Illinois Environmental Protection Agency

Project Summary
For a Construction Permit Application:

Lafarge Midwest, Inc. – Joppa Cement Plant
Plant Expansion
Grand Chain, Illinois

Site Identification No.: 127855AAA
Application No.: 05100026

Schedule

Public Comment Period Begins: April 21, 2006
Public Hearing: June 7, 2006
Public Comment Period Closes: July 7, 2006

Illinois EPA Contacts: Robert Smet
Community Relations Coordinator: Bradley Frost

I. INTRODUCTION

Lafarge Midwest, Inc. has requested a permit to expand its cement manufacturing operations at its Joppa Cement Plant, located in Grand Chain, Illinois. The expansion project will mainly consist of the following activities:

- Installation of two new preheater/precalciner kiln systems
- Shutdown of one of the two existing kilns (kiln #2)
- Installation of two new finish mills
- Ancillary changes to material handling operations

The Illinois EPA has prepared a draft of the construction permit it proposes to issue to authorize the expansion project. The permit identifies the applicable rules governing emissions from the plant, and establishes enforceable limitations on its emissions. The permit also establishes appropriate compliance procedures, including requirements for emissions testing, continuous emission monitoring, record-keeping, and reporting. The Permittee will be required to carry out these procedures on an ongoing basis to demonstrate that the plant is operating within the limitations established by the permit and that emissions are being properly controlled.

II. GENERAL PROCESS DESCRIPTION

The production of Portland cement is a four-step process: (1) acquisition of raw materials, (2) preparation of the raw materials for thermal processing, (3) thermal processing of the raw materials to form Portland cement clinker, and (4) grinding of the clinker with other supplemental material to make finished Portland cement.

The types of raw materials that are used in the production of cement can be divided into four categories: calcium (limestone), silica, alumina and iron. These raw materials are selected, crushed, ground and proportioned so that the resulting mixture has the desired fineness and chemical composition for delivery to the kiln system for thermal processing system.

The rotary kiln is the heart of the Portland cement process since the critical chemical reactions necessary to produce Portland cement take place there. The kiln is a slightly inclined, slowly rotating steel tube that is lined with refractory materials. Raw materials are introduced at the uphill end and the rotation of the kiln causes the solid materials to be slowly transported downhill from the feed end. Fuel is burned at the lower or discharge end of the kiln. The hot, gaseous combustion products move countercurrent to the material flow, thereby exposing the material in the kiln to higher and higher temperatures.

Modern kilns are equipped with a preheater, where the raw kiln feed is introduced into a series of cyclones. In the cyclones, the material flows counter-current with the kiln exhaust, thus recovering heat from the exhaust gases to preheat the raw feed. Modern kilns also have a secondary fuel firing zone called a precalciner where the raw materials are partially calcined prior to entering the kiln.

The product of the rotary kiln, which looks like porous gravel, is known as clinker. Heat from hot clinker leaving the kiln is recovered in cooling devices and a portion is returned to the kiln preheating combustion air. The cooled clinker is mixed with a form of calcium sulfate, usually gypsum, and ground in mills in the finish department to produce Portland cement, which is then stored, pending bulk loadout.

III. PROJECT DESCRIPTION

The expansion project will increase the plant's annual production capacity to a nominal 3.25 million tons of cement. The project includes the installation of two new production trains with preheater/precalciner kiln systems capable of producing 1.38 million tons each of clinker annually. Each production train consists of an in-line raw mill, a blending silo, kiln system (preheat tower, precalciner, and rotary kiln), clinker cooler and a solid fuel mill. Ancillary equipment in the project includes two new clinker storage silos, two new finish mills, and the associated raw material, solid fuel and finished product handling equipment.

In conjunction with this project, existing kiln #2 will be shutdown. Kiln #1 will remain the same except that the exhaust gases will be routed to the existing Kiln #2 baghouse instead of the electrostatic precipitator currently in use. Kilns #3 and #4 are modern 5-stage preheater/precalciner (PH/PC) designs with in-line vertical roller mills (raw mills). The PH/PC design is more fuel efficient, and the fuel firing systems produce less emissions than the long-dry design per ton of cement clinker produced. Each new kiln will have a dedicated fuel mill, blending bin, preheater, precalciner, and clinker cooler.

The principal fuel for the new kilns will be a blend of coal and petroleum coke. Natural gas will be used to fire the kilns during startup operations. . The kilns will also have the capability of using tire derived fuel and other supplementary fuels. .

