	N/A
		ESP	N	Impact to equipment that prohibits production; Roof vents cannot support equipment	N/A	N/A	N/A
Plasma Cutter (Cold Finish - Dry)	Limited Use; BMPs		Y	Currently implemented	N/A	N/A	Currently implemented
		Baghouse	Y		0.035	$629,834	Year 2019
Plasma Cutter (Structural Products - Dry)	Fume collector and control (blended cellulose and polyester fibers)		Y	Currently implemented	N/A	N/A	Currently implemented
		HEPA	N	Manufacturer has not confirmed that this can be implemented.	N/A	N/A	N/A
		ESP	N	Manufacturer has not confirmed that this can be implemented.	N/A	N/A	N/A
Plasma Cutter (NBS-Wet)	Plasma Gas Selection		Y	Currently implemented	N/A	N/A	Currently implemented
	Follow Manufacture recommendation on water submersion techniques		Y	Currently implemented	N/A	N/A	Currently implemented

Table 1 Potential BACT Technologies for Direct $PM_{2.5}$ - Particulate Matter							
Source / Process Area	**Existing Control Technology**	**Potential Control Technologies**	**Potential Technically Feasible? (Y / N)**	**Comment**	**Incremental Emissions Reduction (TPY)**	**Incremental Cost Effectiveness ($/ton)**	**Implementation Year**
		Flex Duct Capture System with HEPA or ESP	N	Capture system would interfere with process flow, critically disrupt hoist and carry equipment and prohibit production.	N/A	N/A	N/A
		Fume Hood with fabric filters (i.e. dry filtration)	N	Capture system would interfere with process flow, critically disrupt hoist and carry equipment and prohibit production.	N/A	N/A	N/A
Plasma Steel Cutter (Structural Products -Wet)	Plasma Gas Selection		Y	Currently implemented	N/A	N/A	Currently implemented
	Follow Manufacture recommendation on water submersion techniques		Y	Currently implemented	N/A	N/A	Currently implemented
		Flex Duct Capture System with HEPA or ESP	N	Capture system would interfere with process flow, critically disrupt hoist and carry equipment and prohibit production.	N/A	N/A	N/A
		Fume Hood with fabric filters (i.e. dry filtration)	N	Capture system would interfere with process flow, critically disrupt hoist and carry equipment and prohibit production.	N/A	N/A	N/A
Bridging Line (Spray box) A	BMPs		Y	Currently implemented; Does not produce direct PM2.5 emissions	N/A	N/A	Currently implemented
Welding	Inert Shielding Gas		Y	Currently implemented	N/A	N/A	Currently implemented
	Electrode Selection		Y	Currently implemented	N/A	N/A	Currently implemented
	Lowest Recommended Current/ Low AMPs		Y	Currently implemented	N/A	N/A	Currently implemented
		1.Flex Duct Capture System HEPA or ESP	N	Capture system would interfere with process flow, critically disrupt hoist and carry equipment and prohibit production.	N/A	N/A	N/A
		2.Torch Fume Extraction HEPA or ESP	N	Capture system would interfere with process flow, critically disrupt hoist and carry equipment and prohibit production.	N/A	N/A	N/A
Spray booth (NBS - Built up Line)	Source Control: HVLP spray guns		Y	Currently implemented	N/A	N/A	Currently implemented
	Exhaust Control: 95% Filter Pads		Y	Currently implemented	N/A	N/A	Currently implemented
		Fabric Filter / Baghouse	N	Spray droplets too large and would clog filter	N/A	N/A	N/A
Spray booth (Structural Products)	Source Control: HVLP spray guns		Y	Currently implemented	N/A	N/A	Currently implemented
	Exhaust Control: 95% Filter Pads		Y	Currently implemented	N/A	N/A	Currently implemented
		Fabric Filter / Baghouse	N	Spray droplets too large and would clog filter	N/A	N/A	N/A
Drying ovens (Spray Box)	Flue gas recirculation emission control		Y	Currently implemented	N/A	N/A	Currently implemented

Table 1 Potential BACT Technologies for Direct $PM_{2.5}$ - Particulate Matter							
Source / Process Area	**Existing Control Technology**	**Potential Control Technologies**	**Potential Technically Feasible? (Y / N)**	**Comment**	**Incremental Emissions Reduction (TPY)**	**Incremental Cost Effectiveness ($/ton)**	**Implementation Year**
		Capture Systems	N	Capture system would interfere with process flow, critically disrupt hoist and carry equipment and prohibit production.	N/A	N/A	N/A
Drying Oven (NBS, Built-Up Line)	Flue gas recirculation emission control		Y	Currently implemented	N/A	N/A	Currently implemented
		Capture Systems	N	Capture system would interfere with process flow, critically disrupt hoist and carry equipment and prohibit production.	N/A	N/A	N/A
Drying Oven (NBS, Purlin Line)	Flue gas recirculation emission control		Y	Currently implemented	N/A	N/A	Currently implemented
		Capture Systems with baghouse	Y		0.040	$551,104	Year 2021
Drying Oven (Structural Products)	Flue gas recirculation emission control		Y	Currently implemented	N/A	N/A	Currently implemented
		Capture Systems	N	Capture system would interfere with process flow, critically disrupt hoist and carry equipment and prohibit production.	N/A	N/A	N/A
Fugitive Spray Booth	-	-	-	2% of the production will be allowed to be painted outside the paint booth. Total emissions <1 tpy.	N/A	N/A	N/A
Haul Roads (NBS, Joist Plant) [A]	Increased paved road length		Y	Currently implemented	N/A	N/A	Currently implemented
	15 mph Speed limit		Y	Currently implemented	N/A	N/A	Currently implemented
	Vacuum Sweeping for paved areas on a monthly basis		Y	Currently implemented	N/A	N/A	Currently implemented
	Water dust suppression		Y	Currently implemented	N/A	N/A	Currently implemented
		Chemical supression	Y		0.029	$794,483	Year 2019
		Pave roads	Y		0.058	$1,453,175	Incremental Paving over 5 years completed by Year 2022

Table 2 Potential BACT Technologies for NO_x - Nitrogen Oxides							
Source / Process Area	**Existing Control Technology**	**Potential Control Technologies**	**Technically Feasible? (Y / N)**	**Comment**	**Incremental Emissions Reduction (TPY)**	**Incremental Cost Effectiveness ($/ton)**	**Implementation Time**
Plasma Cutter (Cold	Limited Use		Y	Currently Implemented	N/A	N/A	Currently Implemented
Drying Oven (Spray Box)	Flue gas recirculation emission control		Y	Currently Implemented	N/A	N/A	Currently Implemented
		SCR/SNCRs	N	Capture system would interfere with process flow, critically disrupt hoist and carry equipment and prohibit production.	N/A	N/A	N/A
		Low NOx Burner	Y		0.39	$85,110	Year 2020
Drying Oven (NBS Built Up Line)	Flue gas recirculation emission control		Y	Currently Implemented	N/A	N/A	Currently Implemented
		SCR/SNCRs	N	Capture system would interfere with process flow, critically disrupt hoist and carry equipment and prohibit production.	N/A	N/A	N/A
		Low NOx Burner	Y		0.49	$86,575	Year 2020
Drying Oven (NBS Purlin Line)	Flue gas recirculation emission control		Y	Currently Implemented	N/A	N/A	Currently Implemented
		SCR/SNCRs	N	Oven temperature not sufficient for effective removal	N/A	N/A	N/A
		Low NOx Burner	Y		0.73	$55,826	Year 2020
Drying Oven (Structural Parts)	Flue gas recirculation emission control		Y	Currently Implemented	N/A	N/A	Currently Implemented
		SCR/SNCRs	N	Capture system would interfere with process flow, critically disrupt hoist and carry equipment and prohibit production.	N/A	N/A	N/A
		Low NOx Burner	Y		0.17	$376,726	Year 2020
Plasma Steel Cutter (Structural Products - Wet)	Plasma Gas Selection		Y	Currently Implemented	N/A	N/A	Currently Implemented
	Follow Manufacture recommendation on water submersion techniques		Y	Currently Implemented	N/A	N/A	Currently Implemented
		Flex Duct Capture System with Wet Scrubbers	N	Capture system would interfere with process flow, critically disrupt hoist and carry equipment and prohibit production.	N/A	N/A	N/A

Table 2 Potential BACT Technologies for NO_x - Nitrogen Oxides							
Source / Process Area	Existing Control Technology	Potential Control Technologies	Technically Feasible? (Y / N)	Comment	Incremental Emissions Reduction (TPY)	Incremental Cost Effectiveness ($/ton)	Implementation Time
		Flex Duct Capture System with Dry Scrubbers	N	Capture system would interfere with process flow, critically disrupt hoist and carry equipment and prohibit production.	N/A	N/A	N/A
		SNCR/SCR	N	Capture system would interfere with process flow, critically disrupt hoist and carry equipment and prohibit production.	N/A	N/A	N/A
Plasma Steel Cutter (NBS -Wet)	Plasma Gas Selection		Y	Currently Implemented	N/A	N/A	Currently Implemented
	Follow Manufacture recommendation on water submersion techniques		Y	Currently Implemented	N/A	N/A	Currently Implemented
		Flex Duct Capture System with Wet Scrubber System	N	Capture system would interfere with process flow, critically disrupt hoist and carry equipment and prohibit production.	N/A	N/A	N/A
		Flex Duct systemwith Dry Scrubbing	N	Capture system would interfere with process flow, critically disrupt hoist and carry equipment and prohibit production.	N/A	N/A	N/A
		SCR/SNCR	N	Capture system would interfere with process flow, critically disrupt hoist and carry equipment and prohibit production.	N/A	N/A	N/A
Plasma Cutter (Structural Products - Dry)	Limited Use; BMPs		Y	Currently Implemented	N/A	N/A	Currently Implemented

Table 3 Potential BACT Technologies for VOCs - Volatile Organic Compounds							
Source / Process Area	**Existing Control Technology**	**Potential Control Technologies**	**Technically Feasible? (Y / N)**	**Comment**	**Incremental Emissions Reduction (TPY)**	**Incremental Cost Effectiveness ($/ton)**	**Implementation Time**
Parts Cleaners (NBS)	Retired 4 from NBS; Replace Stoddard solvent with Safety-Kleen		Y	Currently Implemented	N/A	N/A	Currently Implemented
		Replace Safety-Kleen with low VOC alternative	Y		0.060	Same operational cost	Year 2019
Parts Cleaners (Joist Plant)	Replace Stoddard solvent with Safety-Kleen		Y	Currently Implemented	N/A	N/A	Currently Implemented
		Replace Safety-Kleen with low VOC alternative	Y		0.071	Same operational cost	Year 2019
Parts Cleaners (Cold Finish)	Replace Stoddard solvent with Safety-Kleen		Y	Currently Implemented	N/A	N/A	Currently Implemented
		Replace Safety-Kleen with low VOC alternative	Y		0.040	Same operational cost	Year 2019
Dip Coating	Paint VOC content reduced to 2.1 lbs/gal		Y	Currently Implemented	N/A	N/A	Currently Implemented
	Covering dip tanks when not in use		Y	Currently Implemented	N/A	N/A	Currently Implemented
		Capture System with Thermal Oxidization	N	Fugitive emissions	N/A	N/A	N/A
		Capture System with Carbon Adsorption	N	Fugitive emissions	N/A	N/A	N/A
Joist Coating	Paint VOC content reduced to 2.1 lbs/gal		Y	Currently Implemented	N/A	N/A	Currently Implemented
Bridging Line (Spray box)	Replace vacu-coater; Paint VOC content reduced to 2.1 lbs/gal		Y	Currently Implemented	N/A	N/A	Currently Implemented
Drying Oven (Spray Box)	Flue gas recirculation emission control		Y	Currently Implemented	N/A	N/A	Currently Implemented
		Capture Systems	N	Capture system would interfere with process flow, critically disrupt hoist and carry equipment and prohibit production.	N/A	N/A	N/A
Drying Oven (NBS Built Up Line)	Flue gas recirculation emission control		Y	Currently Implemented	N/A	N/A	Currently Implemented
		Capture Systems	N	Capture system would interfere with process flow, critically disrupt hoist and carry equipment and prohibit production.	N/A	N/A	N/A
Drying Oven (NBS Purlin Line)	Flue gas recirculation emission control		Y	Currently Implemented	N/A	N/A	Currently Implemented

