Suwannee American Cement Company, Inc.
Branford Plant
PSD-FL-259 and 1210465-001-AC
Suwannee County

1. BACKGROUND

The Suwannee American Cement Company, Inc. plans to construct a dry process, preheater/precalciner type portland cement plant to be located at US Highway 27 at County Road 49, Suwannee County.

This facility will consist of a portland cement plant and associated quarry, and raw material and cement handling operations. The plant will combine raw materials and utilize a preheater/precalciner kiln with in-line raw mill to produce clinker. The clinker will be milled and combined with gypsum to produce portland cement. The plant will have a capacity of 178 tons per hour of material fed to the preheater (dry basis), 105 tons per hour of clinker production, and 150 tons per hour of portland cement production. Annual production will be limited (on a rolling 12-month basis) to 1,427,880 tons per year of material fed to the preheater (dry basis), 839,500 tons per year of clinker production, and 1,191,360 tons per year of portland cement production. Fuels allowed to be used in the pyroprocessing system are natural gas, coal, petroleum coke, whole tires and tire derived fuel (TDF). The plant may include a tire gasification system that will utilize heat from the pyroprocessing system to decompose tires to gas, coke and wire which will be utilized in the kiln and pyroprocessing system in an enclosed process. The plant will also include a coal processing operation that will crush coal and petroleum coke and will have an annual processing capacity of 127,896 tons of coal and petroleum coke. Fuel usage will be 14.6 tons per hour of coal, based on a heat content of 12,500 Btu per pound, or 13.0 tons per hour of petroleum coke, based on a heat content of 14,000 Btu per pound. At 40% of maximum heat input, usage of tires will be 5.2 tons per hour, based on a heat content of 14,000 Btu per pound.

Emissions units addressed by this permitting action are:

EMISSIONS UNIT NO.	EMISSIONS UNIT DESCRIPTION
001	1000 TPH primary crusher and associated unenclosed belt conveyors to raw material storage – fugitive emissions
002	Raw material processing – baghouses for transfer points
003	Raw material processing – unenclosed conveyor transfer points
004	In line kiln/raw mill – main stack controlled by baghouse
005	Clinker cooler controlled by ESP
006	Clinker and cement processing – baghouses for transfer points
007	Clinker and cement processing – unenclosed conveyor transfer points
008	Coal mill and coal transfer system baghouses
009	Unenclosed coal conveying equipment
010	Natural gas fired emergency generator set [1]

[1] Emissions unit 010 is exempt from permitting (exempt emissions unit) pursuant to Rule 62-210.300(3)(a)20, F.A.C., provided that total fuel consumption by the generator is limited to 4.4 million cubic feet per year of natural gas. Estimated maximum potential emissions from the generator set are: NOx, 8.5 lb/hr, CO 4.1 lb/hr, and VOC 0.5 lb/hr.

This facility is classified as a Major or Title V Source of air pollution because emissions of at least one regulated air pollutant, such as particulate matter (PM/PM_{10}), sulfur dioxide (SO_2), nitrogen oxides (NOx), carbon monoxide (CO), or volatile organic compounds (VOC) will exceed 100 tons per year (TPY).

This facility is within an industry included in the list of the 28 Major Facility Categories per Table 62-212.400-1, F.A.C. Because emissions will be greater than 100 TPY for at least one criteria pollutant, the facility is also a Major Facility with respect to Rule 62-212.400, Prevention of Significant Deterioration (PSD).

The proposed project is subject to the provisions of Rule 62-212.400, F.A.C., Prevention of Significant Deterioration (PSD), because it will be a new major facility. This review consisted of a determination of Best Available Control Technology (BACT) and an analysis of the air quality impact of the increased emissions.

The proposed project is subject to preconstruction review requirements under the provisions of Chapter 403, Florida Statutes, and Chapters 62-4, 62-204, 62-210, 62-212, 62-214, 62-296, and 62-297 of the Florida Administrative Code (F.A.C.).

This facility is located in an area designated, in accordance with Rule 62-204.340, F.A.C., as attainment for the criteria pollutants ozone, carbon monoxide, sulfur dioxide, and nitrogen dioxide, and designated as unclassifiable for PM_{10}.

The applicant stated that this facility is a major source of hazardous air pollutants (HAPs), because the plant may be a major source of hydrochloric acid. As provided by the federal requirements, the applicant may perform stack testing to confirm whether the facility is or is not a major source of hydrochloric acid.

