Commonwealth of Kentucky
Division for Air Quality

STATEMENT OF BASIS / SUMMARY

Title V/Title I, Construction/Operating
Permit: V-22-011 R2

Novelis Corporation
8155 Old Railroad Lane
Guthrie, KY 42234

March 16, 2026
Walker Reeves, EIT, Reviewer

SOURCE ID:	21-219-00039
AGENCY INTEREST:	136118
ACTIVITY:	APE20250002

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SECTION 1 – SOURCE DESCRIPTION

SIC Code and description: 3341, Secondary Smelting and Refining of Nonferrous Metals (aluminum) and 3353, Aluminum Sheet, Plate, and Foil

Single Source Det. ☐ Yes ☒ No If Yes, Affiliated Source AI:

Source-wide Limit ☐ Yes ☒ No If Yes, See Section 4, Table A

28 Source Category ☒ Yes ☐ No If Yes, Category: Secondary metal production plants

County: Todd
Nonattainment Area ☒ N/A ☐ PM_{10} ☐ $PM_{2.5}$ ☐ CO ☐ NO_X ☐ SO_2 ☐ Ozone ☐ Lead
If yes, list Classification:

PTE* greater than 100 tpy for any criteria air pollutant ☒ Yes ☐ No
If yes, for what pollutant(s)?
☒ PM_{10} ☒ $PM_{2.5}$ ☒ CO ☒ NO_X ☐ SO_2 ☒ VOC

PTE* greater than 250 tpy for any criteria air pollutant ☒ Yes ☐ No
If yes, for what pollutant(s)?
☒ PM_{10} ☒ $PM_{2.5}$ ☒ CO ☒ NO_X ☐ SO_2 ☒ VOC

PTE* greater than 10 tpy for any single hazardous air pollutant (HAP) ☒ Yes ☐ No
If yes, list which pollutant(s): Hydrochloric Acid, Naphthalene

PTE* greater than 25 tpy for combined HAP ☒ Yes ☐ No
*PTE does not include self-imposed emission limitations.

Description of Facility:
The Novelis Inc. facility located in Guthrie, Kentucky filed an application to construct a new aluminum ingot casting facility capable of a production capacity of 370,000 tons/yr aluminum at the site. The new casting plant operates independently from the existing coil finishing plant and does not have any shared infrastructure.

The new casting plant includes one primary scrap shredding and sorting line, one rotary decoating kiln, two sidewell melting furnaces, one Novelis dual-chamber furnace, one front-loaded single chamber tilting melting furnace, one tilting holding furnace fed to a single casting pit, one in-line fluxer/degassing unit, an ingot saw, two preheaters (CFF and DBF), two emergency generators, and two emergency fire pump engines. Ancillary equipment includes a dross house, a sow dryer, three lime silos for lime-injected baghouses, building heating systems, a cooling tower, diesel storage, paved haul roads, and molten metal utility heaters.

Open market, post industrial automotive, and runaround scrap is fed into the scrap processing line. The shredded scrap is either stored for manual feed later or sent directly to the weigh hopper/feeder and into the decoater. Scrap is then fed to either of the two sidewell melting furnaces or the NDC furnace. Clean runaround scrap may be charged to the front-load tilting melting furnace via a charge transfer car. Molten metal from the melting furnaces is received at the holding furnace, which supports solid reactive fluxing. Once the furnace is filled, it may be tilted to feed through the in-line degasser and ultimately to the casting pit. The casting bay uses a CFF and DBF-type metal filtration devices that must be preheated to ensure there is no temperature drop of the molten metal. The casting bay is also equipped with an ingot saw for cutting reject ingots into smaller sizes for remelting or cutting the head/tail of an ingot that does not meet specifications.

The existing coil finishing plant includes one continuous Heat-Treat Line (HTL), one Pre-Treat Line (PTL), two Batch Annealing Lines, processed aluminum coil loadout, steam generation, comfort heating, and wastewater treatment.

The coil products are manufactured on separate lines referred to as the heat-treatment line (HTL) and the pre-treatment line (PTL). These separate processes are continuous in nature (from when an input coil is unwound until it is rewound for further finishing steps). The PTL can also independently be supplied with batch annealed coils through the natural gas supplied annealing furnaces.

Rolled aluminum sheet coils are received by the facility and transferred to coil storage. Input coils can be supplied to either the HTL or batch annealing lines depending on the customer specifications for the final product coils. All production coils will be processed by the PTL, whether it was processed through the HTL or the batch annealing lines.

The HTL is capable of processing 125 kta output coils, and consists of the following process steps:

- Unwinder and Flattener;
- Entry Shear and Joiner;
- Alkaline Pre-Cleaner;
- Accumulator;
- Floating Heat Treat Furnace;
- Water and Air Quench;
- Tension Leveler;
- Reheater Furnace;
- Exit Shear;
- Rewinder; and
- Stenciler and storage.

Coils processed by the HTL can be sent to an Automated Storage & Retrieval System (ASRS) and coil staging area before being processed by the PTL.

Batch annealing furnaces capable of processing 100 kta output coils can also be used to heat treat input aluminum coils that can be supplied to the PTL as well.

The PTL is capable of processing 225 kta, and consists of the following process steps:

- Unwinder and Flattener;
- Entry Shear and Joiner;
- Tension Leveler;
- Chemical Treatment Section including the following operations:
    - Alkaline Etch and Rinse sections,
    - Acid Etch and Rinse sections,
    - Pre-Treatment and Rinse sections;

- Strip Dryer;
- Edge Trimmer;
- Reluber;
- Stenciler;
- Exit Shear;
- Rewinder;
- Stenciler and storage.

Other on-site operations are needed to support the production of automotive sheet coils and include a packing line to wrap and prepare coils for shipment to customers, process and treatment chemicals bulk storage tanks; a wastewater treatment system, including dry lime storage silo (used to produce a lime slurry), associated chemical storage tanks and cooling tower, three boilers used in the wastewater treatment process, building comfort heating, two emergency generators, and two emergency fire pump engines.

SECTION 2 – CURRENT APPLICATION AND EMISSION SUMMARY FORM

Permit Number: V-22-011 R2 Activities: APE20250002

Received: April 28, 2025 Application Complete Date: June 27, 2025

Permit Action: ☐ Initial ☐ Renewal ☒ Significant Rev ☐ Minor Rev ☐ Administrative

Construction/Modification Requested? ☒Yes ☐No NSR Applicable? ☒Yes ☐No

Previous 502(b)(10) or Off-Permit Changes incorporated with this permit action? ☒Yes ☐No
APE20240003 – Section 502(b)10 Change: Addition of EU047, cast pit sump emergency generator, and EU048, decoater backup emergency generator.
APE20240005 – Section 502(b)10 Change: Addition of EU051, molten utility heaters, to insignificant activities.

Description of Action:
This action incorporates two new emergency fire pump engines that were constructed at the facility in October 2024 due to a revised design basis to conform to applicable insurance and internal Novelis loss prevention policies. These fire pumps, EU049 and EU050, were constructed prior to receiving construction authority through a permitting action and are considered to be part of the original PSD project at the facility. While revisiting the PSD permit action, Novelis also elected to incorporate the emergency generators, EU047 and EU048, submitted under action APE20240003, into the revised PSD review.

This action also adjusts the maximum capacity and stack parameters of EU045, ingot saw, due to additional as-built configuration changes. Specifically, the filtration unit stack was changed from an unobstructed, vertical point source to a capped point source at the same location and approximate height. The ingot saw is now being used for more production-focused uses and has changed from an hourly process rate of 32.2 tons/hr to 72.3 tons/hr. Emission calculations for this unit are based on flow capacity of the saw chip collection system and the outlet specification for the integral filtration unit; therefore, the change in process rate does not change the maximum hourly and annual potential emission rates or calculations for BACT limits.

Additionally, the DBF Preheater, EU046b, has had slight changes to stack height, location, and other parameters.

While the entire PSD project and associated air dispersion modeling was revisited to make these changes to the project scope, where the BACT determination was not changed, it has not been revisited here.

EU051, 12 molten metal utility heaters, have been added to the facility as part of a 502(b)(10) change submitted under APE20240005 and is an insignificant activity.

After the Division visited the site on March 10, 2026, Novelis requested the removal of EU039 and EU040, Dross Presses #1 and #2, from the permit in an email on March 13, 2026. Novelis had not constructed the units and had no intention to install them within the 18-month construction window due to budgeting factors and consideration for operational effectiveness.

V-22-011 R2 Emission Summary				
Pollutant	2024 Actual (tpy)	Previous PTE V-22-011 R1 (tpy)*	Change (tpy)	Revised PTE V-22-011 R2 (tpy)*
CO	23.57	280.76	+2.17	282.93
NO_X	28.11	274.23	+1.60	275.83
PT	8.25	93.89	-2.18	91.71
PM_{10}	6.26	116.92	-0.55	116.37
$PM_{2.5}$	5.18	82.92	-0.23	82.69
SO_2	0.180	1.48	+0.01	1.49
VOC	23.14	142.41	+0.09	142.50
Lead	2.2×10^{-4}	0.005	0	0.005
Greenhouse Gases (GHGs)				
Carbon Dioxide	34648	318236	+841	319077
Methane	0.63	4.88	+0.02	4.90
Nitrous Oxide	0.073	0.85	+0.01	0.86
CO_2 Equivalent (CO_2e)	34686	318612	+829	319441
Hazardous Air Pollutants (HAPs)				
Hydrochloric Acid	2.97	113.43	0	113.43
Naphthalene	0.14	7.75	0	7.75
Combined HAPs:	3.64	129.05	+0.04	129.09

*Note: Controlled PTE is listed here due to federally enforceable control devices.

I. Emissions Discussion

A. Project PSD Significance

In the application to revise the Title V/Title I permit based on the new units associated with the casting plant as-built, Novelis calculated the potential air pollutants emitted by the new sources. The new equipment is expected to be a source of both stack and fugitive emissions of these regulated NSR pollutants: PM, PM_{10}, $PM_{2.5}$, NOx, CO, VOC, and GHGs. The new facility will also be a major source of HAPs with the potential to emit for all HAPs above 25 tpy and one individual HAP greater than 10 tpy.

The Novelis project is located in Todd County, Kentucky, designated by the U.S. EPA as Unclassifiable/Attainment for all criteria pollutants in accordance with 40 CFR 81.318. Therefore, under the federal New Source Review permitting program, Prevention of Significant Deterioration (PSD) requirements apply to the proposed facility and the application has been reviewed accordingly. Under PSD, Novelis' new facility is defined as a secondary metal production plant, one of 28 industrial source categories for which the major source threshold is the emission of 100 tpy of any regulated NSR pollutant.

Potential to emit (PTE) pollutants for this facility was calculated based on emission factors obtained from U.S. EPA's AP-42, *Compilation of Air Pollutant Emission Factors,* engineering estimates, mass balances, manufacturer's specifications, Aluminum Association reference documents, EPA dockets, similar processes at other aluminum casting facilities, and Material Safety Data Sheets (MSDS) chemical content specifications. Based on these emission factors and the assumption of a 24 hour, 7 days a week, 52 weeks a year operation (8760 hours per year) for most units, the potential emissions of regulated NSR pollutants, with the exception of lead (Pb) and SO_2, will all exceed 100 tons per year (tpy) each. Therefore, the Novelis facility is considered a new major stationary source under the PSD program. Because one pollutant exceeds the major source threshold for PSD, then PTE for all other regulated NSR pollutants emitted, in this case specifically lead and fluorides, must be compared to the significant emission rate (SER).

The potential increases in emissions of regulated NSR pollutants from the new facility have been calculated and are presented in the following table. A discussion of each pollutant emitted by the new emission units added with this revision, sources, calculation assumptions and source of emission factors used follows. A brief description of the PSD significance of each pollutant is also included, though additional information regarding PSD requirements as a consequence of the emission levels is discussed more thoroughly in the BACT analysis section, below. Where the as-built changes do not necessitate changes to the initial BACT determination made for a given emission unit, the determinations are not revisited here.

Table A-1, Project PSD Significance

Pollutant	**PTE** (tpy)	**PSD Significant Emission Rate (tpy)**	**PSD Significant Emissions Increase?**
PM (filterable, only)	89.57	25	Yes
PM_{10} (filterable & condensable)	109.44	15	Yes
$PM_{2.5}$ (filterable & condensable)	75.88	10	Yes
Pb	0.0048	0.6	No
NOx	201.66	40	Yes
CO	193.15	100	Yes
VOC	92.64	40	Yes
SO_2	0.76	40	No
GHGs (CO_2e)	209,528	75,000	Yes

B. Particulate Matter (PM, PM_{10}, $PM_{2.5}$) Emissions

PM, PM_{10}, and $PM_{2.5}$ are regulated NSR pollutants. Coarse particles, called PM_{10}, have an aerodynamic diameter of 10 microns or less, and fine particles, called $PM_{2.5}$, have an aerodynamic diameter of 2.5 microns or less. Both filterable and condensable components are required to be included in applicability determinations and in establishing emissions limitations for PM_{10} and $PM_{2.5}$. Filterable PM is defined as particles directly emitted as a solid or liquid at stack conditions and captured on the filter of a stack test train. Condensable PM is material that is in a vapor phase at stack conditions that condenses to form a solid or liquid immediately after discharge from a stack.

Particulates, often discharged through stacks or vents, may also be emitted in a fugitive form. The 401 KAR 51:001 defines fugitive emissions as those emissions which could not reasonably pass through a stack, chimney, vent, or other functionally-equivalent opening. Fugitive emissions are counted toward emissions totals. When speciation of particulate type is unavailable, all particulate is assumed to be part of the same size fraction for conservative purposes when calculating the Potential to Emit.

For the Novelis facility, particulate emissions calculations include three different types: PM (all sizes, filterable only), PM_{10} (filterable and condensable) and $PM_{2.5}$ (filterable and condensable). The newly added emergency engines (EU047, EU048, EU049, and EU050) are sources of particulate emissions through the combustion of diesel or natural gas.

PM, PM_{10} and $PM_{2.5}$ PSD Significance

The emissions calculations, using the planned throughputs and accepted emission factors for each piece of equipment, show that:

Potential PM (filterable) emissions for the new facility are estimated to be 89.81 tpy. This emission rate exceeds the significant emission rate threshold of 25 tpy for PM;

Potential PM_{10} (filterable + condensable) emissions for the new facility are estimated to be 109.67 tpy. This emission rate exceeds both the PSD major stationary source threshold of 100 tpy and the significant emission rate threshold of 15 tpy for PM_{10}; and

Potential $PM_{2.5}$ (filterable + condensable) emissions for the new facility are estimated to be 76.08 tpy. This emission rate exceeds the significant emission rate threshold of 10 tpy for $PM_{2.5}$.

Since the SER for each of the particulate emission sizes is exceeded, a BACT analysis for these three pollutants is required for each piece of equipment that emits PM, PM_{10}, and $PM_{2.5}$. Establishment of a BACT limit for the emission of PM (filterable, only), PM_{10}, and $PM_{2.5}$ for each emission point that emits these pollutants is also required. Refer to the **BACT Analysis for PM, PM_{10}, & $PM_{2.5}$** for a discussion of the BACT for all three types of PM.

C. Nitrogen Oxides (NO_X) Emissions

Nitrogen Oxides (NO_X) are a group of highly reactive gases that are a component in the formation of the criteria pollutant Ozone. Sources of NO_X from the project come mostly from natural gas-fueled burners, and diesel-fueled emergency engines. Typical NO_X controls for these types of NO_X sources include the use of low NO_X burners, which control fuel and air mixing to reduce flame temperature and therefore NO_X formation, and good combustion practices. The newly added emergency engines are sources of NO_X emissions through the combustion of diesel or natural gas.

NOx PSD Significance

The emissions calculations, using the planned throughputs and accepted emission factors for each piece of equipment, show that potential NO_X emissions for the new facility are estimated to be 202.18 tpy. This emission rate exceeds both the PSD major stationary source threshold of 100 tpy and the significant emission rate threshold of 40 tpy for this pollutant. Since both the major stationary source threshold and the SER for NO_X is exceeded, a BACT analysis for NO_X is required for each piece of equipment that emits NO_X. Establishment of a BACT limit for the emission of NO_X for each emission point that emits NOx is also required. Refer to the **BACT Analysis for NO_X** for a discussion of the BACT for NO_X.

D. Carbon Monoxide (CO) Emissions

Carbon Monoxide (CO) is a colorless, odorless gas frequently emitted from combustion-based processes. The main sources of CO from the Novelis facility will be from combustion-based process, i.e. natural gas-burners. The newly added emergency engines are sources of CO emissions through the combustion of diesel or natural gas.

CO PSD Significance

The emissions calculations, using the planned throughputs and accepted emission factors for each piece of equipment, show that potential CO emissions for the new facility are estimated to be 193.59 tpy. This emission rate exceeds both the PSD major stationary source threshold of 100 tpy and the significant emission rate threshold of 100 tpy for this pollutant. Since both the major stationary source threshold and the SER for CO is exceeded, a BACT analysis for CO is required for each piece of equipment that emits CO. Establishment of a BACT limit for the emission of CO for each emission point that emits CO is also required. Refer to the **BACT Analysis for CO** for a discussion of the BACT for CO.

E. Volatile Organic Compounds (VOC) Emissions

Volatile Organic Compounds (VOCs) are gases that are a component in the formation of the criteria pollutant, Ozone. As with the CO emissions, any equipment that burns fossil fuel is a source of VOCs, but emission points involved in this project also produce VOCs through use of certain processes or materials. Emission factors for fuel combustion VOCs used in the calculation of emissions are based on emission factors from AP-42, Chapter 1.4, *Natural Gas Combustion*. The newly added emergency engines are sources of VOC emissions through the combustion of diesel or natural gas.

VOC PSD Significance

The emissions calculations, using the planned throughputs and accepted emission factors for each piece of equipment, show that potential VOC emissions for the new facility are estimated to be 92.67 tpy. This emission rate exceeds the significant emission rate threshold of 40 tpy for this pollutant. Since the SER for VOC is exceeded, a BACT analysis for VOC is required for each piece of equipment that emits VOC. Establishment of a BACT limit for the emission of VOC for each emission point that emits VOC is also required. Refer to the **BACT Analysis for VOC** for a discussion of the BACT for VOC.

F. Greenhouse Gas (GHG) Emissions

Gases that trap heat in the atmosphere, and can lead to climate change, are called greenhouse gases. Some greenhouse gases occur naturally and others are emitted solely through human activities. For the purposes of air permitting, GHGs include an aggregate group of six gases: carbon dioxide, nitrous oxide, methane, hydrofluorocarbons, sulfur hexafluoride, and perfluorocarbons. To determine emissions of these gases, the concept of carbon dioxide equivalents [CO_2e] has been established as a metric measure used to compare the emissions from various greenhouse gases based upon their global warming potential (GWP). The tonnage of each type of greenhouse gas emitted is multiplied by its GWP to establish the carbon dioxide equivalence for that particular emission of that particular gas.

For this project, the majority of GHG emissions are due to the combustion of fossil fuels for heat and energy in a variety of processes including furnaces, heaters, preheaters, boilers, and emergency engines.

In the application, calculated emissions show that the major GHGs emitted by this project will be Carbon Dioxide (CO_2), small amounts of Methane (CH_4) and Nitrous Oxide (N_2O). For the natural gas used, emission factors for CO_2, CH_4, and N_2O have been taken from 40 CFR 98, Subpart C. The current global warming potentials found in 40 CFR 98, Subpart A, have also been used in estimating the CO_2e.

The Novelis process is a major consumer of fossil fuel and therefore a large source of greenhouse gas (GHG) emissions. The fuels used are natural gas, which is the fossil fuel that produces the least amount of GHG emissions, and diesel for emergency fire pumps. The natural gas is used primarily as a utility for maintaining temperature in molten and solid metals and heating.

Greenhouse Gas (GHG) PSD Significance

Based on the submitted emission factors and calculations, the potential CO_2e emissions for the new facility are estimated to be 209,528 tpy of CO_2e. This emission rate exceeds the PSD significant emission rate threshold of 75,000 tpy for CO_2e. Since the SER for GHGs and at least one other PSD pollutant are exceeded, a BACT analysis for GHG is required for each piece of equipment that emits GHG. Establishment of a BACT limit for the emission of GHG for each emission point that emits GHG is also required. Refer to the **BACT Analysis for GHG** for a discussion of the BACT for GHG.

G. Toxic and Hazardous Air Pollutants

Toxic and Hazardous Air Pollutants (HAPs) are those pollutants that are known or suspected to cause serious human health effects and some adverse environmental and ecological effects. Under the Clean Air Act, U.S. EPA is required to regulate emissions of hazardous air pollutants. The list of HAPs includes 188 pollutants.

The Novelis facility is a source of some HAPs, mostly through the combustion of fossil fuels and some metallurgical processes. In addition to the emissions of criteria pollutants and GHGs, the facility will also be a source of hydrochloric acid (HCl). The new facility will also be a source of several other HAPs/Toxics in smaller quantities, all less than 10 tpy each.

Other HAPs and Toxics

Smaller amounts of HAPs and Toxics, emitted at less than 10 tpy each (after federally enforceable controls), will come from the new facility. The majority of these are emissions are due to the combustion of natural gas and diesel, but the ingot saw will produce some emissions of HAPs due to the metal fines generated during the process. However, the trace amount of chromium and manganese generated by this process do not substantially affect the total facility PTE of either HAP, and the emission remain well under the 10 tpy threshold.

Air Dispersion Modeling of HAPs and Toxics

Many of the HAPs and Toxics are regulated under federal NESHAPs, i.e. applicable MACT standards, which analyze the amounts and potential effects of HAPs and Toxics emitted by certain industrial activities. MACTs also provide operational and system design requirements for some equipment and emission limits for the HAPs and Toxics. Emissions of HAPs and Toxics, not subject to an applicable MACT, are related to Natural Gas combustion, and as such, the Division has determined that the terms and conditions in the permit (V-22-011 R2) will be sufficient to demonstrate compliance with all applicable regulations and requirements.

II. BACT Analysis

The PSD permitting program is designed to ensure that economic growth occurs in a manner consistent with the preservation of existing clean air resources. It requires that new or modified pollutant sources do not endanger public health and welfare, or deteriorate air quality in areas of special natural, scenic or historical value. The PSD program also allows for public participation in the decision-making process.

The Commonwealth of Kentucky implements a PSD program through 401 KAR 51:017. Pursuant to this regulation, a new major stationary source shall apply BACT for each regulated NSR pollutant for which the source has the potential to emit in significant amounts. BACT represents the maximum degree of reduction for each regulated NSR pollutant that will be emitted from a proposed major stationary source or major modification and is determined by the cabinet pursuant to 401 KAR 51:017, Section 8, after taking into account energy, environmental, and economic impacts and other costs, to be achievable by the source or modification through application of production processes or available methods, systems, and techniques, including fuel cleaning or treatment or innovative fuel combustion techniques for control of that pollutant.

BACT determines what will be the permitted standard (or maximum allowable emissions) for a particular pollutant for a particular project or emission source. BACT is based upon a case-by-case decision that considers energy, environmental and economic impact. BACT can be add-on control equipment or modification of the production processes or methods to reduce emissions or an emission standard. BACT may also be a design, equipment, work practice or operational standard if setting an emissions standard is not practical.

Since the Novelis project will emit more than 100 tpy for several regulated NSR pollutants, it is required to perform BACT on the pollutants that are emitted in quantities that exceed significant emission rates. For the Novelis project, the pollutants requiring BACT analysis are particulate (including PM, PM_{10}, and $PM_{2.5}$), NOx, CO, VOC, and GHGs (see Section I. Emissions, Table A-1 above, for the potential emission levels and thresholds exceeded).

Novelis conducted a BACT analysis for each pollutant with the potential to be emitted in excess of the PSD significant emission rate for their proposed project in accordance with the *"Top-Down" Best Available Control Technology Guidance Document* outlined in the 1990 draft U.S. EPA *New Source Review Workshop Manual*, which outlines steps for conducting a top-down BACT analysis. The steps Novelis followed are:

(1) Identify available control possibilities for each PSD pollutant based on source knowledge and previous regulatory decisions for identical and similar sources;
(2) Reject inappropriate and technically infeasible control options;
(3) Rank feasible alternatives in descending order of control effectiveness;
(4) Evaluate the most effective controls and weigh the economic, energy and environmental impacts of each; and
(5) Select BACT.

BACT analyses for each PSD significant pollutant were included in the Novelis application and supplemented in subsequent submissions to the Division.

The Division reviewed the information submitted by Novelis, along with information available from industry, scholarly publications, and the RACT/BACT/LAER Clearinghouse (RBLC), a U.S. EPA maintained database that contains case-specific information on the "Best Available" air pollution technologies that have been required to reduce the emission of air pollutants from stationary sources. The Division used this information to make BACT determinations for PM, PM_{10}, $PM_{2.5}$, NOx, CO, VOCs, and GHGs, all of which are subject to PSD review for this project.

Under PSD review, once a control technology (or practice) has been selected, BACT limits are assigned. BACT limits may be both emission related or related to operation of equipment. Individual long and short-term BACT limits have been established for each emitted pollutant.

A summary of the BACT analyses, and the Division's decisions, are outlined, below. They are arranged by pollutant first and then by each emission group that produces that pollutant. Within each emission group section, a summary of the BACT decisions made for the group and a table of BACT limits assigned precedes the analysis of possible technologies for that group, a discussion of how the BACT limits were set, and comments on the compliance demonstration required by the permit. This analysis covers the emission units newly added in V-22-011 R2.

A. BACT Analysis for PM, PM_{10}, & $PM_{2.5}$

Novelis submitted BACT analyses for PM, PM_{10}, and $PM_{2.5}$, but addressed all three types of PM together since the same control technologies and practices reduce all three of these emissions. Any reference to PM in this section refers only to filterable PM, whereas PM_{10} and $PM_{2.5}$ includes filterable and condensable components.

Technologies for Particulate Control: The technologies identified as possible BACT controls for the three types of particulate for the Novelis project are the following:

Clean Fuel Use: This is a practice whereby a facility or specific equipment is designed to use natural fuels (such as natural gas), that emit pollutants in lesser quantities than the alternatives (such as fossil fuels).

Good Combustion and Operation Practices: This is a combustion optimization work practices method for minimizing fuel use and emissions from the burning of fossil fuels. Oxygen and carbon in the fuel combine during combustion in a complex process requiring turbulence, temperature and time for the reactants to contact and combine to form carbon dioxide (CO_2) and heat. If the combustion and combination of necessary elements are not controlled, the combustion of the fuel is incomplete and undesirable emissions form. Although particulate from natural gas combustion is normally a small amount, poor air/fuel mixing or maintenance problems can cause extra PM to form. Particulates from natural gas combustion are usually larger molecular weight hydrocarbons that are not fully combusted. Increased CO also occurs when there is poor mixing (not enough turbulence) and/or there is not enough air in the mix. Other pollutants such as NOx form if the temperature is too hot. SO_2 can form if there is too much sulfur in the fuel. By taking measures to optimize the combustion process, including control of air mixing and temperature, and reducing the amount of fuel used, pollutants are minimized. These measures may include choosing good burner designs, using performance monitoring and process control techniques to improve operation, performing regular and thorough maintenance of the combustion system, etc.

Although it is not an add-on control, efficient operation of combustion equipment is often an effective means to reduce combustion related pollutants. Preparation of a specific plan for achieving combustion optimization, such as a Good Combustion and Operation Practices (GCOP) Plan, that defines, measures, and verifies the use of operational and design practices specific to a piece of equipment for the reduction of a specific pollutant provides verifiable implementation of this work practices method.

Catalyzed Diesel Particulate Filters (CDPF) for Diesel-Fired Engines: This type of control equipment consists of a filter media, usually ceramic, which has been coated with a catalyst to promote a chemical reaction between soot that collects in the pores of the filter and particulate components suspended in the exhaust of the diesel engine.

i. ***Cast Pit Sump Emergency Generator (EU 047) and Decoater Backup Emergency Generator (EU 048):***

Decision Summary: Consistent with the BACT evaluation conducted and submitted by the applicant, the Division determines that the use of a good combustion and operating practices (GCOP) plan and limiting operating hours as means to control PM, PM_{10}, and $PM_{2.5}$ (filterable and condensable) emissions constitutes BACT.

No numerical BACT limits for PM, PM_{10}, and $PM_{2.5}$ are proposed for emissions from the natural gas-fired emergency generators.

Technologies: Novelis examined the following technologies as possibilities to control PM emitted from the emergency generators: GCOP, limiting operating hours, and usage of clean fuels.

Control Type	Estimated PM/PM_{10}/$PM_{2.5}$ Control Efficiency
Good Combustion and Operating Practices	Undefined
Limiting Operating Hours	Undefined
Clean Burning Fuel	Undefined

Analyses: All potential control technologies identified above are technically feasible. BACT for this equipment is therefore a Good Combustion and Operation Practices (GCOP) plan.

Initial compliance demonstration with BACT is through development of a GCOP plan within 180 days of equipment startup, and implementation of the GCOP. Continuous compliance is demonstrated through monitoring, recording and reporting throughputs for the equipment.

ii. ***Emergency Fire Pump #3 and Emergency Fire Pump #4 (EU 049 and EU 050):***

Decision Summary: Consistent with the BACT evaluation conducted and submitted by the applicant, the Division determines that the use of a good combustion and operating practices (GCOP) plan as means to control PM, PM_{10}, and $PM_{2.5}$ (filterable and condensable) emissions constitutes BACT.

BACT limits for PM are calculated using the emission standards to which the engines must adhere pursuant to 40 CFR 60.4205(c).

Emission Unit	Maximum Engine Power	Emission Standards g/HP-hr
		PM
049; 050	300≤HP<600	0.15

Technologies: Novelis examined the following technologies as possibilities to control PM emitted from the emergency fire pumps: clean fuel use, GCOP, and catalyzed diesel particulate filters (CDPF).

Control Type	Estimated $PM/PM_{10}/PM_{2.5}$ Control Efficiency
Good Combustion and Operating Practices	Undefined
Limiting Operating Hours	Undefined
Clean Burning Fuel	Undefined
Catalyzed Diesel Particulate Filters	~95%

Analyses: After identifying possible particulate control technologies available, Novelis presented a review of the different possible technologies.

Due to the relatively low PM emissions associated with applying the emergency unit permit basis of 500 hours per year of operation to the casting project's diesel-fired emergency engines, post combustion controls such as a CDPF are not cost effective. Cost per ton of PM removed is approximately $530,500.

Initial compliance demonstration with BACT is through development of a GCOP plan within 180 days of equipment startup and implementation of the GCOP. Continuous compliance is demonstrated through monitoring, recording and reporting throughputs for the equipment.

B. BACT Analysis for NO_X

Novelis submitted BACT analyses for NO_X emissions and evaluated available NO_X control technologies and practices. A control technology for an emission point may serve as a BACT control for other equipment as well.

Control Technologies for NO_X: The possible BACT control technologies for the emission of NO_X are identified below:

Combustion Control Techniques: Combustion control techniques are generally integrated with the design and operation of the combustion unit. It includes burner modifications and low nitrogen fuel (if applicable and available). The possible NOx BACT controls, identified under this control technique, for the Novelis project are:

Purchase of Certified NSPS JJJJ and IIII Engines*:* Engines that are certified by the manufacturer to meet the emission standards of 40 CFR 60, Subpart IIII or Subpart JJJJ for compression ignition or spark ignition engines.

Good Combustion and Operation/Good Work Practices (GCOP/GWP): This is a work practice combustion optimization method for minimizing fuel usage and emissions from fossil fuels. When the combination of necessary elements are not controlled during combustion, the reaction in incomplete, which leads to the formation of undesirable emissions such as excess NOx. Optimizing the process minimizes the formation of pollutants. Having a Good Combustion and Operation Practices (GCOP) Plan that defines, measures and verifies the use of operational and design practices specific pollutant provides verifiable implementation of this work practices method. Although it is not an add-on control, efficient operation of combustion equipment is often an effective means to reduce NOx and other combustion related pollutants. Work practices such as performing inspections and preventative maintenance help keep equipment running in optimal ranges and prevent extra pollutant emissions caused by malfunction.

Post-Combustion Control Techniques: Post combustion control techniques include selective catalytic reduction (SCR) and selective non-catalytic reduction (SNCR). The post combustion techniques considered for Novelis are as follows:

Selective Catalytic Reduction (SCR): SCR units use a nitrogen-based reagent, such as ammonia (NH_3) or urea, to chemically reduce NOx to nitrogen and water vapor. The reagent is injected though a grid system into the flue gas stream, upstream from a catalyst bed. The waste gas mixes with the reagent and enters a reactor module containing catalyst. The hot flue gas and reagent diffuse through the catalyst, where the reagent reacts selectively with NOx within a specific temperature range.

Operating temperatures between 480°F (250°C) and 800°F (427°C) are required of the gas stream at the catalyst bed, in order to carry out the catalytic reduction process. The reaction of NH_3 and NOx is favored by the presence of excess oxygen (greater than 1%). Depending on system design, NOx removal rates of 70 to 90% are achievable under optimum conditions. Technical factors related to this technology include the catalyst reactor design, optimum operating temperature, sulfur content of the charge, catalyst deactivation due to aging, ammonia slip emissions, and design of the ammonia injection system. Below the optimum temperature range, the catalyst activity is greatly reduced, potentially allowing unreacted ammonia (referred to as "ammonia slip") to be emitted directly to the atmosphere. SCR systems may also be subject to catalyst deactivation over time, due to physical deactivation and/or chemical poisoning. Catalyst suppliers typically guarantee a 3-year catalyst lifetime for a sustainable emission limit.

Several variations of SCR exist including Modified SCR (Shell DeNOx System) and Catalytic Oxidation/Adsorption (SCONOX). SCONOx is a catalytic oxidation/absorption technology that removes NOx, CO, and VOCs from an assortment of combustion applications that mostly include small turbines, boilers, and lean burn engines. SCONOx employs a proprietary technology using a single potassium nitrate impregnated catalyst. The flue gas temperature should be in the range of 300°F to 700°F for optimal performance without deleterious effects on the catalyst assembly. SCONOx technology demands stable gas flows, lack of thermal cycling, steady pollutant concentrations and residence times on the order of 1 to 1.5 seconds for optimal performance. The Shell DeNOx system is a variant of traditional SCR technology, which utilizes a high activity dedicated ammonia oxidation catalyst based on a combination of metal oxides. The system is comprised of a catalyst contained in modular reactor housing where, in the presence of ammonia, NOx in the exhaust gas converts to nitrogen and water. The catalyst is contained in a low-pressure drop lateral flow reactor (LFR), which makes best use of the plot space available. Due to the intrinsically high activity of the catalyst, the technology is suited for NOx conversions at lower temperatures with a typical operating range of 250°F to 660°F. The Shell DeNOx technology can not only operate at a lower temperature, but also have a lower pressure drop penalty than traditional SCR technology of around 2 inches water gauge.

***Three-Way Catalyst (TWC) with Air/Fuel Ratio Control System**:* A TWC is used in stoichiometric engines (where the air-to-fuel ratio is close to ideal) to remove NOx, CO, and VOC. The air-to-fuel ratio controller uses a closed-loop system with an oxygen sensor to regulate the air-to-fuel ratio to ensure the catalyst can effectively oxidize CO and VOC while reducing NOx to nitrogen. To support the supplemental air quality analysis, Novelis selected the engine with a TWC and Air/Fuel Ratio control system to meet the more stringent California SCAQMD requirements for the Cast Pit Sump Emergency Generator engine. This separate low-emissions option commonly involving application of TWC with air-to-fuel ratio controllers is available on some of the larger Generac gaseous-fueled generator sets to comply with the more stringent SCAQMD requirements that are recognized in certain areas in California. These SCAQMD-specific SI generator sets are also EPA Certified. However, at the very low emergency generator power output capacity (25 kW) of the Decoater Backup Emergency Generator, SCAQMD certification does not require installation of TWC and air-to-fuel ratio controllers, and thus, Generac does not provide a commercial offering with a lower emissions profiles for emergency generators in this very small size range.

i. ***Cast Pit Sump Emergency Generator (EU 047) and Decoater Backup Emergency Generator (EU 048):***

Decision Summary: Consistent with the BACT evaluation conducted and submitted by the applicant, the Division determines that the use of a GCOP plan as means to control NOx emissions constitutes BACT.

Emission Point	**BACT**	**BACT limit for NO_x**
047	GCOP plan	2.0 g/HP-hr
048	GCOP plan	10 g/HP-hr (NOx+HC)

Technologies: Novelis examined the following technologies as possibilities to control NOx emitted from the emergency generators: GCOP, TWC, SCR.

Control Type	**Estimated NOx Control Efficiency***
SCR	90%
TWC	Up to 90%
GCOP	Undefined

*According to US EPA, Air Pollution Control Technology Fact Sheet.

Analyses: After identifying possible NOx technologies available, Novelis presented a review of the different possible technologies, discussed the technical feasibility of each one and discussed the relevant advantages and disadvantages for use in the emergency generators.

GCOP implemented to minimize NOx formation is technically feasible.

Due to the relatively low NOx emissions associated with applying the emergency unit permit basis of 500 hours per year of operation to the casting project's emergency engines, post combustion controls such as an SCR are not cost effective for reducing NOx emissions from the natural gas-fired SI ICE. Novelis has prepared an annualized control cost analysis for installing SCR on each of the natural gas-fired emergency generators (132 bhp Cast Pit Sump Emergency Generator engine and 38 hp Decoater Backup

Emergency Generator engine) using cost data from EPA technical support documents and Regional Haze Four-Factor Analyses. Annualized cost for NOx controls for the emergency generators exceed a combined $5,000,000/ton of NOx removed.

Novelis concluded and the Division concurs that BACT for this equipment is the development of a GCOP Plan.

Initial compliance demonstration with BACT is through development of a GCOP plan within 180 days of equipment startup and implementation of the GCOP. Continuous compliance is demonstrated through monitoring, recording, and reporting throughputs for the equipment.

ii. ***Emergency Fire Pump #3 and Emergency Fire Pump #4 (EU 049 and EU 050):***
Decision Summary: Consistent with the BACT evaluation conducted and submitted by the applicant, the Division determines that the use of a GCOP plan as means to control NOx emissions constitutes BACT.

Emission Point	BACT	BACT limit for NO_x + NMHC
049	GCOP plan	3.0 g/HP-hr
050	GCOP plan	3.0 g/HP-hr

Technologies: Novelis examined the following technologies as possibilities to control NOx emitted from the emergency generators: GCOP, TWC, SCR.

Control Type	Estimated NOx Control Efficiency*
SCR	90%
GCOP	Undefined

*According to US EPA, Air Pollution Control Technology Fact Sheet.

Analyses: After identifying possible NOx technologies available, Novelis presented a review of the different possible technologies, discussed the technical feasibility of each one and discussed the relevant advantages and disadvantages for use in the emergency generators.

GCOP implemented to minimize NOx formation is technically feasible.

Due to the relatively low NOx emissions associated with applying the emergency unit permit basis of 500 hours per year of operation to the casting project's emergency fire pumps, post combustion controls such as an SCR are not cost effective for reducing NOx emissions from the diesel-fired CI ICE. Novelis has prepared an annualized control cost analysis for installing SCR on each of the 327 bhp diesel-fired emergency fire pumps using cost data from an EPA Alternative Control Techniques (ACT) document for stationary diesel engines. Annualized cost for NOx controls for the emergency generators exceed a combined $48,000/ton of NOx removed.

Novelis concluded and the Division concurs that BACT for this equipment is the development of a GCOP Plan.

Initial compliance demonstration with BACT is through development of a GCOP plan within 180 days of equipment startup and implementation of the GCOP. Continuous compliance is demonstrated through monitoring, recording, and reporting throughputs for the equipment.

C. BACT Analysis for CO & VOC

Novelis submitted BACT analyses for CO and VOC emissions and evaluated available CO and VOC control technologies and practices. Because the control strategies for CO often provide co-control for VOC, the BACT analyses for these pollutants are combined. If a unit emits only VOC, only the control strategies applicable to VOC are analyzed. A control technology for an emission point may serve as a BACT control for other equipment as well.

Control Technologies for CO & VOC: The possible BACT control technologies for the emission of CO and/or VOC are identified below:

Purchase of certified NSPS JJJJ and IIII engines.

Good combustion practices.

Limitations on hours of operation.

Catalytic Oxidation (CatOx), TWC and Diesel Oxidation Catalysts (DOC): Catalytic Oxidation (CatOx) units operate as exhaust gas passes through a catalyst bed, which facilitates an overall combustion reaction between the oxygen in the gas stream and the gaseous pollutant (CO/VOC). The catalyst is typically a porous noble metal material. The catalytic oxidation process for CO control is very temperature sensitive; exhaust temperatures that are too high may damage the catalyst, while exhaust temperatures that are too low will reduce destruction efficiency. CO destruction efficiency for a CatOx is dependent upon exhaust composition and CO concentrations, operating temperature, oxygen concentration, catalyst characteristics, and space velocity (the volumetric flow rate of gas entering the catalyst bed chamber divided by the volume of the catalyst bed). VOC removal efficiencies up to 99% may be achieved with a CatOx unit (depending on the system requirements and exhaust stream concentrations). The range of CatOx control efficiency for CO emissions from incomplete combustion of natural gas and diesel occurring in Novelis affected units may not be as high as for VOC because the CO molecule is generally more difficult to destroy through combustion/oxidation than most of the common organic compounds comprising VOC emissions. A TWC for an SI engine is similar to CatOx except an Air/Fuel Ratio Control system is used to maintain the stochiometric ratio such that CO and VOC are destructed while converting NOx to nitrogen. Diesel Oxidation Catalyst (DOC) units are a commonly used “flow through” control device for stationary diesel engines which contains a honeycomb-like structure or substrate with a large surface area that is coated with an active catalyst layer reduces emissions of CO and VOC. CO, gaseous hydrocarbons and liquid hydrocarbon particles (unburned fuel and oil) in the exhaust gas are oxidized to CO_2 and H_2O. The reduction of CO and VOC varies depending on the catalyst formulations in the DOC.

Catalyzed diesel particulate filters (CDPF) for diesel engines: CDPF devices are passive control technology for diesel combustion units that incorporate a catalyst upstream of the filter or coated onto the filter substrate. The catalyst promotes the oxidation of CO and hydrocarbon particles to form CO_2 and H_2O. CDPF units can reduce CO and hydrocarbon emissions by 90%, but requires sufficient exhaust temperatures to facilitate regeneration by the catalyst.

i. Cast Pit Sump Emergency Generator (EU 047) and Decoater Backup Emergency Generator (EU 048):

Decision Summary: Consistent with the BACT evaluation conducted and submitted by the applicant, the Division determines that the use of a GCOP plan as means to control CO/VOC emissions constitutes BACT.

Emission Point	BACT	BACT limit for CO	BACT limit for VOC
047	GCOP plan	4.0 g/HP-hr	1.0 g/HP-hr
048	GCOP plan	10 g/HP-hr (NOx+HC)	N/A

Technologies: Novelis examined the following technologies as possibilities to control CO/VOC emitted from the emergency generators: CDPF, CatOX/TWC, GCOP.

Analyses: After identifying possible CO/VOC technologies available, Novelis presented a review of the different possible technologies, discussed the technical feasibility of each one and discussed the relevant advantages and disadvantages for use in the emergency generators.