Table 3 Potential BACT Technologies for VOCs - Volatile Organic Compounds							
Source / Process Area	**Existing Control Technology**	**Potential Control Technologies**	**Technically Feasible? (Y / N)**	**Comment**	**Incremental Emissions Reduction (TPY)**	**Incremental Cost Effectiveness ($/ton)**	**Implementation Time**
		Capture Systems with Thermal oxidation	N	Insufficient space	N/A	N/A	N/A
Drying Oven (Structrual Parts)	Flue gas recirculation emission control		Y	Currently Implemented	N/A	N/A	Currently Implemented
		Capture Systems	N	Capture system would interfere with process flow, critically disrupt hoist and carry equipment and prohibit production.	N/A	N/A	N/A
Spray Booth (NBS - Built up Line)	HVLP spray guns		Y	Currently Implemented	N/A	N/A	Currently Implemented
	Paint VOC content reduced to 2.1 lbs/gal		Y	Currently Implemented	N/A	N/A	Currently Implemented
	High efficiency filter systems		Y	Currently Implemented	N/A	N/A	Currently Implemented
		Thermal Oxidization	N	Insufficient space	N/A	N/A	N/A
		Carbon Adsorption	N	Higher concentration of VOCs is required	N/A	N/A	N/A
Spray Booth (Structural Products)	HVLP spray guns		Y	Currently Implemented	N/A	N/A	Currently Implemented
	Paint VOC content reduced to 2.1 lbs/gal		Y	Currently Implemented	N/A	N/A	Currently Implemented
	High efficiency filter systems		Y	Currently Implemented	N/A	N/A	Currently Implemented
		Thermal Oxidization	Y		5.1	$227,102	Year 2022
		Carbon Adsorption	N	Higher concentration of VOCs is required	N/A	N/A	N/A
Vacu-Coater (NBS - Purlin Line)	Paint VOC content reduced to 2.1 lbs/gal		Y	Currently Implemented	N/A	N/A	Currently Implemented
		Thermal Oxidization	N	Insufficient space	N/A	N/A	N/A
		Wet Scrubber	N	Additional studies needed	N/A	N/A	N/A
		Carbon Adsorption	N	Temperature too high for effective removal	N/A	N/A	N/A
Mastic Equipment				Future product development relevant	N/A	N/A	N/A
Lubrication Equipment				Future product development relevant	N/A	N/A	N/A
Fugitive Spray Booth				2% of the production will be allowed to be painted outside the paint booth. Total emissions <0.4 tpy.	N/A	N/A	N/A

Table 3 Potential BACT Technologies for VOCs - Volatile Organic Compounds							
Source / Process Area	**Existing Control Technology**	**Potential Control Technologies**	**Technically Feasible? (Y / N)**	**Comment**	**Incremental Emissions Reduction (TPY)**	**Incremental Cost Effectiveness ($/ton)**	**Implementation Time**
Parts Cleaners (NBS)	Retired 4 from NBS; Replace Stoddard solvent with Safety-Kleen		Y	Currently Implemented	N/A	N/A	Currently Implemented
		Replace Safety-Kleen with low VOC alternative	Y		0.060	Same operational cost	Year 2019
Parts Cleaners (Joist Plant)	Replace Stoddard solvent with Safety-Kleen		Y	Currently Implemented	N/A	N/A	Currently Implemented
		Replace Safety-Kleen with low VOC alternative	Y		0.071	Same operational cost	Year 2019
Parts Cleaners (Cold Finish)	Replace Stoddard solvent with Safety-Kleen		Y	Currently Implemented	N/A	N/A	Currently Implemented
		Replace Safety-Kleen with low VOC alternative	Y		0.040	Same operational cost	Year 2019
Dip Coating	Paint VOC content reduced to 2.1 lbs/gal		Y	Currently Implemented	N/A	N/A	Currently Implemented
	Covering dip tanks when not in use		Y	Currently Implemented	N/A	N/A	Currently Implemented
		Capture System with Thermal Oxidization	N	Fugitive emissions	N/A	N/A	N/A
		Capture System with Carbon Adsorption	N	Fugitive emissions	N/A	N/A	N/A
Joist Coating	Paint VOC content reduced to 2.1 lbs/gal		Y	Currently Implemented	N/A	N/A	Currently Implemented
Bridging Line (Spray box)	Replace vacu-coater; Paint VOC content reduced to 2.1 lbs/gal		Y	Currently Implemented	N/A	N/A	Currently Implemented
Drying Oven (Spray Box)	Flue gas recirculation emission control		Y	Currently Implemented	N/A	N/A	Currently Implemented
		Capture Systems	N	Capture system would interfere with process flow, critically disrupt hoist and carry equipment and prohibit production.	N/A	N/A	N/A
Drying Oven (NBS Built Up Line)	Flue gas recirculation emission control		Y	Currently Implemented	N/A	N/A	Currently Implemented
		Capture Systems	N	Capture system would interfere with process flow, critically disrupt hoist and carry equipment and prohibit production.	N/A	N/A	N/A
Drying Oven (NBS Purlin Line)	Flue gas recirculation emission control		Y	Currently Implemented	N/A	N/A	Currently Implemented

Table 3 Potential BACT Technologies for VOCs - Volatile Organic Compounds							
Source / Process Area	**Existing Control Technology**	**Potential Control Technologies**	**Technically Feasible? (Y / N)**	**Comment**	**Incremental Emissions Reduction (TPY)**	**Incremental Cost Effectiveness ($/ton)**	**Implementation Time**
		Capture Systems with Thermal oxidation	N	Insufficient space	N/A	N/A	N/A
Drying Oven (Structural Parts)	Flue gas recirculation emission control		Y	Currently Implemented	N/A	N/A	Currently Implemented
		Capture Systems	N	Capture system would interfere with process flow, critically disrupt hoist and carry equipment and prohibit production.	N/A	N/A	N/A
Spray Booth (NBS - Built up Line)	HVLP spray guns		Y	Currently Implemented	N/A	N/A	Currently Implemented
	Paint VOC content reduced to 2.1 lbs/gal		Y	Currently Implemented	N/A	N/A	Currently Implemented
	High efficiency filter systems		Y	Currently Implemented	N/A	N/A	Currently Implemented
		Thermal Oxidization	N	Insufficient space	N/A	N/A	N/A
		Carbon Adsorption	N	Higher concentration of VOCs is required	N/A	N/A	N/A
Spray Booth (Structural Products)	HVLP spray guns		Y	Currently Implemented	N/A	N/A	Currently Implemented
	Paint VOC content reduced to 2.1 lbs/gal		Y	Currently Implemented	N/A	N/A	Currently Implemented
	High efficiency filter systems		Y	Currently Implemented	N/A	N/A	Currently Implemented
		Thermal Oxidization	Y		5.1	$227,102	Year 2022
		Carbon Adsorption	N	Higher concentration of VOCs is required	N/A	N/A	N/A
Vacu-Coater (NBS - Purlin Line)	Paint VOC content reduced to 2.1 lbs/gal		Y	Currently Implemented	N/A	N/A	Currently Implemented
		Thermal Oxidization	N	Insufficient space	N/A	N/A	N/A
		Wet Scrubber	N	Additional studies needed	N/A	N/A	N/A
		Carbon Adsorption	N	Temperature too high for effective removal	N/A	N/A	N/A
Mastic Equipment				Future product development relevant	N/A	N/A	N/A
Lubrication Equipment				Future product development relevant	N/A	N/A	N/A
Fugitive Spray Booth				2% of the production will be allowed to be painted outside the paint booth. Total emissions <0.4 tpy.	N/A	N/A	N/A

EXECUTIVE SUMMARY

This Best Available Control Technology (BACT) Evaluation was completed in accordance with the Utah Department of Air Quality's 23 January 2017 letter requesting this analysis as part of the regulatory agency's fine particular matter (particulate matter 2.5 microns or less in diameter or $PM_{2.5}$) Serious Nonattainment State Implementation Plan (SIP) development process. The top-down BACT process was followed to identify BACT for each source and the following associated emission type: $PM_{2.5}$, sulfur oxides (SOx), nitrogen oxides (NOx), volatile organic compounds (VOC), and ammonia (NH_3).

Vulcraft, a Division of Nucor Corporation (Nucor-Vulcraft) is a steel fabrication facility that consists of two main facilities, including the Joist Plant and Nucor Building Systems (NBS). The Joist Plant consists of the Joist Plant, the Cold Finish area, a stock yard, the maintenance facility and administrative buildings. Nucor-Vulcraft is identified as a Major Source for Volatile Organic Compounds (VOCs), which are considered $PM_{2.5}$ precursors.

The applicable sources at the Nucor-Vulcraft facility were identified as: shot blasting, exhaust vents, plasma cutters, spray boxes, welding, spray booths, drying ovens, dip coating, haul roads, resistance welding, joist coating, parts cleaners, vacu- coater, mastic equipment, and lubrication equipment.

All potential control technologies were listed and evaluated for the relevant emission sources. Technically infeasible technologies were eliminated. The remaining technologies were ranked by control effectiveness. An economic feasibility study was then conducted with a cost effectiveness threshold of $10,000 per ton removed per year. As a part of the BACT process, other issues that could adversely impact the environment, safety and health, and energy demand were included in the evaluation. Table 1 lists controls identified as BACT for the applicable emission sources.

Nucor-Vulcraft has significantly reduced VOC emissions during the last 15 years by implementing the use of lower VOC paints (i.e. water based paints). Since 2005, VOC emissions at the facility have been reduced, mainly from painting operations, from 339 tons to 262 tons per year (tpy). The use of low-VOC paints represents the current baseline condition, and is considered BACT for the facility for painting operations. Nucor-Vulcraft experienced an average increase of $4 per gallon to use the low-VOC paint compared to the prior VOC-based paints, which results in an additional annual cost of about $900,000 per year based on the average annual quantities of paint used (i.e., 225,500 gallons).

In addition, Nucor-Vulcraft proposes to reevaluate welding techniques and plasma cutter operations, to confirm if techniques are optimal to ensure that emissions are minimized.

1.0 *INTRODUCTION*

On behalf of Vulcraft, a Division of Nucor Corporation (Nucor-Vulcraft), ERM-West, Inc. (ERM) conducted a Best Available Control Technologies (BACT) evaluation for the company's Brigham City facility. This report presents the BACT process and results for submittal to the Utah Department of Environmental Quality, Division of Air Quality (UDAQ). The BACT evaluation was completed in accordance with the UDAQ's 23 January 2017 letter requesting this analysis as part of the regulatory agency's fine particular matter (particulate matter 2.5 microns or less in diameter or $PM_{2.5}$) Serious Nonattainment State Implementation Plan (SIP) development process.

2.0 *APPROACH*

A top-down BACT analysis was completed for all technologies that would reduce $PM_{2.5}$ emissions and precursors of $PM_{2.5}$ emissions from all regulated sources within the Nucor-Vulcraft facility. The evaluation included assessing all processes from the Cold Finish, Joist Plant, Nucor Building Systems (NBS), and the new Grating and Structural Products lines. All applicable emission control technologies were identified for the emission sources, and they were screened for technical feasibility under the SIP requirements and schedule.

