

## **Permit Summary – Addition of a Kiln and Related Operations At CEMEX Facility in Clinchfield, GA**

### Project Description

This modification involves the construction of a new dry process Portland cement manufacturing line (Kiln No. 6) capable of producing 1,405,104 short tons per year of cement clinker. The modification includes raw material handling and storage, kiln feed preparation with an in-line raw mill, a dry process rotary kiln coupled with preheater and calciner, a clinker cooler, a coal/pet coke mill, a finish mill, and cement storage, packaging and shipping operations.

Fuels authorized for Kiln No. 6 include natural gas, coal, petroleum coke, fuel oils, landfill gas, and other non-hazardous liquid and solid fuels such as “on-specification” used oil fuels, plastic, filter fluff and wood wastes.

Kiln No. 6 uses Selective Non-Catalytic Reduction (SNCR) in combination with staged and controlled combustion (SCC) and low NO<sub>x</sub> burners to minimize NO<sub>x</sub> emissions from the pyroprocessing processes. Fabric filters/baghouses are employed to capture PM emitted from various process units. A hydrated lime injection system is used as necessary to comply with SO<sub>2</sub> emission limits for the kiln. Kiln No. 6 is also designed and will be operated in a mode to minimize emissions of CO and VOC via controlled combustion, and SO<sub>2</sub> via raw material management and hydrated lime injection.

### Relevant PSD/BACT Permit Conditions

#### A. Overall Emission limits (any 12 consecutive months)

SO<sub>2</sub> – 703 tons  
NO<sub>x</sub> – 1,370 tons  
CO – 2,037 tons  
VOC – 351 tons  
PM – 234 tons, including no more than 199 tons PM<sub>10</sub>

#### B. Overall Production Limit

160.4 tons/hr clinker (24-hour rolling average)  
1,405,104 ton/yr clinker (any consecutive 12-month period)

#### C. Authorized Fuels

Authorized fuels may include, but not to be limited to, coal, fuel oil, natural gas, petroleum coke, landfill gas, on-specification used oil, whole or shredded tires, oily water and other non-hazardous wastes as defined in 40 CFR Part 63,

Subpart EEE – “National Emission Standards for Hazardous Air Pollutants from Hazardous Waste Combustors”.

Solid fuel usage limited to 256,000 tons during any consecutive 12-month period  
Raw mill air heater may only be fired with natural gas, landfill gas, distillate fuel, or No. 4 fuel oil.

On-specification used oil limited to 4,230 gal/hr and 3 million gallons during any consecutive 12-month period.

#### D. Technology Requirements

Staged and controlled combustion (SCC) and NH<sub>3</sub> solution-injection based SNCR to reduce NO<sub>x</sub> emissions.

Indirect firing and low NO<sub>x</sub> burner(s) for reducing NO<sub>x</sub> emissions.

Fabric filters/baghouses to reduce PM/PM<sub>10</sub> emissions from process air and/or flue gas streams exhausting through vents/stacks.

Control of SO<sub>2</sub> emissions through equipment design/inherent dry scrubbing, judicious selection/use of raw materials, and hydrated lime injection (as necessary).

Control of CO and VOC emissions through equipment design and combustion process management with good operating practices (i.e., adequate combustion temperature, residence time and excess air), and judicious selection/use of raw materials.

#### E. BACT Emission Limits

Pollutant	Operation	Emission Limit
PM	Air Heater, Raw Mill, Preheater/Precalciner, Calciner, Kiln, and Clinker Cooler/Main Kiln Stack	0.153 lb PM/ton clinker
PM <sub>10</sub>		0.129 lb PM <sub>10</sub> /ton clinker
Visible		Control: Baghouse 10% opacity
PM/PM <sub>10</sub>	Finish Mill and all other point sources	0.1 gr/dscf (0.0085 gr/dscf for PM <sub>10</sub> )
Visible		10% opacity
SO <sub>2</sub>	Air Heater, Raw Mill, Preheater/Precalciner, Calciner, Kiln, and Clinker Cooler/Main Kiln Stack  Control: Inherent dry scrubbing, raw material	1.0 lb/ton clinker  160.0 lb/hr