Despite being technically feasible, any control technology utilized to reduce emissions from the emergency generators is not considered to be cost effective. Costs per ton for removal of CO and VOC range upwards of $90,000/ton.

Novelis concluded and the Division concurs that BACT for this equipment is the development of a GCOP Plan.

Initial compliance demonstration with BACT is through development of a GCOP plan within 180 days of equipment startup, and implementation of the GCOP. Continuous compliance is demonstrated through monitoring and recordkeeping of throughputs for the equipment.

ii. Emergency Fire Pump #3 and Emergency Fire Pump #4 (EU 049 and EU 050):

Decision Summary: Consistent with the BACT evaluation conducted and submitted by the applicant, the Division determines that the implementation of a GCOP plan as means to control CO/VOC emissions constitutes BACT.

Emission Point	BACT	BACT limit for CO	BACT limit for VOC
049	GCOP plan	2.6 g/HP-hr	N/A
050	GCOP plan	2.6 g/HP-hr	N/A

Technologies: Novelis examined the following technologies as possibilities to control CO/VOC emitted from the emergency fire pump engines: CDPF, DOC, GCOP.

Analyses: After identifying possible CO/VOC control technologies available, Novelis presented a review of the different possible technologies, discussed the technical feasibility of each one and discussed the relevant advantages and disadvantages for use in the emergency fire pump engines.

Despite being technically feasible, any control technology utilized to reduce emissions from the emergency fire pump engines is not considered to be cost effective. Costs per ton for removal of CO and VOC range upwards of $250,000/ton.

Novelis concluded and the Division concurs that BACT for this equipment is the development of a GCOP Plan.

Initial compliance demonstration with BACT is through development of a GCOP plan within 180 days of equipment startup, and implementation of the GCOP. Continuous compliance is demonstrated through monitoring and recordkeeping of throughputs for the equipment.

D. BACT Analysis for GHG

Although GHGs are an aggregate group of multiple gases, including CO_2, N_2O, CH_4, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride, they are treated as a single air pollutant for PSD and BACT purposes.

There are no post-combustion control technologies identified or available for GHG emissions from small emergency engines.

i. ***Cast Pit Sump Emergency Generator (EU 047) and Decoater Backup Emergency Generator (EU 048):***

Decision Summary: Consistent with the BACT evaluation conducted and submitted by the applicant, the Division determines that the use of a GCOP plan as means to control GHG emissions constitutes BACT.

Technologies: Energy efficiency measures, including fuel selection and development of a GCOP plan are possible GHG control technologies.

Analyses: Utilizing natural gas constitutes the lowest emission rate of CO_2 per unit of energy. GCOP are an available control measure for GHG, as it promotes efficiency by optimizing fuel usage and ensuring proper operation of the combustion device.

As the units are for emergency use, no numerical BACT has been set for the emergency generators as they have no operational limit for emergency situations. Novelis concluded and the Division concurs that BACT for this equipment is the development of a GCOP Plan.

Initial compliance demonstration with BACT is through development of a GCOP plan within 180 days of equipment startup and implementation of the GCOP. Continuous compliance is demonstrated through monitoring, recording, and reporting throughputs for the equipment.

ii. Emergency Fire Pump #3 and Emergency Fire Pump #4 (EU 049 and EU 050):

Decision Summary: Consistent with the BACT evaluation conducted and submitted by the applicant, the Division determines that the use of a GCOP plan as means to control GHG emissions constitutes BACT.

Technologies: Energy efficiency measures, including fuel selection and development of a GCOP plan are possible GHG control technologies.

Analyses: Utilizing natural gas constitutes the lowest emission rate of CO_2 per unit of energy. GCOP are an available control measure for GHG, as it promotes efficiency by optimizing fuel usage and ensuring proper operation of the combustion device.

As the units are for emergency use, no numerical BACT has been set for the emergency fire pumps as they have no operational limit for emergency situations. Novelis concluded and the Division concurs that BACT for this equipment is the development of a GCOP Plan.

Initial compliance demonstration with BACT is through development of a GCOP plan within 180 days of equipment startup and implementation of the GCOP. Continuous compliance is demonstrated through monitoring, recording, and reporting throughputs for the equipment.

E. AIR QUALITY IMPACT ANALYSIS

i. Screening Methodology

The incremental increases in ambient pollutant concentrations associated with the Novelis casting project have been estimated through the use of a dispersion model (AERMOD) applied in conformance to applicable guidelines in the United States Environmental Protection Agency (USEPA) Guideline on Air Quality Models (GAQM, 40 CFR Appendix W, May 2017) and other applicable guidance, and followed the methodology presented in the Air Dispersion Modeling Protocol approved by KDAQ on February 20, 2022.

Model simulations for short-term and annual-averaged CO, NO_2, PM_{10}, and $PM_{2.5}$ emissions are performed with the AERMOD model using the 5-year meteorological database. The highest predicted impacts (H1H) were used as the design concentrations in the SIL analyses while the design concentrations for the NAAQS and PSD increment analyses followed the form of the NAAQS and PSD increment for each applicable pollutant and averaging time. Each pollutant is being assessed against the SIL for the NAAQS, the maximum value over 5 years for each applicable time averaging period is compared to the appropriate SIL.

Significant Impact Levels (SILs)

Pollutant	Averaging Period	Modeled Concentration (μg/m^3)	Significant Impact Level (μg/m^3)	Significant Monitoring Concentrations (μg/m^3)	SIL Exceeded & Additional Modeling Required?	Significant Monitoring Concentration Exceeded?
CO	1-hour	325.9	2000	-	No	-
	8-hour	52.0	500	575	No	No
PM_{10}	24-hour	13.2	5	10	Yes	Yes
	Annual	2.03	1	-	Yes	-
$PM_{2.5}$	24-hour	9.71	1.2	4	Yes	Yes
	Annual	1.36	0.2	-	Yes	-
NO_2	1-hour	118.0	7.5	-	Yes	-
	Annual	3.88	1	14	Yes	No

ii. Background Concentrations

Representative background concentrations were added to the maximum predicted concentrations so that small sources that were not explicitly modeled are included in the NAAQS and KYAAQS assessment. Background concentrations are based on ambient monitoring data collected for the most recent three year period available (2020 through 2022) determined to be the most representative for use in the modeling analysis. Since all of the study pollutants are not monitored at one location, data from several different monitoring locations are used.

Representative Background Concentrations

Monitoring Location	Site ID	Data Collection Period	Pollutant	Averaging Period	Basis of Design Value	Design Value
Owensboro, KY	21-059-0005	2020-2022	NO_2	1-hour	Average of the three year 98th percentile	52.6 µg/m^3
				Annual	Annual Mean	9.4 µg/m^3
Hopkinsville, KY	21-047-0006	2020-2022	$PM_{2.5}$	24-hour	Average of the three year 98th percentile	22.0 µg/m^3
				Annual	Average of three year annual averages	8.3 µg/m^3
Nashville, TN	47-037-0023	2020-2022	PM_{10}	24-hour	2nd high	51.9 µg/m^3
Hopkinsville, KY	21-047-0006	2020-2022	Ozone	8-hour	3 year 4th high maximum 8-hour average	59 ppb

The applicant may propose, for the reviewing authority's consideration, use of existing monitoring data if appropriate justification is provided. Novelis proposed the use of representative regional background data to satisfy this requirement as necessary.

iii. <u>Cumulative NAAQS Analyses</u>

NAAQS analyses, using five years of meteorological data, were performed for 1-hour and annual NO_2; 24-hour PM_{10}; and 24-hour and annual $PM_{2.5}$. The Ambient Ratio Method (ARM2) regulatory default Tier-2 NO_X to NO_2 conversion methodology for modeling ambient NO_2 impacts was used in the multi-source analyses. The NAAQS analyses were carried out by modeling facility-wide Novelis source parameters and emission rates; modeling off-property source inventory for the surrounding area; and adding the representative background concentrations to modeled concentrations for comparison with the NAAQS.

NAAQS Modeling Results

Pollutant	Averaging Period	Modeled Concentration (µg/m^3)	Background (µg/m^3)	Total (µg/m^3)	NAAQS (µg/m^3)	Max Novelis Contribution (µg/m^3)
PM_{10}	24-hour	22.4	51.9	74.3	150	N/A
$PM_{2.5}$	24-hour	6.87	22.0	28.9	35	N/A
	Annual	2.37	8.3	10.7	12	N/A
NO_2[1]	1-hour	127.9	Included	136.8	188	N/A
	Annual	7.46	9.4	16.90	100	N/A

[1]Maximum total impacts shown include the background concentration. The 1-hour background concentrations are based on ambient monitoring data from the Daviess County, Kentucky site (Site ID 21-059-0005) for the five-year period from 2018 to 2022. The annual average background concentration is the maximum annual arithmetic mean concentration from 2020 to 2022.

iv. Class II Increment Analysis

In addition, a PSD Class II increment modeling analysis, using five years of meteorological data, was also performed for annual NO_2, 24-hr and annual PM_{10}, and 24-hour and annual $PM_{2.5}$ by modeling increment consuming and expanding Novelis source parameters and emission rates as well increment consuming and expanding off-property sources.

Class II Increments

Pollutant	Averaging Period	Modeled Concentration ($\mu g/m^3$)	PSD Class II Increment Standard ($\mu g/m^3$)
PM_{10}	24 hour	24.70	30
	Annual	3.09	17
$PM_{2.5}$	24 hour	8.64	9
	Annual	1.71	4
$PM_{2.5}$[1] (secondary)	24 hour	8.68[1]	9
	Annual	1.71[1]	4
NO_2	Annual	7.43	25
(1) Secondary PM2.5 concentrations estimated using the default KDAQ MERP values.			

v. Secondary $PM_{2.5}$ and Ozone Formation

The Division has provided recent (August 2, 2018) guidance on addressing secondary pollutant impacts with a state-specific guidance on the application of EPA's Modeled Emission Rates for Precursors (MERPs) Tier-1 demonstration tool. This guidance was used to assess secondary formation of ozone and $PM_{2.5}$for this project. A MERP represents a level of precursor emissions that is not expected to contribute significantly to concentrations of ozone or secondarily formed $PM_{2.5}$.

MERPs are used to determine if proposed emission increases from a facility will result in primary and secondary impacts. NOx, SO_2, $PM_{2.5}$, and VOC emissions from the project must be included in the analysis. If the project emissions from all relevant pollutants are below the SER, no further analysis is required. If the project emissions from any of the relevant emissions are above the SER, a Tier 1 demonstration is required. The Tier 1 demonstration consists of a SILs analysis and, if needed, a cumulative analysis. The analysis must be below the NAAQS for each precursor in order to pass.

Novelis Emission for MERPs Analysis

Precursor	Emissions (tpy)	SER (tpy)
NO_X	275.8	40
SO_2	1.49	40
$PM_{2.5}$	82.87	10
VOC	142.5	40

The values represent the maximum predicted concentrations over the five modeling years and are later used in the PSD Increment analysis. In the NAAQS analysis of the direct model-predicted concentrations, the average over 5 years were used.

SIL Modeling Results for $PM_{2.5}$ MERPs Analysis

Pollutant	Project Modeled Concentration ($\mu g/m^3$)
Annual $PM_{2.5}$	2.39
Daily $PM_{2.5}$	7.07

The highest modeled concentration for all sources, including nearby sources, for annual and 24-hour primary $PM_{2.5}$ NAAQS are as follow:

NAAQS and PSD Increment Modeling Results for MERP*s* Analysis

Pollutant	Project + Nearby NAAQS Source Impacts (µg/m^3)	Project + Nearby PSD Increment Source Impacts (µg/m^3)
Annual $PM_{2.5}$	10.7	1.71
Daily $PM_{2.5}$	28.9	8.64

The background concentrations for ozone and $PM_{2.5}$ annual / 24-hour are as follows:

Background Concentrations for MERPs Analysis

Pollutant	Background Concentrations	Monitor ID
Ozone	59	21-047-0006
Annual $PM_{2.5}$	8.3	21-047-0006
Daily $PM_{2.5}$	22.0	

If the result of the SIL Analysis is greater than 1, a cumulative analysis is required for that precursor. If the result is less than 1, a cumulative analysis is not required. The SIL analysis results for ozone and PM2.5 are as follows:

MERPs SIL Analyses

Pollutant	Analysis Results	Less than 1?
Ozone	1.17	No
Annual $PM_{2.5}$	.003	Yes
Daily $PM_{2.5}$	.043	Yes

The table below shows the cumulative analysis results for ozone and $PM_{2.5}$.

MERP Cumulative NAAQS Analysis

Precursor	Analysis	NAAQS	Below NAAQS?
Ozone	60.17	70 ppb	Yes
Annual $PM_{2.5}$	11.6	12 µg/m^3	Yes
Daily $PM_{2.5}$	29.9	35 µg/m^3	Yes

Summary of the PSD Increment analysis results is as follows:

MERPs PSD Increment Analysis

Precursor	Analysis	PSD INC	Below PSD INC?
Annual $PM_{2.5}$	1.71	4 µg/m^3	Yes
Daily $PM_{2.5}$	8.64	9 µg/m^3	Yes

vi. <u>Class I MERPs Analysis</u>

In order to assess the total $PM_{2.5}$ impacts (primary and secondary) at the Class I area, the USEPA approved distance-dependent technique was used. In this case, the MERPs values were calculated based on the concentrations from Barren County hypothetical stack at a specific distance representative of the distance between the Project and the Class I area.

The combined primary and secondary $PM_{2.5}$ impacts were compared to their respective SILs. The 24-hour and the annual $PM_{2.5}$ total concentrations are below the SIL standards. Therefore, it is not expected that the Project will contribute significantly to $PM_{2.5}$ levels at AREA, and no further analysis is necessary.

Class I Primary and Secondary $PM_{2.5}$ Modeling Results

Period	AERMOD $PM_{2.5}$ Concentrations ($\mu g/m^3$) at 50 km			Class I SIL
	Primary	Secondary	Total	
24-hour	0.132	0.043	0.17	0.27
Annual	0.007	0.003	0.01	0.05

vii. <u>Class I Area Analysis</u>

Class I area impacts are addressed if the proposed project has an impact that exceeds the screening threshold as described by Federal Land Managers' (FLM) Air Quality Related Values Work Group (FLAG) guidance. In this guidance the sum of the proposed project emissions (in tpy) of SO_2, NOx, PM_{10} and H_2SO_4 is divided by the distance to the Class I area and compared to the value of 10. This ratio is known as Q/D. If Q/D is 10 or less, the project is considered to have a negligible impact on the Class I area. If the Q/D value is greater than 10, then further analysis to evaluate impacts in the Class I area is warranted.

There are four Class I areas within 300 km of the Novelis casting facility: Mammoth Cave, which is the closest at 101 km followed by Sipsey (AL) 253km, Mingo (MO) 267km and Cohutta (GA) 295km. The sum of emissions (SO_2, NOx, PM_{10} and H_2SO_4) for the proposed project is 312.62tpy. The calculated Q/D for the proposed project relative to Mammoth Cave NP is 3.10; which is below the FLM screening level of 10.

Class I Area Q/D Screening Analysis

Pollutant	Project Emissions (tpy)	Q/D Analysis
NO_2	202.18	
SO_2	0.77	
PM_{10}	109.67	
H_2SO_4	0	
Total	312.62	
AREA	101	3.10

The project related increase of NO_2, PM_{10}, and $PM_{2.5}$, were evaluated against the Class I SILs by applying the AERMOD dispersion model receptors at the maximum spatial extent (50 km from the Project site to receptor). The maximum-modeled concentrations at the 50 km receptors are less than the Class I SILs for all pollutants and averaging periods.

Class I SIL Analysis with AERMOD at 50 km

Pollutant	Averaging Period	Modeled Concentration at 50 km ($\mu g/m^3$)	Class I SIL	% of SIL
PM_{10}	24-hour	0.194	0.3	65%
	Annual	0.009	0.2	5%
$PM_{2.5}$	24-hour	0.132	0.27	49%
	Annual	0.007	0.05	14%
$PM_{2.5}$[1] secondary	24-hour	0.17	0.27	63%
	Annual	0.01	0.05	20%
NO_2	Annual	0.015	0.1	15%
(1) The $PM_{2.5}$ peak concentrations represent the sum of the AERMOD predicted concentrations and the fraction accounting for the secondary $PM_{2.5}$ formations.				

As evident from the AERMOD modeling results, model-predicted impacts from Novelis emission sources are below the Class I SILs for all pollutants and averaging periods; therefore, compliance is demonstrated and no further analysis is required.

SECTION 3 – EMISSIONS, LIMITATIONS AND BASIS

Emission Group 1 – Direct-Fired Furnaces				
Pollutant	**Emission Limit or Standard**	**Regulatory Basis for Emission Limit or Standard**	**Emission Factor Used and Basis**	**Compliance Method**
PM	• $P \leq 0.5$ ton/hr = 2.34 lb/hr • $0.5 < P \leq 30$ ton/hr = $3.59 \times P^{0.62}$ lb/hr	401 KAR 59:010, Section 3(2)	1.9 lb/MMscf AP-42 Chapter 1.4.	Assumed based upon natural gas combustion
Opacity	20% opacity	401 KAR 59:010, Section 3(1)(a)	N/A	Assumed based upon natural gas combustion

Initial Construction Date: 2019

Process Description:
EU002 – Heat Treat Furnace (HTL):
Maximum Continuous Rating: 34.1 MMBtu/hr
Maximum Process Rating: 125,000 tons/yr
Primary Fuel: Natural Gas
Controls: None

Following the Alkaline Pre-Cleaner section, the aluminum sheet enters the Floating Heat Treat Furnace (EU-02). A deflector roller at the furnace inlet makes it possible to guide the strip into the furnace fairly straight. The natural gas fired furnace provides a direct flame to contact the sheet both from above and below, allowing the sheet to become rapidly heated to desired temperatures. The floating sheet furnace is equipped with multiple (~14) zones with several natural gas burners in each zone. The initial zones of the furnace are supplied with preheated combustion air to rapidly heat the strip, while the subsequent zones are supplied with cold combustion air to maintain the thermal energy already in the system or even to cool the sheet down to the desired temperature. Exhaust fans located in each zone remove the resulting combustion gases and associated pollutants through multiple ducting take-off points in such a manner as to provide for uniform temperature monitoring and control of the strip as it passes through this approximately 800 foot long furnace process area. The multiple take-off points are combined in a common manifold and then vented to a single stack that emits to the atmosphere.

EU003 – Reheater Furnace (HTL):
Maximum Continuous Rating: 7.68 MMBtu/hr
Maximum Process Rating: 125,000 tons/yr
Primary Fuel: Natural Gas
Controls: None

After the Heat Treat Furnace, Water/Air Quench, and the HTL - Tension Leveler, the sheet is then further heat treated in the Reheater Furnace. This natural gas fired furnace provides a direct flame to contact the sheet both from above and below to attain the desired temperature profile for the ultimate sheet properties. The combustion exhaust from the Reheater Furnace is discharged through a single duct and vented to a single stack (EP-03) to the atmosphere. The contribution of VOC emissions from the heating of the strip that was applied with lube at the Tension Leveler is also accounted for in the Reheater Furnace emissions. After exiting the Reheater Furnace, the aluminum sheet is sheared and rewound into coil shape again, and then stenciled before being transferred to the ASRS coil storage area.

Emission Group 1 – Direct-Fired Furnaces

Applicable Regulation:
401 KAR 59:010, *New process operations,* applies to each affected facility, associated with a process operation, which is not subject to another emission standard with respect to particulates, commenced on or after July 2, 1975.

State-Origin Requirements:
401 KAR 63:020, *Potentially hazardous matter or toxic substances*

Comments:
Emissions are calculated using AP-42, Chapter 1.4, 40 CFR 98, Subpart C, and similar facility stack test data.

Emission Group 2 – Metal Process Furnaces

Pollutant	Emission Limit or Standard	Regulatory Basis for Emission Limit or Standard	Emission Factor Used and Basis	Compliance Method
PM	• $P \leq 0.5$ ton/hr = 2.34 lb/hr • $0.5 < P \leq 30$ ton/hr = $3.59 \times P^{0.62}$ lb/hr	401 KAR 59:010, Section 3(2)	1.9 lb/MMscf AP-42 Chapter 1.4.	Assumed based upon natural gas combustion
Opacity	20% opacity	401 KAR 59:010, Section 3(1)(a)	N/A	Assumed based upon natural gas combustion

Process Description:
EU005 & EU006 – Batch Annealing Furnace #1 & #2:
Construction Date: 2019
Maximum Continuous Rating: 17.47 MMBtu/hr (each)
Maximum Process Rating: 50,000 tons/yr (each)
Primary Fuel: Natural Gas
Controls: None

The two batch annealing furnaces (EU005 and EU006) are each designed to accommodate four (4) coils at a time. Natural gas heating is used to bring the cooled coils from the storage area to desired temperatures and have cycle times of about 16 hours duration. Coils processed with the batch annealing furnaces can provide 100 kta to the PTL above the capability of the HTL. The furnaces are identical and are individually exhausted through separate emission points. In addition to the natural gas combustion emissions, residual oils on the coils that are received and annealed at the Guthrie facility will be released as VOC emissions as part of the extended heating process, and have been added to the total of VOC emissions expected from the furnaces. The residual oil VOC losses per coil are estimated based on actual testing data for the amount of oil that remains with the coil from another Novelis facility with similar batch annealing furnaces.

Applicable Regulation:
401 KAR 59:010, *New process operations,* applies to each affected facility, associated with a process operation, which is not subject to another emission standard with respect to particulates, commenced on or after July 2, 1975.

Emission Group 2 – Metal Process Furnaces

401 KAR 63:002, Section 2(4)(iiii), 40 C.F.R. 63.7480 through 63.7575, Tables 1 through 13 (Subpart DDDDD), *National Emission Standards for Hazardous Air Pollutants for Major Sources: Industrial, Commercial, and Institutional Boilers and Process Heaters*, applies to each process heater as defined in 40 CFR 63.7575 that is located at, or is part of, a major source of HAPs.

Comments:
As a major source, EU005 and EU006 are now subject to 40 CFR 63, Subpart DDDDD. Emissions are calculated using AP-42, Chapter 1.4, 40 CFR 98, Subpart C, and similar facility stack test data.

Emission Group 3 – Boilers

Pollutant	Emission Limit or Standard	Regulatory Basis for Emission Limit or Standard	Emission Factor Used and Basis	Compliance Method
PM	0.35 lb/MMBtu (each)	401 KAR 59:015, Section 4(1)(c)	1.9 lb/MMscf AP-42 Chapter 1.4.	Assumed based upon natural gas combustion
Opacity	20% opacity	401 KAR 59:015, Section 4(2)	N/A	Assumed based upon natural gas combustion
SO_2	1.31 lbs/MMBtu (each)	401 KAR 59:015, Section 5(1)(c)(2)	0.6 lb/MMscf AP-42 Chapter 1.4.	Assumed based upon natural gas combustion

Initial Construction Date: October 2019

Process Description:
The facility will be equipped with three (3) natural gas fired boilers (EU007, EU008, and EU009) that will produce low pressure steam to use in heat exchangers in the chemical treatment sections of the PTL process.

Emission Unit 007 (EU 007) Boiler #1

Description:

Maximum Continuous Rating: 25.2 MMBtu/hr
Primary Fuel: Natural Gas
Control Equipment: None

Emission Unit 008 (EU 008) Boiler #2

Description:

Maximum Continuous Rating: 25.2 MMBtu/hr
Primary Fuel: Natural Gas
Control Equipment: None

Emission Unit 009 (EU 009) Boiler #3

Description:

Maximum Continuous Rating: 25.2 MMBtu/hr
Primary Fuel: Natural Gas
Control Equipment: None

Applicable Regulation:
401 KAR 59:015, *New Indirect Heat Exchangers*, applies to indirect heat exchangers having a heat input capacity greater than one (1) million BTU per hour (MMBtu/hr) commenced on or after April 9, 1972 (401 KAR 59:015, Section 2(1)).

Emission Group 3 – Boilers

401 KAR 60:005, Section 2(2)(d), 40 C.F.R. 60.40c to 60.48c (Subpart Dc), *Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units*, applies to each steam generating unit for which construction, modification, or reconstruction is commenced after June 9, 1989 and that has a maximum design heat input capacity of 100 million MMBtu/hr or less, but greater than or equal to 10 MMBtu/hr.

401 KAR 63:002, Section 2(4)(iiii), 40 C.F.R. 63.7480 through 63.7575, Tables 1 through 13 (Subpart DDDDD), *National Emission Standards for Hazardous Air Pollutants for Major Sources: Industrial, Commercial, and Institutional Boilers and Process Heaters*, applies to each industrial, commercial, or institutional boiler as defined in 40 CFR 63.7575 that is located at, or is part of, a major source of HAPs.

Comments:
Allowable emissions for the new units are calculated using 401 KAR 59:015, Section 3(1) using the total rated heat input capacity of all affected facilities at a source which is 75.6 MMBtu/hr. As a major source, EU007, EU008, and EU009 are now subject to 40 CFR 63, Subpart DDDDD.

Summary of All Affected Facilities Used to Determine 401 KAR 59:015 Emission Limits

EU	Fuel(s)	Capacity (MMBtu/hr)	Const.	Basis for PM Limit	Total Heat Input Capacity for PM Limit (MMBtu/hr)	Basis for SO_2 Limit	Total Heat Input Capacity for SO_2 Limit (MMBtu/hr)	Notes
007	Natural Gas	25.2	2019	401 KAR 59:015, Section 4 (1)(c)	75.6	401 KAR 59:015, Section 5 (1)(c)(2)	75.6	
008	Natural Gas	25.2	2019	401 KAR 59:015, Section 4 (1)(c)	75.6	401 KAR 59:015, Section 5 (1)(c)(2)	75.6	
009	Natural Gas	25.2	2019	401 KAR 59:015, Section 4 (1)(c)	75.6	401 KAR 59:015, Section 5 (1)(c)(2)	75.6	

Emission Group 4 – Emergency Generators

Pollutant	Emission Limit or Standard	Regulatory Basis for Emission Limit or Standard	Emission Factor Used and Basis	Compliance Method
NOx (for EU011, EU021, and EU047)	2.0 g/HP-hr	40 CFR 60.4233(e); 401 KAR 51:017 for EU047	For EU011 and EU021: 4161.6 lb/MMscf AP-42 Chapter 3.2-2 For EU047: 46.54 lb/MMscf Manufacturer specification	Purchasing a certified engine, monitoring, recordkeeping, reporting, and GCOP plan for EU047 and EU048.
NOx + HC (for EU048)	10 g/HP-hr	40 CFR 60.4233(e); 401 KAR 51:017	390.2 lb/MMscf Manufacturer specification	
CO	EU011, EU021,	40 CFR 60.4233(e);	For EU011 and	

Emission Group 4 – Emergency Generators				
	and EU047: 4.0 g/HP-hr EU048: 387 g/HP-hr	401 KAR 51:017 for EU047 and EU048	EU021: 32.3 lb/MMscf For EU047: 43.8 lb/MMscf Manufacturer specification For EU048: 15445 lb/MMscf Manufacturer specification	
VOC	EU011, EU021, and EU047: 1.0 g/HP-hr	40 CFR 60.4233(e); 401 KAR 51:017 for EU047	VOC – 120.36 lb/MMscf For EU047: 30.1 lb/MMscf Manufacturer specification For EU048: 352.7 lb/MMscf Manufacturer specification	

Initial Construction Date: October 2019 for EU 011 & EU 021; October 2024 for EU 047 & EU 048

Process Description:
Four natural gas-fired spark-ignition emergency engines intended to provide auxiliary power to associated operations in the event of sudden power failure. These generators are 4-stroke lean burn engines with total displacement less than 30 liters. EU 047 and EU 048 are part of the new casting facility and subject to 401 KAR 51:017.

Emission Unit	Unit Name	Maximum Continuous Rating (bhp)	Control Device	Construction Commenced
011	Emergency Generator #1 – (Security Office)	304	None	October 2019
021	Emergency Generator #2 – (Administrative Building)	304	None	October 2019
047	Cast Pit Sump Emergency Generator	132	None	October 2024
048	Decoater Backup Emergency Generator	38	None	October 2024

Emission Group 4 – Emergency Generators
Applicable Regulations: **401 KAR 51:017,** *Prevention of significant deterioration of air quality*, for EU 047 and EU 048; applies to PM, PM_{10}, $PM_{2.5}$, CO, NOx, VOC, & GHG. **401 KAR 60:005, Section 2(2)(eeee), 40 C.F.R. 60.4230 through 60.4248, Tables 1 through 4 (Subpart JJJJ),** *Standards of Performance for Stationary Spark Ignition Internal Combustion Engines*, applies to stationary spark ignition (SI) internal combustion engines (ICE). **401 KAR 63:002, Section 2(4)(eeee), 40 C.F.R. 63.6580 through 63.6675, Tables 1a through 8, and Appendix A (Subpart ZZZZ),** *National Emission Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines*, applies to stationary reciprocating internal combustion engines at major or area sources of Hazardous Air Pollutants (HAP). **Comments:** The emergency engines may be operated for a maximum of 100 hours per calendar year for the purposes of maintenance checks and readiness testing in accordance with 40 CFR 60, Subpart JJJJ. However, because these regulations do not limit the number of hours the emergency generators may operate during an emergency, annual emissions calculations are based on 500 hours per year of operation. Emissions based on AP-42, Section 3.2, 40 CFR 98, Subpart C, Table C-1 and C-2, emission standards from 40 CFR 60, Subpart JJJJ, manufacturer's specifications, and a NG heating value of 1,020 Btu/scf. In order to satisfy the emission limits, as listed in the table above, the permittee shall purchase an engine certified to the standard or follow the alternative as required by 40 CFR 60, Subpart JJJJ.

Emission Group 5 – Emergency Fire Pumps				
Pollutant	**Emission Limit or Standard**	**Regulatory Basis for Emission Limit or Standard**	**Emission Factor Used and Basis**	**Compliance Method**
CO	2.6 g/HP-hr	40 CFR 60.4205(c) referencing 40 CFR 60, Subpart IIII, Table 4; 401 KAR 51:017 for EU049 and EU050	For EU012 and EU022: 39.3 lb/Mgal Manufacturer specification For EU049 and EU050: 32.7 lb/Mgal Manufacturer specification	Purchasing a certified engine, monitoring, recordkeeping, reporting, and GCOP plan for EU049 and EU050.
NMHC + NOx	3.0 g/HP-hr		For EU012 and EU022: 97.52 lb/Mgal Manufacturer specification For EU049 and EU050: 139.94 lb/Mgal	

Emission Group 5 – Emergency Fire Pumps

			Manufacturer specification	
PM	0.15 g/HP-hr		For EU012 and EU022: 3.22 lb/Mgal Manufacturer specification For EU049 and EU050: 4.0 lb/Mgal Manufacturer specification	

Initial Construction Date: October 2019 for EU 012 & EU 022; October 2024 for EU 049 & EU 050

Process Description:
Four emergency fire pumps equipped with diesel-fired engines intended to provide water in the case of a fire. These engines have total displacement less than 10 liters. EU 049 and EU 050 are part of the new casting facility and subject to 401 KAR 51:017.

Emission Unit	Unit Name	Maximum Continuous Rating (bhp)	Control Device	Construction Commenced
012	Emergency Fire Pump #1	175	None	October 2019
022	Emergency Fire Pump #2	175	None	October 2019
049	Emergency Fire Pump #3	327	None	October 2024
050	Emergency Fire Pump #4	327	None	October 2024

Applicable Regulations:
401 KAR 51:017, *Prevention of significant deterioration of air quality*, for EU 049 and EU 050; applies to PM, PM_{10}, $PM_{2.5}$, CO, NOx, VOC, & GHG.

401 KAR 60:005, Section 2(2)(dddd), 40 C.F.R. 60.4200 through 60.4219, Tables 1 through 8 (Subpart IIII), *Standards of Performance for Stationary Compression Ignition Internal Combustion Engines*, applies to stationary compression ignition (CI) internal combustion engines (ICE).

401 KAR 63:002, Section 2(4)(eeee), 40 C.F.R. 63.6580 through 63.6675, Tables 1a through 8, and Appendix A (Subpart ZZZZ), *National Emission Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines*, applies to stationary reciprocating internal combustion engines at major or area sources of Hazardous Air Pollutants (HAP).

Comments:
The emergency engines may be operated for a maximum of 100 hours per calendar year for the purposes of maintenance checks and readiness testing in accordance with 40 CFR 60, Subpart IIII. However, because these regulations do not limit the number of hours the emergency generators may operate during an emergency, annual emissions calculations are based on 500 hours per year of operation. Emissions based on AP-42, Section 3.3, 40 CFR 98, Subpart C, Table C-1 andC-2, emission standards from 40 CFR

Emission Group 5 – Emergency Fire Pumps

60, Subpart IIII, manufacturer's specifications, and a 138.5 MMbtu/Mgal diesel heating value. In order to satisfy the emission limits, as listed in the table above, the permittee shall purchase an engine certified to the standard or follow the alternative as required by 40 CFR 60, Subpart IIII.

Emission Unit 014 – PTL – Shear & Tension Leveler

Initial Construction Date: 2019

Process Description:
Maximum Capacity: 2.078 gallons per hour (lubricant)
Controls: None

Coils heat treated from the HTL or batch annealing furnaces are unwound, sheared and joined to prepare them for processing. The coils are leveled in a Tension Leveler, by adding a petroleum based lubricant to the aluminum sheet through an electrostatic applicator similar to the Tension Leveler for the HTL. The lubricant is solvent based and is applied inside the process building.

Applicable Regulation:
401 KAR 63:010, *Fugitive emissions*, applies to an apparatus, operation, or road which emits or may emit fugitive emissions provided that the fugitive emissions from such facility are not elsewhere subject to an opacity standard within the administrative regulations of the Division for Air Quality.

Comments:
Because of the temperature of the coils and the applied lubricants, the emissions from this process are assumed to be VOC only, and to contain no particulate in the form of aerosol mists.

Emission Unit 020 – Paved Roads

Process Description:

Emission Unit	Unit Name	Maximum Capacity (VMT/day)	Control Device	Construction Commenced
020	Paved Roads	655.7	Sweeping	2019; 2022

Paved haul roads.

Applicable Regulations:
401 KAR 51:017, *Prevention of significant deterioration*, applies to PM, PM_{10}, and $PM_{2.5}$.

401 KAR 63:010, *Fugitive emissions*, applies to an apparatus, operation, or road which emits or may emit fugitive emissions provided that the fugitive emissions from such facility are not elsewhere subject to an opacity standard within the administrative regulations of the Division for Air Quality.

Comments:
Emissions calculated using AP-42 Section 13.2.1.

Emission Unit 026 – Scrap Processing Line #1				
Pollutant	**Emission Limit or Standard**	**Regulatory Basis for Emission Limit or Standard**	**Emission Factor Used and Basis**	**Compliance Method**
PM	• P≤0.5 ton/hr: 2.34 lbs/hr • P≤30 ton/hr: $E = 3.59P^{0.62}$	401 KAR 59:010, Section 3(2)	0.199 lb/ton; 0.002 gr/dscf	Monthly calculation, testing, monitoring, & recordkeeping
PM	0.010 gr/dscf	40 CFR 63.1505(b)(1)	0.199 lb/ton; 0.002 gr/dscf	Testing, monitoring, recordkeeping, & reporting
PM	5.47 lbs/hr; 23.98 tons/yr	401 KAR 51:017	0.199 lb/ton; 0.002 gr/dscf	Testing, monitoring, & recordkeeping
PM_{10}	2.79 lbs/hr; 12.23 tons/yr	401 KAR 51:017	0.101 lb/ton; EPA PM Calculator	Testing, monitoring, & recordkeeping
$PM_{2.5}$	0.82 lbs/hr; 3.60 tons/yr	401 KAR 51:017	0.030 lb/ton; EPA PM Calculator	Testing, monitoring, & recordkeeping
Opacity	10% opacity (if COM is used)	40 CFR 63.1505(b)(2)	N/A	Monitoring, recordkeeping, & reporting
Opacity	20% opacity	401 KAR 59:010, Section 3(1)(a)	N/A	Qualitative observations & recordkeeping

Process Description:

Emission Unit	Unit Name	Maximum Capacity (ton/hr)	Control Device	Construction Commenced
026	Scrap Processing Line #1	27.6	Cold Baghouse #1	2022

Emission Unit 026 (EU 026) Scrap Processing Line #1

Description: Shredding line handling large open market, post-industrial automotive, and runaround scrap including debaling, pre-shredding, hammermill shredder, magnet separator, air knife, and eddy current separator. Capable of feeding into the Decoater or a scrap storage bunker. This emission unit is a new aluminum scrap shredder under 40 CFR 63, Subpart RRR.

Applicable Regulation:

401 KAR 51:017, *Prevention of significant deterioration,* applies to PM, PM_{10}, and $PM_{2.5}$.

401 KAR 59:010, *New process operations,* applies to each affected facility, associated with a process operation, which is not subject to another emission standard with respect to particulates, commenced on or after July 2, 1975.

401 KAR 63:002, Section 2(4)(ccc), 40 C.F.R. 63.1500 through 63.1519, Tables 1 through 3, and Appendix A (Subpart RRR), *National Emission Standards for Hazardous Air Pollutants for Secondary Aluminum Production,* applies to each new aluminum scrap shredder, located at a secondary aluminum production facility that is a major source of hazardous air pollutants (HAPs) as defined in 40 CFR 63.2.

Comments:
Emissions for Scrap Processing Line #1 are calculated using the design grain loading for Cold Baghouse

Emission Unit 026 – Scrap Processing Line #1
#1 of 0.002 gr/dscf and flow rate of 319,355 dscfm for the process, and then speciating using the EPA PM Calculator. Uncontrolled (and uncaptured emissions) are calculated by back calculating using an assumed 90% control efficiency and 98% capture efficiency. HAP/Toxic emissions are calculated using a worst case of 80% aluminum fines and assumed alloys being processed and the composition from "International Alloy Designations and Chemical Composition Limits for Wrought Aluminum and Wrought Aluminum Alloys" from the Aluminum Association in January 2015 (a.k.a, "Teal Sheet").

Emission Unit 029 – Decoater				
Pollutant	**Emission Limit or Standard**	**Regulatory Basis for Emission Limit or Standard**	**Emission Factor Used and Basis**	**Compliance Method**
THC (as propane)	0.20 lb/ton w/afterburner	40 CFR 63.1505(e)(1)(i)	0.060 lb/ton; 0.002 gr/dscf	Testing, monitoring, recordkeeping, & reporting
D/F TEQ	$7.0x10^{-5}$ gr/ton w/ afterburner	40 CFR 63.1505(e)(1)(iii)	40 CFR 63, Subpart RRR allowable	Testing, monitoring, recordkeeping, & reporting
HCl	1.50 lb/ton w/afterburner	40 CFR 63.1505(e)(1)(iv)	0.51 lb/ton; Testing of similar units	Testing, monitoring, recordkeeping, & reporting
Opacity	10% opacity (If COM is used)	40 CFR 63.1505(e)(2)	N/A	Monitoring, recordkeeping, & reporting
Opacity	20% opacity	401 KAR 59:010, Section 3(1)(a)	N/A	Qualitative observations & recordkeeping
PM	• P≤0.5 ton/hr: 2.34 lbs/hr • P≤30 ton/hr: $E = 3.59P^{0.62}$	401 KAR 59:010, Section 3(2)	0.060 lb/ton; 0.002 gr/dscf	Monthly calculation, testing, monitoring, & recordkeeping
PM	0.30 lb/ton w/ afterburner	40 CFR 63.1505(e)(1)(ii)	0.060 lb/ton; 0.002 gr/dscf	Testing, monitoring, recordkeeping, & reporting
PM	1.66 lb/hr; 7.26 ton/yr	401 KAR 51:017	0.060 lb/ton; 0.002 gr/dscf	GCOP, testing, monitoring, & recordkeeping
PM_{10}	5.38 lb/hr; 23.58 ton/yr	401 KAR 51:017	0.20 lb/ton; EPA PM Calculator, UPL for condensable portion	GCOP, testing, monitoring, & recordkeeping
$PM_{2.5}$	5.22 lb/hr; 22.86 ton/yr	401 KAR 51:017	0.19 lb/ton; EPA PM Calculator, UPL for condensable portion	GCOP, testing, monitoring, & recordkeeping
CO	7.73 lb/hr; 33.87 tons/yr	401 KAR 51:017	0.28 lb/ton & 37.0 lb/MMscf; Similar facility testing & vendor estimates	GCOP, testing, monitoring, & recordkeeping
NOx	8.82 lb/hr; 38.63 tons/yr	401 KAR 51:017	0.32 lb/ton; Similar facility BACT	GCOP, testing, monitoring, & recordkeeping
VOC	4.58 lb/hr; 20.04 tons/yr	401 KAR 51:017	0.16 lb/ton; Similar facility testing	GCOP, testing, monitoring, & recordkeeping
GHGs (CO_2e)	52,293 tpy	401 KAR 51:017	304.89 lb/ton & 117,098 lb/MMscf;	GCOP, monitoring, & recordkeeping

Emission Unit 029 – Decoater

			Estimate based on maximum contaminants of feed & 40 CFR 98, Tables C-1 & C-2	

Process Description:

Emission Unit	Unit Name	Maximum Capacity (ton/hr)	Maximum Burner Heat Input Capacity (MMBtu/hr)	Control Device	Construction Commenced
029	Decoater	27.6	30.2	Lime-Injected Hot Baghouse #1; Afterburner	2022

Natural gas-fired rotary decoating kiln used to remove lacquers, oils, water, dust, and fines from aluminum scrap with the capability to charge to two sidewell melt furnaces or the NDC furnace. Shredder scrap is mainly sourced from Scrap Processing Line #1 but may also be manually fed from shredded scrap storage bunkers. This emission unit is a new scrap dryer/delacquering kiln/decoating kiln under 40 CFR 63, Subpart RRR.

Applicable Regulations:
401 KAR 51:017, *Prevention of significant deterioration of air quality,* applies to PM, PM_{10}, $PM_{2.5}$, CO, NOx, VOC, & GHG.

401 KAR 59:010, *New process operations,* applies to each affected facility, associated with a process operation, which is not subject to another emission standard with respect to particulates, commenced on or after July 2, 1975.

401 KAR 63:002, Section 2(4)(ccc), 40 C.F.R. 63.1500 to 63.1519, Tables 1 through 3, and Appendix A (Subpart RRR), *National Emission Standards for Hazardous Air Pollutants for Secondary Aluminum Production*, applies to each new scrap dryer/delacquering kiln/decoating kiln, located at a secondary aluminum production facility that is a major source of hazardous air pollutants (HAPs) as defined in 40 CFR 63.2.

Comments:
Emissions calculated for natural gas consumption using AP-42, Chapter 1.4, Vendor estimates, and 40 CFR 98, Tables C-1 and C-2. Emissions calculated from aluminum metal production using the design grain loading for the baghouse, and allocating the flow for the process (96,734 dscfm), and speciating using the EPA PM Calculator. HCl emission calculations are based on similar facility stack testing. CO emission calculations are based on similar facility stack testing. Metal HAPs calculated using the RTR Modeling Docket Memo.