The emissions units included in this project are subject to regulation under the New Source Performance Standards, 40 CFR 60 Subpart A, General Provisions, Subpart F, Standards of Performance for Portland Cement Plants, Subpart Y Standards of Performance for Coal Preparation Plants, and Subpart OOO, Standards of Performance for Nonmetallic Mineral Processing Plants (all revised as of July 1, 1997). Some of these emissions units are also subject to 40 CFR 63 Subpart LLL, National Emission Standards for Hazardous Air Pollutants from the Portland Cement Manufacturing Industry (40 CFR 63.1340 – 63.1359), revised as of May 14, 1999 and 40 CFR 63 Subpart A, revised as of February 12, 1999. These emissions units are also subject to the requirements of the state rules as indicated in this permit, particularly Rule 62-212.400, F.A.C., Prevention of Significant Deterioration, effective February 5, 1998. Some emissions units are subject to Rule 62-296.701, F.A.C., Portland Cement Plants, effective March 2, 1999. Additionally the permit references the test methods of 40 CFR 60, Appendix A, Test Methods; 40 CFR 63, Appendix A, Test Methods; 40 CFR 51, Appendix M, Recommended Test Methods for State Implementation Plans; 40 CFR 61, Appendix B, Test Methods.

Particulate matter emissions from the in-line kiln/raw mill will be controlled by a baghouse and from the clinker cooler will be controlled by an electrostatic precipitator. Particulate matter emissions from other sources will be controlled by baghouses. Sulfur dioxide emissions are limited by the process. NOx emissions will be controlled by multistage combustion. Carbon monoxide and VOC emissions will be limited by process control.

The total annual air pollutant potential emissions in tons per year from the facility (not including the emergency generator set – emissions unit 010 – will be:

POLLUTANT	PSD SIGNIFICANCE LEVELS [1]	MAXIMUM EMISSIONS	SUBJECT TO PSD REVIEW?
PM	25	226.0	Yes
PM_{10}	15	193.3	Yes
SO_2	40	113.4	Yes
NOx	40	1217.5 [2]	Yes
CO	100	1511.1	Yes
VOC	40	50.4	Yes

[1] Florida Administrative Code 212.400-2.

2 Emissions of NOx for the first year of operation will be 1595.4 tons per year. NOx emissions shown in the table are emissions after the first year of operation. Excess emissions resulting from two startup procedures per year are included in these estimates.

Maximum emissions of mercury will be 97 pounds per year. Control of mercury emissions will result from limiting the mass of mercury introduced into the pyroprocessing system from the preheater feed and fuels. Maximum emissions of dioxin will be 0.002 pounds per year. Dioxin emissions will be controlled by limiting the temperature of the inlet of the baghouse for the in-line kiln/raw mill pursuant to federal NESHAP regulation. Mercury and dioxin are not subject to PSD review.

Emissions of PM and PM_{10} from the unenclosed conveying equipment are expected to be insignificant because of inherent moisture and moisture applied to comply with the reasonable precautions for control of unconfined particulate matter emissions.

2. DATE OF RECEIPT OF A BACT APPLICATION

November 30, 1998
Additional information received February 25, 1999; March 19, 1999; April 21, 1999; May 4, 1999 May 27, 1999 and May 28, 1999.
Additional information and comments on the preliminary draft permit and related documents were received from Koogler & Associates dated November 8, 1999.
Revised permit application and modeling information were received from Koogler & Associates by electronic mail on November 11, 1999.

3. BACT DETERMINATION REQUESTED BY THE APPLICANT

The applicant proposed BACT for the PSD pollutants to be control equipment for particulate matter, process control for SO_2, multistage combustion with a separate line combustion chamber for NOx, and combustion control for CO and VOC.

4. REVIEWER

Joseph Kahn, P.E., prepared BACT determination

5 DETAILED PROCESS DESCRIPTION

The project is a dry process preheater/precalciner type portland cement plant. Portland cement is a fine powder, usually gray in color, that consists of a mixture of dicalcium silicate, tricalcium silicate, tricalcium aluminate, and tetracalcium aluminoferrate, and small amounts of magnesium oxide, sodium, potassium and sulfur, to which one or more forms of calcium sulfate have been added. About 95% of the cement production in the U.S. is portland cement. Masonry cement represents the balance of the domestic cement production.

The proposed preheater/precalciner process is a dry manufacturing process in which thermal efficiency and production capacity have been improved by adding process vessels arranged vertically before the kiln, wherein the hot gases pass counter to the material flow, effecting heat transfer through the intimate contact between the two streams. The improved heat transfer allows the kiln length to be reduced. This arrangement also allows the hot gases from the preheater tower to be used to dry raw materials in the raw mill. In the preheater/precalciner process, fuel combustion is divided between the kiln and a preheater vessel below the preheater tower. This arrangement provides for greater thermal efficiency than the preheater process. A relatively new innovation is the use of a separate line combustion chamber for the preheater burner, so called because it is installed to the side (separate) of the material flow through the precalciner region. This device aids in the control of NOx emissions. The applicant proposed to use the

dry preheater/precalciner process, with a separate line combustion chamber for the calciner burner, in an in-line arrangement with the raw mill.

