Illinois Environmental Protection Agency
Bureau of Air, Permit Section
Springfield, Illinois

Project Summary for a Construction Permit Application from A. Finkl & Sons Co. for a Specialty Steel and Forgings Facility in Chicago, Illinois

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I. INTRODUCTION

A Finkl and Sons Co. (Finkl) has requested a construction permit for a specialty steel and forging facility. The proposed facility would include a melt shop with an electric arc furnace and a ladle metallurgical station. Other downstream operations would include a vacuum tank station for degassing and decarburization of molten steel, forging and reheat furnaces, heat treating furnaces, surface preparation operations, other associated processes and ancillary operations. The proposed facility would be located at 1355 East 93rd Street in Chicago, in buildings formerly occupied by Verson. The proposed facility would completely replace Finkl's existing facility at 2011 North Southport Avenue in Chicago.

The Illinois EPA has reviewed Finkl's application and made a preliminary determination that the application for the proposed project meets applicable requirements. Accordingly, the Illinois EPA has prepared a draft of the construction permit that it would propose to issue for the proposed construction and modifications. However, before issuing the permit, the Illinois EPA is holding a public comment period and a public hearing to receive comments on the proposed issuance of the permit and the terms and conditions of the draft permit.

II. PROJECT DESCRIPTION

Finkl produces specialty steel that it either sells or further processes into dies for other manufacturing facilities or custom steel forgings. It also processes purchased ingots of aluminum and other non-ferrous metals into dies and other forged products.

The principal emission unit at the proposed facility would be the electric arc furnace (EAF), which would melt scrap to produce molten steel. The emissions of the furnace will be controlled by direct evacuation and building enclosure with collected exhaust ducted to a fabric filter. Other emission units in the melt shop would include the ladle metallurgy station and the casting of molten steel into ingots.

Other units at the facility would include a vacuum tank degassing station, a natural gas fired steam generator, various natural gas-fired furnaces used for reheating ingots prior to forging and for heat treating of formed metal, surface processing operations, material handling systems for lime, carbon and furnace dust, cooling towers, and other related operations.

III. PROJECT EMISSIONS

The potential annual emissions of the proposed facility, as would be allowed by the permit, are summarized below. Actual emissions would be less than the permitted emissions as the facility would typically operate at less than its maximum capacity and control equipment normally operates to achieve emission rates that are lower than the applicable standards and limitations.

Permitted Annual Emissions of the Facility (Tons/Year)

PM	VOM	SO_2	NO_x	CO
98.87	98.44	98.98	301.8	1695.2

IV. APPLICABLE EMISSION STANDARDS

The application shows that the emission units at the proposed facility will readily comply with applicable emission standards, including applicable state emission standards (35 Ill. Adm. Code: Subtitle B, Subchapter c) and applicable federal emission standards adopted by the United States EPA (40 CFR Part 60). The applicable state emission standards include the area-specific standards for emissions of particulate matter that apply to sources in the Lake Calumet Area and other areas in Illinois that were formerly nonattainment for PM10. The federal emission standards include the New Source Performance Standards (NSPS) for electric arc furnaces, 40 CFR 60 Subpart AAa, which address the particulate emissions from arc furnaces.

The proposed facility would not be a major source of emissions of hazardous air pollutants (HAPs) for purposes of the federal National Emission Standards for Hazardous Air Pollutants (NESHAP). However, the facility would be subject to NESHAP standards for Electric Arc Furnaces at Steelmaking Facilities, 40 CFR 63 Subpart YYYYY, which were recently adopted by USEPA on December 28, 2007. These standards require that the facility implement a scrap management plan to minimize contamination in its scrap supply that could lead to increased emissions of hazardous air pollutants. These standards also establish limits for emissions of particulate matter that are similar to the applicable limits under the NSPS.

V. APPLICABILITY OF OTHER REGULATORY REQUIREMENTS

A. PREVENTION OF SIGNIFICANT DETERIORATION (PSD)

The proposed facility is a major new source under the federal rules for Prevention of Significant Deterioration (PSD), 40 CFR 52.21, subject to PSD for emissions of particulate matter (measured as PM10), sulfur dioxide (SO_2), nitrogen oxides (NOx), and carbon monoxide (CO).

The PSD rules are relevant because the air quality in the Greater Chicago Area is classified as attainment for PM10, SO_2, NO_2 and CO. The criterion for whether the proposed facility is considered major under the PSD rules is whether its permitted emissions for one or more pollutants addressed by the PSD rules would qualify as major, with potential emissions of 100 tons per year or more. The proposed facility meets this criterion for emissions of both NOx and CO. The potential emissions of PM10 and SO_2 from the facility would also be enough to be considered significant under the PSD rules. Therefore, the project is subject to the substantive requirements of the PSD rules for these pollutants. The potential annual emissions of other PSD pollutants are less than the significant emission rates established for those pollutants. Therefore, this project is not subject to PSD review for these other PSD pollutants.