The SIP is designed to regulate and limit $PM_{2.5}$ and its precursors to below the National Ambient Air Quality Standards (NAAQS) based on data to be collected throughout year 2019. This means that control technology improvements will need to be in place before the end of year 2018 to support compliance with the SIP. Therefore, the evaluation and identification of BACT takes into account whether Nucor-Vulcraft can implement the new controls prior to the end of 2018.

In cases where Nucor-Vulcraft has determined that control technologies are technically feasible, except for the SIP schedule constraints, these controls are not considered BACT, but rather "Additional Feasible Measures" that could be implemented if more time were available. All technologies considered technically feasible as BACT or Additional Feasible Measures were ranked based on their potential emission reduction efficiencies. Energy, environmental, economic impacts and other considerations were evaluated for the feasible technologies; and the most effective, least impactful, cost-effective technologies were identified as BACT or Additional Feasible Measures for the applicable emission units.

2.1 *BACT ANALYSIS PROCESS*

The BACT analysis was organized into the following steps, which are described in the paragraphs that follow:

1. Identify control technologies.
2. Eliminate technically infeasible technologies.
3. Rank technologies by control effectiveness.
4. Evaluate controls for economic feasibility.
5. Recommend BACT.

2.1.1 *Step 1 - Identify Control Technologies*

Nucor-Vulcraft identified its emission sources for $PM_{2.5}$ and precursors; and then identified acceptable control technologies for these sources. The U.S. Environmental Protection Agency (EPA) established the Reasonable Available Control Technologies/BACT/Lowest Achievable Emission Rate (RACT/BACT/LAER) Clearinghouse (RBLC) to provide a central data base of air pollution technology information. Nucor-Vulcraft relied on the RBLC, plus other resources listed in Section 2.2, to identify potentially applicable control technologies. The emission sources and applicable technologies were documented using a BACT Matrix Table for tracking and presentation of the results as presented in Section 3 and the attached tables.

2.1.2 *Step 2 - Eliminate Technically Infeasible Technologies*

Nucor-Vulcraft reviewed the technologies to determine whether they were technically feasible based on site-specific (i.e., real estate) or operational constraints. The SIP time constraints were also taken into account relative to defining technically feasible BACT. Step 3 - Rank Technologies by Control Effectiveness

In most cases, Nucor-Vulcraft conservatively calculated the baseline emissions from its sources using the potential to emit (PTE) calculations used for the Notice of Intent (NOI) submitted 9 February 2017. In select cases, the actual emissions were considered from recent years (e.g., Purlin Line) instead of the PTE calculated values to more accurately account for potential emission reductions. The potential for additional emission reductions was evaluated for the applicable technologies using vendor or EPA provided removal efficiencies. The amount of emissions reductions that could be achieved for the applicable technologies were calculated and the technologies were listed according to rank on the BACT Matrix.

2.1.3 *Step 4 - Evaluate Controls for Economic Feasibility*

Nucor-Vulcraft evaluated the controls for economic feasibility using capital and operating cost estimates provided by the EPA Cost Control Manual, vendor information, ERM experience, and potential project estimates from Nucor-Vulcraft. Energy consumption, environmental and other impacts were considered for the feasible controls to account for all economic impacts. The economic feasibility of increased controls was evaluated using the ratio of the cost for the new controls compared with the incremental emission reductions achieved by the new controls verses the baseline (current) condition in terms of dollars per ton of emissions reduced. Nucor-Vulcraft considered the ratio of $10,000 per ton of emission reductions to represent economically feasible controls.

2.1.4 *Step 5 - Recommend BACT*

Based on the evaluation of control technologies, Nucor-Vulcraft is presenting in this report its analysis and conclusions regarding the controls it believes are technically and economically feasible, and those that can be considered BACT (including compliance with the UDAQ SIP schedule) or Additional Feasible Measures (if more time is permissible for technology implementation). Table 1 presents a summary of BACT selections for each pollutant by source.

2.2 *REGULATORY BACKGROUND*

The following BACT clearinghouses and guidelines were searched as part of Step 1 to identify potentially applicable control technologies for the Nucor-Vulcraft emission sources:

- U.S. EPA RACT/BACT/Lear Clearinghouse (RBLC)
- California Air Resources Board Standard Industrial Classification (SIC) 325180 (other basic inorganic chemical manufacturing) and 2812 (Alkaline and Chlorine)
- Bay Area Air Quality Management District (BAAQMD)
- South Coast Air Quality Management District (SCAQMD)
- Texas Commission of Environmental Quality

The following process types were reviewed for the various operations that are conducted at Nucor-Vulcraft:

- Process Type No. 12.310- Natural Gas -Paint, Heaters, Ovens

- Process Type No. 13.310 – Commercial/Institutional Size Boilers/ Furnace, <100 MMBtu/hr, Natural Gas
- Process Type No. 41.002 – Automobiles and Trucks Surface Coating -Guidecoat and Topcoat Painting
- Process Type No.41.013 – Miscellaneous Metal Parts & Product Surface Coating
- Process Type No. 81.230 – Steel Production Casting & Pouring Processes;
- Process Type No. 81.350 – Steel Foundry Casting & Pouring Processes;
- Process Type No. 81.390 – Other Steel Foundry Processes;
- Process Type No. 81.290 – Other Steel Manufacturing Processes;
- Process Type No. 81.370 – Miscellaneous Melt Shop Operations;
- Process Type No. 99.012- Welding & Grinding
- Process Type No. 99.999 – Other Miscellaneous Sources -Painting Operations

The following regulations were reviewed:

- Code of Federal Regulations Title 40, Part 52
- Code of Federal Regulations Title 40, Part 60
- Code of Federal Regulations Title 40, Part 63
- Utah Air Rules Title 19, Chapter 2 of the Utah Code: R307

To fully evaluate applicable BACT limits for processes with limited RBLC results, based on process type queries, additional RBLC queries were conducted based on process names or key words (e.g., "Blast").

2.3 *BASIS AND STUDY LIMITATION*

Operations were evaluated on a standalone bases per specific emission unit. The prescribed BACT process was followed including further investigation if a control technology appeared feasible, but not economically practical. Costs for these technologies, including implementation costs, were estimated using available regulatory data, vendor information, and best judgement; however, costs for major capital projects like those considered herein can vary by over 100 percent.

The cost effectiveness for BACT was considered at $10,000 per ton removed or less. Nucor-Vulcraft used this value as the basis for determining new BACT selections for this evaluation. The determination of technical feasibility had several criteria that needed to be met such as physical constraints, operational safety, and other environmental protection criteria.

3.0 *BACT EVALUATION*

The BACT Evaluation is summarized for each source in the following sections. Tables 2 through 6 also present the emission sources for direct $PM_{2.5}$ and its precursors (e.g., sulfur oxides (SOx), nitrogen oxides (NOx), volatile organic compounds (VOCs), and ammonia (NH_3)). For each source, these tables list the identified control technologies, if they are technically feasible, the baseline emissions, the estimated emissions reductions, and the cost effectiveness for applicable technologies.

3.1 *WIRE LINE SHOT BLASTING*

3.1.1 *$PM_{2.5}$*

Shot blasting on the wire line produces Direct $PM_{2.5}$ emissions. The identified control technologies are listed on Table 2, including the currently implemented use of a baghouse with 99.99% efficiency.

The technical feasibility evaluation showed that no additional control technologies were feasible for the Wire Line Shot Blasting.

As no additional technologies were identified as technically feasible, no economic analysis was conducted. Therefore, BACT for the Wire Line Shot Blasting is considered to be the current controls: baghouse with 99.99% efficiency.

3.2 *COIL LINE SHOT BLASTING*

3.2.1 *$PM_{2.5}$*

Shot blasting is done on the coil line with possible direct $PM_{2.5}$ emissions. No specific emission factor for $PM_{2.5}$ has been developed for shot blasting and with the absences of combustion in this process, the likelihood of measurable $PM_{2.5}$ being generated is small. Estimated PTE $PM_{2.5}$ emissions equal PM10 emissions, which are 3.3 tons per year (tpy). The identified control technologies are listed on Table 2, including the currently implemented use of a baghouse with 98% efficiency.

The technical feasibility evaluation showed an additional control technology of using a different baghouse filter media which has a removal efficiency of 99.99% down to 0.5 *um*. Based on limited emission factor data, this could reduce the PTE impact by 1.81 tpy.

The economic evaluation showed that this control technology was economically infeasible as the incremental cost effectiveness ratio exceeded $10,000 per ton. One main reason for this exceedance is because the higher efficiency filter media is not available for the current baghouse used at the facility, and full replacement of the existing baghouse would be required. Therefore, BACT for the Coil Line Shot Blasting is considered to be the current control: baghouse with 98% efficiency.

3.3 *BAR LINE SHOT BLASTING*

3.3.1 *$PM_{2.5}$*

Installation of the 99.99% removal efficiency filter media presented in Section 3.2.1 could result in an "on-paper reduction" of 5.29 tpy of $PM_{2.5}$ for this source. For the technical and economic discussion for this emission unit, please see Section 3.2.1. BACT for the Bar Line Shot Blasting is considered to be the current control: baghouse with 98% efficiency.

3.4 *EXHAUST VENTS (JOIST PLANT, COLD FINISH, AND NBS)*

3.4.1 *$PM_{2.5}$*

There are 15 roof vents on the Joist Plant, three (3) roof vents on Cold Finish and six (6) main vents on NBS (24 total roof vents). These fan-driven vents exhaust air from the respective production/assembly lines to the atmosphere. As recommended by the American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHAE), 10 to 15 air exchanges per hour should occur for manufacturing buildings.

Approximately 2.16 tpy of $PM_{2.5}$ based on air sampling events, have been estimated to be exhausted from the 24 roof vents. The combined air flow, based on Approved American National Standard Institute (ANSI) is approximately 300,000 cubic feet per minute (cfm) or about 19,700 cfm per exhaust vent.

Control technologies for $PM_{2.5}$ appear to be limited to fabric filters, with filter bags that remove 99% of $PM_{2.5}$ (Table 2). This technology would involve 15 fabric filters having high volume, high efficiency filters or one large unit with extensive ducting and exhaust fans. Removal of small particulate, high volume air presents several known technical problems. Roof exhaust vents would have to be retrofitted with support structures for on-roof baghouses. Additional structural additions would also need to be made to facilitate servicing the equipment. An alternative approach would be for an extensive duct system to collect and move the exhaust building air down to a centralized baghouse system.

Due to the high volume of air flow that must be maintained, low volume of $PM_{2.5}$ to be removed, extensive structural improvements, and the number of fabric filter housings needed, this technology is neither technologically nor economically feasible.

3.5 *PLASMA CUTTER (COLD FINISH - DRY)*

The Plasma Cutter in Cold Finish produces direct $PM_{2.5}$ emissions and NOx emissions. This source has historically been operated less than 40 hours per year. There is no anticipated increased usage planned for this source.

3.5.1 *$PM_{2.5}$*

Dry plasma cutter operation in Cold Finish for maintenance produces approximately 0.035 tpy of Direct $PM_{2.5}$ emissions. The identified control technologies are listed on Table 2.

As estimated, with a maximum of 40 hours of operation, only 0.035 tpy are emitted from this unit, no additional controls were identified to be technically feasible. Therefore, BACT for the dry plasma cutter in Cold Finish is considered to be the current controls: limited use and best management practices.

3.5.2 *NOx*

The dry plasma cutter in Cold Finish produces 0.03 tpy of NOx emissions. The identified control technologies are listed on Table 4.

The technical feasibility evaluation showed one potential additional control technology: flex duct capture system with an ESP or fume collector. However, this is considered economically infeasible due to the limited operation of the dry plasma cutter, which results in insignificant emissions. Therefore, BACT for the dry plasma cutter in Cold Finish is considered to be the current controls: limited use and best management practices.

