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Project Summary for A Construction Permit Application from Nucor Steel Kankakee Inc., Bourbonnais for Increased Emissions for an Existing Electric Arc Furnace

Site Identification No.: 091801AAA
Application Nos.: 04100024

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Important Dates

Comment Period Begins: August 20, 2006
Comment Period Closes: September 19, 2006

Project Summary – Nucor Steel Kankakee Inc. - Bourbonnais

I. Introduction

Nucor Steel Kankakee Inc. has requested an air pollution control permit that authorizes increased sulfur dioxide (SO2) and volatile organic material (VOM) emissions from the arc furnace at its existing steel production plant in Bourbonnais.

The Illinois EPA Bureau of Air reviews applications for air pollution control permits. The Illinois EPA has reviewed Nucor Steel's application and made a preliminary determination that Nucor's request, as set forth by Nucor in its application, meets applicable requirements. Accordingly, the Illinois EPA has prepared a draft of the permit that it would propose to issue in response to Nucor's request. However, before issuing a permit, the Illinois EPA is holding a public comment period to receive comments on the proposed issuance of a permit and the terms and conditions of the draft permit.

II. Background

Nucor's Bourbonnais plant has a single electric arc furnace to supply the raw steel for the concrete reinforcing bar and other steel bar products manufactured at the plant. Steel scrap is melted and refined in the arc furnace using electricity as the main source of heat. The furnace was installed in 1988 by Birmingham Steel, the owner of the plant at that time, replacing the prior furnace at the plant (Construction Permit 88110038).

The principal air pollutants emitted from the furnace are particulate matter (PM), carbon monoxide (CO), nitrogen oxides (NOx), VOM and SO_2. In addition to having PM emissions due to the physical loss of material during operation, the arc furnace is also a source of gaseous pollutants from the chemical reactions that occur during the refining of the scrap, the presence of contaminants in the scrap, and the high temperature in the furnace.

Emissions of PM from the furnace are controlled by enclosure of the furnace shop with collected exhaust directed to two fabric filters or baghouses, including a supplementary baghouse that Nucor recently installed. Because the furnace was constructed after 1983, the furnace is considered a new furnace and is subject to the federal New Source Performance Standards, NSPS for Steel Plants, 40 CFR 60 Subpart AAa, which addresses PM emissions from arc furnace operations at steel mills.

The furnace is also subject to requirements for emissions of carbon monoxide (CO) and nitrogen oxides (NOx) established under the federal rules for Prevention of Significant Deterioration of Air Quality (PSD), 40 CFR 52.21. These requirements were established in 1993 in conjunction with a modification of the plant that was subject to permitting under the PSD rules. (Refer to Construction Permit 93010095).

III. Description of Nucor's Current Request

Nucor took ownership of this plant in December 2002. After Nucor took over the plant, it performed an engineering evaluation and emissions

testing for the arc furnace to assess compliance with applicable requirements, including the requirements of the existing air pollution control permit. Nucor determined that the arc furnace had the potential to exceed the established SO_2 emission limit of 0.137 lbs/ton of steel. Nucor also found that the VOM emissions of the furnace, which had not been addressed in the existing permits, were significant. Nucor's current request responds to these findings.

Nucor has requested permitted annual emissions from the furnace of approximately 263 tons and 171 tons for SO_2 and VOM, respectively. For SO_2 emissions, this represents an increase from the current permitted emissions of about 203 tons. This request is subject to permitting under the PSD rules for emissions SO_2 and VOM. For emissions of SO2, this is because Nucor has requested limits that would allow a significant increase in the emissions of SO_2 from the furnace, i.e. more than 40 tons/year, compared to the current limits in its CAAPP permit. For VOM, this is because Nucor is requesting limits that would allow significant VOM emission from the furnace. These requests do not reflect a change in intended operation of the furnace. Rather they reflect use of emission factors for the furnace that are higher than the factors previously used by Birmingham Steel, which Nucor believes more accurately account for the potential range of SO_2 and VOM emissions from the furnace.

IV. Applicable Emission Standards

All emission units in Illinois must comply with state emission standards adopted by the Illinois Pollution Control Board. The state emission standards represent the basic requirements for sources in Illinois. The Board has standards for the PM and SO_2 emissions and opacity from the furnace, as it is a process emission unit. The furnace is also subject to a federal NSPS, as already mentioned, which also limits PM emissions and opacity of the furnace. Available information indicates that the furnace is currently complying with these standards. Nucor's current request does not involve PM emissions of the furnace and compliance with applicable emission standards should not be adversely affected by establishing limits for SO_2 and VOM.

V. Best Available Control Technology (BACT)

Because the requested revision triggers applicability of PSD for VOM and SO_2 emissions the furnace, Best Available Control Technology (BACT) must be used for the control of VOM and SO_2 from the furnace. BACT is determined on a case-by-case basis using a "top-down" procedure. The top-down procedure involves ranking available control technologies in descending order of control effectiveness. The top alternative is established as BACT unless this alternative is eliminated due to accompanying cost, energy and environmental impacts.