Emission Group 7 – Group 1 Furnaces and In-Line Degasser				
Pollutant	**Emission Limit or Standard**	**Regulatory Basis for Emission Limit or Standard**	**Emission Factor Used and Basis**	**Compliance Method**
D/F TEQ	EU030, EU031, & EU032: 2.1x10^{-4} gr/ton	40 CFR 63.1505(i)(3)	40 CFR 63, RRR allowable	Testing, monitoring, recordkeeping, & reporting
HCl	EU030, EU031, EU032, & EU034: 0.40 lb/ton or 10% of uncontrolled emissions	40 CFR 63.1505(i)(4)	For EU030, EU031, & EU032: 0.10 lb/ton; For EU034: 0.30 lb/ton; Testing of similar units	Testing, monitoring, recordkeeping, & reporting
	EU036: 0.04 lb/ton	40 CFR 63.1505(j)(1)	0.04 lb/ton; 40 CFR 63, Subpart RRR Allowable	
Opacity	10% opacity (if using COM)	40 CFR 63.1505(i)(5)	N/A	Testing, monitoring, recordkeeping, & reporting
Opacity	20% opacity	401 KAR 59:010, Section 3(1)(a)	N/A	Monitoring & recordkeeping
PM	• P≤0.5 ton/hr: 2.34 lbs/hr • P≤30 ton/hr: $E = 3.59P^{0.62}$ • P>30 ton/hr: $E = 17.3P^{0.16}$	401 KAR 59:010, Section 3(2)	Grain loading design basis; 40 CFR 63, Subpart RRR allowable; refer to comments	Monthly calculation, testing, monitoring, & recordkeeping
PM	EU030, EU031, EU032, & EU034: 0.40 lb/ton	40 CFR 63.1505(i)(1)	Grain loading design basis; 40 CFR 63, Subpart RRR allowable; refer to comments	Testing, monitoring, recordkeeping, & reporting
	EU036: 0.01 lb/ton	40 CFR 63.1505(j)(2)		
PM	EU030: 0.077 lb/ton; 4.86 ton/yr	401 KAR 51:017	Grain loading design basis; 40 CFR 63, Subpart RRR allowable; refer to comments	GCOP, testing, monitoring & recordkeeping
	EU031: 0.077 lb/ton; 4.86 ton/yr			
	EU032: 0.11 lb/ton; 8.08 ton/yr			
	EU034: 0.036 lb/ton; 6.66 ton/yr			
	EU036: 0.010 lb/ton; 1.83 ton/yr			
PM_{10}	EU030: 0.18 lb/ton; 11.61 ton/yr	401 KAR 51:017	TRC report; testing of similar units; EPA PM Calculator	GCOP, testing, monitoring & recordkeeping
	EU031: 0.18 lb/ton; 11.61 ton/yr			
	EU032: 0.21 lb/ton; 15.15 ton/yr			
	EU034: 0.044 lb/ton; 8.05 ton/yr			

Emission Group 7 – Group 1 Furnaces and In-Line Degasser				
	EU036: 0.005 lb/ton; 0.97 ton/yr			
$PM_{2.5}$	EU030: 0.16 lb/ton; 8.09 ton/yr; 1.848 lb/hr	401 KAR 51:017	TRC report; testing of similar units; EPA PM Calculator	GCOP, testing, monitoring & recordkeeping (daily for EU 030, EU 031, and EU 032)
	EU031: 0.16 lb/ton; 8.09 ton/yr; 1.848 lb/hr			
	EU032: 0.17 lb/ton; 10.08 ton/yr; 2.302 lb/hr			
	EU034: 0.042 lb/ton; 7.65 ton/yr			
	EU036: 0.002 lb/ton; 0.37 ton/yr			
CO	EU030: 0.44 lb/ton; 27.79 tons/yr	401 KAR 51:017	For EU030, EU031, & EU032: 0.22 lb/ton; Similar facility testing; & 84 lb/MMscf; AP-42 Table 1.4-1; For EU034: 84.0 lb/MMscf; AP-42 Table 1.4-1	GCOP, testing, monitoring & recordkeeping
	EU031: 0.44 lb/ton; 27.79 tons/yr			
	EU032: 0.52 lb/ton; 33.42 tons/yr			
	EU034: 0.060 lb/ton; 11.04 tons/yr			
NOx	EU030: 0.45 lb/ton; 28.23 tons/yr	401 KAR 51:017	For EU030 & EU031: 0.16 lb/ton; Similar facility testing; & 109.3 lb/MMscf; Vendor Specification; For EU032: 0.16 lb/ton; Similar facility testing; & 163.59 lb/MMscf Vendor specification; For EU034: 62.5 lb/MMscf; Vendor Specification	GCOP, testing, monitoring & recordkeeping
	EU031: 0.45 lb/ton; 28.23 tons/yr			
	EU032: 0.75 lb/ton; 45.64 tons/yr			
	EU034: 0.045 lb/ton; 8.21 tons/yr			
VOC	EU030: 0.23 lb/ton; 14.72 tons/yr	401 KAR 51:017	For EU030, EU031, &EU032: 0.22 lb/ton; Similar facility testing; & 5.5 lb/MMscf; AP-42 Table 1.4-1; For EU034: 0.031 lb/ton; Similar facility BACT	GCOP, testing, monitoring & recordkeeping
	EU031: 0.23 lb/ton; 14.72 tons/yr			
	EU032: 0.24 lb/ton; 17.07 tons/yr			
	EU034: 0.031 lb/ton; 5.69 tons/yr			
GHGs (CO_2e)	EU030: 19,490 tpy	401 KAR 51:017	40 CFR 98, Tables C-1 and C-2	GCOP, monitoring, recordkeeping
	EU031: 19,490 tpy			
	EU032: 46,454 tpy			
	EU034: 15,387 tpy			

Emission Group 7 – Group 1 Furnaces and In-Line Degasser

Process Description:
Emission Unit 030 (EU 030) Sidewell Melting Furnace #1
Emission Unit 031 (EU 031) Sidewell Melting Furnace #2
Emission Unit 032 (EU 032) Novelis Dual Chamber (NDC) Recycling Furnace
Description: Each furnace receives decoated aluminum scrap directly from the decoater via a scrap conveyer and supports solid reactive fluxing. Charge materials can be automatically or manually fed to the sidewell of each furnace. These emission units are new Group 1 furnaces under 40 CFR 63, Subpart RRR.

Emission Unit 034 (EU 034) Holding Furnace #1
Description: Molten aluminum produced in the melting furnaces is troughed to the holding furnace for further alloying and metal purification activities prior to casting. Once completed, molten metal is transported from the holding furnace through an in-line degasser for fluxing prior to casting. This emission unit processes only clean charge in the form of molten aluminum but uses reactive fluxing and is therefore a new Group 1 furnace under 40 CFR 63, Subpart RRR.

Emission Unit 036 (EU 036) In-Line Degasser
Description: Chlorine gas is used as a final metal conditioning step prior to casting. This emission unit is a new In-Line Fluxer under 40 CFR 63, Subpart RRR.

Emission Unit	Unit Name	Maximum Capacity (ton/hr)	Maximum Burner Heat Input Capacity (MMBtu/hr)	Control Device	Construction Commenced
030	Sidewell Melting Furnace #1	14.3	38.0	Lime-Injected Hot Baghouse #2	2022
031	Sidewell Melting Furnace #2	14.3	38.0	Lime-Injected Hot Baghouse #2	2022
032	NDC Recycling Furnace	16.5	59.3	Lime-Injected Hot Baghouse #3	2022
034	Holding Furnace #1	41.9	30.0	Lime-Injected Hot Baghouse #4	2022
036	In-Line Degasser	41.9	N/A	Lime-Injected Hot Baghouse #4	2022

Applicable Regulations:
401 KAR 51:017, *Prevention of significant deterioration of air quality,* applies to PM, PM_{10}, $PM_{2.5}$, CO, NOx, VOC, & GHG.

401 KAR 59:010, *New process operations,* applies to each affected facility, associated with a process operation, which is not subject to another emission standard with respect to particulates, commenced on or after July 2, 1975.

401 KAR 63:002, Section 2(4)(ccc), 40 C.F.R. 63.1500 to 63.1519, Tables 1 through 3, and Appendix A (Subpart RRR), *National Emission Standards for Hazardous Air Pollutants for Secondary Aluminum Production*, applies to each new secondary aluminum processing unit (SAPU), located at a secondary aluminum production facility that is a major source of hazardous air pollutants (HAPs) as defined in 40 CFR 63.2.

Emission Group 7 – Group 1 Furnaces and In-Line Degasser
Comments: For Sidewell Melting Furnaces #1 & #2: Emissions calculated for natural gas consumption using AP-42, Chapter 1.4, Vendor estimates, and 40 CFR 98, Tables C-1 and C-2. Emissions calculated from aluminum metal production using the design grain loading for the baghouse and allocating the flow for the process (64,677 dscfm), and then speciating using the TRC Report for "Side-well Furnace with Baghouse" and the UPL from similar facility testing for condensable portions. HF emissions calculated using a max wt% of fluoride in the salt flux used of 2.71%, and an injection rate of 40.0 lb of salt flux/ton of aluminum. Metal HAPs calculated using the RTR Modeling Docket Memo. For the NDC Furnace: Emissions calculated for natural gas consumption using AP-42, Chapter 1.4, Vendor estimates, and 40 CFR 98, Tables C-1 and C-2. Emissions calculated from aluminum metal production using the design grain loading for the baghouse and allocating the flow for the process (107,667 dscfm), and then speciating using the TRC Report for "Side-well Furnace with Baghouse" and the UPL from similar facility testing for condensable portions. HF emissions calculated using a max wt% of fluoride in the salt flux of 2.71%, and an injection rate of 40.0 lb of salt flux/ton of aluminum. Metal HAPs calculated using the RTR Modeling Docket Memo. Facility requested 416.4 MMscf/yr natural gas usage limitation. For Holding Furnace #1: Emissions calculated for natural gas consumption using AP-42, Chapter 1.4, Vendor estimates, and 40 CFR 98, Tables C-1 and C-2. Emissions calculated from aluminum metal production using the design grain loading for the baghouse and allocating the flow for the process (88,756 dscfm), and then speciating using the TRC Report for "Box Furnace Stack (5M3)" and the UPL from similar facility testing for condensable portions. HF emissions calculated using a max wt% of fluoride in the salt flux of 2.71%, and an injection rate of 0.68 lb of salt flux/ton of aluminum. Metal HAPs calculated using the RTR Modeling Docket Memo. For the In-Line Degasser: Emissions are calculated using the 40 CFR 63, Subpart RRR allowable for PM and HCl, and the EPA PM Calculator for PM_{10}, and $PM_{2.5}$.

Emission Unit 033 – Front-Load Tilting Melting Furnace				
Pollutant	**Emission Limit or Standard**	**Regulatory Basis for Emission Limit or Standard**	**Emission Factor Used and Basis**	**Compliance Method**
Opacity	20% opacity	401 KAR 59:010, Section 3(1)(a)	N/A	Qualitative observations & recordkeeping
PM	• P≤0.5 ton/hr: 2.34 lbs/hr • P≤30 ton/hr: $E = 3.59P^{0.62}$	401 KAR 59:010, Section 3(2)	0.030 lb/ton; 0.002 gr/dscf	Monthly calculation, testing, monitoring, & recordkeeping
PM	0.02 lb/ton; 2.16 ton/yr	401 KAR 51:017	0.030 lb/ton; 0.002 gr/dscf	GCOP, testing, monitoring & recordkeeping
PM_{10}	0.07 lb/ton; 8.72 ton/yr	401 KAR 51:017	0.083 lb/ton; TRC report, similar facility testing	GCOP, testing, monitoring & recordkeeping
$PM_{2.5}$	0.07 lb/ton;	401 KAR 51:017	0.081 lb/ton; TRC	GCOP, testing, daily

Emission Unit 033 – Front-Load Tilting Melting Furnace				
	6.04 ton/yr; 1.380 lb/hr		report, similar facility testing	monitoring & recordkeeping
CO	0.22 lb/ton; 26.70 tons/yr	401 KAR 51:017	0.02 lb/ton & 84.0 lb/MMscf; similar facility testing & AP-42 Table 1.4-1	GCOP, testing, monitoring & recordkeeping
NOx	0.57 lb/ton; 32.21 tons/yr	401 KAR 51:017	0.005 lb/ton & 109.27 lb/MMscf; similar facility testing & vendor estimate	GCOP, testing, monitoring & recordkeeping
VOC	0.08 lb/ton; 10.17 tons/yr	401 KAR 51:017	0.058 lb/ton & 10.92 lb/MMscf; similar facility testing & vendor estimate	GCOP, testing, monitoring & recordkeeping
GHGs (CO_2e)	33,851 tpy	401 KAR 51:017	40 CFR 98, Tables C-1 and C-2	GCOP, monitoring & recordkeeping

Process Description:

Emission Unit	**Unit Name**	**Maximum Capacity (ton/hr)**	**Maximum Burner Heat Input Capacity (MMBtu/hr)**	**Control Device**	**Construction Commenced**
033	Front-Load Tilting Melting Furnace	27.6	66.0	Lime-Injected Hot Baghouse #3	2022

Receives runaround scrap and prime charge (clean) via a charge transfer car only and does not support reactive fluxing. This emission unit is therefore considered a new group 2 furnace as defined in 40 CFR 63, Subpart RRR.

Applicable Regulations:
401 KAR 51:017, *Prevention of significant deterioration,* applies to PM, PM_{10}, $PM_{2.5}$, CO, NOx, VOC, & GHG.

401 KAR 59:010, *New process operations,* applies to each affected facility, associated with a process operation, which is not subject to another emission standard with respect to particulates, commenced on or after July 2, 1975.

401 KAR 63:002, Section 2(4)(ccc), 40 C.F.R. 63.1500 through 63.1519, Tables 1 through 3, and Appendix A (Subpart RRR), *National Emission Standards for Hazardous Air Pollutants for Secondary Aluminum Production*, applies to each new group 2 furnace, located at a secondary aluminum production facility that is a major source of hazardous air pollutants (HAPs) as defined in 40 CFR 63.2.

Comments:
Emissions calculated for natural gas consumption using AP-42, Chapter 1.4, Vendor estimates, and 40 CFR 98, Tables C-1 and C-2. Emissions calculated from aluminum metal production using the design grain loading for the baghouse, and allocating the flow for the process (28,733 dscfm), and then speciating using the TRC Report for “Box Furnace Stack (5M3)”.

Emission Group 8 – Dross Processing and Cutting Operations				
Pollutant	**Emission Limit or Standard**	**Regulatory Basis for Emission Limit or Standard**	**Emission Factor Used and Basis**	**Compliance Method**
Opacity	20% opacity	401 KAR 59:010, Section 3(1)(a)	N/A	Monitoring, recordkeeping
PM	• P ≤0.5 ton/hr: 2.34 lbs/hr • P≤30 ton/hr: $E = 3.59P^{0.62}$	401 KAR 59:010, Section 3(2)	Refer to comments	Assumed when complying with BACT limits
PM	EU038: 2.72 lb/hr; 11.91 ton/yr EU045: 0.022 lb/hr; 0.10 ton/yr	401 KAR 51:017	Refer to comments	GWP, monitoring & recordkeeping, and testing for EU038
PM_{10}	EU038: 2.56 lb/hr; 11.19 ton/yr EU045: 0.022 lb/hr; 0.10 ton/yr	401 KAR 51:017	Refer to comments	GWP, monitoring & recordkeeping, and testing for EU038
$PM_{2.5}$	EU038: 2.12 lb/hr (3-hr avg); 5.57 ton/yr; 1.272 lb/hr (24-hr avg) EU045: 0.022 lb/hr; 0.10 ton/yr	401 KAR 51:017	Refer to comments	GWP, monitoring & recordkeeping (daily for EU038), and testing for EU038
VOC	EU045: 0.99 lb/hr; 4.34 tons/yr	401 KAR 51:017	Refer to comments	GWP, monitoring & recordkeeping

Process Description:
Emission Unit 038 (EU 038) Dross House
<u>Description</u>: Dross produced in the melting furnaces, holding furnace, and in-line degasser is collected and transported to the dross processing building where dross is cooled, stored, loaded into trucks, and sold.

Emission Unit 045 (EU 045) Ingot Saw
<u>Description</u>: One ingot saw to cut reject ingots into smaller pieces for recycling through the melting furnaces or cutting the heads and tails off of cast ingots before shipping to downstream rolling mills. Equipped with an integral cyclone and vents to a dedicated filtration unit.

Emission Unit	Unit Name	Maximum Capacity (ton/hr)	Control Device	Construction Commenced
038	Dross House	2.5	Dross House Baghouse	2022
045	Ingot Saw	72.3	Cyclone/Filtration Unit	2024

Applicable Regulations:
401 KAR 51:017, *Prevention of significant deterioration,* applies to PM, PM_{10}, $PM_{2.5}$.

401 KAR 59:010, *New process operations*, applies to each affected facility, associated with a process operation, which is not subject to another emission standard with respect to particulates, commenced on or

Emission Group 8 – Dross Processing and Cutting Operations
after July 2, 1975. **State-Origin Requirements:** **401 KAR 63:020,** *Potentially hazardous matter of toxic substances*, applies to EU045. **Comments:** Emissions for the Dross House are calculated using AP-42, Chapter 11.7 for uncontrolled emissions (and uncaptured emissions) and controlled emissions are calculated using the design grain loading for Dross House Baghouse (formerly Cold Baghouse #3) of 0.002 gr/dscf and allocating the flow for the process (158,561 dscfm), and then speciating using the EPA PM Calculator. The Dross House is maintained under negative pressure to minimize any uncaptured emissions. Emissions for the Ingot Saw are calculated using design specifications for the integral filtration unit and ingot processing rate. VOC emissions estimated assuming 100% volatilization of applied lubrication at design application rate.

Emission Group 9 – Direct and Small Indirect-Fired Heating Units

Pollutant	Emission Limit or Standard	Regulatory Basis for Emission Limit or Standard	Emission Factor Used and Basis	Compliance Method
Opacity	20% opacity	401 KAR 59:010, Section 3(1)(a)	N/A	Assumed when burning natural gas
PM	• P≤0.5 ton/hr: 2.34 lbs/hr • P≤30 ton/hr: $E = 3.59P^{0.62}$	401 KAR 59:010, Section 3(2)	1.9 lb/MMscf; AP-42 Table 1.4-2	Assumed when burning natural gas
PM	EU037: 0.03 lb/hr; 0.13 ton/yr EU041a: 0.03 lb/hr; 0.12 ton/yr EU041b: 0.01 lb/hr; 0.05 ton/yr EU046b: 0.007 lb/hr; 0.032 ton/yr	401 KAR 51:017	1.9 lb/MMscf; AP-42 Table 1.4-2	GCOP, monitoring & recordkeeping
PM_{10}	EU037: 0.06 lb/hr; 0.30 ton/yr EU041a: 0.05 lb/hr; 0.23 ton/yr EU041b: 0.02 lb/hr; 0.09 ton/yr EU046b: 0.013 lb/hr; 0.057 ton/yr	401 KAR 51:017	3.5 lb/MMscf; AP-42 Table 1.4-2 & EPA SPECIATE Database	GCOP, monitoring & recordkeeping
$PM_{2.5}$	EU037: 0.06 lb/hr; 0.24 ton/yr EU041a: 0.05 lb/hr; 0.23 ton/yr	401 KAR 51:017	3.5 lb/MMscf; AP-42 Table 1.4-2 & EPA SPECIATE Database	GCOP, monitoring & recordkeeping

Emission Group 9 – Direct and Small Indirect-Fired Heating Units				
	EU041b: 0.02 lb/hr; 0.09 ton/yr			
	EU046b: 0.013 lb/hr; 0.057 ton/yr			
CO	EU037: 2.37 lb/hr; 10.37 ton/yr	401 KAR 51:017	148.0 lb/MMscf; Vendor specification	GCOP, monitoring & recordkeeping
	EU041a: 1.24 lb/hr; 5.45 ton/yr		84.0 lb/MMscf; AP-42 Table 1.4-1	
	EU041b: 0.48 lb/hr; 2.09 ton/yr			
	EU046b: 0.32 lb/hr; 1.40 ton/yr			
NOx	EU037: 1.74 lb/hr; 7.64 ton/yr	401 KAR 51:017	109.0 lb/MMscf; Vendor specification	GCOP, monitoring & recordkeeping
	EU041a: 1.48 lb/hr; 6.49 ton/yr		100.0 lb/MMscf; AP-42 Table 1.4-1	
	EU041b: 0.57 lb/hr; 2.48 ton/yr			
	EU046b: 0.29 lb/hr; 1.26 ton/yr		75.99 lb/MMscf; Vendor specification	
VOC	EU037: 0.09 lb/hr; 0.39 ton/yr	401 KAR 51:017	5.5 lb/MMscf; AP-42 Table 1.4-2	GCOP, monitoring & recordkeeping
	EU041a: 0.08 lb/hr; 0.36 ton/yr			
	EU041b: 0.03 lb/hr; 0.14 ton/yr			
	EU046b: 0.021 lb/hr; 0.092 ton/yr			
GHGs (CO_2e)	EU037: 8,206 tpy	401 KAR 51:017	117,098 lb/MMscf; 40 CFR 98, Tables C-1 and C-2	GCOP, monitoring & recordkeeping
	EU041a: 7,793 tpy			
	EU041b: 2,984 tpy			
	EU046b: 2,000 tpy			

Process Description:
Emission Unit 037 (EU037) Sow Dryer

Description: Natural gas-fired drier preheats aluminum sows and other forms of hard "clean charge" prior to manually feeding into the furnaces.

Emission Unit 041a (EU041a) Direct-Fired Building Heating Systems
Emission Unit 041b (EU041b) Indirect-Fired Building Heating Systems ≤ 1 MMBtu

Description: 59 building heating units across 10 different buildings/process areas designed for comfort with no direct discharge to atmosphere. Includes 53 direct-fired units and 6 indirect-fired units ≤ 1 MMBtu/hr. Maximum individual heating rate input for EU041a is 2.58 MMBtu/hr.

Emission Unit 046a (EU 046a) CFF Preheater

Emission Group 9 – Direct and Small Indirect-Fired Heating Units

Emission Unit 046b (EU 046b) DBF Preheater

Description: Ceramic foam filter (CFF) and deep bed filter (DBF) preheaters for ensuring that temperatures are maintained within acceptable ranges during the transfer between the holding furnace and casting machine. The CFF Preheater is not equipped with a stack and discharges combustion emissions inside of the building.

Emission Unit	Unit Name	Maximum Capacity (ton/hr)	Maximum Burner Heat Input Capacity (MMBtu/hr)	Control Device	Construction Commenced
037	Sow Dryer	15.87	16.0	None	2022
041a	Direct-Fired Building Heating Systems	-	14.81 (total)	None	2022
041b	Indirect-Fired Building Heating Systems ≤ 1 MMBtu	-	5.67 (total)	None	2022
046a	CFF Preheater	-	0.32	None	2024
046b	DBF Preheater	-	3.8	None	2024

Applicable Regulations:

401 KAR 51:017, *Prevention of significant deterioration,* applies to PM, PM_{10}, $PM_{2.5}$, CO, NOx, VOC, & GHG.

401 KAR 59:010, *New process operations,* applies to each affected facility, associated with a process operation, which is not subject to another emission standard with respect to particulates, commenced on or after July 2, 1975.

State-Origin Requirements:

401 KAR 63:020, *Potentially hazardous matter or toxic substances*

Comments:

Emissions calculated using AP-42, Chapter 1.4, vendor specifications, 40 CFR 98, Subpart C, and a HHV for natural gas of 1,000 Btu/scf. The metal processing capacity is based on 119.0 tons Al/batch, 7.5 hours/batch.

EU 037 is equipped with a line-type burner that is designed to meet a NO_x emission limit of 0.109 lb/MMBtu and certified to meet the ANSI Z83.4 / CGA 3.7 standard of 0.50 ppm NO_x when the burner combustion byproduct emissions are mixed with the process air. This design constitutes "low NO_x" for this specific style of burner, despite having an emission factor higher than typical AP-42 values for natural gas combustion, due to the consideration of energy and thermal efficiency. Though the short-term potential NO_x emissions are higher, overall NO_x emissions with this design are lower due to decreased fuel usage.

Emission Unit 042 – Hot Baghouse Lime Silos #1, #2, & #3				
Pollutant	**Emission Limit or Standard**	**Regulatory Basis for Emission Limit or Standard**	**Emission Factor Used and Basis**	**Compliance Method**
Opacity	20% opacity	401 KAR 59:010, Section 3(1)(a)	N/A	Qualitative observations & recordkeeping
PM	2.34 lb/hr	401 KAR 59:010, Section 3(2)	0.0071 lb/ton; 0.010 gr/dscf	Assumed when complying with BACT limits
PM	0.0016 lb/hr; 0.007 ton/yr	401 KAR 51:017	0.0071 lb/ton; 0.010 gr/dscf	Monitoring & recordkeeping
PM_{10}	0.0016 lb/hr; 0.007 ton/yr	401 KAR 51:017	0.0071 lb/ton; 0.010 gr/dscf	Monitoring & recordkeeping
$PM_{2.5}$	0.0016 lb/hr; 0.007 ton/yr	401 KAR 51:017	0.0071 lb/ton; 0.010 gr/dscf	Monitoring & recordkeeping

Process Description:

Emission Unit	Unit Name	Maximum Capacity (ton/hr)	Control Device	Construction Commenced
042	Hot Baghouse Lime Silos #1, #2, & #3	0.225	Bin Vent Filters	2022

Storage silos for supplying alkaline reagent to the baghouses. Silos are pneumatically loaded via truck and equipped with a bin vent filter.

Applicable Regulations:
401 KAR 51:017, *Prevention of significant deterioration*, applies to PM, PM_{10}, and $PM_{2.5}$.

401 KAR 59:010, *New process operations*, applies to each affected facility, associated with a process operation, which is not subject to another emission standard with respect to particulates, commenced on or after July 2, 1975.

Comments:
Emissions calculated using the grain loading design value for the bin vent filters of 0.010 gr/dscf and a flow rate of 1.35 dscfm. Because the applicant did not provide information otherwise, it is assumed that PM, PM_{10}, and $PM_{2.5}$ are all equal.

Emission Unit 043 – Cooling Tower #1				
Pollutant	**Emission Limit or Standard**	**Regulatory Basis for Emission Limit or Standard**	**Emission Factor Used and Basis**	**Compliance Method**
Opacity	20% opacity	401 KAR 59:010, Section 3(1)(a)	N/A	Qualitative observations & recordkeeping
PM	• P≤0.5 ton/hr: 2.34 lbs/hr • P≤30 ton/hr: $E = 3.59P^{0.62}$ • P>30 ton/hr: $E = 17.3P^{0.16}$	401 KAR 59:010, Section 3(2)	0.0834 lb/MMgal; 0.001% drift loss, 1,000 ppm TDS	Assumed when complying with BACT limits
PM	0.024 lb/hr; 0.11 ton/yr	401 KAR 51:017	0.084 lb/MMgal; 0.001% drift loss, 1,000 ppm TDS	Monitoring & recordkeeping
PM_{10}	0.011 lb/hr; 0.05 ton/yr	401 KAR 51:017	0.039 lb/MMgal; Reisman Frisbie	Monitoring & recordkeeping
$PM_{2.5}$	0.00006 lb/hr; 0.0002 ton/yr	401 KAR 51:017	0.0002 lb/MMgal; Reisman Frisbie	Monitoring & recordkeeping

Process Description:

Emission Unit	Unit Name	Maximum Capacity (MMgal/hr)	Control Device	Construction Commenced
043	Cooling Tower #1	0.288	Mist Eliminator	2022

Four-cell mechanical draft cooling tower to provide cooled water to the casting machine.

Applicable Regulations:
401 KAR 51:017, *Prevention of significant deterioration*, applies to PM, PM_{10}, and $PM_{2.5}$.

401 KAR 59:010, *New process operations*, applies to each affected facility, associated with a process operation, which is not subject to another emission standard with respect to particulates, commenced on or after July 2, 1975.

Precluded Regulations:
401 KAR 63:002, Section 2(4)(j), 40 C.F.R. 63.400 to 63.407, Table 1 (Subpart Q), *National Emission Standards for Hazardous Air Pollutants for Industrial Process Cooling Towers*, precluded by prohibiting the use of chromium-based water treatment chemicals in the cooling towers.

Comments:
Emissions calculated using the vendor design specification for the mist eliminator of 0.001% drift loss and 1,000 ppm TDS, and Reisman-Frisbie interpolation. The cooling tower may not use chromium based water treatment chemicals to preclude 40 CFR 63, Subpart Q.

Emission Unit 044 – Diesel Fuel Storage and Refueling Station

Process Description:

Emission Unit	Unit Name	Maximum Capacity (gal/yr)	Control Device	Construction Commenced
044	Diesel Fuel Storage and Refueling Station	85,000	None	2022

A 3000-gallon capacity diesel fuel storage tank for various mobile equipment and maintenance operations.

Applicable Regulations:
401 KAR 51:017, *Prevention of significant deterioration*, applies to VOC.

Comments:
Emissions calculated using AP-42 Section 5.2 and TankESP.

SECTION 3 – EMISSIONS, LIMITATIONS AND BASIS (CONTINUED)

Testing Requirements\Results

Emission Unit(s)	Control Device	Parameter	Regulatory Basis	Frequency	Test Method	Permit Limit	Test Result	Thruput and Operating Parameter(s) Established During Test	Activity Graybar	Date of last Compliance Testing
026	CBH #1	PM	401 KAR 51:017; 40 CFR 63.1505(b)	Initial & Every 5 yr	Method 5, 201A	0.010 gr/dscf; 5.47 lb/hr	TBD	TBD	TBD	TBD
		PM_{10}				2.79 lb/hr				
		$PM_{2.5}$				0.82 lb/hr				
029	HBH #1	PM	401 KAR 51:017; 40 CFR 63.1505(e)	Initial & Every 5 yr	Method 5, 201A/202	0.30 lb/ton; 1.66 lb/hr	TBD	TBD	TBD	TBD
		PM_{10}				5.38 lb/hr				
		$PM_{2.5}$				5.22 lb/hr				
		CO	401 KAR 51:017	Initial & Every 5 yr	Method 10	7.73 lb/hr	TBD	TBD	TBD	TBD
		NOx	401 KAR 51:017	Initial & Every 5 yr	Method 7E	8.82 lb/hr	TBD	TBD	TBD	TBD
		VOC	401 KAR 51:017	Initial & Every 5 yr	Method 25A	4.58 lb/hr	TBD	TBD	TBD	TBD
		THC (as propane)	40 CFR 63.1505(e)	Initial & Every 5 yr	Method 25A	0.20 lb/ton	TBD	TBD	TBD	TBD
		D/F	40 CFR 63.1505(e)	Initial & Every 5 yr	Method 23	$7.0x10^{-5}$ gr/ton	TBD	TBD	TBD	TBD
		HCl	40 CFR 63.1505(e)	Initial & Every 5 yr	Method 26A	1.50 lb/ton	TBD	TBD	TBD	TBD
030	HBH #2	PM	401 KAR 51:017;	Initial & Every 5 yr	Method 5, 201A/202	0.40 lb/ton; 0.077 lb/ton	TBD	TBD	TBD	TBD

Emission Unit(s)	Control Device	Parameter	Regulatory Basis	Frequency	Test Method	Permit Limit	Test Result	Thruput and Operating Parameter(s) Established During Test	Activity Graybar	Date of last Compliance Testing
		PM_{10}	40 CFR 63.1505(i)			0.18 lb/ton				
		$PM_{2.5}$				0.16 lb/ton				
		CO	401 KAR 51:017	Initial & Every 5 yr	Method 10	0.44 lb/ton				
		NOx	401 KAR 51:017	Initial & Every 5 yr	Method 7E	0.45 lb/ton				
		VOC	401 KAR 51:017	Initial & Every 5 yr	Method 25A	0.23 lb/ton				
		D/F	40 CFR 63.1505(i)	Initial & Every 5 yr	Method 23	$2.1x10^{-4}$ gr/ton				
		HCl	40 CFR 63.1505(i)	Initial & Every 5 yr	Method 26A	0.40 lb/ton or 10% of uncontrolled				
031	HBH #2	PM	401 KAR 51:017; 40 CFR 63.1505(i)	Initial & Every 5 yr	Method 5, 201A/202	0.40 lb/ton; 0.077 lb/ton	TBD	TBD	TBD	TBD
		PM_{10}				0.18 lb/ton				
		$PM_{2.5}$				0.16 lb/ton				
		CO	401 KAR 51:017	Initial & Every 5 yr	Method 10	0.44 lb/ton				
		NOx	401 KAR 51:017	Initial & Every 5 yr	Method 7E	0.45 lb/ton				
		VOC	401 KAR 51:017	Initial & Every 5 yr	Method 25A	0.23 lb/ton				
		D/F	40 CFR 63.1505(i)	Initial & Every 5 yr	Method 23	$2.1x10^{-4}$ gr/ton				
		HCl	40 CFR 63.1505(i)	Initial & Every 5 yr	Method 26A	0.40 lb/ton or 10% of uncontrolled				

Emission Unit(s)	Control Device	Parameter	Regulatory Basis	Frequency	Test Method	Permit Limit	Test Result	Thruput and Operating Parameter(s) Established During Test	Activity Graybar	Date of last Compliance Testing
032	HBH #3	PM	401 KAR 51:017; 40 CFR 63.1505(i)	Initial & Every 5 yr	Method 5, 201A/202	0.40 lb/ton; 0.11 lb/ton	TBD	TBD	TBD	TBD
		PM_{10}				0.21 lb/ton				
		$PM_{2.5}$				0.17 lb/ton				
		CO	401 KAR 51:017	Initial & Every 5 yr	Method 10	0.46 lb/ton				
		NOx	401 KAR 51:017	Initial & Every 5 yr	Method 7E	0.63 lb/ton				
		VOC	401 KAR 51:017	Initial & Every 5 yr	Method 25A	0.24 lb/ton				
		D/F	40 CFR 63.1505(i)	Initial & Every 5 yr	Method 23	$2.1x10^{-4}$ gr/ton				
		HCl	40 CFR 63.1505(i)	Initial & Every 5 yr	Method 26A	0.40 lb/ton or 10% of uncontrolled				
033	HBH #3	PM	401 KAR 51:017	Initial & Every 5 yr	Method 5, 201A/202	0.02 lb/ton	TBD	TBD	TBD	TBD
		PM_{10}				0.07 lb/ton	TBD	TBD	TBD	TBD
		$PM_{2.5}$				0.07 lb/ton	TBD	TBD	TBD	TBD
		CO	401 KAR 51:017	Initial & Every 5 yr	Method 10	0.22 lb/ton	TBD	TBD	TBD	TBD
		NOx	401 KAR 51:017	Initial & Every 5 yr	Method 7E	0.27 lb/ton	TBD	TBD	TBD	TBD
		VOC	401 KAR 51:017	Initial & Every 5 yr	Method 25A	0.08 lb/ton	TBD	TBD	TBD	TBD
034	HBH #4	PM	401 KAR 51:017; 40 CFR 63.1505(i)	Initial & Every 5 yr	Method 5, 201A/202	0.40 lb/ton; 0.036 lb/ton	0.014 lb/ton	27.0 tons/hr	CMN20250001	10/28/25-10/30/25
		PM_{10}				0.044 lb/ton	0.013 lb/ton			

Emission Unit(s)	Control Device	Parameter	Regulatory Basis	Frequency	Test Method	Permit Limit	Test Result	Thruput and Operating Parameter(s) Established During Test	Activity Graybar	Date of last Compliance Testing
		$PM_{2.5}$				0.042 lb/ton	0.0074 lb/ton			
		CO	401 KAR 51:017	Initial & Every 5 yr	Method 10	0.060 lb/ton	0.0028 lb/ton			
		NOx	401 KAR 51:017	Initial & Every 5 yr	Method 7E	0.045 lb/ton	0.021 lb/ton			
		VOC	401 KAR 51:017	Initial & Every 5 yr	Method 25A	0.031 lb/ton	0.0019 lb/ton			
		D/F	40 CFR 63.1505(i)	Initial & Every 5 yr	Method 23	$2.1x10^{-4}$ gr/ton	TBD	TBD	TBD	TBD
		HCl	40 CFR 63.1505(i)	Initial & Every 5 yr	Method 26A	0.40 lb/ton or 10% of uncontrolled	$1.8x10^{-4}$ lb/ton	27.0 tons/hr	CMN20250003	10/28/25-10/30/25
036	HBH #4	PM	401 KAR 51:017; 40 CFR 63.1512(j)	Initial & Every 5 yr	Method 5, 201A/202	0.01 lb/ton; 0.010 lb/ton	$1.36x10^{-5}$ lb/ton	61.9 tons/hr	CMN20250001	10/28/25-10/30/25
		PM_{10}				0.005 lb/ton	$5.51x10^{-6}$ lb/ton			
		$PM_{2.5}$				0.002 lb/ton	$4.72x10^{-7}$ lb/ton			
		HCl	40 CFR 63.1512(j)	Initial & Every 5 yr	Method 26A	0.04 lb/ton	$9.7x10^{-9}$ lb/ton	61.9 tons/hr	CMN20250003	10/28/25-10/30/25
037	None	CO	401 KAR 51:017	Initial	Method 10	2.37 lb/hr	0.34 lb/hr	108.1 tons/hr	CMN20250002	10/29/25-10/31/25
		NOx			Method 7E	1.74 lb/hr	0.68 lb/hr			
038	CBH #3	PM	401 KAR 51:017	Initial & Every 5 yr	Method 5, 201A	2.72 lb/hr	1.70 lb/hr	17.2 tons/hr	CMN20250004	10/28/25-10/30/25
		PM_{10}				2.56 lb/hr	1.70 lb/hr			
		$PM_{2.5}$				2.12 lb/hr	1.70 lb/hr			

Emission Unit(s)	**Control Device**	**Parameter**	**Regulatory Basis**	**Frequency**	**Test Method**	**Permit Limit**	**Test Result**	**Thruput and Operating Parameter(s) Established During Test**	**Activity Graybar**	**Date of last Compliance Testing**
						(3-hr avg); 1.272 (24-hr avg)				

Footnotes:

SECTION 4 – SOURCE INFORMATION AND REQUIREMENTS

Table A – Group Requirements:

Emission and Operating Limit	Regulation	Emission Unit
N/A		

Table B – Summary of Applicable Regulations:

Applicable Regulations	Emission Unit
401 KAR 51:017, *Prevention of significant deterioration*, applies to the construction of a new major stationary source or a project at an existing major stationary source that commences construction after September 22, 1982, and located in an area designated attainment or unclassifiable.	EU026, EU029, EU030, EU031, EU032, EU033, EU034, EU036, EU037, EU038, EU041(a,b), EU042, EU043, EU044, EU045, EU046(a,b), EU047, EU048, EU049, EU050
401 KAR 59:010, *New process operations*, applies to each affected facility, associated with a process operation, which is not subject to another emission standard with respect to particulates, commenced on or after July 2, 1975.	EU001, EU002, EU003, EU004, EU005, EU006, EU010, EU023, EU024, EU025, EU026, EU029, EU030, EU031, EU032, EU033, EU034, EU036, EU037, EU038, EU041(a,b), EU042, EU043, EU045, EU046(a,b)
401 KAR 59:015, *New indirect heat exchangers,* applies to indirect heat exchangers having a heat input capacity greater than one (1) million BTU per hour (MMBtu/hr) commenced on or after April 9, 1972.	EU007, EU008, EU009
401 KAR 60:005, Section 2(2)(d), 40 C.F.R. 60.40c through 60.48c (Subpart Dc), *Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units,* applies to each steam generating unit for which construction, modification, or reconstruction is commenced after June 9, 1989 and that has a maximum design heat input capacity of 100 million MMBtu/hr or less, but greater than or equal to 10 MMBtu/hr.	EU007, EU008, EU009
401 KAR 63:010, *Fugitive emissions*, applies to an apparatus, operation, or road which emits or may emit fugitive emissions provided that the fugitive emissions from such facility are not elsewhere subject to an opacity standard within the administrative regulations of the Division for Air Quality.	EU014, EU020, EU051

Applicable Regulations	Emission Unit
401 KAR 63:020, *Potentially hazardous matter or toxic substances*, applies to each affected facility which emits or may emit potentially hazardous matter or toxic substances, provided such emissions are not elsewhere subject to provisions of an administrative regulation of the Division for Air Quality.	EU002, EU003, EU004B, EU016, EU017, EU018, EU024, EU025, EU037, EU041(a,b), EU045, EU046(a,b), EU051
401 KAR 60:005, Section 2(2)(dddd), 40 C.F.R. 60.4200 through 60.4219, Tables 1 through 8 (Subpart IIII) *Standards of Performance for Stationary Compression Ignition Internal Combustion Engines*, applies to stationary compression ignition (CI) internal combustion engines (ICE).	EU012, EU022, EU049, EU050
401 KAR 60:005, Section 2(2)(eeee), 40 C.F.R. 60.4230 through 60.4248, Tables 1 through 4 (Subpart JJJJ) *Standards of Performance for Stationary Spark Ignition Internal Combustion Engines,* applies to stationary spark ignition (SI) internal combustion engines (ICE).	EU011, EU021, EU047, EU048
401 KAR 63:002, Section 2(4)(ccc), 40 C.F.R. 63.1500 through 63.1519, Tables 1 through 3, and Appendix A (Subpart RRR), *National Emission Standards for Hazardous Air Pollutants for Secondary Aluminum Production*, applies to the following affected sources, located at a secondary aluminum production facility that is a major source of hazardous air pollutants (HAPs) as defined in 40 CFR 63.2: • Each new and existing aluminum scrap shredder; • Each new and existing scrap dryer/delacquering kiln/decoating kiln; • Each new and existing group 2 furnace; • Each new and existing secondary aluminum processing unit.	EU026, EU029, EU030, EU031, EU032, EU033, EU034, EU036
401 KAR 63:002, Section 2(4)(eeee), 40 C.F.R. 63.6580 to 63.6675, Tables 1a to 8, and Appendix A (Subpart ZZZZ) *National Emission Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines,* applies to stationary reciprocating internal combustion engines at major or area sources of Hazardous Air Pollutants (HAP)	EU011, EU012, EU021, EU022, EU047, EU048, EU049, EU050
401 KAR 63:002, Section 2(4)(iiii), 40 C.F.R. 63.7480 through 63.7575, Tables 1 through 13 (Subpart DDDDD), *National Emission Standards for Hazardous Air Pollutants for Major Sources: Industrial, Commercial, and Institutional Boilers and Process Heaters*, applies to each industrial, commercial, or institutional boiler or process heater as defined in 40 CFR 63.7575 that is located at, or is part of, a major source of HAPs.	EU005, EU006, EU007, EU008, EU009

Table C - Summary of Precluded Regulations:

Precluded Regulations	Emission Unit
401 KAR 63:002, Section 2(4)(j), 40 C.F.R. 63.400 to 63.407, Table 1 (Subpart Q), *National Emission Standards for Hazardous Air Pollutants for Industrial Process Cooling Towers,* precluded by prohibiting the use of chromium-based water treatment chemicals in the cooling towers.	EU043

Table D - Summary of Non Applicable Regulations:
N/A

Air Toxic Analysis
401 KAR 63:020, *Potentially Hazardous Matter or Toxic Substances*
The Division for Air Quality (Division) has determined based upon the use of natural gas and other pertinent information provided by the applicant that the conditions outlined in this permit will assure compliance with the requirements of 401 KAR 63:020.