3.6 *PLASMA CUTTER (NBS - WET)*

3.6.1 *$PM_{2.5}$*

Nucor-Vulcraft operates a wet plasma cutter at NBS. This source reports emissions of Direct $PM_{2.5}$ although no specific emission factors are available for this operation, thus $PM_{2.5}$ equals PM10. A PTE of 0.30 tpy of $PM_{2.5}$ is estimated. The particulate emissions are controlled by the water blanket that covers the plasma cutting. The identified control technologies are listed on Table 2, including the currently implemented plasma gas selection and manufacture recommendations on water submersion techniques.

The technical feasibility evaluation showed that potential additional controls could include best management practices (BMPs) on water submerging, flex duct capture system with HEPA, ESP, and fume hood with fabric filters. The safety and process flow would be critically disrupted with the hoist and carry technologies if a capture system was installed. Therefore, these additional technologies are considered technically infeasible.

As no additional technologies were identified as technically feasible, no economic analysis was conducted. Therefore, BACT for the plasma cutter is considered to be the current controls: plasma gas selection and following manufacture recommendations on water submersion techniques. A manufacturer's inspection and implementation of BMPs could help minimize emissions.

3.6.2 *NOx*

The wet plasma cutter at NBS also produces NOx emissions. The identified control technologies for NOx are listed on Table 4, including the currently implemented plasma gas selection and manufacture recommendations on water submersion techniques.

The technical feasibility evaluation showed that potential additional control included additional BMPs such as a flex duct capture system with wet or dry scrubbers, a non-selective catalytic reduction (NSCR), selective catalytic reduction (SCR). A re-evaluation of the operation and current settings (e.g., lowest recommended current, arc voltage, and arc length, travel speed and additional training on proper angle) was also identified as BACT in our literature research. A wet plasma manufacturer' representative professional evaluation would be required to determine if re-evaluating the settings would decrease emissions. The safety and process flow would be critically disrupted with the hoist and carry system if a capture system was installed. There is no flue to inject urea for the NSCR or SCR. Therefore, these additional technologies are considered technically infeasible. The BACT for the wet plasma cutter should be considered the currently implemented plasma gas selection and manufacture recommendations on water submersion techniques.

3.7 *PLASMA CUTTER (STRUCTURAL PRODUCTS – WET)*

3.7.1 *$PM_{2.5}$*

A new wet plasma cutter will be installed in the Structural Products section of the Joist Plant. The particulate emissions are controlled by the water blanket that covers the plasma cutting.

The uncontrolled $PM_{2.5}$ PTE is estimated to be 0.03 tpy. The existing wet blanket technique results in a 95% reduction in emissions. Additional controls would result in insignificant amounts of $PM_{2.5}$ removal, thus making additional controls technically and economically infeasible. .

Therefore, BACT for the plasma cutter is considered to be the current controls: plasma gas selection and following manufacture recommendations on water submersion techniques.

See Section 3.6.1.

3.7.2 *NOx*

See Section 3.6.2.

3.8 *PLASMA CUTTER (STRUCTURAL PRODUCTS – DRY)*

3.8.1 *$PM_{2.5}$*

Nucor-Vulcraft is installing a dry plasma cutter for the Structural Products line. This source produces $PM_{2.5}$ emissions. The identified control technologies are listed on Table 2, including the currently implemented fume collector and control (blended cellulose and polyester fibers).

The technical feasibility evaluation showed that potential additional control technologies include additional BMPs such as a flex duct capture system with HEPA, ESP, or fume collector, improved filter efficiency (i.e., dry filtration), and re-evaluating the settings (e.g., lowest recommended current, arc voltage, and arc length, travel speed and additional training on proper angle). An expert evaluation would be required to determine if re-evaluating the settings would decrease emissions. The safety and process flow would be critically disrupted with the hoist and carry system if a capture system was installed. There is no flue to inject urea for the NSCR or SCR. Therefore, these additional technologies are considered technically infeasible.

As no additional technologies were identified as technically feasible, no economic analysis was conducted. Therefore, BACT for the plasma cutter is considered to be the current controls: using a fume collector and control.

3.8.2 NOx

The dry plasma cutter in Structural Products also produces NOx emissions. The identified control technologies are listed on Table 5, including the currently implemented fume collector and control.

The technical feasibility evaluation showed that potential additional control technologies include a flex duct capture system with wet or dry scrubbers. The safety and process flow would be critically disrupted with the hoist and carry system if a capture system was installed. Therefore, these additional technologies are considered technically infeasible.

As no additional technologies were identified as technically feasible, no economic analysis was conducted. Therefore, BACT for the plasma cutter is considered to be the current controls: using a fume collector and control.

3.9 BRIDGING LINE (SPRAY BOX)

3.9.1 $PM_{2.5}$

Nucor-Vulcraft operates a Bridging Line that produces direct $PM_{2.5}$ emissions. The identified control technologies are listed on Table 2, including best management practices.

The technical feasibility evaluation showed one potential additional control technology: fabric filter. However, the majority of particle matter created from the Spray Box is greater than 2.5 μm. The Spray Box is a self-contained chamber that coats parts along the production line. Although $PM_{2.5}$ emissions have been calculated, the presences of $PM_{2.5}$ at this operation are highly unlikely. Effective control of non-existent $PM_{2.5}$ emissions therefore is technically infeasible.

As no additional technologies were identified as technically feasible, no economic analysis was conducted. Therefore, BACT for the bridging line is considered to be the current controls: best management practices.

3.9.2 VOCs

The Bridging Line spray box produces VOC emissions. The identified control technologies are listed on Table 5, including replacing the vacu-coater with the spray box in the NOI submittal dated February 9, 2017 and reducing the paint VOC content to 2.1 lb/gal.

The technical feasibility evaluation showed no additional control technologies were feasible for the spray box.

As no additional technologies were identified as technically feasible, no economic analysis was conducted. Therefore, BACT for the spray box is considered to be the current controls: replacement of vacu-coater and the reduction of VOC content to 2.1 lb/gal.

3.10 WELDING

3.10.1 $PM_{2.5}$

Nucor-Vulcraft performs welding operations. This source produces $PM_{2.5}$ emissions. The identified control technologies are listed on Table 2, including the currently implemented inert shielding gas, the electrode selection, and using lowest recommended current/low amperes (AMPs).

The technical feasibility evaluation showed that potential additional control technologies include additional BMPs such as a flex duct capture system with HEPA or ESP, a torch fume extraction HEPA or ESP, and re-evaluating the settings (e.g., lowest recommended current, arc voltage, and arc length, travel speed and additional training on proper angle). An expert evaluation would be required to determine if re-evaluating the settings would decrease emissions. The safety and process flow would be critically disrupted with the hoist and carry system if a capture system was installed. Therefore, these additional technologies are considered technically infeasible.

As no additional technologies were identified as technically feasible, no economic analysis was conducted. Therefore, BACT for welding is considered to be the current controls: using an inert shielding gas, the electrode selection, and using the lowest recommended current/low AMPs.

3.11 SPRAY BOOTH (NBS - BUILT UP LINE)

3.11.1 $PM_{2.5}$

The PTE for $PM_{2.5}$ is based on the same emission factor as PM10, along with the control efficiency of the existing fabric filters. Given the existing fabric filters are estimated to control $PM_{2.5}$ by 95%, the estimated production of $PM_{2.5}$ from spray painting operations is due to the lack of quality emission factors. As estimated, NBS will produce a maximum of 1.87 tpy of $PM_{2.5}$.

Table 2 lists the identified control technologies for Direct $PM_{2.5}$ including, high-efficiency filter technology. This includes baghouses, cartridge, and fabric filters. However, the characteristics of spray painting and the associated overspray results in large diameter droplets that would immediately clog higher efficiency filter media.

The technological feasibility along with the non-effectiveness of reducing perceived $PM_{2.5}$ makes further controls not implementable. Therefore, BACT for the spray booth is considered the currently implemented use of high volume low pressure (HVLP) spray guns and 95% efficient filter pads.

3.11.2 VOCs

The identified control technologies for the control of VOCs from spray painting operations are carbon adsorption and TO technologies (Table 5). Carbon Adsorption requires a higher concentration of VOCs for this technology to be both cost effective and technically effective. Space restraints on the manufacturing floor also need to be considered for the carbon canisters associated with carbon adsorption.

The technical feasibility evaluation showed that TO technology is a viable consideration for spray painting operations. VOC PTE is estimated at 55.1 tpy for NBS and 17.8 tpy for Structural Products. TO technology could reduce VOC emission by more than 95%.

Feasibility of implementing this technology must consider the number of TO units, the extensive duct work and air movers and the large amount of natural gas that would be required for proper combustion. Environmental feasibility must consider that over 380 pounds of criteria pollutants would be produced for every million cubic feet of natural gas combusted, or that for every pound of VOC destroyed, 0.5 pounds of criteria pollutants are produced.

Economic feasibility evaluation shows that the incremental cost effectiveness exceeds $68,000 per ton destroyed at the NBS booth. Therefore, BACT should be considered the currently implemented lower VOC paints being used; work practice standards to limit the amount of overspray, and HVLP spray painting technology.

3.12 *SPRAY BOOTH (STRUCTURAL PRODUCTS)*

3.12.1 *$PM_{2.5}$*

The PTE for $PM_{2.5}$ is based on the same emission factor as PM10, along with the control efficiency of the existing fabric filters. Given the existing fabric filters are estimated to control $PM_{2.5}$ by 95%, the estimated production of $PM_{2.5}$ from spray painting operations is due to the lack of quality emission factors. As estimated, 1.0 tpy of $PM_{2.5}$ could be emitted from Structural Products' spray booth.

Table 2 lists the identified control technologies for Direct $PM_{2.5}$ including, high-efficiency filter technology. This includes both baghouse, cartridge and fabric filters. However, the characteristics of spray painting and the associated overspray results in large diameter droplets that would immediately clog higher efficiency filter media.

The technological feasibility along with the non-effectiveness of reducing perceived $PM_{2.5}$ makes further controls not implementable. Therefore, BACT should be considered the currently implemented use of HVLP spray guns and 95% efficient filter pads.

3.12.2 *VOCs*

The identified control technologies for the control of VOCs from spray painting operations are carbon adsorption and TO technologies (Table 5). Carbon Adsorption requires a higher concentration of VOCs for this technology to be both cost effective and technically effective. Space restraints on the manufacturing floor also need to be considered for the carbon canisters associated with carbon adsorption.

The technical feasibility evaluation showed that TO technology is a viable consideration for spray painting operations. VOC PTE is estimated at 17.8 tpy for Structural Products. TO technology could reduce VOC emission by more than 95%.

Feasibility of implementing this technology must consider the number of TO units, the extensive duct work and air movers and the large amount of natural gas that would be required for proper combustion. Environmental feasibility must consider that over 380 pounds of criteria pollutants would be produced for every million cubic feet of natural gas combusted or that for every pound of VOC destroyed, 0.5 pounds of criteria pollutants are produced.

Economic feasibility evaluation shows that the incremental cost effectiveness exceeds $246,000 at structural parts, exceeding the $10,000 threshold. Therefore

BACT should be considered the lower VOC paints being used; work practice standards to limit the amount of overspray, and HVLP spray painting technology.

3.13 DRYING OVENS (JOIST PLANT, NBS, STRUCTURAL PRODUCTS)

3.13.1 $PM_{2.5}$

Nucor-Vulcraft operates drying ovens in the Joist Plant, NBS, and Structural Products that produces $PM_{2.5}$ emissions. The identified control technologies are listed on Table 2, including currently used flue gas recirculation emission control.

The technical feasibility evaluation showed that potential additional control technologies for the drying oven include a capture system. This oven is designed to pass the steel products through the heating elements at a slow rate via overhead crane. Capture systems are not feasible due to the movement and weight of the products being processed.