Raw material and solid fuel handling conveyors will have weather covers, and transfer points will be enclosed to prevent wind-blown particulate emissions. Water sprays will be used on transfer points and open stockpiles to maintain raw material and solid fuel moisture contents and to suppress fugitive dust as needed. The kiln, clinker coolers, mills, and storage bins will all be equipped with fabric filters (baghouses) to control particulate matter emissions. All clinker and cement conveying equipment transfer points will also be equipped with baghouses. Sweeping and watering will be used to control fugitive dust from paved roadways.

Kilns #3 and #4 will utilize indirect firing and low-NOx burner technology to minimize formation of NOx. In addition, an aqueous ammonia injection system will be installed in the transition area of each kiln between the kiln and the preheater/precalciner, for control of NOx emissions..

IV. PROJECT EMISSIONS

Overall, the expansion project will result in no significant net emission increases in air pollutants except for carbon monoxide (CO). The net change in emissions, in tons per year, associated with the expansion project is presented below, as well as the potential emissions that result. Potential emissions are calculated based on continuous operation at the maximum design throughputs for the kilns. Actual emissions will be less, to the extent that units do not operate at maximum design throughput.

Proposed Project Emissions and Increases (tons/year)

Pollutant	Past Emissions	Potential Emissions	Net Emissions Change	PSD Significance Threshold
Particulate Matter (TSP)	690	490	-200	25
Particulate Matter (PM_{10})	424	415	-9	15
Sulfur Dioxide (SO_2)	1,732	1,771	+39	40
Nitrogen Oxides (NOx)	3,904	3,943	+39	40
Carbon Monoxide (CO)	686	3,599	+2,913	100
Volatile Organic Material (VOM)	105	134	+29	40
Lead	0.05	0.15	+0.1	0.6
Fluorides	0.5	1.3	+0.8	3
Sulfuric Acid Mist	30.9	25.4	-5.5	7

The increase in PM emissions as a result of the project will not be significant. This is due to the fact that kiln 2 will be shut down and PM emissions from raw material and clinker handling and storage will be significantly reduced by the use of storage silos and a reduction of outdoor stockpiles. Appropriate control measures and work practices for the emissions units located throughout the plant that emit PM are required to ensure that the project's PM and PM10 emissions increases are not significant. Such measures include requiring that baghouses on controlled units comply with performance standards-based limits (either grain loading or pound per ton). Emissions of fugitive dust must be well controlled through the use of water or chemical surfactants.

V. APPLICABLE EMISSION STANDARDS

All emission sources in Illinois must comply with Illinois Pollution Control Board emission standards. The plant is subject to state emission standards for NOx, 35 IAC Part 217, Subpart T. Kiln 1 currently meets the requirements of 35 IAC 217.402 (a)(1) by utilizing indirect firing and low-NOx burner technology. Likewise, Kilns #3 and #4 will also comply with the requirements of 35 IAC 217.402(1)(1). The operations at the plant are also subject to various requirements under Part 212, for emissions of particulate matter, including requirements related to fugitive dust and opacity. The new and modified emission units at the plant should readily comply with applicable Board standards like the existing units at the plant.

The plant is subject to the federal National Emission Standard for Hazardous Air Pollutants (NESHAP). The NESHAP sets emission limits to address hazardous air pollutants from cement kilns, raw mills and clinker coolers at cement plants. It also sets opacity limits for other units. Requirements for testing, continuous opacity monitoring, recordkeeping and reporting are also specified.

Certain new and modified units that are part of the expansion project are subject to 40 CFR 60 Subpart Y, for Coal Preparation Plants. The Illinois EPA administers the NSPS in Illinois on behalf of the USEPA under a delegation agreement. The Coal Preparation Plant NSPS sets opacity limits for coal processing, conveying, storage, transfer, and loading systems. Requirements for testing, recordkeeping and reporting are also specified.

VI. OTHER APPLICABLE REGULATIONS

a. Prevention of Significant Deterioration (PSD)

The Joppa Cement Plant is an existing major stationary source under the PSD rules. For PSD-pollutants other than CO, the project will not involve a significant net emission increase. Thus, the project is subject to PSD review only for CO.

A full PSD review requires: 1) a case-by-case Best Available Control Technology (BACT) determination, taking into account energy, environmental and economic impacts, as well as technical feasibility; 2) an ambient air quality impact analysis, including a baseline determination and dispersion modeling, to determine whether the allowable emissions from the source, in conjunction with the proposed net emissions increase, would cause or contribute to a violation of the applicable PSD increment or National Ambient Air Quality Standard (NAAQS); 3) an assessment of the impact on soils, vegetation and visibility; and 4) public notice and comment, including an opportunity for public hearing. The Illinois EPA has been delegated authority by the USEPA to administer the federal PSD program. A discussion of BACT for CO will be addressed in section VII.