The process for this plant is discussed in more detail below.

Limestone will be mined primarily below the water table. The overburden, consisting of sand and clay, will be removed from the limestone surface and stockpiled in the vicinity of the crusher. The crusher will be portable, and will be relocated periodically in accordance with the mining plan. The overburden and the limestone will be fed into the crusher with front end loaders in the ratios dictated by the target chemical composition of the desired raw mix. The quarry mix will be delivered to a covered storage hall by a conveyor belt system. The quarry mix will have a moisture content of 10-20%. The storage hall will have space devoted to storage of the other raw materials: iron ore and coal ash, sand, and limestone. The other raw materials will be transported to the facility by truck.

Fugitive emissions from raw material handling and conveying will be minimized by inherent moisture and by the application of water for suppression of unconfined emissions of particulate matter. Unpaved roads will be sprayed by a water truck as required to prevent unconfined particulate matter emissions. Material stockpiles at the plant will be covered to limit particulate matter generated by wind erosion.

The quarry mix and other raw materials will be conveyed to the raw mill feed bin with a capacity of 90 short tons. Raw materials will be fed from the raw mill feed bin to the raw mill. The raw mill will grind and mix the raw materials, and dry the raw materials with the hot gases from the pyroprocessing system. Emissions from the raw mill (and in-line kiln) will be controlled by a baghouse. The baghouse is kept under slight negative pressure with an induced draft fan discharging into a stack. The baghouse catch (kiln dust) and the raw mill product will be conveyed to the homogenization silo of 8,000 tons capacity. (Because the baghouse catch is re-introduced to the process, this cement plant will not generate cement kiln dust (CKD) as a waste product.) Other enclosed emission sources will be controlled by baghouses (fabric filters).

The kiln feed from the homogenization silo will be conveyed to the preheater by means of an airlift. The feed will enter the top stage of the preheater or, during wet material conditions, drop into the next lower stage of the preheater to increase the gas temperature to the raw mill. Gases from the pyroprocessing system will flow counter to the material direction to the raw mill and the baghouse.

Coal and petroleum coke will be burned in the precalciner separate line combustion chamber near the inlet to the kiln as well as at the main burner at the discharge end of the kiln. Natural gas will be used as a startup and supplemental fuel and to fire a small supplementary air heater for the raw mill. The plant will also burn tires and tire derived fuel either directly at the transition from the preheater to the kiln feed end, or via a tire gasification system, as described previously. Combustion air for the precalciner will be provided through a tertiary air duct from the clinker cooler. Multi-stage combustion will control NOx emissions.

The pyroprocessing system will transform the raw meal from the homogenization silo into clinker. The pyroprocessing system will produce 105 tons per hour of clinker, from 178 tons of dry preheater feed per hour. This amount of clinker will produce 150 tons of cement per hour. The plant will be limited by permit to an annual production rate of 839,500 tons of clinker and 1,191,360 tons of portland cement.

After discharge from the kiln, the clinker will be cooled with ambient air in a reciprocating grate cooler equipped with an electrostatic precipitator (ESP) and ID fan for particulate control. A portion of the clinker cooler gases will be ducted to the coal mill to dry the coal. These gases will then exhaust through the coal mill fabric filter into another stack. A portion of the clinker cooler gases will be ducted to the precalciner, the precalciner combustion chamber and the tire gasification system, if installed.

The clinker will be conveyed to one of two clinker silos with a capacity of 25,000 short tons each. The clinker will be withdrawn from the silos by vibrating feeders, and discharged onto the finish mill feed belt. Enclosed clinker handling operations and storage silos will be controlled with baghouses.

Gypsum and limestone will be received by truck and stored under cover in stockpiles. Each material will be transferred by a front end loader to feed hoppers, and conveyed to the finish mill. The finish mill can produce up to 150 tons per hour of cement.

All enclosed sources associated with the finish milling operation will be controlled with baghouses. Fugitive emissions from gypsum and limestone handling and conveying associated with the finish milling operation will be minimized by inherent moisture and by the application of water for suppression of unconfined emissions of particulate matter.

Finished cement will be stored in five concrete silos. Cement will be withdrawn from the silos and loaded into tanker trailers for bulk shipment or into bags which will be cleaned and placed on pallets for shipment. All product will be transported by truck.

All enclosed sources associated with the cement handling operation will be controlled with baghouses.

Coal and petroleum coke will be received by truck. These will drop into a hopper and be conveyed to a bucket elevator at a rate of 200 TPH. The bucket elevator will discharge either into a covered storage facility or onto a belt and then to a bin. Coal and petroleum coke in covered storage will be reclaimed by a front end loader through unloading system. Coal and petroleum coke will be metered from the bin to a vertical mill, for milling and drying with hot gases from the clinker cooler. The milled fuels will be stored in a pulverized fuel storage bin for pneumatic conveyance to the main burner and precalciner burner.