The substantive requirements of the PSD rules for a major project for a pollutant are: 1) A case-by-case determination of Best Available Control Technology (BACT), 2) An ambient air quality impact analysis to confirm that the project would not cause or contribute to a violation of the National Ambient Air Quality Standard(s) (NAAQS) or applicable PSD increment(s); and 3) An analysis of the impacts on soils, vegetation and visibility. These requirements are addressed in later in this document.

B. NONATTAINMENT NEW SOURCE REVIEW

The rules for Major Stationary Sources Construction and Modification (MSSCAM), 35 IAC Part 203, apply to construction of major projects in nonattainment areas. The proposed facility would be located in the Greater Chicago area, which is designated nonattainment for ozone and $PM_{2.5}$. In ozone nonattainment areas, MSSCAM addressed emissions of NOx and VOM, which are regulated as precursors to the formation of ozone in the atmosphere. This facility is subject to MSSCAM for NOx as the facility's potential or permitted NOx emissions would be major, i.e., equal to or greater than 100 tons per year. The facility is not subject to MSSCAM for VOM because its potential VOM emissions are not major. The facility also is not subject to MSSCAM for particulate matter. This is because the facility's potential particulate emissions in terms of PM_{10}, which currently serves as a surrogate for $PM_{2.5}$ for the MSSCAM rules, will also not be major.

For a major project for a pollutant, the MSSCAM rules require: 1) an "emission limit" which represents the Lowest Achievable Emission Rate (LAER), 2) compensating emission reductions from other sources, commonly called offsets, 3) an analysis of alternatives to the project, and 4) information confirming that other existing major sources owned by the applicant within Illinois are in compliance with applicable air pollution regulations or on a program to come into compliance. A discussion of these requirements for NOx emissions follows.

i. Lowest Achievable Emission Rate (LAER)

The determination of LAER for the facility's emissions of NOx is discussed in Section VI.

ii. Emission Offsets

The emissions associated with a major project in a nonattainment area must not interfere with the state plan to achieve attainment of the national ambient air quality standards. This plan consists of new programs and regulations designed to achieve the national standards and are based on a detailed analysis of current and projected emission and air quality levels. In order to account for the emissions increase from a major project proposed in a nonattainment area, the applicant must provide compensating emission reductions from other sources that have not been relied on in the attainment plan. These emission reductions are commonly referred to as "emission offsets".

Because the Chicago Area is a severe ozone nonattainment area, emission offsets at a ratio of 1.15:1.0, i.e., for each ton of

permitted NOx emissions from a project, 1.15 ton of offsets must be provided. Because the facility is permitted for potential NOx emissions of 301.8 tons per year, an offset of 347 tons NOx per year must be secured prior to commencement of construction of the facility. Finkl will obtain emission offsets from the shutdown of its existing facility on Southport Avenue in Chicago. It plans to obtain the remainder of the needed emissions offsets from Corn Products International, in Bedford Park, and ADM, in Chicago.

iii. Existing Source Compliance

Finkl currently has one major source in Illinois, its existing facility at Southport Avenue in Chicago. This facility is currently in compliance. As this proposed facility would replace this existing facility, the existing facility would also be permanently shut down, as would be required by the draft permit because the shut down of the existing facility is relied upon for some of NOx emission offsets needed for the proposed facility.

iv. Analysis of Alternatives to the Proposed Project

Finkl has demonstrated that the benefits of this new facility significantly outweighs the environmental and social costs imposed as a result of its location, construction, based upon an analysis of alternative sites, sizes, production processes, and environmental control techniques for the proposed facility, as required by 35 IAC 203.306,

C. Emissions Reduction Market System (ERMS)

The facility's actual seasonal emissions of VOM likely will be greater than 10 tons, so that the facility will be subject to the ERMS, 35 IAC Part 205. To comply with the ERMS, Finkl would be required to obtain allotment trading units (ATU) in an amount equal to its VOM emissions during each ozone season.

VI. CASE-BY-CASE CONTROL TECHNOLOGY DETERMINATION FOR BACT AND LAER

Finkl submitted a "top-down" BACT demonstration in its application reflecting its judgment as to the control technologies for emissions of PM, SO_2, and CO and associated emission limits that should be considered BACT under the PSD rules for the various units at the proposed facility.