As no additional technologies were identified as technically feasible, no economic analysis was conducted. Therefore, BACT for the drying oven in Joist Plant is considered to be the current control: flue gas recirculation.

3.13.2 SOx

The drying ovens are natural gas fired using pipeline quality natural gas. Other potential control technologies include a wet scrubber and a capture system with a flue gas desulphurization (Table 3). However, the amount of SOx emitted for the entire facility is <0.02 tpy. Therefore, the additional control technologies are considered technically and economically infeasible.

3.13.3 NOx

The drying ovens produce NOx emissions. The identified control technologies are listed on Table 4, including currently used flue gas recirculation emission control.

The technical feasibility evaluation showed that potential additional control technologies for the drying oven including SCR/SNCR and a LNB. However, to implement these would produce unacceptable safety and process mechanism issues, and they are therefore technically infeasible.

As no additional technologies were identified as technically feasible, no economic analysis was conducted. Therefore, BACT for the drying oven in Joist Plant is considered to be the current controls: flue gas recirculation.

3.13.4 *VOC*

The drying ovens produce VOC emissions. The identified control technologies are listed on Table 5, including currently used flue gas recirculation emission control.

The technical feasibility evaluation showed that additional control technologies for the drying oven include capture systems, except for the Purlin Line. To implement add-on controls would produce unacceptable safety and process mechanism issues, and therefore are technically infeasible.

The Purlin Line oven receives freshly painted beams and it is estimated that 90% of the VOC emissions are released during the baking process. The Purlin oven is already equipped with ducts that exhaust combustion and paint emissions to ambient air. Please see Section 3.20 for further discussion on controls.

As no additional technologies were identified as technically feasible, no economic analysis was conducted. Therefore, BACT for the drying oven in the Joist Plant is considered to be the current controls: flue gas recirculation.

3.13.5 *NH_3*

Ammonia emissions are not of concern because of insignificant emission rates from the Nucor-Vulcraft facility (Table 6).

3.14 *FUGITIVE SPRAY*

3.14.1 *$PM_{2.5}$*

The ability to paint 2% of the production was requested in the recent NOI submittal dated 9 February 2017. As the fugitive spray emissions are less than 1 tpy of direct $PM_{2.5}$, no BACT technologies were identified.

3.14.2 *VOCs*

The ability to paint 2% of the production was requested in the recent NOI submittal dated February 9, 2017. As the fugitive spray emissions are less than 0.4 tpy of VOC, no BACT technologies were identified.

3.15 *HAUL ROADS (NBS)*

3.15.1 *$PM_{2.5}$*

Nucor-Vulcraft has both paved and unpaved haul roads that produce direct $PM_{2.5}$ emissions. The identified control technologies are listed on Table 2, including the currently implemented 10 mph speed limit, vacuum sweeping, and water dust suppression.

The technical feasibility evaluation identified one potential additional control technology for haul roads: quarterly chemical treatment. However, UDAQ adopted chemical treatment emission factors that will not result in documented lower emissions. This technology is therefore considered technically and economically infeasible.

Paving additional areas that experience heavy traffic may reduce the amount of dust particulate matter. However, the total $PM_{2.5}$ emissions are less than 0.2 tpy. Therefore no additional BACT technologies were identified.

BACT for haul roads is considered to be the current controls: enforce 10 mph speed limit, vacuum sweeping, and water dust suppression.

3.16 *HAUL ROADS (JOIST PLANT)*

3.16.1 *$PM_{2.5}$*

Nucor-Vulcraft has both paved and unpaved haul roads that produce direct $PM_{2.5}$ emissions. The identified control technologies are listed on Table 2, including the currently implemented recent increase of paved road length, 10 mph speed limit, vacuum sweeping, and water dust suppression.

The technical feasibility evaluation showed that potential additional control technologies include vacuum sweeping on a more frequent basis and quarterly chemical treatment. However, these will not lower emissions and are therefore considered technically and economically infeasible.

As no additional technologies were identified as technically feasible, no economic analysis was conducted. Therefore, BACT for haul roads is considered to be the current controls: the recent increase of paved road length, 10 mph speed limit, vacuum sweeping, and water dust suppression.

3.17 RESISTANCE WELDING

3.17.1 $PM_{2.5}$

Nucor-Vulcraft uses resistance welding as a part of the Grating Line, which may produce direct $PM_{2.5}$ emissions. Nucor-Vulcraft could not identify any documentation on emission factors in order to quantify emissions from this process. Several resource documents indicate that resistance welding produces insignificant amounts of criteria pollutants. The identified control practice is listed on Table 2; this includes the currently implemented operation according to manufacturing specifications.

The technical feasibility evaluation showed that potential additional control technologies include a reevaluation to lower the current intensity. However, further evaluation beyond BACT would be required to determine if this would indeed lower emissions.

As no additional technologies were identified as technically feasible, no economic analysis was conducted. Therefore, BACT for resistance welding is considered to be the current control: operation according to manufacturing specifications.

3.18 PARTS CLEANERS (NBS, JOIST PLANT, COLD FINISH)

3.18.1 VOCs

Nucor-Vulcraft has parts cleaners in NBS, Joist Plant, and Cold Finish that produce VOC emissions. The identified control technologies are listed on Table 5 including the currently implemented replacement of Stoddard solvent with Safety-Kleen's Type II Solvent and the 2017 retirement of four parts cleaner units.

The technical feasibility evaluation showed one potential additional control for the parts cleaners: replace Safety-Kleen Type II solvent with extremely low VOC solvent solutions (e.g. citrus cleaner & degreaser). This replacement could decrease current emissions by a PTE estimated total of 0.171 tpy. To determine if this is technically feasible, testing various surface washing agents would need to be evaluated in these three areas (NBS, Joist Plant and Cold Finish) to determine the performance.

If surface washing agent can perform well enough to use, this would be considered BACT. Economic feasibility appears to be valid. However, until it can be tested, BACT is considered the current controls: using Safety-Kleen Type II solvent and the retirement of four parts cleaners.

3.19 DIP COATING (JOIST PLANT, NBS)

3.19.1 VOCs

Dip coating operations are performed at the Joist Plant, truss painting equipment, Structural Parts line, NBS and at the Accessory Dip Tank. The weight and irregular shape(s) of many of the truss, beams, rods, structures, etc., (e.g. "parts") to be painted, require dip coating as opposed to spray booth painting. The existing tanks at the facility are long narrow structures, deep enough to submerge a given part. The rate of VOC emissions are based on the VOC content of the paint, the surface area of the parts being painted, and the surface area of the tank's liquid surface. The dip tank process has no energy inputs (i.e. fuel or electricity) so the process does not have a start up or shut down period. By operation, these emissions are fugitive.

The identified control technologies for VOC mitigation are listed on Table 5 and are discussed below. Thermal oxidation (TO) technologies have been implemented for large metal painting operations and the control of VOCs. Up to 95% control has been achieved using TO. Carbon Adsorption requires a higher concentration of VOCs for this technology to be both cost effective and technically effective.

The technical feasibility evaluation showed that TO technologies determined to be economically infeasible with incremental cost effectiveness ratios exceeding:

- $143,800 to $252,700 per ton of VOC removed for the Joist Plant painting operations; and

- $40,300 to $70,500 per ton of VOC removed for the NBS painting operations.

Collecting these fugitive VOCs while maintaining functional operations is one of the main drivers for the high estimated cost.

Work practice standards to control VOC emissions currently consist of the tank lids placed back on the tank at the end of each shift and placed back on the tank during the shift if the dip tanks will not be used for one hour or more. Additional work practice standards have reduced emissions because this facility does not offer or provide specialty painting of parts or second/finishing coats.

A significant reduction in VOC emissions has occurred during the last 15 years through Nucor-Vulcraft's use of lower VOC paints (i.e., water based paints) that provide the needed attributes for steel structures and parts while reducing VOC concentrations. Since 2005, annual VOC emissions at the facility have been reduced, mainly from painting operations, from 339 tons to 262 tpy based on the 9 February 2017 PTE calculations. Nucor-Vulcraft experienced an average increase of $4 per gallon to use the low-VOC paint compared to the prior VOC-based paints, which results in an additional annual cost of about $900,000 per year based on the average annual quantities of paint used.

3.20 VACU-COATER (NBS – PURLIN LINE)

The Purlin Line (secondary structural components) production line has a vacu-coater that provides a protective layer of paint onto the horizontal beams. The vacu-coater applies the paint on moving beams and then the beam immediately enters the Purlin oven.

Purlin coating is a specialty type of painting that cannot be achieved with spray booths or dip tanks.

As estimated for PTE purposes, the paint applied from the vacu-coater produces up to 33 tpy of VOC emissions. This is based on 1.7 gallons of paint applied per ton of steel, and 2.1 pounds of VOCs per gallon of paint, and 31,475 gallons of paint used at the Purlin Line.

However, actual current emissions from the Purlin Line operation are significantly lower than the PTE estimated values. Actual data show that the painting efficiency is correct at 1.7 gallons of paint per ton of steel; however, the paint at the Purlin Line has lower VOC content at 1.1 pounds of VOC per gallon of paint, and paint usage averaged only of 13,600 gallons. This results in an actual emission rate for VOCs of 9.3 tons per year.

The identified control technologies for VOCs are listed on Table 5. The identified additional control technologies, besides the already implemented low VOC paints, include scrubbers, carbon adsorption and various applications of thermal oxidation (TO). The technical feasibility evaluation showed that two control technologies to be technically implementable: wet scrubber and carbon adsorption. The characteristics of TO technology result in spatial and safety issues due to limited space, plumbing in a natural gas line and ignition sources. Employing TO technology will also create a half ton of pollutants for every ton of VOC removed. Therefore, TO technology is considered infeasible due to space limitations and safety and environmental issues.

Recent advances in wet, packed-tower, scrubbing units for the removal of VOCs might be technically and economically feasible. Further on site studies would have to be conducted to determine if the VOCs produced at the purlin line are soluble enough for wet scrubbing to be effective.

Carbon adsorption systems may also be technically feasible but the limited floor space available is a concern. Either a series of 55-gallon drums or a Carbtrol Hi-Flow G-14-PPL may be a functional control technology for this system.

An evaluation of these technologies shows that either control technology could be installed immediately following the Purlin vacu-coater. The Purlin oven already is equipped with exhaust ducts that are estimated to capture 90% of the paint VOCs and combustion gases from the oven. The construction of an augmented collection system would be possible. Existing exhaust fans/ducts could be plumbed to a control unit.

The BACT economic analyses results in an economic feasibility ratio for the carbon adsorption control at approximately $12,000 per ton of VOC removed, and the wet scrubber control at approximately $14,000 per ton of VOC removed.

Nucor-Vulcraft has already significantly reduced the VOC impact from this operation by implementing operational and raw material (painting) practices. Implementation included the following:

- Painting efficiency of 1.7 gallons of paint per ton of steel throughput; and
- VOC content of paint averaging 1.1 pounds of VOC per gallon of paint.

These voluntary operational parameters lead to significant and actual reductions. The main benefit is that it controls VOC emissions at the source. Past estimates assume VOCs are emitted either during application process (10%) or in the oven (90%). Actually, fugitive VOC emissions occur as soon as the container of paint is opened until final drying of the Purlin Line product in the yard. Controlling the amount of VOCs that can be emitted is a more effective means for actual VOC reductions, and these operational controls are considered BACT for this operation without further equipment controls.

3.21 MASTIC EQUIPMENT

3.21.1 VOCs

Mastic Equipment is used in NBS on the Standing Seam line. A rust preventer is applied along the moving production line. The VOC content of the material averages 1.75 pounds per gallon. The capture system for the VOCs would have to extend along the line to capture the continuous evaporation of the mastic. Control technologies were not identified for this application, although typical VOC control techniques likely should be considered. As previously discussed, carbon adsorption requires a more concentrated captured VOC stream and TO technology will require additional natural gas usage. Natural gas combustion to control the VOCs will create 0.5 tons of criteria pollutants and GHGs for every million cubic feet of natural gas flow. No control technologies were identified as future product development would be required.

