KOOGLER & ASSOCIATES
ENVIRONMENTAL SERVICES
4014 NW THIRTEENTH STREET
GAINESVILLE, FLORIDA 32609
904/377-5822 • FAX 377-7158

K&A 187-94-02

April 5, 1995

Teresa Heron
Air Permit Engineer
Bureau of Air Regulation
FDEP - Tallahassee
2600 Blair Stone Road
Tallahassee, FL 32399-2400

SUBJECT: Florida Rock Industries, Inc.; Newberry Cement Plant
Application to Construct

Dear Teresa:

Enclosed please find the following items for inclusion with the application to construct:

1. Sulfur Dioxide Emission Rate Justification (3 pages)
2. Replacement application page 87
3. Replacement application page 96

The Sulfur Dioxide Emission Rate Justification provides the justification for the SO2 emission rate as requested. The total available SO2 from the fuel and the raw meal is evaluated with respect to reasonable, process-based control efficiencies referenced in AP-42. The evaluation shows that the requested SO2 emission rate is reasonable.

The replacement application pages 87 and 96 clarify the proposed combustion of tires as partial fuel replacement for coal. Process limitations will restrict the use of tires to 30% of the total heat input. Replacement page 87 is a revised emissions unit description for emissions unit 3 of 7; and replacement page 96 is a revised segment description for segment 3 of 3.

Please call me if I can answer any questions regarding this information or the application.

Sincerely,

Steven C. Cullen, P.E
Koogler & Associates

copies to: Fred Colhrs, FRI
Al Linero, FDEP

FLORIDA ROCK INDUSTRIES, INC.
NEWBERRY CEMENT PLANT
ALACHUA COUNTY

SULFUR DIOXIDE (SO2) EMISSION RATE JUSTIFICATION

I. Sulfur Dioxide Formation

Sulfur dioxide is liberated by the combustion of coal at each burner; and is liberated from sulfur compounds in the raw meal by the kiln.

Coal: Maximum 1.0% sulfur by weight, 14 tph combusted (total)
60% of coal is combusted in precalciner burner = 8.4 tph = 16,800 lbs/hr
40% of coal is combusted in discharge burner = 5.6 tph = 11,200 lbs/hr
Sulfur to sulfur dioxide ratio = 1:2 (2 lbs. SO2 per 1 lb. S)

SO2 from precalciner burner =
16,800 lbs. coal/hr X 0.01 lb. S/lb. coal X 2 lbs. SO2/1 lb. S = **336 lbs/hr**

SO2 from kiln discharge end burner =
11,200 lbs. coal/hr X 0.01 lb. S/lb. coal X 2 lbs. SO2/1 lb. S = **224 lbs/hr**

Raw Meal:
Sulfite (SO3) from raw meal (as tested) = 0.08% by weight
Raw meal is processed at the rate of 150 tph = 300,000 lbs/hr
Sulfite to sulfur dioxide ratio = 5:4 (4 lbs. SO2 per 5 lbs. SO3)

SO2 from raw meal =
300,000 lbs/hr X 0.0008 lbs. SO3/lb X 4 lbs. SO2/5 lbs. SO3 = **192 lbs/hr**

Total SO2 from coal and raw meal = 336 + 224 + 192 = **752 lbs/hr**

II. Sulfur Dioxide Removal Processes

Sulfur dioxide is removed from the exhaust gas stream by absorption. The absorption involves two closely related mechanisms. The first removal mechanism is the dry removal in the presence of the absorbing reagent calcium oxide (CaO). The second removal mechanism is the absorption by calcium carbonate ($CaCO_3$) in the presence of moisture.

Calcium oxide is formed by the calcination of calcium carbonate (limestone) in the preheater cyclones and in the kiln. The kiln dust captured by the ESP therefore contains calcium oxide.

Dry removal takes place in the kiln, in the preheater cyclones, and in the ESP. Wet removal takes place in the raw mill, where moisture and calcium carbonate are simultaneously present.

III. Estimated Sulfur Dioxide Removal Efficiencies

> Reference 1: AP-42 Fourth Edition, Section 8.6, Portland Cement Manufacturing
> "The alkaline nature of the cement, however, provides for direct absorption of SO2 into the product. Using a baghouse that allows the SO2 to come in contact with the cement dust provides inherent reduction of 75 percent or more of the raw material and fuel sulfur content."

It is assumed that the dry ESP specified for the plant will allow the SO2 to come in contact with the cement dust, and result in a similar removal efficiency (75%).