Finkl also submitted a control technology demonstration in its application reflecting its judgment as to the emission control technology and associated emission limits that should be considered LAER for NOx emissions for units at the facility as required under MSSCAM. LAER for an emission unit is the more stringent rate of emissions based on either the most stringent emission standard, which is contained in the implementation plan of any state for the class of unit, unless it is demonstrated that such limitation is not achievable, or the most stringent emission limitation which is achieved in practice or is achievable for the class of unit. As such, LAER is equal to or more stringent than BACT.

The Illinois EPA has reviewed the material submitted by Finkl and made its independent determinations of BACT and LAER. In addition to the material submitted by Finkl, the Illinois EPA's determination of BACT relies upon its general knowledge of the types of operations at the proposed facility and specific information about existing facilities with similar operations that are located in Illinois. As explained below, the Illinois EPA concurred with Finkl's selection of control technologies as it reflected technologies that are in common use at similar facilities and effectively control emissions. However, the Illinois EPA's determination of BACT for the proposed facility, as set forth in the draft permit, would establish performance requirements for the control technology on certain units that are more stringent than those initially proposed by Finkl in its application.

A. BACT/LAER DISCUSSION FOR THE MELT SHOP

NOx

Finkl's LAER demonstration included the evaluation of a number of technologies to control NOx emissions from the units in the Melt Shop, i.e., the Electric Arc Furnace (EAF), Ladle Metallurgical Station or Furnace (LMF) and the scrap cutting operation. The following add-on control technologies are available but infeasible: selective catalytic reduction (SCR), selective non-catalytic reduction (SNCR), and SCONOX. SCR and SNCR would lead to increased NOx emissions if used and therefore are not practical emission reduction techniques. SCONOx requires a consistent exhaust gas flow rate and stable operating temperatures between 300 to 700 ^{o}F. The exhaust from the EAF is highly variable and would not provide the needed operating conditions for SCONOX. Also SCONOx uses a catalyst, which would be fouled or poisoned due to the dust from the EAF.

NOx emissions from the EAF are minimized by the conditions inside the EAF. EAFs are maintained with a neutral or reducing atmosphere inside the furnace to minimize formation of iron oxide and the loss of alloying materials, which acts to minimize generation of NOx. This is accompanied by formation of CO in the furnace due to the combined effect of the carbon content of the scrap steel, the added charge carbon, the erosion or consumption of the graphite electrodes, and as a by-product of the "foamy slag" practice, which is created by injecting carbon and oxygen into the slag. The CO created by the carbon and oxygen causes the slag to foam, significantly reducing the density of the slag. The foamed slag expands and shrouds the electric arc from the furnace and the furnace atmosphere. By shielding the arc from the air that may be drawn into the furnace, the NOx generated by the arc is significantly reduced. The CO generated by the foamy slag is also beneficial in creating an atmosphere in the EAF that is not conducive for the creation of NOx.

Direct shell evacuation control (DEC) maintains negative pressure within the electric arc furnace above the slag or metal and ducts emissions to a control device. This facilitates management of furnace draft to minimize the variation in EAF pressure during the melt cycle. High negative pressure inside the EAF will introduce air that, with the elevated temperatures inside the EAF, may contribute to increased NOx formation. Large positive pressure in the EAF would cause excessive shop opacity and decrease combustion of CO and VOM. Balancing the

furnace pressure between these two extreme conditions appropriately minimizes the emissions of NOx, and emissions of CO.

Of the available technically feasible technologies, DEC, low-NOx oxy-fuel burners and operating practices will be applied to the EAF. For the LMF only DEC and operating practices will be applied, as LMFs are not equipped with burners.

The USEPA's *RACT/BACT/LAER Clearinghouse* was reviewed to identify NOx emission rates set as BACT for EAFs at other steel plants. The LAER determination in The *Clearinghouse* reports that a NOx limit of 0.35 lbs/ton was set in a permit for an EAF at Republic Engineered Products, issued August 2005. The proposed LAER technology for the EAF is DEC, low NOx/oxy-fuel burners, and good operating practices, with a NOx rate of 0.35 lb/ton of steel, 24-hour average. The proposed LAER technology for the LMF is DEC and good operating practices with a NOx rate of 0.054 lbs/ton of steel, 24-hour average. LMF processing for alloy steel requires a significant increase in time in the LMF for alloy addition and refining that is not a consideration for metal alloys which require less refining, i.e., non-high grade metals. There are no add-on NOx controls for torch cutting of scrap. NOx from this process is controlled by use of oxygen torches, rather than air, with proper operating practices. Finkl has proposed a NOx limit of 0.98 lb/hour for this process, which is equivalent to a NOx emission rate of .017 lb/ton. The combination of these rates results in a combined LAER limit for NOx of 0.421 lbs/ton of steel produced, 24-hour average.