Single Source Determination
N/A

SECTION 5 – PERMITTING HISTORY

Permit	Permit Type	Activity #	Complete Date	Issuance Date	Summary of Action	PSD/Syn Minor
S-18-023	Initial	APE20180001	3/22/2018	5/14/2018	Initial Construction Permit	N/A
S-18-023 R1	Revision	APE20190001	7/16/2019	8/18/2019	Updates to reflect changes to project scope	N/A
S-18-023 R2	Revision	APE20210002	6/2/2021	6/13/2021	Change to EU011 and EU021, Changes to Insignificant Activities List, Removal of EU026 from Section B.	N/A
V-22-011	Initial Title V/Title I	APE20210003	2/17/2022	7/25/2022	Initial Title V/PSD Permit for Addition of New Casting Plant	PSD
V-22-011 R1	Significant Revision	APE20230001	10/2/2023	6/7/2024	As-built revision	PSD

SECTION 6 – PERMIT APPLICATION HISTORY

Permit Number: V-22-011 R1 Activities: APE20230001
Received: August 1, 2023 Application Complete Date: October 2, 2023
Permit Action: ☐ Initial ☐ Renewal ☒ Significant Rev ☐ Minor Rev ☐ Administrative
Construction/Modification Requested? ☒Yes ☐No NSR Applicable? ☒Yes ☐No
Previous 502(b)(10) or Off-Permit Changes incorporated with this permit action ☐Yes☒No

Description of Action:
This action revises the scope of the project of the original Title V/PSD permit V-22-011 with as-built design configurations. As such the following emission units have been removed from the scope of the project and the permit:

- EU 027 – Scrap Processing Line #2
- EU 028 – Scrap Sorting Line #1
- EU 035 – Holding Furnace #2
- EU 041c – Indirect-Fired Building Heating Systems > 1 MMBtu

The following emission units have been added to the scope of the project and the permit:

- EU 045 – Ingot Saw
- EU 046a – CFF Preheater
- EU 046b – DBF Preheater

The following emission units, included in the project, experienced changes to maximum capacity, emission factors, control efficiency, stack parameters, or BACT limits:

- EU 020 – Paved Roads: maximum capacity changed from 426.5 VMT/day to 578.1 VMT/day due to rerouting of planned haul roads.
- EU 026 – Scrap Processing Line #1: stack parameters updated.
- EU 029 – Decoater: maximum burner heat input capacity increased from 30.0 MMBtu/hr to 30.2 MMBtu/hr. Associated BACT limits for CO, VOC, and GHGs were updated accordingly.
- EU 030 – Sidewell Melting Furnace #1: stack parameters updated, maximum burner heat input capacity increased from 32.0 MMBtu/hr to 38.0 MMBtu/hr, NOx emission factor decreased from 0.125 lb/MMBtu to 0.109 lb/MMBtu per manufacturer specification. Associated BACT limits for CO, NOx, VOC, and GHGs were updated accordingly.
- EU 031 – Sidewell Melting Furnace #2: stack parameters updated, maximum burner heat input capacity increased from 32.0 MMBtu/hr to 38.0 MMBtu/hr, NOx emission factor decreased from 0.125 lb/MMBtu to 0.109 lb/MMBtu per manufacturer specification. Associated BACT limits for CO, NOx, VOC, and GHGs were updated accordingly.
- EU 032 – NDC Recycling Furnace: stack parameters updated, maximum burner heat input capacity increased from 54.0 MMBtu/hr to 59.3 MMBtu/hr, NOx emission factor increased from 0.143 lb/MMBtu to 0.163 lb/MMBtu per manufacturer specification, the maximum capacity of natural gas usage in this unit is 519.5 MMscf/yr but the facility requested a natural gas usage limit of 416.4 MMscf/yr. Associated BACT limits for PM, PM_{10}, $PM_{2.5}$, CO, NOx, VOC, and GHGs were updated accordingly.
- EU 033 – Front-Load Tilting Melting Furnace: stack parameters updated, maximum capacity increased from 15.0 tons/hr to 27.6 tons/hr, maximum burner heat input capacity decreased from 68.0 MMBtu/hr to 66.0 MMBtu/hr, NOx emission factor decreased from 0.125 lb/MMBtu to 0.11 lb/MMBtu per manufacturer specification, VOC emission factor

increased from 0.006 lb/MMBtu to 0.01092 lb/MMBtu per manufacturer specification. Associated BACT limits for PM, PM_{10}, $PM_{2.5}$, CO, NOx, VOC, and GHGs were updated accordingly.

- EU 034 – Holding Furnace #1: stack parameters updated. Associated BACT limits for PM, PM_{10}, and $PM_{2.5}$ were updated accordingly.
- EU 036 – In-line Degasser: stack parameters updated.
- EU 037 – Sow Dryer: maximum capacity adjusted from 15.90 tons/hr to 15.87 tons/hr based on batch calculations, maximum burner heat input capacity decreased from 20.0 MMBtu/hr to 16.0 MMBtu/hr, CO emission factor increased from 0.073 lb/MMBtu to 0.148 lb/MMBtu per manufacturer specification, NOx emission factor increased from 0.054 lb/MMBtu to 0.109 lb/MMBtu per manufacturer specification. Associated BACT limits for PM, PM_{10}, $PM_{2.5}$, CO, NOx, VOC, and GHGs were updated accordingly.
- EU 038 – Dross House: stack parameters updated. Associated BACT limits for PM, PM_{10}, and $PM_{2.5}$ were updated accordingly.
- EU 039 – Dross Press #1: stack parameters updated.
- EU 040 – Dross Press #2: stack parameters updated.
- EU 041a – Direct-Fired Building Heating Systems: maximum burner heat input capacity decreased from 53.0 MMBtu/hr (total) to 14.81 MMBtu/hr (total). Associated BACT limits for PM, PM_{10}, $PM_{2.5}$, CO, NOx, VOC, and GHGs were updated accordingly.
- EU 041b – Indirect-Fired Building Heating Systems ≤ 1 MMBtu: maximum burner heat input capacity increased from 3.0 MMBtu/hr (total) to 5.67 MMBtu/hr (total). Associated BACT limits for PM, PM_{10}, $PM_{2.5}$, CO, NOx, VOC, and GHGs were updated accordingly.
- EU 042 – Hot Baghouse Lime Silos #1, #2, and #3: added a third lime silo, maximum capacity increased from 0.2 tons/hr to 0.225 tons/hr. Associated BACT limits for PM, PM_{10}, and $PM_{2.5}$ were updated accordingly.
- EU 043 – Cooling Tower #1: stack parameters updated, updated from three-cell to four-cell tower, maximum capacity increased from 0.15 MMgal/hr to 0.288 MMgal/hr. Associated BACT limits for PM, PM_{10}, and $PM_{2.5}$ were updated accordingly.
- EU 044 – Diesel Fuel Storage and Refueling Station: capacity increased from 2,000 gallons to 3,000 gallons, maximum capacity increased from 68,000 gal/yr to 85,000 gal/yr, emission factors for VOC updated per TankESP and AP-42.

The removal of units and adjustment of stack configurations caused a significant change in the stack gas flow contribution from several emission units. As control efficiencies were based on exit grain loading from the baghouses and flow contribution by unit, there were changes to the calculated emissions for EU 032, EU 033, EU 034, and EU 038. While the BACT limits for these units were affected by these changes, the Division reviewed the BACT determinations and found that all previous determinations still constitute BACT.

Novelis requested voluntary, federally enforceable, modeling-based, 24-hour average $PM_{2.5}$ limits for EU 030 (1.848 lb/hr), EU 031 (1.848 lb/hr), EU 032 (2.302 lb/hr), EU 033 (1.380 lb/hr), and EU 038 (1.272 lb/hr) to comply with the NAAQS. These limits also necessitated an adjustment of the ton/yr BACT limits for $PM_{2.5}$ for these units but did not otherwise affect the BACT determinations previously made for these units.

The Division has revised the NO_x BACT limits for EU 037 from 0.054 lb/MMBtu to 0.109 lb/MMBtu. When ordering equipment for EU 037, Novelis considered alternative designs to the as-built configuration, but changes of availability in the burner market and energy efficiency considerations led Novelis to selecting an AH-MA line-style burner over direct-fired styles that have been used at similar facilities. Operational needs also played into this decision, as the sow drying process at Novelis has strict temperature requirements to prevent melting or otherwise thermally degrading the sows. The selected burner is designed to meet a 0.109 lb/MMBtu emission limit and is certified to meet ANSI Z83.4 / CGA 3.7 emission standards. American National Standards Institute (ANSI) is a private, non-profit organization that administers and coordinates the U.S. voluntary standards and conformity assessment system for various commercial products for global trade to increase efficiency, open markets, boost consumer confidence and reduce costs. The specified standard requires that a direct-fired heating application not produce more than 0.50 ppm NO_x when the burner combustion byproduct emissions are mixed with the process air. Thus, the design is still technically indicative of a low NO_x burner due to the emission certification and that overall natural gas usage and batch cycle time has decreased. The Division has determined after considering these energy and environmental impacts, as well as the changes to the market during the time when the sow dryer was designed and purchased, that the low NO_x line-style burner and revised emission limitations constitute BACT.

The Division has modified the testing requirements for Emission Group 8 to more clearly specify the units the Division is requiring testing for at this time (EU 038). Because the emissions from EU 039, EU 040, and EU 045 are relatively small and controlled, the Division is choosing to not require testing at this time for these units. These units have work practice standards and monitoring, recordkeeping, and reporting requirements they must meet to demonstrate compliance.

Summary of All Affected Facilities Used to Determine 401 KAR 59:015 Emission Limits								
EU	**Fuel(s)**	**Capacity (MMBtu/ hr)**	**Const.**	**Basis for PM Limit**	**Total Heat Input Capacity for PM Limit (MMBtu/hr)**	**Basis for SO_2 Limit**	**Total Heat Input Capacity for SO_2 Limit (MMBtu/hr)**	**Notes**
007	Natural Gas	25.2	2019	401 KAR 59:015, Section 4 (1)(c)	75.6	401 KAR 59:015, Section 5 (1)(c)(2)	75.6	
008	Natural Gas	25.2	2019	401 KAR 59:015, Section 4 (1)(c)	75.6	401 KAR 59:015, Section 5 (1)(c)(2)	75.6	
009	Natural Gas	25.2	2019	401 KAR 59:015, Section 4 (1)(c)	75.6	401 KAR 59:015, Section 5 (1)(c)(2)	75.6	

V-22-011 R1 Emission Summary				
Pollutant	2022 Actual (tpy)	Previous PTE V-22-011 (tpy)	Change (tpy)	Revised PTE V-22-011 R1 (tpy)*
CO	6.82	303.98	-23.22	280.76
NO_X	11.30	305.87	-31.64	274.23
PT	0.73	93.58	+0.31	93.89
PM_{10}	0.73	113.16	+3.76	116.92
$PM_{2.5}$	0.73	88.27	-5.35	82.92
SO_2	0.069	1.69	-0.21	1.48
VOC	5.22	134.62	+7.79	142.41
Lead	4.8×10^{-5}	0.005	0	0.005

V-22-011 R1 Emission Summary				
Pollutant	2022 Actual (tpy)	Previous PTE V-22-011 (tpy)	Change (tpy)	Revised PTE V-22-011 R1 (tpy)*
Greenhouse Gases (GHGs)				
Carbon Dioxide	12781	360343	-42107	318236
Methane	0.24	5.67	-0.79	4.88
Nitrous Oxide	0.024	0.93	-0.08	0.85
CO_2 Equivalent (CO_2e)	12794	360762	-42150	318612
Hazardous Air Pollutants (HAPs)				
Hydrochloric Acid	0	113.43	0	113.43
Naphthalene	0	7.75	0	7.75
Combined HAPs:	0.17	129.79	-0.74	129.05

*Note: Controlled PTE is listed here due to federally enforceable control devices.

III. Emissions Discussion

A. Project PSD Significance

In the application to revise the Title V/Title I permit based on the design of the new casting plant as-built, Novelis calculated the potential air pollutants emitted by the new sources. The new equipment is expected to be a source of both stack and fugitive emissions of these regulated NSR pollutants: PM, PM_{10}, $PM_{2.5}$, NOx, CO, VOC, and GHGs. The new facility will also be a major source of HAPs with the potential to emit for all HAPs above 25 tpy and one individual HAP greater than 10 tpy.

The Novelis project is located in Todd County, Kentucky, designated by the U.S. EPA as Unclassifiable/Attainment for all criteria pollutants in accordance with 40 CFR 81.318. Therefore, under the federal New Source Review permitting program, Prevention of Significant Deterioration (PSD) requirements apply to the proposed facility and the application has been reviewed accordingly. Under PSD, Novelis' new facility is defined as a secondary metal production plant, one of 28 industrial source categories for which the major source threshold is the emission of 100 tpy of any regulated NSR pollutant.

Potential to emit (PTE) pollutants for this facility was calculated based on emission factors obtained from U.S. EPA's AP-42, *Compilation of Air Pollutant Emission Factors,* engineering estimates, mass balances, manufacturer's specifications, Aluminum Association reference documents, EPA dockets, similar processes at other aluminum casting facilities, and Material Safety Data Sheets (MSDS) chemical content specifications. Based on these emission factors and the assumption of a 24 hour, 7 days a week, 52 weeks a year operation (8760 hours per year) for most units, the potential emissions of regulated NSR pollutants, with the exception of lead (Pb) and SO_2, will all exceed 100 tons per year (tpy) each. Therefore, the Novelis facility is considered a new major stationary source under the PSD program. Because one pollutant exceeds the major source threshold for PSD, then PTE for all other regulated NSR pollutants emitted, in this case specifically lead and fluorides, must be compared to the significant emission rate (SER).

The potential increases in emissions of regulated NSR pollutants from the new facility have been calculated and are presented in the following table. A discussion of each pollutant emitted by the new emission units added with this revision, sources, calculation assumptions and source of emission factors used follows. A brief description of the PSD significance of each pollutant is also included, though additional information regarding PSD requirements as a consequence of the emission levels is discussed more thoroughly in the BACT analysis section, below. Where the as-built changes do not necessitate changes to the initial BACT determination made for a given emission unit, the determinations are not revisited here.

Table A-1, Project PSD Significance

Pollutant	PTE (tpy)	PSD Significant Emission Rate (tpy)	PSD Significant Emissions Increase?
PM (filterable, only)	89.76	25	Yes
PM_{10} (filterable & condensable)	109.61	15	Yes
$PM_{2.5}$ (filterable & condensable)	76.02	10	Yes
Pb	0.0048	0.6	No
NOx	200.59	40	Yes
CO	191.43	100	Yes
VOC	92.58	40	Yes
SO_2	0.76	40	No
GHGs (CO_2e)	209,318	75,000	Yes

B. Particulate Matter (PM, PM_{10}, $PM_{2.5}$) Emissions

PM, PM_{10}, and $PM_{2.5}$ are regulated NSR pollutants. Coarse particles, called PM_{10}, have an aerodynamic diameter of 10 microns or less, and fine particles, called $PM_{2.5}$, have an aerodynamic diameter of 2.5 microns or less. Both filterable and condensable components are required to be included in applicability determinations and in establishing emissions limitations for PM_{10} and $PM_{2.5}$. Filterable PM is defined as particles directly emitted as a solid or liquid at stack conditions and captured on the filter of a stack test train. Condensable PM is material that is in a vapor phase at stack conditions that condenses to form a solid or liquid immediately after discharge from a stack.

Particulates, often discharged through stacks or vents, may also be emitted in a fugitive form. The 401 KAR 51:001 defines fugitive emissions as those emissions which could not reasonably pass through a stack, chimney, vent, or other functionally-equivalent opening. Fugitive emissions are counted toward emissions totals. When speciation of particulate type is unavailable, all particulate is assumed to be part of the same size fraction for conservative purposes when calculating the Potential to Emit.

For the Novelis facility, particulate emissions calculations include three different types: PM (all sizes, filterable only), PM_{10} (filterable and condensable) and $PM_{2.5}$ (filterable and condensable). The newly added Ingot Saw (EU 045) and CFF/DBF Preheaters (EU 046a and EU 046b) are sources of particulate emissions.

Ingot Saw (EU 045):
This emission unit produces particulate through the primary action of cutting the ingots for the purpose of quality control or recycling. The process of cutting aluminum ingots generates chips that are captured by an integral cyclone and fines that are captured by an integral filter.

DBF Preheater (EU 046b):
This emission unit produces particulate emissions through the combustion of natural gas.

PM, PM_{10} and $PM_{2.5}$ PSD Significance

The emissions calculations, using the planned throughputs and accepted emission factors for each piece of equipment, show that:

Potential PM (filterable) emissions for the new facility are estimated to be 89.76 tpy. This emission rate exceeds the significant emission rate threshold of 25 tpy for PM;

Potential PM_{10} (filterable + condensable) emissions for the new facility are estimated to be 109.61 tpy. This emission rate exceeds both the PSD major stationary source threshold of 100 tpy and the significant emission rate threshold of 15 tpy for PM_{10}; and

Potential $PM_{2.5}$ (filterable + condensable) emissions for the new facility are estimated to be 76.02 tpy. This emission rate exceeds the significant emission rate threshold of 10 tpy for $PM_{2.5}$.

Since the SER for each of the particulate emission sizes is exceeded, a BACT analysis for these three pollutants is required for each piece of equipment that emits PM, PM_{10}, and $PM_{2.5}$. Establishment of a BACT limit for the emission of PM (filterable, only), PM_{10}, and $PM_{2.5}$ for each emission point that emits these pollutants is also required. Refer to the **BACT Analysis for PM, PM_{10}, & $PM_{2.5}$** for a discussion of the BACT for all three types of PM.

C. Nitrogen Oxides (NOx) Emissions

Nitrogen Oxides (NOx) are a group of highly reactive gases that are a component in the formation of the criteria pollutant Ozone. Sources of NOx from the project come mostly from natural gas-fueled burners, and diesel-fueled emergency engines. Typical NOx controls for these types of NOx sources include the use of low NOx burners, which control fuel and air mixing to reduce flame temperature and therefore NOx formation, and good combustion practices.

DBF Preheater (EU 046b):

Emissions of NOx are generated from the combustion of natural gas.

NOx PSD Significance

The emissions calculations, using the planned throughputs and accepted emission factors for each piece of equipment, show that potential NO_X emissions for the new facility are estimated to be 200.59 tpy. This emission rate exceeds both the PSD major stationary source threshold of 100 tpy and the significant emission rate threshold of 40 tpy for this pollutant. Since both the major stationary source threshold and the SER for NO_X is exceeded, a BACT analysis for NO_X is required for each piece of equipment that emits NO_X. Establishment of a BACT limit for the emission of NOx for each emission point that emits NOx is also required. Refer to the **BACT Analysis for NO_X** for a discussion of the BACT for NO_X.

D. Carbon Monoxide (CO) Emissions

Carbon Monoxide (CO) is a colorless, odorless gas frequently emitted from combustion-based processes. The main sources of CO from the Novelis facility will be from combustion-based process, i.e. natural gas-burners.

DBF Preheater (EU 046b):
Emissions of CO are generated from the combustion of natural gas.

CO PSD Significance
The emissions calculations, using the planned throughputs and accepted emission factors for each piece of equipment, show that potential CO emissions for the new facility are estimated to be 191.43 tpy. This emission rate exceeds both the PSD major stationary source threshold of 100 tpy and the significant emission rate threshold of 100 tpy for this pollutant. Since both the major stationary source threshold and the SER for CO is exceeded, a BACT analysis for CO is required for each piece of equipment that emits CO. Establishment of a BACT limit for the emission of CO for each emission point that emits CO is also required. Refer to the **BACT Analysis for CO** for a discussion of the BACT for CO.

E. Volatile Organic Compounds (VOC) Emissions
Volatile Organic Compounds (VOCs) are gases that are a component in the formation of the criteria pollutant, Ozone. As with the CO emissions, any equipment that burns fossil fuel is a source of VOCs, but emission points involved in this project also produce VOCs through use of certain processes or materials. Emission factors for fuel combustion VOCs used in the calculation of emissions are based on emission factors from AP-42, Chapter 1.4, *Natural Gas Combustion*.

DBF Preheater (EU 046b):
Emissions of VOC are generated from the combustion of natural gas.

Ingot Saw (EU 045):
This emission unit produces VOC emissions through due to the volatilization of a lubricant applied to the ingot during the cutting process.

VOC PSD Significance
The emissions calculations, using the planned throughputs and accepted emission factors for each piece of equipment, show that potential VOC emissions for the new facility are estimated to be 92.58 tpy. This emission rate exceeds the significant emission rate threshold of 40 tpy for this pollutant. Since the SER for VOC is exceeded, a BACT analysis for VOC is required for each piece of equipment that emits VOC. Establishment of a BACT limit for the emission of VOC for each emission point that emits VOC is also required. Refer to the **BACT Analysis for VOC** for a discussion of the BACT for VOC.

F. Greenhouse Gas (GHG) Emissions
Gases that trap heat in the atmosphere, and can lead to climate change, are called greenhouse gases. Some greenhouse gases occur naturally and others are emitted solely through human activities. For the purposes of air permitting, GHGs include an aggregate group of six gases: carbon dioxide, nitrous oxide, methane, hydrofluorocarbons, sulfur hexafluoride, and perfluorocarbons. To determine emissions of these gases, the concept of carbon dioxide equivalents [CO_2e] has been established as a metric measure used to compare the emissions from various greenhouse gases based upon their global warming potential (GWP). The tonnage of each type of greenhouse gas emitted is multiplied by its GWP to establish the carbon dioxide equivalence for that particular emission of that particular gas.

For this project, the majority of GHG emissions are due to the combustion of fossil fuels for heat and energy in a variety of processes including furnaces, heaters, preheaters, and boilers.

In the application, calculated emissions show that the major GHGs emitted by this project will be Carbon Dioxide (CO_2), small amounts of Methane (CH_4) and Nitrous Oxide (N_2O). For the natural gas used, emission factors for CO_2, CH_4, and N_2O have been taken from 40 CFR 98, Subpart C. The current global warming potentials found in 40 CFR 98, Subpart A, have also been used in estimating the CO_2e.

The Novelis process is a major consumer of fossil fuel and therefore a large source of greenhouse gas (GHG) emissions. The only fuel used is natural gas, which is the fossil fuel that produces the least amount of GHG emissions. The natural gas is used primarily as a utility for maintaining temperature in molten and solid metals and heating.

DBF Preheater (EU 046b):
Emissions of GHGs are generated from the combustion of natural gas.

Greenhouse Gas (GHG) PSD Significance
Based on the submitted emission factors and calculations, the potential CO_2e emissions for the new facility are estimated to be 209,318 tpy of CO_2e. This emission rate exceeds the PSD significant emission rate threshold of 75,000 tpy for CO_2e. Since the SER for GHGs and at least one other PSD pollutant are exceeded, a BACT analysis for GHG is required for each piece of equipment that emits GHG. Establishment of a BACT limit for the emission of GHG for each emission point that emits GHG is also required. Refer to the **BACT Analysis for GHG** for a discussion of the BACT for GHG.

G. Toxic and Hazardous Air Pollutants

Toxic and Hazardous Air Pollutants (HAPs) are those pollutants that are known or suspected to cause serious human health effects and some adverse environmental and ecological effects. Under the Clean Air Act, U.S. EPA is required to regulate emissions of hazardous air pollutants. The list of HAPs includes 188 pollutants.

The Novelis facility is a source of some HAPs, mostly through the combustion of fossil fuels and some metallurgical processes. In addition to the emissions of criteria pollutants and GHGs, the facility will also be a source of hydrochloric acid (HCl). The new facility will also be a source of several other HAPs/Toxics in smaller quantities, all less than 10 tpy each.

Other HAPs and Toxics
Smaller amounts of HAPs and Toxics, emitted at less than 10 tpy each (after federally enforceable controls), will come from the new facility. The majority of these are emissions are due to the combustion of natural gas, but the new ingot saw will produce some emissions of HAPs due to the metal fines generated during the process. However, the trace amount of chromium and manganese generated by this process do not substantially affect the total facility PTE of either HAP, and the emission remain well under the 10 tpy threshold.

Air Dispersion Modeling of HAPs and Toxics
Many of the HAPs and Toxics are regulated under federal NESHAPs, i.e. applicable MACT standards, which analyze the amounts and potential effects of HAPs and Toxics emitted by certain industrial activities. MACTs also provide operational and system design

requirements for some equipment and emission limits for the HAPs and Toxics. Emissions of HAPs and Toxics, not subject to an applicable MACT, are related to Natural Gas combustion, and as such, the Division has determined that the terms and conditions in the permit (V-22-011 R1) will be sufficient to demonstrate compliance with all applicable regulations and requirements.

IV. BACT Analysis

The PSD permitting program is designed to ensure that economic growth occurs in a manner consistent with the preservation of existing clean air resources. It requires that new or modified pollutant sources do not endanger public health and welfare, or deteriorate air quality in areas of special natural, scenic or historical value. The PSD program also allows for public participation in the decision-making process.

The Commonwealth of Kentucky implements a PSD program through 401 KAR 51:017. Pursuant to this regulation, a new major stationary source shall apply BACT for each regulated NSR pollutant for which the source has the potential to emit in significant amounts. BACT represents the maximum degree of reduction for each regulated NSR pollutant that will be emitted from a proposed major stationary source or major modification and is determined by the cabinet pursuant to 401 KAR 51:017, Section 8, after taking into account energy, environmental, and economic impacts and other costs, to be achievable by the source or modification through application of production processes or available methods, systems, and techniques, including fuel cleaning or treatment or innovative fuel combustion techniques for control of that pollutant.

BACT determines what will be the permitted standard (or maximum allowable emissions) for a particular pollutant for a particular project or emission source. BACT is based upon a case-by-case decision that considers energy, environmental and economic impact. BACT can be add-on control equipment or modification of the production processes or methods to reduce emissions or an emission standard. BACT may also be a design, equipment, work practice or operational standard if setting an emissions standard is not practical.

Since the Novelis project will emit more than 100 tpy for several regulated NSR pollutants, it is required to perform BACT on the pollutants that are emitted in quantities that exceed significant emission rates. For the Novelis project, the pollutants requiring BACT analysis are particulate (including PM, PM_{10}, and $PM_{2.5}$), NOx, CO, VOC, and GHGs (see Section I. Emissions, Table A-1 above, for the potential emission levels and thresholds exceeded).

Novelis conducted a BACT analysis for each pollutant with the potential to be emitted in excess of the PSD significant emission rate for their proposed project in accordance with the *"Top-Down" Best Available Control Technology Guidance Document* outlined in the 1990 draft U.S. EPA *New Source Review Workshop Manual*, which outlines steps for conducting a top-down BACT analysis. The steps Novelis followed are:

(6) Identify available control possibilities for each PSD pollutant based on source knowledge and previous regulatory decisions for identical and similar sources;
(7) Reject inappropriate and technically infeasible control options;
(8) Rank feasible alternatives in descending order of control effectiveness;
(9) Evaluate the most effective controls and weigh the economic, energy and environmental impacts of each; and
(10) Select BACT.

BACT analyses for each PSD significant pollutant were included in the Novelis application and supplemented in subsequent submissions to the Division.

The Division reviewed the information submitted by Novelis, along with information available from industry, scholarly publications, and the RACT/BACT/LAER Clearinghouse (RBLC), a U.S. EPA maintained database that contains case-specific information on the "Best Available" air pollution technologies that have been required to reduce the emission of air pollutants from stationary sources. The Division used this information to make BACT determinations for PM, PM_{10}, $PM_{2.5}$, NOx, CO, VOCs, and GHGs, all of which are subject to PSD review for this project.

Under PSD review, once a control technology (or practice) has been selected, BACT limits are assigned. BACT limits may be both emission related or related to operation of equipment. Individual long and short-term BACT limits have been established for each emitted pollutant.

A summary of the BACT analyses, and the Division's decisions, are outlined, below. They are arranged by pollutant first and then by each emission group that produces that pollutant. Within each emission group section, a summary of the BACT decisions made for the group and a table of BACT limits assigned precedes the analysis of possible technologies for that group, a discussion of how the BACT limits were set, and comments on the compliance demonstration required by the permit. This analysis covers the emission units newly added in V-22-011 R1.

A. BACT Analysis for PM, PM_{10}, & $PM_{2.5}$

Novelis submitted BACT analyses for PM, PM_{10}, and $PM_{2.5}$, but addressed all three types of PM together since the same control technologies and practices reduce all three of these emissions. Any reference to PM in this section refers only to filterable PM, whereas PM_{10} and $PM_{2.5}$ includes filterable and condensable components.

Technologies for Particulate Control: The technologies identified as possible BACT controls for the three types of particulate for the Novelis project are the following:

Cyclones: These mechanical collectors work on the principal of inertial separation. The collectors use a rapid change in air direction and the property of inertia to separate mass (particulate) from the process gas stream. This type of control is often used when there is a high concentration of coarse particulate. A cyclone is a feasible control, but has a lower collection efficiency (about 70 %), over the range of possible particulate sizes and are most effective for particulate of >10 micron size. They are often used as pre-controls to reduce particle concentration in a gas stream before it enters a second control device.

Scrubbers: In a wet scrubber, the process gas stream is either sprayed with a liquid or forced into contact with a liquid in order to impact and remove particles entrained in the gas. The particles are captured in liquid droplets that are then collected from the gas stream in a mist eliminator. The resulting liquid is then treated to remove the particles and recycled or discharged. Wet scrubbers are especially useful when the particulate is sticky, combustive, corrosive or explosive. Dry scrubbers, which do not saturate the gas stream, are generally used to remove acids from waste gas and are not used for particulate control.

Electrostatic precipitators (ESPs): ESPs are another control technology often used to remove particulate from flue gases before they are released to atmosphere. In this technology, particulate entrained in a gas stream is given an electrical charge as the stream passes through a gaseous ion region (corona). The charged particles are then attracted to, and collected by, a neutral or oppositely charged collector plate. In a dry electrostatic precipitator (ESPs), the collector plate is subjected to intermittent mechanical or sonic percussion to knock the particles off the plate and into a hopper positioned under the plate. A wet ESP operates similarly to the dry ESP for removing PM from a gas stream, but the collecting surface is cleaned by water, either intermittently or continuously.

Fabric filters (baghouses): This type of control equipment consists of a series of bags (filters) contained in a shell structure, through which process gas or a dust laden air stream is passed. Baghouses function based on the fact that particles are larger than gas molecules. When a particulate-laden gas is passed through a membrane (fabric filter), the particulate is captured on the filter while the clean gas passes through. The bags can be of woven or felted cotton, synthetic, or glass-fiber material in either a tube or envelope shape. Fabric filters, and the materials from which they are made, can be chosen to effectively clean particulates based on the sizes, shapes, and textures of the particulate expected. Baghouses also have cleaning devices, such as pulse jet, shakers or rappers, reverse air capability, or sonic cleaners, that cause collected dust to fall into dust hoppers at the bottom of the shell structure. The particulate removal efficiency of a baghouse can be as high as 99.9 %. The bin vent filters used in the Novelis project are in this category of control.

Good Combustion and Operation Practices: This is a combustion optimization work practices method for minimizing fuel use and emissions from the burning of fossil fuels. Oxygen and carbon in the fuel combine during combustion in a complex process requiring turbulence, temperature and time for the reactants to contact and combine to form carbon dioxide (CO_2) and heat. If the combustion and combination of necessary elements are not controlled, the combustion of the fuel is incomplete and undesirable emissions form. Although particulate from natural gas combustion is normally a small amount, poor air/fuel mixing or maintenance problems can cause extra PM to form. Particulates from natural gas combustion are usually larger molecular weight hydrocarbons that are not fully combusted. Increased CO also occurs when there is poor mixing (not enough turbulence) and/or there is not enough air in the mix. Other pollutants such as NOx form if the temperature is too hot. SO_2 can form if there is too much sulfur in the fuel. By taking measures to optimize the combustion process, including control of air mixing and temperature, and reducing the amount of fuel used, pollutants are minimized. These measures may include choosing good burner designs, using performance monitoring and process control techniques to improve operation, performing regular and thorough maintenance of the combustion system, etc.

Although it is not an add-on control, efficient operation of combustion equipment is often an effective means to reduce combustion related pollutants. Preparation of a specific plan for achieving combustion optimization, such as a Good Combustion and Operation Practices (GCOP) Plan, that defines, measures, and verifies the use of operational and design practices specific to a piece of equipment for the reduction of a specific pollutant provides verifiable implementation of this work practices method.

Clean Fuel Use: This is a practice whereby a facility or specific equipment is designed to use natural fuels (such as natural gas), that emit pollutants in lesser quantities than the alternatives (such as fossil fuels).

Good Work Practices: Work practices such as performing inspections and preventative maintenance, help keep equipment running in optimal ranges and prevent extra pollutant emissions caused by malfunction. Designing equipment for minimal emissions is also considered.

i. ***Ingot Saw (EU045):***

Decision Summary: Consistent with the BACT evaluation conducted and submitted by the applicant, the Division determines that the use of a fabric filter and a good work practices plan as means to control PM, PM_{10}, and $PM_{2.5}$ (filterable and condensable) emissions constitutes BACT.

BACT limits for PM, PM_{10}, and $PM_{2.5}$ are calculated using the fabric filter performance specification, the flowrate for the filtration unit, and 8,760 hours per year to determine a maximum lb/hr and ton/yr limit. Because the fabric filters will emit at the same outlet grain loading, regardless of inlet grain loading, BACT limits for PM, PM_{10}, and $PM_{2.5}$ are more appropriately set this way.

Emission Point	BACT	BACT limit for PM (filterable)	BACT limit for PM_{10}	BACT limit for $PM_{2.5}$
045	Fabric Filter; GWP Plan	0.022 lb/hr; 0.10 ton/yr	0.022 lb/hr; 0.10 ton/yr	0.022 lb/hr; 0.10 ton/yr

Technologies: Novelis examined the following technologies as possibilities to control PM emitted from the furnaces: Fabric Filters (Baghouses), Wet Scrubbers or High Efficiency Venturi Scrubber, Electrostatic Precipitators (ESPs), High Efficiency Cyclone, Low Sulfur Fuel, and Good Work Practices.

Control Type	Estimated PM/PM_{10}/$PM_{2.5}$ Control Efficiency*
Fabric Filter (Baghouse)	95-99%
Wet ESP	90-99%
Good Work Practices	Undefined

*Based on low end of efficiency range for filterable particulate matter based on low inlet loading.

Analyses: After identifying possible particulate control technologies available, Novelis presented a review of the different possible technologies, discussed the technical feasibility of each one and discussed the relevant advantages and disadvantages for use in the Ingot Saw.

Fine particles of aluminum generated by the Ingot Saw and transported by the chip collection system have an inherent explosion risk. The Aluminum Association suggests that special consideration should be given to hazards, specifically explosivity, associated with the use of baghouses and other dry control methods for particulate control of aluminum dust. Based on the health and safety risks related to the explosivity hazards associated with the use of dry control technologies, Novelis has only considered specially designed filtration units with specific features included for combustible dust management as technically feasible particulate matter control techniques for application to this process. Filtration units are addressed in the remaining steps of the BACT analysis for PM emissions generated by the Ingot Saw.

The typical wet scrubber emission stream characteristic ranges encompass the design air flow and temperature of the Ingot Saw. However, the minimum PM inlet concentration for effective operation of a wet scrubber is orders of magnitude higher than the estimated inlet concentrations that would be expected from the Ingot Saw. Therefore, this technology is not considered to be technically feasible for the Ingot Saw, and it is eliminated from the remaining steps of the BACT evaluation.

The Ingot Saw includes an integral process cyclone design. Exhaust from the Ingot Saw cyclones is routed to the filtration unit. A high efficiency cyclone would be required to further reduce emissions from the product collection cyclone-focused vent streams. The typical cyclone emission stream characteristic ranges encompass the design air flow and temperature of the Ingot Saw; however, the outlet concentrations of each of the process cyclones are orders of magnitude lower than the minimum cyclone inlet loading of 0.44 gr/scf. Cyclones perform more efficiently with higher pollutant loadings and given that the processes already include integral process cyclones, additional particulate control cyclones are infeasible. Therefore, cyclones as control technology are not addressed in the remaining steps of the BACT evaluation for this source.

Good operating and maintenance practices represent a technically feasible control option for minimizing PM emissions from the Ingot Saw. This method is addressed in the remaining steps of the BACT evaluation.

BACT for this equipment is therefore a Fabric Filter and a Good Work Practices Plan.

Initial compliance demonstration with BACT is through development of a GWP plan within 180 days of equipment startup, implementation of the GWP, and stack testing the fabric filter. Continuous compliance is demonstrated through monitoring, recording and reporting throughputs for the equipment and, as applicable, the control device(s).

ii. DBF Preheater (EU 046b):

Decision Summary: Consistent with the BACT evaluation conducted and submitted by the applicant, the Division determines that the use of low sulfur fuel and a good combustion and operating practices (GCOP) plan as means to control PM, PM_{10}, and $PM_{2.5}$ (filterable and condensable) emissions constitutes BACT.

BACT limits for PM, PM_{10}, and $PM_{2.5}$ are calculated using the vendor guaranteed emission factors and 8,760 hours per year to determine a maximum lb/hr and ton/yr limit.

Emission Point	**BACT**	**BACT limit for PM (filterable)**	**BACT limit for PM_{10}**	**BACT limit for $PM_{2.5}$**
046b	GCOP Plan; Low Sulfur Fuel	0.007 lb/hr; 0.032 ton/yr	0.013 lb/hr; 0.057 ton/yr	0.013 lb/hr; 0.057 ton/yr

Technologies: Novelis examined the following technologies as possibilities to control PM emitted from the DBF Preheater: Fabric Filters (Baghouses), Wet Scrubbers or High Efficiency Venturi Scrubber, Electrostatic Precipitators (ESPs), High Efficiency Cyclone, Low Sulfur Fuel, and Good Combustion and Operating Practices.

Control Type	Estimated $PM/PM_{10}/PM_{2.5}$ Control Efficiency
GCOP	Undefined
Low Sulfur Fuel	Undefined
Fabric Filter (Baghouse)	Not technically feasible
Wet Scrubber or high efficiency Venturi Scrubber	Not technically feasible
Cyclone	Not technically feasible
ESP	Not technically feasible

Analyses: After identifying possible particulate control technologies available, Novelis presented a review of the different possible technologies, discussed the technical feasibility of each one and discussed the relevant advantages and disadvantages for use in the DBF Preheater.

The typical baghouse emission stream characteristic ranges encompass the design air flow and temperature of the DBF preheater. However, the minimum PM inlet concentration of 0.05 gr/scf is an order of magnitude higher than estimated inlet concentrations for the DBF preheater. Therefore, this technology is considered to be technically infeasible and is not addressed for this source in the remaining steps of the BACT evaluation.

The low exhaust gas particulate loading, small air flow rate, and variable particulate concentrations of the DBF preheater render ESP as a technically infeasible control option. Therefore, this technology is not addressed in the remaining steps of the BACT evaluation.

While the air flow and temperature stream characteristics are in range for using a wet scrubber for the DBF preheater, the estimated inlet loading concentrations are orders of magnitude lower than the scrubber design inlet concentration range of 0.1 to 50 gr/cf. Therefore, this technology is not considered to be technically feasible for the DBF preheater and is not addressed in the remaining steps of the BACT evaluation.

The typical cyclone emission stream characteristic ranges encompass the design air flow and temperature of the DBF preheater; however, the estimated inlet loading of each furnace is orders of magnitude lower than the minimum cyclone inlet loading of 0.44 gr/scf. Therefore, cyclones as a control technology are not addressed in the remaining steps of the BACT evaluation for this source.

Utilizing low sulfur fuel represents a technically feasible control option for minimizing PM emissions from the DBF preheater. This method is addressed in the remaining steps of the BACT evaluation.

The good design and operating practices represent a technically feasible control option for minimizing PM emissions from the DBF preheater. This method is addressed in the remaining steps of the BACT evaluation.

Initial compliance demonstration with BACT is through development of a GCOP plan within 90 days of equipment startup, implementation of the GCOP. Continuous compliance is demonstrated through monitoring, recording and reporting throughputs for the equipment and, as applicable, the control device(s).

B. BACT Analysis for NO_X

Novelis submitted BACT analyses for NO_X emissions and evaluated available NO_X control technologies and practices. A control technology for an emission point may serve as a BACT control for other equipment as well.

Control Technologies for NO_X: The possible BACT control technologies for the emission of NO_X are identified below:

Combustion Control Techniques: Combustion control techniques are generally integrated with the design and operation of the combustion unit. It includes burner modifications and low nitrogen fuel (if applicable and available). The possible NOx BACT controls, identified under this control technique, for the Novelis project are:

Low-NO_X Burners (LNB)*:* Low-NO_X burners increase combustion efficiency by using specially designed burners that use modified air and fuel entry to slow the mixing rate, reduce the oxygen available for NO_X formation in critical NOx formation zones, and/or reduce the amount of fuel burned at peak flame temperatures. Low-NO_X Burners can implement different methods: Low Excess Air (LEA), Off Stoichiometric Combustions (OSC), Flue Gas Recirculation (FGR), or a combination of the three. LEA inhibits NO_X Formation by reducing the excess air to less than normal ratios, this helps reduce both thermal and fuel NO_X formation. OSC reduces NOx emissions by carrying out the initial combustion in a fuel-rich combustion zone and completing combustion at a lower temperature in a second, fuel-lean zone. FGR recycles a part of the flue gas to the primary combustion zone. It reduces NO_X by reducing the peak flame temperature by introducing inert combustion products and lowering the oxygen concentration in the primary flame zone.

Oxy-fuel Burner*:* Another approach to increasing combustion efficiency is to fire specially designed burners with oxygen instead of air. The conversion to oxygen firing instead of air reduces NO_X emissions by eliminating some of the nitrogen in combustion air. In addition, when small amounts of combustion air are replaced with oxygen, a significant increase in flame temperature can be realized and an intense flame is produced. Excess fuel air or steam, injected just after the combustion chamber, is sufficient to rapidly quench the flue gas to temperatures below the NO_X formation temperature range. Combustion can then be completed in over fire air.

Good Combustion and Operation/Good Work Practices (GCOP/GWP): This is a work practice combustion optimization method for minimizing fuel usage and emissions from fossil fuels. When the combination of necessary elements are not controlled during combustion, the reaction in incomplete, which leads to the formation of undesirable emissions such as excess NO_X. Optimizing the process minimizes the formation of pollutants. Having a Good Combustion and Operation Practices (GCOP) Plan that defines, measures and verifies the use of operational and design practices specific pollutant provides verifiable implementation of this work practices method. Although it is not an add-on control, efficient operation of combustion equipment is often an effective means to reduce NO_X and other combustion related pollutants. Work practices such as performing inspections and preventative maintenance help keep equipment running in optimal ranges and prevent extra pollutant emissions caused by malfunction.

Post-Combustion Control Techniques: Post combustion control techniques include selective catalytic reduction (SCR) and selective non-catalytic reduction (SNCR). The post combustion techniques considered for Novelis are as follows:

Selective Catalytic Reduction (SCR): SCR units use a nitrogen-based reagent, such as ammonia (NH_3) or urea, to chemically reduce NO_X to nitrogen and water vapor. The reagent is injected though a grid system into the flue gas stream, upstream from a catalyst bed. The waste gas mixes with the reagent and enters a reactor module containing catalyst. The hot flue gas and reagent diffuse through the catalyst, where the reagent reacts selectively with NO_X within a specific temperature range.