3.22 LUBRICATION EQUIPMENT

3.22.1 VOCs

A highly evaporative lubricant is used to protect the finish of some of the panels in the NBS side panels. Calculations assume 100 % of the oil used evaporates as VOCs (7 lb/gal). A liberal calculation, using just over 2,600 gallons of lubricant, is used to estimate VOC emissions at 9.2 tpy. For actual usage, the amount of emissions and volume of emissions is much less than calculated.

The technical feasibility of this approach appears not to be implementable due to challenges of collecting emissions along the entire production line (emissions continue to emit long after application) and the potential safety hazards of collecting and oxidizing the emissions.

4.0 BACT RECOMMENDATIONS

Based on the UDAQ expectation that BACT be defined as control technologies that could be installed and made operational by the end of 2018, Nucor-Vulcraft has determined that baseline conditions represent BACT for practically all emission sources. The enhanced use of low-VOC paints during the past 15 years is considered BACT for the painting operations, which has reduced VOC emissions from 339 tons to 262 tons per year (tpy). In addition, Nucor-Vulcraft proposes to evaluate welding techniques and plasma cutter operations, to confirm if techniques are optimal to ensure that emissions are minimized.

The emission limits and monitoring outlined in the 9 February 2017 NOI take into account the continuous reduction in emissions being achieved at Nucor-Vulcraft and are believed to represent BACT for the facility with the amendments acknowledged herein.

25 April 2018

Utah Department of Environmental Quality
Division of Air Quality
Mr. Jon L. Black - Manager
C/O Nando Meli – Environmental Engineer
195 North 1950 West
Salt Lake City, Utah 84116

RE: Serious $PM_{2.5}$ Nonattainment Area (NAA) State Implementation Plan (SIP) Control Strategy – Ammonia BACT Requirement

Dear Mr. Black:

A Best Achievable Control Technology (BACT) Evaluation Report (revised) for Nucor-Vulcraft's Brigham City, Utah facility was prepared by ERM-West, Inc. (ERM) and submitted to the Utah Division of Air Quality (UDAQ) on 23 February 2018. That BACT evaluation was performed in response to the UDAQ's original request for BACT analysis in connection with the PM2.5 State Implementation Plan (SIP) being prepared by the agency. Nucor-Vulcraft evaluated direct PM2.5 and precursors (including NO_x, SO_2 and ammonia), and it was stated in our report that there are no sources of ammonia (NH_3) at the Nucor-Vulcraft facility.

Also during 2017, ERM supported Nucor-Vulcraft with air permitting technical support, which included refinement of the potential-to-emit (PTE) calculcations for our facility. A copy of the revised PTE calculation spreadsheets was provided to the UDAQ in connection with renewal of our facility Title V Air Permit. Upon receipt of your new request for ammonia BACT evaluation, we observed an error in the PTE spreadsheets that inadvertently suggested a potential for ammonia emissions from the drying ovens at our Nucor Building Systems (NBS) operation. However, ERM has confirmed that neither AP-42 Section 1.4 nor the March 1998 Emission Factor Documentation for AP-42 Section 1.4 - Natural Gas Combustion, present emission factors for ammonia relating to natural gas combition in ovens. Therefore, Nucor-Vulcraft has removed the ammonia emissions from the PTE calculations and we are providing our revised PTE calculation spreadsheets for your records as a separate Excel file attachment.

In conclusion, as there are no ammonia emission units at Nucor-Vulcraft, please consider this as the complete response to your request for an ammonia BACT evaluation for our Brigham City plant. Please contact me at (435)734-4443 or aaronb@vulcraft-ut.com if you have any questions.

Sincerely,

Aaron Bell
Environmental Coordinator

Attachments:

Nucor-Vulcraft Facility-wide PTE Calculations Spreadsheet

Company: Nucor Vulcraft
Site: Nucor Vulcraft, Brigham City, Utah
Source: Facility Emission Summary

Future Potentials

Emission Unit	Criteria Pollutants (ton per year, tpy)											
	NOx	**CO**	**VOC**	**SO2**	**PM10 (F)**	**PM2.5 (F) ***	**PM10(CON)***	**PM2.5(CON)***	**PM10 (Roads)***	**PM2.5 (Roads)***	**HAP(agg)**	**CO2-e***
Cold Finish	0.03	0.00	0.04	0.00	14.6	14.30	0.00	0.00	-	-	0.05	0
Joist Plant	1.05	0.88	117.03	0.01	18.57	4.11	0.06	0.06	1.23	0.14	0.19	12622
Nucor Build Systems	4.53	2.76	116.67	0.02	2.23	2.23	0.15	0.15	1.45	0.14	0.00	39443
Grating	0	0	10.24	0	0.26	0.26	0.00	0.00	-	-	0.02	0
Structural Products	2.73	0.38	18.1	0.00	2.49	2.38	0.03	0.03	-	-	0.04	5446
TOTAL	**8.34**	**4.02**	**262.11**	**0.03**	**38.10**	**23.29**	**0.24**	**0.24**	**2.68**	**0.29**	**0.30**	**57512**

Company: Nucor Vulcraft
Site: Nucor Vulcraft, Brigham City, Utah
Source: Cold Finish

	Design Rate			
Wire Line	2800	cu ft/min	2188	
Coil line	5500	cu ft/min		
Bar Line Baghouse	16000	cu ft/min		
Exhaust Vents	33000	cu ft/min		
Plasma Cutting[8]	40	hr/yr		
Plasma Cutter Baghouse	4000	cu ft/min		
Parts Cleaners[2]	11	gal/yr	54	gal/yr

	Criteria Pollutants (tpy)					
	NOx	**CO**	**VOC**	**SO2**	**PM10**	**PM2.5**
Wire Line Bghse (Current)	-	-	-	-	1.31	1.31
Wire Line Bghse (Proposed)	-	-	-	-	0.42	0.42
Coil Line Baghouse	-	-	-	-	3.30	3.30
Bar Line Baghouse	-	-	-	-	9.61	9.61
Exhaust Vents	-	-	-	-	0.26	0.039
Parts Cleaners	-	-	0.04	-	-	-
Plasma cutter - Dry Uncontrolled	0.03	-	-	-	0.1	0.035
TOTAL Current	**0.03**	**0.00**	**0.04**	**0.00**	**14.55**	**14.30**
TOTAL Proposed	**0.03**	**0.00**	**0.04**	**0.00**	**13.66**	**13.41**

	Emission Factors (Criteria)					
	NOx	**CO**	**VOC[3]**	**SO2**	**PM10[4]**	**PM2.5**
Wire Line Bghse (Current)					0.016	
Wire Line BgHse (Proposed)					0.004	
Coil Line Baghouse					0.016	
Bar Line Baghouse					0.016	
Exhaust Vents						
Parts Cleaners[3]			6.5			
Plasma Cutter (Wet)[5,7]	1.05				0.25	0.144
Plasma Cutter (Dry)[5,7]	4.95				23	13.27

Notes
1 Values based on past actuals plus 20% for PTE calculations
2 Values based on past actuals split between 5 parts cleaners (Lbs VOC/gal)
(Previous PTE 98 gal/yr for 9 parts cleaners and 54.4 gal/yr for 5 parts cleaners)
3 Safety-Kleen emission factor (lbs VOC/gal)
4 Grain size emission factor based on specification sheet for baghouses
5 Plasma cutter emission factors based on "Emission of Fume, nitrogen oxides, and noise 1994
in plasma cutting of stainless and mild steel", Bramsen B. et al., Sweden
6 Table 1.4-2 from AP-42 used for baghouse lead emission factors
7 Size Distribution and Rate of Production of Airborne Particulate Matter generated during Metal Cutting,
Ebadian, M.A. Florida International University, Jamiaru 2001 page 22
8 Based on amount of maintenance work
9 Based on ratio in AP-42 Table 13.2.4-3 as used in 2015 Emissions Inventory

Company: Nucor Vulcraft
Site: Nucor Vulcraft, Brigham City, Utah
Source: Cold Finish

Constants		Unit Conversions	
8760	hr/yr	7000	grains/lb
0.016	grains/dry scf	2000	lb/ton
50%	PM	60	min/hr
0.965	mg/m^3 (PM concentration)	0.0283	m^3/ft^3
15%	PM2.5[9]	0.0000022	lb/mg
3	µg/m^3	0.0022	lb/g
0.35%	lead in steel	1000000	µg/g
75%	efficiency spray	453.592	g/lb
46	g NO2/mole	22.4	L/mole at STP
0.004	grains/dry scf	7	days/week
25	unpaved acres	5280	ft/mile
		50	week/year

	HAPs (tpy)		Green House Gases (tpy)			
	Lead	HAP(m)	CO2	N2O	CH4	CO2-e
Wire Line Bghse (Current)	0.005					
Wire Line Bghse (Proposed)	0.001	0.001				0.000
Coil Line Baghouse	0.012	0.012				0.000
Bar Line Baghouse	0.034	0.034				0.000
Exhaust Vents	0.002	0.002				0.000
Parts Cleaners	-	-				0.000
Plasma cutter - Dry Uncontrolled	-	-				0.000
TOTAL Current	**0.05**	**0.05**				**0.00**
TOTAL Proposed	**0.05**	**0.05**				**0.00**

	Emission Factors (Non-criteria)					
	Lead[6]		CO2	N2O	CH4	
Wire Line Bghse (Current)	0.0005					
Wire Line BgHse (Proposed)	0.0005					
Coil Line Baghouse	0.0005					
Bar Line Baghouse	0.0005					
Exhaust Vents						
Parts Cleaners[3]						
Plasma Cutter (Wet)[5,7]						
Plasma Cutter (Dry)[5,7]						

Notes

1 Values based on past actuals plus 20% for PTE calculations
2 Values based on past actuals split between 5 parts cleaners (Lbs VOC/gal)
(Previous PTE 98 gal/yr for 9 parts cleaners and 54.4 gal/yr for 5 parts cleaners)
3 Safety-Kleen emission factor (lbs VOC/gal)
4 Grain size emission factor based on specification sheet for baghouses
5 Plasma cutter emission factors based on "Emission of Fume, nitrogen oxides, and noise 1994 in plasma cutting of stainless and mild steel", Bramsen B. et al., Sweden
6 Table 1.4-2 from AP-42 used for baghouse lead emission factors
7 Size Distribution and Rate of Production of Airborne Particulate Matter generated during Metal Cutting, Ebadian, M.A. Florida International University, Jamiaru 2001 page 22
8 Based on amount of maintenance work
9 Based on ratio in AP-42 Table 13.2.4-3 as used in 2015 Emissions Inventory

Company: Nucor Vulcraft
Site: Nucor Vulcraft, Brigham City, Utah
Source: Joist Plant

Paint		
Bridging	11.6	lb/gal (density)
	9.6%	VOC
	47%	Solids by weight
Dip Coating	11.17	lb/gal (density)
	4.2%	VOC
Joist	8.26	lb/gal (density)
	19.4%	VOC

	Design Rate	Units	Hours of operation	Units
Exhaust Vents	33000	cu ft/min	4380	hr/yr
Oven	2.4	*10^6 btu/hr	8760	
Welding[2]	594	tons of wire		
Bridging[1]	4000	gal/yr	3333	gal/yr
Dip Coating[1]	106385	gal/yr	88654	gal/yr
Joist Coating[1]	948	gal/yr	790	gal/yr
Parts Cleaners[3]	11	gal/yr	54	gal/yr

Bridging Spray Box	98%
Capture Efficiency - Bridging Box	92%
Settling Eff'y Bridg'g	50%