All enclosed sources associated with the coal and petroleum coke handling and milling operation will be controlled with baghouses. Fugitive emissions from coal and petroleum coke handling and conveying will be minimized by inherent moisture and by the application of water for suppression of unconfined emissions of particulate matter.

6. BACT DETERMINATION PROCEDURE

In accordance with Chapter 62-212, F.A.C., this BACT determination is based on the maximum degree of reduction of each pollutant emitted which the Department of Environmental Protection (Department), on a case by case basis, taking into account energy, environmental and economic impacts, and other costs, determines is achievable through application of production processes and available methods, systems, and techniques for control of each such pollutant. In addition, Rule 62-212.400(6)(a), F.A.C., states that in making the BACT determination, the Department shall give consideration to:

1. Any Environmental Protection Agency determination of BACT pursuant to Section 169 of the Clean Air Act, and any emission limitation contained in 40 CFR Part 60 (Standards of Performance for New Stationary Sources) or 40 CFR Part 61 (National Emission Standards for Hazardous Air Pollutants).
2. All scientific, engineering, and technical material and other information available to the Department.
3. The emission limiting standards or BACT determination of any other state.
4. The social and economic impact of the application of such technology.

The EPA currently directs that BACT should be determined using the "top-down" approach. In this approach, available control technologies are ranked in order of control effectiveness for the emissions unit under review. The most stringent alternative is evaluated first. That alternative is selected as BACT unless the alternative is found to not be achievable based on technical considerations or energy, environmental or economic impacts. If this alternative is eliminated for these reasons, the next most stringent alternative is considered. This top-down approach is continued until BACT is determined. In general EPA has identified five key steps in the top-down BACT process: Identify alternative control

technologies; eliminate technically infeasible options; rank remaining control technologies by control effectiveness; evaluate most effective controls; select BACT.

BACT evaluation should be performed for each emissions source and pollutant under consideration. All of the combustion emissions from the plant are associated with the in-line kiln/raw mill. BACT for particulate matter can be treated separately for the in-line kiln/raw mill, clinker cooler, the enclosed material handling processes and the unenclosed conveyors.

The Department will consider the control or reduction of "non-regulated" air pollutants when determining the BACT limit for regulated pollutants, and will weigh control of non-regulated air pollutants favorably when considering control technologies for regulated pollutants. The Department will also favorably consider control technologies that utilize pollution prevention strategies. These approaches are consistent with EPA's consideration of environmental impacts.

The EPA has determined that a BACT determination shall not result in a selection of a control technology which would not meet any applicable emission limitation under 40 CFR Part 60 (Standards of Performance for New Stationary Sources) or 40 CFR Part 61 (National Emission Standards for Hazardous Air Pollutants). This project is subject to such standards as described above.

In addition to the information submitted by the applicant and that information mentioned above, the Department may rely upon other available information in making its BACT determination. For this project, the Department relied upon information from the EPA Publication: Alternative Control Techniques Document – NOx Emissions from Cement Manufacturing, March 1994. The Department also relied upon recent BACT determinations it made for similar facilities and information in EPA's BACT/LAER Clearinghouse, and BACT guidelines for the California Air Resources Board, South Coast Air Quality Management District, and Bay Area Air Quality Management District.

7. BACT POLLUTANT ANALYSIS AND DEPARTMENT'S DETERMINATION

For this project the PSD pollutants of concern are PM, PM_{10}, SO_2, NOx, CO and VOC. The applicant proposed control strategies for these pollutants for the emission sources at this facility. The applicant's proposal and the Department's BACT for each pollutant and source is discussed below.

Nitrogen Oxides (NOx)

Emissions of NOx from cement plants result from fuel combustion in the pyroprocessing system. Oxides of nitrogen (NOx) are generated during fuel combustion by oxidation of chemically bound nitrogen in the fuel (fuel NOx) and by oxidation of elemental nitrogen in the combustion air (thermal NOx). The thermal NOx reaction occurs in regions of high temperature associated with the combustion of fuel. As flame temperature increases, the amount of thermal NOx increases. Fuel type affects the quantity and type of NOx generated. Pipeline natural gas is low in nitrogen. However it causes higher flame temperatures and generates more thermal NOx than coal, which has higher fuel nitrogen content, but exhibits lower flame temperatures.

The emissions of NOx can potentially be reduced at cement plants by two methods: Minimizing the quantity of NOx generated during combustion through combustion process controls and modifications; or reducing the quantity of NOx in the flue gas stream through flue gas controls.

A review of the EPA's BACT/LAER Clearinghouse indicates that NOx emissions at all operating facilities are minimized by combustion process control.