Nucor submitted a BACT demonstration in its application reflecting its judgment as to the emission control technology and associated emission limits that should be considered BACT for the furnace. The Illinois EPA has reviewed the material submitted by Nucor and made its independent determination of BACT. As explained below, the Illinois EPA concurred with Nucor's selection of a scrap management plan, a work practice as BACT, rather than use of add-on emission control devices. The Illinois EPA also determined that Nucor selected appropriate emission limits for

the furnace that reflect effective management of the scrap supply to the furnace.

BACT for VOM Emissions

For emissions of VOM from the furnace, the BACT demonstration considered the following potentially applicable control techniques: 1) add-on combustion-type control devices; 2) degreasing of scrap prior to use; and 3) a scrap management program to prevent use of scrap that is heavily laden with oil. The first two "equipment-based" options pose significant technical challenges. These options have not been applied in practice at steel plants and must be considered theoretical in nature. In particular, add-on combustion devices would be ill-suited to the low concentration of VOM in the exhaust and the range of temperatures and dust loading present in the exhaust during the operating cycle of the furnace, with charging, melting and refining, and tapping. A scrap degreasing process would potentially generate more emissions than would be eliminated from the furnace. Degreasing would also would increase the risk of water or solvents being present in the scrap, which poses safety concerns for the operation of the furnace.

In contrast, a scrap management program can include provisions restricting the use of scrap that is heavily oiled, an undesirable practice that is directly correlated with VOM emissions from an arc furnace. Using "clean scrap" is an effective technique for controlling VOM emissions from a furnace. Managing the scrap supply to an arc furnace is readily feasible, as steel plants must carefully manage the composition of scrap in any case to efficiently and economically produce raw steel of the desired properties. As provisions are present in a scrap management plan to address the amount of oil present in the scrap, they act to prevent introduction of excessive amounts of oil into the scrap at the source where it is generated or the subsequent recovery of such oil at the such source so that the oil can be reused.

Based upon a review of VOM emission data from various arc furnaces across the country and the VOM emission rate measured on the furnace, a limit of 0.35 lb VOM per ton of steel is being proposed as BACT. This limit is based on the VOM limits set for arc furnaces at other plants making similar products, which are made entirely from scrap. This limit would preclude the use of heavily oiled scrap, such as the steel casings from waste oil filters. This limit would also provide an appropriate margin for compliance, considering the potential variability in the effectiveness of properly implemented scrap management program and variability in the potential sources of scrap that are available to Nucor for the products that the plant is designed to manufacture.

BACT for SO_2 Emissions

For emissions of SO_2 from the furnace, the BACT demonstration also evaluated several potentially applicable control techniques: 1) add-on scrubber-type control devices; 2) use of carbon sources with low-sulfur content in the furnace; and 3) a scrap management program to prevent use of scrap that contains excessive levels of constituents that contribute to SO2 emissions, including oils. As with VOM missions, the first "equipment-based" option poses significant technical challenges, have not been applied in practice at steel plants, and must be considered theoretical in nature. A key factor is again the low concentration of SO2 in the exhaust. The two work practice alternatives are feasible, although more complex as sulfur is present in both the scrap and the required carbon addition to the furnace.

While feasible, management of the sources of carbon additives to reduce sulfur content would not be an effective or appropriate means to control SO_2 emissions from the furnace. This is because the carbon additives generally play a secondary role in SO_2 emissions and the selection of additive(s) is governed by the steel product that is being manufactured. In contrast, management of steel scrap is an effective and appropriate means to limit SO_2, as sulfur is an undesired component in the scrap that is associated with non-metallic materials that are present in the scrap, including oils, as well as paint and rubber.

Based upon a review of SO_2 emission data from arc furnaces at other plants producing similar products and the emission data at Nucor, a limit of 0.60 lb SO_2 per ton of steel is being proposed as BACT. This limit would preclude the use of scrap that contains significant levels of sulfur. This limit would also provide an appropriate margin for compliance, considering the potential variability in the effectiveness of properly implemented scrap management program and variability in the potential sources of scrap that are available to Nucor for the products that the plant is designed to manufacture.

VI. AIR QUALITY ANALYSIS

The United States EPA has established standards to define levels of ambient air quality for the major air pollutants at which adverse human health impacts and welfare impacts may occur. Based upon the nature and effects of a pollutant, appropriate numerical limitation(s) and associated averaging times are set to protect against adverse impacts. For some pollutants several standards are set, for others only a single standard has been established.

Modeling is performed by computer, allowing detailed estimates to be made of air quality impacts over a range of weather data. Modeling techniques are well developed for essentially stable pollutants like particulate matter, NO_x, and CO, and can readily address the impact of individual sources. Modeling techniques for reactive pollutants, e.g., ozone, are more complex and have generally been developed for analysis of entire urban areas. They are not routinely applied to address the potential impacts of a single source or project.

Air quality analysis is the process of predicting ambient concentrations in an area or as a result of a project and comparing the concentration to the air quality standard or other reference level. Air quality analysis uses a combination of computer modeling and ambient air monitoring data as appropriate.