CO

There are several possible controls to reduce emissions of CO, including direct-shell evacuation control (DEC) with an air gap in the collecting duct, thermal oxidation, catalytic oxidation, duct burners, oxygen injection and other operational practices.

Two forms of oxidation devices can be used to minimize CO emissions, thermal oxidizers and catalytic oxidizers. In a thermal oxidizer a combustion chamber is maintained at an elevated temperature through the combustion of an auxiliary fuel in order to thermally break down or burn emissions. The pollutant to be controlled dictates the required combustion temperature. However, the air gap already provides control of CO in the same manner as thermal oxidation. Catalytic oxidizers are similar to thermal oxidizers, except that a catalyst bed is used to enable oxidation to take place at a lower temperature. The difficulty with a catalytic oxidizer is "blinding" of the catalyst bed. Blinding occurs when particulate in an exhaust stream coats the surface of the catalyst or plugs the catalyst bed preventing the catalyst from functioning effectively.

In oxygen injection, oxygen is injected into the furnace, which then reacts with CO to enhance oxidation in the furnace itself. One difficulty with oxygen injection is process sensitivity, such that normal variation in furnace operating conditions make this technique impractical. Also, at elevated temperatures oxygen injection can lead to increased generation of CO.

Of these technologies, thermal and catalytic oxidation are both technically infeasible when applied to an EAF for CO control. This is

due to the variable and low concentrations of CO in the exhaust stream (100 to 500 ppmv) after combustion from the air gap that is part of the DEC technology. These technologies also would not be cost-effective given the quantity of natural gas that would be needed to reheat the exhaust stream to a temperature at which additional combustion of CO would occur, which would cost millions of dollars each year. In addition, the burning of this supplemental fuel would itself be a additional source of NOx emissions from the facility.

Like oxidizers, duct burners suffer from the low and variable concentrations of CO and large exhaust volume inherent with an EAF operated with DEC. Duct burners would also generate additional NOx emissions.

Oxygen injection has proven unreliable on previous EAF applications. One of the primary limiting factors in CO combustion is inconsistent exhaust gas temperature; due to the variable nature of the EAF exhaust gas cycle temperature concentrations varying greatly. In addition, as the oxygen injection supplies additional oxygen to facilitate combustion of CO, the air gap in the DEC already provides for combustion of CO in the ductwork outside of the furnace itself.

Of the remaining control options discussed above, DEC and work practices are applicable and are proposed as BACT. The proposed BACT limit for CO is 5.41 lbs/ton of steel, 24-hour average.

PM

Particulate emissions of the furnaces would be effectively controlled by direct enclosure and secondary capture hoods with captured emissions controlled by fabric filtration.

Direct shell evacuation employs an induced draft to directly capture particulate emissions from the furnace during melting through a fourth hole in the furnace roof. (The electrodes are inserted into the furnace through the other three holes in the furnace roof.) Air is then introduced at a gap in the ductwork to combust the CO in a section of ductwork that is appropriately designed to accommodate combustion. The exhaust is then cooled and sent to the particulate matter control device.

Fabric filtration or baghouse technology removes PM emissions by passing an exhaust stream through a filter. The nature of the exhaust stream is important in selecting the type of filter material used in a baghouse. The material must reliably tolerate the peak temperatures of the exhaust stream and not become plugged by dust so as to impede flow of gas, which conditions could otherwise lead to premature failure of the filter material.

For EAFs and LMFs, baghouses are generally considered the most effective particulate matter control devices. Cyclones remove PM from waste gas streams by centrifugal and inertial forces, which are of only limited effectiveness in collecting PM10. Electrostatic precipitators (ESP) use electrical force to remove particles from a exhaust stream. ESPs are not suited for processes that have a highly variable exhaust gas stream. The highly variable nature of an EAF/LMF flow rate, temperature, and particulate loading, make ESP control for these units

technically infeasible. In scrubbers, the PM in the exhaust stream is removed by contact with liquid droplets generated by the spray nozzles or a Venturi. This technology is again ill-suited for the variable conditions in the exhaust stream from arc furnaces, so that scrubbers are not as efficient for control of the PM as fabric filters. In addition, wet scrubbers generate wastewater or sludge making scrubbing undesirable.