The applicant proposed that NOx emissions at this facility will be controlled through multistage combustion with a separate line combustion chamber (MSC-CC). The applicant considered other possible control methods, and rejected Selective Catalytic Reduction and Low NOx burners as not feasible for this project. The applicant performed a control cost analysis for Selective Non-catalytic

Reduction (SNCR) and MSC-CC. MSC-CC is the more cost effective control technology at $360 per ton of NOx controlled, versus $1251 for SNCR. The applicant did not reject SNCR based on cost alone, but further because MSC-CC will result in a higher level of control guaranteed by the plant manufacturer, because the plant will be more energy efficient using the MSC process, and because of concerns about handling the non-catalytic reactant. Possible reactants considered by the applicant were ammonia water and anhydrous ammonia, both of which present concerns over transport, handling and storage at the proposed location. Ammonia slip is another concern, and is a consideration of the Department. MSC-CC is also a pollution prevention technique. The Department also considered another SNCR reagent, cyanuric acid, that is listed as a control technology in the Bay Area BACT guideline. This reactant will decompose to isocyanic acid at 320°C, well below the required temperature for reaction. Cyanide compounds are classified as hazardous air pollutants pursuant to Department rule, and the Department rejects this reagent on this basis. Also, SNCR systems using this reagent are not likely to be less expensive than SNCR systems using ammonia.

MSC works by staging the introduction of fuel, combustion air, and raw meal in a manner to reduce NOx formation and reduce NOx to nitrogen. NOx formed in the kiln's sintering zone is chemically reduced by maintaining a reducing atmosphere at the kiln feed end by firing fuel in this region. The reducing atmosphere is maintained in the calciner region by controlling combustion air such that the calcining fuel is first burned under reducing conditions to reduce NOx, then under oxidizing conditions to complete the combustion reaction. Controlling the introduction of raw meal allows for control over temperature in the calciner. Through these mechanisms, both fuel NOx and thermal NOx are controlled. The combustion chamber allows for improved control over introduction of tertiary air in the calciner region, helping to promote the proper reducing environment for NOx control.

One public commentor suggested combusting the fuels in the pyroprocessing system with pure oxygen, presumably to reduce the formation of thermal NOx. The pure oxygen would be supplied from a liquid air fractionation plant which would be located at or near the facility. The Department considered this suggestion but rejected it for the following reasons. The facility will have large combustion air requirements and would require large volumes of pure oxygen to offset the air required, at a significant cost; this technology has not been demonstrated to be feasible for the production of cement or for similar pyroprocessing processes; oxygen actively supports combustion to the extent that it is explosive on contact with heat or oxidizable materials, thus presenting a safety hazard; and use of pure oxygen will do nothing to prevent the formation of fuel NOx. This suggestion can best be characterized as speculative, and extensive redesign and pilot study of the entire pyroprocessing system would be required to accomplish pure oxygen firing, if it is possible at all; such a change would completely alter the mass and heat transfer characteristics of the plant. MSC-CC is an effective control technology that will reduce both thermal NOx and fuel NOx.

Except for emissions during startup of the kiln, the applicant has proposed a NOx emission rate of 3.0 pounds per ton of clinker produced. The applicant advised that excess emissions of NOx during a startup of the pyroprocessing system when there is no material in the kiln may be as high as 600 pounds per hour for up to an hour.

We note that no plant has been constructed in the U.S. with SNCR as a control technology. The Department's research of EPA's BACT/LAER Clearinghouse found one plant achieving a permitted limit less than 2.8 pounds per ton of clinker: A Lone Star facility in California that uses a preheater/precalciner design, and meets a limit of 2.5 lb/ton clinker. In its previous BACT determinations for Florida Rock Industries and Florida Crushed Stone, the Department determined that this value is equal to 2.8 lb/ton clinker when corrected for the additional heat requirement necessary to process the higher moisture limestone mined in Florida. The proposed plant will utilize rock with a higher moisture content than the Florida Rock Industries plant, so the applicant proposed a higher NOx limit than the BACT limit of 2.8 lb/ton clinker imposed for Florida Rock Industries. The three factors most affecting NOx emissions at

portland cement plants are fuel volatility, burnability of the material mix and moisture content. The Department considered these factors in previous BACT determinations for cement plants, and in making its determination for this plant, and concluded that moisture content is the factor that warrants most consideration in setting BACT for NOx for cement plants.

The dry process with preheater/precalciner proposed by the applicant is the most energy-efficient process for the production of portland cement. Therefore, one would expect the increased efficiency and consequent lower fuel consumption to result in the lowest possible emissions compared to wet process or other dry process operations, all else being equal. Additionally, the lower flame temperature realized when burning coal compared with burning natural gas, as well as documented NOx reductions from tire burning (tires have a higher heat content and lower nitrogen content than coal), are further reasons to expect the lowest possible emission rate among kilns employing the preheater/precalciner design. MSC-CC is a pollution prevention technique that is integrated into the energy efficient design of the preheater/precalciner process.