	Criteria Pollutants - Future Potentials (tpy)							
	NOx	**CO**	**VOC**	**SO2**	**PM10**	**PM2.5**	**PM10(CON)**	**PM2.5(CON)**
Dip Coating	-	-	111.70	-	-	-	-	-
Joist Coating	-	-	1.00	-	-	-	-	-
Bridging Line (Spray box)	-	-	4.20	-	0.42	0.42	-	-
Bridging Line (Oven)	1.05	0.88	0.06	0.01	0.02	0.02	0.06	0.06
Exhaust Vents	-	-	-	-	16.6	2.13	-	-
Parts Cleaners	-	-	0.035	-	-	-	-	-
Parts Cleaners (Truck Shop)[3]	-	-	0.035	-	-	-	-	-
Welding	-	-	-	-	1.54	1.54	-	-
TOTAL	**1.05**	**0.88**	**117.03**	**0.01**	**18.57**	**4.11**	**0.06**	**0.06**

	Emission Factors (Criteria)							
	NOx	**CO**	**VOC**	**SO2**	**PM10**	**PM2.5**	**PM10(CON)**	**PM2.5(CON)**
Dip Coating[5]			2.1					
Joist Coating[5]			2.1					
Bridging Line (Coating)[5]			2.1		5.42			
Bridging Line (Oven)[6]	100	84	5.5	0.6	1.9		5.7	
Exhaust Vents								
Parts Cleaners[4]			6.5					
Exhaust Vents (Compressor building)								
Exhaust Vents (Truck Shop)								
Parts Cleaners (Truck Shop)[4]			6.5					
Welding					5.2			

Notes
1 Values based on past actuals plus 20% for PTE calculations
2 Value based on previous Approval Order August 11, 2005
3 Values based on past actuals split between 5 parts cleaners (Lbs VOC/gal)
(Previous PTE 98 gal/yr for 9 parts cleaners and 54.4 gal/yr for 5 parts cleaners as 4 parts cleaners in NBS are being retired)
4 Simple green emission factor (lbs VOC/gal)
5 Emission Factor based on past actuals
6 Emission Factors based on AP-42 Table 1.4-1 and Table 1.4-2
7 Calculations based on previous Approval Order August 11, 2005
8 Based on ratio in AP-42 Table 13.2.4-3 as used in 2015 Emissions Inventory

Company: Nucor Vulcraft
Site: Nucor Vulcraft, Brigham City, Utah
Source: Joist Plant

Unit Conversions	
7000	grains/lb
2000	lb/ton
60	min/hr
0.0283	m^3/ft^3
0.0000022	lb/mg

Air Exhausted[7]	
637700	cfm (Summer)
4.74E+09	m^3 (Summer)
72900	cfm (Winter)
5.42E+08	m^3 (Winter)
5.285E+09	m^3 (Total)

Constants	
8760	hr/yr
0.5	% PM
5.85	mg/m^3 (PM [conc])
15%	PM2.5[8]
1000	btu/ft^3

	HAPs (tpy)		Green House Gases (tpy)			
	Manganese	**HAP(m)**	**CO2**	**N2O**	**CH4**	**CO2-e**
Dip Coating	-	-				0.00
Joist Coating	-	-				0.00
Bridging Line (Spray box)	-	-				0.00
Bridging Line (Oven)	-	-	12614.4	0.023	0.024	12621.90
Exhaust Vents	-	-				0.00
Parts Cleaners	-	-				0.00
Parts Cleaners (Truck Shop)[3]	-	-				0.00
Welding	0.19	0.19				0.00
TOTAL	**0.19**	**0.19**	**12614**	**0.02**	**0.02**	**12622**

	Emission Factors (non-criteria)				
	Manganese		**CO2**	**N2O**	**CH4**
Dip Coating[5]					
Joist Coating[5]					
Bridging Line (Coating)[5]					
Bridging Line (Oven)[6]	3.18		1200000	2.2	2.3
Exhaust Vents					
Parts Cleaners[4]					
Exhaust Vents (Compressor building)					
Exhaust Vents (Truck Shop)					
Parts Cleaners (Truck Shop)[4]					
Welding	0.318				

Notes
1 Values based on past actuals plus 20% for PTE calculations
2 Value based on previous Approval Order August 11, 2005
3 Values based on past actuals split between 5 parts cleaners (Lbs VOC/gal)
(Previous PTE 98 gal/yr for 9 parts cleaners and 54.4 gal/yr for 5 parts cleaners as 4 parts cleaners in NBS are being retired)
4 Simple green emission factor (lbs VOC/gal)
5 Emission Factor based on past actuals
6 Emission Factors based on AP-42 Table 1.4-1 and Table 1.4-2
7 Calculations based on previous Approval Order August 11, 2005
8 Based on ratio in AP-42 Table 13.2.4-3 as used in 2015 Emissions Inventory

Company: Nucor Vulcraft — Recreated from 2006 NOI
Site: Nucor Vulcraft, Brigham City, Utah
Source: NBS

	Predicted Past Actuals	Past PTE	Units	PTE Hrs of Ops	Past Predicted Hrs of Ops
Exhaust Vents	33000	33000	cu ft/min	8760	
Drying Oven - Built Up Line	5500	5500	cu ft/min	8760	
Drying Oven - Purlin Line	5500	5500	cu ft/min	8760	
Spray Booth Built up line[1]	52491	119616	gal/yr	8760	
Flow Coater - Purlin line[1]	31475	71802	gal/yr	8760	
Flow Coater - Rod line[1]	1400	3277	gal/yr	8760	
Accessory Dip Tanks[1]	2188	4915	gal/yr		
Mastic Equipment[1]	17500	17500	gal/yr	1920	hr/yr
Vanishing Oil	2636	12454	gal/yr	1920	hr/yr
Parts Cleaners[1,6]	10.9	98	gal/yr		
Parts Cleaners Proposed (Retire 4)[1,7]	6.0	54	gal/yr		
Drying Oven-Built Up Line[3]	11.52	26.28	*10^6 cu ft/yr	8760	3840
Drying Oven - Purlin Line[3]	17.28	39.42	*10^6cu ft/yr		3840
Lubrication Equipment[3]	2636	56821	gal/yr		

	Criteria Pollutants (tpy)							
	NOx	CO	VOC	SO2	PM10	PM2.5	PM10(CON)	PM2.5(CON)
Plasma Steel Cutters - Wet	1.25	-	-	-	0.30	0.30		
Spray Booth Built Up Line	-	-	55.1	-	1.87	1.87		
Drying oven - Built up line	1.31	1.10	0.07	0.008	0.025	0.02	0.075	0.07
Exhaust vents - Built up line	-	-	-	-	-	-		
Parts cleaners - Built up line Existing	-	-	0.04	-	-	-		
Parts cleaners - Built up line Proposed			0.02					
Flow Coater - Purlin Line	-	-	33.0	-	-	-		
Drying oven - Purlin line	1.97	1.66	0.11	0.012	0.04	0.04	0.075	0.075
Exhaust vents - Purlin line	-	-	-	-	0.00	0.00		
Flow Coater - Rod line	-	-	1.47	-	-	-		
Exhaust vents - Rod line	-	-	-	-	0.00	0.00		
Accessory Dip Tanks	-	-	2.30	-	-	-		
Exhaust Vents - Accessory Dip Coating	-	-	-	-	0.00	0.00		
Mastic equipment - metal roofing	-	-	15.3	-	-	-		
lubrication equipment - metal roofing	-	-	9.2	-	-	-		
TOTAL (Proposed)	**4.53**	**2.76**	**116.67**	**0.02**	**2.23**	**2.23**	**0.15**	**0.15**

	Emission Factors (Criteria)							
	NOx	CO	VOC	SO2	PM10	PM2.5	PM10(CON)	PM2.5(CON)
Plasma Steel Cutters - Wet[2]	1.05				0.25	0.25		
Spray Booth Built Up Line			2.1		5	5		
Drying oven - Built up line[4]	100	84	5.5	0.6	1.9	1.9	5.7	5.7
Exhaust vents - Built up line								
Parts cleaners - Built up line			6.5					
Flow Coater - Purlin Line			2.1					
Drying oven - Purlin line[4]	100	84	5.5	0.6	1.9	1.9	5.7	5.7
Exhaust vents - Purlin line								
Flow Coater - Rod line			2.1					
Exhaust vents - Rod line								
Accessory Dip Tanks			2.1					
Exhaust Vents - Accessory Dip Coating								
Mastic equipment - metal roofing[1]			1.75					
lubrication equipment - metal roofing[1]			7					
Exhaust vents - metal roofing								
Exhaust vents - compressor building								
Exhaust vents - maintenance shop								

Notes

1 Values based on previous PTE calculations (NBS UT) Rev. 7.xls (2006)
2 Plasma cutter emission factors based on "Emission of Fume, nitrogen oxides, and noise in plasma cutting of stainless and mild steel", Bramsen B. et al., Sweden 1994
3 Based on previous Approval Order
4 Emission Factors based on AP-42 Table 1.4-1 and Table 1.4-2
5 Based on ratio in AP-42 Table 13.2.4-3 as used in 2015 Emissions Inventory
6 Values based on past actuals split between 9 parts cleaners (Lbs VOC/gal)
7 Values based on past actuals split between 5 parts cleaners (Lbs VOC/gal)
(Previous PTE 98 gal/yr for 9 parts cleaners and 54.4 gal/yr for 5 parts cleaners as 4 parts cleaners in NBS are being retired)

Company: Nucor Vulcraft
Site: Nucor Vulcraft, Brigham City, Utah
Source: NBS

Constants	
8760	hr/yr
0.016	grains/dry scf
0.0000022	lb/mg
0.5	50% PM
15%	PM2.5[5]
46	g NO2/mole

Unit Conversions	
2000	lb/ton
60	min/hr
0.0283	m^3/ft^3
7000	grains/lb
453.592	g/lb
22.4	L/mole at STP

Spray Paint Booth	
Controlled Overspray	29%
Uncontroled Overspray	2%
Filter Efficiency	95%

	HAPs (tpy)		Green House Gases (tpy)			
	Lead	HAP	CO2	N2O	CH4	CO2-e
Plasma Steel Cutters - Wet	-	0				0
Spray Booth Built Up Line	-	0				0
Drying oven - Built up line	0.00001	0.00001	15768	0.03	0.03	15777.37
Exhaust vents - Built up line	-	0				0
Parts cleaners - Built up line Existing	-	0				0
Parts cleaners - Built up line Proposed						
Flow Coater - Purlin Line	-	0				0
Drying oven - Purlin line	0.00001	0.00001	23652	0.04	0.05	23666.055
Exhaust vents - Purlin line	-	0				0
Flow Coater - Rod line	-	0				0
Exhaust vents - Rod line	-	0				0
Accessory Dip Tanks	-	0				0
Exhaust Vents - Accessory Dip Coating	-	0				0
Mastic equipment - metal roofing	-	0				0
lubrication equipment - metal roofing	-	0				0
TOTAL (Proposed)	**0.00002**	**0.00**	**39420**	**0.072**	**0.076**	**39443.425**

	Emission Factors (Non-Criteria)				
	Lead		CO2	N2O	CH4
Plasma Steel Cutters - Wet[2]					
Spray Booth Built Up Line					
Drying oven - Built up line[4]	0.0005		1200000	2.2	2.3
Exhaust vents - Built up line					
Parts cleaners - Built up line					
Flow Coater - Purlin Line					
Drying oven - Purlin line[4]	0.0005		1200000	2.2	2.3
Exhaust vents - Purlin line					
Flow Coater - Rod line					
Exhaust vents - Rod line					
Accessory Dip Tanks					
Exhaust Vents - Accessory Dip Coating					
Mastic equipment - metal roofing[1]					
lubrication equipment - metal roofing[1]					
Exhaust vents - metal roofing					
Exhaust vents - compressor building					
Exhaust vents - maintenance shop					