Finkl will implement the most effective control strategy for control of particulate matter emission, a DEC and a secondary, roof canopy system connected to a fabric filter baghouse. This is the control option used by all EAF operations addressed by the USEPA *Clearinghouse*. Finkl proposes to install a common melt shop baghouse to control the EAF, LMF and scrap cutting emissions. The proposed BACT limits for this baghouse are 0.0032 and 0.018 grains/dscf, 24-hour block average, for total and filterable PM respectively. For the EAF, the proposed BACT determination would not allow any visible emissions from the building enclosing the furnace. The opacity of any uncaptured emissions from the LMF and the scrap cutting operation would be limited to 3.0 percent opacity, measured at the roof monitor.

SO_2

Most of the SO_2 emissions from the facility occur at the EAF and LMF from the combustion of sulfur containing materials used in the steel making process. As compared to most steel mills, Finkl is unusual in that it makes certain steels for tool stock and other specialty applications in which sulfur is a desirable constituent to aid in machinability. When this type of steel is being made, the molten steel is resulfurized in the LMF by adding bulk and wire strand sulfur to the melt to increase its sulfur content to meet applicable grade specifications. The in-house scrap from the manufacture of these grades of steel then contributes additional sulfur at the EAF.

Potential control technologies include low-sulfur charge carbon, scrap management, DEC, work practices, and add-on flue gas desulfurization (FGD) systems. The addition of charge carbon to the melt is an essential component of steel. The high performance grades of steel forgings that Finkl produces need high purity carbon additions with a minimal amount of other constituents, which could affect the final quality of the steel. Currently, Finkl is using low-sulfur charge carbon that has less than 0.5% sulfur by weight. This minimizes the contribution of charge carbon additions to SO_2 emissions.

Higher-quality grades of scrap steel with lower levels of undesirable constituents and contamination, which could affect the quality of the steel product, is generally needed to make the high quality specialty steel that Finkl produces. This acts to prevent steel scrap that could contribute to SO_2 emissions from being accepted at the facility and being used. This is formally addressed in the scrap management program that the facility follows to ensure suitable feed to the EAF.

Direct shell evacuation control (DEC) maintains a negative pressure above the metal or slag inside an EAF and captures emissions for direct ducting to the particulate control device. Dampers are used to maintain sufficient negative pressure to adequately control emissions, without drawing in so much air that emission are increased due to the

presence of additional oxygen. The air gap in the ductwork then provides sufficient air for combustion of CO without having excessive air (oxygen) in the furnace itself, which would act to lower the amount of sulfur retained in the steel or absorbed in the slag, with increased loss of sulfur from the furnace as SO_2 emissions.

The work practices for the furnace during the melt phase work with the DEC to minimize emissions, as they minimize the variation in the furnace pressures. Extreme negative pressure inside the furnace is prevented, which would contribute to increased SO_2 formation. Any positive pressure is also prevented, which would reduce the effectiveness of the DEC in capturing PM, increasing the loading to the secondary capture hoods. Any positive pressure would also reduce the effectiveness of the air gap in combusting CO.

Flue gas desulfurization (FGD), also known as SO_2 scrubbing, uses limestone, lime or other alkaline reagent absorb SO_2 and remove it from an exhaust stream. FGD is not considered technically feasible for the furnaces for the following reasons. Relatively low SO_2 concentrations and large exhaust volumes provide limited driving force to SO_2 to react with the reagent. The controlled outlet SO_2 concentration typically found with FGD systems is higher than the exhaust concentrations that would be present from the melt shop. In addition, SO_2 concentrations vary through the furnace cycle, making operation of any scrubber system problematic. Finally, the exhaust gas flow rate and temperature also vary greatly throughout the furnace cycle, also presenting conditions that are not amenable to effective operation of a scrubber.

The technically feasible options are low-sulfur charge carbon, scrap management, DEC, and work practices, which are all proposed as BACT for SO_2. The proposed individual SO_2 emission rates are provided below in lb SO_2/ton of steel, 24-hour average. The proposed “combined” BACT rates for the common baghouse that serves the EAF and LMF are 0.34 and 1.00 lbs SO_2/ton, 24-hour average, for production of regular and resulfurized grades of steel, respectively.

Unit	SO_2 Emission Rate (lbs/ton steel)	
	Regular Steel	Resulfurized Steel
EAF	0.30	0.30
LMF	0.04	0.70
Total	0.34	1.00

B. BACT DISCUSSION FOR TEEMING

In the teeming area, molten steel is poured into molds to solidify and form solid ingots of the desired shape and size. The metal is either poured from the ladle using an overhead crane or a ladle teeming car. The hot metal in the molds then solidifies, as the molds slowly cool in the open air in the teeming pit. The heat from the process escapes from the building through roof monitors located over the teeming area.