> Reference 2: AP-42 Fifth Edition, Section 11.6, Portland Cement Manufacturing
> "Cement kiln systems have highly alkaline internal environments that can absorb up to 95 percent of potential SO2 emissions. However, in systems that have sulfide sulfur (pyrites) in the kiln feed, the sulfur absorption rate may be as low as 50 percent without unique design considerations or changes in raw materials."

It is assumed that the preheater cyclones and the kiln will remove SO2 due to alkaline internal environments.

> Reference 3: AP-42 Fifth Edition, Section 11.6, Portland Cement Manufacturing
> "It has been observed that as much as 50 percent of the SO2 can be removed from the pyroprocessing system exhaust gases when this gas stream is used in a raw mill for heat recovery and drying."

It is assumed that additional SO2 removal will take place when the preheater/precalciner/kiln exhaust gases exit through the raw mill (compound operation).

IV. SO2 Emission Rate Justification

Emission Rate from kiln system = 51.75 lbs/hr
SO2 formation rate = 752 lbs/hr

Overall efficiency = [1 - (51.75/752)] X 100 = 93.1%

ESP, efficiency range = 75% +
Assumed efficiency = 75%, inefficiency = 25%
Outlet = 51.75 lbs/hr
Inlet = 51.75/25% = 207 lbs/hr

Kiln System, efficiency range = 50% - 95%
Assumed efficiency = 72.5%, inefficiency = 27.5%
Outlet = 207 lbs/hr
Initial = 207/27.5% = 752 lbs/hr

IV. SO2 Emission Rate Justification (continued)

Raw Mill, efficiency range = <50%
It is assumed that SO2 emissions will be reduced when the plant is in compound operation. No efficiencies have been assigned for compound operation, as direct operation presents the "worst-case" emissions scenario.

V. Conclusion

This analysis has shown that the requested SO2 emission rate is valid and justified, based on the fuel, raw materials, and processing operations at this cement plant.

Emissions Unit Description and Status

1. Description of Emissions Unit Addressed in This Section: **Kiln System:**
Dry process rotary kiln with preheater and precalciner. Kiln feed material (raw meal) is conveyed into the top stage of the preheater or the next lower stage. Coal is burned in the precalciner near the inlet to the kiln, as well as at the main burner at the discharge end of the kiln. Tires may be substituted for coal with a maximum substitution rate of 30% (heat input basis).

Preheater/precalciner/kiln exhaust gases are ducted to the raw mill for material drying, or are exhausted through an ESP to the stack. Combustion air for the precalciner burner is ducted from the clinker cooler.

2. ARMS Identification Number: [X] No Corresponding ID [ ] Unknown

3. Emissions Unit Status Code: C	4. Acid Rain Unit? [ ] Yes [X] No	5. Emissions Unit Major Group SIC Code: 32

6. Initial Startup Date (DD-MON-YYYY): N/A

7. Long-term Reserve Shutdown Date (DD-MON-YYYY): N/A

8. Package Unit: N/A
Manufacturer: Model Number:

9. Generator Nameplate Rating: N/A MW

10. Incinerator Information: N/A
Dwell Temperature: °F
Dwell Time: seconds
Incinerator Afterburner Temperature : °F

11. Emissions Unit Comment: N/A

Segment Description and Rate: Segment 3 of 3

1. Segment Description (Process/Fuel Type and Associated Operating Method/Mode):

In-Process Fuel Use: Tires: Cement Kiln

Combustion of tires in kiln. Emissions will be equivalent or less than allowable emissions from coal combustion.

Process limitations restrict tire usage to 30% substitution of coal by heat input. Tires heat content is assumed as equivalent to coal heat content (13,000 Btu/lb).

2. Source Classification Code (SCC): **3-90-999-99**

3. SCC Units: **MMBtu Heat Input**

4. Maximum Hourly Rate:	5. Maximum Annual Rate:
109.2 MMBtu Heat Input	**956,592 MMBtu Heat Input**

6. Estimated Annual Activity Factor: **N/A**

7. Maximum Percent Sulfur: **N/A**	8. Maximum Percent Ash: **N/A**

9. Million Btu per SCC Unit: **N/A**

10. Segment Comment:

14 tph coal X 2000 lb/ton X 13,000 Btu/lb X 1 MMBtu/1,000,000 Btu = **364 MMBtu/hr**

30% from tires: 0.30 X 364 MMBtu/hr = **109.2 MMBtu/hr from tires**

109.2 MMBtu/hr X 8760 hpy = **956,592 MMBtu/yr**