Pollutant	Operation	Emission Limit
	management, hydrated lime injection if necessary	
NO <sub>x</sub>	Air Heater, Raw Mill, Preheater/ Precalciner, Calciner, Kiln, and Clinker Cooler/Main Kiln Stack  Control: SCC, SNCR and Low NO <sup>x</sup> burner control	1.95 lb/ton clinker  312.0 lb/hr
NO <sub>x</sub> (initial startup)	Air Heater, Raw Mill, Preheater/ Precalciner, Calciner, Kiln, and Clinker Cooler/Main Kiln Stack  Control: SCC, SNCR and Low NO <sub>x</sub> burner control	3.0 lb/ton clinker  480.0 lb/hr
CO	Air Heater, Raw Mill, Preheater/ Precalciner, Calciner, Kiln, and Clinker Cooler/Main Kiln Stack  Control: Good equipment design and combustion processes	2.9 lb/ton clinker  464 lb/hr
VOC	Air Heater, Raw Mill, Preheater/ Precalciner, Calciner, Kiln, and Clinker Cooler/Main Kiln Stack  Control: Good equipment design and combustion processes	0.5 lb/ton clinker  80.0 lb/hr

## Initial Topics for the Applicant and Regulatory Authority to Consider for Energy Efficiency Evaluations in PSD Permit Applications for Portland Cement Manufacturing

### I. Raw Material Preparation

#### A. Transport Systems

- Will the proposed facility use pneumatic or mechanical conveyor systems? If the plant design specifies pneumatic conveyor systems, what justification is given to choose that system over a mechanical system since mechanical systems typically use less energy than pneumatic systems?
- For existing facilities, has a cost analysis been performed for the conversion from pneumatic to mechanical systems?

#### B. Raw Meal Blending

- Will the raw meal blending operation use a mechanical system, air fluidized silos, or gravity-type homogenizing silos? Since gravity-type silos typically use less energy, what justifications have been provided to select a different system?
- For existing facilities, has a cost analysis been performed for modifying existing silos?

#### C. Raw Material Grinding

- Does the facility design incorporate the most energy efficiency mills for grinding the raw materials? If the design specifies ball mills, what justifications are given for not using high efficiency roller mills or high pressure grinding rolls?
- For existing facilities, has a cost analysis been performed for replacing older roller mills?
- Has the facility considered combining the raw material drying step with vertical roller mills by utilizing waste heat from the kilns or clinker coolers?

#### D. Classifiers and Separators

- Does the facility design incorporate high efficiency (in terms of efficient particle separation to reduce the amount of material returned to the grinder) classifiers or separators?
- For existing facilities, has a cost analysis been performed for replacing older, less efficient classifiers and separators?

## E. Fuel (Coal) Grinding

- If coal is used as a fuel, the same analysis as listed above for raw material grinding applies.

## II. Clinker Production

### A. Process Control and Management Systems

- New facility designs should incorporate the latest computerized and automated control systems to optimize operating conditions in the kiln.
- There should be few barriers to installing control systems on existing facilities, so significant facility modifications should include upgrading these systems.

### B. Replacement of Kiln Seals

- Consideration should be given to replacing kiln seals during modifications.
- New and existing facilities should develop and implement a regular maintenance plan for the seals.

### C. Raw Mix Burnability

- Does the kiln operation include the use of fluxing agents or mineralizers to reduce kiln energy consumption?
- If so, what alternatives were considered, and did those alternatives lead to different levels of energy consumption? What justification is available for why one alternative was selected over another (alternatives may be specific to the type of product produced)?

### D. Kiln/Preheater Insulation

- What refractory material is being used to line the kiln? Does this material provide the highest level of insulation available?
- For existing facilities, are there any structural issues that would preclude the use of a heavier refractory material? Can the structural issues be overcome?
- Is the outer surface of the preheater vessels and cooler housings insulated? What is the efficiency of the insulation and are more efficient alternatives available?

### E. Grate Cooler

- New facilities typically use reciprocating grate coolers because of their higher heat recovery efficiency. If planetary or travelling grate coolers are used, a justification should be provided as to why reciprocating grate coolers cannot be used.

- For existing facilities, conversion of the grate cooler should be analyzed, particularly if the precalciner is being replaced.

#### F. Heat Recovery

- To what extent is the facility recovering energy from exhaust streams from the kiln, clinker cooler, and kiln preheater? Has an analysis been performed to determine whether it would be economical to recover the energy in these streams through power generation?