Operating temperatures between 480°F (250°C) and 800°F (427°C) are required of the gas stream at the catalyst bed, in order to carry out the catalytic reduction process. The reaction of NH_3 and NO_X is favored by the presence of excess oxygen (greater than 1%). Depending on system design, NO_X removal rates of 70 to 90% are achievable under optimum conditions. Technical factors related to this technology include the catalyst reactor design, optimum operating temperature, sulfur content of the charge, catalyst deactivation due to aging, ammonia slip emissions, and design of the ammonia injection system. Below the optimum temperature range, the catalyst activity is greatly reduced, potentially allowing unreacted ammonia (referred to as "ammonia slip") to be emitted directly to the atmosphere. SCR systems may also be subject to catalyst deactivation over time, due to physical deactivation and/or chemical poisoning. Catalyst suppliers typically guarantee a 3-year catalyst lifetime for a sustainable emission limit.

Several variations of SCR exist including Modified SCR (Shell DeNOX System) and Catalytic Oxidation/Adsorption ($SCONO_X$). SCONOx is a catalytic oxidation/absorption technology that removes NO_X, CO, and VOCs from an assortment of combustion applications that mostly include small turbines, boilers, and lean burn engines. SCONOx employs a proprietary technology using a single potassium nitrate impregnated catalyst. The flue gas temperature should be in the range of 300°F to 700°F for optimal performance without deleterious effects on the catalyst assembly. SCONOx technology demands stable gas flows, lack of thermal cycling, steady pollutant concentrations and residence times on the order of 1 to 1.5 seconds for optimal performance. The Shell DeNOx system is a variant of traditional SCR technology, which utilizes a high activity dedicated ammonia oxidation catalyst based on a combination of metal oxides. The system is comprised of a catalyst contained in modular reactor housing where, in the presence of ammonia, NOx in the exhaust gas converts to nitrogen and water. The catalyst is contained in a low-pressure drop lateral flow reactor (LFR), which makes best use of the plot space available. Due to the intrinsically high activity of the catalyst, the technology is suited for NOx conversions at lower temperatures with a typical operating range of 250°F to 660°F. The Shell DeNOx technology can not only operate at a lower temperature, but also have a lower pressure drop penalty than traditional SCR technology of around 2 inches water gauge.

Selective Non-Catalytic Reduction (SNCR): SNCR is a post-combustion technique that involves injecting ammonia or urea into specific temperature zones in the upper furnace or connective pass of a boiler or process heater to reduce both NOx and CO emissions. A temperature of between 1,600°F and 2,100°F is required at the injection site for the process reaction to take place. The ammonia or urea reacts with NOx in the gas to produce molecular nitrogen and water vapor. The NOx reduction reaction is favored over other chemical reaction processes for a specific temperature range and in the presence of oxygen; therefore, it is considered a selective chemical process. SNCR is effective only in a stoichiometric or fuel-rich environment where combustion gas is nearly depleted of oxygen.

i. ***DBF Preheater (EU 046b):***

Decision Summary: Consistent with the BACT evaluation conducted and submitted by the applicant, the Division determines that the use of low NOx burners, and a GCOP plan as means to control NOx emissions constitutes BACT.

Emission Point	BACT	BACT limit for NO_x
046b	Low NOx Burner; GCOP Plan	0.29 lb/hr; 1.26 tons/yr

Technologies: Novelis examined the following technologies as possibilities to control NOx emitted from the DBF Preheater: GCOP, LNB, SCR, and SNCR.

Control Type	Estimated NOx Control Efficiency*
SCR	90%
SNCR	50%
LNB	40-85%
GCOP	Undefined

*According to US EPA, Air Pollution Control Technology Fact Sheet.

Analyses: After identifying possible NOx technologies available, Novelis presented a review of the different possible technologies, discussed the technical feasibility of each one and discussed the relevant advantages and disadvantages for use in the DBF Preheater.

GCOP implemented to minimize NOx formation and LNB are technically feasible.

SCR is not commercially available or technically feasible for small direct-fired combustion systems which operate on an intermittent basis for process heating purposes. SCR is only used for larger scale combustion systems with a maximum heat input rating of at least 50 MMBtu/hr and for emission units that would not experience frequent on/off cycling like the DBF preheater.

SNCR is not technically feasible for controlling NOx emissions from the DBF preheater both due to the same on/off cycling and intermittent use issue associated with the application of SCR and the low temperature of the exhaust (650 deg. F) relative to the required operating temperature range of SNCR (1,600 deg. F to 2,000 deg. F).

Novelis concluded and the Division concurs that BACT for this equipment is the installation of LNBs and a GCOP Plan.

Initial compliance demonstration with BACT is through development of a GCOP plan within 90 days of equipment startup, implementation of the GCOP, and installation of low NOx burners. Continuous compliance is demonstrated through monitoring, recording and reporting throughputs for the equipment.

C. BACT Analysis for CO & VOC

Novelis submitted BACT analyses for CO and VOC emissions and evaluated available CO and VOC control technologies and practices. Because the control strategies for CO often provide co-control for VOC, the BACT analyses for these pollutants are combined. If a unit emits only VOC, only the control strategies applicable to VOC are analyzed. A control technology for an emission point may serve as a BACT control for other equipment as well.

Control Technologies for CO & VOC: The possible BACT control technologies for the emission of CO and/or VOC are identified below:

Incineration: This technology, also called thermal oxidation, is a process of combusting (burning) gases, such as CO and VOC, at a high temperature to decompose the gas into carbon dioxide (CO_2) and water (H_2O) before release into the atmosphere. Temperature of the gas is raised above its auto-ignition point, in the presence of oxygen, and maintained at a high temperature (>1,500°F) for sufficient time to complete combustion.

Add-on air pollution controls that accomplish incineration of pollutants include regenerative thermal oxidizers (RTOs), regenerative catalytic oxidizers (RCO), recuperative thermal oxidizers, and recuperative catalytic oxidizers. Of these only RCO and recuperative catalytic oxidizers are known to control CO. All of the thermal oxidation methods provide co-control for VOC. Thermal incinerators are not well suited to highly variable flow waste gas streams.

RTOs use a ceramic bed as a heat exchanger that absorbs heat from cleaned, hot gases exiting a combustion chamber and releases that heat to the next in-coming, waste gas stream as a means of preheating. Once this preheated waste gas is combusted in a chamber (and cleaned), the now hot, clean gas is passed over a different ceramic bed that was cooled in the previous cycle. This now heated bed begins the next cycle by preheating the next in-coming waste gas stream. RTOs are the most common means of VOC control, have high temperature capability, are fairly rugged and easy to maintain and produce less NOx emissions than flares. RTOs have VOC destructive efficiency that ranges from 95 to 99 % with the lower efficiencies generally being associated with lower VOC concentrations in the waste gas flow. Disadvantages include high capital costs, large size with complex, expensive installation, and high maintenance demand for moving parts.

RCOs operate in the same type of cycle as an RTO, but use a catalyst material rather than ceramic for the bed. A catalyst is a substance that increases the rate of a chemical reaction without undergoing permanent chemical change itself. Since the material in the bed pushes the combustion of the waste gases, it allows for the cleaning process to occur at a lower temperature. This means less fuel is required to complete combustion in the combustion chamber. RCOs have lower fuel requirements and less NOx emissions than RTOs. RCOs typically have efficiencies in the 90 to 99 % effective range for VOC, but have an additional advantage in that they also can destroy 98% or more of the CO in a waste gas stream. However, the need to change out the catalyst, usually platinum, palladium or rhodium, translates to higher long-term maintenance costs. RCOs also have high capital costs and require a large area for installation.

Recuperative thermal oxidizers are similar to RTOs in that they use incineration to destroy pollutants in waste gas, but the recuperative thermal oxidizer passes hot exhaust through a non-contact air-to air heat exchanger to heat the cooler inlet gas. Recuperative thermal oxidizers use metallic shell and tube heat exchangers to accomplish the transfer. They are good for low volume applications, are compact and have a long life span. Depending on characteristics of the waste stream, efficiencies range from 98 % to 99.9999+ % destruction of VOCs. Waste streams generally require 1500 to 3000 ppmv of VOC to achieve higher efficiencies. Disadvantages include the higher energy costs (operating costs) and lower effectiveness on higher air flows (>30,000 cfm).

Recuperative catalytic oxidizers are arranged such that after incoming waste gases are heated in the heat exchanger, they are passed through a catalyst to enhance the oxidation process in the combustion chamber. As with the RCO, full combustion can occur at lower temperatures than in the non-catalytic recuperative thermal oxidizer. This means recuperative catalytic oxidizers have lower fuel costs and produce fewer NOx emissions. Some disadvantages of this form of control are the high capital costs and higher long-term maintenance costs.

Good Combustion and Operation Practices (GCOP): This is a work practice combustion optimization method for minimizing fuel use and emissions from the burning of fossil fuels. When the combination of necessary elements are not controlled during combustion, the reaction in incomplete, which leads to the formation of undesirable emissions such as excess CO. CO emissions are increased when there is poor mixing (not enough turbulence) and/or there is not enough air in the mix. By taking measures to optimize the combustion process, pollutants are minimized. Optimizing the process minimizes the formation of pollutants. Having a Good Combustion and Operation Practices (GCOP) Plan that defines, measures and verifies the use of operational and design practices specific pollutant provides verifiable implementation of this work practices method. Although it is not an add-on control, efficient operation of combustion equipment is often an effective means to reduce CO and other combustion related pollutants. Work practices such as performing inspections and preventative maintenance help keep equipment running in optimal ranges and prevent extra pollutant emissions caused by malfunction.

Alternative Lubricant Formulations: The Ingot Saw will use hydrocarbon-based lubricants to facilitate the ingot processing steps. In order to minimize VOC emissions associated with the use of this lubricant, a material with low volatility could be preferentially selected in the absence of any adverse process impacts or other operational constraints that could jeopardize the processing capabilities of the equipment. Materials proposed to be used in the Ingot Saw, however, are applied at the lowest possible application rate, and therefore are already inherently low-emitting. Additionally, similar source control device searches did not identify any instances of alternative material formulations being used to control VOC emissions from a similar source. Therefore, this technology is not considered to be technically feasible for the Ingot Saw. As such, it is not addressed in the remaining steps of the BACT evaluation.

Good Operating and Maintenance Practices: In addition to add-on control technologies and alternative lubricant formulations, this BACT evaluation considers good operating and maintenance practices as an additional means of minimizing VOC emissions from the Ingot Saw. Specifically, key operating and maintenance practices can be implemented to prevent excessive evaporative losses of the lubricant. Operating and maintenance practices intended to minimize VOC emissions include but are not limited to the following:

- Controlling lubricant application rates to ensure process conditions are maintained at optimum levels;
- Maintaining the supplied lubricant temperature within desired ranges to minimize volatilization; and
- Implementing spill prevention and other waste reduction measures to ensure that the lubricant remains within the bounds of the storage, circulation, filtration, and treatment systems.

Adhering to written instructions and procedures that specify good operating and maintenance practices is a common approach for minimizing lubricant losses and the associated VOC emissions which may result from lost or otherwise wasted lubricant. Good operating and maintenance practices represent a technically feasible control option for minimizing VOC emissions from the Ingot Saw. Based on the results of the remaining technical feasibility evaluations for candidate control options, the only technically feasible option for VOC control on the Ingot Saw is good operating and maintenance practices.

i. <u>Ingot Saw (EU045):</u>

Decision Summary: Consistent with the BACT evaluation conducted and submitted by the applicant, the Division determines that the use of a good work practices (GWP) plan, including controlling lubricant application rates, maintaining the supplied lubricant temperature within desired ranges to minimize volatilization, and implementing spill prevention and other waste reduction measures to ensure that the lubricant remains within the bounds of the storage, circulation, filtration, and treatment systems, constitutes BACT. To ensure compliance with these limitations, the permit requires monitoring and recordkeeping.

Emission Point	BACT	BACT limit for VOC
045	GWP Plan	0.99 lb/hr; 4.34 tons/yr

Technologies: The possible control technologies identified for the ingot saw include good work practice standards.

Analyses: Novelis noted that the only technically feasible options were to develop the work practice standards mentioned above. No add-on controls are technically feasible.

Initial compliance demonstration with BACT is through development of a GWP plan within 180 days of equipment startup, and implementation of the GWP. Continuous compliance is demonstrated through monitoring and recordkeeping of throughputs for the equipment.

ii. <u>DBF Preheater (EU 046b)</u>:

Decision Summary: Consistent with the BACT evaluation conducted and submitted by the applicant, the Division determines that the implementation of a GCOP plan as means to control CO/VOC emissions constitutes BACT.

Emission Point	BACT	BACT for CO	BACT for VOC
046b	GCOP Plan	0.32 lb/hr; 1.40 tons/yr	0.021 lb/hr; 0.092 tons/yr

Technologies: Novelis examined the following technologies as possibilities to control CO/VOC emitted from the DBF Preheater: thermal oxidation, catalytic oxidation, and GCOP.

Control Type	Estimated CO/VOC Control Efficiency*
Thermal oxidation	98-99.99% / Undefined
Catalytic oxidation	98-99% / <90%
GCOP	Undefined

*According to US EPA, Air Pollution Control Technology Fact Sheet.

Analyses: After identifying possible CO/VOC control technologies available, Novelis presented a review of the different possible technologies, discussed the technical feasibility of each one and discussed the relevant advantages and disadvantages for use in the decoater.

GCOP implemented to minimize CO and VOC formation is technically feasible.

Based upon a review of available information, there is no known application of CatOx to control CO or VOC emissions from small direct-fired preheaters used for conditioning refractory and performing other similar direct-fired process heating applications. For relatively small natural gas-fired sources, such as the DBF preheater, post-combustion controls, such as thermal oxidizers and CatOx are technically infeasible and impractical due to the relatively small quantities of CO and VOC present in the exhaust gas. Furthermore, thermal oxidation would increase combustion emissions and require additional fuel use (wasted energy).

BACT for this equipment is the implementation of a GCOP Plan.

Initial compliance demonstration with BACT is through development of a GCOP plan within 90 days of equipment startup, and implementation of the GCOP. Continuous compliance is demonstrated through monitoring and recordkeeping of throughputs for the equipment.

D. BACT Analysis for GHG

Although GHGs are an aggregate group of multiple gases, including CO_2, N_2O, CH_4, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride, they are treated as a single air pollutant for PSD and BACT purposes. Novelis analyzed the methods and technologies for reduction and/or destruction for CO_2, the major GHG pollutant component from metal casting, as applicable for all emitted GHGs at the proposed project.

Control Technologies for GHGs: Two broad categories of possible CO_2 technologies are identified and analyzed for the project, Carbon Capture and Sequestration (CCS) and Energy Efficiency Measures. The CCS is based on the separation and capture of CO_2 from process gases and injecting the CO_2 into a suitable geologic formation for long-term storage. For an energy efficiency strategy, the focus is on thermal efficiency to reduce the site-wide consumption of fuels and also reduce electricity use to reduce GHGs emitted by the power utilities that supply energy to the site.

Carbon Capture and Sequestration: Carbon capture and sequestration (CCS) is the long-term isolation of fossil fuel CO_2 emissions from the atmosphere through capturing and storing the CO_2 deep in the subsurface of the earth. CCS is the only potentially available add-on control option to reduce large-scale direct emissions from industrial processes. CCS is made up of three key stages:

***Capture*:** Carbon capture is the separation of CO_2 from other gases produced when fossil fuels are combusted. Post-combustion CO_2 separation can be performed with chemical absorption systems using aqueous solution of amines as chemical solvents, or physical absorption systems using methanol or other solvents. There are three main technology categories proposed for the first step of separation and capture: pre-combustion, oxy-fuel combustion, and post-combustion.

Pre-combustion involves the removal of the CO_2 from a fossil fuel before it is combusted. In this type of system, a fuel is converted to gas through heating with steam and air or oxygen. A gas containing mainly hydrogen and CO is produced. The CO is reacted with steam to produce CO_2 and additional hydrogen. The CO_2 is separated out though physical or chemical adsorption.

Oxy-fuel combustion uses pure oxygen, instead of air, and the resulting combustion yields gas with highly concentrated with CO_2. Available technologies for producing pure oxygen are mostly based on cryogenic separation of oxygen from air. Extreme cooling of air produces liquid oxygen, nitrogen, and argon. The process is energy consuming (i.e. produces GHGs at power utilities), costly, and still in the demonstration phase of research.

Post-combustion capture involves removing and capturing CO_2 from flue gas prior to release to atmosphere. Included in this category of capture are chemical absorption, physical absorption, calcium cycle separation, cryogenic separation, membrane separation and adsorption. The following are Post-combustion capture technologies:

Chemical absorption is considered the best option of the post-combustion technologies (Simonds, M., et. al., *A Study of Very Large Scale Post Combustion CO_2 Capture at a Refining & Petrochemical Complex*, 6th International Conference on Green House Gas

Control Technologies, Kyoto, 2002). A solvent is used at low partial pressure to separate CO_2 in flue gas. Drawbacks for this include the corrosive nature of the solvent in the presence of oxygen, high solvent degradation rates (highly reactive with SO_2 and NOx) and the energy required for solvent regeneration.

Physical absorption uses a solvent at high pressure and low temperature and is typically used for CO_2 removal from natural gas. The low CO_2 concentration in flue gas makes this process unsuitable for use with heat recovery coking processes. The flue gas would have to be strongly compressed to achieve the reaction and would require significant energy to function properly, off-setting any reduction in CO_2 emissions.

Calcium cycle separation is still in the research and testing phase. This technology uses quicklime to yield limestone. The limestone is heated to release CO_2 and produce quicklime, again, for recycling. Performance, cost and commercial viability are not yet established (Mackenzie, A., et. al., *Economics of CO_2 Capture Using the Calcium Cycle with a Pressurized Fluidized Bed Combustor*).

Cryogenic separation is widely used for purification of CO_2 from streams that have high concentration of CO_2. This technology is based on solidifying CO_2 by frosting and separating it out.

Gas separation membranes may be used to selectively transport gases through the film. This technology is used mainly for CO_2 removal from natural gas at high pressure and high concentrations of CO_2. It is a new technology for this application and has not been optimized for large scale applications (*CO_2 Capture and Storage: A VGB Report on the State of the Art*, VGB Power Tech, 2004). Low concentrations of CO_2 in the flue gas would make this technology uneconomical for use.

Adsorption of CO_2 can be accomplished by passing flue gas through a bed of solid material, such as activated carbon. Adsorption requires high compression or multiple separation steps and is not applicable for industrial operations, yet (VGB Power Tech, 2004).

In fact, most of these technologies have been developed for use with higher CO_2 emitting fuels, such as coal, and are not well suited for use with smaller natural gas combusting units and groups. Lower concentrations of CO_2 in flue gases to treat and the high energy costs for these technologies make them uneconomical and impractical for the NOVELIS project.

Other less developed technologies, including aqueous ammonia wet scrubbing, solid sorbents, metal organic frameworks, enzyme-based systems and ionic liquids, are not mature enough to be commercially available.

Along with separation/capture technologies, the transportation and sequestration of the CO_2 must also be accomplished to truly reduce GHGs. The captured CO_2 must either be reused or liquefied, transported, and permanently stored.

Transport: After separation, CO_2 is compressed to facilitate transportation and storage if a locally available site for direct injection is unavailable. After compression, CO_2 is transported utilizing a third-party CO_2 pipeline system to transport CO_2 to distant geologic formations that may be more conducive to sequestration than sites in the immediate area.

Pipelines are the most common method of transporting large amount of CO_2 over long distances. The gas must be compressed under high pressure for pipeline transport, which requires high energy consumption. Water must be eliminated from the pipeline to prevent the formation of corrosive carbonic acid. Booster compressors along the pipeline may be needed to maintain the pressure along the long lengths of transport pipe. Pipelines must also be maintained to prevent CO_2 escape. There are around 50 CO_2 pipelines in the U.S., mostly in the Western states. Many of the CO_2 pipelines connect sources with specific customers.

Building transport facilities, such as a pipeline for dedicated use by a single facility, will make many projects economically infeasible, both from an absolute and BACT review perspective. However, such an option may be effective only if adequate storage capacity exists downstream and reasonable transportation prices can be arranged with the pipeline operator.

Storage: At a storage site, CO_2 is injected into deep underground rock formations, often at depths of one (1) km or more. Storage options for the CO_2 are still under development. These include storage in geological formations, such as exhausted oil fields, saline formations, under ocean liquid storage, solid carbonate storage, and terrestrial sequestration. These storage sites generally have an impermeable rock above them, with seals and other geologic features to prevent CO_2 from returning to the surface. Monitoring, reporting, and verifying are important to demonstrate that CO_2 is safely stored. A partnership of the U.S. Department of Energy (DOE), Office of Fossil Energy (FE), and National Energy Technology Laboratory (NETL) Energy is currently working on seven CO_2 storage projects in the United States. In 2017, the ADM Illinois Industrial Carbon Capture & Storage Project successfully began capturing CO_2 from an ethanol production facility and sequestering it in a deep saline formation.

Despite the recent research and activity, the CCS technology is still cost prohibitive for facilities emitting relatively smaller amounts of CO_2. In the United States, only one large-scale, fossil-fueled power plant, Petra Nova in Texas, is using CCS. The plant offsets some of the costs of the technology through selling CO_2 for use in oil recovery.

A recent Congressional Research Service report (Folger, August 9, 2018) states that "There is a broad agreement that costs for CCS would need to decrease before the technologies could be deployed commercially across the nation."

Energy Efficiency Measures: Thermal efficiency is an emissions reduction strategy focused on increasing energy efficiency. Energy efficient processes reduce the amount of fuel consumed. Reductions in fuel consumption result in reductions of direct emissions of GHGs at the steel plant, and reductions in electricity usage result in reductions of indirect GHG emissions. Many operating practices of an EAF affect the energy efficiency including stirring method, addition of oxy-fuel burners, and material preheating.

In general, for energy efficiency measures, the plant design and work practices would be planned to reduce fuel usage (on and off-site), use less polluting fuels, and use more efficient combustion equipment. These measures include development of a Good Combustion and Operation Practices plan, Fuel Selection, Good Equipment Design, Good Material Selection/Substitution.

Since the separation, capture and sequestration technologies are either not feasible and may be cost prohibitive (*Cost and Performance of Carbon Dioxide Capture from Power Generation Working Paper*, IEA, 2011) the Division finds selection of Energy Efficiency Measures acceptable as BACT for control of GHG emissions for the Novelis Project.

i. DBF Preheater (EU 046b):

Decision Summary: Consistent with the BACT evaluation conducted and submitted by Novelis, the Division determines that the development of a GCOP plan, optimum unit efficiency, and use of natural gas to control GHG emissions constitutes BACT for this equipment. The permit establishes long term (ton/yr) BACT limits and design/operational requirements, which are as follows:

EP	BACT	BACT for GHGs
046b	GCOP Plan, Optimum Unit Efficiency[1], Fuel Selection	2,000 tpy

Footnotes:
[1] Includes the following design and operational requirements: install high-efficiency combustion equipment, combust only natural gas, and implement good design and operating practices. The DBF preheater will be operated only intermittently and with varying heating loads and cycle times depending on the process heating requirements of the DBF. However, this unit will use insulated media, lid seals, and seals around equipment traversing the DBF unit shell to minimize convective and radiant heat losses.

Technologies: The possible GHG control technologies identified are Carbon Capture and Storage (CCS), and energy efficiency measures, including fuel selection, development of a GCOP plan, and optimum furnace efficiency.

Analyses: CCS is a potential control measure for GHG that requires GHG separation, transportation, and a viable storage location. CO_2 can be captured by low pressure scrubbing with solvents, solid sorbents, or membranes. Of these capture media, only solvents have been demonstrated on a commercial scale. CO_2 must then be compressed to pipeline pressure (around 2,000 psia) for transportation, requiring a significant amount of power. Pipelines are the most viable method of CO_2 transportation. For storage, CO_2 can be injected into subsurface formations for long-term sequestration. Underground injection of CO_2 can also boost production efficiency of oil and gas by re-pressurizing oil reservoirs or increasing oil mobility.

To successfully implement CCS, it would be necessary to convey CO_2 from Novelis to another site via a new pipeline in which CO_2 could be transported. The Division has determined that the cost of capturing, pressurizing, and constructing a pipeline for the purpose of CCS implementation is prohibitive. For these reasons, CCS is not feasible to control the GHG emissions from the natural gas combusting units at the facility.

The selection of fuel is an available measure for control of CO_2 emissions. Natural gas has the lowest emission rate of CO_2 per unit of energy. All of the natural gas combusting units discussed here will combust natural gas to minimize emissions of GHG.

GCOP are an available control measure for GHG. A GCOP plan promotes efficiency by optimizing fuel usage and minimizing pollutant generation by ensuring proper operation of the combustion device. All the natural gas combusting units at the facility will implement GCOP and meet specific design and operation requirements in Section B for each unit.

The Division has determined that BACT is a GCOP plan that defines, measures and verifies the use of operational and design practices determined as BACT for minimizing GHG emissions. The plan shall be incorporated into the plant standard operating procedures (SOP) and shall include, but not be limited to: a list of combustion optimization practices and a means of verifying that the practices have occurred, a list of combustion and operation practices to be used to lower energy consumption and a means of verifying that the practices have occurred, and a list of the design choices determined to be BACT and the verification that designs were implemented in the final construction.

BACT limits for GHG from the natural gas combusting equipment have been set based upon the proposed use of natural gas as fuel, the capacity of the burners chosen, and the basic combustion emission factors found in AP-42, Section 1.4.

Initial compliance demonstration with BACT will be through development of a GCOP plan within 90 days of equipment startup and design certification within 180 days of startup. Implementation of the GCOP plan and monitoring, recording and reporting gas usage will provide continuous compliance assurance for the subject equipment.

E. CFF Preheater (EU 046a):

This unit, along with the DBF Preheater (EU 046b), ensures that the molten aluminum is maintained at an appropriate temperature during the transfer between the holding furnace and casting machine and generate PM emissions through the combustion of natural gas. Due to the size of this unit and nature of emissions generation, the Division has determined that there are no technically feasible and cost effective controls available to control the emissions from this unit. As such, the Division has determined that control of emissions through good combustion and operating practices (GCOP) for all applicable pollutants constitutes BACT for this unit.

F. AIR QUALITY IMPACT ANALYSIS

i. Screening Methodology

The incremental increases in ambient pollutant concentrations associated with the Novelis casting project have been estimated through the use of a dispersion model (AERMOD) applied in conformance to applicable guidelines in the United States Environmental Protection Agency (USEPA) Guideline on Air Quality Models (GAQM, 40 CFR Appendix W, May 2017) and other applicable guidance, and followed the methodology presented in the Air Dispersion Modeling Protocol approved by KDAQ on February 20, 2022.

Model simulations for short-term and annual-averaged CO, NO_2, PM_{10}, and $PM_{2.5}$ emissions are performed with the AERMOD model using the 5-year meteorological database. The highest predicted impacts (H1H) were used as the design concentrations in the SIL analyses while the design concentrations for the NAAQS and PSD increment analyses followed the form of the NAAQS and PSD increment for each applicable pollutant and averaging time. Each pollutant is being assessed against the SIL for the NAAQS, the maximum value over 5 years for each applicable time averaging period is compared to the appropriate SIL.

Significant Impact Levels (SILs)

Pollutant	Averaging Period	Modeled Concentration (μg/m^3)	Significant Impact Level (μg/m^3)	Significant Monitoring Concentrations (μg/m^3)	SIL Exceeded & Additional Modeling Required?	Significant Monitoring Concentration Exceeded?
CO	1-hour	136.7	2000	-	No	-
	8-hour	49.25	500	575	No	No
PM_{10}	24-hour	13.1	5	10	Yes	Yes
	Annual	2.03	1	-	Yes	-
$PM_{2.5}$	24-hour	9.6	1.2	4	Yes	Yes
	Annual	1.36	0.2	-	Yes	-
NO_2	1-hour	109.1	7.5	-	Yes	-
	Annual	3.72	1	14	Yes	No

ii. <u>Background Concentrations</u>

Representative background concentrations were added to the maximum predicted concentrations so that small sources that were not explicitly modeled are included in the NAAQS and KYAAQS assessment. Background concentrations are based on ambient monitoring data collected for the most recent three year period available (2020 through 2022) determined to be the most representative for use in the modeling analysis. Since all of the study pollutants are not monitored at one location, data from several different monitoring locations are used.

Representative Background Concentrations

Monitoring Location	Site ID	Data Collection Period	Pollutant	Averaging Period	Basis of Design Value	Design Value
Owensboro, KY	21-059-0005	2020-2022	NO_2	1-hour	Average of the three year 98th percentile	52.6 μg/m^3
				Annual	Annual Mean	9.4 μg/m^3
Hopkinsville, KY	21-047-0006	2020-2022	$PM_{2.5}$	24-hour	Average of the three year 98th percentile	23.0 μg/m^3
				Annual	Average of three year annual averages	9.2 μg/m^3
Nashville, TN	47-037-0023	2020-2022	PM_{10}	24-hour	2nd high	51.9 μg/m^3
Hopkinsville, KY	21-047-0006	2020-2022	Ozone	8-hour	3 year 4th high maximum 8-hour average	.059 μg/m^3

The applicant may propose for the reviewing authority's consideration use of existing monitoring data if appropriate justification is provided. Novelis proposed the use of representative regional background data to satisfy this requirement as necessary.

iii. Cumulative NAAQS Analyses

NAAQS analyses, using five years of meteorological data, were performed for 1-hour and annual NO_2; 24-hour PM_{10}; and 24-hour and annual $PM_{2.5}$. The Ambient Ratio Method (ARM2) regulatory default Tier-2 NO_X to NO_2 conversion methodology for modeling ambient NO_2 impacts was used in the multi-source analyses. The NAAQS analyses were carried out by modeling facility-wide Novelis source parameters and emission rates; modeling off-property source inventory for the surrounding area; and adding the representative background concentrations to modeled concentrations for comparison with the NAAQS.

NAAQS Modeling Results

Pollutant	Averaging Period	Modeled Concentration (μg/m^3)	Background (μg/m^3)	Total (μg/m^3)	NAAQS (μg/m^3)	Max Novelis Contribution (μg/m^3)
PM_{10}	24-hour	22.4	51.9	74.3	150	N/A
$PM_{2.5}$	24-hour	6.87	23.0	29.9	35	N/A
	Annual	2.37	9.2	11.6	12	N/A
NO_2[1]	1-hour	127.9	Included	127.9	188	N/A
	Annual	7.46	9.4	16.86	100	N/A

[1]Maximum total impacts shown include the background concentration. The 1-hour and annual average background concentrations are based on ambient monitoring data from the Daviess County, Kentucky site (Site ID 21-059-0005) for the three-year period from 2020 to 2022. The annual average background concentration is the maximum annual arithmetic mean concentration from 2020 to 2022.

iv. Class II Increment Analysis

In addition, a PSD Class II increment modeling analysis, using five years of meteorological data, was also performed for annual NO_2, 24-hr and annual PM_{10}, and 24-hour and annual $PM_{2.5}$ by modeling increment consuming and expanding Novelis source parameters and emission rates as well increment consuming and expanding off-property sources.

Class II Increments

Pollutant	Averaging Period	Modeled Concentration (μg/m^3)	PSD Class II Increment Standard (μg/m^3)
PM_{10}	24 hour	24.68	30
	Annual	3.09	17
$PM_{2.5}$	24 hour	8.55	9
	Annual	1.71	4
$PM_{2.5}$[1] (secondary)	24 hour	8.59[1]	9
	Annual	1.71[1]	4
NO_2	Annual	7.39	25
(1) Secondary PM2.5 concentrations estimated using the default KDAQ MERP values.			

v. Secondary $PM_{2.5}$ and Ozone Formation

The Division has provided recent (August 2, 2018) guidance on addressing secondary pollutant impacts with a state-specific guidance on the application of EPA's Modeled Emission Rates for Precursors (MERPs) Tier-1 demonstration tool. This guidance was used to assess secondary formation of ozone and $PM_{2.5}$for this project. A MERP represents a level of precursor emissions that is not expected to contribute significantly to concentrations of ozone or secondarily formed $PM_{2.5}$.

MERPs are used to determine if proposed emission increases from a facility will result in primary and secondary impacts. NOx, SO_2, $PM_{2.5}$, and VOC emissions from the project must be included in the analysis. If the project emissions from all relevant pollutants are below the SER, no further analysis is required. If the project emissions from any of the relevant emissions are above the SER, a Tier 1 demonstration is required. The Tier 1 demonstration consists of a SILs analysis and, if needed, a cumulative analysis. The analysis must be below the NAAQS for each precursor in order to pass.

Novelis Emission for MERPs Analysis

Precursor	Emissions (tpy)	SER (tpy)
NO_X	274.2	40
SO_2	1.48	40
$PM_{2.5}$	82.8	10
VOC	142.4	40

The values represent the maximum predicted concentrations over the five modeling years and are later used in the PSD Increment analysis. In the NAAQS analysis of the direct model-predicted concentrations, the average over 5 years were used.

SIL Modeling Results for $PM_{2.5}$ MERPs Analysis

Pollutant	Project Modeled Concentration (µg/m^3)
Annual $PM_{2.5}$	2.374
Daily $PM_{2.5}$	6.865

The highest modeled concentration for all sources, including nearby sources, for annual and 24-hour primary $PM_{2.5}$ NAAQS are as follow:

NAAQS and PSD Increment Modeling Results for MERP*s* Analysis

Pollutant	Project + Nearby NAAQS Source Impacts (µg/m^3)	Project + Nearby PSD Increment Source Impacts (µg/m^3)
Annual $PM_{2.5}$	11.6	1.7
Daily $PM_{2.5}$	29.9	8.6

The background concentrations for ozone and $PM_{2.5}$ annual / 24-hour are as follows:

Background Concentrations for MERPs Analysis

Pollutant	Background Concentrations	Monitor ID
Ozone	.059	21-047-0006
Annual $PM_{2.5}$	23.0	21-047-0006
Daily $PM_{2.5}$	9.2	

If the result of the SIL Analysis is greater than 1, a cumulative analysis is required for that precursor. If the result is less than 1, a cumulative analysis is not required. The SIL analysis results for ozone and PM2.5 are as follows:

MERPs SIL Analyses

Pollutant	Analysis Results	Less than 1?
Ozone	1.17	No
Annual $PM_{2.5}$	.003	Yes
Daily $PM_{2.5}$	.043	Yes

The table below shows the cumulative analysis results for ozone and $PM_{2.5}$.

MERP Cumulative NAAQS Analysis

Precursor	Analysis	NAAQS	Below NAAQS?
Ozone	60.17	70 ppb	Yes
Annual $PM_{2.5}$	11.6	12 $\mu g/m^3$	Yes
Daily $PM_{2.5}$	29.9	35 $\mu g/m^3$	Yes

Summary of the PSD Increment analysis results is as follows:

MERPs PSD Increment Analysis

Precursor	Analysis	PSD INC	Below PSD INC?
Annual $PM_{2.5}$	1.7	4 $\mu g/m^3$	Yes
Daily $PM_{2.5}$	8.6	9 $\mu g/m^3$	Yes

vi. <u>Class I MERPs Analysis</u>

In order to assess the total $PM_{2.5}$ impacts (primary and secondary) at the Class I area, the USEPA approved distance-dependent technique was used. In this case, the MERPs values were calculated based on the concentrations from Barren County hypothetical stack at a specific distance representative of the distance between the Project and the Class I area.

The combined primary and secondary $PM_{2.5}$ impacts were compared to their respective SILs. The 24-hour and the annual $PM_{2.5}$ total concentrations are below the SIL standards. Therefore, it is not expected that the Project will contribute significantly to $PM_{2.5}$ levels at AREA, and no further analysis is necessary.

Class I Primary and Secondary PM $_{2.5}$ Modeling Results

Period	AERMOD $PM_{2.5}$ Concentrations ($\mu g/m^3$) at 50 km			Class I SIL
	Primary	Secondary	Total	
24-hour	0.132	0.043	0.17	0.27
Annual	0.007	0.003	0.01	0.05

vii. <u>Class I Area Analysis</u>

Class I area impacts are addressed if the proposed project has an impact that exceeds the screening threshold as described by Federal Land Managers' (FLM) Air Quality Related Values Work Group (FLAG) guidance. In this guidance the sum of the proposed project emissions (in tpy) of SO_2, NOx, PM_{10} and H_2SO_4 is divided by the distance to the Class I area and compared to the value of 10. This ratio is known as Q/D. If Q/D is 10 or less, the project is considered to have a negligible impact on the Class I area. If the Q/D value is greater than 10, then further analysis to evaluate impacts in the Class I area is warranted.

There are four Class I areas within 300 km of the Novelis casting facility: Mammoth Cave, which is the closest at 101 km followed by Sipsey (AL) 253km, Mingo (MO) 267km and Cohutta (GA) 295km. The sum of emissions (SO_2, NOx, PM_{10} and H_2SO_4) for the proposed project is 392.48tpy. The calculated Q/D for the proposed project relative to Mammoth Cave NP is 3.88; which is below the FLM screening level of 10.

Class I Area Q/D Screening Analysis

Pollutant	Project Emissions (tpy)	Q/D Analysis
NO_2	274	[redacted]
SO_2	1.48	
PM_{10}	117	
H_2SO_4	0	
Total	392.48	
AREA	101	3.88

The project related increase of NO_2, PM_{10}, and $PM_{2.5}$, were evaluated against the Class I SILs by applying the AERMOD dispersion model receptors at the maximum spatial extent (50 km from the Project site to receptor). The maximum-modeled concentrations at the 50 km receptors are less than the Class I SILs for all pollutants and averaging periods.

Class I SIL Analysis with AERMOD at 50 km

Pollutant	Averaging Period	Modeled Concentration at 50 km ($\mu g/m^3$)	Class I SIL	% of SIL
PM_{10}	24-hour	0.194	0.3	65%
	Annual	0.009	0.2	5%
$PM_{2.5}$	24-hour	0.132	0.27	49%
	Annual	0.007	0.05	14%
$PM_{2.5}$[1] secondary	24-hour	0.17	0.27	63%
	Annual	0.01	0.05	20%
NO_2	Annual	0.014	0.1	14%
(1) The $PM_{2.5}$ peak concentrations represent the sum of the AERMOD predicted concentrations and the fraction accounting for the secondary $PM_{2.5}$ formations.				

As evident from the AERMOD modeling results, model-predicted impacts from Novelis emission sources are below the Class I SILs for all pollutants and averaging periods; therefore, compliance is demonstrated and no further analysis is required.

Permit Number: V-22-011 Activity: APE20210003
Received: November 10, 2021 Application Complete Date(s): February 17, 2022
Permit Action: ☒ Initial ☐ Renewal ☐ Significant Rev ☐ Minor Rev ☐ Administrative
Construction/Modification Requested? ☒Yes ☐No NSR Applicable? ☒Yes ☐No
Previous 502(b)(10) or Off-Permit Changes incorporated with this permit action ☐Yes ☒No

Description of Action:
With this action, Novelis seeks a permit to construct a new casting plant at the previously permitted coil finishing plant. The new casting plant includes one primary scrap shredding and sorting line, one smaller scrap shred line, one rotary decoating kiln, two sidewell melting furnaces, one Novelis dual-chamber furnace, one front-loaded single chamber tilting melting furnace, two tilting holding furnaces fed to a single casting pit, and one in-line fluxer/degassing unit. Ancillary equipment includes a scrap storage and handling areas, dross presses, a dross house, sow dryers, lime silo for lime-injected baghouses, building heating systems, cooling tower, diesel storage, and paved haul roads. The EPA and federal agencies were provided with this application on December 6, 2021.

The Division issued a Notice of Deficiency (NOD) to Novelis identifying deficiencies in the application on December 13, 2021. Novelis provided an initial response on December 23, 2021, with additional information on January 13, 2022, and the final NOD response on January 21, 2022. The Division transmitted this update to the application to the EPA and federal agencies on February 17, 2022. Novelis submitted a request for determination to the Federal Land Managers of all four Class I area located within 300 km of the Novelis Guthrie site on April 28, 2022. Novelis submitted a revised modeling report to the Division on April 29, 2022 addressing comments the EPA had made on January 13, 2022 on the original modeling submittal. This revised modeling report does not affect any of the previous AERMOD modeling input parameters for the Novelis Guthrie site sources or previously included regional inventory sources.

EU005 through EU009 from the legacy coil finishing plant will be newly subject to 40 CFR 63, Subpart DDDDD upon startup of the new casting plant pursuant to 40 CFR 63.7495(c)(1).

Summary of All Affected Facilities Used to Determine 401 KAR 59:015 Emission Limits								
EU	**Fuel(s)**	**Capacity (MMBtu/hr)**	**Const.**	**Basis for PM Limit**	**Total Heat Input Capacity for PM Limit (MMBtu/hr)**	**Basis for SO_2 Limit**	**Total Heat Input Capacity for SO_2 Limit (MMBtu/hr)**	**Notes**
007	Natural Gas	25.2	2019	401 KAR 59:015, Section 4 (1)(c)	75.6	401 KAR 59:015, Section 5 (1)(c)(2)	75.6	
008	Natural Gas	25.2	2019	401 KAR 59:015, Section 4 (1)(c)	75.6	401 KAR 59:015, Section 5 (1)(c)(2)	75.6	
009	Natural Gas	25.2	2019	401 KAR 59:015, Section 4 (1)(c)	75.6	401 KAR 59:015, Section 5 (1)(c)(2)	75.6	
041c	Natural Gas	19.2	2022	401 KAR 59:015, Section 4 (1)(c)	94.8	401 KAR 59:015, Section 5 (1)(c)(2)	94.8	

V-22-011 Emission Summary				
Pollutant	2021 Actual (tpy)	Previous PTE S-18-023 R2 (tpy)	Change (tpy)	Revised PTE V-22-011 (tpy)*
CO	0.54	89.33	+214.65	303.98
NO_X	0.55	73.65	+232.22	305.87
PT	0.065	5.28	+88.30	93.58
PM_{10}	0.055	7.50	+105.66	113.16
$PM_{2.5}$	0.053	6.92	+81.35	88.27
SO_2	0.007	0.72	+0.97	1.69
VOC	0.10	49.83	+84.79	134.62
Lead	$2.5x10^{-6}$	0.0004	+0.0046	0.005
Greenhouse Gases (GHGs)				
Carbon Dioxide	651	109073	+251270	360343
Methane	0.012	2.07	+3.60	5.67
Nitrous Oxide	0.0033	0.57	+0.36	0.93
CO_2 Equivalent (CO_2e)	652	109295	+251467	360762
Hazardous Air Pollutants (HAPs)				
Hydrochloric Acid	0	0	+113.43	113.43
Naphthalene	Not reported	0.00064	+7.75	7.75
Combined HAPs:	0.010	1.68	+128.11	129.79

*Note: Controlled PTE is listed here due to federally enforceable control devices.

V. Emissions Discussion

A. Project PSD Significance

In the application to construct and operate a new casting plant, Novelis calculated the potential air pollutants emitted by the new sources. The new equipment is expected to be a source of both stack and fugitive emissions of these regulated NSR pollutants: PM, PM_{10}, $PM_{2.5}$, NOx, CO, VOC, and GHGs. The new facility will also be a major source of HAPs with the potential to emit for all HAPs above 25 tpy and one individual HAP greater than 10 tpy.