Notes

1 Values based on previous PTE calculations (NBS UT) Rev. 7.xls (2006)
2 Plasma cutter emission factors based on "Emission of Fume, nitrogen oxides, and noise in plasma cutting of stainless and mild steel", Bramsen B. et al., Sweden 1994
3 Based on previous Approval Order
4 Emission Factors based on AP-42 Table 1.4-1 and Table 1.4-2
5 Based on ratio in AP-42 Table 13.2.4-3 as used in 2015 Emissions Inventory
6 Values based on past actuals split between 9 parts cleaners (Lbs VOC/gal)
7 Values based on past actuals split between 5 parts cleaners (Lbs VOC/gal)
(Previous PTE 98 gal/yr for 9 parts cleaners and 54.4 gal/yr for 5 parts cleaners as 4 parts cleaners in NBS are being retired)

Company: Nucor Vulcraft
Site: Nucor Vulcraft, Brigham City, Utah
Source: Structural Products (New Spray Paint Booth)

	Design Rate			
Oven	2.4	*10^6 btu/hr		
Spray Booth[2]	16912	gal/yr		
		Controlled	Overspray	29%
		Uncontrolled Overspray		2%
Welding[5]	249	10^3 lb electrode consumed/yr		

Constants	
5400	hr/yr
0.016	grains/dry scf
15%	PM2.5
0.7	70% spray applied
95%	Filter Efficiency
1.3	gal/ton
18584	ton/yr
3.44	ton/hr
13.4	lb electrode/ton steel[7]
70%	production painted
2%	of spray outside booth
60%	wet plasma
50%	dry plasma

	Criteria Pollutants (tpy)							
	NOx	CO	VOC	SO2	PM10	PM2.5	PM10(CON)	PM2.5(CON)
Spray booth[4]	-	-	17.76	-	0.60	0.60		
Spray booth fugitive	-	-	0.36	-	1.0	1.0		
Welding	-	-	-	-	0.65	0.65		
Oven[3]	0.45	0.38	0.02	0.00	0.01	0.01	0.03	0.03
Plasma Cutter (Wet)	0.46	-	-	-	0.05	0.03		
Plasma Cutter (Dry)	1.82	-	-	-	4.11	2.37		
Plasma Cutter Controlled	2.28				0.26	0.15		
TOTAL	**2.73**	**0.38**	**18.14**	**0.00**	**2.49**	**2.38**	**0.03**	**0.03**

	Emission Factors (Criteria)							
	NOx	CO	VOC	SO2	PM10	PM2.5	PM10(CON)	PM2.5(CON)
Spray booth			2.1		5	5		
Welding (Ladle and Stack)					5.2	5.2		
Oven	100	84	5.5	0.6	1.9	1.9	5.7	5.7
Plasma Cutter (Wet)[1,6]	1.05				0.25	0.14425		
Plasma Cutter (Dry)[1,6]	4.95				23	13.271		

Notes

1. Plasma cutter emission factors based on "Emission of Fume, nitrogen oxides, and noise in plasma cutting of stainless and mild steel", Bramsen B. et al., Sweden 1994
2. Based on projected actual value, 18 hours/day, 6 days/week, 50 weeks/year, and 1.3 gal paint per ton of steel
3. Value based on 18 hours/day, 6 days/week, 50 weeks/year
4. 70% applied, 30% overspray through filters and stack
5. Based on 13.4 lb electrode consumed/ton of steel in 2015 for NBS and the production of steel/year
6. Size Distribution and Rate of Production of Airborne Particulate Matter generated during Metal Cutting, Ebadian, M.A. Florida International University, Jamiaru 2001 page 22
7. Average Consumption of steel at NBS in 2015

Company: Nucor Vulcraft
Site: Nucor Vulcraft, Brigham City, Utah
Source: Structural Products (New Spray Paint Booth)

Unit Conversions	
2000	lb/ton
60	min/hr
0.0283	m^3/ft^3
7000	grains/lb
453.592	g/lb
22.4	L/mole at STP
0.0000022	lb/mg
46	g NO2/mole
1000	btu/ft^3

	Green House Gases (tpy)				HAPs (tpy)					
	CO2	**N2O**	**CH4**	**CO2-e**	**Cr**	**Co**	**Mn**	**Ni**	**Ethylene G**	**HAP(m)**
Spray booth[4]	-	-	-	0	-	-	-	-	0.32	0
Spray booth fu	-	-	-	-	-	-	-	-		0
Welding	-	-	-	-	0.000	0.000	0.040	0.000		0.04
Oven[3]	5443.2	0.01	0.01	5446	-	-	-	-		0.0003
Plasma Cutter	-	-	-	0	-	-	-	-		0
Plasma Cutter (Dry)					-	-	-	-		0
Plasma Cutter Controlled										
TOTAL	**5443.2**	**0.01**	**0.01**	**5446**	**0.00**	**0.00**	**0.04**	**0.00**		**0.04**

	Emission Factors (Non-Criteria)									
	CO2	**N2O**	**CH4**	**CO2-e**	**Cr**	**Co**	**Mn**	**Ni**	**Ethylene G**	**HAP (Sum)**
Spray booth									0.018	
Welding (Ladle and Stack)					0.001	0.001	0.318	0.001		
Oven	1200000	2.2	2.3							0.0771
Plasma Cutter (Wet)[1,6]										
Plasma Cutter (Dry)[1,6]										

Notes

1. Plasma cutter emission factors based on "Emission of Fume, nitrogen oxides, and noise in plasma cutting of stainless and mild steel", Bramsen B. et al., Sweden 1994
2. Based on projected actual value, 18 hours/day, 6 days/week, 50 weeks/year, and 1.3 gal paint per ton of steel
3. Value based on 18 hours/day, 6 days/week, 50 weeks/year
4. 70% applied, 30% overspray through filters and stack
5. Based on 13.4 lb electrode consumed/ton of steel in 2015 for NBS and the production of steel/year
6. Size Distribution and Rate of Production of Airborne Particulate Matter generated during Metal Cutting, Ebadian, M.A. Florida International University, Jamiaru 2001 page 22
7. Average Consumption of steel at NBS in 2015

Company: Nucor Vulcraft
Site: Nucor Vulcraft, Brigham City, Utah
Source: Grating

Emission Units	Value	Units
Dip Tank[3]	9750	gal/yr
Welding[4]	101	10^3 lb electrode consumed/yr
Cutting[1]	6000	hr/yr

Constants	
0.016	grains/dry scf
0.0000022	lb/mg
0.5	50% PM
15%	PM2.5
75%	efficiency spray
46	g NO2/mole
10	hours/shift
2	shifts/day
6	days/week
1.3	gallons/ton dipped
7500	tons produced
13.4	lb electrode/ton steel [5]

Unit Conversions	
2000	lb/ton
60	min/hr
0.0283	m^3/ft^3
7000	grains/lb
453.592	g/lb
22.4	L/mole at STP
50	wks/yr

	Criteria Pollutants (tpy)						HAPs (tpy)				Green House Gases (tpy)			
	NOx	CO	VOC	SO2	PM10	PM2.5	Manganese	Chromium	Nickel	HAP (m)	CO2	N2O	CH4	CO2-e
Welding	-	-	-	-	0.26	0.26	0.0160	0.0001	0.0001	0.0161	-	-	-	0
Dip Tank	-	-	10.2	-	-	-	-	-	-	-	-	-	-	0
TOTAL	**0.0**	**0.0**	**10.2**	**0.0**	**0.3**	**0.3**	**0.016**	**0.0001**	**0.0001**	**0.0161**	**0**	**0**	**0**	**0**

	Emission Factors (Criteria)						Emission Factors (Non-Criteria)							
	NOx	CO	VOC	SO2	PM10	PM2.5	Manganese	Chromium	Nickel		CO2	N2O	CH4	CO2-e
Welding[2]					5.2	5.2	0.318	0.001	0.001					
Dip Tank			2.1											

Notes

1 Value based on 10 hours/shift, 2 shifts/day, 6 days/week
2 Emission Factors based on AP-42 Table 12.19-1
3 Value based on 1.3 gallons of paint per ton of steel dipped and 7500 tons of steel produced
4 Based on 13.4 lb electrode consumed/ton of steel in 2015 for NBS and the production of steel/year
5 Average consumption at NBS in 2015

Company: Nucor Vulcraft
Site: Nucor Vulcraft, Brigham City, Utah
Source: Roads - Future Calculations

	PTE	2015 VMT[3]	2015 Vehicle Hours	Average speed	% driving
Hyster Haul Roads	13705	12459	8306	5	30%
Shag Haul Roads	9979	9072	2592	5	70%
NBS Forklift	9192	8357	5571	5	30%
NBS Shag	3619	3290	940	5	70%

Constants/Efficiencies	
75%	efficiency spray[2]
95%	eff. Sweep, vacuum, spray[2]
3%	Paved - NBS
97%	Unpaved - NBS
70%	Paved - Vulcraft
30%	Unpaved - Vulcraft
2000	lb/ton

Future Potentials

	Criteria Pollutants (tpy)					
	NOx	CO	VOC	SO2	PM10	PM2.5
Hyster Haul Road - Paved	-	-	-	-	0.23	0.02
Hyster Haul Road - Unpaved	-	-	-	-	0.49	0.05
Shag Haul Road- Paved	-	-	-	-	0.165	0.038
Shag Haul Road- Unpaved	-	-	-	-	0.354	0.035
NBS Forklift - Paved	-	-	-	-	0.01	0.001
NBS Forklift - Unpaved	-	-	-	-	1.03	0.10
NBS Shag - Paved	-	-	-	-	0.00	0.000
NBS Shag - Unpaved	-	-	-	-	0.41	0.04
TOTAL	-	-	-	-	**2.68**	**0.29**

	Emission Factors (Criteria)					
	NOx	CO	VOC	SO2	PM10	PM2.5
Hyster Haul Road(paved)[1]					0.95	0.09
Hyster Haul Road(unpaved)[1]					0.95	0.09
Shag Haul Road(paved)[1]					0.95	0.22
Shag Haul Road(unpaved)[1]					0.95	0.09
NBS Forklift (paved)[1]					0.93	0.09
NBS Forklift (unpaved)[1]					0.93	0.09
NBS Shag (paved)[1]					0.93	0.09
NBS Shag (unpaved)[1]					0.93	0.09

Notes

1 Emission Factors based on Table 13.2.2 from AP-42
2 Based on Utah DAQ "Emission Factors for Paved and Unpaved Haul Roads". January 12, 2015
3 Based on 2015 vehicle hours, average speed, and percent driving on road

Company: Nucor Vulcraft
Site: Nucor Vulcraft, Brigham City, Utah
Source: Roads - Previous Calculations

PTE		2015 Emission Inventory		Constants/Efficiencies	
19186	miles/	17442	VMT/yr	75%	efficiency spray[2]
399	miles/	363	VMT/yr	2000	lb/ton
28648	miles/	26044	VMT/yr		

Previous Calculations

	Criteria Pollutants (tpy)					
	NOx	CO	VOC	SO2	PM10	PM2.5
Hyster Haul Road	-	-	-	-	5.85	0.58
Shag Haul Road	-	-	-	-	0.12	0.01
NBS Roads	-	-	-	-	7.57	0.76
TOTAL	-	-	-	-	**13.53**	**1.35**

	Emission Factors (Criteria)					
	NOx	CO	VOC	SO2	PM10	PM2.5
Hyster Haul Road[1]					2.44	0.24
Shag Haul Road[1]					2.40	0.24
NBS Roads[1]					2.11	0.21

Notes
1 Emission Factors based on Table 13.2.2 from AP-42
2 Based on Utah DAQ "Emission Factors for Paved and Unpaved Haul Roads". January 12, 2015
3 Based on 2015 vehicle hours, average speed, and percent driving on road