The Department agrees with the applicant that MSC-CC is the most cost effective control technology and is BACT for NOx for this project. However, considering the additional benefits that will be derived from the separate line combustion chamber, the Department has determined that the emission limit for this control technology at this facility shall be 2.9 pounds of NOx per ton of clinker produced, and 304.5 pounds per hour. The Department has determined that the appropriate averaging time for this emission limit at this facility shall be a rolling 24 hour period.

The applicant requested a higher limit for NOx for two years after startup, to allow time for adjustment of the plant controls to assure that compliance with the BACT limit will be attained. The Department commented to the applicant that although the temporary exemption language of Department rules provides for exemption from certain PSD requirements for emissions lasting up to two years, such time period for NOx seems excessive given the plant manufacturer's experience with the startup of similar facilities, and the experience it will gain with the startup of the similar Florida Rock plant (which is scheduled to begin operation prior to completion of this facility). The applicant subsequently revised its request to a period of one year after startup, and the Department agrees that such a period is reasonable. During first year after startup, the kiln shall not exceed a NOx limit of 3.8 lb/ton clinker, and 399.0 pounds per hour; the limit of 2.9 lb/ton clinker (304.5 lb/hr) shall be imposed thereafter. Emissions of NOx up to 600 lb/hr for up to one hour in duration shall be allowed for startup of the pyroprocessing system when there is no material in the kiln. (Assuming that two of these startups occur per year, excess NOx emissions will be 591 pounds per year greater than allowable.)

Sulfur Dioxide (SO_2)

Sulfur dioxide is generated from volatilization and subsequent oxidation of sulfur compounds in the raw materials within the preheater and precalciner regions, and by oxidation of sulfur compounds in the fuel during combustion. Sulfur dioxide at this facility will be generated through these mechanisms. The sulfur content of both raw materials and fuels varies based on the raw materials and fuels available at a given location, and consequently sulfur dioxide emissions vary with these factors. As is typical of conditions in Florida, the limestone, which is the principal raw material, will be low in sulfur compounds. Sulfur compounds present in the other raw materials such as the iron sources, which represent a small proportion of the total raw materials, will most significantly contribute to sulfur dioxide emissions.

Most of the sulfur dioxide formed subsequently reacts with alkaline compounds present in the pyroprocessing environment to form alkali sulfates, which become incorporated in the cement clinker. The amount of sulfur dioxide released in the flue gases will vary with the amount of excess alkali available for absorption. The pyroprocessing system is very alkaline, and will be quite effective at removing sulfur dioxide formed from fuel sulfur. A significant proportion of sulfur dioxide from sulfur in raw materials will be removed through intimate contact with the incoming alkaline raw materials which

flow counter to the gas flow. Further contact is achieved in the raw mill where the flue gases are used to dry incoming material feed.

Control for sulfur dioxide applicable to the project are use of low sulfur raw materials; process control to assure a sufficiently alkaline environment is present for reaction with sulfur dioxide formed during pyroprocessing, and to assure intimate contact between flue gases and incoming materials; and flue gas controls – principally scrubbers.

The applicant proposes to limit sulfur dioxide emissions through process control. This will be accomplished by taking advantage of the alkaline environment in the kiln, preheater/precalciner, and raw mill to effect substantial removal of sulfur dioxide. Ultimately, the sulfur is incorporated into the clinker, thus minimizing the amount emitted to the atmosphere. The applicant proposed a sulfur dioxide limit of 0.28 pounds per ton of clinker produced.

Several cement plants in the U.S. use scrubbers for control of sulfur dioxide, ammonia and visible plumes that occur at some plants. Many more plants use process control for sulfur dioxide control. The Department investigated the applicability of a dry circulating scrubber for sulfur dioxide control for this project, and requested comments from the applicant. The applicant provided information regarding control cost for wet scrubbing, and discussed problems with installing the dry circulating bed system at this facility. The applicant demonstrated that wet scrubbing is not cost effective, having estimated a control cost for wet scrubbing of $29,700 per ton. Despite the problems pointed out by the applicant, the Department estimated the control cost for the dry circulating scrubber, assuming, to simplify the cost estimate, the originally proposed ESP for the in-line kiln/raw mill could be used for reagent recovery. (The applicant has changed the design to use a baghouse for particulate control for the in-line kiln/raw mill.) Based on a capital cost estimate of $8 million and 20 year depreciation period and estimated 90% efficiency, provided by Ken Olen, Ph.D., the control cost was estimated to be $7,400 per ton. It is possible that an additional ESP would be required to effect proper operation of the dry circulating scrubber at this facility, raising this cost estimate substantially. The applicant's engineer commented by letter dated November 8, 1999 that he believes that such additional equipment is necessary. The Department agrees with the applicant that flue gas controls are not cost effective for this project, and are not required as BACT.