The Novelis project will be located in Todd County, Kentucky, designated by the U.S. EPA as Unclassifiable/Attainment for all criteria pollutants in accordance with 40 CFR 81.318. Therefore, under the federal New Source Review permitting program, Prevention of Significant Deterioration (PSD) requirements apply to the proposed facility and the application has been reviewed accordingly. Under PSD, Novelis' new facility is defined as a secondary metal production plant, one of 28 industrial source categories for which the major source threshold is the emission of 100 tpy of any regulated NSR pollutant.

Potential to emit (PTE) pollutants for this facility was calculated based on emission factors obtained from U.S. EPA's AP-42, *Compilation of Air Pollutant Emission Factors,* engineering estimates, mass balances, manufacturer's specifications, Aluminum Association reference documents, EPA dockets, similar processes at other aluminum casting facilities, and Material Safety Data Sheets (MSDS) chemical content specifications. Based on these emission factors and the assumption of a 24 hour, 7 days a week, 52 weeks a year operation (8760 hours per year) for most units, the potential emissions of regulated NSR pollutants, with the exception of lead (Pb) and SO_2, will all exceed 100 tons per year (tpy) each.

Therefore, the Novelis facility is considered a new major stationary source under the PSD program. Because one pollutant exceeds the major source threshold for PSD, then PTE for all other regulated NSR pollutants emitted, in this case specifically lead and fluorides, must be compared to the significant emission rate (SER).

The potential increases in emissions of regulated NSR pollutants from the new facility have been calculated and are presented in the following table. A discussion of each pollutant, sources, calculation assumptions and source of emission factors used follows. A brief description of the PSD significance of each pollutant is also included, though additional information regarding PSD requirements as a consequence of the emission levels is discussed more thoroughly in the BACT analysis section, below.

Table A-1, Project PSD Significance

Pollutant	**PTE** (tpy)	**PSD Significant Emission Rate (tpy)**	**PSD Significant Emissions Increase?**
PM (filterable, only)	89.46	25	Yes
PM_{10} (filterable & condensable)	105.85	15	Yes
$PM_{2.5}$ (filterable & condensable)	81.39	10	Yes
Pb	0.0048	0.6	No
NOx	232.22	40	Yes
CO	214.65	100	Yes
VOC	84.79	40	Yes
SO_2	0.98	40	No
GHGs (CO_2e)	251,468	75,000	Yes

B. Particulate Matter (PM, PM_{10}, $PM_{2.5}$) Emissions

PM, PM_{10}, and $PM_{2.5}$ are regulated NSR pollutants. Coarse particles, called PM_{10}, have an aerodynamic diameter of 10 microns or less, and fine particles, called $PM_{2.5}$, have an aerodynamic diameter of 2.5 microns or less. Both filterable and condensable components are required to be included in applicability determinations and in establishing emissions limitations for PM_{10} and $PM_{2.5}$. Filterable PM is defined as particles directly emitted as a solid or liquid at stack conditions and captured on the filter of a stack test train. Condensable PM is material that is in a vapor phase at stack conditions that condenses to form a solid or liquid immediately after discharge from a stack.

Particulates, often discharged through stacks or vents, may also be emitted in a fugitive form. The 401 KAR 51:001 defines fugitive emissions as those emissions which could not reasonably pass through a stack, chimney, vent, or other functionally-equivalent opening. Fugitive emissions are counted toward emissions totals. When speciation of particulate type is unavailable, all particulate is assumed to be part of the same size fraction for conservative purposes when calculating the Potential to Emit.

For the Novelis facility, particulate emissions calculations include three different types: PM (all sizes, filterable only), PM_{10} (filterable and condensable) and $PM_{2.5}$ (filterable and condensable). With the exception of the Diesel Fuel Storage Tanks (EU044), all new emission points are sources of particulate emissions.

Scrap Processing Line #1 (EU026), Scrap Processing Line #2 (EU027), and Scrap Sorting Line #1 (EU028):
Two (2) new aluminum Scrap Processing Lines (#1-#2) will be used to de-bale, shred, clean, and sort purchased aluminum scrap in preparation for further processing in the new Decoater. The exhaust streams from these lines are routed through various hoods and pickup points. A Scrap Sorting Line (#1) is located on the back end of Scrap Processing Line #1. Particulate emissions are generated by the process of shredding and sorting the scrap aluminum, and through collisions of abrasive dust in the exhaust streams. These processes create metal dust and chips of which a small percentage can be classified as particulate matter. These metal fines pose a safety hazard due to their capability of combustion or explosion when contacting an ignition source. Based on the current design for the facility, emissions from Scrap Processing Lines #1 and #2 will be collected and routed to their dedicated baghouses (Cold Baghouse #1 and #2, respectively) for PM emissions control. A third baghouse (Cold Baghouse #3) will serve Scrap Sorting Line #1 as well as the two (2) feed hoppers supplying shreds to the Decoater and the Dross House. Emissions from each baghouse are calculated using the baghouse's exit grain-loading design performance specification. Minor amounts of particulate become fugitive and escape from openings in the building.

Decoater (EU029):
The decoater will be used for thermal decoating of non-clean aluminum scrap. Specifically, the unit will be used to remove various organic contaminants (such as oil, paint, lacquer, or other coating types) from recycled aluminum scrap prior to melting in one of the Sidewell Melting Furnaces or the NDC furnace. Emissions generated by the rotary decoaters will be controlled by an integral hot gas generator or afterburner (used for CO and VOC control) as well as a lime-injected baghouse (Hot Baghouse #1; used for PM and HCl control). Emissions from each baghouse are calculated using the baghouse's exit grain-loading design performance specification and an upper-prediction limit of the condensable portion of PM_{10} and $PM_{2.5}$. Minor amounts of particulate become fugitive and escape from openings in the building.

Group 1 Furnaces and In-Line Degasser:
Sidewell Melting Furnaces #1 and #2 (EU030 and EU031) is a source of all three types of PM due to the combustion of natural gas and loading, transferring, and melting of aluminum scrap. The furnaces will primarily receive decoated aluminum scrap directly from the new Decoater via a scrap conveyor. Charge materials will be both automatically and manually fed to the sidewell of each furnace throughout a given operating cycle. The furnaces will also support solid reactive fluxing, classifying the two (2) units as Group 1 Furnaces under 40 CFR 63, Subpart RRR. Emissions generated in each sidewell melt furnace charge well and furnace main hearth will be routed to the baghouse (Hot Baghouse #2) serving Sidewell Melting Furnaces #1 and #2.

NDC Recycling Furnace (EU032) is a source of all three types of PM due to the combustion of natural gas and loading, transferring, and melting of aluminum scrap. The NDC Furnace will receive decoated aluminum scrap directly from the new Decoater via a scrap conveyor that discharges into the stirring well portion of the open sidewell. Additionally, runaround scrap, post-industrial automotive (auto) scrap, and/or open market scrap will be charged from a charging machine into the charging chamber. The NDC Furnace can also be fed manually into the open sidewell. The open sidewell will also support solid reactive fluxing, classifying the NDC Furnace as a Group 1 Furnace under 40 CFR 63, Subpart RRR.

Holding Furnaces #1 and #2 (EU034 and EU035) is a source of all three types of PM due to the combustion of natural gas and loading, transferring, and melting of aluminum scrap. Molten aluminum produced by the other Group 1 and Group 2 furnaces will be troughed directly to one of the two (2) new Holding Furnaces for further alloying and metal purification activities prior to casting. Emissions generated by each Holding Furnace will be collected and ducted to a shared baghouse (Hot Baghouse #4).

In-Line Degasser (EU036) is a source of all three types of PM due to the gas stream carrying particulate impurities to the surface of the molten aluminum. Once alloying, reactive fluxing, and drossing activities in the Holding Furnaces are completed, molten metal is transported from a single Holding Furnace at a time through an In-line Degasser where a limited amount of reactive fluxing using chlorine gas is performed as a final metal conditioning step prior to casting. Once metal flows through the In-line Degasser, it is cast in one of the seven (7) ingot casting molds in the proposed project's casting bay. Emissions generated by the In-line Degasser will be collected and ducted to the same baghouse as the Holding Furnaces (Hot Baghouse #4).

Front-Load Tilting Melting Furnace (EU033):
The Front-load Furnace will solely receive runaround scrap and prime charge (clean charge) via a charge transfer car. The Front-load Furnace does not support solid reactive fluxing. Accordingly, it is classified as a Group 2 Furnace under 40 CFR 63, Subpart RRR. Emissions generated in the furnace will be routed to a shared baghouse (Hot Baghouse #3) serving both the NDC Furnace and the Front-load Furnace. Minor amounts of particulate become fugitive and escape from openings in the building.

Sow Dryer (EU037):
One sow dryer will be installed to dry and preheat charge materials prior to charging into the various melting furnaces identified in this section. Heat will be provided through the use of natural gas-fired burners. Emissions from the sow dryer will exhaust to a dedicated, uncontrolled stack for release to the atmosphere. Particulate is generated due to the combustion of natural gas.

Dross Processing Building:
Dross House (EU038) produces particulate primarily through the handling and transport of the dross itself. Dross produced by the melting and casting area units will be collected and transported to a dedicated dross processing building. Once there, dross is cooled, stored, loaded into trucks, and eventually sold to outside firms for processing and metal reclamation. Emissions generated by dross handling activities will be collected and ducted to a baghouse serving the Dross House and Scrap Sorting Line #1 (Cold Baghouse #3) for emissions control.

Dross Press #1 and #2 (EU039 and EU040) produce particulate through the primary action of pressing the dross, as the dross can flake or powder under pressure. Emissions generated by the dross presses will be collected and ducted to Hot Baghouse #2 (for Dross Press #1) and Hot Baghouse #3 (for Dross Press #2).

Direct and Indirect Fired Building Heating Systems (EU041a, EU041b, and EU041c):
These units provide heat, producing PM emissions through the combustion of natural gas.

Hot Baghouse Lime Silos #1 & #2 (EU042):
The hot baghouses will use two (2) free standing Lime Silos complete with two (2) level sensors including a high-level sensor to avoid overfilling. Silo venting will be accomplished by a bin vent, so no additional pressure relief device will be used. A fill line from the truck unload station to the silo will be equipped with a pneumatic knife gate with operator. The materials will remain free flowing due to the live bin bottom. The bin vent filter control will be used to minimize materials losses.

Cooling Tower #1 (EU043):
Because cooling towers provide direct contact between cooling water and the air passing through the tower, the air may carry water out of the tower as drift droplets. Impurities in the water become a source of particulates as the water evaporates and the chemical and mineral contaminants crystalize and become airborne. Drift loss from these cooling towers will be minimized through the use of drift eliminators, which represent a category of mist eliminators designed specifically for implementation on cooling towers.

Paved Roads (EU020):
Produces all three types of fugitive PM due to vehicle travel on the paved roads. Controls include sweeping to suppress PM emissions.

PM, PM_{10} and $PM_{2.5}$ PSD Significance
The emissions calculations, using the planned throughputs and accepted emission factors for each piece of equipment, show that:

Potential PM (filterable) emissions for the new facility are estimated to be 89.46 tpy. This emission rate exceeds the significant emission rate threshold of 25 tpy for PM;

Potential PM_{10} (filterable + condensable) emissions for the new facility are estimated to be 105.85 tpy. This emission rate exceeds both the PSD major stationary source threshold of 100 tpy and the significant emission rate threshold of 15 tpy for PM_{10}; and

Potential $PM_{2.5}$ (filterable + condensable) emissions for the new facility are estimated to be 81.39 tpy. This emission rate exceeds the significant emission rate threshold of 10 tpy for $PM_{2.5}$.

Since the SER for each of the particulate emission sizes is exceeded, a BACT analysis for these three pollutants is required for each piece of equipment that emits PM, PM_{10}, and $PM_{2.5}$. Establishment of a BACT limit for the emission of PM (filterable, only), PM_{10}, and $PM_{2.5}$ for each emission point that emits these pollutants is also required. Refer to the **BACT Analysis for PM, PM_{10}, & $PM_{2.5}$** for a discussion of the BACT for all three types of PM.

C. Lead (Pb) Emissions & PSD Significance
The emissions calculations, using the planned throughputs and accepted emission factors for each piece of equipment, show that potential lead emissions for the new facility are estimated to be 0.0048 tpy. This emission rate is below the PSD significant emission rate of 0.6 tpy for Pb. Therefore, a BACT analysis for Lead is not required for this project.

D. Nitrogen Oxides (NOx) Emissions

Nitrogen Oxides (NOx) are a group of highly reactive gases that are a component in the formation of the criteria pollutant Ozone. Sources of NOx from the project come mostly from natural gas-fueled burners, and diesel-fueled emergency engines. Typical NOx controls for these types of NOx sources include the use of low NOx burners, which control fuel and air mixing to reduce flame temperature and therefore NOx formation, and good combustion practices.

Decoater (EU029), Sidewell Melting Furnaces #1 and #2 (EU030 and EU031), NDC Recycling Furnace (EU032), Front-Load Tilting Melting Furnace (EU033), and Holding Furnaces #1 and #2 (EU034 and EU035):
Emissions of NOx come from the burning of natural gas. As with the particulates, most of these emissions are captured and routed to the associated baghouse, either directly or are captured by overhead canopies and hoods and routed to the baghouse. Baghouses provide no control for NOx emissions. Low NOx burners will be equipped to carry out combustion of natural gas in stages and reduce peak flame temperature, thereby lowering the amount of NOx formation. Minor amounts of NOx become fugitive and escape from openings in the building.

Sow Dryer (EU037):
Emissions of NOx come from the burning of natural gas. Low NOx burners will be equipped to carry out combustion of natural gas in stages and reduce peak flame temperature, thereby lowering the amount of NOx formation. Minor amounts of NOx become fugitive and escape from openings in the building.

Direct and Indirect Fired Building Heating Systems (EU041a, EU041b, and EU041c):
These units provide heat, producing NOx emissions through the combustion of natural gas.

NOx PSD Significance
The emissions calculations, using the planned throughputs and accepted emission factors for each piece of equipment, show that potential NOx emissions for the new facility are estimated to be 232.22 tpy. This emission rate exceeds both the PSD major stationary source threshold of 100 tpy and the significant emission rate threshold of 40 tpy for this pollutant. Since both the major stationary source threshold and the SER for NOx is exceeded, a BACT analysis for NOx is required for each piece of equipment that emits NOx. Establishment of a BACT limit for the emission of NOx for each emission point that emits NOx is also required. Refer to the **BACT Analysis for NOx** for a discussion of the BACT for NOx.

E. Carbon Monoxide (CO) Emissions

Carbon Monoxide (CO) is a colorless, odorless gas frequently emitted from combustion-based processes. The main sources of CO from the Novelis facility will be from combustion-based process, i.e. natural gas-burners.

Decoater (EU029):
Emissions of CO come from the burning of natural gas and decoating of scrap. As with the particulates, most of these emissions are captured and routed to the associated baghouse, either directly or are captured by overhead canopies and hoods and routed to the baghouse. Baghouses provide no control for CO emissions. The decoater includes a thermal oxidizer at the exit of the rotary drum as part of the design.

Sidewell Melting Furnaces #1 and #2 (EU030 and EU031), NDC Recycling Furnace (EU032), Front-Load Tilting Melting Furnace (EU033), and Holding Furnaces #1 and #2 (EU034 and EU035):
Emissions of CO come from the burning of natural gas. As with the particulates, most of these emissions are captured and routed to the associated baghouse, either directly or are captured by overhead canopies and hoods and routed to the baghouse. Baghouses provide no control for CO emissions. Minor amounts of CO become fugitive and escape from openings in the building.

Sow Dryer (EU037):
Emissions of CO come from the burning of natural gas. Minor amounts of CO become fugitive and escape from openings in the building.

Direct and Indirect Fired Building Heating Systems (EU041a, EU041b, and EU041c):
These units provide heat, producing CO emissions through the combustion of natural gas.

CO PSD Significance
The emissions calculations, using the planned throughputs and accepted emission factors for each piece of equipment, show that potential CO emissions for the new facility are estimated to be 214.65 tpy. This emission rate exceeds both the PSD major stationary source threshold of 100 tpy and the significant emission rate threshold of 100 tpy for this pollutant. Since both the major stationary source threshold and the SER for CO is exceeded, a BACT analysis for CO is required for each piece of equipment that emits CO. Establishment of a BACT limit for the emission of CO for each emission point that emits CO is also required. Refer to the **BACT Analysis for CO** for a discussion of the BACT for CO.

F. Volatile Organic Compounds (VOC) Emissions
Volatile Organic Compounds (VOCs) are gases that are a component in the formation of the criteria pollutant, Ozone. As with the CO emissions, any equipment that burns fossil fuel is a source of VOCs, but emission points involved in this project also produce VOCs through use of certain processes or materials. Emission factors for fuel combustion VOCs used in the calculation of emissions are based on emission factors from AP-42, Chapter 1.4, *Natural Gas Combustion*.

Decoater (EU029):
Emissions of VOC come from the burning of natural gas and the decoating of scrap. As with the particulates, most of these emissions are captured and routed to the associated baghouse, either directly or are captured by overhead canopies and hoods and routed to the baghouse. Baghouses provide no control for VOC emissions. The decoater includes a thermal oxidizer at the exit of the rotary drum as part of the design.

Sidewell Melting Furnaces #1 and #2 (EU030 and EU031) and NDC Recycling Furnace (EU032):
Emissions of VOC come from the burning of natural gas and the melting and fluxing of scrap. As with the particulates, most of these emissions are captured and routed to the associated baghouse, either directly or are captured by overhead canopies and hoods and routed to the baghouse. Baghouses provide no control for VOC emissions. Minor amounts of VOC become fugitive and escape from openings in the building.

Front-Load Tilting Melting Furnace (EU033) and Holding Furnaces #1 and #2 (EU034 and EU035):
Emissions of VOC come from the burning of natural gas. As with the particulates, most of these emissions are captured and routed to the associated baghouse, either directly or are captured by overhead canopies and hoods and routed to the baghouse. Baghouses provide no control for VOC emissions. Minor amounts of VOC become fugitive and escape from openings in the building.

Sow Dryer (EU037):
Emissions of VOC come from the burning of natural gas. Minor amounts of VOC become fugitive and escape from openings in the building.

Direct and Indirect Fired Building Heating Systems (EU041a, EU041b, and EU041c):
These units provide heat, producing VOC emissions through the combustion of natural gas.

VOC PSD Significance
The emissions calculations, using the planned throughputs and accepted emission factors for each piece of equipment, show that potential VOC emissions for the new facility are estimated to be 84.79 tpy. This emission rate exceeds the significant emission rate threshold of 40 tpy for this pollutant. Since the SER for VOC is exceeded, a BACT analysis for VOC is required for each piece of equipment that emits VOC. Establishment of a BACT limit for the emission of VOC for each emission point that emits VOC is also required. Refer to the **BACT Analysis for VOC** for a discussion of the BACT for VOC.

G. Sulfur Dioxide (SO_2) Emissions and PSD Significance
The emissions calculations, using the planned throughputs and accepted emission factors for each piece of equipment, show that potential SO_2 emissions for the new facility are estimated to be 0.98 tpy. This emission rate is below the PSD significant emission rate of 40 tpy for SO_2. Therefore, a BACT analysis for SO_2 is not required for this project.

H. Fluoride (F) Emissions and PSD Significance
The emissions calculations, using the planned throughputs and accepted emission factors for each piece of equipment, show that there are no emission units that will emit fluoride in the particulate form. Thus, the estimated fluoride emissions for the new facility are 0.00 tpy. This emission rate is below the PSD significant emission rate of 3.0 tpy for fluorides. Therefore, a BACT analysis for Fluoride is not required for this project.

I. Greenhouse Gas (GHG) Emissions
Gases that trap heat in the atmosphere, and can lead to climate change, are called greenhouse gases. Some greenhouse gases occur naturally and others are emitted solely through human activities. For the purposes of air permitting, GHGs include an aggregate group of six gases: carbon dioxide, nitrous oxide, methane, hydrofluorocarbons, sulfur hexafluoride, and perfluorocarbons. To determine emissions of these gases, the concept of carbon dioxide equivalents [CO_2e] has been established as a metric measure used to compare the emissions from various greenhouse gases based upon their global warming potential (GWP). The

tonnage of each type of greenhouse gas emitted is multiplied by its GWP to establish the carbon dioxide equivalence for that particular emission of that particular gas.

For this project, the majority of GHG emissions are due to the combustion of fossil fuels for heat and energy in a variety of processes including furnaces, heaters, preheaters, and boilers.

In the application, calculated emissions show that the major GHGs emitted by this project will be Carbon Dioxide (CO_2), small amounts of Methane (CH_4) and Nitrous Oxide (N_2O). For the natural gas used, emission factors for CO_2, CH_4, and N_2O have been taken from 40 CFR 98, Subpart C. The current global warming potentials found in 40 CFR 98, Subpart A, have also been used in estimating the CO_2e.

The Novelis process is a major consumer of fossil fuel and therefore a large source of greenhouse gas (GHG) emissions. The only fuel used is natural gas, which is the fossil fuel that produces the least amount of GHG emissions. The natural gas is used primarily as a utility for maintaining temperature in molten and solid metals and heating.

Decoater (EU029), Sidewell Melting Furnaces #1 and #2 (EU030 and EU031), NDC Recycling Furnace (EU032), Holding Furnaces #1 and #2 (EU034 and EU035), Front-Load Tilting Melting Furnace (EU033):
Emissions of GHG come from the burning of natural gas. As with the particulates, most of these emissions are captured and routed to the associated baghouse, either directly or are captured by overhead canopies and hoods and routed to the baghouse. Baghouses provide no control for GHG emissions. Minor amounts of GHG become fugitive and escape from openings in the building.

Sow Dryer (EU037):
Emissions of GHG come from the burning of natural gas. Minor amounts of GHG become fugitive and escape from openings in the building.

Direct and Indirect Fired Building Heating Systems (EU041a, EU041b, and EU041c):
These units provide heat, producing GHG emissions through the combustion of natural gas.

Greenhouse Gas (GHG) PSD Significance
Based on the submitted emission factors and calculations, the potential CO_2e emissions for the new facility are estimated to be 251,468 tpy of CO_2e. This emission rate exceeds the PSD significant emission rate threshold of 75,000 tpy for CO_2e. Since the SER for GHGs and at least one other PSD pollutant are exceeded, a BACT analysis for GHG is required for each piece of equipment that emits GHG. Establishment of a BACT limit for the emission of GHG for each emission point that emits GHG is also required. Refer to the **BACT Analysis for GHG** for a discussion of the BACT for GHG.

J. Toxic and Hazardous Air Pollutants

Toxic and Hazardous Air Pollutants (HAPs) are those pollutants that are known or suspected to cause serious human health effects and some adverse environmental and ecological effects. Under the Clean Air Act, U.S. EPA is required to regulate emissions of hazardous air pollutants. The list of HAPs includes 189 pollutants.

The Novelis facility is a source of some HAPs, mostly through the combustion of fossil fuels and some metallurgical processes. In addition to the emissions of criteria pollutants and

GHGs, the facility will also be a source of hydrochloric acid (HCl). The new facility will also be a source of several other HAPs/Toxics in smaller quantities, all less than 10 tpy each.

Hydrochloric Acid (HCl)
HCl is a colorless, corrosive, strong mineral acid with many industrial uses among which, when it reacts with an organic base it forms a hydrochloride salt. HCl can be used as a fluxing agent to purify or otherwise adjust the chemical composition of metals prior to casting.

HCl calculations are based on testing of similar units and the allowable limit in 40 CFR 63, Subpart RRR. HCl is controlled by injecting baghouses with lime, which reacts and catches the HCl from the gas stream. The site-wide total for HCl emissions from new equipment (after control) is 113.43 tpy.

Other HAPs and Toxics
Smaller amounts of HAPs and Toxics, emitted at less than 10 tpy each (after federally enforceable controls), will also come from the new facility. The majority of these are emissions are due to the combustion of natural gas. Burning these fuels in heaters, furnaces, boilers and engines causes not only the criteria and GHG pollutants discussed above, but also includes a wide variety of volatile organic compounds and metallic fume and particulate classified as HAPs. Among the organic compounds emitted are acetaldehyde, benzene, dichlorobenzene, formaldehyde, toluene, and the metals include arsenic, beryllium, cadmium, chromium, cobalt, manganese, mercury, nickel and selenium. As mentioned, each of these HAPs are emitted at less than 10 tpy and in many cases, several orders of magnitude below the 10 tpy threshold.

Air Dispersion Modeling of HAPs and Toxics
Many of the HAPs and Toxics are regulated under federal NESHAPs, i.e. applicable MACT standards, which analyze the amounts and potential effects of HAPs and Toxics emitted by certain industrial activities. MACTs also provide operational and system design requirements for some equipment and emission limits for the HAPs and Toxics. Emissions of HAPs and Toxics, not subject to an applicable MACT, are related to Natural Gas combustion, and as such, the Division has determined that the terms and conditions in the permit (V-22-011) will be sufficient to demonstrate compliance with all applicable regulations and requirements.

VI. BACT Analysis

The PSD permitting program is designed to ensure that economic growth occurs in a manner consistent with the preservation of existing clean air resources. It requires that new or modified pollutant sources do not endanger public health and welfare, or deteriorate air quality in areas of special natural, scenic or historical value. The PSD program also allows for public participation in the decision making process.

The Commonwealth of Kentucky implements a PSD program through 401 KAR 51:017. Pursuant to this regulation, a new major stationary source shall apply BACT for each regulated NSR pollutant for which the source has the potential to emit in significant amounts. BACT represents the maximum degree of reduction for each regulated NSR pollutant that will be emitted from a proposed major stationary source or major modification and is determined by the cabinet pursuant to 401 KAR 51:017, Section 8, after taking into account energy, environmental, and economic impacts and other costs, to be achievable by the source or modification through application of production processes or available methods, systems, and techniques, including fuel cleaning or treatment or innovative fuel combustion techniques for control of that pollutant.

BACT determines what will be the permitted standard (or maximum allowable emissions) for a particular pollutant for a particular project or emission source. BACT is based upon a case-by-case decision that considers energy, environmental and economic impact. BACT can be add-on control equipment or modification of the production processes or methods to reduce emissions or an emission standard. BACT may also be a design, equipment, work practice or operational standard if setting an emissions standard is not practical.

Since the Novelis project will emit more than 100 tpy for several regulated NSR pollutants, it is required to perform BACT on the pollutants that are emitted in quantities that exceed significant emission rates. For the Novelis project, the pollutants requiring BACT analysis are particulate (including PM, PM_{10}, and $PM_{2.5}$), NOx, CO, VOC, and GHGs (see Section I. Emissions, Table A-1 above, for the potential emission levels and thresholds exceeded).

Novelis conducted a BACT analysis for each pollutant with the potential to be emitted in excess of the PSD significant emission rate for their proposed project in accordance with the *"Top-Down" Best Available Control Technology Guidance Document* outlined in the 1990 draft U.S. EPA *New Source Review Workshop Manual*, which outlines steps for conducting a top-down BACT analysis. The steps Novelis followed are:
(11) Identify available control possibilities for each PSD pollutant based on source knowledge and previous regulatory decisions for identical and similar sources;
(12) Reject inappropriate and technically infeasible control options;
(13) Rank feasible alternatives in descending order of control effectiveness;
(14) Evaluate the most effective controls and weigh the economic, energy and environmental impacts of each; and
(15) Select BACT.

BACT analyses for each PSD significant pollutant were included in the Novelis application and supplemented in subsequent submissions to the Division.

The Division reviewed the information submitted by Novelis, along with information available from industry, scholarly publications, and the RACT/BACT/LAER Clearinghouse (RBLC), a U.S. EPA maintained database that contains case-specific information on the "Best Available" air pollution technologies that have been required to reduce the emission of air pollutants from stationary sources. The Division used this information to make BACT determinations for PM, PM_{10}, $PM_{2.5}$, NOx, CO, VOCs, and GHGs, all of which are subject to PSD review for this project.

Under PSD review, once a control technology (or practice) has been selected, BACT limits are assigned. BACT limits may be both emission related or related to operation of equipment. Individual long and short-term BACT limits have been established for each emitted pollutant.

A summary of the BACT analyses, and the Division's decisions, are outlined, below. They are arranged by pollutant first and then by each emission group that produces that pollutant. Within each emission group section, a summary of the BACT decisions made for the group and a table of BACT limits assigned precedes the analysis of possible technologies for that group, a discussion of how the BACT limits were set, and comments on the compliance demonstration required by the permit.

A. BACT Analysis for PM, PM_{10}, & $PM_{2.5}$

Novelis submitted BACT analyses for PM, PM_{10}, and $PM_{2.5}$, but addressed all three types of PM together since the same control technologies and practices reduce all three of these emissions. Any reference to PM in this section refers only to filterable PM, whereas PM_{10} and $PM_{2.5}$ includes filterable and condensable components.

Technologies for Particulate Control: The technologies identified as possible BACT controls for the three types of particulate for the Novelis project are the following:

Cyclones: These mechanical collectors work on the principal of inertial separation. The collectors use a rapid change in air direction and the property of inertia to separate mass (particulate) from the process gas stream. This type of control is often used when there is a high concentration of coarse particulate. A cyclone is a feasible control, but has a lower collection efficiency (about 70 %), over the range of possible particulate sizes and are most effective for particulate of >10 micron size. They are often used as pre-controls to reduce particle concentration in a gas stream before it enters a second control device.

Scrubbers: In a wet scrubber, the process gas stream is either sprayed with a liquid or forced into contact with a liquid in order to impact and remove particles entrained in the gas. The particles are captured in liquid droplets that are then collected from the gas stream in a mist eliminator. The resulting liquid is then treated to remove the particles and recycled or discharged. Wet scrubbers are especially useful when the particulate is sticky, combustive, corrosive or explosive. Dry scrubbers, which do not saturate the gas stream, are generally used to remove acids from waste gas and are not used for particulate control.

Electrostatic precipitators (ESPs): ESPs are another control technology often used to remove particulate from flue gases before they are released to atmosphere. In this technology, particulate entrained in a gas stream is given an electrical charge as the stream passes through a gaseous ion region (corona). The charged particles are then attracted to, and collected by, a neutral or oppositely charged collector plate. In a dry electrostatic precipitator (ESPs), the collector plate is subjected to intermittent mechanical or sonic percussion to knock the particles off the plate and into a hopper positioned under the plate. A wet ESP operates similarly to the dry ESP for removing PM from a gas stream, but the collecting surface is cleaned by water, either intermittently or continuously.

Mist eliminators: Mist eliminators remove visible or entrained oil vapor, moisture, and mist (mostly considered to be particulate matter greater than 10 microns in diameter) from the gaseous stream of processes when liquid droplets contact the wire mesh surface/pad or filter. The liquids present in the gas stream are separated by either diffusion, impaction, or interception and are then collected, filtered, and sent to a storage tank. They work effectively with gas stream velocities above 1 ft/s and remove entrained liquid drops down to 3 μm in diameter. Mist eliminators can achieve removal efficiencies of up to 90% according to Table B.2-3 in AP-42. Mist eliminators are typically inexpensive to purchase and operate and can be easily installed on a new or existing equipment. Mist eliminators are only used for control of mist particulate in exhaust streams (e.g., particulate generated from a lubricant spray) and not dry particulate (e.g., particulate generated from abrasive mechanical grinding).

Fabric filters (baghouses): This type of control equipment consists of a series of bags (filters) contained in a shell structure, through which process gas or a dust laden air stream is passed. Baghouses function based on the fact that particles are larger than gas molecules. When a particulate-laden gas is passed through a membrane (fabric filter), the particulate is captured on the filter while the clean gas passes through. The bags can be of woven or felted cotton, synthetic, or glass-fiber material in either a tube or envelope shape. Fabric filters, and the materials from which they are made, can be chosen to effectively clean particulates based on the sizes, shapes, and textures of the particulate expected. Baghouses also have cleaning devices, such as pulse jet, shakers or rappers, reverse air capability, or sonic cleaners, that cause collected dust to fall into dust hoppers at the bottom of the shell structure. The particulate removal efficiency of a baghouse can be as high as 99.9 %. The bin vent filters used in the Novelis project are in this category of control.

Enclosure: Placing operations within a building or enclosure protects surfaces from air currents and prevents dust from becoming airborne. Depending on the openings, such as vents, windows and doors, and fans used, buildings can provide efficient reduction in particulates generated within the structure. Building enclosures around conveyors and material piles also provides protection against particles becoming airborne.

Good Combustion and Operation Practices: This is a combustion optimization work practices method for minimizing fuel use and emissions from the burning of fossil fuels. Oxygen and carbon in the fuel combine during combustion in a complex process requiring turbulence, temperature and time for the reactants to contact and combine to form carbon dioxide (CO_2) and heat. If the combustion and combination of necessary elements are not controlled, the combustion of the fuel is incomplete and undesirable emissions form. Although particulate from natural gas combustion is normally a small amount, poor air/fuel mixing or maintenance problems can cause extra PM to form. Particulates from natural gas combustion are usually larger molecular weight hydrocarbons that are not fully combusted. Increased CO also occurs when there is poor mixing (not enough turbulence) and/or there is not enough air in the mix. Other pollutants such as NOx form if the temperature is too hot. SO_2 can form if there is too much sulfur in the fuel. By taking measures to optimize the combustion process, including control of air mixing and temperature, and reducing the amount of fuel used, pollutants are minimized. These measures may include choosing good burner designs, using performance monitoring and process control techniques to improve operation, performing regular and thorough maintenance of the combustion system, etc.

Although it is not an add-on control, efficient operation of combustion equipment is often an effective means to reduce combustion related pollutants. Preparation of a specific plan for achieving combustion optimization, such as a Good Combustion and Operation Practices (GCOP) Plan, that defines, measures, and verifies the use of operational and design practices specific to a piece of equipment for the reduction of a specific pollutant provides verifiable implementation of this work practices method.

Clean Fuel Use: This is a practice whereby a facility or specific equipment is designed to use natural fuels (such as natural gas), that emit pollutants in lesser quantities than the alternatives (such as fossil fuels).

Good Housekeeping Practices: Work practices, such as sweeping floors or pavement, wiping off equipment, keeping doors and windows closed, and generally keeping dusts from gathering or escaping from a building is a good general way to cut down on dust generation and emission.

Good Work Practices: Work practices such as performing inspections and preventative maintenance, help keep equipment running in optimal ranges and prevent extra pollutant emissions caused by malfunction. Designing equipment for minimal emissions is also considered.

Wet Suppression and other Fugitive Controls: The use of wet suppression, keeping trucks covered and cleaned, paving roadways, sweeping, etc. are general ways to minimize outdoor fugitives from the facility property.

i. Scrap Processing Line #1 (EU026), Scrap Processing Line #2 (EU027), and Scrap Sorting Line #1 (EU028):

Decision Summary: Consistent with the BACT evaluation conducted and submitted by the applicant, the Division determines that the use of a baghouse and good design and operating practices as means to control PM, PM_{10}, and $PM_{2.5}$ (filterable and condensable) emissions constitutes BACT.

BACT limits for PM, PM_{10}, and $PM_{2.5}$ are calculated using the grain loading BACT limit for each particulate size, the flowrate for the baghouse, and 8,760 hours per year to determine a maximum lb/hr and ton/yr limit. Because the fabric filters will emit at the same outlet grain loading, regardless of inlet grain loading, BACT limits for PM, PM_{10}, and $PM_{2.5}$ are more appropriately set this way.

Emission Point	**BACT**	**BACT limit for PM (filterable)**	**BACT limit for PM_{10}**	**BACT limit for $PM_{2.5}$**
026	Cold Baghouse #1; GWP Plan	5.47 lb/hr; 23.98 ton/yr	2.79 lb/hr; 12.23 ton/yr	0.82 lb/hr; 3.60 ton/yr
027	Cold Baghouse #2; GWP Plan	1.38 lb/hr; 6.04 ton/yr	0.70 lb/hr; 3.08 ton/yr	0.21 lb/hr; 0.91 ton/yr
028	Cold Baghouse #3; GWP Plan	1.98 lb/hr; 8.67 ton/yr	1.01 lb/hr; 4.42 ton/yr	0.30 lb/hr; 1.30 ton/yr

Technologies: Novelis examined the following technologies as possibilities to control PM emitted from the scrap processing operations: Fabric Filters (Baghouses), Wet Scrubbers or High Efficiency Venturi Scrubber, Electrostatic Precipitators (ESPs), High Efficiency Cyclone, and Good Work Practices.

Control Type	**Estimated PM/PM_{10}/$PM_{2.5}$ Control Efficiency***
Fabric Filter (Baghouse)	90% (nominal)
Wet Scrubber or high efficiency Venturi Scrubber	70% (nominal)
Good Work Practices	Undefined
ESP	Not technically feasible
Cyclone	Not technically feasible

*Based on low end of efficiency range for filterable particulate matter based on low inlet loading associated with scrap processes.

Analyses: After identifying possible particulate control technologies available, Novelis presented a review of the different possible technologies, discussed the technical feasibility of each one and discussed the relevant advantages and disadvantages for use in the scrap processing operations.

Fabric filters (baghouses) represent a technically feasible control option for minimizing PM emissions from the Scrap Processing and Sorting Lines.

Fine particles of aluminum generated by the scrap operations have an inherent explosion risk. The Aluminum Association suggests that special consideration should be given to hazards, specifically explosivity, associated with the use of dry control methods for particulate control of aluminum dust. Based on the health and safety risks related to the explosivity hazards associated with the use of dry control technologies, dry ESPs are not recommended for control of particulates from the shredding of aluminum. This control method has a risk of static electrical charge buildup, which may result in an increased risk of explosion of the aluminum fines. Wet ESPs would not have this risk; however, ESPs are not suited for use in processes which are highly variable because they are very sensitive to fluctuations in gas stream conditions (flow rates, temperatures, particulate and gas composition, and particulate loadings). The variable nature of the particulate loadings of the exhaust streams from these non-continuous processes would make this option technically infeasible.

The typical wet scrubber emission stream characteristic ranges encompass the design air flow and temperature of the scrap sorting processes; however, the minimum PM inlet concentration for venturi scrubbers (0.1 gr/scf) is five times the estimated grain-loading for the scrap processing and sorting lines (0.02 gr/scf, uncontrolled). Therefore, only packed tower and spray tower scrubbers are considered in the remaining steps of the BACT evaluation for these sources.

The typical cyclone emission stream characteristic ranges encompass the design air flow and temperature of the scrap sorting processes' exhaust streams; however, the estimated concentration of these exhaust streams (0.02 gr/scf, uncontrolled) are orders of magnitude lower than the minimum cyclone inlet loading of 0.44 gr/scf. Therefore, cyclones as a control technology are not addressed in the remaining steps of the BACT evaluation for these sources.

BACT for this equipment is therefore a Baghouse and a Good Work Practices Plan.

Initial compliance demonstration with BACT is through development of a Good Work Practices Plan (GWP) within 180 days of equipment startup, implementation of the GWP, and stack testing each cold baghouse. Continuous compliance is demonstrated through monitoring, recording and reporting throughputs for the equipment and, as applicable, the control device(s). Additional continuous compliance assurance for the baghouse shall be demonstrated through use of baghouse leak detection/monitoring, and inspections.

ii. Decoater (EU029)

Decision Summary: Consistent with the BACT evaluation conducted and submitted by the applicant, the Division has determined that the use of a baghouse, low sulfur fuel and a good combustion and operating practices (GCOP) plan as means to control PM, PM_{10}, and $PM_{2.5}$ (filterable and condensable) emissions constitutes BACT.

BACT limits for PM, PM_{10}, and $PM_{2.5}$ are calculated using the grain loading BACT limit for each particulate size, the flowrate for the baghouse, and 8,760 hours per year to determine a maximum lb/hr and ton/yr limit. Because the fabric filters will emit at the same outlet grain loading, regardless of inlet grain loading, BACT limits for PM, PM_{10}, and $PM_{2.5}$ are more appropriately set this way.

Emission Point	**BACT**	**BACT limit for PM (filterable)**	**BACT limit for PM_{10}**	**BACT limit for $PM_{2.5}$**
029	Hot Baghouse #1; GCOP Plan	1.66 lb/hr; 7.26 ton/yr	5.39 lb/hr; 23.58 ton/yr	5.22 lb/hr; 22.86 ton/yr

Technologies: Novelis examined the following technologies as possibilities to control PM emitted from the decoater: Fabric Filters (Baghouses), Wet Scrubbers or High Efficiency Venturi Scrubber, Electrostatic Precipitators (ESPs), High Efficiency Cyclone, Low Sulfur Fuel, and Good Combustion and Operation Practices.

Control Type	**Estimated PM/PM_{10}/$PM_{2.5}$ Control Efficiency***
Fabric Filter (Baghouse)	98% (nominal)
Wet Scrubber or high efficiency Venturi Scrubber	90% (nominal)
GCOP	Undefined
Low Sulfur Fuel	Undefined
ESP	Not technically feasible
Cyclone	Not technically feasible

*Based on low end of efficiency range for filterable particulate matter based on low inlet loading.

Analyses: After identifying possible particulate control technologies available, Novelis presented a review of the different possible technologies, discussed the technical feasibility of each one and discussed the relevant advantages and disadvantages for use in the decoater.
Fabric filters (baghouses) represent a technically feasible control option for minimizing PM emissions from the Scrap Processing and Sorting Lines.

Dry ESPs (Wire-Plate Type) are typically designed to control gas flow rates of 200,000 – 1,000,000 scfm with a typical inlet loading concentration of 1 to 50 gr/cf. The inlet loading concentration (0.10 gr/scf, uncontrolled) for the Decoater is an order of magnitude smaller than the typical dry ESP range. Wet ESPs (Wire-Pipe Type) are typically designed to control gas flow rates of 1,000 – 100,000 scfm with a typical inlet loading concentration of 1 to 50 gr/cf. While the gas flow rate for the Decoater is in this range, the inlet loading concentration is an order of magnitude smaller than the typical wet ESP range. ESPs in general are not suited for use in processes which are highly variable because they are very sensitive to fluctuations in gas stream conditions (flow rates, temperatures, particulate and gas composition, and particulate loadings). Variability in the material processed by the Decoater will result in variable particulate flow to the ESP. Additionally, ESPs have large space and power requirements. Furthermore, the RBLC search did not identify any instances of an ESP being used on a similar source. Therefore, this technology is considered to be technically infeasible for the Decoater and is not addressed in the remaining steps of the BACT evaluation.

Wet scrubbers represent a technically feasible control option for minimizing PM emissions from the Decoater. This technology is addressed in the remaining steps of the BACT evaluation.

The typical cyclone emission stream characteristic ranges encompass the design air flow and temperature of the Decoater exhaust streams; however, the estimated concentration of this exhaust stream (0.10 gr/scf, uncontrolled) is significantly lower than the minimum cyclone inlet loading of 0.44 gr/scf. Furthermore, the RBLC search did not identify any instances of a cyclone being used as the primary PM control on a similar source, rather, the RBLC identifies two facilities that use a cyclone to treat the exhaust before sending the vent stream to an afterburner. Therefore, cyclones as a control technology are not addressed in the remaining steps of the BACT evaluation for this source.

Utilizing low sulfur fuel represents a technically feasible control option for minimizing PM emissions from the Decoater, as the Decoater will combustion natural gas which has a low sulfur content. This method is addressed in the remaining steps of the BACT evaluation.

The good combustion and operating practices represent a technically feasible control option for minimizing PM emissions from the Decoater. This method is addressed in the remaining steps of the BACT evaluation.