SO_2 Air Quality Analysis

An ambient air quality analysis was conducted by a consulting firm, Environmental resources Management (ERM), on behalf of Nucor to assess the air quality impacts of the requested limits for SO_2 emissions. Under the PSD rules, this analysis must demonstrate that the SO_2 emissions will not cause or contribute to a violation of any applicable air quality standard or PSD increment.

The following tables summarize the results of the air quality analysis. The initial analysis necessary for this project under the PSD rules evaluated whether the furnace would have "significant impacts" for SO_2. In its guidance for the performance of PSD air quality analyses, USEPA

has established Significant Impact Levels for different averaging times and pollutants. If modeled impacts of a project are above the level for a pollutant, a more refined air quality analysis is required under the PSD rules. This more refined analysis must also address existing emission units at the source at which a project is located and other large stationary sources in the surrounding area, in addition to the proposed project. The significant impact levels are a fraction of the applicable National Ambient Air Quality Standards for a pollutant, which are the threshold levels set by USEPA for health and welfare effects from a pollutant.

The initial analysis conducted for the proposed limits showed maximum impacts for SO_2 air quality are above the applicable significant impact levels. For this evaluation, ERMS modeled all SO_2 emissions that would be permitted from the plant, not simply the increase in emissions. Because the maximum impacts exceeded the PSD significant impact levels, further modeling had to be performed to address to address both the SO_2 ambient air quality standards and the PSD Increments for SO_2.

Table 1. Significant Impact Modeling for SO_2(ug/m^3)

Averaging Period	Maximum Predicted Impact	Significant Impact Level
3-hour	269.3	25
24-hour	88.7	5
Annual	5.9	1

The first part of the further air quality analysis involved modeling to confirm that the National Ambient Air Quality Standards (NAAQS) for SO_2 would not be violated. This modeling combines the maximum modeled impacts for the requested SO_2 emissions from the plant and the emissions from existing large sources in the area, with representative background concentrations. Background values were taken data collected in 2001, 2002 and 2003 at the ambient monitoring station in Joliet, the station nearest to Bourbonnais at which SO_2 is monitored. The results of this analysis, as provided below, show that the proposed project will not cause or contribute to violations of the applicable NAAQS.

Table 2: Results of the NAAQS Analysis for SO_2 (ug/m^3)

Averaging Period	Maximum* Modeled Impact	Monitored Background	Total Impact	NAAQS
3-hour	764.2	202.6	966.8	1300
24-Hour	227.1	73.7	300.8	365
Annual	32.8	13.2	46.0	80

* The maximum air quality impacts are determined using the appropriate procedure for consistency with the applicable measure of air quality impact, as follows: Highest average of annual data for five years for the Annual NAAQS, and highest second high in five years for the hourly NAAQS.

The other part the further analysis involved modeling the requested increase in emissions and all other new and modified units in the area that consume PSD SO_2 increment to determine whether the PSD increment will be exceeded. This analysis was done with an inventory of increment consuming emission units supplied by Illinois EPA. The results of the

increment consumption modeling, as provided below, show that this project will not result in an exceedance of the SO_2 increments.

Table 3: SO_2 Increment Consumption (ug/m^3)

Averaging Period	Maximum* Increment Consumed	Applicable Increment
3-Hour	227.1	512
24-Hour	65.5	91
Annual	6.2	20

* The maximum air quality impacts are determined using the appropriate procedure for consistency with the applicable measure of air quality impact, as follows: Highest 1st high for the annual increment and highest second high for the 3-hour and 24-hour increments.

Other Air Quality Related Impacts

Under the PSD rules, NUCOR must also submit analyses to address changes in air quality from growth in the area that result from the project, and construction of the source itself. It must also evaluate the potential for visibility impairment and address the potential impacts on soil and vegetation. NUCOR provided the required analyses.

No emissions impacts are anticipated from growth associated with the requested changes, as this project does not involve changes to the operation of the furnace that would trigger or stimulate such growth. Similarly, no deterioration of visibility or vegetation is anticipated from the project.

V. Draft Permit

The permit is intended to identify the applicable requirements governing the VOM and SO_2 emission from the furnace, including BACT. The permit also contains compliance procedures to ensure that the furnace is operated to meet these emission control requirements, including monitoring, recordkeeping and reporting requirements for VOM and SO_2 emissions. The Permittee must carry out these procedures on an on-going basis to demonstrate that the furnace is operating within the limitations set by the permit and VOM and SO_2 emissions are being properly controlled.

The permit also identifies other applicable requirements for other pollutants emitted from the furnace, along with the compliance procedures associated with those emission control requirements.

VI. Request for Comments

It is the Illinois EPA’s preliminary determination that Nucor’s application meets all applicable state and federal air pollution control requirements, subject to the conditions proposed in the draft permit. The Illinois EPA is therefore proposing to issue a permit. Comments are requested on this proposed action by the Illinois EPA and the proposed conditions on the draft permit. If substantial public interest is shown in this matter, the Illinois EPA will consider holding a public hearing in accordance with 35 Ill. Adm. Code Part 164.

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