The Department believes that process control is the appropriate technology for control of sulfur dioxide emissions for this project and is BACT. The Department considered imposing limitations on the sulfur content of the fuels and the raw materials used, but determined that such limits are not required. Fuel sulfur is largely irrelevant because of the substantial exposure and contact between sulfur dioxide formed from fuel sulfur and the alkaline materials. Sulfur limits on the raw materials are not needed because the primary raw material, limestone, will be naturally low in sulfur. The other raw materials will be obtained by the applicant, which will acquire materials with regard to the alkali available in the process for control of sulfur dioxide formed from volatilization and oxidation of sulfur compounds in these materials. The Department will require a continuous emission monitor system for sulfur dioxide, which will offer a continuous demonstration of compliance with the emission limit, as well as process control data for the plant operators. The use of a CEM system ensures that process control will be effective, and eliminates the need for a limit on sulfur in raw materials.

The Department has determined that BACT for sulfur dioxide is process control. The BACT sulfur dioxide emission limit for this plant shall be 0.27 pounds/ton of clinker produced, and 28.4 pounds per hour, based on a rolling 3-hour averaging time. Process control will allow for sulfur dioxide emissions to be minimized by maintaining a sufficient alkaline environment in the pyroprocessing system and by intimate contact between raw materials and exhaust gases. The sulfur dioxide that would result from fuel sulfur, as well as that resulting from volatilization and oxidation of sulfur from raw materials, will be controlled in this manner.

Particulate Matter (PM and PM_{10})

Particulate matter results from the various physical and chemical processes at a cement manufacturing plant such as: quarrying and crushing, material transfer and storage, grinding and blending, clinker production, finish grinding, and packaging and loading. As is typical of cement plants, the largest emission source of particulate matter at this facility will be the pyroprocessing system that includes the in-line kiln/raw mill and clinker cooler. At this facility, all cement kiln dust (CKD) captured in the in-line kiln/raw mill baghouse will be returned to the pyroprocessing system as raw material. Emissions from enclosed fuel and material handling and storage operations represent another significant source of emissions at this facility. Unenclosed sources represent the smallest sources of emissions, given the use of proper controls. The limestone will primarily be mined below the water table and have an average moisture of 10-20%. The quarrying activities and associated crushing and transport will involve moist or wet raw materials with negligible unconfined emissions.

Common control devices for controlling emissions of particulate matter at cement plants are fabric filters (baghouses) and electrostatic precipitators (ESPs). Baghouses and ESPs are generally considered equivalent for particulate control. Both types of devices can achieve removal efficiencies of over 99%. ESPs and baghouses are used extensively as control devices at cement plants. ESPs are generally specified for kiln and clinker cooler exhaust gases because of their ability to operate effectively at varying temperatures, although baghouses are also used at some facilities for this purpose. Both types of control equipment provide for the recovery and recycling of CKD back into the process stream. ESPs offer the advantage of having no fabric filters that will wear and break and require routine replacement, while baghouses offer the advantage of providing for "passive" control in the event of an electrical power failure. A review of the BACT/LAER Clearinghouse shows that baghouses and ESPs are widely used to control particulate matter from process emission units at cement plants. Both offer an essentially equivalent level of control and are commonly accepted as BACT. Baghouses are also generally used to control particulate emissions from most other material processing operations at cement plants.

Common controls to limit particulate emissions from fugitive sources (such as roadways, stockpiles, and material processing and conveying equipment) include application of water for dust suppression, removal of dust, application of water and other dust suppressants, paving of roads and covering of stockpiles to reduce wind erosion. These methods of controlling fugitive particulate matter emissions are generally considered to be BACT for most material handling operations and unpaved roads.

The applicant proposed respective PM and PM_{10} emission limits of 0.20 and 0.17 pounds per ton of dry preheater feed for the in-line kiln/raw mill, and 0.10 and 0.085 pounds per ton of dry preheater feed for the clinker cooler. After comment from the Department that lower limits are found in the BACT/LAER Clearinghouse, the applicant revised the PM_{10} limits to 0.11 and 0.06 pounds per ton of dry preheater feed (equivalent to 19.6 and 10.7 lb/hr at maximum process rate) for the in-line kiln/raw mill and clinker cooler, respectively. The applicant originally proposed to achieve these limits using an ESP for the in-line kiln/raw mill and an ESP for the clinker cooler, with other enclosed sources controlled by baghouses. The applicant later revised its design to use a baghouse for the in-line kiln/raw mill.