BACT for this equipment is therefore a Baghouse, use of Low Sulfur Fuel, and a Good Combustion and Operation Plan.

Initial compliance demonstration with BACT is through development of a GCOP plan within 90 days of equipment startup, implementation of the GCOP, and stack testing the hot baghouse. Continuous compliance is demonstrated through monitoring, recording and reporting throughputs for the equipment and, as applicable, the control device(s). Additional continuous compliance assurance for the baghouse shall be demonstrated through use of baghouse leak detection/monitoring, and inspections.

iii. Sidewell Melting Furnace #1 (EU030), Sidewell Melting Furnace #2 (EU031), Novelis Dual Chamber (NDC) Recycling Furnace (EU032), Front-Load Tilting Melting Furnace (EU033), Holding Furnace #1 (EU034), Holding Furnace #2 (EU035), and In-Line Degasser (EU036):

Decision Summary: Consistent with the BACT evaluation conducted and submitted by the applicant, the Division determines that the use of a baghouse, low sulfur fuel and a good combustion and operation practices plan as means to control PM, PM_{10}, and $PM_{2.5}$ (filterable and condensable) emissions constitutes BACT.

BACT limits for PM, PM_{10}, and $PM_{2.5}$ are calculated using the grain loading BACT limit for each particulate size, the flowrate for the baghouse, and 8,760 hours per year to determine a maximum lb/hr and ton/yr limit. Because the fabric filters will emit at the same outlet grain loading, regardless of inlet grain loading, BACT limits for PM, PM_{10}, and $PM_{2.5}$ are more appropriately set this way.

Emission Point	BACT	BACT limit for PM (filterable)	BACT limit for PM_{10}	BACT limit for $PM_{2.5}$
030	Hot Baghouse #2; GCOP Plan; Low Sulfur Fuel	0.08 lb/ton; 4.86 ton/yr	0.18 lb/ton; 11.61 ton/yr	0.16 lb/ton; 9.91 ton/yr
031	Hot Baghouse #2; GCOP Plan; Low Sulfur Fuel	0.08 lb/ton; 4.86 ton/yr	0.18 lb/ton; 11.61 ton/yr	0.16 lb/ton; 9.91 ton/yr
032	Hot Baghouse #3; GCOP Plan; Low Sulfur Fuel	0.10 lb/ton; 7.33 ton/yr	0.20 lb/ton; 14.62 ton/yr	0.17 lb/ton; 12.05 ton/yr
033	Hot Baghouse #3; GCOP Plan; Low Sulfur Fuel	0.03 lb/ton; 1.96 ton/yr	0.08 lb/ton; 5.41 ton/yr	0.08 lb/ton; 5.29 ton/yr
034	Hot Baghouse #4; GCOP Plan; Low Sulfur Fuel	0.03 lb/ton; 4.84 ton/yr	0.04 lb/ton; 6.50 ton/yr	0.03 lb/ton; 6.21 ton/yr
035	Hot Baghouse #4; GCOP Plan; Low Sulfur Fuel	0.03 lb/ton; 4.84 ton/yr	0.04 lb/ton; 6.50 ton/yr	0.03 lb/ton; 6.21 ton/yr
036	Hot Baghouse #4; GCOP Plan	0.010 lb/ton; 1.83 ton/yr	0.005 lb/ton; 0.97 ton/yr	0.002 lb/ton; 0.37 ton/yr

Technologies: Novelis examined the following technologies as possibilities to control PM emitted from the furnaces: Fabric Filters (Baghouses), Wet Scrubbers or High Efficiency Venturi Scrubber, Electrostatic Precipitators (ESPs), High Efficiency Cyclone, Low Sulfur Fuel, and Good Combustion and Operation Practices.

Control Type	Estimated PM/PM_{10}/$PM_{2.5}$ Control Efficiency*
Fabric Filter (Baghouse)	67-91.8% (nominal)
Wet Scrubber or high efficiency Venturi Scrubber	50-70% (nominal)
Cyclone	50% (nominal)
GCOP	Undefined
Low Sulfur Fuel	Undefined
ESP	Not technically feasible

*Based on low end of efficiency range for filterable particulate matter based on low inlet loading.

Analyses: After identifying possible particulate control technologies available, Novelis presented a review of the different possible technologies, discussed the technical feasibility of each one and discussed the relevant advantages and disadvantages for use in the decoater.

Fabric filters (baghouses) represent a technically feasible control option for minimizing PM emissions from each molten metal processing furnace and the In-line Degasser. This technology is addressed in the remaining steps of the BACT evaluation.

Dry ESPs (Wire-Plate Type) are typically designed to control gas flow rates of 200,000 – 1,000,000 scfm with a typical inlet loading concentration of 1 to 50 gr/cf. The gas flows (approximately 65,000 dscfm for each of the Sidewell Melting Furnaces; 98,000 dscfm for the NDC Furnace; 26,000 dscfm for the Front-load Furnace; 64,000 dscfm for the Holding Furnaces) and inlet loading concentrations (approximately 0.02 gr/cf for each melting furnace; 0.006 for the Holding Furnaces) are smaller than the typical dry ESP range. Wet ESPs (Wire-Pipe Type) are typically designed to control gas flow rates of 1,000 – 100,000 scfm with a typical inlet loading concentration of 1 to 50 gr/cf. While the gas flows for the molten metal processing furnaces are in this range, the inlet loading concentrations are orders of magnitude smaller than the typical wet ESP range. ESPs in general are not suited for use in processes which are highly variable because they are very sensitive to fluctuations in gas stream conditions (flow rates, temperatures, particulate and gas composition, and particulate loadings). The molten metal processing furnaces will not be operated continuously and will operate in cycles, resulting in variable particulate flow to the ESP. Additionally, ESPs have a large space and power requirements. Furthermore, the RBLC search did not identify any instances of an ESP being used on a similar source. Therefore, this technology is considered to be technically infeasible for the molten metal processing furnaces at the facility, and it is not addressed in the remaining steps of the BACT evaluation.

The typical wet scrubber emission stream characteristic ranges encompass the design air flow and temperature of the Melting and Casting area exhaust system. The estimated PM inlet concentration is lower than typical inlet concentrations. For conservatism this technology is considered to be technically feasible for the molten metal processing sources and degassing sources at the facility, and it is addressed in the remaining steps of the BACT evaluation.

Cyclones have relatively low PM collection efficiencies, particularly below the particle size of 30 microns, and as particle size decreases, so does control efficiency. Approximately 85% of the filterable PM emissions from the furnaces are smaller than 10 microns and approximately 80% are smaller than 2.5 microns. According to AP-42 Table B.2-3, the control efficiency of a single cyclone for PM between 0 and 2.5 microns is 10%, between 2.5 and 6 microns is 35%, and between 6 and 10 microns is 50%. Additionally, the RBLC search results did not identify any instances of a cyclone system being used to control PM emissions from a similar source. While the control efficiency potential of a cyclone system is low, this technology is considered to be technically feasible for the molten metal processing furnaces at the facility, and it is addressed in the remaining steps of the BACT evaluation.

Utilizing low sulfur fuel represents a technically feasible control option for minimizing PM emissions from the combustion sources processing molten metal, as the sources will combustion natural gas which has a low sulfur content. This method is addressed in the remaining steps of the BACT evaluation.

The good design and operating practices represent a technically feasible control option for minimizing PM emissions from the combustion sources processing molten metal. This method is addressed in the remaining steps of the BACT evaluation.

BACT for this equipment is therefore a Baghouse, use of Low Sulfur Fuel, and a Good Combustion and Operation Practices Plan.

Initial compliance demonstration with BACT is through development of a GCOP plan within 90 days of equipment startup, implementation of the GCOP, and stack testing the hot baghouse. Continuous compliance is demonstrated through monitoring, recording and reporting throughputs for the equipment and, as applicable, the control device(s). Additional continuous compliance assurance for the baghouse shall be demonstrated through use of baghouse leak detection/monitoring, and inspections.

iv. Sow Dryer (EU037):

Decision Summary: Consistent with the BACT evaluation conducted and submitted by the applicant, the Division determines that the use of low sulfur fuel and a good combustion and operating practices (GCOP) plan as means to control PM, PM_{10}, and $PM_{2.5}$ (filterable and condensable) emissions constitutes BACT.

BACT limits for PM, PM_{10}, and $PM_{2.5}$ are calculated using the vendor guaranteed emission factors and 8,760 hours per year to determine a maximum lb/hr and ton/yr limit.

Emission Point	**BACT**	**BACT limit for PM (filterable)**	**BACT limit for PM_{10}**	**BACT limit for $PM_{2.5}$**
037	GCOP Plan; Low Sulfur Fuel	0.04 lb/hr; 0.17 ton/yr	0.07 lb/hr; 0.30 ton/yr	0.07 lb/hr; 0.30 ton/yr

Technologies: Novelis examined the following technologies as possibilities to control PM emitted from the decoater: Fabric Filters (Baghouses), Wet Scrubbers or High Efficiency Venturi Scrubber, Electrostatic Precipitators (ESPs), High Efficiency Cyclone, Low Sulfur Fuel, and Good Combustion and Operating Practices.

Control Type	**Estimated PM/PM_{10}/$PM_{2.5}$ Control Efficiency**
GCOP	Undefined
Low Sulfur Fuel	Undefined
Fabric Filter (Baghouse)	Not technically feasible
Wet Scrubber or high efficiency Venturi Scrubber	Not technically feasible
Cyclone	Not technically feasible
ESP	Not technically feasible

Analyses: After identifying possible particulate control technologies available, Novelis presented a review of the different possible technologies, discussed the technical feasibility of each one and discussed the relevant advantages and disadvantages for use in the Sow Dryer.

The typical baghouse emission stream characteristic ranges encompass the design air flow and temperature of the Sow Dryer. However, the minimum PM inlet concentration of 0.05 gr/scf is an order of magnitude higher than estimated inlet concentrations for the Sow Dryer. Therefore, this technology is considered to be technically infeasible and is not addressed for this source in the remaining steps of the BACT evaluation.

The low exhaust gas particulate loading and small air flow rate of the Sow Dryer render ESP as a technically infeasible control option. Furthermore, the RBLC search did not identify any instances of an ESP being used on a Sow Dryer with a similar uncontrolled PM emissions profile. Therefore, this technology is considered to be technically infeasible and is not addressed in the remaining steps of the BACT evaluation.

While the air flow and temperature stream characteristics are in range for using a wet scrubber for the Sow Dryer, the estimated inlet loading concentrations are orders of magnitude lower than the scrubber design inlet concentration range of 0.1 to 50 gr/cf. Therefore, this technology is not considered to be technically feasible for the Sow Dryer and is not addressed in the remaining steps of the BACT evaluation.

The typical cyclone emission stream characteristic ranges encompass the design air flow and temperature of the Sow Dryer; however, the estimated inlet loading of the sow dryer is orders of magnitude lower than the minimum cyclone inlet loading of 0.44 gr/scf. Furthermore, the RBLC search did not identify any instances of a cyclone being used on a similar source. Therefore, cyclones as a control technology are not addressed in the remaining steps of the BACT evaluation for this source.

Utilizing low sulfur fuel represents a technically feasible control option for minimizing PM emissions from the Sow Dryer. This method is addressed in the remaining steps of the BACT evaluation.

The good design and operating practices represent a technically feasible control option for minimizing PM emissions from the Sow Dryer. This method is addressed in the remaining steps of the BACT evaluation.

Initial compliance demonstration with BACT is through development of a GCOP plan within 90 days of equipment startup, implementation of the GCOP. Continuous compliance is demonstrated through monitoring, recording and reporting throughputs for the equipment and, as applicable, the control device(s).

v. Direct-Fired Building Heating Systems (EU041a), Indirect-Fired Building Heating Systems ≤ 1 MMBtu (EU041b), and Indirect-Fired Building Heating Systems > 1 MMBtu (EU041c):

Decision Summary: The Division determines that the use of a good combustion and operating practices (GCOP) plan as means to control PM, PM_{10}, and $PM_{2.5}$ (filterable and condensable) emissions constitutes BACT.

Emission Point	Description	BACT for PM (filterable)	BACT for PM_{10}	BACT for $PM_{2.5}$
041a	Direct-Fired Building Heating Systems	0.10 lb/hr; 0.44 ton/yr	0.40 lb/hr; 1.76 ton/yr	0.40 lb/hr; 1.76 ton/yr
041b	Indirect-Fired Building Heating Systems ≤ 1 MMBtu	0.006 lb/hr; 0.025 ton/yr	0.02 lb/hr; 0.10 ton/yr	0.02 lb/hr; 0.10 ton/yr
041c	Indirect-Fired Building Heating Systems > 1 MMBtu	0.04 lb/hr; 0.16 ton/yr	0.15 lb/hr; 0.64 ton/yr	0.15 lb/hr; 0.64 ton/yr

Technologies: Due to the nature of these emission units consisting of numerous small sources of uncaptured natural gas combustion byproduct emissions that are spread across the facility, there are no technically feasible means of controlling emissions besides good combustion and operating practices.

Analyses: Novelis noted that setting BACT limits for the heating systems is not technically feasible because testing using EPA Reference Test Methods is not possible; however, the actual emission rate may be compared to the allowable emission rate using actual natural gas usage and emission factors from AP-42. For this reason, the Division has elected to set BACT limits for these units.

Initial compliance demonstration with BACT is through development of a GCOP plan within 90 days of equipment startup, and implementation of the GCOP. Continuous compliance is demonstrated through monitoring and recordkeeping of throughputs for the equipment.

vi. ***<u>Dross House (EU038), Dross Press #1 (EU039), Dross Press #2 (EU040):</u>***

Decision Summary: Consistent with the BACT evaluation conducted and submitted by the applicant, the Division determines that the use of baghouses and a good work practices plan as means to control PM, PM_{10}, and $PM_{2.5}$ (filterable and condensable) emissions constitutes BACT.

BACT limits for PM, PM_{10}, and $PM_{2.5}$ are calculated using the grain loading BACT limit for each particulate size, the flowrate for the baghouse, and 8,760 hours per year to determine a maximum lb/hr and ton/yr limit. Because the fabric filters will emit at the same outlet grain loading, regardless of inlet grain loading, BACT limits for PM, PM_{10}, and $PM_{2.5}$ are more appropriately set this way.

Emission Point	BACT	BACT limit for PM (filterable)	BACT limit for PM_{10}	BACT limit for $PM_{2.5}$
038	Cold Baghouse #3; GWP Plan	1.14 lb/hr; 4.99 ton/yr	1.07 lb/hr; 4.69 ton/yr	0.89 lb/hr; 3.89 ton/yr
039	Hot Baghouse #2; GWP Plan	0.03 lb/hr; 0.11 ton/yr	0.02 lb/hr; 0.11 ton/yr	0.02 lb/hr; 0.09 ton/yr
040	Hot Baghouse #3; GWP Plan	0.03 lb/hr; 0.11 ton/yr	0.02 lb/hr; 0.11 ton/yr	0.02 lb/hr; 0.09 ton/yr

Technologies: Novelis examined the following technologies as possibilities to control PM emitted from the furnaces: Fabric Filters (Baghouses), Wet Scrubbers or High Efficiency Venturi Scrubber, Electrostatic Precipitators (ESPs), High Efficiency Cyclone, Low Sulfur Fuel, and Good Work Practices.

Control Type	**Estimated PM/PM_{10}/$PM_{2.5}$ Control Efficiency***
Fabric Filter (Baghouse)	87.8-92% (nominal)
Wet Scrubber or high efficiency Venturi Scrubber	70% (nominal)
Good Work Practices	Undefined
Cyclone	Not technically feasible
ESP	Not technically feasible

*Based on low end of efficiency range for filterable particulate matter based on low inlet loading.

Analyses: After identifying possible particulate control technologies available, Novelis presented a review of the different possible technologies, discussed the technical feasibility of each one and discussed the relevant advantages and disadvantages for use in the Dross House and Dross Presses.

Fabric filters (baghouses) represent a technically feasible control option for minimizing PM emissions from the Dross House and Dross Presses. This technology is addressed in the remaining steps of the BACT evaluation.

Dry ESPs (Wire-Plate Type) are typically designed to control gas flow rates of 200,000 – 1,000,000 scfm with a typical inlet loading concentration of 1 to 50 gr/cf. The inlet loading concentration (approximately 0.02 gr/scf, uncontrolled) for the dross handling and storage processes is orders of magnitude smaller than the typical dry ESP range. Wet ESPs (Wire-Pipe Type) are typically designed to control gas flow rates of 1,000 – 100,000 scfm with a typical inlet loading concentration of 1 to 50 gr/cf. While the gas flow rate for the dross handling and storage processes is in this range, the inlet loading concentration is orders of magnitude smaller than the typical wet ESP range. ESPs in general are not suited for use in processes which are highly variable because they are very sensitive to fluctuations in gas stream conditions (flow rates, temperatures, particulate and gas composition, and particulate loadings). Variability in the material processed by the Dross House will result in variable particulate flow to the ESP. Additionally, ESPs have large space and power requirements. Furthermore, the RBLC search did not identify any instances of an ESP being used on a similar source. Therefore, this technology is considered to be technically infeasible for the dross handling and storage processes and is not addressed in the remaining steps of the BACT evaluation.

The typical wet scrubber emission stream characteristic ranges encompass the design air flow and temperature of the dross handling and storage processes; however, the minimum PM inlet concentration for venturi scrubbers (0.1 gr/scf) is five times the estimated grain-loading for the dross activities (0.02 gr/scf, uncontrolled). Therefore, only packed tower and spray tower scrubbers are considered in the remaining steps of the BACT evaluation for this source.

The typical cyclone emission stream characteristic ranges encompass the design air flow and temperature of the dross handling and storage processes exhaust streams; however, the estimated concentration of this exhaust stream (0.02 gr/scf, uncontrolled) is orders of magnitude lower than the minimum cyclone inlet loading of 0.44 gr/scf. Furthermore, the RBLC search did not identify any instances of a cyclone being used on a similar source. Therefore, cyclones as a control technology are not addressed in the remaining steps of the BACT evaluation for this source.

The good design and operating practices represent a technically feasible control option for minimizing PM emissions from the dross handling and storage processes. This method is addressed in the remaining steps of the BACT evaluation.

BACT for this equipment is therefore a Baghouse and a Good Work Practices Plan.

Initial compliance demonstration with BACT is through development of a GWP plan within 180 days of equipment startup, implementation of the GWP, and stack testing the baghouses. Continuous compliance is demonstrated through monitoring, recording and reporting throughputs for the equipment and, as applicable, the control device(s). Additional continuous compliance assurance for the baghouse shall be demonstrated through use of baghouse leak detection/monitoring, and inspections.

vii. <u>Hot Baghouse Limo Silos #1 & #2 (EU042):</u>

Decision Summary: Consistent with the BACT evaluation conducted and submitted by the applicant, the Division determines that the use of the integral bin vent and a good work practices plan as means to control PM, PM_{10}, and $PM_{2.5}$ (filterable and condensable) emissions constitutes BACT.

BACT limits for PM, PM_{10}, and $PM_{2.5}$ are calculated using the grain loading BACT limit, the flowrate for the bin vent filter, and 8,760 hours per year to determine a maximum lb/hr and ton/yr limit. Because the fabric filters will emit at the same outlet grain loading, regardless of inlet grain loading, BACT limits for PM, PM_{10}, and $PM_{2.5}$ are more appropriately set this way.

Emission Point	**BACT**	**BACT limit for PM (filterable)**	**BACT limit for PM_{10}**	**BACT limit for $PM_{2.5}$**
042	Bin Vent Filter; GWP Plan	0.0014 lb/hr; 0.006 ton/yr	0.0014 lb/hr; 0.006 ton/yr	0.0014 lb/hr; 0.006 ton/yr

Technologies: Novelis examined the following technologies as possibilities to control PM emitted from the furnaces: Fabric Filters (Baghouses), Wet Scrubbers or High Efficiency Venturi Scrubber, Electrostatic Precipitators (ESPs), High Efficiency Cyclone, Low Sulfur Fuel, and Good Work Practices.

Control Type	**Estimated PM/PM_{10}/$PM_{2.5}$ Control Efficiency***
Good Work Practices	Undefined

*Based on low end of efficiency range for filterable particulate matter based on low inlet loading.

Analyses: After identifying possible particulate control technologies available, Novelis noted that due to the inclusion of a bin vent filter, other add-on control devices are not technically feasible.

The good design and operating practices represent a technically feasible control option for minimizing PM emissions from the dross handling and storage processes. This method is addressed in the remaining steps of the BACT evaluation.

BACT for this equipment is therefore a Bin Vent Filter and a Good Work Practices Plan.

Initial compliance demonstration with BACT is through development of a GWP plan within 180 days of equipment startup, implementation of the GWP. Continuous compliance is demonstrated through monitoring and recording throughputs for the equipment and, as applicable, the control device(s).

viii. Cooling Tower #1 (EU043):

Decision Summary: Consistent with the BACT evaluation conducted and submitted by Novelis, the Division determines that the use of the use of high efficiency mist eliminators and limiting TDS constitutes BACT for PM, PM_{10}, and $PM_{2.5}$ for the cooling tower. The permit establishes the BACT limits, both short term (lb/hr) and long term (ton/year), which are as follows:

Emission Point	**BACT**	**BACT limit for PM (filterable)**	**BACT limit for PM_{10}**	**BACT limit for $PM_{2.5}$**
043	Mist Eliminator	0.013 lb/hr 0.06 ton/yr	0.006 lb/hr 0.03 ton/yr	0.00003 lb/hr 0.0001 ton/yr

Technologies: Feasible control technologies provided by the applicant include high efficiency drift eliminators, limiting total dissolved solid concentrations in circulating water, and proper equipment design, operation, and maintenance.

Analyses: Each of the control technologies listed above are feasible for control of particulate emissions from cooling towers. Limiting TDS concentration and proper equipment maintenance, design, and operation are essentially free, base case technologies. The BACT is selected as a high efficiency drift eliminator (<0.001%) because this has the greatest quantifiable level of particulate control. Each of the above technologies will be used in conjunction to reduce emissions as much as possible.

Initial compliance demonstration with BACT will be shown by properly installing mist eliminators on EU043 and using parametric monitoring for the cooling tower to ensure the TDS remains below the specified value.

ix. Paved Roads (EU020):

Decision Summary: Consistent with the BACT evaluation conducted and submitted by the applicant, the Division determines that the use of good work practices, including sweeping and covering haul trucks shipping material offsite, constitutes BACT. To ensure compliance with these limitations, the permit requires recordkeeping.

Technologies: The possible control technologies identified for the haul roads are surface improvements and good work practice standards.

Analyses: Novelis noted that the only technically feasible options were to maintain paved surfaces and good work practice standards. As a fugitive source of emissions, no add-on controls are technically feasible.

Initial compliance demonstration with BACT will be shown by implementing a speed limit, sweeping, and employing reasonable precautions to control particulate emissions. Continuous compliance will be shown through monitoring and recordkeeping.

B. <u>BACT Analysis for NOx</u>

Novelis submitted BACT analyses for NOx emissions and evaluated available NOx control technologies and practices. A control technology for an emission point may serve as a BACT control for other equipment as well.

Control Technologies for NOx: The possible BACT control technologies for the emission of NOx are identified below:

Combustion Control Techniques: Combustion control techniques are generally integrated with the design and operation of the combustion unit. It includes burner modifications and low nitrogen fuel (if applicable and available). The possible NOx BACT controls, identified under this control technique, for the Novelis project are:

***Low-NOx Burners (LNB)**:* Low-NOx burners increase combustion efficiency by using specially designed burners that use modified air and fuel entry to slow the mixing rate, reduce the oxygen available for NOx formation in critical NOx formation zones, and/or reduce the amount of fuel burned at peak flame temperatures. Low-NOx Burners can implement different methods: Low Excess Air (LEA), Off Stoichiometric Combustions (OSC), Flue Gas Recirculation (FGR), or a combination of the three. LEA inhibits NOx Formation by reducing the excess air to less than normal ratios, this helps reduce both thermal and fuel NOx formation. OSC reduces NOx emissions by carrying out the initial combustion in a fuel-rich combustion zone and completing combustion at a lower temperature in a second, fuel-lean zone. FGR recycles a part of the flue gas to the primary combustion zone. It reduces NOx by reducing the peak flame temperature by introducing inert combustion products and lowering the oxygen concentration in the primary flame zone.

***Oxy-fuel Burner**:* Another approach to increasing combustion efficiency is to fire specially designed burners with oxygen instead of air. The conversion to oxygen firing instead of air reduces NOx emissions by eliminating some of the nitrogen in combustion air. In addition, when small amounts of combustion air are replaced with oxygen, a significant increase in flame temperature can be realized and an intense flame is produced. Excess fuel air or steam, injected just after the combustion chamber, is sufficient to rapidly quench the flue gas to temperatures below the NOx formation temperature range. Combustion can then be completed in over fire air.

Good Combustion and Operation/Good Work Practices (GCOP/GWP): This is a work practice combustion optimization method for minimizing fuel usage and emissions from fossil fuels. When the combination of necessary elements are not controlled during combustion, the reaction in incomplete, which leads to the formation of undesirable emissions such as excess NOx. Optimizing the process minimizes the formation of pollutants. Having a Good Combustion and Operation Practices (GCOP) Plan that defines, measures and verifies the use of operational and design practices specific pollutant provides verifiable implementation of this work practices method. Although it is not an add-on control, efficient operation of combustion equipment is often an effective means to reduce NOx and other combustion related pollutants. Work practices such as performing inspections and preventative maintenance help keep equipment running in optimal ranges and prevent extra pollutant emissions caused by malfunction.

Post-Combustion Control Techniques: Post combustion control techniques include selective catalytic reduction (SCR) and selective non-catalytic reduction (SNCR). The post combustion techniques considered for Novelis are as follows:

Selective Catalytic Reduction (SCR)*:* SCR units use a nitrogen-based reagent, such as ammonia (NH_3) or urea, to chemically reduce NOx to nitrogen and water vapor. The reagent is injected though a grid system into the flue gas stream, upstream from a catalyst bed. The waste gas mixes with the reagent and enters a reactor module containing catalyst. The hot flue gas and reagent diffuse through the catalyst, where the reagent reacts selectively with NOx within a specific temperature range.

Operating temperatures between 480°F (250°C) and 800°F (427°C) are required of the gas stream at the catalyst bed, in order to carry out the catalytic reduction process. The reaction of NH_3 and NOx is favored by the presence of excess oxygen (greater than 1%). Depending on system design, NOx removal rates of 70 to 90% are achievable under optimum conditions. Technical factors related to this technology include the catalyst reactor design, optimum operating temperature, sulfur content of the charge, catalyst deactivation due to aging, ammonia slip emissions, and design of the ammonia injection system. Below the optimum temperature range, the catalyst activity is greatly reduced, potentially allowing unreacted ammonia (referred to as "ammonia slip") to be emitted directly to the atmosphere. SCR systems may also be subject to catalyst deactivation over time, due to physical deactivation and/or chemical poisoning. Catalyst suppliers typically guarantee a 3-year catalyst lifetime for a sustainable emission limit.

Several variations of SCR exist including Modified SCR (Shell DeNOX System) and Catalytic Oxidation/Adsorption (SCONOX). SCONOx is a catalytic oxidation/absorption technology that removes NOx, CO, and VOCs from an assortment of combustion applications that mostly include small turbines, boilers, and lean burn engines. SCONOx employs a proprietary technology using a single potassium nitrate impregnated catalyst. The flue gas temperature should be in the range of 300°F to 700°F for optimal performance without deleterious effects on the catalyst assembly. SCONOx technology demands stable gas flows, lack of thermal cycling, steady pollutant concentrations and residence times on the order of 1 to 1.5 seconds for optimal performance. The Shell DeNOx system is a variant of traditional SCR technology, which utilizes a high activity dedicated ammonia oxidation catalyst based on a combination of metal oxides. The system is comprised of a catalyst contained in modular reactor housing where, in the presence of ammonia, NOx in the exhaust gas converts to nitrogen and water. The catalyst is contained in a low-pressure drop lateral flow reactor (LFR), which makes best use of the plot space available. Due to the intrinsically high activity of the catalyst, the technology is suited for NOx conversions at lower temperatures with a typical operating range of 250°F to 660°F. The Shell DeNOx technology can not only operate at a lower temperature, but also have a lower pressure drop penalty than traditional SCR technology of around 2 inches water gauge.

Selective Non-Catalytic Reduction (SNCR): SNCR is a post-combustion technique that involves injecting ammonia or urea into specific temperature zones in the upper furnace or connective pass of a boiler or process heater to reduce both NOx and CO emissions. A temperature of between 1,600°F and 2,100°F is required at the injection site for the process reaction to take place. The ammonia or urea reacts with NOx in the gas to produce molecular nitrogen and water vapor. The NOx reduction reaction is favored over other chemical reaction processes for a specific temperature range and in the presence of oxygen; therefore, it is considered a selective chemical process. SNCR is effective only in a stoichiometric or fuel-rich environment where combustion gas is nearly depleted of oxygen.

i. Decoater (EU029)

Decision Summary: Consistent with the BACT evaluation conducted and submitted by the applicant, the Division determines that the use of low NOx burners, and a GCOP plan as means to control NOx emissions constitutes BACT.

Emission Point	BACT	BACT limit for NO_x
029	Low NOx Burner; GCOP Plan	8.82 lb/hr; 38.63 tons/yr

Technologies: Novelis examined the following technologies as possibilities to control NOx emitted from the decoater: GCOP, LNB, SCR, and SNCR.

Control Type	Estimated NOx Control Efficiency*
SCR	90%
SNCR	50%
LNB	40-85%
GCOP	Undefined

*According to US EPA, Air Pollution Control Technology Fact Sheet.

Analyses: After identifying possible particulate control technologies available, Novelis presented a review of the different possible technologies, discussed the technical feasibility of each one and discussed the relevant advantages and disadvantages for use in the decoater.

For rotary decoaters, GCOP implemented to minimize NOx formation are technically feasible.

For rotary decoaters, LNB are technically feasible.

SCR is technically infeasible at the exit of the rotary decoater. The SCR oxidation process requires temperatures of 480 to 800 °F to achieve high conversion rates for NOx. Below this temperature range, the reaction rate drops sharply, and effective reduction of NOx is no longer feasible. Above this temperature, conventional reduction catalysts break down and are unable to perform their desired functions. As the temperature of the gas exiting the afterburner is much higher than this range at approximately 1600 °F, the gas would need to be diluted in order for an SCR system to function adequately. Moreover, the SCR is technically infeasible at the exit of the rotary decoater due to the PM loading and the presence of acid gases.

SCR is thought to be technically infeasible at the exit of the lime injected baghouses due to low temperature and low concentration of NOx from dilution. The temperature at the exit of the baghouses is expected to be 350 °F. It may be technically feasible to heat the exhaust air to the temperature range required for SCR; however, upon exiting the baghouse, the concentration of NOx will be much lower than can be effectively controlled. The baghouse has an exhaust flow rate of 148,500 acfm. At this exhaust flow rate, the NOx concentration will be approximately 13 ppm. SCR is capable of achieving high reduction efficiencies down to NOx concentration as low as 20 ppm. Even though SCR is technically infeasible at the baghouse exit because the NOx concentration will already be too low for effective control by SCR, Novelis has retained SCR for consideration in subsequent steps of this BACT analysis.

Given the high annualized control costs and the previously cited technical challenges regarding designing and installing a large exhaust gas preheating system, Novelis concludes that installing and operating an SCR system for reducing NOx emissions from the melting and holding furnaces considered is not cost effective. As such, the SCR will be eliminated from further consideration in this BACT analysis. Also, no further evaluation of energy and environmental impacts are warranted.

The aforementioned technical challenges posed by SCR are also relevant to the installation of an SNCR to treat the rotary decoater’s exhaust. Furthermore, because of the nature of the system design (closed-loop with a tempering air by-pass) several challenges exist in implementing a urea-injection system. These challenges include unknown/unwanted chemical reactions within the process zones between the urea and the off-gasses, VOC and carbon and the potential plating of the particulates entrained within the gas stream that negatively impact sensors and fans. In addition, variability of volume flow rates and NOx emissions make it challenging to properly regulate the injection of urea further compounding the challenges. Despite these issues, Novelis has chosen to retain SNCR for further consideration.

Given the high annualized control costs and the previously cited technical challenges regarding designing and installing a large exhaust gas preheating system, Novelis concludes that installing and operating an SNCR system for reducing NOx emissions from the Decoater is not cost effective. As such, the SNCR will be eliminated from further consideration in this BACT analysis, and thus, no further evaluation of energy and environmental impacts are warranted.

Novelis concluded and the Division concurs that BACT for this equipment is the installation of LNBs and a GCOP Plan.

Initial compliance demonstration with BACT is through development of a GCOP plan within 90 days of equipment startup, implementation of the GCOP, and installation of low NOx burners. Continuous compliance is demonstrated through monitoring, recording and reporting throughputs for the equipment.

ii. Molten Metal Processing Furnaces* (EU030 through EU035):
*Includes the Group 1 Furnaces, and the Front-Load Tilting Melting Furnace (EU033).

Decision Summary: Consistent with the BACT evaluation conducted and submitted by the applicant, the Division determines that the use of low NOx burners and a GCOP plan as means to control NOx emissions constitutes BACT.

Emission Point	BACT	BACT limit for NOx
030	Low NOx Burner; GCOP Plan	0.44 lb/ton; 27.56 tons/yr
031	Low NOx Burner; GCOP Plan	0.44 lb/ton; 27.56 tons/yr
032	Low NOx Burner; GCOP Plan	0.63 lb/ton; 45.36 tons/yr
033	Low NOx Burner; GCOP Plan	0.57 lb/ton; 37.57 tons/yr
034	Low NOx Burner; GCOP Plan	0.04 lb/ton; 8.21 tons/yr
035	Low NOx Burner; GCOP Plan	0.04 lb/ton; 8.21 tons/yr

Technologies: Novelis examined the following technologies as possibilities to control NOx emitted from the melting furnaces: GCOP, LNB, and SCR.

Control Type	Estimated NOx Control Efficiency*
SCR	90%
SNCR	50%
LNB	40-85%
GCOP	Undefined

*According to US EPA, Air Pollution Control Technology Fact Sheet.

Analyses: After identifying possible particulate control technologies available, Novelis presented a review of the different possible technologies, discussed the technical feasibility of each one and discussed the relevant advantages and disadvantages for use in the furnaces.

For all molten metal processing furnaces, GCOP implemented to minimize NOx formation are technically feasible.

For all molten metal processing furnaces, LNB are technically feasible.

BACT for this equipment is therefore the installation of LNBs and a GCOP Plan.

At approximately 320 °F, on average (range of 258 to 396 °F) the exhaust gas from melting and holding furnaces falls outside of the SCR recommended range of 480 to 800 °F. Without additional available heat input capacity from the process stream (i.e., high levels of CO, combustible organic compounds, etc.), a preheating system will require firing significant amounts of natural gas to achieve the temperatures necessary for proper operation of the SCR. As a result, the natural gas-fired preheating system by itself will generate the same pollutants as the furnaces. In addition, the use of SCR has not been commercially demonstrated on a furnace in any configuration. The necessary components of the ammonia injection system are not feasible without extensive structural modifications to the furnaces and associated buildings. Therefore, SCR is considered technically infeasible as an add-on control device on melting furnaces, but for the sake of conservatism, Novelis has chosen to retain SCR for further consideration in subsequent steps of this BACT analysis.

At exhaust temperatures in the range of approximately 250 to 400 °F, the exhaust gas from melting and holding furnaces would need to be preheated by more than 1,200°F in order to achieve effective control through SNCR. With a much higher preheating temperature required for SNCR to be effective as compared to SCR (i.e., 1,800°F vs. 700°F optimum operating temperature) and a lower achievable NOx reduction efficiency for SNCR as compared to an SCR (i.e., 50% vs. 90% NOx control efficiency), the previous arguments regarding additional NOx emissions from the preheating process rise to the level of eliminating SNCR from subsequent steps in the BACT analysis solely on the basis of technical infeasibility; therefore, this control technology is eliminated from subsequent steps in the BACT analysis.

Initial compliance demonstration with BACT is through development of a GCOP plan within 90 days of equipment startup, implementation of the GCOP, and installation of low NOx burners. Continuous compliance is demonstrated through monitoring, recording and reporting throughputs for the equipment.

iii. ***Sow Dryer (EU037):***

Decision Summary: Consistent with the BACT evaluation conducted and submitted by the applicant, the Division determines that the use of low NOx burners and a GCOP plan as means to control NOx emissions constitutes BACT.

Emission Point	BACT	BACT limit for NOx
037	Low NOx Burner; GCOP Plan	1.08 lb/hr; 4.73 tons/yr

Technologies: Novelis examined the following technologies as possibilities to control NOx emitted from the sow dryer: GCOP, LNB, and SCR.

Control Type	Estimated NOx Control Efficiency*
SCR	90%
SNCR	50%
LNB	40-85%
GCOP	Undefined

*According to US EPA, Air Pollution Control Technology Fact Sheet.

Analyses: After identifying possible particulate control technologies available, Novelis presented a review of the different possible technologies, discussed the technical feasibility of each one and discussed the relevant advantages and disadvantages for use in the sow dryer.

For the sow dryer, GCOP implemented to minimize NOx formation are technically feasible.

For the sow dryer, LNB are technically feasible.

At 350 °F, the exhaust gas from the sow dryer falls below the recommended SCR range. SCR is feasible add-on control device on gas-fired combustion units greater than 50 MMBtu/hr. Even though the sow dryer is not over the unit size feasibility threshold, Novelis is considering SCR in subsequent steps of this BACT analysis for all metal processing furnaces for conservatism.

SNCR is thought to be technically infeasible at the exit of the sow dryer due to its non-steady-state use, as well as the low exhaust temperature. At 350 °F, the exhaust gas from the sow dryer would need to be preheated in order to provide effective NOx control through SNCR, but preheating is considered technically feasible. SNCR is feasible on combustion units ranging in size from 50 to 6,000 MMBtu/hr, and at 20 MMBtu/hr, the sow dryer is below the feasibility threshold for SNCRs. Due to the significant technical challenges posed by the installation of a SNCR for treating the exhaust streams from the sow dryer, this control technology is being eliminated from subsequent steps in the BACT analysis.

BACT for this equipment is the installation of LNBs and a GCOP Plan.

Initial compliance demonstration with BACT is through development of a GCOP plan within 90 days of equipment startup, implementation of the GCOP, and installation of low NOx burners. Continuous compliance is demonstrated through monitoring, recording and reporting throughputs for the equipment.

iv. ***<u>Direct-Fired Building Heating Systems (EU041a), Indirect-Fired Building Heating Systems ≤ 1 MMBtu (EU041b), and Indirect-Fired Building Heating Systems > 1 MMBtu (EU041c):</u>***

Decision Summary: The Division determines that the use of a good combustion and operating practices (GCOP) plan as means to control NOx emissions constitutes BACT.

Emission Point	Description	BACT for NO_x
041a	Direct-Fired Building Heating Systems	5.30 lb/hr; 23.21 tons/yr
041b	Indirect-Fired Building Heating Systems ≤ 1 MMBtu	0.30 lb/hr; 1.31 tons/yr
041c	Indirect-Fired Building Heating Systems > 1 MMBtu	1.92 lb/hr; 8.41 tons/yr

Technologies: Due to the nature of these emission units consisting of numerous small sources of uncaptured natural gas combustion byproduct emissions that are spread across the facility, there are no technically feasible means of controlling emissions besides good combustion and operating practices.

Analyses: Novelis noted that setting BACT limits for the heating systems is not technically feasible because testing using EPA Reference Test Methods is not possible; however, the actual emission rate may be compared to the allowable emission rate using actual natural gas usage and emission factors from AP-42. For this reason, the Division has elected to set BACT limits for these units.

Initial compliance demonstration with BACT is through development of a GCOP plan within 90 days of equipment startup, and implementation of the GCOP. Continuous compliance is demonstrated through monitoring and recordkeeping of throughputs for the equipment.

C. BACT Analysis for CO & VOC

Novelis submitted BACT analyses for CO and VOC emissions and evaluated available CO and VOC control technologies and practices. Because the control strategies for CO often provide co-control for VOC, the BACT analyses for these pollutants are combined. If a unit emits only VOC, only the control strategies applicable to VOC are analyzed. A control technology for an emission point may serve as a BACT control for other equipment as well.

Control Technologies for CO & VOC: The possible BACT control technologies for the emission of CO and/or VOC are identified below:

Incineration: This technology, also called thermal oxidation, is a process of combusting (burning) gases, such as CO and VOC, at a high temperature to decompose the gas into carbon dioxide (CO_2) and water (H_2O) before release into the atmosphere. Temperature of the gas is raised above its auto-ignition point, in the presence of oxygen, and maintained at a high temperature (>1,500°F) for sufficient time to complete combustion.

Add-on air pollution controls that accomplish incineration of pollutants include regenerative thermal oxidizers (RTOs), regenerative catalytic oxidizers (RCO), recuperative thermal oxidizers, and recuperative catalytic oxidizers. Of these only RCO and recuperative catalytic oxidizers are known to control CO. All of the thermal oxidation methods provide co-control for VOC. Thermal incinerators are not well suited to highly variable flow waste gas streams.

RTOs use a ceramic bed as a heat exchanger that absorbs heat from cleaned, hot gases exiting a combustion chamber and releases that heat to the next in-coming, waste gas stream as a means of preheating. Once this preheated waste gas is combusted in a chamber (and cleaned), the now hot, clean gas is passed over a different ceramic bed that was cooled in the previous cycle. This now heated bed begins the next cycle by preheating the next in-coming waste gas stream. RTOs are the most common means of VOC control, have high temperature capability, are fairly rugged and easy to maintain and produce less NOx emissions than flares. RTOs have VOC destructive efficiency that ranges from 95 to 99 % with the lower efficiencies generally being associated with lower VOC concentrations in the waste gas flow. Disadvantages include high capital costs, large size with complex, expensive installation, and high maintenance demand for moving parts.

RCOs operate in the same type of cycle as an RTO, but use a catalyst material rather than ceramic for the bed. A catalyst is a substance that increases the rate of a chemical reaction without undergoing permanent chemical change itself. Since the material in the bed pushes the combustion of the waste gases, it allows for the cleaning process to occur at a lower temperature. This means less fuel is required to complete combustion in the combustion chamber. RCOs have lower fuel requirements and less NOx emissions than RTOs. RCOs typically have efficiencies in the 90 to 99 % effective range for VOC, but have an additional advantage in that they also can destroy 98% or more of the CO in a waste gas stream. However, the need to change out the catalyst, usually platinum, palladium or rhodium, translates to higher long-term maintenance costs. RCOs also have high capital costs and require a large area for installation.

Recuperative thermal oxidizers are similar to RTOs in that they use incineration to destroy pollutants in waste gas, but the recuperative thermal oxidizer passes hot exhaust through a non-contact air-to air heat exchanger to heat the cooler inlet gas. Recuperative thermal oxidizers use metallic shell and tube heat exchangers to accomplish the transfer. They are good for low volume applications, are compact and have a long life span. Depending on characteristics of the waste stream, efficiencies range from 98 % to 99.9999+ % destruction of VOCs. Waste streams generally require 1500 to 3000 ppmv of VOC to achieve higher efficiencies. Disadvantages include the higher energy costs (operating costs) and lower effectiveness on higher air flows (>30,000 cfm).