The project will net out of review for NOx, VOM, PM, PM10, SO2, sulfuric acid mist, lead and fluorides. The pollutants of most concern to ensure that PSD will not be triggered are NOx, SO2 and PM/PM10. The NOx and SO2 emissions are emitted from the three kilns and future emissions will be monitored to verify that the emissions increases are not significant.

b. Clean Air Act Permit Program (CAAPP)

The plant is a major stationary source under Illinois' Clean Air Act Permit Program (CAAPP), pursuant to Title V of the Clean Air Act and currently operates under an issued CAAPP permit. Upon successful completion of emission testing demonstrating compliance, the source may continue to operate the plant and associated equipment covered by this permit until the Illinois EPA takes final action to modify the sources' existing CAAPP permit to address this project.

VII. BEST AVAILABLE CONTROL TECHNOLOGY (BACT)

BACT is defined as an emission limitation based on the maximum degree of pollution reduction determined on a case-by-case basis considering technical, economic energy and environmental considerations. Through the use of the Top-Down BACT process, good combustion practices are concluded to be BACT for control of CO emissions from the new kilns, as summarized below. That is because add-on control devices are not used to control CO emissions from cement kilns. The two units for which regenerative thermal oxidizers have been attempted, experienced severe operational and mechanical problems, that led to the discontinued use of these devices. Another technique that can be used to reduce CO emissions is to provide excess air into the combustion zone, which reduces CO by oxidizing it to CO2. The use of excess air can have a detrimental effect on the clinker quality because it alters the flame characteristics in the kiln and precalciner which would increase NOx emissions. It also acts to reduce thermal efficiency, so further increases in emissions of NOx also increase emissions of SO2 and PM.

Averaging Time	Emission Limit
Rolling Annual Average	2.5 lbs/ton clinker
8-Hour Block Average	5.0 lbs/ton clinker hour block average

There was only one recent entry in the RACT/BACT/LAER Clearinghouse for control of CO from cement kilns. In like fashion, no add-on control was required for that kiln, located at the Essroc facility in Nazareth, Pennsylvania. At Essroc, a short-term (1-hr) average limit was likewise imposed on CO, as was a long-term (12-mo.) average. Due to the use of continuous emissions monitors on the stacks, BACT limits can be set on both a short-term and long-term basis.

VIII. AIR QUALITY ANALYSIS

a. Introduction

The USEPA has established standards, which set limits on the level of pollution in the ambient air. These ambient air quality standards are based on a broad collection of scientific data to define ambient concentrations where adverse human health and welfare impacts may occur. Based upon the nature and effects of a pollutant, appropriate numerical limitation (s) called air quality standards are set to protect against adverse impacts.

Compliance with air quality standards are most often demonstrated by dispersion modeling. Dispersion modeling is performed by computer, allowing detailed estimates to be made of air quality impacts from a proposed project, over a range of widely differing weather conditions. Dispersion modeling techniques are well developed for pollutants like CO, and can readily address the impact of individual sources.

b. Air Quality Analysis Results for the Proposed Expansion Project

An air quality analysis was conducted to assess the impact of the project on ambient air quality for emissions of CO. Under the PSD rules, this analysis must determine whether the proposed project will cause or contribute to a violation of any applicable air quality standard. The analysis performed conforms to the guidance and requirements of the USEPA and the Illinois EPA.

The modeling analysis determined that the air quality impacts of the proposed project do not exceed the PSD Significant Air Quality Impact Levels for CO. Therefore, no further analysis is required. The results of the dispersion modeling for this project are shown below:

The analysis also considered whether startup of the kilns would be accompanied by higher impacts. Startup involves heating the refractory-lined portions of the kiln system to a temperature where calcinations will occur properly. A cold startup, whereby startup occurs after the kiln has been completely shutdown for a major maintenance activity, typically takes 24 hours to complete. Because natural gas is used as the initial fuel during the startup, and due to the consequent low temperatures and use of good combustion practices, the resulting emissions during startup will be low. The analysis showed that maximum impacts would occur during operation of the kiln, as addressed below, rather than during startup.

Impact Analysis Results (ug/m3)

Pollutant	Averaging Period	Maximum Impact	Significant Impact Level	NAAQS
CO	1-hour	749	2,000	40,000
	8-hour	197	500	10,000

c. Other Impacts

Because the air quality impacts for CO are well below the significant impact level as shown above, there will be no significant impacts on air quality, soils, vegetation, visibility, or Federal Class I areas.

VIII. REQUEST FOR COMMENTS

It is the Illinois EPA's preliminary determination that the proposed permit meets all applicable state and federal air pollution control requirements, subject to the conditions proposed in the draft permit.