The Department agrees with the applicant's proposal, but has instituted additional limits for PM of 0.13 and 0.07 pounds per ton of dry preheater feed (and 23.1 and 12.5 lb/hr) for the in-line kiln/raw mill and clinker cooler, respectively. BACT is the use of a baghouse to control particulate matter emissions from the in-line kiln/raw mill and an ESP to control particulate matter emissions from the clinker cooler to the PM and PM_{10} limits noted above. Visible emissions from these sources shall not exceed 10 percent opacity. BACT for other enclosed emission sources will be control of particulate matter emissions using baghouses to meet respective PM and PM_{10} emission limits of 0.01 and 0.0085 grains per dry standard cubic foot. Visible emissions from these sources shall not exceed 5 percent opacity.

BACT for unenclosed sources is generally control of particulate matter emissions by inherent or applied moisture. Unpaved roads will be sprayed with water or dust suppressants to prevent unconfined particulate matter emissions. Material and fuel storage piles will be stored under roof or in enclosed vessels. Storage piles shall be shaped, compacted and oriented to minimize wind erosion. Storage piles shall be wetted with devices located near such piles when visual inspection determines wetting is needed. Water spray bars shall be located at each unenclosed conveyor and used for wetting of materials and fuel if inherent or previously-applied moisture is insufficient to prevent unconfined PM emissions. Paving of the manufacturing area and access roadways is required. Bulk transport trucks leaving the plant must travel through a tire wash prior to traveling on access roadways.

The Department believes that these controls and emission limits constitute BACT for particulate matter.

Carbon Monoxide (CO) and Volatile Organic Compounds (VOC)

Carbon monoxide is a pollutant formed by the incomplete combustion of carbon in the fuels fired during pyroprocessing. When insufficient oxygen is provided or poor combustion conditions occur, more CO and less CO_2 is formed than under ideal conditions. VOC is also a pollutant formed by the incomplete combustion of fuel.

Emissions of CO and VOC are controlled by utilization of proper combustion practices to maximize the oxidation of carbon to CO_2 instead of CO, and by flue gas controls. No add-on controls for CO or VOC have been demonstrated for cement plants. The high temperatures and control of excess air, process temperatures and fuel typically results in simultaneous optimization for control of CO, VOC and NOx. CO and NOx generally show an inverse relationship in cement plants as in many combustion processes, so reduction of NOx results in higher CO emissions. The applicant proposed combustion control as BACT for CO and VOC from this plant, and proposed emission limits of 3.6 and 0.12 pounds per ton of clinker produced for CO and VOC, respectively.

The Department agrees with the applicant. BACT for CO and VOC shall be combustion control. The emission limit for CO shall be 3.6 pounds per ton of clinker produced, and 378.0 pounds per hour, based on a 3 hour average. The averaging time is that of the annual test. A CEM will not be required for CO. However, the facility will install process monitors for CO to provide for the use of CO as a short-term measure of the efficacy of combustion control. The emission limit for VOC shall be 0.12 pounds per ton of clinker produced, and 12.6 pounds per hour, based on a 30 day averaging time. This averaging time is consistent with the NESHAP requirements.

Based on the information provided by the applicant and the informed judgement of the Department, BACT for PM, PM_{10}, SO_2, NOx, CO and VOC for the emission sources at this facility is determined to be the control technologies and emission limits discussed above.

8. COMPLIANCE

The compliance methods are briefly summarized here. Except for PM, PM_{10} and CO, compliance with the emission and process limitations for the in-line kiln/raw mill shall be demonstrated on a regular basis through a variety of continuous monitoring systems, and by record keeping for some production parameters. Compliance with the visible emissions limitation for the clinker cooler shall be regularly demonstrated using COM system clinker cooler stack. Annual emission tests will be required for all emission-limited pollutants, including visible emissions, from the in-line kiln/raw mill and the clinker cooler. Tests conducted for the annual RATA can satisfy the annual test requirements for the in-line kiln/raw mill. Initial compliance testing to demonstrate compliance with the emission limits for the three largest process sources controlled by baghouses will be required; thereafter, no subsequent tests will be required if these sources meet a visible emissions limit of 5% opacity. Initial and annual tests for the other process sources controlled by baghouses is not required if these sources meet a visible emissions limit of 5% opacity. The opacity limit for the clinker cooler is 10%. Compliance with the mercury

throughput limitation will be demonstrated via sampling and analysis of the materials and fuels. Compliance with the dioxin emissions limit of the NESHAP shall be demonstrated via testing, and continuous monitoring of the temperature at the inlet of the baghouse for the in-line kiln/raw mill, in accordance with that rule.

The Department will require that the data from continuous monitors for emissions be available to the Department via a data retrieval system to one of the Department's offices. This data will also be posted to an Internet site by the permittee, if technically feasible.