Particulate emissions occur from teeming mainly due to contact of the stream of molten metal with air during pouring. Traditional teeming, with pouring of steel into the top of the ingot molds is accompanied by splashing of steel, which increases the extent of contact between molten steel and air. The filling of ingot molds at the proposed

facility will use “bottom pouring.” In bottom pouring, molten steel is poured into a hollow ceramic distribution system that directs the liquid into the bottom of the molds without splashing, thereby reducing contact with air and particulate emissions. Also, the point where the molten steel enters the distribution system can be enclosed with mechanical or chemical shrouds to minimize air contact. Other minor points of emissions from teeming occur during the opening of a plugged ladle outlet and during the application of a exothermic layer of material on the top of the ingot in order to minimize porosity.

BACT technology for teeming is proposed as use of bottom pouring to minimize generation of particulate. The proposed BACT limit is 3.0 percent opacity, as measured at the roof monitor.

C. BACT DISCUSSION FOR HANDLING OF LIME AND CARBON

Because of the dusty nature of lime and carbon, equipment that handles these materials used in the furnaces is a potential source of particulate emissions. Emissions from these types of operations are typically controlled by fabric filters. Although there are other technologies that could theoretically be used to control particulate from these types of units, such as electrostatic precipitators and scrubbers, such technologies have not been applied to these types of units. They offer no performance advantages over fabric filters.

BACT for these units is proposed as enclosure to prevent visible fugitive emissions and venting of collected emissions through a filter control device from which PM emissions, as would be measured by USEPA Method 5, shall not exceed 0.005 gr/dscf.

D. BACT DISCUSSION FOR THE MELT SHOP FURNACE DUST HANDLING

The handling of the furnace dust that has been collected by the melt shop baghouse is also a potential source of particulate emissions. The emissions from handling of dust collected by control devices is typically controlled by using practices that do not release dust laden air or by use of filters. Although there are other types of control devices that could theoretically be used for handling of furnace dust such as electrostatic precipitators and scrubbers, other types of control devices are not routinely used. These other types of control devices offer no performance advantages over the use of filters.

The most effective control technology for these emissions is the total enclosure of the activity that is generating the particulate matter, coupled with a filter system to control particulates from any displaced air or exhaust that is generated. Finkl is proposing to use these practices for handling of furnace dust. BACT is proposed as enclosure to prevent visible fugitive emissions and if an exhaust stream is present, use of filter devices from which PM emissions, as would be measured by USEPA Method 5, do not exceed 0.005 gr/dscf.

E. BACT DETERMINATION FOR THE VACUUM TANK DEGASSING STATION

Vacuum degassing and vacuum oxygen decarburization are performed in the Vacuum Tank Degassing Station to purify molten steel. The decarburization process occurs after a ladle of molten of steel is placed in the station and a vacuum is applied. Under vacuum, the

oxygen dissolved in the steel “naturally” reacts with the carbon rapidly forming CO, which “boils” out of the molten steel. This process can then be followed by vacuum oxygen degassing to achieve very low levels of carbon for stainless and low carbon grades of steel. In vacuum oxygen decarburization, an oxygen lance in the roof of the vacuum tank introduces oxygen at the top of the molten steel in the ladle and argon is used to stir the liquid steel. The oxygen reacts with the dissolved carbon, lowering the carbon content of the steel to the desired level, again generating CO.

CO emissions from the vacuum tank station can be reduced through use of combustion or oxidation technology. Oxidation is the process of burning a combustible material by maintaining it at a high enough temperature for sufficient time to complete combustion. Due to the high vacuum level between the actual tank and the outlet steam ejector that applies the vacuum, any oxidation techniques would have to be applied after the ejector outlet. Thermal oxidation, catalytic oxidation, and flaring are the three combustion techniques available for these processes. Due to the nature of steam ejectors and the potential for a thermal oxidizer or catalytic oxidizer to negatively affect the vacuum process, the only technically feasible option is a flare. However, a flare cannot be safely used during natural decarburization due to the rapid release of gas and the risk of explosion. It is practicable for vacuum oxygen carburization, which is a steadier process as it is driven by the introduction of oxygen and generates substantially more CO to be controlled.

For vacuum oxygen decarburization, flaring is proposed as BACT. The proposed BACT limit is proper operation of the flare so that the duration of visible emissions does not exceed 2 minutes during 60 minutes of operation of the vacuum oxygen decarburization process.

F. BACT/LAER DISCUSSION FOR THE NATURAL GAS FIRED BOILER & FURNACES

The facility will include a natural gas fired steam generator, natural gas fired reheat and forging furnaces and heat treating furnaces, and various natural gas-fired burners. The steam generator will provide steam as needed by the vacuum ejector system on the vacuum tank degassing station, which is used to purify molten steel. The various furnaces will be used to raise the temperature of steel in the course of processing to a temperature suitable for hot working or shaping and for heat treating of steel. There is a range in the size of the furnaces and other aspects of the design, such as batch and continuous furnaces. The burners are used with the steel ladles in the melt shop to preheat the ladles prior to filling with steel and for curing refractory after repair. These units will be subject to LAER for NOx and BACT for CO, SO_2 and PM.