#### G. Preheater Cyclones

- Are low pressure drop cyclones used for preheating the raw meal prior to the kiln?
- At existing facilities, can the cyclones be replaced without a rebuild of the preheat tower? Even if a tower rebuild would be required, is the modification cost effective?

#### H. Multistage Preheater

- New facilities should employ four- or five-stage preheaters prior to the kiln. Justification should be provided for a new facility that does not include this type of preheater.
- For existing facilities, has a cost analysis been performed on replacing (or adding when no preheating is currently used) the preheater without replacing the kiln? If kiln replacement is required to make the preheater modification cost effective, can the modification be expanded to this level?

#### I. Conversion of Long Dry Kiln to Preheater/Precalciner Kiln

- For existing facilities without a preheater or with a single- or double-stage preheater, consideration should be given to upgrading to a multistage preheater/precincer kiln.

#### J. Kiln Drive

- Does the facility design incorporate high efficiency motors for the kiln drive? For direct drive motors, the highest efficiency is typically obtained with a single pinion drive with an air clutch and a synchronous motor. Alternating current motors may result in slightly less energy consumption than direct drive motors.

#### K. Adjustable Speed Drive for Kiln Fan

- Does the facility design for new facilities incorporate an adjustable speed drive for the kiln fan so that energy consumption can be reduced when full fan capacity is not required?

- For existing facilities, has a cost analysis been performed for installing an adjustable speed drive?

#### L. Oxygen Enrichment

- Was oxygen enrichment considered in the design of new facilities to increase production levels?
- For existing facilities, was a cost analysis performed to install oxygen enrichment?
- In either case, is there a source of oxygen available at the facility?

#### M. Mid-Kiln Firing

- For new facilities, does the kiln design allow for mid-kiln firing? If so, was an analysis performed for different types of fuels that could be used (for example, burning scrap tires may emit less CO<sub>2</sub>/MMBtu than coal)?

#### N. Mixing Air Technology

- Does the kiln design incorporate high pressure air injection? If not, was an analysis performed on the viability of using air injection to improve combustion efficiency?
- For existing facilities, was a cost analysis performed for modifying the kiln for air injection?

#### O. Preheater Riser Duct Firing

- New facilities will most likely always include a preheater prior to the kiln. The preheater design should consider firing a portion of the fuel in the riser duct to increase the degree of calcinations in the preheater.
- For existing facilities, preheater riser duct firing should be considered when modifications are made to the preheater or when a new preheater is installed.

#### P. Selective Non-Catalytic Reduction

- Although SNCR is a NO<sub>x</sub> control technique, the process includes injection urea or ammonia into the kiln near the flame end, which in certain situations may reduce fuel CO<sub>2</sub> emissions. This option should be considered when NO<sub>x</sub> control is required.

### III. Finish Grinding

#### A. Milling Operations

- Does the design of the finish grinding operation include roller presses or roller mills in combination with a ball mill to reduce energy consumption?

- The same analysis as listed above for raw material grinding applies.

#### B. Classifiers

- The same analysis as listed above for classifiers and separators applies.

### IV. Facility Operations

#### A. Blended Cement

- Did the facility design consider the use of supplementary cementitious materials (such as blast furnace slag, fly ash from coal combustion, and natural pozzolans) to replace a portion of the clinker production?

#### B. Motors

- Cement manufacturing facilities may include 500-700 motors. A motor management plan should be implemented that evaluates factors such as strategic motor selection, maintenance, proper size, adjustable speed drives, power factor correction, minimization of voltage unbalances.
- Variable speed drives should be considered where load conditions may vary.

#### C. High Efficiency Fans

- New facilities should use the latest designs in high efficiency fans that reduce energy consumption.
- Existing facilities should evaluate upgrading fans to modern designs.

#### D. Compressed Air Systems

- A comprehensive maintenance plan should be implemented for the compressed air system, including repair of leaks.
- The air inlet should be located at the coolest point possible.
- Recovery of the heat generated by the compressor should be evaluated.

#### E. Lighting Systems

- Does the facility design incorporate energy efficient lighting systems and automated lighting controls?

#### F. Alternative Energy Sources

- Can alternative energy sources such as solar panels be used to supply a portion of the plant's electricity needs?



## G. Other Conservation measures

- In general, what energy conservation measures were incorporated into the plant design?