Recuperative catalytic oxidizers are arranged such that after incoming waste gases are heated in the heat exchanger, they are passed through a catalyst to enhance the oxidation process in the combustion chamber. As with the RCO, full combustion can occur at lower temperatures than in the non-catalytic recuperative thermal oxidizer. This means recuperative catalytic oxidizers have lower fuel costs and produce fewer NOx emissions. Some disadvantages of this form of control are the high capital costs and higher long-term maintenance costs.

Good Combustion and Operation Practices (GCOP/GWP): This is a work practice combustion optimization method for minimizing fuel use and emissions from the burning of fossil fuels. When the combination of necessary elements are not controlled during combustion, the reaction in incomplete, which leads to the formation of undesirable emissions such as excess CO. CO emissions are increased when there is poor mixing (not enough turbulence) and/or there is not enough air in the mix. By taking measures to optimize the combustion process, pollutants are minimized. Optimizing the process minimizes the formation of pollutants. Having a Good Combustion and Operation Practices (GCOP) Plan that defines, measures and verifies the use of operational and design practices specific pollutant provides verifiable implementation of this work practices method. Although it is not an add-on control, efficient operation of combustion equipment is often an effective means to reduce CO and other combustion related pollutants. Work practices such as performing inspections and preventative maintenance help keep equipment running in optimal ranges and prevent extra pollutant emissions caused by malfunction.

i. Decoater (EU029)

Decision Summary: Consistent with the BACT evaluation conducted and submitted by the applicant, the Division determines that the use of the afterburner (thermal oxidation), and a GCOP plan as means to control CO/VOC emissions constitutes BACT.

Emission Point	**BACT**	**BACT for CO**	**BACT for VOC**
029	Afterburner; GCOP Plan	7.72 lb/hr; 33.83 tons/yr	4.57 lb/hr; 20.04 tons/yr

Technologies: Novelis examined the following technologies as possibilities to control CO/VOC emitted from the decoater: thermal oxidation, catalytic oxidation, and GCOP.

Control Type	Estimated CO/VOC Control Efficiency*
Thermal oxidation	98-99.99% / Undefined
Catalytic oxidation	98-99% / <90%
GCOP	Undefined

*According to US EPA, Air Pollution Control Technology Fact Sheet.

Analyses: After identifying possible particulate control technologies available, Novelis presented a review of the different possible technologies, discussed the technical feasibility of each one and discussed the relevant advantages and disadvantages for use in the decoater.

For rotary decoaters, GCOP implemented to minimize CO formation are technically feasible.

Thermal oxidation is technically feasible at the exit of the rotary drum and is already part of the design. Specifically, the secondary combustion chamber in the proposed decoating system will employ thermal oxidation to reduce the emissions of CO and VOC.

CatOx is technically infeasible at the exit of the rotary decoater due to particulate loading and HCl contamination. In order for CatOx to function effectively, the exhaust gases must be relatively free of catalyst poisons. The catalyst can be chemically washed to restore its effectiveness, but eventually irreversible degradation occurs. The presence of particulate and HCl in the exhaust stream would adversely affect the performance of the catalyst such that it would be an ineffective control technology. CatOx is technically infeasible at the exit of the lime-injected baghouses due to low temperature and low concentration of CO from dilution. The catalytic oxidation process requires temperatures of 600 to 1,000 °F to achieve high conversion rates for CO. Below this temperature range, the reaction rate drops sharply, and effective oxidation of CO is no longer feasible. It may be technically feasible to heat the exhaust air to the temperature required for CatOx; however, upon exiting the baghouse, the concentrations of CO and VOC will be much lower than can be effectively controlled. Even though CatOx is technically infeasible at the baghouse exit because the CO and VOC concentration will already be too low (~26 ppmvd for CO and ~8 ppmvd for VOC) for effective control, Novelis has retained CatOx for consideration in subsequent steps of this BACT analysis.

While Novelis considers the control costs for this analysis to clearly be not cost effective, the true costs for installing and operating a CatOx on the Decoaters is expected to be even higher when the site-specific challenges associated with CatOx implementation are fully considered. In the actual design and implementation of any CatOx control solution for the Decoater, Novelis would have to work closely with the selected CatOx vendor to either:

1. Design and implement an enhanced control system for additional HCl removal or,
2. Select a customized and more expensive catalyst that could still effectively remove CO in the presence of the HCl emissions contributed to the exhaust stream by the Decoaters.

Ultimately, this effort and the associated changes to the CatOx system to accommodate the HCl loading from the Decoater would drive up the costs of the CatOx relative to the estimates of $33,199/ton of CO removed and $58,709/ton of VOC removed. This situation further illustrates that CatOx is not a cost effective control option for the Decoater.

BACT for this equipment is the use and maintenance of the afterburner and a GCOP Plan.

Initial compliance demonstration with BACT is through development of a GCOP plan within 90 days of equipment startup, implementation of the GCOP, and installation of the decoater with an afterburner. Continuous compliance is demonstrated through monitoring, recording and reporting throughputs for the equipment. Testing must be performed at the outlet of the decoater using applicable test methods to ensure compliance with limits.

ii. Molten Metal Processing Furnaces* (EU030 through EU035):

*Includes the Group 1 Furnaces, and the Front-Load Tilting Melting Furnace (EU033).

Decision Summary: Consistent with the BACT evaluation conducted and submitted by the applicant, the Division determines that the use of a GCOP plan as means to control CO/VOC emissions constitutes BACT.

Emission Point	BACT	BACT for CO	BACT for VOC
030	GCOP Plan	0.41 lb/ton; 25.56 tons/yr	0.23 lb/ton; 14.57 tons/yr
031	GCOP Plan	0.41 lb/ton; 25.56 tons/yr	0.23 lb/ton; 14.57 tons/yr
032	GCOP Plan	0.49 lb/ton; 35.80 tons/yr	0.24 lb/ton; 17.23 tons/yr
033	GCOP Plan	0.40 lb/ton; 26.33 tons/yr	0.08 lb/ton; 5.60 tons/yr
034	GCOP Plan	0.06 lb/ton; 11.04 tons/yr	0.03 lb/ton; 5.69 tons/yr
035	GCOP Plan	0.06 lb/ton; 11.04 tons/yr	0.03 lb/ton; 5.69 tons/yr

Technologies: Novelis examined the following technologies as possibilities to control NOx emitted from the melting furnaces: thermal oxidation, catalytic oxidation, and GCOP.

Control Type	Estimated CO/VOC Control Efficiency*
Thermal oxidation	98-99.99% / Undefined
Catalytic oxidation	98-99% / <90%
GCOP	Undefined

*According to US EPA, Air Pollution Control Technology Fact Sheet.

Analyses: After identifying possible particulate control technologies available, Novelis presented a review of the different possible technologies, discussed the technical feasibility of each one and discussed the relevant advantages and disadvantages for use in the furnaces.

For all molten metal processing furnaces, GCOP implemented to minimize CO and VOC formation are technically feasible.

Based upon a review of available information, typical BACT control technologies for molten metal processing furnaces include good combustion and operating practices. Afterburners are best suited for applications with high concentrations of VOC. For exhaust streams with VOC concentration of less than 2000 ppmv, VOC reduction efficiencies decrease. The concentrations of VOC and CO in the exhaust stream for the molten metal processing furnaces are extremely low (in the range of ~3-8 ppmvd for VOC and ~9-26 ppmvd for CO), making the use of thermal oxidation impractical. Furthermore, thermal oxidation would increase combustion emissions and require additional fuel use (wasted energy). As such, thermal oxidation is not considered further in this BACT analysis.

Based upon a review of available information, there is no known application of CatOx to control CO or VOC emissions from molten metal processing furnaces. CatOx systems are limited in application due to potential poisoning, deactivation, and/or blinding of the catalyst. Particulate can also build up on the catalyst, effectively blocking the porous catalyst matrix and rendering the catalyst inactive. In cases of significant levels of poisoning compounds and particulate loading, catalyst replacement costs are significant. Installation of a CatOx system after baghouse control would require significant reheating of large air streams and would result in significant energy demands and increased emissions due to the combustion necessary to heat the exhaust from the baghouse to the temperatures required to obtain the operating temperature necessary for oxidation. For these reasons, CatOx will not be considered further in this BACT analysis.

BACT for this equipment is the implementation of a GCOP Plan.

Initial compliance demonstration with BACT is through development of a GCOP plan within 90 days of equipment startup, and implementation of the GCOP. Continuous compliance is demonstrated through monitoring, recording and reporting throughputs for the equipment.

iii. Sow Dryer (EU037):

Decision Summary: Consistent with the BACT evaluation conducted and submitted by the applicant, the Division determines that the use of a GCOP plan as means to control CO/VOC emissions constitutes BACT.

Emission Point	BACT	BACT for CO	BACT for VOC
037	GCOP Plan	1.46 lb/hr; 6.39 tons/yr	0.11 lb/hr; 0.48 tons/yr

Technologies: Novelis examined the following technologies as possibilities to control NOx emitted from the sow dryer: thermal oxidation, catalytic oxidation, and GCOP.

Control Type	Estimated CO/VOC Control Efficiency*
Thermal oxidation	98-99.99% / Undefined
Catalytic oxidation	98-99% / <90%
GCOP	Undefined

*According to US EPA, Air Pollution Control Technology Fact Sheet.

Analyses: After identifying possible particulate control technologies available, Novelis presented a review of the different possible technologies, discussed the technical feasibility of each one and discussed the relevant advantages and disadvantages for use in the sow dryer.

For the sow dryer, GCOP implemented to minimize CO and VOC formation are technically feasible.

For relatively small natural gas-fired sources, such as the sow dryer, post-combustion controls, such as thermal oxidizers and CatOx are technically infeasible and impractical due to the relatively small quantities of CO and VOC present in the exhaust gas. Furthermore, thermal oxidation would increase combustion emissions and require additional fuel use (wasted energy).

Based upon a review of available information, there is no known application of CatOx to control CO or VOC emissions from solid metal processing dryers. For relatively small natural gas-fired sources, such as the sow dryer, post-combustion controls, such as thermal oxidizers and CatOx are technically infeasible and impractical due to the relatively small quantities of CO and VOC present in the exhaust gas.

BACT for this equipment is the implementation of a GCOP Plan.

Initial compliance demonstration with BACT is through development of a GCOP plan within 90 days of equipment startup, and implementation of the GCOP. Continuous compliance is demonstrated through monitoring, recording and reporting throughputs for the equipment.

iv. ***Direct-Fired Building Heating Systems (EU041a), Indirect-Fired Building Heating Systems ≤ 1 MMBtu (EU041b), and Indirect-Fired Building Heating Systems > 1 MMBtu (EU041c):***

Decision Summary: The Division determines that the use of a good combustion and operating practices (GCOP) plan as means to control CO and VOC emissions constitutes BACT.

Emission Point	Description	BACT for CO	BACT for VOC
041a	Direct-Fired Building Heating Systems	4.45 lb/hr; 19.50 tons/yr	0.29 lb/hr; 1.28 tons/yr
041b	Indirect-Fired Building Heating Systems ≤ 1 MMBtu	0.25 lb/hr; 1.10 tons/yr	0.02 lb/hr; 0.07 tons/yr
041c	Indirect-Fired Building Heating Systems > 1 MMBtu	1.61 lb/hr; 7.06 tons/yr	0.11 lb/hr; 0.46 tons/yr

Technologies: Due to the nature of these emission units consisting of numerous small sources of uncaptured natural gas combustion byproduct emissions that are spread across the facility, there are no technically feasible means of controlling emissions besides good combustion and operating practices.

Analyses: Novelis noted that setting BACT limits for the heating systems is not technically feasible because testing using EPA Reference Test Methods is not possible; however, the actual emission rate may be compared to the allowable emission rate using actual natural gas usage and emission factors from AP-42. For this reason, the Division has elected to set BACT limits for these units.

Initial compliance demonstration with BACT is through development of a GCOP plan within 90 days of equipment startup, and implementation of the GCOP. Continuous compliance is demonstrated through monitoring and recordkeeping of throughputs for the equipment.

v. ***Diesel Fuel Storage and Refueling Station (EU044):***

Decision Summary: Consistent with the BACT evaluation conducted and submitted by the applicant, the Division determines that the use of a good work practices (GWP) plan, including designing and equipping the diesel tanks with submerged fill pipes and spill and overfill protection, constitutes BACT. To ensure compliance with these limitations, the permit requires monitoring and recordkeeping.

Technologies: The possible control technologies identified for the diesel storage station include good work practice standards.

Analyses: Novelis noted that the only technically feasible options were to design the tanks with submerged fill pipes and spill and overfill protection. Due to the relatively minimal emissions that could be produced by this source, setting numerical BACT limits is not feasible. No add-on controls are technically feasible.

Initial compliance demonstration with BACT is through development of a GWP plan within 180 days of equipment startup, and implementation of the GWP. Continuous compliance is demonstrated through monitoring and recordkeeping of throughputs for the equipment.

D. BACT Analysis for GHG

Although GHGs are an aggregate group of multiple gases, including CO_2, N_2O, CH_4, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride, they are treated as a single air pollutant for PSD and BACT purposes. Novelis analyzed the methods and technologies for reduction and/or destruction for CO_2, the major GHG pollutant component from metal casting, as applicable for all emitted GHGs at the proposed project.

Control Technologies for GHGs: Two broad categories of possible CO_2 technologies are identified and analyzed for the project, Carbon Capture and Sequestration (CCS) and Energy Efficiency Measures. The CCS is based on the separation and capture of CO_2 from process gases and injecting the CO_2 into a suitable geologic formation for long-term storage. For an energy efficiency strategy, the focus is on thermal efficiency to reduce the site-wide consumption of fuels and also reduce electricity use to reduce GHGs emitted by the power utilities that supply energy to the site.

Carbon Capture and Sequestration: Carbon capture and sequestration (CCS) is the long-term isolation of fossil fuel CO_2 emissions from the atmosphere through capturing and storing the CO_2 deep in the subsurface of the earth. CCS is the only potentially available add-on control option to reduce large-scale direct emissions from industrial processes. CCS is made up of three key stages:

Capture**:** Carbon capture is the separation of CO_2 from other gases produced when fossil fuels are combusted. Post-combustion CO_2 separation can be performed with chemical absorption systems using aqueous solution of amines as chemical solvents, or physical absorption systems using methanol or other solvents. There are three main technology categories proposed for the first step of separation and capture: pre-combustion, oxy-fuel combustion, and post-combustion.

Pre-combustion involves the removal of the CO_2 from a fossil fuel before it is combusted. In this type of system, a fuel is converted to gas through heating with steam and air or oxygen. A gas containing mainly hydrogen and CO is produced. The CO is reacted with steam to produce CO_2 and additional hydrogen. The CO_2 is separated out though physical or chemical adsorption.

Oxy-fuel combustion uses pure oxygen, instead of air, and the resulting combustion yields gas with highly concentrated with CO_2. Available technologies for producing pure oxygen are mostly based on cryogenic separation of oxygen from air. Extreme cooling of air produces liquid oxygen, nitrogen, and argon. The process is energy consuming (i.e. produces GHGs at power utilities), costly, and still in the demonstration phase of research.

Post-combustion capture involves removing and capturing CO_2 from flue gas prior to release to atmosphere. Included in this category of capture are chemical absorption, physical absorption, calcium cycle separation, cryogenic separation, membrane separation and adsorption. The following are Post-combustion capture technologies:

Chemical absorption is considered the best option of the post-combustion technologies (Simonds, M., et. al., *A Study of Very Large Scale Post Combustion CO_2 Capture at a Refining & Petrochemical Complex*, 6th International Conference on Green House Gas Control Technologies, Kyoto, 2002). A solvent is used at low partial pressure to separate CO_2 in flue gas. Drawbacks for this include the corrosive nature of the solvent in the presence of oxygen, high solvent degradation rates (highly reactive with SO_2 and NOx) and the energy required for solvent regeneration.

Physical absorption uses a solvent at high pressure and low temperature and is typically used for CO_2 removal from natural gas. The low CO_2 concentration in flue gas makes this process unsuitable for use with heat recovery coking processes. The flue gas would have to be strongly compressed to achieve the reaction and would require significant energy to function properly, off-setting any reduction in CO_2 emissions.

Calcium cycle separation is still in the research and testing phase. This technology uses quicklime to yield limestone. The limestone is heated to release CO_2 and produce quicklime, again, for recycling. Performance, cost and commercial viability are not yet established (Mackenzie, A., et. al., *Economics of CO_2 Capture Using the Calcium Cycle with a Pressurized Fluidized Bed Combustor*).

Cryogenic separation is widely used for purification of CO_2 from streams that have high concentration of CO_2. This technology is based on solidifying CO_2 by frosting and separating it out.

Gas separation membranes may be used to selectively transport gases through the film. This technology is used mainly for CO_2 removal from natural gas at high pressure and high concentrations of CO_2. It is a new technology for this application and has not been optimized for large scale applications (*CO_2 Capture and Storage: A VGB Report on the*

State of the Art, VGB Power Tech, 2004). Low concentrations of CO_2 in the flue gas would make this technology uneconomical for use.

Adsorption of CO_2 can be accomplished by passing flue gas through a bed of solid material, such as activated carbon. Adsorption requires high compression or multiple separation steps and is not applicable for industrial operations, yet (VGB Power Tech, 2004).

In fact, most of these technologies have been developed for use with higher CO_2 emitting fuels, such as coal, and are not well suited for use with smaller natural gas combusting units and groups. Lower concentrations of CO_2 in flue gases to treat and the high energy costs for these technologies make them uneconomical and impractical for the NOVELIS project.

Other less developed technologies, including aqueous ammonia wet scrubbing, solid sorbents, metal organic frameworks, enzyme-based systems and ionic liquids, are not mature enough to be commercially available.

Along with separation/capture technologies, the transportation and sequestration of the CO_2 must also be accomplished to truly reduce GHGs. The captured CO_2 must either be reused or liquefied, transported, and permanently stored.

Transport: After separation, CO_2 is compressed to facilitate transportation and storage if a locally available site for direct injection is unavailable. After compression, CO_2 is transported utilizing a third-party CO_2 pipeline system to transport CO_2 to distant geologic formations that may be more conducive to sequestration than sites in the immediate area.

Pipelines are the most common method of transporting large amount of CO_2 over long distances. The gas must be compressed under high pressure for pipeline transport, which requires high energy consumption. Water must be eliminated from the pipeline to prevent the formation of corrosive carbonic acid. Booster compressors along the pipeline may be needed to maintain the pressure along the long lengths of transport pipe. Pipelines must also be maintained to prevent CO_2 escape. There are around 50 CO_2 pipelines in the U.S., mostly in the Western states. Many of the CO_2 pipelines connect sources with specific customers.

Building transport facilities, such as a pipeline for dedicated use by a single facility, will make many projects economically infeasible, both from an absolute and BACT review perspective. However, such an option may be effective only if adequate storage capacity exists downstream and reasonable transportation prices can be arranged with the pipeline operator.

Storage: At a storage site, CO_2 is injected into deep underground rock formations, often at depths of one (1) km or more. Storage options for the CO_2 are still under development. These include storage in geological formations, such as exhausted oil fields, saline formations, under ocean liquid storage, solid carbonate storage, and terrestrial sequestration. These storage sites generally have an impermeable rock above them, with seals and other geologic features to prevent CO_2 from returning to the surface. Monitoring, reporting, and verifying are important to demonstrate that CO_2 is safely stored. A partnership of the U.S. Department of Energy (DOE), Office of Fossil Energy (FE), and National Energy Technology Laboratory (NETL) Energy is currently working on seven CO_2 storage projects in the United States. In 2017, the ADM Illinois Industrial Carbon Capture & Storage Project successfully began capturing CO_2 from an ethanol production facility and sequestering it in a deep saline formation.

Despite the recent research and activity, the CCS technology is still cost prohibitive for facilities emitting relatively smaller amounts of CO_2. In the United States, only one large-scale, fossil-fueled power plant, Petra Nova in Texas, is using CCS. The plant offsets some of the costs of the technology through selling CO_2 for use in oil recovery.

A recent Congressional Research Service report (Folger, August 9, 2018) states that "There is a broad agreement that costs for CCS would need to decrease before the technologies could be deployed commercially across the nation."

Energy Efficiency Measures: Thermal efficiency is an emissions reduction strategy focused on increasing energy efficiency. Energy efficient processes reduce the amount of fuel consumed. Reductions in fuel consumption result in reductions of direct emissions of GHGs at the steel plant, and reductions in electricity usage result in reductions of indirect GHG emissions. Many operating practices of an EAF affect the energy efficiency including stirring method, addition of oxy-fuel burners, and material preheating.

In general, for energy efficiency measures, the plant design and work practices would be planned to reduce fuel usage (on and off-site), use less polluting fuels, and use more efficient combustion equipment. These measures include development of a Good Combustion and Operation Practices plan, Fuel Selection, Good Equipment Design, Good Material Selection/Substitution.

Since the separation, capture and sequestration technologies are either not feasible and may be cost prohibitive (*Cost and Performance of Carbon Dioxide Capture from Power Generation Working Paper*, IEA, 2011) the Division finds selection of Energy Efficiency Measures acceptable as BACT for control of GHG emissions for the Novelis Project.

i. Decoater (EU029), Sidewell Melting Furnaces #1 and #2 (EU030 and EU031), NDC Recycle Furnace (EU032), Front-Load Furnace (EU033), Holding Furnaces #1 and #2 (EU034 and EU035), Sow Dryer (EU037), and Building Heating Systems (EU041a,b,c):

Decision Summary: Consistent with the BACT evaluation conducted and submitted by Novelis, the Division determines that the development of a GCOP plan, optimum furnace efficiency, and use of natural gas to control GHG emissions constitutes BACT for this equipment. The permit establishes long term (ton/yr) BACT limits and design/operational requirements, which are as follows:

EP	BACT	BACT for GHGs
029	GCOP Plan, Optimum Furnace Efficiency[1], Fuel Selection	52,191 tpy
030	GCOP Plan, Optimum Furnace Efficiency[2], Fuel Selection	16,412 tpy
031	GCOP Plan, Optimum Furnace Efficiency[2], Fuel Selection	16,412 tpy
032	GCOP Plan, Optimum Furnace Efficiency[2], Fuel Selection	49,771 tpy

EP	BACT	BACT for GHGs
033	GCOP Plan, Optimum Furnace Efficiency[3], Fuel Selection	34,876 tpy
034	GCOP Plan, Optimum Furnace Efficiency[4], Fuel Selection	15,387 tpy
035	GCOP Plan, Optimum Furnace Efficiency[4], Fuel Selection	15,387 tpy
037	GCOP Plan, Optimum Furnace Efficiency[5], Fuel Selection	10,258 tpy
041a	GCOP Plan, Optimum Furnace Efficiency[5], Fuel Selection	27,890 tpy
041b		1,579 tpy
041c		10,104 tpy

Footnotes:

[1] Includes the following design and operational requirements: ultra-low NOx cold air baffle burners; monitoring of afterburner temperature, kiln temperature, combustion fuel/air ratios, kiln inlet O2, and kiln operating pressure; installing and maintaining kiln feed and discharge airlocks and seals to minimize vagrant air inflow; maintaining low external surface temperatures of rotary drums through installation and maintenance of adequate refractory/insulation lining to minimize convective and radiant heat losses.

[2] Includes the following design and operational requirements: using regenerative burners to achieve the maximum combustion air preheat temperatures; installing, operating, and maintaining regenerative burners in accordance with manufacturer's specifications to achieve consistent air preheat temperatures resulting in high thermal efficiency; incorporating the ability to receive hot shredded aluminum scrap from the Decoater; using molten metal vortexing when charging shredded scrap in the sidewell to ensure rapid and efficient mixing of incoming scrap stream with the molten metal bath; installing and maintaining an insulation-lined door with adequate door seals to prevent cold air infiltration; installing and maintaining a limit switch on door to drive burners to low fire and to open flue damper when the door is raised; utilizing a molten metal circulation well to avoid bath temperature stratification and to decrease the impact of introducing cold charge to the metal bath; installing and maintaining seals and modern insulation media to minimize heat losses from the furnace hearth, upper and lower sidewalls, doors, roof, and any openings around the burners or other equipment traversing through the furnace shell.

[3] Includes the following design and operational requirements: incorporate the use of molten metal vortexing when charging shredded scrap in the sidewell to ensure rapid and efficient mixing of incoming scrap stream with molten metal bath; the use of regenerative burners to achieve the maximum combustion air preheat temperatures; installing and maintaining an insulation-lined door with adequate door seals to prevent cold air infiltration; installing and maintaining a limit switch on door to drive burners to low fire and to open flue damper when the door is raised; utilizing a molten metal circulation well to avoid bath temperature stratification and to decrease the impact of introducing cold charge to the metal bath; installing and maintaining seals and modern insulation media to minimize heat losses from the furnace hearth, upper and lower sidewalls, doors, roof, and any openings around the burners or other equipment traversing through the furnace shell; periodic preventive maintenance of gas supply valves in accordance with the manufacturer's recommended procedures and schedule; periodic calibration of gas supply meter in accordance with the manufacturer's recommended procedures and schedule; periodic calibration of furnace pressure control system in accordance with the manufacturer's recommended procedures and schedule; installing, operating, and maintaining regenerative burners in accordance with manufacturer's specifications to achieve consistent air preheat temperatures resulting in high thermal efficiency.

[4] Includes the following design and operational requirements: using high velocity cold air burners; installing and maintaining an insulation-lined door with adequate door seals to prevent cold air infiltration; installing and maintaining a limit switch on door to drive burners to low fire and to open flue damper when the door is raised; installing and maintaining seals and modern insulation media to minimize heat losses from the furnace hearth, upper and lower sidewalls, doors, roof, and any openings around the burners or other equipment traversing through the furnace shell; installing, operating, and maintaining a combustion system that includes air to fuel ratio control for improved fuel efficiency; implementing burner temperature control to achieve optimum temperature uniformity; utilize long flame burners for efficient radiant energy transfer.

[5] Includes the following design and operational requirements: use only pipeline quality natural gas; install, operate, and maintain a combustion system that includes air-to-fuel ratio control for improved fuel efficiency, adequate temperature for complete combustion, and sufficient gas residence time to complete combustion; conduct periodic calibration of gas supply system in accordance with manufacturer's recommended procedures and schedule; maintain gas supply valves in accordance with the manufacturer's recommended procedures and schedule.

Technologies: The possible GHG control technologies identified are Carbon Capture and Storage (CCS), and energy efficiency measures, including fuel selection, development of a GCOP plan, and optimum furnace efficiency.

Analyses: CCS is a potential control measure for GHG that requires GHG separation, transportation, and a viable storage location. CO_2 can be captured by low pressure scrubbing with solvents, solid sorbents, or membranes. Of these capture media, only solvents have been demonstrated on a commercial scale. CO_2 must then be compressed to pipeline pressure (around 2,000 psia) for transportation, requiring a significant amount of power. Pipelines are the most viable method of CO_2 transportation. For storage, CO_2 can be injected into subsurface formations for long-term sequestration. Underground injection of CO_2 can also boost production efficiency of oil and gas by re-pressurizing oil reservoirs or increasing oil mobility.

To successfully implement CCS, it would be necessary to convey CO_2 from Novelis to another site via a new pipeline in which CO_2 could be transported. The Division has determined that the cost of capturing, pressurizing, and constructing a pipeline for the purpose of CCS implementation is prohibitive. For these reasons, CCS is not feasible to control the GHG emissions from the natural gas combusting units at the facility.

The selection of fuel is an available measure for control of CO_2 emissions. Natural gas has the lowest emission rate of CO_2 per unit of energy. All of the natural gas combusting units discussed here will combust natural gas to minimize emissions of GHG.

GCOP are an available control measure for GHG. A GCOP plan promotes efficiency by optimizing fuel usage and minimizing pollutant generation by ensuring proper operation of the combustion device. All the natural gas combusting units at the facility will implement GCOP and meet specific design and operation requirements in Section B for each unit.

The Division has determined that BACT is a GCOP plan that defines, measures and verifies the use of operational and design practices determined as BACT for minimizing

GHG emissions. The plan shall be incorporated into the plant standard operating procedures (SOP) and shall include, but not be limited to: a list of combustion optimization practices and a means of verifying that the practices have occurred, a list of combustion and operation practices to be used to lower energy consumption and a means of verifying that the practices have occurred, and a list of the design choices determined to be BACT and the verification that designs were implemented in the final construction.

BACT limits for GHG from the equipment in the natural gas combusting equipment have been set based upon the proposed use of natural gas as fuel, the capacity of the burners chosen, and the basic combustion emission factors found in AP-42, Section 1.4.

Initial compliance demonstration with BACT will be through development of a GCOP plan within 90 days of equipment startup and design certification within 180 days of startup. Implementation of the GCOP plan and monitoring, recording and reporting gas usage will provide continuous compliance assurance for the subject equipment.

E. AIR QUALITY IMPACT ANALYSIS

i. Screening Methodology

The incremental increases in ambient pollutant concentrations associated with the Novelis casting project have been estimated through the use of a dispersion model (AERMOD) applied in conformance to applicable guidelines in the United States Environmental Protection Agency (USEPA) Guideline on Air Quality Models (GAQM, 40 CFR Appendix W, May 2017) and other applicable guidance, and followed the methodology presented in the Air Dispersion Modeling Protocol approved by KDAQ on February 20, 2022.

Model simulations for short-term and annual-averaged CO, NO_2, PM_{10}, and $PM_{2.5}$ emissions are performed with the AERMOD model using the 5-year meteorological database. The highest predicted impacts (H1H) were used as the design concentrations in the SIL analyses while the design concentrations for the NAAQS and PSD increment analyses followed the form of the NAAQS and PSD increment for each applicable pollutant and averaging time. Each pollutant is being assessed against the SIL for the NAAQS, the maximum value over 5 years for each applicable time averaging period is compared to the appropriate SIL.

Significant Impact Levels (SILs)

Pollutant	Averaging Period	Modeled Concentration (μg/m^3)	Significant Impact Level (μg/m^3)	Significant Monitoring Concentrations (μg/m^3)	SIL Exceeded & Additional Modeling Required?	Significant Monitoring Concentration Exceeded?
CO	1-hour	179.0	2000	-	No	-
	8-hour	41.78	500	575	No	No
PM_{10}	24-hour	13.2	5	10	Yes	Yes
	Annual	2.15	1	-	Yes	-
$PM_{2.5}$ (2)	24-hour	11.0	1.2	4	Yes	Yes
	Annual	1	0.2	-	Yes	-
NO_2	1-hour	99.4	7.5	-	Yes	-

Pollutant	Averaging Period	Modeled Concentration ($\mu g/m^3$)	Significant Impact Level ($\mu g/m^3$)	Significant Monitoring Concentrations ($\mu g/m^3$)	SIL Exceeded & Additional Modeling Required?	Significant Monitoring Concentration Exceeded?
	Annual	3.74	1	14	Yes	No

ii. Background Concentrations

Representative background concentrations were added to the maximum predicted concentrations so that small sources that were not explicitly modeled are included in the NAAQS and KYAAQS assessment. Background concentrations are based on ambient monitoring data collected for the most recent three year period available (2018 through 2020) determined to be the most representative for use in the modeling analysis. Since all of the study pollutants are not monitored at one location, data from several different monitoring locations are used.

Representative Background Concentrations

Monitoring Location	Site ID	Data Collection Period	Pollutant	Averaging Period	Basis of Design Value	Design Value
Owensboro, KY	21-059-0005	2018-2020	NO_2	1-hour	Average of the three year 98th percentile	50.8 $\mu g/m^3$
				Annual	Annual Mean	7.5 $\mu g/m^3$
Hopkinsville, KY	21-047-0006	2018-2020	$PM_{2.5}$	24-hour	Average of the three year 98th percentile	19.0 $\mu g/m^3$
				Annual	Average of three year annual averages	8.1 $\mu g/m^3$
Nashville, TN	47-037-0023	2017-2019	PM_{10}	24-hour	2nd high	34.0 $\mu g/m^3$
Hopkinsville, KY	21-047-0006	2018-2020	Ozone	8-hour	3 year 4th high maximum 8-hour average	0.058 $\mu g/m^3$

The applicant may propose for the reviewing authority's consideration use of existing monitoring data if appropriate justification is provided. Novelis proposed the use of representative regional background data to satisfy this requirement as necessary.

iii. Cumulative NAAQS Analyses

NAAQS analyses, using five years of meteorological data, were performed for 1-hour and annual NO_2; 24-hour PM_{10}; and 24-hour and annual $PM_{2.5}$. The Ambient Ratio Method (ARM2) regulatory default Tier-2 NO_X to NO_2 conversion methodology for modeling ambient NO_2 impacts was used in the multi-source analyses. The NAAQS analyses were carried out by modeling facility-wide Novelis source parameters and emission rates; modeling off-property source inventory for the surrounding area; and adding the representative background concentrations to modeled concentrations for comparison with the NAAQS.

NAAQS Modeling Results

Pollutant	Averaging Period	Modeled Concentration (μg/m^3)	Background (μg/m^3)	Total (μg/m^3)	NAAQS (μg/m^3)	Max Novelis Contribution (μg/m^3)
PM_{10}	24-hour	9.8	34.0	43.8	150	N/A
$PM_{2.5}$	24-hour	4.26	19.0	23.3	35	N/A
	Annual	1.46	8.1	9.56	12	N/A
NO_2[1]	1-hour	202.4	Included	202.4	188	.00085
	Annual	15.43	7.5	22.95	100	N/A

[1]The 1-hour NO2 NAAQS Analysis involved temporal pairing of monitored and modeled concentrations consistent with recent EPA guidance. Maximum impacts shown include the background concentration. The 1-hour and annual average background concentrations are based on ambient monitoring data from the Daviess County, Kentucky site (Site ID 21-059-0005) for the three-year period from 2018 to 2020. The annual average background concentration is the maximum annual arithmetic mean concentration from 2018 to 2020.

iv. Class II Increment Analysis

In addition, a PSD Class II increment modeling analysis, using five years of meteorological data, was also performed for annual NO_2, 3-hour SO_2, 24-hr and annual PM_{10}, and 24-hour and annual $PM_{2.5}$ by modeling increment consuming and expanding Novelis source parameters and emission rates as well increment consuming and expanding off-property sources.

Class II Increments

Pollutant	Averaging Period	Modeled Concentration (μg/m^3)	PSD Class II Increment Standard (μg/m^3)
PM_{10}	24 hour	10.65	30
	Annual	2.39	17
$PM_{2.5}$	24 hour	6.75	9
	Annual	1.39	4
$PM_{2.5}$[1] (secondary)	24 hour	6.80[1]	9
	Annual	1.39[1]	4
NO_2	Annual	7.74	25
(1) Secondary PM2.5 concentrations estimated using the default KDAQ MERP values.			

v. Secondary $PM_{2.5}$ and Ozone Formation

The Division has provided recent (August 2, 2018) guidance on addressing secondary pollutant impacts with a state-specific guidance on the application of EPA's Modeled Emission Rates for Precursors (MERPs) Tier-1 demonstration tool. This guidance was used to assess secondary formation of ozone and $PM_{2.5}$for this project. A MERP represents a level of precursor emissions that is not expected to contribute significantly to concentrations of ozone or secondarily formed $PM_{2.5}$.

MERPs are used to determine if proposed emission increases from a facility will result in primary and secondary impacts. NOx, SO_2, $PM_{2.5}$, and VOC emissions from the project must be included in the analysis. If the project emissions from all relevant pollutants are below the SER, no further analysis is required. If the project emissions from any of the relevant emissions are above the SER, a Tier 1 demonstration is required. The Tier 1 demonstration consists of a SILs analysis and, if needed, a cumulative analysis. The analysis must be below the NAAQS for each precursor in order to pass.

Novelis Emission for MERPs Analysis

Precursor	Emissions (tpy)	SER (tpy)
NO_X	232.22	40
SO_2	0.98	40
$PM_{2.5}$	81.39	10
VOC	84.79	40

The values represent the maximum predicted concentrations over the five modeling years and are later used in the PSD Increment analysis. In the NAAQS analysis of the direct model-predicted concentrations, the average over 5 years were used.

SIL Modeling Results for $PM_{2.5}$ MERPs Analysis

Pollutant	Project Modeled Concentration (µg/m^3)
Annual $PM_{2.5}$	1.455
Daily $PM_{2.5}$	4.264

The highest modeled concentration for all sources, including nearby sources, for annual and 24-hour primary $PM_{2.5}$ NAAQS are as follow:

NAAQS and PSD Increment Modeling Results for MERP*s* Analysis

Pollutant	Project + Nearby NAAQS Source Impacts (µg/m^3)	Project + Nearby PSD Increment Source Impacts (µg/m^3)
Annual $PM_{2.5}$	9.6	1.4
Daily $PM_{2.5}$	23.3	6.8

The background concentrations for ozone and $PM_{2.5}$ annual / 24-hour are as follows:

Background Concentrations for MERPs Analysis

Pollutant	Background Concentrations	Monitor ID
Ozone	58	21-047-0006
Annual $PM_{2.5}$	19.0	21-047-0006
Daily $PM_{2.5}$	8.1	

If the result of the SIL Analysis is greater than 1, a cumulative analysis is required for that precursor. If the result is less than 1, a cumulative analysis is not required. The SIL analysis results for ozone and PM2.5 are as follows:

MERPs SIL Analyses

Pollutant	Analysis Results	Less than 1?
Ozone	1.36	No
Annual $PM_{2.5}$	.05	Yes
Daily $PM_{2.5}$	.27	Yes

The table below shows the cumulative analysis results for ozone and $PM_{2.5}$.

MERP Cumulative NAAQS Analysis

Precursor	Analysis	NAAQS	Below NAAQS?
Ozone	59.36	70 ppb	Yes
Annual $PM_{2.5}$	9.6	12 µg/m^3	Yes
Daily $PM_{2.5}$	23.3	35 µg/m^3	Yes

Summary of the PSD Increment analysis results is as follows:

MERPs PSD Increment Analysis

Precursor	Analysis	PSD INC	Below PSD INC?
Annual $PM_{2.5}$	1.4	4 µg/m^3	Yes
Daily $PM_{2.5}$	6.8	9 µg/m^3	Yes

vi. <u>Class I MERPs Analysis</u>

In order to assess the total $PM_{2.5}$ impacts (primary and secondary) at the Class I area, the USEPA approved distance-dependent technique was used. In this case, the MERPs values were calculated based on the concentrations from Barren County hypothetical stack at a specific distance representative of the distance between the Project and the Class I area.

The combined primary and secondary $PM_{2.5}$ impacts were compared to their respective SILs. The 24-hour and the annual $PM_{2.5}$ total concentrations are below the SIL standards. Therefore, it is not expected that the Project will contribute significantly to $PM_{2.5}$ levels at AREA, and no further analysis is necessary.

Class I Primary and Secondary PM $_{2.5}$ Modeling Results

Period	AERMOD $PM_{2.5}$ Concentrations (µg/m^3) at 50 km			Class I SIL
	Primary	Secondary	Total	
24-hour	0.109	0.050	0.16	0.27
Annual	0.006	0.003	0.01	0.05

vii. <u>Class I Area Analysis</u>

Class I area impacts are addressed if the proposed project has an impact that exceeds the screening threshold as described by Federal Land Managers' (FLM) Air Quality Related Values Work Group (FLAG) guidance. In this guidance the sum of the proposed project emissions (in tpy) of SO_2, NOx, PM_{10} and H_2SO_4 is divided by the distance to the Class I area and compared to the value of 10. This ratio is known as Q/D. If Q/D is 10 or less, the project is considered to have a negligible impact on the Class I area. If the Q/D value is greater than 10, then further analysis to evaluate impacts in the Class I area is warranted.

There are four Class I areas within 300 km of the Novelis casting facility: Mammoth Cave, which is the closest at 101 km followed by Sipsey (AL) 253km, Mingo (MO) 267km and Cohutta (GA) 295km. The sum of emissions (SO_2, NOx, PM_{10} and H_2SO_4) for the proposed project is 335.2 tpy. The calculated Q/D for the proposed project relative to Mammoth Cave NP is 3.35; which is below the FLM screening level of 10.

Class I Area Q/D Screening Analysis

Pollutant	Project Emissions (tpy)	Q/D Analysis
NO_2	232.22	
SO_2	0.98	
PM_{10}	105.85	
H_2SO_4	0	
Total	339.05	
AREA	101	3.36

The project related increase of NO_2, PM_{10}, and $PM_{2.5}$, were evaluated against the Class I SILs by applying the AERMOD dispersion model receptors at the maximum spatial extent (50 km from the Project site to receptor). The maximum-modeled concentrations at the 50 km receptors are less than the Class I SILs for all pollutants and averaging periods.

Class I SIL Analysis with AERMOD at 50 km

Pollutant	Averaging Period	Modeled Concentration at 50 km (μg/m^3)	Class I SIL	% of SIL
PM_{10}	24-hour	0.152	0.3	51%
	Annual	0.008	0.2	4%
$PM_{2.5}$	24-hour	0.109	0.27	40%
	Annual	0.006	0.05	12%
$PM_{2.5}$[1] secondary	24-hour	0.16	0.27	60%
	Annual	0.01	0.05	20%
NO_2	Annual	0.017	0.1	17%

(1) The $PM_{2.5}$ peak concentrations represent the sum of the AERMOD predicted concentrations and the fraction accounting for the secondary $PM_{2.5}$ formations.

As evident from the AERMOD modeling results, model-predicted impacts from Novelis emission sources are below the Class I SILs for all pollutants and averaging periods; therefore, compliance is demonstrated and no further analysis is required.

APPENDIX A – ABBREVIATIONS AND ACRONYMS

AAQS – Ambient Air Quality Standards
BACT – Best Available Control Technology
Btu – British thermal unit
CAA – Clean Air Act
CAM – Compliance Assurance Monitoring
CEM – Continuous Emission Monitoring
CFF – Ceramic Foam Filter
CI – Compression Ignition
CO – Carbon Monoxide
CO_2e – Carbon Dioxide Equivalent
Division – Kentucky Division for Air Quality
DBF – Deep Bed Filter
EAF – Electric Arc Furnace
ESP – Electrostatic Precipitator
GCOP – Good Combustion & Operating Practices
GDF – Gasoline Dispensing Facility
GHG – Greenhouse Gas
GWP – Good Work Practices
HAP – Hazardous Air Pollutant
HF – Hydrogen Fluoride (Gaseous)
HP – Horse Power
KTA – Thousand Tons of Aluminum
LMF – Ladle Metallurgical Furnace
MSDS – Material Safety Data Sheets
mmHg – Millimeter of mercury column height
NAAQS – National Ambient Air Quality Standards
NESHAP – National Emissions Standards for Hazardous Air Pollutants
NO_x – Nitrogen Oxides
PM – Particulate Matter
PM_{10} – Particulate Matter equal to or smaller than 10 micrometers
$PM_{2.5}$ – Particulate Matter equal to or smaller than 2.5 micrometers
PSD – Prevention of Significant Deterioration
PTE – Potential to Emit
RICE – Reciprocating Internal Combustion Engine
SEN – Submerged Entry Nozzle
SER – Significant Emission Rate
SI – Spark Ignition
SO_2 – Sulfur Dioxide
SSM – Startup, Shutdown, & Malfunction
TDS – Total Dissolved Solids
TF – Total Fluoride (Particulate & Gaseous)
VMT – Vehicle Miles Traveled
VOC – Volatile Organic Compounds
MMBtu/hr– million BTU per hour