NOx

NOx is formed during combustion of natural gas by thermal NOx formation. Thermal NOx results from the high temperature oxidation of nitrogen (N_2) and oxygen (O_2). The N_2 is supplied from air, which is approximately 79 % N_2. Thermal NOx formation is primarily dependent on combustion temperature and the availability of oxygen.

The RBLC database was reviewed to identify technologies that could theoretically be used to control NOx emissions from gas-fired units. The NOx control technologies identified include low excess air (LEA), low-NOx burners (LNB) with and without flue gas recirculation(FGR), Ultra low NOx regenerative burners (ULNRB), selective catalytic reduction (SCR), and selective noncatalytic reduction(SNCR). Due to the relatively small size of these units, none of which would have a rated capacity greater than 32 million Btu/hour, there are limited control technologies available in practice for these units. Ultra-low NOx burner technology is available for the larger reheat and forging furnaces and will be utilized on these units. The steam generator and the remainder of the furnaces will use low-NOx burners. Low-NOx technology is not available for burners used to heat ladles in the melt shop.

For the furnaces, only low-NOx burners and SCR are considered technically feasible. Small combustion units, like those at this plant are compact and have insufficient residence time at the correct temperature to allow effective use of SNCR technology. The application of SNCR to the planned gas-fired units would require innovative designs of specially fabricated units, for which the actual effectiveness of SNCR would still be uncertain. Moreover, advanced LNB technology can likely achieve lower NOx emissions than would be achieved with SNCR technology alone, but at much lower costs. As such, SNCR is not considered a technically feasible control option for the combustion units at the plant.

For the high temperature heat treat furnaces only low excess air (LEA), low NOx burners (LNB), Ultra Low NOx regenerative burners (ULNRB) and low NOx burner plus flue gas recirculation (LNB + FGR) are technically feasible options. The most effective control technology is the ULNRB. The ULNRB allows for significant NOx reductions without loss in efficiency. BACT is proposed as ULNRB on all high temperature forge reheat furnaces with a NOx a limit of 0.099 lbs/million Btu.

Control Technology	Emissions lb/MMSCF	Percent Reduction
Uncontrolled	805	--
LEA	705	12
LNB	275	66
LNB + FGR	185	77
ULNRB	99	88

A smaller number of NOx reduction technologies are available for the steam generator and smaller heat treat furnaces. Ultra low NOx regenerative burners are not available for these units. However, due to their smaller size and lower heating demands present for such units, BACT for these units is proposed as low-NOx burners with a NOx limit of 0.060 lbs/million Btu. BACT for the burners in the melt shop, which are used with the ladles and are not part of distinct furnaces, is proposed at 0.10 lbs/million Btu.

CO

CO will be emitted from combustion units as a result of incomplete fuel combustion. Good combustion control is the only technically feasible control option for CO from the various fuel combustion units at the

facility, given their relatively small size and variable manner of operation. The proposed CO BACT limit for the units is 0.84 lbs/million Btu.

SO_2

Emissions of SO_2 result from the oxidation of sulfur in fuel. During combustion, the majority of the fuel sulfur is emitted as SO_2. Natural gas is treated by the supplier to very low levels of sulfur compounds resulting in a typical emission factor of 0.006 lb SO_2/mmBtu. Use of natural gas is widely recognized as providing BACT for emissions of SO_2.

PM

Use of natural gas is also widely recognized as BACT for PM emissions from combustion of fuel.

G. BACT DETERMINATION FOR COOLING TOWER

The facility will have several non-contact cooling towers to supply cooling water for the furnaces and other processes. These cooling towers will emit particulate matter due to drift or loss of water droplets containing dissolved solids from the towers. Based on the review of BACT databases, the appropriate control technology identified is the use of high efficiency drift eliminators and maintaining a low level of solids in the circulating water.

BACT for the affected cooling tower cells is proposed as drift eliminators that are designed to reduce drift loss to no more than 0.0005 weight percent of the circulating water flow. Additionally, the total dissolved solids (TDS) content of the water circulated in the cooling tower shall not exceed 2500 ppm, annual average.

H. BACT DETERMINATION FOR ROADWAYS

The facility will have roads for raw material delivery and product shipment. Truck traffic on facility roadways is a source of fugitive PM10 emissions requiring the application of BACT. Preventative control measures for emissions include road design (i.e., paving) and adherence to general best management practices for minimizing fugitive emissions. Available mitigation measures include water spray or chemical stabilization of unpaved roads and sweeping and/or water flushing of paved roads.

Based on an assessment of available control options, the Illinois EPA determined that BACT for roadways is implementation of a dust control program accompanied by limits on opacity of fugitive particulate emissions from roadways. Specifically opacity is proposed to be limited to 5 percent, with opacity determined in accordance with the methodology established by 35 IAC 212.109. This will require that stringent practices be implemented to control emissions of fugitive dust from roadways at the facility.

I. BACT DETERMINATION FOR OTHER PROCESS OPERATIONS

Other process units at the facility will also utilize BACT. In particular, the various processes to physically prepare the surfaces of

the ingots for forging, including abrasive cutting, grinding and shot blasting, which are sources of particulate. Cleaning of the interior surface of the copper crucibles used in the vacuum arc remelt furnaces is also a potential source of PM emissions. Filters are commonly recognized as providing the most effective control of PM emissions from these types of operations. The proposed limit for PM is 0.0050 gr/scf.

VII. PSD IMPACT ANALYSES

A. AIR QUALITY ANALYSES

Ambient air quality analyses were conducted by a consulting firm, CRA, on behalf of Finkl to assess the impact of the emissions of PM10, NO_2, SO_2, and CO from the proposed facility. Under the PSD rules, these analyses must show that the proposed project will not cause or contribute to a violation of any applicable air quality standard. The air quality analyses were performed using computerized dispersion modeling. The analyses were conducted using current USEPA guidance, including use of the AERMOD dispersion model. The analyses indicate that the proposed facility will not cause or contribute to a violation of the National Ambient Air Quality Standards (NAAQS) for PM10, NO_2, SO_2, or CO air quality standards or applicable PSD increments.

Results of Analysis for the PSD Increments ($\mu g/m^3$)

Pollutant	EAF Load	Averaging Period	Maximum Modeled Concentration	PSD Increment	Does Impact Exceed Increment
PM10	100	24-hour	36.8	37	No
	100	Annual	12.9	19	No
SO_2	75	3-hour	87.6	700	No
	75	24-hour	22.6	91	No
	50	Annual	1.12	20	No
NO_2	100	Annual	11.3	25	No

Results of Analysis for the NAAQS for PM10, SO_2, NO_2 and CO ($\mu g/m^3$)

Pollutant	EAF Load (%)	Averaging Period	Maximum Modeled Impact	Background	Maximum Combined Impact	NAAQS
PM10	100	24-hour[a]	43.8	81.0	124.8	150
	100	Annual	15.9	26.0	41.9	50
SO_2	75	3-hour	172.5	136.1	308.6	1300
	75	24-hour	44.7	55.0	99.7	365
	100	Annual	8.1	15.7	23.8	80
NO_2	100	Annual	19.9	37.6	57.5	100
CO	75	1-hour	2632	4466	7098	40000
	75	8-hour	1034	2748	3782	10000

B. IMPACTS ON SOIL, VEGETATION AND VISIBILITY

As the facility is located in an urban area, the NAAQS and PSD Increments are adequate to protect against the potential adverse

impacts from the facility’s emissions eon soils, vegetation, and visibility.

VIII. PERMIT CONDITIONS

The conditions of the permit set forth the air pollution control requirements that the facility must meet. These requirements include the applicable emission standards that apply to the units at the facility. They also include the measures that must be used and the emission limits that must be met by emission units as BACT for emissions of PM, SO_2, and CO and LAER for emissions of NOx.

The permit also establishes enforceable limitations on the amount of emissions for which the project is permitted. In addition to annual limitations on emissions, the permit includes short-term emission limitations and operational limitations, as needed to provide practical enforceability of the annual emission limitations. As previously noted, actual emissions associated with the project would be less than the permitted emissions to the extent that the facility operates at less than capacity and control equipment normally operates to achieve emission rates that are lower than the applicable standards and limitations.

The permit also establishes appropriate compliance procedures for the ongoing operation of the facility, including requirements for emission testing, required work practices, operational monitoring, recordkeeping, and reporting. These measures are imposed to assure that the operation and emissions of the facility are appropriately tracked to confirm compliance with the various limitations and requirements established for individual emission units.

IX. REQUEST FOR COMMENTS

It is the Illinois EPA's preliminary determination that the application for the proposed facility meets applicable state and federal air pollution control requirements. The Illinois EPA is therefore proposing to issue a construction permit for the facility.

Comments are requested on this proposed action by the Illinois EPA and the conditions of the draft permit.